Group 1 – PUMPS

Group 2 - PRESSURE CONTROL VALVES

Group 3 - FLOW CONTROL VALVES

Group 4 - DIRECTIONAL VALVES

Group 5 - SUBPLATES AND MANIFOLDS

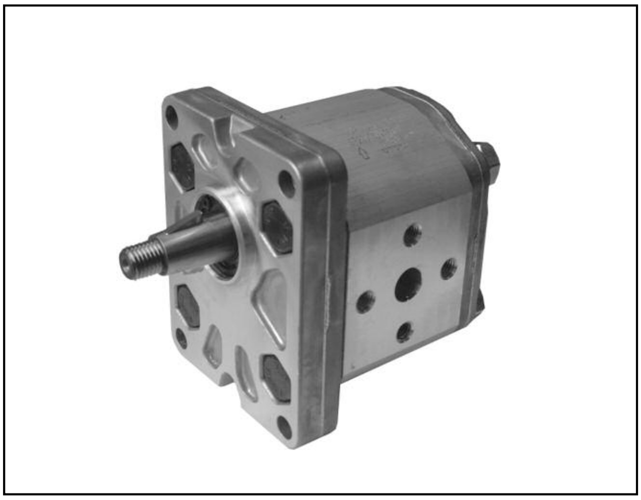
Group 6 - MODULAR VALVES

Group 7 – ACTUATORS

Group 8 - PROPORTIONAL VALVES

Group 8 - ELECTRONIC CONTROL UNITS

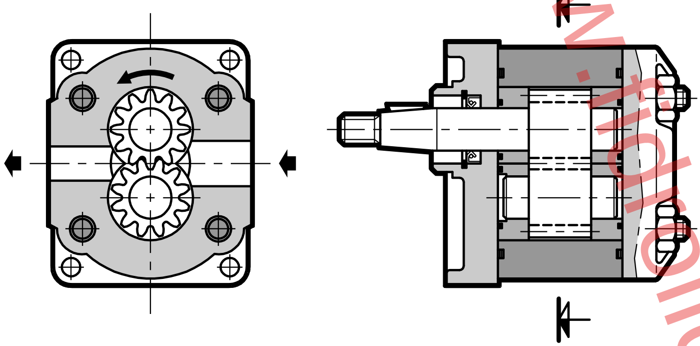
Group 9 - ACCESSORIES



GP

EXTERNAL GEAR PUMPS
SERIES 20

OPERATING PRINCIPLE



— The GP pumps are fixed displacement external gear pumps with axial clearance compensation.

— They give high volumetric efficiency even with high operating pressures, a low noise level, and they have a high endurance thanks to the balancing system of the loads on the guide bushings.

— They are divided into three size groups, with displacements of up to 9,1 - 27,9 and 87,6 cm^3/rev respectively, and with operating pressures of up to 250 bar (standard) and up to 310 bar (version for high pressures H).

— They are available with clockwise, anticlockwise and reversible rotation, with tapered shaft (standard). Other kind of shaft are available upon request.

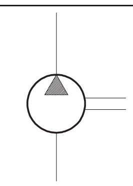
— They are available in multiple versions, and can be combined in multi-flow groups, with a splined connection motion system that guarantees high power performances.

TECHNICAL SPECIFICATIONS

GP PUMP SIZE		GP1	GP2	GP3
Displacement range	cm^3/rev	1.3 ÷ 9.1	7 ÷ 27.9	20.7 ÷ 87.6
Flow rate and operating pressures		see table 3 - Performances		
Rotation speed		see table 3 - Performances		
Rotation direction		clockwise, anticlockwise or reversible (seen from the shaft side)		
Loads on the shaft		radial and axial load are not allowed		
Max torque applicable to the shaft		see paragraph 14.1		
Hydraulic connection		flanged fittings (see paragraph 16)		
Type of mounting		4 hole flange - rectangular type		
Mass: standard version version H	kg	1.2 ÷ 1.6 1.9 ÷ 2.3	2.6 ÷ 3.5 3.8 ÷ 4.7	6 ÷ 8.5 8.7 ÷ 11.2

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-15 / +80
Fluid viscosity range	see paragraph 2.2	
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	25 ÷ 100

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

1.1 - Identification code for single and front pumps

G	P			-						/	20	N	

External gear pump

Pump size:
1 = from 1,3 to 9,1 cm^3/rev
2 = from 7,0 to 27,9 cm^3/rev
3 = from 20,7 to 87,6 cm^3/rev

omit for single pumps (**standard**)
F = only for front pump to be coupled

Nominal size
(see table 3 - Performances)

Rotation direction (seen from the shaft side)
R = clockwise (**standard**) **L** = anticlockwise
D = reversible (option available for single pumps only)

Mounting flange
9 = 4 hole - rectangular type (**standard**)
0 = SAE J744 - 2 hole

Type of shaft - see **NOTE 1**
7 = tapered with key (**standard**)
5 = cylindrical with key
(available for single pumps only)
0 = cylindrical with key SAE-J744
1 = SAE-J744 splined

Hydraulic connection
F = flanged ports (**standard**)
B = BSP threaded ports
U = UNF threaded ports

Series No. (from 20 to 29 sizes and mounting dimensions remain unchanged)

Seals:
N = NBR seals for mineral oils

H = version for high pressures.
Omit for standard pressure.

NOTE 1: See at table 1.4 compatibility among mounting flange, type of shaft and type of hydraulic connection

1.2 - Identification code for intermediate and rear pumps

G	P			-				/	20	N	

External gear pump

Pump size:
1 = from 1,3 to 9,1 cm^3/rev
2 = from 7,0 to 27,9 cm^3/rev
3 = from 20,7 to 87,6 cm^3/rev

Pump position:
M = Intermediate
R = Rear

Nominal size
(see table 3 - Performances)

Rotation direction (seen from the shaft side)
R = clockwise (**standard**) **L** = anticlockwise

Hydraulic connection
F = flanged ports (**standard**)
B = BSP threaded ports
U = UNF threaded ports

Series No.
(from 20 to 29 sizes and mounting dimensions remain unchanged)

Seals:
N = NBR seals for mineral oils

H = version for high pressures.
Omit for standard pressure.

NOTE 2: Front, intermediate or rear pumps for multiple groups are supplied without mating joint, which must be ordered separately (see paragraph 1.5). To order a group of one or more pumps completely assembled see paragraph 1.3.

1.3 - Identification code for multiple pumps

identification code front pump	+	identification code intermediate pump (omit for double pumps)	+	identification code rear pump

1.4 - Compatibility among mounting flange, type of shaft and type of hydraulic connection

FLANGE CODE	SHAFT CODE				HYDRAULIC CONNECTION CODE		
	7	5	0	1	F	B	U
9	yes	yes	no	no	yes	yes	no
0	no	no	yes	yes	yes	no	yes

1.5 - Identification code for mating joints

FIRST PUMP	SECOND PUMP		
	GP1	**GP2**	**GP3**
GP1	3101100003	-	-
GP2	3101100004	3101100005	-
GP3	3101100006	3101100007	3101100008

1.6 - Examples

a) single pump size 1 - 1,3 cm^3/rev - anticlockwise rotation - standard flange and shaft
GP1-0013L97F/20N

b) single pump size 2 - 14 cm^3/rev - clockwise rotation - standard flange and shaft
GP2-0140R97F/20N

c) single pump size 3 - 22,5 cm^3/rev - clockwise rotation - SAE flange and shaft
GP3-0225R01F/20N

d) double pump made of: - pump size 2 - 7 cm^3/rev
- pump size 1 - 2 cm^3/rev - high pressure

GP2F-0070R97F/20N + GP1R-0020RF/20NH

e) triple pump made of: - pump size 3 - 22,5 cm^3/rev
- pump size 2 - 14 cm^3/rev
- pump size 1 - 2 cm^3/rev

GP3F-0225R97F/20N + GP2M-0140RF/20N + GP1R-0020RF/20N

2 - HYDRAULIC FLUID

2.1 Type of fluid

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives, in conformity with the requisites of the following standards:
- FZG test - 11th stage
- DIN 51525
- VDMA 24317

For use with other types of fluid (water glycol, phosphate esters and others), consult our technical dept. Operation with fluid at a temperature greater than 80°C causes a premature deterioration of the fluid quality and of the seals. The physical and chemical properties of the fluid must be maintained.

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	12 cSt	referred to the maximum fluid temperature of 80 °C
optimum viscosity	25 ÷ 100 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	1600 cSt	limited to only the start-up phase of the pump

2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with β20 ≥75 is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with β10 ≥100 is recommended.

If there is a filter installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in paragraph 13.

The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

3 - PERFORMANCE RATINGS

(values obtained with mineral oil with viscosity of 36 cSt at 50°C)

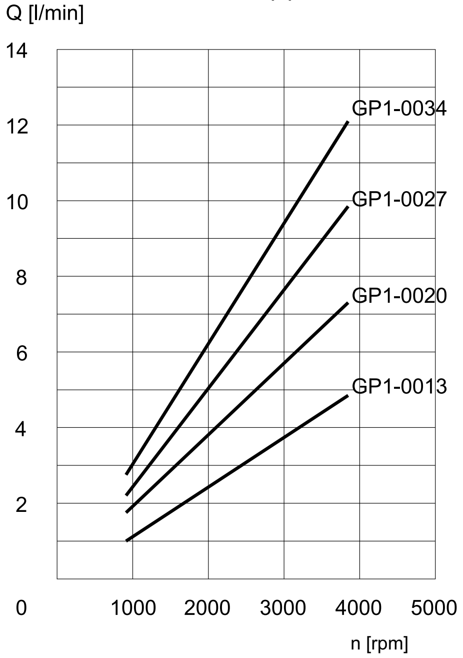
<table>
<tr><th>PUMP SIZE</th><th>NOMINAL SIZE</th><th>DISPLACEMENT [cm3/rev]</th><th>MAX FLOW RATE (at 1500 rpm) [l/min.]</th><th>MAX OPERATING PRESSURE (at 1500 rpm) [bar]</th><th>MAX PEAK PRESSURE (at 1500 rpm) [bar]</th><th>MAX ROTATION SPEED [rpm]</th><th>MIN ROTATION SPEED [rpm]</th></tr>
<tr><td rowspan="9">GP1</td><td>0013</td><td>1,3</td><td>2,0</td><td rowspan="5">250 (270)</td><td rowspan="5">290 (310)</td><td rowspan="2">6000</td><td rowspan="7">800</td></tr>
<tr><td>0020</td><td>2,0</td><td>3,0</td></tr>
<tr><td>0027</td><td>2,7</td><td>4,0</td><td rowspan="2">5000</td></tr>
<tr><td>0034</td><td>3,4</td><td>5,1</td></tr>
<tr><td>0041</td><td>4,1</td><td>6,1</td><td rowspan="2">4000</td></tr>
<tr><td>0051</td><td>5,1</td><td>7,6</td><td rowspan="2">230 (260)</td><td rowspan="2">260 (290)</td></tr>
<tr><td>0061</td><td>6,1</td><td>9,1</td><td>3800</td></tr>
<tr><td>0074</td><td>7,4</td><td>11,1</td><td>200</td><td>230</td><td>3200</td><td rowspan="2">600</td></tr>
<tr><td>0091</td><td>9,1</td><td>13,6</td><td>180</td><td>210</td><td>2600</td></tr>
<tr><td rowspan="9">GP2</td><td>0070</td><td>7,0</td><td>10,5</td><td rowspan="2">250 (280)</td><td rowspan="2">290 (310)</td><td>4000</td><td rowspan="4">600</td></tr>
<tr><td>0095</td><td>9,5</td><td>14,2</td><td>3000</td></tr>
<tr><td>0113</td><td>11,3</td><td>16,9</td><td rowspan="2">230 (260)</td><td rowspan="2">270 (300)</td><td rowspan="3">4000</td></tr>
<tr><td>0140</td><td>14,0</td><td>21,0</td></tr>
<tr><td>0158</td><td>15,8</td><td>23,7</td><td rowspan="2">210 (260)</td><td rowspan="2">240 (290)</td><td rowspan="5">500</td></tr>
<tr><td>0178</td><td>17,8</td><td>26,7</td><td>3600</td></tr>
<tr><td>0208</td><td>20,8</td><td>31,2</td><td rowspan="2">180 (230)</td><td rowspan="2">210 (260)</td><td>3200</td></tr>
<tr><td>0234</td><td>23,4</td><td>35,1</td><td>3000</td></tr>
<tr><td>0279</td><td>27,9</td><td>41,8</td><td>170 (200)</td><td>200 (230)</td><td>2500</td></tr>
<tr><td rowspan="12">GP3</td><td>0207</td><td>20,7</td><td>31,0</td><td rowspan="4">230 (280)</td><td rowspan="4">270 (310)</td><td rowspan="2">3500</td><td rowspan="5">500</td></tr>
<tr><td>0225</td><td>22,5</td><td>33,7</td></tr>
<tr><td>0264</td><td>26,4</td><td>39,6</td><td rowspan="3">3000</td></tr>
<tr><td>0337</td><td>33,7</td><td>50,5</td></tr>
<tr><td>0394</td><td>39,4</td><td>59,1</td><td>220 (260)</td><td>260 (290)</td></tr>
<tr><td>0427</td><td>42,7</td><td>64,0</td><td>210 (250)</td><td>250 (280)</td><td>2800</td><td rowspan="7">400</td></tr>
<tr><td>0514</td><td>51,4</td><td>77,1</td><td>200 (230)</td><td>240 (260)</td><td>2400</td></tr>
<tr><td>0600</td><td>60,0</td><td>90,0</td><td>190</td><td>220</td><td>2800</td></tr>
<tr><td>0696</td><td>69,6</td><td>104,4</td><td>170</td><td>200</td><td>2500</td></tr>
<tr><td>0776</td><td>77,6</td><td>116,4</td><td>160</td><td>190</td><td>2300</td></tr>
<tr><td>0876</td><td>87,6</td><td>131,4</td><td>140</td><td>170</td><td>2000</td></tr>
</table>

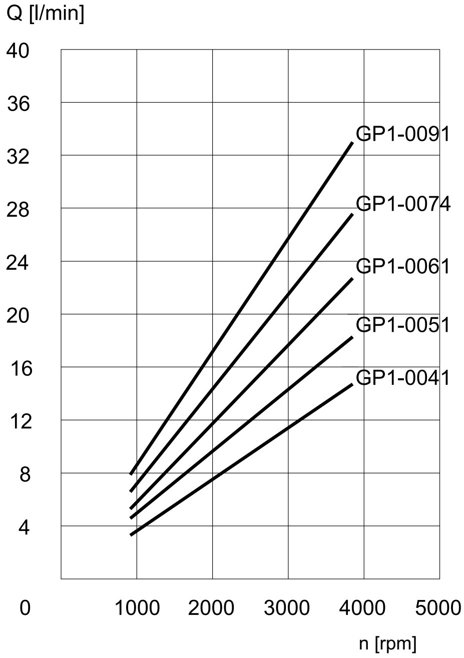
NOTE: The values in parentheses refer to the version **H,** for high pressures.

4 - CURVES AND CHARACTERISTIC DATA OF GROUP GP1 PUMPS

(values obtained with mineral oil with viscosity of 36 cSt at 50°C)

4.1 - Flow rate curves Q=f (n) obtained with operating pressure 0 bar





4.2 - Efficiencies

PUMP NOMINAL SIZE	VOLUMETRIC EFFICIENCY [%]	TOTAL EFFICIENCY [%]
0013	0,90	0,82
0020	0,90	0,85
0027	0,95	0,90
0034	0,91	0,87
0041	0,94	0,90
0051	0,96	0,92
0061	0,96	0,92
0074	0,96	0,90
0091	0,96	0,88

The volumetric and total efficiencies for the various nominal dimensions of the Group GP1 pumps, measured at 1500 rpm and with 150 bar operating pressure, are shown in the table.

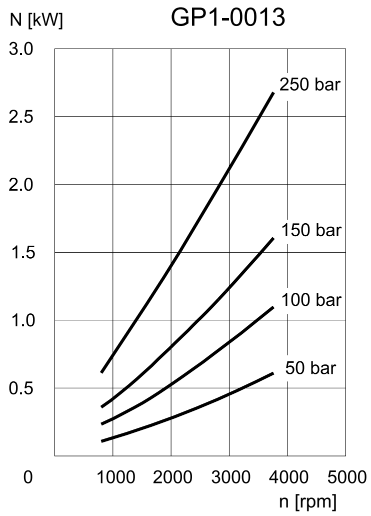
The total efficiency considers the volumetric efficiency and the mechanical efficiency of the pump in the specified operating conditions.

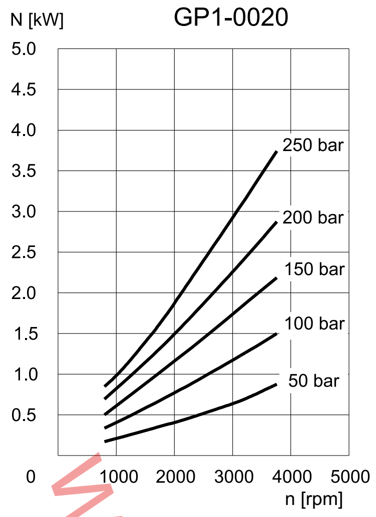
4.3 - Noise level

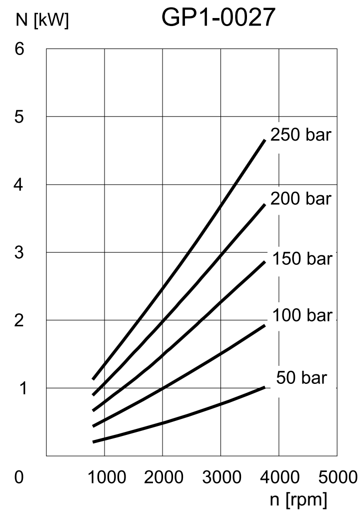
PUMP NOMINAL SIZE	NOISE LEVEL [dB (A)]
0013	65
0020	66
0027	68
0034	68
0041	70
0051	73
0061	73
0074	73
0091	77

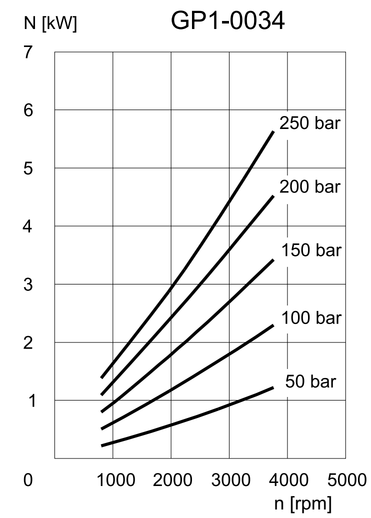
The noise levels for the various nominal dimensions of the Group GP1 pumps, measured at 1500 rpm, with 150 bar operating pressure and measured at a distance of 1 metre from the pump, are shown in the table.

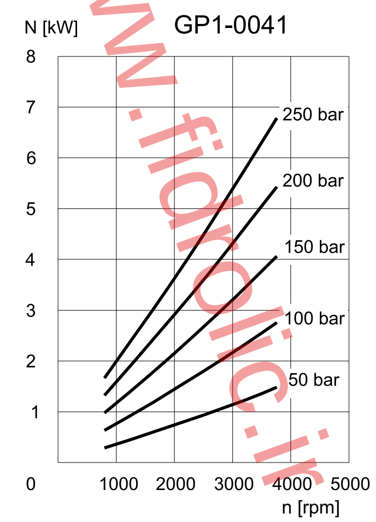
4.4 - Absorbed power curves N=f (n), measured with operating pressures from 50 to 250 bar

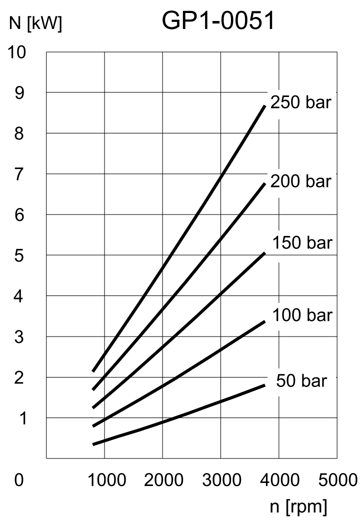


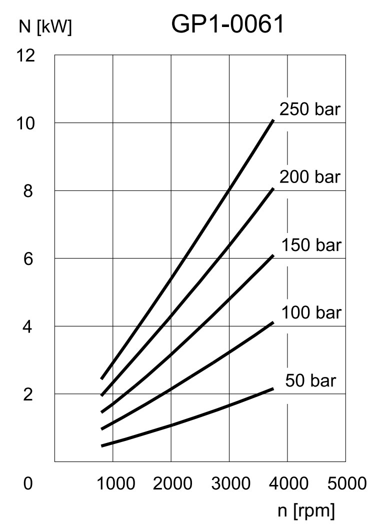


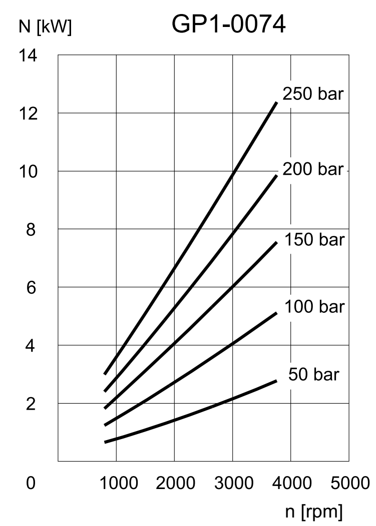


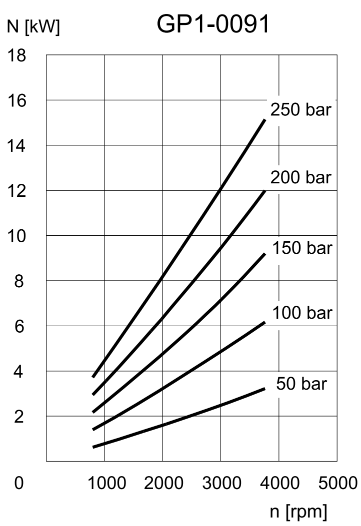








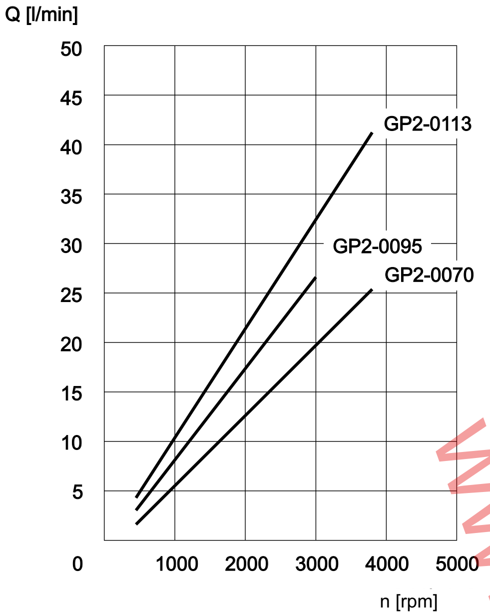


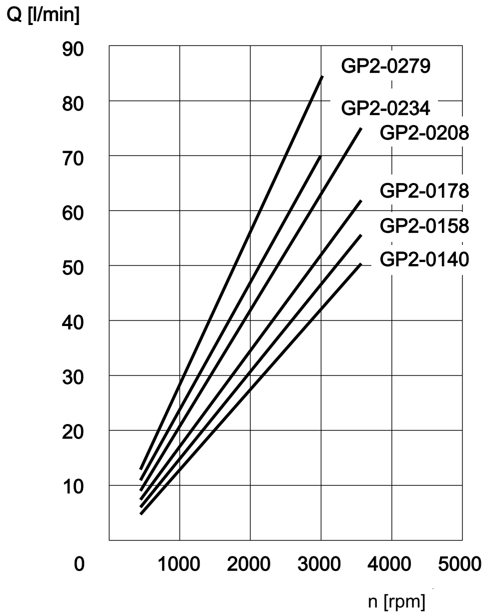


5 - CURVES AND CHARACTERISTIC DATA OF GROUP GP2 PUMPS

(values obtained with mineral oil with viscosity of 36 cSt at 50°C)

5.1 - Flow rate curves Q=f (n) obtained with operating pressure 0 bar





5.2 - Efficiencies

PUMP NOMINAL SIZE	VOLUMETRIC EFFICIENCY [%]	TOTAL EFFICIENCY [%]
0070	0,92	0,87
0095	0,95	0,88
0113	0,95	0,87
0140	0,93	0,87
0158	0,95	0,86
0178	0,93	0,85
0208	0,93	0,88
0234	0.97	0,89
0279	0,94	0,85

The volumetric and total efficiencies for the various nominal dimensions of the Group GP2 pumps, measured at 1500 rpm and with 150 bar operating pressure, are shown in the table.

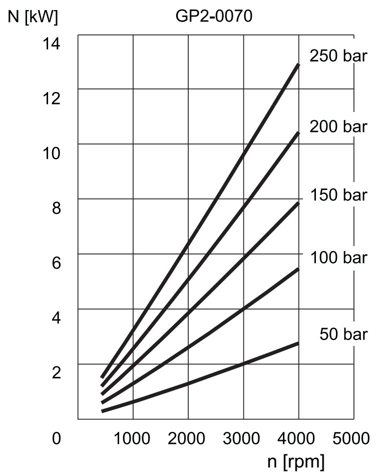
The total efficiency considers the volumetric efficiency and the mechanical efficiency of the pump in the specified operating conditions.

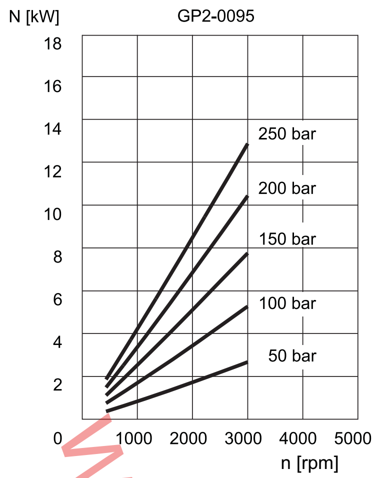
5.3 - Noise level

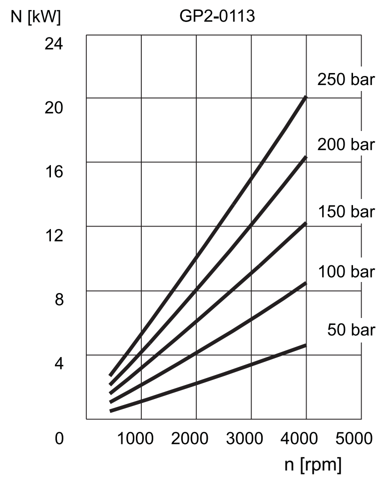
PUMP NOMINAL SIZE	NOISE LEVEL [dB (A)]
0070	75
0095	77
0113	77
0140	72
0158	72
0178	73
0208	74
0234	76
0279	76

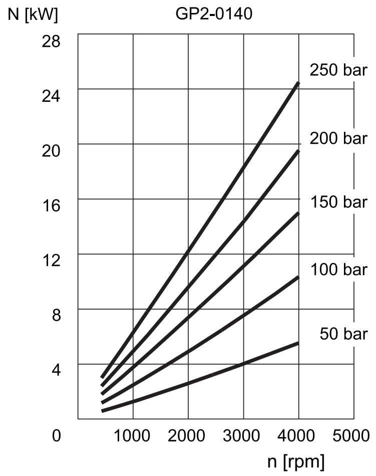
The noise levels for the various nominal dimensions of the Group GP2 pumps, measured at 1500 rpm, with 150 bar operating pressure and measured at a distance of 1 metre from the pump, are shown in the table.

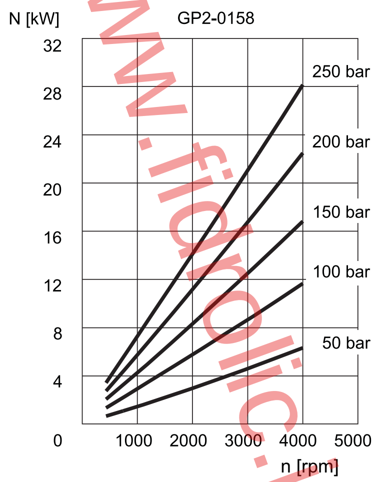
5.4 - Absorbed power curves N=f (n), measured with operating pressures from 50 to 250 bar

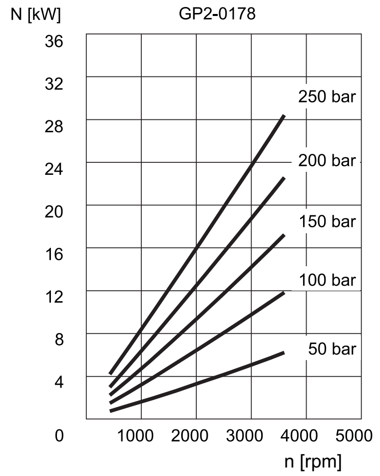


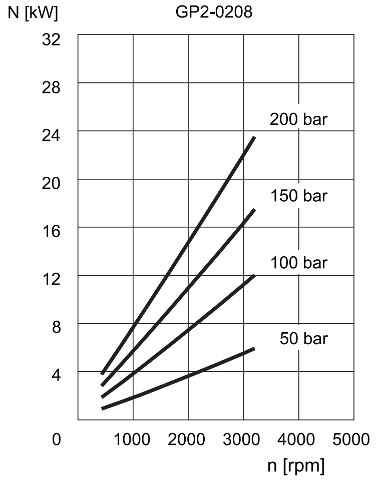


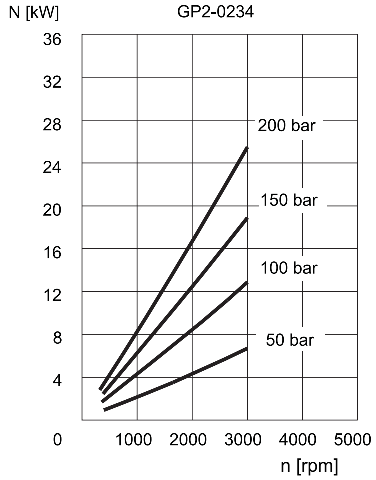


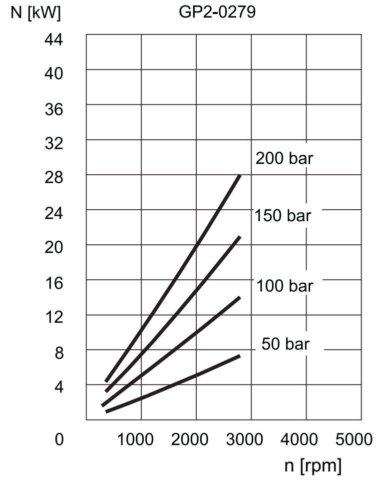








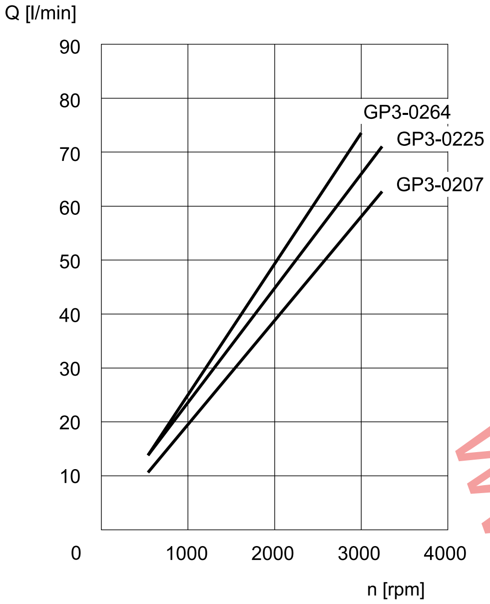


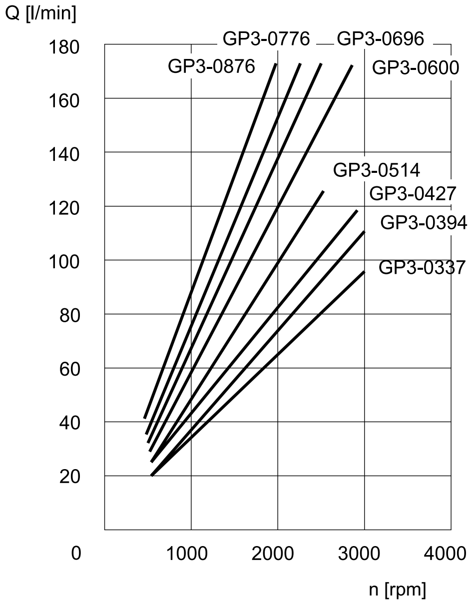


6 - CURVES AND CHARACTERISTIC DATA OF GROUP GP3 PUMPS

(values obtained with mineral oil with viscosity of 36 cSt at 50°C)

6.1 - Flow rate curves Q=f (n) obtained with operating pressure 0 bar





6.2 - Efficiencies

PUMP NOMINAL SIZE	VOLUMETRIC EFFICIENCY [%]	TOTAL EFFICIENCY [%]
0207	0,88	0,83
0225	0,97	0,92
0264	0,90	0,84
0337	0,92	0,87
0394	0,91	0,86
0427	0,92	0,82
0514	0,93	0,83
0600	0,85	0,82
0696	0,95	0,90
0776	0,93	0,87
0876	0,89	0,84

The volumetric and total efficiencies for the various nominal dimensions of the Group GP3 pumps, measured at 1500 rpm and with 150 bar operating pressure, are shown in the table.

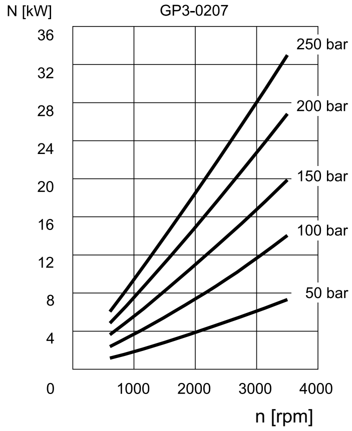
The total efficiency considers the volumetric efficiency and the mechanical efficiency of the pump in the specified operating conditions.

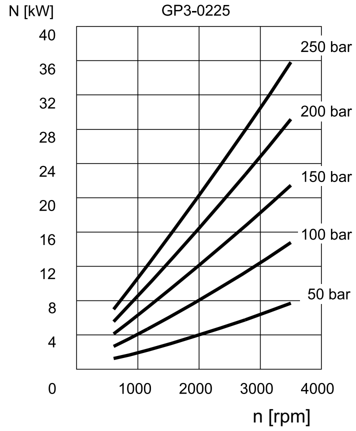
6.3 - Noise level

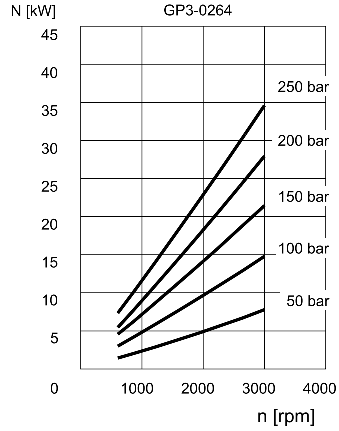
PUMP NOMINAL SIZE	NOISE LEVEL [dB (A)]
0207	75
0225	75
0264	76
0337	72
0394	72
0427	73
0514	75
0600	77
0696	77
0776	76
0876	78

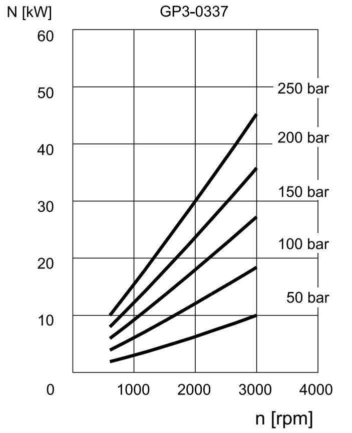
The noise levels for the various nominal dimensions of the Group GP3 pumps, measured at 1500 rpm, with 150 bar operating pressure and measured at a distance of 1 metre from the pump, are shown in the table.

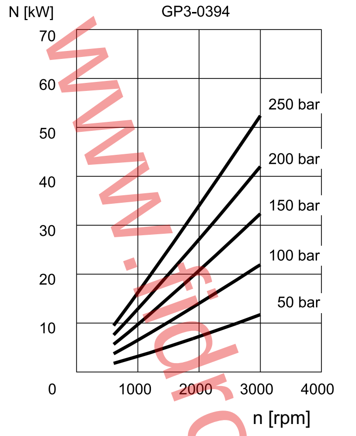
6.4 - Absorbed power curves N=f (n), measured with operating pressures from 50 to 250 bar

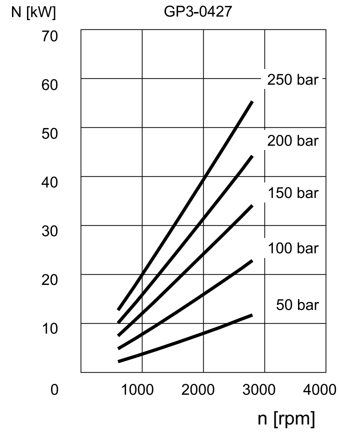


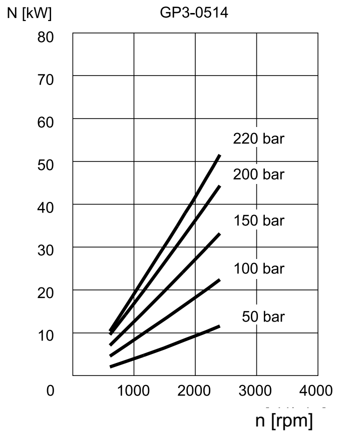


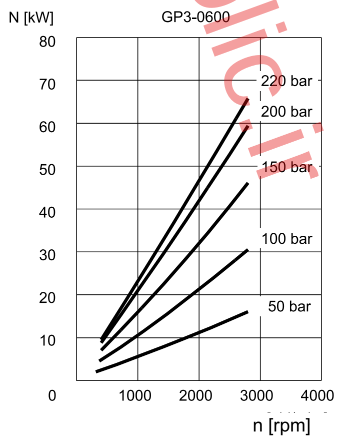


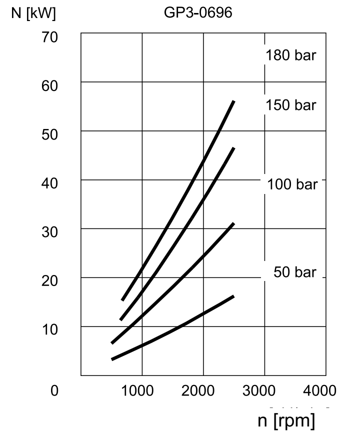


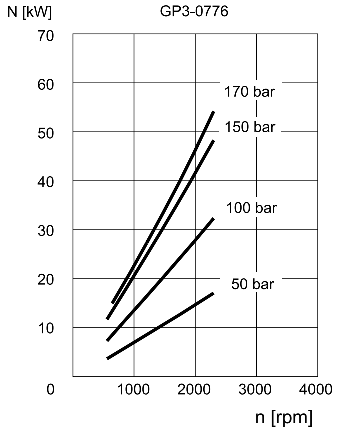


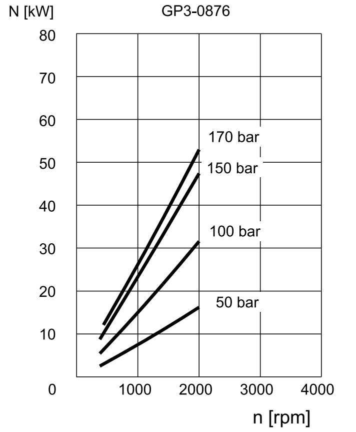






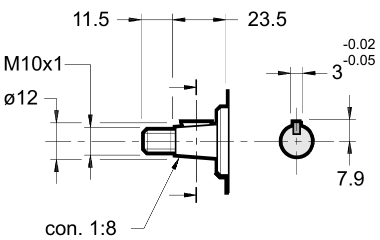




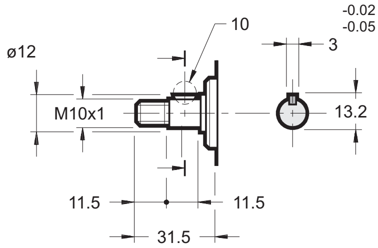


7 - GROUP GP1 PUMPS OVERALL AND MOUNTING DIMENSIONS WITH STANDARD FLANGE

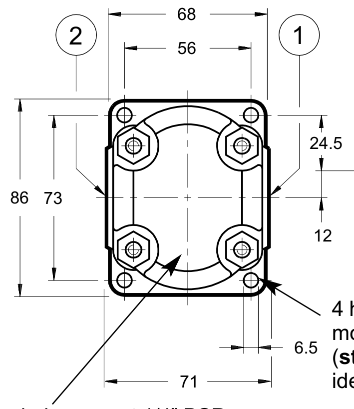
dimensions in mm



tapered shaft end
(standard, identification code **7**)

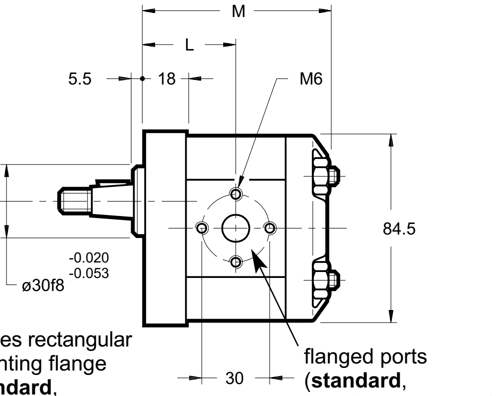


cylindrical with key shaft end
(identification code: **5**)



4 holes rectangular mounting flange (**standard**, identification code **9**)

drainage port 1/4" BSP on reversible pump only



flanged ports (**standard**, identification code **F**)

also available with BSP ports (identification code **B**)

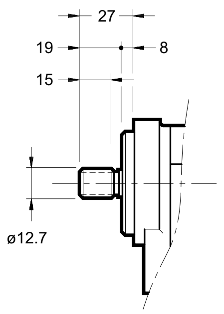
NOTE:
1. On pumps with anticlockwise rotation the ports (1) and (2) are reversed
2. On reversible pumps the delivery port has the same size of the suction

pump nominal dimension	L	M	1 suction port clockwise rotation		2 delivery port clockwise rotation	
			flange	BSP	flange	BSP
0013	40	80,5	Ø13	1/2"	Ø13	3/8"
0020	41	82,5				
0027	42	84,5				
0034	43	86,5				
0041	44	88,5				1/2"
0051	45,5	91,5				
0061	47	94,5				
0074	49	98,5				
0091	51,5	103,5				

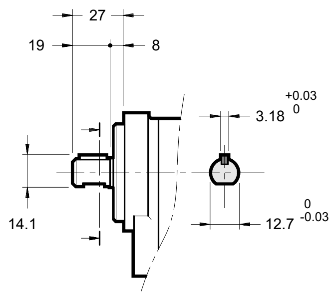
8 - GROUP GP1 PUMPS OVERALL AND MOUNTING DIMENSIONS WITH SAE FLANGE

dimensions in mm

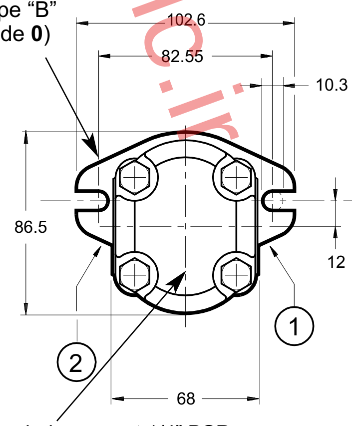
splined shaft end
SAE J744 20/40 d.p. - 9T
(standard, id. code **1**)



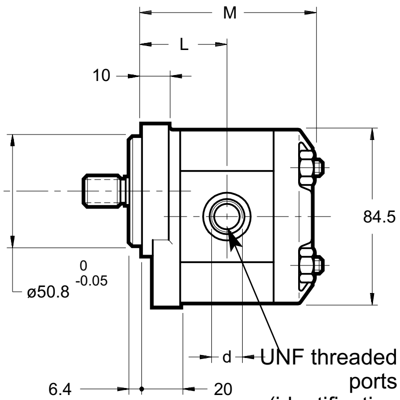
cylindrical shaft end SAE J744
(identification code: **0**)



2 holes SAE J744
flange - type "B"
(identification code **0**)



drainage port 1/4" BSP on reversible pump only



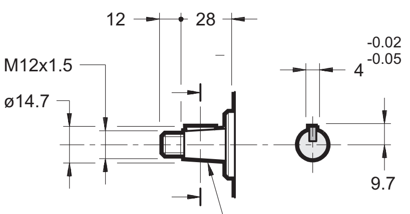
UNF threaded ports
(identification code **U**)

NOTE:
1. On pumps with anticlockwise rotation the ports (1) and (2) are reversed
2. On reversible pumps the delivery port has the same size of the suction

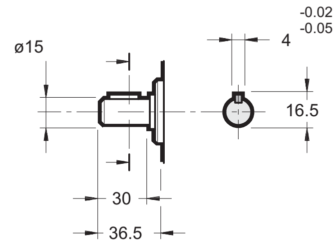
Pump nominal dimension	L	M	1 suction port clockwise rotation		2 delivery port clockwise rotation	
			flange	UNF	flange	UNF
0013	42	82,5	∅ 13	3/4" - 16 UNF	∅ 13	9/16" - 18 UNF
0020	43	84,5				
0027	44	86,5				
0034	45	88,5				
0041	46	90,5				
0051	47,5	93,5				
0061	49	96,5				
0074	51	100,5		7/8" - 14 UNF		3/4" - 16 UNF
0091	53,5	105,5				

9 - GROUP GP2 PUMPS OVERALL AND MOUNTING DIMENSIONS WITH STANDARD FLANGE

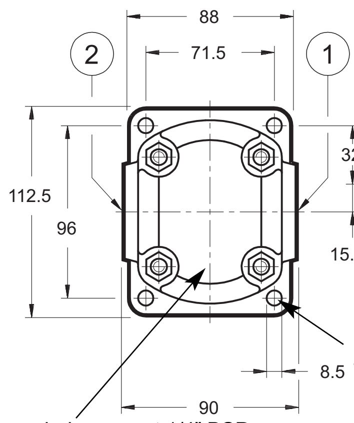
dimensions in mm



tapered shaft end
(standard, id. code **7**)

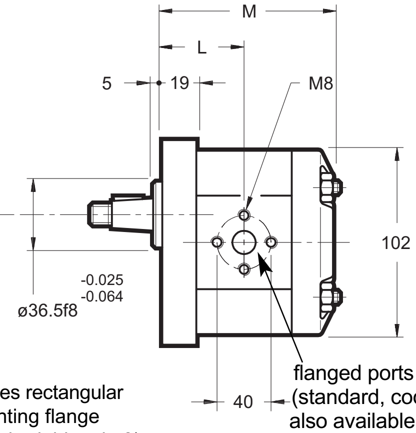


cylindrical with key shaft end
(id code: **5**)



4 holes rectangular mounting flange (standard, id.code **9**)

drainage port 1/4” BSP on reversible pump only



flanged ports (standard, code **F**) also available with BSP ports id.code **B**)

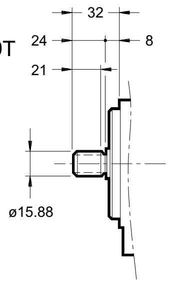
NOTE:
1. On pumps with anticlockwise rotation the ports (1) and (2) are reversed
2. On reversible pumps the delivery port has the same size of the suction

pump nominal dimension	L	M	1 suction port clockwise rotation		2 delivery port clockwise rotation	
			flange	BSP	flange	BSP
0070	47,5	97,5	Ø13	1/2”	Ø13	1/2”
0095	49,5	101,5				
0113	51	104,5	Ø19	3/4”		
0140	53	108,5				
0158	54,5	111,5				
0178	56	114,5				
0218	58,5	119,5			Ø19	
0234	60,5	123,5				
0279	64	130,5				

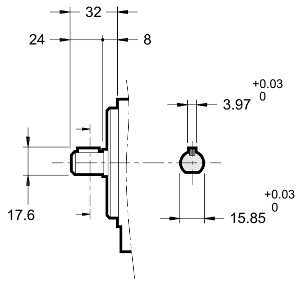
10 - GROUP GP2 PUMPS OVERALL AND MOUNTING DIMENSIONS WITH SAE FLANGE

dimensions in mm

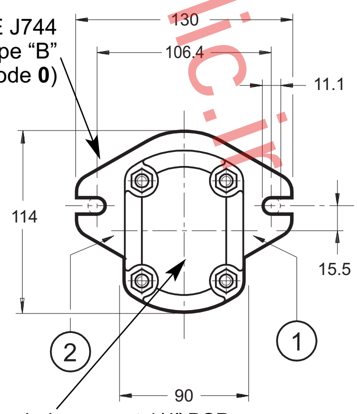
splined shaft end
SAE J744 6/32 d.p. - 9T
(standard, id. code **1**)



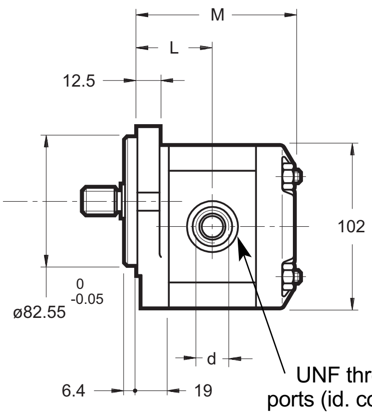
cylindrical shaft end
SAE J744
(id. code: **0**)



2 holes SAE J744 flange - type “B” (id. code **0**)



drainage port 1/4” BSP on reversible pump only



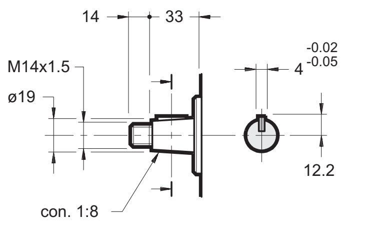
UNF threaded ports (id. code **U**)

NOTE:
1. On pumps with anticlockwise rotation the ports (1) and (2) are reversed
2. On reversible pumps the delivery port has the same size of the suction

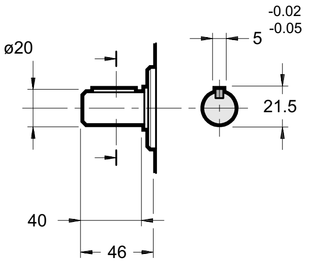
Pump nominal dimension	L	M	1 suction port clockwise rotation		2 delivery port clockwise rotation	
			flange	UNF	flange	UNF
0070	47,5	97,5	∅ 13	11/16” 12 UNF	∅ 13	7/8” 14 UNF
0095	49,5	101,5				
0113	51	104,5	∅ 19			
0140	53	108,5				
0158	54,5	111,5				
0178	56	114,5				
0208	58,5	119,5			∅ 19	
0234	60,5	123,5				
0279	64	130,5				

11 - GROUP GP3 PUMPS OVERALL AND MOUNTING DIMENSIONS WITH STANDARD FLANGE

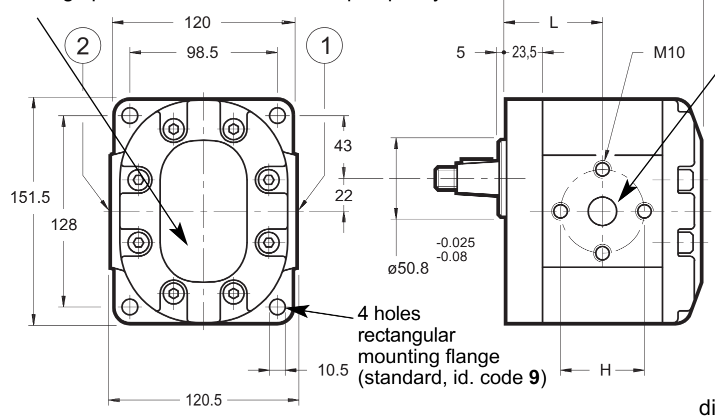
tapered shaft end
(standard, id. code **7**)



cylindrical with key shaft end
(id. code: **5**)



drainage port 3/8" BSP on reversible pump only



flanged ports
(standard,
id. code **F**)

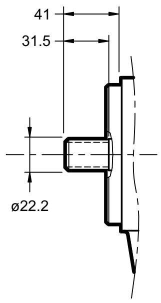
dimensions in mm

<table>
<tr><th rowspan="2">Pump nominal dimension</th><th rowspan="2">L</th><th rowspan="2">M</th><th rowspan="2">H</th><th colspan="2">1suction port clockwise rot.</th><th colspan="2">2 delivery port clockwise rot.</th></tr>
<tr><th>flange</th><th>BSP</th><th>flange</th><th>BSP</th></tr>
<tr><td>0207</td><td>64</td><td>129,5</td><td>56</td><td rowspan="7">∅ 27</td><td rowspan="2">3/4"</td><td rowspan="5">∅ 19</td><td rowspan="5">3/4"</td></tr>
<tr><td>0225</td><td>64,5</td><td>130,5</td><td>56</td></tr>
<tr><td>0264</td><td>66</td><td>133,5</td><td>56</td><td rowspan="3">1"</td></tr>
<tr><td>0337</td><td>68,5</td><td>138,5</td><td>56</td></tr>
<tr><td>0394</td><td>70,5</td><td>142,5</td><td>56</td></tr>
<tr><td>0427</td><td>72</td><td>145,5</td><td>51</td><td rowspan="3">1 1/4"</td><td rowspan="6">∅ 27</td><td rowspan="3">1"</td></tr>
<tr><td>0514</td><td>75</td><td>151,5</td><td>56</td></tr>
<tr><td>0600</td><td>78</td><td>157,5</td><td>62*</td><td rowspan="4">∅ 33</td></tr>
<tr><td>0696</td><td>81,5</td><td>164,5</td><td>62*</td><td rowspan="3">1 1/2"</td><td rowspan="3">1 1/4"</td></tr>
<tr><td>0776</td><td>84</td><td>169,5</td><td>62*</td></tr>
<tr><td>0876</td><td>87</td><td>175,5</td><td>62*</td></tr>
</table>

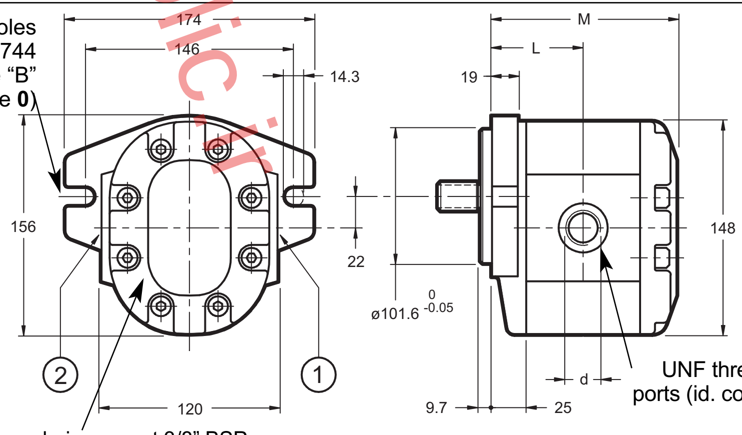
NOTE:
1. On pumps with anticlockwise rotation the ports (1) and (2) are reversed
2. On reversible pumps the delivery port has the same size of the suction
3. On dimension H, the values marked with * refer to the suction port only, whereas the delivery port dimension is 51 mm

12 - GROUP GP3 PUMPS OVERALL AND MOUNTING DIMENSIONS WITH SAE FLANGE

SAE J744 splined shaft end
16/32 d.p. - 13T
(standard, id. code **1**)



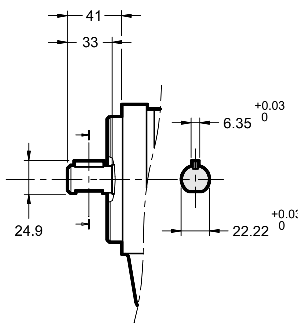
2 holes
SAE J744
flange type "B"
(id.code **0**)



UNF threaded
ports (id. code **U**)

drainage port 3/8" BSP on
reversible pump only

SAE J744 cylindrical shaft end
(id. code: **0**)



dimensions in mm

<table>
<tr><th rowspan="2">Pump nominal dimension</th><th rowspan="2">L</th><th rowspan="2">M</th><th colspan="2">1suction port clockwise rot.</th><th colspan="2">2 delivery port clockwise rot.</th></tr>
<tr><th>flange</th><th>UNF</th><th>flange</th><th>UNF</th></tr>
<tr><td>0207</td><td>65</td><td>130,5</td><td rowspan="7">∅ 27</td><td rowspan="4">15/16"
12 UNF</td><td rowspan="4">∅ 19</td><td rowspan="7">11/16"
12 UNF</td></tr>
<tr><td>0225</td><td>65,5</td><td>131,5</td></tr>
<tr><td>0264</td><td>67</td><td>134,5</td></tr>
<tr><td>0337</td><td>69,5</td><td>139,5</td></tr>
<tr><td>0394</td><td>71,5</td><td>143,5</td><td rowspan="3">15/8"
12 UNF</td><td rowspan="7">∅ 27</td></tr>
<tr><td>0427</td><td>73</td><td>146,5</td></tr>
<tr><td>0514</td><td>76</td><td>152,5</td></tr>
<tr><td>0600</td><td>79</td><td>158,5</td><td rowspan="4">∅ 33</td><td rowspan="4">17/8"
12 UNF</td><td rowspan="4">15/16"
12 UNF</td></tr>
<tr><td>0696</td><td>82,5</td><td>165,5</td></tr>
<tr><td>0776</td><td>85</td><td>170,5</td></tr>
<tr><td>0876</td><td>88</td><td>176,5</td></tr>
</table>

NOTE:
1. On pumps with anticlockwise rotation the ports (1) and (2) are reversed
2. On reversible pumps the delivery port has the same size of the suction

13 - INSTALLATION

– The GP gear pumps can be installed with the shaft oriented in any position.

– Be sure the control rotation direction corresponds to the direction of the arrow marked on the pump before putting the pump into operation.

– Before starting, the pump body has to be filled with the fluid.

– It is necessary to vent the air from the delivery connection before operating it the first time.

– The pump start up, especially at a cold temperature, should occur with the pump unloading.

– The suction line must be suitably sized to facility the flow of the oil. Bends and restrictions or an excessive line length can impede correct operation of the pump. It is advisable that the speed of 1 ÷ 2 m/sec is not exceeded in the suction line.

– The minimum suction pressure allowed is -0,3 bar relative. The pumps can not function with suction pressure.

– The gear pumps must not operate with a rotation rating of less than the minimum rotation speed (see table 3 - performance ratings). They must be filled with the same plant operation oil before installation. Filling is done through the connection lines. If necessary, rotate the pump manually.

– The motor-pump connection must be carried out directly with a flexible coupling able to compensate any offsets. Couplings that generate axial or radial loads on the pump shaft are not allowed.

14 - MULTIPLE PUMPS

The possibility to couple several pumps makes it possible to create multi-flow groups with independent hydraulic circuits.

While sizing coupled pumps, it is necessary to make reference to the following conditions:

- The coupling can be carried out between pumps with the same dimensions or to a size of decreasing order.
- The max. rotation speed is determined by the pump with the lowest speed.
- The values of the max. applicable torque can not be exceeded.

14.1 - Maximum applicable torque

The input torque (M) for each pump is given by the following ratio:

$$M = \frac{9550 \cdot N}{n} = [Nm]$$

where the absorbed power (N) is given by:

$$N = \frac{Q \cdot \Delta p}{600 \cdot \eta\ tot} = [kW]$$

n = rotation speed [rpm]

Q = flow rate [l/min]

Δp = differential pressure between the pump suction and delivery [bar]

η_{tot} = total efficiency (see diagrams in par. 4.2 - 5.2 - 6.2).

or it can be obtained from the diagrams ABSORBED POWER (see paragraphs 4.4 - 5.4 - 6.4).

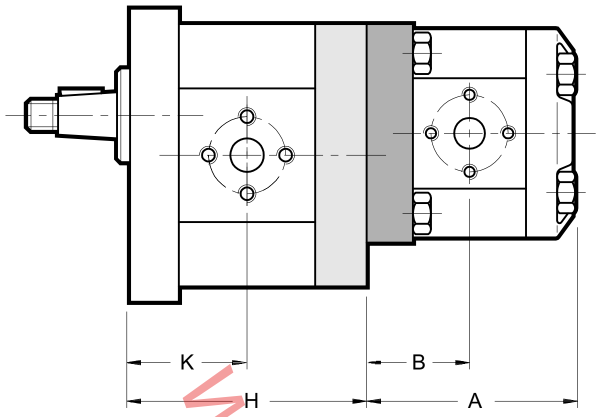
If several pumps are coupled, the torque of each single pump has to be added to the torque of subsequent pumps when they are loaded simultaneously.

The obtained torque value for each pump has to be lower than the value specified in the table below.

If the obtained torque values are higher than the ones stated in the table, it is necessary to reduce the working pressure value or to replace the overloaded pump with a pump suitable to bear the required torque.

<table>
<tr><th rowspan="3">FRONT PUMP SIZE</th><th colspan="3">MAX TORQUE APPLICABLE TO THE SHAFT OF THE FRONT PUMP [Nm]</th><th colspan="3">MAX APPLICABLE TORQUE [Nm] (not simultaneously to the front pump)</th></tr>
<tr><td rowspan="2">tapered shaft with key code 7</td><td rowspan="2">SAE J744 splined shaft code 1</td><td rowspan="2">SAE J744 cylindrical shaft cod. 0</td><td colspan="3">PUMP TO BE MATED</td></tr>
<tr><td>GP1</td><td>GP2</td><td>GP3</td></tr>
<tr><td>GP1</td><td>100</td><td>100</td><td>60</td><td rowspan="3">50</td><td>-</td><td rowspan="2">-</td></tr>
<tr><td>GP2</td><td>200</td><td>185</td><td>140</td><td rowspan="2">100</td></tr>
<tr><td>GP3</td><td>300</td><td>600</td><td>450</td><td>220</td></tr>
</table>

15 - MULTIPLE PUMPS OVERALL DIMENSIONS



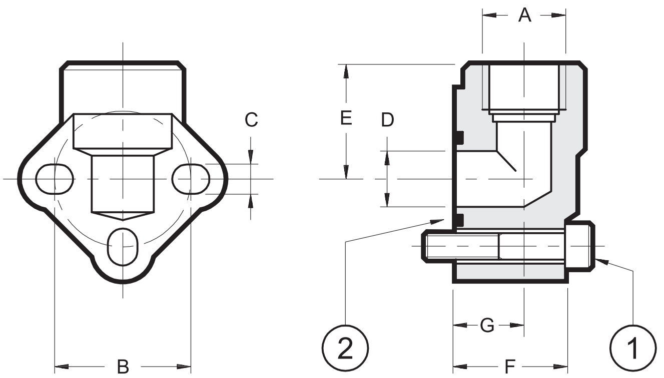
dimensions in mm

PUMP SIZE	NOMINAL SIZE	FRONT PUMP		REAR PUMP	
		H	K	A	B
GP1	0013	86	40	86,5	46
	0020	88	41	88,5	47
	0027	90	42	90,5	48
	0034	92	43	92,5	49
	0041	94	44	94,5	50
	0051	97	45,5	97,5	51,5
	0061	100	47	100,5	53
	0074	104	49	104,5	55
	0091	109	51,5	109,5	57,5
GP2	0070	101	47,5	103,5	53,5
	0095	105	49,5	107,5	55,5
	0113	108	51	110,5	57
	0140	112	53	114,5	59
	0158	115	54,5	117,5	60,5
	0178	118	56	120,5	62
	0208	123	58,5	125,5	64,5
	0234	127	60,5	129,5	66,5
	0279	134	64	136,5	70
GP3	0207	135,5	64	137	71,5
	0225	136,5	64,5	138	72
	0264	139,5	66	141	73,5
	0337	144,5	68,5	146	76
	0394	148,5	70,5	150	78
	0427	151,5	72	153	79,5
	0514	157,5	75	159	82,5
	0600	163,5	78	165	85,5
	0696	170,5	81,5	172	89
	0776	175,5	84	177	91,5
	0876	181,5	87	183	94,5

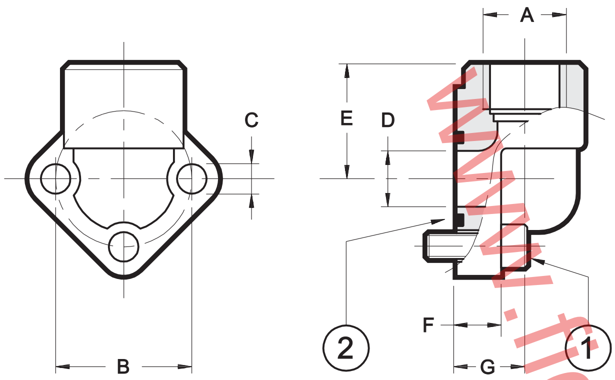
NOTE: For the dimensions of groups composed of three or more pumps, please consult our Technical Dept.

16 - CONNECTION FLANGES

dimensions in mm



ALUMINIUM FLANGES
TYPE **RP**



STEEL FLANGES
TYPE **RPA**

Fastening bolt and O-rings included

ALUMINIUM FLANGES TYPE RP

	Flange code	Flange description	p_{max} [bar]	ØA	B	C	ØD	E	F	G	(1) SHC bolts	(2) seals
GP1	0610506	RP1 - 38	180	3/8" BSP	30	6,5	12,5	30	26	18	n°3 - M6x35	OR 121 (15.88x2.62)
	0610248	RP1 - 12		1/2" BSP	30	6,5	12,5	30	26	18		
GP2	0610508	RP2 - 12		1/2" BSP	40	8,5	18,5	40	31	20	n°3 - M8x45	OR 130 (22.22x2.62)
	0610249	RP2 - 34		3/4" BSP	40	8,5	18,5	40	31	20		
GP3	0610717	RP3 - 34		3/4" BSP	51	10,5	25	46	43	26	n°3 - M10x60	OR 4118 (29.75x3.53)
	0610250	RP3 - 100		1" BSP	56	10,5	25	46	43	26		

STEEL FLANGES TYPE RPA

	Flange code	Flange description	p_{max} [bar]	ØA	B	C	ØD	E	F	G	(1) SHC bolts	(2) seals
GP1	0771048	RPA1 - 38	315	3/8" BSP	30	6,5	12	24	17	9,5	n°3 - M6x20	OR 121 (15.88x2.62)
	0771049	RPA1 - 12		1/2" BSP	30	6,5	12	24	17	9,5		
GP2	0771050	RPA2 - 12		1/2" BSP	40	8,5	20	36	22	11,5	n°3 - M8x25	OR 132 (23.81x2.62)
	0770615	RPA2 - 34		3/4" BSP	40	8,5	20	36	22	11,5		
GP3	0771051	RPA3 - 34A		3/4" BSP	51	10,5	24	46	26	13	n°3 - M10x30	OR 3125 (31.42x2.62)
	0770617	RPA3 - 100A		1" BSP	51	10,5	24	46	26	13		
	0770618	RPA3 - 34B		3/4" BSP	56	10,5	24	46	26	13		
	0770619	RPA3 - 100B		1" BSP	56	10,5	24	46	26	13		
	0771052	RPA35 - 114A		1" ¼ BSP	62	13	31	55	35	17	n°3 - M10x35	

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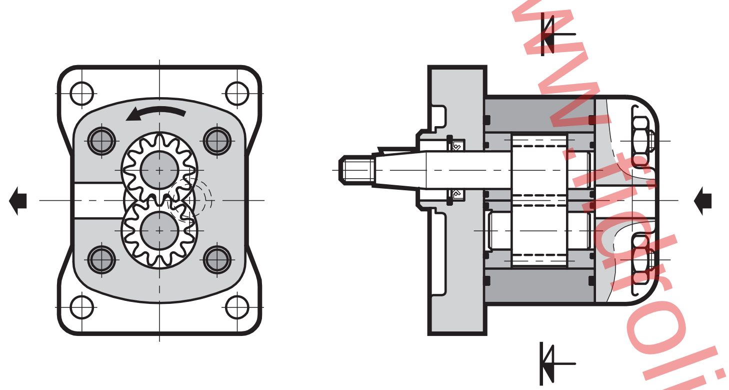
1P
EXTERNAL GEAR PUMPS
SERIES 11

OPERATING PRINCIPLE



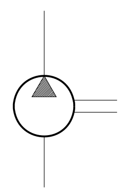
- The 1P pumps are fixed displacement external gear pumps with axial clearance compensation.
- They give high volumetric flows even with high operating pressures, a low noise level, and they have a high endurance thanks to the balancing system of the loads on the guide bushings.
- They are available with displacements going from 1,1 to 8,0 cm³/rev and with operating pressures of up to 230 bar.
- They are available with clockwise rotation direction and with tapered shaft.
- The hydraulic connection is with BSP threaded ports type.

TECHNICAL SPECIFICATIONS

PUMP SIZE		**1P**
Displacement range	cm³/rev	1,1 ÷ 8,0
Flow rate and operating pressures		see table 3 - Performances
Rotation speed		see table 3 - Performances
Rotation direction		clockwise (seen from the shaft side)
Loads on the shaft		radial and axial load are not allowed
Hydraulic connection		threaded ports BSP
Type of mounting		4 hole flange - rectangular type
Mass	kg	approx. 1,6

Ambient temperature range	°C	–20 / +50
Fluid temperature range	°C	–15 / +80
Fluid viscosity range	see par. 2.2	
Recommended viscosity	cSt	25 ÷ 100
Degree of fluid contamination	see par. 2.3	

HYDRAULIC SYMBOL



1 - CODIFICATION

1	P	-		R	/	11	N

- **1P** – External gear pump with 4 hole rectangular flange and BSP threaded ports
- **(blank box)** – Nominal size (flow rate in l/min a 1450 rev/min) see table 3 - performances
- **R** – Clockwise rotation and tapered shaft with key
- **11** – Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)
- **N** – Seals: **N** = NBR seals for mineral oils

2 - HYDRAULIC FLUID

2.1 Type of fluid

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives, in conformity with the requisites of the following standards:
- FZG test - 11th stage - DIN 51525 - VDMA 24317

For use with other types of fluid (water glycol, phosphate esters and others), consult our technical dept.

Operation with fluid at a temperature greater than 80°C causes a premature deterioration of the fluid quality and of the seals. The physical and chemical properties of the fluid must be maintained.

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	12 cSt	referred to the maximum fluid temperature of 80 °C
optimum viscosity	25 ÷ 100 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	1600 cSt	limited to only the start-up phase of the pump

2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with β_{20} ≥75 is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with β_{10} ≥100 is recommended.

If there is a filter installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in paragraph 6.

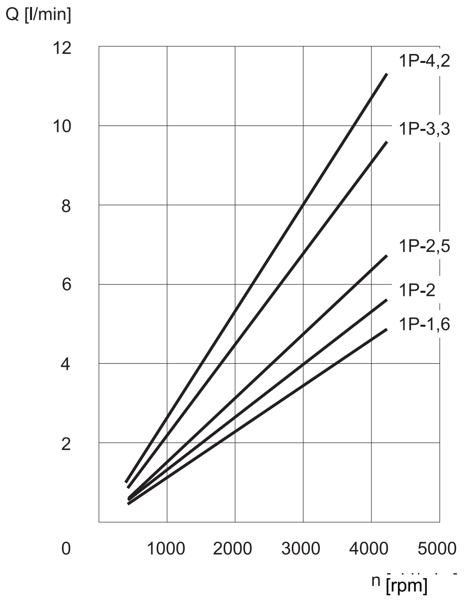
The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

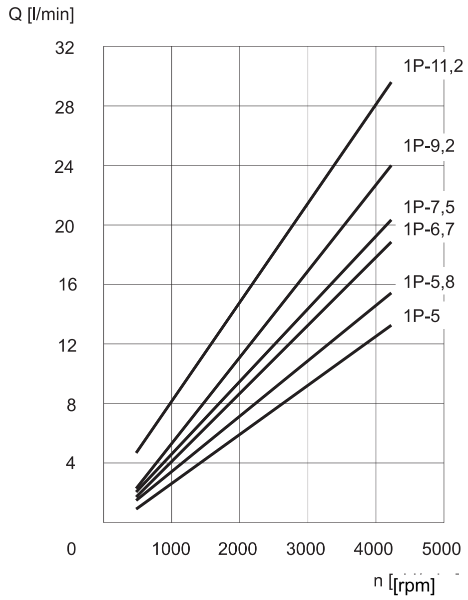
3 - PERFORMANCES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

<table>
<tr><th>PUMP SIZE</th><th>NOMINAL SIZE</th><th>DISPLACEMENT [cm³/rev]</th><th>MAX. FLOW RATE (at 1500 rpm) [l/min.]</th><th>MAX. OPERATING PRESSURE (ar 1500 rpm) [bar]</th><th>MAX. PEAK PRESSURE (at 1500 rpm.) [bar]</th><th>MAX.ROTATION SPEED [rpm]</th><th>MIN.ROTATION SPEED [rpm]</th></tr>
<tr><td rowspan="11">1P</td><td>1,6</td><td>1,1</td><td>1,6</td><td rowspan="5">230</td><td rowspan="5">270</td><td rowspan="5">6000</td><td rowspan="4">1000</td></tr>
<tr><td>2</td><td>1,3</td><td>2,0</td></tr>
<tr><td>2,5</td><td>1,6</td><td>2,4</td></tr>
<tr><td>3,3</td><td>2,1</td><td>3,2</td></tr>
<tr><td>4,2</td><td>2,7</td><td>4,0</td><td rowspan="4">800</td></tr>
<tr><td>5</td><td>3,2</td><td>4,8</td><td rowspan="3">210</td><td rowspan="3">250</td><td>5000</td></tr>
<tr><td>5,8</td><td>3,7</td><td>5,6</td><td>4500</td></tr>
<tr><td>6,7</td><td>4,2</td><td>6,4</td><td>4000</td></tr>
<tr><td>7,5</td><td>4,8</td><td>7,2</td><td rowspan="2">190</td><td rowspan="2">230</td><td>3500</td><td rowspan="3">600</td></tr>
<tr><td>9,2</td><td>5,8</td><td>8,7</td><td>3000</td></tr>
<tr><td>11,5</td><td>8,0</td><td>11,9</td><td>160</td><td>200</td><td>2100</td></tr>
</table>

4 - CURVES AND CHARACTERISTIC DATA OF GROUP 1P PUMPS (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

4.1 - Flow rate curves Q=f (n) obtained with operating pressure 0 bar





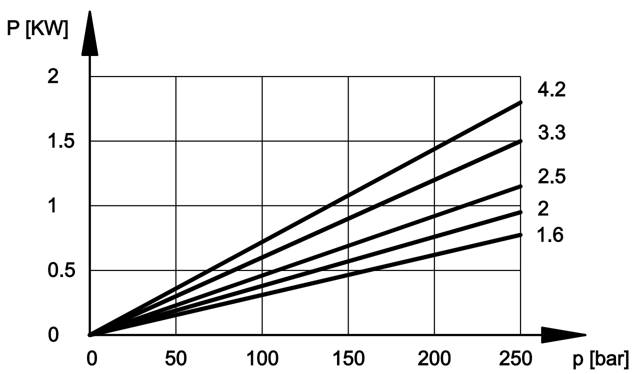
4.2 - Efficiencies

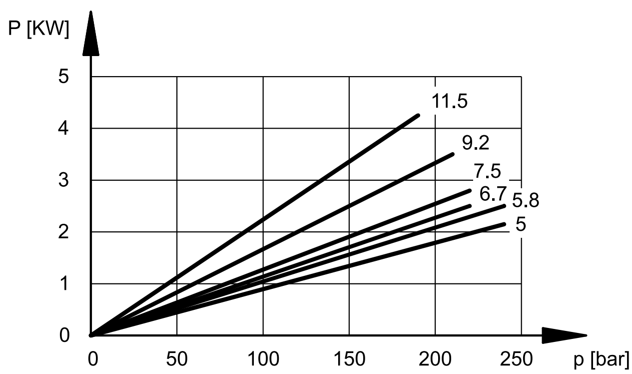
PUMP NOMINAL SIZE	VOLUMETRIC EFFICIENCY [%]	TOTAL EFFICIENCY [%]
1,6	0,96	0,85
2	0,94	0,87
2,5	0,94	0,87
3,3	0,96	0,90
4,2	0,96	0,90
5	0,96	0,90
5,8	0,96	0,89
6,7	0,97	0,92
7,5	0,97	0,93
9,2	0,95	0,89
11,5	0,94	0,89

4.3 - Noise level (at 1500 rpm)

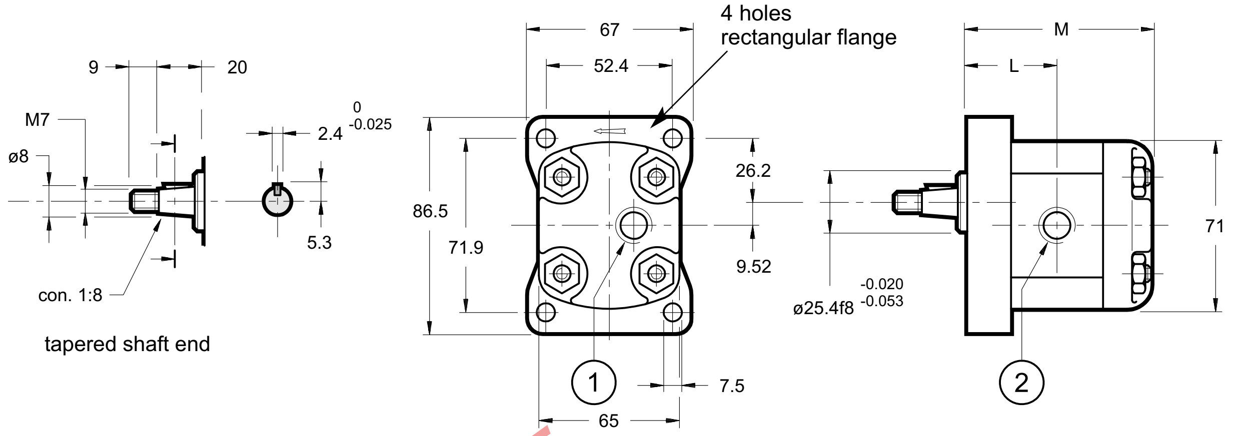
PUMP NOMINAL SIZE	NOISE LEVEL [dB (A)]
1,6	55
2	58
2,5	58
3,3	60
4,2	65
5	66
5,8	66
6,7	68
7,5	72
9,2	72
11,5	74

4.4 - Absorbed power / pressure (at 1500 rpm)





5 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

Pump code	Pump nominal dimension	L	M	1	2
0710842	1P-1,6	34	75	suction port: 3/8” BSP clockwise rotation direction	delivery port: 3/8” BSP clockwise rotation direction
0710843	1P-2	34,5	76		
0710844	1P-2,5	35	77		
0710845	1P-3,3	36	79		
0710846	1P-4,2	37	81		
0710847	1P-5	38	83		
0710848	1P-5,8	39	85		
0710849	1P-6,7	40	87		
0710850	1P-7,5	41	89		
0710851	1P-9,2	43	93		
0710852	1P-11,5	47	101		

6 - INSTALLATION

– The 1P gear pumps can be installed with the shaft oriented in any position.
– Be sure the control rotation direction corresponds to the direction of the arrow marked on the pump before putting the pump into operation.
– It is necessary to vent the air from the delivery connection before operating it the first time.
– The pump start up, especially at a cold temperature, should occur with the pump unloading.
– The suction line must be suitably sized to facility the flow of the oil. Bends and restrictions or an excessive line length can impede correct operation of the pump. It is advisable that the speed of 1 ÷ 2 m/sec is not exceeded in the suction line.
– The minimum suction pressure allowed is -0,3 bar relative. The pumps can not function with suction pressure.
– The gear pumps must not operate with a rotation rating of less than the minimum rotation speed (see table 3 - performances). They must be filled with the same plant operation oil before installation. Filling is done through the connection lines. If necessary, rotate the pump manually.
– The motor-pump connection must be carried out directly with a flexible coupling able to compensate any offsets. Couplings that generate axial or radial loads on the pump shaft are not allowed.

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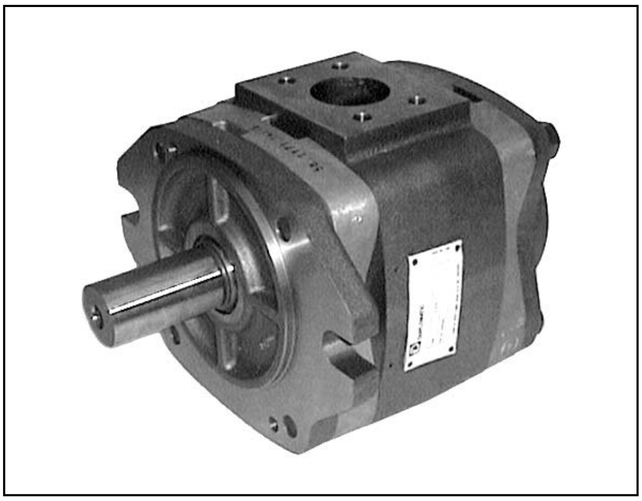
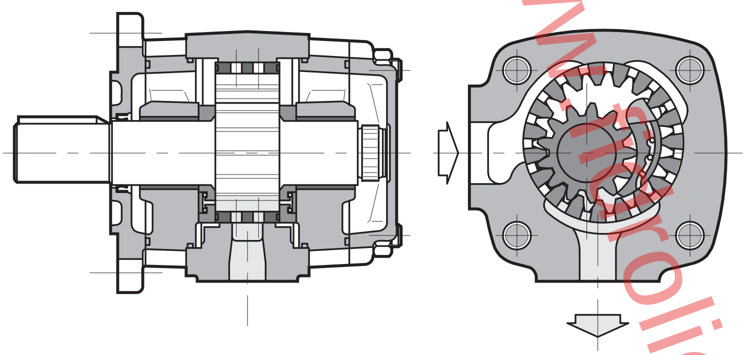


IGP
INTERNAL GEAR PUMPS
SERIES 10

OPERATING PRINCIPLE



— IGP pumps are volumetric displacement pumps with internal gears, available in five sizes, each divided into a range of different displacement.

— The pumps feature high volumetric performance levels, thanks to both radial and axial compensation in proportion to operating pressure, in addition to low noise levels.

— Optimal load distribution and special friction bearings enable continuous duty at high pressures and ensure extended pump lifetime.

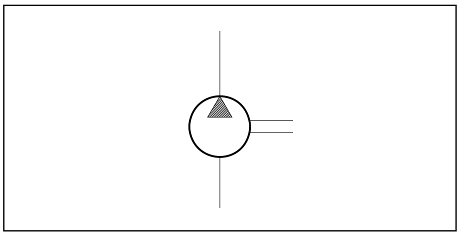
— IGP pumps are also available in multiple versions which can be combined to make multi-flow groups.

TECHNICAL SPECIFICATIONS

IGP PUMP SIZE		3	4	5	6	7
Displacement range	cm³/rev	3,6 ÷ 10,2	13,3 ÷ 32,6	33,1 ÷ 64,9	64,1 ÷ 126,2	125,8 ÷ 251,7
Flow rate range (at 1.500 rpm)	l/min.	5,4 ÷ 15,3	19,9 ÷ 48,9	49,6 ÷ 97,3	96,1 ÷ 189,3	188,7 ÷ 377,5
Operating pressures		see table 3 - performances				
Rotation speed		see table 3 - performances				
Rotation direction		clockwise or anticlockwise (seen from the shaft side)				
Loads on the shaft		consult our technical department for the extent of axial and radial loads				
Hydraulic connection		flanged fittings SAE J518 c code 61 (see par. 28)				
Type of fastening		flanged SAE J744 c				
Mass (single pump)	kg	4 ÷ 4,8	8,6 ÷ 11	15,5 ÷ 18,7	29,2 ÷ 35	46,5 ÷ 59

Ambient temperature range	°C	–10 / +60
Fluid temperature range	°C	–10 / +80
Fluid viscosity range	see par. 2.2	
Recommended true viscosity	cSt	25 ÷ 100
Degree of fluid contamination	see par. 2.3	

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

I	G	P			-		/		-				/	10

Internal gear pump

Pump size:
- single pump
- front pump (only for double pumps):

3 = from 3,6 to 10,2 cm^3/rev
4 = from 13,3 to 32,6 cm^3/rev
5 = from 33,1 to 64,9 cm^3/rev
6 = from 64,1 to 126,2 cm^3/rev
7 = from 125,8 to 251,7 cm^3/rev

Added pump size
(only for double pumps):

3 = from 3,6 to 10,2 cm^3/rev
4 = from 13,3 to 32,6 cm^3/rev
5 = from 33,1 to 64,9 cm^3/rev
6 = from 64,1 to 126,2 cm^3/rev
7 = from 125,8 to 251,7 cm^3/rev

Size:
- single pump
- front pump (only for double pumps)
(see performances table, par. 3)

Added pump size:
(only for double pumps)
(see performances table, par. 3)

Rotation direction (seen from the shaft side)
R = clockwise **L** = anticlockwise

Mounting flange
0 =type SAE - 2
1 =type SAE - 4 (only for IGP7)
other flange types are available upon request

Type of shaft end
1 = with key
other types of shafts are available upon request

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

2 - HYDRAULIC FLUID

2.1 - Fluid type

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives.
For use with other types of fluid, keep in mind the limitations shown in the following table or consult our technical department for authorization of use.

FLUID TYPE	NOTES
HFC (water glycol solution with proportion of water ≤ 40 %)	- The performances shown in the table in par. 3 must be reduced of 20%. - The maximum speed of the fluid in the suction line must not exceed 1 m/s. - The suction pressure must not be less than 0,8 bar absolute. - The maximum fluid temperature must be less than 50°C.
HFD (phosphate esters)	Operation with this type of fluid is not allowed.

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to the maximum fluid temperature of 80 °C
optimum viscosity	25 ÷ 100 cSt	referred to the fluid working temperature in the tank
maximum viscosity	2000 cSt	limited to only the start-up phase of the pump

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with β_{20} ≥75 is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with β_{10} ≥100 is recommended.

If there is a filter installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in paragraph 3. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

3 - PERFORMANCES (obtained with mineral oil with viscosity in the range of 25 ÷ 100 cSt)

PUMP SIZE	NOMINAL DIMENSION	DISPLACEMENT [cm³/rev] (note 2)	MAX. FLOW RATE (at 1500 rpm) [l/min.]	PRESSURE [bar] (note 3) steady	PRESSURE [bar] (note 3) peak	MAX. ROTATION SPEED [rpm]	MIN. ROTATION SPEED [rpm] (note 4)
IGP3	003	3,6	5,4	330	345	3600	400
	005	5,2	7,8				
	006	6,4	9,6				
	008	8,2	12,3				
	010	10,2	15,3				
IGP4	013	13,3	19,9	330	345	3600	400
	016	15,8	23,7			3400	
	020	20,7	31,0			3200	
	025	25,4	38,1	300	330	3000	
	032	32,6	48,9	250	280	2800	
IGP5	032	33,1	49,6	315	345	3000	400
	040	41	61,5			2800	
	050	50,3	75,4	280	315	2500	
	064	64,9	97,3	230	250	2200	
IGP6	064	64,1	96,1	300	330	2600	400
	080	80,7	121,0	280	315	2400	
	100	101,3	151,9	250	300	2100	
	125	126,2	189,3	210	250	1800	
IGP7	125	125,8	188,7	300	330	2200	400
	160	160,8	241,2	280	315	2000	
	200	202,7	304,0	250	300	1800	
	250	251,7	377,5	210	250		

Note 1) In continuous operating conditions, the maximum suction pressure is 2 bar while the minimum pressure must not be less than -0,2 bar. A minimum suction pressure of - 0,4 bar is allowed for brief periods of time (the pressure values are to be considered relative).

Note 2) The working tolerances can reduce the displacement by 1,5% max. The flow rate at 1500 rpm shown in the table considers operation with pressure of 10 bar.

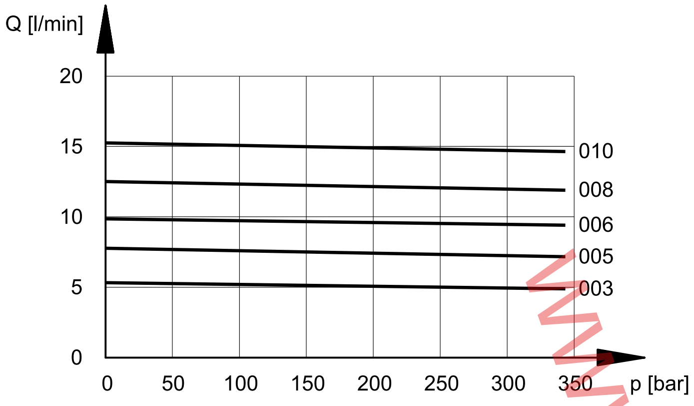
Note 3) The steady and peak pressures shown above are valid in the speed range of 400-1500 rpm.
For speeds greater than 1500 rpm, the extent of the peak pressure must be reduced.

Note 4) For use at variable speed in the range less than 400 rpm or greater than 1500 rpm, there are limitations of the allowable pressures. Contact our technical department for applications outside this range.

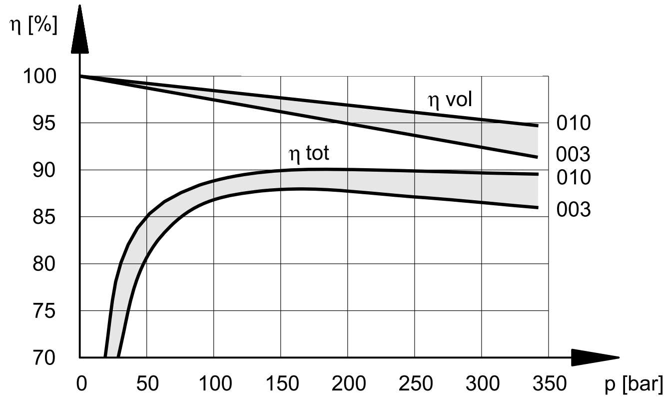
4- IGP3 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

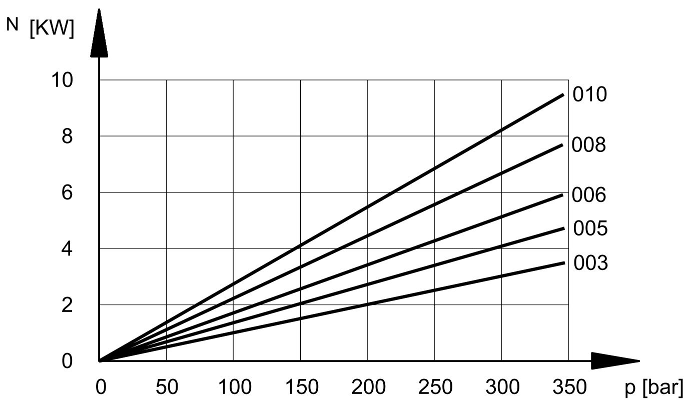
FLOW RATE/PRESSURE CURVES



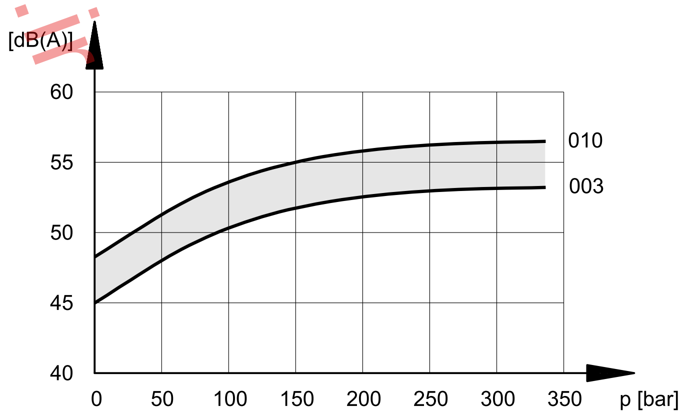
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

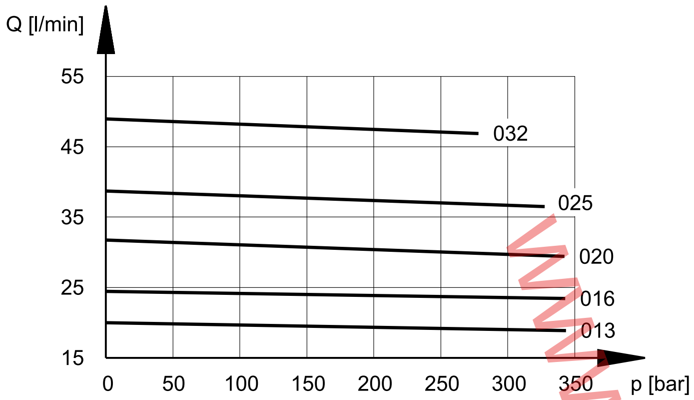


The noise pressure levels were measured in a semi-anecoic room, at an axial distance of 1 m from the pump.
The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anecoic room.

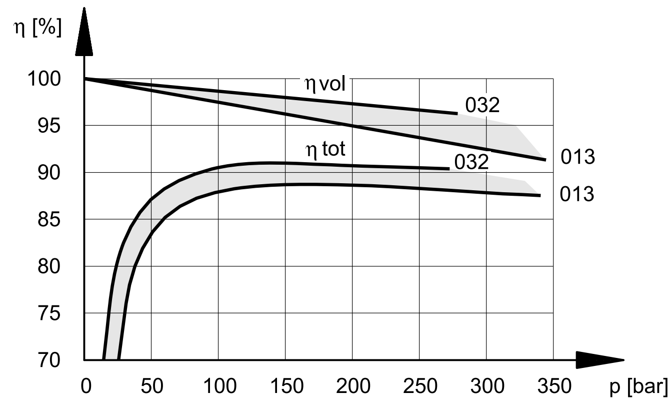
5- IGP4 PUMP CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

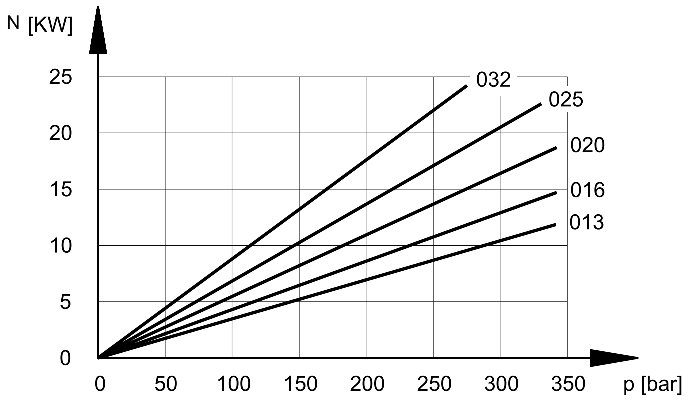
FLOW RATE/PRESSURE CURVES



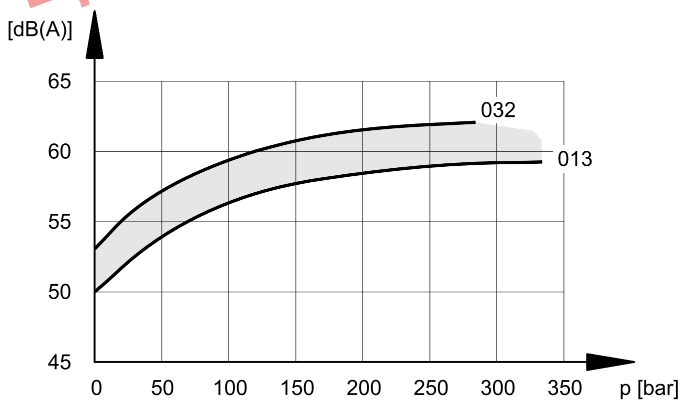
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

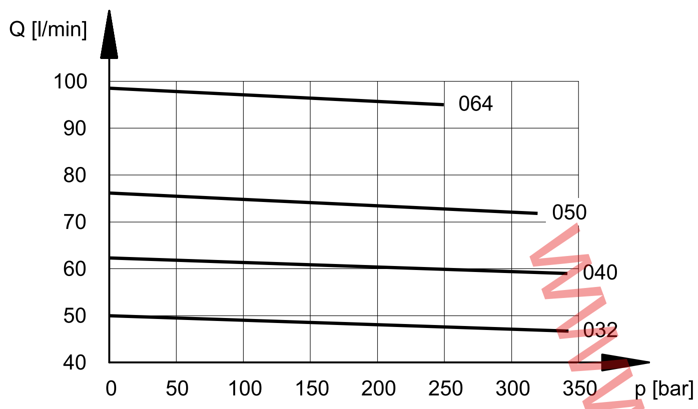


The noise pressure levels were measured in a semi-anecoic room, at an axial distance of 1 m from the pump.
The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anecoic room.

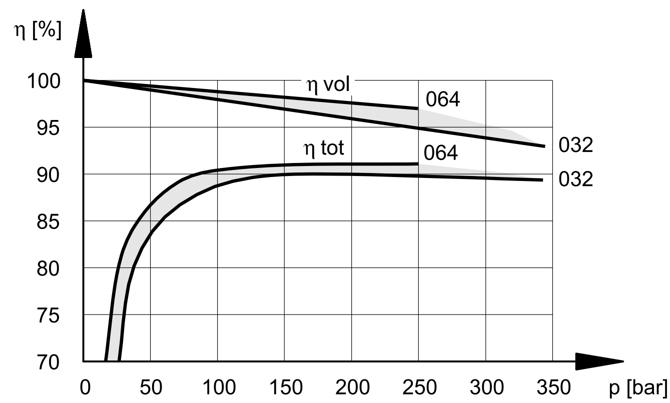
6- IGP5 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

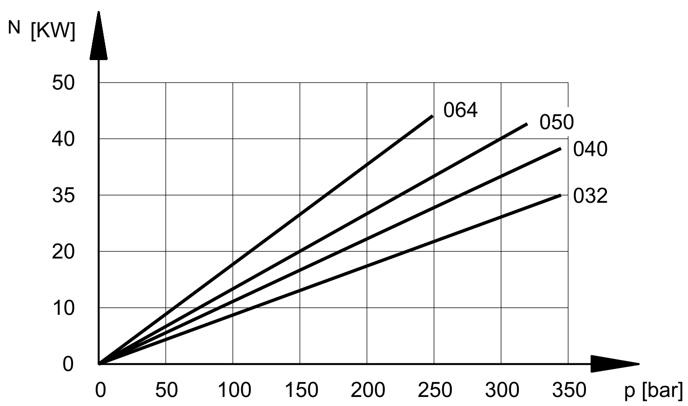
FLOW RATE/PRESSURE CURVES



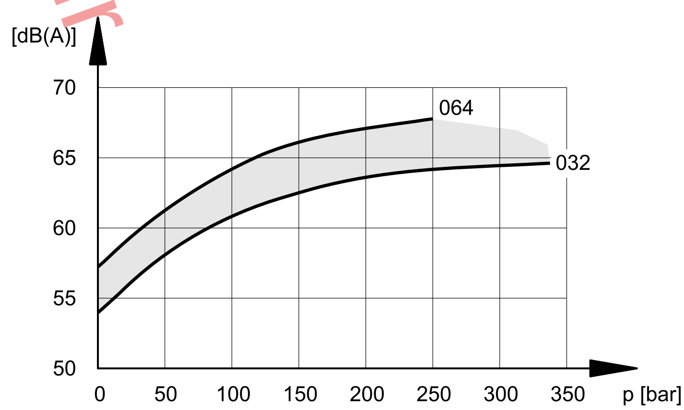
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

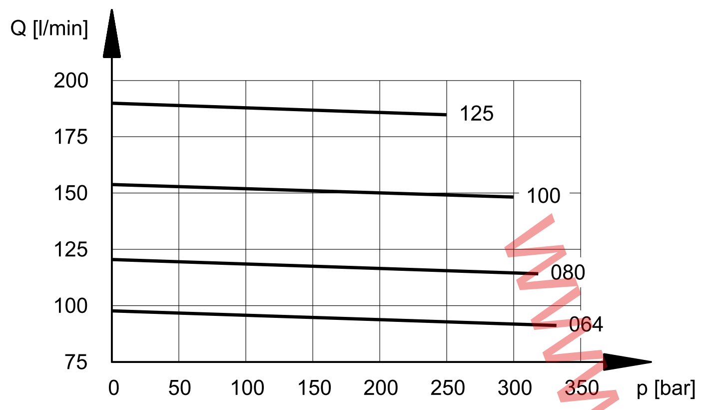


The noise pressure levels were measured in a semi-anecoic room, at an axial distance of 1 m from the pump.
The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anecoic room.

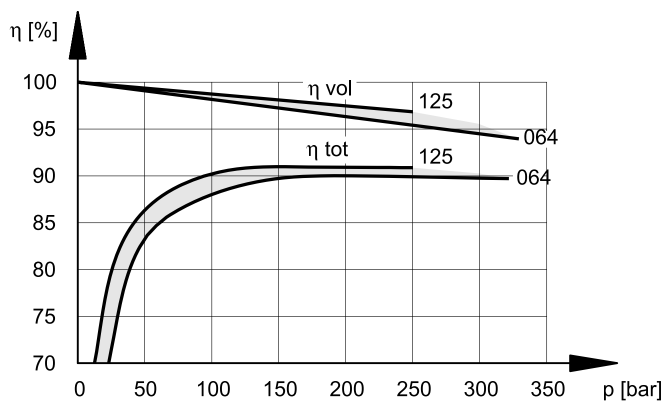
7- IGP6 PUMP CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

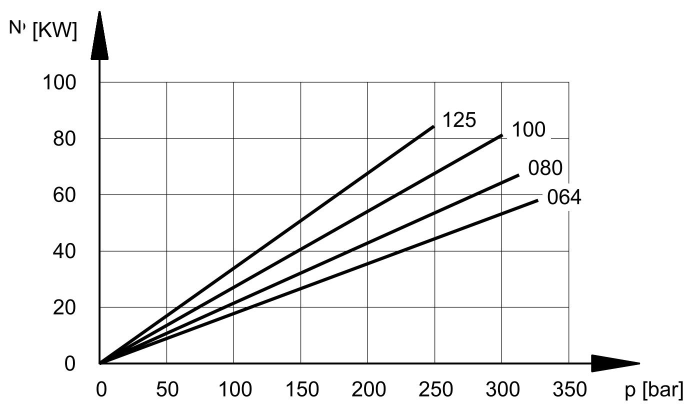
FLOW RATE/PRESSURE CURVES



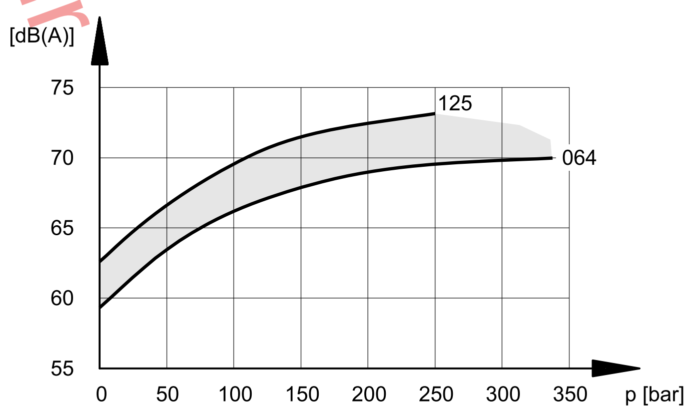
VOLUMETRIC AND TOTAL EFFICIENCIES



ABSORBED POWER



NOISE LEVEL

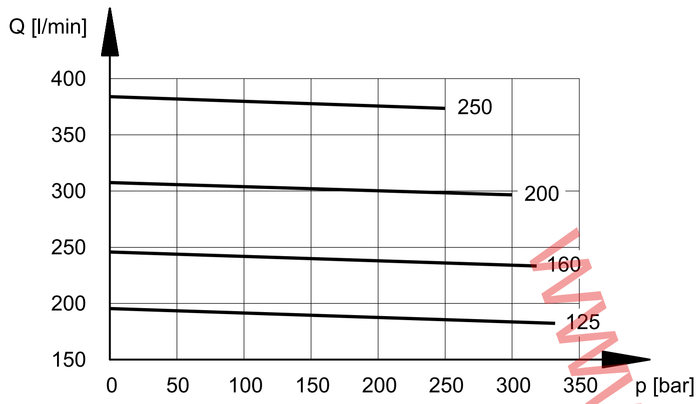


The noise pressure levels were measured in a semi-anecoic room, at an axial distance of 1 m from the pump.
The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anecoic room.

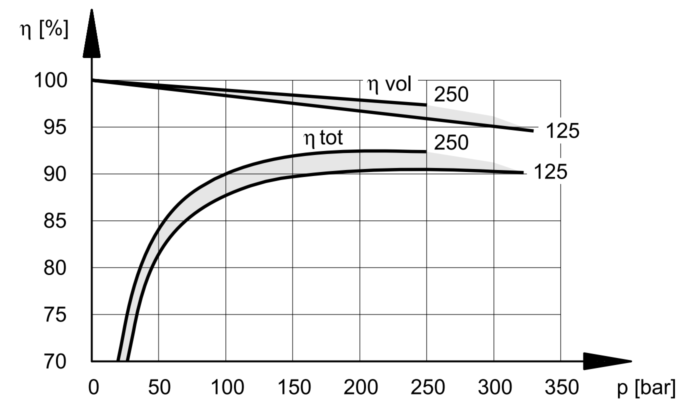
8- IGP7 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 46 cSt at 40°C)

The data shown in the diagrams were noted with pump rotation speed = 1500 rpm.

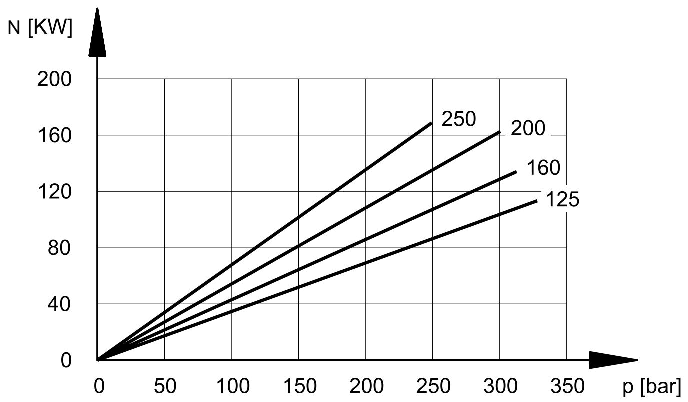
FLOW RATE/PRESSURE CURVES



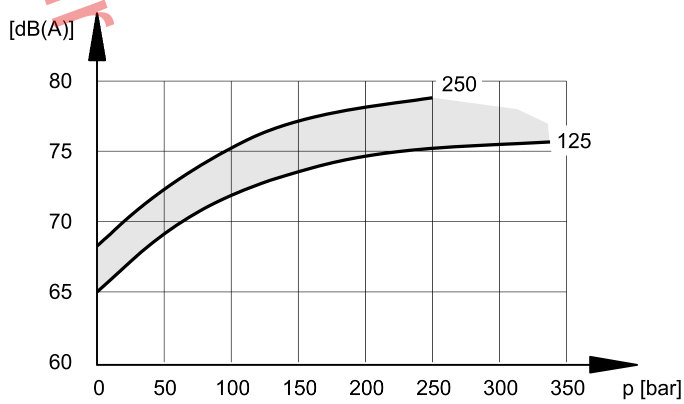
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



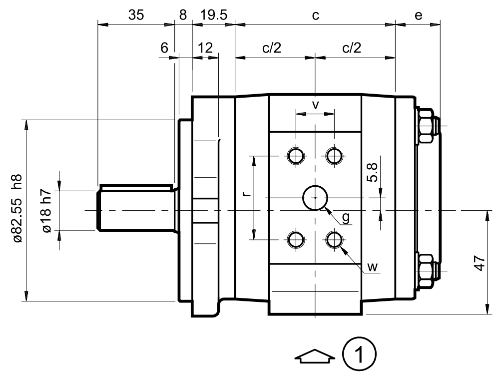
NOISE LEVEL

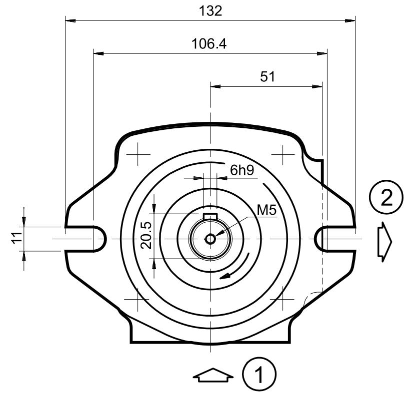


The noise pressure levels were measured in a semi-anecoic room, at an axial distance of 1 m from the pump.
The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anecoic room.

9 - IGP3 PUMP OVERALL AND MOUNTING DIMENSIONS

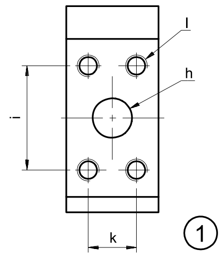
dimensions in mm





1	Suction port	
2	Delivery port	

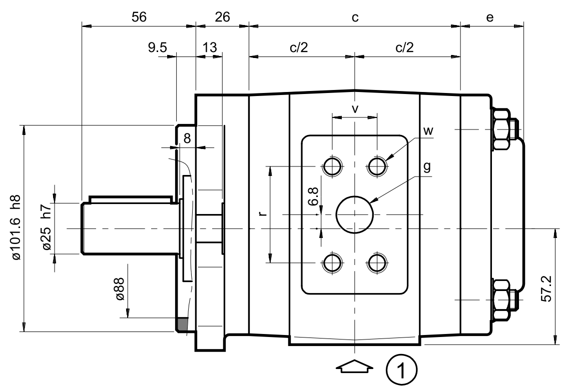
NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery port, 2), is on the opposite side of the pump

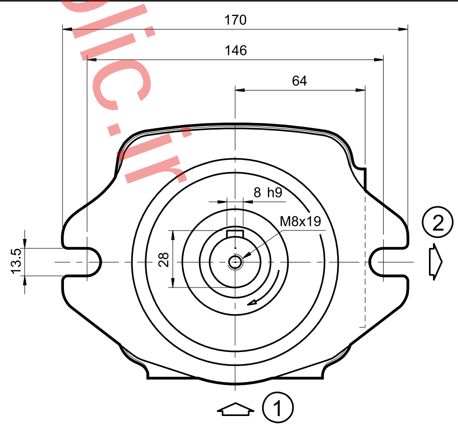


											CONNECTION FLANGE (see par. 28)	
	c	e	g	h	i	k	l	r	v	w	DELIVERY	SUCTION
IGP3-003	66	20,5	9	14	38,1	17,5	M8x13	38,1	17,5	M8x13	0610718	0610718
IGP3-005	70	20,5	11	14	38,1	17,5	M8x13	38,1	17,5	M8x13	0610718	0610718
IGP3-006	73	20,5	11	19	47,5	22	M10x15	38,1	17,5	M8x13	0610718	0610719
IGP3-008	77,5	20,5	13	19	47,5	22	M10x15	38,1	17,5	M8x13	0610718	0610719
IGP3-010	82,5	20,5	13	21	52,4	26,2	M10x15	38,1	17,5	M8x13	0610718	0610713

10 - IGP4 PUMP OVERALL AND MOUNTING DIMENSIONS

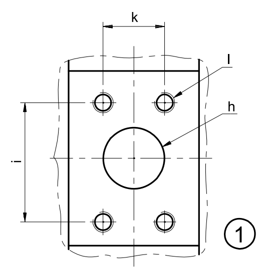
dimensions in mm





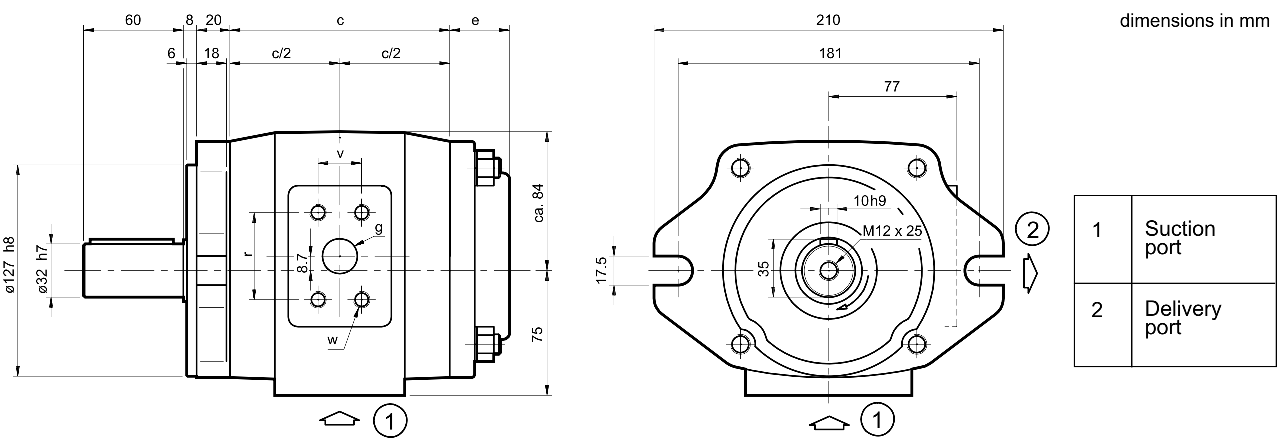
1	Suction port	
2	Delivery port	

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery port, 2), is on the opposite side of the pump

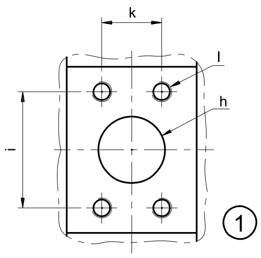


											CONNECTION FLANGE (see par. 28)	
	c	e	g	h	i	k	l	r	v	w	DELIVERY	SUCTION
IGP4-013	88,5	31	13	23	52,4	26,2	M10x15	38,1	17,5	M8x13	0610718	0610713
IGP4-016	92,5	31	14	25	52,4	26,2	M10x15	38,1	17,5	M8x13	0610718	0610713
IGP4-020	98	31	18	27	58,7	30,2	M10x15	47,5	22	M10x15	0610719	0610720
IGP4-025	104	31	18	30	58,7	30,2	M10x15	47,5	22	M10x15	0610719	0610720
IGP4-032	113	31	18	32	58,7	30,2	M10x15	47,5	22	M10x15	0610719	0610720

11- IGP5 PUMP OVERALL AND MOUNTING DIMENSIONS

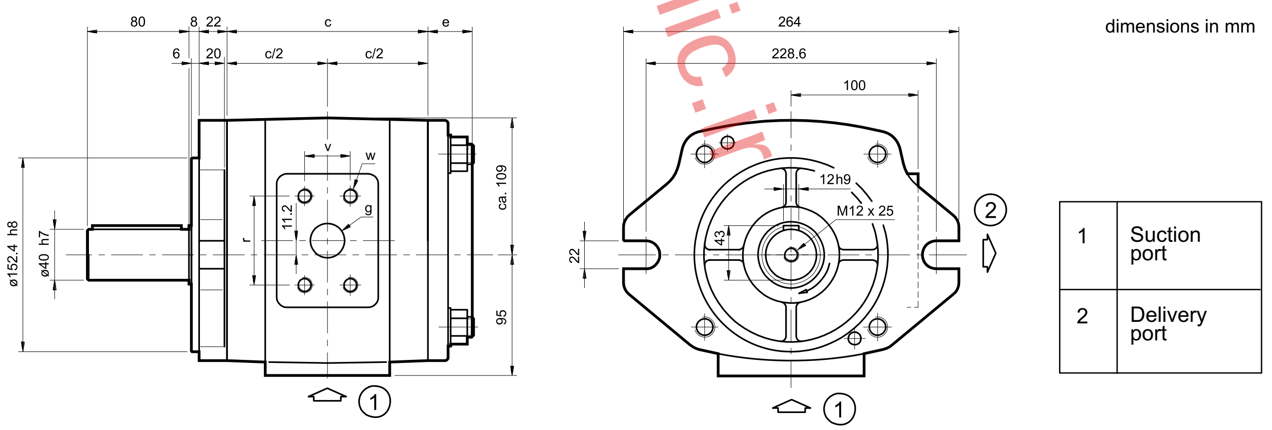


NOTE: the pump is represented in the clockwise rotation configuration
For the anticlockwise configuration, the delivery port, 2), is on the opposite side of the pump

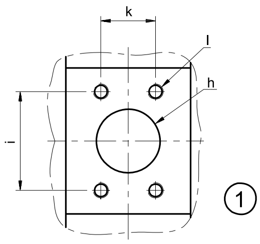


	c	e	g	h	i	k	l	r	v	w	CONNECTION FLANGES (see par. 28) DELIVERY	SUCTION
IGP5-032	119	36	18	32	58,7	30,2	M10x15	47,5	22	M10x15	0610719	0610720
IGP5-040	125	36	19	35	70	36	M12x20	52,4	26,2	M10x15	0610713	0610714
IGP5-050	132	36	21	40	70	36	M12x20	52,4	26,2	M10x15	0610713	0610714
IGP5-064	143	36	23	40	70	36	M12x20	52,4	26,2	M10x15	0610713	0610714

12- IGP6 PUMP OVERALL AND MOUNTING DIMENSIONS

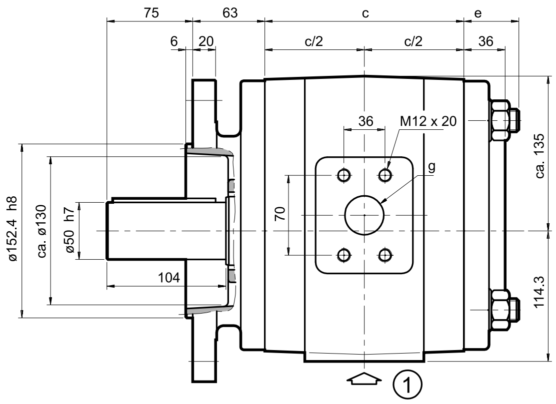


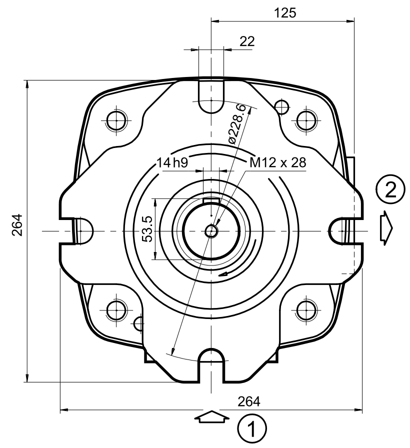
NOTE: the pump is represented in the clockwise rotation configuration
For the anticlockwise configuration, the delivery port, 2), is on the opposite side of the pump



	c	e	g	h	i	k	l	r	v	w	CONNECTION FLANGES (see par. 28) DELIVERY	SUCTION
IGP6-064	140	40	23	40	70	36	M12x20	52,4	26,2	M10x15	0610713	0610714
IGP6-080	148	35	23	45	77,8	42,9	M12x20	70	36	M12x20	0610714 note 5	0610721
IGP6-100	158	35	27	50	77,8	42,9	M12x20	70	36	M12x20	0610714 note 5	0610721
IGP6-125	170	40	30	50	77,8	42,9	M12x20	70	36	M12x20	0610714 note 5	0610721

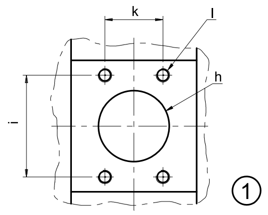
13- IGP7 PUMP OVERALL AND MOUNTING DIMENSIONS





dimensions in mm

1	Suction port
2	Delivery port

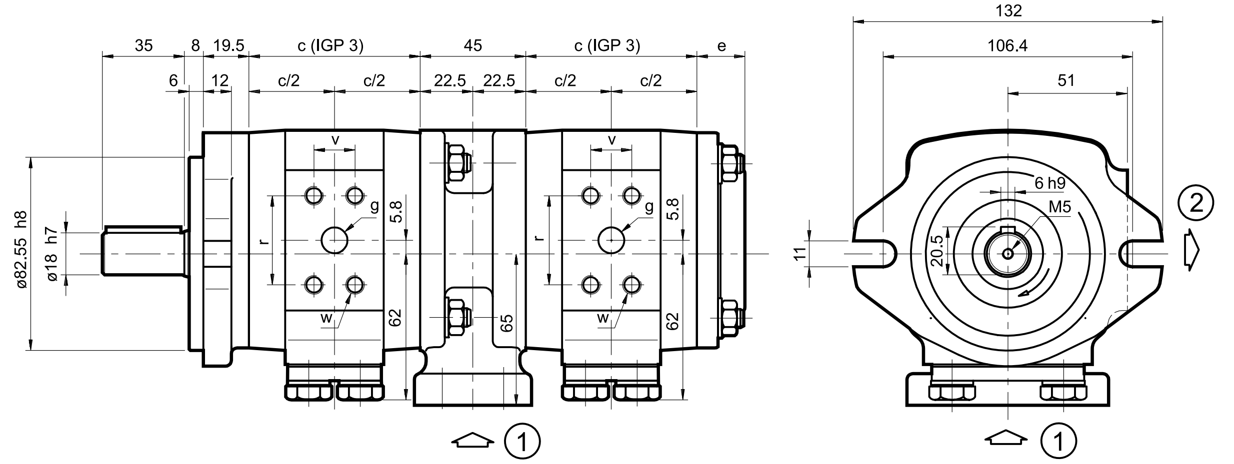


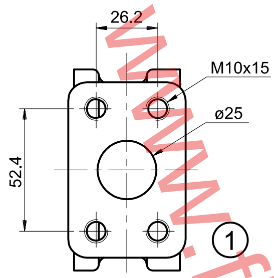
NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery port, 2), is on the opposite side of the pump

										CONNECTION FLANGES (see par. 28)	
	c	e	g	h	i	k	l	r	v	w	DELIVERY	SUCTION
IGP7-125	152	48	30	50	77,8	42,9	M12x20	70	36	M12x20	0610714 note 5	0610721
IGP7-160	162	48	30	56	89	50,8	M12x20	70	36	M12x20	0610714 note 5	0610722
IGP7-200	174	46	34	62	89	50,8	M12x20	70	36	M12x20	0610714 note 5	0610722
IGP7-250	188	42	38	72	106,3	62	M16x25	70	36	M12x20	0610714 note 5	0610723

NOTE 5: For applications with delivery pressure greater than 200 bar, it is necessary to use the special connection flange, code 0610725.

14 - IGP33 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





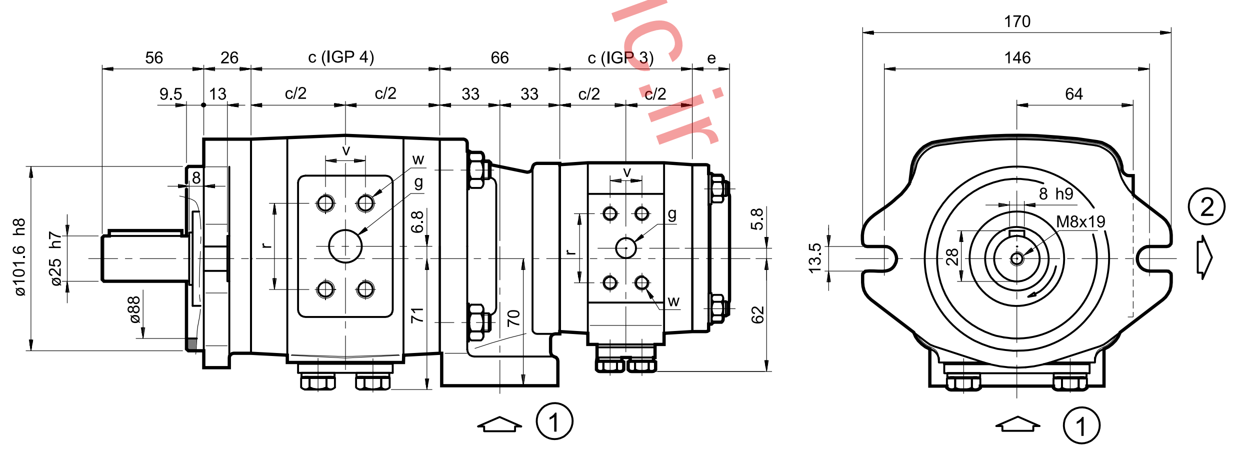
Refer to the values in the table of par. 9 for the dimensions expressed with alphabetical letters

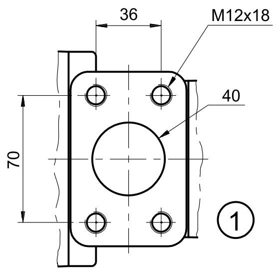
1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

15 - IGP43 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





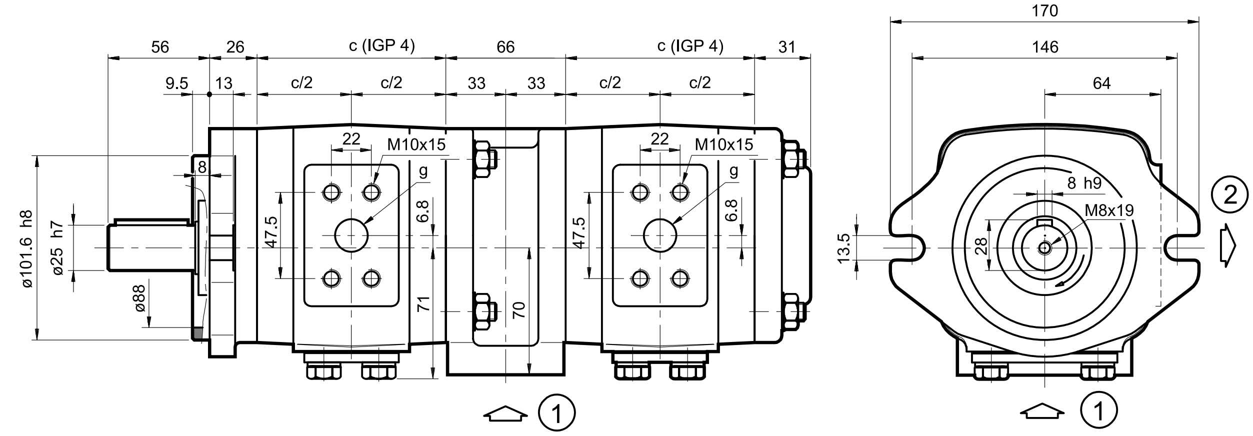
Refer to the values in the tables of:
paragraph 9 for IGP3
paragraph 10 for IGP4
for the dimensions expressed with alphabetical letters

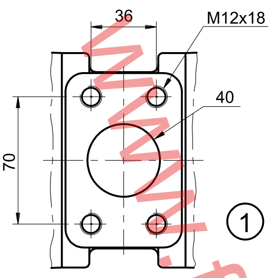
1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

16 - IGP44 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





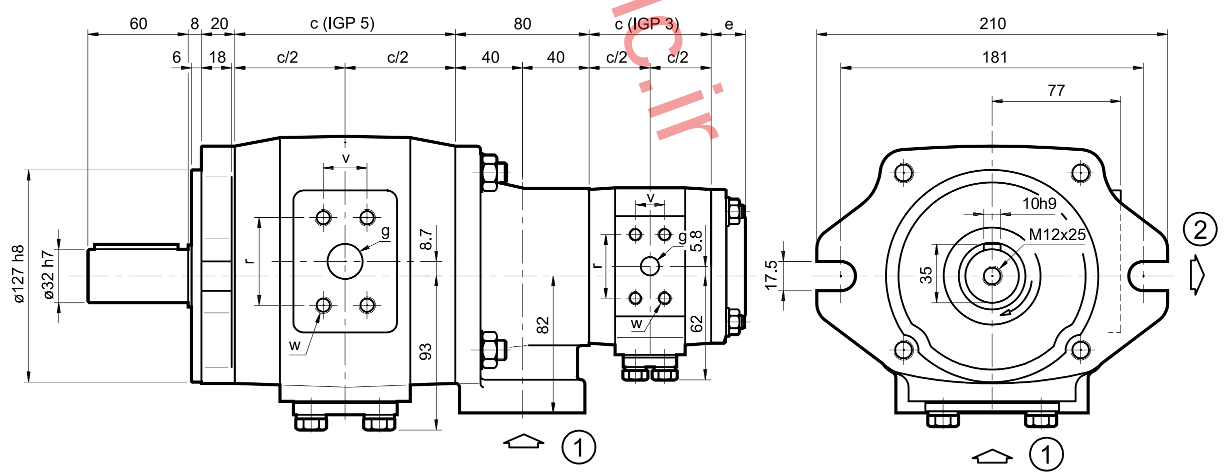
Refer to the values in the table of par. 10 for the dimensions expressed with alphabetical letters

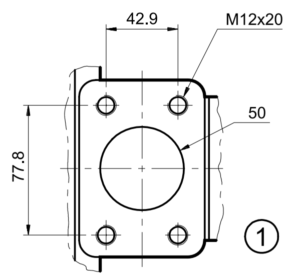
1	Suction port
2	Delivery ports

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

dimensions in mm

17 - IGP53 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





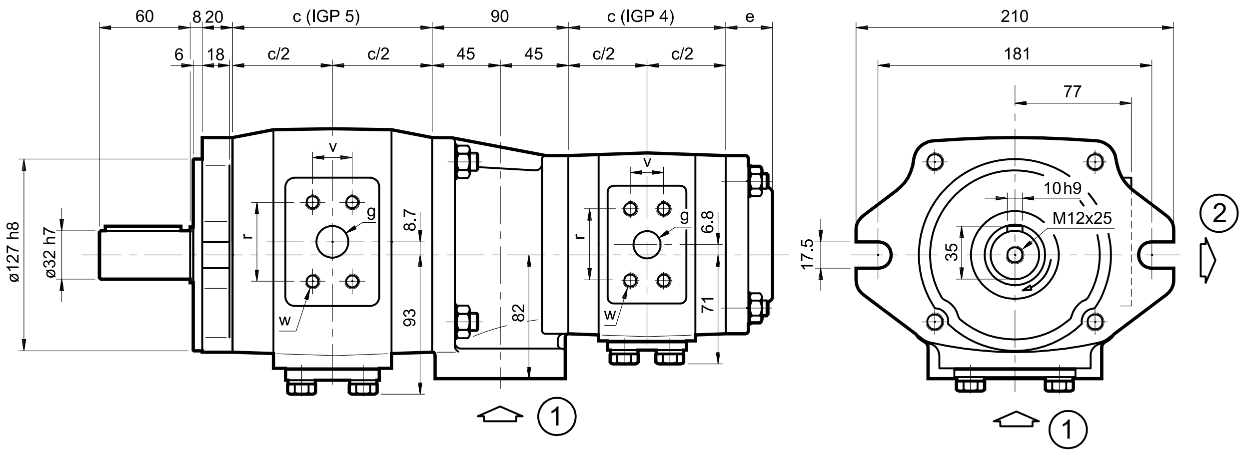
Refer to the values in the tables of:
paragraph 9 for IGP3
paragraph 11 for IGP5
for the dimensions expressed with alphabetical letters

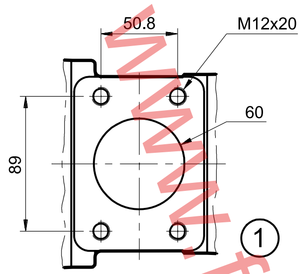
1	Suction port
2	Delivery ports

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

dimensions in mm

18 - IGP54 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





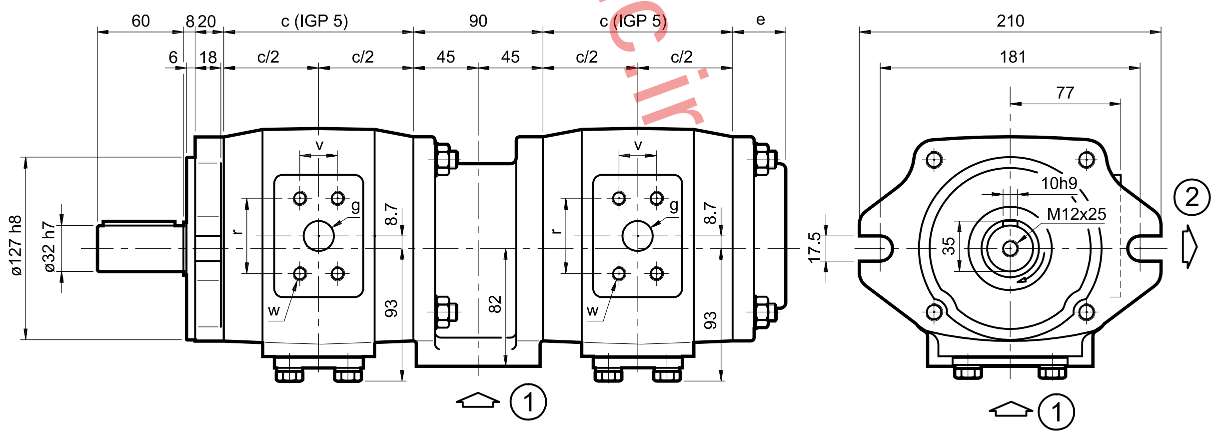
Refer to the values in the tables of:
paragraph 10 for IGP4
paragraph 11 for IGP5
for the dimensions expressed with alphabetical letters

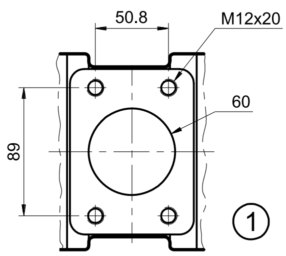
1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

19 - IGP55 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





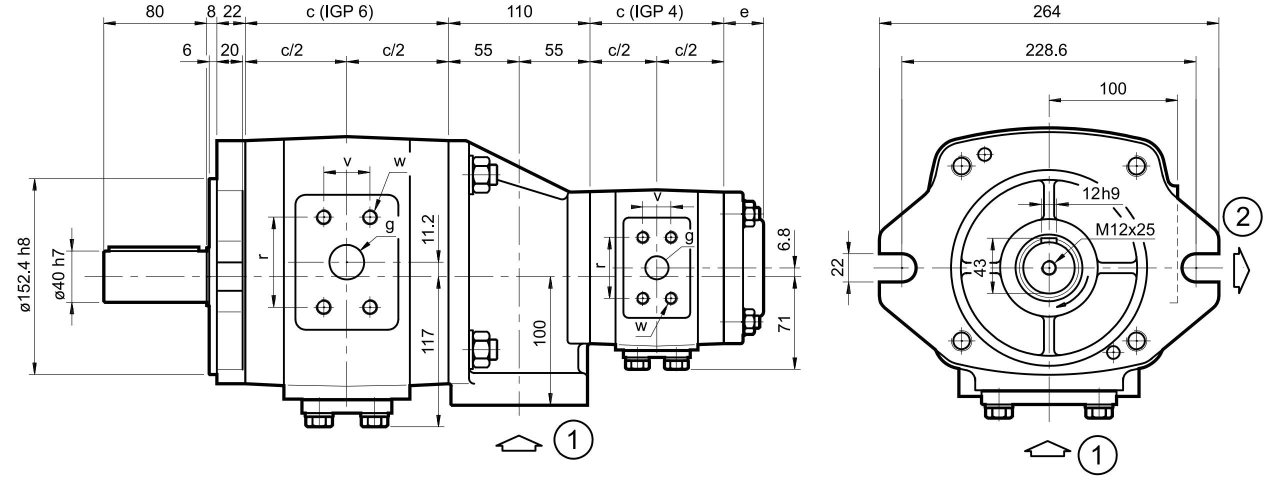
Refer to the values in the table of par. 11 for the dimensions expressed with alphabetical letters

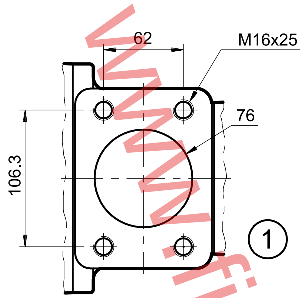
1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

20 - IGP64 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





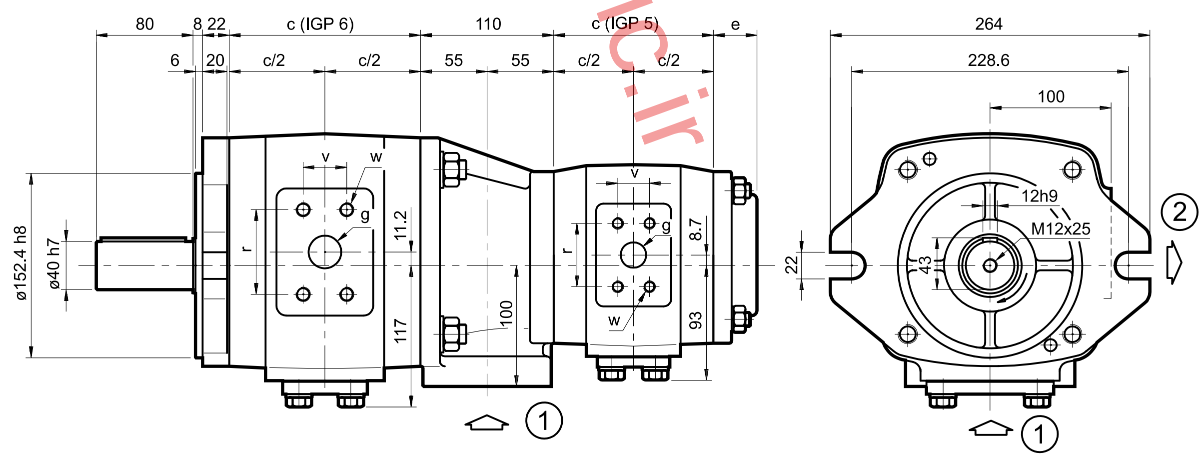
Refer to the values in the tables of:
paragraph 10 for IGP4
paragraph 12 for IGP6
for the dimensions expressed with
alphabetical letters

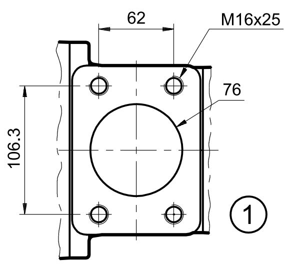
dimensions in mm

1	Suction port
2	Delivery ports

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

21 - IGP65 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





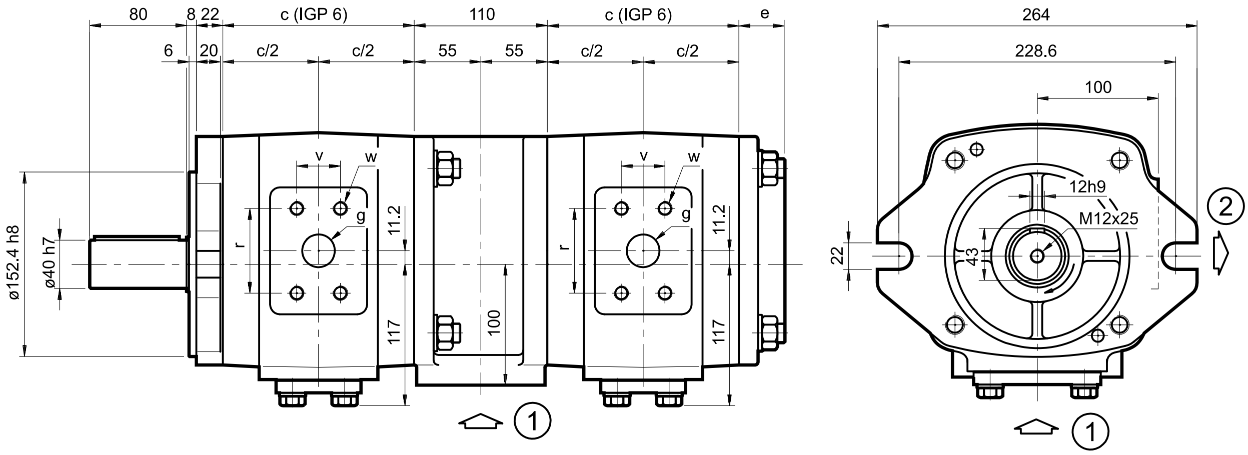
Refer to the values in the tables of:
paragraph 11 for IGP5
paragraph 12 for IGP6
for the dimensions expressed with
alphabetical letters

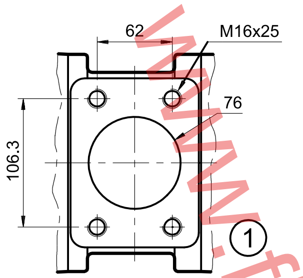
dimensions in mm

1	Suction port
2	Delivery ports

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

22 - IGP66 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





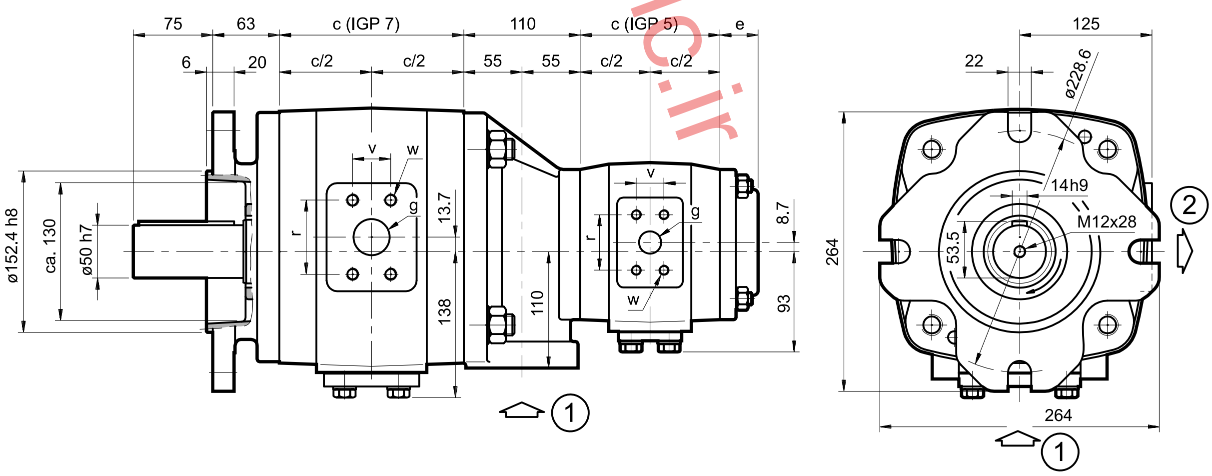
Refer to the values in the table of par. 12 for the dimensions expressed with alphabetical letters

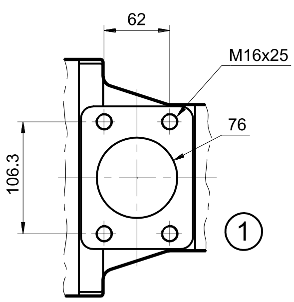
1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

23 - IGP75 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





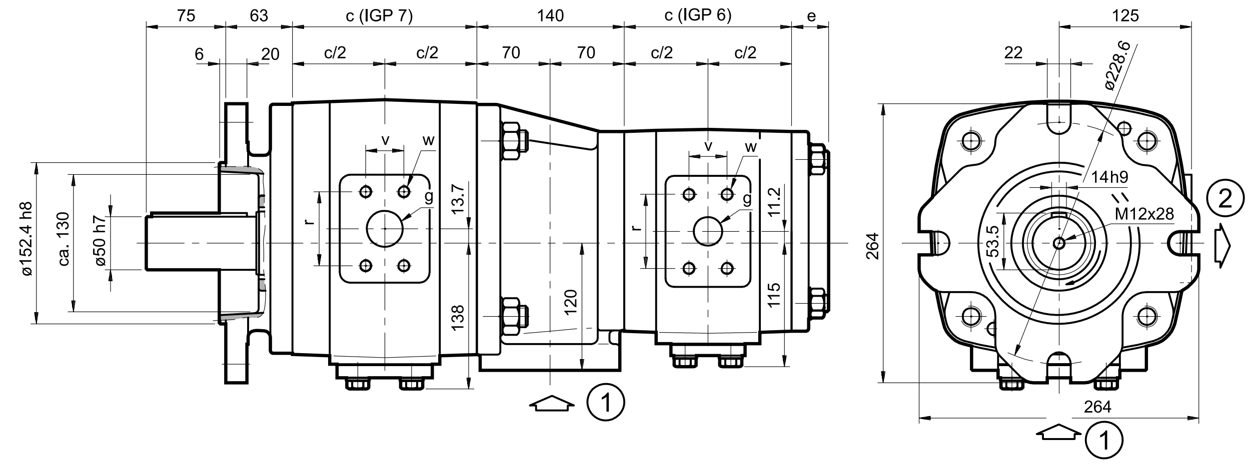
Refer to the values in the tables of:
paragraph 11 for IGP5
paragraph 13 for IGP7
for the dimensions expressed with alphabetical letters

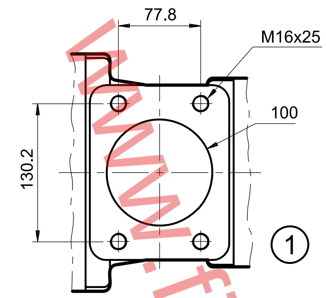
1	Suction port
2	Delivery ports

dimensions in mm

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

24- IGP76 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





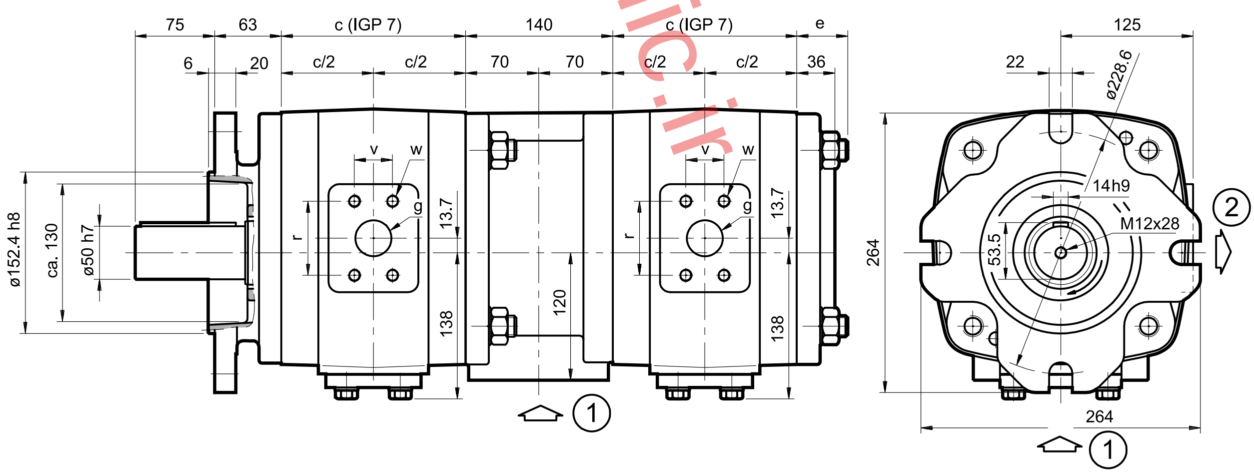
Refer to the values in the tables of:
paragraph 12 for IGP6
paragraph 13 for IGP7
for the dimensions expressed with alphabetical letters

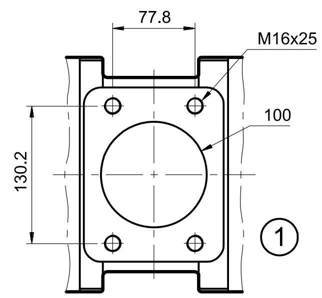
dimensions in mm

1	Suction port
2	Delivery ports

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

25- IGP77 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS





Refer to the values in the table of par. 13 for the dimensions expressed with alphabetical letters

dimensions in mm

1	Suction port
2	Delivery ports

NOTE: the pump is shown in the clockwise rotation configuration
For the anticlockwise configuration, the delivery ports, 2), are on the opposite side of the pump

26 - INSTALLATION

— The IGP pumps can be installed with the shaft oriented in any position.

— Prior to putting the pump into operation, check that the rotation direction of the motor is according to the direction of the arrow marked on the pump body.

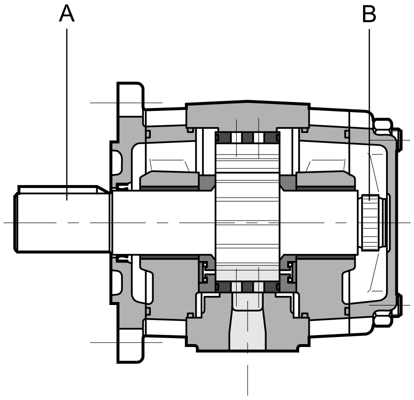
— The suction line must be sized so that the speed of the fluid does not exceed 1 m/s (1,5 m/s with positive pressure at the pump inlet).
The pump start up, especially at a cold temperature, should occur with the pump unloading.
Any bends and restrictions or an excessive line length can impair correct working of the pump.
The height of suction from the bottom of the tank must not be less than 50 mm.

— The IGP pumps are self-priming in the entire operating speed range specified. At the first start-up of the pump, it is necessary to vent the air from the delivery line.
If a check valve with cracking pressure of >1 bar is installed on the delivery line, it is necessary to vent the air from the circuit branch between the check valve and the pump at the time of start-up.

— The motor-pump connection must be carried out directly with a flexible coupling.
Consult our technical dept. for installations that generate axial or radial loads on the pump shaft.
The coupling must be mounted without axially forcing the pump shaft. Be sure that the joint coupling diameter be made with a K7 tolerance.

— Refer to paragraph 2.3 for the characteristics and installation of the filtering elements.

27 - MAXIMUM APPLICABLE TORQUE



PUMP SIZE	MAX. TORQUE APPLIED TO THE SHAFT [Nm]	
	PRIMARY SHAFT **A**	SECONDARY SHAFT **B**
IGP3	160	80
IGP4	335	190
IGP5	605	400
IGP6	1050	780
IGP7	1960	1200

NOTE: The pumps must be connected in order of decreasing displacement and size.

27.1 - Maximum applicable torque for double pumps

In the case of double pumps, even of the same displacement, each pump can operate at the maximum performances specified in par. 3.

27.2 - Maximum applicable torque for multiple pumps

The torque (M) at the inlet of each pump is given from the following equation:

$$M = \frac{9549 \cdot N}{n} = [Nm]$$

where the absorbed power (N) is given from:

$$N = \frac{Q \cdot \Delta p}{600 \cdot \eta\ tot} = [kW]$$

n = rotation speed [rpm]
Q = delivery [l/min]
Δp = differential pressure on the pump [bar]
η tot = total efficiency (noted from the relative diagrams in par. 4-5-6-7-8)

or is calculated from the ABSORBED POWER diagrams (see par. 4-5-6-7-8).

In the case of multiple pumps, the torque of the single pump must be added to the torque generated by the downstream pumps.

The torque value thus calculated for each pump must be less than the relative value specified in the above table, taking the following into consideration:

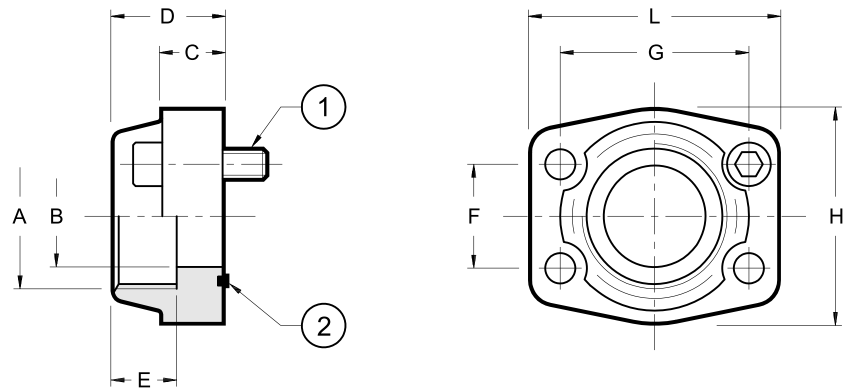
1st pump = refer to the specified values for primary shaft A

2nd, 3rd, 4th pump = refer to the specified values for secondary shaft B

In the event the calculated torque values are greater than the values shown in the table, it is necessary to reduce the operating pressure or substitute the overloaded pump with one that can support the required torque.

28 - SAE J518 c code 61 CONNECTION FLANGES

dimensions in mm



Flange code	Flange description	Pmax [bar]	∅A	∅B	C	D	E	F	G	H	L	1 4 bolts	2
0610718	SAE - 1/2”	345	1/2” BSP	13	16	36	19	17,5	38,1	46	54	M8 x 30	OR 4075
0610719	SAE - 3/4”	345	3/4” BSP	19	18	36	19	22,2	47,6	50	65	M10 x 35	OR 4100
0610713	SAE - 1”	345	1” BSP	25	18	38	22	26,2	52,4	55	70		OR 4131
0610720	SAE - 1 1/4”	276	1 1/4” BSP	32	21	41	22	30,2	58,7	68	79		OR 4150
0610714	SAE - 1 1/2”	207	1 1/2” BSP	38	25	45	24	35,7	70	78	94	M12 x 45	OR 4187
0610725	SAE - 1 1/2”	345	1 1/2” BSP	38	36	50	25	36	70	80	95	M12 x 55 12K	OR 4187
0610721	SAE - 2”	207	2” BSP	51	25	45	30	43	77,8	90	102	M12 x 45	OR 4225
0610722	SAE - 2 1/2”	172	2 1/2” BSP	63	25	50	30	50,8	89	105	116		OR 4275
0610723	SAE - 3”	138	3” BSP	73	27	50	34	62	106,4	124	134	M16 x 50	OR 4437
0610726	SAE - 4”	34	4” BSP	99	27	48	34	77,8	130,2	146	162		OR 4437

The fastening bolts and the O-Rings must be ordered separately.

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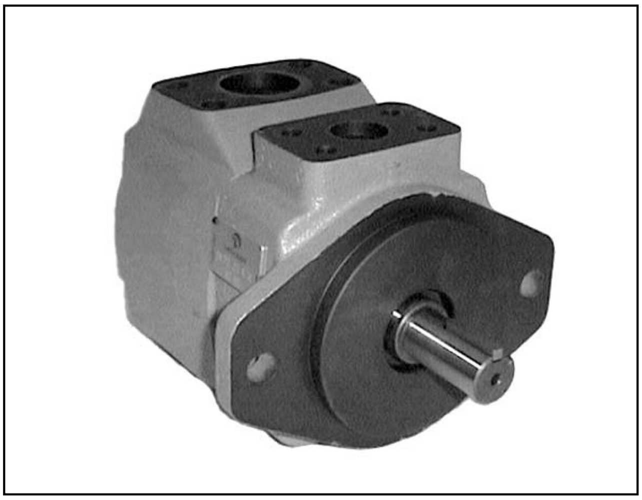
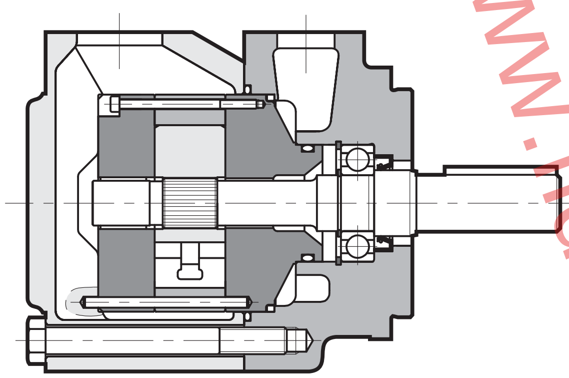


DFP

FIXED DISPLACEMENT VANE PUMPS

SERIES 20

OPERATING PRINCIPLE



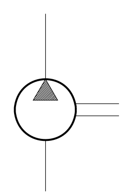
- The DFP pumps are fixed displacement vane pumps made in four different sizes, each size having five different nominal displacement. They are available with one pumping element (single pump) or with double pumping element (double pump). See par. 15 ÷ 20 for the combinations of double pumps.
- The pumping group is composed of a cartridge type compact element that contains the rotor, the vanes, the cam ring and the head disks. The cartridge is easily removable without the need to disconnect the pump from the hydraulic circuit, thus simplifying the maintenance operations.
- The special elliptical profile of the cam ring, with double suction and delivery chambers one against the other, eliminates the radial thrusts on the rotor, decisively reducing wear of the pump. In addition, the use of a 12-vane rotor reduces the delivery pressure pulsations, suppressing the vibrations and noise level of the pump.

TECHNICAL SPECIFICATIONS

DFP PUMP SIZE		1	2	3	4
Displacement range	cm^3/rev	18 ÷ 45,9	40,1 ÷ 67,5	69 ÷ 121,6	138,6 ÷ 193,4
Flow rate range (at 1.500 rpm)	l/min.	26,1 ÷ 69,6	58,8 ÷ 99,8	101,4 ÷ 177,3	203,4 ÷ 285
Operating pressures		see table 3 - performances			
Rotation speed		see table 3 - performances			
Rotation direction		clockwise or anticlockwise (seen from the shaft side)			
Loads on the shaft		axial loads are not allowed			
Hydraulic connection		flange fittings SAE J518 (see par. 22)			
Type of fastening		flanged SAE			
Mass (single pump)	kg	12	15	23	34

Ambient temperature range	°C	–20 / +50
Fluid temperature range (see par. 4)	°C	–10 / +70
Fluid viscosity range	see par. 4.2	
Recommended true viscosity	cSt	25 ÷ 50
Degree of fluid contamination	see par. 4.3	

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

D	F				-		/		-					/	20	/	

Fixed displacement vane pump

Pump type
P = single pump
DP = double pump

C = shaft side cartridge or for single pump
CC= cover side cartridge

Pump size:
- single pump
- shaft side pump
(only for double pumps):

1 = from 18 to 45,9 cm³/rev
2 = from 40,1 to 67,5 cm³/rev
3 = from 69 to 121,6 cm³/rev
4 = from 138,6 to 193,4 cm³/rev

Added pump size
(only for double pumps):

1 = from 18 to 45,9 cm³/rev
2 = from 40,1 to 67,5 cm³/rev
3 = from 69 to 121,6 cm³/rev

NOTE: the cover side pump must be at least one size smaller than the shaft side pump

Size:
- single pump
- shaft side pump
- shaft side cartridge
(see performances table, par. 3)

Size (only for double pumps)
- cover side pump
- cover side cartridge
(see performances table, par. 3)

Rotation direction (seen from the shaft side)
R = clockwise **L** = anticlockwise

Suction opening orientation compared with the delivery (omit for cartridges)
A = aligned on the same side
B = at 90°
C = opposed to each other
D = at 270°
see par. 2

Cover side delivery port orientation compared with the shaft side delivery - for double pumps (omit for single pumps or cartridges)
A = aligned on the same side
B = at 90°
C = opposed to each other
D = at 270°
see par. 2

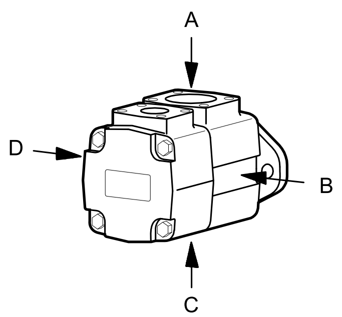
Type of shaft end
1 = with key
other shaft types are available upon request

Series No.
(the overall and mounting dimensions remain unchanged from 20 to 29)

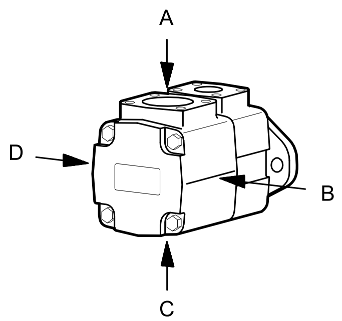
Seals: omit for mineral oils
V = viton for special fluids

2 - PORTS ORIENTATION

SINGLE PUMPS



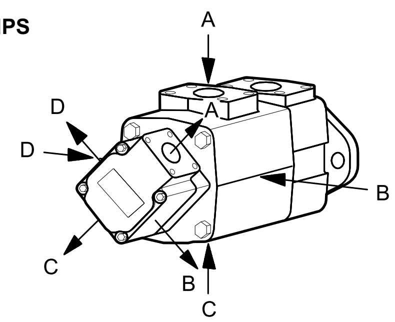
DFP1

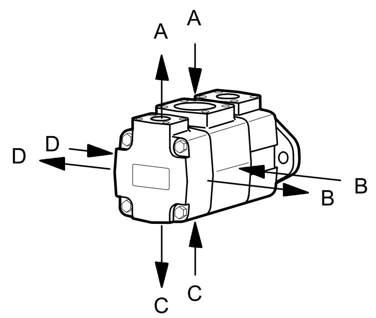


DFP2
DFP3
DFP4

DOUBLE PUMPS

DFP21
DFP31
DFP32
DFP41
DFP42





DFP43

3 - PERFORMANCES (obtained with mineral oil with viscosity of 32 cSt at 40°C)

PUMP SIZE	NOMINAL DIMENSION	DISPLACEMENT [cm³/rev]	MAX. FLOW RATE (at 1500 rpm) [l/min.]	MAX. OPERATING PRESSURE (at 1500 rpm) [bar]	MAX. ROTATION SPEED [rpm] (see par. 5)	MIN. ROTATION SPEED [rpm]
DFP1	05	18	26,1	210	2700	600
	08	27,4	39,4			
	11	36,4	52,6			
	12	39,5	58,7	160		
	14	45,9	69,6	140		
DFP2	12	40,1	58,8	210	2500	600
	14	45,4	65,7			
	17	55,2	80,2			
	19	60,1	88,7			
	21	67,5	99,8			
DFP3	21	69	101,4	210	2400	600
	25	81,6	120,1			
	30	97,7	141,2			
	35	112,7	167,2			
	38	121,6	177,3			
DFP4	42	138,6	203,4	175	2200	600
	47	153,5	222,7			
	50	162,2	234			
	57	183,4	267			
	60	193,4	285			

4 - HYDRAULIC FLUID

4.1 Fluid type

TYPE OF FLUID	MAXIMUM PRESSURE (bar)				MAXIMUM SPEED (rpm)				MAXIMUM FLUID TEMPERATURE [°C]
	DFP1	DFP2	DFP3	DFP4	DFP1	DFP2	DFP3	DFP4	
HFD PHOSPHATE ESTERS	175	175	175	175	1200	1200	1200	1200	$\leq$ 70
HFC WATER GLYCOL	140	140	140	140	1500	1500	1500	1500	$\leq$ 50

NOTE 1: The maximum suction pressure allowed, with all fluid types, is 1,4 bar. The minimum suction pressure varies from -0,2 bar with mineral oil to -0,1 bar with the other fluid types (the pressure values are to be considered relative).

The pressures, the maximum allowed speeds and the recommended temperatures according to the different types of hydraulic fluids used are shown in the table.

4.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	16 cSt	referred to the maximum temperature of 80 °C of the fluid
optimum viscosity	25 ÷ 50 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	800 cSt	limited to only the pump start-up phase

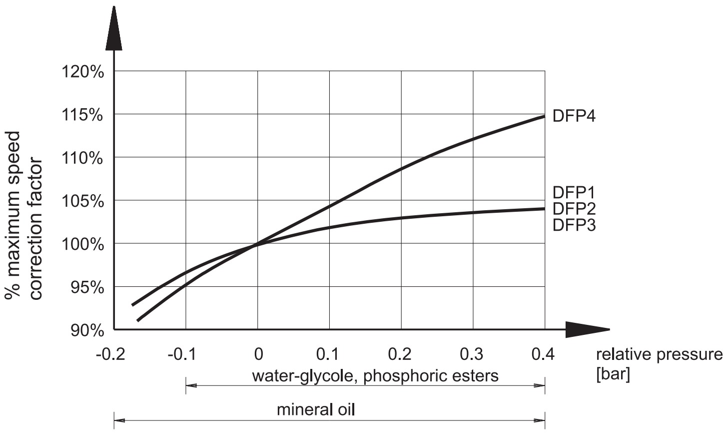
When choosing the fluid type, verify that the true viscosity at the operating temperature is within the above range.

4.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with $\beta_{20} \geq 75$ is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with $\beta_{10} \geq 100$ is recommended.

If there is a filter installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in the note 1, at paragraph 3. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

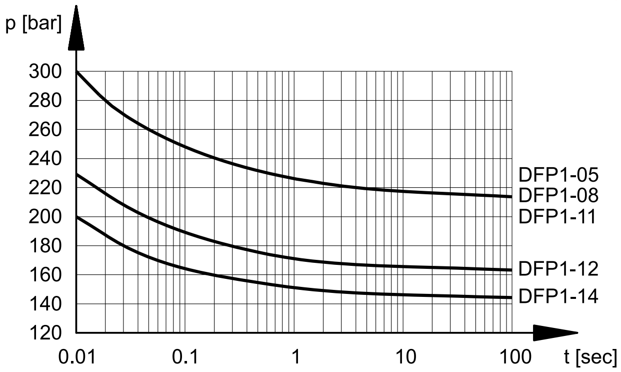
5 - MAXIMUM SPEED CORRECTION FACTOR

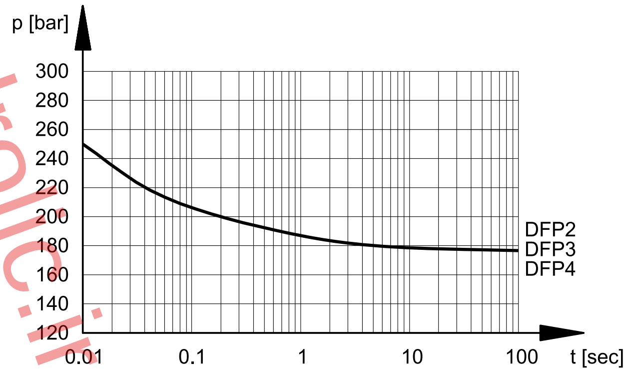


If the pressure in the suction line is different than zero, the maximum rotation speed shown in table 3 must be multiplied by the correction factor obtained from the diagram seen on the left.

6 - PRESSURE PEAK (values obtained with mineral oil with viscosity of 32 cSt at 40°C, delivery pressure 140 bar and suction pressure 0 bar)

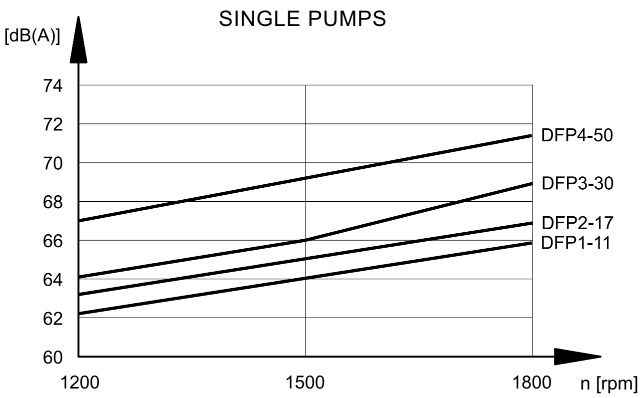
The maximum allowed over pressure on the pump delivery according to the pressure peak residency time is shown in the diagrams. The curves are valid for both single pumps and double pumps.

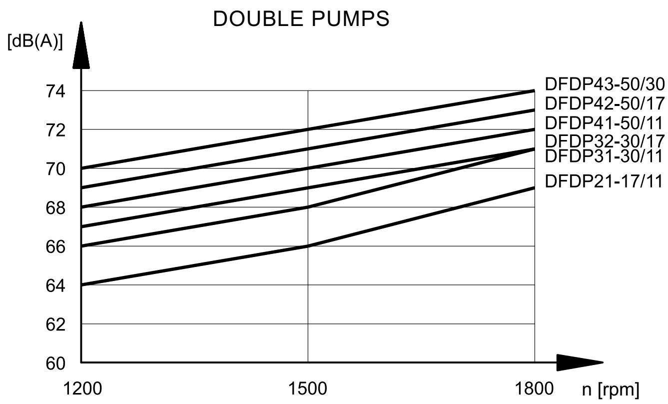




7- NOISE LEVEL (values obtained with mineral oil with viscosity of 32 cSt at 40°C, delivery pressure 140 bar and suction pressure 0 bar)

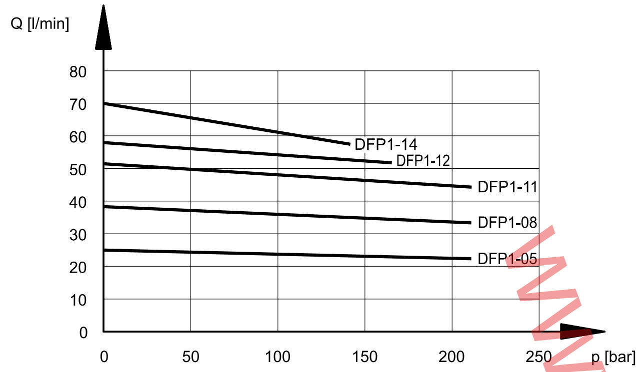
The diagram curves were measured in a semi-anechoic room according to ISO 4412/1 at a distance of 1 m from the pump. The values refer to the intermediate size pump.



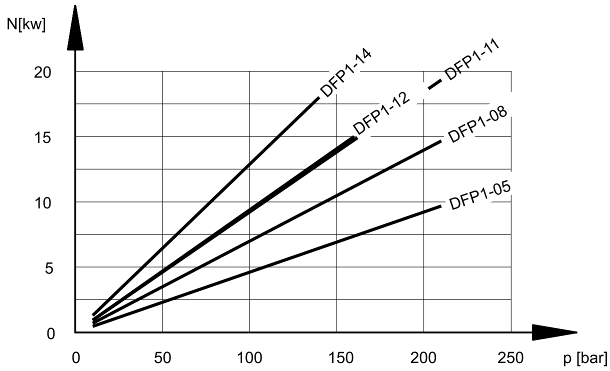


8 - DFP1 PUMP CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 32 cSt at 40°C)

FLOW RATE/PRESSURE CURVES (measured at 1500 rpm)

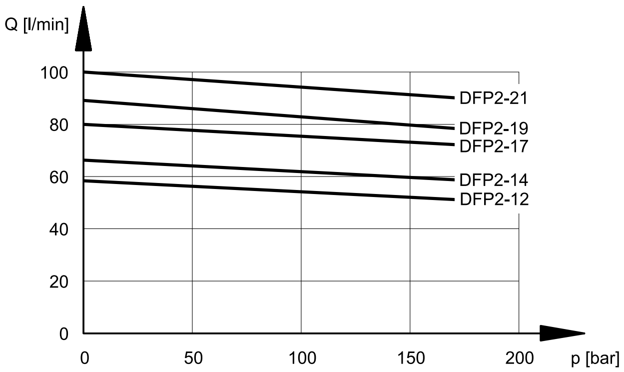


ABSORBED POWER/PRESSURE CURVES (measured at 1500 rpm)

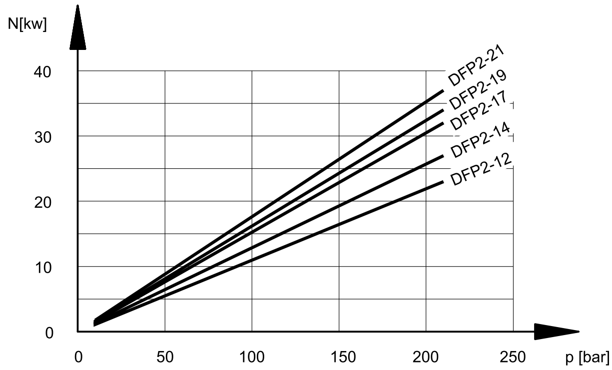


8 - DFP2 PUMP CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 32 cSt at 40°C)

FLOW RATE/PRESSURE CURVES (measured at 1500 rpm)

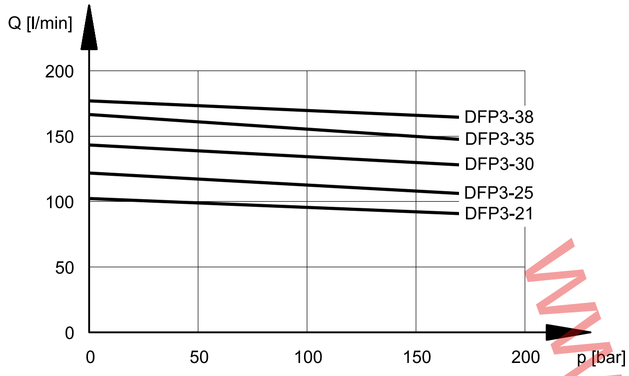


ABSORBED POWER/PRESSURE CURVES (measured at 1500 rpm)

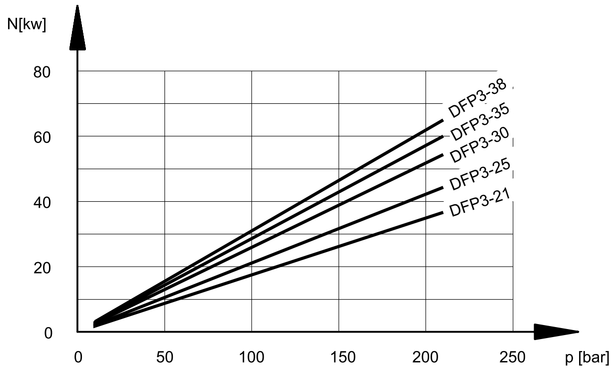


9 - DFP3 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 32 cSt at 40°C)

FLOW RATE/PRESSURE CURVES (measured at 1500 rpm)

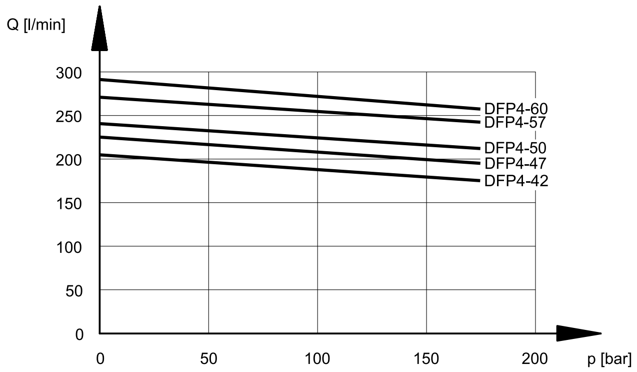


ABSORBED POWER/PRESSURE CURVES (measured at 1500 rpm)

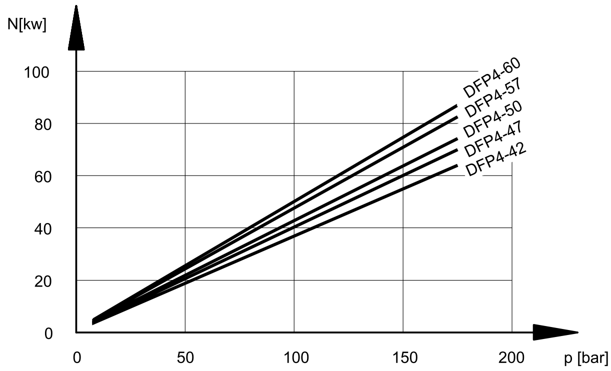


10 - DFP4 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 32 cSt at 40°C)

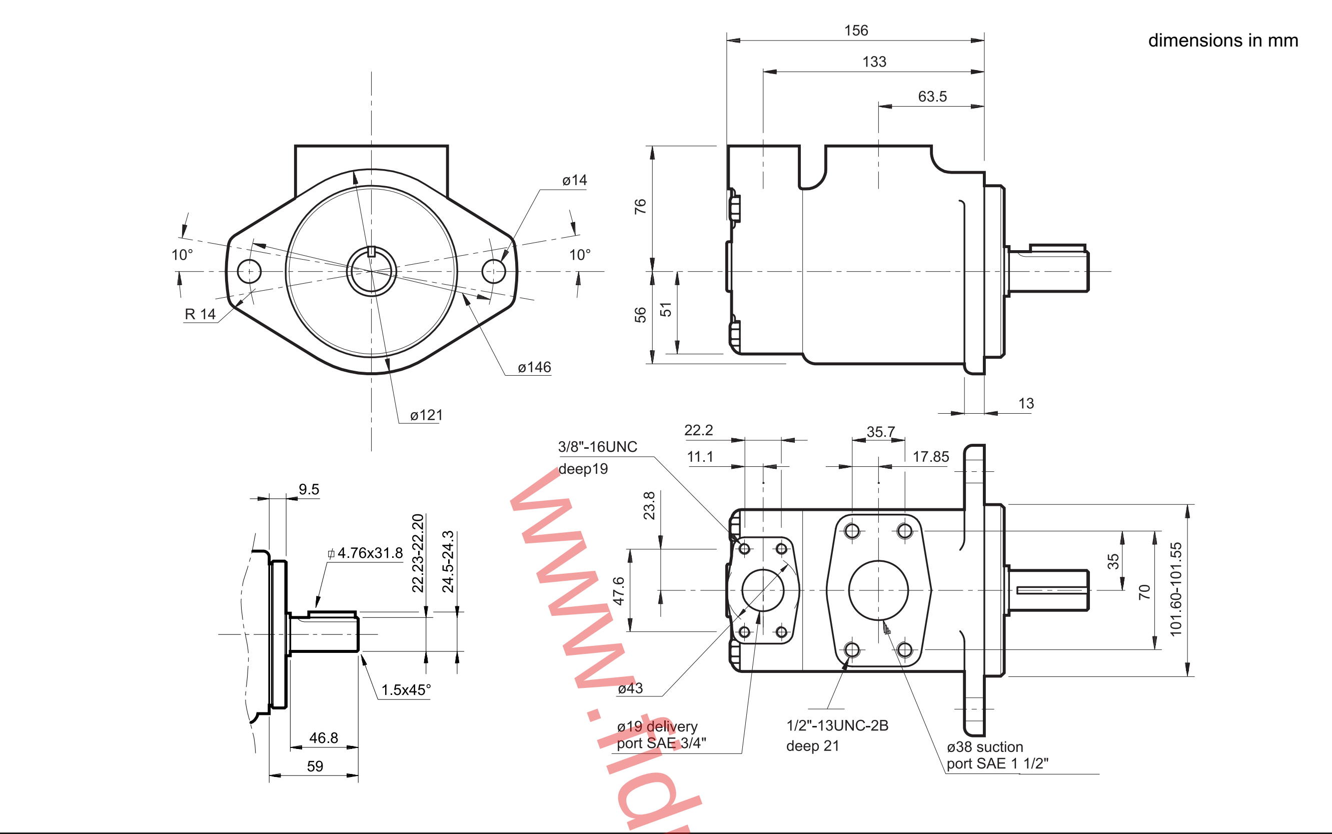
FLOW RATE/PRESSURE CURVES (measured at 1500 rpm)



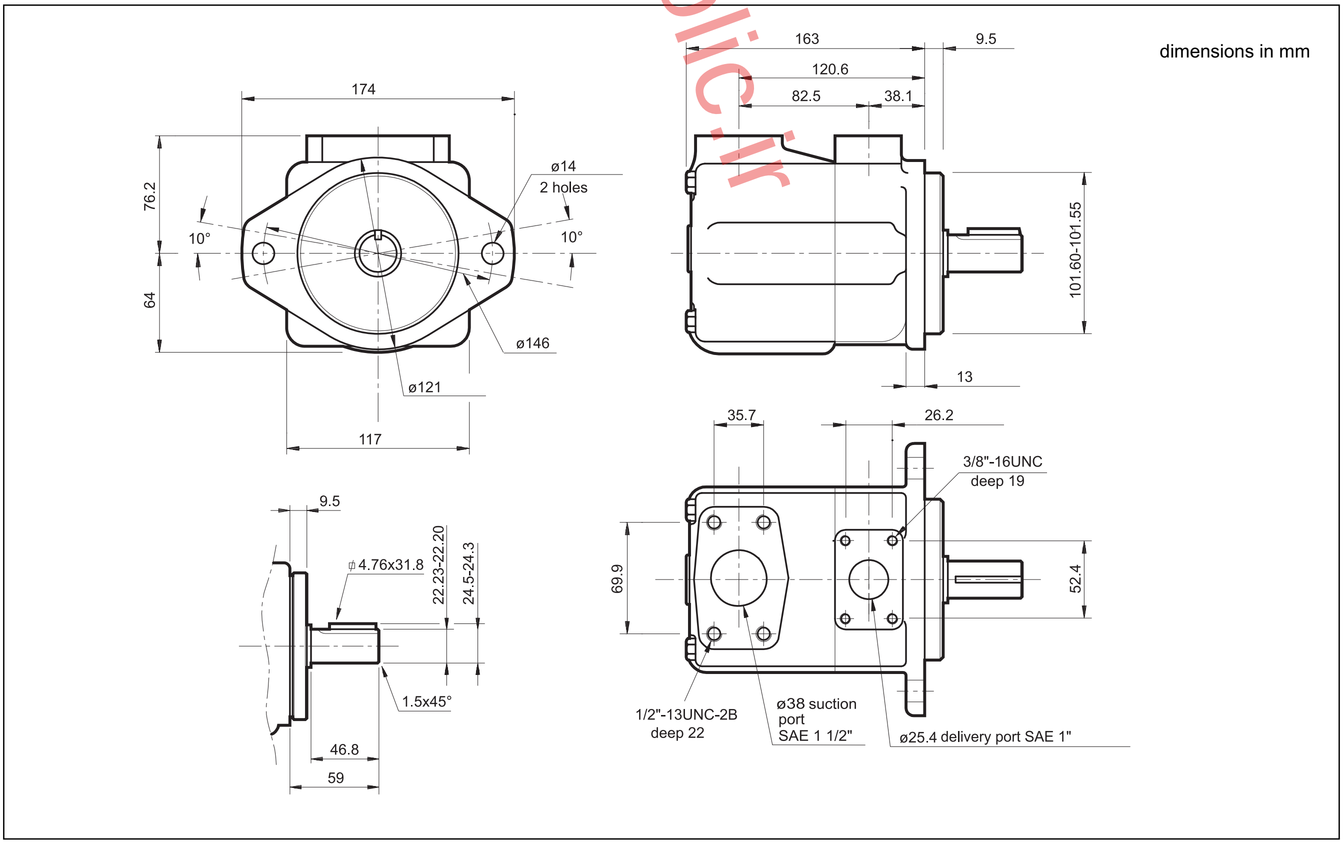
ABSORBED POWER/PRESSURE CURVES (measured at 1500 rpm)



11 - DFP1 PUMP OVERALL AND MOUNTING DIMENSIONS

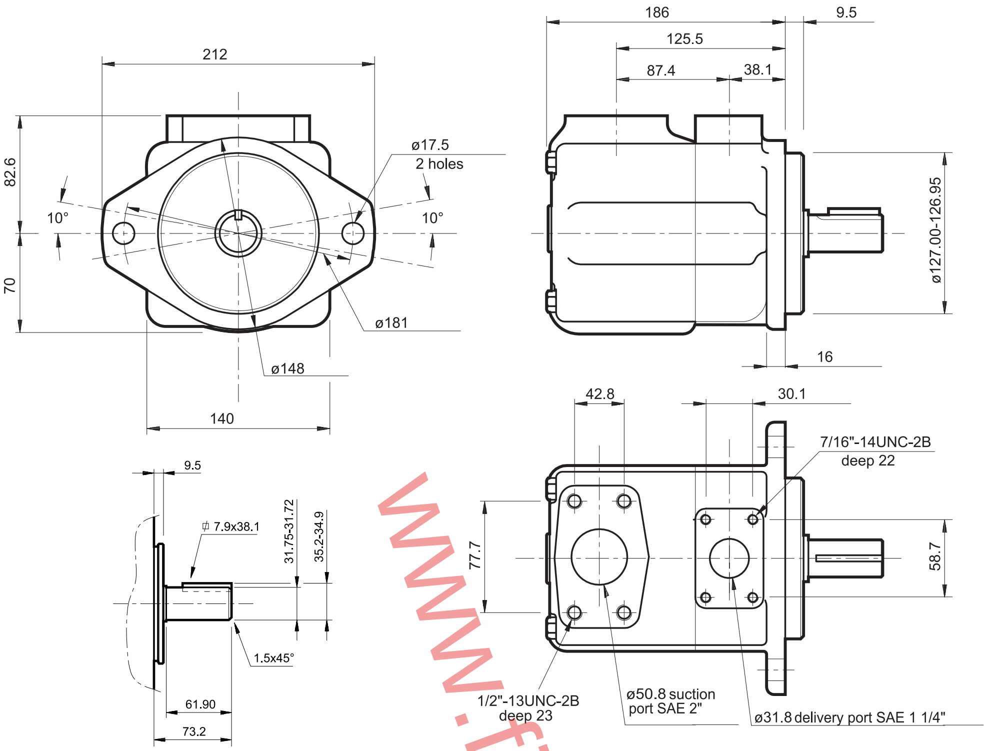


12 - DFP2 PUMP OVERALL AND MOUNTING DIMENSIONS



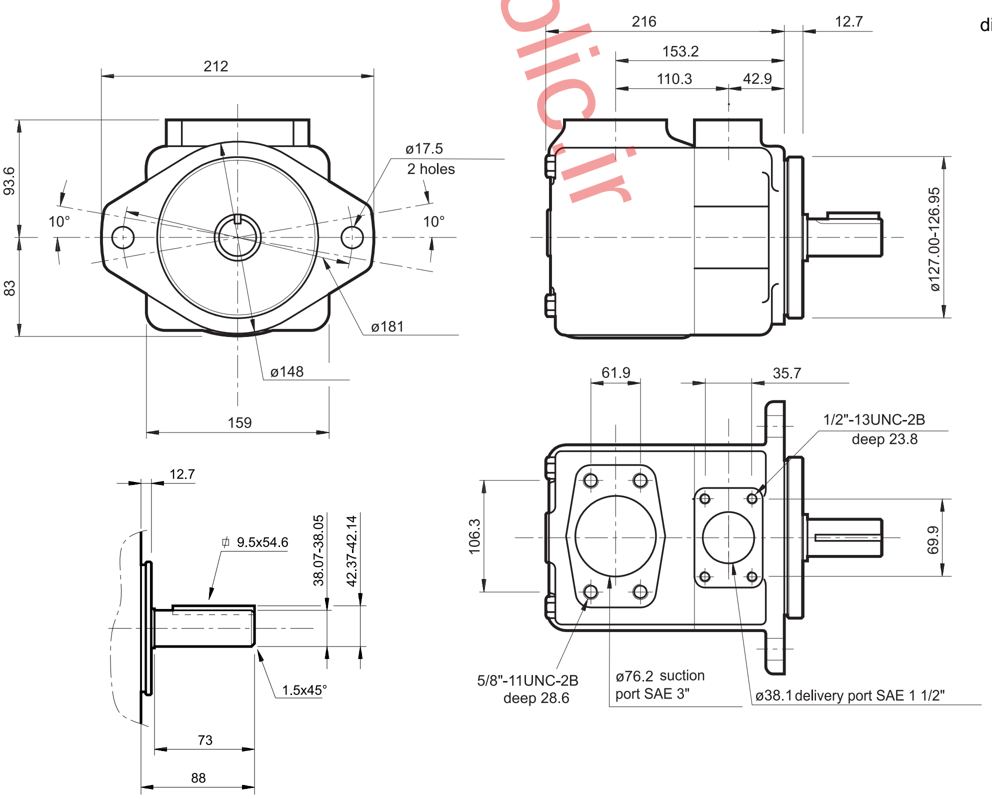
13 - DFP3 PUMP OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



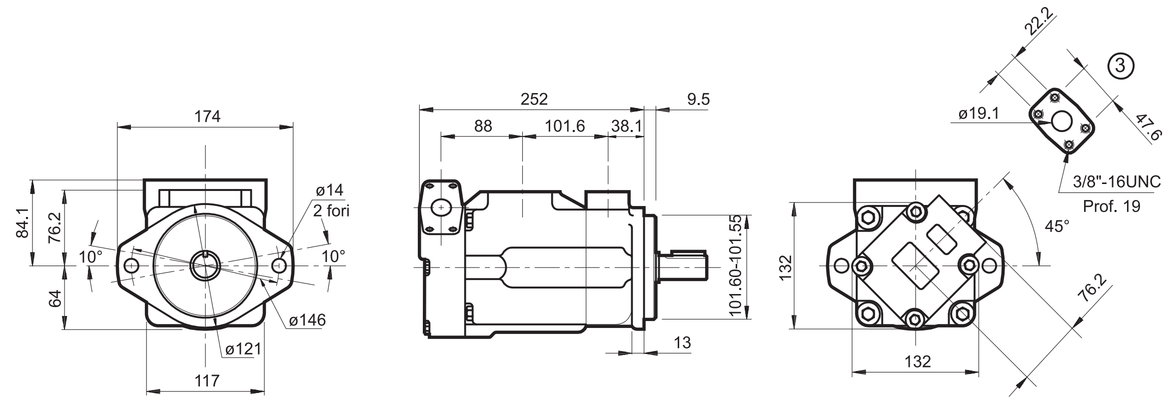
14 - DFP4 PUMP OVERALL AND MOUNTING DIMENSIONS

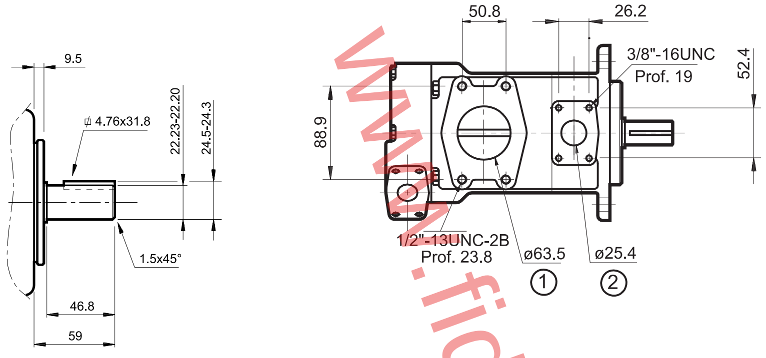
dimensions in mm



15 - DFDP21 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

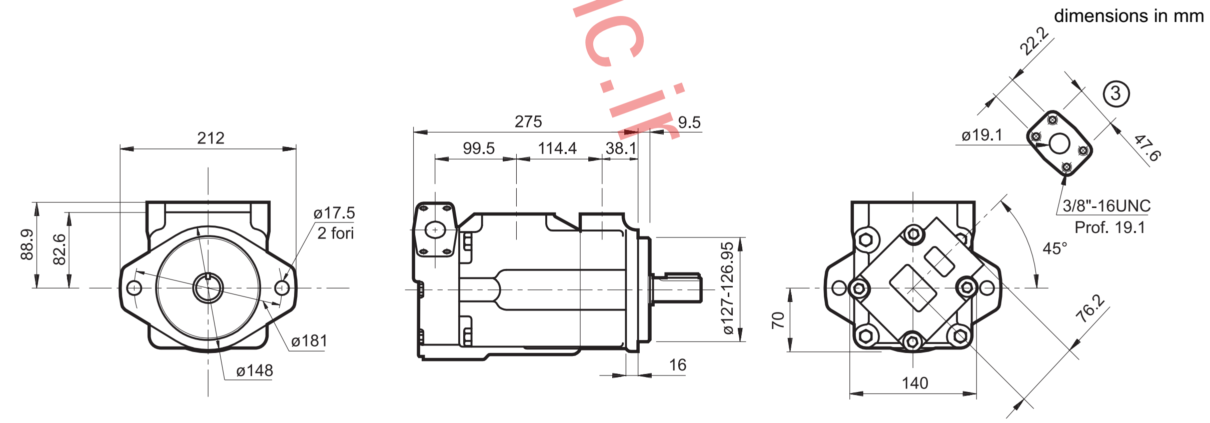


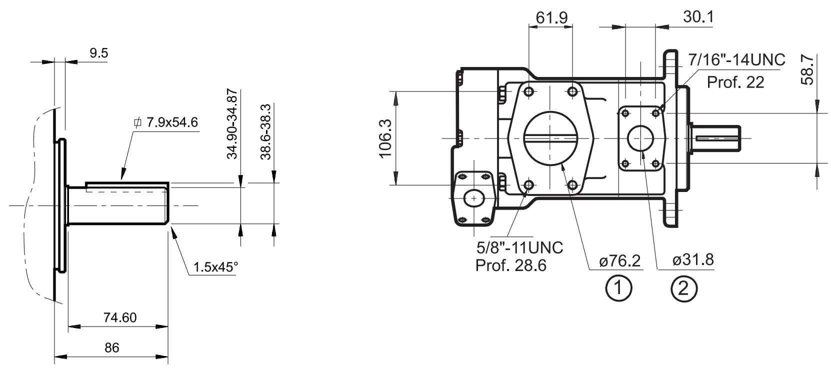


1	Suction port SAE 2 1/2”
2	Pump delivery port shaft side SAE 1”
3	Pump delivery port cover side SAE 3/4”

16 - DFDP31 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

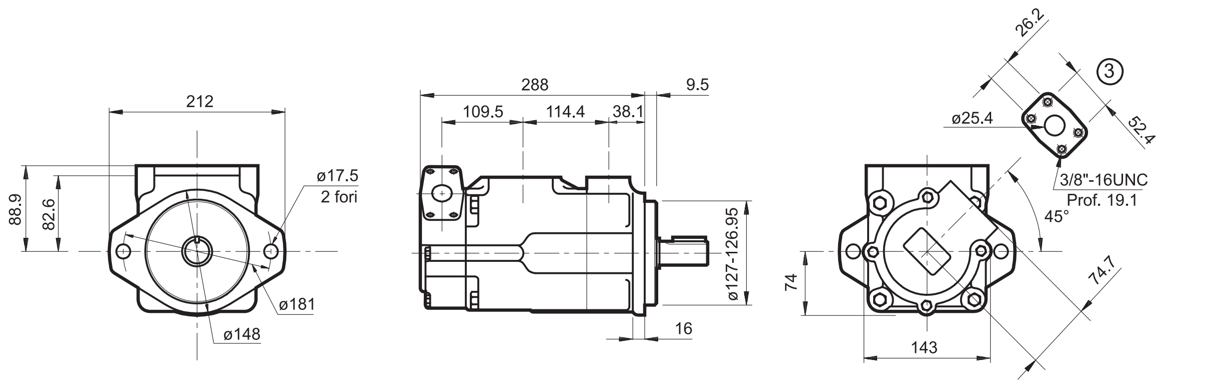


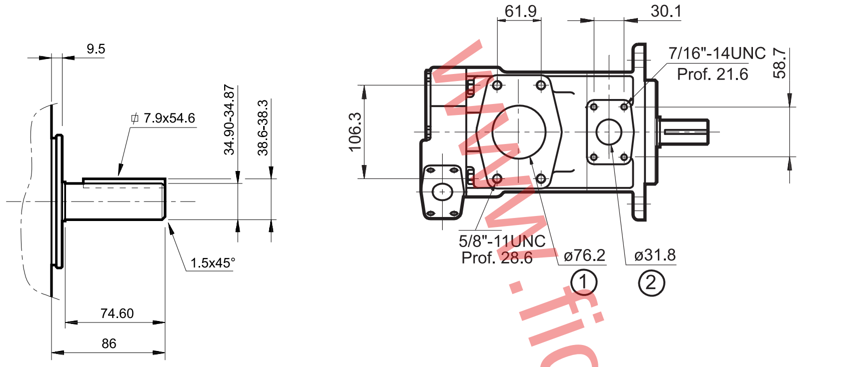


1	Suction port SAE3”
2	Pump delivery port shaft side SAE 1 1/4”
3	Pump delivery port cover side SAE 3/4”

17 - DFDP32 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

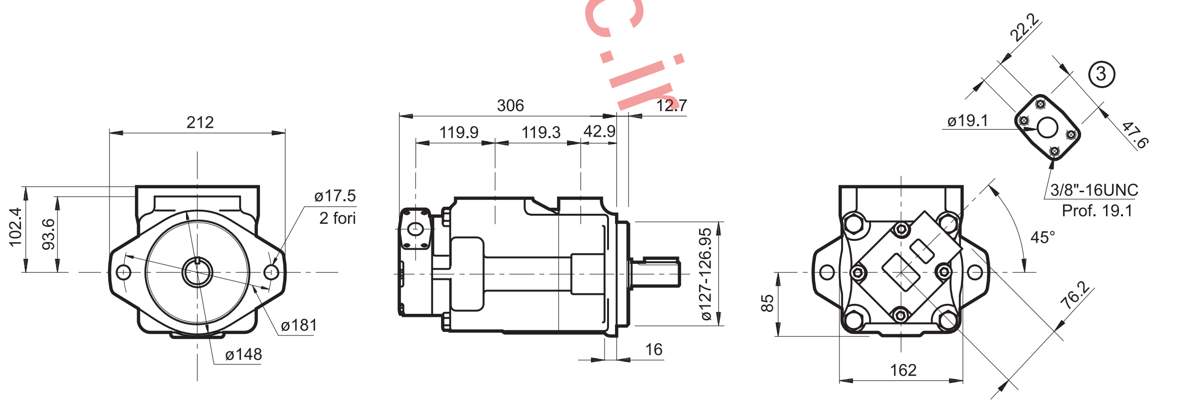


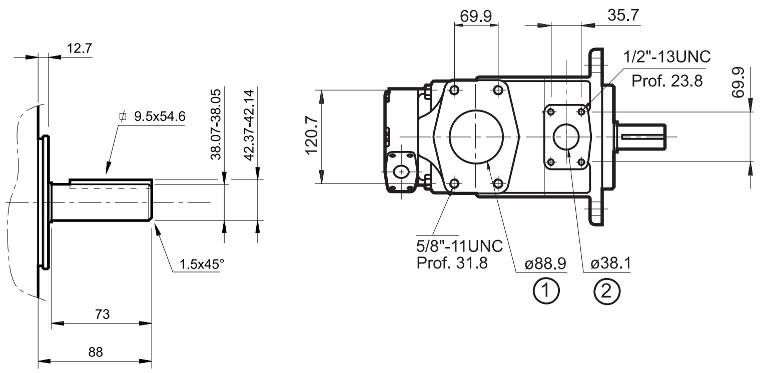


1	Suction port SAE 3”
2	Pump delivery port shaft side SAE 1 1/4”
3	Pump delivery port cover side SAE 1”

18 - DFDP41 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

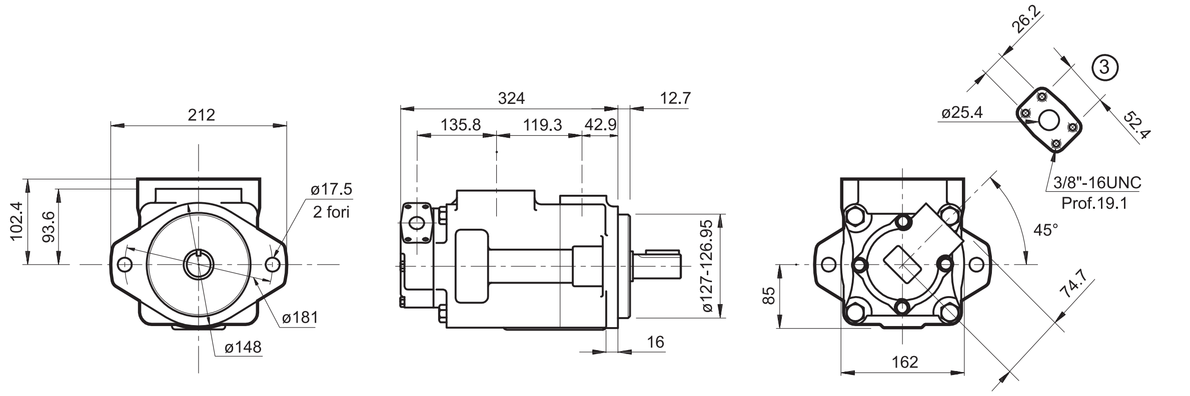


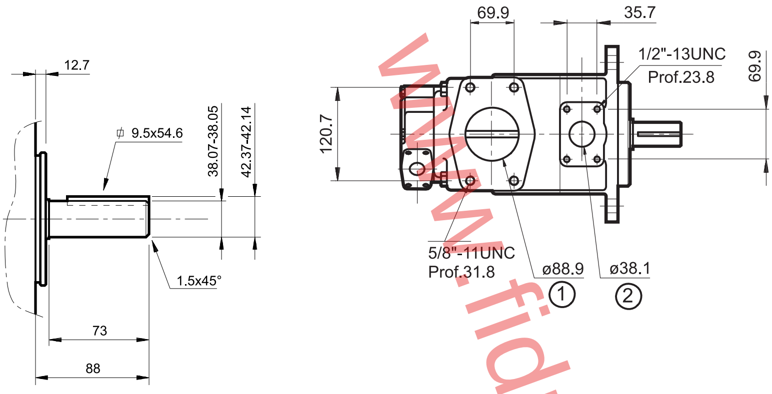


1	Suction port SAE 3 1/2”
2	Pump delivery port shaft side SAE 1 1/2”
3	Pump delivery port cover side SAE 3/4”

19 - DFDP42 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

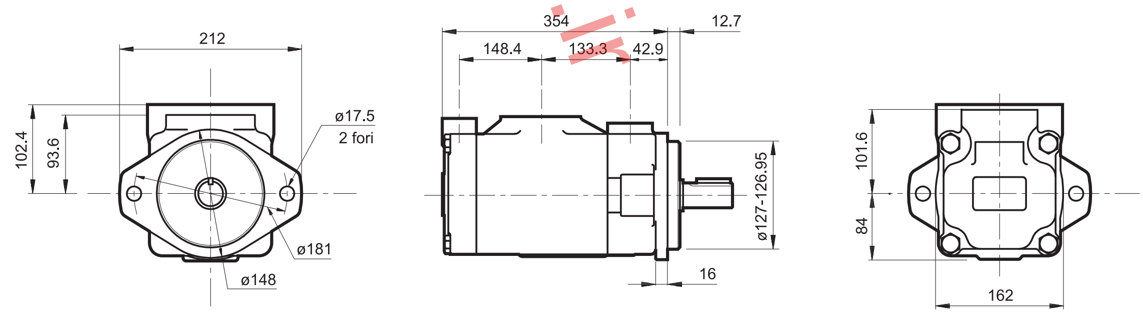


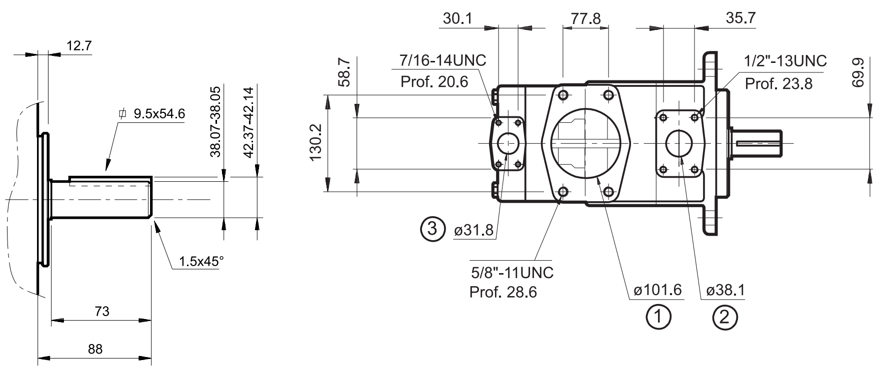


1	Suction port SAE 3 1/2”
2	Pump delivery port shaft side SAE 1 1/2”
3	Pump delivery port cover side SAE 1”

20 - DFDP43 DOUBLE PUMP OVERALL AND MOUNTING DIMENSIONS

dimensions in mm





1	Suction port SAE 4”
2	Pump delivery port shaft side SAE 1 1/2”
3	Pump delivery port cover side SAE 1 1/4”

21 - INSTALLATION

— The DFP pumps can be installed with the shaft oriented in any position.

— Check that the rotation direction of the motor is according to the rotation direction of the pump before start up.

— The pump start up, especially at a cold temperature, should occur with the pump unloading.

— The suction line must be suitably sized to facilitate the flow of oil.
Bends and restrictions or an excessive line length can impair correct functioning of the pump.

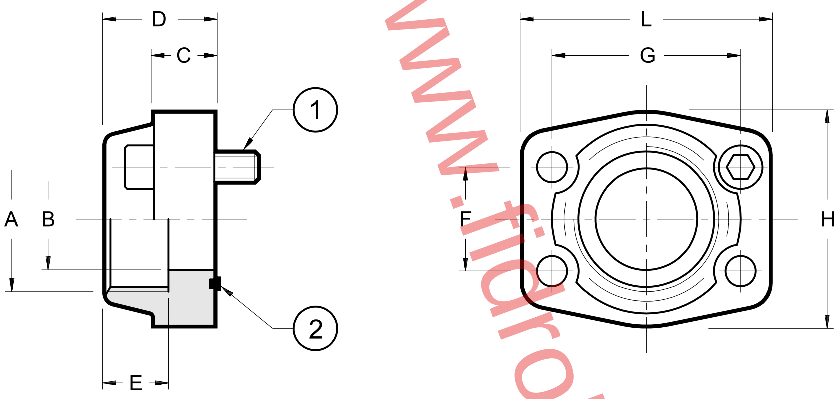
— The pumps are normally positioned directly above the oil tank.
Flooded suction port installation of the pumps is advisable in the case of circuits with high flow rates and pressures.

— The motor-pump coupling must be made directly with a flexible coupling.
Couplings that generate axial or radial loads on the pump shaft are not allowed.

— Refer to paragraph 4.3 for the characteristics and installation of the filtering elements.

22 - SAE J518 CONNECTION FLANGES

dimensions in mm



Flange code	Flange description	pmax [bar]	ØA	ØB	C	D	E	F	G	H	L	1 N. 4 SHC bolts	Bolts code	2
0610719	SAE - 3/4”	345	3/4” BSP	19	18	36	19	22,2	47,6	50	65	3/8” UNC x 1 1/2”	0530612	OR 4100
0610713	SAE - 1”	345	1” BSP	25	18	38	22	26,2	52,4	55	70			OR 4131
0610720	SAE - 1 1/4”	276	1 1/4” BSP	32	21	41	22	30,2	58,7	68	79	7/16” UNC x 1 1/2”	0530613	OR 4150
0610714	SAE - 1 1/2”	207	1 1/2” BSP	38	25	45	24	35,7	70	78	93	1/2” UNC x 1 3/4”	0530638	OR 4187
0610721	SAE - 2”	207	2” BSP	51	25	45	30	43	77,8	90	102			OR 4225
0610722	SAE - 2 1/2”	172	2 1/2” BSP	63	25	50	30	50,8	89	105	116			OR 4175
0610723	SAE - 3”	138	3” BSP	73	27	50	34	62	106,4	116	134	5/8” UNC x 2”	0530658	OR 4337
0610724	SAE - 3 1/2”	34	3 1/2” BSP	89	27	48	34	69,8	120,7	136	152			OR 4387
0773528	SAE - 4”	34	4” BSP	99	27	48	34	77,77	130,18	146	162			OR 4437

The fastening bolts and the O-Rings must be ordered separately.

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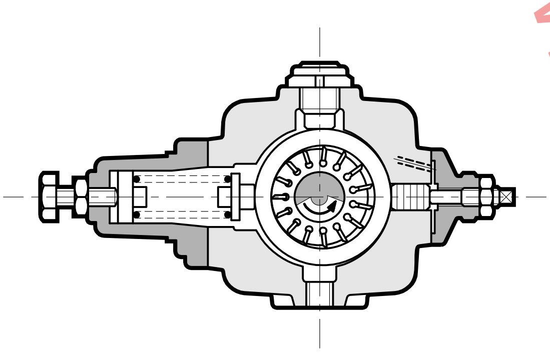
DUPLOMATIC OLEODINAMICA

PVD

VARIABLE DISPLACEMENT VANE PUMPS WITH DIRECT PRESSURE ADJUSTER

OPERATING PRINCIPLE



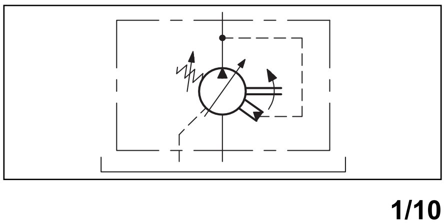
- The PVD pumps are variable displacement vane pumps with a mechanical type of pressure compensator.
- They allow instantaneous adjustment of the flow rate according to the circuit requirements. The consequence is that energy consumption is reduced and adequate in every phase of the cycle.
- The pump group is complete with hydrostatic axial compensation distribution plates that improve the volumetric efficiency and reduce wear of the components.
- The pressure compensator keeps the cam ring of the pumping group in the eccentric position with use of an adjustable load spring. When the delivery pressure equals the pressure corresponding to the spring setting, the cam ring is moved toward the center, adjusting the flow rate to the values required by the plant.
- In zero flow demand conditions, the pump delivers oil only to compensate any possible bleedings and pilotings, keeping the circuit pressure constant.
- The compensator response times are very low such as to allow elimination of the pressure relief valve.

PERFORMANCE RATINGS (measured with mineral oil with viscosity of 36 cSt at 50°C)

PVD sizes		25	28	35	45	56	72	90	115	145
Geometric displacement (UNI ISO 3662)	cm^3/rev	16	20	25	31,5	40	50	63	80	100
Actual displacement	cm^3/rev	17,9	22,1	26,9	34,5	42,8	53,1	69	86,2	105,5
Maximum flow at 1450 rpm and p = 80 bar	l/min	25	29	36,2	45,6	58	72,5	91,3	116	145
Max working pressure	bar	120	100		100			80		
Pressure adjustment range	bar	20 ÷ 120	30 ÷ 100		30 ÷ 100			30 ÷ 80		
Maximum drain port pressure allowed	bar	1								
Rotation speed range	rpm	800 ÷ 1800								
Rotation direction		clockwise (seen from the outlet shaft side)								
Shaft loads		radial and axial loads are not allowed								
Max applicable torque on shaft: version H / version K	Nm	110 / 70	197 / -		400 / -			740 / -		
Mass	kg	7,3	12		32			44		

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-10 / +50
Fluid viscosity range		see paragraph 3.2
Recommended viscosity	cSt	22 ÷ 68
Degree of fluid contamination		see paragraph 3.3

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

P	V	D				/		/		

Variable displacement vane pump

Mechanical pressure compensator

Size:
25 = 25 l/min
28 = 29 l/min
35 = 36,2 l/min
45 = 45,6 l/min
56 = 58 l/min
72 = 72,5 l/min
90 = 91,3 l/min
115 = 116 l/min
145 = 145 l/min

Mounting flange and shaft end:
K = four-bolt flange with conical keyed shaft end (for PVD25 only interchangeable with PVD 9, 13 and 17 series 30)
H = ISO 3019-2 four-bolt flange with cylindrical keyed shaft end

Option:
Q = Flow adjustment screw. Always present on PVD25
Omit if not required (see at par. 2)

Series No.
31 for PVD25
30 for other sizes
(the overall and mounting dimensions remain unchanged from 30 to 39):

Seals: omit for mineral oils
V = viton for special fluids

Option: Combined pumps.
Omit for single pump
Not available for PVD25
see at par. 13

2 - VOLUME ADJUSTMENT SCREW - PVD*Q

The volume adjuster is fitted as standard on PVD25 pumps, while is optional on the other sizes .It consists of an adjustment screw and a small balanced piston that limit the maximum eccentricity of the pumping group cam ring, changing the displacement. The maximum flow is reduced by turning the adjustment screw clockwise.

Size		**25**	**28**	**35**	**45**	**56**	**72**	**90**	**115**	**145**
Reduced displacement for screw turn	cm^3	9,7	9,7	9,7	16,4	16,4	16,4	23,8	23,8	23,8
MIN displacement	cm^3/rev	3,1	7,6	11,7	1,6	9,9	20,9	9,7	26,9	45,5

Tools required for adjustment:

PVD 25: adjustment screw hexagon socket key 5. Locking nut spanner 17.
PVD 28 to 145: square head screw, spanner 7, tooth retainer KM1 type, to loosen with hook wrench.

3 - HYDRAULIC FLUID

3.1 - Fluid type

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives. For use of other types of fluid, keep in mind the limitations shown in the following table or consult our technical department for approval.

FLUID TYPE	NOTES
HFC (water glycol solutions with proportion of water ≤ 40%)	-The values shown in the performance ratings table must be reduced by at least 50% - The pump rotation speed must be limited to 1000 rpm. - Use NBR seals only
HFD (phosphate esters)	There are no particular limitations with this kinds of fluids. Operation with a fluid viscosity as close as possible to the optimum viscosity range specified in par. 3.2 is recommended. - Use FPM (Viton) seals only

3.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	16 cSt	referred to the maximum drainage fluid temperature of 50 °C
optimum viscosity	22 ÷ 68 cSt	referred to the fluid working temperature in the tank
maximum viscosity	400 cSt	limited to only the start-up phase of the pump

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

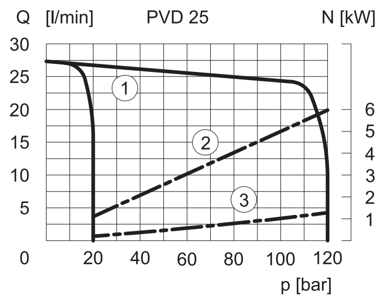
3.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with β_{20} ≥75 is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with $\beta_{10} \geq 100$ is recommended.

If there is a filter installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in paragraph 12. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

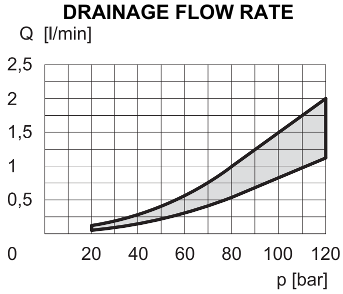
4 - PVD25 CHARACTERISTIC CURVES (obtained with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE - ABSORBED POWER

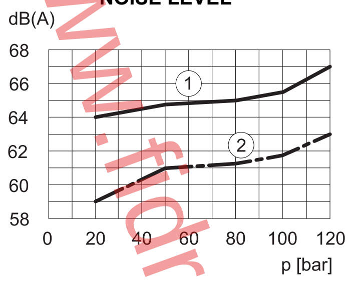


1) Flow rate - pressure curves, measured at 1500 rpm
2) Absorbed power at the maximum flow rate
3) Absorbed power at zero flow rate

DRAINAGE FLOW RATE



NOISE LEVEL

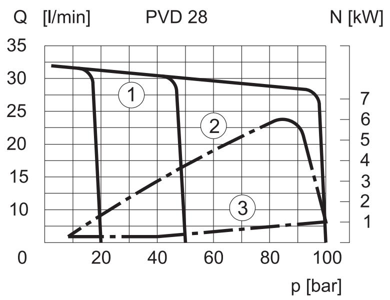


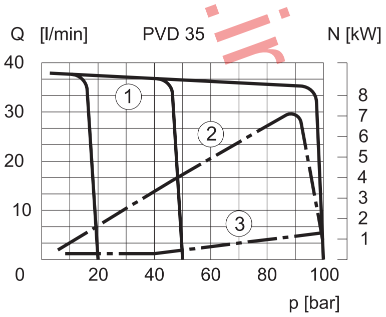
Approximate maximum values of noise level to minimum and maximum flow rate measured with the sound-level meter placed at one meter from pump coupling with flexible coupling.

1) noise at max flow
2) noise with zero flow

5 - PVD28, PVD35 CHARACTERISTIC CURVES (obtained with viscosity of 36 cSt at 50°C)

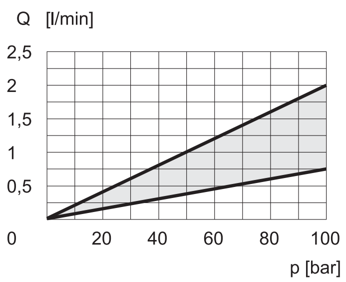
FLOW RATE - PRESSURE - ABSORBED POWER



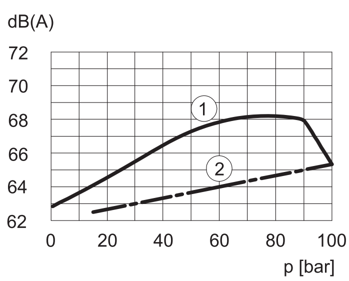


1) Flow rate - pressure curves, measured at 1450 rpm
2) Absorbed power at the maximum flow rate
3) Absorbed power at zero flow rate

DRAINAGE FLOW RATE



NOISE LEVEL

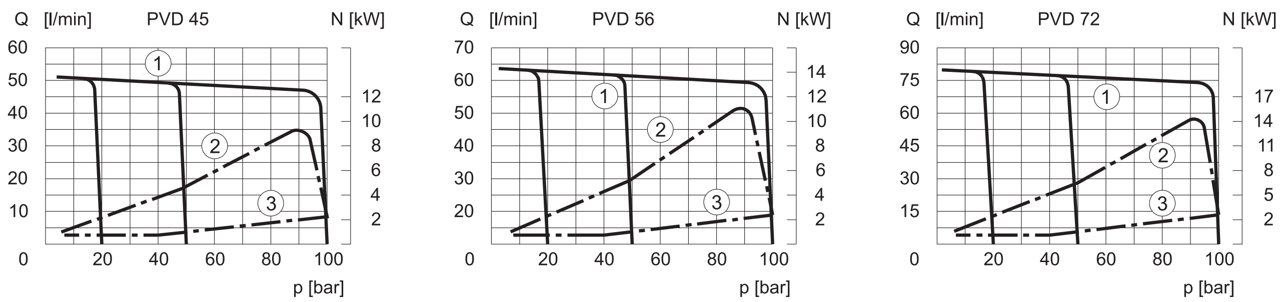


Approximate maximum values of noise level to minimum and maximum flow rate measured with the sound-level meter placed at one meter from pump coupling with flexible coupling.

1) noise at max flow
2) noise with zero flow

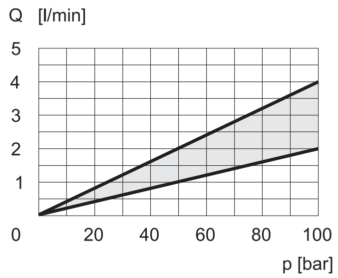
6 - PVD45, PVD56 and PVD72 CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE - ABSORBED POWER

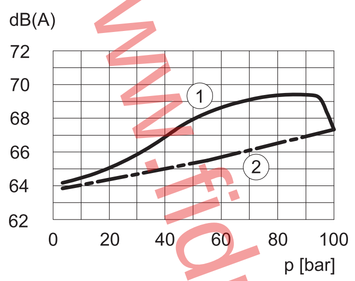


1) Flow rate - pressure curves, measured at 1450 rpm
2) Absorbed power at the maximum flow rate
3) Absorbed power at zero flow rate

DRAINAGE FLOW RATE



NOISE LEVEL

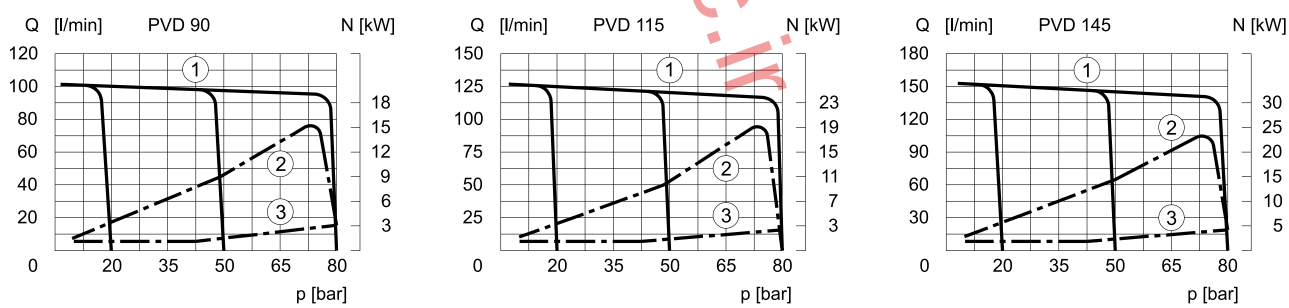


Approximate maximum values of noise level to minimum and maximum flow rate measured with the sound-level meter placed at one meter from pump coupling with flexible coupling.

1) noise at max flow
2) noise with zero flow

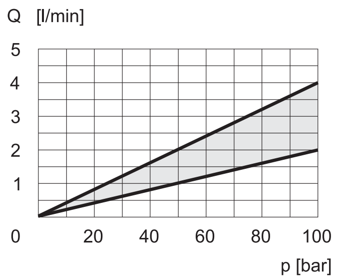
7 - PVD90, PVD115 and PVD145 CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE - ABSORBED POWER

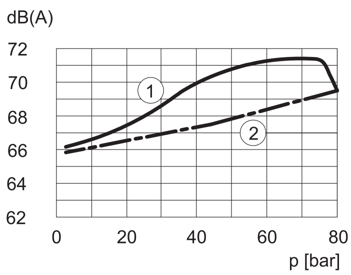


1) Flow rate - pressure curves, measured at 1450 rpm
2) Absorbed power at the maximum flow rate
3) Absorbed power at zero flow rate

DRAINAGE FLOW RATE



NOISE LEVEL



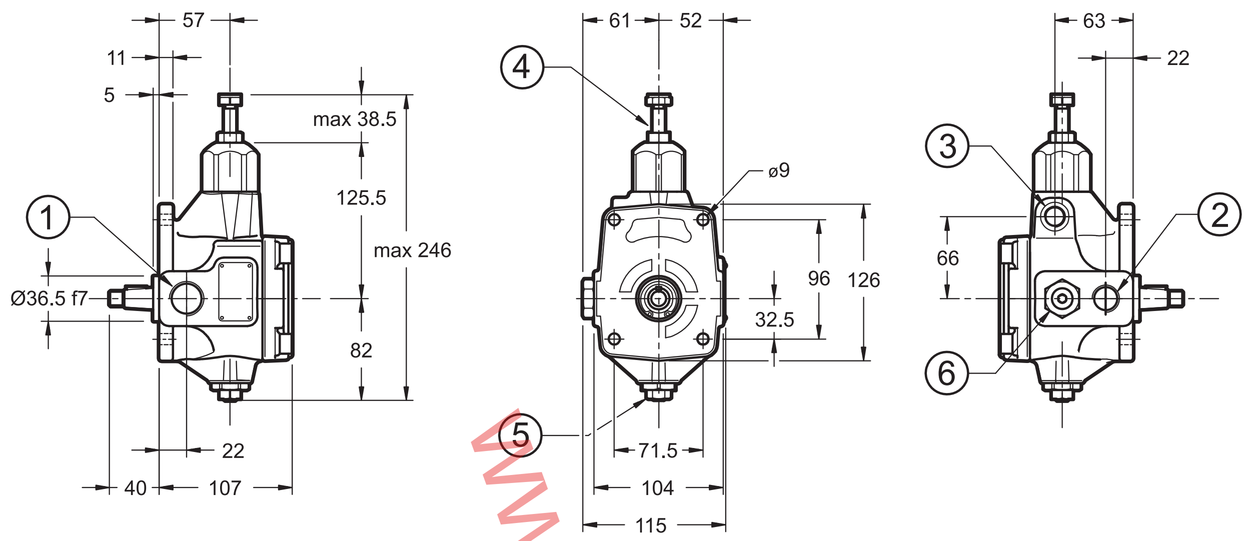
Approximate maximum values of noise level to minimum and maximum flow rate measured with the sound-level meter placed at one meter from pump coupling with flexible coupling.

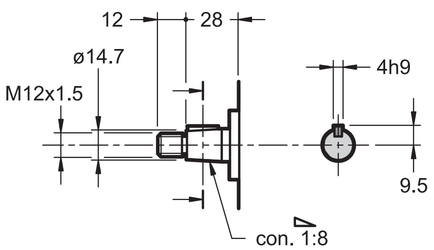
1) noise at max flow
2) noise with zero flow

8 - PVD25 OVERALL AND MOUNTING DIMENSIONS

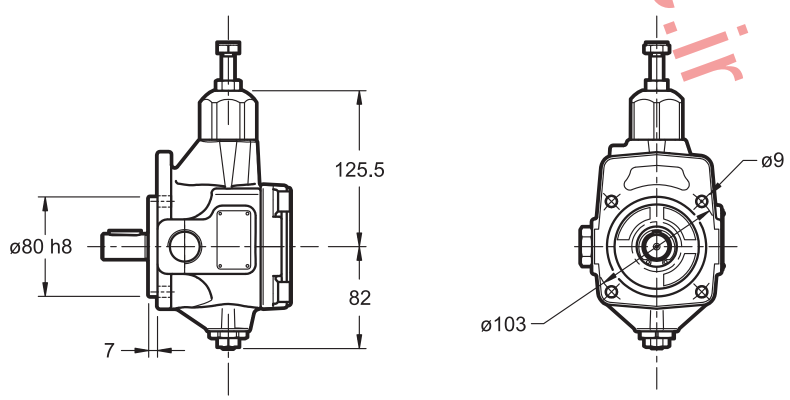
dimensions in mm

PVD25K

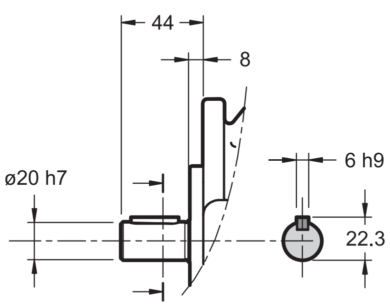




PVD25H



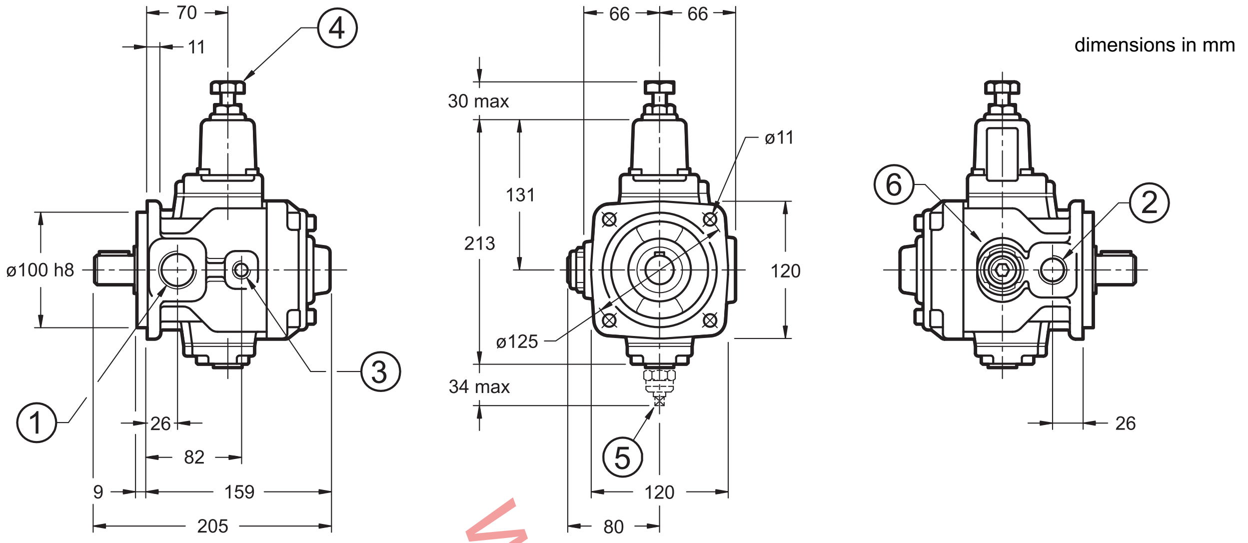
for non quoted dimensions
refer to the drawing PVD25K

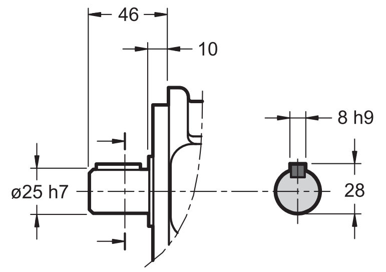


1	Suction port: 3/4” BSP
2	Delivery port: 1/2” BSP
3	Drainage port: 3/8” BSP
4	Pressure adjustment screw. Rotate clockwise to increase pressure. Spanner 17. Locking nut : spanner 17.
5	Flow adjustment screw. Rotate clockwise to decrease flow. socket hex screw, hex key 5.Locking nut: spanner 17.
6	Guide block balancing adjustment screw. **Do not tamper.**

9 - PVD28, PVD35 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

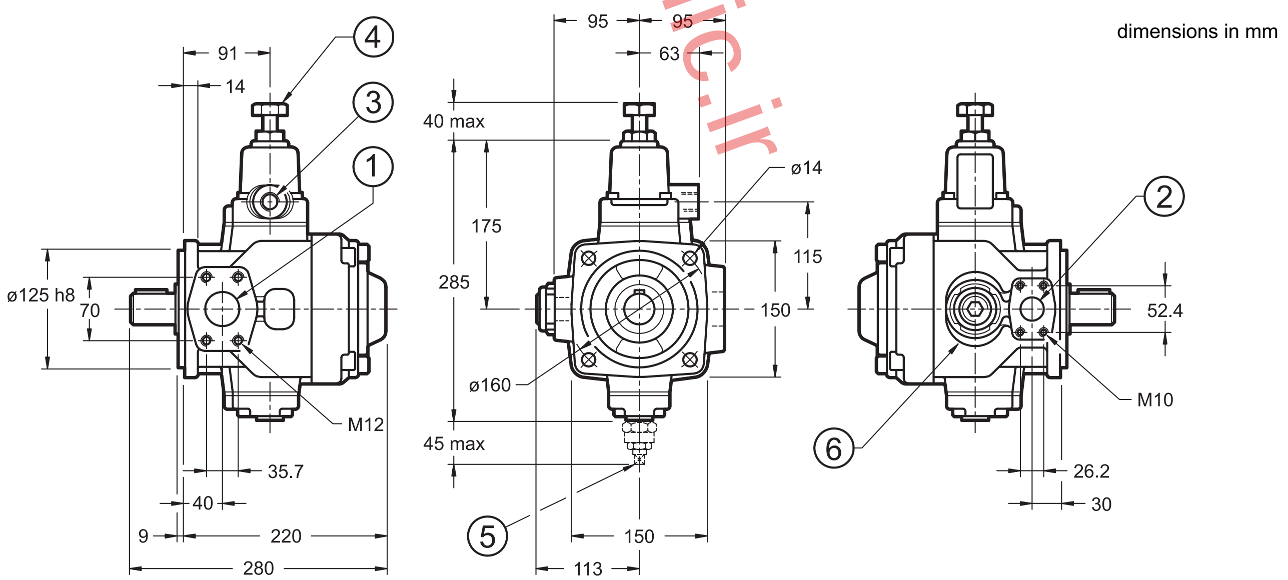


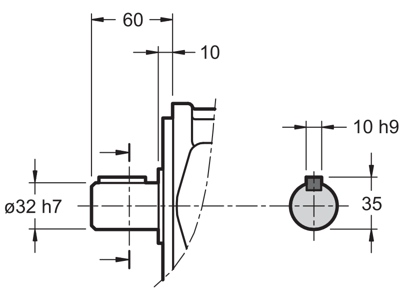


1	Suction port: 1” BSP
2	Delivery port: 3/4” BSP
3	Drainage port: 3/8” BSP
4	Pressure adjustment screw. Rotate clockwise to increase pressure. Spanner 17. Locking nut : spanner 17.
5	Flow adjustment screw. Rotate clockwise to decrease flow. square head screw, spanner n° 7. Retainer KM1 type.
6	Guide block balancing adjuster. **Do not tamper.**

10 - PVD45, PVD56 AND PVD72 OVERALL AND MOUNTING DIMENSIONS

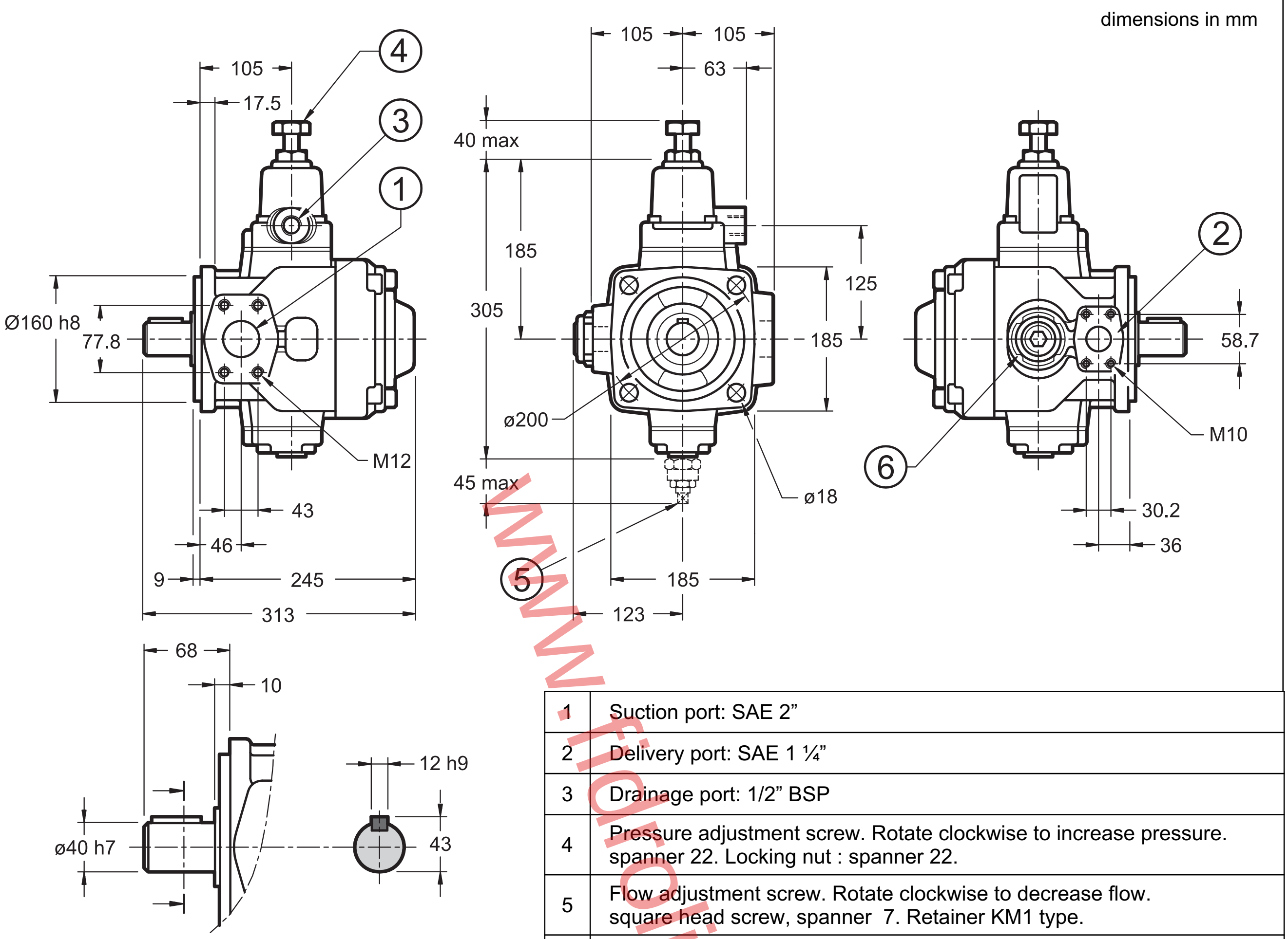
dimensions in mm





1	Suction port: SAE 1 1/2”
2	Delivery port: SAE 1”
3	Drainage port: 1/2” BSP
4	Pressure adjustment screw. Rotate clockwise to increase pressure. Spanner 22. Locking nut : spanner 22.
5	Flow adjustment screw. Rotate clockwise to decrease flow. square head screw, spanner n° 7. Retainer KM1 type.
6	Guide block balancing adjuster. **Do not tamper.**

11 - PVD90, PVD115 AND PVD145 OVERALL AND MOUNTING DIMENSIONS



1	Suction port: SAE 2”
2	Delivery port: SAE 1 ¼”
3	Drainage port: 1/2” BSP
4	Pressure adjustment screw. Rotate clockwise to increase pressure. spanner 22. Locking nut : spanner 22.
5	Flow adjustment screw. Rotate clockwise to decrease flow. square head screw, spanner 7. Retainer KM1 type.
6	Guide block balancing adjuster. **Do not tamper.**

12 - INSTALLATION

— The instruction manual for the installation and commissioning of the pumps is always included in the packaging with the pump. Observe restrictions in this document and follow the instructions.

— The PVD pumps up to size 35 can be installed with the axis oriented in any position. For other sizes the pump must be installed with the axis in horizontal position and with the pressure compensator upward.

— The motor-pump connection must be carried out directly with a flexible coupling. Couplings that generate axial or radial loads on the pump shaft are not allowed.

— The suction line must be short, with end pipe cut at 45 ° and suitably sized: the minimum cross-section of the tube should reflect that of the thread on the inlet port of the pump to facilitate the oil flow. Bends and restrictions or an excessive line length can impair correct operation of the pump.
Suction pressure should be between 0.8 and 1.5 bar absolute

— The drainage pipe must be connected directly to the tank by a line separate from other discharges, located as far as possible from the suction line and lengthened to below the minimum oil level in order to avoid foaming.

— The tank must be suitably sized in order to allow the cooling of the fluid. It should be good that the fluid in the tank do not exceed 50°C. If necessary, consider the installation of a heat exchanger on the drain line.

— The pump start up must be done in full displacement (P→T) with flow to the tank, to purge the air.

— It’s essential that the difference between the fluid temperature and the ambient (pump body) temperature doesn’t exceed 20°C

— The pumps are usually placed directly upon the oil tank. Flooded suction port installation of the pumps is recommended in the case of circuits with high flow rates and pressures.

13 - MULTIPLE PUMPS

The PVD pumps from size 28 and up are designed to be connected one to the other in decreasing order of displacement. They can be combined also with PVA type pumps (see catalogue 14 200) and with GP1 and GP2 size gear pumps (see catalogue 11 100). The torque on the shaft must be further reduced after the second pump. Consult our technical department for this type of applications .

IDENTIFICATION CODE FOR MULTIPLE PUMPS

Fill the ordering code, following the coupling sequence of the pumps. Insert the suffix that shows the pump position at the end of each PVD pump identification code.

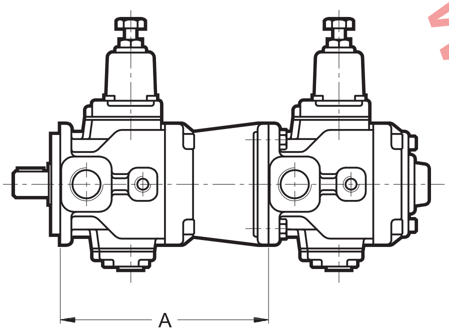
/	30		— pump location:

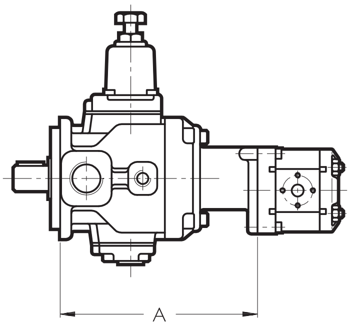
pump location:
/A = Front
/ I = Intermediate
/ P = Rear

identification code 1st pump + identification code 2nd pump + identification code 3rd pump (omit for single pumps)

Double pump identification example: PVD35HQ/30/V **/A +** PVD28H/30/V **/P**
Triple pump identification example: PVD90H/30 **/A +** PVD35HQ/30 **/I +** PVD28H/30 **/P**
PVD pump + GP pump identification example: PVD35HQ/30 **/A +** GP1-0061R97F/20N

NOTE: for the single pump identification codes see: cat. 11 100 par. 1 for GP pumps - cat. 14 200 par. 1 for PVA pumps



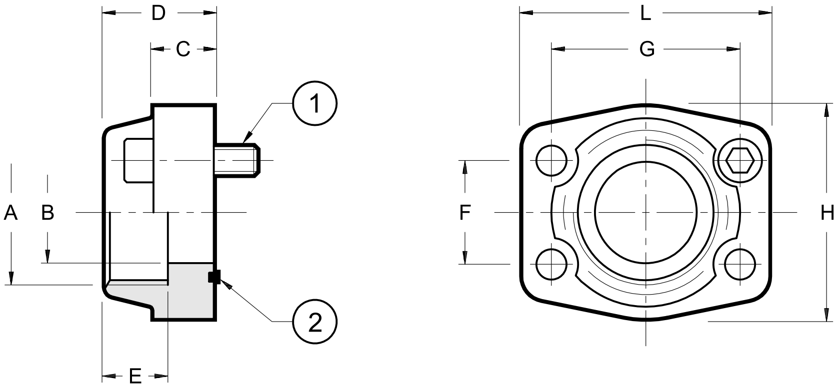


Max. torque applied to the shaft of the second pump (Nm)		
size group Primary pump	Second pump (same size group)	Second pump (smaller size group)
PVD 28/35	43	-
PVD 45/56/72	113	113
PVD 90/115/145	186	113

dimension A (mm)		
with PVD pump (same size group)	With gear pump type:	
207	GP1 and GP2	196
275	GP1 and GP2	262
315	GP1 and GP2	287

14 - CONNECTION FLANGES

dimensions in mm



The fastening bolts and the O-Rings must be ordered separately.

flange code	flange description	p_{max} [bar]	ØA	ØB	C	D	E	F	G	H	L	(1) bolts	(2)
0610713	SAE - 1”	345	1” BSP	25	18	38	22	26.2	52.4	22	70	N. 4 SHC M10x35	OR 4131 (32.93x3.53)
0610720	SAE - 1 1/4”	276	1 1/4” BSP	32	21	41	22	30.2	58.7	68	79		OR 4150 (37.69x3.53)
0610714	SAE - 1 1/2”	207	1 1/2” BSP	38	25	44	24	35.7	70	78	93	N. 4 SHC M12x45	OR 4187 (47.22x3.53)
0610721	SAE - 2”	207	2” BSP	51	25	45	30	43	77.8	90	102		OR 4225 (56.74x3.53)

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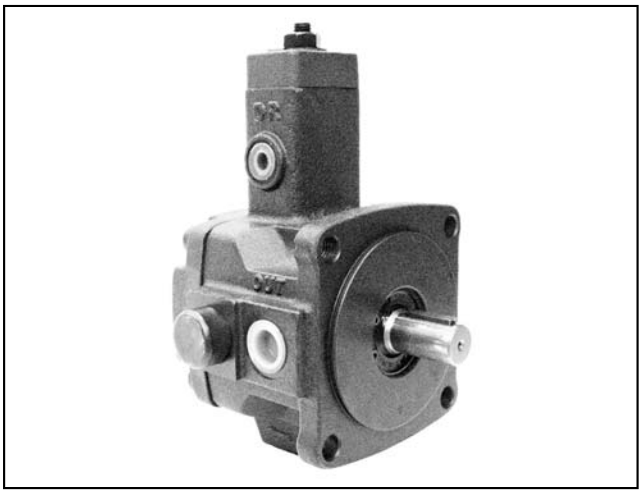
DUPLOMATIC OLEODINAMICA

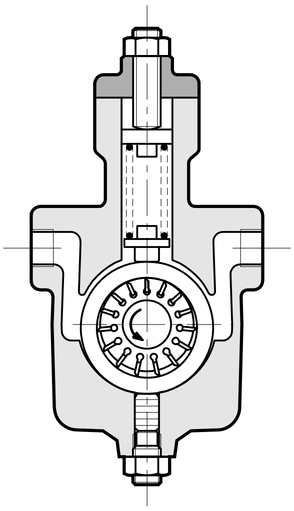


PVE

VARIABLE DISPLACEMENT VANE PUMPS WITH DIRECT PRESSURE ADJUSTMENT

SERIES 30

OPERATING PRINCIPLE



— The PVE pumps are variable displacement vane pumps with direct pressure regulator.

— The pump group is complete with hydrostatic axial compensation distribution plates that improve the volumetric efficiency and reduce wear of the components.

— The pressure regulator adjustable load spring keeps the pump group cam ring in eccentric position.

When the delivery pressure equals the pressure corresponding to the spring setting, the cam ring is moved so to reduce the displacement, adjusting the flow rate to the values required by the plant.

In zero flow demand conditions, the pump delivers oil only to compensate any possible bleedings, keeping the circuit pressure constant.

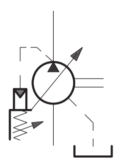
— The PVE pumps are available in four dimensions with maximum displacement from 6,6 to 22,2 cm^3/rev and with pressure regulator max setting values up to 35 bar and 70 bar (standard).

TECHNICAL SPECIFICATIONS

PUMP SIZE		006	011	016	023
Displacement	cm^3/rev	6,6	11,1	16,6	22,2
Flow rate (at 1.500 rpm and with 3.5 bar delivery pressure)	l/min	10,0	16,7	25,0	33,3
Operating pressure	bar	70			
Rotation speed	rpm	min 800 - max 1800			
Rotation direction		clockwise (seen from the shaft side)			
Shaft loads	N	radial and axial loads are not allowed			
Hydraulic connection		BSPP (parallel) threading fittings			
Type of mounting		SAE flange J744 - 2 holes		rectangular flange - 4 holes	
Mass	kg	5	6	9	9

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-10 / +70
Fluid viscosity range	see paragraph 2.2	
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	25 ÷ 50

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

P	V	E	-			-	R		0	B	/	30	N

Variable displacement vane pumps with direct pressure regulator

Pump dimension:

006
011
016
023
see table 3

Pressure regulator:
PC3 up to 70 bar (**standard**)
PC2 up to 35 bar

NBR seals for mineral oils (**standard**)

Series No. (the overall and mounting dimensions remain unchanged from 30 to 39)

BSPP (British Standard Pipe Parallel) threading hydraulic connection

Shaft end type cylindrical SAE J744

Mounting flange
0 = SAE J744 - 2 holes (only for PVE-006 and PVE-011)
9 = rectangular - 4 holes (only for PVE-016 and PVE-023)

Clockwise rotation (seen from the shaft side)

2 - HYDRAULIC FLUID

2.1 - Fluid type

Use only HL and HLP mineral oil based hydraulic fluids according to ISO 6743/4.

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	16 cSt	referred to the maximum drainage fluid temperature of 70 °C.
optimum viscosity	25 ÷ 50 cSt	referred to the fluid working temperature in the tank.
maximum viscosity	800 cSt	limited to only the start-up phase of the pump.

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter with $\beta_{20} \geq 75$ is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with $\beta_{10} \geq 100$ is recommended.

The filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

3 - PERFORMANCES (obtained with viscosity of 46 cSt at 40°C)

PUMP	REGULATOR	DISPLACEMENT [cm³/rev]	MAX FLOW RATE [l/min]		PRESSURE ADJUSTMENT RANGE [bar]		ROTATION SPEED [rpm]	
			1500 rev	1800 rev	min	max	min	max
PVE-006	PC2	6,6	10	12	15	35	800	1800
	PC3				50	70		
PVE-011	PC2	11,1	16,7	20	15	35		
	PC3				50	70		
PVE-016	PC2	16,6	25	30	15	35		
	PC3				50	70		
PVE-023	PC2	22,2	33,3	40	15	35		
	PC3				50	70		

NOTE: Flow rate values are obtained with delivery pressure = 3.5 bar

4 - NOISE LEVEL

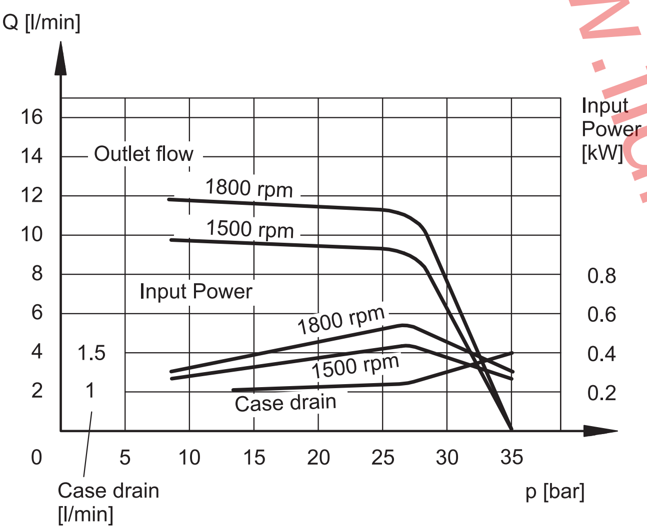
PUMP	NOISE LEVEL [dB (A)] null displacement	full displacement
PVE-006	61	63
PVE-011	62	65
PVE-016	64	68
PVE-023	64	70

The noise pressure levels were measured in a semi-anechoic room, at an axial distance of 1 m from the pump.
The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

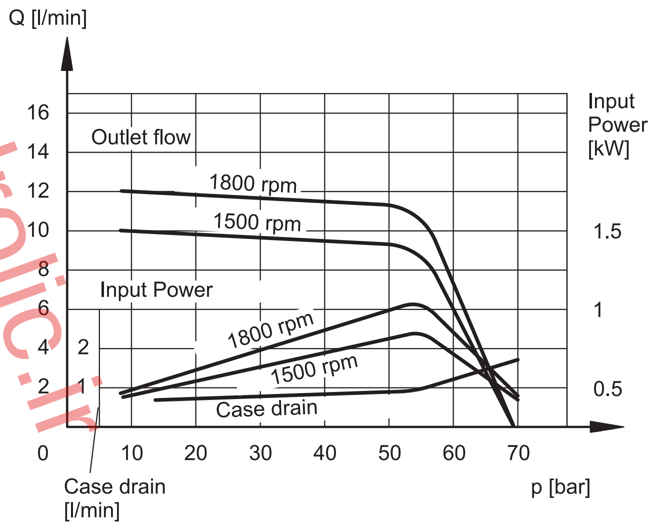
5 - CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 46 cSt at 40°C)

The diagram curves were measured with a pump rotation speed of 1500 and 1800 rev/min.

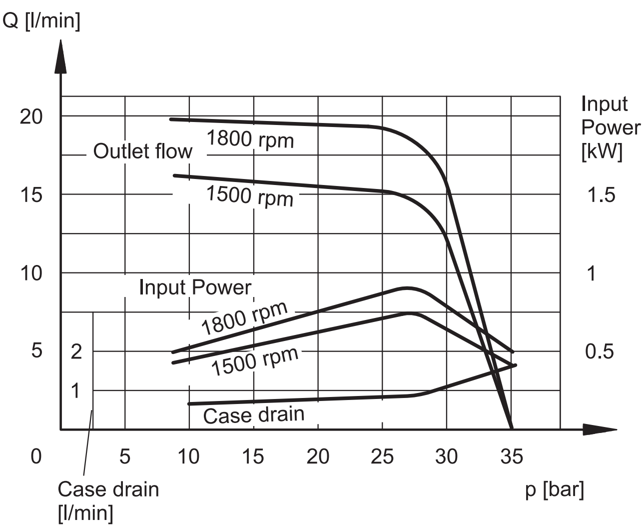
PVE-006PC2



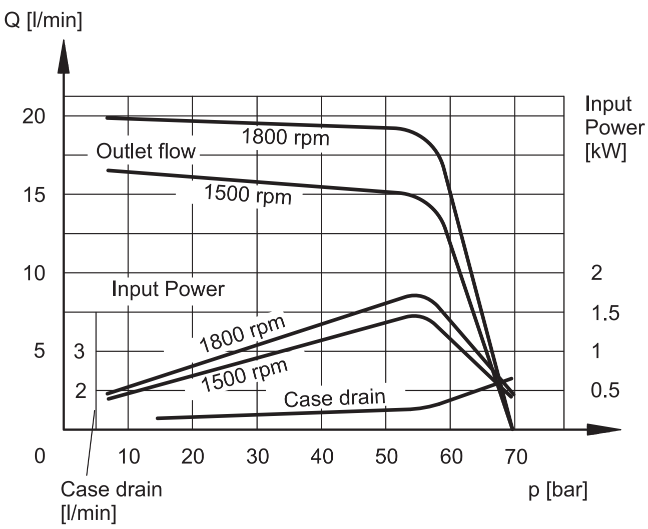
PVE-006PC3



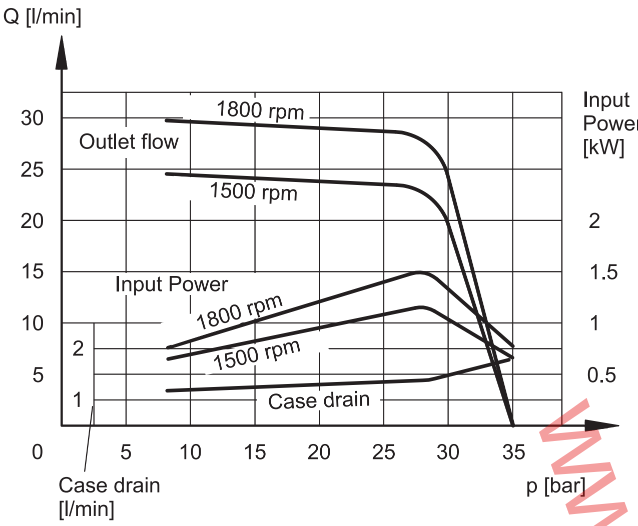
PVE-011PC2



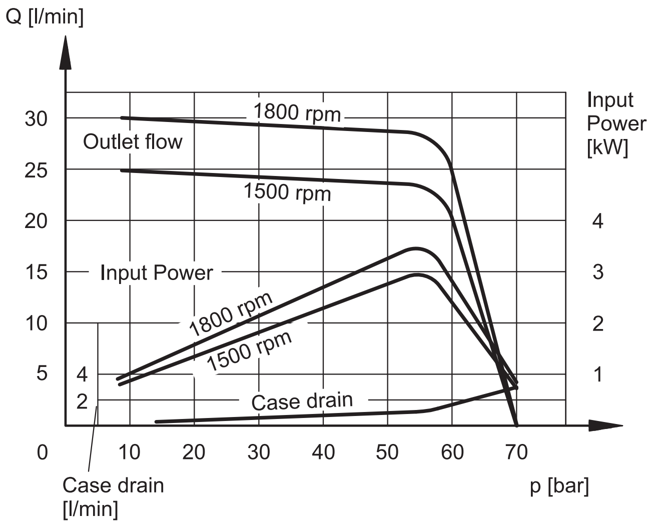
PVE-011PC3



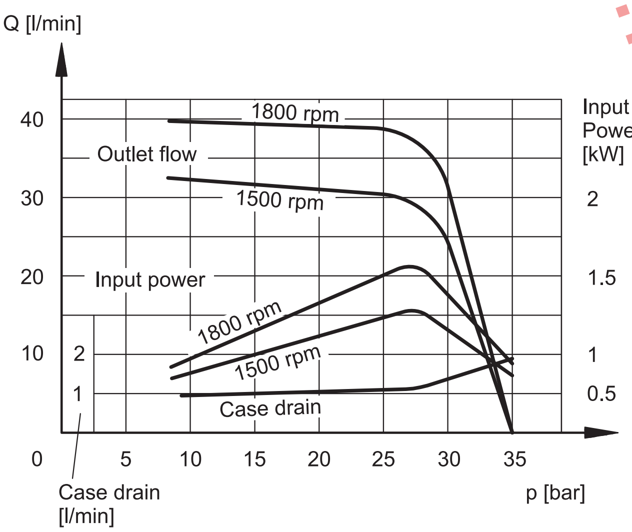
PVE-016PC2



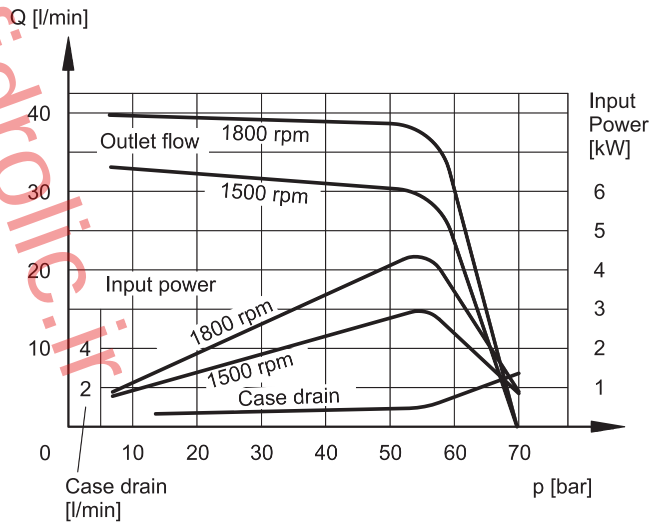
PVE-016PC3



PVE-023PC2

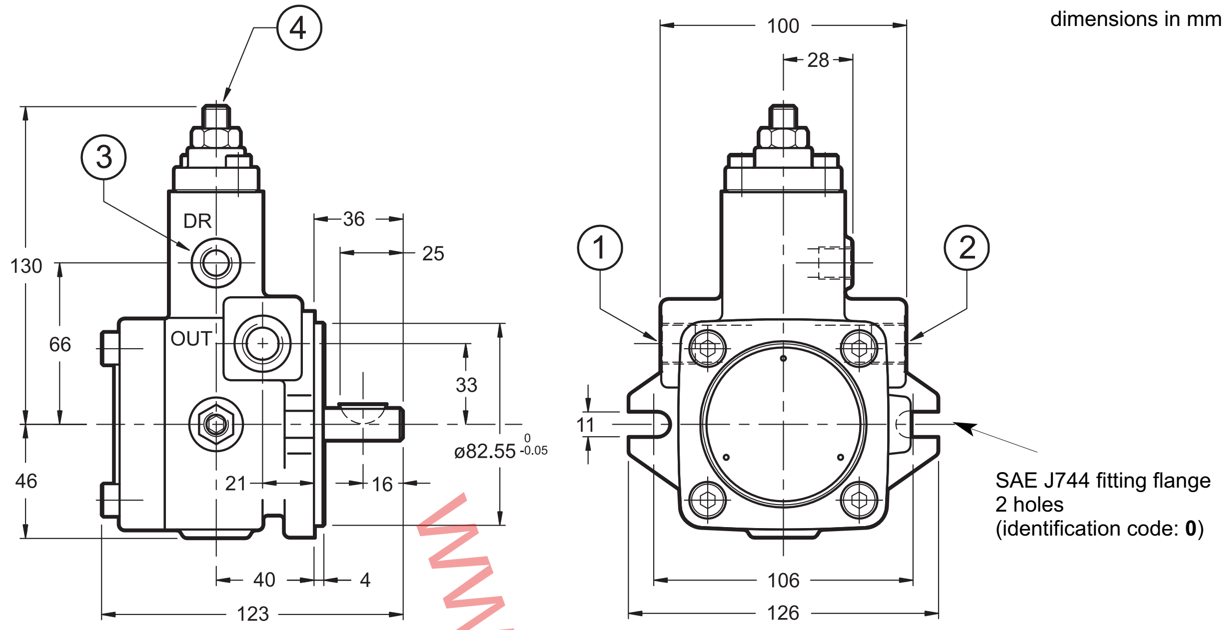


PVE-023PC3

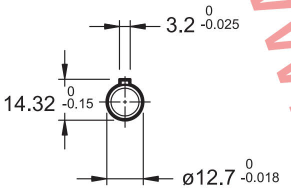


6 - OVERALL AND MOUNTING DIMENSIONS PVE-006

dimensions in mm



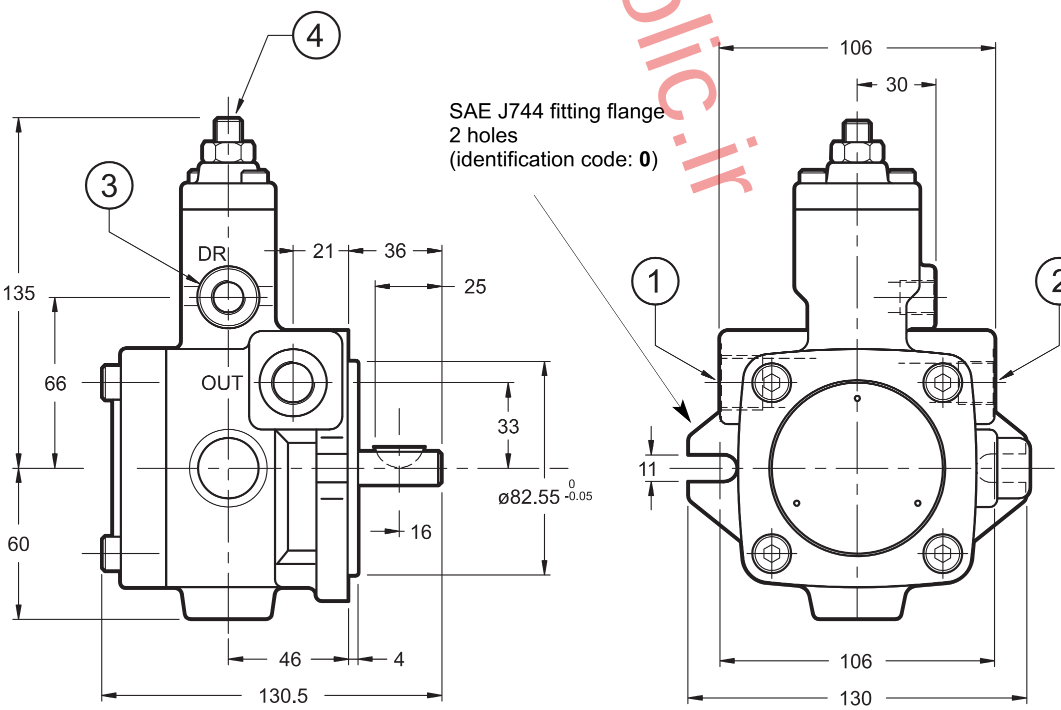
Cylindrical with
key shaft end SAE J744
(identification code: **0**)



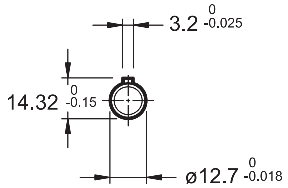
1	Suction port: 3/8" BSPP (parallel)
2	Delivery port: 3/8" BSPP (parallel)
3	Case drainage port: 1/4" BSPP (parallel)
4	Pressure compensator. Clockwise rotation to higher pressure.

7 - OVERALL AND MOUNTING DIMENSIONS PVE-011

dimensions in mm

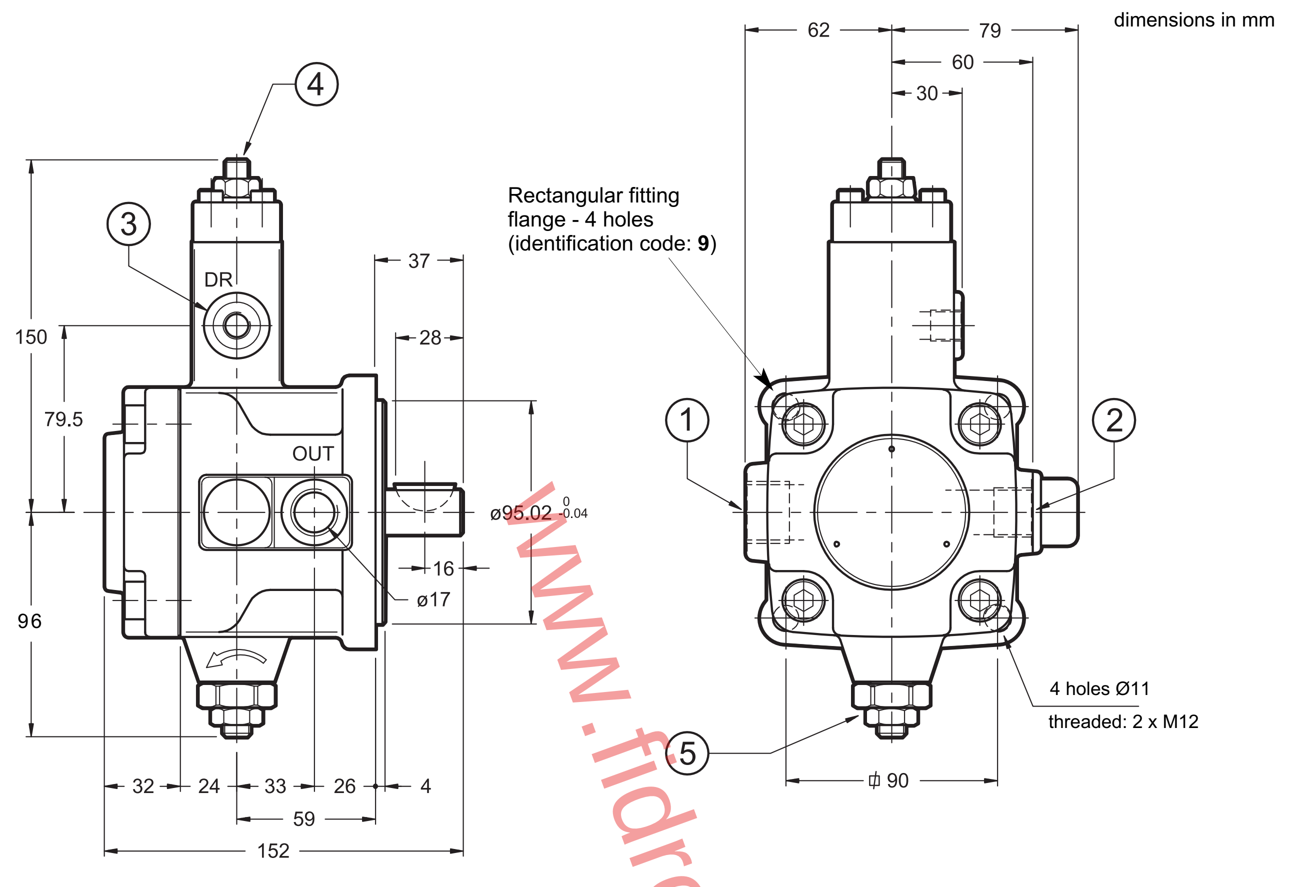


Cylindrical with key shaft end
SAE J744
(identification code: **0**)



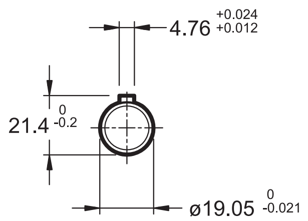
1	Suction port: 1/2" BSPP (parallel)
2	Delivery port: 3/8" BSPP (parallel)
3	Case drainage port: 1/4" BSPP (parallel)
4	Pressure compensator. Clockwise rotation to higher pressure.

8 - OVERALL AND MOUNTING DIMENSIONS PVE-016 AND PVE-023



Cylindrical with key shaft end
SAE J744

(identification code: **0**)



1	Suction port: 3/4” BSPP (parallel)
2	Delivery port: 1/2” BSPP (parallel)
3	Case drainage port: 1/4” BSPP (parallel)
4	Pressure compensator. Clockwise rotation to higher pressure.
5	Volume adjustment. Clockwise rotation to reduce flow.

9 - INSTALLATION

— The PVE pumps can be installed with the axis oriented in any position.

— The suction tube has to be suitably sized so that the suction pressure is never lower than -0.3 bar (relative). Bends or restrictions or an excessive tube length could further decrease the value of the suction pressure with a following increase in the noise emissions and a decrease in the pump lifetime.

— The drainage port must be connected directly to the tank by a line separate from other discharges, located far from the suction line and lengthened to below the minimum oil level so as to avoid formation of foam.

— **Before starting, the pump body has to be filled with the fluid.** The pump start up, especially at a cold temperature, should occur with the pump unloading. Start and stop motor several time in order to purge the air from pump and pipelines.

— The pumps are normally positioned directly above the oil tank. Flooded suction port installation of the pumps is advisable in the case of circuits with high flow rates and pressures.

— The drainage tube has to be sized so that the pressure inside the pump body is always lower than 0.3 bars (relative), even during the dynamic change and flow rate phases. The drainage tube has to unload inside the tank far from the suction area. We suggest to interpose a screen between the two lines.

— The motor-pump connection must be carried out directly with a flexible coupling. Couplings that generate axial or radial loads on the pump shaft are not allowed.

10 - MULTIPLE PUMPS

PVE-016 and PVE-023 pumps can be connected to external gear pumps (see available displacements in the table at par. 10.3). The possibility to couple two pumps makes possible to create multi-flow groups with independent hydraulic circuits.

10.1 - Maximum applicable torque

While sizing coupled pumps, consider that the shaft of the front pump must bear the torque generated by both pumps when they are loaded simoultaneusly.

NOTE: The maximum applicable torque at the shaft of the front pump is 62 Nm.

The input torque (M) for each pump is given by the following ratio:

$$M = \frac{9550 \cdot N}{n} = [Nm]$$

n = rotation speed [rpm]

where the absorbed power (N) is given by:

$$N = \frac{Q \cdot \Delta p}{600 \cdot \eta_{tot}} = [kW]$$

Q = flow rate [l/min]
Δp = differential pressure between the pump suction and delivery [bar]
η_{tot} = total efficiency (coefficient = 0.8)

If the total of the obtained torques is higher than 62 Nm, it is necessary to reduce the working pressure / flow value of one or both the pumps until the total torque becomes lower than the maximum value indicated.

10.2 - Multiple pumps identification code

	+	G		/	30	N

PVE-016 or PVE-023 pump code (see par. 1)

G: External gear pump

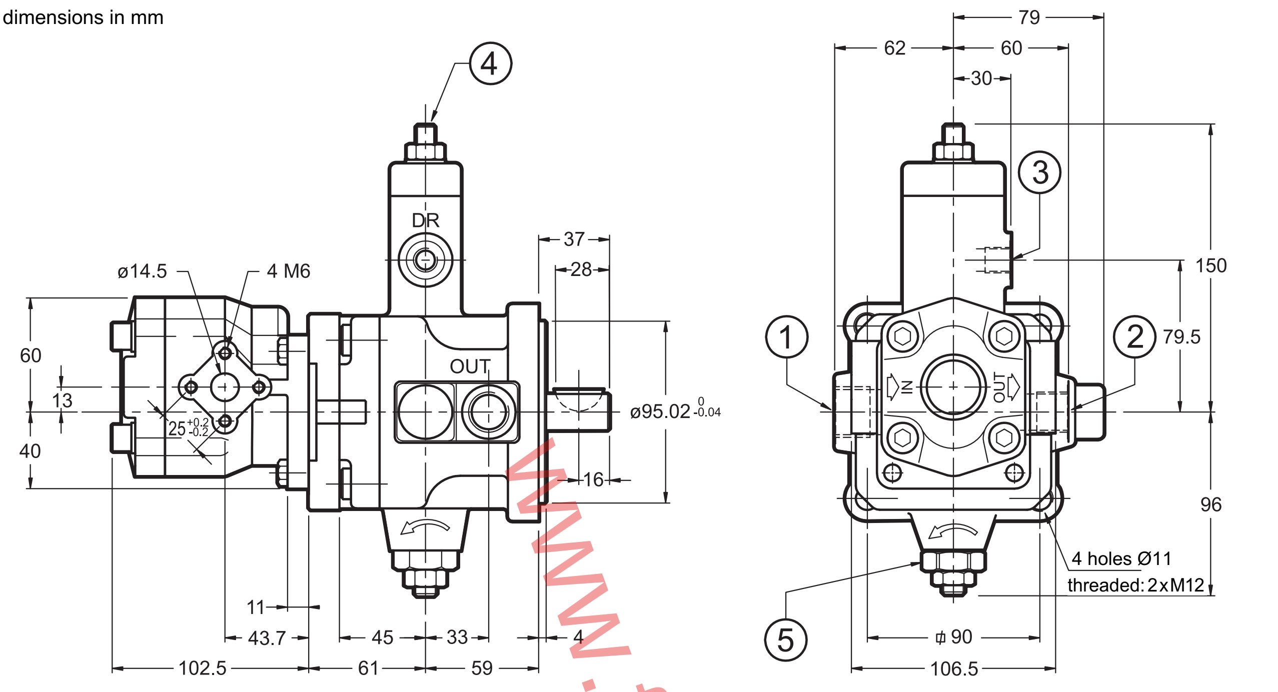
Nominal dimension (see table par. 10.3)

30: Series No. (the overall and mounting dimensions remain unchanged from 30 to 39)

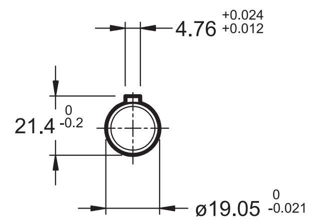
N: NBR seals for mineral oils

10.3 - Multiple pumps overall and mounting dimensions

dimensions in mm



Cylindrical with key shaft end
SAE J744
(identification code: **0**)



AVAILABLE GEAR PUMPS

<table>
<tr><th>Nominal dimension</th><th>Displacement [cm³/rev]</th><th>Max working pressure [bar]</th><th>Peak pressure [bar]</th><th>Min speed [rev/min]</th></tr>
<tr><td>0020</td><td>2</td><td rowspan="9">210</td><td rowspan="9">250</td><td>900</td></tr>
<tr><td>0025</td><td>2.5</td><td rowspan="2">850</td></tr>
<tr><td>0030</td><td>3</td></tr>
<tr><td>0040</td><td>4</td><td rowspan="7">800</td></tr>
<tr><td>0050</td><td>5</td></tr>
<tr><td>0060</td><td>6</td></tr>
<tr><td>0075</td><td>7.5</td></tr>
<tr><td>0090</td><td>9</td></tr>
<tr><td>0105</td><td>10.5</td></tr>
<tr><td>0120</td><td>12</td><td>175</td><td>210</td></tr>
</table>

Gear pump weight: 1.7 kg

1	Suction port: 3/4” BSPP (parallel)
2	Delivery port: 1/2” BSPP (parallel)
3	Case drainage port: 1/4” BSPP (parallel)
4	Pressure compensator. Clockwise rotation to higher pressure.
5	Volume adjustment. Clockwise rotation to reduce flow.

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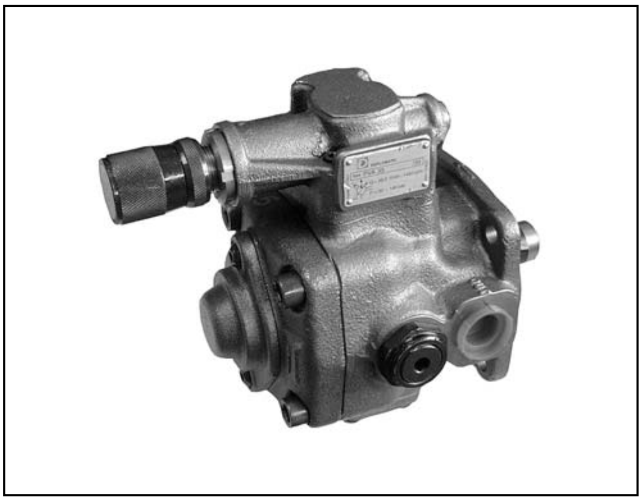
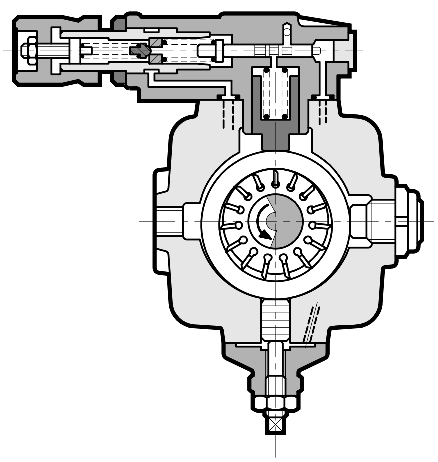


PVA
VARIABLE DISPLACEMENT VANE PUMPS
SERIES 30

OPERATING PRINCIPLE



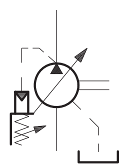
- The PVA pumps are variable displacement vane pumps with piloted type hydraulic pressure compensator.
- They permit instantaneous adjustment of the flow rate according to the circuit requirements.The consequence is that energy consumption is reduced and adequate in every cycle phase.
- The pumping group is complete with hydrostatic axial compensation distribution plates that improve the volumetric efficiency and reduce wear of the components.
- The pressure compensator operates with the principle of keeping the cam ring of the pumping group in the eccentric position with use of a piston controlled hydraulically by a pressure pilot stage.
- When the delivery pressure equals the pressure corresponding to the pilot stage setting, the cam ring is moved toward the center adjusting the flow rate to the plant requirements.
- In zero flow demand conditions, the pump delivers oil only to compensate any possible bleedings and pilotings, keeping the circuit pressure constant.
- The compensator response times are very restrained and such as to allow elimination of the pressure relief valve.
- Also available are the versions with maximum flow adjustment PVA***Q and with the device for selection of two independent pressure values with solenoid valve PVA***M.

TECHNICAL SPECIFICATIONS (measured with mineral oil with viscosity of 36 cSt at 50°C)

PUMP SIZE		22	28	35	45	56	72	90	115	145
Displacement	cm^3/rev	16	20	25	31,5	40	50	63	80	100
Nominal flow rate (at 1450 rpm)	l/min	23,2	29	36,2	45,6	58	72,5	91,3	116	145
Maximum operating range	bar	160						150		
Pressure adjustment range	bar	30 ÷ 160						30 ÷ 150		
Maximum pressure on drain port	bar	1								
Rotation speed range	rpm	800 ÷ 1800								
Rotation direction		clockwise (seen from the outlet shaft side)								
Loads on the shaft:		loads radial and axial not allowed								
Maximum applicable shaft torque	Nm	197			400			740		
Mass	kg	13			33			45		

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-10 / +70
Fluid viscosity range	see paragraph 2.2	
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	25 ÷ 50

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

P	V	A				/	30	/		/	

Variable displacement vane pump

Size
22 = 23,2 l/min
28 = 29 l/min
35 = 36,2 l/min
45 = 45,6 l/min
56 = 58 l/min
72 = 72,5 l/min
90 = 91,3 l/min
115 = 116 l/min
145 = 145 l/min

M = Dual pressure value selection device (omit if not required)

Q = flow adjuster (omit if not required)

Series No. (the overall and mounting dimensions remain unchanged from 30 to 39)

Seals: omit for mineral oils
V = viton for special fluids

Pump position: add for multiple pumps only
A = Front
I = Intermediate
P = Rear

2 - HYDRAULIC FLUID

2.1 - Fluid type

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives. For use of other types of fluid, keep in mind the limitations shown in the following table or consult our technical department for authorization of use.

FLUID TYPE	NOTES
HFC (water glycol solutions with proportion of water ≤ 40 %)	- The values shown in the performance ratings table must be reduced by at least 50% . - The pump rotation speed must be limited to 1000 rpm. - The maximum fluid temperature must be less than 50°C.
HFD (phosphate esters)	There are no particular limitations with respect to the values shown in the performance ratings table. Operation with a fluid viscosity as close as possible to the optimum viscosity range specified in par. 2.2 is recommended.

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	16 cSt	referred to the maximum drainage fluid temperature of 70 °C
optimum viscosity	25 ÷ 50 cSt	referred to the fluid working temperature in the tank
maximum viscosity	800 cSt	limited to only the start-up phase of the pump

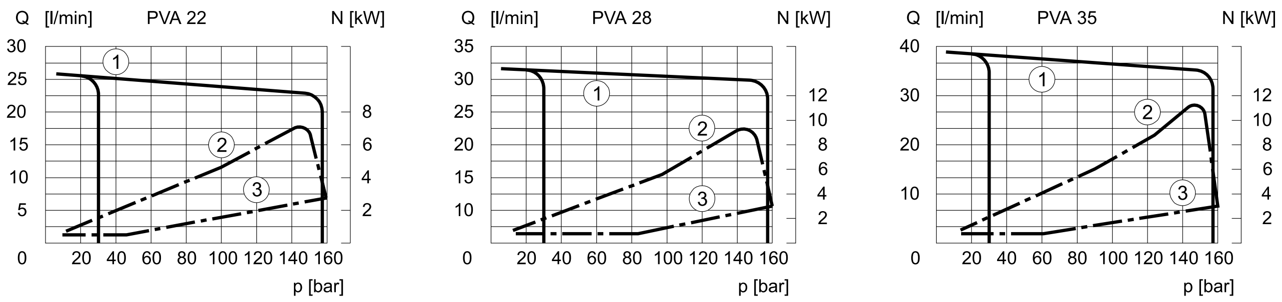
When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore, use of a filter withβ_{20} ≥75 is recommended. A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, use of a filter with β_{10} ≥100 is recommended.
The filter must be equipped with a by-pass valve and, if possible, with a clogging indicator.

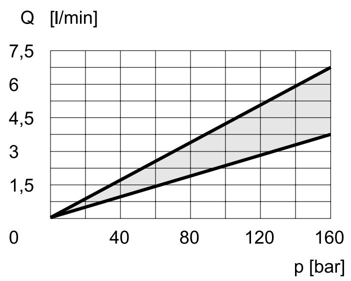
3 - PVA - 22/28/35 CHARACTERISTIC CURVES (obtained with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE - ABSORBED POWER



① Flow rate - pressure curves, measured at 1450 rpm
② Absorbed power at the maximum flow rate
③ Absorbed power at the zero flow rate

DRAINAGE FLOW RATE



RESPONSE TIMES AND PRESSURE PEAK

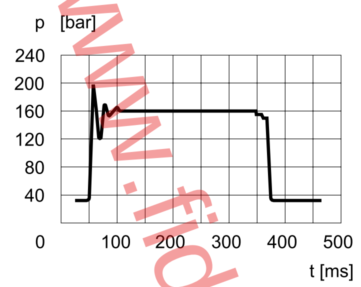
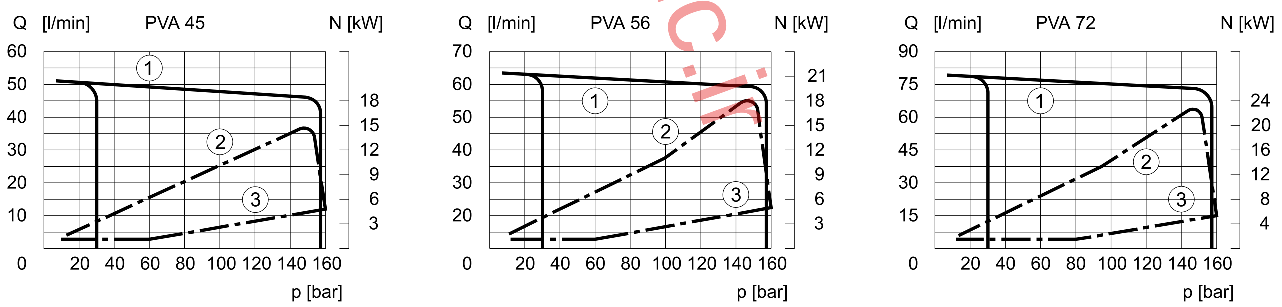


Diagram noted passing from maximum flow rate to zero flow rate and vice versa

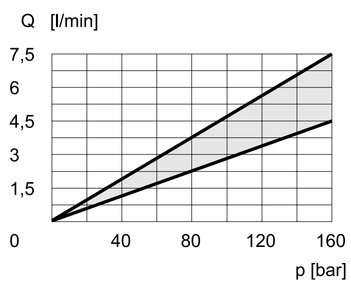
4 - PVA - 45/56/72 CHARACTERISTIC CURVES (obtained with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE - ABSORBED POWER



① Flow rate - pressure curves, measured at 1450 rpm
② Absorbed power at the maximum flow rate
③ Absorbed power at the zero flow rate

DRAINAGE FLOW RATE



RESPONSE TIMES AND PRESSURE PEAK

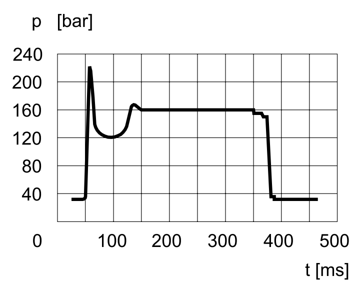
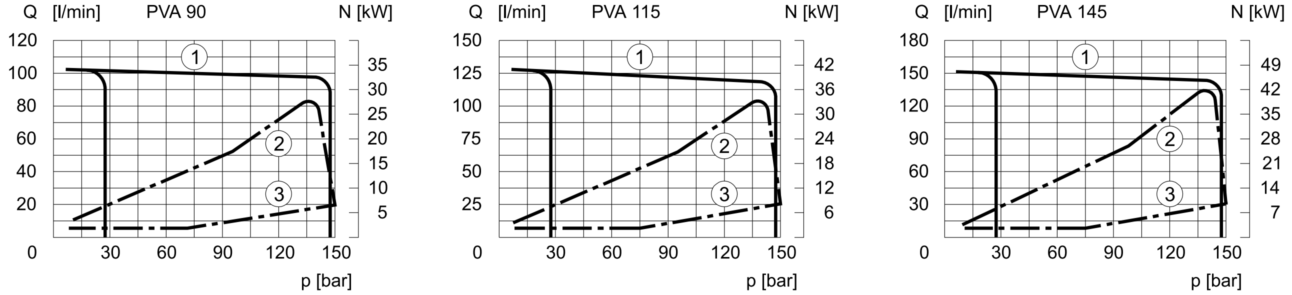


Diagram noted passing from maximum flow rate to zero flow rate and vice versa

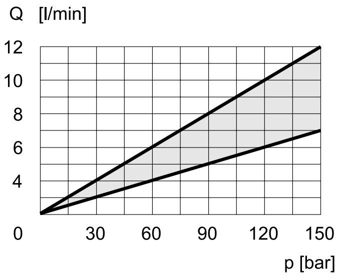
5 - PVA - 90/115/145 CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE - ABSORBED POWER



1. Flow rate - pressure curves, measured at 1450 rpm
2. Absorbed power at the maximum flow rate
3. Absorbed power at zero flow rate

DRAINAGE FLOW RATE



RESPONSE TIMES AND PRESSURE PEAK

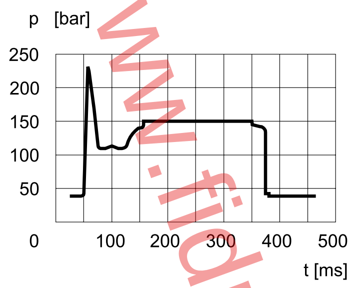
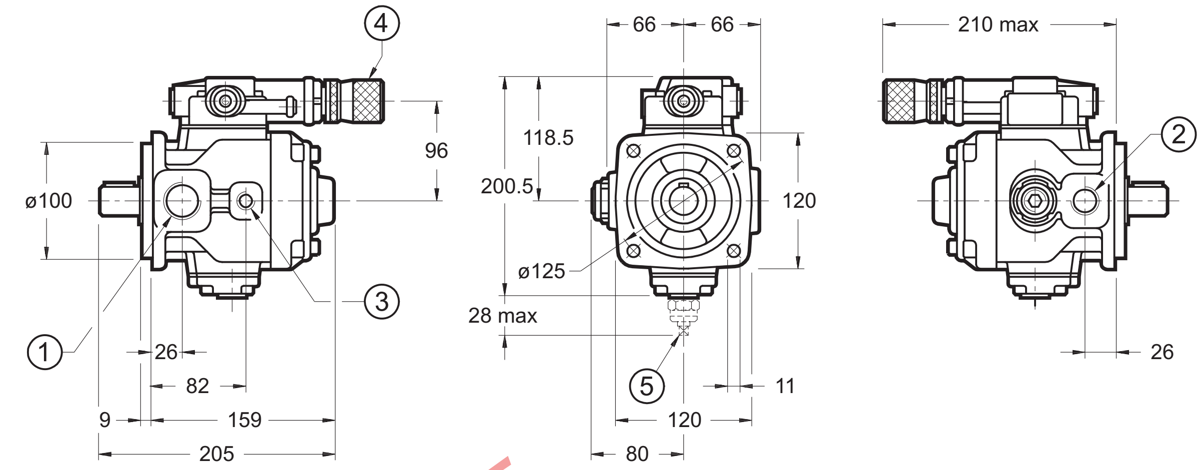
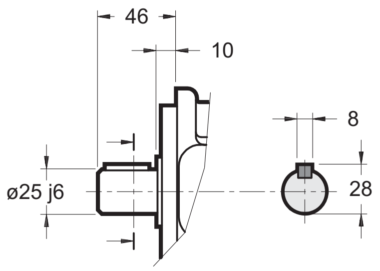


Diagram noted passing from maximum flow rate to zero flow rate and vice versa

6 - PVA - 22/28/35 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

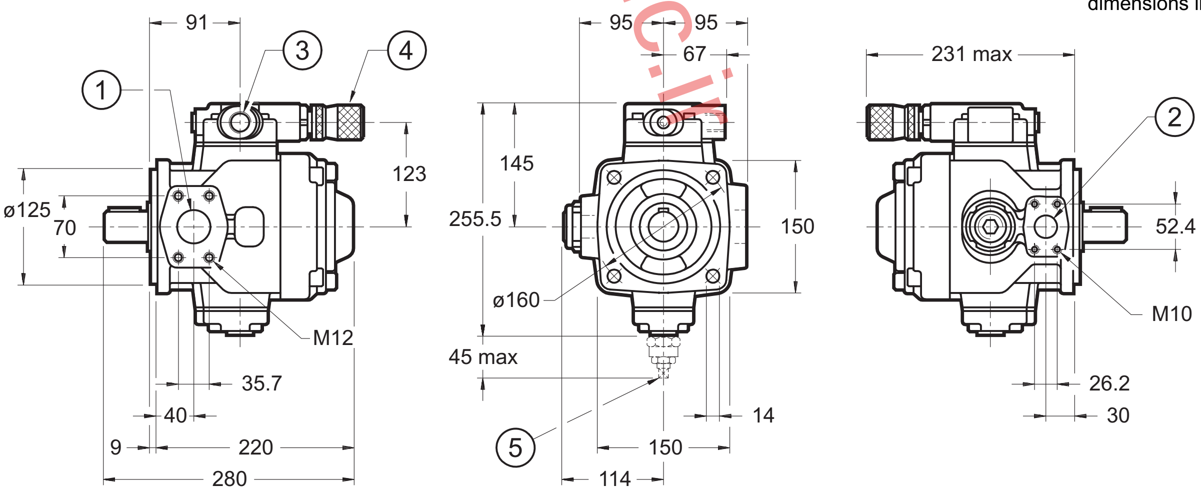


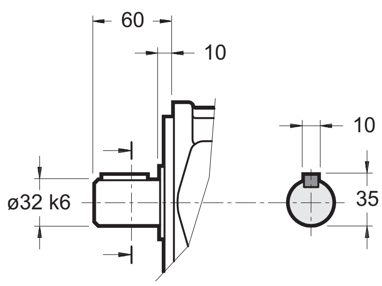


1	Suction port: 1” BSP
2	Delivery port: 3/4” BSP
3	Drainage port: 3/8” BSP
4	Pressure compensator. Clockwise rotation to increase pressure.
5	Flow adjuster

7 - PVA - 45/56/72 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

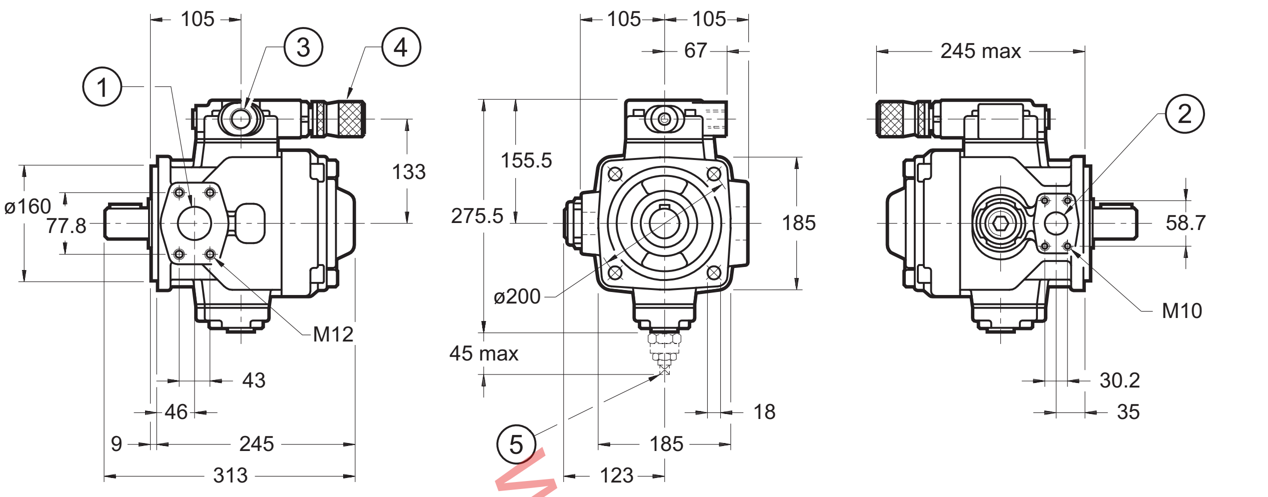


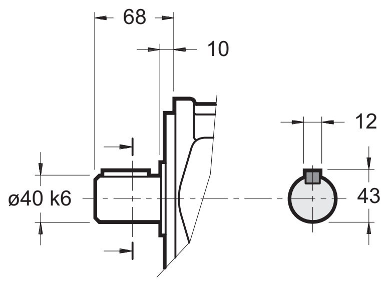


1	Suction port: flange SAE 1 1/2”
2	Delivery port: flange SAE 1”
3	Drainage port: 3/4” BSP
4	Pressure compensator. Clockwise rotation to increase pressure.
5	Flow adjuster

8 - PVA - 90/115/145 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm





1	Suction port: flange SAE 2”
2	Delivery port: flange SAE 1 1/4”
3	Drainage port: 3/4” BSP
4	Pressure compensator. Clockwise rotation to increase pressure.
5	Flow adjuster

9 - INSTALLATION

— The PVD pumps up to size 35 can be installed with the axis oriented in any position. For other sizes the pump must be installed with the axis in horizontal position.

— The suction line must be suitably sized to facility the flow of oil.
Bends and restrictions or an excessive line length can impair correct operation of the pump.

— The drainage port must be connected directly to the tank by a line separate from other discharges, located far from the suction line and lengthened to below the minimum oil level so as to avoid formation of foam.

— The pump start up, especially at a cold temperature, should occur with the pump unloading.

— The pumps are normally positioned directly above the oil tank.
Flooded suction port installation of the pumps is advisable in the case of circuits with high flow rates and pressures.

— The motor-pump connection must be carried out directly with a flexible coupling.
Couplings that generate axial or radial loads on the pump shaft are not allowed.

10 - PVA***Q FLOW ADJUSTER

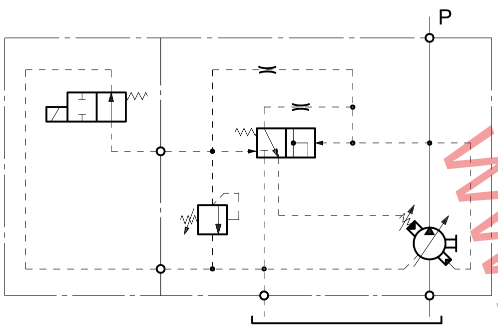
The flow adjustment group, supplied upon request, consists of an adjustment screw and a small balanced piston that limit the maximum eccentricity of the pumping group cam ring, changing the displacement.
The screw is supplied with square head, spanner 7, that allows assembly of an adjustment handwheel or the attachment for remote control.
The maximum flow is reduced by turning the adjustment screw clockwise.

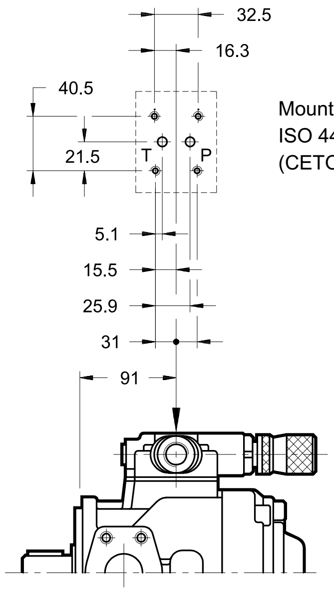
11 - PVA**M DUAL PRESSURE VALUE SELECTION DEVICE

This version permits selection of two different set pump pressure values with a solenoid valve.
The main pressure compensator is equipped with a iISO 4401-03 (CETOP 03) mounting interface for mounting the control valve of the second pressure value and of the selection solenoid valve. **NOTE**: The valves are not included in the supply.
It is possible to make different pump set pressure control circuits and some examples are outlined in paragraph 13.

dimensions in mm

DUAL PRESSURE VALUE PUMP OPERATING DIAGRAM





Mounting interface
ISO 4401-03
(CETOP 03)

12 - MULTIPLE PUMPS

The PVA pumps are designed to be connected one to the other in descending order of displacement. They can be connected also with PVD type pumps (see catalogue 14 100) and with GP1 and GP2 size gear pumps (see catalogue 11 100).

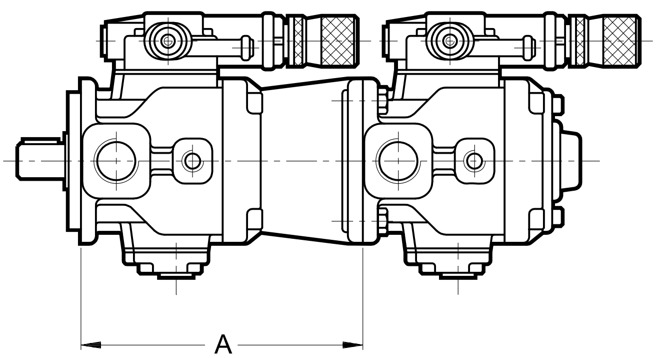
The torque on the shaft must be further reduced after the second pump.

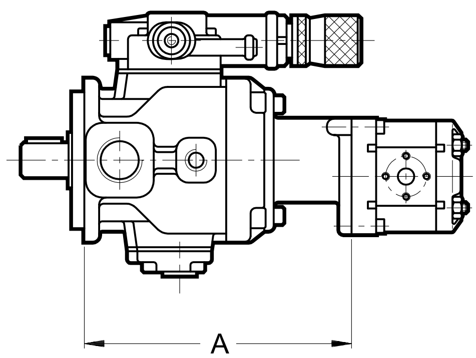
Consult our technical department for applications of this type.

IDENTIFICATION CODE FOR MULTIPLE PUMPS
identification code + identification code + identification code
1st pump 2nd pump 3rd pump
(omit for double pumps)

Double pump identification example: **PVA 35 Q / 30 A + PVA 22 / 30/P**
Triple pump identification example: **PVA 56 / 30 / A + PVA 35 Q / 30/I + PVD 22 H/30/P**
PVA pump + GP pump identification example: **PVA35Q/30/A + GP1-0061R97F/20N**

NOTE: for the identification codes of the single pumps see:
cat. 11 100 par. 1 for GP pumps
cat. 14 100 par. 1 for PVD pumps
cat. 14 200 par. 1 for PVA pumps

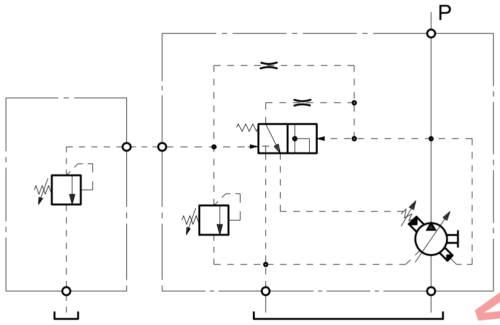




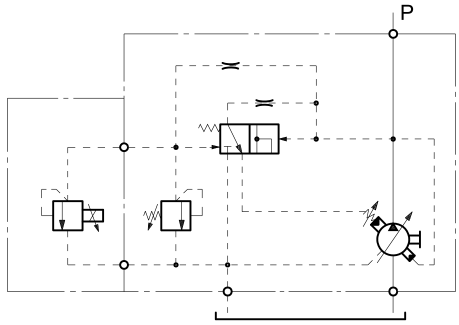
Max. torque applied to the shaft of the second pump (Nm)			Dimension A (mm)		
Size Group First pump	Second pump (same size group)	Second pump (smaller size group)	With PVA pump (same size group)	With gear pump type:	
PVA 22/28/35	43	-	207	GP1	203
PVA 45/56/72	113	113	275	GP1 and GP2	262
PVA 90/115/145	186	113	315	GP1 and GP2	287

13 - SET PRESSURE CONTROL CIRCUIT EXAMPLES

PUMP WITH REMOTE PRESSURE ADJUSTMENT

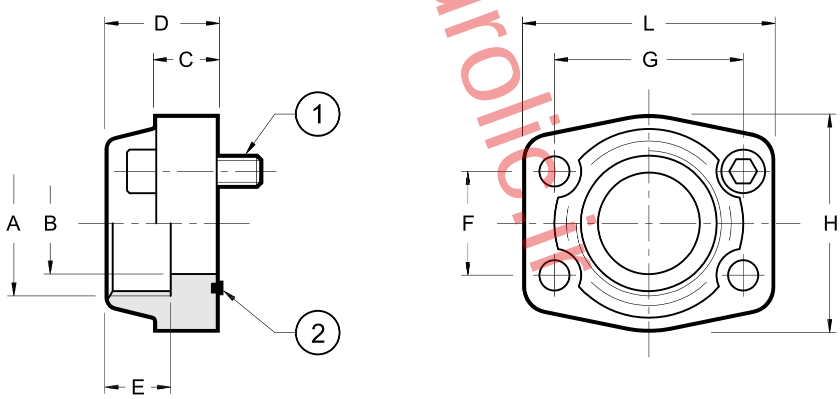


PUMP WITH PROPORTIONAL PRESSURE ADJUSTMENT



14 - CONNECTION FLANGES

dimensions in mm



The fastening bolts and the O-Rings must be ordered separately.

Flange code	Flange description	p_{max} [bar]	ØA	ØB	C	D	E	F	G	H	L	(1)	(2)
0610713	SAE - 1”	345	1” BSP	25	18	38	22	26.2	52.4	22	70	N. 4 TCEI M10x35	OR 4131 (32.93x3.53)
0610720	SAE - 1 1/4”	276	1 1/4” BSP	32	21	41	22	30.2	58.7	68	79		OR 4150 (37.69x3.53)
0610714	SAE - 1 1/2”	207	1 1/2” BSP	38	25	44	24	35.7	70	78	93	N. 4 TCEI M12x45	OR 4187 (47.22x3.53)
0610721	SAE - 2”	207	2” BSP	51	25	45	30	43	77.8	90	102		OR 4225 (56.74x3.53)

DUPLOMATIC OLEODINAMICA
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20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
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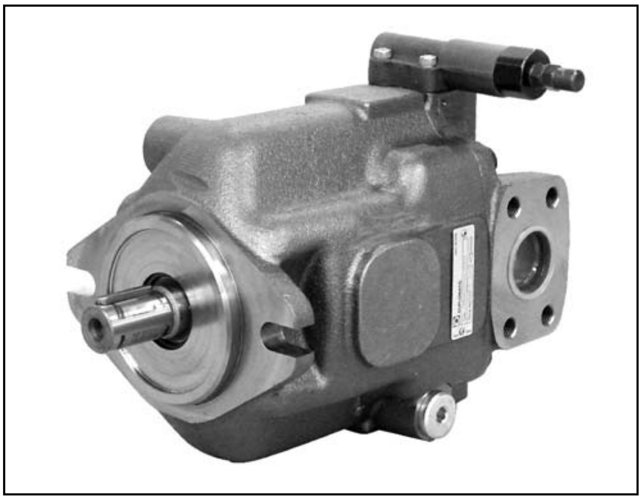
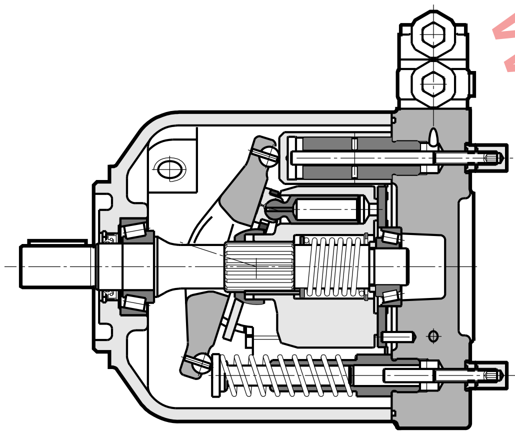
DUPLOMATIC OLEODINAMICA



VPPM
VARIABLE DISPLACEMENT AXIAL-PISTON PUMPS

OPERATING PRINCIPLE



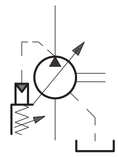
- The VPPM pumps are variable displacement axial-piston pumps with variable swash plate, suitable for applications with open circuits.
- They are available in three different frame sizes with maximum displacements up to 29, 46, 73 and 87cm^3/rev.
- The pump flow rate is proportional to the rotation speed and to the angle of the swash plate, which can be continuously modulated. The maximum and minimum angle can be limited mechanically via suitable regulating screws.
- The pumps feature medium-high working pressures (up to 280 bar constant and 350 bar peak). Thanks to some particular design features, these pumps are able to bear high axial and radial loads on the shaft.
- They are usually supplied with a ISO 3019/2 mounting flange, with the exception of the rear and intermediate pumps, if multiple pumps, which are only available with a SAE J744 2-holes flange and a SAE J744 splined shaft (see paragraph 16).
- They are available with seven different types of regulating control, each according to the application needs (see paragraphs 8 ÷ 14).

TECHNICAL SPECIFICATIONS

PUMP SIZE		**029**	**046**	**073**	**087**
Maximum displacement	cm^3/rev	29	46	73	087
Max. delivery pressure (relative): - continuous - intermittent (**NOTE 1**) - peak	bar	280 315 350			250 280 315
Maximum rotation speed at maximum displacement (**NOTE 2**)	rpm	3000	2600	2200	1850
Rotation direction		clockwise or anticlockwise (looking at the drive shaft)			
Hydraulic connection		SAE flange fittings (see paragraph 24)			
Type of mounting (single pump)		ISO 3019/2 flange			
Mass (empty single pump)	kg	18	24	33	33

Ambient temperature range	°C	-15 / +70
Fluid temperature range	°C	-25 / +80
Fluid viscosity range	see paragraph 2.2	
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	15 ÷ 35

HYDRAULIC SYMBOL



NOTE 1: Allowed intermittent duty pressures with a duration equal to 6 seconds per minute.
NOTE 2: Values referring to a zero bar pressure (relative) on the suction port.

1 - IDENTIFICATION CODES

1.1 - Identification code for single and front pumps with a through output shaft

V	P	P	M	-			-					/				/	

Variable displacement piston pump

Pump size:
029 = 29 cm^3/rev
046 = 46 cm^3/rev
073 = 73 cm^3/rev
087 = 87 cm^3/rev

Regulator type:

PC = pressure regulator
PCR = remote-controlled pressure regulator
PCX = regulator with pressure control devices
PQC = pressure and flow rate regulator
PQCE5 = integrated proportional flow and pressure control regulator - pmax 280 bar (not available for VPPM-029)
PQNC = power regulator
PQNCE5 = power regulator with integrated proportional flow and pressure control pmax 280 bar (not available for VPPM-029)

Rotation direction (seen from the shaft end)
R = clockwise **L** = anticlockwise

Mounting flange
5 = ISO 3019/2 (**standard**)
0 = SAE J744 - 2 holes

Shaft end type
5 = cylindrical with key ISO 3019/2 (**standard**)
0 = cylindrical with key SAE J744
1 = splined SAE J744

Hydraulic connection
S = suction / delivery SAE flange with metric bolts (**standard**) drainage port with BSP threading
T = suction / delivery SAE flange with UNF bolts drainage port with UNF threading

Series No.
11 for VPPM-*PQCE5 and VPPM-*PQNCE5
10 for all the other versions
(from 10 to 19 sizes and mounting dimensions remain unchanged)

Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

Intermediate flange
000 = single pump without flange
12S, **62S**, **63S**, **64S**: intermediate flange and mating joint for rear pumps (see par. 1.4)

MXXX:
Torque setting value [Nm] only for pumps with a PQNC and PQNCE regulator (see paragraph 1.5)

NOTE 1: See at table below compatibility among mounting flange, type of shaft and type of hydraulic connection

Compatibility among mounting flange, type of shaft and type of hydraulic connection

FLANGE CODE	SHAFT CODE			HYDRAULIC CONNECTION CODE	
	5	0	1	S	T
5	yes	no	no	yes	no
0	no	yes	yes	yes	yes

VPPM pumps are supplied as standard with mechanical minimum and maximum displacements limit controls. These devices are not available for front and intermediate pumps with a through output shaft.

1.2 - Identification code for intermediate pumps with a through output shaft and rear pumps

V	P	P	M	-			-		0	1		/	10			/	

Variable displacement piston pump

Pump size:
029 = 29 cm^3/rev
046 = 46 cm^3/rev
073 = 73 cm^3/rev
087 = 87 cm^3/rev

Regulator type:
PC = pressure regulator
PCR = remote-controlled pressure regulator
PCX = regulator with pressure control devices
PQC = pressure and flow rate regulator
PQNC = power regulator

Rotation direction (seen from the shaft end)
R = clockwise **L** = anticlockwise

Mounting flange
SAE J744 - 2 holes (**mandatory**)

Type of shaft end
splined SAE J744 (**mandatory**)

Hydraulic connection
S = suction / delivery SAE flange with metric bolts (**standard**)
drainage port with BSP threading
T = suction / delivery SAE flange with UNF bolts
drainage port with UNF threading

Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

Intermediate flange
000 = single pump without flange
12S, **62S**, **63S**, **64S** intermediate flange and mating joint for rear pumps (see paragraph 1.4)

MXXX: torque setting value [Nm] only for pumps with a PQNC regulator (see paragraph 1.5)

1.3 - Identification code for double pumps

identification code + identification code
1st pump 2nd pump

1.4 - Identification code for intermediate flange and mating joint for pumps with a through output shaft

According to the pump to be coupled, it is necessary to define, into the identification code, the flange and mating joint type to be applied to the pump with a through output shaft.
The following table states the flange and joint reference code according to the different pump types to be pulled, stating also the possible coupling combinations.

Identification code for intermediate flange + mating joint	intermediate flange	mating joint	pump to be mated	possible combinations for VPPM pump with a through output shaft			
				29	46	73	87
12S	SAE J744 2 holes - type “A”	SAE J744 splined 16/32 D.P. - 9T	GP 2 external gear	yes	yes	yes	yes
62S	SAE J744 2 holes - type “B”	SAE J744 splined 16/32 D.P. - 13T	GP 3 external gear VPPM-029	yes	yes	yes	yes
63S	SAE J744 2 holes - type “B”	SAE J744 splined 16/32 D.P. - 15T	VPPM-046	no	yes	yes	yes
64S	SAE J744 2 holes - type “C”	SAE J744 splined 12/24 D.P. - 14T	VPPM-073	no	no	yes	yes
64S	SAE J744 2 holes - type “C”	SAE J744 splined 12/24 D.P. - 14T	VPPM-087	no	no	no	yes

NOTE: For the flange type and dimensions see paragraph 20.

1.5 - Standardized torque values for PQNC and PQNCE regulators

ELECTRICAL MOTOR 4 POLES		VPPM-029		VPPM-046		VPPM-073		VPPM-087	
Power [kW]	N [rpm]	**torque [Nm]**	p regulation start. [bar]	**torque [Nm]**	p regulation start. [bar]	**torque [Nm]**	p regulation start. [bar]	**torque [Nm]**	p regulation start. [bar]
4	1425	**26 (#)**	46	**-**	-	**-**	-	**-**	-
5,5	1440	**36 (#)**	62	**36 (#)**	41	**-**	-	**-**	-
7,5	1450	**50**	84	**50 (#)**	56	**-**	-	**-**	-
9,2	1460	**60**	103	**60 (#)**	68	**60 (#)**	44	**-**	-
11	1455	**72**	124	**72**	82	**72 (#)**	53	**-**	-
15	1460	**98**	168	**98**	111	**98 (#)**	72	**-**	-
18,5	1460	**-**	-	**122**	137	**122**	89	**-**	-
22	1465	**-**	-	**144**	163	**144**	105	**-**	-
30	1470	**-**	-	**-**	-	**196**	143	**196**	126
37	1470	**-**	-	**-**	-	**240**	175	**240**	156
45	1470	**-**	**-**	**-**	**-**	**-**	**-**	**293**	190
55	1475	**-**	**-**	**-**	**-**	**-**	**-**	**356**	231

(#) With this adjustment value the pump is in venting position with a pressure lower than 280 bar.

1.6 - Identification examples

a) 29 cm^3/rev single pump with pressure regulator - ISO mounting flange and shaft (standard)
VPPM-029PC-R55S/10N000

b) 46 cm^3/rev single pump with pressure regulator with remote control - SAE mounting flange and SAE splined shaft
VPPM-046PCR-R01S/10N000

c) 73 cm^3/rev single pump with pressure control devices - ISO mounting flange and shaft (standard)
VPPM-073PCX-R55S/10N000

d) 46 cm^3/rev single pump with integrated proportional flow and pressure control regulator - pressure regulation up to 280 bar
VPPM-046PQCE5-R55S/11N000

e) 46 cm^3/rev single pump with power regulator set at 18,5 kW at 1460 rpm (torque = 122 Nm)
VPPM-046PQNC-R55S/10N000/M122

f) 73 cm^3/rev single pump with power regulator with integrated proportional flow and pressure control - power regulator set at 98 Nm - pressure regulation up to 280 bar
VPPM-073PQNCE5-R55S/11N000/M098

g) 73 cm^3/rev front pump with pressure regulator, ready to mate to a VPPM-029 pump
VPPM-073PC-R55S/10N62S

h) double pump made of:
- 46 cm^3/rev front pump with pressure and flow rate regulator
- 29 cm^3/rear pump with pressure regulator

VPPM-046PQC-R55S/10N62S + VPPM-029PC-R01S/N000

i) triple pump made of:
- 73 cm^3/rev front pump with flow rate and pressure regulator
- 46 cm^3/rev intermediate pump with pressure regulator
- 14 cm^3/rev rear gear pump group 2

VPPM-073PQC-R55S/10N63S + VPPM-046PC-R01S/10N12S + GP2-0140R01F/20N

2 - HYDRAULIC FLUID

2.1 - Fluid type

Use mineral oil based hydraulic fluids with anti-foam and antioxidant additives according to the DIN 51524 norm.
For use with other types of fluid, keep in mind the limitations shown in the following table or consult our technical department for authorization of use.

FLUID TYPE	NOTES
HFC (water glycol solutions with proportion of water ≤ 40%)	The performance ratings shown in the table 'PERFORMANCES' must be reduced as follows: max continuous pressure: 170 bar max peak pressure: 200 bar max rotation speed: VPPM-029 = 2100 rpm VPPM-046 = 2000 rpm VPPM-073 and VPPM-087 = 1700 rpm - The suction pressure must be lower than 0,8 absolute bars (-0,2 relative bars) - The fluid maximum temperature must be between 0°C and 50°C. - Use NBR seals only.
HFD (phosphate esters)	Such fluids do not require any particular performance limitation. It is suggested to operate with continuous duty pressures not higher than 200 bar and pressure peaks not higher than 240 bar. - The operating temperature must be between -10°C and 90°C. - Use VITON seals

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to a maximum temperature of 90 °C for the drainage fluid
optimum viscosity	15÷ 35 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	1000 cSt	limited only to the cold start-up of the pump, which has to be carried out with the plant at minimum pressure.

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore the use of a delivery or return filter with $\beta_{10\,(c)} \geq 75$ is suggested.

A degree of maximum fluid contamination according to ISO 4406:1999 class 18/16/13 is recommended for optimum endurance of the pump. Hence, the use of a filter with $\beta_{10\,(c)} \geq 100$ is recommended.

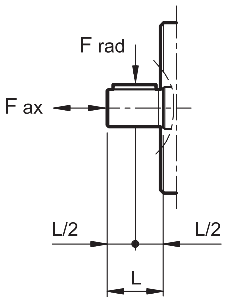
In the event that the filter is installed on the suction line, be sure that the pressure at the pump inlet is not lower than the values specified in the table of paragraph 3.

The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator and should be oversized to avoid cavitation problems.

3 - PERFORMANCES (measured with mineral oil with viscosity of 36 cSt at 50°C)

PUMP SIZE		029	046	073	087
Maximum displacement	cm^3/rev	29	46	73	87
Maximum flow rate: - at 1500 rpm - at max rotation speed	l/min	43,5 87	69 119,6	109,5 160,5	131,9 162,6
Input pressure (absolute): - min - max	bar (abs)	0,8 25			
Max. delivery pressure (absolute): - continuous - intermittent (**NOTE 1**) - peak		280 315 350			250 280 315
Max pressure on drainage port	bar (abs)	2			
Maximum power (Δp = 280 bar): - at 1500 rpm - at max rotation speed	kW	20,3 40,6	32,2 55,8	51,1 74,9	54,9 67,8
Max velocity at maximum displacement	rpm	3000	2600	2200	1850
Moment of inertia on the shaft	kgm^2	0,0020	0,0030	0,0080	0,0080
Max absorbed torque: - Δp = 100 bar - Δp = 280 bar	Nm	46,2 129,3	73,2 205	116,2 325,3	139,9 349,8
Max operating pressure with NBR seals - minimum - continuous - peak	°C	-25 80 100			
Max operating pressure with Viton seals - minimum - continuous - peak	°C	-10 110 125			
Oil volume in the pump body	lt	0,7	0,9	1,5	1,5

NOTE 1: Allowed intermittent duty pressures with a duration equal to 6 seconds per minute.

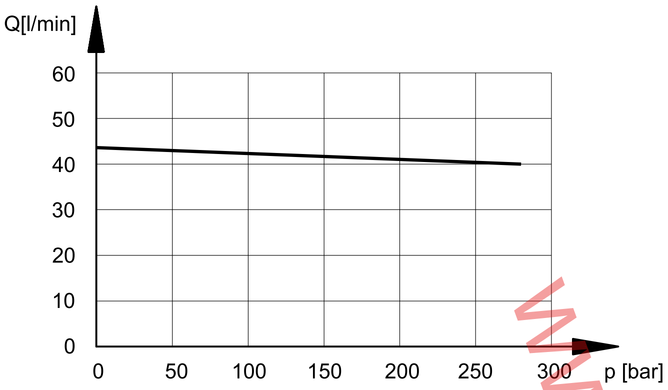


		029	046	073	087
Loads on the shaft: - axial load (F_{ax}) - radial load (F_{rad})	N	1000 1500	1500 1500	2000 3000	2000 3000

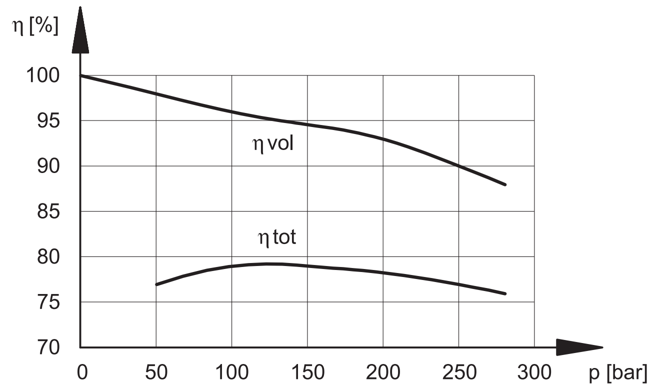
4 - VPPM-029 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

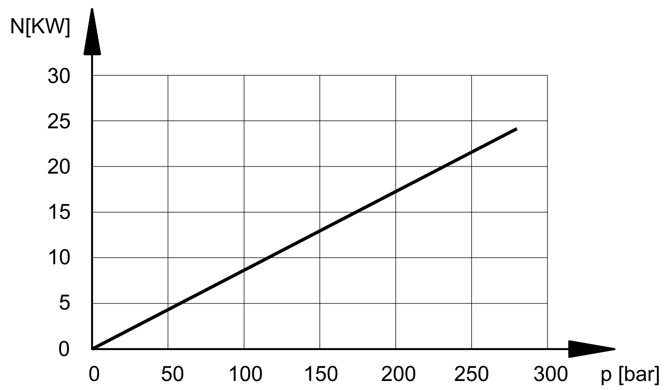
FLOW RATE/PRESSURE CURVES



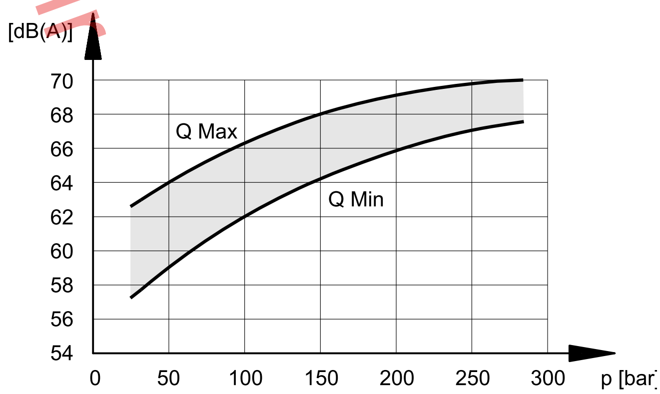
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

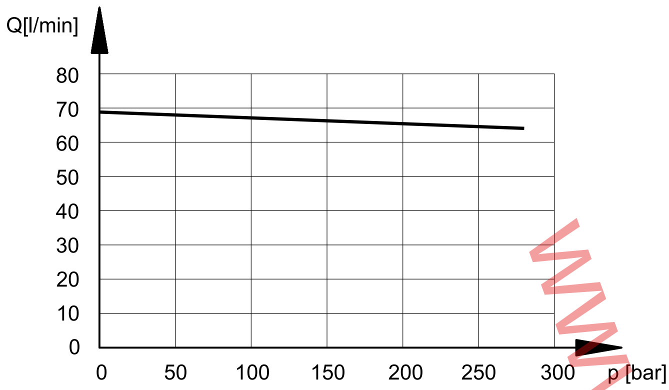


The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of ± 2 dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

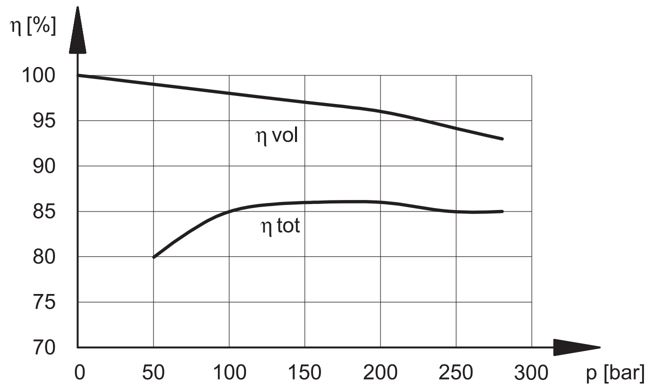
5 - VPPM-046 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

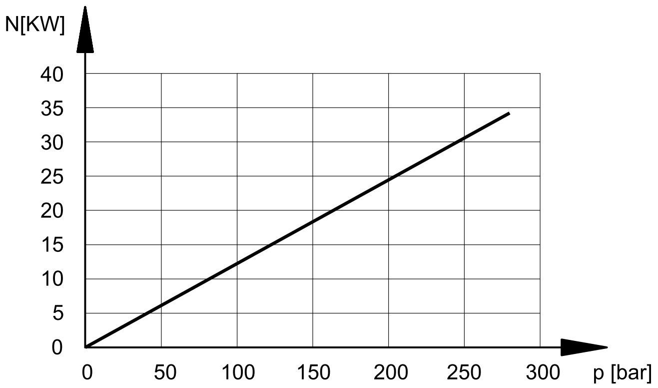
FLOW RATE/PRESSURE CURVES



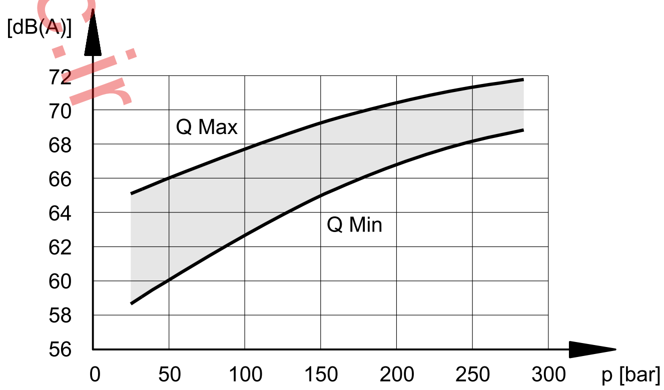
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

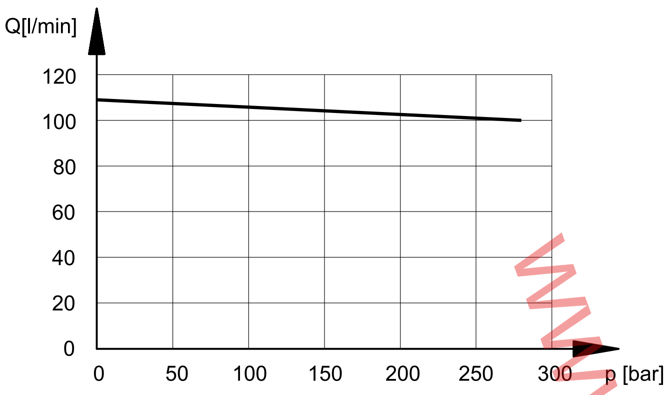


The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of ± 2 dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

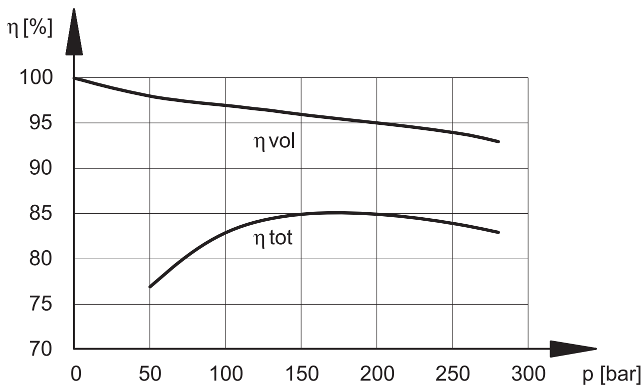
6 - VPPM-073 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

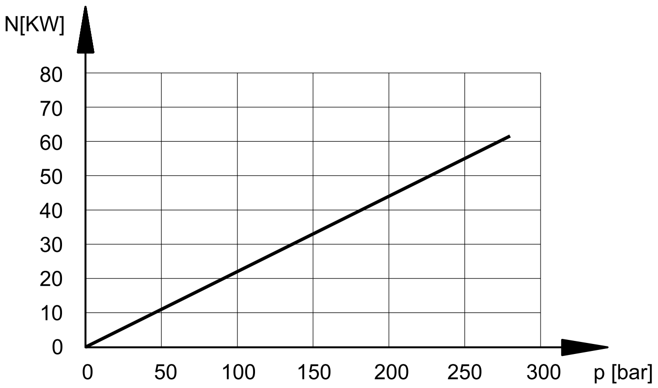
FLOW RATE/PRESSURE CURVES



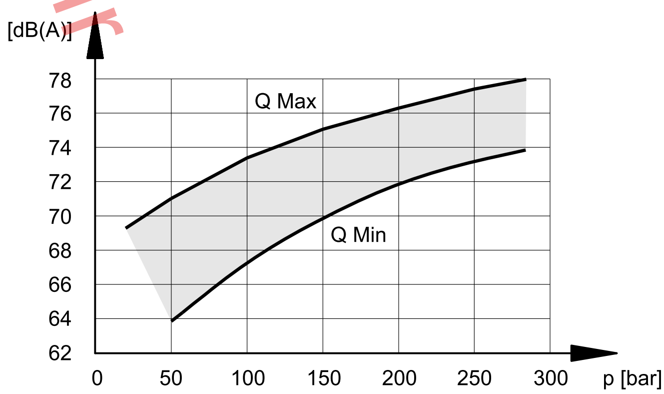
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



NOISE LEVEL

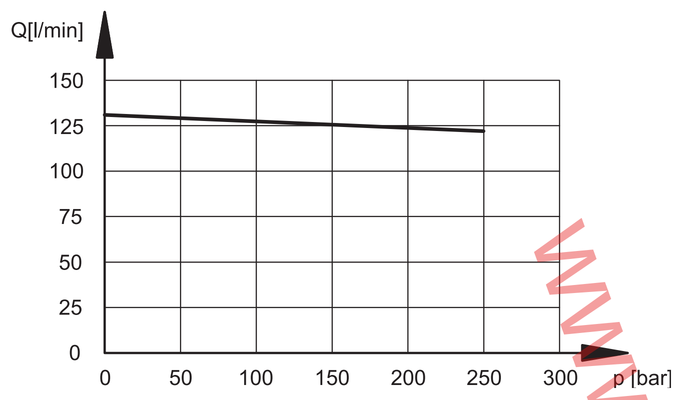


The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of ± 2 dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

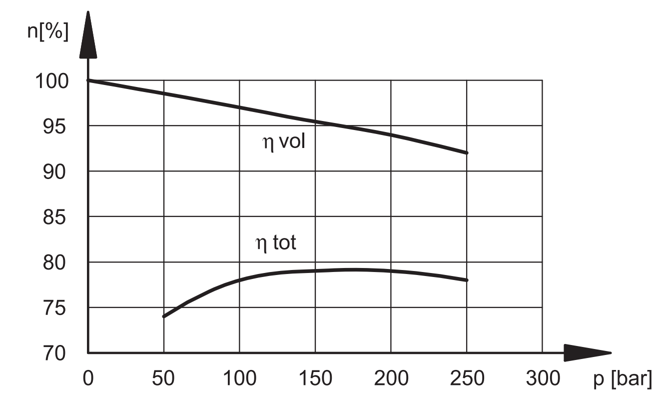
7 - VPPM-087 PUMP CHARACTERISTIC CURVES (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm.

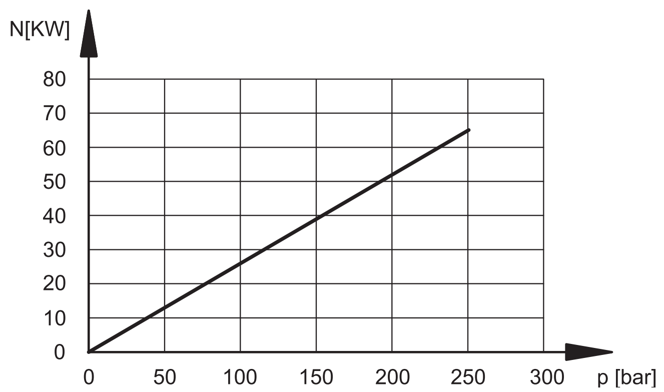
FLOW RATE/PRESSURE CURVES



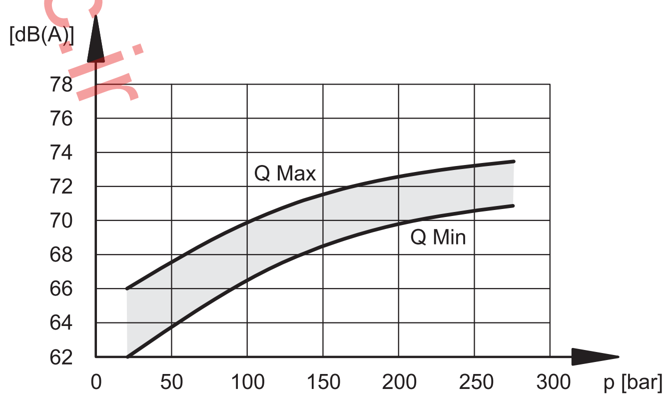
VOLUMETRIC AND TOTAL EFFICIENCY



ABSORBED POWER



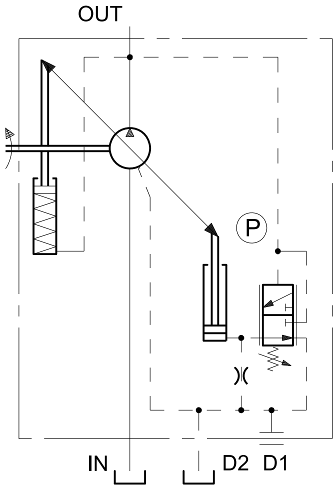
NOISE LEVEL



The noise pressure levels were measured in a semi-anechoic chamber, at a distance of 1 m from the pump and with a tolerance of ± 2 dB(A). The values shown must be reduced by 5 dB(A) if they are to be considered in a completely anechoic room.

8 - PRESSURE REGULATOR: PC

FUNCTIONAL DIAGRAM



The PC pressure regulator keeps the pressure at a constant set level in the circuit, thus adjusting automatically the pump flow rate according to the real need of the system.
The desired pressure can be set by manually adjusting the (P) regulation valve.

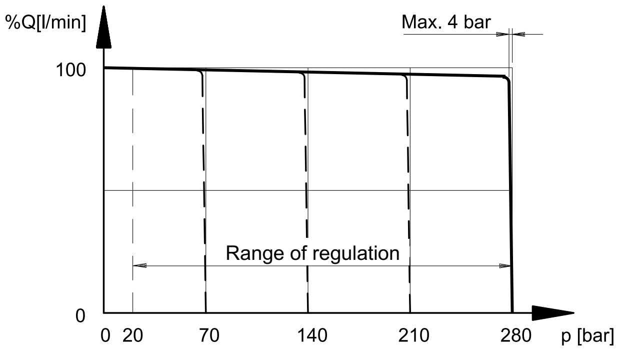
FEATURES OF THE PC REGULATOR:

- pressure regulating range (P) = 20 ÷ 350 bars
- default setting (P) = 280 bars

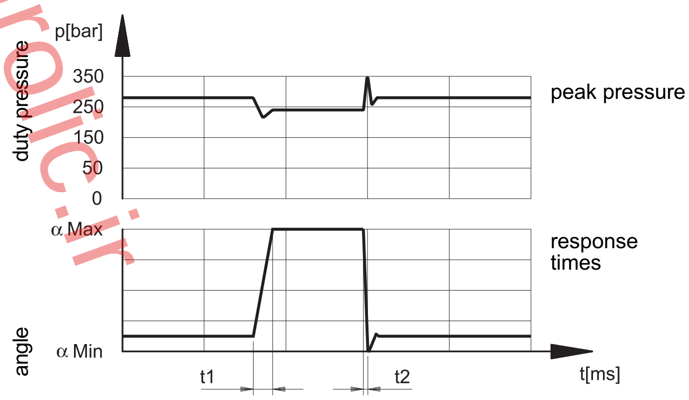
8.1 - Characteristic curves of the PC regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

FLOW RATE/PRESSURE FEATURE



RESPONSE TIMES AND PEAK PRESSURE



t1 = response time for a change from a min. to a max. displacement.
t2 = response time for a change from a max. to a min. displacement.

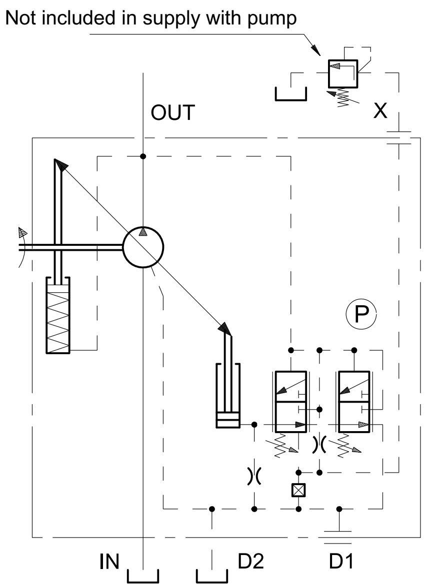
PC pressure regulator set at 280 bars

pump size	t1 [ms]	t2 [ms]
029	30	20
046	45	25
073	50	30
087	53	28

The values stated in the table are obtained from the opening until the instant the delivery level is achieved, by using a maximum pressure valve set at 350 bars for a load simulation, placed at a distance of 1 m from the pump delivery port.

9 - REMOTE-CONTROLLED PRESSURE REGULATOR: PCR

FUNCTIONAL DIAGRAM



The PCR regulator, apart from limiting the line maximum pressure (P valve), allows a remote-control of the device via a remote control connected to the X port (typical application for submerged pumps). In case a pressure regulating valve is used for the remote-control, it is suggested to use a direct operated valve with a size suitable to 1,5 l/min pilot flow rate.

N.B. The maximum length of the connection between the valve and the pump X port must not be longer than 2 m.

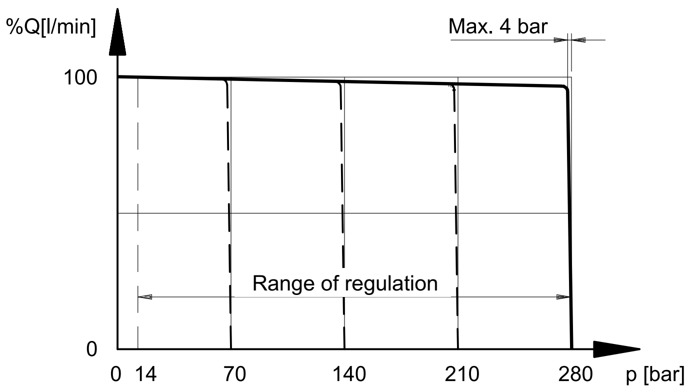
PCR FEATURES:

- pressure regulating range (P) = 20 ÷ 350 bars
- default setting (P) = 280 bars
- remote-regulated pressure range = 14 ÷ 315 bars
- flow rate available on the X port for the remote-control = about 1,5 l/min

9.1- Characteristic curves of the PCR regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

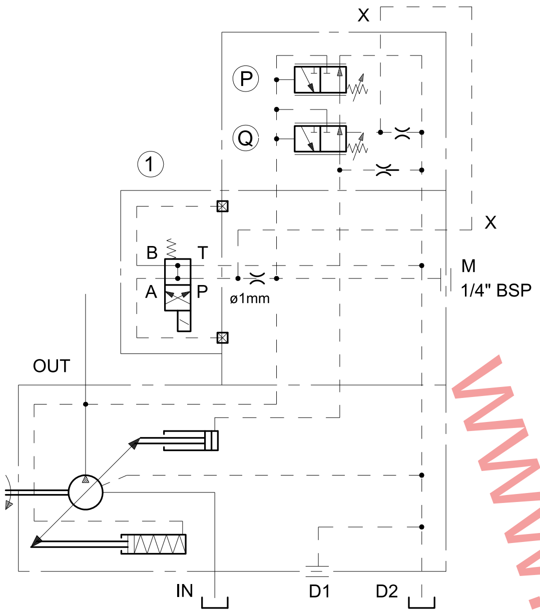
FLOW RATE / PRESSURE FEATURE



10 - REGULATOR WITH PRESSURE CONTROL DEVICES: PCX

10.1 - Electrical unloading

FUNCTIONAL DIAGRAM



The PCX regulator, mated to a suitable two-position solenoid valve, allows the electrical switching of the pump displacement in null condition and with minimum delivery pressure.

This function is useful for the pump unloading at the start-up or to operate at minimum pressure in the system during the machine cycle pause, with considerable energy saving.

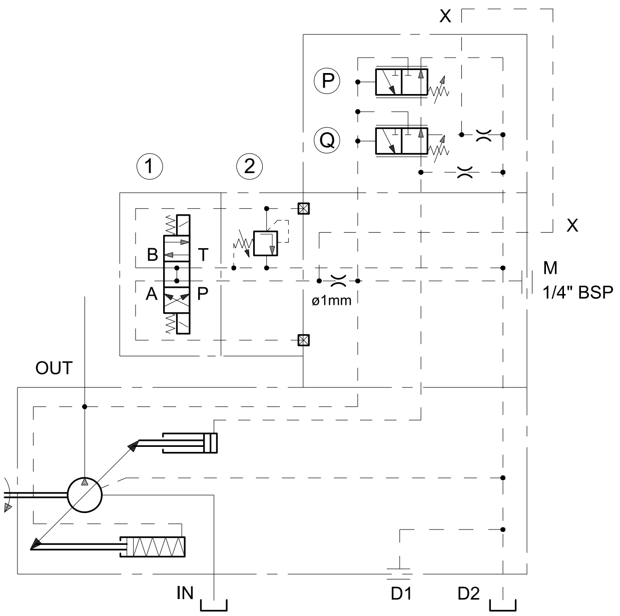
The pressure switching is made by means of a solenoid valve (to be ordered separately) installed on the pump regulator directly.

PCX FEATURES (electrical unloading):

- solenoid switching valve (1) = DS3-SA2 (to be ordered separately see cat. 41 150)
- solenoid valve OFF = pump at null displacement and delivery pressure = 20 bar
- solenoid valve ON = maximum displacement and delivery pressure set on regulator (P).
- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar

10.2 - Two pressure settings + unloading

FUNCTIONAL DIAGRAM



This type of regulator allows to select, by means of a three-position solenoid valve, two different working pressures; it allows also the pump unloading.

The solenoid valve (1) and the relief valve (2) for the intermediate pressure setting are directly installed on the pump regulator and they are to be ordered separately.

PCX FEATURES (two pressure settings + unloading):

- solenoid switching valve (1) = DS3-S2 (to be ordered separately see catalogue 41 150)
- solenoid valve OFF = pump unloading - delivery pressure = 20 bar
- solenoid side "a" ON = maximum displacement and delivery pressure set on relief valve (2) (intermediate value)
- solenoid side "b" ON = maximum displacement and delivery pressure set on regulator (P) (maximum value)

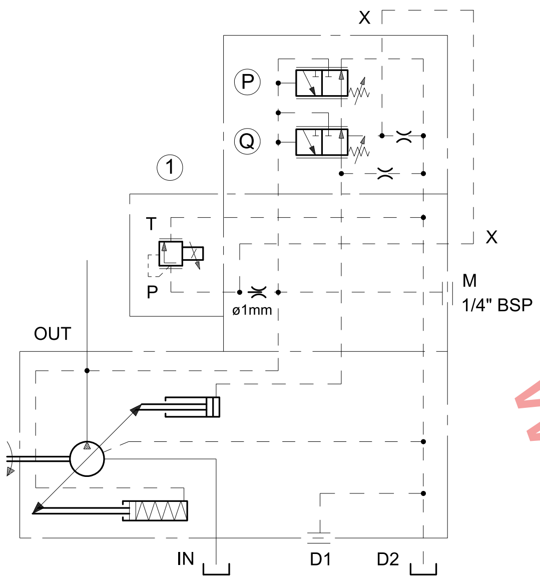
- pressure relief valve (2) = MCD*-SBT (to be ordered separately - see cat. 61 200)
- pressure regulating range (2) = MCD3-SBT 20 ÷ 100 bar
  MCD5-SBT 20 ÷ 250 bar

- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar

NOTE: For PCX regulators characteristic curves (with two pressure settings + unloading functions), see PC regulator diagrams at paragraph 8.1.

10.3 - Pressure regulation with electric proportional control

FUNCTIONAL DIAGRAM



The PCX regulator mated with a proportional pressure relief valve, allows a continuous control and modulation of the system pressure.

The proportional pressure relief valve (to be ordered separately) is installed on the pump regulator directly.

PCX FEATURES (proportional pressure regulation):

- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar

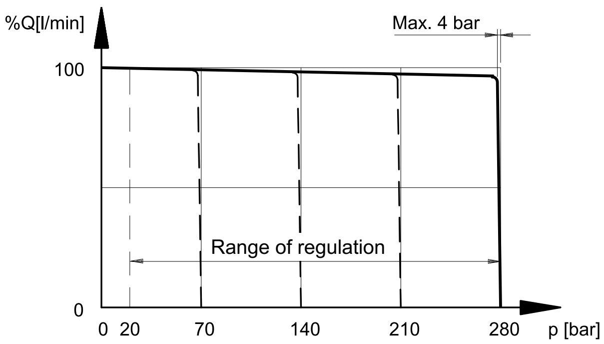
- proportional pressure relief valve (1) = PRED3 (to be ordered separately with its relative electronic control unit - see catalogue 81 210)
- proportional pressure regulating range:
  PRED3-070 20 ÷ 100 bar
  PRED3-210 20 ÷ 240 bar

Hysteresis = < 5% of p nom
Repeatability = < ± 1,5% of p nom

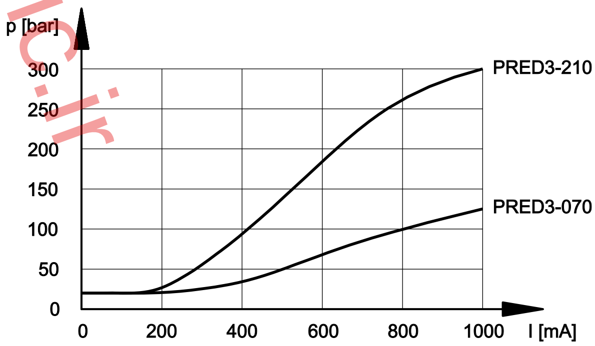
10.3.1 - Characteristic curves (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

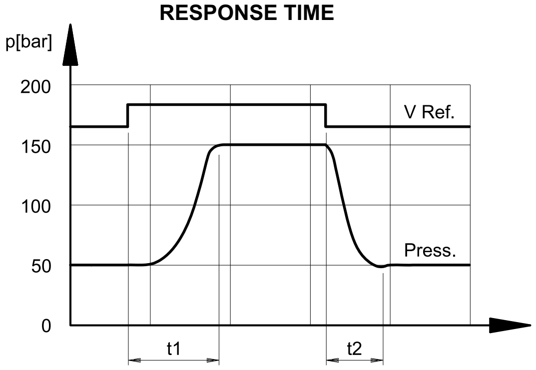
FLOW RATE / PRESSURE FEATURE



CURRENT / PRESSURE FEATURE



RESPONSE TIME

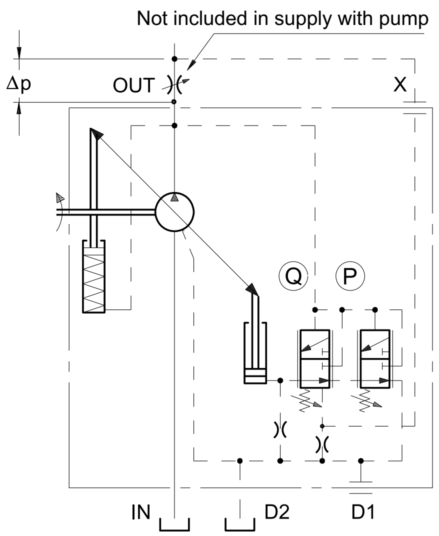


The response times are obtained with a VPPM-046 pump, by changing the reference signal (V Ref) on the proportional valve in order to have a line pressure variation from 50 to 150 bar and vice versa, with an oil volume of 5 lt.

t1 = 80 ms (response time for an increasing pressure change)
t2 = 60 ms (response time for a decreasing pressure change)

11 - FLOW RATE AND PRESSURE REGULATOR: PQC

FUNCTIONAL DIAGRAM



This regulator, apart from regulating the pressure (as for the PC model), allows the pump flow rate to be regulated according to the Δp pressure drop measured on either side of a throttle valve installed on the user line.
The connection pipe between the X port and the flow line downstream the restrictor (or valve) must always be made (customer charge).

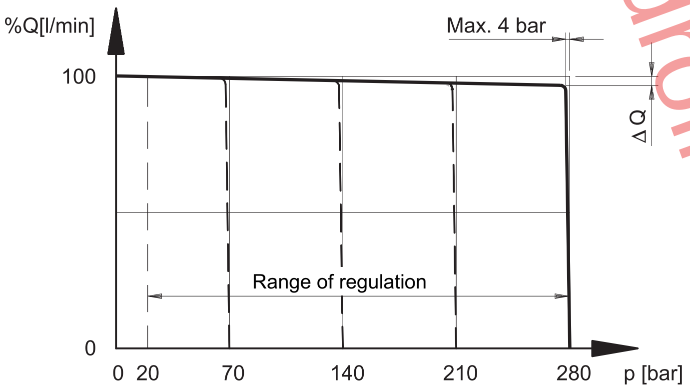
PQC FEATURES:

- pressure regulating range (P) = 20 ÷ 350
- default setting (P) = 280 bar
- differential pressure regulating range (Q) = 10 ÷ 40 bars
- default setting = 14 bar
- Min. discharge head = 18 ± 2 bar
  (with a zero flow rate, X discharge pilot and with a default (Q) setting of the differential regulator)

11.1 - Characteristic curves of the PQC regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

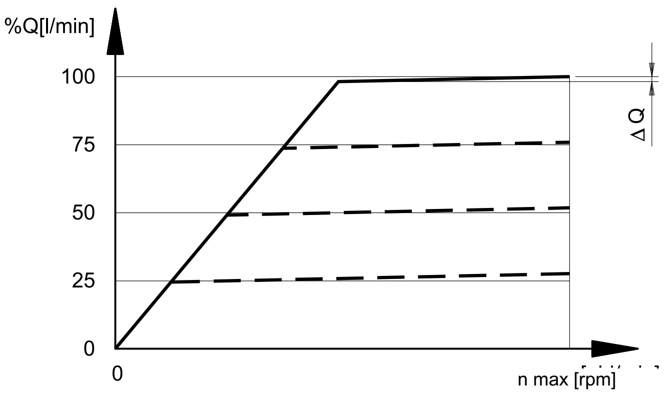
FLOW RATE / PRESSURE FEATURE



Flow variation between minimum and maximum pressure with pump set at max displacement

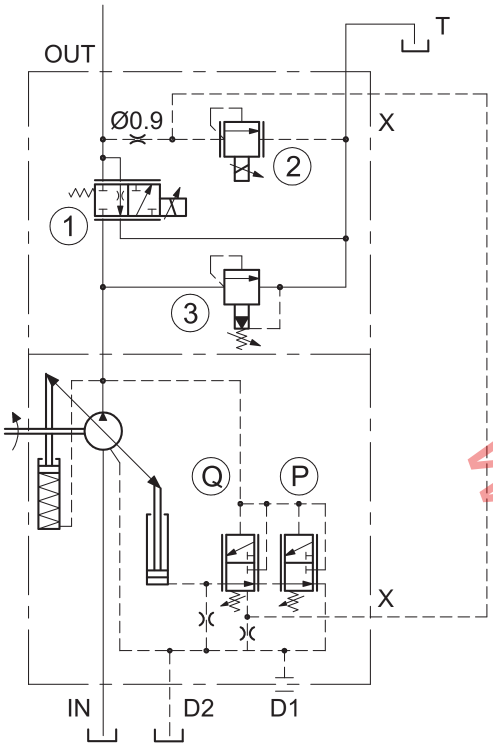
pump size	ΔQ max [l/min]
029	0.9
046	1.7
073	2.5
087	2.5

FLOW RATE / ROTATION SPEED STATIC FEATURE



12 - INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL REGULATOR: PQCE5

FUNCTIONAL DIAGRAM



This regulator allows an independent regulation of the pump flow and pressure, both with an electric proportional control.

The pump flow is regulated through the proportional valve (1) which operates directly on the pump delivery, while the system pressure is controlled by means of the proportional relief valve (2) working as a pilot stage of the differential regulator (Q).

The maximum system pressure is limited by the regulator (P). The regulator is also equipped of a built-in pressure relief valve (3) with manual adjustment, which limits the pressure peak due to quick flow variations in the system.

PQCE5 FEATURES

- pressure regulating range (P) = 20 ÷ 350 bar
- default setting (P) = 280 bar

- differential pressure regulating range (Q) = 10 ÷ 30 bar
- default setting = 16 bar

- proportional pressure regulating range:
  20 ÷ 250 bar (for VPPM-*PQCE5 pump)

- proportional flow regulating range:
  0 ÷ 69 l/min (for VPPM-046 PQCE5 pump)
  0 ÷ 109,5 l/min (for VPPM-073 PQCE5 pump)
  0 ÷ 132 l/min (for VPPM-073 PQCE5 pump)

PERFORMANCES and ELECTRICAL CHARACTERISTICS

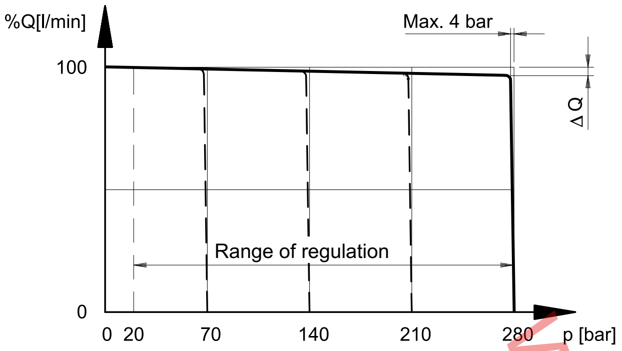
	FLOW REGULATION (1) (DSE5 valve)	PRESSURE REGULATION (2) (CRE valve)
HYSTERESIS	< 6% of Q max	< 5% of p nom
REPEATABILITY	< ±1,5% of Q max	< ±1,5% of p nom
NOMINAL VOLTAGE	24 VDC	24 VDC
COIL RESISTANCE (at 20°C)	8,65 Ω	16,6 Ω
MAXIMUM CURRENT	1,6 A	0,85 A
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CEE	
DEGREE OF PROTECTION : Atmospheric agents (CEI EN 60529)	IP 65	
ELECTRONIC CONTROL UNITS for proportional valves	EDM-M3312 see cat. 89 250	

12.1 - Characteristic curves of the PQCE5 regulator

(values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

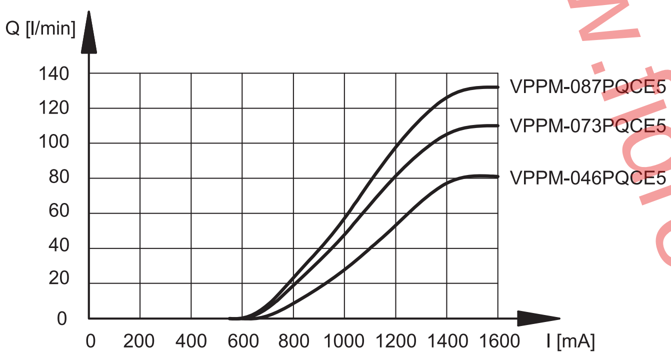
FLOW RATE / PRESSURE CURVE



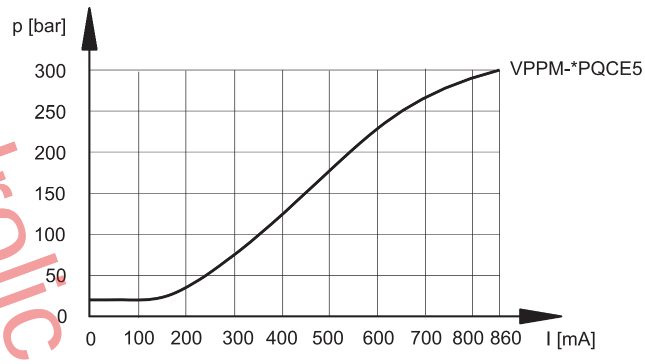
Flow variation between minimum and maximum pressure with pump set at max displacement

pump size	ΔQ max [l/min]
046	1.7
073	2.5
087	2.5

CURRENT / FLOW CURVE

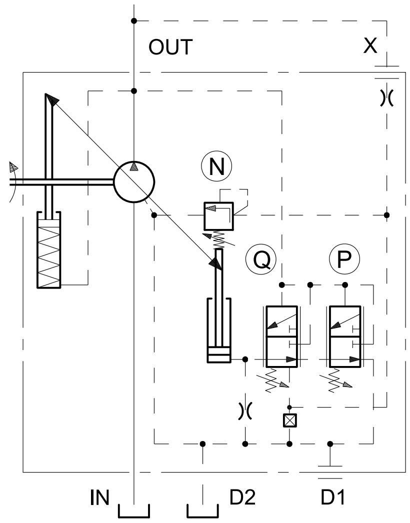


CURRENT / PRESSURE CURVE



13 - POWER REGULATOR: PQNC

FUNCTIONAL DIAGRAM



Such regulator keeps the pump torque at a constant level by changing the displacement according to the delivery pressure, so that the ratio p x (Q) (absorbed power) remains unchanged. The functions limiting the (P) maximum pressure and regulating the (Q) flow rate are always present, if a restrictor has been installed on the user line.

In the 1/8” BSP coupling supplied for the X port, there is a restrictor of Ø0,8 orifice.

Note: The connection pipe between the X port and the pump outlet must always be made (customer charge).

PQNC FEATURES:

- pressure regulating range (P) = 20 ÷ 350
- default setting (P) = 280 bar

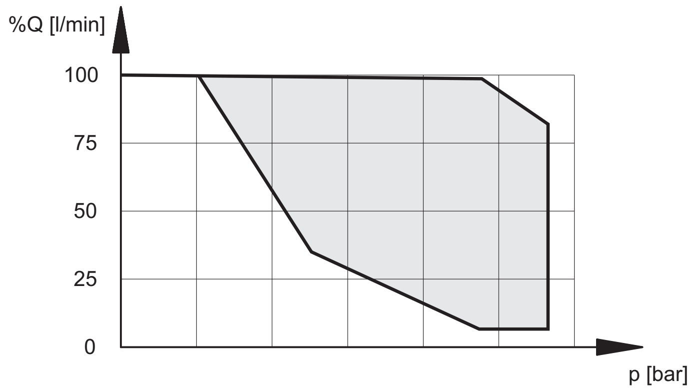
- differential pressure regulating range (Q) = 10 ÷ 30 bar
- default setting = 16 bar

- min. discharge head = 18 ± 2 bar
  (with a zero flow rate, X discharge pilot and with a default Q setting of the differential regulator)
- the power regulator is factory set. The setting value has to be specified with the order, by stating into the identification code the Nm torque value (see paragraph 1).
- Start of the regulation: looking at values table of paragraph 1.5

13.1 - Characteristic curves of the PQNC regulator (values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

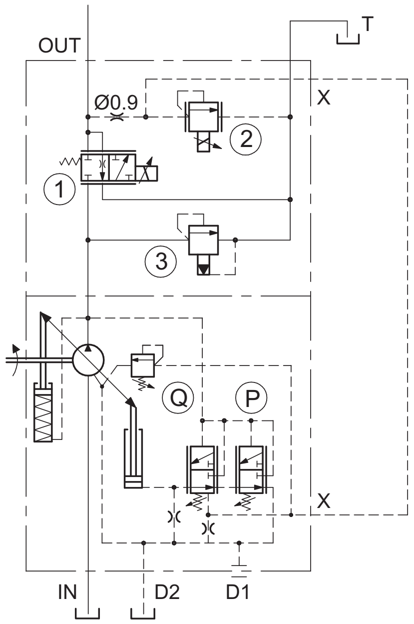
The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

FLOW RATE / PRESSURE CURVE



14 - POWER REGULATOR WITH INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL: PQNCE5

FUNCTIONAL DIAGRAM



This system combines all the functions of the constant power control as a standard PQNC5 regulator, and moreover it allows the independent proportional regulation of the pump flow and pressure at values behind the power curve characteristic set on the regulator (N).

PQNCE5 FEATURES

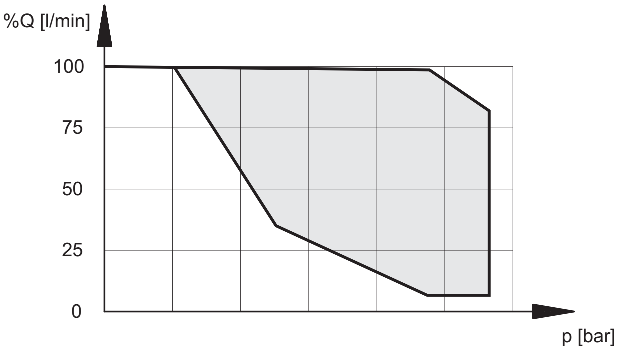
For technical characteristics and settings of regulator, see paragraph 13.

14.1 - Characteristic curves of the PQNCE5 regulator

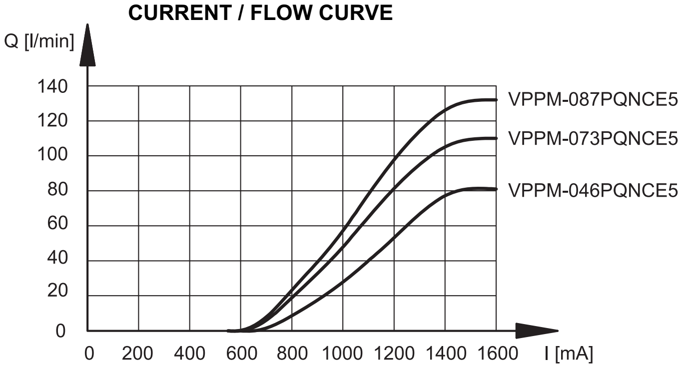
(values obtained with mineral oil with viscosity of 36 cSt at 50°C with driver EDM-M3312)

The diagram curves were measured with a pump rotation speed of 1500 rpm and an oil temperature of 50°C.

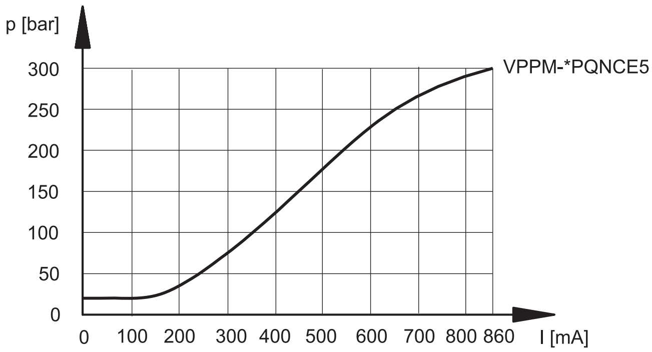
FLOW RATE / PRESSURE CURVE



CURRENT / FLOW CURVE

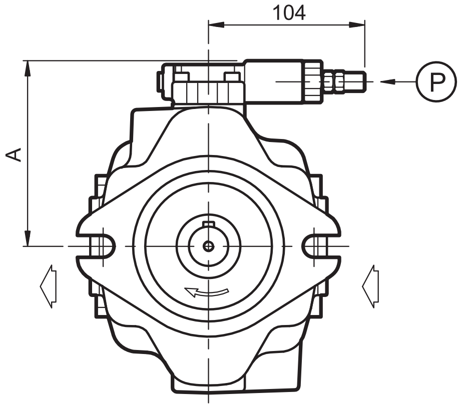


CURRENT / PRESSURE CURVE



15 - REGULATOR OVERALL DIMENSIONS

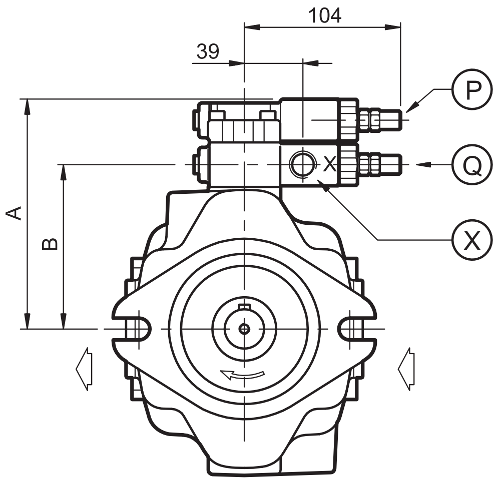
dimensions in mm



PRESSURE REGULATOR PC

pump size	A [mm]
029	114
046	123
073 / 087	136

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13

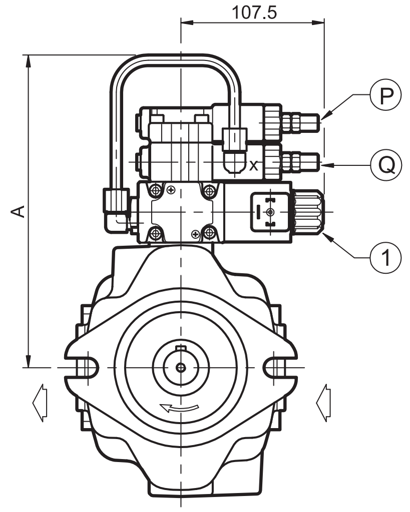


REMOTE-CONTROLLED PRESSURE REGULATOR PCR

pump size	A [mm]	B [mm]
029	144	100
046	153	109
073 / 087	165	122

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
X	Pilot port for remote control X: 1/8” BSP

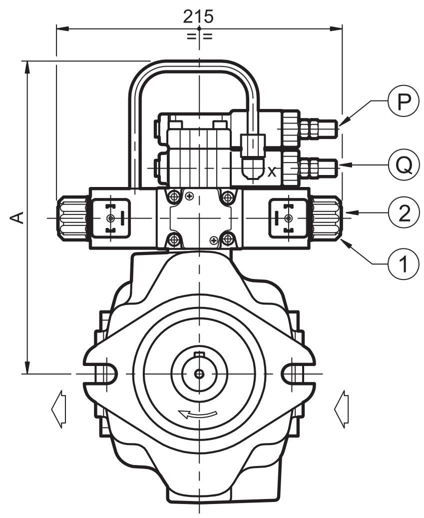
dimensions in mm



PCX REGULATOR WITH ELECTRICAL UNLOADING

pump size	A [mm]
029	244
046	253
073 / 087	265

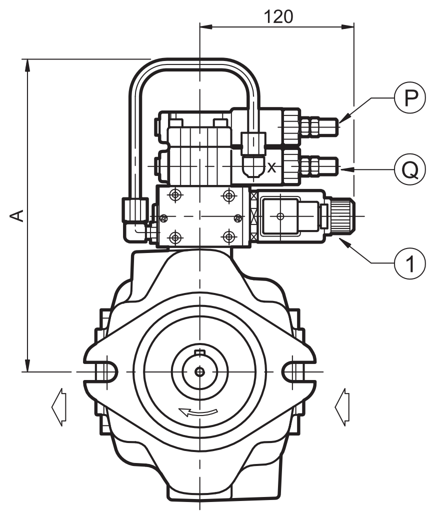
P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Solenoid switching valve type DS3-SA2



PCX REGULATOR WITH TWO PRESSURE SETTINGS + UNLOADING

pump size	A [mm]
029	244
046	253
073 / 087	265

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Solenoid switching valve type DS3-S2
2	Relief valve for the intermediate pressure setting MCI*-SBT

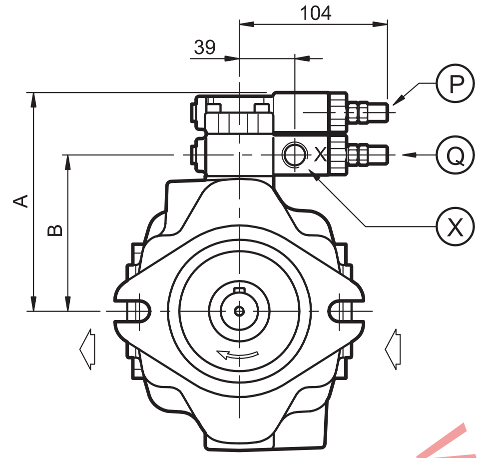


PCX REGULATOR FOR PRESSURE REGULATION WITH ELECTRIC PROPORTIONAL CONTROL

pump size	A [mm]
029	244
046	253
073 / 087	265

P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Proportional pressure relief valve PRED3 type

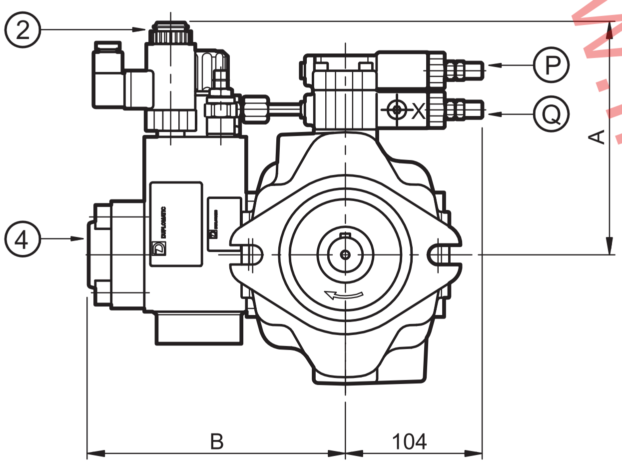
dimensions in mm



FLOW RATE AND PRESSURE REGULATOR PQC

pump size	A [mm]	B [mm]
029	144	100
046	153	109
073 / 087	165	122

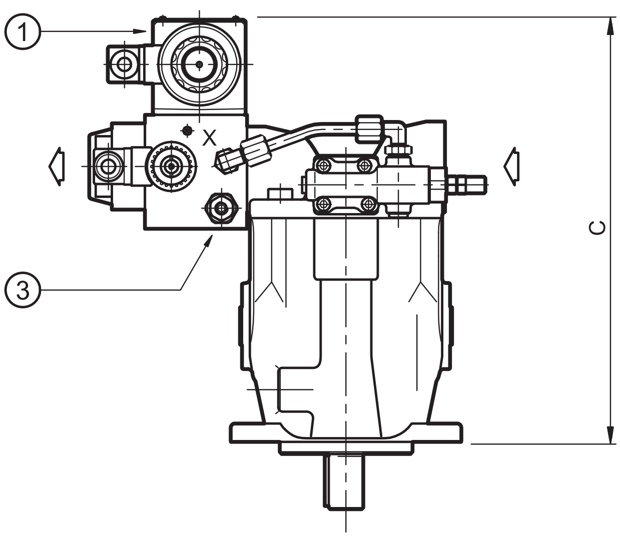
P	Pressure regulator countersunk hex adjustment screw: Spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
X	Pilotage port X: 1/8” BSP (see paragraph 11)



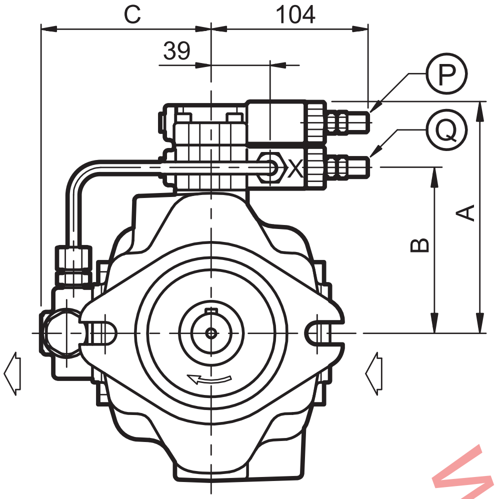
PQCE REGULATOR WITH INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL

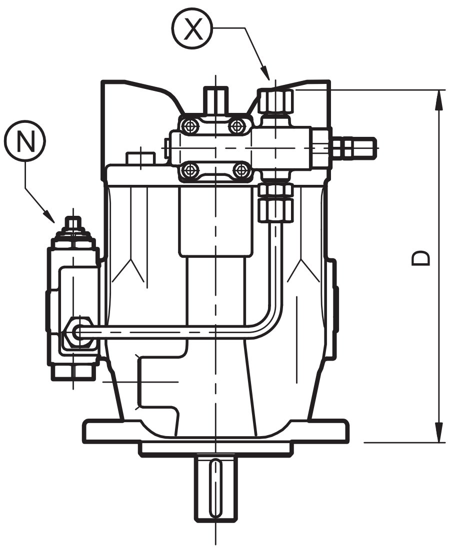
pump size	A [mm]	B [mm]	C [mm]
046	175	194	337
073 / 087	181	207	345

P	Pressure regulator countersunk hex adjustment screw: Spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
1	Proportional flow control valve type: DSE5-P070B - DSE5-P110SB
2	Proportional pressure valve type: CRE-250
3	Safety pressure relief valve
4	Delivery port SAE 6000 flange 1” for VPPM-046 - 1 ¼” for VPPM-073 and -087



dimensions in mm





POWER REGULATOR PQNC

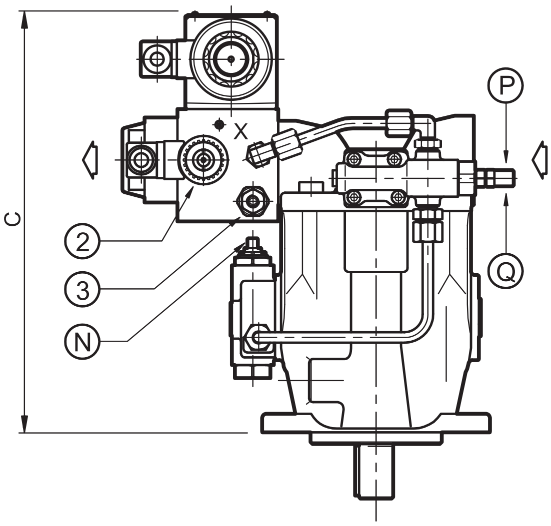
pump size	A [mm]	B [mm]	C [mm]	D [mm]
029	144	100	104	211
046	153	109	111	235
073 / 087	165	122	120	258

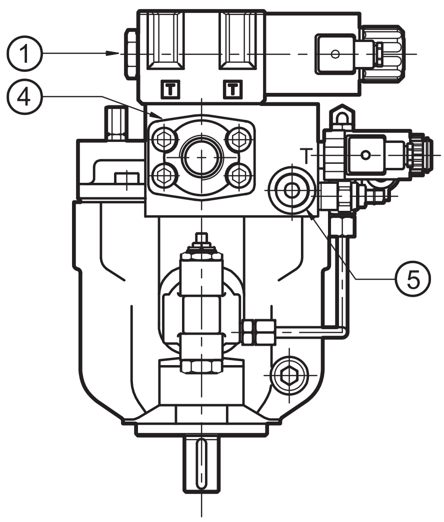
P	Pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
X	Pilotage port X: 1/8” BSP (restrictor with Ø0,8 orifice included - see paragraph 13)
N	Power regulator

POWER REGULATOR WITH INTEGRATED PROPORTIONAL FLOW AND PRESSURE CONTROL PQNCE5

(for dimensions see PQCE5 page 22)

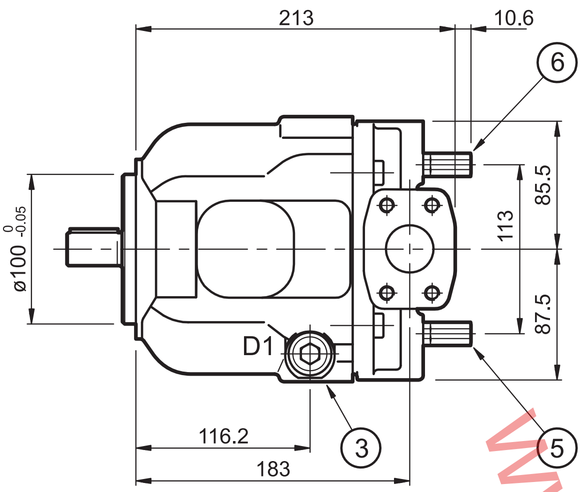
P	Pressure regulator countersunk hex adjustment screw: spanner 4. Clockwise rotation to increase pressure Locknut: spanner 13
Q	Differential pressure regulator countersunk hex adjustment screw: spanner 4 Clockwise rotation to increase differential pressure Locknut: spanner 13
N	Power regulator
1	Proportional flow control valve type: DSE5-P070SB - DSE5-P110SB
2	Proportional pressure control valve type: CRE-250
3	Safety pressure relief valve
4	Delivery port SAE 6000 flange: 1” for VPPM-046 - 1 ¼” for VPPM-073 and -087
5	Outlet port T: 3/4” BSP

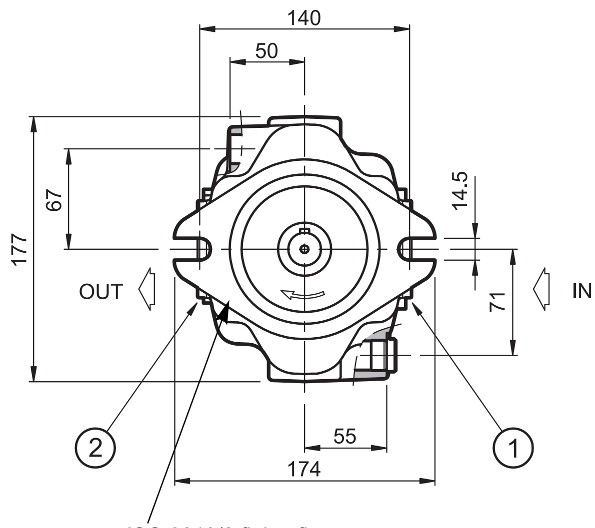




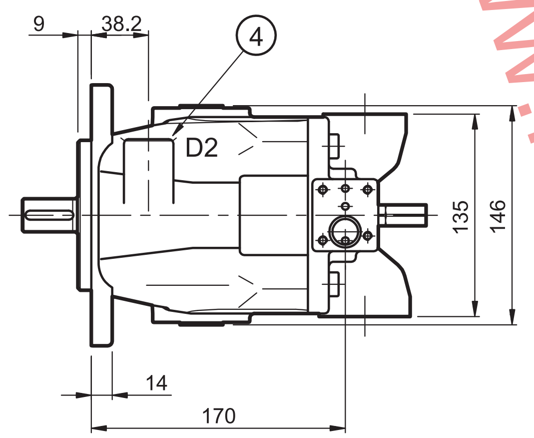
16 - VPPM-029 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

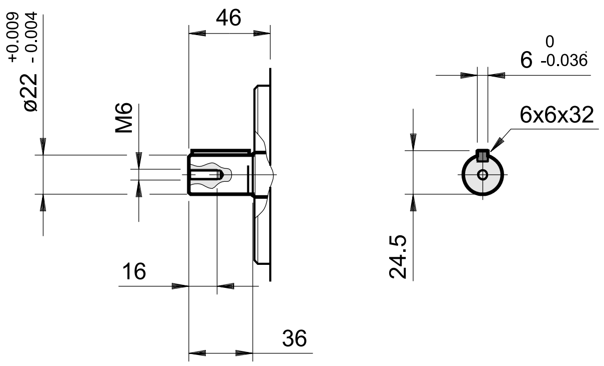




ISO 3019/2 fitting flange
(standard, identification code **5**)



Cylindrical shaft end with ISO 3019/2 key
(standard, identification code **5**)

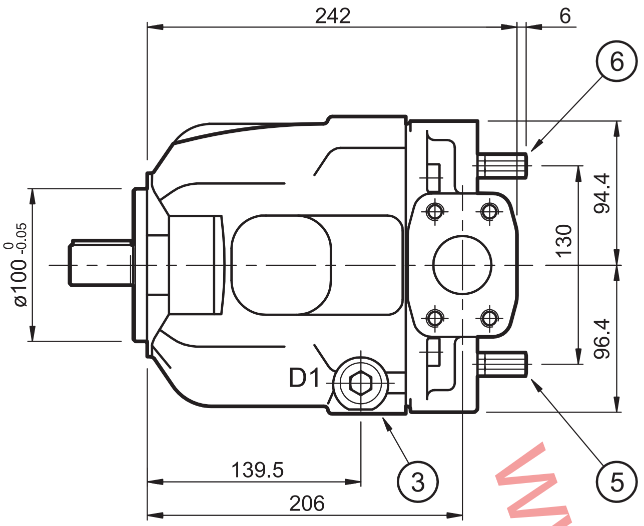


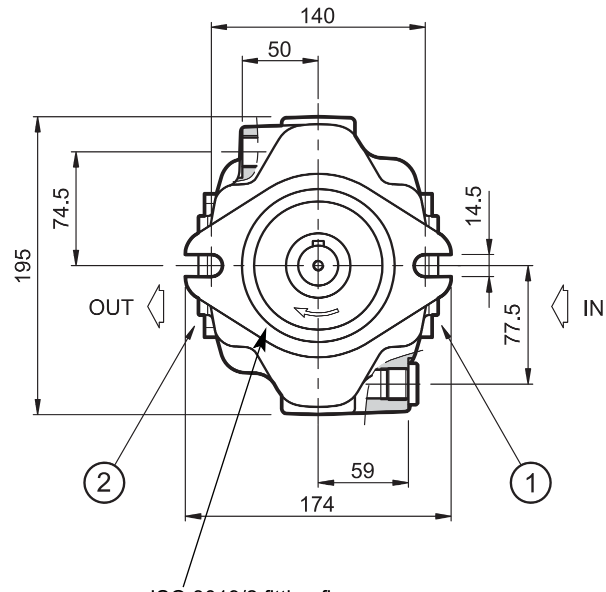
1	Suction port: IN flange SAE 3000 1¼” (for overall dimensions see paragraph 24)
2	Delivery port: OUT flange SAE 6000 3/4” (for overall dimensions see paragraph 24)
3	Additional port drainage D1: 1/2” BSP (closed)
4	Drainage port D2: 1/2” BSP
5	Minimum displacement limit control (**NOTE**) - Locknut: spanner 14 - countersunk hex adjustment screw: spanner 4 - displacement regulation range: 0 ÷ 50 % max. displacement
6	Maximum displacement limit control - Locknut: spanner 14 - countersunk hex adjustment screw: spanner 4 - torque: 10 Nm - displacement regulation range: 100 ÷ 70% max. displacement Δ displacement / screw round = 1,5 cm^3

NOTE: The limit control is supplied factory set at zero minimum displacement and is sealed up with red paint.
Any modification of this setting by the user makes the pump unable to reach the null displacement condition.

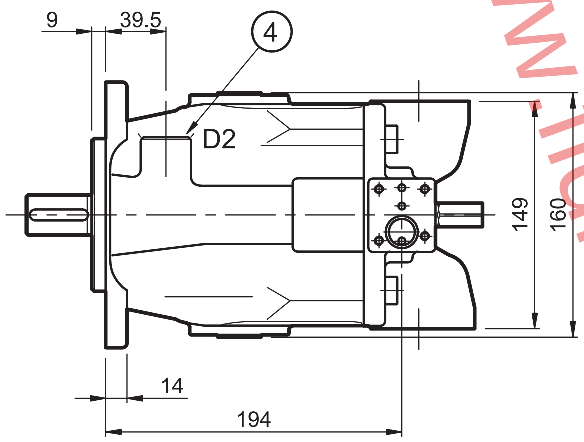
17 - VPPM-046 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm





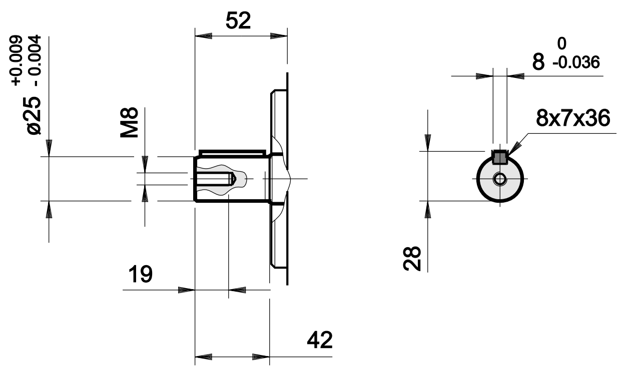
ISO 3019/2 fitting flange
(standard, identification code **5**)



1	Suction port: IN flange SAE 3000 1½” (for overall dimensions see paragraph 24)
2	Delivery port: OUT flange SAE 6000 1” (for overall dimensions see paragraph 24)
3	Additional port drainage D1: 1/2” BSP (closed)
4	Drainage port D2: 1/2” BSP
5	Minimum displacement limit control (**NOTE**) - Locknut: spanner 14 - countersunk hex adjustment screw: spanner 4 - displacement regulation range: 0 ÷ 50 % max. displacement
6	Maximum displacement limit control - Locknut: spanner 14 - countersunk hex adjustment screw: spanner 4 - torque: 10 Nm - displacement regulation range: 100 ÷ 70% max. displacement Δ displacement / screw round = 2,2 cm^3

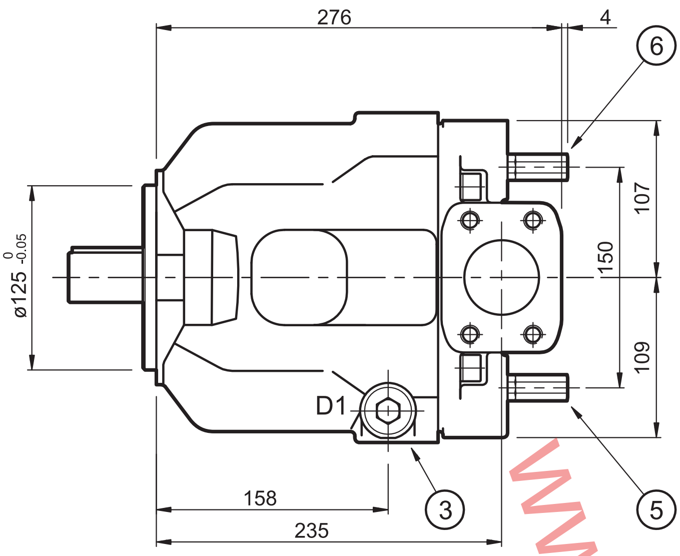
NOTE: The limit control is supplied factory set at zero minimum displacement and is sealed up with red paint.
Any modification of this setting by the user makes the pump unable to reach the null displacement condition.

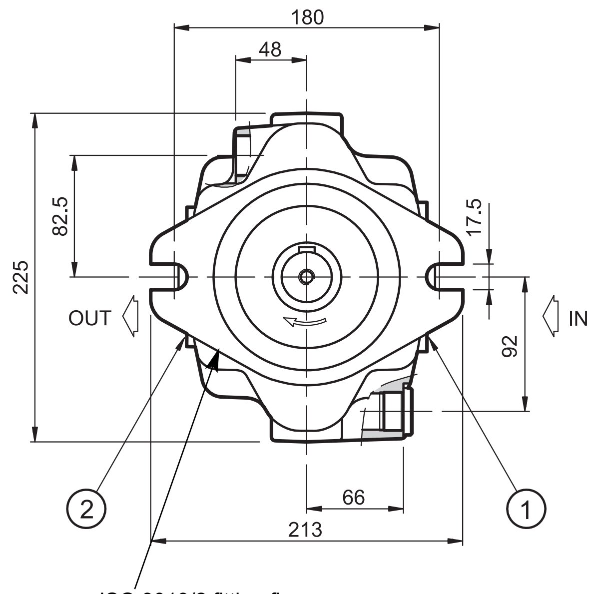
Cylindrical shaft end with ISO 3019/2 key
(standard, identification code **5**)



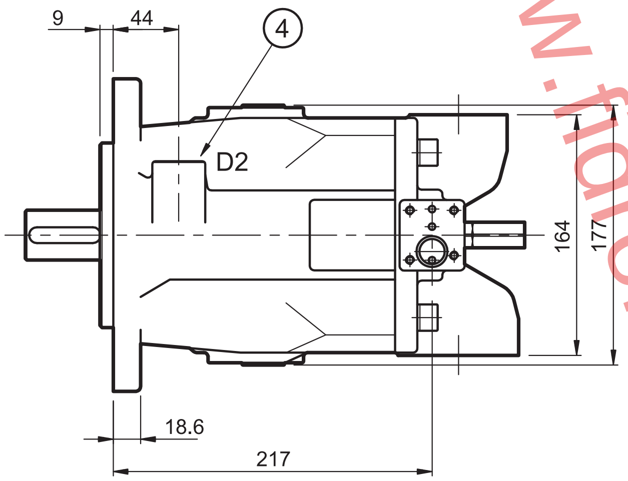
18 - VPPM-073 AND VPPM-087 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

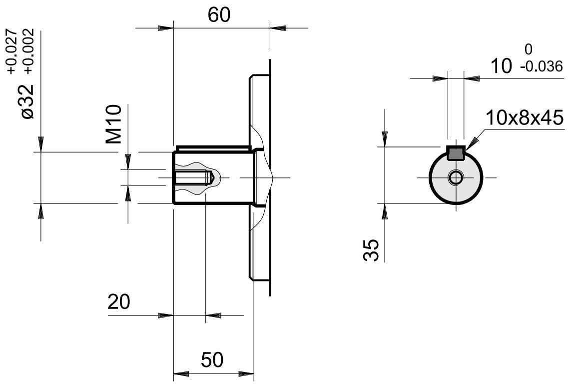




ISO 3019/2 fitting flange
(standard, identification code **5**)



Cylindrical shaft end with ISO 3019/2 key
(standard, identification code **5**)



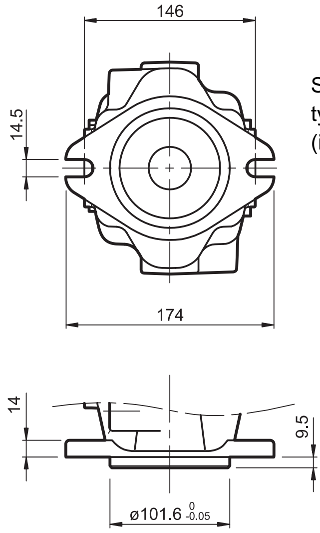
1	Suction port: IN flange SAE 3000 2” (for overall dimensions see paragraph 24)
2	Delivery port: OUT flange SAE 6000 1 ¼” (for overall dimensions see paragraph 24)
3	Additional port drainage D1: 1/2” BSP (closed)
4	Drainage port D2: 1/2” BSP
5	Minimum displacement limit control (**NOTE**) - Locknut: spanner 17 - countersunk hex adjustment screw: spanner 5 - displacement regulation range: 0 ÷ 50 % max. displacement
6	Maximum displacement limit control - Locknut: spanner 17 - countersunk hex adjustment screw: spanner 5 - torque: 10 Nm - displacement regulation range: 100 ÷ 50% max. displacement ∆ displacement / screw round = 3,9 cm^3

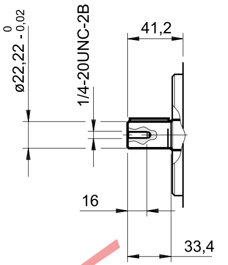
NOTE: The limit control is supplied factory set at zero minimum displacement and is sealed up with red paint.
Any modification of this setting by the user makes the pump unable to reach the null displacement condition.

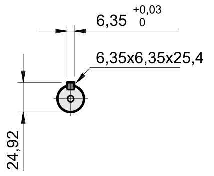
19 - OVERALL DIMENSIONS FOR FLANGES AND SHAFTS TYPE SAE J744

VPPM-029

SAE J744 - 2-hole fitting flange
type “B”
(identification code: **0**)

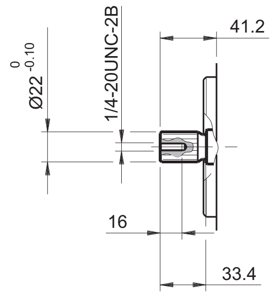






cylindrical with key shaft end
SAE J744
(identification code: **0**)

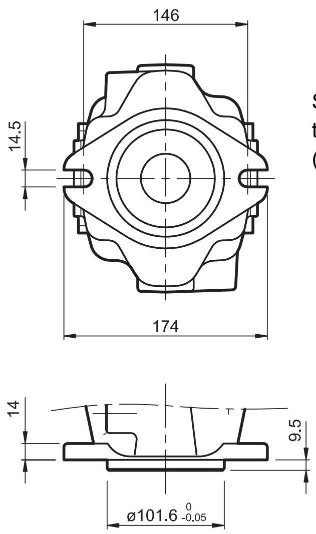
SAE J744 splined shaft end
16/32 d.p. - 13T
(identification code: **1**)

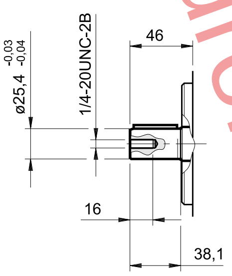


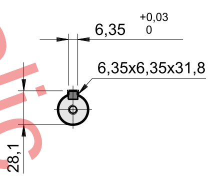
dimensions in mm

VPPM-046

SAE J744 - 2-hole fitting flange
type “B”
(identification code: **0**)

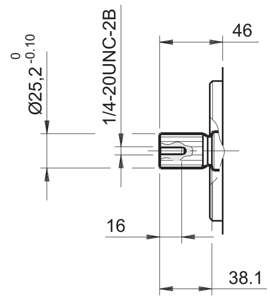






cylindrical with key shaft end
SAE J744
(identification code: **0**)

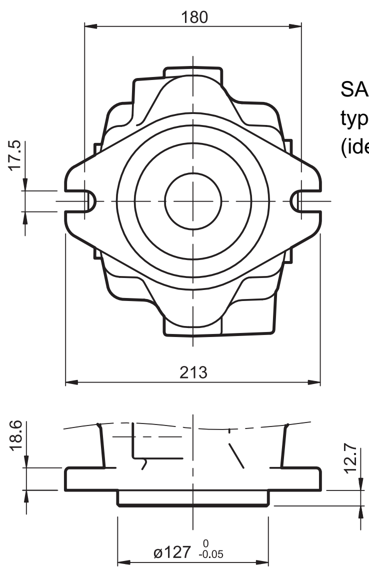
SAE J744 splined shaft end
16/32 d.p. - 15T
(identification code: **1**)

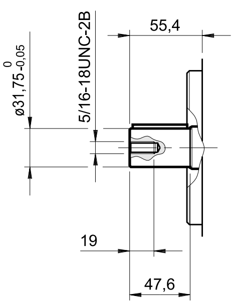


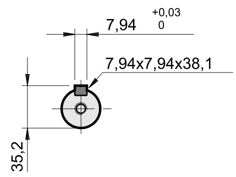
dimensions in mm

VPPM-073
VPPM-087

SAE J744 - 2-hole fitting flange
type “C”
(identification code: **0**)

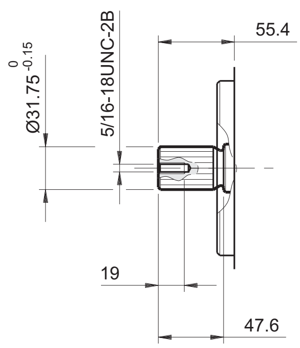






cylindrical with key shaft end
SAE J744
(identification code: **0**)

SAE J744 splined shaft end
12/24 d.p. - 14T
(identification code: **1**)



dimensions in mm

20 - INSTALLATION

- The VPPM pumps can be installed both in a horizontal and vertical position, with the shaft in an upward position.

  N.B.: The drainage port has to be oriented so that the oil level inside the pump body is never lower than 3/4 of its volume (according to the installation use the D1 or D2 drainage ports).

- Installation below the oil reservoir is suggested. As for an installation above the oil level, check that the min. suction pressure is not lower than -0.2 bars (relative). If a low noise emission level is required, the installation inside the tank is suggested.

  In case of an installation inside the tank, with an oil level which does not grant complete pump submersion, it is suggested that the drain tube is adjusted so that the pump higher bearing can be always lubricated.

- **Before starting, the pump body has to be filled with the fluid.**

- It is necessary to vent the air from the delivery connection before operating it the first time. The pump start up, especially at a cold temperature, should occur with the plant at minimum pressure.

- The suction tube has to be suitably sized so that the suction pressure is never lower than -0.2 bar (relative). Bends or restrictions or an excessive tube length could further decrease the value of the suction pressure with a following increase in the noise emissions and a decrease in the pump lifetime.

- The drainage tube has to be sized so that the pressure inside the pump body is always lower than 2 bar (absolute), even during the dynamic change and flow rate phases. The drainage tube has to unload inside the tank far from the suction area. We suggest to interpose a screen between the two lines.

- The drain pressure can be max 0.5 bar higher than the suction pressure but it can never exceed the max of 2 bar of absolute pressure.

- No check valves allowed on the suction line.

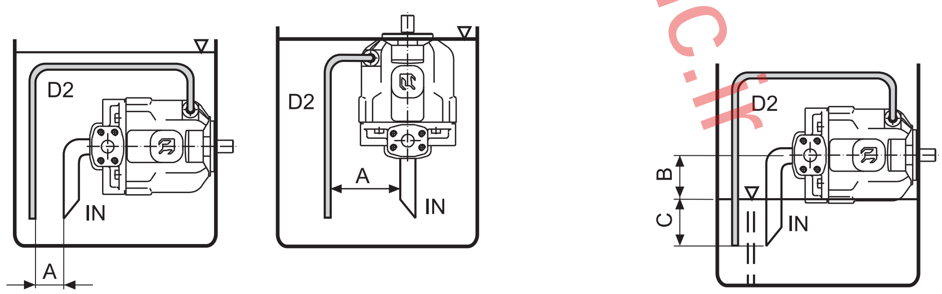
- The motor-pump connection must be carried out directly with a flexible coupling. Radial and axial loads have to be lower than the values specified in the table at paragraph 3.

- As for details and the installation of filter elements, see par. 2.3.

MOUNTING INSIDE THE TANK

Minimum level of oil in the tank at or above the surface of the pump flange
A ≥ 200 mm

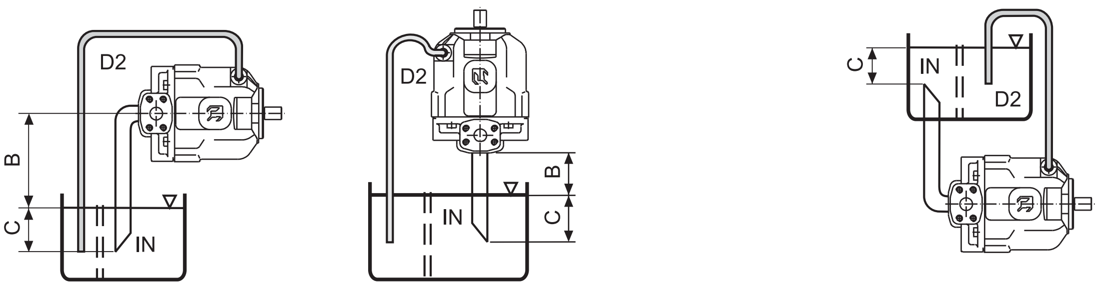
Minimum level of oil in the tank below the surface of the pump flange
Minimum inlet pressure = -0,2 bar (relative)
B ≤ 800 mm C = 200 mm



MOUNTING OUTSIDE THE TANK

Minimum inlet pressure = -0,2 bar (relative)
B ≤ 800 mm C = 200 mm

C = 200 mm



21 - THROUGH OUTPUT SHAFT

The VPPM pumps can be supplied with a through output shaft, which allows coupling with other pump models.

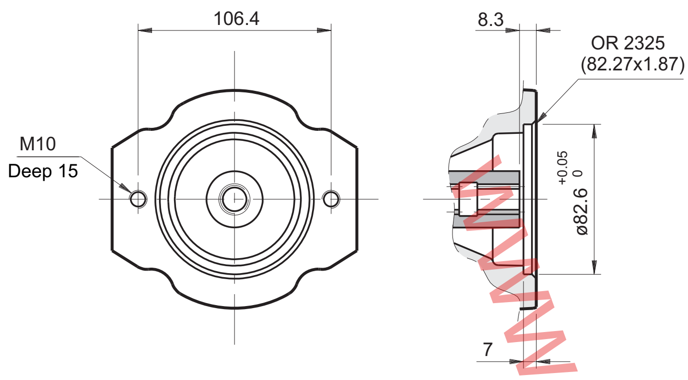
N.B.: The pumps with a through output shaft are supplied with an intermediate 2-hole flange type SAE J744 - and with a mating joint for splined shaft type SAE J744.

The mechanical adjustment for the min and max displacement are not available on these front or intermediate pumps: VPPM-029 with flange 62S, VPPM-073 with flange 64S, VPPM-087 with flange 64S.

As for identification see par. 1 “Identification code”. For the pump overall dimensions (intermediate flange included) see paragraph 23 “overall dimensions for multiple pumps”.

FLANGE + JOINT FOR THE COUPLING OF A GEAR PUMP GROUP 2

identification code **12S**

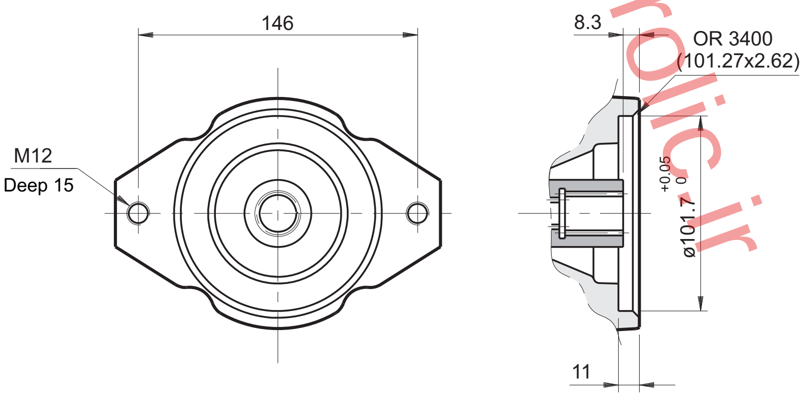


SAE J744 - 2-hole intermediate flange type “A”

mating joint for a SAE J744 splined shaft 16/32 D.P. - 9T

FLANGE + JOINT FOR THE COUPLING OF A PUMP TYPE VPPM-029 OR OF A GEAR PUMP GROUP 3

identification code **62S**

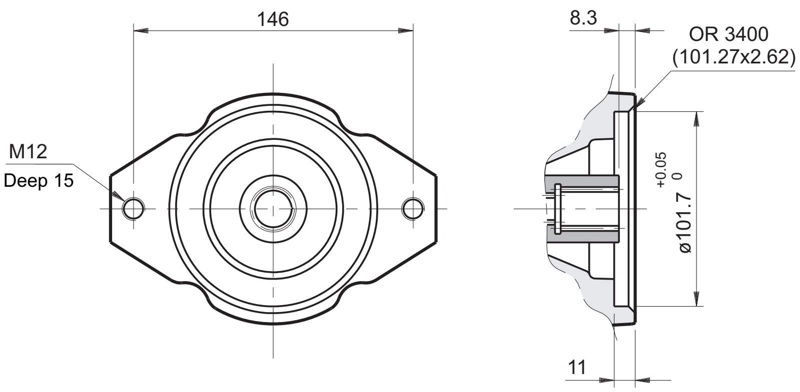


SAE J744 - 2-holes intermediate flange type “B”

mating joint for a SAE J744 splined shaft 16/32 D.P. - 13T

FLANGE + JOINT FOR THE COUPLING OF A PUMP TYPE VPPM-046

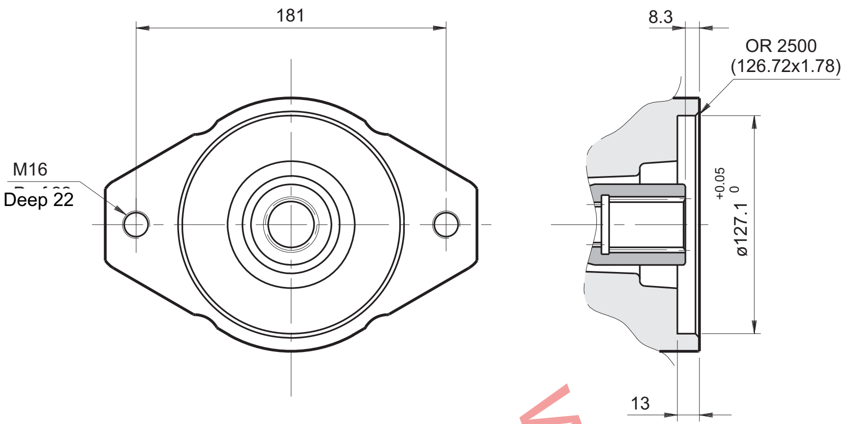
identification code **63S**



SAE J744 - 2-holes intermediate flange type“B”

mating joint for a SAE J744 splined shaft 16/32 D.P. - 15T

FLANGE + JOINT FOR THE COUPLING OF A PUMP TYPE VPPM-073
identification code **64S**



SAE J744 - 2-holes intermediate flange type “C”

mating joint for a SAE J744 splined shaft 12/24 D.P. - 14T

22 - MULTIPLE PUMPS

The possibility to couple several pumps makes it possible to create multi-flow groups with independent hydraulic circuits. While sizing coupled pumps, it’s necessary to make reference to the following conditions:

- The coupling can be carried out between pumps with the same dimensions or to a size of decreasing order.
- The max. rotation speed is determined by the pump with the lowest speed.
- The values of the max. applicable torque can not be exceeded.

22.1 - Max. applicable torque

The input torque (M) for each pump is given by the following ratio:

$$M = \frac{9550 \cdot N}{n} = [Nm]$$

where the absorbed power (N) is given by:

$$N = \frac{Q \cdot \Delta p}{600 \cdot \eta_{tot}} = [kW]$$

n = rotation speed [rpm]

Q = flow rate [l/min]
Δp = differential pressure between the pump suction and delivery [bar]
η_{tot} = total efficiency (obtainable from the diagrams in par. 4-5-6)

or it can be obtained from the diagrams ABSORBED POWER (see par. 4 - 5 - 6 -7).

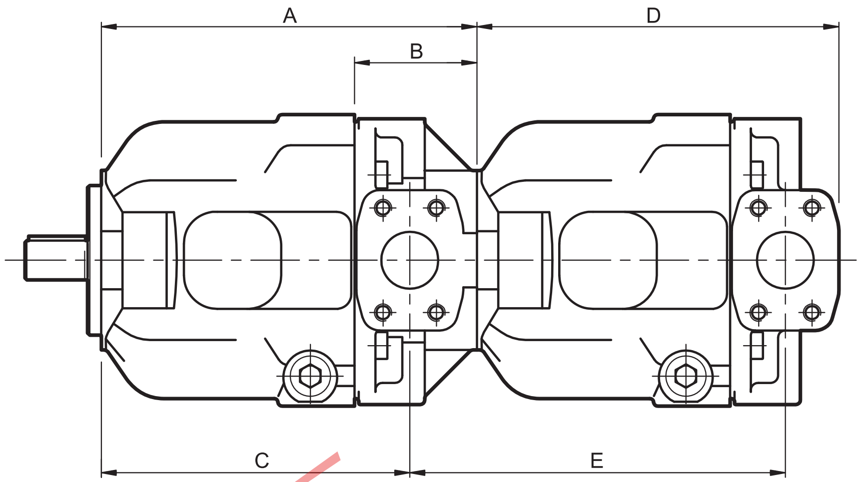
If several pumps are coupled, the torque of each single pump has to be added to the torque of subsequent pumps when they are loaded simultaneously.
The obtained torque value for each pump has to be lower than the value specified in the table below :

pump with a through output shaft	MAXIMUM TORQUE APPLICABLE AT THE FRONT PUMP SHAFT [Nm]			MAXIMUM TORQUE APPLICABLE AT THE PUMP TO BE COUPLED [Nm] (not simultaneously to the front pump)					
	cylindrical ISO 3019/2 (cod. 5)	cylindrical SAE J744 (cod. 0)	splined SAE J744 (cod. 1)	GP2 external gear	GP3 external gear	VPPM-029	VPPM-046	VPPM-073	VPPM-087
VPPM-029	170	200	190	100	135	135	-	-	-
VPPM-046	220	230	330	135	250	250	250	-	-
VPPM-073	450	490	620	135	330	330	400	440	-
VPPM-087	450	490	620	135	330	330	400	440	440

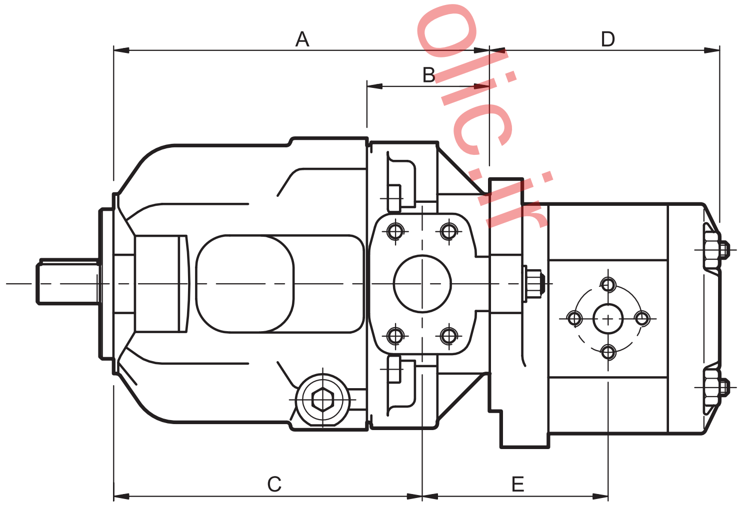
The maximum transmissible torque for those pumps with a through output shaft is determined by the coupling used for the transmission. If the obtained torque values are higher than the ones stated in the table, it is necessary to reduce the working pressure value or to replace the overloaded pump with a pump suitable to bear the required torque.

23 - OVERALL DIMENSIONS FOR MULTIPLE PUMPS

dimensions in mm



	REAR PUMP														
	VPPM-029					VPPM-046					VPPM-073 / 087				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
VPPM-029	222	77	183	213	222	-	-	-	-	-	-	-	-	-	-
VPPM-046	251	82	206	213	220	251	82	206	242	251	-	-	-	-	-
VPPM-073 VPPM-087	291	99	235	213	226	291	99	235	242	249	296	104	235	276	296



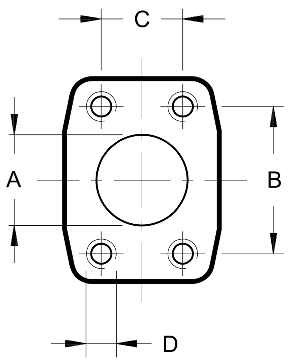
	REAR PUMP									
	external gear GP2					external gear GP3				
	A	B	C	D	E	A	B	C	D	E
VPPM-029	222	77	183	99 ÷121	86 ÷ 97	-	-	-	-	-
VPPM-046	251	82	206	99 ÷121	85 ÷ 96	251	82	206	132 ÷ 147	103 ÷ 110
VPPM-073 VPPM-087	291	99	235	99 ÷121	91 ÷ 102	291	99	235	132 ÷ 147	109 ÷ 116

NOTE: The D and E values in the table make reference to the dimensions of the gear pumps according to the available min. and max. displacement range. For further details apply to our Technical department.

24 - SUCTION AND DELIVERY PORTS DIMENSIONS FOR SAE FLANGES

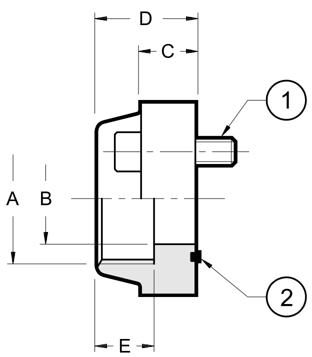
SUCTION PORT: "IN" (SAE 3000)						
Pump	nominal size	A mm	B mm	C mm	D threading and depth (mm) METRIC	UNC
VPPM 029	1 ¼"	32	58,7	30,2	M 10x28	7/16 -14 UNC-2B 28
VPPM 046	1 ½"	38,1	70	35,7	M12x26	½ -13 UNC-2B 26
VPPM 073 VPPM 087	2"	50,8	77,8	43	M12x25	½ -13 UNC-2B 25

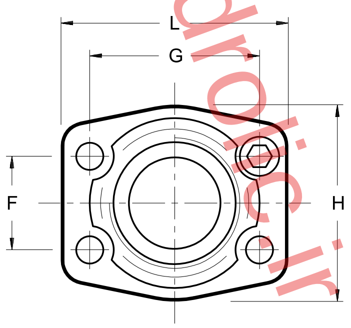
DELIVERY PORT "OUT" (SAE 6000)						
Pump	nominal size	A mm	B mm	C mm	D threading and depth (mm) METRIC	UNC
VPPM 029	3/4"	19	50,8	23,8	M10x24	⅜ - 16 UNC-2B 24
VPPM 046	1"	25,4	57,1	27,7	M12x20	7/16 -14 UNC-2B 20
VPPM 073 VPPM 087	1 ¼"	32	66,7	31,7	M14x23	½ - 13 UNC-2B 23



25 - CONNECTION FLANGES

dimensions in mm
The fastening bolts and the O-Rings must be ordered separately





	Flange code	Flange description
SAE 3000	0610720	OR 4150 (37.69x3.53)
	0610714	OR 4187 (47.22x3.53)
	0610721	OR 4225 (56.74x3.53)
SAE 6000	0770075	OR 4100 (24.99x3.53)
	0770092	OR 4131 (32.93x3.53)
	0770106	OR 4150 (37.69x3.53)

	Flange code	Flange description	p_{max} [bar]	ØA	ØB	C	D	E	F	G	H	L	1 metric SHCS	UNC SHCS
SAE 3000	0610720	SAE - 1 ¼"	280	1 ¼" BSP	32	21	41	22	30,2	58,7	68	79	n° 4 - M10x35	n° 4 - 7/16 UNC x 1 ½"
	0610714	SAE - 1 ½"	210	1 ½" BSP	38	25	45	24	35,7	70	78	94	n° 4 - M12x45	n° 4 - ½ UNC x 1 ¾"
	0610721	SAE - 2"	210	2" BSP	51	25	45	30	43	77,8	90	102	n° 4 - M12x45	n° 4 - ½ UNC x 1 ¾"
SAE 6000	0770075	SAE - 3/4"	420	3/4" BSP	19	21	35	22	23,8	50,8	55	71	n° 4 - M10x35	n° 4 - ⅜ x 1 ½"
	0770092	SAE - 1"	420	1" BSP	25	25	42	24	27,7	57,1	65	81	n° 4 - M12x45	n° 4 - 7/16 x 1 ¾"
	0770106	SAE - 1 ¼"	420	1 ¼" BSP	32	27	45	25	31,7	66,7	78	95	n° 4 - M14x50	n° 4 - ½ x 1 ¾"

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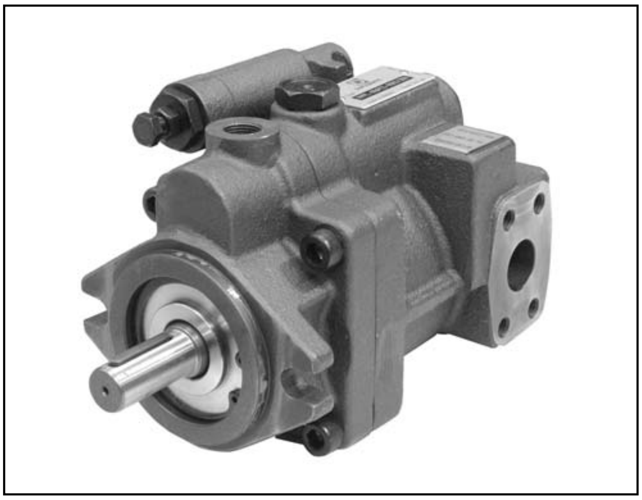
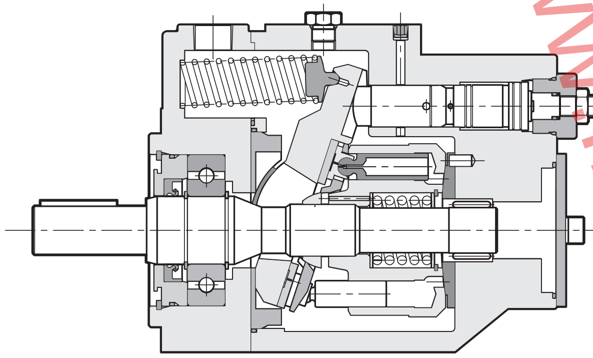


VPPL

VARIABLE DISPLACEMENT AXIAL-PISTON PUMPS FOR INTERMEDIATE PRESSURE

SERIES 20

OPERATING PRINCIPLE



— The VPPL are variable displacement axial-piston pumps with variable swash plate, suitable for applications with open circuits and intermediate pressures.

— They are available in seven nominal sizes, with displacements of 8, 16, 22, 36, 46, 70 and 100 cm^3/rev.

— The pump flow rate is proportional to the rotation speed and to the angle of the swash plate, which can be continuously modulated. The maximum and minimum angle can be limited mechanically via suitable regulating screws.

— They are usually supplied with a SAE J744 2-hole flange and a SAE J744 cylindrical with key shaft.

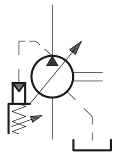
— They are available with four different types of regulating control, each according to the application needs.

TECHNICAL SPECIFICATIONS

PUMP SIZE		008	016	022	036	046	070	100
Maximum displacement	cm^3/rev	8	16	22	36	46	70	100
Flow rate at 1500 rpm	lt/min	12	24	33	54	69	105	150
Operating pressures	bar	210					280	
Rotation speed	rpm	min 500 - max 2000					min 500 - max 1800	
Rotation direction		clockwise (seen from the shaft side)						
Hydraulic connection		SAE flange						
Type of mounting		SAE flange J744 - 2 holes						
Oil volume in the pump body	dm^3	0,2	0,3		0,6		1	1,8
Mass	kg	8	12	12	23	23	41	60

Ambient temperature range	°C	-10 / +50
Fluid temperature range	°C	-10 / +70
Fluid contamination degree	see paragraph 2.3	
Recommended viscosity	cSt	20 ÷ 50

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

V	P	P	L	-			-	R		0		/	20	N

Variable displacement axial piston pump for intermediate pressure

Pump size:
008 = 8 cm^3/rev
016 = 16 cm^3/rev
022 = 22 cm^3/rev
036 = 36 cm^3/rev
046 = 46 cm^3/rev
070 = 70 cm^3/rev
100 = 100 cm^3/rev

Regulator type:
PC* = pressure regulator
PC5 p max 210 bar for VPPL-008, 016, 022, 036, 046
PC6 p max 280 bar for VPPL-070 and 100
PCR = remote-controlled pressure regulator
PQC = pressure and flow rate regulator (load sensing)
PCX* = regulator with pressure control devices
PC5 p max 210 bar for VPPL-008, 016, 022, 036, 046
PC6 p max 280 bar for VPPL-070 and 100

Clockwise rotation (seen from the shaft side)

NBR sealing rings for mineral oils

Series no:
(the overall and mounting dimensions remain unchanged from 20 to 29)

Hydraulic connection
S = suction / delivery: SAE flange with metric bolts. Drainage with BSP threaded ports (not available for VPPL-008)
B = BSP threaded ports (only for VPPL-008)

Shaft end type:
cylindrical with key SAE J744

Mounting flange:
0 = SAE-2 type for VPPL-008, 016, 022, 036 and 046
1 = SAE-4 type for VPPL-070 and VPPL 100
(dimensions of VPPL-070 are not standardized)

2 - HYDRAULIC FLUID

2.1 - Fluid type

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. With these fluids use NBR seals. Using fluids at temperatures higher than 70 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

2.2 - Fluid viscosity

The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to a maximum temperature of 90 °C for the drainage fluid
optimum viscosity	20 / 50 cSt	referred to the operating temperature of the fluid in the tank
maximum viscosity	1000 cSt	limited only to the cold start-up of the pump, which has to be carried out with the plant at minimum pressure.

When selecting the fluid type, be sure that the true viscosity is within the range specified above at the operating temperature.

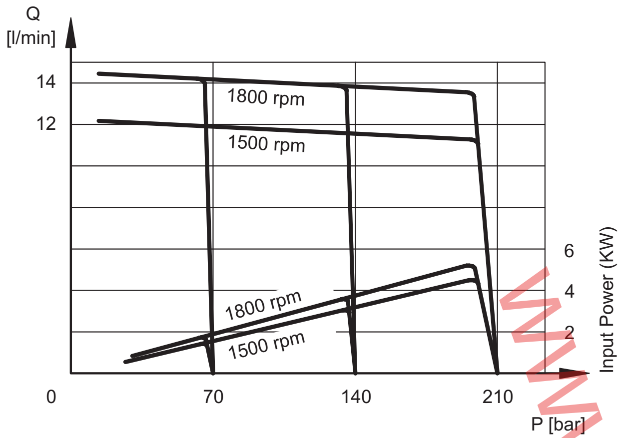
2.3 - Degree of fluid contamination

The maximum degree of fluid contamination must be according to ISO 4406:1999 class 20/18/15; therefore the use of a delivery or return filter with $\beta_{20} \geq 75$ is suggested.
A degree of maximum fluid contamination according to ISO 4406:1999 class 20/16/13 is recommended for optimum endurance of the pump. Hence, the use of a filter with $\beta_{10} \geq 100$ is recommended.
For the installation of filters on the suction line, see paragraph 10. The suction filter must be equipped with a by-pass valve and, if possible, with a clogging indicator and should be oversized to avoid cavitation problems.

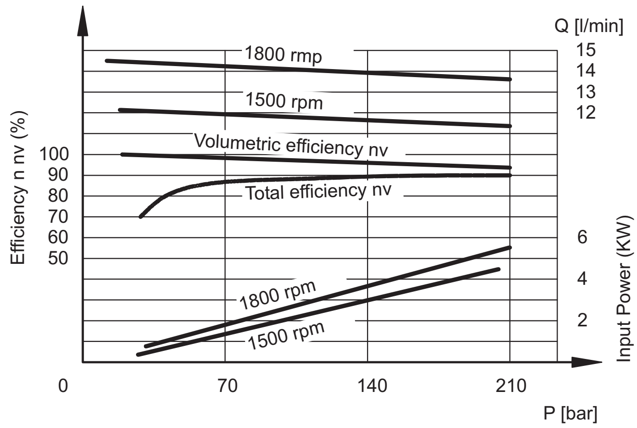
3 - CHARACTERISTIC CURVES

3.1 - VPPL-008 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

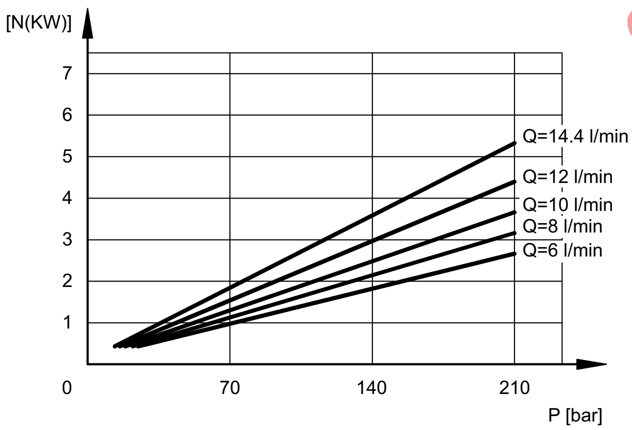
FLOW RATE / PRESSURE CURVES



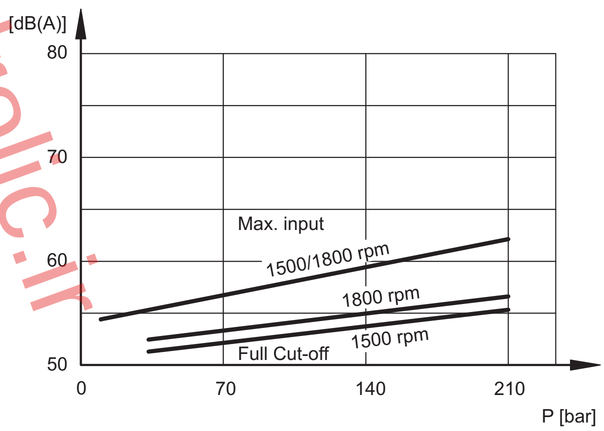
VOLUMETRIC AND TOTAL EFFICIENCY



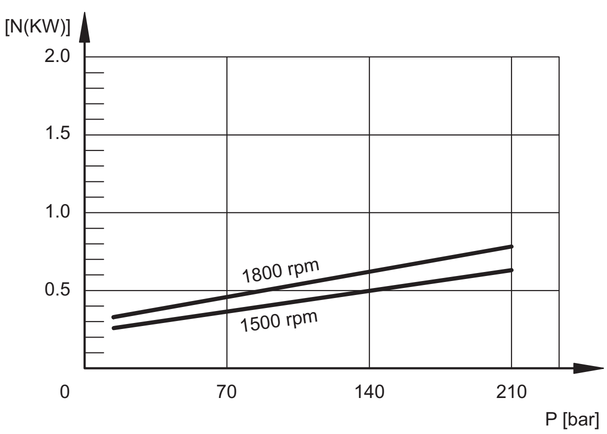
ABSORBED POWER



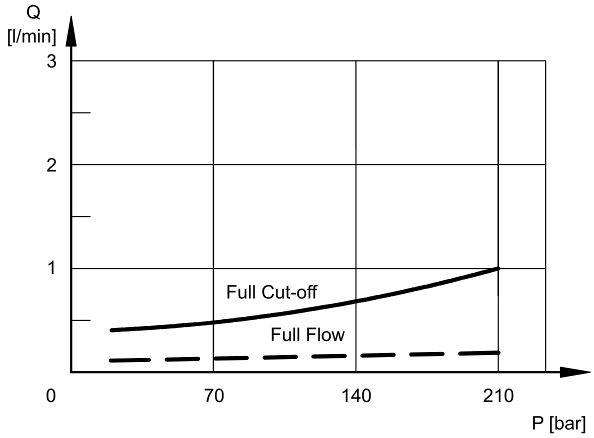
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

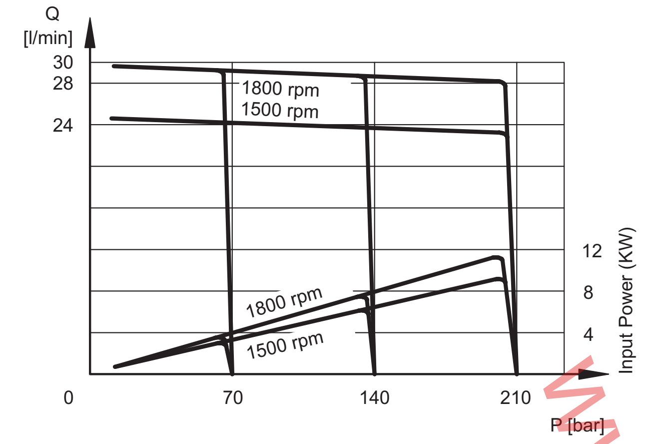


DRAIN FLOW RATE

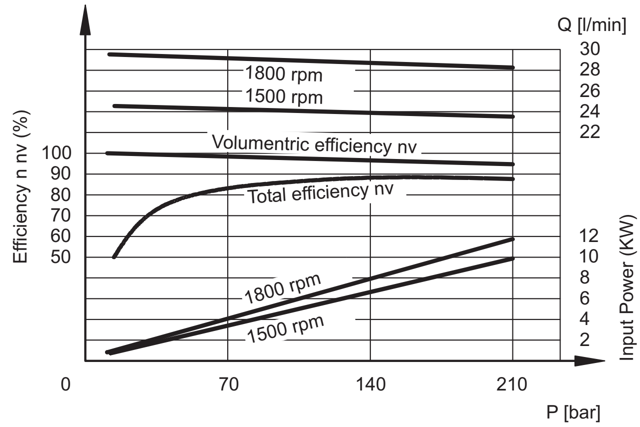


3.2 - VPPL-016 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

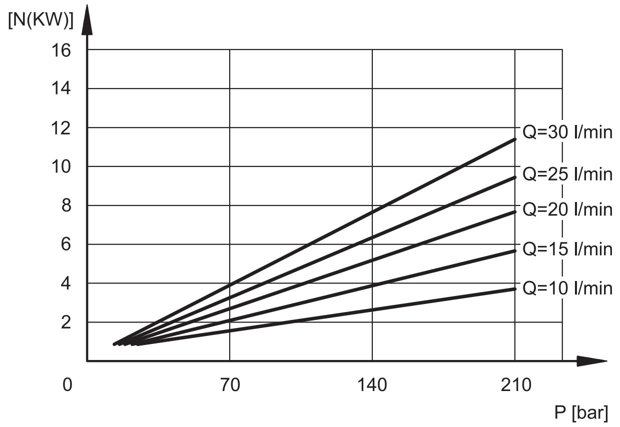
FLOW RATE / PRESSURE CURVES



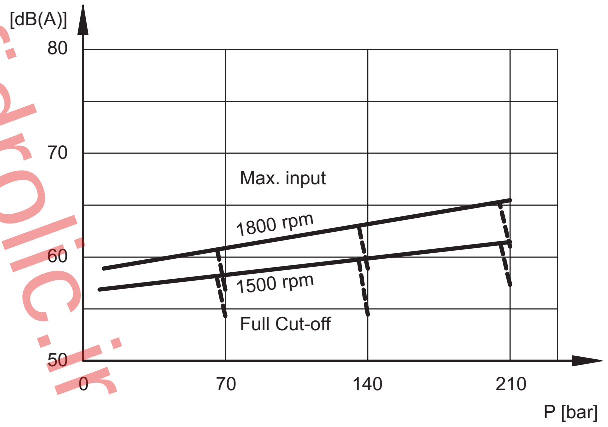
VOLUMETRIC AND TOTAL EFFICIENCY



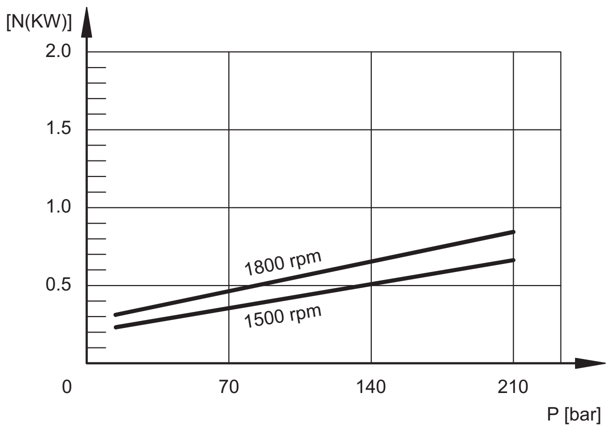
ABSORBED POWER



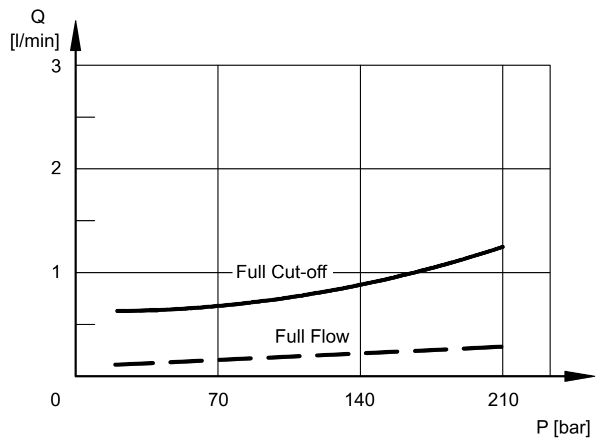
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

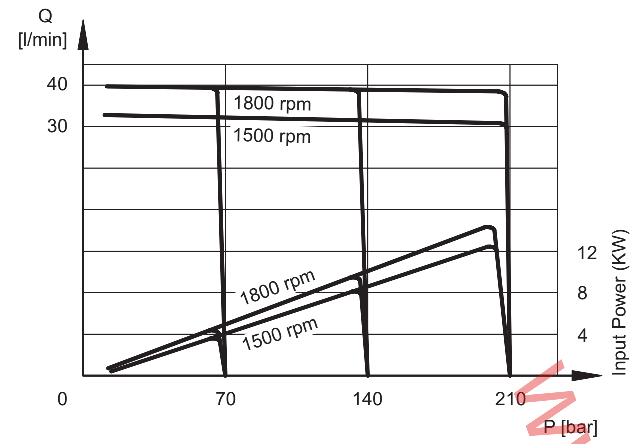


DRAIN FLOW RATE

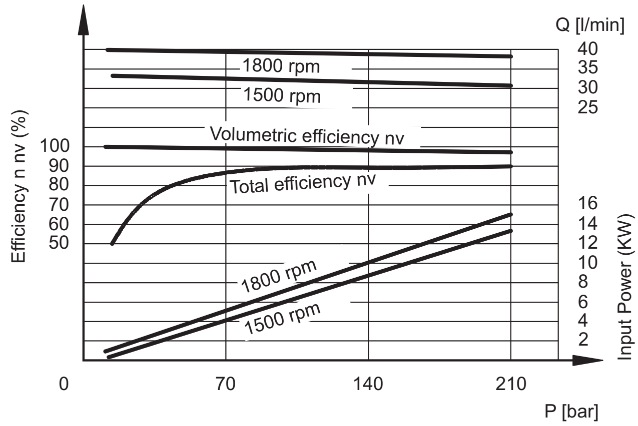


3.3 - VPPL-022 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

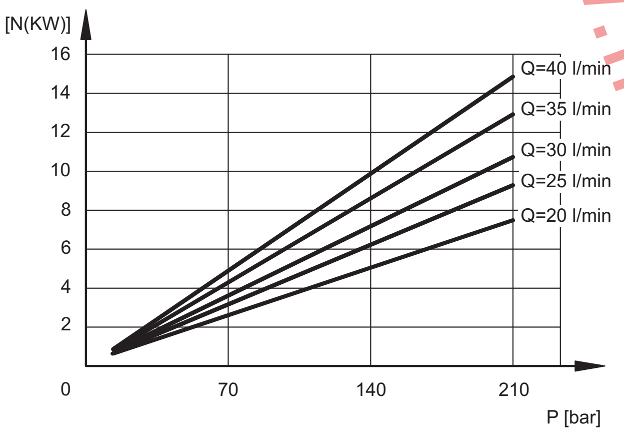
FLOW RATE / PRESSURE CURVES



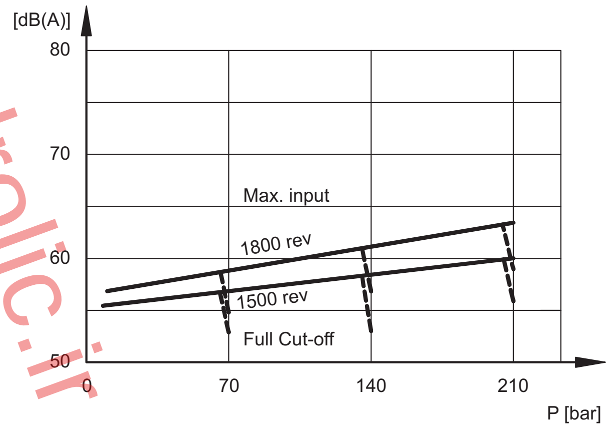
VOLUMETRIC AND TOTAL EFFICIENCY



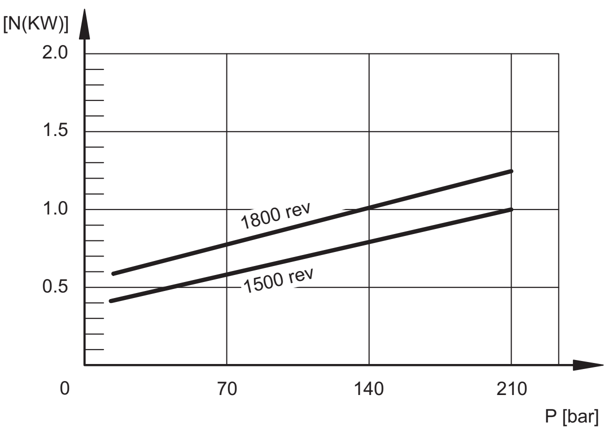
ABSORBED POWER



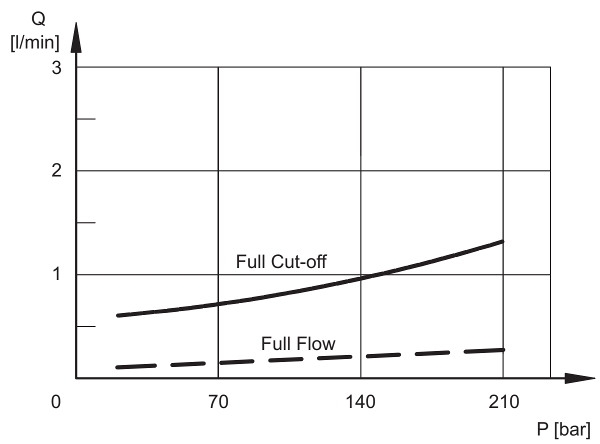
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

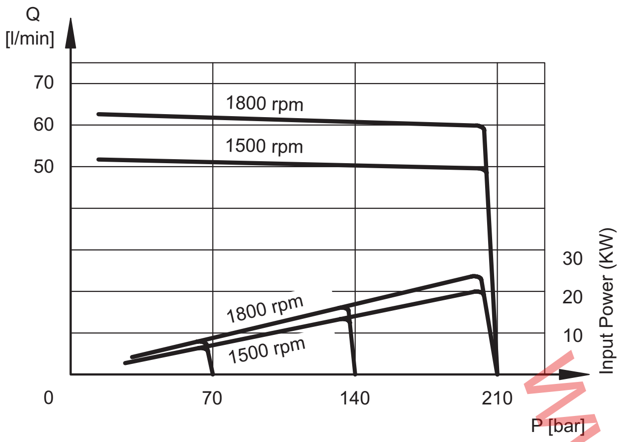


DRAIN FLOW RATE

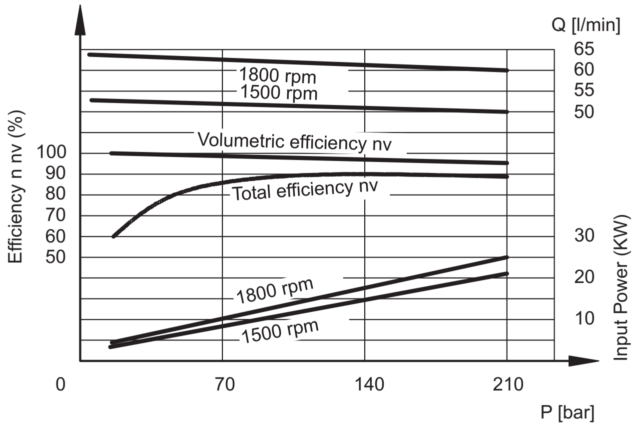


3.4 - VPPL-036 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

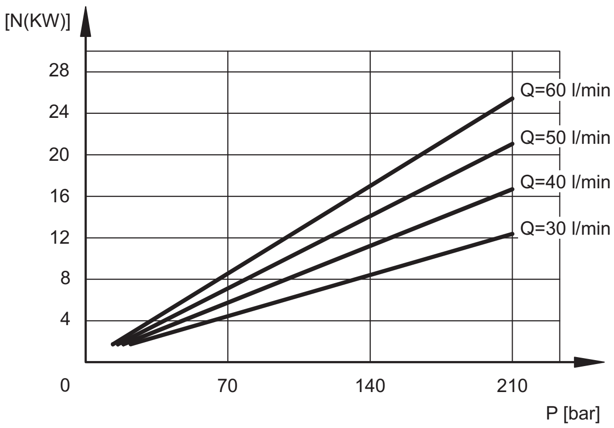
FLOW RATE / PRESSURE CURVES



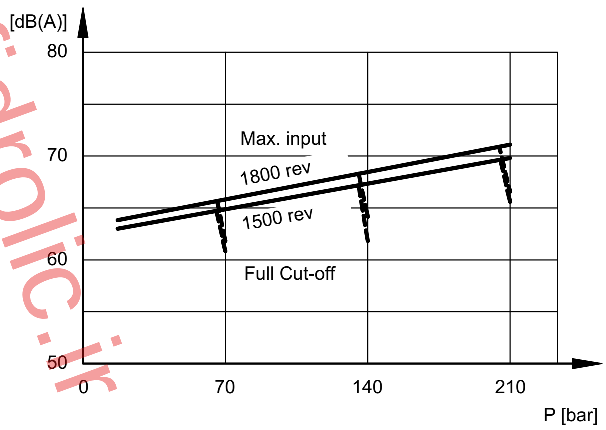
VOLUMETRIC AND TOTAL EFFICIENCY



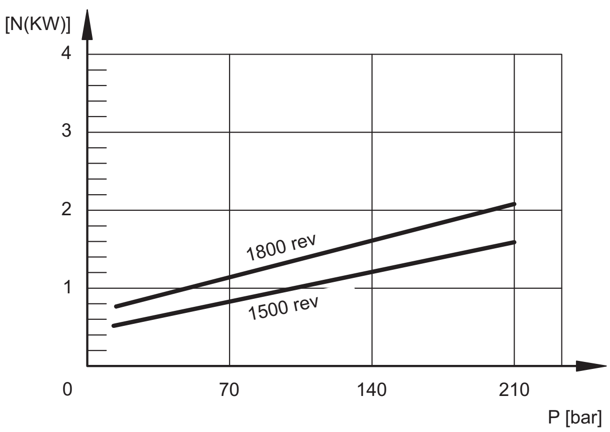
ABSORBED POWER



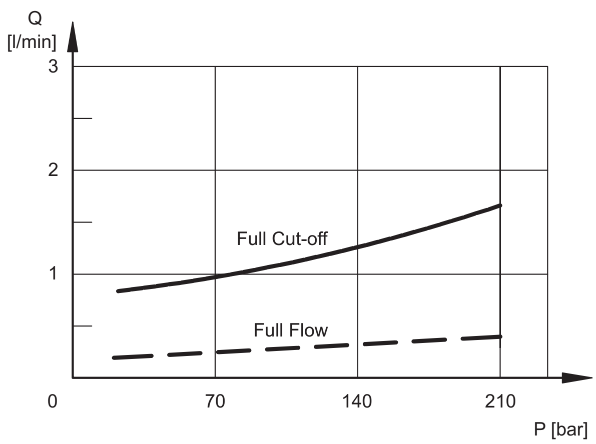
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

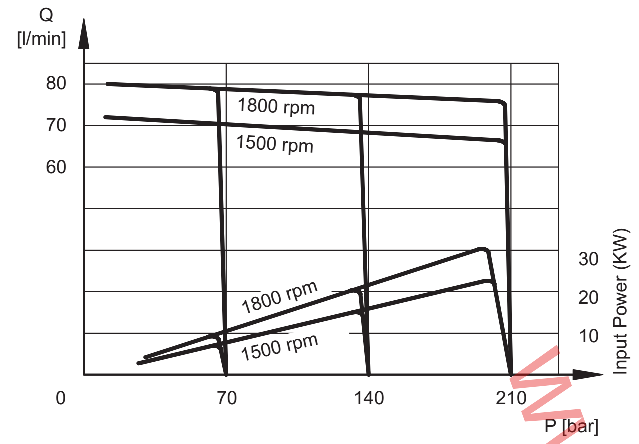


DRAIN FLOW RATE

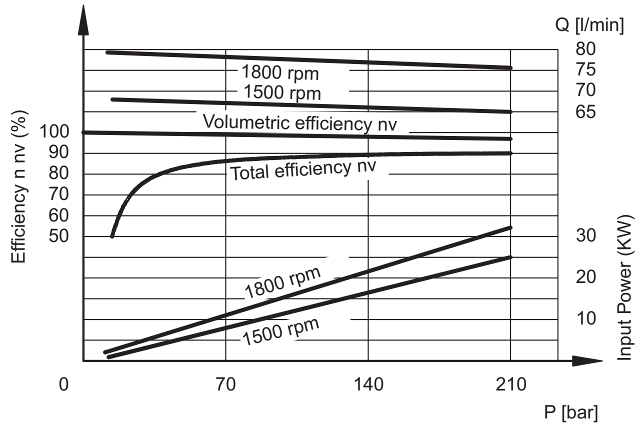


3.5 - VPPL-046 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

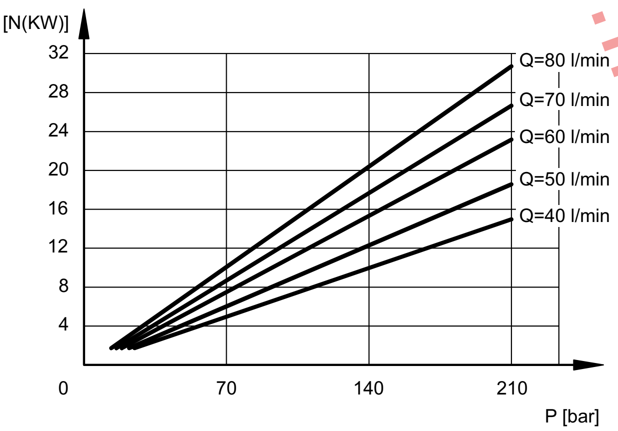
FLOW RATE / PRESSURE CURVES



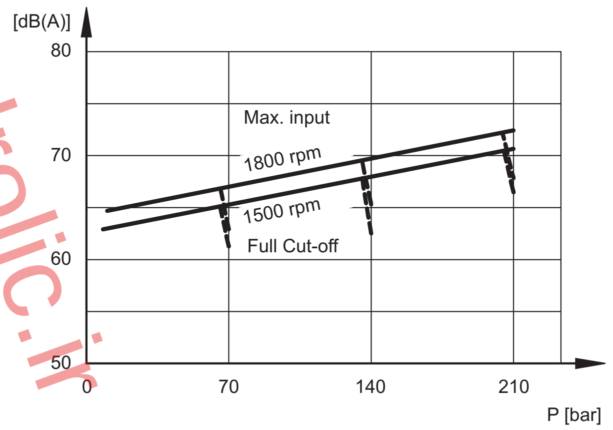
VOLUMETRIC AND TOTAL EFFICIENCY



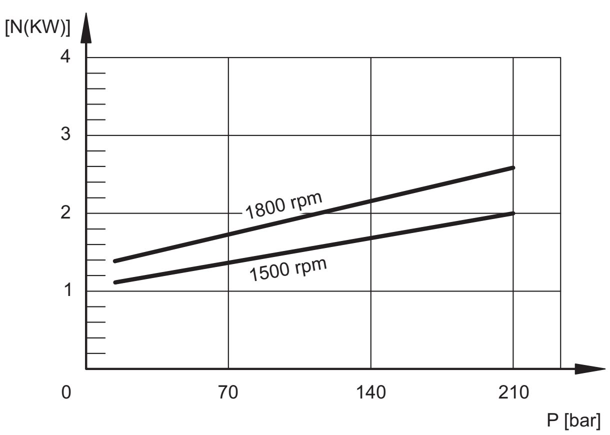
ABSORBED POWER



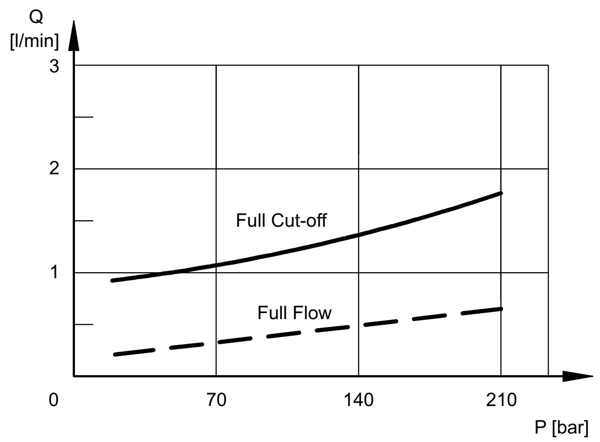
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

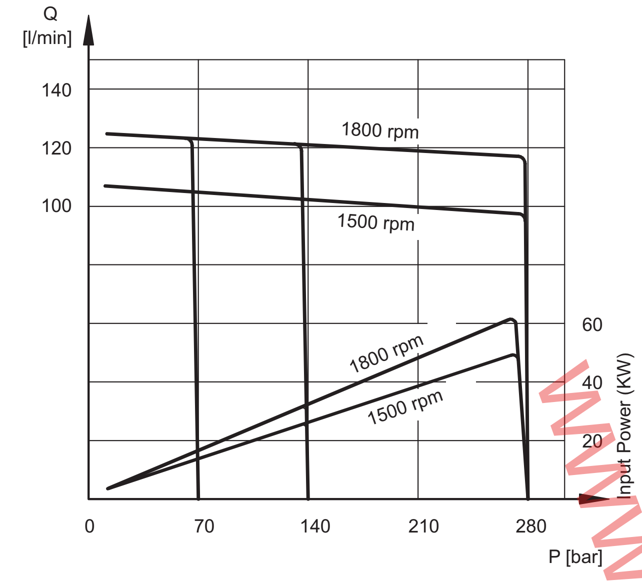


DRAIN FLOW RATE

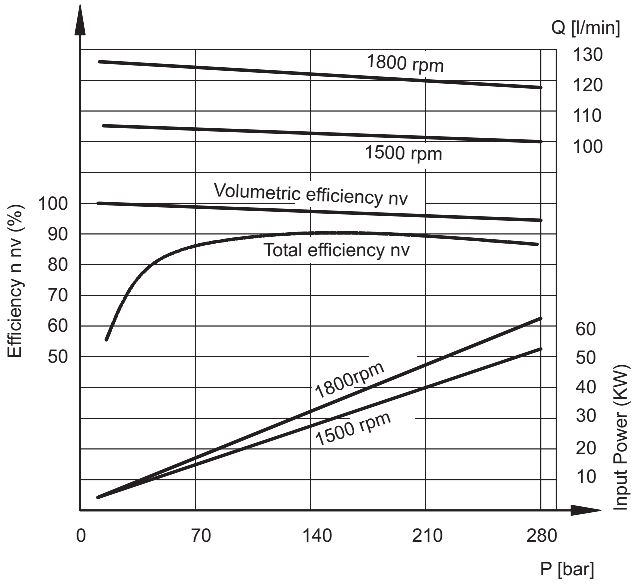


3.4 - VPPL-070 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

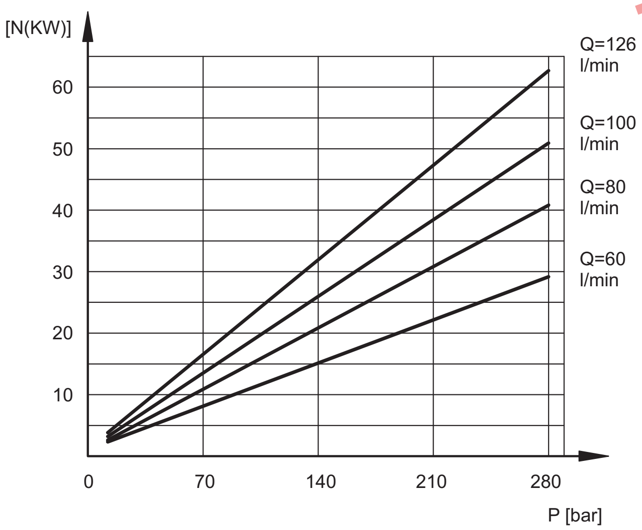
FLOW RATE / PRESSURE CURVES



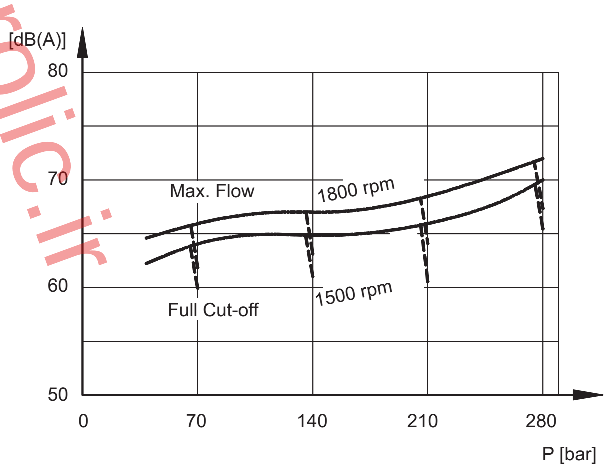
VOLUMETRIC AND TOTAL EFFICIENCY



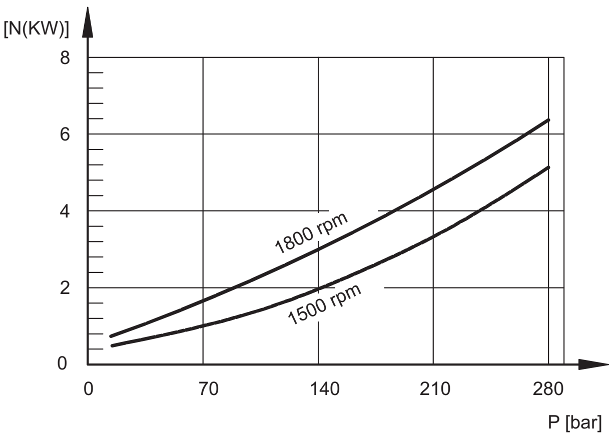
ABSORBED POWER



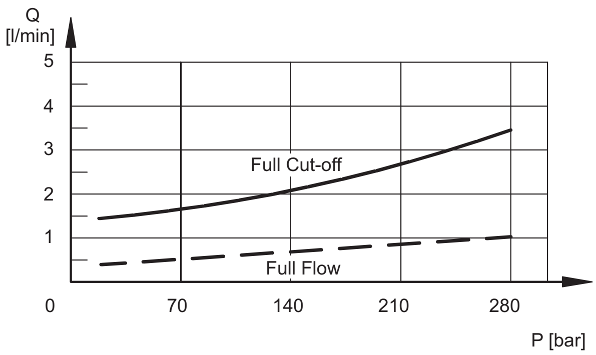
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

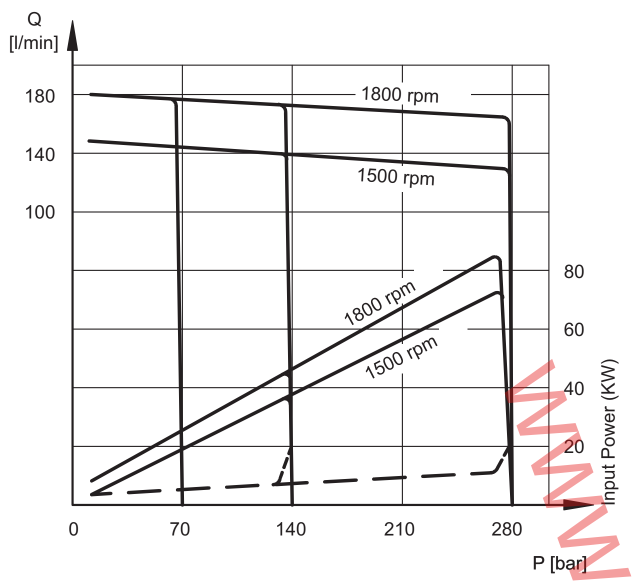


DRAIN FLOW RATE

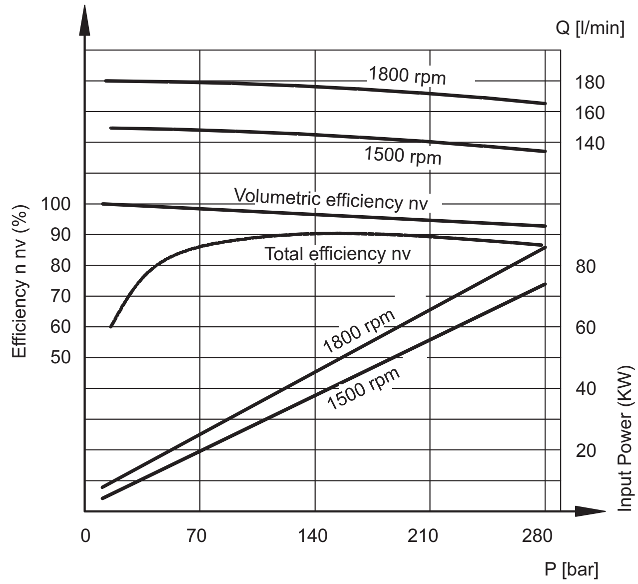


3.5 - VPPL-100 pump characteristic curves (values obtained with mineral oil with viscosity of 36 cSt at 50°C)

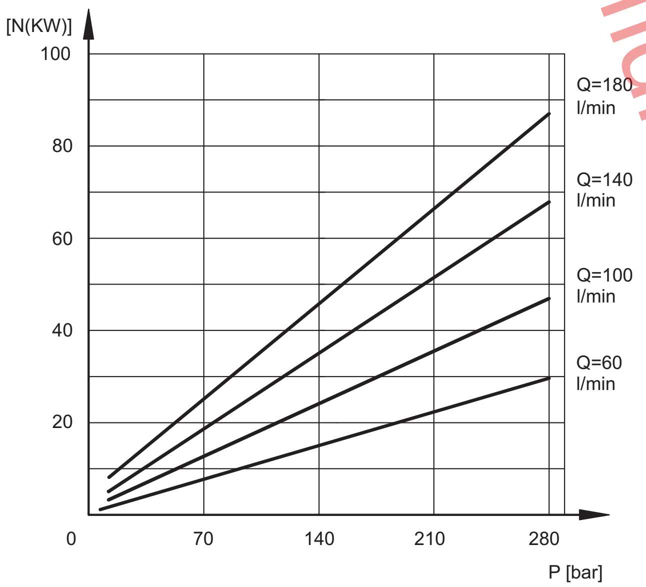
FLOW RATE / PRESSURE CURVES



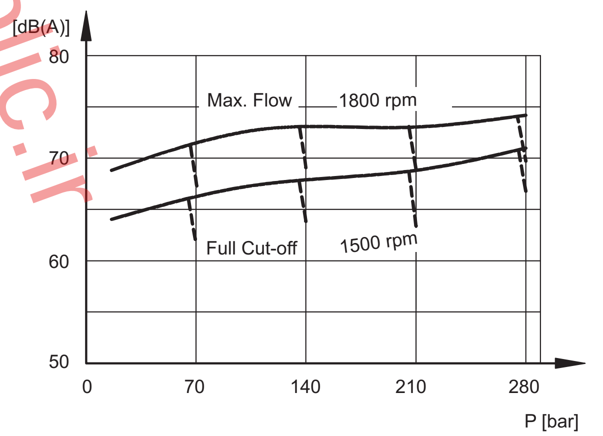
VOLUMETRIC AND TOTAL EFFICIENCY



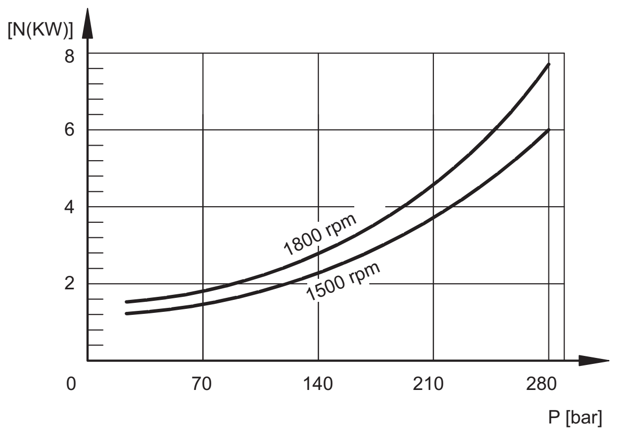
ABSORBED POWER



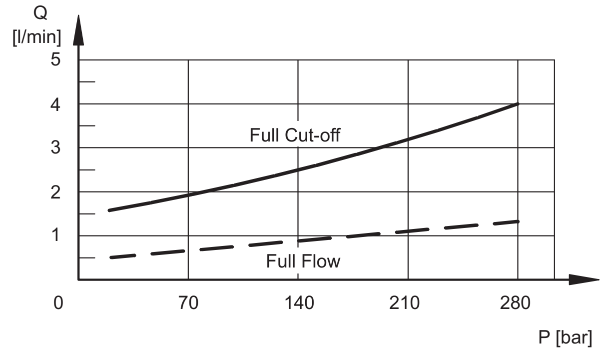
NOISE LEVEL



INPUT POWER AT FULL CUT-OFF

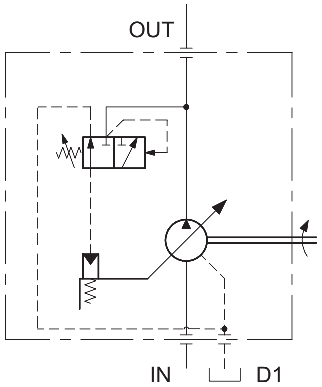


DRAIN FLOW RATE



4 - REGULATORS

4.1 - Pressure regulator: PC*



The PC* pressure regulator keeps the pressure at a constant set level in the circuit, thus adjusting automatically the pump flow rate according to the real need of the system.
The desired pressure can be set by manually adjusting the P regulation valve. The clockwise rotation of the adjustment bolt makes the pressure increase.

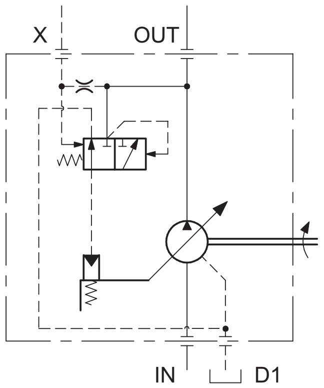
FEATURES OF THE PC REGULATOR:
- pressure adjustment range:
  PC5 = 30 ÷ 210 bar (for VPPL 008, 016, 022, 036 and 046)
  pressure increase/adjustment screw round: 69 bar
  PC6 = 30 ÷ 280 bar (for VPPL 070 and 100)
  pressure increase/adjustment screw round: 78 bar

4.2 - Remote-controlled pressure regulator: PCR

The PCR regulator allows a remote-control of the device via a remote control connected to the X port (typical application for submerged pumps).
In case a pressure regulating valve is used for the remote-control, it is suggested to use a direct operated valve with a size suitable to 1,5 l/min pilot flow rate.
Note: The maximum length of the connection between the valve and X port of the pump must not be longer than 2 m.

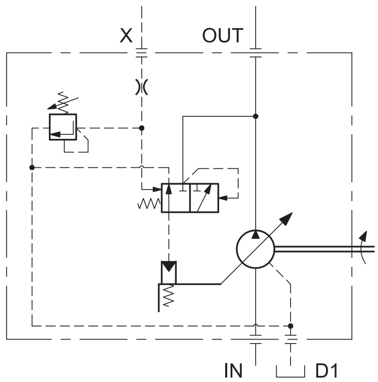
4.2.1 - Remote-controlled pressure regulator: PCR for VPPL 008, 016, 022, 036 e 046

FEATURES OF THE REGULATOR:
- remote-adjustment pressure = 20 ÷ 210 bar
- flow rate available on the X port
  for the remote-control = about 1,5 l/min (approx.)

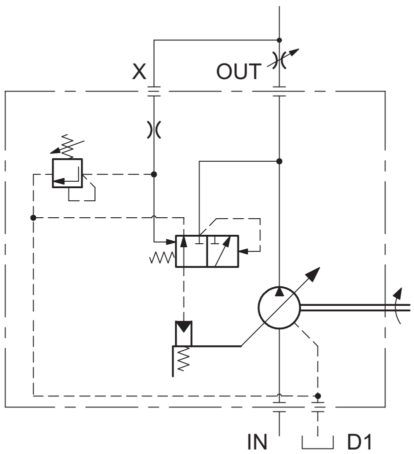


4.2.2 - Remote-controlled pressure regulator: PCR for VPPL 070 e 100

FEATURES OF THE REGULATOR:
It also limits the line maximum pressure.
- pressure regulating range 30 ÷ 280 bar
- pressure increase/adjustment screw round: 78 bar
- remote-regulated pressure range = 20 ÷ 280 bar
- flow rate available on the X port for the remote-control = about 1,5 l/min



4.3 - Pressure and flow rate regulator: PQC

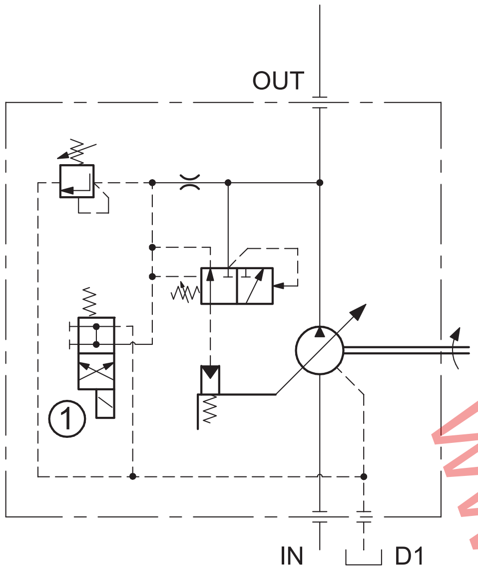


This regulator, in addition to the pressure adjustment (as for the PC* model), allows the pump flow rate control, according to the Δp pressure drop measured on either side of a throttle valve installed on the user line.
Note: The connection pipe between the X port and the flow line downstream the restrictor (or valve) must always be made (customer charge).

FEATURES OF THE PQC REGULATOR:
- pressure adjustment range:
  11 ÷ 190 bar (for VPPL 008, 016, 022, 036 and 046)
  13 ÷ 230 bar (for VPPL 070 and 100)
- pressure increase/adjustment screw round: 78 bar
- differential pressure adjustment range = 15 ÷ 28 bar
- minimum delivery pressure = 15 bar

4.4 - Regulator with pressure control devices: PCX*

4.4.1 - Electrical unloading



The PCX* regulator, mated to a suitable two-position solenoid valve, allows the electrical switching of the pump displacement in null condition and with minimum delivery pressure.

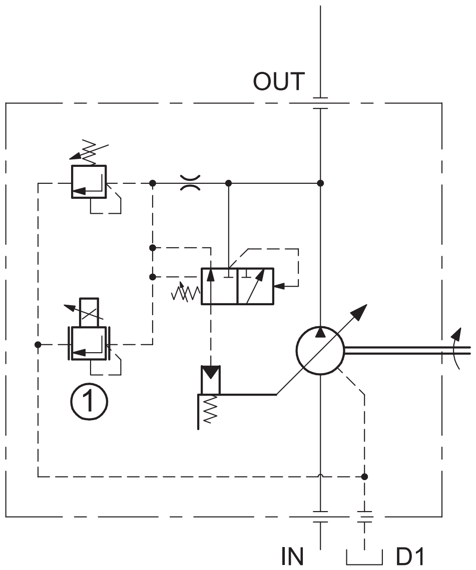
This function is useful for the pump unloading at the start-up or to operate at minimum pressure in the system during the machine cycle pause, with considerable energy saving.

The pressure switching is made by means of a solenoid valve (to be ordered separately) installed on the pump regulator directly.

PCX* FEATURES (electrical unloading):

- solenoid switching valve (1) = DS3-SA2 type
  (to be ordered separately - see cat. 41 150)
- solenoid valve OFF = pump at null displacement and delivery pressure = 20 bar
- solenoid valve ON = maximum displacement and delivery pressure set on regulator.
- pressure regulating range:
  20 ÷ 210 bar for VPPL-008, 016, 022, 036 and 046
  20 ÷ 280 bar for VPPL-070 and 100
- pressure increase/adjustment screw round = 78 bar
- default settings:
  210 bar for VPPL-008, 016, 022, 036 and 046
  280 bar for VPPL-070 and 100

4.4.2 - Pressure regulation with electric proportional control



The PCX regulator mated with a proportional pressure relief valve, allows a continuous control and modulation of the system pressure.

The proportional pressure relief valve (to be ordered separately) is installed on the pump regulator directly.

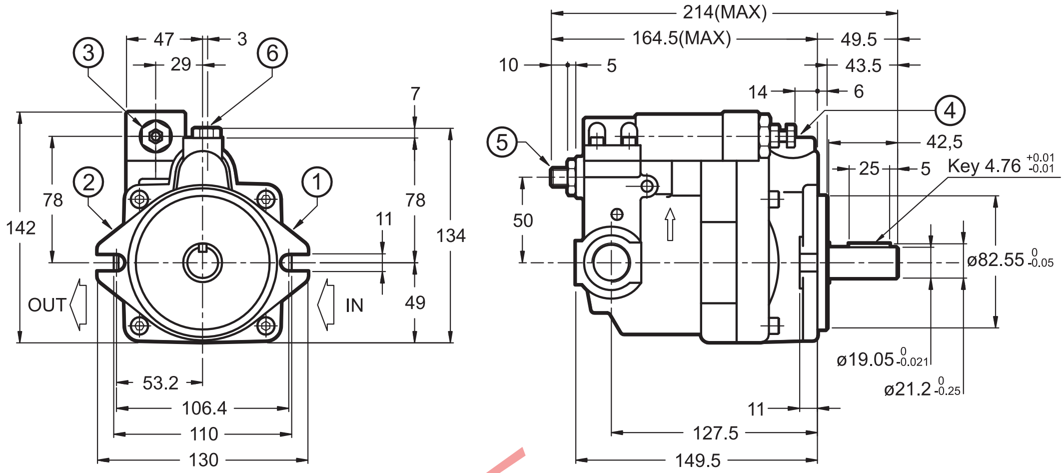
PCX* FEATURES (proportional pressure regulation):

- pressure regulating range:
  PCX5 = 20 ÷ 210 bar for VPPL-008, 016, 022, 036, 046.
  PCX6 = 20 ÷ 280 bar for VPPL-070 and 100
- pressure increase/adjustment screw round = 78 bar
- default setting:
  PCX5 = 210 bar for VPPL-008, 016, 022, 036 and 046
  PCX6 = 280 bar for VPPL-070 and 100
- proportional pressure relief valve (1) = PRED3 type
  (to be ordered with the relative control card separately - see cat. 81 210)
- proportional pressure regulating range :
  PRED3-070 20 ÷ 85 bar
  PRED3-210 20 ÷ 225 bar

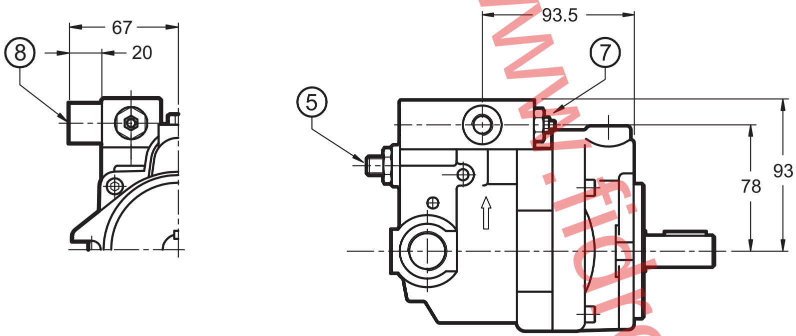
Hysteresis = < 5% of p nom
Repeatability = < ±1,5% of p nom

5 - VPPL-008 PUMPS OVERALL AND MOUNTING DIMENSIONS

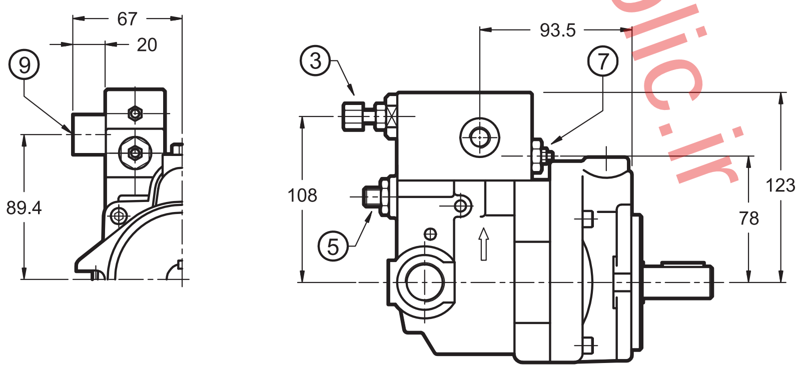
VPPL-008PC5 PUMPS



VPPL-008PCR PUMPS

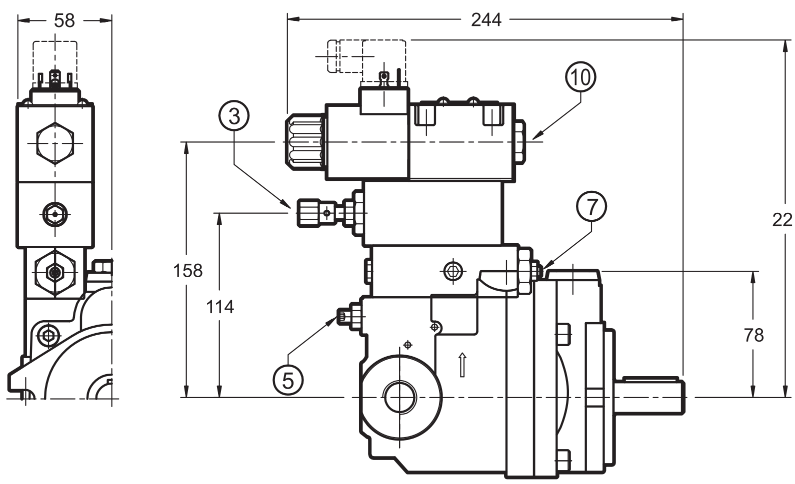


VPPL-008PQC PUMPS



dimensions in mm

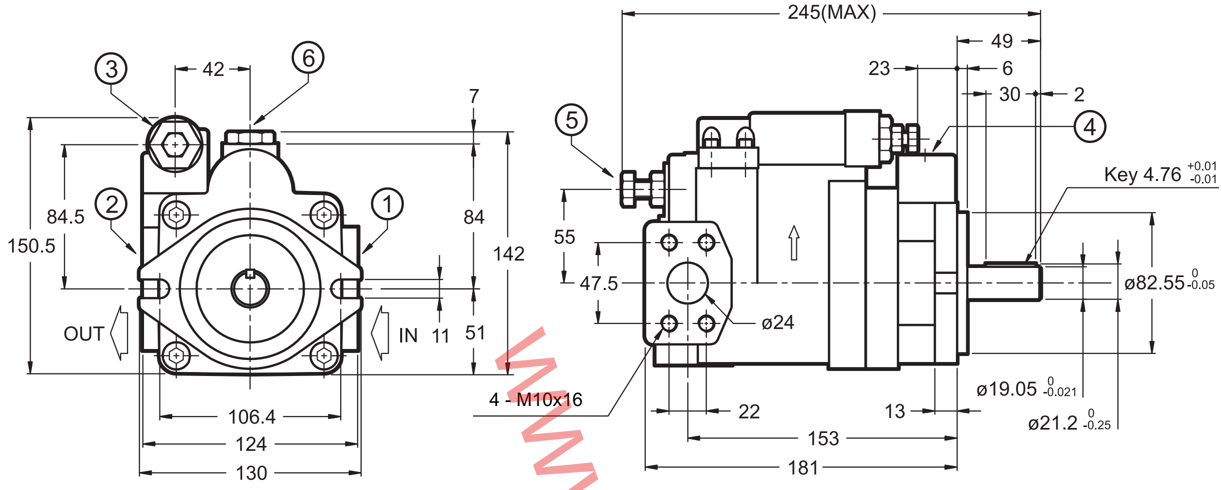
VPPL-008PCX5 PUMPS



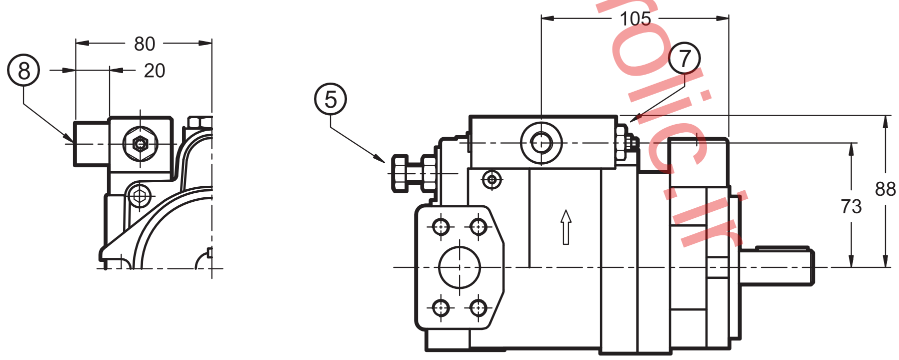
1	Suction port IN: 1/2” BSP
2	Delivery port OUT: 1/2” BSP
3	Pressure adjustment screw
4	Drain port: 3/8” BSP
5	Flow adjustment screw ∆ displacement/round = 0,8 cm³
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP
9	Load sensing port: 1/4" BSP
10	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)

6 - VPPL-016 and VPPL-022 PUMPS OVERALL AND MOUNTING DIMENSIONS

VPPL-016PC5 and VPPL-022PC5 PUMPS

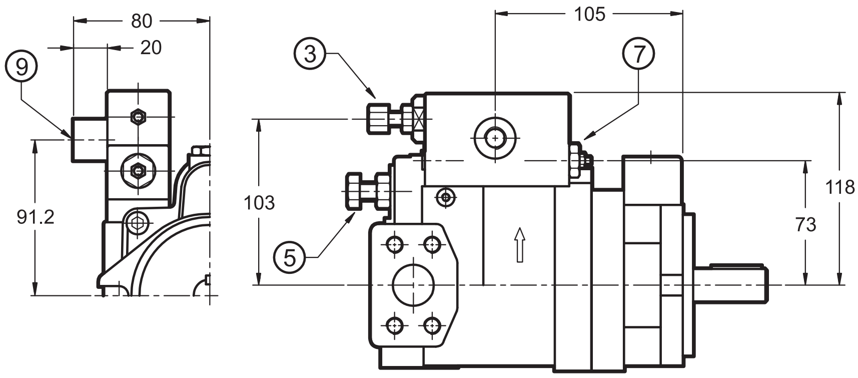


VPPL-016PCR and VPPL-022PCR PUMPS



dimensions in mm

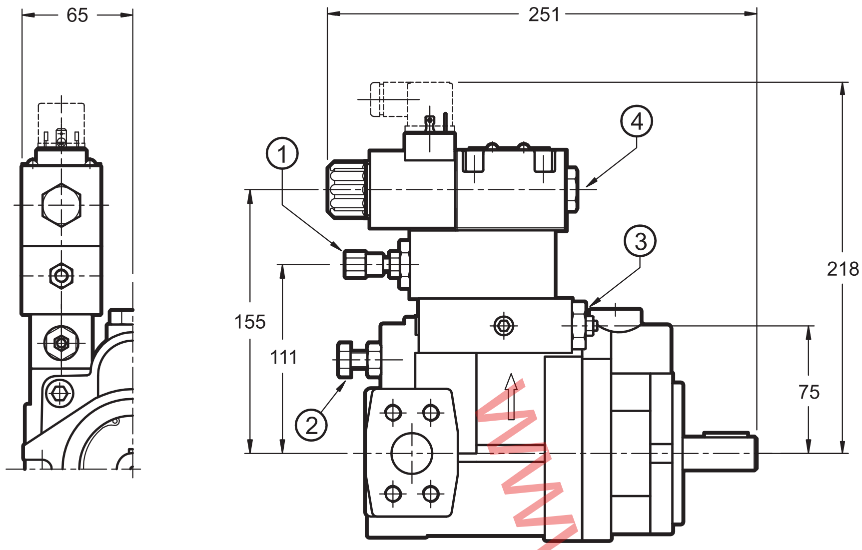
VPPL-016PQC and VPPL-022PQC PUMPS



1	Suction port IN: SAE 3000 1” flange (see par. 11)
2	Delivery port OUT: SAE 3000 3/4” flange (see par. 11)
3	Pressure adjustment screw
4	Drain port: 3/8” BSP
5	Flow adjustment screw Δ displacement/round: 1,5 cm³ (for VPPL-016) 2,0 cm³ (for VPPL-022)
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP
9	Load sensing port: 1/4" BSP

VPPL-016PCX5 and VPPL-022PCX5 PUMPS

dimensions in mm

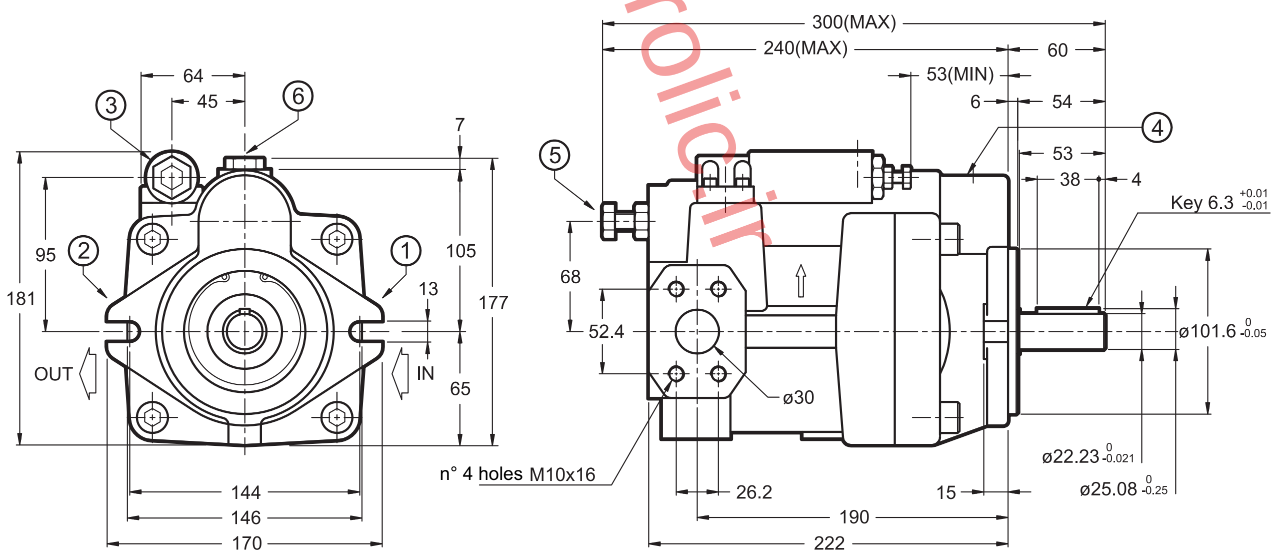


1	Pressure adjustment screw
2	Flow adjustment screw ∆ displacement/round: 1,5 cm³ (for VPPL-016) 2,0 cm³ (for VPPL-022)
3	Differential pressure (not adjustable)
4	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)

7 - VPPL-036 and VPPL-046 PUMPS OVERALL AND MOUNTING DIMENSIONS

VPPL-036PC5 and VPPL-046PC5 PUMPS

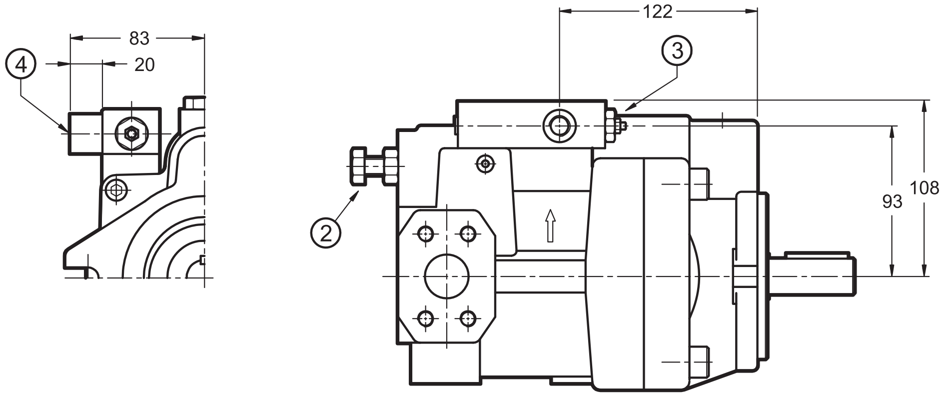
dimensions in mm



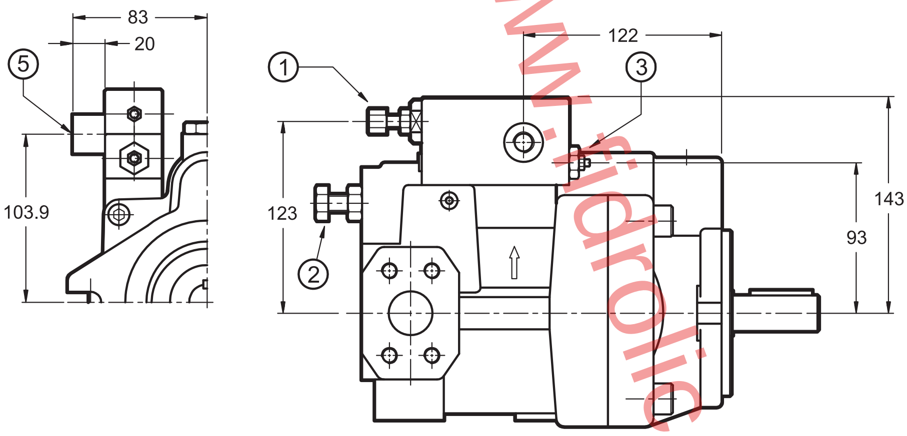
1	Suction port IN: SAE 3000 1 ¼" flange (see par. 11)
2	Delivery port OUT: SAE 3000 1" flange (see par. 11)
3	Pressure adjustment screw
4	Drain port: 1/2" BSP
5	Flow adjustment screw ∆ displacement/round: 2,6 cm³ (for VPPL-036) 3,2 cm³ (for VPPL-046)
6	Oil supply port

VPPL-036PCR and VPPL-046PCR PUMPS

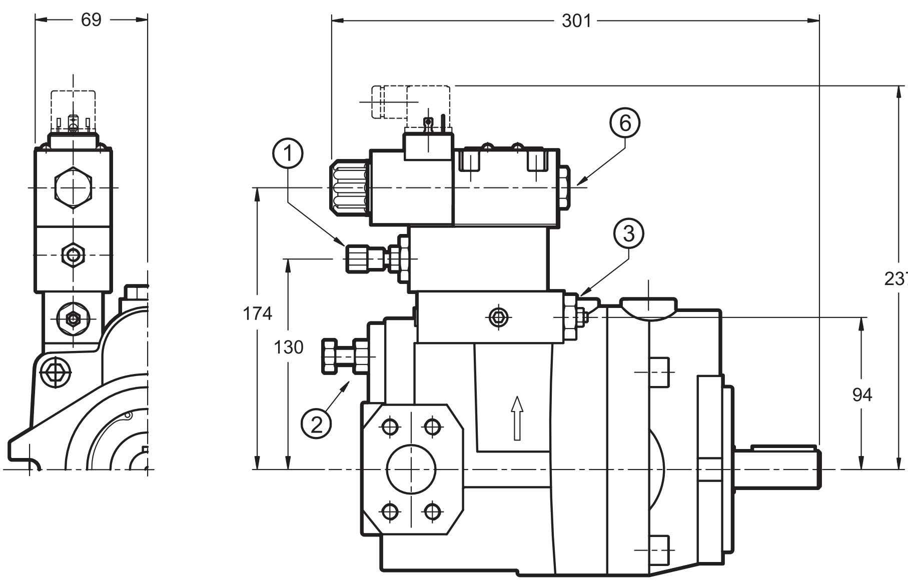
dimensions in mm



VPPL-036PQC and VPPL-046PQC PUMPS



VPPL-036PCX5 and VPPL-046PCX5 PUMPS

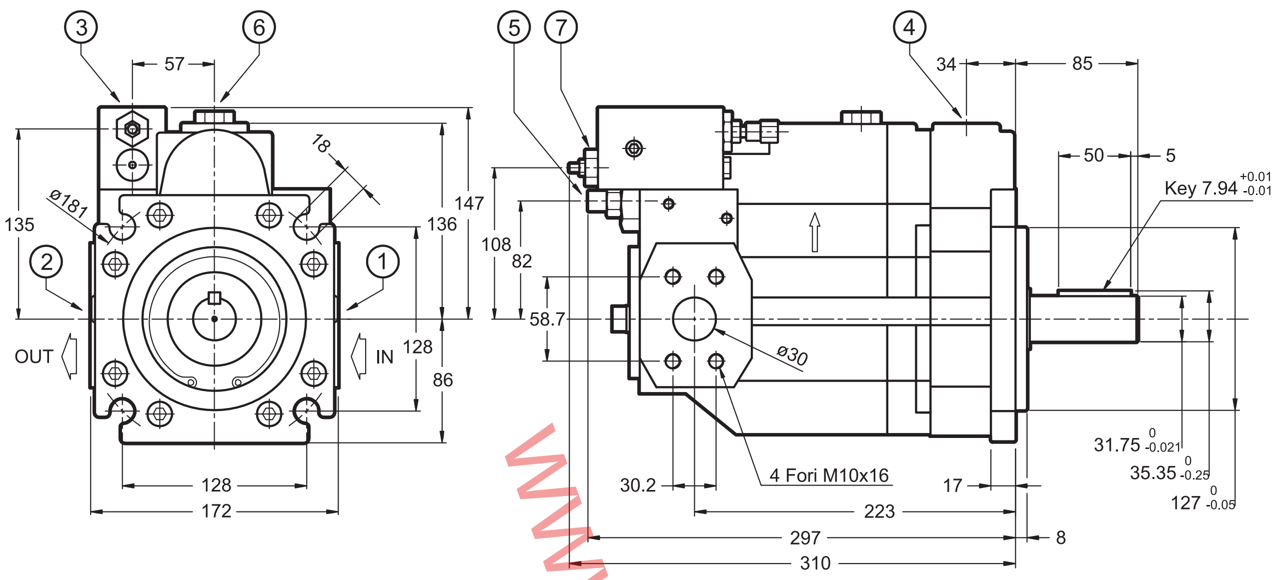


1	Pressure adjustment screw
2	Flow adjustment screw Δ displacement/round: 2,6 cm³ (per VPPL-036) 3,2 cm³ (per VPPL-046)
3	Differential pressure (not adjustable)
4	Remote pressure control port: 1/4" BSP
5	Load sensing port: 1/4" BSP
6	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150)

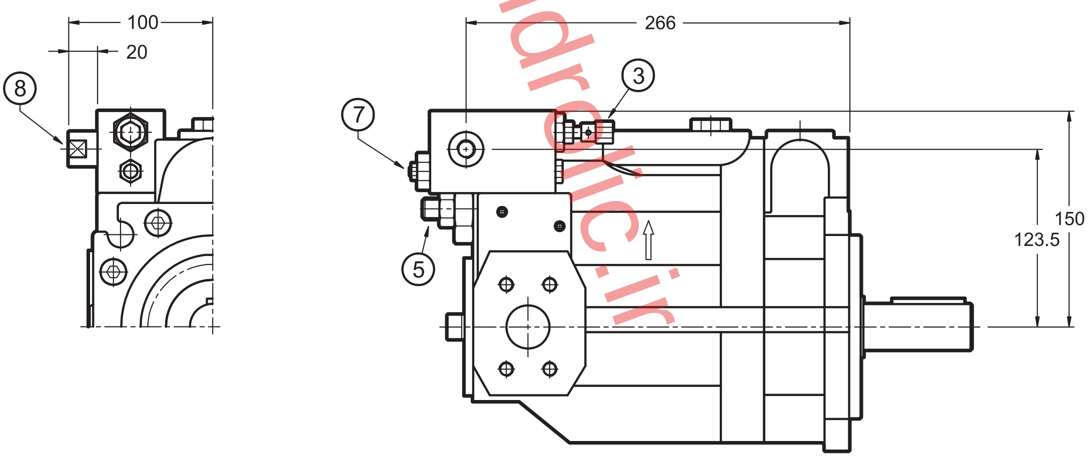
8 - OVERALL AND MOUNTING DIMENSIONS VPPL-070 PUMPS

VPPL-070PC6 PUMP

dimensions in mm



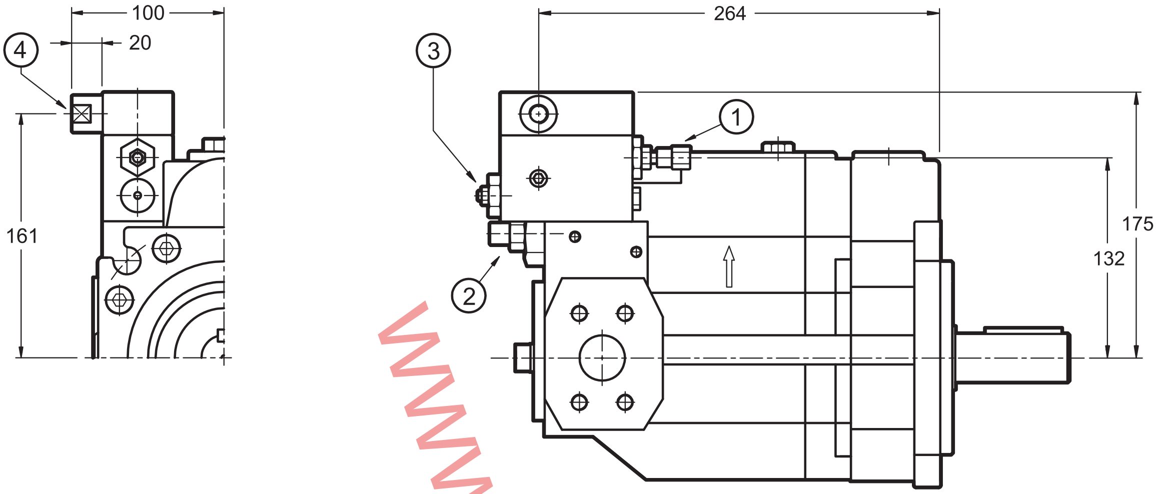
VPPL-070PCR PUMP



1	Suction port IN: SAE 3000 1 ½" flange (see paragraph 11)
2	Delivery port OUT: SAE 3000 1 ¼" flange (see paragraph 11)
3	Pressure adjustment screw
4	Drain port: 3/4" BSP
5	Flow adjustment screw ∆ displacement/round = 4,1 cm³
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP

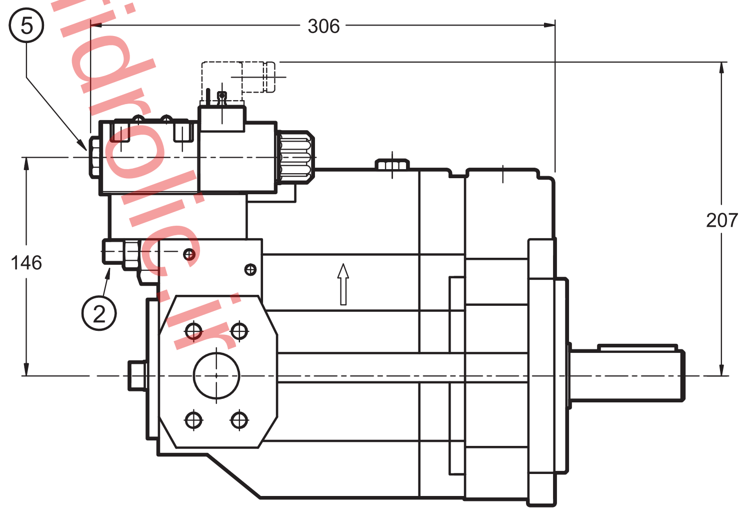
dimensions in mm

VPPL-070PQC PUMP

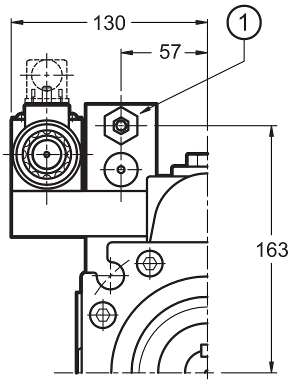


VPPL-070PCX6 PUMP

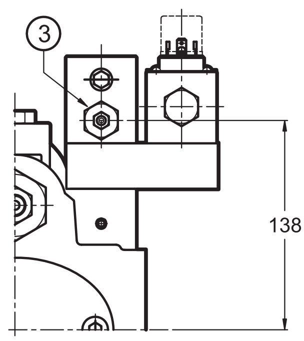
1	Pressure adjustment screw
2	Flow adjustment screw Δ displacement/round = 4,1 cm³
3	Differential pressure (not adjustable)
4	Load sensing port: 1/4" BSP
5	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150



Shaft side view



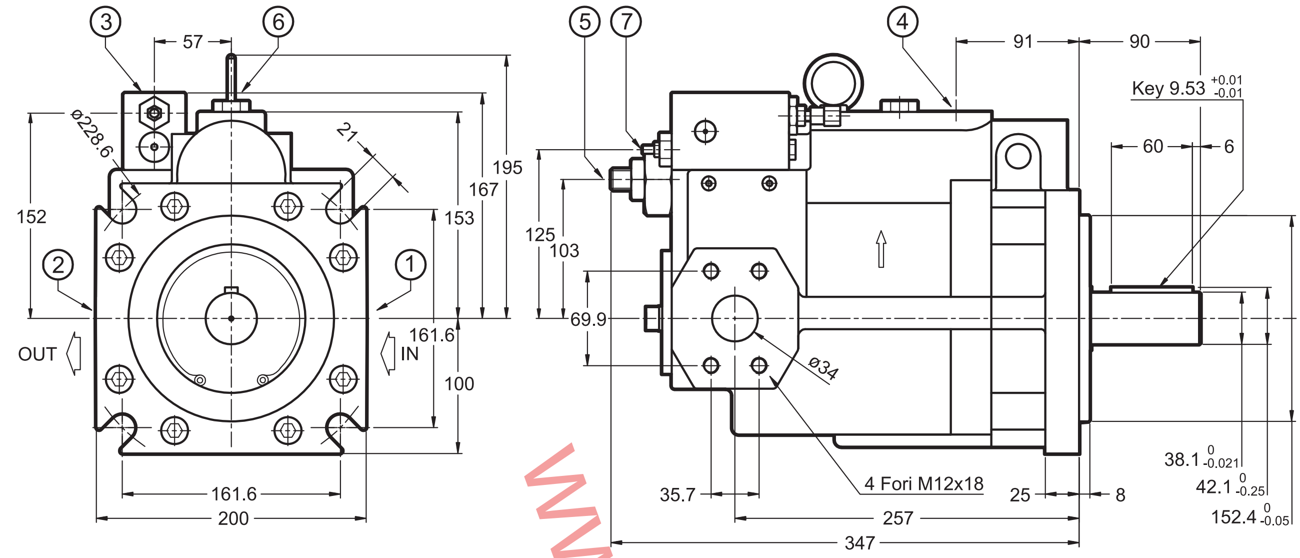
Regulator side view



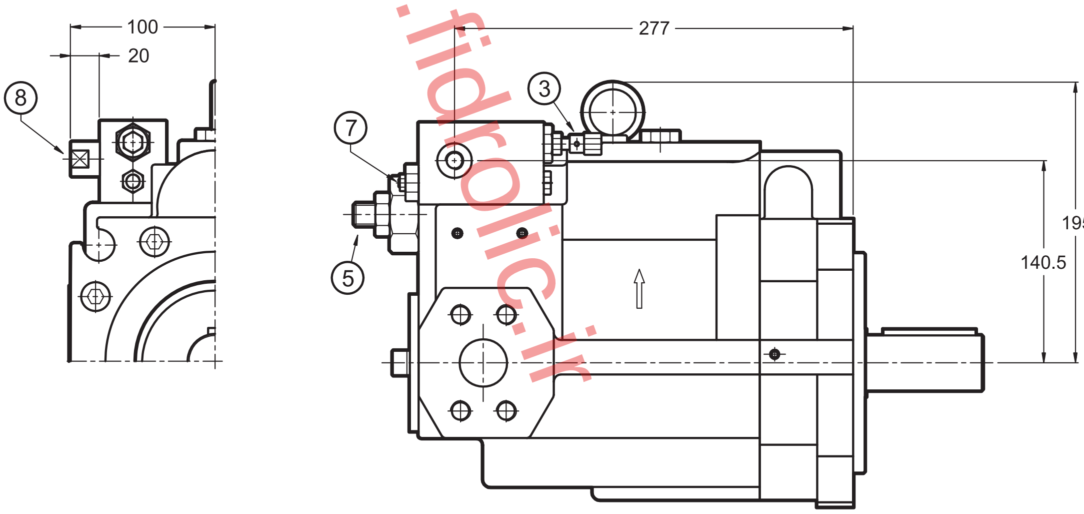
9 - OVERALL AND MOUNTING DIMENSIONS VPPL-100 PUMPS

VPPL-100PC6 PUMP

dimensions in mm



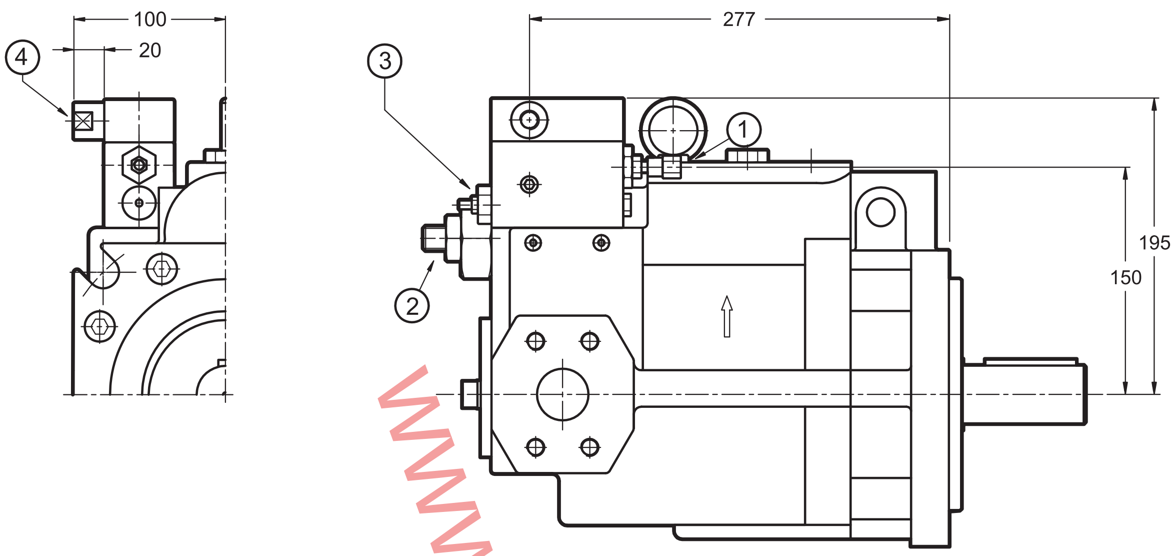
VPPL-100PCR PUMP



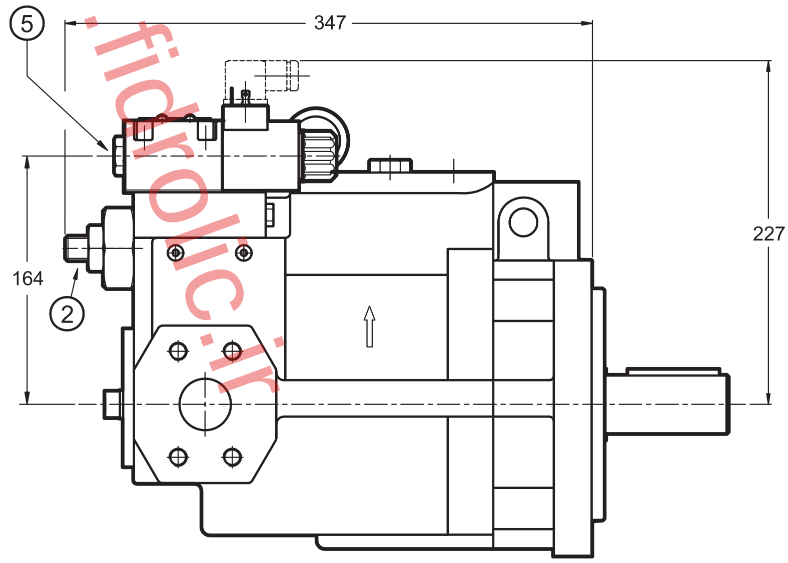
1	Suction port IN: SAE 3000 2" flange (see paragraph 11)
2	Delivery port OUT: SAE 6000 1 ¼" flange (see paragraph 11)
3	Pressure adjustment screw
4	Drain port: 3/4" BSP
5	Flow adjustment screw Δ displacement/round = 5,1 cm³
6	Oil supply port
7	Differential pressure (not adjustable)
8	Remote pressure control port: 1/4" BSP

VPPL-100PQC PUMP

dimensions in mm

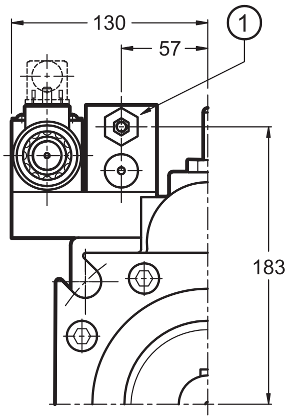


VPPL-100PCX6 PUMP

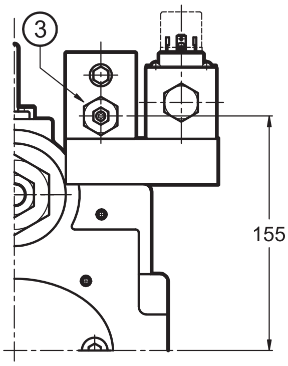


1	Pressure adjustment screw
2	Flow adjustment screw ∆ displacement/round = 5,1 cm³
3	Differential pressure (not adjustable)
4	Load sensing port: 1/4" BSP
5	Solenoid switching valve DS3-SA2 type (to be ordered separately - see cat. 41 150

Shaft side view



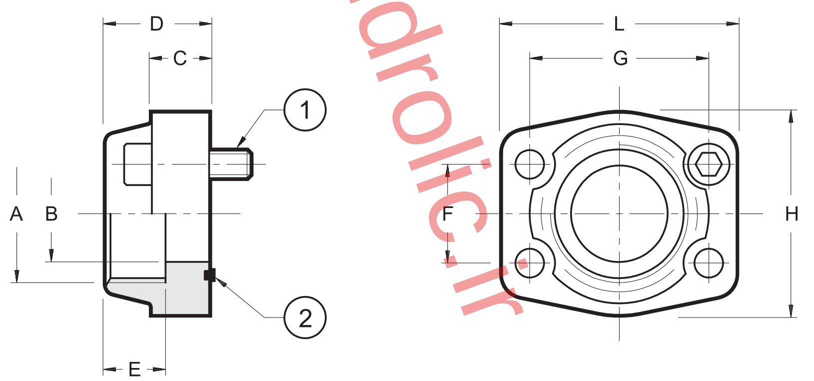
Regulator side view



10 - INSTALLATION

- The VPPL pumps can be installed both in a horizontal and vertical position, with the shaft in an upward position.
  Note: the drain port has to be oriented so that the oil level inside the pump body is never lower than 3/4 of its volume.
- In the case of installation above the oil level, check that the minimal inlet pressure is not lower than -0.2 bars (relative). If a low noise emission level is required, the installation inside the tank is suggested.
  In case of an installation inside the tank, with an oil level which does not grant complete pump submersion, it is suggested to adjust thee drain tube so that the pump higher bearing can be always lubricated.
- **Before starting, the pump body has to be filled with the fluid.**
- Check the pump direction of rotation.
- It is necessary to vent the air from the delivery connection before operating it the first time. If the air venting should be difficult, the use of a venting valve is recommended.
  The pump start up should occur with the plant at minimum pressure, especially with low temperatures.
- The suction tube has to be suitably sized so that the suction pressure is never lower than -0.2 bar (relative). Bends or restrictions or an excessive tube length could further decrease the value of the suction pressure with a following increase in the noise emissions and a decrease in the pump lifetime.
- The drainage tube has to be sized so that the pressure inside the pump body is always lower than 0.5 bars (relative), even during the dynamic change and flow rate phases. The minimum piping size is 3/8" for the pump type 008, 016 and 022, while it should be at least 1/2" for the pumps type 036 and 046, 3/4" for the 070 and 100 pumps type.
  The drain tube has to unload inside the tank far from the suction area.
- No check valves allowed on the suction line. As for details and the installation of filter elements, see paragraph 2.3.
- The motor-pump connection must be carried out directly with a flexible coupling, to reduce at the minimum the axial and radial loads on the pump shaft. The alignment tolerance between the two shafts must be within 0.05 mm.

11 - CONNECTION FLANGES



dimensions in mm
Bolts and O-rings must be ordered separately.

	Flange code	Flange description	p_{max} [bar]	ØA	ØB	C	D	E	F	G	H	L	1 SHC bolts ISO 4762	2
SAE 3000	0610719	SAE - 3/4"	345	3/4" BSP	19	18	36	19	22,2	47,6	50	65	n° 4 - M10x35	OR 4100 (24.99x3.53)
	0610713	SAE - 1"	345	1" BSP	25	18	38	22	26,2	52,4	55	70		OR 4131 (32.93x3.53)
	0610720	SAE - 1 ¼"	276	1 ¼" BSP	32	21	41	22	30,2	58,7	28	79		OR 4150 (37.69x3.53)
	0610714	SAE - 1 ½"	207	1 ½" BSP	38	25	45	24	35,7	69,9	78	93	n° 4 - M12x45	OR 4187 (47.23x3.53)
	0610721	SAE - 2"	207	2" BSP	51	25	45	30	42,9	77,8	90	102	n° 4 - M12x45	OR 4225 (56.74x3.53)
SAE 6000	0770106	SAE - 1 ¼"	420	1 ¼" BSP	32	27	45	25	31,7	66,7	78	95	n° 4 - M14x50	OR 4150 (37.69x3.53)

DUPLOMATIC OLEODINAMICA

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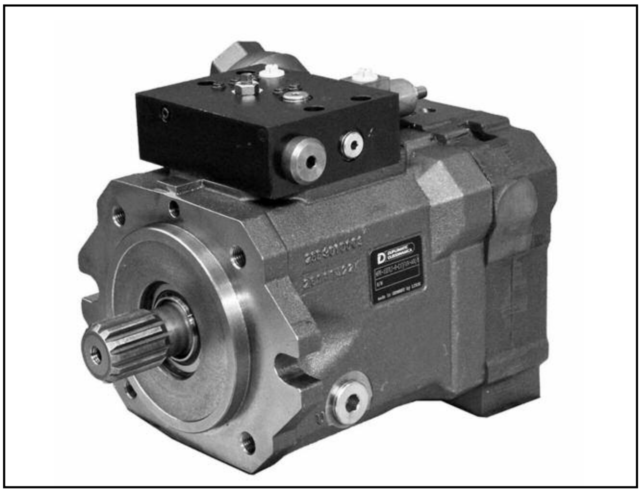
DUPLOMATIC OLEODINAMICA

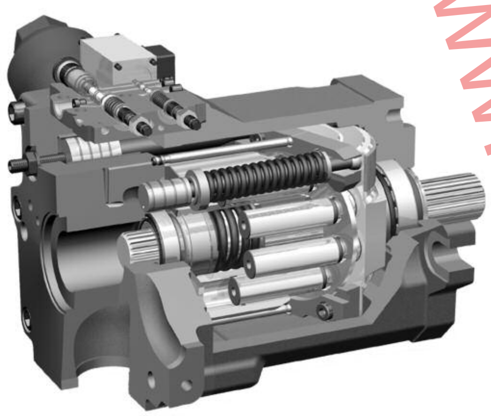


HPR

HIGH PRESSURE SELF-REGULATING PUMP FOR OPEN LOOP OPERATION

SERIES 10

OPERATING PRINCIPLE



- HPR pumps are variable displacement axial-piston pumps with swash plate design, suitable for applications with open circuits.
- Seven frame sizes are available, from 55 up to 280 cm^3/rev.
- The pump flow rate is proportional to the shaft speed and to the swash plate angle, which can be continuously modulated. The maximum angle can be limited mechanically by means of an adjustment screw.
- Due to the special design, these pumps are able to operate at high working pressures (420 bar continuously and 500 bar peak)
- All the pumps are equipped with a noise reduction device.

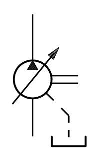
TECHNICAL SPECIFICATIONS

PUMP SIZE		55	75	105	135	165	210	280
Maximum displacement	cm^3/rev	55	75,9	105	135,7	165,6	210,1	281,9
Maximum operating pressure	bar	420						
Rotation speed and operating flow rate		see table 3 - Performances						
Rotation direction		clockwise						
Loads on the shaft: axial load radial load	N	2000 on request						
Hydraulic connection		flange fittings - SAE 3000 suction / SAE 6000 pressure						
Type of mounting		SAE J744						
Mass (empty single pump)	kg	39	39	50	65	89	116	165

Ambient temperature range	°C	-15 / +70
Fluid temperature range	°C	-20 / +80
Fluid recommended viscosity	cSt	15 ÷ 30
Fluid contamination degree (ISO 4406:1999)	18/16/13	

NOTE: Values referring to 1 bar absolute on suction port.

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODES

1.1 - Identification code for single pumps and pumps with power take-off

H	P	R	-			-	R		/	10	V	-		-		/		

Self-regulating piston pump for high pressure

Pump size:
055 = 55 cm³/rev
075 = 75,9 cm³/rev
105 = 105 cm³/rev
135 = 135,7 cm³/rev
165 = 165,6 cm³/rev
210 = 210,1 cm³/rev
280 = 281,9 cm³/rev

Pump controls:
LP6 = load sensing with pressure cut-off adj. range 230-350 bar (**standard**) Other ranges are available upon request. See section 5.
TL2 = load sensing with power control (not available on sizes 055, 075 and 165)
ET6 = electro-proportional displacement control with power limiter and pressure cut-off adj. range 230-350 bar (**standard**) Other ranges are available upon request. See section 7. (not available on sizes 055, 075 and 165)

Rotation direction (seen from the shaft end):
R = clockwise (**standard**)
Anticlockwise rotation direction on request. (**NOTE**)

Mounting flange / splined shaft (see section 13)
HPR 55:
C14 = SAE C flange - 2 holes - shaft 12/24 14t
HPR 75:
C14 = SAE C flange - 2 holes - shaft 12/24 14t (**standard**)
C21 = SAE C flange - 2 holes - shaft 16/32 21t
HPR 105:
C17 = SAE C flange - 2 holes - shaft 12/24 17t (**standard** for TL2)
C23 = SAE C flange - 2 holes - shaft 16/32 23t (**standard** for LP6)
HPR 135 and HPR 165 :
D13 = SAE D flange - 2 holes - shaft 8/16 13t (**standard** for 135)
D27 = SAE D flange - 2 holes - shaft 16/32 27t (**standard** for 165)
HPR 210 and HPR 280
E15 = SAE E flange - 4 holes - shaft 15t 8/16

Keyed shaft available on request, on HPR280 only.

Series No.
(from 10 to 19 size and mounting dimensions remain unchanged)

FPM seals

Options for ET6 control
(Omit for other controls)
D12K2 = 12V DC supply and AMP Junior connection
D24K2 = 24V DC supply and AMP Junior connection

PTO - power take off / through drive shaft
A00 = SAE A flange - no shaft coupling (**standard**) (single pump)

A09 = SAE A flange - coupling 16/32 9t
B13 = SAE B flange - coupling 16/32 13t
B15 = SAE B flange - coupling 16/32 15t (not available on HPR 135 and 210)
C14 = SAE C flange - coupling 12/24 14t
D27 = SAE D flange - coupling 16/32 27t (not available on HPR 135, 165 e 210)
E27 = SAE E flange - coupling 27t 16/32 (not available on HPR 210)

Option:
Torque
Omit if not required (see par 6.1)

(Duplomatic reserved field)

NOTE: Pumps with anticlockwise rotation are available from HPR55 to HPR210 with limited options, such no noise reduction device. Please contact our technical dept. for availability.

2 - HYDRAULIC FLUID

2.1 - Fluid type

Use mineral oil based hydraulic fluids HLP with anti-foam and antioxidant additives according to the DIN 51524-2 standard. For use with other types of fluid, keep in mind the limitations shown here below or consult our technical department for authorization of use.

2.2 - Fluid viscosity

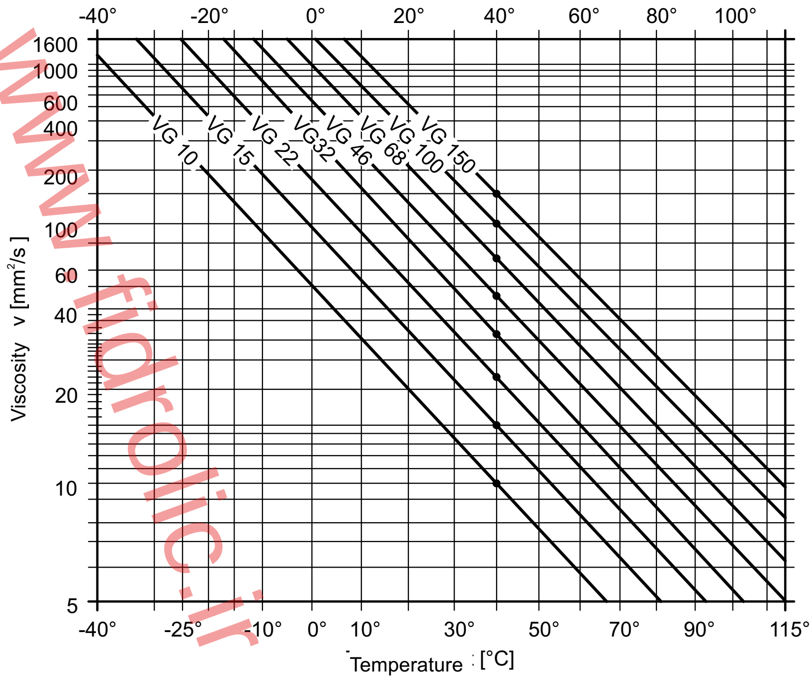
The operating fluid viscosity must be within the following range:

minimum viscosity	10 cSt	referred to a maximum temperature of 80°C for the drain line
optimum viscosity	15 ÷ 30 cSt	referred to the fluid operating temperature in the tank.
maximum viscosity	1000 cSt	limited to the cold start-up of the pump only, which has to be carried out with the circuit at minimum pressure.

When selecting the fluid type, check its viscosity is within the range specified above at the operating temperature.

Recommended viscosity values are indicated in the table and diagram.

Operating temperature [°C]	Viscosity class [cSt at 40°C]
from 30 to 40	22
from 40 to 60	32
from 60 to 80	46 or 68



2.3 - Degree of fluid contamination

In order to guarantee long-term proper function and high efficiency of the hydraulic pumps the purity of the operating fluid must comply with the following class according to the ISO 4406:1999. High purity oil can extend the service time of the hydraulic system significantly.

For reliable proper function and long service life	18/16/13
Minimum requirements	20/18/15
Commissioning	The minimum purity requirement for the hydraulic oil is based on the most sensitive system component. For commissioning we recommend a filtration in order to achieve the required purity
Filling and operation of hydraulic systems	The required purity of the hydraulic oil must be ensured during filling or topping up. When drums, canisters or large-capacity tanks are used the oil generally needs to be filtered. We recommend the implementation of suitable measures (e.g. filters) to ensure the required minimum purity of the oil is also achieved during these tasks.

3 - PERFORMANCES

(values obtained with mineral oil with a viscosity of 36 cSt at 50°C)

PUMP SIZE		055	075	105	135	165	210	280
Max displacement	cm^3/rev	55	75.9	105	135.7	165.6	210.1	281.9
Max flow: - at 1500 rpm - at max rotation speed	l/min	82.5 148.5	113.9 189.8	157.5 262.5	203.5 318.9	248.2 364.1	315.5 441.2	422.9 563.8
Minimum operating speed	rpm	500						
Maximum operating speed	rpm	2700	2500	2500	2350	2200	2100	2000
Max delivery pressure: - continuous - intermittent	bar	420 500						
Inlet pressure:	bar abs	from 0.8 up to 20 bar (see par. 12)						
Max housing pressure	bar	1,5						
Max power (Δp = 420 bar): - at 1500 rpm - at max rotation speed	kW	57.8 104	79.7 132.8	110.3 183.8	142.5 223.2	173.8 254.9	220.6 308.8	296 394.7
Max absorbed torque: Δp =100 bar Δp = 420 bar	Nm	87 368	121 507	167 702	216 907	263 1106	334 1404	446 1884
Moment of inertia on the shaft	$kgm^2 x10^{-2}$	0,79	0,79	1,44	2,15	3,41	4,68	8,34

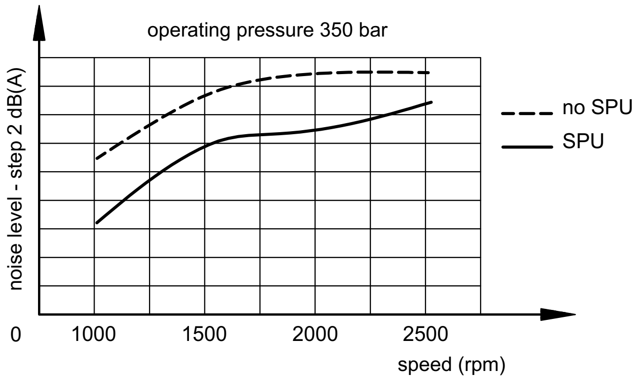
4 - NOISE REDUCTION DEVICE

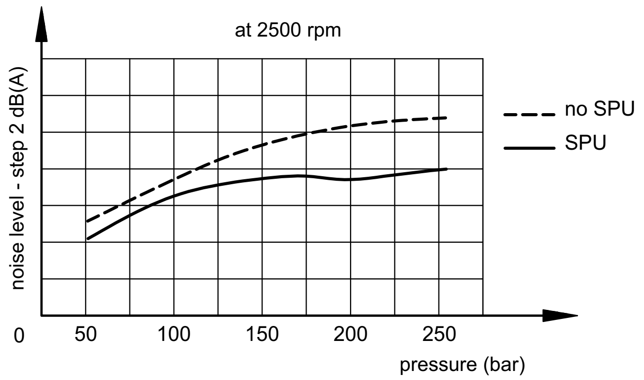
All the HPR-02 hydraulic pumps are optimized with respect to pulsation characteristics and therefore noise generation. In addition to common primary measures such as exclusive use of noise-optimized port plates, the SPU noise reduction device is available.

Without affecting the functionality and efficiency of the pump, this system reduces pressure noise by up to 70%, irrespective of pressure, speed or temperature.

The SPU system is adaptive over the entire operating range. No setting up or maintenance is required.

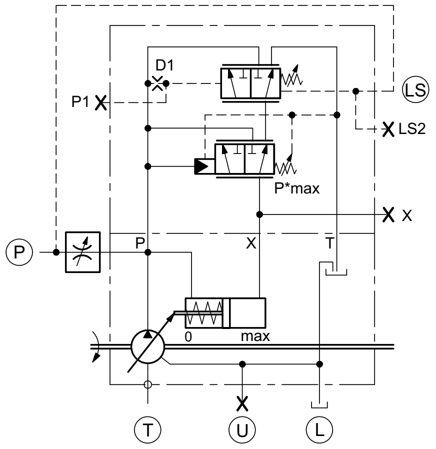
Comparison of noise pressure levels for a HPR 75 pump with and without SPU





5 - LP6 - LOAD SENSING WITH PRESSURE CUT-OFF CONTROL

Load sensing operation



This load sensing control allows the pump flow rate to be regulated according to the Δp pressure drop measured on both the sides of a throttle valve installed on the working line.

NOTE: The connection pipe between the LS port and the flow line downstream the restrictor (or valve) is always in customer's charge. **The restrictor is not supplied.**

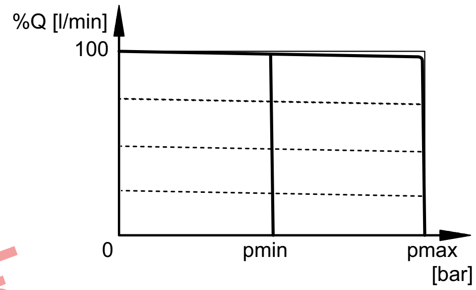
The maximum operating pressure can be set manually adjusting the P*max valve.

LP* FEATURES:

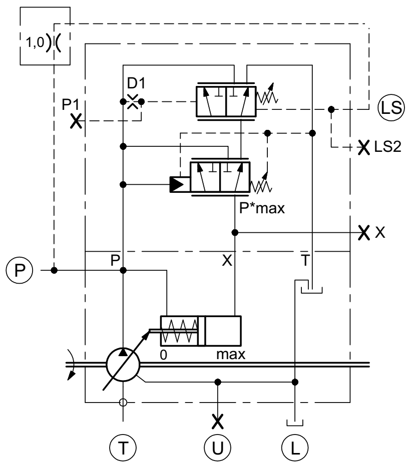
- pressure adjustment range:
  LP6 = 230 ÷ 350 (**standard**)
  default setting = 350 bar

  LP5 = 125 ÷ 230 (upon request)
  LP7 = 350 ÷ 420 (upon request)

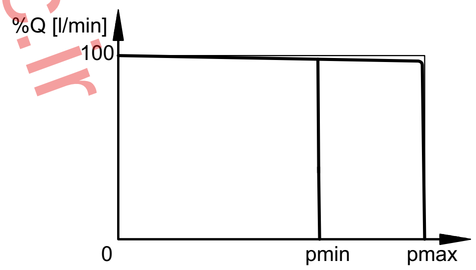
- differential pressure regulating range = 16 ÷ 27 bar
- default setting = 20 bar



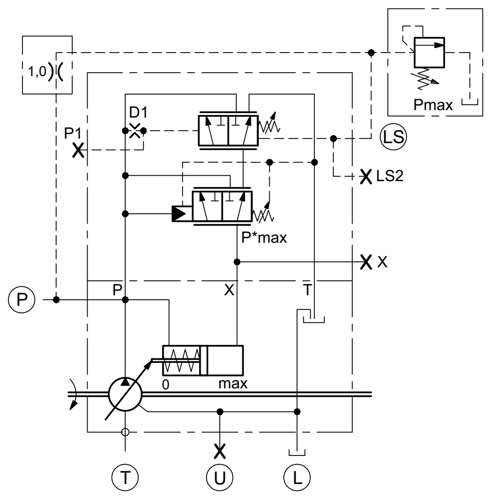
Pressure control operation



Bypassing both P and LS ports with an external connection and an orifice (both in customer's charge) the pump will operate as pressure control that works at maximum displacement up to the set pressure P*max.

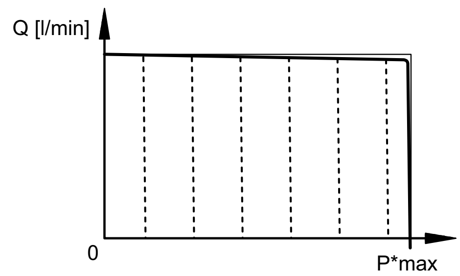


Remote pressure operation

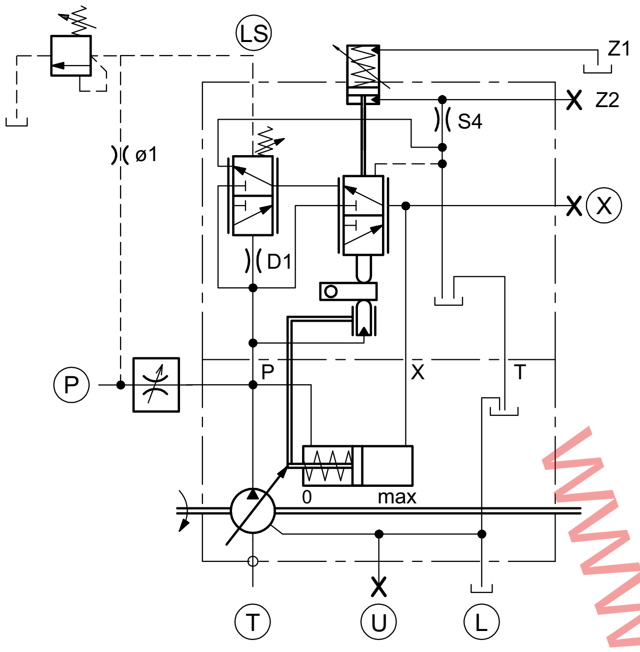


It is possible to create a remote pressure control by means of both an external pressure relief valve and an orifice (both in customer's charge) as shown in the schema.

This configuration allows to regulate remotely the maximum pressure up to P*max. When the pressure it's lower than the set value P*max the pump is at its maximum displacement.



6 - TL2 - LOAD SENSING WITH POWER CONTROL



The TL2 control is available for pumps HPR105, HPR135, HPR210 and HPR280.

This control combines the load sensing function typical of LP control with a power limiter with hyperbolic characteristic. Such limiter keeps the pump torque at a constant level by changing the displacement according to the delivery pressure, so that the absorbed power remains unchanged (at constant pump speed).

The Z1 port must always be connected to the tank separately and without back pressure. The Z2 port is plugged.

NOTE: The pipe connection between the LS port and the delivery of the pump, the orifice and the external pressure relief valve are always charged to the customer.

NOTE: The feature of the pressure cut-off is not present on this control, it is necessary to provide suitable external valve, as shown in the diagram at side.

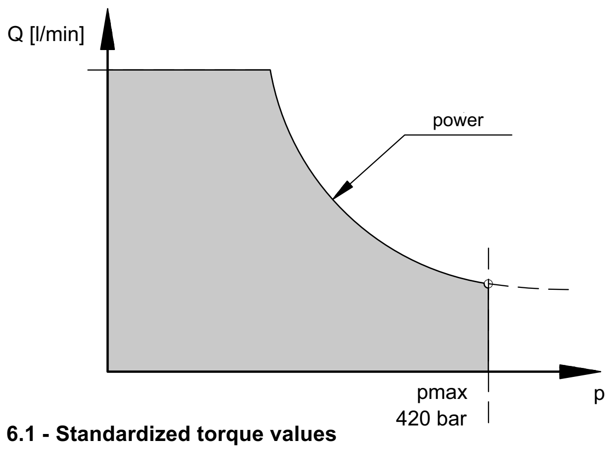
TL2 FEATURES:

- differential pressure adjustment range = 16 ÷ 27 bar
  default setting = 20 bar

- pressure adjustment range for torque regulation:
  HPR105, HPR135 = 60 ÷ 250 bar
  HPR210, HPR280 = 80 ÷ 250 bar
  default setting = 250 bar

The power control is factory set. The setting value has to be specified with the order, by stating into the identification code the Nm torque value.

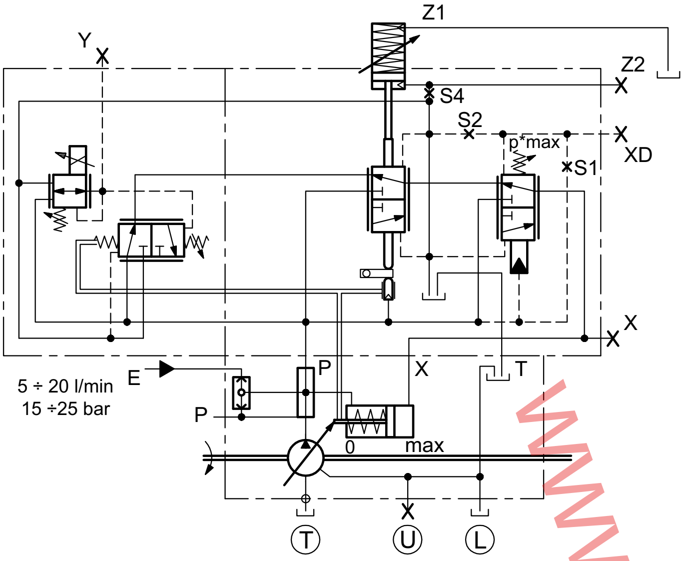
Start of the regulation: looking at values table below.



6.1 - Standardized torque values

PUMPS	ELECTRICAL MOTOR 4 POLES (at 50 Hz)										
	Power [kW]	**18.5**	**22**	**30**	**37**	**45**	**55**	**75**	**90**	**110**	**132**
	N [rpm]	1500									
	torque [Nm]	**118**	**140**	**191**	**236**	**286**	**350**	**477**	**573**	**700**	**840**
105	start of pressure regulation [bar]	63	75	103	127	154	189	-	-	-	-
135		-	-	80	98	119	146	199	239	-	-
210		-	-	-	-	-	94	129	154	188	226
280		-	-	-	-	-	-	96	115	140	169

7 - ET6 - ELECTRO-PROPORTIONAL DISPLACEMENT CONTROL WITH POWER LIMITER AND REMOTE PRESSURE CUT-OFF



The ET6 control is available for pumps HPR105, HPR135, HPR210 and HPR280.

It combines a pump displacement regulation proportional to the current supplied to the solenoid with a constant input torque control. The limitation of maximum pressure is also available.

With no current the pump is in null displacement, so it is required a supply pressure on port E (located on the pump body) for the start of the control.

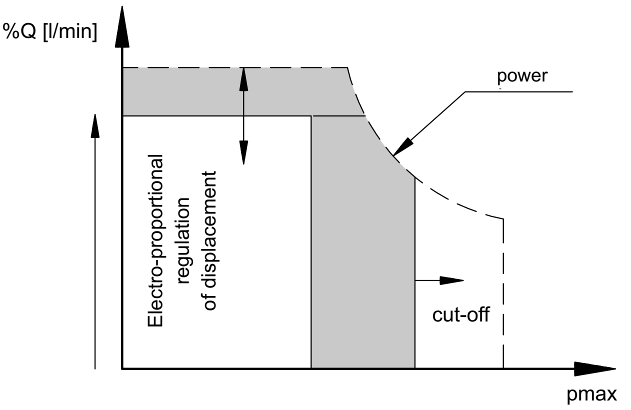
Once the P port is pressurized, then the shuttle valve on the pump excludes the piloting of port E and picks the fluid directly from the pump delivery line.

ET6 FEATURES:

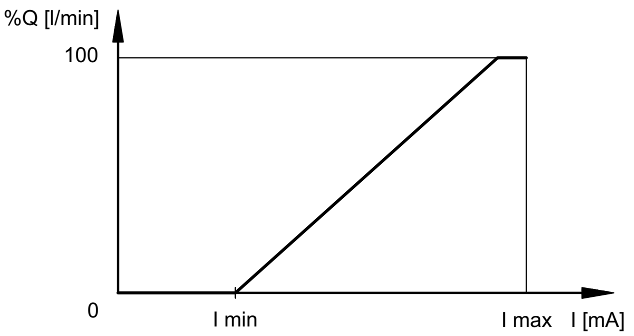
- pressure adjustment range:
  ET6 = 230 ÷ 350 (**standard**)
  default setting = 350 bar

  ET5 = 125 ÷ 230 (on request)
  ET7 = 350 ÷ 420 (on request)

- pressure adjustment range for torque regulation:
  HPR105, HPR135 = 60 ÷ 250 bar
  HPR210, HPR280 = 80 ÷ 250 bar
  default setting = 250 bar



		D12K2	D24K2
Nominal voltage	V CC	12	24
Coil connection	AMP Junior (2 pin)		
Power consumption	W	15,6	
Nominal current	A	1,2	0,6
Relative duty cycle	100%		
Protection class (EN 60529)	IP 67		



regulation	pump	ET1	ET2
I min	**105, 135**	464 mA	232 mA
	210	490 mA	245 mA
	280	524 mA	262 mA
I max	**ALL**	1200 mA	600 mA

8 - PUMPS WITH LP6 CONTROL - OVERALL DIMENSIONS

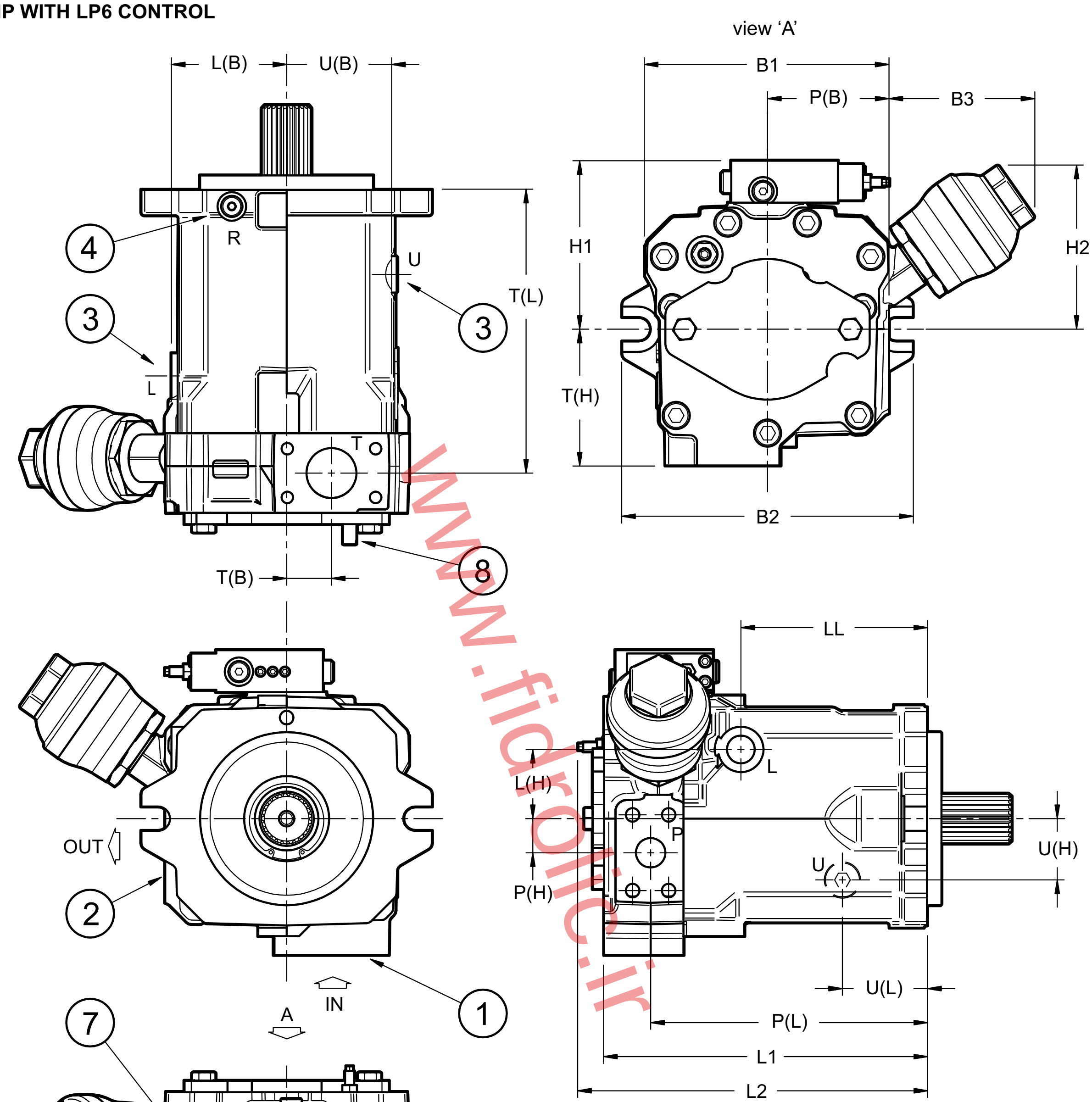
dimensions in mm

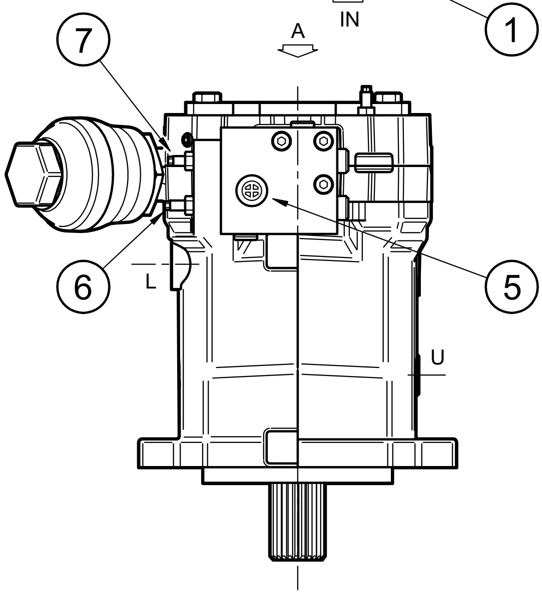
PUMP	**55**	**75**	**105**	**135**	**165**	**210**	**280**
Ø of flange	127			152.4		165.1	
L1	220.3	231.8	262	284.5	333.1	348	403
L2	259.3	270.8	301	323.5	372.1	387	442
H1	137	139	140.5	148.5	165.5	171.5	189
H2	146	146	136	145.5	152.4	143.5	238
B1	11	190.3	199.6	216	251.5	268	306.1
B2	208		207	256	269	268.8	314.5
B3	120	111	122	129	128.9	126.5	125.1

PUMP	**55**	**75**	**105**	**135**	**165**	**210**	**280**
P delivery (SAE)	3/4"		1"	1¼"		1½"	
P (L)	182.8	194.3	218	243.5	283.1	295	344.5
P (H)	23.5		26	30	43	27	46
P (B)	91	90.5	100	107	134.5	134.5	149.5
T suction (SAE)	1½"		2"	2"	2½"	3"	3½"
T (L)	189.8	201.3	227	249.5	285.6	298	344.5
T (H)	94		103.5	120	119	149	167
T (B)	21		25	30	0	57	
L, U drain ports	M22x1.5			M27x2			M33x2
L (L)	112.8	124.3	142	164	180.6	197.5	215.5
L (H)	52		53	61	65	71.5	80.5
L (B)	86.5		85	101.5	108	128	145
U (L)	72		72	74.5	81.1	83	109
U (H)	44		54	54	62	60	68
U (B)	78.5		92.5	92.5	101	118	129.5
R - additional drain port	M14x1.5, 13 deep (**NOTE**)						

NOTE: If the pump is set vertically with shaft upward then the R port is strictly to be connected. The port R is located on the flange, at side (like U port) or bottom (like suction port) depending on the pump shape.

PUMP WITH LP6 CONTROL





1	Suction port: IN flange SAE 3000
2	Delivery port: OUT flange SAE 6000
3	Drain ports L, U (plugged)
4	Additional drain port R
5	Load sensing port M14.x1.5 (plastic plug)
6	Load sensing adjustment: 29 bar/turn
7	P*max adjustment: 22.8 bar/turn
8	Max displacement limit adjustment see par. 11

9 - SINGLE PUMPS WITH TL2 CONTROL - OVERALL DIMENSIONS

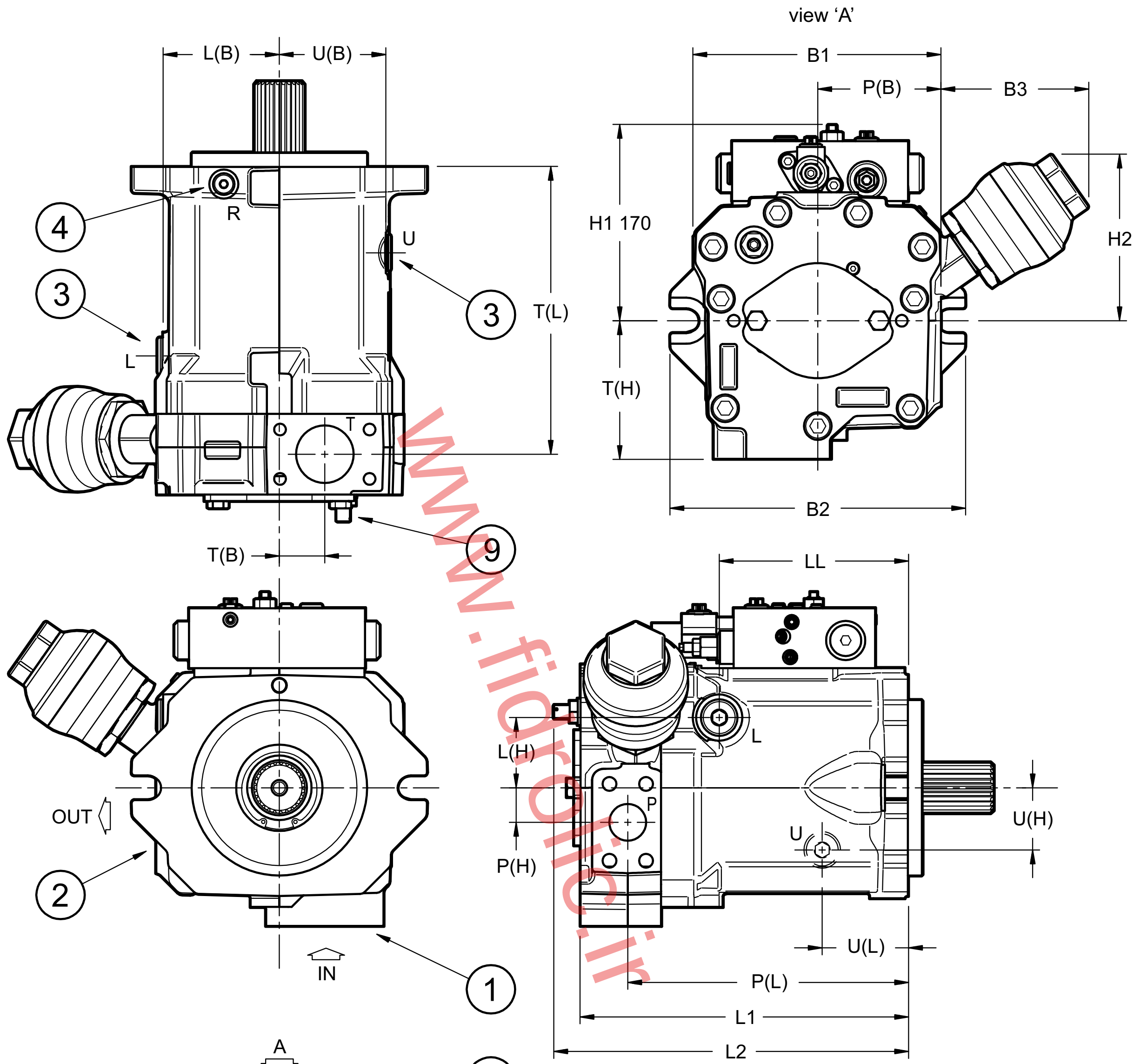
dimensions in mm

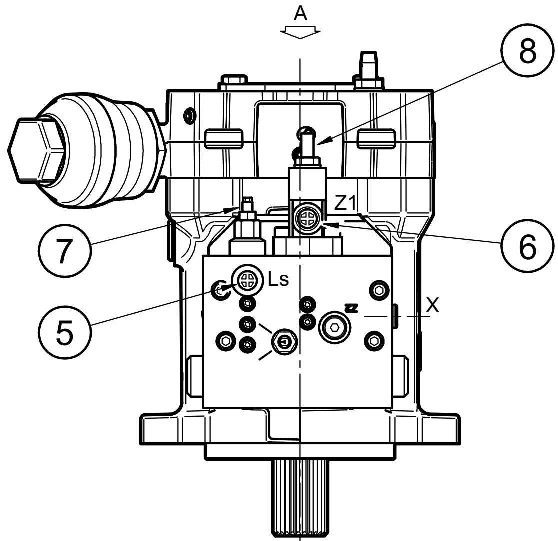
PUMP	105	135	210	280
Ø flange	127	152.4	165.1	165.1
L1	262	284.5	348	403
L2	301	323.5	387	442
H1	163	170	193	210.5
H2	134	144	144.3	200.7
H3	104.5	104	135	135
B1	194.5	214.8	266.3	314.5
B2	208	256.5	269	272
B3	118	106.7	102.4	119.5

PUMP	105	135	210	280
P delivery (SAE)	1”	1¼”	1½”	
P (L)	218	243.5	295	344.5
P (H)	26	30	27	46
P (B)	100	107	144.5	154.1
T suction (SAE)	2”	2”	3”	3½”
T (L)	227	249.5	298	344.5
T (H)	104	120	149	167
T (B)	25	39.5	27	44
L, U drain ports	M22x1.5	M27x2	M27x2	M33x2
L (L)	142	164	191	215.5
L (H)	53	61	97.5	80.5
L (B)	92.5	101	128	129.5
U (L)	72	74.5	83	109
U (H)	54	54	60	68
U (B)	85	92	118	159.5
R - additional drain port	M14x1.5 deep 13 (**NOTE**)			

NOTE: If the pump is set vertically with shaft upward then the R port is strictly to be connected. The port R is located on the flange, at side (like U port) or bottom (like suction port) depending on the pump shape.

PUMP WITH TL2 CONTROL





1	Suction port: IN flange SAE 3000
2	Delivery port: OUT flange SAE 6000
3	Drain ports L, U (plugged)
4	Additional drain port R
5	Load sensing port M14.x1.5 (plastic plug)
6	Z1 port to be connected to the tank. M14.x1.5 (plastic plug)
7	Load sensing adjustment: 18.8 bar/turn
8	Power adjustment: 18.8 bar/turn
9	Max displacement limit adjustment see par. 11

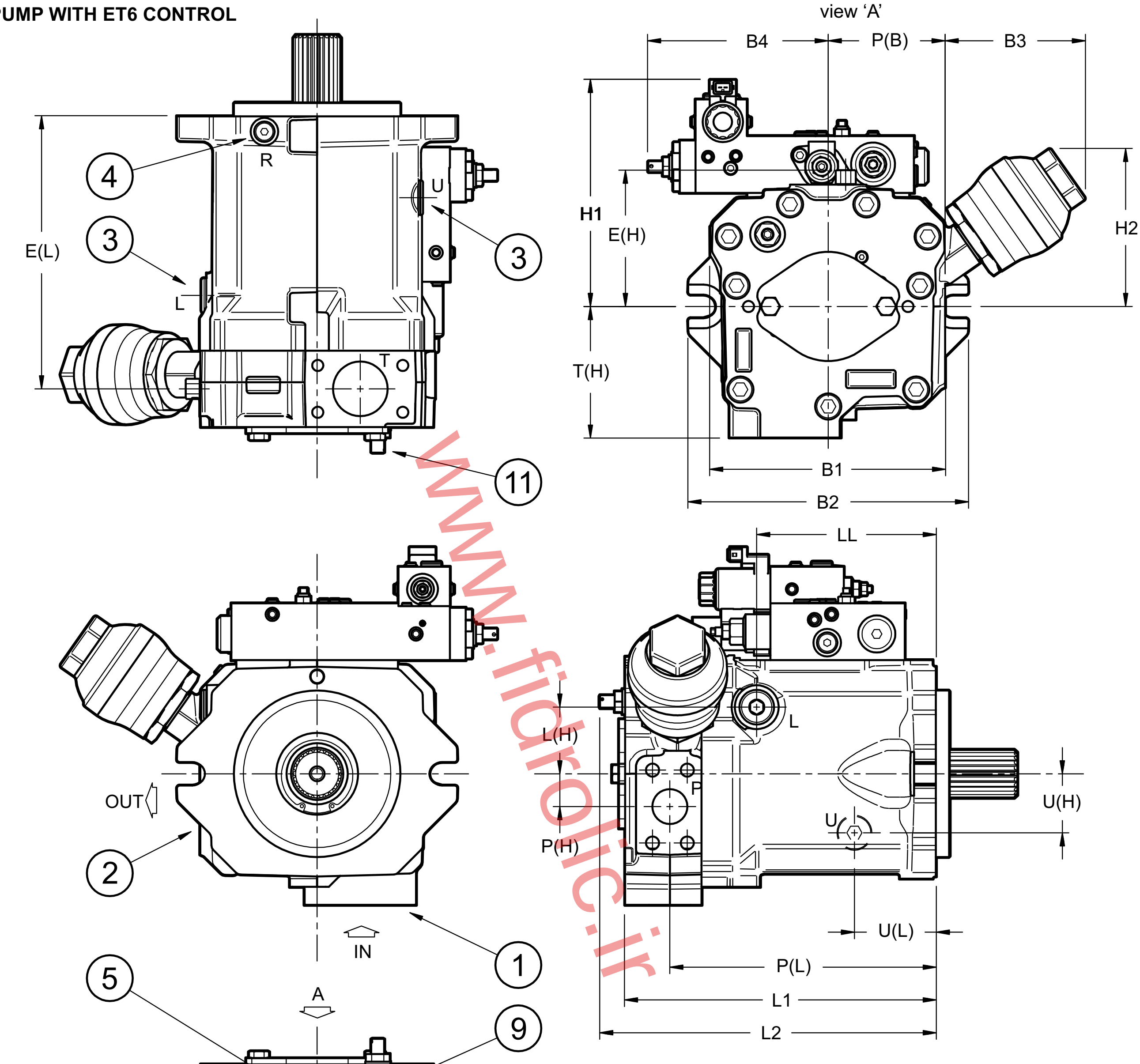
10 - SINGLE PUMPS WITH ET6 CONTROL - OVERALL DIMENSIONS

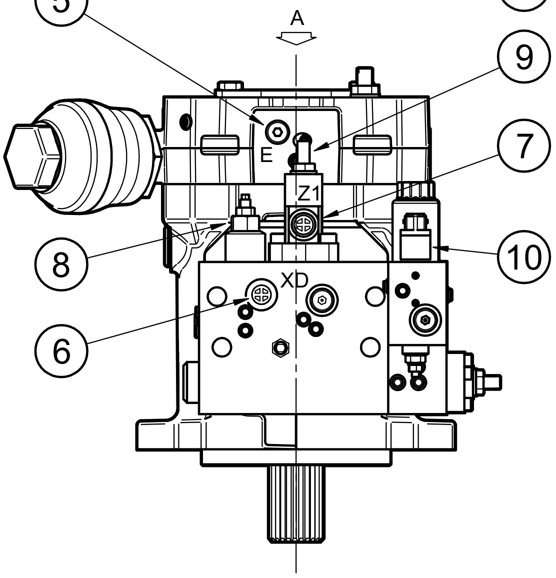
PUMP	105	135	210	280
Ø flange	127	152.4	165.1	165.1
L1	262	284.5	348	403
L2	301	323.5	387	442
L3	108.9	82.8	138.5	168
H1	200.5	207.5	230.5	248
H2	134	144	144.3	200.7
H3	104.5	104	135	135
B1	194.5	214.8	266.3	314.5
B2	208	256.5	269	272
B3	118	106.7	102.4	119.5
B4	165	165	165	146.5

PUMP	105	135	210	280
P delivery (SAE)	1”	1¼”	1½”	
P (L)	218	243.5	295	344.5
P (H)	26	30	27	46
P (B)	100	107	144.5	154.1
T suction (SAE)	2”	2”	3”	3½”
T (L)	227	249.5	298	344.5
T (H)	104	120	149	167
T (B)	25	39.5	27	44
L, U drain ports	M22x1.5	M27x2	M27x2	M33x2
L (L)	142	164	191	215.5
L (H)	53	61	97.5	80.5
L (B)	92.5	101	128	129.5
U (L)	72	74.5	83	109
U (H)	54	54	60	68
U (B)	85	92	118	159.5
R - additional drain port	M14x1.5 deep 13 (**NOTE**)			
E - external supply pressure	M14.x1.5			
E (L)	240.8	249.5	303	375
E (H)	135.6	142.6	165.6	183.1
E (B)	15	16	20	20

NOTE: If the pump is set vertically with shaft pointing upward then the R port is strictly to be connected. The port R is located on the flange, at side (like U port) or bottom (like suction port) depending on the pump shape.

PUMP WITH ET6 CONTROL

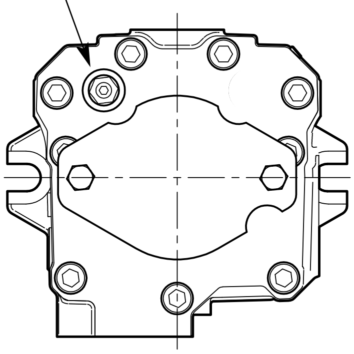




1	Suction port IN: flange SAE 3000
2	Delivery port OUT: flange SAE 6000
3	Drain ports L, U (plugged)
4	Additional drain port R
5	External supply pressure E
6	Port XD M14x1.5 to be plugged (plastic plug)
7	Port Z1 M14x1.5 to be connected to tank (plastic plug)
8	Pressure limiter adjustment: 18.8 bar/turn
9	Power adjustment: 18.8 bar/giro
10	Valve for proportional control of displacement AMP Junior connection
11	Max displacement limit adjustment see par. 11

11 - MAXIMUM DISPLACEMENT LIMITATION

The max angle for the swash plate is adjustable. The adjustment screw is placed on pump back. Values for pumps with rotary clockwise.

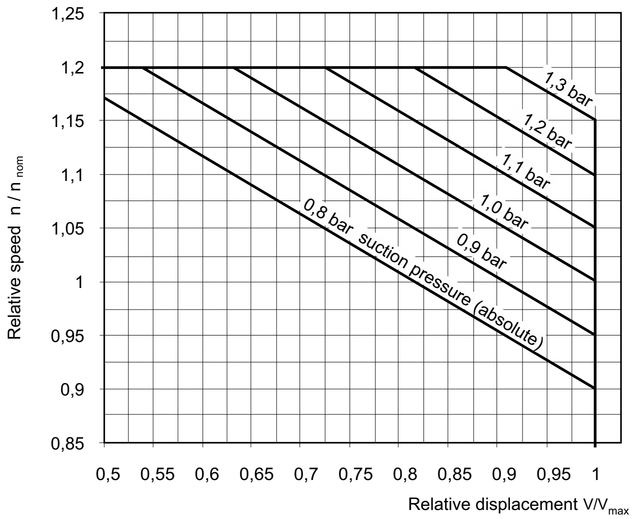


	Q max (cm³/turn)	displacement range (cm³)
55	4.9	35 - 55
75	5.2	50 - 75
105	6.2	75 - 105
135	7	105 - 135
165		135 - 165
210	9.4	165 - 210
280		210 - 280

12 - INSTALLATION AND START-UP

It is recommended to install the pump below the oil level and horizontally as shown. For installations above oil level and / or vertically, contact our. technical dept. The maximum allowed input speed is also directly dependent on the suction pressure.

The temperature should not exceed 80 °C in any part of the system.



Suction

- Provide suction/inlet line continuously rising towards the tank.
- Avoid cavitation events providing adequate flooded suction or pressurized inlet should be of adequate supply as to guard against cavitation.
- On designing the suction line attention must be paid to a straight, short conduct largely avoiding bends. If bends are required, the bending radius must be as large as possible. The suction inlet in the hydraulic tank must have as largest section as possible.
- The suction line itself must be installed in such a way that it ends more than ≥100 mm above the tank bottom. In order to enlarge the entry diameter of the suction boss in the hydraulic tank, its end must be cut under 45°. The distance between entry and oil surface must be large enough to avoid air suction, recommended ≥ 200 mm.
- Take care of the tightness of the pipe/hose so that air is not drawn in.

Case drain

- Positive venting is vital for the correct operation of the hydraulic system.
- **The pump must be always filled with oil, both at start-up and during stops, also long term stops.**
- All case drain lines must be mounted continuously rising towards the tank. This allows any entrapped air to escape freely from the pump housing.
- **The highest case drain port of the pump housing (ports U, L and R) must be connected separately to the tank.** As a rule drain lines have to be kept separate from the main return line. The drain line has to enter the hydraulic tank below the oil level.
- The dimension must be ample enough that even at low temperatures the return flow pressure of the leak oil will be near zero. The case pressure (build-up) should not rise and stay higher than 2.5 bar(absolute) during operation.

Piping

- Pipe work should be seamless drawn precision steel tube or hoses of suitable pressure rating.
- During installation, attention should be paid to cleanliness. The pipes must be deburred, washed and blown through.
- Scaled or rusted pipes must be scoured and then neutralized - Hoses must be brushed and flushed through when contaminated.

Cleanliness

- Oil tank and installation have to be checked again for cleanliness before the hydraulic medium is added. This procedure has to be performed immediately before pouring takes place. It may even be expedient to flush the entire installation! Make sure that the pressure fluid corresponds to the required grade of cleanliness.

Drive rotation

- **Before starting the engine** make sure that the HPR-02 pump will be driven with the correct direction of rotation. With electric motors, it must be checked that the electrical connections are correct.

Filling pump and circuit:

- The initial filling of the system must be carried out in such a way that all of the air can escape from the high pressure circuit and from the pump housing before the hydraulic units are operated.
- **The suction port and the casing of the HPR-02 are not related to each other.** Before the hydraulic components may be exposed to load, the entire circuit must be filled and vented.

- Manually fill the HPR-02 pump at the most accessible case drain port with filtered oil. Manually fill the high pressure line with filtered oil. Fill the oil tank to the maximum level with filtered oil and fill all motor housings to the maximum level via the most accessible case drain port with filtered oil.

Start-up

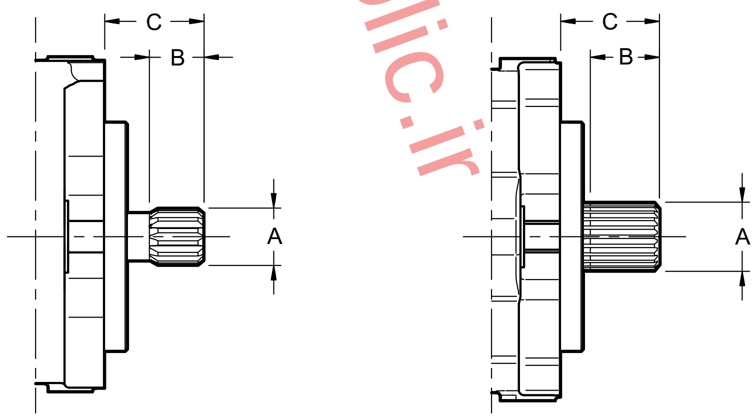
- If there is an on/off valve in the suction line, make sure it is completely open before starting the engine.
- Start the electric motor and allow the HPR-02 to rotate for 5 seconds.
- Switch engine off and check fluid level in the tank. Top off if necessary. Before restarting the engine, check the installation for tightness.
- Repeat previous steps at least four more times.
- Start the electric motor, then slowly actuate the pump function to allow the pump to increase to maximum displacement. Leave the function fully actuated for 30 seconds, and then repeat the step three times.
- Warm the system up by steadily increasing the pressure so as to allow any air to be purged from the fluid.
- Check the HPR-02 stand-by pressure, load sense margin pressure, pressure compensator setting (if applicable) and maximum flow setting when the hydraulic oil reaches its normal operating temperature.
- Check the oil level in the tank and refill with filtered oil if necessary before delivery of the machine.

13 - FLANGES AND SHAFTS

13.1 - Mounting flanges and splined shafts available as standard (SAE J774)

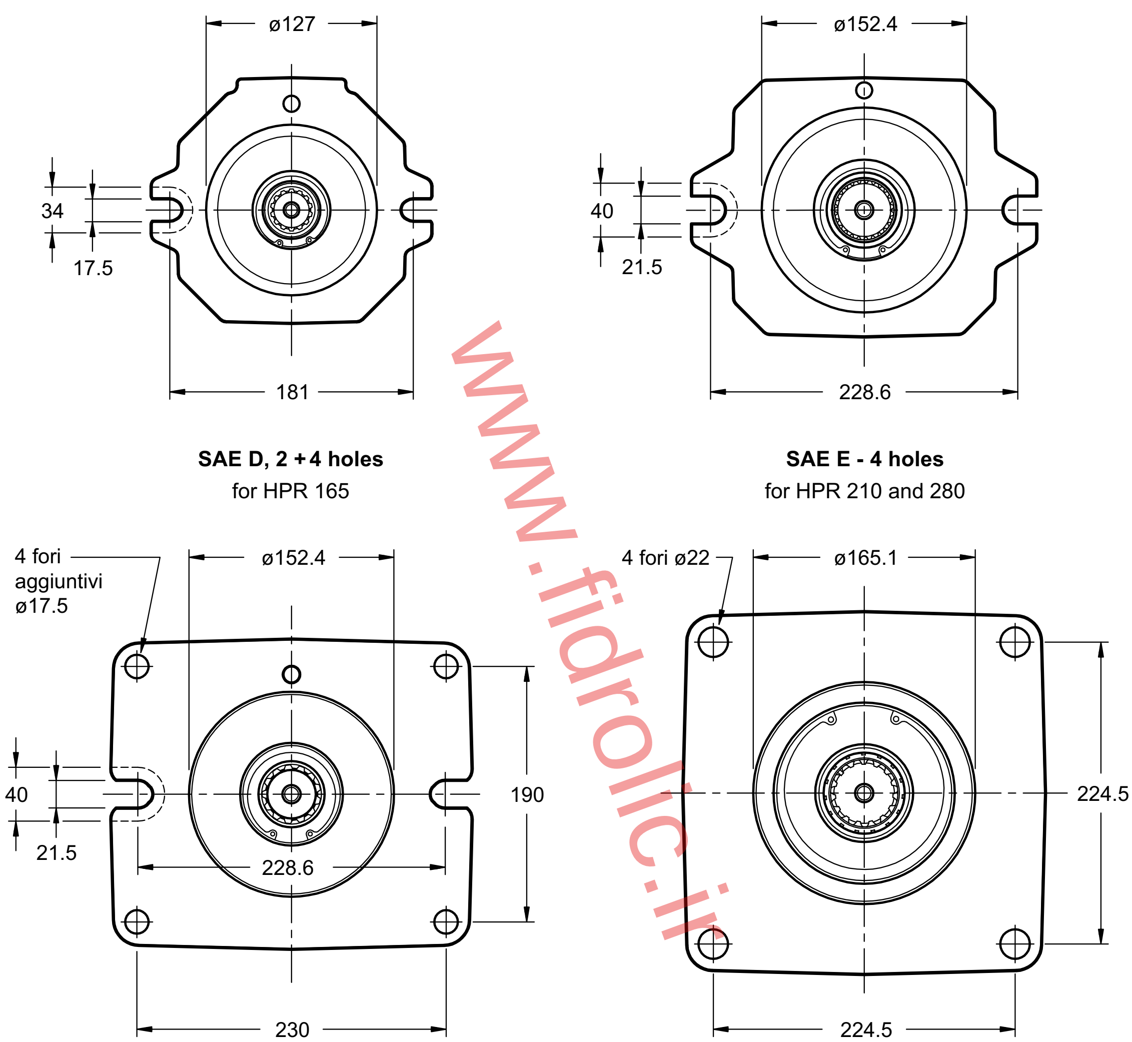
<table>
<tr><th>PUMP</th><th>55</th><th>75</th><th>105</th><th>135</th><th>165</th><th>210</th><th>280</th></tr>
<tr><td>Front mounting flange</td><td colspan="3">SAE C - 2 holes</td><td colspan="2">SAE D - 2 holes (NOTE)</td><td colspan="2">SAE E - 4 holes</td></tr>
<tr><td>Pilot diameter</td><td colspan="3">127</td><td colspan="2">152,4</td><td colspan="2">165,1</td></tr>
<tr><td rowspan="2">Shaft</td><td colspan="2">SAE C
14 t 12/24 DP</td><td>SAE C-C
17 t 12/24 DP</td><td colspan="2">SAE D
13 t 8/16 DP</td><td colspan="2">SAE F
15t 8/16 DP</td></tr>
<tr><td>-</td><td>21t 16/32</td><td>23t 16/32</td><td colspan="2">27t 16/32</td><td colspan="2">-</td></tr>
</table>

NOTE: HPR165 has also 4 additional holes Ø17.5



<table>
<tr><th rowspan="2">Shaft</th><th rowspan="2">SAE-J744 code</th><th rowspan="2">Type</th><th rowspan="2">A</th><th rowspan="2">B</th><th colspan="5">C</th></tr>
<tr><th>HPR 55</th><th>HPR 75</th><th>HPR 105</th><th>HPR 135 /165</th><th>HPR 210 / 280</th></tr>
<tr><td>14 T 12/24 DP</td><td>SAE C</td><td>with undercut</td><td>31.22</td><td>30</td><td>54</td><td rowspan="2">55</td><td rowspan="2">-</td><td rowspan="4">-</td><td rowspan="6">-</td></tr>
<tr><td>21t 16/32</td><td></td><td>no undercut</td><td>34.51</td><td>39.5</td><td rowspan="6">-</td></tr>
<tr><td>17 t 12/24 DP</td><td>SAE C-C</td><td>with undercut</td><td>37.68</td><td>30</td><td rowspan="5">-</td><td rowspan="2">55</td></tr>
<tr><td>23t 16/32</td><td></td><td>no undercut</td><td>37.68</td><td>38.5</td></tr>
<tr><td>13 t 8/16 DP</td><td>SAE D</td><td>with undercut</td><td>43.71</td><td>50</td><td rowspan="3">-</td><td rowspan="2">75</td></tr>
<tr><td>27t 16/32</td><td></td><td>no undercut</td><td>44.05</td><td>62</td></tr>
<tr><td>15t 8/16 DP</td><td>SAE F</td><td>no undercut</td><td>50.06</td><td>58</td><td>-</td><td>75</td></tr>
</table>

13.2 - Flanges

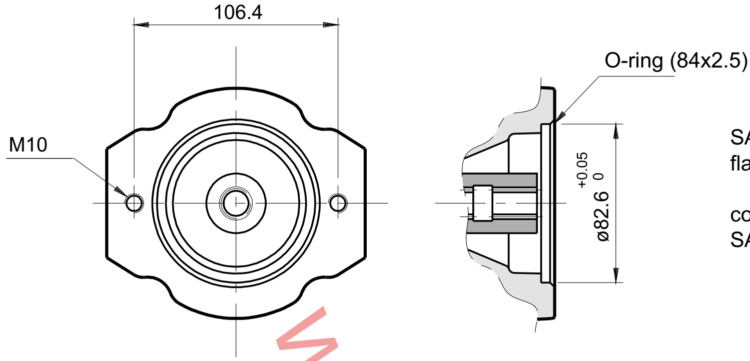


PUMP	55	75	105	135	165	210	280
flange thickness near fastening holes (mm)	20				25	26	30

14 - PTO - POWER TAKE OFF

The HPR pumps can be supplied with a power take-off SAE J744 type, which allows coupling with other pumps models. As for identification see par. 1 “Identification code”.

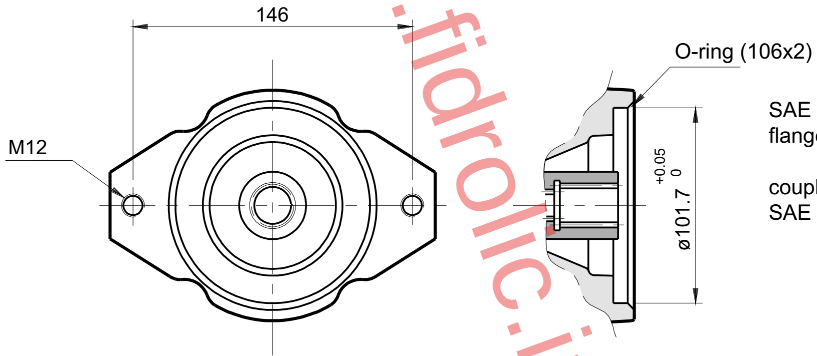
SAE A
identification code **A09**



SAE J744 - 2 holes intermediate flange type “A”

coupling for splined shaft SAE J744 16/32 D.P. - 9T

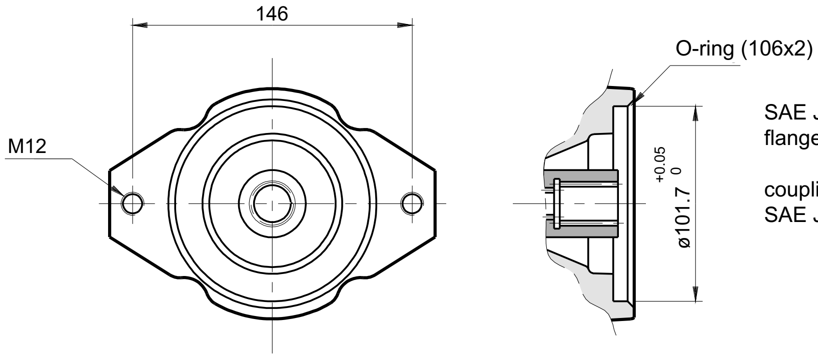
SAE B
identification code **B13**



SAE J744 - 2 holes intermediate flange type “B”

coupling for splined shaft SAE J744 16/32 D.P. - 13T

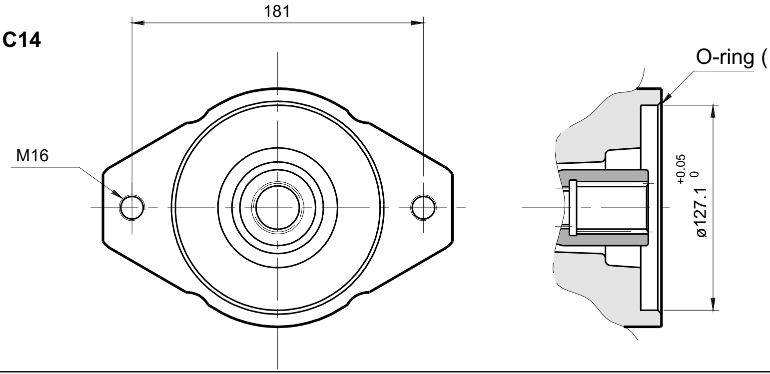
SAE BB
identification code **B15**



SAE J744 - 2 holes intermediate flange type “B”

coupling for splined shaft SAE J744 16/32 D.P. - 15T

SAE C
identification code **C14**

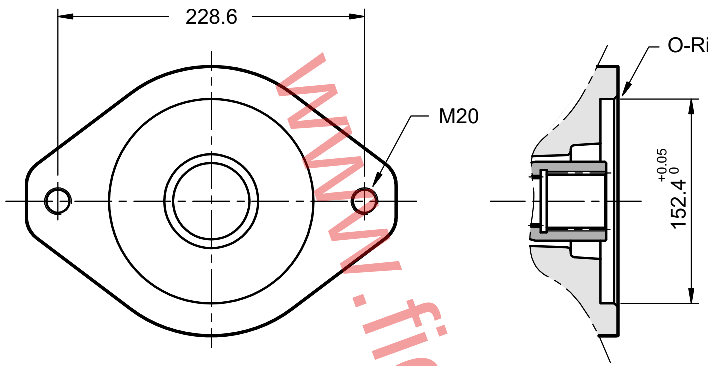


SAE J744 - 2 holes intermediate flange type “C”

coupling for splined shaft
SAE J744 12/24 D.P. - 14T

SAE D
identification code **D27**

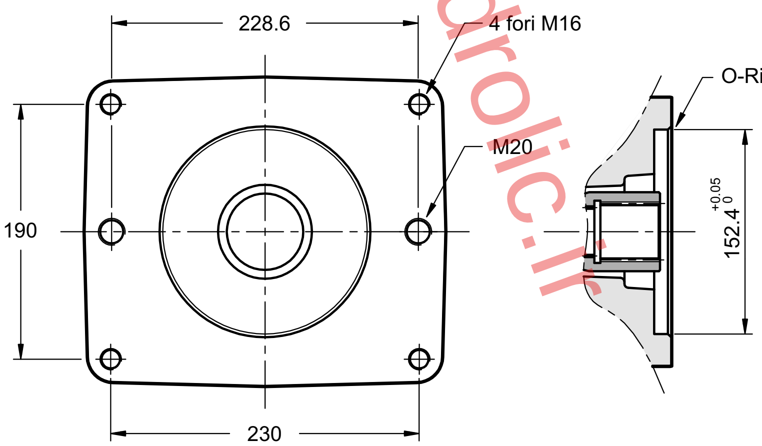
HPR 135



SAE J744 - 2 holes intermediate flange type “D”

coupling for splined shaft
SAE J744 16/32 D.P. - 27T

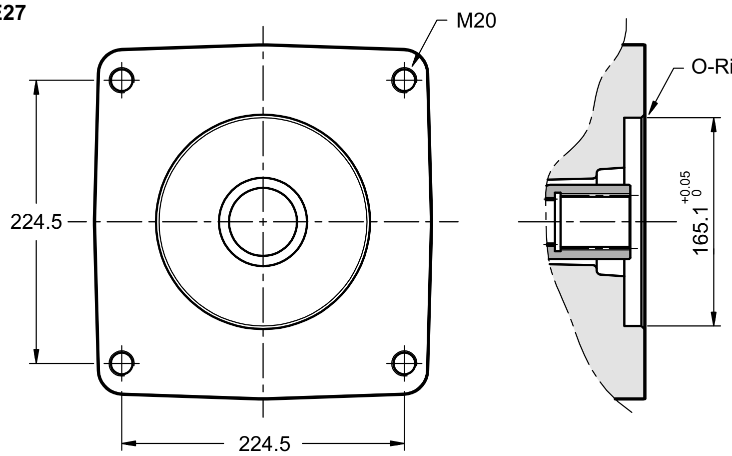
HPR 165 / 210



SAE J744 - 2 holes intermediate flange type “D”

coupling for splined shaft
SAE J744 16/32 D.P. - 27T

SAE E
identification code **E27**



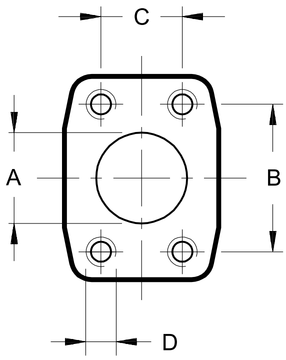
SAE J744 - 4 holes intermediate flange type “E”

coupling for splined shaft
SAE J744 16/32 D.P. - 27T

15 - SUCTION AND DELIVERY PORTS DIMENSIONS FOR SAE FLANGE WITH METRIC BOLTS

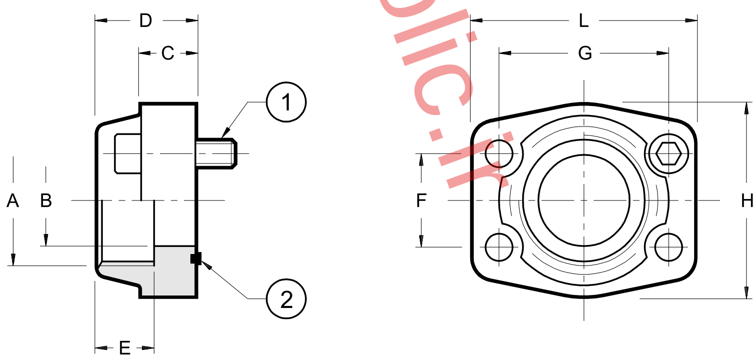
T - SUCTION (SAE 3000)					
Pump	**nominal size**	**A** mm	**B** mm	**C** mm	**D** Threading and depth mm
55, 75	1 ½”	38	69.9	35,7	M12x16
105	2”	50	77,8	42.9	M12x16
135	2”	50	77,8	42.9	M12x17
165	2 ½”	64	88,9	50,8	*M12x21.5
210	3”	76.2	106,4	61,9	M16x28.5
280	3 ½””	90	120.7	69,9	M16x29

P - DELIVERY (SAE 6000)					
Pump	**nominal size**	**A** mm	**B** mm	**C** mm	**D** Threading and depth mm
55, 75	3/4”	19	50,8	23,5	M10x17
105	1”	21	57,2	27,8	M12x17
135	1 ¼”	32	66.7	31.8	M14x19
165	1 ¼”	32	66,6	31.8	*M12x18.5
210	1 ½”	38.1	79,3	36,5	M16x25.5
280	1 ½”	38.1	79,3	36,5	M16x29



(*) deviation from standard

16 - CONNECTION FLANGES



dimensions in mm
The fastening bolts and the O-Rings must be ordered separately

	Flange code	Flange description	p_{max} [bar]	ØA	ØB	C	D	E	F	G	H	L	1 SHC screws	2
SAE 3000	0610714	SAE - 1 ½”	210	1 ½” BSP	38	25	45	24	35,7	70	78	94	n° 4 - M12x40	OR 4187 (47.22x3.53)
	0610721	SAE - 2”	210	2” BSP	51	25	45	30	43	77,8	90	102	n° 4 - M12x40	OR 4225 (56.74x3.53)
	0610722	SAE - 2 ½”	172	2 ½” BSP	63	25	50	30	50,8	89	105	116	n° 4 - M12x45	OR 4275 (69,44x3.53)
	0610723	SAE - 3”	138	3” BSP	73	27	50	34	61,9	106,3	124	134	n° 4 - M16x55	OR 4337 (85.32x3.53)
	0610724	SAE - 3 ½”	34	3 ½” BSP	89	27	48	34	69,8	120,6	136	152	n° 4 - M16x55	OR 4387 (98,02x3.53)
SAE 6000	0770075	SAE - 3/4”	420	3/4” BSP	19	21	35	22	23,8	50,8	55	71	n° 4 - M10x35	OR 4100 (24.99x3.53)
	0770092	SAE - 1”	420	1” BSP	25	25	42	24	27,7	57,1	65	81	n° 4 - M12x40	OR 4131 (32.93x3.53)
	0770106	SAE - 1 ¼”	420	1 ¼” BSP	32	27	45	25	31,7	66,7	78	95	n° 4 - M14x45	OR 4150 (37.69x3.53)
	0773462	SAE - 1 ½”	420	1 ½” BSP	38	30	94	26	36,5	79,3	94	112	n° 4 - M16x55	OR 4187 (47.22x3.53)

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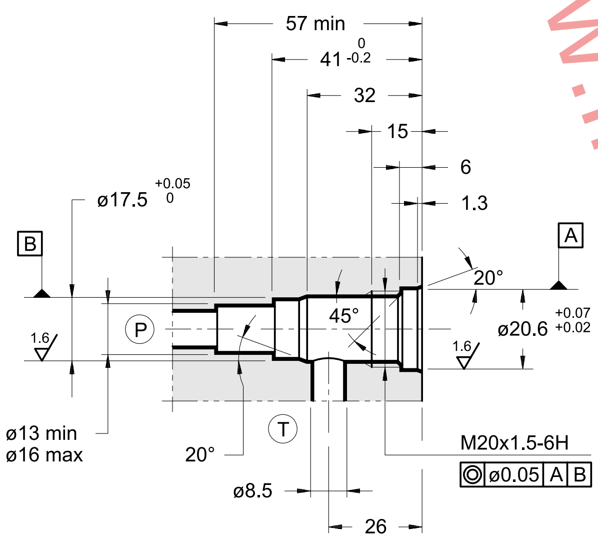
DUPLOMATIC OLEODINAMICA

CR
DIRECT OPERATED PRESSURE CONTROL VALVE
SERIES 22

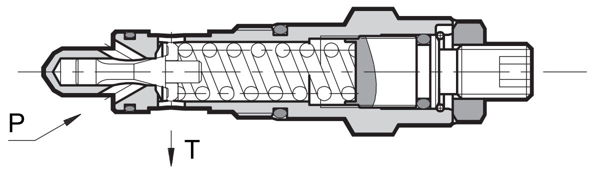
CARTRIDGE TYPE

p max **350** bar
Q max **50** l/min

SEAT DIMENSIONS: D-10B



OPERATING PRINCIPLE

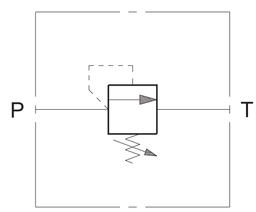


- The CR valve is a direct operated pressure control valve cartridge type that can be used in blocks or panels with type D-10B seat.
- It is normally used to control the maximum pressure in the hydraulic circuits or as a limiting device for pressure peaks generated during hydraulic actuator movement variation.
- It is available in five different pressure control ranges up to 350 bar.
- The circuit pressure acts on the shutter which is directly loaded by a spring on the opposite side. Once the set pressure is reached, the shutter opens, and discharges the excess flow in port T connected directly to the reservoir.
- The pressure can be adjusted by a screw, usually supplied as the countersunk hex type, equipped with locking nut and maximum adjustment limiter.

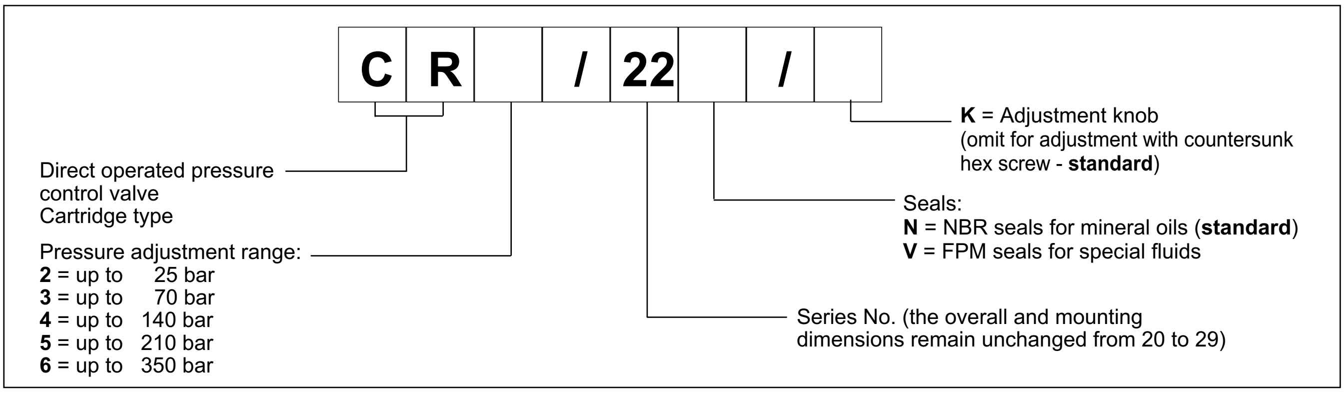
PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

Max working pressure	bar	350
Minimum controlled pressure and pressure drop	see diagram	
Maximum flow rate	l/min	50
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,16
Surface treatment: electrolytic zinc covering	Fe // Zn 8 // B EN 12329	

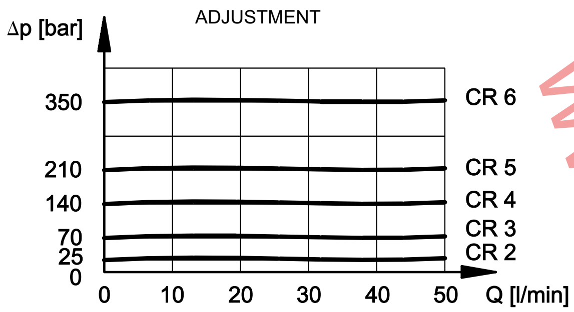
HYDRAULIC SYMBOL

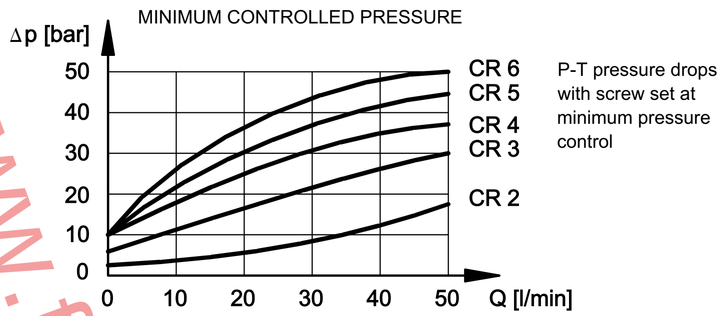


1 - IDENTIFICATION CODE



2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



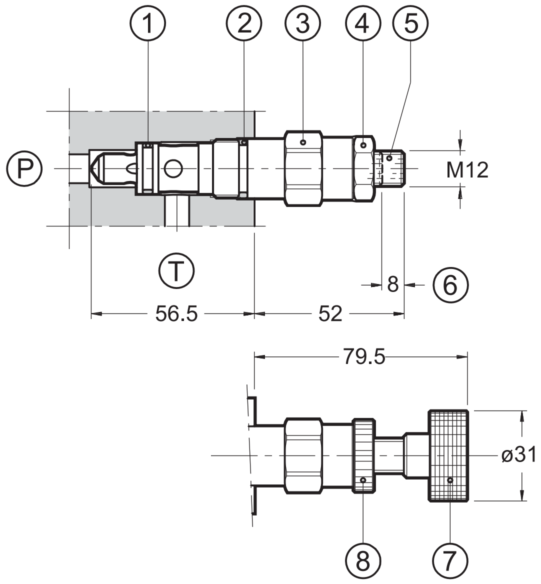


3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	OR tipo 2056 (14.00x1.78) 90 Shore
2	OR tipo 3062 (15.54x2.62) 90 Shore
3	Hexagonal: spanner 22 Tightening torque 45 ÷ 50 Nm
4	Locking nut: spanner 19
5	Countersunk hex adjustment screw: spanner 6 (**standard**) Clockwise rotation to increase pressure
6	Maximum screw stroke
7	Adjustment knob: K
8	Locking ring

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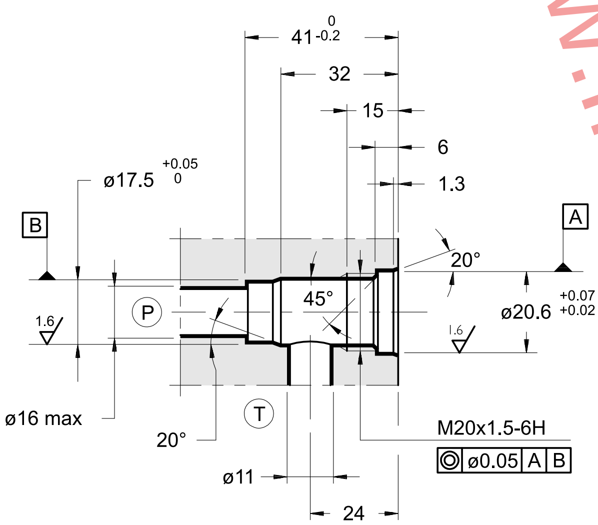
CRQ
PILOT OPERATED PRESSURE CONTROL VALVE
SERIES 12

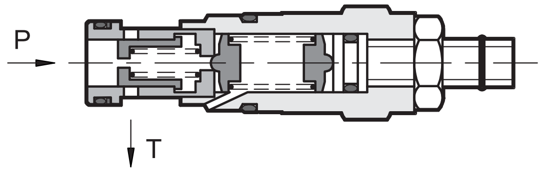
CARTRIDGE TYPE

p max **350** bar
Q max **100** l/min

SEAT DIMENSIONS: D-10C



OPERATING PRINCIPLE



— The CRQ valve is a pilot operated pressure control valve cartridge type that can be used in blocks or panels with D-10C type seat.

— It is normally used to control the hydraulic circuit pressure and allows use of the entire flow of the pump even at pressure values near the set value.

— It is available in four different pressure control ranges up to 350 bar.

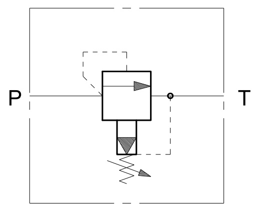
— It consists of a main balanced type spool and a pilot stage. The main spool, normally closed, opens when the circuit pressure exceeds the set value generated by the pilot stage, discharging the excess flow in port T, directly connected to the tank.

— The pressure is adjustable with a screw, usually supplied as the countersunk hex type, equipped with locking nut and with maximum adjustment limiter.

PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

Max working pressure	bar	350
Minimum controlled pressure and pressure drop	see diagram	
Maximum flow rate	l/min	100
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,16
Surface treatment:electrolytic zinc covering	Fe // Zn 8 // B EN 12329	

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

C	R	Q		/		/	12	/	

Pilot operated pressure control valve Cartridge type

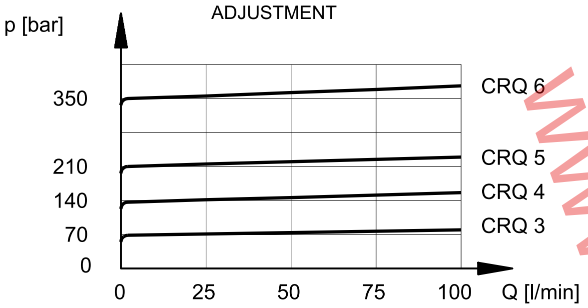
Pressure adjustment range:
3 = up to 70 bar
4 = up to 140 bar
5 = up to 210 bar
6 = up to 350 bar

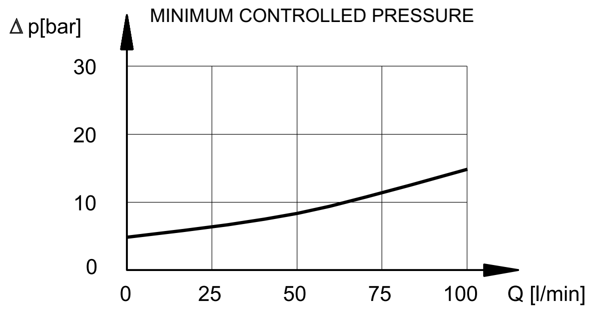
M1 = Adjustment knob (omit for adjustment with countersunk hex screw)

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals: omit for mineral oils
V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

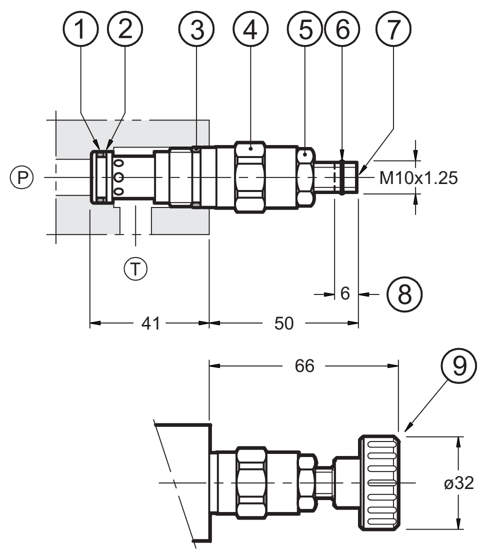




3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

1	OR type 2056 (14.00x1.78) 90 Shore
2	Parbak 8-015 (14.81x1.14x1.35)
3	OR type 3062 (15.54x2.62) 90 Shore
4	Hexagonal: spanner 22 Tightening torque 45 ÷ 50 Nm
5	Locking nut: spanner 17
6	Maximum adjustment limiting device
7	Countersunk hex adjustment screw: spanner 5 Clockwise rotation to increase pressure
8	Maximum screw stroke
9	Adjustment knob: M1

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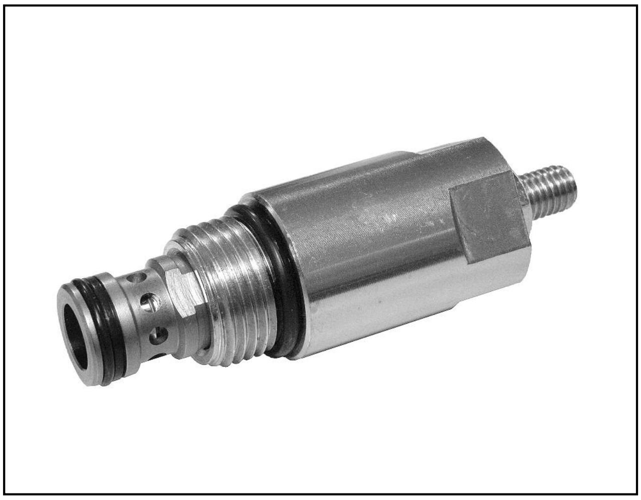
PRK10

PILOT OPERATED PRESSURE CONTROL VALVE

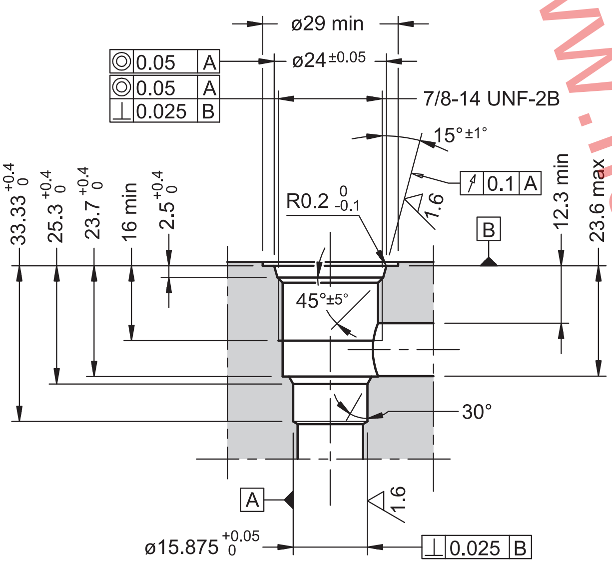
SERIES 11



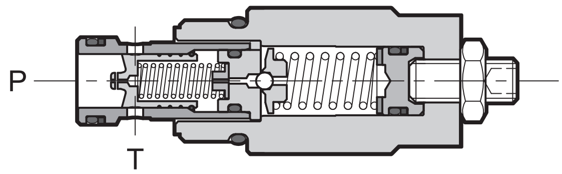
CARTRIDGE TYPE
seat 7/8-14 UNF-2B (SAE - 10)

p max **350** bar
Q max **120** l/min

SEAT DIMENSIONS: 7/8 - 14 UNF- 2B (SAE - 10)



OPERATING PRINCIPLE



— The PRK10 valve is a pilot operated pressure control valve, cartridge type, that can be used in blocks or panels with 7/8-14 UNF-2B (SAE - 10) type seat.

— It is used to control the hydraulic circuit pressure and allows use of the entire flow of the pump even at pressure values near the set value.

— It consists of a main balanced type spool and a pilot stage. The main spool, normally closed, opens when the circuit pressure exceeds the set value generated by the pilot stage, discharging the excess flow in port T, directly connected to the tank.

— It's available in 4 pressure control ranges from 6 to 350 bar.

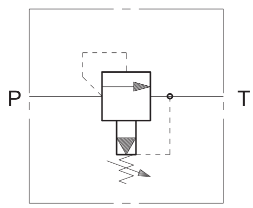
— The PRK10 are supplied with a finishing surface treatment (zinc-nickel) suitable to ensure a salt spray resistance up to 600 h (test according to UNI EN ISO 9227 standards and test evaluation according to UNI EN ISO 10289 standards)

— The pressure is adjustable by a socket set screw with locking nut, or by knob.

PERFORMANCES
(measured with mineral oil of viscosity 36 cSt at 50°C)

Max working pressure	bar	350
Minimum controlled pressure and pressure drop	see diagram	
Maximum flow rate	l/min	120
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,2
Surface finishing: galvanic treatment	zinc-nickel	

HYDRAULIC SYMBOL



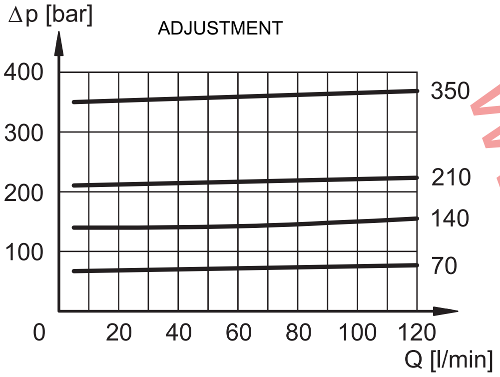
1 - IDENTIFICATION CODE

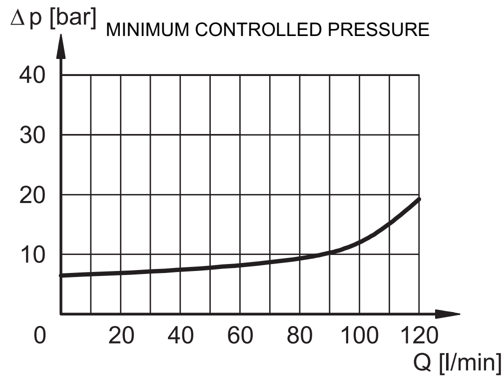
P	R	K	10	-		/	11		/	

- Pressure control valve, pilot operated (P R)
- Cartridge type (K)
- Size (10)
- Pressure adjustment range:
  - **070** = from 6 to 70 bar (17 bar/turn)
  - **140** = from 6 to 140 bar (32 bar/turn)
  - **210** = from 6 to 210 bar (47 bar/turn)
  - **350** = from 6 to 350 bar (78 bar/turn)
- Series No. (the overall and mounting dimensions remain unchanged from 10 to 19) (11)
- Seals:
  N = NBR seals for mineral oils (**standard**)
  V = FPM seals for special fluids
- Option: **K** = Adjustment knob.
  Omit for adjustment with hex socket screw (**standard**)

2 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)





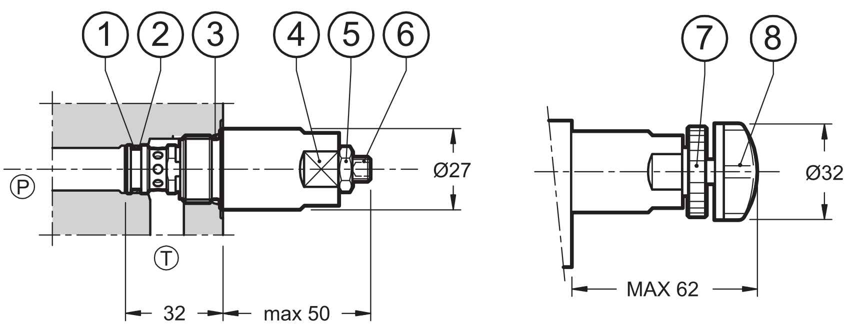
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	OR type 2050 (12.42x1.78)
2	Parbak 8-014 (13.23x1.14x1.35)
3	OR type 3-910 (19.18x2.46)
4	Cartridge tightening: spanner 24 Tightening torque 38 Nm
5	Locking nut: spanner 13
6	Socket hex adjustment screw: Hex key 4. Rotate clockwise to increase pressure
7	Locking ring
8	Adjustment knob: K

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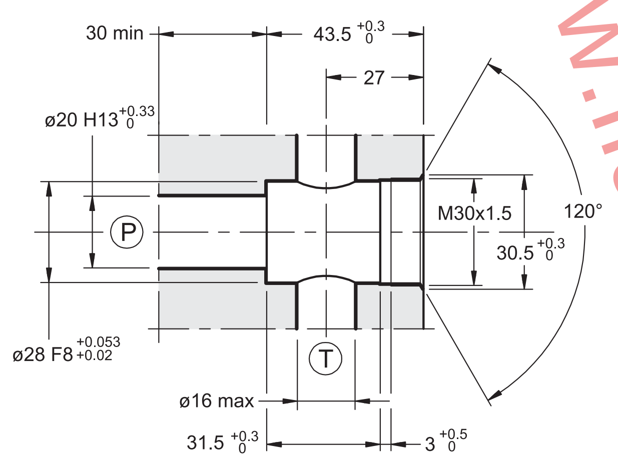
DUPLOMATIC OLEODINAMICA

DBV
DIRECT OPERATED PRESSURE CONTROL VALVE
SERIES 10

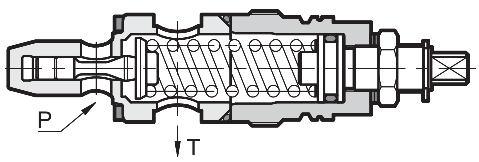
CARTRIDGE TYPE

p max **380** bar
Q max **120** l/min

SEAT DIMENSIONS: D-10E



OPERATING PRINCIPLE

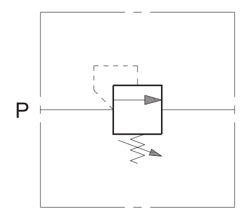


- The DBV valve is a direct operated pressure control valve cartridge type that can be used in blocks or panels with seat.
- It is normally used to control the maximum pressure in the hydraulic circuits or as a limiting device for pressure peaks generated during hydraulic actuator movement variation.
- It is available in differents pressure control ranges up to 300 bar.
- The circuit pressure acts on the shutter which is directly loaded by a spring on the opposite side. Once the set pressure is reached, the shutter opens, and discharges the excess flow in port T connected directly to the reservoir.
- The pressure can be adjusted by a screw, equipped with locking nut and maximum adjustment limiter.

PERFORMANCES
(measured with mineral oil of viscosity 36 cSt at 50°C)

Max working pressure	bar	380
Minimum controlled pressure and pressure drop	see diagram	
Maximum flow rate	l/min	120
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,25
Surface treatment:electrolytic zinc covering	Fe // Zn 8 // B EN 12329	

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

D B V - [ ] / 10 [ ] / [ ]

Direct operated pressure control valve
Cartridge type

Pressure adjustment range:

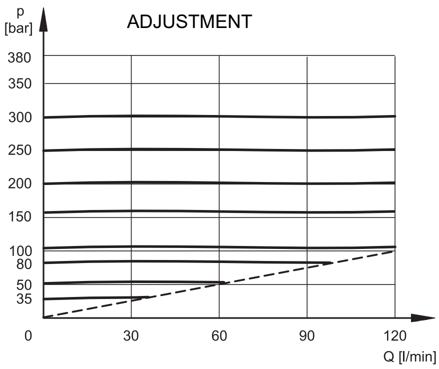
035 = up to 35 bar
050 = up to 50 bar
080 = up to 80 bar
100 = up to 100 bar
160 = up to 160 bar
200 = up to 200 bar
250 = up to 250 bar
300 = up to 300 bar

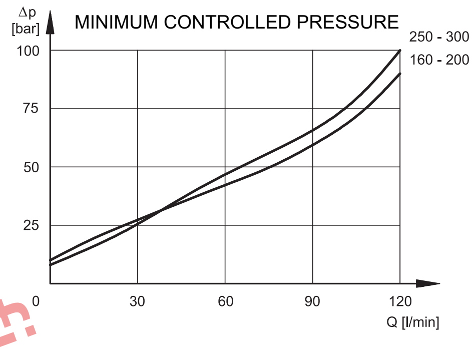
Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

K = Adjustment knob
(omit for adjustment with hex screw - **standard**)

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)





P-T pressure drops with screw set at minimum pressure control

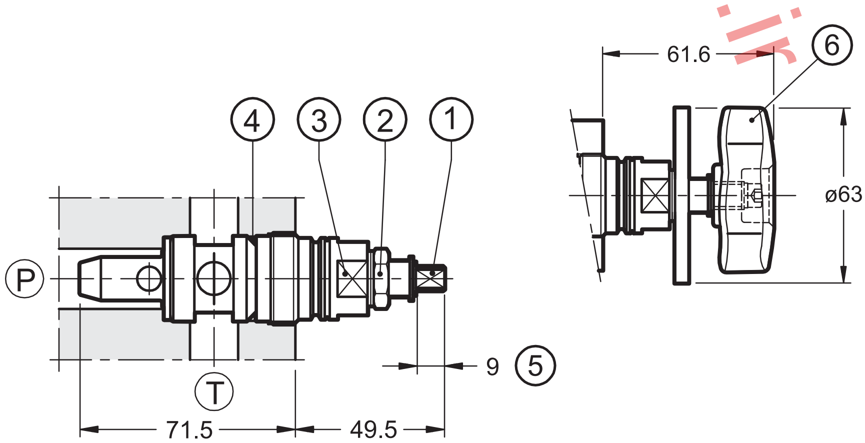
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Socket hex adjustment screw: spanner 8 (**standard**) Clockwise rotation to increase pressure
2	Locking nut: spanner 17
3	Hexagonal spanner 24 Tightening torque 70 ÷ 100 Nm
4	OR type 130 (22.22x2.62) 90 Shore
5	Maximum screw stroke
6	Adjustment knob: **K**

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PCK06

TWO- AND THREE-WAY PRESSURE COMPENSATOR WITH FIXED OR VARIABLE ADJUSTMENT

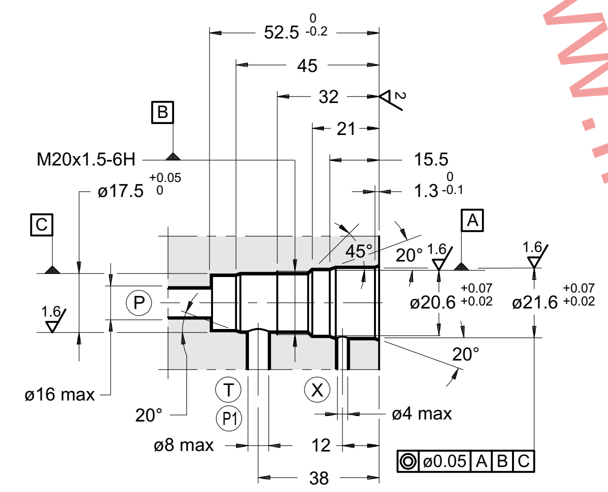
SERIES 10

CARTRIDGE TYPE

p max **350** bar

Q max **40** l/min

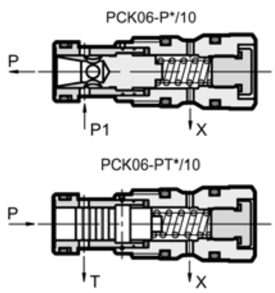
SEAT DIMENSIONS D-10D



(T): relevant to three-way compensator

(P1) : relevant to two-way compensator

OPERATING PRINCIPLE

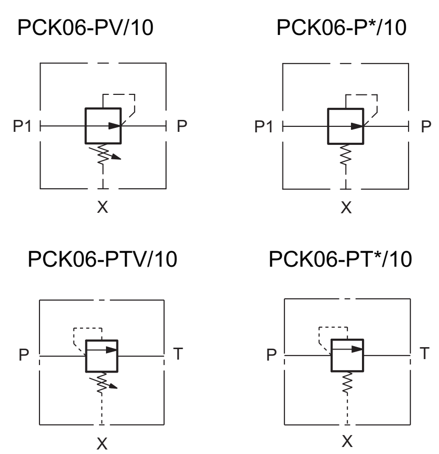


- The PCK06 valve is a two or three-way pressure compensator, cartridge type, for block or manifold application.
- It keeps the pressure drop (characteristic Δp) between the P and the X pilot connections, at a constant level.
- It is normally used together with proportional directional valves, in order to control the flow rate independently of the pressure variations.
- The setting of the variable adjustment compensator can be varied from 7 to 33 bar; adjustment can be operated either via a countersunk hex adjustment screw, or via an adjustment knob.
- The fixed adjustment version can be supplied with a characteristic Δp setting of either 4 or 8 bar.

PERFORMANCES (working with mineral oil of viscosity of 36 cSt a 50°C)

Maximum operating pressure	bar	350
Characteristic Δp: fixed adjustment variable adjustment	bar	4 - 8 7 ÷ 33
Maximum flow rate	l/min	40
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	0,2
Surface treatment : electrolytic zinc covering	Fe // Zn 8 // B EN 12329	

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

1.1 - Two-way compensator identification code

P	C	K	06	-	P		/	10		/	

Pressure compensator

Cartridge type

Nominal size

2 ways

Adjustment:
V = variable from 7 to 33 bar
4 = 4 bar
8 = 8 bar

Series no.:
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

Option: adjustment.
Available only for version with variable adjustment (**PV**).
Omit for adjustment with countersunk hex screw (**standard)**
K1 = adjustment knob

1.2 - Three-way compensator identification code

P	C	K	06	-	PT		/	10		/	

Pressure compensator

Cartridge type

Nominal size

3 ways

Adjustment:
V = variable from 7 to 33 bar
4 = 4 bar
8 = 8 bar

Series no.:
(the overall and mounting dimensions remain unchanged from 10 to 19)

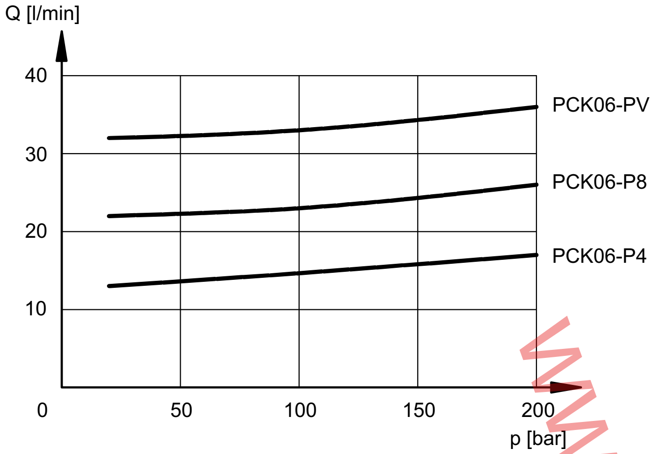
Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

Option: adjustment.
Available only for version with variable adjustment (**PTV**).
Omit for adjustment with countersunk hex screw (**standard)**
K1 = adjustment knob

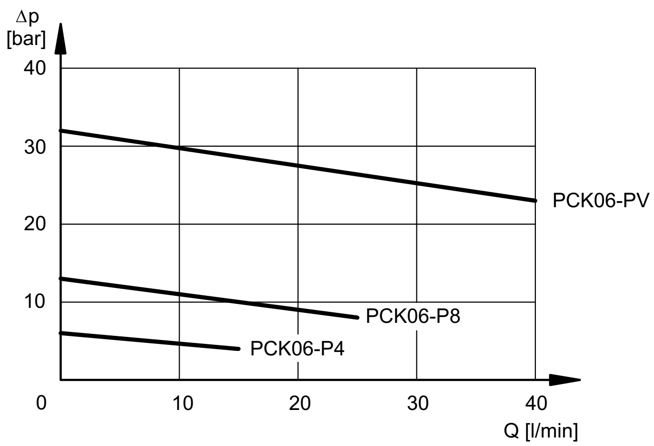
2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

2.1 - Two-way compensator characteristic curves

FLOW RATE - PRESSURE Q = f (p)

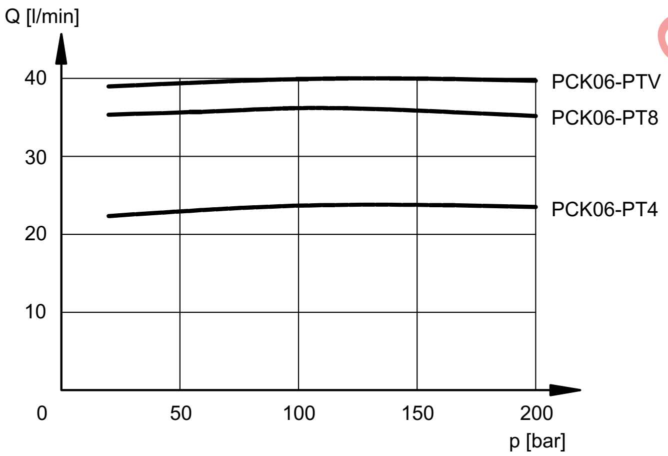


PRESSURE DROPS Δp = f (Q)

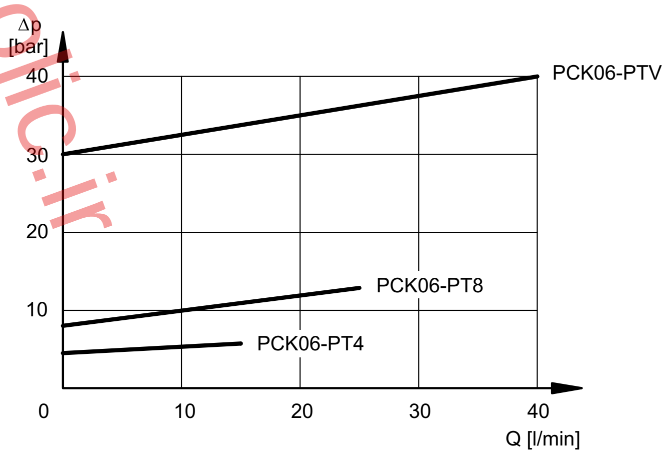


2.2 - Three-way compensator characteristic curves

FLOW RATE - PRESSURE Q = f (p)



PRESSURE DROPS Δp = f (Q)

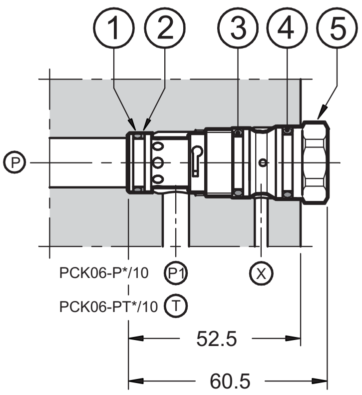


3 - HYDRAULIC FLUIDS

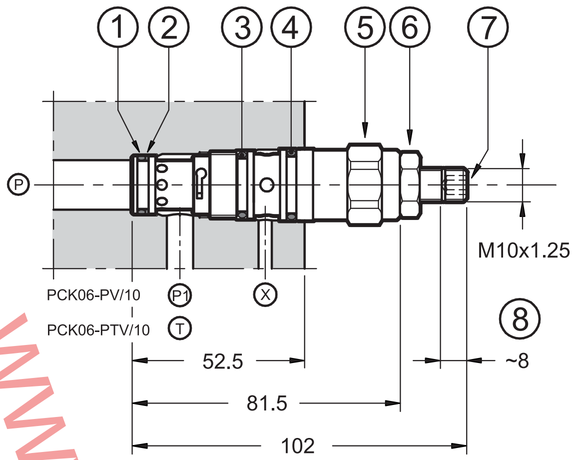
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

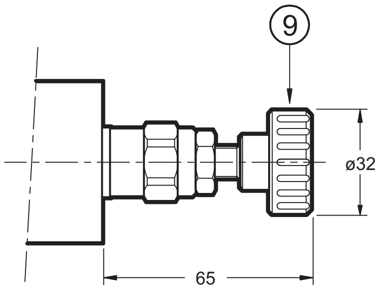
PCK06-P*/10
PCK06-PT*/10



PCK06-PV/10
PCK06-PTV/10



PCK06-PV/10*/K1
PCK06-PTV/10*/K1



dimensions in mm

1	OR type 2056 (14.00x1.78)
2	Parbak 8-015 (14.81x1.14x1.35)
3	OR type 3062 (15.54x2.62)
4	OR type 3062 (15.54x2.62)
5	Hexagonal: spanner 22 Tightening torque 45 ÷ 50 Nm
6	Locking nut: spanner 17
7	Countersunk hex adjustment screw: spanner 5 Clockwise rotation to increase pressure
8	Maximum screw stroke
9	Adjustment knob: **K1**

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DUPLOMATiC OLEODiNAMiCA

CD1-W

DIRECT OPERATED PRESSURE CONTROL VALVE

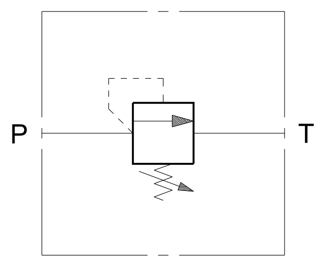
SERIES 10

THREADED PORTS

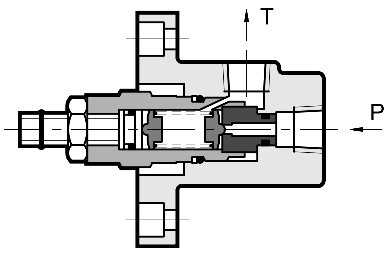
p max **350** bar

Q max **3** l/min

HYDRAULIC SYMBOL



OPERATING PRINCIPLE



— The CD1-W valve is a direct operated pressure control valve with threaded ports and for flange mounting installation.

— It is used also for remote piloting of control valves and two-stage pressure reducers.

— It is available in four different pressure control ranges up to 350 bar.

— It is normally supplied with a countersunk hex adjustment screw, a locking nut and a maximum adjustment fastener.

PERFORMANCE RATINGS (measured with mineral oil of viscosity 36 cSt at 50°C)

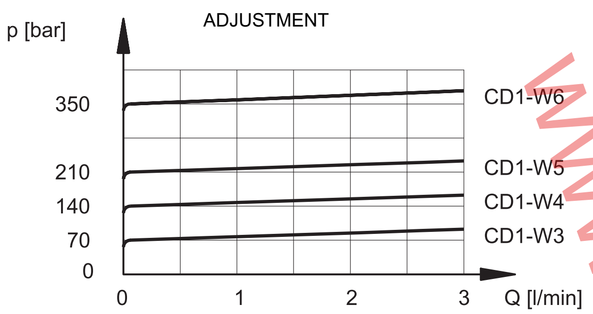
Maximum operating pressure	bar	350
Minimum controlled pressure	see diagram	
Maximum flow rate	l/min	3
Ambient temperature range	°C	–20 / +50
Fluid temperature range	°C	–20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Recommended filtration		according to ISO4406:1999 class 20/18/15
Recommended viscosity	cSt	25
Mass	kg	1,2

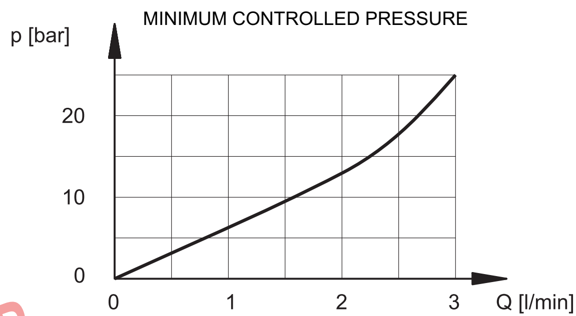
1 - IDENTIFICATION CODE

C	D	1	-	W		/		/	10	/	

- Direct operated pressure control valve
- Nominal dimension
- Threaded ports: 1/4” NPT
- Pressure adjustment range:
  3 = up to 70 bar **5** = up to 210 bar
  4 = up to 140 bar **6** = up to 350 bar
- **M1** = Adjustment knob
  (omit for adjustment with countersunk hex screw)
- Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)
- Seals:
  omit for mineral oils
  V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



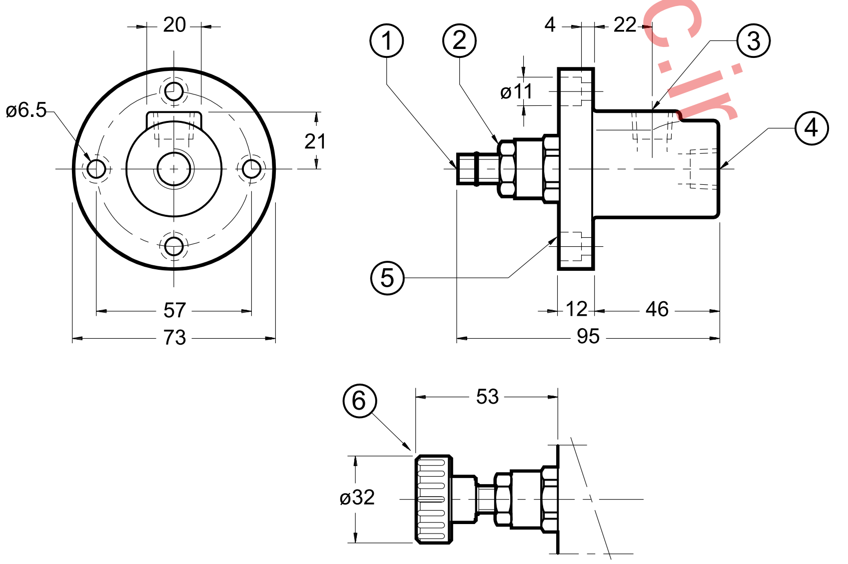


3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Countersunk hex adjustment screw: spanner 5 Clockwise rotation to increase pressure
2	Locking nut: spanner 17
3	Outlet port T: 1/4” NPT
4	Pressure port P: 1/4” NPT
5	Identification label
6	Adjustment knob: M1

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DUPLOMATIC OLEODINAMICA

RM*-W

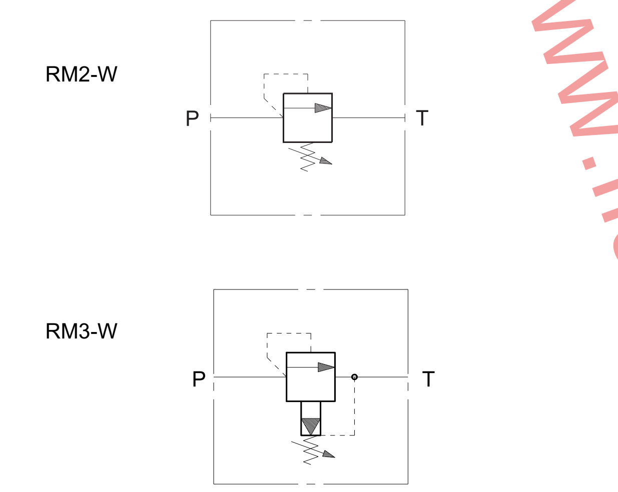
PRESSURE CONTROL VALVES

RM2-W SERIES 31
RM3-W SERIES 30

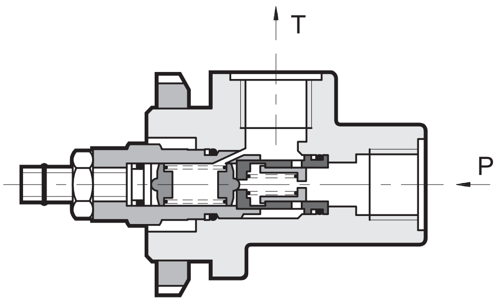
THREADED PORTS

p max **350** bar
Q max (see table of performances)

HYDRAULIC SYMBOLS



OPERATING PRINCIPLE



— The RM*-W valves are pressure control valves with threaded ports for panel mounting with a ring-nut fastening.

— They are available in two different sizes: RM2-W direct operated for flows up to 50 l/min; RM3-W pilot operated for flows up to 75 l/min.

— They are normally supplied with a countersunk hex adjustment screw, a locking nut and a maximum adjustment fastener.

PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

		RM2-W	RM3-W
Maximum operating pressure	bar	350	
Minimum controlled pressure	see diagram		
Maximum flow rate	l/min	50	75
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass	kg	0,9	

1 - IDENTIFICATION CODE

R	M		-	W		/					

Example: RM2-W3/31N/K
RM3-W3/M1/30/V

Pressure control valve

Nominal dimension:
2 = 3/8” **3** = 1/2”

Threaded ports BSP

Pressure adjustment range:
3 = up to 70 bar **5** = up to 210 bar
4 = up to 140 bar **6** = up to 350 bar

only for RM3: **M1** = Adjustment knob
(omit for adjustment with countersunk hex screw)

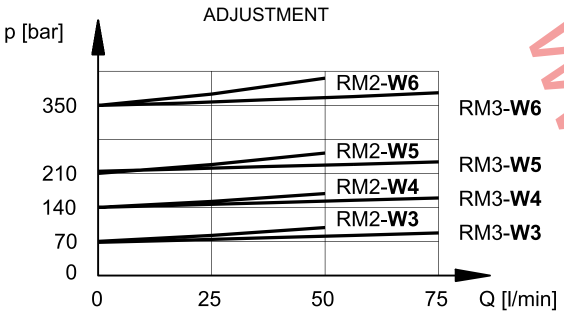
only for RM2: Seals
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

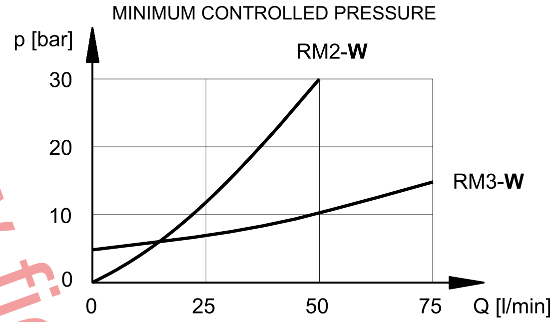
Series no: **31** for RM2-W **30** for RM3-W

only for RM3: Seals
Omit for NBR seals for mineral oils (**standard**)
/V = FPM seals for special fluids

only for RM2: **/K** = Adjustment knob
(omit for adjustment with countersunk hex screw)

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



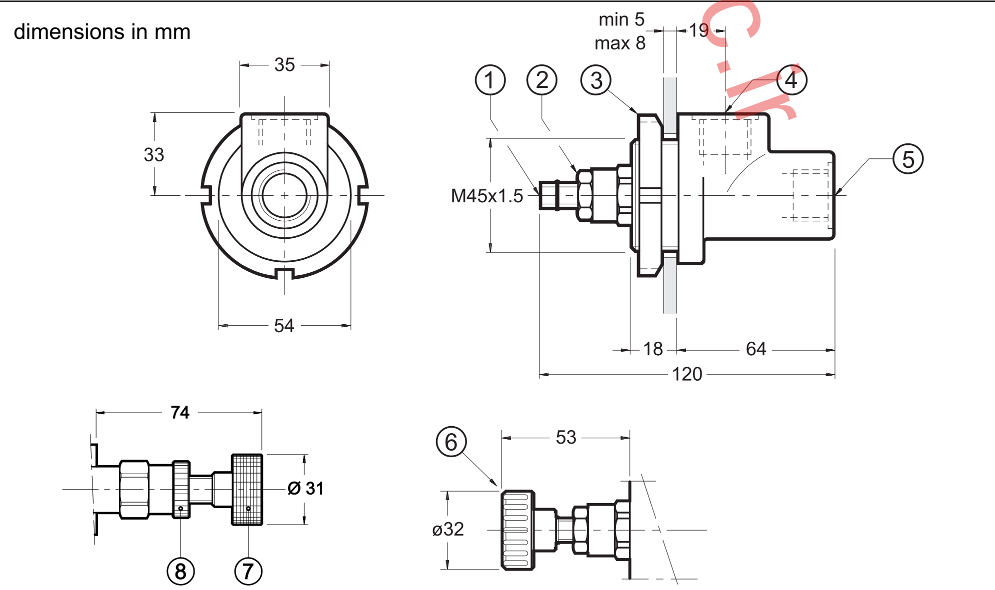


3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Countersunk hex adjustment screw: **RM2-W**: spanner 6 **RM3-W**: spanner 5 Clockwise rotation to increase pressure
2	Locking nut: **RM2-W**: spanner 19 **RM3-W**:spanner 17
3	Ring-nut for flange mounting type SKF KM9
4	Outlet port 1/2” BSP
5	Pressure port: **RM2-W**: 3/8” BSP **RM3-W**: 1/2” BSP
6	Adjustment knob: **RM3-W**: **M1**
7	Adjustment knob: **RM2-W**: **K**
8	Locking ring

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DUPLOMATIC OLEODINAMICA

RQ*-W

PRESSURE RELIEF VALVE

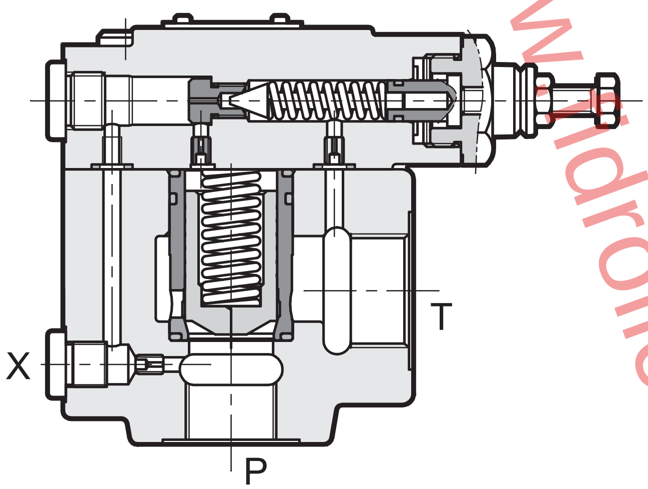
SERIES 41

THREADED PORTS

p max **350** bar

Q max (see table of performances)

OPERATING PRINCIPLE



— The RQ*-W valves are pilot operated pressure relief valves with threaded ports, available in two nominal sizes for a flow rate up to 400 l/min.

— Main stage with shutter and cone seal.

— Possibility of remote piloting using port X (see par. 4).

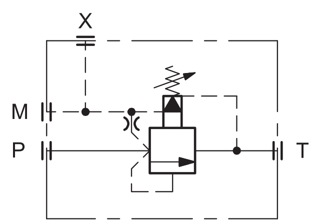
— The valves allow the use of the entire flow of the pump even with pressure values near the set value. The wide passages allow reduced pressure drops and fluid heating due to low pressure drop across the valve.

— They are normally supplied with a hexagonal head adjustment screw. Upon request, they can be equipped with a SICBLOC adjustment knob.

PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

		RQ5-W	RQ7-W
Maximum operating pressure	bar	350	
Maximum flow rate	l/min	250	400
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass	kg	4,1	8

HYDRAULIC SYMBOL

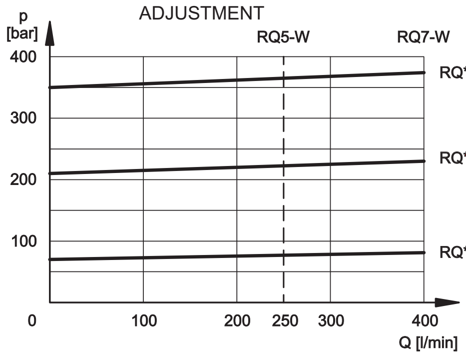


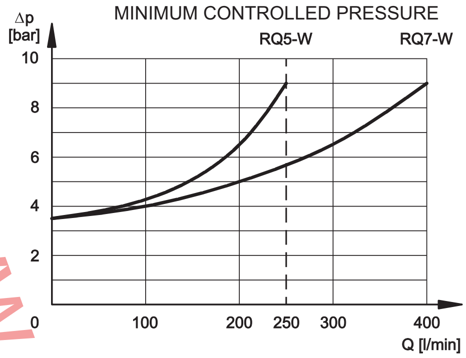
1 - IDENTIFICATION CODE

R	Q		-	W		/		/	41	/	

- Pressure control valve (RQ)
- Nominal dimension **5** = DN 25, **7** = DN 40
- BSP threaded ports (W)
- Pressure adjustment range:
  - **3** = up to 70 bar
  - **5** = up to 210 bar
  - **6** = up to 350 bar
- **M** = adjustment with SICBLOC knob (omit for adjustment with hexagonal head screw)
- Series No. (the overall and mounting dimensions remain unchanged from 40 to 49)
- Seals: omit for mineral oils, **V** = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

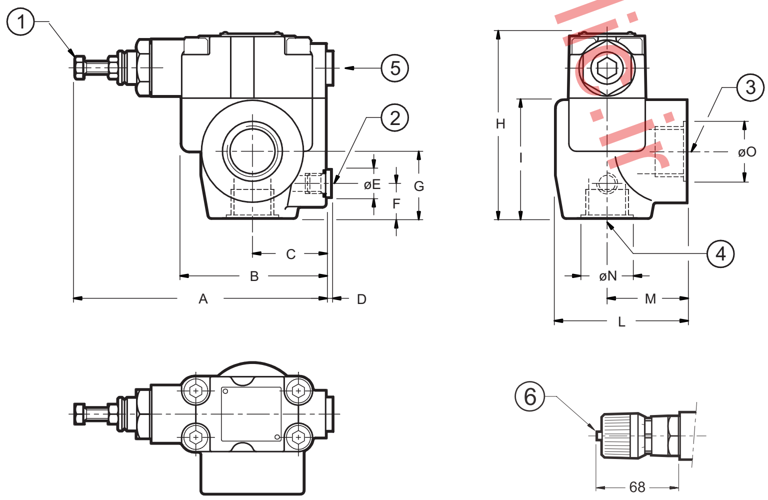




3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

1	Hexagonal head adjustment screw. Spanner 13. Clockwise rotation to increase pressure
2	Remote piloting port X: 1/4” BSP
3	Outlet port T **RQ5-W**: 1” BSP **RQ7-W**: 1” 1/2 BSP
4	Pressure port P **RQ5-W**: 3/4” BSP **RQ7-W**: 1” 1/4 BSP
5	Pressure gauge port 3/8” BSP
6	SICBLOC adjustment knob. To operate, push and rotate at the same time.

	A	B	C	D	ØE	F	G	H	I	L	M	ØN	ØO
RQ5-W	168	98	49	4	22	21.5	44.5	123	80	87	53	35.5	46
RQ7-W	168	98	49	4	22	43	59.5	145	102	109	68	50	56

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RQM*-W

SOLENOID OPERATED PRESSURE RELIEF VALVE WITH UNLOADING AND PRESSURE SELECTION

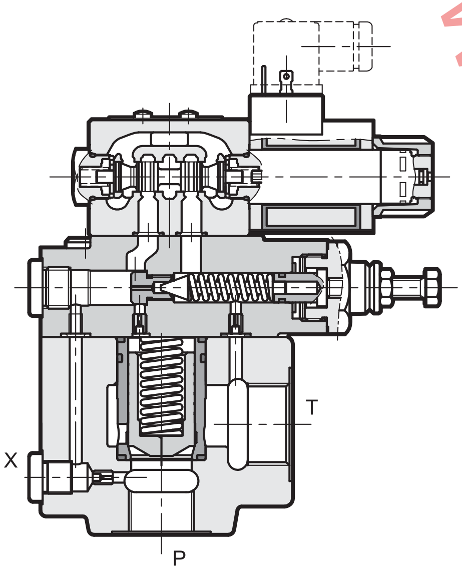
SERIES 60

THREADED PORTS

p max **350** bar

Q max (see table of performances)

OPERATING PRINCIPLE



— The RQM*-W valves are pilot operated pressure relief valves with BSP threaded ports, available in two nominal sizes for a flow rate up to 400 l/min.

— Available in five versions that allow, by means of a solenoid valve, unloading of the total flow and selection up to three pressure values (see table 2 for different versions).

— The adjustment of the second and third pressure value is obtained by a pressure relief valve placed between the main stage and the solenoid valve.

— They are normally supplied with a hexagonal head adjustment screw. Upon request, they can be equipped with a SICBLOC adjustment knob on the main pressure control.

PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

		RQM5-W	RQM7-W
Maximum operating pressure	bar	350	
Maximum flow rate	l/min	250	400
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	

NOTE: for the solenoid valve DS3 characteristics see catalogue 41 150

1 - IDENTIFICATION CODE

R	Q	M		-	W		/		/		/	60		-		K1	/	

Pressure relief valve pilot operated

solenoid valve for venting / pressure selection

Nominal dimension: **5** = ND 25
7 = ND 40

BSP threaded ports

Pressure adjustment range:
3 = up to 70 bar
5 = up to 210 bar
6 = up to 350 bar

Versions: **A**, **B**, **C**, **D**, **G** — see description in table 2 versions

M = adjustment with SICBLOC knob available on the main pressure control (omit for adjustment with hexagonal head screw)

Series No. (the overall and mounting dimensions remain unchanged from 60 to 69)

NOTE: The locking rings of the coils and the relevant O-Rings are supplied together with valves

Manual override: omit for override integrated in the tube (**standard**)
CM = manual override, boot protected

Coil electrical connection: plug for connector type DIN 43650 (**standard**)

DC power supply
D12 = 12 V
D24 = 24 V
D48 = 48 V
D110 = 110 V
D220 = 220 V
D00 = valve without coils (see **NOTE**)

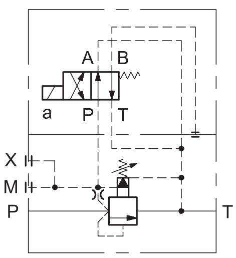
AC power supply
A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A110 = 110 V - 50 Hz / 120 V - 60 Hz
A230 = 230 V - 50 Hz / 240 V - 60 Hz
A00 = valve without coils (see **NOTE**)

F110 = 110 V - 60 Hz
F220 = 220 V - 60 Hz

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

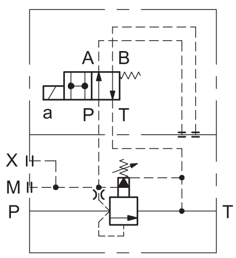
2 - VERSIONS

RQM*-W*/**A**



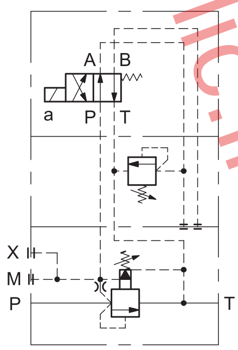
1 pressure setting and unloading with de-energized solenoid

RQM*-W*/**B**



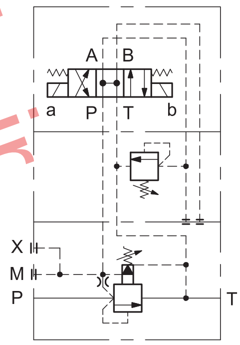
1 pressure setting and unloading with energized solenoid

RQM*-W*/**C**



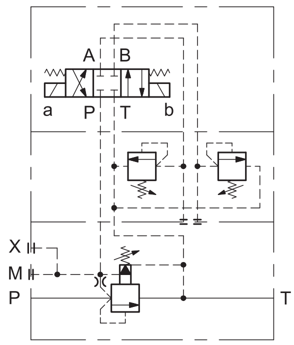
2 pressure settings The highest setting is reached with energized solenoid

RQM*-W*/**D**



2 pressure settings and unloading with de-energized solenoids

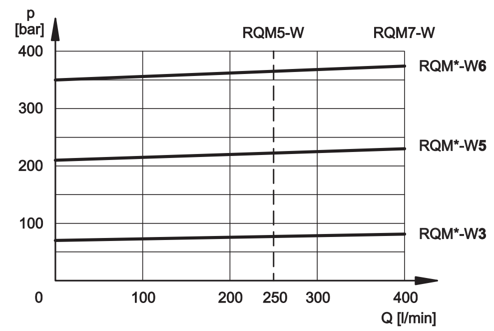
RQM*-W*/**G**



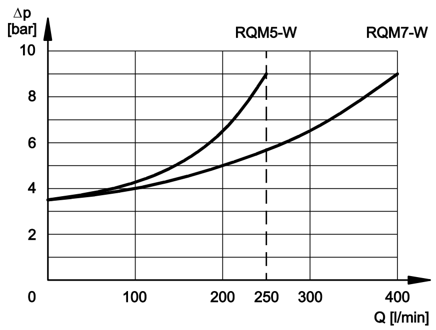
3 pressure settings The highest setting is reached with de-energized solenoids

3 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

ADJUSTMENT



MINIMUM CONTROLLED PRESSURE



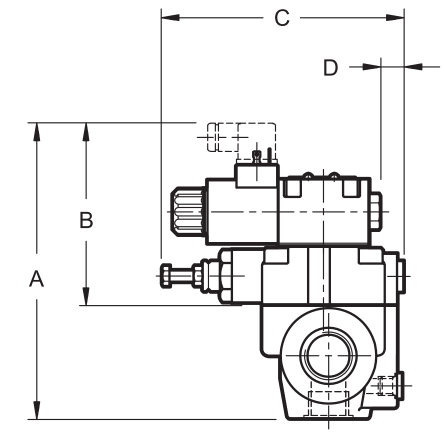
4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

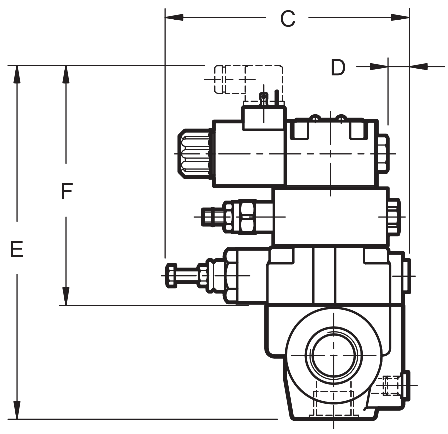
5 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

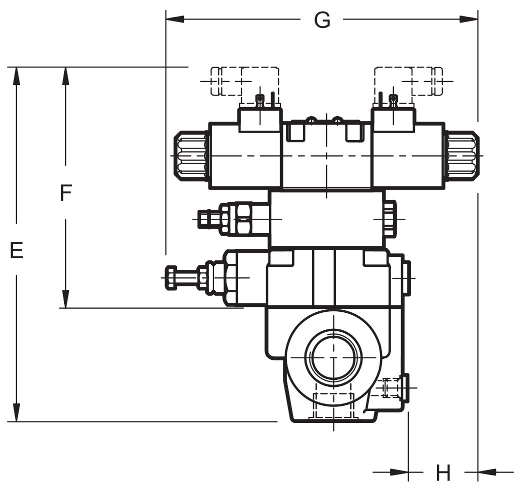
RQM*-W*/**A**
RQM*-W*/**B**



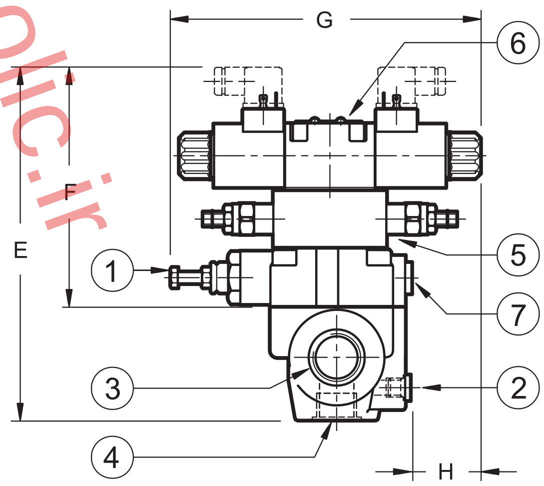
RQM*-W*/**C**



RQM*-W*/**D**



RQM*-W*/**G**



	A	B	C	D	E	F	G	H
RQM5-W	210	130	172	17	247	167	221.5	49.5
RQM7-W	232	130	172	17	269	167	221.5	49.5

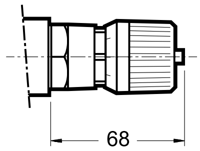
1	Hexagonal head main pressure adjustment screw: Spanner 13 Clockwise rotation to increase pressure
2	Remote piloting port X 1/4” BSP
3	Outlet port T **RQM5-W**: 1” BSP **RQM7-W**: 1” 1/2 BSP
4	Pressure port P **RQM5-W**: 3/4” BSP **RQM7-W**: 1” 1/4 BSP

5	Second value pressure adjustment valve. Countersunk hex adjustment screw: spanner 5 Clockwise rotation to increase pressure
6	ISO 4401-03 (CETOP 03) solenoid valve for pressure selection / unloading
7	Pressure gauge port 3/8” BSP

6 - ADJUSTMENT KNOB

The RQ valves can be equipped with a SICBLOC adjustment knob, only on the main pressure regulation. To operate it, push and rotate at the same time.

To request this option, add: /**M** (see paragraph 1).



7 - ELECTRIC CONNECTORS

The solenoid operated valves are delivered without the connectors. They must be ordered separately.
For the identification of the connector type to be ordered, please see catalogue 49 000.

8 - MANUAL OVERRIDE, BOOT PROTECTED: CM

Whenever the solenoid valve installation may involve exposure to atmospheric agents or utilization in tropical climates, use of the manual override, boot protected, is recommended. Add the suffix **CM** to request this device (see paragraph1).

For overall dimensions see catalogue 41 150.

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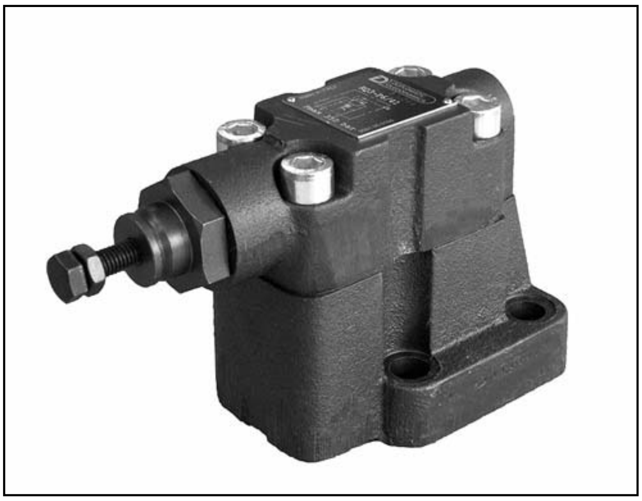


RQ*-P

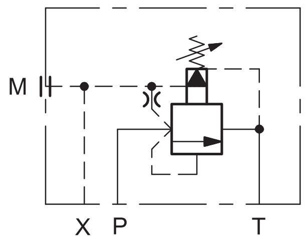
PRESSURE RELIEF VALVES

SERIES 41

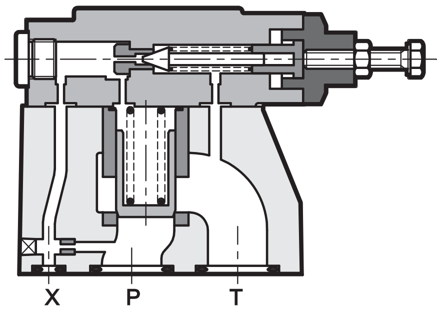
SUBPLATE MOUNTING

RQ3-P ISO 6264-06 (CETOP R06)
RQ5-P ISO 6264-08 (CETOP R08)
RQ7-P ISO 6264-10 (CETOP R10)

HYDRAULIC SYMBOL



OPERATING PRINCIPLE



— Pilot operated pressure relief valve; main stage with shutter and cone seal.

— Subplate mounting in accordance with ISO 6264 (CETOP RP 121H) standards.

— Possibility of remote piloting using port X (see Hydraulic symbol table).

— The RQ*-P valves allow use of the entire flow of the pump even with pressure values near the set value.

— The wide passages allow reduced pressure drops, improving the energy efficiency of the plant.

PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

		RQ3-P	RQ5-P	RQ7-P
Maximum operating pressure	bar	350		
Maximum flow rate	l/min	200	400	500
Ambient temperature range	°C	-20 / +50		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15			
Recommended viscosity	cSt	25		
Mass	kg	3,5	4,3	6,5

1 - IDENTIFICATION CODE

R	Q		-	P		/		/	41	/	

Double stage pressure relief valve

Size: **3** = ISO 6264-06 (CETOP R06)
5 = ISO 6264-08 (CETOP R08)
7 = ISO 6264-10 (CETOP R10)

Subplate mounting

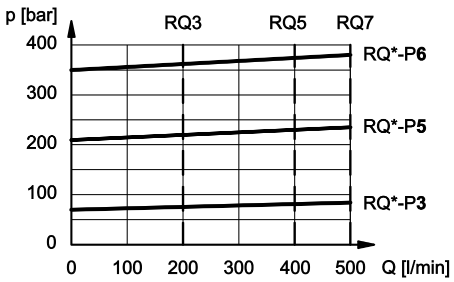
Pressure adjustment range:
3 = up to 70 bar **6** = up to 350 bar
5 = up to 210 bar

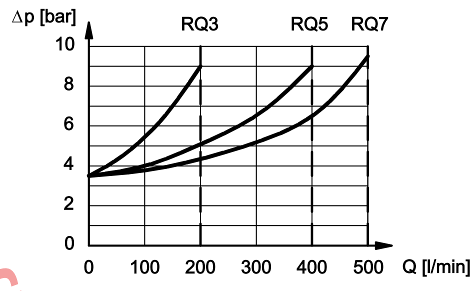
Seals: omit for mineral oils
V = viton for special fluids

Series No.
(the overall and mounting dimensions remain unchanged from 40 to 49)

M = adjustment with SICBLOC knob
(omit for adjustment with hexagonal head screw)

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



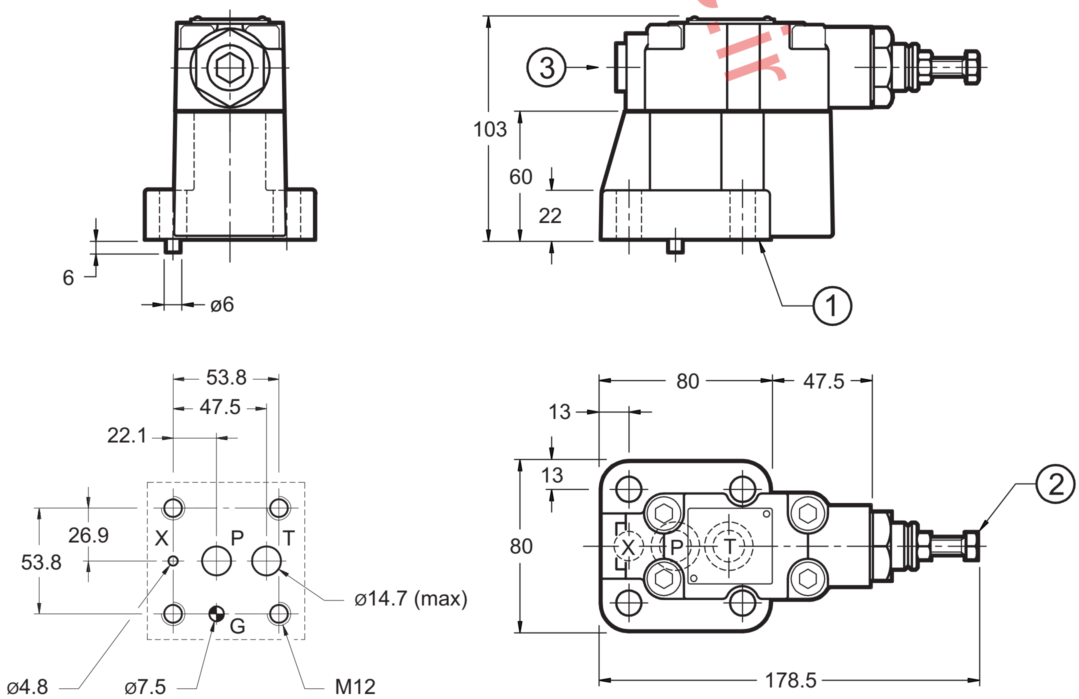


3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - RQ3-P OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

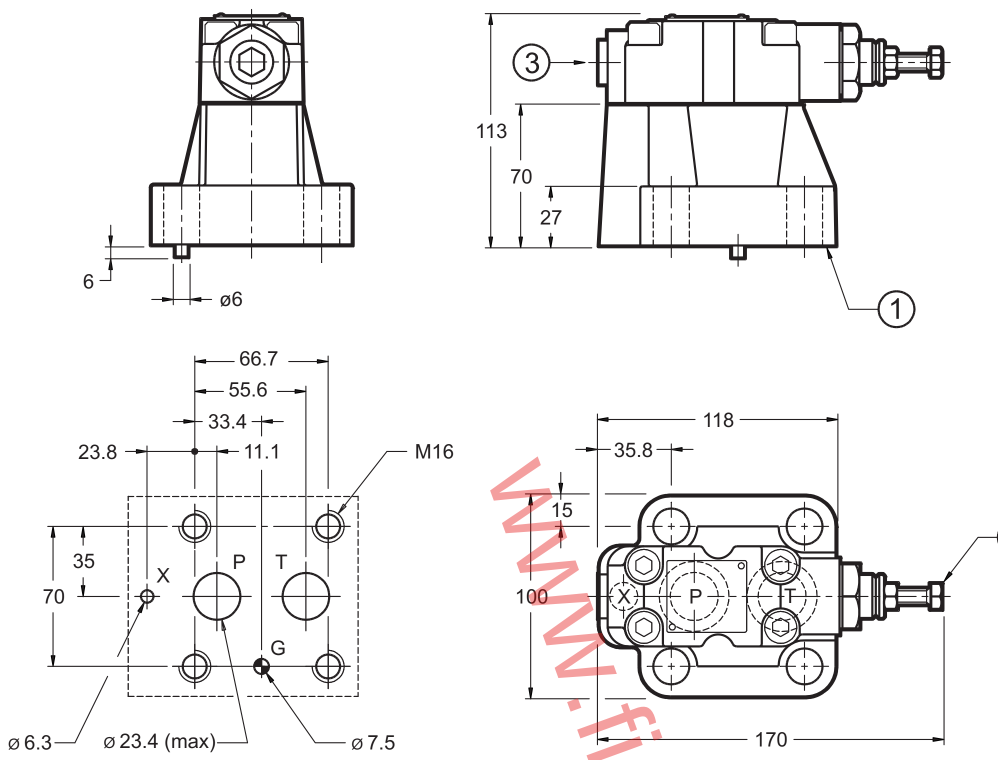
1	Mounting surface with sealing rings: 2 OR type 123 (17.86x2.62) 90 Shore 1 OR type 109 (9.13x2.62) 90 Shore
2	Hexagonal head adjustment screw. Spanner 13. Clockwise rotation to increase pressure.
3	Pressure gauge port Y 3/8” BSP

FASTENING BOLTS:
4 SHC bolts M12x40
Tightening torque: 69 Nm

MOUNTING SURFACE: ISO 6264-06-09-*-97 (CETOP 4.4.2-2-R06-350)

5 - RQ5-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



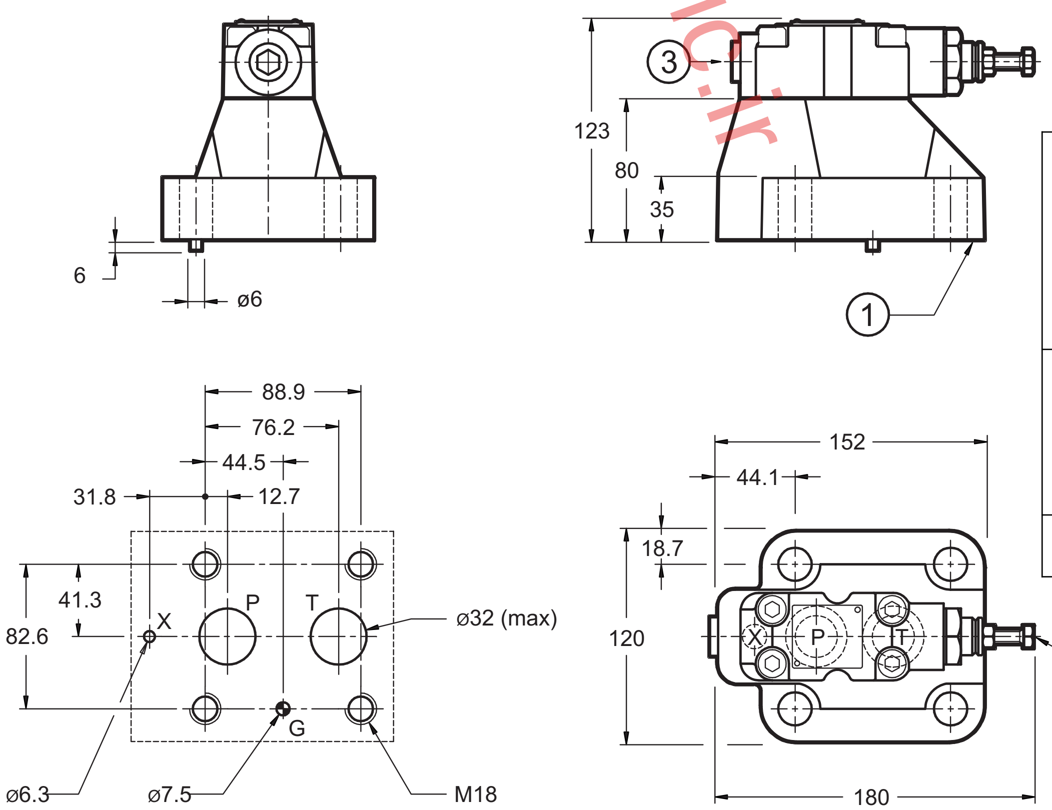
1	Mounting surface with sealing rings: N. 2 OR 3118 (29.82x2.62) 90 Shore N. 1 OR 109 (9.13x2.62) 90 Shore
2	Hexagonal head adjustment screw. Spanner 13. Clockwise rotation to increase pressure.
3	Pressure gauge port 3/8" BSP

FASTENING BOLTS:
4 SHC bolts M16x50
Tightening torque 170 Nm

MOUNTING SURFACE: ISO 6264-08-13-*-97 (CETOP 4.4.2-2-R08-350)

6 - RQ7-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: N. 2 OR 4137 (34.52x3.53) 90 Shore N. 1 OR 109 (9.13x2.62) 90 Shore
2	Hexagonal head adjustment screw. Spanner 13. Clockwise rotation to increase pressure.
3	Pressure gauge port 3/8" BSP

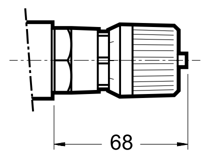
FASTENING BOLTS:
4 SHC bolts M18x60
Tightening torque: 235 Nm

MOUNTING SURFACE: ISO 6264-10-17-*-97 (CETOP 4.4.2-2-R10-350)

7 - ADJUSTMENT KNOB

The RQ valves can be equipped with a SICBLOC adjustment knob. To operate it, push and rotate at the same time.

To request this option, add: **/M** (see paragraph 1).



8 - SUBPLATES (see catalogue 51 000)

	RQ3-P	RQ5-P	RQ7-P
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports
P, T ports dimension	P: 1/2" BSP T: 3/4" BSP	1" BSP	1" 1/4 BSP
X port dimension	1/4" BSP	1/4" BSP	1/4" BSP

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DUPLOMATIC OLEODINAMICA

RQM*-P

SOLENOID OPERATED PRESSURE RELIEF VALVES WITH UNLOADING AND PRESSURE SELECTION

SERIES 60

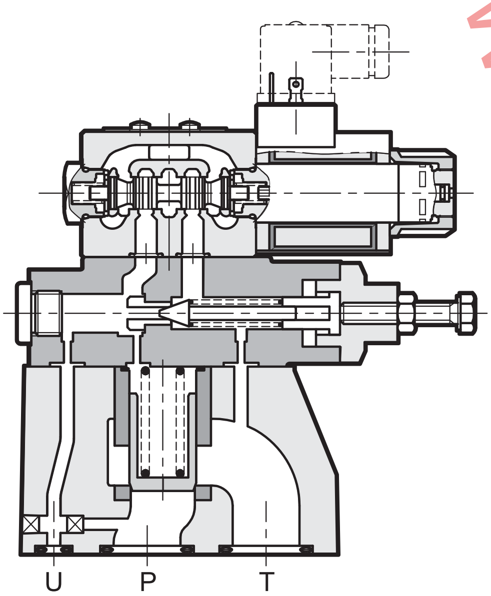
SUBPLATE MOUNTING

RQM3-P ISO 6264-06 (CETOP R06)

RQM5-P ISO 6264-08 (CETOP R08)

RQM7-P ISO 6264-10 (CETOP R10)

OPERATING PRINCIPLE



— The RQM*-P valves are pressure relief valves available in three nominal sizes for flow up to 500 l/min.

— They are available in ISO 6264 (CETOP RP 121H) subplate mounting version.

— Available in five versions that allow, by means of a solenoid valve, unloading of the total flow and selection up to three pressure values (see table 2 Versions).

— The adjustment of the second and third pressure values is obtained by a pressure relief valve placed between the main stage and the solenoid valve.

— It is supplied with an hexagonal head adjustment screw. Upon request, it can be equipped with a SICBLOC adjustment knob on the main pressure control.

PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

		RQM3-P	RQM5-P	RQM7-P
Maximum operating pressure	bar	350		
Maximum flow rate	l/min	200	400	500
Ambient temperature range	°C	-20 / +50		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15			
Recommended viscosity	cSt	25		

NOTE: for the solenoid valve DS3 characteristics see catalogue 41 150

1 - IDENTIFICATION CODE

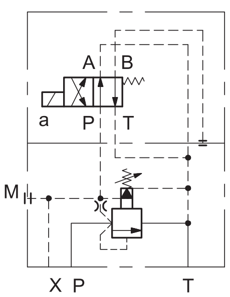
R	Q	M		-	P		/		/		/ 60		-		K1	/	

- **RQ**: pilot operated pressure relief valve
- **M**: solenoid valve for unloading / pressure selection
- Size: **3** = ISO 6264-06 (CETOP R06); **5** = ISO 6264-08 (CETOP R08); **7** = ISO 6264-10 (CETOP R10)
- **P**: Subplate mounting
- Pressure adjustment range: **3** = up to 70 bar; **5** = up to 210 bar; **6** = up to 350 bar
- Versions: **A**, **B**, **C**, **D**, **G** – see description in hydraulic symbols table
- **M** = adjustment with SICBLOC knob available only on the main pressure control (Omit for adjustment with hexagonal head screw)
- Series No. (the overall and mounting dimensions remain unchanged from 60 to 69)
- Seals: **N** = NBR seals for mineral oil (**standard**); **V** = FPM seals for special fluids
- DC power supply:
  - **D12** = 12 V
  - **D24** = 24 V
  - **D48** = 48 V
  - **D110** = 110 V
  - **D220** = 220 V
  - **D00** = valve without coils (see note)
- AC power supply:
  - **A24** = 24 V - 50 Hz
  - **A48** = 48 V - 50 Hz
  - **A110** = 110 V - 50 Hz / 120 V - 60 Hz
  - **A230** = 230 V - 50 Hz / 240 V - 60 Hz
  - **A00** = valve without coils (see note)
  - **F110** = 110 V - 60 Hz
  - **F220** = 220 V - 60 Hz
- **K1**: Coil electrical connection: plug for connector type DIN 43650 (**standard**)
- Manual override: omit for override integrated in the tube (**standard**); **CM** = manual override, boot protected

NOTE: The locking rings of the coils and the relevant O-Rings are supplied together with valves

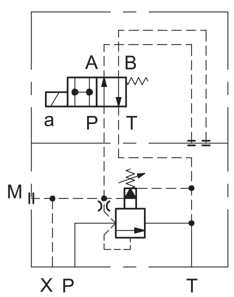
2 - VERSIONS

RQM*-P*/**A**



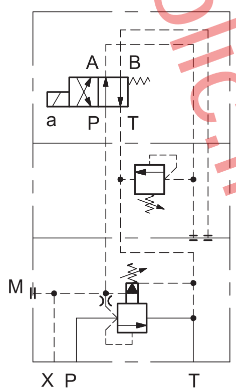
1 pressure setting and unloading with de-energized solenoid

RQM*-P*/**B**



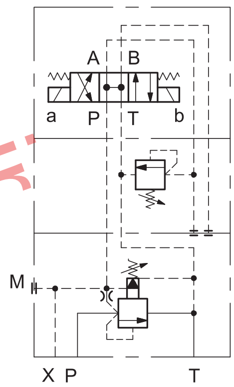
1 pressure setting and unloading with energized solenoid

RQM*-P*/**C**



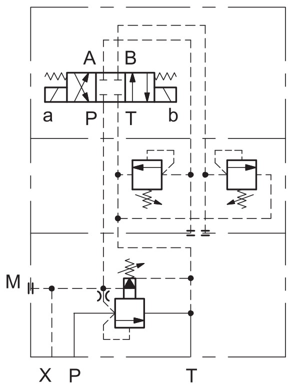
2 pressure settings The highest setting is reached with energized solenoid

RQM*-P*/**D**



2 pressure settings and unloading with de-energized solenoids

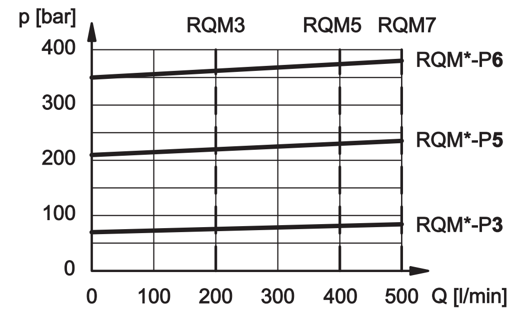
RQM*-P*/**G**



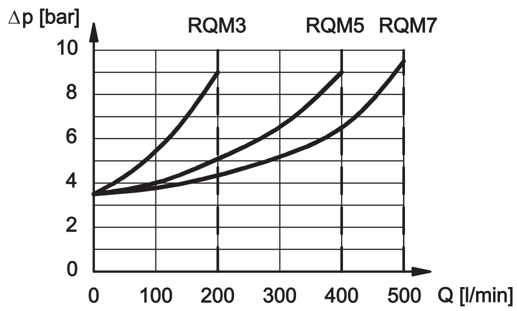
3 pressure settings The highest setting is reached with de-energized solenoids

3 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

ADJUSTMENT



MINIMUM CONTROLLED PRESSURE

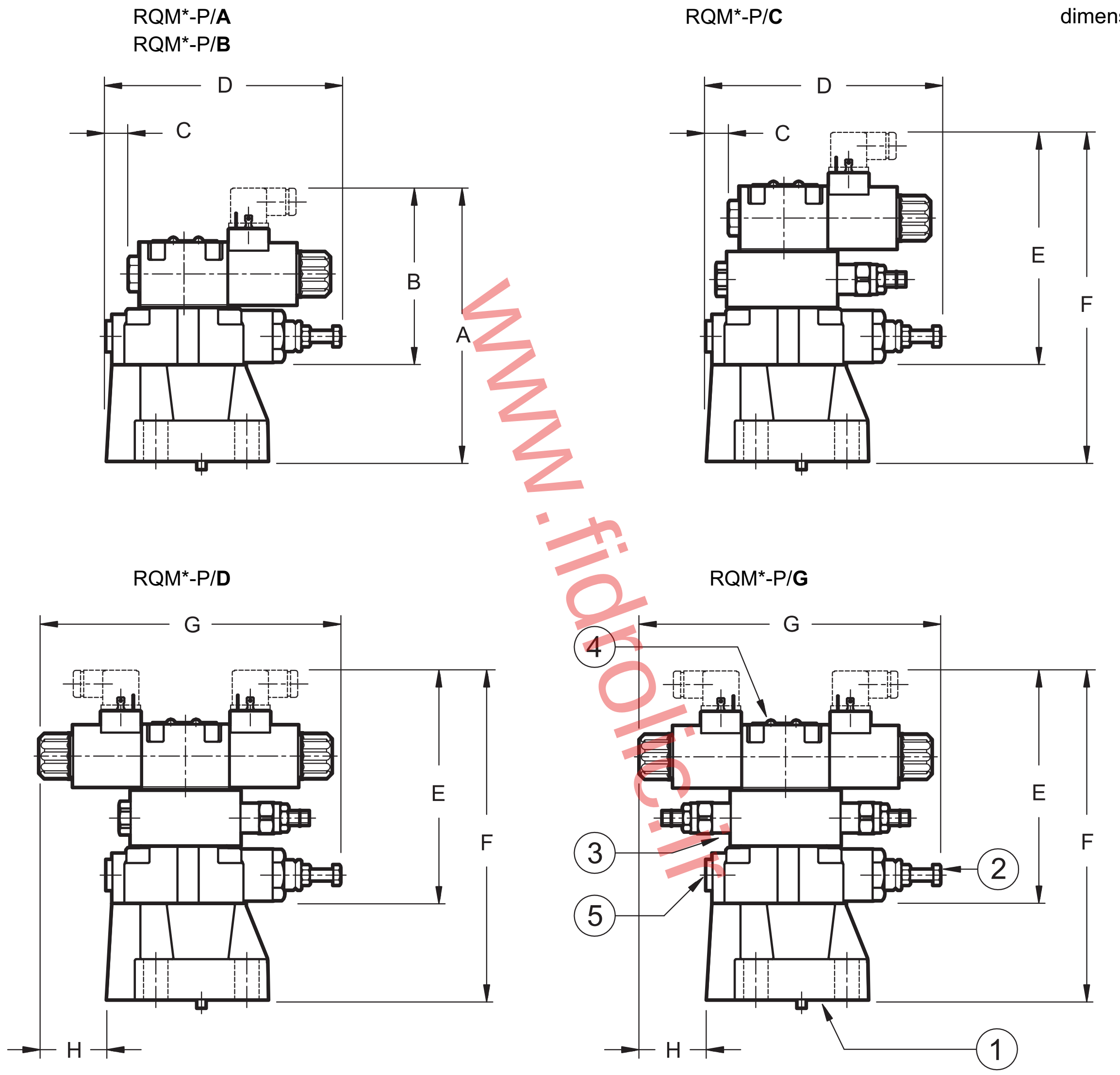


4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

5 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

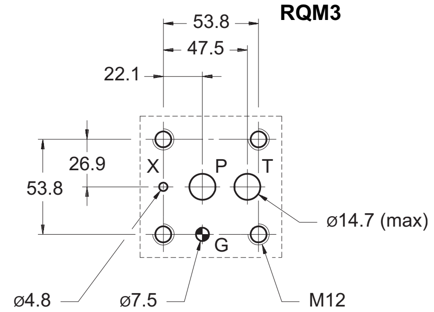


1	Mounting surface For fastening bolts and sealing rings see paragraph 10
2	Hexagonal head main pressure adjustment screw: Spanner 13 Clockwise rotation to increase pressure
3	Second value pressure adjustment valve. Countersunk hex adjustment screw: Spanner 5 Clockwise rotation to increase pressure

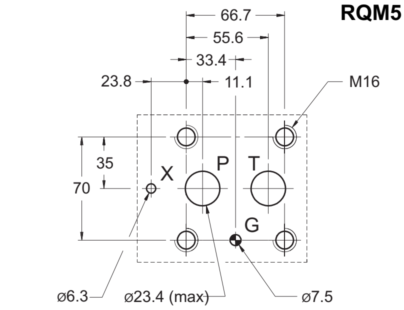
4	ISO 4401-03 (CETOP 03) solenoid valve for pressure selection / unloading
5	Pressure gauge port 3/8" BSP

	A	B	C	D	E	F	G	H
RQM3-P	186	126	22	179	164	226	223	44
RQM5-P	196	126	14	170	164	236	222	52
RQM7-P	206	126	25	180	164	246	221	41

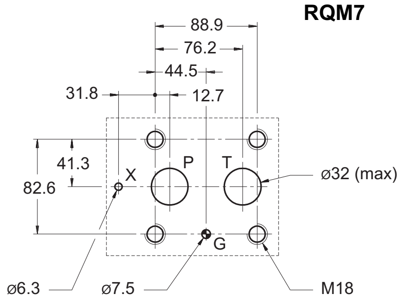
6 - MOUNTING SURFACES



ISO 6264-06-09-*-97 (CETOP 4.4.2-2-R06-350)



ISO 6264-08-13-*-97 (CETOP 4.4.2-2-R08-350)

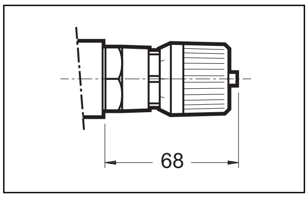


ISO 6264-10-17-*-97 (CETOP 4.4.2-2-R10-350)

7 - ADJUSTMENT KNOB

The valves can be equipped with a SICBLOC adjustment knob, only on the main pressure regulation. To operate it, push and rotate at the same time.

To request this option, add: **/M** (see paragraph 1).



8 - ELECTRIC CONNECTORS

The solenoid valves are never supplied with connector. Connectors must be ordered separately. For the identification of the connector type to be ordered, please see catalogue 49 000.

9 - MANUAL OVERRIDE, BOOT PROTECTED: CM

Whenever the solenoid valve installation may involve exposure to atmospheric agents or utilization in tropical climates, use of the manual override boot protected is recommended.

Add the suffix **CM** to request this device (see paragraph 1). For overall dimensions see catalogue 41 150.

10 - FASTENING BOLTS AND SEALING RINGS

	RQM3-P	RQM5-P	RQM7-P
Fastening (4 SHC bolts ISO 4762)	M12 x 40	M16 x 50	M18 x 60
Torque	69 Nm	170 Nm	235 Nm
Sealing rings	N. 2 OR type 123 (17.86x2.62) 90 Shore N. 1 OR type 109 (9.13x2.62) 90 Shore	N. 2 OR type 3118 (29.82x2.62) 90 Shore N. 1 OR type 109 (9.13x2.62) 90 Shore	N. 2 OR type 4137 (34.52x3.53) 90 Shore N. 1 OR type 109 (9.13x2.62) 90 Shore

11 - SUBPLATES (see catalogue 51 000)

	RQM3-P	RQM5-P	RQR7-P
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports
P, T, U ports dimension	P: 1/2” BSP T: 3/4” BSP	1” BSP	1” 1/4 BSP
X port dimension	1/4” BSP	1/4” BSP	1/4” BSP

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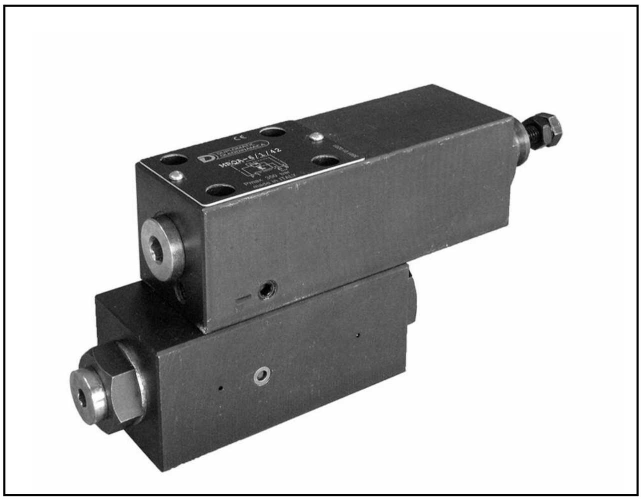


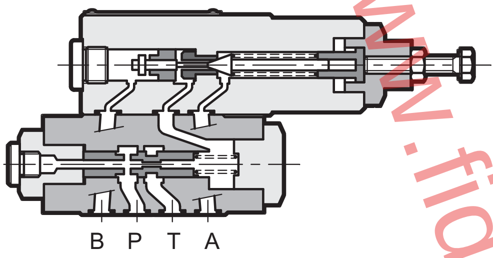
MRQA

UNLOADING VALVE
(FOR CIRCUITS WITH ACCUMULATOR)
SERIES 42

SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

p max **350** bar
Q max **40** l/min

OPERATING PRINCIPLE



— MRQA is a pressure relief and safety valve with automatic unloading. Upon reaching the set value, the valve freely unloads the pump and puts it under pressure again when the pressure values descend in the circuit to correspond to 63% or 75% of the set value.

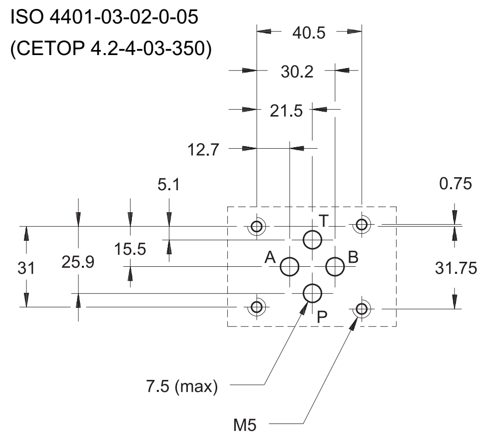
In order to assure this operation, it is necessary to use an accumulator (see hydraulic diagram) that guarantees pressure maintenance in the circuit. A check valve, incorporated in the panel or available as a plate under the valve MRQA/C, prevents the accumulator unloading through the open valve.

This system maintains the pressure in the hydraulic circuit, avoiding heating of the oil and reducing energy consumption.

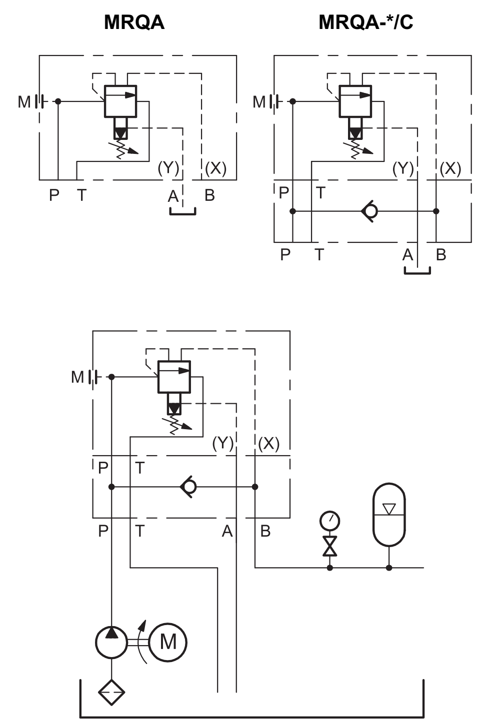
It is recommended to place the accumulator as close as possible to the MRQA, without reducing the connection size.

— The cycle time depends on the pump flow rate, the accumulator capacity and pre-charge, and the flow requirement of the system.

MOUNTING SURFACE



HYDRAULIC SYMBOLS & DIAGRAM



PERFORMANCE RATINGS (measured with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	40
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 21/19/16	
Recommended viscosity	cSt	25
Mass: MRQA MRQA*/C	kg	3,3 4,2

1 - IDENTIFICATION CODE

M	R	Q	A	-		/		/		/		/	42	/	

Size ISO 4401-03 (CETOP 03)

Unloading valve

Automatic unloading for circuits with accumulator

Pressure adjustment range:
3 = 25 ÷ 70 bar
5 = 50 ÷ 210 bar
6 = 100 ÷ 280 bar

Differential pressure (values ± 2.5%)
1 = pump switch on at 75% of adjustment value
2 = pump switch on at 63% of adjustment value

M = Adjustment with SICBLOC knob (omit for adjustment with hexagonal head screw)

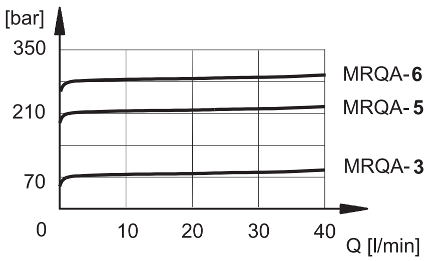
C = Check valve (omit if not required)

Series No. (the overall and mounting dimensions remain unchanged from 40 to 49)

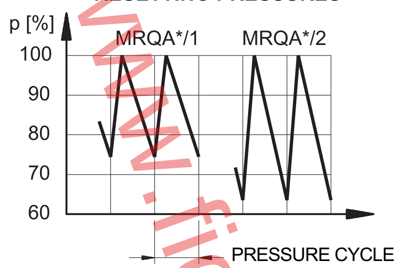
Seals: omit for mineral oils
V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

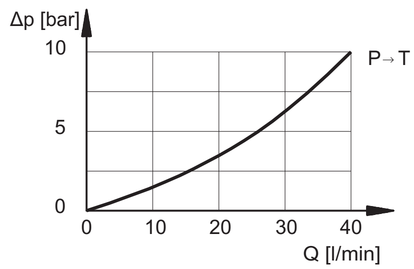
ADJUSTMENT



RESETTING PRESSURES



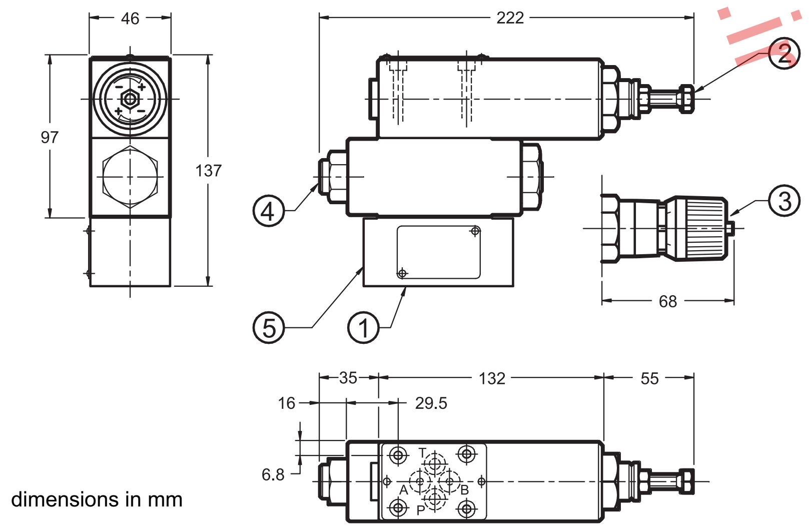
PRESSURE DROPS Δp-Q



3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

FASTENING SCREWS:
MRQA
4 SHC screws ISO 4762 M5x95
MRQA/C
4 SHC screws ISO 4762 M5x135
Tightening torque: 5 Nm

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Hexagonal head adjustment screw. Spanner 13. Clockwise rotation to increase pressure
3	SICBLOC adjustment knob. To operate, push and rotate at the same time.
4	Pressure gauge port 1/4” BSP
5	Check valve for version /C

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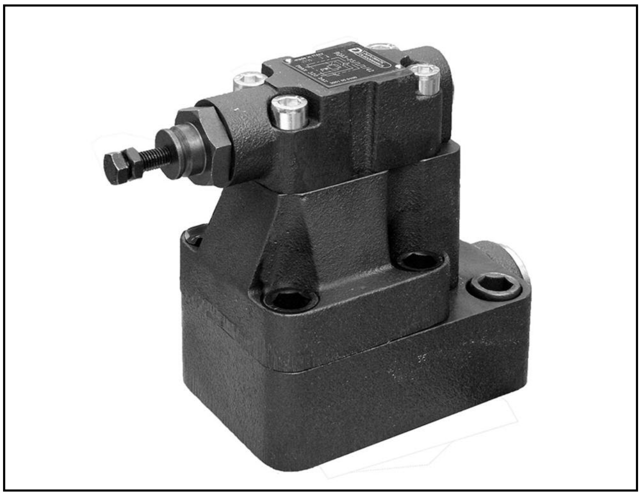


RQ**-P
UNLOADING VALVE
(FOR CIRCUITS WITH ACCUMULATOR)
SERIES 42

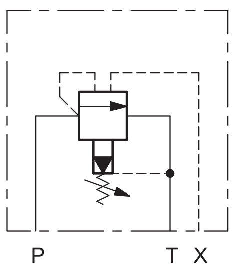
RQR*-P
FOR REMOTE PILOTING

RQA*-P
WITH INCORPORATED CHECK VALVE

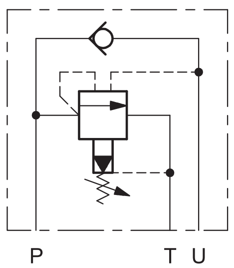
SUBPLATE MOUNTING

HYDRAULIC SYMBOLS

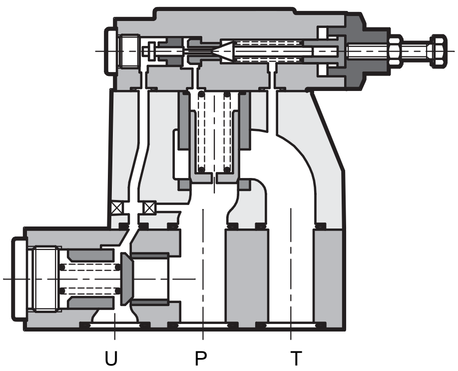
RQR*/I



RQA*/I



OPERATING PRINCIPLE



— The RQR*-P and RQR*-A valves have not only the normal function of relief valves or safety valves but also the characteristic of freely discharging the pump flow when the set pressure value is reached.

In order to assure this condition, the use of an accumulator that guarantees pressure in the circuit is required. The use of a check valve prevents the accumulator from discharging through the valve in the open position.

— Those valves are made with a balanced shutter main stage that has wide passages for big flows and reduced pressure drops.

PERFORMANCES
(measured with mineral oil of viscosity 36 cSt at 50°C)

		RQR3-P	RQR5-P	RQR7-P	RQA5-P	RQA7-P
Maximum operating pressure	bar	350				
Maximum flow rate	l/min	200	400	500	400	500
Ambient temperature range	°C	-20 / +50				
Fluid temperature range	°C	-20 / +80				
Fluid viscosity range	cSt	10 ÷ 400				
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15					
Recommended viscosity	cSt	25				
Mass	Kg	3,5	4,3	6,5	10	17

1 - IDENTIFICATION CODE

R	Q			-	P		/		/	I	/		/	42	/	

Unloading valve

Automated unloading for circuits with accumulator
R = for remote piloting
A = with incorporated check valve (size 3 excluded)

Size:
3 = RQR3-P ISO 6264-06-09-*-97 (CETOP R06)
5 = RQR5-P ISO 6264-08-13-*-97 (CETOP R08)
5 = RQA5-P
7 = RQR7-P ISO 6264-10-07-*-97 (CETOP R10)
7 = RQA7-P

Subplate mounting

Pressure adjustment range:
3 = up to 70 bar
5 = up to 210 bar
6 = up to 280 bar

Differential pressure (values ±2.5%)
1 = pump switch on at 75% of the set value
2 = pump switch on at 63% of the set value

Internal drainage

M = adjustment with SICBLOC knob (omit for adjustment with hexagonal head screw)

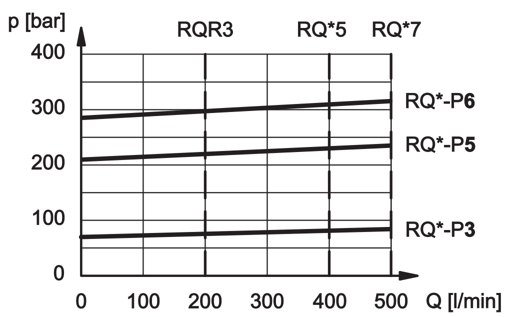
Series No. (the overall and mounting dimensions remain unchanged from 40 to 49)

Seals: omit for mineral oils
V = viton for special fluids

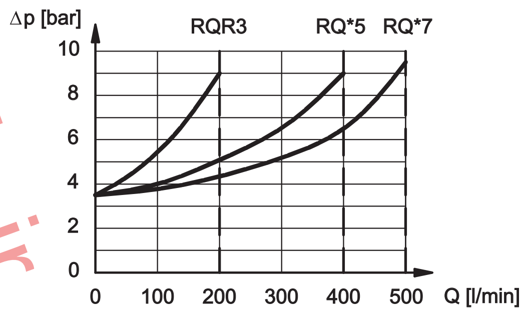
2 - CHARACTERISTIC CURVES

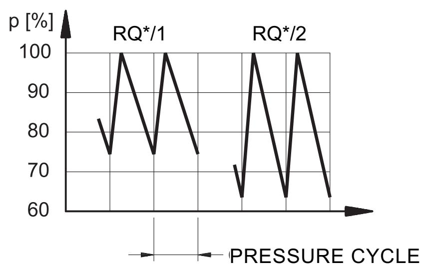
(values obtained with viscosity of 36 cSt at 50°C)

ADJUSTMENT



MINIMUM CONTROLLED PRESSURE





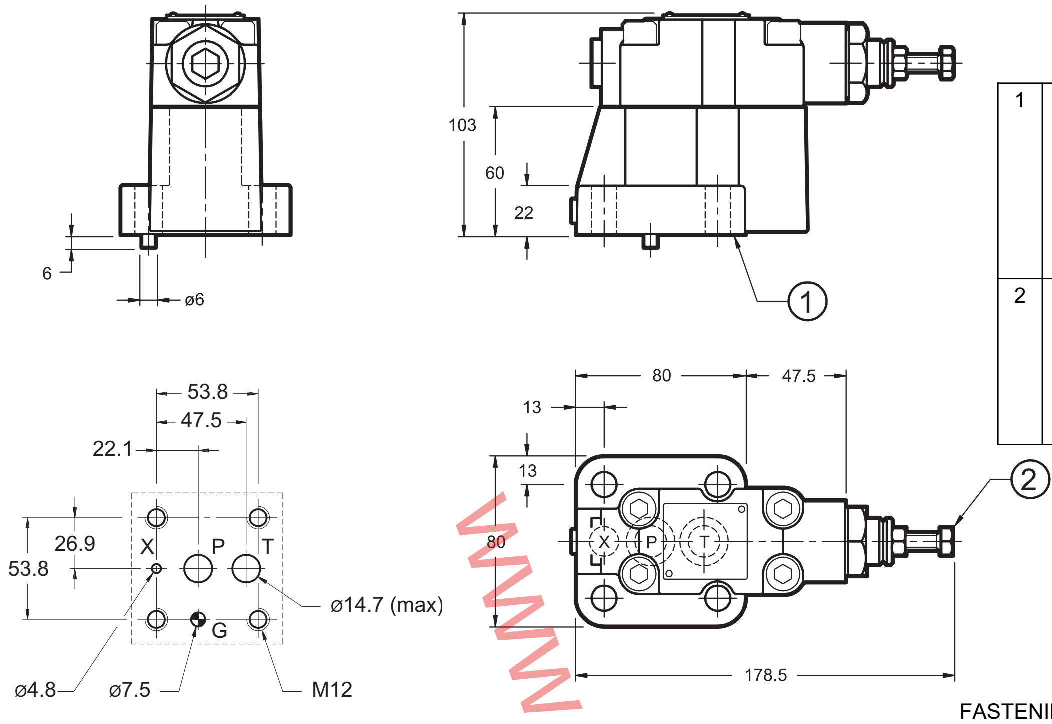
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - RQR3-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



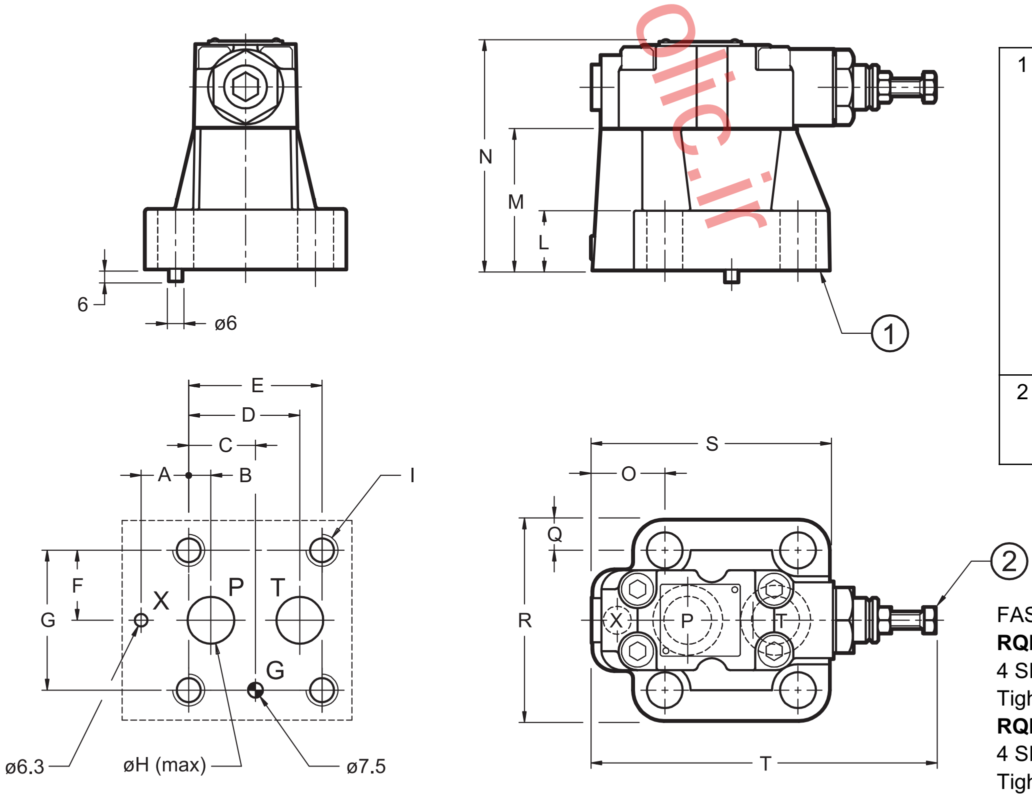
1	Mounting surface with sealing rings: N. 2 OR type 123 (17.86x2.62) N. 1 OR type 109 (9.13x2.62) 90 Shore
2	Hexagonal head adjustment screw. Spanner 13. Clockwise rotation to increase pressure.

MOUNTING SURFACE: ISO 6264-06-09-*-97 (CETOP 4.4.2-2-R06-350)

FASTENING BOLTS (included):
4 SHC bolts ISO 4762 M12x40
Tightening torque: 69 Nm

5 - RQR5-P AND RQR7-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



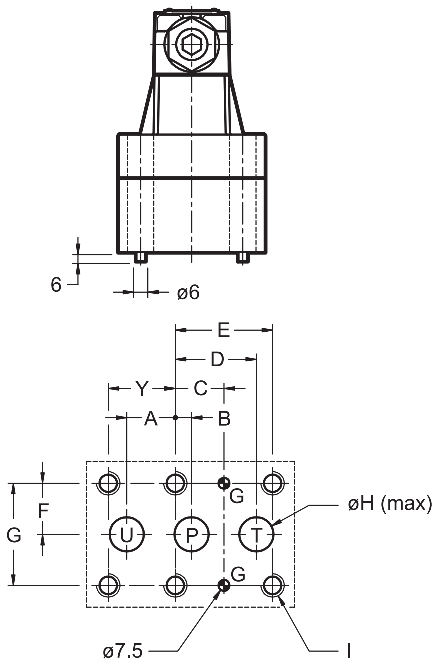
1	Mounting surface with sealing rings: **RQR5** N. 2 OR type 3118 (29.82x2.62) N. 1 OR type 109 (9.13x2.62) - 90 Shore **RQR7** N. 2 OR type 4137 (34.52x3.53) N. 1 OR type 109 (9.13x2.62) - 90 Shore
2	Hexagonal head adjustment screw. Spanner 13.

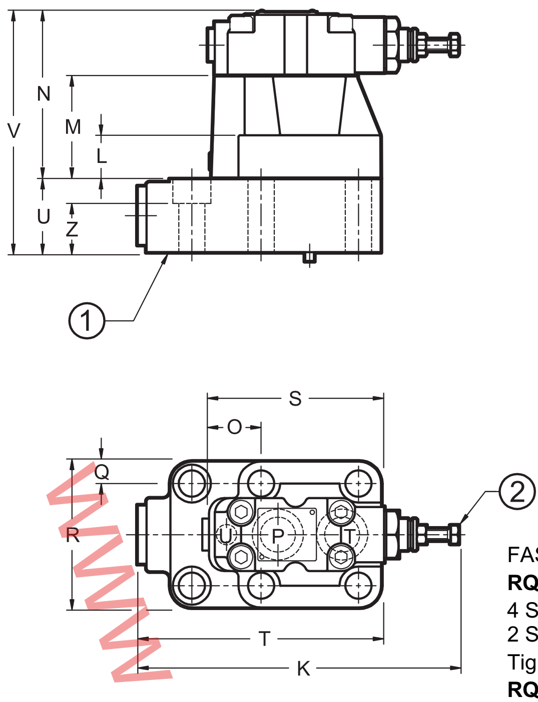
FASTENING BOLTS (included):
RQR5
4 SHC bolts ISO 4762 M16x50
Tightening torque: 170 Nm
RQR7
4 SHC bolts ISO 4762 M18x60
Tightening torque: 235 Nm

	MOUNTING SURFACE	A	B	C	D	E	F	G	ØH	I	L	M	N	O	Q	R	S	T
RQR5-P	ISO 6264-08-13-*-97 (CETOP 4.4.2-2-R08-350)	23.8	11.1	33.4	55.6	66.7	35	70	23.4	M16	27	70	113	35.8	15	100	118	170
RQR7-P	ISO 6264-10-17-*-97 (CETOP 4.4.2-2-R10-350)	31.8	12.7	44.5	76.2	88.9	41.3	82.6	32	M18	35	80	123	44.1	18.7	120	152	180

6 - RQA5-P AND RQA7P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm





1	Mounting surface with sealing rings: **RQA5** N. 3 OR type 3118 (29.82x2.62) 90 Shore **RQR7** N. 2 OR type 4137 (34.52x3.53) 90 Shore
2	Hexagonal head adjustment screw. Spanner 13.

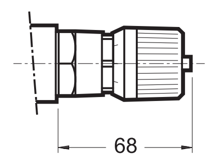
FASTENING BOLTS (included):
RQA5
4 SHC bolts ISO 4762 M16x100
2 SHC bolts ISO 4762 M16x55
Tightening torque:170 Nm
RQA7
4 SHC bolts ISO 4762 M18x130
2 SHC bolts ISO 4762 M18x70
Tightening torque: 235 Nm

	A	B	C	D	E	F	G	ØH	I	K	L	M	N	O	Q	R	S	T	U	V	Y	Z
RQA5-P	33.3	11.1	33.4	55.6	66.7	35	70	23.4	M16	213	27	70	113	35.8	15	100	118	167	50	163	46	33.5
RQA7-P	38	12.7	44.5	76.2	88.9	41.3	82.6	32	M18	245	35	80	123	44.1	18.7	120	152	222	66	189	50.8	48

7 - ADJUSTMENT KNOB

The valves can be equipped with a SICBLOC adjustment knob. To operate it, push and rotate at the same time.

To request this option, add **M** (see paragraph 1) in the proper square.



8 - SUBPLATES

(see catalogue 51 000)

	RQR3-P	RQR5-P	RQR7-P	RQA5-P	RQA7-P
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports	PMRQA5-AI5G rear ports	PMRQA7-AI7G rear ports
P, T, U ports dimensions	P: 1/2” BSP T: 3/4” BSP	1” BSP	1” 1/4 BSP	3/4” BSP	1” 1/4 BSP
X port dimension	1/4” BSP	1/4” BSP	1/4” BSP	-	-

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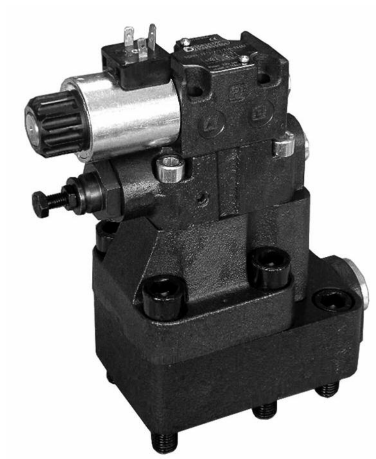
DUPLOMATIC OLEODINAMICA



RQ*M*-P

UNLOADING VALVE WITH AUTOMATIC OR SOLENOID OPERATED VENTING

(FOR CIRCUITS WITH ACCUMULATOR)

SERIES 51

RQRM*-P

FOR REMOTE PILOTING

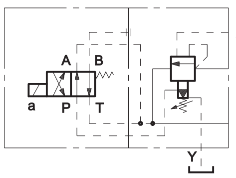
RQAM*-P

WITH INCORPORATED CHECK VALVE

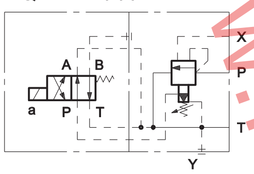
SUBPLATE MOUNTING

HYDRAULIC SYMBOLS

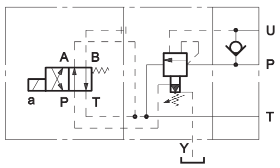
RQRM*-P*/*/A



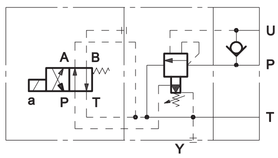
RQRM*-P*/*/I/A



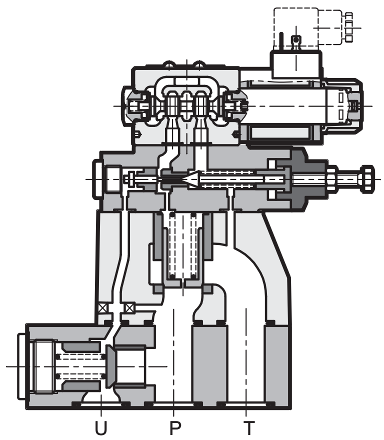
RQAM*-P*/*/A



RQAM*-P*/*/I/A



OPERATING PRINCIPLE



— The RQ*M*-P valves have not only the normal function of relief valves or safety valves but also the characteristic of freely discharging the pump flow either when the set pressure value is reached, or when the solenoid valve is de-energized. In order to assure this condition, the use of an accumulator that guarantees pressure in the circuit is required. The use of a check valve prevents the accumulator from discharging through the valve in the open position.

— They are made with a balanced shutter main stage that has wide passages for large flows, with reduced pressure drops.

PERFORMANCES

(measured with mineral oil of viscosity 36 cSt at 50°C)

		RQRM3-P	RQRM5-P	RQRM7-P	RQAM5-P	RQAM7-P
Maximum operating pressure	bar	350				
Maximum flow rate	l/min	200	400	500	400	500
Ambient temperature range	°C	-20 / +50				
Fluid temperature range	°C	-20 / +80				
Fluid viscosity range	cSt	10 ÷ 400				
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15					
Recommended viscosity	cSt	25				
Mass	Kg	5	5,8	8	12	19

NOTE: for the solenoid valve DS3 characteristics see catalogue 41 150

1 - IDENTIFICATION CODE

R	Q		M		- P		/		/ A	/		/		/ 51		-		K1	/	

Unloading valve

Automatic venting for circuits with accumulator

R = for remote piloting
A = with embedded check valve (unavailable on size 3)

Solenoid valve for electrical unloading

Size:
3 = (RQRM3-P) ISO 6264-06-09-*-97 (CETOP R06)
5 = (RQRM5-P) ISO 6264-08-13-*-97 (CETOP R08)
5 = (RQAM5-P)
7 = (RQRM7-P) ISO 6264-10-17-*-97 (CETOP R10)
7 = (RQAM7-P)

Subplate mounting

Pressure adjustment range:
3 = up to 70 bar **6** = up to 280 bar
5 = up to 210 bar

Differential pressure (values ± 2.5%)
1 = pump switch on at 75% of the set value
2 = pump switch on at 63% of the set value

Unloading with de-energized solenoid

I = internal drainage (not possible when the backpressure on the return line is greater than 2 bar). Omit for external drainage.

CM = manual override, boot protected.
Omit for override integrated in the tube (**standard**)

Coil electrical connection: plug for connector type DIN 43650 (**standard**)

DC power supply
D12 = 12 V
D24 = 24 V
D48 = 48 V
D110 = 110 V
D220 = 220 V
D00 = valve without coils (see **NOTE**)

AC power supply
A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A110 = 110 V - 50 Hz / 120 V - 60 Hz
A230 = 230 V - 50 Hz / 240 V - 60 Hz
A00 = valve without coils (see **NOTE**)
F110 = 110 V - 60 Hz
F220 = 220 V - 60 Hz

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)

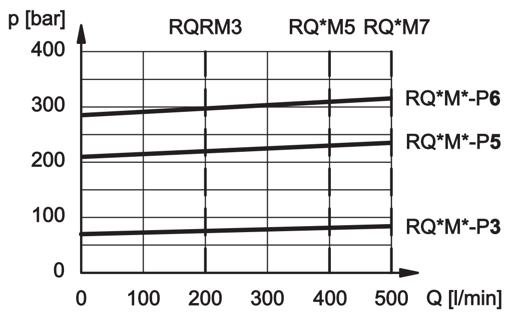
M = adjustment with SICBLOC knob (omit for adjustment with hexagonal head screw)

NOTE: The locking rings of the coils and the relevant O-Rings are supplied together with valves

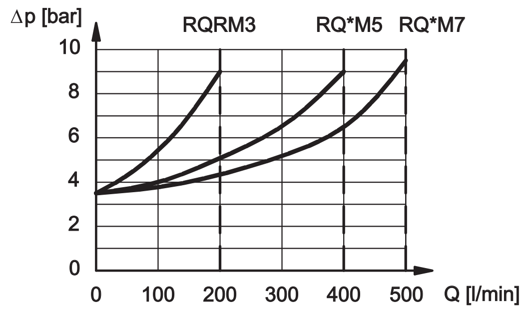
2 - CHARACTERISTIC CURVES

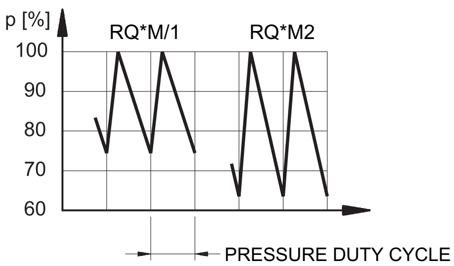
(values obtained with viscosity of 36 cSt at 50°C)

ADJUSTMENT



MINIMUM CONTROLLED PRESSURE





3 - HYDRAULIC FLUIDS

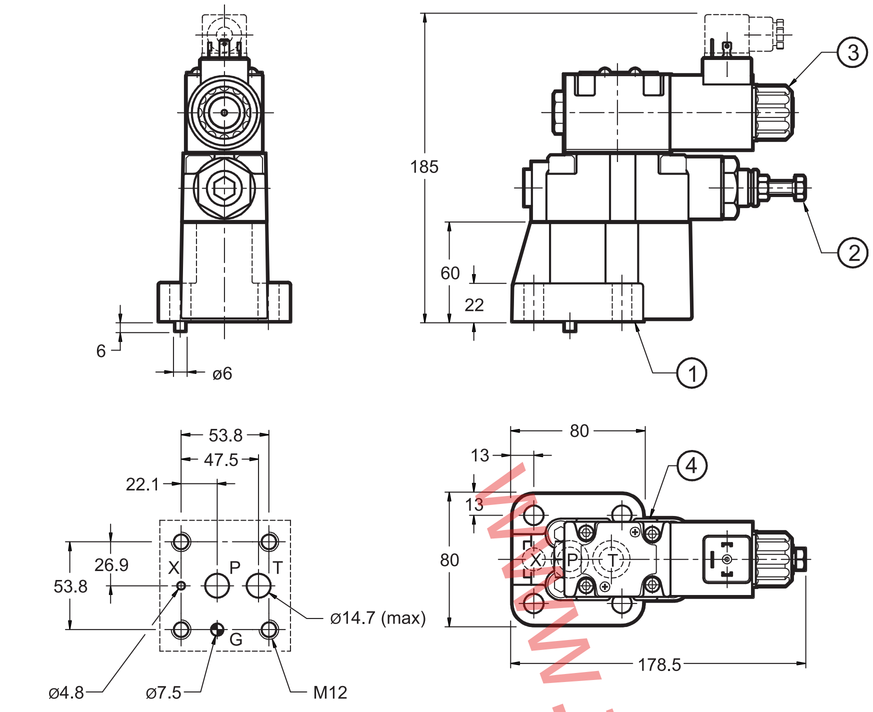
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - RQRM3-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



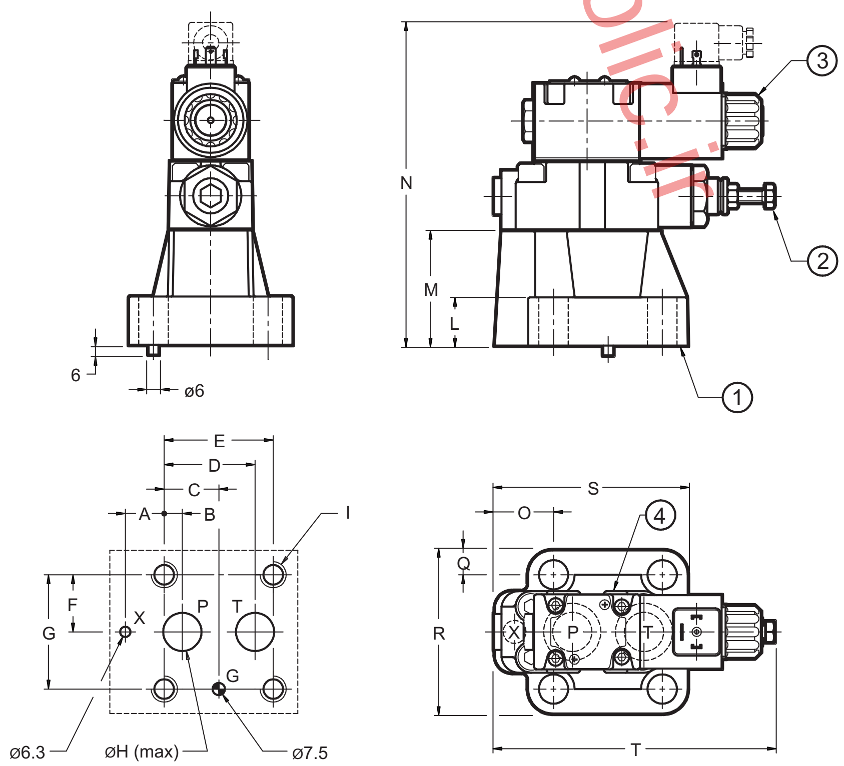
1	Mounting surface with sealing rings: N. 2 OR type 123 (17.86x2.62) 90 Shore N. 1 OR type 109 (9.13x2.62) 90 Shore
2	Hexagonal head main pressure adjustment screw. Spanner 13. Clockwise rotation to increase pressure.
3	ISO 4401-03 (CETOP 03) solenoid valve for unloading
4	External drainage port Y 1/8" NPT

MOUNTING SURFACE: ISO 6264-06-09-*-97 (CETOP 4.4.2-2-R06-350)

FASTENING BOLTS:
4 bolts M12x40 Torque: 69 Nm

5 - RQRM5-P AND RQRM7-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



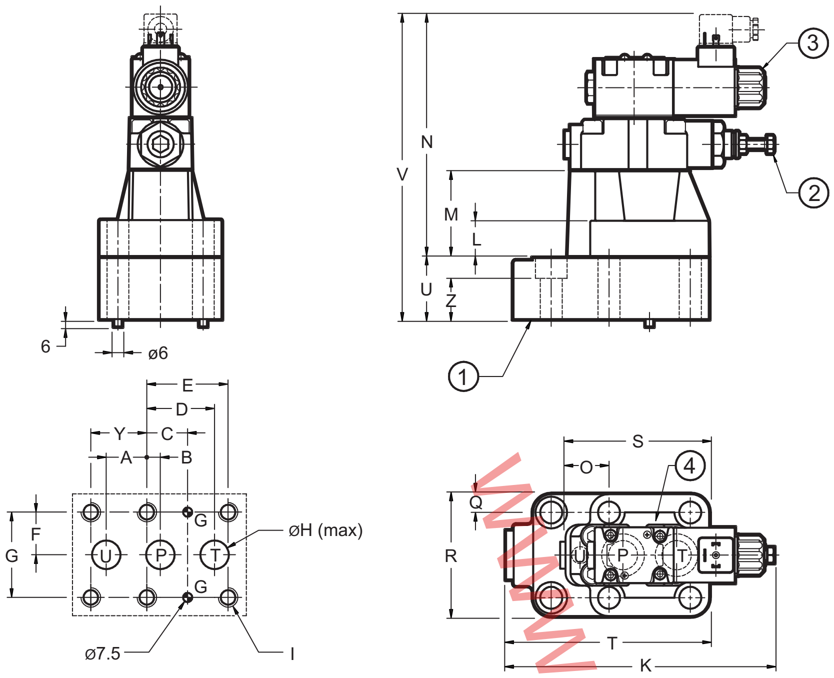
1	Mounting surface with sealing rings: **RQRM5** N. 2 OR type 3118 (29.82x2.62) - 90 Shore N. 1 OR type 109 (9.13x2.62) - 90 Shore **RQRM7** N. 2 OR type 4137 (34.52x3.53) - 90 Shore N. 1 OR type 109 (9.13x2.62) - 90 Shore
2	Hexagonal head main pressure adjustment screw. Spanner 13. Clockwise rotation to increase pressure.
3	ISO 4401-03 (CETOP 03) solenoid valve for unloading
4	External drainage port Y 1/8" NPT

FASTENING BOLTS:
RQRM5
4 bolts M16x50 Torque: 170 Nm
RQRM7
4 bolts M18x60 Torque: 235 Nm

	MOUNTING SURFACE	A	B	C	D	E	F	G	ØH	I	L	M	N	O	Q	R	S	T
RQRM5-P	ISO 6264-08-13-*-97 (CETOP 4.4.2-2-R08-350)	23.8	11.1	33.4	55.6	66.7	35	70	23.4	M16	27	70	194	35.8	15	100	118	170
RQRM7-P	ISO 6264-10-17-*-97 (CETOP 4.4.2-2-R10-350)	31.8	12.7	44.5	76.2	88.9	41.3	82.6	32	M18	35	80	204	44.1	18.7	120	152	180

6 - RQAM5-P AND RQAM7-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: **RQAM5** N. 2 OR type 3118 (29.82x2.62) - 90 Shore **RQAM7** N. 2 OR type 4137 (34.52x3.53) - 90 Shore
2	Hexagonal head main pressure adjustment screw. Spanner 13. Clockwise rotation to increase pressure.
3	ISO 4401-03 (CETOP 03) solenoid valve for unloading
4	External drainage port Y 1/8" NPT

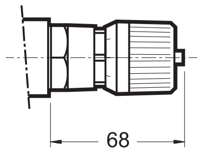
FASTENING BOLTS:

RQAM5	**RQAM7**
4 bolts M16x100	4 bolts M18x130
2 bolts M16x55	2 bolts M18x70
Torque:170 Nm	Torque: 235 Nm

	A	B	C	D	E	F	G	ØH	I	K	L	M	N	O	Q	R	S	T	U	V	Y	Z
RQAM5-P	33.3	11.1	33.4	55.6	66.7	35	70	23.4	M16	212	27	70	194	35.8	15	100	118	160	50	244	46	33.5
RQAM7-P	38	12.7	44.5	76.2	88.9	41.3	82.6	32	M18	242	35	80	204	44.1	18.7	120	152	218	66	270	50.8	48

7 - ADJUSTMENT KNOB

The RQ*M*-P valves can be equipped with a SICBLOC adjustment knob. To operate it, push and rotate at the same time. To request this option, add: /**M** (see paragraph 1).



8 - ELECTRIC CONNECTORS

The solenoid valves are never supplied with connectors. Connectors must be ordered separately, please see catalogue 49 000.

9 - MANUAL OVERRIDE, BOOT PROTECTED: CM

Whenever the solenoid valve installation may involve exposure to atmospheric agents or utilization in tropical climates, use of the manual override, boot protected is recommended. Add the suffix **CM** to request this device (see paragraph 1).

For overall dimensions see catalogue 41 150.

10 - SUBPLATES

(see catalogue 51 000)

	RQRM3-P	RQRM5-P	RQRM7-P	RQAM5-P	RQAM7-P
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports	PMRQA5-AI5G rear ports	PMRQA7-AI7G rear ports
P, T, U ports dimensions	P: 1/2" BSP T: 3/4" BSP	1" BSP	1" 1/4 BSP	3/4" BSP	1" 1/4 BSP
X port dimensions	1/4" BSP	1/4" BSP	1/4" BSP	-	-

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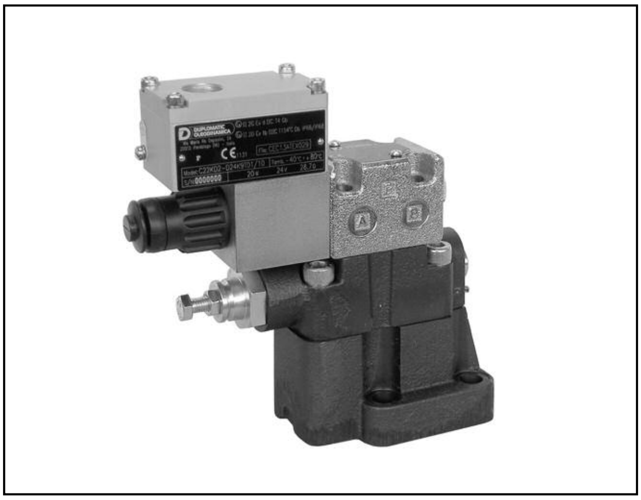
RQM*K*- P

EXPLOSION-PROOF SOLENOID OPERATED PRESSURE RELIEF VALVES WITH UNLOADING AND PRESSURE SELECTION ATEX, IECEx, INMETRO

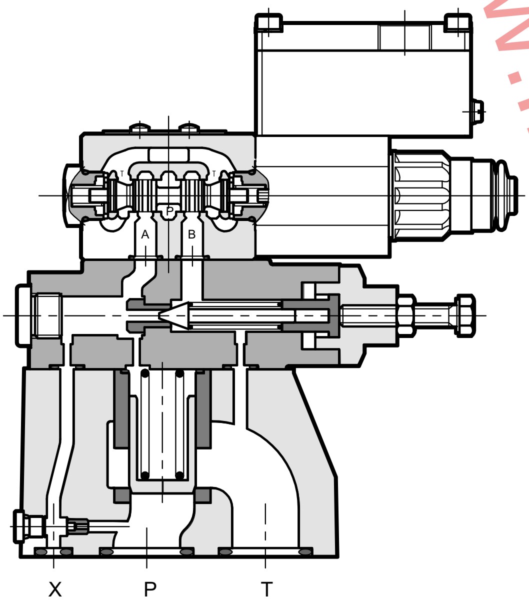
SERIES 10



SUBPLATE MOUNTING

RQM3K*-P ISO 6264-06
RQM5K*-P ISO 6264-08
RQM7K*-P ISO 6264-10

OPERATING PRINCIPLE



— The RQM*K*-P are explosion-proof pressure relief valves for subplate mounting ISO 6264. They are available in three nominal sizes for flows up to 500 l/min.

— They are compliant with ATEX, IECEx and INMETRO requirements and are suitable for use in potentially explosive atmospheres, for surface plants or mines.

— A low temperature version (up to -40 °C) is also available.

— They are available in five versions that allow the unloading of the total flow or the selection of up to three pressure values (see paragraph 2 - Versions) by means of a solenoid valve.

— They are supplied with a hexagonal head adjustment screw. Upon request, it can be equipped with a SICBLOC adjustment knob on the main pressure control.

— The adjustment of the second and third pressure values is obtained by a pressure relief valve placed between the main stage and the solenoid valve.

— The valves are supplied with standard surface treatment of phosphating black for the main body and zinc-nickel for the pilot body. Upon request we can supply these valves completely with zinc-nickel surface treatment, suitable to ensure a salt spray resistance up to 600 h.

— **Details for classification, operating temperatures and electrical characteristics are in the technical data sheet 02 500 'Explosion proof classification'.**

PERFORMANCES
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

		RQM3K*-P	RQM5K*-P	RQM7K*-P
Maximum operating pressure	bar	350		
Maximum flow rate	l/min	200	400	500
Temperature range (ambient and fluid)		see data sheet 02 500		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15			
Recommended viscosity	cSt	25		

1 - IDENTIFICATION CODE

R	Q	M			-	P		/		/		/	10		-		K9		/			

Pilot operated pressure relief valve

Solenoid valve for unloading / pressure selection

Size:
3 = ISO 6264-06
5 = ISO 6264-08
7 = ISO 6264-10

Explosion-proof certification:
See table 1.1

Subplate mounting

Pressure adjustment range:
3 = up to 70 bar
5 = up to 210 bar
6 = up to 350 bar

Versions: **A**, **B**, **C**, **D**, **G** — see description in the table 2 - versions

M = adjustment with SICBLOC knob available only on the main pressure control
Omit for adjustment with hexagonal head screw

Series No.
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
For temperature range -20 / +80 °C
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids
For temperature range -40 / +80 °C
NL = seal for low temperatures (for mineral oil)

Power supply:
Direct current (DC)
D12 = 12 V
D24 = 24 V
D48 = 48 V
D110 = 110 V
Alternate current with built-in rectifier bridge (RAC)
R120 = 120 V
R240 = 240 V

Coil electrical connection: by terminal block

Connection type for cable gland
upper connection:
T01 = M20x1.5 - ISO 261
T02 = Gk 1/2 - UNI EN 10226-2
not available for INMETRO
T03 = 1/2” NPT - ANSI B1.20.1
(ex ANSI B2.1)
side connection:
S01 = M20x1.5 - ISO 261
S02 = Gk 1/2 - UNI EN 10226-2
not available for INMETRO
S03 = 1/2” NPT - ANSI B1.20.1
(ex ANSI B2.1)
S04 = M16x1.5 - ISO 261

Manual override:
CM = boot protected
standard for both N and V seals
not available for NL seals
CB = blind ring nut
standard for NL seals
available upon request for both N and V seals
see at par. 12

Option: **/T5**
version in T5 temperature class.
Omit if not required.

Option: surface treatment not standard. Omit if not required (see **NOTE**)

NOTE: the valves are supplied with standard surface treatment of phosphating black for the main body and zinc-nickel for the pilot body.

Upon request we can supply these valves with full zinc-nickel surface treatment, suitable to ensure a salt spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

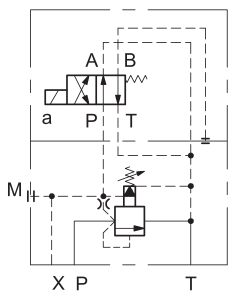
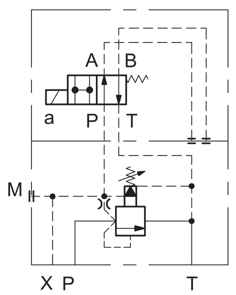
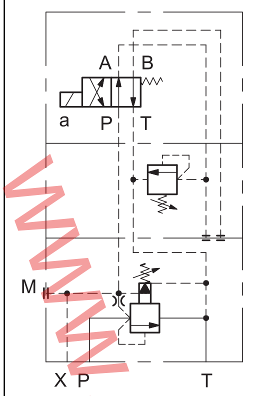
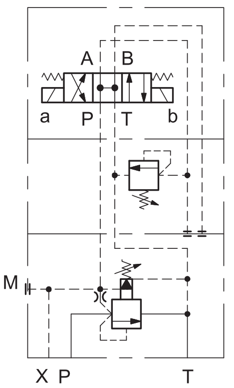
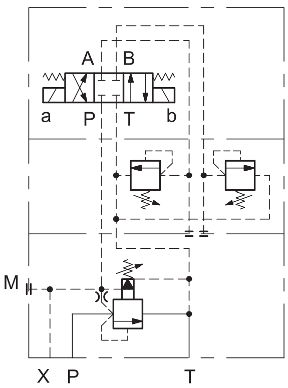
For full zinc-nickel surface treatment add the suffix **/W7** at the end of the identification code.

1.1 - Names of valves per certification

	ATEX		IECEx		INMETRO	
for gases for dusts	**KD2**	II 2GD	**KXD2**	IECEx Gb IECEx Db	**KBD2**	INMETRO Gb INMETRO Db
for mines	**KDM2**	I M2	**KXDM2**	IECEx Mb	**KBDM2**	INMETRO Mb

NOTE: Refer to the technical data sheet 02 500 for marking, operating temperatures and available versions.

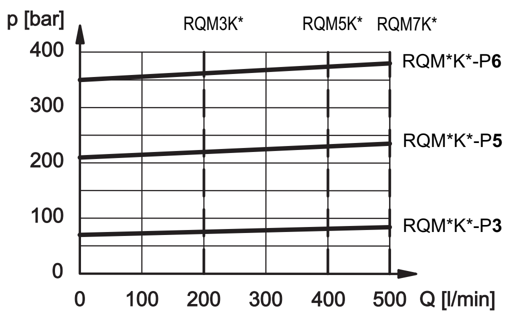
2 - VERSIONS

RQM*K*-P*/**A**	RQM*K*-P*/**B**	RQM*K*-P*/**C**	RQM*K*-P*/**D**	RQM*K*-P*/**G**
				
1 pressure setting and unloading with de-energized solenoid	**1 pressure setting and unloading with energized solenoid**	**2 pressure settings The highest setting is reached with energized solenoid**	**2 pressure settings and unloading with de-energized solenoids**	**3 pressure settings The highest setting is reached with de-energized solenoids**

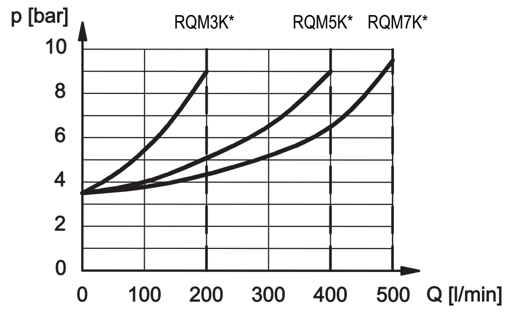
3 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)

ADJUSTMENT



MINIMUM CONTROLLED PRESSURE



4 - ELECTRICAL CHARACTERISTICS

(values ± 5%)

Coil type	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [W]
D12	12	7,2	1,7	20
D24	24	28,7	0,83	20
D48	48	115	0,42	20
D110	110	549	0,2	22

Coil type (**NOTE**)	Nominal voltage [V]	Freq. [Hz]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [VA]
R120	110V-50Hz	50/60	489,6	0,19	21
	120V-60Hz			0,21	25
R240	230V-50Hz		2067,7	0,098	22,5
	240V-60Hz			0,1	24

NOTE: type R* coils are for alternating current supply for both 50 or 60 Hz. For R* coils the resistance can not be measured in the usual way because of the presence of diodes bridge inside the coil.

VOLTAGE SUPPLY FLUCTUATION (ripple included)	± 10% Vnom
MAX SWITCH ON FREQUENCY	6.000 ins/hour
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2014/30/EU
CLASS OF PROTECTION: Atmospheric agents Coil insulation (VDE 0580)	IP66 / IP68 class H

4.1 - Wiring

In order to realise the electrical connection of the coil, it is necessary to access the terminal block (1) unscrewing the 4 screws (2) that fasten the cover (3) with the box (4) that contains the terminal block.

The electrical connection is polarity-independent.

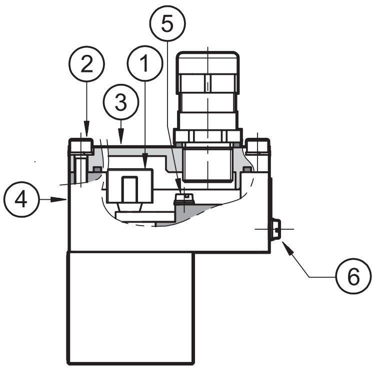
By doing electrical connection it is important to connect also the grounding point (5) in the terminal block box (M4 screws), through suitable conductors with the general grounding line of the system.

On the external body of the coil there is a grounding point (6) (M4 screw) that allow to ensure equipotentiality between the valve and the general grounding line of the system; connecting this point the regulation of the EN 13463-1 standard, that impose to verify the equipotentiality of the elements included in a potentially explosive environment (the maximum resistance between the elements must be 100 Ω), is guaranteed.

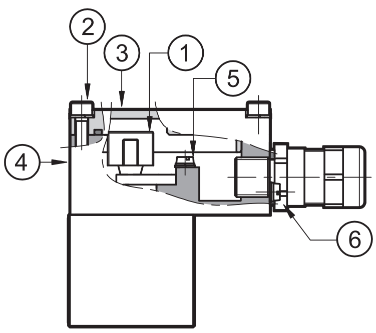
At the end of the electrical wiring, it is necessary to reassemble the cover (3) on the box (4), checking the correct positioning of the seal located in the cover seat and fastening the 4 M5 screws with a torque of 4.9÷6 Nm.

Electrical wiring must be done following in compliance with standards about protection against explosion hazards.

Characteristics of the cables connectable for wiring are indicated in the table below:



K9T*



K9S*

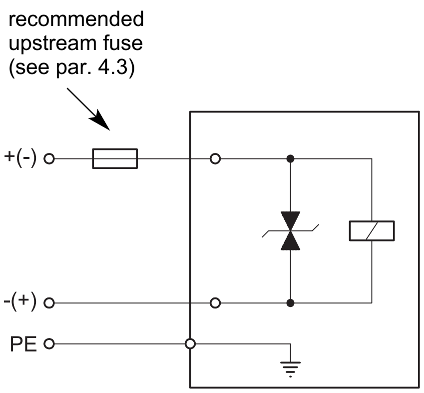
Function	Cable section
Operating voltage cables connection	max 2.5 mm²
Connection for internal grounding point	max 2.5 mm²
Connection for external equipotential grounding point	max 6 mm²

Cables for wiring must be non-armoured cables, with external covering sheath and must be suitable for use in environments with temperatures from - 20 °C to +110 °C (for valves either with N or V seals) or from - 40 °C to +110 °C (for valves with NL seals).

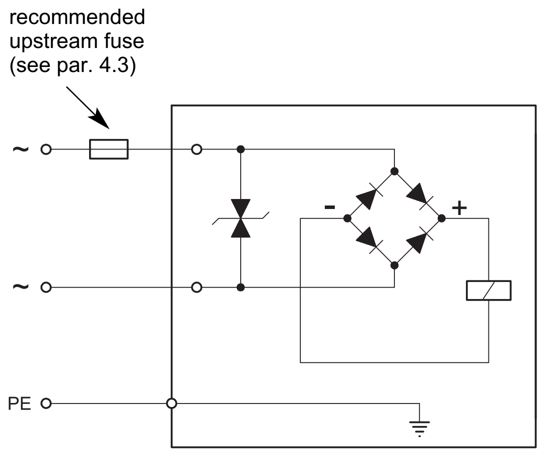
Cable glands (which must be ordered separately, see paragraph 12) allow to use cables with external diameter between 8 and 10 mm.

4.2 - Electrical diagrams

DC coil



RAC coil



4.3 - Overcurrent fuse and switch-off voltage peak

Upstream of each valve, an appropriate fuse (max 3 x In according to IEC 60127) or a protective motor switch with short-circuit and thermal instantaneous tripping, as short-circuit protection, must be connected. The cut-off power of the fuse must correspond or exceed the short circuit current of the supply source. The fuse or the protective motor must be placed outside the dangerous area or they must be protected with an explosion-proof covering.

In order to safeguard the electronic device to which the valve is connected, there is a protection circuit in the coil, that reduces voltage peaks, which can occur when inductances are switched off.

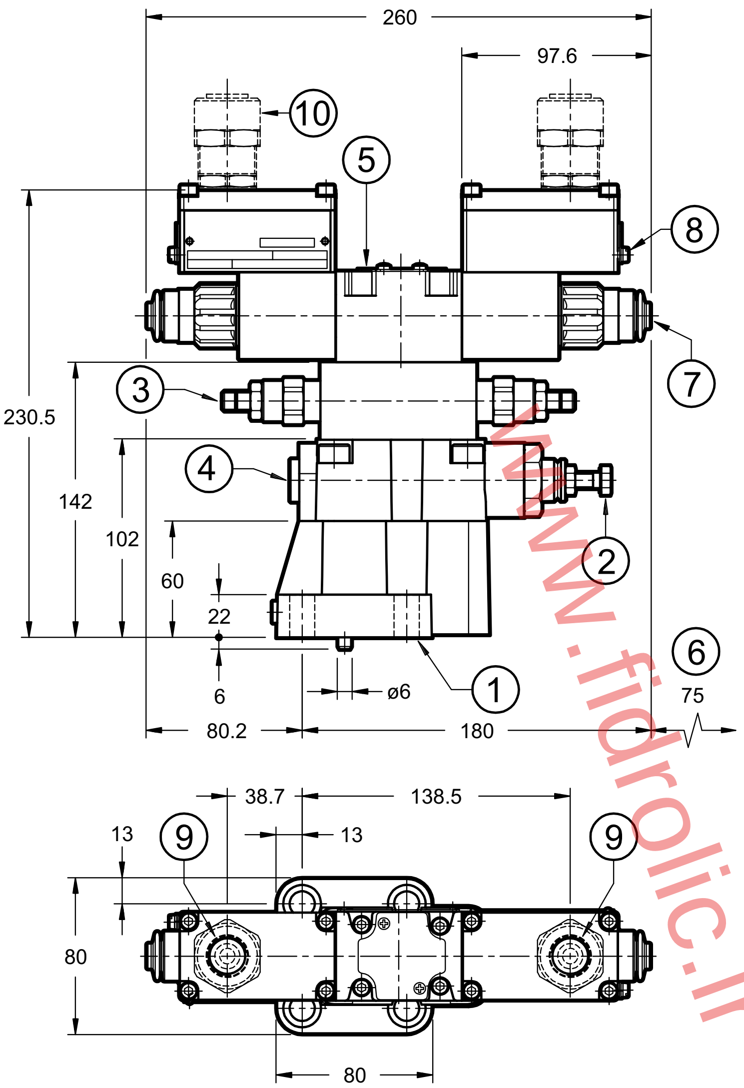
The table shows the type of fuse recommended according to the nominal voltage of the valve and to the value of the voltage peaks reduction.

Coil type	Nominal voltage [V]	Rated current [A]	**Recommended pre-fuse characteristics medium time-lag according to DIN 41571 [A]**	Maximum voltage value upon switch off [V]	Suppressor circuit
D12	12	1,7	2,5	- 49	Transient voltage suppressor bidirectional
D24	24	0,83	1,25	- 49	
D48	48	0,42	0,6	- 81	
D110	110	0,2	0,3	- 309	
R120	120	0,21	0,3	- 3	
R240	240	0,1	0,15	- 3	

5 - RQM3K*-P OVERALL AND MOUNTING DIMENSIONS

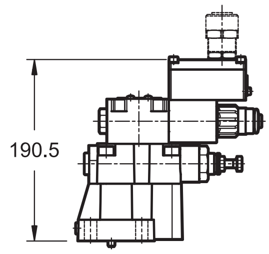
dimensions in mm

RQM3K*-P*/G/10*-*K9T*

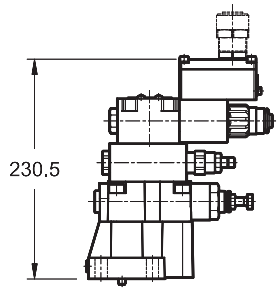


NOTE: for side port cable gland see paragraph 8.

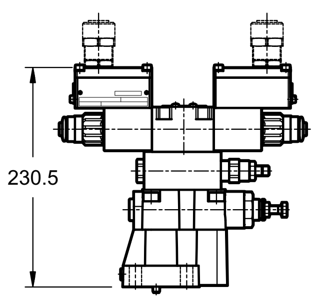
RQM3K*-P*/A/10*-*K9T*
RQM3K*-P*/B/10*-*K9T*



RQM3K*-P*/C/10*-*K9T*



RQM3K*-P*/D/10*-*K9T*



1	Mounting surface with sealing rings: 2 OR type 123 (17.86x2.62) 90 Shore 1 OR type 109 (9.13x2.62) 90 Shore
2	Hexagonal head adjustment screw for main pressure value: spanner 13 Clockwise rotation to increase pressure
3	Second pressure value adjustment: Socket hex adjustment screw: Allen key 5 Clockwise rotation to increase pressure
4	Pressure gauge port 3/8” BSP

5	ISO 4401-03 solenoid valve for pressure selection / unloading with explosion-proof coils
6	Minimum clear space required
7	Manual override, boot protected **standard for both N and V seals** For blind ring nut dimensions (standard for NL seals) see par. 12
8	Terminal for supplementary earth connection
9	Upper port for cable gland
10	Cable gland . To be ordered separately, see paragraph 14

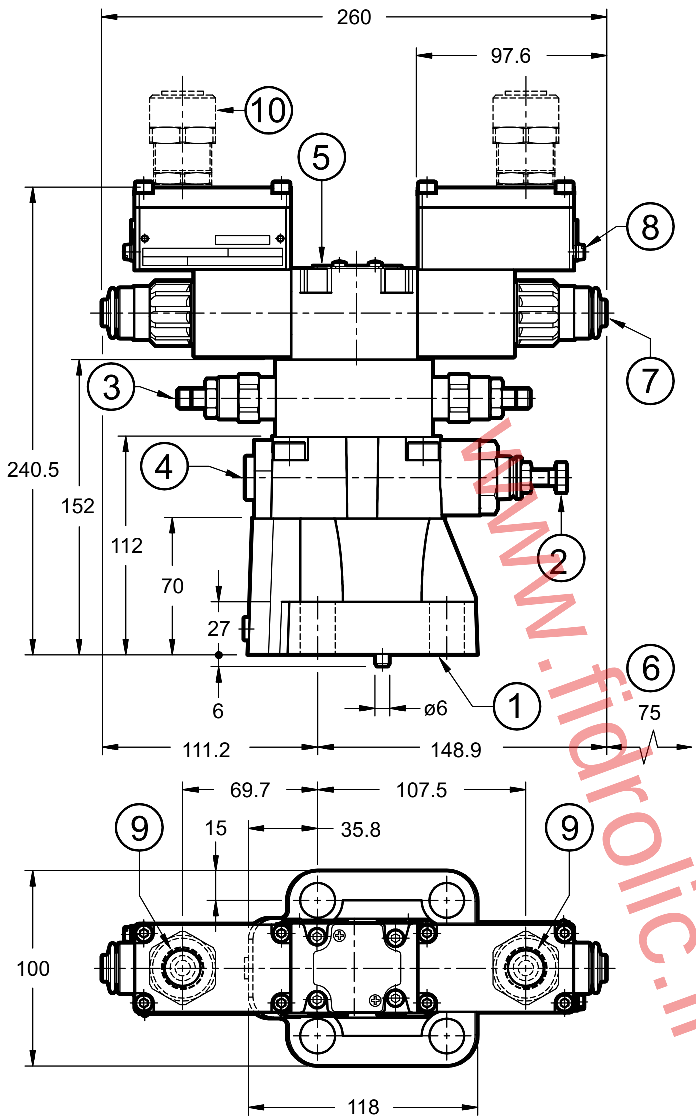
Valve	Mass
RQM3K*-P*/A and RQM3K*-P*/B	5,3
RQM3K*-P*/C	6,4
RQM3K*-P*/D	7,3
RQM3K*-P*/G	7,4

Valve fastening: N. 4 SHC screws M12x40 ISO 4762
Tightening torque: 69 Nm (A8.8 screws)
Threads of mounting holes: M12x20

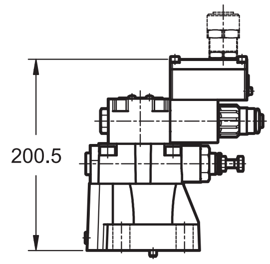
6 - RQM5K*-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

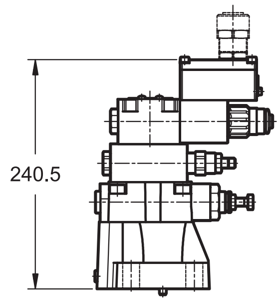
RQM5K*-P*/G/10*-*K9T*



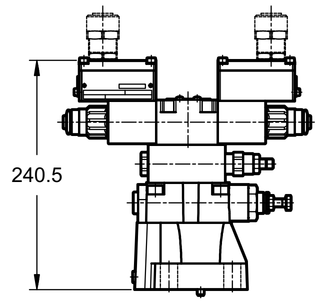
RQM5K*-P*/A/10*-*K9T*
RQM5K*-P*/B/10*-*K9T*



RQM5K*-P*/C/10*-*K9T*



RQM5K*-P*/D/10*-*K9T*



NOTE: for side port cable gland see paragraph 8.

1	Mounting surface with sealing rings: 2 OR type 3118 (29.82x2.62) 90 Shore 1 OR type 109 (9.13x2.62) 90 Shore
2	Hexagonal head adjustment screw for main pressure value: spanner 13 Clockwise rotation to increase pressure
3	Second pressure value adjustment: Socket hex adjustment screw: Allen key 5 Clockwise rotation to increase pressure
4	Pressure gauge port 3/8” BSP

5	ISO 4401-03 solenoid valve for pressure selection / unloading with explosion-proof coils
6	Minimum clear space required
7	Manual override, boot protected **standard for both N and V seals** For blind ring nut dimensions (standard for NL seals) see par. 12
8	Terminal for supplementary earth connection
9	Upper port for cable gland
10	Cable gland. To be ordered separately, see paragraph 14

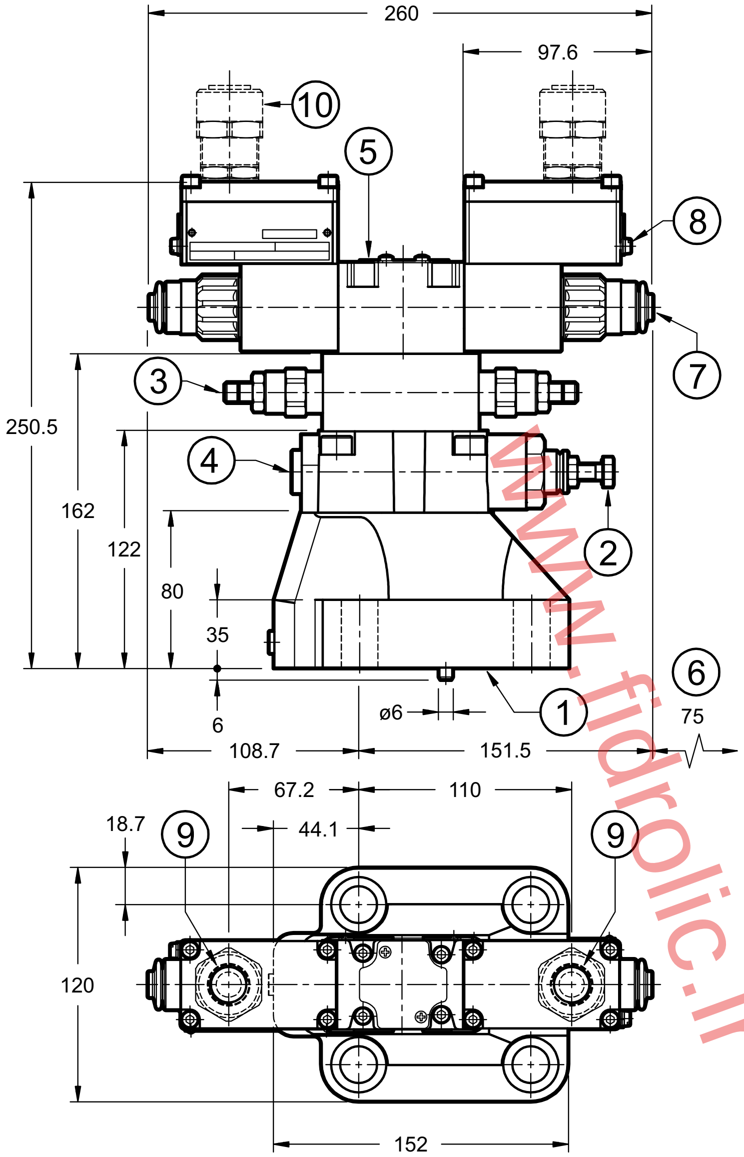
Valve	Mass
RQM5K*-P*/A and RQM5K*-P*/B	6,3
RQM5K*-P*/C	7,4
RQM5K*-P*/D	8,3
RQM5K*-P*/G	8,4

Valve fastening: N. 4 SHC screws M16x50 ISO 4762
Tightening torque: 170 Nm (A8.8 screws)
Threads of mounting holes: M16x25

7 - RQM7K*-P OVERALL AND MOUNTING DIMENSIONS

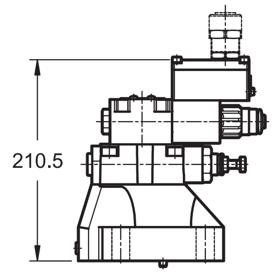
dimensions in mm

RQM7K*-P*/G/10*-*K9T*

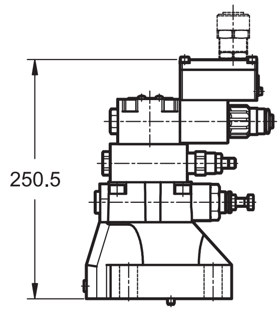


NOTE: for side port cable gland see paragraph 8.

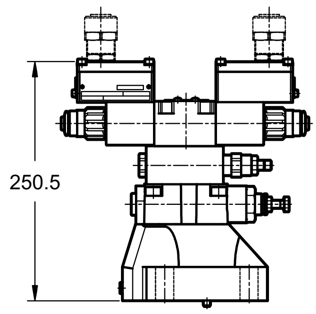
RQM7K*-P*/A/10*-*K9T*
RQM7K*-P*/B/10*-*K9T*



RQM7K*-P*/C/10*-*K9T*



RQM7K*-P*/D/10*-*K9T*



1	Mounting surface with sealing rings: 2 OR type 4137 (34.52x3.53) 90 Shore 1 OR type 109 (9.13x2.62) 90 Shore
2	Hexagonal head adjustment screw for main pressure value: spanner 13 Clockwise rotation to increase pressure
3	Second pressure value adjustment: Socket hex adjustment screw: Allen key 5 Clockwise rotation to increase pressure
4	Pressure gauge port 3/8" BSP

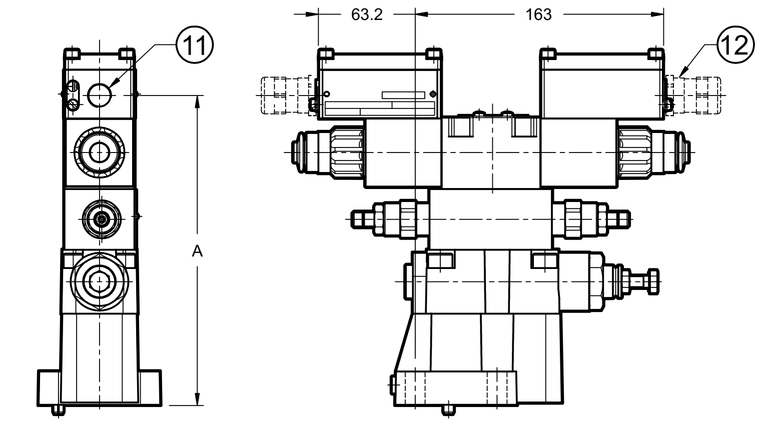
5	ISO 4401-03 solenoid valve for pressure selection / unloading with explosion-proof coils
6	Minimum clear space required
7	Manual override, boot protected **standard for both N and V seals** For blind ring nut dimensions (standard for NL seals) see par. 12
8	Terminal for supplementary earth connection
9	Upper port for cable gland
10	Cable gland To be ordered separately, see paragraph 14

Valve	Mass
RQM7K*-P*/A and RQM7K*-P*/B	8,5
RQM7K*-P*/C	9,6
RQM7K*-P*/D	10,5
RQM7K*-P*/G	10,6

Valve fastening: N. 4 SHC screws M18x60 ISO 4762
Tightening torque: 235 Nm (A8.8 screws)
Threads of mounting holes: M18x27

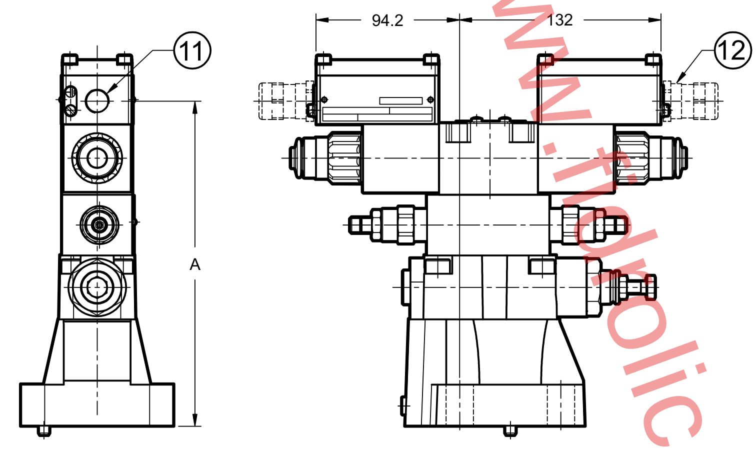
8 - RQM*K*- P* SIDE CONNECTION OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



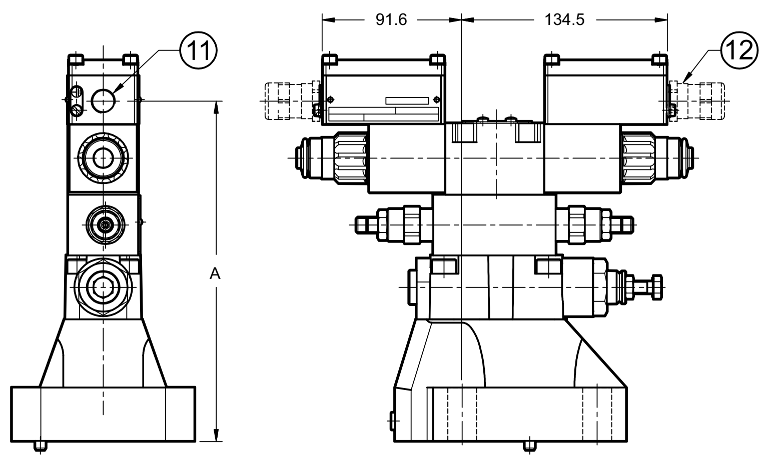
RQM3K*-P*/*/10*-*K9S*

Side port type	Dimension A	
	RQM3K*-P*/A RQM3K*-P*/B	RQM3K*-P*/C RQM3K*-P*/D RQM3K*-P*/G
S01, S04	162.5	202.5
S02, S03	162	202



RQM5K*- P*/*/10*-*K9S*

Side port type	Dimension A	
	RQM5K*-P*/A RQM5K*-P*/B	RQM5K*-P*/C RQM5K*-P*/D RQM5K*-P*/G
S01, S04	172.5	212.5
S02, S03	172	212



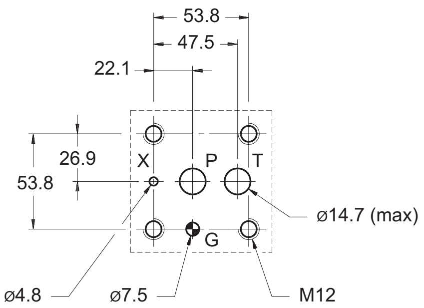
RQM7K*-P*/*/10*-*K9S*

Side port type	Dimension A	
	RQM7K*-P*/A RQM7K*-P*/B	RQM7K*-P*/C RQM7K*-P*/D RQM7K*-P*/G
S01, S04	182.5	222.5
S02, S03	182	222

11	Side port
12	Cable gland To be ordered separately, see par. 14

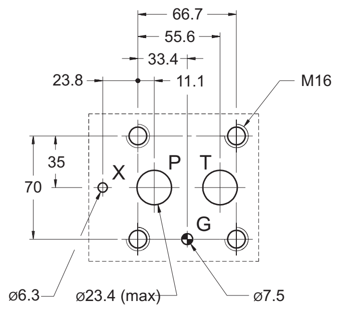
9 - MOUNTING SURFACES

RQM3K*-P



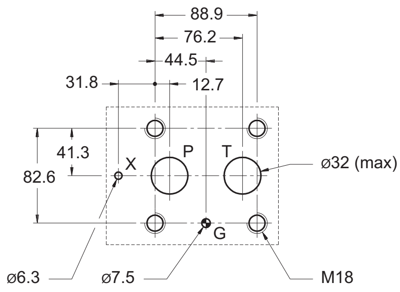
ISO 6264-06-09-*-97
(CETOP 4.4.2-2-R06-350)

RQM5K*-P



ISO 6264-08-13-*-97
(CETOP 4.4.2-2-R08-350)

RQM7K*-P



ISO 6264-10-17-*-97
(CETOP 4.4.2-2-R10-350)

10 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

11 - INSTALLATION

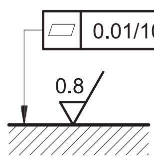
Installation must adheres to instructions reported in the *Use and Maintenance manual*, always attached to the valve. Unauthorized interventions can be harmful to people and goods because of the explosion hazards present in potentially explosive atmospheres.

The valves can be installed in any position without impairing correct operation.

Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

Surface finishing



12 - MANUAL OVERRIDE CB

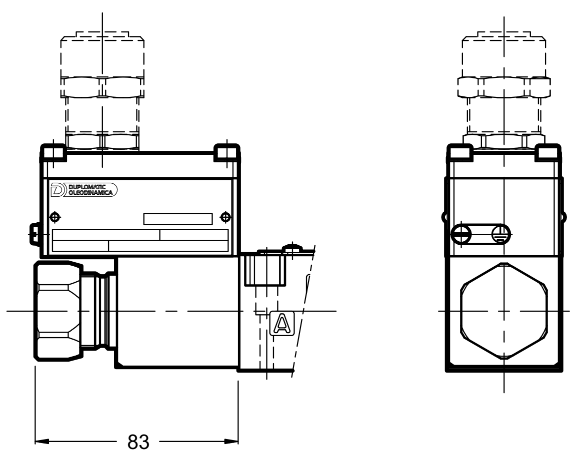
CB - Blind ring nut

The metal ring nut protects the solenoid tube from atmospheric agents and isolates the manual override from accidental operations. The ring nut is tightened on a threaded fastener that keeps the coil in its position even without the ring nut.

To access the manual override loosen the ring nut and remove it; then reassemble hand tightening, until it stops.

Activate the manual override always and only with non-sparking tools suitable for use in potentially explosive atmospheres.

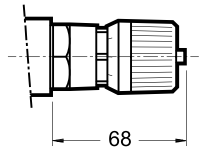
More information on safe use of explosion-proof components are provided in the instruction manual, always supplied with the valve.



13 - ADJUSTMENT KNOB

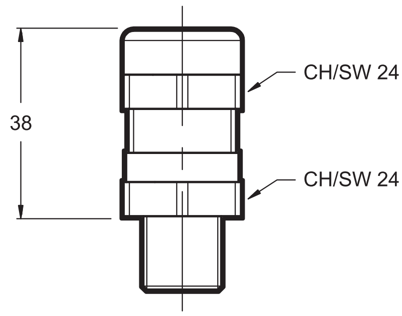
The valves can be equipped with a SICBLOC adjustment knob, only on the main pressure regulation. To operate it, push and rotate at the same time.

To request this option, add: **/M** (see paragraph 1).



14 - CABLE GLANDS

Cable glands must be ordered separately; Duplomatic offers some types of cable glands with the following features:



- version for non-armoured cable, external seal on the cable (suitable for Ø8÷10 mm cables);
- ATEX II 2GD, I M2; IECEx Gb, Db, Mb; INMETRO Gb, Db, Mb certified
- cable gland material: nickel brass
- rubber tip material: silicone
- ambient temperature range: -70 °C ÷ +220 °C
- protection degree: IP66/IP68
- tightening torque: 15 Nm

To order, list the description and the code of the version chosen from among those listed below:

Description: CGK2/NB-01/10

Code: 3908108001

M20x1.5 - ISO 261 male thread, suitable for coils with T01 and S01 connections. It is supplied equipped with silicone seal, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Description: CGK2/NB-02/10

Code: 3908108002

Gk 1/2 - UNI EN 10226-2 male thread, suitable for coils with T02 and S02 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Description: CGK2/NB-03/10

Code: 3908108003

1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1), suitable for coils with T03 and S03 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Description: CGK2/NB-04/10

Code: 3908108004

M16x1.5 - ISO 261 male thread, suitable for coils with S04 connection. It is supplied equipped with silicone seal, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

15 - SUBPLATES

(see catalogue 51 000)

	RQM3K*-P	RQM5K*-P	RQR7K*-P
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports
P, T ports dimension	P: 1/2" BSP T: 3/4" BSP	1" BSP	1" 1/4 BSP
X port dimension	1/4" BSP	1/4" BSP	1/4" BSP

NOTE: Subplates (to be ordered separately) do not contain neither aluminium nor magnesium at a higher rate than the value allowed by norms according to ATEX directive for category II 2GD and I M2.

The user must take care and make a complete assessment of the ignition risk, that can occur from the relative use in potentially explosive environments.

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EXPLOSION-PROOF CLASSIFICATION for

SOLENOID AND PROPORTIONAL VALVES

ref. catalogues:

pressure valves

RQM*K*-P	21 515
PRE(D)*K*	81 315
ZDE3K*	81 515
DZCE*K*	81 605

directional valves

D*K*	41 515
DS(P)E*K*	83 510

GENERAL INFO

This informative technical datasheet displays information about **classification and marking** of Duplomatic explosion-proof valves range.

Duplomatic offers valves with the following certifications:

ATEX	**II 2G**	**II 2D**	**I M2**
IECEx	**Gb**	**Db**	**Mb**
INMETRO	**Gb**	**Db**	**Mb**

Instructions for use and maintenance can be found in the related manuals, always supplied toghether with valves.

1 - ATEX CLASSIFICATION AND TEMPERATURES

Duplomatic certificates the combination valve-coil for the valves suitable for application and installation in potentially explosive atmospheres, according to ATEX directive; the supply always includes the declaration of conformity to the directive and the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environments.

Coils assembled on these valves have been separately certified according to ATEX directive and so they are suitable for use in potentially explosive atmospheres.

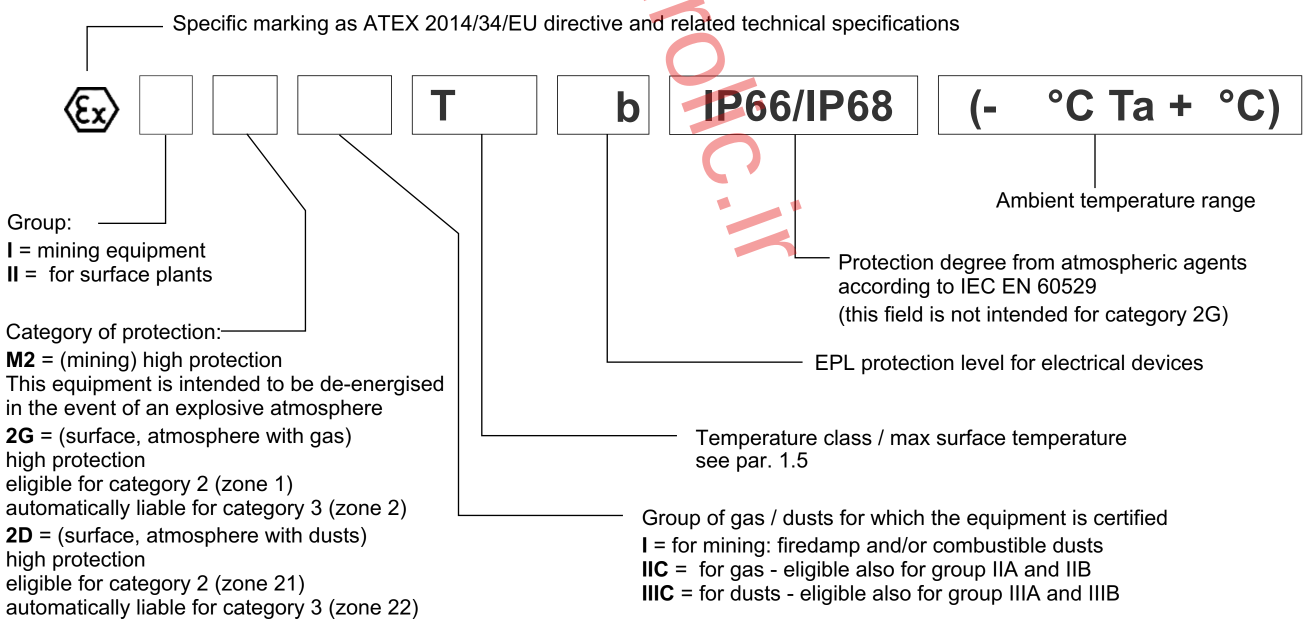
1.1 - ATEX classification for valves

Type examination certificate: CEC 13 ATEX 030-REV.2
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

ATEX II 2G ATEX II 2D	***KD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
ATEX I M2	***KDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

1.2 - ATEX marking for valves

valve code		N and V seals	NL seals
***KD2**	for gas	Ex II 2G IIC T4 Gb (-20°C Ta +80°C)	Ex II 2G IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex II 2D IIIC T154°C Db IP66/IP68 (-20°C Ta +80°C)	Ex II 2D IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
***KD2 /T5**	for gas	Ex II 2G IIC T5 Gb (-20°C Ta +55°C)	Ex II 2G IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex II 2D IIIC T129°C Db IP66/IP68 (-20°C Ta +55°C)	Ex II 2D IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
***KDM2**	mining	Ex I M2 I T150°C Mb IP66/68 (-20°C Ta +75°C)	Ex I M2 I T150°C Mb IP66/68 (-40°C Ta +75°C)



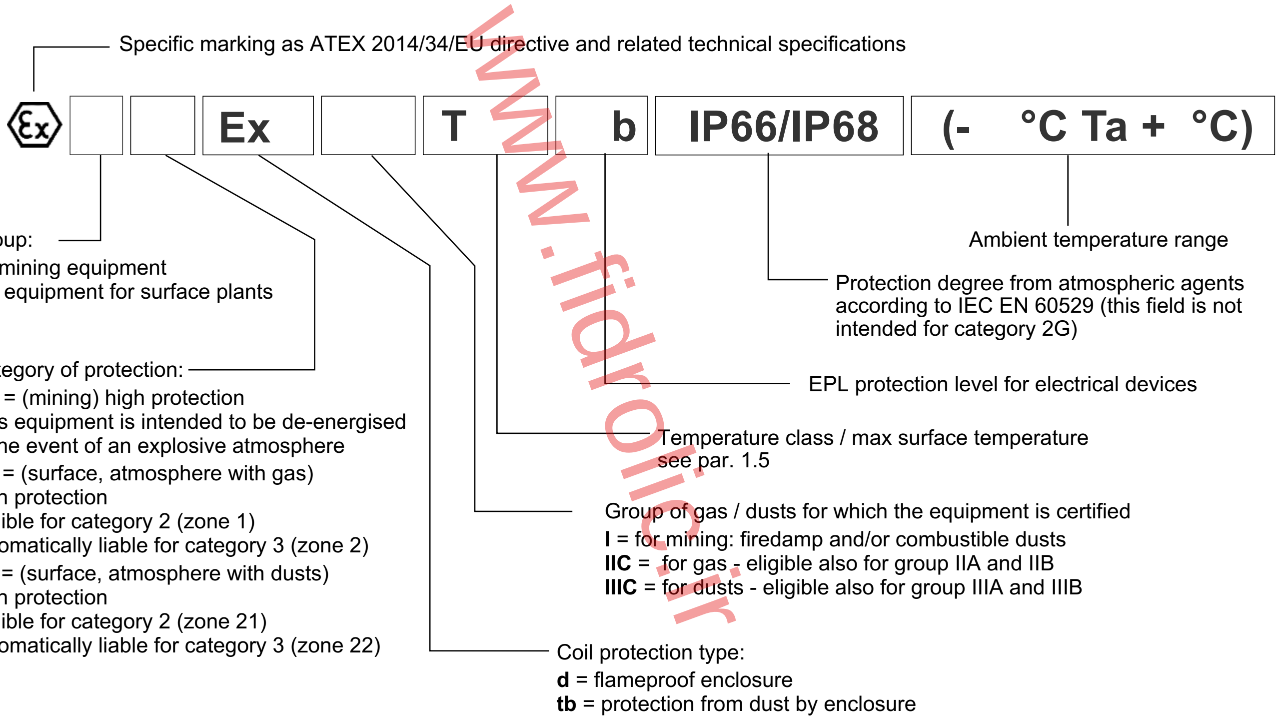
1.3 - ATEX classification of the coils

The coil of the explosion-proof valves is ATEX certified itself an as such is identified with its own tag, carries the relative ATEX marking. **The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an "Ex d" type protection (explosion-proof coil).**

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

1.4 - ATEX marking on coils

for valve type ***KD2**	for gas	Ex II 2G Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex II 2D Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
for valve type ***KD2 /T5**	for gas	Ex II 2G Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex II 2D Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
for valve type ***KDM2**	mining	Ex I M2 Ex d I T150°C Mb IP66/IP68 (-40°C Ta +75°C)



1.5 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

The valves in group II can also be used for less limiting temperature classes (surface temperature allowed higher).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
ATEX II 2G ATEX II 2D	***KD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas)	T3, T2, T1
		of fluid			T154°C (dusts)	T200°C and higher
	***KD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas)	T4, T3, T2, T1
		of fluid	-20 / +60 °C	-40 / +60 °C	T129°C (dusts)	T135°C and higher
ATEX I M2	***KDM2**	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				

2 - IECEx CLASSIFICATION AND TEMPERATURES

The IECEx certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with IECEx certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex db” type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

2.1 - IECEx classification

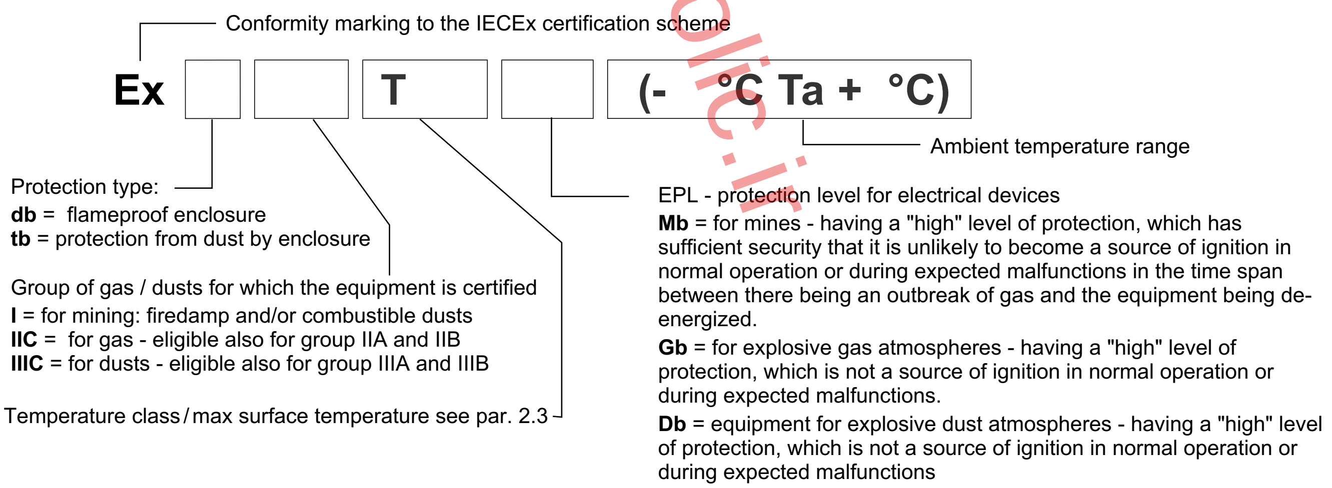
Certificate of conformity (CoC): IECEx TUN 15.0028X
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

IECEx Gb IECEx Db	***KXD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
IECEx Mb	***KXDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

2.2 - IECEx marking

There is a plate with the IECEx mark on each coil.

***KXD2** valves	for gas	Ex db IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T135°C Db (-40°C Ta +80°C)
***KXD2 /T5** valves	for gas	Ex db IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T100°C Db (-40°C Ta +55°C)
***KDM2** valves	mining	Ex db I Mb (-40°C Ta +80°C)



2.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
IECEx Gb IECEx Db	***KXD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T135°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KXD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T100°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
IECEx Mb	***KXDM2**	of ambient	-20 / +80 °C	-40 / +80 °C	-	-
		of fluid				

3 - INMETRO CLASSIFICATION AND TEMPERATURES

The INMETRO certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with INMETRO certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex d” type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

3.1 - INMETRO classification

Certificate of conformity: DNV 15.0094 X
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

INMETRO Gb INMETRO Db	***KBD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
INMETRO Mb	***KBDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

3.2 - INMETRO marking

There is a plate with the INMETRO mark on each coil.

***KBD2** valves	for gas	Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
***KBD2 /T5** valves	for gas	Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
***KBDM2** valves	mining	Ex d I T150° Mb IP66/IP68 (-40°C Ta +75°C)

Conformity marking to the INMETRO certification scheme

Ambient temperature range

Ex [ ] [ ] **T** [ ] **IP66/IP68** **(- °C Ta + °C)**

Protection degree from atmospheric agents according to IEC EN 60529 (this field is not intended for gases)

Protection type:
d = flameproof enclosure
tb = protection from dust by enclosure

Group of gas / dusts for which the equipment is certified
I = for mining: firedamp and/or combustible dusts
IIC = for gas - eligible also for group IIA and IIB
IIIC = for dusts - eligible also for group IIIA and IIIB

Temperature class / max surface temperature see par. 3.3

EPL - protection level for electrical devices
Mb = for mines - having a "high" level of protection, which has sufficient security that it is unlikely to become a source of ignition in normal operation or during expected malfunctions in the time span between there being an outbreak of gas and the equipment being de-energized.
Gb = for explosive gas atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions.
Db = equipment for explosive dust atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions

3.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
INMETRO Gb INMETRO Db	***KBD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T154°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KBD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T129°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
INMETRO Mb	***KBDM2**	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				

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Z*-P

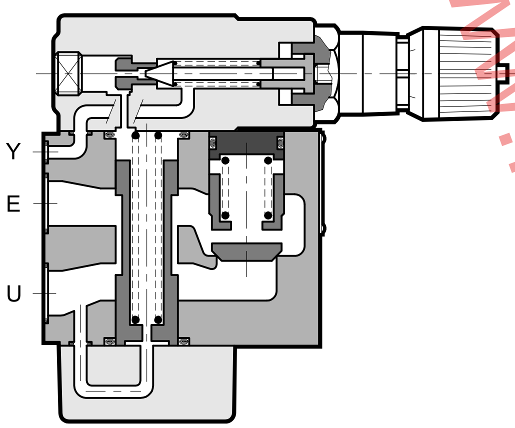
PRESSURE REDUCING VALVES

SERIES 22

SUBPLATE MOUNTING

Z3-P ISO 5781-06 (CETOP 06)
Z5-P ISO 5781-08 (CETOP 08)

OPERATING PRINCIPLE



— The Z*-P type valves are used when a branch with a lower pressure than the main one is desired in the hydraulic circuits.

Being normally open, they allow passage of oil up to the point when the outlet pressure is less than that set on the valve; the valve closes and keeps the outlet pressure constant when it reaches the set value. The intake pressure fluctuation, for values greater than the set values, does not affect the reduced outlet pressure, and furthermore the particular design of the valve prevents exceeding the set value even in transients.

The drainage, to be connected directly to the tank, discharges about 0,8 l/min. The valves are available, upon request, with reduced drainage (0,4 l/min).

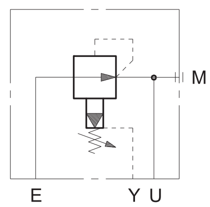
— Available even with incorporated check valve upon request, with cracking pressure of 0,5 bar.

PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

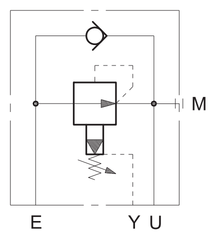
		Z3-P	Z5-P
Maximum operating pressure	bar	250	
Maximum flow rate	l/min	40	110
Drain flow rate: for Z*-P for Z*-P*R	l/min	0,8 0,4	
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	According to ISO 4406:1999 classe 20/18/15		
Recommended viscosity	cSt	25	
Mass	kg	3,9	6,1

HYDRAULIC SYMBOLS

Z*-P



Z*-P/C



1 - IDENTIFICATION CODE

Z		-	P	5		/		/	22	/	

Pressure reducing valve

Size:
3 = ISO 5781-06-07-*-00
(CETOP 4.4.5-2-06-250)
5 = ISO 5781-08-10-*-00
(CETOP 4.4.5-2-08-250)

Subplate mounting

Pressure adjustment range:
5 ÷ 210 bar

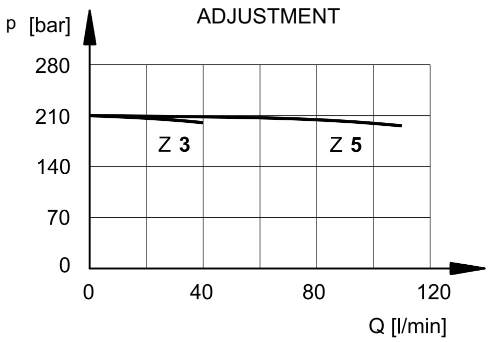
R = Reduced drainage (omit if not required)

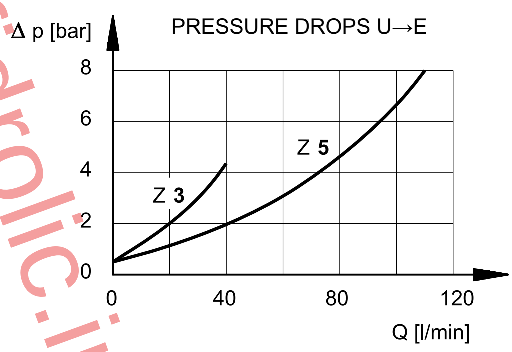
C = check valve for free flow from U→E
Cracking pressure 0,5 bar
(omit if not required)

Series No.
(the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
omit for mineral oils
V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)





3 - HYDRAULIC FLUIDS

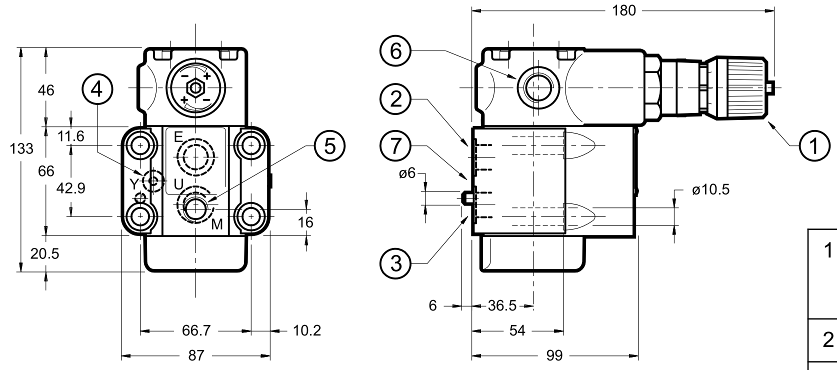
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V).

For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

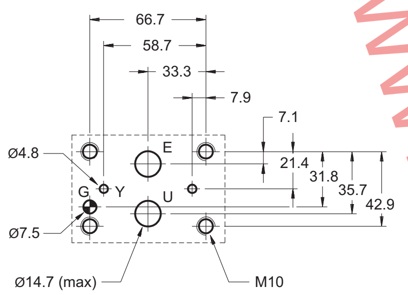
4 - Z3-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	SICBLOC adjustment knob. To operate, push and rotate at the same time.
2	Intake
3	Outlet port
4	Drainage port
5	Pressure gauge port 1/4” NPT
6	Supplementary tube port for drainage 1/4” BSP
7	Mounting surface with sealing rings: N. 2 OR type 3068 (17.13x2.62) N. 2 OR type 2021 (5.28x1.78) 90 Shore

MOUNTING SURFACE:
ISO 5781-06-07-*-00 (CETOP 4.4.5-2-06-250)

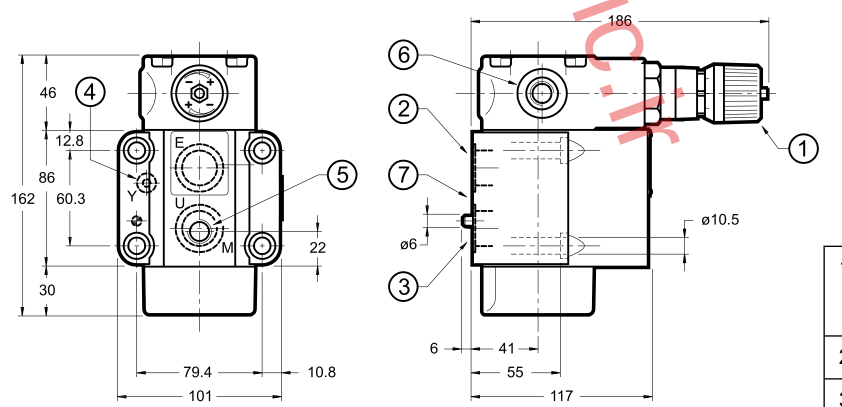


NOTE: the position of the Y port corresponds to the position of the X port provided for by the ISO Standard

FASTENING BOLTS:
4 bolts M10x70
Tightening torque: 40 Nm

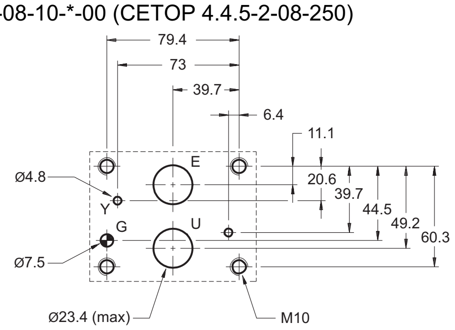
5 - Z5-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	SICBLOC adjustment knob. To operate, push and rotate at the same time.
2	Intake
3	Outlet port
4	Drainage port
5	Pressure gauge port 1/4” NPT
6	Supplementary plug for drainage 1/4” BSP
7	Mounting surface with sealing rings: N. 2 OR type 3100 (25.07x2.62) 90 Shore N. 2 OR type 2021 (5.28x1.78) 90 Shore

MOUNTING SURFACE:
ISO 5781-08-10-*-00 (CETOP 4.4.5-2-08-250)



NOTE: the position of the Y port corresponds to the position of the X port provided for by the ISO Standard

FASTENING BOLTS:
4 bolts M10x70
Tightening torque: 40 Nm

6 - SUBPLATES (see catalogue 51 000)

	Z3-P	Z5-P
Type	PMSZ3-AI4G with rear ports	PMSZ5-AI6G with rear ports
Port dimensions: - E, U - X, Y	 1/2” BSP 1/4” BSP	 1” BSP 1/4” BSP

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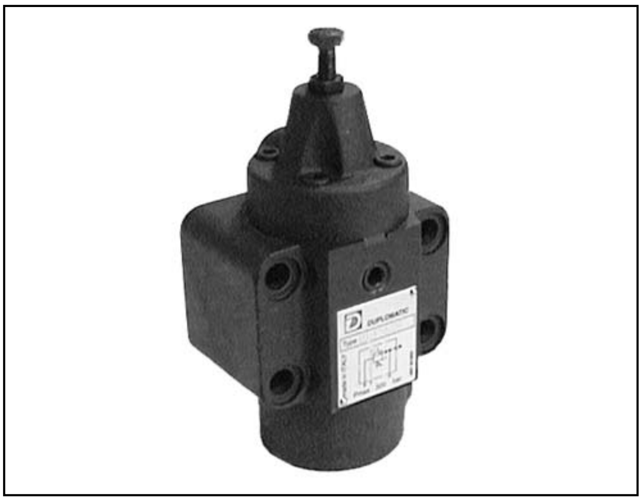
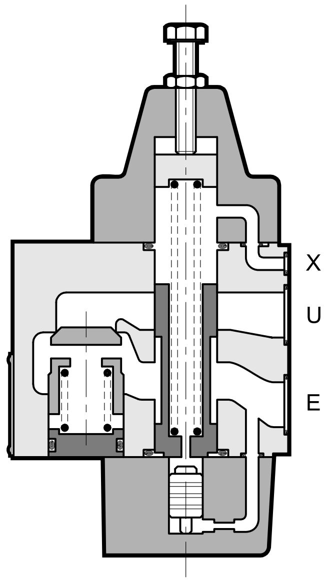


S*-P
SEQUENCE VALVE
U*-P
UNLOADING VALVE
T*-P
BACKPRESSURE VALVE
X*-P
BALANCING VALVE

SERIES 20

OPERATING PRINCIPLE



— The S U T X sequence valves are used for pressure control. They are direct-acting and normally closed.

— They are available in two nominal sizes for flows up to 150 l/min and in four pressure adjustment ranges.

— Opening takes place by means of a pilot pressure that, acting on a small piston, resists the force of the adjustment spring.

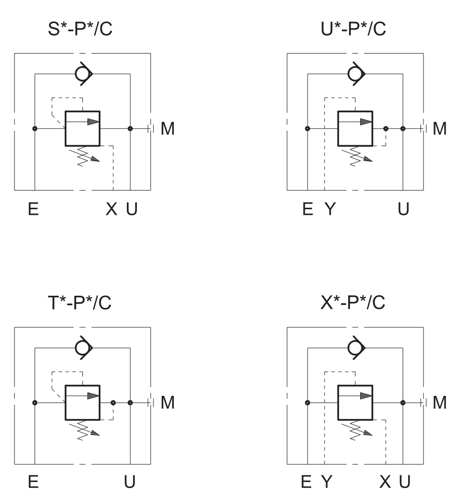
— The valve can be easily modified to get any one of the four versions **S**, **U**, **T**, **X**, turning the upper and the bottom covers in order to obtain the X and Y internal connections, as indicated in par. 7.

The figure represents the section of a type S valve.

PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

		size 3	size 5
Maximum operating pressure	bar	320	250
Maximum flow rate	l/min	4060	150
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass	kg	5,8	6,7

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

		-	P		/		/	20	/	

Valve type:
S = sequence valve
U = unloading valve
T = backpressure valve
X = balancing valve

Size:
3 = ISO 5781-06 (CETOP 06)
5 = ISO 5781-08 (CETOP 08)

Subplate mounting

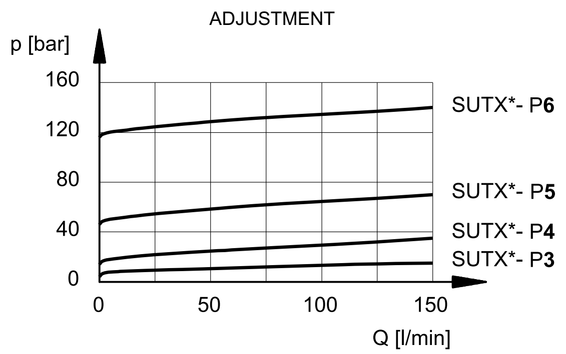
Pressure adjustment range:
3 = 5 ÷ 20 bar
4 = 10 ÷ 35 bar
5 = 15 ÷ 70 bar
6 = 35 ÷ 140 bar

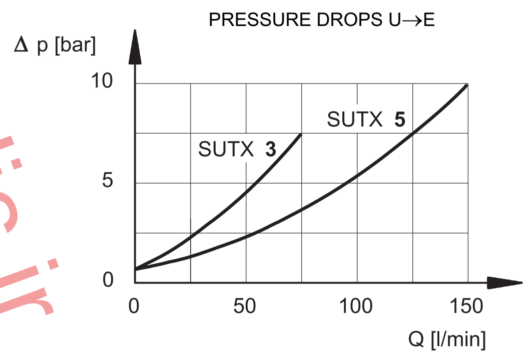
C = check valve for free flow from U to E.
Cracking pressure 0,5 bar.
(omit for version without check valve)

Series No. (the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
omit for mineral oils
V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

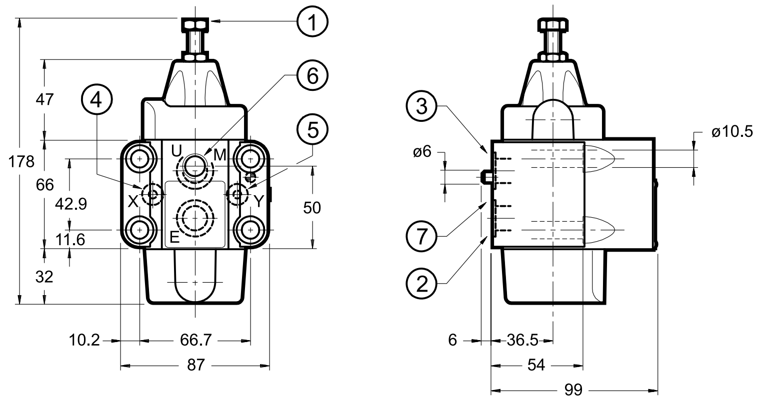




3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

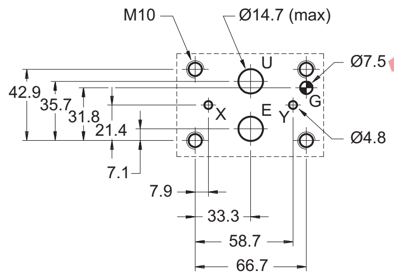
4 - S U T X 3-P OVERALL AND MOUNTING DIMENSIONS



FASTENING BOLTS:
4 bolts M10x70
Tightening torque: 40 Nm

dimensions in mm

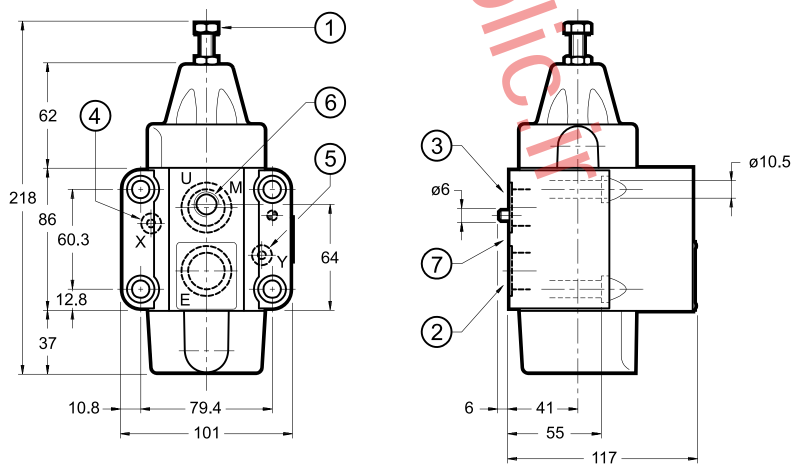
MOUNTING SURFACE:
ISO 5781-06-07-*-00 (CETOP 4.4.4-2-06-320)



1	Hexagonal head adjustment screw. Spanner 13.
2	Intake port
3	Outlet port
4	External drainage port
5	External piloting port
6	Pressure gauge port 1/4” NPT
7	Mounting surface with sealing rings: N. 2 OR type 3068 (17.13x2.62)- 90 Shore N. 2 OR type 2021 (5.28x1.78) - 90 Shore

NOTE: the positions of the X and Y ports are reversed from the requirements of the ISO Standard

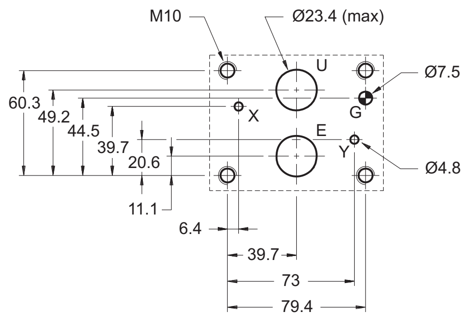
5 - S U T X 5-P OVERALL AND MOUNTING DIMENSIONS



FASTENING BOLTS:
4 bolts M10x70
Tightening torque: 40 Nm

dimensions in mm

MOUNTING SURFACE:
ISO 5781-08-10-*-00 (CETOP 4.4.5-2-08-320)



1	Hexagonal head adjustment screw. Spanner 13.
2	Intake port
3	Outlet port
4	External drainage port
5	External piloting port
6	Pressure gauge port 1/4” NPT
7	Mounting surface with sealing rings: N. 2 OR type 3100 (25.07x2.62) - 90 Shore N. 2 OR type 2021 (5.28x1.78) - 90 Shore

NOTE: the positions of the X and Y ports are reversed from the requirements of the ISO Standard

6 - APPLICATIONS

"S" The type "S" sequence valve is normally used to successively command two or more actuators: when the pressure in the primary circuit reaches the set value on the valve, it opens and allows the fluid to feed the second circuit branch, keeping the pressure in the first branch.

The valve remains open until the pressure at the intake falls below the set value; under these conditions, the maximum pressure setting on the first circuit branch will be achieved also at the outlet.

It is also used to keep a circuit under pressure when simultaneous supply of various users, requiring the total delivery of the pump, would make the pressure value decrease.

"U" This is normally used in automatic circuits (high-low pressure) for unloading the low pressure pump; this occurs when the pressure in the circuit reaches the set value of the valve.

In this manner it is possible to utilize the total flow of the two pumps for fast movements at low pressure, with electric power saving, using high pressure only for working movements.

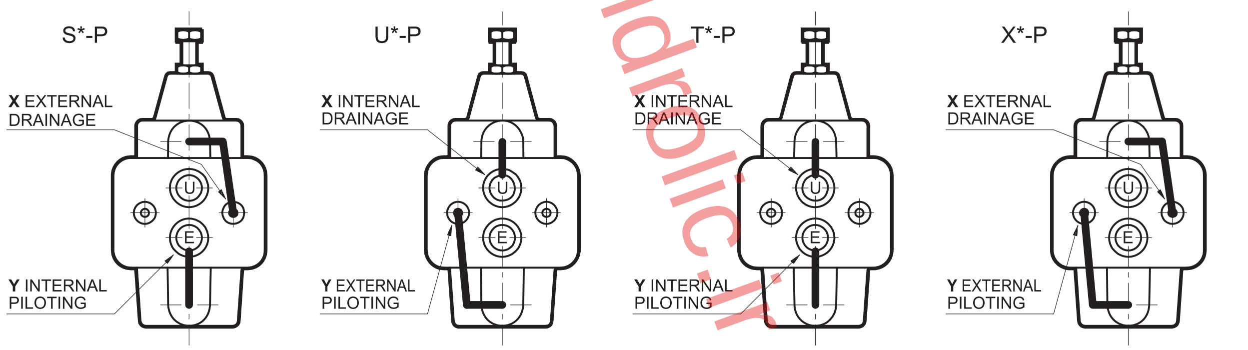
Furthermore, it is used to allow quick discharge of the large chamber of a high differential cylinder which the directional valve would not be able to drain; in this case the valve piloting is connected to the small chamber of the cylinder.

"T" Normally this is used to create hydraulic resistance (back pressure) to prevent uncontrolled movements, especially in the case of suspended loads.

The valve, normally closed, opens only when the set pressure is reached, and thus the descent of the load occurs in a controlled manner and the descending speed depends on the delivery of the pump.

"X" This is mainly used for load balancing. The piloting pressure can be taken from any point in the plant. The valve stays closed until the pilot pressure reaches the set value.

7 - COVER ORIENTATION FOR ALL THE VERSIONS S, U, T, X



NOTE: in this kind of valves Y is the piloting port while X is the drainage port

7 - SUBPLATES (see catalogue 51 000)

		SIZE 3	SIZE 5
Type with rear ports		PMSZ3-AI4G	PMSZ5-AI5G
Ports dimensions:	E, U X, Y	1/2" BSP 1/4" BSP	1" BSP 1/4" BSP

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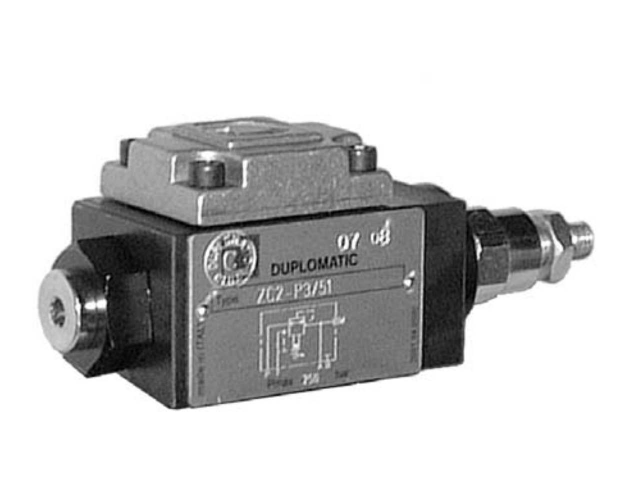


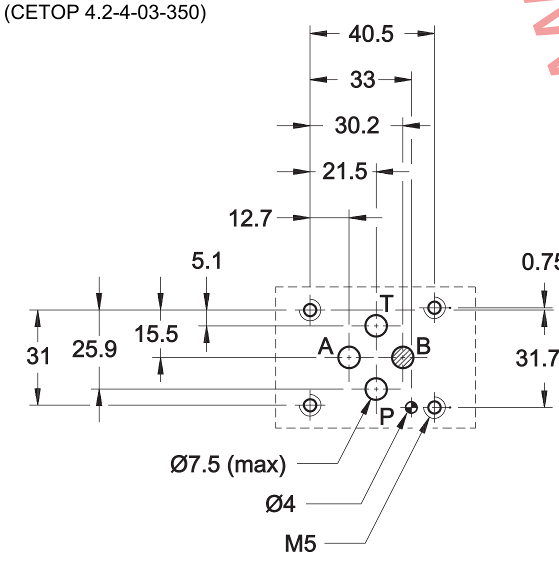
ZC2
BALANCING VALVES
SERIES 51

SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

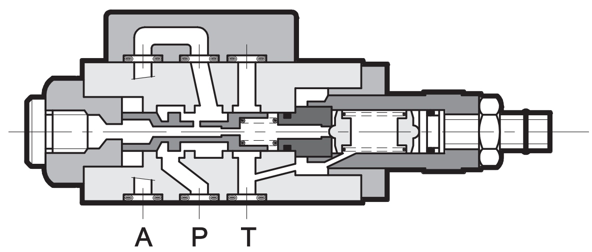
p max **350** bar
Q max **25** l/min

MOUNTING INTERFACES

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



OPERATING PRINCIPLE



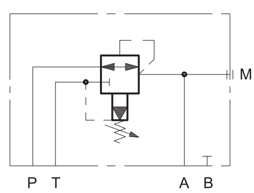
— The type ZC2 balancing valves act as pressure reducing valves that, besides reducing the pressure from line P to user A, allow the flow to return from user A to discharge T when a pressure greater than the set value is generated in the downstream circuit (user A). (A typical case of hydraulic counterweight or load balancing)

— They have a mounting surface in accordance with ISO 4401 (CETOP RP121H) standards. Port B is never used.

PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	25
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	1,3

HYDRAULIC SYMBOL



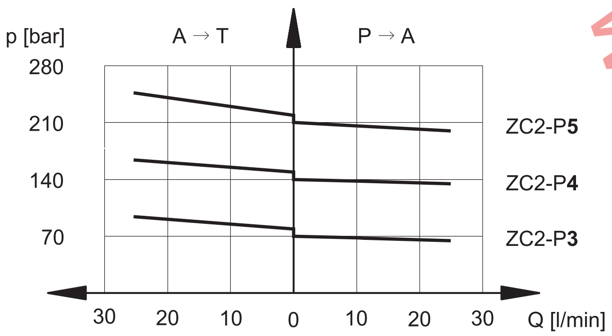
1 - IDENTIFICATION CODE

Z	C	2	-	P		/		/	51	/	

- Balancing valve (ZC)
- Size: ISO 4401-03 (CETOP 03) (2)
- Subplate mounting (P)
- Pressure adjustment range: **3** = 10 ÷ 70 bar **4** = 30 ÷ 140 bar **5** = 50 ÷ 210 bar
- **M1**= Adjustment knob (omit for adjustment with countersunk hex screw)
- Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)
- Seals: omit for mineral oils; **V** = viton for special fluids

2 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)



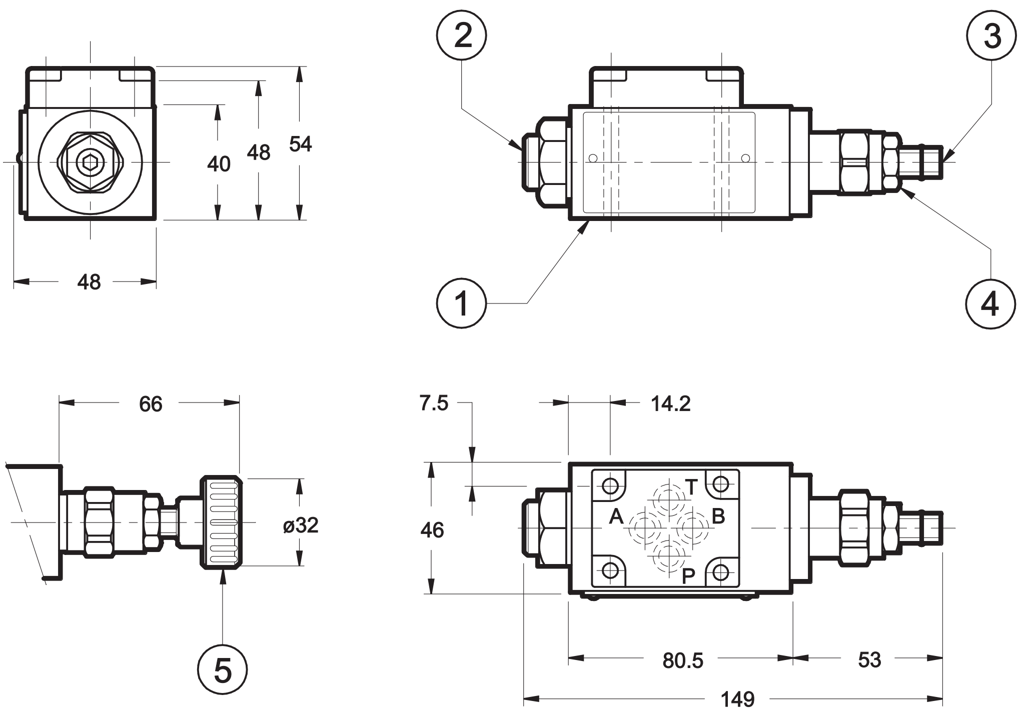
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - ZC2 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



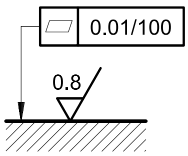
1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) 90 Shore
2	Pressure gauge port 1/4" BSP
3	Countersunk hex adjustment screw: Spanner 5. Clockwise rotation to increase pressure
4	Locking nut: spanner 17
5	Adjustment knob: M1

9 - INSTALLATION

The ZC2 valves can be installed in any position without impairing correct operation.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Surface finishing



6 - FASTENING BOLTS

N. 4 bolts M5x55
Tightening torque: 5Nm (A screws 8.8)

7 - SUBPLATES (see cat. 51 000)

Type PMMD-AI3G ports on rear 3/8" BSP
Type PMMD-AL3G side ports3/8" BSP

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DZC*

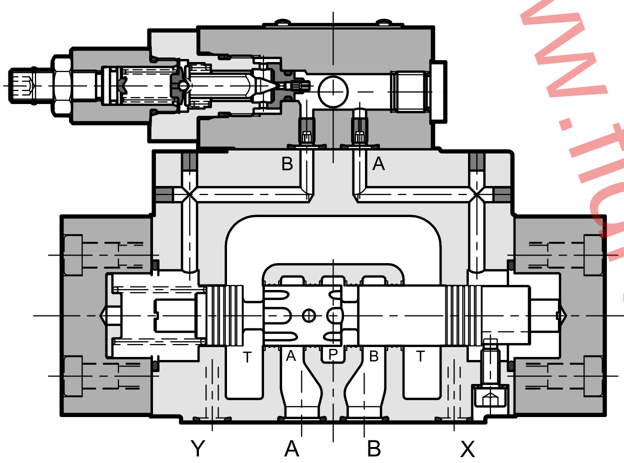
PRESSURE REDUCING VALVES

SERIES 12

DZC5	**CETOP P05**
DZC5R	**ISO 4401-05**
DZC7	**ISO 4401-07**
DZC8	**ISO 4401-08**

p max **350** bar
Q max (see table of performances)

OPERATING PRINCIPLE



— The DZC* valves, besides reducing the pressure from line P to working line A, allow the flow to return from the line A to the return line T when a pressure greater than the set value is generated in the downstream circuit (flow path A): a typical example of hydraulic counterweight or load balancing.

— They have a mounting surface according to ISO 4401 standards. Port B is never used.

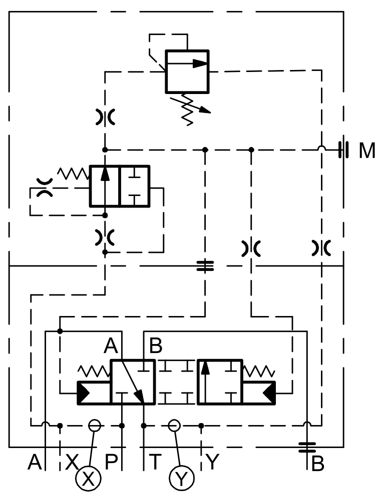
— They are available in three different sizes for flow rates up to 500 l/min.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

		DZC5 DZC5R	DZC7	DZC8
Maximum operating pressure	bar	350		
Maximum flow	l/min	150	300	500
Ambient temperature range	°C	-20 / +50		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15			
Recommended viscosity	cSt	25		
Mass:	kg	6,3	8,6	15

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

D	Z	C		-		/	12		-			/	

Pressure reducing valve

Nominal size:
5 = CETOP P05 (**NOTE**)
5R = ISO 4401-05
7 = ISO 4401-07
8 = ISO 4401-08

Pressure control range
070 = 5 ÷ 70 bar
140 = 5 ÷ 140 bar
210 = 5 ÷ 210 bar

Series No.
(the overall and mounting dimensions remain unchanged from 10 to 19)

NOTE: This version is interchangeable with the previous model ZC4 Duplomatic

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Piloting: **I** = internal
E = external

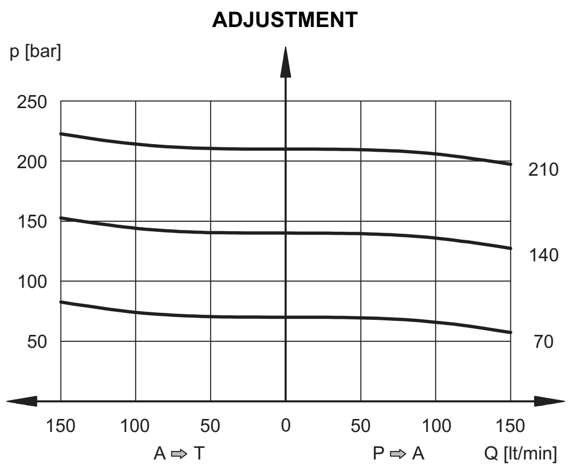
Drainage: **I** = internal
E = external

K1= Adjustment knob (omit for adjustment with socket hex screw)

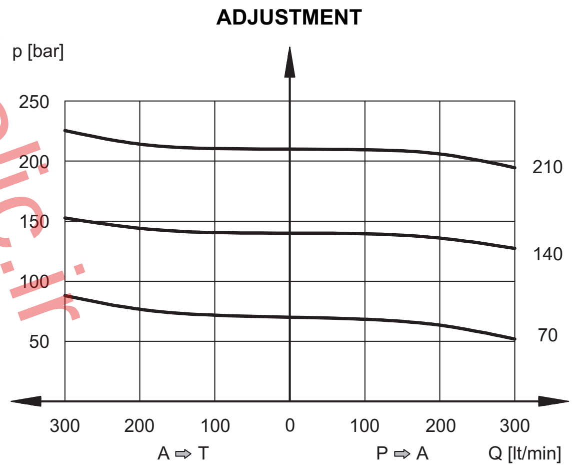
2 - CHARACTERISTIC CURVES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

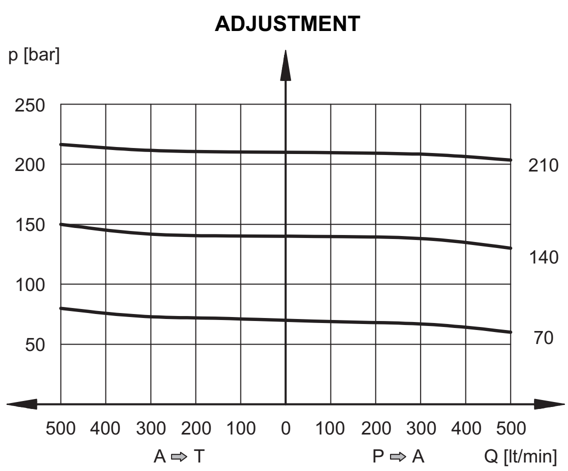
2.1 - Characteristic curves DZC5 and DZC5R



2.2 - Characteristic curves DZC7



2.3 - Characteristic curves DZC8



3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - PILOTING AND DRAINAGE

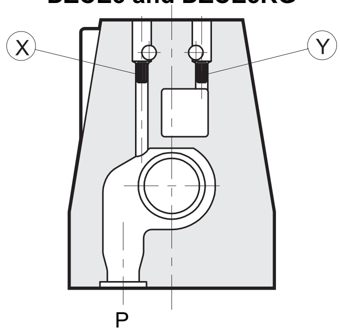
The valves are available with piloting and drainage, both internal and external. The version with external drainage allows a higher backpressure on the unloading.

TYPE OF VALVE		Plug assembly X	Plug assembly Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

PRESSURES
(bar)

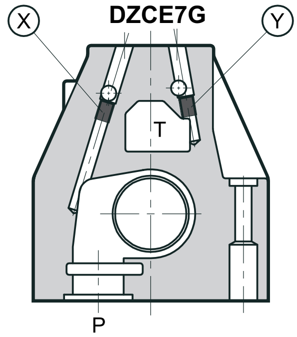
Pressure	MIN	MAX
Pilot pressure on port X	30	210
Pressure on T port with internal drain	-	2
Pressure on T port with external drain	-	250

DZCE5 and DZCE5RG



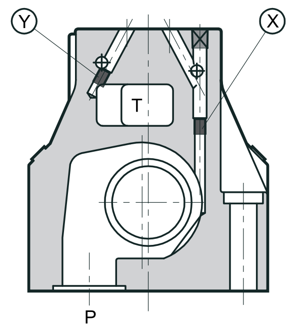
X: M5x6 plug for external pilot
Y: M5x6 plug for external drain

DZCE7G



X: M6x8 plug for external pilot
Y: M6x8 plug for external drain

DZCE8G



X: M6x8 plug for external pilot
Y: M6x8 plug for external drain

5 - INSTALLATION

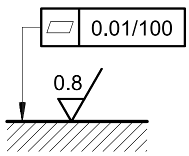
The DZC* valves can be installed in any position without impairing correct operation.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.

Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

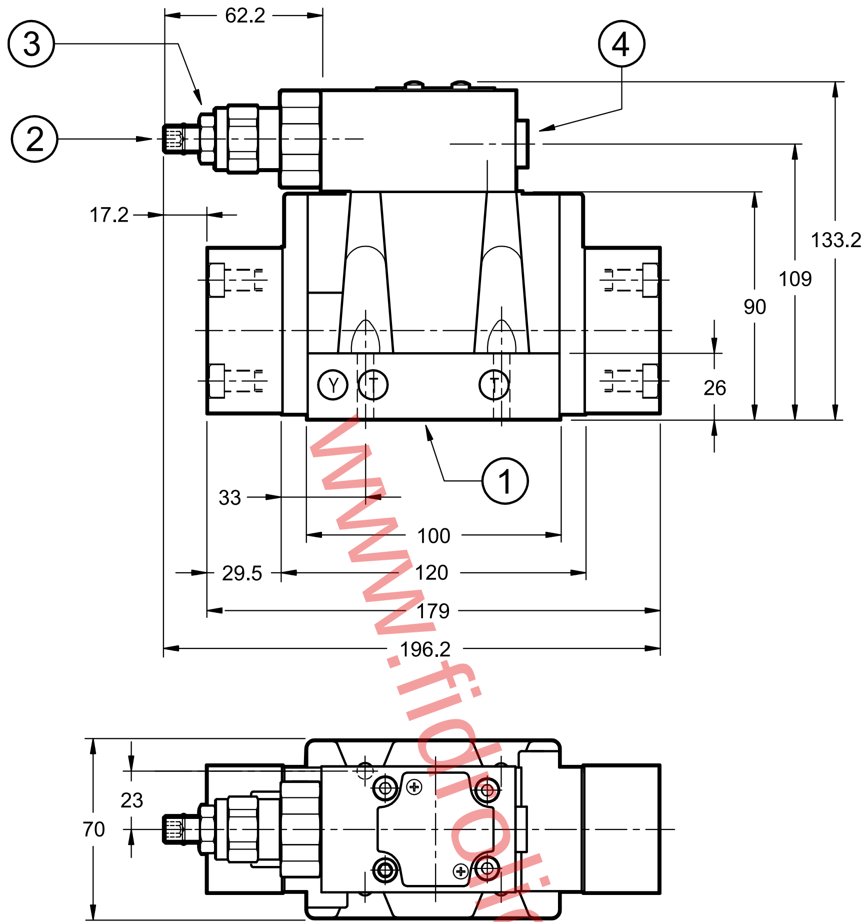
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

surface finishing



6 - DZC5 AND DZC5R OVERALL AND MOUNTING DIMENSIONS

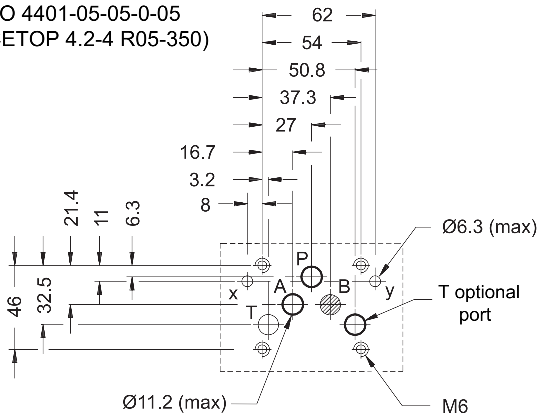
dimensions in mm



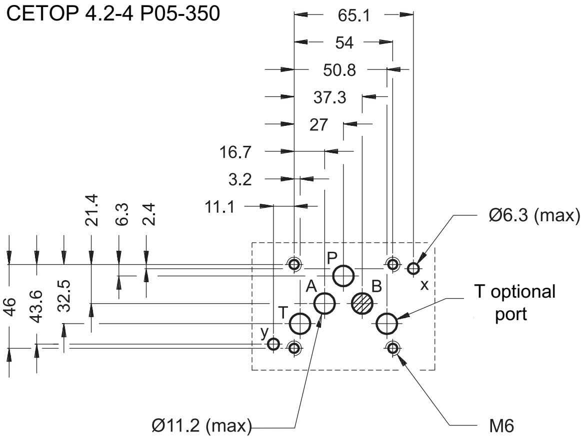
1	Mounting surface with sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore N. 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Socket hex adjustment screw: Allen key 5. Clockwise rotation to increase pressure
3	Locking nut: spanner 17
4	Pressure gauge port 1/4” BSP

Valve fastening: N. 4 bolts SHC ISO 4762 M6x35
Tightening torque: 8 Nm (A 8.8 bolts)
Thread of mounting holes: M6x10

DZC5R MOUNTING SURFACE
ISO 4401-05-05-0-05
(CETOP 4.2-4 R05-350)

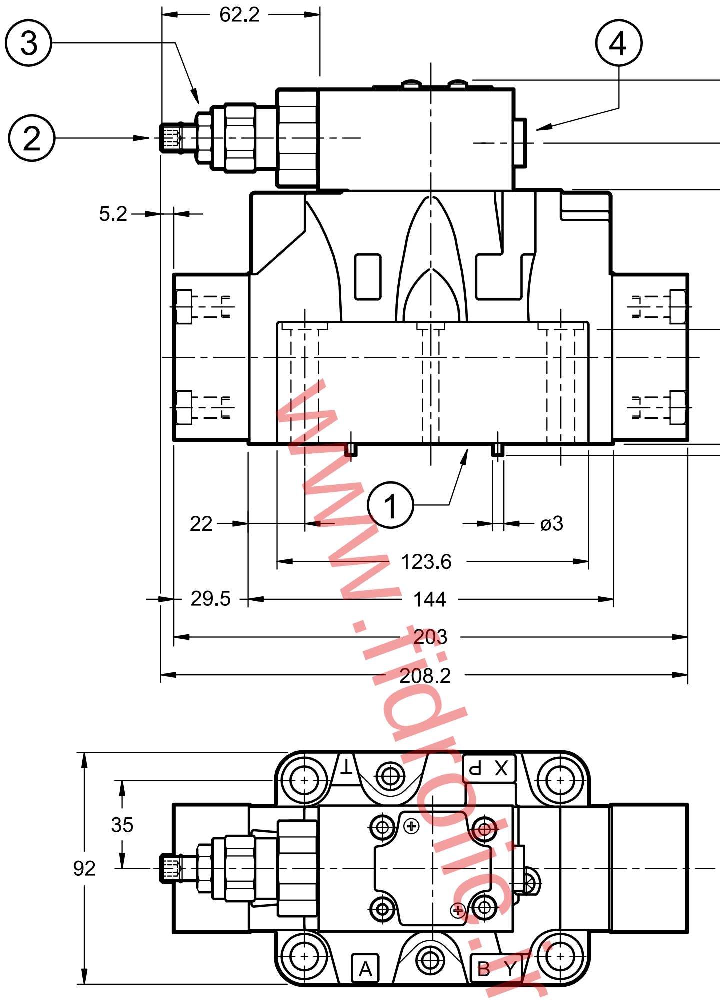


DZC5 MOUNTING SURFACE
CETOP 4.2-4 P05-350



7 - DZC7 OVERALL AND MOUNTING DIMENSIONS

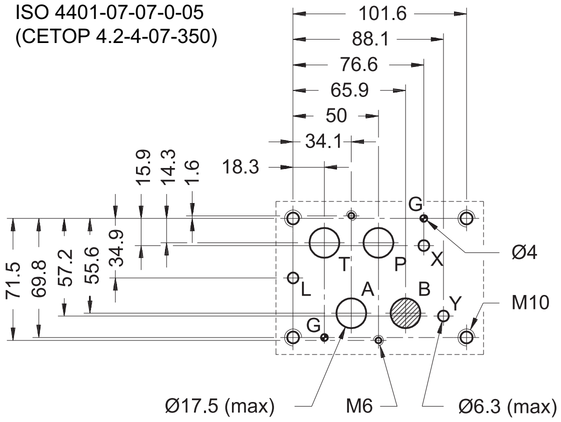
dimensions in mm



1	Mounting surface with sealing rings: N. 4 OR type 130 (22.22x2.62) - 90 Shore N. 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Socket hex adjustment screw: Allen key 5. Clockwise rotation to increase pressure
3	Locking nut: spanner 17
4	Pressure gauge port 1/4" BSP

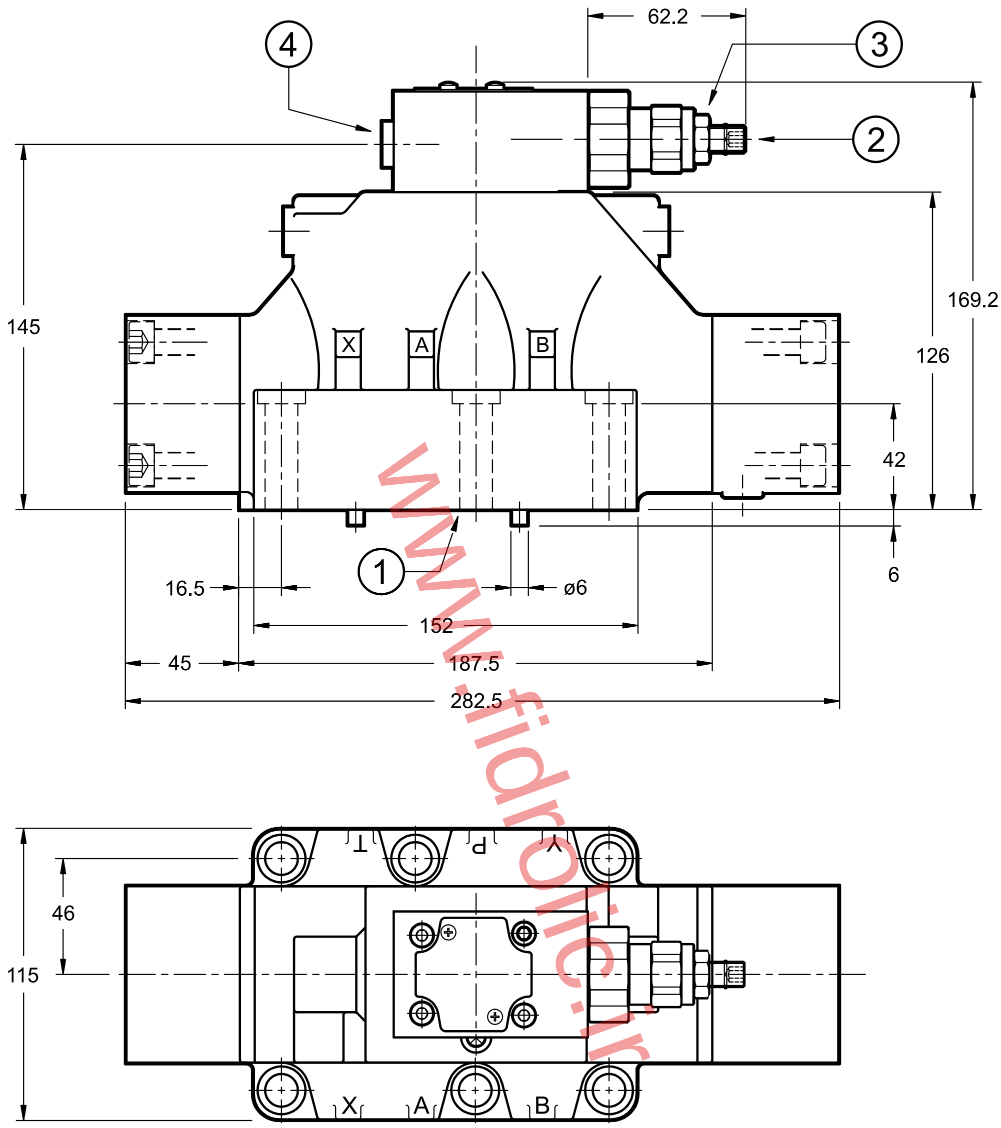
Single valve fastening: N. 4 SHC bolts ISO 4762 M10x60 N. 2 SHC bolts ISO 4762 M6x60
Tightening torque M10x60: 40 Nm (A 8.8 bolts) M6x60: 8 Nm (A 8.8 bolts)
Thread of mounting holes: M6x18; M10x18

MOUNTING SURFACE
ISO 4401-07-07-0-05
(CETOP 4.2-4-07-350)

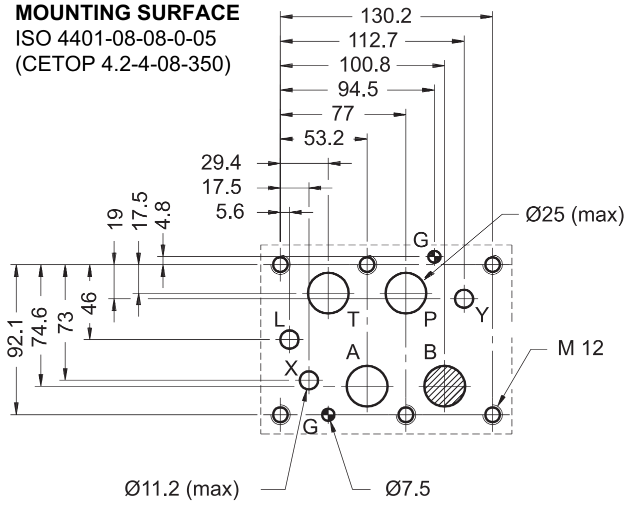


8 - DZC8 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



MOUNTING SURFACE
ISO 4401-08-08-0-05
(CETOP 4.2-4-08-350)

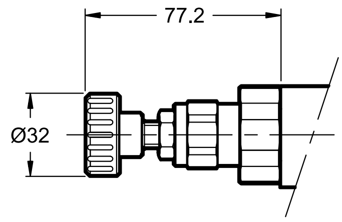


1	Mounting surface with sealing rings: N. 4 OR type 3118 (29.82x2.62) - 90 Shore N: 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Socket hex adjustment screw: Allen key 5. Clockwise rotation to increase pressure
3	Locking nut: spanner 17
5	Pressure gauge port 1/4” BSP

Valve fastening: N. 6 SHC bolts ISO 4762 M12x60
Tightening torque: 69 Nm (A 8.8 bolts)
Thread of mounting holes: M12x20

9 - OPTIONS

The valves can be equipped with adjustment knob instead of the standard socket head screw.
Add **K1** at the identification code end (see par.1).



10 - SUBPLATES

(See catalogue 51 000)

	DZC5	DZC7	DZC8
Model with rear ports	PME4-AI5G	PME07-AI6G	-
Model with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G
Thread of ports: P - T - A - B X - Y	3/4" BSP 1/4" BSP	1" BSP 1/4" BSP	1½" BSP 1/4" BSP

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RS*

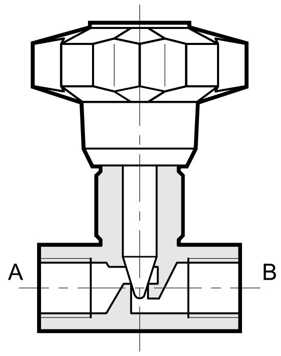
DOUBLE-ACTING THROTTLE FLOW CONTROL VALVE

SERIES 30

THREADED PORTS
CARTRIDGE TYPE

p max (see table of performances)
Q max (see table of performances)

OPERATING PRINCIPLE



— The RS* and RS*-I valves are throttle flow control valves for in-line mounting, directly in the line or as a cartridge complete with threading for in-block mounting.

— Adjustment is obtained with a conical throttle that operates in a cylindrical seat and allows a good linearity of the adjusted flow.

— They are also used as flow shut-off valves since they guarantee good sealing when completely closed.

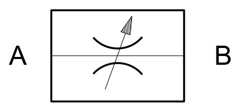
— The valves are always supplied with an adjustment knob that can be locked in any position with a transverse positioned grub screw, as may be required.

PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C)

Valve code	Port dimensions BSP	Nominal flow rate [l/min]	Mass [kg]	Max. operating pressure [bar]
RS2	1/4”	15	0,2	400
RS3	3/8”	30	0,4	
RS4	1/2”	50	0,6	
RS5	3/4”	80	1,3	
RS6	1”	150	2,6	320
RS7	1 ¼”	200	3,0	
RS8	1 ½”	220	4,2	
RS2-I	_	15	0,15	320
RS3-I	_	30	0,2	
RS4-I	_	50	0,3	
RS5-I	_	80	0,6	
RS6-I	_	150	1,2	

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

R	S		-		/	30	/	

Throttle flow control valve

Nominal dimension:
2 = 1/4” **5** = 3/4”
3 = 3/8” **6** = 1”
4 = 1/2” **7** = 1¼”
8 = 1½”

I = In-block cartridge version, available only in dimensions 2-3-4-5-6
Omit for version with threaded ports

Series No. (the overall and mounting dimensions remain unchanged from 30 to 39)

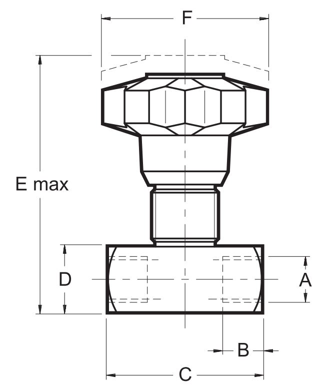
Seals:
omit for mineral oils
V = viton for special fluids

3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

3 - OVERALL AND MOUNTING DIMENSIONS RS*

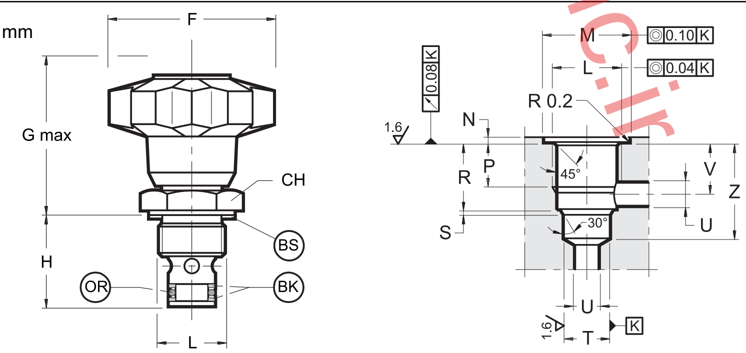
dimensioni in mm



Valve	A BSP	B	C	⌀ D	E max	Ø F
RS2	1/4”	12,5	49	20	78	50
RS3	3/8”	12,5	59	25	93	70
RS4	1/2”	15,5	68	30	107	80
RS5	3/4”	17	86	40	132,5	100
RS6	1”	20	105	50	167,5	120
RS7	1 ¼”	22	120	55	172,5	120
RS8	1 ½”	24	134	65	181	120

4 - OVERALL AND MOUNTING DIMENSIONS RS*-I

dimensioni in mm



* *“BONDED SEAL”*
seal excluded from the supply

sigla valvola	ØF	G max	H	L 6H	ØM +0.2 0	N	P min	R ±0.2	S +0.2 0	ØT H8	ØU max	V ±0.2	Z min	CH	OR type	BK type	BS* type
RS2-I	50	49.5	26.5	M20x1.5	27	1	12	16.5	1	14	5	13.3	27	27	2043	2043	400-513
RS3-I	70	57.5	30.5	M20x1.5	27	1	12	20	1.2	16	8	15.2	32	27	2050	2050	400-513
RS4-I	80	66.5	40	M27x2	33	1.3	18	28	1.2	19	10	22	41	32	2062	2062	400-520
RS5-I	100	76.5	44	M33x2	40	1.3	18	30.5	1.2	27	12	23	45.5	41	130	130	400-515
RS6-I	120	102	52.5	M42x2	50	1.3	21.5	36.5	1.5	35	16	28.5	55	50	3118	3118	400-516

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RSN*

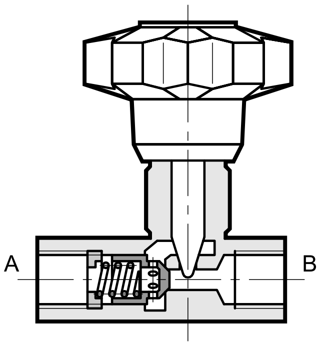
SINGLE-ACTING THROTTLE FLOW CONTROL VALVE

SERIES 30

THREADED PORTS
CARTRIDGE TYPE

p max (see table of performances)
Q max (see table of performances)

OPERATING PRINCIPLE



— The RSN* and RSN*-I valves are single-acting throttle flow control valves for in-line mounting, directly in the line or as a cartridge complete with threading for in-block mounting.

— Adjustment is obtained with a conical throttle that operates in a cylindrical seat and allows a good linearity of the adjusted flow.

— They are also used as signle direction flow shut-off valves since they guarantee good sealing when completely closed. They also allow a free return in the opposite direction.

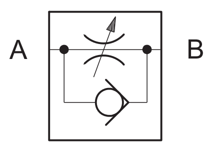
— The valves are always supplied with an adjustment knob that can be locked in any position with a transverse positioned grub screw, as may be required.

PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C)

Valve Code	Port dimensions BSP	Nominal flow rate [l/min]	Max. flow with open flow [l/min]	Mass [kg]	Max. operating pressure [bar]
RSN2	1/4”	15	35	0,25	400
RSN3	3/8”	30	80	0,5	
RSN4	1/2”	50	150	0,75	
RSN5	3/4”	80	200	1,6	
RSN6	1”	150	300	3,05	320
RSN7	1 ¼”	200	400	3,75	
RSN8	1 ½”	220	500	5,75	
RSN2-I	_	15	35	0,13	320
RSN3-I	_	30	80	0,25	
RSN4-I	_	50	150	0,34	
RSN5-I	_	80	200	0,62	

Direct check valve opening pressure	bar	0,35
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

R	S	N		-		/	30	/	

Single-acting throttle flow control valve

Nominal dimension:
2 = 1/4” **5** = 3/4”
3 = 3/8” **6** = 1”
4 = 1/2” **7** = 1¼”
8 = 1½”

I = in-block cartidge version, available only in dimensions 2-3-4-5
Omit for version with threaded ports

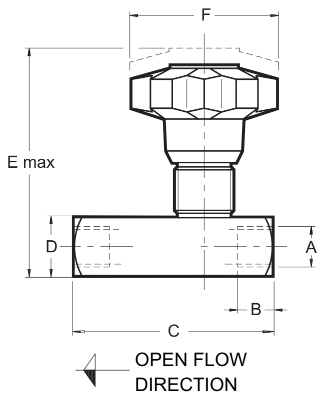
Series No. (the overall and mounting dimensions remain unchanged from 30 to 39)

Seals:
omit for mineral oils
V = viton for special fluids

2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

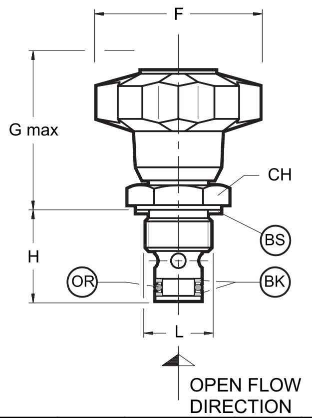
3 - OVERALL AND MOUNTING DIMENSIONS RSN*

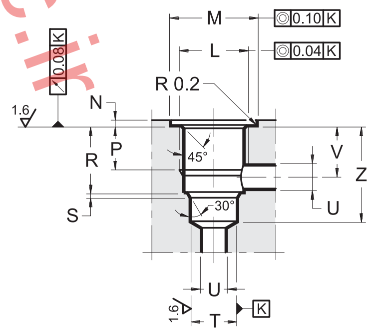


dimensions in mm

Valve	A BSP	B	C	⊘ D	E max	Ø F
RSN2	1/4”	12,5	66	20	78	50
RSN3	3/8”	12,5	79	25	93	70
RSN4	1/2”	15,5	94,5	30	107	80
RSN5	3/4”	17	115	40	132,5	100
RSN6	1”	20	138,5	50	167,5	120
RSN7	1¼”	22	157	55	172,5	120
RSN8	1½”	24	190	65	181	120

4 - OVERALL AND MOUNTING DIMENSIONS RSN*-I





dimensions in mm

*“BONDED SEAL” seal excluded from the supply

Valve	ØF	G max	H	L 6H	ØM + 0.2 0	N	P min	R ± 0.2	S + 0.2 0	ØT H8	ØU max	V ± 0.2	Z min	CH	OR type	BK type	BS* type
RSN2-I	50	49	30.5	M20x1.5	27	1	12	20	1.2	16	8	15.2	32	27	2050	2050	400-513
RSN3-I	70	56	40	M27x2	33	1.3	18	28	1.2	19	10	22	41	32	2062	2062	400-520
RSN4-I	80	70	44.5	M33x2	40	1.3	18	30.5	1.2	27	12	23	45.5	41	130	130	400-515
RSN5-I	100	80	52.5	M42x2	50	1.3	21.5	36.5	1.5	35	16	28.5	55	50	3118	3118	400-516

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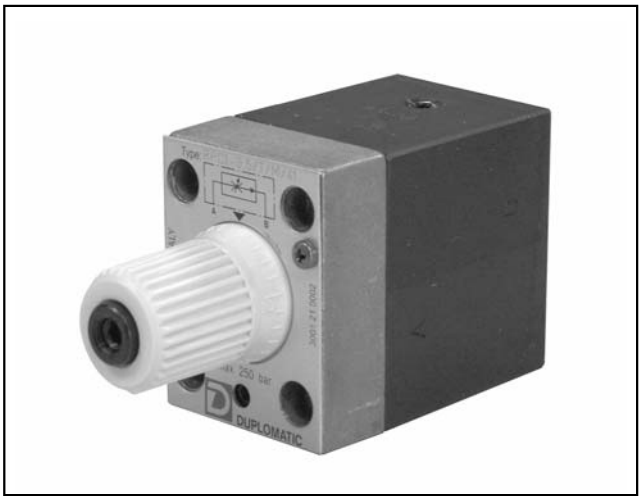


RPC1

PRESSURE AND TEMPERATURE COMPENSATED FLOW CONTROL VALVE

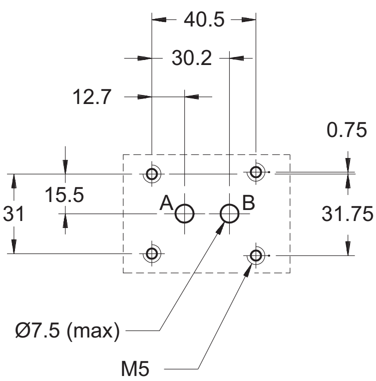
SERIES 41

SUBPLATE MOUNTING
ISO 6263-03 (CETOP 03)

p max **250** bar
Q max (see table of performances)

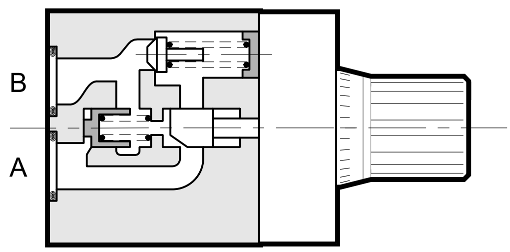
MOUNTING INTERFACE

ISO 6263-03-03-*-97
(CETOP 4.5.2-2-03-250)



NOTE: The RPCED1 mounting interface, with CETOP 03 holes, must not have P and T ports or must have the 0113388 subplate (see paragraph 9)

OPERATING PRINCIPLE

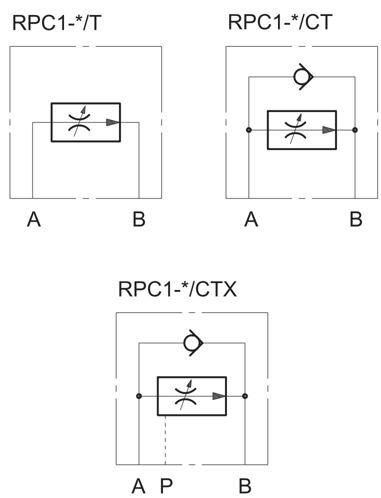


— The RPC1 valve is a pressure and temperature compensated flow control valve.
— The flow is adjusted by a calibrated knob that modulates the opening of the control gap and can be locked in any adjustment position. Adjustment is made with three turns, and upon request one-turn adjustment, RPC1*/M, is available.
— It is available in seven different flow rate adjustment ranges from 0,5 l/min up to 30 l/min.

PERFORMANCE RATINGS (obtained with mineral oil with viscosity of 36 cSt at 50°C)

Maximum operating pressure Minimum pressure difference between A and B Check valve cracking pressure	bar	250 10 0,5
Maximum controlled flow rates Minimum controlled flow rate (for 0,5-1 and 4 l/min) Maximum flow rate in free flow direction	l/min	0,5-1-4-10-16-22-30 0,025 40
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree Fluid contamination degree for flows < 0,5 l/min	According to ISO 4406:1999 class 20/18/15 According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	1,3
Number of adjustment knob turns	RPC1 RPC1-*/M	3 1

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

R	P	C	1	-		/		T		/		/	41	/	

Pressure compensated flow control valve

Size ISO 6263-03 (CETOP 03)

Controlled flow
0,5 = 0,5 l/min
1 = 1 l/min
4 = 4 l/min
10 = 10 l/min
16 = 16 l/min
22 = 22 l/min
30 = 30 l/min

C = incorporated check valve (omit if not required)

Temperature compensation

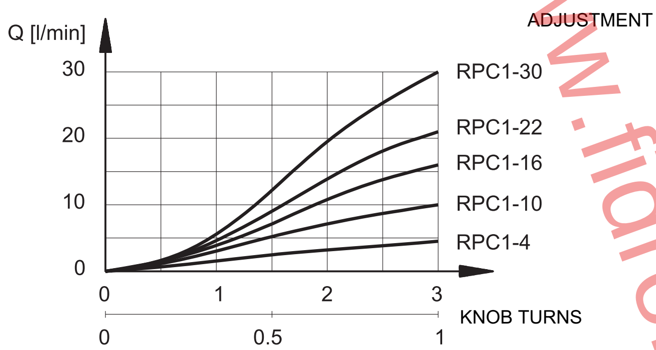
X = with speed anti-jump port P, available only in the check valve version (Omit if not required)

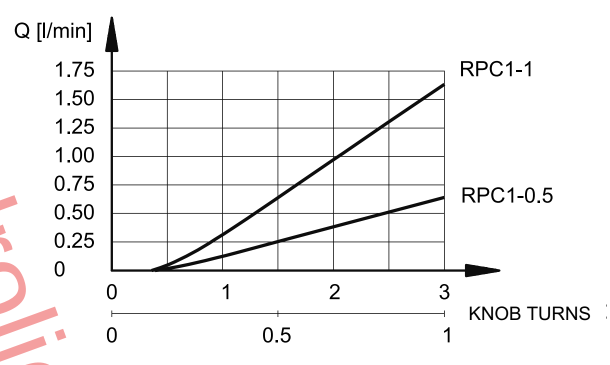
M = single-turn adjustment knob (omit for three-turn adjustment)

Series No. (the overall and mounting dimensions remain unchanged from 40 to 49)

Seals: omit for mineral oils
V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)





3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - PRESSURE COMPENSATION

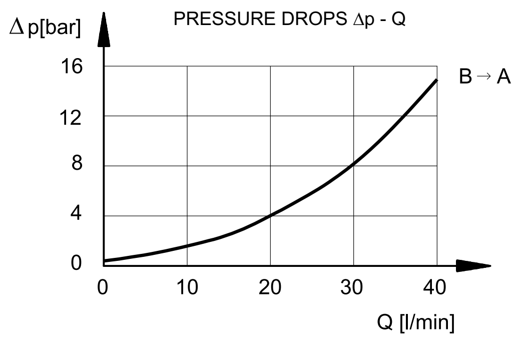
Two throttles in series are in the valve. The first is an opening regulated by the knob; the second, piloted by the pressure upstream and downstream of the first throttle, assures a constant pressure drop across the adjustable throttle. In these conditions, the set flow rate value stays constant within a tolerance range of ± 2% of the maximum flow controlled by the valve for maximum pressure variation between the intake and outlet chambers of the valve.

5 - TEMPERATURE COMPENSATION

The valve temperature compensation is obtained with the principle of fluid passage across a thin wall orifice in which the flow rate is not subtantially influenced by the oil viscosity fluctuations. For controlled flows of less than 0,5 l/min and with a temperature difference of 50 °C, flow is increased by about 13% of the set flow value. For higher flow rates, and with the same temperature difference, the flow increase is about 4% of the maximum flow controlled by the valve.

6 - REVERSE FREE FLOW

The RPC1 valve, upon request, is supplied with an incorporated check valve to allow free flow in the direction opposite to the controlled flow, B→A.
In this case the valve code becomes RPC1-*/**C**T.

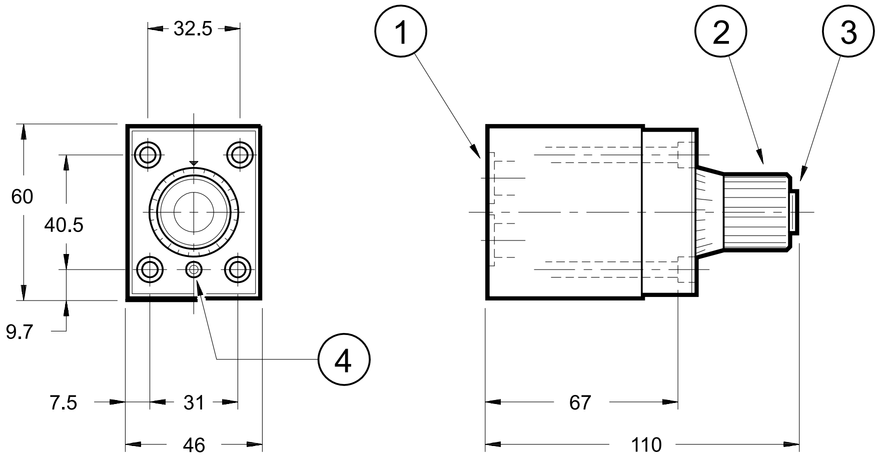


7 - RPC1-*/CTX

This valve is normally used for intake control and is positioned downstream of the directional valve.
The piloting connection “P” keeps the compensator in the closed position, thus avoiding the initial speed jump that occurs at the time the distributor sends oil to the valve (see the application diagram, paragraph 11).

8 - RPC1-* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

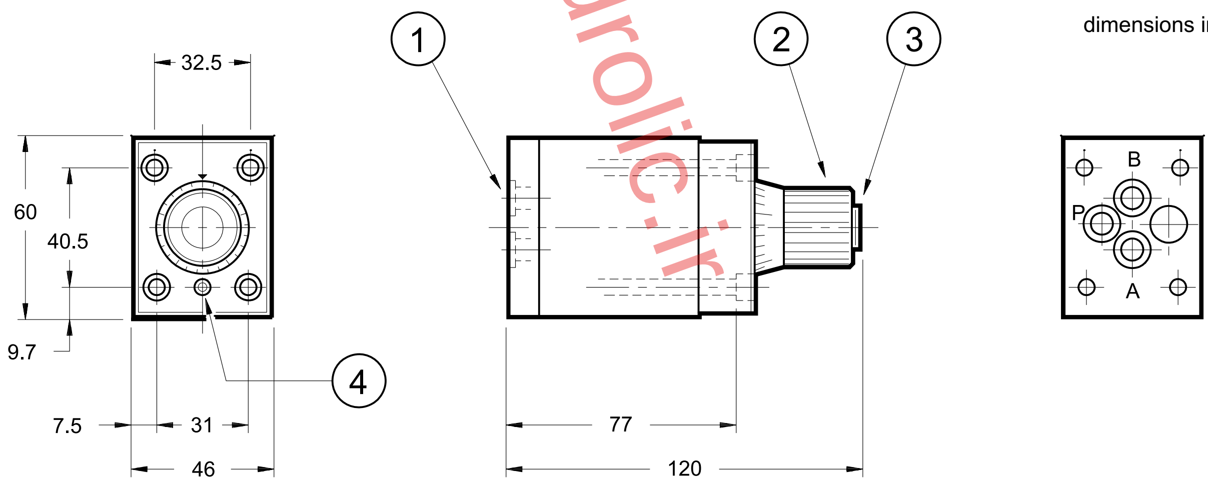


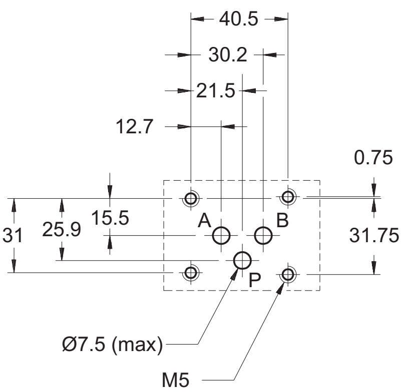
1	Mounting surface with sealing rings: 2 ORM - 0140 - 20 (14x2)
2	Adjustment knob. Anticlockwise rotation to increase flow.
3	Indicator of knob turns
4	Knob locking screw

FASTENING BOLTS
4 bolts M5x75
Tightening torque: 5 Nm

9 - RPC1-*/CTX OVERALL AND MOUNTING DIMENSIONS

dimensions in mm





1	Subplate cod. 0113388. Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 Shore)
2	Adjustment knob. Anticlockwise rotation to increase flow.
3	Indicator of knob turns
4	Knob locking screw

Mounting surface: ISO 6263-03-03-*-97 (CETOP 4.5.2-2-03-250)

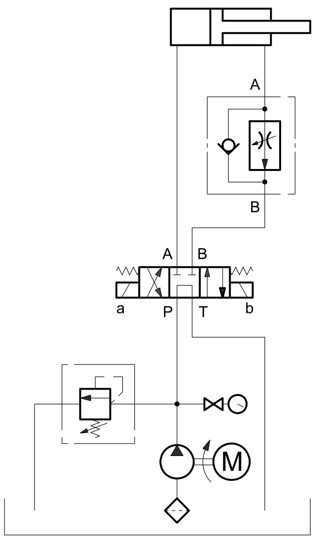
FASTENING BOLTS
4 bolts M5x85
Tightening torque: 5 Nm

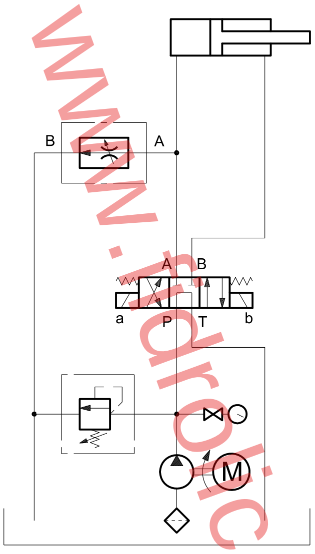
10 - SUBPLATES (look at datasheet 51 000)

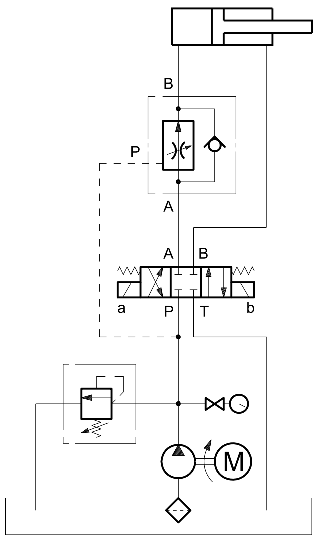
Type	PMRPC1-AI3G with rear ports PMRPC1-AL3G with side ports	
Type	PMMD-AI3G with rear ports, with user T plugged PMMD-AL3G with side ports, with user T plugged	only for valve RPC1-*/CTX
Port dimension	3/8” BSP	

11 - APPLICATION EXAMPLES

Meter-out control	Bleed-off control	Meter-in control with anti-jump device







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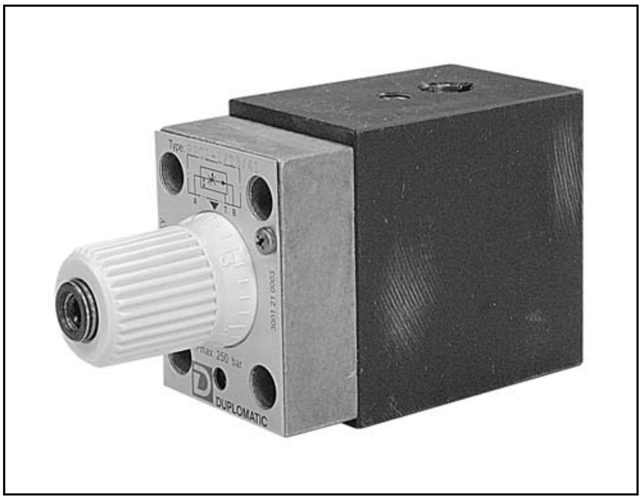


RPC1-T3

PRESSURE AND TEMPERATURE COMPENSATED THREE-WAY FLOW CONTROL VALVE

SERIES 41

SUBPLATE MOUNTING

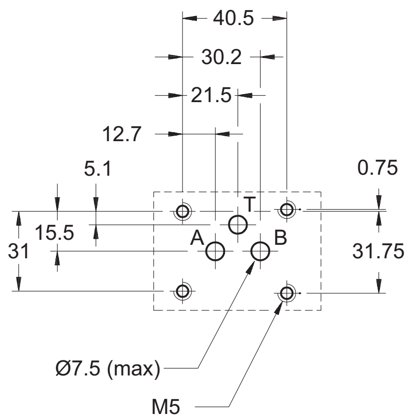
ISO 6263-03 (CETOP 03)

p max **250** bar

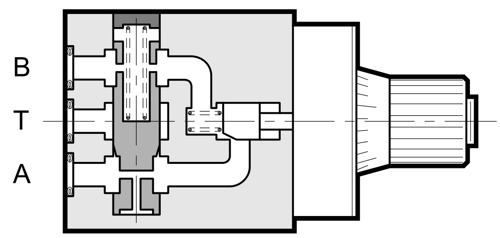
Q max (see table of performances)

MOUNTING INTERFACE

ISO 6263-03-03-*-97
(CETOP 4.5.2-3-03-250)



OPERATING PRINCIPLE



— The pressure and temperature compensated three-way flow control valves serve to control the flow sent to the actuator and to discharge it, which exceeds that required, back to tank at system pressure rather than at relief value pressure.

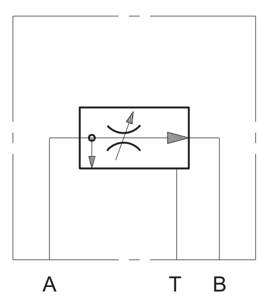
— The flow rate adjustment range is carried out with three turns of the knob and an indicator shows the number of turns made. A one-turn adjustment on the knob, RPC1*/M, is available upon request.

— The adjustment knob can be locked in any position in the adjustment range by a screw.

PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C)

Maximum operating pressure Minimum pressure difference between A and B	bar	250 12
Maximum controlled flow rates Minimum controlled flow rate (for 1 and 4 l/min)	l/min	1-4-10-16-22 0,035
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree Fluid contamination degree for flows < 0,5 l/min	According to ISO 4406:1999 class 20/18/15 According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	1,5
Number of adjustment knob turns	RPC1/T3 RPC1-/T3/M	3 1

HYDRAULIC SYMBOL

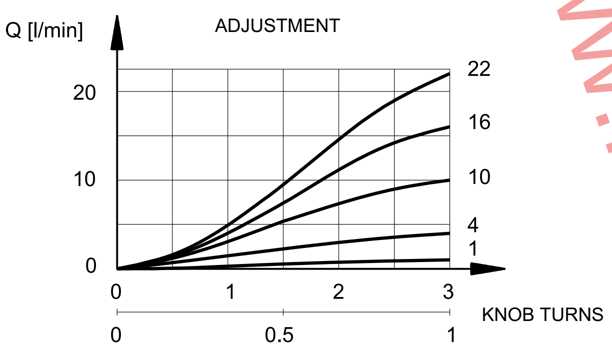


1 - IDENTIFICATION CODE

R P C 1 - [ ] / T 3 / [ ] / 41 / [ ]

- RPC: Pressure compensated flow control valve
- 1: Size ISO 6263-03 (CETOP 03)
- Controlled flow: **1** = 1 l/min; **4** = 4 l/min; **10** = 10 l/min; **16** = 16 l/min; **22** = 22 l/min
- T: Temperature compensation
- 3: Number of ways
- **M** = single-turn adjustment knob (omit for three-turn adjustment)
- 41: Series No. (the overall and mounting dimensions remain unchanged from 40 to 49)
- Seals: omit for mineral oils; **V** = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - PRESSURE COMPENSATION

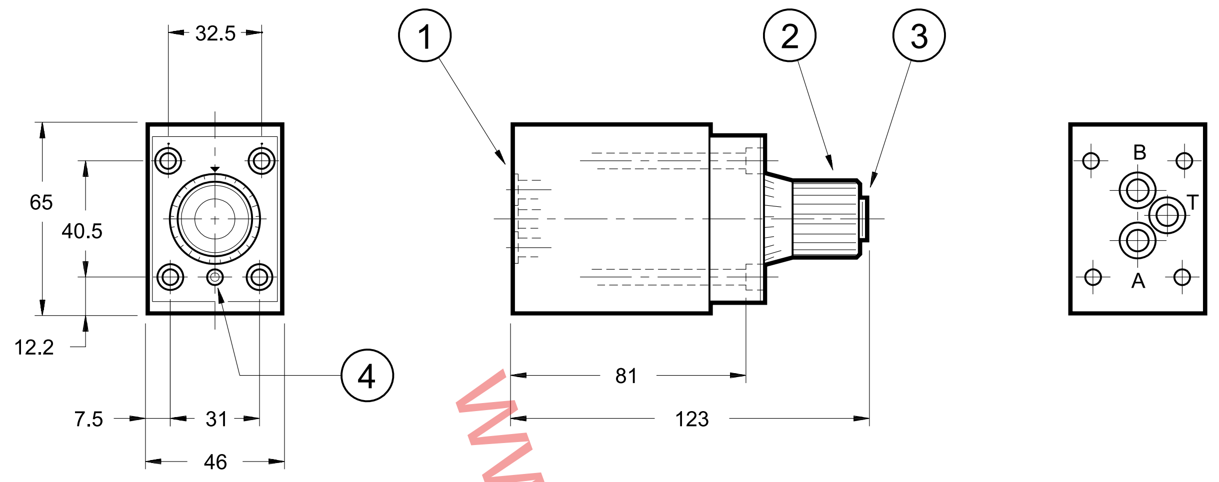
Two throttles in series are in the valve. The first is an opening regulated by the knob; the second, piloted by the pressure upstream and downstream of the first throttle, assures a constant pressure drop across the adjustable throttle. In these conditions, the set flow rate value stays constant within a tolerance range of ±2% of the maximum flow controlled by the valve for maximum pressure variation between the intake and outlet chambers of the valve.

5 - TEMPERATURE COMPENSATION

The valve temperature compensation is obtained with the principle of fluid passage across a thin wall orifice in which the flow rate is not subtantially influenced by the oil viscosity fluctuations. For controlled flows of less than 0,5 l/min and with a temperature difference of 50 °C, flow is increased by about 13% of the set flow value. For higher flow rates, and with the same temperature difference, the flow increase is about 4% of the maximum flow controlled by the valve.

6 - OVERALL AND MOUNTING DIMENSIONS

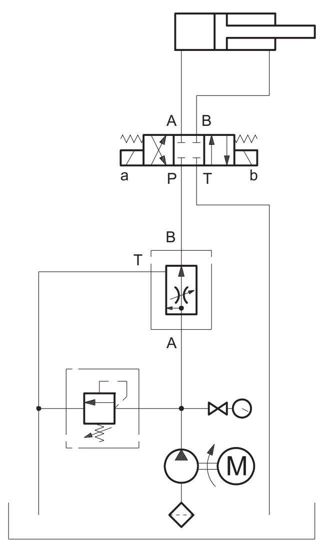
dimensions in mm



1	Mounting surface with sealing rings: 3 OR type 2037 (9.25x1.78) - Shore 90
2	Adjustment knob
3	Indicator of knob turns
4	Knob locking screw

FASTENING BOLTS
4 bolts M5x90
Tightening torque: 5 Nm

7 - APPLICATION EXAMPLE



8 - SUBPLATES (see datasheet 51 000)

Type	PMMD-AI3G with rear ports with user P plugged
Type	PMMD-AL3G with side ports with user P plugged
Port dimension	3/8” BSP

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DUPLOMATIC OLEODINAMICA

RPC*

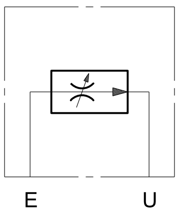
PRESSURE AND TEMPERATURE COMPENSATED FLOW CONTROL VALVES

SUBPLATE MOUNTING

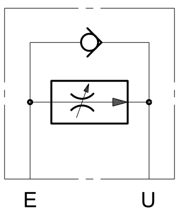
RPC2 **ISO 6263-06** (CETOP 06)
RPC3 **ISO 6263-07** (CETOP 07)

HYDRAULIC SYMBOL

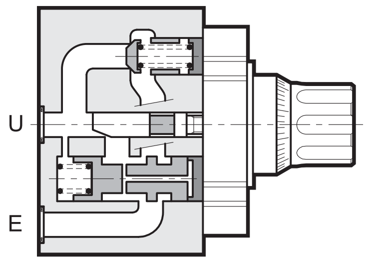
RPC*/T



RPC*/CT



OPERATING PRINCIPLE



- The RPC* valve is a pressure and temperature compensated flow control valve.
- The flow rate is adjusted with a calibrated knob that modulates the opening of the control gap and can be locked in any adjustment position by a screw.
- The flow rate adjustment range is carried out with six turns of the knob, with indication of the number of turns made. A one-turn adjustment on the knob, RPC*/M, is available upon request.

PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C)		**RPC2**	**RPC3**
Maximum operating pressure Check valve cracking pressure Minimum pressure difference between E and U	bar	320 0,5 10	250 0,5 12
Maximum controlled flow rates Minimum controlled flow rate	l/min	22 - 38 -70 0,050	100 - 150 0,120
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25	
Mass	kg	3,6	7,8

1 - IDENTIFICATION CODE

R P C [ ] - [ ] T [ ] / [ ] / [ ] / [ ] / [ ]

Pressure compensated flow control valve

Size:
2 = ISO 6263-06 (CETOP 06)
3 = ISO 6263-07 (CETOP 07)

C = incorporated check valve
(omit if not required)

Temperature compensation

Controlled flow	Size 2	Size 3
N =	22 l/min	100 l/min
S =	38 l/min	150 l/min
70 =	70 l/min	

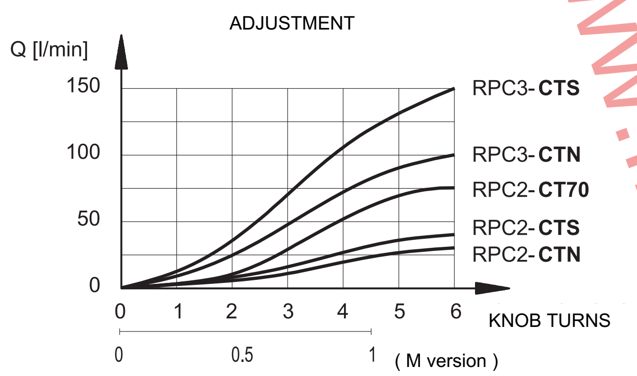
RC = compensating stroke governor
(Omit if not required)

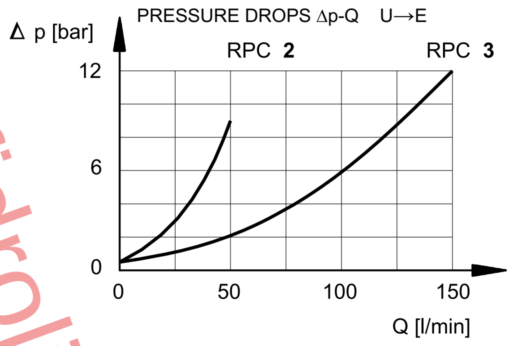
M = single-turn adjustment knob
(omit for six-turn adjustment)

Series No.
31 for RPC*2
43 for RPC*3
(the overall and mounting dimensions remain unchanged from 30 to 39 and from 40 to 49)

Seals: omit for mineral oils
V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)





3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - PRESSURE COMPENSATION

Two throttles in series are in the valve. The first is an opening regulated by the knob; the second, piloted by the pressure upstream and downstream of the first throttle, assures a constant pressure drop across the adjustable throttle. In these conditions, the set flow rate value stays constant within a tolerance range of ± 3% of the maximum flow controlled by the valve for the maximum pressure variation between inlet and outlet chambers of the valve.

5 - TEMPERATURE COMPENSATION

A device located on the first throttle which is sensitive to the temperature fluctuations corrects the position keeping the controlled flow more or less unaltered even should the oil viscosity change.

The fluctuation of the set flow rate stays within ± 2,5% of the maximum flow controlled by the valve.

6 - REVERSE FREE FLOW

The RPC* valves, upon request, are supplied with an incorporated check valve to allow free flow in the direction opposite of the controlled flow. In this case the valve code becomes RPC*-**CT**.

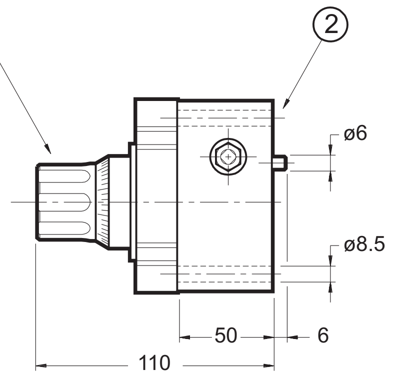
7 - COMPENSATING STROKE GOVERNOR

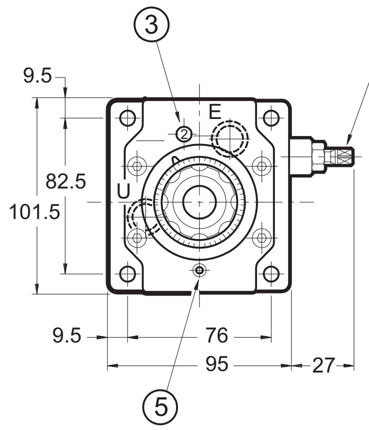
In order to avoid jumps in the actuator when it is started, the RPC valve can be equipped with a special accessory that controls the compensating stroke, thus preventing it from making uncontrolled movements.

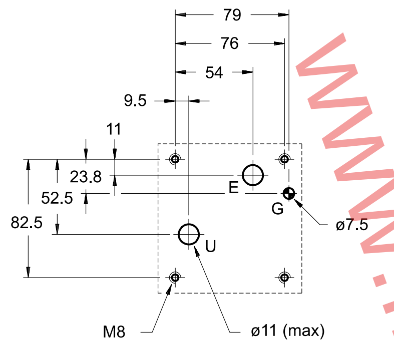
Add the suffix **RC** to the identification code to request this governor. See paragraph 1.

8 - RPC2 SERIES 31 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm







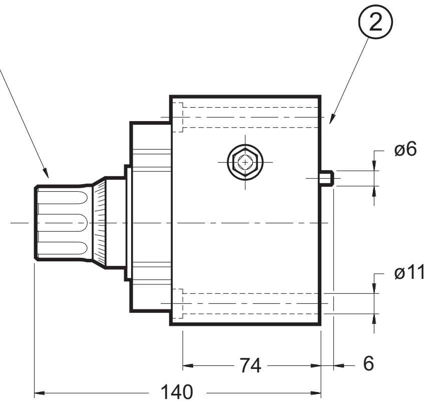
1	Adjustment knob. Anticlockwise rotation to increase flow rate
2	Mounting surface with sealing rings: n° 2 OR type 119 (15.08x2.62)
3	Indicator of number of knob turns
4	Compensating stroke governor (optional)
5	Knob locking screw

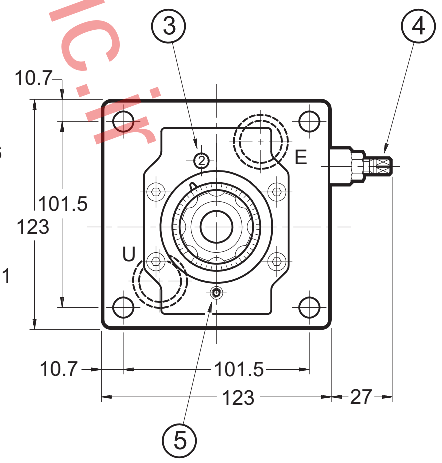
FASTENING BOLTS:
4 SHC bolts ISO 4762 M8x60
Tightening torque: 20 Nm

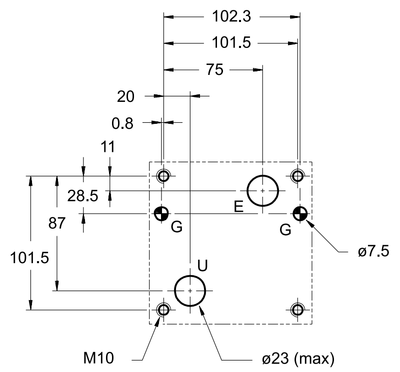
MOUNTING SURFACE: ISO 6263-06-05-*-97 (CETOP 4.5.2-2-06-320)

9 - RPC3 SERIES 43 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm







1	Adjustment knob. Anticlockwise rotation to increase flow rate
2	Mounting surface with sealing rings: n° 2 OR type 3106 (26.65x2x62)
3	Indicator of number of knob turns
4	Compensating stroke governor (optional)
5	Knob locking screw

FASTENING BOLTS:
4 SHC bolts ISO 4762 M10x90
Tightening torque: 40 Nm

MOUNTING SURFACE: ISO 6263-07-09-*-97 (CETOP 4.5.2-2-07-250)

10 - SUBPLATES (see catalogue 51 000)

	RPC2	RPC3
Type	PMRPC2-AI4G rear ports	PMRPC3-AI6G rear ports
Port dimensions	1/2” BSP	1” BSP

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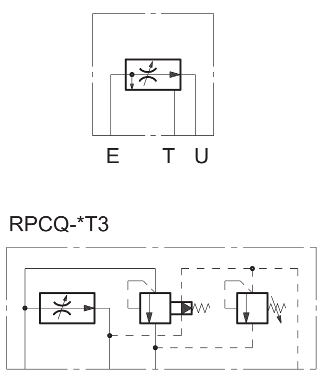
RPC*-*T3

PRESSURE AND TEMPERATURE COMPENSATED THREE-WAY FLOW CONTROL VALVES

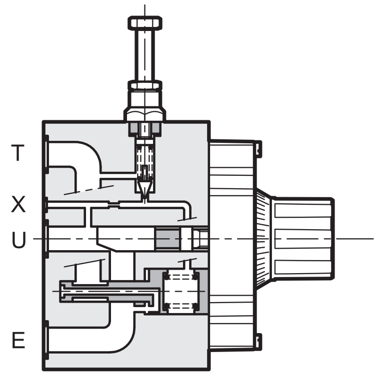
SUBPLATE MOUNTING

RPC-2T3 **ISO 6263-06** (CETOP 06)
RPC-3T3 **ISO 6263-07** (CETOP 07)

HYDRAULIC SYMBOLS



OPERATING PRINCIPLE



— The RPC*-*T3 valve is a pressure and temperature compensated three-way flow control valve.

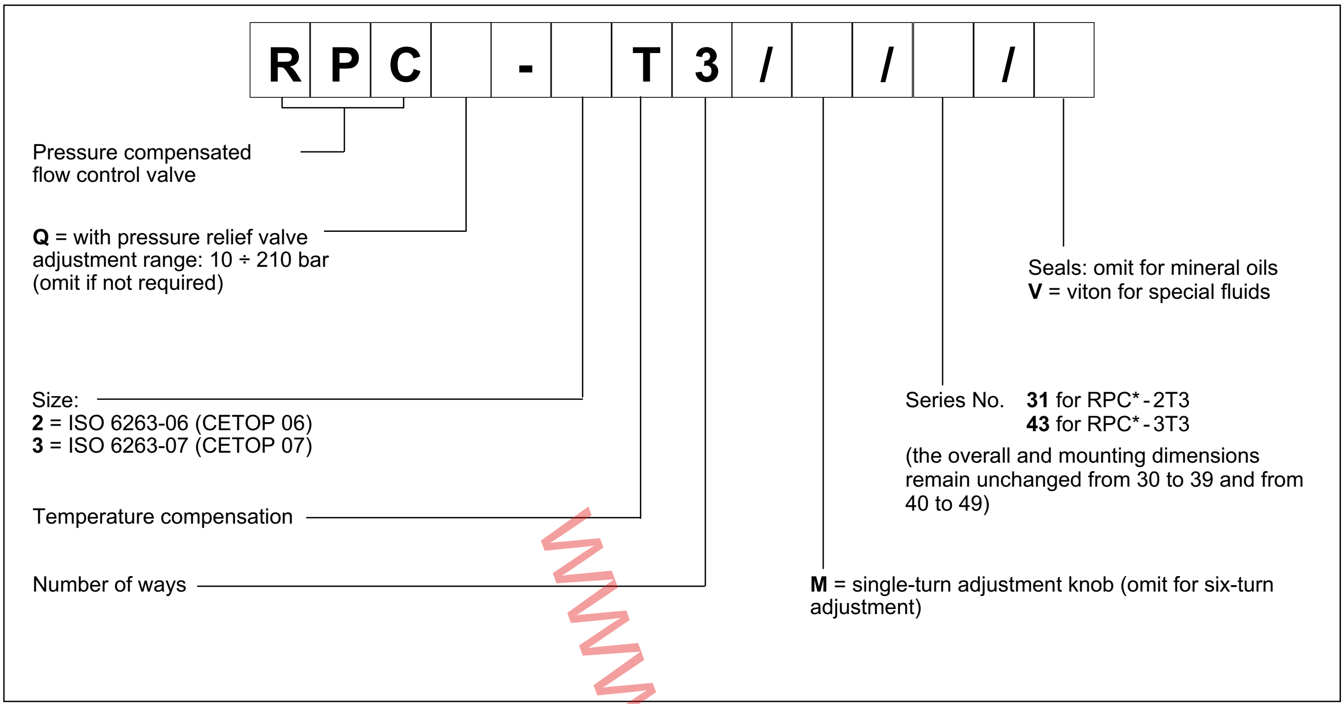
— It allows the control of flow rate to an actuator by discharging the flow exceeding that required by the plant at any one moment. As a consequence, energy consumption is reduced and appropriate at every instant throughout the cycle.

— Single-turn adjustment knob (RPC**/M) and built-in pressure relief valve (RPCQ*) are available upon request.

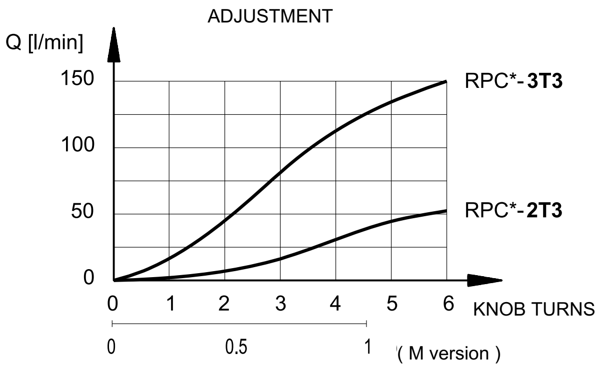
PERFORMANCE RATINGS (obtained with mineral oil with viscosity of 36 cSt at 50°C)

		RPC*-2T3	RPC*-3T3
Maximum operating pressure Minimum pressure difference between E and U	bar	320 10	250 12
Maximum controlled flow rate Minimum controlled flow rate	l/min	50 0,060	150 0,130
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree Fluid contamination degree for flow rate <0,5 l/min		According to ISO 4406:1999 class 20/18/15 According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25	
Mass	kg	4,7	9

1 - IDENTIFICATION CODE



2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - PRESSURE COMPENSATION

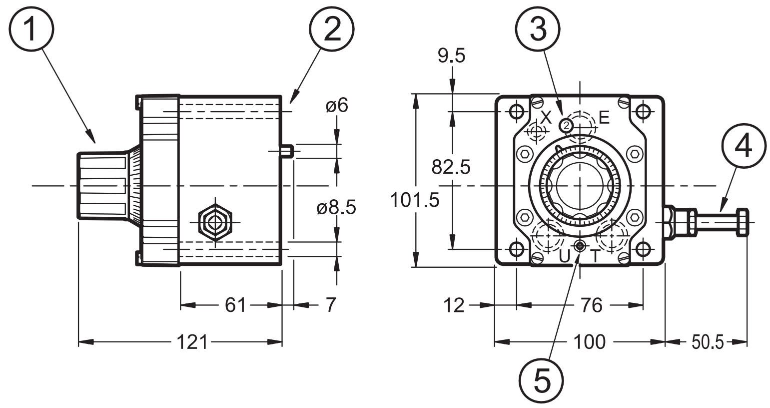
Two throttles in series are in the valve. The first is an opening regulated by the knob; the second, piloted by the pressure upstream and downstream of the first throttle, assures a constant pressure drop across the adjustable throttle. In these conditions, the set flow rate value stays constant within a tolerance range of ±3% of the maximum flow controlled by the valve for maximum pressure variation between the intake and outlet chambers of the valve.

5 - TEMPERATURE COMPENSATION

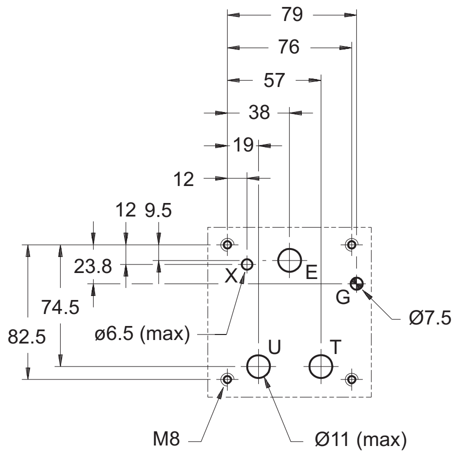
A device located on the first throttle which is sensitive to the temperature fluctuations corrects the position keeping the controlled flow more or less unaltered even should the oil viscosity change.
The fluctuation of the set flow rate stays within ±2,5% of the maximum flow controlled by the valve.

6 - RPC*-2T3 SERIES 31 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



MOUNTING SURFACE:
ISO 6263-06-07-*-97
(CETOP 4.5.2-3-06-320)

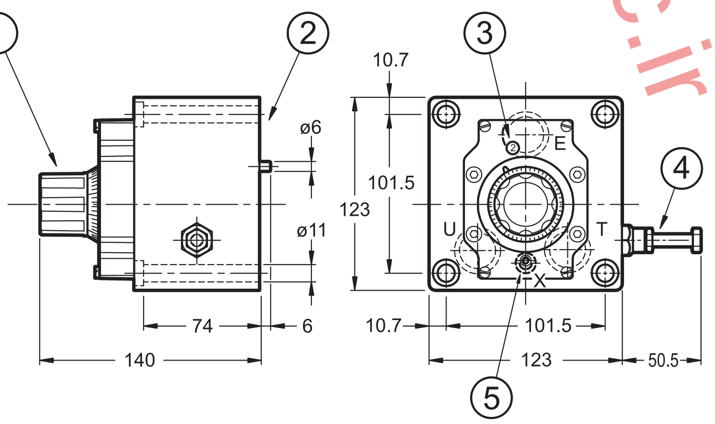


1	Adjustment knob with setting range in 6 turns. Anticlockwise rotation to increase flow rate	
2	Mounting surface with sealing rings: N. 3 OR type 3068 (17.13x2.62) N. 1 OR type 109 (9.13x2.62)	
3	Indicator of number of knob turns	
4	Pressure adjustment screw RPCQ	
5	Knob locking screw	

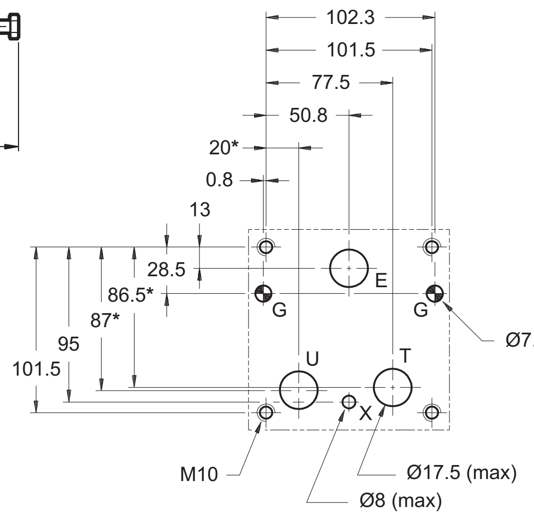
FASTENING BOLTS: 4 SHC bolts ISO 4762 M8x75
Tightening torque: 20 Nm

7 - RPC*-3T3 SERIES 43 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



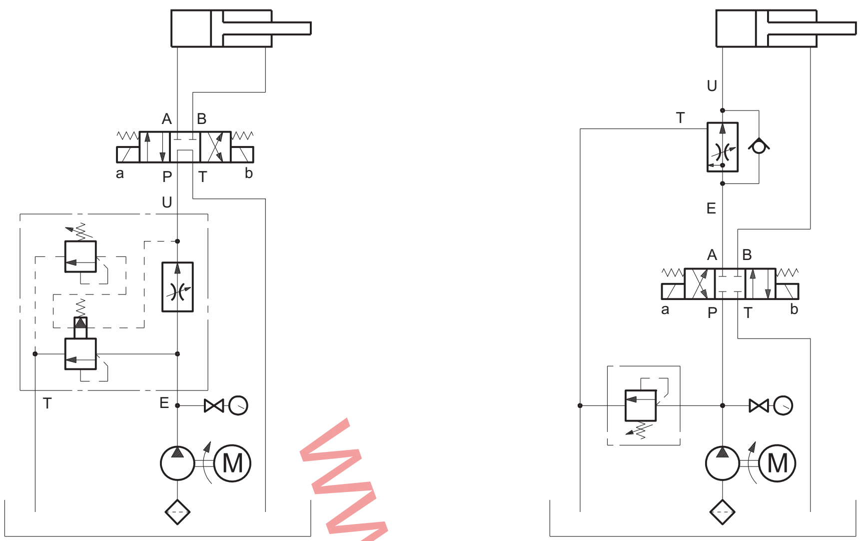
MOUNTING SURFACE:
ISO 6263-07-11-*-97
(CETOP 4.5.2-3-07-250)



1	Adjustment knob with setting range in 6 turns. Anticlockwise rotation to increase flow rate	
2	Mounting surface with sealing rings: N. 3 OR type 3106 (26.65x2.62) N. 1 OR type 3043 (10.78x2.62)	
3	Indicator of number of knob turns	
4	Pressure adjustment screw RPCQ	
5	Knob locking screw	

FASTENING BOLTS: 4 SHC bolts ISO 4762 M10x90
Tightening torque: 40 Nm

11 - APPLICATION EXAMPLES



12 - SUBPLATES (see catalogue 51 000)

	RPC*-2T3	RPC*-3T3
Type	PMRPCQ2-AI4G rear ports	PMRPCQ3-AI6G rear ports
E, U, T port dimensions	1/2" BSP	1" BSP
X port dimensions	1/4" BSP	1/4" BSP

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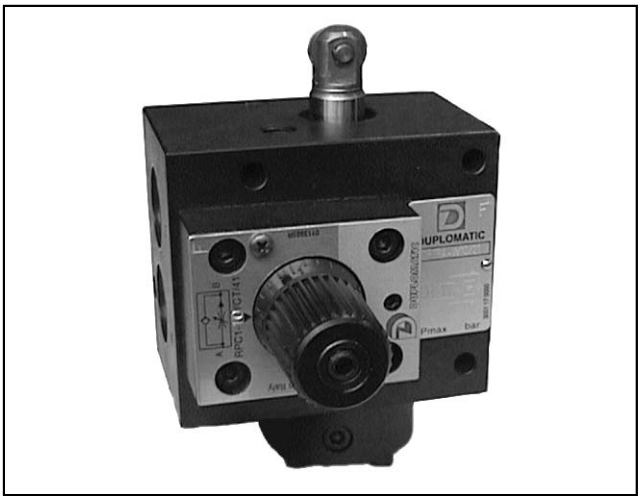
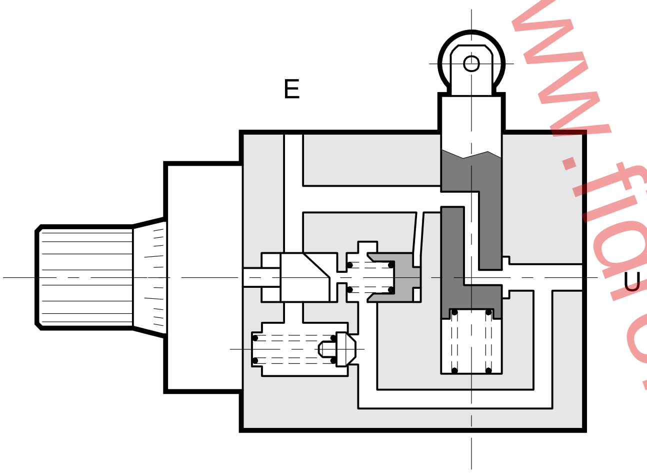


CP1R*-W
ROLLER OPERATED FAST/SLOW SPEED SELECTION VALVE
SERIES 21

THREADED PORTS

p max **70** bar
Q max **40** l/min

OPERATING PRINCIPLE



— The CP1R*-W valve is used for the selection and control of fast/slow speed of hydraulic axis by mechanical roller operation.

— The slow working speed adjustment is obtained by using a pressure compensated flow control valve.

The special shape of the control openings allows fine adjustment even with very low flow rates.

— Adjustment of the flow rate is carried out with three turns of the knob that can be locked in any position with a screw.

— It is available in two configurations:
normally open CP1RA,
normally closed CP1RC.

— It is supplied with an incorporated check valve that allows free passage of the reverse flow.

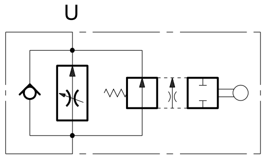
CONFIGURATIONS (see Hydraulic symbols table)
– CP1RA-W: normally open - fast movement with roller in rest position and controlled slow movement with roller in operation.
– CP1RC-W: normally closed - controlled slow movement with roller in rest position and fast movement with roller in operation.

PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C)

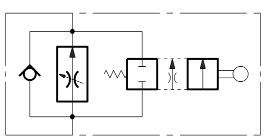
Maximum operating pressure		bar	70
Fast movement maximum flow rate		l/min	40
Controlled slow monement flow rate	max	l/min	4 - 10 - 16
	min	l/min	0,1
Roller working movement		mm	6
Ambient temperature range		°C	-20 / +50
Fluid temperature range		°C	-20 / +80
Fluid viscosity range		cSt	10 ÷ 400
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15	
Recommended viscosity		cSt	25
Massa		kg	3,2

HYDRAULIC SYMBOLS

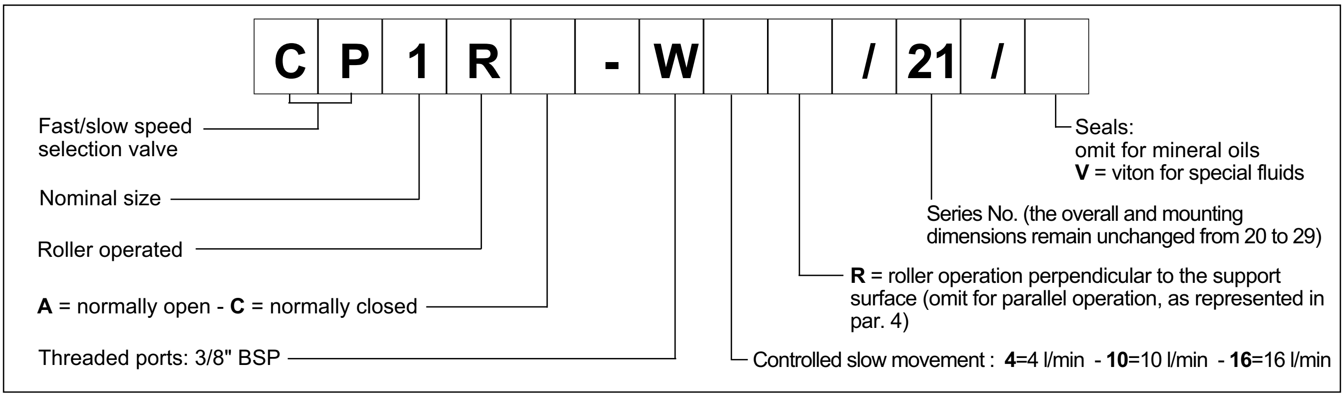
CP1RA



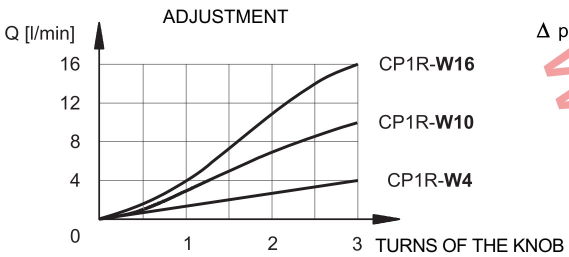
CP1RC

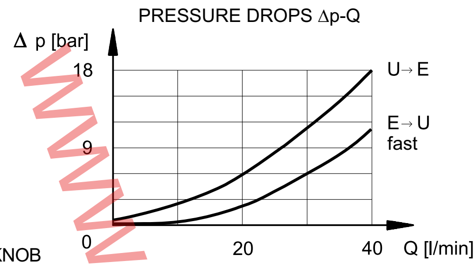


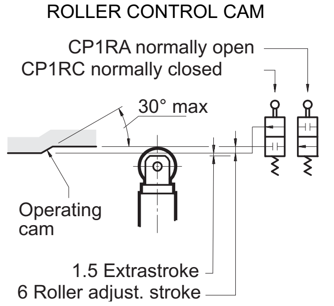
1 - IDENTIFICATION CODE



2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)





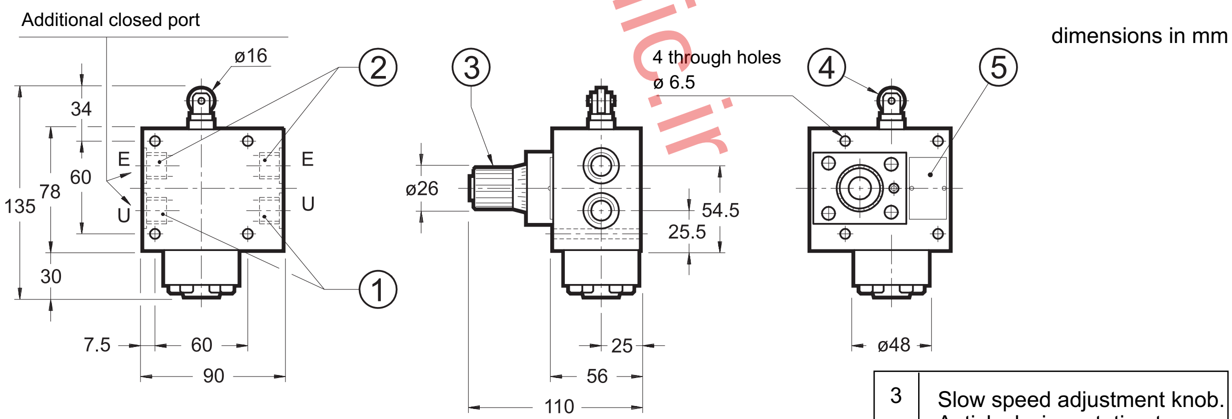


3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Outlet port U 3/8” BSP
2	Intake port E 3/8” BSP

3	Slow speed adjustment knob. Anticlockwise rotation to increase flow rate
4	Control roller for fast/slow selection
5	Identification plate

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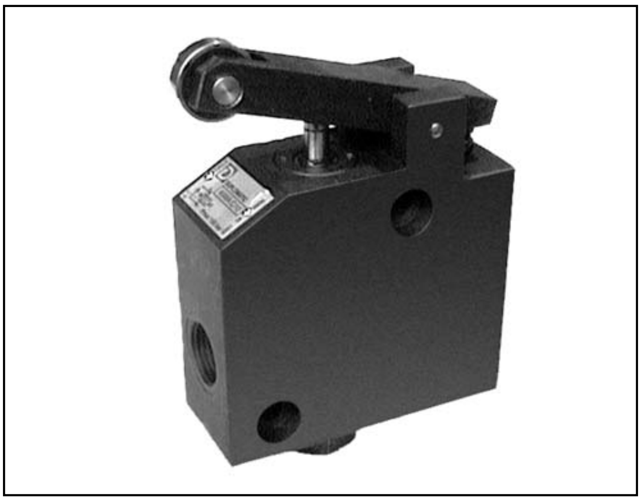


K4WA/C

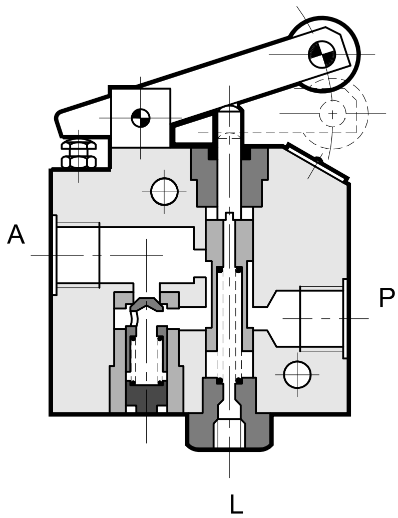
DECELERATION VALVE

SERIES 10

THREADED PORTS

p max **150** bar
Q max **40** l/min

OPERATING PRINCIPLE



— The K4WA/C valve is a mechanically operated decelerating valve with BSPP threaded ports for in-line mounting on hydraulic lines.

— It is normally used to change the movement speed of the hydraulic axis, such as changing from fast to slow, or for slow stops.

— The valve is normally open in the free condition and allows free flow passage from port P to port A.

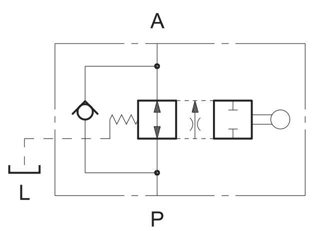
The flow is partially or completely shut off by operating the mechanical drive of the valve.

— It is always supplied with a built in check valve that allows reverse free flow from port A to port P.

PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure	bar	150
Cracking pressure of the check valve	bar	0,5
Maximum flow rate	l/min	40
Needed force on the lever to operate: - at beginning - at end stroke	Kg	6,8 12,0
Maximum leakage with closed valve (Δp 100 bar)	l/min	0,05
Stroke (from all open to completely closed)	mm	20
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	2,5

HYDRAULIC SYMBOL

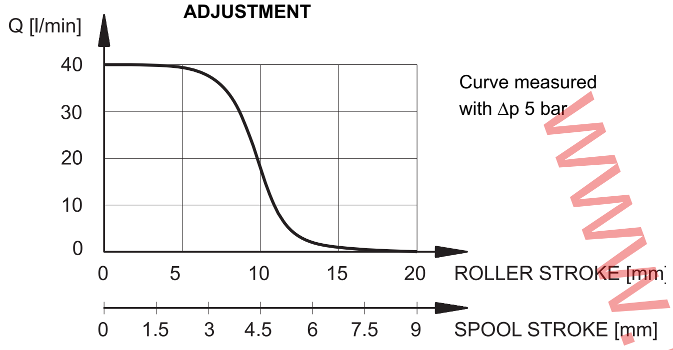


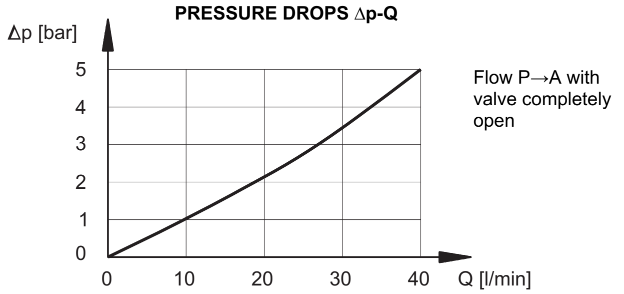
1 - IDENTIFICATION CODE

K	4	W	A	/	C	/	10	/	

- K: Deceleration valve
- 4: Nominal size: 1/2”
- W: Threaded ports: 1/2” BSP
- A: Normally open
- C: Built in check valve
- 10: Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)
- Last box: Seals: omit for mineral oils; **V** = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)





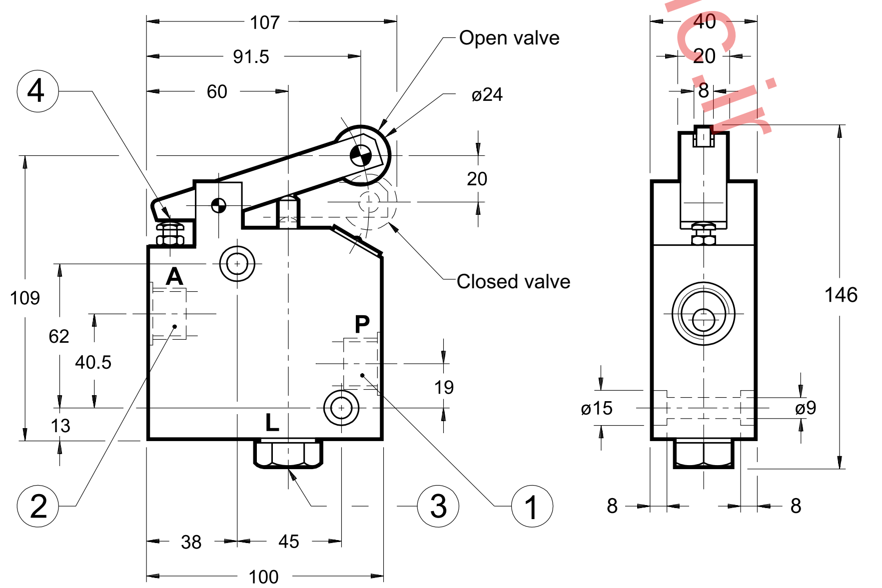
NOTE: For flow A→P, with valve closed, add the cracking pressure (0,5 bar) to the values shown in the diagram.

3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Intake port P 1/2” BSP
2	Outlet port A 1/2” BSP
3	Port for drainage L 1/8” BSPP to connect to the reservoir
4	Hexagonal head screw for maximum opening adjustment: spanner 10

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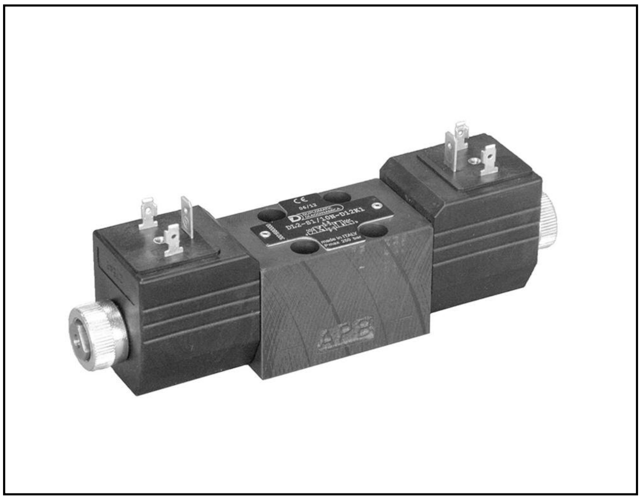


DL2

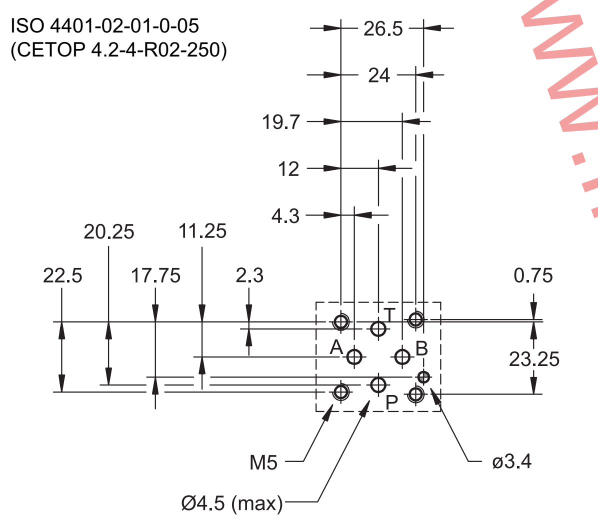
SOLENOID OPERATED DIRECTIONAL CONTROL VALVE COMPACT VERSION

SERIES 10

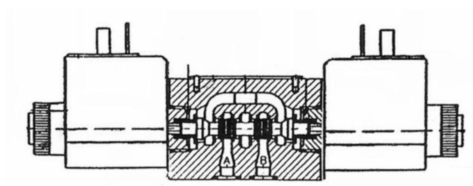
SUBPLATE MOUNTING
ISO 4401-02 (CETOP R02)

p max **250** bar
Q max **20** l/min

MOUNTING SURFACE



OPERATING PRINCIPLE



— Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401-02 (CETOP RP 121H) standards.

— Compact design with reduced solenoid dimensions, suitable for mini-power packs and mobile and agricultural applications.

— The valve body is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (for further information on solenoids see paragraph 7).

— The valve is supplied with 4 way designs, with 2 or 3 positions and with several interchangeable spools with different porting arrangements.

— The valve is available with DC or rectified current solenoids.

PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

Maximum operating pressure: - ports P - A - B - port T	bar	250 160
Maximum flow rate	l/min	20
Pressure drop Δp-Q	see paragraph 4	
Operating limits	see paragraph 5	
Electrical features	see paragraph 7	
Electrical connections	DIN 43650	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Masse: single solenoid valve double solenoid valve	kg	0,8 1,1

1 - IDENTIFICATION CODE

D | L | 2 | - | | / | 10 | | - | | K1

Solenoid operated directional control valve

Compact version

ISO 4401-02 (CETOP R02) size

Spool type (see paragraph 2):
S* **SA*** **SB*** **TA** **TB**

Series no.:
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Coil electrical connection:
plug for connector type
DIN 43650 (**standard**)

Power supply
D12 = 12 V
D24 = 24 V } direct current

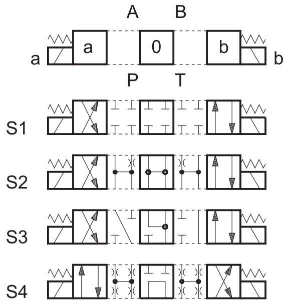
R110 = 110 V
R230 = 230 V } rectified current

D00 = valve without coils (see **NOTE**)

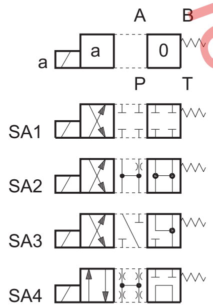
NOTE: Coils locking ring and related OR are supplied together with valves.

2 - SPOOL TYPE

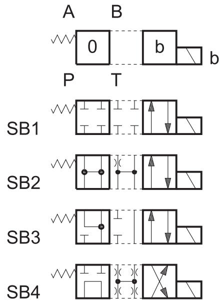
Type **S***:
2 solenoids - 3 positions
with spring centering



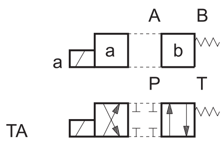
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



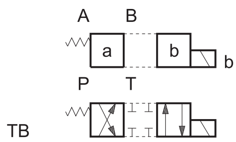
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



Type **TA**:
1 solenoid side A
2 external positions
with return spring



Type **TB**:
1 solenoid side B
2 external positions
with return spring



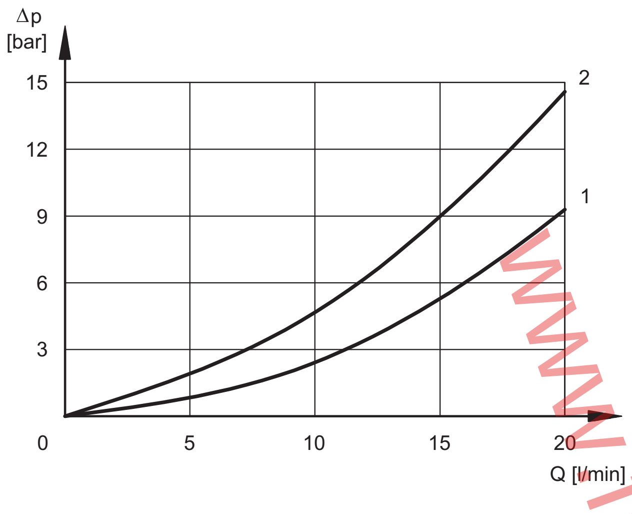
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - PRESSURE DROPS Δp-Q

(obtained with viscosity of 36 cSt at 50 °C)



ENERGIZED VALVE

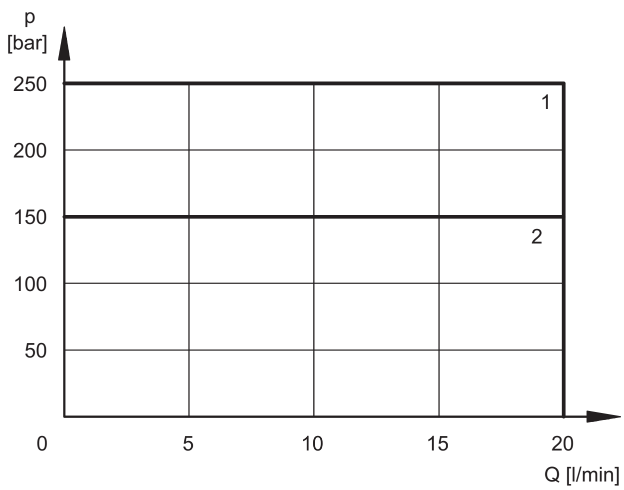
SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1, SA1, SB1	1	1	1	1
S2, SA2, SB2	1	1	1	1
S3, SA3, SB3	1	1	1	1
S4, SA4, SB4	2	2	2	2
TA, TB	1	1	1	1

For the pressure drop with a de-energized valve P→T of the spools S2 and S4 refer to the curve 1.

5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



SPOOL	CURVE
S1, S3, S4, TA, TB	1
S2	2

6 - SWITCHING TIMES

The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

TIMES (±10%) [ms]	
ENERGIZING	DE-ENERGIZING
25 ÷ 75	15 ÷ 25

7 - ELECTRICAL FEATURES

7.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated 360°, to suit the available space.

The interchangeability of coils of different voltages is allowed within the same type of supply current, alternating or direct.

NOTE: In order to further reduce the emissions, with DC supply, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

SUPPLY VOLTAGE FLUCTUATION	+5% -10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95 EC
CLASS OF PROTECTION : Atmospheric agents CEI EN 60529 Coil insulation (VDE 0580) Impregnation:	 IP 65* class H class F

(*) The protection degree is guaranteed only with the connector correctly connected and installed

7.2 - DC valve - Current and power consumption

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law: V = R x I

'R' coil must be used when the valve is fed with AC power supply subsequently rectified by means of rectifier bridge, externally or incorporated in the "D" type connector (see cat. 49 000).

The table shows current and power consumption values for DC and rectified current coil types.

	Nominal voltage [V]	Resistance at 20°C (±1%) [Ω]	Current consumption (±5%) [A]	Power consumption (+5% -10%) [W]	Power consumption (+5% -10%) [VA]	Coil code
D12	12	6.7	2.4	28.8		1903320
D24	24	24	1.2	28.8		1903321
R110	110	350	0.3		29.7	1903322
R220	230	1500	0.15		31	1903323

8 - ELECTRIC CONNECTORS

The solenoid valves are not supplied with connector. Connectors must be ordered separately. For the identification of the connector type to be ordered, please see catalogue 49 000.

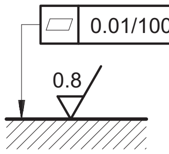
9 - INSTALLATION

Configurations with centering and return springs can be mounted in any position.

Valve fitting takes place by means of screws or tie rods, fixing the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

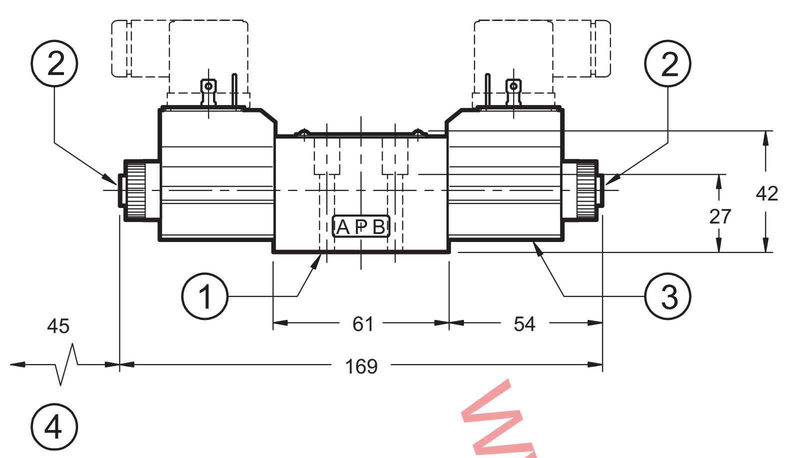
Surface finishing

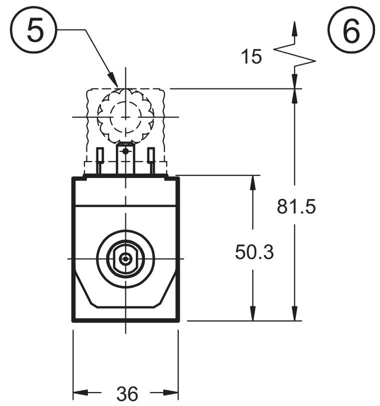


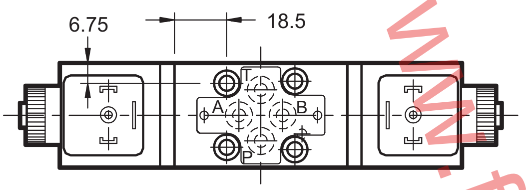
10 - DL2 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

DL2-S*

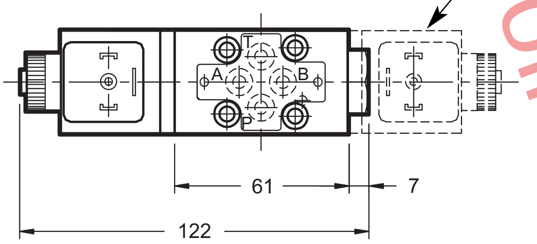






DL2-TA, DL2-SA*

solenoid position for TB and SB* configurations



1	Mounting surface with sealing rings: N. 4 KANTSEAL type DKAR00011 (7.65x1.68x1.68) - 70 Shore
2	Manual override, integrated in the tube
3	Coil (360° revolving)
4	Coil removal space
5	DIN 43650 electrical connector (to be ordered separately - see at catalogue 49 000)
6	Connector removal space

Single valve fastening: 4 SHC screws M5x35 - ISO 4762
Tightening torque: 5 Nm (bolts A 8.8)
Threads of mounting holes: M5x10

DUPLOMATIC OLEODINAMICA

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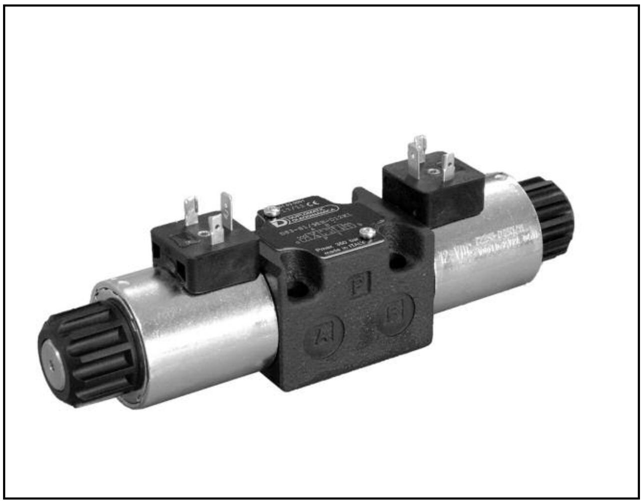
www.duplomatic.com • e-mail: sales.exp@duplomatic.com



DS3

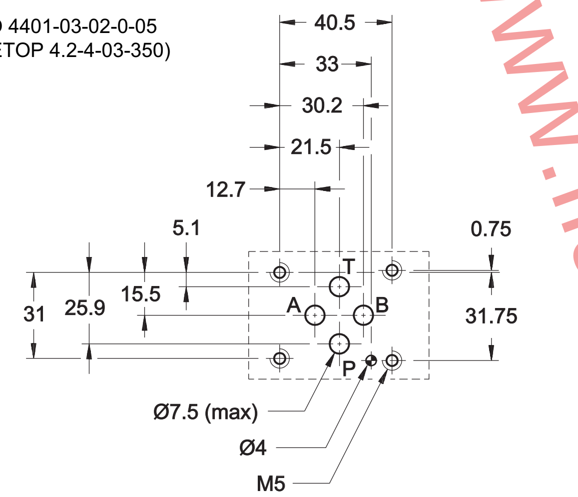
SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

SUBPLATE MOUNTING
ISO 4401-03

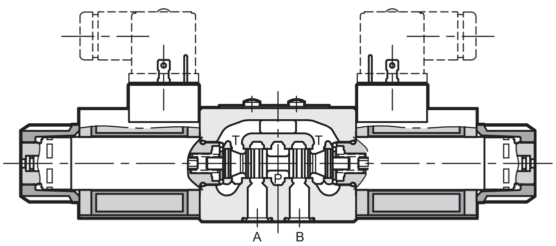
p max **350** bar
Q max **100** l/min

MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



OPERATING PRINCIPLE



— Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401-03 standards.

— The valve is supplied with 3 or 4 ways design, with 2 or 3 positions with a wide range of spools.

— The valve body is made with high strength iron castings provided with wide internal paths in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (for further information on solenoids see par. 7).

— The valve is available with DC or AC solenoids. DC solenoids can also be fed with AC power supply, by using connectors with a built-in rectifier bridge (see paragraphs 6.4 and 7.2).

— The DC valve is also available in a soft-shifting version (see par. 14).

— The DC valve is also available with zinc-nickel coating that ensures a salt spray resistance up to 600 hours .

— It is available a version with UL certified 24V DC coils for Canada and the United States. (see par. 15).

— Alternative to the standard manual override there are lever, push, boot and mechanical detent devices.

PERFORMANCES
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

		CC	CA
Maximum operating pressure: - P - A - B ports - T port	bar	350 210	 160
Maximum flowrate	l/min	100	
Pressure drops Δp-Q	see paragraph 4		
Operating limits	see paragraph 6		
Electrical features	see paragraph 7		
Electrical connections	see paragraph 11		
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass: single solenoid valve double solenoid valve	kg	1,5 2	1,4 2

1 - IDENTIFICATION CODE

D	S	3	-		/	11		-			/		

Solenoid operated directional control valve

ISO 4401-03 size

Spool type (see paragraph 3)

S*	**RSA***	**TA**	**RK**
SA*	**RSB***	**TB**	
SB*		**TA***	
		TB*	

Series:
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

DC power supply
D12 = 12 V
D14 = 14 V
D24 = 24 V
D28 = 28 V
D48 = 48 V
D110 = 110 V
D125 = 125 V
D220 = 220 V

D00 = valve without coils (see **NOTE 1**)

AC power supply
A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A100 = 100 V - 50 Hz / 100 V - 60 Hz
A110 = 110 V - 50 Hz / 120 V - 60 Hz
A230 = 230 V - 50 Hz / 240 V - 60 Hz

A00 = valve without coils (see **NOTE**)

F110 = 110 V - 60 Hz
F220 = 220 V - 60 Hz

NOTE 1 : Coils locking ring and related OR are supplied together with valves.

Option:
/ W7 = Zinc-nickel surface treatment (see **NOTE 2**)
Omit if not required

Manual override:
omit for override integrated in the tube (**standard**)

CM = manual override, boot protected

CH = lever manual override (only for DC version)

The device is not available for TB, TB*and RSB* spools.
RSA* spools: available only for RSA1 and RSA2.

CP = push manual override (only for DC version)

CK = knob manual override (only for DC version)

CPK = push manual override with mechanical retention (only for DC version)

Coil electrical connection (see par. 11):

K1 = plug for connector type DIN 43650 (**standard**)

K2 = plug for connector type AMP JUNIOR (available on **D12** and **D24** coils only)

K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

NOTE 2: The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing on the valve body makes the valve suitable to ensure a salt spray resistance up to **240** hours. For a salt spray resistance up to **600** hours refer to paragraph 16.

(test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

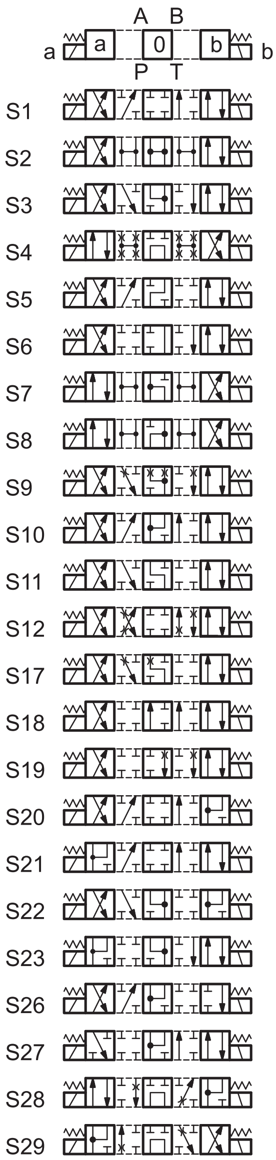
2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

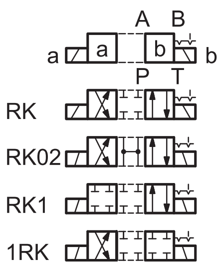
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - SPOOL TYPE

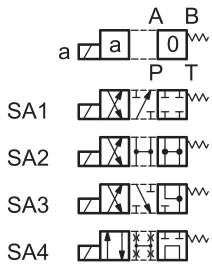
Type **S***:
2 solenoids - 3 positions
with spring centering



Type **RK**:
2 solenoids - 2 positions
with mechanical retention

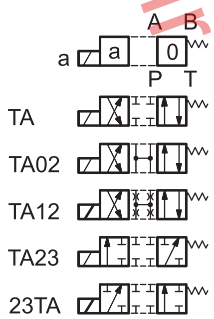


Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering

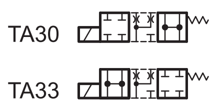


Type **RSA***:
1 solenoid side A
2 positions (external + central)
with return spring

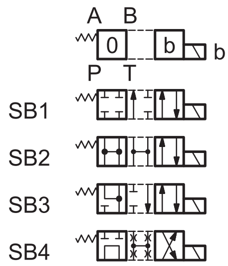
Type **TA**:
1 solenoid side A
2 external positions
with return spring



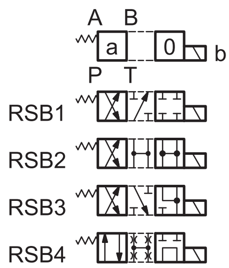
Type **TA***:
1 solenoid side A
2 positions with return spring



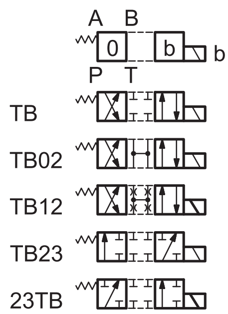
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



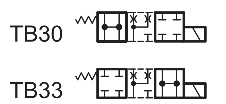
Type **RSB***:
1 solenoid side B
2 positions (external + central)
with return spring



Type **TB**:
1 solenoid side B
2 external positions
with return spring



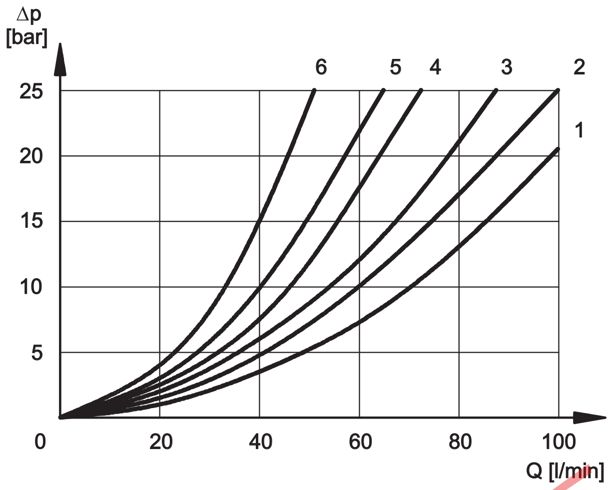
Type **TB***:
1 solenoid side B
2 positions with return spring



Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our technical department for their identification, feasibility and operating limits.

4 - PRESSURE DROPS Δp-Q

(obtained with viscosity 36 cSt at 50 °C)



ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	3	3
S2, SA2, SB2	1	1	3	3
S3, SA3, SB3, RSA3, RSB3	3	3	1	1
S4, SA4, SB4, RSA4, RSB4	5	5	5	5
S5	2	1	3	3
S6	2	2	3	1
S7, S8	4	5	5	5
S9	2	2	3	3
S10	1	3	1	3
S11	2	2	1	3
S12, S17, S19	2	2	3	3
S18	1	2	3	3
S20, S22	1	5	2	
S21, S23	5	1		2
S28	6	5	-	6
S29	5	6	6	-
TA, TB	3	3	3	3
TA02, TB02	2	2	2	2
TA23, TB23	3	3		
RK, RK02, RK1, 1RK	2	2	2	2

For pressure drops between A and B lines of spools S10, S20, S21, S22 and S23, which are used in the regenerative diagram, refer to curve 5.

DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2					2
S3, SA3, SB3, RSA3, RSB3			3	3	
S4, SA4, SB4, RSA4, RSB4					3
S5		4			
S6				3	
S7, S8			6	6	3
S10	3	3			
S11			3		
S18	4				
S22, S23			3	3	
S28, S29				6	

5 - SWITCHING TIMES

The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

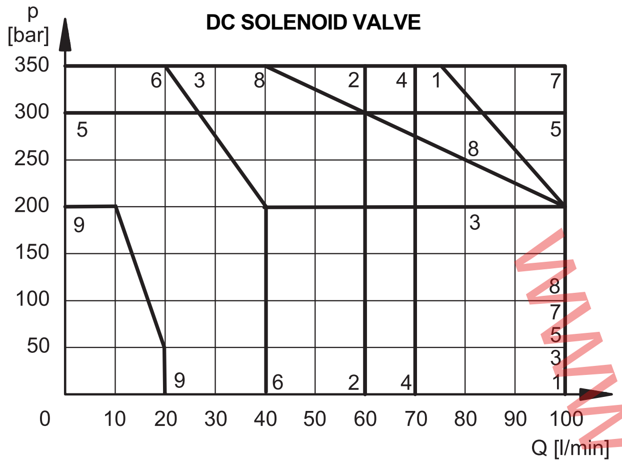
SPOOL TYPE	TIMES [ms]	
	ENERGIZING	DE-ENERGIZING
CC	25 ÷ 75	15 ÷ 25
CA	10 ÷ 25	15 ÷ 40

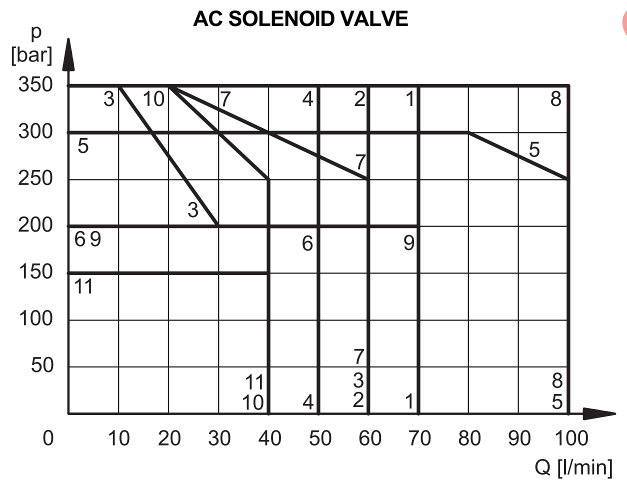
6 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

The limits for TA02 and TA spools refer to the 4-way operation. The operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow are shown in the chart on the next page. The performance of the DC solenoid powered by AC with rectifier connectors are at par. 6.4. The performances of the soft-shift valve are shown at par. 14.

6.1 - Valves in standard operation



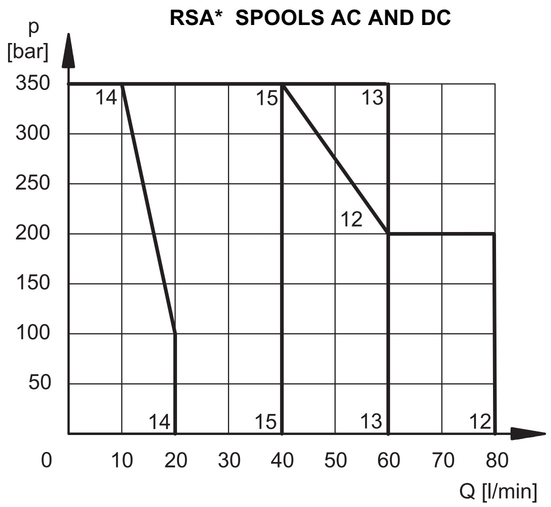


DC SOLENOID VALVE

SPOOL	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	3	3
S4, SA4, SB4	4	4
S5	5	5
S6	4	6
S7	4	4
S8	4	4
S9	7	7
S10	7	7
S11	4	6
S12	1	1
S17	4	4
S18	5	5
S19	4	4
S20	6*	6
S21	6	6*
S22	6	6
S23	6	6
S28	9*	9*
S29	9*	9*
TA, TB	7	7
TA02, TB02	8	8
TA23, TB23	2	2
RK	7	7
RK02	8	8
RK1, 1RK	7	7

AC SOLENOID VALVE

SPOOL	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	3	3
S4, SA4, SB4	2	2
S5	5	5
S6	6	6
S7	4	4
S8	4	4
S9	7	7
S10	8	8
S11	6	6
S12	2	2
S17	7	7
S18	5	5
S19	7	7
S20	10*	10
S21	10	10*
S22	10*	10
S23	10	11*
S28		
S29		
TA, TB	1	1
TA02, TB02	1	1
TA23, TB23	2	2
RK	8	8
RK02	9	9
RK1, 1RK	8	8



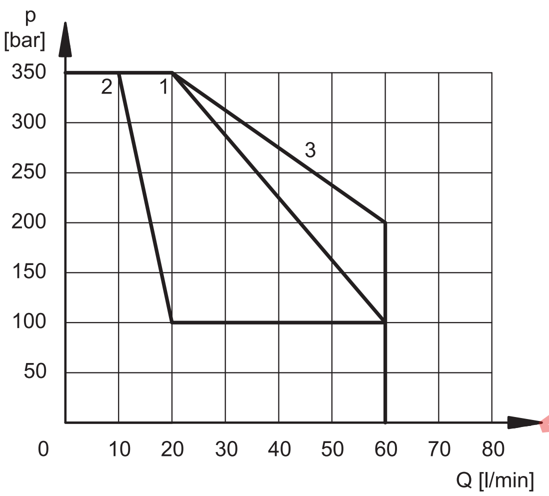
* Performance obtained for a valve with A and B lines connected the one to the piston-side chamber and the other to the rod-side chamber of a double-acting cylinder with area ratio 2:1.

SPOOL	CURVE
RSA1	12
RSA2	13
RSA3	14
RSA4	15

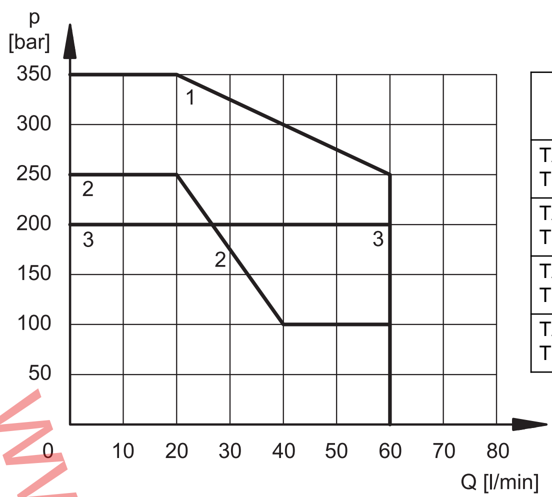
6.2 - 4-way valve in 3-way operation

Operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow.

DC VALVE

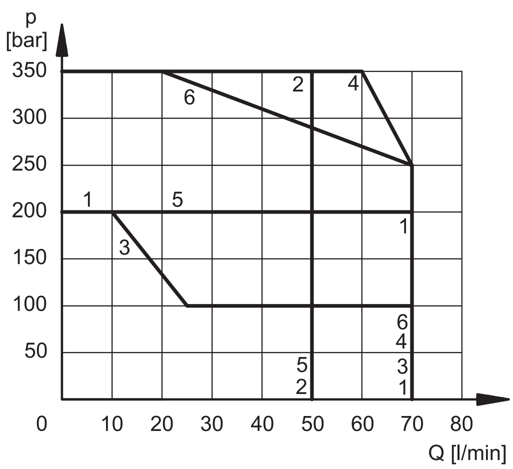


AC VALVE



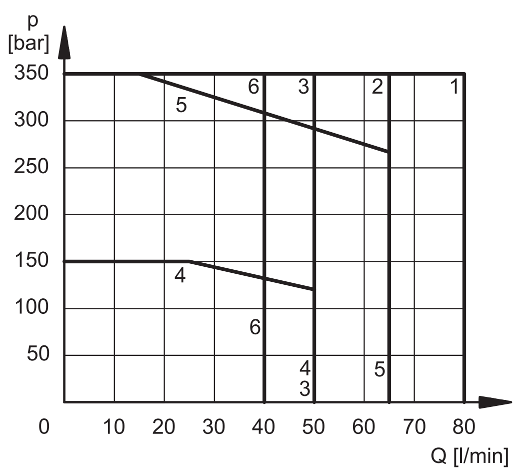
SPOOL	CURVE	
	DC	AC
TA backpr. A TB backpr. B	1	1
TA02 backpr. A TB02 backpr. B	1	1
TA backpr. B TB backpr. A	2	1
TA02 backpr. B TB02 backpr. A	3	3

6.3 - AC solenoid valve with coil A110 fed with 110V - 60 Hz



SPOOL	CURVE	
	P→A	P→B
S1,SA1, SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	3	3
S4, SA4, SB4	4	4
S9	5	5
TA, TB	2	2
RK	6	6

6.4 - Operating limits for DC solenoid valves fed with AC with rectifier connectors



SPOOL	CURVE	
	P→A	P→B
S1, SA1, SB1	2	2
S2, SA2, SB2	3	3
S3, SA3, SB3	4	4
S4, SA4, SB4	2	2
S9	5	5
TA, TB	6	6
RK	1	1

7 - ELECTRICAL FEATURES

7.1- Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated 360°, to suit the available space.

Protection from atmospheric agents IEC 60529

The IP protection degree is guaranteed only with both valve and connectors correctly connected and installed.

connection type	electric connection protection	whole valve protection
K1 DIN 43650	IP65	IP65
K2 AMP JUNIOR	IP65/67	
K7 DEUTSCH DT04 male	IP65/IP67/IP69 IP69K*	

(*) The IP69K protection degree is not taken into account in IEC 60529 but it is included in ISO 20653.

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	18.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE)	In compliance with 2014/30/EU
LOW VOLTAGE	In compliance with 2014/35/EU
CLASS OF PROTECTION : Coil insulation (VDE 0580) Impregnation (DC valve) (AC valve)	 class H class F class H

NOTE: In order to further reduce the emissions, with DC supply, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

7.2 - Current and absorbed power for DC solenoid valve

The table shows current and power consumption values of the DC coils.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 48V voltage) with alternating current (50 or 60 Hz), considering a reduction of the operating limits (see diagram at section 6.4).

Coils for direct current (values ±10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code K1	K2	K7
D12	12	4,4	2,72	32,7	1903080	1903100	1902940
D14	14	7,2	1.93	27	1903086		
D24	24	18,6	1,29	31	1903081	1903101	1902941
D28	28	26	1,11	31	1903082		
D48	48	78,6	0,61	29,5	1903083		
D110	110	423	0,26	28,2	1903464		
D125	125	550	0,23	28,6	1903467		
D220	220	1692	0,13	28,2	1903465		

7.3 - Current and absorbed power for AC solenoid valve

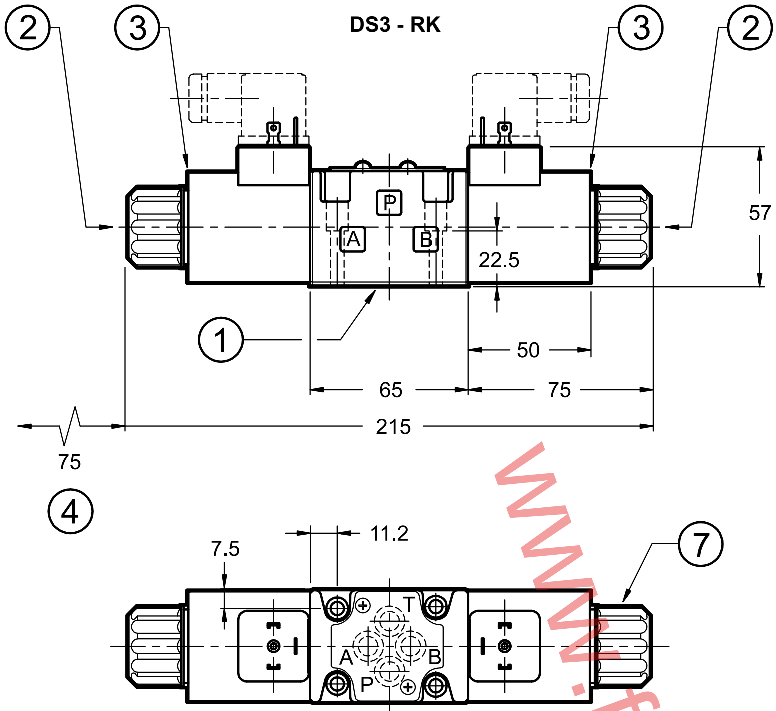
The table shows current and power consumption values at inrush and at holding, for AC coils.

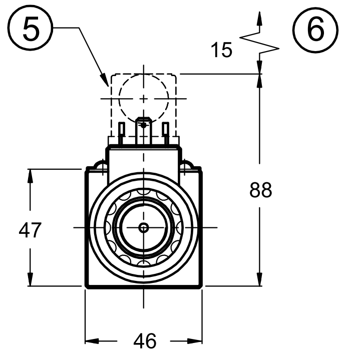
Coils for alternating current (values ± 5%)

Suffix	Nominal Voltage [V]	Freq. [Hz]	Resistance at 20°C [Ω] (±1%)	Current consumption at inrush [A] (±5%)	Current consumption at holding [A] (±5%)	Power consumption at inrush (±5%) [VA]	Power consumption at holding (±5%) [VA]	Coil Code K1 and K12
A24	24	50	1,46	8	2	192	48	1902830
A48	48		5,84	4,4	1,1	204	51	1902831
A100	100V-50Hz	50/60	23,3	2,27	0,49	227	49	1902836
	100V-60Hz			2,01	0,38	201	38	
A110	110V-50Hz		32	1,84	0,46	192	48	1902832
	120V-60Hz			1,56	0,39	188	47	
A230	230V-50Hz		140	0,76	0,19	176	44	1902833
	240V-60Hz			0,6	0,15	144	36	
F110	110	60	26	1,6	0,4	176	44	1902834
F220	220		106	0,8	0,2	180	45	1902835

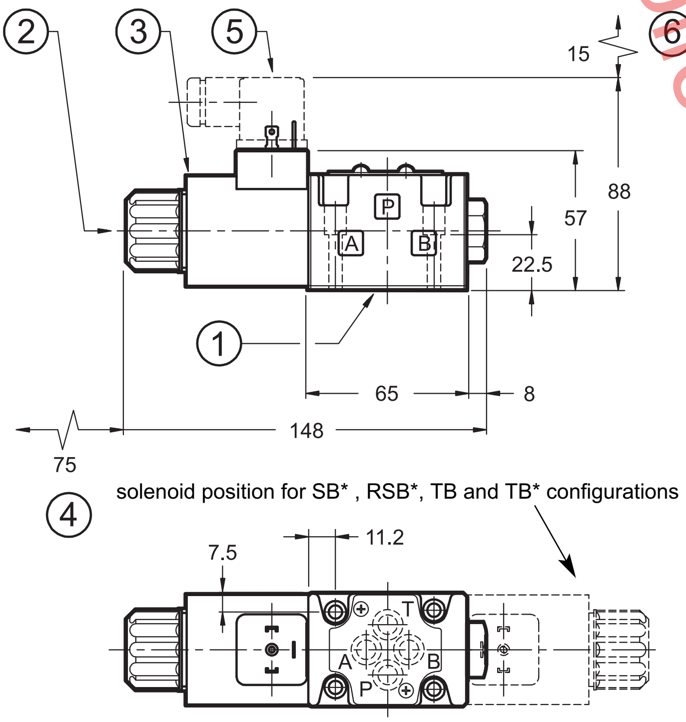
8 - OVERALL AND MOUNTING DIMENSIONS FOR DC SOLENOID VALVES

DS3 - S*
DS3 - RK





DS3-SA*, DS3-RSA*
DS3-TA, DS3-TA*



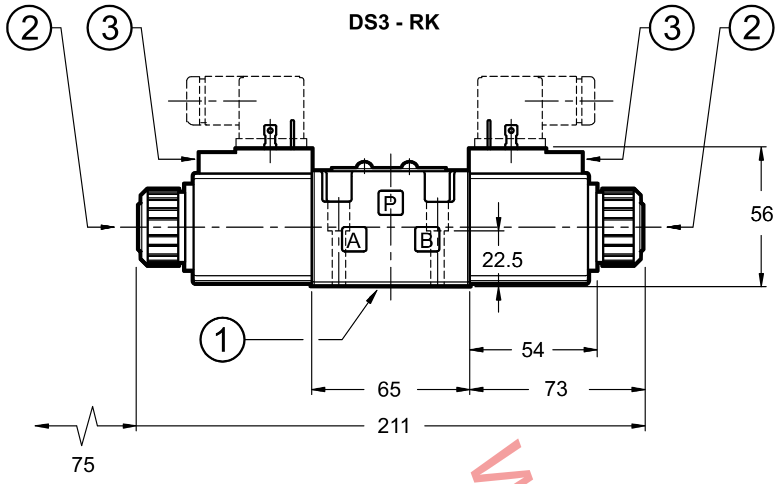
dimensions in mm

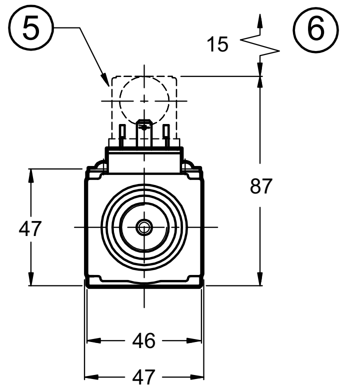
1	Mounting surface with sealing rings: 4 OR 2037 (9.25x1.78) - 90 shore
2	Standard manual override included in the solenoid tube
3	Coil (360° revolving)
4	Coil removal space
5	DIN 43650 connector (standard K1 shown) to be ordered separately (see cat. 49 000)
6	Connector removal space
7	Locking ring: tightening torque 5 ±0.5 Nm

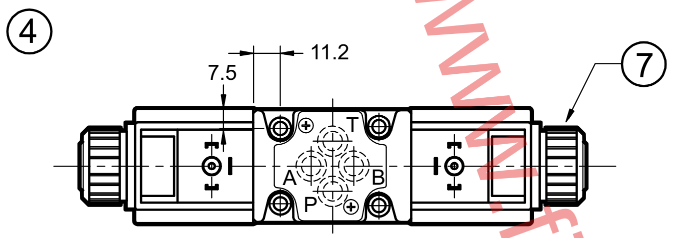
Valve fastening: 4 SHC screws ISO 4762 M5x30
Tightening torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

9 - OVERALL AND MOUNTING DIMENSIONS FOR AC SOLENOIDS VALVES

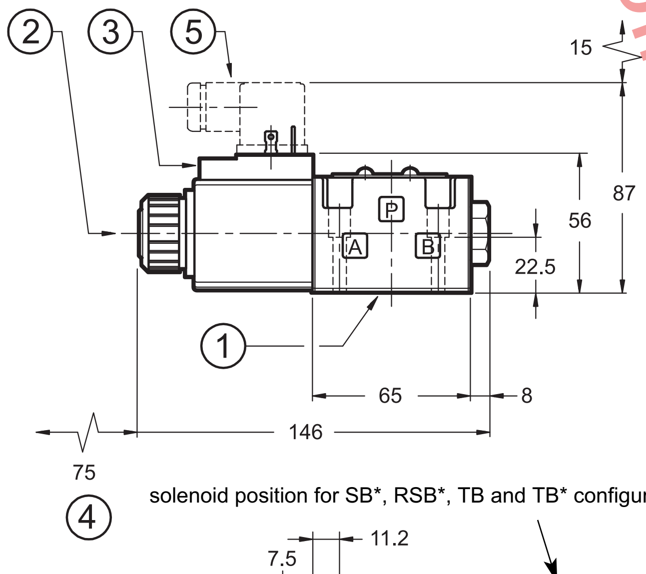
DS3 - S*
DS3 - RK



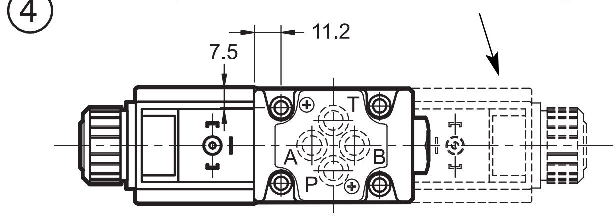




DS3-SA*, DS3-RSA*
DS3-TA, DS3-TA*



solenoid position for SB*, RSB*, TB and TB* configurations



dimensions in mm

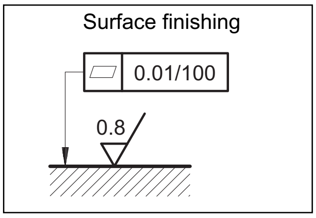
Valve fastening: 4 SHC screws ISO 4762 M5x30	
Tightening torque: 5 Nm (A8.8)	
Threads of mounting holes: M5x10	

1	Mounting surface with sealing rings: 4 OR 2037 (9.25x1.78) - 90 shore
2	Standard manual override included in the solenoid tube
3	Coil (90° revolving)
4	Coil removal space
5	DIN 43650 connector to be ordered separately (see cat. 49 000)
6	Connector removal space
7	Locking ring: tightening torque 5 ±0.5 Nm

10 - INSTALLATION

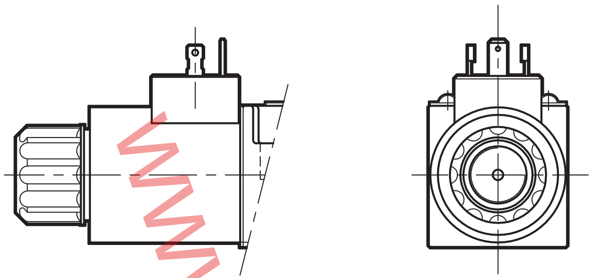
Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

Valve fixing takes place by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity and/or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

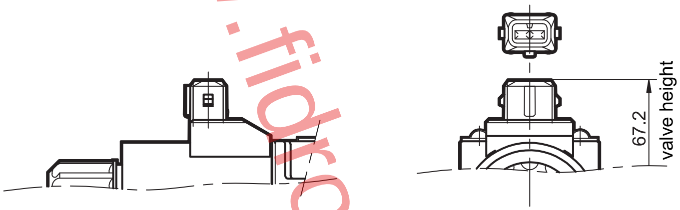


11 - ELECTRIC CONNECTIONS

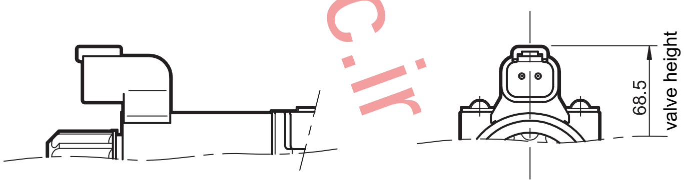
connection for DIN 43650 connector
code **K1** (**standard**)
code **WK1** (W7 version only)



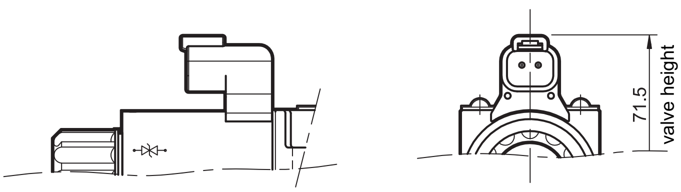
connection for AMP JUNIOR connector
code **K2**



connection for
DEUTSCH DT06-2S male connector
code **K7**



connection for
DEUTSCH DT06-2S male
connector - coil with diode
code **WK7D** (W7 version only)



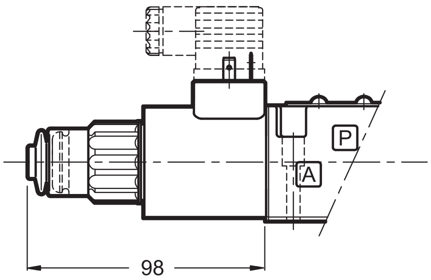
12 - ELECTRIC CONNECTORS

The valves are delivered without connector. Connectors for K1 connections (DIN 43650) can be ordered separately. See catalogue 49 000.

13 - MANUAL OVERRIDES

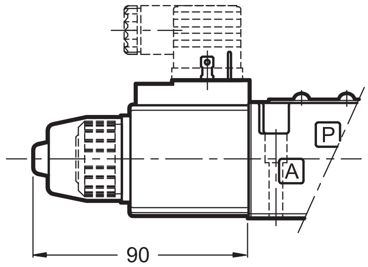
13.1 - Manual override, boot protected

CM-DS3/11 - Version for DC solenoid valve



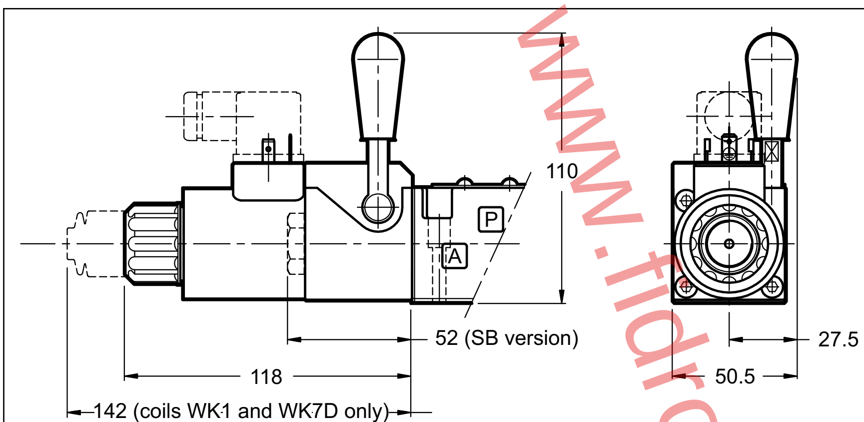
Code: 3401150006

Version for AC solenoid valve



Code: 0269201

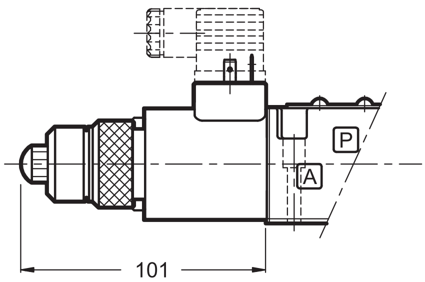
13.2 - CH-DS3/11 Lever manual override (only for DC solenoid valve)



NOTE: The lever device is always located in the A side of the valve.

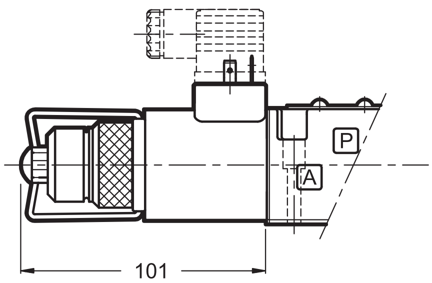
The high resistance to corrosion valves (par. 16) are equipped with a cap for solenoid tube protection.

13.3 - CP-DS3/10 Push manual override (only for DC solenoid valve)



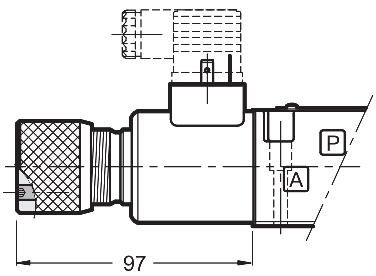
Code: 3401150005

13.5 - CPK-DS3/10 Push manual override with mechanical retention (only for DC solenoid valve)



Code: 3401150004

13.4 - CK-DS3/10 Knob manual override (only for DC solenoid valve)



When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.

Spanner: 3 mm

Code: 3401150009

14 - SOFT-SHIFT VERSION FOR DC VALVE

14.1 - Identification code

D	S	3	-		/	13		-			/	F		

Solenoid operated directional control valve

ISO 4401-03 size

Spool type
The hydraulic symbols of S2F and S4F are identical to those of S2 and S4 spools (p.2)

S1	**TA12**
S2F	**TB12**
S4F	**TA23**
S9	**TB23**
S12	

Series:
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

DC power supply
D12 = 12 V
D24 = 24 V
D28 = 28 V
D110 = 110 V
D220 = 220 V

Coil electrical connection (see par. 11):
K1 = plug for connector type DIN 43650 (**standard**)
K2 = plug for connector type AMP JUNIOR (available on **D12** and **D24** coils only)
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

Soft-shifting

Manual override
(see par.1 and 13)

Option:
/ W7 = see par. 1

This version enables hydraulic actuators to perform a smooth start and stop by reducing the speed of movement of the valve spool.

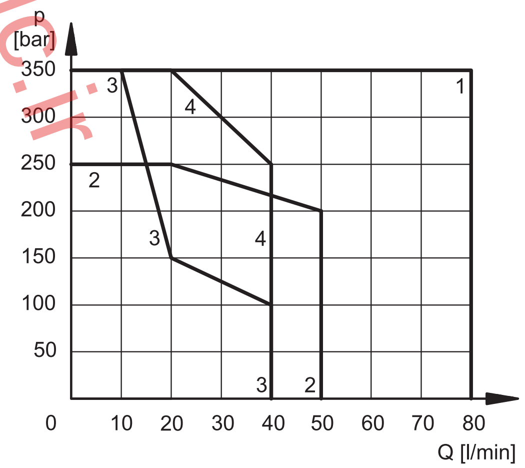
In this version, the S9 spool must be used instead of the S3 type.

The diagram on the side shows the operating limits of the spools available in the soft-shifting version, while the table shows the switching times.

The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

The shifting time and characteristics curves are influenced by the viscosity (and thus by the temperature) of the operating fluid. Moreover, times can vary according to the flow rate and operating pressure values of the valve.

For correct operation of the soft-shifting ensure the solenoid tubes are always filled with oil. At this matter, we recommend to install a backpressure valve set at 1 ÷ 2 bar on T line.



SPOOL	CURVE	TIMES [ms]	
		ENERGIZING	DE-ENERGIZING
S1, S12	1	350	200 ÷ 300
S2F	2	400	100 ÷ 250
S4F	4	350	150 ÷ 300
S9	1	400	200 ÷ 300
TA12, TB12	3	180	200 ÷ 300
TA23, TB23		300	200 ÷ 300

15 - VERSION WITH UL CERTIFIED COILS

15.1 - Identification code

D	S	3	-		/	11		-	D24	UL	K1	/	

Solenoid operated directional control valve

ISO 4401-03 size

Spool type
See paragraph 3

Series:
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Manual override:
omit for override integrated in the tube (**standard**)
CM = manual override, boot protected

Coil electrical connection for connector type DIN 43650

LISK coil, UL certified to United States and Canada. Class 155 (F)

Power supply DC 24 V

15.2 - UL file number

The UL database website provides informations about the certification, by entering the code MH29222 in the 'UL file number' field.

15.3 - Electrical features

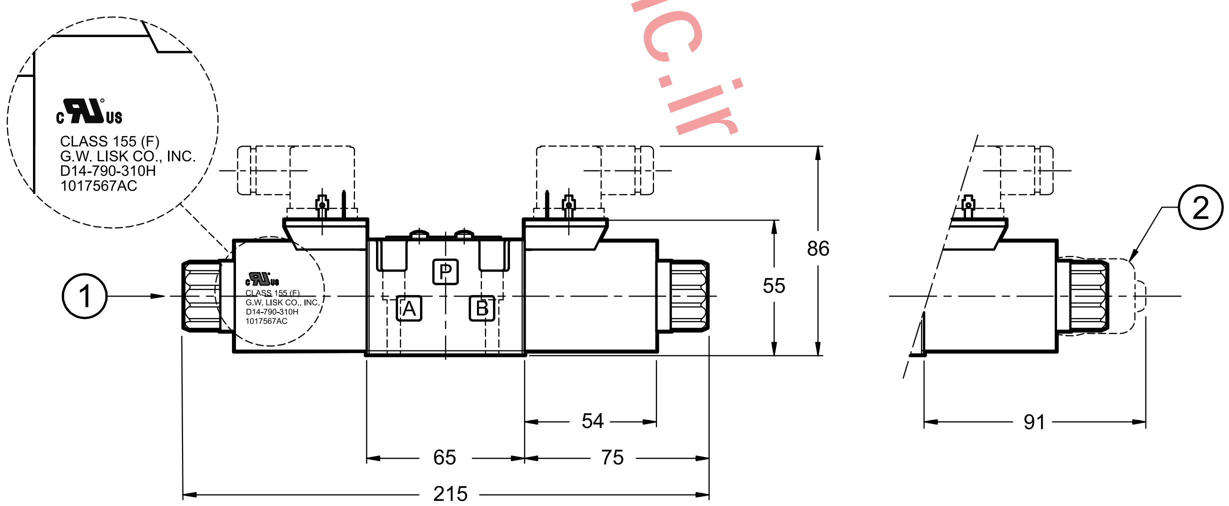
(values ± 10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code
D24ULK1	24	19.2	1.25	30	1903341

NOTE: Valves with UL coils must be ordered complete. **The UL coils are not interchangeable with those of standard valves.**

15.4 - Overall and mounting dimensions

dimensions in mm



Valve fastening: 4 SHC screws ISO 4762 M5x30	
Tightening torque: 5 Nm (A8.8)	
Threads of mounting holes: M5x10	

1	Standard manual override included in the solenoid tube
2	CM version: boot manual ovverride, rubber

15.5 - Spare parts

UL certified coil: C22S3-D24ULK1/11
Solenoid tube : NBR TD22-DS3-UL/11N
viton TD22-DS3-UL/11V

Solenoid tube plunger: cod. 0119545
Locking ring: cod. 0119546
Seals : kit for standard DC valves

16 - HIGH CORROSION RESISTANCE VERSION

16.1 - identification code

D	S	3	-		/			-			/		/	W7

Solenoid operated directional control valve

ISO 4401-03 size

Spool type
See paragraph 3 or 14.

Series: (See paragraph 1 or 14)
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

DC power supply
D12 = 12 V
D24 = 24 V

Coil electrical connection
WK1 = plug for connector type DIN 43650
WK7D = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S. Coil with diode.

Manual override:
CM = manual override, boot protected (**standard**)
CH = lever manual override
CP = push manual override
CK = knob manual override
CPK = push manual override with mechanical retention

16.2 - Corrosion resistance

This version features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600** hours (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

16.3 - DC coils

The coils feature a zinc-nickel surface treatment.

The WK7D coil includes a suppressor diode of pulses for protection from voltage peaks during switching.

During the switching the diode significantly reduces the energy released by the winding, by limiting the voltage to 31.4V in the D12 coil and to 58.9 V in the D24 coil.

(values ±10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code WK1	Coil code WK7D
D12	12	4,4	2,72	32,7	1903050	1903400
D24	24	18,6	1,29	31	1903051	1903401

16.4 - Protection from atmospheric agents IEC 60529

The IP protection degree is guaranteed only with both valve and connectors correctly connected and installed.

connection type	electric connection protection	whole valve protection
WK1 DIN 43650	IP65	IP65
WK7D DEUTSCH DT04 male	IP65/IP67/IP69 IP69K*	IP65/IP67

(*) The IP69K protection degree is not taken into account in IEC 60529 but it is included in ISO 20653.

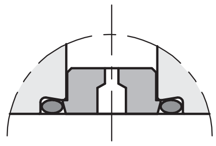
17- PORT RESTRICTORS

Port restrictors are recommended if flow variations occur which exceed the valve performance limit during the switching processes, or for circuit dampening.

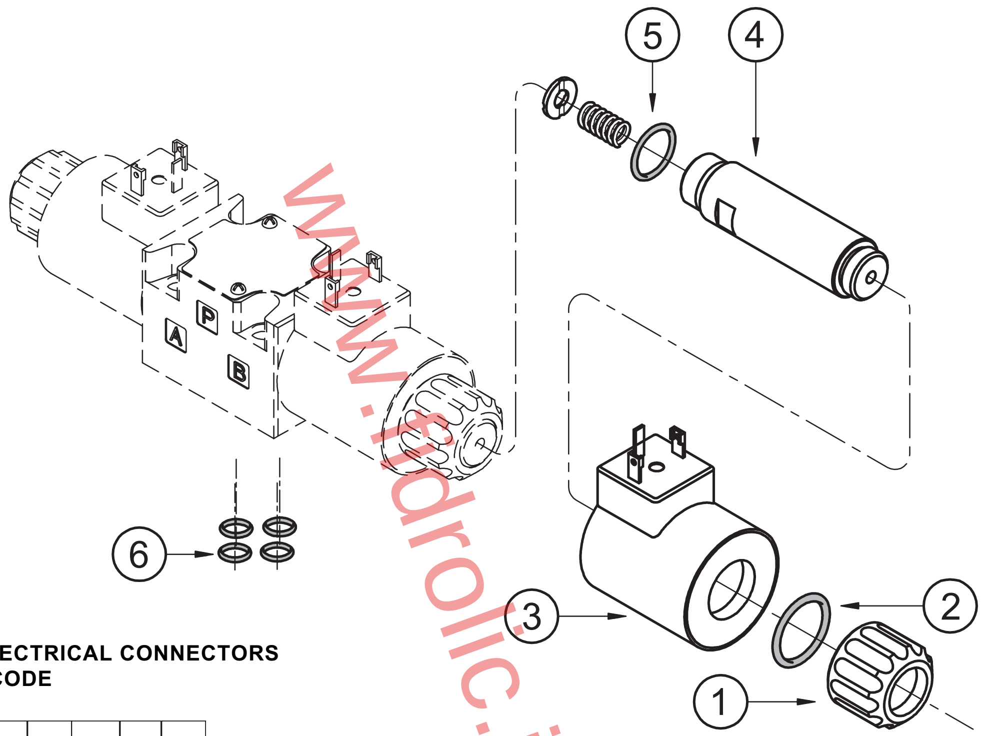
The port restrictor plugs can be ordered separately with the part numbers shown at left.

Ø (mm)	part number
blank	**0144162**
0.6	**0144163**
0.8	**0144033**
1	**0144034**

Ø (mm)	part number
1.2	**0144035**
1.5	**0144036**
1.8	**0144164**
2	**0144165**



18 - SPARE PARTS FOR DC SOLENOID VALVE



DC COILS AND ELECTRICAL CONNECTORS IDENTIFICATION CODE

C	**22S3**	**-**			**/**	

Supply voltage

D12 = 12 V
D14 = 14 V
D24 = 24 V
D28 = 28 V
D48 = 48 V
D125 = 125 V
D110 = 110 V
D220 = 220 V

Series no.:
10 = for K7
11 = for K1 up to D48, WK1, K2 and WK7D
12 = for K1 D110, D125 and D220

Coil electrical connection (see par. 11):
K1 = plug for connector DIN 43650

D12 and **D24** coils only:
K2 = plug for connector AMP JUNIOR
K7 = plug DEUTSCH DT04-2P for male connector DEUTSCH DT06-2S (

W7 version
WK1 = plug for connector DIN 43650
WK7D = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S. Coil with diode.

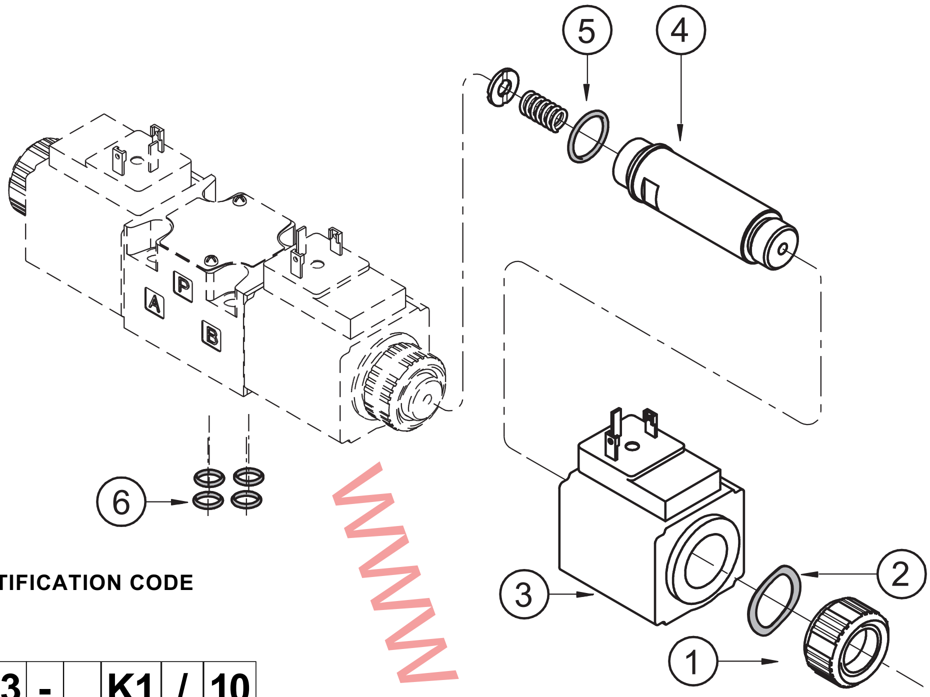
1	Coil locking ring with seal included cod. 0119412 Tightening torque 5 ±0.5 Nm
2	ORM type 0220-20 (22x2) - 70 Shore
3	Coil (see identification code)
4	Solenoid tube for standard version: TD22-DS3/10N (NBR seals) TD22-DS3/10V (FPM seals) Solenoid tube for version with soft-shifting: TD22-DS3F/10N (NBR seals) TD22-DS3F/10V (FPM seals) **NOTE:** OR n°5 included
5	OR type 2062 (15.6x1.78) - 70 Shore
6	4 OR type 2037 (9.25x1.78) - 90 Shore

SEALS KIT

The codes include the O-Ring n° 2, 5 and 6.

Cod. 1985406 NBR seals
Cod. 1985410 FPM (viton) seals

19 - SPARE PARTS FOR AC SOLENOID VALVE



AC COILS IDENTIFICATION CODE

C	20.6S3	-		K1	/	10

Supply voltage
A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A100 = 100 V - 50 Hz
100 V - 60 Hz
A110 = 110 V - 50 Hz
120 V - 60 Hz
A230 = 230 V - 50 Hz
240 V - 60 Hz
F110 = 110 V - 60 Hz
F220 = 220 V - 60 Hz

Plug for connector type DIN 43650

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

1	Coil locking ring cod. 0119333 Tightening torque 5 ±0.5 Nm
2	Snap ring cod. 0550483
3	Coil (see identification code on the side)
4	Solenoid tube : TA20.6-DS3/10N (NBR seals) TA20.6-DS3/10V (FPM seals) **NOTE**: OR n° 5 included
5	OR type 2062 (15.6x1.78) - 70 Shore
6	N. 4 OR type 2037 (9.25x1.78) - 90 Shore

SEALS KIT

The codes include the OR nr. 5 and 6.

Cod. 1985406 NBR seals
Cod. 1985410 FPM (viton) seals

20 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G with rear ports 3/8" BSP
Type PMMD-AL3G with side ports 3/8" BSP

DUPLOMATIC OLEODINAMICA

DUPLOMATIC OLEODINAMICA S.p.A.
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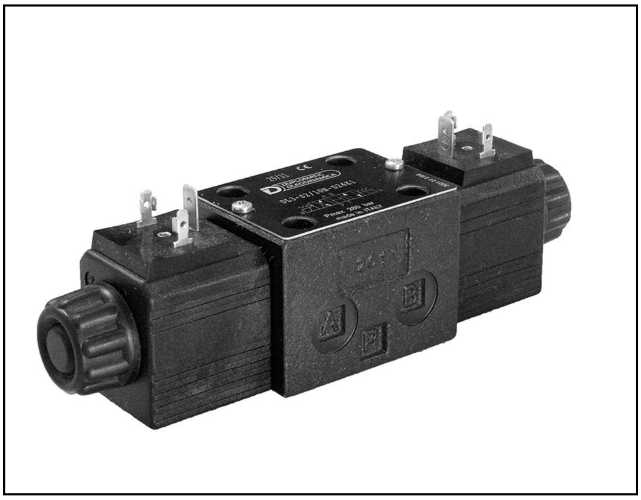
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

DUPLOMATIC OLEODINAMICA



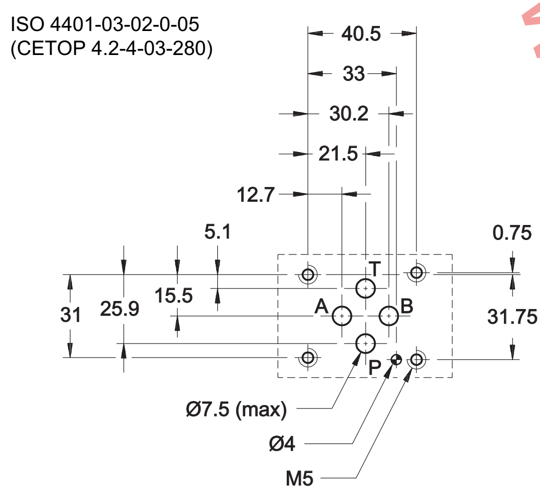
DL3

SOLENOID OPERATED DIRECTIONAL CONTROL VALVE COMPACT VERSION

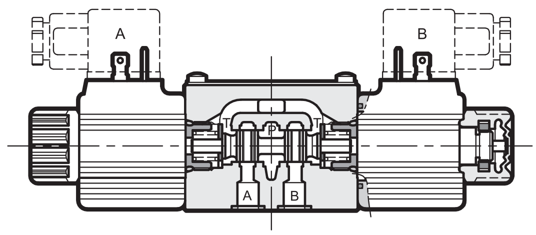
SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

p max **280** bar
Q max **50** l/min

MOUNTING SURFACE



OPERATING PRINCIPLE



— Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401-03 (CETOP RP 121H) standards.

— Compact design with reduced solenoid dimensions, suitable for mini-power packs and mobile and agricultural applications.

— The valve body is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (for further information on solenoids see paragraph 7).

— The valve is supplied with 3 or 4 way designs and with several interchangeable spools with different porting arrangements.

— The valve is available with DC or AC current solenoids and with several types of electrical connections to cover various installation requirements (see paragraphs 7, 11 and 12).

— The DC valve comes with boot protected manual override which ensures a protection degree IP69K with connections type K7 and K8.

— It is available also with zinc-nickel surface treatment, that ensures a salt spray resistance up to 600 hours.

PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

		CC	CA
Maximum operating pressure: - ports P - A - B - port T	bar	280 250	 160
Maximum flow rate	l/min	50	
Pressure drop Δp-Q	see paragraph 4		
Operating limits	see paragraph 5		
Electrical features	see paragraph 7		
Electrical connections	see paragraph 12		
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Masse: single solenoid valve double solenoid valve	kg	1,1 1,4	

1 - IDENTIFICATION CODE

D	L	3	-		/			-			/		

Solenoid operated directional control valve

Compact version

ISO 4401-03 (CETOP 03) size

Spool type (see paragraph 3):

S*	**TA**
SA*	**TB**
SB*	**RK**

Series no.:
10 = for direct current valves
11 = for alternate current valves
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Option:
Surface treatment non standard.
Omit if not required
(see **NOTE 2**)

Manual override (see par. 13)
on **DC** version:
omit for boot manual override integrated in the coil locking ring
CK = knob manual override
on **AC** version:
omit for manual override integrated in the tube
CM = manual override boot protected

Coil electrical connection:
(see paragraph 11)
K1 = plug for connector type DIN 43650 (**standard**)

For **DC** supply, **D12** and **D24** coils only:
K2 = plug for connector type AMP JUNIOR
K4 = outgoing cables
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S
K8 = plug for connector type AMP SUPER SEAL

DC power supply
D12 = 12 V
D24 = 24 V
D28 = 28 V
D48 = 48 V
} direct current
R110 = 110 V
R230 = 230 V
} rectified current
D00 = valve without coils (see **NOTE 1**)

AC power supply
A24 = 24 V - 50 Hz
A110 = 110 V - 50 Hz
A230 = 230 V - 50 Hz
A00 = valve without coils (see **NOTE 1**)

NOTE 1: Coils locking ring and related OR are supplied together with valves.

NOTE 2:The standard surface treatment is phosphating black.
On request we can supply these valves with zinc-nickel finishing, making the valve suitable to ensure a salt spray resistance up to 600 hours (test operated according to UNI EN ISO 9227 standard and test evaluation operated according to UNI EN ISO 10289 standard)
Add **/W7** at the end of the identification code.

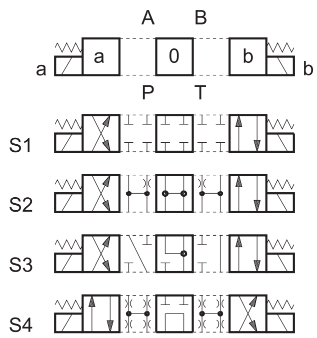
2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

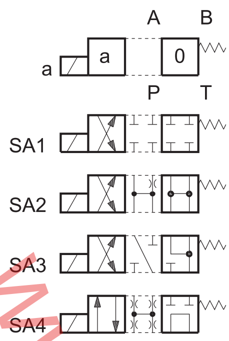
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - SPOOL TYPE

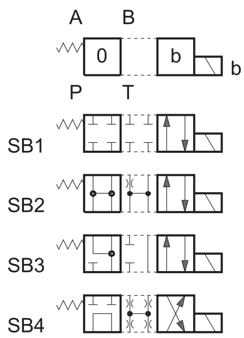
Type **S***:
2 solenoids - 3 positions
with spring centering



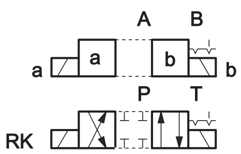
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



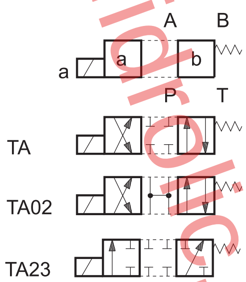
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



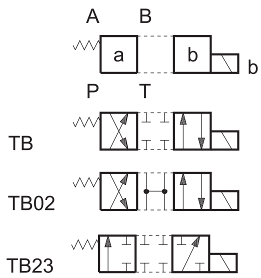
Type **RK**:
2 solenoids - 2 positions
with mechanical retention



Type **TA**:
1 solenoid side A
2 external positions
with return spring



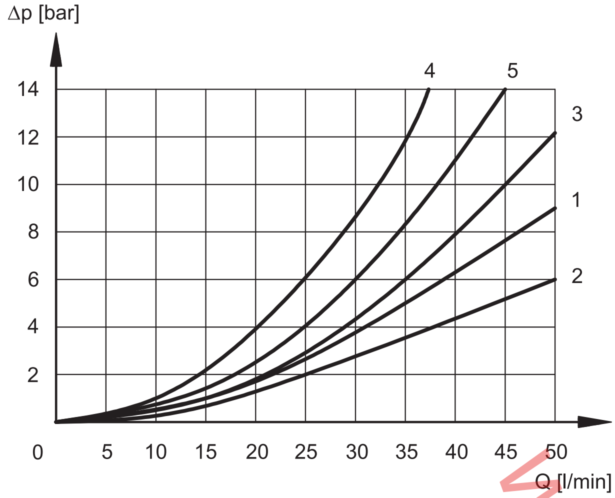
Type **TB**:
1 solenoid side B
2 external positions
with return spring



NOTE: Others spools available on request only.

4 - PRESSURE DROPS ΔP-Q

(obtained with viscosity of 36 cSt at 50 °C)



ENERGIZED VALVE

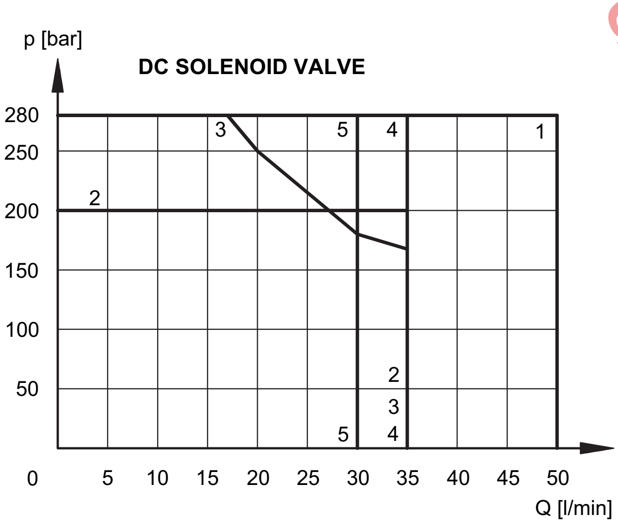
SPOOL	FLOW DIRECTIONS				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPHS				
S1	1	1	1	1	-
S2	1	1	2	2	3
S3	3	3	2	2	-
S4	4	4	4	4	5
RK	1	1	1	1	-
TA	3	3	3	3	-

5 - OPERATING LIMITS

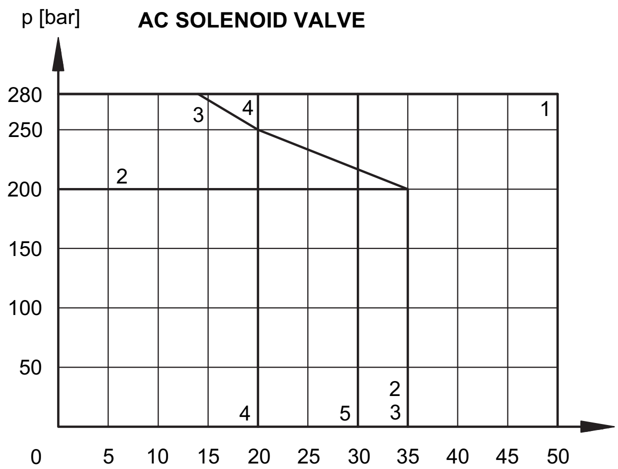
The curves define the flow rate operating fields according to the valve pressure of the different versions. The values indicated in the graphs are relevant to the standard solenoid valve.

The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



SPOOL	CURVE
S1, TA	1
S2	2
S3	3
S4	4
RK	5



SPOOL	CURVE
S1, TA	1
S2	2
S3	3
S4	4
RK	5

6 - SWITCHING TIMES

The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

SUPPLY	TIMES (±10%) [ms]	
	ENERGIZING	DE-ENERGIZING
DC	25 ÷ 75	15 ÷ 25
AC	10 ÷ 25	15 ÷ 30

7 - ELECTRICAL FEATURES

7.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated +/- 90°, to suit the available space.

The interchangeability of coils of different voltages is allowed within the same type of supply current, alternating or direct.

Protection from atmospheric agents CEI EN 60529

Connector	IP 65	IP 67	IP 69 K
K1 DIN 43650	x (*)		
K2 AMP JUNIOR	x	x (*)	
K4 outgoing cable	x	x	
K7 DEUTSCH DT04 male	x	x	x (*)
K8 AMP SUPER SEAL	x	x	x (*)

(*) The protection degree is guaranteed only with the connector correctly connected and installed

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95 EC
CLASS OF PROTECTION : Coil insulation (VDE 0580) Impregnation:	 class H class H

NOTE: In order to further reduce the emissions, with DC supply, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

7.2 - DC valve - Current and power consumption

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law: V = R x I

"R" coil must be used when the valve is fed with AC power supply subsequently rectified by means of rectifier bridge, externally or incorporated in the "D" type connector (see cat. 49 000).

The table shows current and power consumption values for CC and RC coil types.

Coils for direct current (values ±5%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumption [A]	Power consumption [W]	Power consumption [VA]	Coil code K1	Coil code K2	Coil code K4	Coil code K7	Coil code K8
D12	12	5,4	2,2	26,5		1902740	1902750	1902770	1902980	1903020
D24	24	20,7	1,16	27,8		1902741	1902751	1902771	1902981	1903021
D28	28	27,5	1,02	28,5		1902744				
D48	48	82	0,58	28		1902745				
R110	110	363	0,25		27,2	1902742				
R230	230	1640	0,11		26,4	1902743				

7.3 - AC valve - Current and power consumption

In alternating current energizing, an initial phase (maximum movement) is seen, during which the solenoid consumes elevated value currents (inrush current); the current values diminish during the plunger stroke until it reaches the minimum values (holding current) when the plunger reaches the stroke end. The table shows the values of absorption at the inrush and at holding.

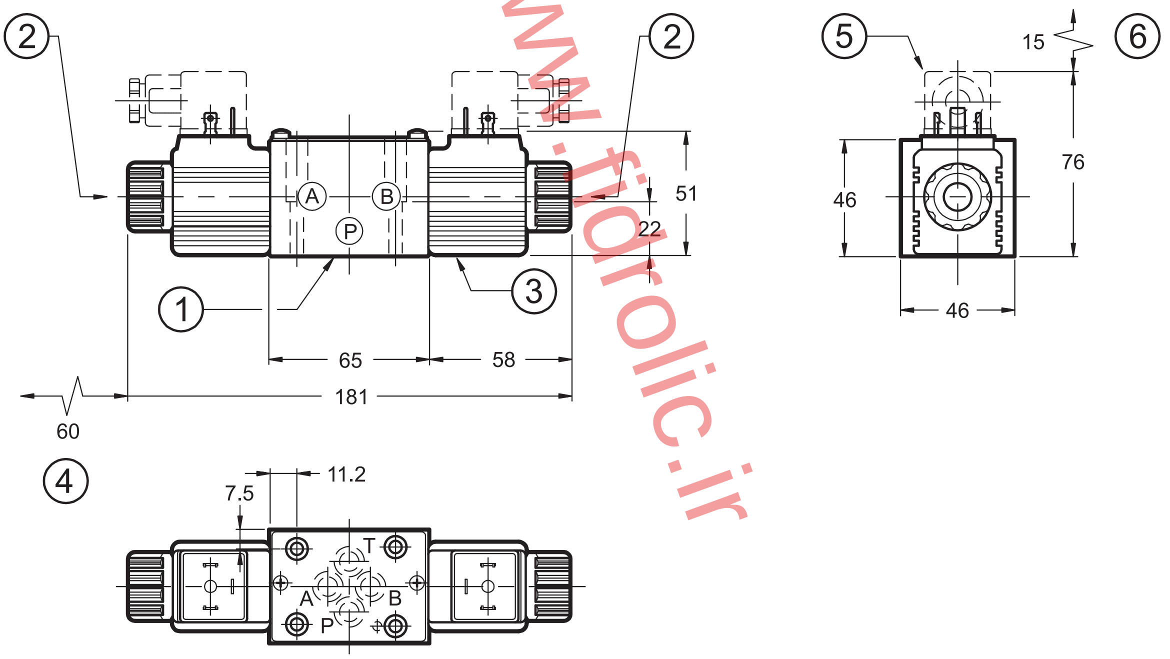
Coils for alternating current (values ±10%)

	Nominal voltage [V]	Freq. [Hz]	Resistance at 20°C [Ω]	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Coil code K1
A24	24	50	2,7	4,5	1,47	109,2	35,3	1903190
A110	110		73,4	1,0	0,31	107,8	34,1	1903192
A230	230		320	0,5	0,16	112,7	36,8	1903193

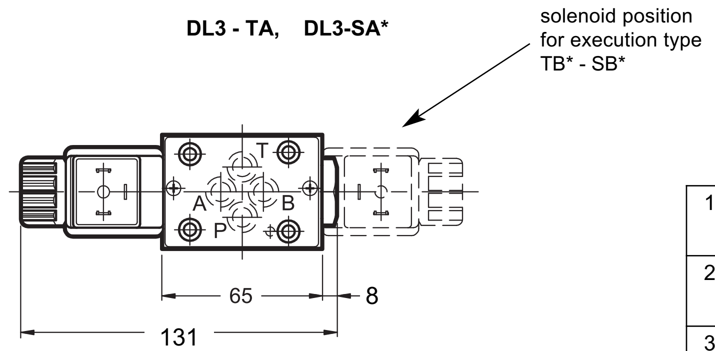
8 - DL3 DC OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

DL3 - S*



DL3 - TA, DL3-SA*

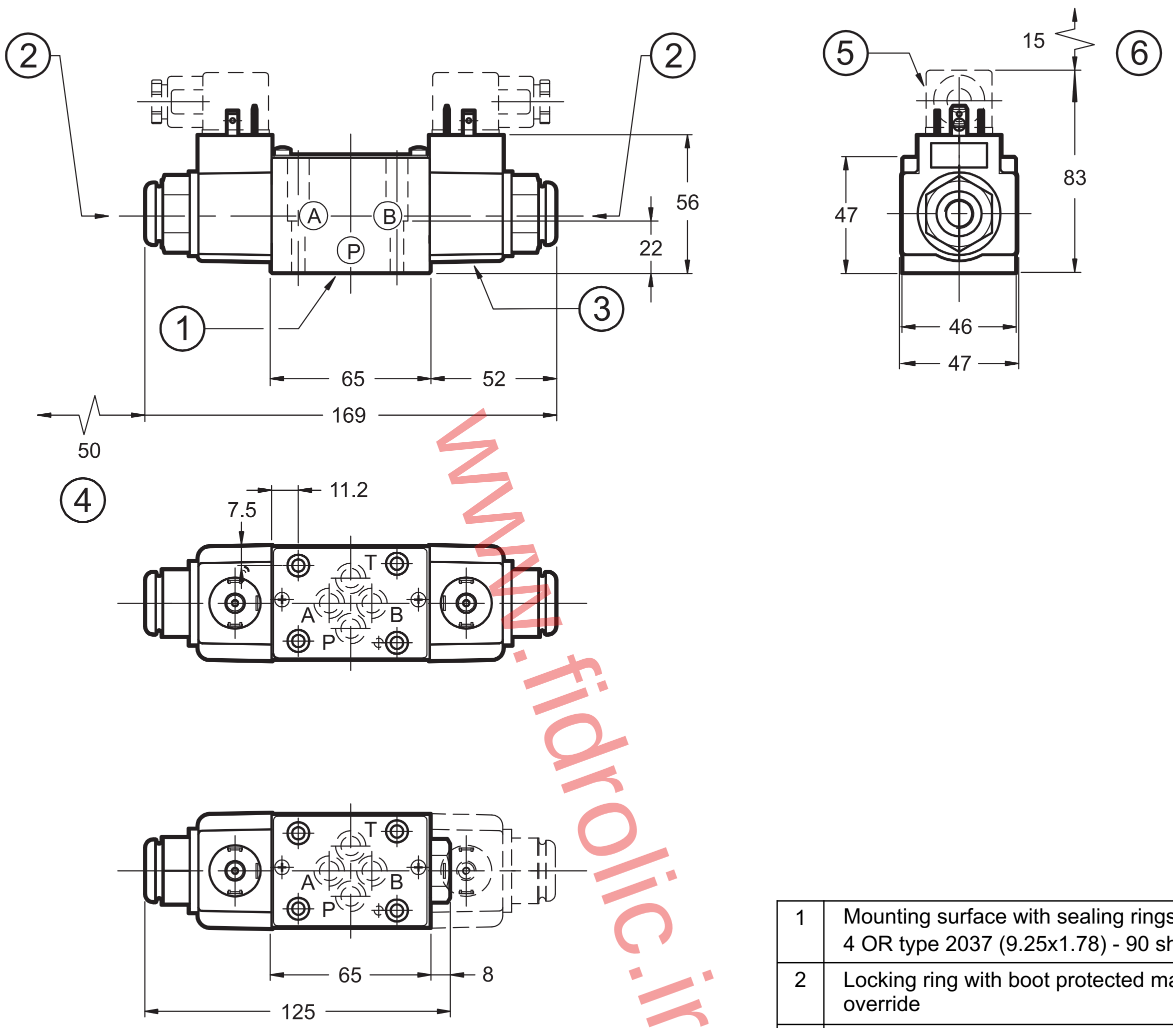


Valve fastening: 4 SHC screws ISO 4762 M5x30	
Tightening torque: 5 Nm (A8.8)	
Threads of mounting holes: M5x10	

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 shore
2	Locking ring with boot protected manual override
3	Coil (90° revolving)
4	Coil removal space
5	DIN 43650 electrical connector (representation with K1 standard connection - see paragraph 12 for other connection types)
6	Connector removal space

9 - DL3 AC OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 shore
2	Locking ring with boot protected manual override
3	Coil
4	Coil removal space
5	DIN 43650 electrical connector (representation with K1 connection)
6	Connector removal space

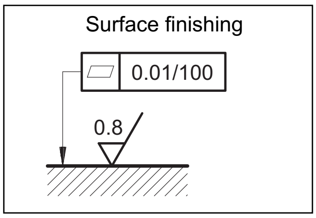
Valve fastening: 4 SHC screws ISO 4762 M5x30
Tightening torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

10 - INSTALLATION

Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

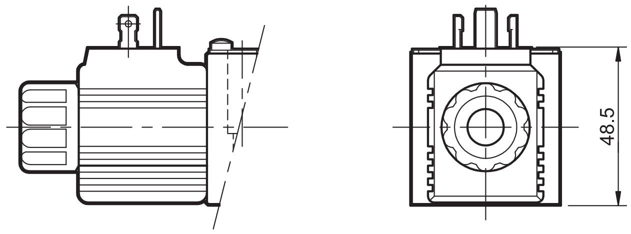
Valve fitting takes place by means of screws or tie rods, fixing the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

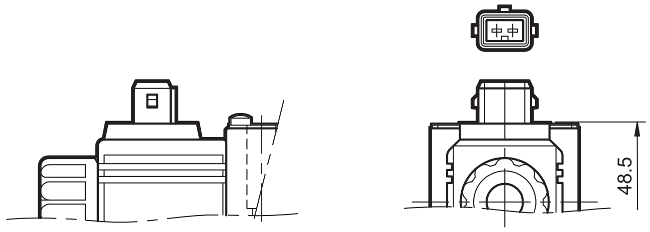


11 - ELECTRIC CONNECTIONS

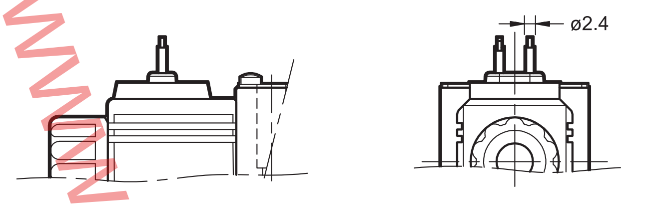
connection for DIN 43650
connector type
code **K1 (standard)**



connection for AMP JUNIOR
connector type
code **K2**

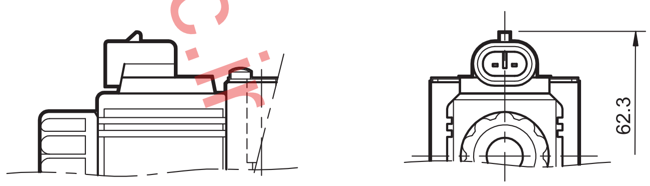


outgoing cable connections
cable length = 1 mt
code **K4**



connection for DEUTSCH DT04-2P
for male connector type DEUTSCH DT06
code **K7**

connection for AMP SUPER SEAL
(two contacts) connector type
code **K8**



12 - ELECTRIC CONNECTORS

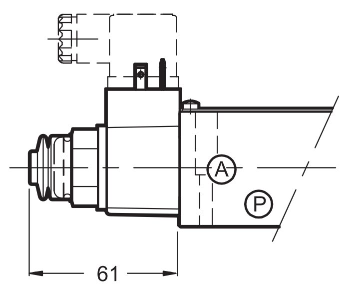
The solenoid operated valves are delivered without connectors. For coils with standard electrical connection K1 type (DIN 43650), the connectors can be ordered separately. See catalogue 49 000. We do not have connectors for connections K2, K7 and K8.

13 - OPTIONAL MANUAL OVERRIDES

13.1 - Boot protected manual override

On the DC version the boot override is integrated in the coil locking ring, as standard.

On the AC version, however, the boot override can be ordered by entering the code **CM** in the identification code at par. 1, or is available as option to be ordered separately: code **3401210001.**



Code: 3401210001

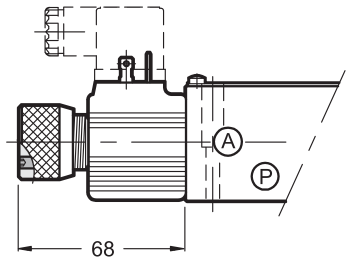
13.2 - Knob manual override

Available only for DC version

When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.

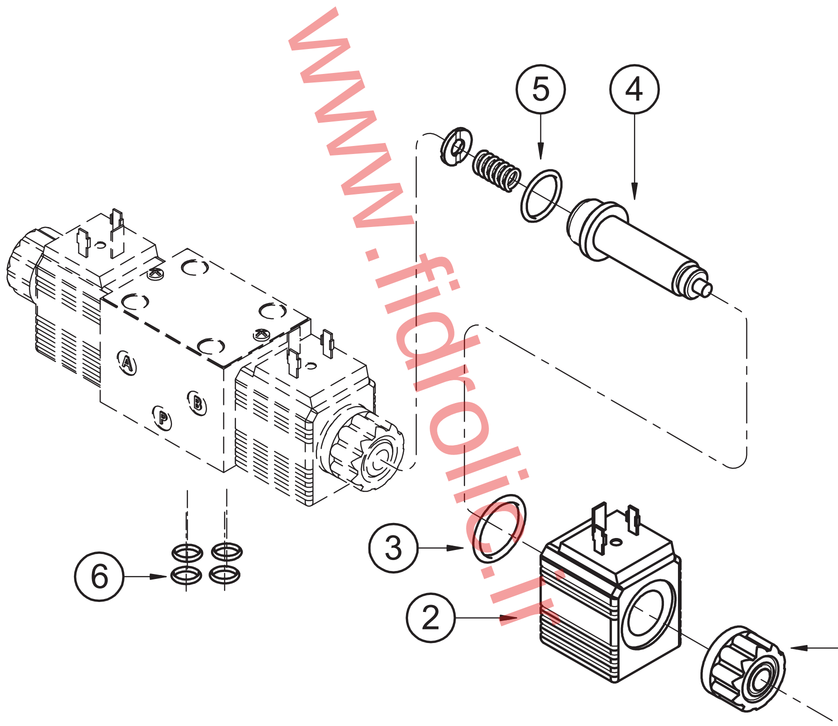
Spanner: 2.5 mm

The knob override can be ordered by entering the code **CK** in the identification code at par. 1, or is available as option to be ordered separately: code **3401210002.**



Code: 3401210002

14 - SPARE PARTS FOR DC SOLENOID VALVE



IDENTIFICATION CODE FOR DC AND RC COILS

C	14	L3	-			/	10

Supply voltage
- **D12** = 12 V, **D24** = 24 V, **D28** = 28 V, **D48** = 48 V — direct current
- **R110** = 110 V, **R230** = 230 V — rectified current

Coil electrical connection:
- **K1** = plug for connector type DIN 43650 (**standard**)
- **K2** = plug for connector type AMP JUNIOR
- **K4** = outgoing cables
- **K7** = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S
- **K8** = plug for connector type AMP SUPER SEAL

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

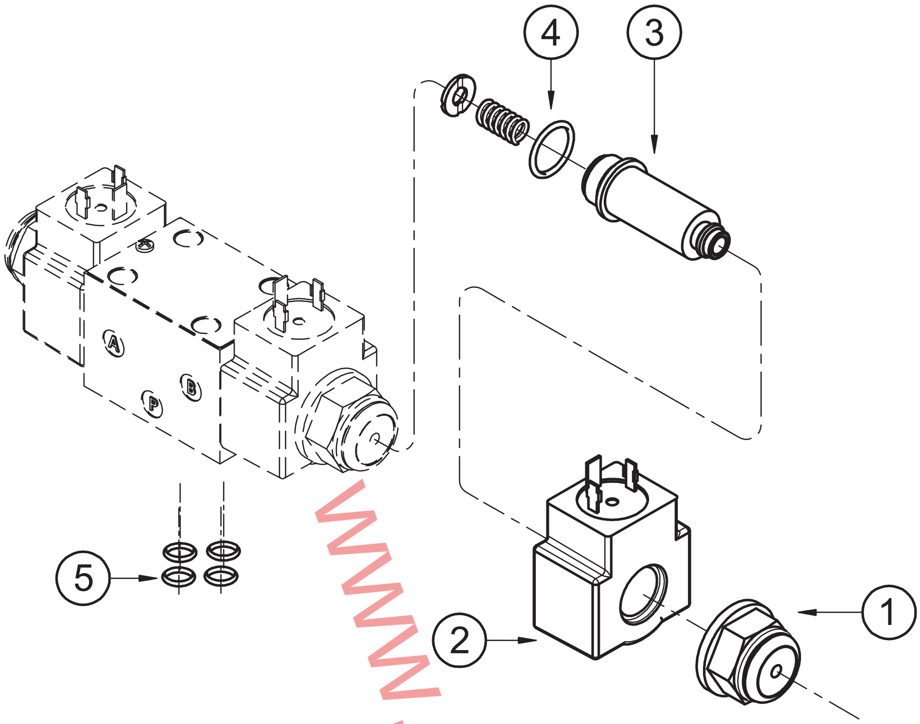
1	Coil locking ring - code 0119382 tightening torque: 3 ÷ 3.4 Nm
2	Coil (see identification code)
3	OR type 2112 (28.3x1.78)
4	Solenoid tube: TD14-M18/11N (NBR seals) TD14-M18/11V (FPM seals) (OR n° 5 included)
5	OR type 2062 (15.6x1.78) - 70 Shore
6	N. 4 OR type 2037 (9.25x1.78) - 90 Shore

SEAL KIT

The codes included the OR n° 5 and 6.

Cod. 1984435 NBR seals
Cod. 1984436 FPM seals

15 - SPARE PARTS FOR AC SOLENOID VALVE



IDENTIFICATION CODE FOR AC COILS

C	18	L3	-		K1	/	11

Supply voltage
A24 = 24 V - 50 Hz
A110 = 110 V - 50 Hz
A230 = 230 V - 50 Hz

Coil electrical connection:
plug for connector type
DIN 43650

Series no.:
(the overall and mounting dimensions remain unchanged from 10 to 19)

1	Coil locking ring - code. 0119469 tightening torque: 3 ÷ 3.4 Nm
2	Coil (see identification code)
3	Solenoid tube: TA18-M18/11N (NBR seals) TA18-M18/11V (FPM seals) **NOTE**: OR n° 4 included.
4	OR type 2062 (15.6x1.78) - 70 Shore
5	N. 4 OR type 2037 (9.25x1.78) - 90 Shore

SEAL KIT

The codes included the OR n° 5 and 6.
Cod. 1984435 NBR seals
Cod. 1984436 FPM seals

16 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G with rear ports
Type PMMD-AL3G with side ports
P, T, A, B port threading: 3/8” BSP

DUPLOMATIC OLEODINAMICA

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Fax +39 0331.895.339
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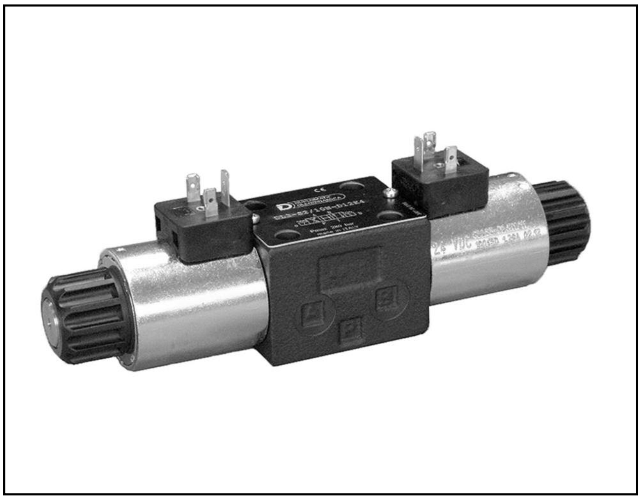
DUPLOMATIC OLEODINAMICA

DL3B

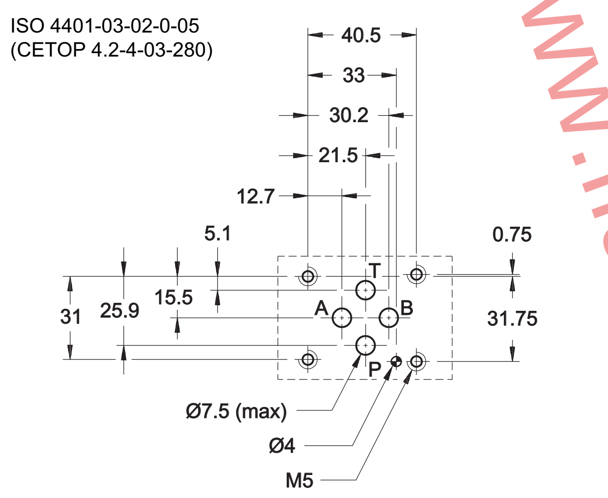
8 WATT SOLENOID OPERATED DIRECTIONAL CONTROL VALVE
SERIES 10



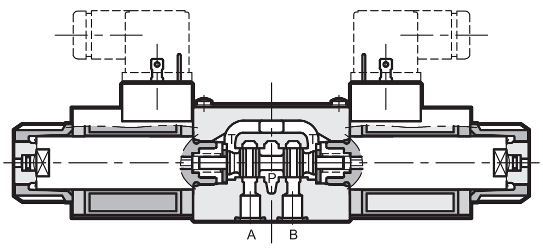
SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

p max **280** bar
Q max **60** l/min

MOUNTING SURFACE



OPERATING PRINCIPLE



— 8 watt direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401-03 (CETOP RP 121H) standards.

— Compact design with reduced solenoid dimensions, suitable for mini-power packs and mobile and agricultural applications.

— The valve body is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (for further information on solenoids see par. 7).

— The valve is supplied with 4 way designs and with several interchangeable spools with different porting arrangements.

— It is available also with zinc-nickel surface treatment, that ensures a salt spray resistance up to 240 hours.

— The valve is available with DC current solenoids with 24 V power supply.

PERFORMANCES
(with mineral oil of viscosity of 36 cSt at 50°C)

Maximum operating pressure: - ports P - A - B - port T	bar	280 210
Maximum flow rate	l/min	50
Pressure drop Δp-Q	see paragraph 4	
Operating limits	see paragraph 5	
Electrical features	see paragraph 7	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	1,5 2

1 - IDENTIFICATION CODE

D	L	3	B	-		/	10		-	DL24	K1	

Solenoid operated directional control valve

Compact version

ISO 4401-03 (CETOP 03) size

Spool type (see paragraph 3):
S* **TA**
SA* **TB**
SB* **RK**

Series N.
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

DC power supply 24 V

Coil electrical connection:
plug for connector type DIN 43650 (**standard**)

Option:
Surface treatment not standard.
Omit if not required
(see **NOTE**)

NOTE: Standard surface treatment is phosphating black.

On request we can supply these valves with zinc-nickel finishing, suitable to ensure a salt spray resistance up to 240 h (test operated according to UNI EN ISO 9227 standard and test evaluation operated according to UNI EN ISO 10289 standard)

Add **/ W7** at the end of the code.

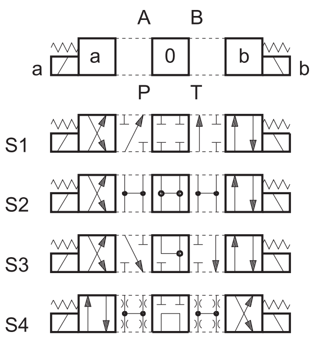
2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

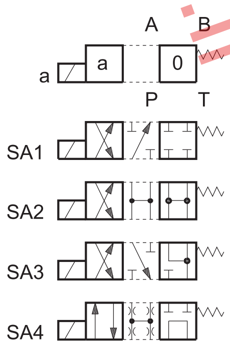
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - SPOOL TYPE

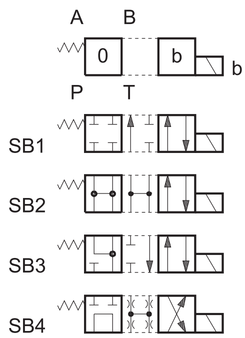
Type **S***:
2 solenoids - 3 positions
with spring centering



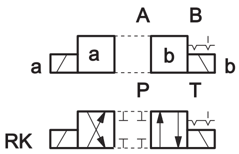
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



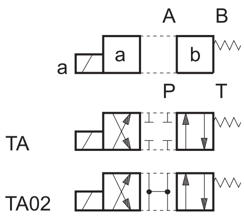
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



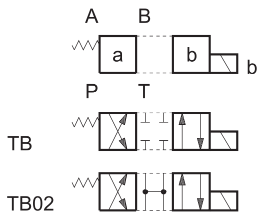
Type **RK**:
2 solenoids - 2 positions
with mechanical retention



Type **TA**:
1 solenoid side A
2 external positions
with return spring



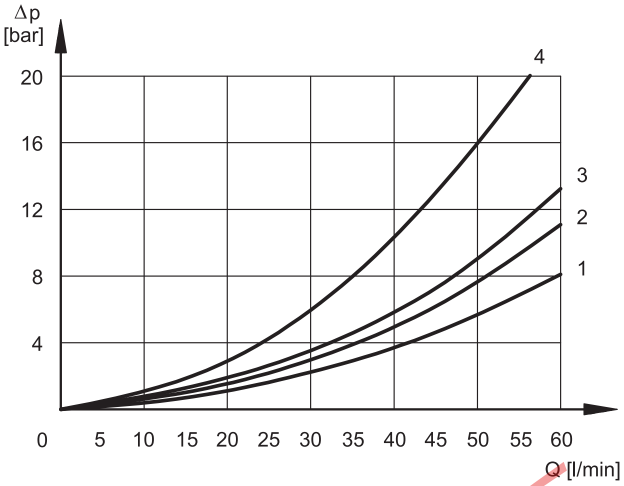
Type **TB**:
1 solenoid side B
2 external positions
with return spring



NOTE: Others spools available on request only.

4 - PRESSURE DROPS ΔP-Q

(obtained with viscosity of 36 cSt at 50 °C)



ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1	2	3	3	2
S2	1	1	1	1
S3	3	3	1	1
S4	4	4	4	4
RK	3	3	3	3
TA, TB	3	3	3	3
TA02, TB02	1	1	1	1

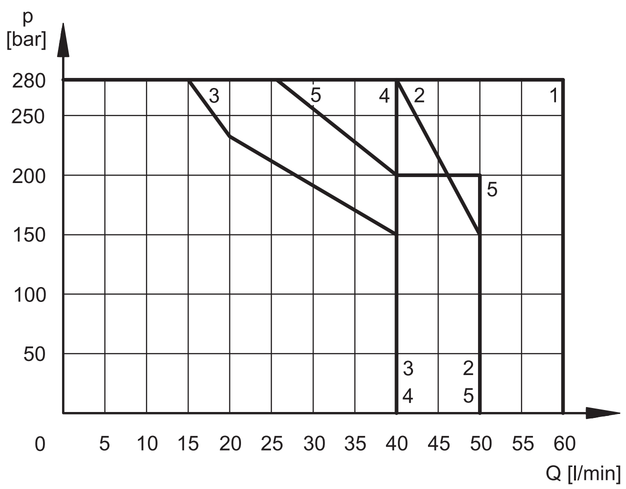
For the pressure drop with a de-energized valve P→T of the spools S2 and S4 refer to the curve 3; for the spool S4 refer to the curve 4.

5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

The limits for TA02 and TA spools refer to the 4-way operation. The operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow are shown in the chart on the next page.



SPOOL	CURVE
S1	1
S2	1
S3	3
S4	4
TA, TB	5
TA02, TB02	2
RK	4

6 - SWITCHING TIMES

The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

TIMES (±10%) [ms]	
ENERGIZING	DE-ENERGIZING
25 ÷ 75	15 ÷ 25

7 - ELECTRICAL FEATURES

7.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated 360°, to suit the available space.

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	7.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95 EC
CLASS OF PROTECTION : Atmospheric agents IEC EN 60529 Coil insulation (VDE 0580) Impregnation	 IP 65 (**NOTE**) class H class F

NOTE: The IP65 protection degree is guaranteed only with the connector correctly connected and installed.

7.2 - Current and absorbed power for solenoid valve

The table shows current and power consumption values relevant to the 24 VDC coil.

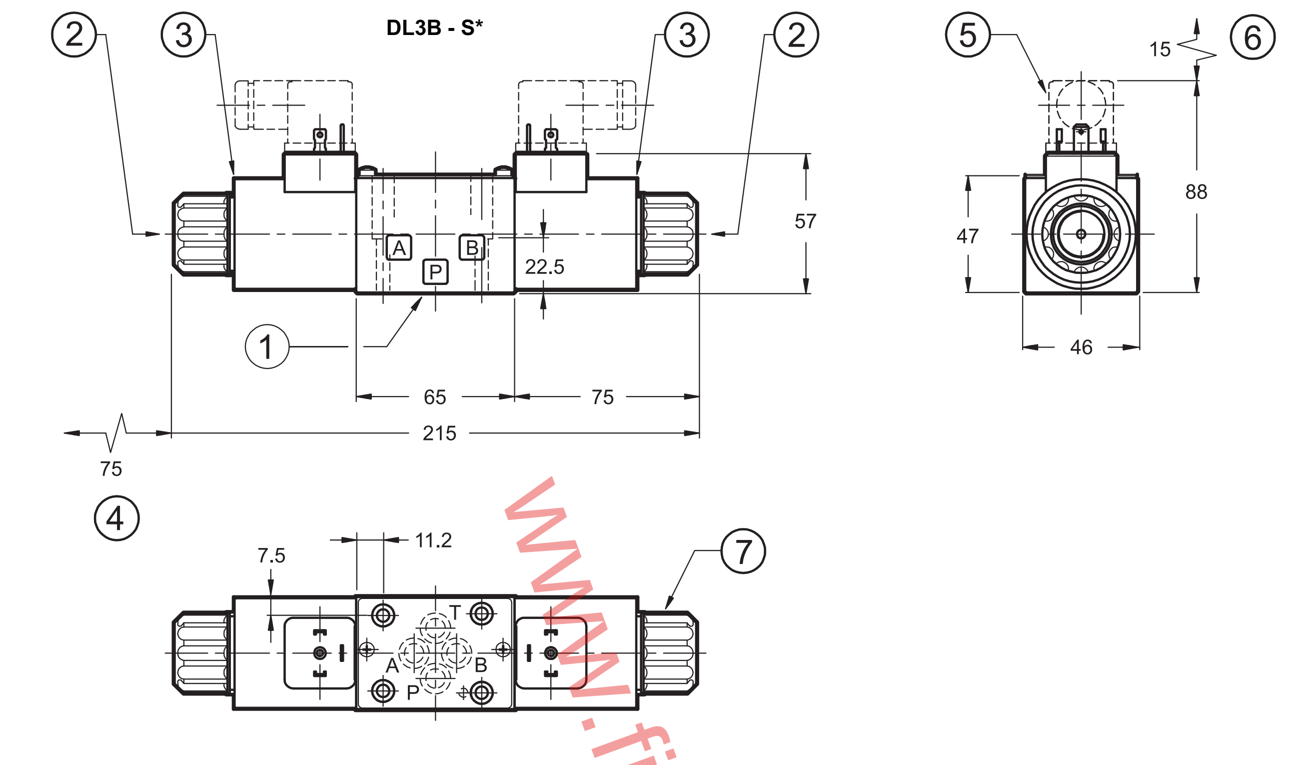
Coil for direct current (values ±10%)

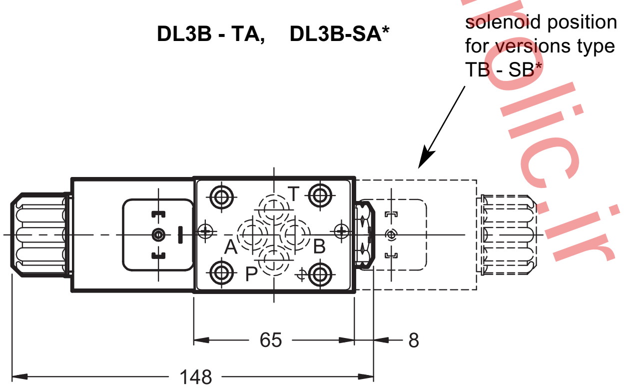
	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code
DL24	24	64.6	0.37	8.92	1903291

8 - ELECTRIC CONNECTORS

Connectors must be ordered separately. See catalogue 49 000.

9 - DL3B OVERALL AND MOUNTING DIMENSIONS





dimensions in mm

1	Mounting surface with sealing rings: 4 OR 2037 (9.25x1.78) - 90 shore
2	Standard manual override included in the solenoid tube
3	Coil (360° revolving)
4	Coil removal space
5	DIN 43650 connector to be ordered separately (see cat. 49 000)
6	Connector removal space
7	Locking ring: tightening torque 5 ±0.5 Nm

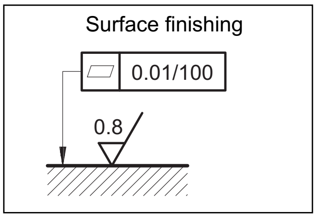
Valve fastening: 4 SHC screws ISO 4762 M5x30
Tightening torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

10 - INSTALLATION

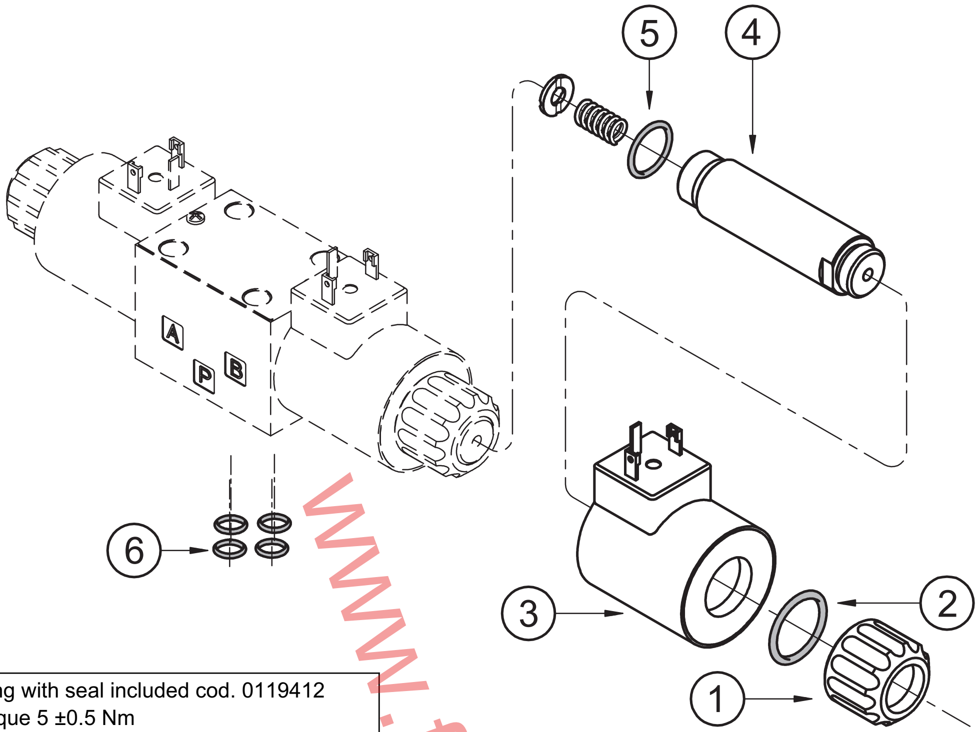
Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

Valve fitting takes place by means of screws or tie rods, fixing the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



11 - SPARE PARTS FOR SOLENOID VALVE



1	Coil locking ring with seal included cod. 0119412 Tightening torque 5 ±0.5 Nm
2	ORM type 0220-20 (22x2) - 70 Shore
3	Coil C22L3B-DL24K1/11
4	Solenoid tube for standard version: TD22-DL3B/10N (NBR seals) TD22-DL3B/10V (FPM seals) **NOTE:** OR n°5 included
5	OR type 2062 (15.6x1.78) - 70 Shore
6	N. 4 OR type 2037 (9.25x1.78) - 90 Shore

SEALS KIT

The codes include the O-Ring n° 2, 5 and 6.
Cod. 1985406 NBR seals
Cod. 1985410 FPM (viton) seals

12 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G with rear ports 3/8” BSP
Type PMMD-AL3G with side ports 3/8” BSP

DUPLOMATIC OLEODINAMICA
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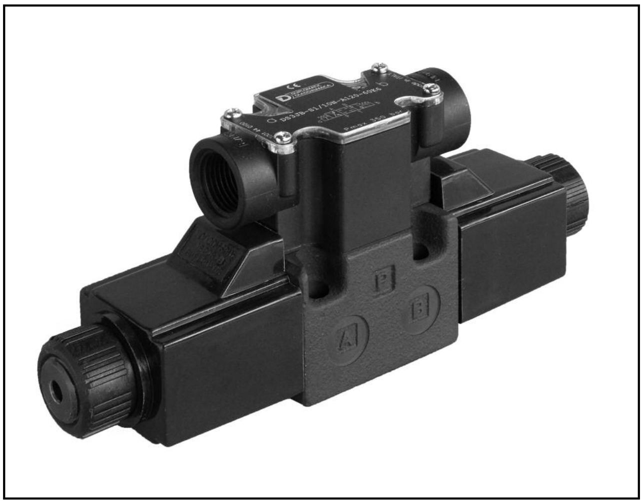
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

DS3JB

SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

AC
SERIES 10



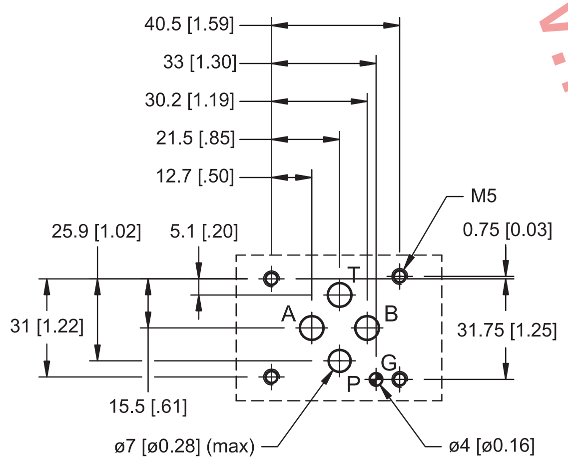
SUBPLATE MOUNTING
NFPA D03 (ISO 4401-03)

p max **5000** psi (350 bar)
Q max **20** GPM (76 l/min)

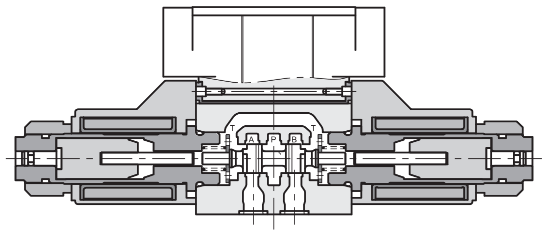
MOUNTING SURFACE

ISO 4401-03-02-0-05
NFPA D03

dimensions in mm [inch]



OPERATING PRINCIPLE



— Direct acting, subplate mounting directional control valve, with mounting surface according to NFPA D03 standards.

— The valve is supplied with 3 or 4 ports designs, with 2 or 3 positions with a wide range of spools.

— The valve body is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (for further information on solenoids see par. 7).

— The valve is equipped with junction box to be wired.

— The valve is available with AC solenoids.

— A boot protected manual override is available for applications in tropical climate.

PERFORMANCES

(obtained with mineral oil with viscosity of 170 SUS at 50°C)

Maximum operating pressure: - P - A - B ports - T port	psi	5000 2300
Maximum flowrate	GPM	20
Electrical connection	junction box	
Ambient temperature range	°F	-4 / +122
Fluid temperature range	°F	-24 / +176
Fluid viscosity range	SUS	60 ÷ 1900
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15	
Recommended viscosity	SUS	120
Mass: single solenoid valve dual solenoid valve	lbs	3.15 4.15

1 - IDENTIFICATION CODE

D	S	3	JB	-		/	10		-		K6	/	

Solenoid operated directional control valve (D S)

NFPA D03 (ISO 4401-03) size (3)

Junction box (JB)

Spool type (see paragraph 2)
S* **TA** **RK**
SA* **TB**
SB*

Series:
(the overall and mounting dimensions remain unchanged from 10 to 19) (10)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

AC coil type
A120-60 = 110/120 V - 60 Hz
A240-60 = 220/240 V - 60 Hz

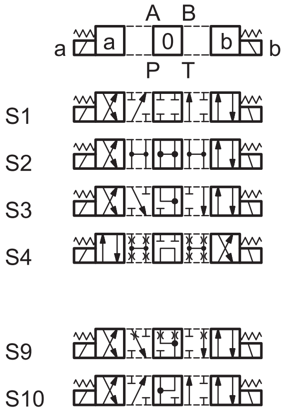
Coil electrical connection:
K6 = 2 pins for junction box

Manual override:
Omit for override integrated in the tube (**standard**)
CM = boot protected

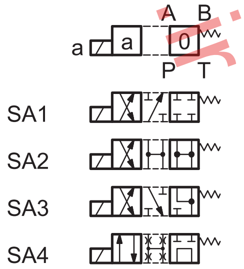
2 - SPOOL TYPE

Other spools are available on request.

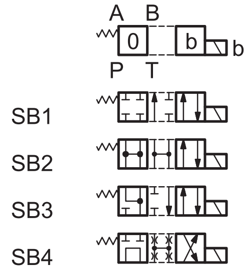
Type **S***:
2 solenoids - 3 positions
with spring centering



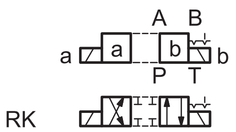
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



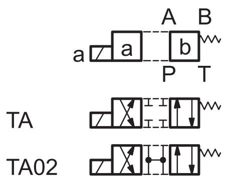
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



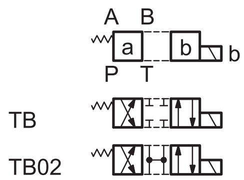
Type **RK**:
2 solenoids - 2 positions
with mechanical retention



Type **TA**:
1 solenoid side A
2 external positions
with return spring



Type **TB**:
1 solenoid side B
2 external positions
with return spring



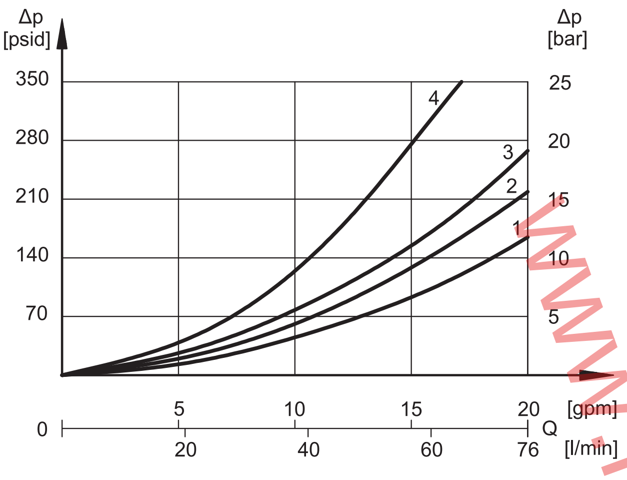
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 176 °F causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - PRESSURE DROPS Δp-Q

(obtained with viscosity 170 SUS at 122 °F)



When spool S10 is used for regenerative circuits, pressure drops between A and B lines are described by curve 4 .

PRESSURE DROPS WITH VALVE IN ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	3	3
S2, SA2, SB2	1	1	3	3
S3, SA3, SB3	3	3	1	1
S4, SA4, SB4	4	4	4	4
S9	2	2	3	3
S10	1	3	1	3
TA, TB	3	3	3	3
TA02, TB02	2	2	2	2
RK	2	2	2	2

PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2					2
S3, SA3, SB3			3	3	
S4, SA4, SB4					3
S10	3	3			

5 - SWITCHING TIMES

The values indicated are obtained according to ISO 6403 standard. They refer to an S1 solenoid valve for Q = 10 GPM, p = 2,000 psi working with mineral oil at a temperature of 122 °F, a viscosity of 170 SUS and with PA and BT connections.

The energizing times are obtained at the time the spool switches over. The de-energizing times are measured at the time pressure variation occurs on the line.

	ENERGIZING	DE-ENERGIZING
TIMES (±10%) [ms]	10 ÷ 25	15 ÷ 40

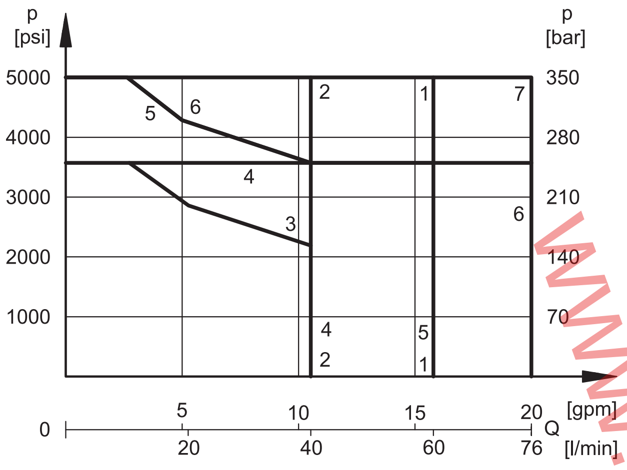
6 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure.

The values have been obtained according to ISO 6403 standard, with mineral oil, viscosity 170 SUS, temperature 122 °F and filtration according to ISO 4406:1999 class 18/16/13, with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

The limits for TA02 and TA spools refer to the 4-port operation. The operating limits can be considerably reduced if a 4-port valve is used as 3-port valve with port A or B plugged or without flow.

Valves fed at 110 V / 60 Hz may have slightly lower performance limits than those showed in the diagram.



SPOOL	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	3	3
S4, SA4, SB4	1	1
S9	4	4
S10	1	1
TA, TB	5	5
TA02, TB02	6	6
RK	7	7

7 - ELECTRICAL FEATURES

7.1 Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded nut.

The interchangeability of coils of different voltages is allowed.

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95/EC
CLASS OF PROTECTION : Class of protection IEC 60529 Coil insulation (VDE 0580) Impregnation:	 IP65 class H class H

7.2 Current and absorbed power

The table shows current and power consumption values at inrush and at holding. In alternating current energizing, an initial phase (maximum movement) is seen, during which the solenoid consumes elevated value currents (inrush current); the current values diminish during the plunger stroke until it reaches the minimum values (holding current) when the plunger reaches the stroke end.

Coils (values ± 10%)

Suffix	Nominal Voltage [V]	Frequency [Hz]	Resistance at 20°C [Ohm]	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Coil Code
C20.6-A120-60K6/10	110	60	27.5	1.8	0.36	198	39.6	1902820
	120			2	0.43	240	51.6	
C20.6-A240-60K6/10	220		110	0.86	0.17	189.2	37.4	1902821
	240			0.98	0.2	235.2	48	

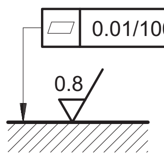
8 - INSTALLATION

Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

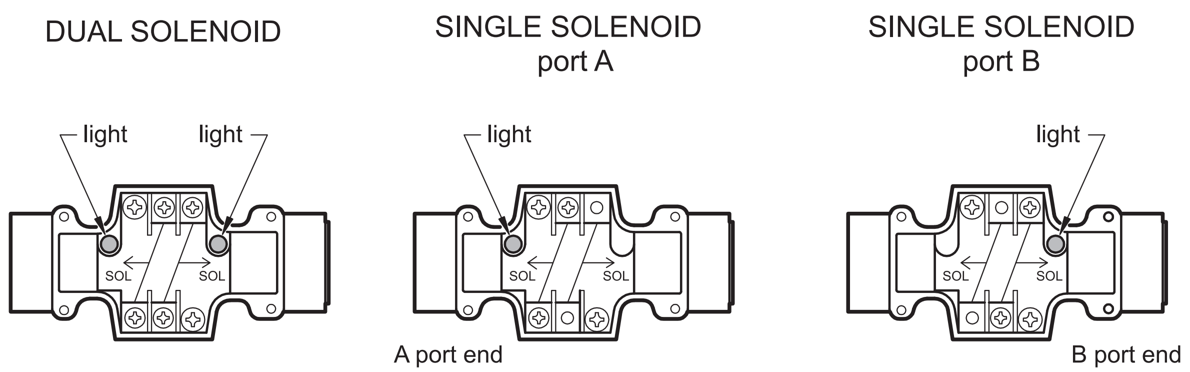
Valve fixing takes place by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity and/or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

For use in tropicat climate, we recommend the use of boot (CM option, see secton 11) to protect the manual override.

Surface finishing



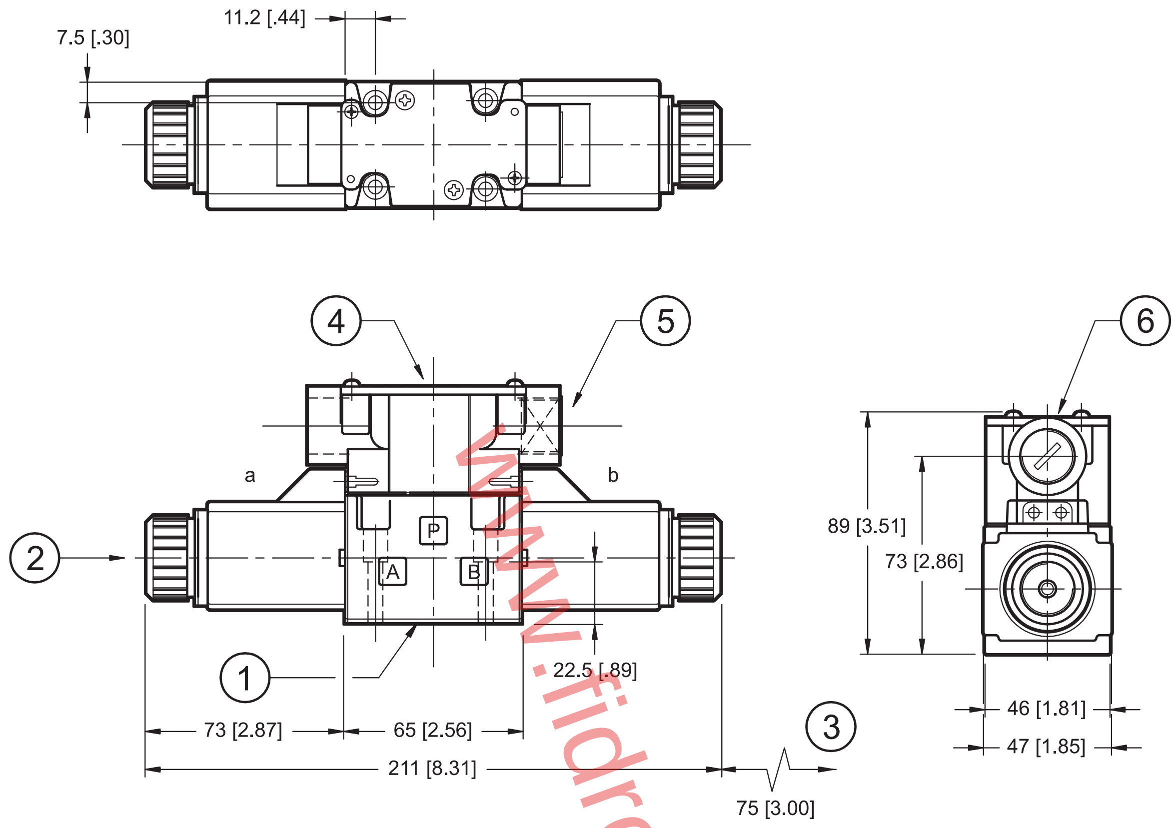
9 - JUNCTION BOX



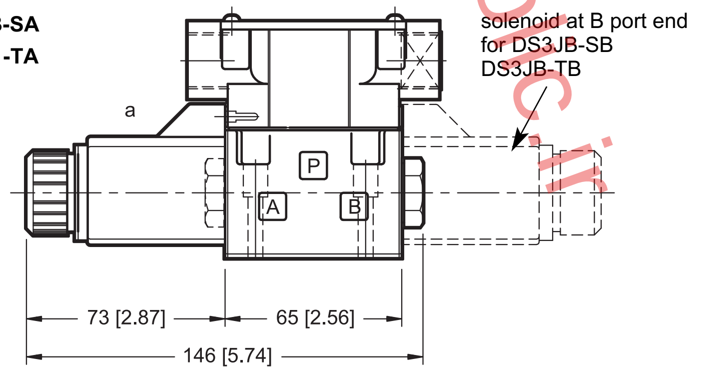
10 - OVERALL AND MOUNTING DIMENSIONS

DS3JB - S*
DS3JB - RK

dimensions in mm [inch]

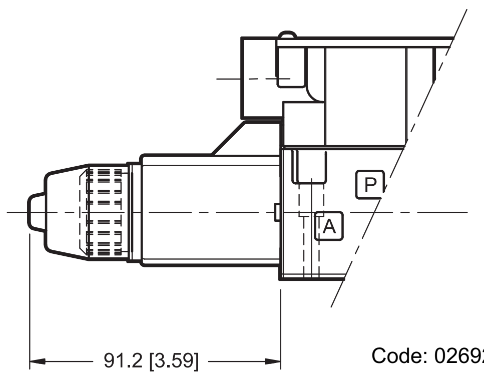


DS3JB-SA
-TA



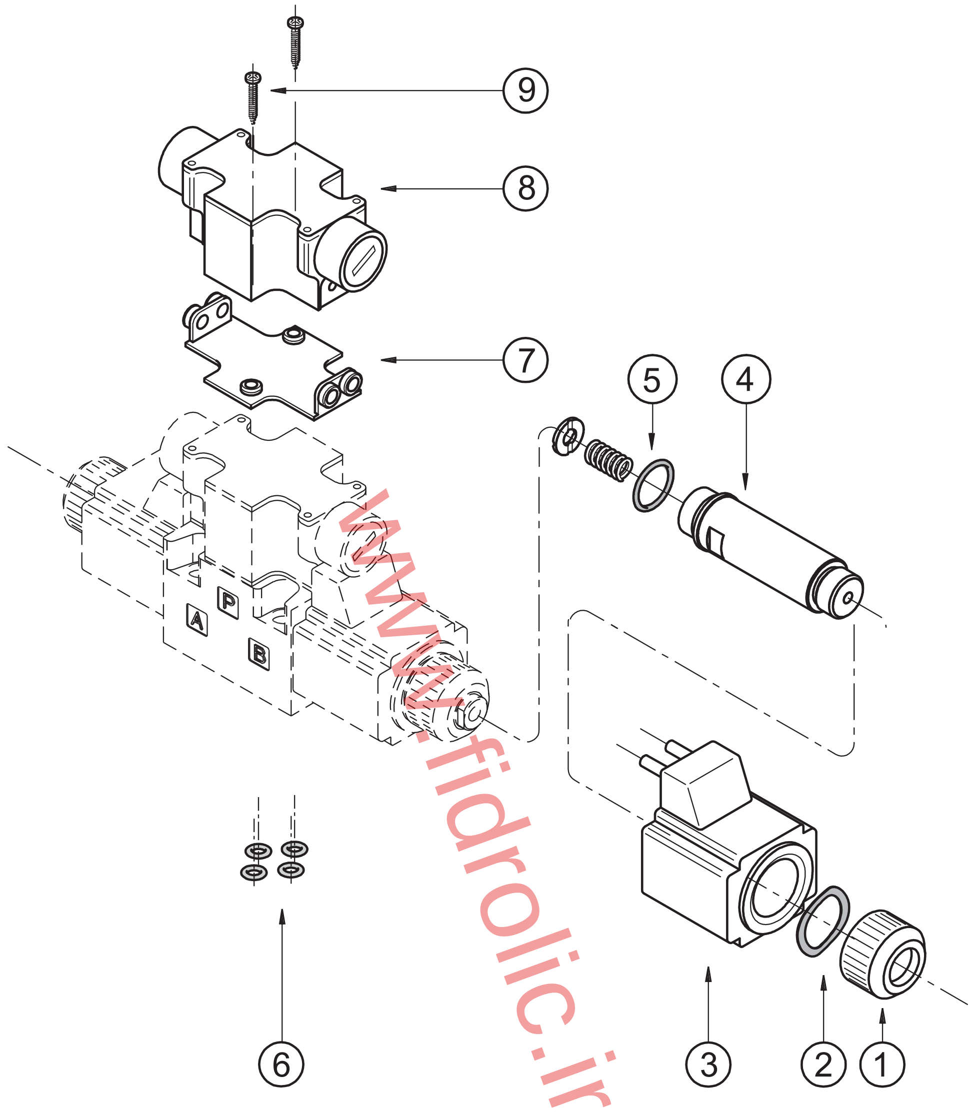
1	Mounting surface with sealing rings: 4 pcs. AS568-012 90 Shore A
2	Standard manual override included in the solenoid tube
3	Coil
4	Junction box
5	Port 1/2” NPT plugged
6	Port for cable gland 1/2” NPT
7	Locking ring tightening torque 4-5 lbf-ft

11 - CM MANUAL OVERRIDE



Code: 0269201

12 - SPARE PARTS



COILS IDENTIFICATION CODE

C	20.6	-		K6	/	10

Supply voltage
A120-60 = 110/120 V - 60 Hz
A240-60 = 220/240 V - 60 Hz

Coil electrical connection:
2 pins for junction box

Series no.
(the overall and mounting dimensions remain unchanged from 10 to 19)

SEALS KIT

The codes include the O-Ring nr. 5 and 6.

Cod. **1985406** NBR seals
Cod. **1985410** FPM (viton) seals

1	Coil locking ring cod. 0119333 Tightening torque 5 ±0.5 Nm
2	Spring washer code 0550483
3	Coil (see identification code at side)
4	Solenoid tube : TA20.6-DS3/10N (NBR seals) TA20.6-DS3/10V (FPM seals) **NOTE**: OR n° 5 included
5	AS568-016 70 Shore A
6	4 pcs. AS568-012 90 Shore A
7	Seal for junction box code 0119407
8	Junction box
9	2 pcs. Phillips screws M3x25

13 - FASTENING BOLTS

4 SHC M5x30 - ISO 4762 (or 10-24 UNC - 2Bx1.25)
Tightening torque 4-5 lbs.ft

DUPLOMATIC OLEODINAMICA

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Fax +39 0331.895.339
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MDS3

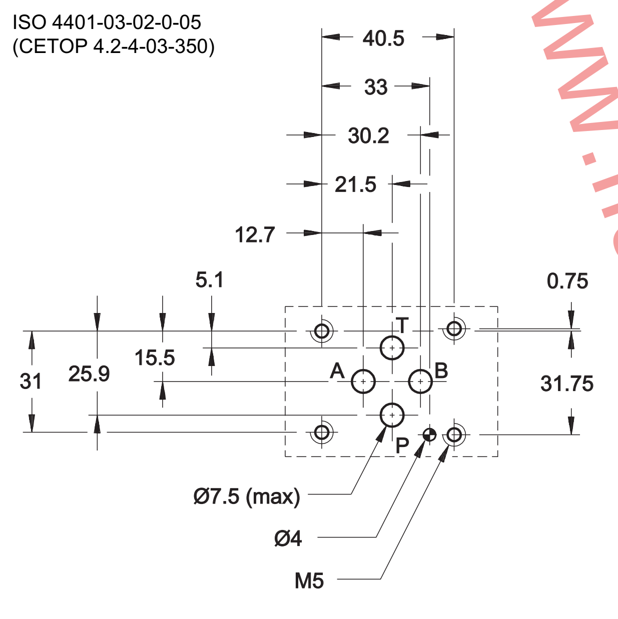
SOLENOID OPERATED SWITCHING VALVE

SERIES 10

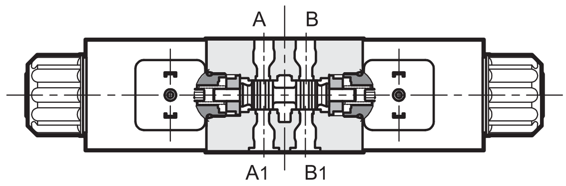
MODULAR VERSION ISO 4401-03

p max **350** bar
Q max **50** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



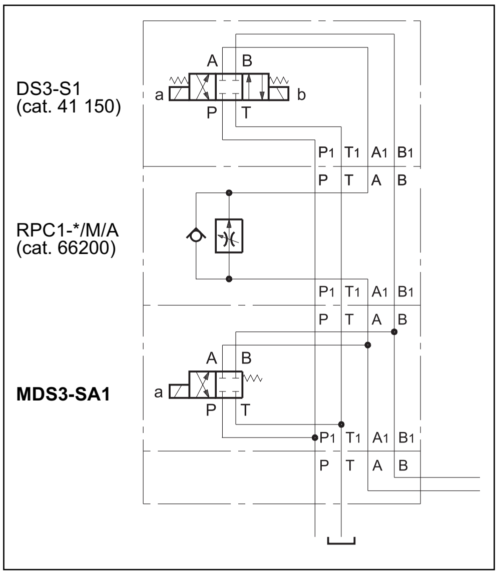
- The MDS3 valve is used to switch multiple flow directions, or to select pressure values. An application example can be seen here below.
- The straight flow paths pass the valve body and due to this particular design feature, the MDS3 can be assembled with all ISO 4401-03 modular valves.
- The special connection of the valve in parallel to the P - T - A - B lines of the circuit allows easy construction of differents hydraulic configurations, reducing pressure drops to a minimum.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Max operating pressure: P - A - B ports T port (DC version) T port (AC version)	bar	350 210 140
Maximum flow on P - A - B ports	l/min	50
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: double solenoid single solenoid	kg	2 1,5

APPLICATION EXAMPLE



1 - IDENTIFICATION CODE

MDS	3	-		/	10		-			/	

Modular switching valve

Size: ISO 4401-03

Spools (see paragraph 3):

S* **SA*** **SB*** **TA**
RSA1 **RSB1** **TB**
TA31 DC only
TB31 DC only

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

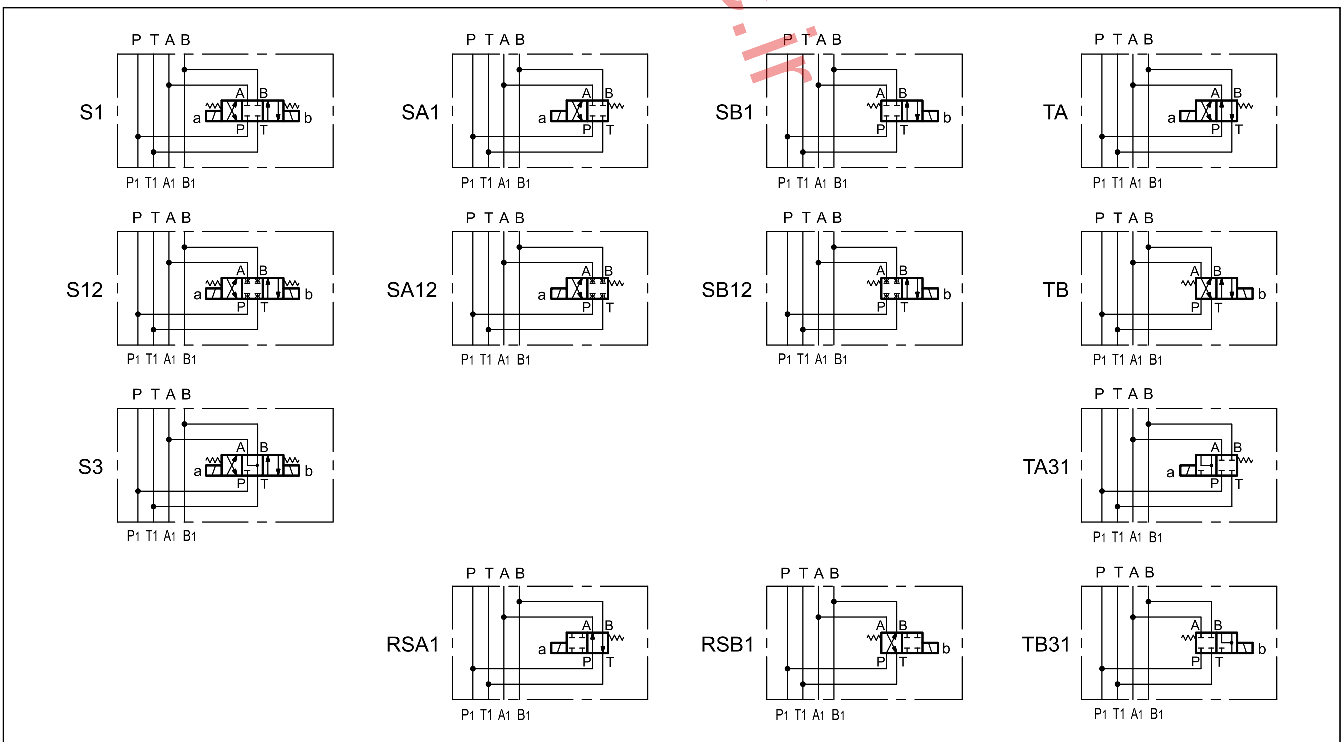
Manual override (see at paragraph 12):
Omit for override integrated in the tube (**standard**)

Coil electrical connection :
K1 = plug for connector type DIN 43650 (**standard**)
K7 = plug for connector type DEUTSCH DT04-2P male (available on **D12** and **D24** coils only)

DC power supply
D12 = 12 V
D24 = 24 V
D28 = 28 V
D48 = 48 V
D110 = 110 V
D220 = 220 V

AC power supply
A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A110 = 110 V - 50 Hz / 120 V - 60 Hz
A220 = 220 V - 50 Hz / 240 V - 60 Hz

2 - SPOOLS TYPES

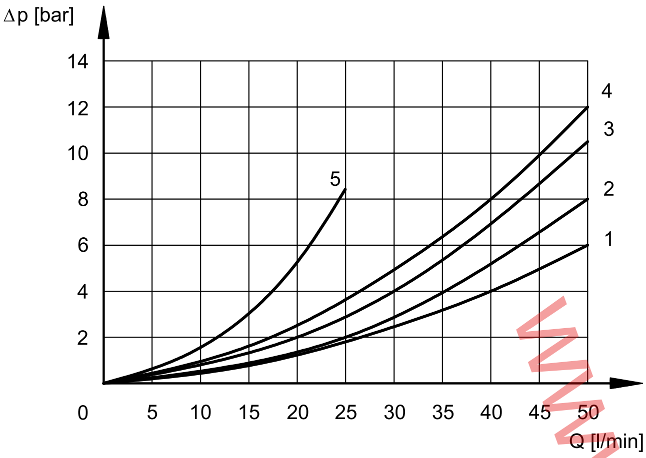


3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - PRESSURE DROPS Δp-Q



SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1, S12	2	2	3	3
S3 (*)	2	2	1	1
RSA1	2			2
TA	3	4	4	4
TA31			3	

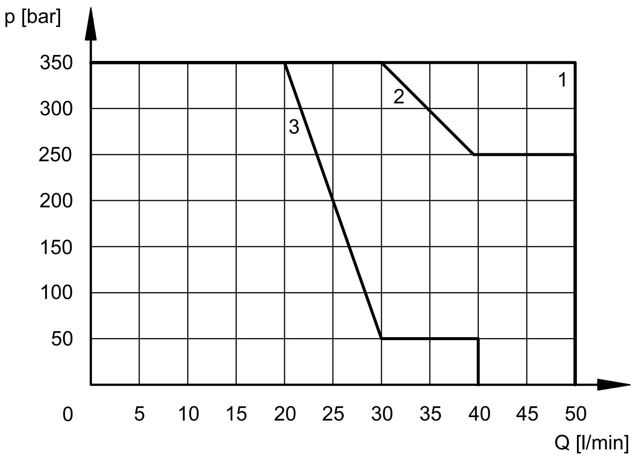
(*) the limit for central position of S3 spool is 25/lmin (curve 5)

5 - OPERATING LIMITS

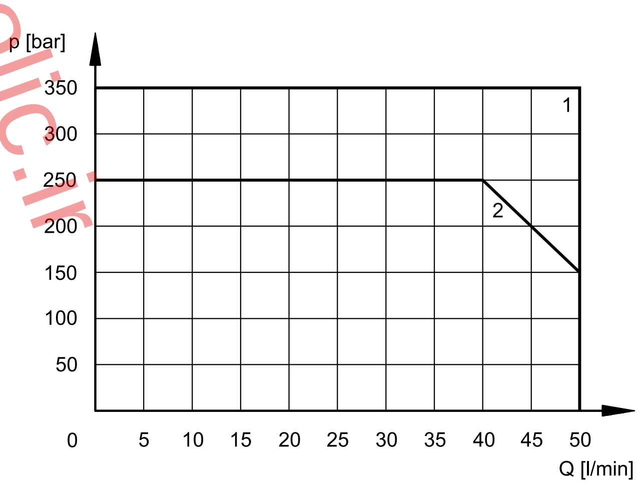
The curves define the flow rate operating fields according to the valve pressure of the different versions. The values indicated in the graphs are relevant to the standard solenoid valve.

The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



SPOOL	CURVE
S1, S12, RSA1, TA	1
S3	2
TA31	3



SPOOL	CURVE
S1, S12, RSA1, TA	1
S3	2

6 - SWITCHING TIMES

The values indicated are obtained, according to ISO 6403 standards, with mineral oil viscosity 36 cSt at 50°C.

	TIMES (±10%) [ms]	
	ENERGIZING	DE-ENERGIZING
DC	80 -150	15 - 25
AC	25 - 50	20 - 40

8 - ELECTRICAL FEATURES

8.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated to suit the available space.

Protection from atmospheric agents EN 60529

Connector	IP 65	IP 67	IP 69 K
K1 DIN 43650	x (*)		
K7 DEUTSCH DT04 male	x	x	x (*)

(*) The protection degree is guaranteed only with the connector correctly connected and installed

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY DC valve AC valve	 18.000 ins/hr 10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95 EC
CLASS OF PROTECTION : Coil insulation (VDE 0580) Impregnation	 class H class F

NOTE: In order to further reduce the emissions is recommended the use of type H connectors. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

8.2 - Current and absorbed power for DC solenoid valve

The table shows current and power consumption values relevant to the DC coils.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 48V voltage) with alternating current (50 or 60 Hz), considering a reduction of the operating limits .

Available DC coils (values ±5%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code K1	K7
D12	12	4,4	2,72	32,6	1903080	1902940
D24	24	18,6	1,29	31	1903081	1902941
D28	28	26	1,11	31	1903082	
D48	48	78,6	0,61	29,3	1903083	
D110	110	436	0,26	28,6	1903464	
D220	220	1758	0,13	28,6	1903465	

8.3 - Current and absorbed power for AC solenoid valve

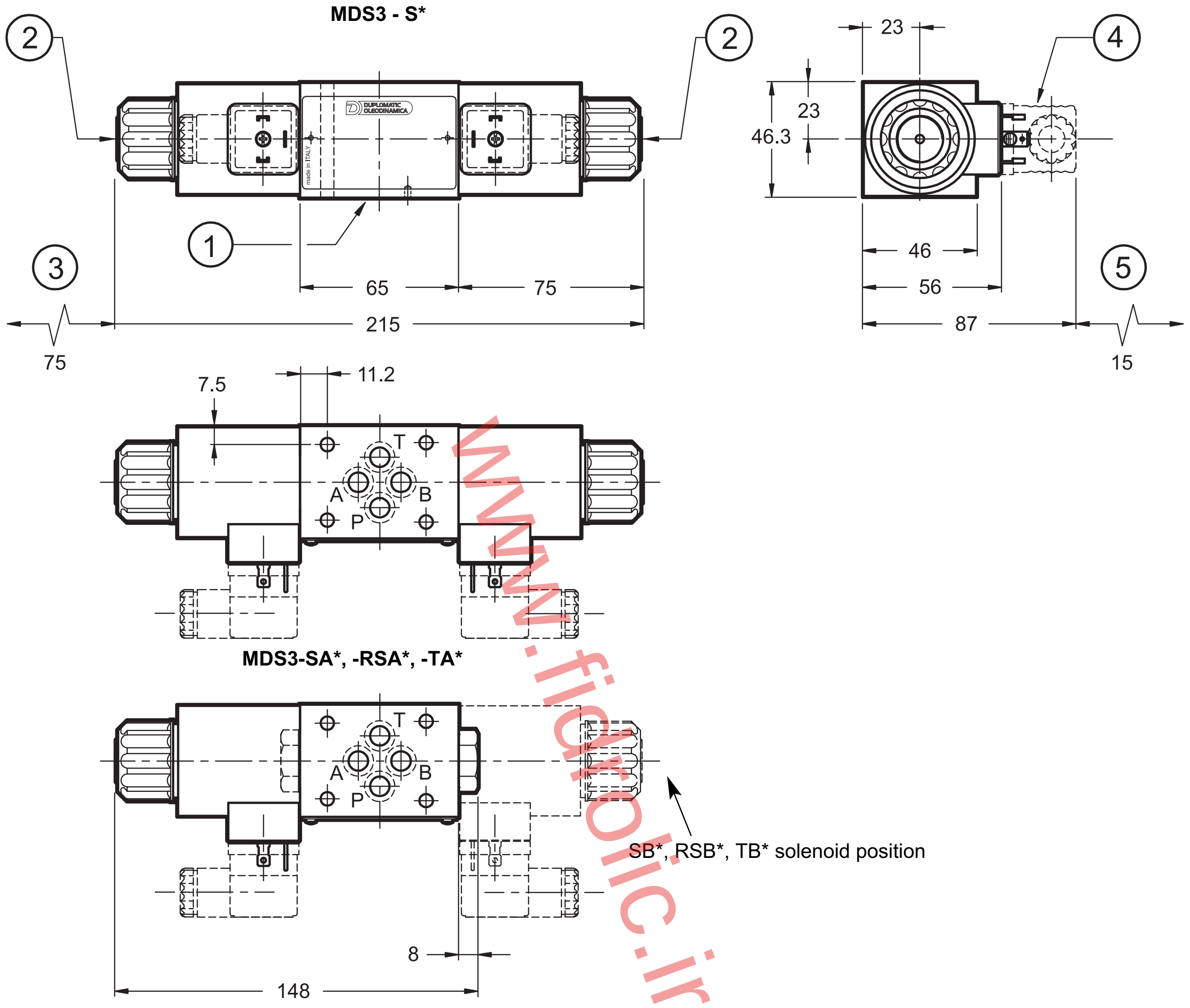
The table shows current and power consumption values at inrush and at holding, relevant to the different coil types for AC current.

Available AC coils (values ± 5%)

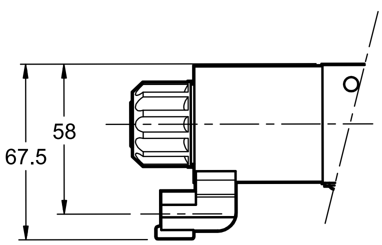
<table>
<tr><th>Suffix</th><th>Nominal Voltage
[V]</th><th>Freq.
[Hz]</th><th>Resistance at 20°C
[Ω] (±1%)</th><th>Current consumption at inrush [A]</th><th>Current consumption at holding [A]</th><th>Power consumption at inrush [VA]</th><th>Power consumption at holding [VA]</th><th>Coil Code
K1</th></tr>
<tr><td>A24</td><td>24</td><td rowspan="2">50</td><td>0.88</td><td>8.7</td><td>2.35</td><td>209</td><td>56.5</td><td>1902660</td></tr>
<tr><td>A48</td><td>48</td><td>3.2</td><td>4.5</td><td>1.25</td><td>216</td><td>60</td><td>1902661</td></tr>
<tr><td rowspan="2">A110</td><td rowspan="2">110V-50Hz
120V-60Hz</td><td rowspan="4">50/60</td><td rowspan="2">17.5</td><td>1.9</td><td>0.48</td><td>209</td><td>52.8</td><td rowspan="2">1902677</td></tr>
<tr><td>1.8</td><td>0.45</td><td>216</td><td>54</td></tr>
<tr><td rowspan="2">A220</td><td rowspan="2">220V-50Hz
240V-60Hz</td><td rowspan="2">70</td><td>0.95</td><td>0.23</td><td rowspan="2">209</td><td>50.6</td><td rowspan="2">1902678</td></tr>
<tr><td>0.87</td><td>0.21</td><td>50.4</td></tr>
</table>

8 - DC VALVE - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



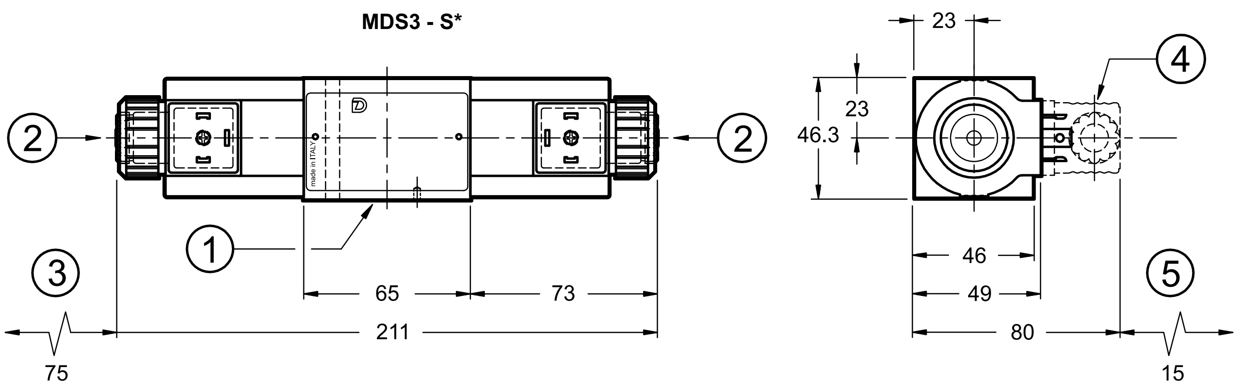
K7 coil connection

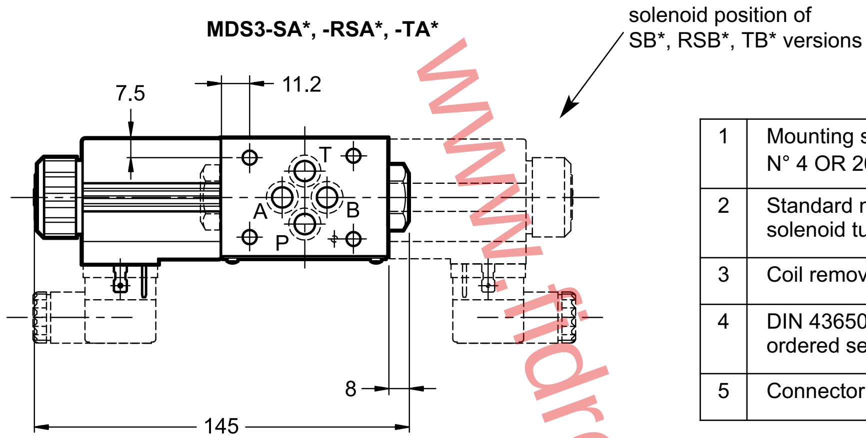


1	Mounting surface with sealing rings: N° 4 OR 2037 (9.25x1.78) - 90 Shore
2	Standard manual override included in the solenoid tube
3	Coil removal space
4	DIN 43650 electrical connector (K1 standard connector shown) to be ordered separately (see cat. 49 000)
5	Connector removal space

9 - DC VALVE - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm





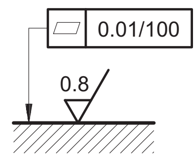
1	Mounting surface with sealing rings: N° 4 OR 2037 (9.25x1.78) - 90 Shore
2	Standard manual override included in the solenoid tube
3	Coil removal space
4	DIN 43650 electrical connector to be ordered separately (see cat. 49 000)
5	Connector removal space

10 - INSTALLATION

The valve can be mounted in any position. Valve fixing takes place by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity and/or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

Surface finishing



11 - ELECTRIC CONNECTORS

The solenoid valves are supplied without connectors. For coils with standard electrical connection K1 type (DIN 43650) the connectors can be ordered separately: see catalogue 49 000.

12 - MANUAL OVERRIDES

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

Three different manual override versions are available upon request: **CM**: boot protected; **CP**: Push (for DC valves only); **CPK**: Push manual override with mechanical retention (for DC valves only).

For more information about these manual overrides, see the catalogue 41150.

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MDF3

SHUT-OFF SOLENOID VALVE

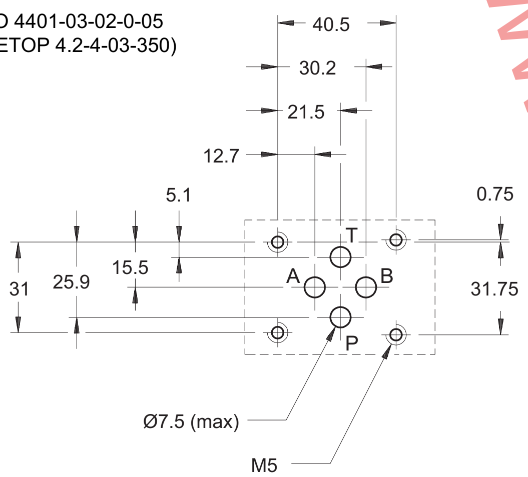
SERIES 10

MODULAR VERSION
ISO 4401-03

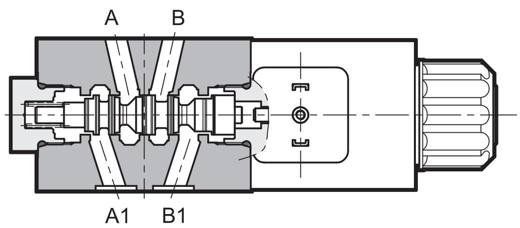
p max **350** bar
Q max **50** l/min

MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



OPERATING PRINCIPLE



- Shut-off solenoid valve, direct-acting, available in two versions at rest: with lines blocked and with unloading lines.
- It is used with directional control servovalves to guarantee the circuit's safety if there is a power failure.
- Wet armature solenoids with interchangeable coils are used (for further information see par. 6).

SPOOL TYPE

(see hydraulic symbols table)

Type "A": it is used to unload the lines, with the valve at rest.
Type "C": it is used to block the lines, with the valve at rest.

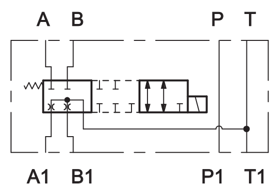
PERFORMANCE RATINGS

(working with mineral oil of viscosity of 36 cSt at 50°C)

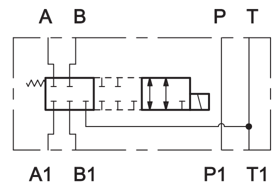
Maximum operating pressure	bar	350
Maximum flow rate	l/min	50
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	1,5

HYDRAULIC SYMBOLS

MDF3-A



MDF3-C



1 - IDENTIFICATION CODE

M	D	F	3	-		/	10		-		K1

Modular solenoid valve

FAIL SAFE feature

ISO 4401-03 (CETOP 03) size

Spool type:
A = open (with lines A1 and B1 in T at rest)
C = closed (with lines A1 and B1 closed, at rest)

Series: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Power supply:
D12 = 12 V
D24 = 24 V
D48 = 48 V
D110 = 110 V
D220 = 220 V
D00 = valve without coils
(see **NOTE**)

Coil electrical connection:
plug for connector type DIN 43650
(standard)

NOTE: the locking ring of the coil and the relevant O-Rings are supplied together with valves.

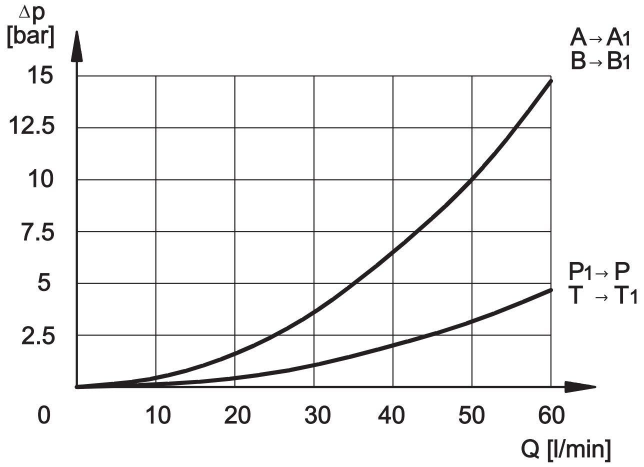
2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - PRESSURE DROPS Δp-Q

(obtained with viscosity 36 cSt at 50 °C)



4 - SWITCHING TIMES

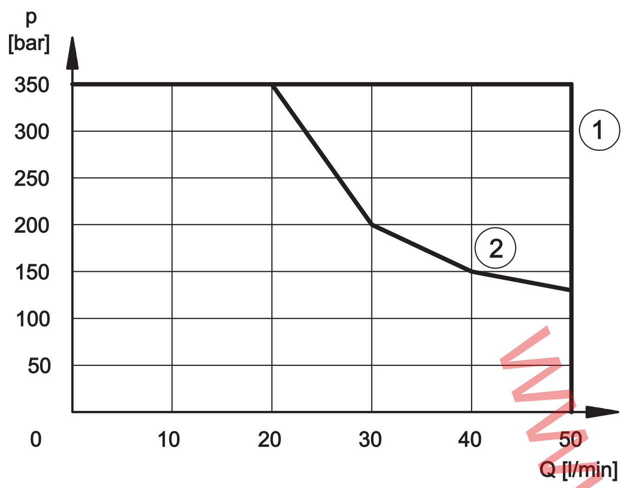
The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

TIMES	
ENERGIZING	DE-ENERGIZING
60 ÷ 90 ms	20 ÷ 50 ms

5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions.
The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

The values have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/15.



1) Curve related to the de-energizing of the solenoid valve
Curve related to the energizing of the solenoid valve, without any flow in A and B lines

2) Curve related to the energizing of the solenoid valve, with flow in A and B lines

6 - ELECTRICAL FEATURES

6.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated, to suit the available space.

NOTE 1: In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

NOTE 2: The IP65 protection degree is guaranteed only with the connector correctly connected and installed.

VOLTAGE SUPPLY FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	18.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE 1)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95/EC
CLASS OF PROTECTION: Atmospheric agents (IEC EN 60529) Coil insulation (VDE 0580) Impregnation	 IP 65 (**NOTE 2**) class H class F

6.2 - Current and absorbed power

The table shows current and power consumption values relevant to the different coil types for DC.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 48V voltage) with alternating current (50 or 60 Hz), considering a reduction of the operating limitsof about 5-10%.

Coils for direct current (values ± 5%)

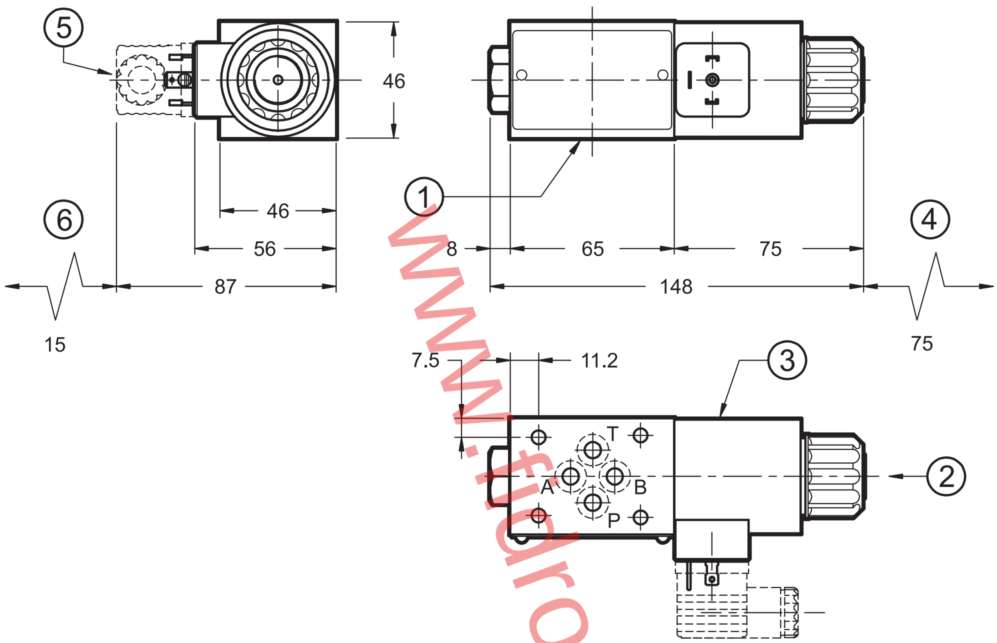
Suffix	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [W]	Coil code
D12	12	4,4	2,72	32,6	1903080
D24	24	18,6	1,29	31	1903081
D48	48	78,6	0,61	29,3	1903083
D110	110	436	0,26	28,6	1903464
D220	220	1758	0,13	28,6	1903465

7 - ELECTRIC CONNECTORS

The solenoid operated valves are delivered without the connectors. They must be ordered separately.
For the identification of the connector type to be ordered, please see catalogue 49 000.

8 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Standard manual override included in the solenoid tube
3	Coil 360° revolving (to suit the available space)
4	Coil removal space
5	DIN 43650 electrical connector to be ordered separately (see cat. 49 000)
6	Connector removal space

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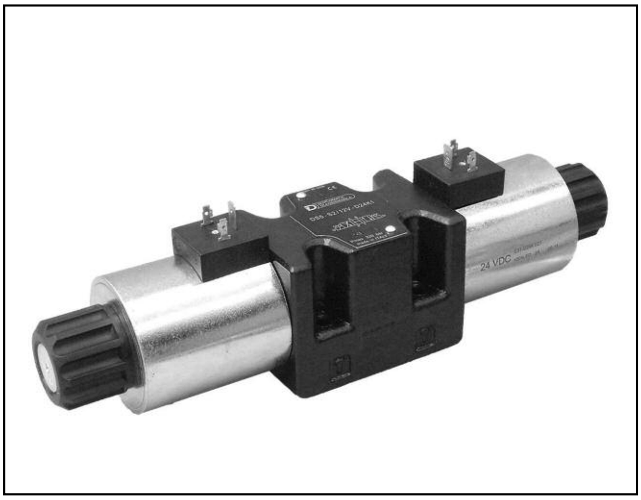
DS5

SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

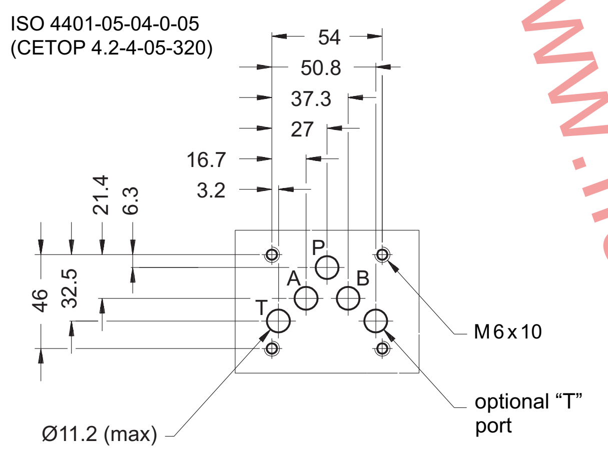
SERIES 12



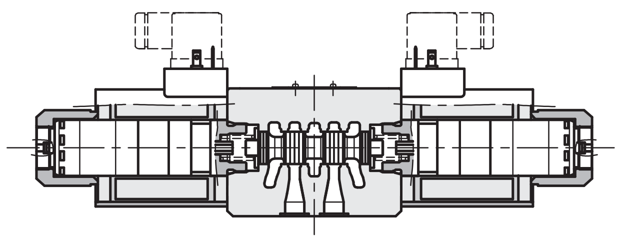
SUBPLATE MOUNTING
ISO 4401-05

p max **320** bar
Q max **150** l/min

MOUNTING SURFACE



OPERATING PRINCIPLE



— Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401.

— The valve is supplied with 3 or 4 way designs and with several interchangeable spools with different porting arrangements.

— The valve body is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (see paragraph 7).

— The valve is available with DC or AC solenoids. DC solenoids can also be fed with AC power supply, by using connectors with a built-in rectifier bridge (see paragraph 7.2).

— The DS5 directional valve direct current version is available in the following special versions:

- version with Y external subplate drain port, (see par. 13.1 and 13.2).
- version with soft-shifting (see par. 13.3 and 13.4)
- version with adjustable "soft-shift" device (see paragraph 13.5)

PERFORMANCE RATINGS (with mineral oil of viscosity of 36 cSt at 50°C)

		DC	AC
Maximum operating pressure P - A - B ports T port - standard version T port - version with Y port (ext.drain)	bar	320 210 320	320 140 -
Maximum flow rate	l/min	150	120
Pressure drops Δp-Q		see paragraph 4	
Operating limits		see paragraph 6	
Electrical features		see paragraph 7	
Electrical connections		see paragraph 11	
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree		according to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25	
Mass: single solenoid valve double solenoid valve	kg	4,5 6,1	3,6 4,3

1 - IDENTIFICATION CODE

D	S	5	-		/	12		-			/		

Solenoid operated directional control valve

ISO 4401-05 size

Spool type (see par. 3)

S* **TA**
SA* **TB**
SB* **RK**

Series: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

DC power supply
D12 = 12 V
D24 = 24 V
D28 = 28 V
D48 = 48 V
D110 = 110 V
D125 = 125 V
D220 = 220 V
D00 = valve without coils (see **NOTE 1**)

AC power supply
A24 = 24 V - 50 Hz.
Not available for S4, SA4, SB4, S7 and S8 spools
A48 = 48 V - 50 Hz
A110 = 110 V - 50 Hz / 120 V - 60 Hz
A230 = 230 V - 50 Hz / 240 V - 60 Hz
A00 = valve without coils (see **NOTE 1**)
F110 = 110 V - 60 Hz
F220 = 220 V - 60 Hz

Coil electrical connection (see par. 11):
K1 = plug for connector type DIN 43650 (**standard**)
K2 = plug for connector type AMP JUNIOR (available on **D12** and **D24** coils only)
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

Manual override:
omit for override integrated in the tube (**standard**)
CM = manual override, boot protected (only for DC version)
CK = knob manual override (only for DC version)

Option: Surface treatment not standard. Omit if not required (see **NOTE 2**)

NOTE 1: Coils locking ring and related OR are supplied together with valves.

NOTE 2:The standard surface treatment is phosphating black.

On request we can supply these valves with zinc-nickel finishing, making the valve suitable to ensure a salt spray resistance up to 240 hours (test operated according to UNI EN ISO 9227 standard and test evaluation operated according to UNI EN ISO 10289 standard)

Add **/ W7** at the end of the identification code.

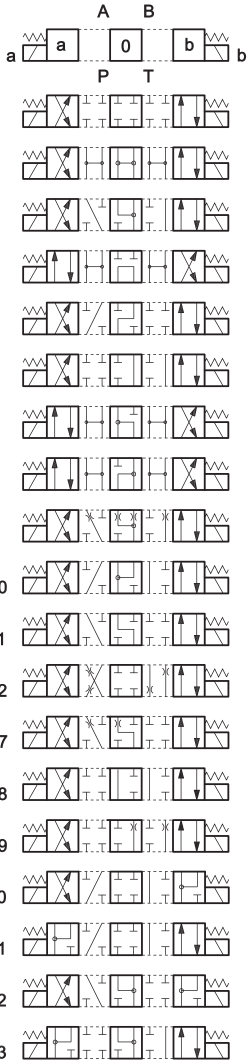
2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

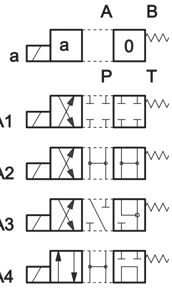
3 - SPOOL TYPE

Type **S***:
2 solenoids - 3 positions
with spring centering



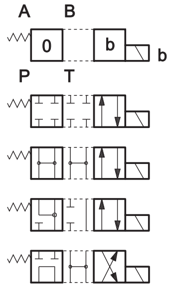
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
S11
S12
S17
S18
S19
S20
S21
S22
S23

Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



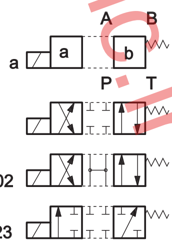
SA1
SA2
SA3
SA4

Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



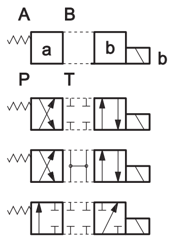
SB1
SB2
SB3
SB4

Type **TA**:
1 solenoid side A
2 external positions
with return spring



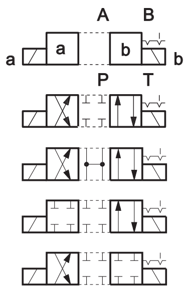
TA
TA02
TA23

Type **TB**:
1 solenoid side B
2 external positions
with return spring



TB
TB02
TB23

Type **RK**:
2 solenoids - 2 positions
with mechanical retention

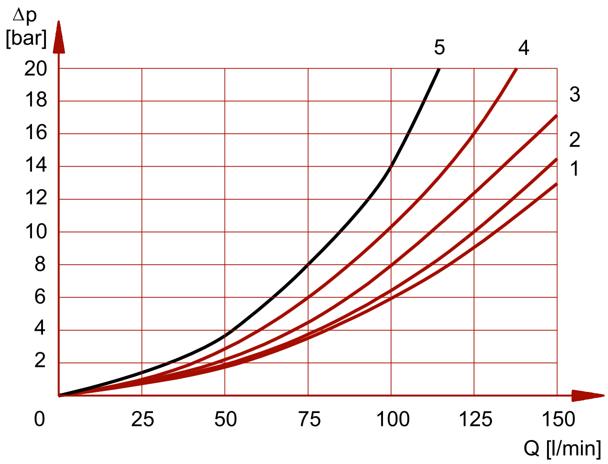


RK
RK02
RK1
1RK

Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our technical department for their identification, feasibility and operating limits.

4 - PRESSURE DROPS Δp-Q

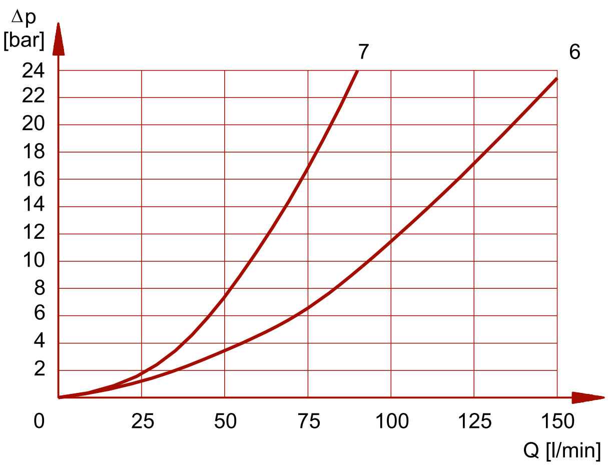
(obtained with viscosity 36 cSt at 50 °C)



PRESSURE DROPS WITH VALVE ENERGIZED

SPOOL TYPE	FLOW DIRECTION			
	P-A	P-B	A-T	B-T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	1	1
S2, SA2, SB2	3	3	1	1
S3, SA3, SB3	3	3	2	2
S4, SA4, SB4	1	1	2	2
S5	2	1	1	1
S6, S11	3	3	2	2
S7, S8	1	1	2	2
S9	3	3	2	2
S10	1	1	3	3
S12	2	2	1	1
S17, S19	2	2	1	1
S18	1	2	1	1
S20, S22	2	4	4	-
S21, S23	4	2	-	4
TA, TB	3	3	2	2
TA02, TB02	3	3	2	2
TA23, TB23	4	4		
RK	3	3	2	2
RK02	3	3	2	2
RK1, 1RK	3	3	2	2

For pressure drops between A and B lines of S10, S20, S21, S22 spools which are used in the regenerative diagram, refer to curve 5.



PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P-A	P-B	A-T	B-T	P-T
	CURVES ON GRAPH				
S2, SA2, SB2					6
S3, SA3, SB3			7	7	
S4, SA4, SB4					6
S5		3			
S6				7	
S7					6
S8					6
S10	3	3			
S11			7		
S18	3				
S22			7	7	

5 - SWITCHING TIMES

The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

COIL TYPE	TIMES [ms]	
	ENERGIZING	-ENERGIZING
DC	100 ÷ 150 ms	20 ÷ 50 ms
AC	15 ÷ 30 ms	20 ÷ 50 ms

6 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

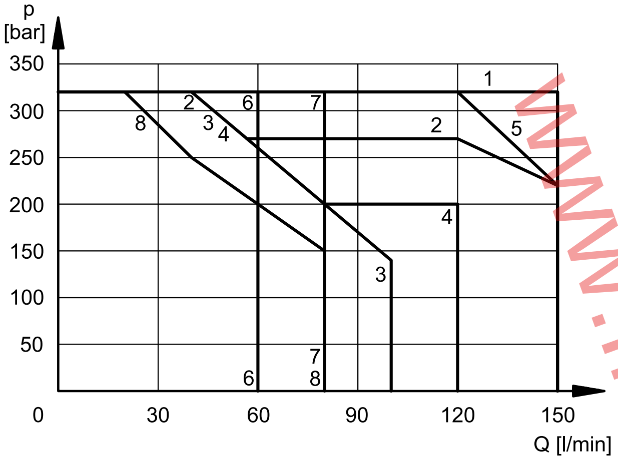
The values have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13 and are relevant to the standard solenoid valve.

The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.

For flow and pressure performances of soft-shifting configuration (options F) see par. 13.4.

Flow and pressure performances of adjustable soft-shifting device configurations (options S, par. 13.5) are influenced by the set shifting time.

DC SOLENOID VALVE

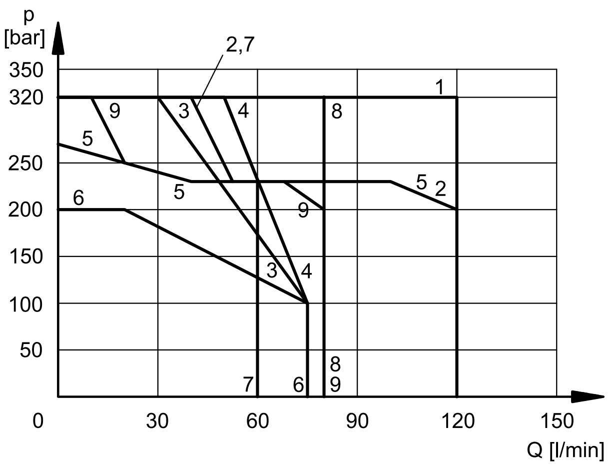


SPOOL	CURVE	
	P→A	P→B
S1, SA1, SB1	1	1
S2, SA2, SB2	1	1
S3, SA3, SB3	2	2
S4, SA4, SB4	3	3
S5	1	1
S6	2	1
S7	3	3
S8	3	3
S9	1	1
S10	3	3
S11	1	2
S12	1	1

SPOOL	CURVE	
	P→A	P→B
S17	1	4
S18	1	1
S19	4	1
S20	8*	7
S21	7	8*
S22	6*	6
S23	6	6*
TA, TB	5	5
TA02, TB02	4	4
TA23, TB23	1	1
RK	1	1
RK02	1	1
RK1, 1RK	1	1

* Performance obtained for a valve with A and B lines connected the one to the piston-side chamber and the other to the rod-side chamber of a double-acting cylinder with area ratio 2:1.

AC SOLENOID VALVE



SPOOL	CURVE	
	P→A	P→B
S1, SA1, SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	2	2
S4, SA4, SB4	4	4
S5	1	1
S6	2	1
S7	3	3
S8	3	3
S9	2	2
S10	1	1
S11	1	2
S12	1	1

SPOOL	CURVE	
	P→A	P→B
S17	1	5
S18	1	1
S19	5	1
S20	9*	8
S21	8	9
S22	7	7
S23	7	7
TA, TB	1	1
TA02, TB02	5	5
TA23, TB23	1	1
RK	1	1
RK02	1	1
RK1, 1RK	1	1

7 - ELECTRICAL FEATURES

7.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated, to suit the available space.

Protection from atmospheric agents CEI EN 60529

Plug-in type	IP 65	IP 67	IP 69 K
K1 DIN 43650	x (*)		
K2 AMP JUNIOR	x	x (*)	
K7 DEUTSCH DT04 male	x	x	x (*)

(*) The protection degree is guaranteed only with the connector correctly connected and installed

VOLTAGE SUPPLY FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	15.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE 1)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95/EC
CLASS OF PROTECTION: Coil insulation (VDE 0580) Impregnation:	 class H class F

NOTE 1: In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see CAT. 49 000).

7.2 - Current and absorbed power for DC solenoid valve

The table shows current and power consumption values relevant to the coil types for DC.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 48V voltage) with alternating current (50 or 60 Hz).

However, when supplying the valve with rectified current, it is necessary to consider a reduction of the operating limits by 15-20% approx.

Coils for direct current (values ± 5%)

Suffix	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [W]	Coil code K1	Coil code K2	Coil code K7
D12	12	3,2	3,75	45	1903200	1903210	1903220
D24	24	12	2	48	1903201	1903211	1903221
D28	28	16,2	1,72	48	1903202		
D48	48	49	0,98	47	1903203		
D110	110	250	0,44	48	1903204		
D125	125	338	0,37	46	1903206		
D220	220	1050	0,21	47	1903205		

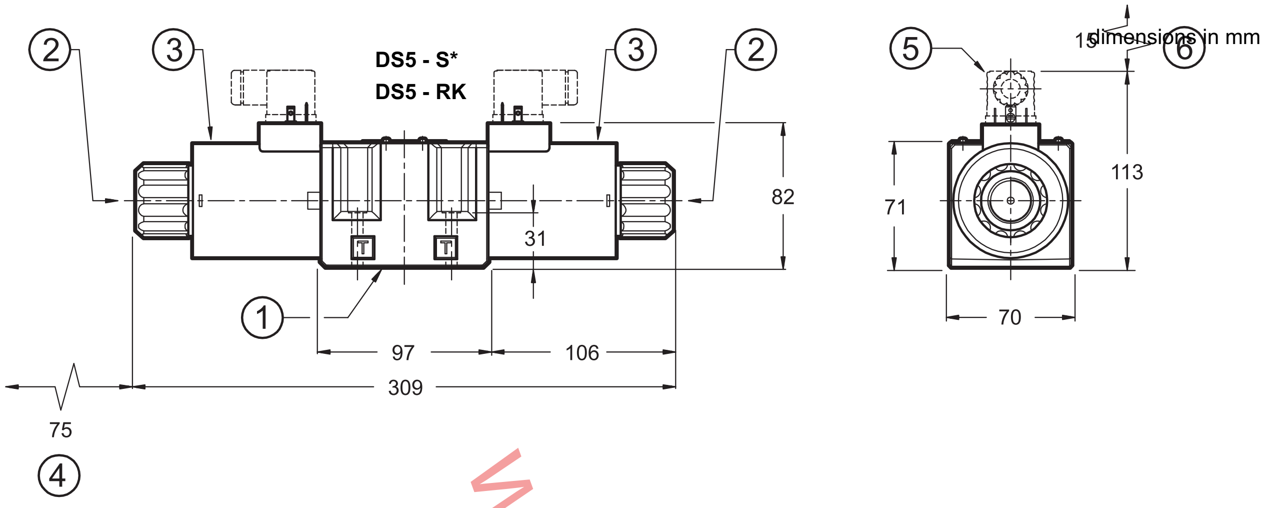
7.3 - Current and absorbed power for AC solenoid valve

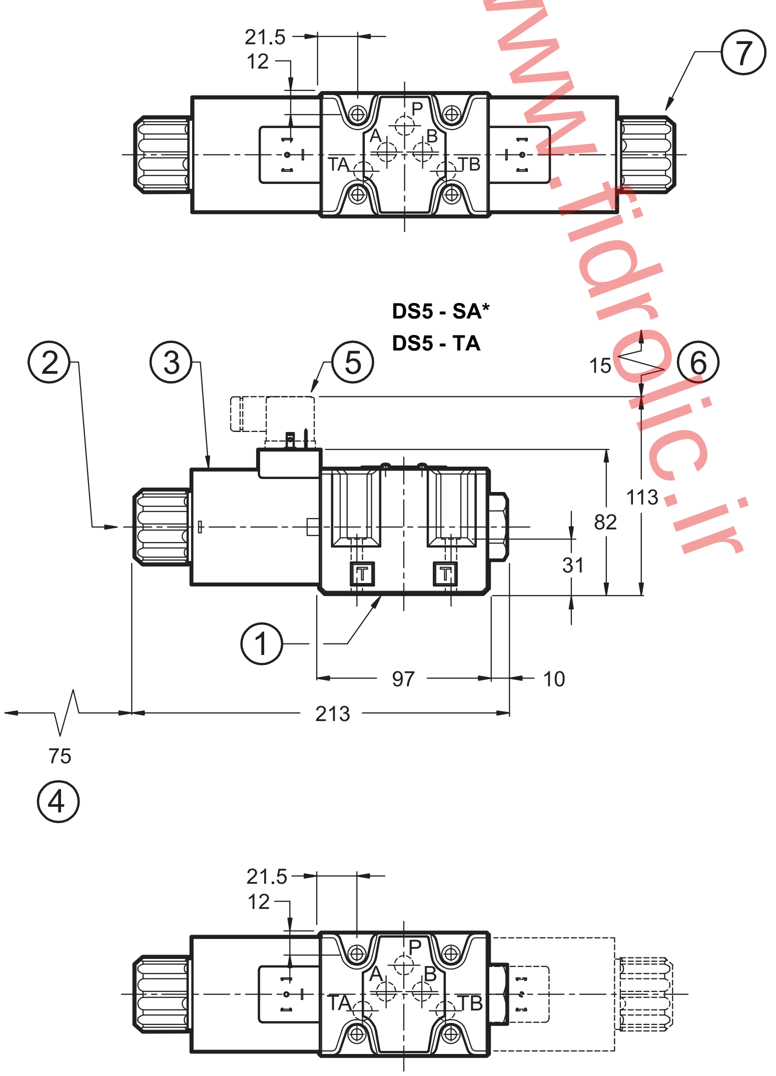
The table shows current and power consumption values at inrush and at holding, relevant to the different coil types for AC current.

Coils for alternating current (values ± 5%)

Suffix	Nominal voltage [V]	Frequency [Hz]	Resistance at 20°C [ohm]	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Coil code
A24	24	50	0,53	25	3,96	600	95	1902890
A48	48		2,09	12,5	2,3	600	110	1902891
A110	110V-50Hz	50/60	10,9	5,2	0,96	572	105	1902892
	120V-60Hz		10,9	5,2	0,89	572	105	
A230	230V-50Hz		52,7	2,8	0,46	644	105	1902893
	240V-60Hz		52,7	2,8	0,38	644	105	
F110	110	60	8,80	5,2	0,95	572	105	1902894
F220	220		35,2	2,7	0,48	594	105	1902895

8 - OVERALL AND MOUNTING DIMENSIONS FOR DC SOLENOID VALVES



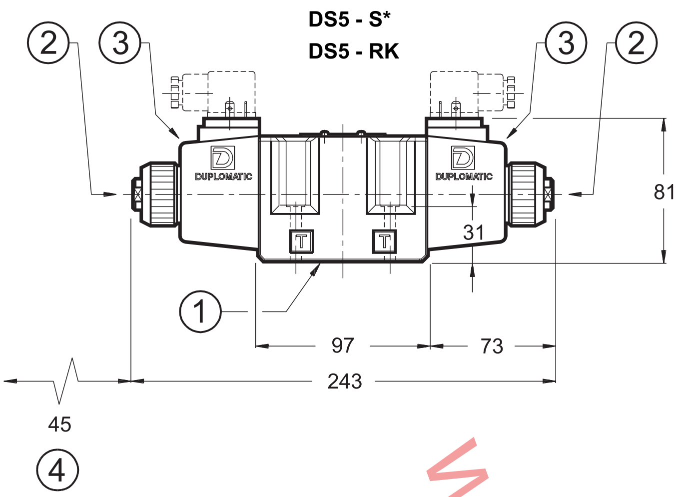


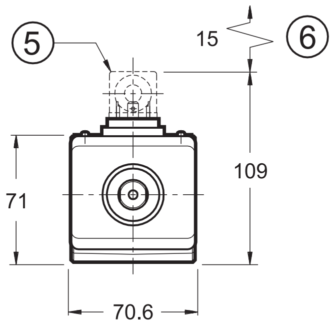
1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore Additional for Y version only: 1 OR 2037 (9.25x1.78) - 90 shore
2	Standard manual override included in the solenoid tube
3	Coil (360° revolving)
4	Coil removal space
5	DIN 43650 connector (standard K1 shown) to be ordered separately (see cat. 49 000)
6	Connector removal space
7	Locking ring: tightening torque: 6 Nm

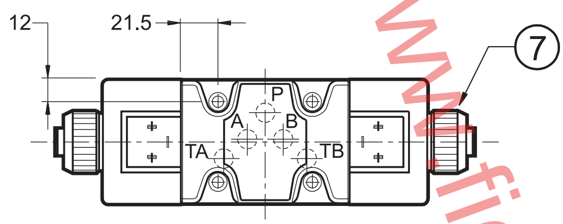
Valve fastening: 4 SHC screws ISO 4762 M6x40
Tightening torque: 8 Nm (screws A8.8)
Threads of mounting holes: M6x10

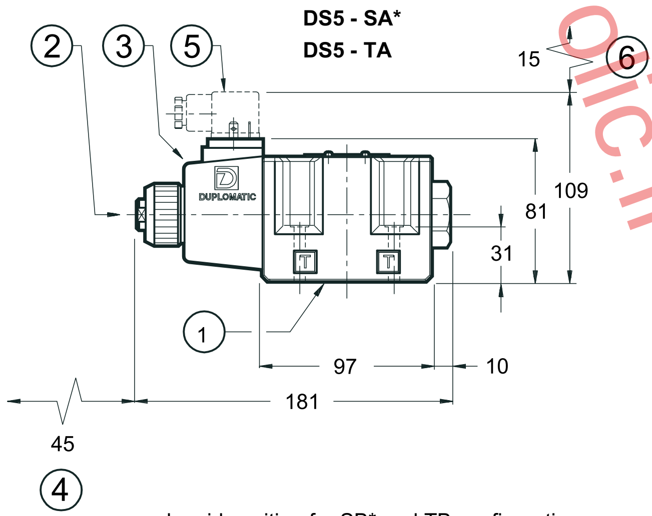
9 - OVERALL AND MOUNTING DIMENSIONS FOR AC SOLENOID VALVES

dimensions in mm

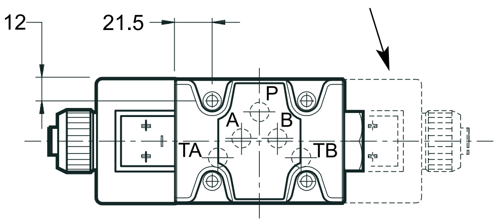








solenoid position for SB* and TB configurations



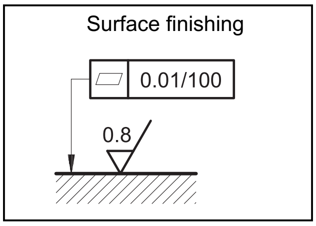
1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore
2	Standard manual override included in the solenoid tube
3	Coil (360° revolving)
4	Coil removal space
5	DIN 43650 connector - to be ordered separately (see cat. 49 000)
6	Connector removal space
7	Locking ring: tightening torque: 4.5 - 5 Nm

Valve fastening: 4 SHC screws ISO 4762 M6x40
Tightening torque: 8 Nm (screws A8.8)
Threads of mounting holes: M6x10

10 - INSTALLATION

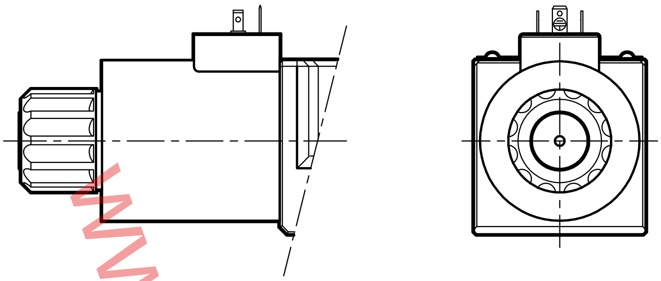
Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal. Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.

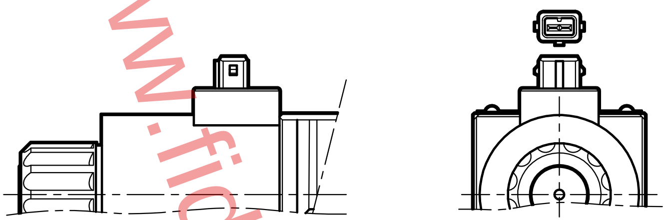


11 - ELECTRIC CONNECTIONS

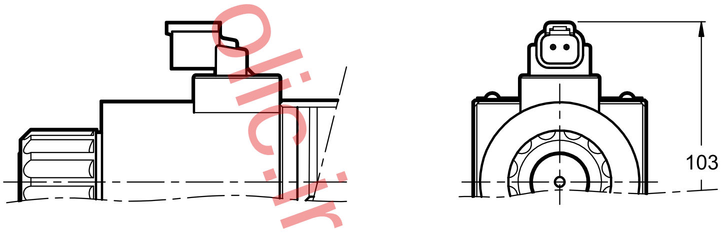
connection for DIN 43650 connector type code **K1** (**standard**)



connection for AMP JUNIOR connector type code **K2**



connection for DEUTSCH DT06-2S male connector type code **K7**



12 - ELECTRIC CONNECTORS

The solenoid operated valves are delivered without connectors. For coils with standard electrical connections K1 type (DIN 43650) the connectors can be ordered separately. For the identification of the connector type to be ordered please see cat. 49 000. For K2 and K7 connection type the related connectors are not available.

13 - SPECIAL VERSIONS FOR DC SOLENOID VALVE

13.1 - Identification code for external drain version

D	S	5	-		/	12		-		K1	/	Y		

Solenoid operated directional control valve

ISO 4401-05 size

Spool type (see par. 3)

Series n.:
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Coil type

D12 = 12 V
D24 = 24 V
D28 = 28 V
D48 = 48 V
D110 = 110 V
D125 = 125 V
D220 = 220 V

Option: Surface treatment not standard. Omit if not required (see **NOTE**)

Manual override:
omit for override integrated in the tube (**standard**)
CM = manual override, boot protected
CK = knob manual override

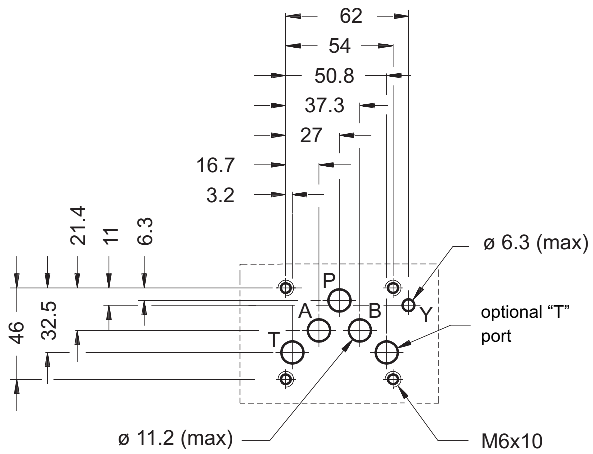
Port for subplate external drain

Coil electrical connection (see par. 11):
K1 = plug for connector type DIN 43650 (**standard**)
K2 = plug for connector type AMP JUNIOR (available on **D12** and **D24** coils only)
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

NOTE :The standard surface treatment is phosphating black.
On request we can supply these valves with zinc-nickel finishing, making the valve suitable to ensure a salt spray resistance up to 240 hours (test operated according to UNI EN ISO 9227 standard and test evaluation operated according to UNI EN ISO 10289 standard)
Add **/W7** at the end of the identification code.

13.2 - Subplate external drain port (option Y)

This version allows the operation with pressures up to 320 bar on the valve T port.
It is a drain port Y realized on the valve mounting interface in compliance with ISO 4401-05-05-0-05. The Y port is connected with the solenoid chamber: in this way the tubes are not stressed by the pressure operating on the valve T port.



13.3- Identification code for soft-shifting versions

D	S	5	-		/			-			/		

Solenoid operated directional control valve

ISO 4401-05 size

Spool type (see par. 3)
S1 **S4** **TA**
S2 **S7** **TB**
S9 **S8** **TA02**
S12 **TB02**

Series n.:
12 - for version **S**
13 - for version **F**
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Power supply
D12 = 12 V
D24 = 24 V
D28 = 28 V
D110 = 110 V
D220 = 220 V

Coil electrical connection (see par. 11):
K1 = plug for connector type DIN 43650 (**standard**)
K2 = plug for connector type AMP JUNIOR (available on **D12** and **D24** coils only)
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

Options:
F = soft-shifting (see par. 13.4)
S = adjustable soft-shifting device (see par 13.5)

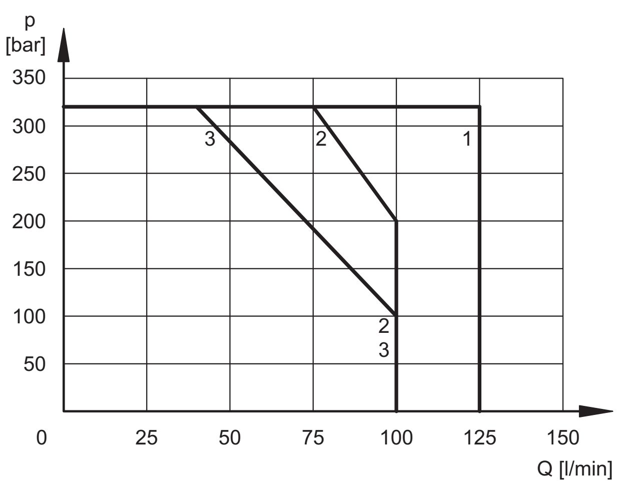
Manual override:
omit for override integrated in the tube (**standard**)
CM = manual override, boot protected
CK = knob manual override

13.4 - Fixed restrictor for soft-shifting (option F)

This version enables hydraulic actuators to perform a smooth start and stop by reducing the speed of movement of the valve spool.

The diagram on the side shows the operating limits of the spools available in the soft-shifting version (Note: for this version, the S9 spool must be used instead of the S3 one). The table on the side shows the switching times. The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

The shifting time and characteristics curves are influenced by the viscosity (and thus by the temperature) of the operating fluid. Moreover, times can vary according to the flow rate and operating pressure values of the valve.

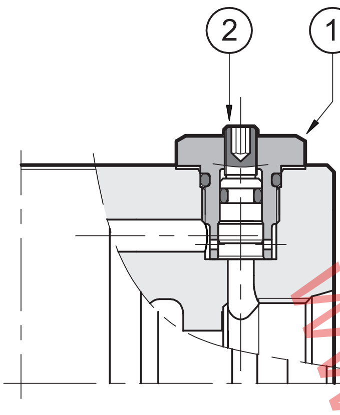


SPOOL TYPE	CURVE		TIMES	
	P-A	P-B	ENERGIZING	DE-ENERGIZING
S1, S12	1	1	300 ÷ 500	300 ÷ 500
S2	2	2	450	200 ÷ 300
S4, S7, S8	3	3	400	400 ÷ 200
S9	1	1	300 ÷ 500	300 ÷ 500
TA, TB	2	2	300 ÷ 400	300 ÷ 400
TA02, TB02	2	2	400	200 ÷ 300

13.5 - Directional solenoid valve with adjustable “soft-shifting” device (option S)

This solenoid valve is supplied with a suitable device, adjustable by the user, which enables the control of the valve spool shifting time.
In this way the hydraulic actuators can perform smooth movements, by controlling the valve switching time according to the machine cycle and the inertia of the moving parts.

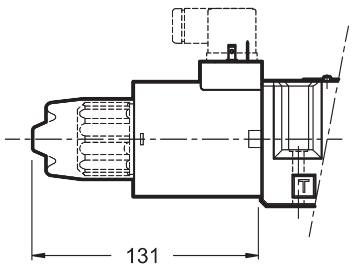
NOTE: during the first start-up the valve body must be filled with the operating fluid through the tap (1) .



1	Spanner for plug: 17 mm - tightening torque 20 Nm
2	Socket hex adjustment screw for shifting time: spanner 2,5 mm

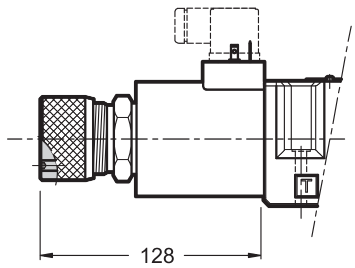
14 - MANUAL OVERRIDES FOR DC SOLENOID VALVES

14.1 - CM - Manual override, boot protected



Code: 0239050

14.2 - CK-DS5/10 Knob manual override

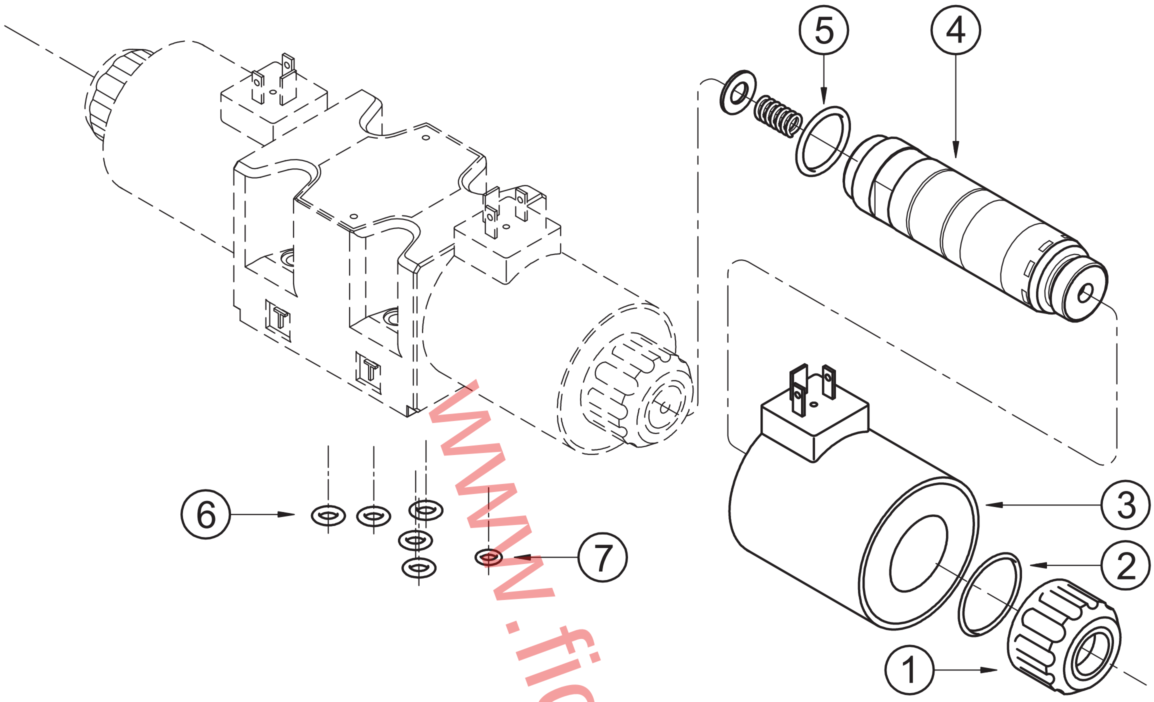


When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.

Spanner: 3 mm

Code: 3401150003

15 - SPARE PARTS FOR DC SOLENOID VALVE



DC COILS IDENTIFICATION CODE

C	31	-			/	21

Supply voltage

D12 = 12 V
D24 = 24 V
D28 = 28 V
D48 = 48 V
D110 = 110 V
D125 = 125 V
D220 = 220 V

Series no.:
(the overall and mounting dimensions remain unchanged from 20 to 29)

Coil electrical connection (see par. 11):

K1 = plug for connector type DIN 43650 (**standard**)

K2 = plug for connector type AMP JUNIOR (available on **D12** and **D24** coils only)

K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

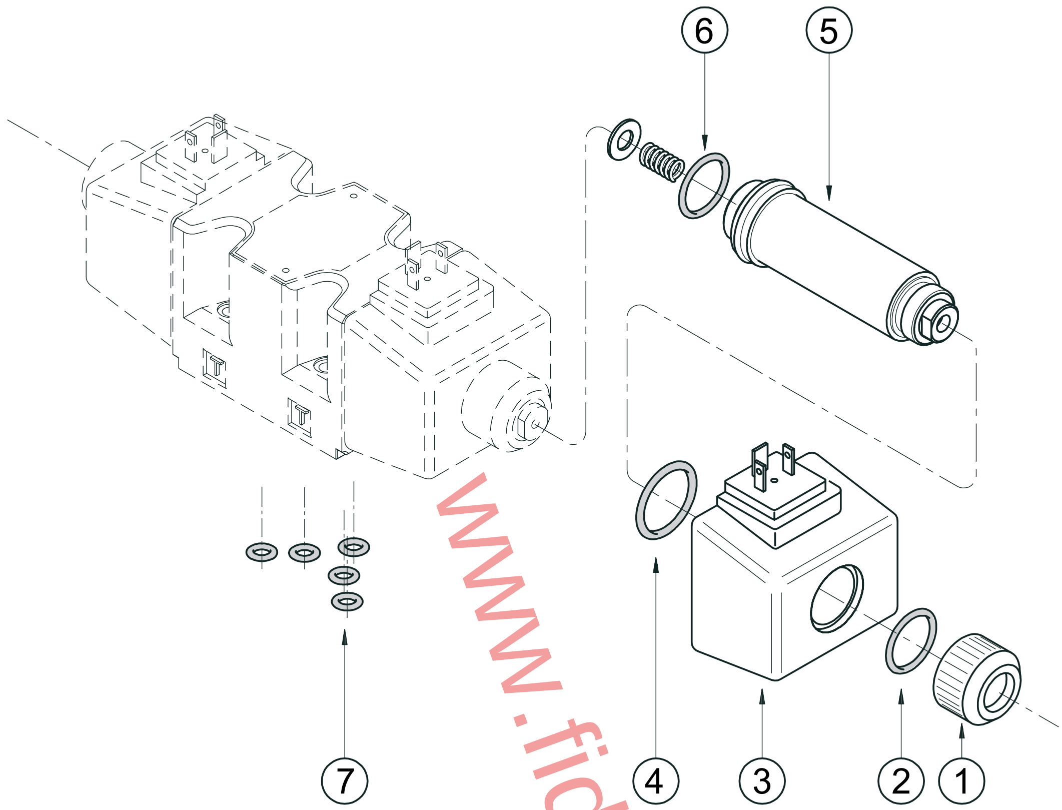
1	Coil locking ring with seal included cod. 0119383 tightening torque: 6 Nm
2	ORM type 0320 - 25 (32x2.5) - 70 Shore
3	Coil (see identification code)
4	Solenoid tube TD31-M27/20N (NBR seals) TD31-M27/20V (FPM seals) **NOTE**: the solenoid tube is supplied with OR n° 5.
5	OR type 3-912 (23.47x2.95) - 70 Shore
6	N. 5 OR type 2050 (12.42x1.78) - 90 Shore
7	For version with external subplate drain only (Y option): OR type 2037 (9.25x1.78) - 90 Shore

SEALS KIT

The codes here below include O-Rings ref. 2, 5, 6 and 7.

Cod. 1984418 NBR seals
Cod. 1984419 FPM (viton) seals

16 - SPARE PARTS FOR AC SOLENOID VALVE



AC COILS IDENTIFICATION CODE

C	25.4	-		K1	/	11

Supply voltage

A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A110 = 110 V - 50 Hz
120 V - 60 Hz
A230 = 230 V - 50 Hz
240 V - 60 Hz
F110 = 110 V - 60 Hz
F220 = 220 V - 60 Hz

plug for connector type DIN 43650 (**standard**)

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

1	Coil locking ring cod. 0119402 tightening torque: 4.5 - 5 Nm
2	OR type 4100 (24.99x3.53) - 90 Shore
3	Coil (see identification code)
4	OR type 2112 (28.30x1.78) - 90 Shore
5	Solenoid tubes: TA25.4-M27/11N (NBR seals) TA25.4-M27/11V (FPM seals) **NOTE**: the tube is supplied with OR n° 6.
6	OR type 3-912 (23.47x2.95) - 70 Shore
7	N. 5 OR type 2050 (12.42x1.78) - 90 Shore

SEALS KIT

The codes here below include O-Rings ref. 2, 4, 6 and 7.

Cod. 1984420 NBR seals
Cod. 1984421 FPM (viton) seals

17 - SUBPLATES (see catalogue 51 000)

Type PMD4-AI4G with rear ports 1/2” BSP
Type PMD4-AL4G with side ports 1/2” BSP

DUPLOMATIC OLEODINAMICA

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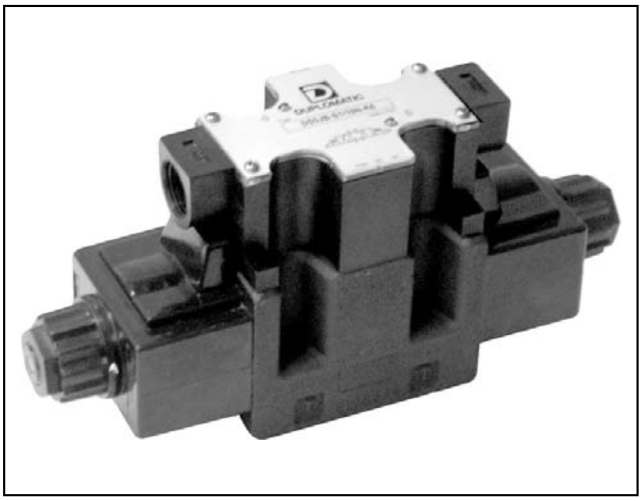


DS5JB

SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

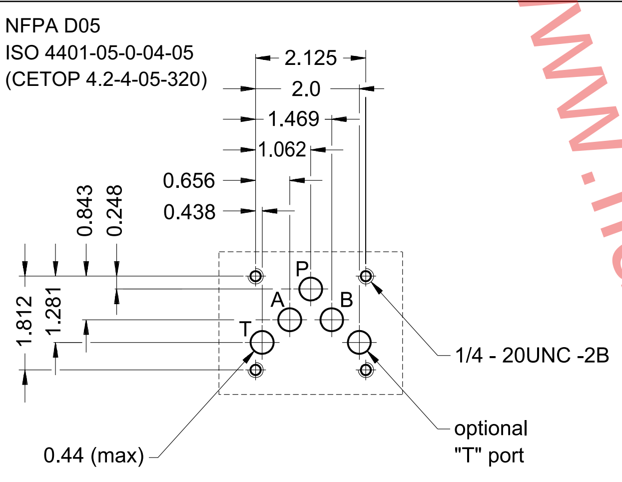
ALTERNATING CURRENT SERIES 10

NFPA D05 (ISO 4401-05 / CETOP 05)

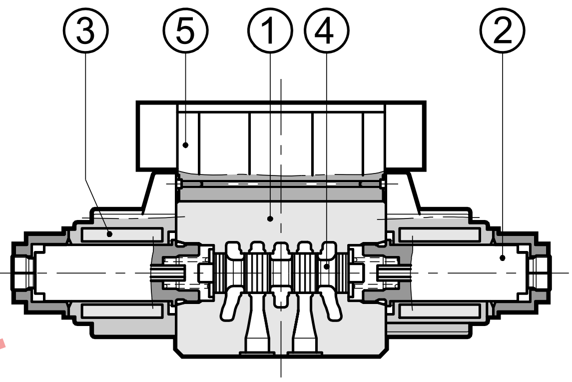
p max **4600** psi

Q max **32** GPM

MOUNTING INTERFACE



OPERATING PRINCIPLE



— Direct acting, subplate mounting directional control valve, with mounting surface according to NFPA D05 standard.

— The valve body (1) is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids (2) with easily removable interchangeable coils (3) are used (for further information on solenoids see par. 7). It is supplied with junction box (5) for the electrical connection.

— The valve is supplied with 3 or 4 way designs and with several interchangeable spools (4) with different porting arrangements.

— The valve is available with AC solenoids.

PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

Maximum operating pressure Ports P - A - B Port T	psi	 4600 2000
Maximum flow rate	GPM	32
Pressure drop Δp-Q	see paragraph 4	
Operating limits	see paragraph 6	
Electrical features	see paragraph 7	
Electrical connections	junction box	
Ambient temperature range	°F	-4 / +125
Fluid temperature range	°F	-4 / +175
Fluid viscosity range	cSt	10 - 400
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Masse: single solenoid valve double solenoide valve	lbs	5.5 7.5

1 - IDENTIFICATION CODE

D	S	5	JB	-		/	10		-		K6

DS: Solenoid operated directional control valve

5: NFPA D05 size

JB: Junction box

Configuration and spool type (see par. 3)

10: Series: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Coil type

A120-60 = 120 V - 60 Hz
A220-60 = 220 V - 60 Hz

K6: Coil electrical connection: 2 pins for junction box

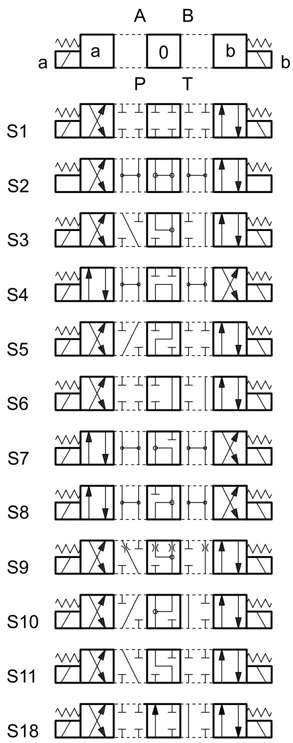
2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

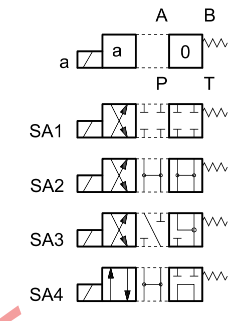
Using fluids at temperatures higher than 175 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - CONFIGURATIONS

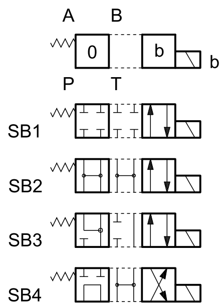
Type **S***:
2 solenoids - 3 positions
with spring centering



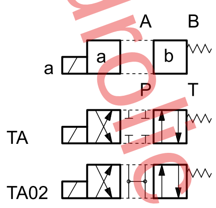
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



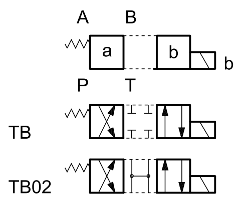
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



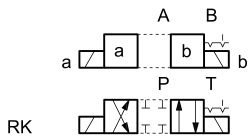
Type **TA**:
1 solenoid side A
2 external positions
with return spring



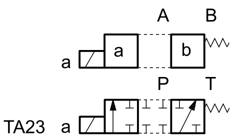
Type **TB**:
1 solenoid side B
2 external positions
with return spring

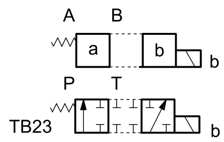


Type **RK**:
2 solenoids - 2 positions
with mechanical retention



Type **TA23 / TB23**
three-way valve - 1 solenoid - 2 external positions, return spring

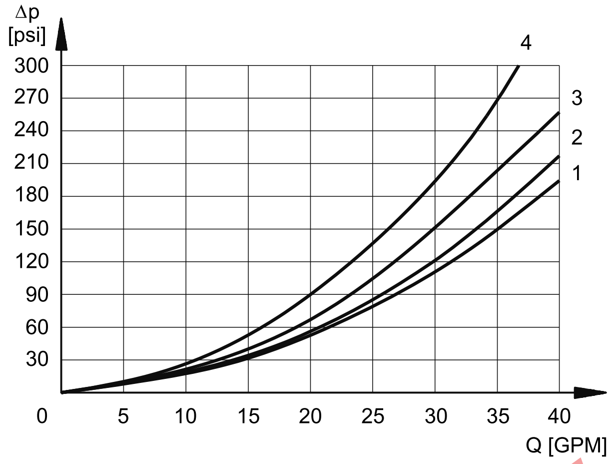




Note:Type TB23 corresponds
to type 23TA of the old valve
(D4D)

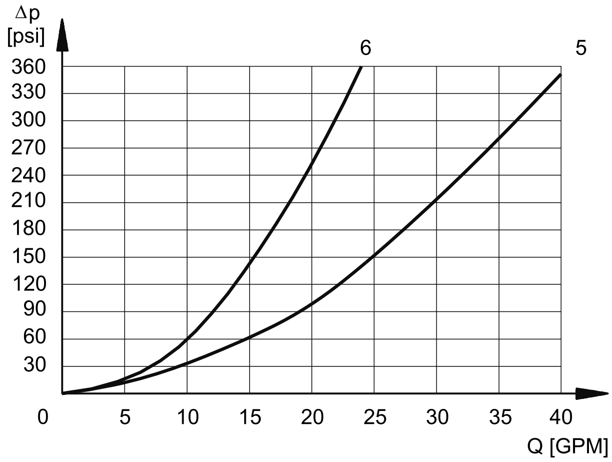
Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our technical department for their identification, feasibility and operating limits.

4 - PRESSURE DROPS Δp-Q (obtained with viscosity 170 SSU at 120 °F)



PRESSURE DROPS WITH VALVE ENERGIZED

SPOOL TYPE	FLOW DIRECTION			
	P-A	P-B	A-T	B-T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	1	1
S2, SA2, SB2	3	3	1	1
S3, SA3, SB3	3	3	2	2
S4, SA4, SB4	1	1	2	2
S5	2	1	1	1
S6	3	3	2	2
S7	1	1	2	2
S8	1	1	2	2
S9	3	3	2	2
S10	1	1	1	1
S11	3	3	2	2
S18	1	2	2	2
TA, TB	3	3	2	2
TA02, TB 02	3	3	2	2
TA23, TB23	4	4		
RK	3	3	2	2



PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P-A	P-B	A-T	B-T	P-T
	CURVES ON GRAPH				
S2, SA2, SB2					5
S3, SA3, SB3			6	6	
S4, SA4, SB4					5
S5		3			
S6					
S7					
S8					
S9					
S10					
S11					
S18	3				

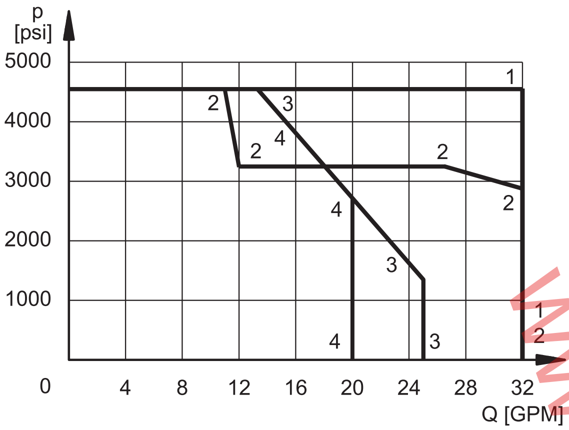
5 - SWITCHING TIMES

The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 170 SSUat 120°F.

SOLENOID TYPE	TIMES	
	ENERGIZING	**DE-ENERGIZING**
AC	15 ÷ 25 ms	20 ÷ 50 ms

6 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure with AC solenoids.
The value have been obtained accordind to ISO 6403, with mineral oil, viscosity 170 SSU, temperature 120 °F.



SPOOL TYPE	CURVE	
	P-A	P-B
S1,SA1,SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	3	3
S4, SA4, SB4	4	4
S5	1	1
S6	2	1
S7	4	4
S8	4	4

SPOOL TYPE	CURVE	
	P-A	P-B
S9	2	2
S10	1	1
S11	1	2
S18	1	1
TA, TB	1	1
TA02, TB02	2	2
TA23, TB23	1	1
RK	1	1

NOTE: The values indicated in the graphs are relevant to the standard solenoid valve. The operating limits can be considerably reduced if a 4-way valve is used as a 3-way valve with port A or B plugged or without flow.

7 - ELECTRICAL FEATURES

7.1 Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.
The coil is fastened to the tube by a threaded ring.

SUPPLY VOLTAGE FLUNCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	15.000 ins/hr
DUTY CYCLE	100%
Class of protection: Atmospheric agents (CEI EN 60529) Coil insulation (VDE 0580) Impregnation	IP 65 (see note 2) class H class F

Note: The IP65 protection degree is guaranteed only with the connector correctly connected and installed.

7.2 Current and absorbed power

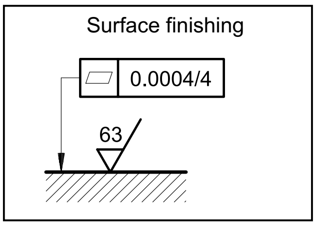
The table shows current and power consumption values at inrush and at holding, relevant to the different coil types for AC current.

Coils (values ± 5%)

Type of coil	Frequency [Hz]	Nominal voltage [V]	Resistance at 20°C [Ohm]	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Code
C26-A120-60K6/10	60	120	9,65	4,5	0,88	540	105,6	1902840
C26-A220-60K6/10		220	29,6	2,5	0,46	550	101,2	1902841

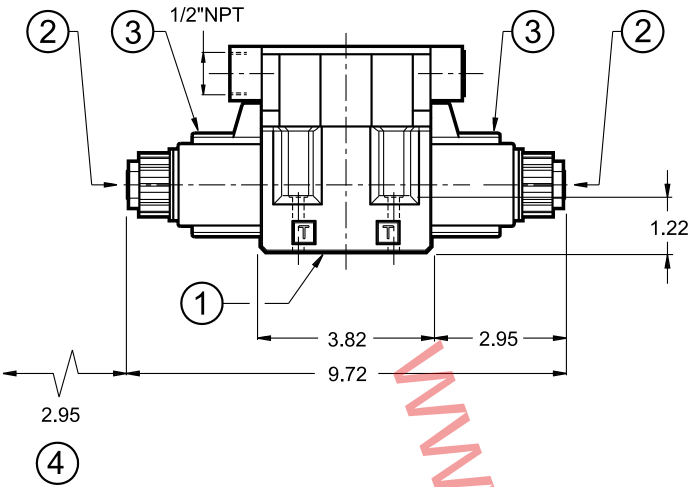
8 - INSTALLATION

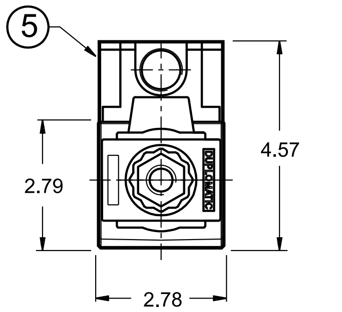
Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal. Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.

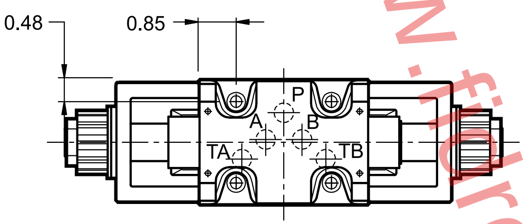


9 - OVERALL AND MOUNTING DIMENSIONS

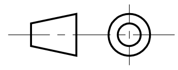
DS5JB - S*
DS5JB - RK



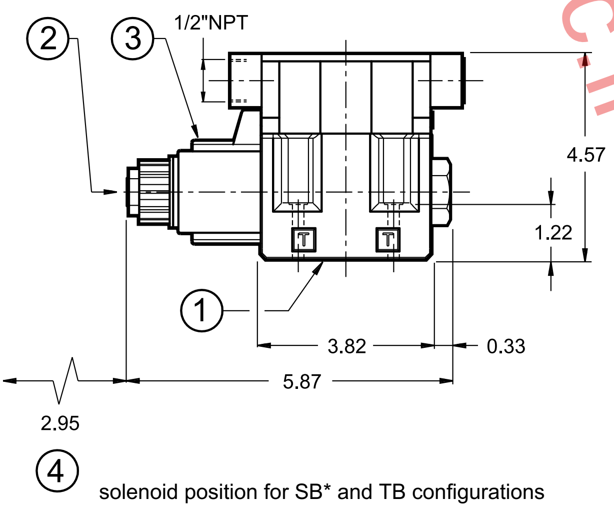


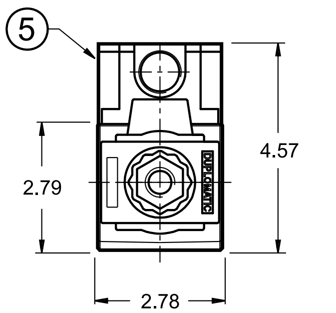


Drawing view in compliance with ISO 128

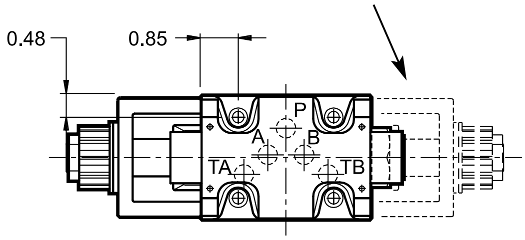


DS5JB - SA*
DS5JB - TA





solenoid position for SB* and TB configurations

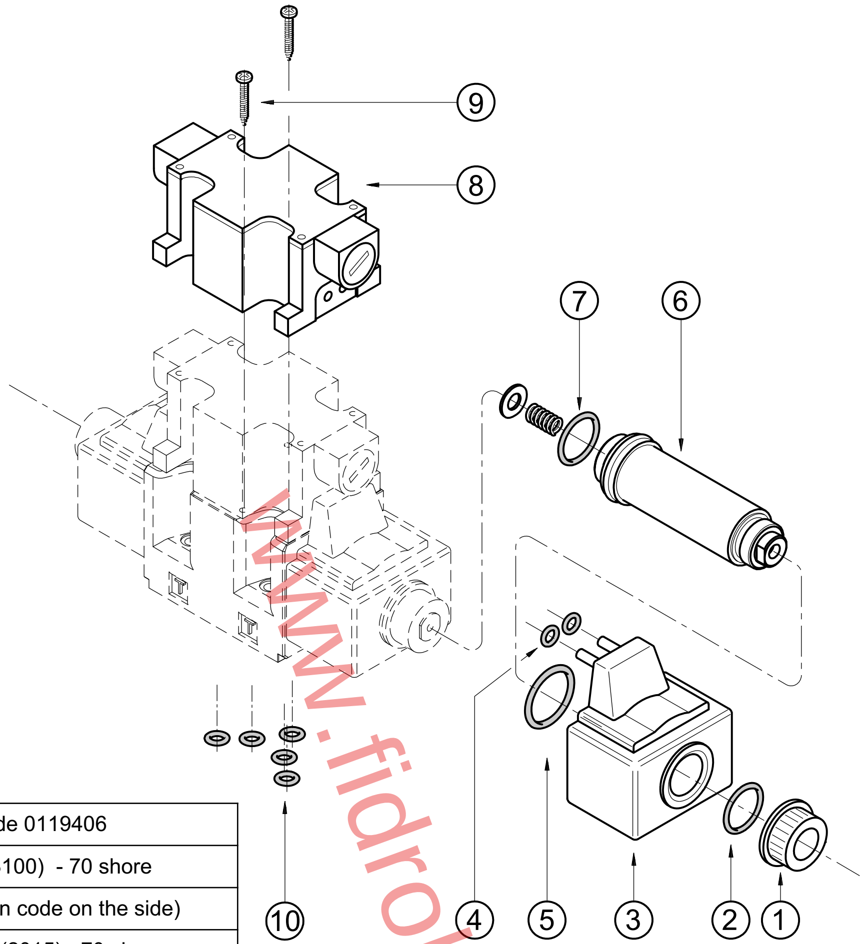


dimensions in inches

1	Mounting surface with sealing rings
2	Standard manual override included in the solenoid tube
3	Coil
4	Coil removal space
5	Junction box

See par. 10 and 11 for sealing rings and fastening bolts

10 - SPARE PARTS FOR AC SOLENOID VALVE



1	Coil locking ring - code 0119406
2	O-Ring type 2-120 (3100) - 70 shore
3	Coil (see identification code on the side)
4	2 O-Ring type 2-007 (2015) - 70 shore
5	O-Ring type 6-454 (ORM-0300-40) 70 shore
6	Solenoid tubes: TA26-M27/10N (NBR seals) TA26-M27/10V (FPM seals) **NOTE**: the tube is supplied with O-Ring rif. 7
7	2 O-Ring type 3-912 - 70 shore
8	Junction box: EJB5-D/10 (double solenoid valve) EJB5-S/10 (single solenoid valve)
9	2 bolts M3x35 (for single solenoid valve 1 bolt M3x35 + 1 bolt M3x6)
10	5 O-Ring type 2-014 (2050) - 90 shore

COILS IDENTIFICATION CODE

C	26	-		K6	/	10

Supply voltage

A120-60 = 120 V - 60 Hz
A220-60 = 220 V - 60 Hz

Coil electrical connection:
2 pins for junction box

Series no.: (the overall and mounting dimensions remain unchanged from10 to 19)

SEALS KIT

The codes here below include O-Rings ref. 2, 4, 6 and 10

Cod. 1984447 NBR seals
Cod. 1984448 FPM (viton) seals

11 - FASTENING BOLTS

4 bolts type 1/4-20 UNC-2Bx1 3/4 (12.9 class recommended)
Tightening torque 70 lbs·inch

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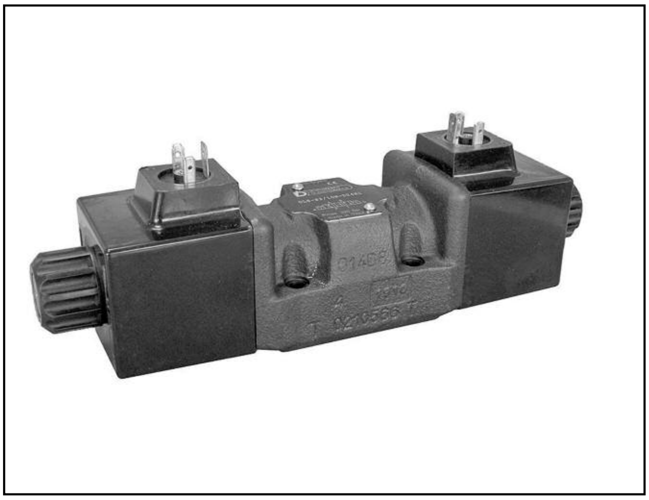


DL5

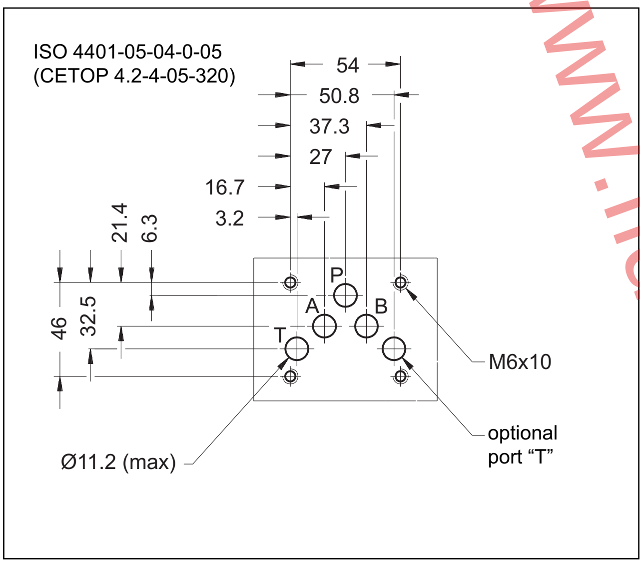
SOLENOID OPERATED DIRECTIONAL CONTROL VALVE COMPACT VERSION

SERIES 10

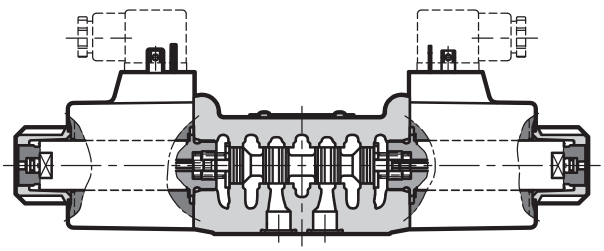
SUBPLATE MOUNTING
ISO 4401-05

p max **320** bar
Q max **125** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



— Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401 standards.

— The valve is suitable for special applications, guaranteed by the reduced solenoid dimensions.

— The valve body is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (for further information on solenoids see paragraph 7).

— The valve is supplied with 3 or 4 way designs and with several interchangeable spools with different porting arrangements.

— The valve is available with DC or AC current solenoids.

PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

		CC	CA
Maximum operating pressure: - ports P - A - B - port T	bar	320 210	 160
Maximum flow rate	l/min	125	100
Pressure drop Δp-Q	see paragraph 4		
Operating limits	see paragraph 5		
Electrical features	see paragraph 7		
Electrical connections	DIN 43650		
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Masse: single solenoid valve double solenoid valve	kg	2,8 3,7	

1 - IDENTIFICATION CODE

D	L	5	-		/	10		-		K1	/		

Solenoid operated directional control valve

Model in compact execution

ISO 4401-05 (CETOP 05) size

Spool type (see paragraph 3):

S*	**TA***
SA*	**TB***
SB*	**RK**

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Option:
/ W7 = Zinc-nickel surface treatment.
Omit if not required (see **NOTE 2**)

Manual override - see par. 12
Omit for override integrated in the tube (**standard**)
CM = boot protected. For DC version only.
CK = knob. For DC version only.

Coil electrical connection:
plug for connector type DIN 43650 (**standard**)

DC power supply
D12 = 12 V
D24 = 24 V
D28 = 28 V
D00 = valve without coils (see **NOTE 1**)

AC power supply
A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A110 = 110 V - 50 Hz
A230 = 230 V - 50 Hz
A00 = valve without coils (see **NOTE 1**)

NOTE 1: Coils locking ring and related OR are supplied together with valves.

NOTE 2:The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing makes the valve suitable to ensure a salt spray resistance up to 240 hours (test operated according to EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

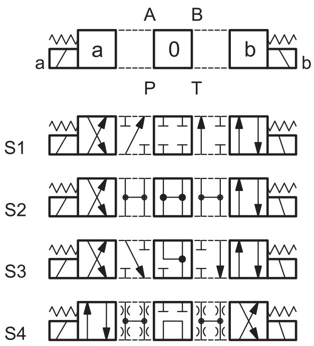
2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

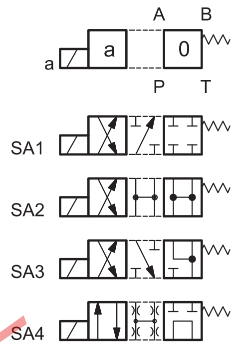
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - SPOOL TYPE

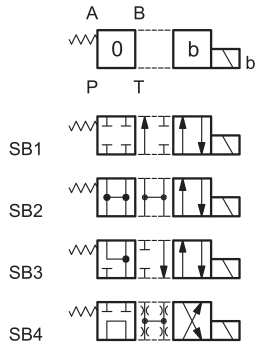
Type **S***:
2 solenoids - 3 positions
with spring centering



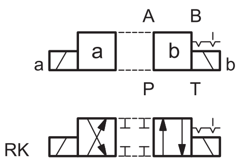
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



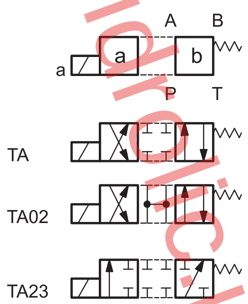
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



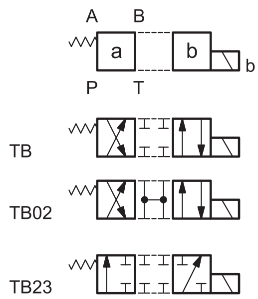
Type **RK**:
2 solenoids - 2 positions
with mechanical retention



Type **TA**:
1 solenoid side A
2 external positions
with return spring

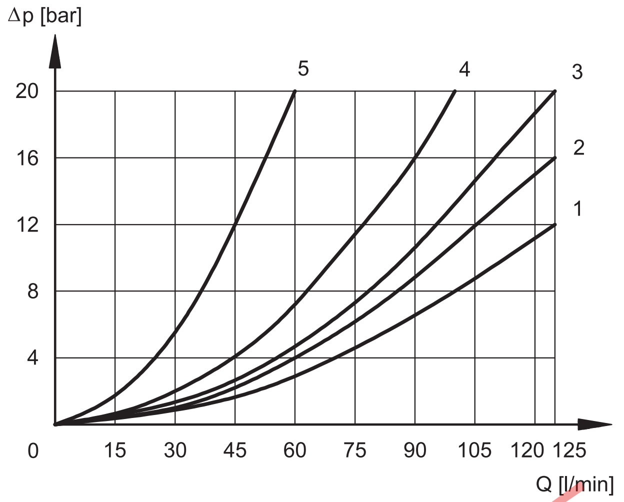


Type **TB**:
1 solenoid side B
2 external positions
with return spring



NOTE: Others spools available on request only.

4 - PRESSURE DROPS Δp-Q (obtained with viscosity of 36 cSt at 50 °C)



ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1	1	1	2	2
S2	1	1	1	1
S3	1	1	1	1
S4	4	4	4	4
RK	2	2	2	2
TA	2	2	3	3
TA02	2	2	1	1
TA23	3	3	-	-

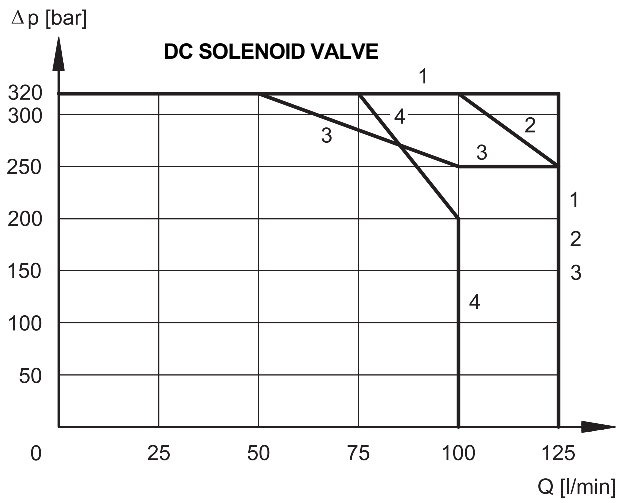
DE-ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS		
	A→T	B→T	P→T
	CURVES ON GRAPHS		
S2	-	-	1
S3	5	5	-
S4	-	-	1

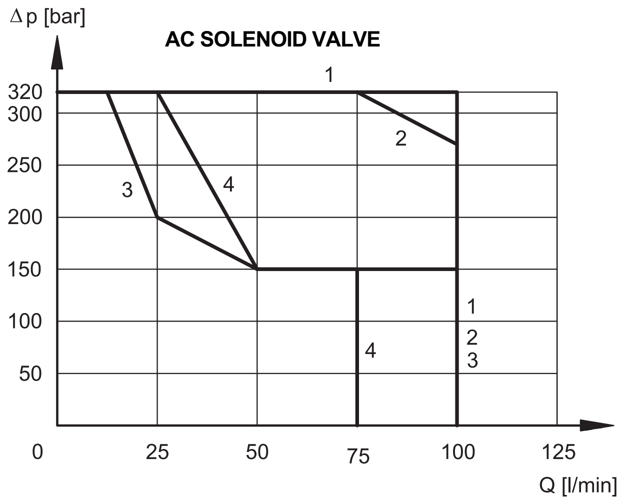
5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions.The values indicated in the graphs are relevant to the standard solenoid valve. The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

5.1 - Standard operating limits



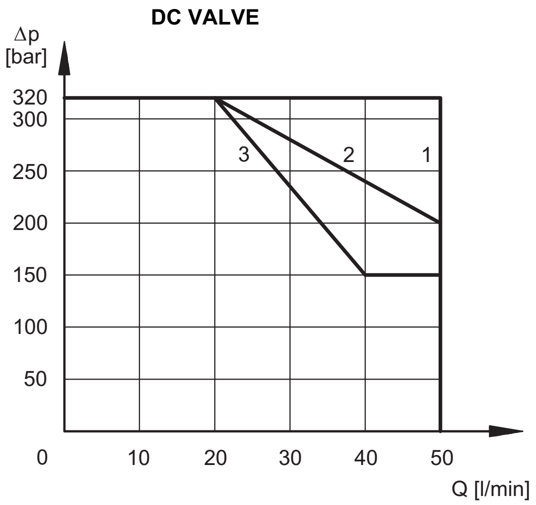
SPOOL	CURVE
S1, S2, RK, TA, TA23	1
S9, TA02	2
S3	3
S4	4

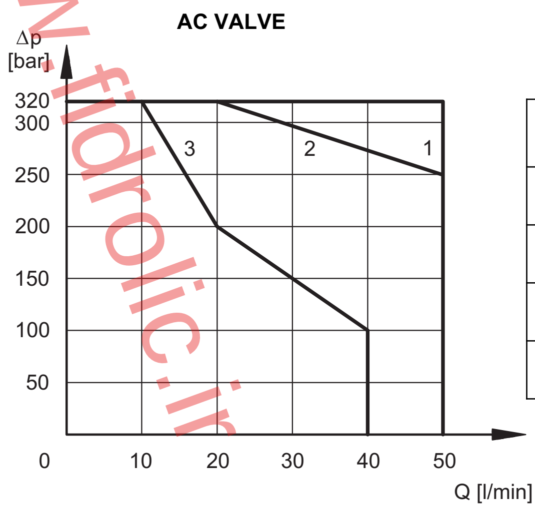


SPOOL	CURVE
S1, RK, TA, TA02, TA23	1
S2	2
S3, S9	3
S4	4

5.2 - 4-way valve in 3-way operation

Operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow.





SPOOL	CURVE	
	DC	AC
TA backpr. A TB backpr. B	2	1
TA02 backpr. A TB02 backpr. B	1	1
TA backpr. B TB backpr. A	3	3
TA02 backpr. B TB02 backpr. A	2	2

6 - SWITCHING TIMES

The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

SUPPLY	TIMES (±10%) [ms]	
	ENERGIZING	DE-ENERGIZING
DC	40 ÷ 90	20 ÷ 50
AC	15 ÷ 30	20 ÷ 50

7 - ELECTRICAL FEATURES

7.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation. The coil is fastened to the tube by a threaded ring, and can be rotated +/- 90°, to suit the available space.

The interchangeability of coils of different voltages is allowed within the same type of supply current, alternating or direct.

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) - NOTE	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95/EC
CLASS OF PROTECTION : **ATMOSPHERIC AGENTS EN 60529** Coil insulation (VDE 0580) Impregnation:	 IP 65 (*) class H class H

(*) The protection degree is guaranteed only with the connector correctly connected and installed

NOTE: In order to further reduce the emissions, with DC supply, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

7.2 - DC valve - Current and power consumption

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law: V = R x I

The table shows current and power consumption values for DC types.

	Resistance at 20°C [Ω] (±5%)	Current consumption [A] (±10%)	Power consumption [W] (±10%)	Coil code K1
C22L5-D12K1	2,9	4,14	50	1903150
C22L5-D24K1	12,3	1,95	47	1903151
C22L5-D28K1	16,8	1,67	47	1903152

7.3 - AC valve - Current and power consumption

In alternating current energizing, an initial phase (maximum movement) is seen, during which the solenoid consumes elevated value currents (inrush current); the current values diminish during the plunger stroke until it reaches the minimum values (holding current) when the plunger reaches the stroke end.

The table shows the values of absorption at the inrush and at holding.

	Freq. [VAC/Hz] (±10%)	Resistance at 20°C [Ω] (±5%)	Current consumption at inrush [A] (±10%)	Current consumption at holding [A] (±5%)	Power consumption at inrush (±10%) [VA]	Power consumption at holding (±10%) [VA]	Coil code K1
C26L5-A24K1	24/50	0,58	15,1	2,84	362,4	68,2	1931600
C26L5-A48K1	48/50	2,34	7,4	1,29	355,2	61,9	1931610
C26L5-A110K1	110/50-120/60	12,3	3,6 - 3,3	0,64 - 0,62	396	70,4 - 74,4	1931620
C26L5-A230K1	230/50-240/60	51,6	1,8 - 1,6	0,31 - 0,28	414 - 384	71,3 - 67,2	1931630

8 - ELECTRIC CONNECTORS

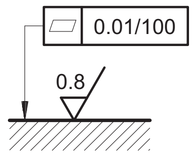
The solenoid valves are not supplied with connector. Connectors must be ordered separately.
For the identification of the connector type to be ordered, please see catalogue 49 000.

9 - INSTALLATION

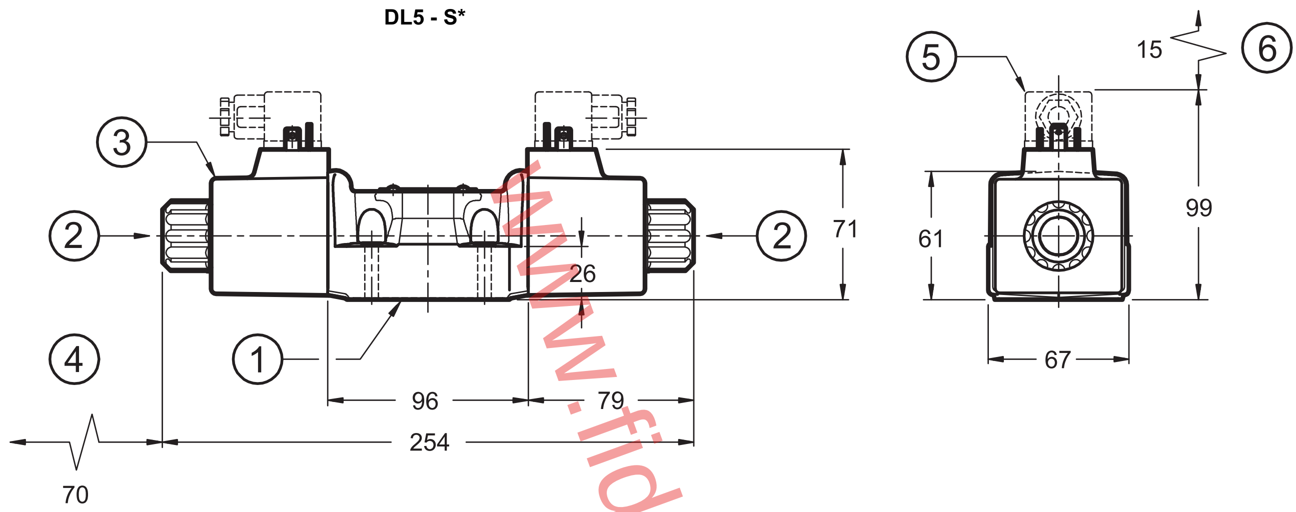
The configuration with centering and return springs can be mounted in any position.

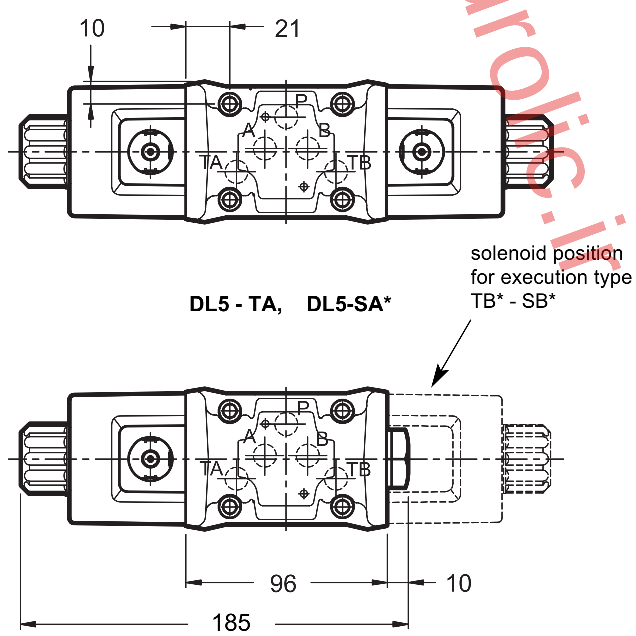
Valve fitting takes place by means of screws or tie rods, fixing the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

Surface finishing



10 - DL5 DC OVERALL AND MOUNTING DIMENSIONS



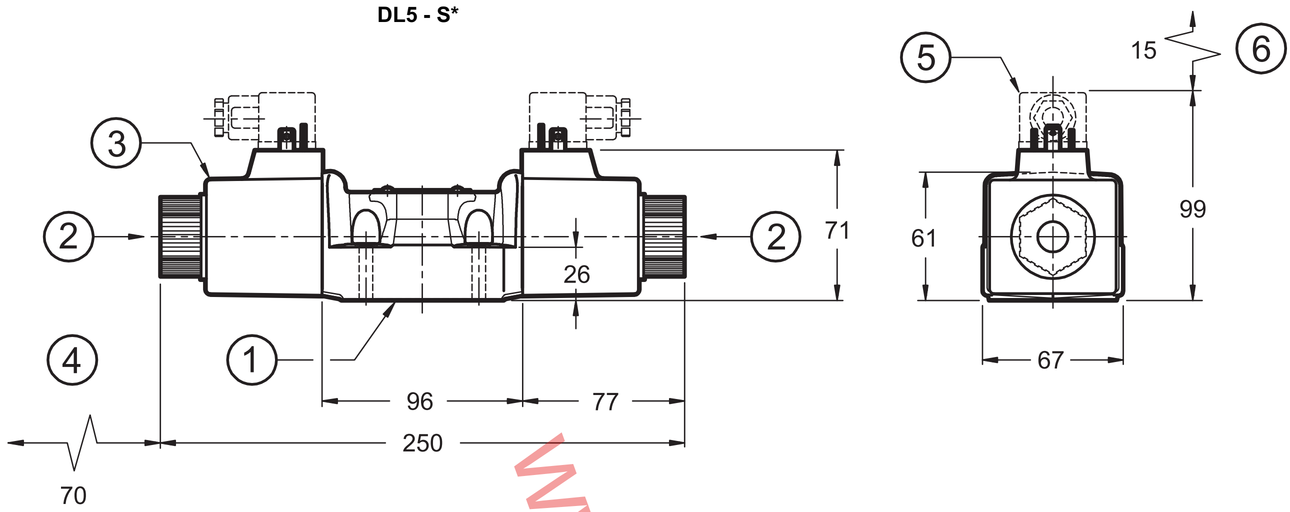


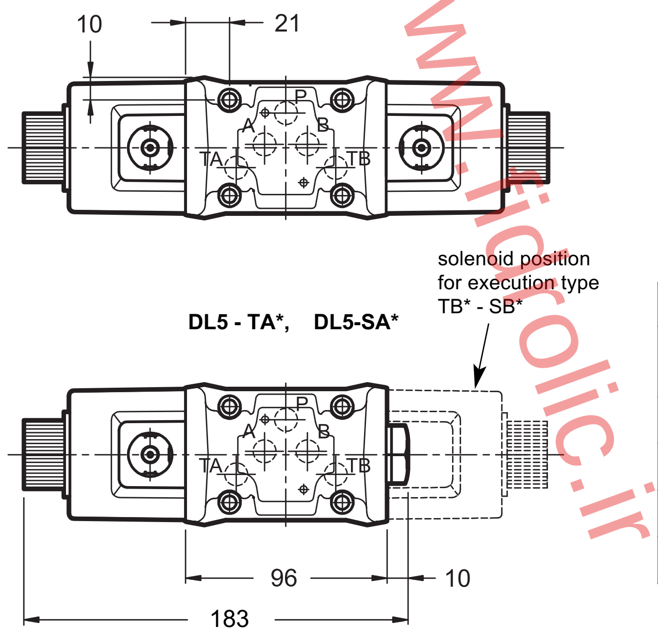
dimensions in mm

1	Mounting surface with sealing rings
2	Locking ring with standard manual override integrated in the tube
3	Coil
4	Coil removal space
5	DIN 43650 electrical connector
6	Connector removal space

See par. 15 for fastening bolts and sealing rings

11 - DL5 AC OVERALL AND MOUNTING DIMENSIONS



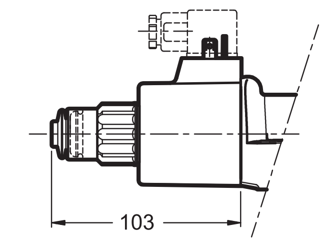


dimensions in mm

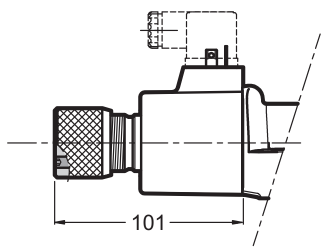
1	Mounting surface with sealing rings
2	Locking ring with standard manual override integrated in the tube
3	Coil
4	Coil removal space
5	DIN 43650 electrical connector
6	Connector removal space

See par. 15 for fastening bolts and sealing rings

12 - OPTIONAL MANUAL OVERRIDES



12.1 - Boot protected manual override (only for DC solenoid valve)
It can be ordered by entering the code **CM** in the identification code at par. 1, or is available as option to be ordered separately: code **3401150006.**

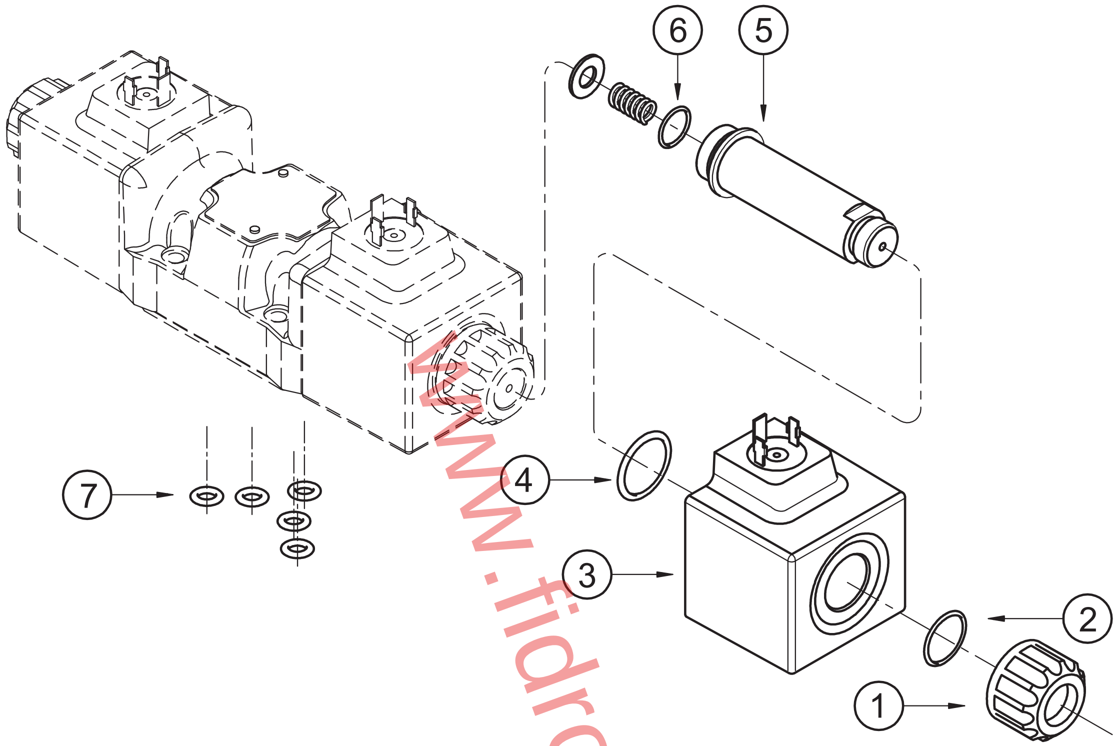


12.2 - Knob manual override (only for DC solenoid valve)
When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.

Spanner: 3 mm

The knob override can be ordered by entering the code **CK** in the identification code at par. 1, or is available as option to be ordered separately: code **3401150009.**

13 - SPARE PARTS FOR DC SOLENOID VALVE



IDENTIFICATION CODE FOR DC AND RC COILS

C	22	L5	-		K1	/	10

Supply voltage
D12 = 12 V
D24 = 24 V
D28 = 28 V

Series no.:
(the overall and mounting dimensions remain unchanged from 10 to 19)

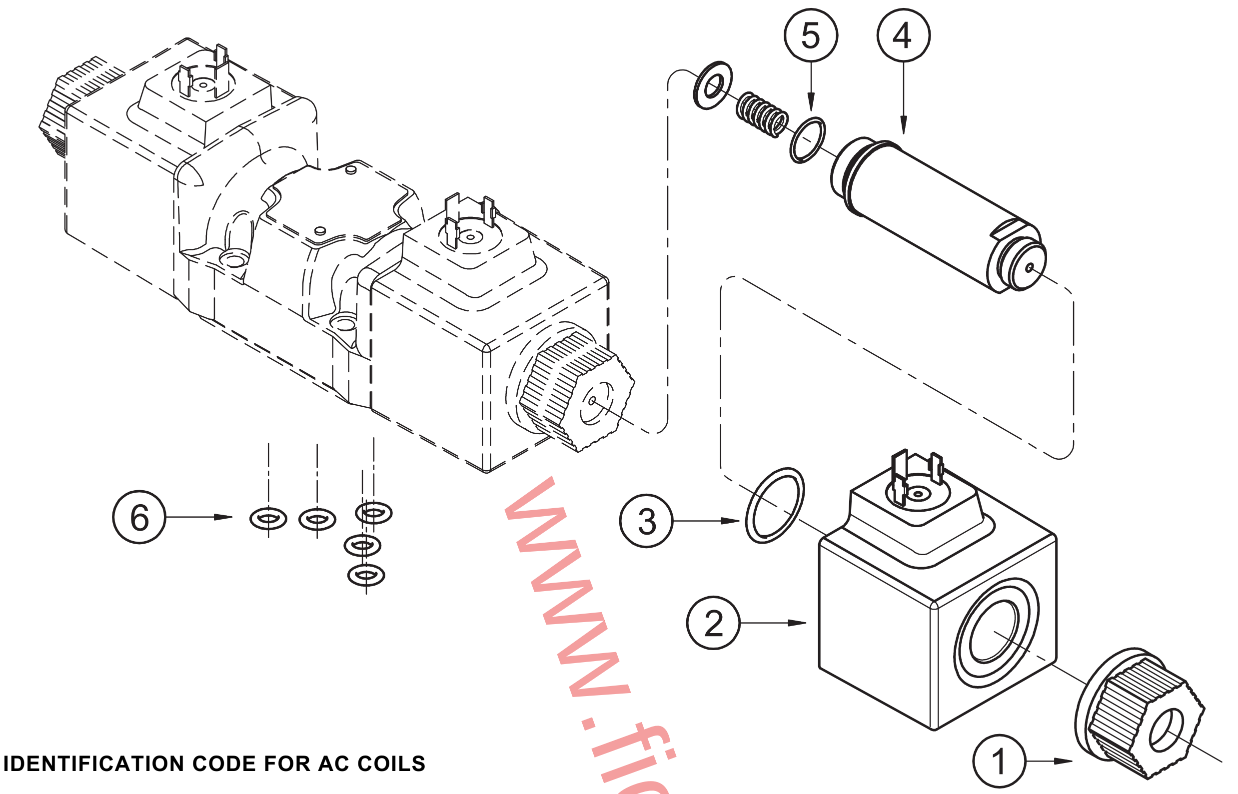
Coil electrical connection:
plug for connector type DIN 43650 (**standard**)

1	Coil locking ring - code 0119412
2	ORM-0220-20 - 70 shore
3	Coil (see identification code)
4	ORM-0296-24 (29.6x2.4) - 70 shore
5	Solenoid tube: TD22-DL5/10N (NBR seals) TD22-DL5/10V (FPM seals) (OR n° 6 included)
6	OR type 3.910 (19.18x2.46) - 70 shore
7	N. 5 OR type 2050 (12.42x1.78) - 90 Shore

SEAL KIT

The codes included the OR n° 2, 4, 6 and 7.
Cod. 1985447 NBR seals
Cod. 1985448 FPM seals

14 - SPARE PARTS FOR AC SOLENOID VALVE



IDENTIFICATION CODE FOR AC COILS

C	26	L5	-		K1	/	10

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Coil electrical connection: plug for connector type DIN 43650 (**standard**)

Supply voltage
A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A110 = 110 V - 50 Hz / 120 V - 60 Hz
A230 = 230 V - 50 Hz / 240 V - 60 Hz

1	Coil locking ring - code. 0119480
2	Coil (see identification code)
3	ORM-0296-24 (29.6x2.4) - 70 shore
4	Solenoid tube: TA26-DL5/10N (NBR seals) TA26-DL5/10V (FPM seals) (OR n° 5 included)
5	OR type 3.910 (19.18x2.46) - 70 shore
6	N. 5 OR type 2050 (12.42x1.78) - 90 Shore

SEAL KIT
The codes included the OR n° 3, 5 and 6.
Cod. 1985449 NBR seals
Cod. 1985450 FPM seals

15 - FASTENING BOLTS AND SEALING RINGS

Single valve fastening: 4 SHC screws ISO 4762 M6x35
Tightening torque: 8 Nm
Sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore

16 - SUBPLATES (see catalogue 51 000)

Type PMD4-AI4G with rear ports - port threading: 3/4” BSP
Type PMD4-AL4G with side ports - port threading: 1/2” BSP

DUPLOMATIC OLEODINAMICA
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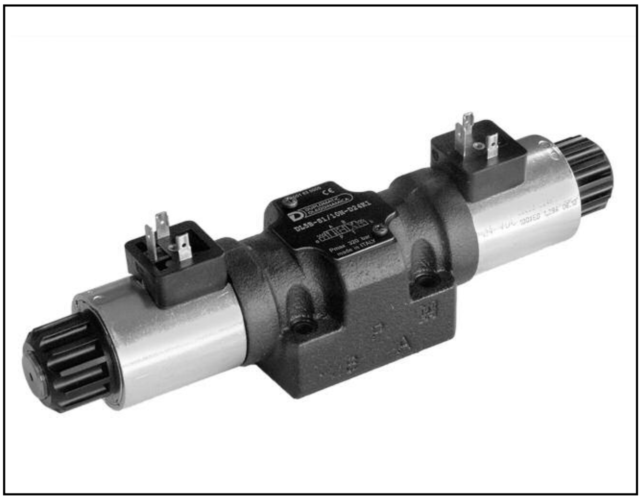
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

DL5B

SOLENOID OPERATED DIRECTIONAL CONTROL VALVE COMPACT VERSION

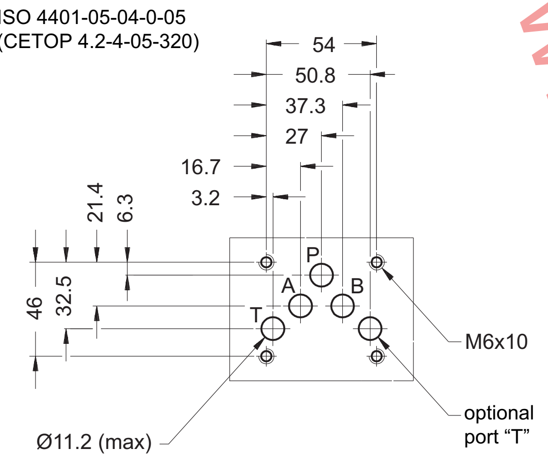
SERIES 10



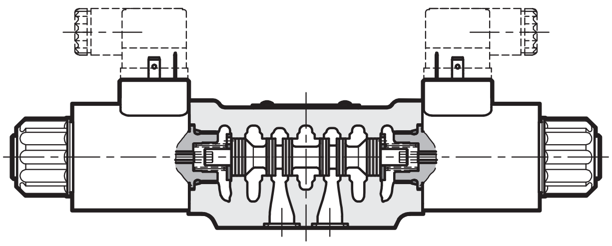
SUBPLATE MOUNTING
ISO 4401-05 (CETOP 05)

p max **320** bar
Q max **125** l/min

MOUNTING SURFACE



OPERATING PRINCIPLE



— Direct acting, subplate mounting directional control valve, with mounting surface according to ISO 4401 (CETOP RP 121H) standards.

— The valve is suitable for special applications, guaranteed by the reduced solenoid dimensions.

— The valve body is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop. Wet armature solenoids with interchangeable coils are used (for further information on solenoids see paragraph 7).

— The valve is supplied with 3 or 4 way designs and with several interchangeable spools with different porting arrangements.

— The valve is available with DC current solenoids only.

— The valve is also available with zinc-nickel coating that ensures a salt spray resistance up to 600 hours.

— Alternative to the standard manual override there are push, boot, knob and mechanical detent devices.

PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

Maximum operating pressure: - ports P - A - B - port T	bar	320 210
Maximum flow rate	l/min	125
Pressure drop Δp-Q	see paragraph 4	
Operating limits	see paragraph 6	
Electrical features	see paragraph 7	
Electrical connections	see paragraph 9	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Masse: single solenoid valve double solenoid valve	kg	2,4 3

1 - IDENTIFICATION CODE

1.1 - Standard version

D	L	5	B	-		/	10		-			/		

Solenoid operated directional control valve

Compact version

ISO 4401-05 (CETOP 05) size

Spool type (see paragraph 3):
S* **TA***
SA* **TB***
SB* **RK**

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

DC power supply
D12 = 12 V
D24 = 24 V
D28 = 28 V
D00 = valve without coils
(coils locking ring and related OR are supplied together with the valves.)

Coil electrical connection (see par. 9):
K1 = plug for connector type DIN 43650 (**standard**)
K2 = plug for connector type AMP JUNIOR (available on **D12** and **D24** coils only)
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

Manual override:
Omit for override integrated in the tube (**standard**)
CM = manual override, boot protected
CP = push manual override
CK = knob manual override
CPK = push manual override with mechanical retention

Option:
/ W7 = Zinc-nickel surface treatment (see **NOTE**)
Omit if not required

NOTE: The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing on the valve body makes the valve suitable to ensure a salt spray resistance up to 240 hours.

For a salt spray resistance up to 600 hours order the high corrosion resistance version.

1.2 - High corrosion resistance version

This version features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600 hours** (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

The coil are specific for this version, featuring a zinc-nickel surface treatment.The coil for DEUTSCH connector has a diode inside. Electrical features at paragraph 7.2

The boot manual override (CM) is installed as standard in order to protect the solenoid tube.

Follow the indentification code below to order it

D	L	5	B	-		/	10		-			/		/	W7

Choices as in standard identification code

DC power supply
D12 = 12 V
D24 = 24 V

Coil electrical connection
WK1 = plug for connector type DIN 43650
WK7D = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S.
Coil with diode.

Manual override:
CM = manual override, boot protected (**standard**)
CP = push manual override
CK = knob manual override
CPK = push manual override with mechanical retention

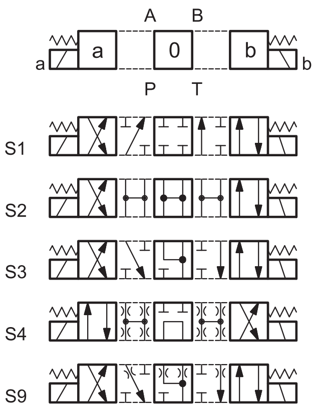
2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

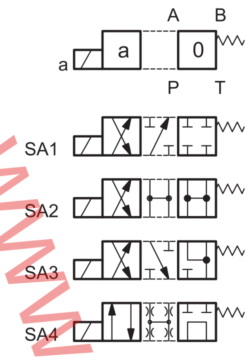
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - SPOOL TYPE

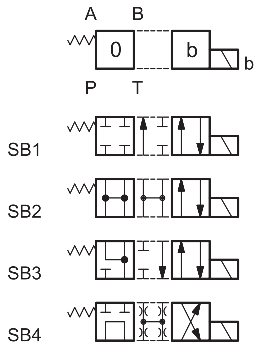
Type **S***:
2 solenoids - 3 positions
with spring centering



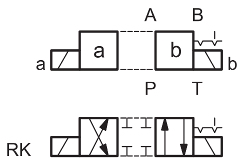
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



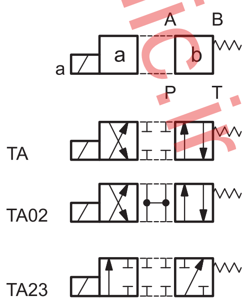
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



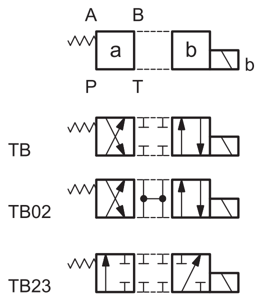
Type **RK**:
2 solenoids - 2 positions
with mechanical retention



Type **TA**:
1 solenoid side A
2 external positions
with return spring



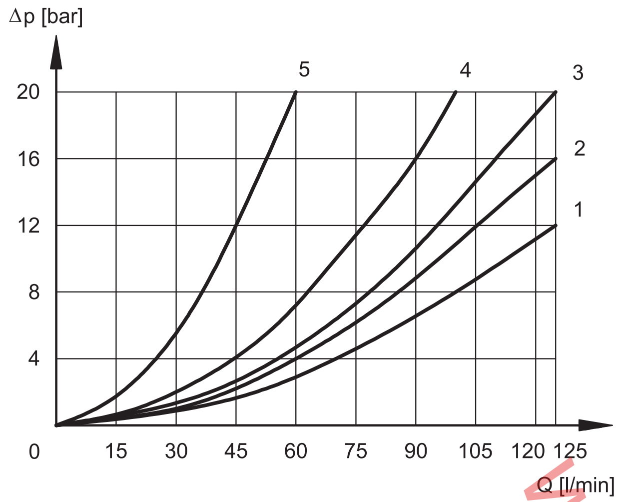
Type **TB**:
1 solenoid side B
2 external positions
with return spring



NOTE: Others spools available on request only.

4 - PRESSURE DROPS ΔP-Q

(obtained with viscosity of 36 cSt at 50 °C)



ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1	1	1	2	2
S2	1	1	1	1
S3	1	1	1	1
S4	4	4	4	4
S9	1	1	1	1
RK	2	2	2	2
TA	2	2	3	3
TA02	2	2	1	1
TA23	3	3	-	-

DE-ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS		
	A→T	B→T	P→T
	CURVES ON GRAPHS		
S2	-	-	1
S3	5	5	-
S4	-	-	1

5 - SWITCHING TIMES

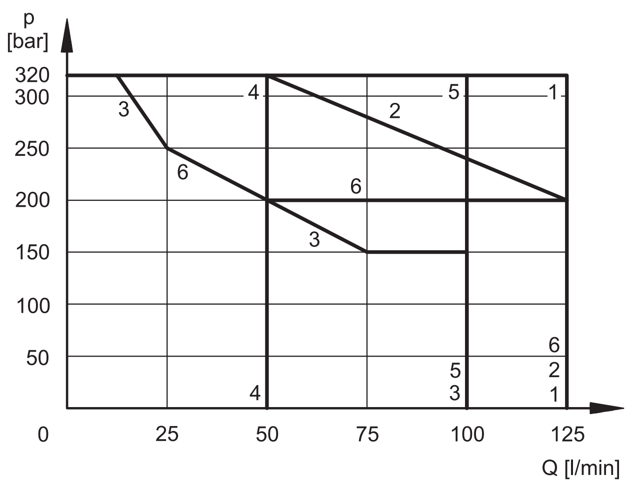
The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

SUPPLY	TIMES (±10%) [ms]	
	ENERGIZING	DE-ENERGIZING
DC	70 ÷ 100	15 ÷ 20

6 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

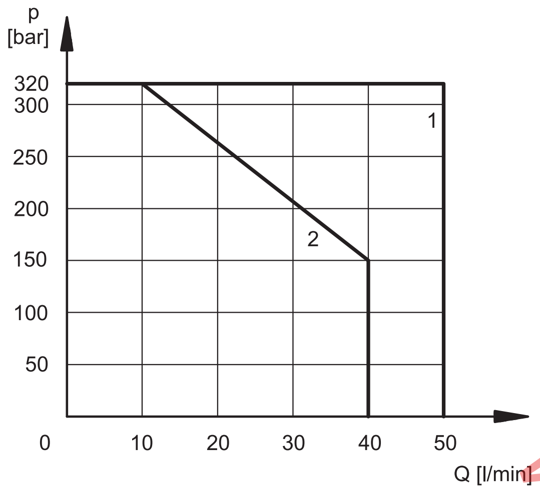
The limits for TA02 and TA spools refer to the 4-way operation. The operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow are shown in the chart on the next page.



SPOOL	CURVE
S1, S2, RK	1
TA02	2
S3	3
S4	4
TA, TA23	5
S9	6

6.1 - 4-way valve in 3-way operation

Operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow.



SPOOL	CURVE
TA	1
TA02	2

7 - ELECTRICAL FEATURES

7.1 Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring. The coils are interchangeabile.

Protection from atmospheric agents EN 60529

Plug-in type	IP 65	IP 67	IP 69 K
K1 DIN 43650	x (*)		
K2 AMP JUNIOR	x	x (*)	
K7 DEUTSCH DT04 male	x	x	x (*)

(*) The protection degree is guaranteed only with the connector correctly connected and installed

NOTE: In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95/EC
CLASS OF PROTECTION : Coil insulation (VDE 0580) Impregnation:	 class H class F

7.2 Coils - current and power consumption

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law: V = R x I

The WK1 and WK7D are coils specific for the high corrosion resistance version of the valve.

The WK7D coil includes a suppressor diode of pulses for protection from voltage peaks during switching. During the switching the diode significantly reduces the energy released by the winding, by limiting the voltage to 31.4V in the D12 coil and to 58.9 V in the D24 coil.

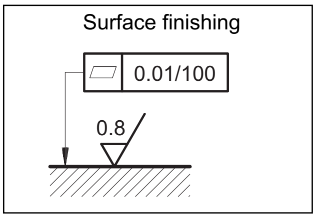
(values ±10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumption [A]	Power consumption [W]	Coil code				
					K1	WK1	K2	K7	WK7D
D12	12	4,4	2,72	32,7	1903080	1903050	1903100	1902940	1903400
D24	24	18,6	1,29	31	1903081	1903051	1903101	1902941	1903401
D28	28	26	1,11	31	1903082			-	

8 - INSTALLATION

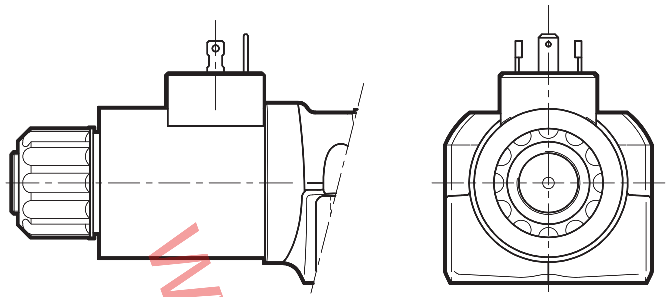
The configuration with centering and return springs can be mounted in any position.

Valve fitting takes place by means of screws or tie rods, fixing the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



9 - ELECTRIC CONNECTIONS

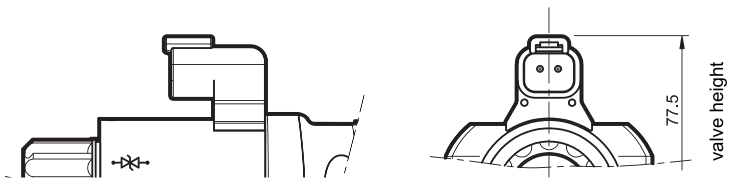
connection for DIN 43650 connector
code **K1** (**standard**)
code **WK1** (W7 version only)



connection for AMP JUNIOR connector
code **K2**

connection for
DEUTSCH DT06-2S male connector
code **K7**

connection for
DEUTSCH DT06-2S male connector - coil with diode
code **WK7D** (W7 version only)



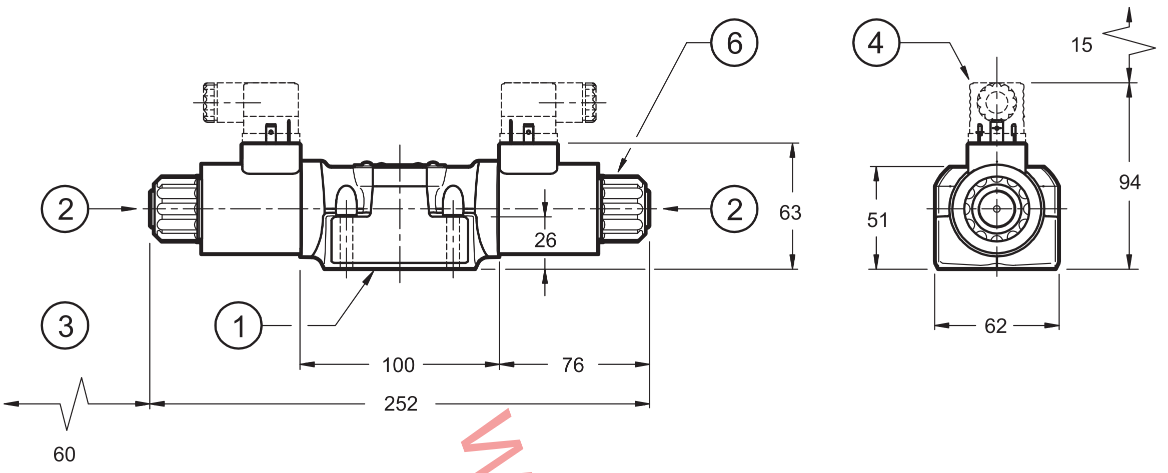
10 - ELECTRIC CONNECTORS

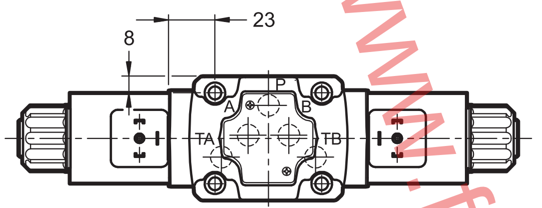
The valves are delivered without connector. Connectors for K1 connections (DIN 43650) can be ordered separately. See catalogue 49 000.

11 - DL5B OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

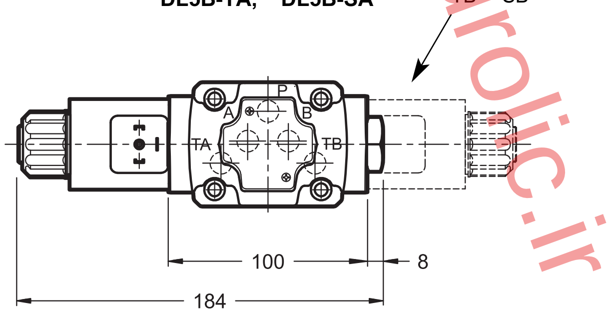
DL5B-S*





solenoid position for versions type TB* - SB*

DL5B-TA, DL5B-SA*

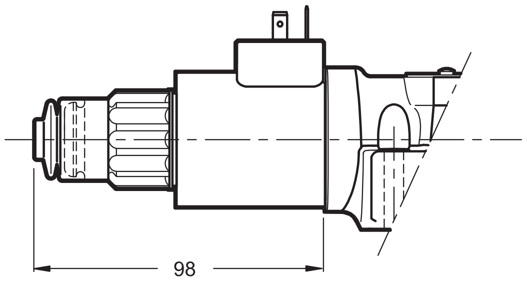


1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore
2	Locking ring with standard manual override integrated in the tube
3	Coil removal space
4	DIN 43650 electrical connector (representation with K1 standard connection)
5	Connector removal space
6	Locking ring: tightening torque: 5 ± 0.5 Nm

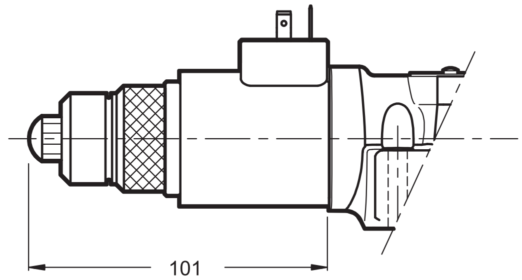
Valve fastening: 4 SHC screws ISO 6742 M6x35
Tightening torque: 8 Nm (A8.8)
Threads of mounting holes: M6x10

12 - MANUAL OVERRIDES

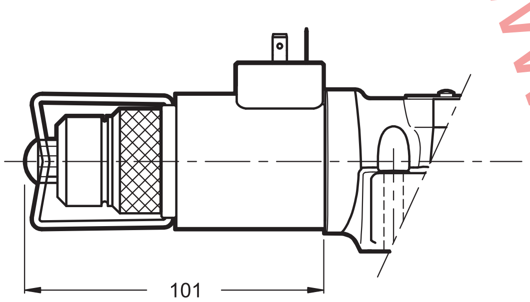
12.1 - CM manual override, boot protected



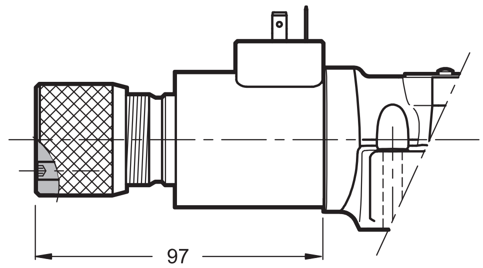
12.2 - CP Push manual override



12.3 - CPK Push manual override with mechanical retention



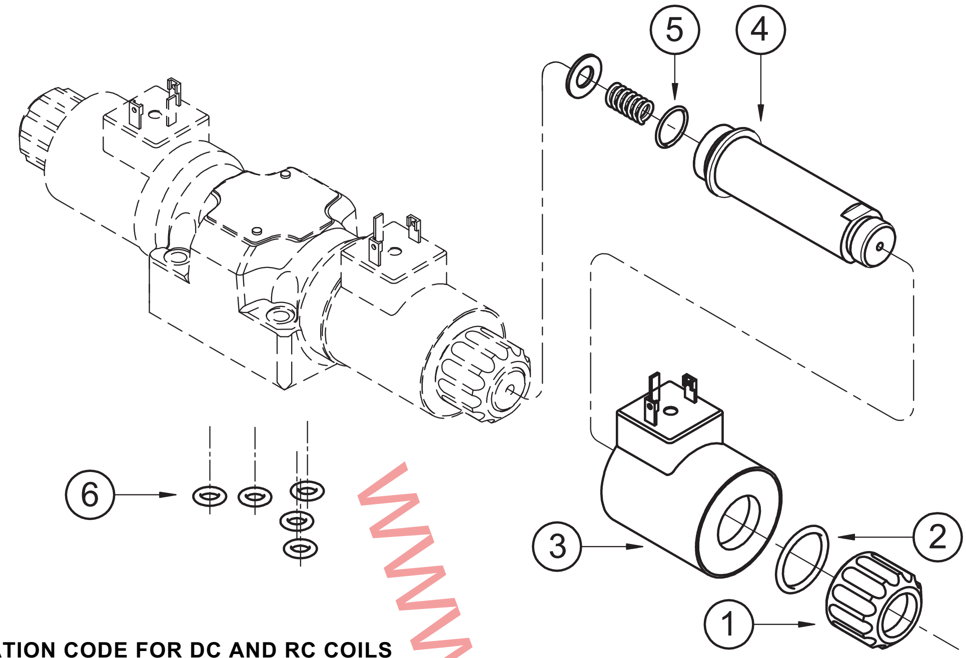
12.4 - CK Knob manual override



When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.

Spanner: 3 mm

13 - SPARE PARTS FOR DC SOLENOID VALVE



IDENTIFICATION CODE FOR DC AND RC COILS

C	22	S3	-			/	

Supply voltage
D12 = 12 V
D24 = 24 V
D28 = 28 V

Series no.:
10 = for K7
11 = for K1, WK1, K2 and WK7D
(the overall and mounting dimensions remain unchanged from 10 to 19)

Coil electrical connection (see par. 9):
K1 = plug for connector DIN 43650
K2 = plug for connector AMP JUNIOR (available on **D12** and **D24** coils only)
K7 = plug DEUTSCH DT04-2P for male connector DEUTSCH DT06-2S (available on **D12** and **D24** coils only)

For W7 version only (**D12** and **D24** only)
WK1 = plug for connector DIN 43650
WK7D = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S. Coil with diode.

1	Coil locking ring - code 0119412 tightening torque: 5 ±0.5 Nm
2	ORM-0220-20 - 70 shore
3	Coil (see identification code)
4	Solenoid tube: TD22-DL5/10N (NBR seals) TD22-DL5/10V (FPM seals) (OR n° 6 included)
5	OR type 3.910 (19.18x2.46) - 70 shore
6	N. 5 OR type 2050 (12.42x1.78) - 90 Shore

SEAL KIT

The codes included the OR n° 2, 5, and 6.
Cod. 1985461 NBR seals
Cod. 1985462 FPM seals

14 - SUBPLATES

(See catalogue 51 000)

Type PMD4-AI4G with rear ports - threading: 3/4” BSP
Type PMD4-AL4G with side ports - threading: 1/2” BSP

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DUPLOMATIC OLEODINAMICA

MDS5

SOLENOID OPERATED SWITCHING VALVE

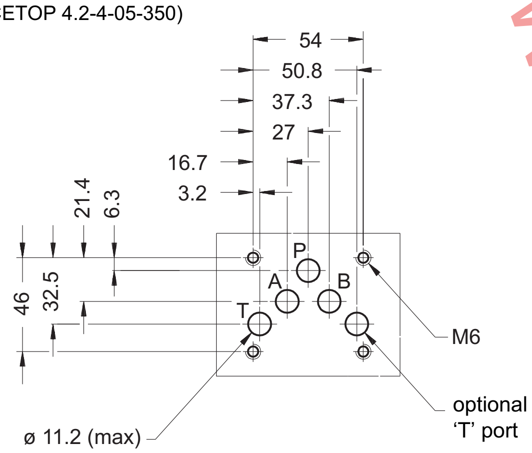
SERIES 10

MODULAR VERSION
ISO 4401-05

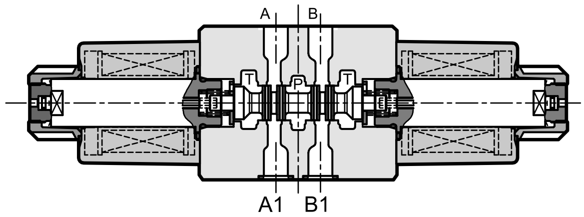
p max **350** bar
Q max **100** l/min

MOUNTING INTERFACE

ISO 4401-05-04-0-05
(CETOP 4.2-4-05-350)



OPERATING PRINCIPLE



— The MDS5 valve is used to switch multiple flow directions, or to select pressure values. Application example here below.

— The flow paths pass right through the entire valve body and due to this particular design, the MDS5 can be assembled with all ISO 4401-05 modular valves.

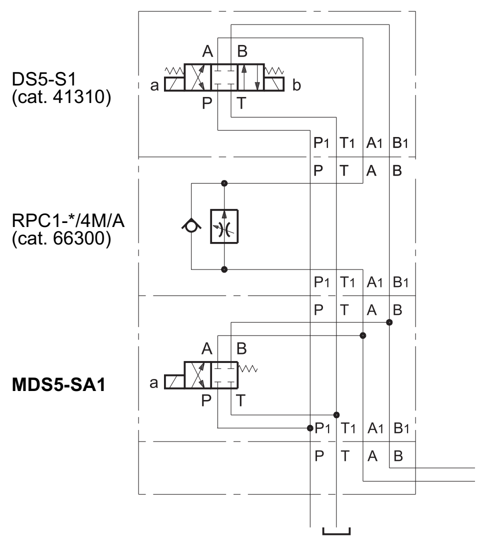
— The special connection of the valve in parallel to the P - T A - B lines of the circuit allows easy construction of different hydraulic configurations, reducing the pressure drops to a minimum.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Max operating pressure: P - A - B ports T port (DC version) T port (AC version)	bar	 350 210 160
Maximum flow on P - A - B ports	l/min	100
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: double solenoid single solenoid	kg	4,6 3,7

APPLICATION EXAMPLE



1 - IDENTIFICATION CODE

MDS	5	-		/	10		-		K1	/	

Modular switching valve

Size: ISO 4401-05

Spools (see paragraph 2):
S1 **SA1** **SB1**
TA **TB**

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

Option : manual override
Omit for override integrated in the tube (**standard**)
For DC version only:
CM = boot protected.
CK = knob
Details in catalogue 41 330.

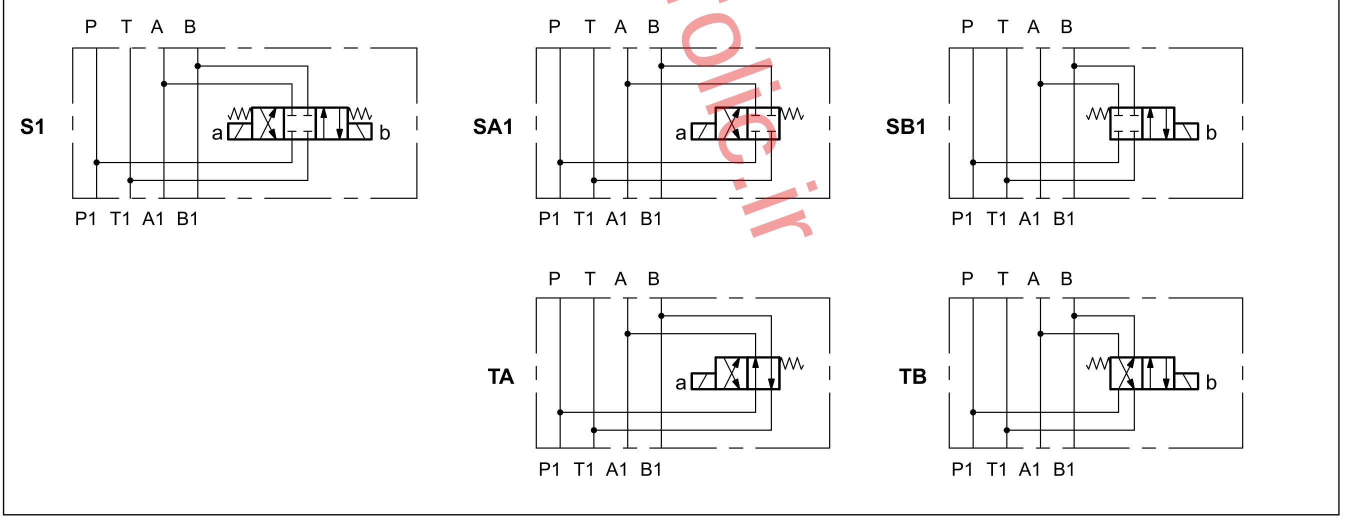
Coil electrical connection
plug for connector type DIN 43650

Power supply:
Details of electrical features are in catalogue 41 330.

DC power supply
D12 = 12 V
D24 = 24 V

AC power supply
A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A110 = 110 V - 50 Hz / 120 V - 60 Hz
A230 = 230 V - 50 Hz / 240 V - 60 Hz

2 - SPOOLS



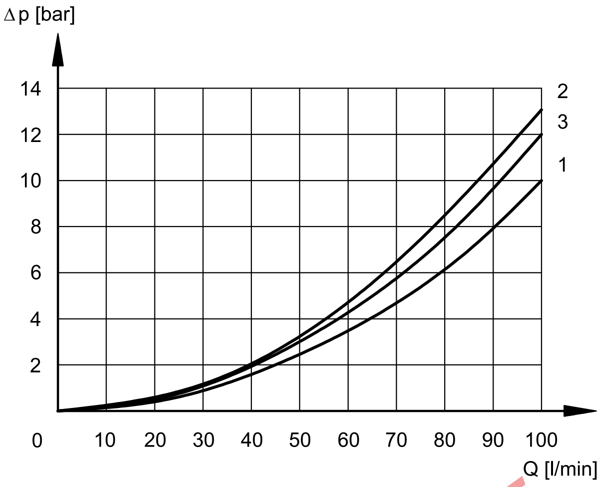
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - PRESSURE DROPS ∆P-Q

(obtained with viscosity of 36 cSt at 50 °C)



ENERGIZED VALVE

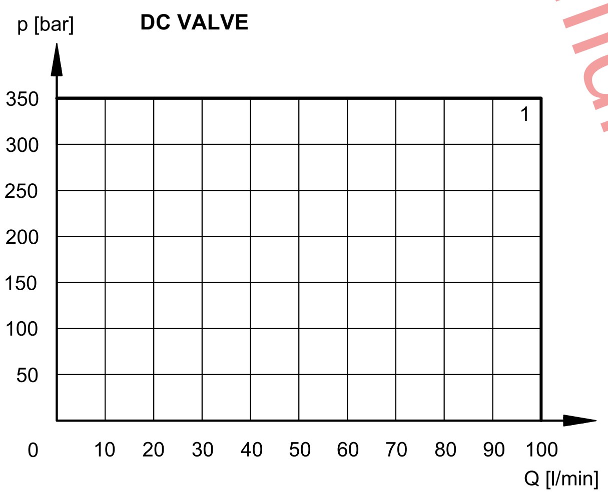
SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1	3	2	1	1

5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values indicated in the graphs are relevant to the standard solenoid valve.

The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



SPOOL	CURVE
S1, TA	1

6 - SWITCHING TIMES

The values indicated are obtained with spool S1, according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

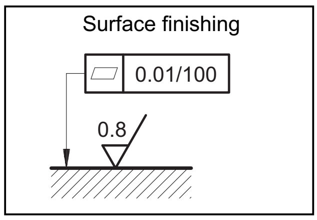
SUPPLY	TIMES (±10%) [ms]	
	ENERGIZING	DE-ENERGIZING
DC	40 ÷ 90	20 ÷ 50
AC	15 ÷ 30	20 ÷ 50

7 - INSTALLATION

The valve can be mounted in any position.

Valve fixing takes place by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

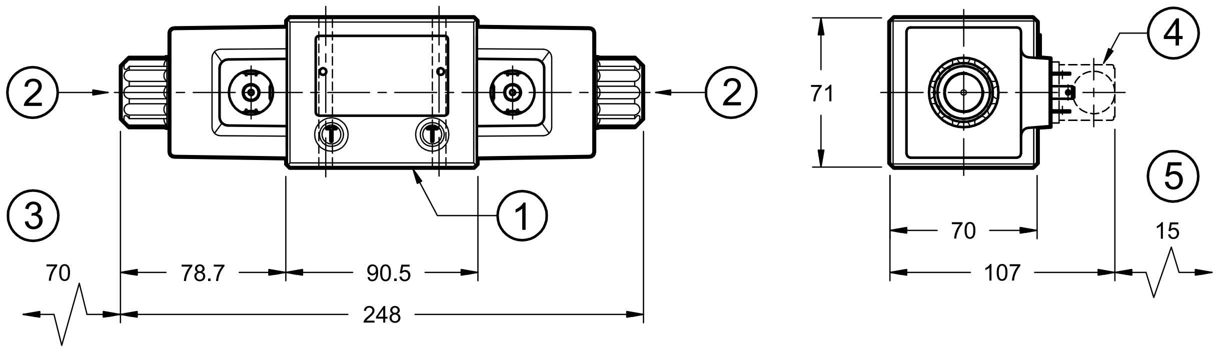
If the minimum values of planarity and/or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



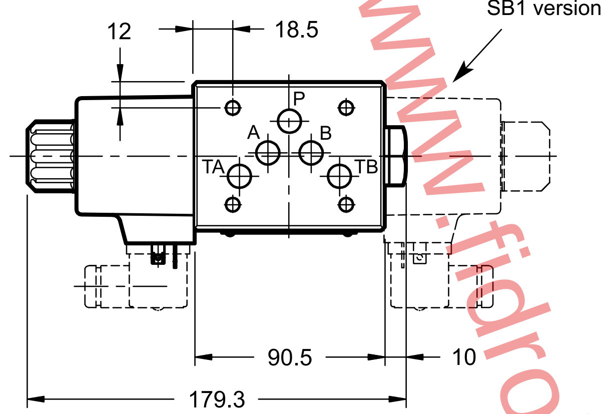
8 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

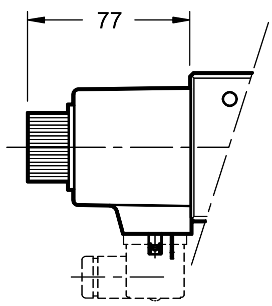
MDS5-S1/10*-D*



MDS5-TA/10*-D*



MDS5-*/10*-A*



1	Mounting surface with sealing rings: N° 5 OR 2050 (12.42x1.78) - 90 Shore
2	Standard manual override included in the solenoid tube
3	Coil removal space
4	DIN 43650 electrical connector to be ordered separately (see cat. 49 000)
5	Connector removal space

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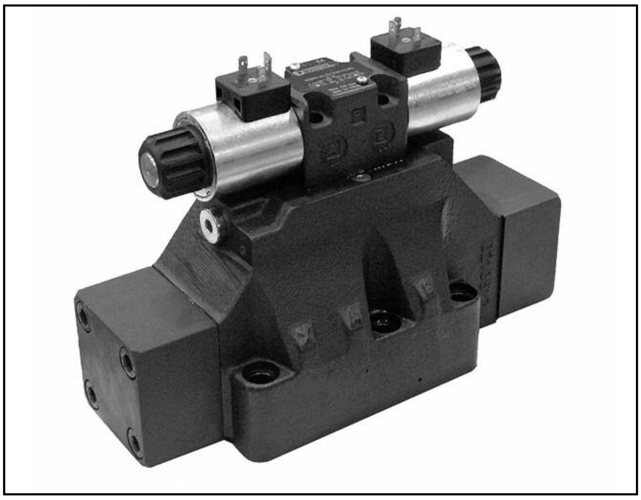
E*P4

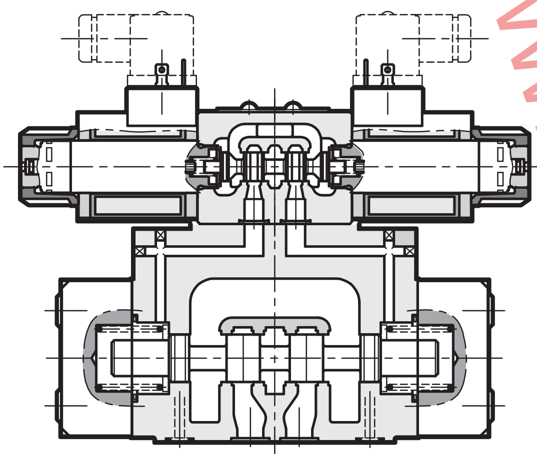
PILOT OPERATED DISTRIBUTOR SOLENOID OR HYDRAULIC (C*P4) CONTROLLED



E4P4 CETOP P05
E4R4 ISO 4401-05
E5 ISO 4401-08

p max (see table of performances)
Q max (see table of performances)

OPERATING PRINCIPLE



— The E*P4 piloted valves are constituted of a 4-way hydraulic operated distributor with a mounting surface in accordance with the ISO 4401 standards, operated by a ISO 4401-03 solenoid directional valve.

— They are made in CETOP P05 and ISO 4401-05 sizes with flow rates up to 150 l/min, and in ISO 4401-08 size with flow rates up to 600 l/min.

— They are available with different spool types (see par. 2) and with some options for the opening control.

— They are available with both the solenoid and the hydraulic control from the X and Y ways.

— A version for high pressures (H) is available.

— It is available also with zinc-nickel surface treatments, that ensures a salt spray resistance up to 600 hours.

PERFORMANCES
(obtained with mineral oil of viscosity of 36 cSt at 50°C)

		E4*4	E4HP4	E5P4	E5HP4
Maximum operating pressure - ports P - A - B - port T (external drainage) - port T (internal drainage) (DC / AC)	bar	320 210 210 / 160	420 350 210 / 160	320 210 210 / 160	420 350 210 / 160
Maximum flow rate from port P to A - B - T	l/min	150		600	
Ambient temperature range	°C	-20 / +50			
Fluid temperature range	°C	-20 / +80			
Fluid viscosity range	cSt	10 ÷ 400			
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15				
Recommended viscosity	cSt	25			
Mass: E*P4-S, RK E*P4-TA/TC	kg	7 6,4		15,6 15,0	

1 - IDENTIFICATION CODE FOR SOLENOID CONTROLLED DISTRIBUTOR

E			P	4	-		/					/			-			/		

Directional valve, solenoid controlled, pilot operated

Size:
- **4** = CETOP P05
- **5** = ISO 4401-08 (CETOP 08)

Option
(Omit for standard version)
H = high pressure version
pmax = 420 bar
E4HP4-S4 not available

P = Subplate mounting
R = Mounting interface
ISO 4401-05-05-0-05
(for E4 only - not available for high pressure version H)

Number of ways

Spool type (see par. 2):

S*	**TA***
***TA**	**TC***
***TC**	**RK***

Options - see par. 10 (omit if not required):
- **C** = main spool stroke control
- **D** = main spool shifting speed control
- **G** = main spool stroke and shifting speed control
- **PF** = subplate with restrictor Ø0,8 on port P placed under solenoid valve

Piloting:
Omit for internal piloting
E = external pilot
Mandatory for spools types: S2 - S4 - S7 - S8 - TA002 - TC002 - RK002.
With these spools the internal piloting is possible only with E5 valve with C3 option.

Drainage:
Omit for external drainage, which is recommended when the valve is used with backpressure on the tank line.
I = internal drainage

Option:
/ C3 = Check valve incorporated on line P setting 5 bar
Option available for E5 valves only. See paragraph 8.1

Option:
/ W7 = Zinc-nickel surface treatment (see **NOTE 2**)
Omit if not required

Manual override:
omit for override integrated in the tube (**standard**)
CM = manual override, boot protected (see paragraph 16)

Coil electrical connection (see par. 14):
K1 = plug for connector type DIN 43650 (**standard**)
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on D12 and D24 coils only)

Power supply (see paragraph 9)

direct current
D12 = 12 V
D24 = 24 V
D48 = 48 V
D110 = 110 V
D220 = 220 V
D00 = valve without coils (see **NOTE 1**)

alternate current
A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A110 = 110 V - 50 Hz / 120 V - 60 Hz
A230 = 230 V - 50 Hz / 240 V - 60 Hz
A00 = valve without coils (see **NOTE 1**)
F110 = 110 V - 60 Hz
F220 = 220 V - 60 Hz

Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

Series No.:
50 - for valve E4
40 - for valve E5
(the overall and mounting dimensions within the same ten remain unchanged)

NOTE 1: Coils locking ring and related OR are supplied together with valves.

NOTE 2: The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing on the valve body (both main and pilot) makes the valve suitable to ensure a salt spray resistance up to **240** hours (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

For a salt spray resistance up to **600** hours refer to paragraph 1.1.

1.1 - High corrosion resistance version

This version, available for the basic valve (without option of par. 10) features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600 hours** (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

The coil are DC only and specific for this version, featuring a zinc-nickel surface treatment. The coil for DEUTSCH connector has a diode inside. Electrical features at paragraph 9.2. The boot manual override (CM) is installed as standard in order to protect the solenoid tube.

Follow the identification code below to order it

E....	/			/	CM	/	W7

Choices as in standard identification code

DC power supply
D12 = 12 V **D24** = 24 V

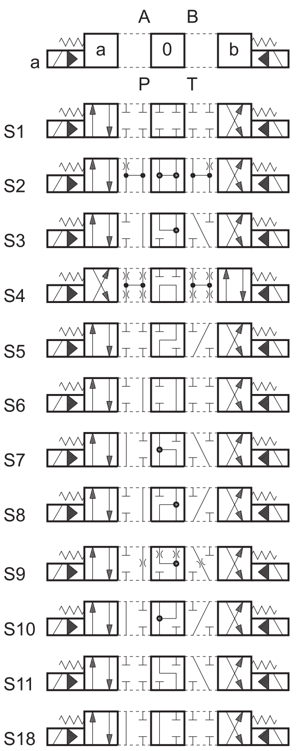
Coil electrical connection (see par. 15)
WK1 = plug for connector type DIN 43650
WK7D = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S. Coil with diode.

Manual override, boot protected

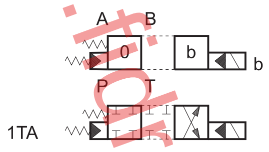
2 - SPOOLS TYPES

Symbols are referred to the solenoid valve **E***. For the hydraulic operated version **C*** please verify the connection scheme (see par. 4).

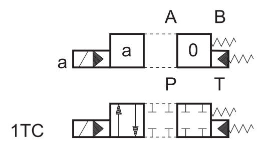
Type **S:**
3 positions with spring centering



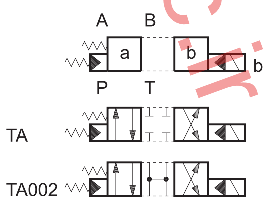
Type ***TA:**
2 positions (central + external) with spring centering



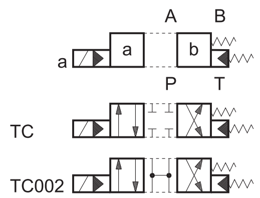
Type ***TC:**
2 positions (central + external) with spring centering



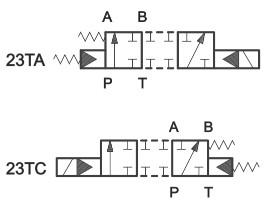
Type **TA:**
2 external positions with return spring



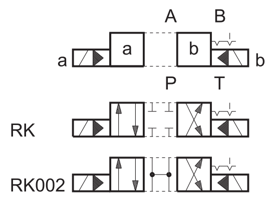
Type **TC:**
2 external positions with return spring



Type **23 (TA/TC)**:
3-way, 2 external positions with return spring



Type **RK:**
2 positions with mechanical detent on pilot valve



Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our technical department for their identification, feasibility and operating limits.

3 - IDENTIFICATION CODE FOR HYDRAULIC CONTROLLED DISTRIBUTOR C*P4

C			P	4	-			/	E	/			

Hydraulic operated directional valve through X and Y lines

Size:
4 = CETOP P05
5 = ISO 4401-08 (CETOP 08)

Option (Omit for standard version)
H = high pressure version pmax = 420 bar
C4HP4-S4 not available

Mounting:
P = Subplate mounting
R = Mounting interface ISO 4401-05-05-0-05 (CETOP R05) only for C4 standard valve.

Number of ways

Spool type (see paragraph 2)
S* **TA***
TA** **TC
***TC**

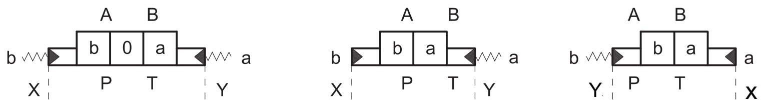
Option:
/ W7 = Zinc-nickel surface treatment (see **NOTE**)
Omit if not required

Seals:
omit for mineral oils (**standard**)
V = FPM seals for special fluids

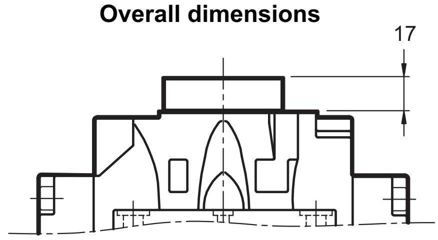
Series No.:
43 - for valve C4
34 - for valve C5
(the overall and mounting dimensions within the same ten remain unchanged)

External piloting
External drainage
(see paragraph 8)

Spool type
The distributor is delivered with short-circuit subplate. The X and Y ports are used for the hydraulic control of the valve.



Overall dimensions



4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N for solenoid controlled distributors, omit for hydraulic controlled). For fluids HFDR type (phosphate esters) use FPM seals (code V).

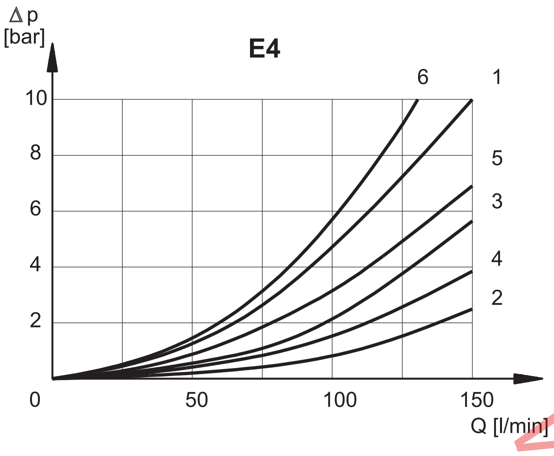
For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

5 - PRESSURE DROPS Δp-Q

(values obtained with viscosity 36 cSt at 50 °C)

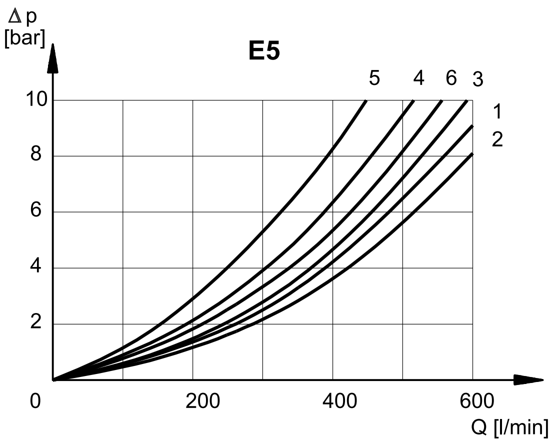
5.1 - Pressure drops E4P4



SPOOL TYPE	SPOOL POSITION	E4 CONNECTIONS P → A	P → B	A → T	B → T	P → T
		CURVES ON GRAPH				
S1	Energized	1	1	2	3	
S2	De-energized Energized	5	5	2	4	6*
S3	De-energized Energized	1	1	1• 2	1° 4	
S4	De-energized Energized	6	6	3	5	6
S5	De-energized Energized	1	1 5	2	3	
S6	De-energized Energized	1	1	2	1 4	
S7	De-energized Energized	6	6	3	5	6°
S8	De-energized Energized	6	6	3	5	6•
S9	Energized	1	1	2	2	
S10	De-energized Energized	1' 5	1° 5	2	3	
S11	De-energized Energized	1	1	1 2	3	
S18	De-energized Energized	5 5	1	2	3	
TA	De-energized Energized	1	1	4	3	
RK	Energized	1	1	4	3	

* A-B blocked • B blocked ° A blocked

5.2 - Pressure drops E5P4



SPOOL TYPE	SPOOL POSITION	E5 CONNECTIONS P → A	P → B	A → T	B → T	P → T
		CURVES ON GRAPH				
S1	Energized	1	1	2	3	
S2	De-energized Energized	2	2	1	2	6*
S3	De-energized Energized	1	1	4• 1	4° 2	
S4	De-energized Energized	6	6	3	4	5
S5	De-energized Energized	1	4 2	2	3	
S6	De-energized Energized	1	1	2	4 2	
S7	De-energized Energized	6	6	3	4	5°
S8	De-energized Energized	6	6	4	3	5•
S9	Energized	1	1	2	3	
S10	De-energized Energized	4• 2	4° 2	2	3	
S11	De-energized Energized	1	1	3 1	3	
S18	De-energized Energized	4 2	1	2	3	
TA	De-energized Energized	1	1	2	3	
RK	Energized	1	1	2	3	

* A-B blocked • B blocked ° A blocked

6 - SWITCHING TIMES

6.1 - E4P4

The values indicated refer to a solenoid valve working with piloting pressure of 100 bar, with mineral oil at a temperature of 50°C, at viscosity of 36 cSt and with PA and BT connections.

The energizing and de-energizing times are obtained at the pressure variation which occurs on the lines.

E4				
TIMES (± 10%) [ms]	ENERGIZED		DE-ENERGIZED	
	2 Pos.	3 Pos.	2 Pos.	3 Pos.
CA solenoid	35	25	35	25
DC solenoid	60	50	50	40

6.2 - E5P4

The values indicated refer to a solenoid valve working with piloting pressure of 100 bar, with mineral oil at a temperature of 50°C, at viscosity of 36 cSt and with PA and BT connections.

The energizing and de-energizing times are obtained at the pressure variation which occurs on the lines.

E5				
TIMES (± 10%) [ms]	ENERGIZED		DE-ENERGIZED	
	2 Pos.	3 Pos.	2 Pos.	3 Pos.
CA solenoid	70	40	70	40
DC solenoid	100	70	80	50

7 - PERFORMANCE CHARACTERISTICS

E4 - PRESSURES [bar]	**E4*4**	**E4HP4**	**C4*4**	**C4HP4**
Max pressure in P, A, B ports	320	420	320	420
Max pressure in T line with external drainage	210	350	210	350
Max pressure in T line with internal drainage	210 (DC) 160 (AC)	210 (DC) 160 (AC)	-	-
Max pressure in Y line with external drainage	210 (DC) 160 (AC)	210 (DC) 160 (AC)	-	-
Min piloting pressure **NOTE 1**	5 ÷ 12			
Max piloting pressure	210	350	210	350

E5 - PRESSURES [bar]	**E4*4**	**E4HP4**	**C4*4**	**C4HP4**
Max pressure in P, A, B ports	320	420	320	420
Max pressure in T line with external drainage	210	350	210	350
Max pressure in T line with internal drainage	210 (DC) 160 (AC)	210 (DC) 160 (AC)	-	-
Max pressure in Y line with external drainage	210 (DC) 160 (AC)	210 (DC) 160 (AC)	-	-
Min piloting pressure **NOTE 1**	5 ÷ 12			
Max piloting pressure	210	350	210	350

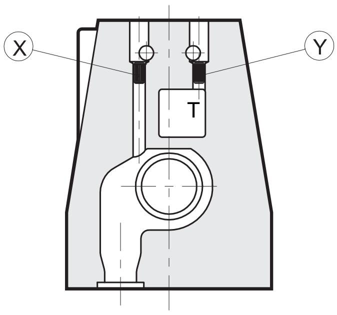
NOTE 1 minimum piloting pressure can be the lower range value at low flows rates, but with higher flow rates the higher value is needed.

MAXIMUM FLOW RATES [l/min]	**E4**		**E5**	
	PRESSURES			
Spool type	at 210 bar	at 320 bar	at 210 bar	at 280 bar
S4, S7, S8	120	100	500	450
All other spools	150	120	600	500

8 - PILOTING AND DRAINAGE

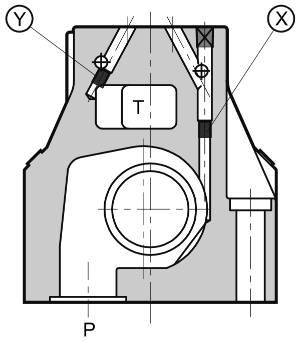
The E*P4 valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.

E4P4



X: plug M5x6 for external pilot
Y: plug M5x6 for external drain

E5P4



X: plug M6x8 for external pilot
Y: plug M6x8 for external drain

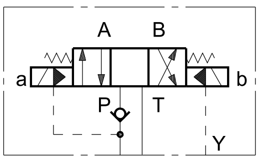
TYPE OF VALVE		Plug assembly	
		X	Y
E*P4-**	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
E*P4-**/I	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
E*P4-**/E	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
E*P4-**/EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

8.1 - Backpressure valve incorporated on line P available for E5 valve only)

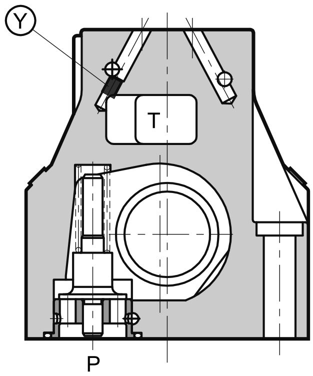
Valve E5 is available upon request with backpressure valve incorporated on line P. This is necessary to obtain the piloting pressure when the control valve, in the rest position, has the line P connected to the T outlet (spools S2 - S4 - S7 - S8 - TA002 - TC002 - RK002). The cracking pressure is of 5 bar.

Add **C3** to the identification code for this request (see paragraph 1). **In the C3 version the piloting is always internal.**

E5P4/C3

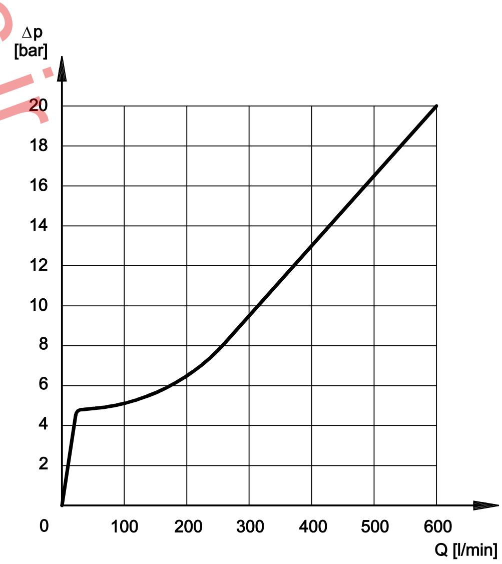


E5P4 (with C3 option)



pilot always internal

Y: plug M6x8 for external drain



NOTE: the backpressure valve can’t be used as direct check valve because it doesn’t assure the seal.

The curve refers to the pressure drop (body part only) with backpressure valve energized to which the pressure drop of the reference spool must be added. (see paragraph 5)

9 - ELECTRICAL FEATURES

9.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated 360°, to suit the available space.

NOTE 1: In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see catalogue. 49 000).

VOLTAGE SUPPLY FLUCTUATION	±10% Vnom
MAX SWITCH ON FREQUENCY E4 E5	 10.000 ins/hr 8.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) (**NOTE 1**)	According to 2004/108/EC
LOW VOLTAGE	According to 2006/95/EC
CLASS OF PROTECTION: Atmospheric agents (IEC 60529) Coil insulation (VDE 0580) Impregnation: DC valve AC valve	 IP 65 (**NOTE 2**) class H class F class H

Protection from atmospheric agents IEC 60529

Connection	IP 65	IP 67	IP 69 K
K1 DIN 43650	x (*)		
K7 DEUTSCH DT04 male	x	x	x (*)

(*) The protection degree is guaranteed only with the connector correctly connected and installed

9.2 - DC coils

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law: V = R x I.

The WK1 and WK7D are coils specific for the high corrosion resistance version of the valve.

The WK7D coil includes a suppressor diode of pulses for protection from voltage peaks during switching. During the switching the diode significantly reduces the energy released by the winding, by limiting the voltage to 31.4V in the D12 coil and to 58.9 V in the D24 coil.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 48V voltage) with alternating current (50 or 60 Hz), considering a reduction of the operating limits by approximately 5 ÷ 10%.

The table shows current and power consumption values relevant to DC coils.

(values ±10%)

	Resistance at 20°C [Ω]	Current consumption [A]	Power consumption [W]	Coil code			
				K1	WK1	K7	WK7D
D12	4,4	2,72	32,7	1903080	1903050	1902940	1903400
D24	18,6	1,29	31	1903081	1903051	1902941	1903401
D48	78,6	0,61	29,5	1903083			
D110	436	0,26	28,2	1903464			
D220	1758	0,13	28,2	1903465			

9.3 - AC coils

The table shows current and power consumption values at inrush and at holding, relevant to the different coil types for AC current.

Coils for alternating current (values ± 5%)

Suffix	Nominal Voltage [V]	Freq. [Hz]	Resistance at 20°C [Ohm] (±1%)	Current consumption at inrush [A] (±5%)	Current consumption at holding [A] (±5%)	Power consumption at inrush (±5%) [VA]	Power consumption at holding (±5%) [VA]	Coil Code
A24	24	50	1,46	8	2	192	48	1902830
A48	48		5,84	4,4	1,1	204	51	1902831
A110	110V-50Hz	50/60	32	1,84	0,46	192	48	1902832
	120V-60Hz			1,56	0,39	188	47	
A230	230V-50Hz		140	0,76	0,19	176	44	1902833
	240V-60Hz			0,6	0,15	144	36	
F110	110	60	26	1,6	0,4	176	44	1902834
F220	220		106	0,8	0,2	180	45	1902835

10 - OPTIONS

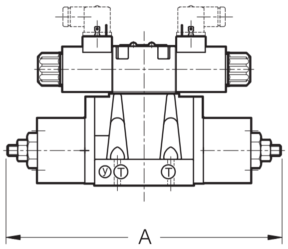
10.1 - Control of the main spool stroke: C

It is possible to introduce special stroke controls in the heads of the hydraulic pilot operated valve so as to vary the maximum spool clearance opening.

This solution allows control of the flow rate from the pump to the actuator and from the actuator to the outlet, obtaining a double adjustable control on the actuator.

Add the letter **C** to the identification code to request this device (see paragraph 1).

E*P4-S*/C

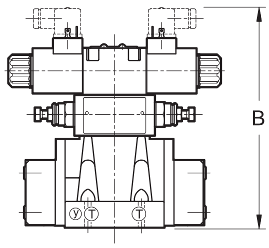


10.2 - Control of the main spool shifting speed: D

By placing a MERS type double flow control valve between the pilot solenoid valve and the hydraulic operated valve, the piloted flow rate can be controlled and therefore the changeover smoothness can be varied.

Add the letter **D** to the identification code to request this device (see paragraph 1).

E*P4-S*/D



10.3 - Subplate with throttle on line P

It is possible to introduce a subplate with a restrictor of Ø0,8 on line P between the pilot solenoid valve and the main distributor.

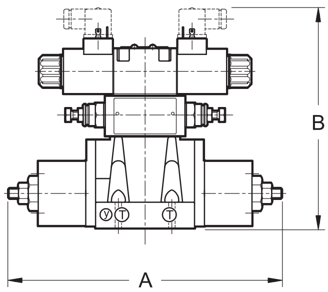
Add **PF** to the identification code to request this option (see paragraph 1).

10.4 - Control of the main spool stroke and shifting speed: G

It is possible to have the valve fitted with both the spool stroke device and the piloting flow rate control device.

Add the letter **G** to the identification code to request this solution (see paragraph 1).

E*P4-S*/G



dimensions in mm

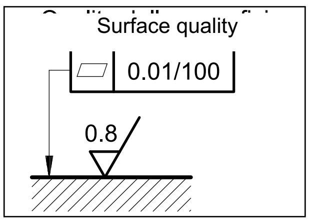
	E4	E5
A	280	401,5
B	218	254

11 - INSTALLATION

Configurations with centering and recall springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

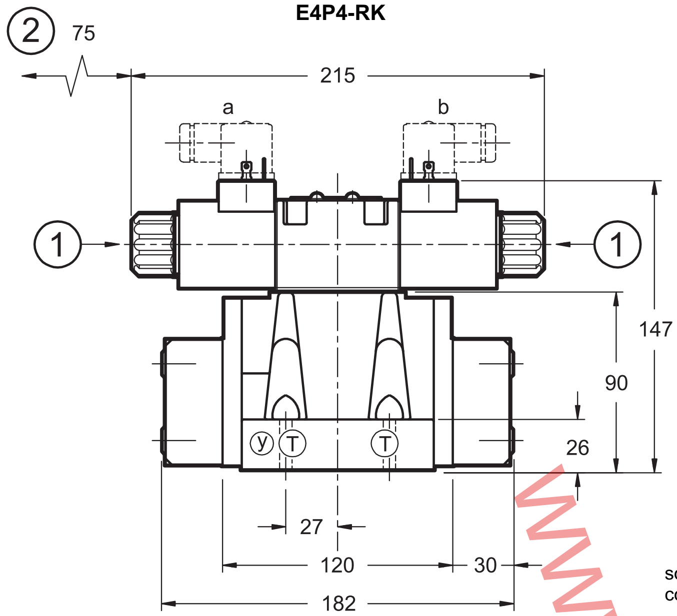
Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

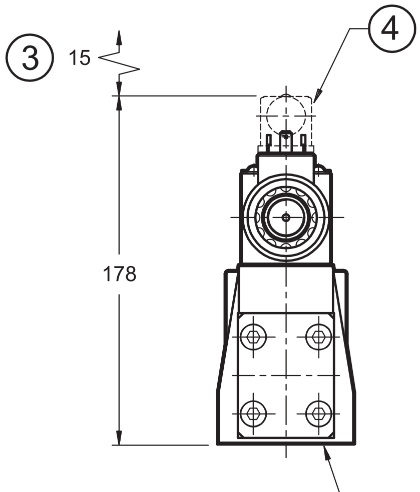
NOTE: Use of class 10.9 fastening screws is recommended for valves in version H (high pressure).



12 - E4 OVERALL AND MOUNTING DIMENSIONS

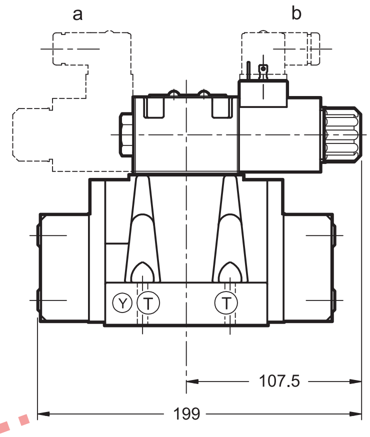
E4P4-S
E4P4-RK

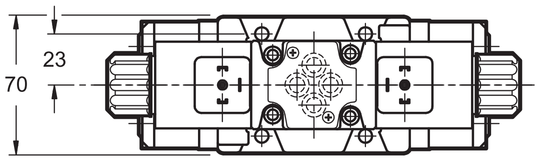




E4P4-TA
E4P4-*TA

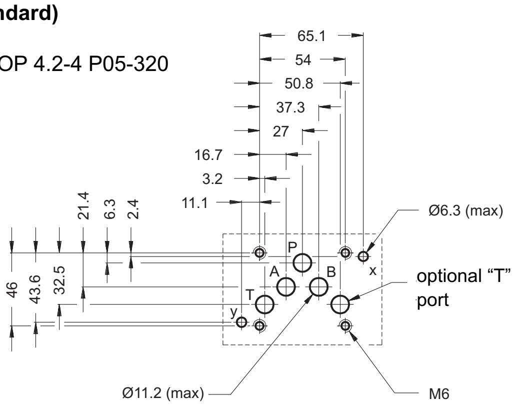
solenoid position
configuration TC/*TC





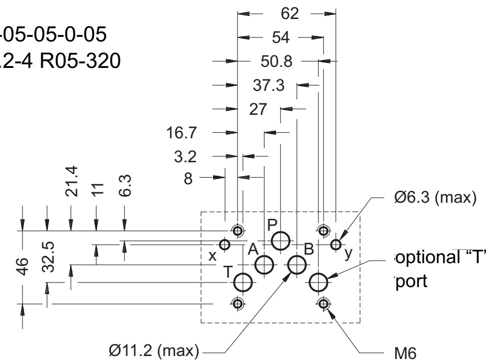
MOUNTING INTERFACES
(standard)

CETOP 4.2-4 P05-320



Valves with ISO 4401-05-05-0-05 mounting interface are available upon request. See par. 1 for their identification.

ISO 4401-05-05-0-05
CETOP 4.2-4 R05-320



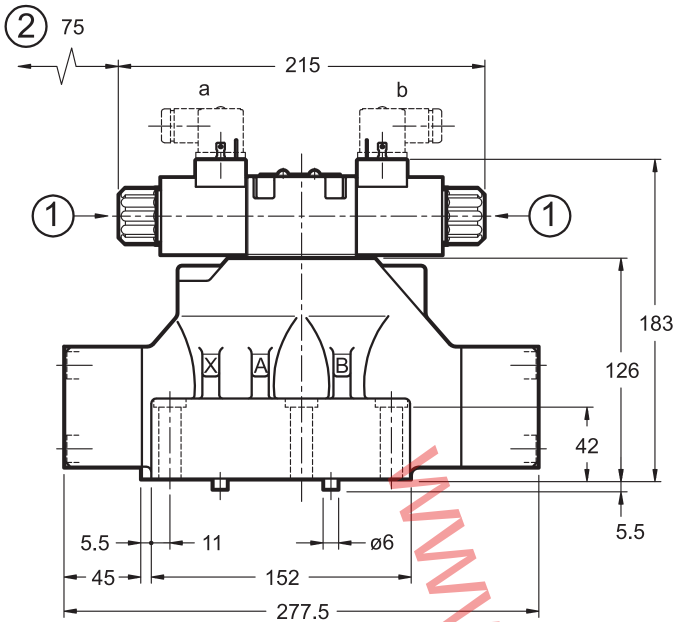
dimensions in mm

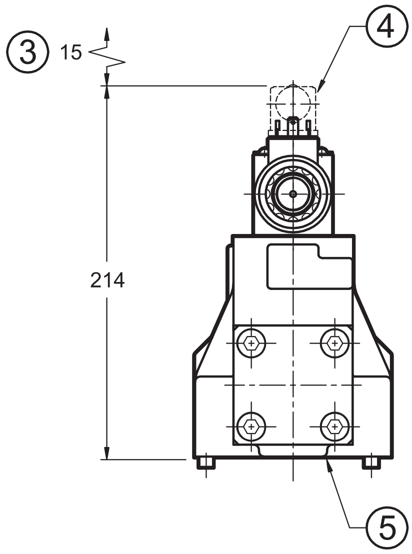
Valve fastening: 4 SHCS ISO 4762 M6x35 (see par. 11, **NOTE**)
Tightening torque: 8 Nm (bolt A 8.8) - 12 Nm (bolt A 10.9)
Threads of mounting holes: M6x10
Sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore N. 2 OR type 2037 (9.25x1.78) - 90 Shore

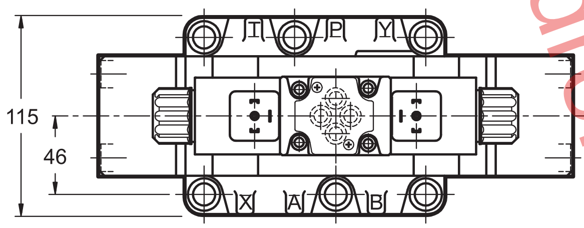
1	Manual override
2	Coil removal space
3	Connector removal space
4	Electric connector (to be ordered separately)
5	Mounting surface with sealing rings

13 - E5 OVERALL AND MOUNTING DIMENSIONS

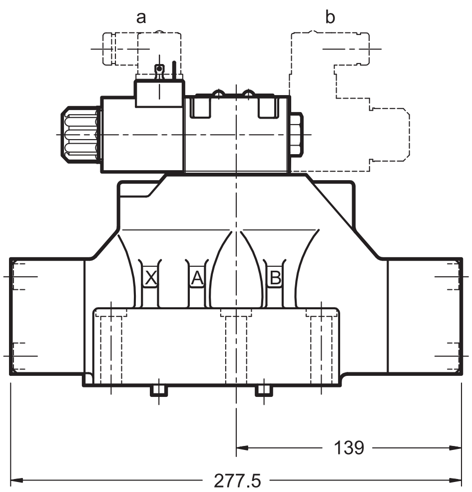
E5P4-S
E5P4-RK





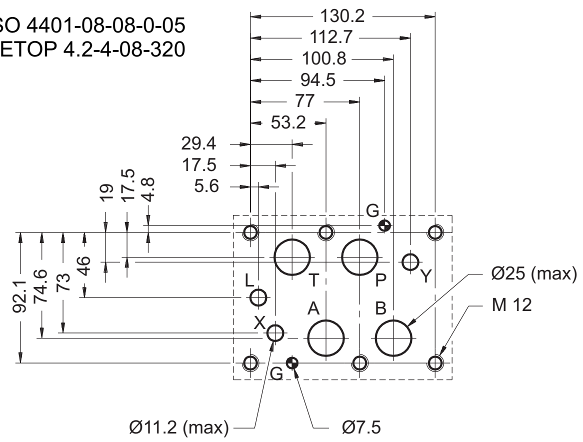


E5P4-TC
E5P4-*TC



MOUNTING INTERFACE

ISO 4401-08-08-0-05
CETOP 4.2-4-08-320



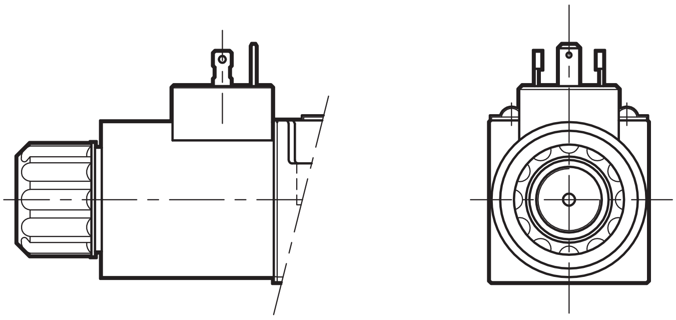
dimensions in mm

Valve fastening: 6 SHCS ISO 4762 M12x60 (see par. 11, **NOTE**)	
Tightening torque: 69 Nm (bolt A 8.8) - 115 Nm (bolt A 10.9)	
Threads of mounting holes: M12x20	
Sealing rings:	4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore

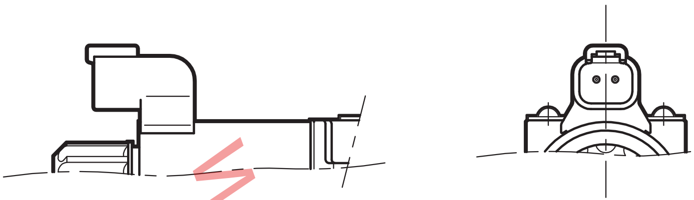
1	Manual override
2	Coil removal space
3	Connector removal space
4	Electric connector (to be ordered separately)
5	Mounting surface with sealing rings

14 - ELECTRIC CONNECTIONS

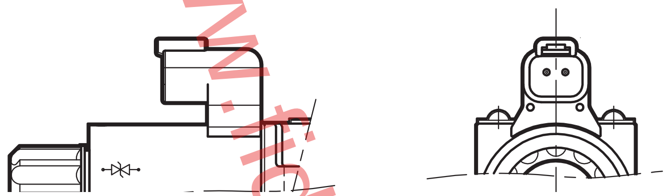
connection for DIN 43650 connector
code **K1** (**standard**)
code **WK1** (W7 version only)



connection for
DEUTSCH DT06-2S male connector type
code **K7**



connection for
DEUTSCH DT06-2S male connector - coil with diode
code **WK7D** (W7 version only)



15 - ELECTRIC CONNECTORS

The valves are delivered without connectors. Connectors for K1/ WK1 connections (DIN 43650) can be ordered separately. See catalogue 49 000.

16 - MANUAL OVERRIDE

Whenever the solenoid valve installation may involve exposure to atmospheric agents or use in tropical climates, the manual override, boot protection is recommended. For overall dimensions see catalogue 41 150.

Add the suffix **CM** to request this device (see paragraph 1).

17 - SUBPLATES
(see catalogue 51 000)

These plates are not suitable for high pressure valves E4HP4 and E5HP4..

	E4	E5
Type with rear ports	PME4-AI5G	
Type with side ports	PME4-AL5G	PME5-AL8G
P, T, A, B, port dimensions	3/4”	1½” BSP
X, Y port dimensions	1/4” BSP	1/4” BSP

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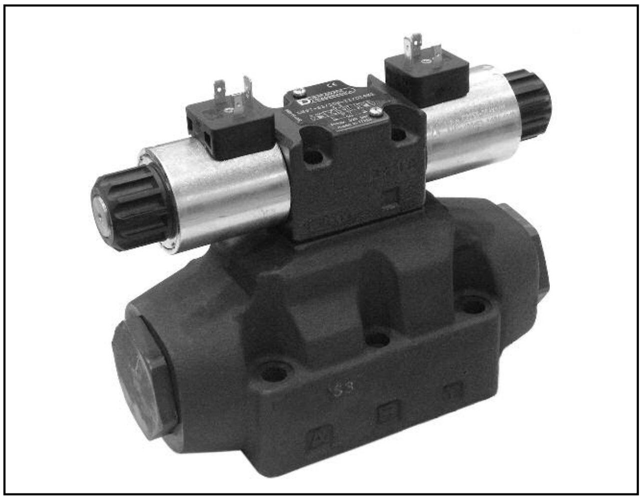
DSP7

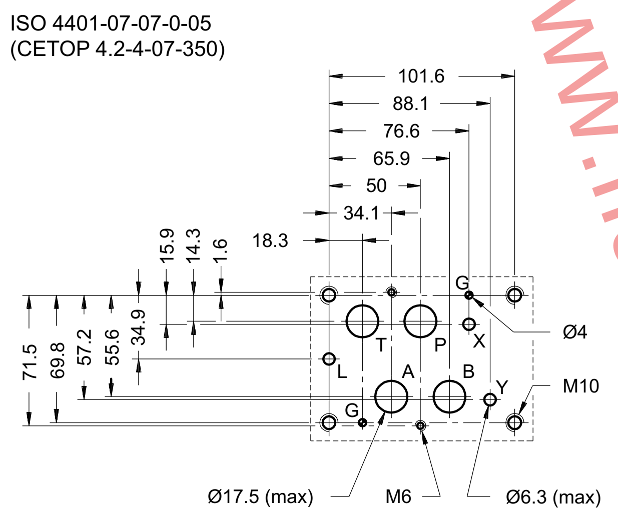
PILOT OPERATED DISTRIBUTOR SOLENOID OR HYDRAULIC (DSC7) CONTROLLED

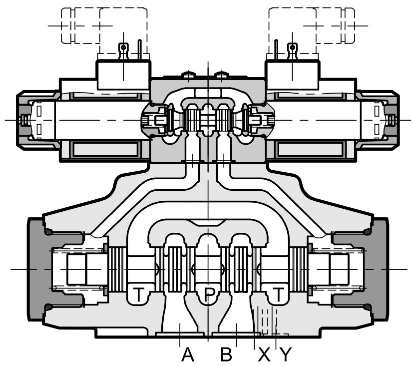


SUBPLATE MOUNTING
ISO 4401-07 (CETOP 07)

p max **350** bar
Q max **300** l/min

MOUNTING SURFACE





— The DSP7 piloted valve is made up of a 4-way hydro-piloted distributor with mounting surface according to ISO 4401-07 (CETOP 07) standards, operated by an ISO 4401-03 (CETOP 03) solenoid directional valve.

— It is available with different spool types (see par. 2), with some options for the opening control.

— It is available with both the solenoid and the hydraulic control from the X and Y ways.

— A version for high pressures (H) is available.

— It is available also with zinc-nickel surface treatments, that ensures a salt spray resistance up to 600 hours.

PERFORMANCES

(obtained with mineral oil of viscosity of 36 cSt at 50°C)

		DSP7	DSP7H
Maximum operating pressure - ports P - A - B - port T (external drainage) - port T (internal drainage)	bar	350 250 210 (DC) / 160 (AC)	420 350 210 (DC) / 160 (AC)
Maximum flow rate from port P to A - B - T	l/min	300	
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass: DSP7-S, RK DSP7-T*, SA*, SB* DSC7	kg	8,6 8,0 6,6	

1 - IDENTIFICATION CODE FOR DSP7 SOLENOID VALVES

D	S	P	7		-		/	20		-			/		/			/		

Directional valve,
Solenoid controlled,
Pilot operated

Size:
ISO 4401-07 (CETOP 07)

Option:
(omit for standard version)
H = high pressure version
pmax = 420 bar

Spool type (see paragraph 2)

S* **TA**
SA* **TB**
SB* **RK**

Series: (the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Piloting (see paragraph 9):
I = internal (not available for spools S2 - S4 - S7 - S8 - TA02 - TB02 RK02 - S*2 - S*4. If internal pilot is required, choose pilot type C)
C = internal piloting with backpressure valve
Z = internal piloting with 30 bar fixes adjustment pressure reducing valve (see paragraph 8)
E = external

Drainage (see paragraph 9):
I = Internal
E = External

Control options (see paragraph 11):
C = Main spool stroke control
D = Main spool switching speed control
P08 = Subplate placed under solenoid valve with restrictor of Ø0.8 on port P
S2 = Distributor delivered with pilot solenoid valve with spool S2

Option:
/ W7 = Zinc-nickel surface treatment (see **NOTE 2**)
Omit if not required

Manual override:
omit for override integrated in the tube (**standard**)
CM = manual override, boot protected (see paragraph 17)

Coil electrical connection (see par. 15):
K1 = plug for connector type DIN 43650 (**standard**)
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available on D12 and D24 coils only)

Power supply (see paragraph 10)

direct current
D12 = 12 V
D24 = 24 V
D48 = 48 V
D110 = 110 V
D220 = 220 V
D00 = valve without coils (see **NOTE 1**)

alternate current
A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A110 = 110 V - 50 Hz / 120 V - 60 Hz
A230 = 230 V - 50 Hz / 240 V - 60 Hz
A00 = valve without coils (see **NOTE 1**)
F110 = 110 V - 60 Hz
F220 = 220 V - 60 Hz

NOTE 1: Coils locking ring and related OR are supplied together with valves.

NOTE 2: The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing on the valve body (both main and pilot) makes the valve suitable to ensure a salt spray resistance up to **240** hours (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

For a salt spray resistance up to **600** hours refer to paragraph 1.1.

1.1 - High corrosion resistance version

This version, available for the basic valve (without option of par. 13) features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600 hours** (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

The coil are DC only and specific for this version, featuring a zinc-nickel surface treatment. The coil for DEUTSCH connector has a diode inside. Electrical features at paragraph 10.2. The boot manual override (CM) is installed as standard in order to protect the solenoid tube.

Follow the identification code below to order it

DSP7....	/			/	CM	/	W7

Choices as in standard identification code

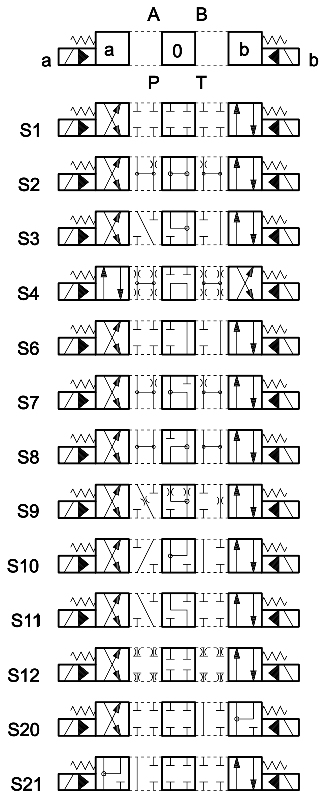
DC power supply
D12 = 12 V **D24** = 24 V

Coil electrical connection (see par. 15)
WK1 = plug for connector type DIN 43650
WK7D = plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S. Coil with diode.

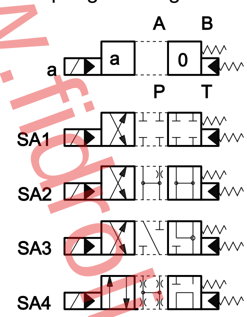
Manual override, boot protected

2 - SPOOL TYPE FOR DSP7

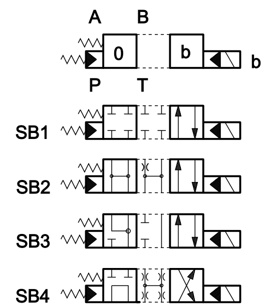
Type **S***:
2 solenoids - 3 positions
with spring centring



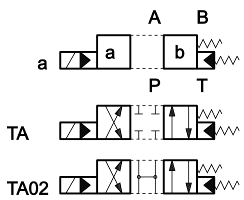
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centring



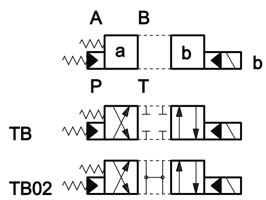
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centring



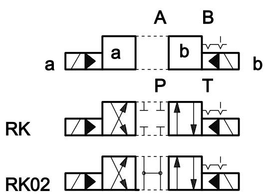
Type **TA**:
1 solenoid side A
2 external positions
with return spring



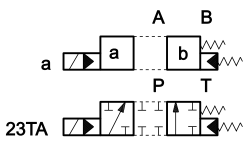
Type **TB**:
1 solenoid side B
2 external positions
with return spring

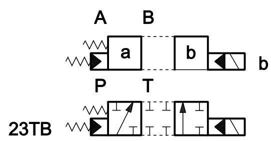


Type **RK**:
2 solenoids - 2 positions
with mechanical retention



Type **23TA / 23TB**
three-way valve - 1 solenoid - 2 external positions, return spring





Besides the diagrams shown, special versions are available: consult our technical dept. for their identification, feasibility and operating limits.

3 - IDENTIFICATION CODE AND SPOOL TYPE FOR DSC7 - HYDRAULIC OPERATED VALVE

D	S	C	7		-		/	10		-	E	E	

Directional valve, hydraulic controlled pilot operated through X and Y ports.

Size: ISO 4401-07 (CETOP 07)

Option: (omit for standard version)
H = high pressure version
pmax = 420 bar

Spool type (see paragraph 2 and below)

S*	**TA**
SA*	**TB**
SB*	**R**

Option:
/ W7 = Zinc-nickel surface treatment (see **NOTE**)
Omit if not required

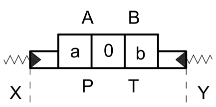
External drain (see par. 9)

External pilot (see par. 9)

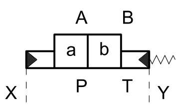
Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Series: (the overall and mounting dimensions remain unchanged from 10 to 19)

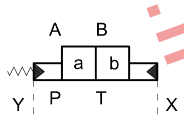
Spool type
The distributor is delivered with short-circuit subplate. The X and Y ports are used for the hydraulic control of the valve.



DSC7-S*



DSC7-TA



DSC7-TB

NOTE : The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing makes the valve suitable to ensure a salt spray resistance up to **600** hours. (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

4 - HYDRAULIC FLUIDS

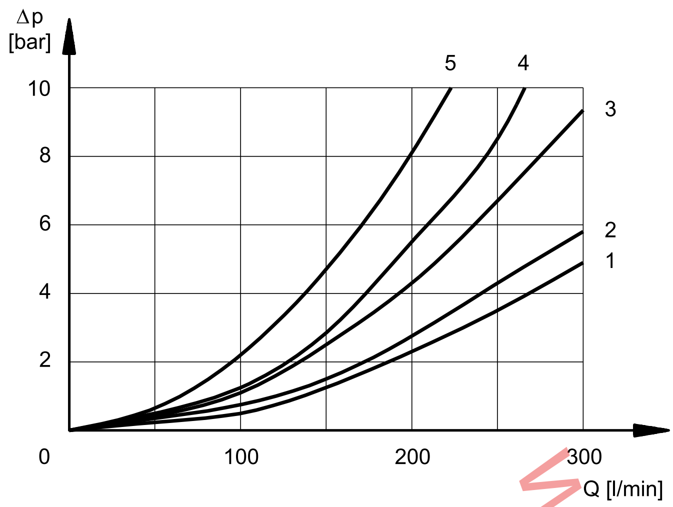
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V).

For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

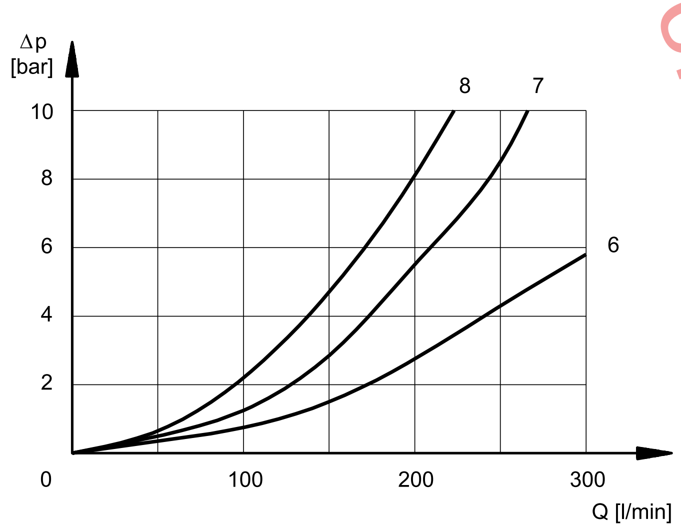
5 - PRESSURE DROPS ΔP-Q

(values obtained with viscosity 36 cSt at 50 °C)



PRESSURE DROPS WITH VALVE ENERGIZED

SPOOL TYPE	FLOW DIRECTION			
	P-A	P-B	A-T	B-T
	CURVES ON GRAPH			
S1, SA1, SB1	1	1	3	4
S2, SA2, SB2	1	1	4	4
S3, SA3, SB3	1	1	4	4
S4, SA4, SB4	2	2	4	5
S6	1	1	3	4
S7	1	1	4	4
S8	1	1	3	4
S9	1	1	3	4
S10	1	1	3	4
S11	1	1	3	4
S12	1	1	3	4
S20	1	1	3	4
S21	1	1	4	4
TA, TB	1	1	3	4
TA02, TB 02	1	1	4	4
RK	1	1	3	4



PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P-A	P-B	A-T	B-T	P-T
	CURVES ON GRAPH				
S2, SA2, SB2					6
S3, SA3, SB3			7	7	
S4, SA4, SB4					7
S6				7	
S7					8
S8					8
S10			7	7	
S11			7		

6 - SWITCHING TIMES

The values indicated refer to a solenoid valve working with piloting pressure of 100 bar, with mineral oil at a temperature of 50°C, at viscosity of 36 cSt and with PA and BT connections. The energizing and de-energizing times are obtained at the pressure variation which occurs on the lines.

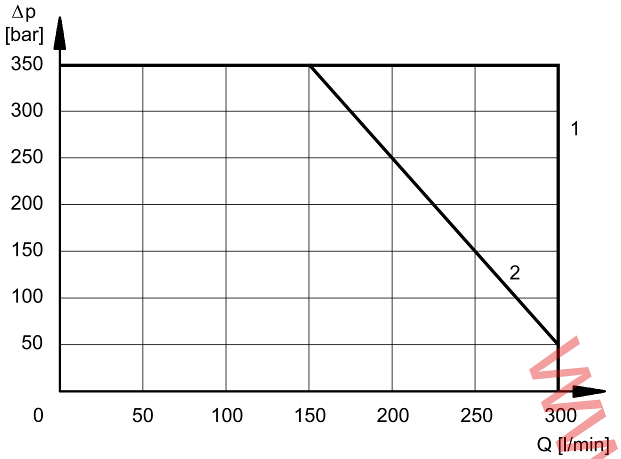
TIMES (± 10%) [ms]	ENERGIZED		DE-ENERGIZED	
	2 Pos.	3 Pos.	2 Pos.	3 Pos.
AC solenoid	45	30	45	30
DC solenoid	75	60	60	45

7 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure for the different spool types.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

The values have been obtained with mineral oil, viscosity 36 cSt at 50 °C, and filtration ISO 4406:1999 class 18/16/13.



SPOOL	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	1	1
S3, SA3, SB3	1	1
S4, SA4, SB4	2	2
S6	1	1
S7	2	2
S8	2	2
S9	1	1
S10	1	1
S11	1	1
S12	1	1
S20	1	1
S21	1	1

SPOOL	CURVE	
	P→A	P→B
TA, TB	1	1
TA02, TB02	1	1
23TA, 23TB	1	1
RK	1	1

8 - PERFORMANCE CHARACTERISTICS

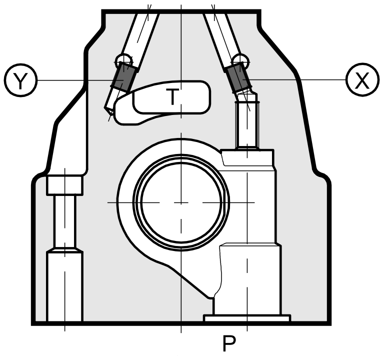
PRESSURES [bar]	DSP7	DSP7H	DSC7	DSC7H
Max pressure in P, A, B ports	350	420	350	420
Max pressure in T line with external drainage	250	350	250	350
Max pressure in T line with internal drainage	210 (DC) 160 (AC)	210 (DC) 160 (AC)	-	-
Max pressure in Y line with external drainage	210 (DC) 160 (AC)	210 (DC) 160 (AC)	-	-
Min piloting pressure **NOTE 1**	5 ÷ 12			
Max piloting pressure **NOTE 2**	210	350	210	420

NOTE 1 minimum piloting pressure can be the lower range value at low flows rates, but with higher flow rates the higher value is needed.

NOTE 2 If the valve operates at higher pressures it is necessary to use the version with external pilot and reduced pressure. Otherwise, the valve can be ordered with internal pilot and pressure reducing valve with 30 bar fixed adjustment (pilot type **Z**, see identification code)

9 - PILOTING AND DRAINAGE

The DSP7 valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.



X: plug M6x8 for external pilot
Y: plug M6x8 for external drain

TYPE OF VALVE		Plug assembly	
		X	Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

9.1 - Backpressure valve incorporated on line P

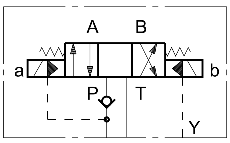
Valves DSP7 are available upon request with backpressure valve incorporated on line P. This is necessary to obtain the piloting pressure when the control valve, in rest position, has the line P connected to the T port (spools S2, S4, S7, S8, S*2, S*4, TA02, TB02, RK02). The cracking pressure is of 5 bar with a minimum flow rate of 15 l/min.

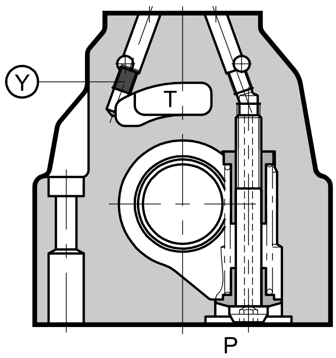
Add **C** to the identification code for this request (see paragraph 1).

In the C version the piloting is always internal.

The backpressure valve can be also delivered separately and it can be easily mounted on line P of the main control valve. Specify the code **0266577** to order the backpressure valve separately.

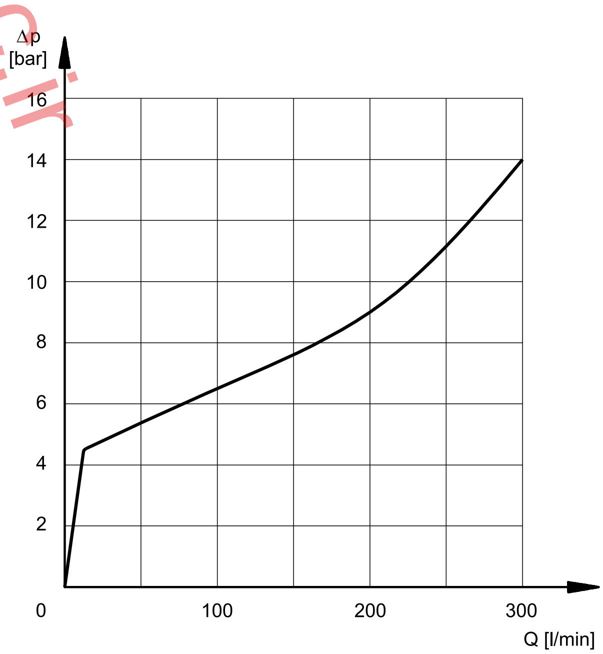
DSP7-C





pilot always internal
Y: plug M6x8 for external drain

NOTE: the backpressure valve can't be used as check valve because it doesn't assure the seal.



The curve refers to the pressure drop (body part only) with backpressure valve energized to which the pressure drop of the reference spool must be added. (see paragraph 5)

10 - ELECTRICAL FEATURES

10.1 Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated 360°, to suit the available space.

NOTE: In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see data sheet 49 000).

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hour
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95/EC
CLASS OF PROTECTION : Coil insulation (VDE 0580) Impregnation: (DC valve) (AC valve)	 class H class F class H

Protection from atmospheric agents IEC EN 60529

Connection	IP 65	IP 67	IP 69 K
K1 DIN 43650	x (*)		
K7 DEUTSCH DT04 male	x	x	x (*)

(*) The protection degree is guaranteed only with the connector correctly connected and installed

10.2 - DC coils

In direct current energizing, current consumption stays at fairly constant values, essentially determined by Ohm's law: V = R x I.

The WK1 and WK7D are coils specific for the high corrosion resistance version of the valve.

The WK7D coil includes a suppressor diode of pulses for protection from voltage peaks during switching. During the switching the diode significantly reduces the energy released by the winding, by limiting the voltage to 31.4V in the D12 coil and to 58.9 V in the D24 coil.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 48V voltage) with alternating current (50 or 60 Hz), considering a reduction of the operating limits by approximately 5 ÷ 10%.

The table shows current and power consumption values for DC coils.

(values ±10%)

	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumption [A]	Power consumption [W]	Coil code			
					K1	WK1	K7	WK7D
D12	12	4,4	2,72	32,7	1903080	1903050	1902940	1903400
D24	24	18,6	1,29	31	1903081	1903051	1902941	1903401
D48	48	78,6	0,61	29,5	1903083			
D110	110	436	0,26	28,2	1903464			
D220	220	1758	0,13	28,2	1903465			

10.3 - AC coils

The table shows current and power consumption values at inrush and at holding, relevant to the different coil types for AC current.

Coils for alternating current (values ± 5%)

Suffix	Nominal Voltage [V]	Freq. [Hz]	Resistance at 20°C [Ohm] (±1%)	Current consumption at inrush [A] (±5%)	Current consumption at holding [A] (±5%)	Power consumption at inrush (±5%) [VA]	Power consumption at holding (±5%) [VA]	Coil Code
A24	24	50	1,46	8	2	192	48	1902830
A48	48		5,84	4,4	1,1	204	51	1902831
A110	110V-50Hz 120V-60Hz	50/60	32	1,84	0,46	192	48	1902832
				1,56	0,39	188	47	
A230	230V-50Hz 240V-60Hz		140	0,76	0,19	176	44	1902833
				0,6	0,15	144	36	
F110	110	60	26	1,6	0,4	176	44	1902834
F220	220		106	0,8	0,2	180	45	1902835

11 - OPTIONS

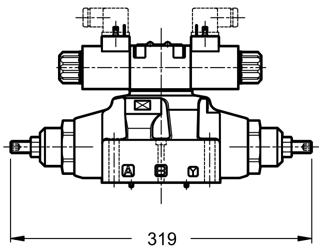
11.1 - Control of the main spool stroke: C

With the help of special side plugs, it is possible to introduce stroke controls in the heads of the piloted valve so as to vary the maximum spool clearance opening.

This solution allows control of the flow rate from the pump to the actuator and from the actuator to the outlet, obtaining a double adjustable control on the actuator.

Add the letter **C** to the identification code to request this device (see paragraph 1).

DSP7-S*/C

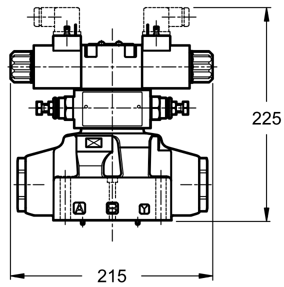


11.2 - Control of the main spool shifting speed: D

By placing a MERS type double flow control valve between the pilot solenoid valve and the main distributor, the piloted flow rate can be controlled and therefore the changeover smoothness can be varied.

Add the letter **D** to the identification code to request this device (see paragraph 1).

DSP7-S*/D

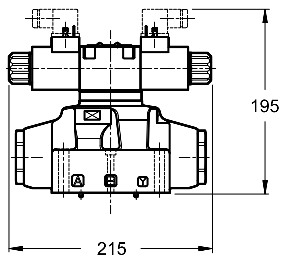


11.3 - Subplate with throttle on line P

It is possible to introduce a subplate with a restrictor of Ø0,8 on line P between the pilot solenoid valve and the main distributor.

Add **P08** to the identification code to request this option (see paragraph 1).

DSP7-S*/P08



11.4 - Solenoid operated distributor with pilot valve in configuration S2

It is possible to deliver the solenoid operated distributor with pilot valve in configuration S2 (all the ports at outlet). With this option the piloting is necessarily external.

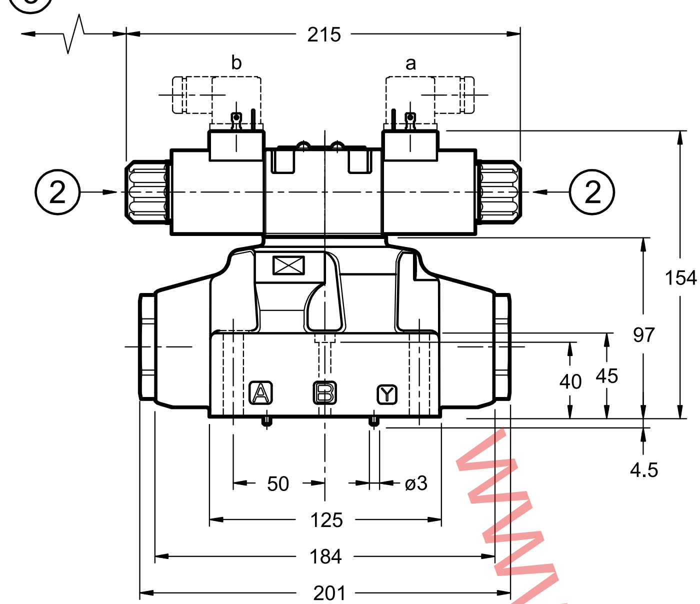
Add **S2** to the identification code to request this option (see paragraph 1).

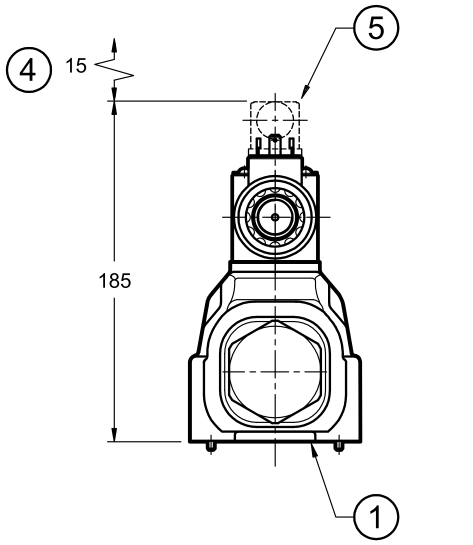
This configuration is used with external piloting in order to allow the unloading of the piloting line when the solenoid operated valve is in rest position.

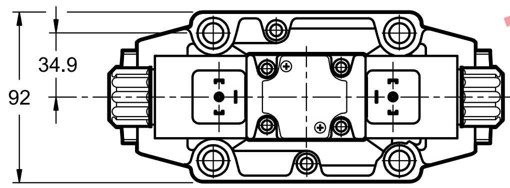
12 - DSP7 OVERALL AND MOUNTING DIMENSIONS FOR SOLENOID DISTRIBUTOR

dimensions in mm

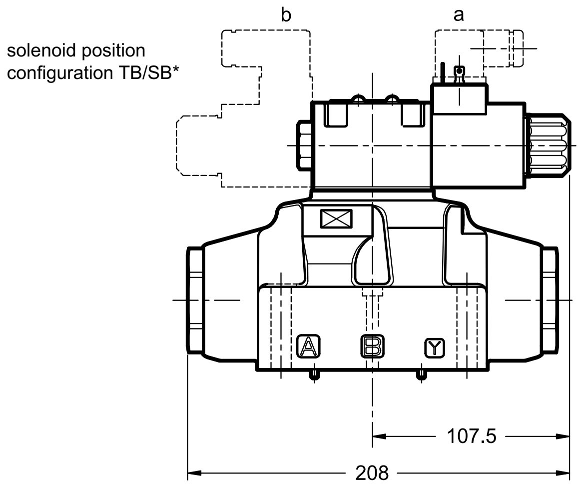
DSP7-S
DSP7-RK



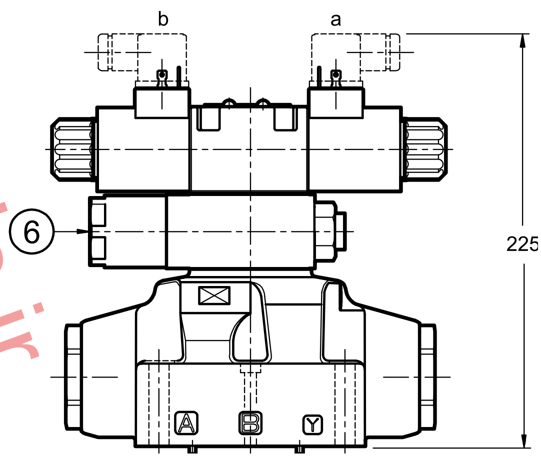




DSP7-TA
DSP7-SA*



DSP7-*/20*-Z*



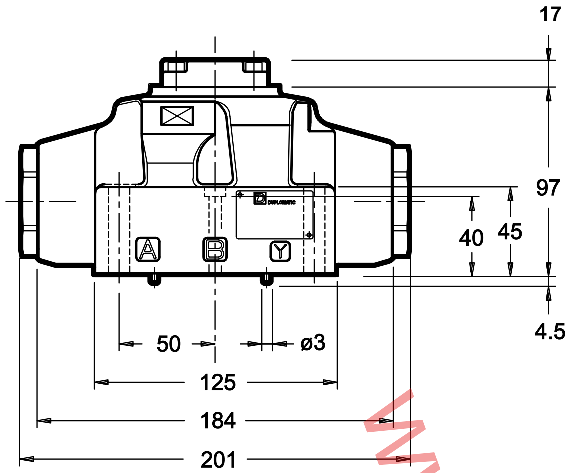
NOTE: Use of fastening screws class A10.9 is recommended for valves in version **H** (high pressure)

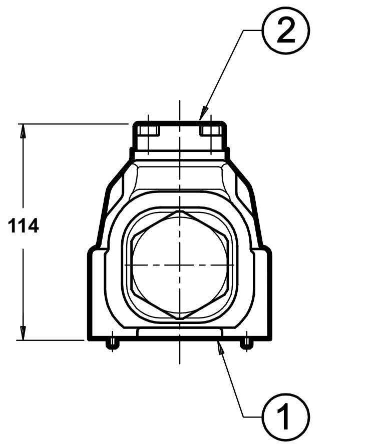
Fastening of single valve:	4 SHC screws ISO 4762 M10x60 2 SHC screws ISO 4762 M6x50
Tightening torque:	M10x60: 40 Nm (A8.8) - 57 Nm (A10.9) M6x50: 8 Nm (A8.8) - 12 Nm (A10.9)
Threads of mounting holes: M6x12; M10x18	

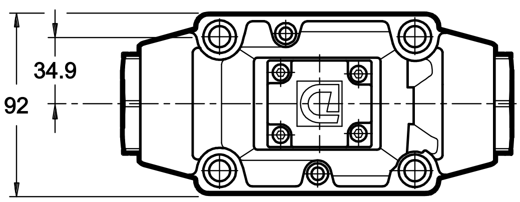
1	Mounting surface with sealing rings 4 OR type 130 (22.22X2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Manual override
3	Coil removal space
4	Connector removal space
5	Electric connector to be ordered separately (see cat. 49 000)
6	Reducing valve with fixed adjustment 30 bar

13 - DSC7 OVERALL AND MOUNTING DIMENSIONS FOR HYDRAULIC DISTRIBUTOR DSC7

dimensions in mm







NOTE: Use of fastening screws class A10.9 is recommended for valves in version **H** (high pressure)

Fastening of single valve:	4 SHC screws ISO 4762 M10x60 2 SHC screws ISO 4762 M6x50
Tightening torque:	M10x60: 40 Nm (A8.8) - 57 Nm (A10.9) M6x50: 8 Nm (A8.8) - 12 Nm (A10.9)
Threads of mounting holes: M6x12; M10x18	

1	Mounting surface with sealing rings: 4 OR type 130 (22.22X2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Short-circuit subplate

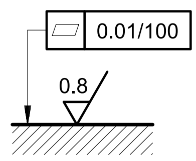
14 - INSTALLATION

Configurations with centring and recall springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

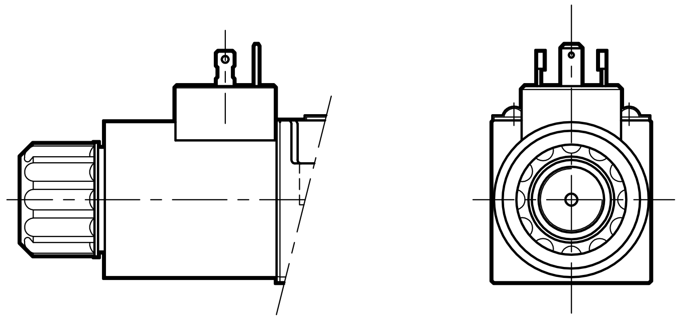
NOTE: Use of fastening screws class 10.9 is recommended for valves in version **H** (high pressure).

Surface quality

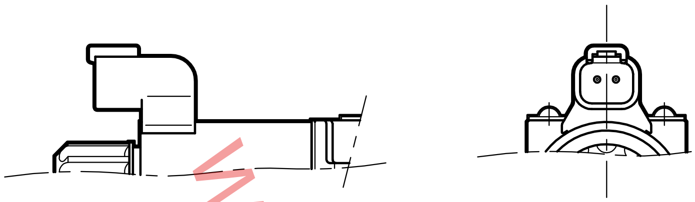


15 - ELECTRIC CONNECTIONS

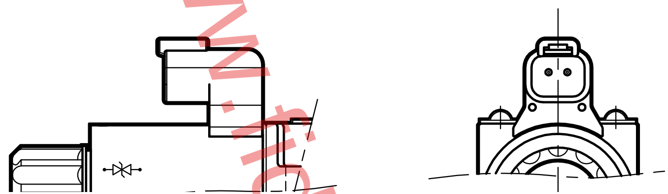
connection for DIN 43650 connector
code **K1** (**standard**)
code **WK1** (W7 version only)



connection for DEUTSCH DT06-2S male connector type
code **K7**



connection for DEUTSCH DT06-2S male connector - coil with diode
code **WK7D** (W7 version only)



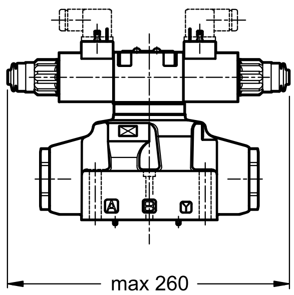
16 - ELECTRIC CONNECTORS

The valves are delivered without connectors. Connectors for K1/ WK1 connections (DIN 43650) can be ordered separately. See catalogue 49 000.

17 - MANUAL OVERRIDE

Whenever the solenoid valve installation may involve exposure to atmospheric agents or use in tropical climates, the manual override, boot protection is recommended.

Add the suffix **CM** to request this device (see paragraph 1).



18 - SUBPLATES

(see catalogue 51 000)

These plates are not suitable for high pressure valves DSP7H.

Type with rear ports	PME07-AI6G
Type with side ports	PME07-AL6G
P, T, A, B, port dimensions X, Y; L port dimensions	1" BSP 1/4" BSP

DUPLOMATIC OLEODINAMICA

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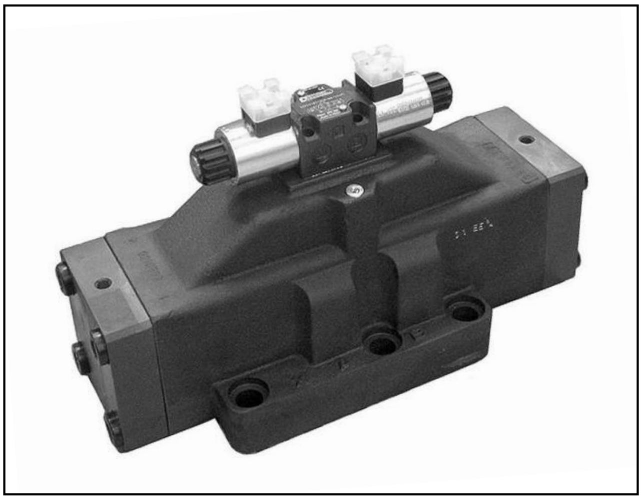
DSP10

PILOT OPERATED DISTRIBUTOR SOLENOID OR HYDRAULIC (DSC10) CONTROLLED

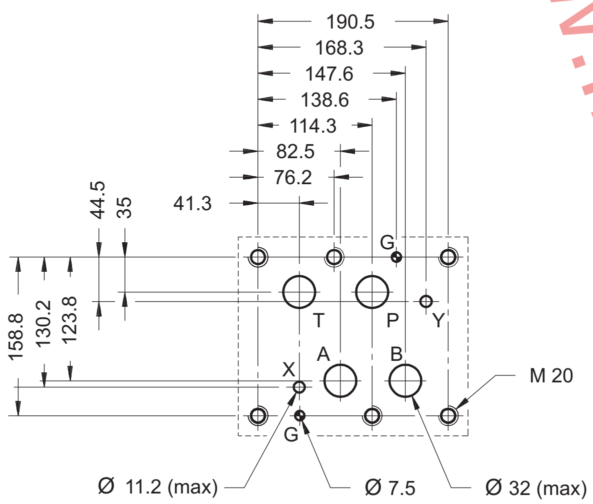


SUBPLATE MOUNTING
ISO 4401-10 (CETOP 10)

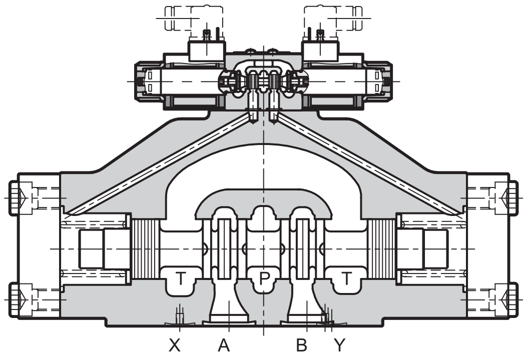
p max **350** bar
Q max **1100** l/min

MOUNTING INTERFACE

ISO 4401-10-09-0-05
(CETOP 4.2-4-10-350)



OPERATING PRINCIPLE



— The DSP10 piloted valve is a 4-way hydropiloted distributor with a connection surface in accordance with the ISO 4401-10 (CETOP RP121H) standards, operated by a ISO 4401-03 (CETOP 03) solenoid directional valve.

— It is available with different spool types (see par. 2) and with some options for the opening control.

— It is available with both the solenoid and the hydraulic control from the X and Y ways.

— The piloting and the drainage can be made inside or outside the valve by inserting or removing the proper threaded plugs located in the main directional control valve (see paragraph 9).

PERFORMANCES

(obtained with mineral oil of viscosity of 36 cSt at 50°C)

Maximum operating pressure - ports P - A - B (**standard** version) - port T (external drainage)	bar	350 210
Maximum flow rate from port P to A - B - T	l/min	1100
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: DSP10 DSC10	kg	50 48

1 - IDENTIFICATION CODE FOR SOLENOID DISTRIBUTOR DSP10

D	S	P	10	-		/	20		-			/		/		K1	/	

Solenoid operated directional valve

ISO 4401-10 (CETOP 10) size

Spool type (see paragraph 2)

S* **TA**
SA* **TB**
SB* **RK***

Series: (the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Piloting (see paragraph 9):
I = internal (not available for spools S2 - S4 - TA02 - TB02 - RK02 S*2 - S*4)
E = external
Z = internal piloting with 30 bar fixes adjustment pressure reducing valve

Drainage (see paragraph 9):
I = Internal
E = External

Controls (see paragraph 13):
C = Main spool stroke control
D = Main spool switching speed control
P15 = Subplate placed under solenoid valve with restrictor of Ø1.5 on port P

Manual override:
omit for override integrated in the tube (**standard**)
CM = manual override, boot protected (see paragraph 17)

Coil electrical connection: plug for connector type DIN 43650

Power supply (see paragraph 10)
direct current
D12 = 12 V
D24 = 24 V
D48 = 48 V
D110 = 110 V
D220 = 220 V
D00 = valve without coils (see **NOTE 1**)

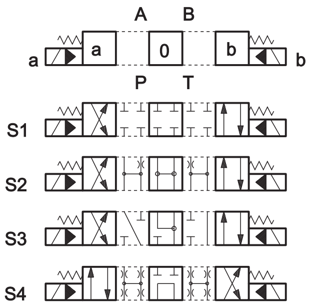
alternate current
A24 = 24 V - 50 Hz
A48 = 48 V - 50 Hz
A110 = 110 V - 50 Hz / 120 V - 60 Hz
A230 = 230 V - 50 Hz / 240 V - 60 Hz
A00 = valve without coils (see **NOTE 1**)
F110 = 110 V - 60 Hz
F220 = 220 V - 60 Hz

NOTE: The locking rings of the coils and the relevant O-Rings are supplied together with valves

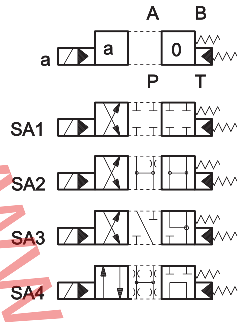
2 - SPOOL TYPE

NOTE: Symbols refers to the **DSP10** solenoid valve. For the **DSC10** hydraulic control version, please verify the connection scheme (see par. 3).

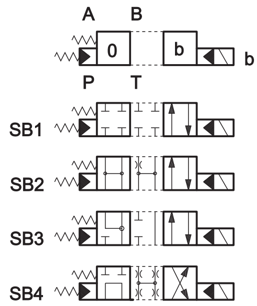
Type **S***:
2 solenoids - 3 positions
with spring centering



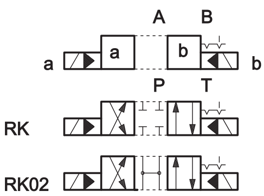
Type **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering



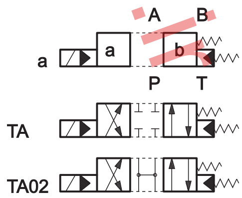
Type **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



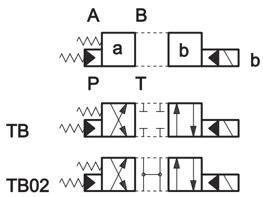
Type **RK**:
2 solenoids - 2 positions
with mechanical retention



Type **TA**:
1 solenoid side A
2 external positions
with return spring

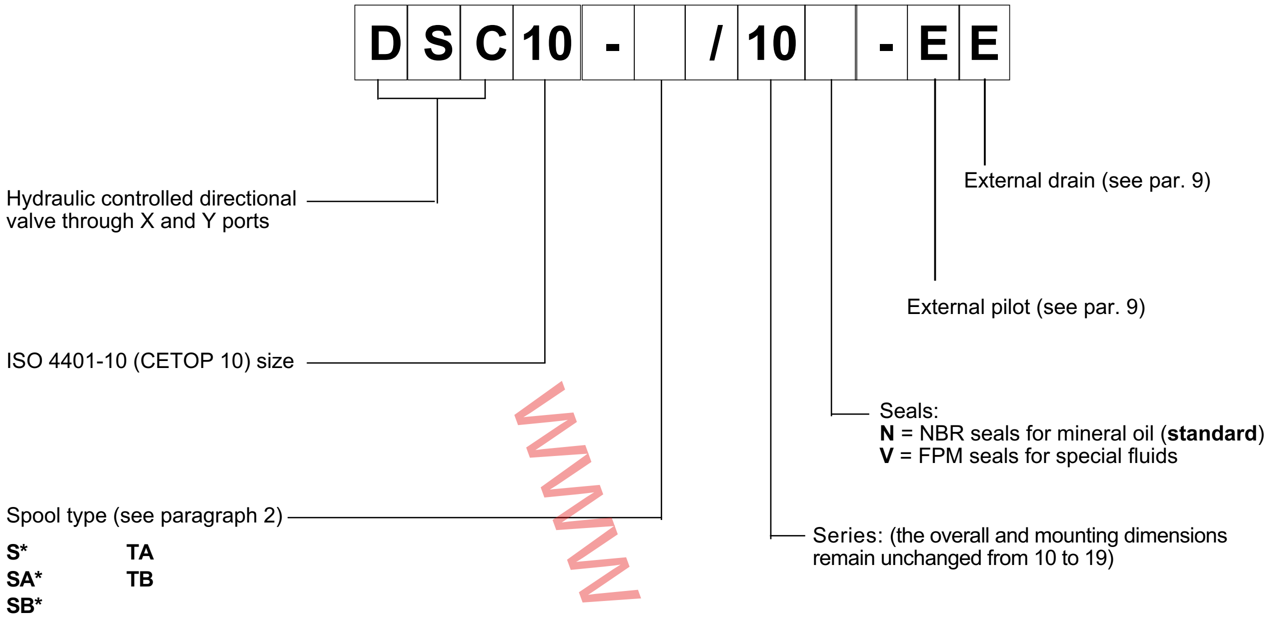


Type **TB**:
1 solenoid side B
2 external positions
with return spring



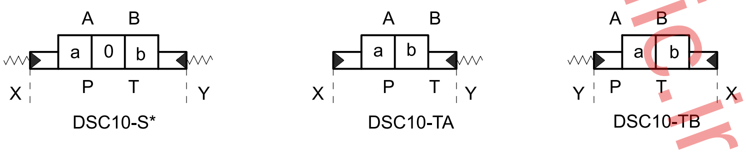
If other spool types are necessary please consult our Technical Department

3 - IDENTIFICATION CODE FOR HYDRAULIC DISTRIBUTOR DSC10



Spool type

The distributor is delivered with short-circuit subplate. The X and Y ports are used for the hydraulic control of the valve.



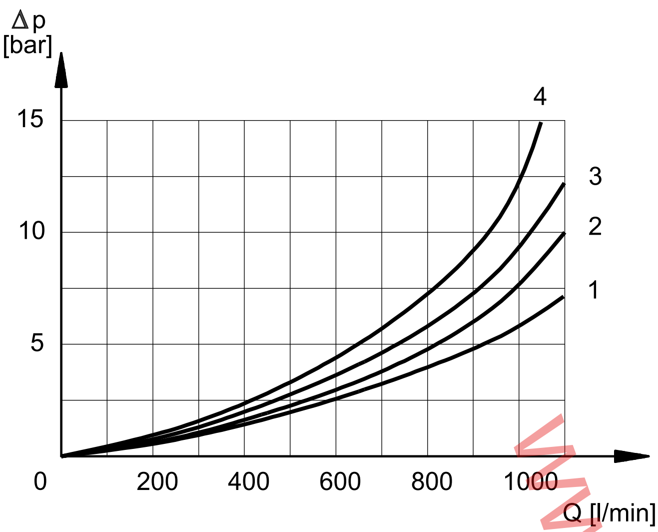
4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code V). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

5 - PRESSURE DROPS ΔP-Q

(values obtained with viscosity 36 cSt at 50 °C)



PRESSURE DROPS WITH VALVE ENERGIZED

SPOOL TYPE	FLOW DIRECTION			
	P-A	P-B	A-T	B-T
	CURVES ON GRAPH			
S1, SA1, SB1	1	1	1	1
S2, SA2, SB2	2	2	2	2
S3, SA3, SB3	1	1	4	4
S4, SA4, SB4	2	2	2	2
TA, TB	1	1	1	1
TA02, TB 02	1	1	1	1
RK	1	1	1	1

PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P-A	P-B	A-T	B-T	P-T
	CURVES ON GRAPH				
S2, SA2, SB2					3
S3, SA3, SB3			4	4	
S4, SA4, SB4					4

6 - SWITCHING TIMES

The values indicated refer to a solenoid valve working with piloting pressure of 100 bar, with mineral oil at a temperature of 50°C, at viscosity of 36 cSt and with PA and BT connections.

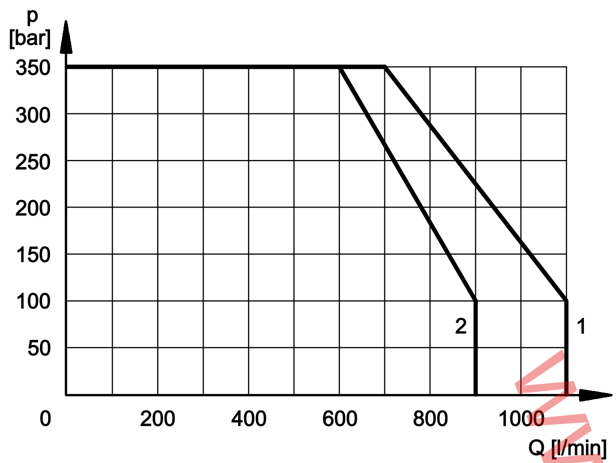
The energizing and de-energizing times are obtained at the pressure variation which occurs on the lines.

TIMES (± 10%) [ms]	ENERGIZED		DE-ENERGIZED	
	2 Pos.	3 Pos.	2 Pos.	3 Pos.
AC solenoid	90	60	90	60
DC solenoid	130	100	90	60

7 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406.1999 class 18/16/13.



SPOOL TYPE	CURVE	
	P-A	P-B
S1,SA1,SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	1	1
S4, SA4, SB4	2	2
TA, TB	1	1
TA02, TB02	1	1
TA23, TB23	1	1
RK	1	1

8 - PERFORMANCE CHARACTERISTICS

PRESSURES [bar]	**DSP10**
Max pressure in P, A, B ports	350
Max pressure in T line with external drainage	250
Max pressure in T line with internal drainage	210 (DC) / 160 (AC)
Max pressure in Y line with external drainage	210 (DC) / 160 (AC)
Min piloting pressure **NOTE 1**	6 ÷ 12
Max piloting pressure **NOTE 2**	280

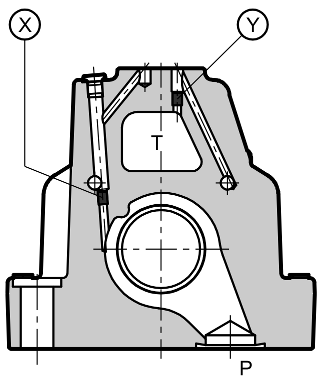
NOTE 1 minimum piloting pressure can be the lower range value at low flows rates, but with higher flow rates the higher value is needed.

NOTE 2 If the valve operates at higher pressures it is necessary to use the version with external piloting and reduced pressure.

Otherwise, the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered (Piloting type **Z**, see dimensions at par. 11)

9 - PILOTING AND DRAINAGE

These valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.



X: plug M6x8 for external pilot
Y: plug M6x8 for external drain

	TYPE OF VALVE	Plug assembly	
		X	Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

10 - ELECTRICAL FEATURES

10.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated 360°, to suit the available space.

NOTE 1: In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see CAT. 49 000).

NOTE 2: The IP65 protection degree is guaranteed only with the connector correctly connected and installed.

VOLTAGE SUPPLY FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	6.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE 1)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95/EC
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529) Coil insulation (VDE 0580) Impregnation: DC valve AC valve	 IP 65 (**NOTE 2**) class H class F class H

10.2 - Current and absorbed power for DC solenoid valve

The table shows current and power consumption values of the DC coils.

Using connectors type "D" (see cat. 49 000) with embedded bridge rectifier it is possible to feed DC coils (starting from 48V voltage) with alternating current (50 or 60 Hz), considering a reduction of the operating limits by 5 ÷ 10% approx.

(values ± 10%)

	Resistance at 20°C [Ω]	Current consumption [A]	Power consumption [W]	Coil code K1
D12	4,4	2,72	32,7	1903080
D24	18,6	1,29	31	1903081
D48	78,6	0,61	29,5	1903083
D110	436	0,26	28,2	1903464
D220	1758	0,13	28,2	1903465

10.3 - Current and absorbed power for AC solenoid valve

The table shows current and power consumption values at inrush and at holding, relevant to the different coil types for AC current.

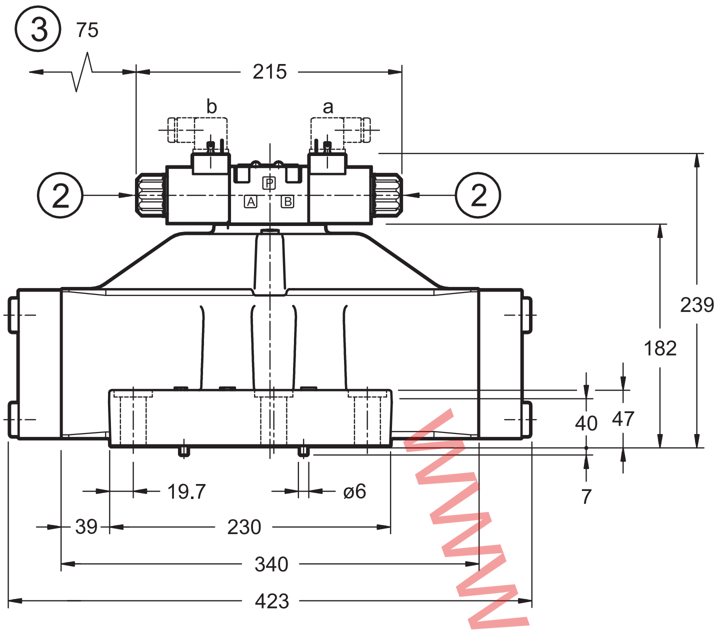
(values ± 5%)

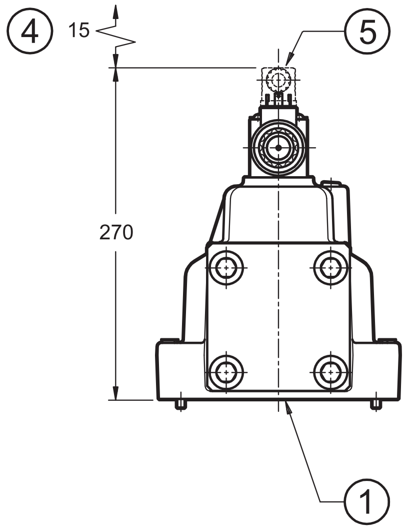
Suffix	Nominal Voltage [V]	Freq. [Hz]	Resistance at 20°C [Ohm]	Current consumption at inrush [A]	Current consumption at holding [A]	Power consumption at inrush [VA]	Power consumption at holding [VA]	Coil Code
A24	24	50	1,46	8	2	192	48	1902830
A48	48		5,84	4,4	1,1	204	51	1902831
A110	110V-50Hz 120V-60Hz	50/60	32	1,84	0,46	192	48	1902832
				1,56	0,39	188	47	
A230	230V-50Hz 240V-60Hz		140	0,76	0,19	176	44	1902833
				0,6	0,15	144	36	
F110	110	60	26	1,6	0,4	176	44	1902834
F220	220		106	0,8	0,2	180	45	1902835

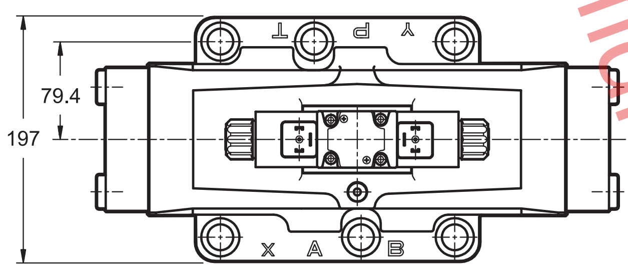
11 - OVERALL AND MOUNTING DIMENSIONS FOR DSP10

dimensions in mm

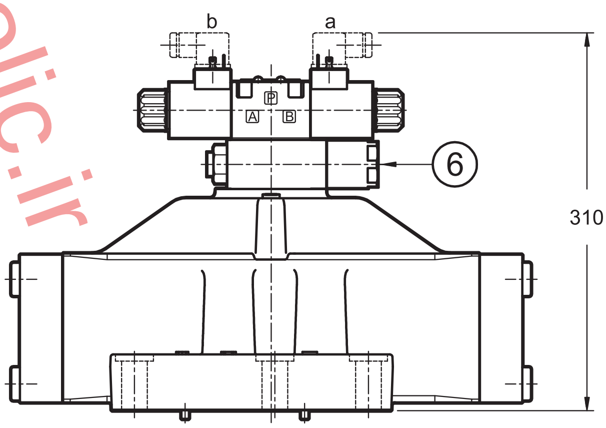
DSP10-S DSP10-RK



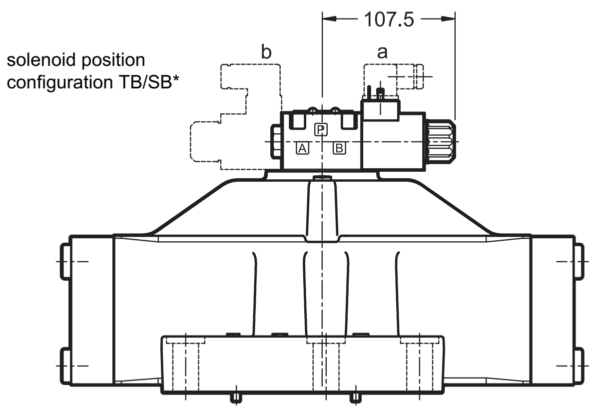




DSP10-*/20*- Z



DSP10-TA DSP10-SA*

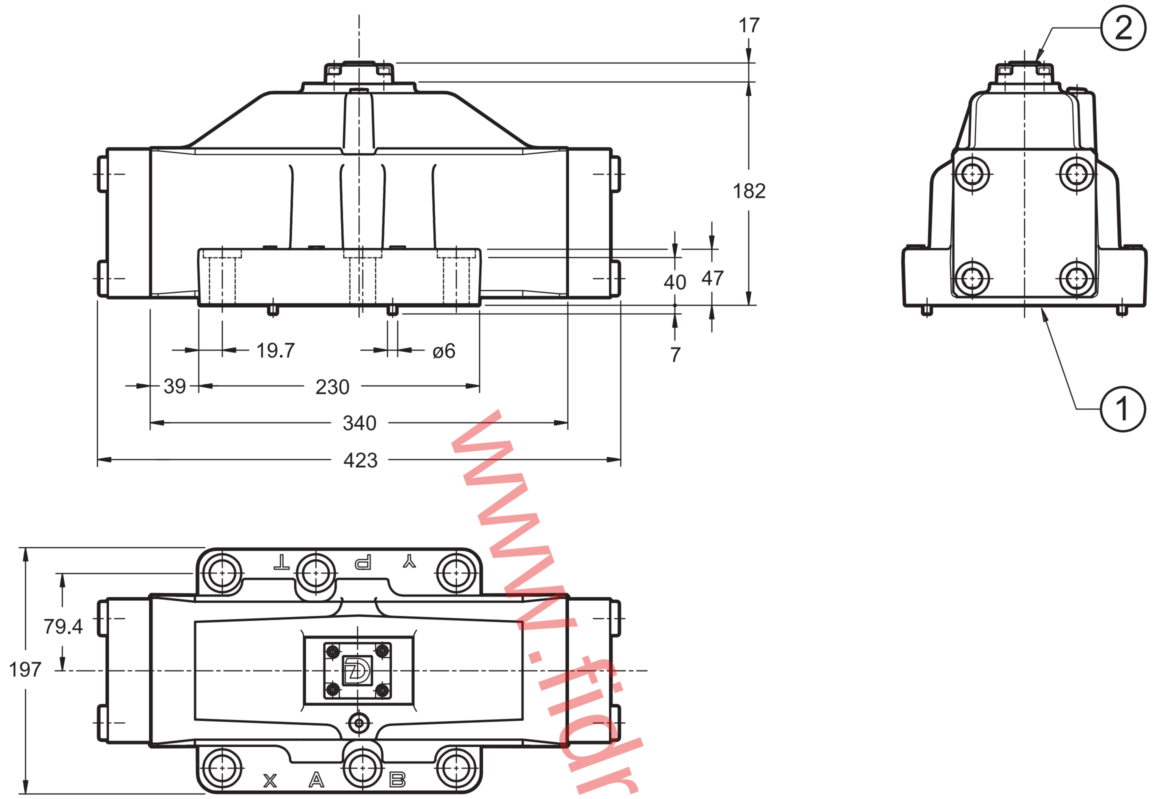


Fastening of single valve:	4 SHC screws ISO 4762 M20x70
Tightening torque:	330 Nm (A 8.8) - 560 Nm (bolt A10.9)
Threads of mounting holes: M20x40	

1	Mounting surface with sealing rings 4 OR type 4150 - 90 shore (37.59 x 3.53) 2 OR type 3081 - 90 shore (20.24 x 2.62)
2	Manual override
3	Coil removal space
4	Connector removal space
5	Electric connector to be ordered separately (see cat. 49 000)
6	Reducing valve with fixed adjustment 30 bar

12 - OVERALL AND MOUNTING DIMENSIONS FOR DSC10

dimensions in mm



Fastening of single valve:	4 SHC screws ISO 4762 M20x70
Tightening torque:	330 Nm (A 8.8) - 560 Nm (bolt A10.9)
Threads of mounting holes: M20x40	

1	Mounting surface with sealing rings 4 OR type 4150 - 90 shore (37.59 x 3.53) 2 OR type 3081 - 90 shore (20.24 x 2.62)
2	Short-circuit subplate

13 - OPTIONS

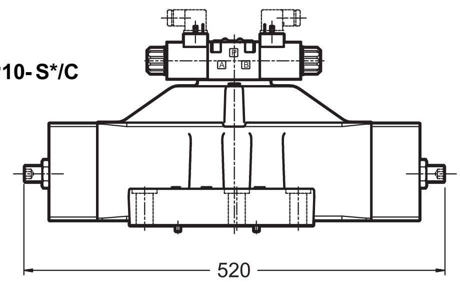
13.1 - Control of the main spool stroke: C

With the help of special side plugs, it is possible to introduce stroke controls in the heads of the piloted valve so as to vary the maximum spool clearance opening.

This solution allows control of the flow rate from the pump to the actuator and from the actuator to the outlet, obtaining a double adjustable control on the actuator.

Add the letter **C** to the identification code to request this device (see paragraph 1).

DSP10- S*/C

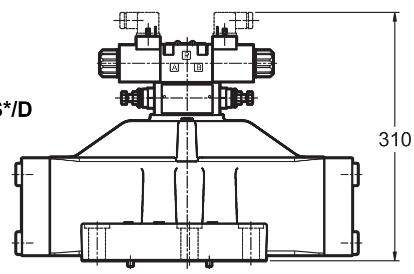


13.2 - Control of the main spool shifting speed: D

By placing a MERS type double flow control valve between the pilot solenoid valve and the main distributor, the piloted flow rate can be controlled and therefore the changeover smoothness can be varied.

Add the letter **D** to the identification code to request this device (see paragraph 1).

DSP10- S*/D

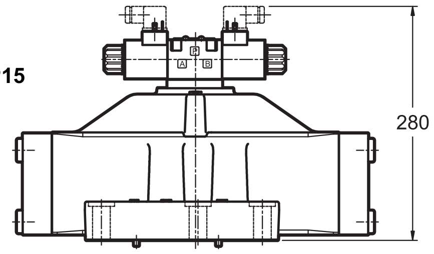


13.3 - Subplate with throttle on line P

It is possible to introduce a subplate with a restrictor of Ø1,5 on line P between the pilot solenoid valve and the main distributor.

Add **P15** to the identification code to request this option (see paragraph 1).

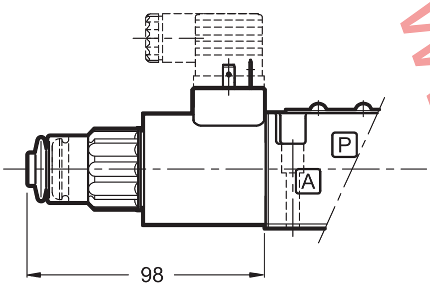
DSP10-S*/P15



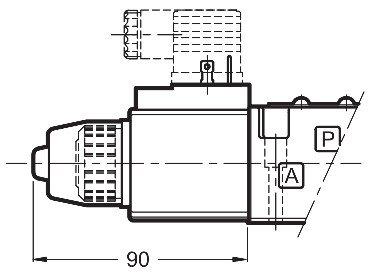
14 - MANUAL OVERRIDE, BOOT PROTECTED: CM

Whenever the solenoid valve installation may involve exposure to atmospheric agents or use in tropical climates, the manual override, boot protection is recommended. Add /**CM** at the end of the identification code to request this device (see paragraph 1).

CC valve



CA valve



15 - ELECTRIC CONNECTORS

The valves are delivered without connector. Connectors for K1 connections (DIN 43650) can be ordered separately. See catalogue 49 000.

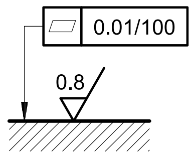
16 - INSTALLATION

Configurations with centering and recall springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

Surface quality



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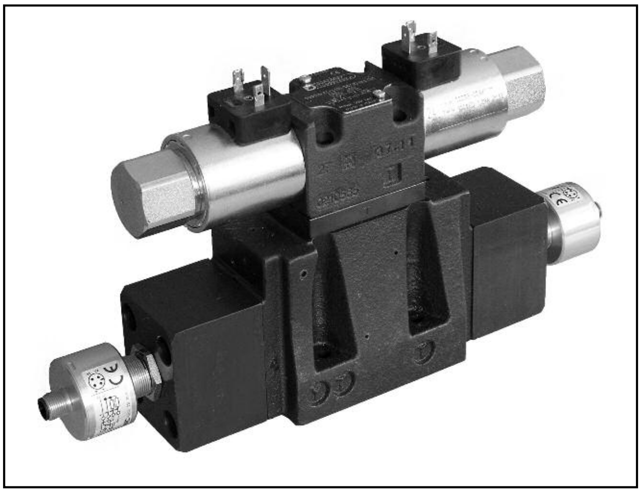
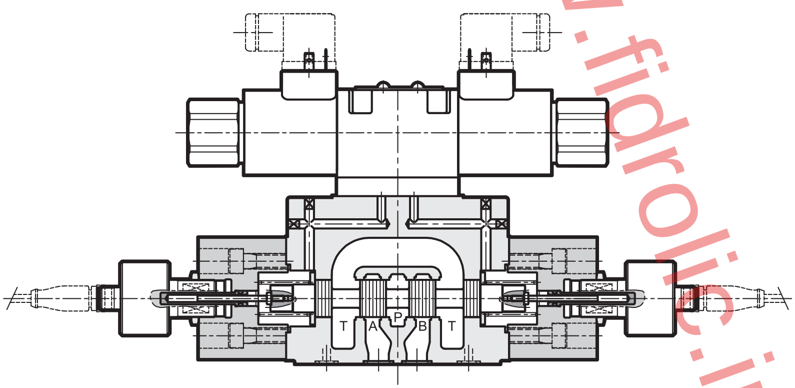


DS(P)*M

DIRECTIONAL VALVES WITH SPOOL POSITION MONITORING

DS3M	**ISO 4401-03**
DS5M	**ISO 4401-05**
DSP5RM	**ISO 4401-05**
DSP5M	**CETOP P05**
DSP7M	**ISO 4401-07**
DSP8M	**ISO 4401-08**
DSP10M	**ISO 4401-10**

OPERATING PRINCIPLE



— These solenoid operated directional valves are equipped with position sensors that monitor the main spool position. The switching position is indicated by a binary signal.

— TÜV certification body certifies the compliance of DS(P)*M valves with the EC safety standards ISO 4413:2012, UNI EN 12622:2014, UNI EN 693:2001 +A2:2001, UNI EN 201:2010 and UNI EN 422:2009 with certificate TÜV IT 14 MAC 0043 .

— The valves are available in direct current versions only (see paragraph 8).

— These valves do not have manual override and can not be disassembled, because of their characteristics and their possible use on machinery subject to safety requirements. Moreover, their components are not interchangeable. Read the *Use and Maintenance manual* for instructions on operation, safe use and repair of the product

PERFORMANCES
(working with mineral oil of viscosity of 36 cSt at 50°C)

		DS3M	DS5M	DSP5M DSP5RM	DSP7M	DSP8M	DSP10M
Maximum operating pressure: P - A - B ports	bar	350	320	320	350	350	350
T port	bar	210		see performance limits at paragraph 5.5			
Maximum flow rate from P to A - B - T	l/min	80	120	150	300	600	1100
Ambient temperature range	°C	-20 / +50					
Fluid temperature range	°C	-20 / +80					
Fluid viscosity range	cSt	10 ÷ 400					
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15					
Recommended viscosity	cSt	25					
Mass: single solenoid valve	kg	1,8	5	7,1	8,7	15,6	50
double solenoid valve	kg	2,2	-	8	9,6	16,6	50.5

MACHINE DIRECTIVE CERTIFICATION

All solenoid valves and solenoid operated valves of the DS(P)*M family were tested on a voluntary basis by TÜV and found to comply with the applicable requirements of the following standards:

- UNI EN ISO 4413:2012 - Hydraulic fluid power – General rules and safety requirements for systems and their components
- UNI EN 12622:2014 - Safety of machine tools - Hydraulic press brakes
- UNI EN 693:2001+A2:2011 - Machine tools – Safety – Hydraulic presses
- UNI EN 201:2010 - Plastics and rubber machines - Injection moulding machines - Safety requirements
- UNI EN 422:2009 - Rubber and Plastic machines – Safety requirements

1 - IDENTIFICATION OF SOLENOID VALVES DIRECT OPERATED

1.1 - Identification code

D	S		M	-		/			-		K1	/	

Directional control valve solenoid operated

3 = ISO 4401-03 size
5 = ISO 4401-05 size

Monitoring of the spool position

Spool type (see par. 1.2)

S1	**SA1**	**SB1**	**TA**	**TB**
S3			**TA02**	**TB02**
S4	**SA4**	**SB4**	**TA100**	**TB100**

Series No.
20 = for DS5M
21 = for DS3M
(the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Monitored position:
(see par. 16 for switching logic)
R0 = monitored rest position
MA = monitored position 'a'
MB = monitored position 'b'

Coil electrical connection:
plug for connector type
DIN 43650 (**standard**)

DC power supply
D12 = 12 V
D24 = 24 V
D110 = 110 V
D220 = 220 V

NOTE: To be compliant with the EN 693:2011 standard, the valves have no manual override.

NOTE: Verify spool and sensor type availability in the tables below

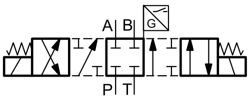
DS3		SPOOLS				
		S*	**SA***	**SB***	**TA TA100**	**TB TB100**
SENSOR TYPE	**R0**	x				
	MA		x	x	x	x
	MB		x	x	x	x

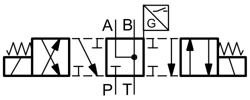
DS5		SPOOLS					
		S*	**SA***	**SB***	**TA TA100**	**TA02 TB02**	**TB TB100**
SENSOR TYPE	**R0**	x					
	MA		x	x	x	x	x
	MB		x	x	x	x	x

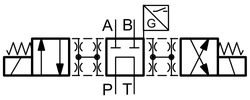
1.2 - Spool types for DS3M and DS5M

Type **S***:
2 solenoids - 3 positions
with spring centering

Sensor **RO**

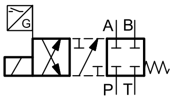
S1


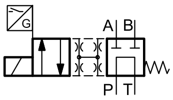
S3


S4


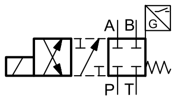
Type **SA***:
1 solenoid side A
2 positions (central + external) with spring centering

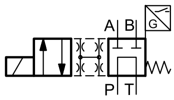
Sensor **MA**

SA1


SA4


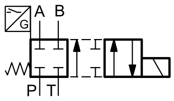
Sensor **MB**

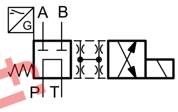
SA1


SA4


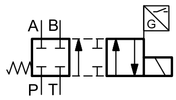
Type **SB***:
1 solenoid side B
2 positions (central + external) with spring centering

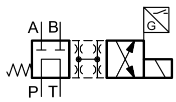
Sensor **MA**

SB1


SB4


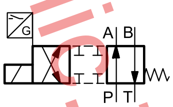
Sensor **MB**

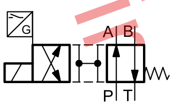
SB1


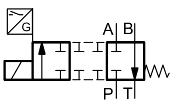
SB4


Type **TA**:
1 solenoid side A
2 external positions with return spring

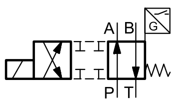
Sensor **MA**

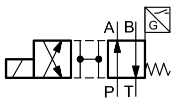
TA


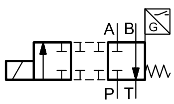
TA02


TA100


Sensor **MB**

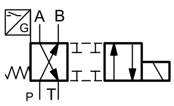
TA


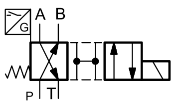
TA02


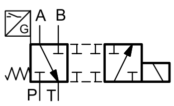
TA100


Type **TB**:
1 solenoid side B
2 external positions with return spring

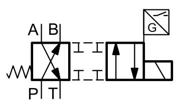
Sensor **MA**

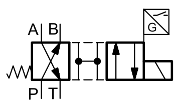
TB


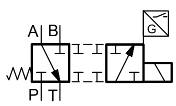
TB02


TB100


Sensor **MB**

TB


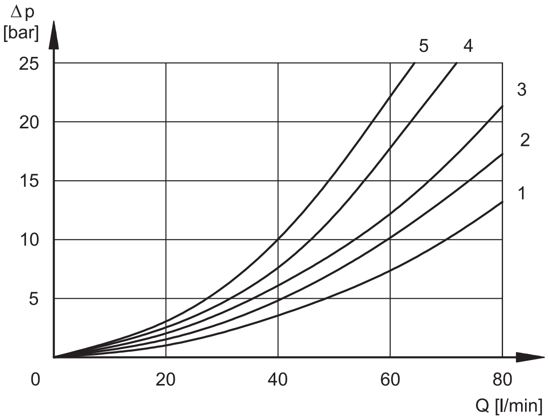
TB02


TB100


2 - CHARACTERISTIC CURVES OF DIRECT OPERATED SOLENOID VALVES

(obtained with viscosity 36 cSt at 50 °C)

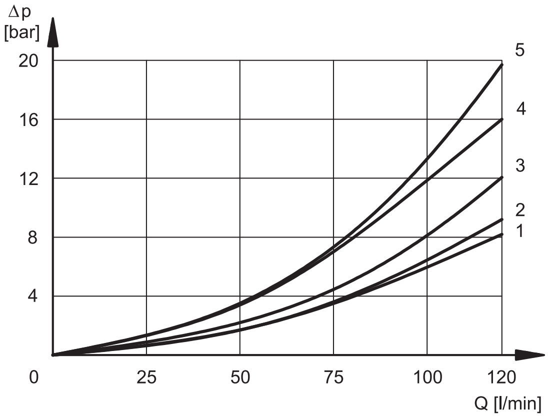
2.1 - DS3M - Pressure drops Δp-Q



SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S1, SA1; SB1	2	2	3	3	-
S3	3	3	1	1	-
S4, SA4	5	5	5	5	3
TA, TB	2	2	2	2	-
TA100, TB100	4	4	4	4	-

For S3 in central position B→T refer to curve 3.

2.2 - DS5M - Pressure drops Δp-Q



SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S1, SA1, SB1	2	2	1	1	
S3	2	1	2	3	
S4, SA4, SB4	1	1	2	2	4
TA, TB, TA02, TB02	3	3	2	2	-
TA100, TB100	2	2	2	2	-

For S3 in central position B→T refer to curve 5.

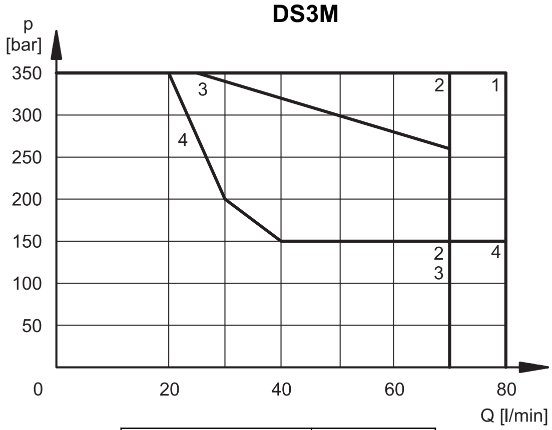
2.3 - Performance limits for DS3M and DS5M solenoid valves

The curves define the flow rate operating fields according to the valve pressure of the different versions.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The values have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

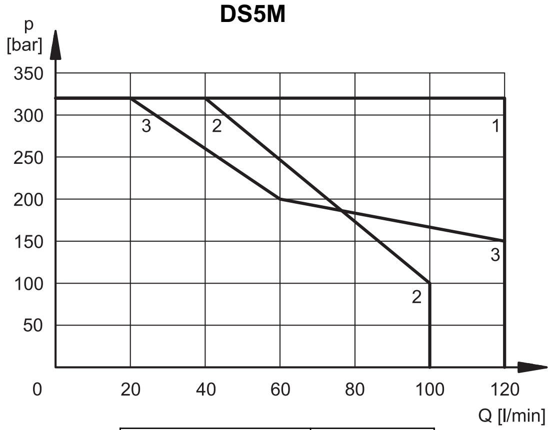
The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.

DS3M



SPOOL	CURVE	
	P→A	P→B
S1,SA1	1	1
S3,	4	4
S4, SA4	2	2
TA, TB	1	1
TA100, TB100	3	3

DS5M



SPOOL	CURVE	
	P→A	P→B
S1	1	1
S3	3	3
S4	2	2
TA02	1	1
TA, TA100	1	1

2.4 - Switching times

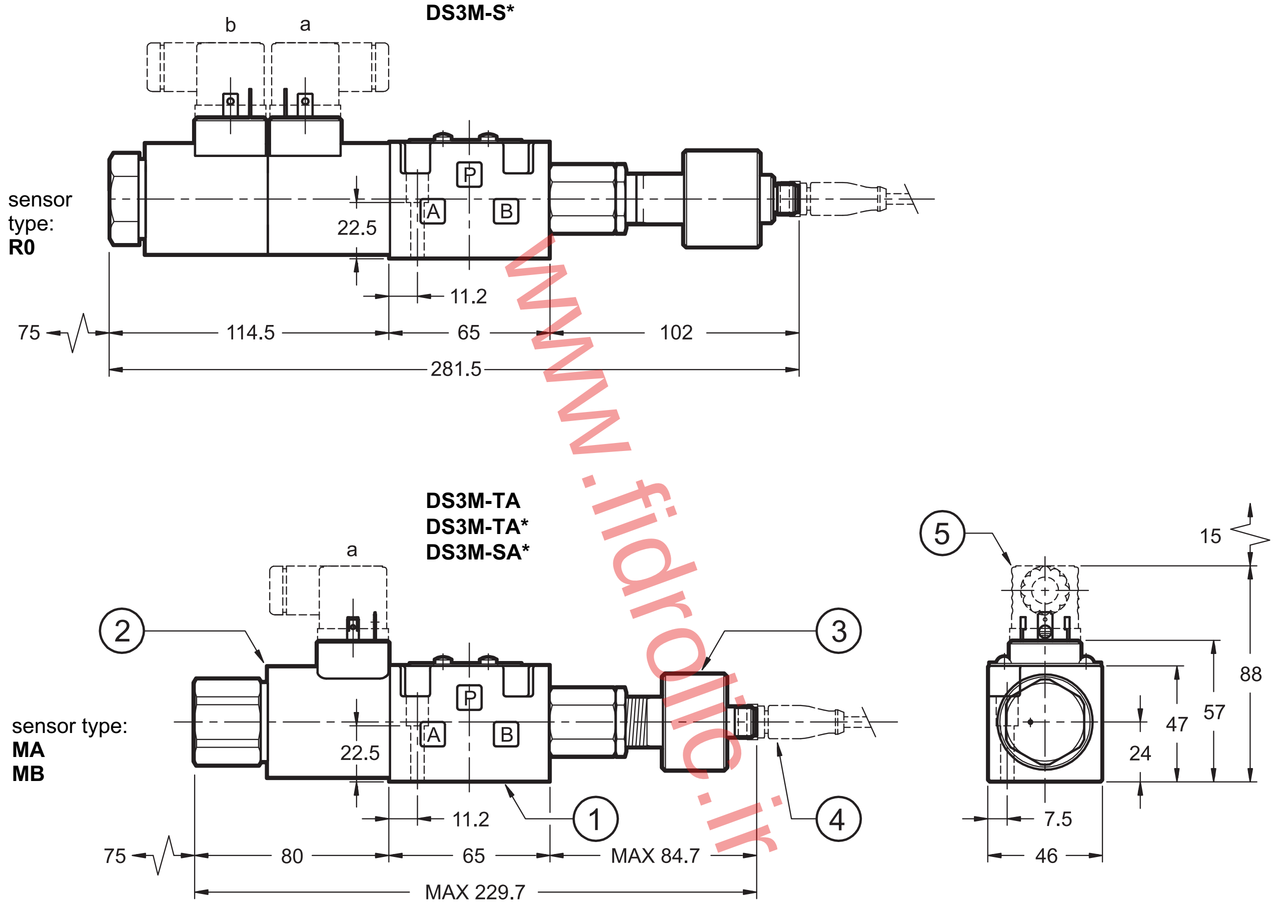
The indicated values had obtained according to ISO 6403 standards, using mineral oil with viscosity 36 cSt at 50 °C.

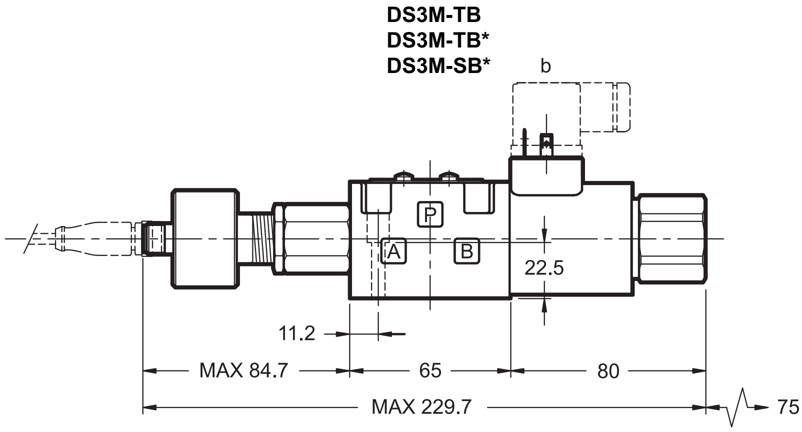
TIMES [ms]	ENERGIZING	DE-ENERGIZING
DS3M	25 ÷ 75	15 ÷ 25

TIMES [ms]	ENERGIZING	DE-ENERGIZING
DS5M	100 ÷ 150	20 ÷ 50

3 - OVERALL AND MOUNTING DIMENSIONS FOR DIRECT OPERATED VALVES

dimensions in mm



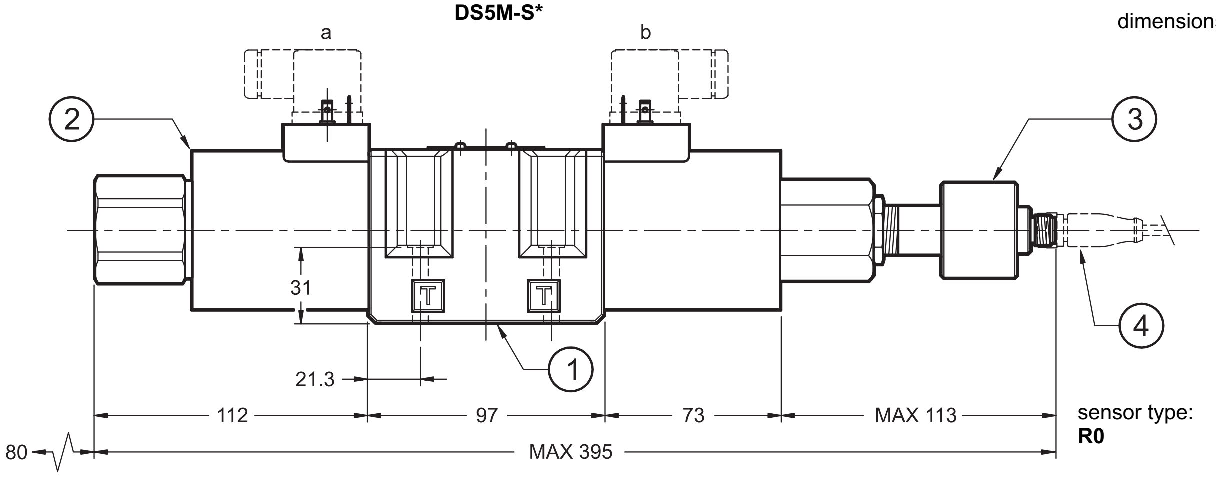


1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) 90 Shore
2	Coil rotating 360°
3	Positioning sensor: setting sealed at factory, do not tamper.
4	Connector for positioning sensor type straight, molded. To be ordered separately, see par.17
5	Coil electric connector DIN 43650 type to be ordered separately cat. 49 000

Valve fastening: 4 SHC screws ISO 4762 M5x30
Tightening torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

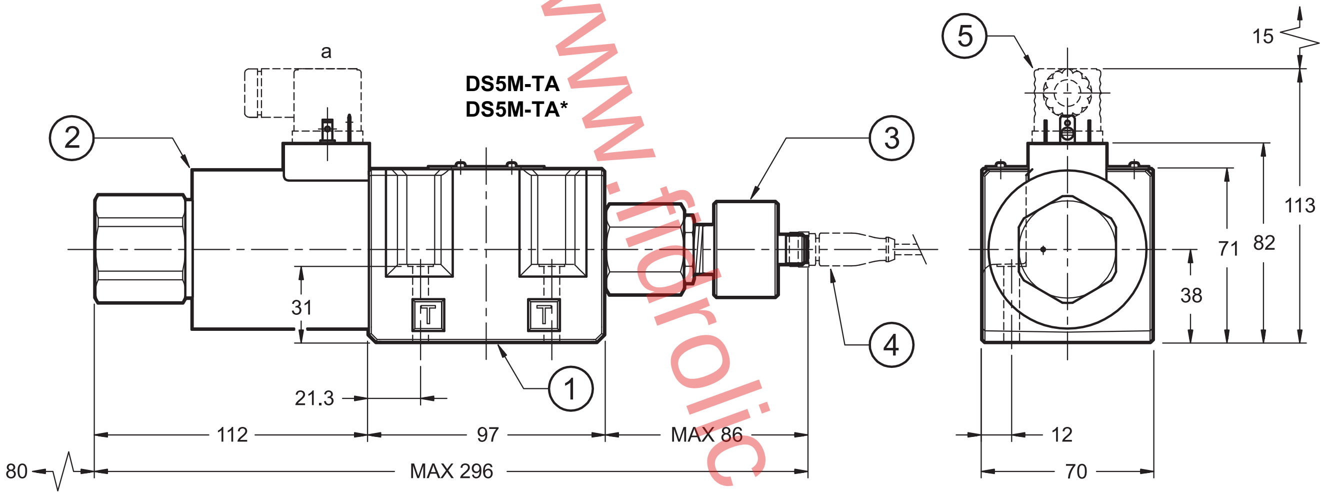
dimensions in mm

DS5M-S*



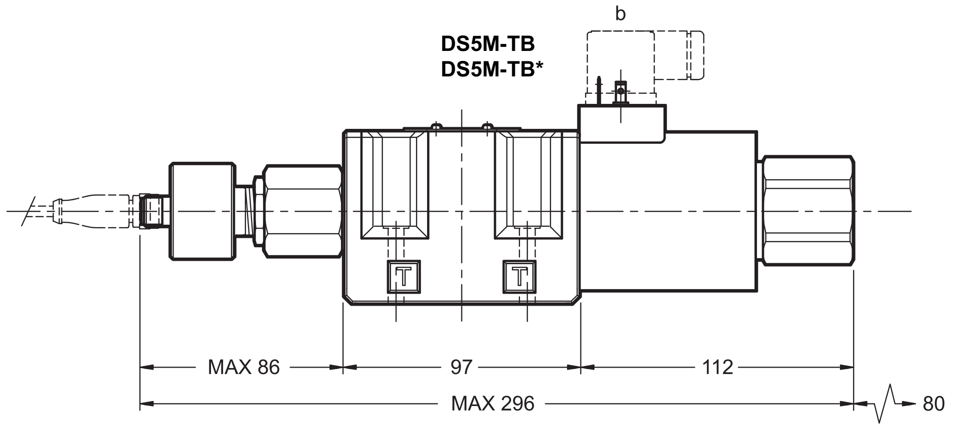
sensor type:
R0

DS5M-TA
DS5M-TA*



sensor
type:
MA
MB

DS5M-TB
DS5M-TB*



1	Mounting surface with sealing rings. 5 OR type 2050 (12.42x1.78) - 90 Shore
2	Coil rotating 360°
3	Positioning sensor: setting sealed at factory, do not tamper.
4	Connector for positioning sensor type straight, molded. To be ordered separately, see par. 17
5	Coil electric connector DIN 43650 type to be ordered separately cat. 49 000

Valve fastening: 4 SHC screws ISO 4762 M6x40
Tightening torque: 8 Nm
Threads of mounting holes: M6x10

4 - IDENTIFICATION OF PILOT OPERATED SOLENOID VALVES

4.1 - Identification code

D	S	P		M	-		/			-			/		/		K1	/	

Directional valve,
Solenoid controlled
Pilot operated

Size:
5 = CETOP P05
5R = ISO 4401-05 (CETOP R05)
7 = ISO 4401-07 (CETOP 07)
8 = ISO 4401-08 (CETOP 08)
10 = ISO 4401-10 (CETOP 10)

Monitoring of the spool position

Spool type (see paragraph 4.2)

S1	**SA1**	**SB1**	**TA**	**TB**
S3			**TA100**	**TB100**
S4				
RK				

Series:
10 = for DSP5M, DSP5RM and DSP8M
20 = for DSP7M
30 = for DSP10M
(the overall and mounting dimensions within the same ten remain unchanged)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Piloting (see paragraph 6):
I = internal (not available for S4 spool)
E = external
C = internal piloting with backpressure valve (available on DSP7 and DSP8 only)
Z = internal piloting with 30 bar fixes adjustment pressure reducing valve (see par. 5.5)

Drainage (see paragraph 6):
I = Internal
E = External

P = Subplate with restrictor on port P placed under the pilot valve
(omit for valves with piloting type Z and for valves with option D - control of the shifting speed of the main spool)
D = shifting speed of the main spool (see par. 7)

DC power supply
D12 = 12 V
D24 = 24 V
D110 = 110 V
D220 = 220 V

Coil electrical connection:
plug for connector type
DIN 43650 (**standard**)

Monitored position:
(see par. 16 for switching logic)

1 positioning sensor
R0 = rest position monitored
MA = position ‘a’ monitored
MB = position ‘b’ monitored

2 positioning sensor
M0 = rest position monitored
MAB = ‘a’ and ‘b’ positions monitored

Verify spool and sensor type availability in the table below

		SPOOLS				
		S*	**SA* SB***	**TA TB**	**TA100 TB100**	**RK**
SENSOR TYPE	**R0**	x				
	MA		x	x	x	x
	MB		x	x	x	x
	M0	x				
	MAB	x	x	x	x	

NOTE: DSP10M available with spools S1 or S4, with monitored position R0 or M0 only.

NOTE: To be compliant with the EN 693:2011 standard, the valves have no manual override.

4.2 - Spool types for DSP5M, DSP5RM, DSP7M and DSP8M

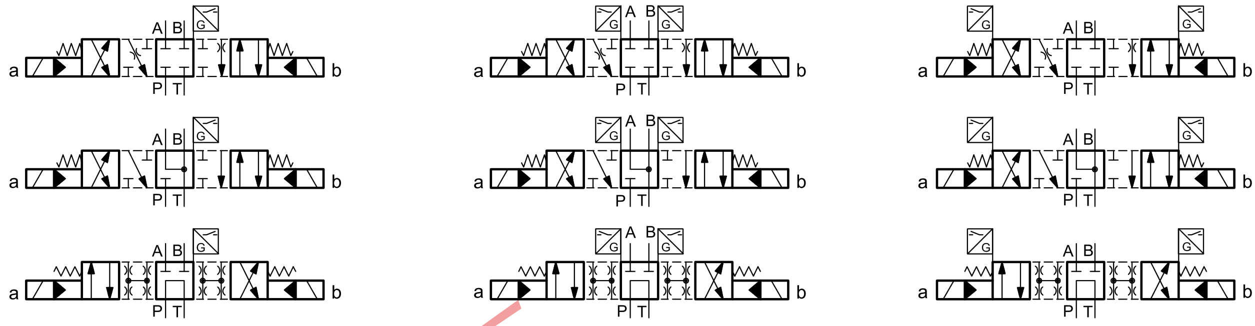
Type **S***:
2 solenoids - 3 positions with spring centering

sensor **R0** | sensor **M0** | sensor **MAB**

S1

S3

S4



sensor **MA** | sensor **MB** | sensor **MAB**

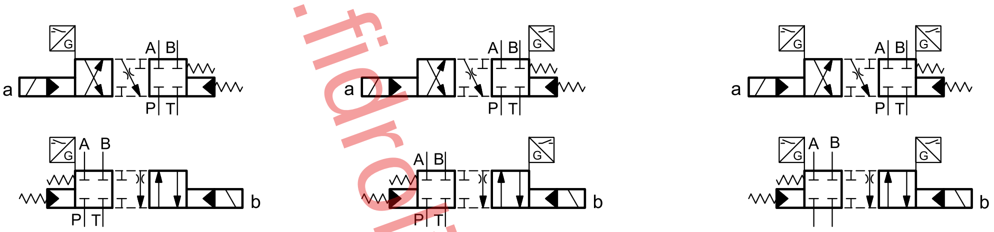
Type **SA***:
1 solenoid side A

SA1

Type **SB***:
1 solenoid side B

SB1

2 positions
(central + external)
with spring centering



sensor **MA** | sensor **MB** | sensor **MAB**

Type **TA**:
1 solenoid side A

TA

2 external positions
with return spring

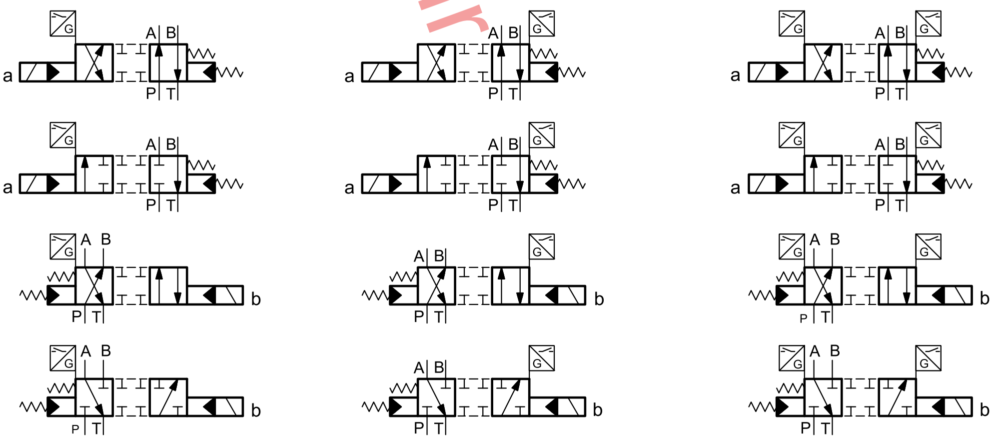
TA100

Type **TB**:
1 solenoid side B

TB

2 external positions
with return spring

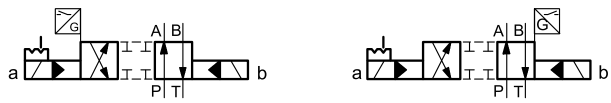
TB100



sensor **MA** | sensor **MB**

Type **RK**:
2 solenoids - 2 positions
with mechanical detent

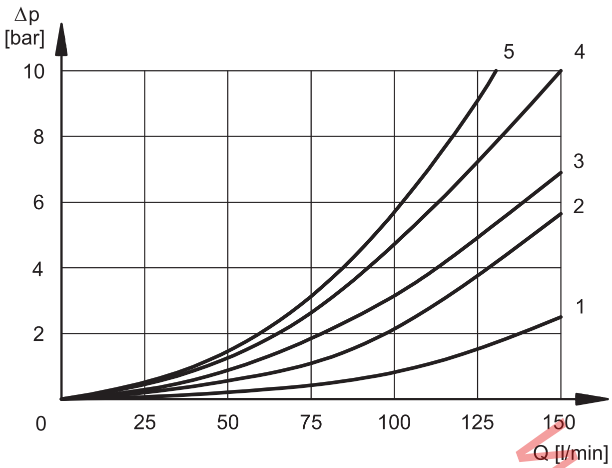
RK



5 - CHARACTERISTIC CURVES AND PERFORMANCES

(values obtained with viscosity 36 cSt at 50 °C)

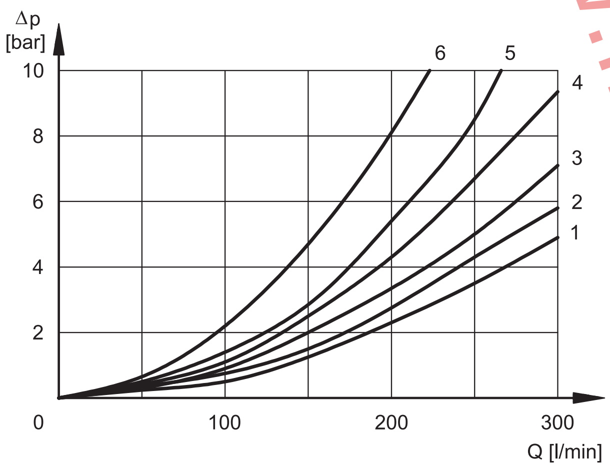
5.1 - DSP5M and DSP5RM - Pressure drops Δp-Q



SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S1, SA1	4	4	1	1	-
S3	4	4	1	1	-
S4	5	5	2	3	5
TA, TB	4	4	1	1	-
TA100, TB100	3	3	1	1	-
RK	4	4	1	1	-

For pressure drops of the S3 spool in central position refer to the curve 4.

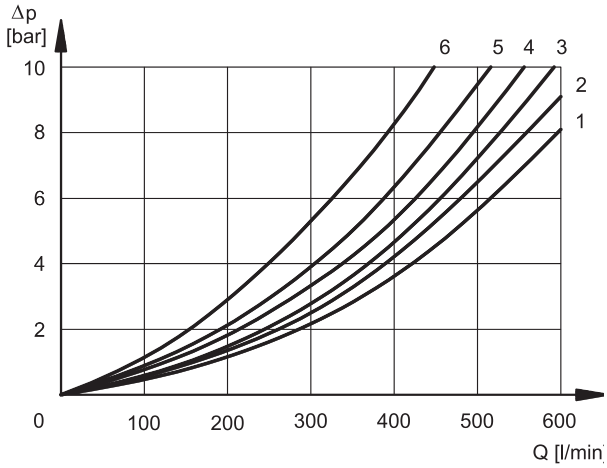
5.2 - DSP7M - Pressure drops Δp-Q



SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S1, SA1	1	1	4	5	-
S3	1	1	5	5	-
S4	2	2	5	6	5
TA, TB	1	1	4	5	-
TA100, TB100	3	3	3	5	-
RK	1	1	4	5	-

For pressure drops of the S3 spool in central position refer to the curve 5.

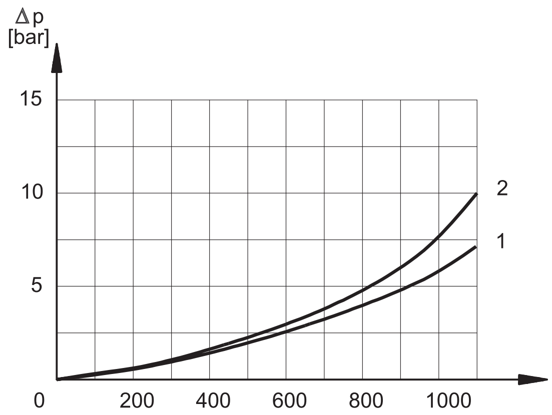
5.3 - DSP8M - Pressure drops Δp-Q



SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S1, SA1	2	2	3	3	-
S3	2	2	2	1	-
S4	4	4	3	5	6
TA, TB	2	2	3	3	-
TA100, TB100	5	5	5	5	-
RK	2	2	3	3	-

For pressure drops of the S3 spool in central position refer to the curve 4.

5.4 - DSP10M - Pressure drops ∆p-Q



SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S1	1	1	1	1	-
S4	2	2	2	2	-

5.5 - Performance limits for pilot operated valves

PRESSURES	DSP5M DSP5RM	DSP7M	DSP8M	DSP10M
Max pressure in P, A, B ports	320	350	350	350
Max pressure in T line	210	210	210	210
Max pressure in Y line	210	210	210	210
Min piloting pressure **NOTE 1**	5 ÷ 10	5 ÷ 12	7 ÷ 14	6 ÷ 12
Max piloting pressure **NOTE 2**	210	210	210	280

NOTE 1: minimum piloting pressure can be the lower range value at low flows rates, but with higher flow rates the higher value is needed.

NOTE 2: if the valve operates with higher pressures it is necessary to use the version with external pilot and reduced pressure. Otherwise, the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered.

Add the letter **Z** to the identification code to order this option (see par. 4.1).

MAXIMUM FLOW RATES		DSP5M DSP5RM		DSP7M		DSP8M		DSP10M	
Spool type		PRESSURES 210 bar	320 bar	210 bar	350 bar	210 bar	350 bar	210 bar	350 bar
S4 - TA100	[l/min]	120	100	200	150	500	450	750	600
S1 - S3 - TA - RK	[l/min]	150	120	300	300	600	500	900	700

5.6 - Switching times

The values indicated refer to a solenoid valve working with piloting pressure of 100 bar, with mineral oil at a temperature of 50°C, at viscosity of 36 cSt and with PA and BT connections.

The energizing and de-energizing times are obtained at the pressure variation which occurs on the lines.

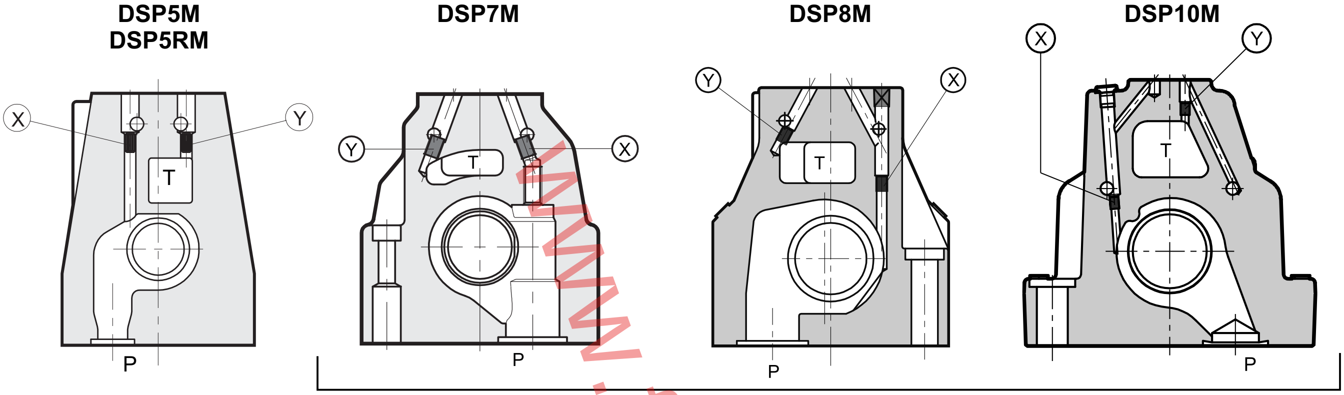
TIMES (± 10%) [ms]	ENERGIZING		DE-ENERGIZING	
	2 Pos.	3 Pos.	2 Pos.	3 Pos.
DSP5M - DSP5RM	60	50	50	40
DSP7M	75	60	60	45
DSP8M	100	70	80	50
DSP10M	-	100	-	140

6 - PILOTING AND DRAINAGE

These valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.

TYPE OF VALVE		Plug assembly X	Plug assembly Y
IE	internal pilot and external drain	NO	YES
II	Internal pilot and internal drain	NO	NO
EE	external pilot and external drain	YES	YES
EI	external pilot and internal drain	YES	NO

DSP5M
DSP5RM | **DSP7M** | **DSP8M** | **DSP10M**



X: plug M5x6 for external pilot
Y: plug M5x6 for external drain

X: plug M6x8 for external pilot
Y: plug M6x8 for external drain

6.1 - Backpressure valve incorporated on line P (C option)

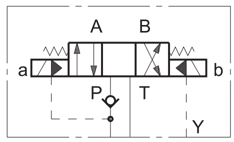
DSP7M and DSP8M valves are available upon request with backpressure valve incorporated on line P. This is necessary to obtain the piloting pressure when the control valve, in rest position, has the line P connected to the T port (spools S4).

The cracking pressure is of 5 bar with a minimum flow rate of 15 l/min.

In the C version the piloting is always internal.

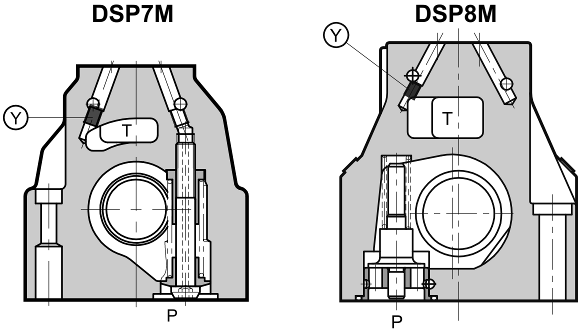
NOTE: the backpressure valve can't be used as check valve because it doesn't assure the seal.

Add **C** to the identification code for this request (see paragraph 4.1).

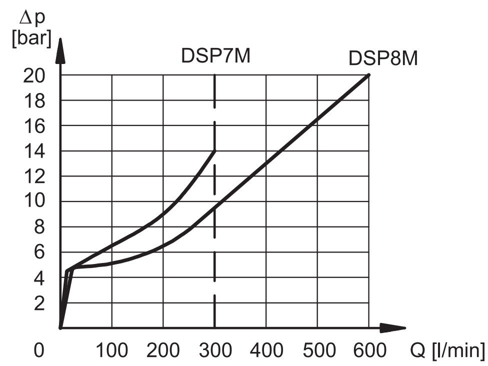


For DSP7M only, the backpressure valve can be also delivered separately and it can be easily mounted on line P of the main control valve. Ask for code **0266577** to order the backpressure valve.

DSP7M | **DSP8M**



pilot always internal
Y: plug M6x8 for external drain



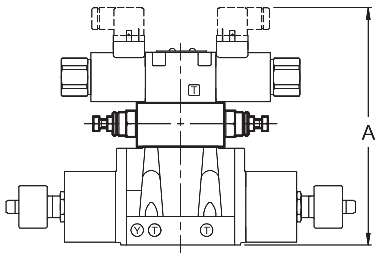
The curve refers to the pressure drop (body part only) with backpressure valve inside, to which the pressure drop of the reference spool must be added. (see par. 5)

7 - OPTIONS

7.1 - Option D : control of the main spool shifting speed

By placing a MERS type double flow control valve between the pilot solenoid valve and the hydropiloted valve, the piloted flow rate can be controlled and therefore the change over smoothness can be varied.

Add the letter **D** to the identification code to request this device (see paragraph 4.1).



dimensions in mm

	DSP5	DSP7	DSP8	DSP10
A	218	225	254	307

8 - ELECTRICAL FEATURES

8.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

The coil is fastened to the tube by a threaded ring, and can be rotated and locked to suit the available space.

NOTE 1 : In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see catalogue 49 000).

NOTE 2: The IP65 protection degree is guaranteed only with the connector correctly connected and installed.

VOLTAGE SUPPLY FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY DS3M DS5M DSP5M - DSP5RM DSP7M DSP8M DSP10M	 15.000 ins/hr 13.000 ins/hr 5.000 ins/hr 5.000 ins/hr 4.000 ins/hr 3.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE 1)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95/EC
CLASS OF PROTECTION: Atmospheric agents (EN 60529) Coil insulation (VDE 0580) Impregnation	 IP 65 (**NOTE 2**) class H class F

8.2 - Current and absorbed power

The tables shows current and power consumption values relevant to the different coil types for DC.

DS3M, DSP5M, DSP5RM, DSP7M, DSP8M and DSP10M (values ± 10%)

Suffix	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code
D12	12	4,4	2,72	32,7	1903080
D24	24	18,6	1,29	31	1903081
D110	110	436	0,26	28,2	1903464
D220	220	1758	0,13	28,2	1903465

DS5M (values ± 5%)

Suffix	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt [W]	Coil code
D12	12	3,2	3,75	45	1903200
D24	24	12	2	48	1903201
D110	110	250	0,44	48	1903204
D220	220	1050	0,21	47	1903205

9 - COIL CONNECTORS

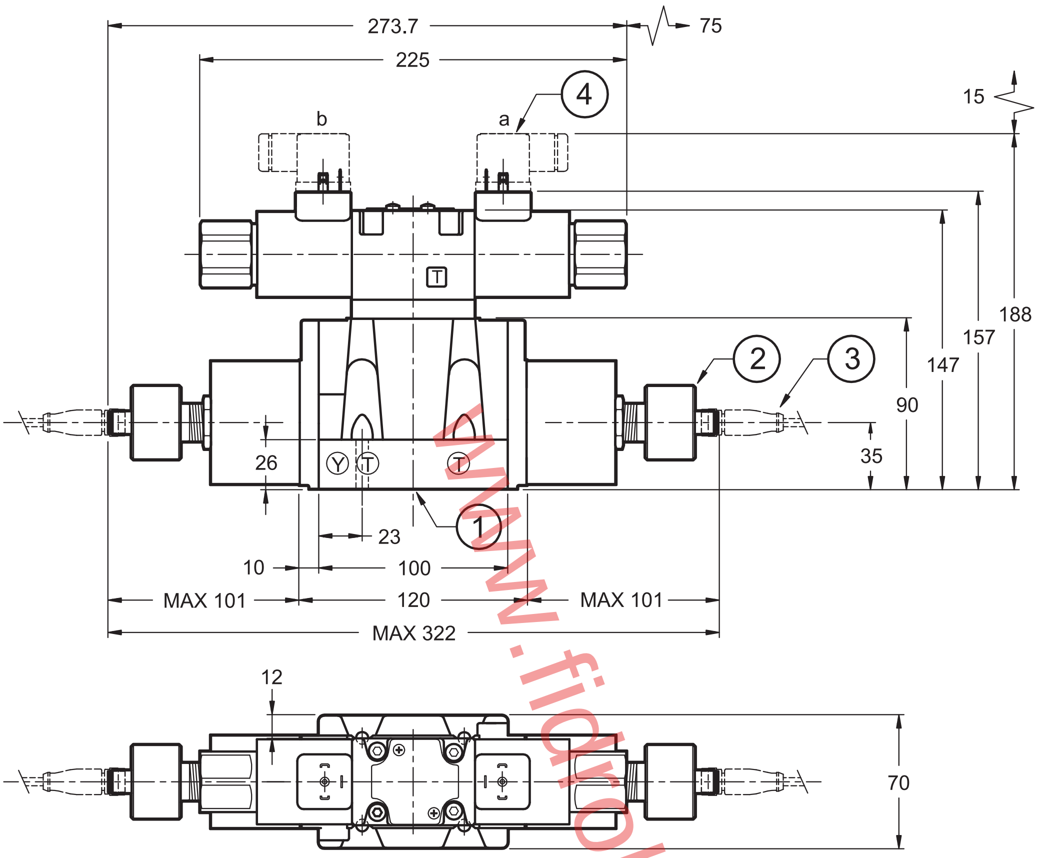
The solenoid operated valves are delivered without the connectors. They can be ordered separately.

For the identification of the connector type to be ordered, please see catalogue 49 000.

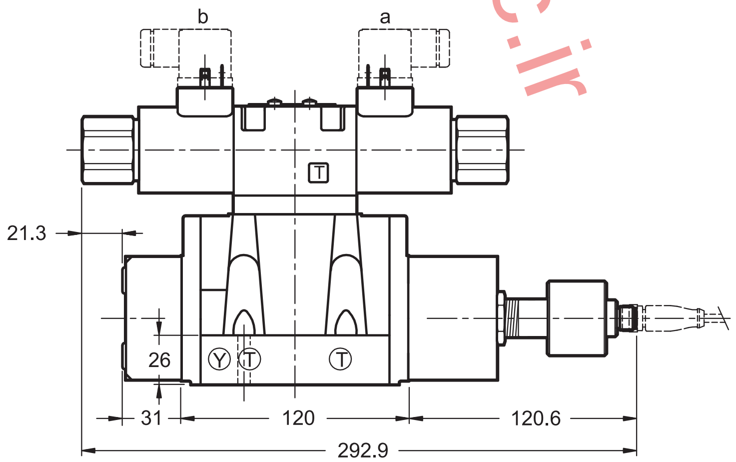
10 - DSP5M AND DSP5RM OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

DSP5M-S*
DSP5RM-S*



sensor type:
M0
MAB



sensor type:
R0

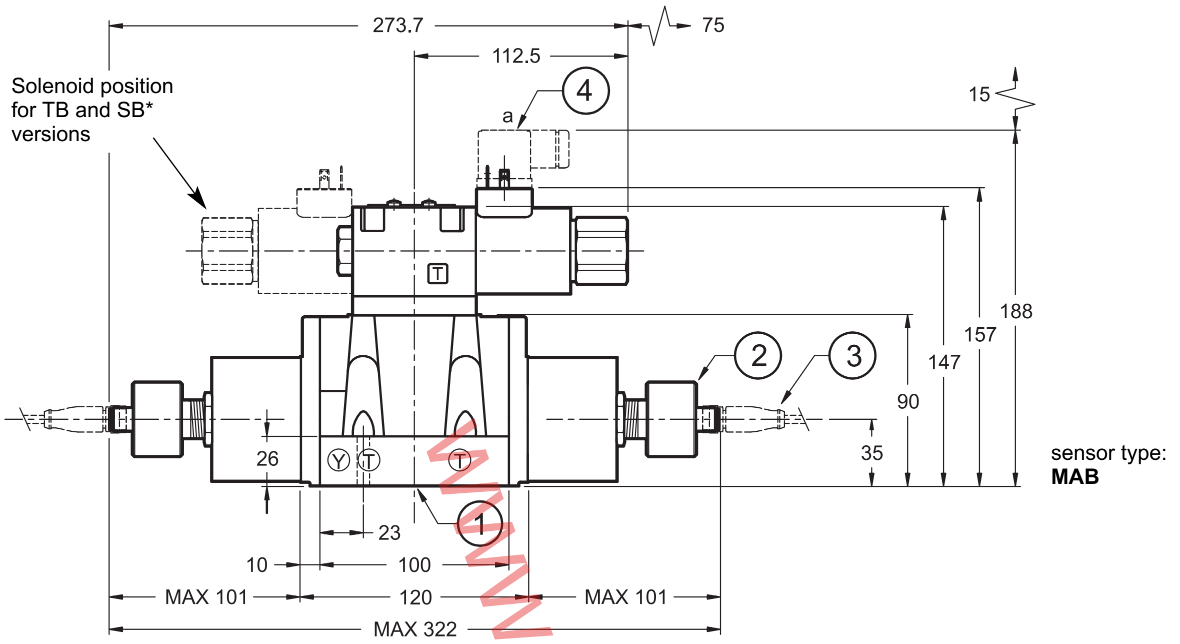
NOTE: for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

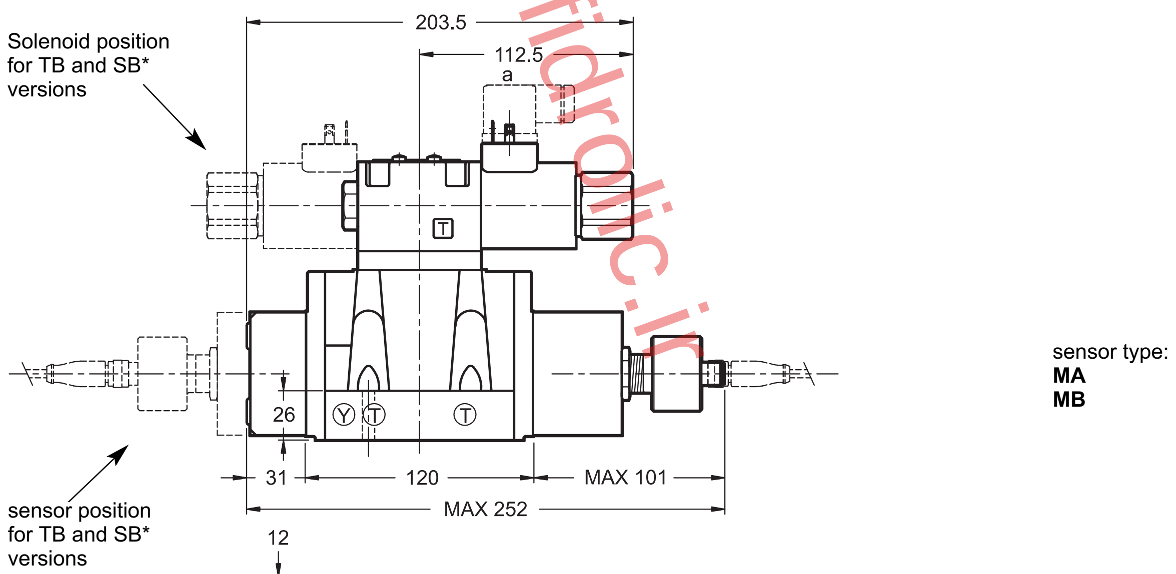
Valve fastening: 4 SHC screws ISO 4762 M6x35
Tightening torque: 8 Nm (screws A 8.8)
Threads of mounting holes: M6x10

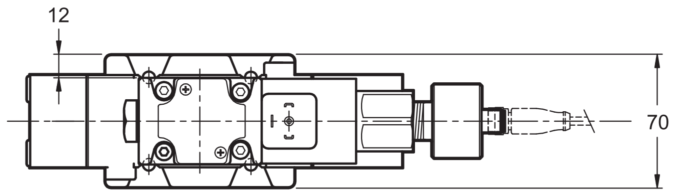
1	Mounting surface with sealing rings 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

DSP5M-TA, TA100, SA1
DSP5RM-TA, TA100, SA1

dimensions in mm





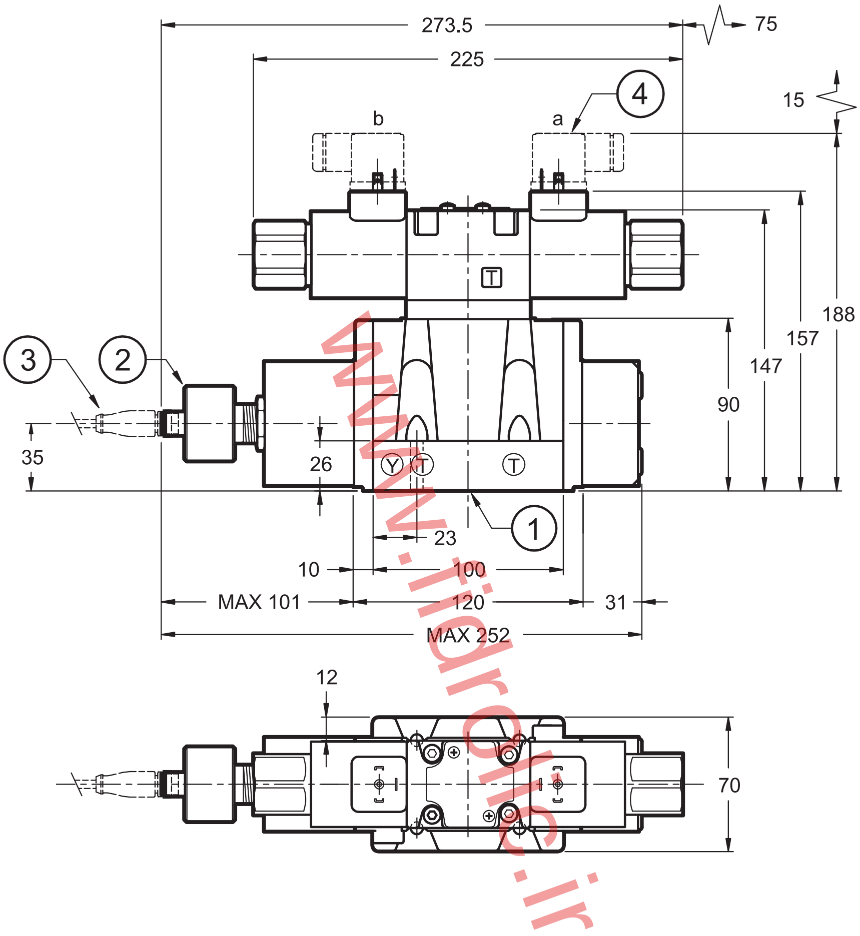


1	Mounting surface with sealing rings 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

NOTE: for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

dimensions in mm

DSP5M-RK
DSP5RM-RK



sensor type:
MA
MB

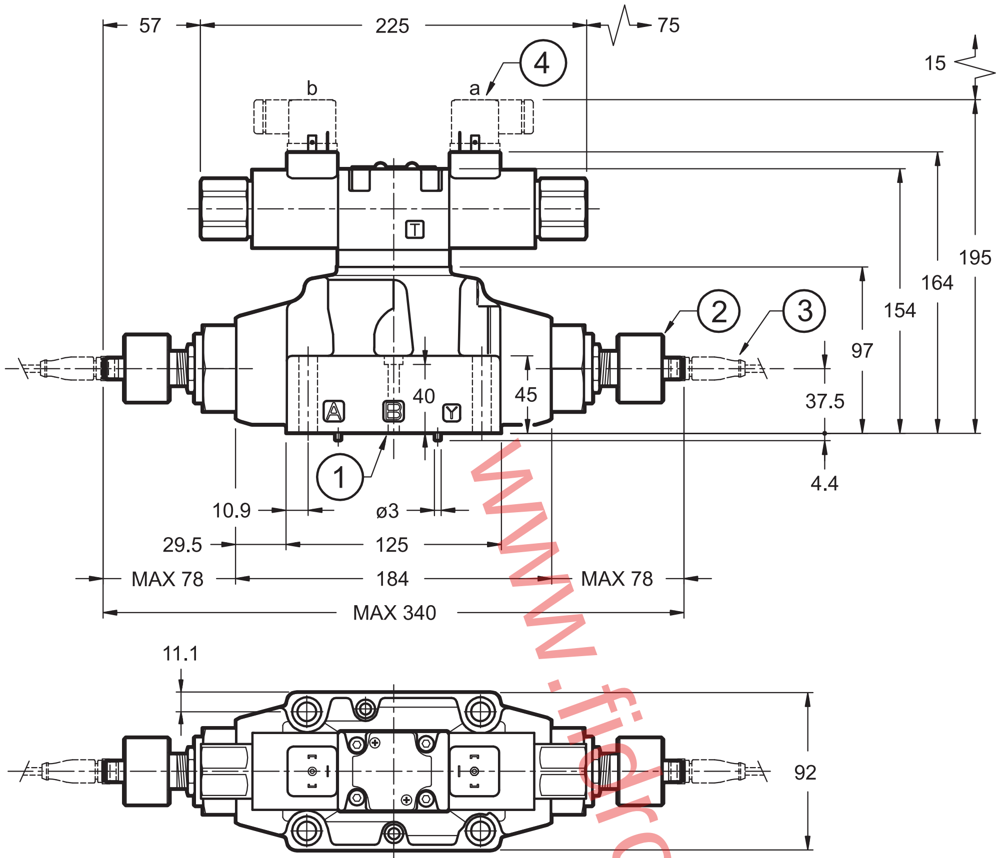
1	Mounting surface with sealing rings 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

NOTE: for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

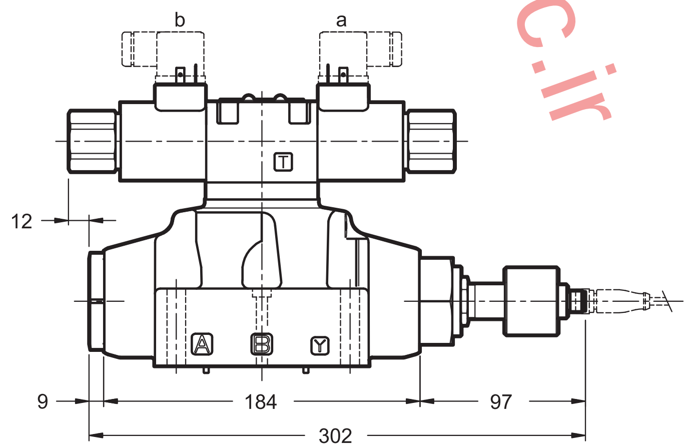
11 - DSP7M OVERALL AND MOUNTING DIMENSIONS

DSP7M-S*

dimensions in mm



sensor type:
M0
MAB



sensor type:
R0

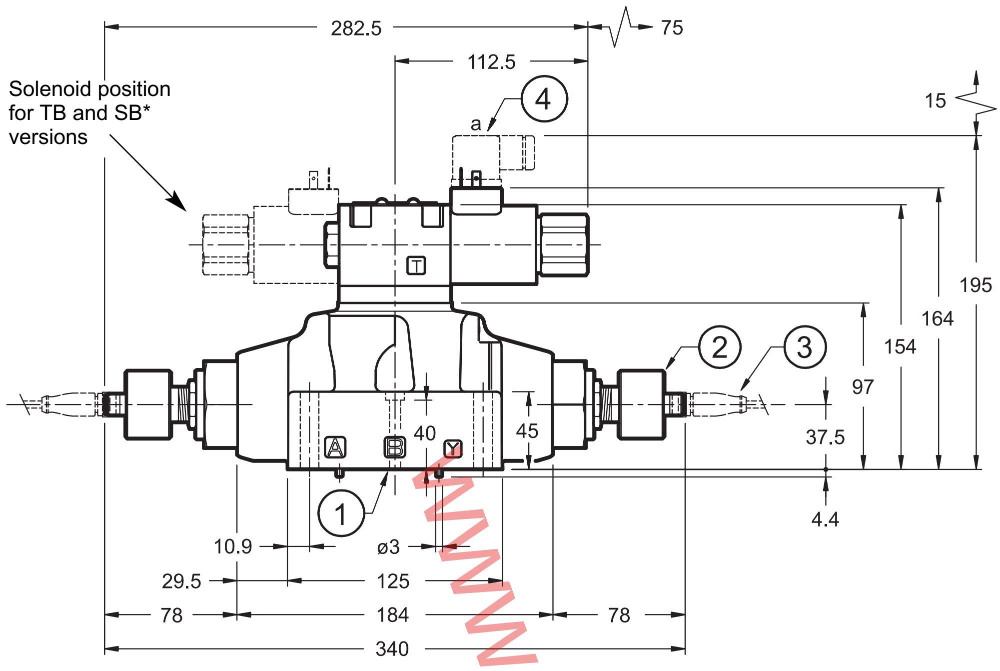
NOTE: for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

Valve fastening:	4 SHC screws ISO 4762 M10x60 2 SHC screws ISO 4762 M6x50
Tightening torque:	M10x60: 40 Nm M6x50: 8 Nm
Threads of mounting holes: M6x18; M10x18	

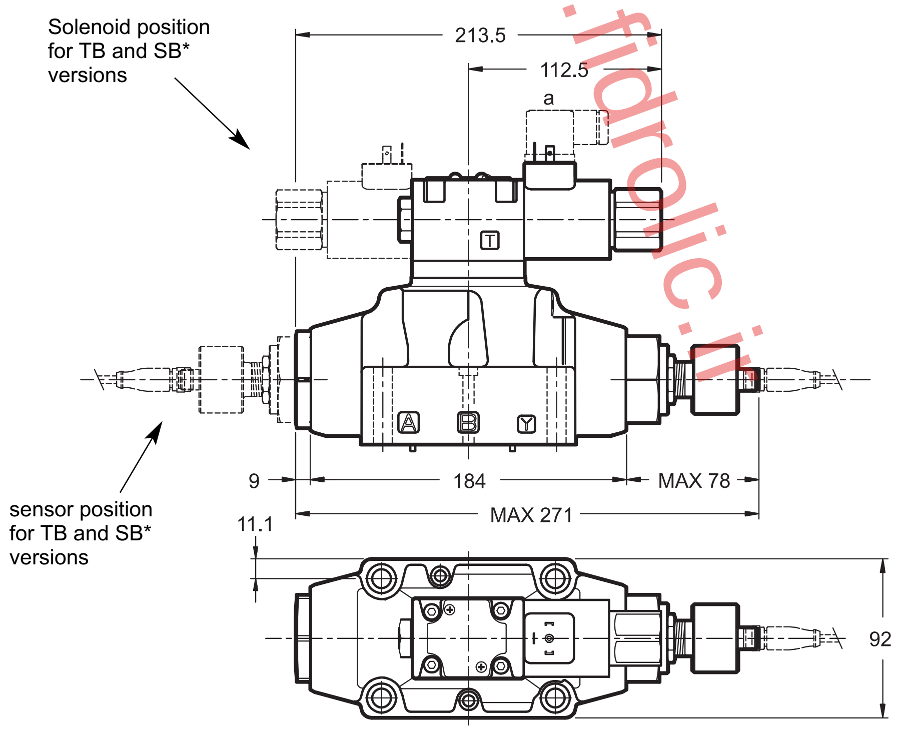
1	Mounting surface with sealing rings. 4 OR type 130 (22.22x2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

DSP7M-TA, TA100, SA1

dimensions in mm



sensor type: **MAB**



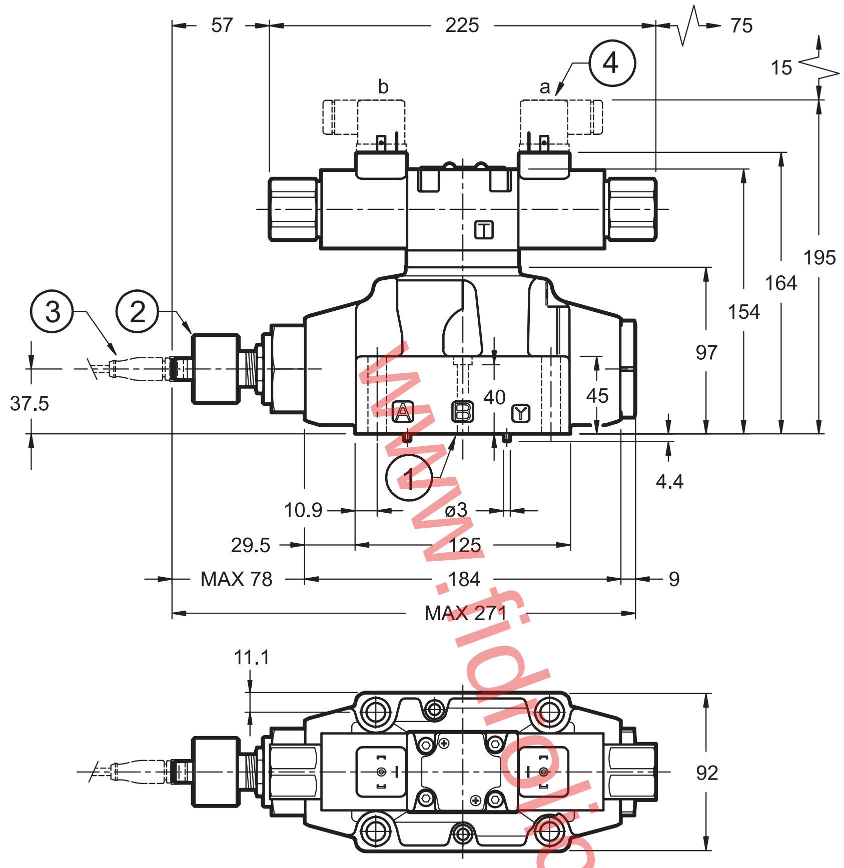
sensor type: **MA** **MB**

1	Mounting surface with sealing rings. 4 OR type 130 (22.22x2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

NOTE: for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

dimensions in mm

DSP7M-RK



sensor type:
MA
MB

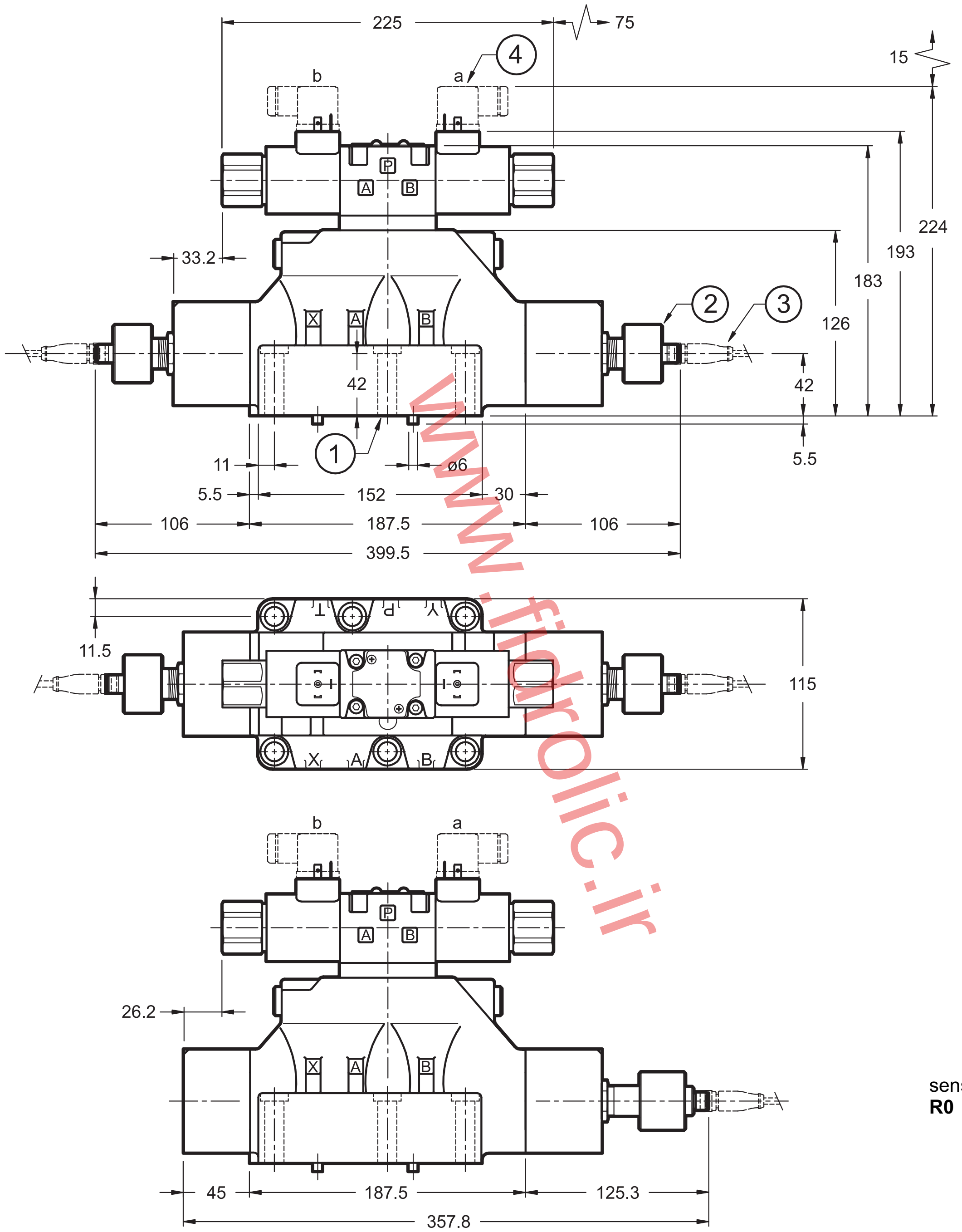
1	Mounting surface with sealing rings. 4 OR type 130 (22.22x2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

NOTE: for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

12 - DSP8M OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

DSP8M-S*



sensor type:
M0
MAB

sensor type:
R0

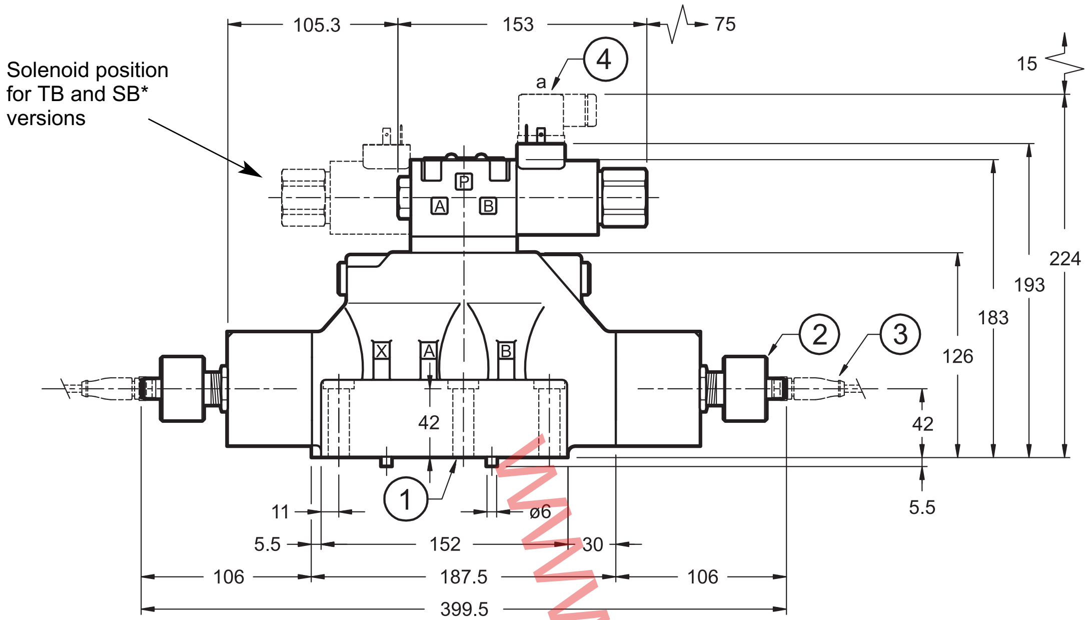
NOTE: for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

Valve fastening: 6 SHC screws ISO 4762 M12x60
Tightening torque: 69 Nm
Threads of mounting holes: M12x20

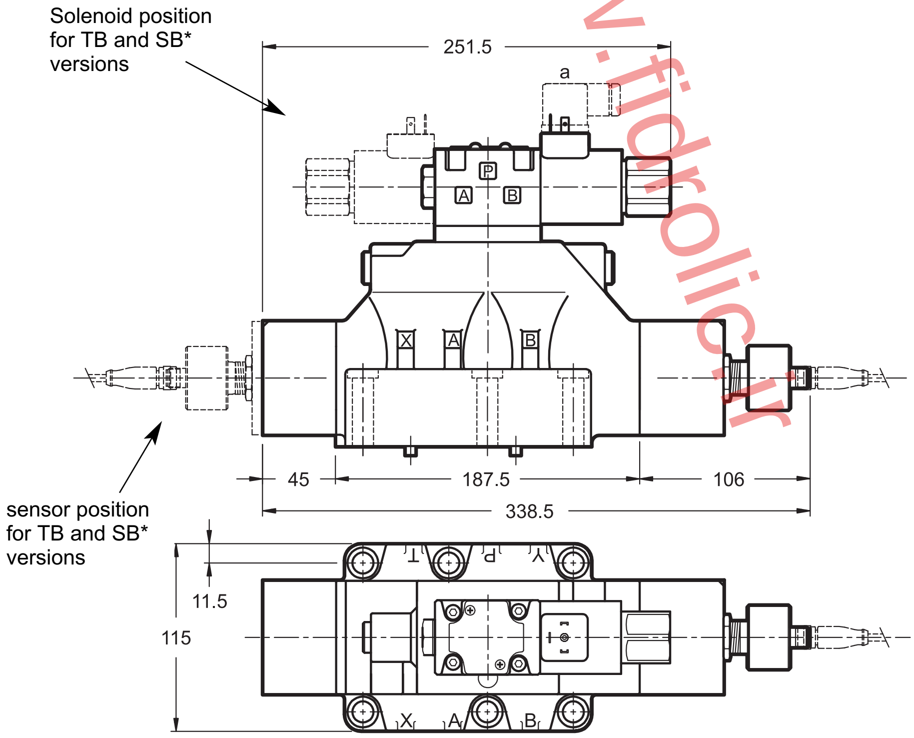
1	Mounting surface with sealing rings. 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

DSP8M-TA, TA100, SA1

dimensions in mm



sensor type:
MAB



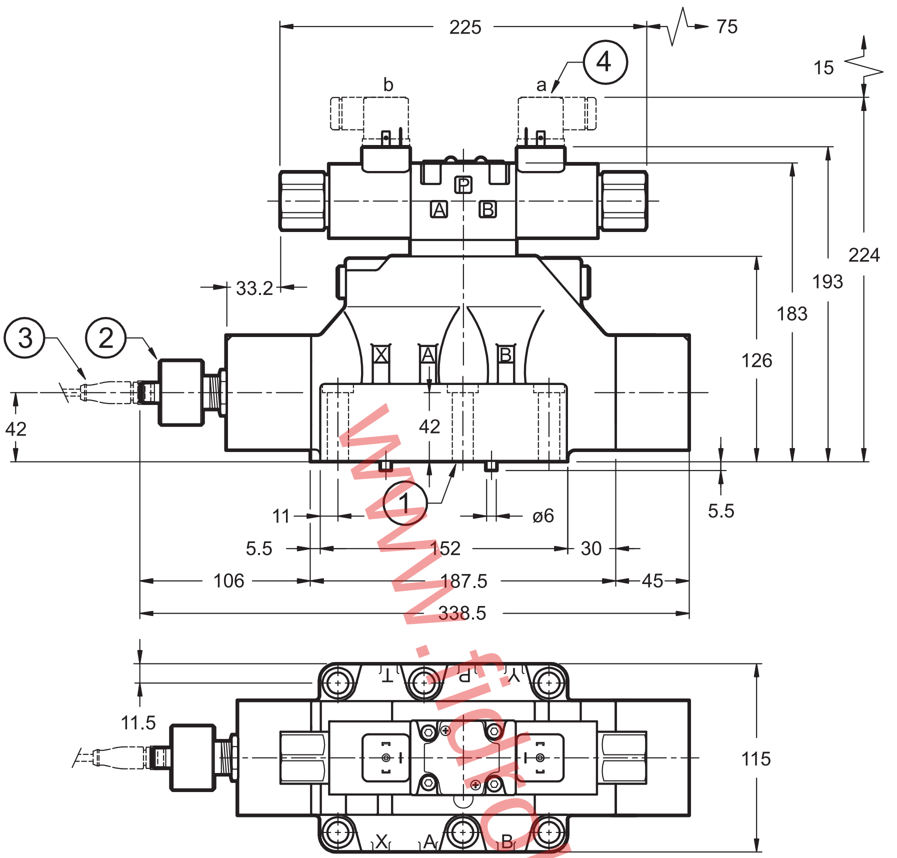
sensor type:
MA
MB

1	Mounting surface with sealing rings. 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

NOTE: for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

DSP8M-RK

dimensions in mm



sensor type:
M0
MAB

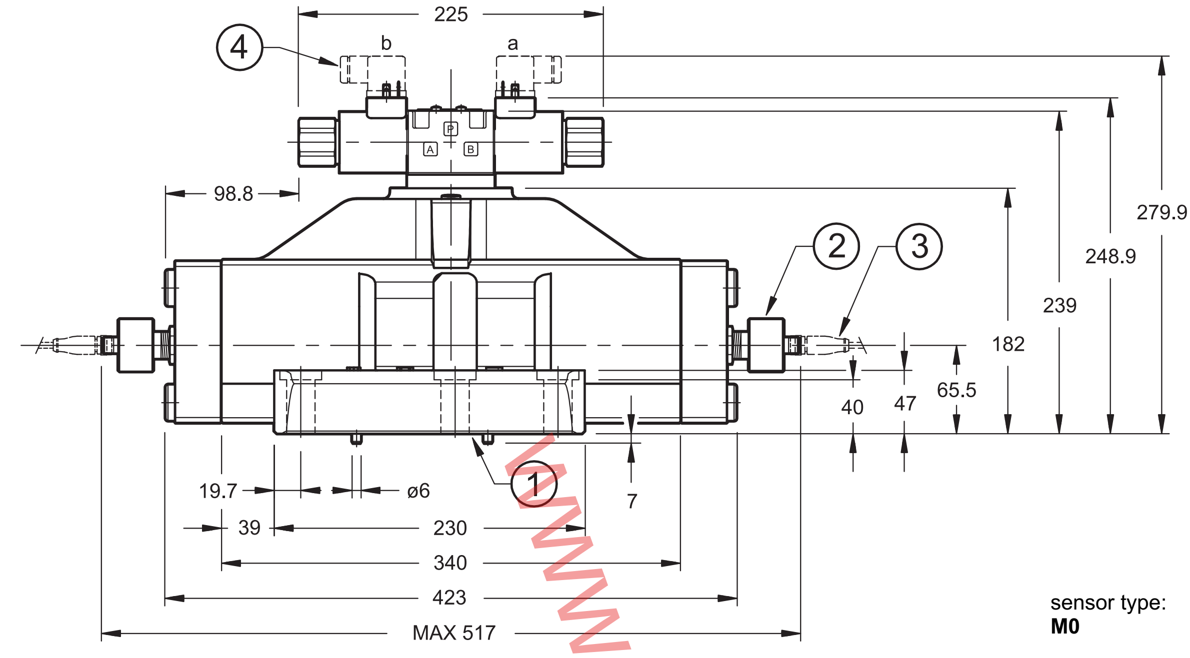
1	Mounting surface with sealing rings. 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Position sensor: set and sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil electric connector DIN 43650 type To be ordered separately see cat. 49 000

NOTE: for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

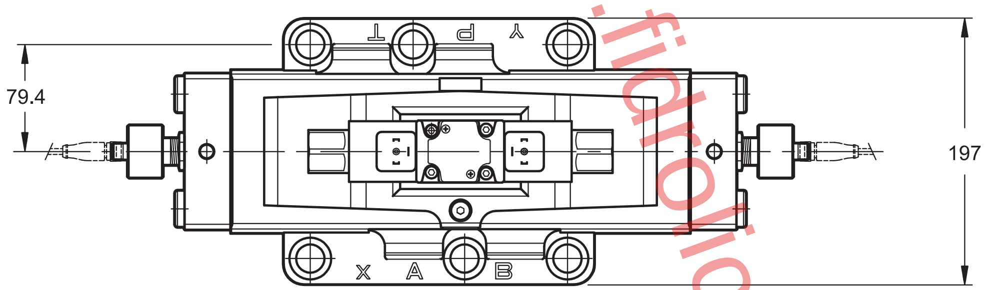
13 - DSP10M OVERALL AND MOUNTING DIMENSIONS

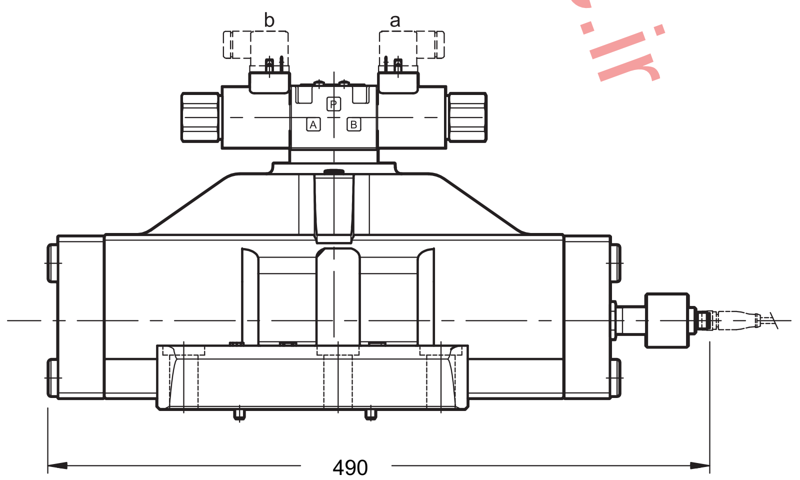
dimensions in mm

DSP8M-S*



sensor type:
M0





sensor type:
R0

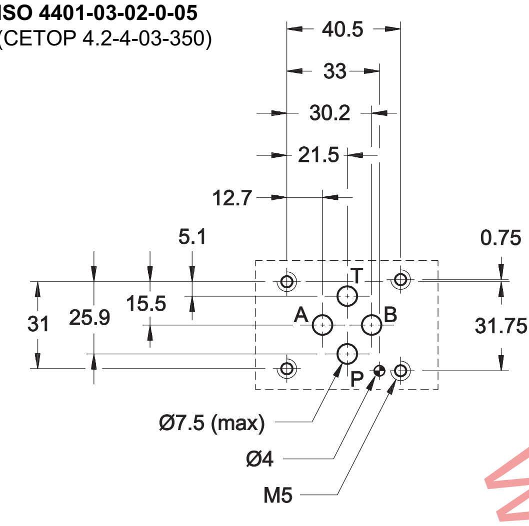
NOTE: for overall dimensions with **Z** option (fixed adjustment pressure reducing valve) consider an increase of 30 mm in height.

Valve fastening: 6 SHC screws ISO 4762 M20x70
Tightening torque: 330 Nm (A8.8 screws)
Threads of mounting holes: M20x40

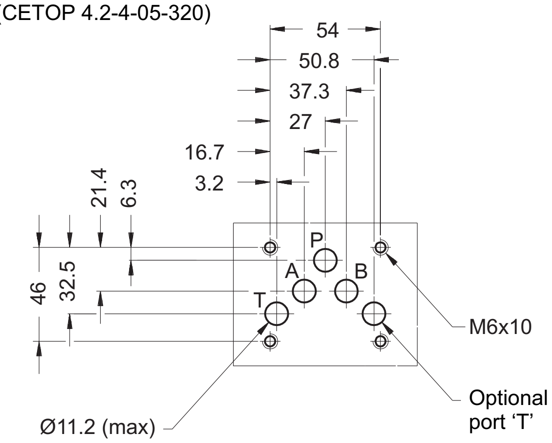
1	Mounting surface with sealing rings. 4 OR type 4150 (37.59x3.53) - 90 shore 2 OR type 3081 (20.24x2.62) - 90 shore
2	Positioning sensor : setting sealed at factory, do not tamper.
3	Connector for positioning sensor, type straight, molded. To be ordered separately, see par. 17
4	Coil connector DIN 43650 type To be ordered separately see cat. 49 000

14 - MOUNTING SURFACES

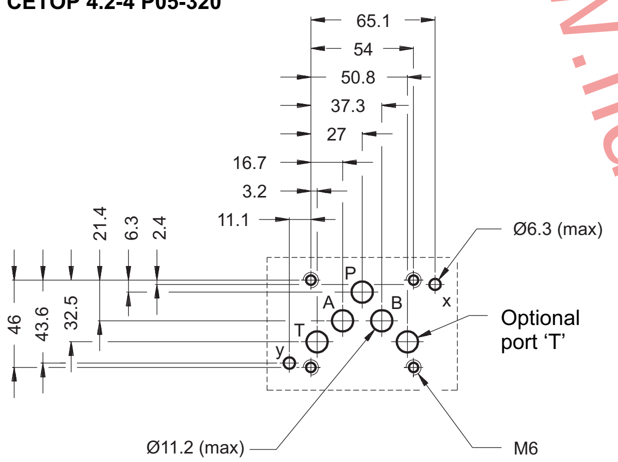
DS3M
ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



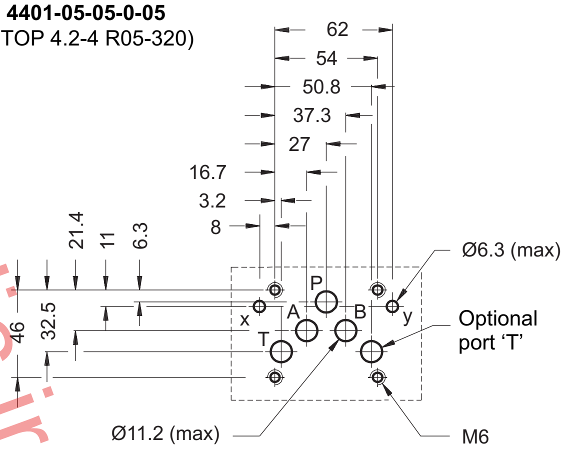
DS5M
ISO 4401-05-04-0-05
(CETOP 4.2-4-05-320)



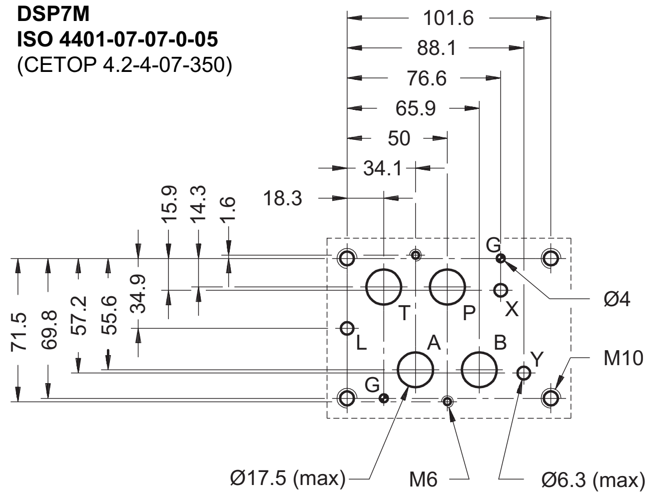
DSP5M
CETOP 4.2-4 P05-320



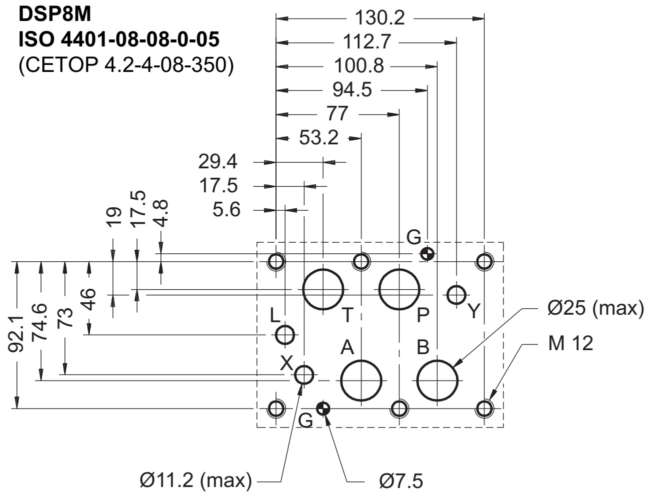
DSP5RM
ISO 4401-05-05-0-05
(CETOP 4.2-4 R05-320)



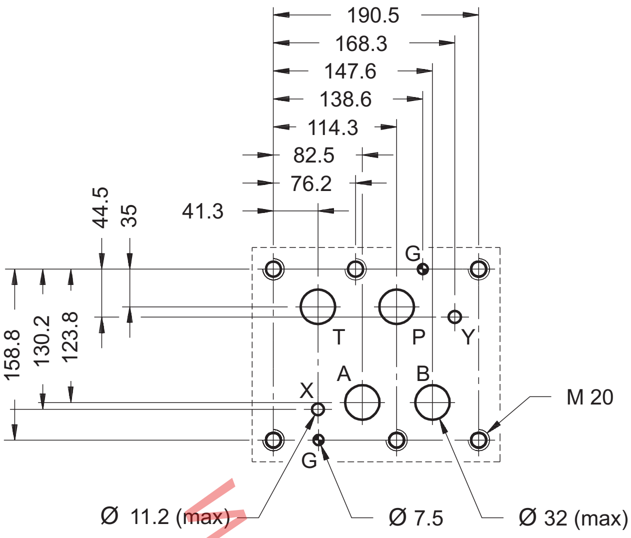
DSP7M
ISO 4401-07-07-0-05
(CETOP 4.2-4-07-350)



DSP8M
ISO 4401-08-08-0-05
(CETOP 4.2-4-08-350)



DSP10M
ISO 4401-10-09-0-05
(CETOP 4.2-4-10-350)

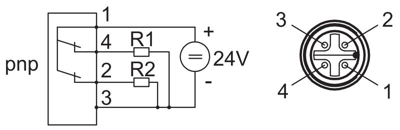


15 - POSITIONING SENSORS

WARNING ! The disassembly of the valve is not allowed. The sensors must not be unscrewed or tampered with in any way.

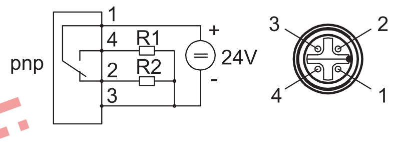
The M0 and MAB versions have two positioning sensors; consider that the connection scheme shown must be done for each sensor.

R0 CONNECTION SCHEME



Pin	Values	Function
1	+24 V	Supply
2	NC	Normal Closed -
3	0 V	-
4	NC	Normal Closed +

M* CONNECTION SCHEME



Pin	Values	Function
1	+24 V	Supply
2	NC	Normal Closed
3	0 V	-
4	NO	Normal Open

ELECTRICAL CHARACTERISTICS		
Operating voltage range	V DC	20 ÷ 32
Absorbed current	A	0.4
Max output load	mA	400
Output		2 PNP
Electric protections	polarity inversion short circuit	
Hysteresis	mm	≤ 0.1
Operating temperature range	°C	-25 / +80
Class of protection according to CEI EN 60529 standards (atmospheric agents)		IP65
EMC Electromagnetic compatibility	DIN EN 61000-6-1/2/3/4	

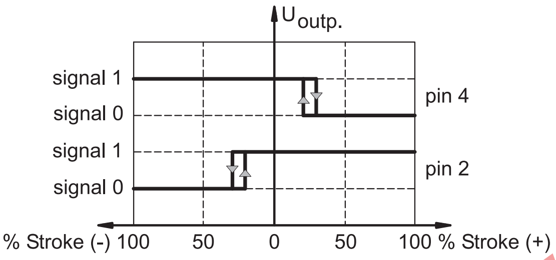
16 - SWITCHING LOGICS

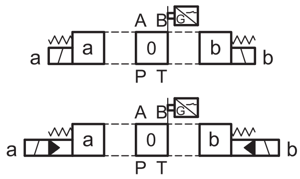
Duplomatic offers a wide range of available positions to be monitored, and for the pilot operated valve there are even monitorning with redundant signal.

16.1 - R0 monitoring

Central position monitored with one positioning sensor.

Available on both direct and pilot operated valves;
spool type S*

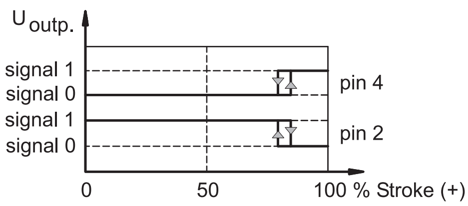


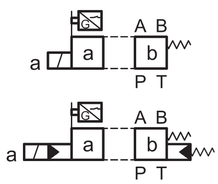


16.2 - MA monitoring

Energized position monitored with one positioning sensor.

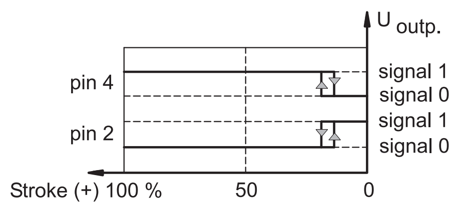
Available on both direct and pilot operated valves;
spool type SA*, TA, TA02, TA100

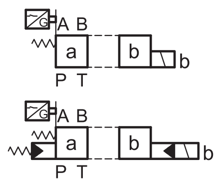




De-energized position monitored with one positioning sensor.

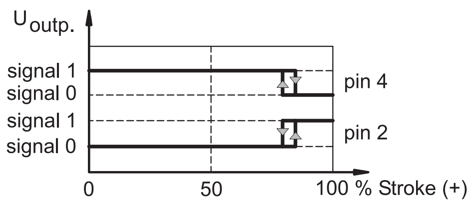
Available on both direct and pilot operated valves;
spool type SB*, TB, TB02, TB100

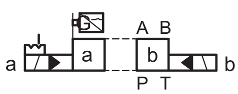




Position 'a' monitored with one positioning sensor.

Available on pilot operated valves only;
spool type RK

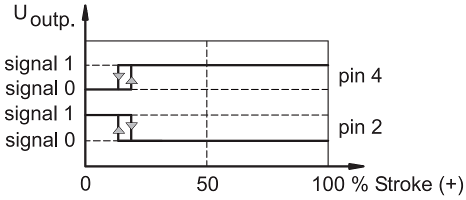


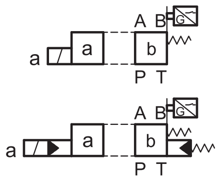


16.3 - MB monitoring

De-energized position monitored with one positioning sensor.

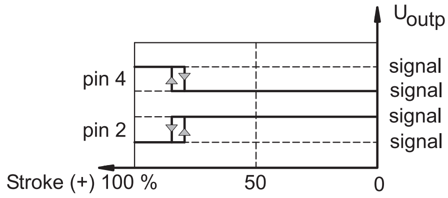
Available on both direct and pilot operated valves;
spool type SA*, TA, TA02, TA100

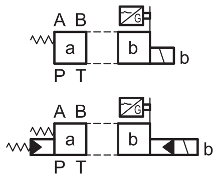




Energized position monitored with one positioning sensor.

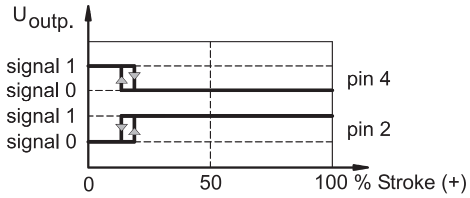
Available on both direct and pilot operated valves;
spool type SB*, TB, TB02, TB100

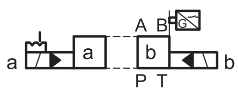




Position 'b' monitored with one positioning sensor.

Available on pilot operated valves only;
spool type RK

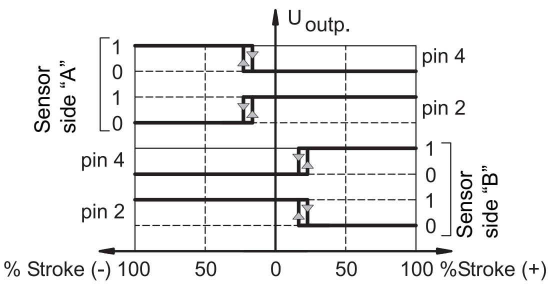


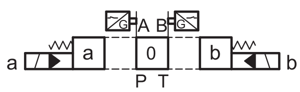


16.4 - M0 monitoring

Central position monitored by two separate positioning sensors.

Available on pilot operated valves only;
spool type S*

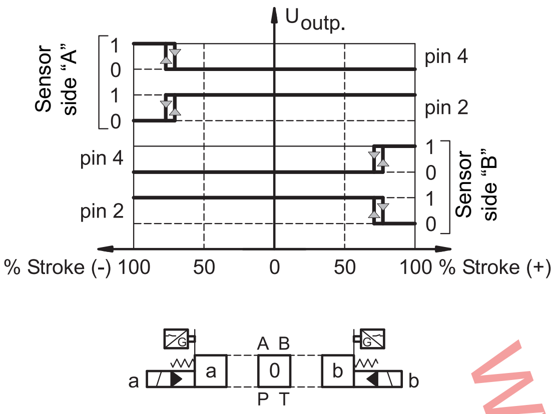




16.5 - MAB monitoring

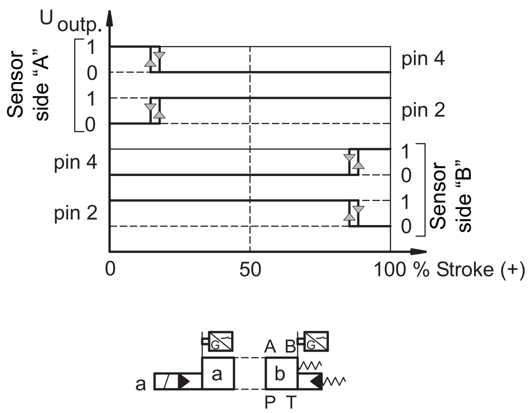
Both external positions monitored by two separate positioning sensors.

Available on pilot operated valves only;
spool type S*



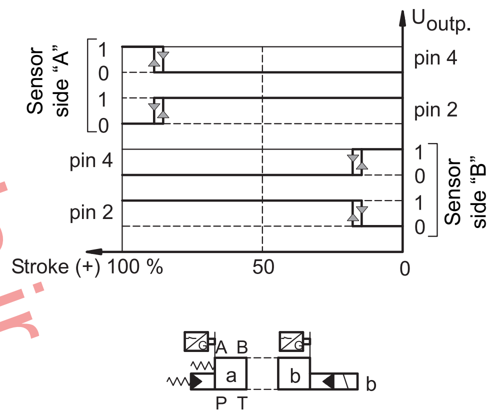
De-energized position monitored on side A.
Energized position monitored on side B.

Available on pilot operated valves only;
spool type SA1, TA, TA100



Energized position monitored on side A.
De-energized position monitored on side B.

Available on pilot operated valves only;
spool type SB1, TB, TB100



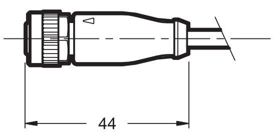
17 - SENSOR CONNECTORS

The female connectors for position switches can be ordered separately, by specifying the descriptions here below, depending on the desired type.

STRAIGHT CONNECTOR, MOLDED CABLE, PRE-WIRED

description: ECM4S/M12L/10

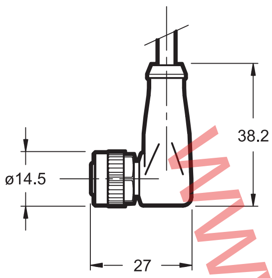
Protection class: IP68
Cable: 4 conductors 0.34 mm²
length 5 mt - Ø 4.7 mm
Cable material: polyurethane resin (oil resistant)
Without LED.



ANGLED CONNECTOR, MOLDED CABLE, PRE-WIRED

description: ECM4S/M12S/10

Protection class: IP68
Cable: 4 conductors 0.34 mm²
length 5 mt - Ø 4.7 mm
Cable material: polyurethane resin (oil resistant)
Without LED.

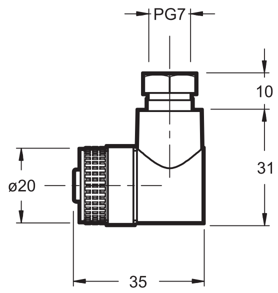


ANGLED CONNECTOR, UNASSEMBLED

Circular connector with screw locking; strain relief by means of clamping cage.

description: EC4S/M12S/10

Protection class: IP67
IEC 61076-2-101 (Ed. 1)
IEC 60947-5-2
Conductor size: max 0.75 mm²
Cable gland: PG7
suitable cables: 4 ÷ 6 mm²
Case material: polyamide (nylon)
Without LED.



18 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

19 - INSTALLATION

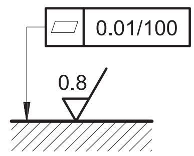
WARNING! These valves must be installed and commissioned by qualified personnel only. Before starting any installation, commissioning or maintenance is mandatory read the *manual of use and maintenance*, delivered together with the valve.

Configurations with centering and recall springs can be mounted in any position; The RK versions, without springs and with mechanical detent, must be mounted with the longitudinal axis horizontal.

Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

Surface finishing



20 - SUBPLATES

(see catalogue 51 000)

	DS3M	DS5M	DSP5M	DSP7M	DSP8M
Type with rear ports	PMMD-AI3G	PMD4-AI4G	PME4-AI5G	PME07-AI6G	-
Type with side ports	PMMD-AL3G	PMD4-AL4G	PME4-AL5G	PME07-AL6G	PME5-AL8G
P, T, A, B ports dimensions	3/8” BSP	3/4” BSP (PMD4-AI4G) 1/2” BSP (PMD4-AL4G)	3/4” BSP	1” BSP	1 ½” BSP
X, Y ports dimensions	-	-	1/4” BSP	1/4” BSP	1/4” BSP

DUPLOMATIC OLEODINAMICA

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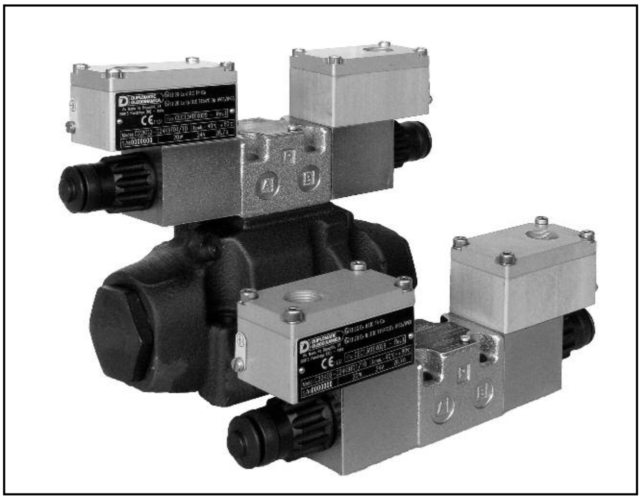
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

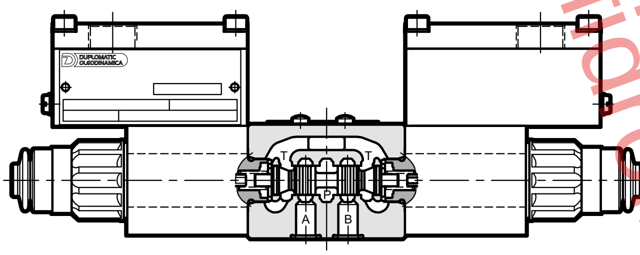
D*K*

EXPLOSION-PROOF SOLENOID OPERATED DIRECTIONAL CONTROL VALVES ATEX, IECEx, INMETRO



DS3K*	ISO 4401-03
DL5BK*	ISO 4401-05
DSP5K*	CETOP P05
DSP5RK*	ISO 4401-05
DSP7K*	ISO 4401-07
DSP8K*	ISO 4401-08
DSP10K*	ISO 4401-10

OPERATING PRINCIPLE



— The direct operated directional valves are available in ISO 4401-03 and ISO 4401-05 size; available pilot operated sizes are: CETOP P05, ISO 4401-05, ISO 4401-07, ISO 4401-08 and ISO 4401-10.

— They are compliant with ATEX, IECEx and INMETRO requirements and are suitable for use in potentially explosive atmospheres, for surface plants or mines.

— A low temperature version (up to -40 °C) is also available.

— DS3K* and DL5BK* valves are supplied with a zinc-nickel finishing surface treatment that ensures a salt spray resistance up to 600 h; for DSP*K* valves, this treatment is available upon request.

— **Details for classification, operating temperatures and electrical characteristics are in the technical data sheet 02 500 'Explosion proof classification'.**

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

		DS3K*	DL5BK*	DSP5K* DSP5RK*	DSP7K*	DSP8K*	DSP10K*
Maximum operating pressure P - A - B ports T port	bar	350 210	320 210	320 see operating limits at paragraph 6	350	350	350
Maximum flow from P port to A - B - T	l/min	80	125	150	300	600	1100
Operating temperatures (ambient and fluid)	°C	see data sheet 02 500					
Fluid viscosity range	cSt	10 ÷ 400					
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15					
Recommended viscosity	cSt	25					
Mass single solenoid valve double solenoid valve	kg	1,8 2,8	2,7 3,8	6,8 7,8	8,6 9,6	15,5 16,5	52 53

1 - IDENTIFICATION OF DIRECT OPERATED SOLENOID VALVES

1.1 - Identification code

D			-		/	10		-		K9		/		

Direct operated solenoid valve

Size:
S3 = ISO 4401-03
L5B = ISO 4401-05

Explosion-proof certification:
See table 1.2

Spool type (see par. 1.3)

S*	**TA**	**TB**	**RK**
SA*	**TA02**	**TB02**	
SB*	**TA23**	**TB23**	

Series No.:
(the overall and mounting dimensions do not change from 10 to 19)

Seals:
For temperature range -20 / +80 °C
N = NBR seals for mineral oil (standard)
V = FPM seals for special fluids
For temperature range -40 / +80 °C
NL = seal for low temperatures (for mineral oil)

Power supply:
Direct current (DC)
D12 = 12 V
D24 = 24 V
D48 = 48 V
D110 = 110 V
Alternate current with built-in rectifier bridge (RAC)
R120 = 120 V
R240 = 240 V

Coil electrical connection: by terminal block

Connection type for cable gland
upper connection:
T01 = M20x1.5 - ISO 261
T02 = Gk 1/2 - UNI EN 10226-2
not available for INMETRO
T03 = 1/2” NPT - ANSI B1.20.1 (ex ANSI B2.1)
side connection:
S01 = M20x1.5 - ISO 261
S02 = Gk 1/2 - UNI EN 10226-2
not available for INMETRO
S03 = 1/2” NPT - ANSI B1.20.1 (ex ANSI B2.1)
S04 = M16x1.5 - ISO 261

Manual override:
CM = boot protected
standard for both N and V seals
not available for NL seals
CB = blind ring nut
standard for NL seals
available upon request for both N and V seals
CK = knob manual override
(only for DC version)
CH = lever manual override.
Not avaliable for DLB5K*
Dimensions for CB and CH at par. 16

Option: **/T5**
version in T5 temperature class.
Omit if not required.

NOTE: the zinc-nickel standard finishing surface treatment is suitable to ensure a salt spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards)

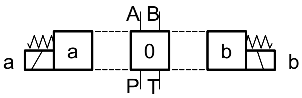
1.2 - Names of valves per certification

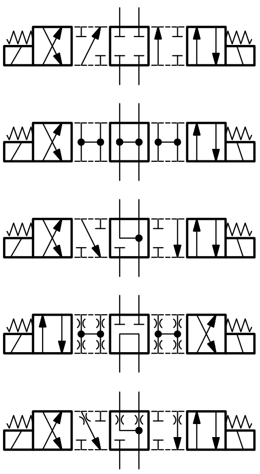
	ATEX		IECEx		INMETRO	
for gases for dusts	**KD2**	II 2GD	**KXD2**	IECEx Gb IECEx Db	**KBD2**	INMETRO Gb INMETRO Db
for mines	**KDM2**	I M2	**KXDM2**	IECEx Mb	**KBDM2**	INMETRO Mb

NOTE: Refer to the technical data sheet 02 500 for marking, operating temperatures and available versions.

1.3 - Available spools

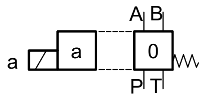
Version **S***:
2 solenoids - 3 positions
with spring centering

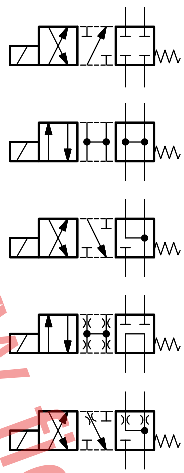




S1
S2
S3
S4
S9

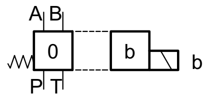
Version **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering

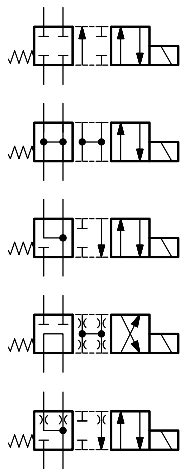




SA1
SA2
SA3
SA4
SA9

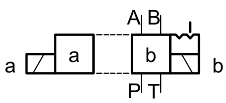
Version **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



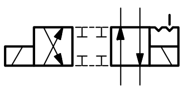


SB1
SB2
SB3
SB4
SB9

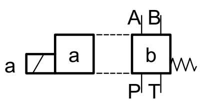
Version **RK**:
2 solenoids - 2 positions
with mechanical detent

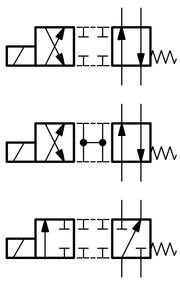


RK



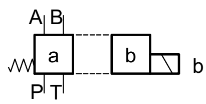
Version **TA**:
1 solenoid side A
2 external positions
with return spring

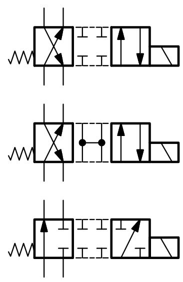




TA
TA02
TA23

Version **TB**:
1 solenoid side B
2 external positions
with return spring





TB
TB02
TB23

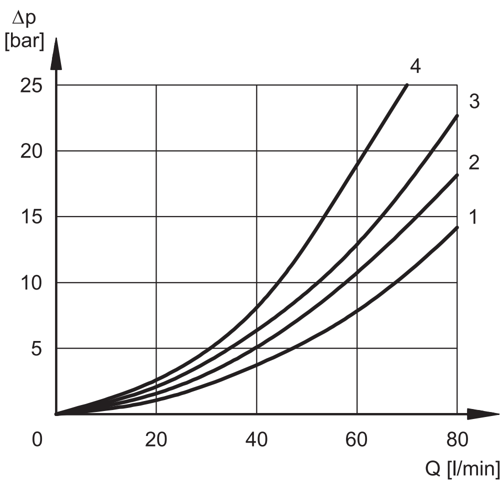
NOTE: TA02/TB02
spools are not available
for RAC solenoid valves.

2 - CHARACTERISTIC CURVES AND PERFORMANCES OF DIRECT OPERATED SOLENOID VALVES

2.1 - Pressure drops Δp-Q

(values obtained with viscosity 36 cSt at 50 °C)

DS3K*



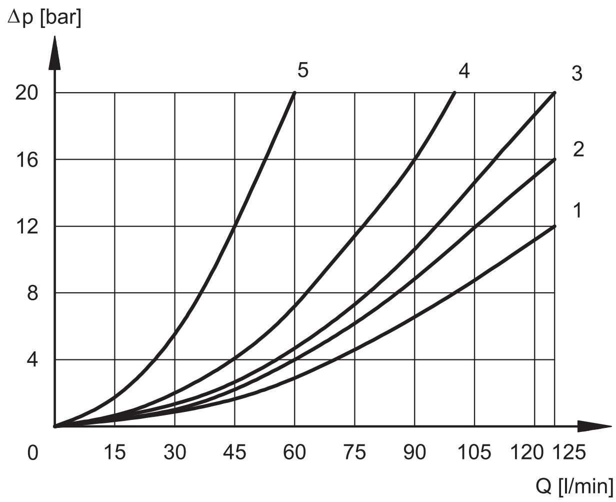
ENERGIZED VALVE

SPOOL	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB2	2	2	3	3
S2, SA2, SB2	1	1	3	3
S3, SA3, SB3	3	3	1	1
S4, SA4, SB4	4	4	4	4
S9, SA9, SB9	2	2	3	3
TA, TB	3	3	3	3
TA02, TB02	2	2	2	2
TA23, TB23	3	3	-	-
RK	2	2	2	2

DE-ENERGIZED VALVE

SPOOL	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2	-	-	-	-	2
S3, SA3, SB3	-	-	3	3	-
S4, SA4, SB4	-	-	-	-	3

DL5BK*



ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1	1	1	2	2
S2	1	1	1	1
S3	1	1	1	1
S4	4	4	4	4
S9	1	1	1	1
RK	2	2	2	2
TA	2	2	3	3
TA02	2	2	1	1
TA23	3	3	-	-

DE-ENERGIZED VALVE

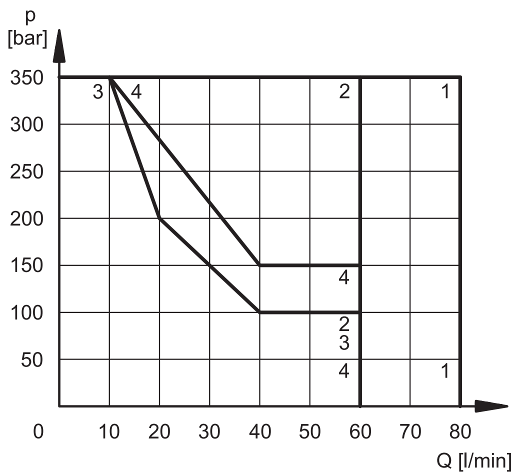
SPOOL	FLOW DIRECTIONS		
	A→T	B→T	P→T
	CURVES ON GRAPHS		
S2	-	-	1
S3	5	5	-
S4	-	-	1

2.2 - Performance limits

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage, with mineral oil with viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.

DS3K*



DC SOLENOID VALVE

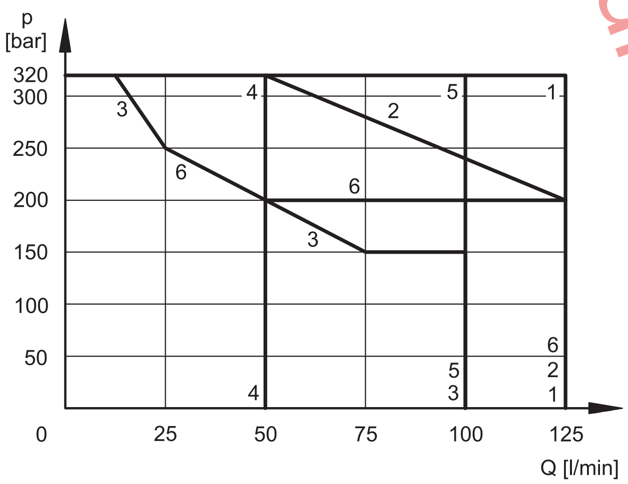
SPOOL	CURVE P→A	CURVE P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	3	3
S4, SA4, SB4	2	2
S9, SA9, SB9	1	1
TA, TB	1	1
TA02, TB02	4	4
TA23, TB23	4	4
RK	1	1

RAC SOLENOID VALVE

SPOOL	CURVE P→A	CURVE P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	3	3
S4, SA4, SB4	4	4
S9, SA9, SB9	1	1
TA, TB	1	1
TA02 *, TB02 *		
TA23, TB23	4	4
RK	1	1

* not available

DL5BK*



SPOOL	CURVE
S1, S2, RK	1
TA02	2
S3	3
S4	4
TA, TA23	5
S9	6

2.3 - Switching times

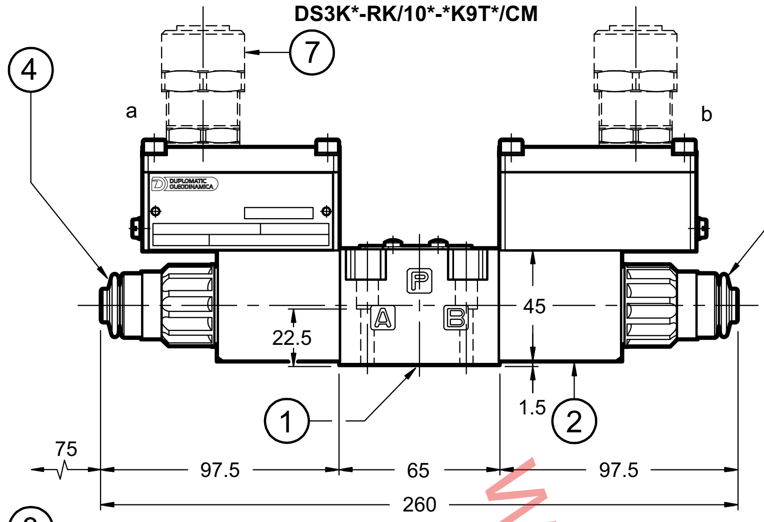
The indicated values are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

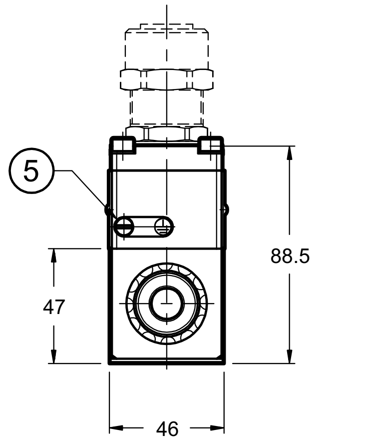
	DS3K*		DL5BK*	
TIMES [ms]	ENERGIZING	DE-ENERGIZING	ENERGIZING	DE-ENERGIZING
DC	60	40	70 ÷ 100	15 ÷ 20
RAC	60	140	70 ÷ 100	140

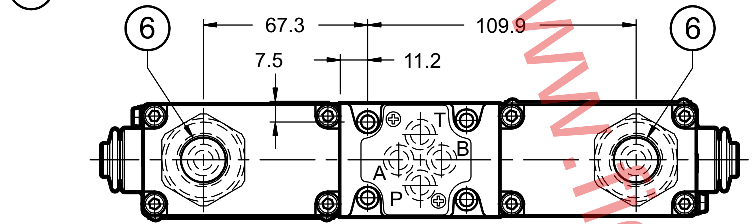
3 - OVERALL AND MOUNTING DIMENSIONS OF DIRECT OPERATED VALVES

DS3K*-S*/10*-*K9T*/CM
DS3K*-RK/10*-*K9T*/CM

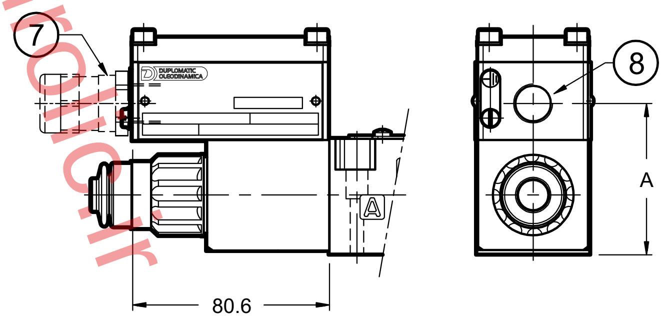
dimensions in mm





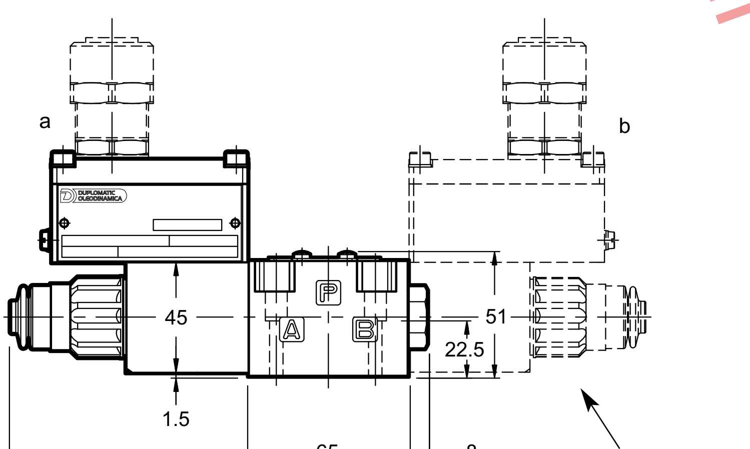


DS3K*-*/10*-*K9S*/CM



Side port type	A
S01, S04	60.5
S02, S03	60

DS3K*-SA*/10*-*K9T*/CM
DS3K*-TA/10*-*K9T*/CM
DS3K*-TA*/10*-*K9T*/CM



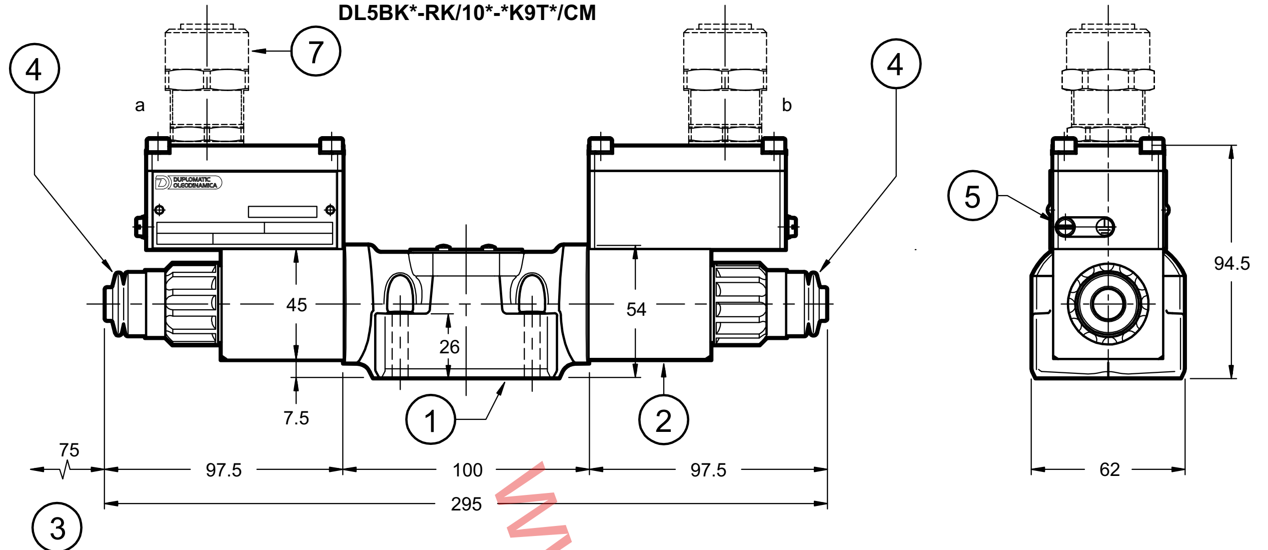
Solenoid position for versions SB*, TB and TB*

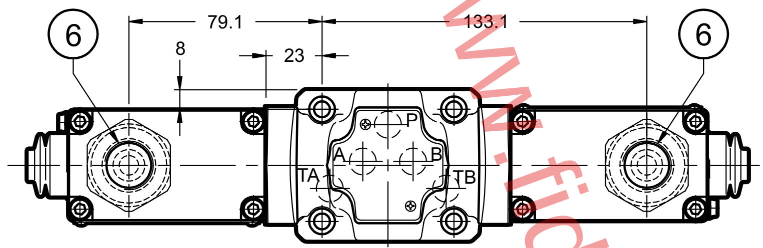
1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected (**standard for both N and V seals**) - for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see paragraph 19
8	Side port for cable gland

Valve fastening: 4 SHC screws ISO 4762 M5x30
Tightening torque: 5 Nm (A8.8 screws)
Threads of mounting holes: M5x10

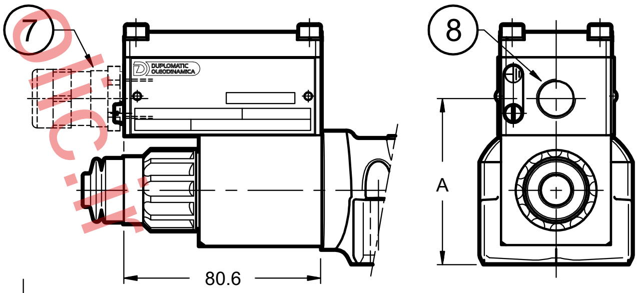
dimensions in mm

DL5BK*-S*/10*-*K9T*/CM
DL5BK*-RK/10*-*K9T*/CM



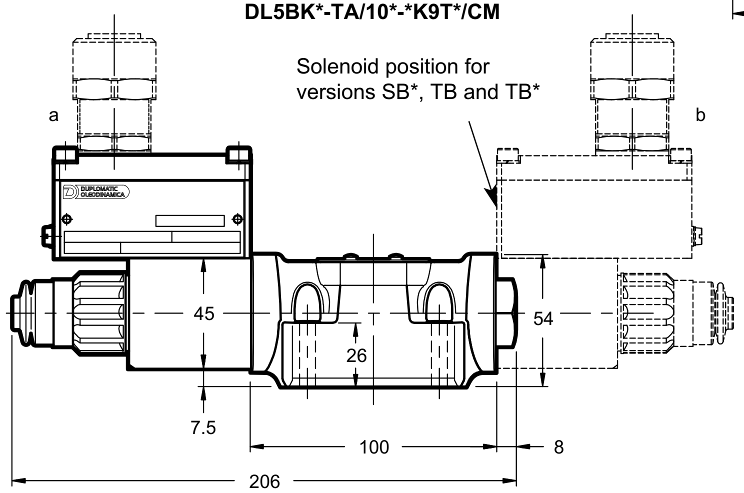


DL5BK*-*/10*-*K9S*/CM



Side port type	Dimension A
S01, S04	66.5
S02, S03	66

DL5BK*-SA*/10*-*K9T*/CM
DL5BK*-TA/10*-*K9T*/CM



1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected (**standard for both N and V seals**) - for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see paragraph 19
8	Side port for cable gland

Valve fastening: 4 SHC screws ISO 4762 M6x35
Tightening torque: 8 Nm (A8.8 screws)
Threads of mounting holes: M6x10

4 - IDENTIFICATION OF PILOT OPERATED SOLENOID VALVES DSP*K*

4.1 - Identification code

DSP			-		/	10		-			/		/		K9		/			

Pilot operated directional valve

Size:
5 = CETOP P05
5R = ISO 4401-05
7 = ISO 4401-07
8 = ISO 4401-08
10 = ISO 4401-10

Explosion-proof certification:
See table 1.2

Spool type (see par. 6.2)

S*	**TA**	**TB**	**RK**
SA*	**TA02**	**TB02**	
SB*			

Series No.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
For temperature range -20 / +80 °C
N = NBR seals for mineral oil (standard)
V = FPM seals for special fluids
For temperature range -40 / +80 °C
NL = seal for low temperatures (for mineral oil)

Piloting:
I = internal (not available for spools S2, S4, TA02, TB02, S*2 and S*4. If internal piloting should be necessary, choose piloting type C)
E = external
C = internal piloting with backpressure valve (available on DSP7 and DSP8)
Z = internal piloting with 30 bar fixed adjustment pressure reducing valve

Drainage:
I = Internal
E = External

Options:
C = main spool stroke control
D = main spool shifting speed control
P08 = Subplate with restrictor Ø0,8 on port P placed under the solenoid valve - for valves DSP5 - DSP5R - DSP7 - DSP8
P15 = subplate with restrictor Ø1,5 on port P placed under the solenoid valve - only for valves DSP10

Power supply:
Direct current (DC)
D12 = 12 V
D24 = 24 V
D48 = 48 V
D110 = 110 V
Alternate current with built-in rectifier bridge (RAC)
R120 = 120 V
R240 = 240 V

Coil electrical connection: by terminal block

Connection type for cable gland
upper connection:
T01 = M20x1.5 - ISO 261
T02 = Gk 1/2 - UNI EN 10226-2 not available for INMETRO
T03 = 1/2” NPT - ANSI B1.20.1 (ex ANSI B2.1)
side connection:
S01 = M20x1.5 - ISO 261
S02 = Gk 1/2 - UNI EN 10226-2 not available for INMETRO
S03 = 1/2” NPT - ANSI B1.20.1 (ex ANSI B2.1)
S04 = M16x1.5 - ISO 261

Manual override:
CM = boot protected
standard for both N and V seals
not available for NL seals
CB = blind ring nut
standard for NL seals
available upon request for both N and V seals
see dimensions at paragraph 16

Option: **/T5**
version in T5 temperature class.
Omit if not required.

Option: surface treatment not standard.
Omit if not required
(see **NOTE**)

A version suitable for an operating pressure value of **420 bar** on ports P - A - B is available upon request, except for DSP5K*-S4 / DSP5RK* and DSP10K* valves. On this version, the maximum pressure value on port T with external drain and the pilot pressure are equal to 350 bar. The maximum pressure on port T with internal drainage is 210 bar.

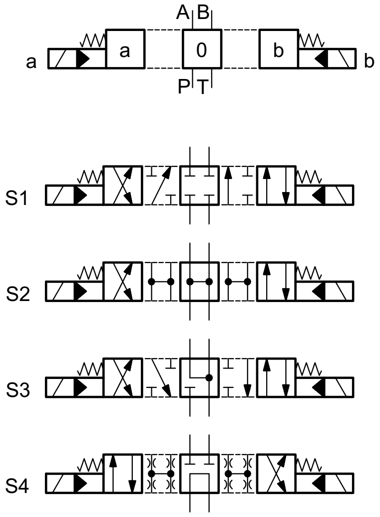
Add the letter **H** to request this version (ex. DSP7**H**K*).

NOTE: the valves are supplied with standard surface treatment of phosphating black for the main body and zinc-nickel for the pilot body. Upon request we can supply these valves with full zinc-nickel surface treatment, suitable to ensure a salt spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

For full zinc-nickel surface treatment add **/W7** at the end of the identification code.

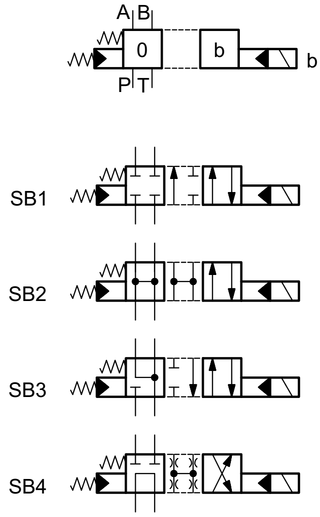
4.2 - Spool types

Version **S***:
2 solenoids - 3 positions
with spring centering

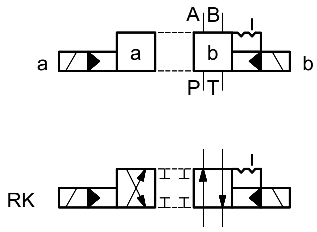


Version **SA***:
1 solenoid side A
2 positions (central + external)
with spring centering

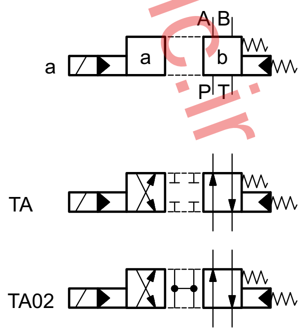
Version **SB***:
1 solenoid side B
2 positions (central + external)
with spring centering



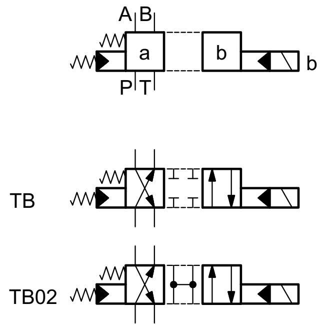
Version **RK**:
2 solenoids - 2 positions
with mechanical retention



Version **TA**:
1 solenoid side A
2 external positions
with return spring



Version **TB**:
1 solenoid side B
2 external positions
with return spring

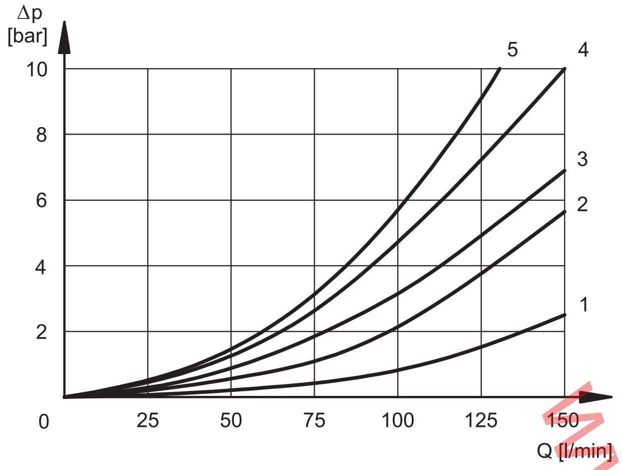


5 - CHARACTERISTIC CURVES AND PERFORMANCES OF PILOT OPERATED SOLENOID VALVES

5.1 - Pressure drops Δp-Q

(values obtained with viscosity 36 cSt at 50 °C)

DSP5K* - DSP5RK*



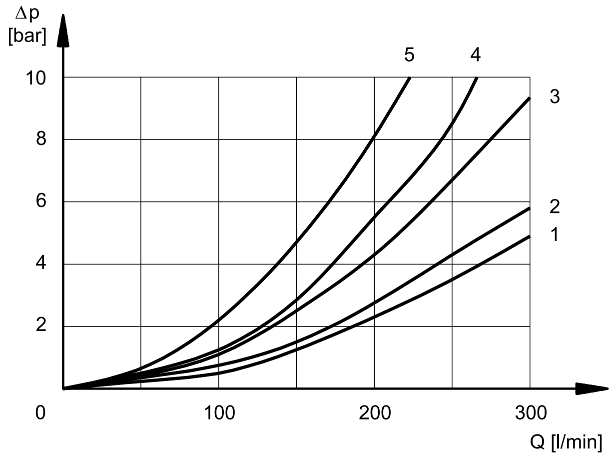
ENERGIZED POSITION

SPOOL	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	4	4	1	1
S2, SA2, SB2	3	3	1	2
S3, SA3, SB3	4	4	1	1
S4, SA4, SB4	5	5	2	3
TA, TB	4	4	1	1
TA02, TB02	3	3	1	1
RK	4	4	1	1

DE-ENERGIZED POSITION

SPOOL	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2	-	-	-	-	5
S3, SA3, SB3	-	-	4	4	-
S4, SA4, SB4	-	-	-	-	5

DSP7K*



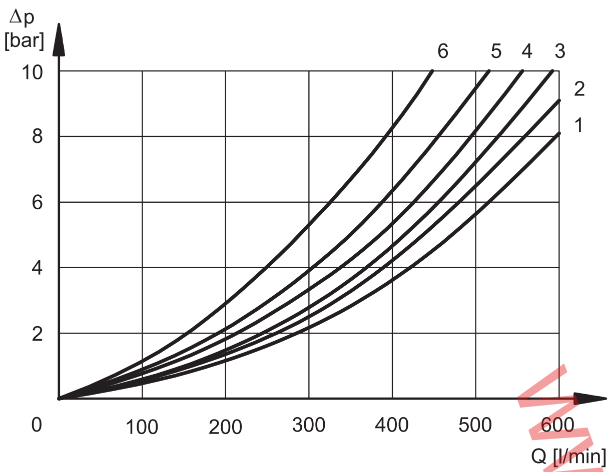
ENERGIZED POSITION

SPOOL	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	1	1	3	4
S2, SA2, SB2	1	1	4	4
S3, SA3, SB3	1	1	4	4
S4, SA4, SB4	2	2	4	5
TA, TB	1	1	3	4
TA02, TB02	1	1	4	4
RK	1	1	3	4

DE-ENERGIZED POSITION

SPOOL	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2	-	-	-	-	2
S3, SA3, SB3	-	-	4	4	-
S4, SA4, SB4	-	-	-	-	4

DSP8K*



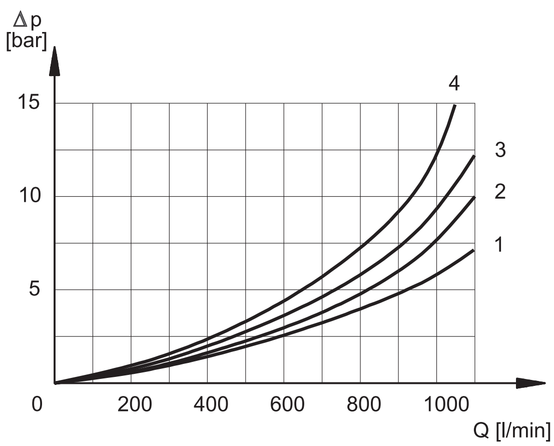
ENERGIZED POSITION

SPOOL	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	3	3
S2, SA2, SB2	1	1	2	1
S3, SA3, SB3	2	2	2	1
S4, SA4, SB4	4	4	3	5
TA, TB	2	2	3	3
TA02, TB02	2	2	3	3
RK	2	2	3	3

DE-ENERGIZED POSITION

SPOOL	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2	-	-	-	-	4
S3, SA3, SB3	-	-	4	4	-
S4, SA4, SB4	-	-	-	-	6

DSP10K*



ENERGIZED POSITION

SPOOL	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	1	1	1	1
S2, SA2, SB2	2	2	2	2
S3, SA3, SB3	1	1	4	4
S4, SA4, SB4	2	2	2	2
TA, TB	1	1	1	1
TA02, TB02	1	1	1	1
RK	1	1	1	1

DE-ENERGIZED POSITION

SPOOL	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2	-	-	-	-	3
S3, SA3, SB3	-	-	4	4	-
S4, SA4, SB4	-	-	-	-	4

5.2 - Switching times

The values indicated refer to a solenoid valve working with piloting pressure of 100 bar, with mineral oil at a temperature of 50°C, at viscosity of 36 cSt and with PA and BT connections.

The energizing and de-energizing times are obtained at the pressure variation which occurs on the lines.

TIMES (± 10%) [ms]	ENERGIZING	DE- ENERGIZING	
	DC - RAC	DC	RAC
DSP5K* - DSP5RK*	70	60	160
DSP7K*	80	70	170
DSP8K*	90	70	170
DSP10K*	120	90	190

6 - HYDRAULIC CHARACTERISTICS

PRESSURES (bar)	DSP5K* DSP5RK*	DSP7K*	DSP8K*	DSP10K*
Max pressure in P, A, B ports	320	350	350	350
Max pressure in T line with external drainage	210	250	210	210
Max pressure in T line with internal drainage	210	210	210	210
Max pressure in Y line with external drainage	210	210	210	210
Min piloting pressure **NOTE 1**	5 ÷ 12			6 ÷ 12
Max piloting pressure **NOTE 2**	210	210	210	280

NOTE 1: minimum piloting pressure can be the lower range value at low flows rates, but with higher flow rates the higher value is needed.

NOTE 2: if the valve operates with higher pressures it is necessary to use the version with external pilot and reduced pressure. Otherwise, the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered.

Add the letter **Z** to the identification code to order this option (see par. 4.1). Consider that, by adding the pressure reducing valve, the overall dimensions increase 40 mm in height.

MAXIMUM FLOW RATES		DSP5K* DSP5RK*		DSP7K*		DSP8K*		DSP10K*	
Spool type		PRESSURES							
		at 210 bar	at 320 bar	at 210 bar	at 350 bar	at 210 bar	at 350 bar	at 210 bar	at 350 bar
S4 - SA4 - SB4	[l/min]	120	100	200	150	500	450	750 (**NOTE**)	600 (**NOTE**)
Other spools		150	120	300	300	600	500	900	700

NOTE: for the DSP10K* valve these values are the same even for S2 - SA2 - SB2 spools.

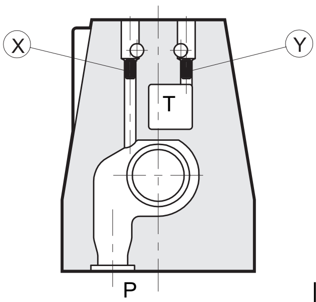
7 - PILOT AND DRAIN

DSP*K* valves are available with piloting and drainage, both internal and external.

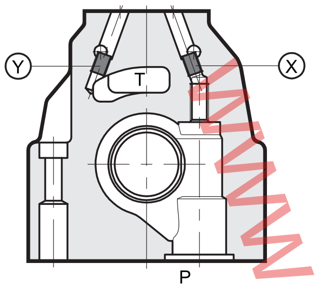
The version with external drainage allows for a higher back pressure on the outlet.

TYPE OF VALVE		Plug assembly X	Plug assembly Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

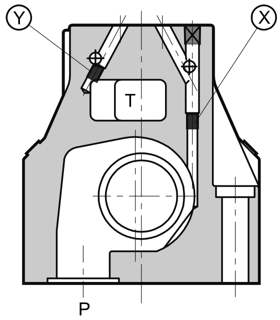
DSP5K*
DSP5RK*



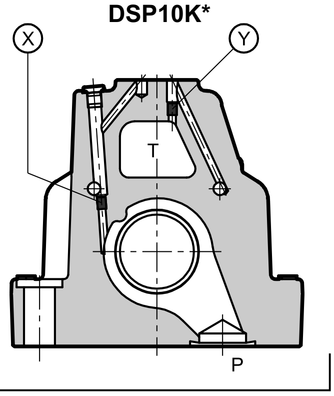
DSP7K*



DSP8K*



DSP10K*

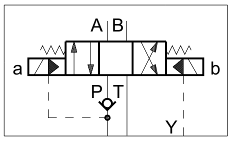


X: plug M5x6 for external pilot
Y: plug M5x6 for external drain

X: plug M6x8 for external pilot
Y: plug M6x8 for external drain

7.1 - Backpressure valve incorporated on line P (C option)

DSP7K* and DSP8K* valves are available upon request with backpressure valve incorporated on line P. This is necessary to obtain the piloting pressure when the control valve, in rest position, has the line P connected to the T port (spools S2 - S4 - S*2 - S*4 - T*02). The cracking pressure is of 5 bar with a minimum flow rate of 15 l/min.



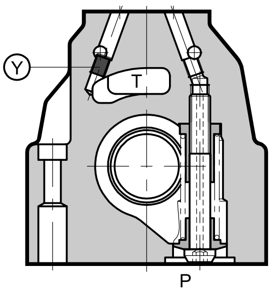
In the C version the piloting is always internal.

NOTE: the backpressure valve can't be used as check valve because it doesn't assure the seal.

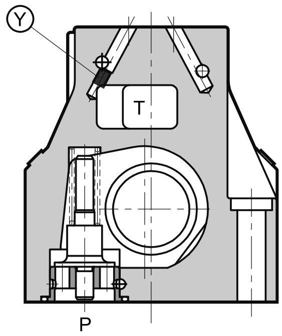
Add **C** to the identification code for this request (see paragraph 4.1).

For DSP7K* only, the backpressure valve can be also delivered separately and it can be easily mounted on line P of the main control valve. Ask for code **0266577** to order the backpressure valve.

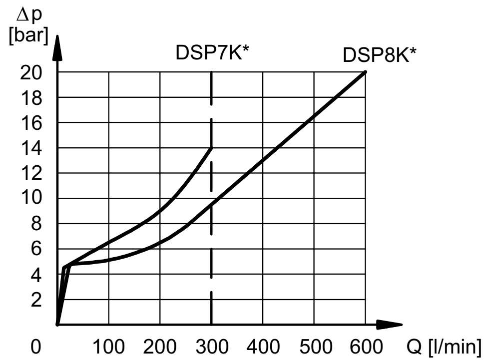
DSP7K*



DSP8K*



pilot always internal
Y: plug M6x8 for external drain



The curve refers to the pressure drop (body part only) with backpressure valve energized to which the pressure drop of the reference spool must be added (see paragraph 5).

8 - ELECTRICAL CHARACTERISTICS

(values ± 5%)

Coil type	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [W]
D12	12	7,2	1,7	20
D24	24	28,7	0,83	20
D48	48	115	0,42	20
D110	110	549	0,2	22

Coil type (**NOTE**)	Nominal voltage [V]	Freq. [Hz]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [VA]
R120	110V-50Hz 120V-60Hz	50/60	489,6	0,19	21
				0,21	25
R240	230V-50Hz 240V-60Hz		2067,7	0,098	22,5
				0,1	24

VOLTAGE SUPPLY FLUCTUATION (ripple included)	± 10% Vnom
MAX SWITCH ON FREQUENCY DS3K*, DL5BK* DSP5K*, DSP5RK* DSP7K* DSP8K* DSP10K*	 8.000 ins/hr 6.000 ins/hr 6.000 ins/hr 4.000 ins/hr 3.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2014/30/EU
CLASS OF PROTECTION: Atmospheric agents Coil insulation (VDE 0580)	 IP66 / IP68 class H

NOTE: type R* coils are for alternating current supply for both 50 or 60 Hz. For R* coils the resistance can not be measured in the usual way because of the presence of diodes bridge inside the coil.

8.1 - Wiring

In order to realise the electrical connection of the coil, it is necessary to access the terminal block (1) unscrewing the 4 screws (2) that fasten the cover (3) with the box (4) that contains the terminal block.

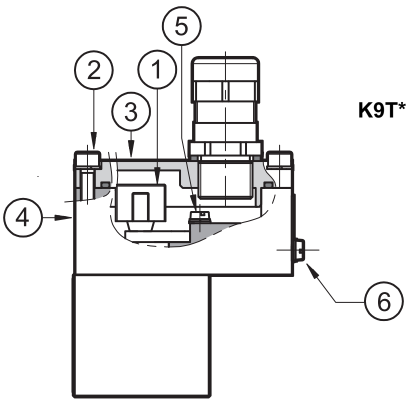
The electrical connection is polarity-independent.

By doing electrical connection it is important to connect also the grounding point (5) in the terminal block box (M4 screws), through suitable conductors with the general grounding line of the system.

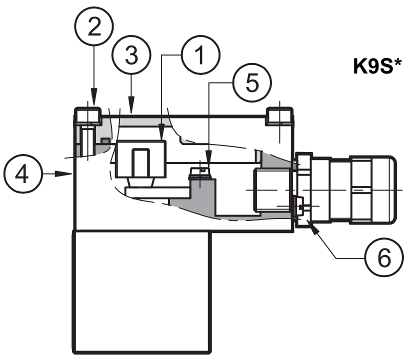
On the external body of the coil there is a grounding point (6) (M4 screw) that allow to ensure equipotentiality between the valve and the general grounding line of the system; connecting this point the regulation of the EN 13463-1 standard, that impose to verify the equipotentiality of the elements included in a potentially explosive environment (the maximum resistance between the elements must be 100 Ω), is guaranteed.

At the end of the electrical wiring, it is necessary to reassemble the cover (3) on the box (4), checking the correct positioning of the seal located in the cover seat and fastening the 4 M5 screws with a torque of 4.9÷6 Nm.

Electrical wiring must be done following in compliance with standards about protection against explosion hazards.



K9T*



K9S*

Characteristics of the cables connectable for wiring are indicated in the table below:

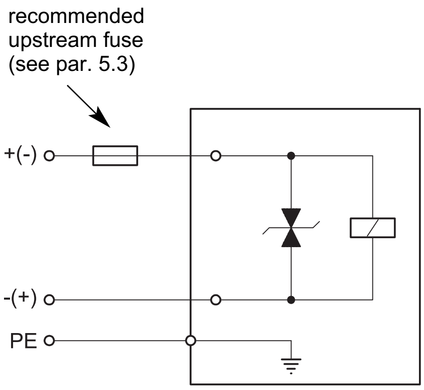
Function	Cable section
Operating voltage cables connection	max 2.5 mm²
Connection for internal grounding point	max 2.5 mm²
Connection for external equipotential grounding point	max 6 mm²

Cables for wiring must be non-armoured cables, with external covering sheath and must be suitable for use in environments with temperatures from - 20 °C to +110 °C (for valves either with N or V seals) or from - 40 °C to +110 °C (for valves with NL seals).

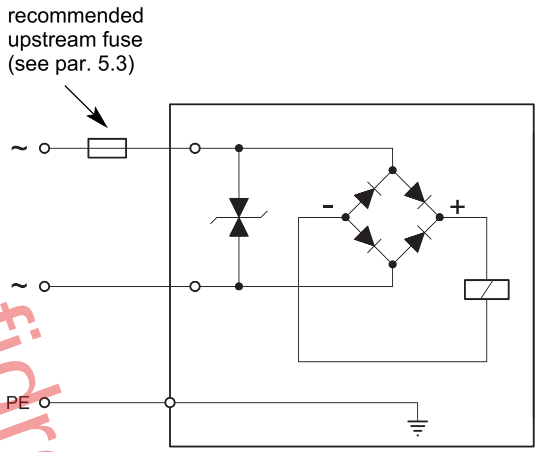
Cable glands (which must be ordered separately, see paragraph 19) allow to use cables with external diameter between 8 and 10 mm.

8.2 - Electrical diagrams

DC coil



RAC coil



8.3 - Overcurrent fuse and switch-off voltage peak

Upstream of each valve, an appropriate fuse (max 3 x In according to IEC 60127) or a protective motor switch with short-circuit and thermal instantaneous tripping, as short-circuit protection, must be connected. The cut-off power of the fuse must correspond or exceed the short circuit current of the supply source. The fuse or the protective motor must be placed outside the dangerous area or they must be protected with an explosion-proof covering.

In order to safeguard the electronic device to which the valve is connected, there is a protection circuit in the coil, that reduces voltage peaks, which can occur when inductances are switched off.

The table shows the type of fuse recommended according to the nominal voltage of the valve and to the value of the voltage peaks reduction.

Coil type	Nominal voltage [V]	Rated current [A]	**Recommended pre-fuse characteristics medium time-lag according to DIN 41571 [A]**	Maximum voltage value upon switch off [V]	Suppressor circuit
D12	12	1,7	2,5	- 49	Transient voltage suppressor bidirectional
D24	24	0,83	1,25	- 49	
D48	48	0,42	0,6	- 81	
D110	110	0,2	0,3	- 309	
R120	120	0,21	0,3	- 3	
R240	240	0,1	0,15	- 3	

9 - OPTIONS

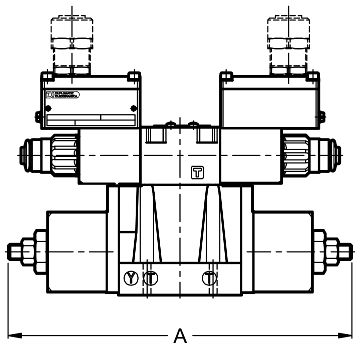
9.1 - Control of the main spool stroke: C

With the help of special side plugs, it is possible to introduce stroke controls in the heads of the piloted valve so as to vary the maximum spool clearance opening.

This solution allows control of the flow rate from the pump to the actuator and from the actuator to the outlet, obtaining a double adjustable control on the actuator.

Add the letter **C** to the identification code to request this device (see paragraph 4.1).

DSP*K*-*/C



dimensions in mm

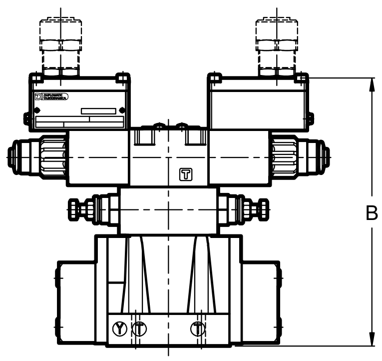
	DSP5K* DSP5RK*	DSP7K*	DSP8K*	DSP10K*
A	280	319	401.5	520

9.2 - Control of the main spool shifting speed: D

By placing a MERS type double flow control valve between the pilot solenoid valve and the main distributor, the piloted flow rate can be controlled and therefore the changeover smoothness can be varied.

Add the letter **D** to the identification code to request this device (see paragraph 4.1).

DSP*K*-*/D



dimensions in mm

	DSP5K* DSP5RK*	DSP7K*	DSP8K*	DSP10K*
B	218.5	225.5	254.5	310.5

9.3 - Subplate with throttle on line P

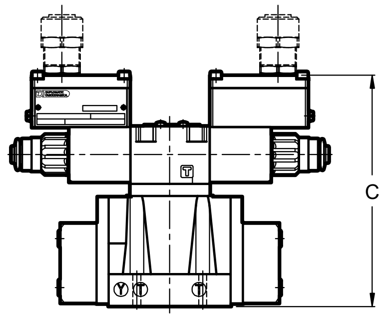
It is possible to introduce a subplate with a restrictor on line P between the pilot solenoid valve and the main distributor.

restrictor Ø0.8 for DSP5K*, DSP5RK*, DSP7K* e DSP8K*
restrictor Ø1.5 for DSP10K*:

To request include in the code (par. 4.1):

P08 for DSP5K*, DSP5RK*, DSP7K* and DSP8K*
P15 for DSP10K*

DSP*K*-*/P*



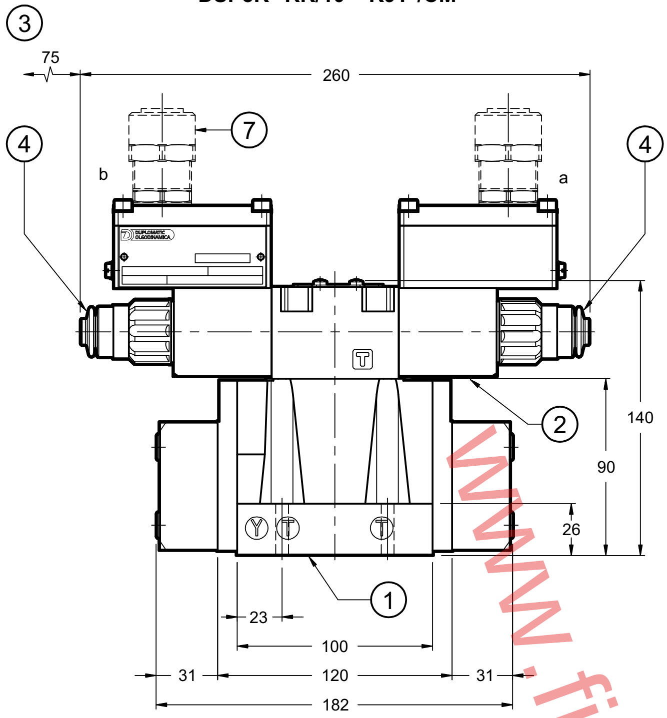
dimensions in mm

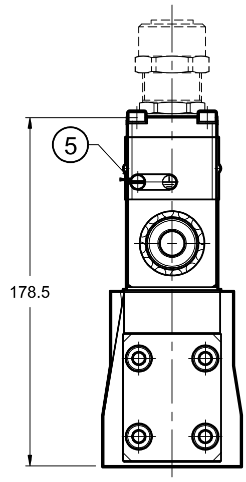
	DSP5K* DSP5RK*	DSP7K*	DSP8K*	DSP10K*
C	188.5	195.5	224.5	280.5

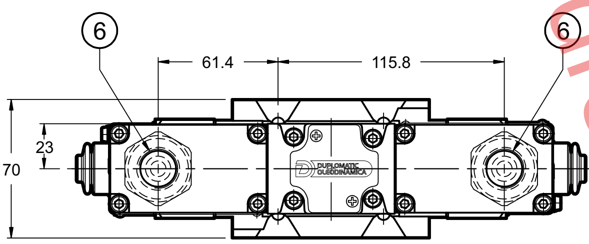
10 - DSP5K* AND DSP5RK* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

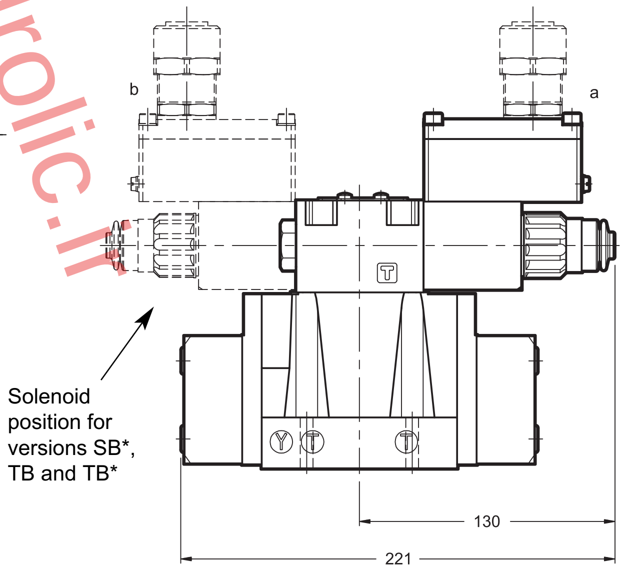
DSP5K*-S*/10*-*K9T*/CM
DSP5K*-RK/10*-*K9T*/CM







DSP5K*-SA*/10*-*K9T*/CM
DSP5K*-TA/10*-*K9T*/CM
DSP5K*-TA*/10*-*K9T*/CM



1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected (**standard for both N and V seals**) - for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see paragraph 19

NOTE 1: for overall dimensions with Z option (fixed adjustment pressure reducing valve) consider an increase of 40 mm in height.
NOTE 2: for side port cable gland see paragraph 14.
NOTE 3: use of class 10.9 fastening screws is recommended for version H valves (high pressure).

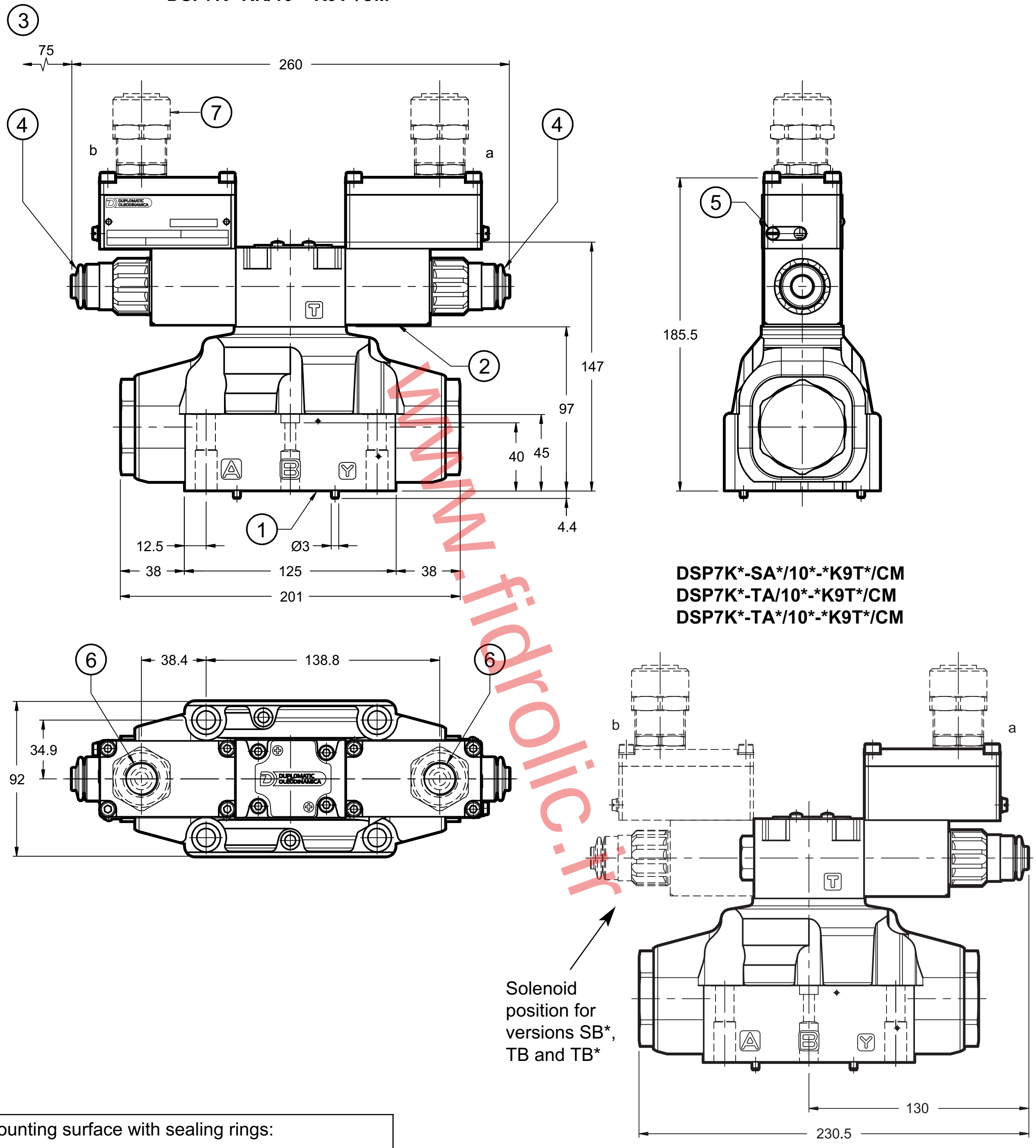
Valve fastening: 4 SHC ISO 4762 screws M6x35
Tightening torque: 8 Nm (A8.8 screws) 12 Nm (A10.9 screws)
Threads of mounting holes: M6x10

11 - DSP7K* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

DSP7K*-S*/10*-*K9T*/CM
DSP7K*-RK/10*-*K9T*/CM

DSP7K*-SA*/10*-*K9T*/CM
DSP7K*-TA/10*-*K9T*/CM
DSP7K*-TA*/10*-*K9T*/CM



1	Mounting surface with sealing rings: 4 OR type 130 (22.22X2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected (**standard for both N and V seals**) - for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see paragraph 19

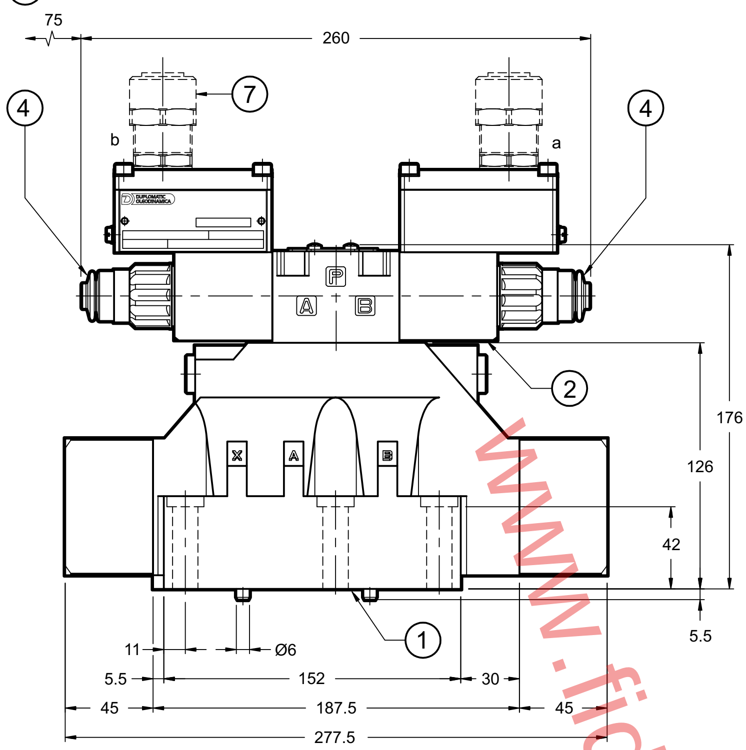
NOTE 1: for overall dimensions with Z option (fixed adjustment pressure reducing valve) consider an increase of 40 mm in height.
NOTE 2: for side port cable gland see paragraph 14.
NOTE 3: use of class 10.9 fastening screws is recommended for version H valves (high pressure).

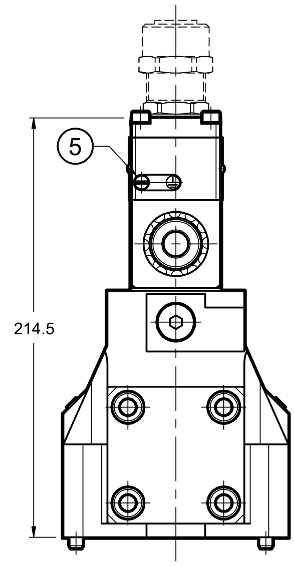
Valve fastening: 4 SHC screws ISO 4762 M10x60 2 SHC screws ISO 4762 M6x50
Tightening torque: M10x60: 40 Nm (A8.8 screws) - 57 Nm (A10.9 screws) M6x50: 8 Nm (A8.8 screws) - 12 Nm (A10.9 screws)
Threads of mounting holes: M6x12; M10x18

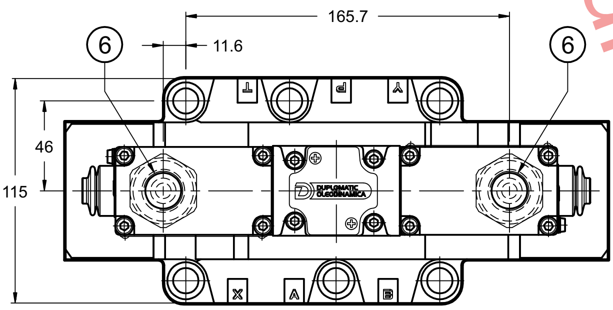
12 - DSP8K* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

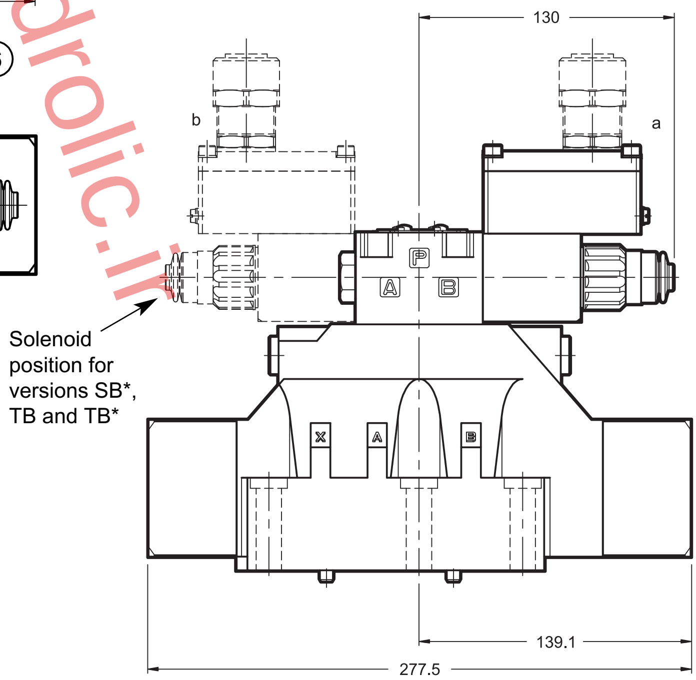
DSP8K*- S*/10*-*K9T*/CM
DSP8K*- RK/10*-*K9T*/CM







DSP8K*-SA*/10*-*K9T*/CM
DSP8K*-TA/10*-*K9T*/CM
DSP8K*-TA*/10*-*K9T*/CM



1	Mounting surface with sealing rings: 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected (**standard for both N and V seals**) - for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see paragraph 19

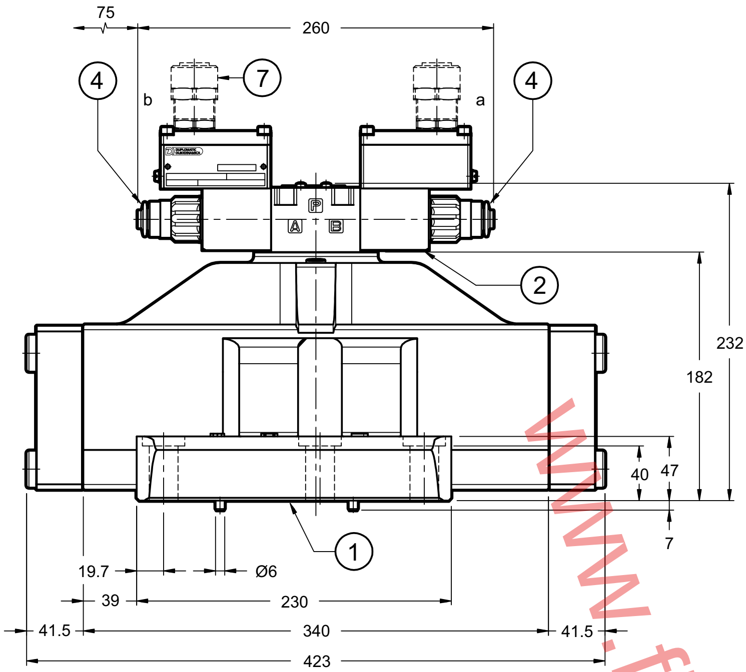
NOTE 1: for overall dimensions with Z option (fixed adjustment pressure reducing valve) consider an increase of 40 mm in height.
NOTE 2: for side port cable gland see paragraph 14.
NOTE 3: use of class 10.9 fastening screws is recommended for version H valves (high pressure).

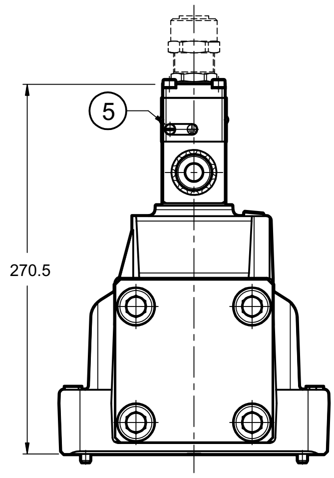
Valve fastening: 6 SHC ISO 4762 screws M12x60
Tightening torque: 69 Nm (A8.8 screws) - 97 Nm (A10.9 screws)
Threads of mounting holes: M12x20

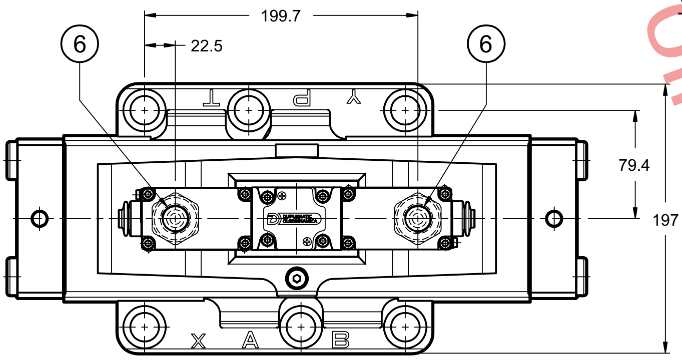
13 - DSP10K* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

DSP10K*-S*/10*-*K9T*/CM
DSP10K*-RK/10*-*K9T*/CM

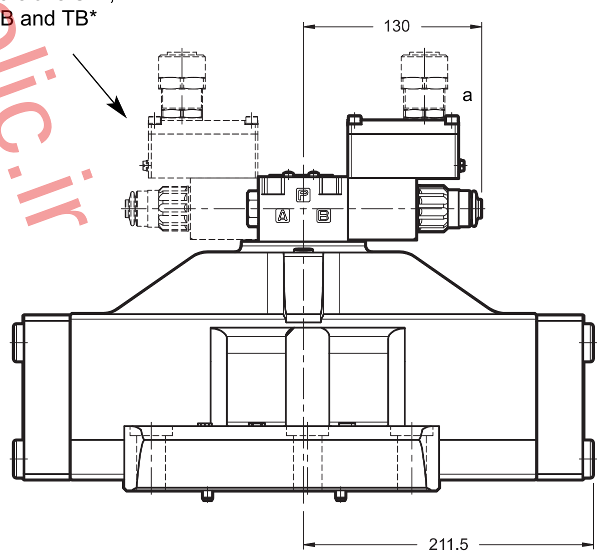






DSP10K*-SA*/10*-*K9T*/CM
DSP10K*-TA/10*-*K9T*/CM
DSP10K*-TA*/10*-*K9T*/CM

Solenoid position for versions SB*, TB and TB*



1	Mounting surface with sealing rings: 4 OR type 4150 (37.59x3.53) - 90 shore 2 OR type 3081 (20.24x2.62) - 90 shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected (**standard for both N and V seals**) - for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see paragraph 19

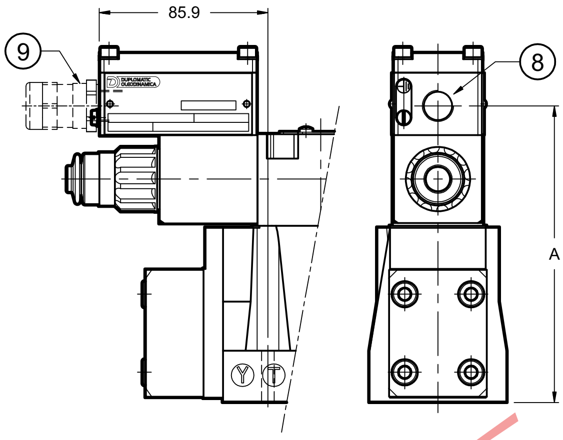
NOTE 1: for overall dimensions with Z option (fixed adjustment pressure reducing valve) consider an increase of 40 mm in height.
NOTE 2: for side port cable gland see paragraph 14.

Valve fastening: 6 SHC screws ISO 4762 M20x70
Tightening torque: 330 Nm (A8.8 screws)
Threads of mounting holes: M20x40

14 - OVERALL AND MOUNTING DIMENSIONS OF DSP*K* WITH SIDE CONNECTION

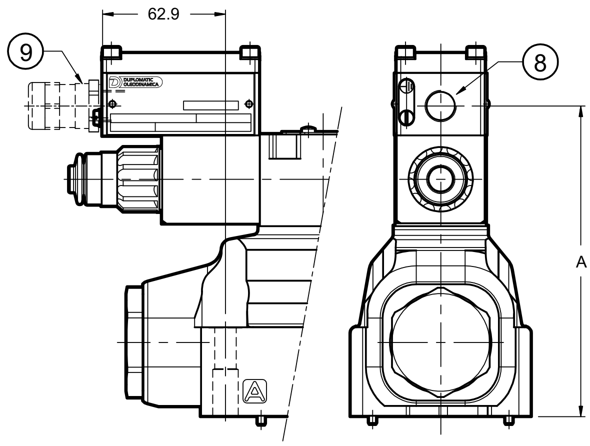
dimensions in mm

DSP5K*-*/10*-*K9S*/*
DSP5RK*-*/10*-*K9S*/*



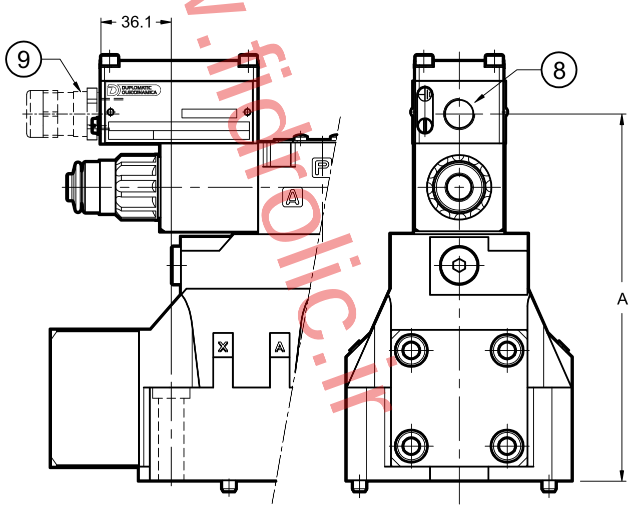
Side port type	A
S01, S04	150.5
S02, S03	150

DSP7K*-*/10*-*K9S*/*



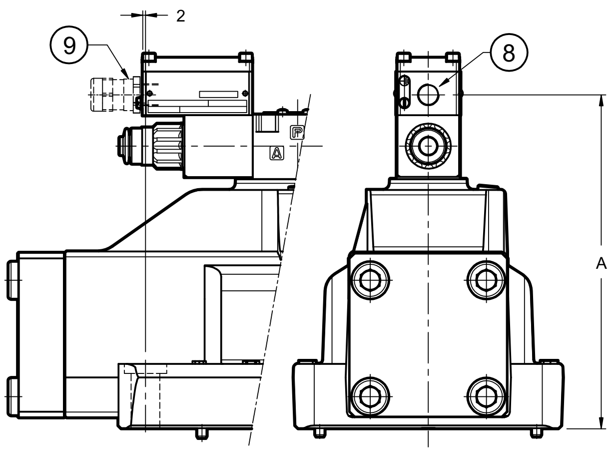
Side port type	A
S01, S04	157.5
S02, S03	157

DSP8K*-*/10*-*K9S*/*



Side port type	A
S01, S04	186.5
S02, S03	186

DSP10K*-*/10*-*K9S*/*

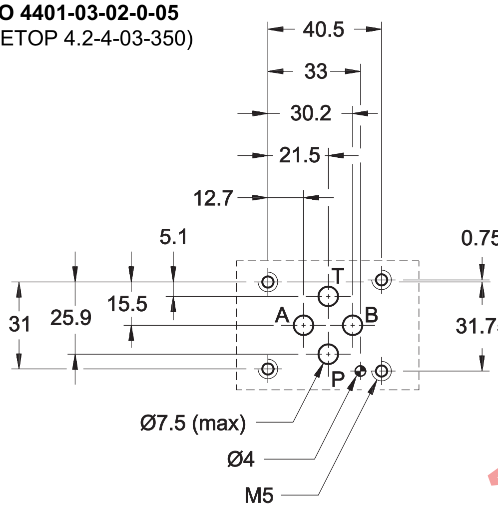


Side port type	A
S01, S04	242.5
S02, S03	242

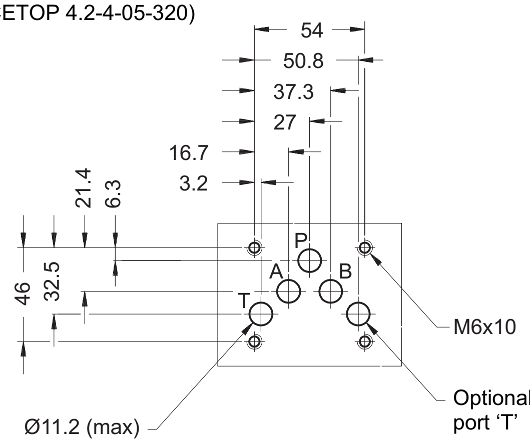
8	Side port
9	Cable gland. To be ordered separately, see par. 19

15 - MOUNTING SURFACES

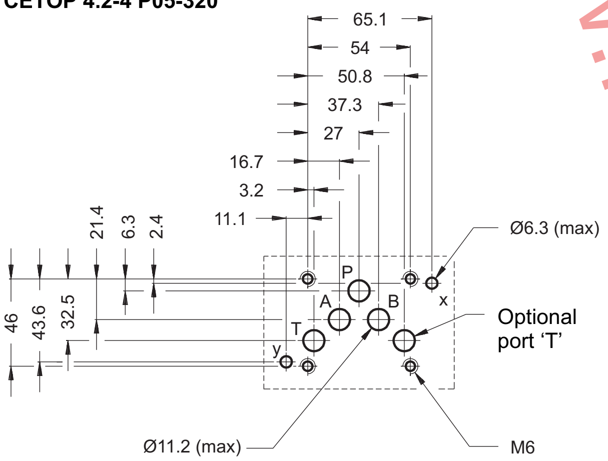
DS3K*
ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



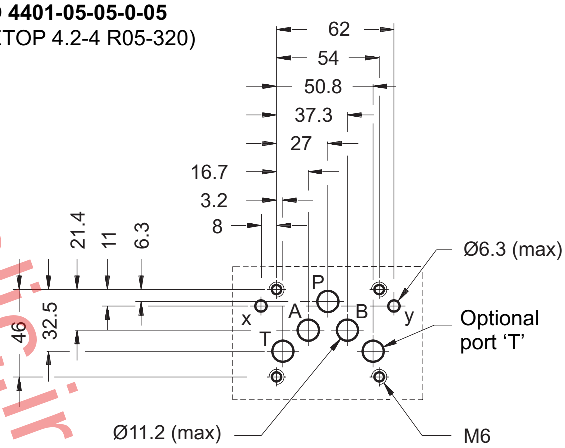
DL5BK*
ISO 4401-05-04-0-05
(CETOP 4.2-4-05-320)



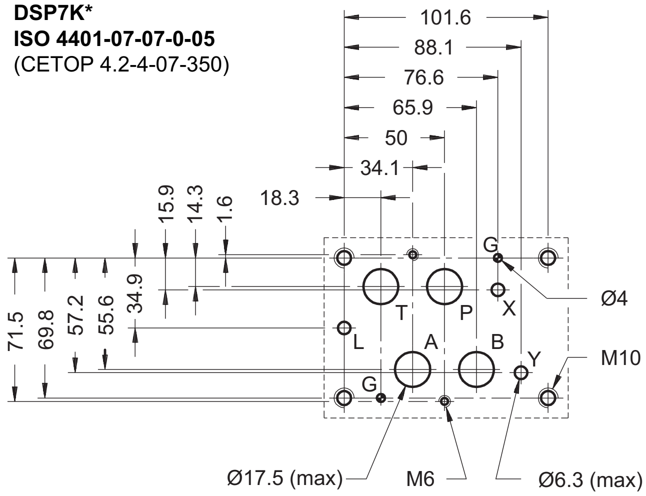
DSP5K*
CETOP 4.2-4 P05-320



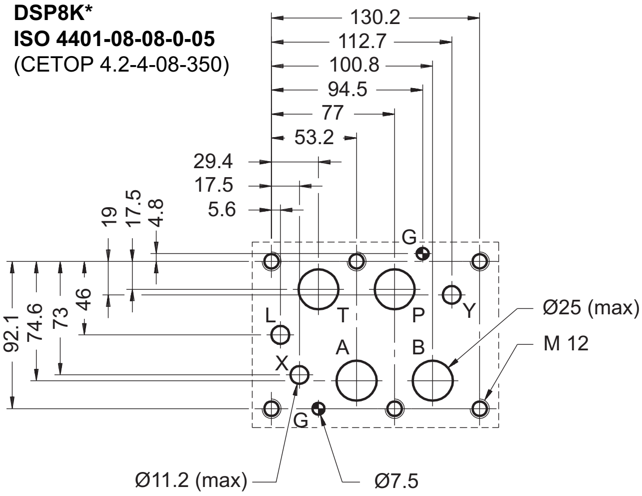
DSP5RK*
ISO 4401-05-05-0-05
(CETOP 4.2-4 R05-320)



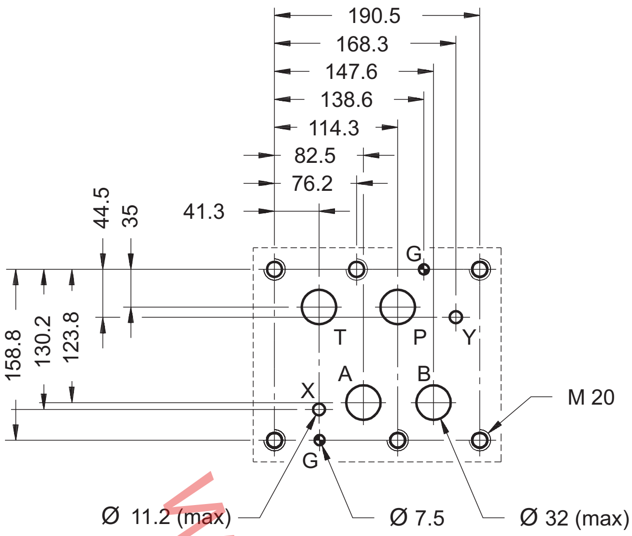
DSP7K*
ISO 4401-07-07-0-05
(CETOP 4.2-4-07-350)



DSP8K*
ISO 4401-08-08-0-05
(CETOP 4.2-4-08-350)



DSP10K*
ISO 4401-10-09-0-05
(CETOP 4.2-4-10-350)



16 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

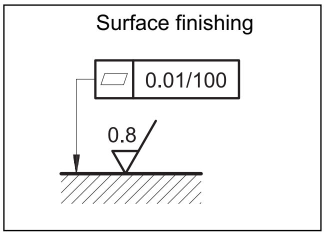
17 - INSTALLATION

Installation must adheres to instructions reported in the *Use and Maintenance manual*, always attached to the valve. Unauthorized interventions can be harmful to people and goods because of the explosion hazards present in potentially explosive atmospheres.

Configurations with centering and recall springs can be mounted in any position; The RK versions, without springs and with mechanical detent, must be mounted with the longitudinal axis horizontal.

Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.



18 - MANUAL OVERRIDES

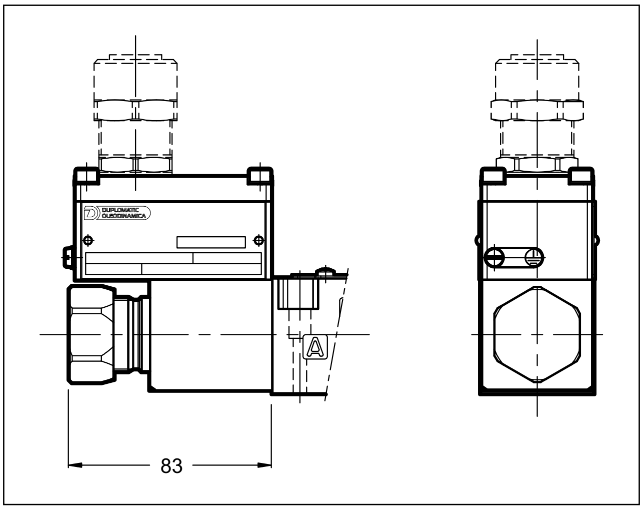
18.1 - CB - Blind ring nut

The metal ring nut protects the solenoid tube from atmospheric agents and isolates the manual override from accidental operations. The ring nut is tightened on a threaded fastener that keeps the coil in its position even without the ring nut.

To access the manual override loosen the ring nut and remove it; then reassemble hand tightening, until it stops.

Activate the manual override always and only with non-sparking tools suitable for use in potentially explosive atmospheres.

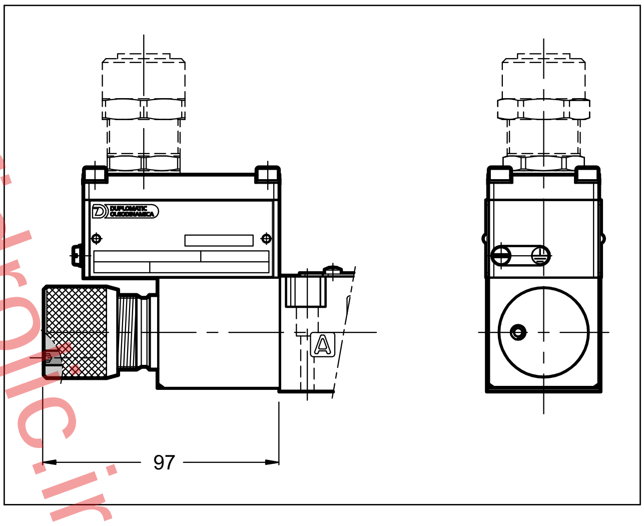
More information on safe use of explosion-proof components are provided in the instruction manual, always supplied with the valve.



18.2 - CK - Knob manual override

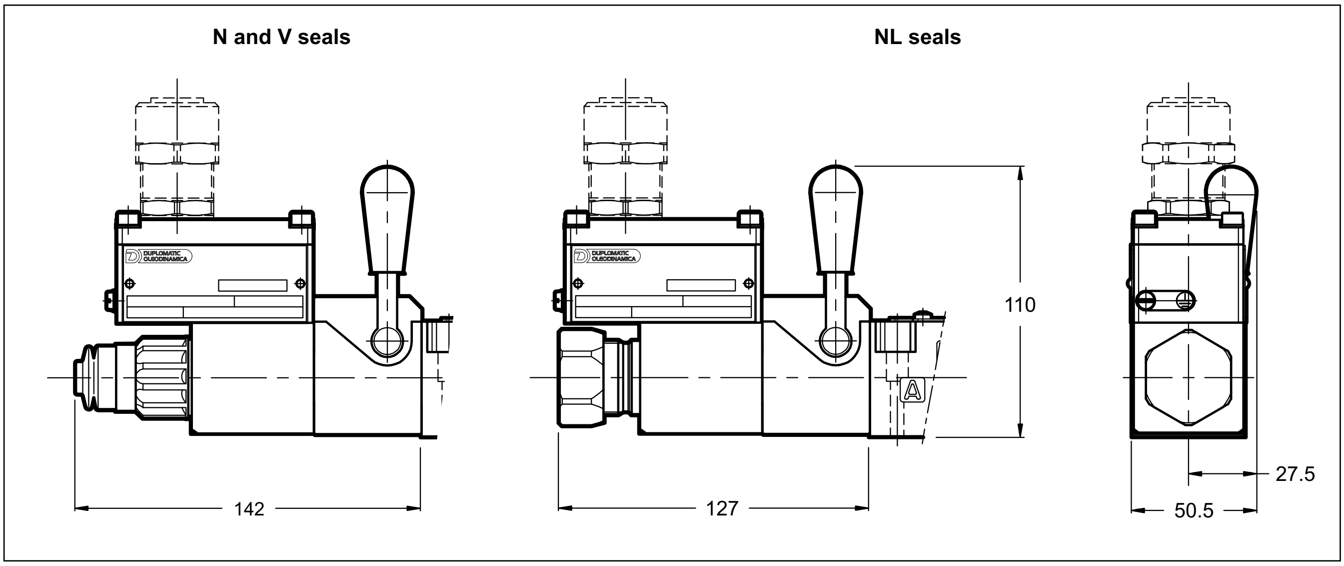
When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing. Available for DC valves only.

Spanner: 3 mm



18.3 - CH - Lever manual override

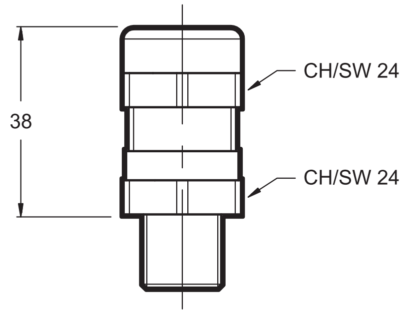
The lever manual override is available for DSE3K only. The seals choice leads the type of the standard ring nut to be mounted. The lever device is always placed at side A.



19 - CABLE GLANDS

Cable glands must be ordered separately; Duplomatic offers some types of cable glands with the following features:

- version for non-armoured cable, external seal on the cable (suitable for Ø 8 ÷ 10 mm cables);
- ATEX II 2GD, I M2; IECEx Gb, Db, Mb; INMETRO Gb, Db, Mb certified
- cable gland material: nickel brass
- rubber tip material: silicone
- ambient temperature range: -70 °C ÷ +220 °C
- protection degree: IP66/IP68
- tightening torque: 15 Nm



To order, list the description and the code of the version chosen from among those listed below:

Description: CGK2/NB-01/10

Code: 3908108001

M20x1.5 - ISO 261 male thread, suitable for coils with T01 and S01 connections. It is supplied equipped with silicone seal, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Description: CGK2/NB-02/10

Code: 3908108002

Gk 1/2 - UNI EN 10226-2 male thread, suitable for coils with T02 and S02 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Description: CGK2/NB-03/10

Code: 3908108003

1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1), suitable for coils with T03 and S03 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Description: CGK2/NB-04/10

Code: 3908108004

M16x1.5 - ISO 261 male thread, suitable for coils with S04 connection. It is supplied equipped with silicone seal, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

20 - SUBPLATES

(see catalogue 51 000)

	DS3K*	DL5BK*		DSP5K*	DSP7K*	DSP8K*
Type with rear ports	PMMD-AI3G	PMD4-AI4G	-	PME4-AI5G	PME07-AI6G	-
Type with side ports	PMMD-AL3G	-	PMD4-AL4G	PME4-AL5G	PME07-AL6G	PME5-AL8G
P, T, A, B ports dimensions X, Y ports dimensions	3/8" BSP -	3/4" BSP -	1/2" BSP -	3/4" BSP 1/4" BSP	1" BSP 1/4" BSP	1 ½" BSP 1/4" BSP

NOTE: Subplates (to be ordered separately) do not contain neither aluminium nor magnesium at a higher rate than the value allowed by norms according to ATEX directive for categories II 2GD and I M2.

The user must take care and make a complete assessment of the ignition risk, that can occur from the relative use in potentially explosive environments.

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www.duplomatic.com • e-mail: sales.exp@duplomatic.com

EXPLOSION-PROOF CLASSIFICATION for

SOLENOID AND PROPORTIONAL VALVES

ref. catalogues:

pressure valves

RQM*K*-P	21 515
PRE(D)*K*	81 315
ZDE3K*	81 515
DZCE*K*	81 605

directional valves

D*K*	41 515
DS(P)E*K*	83 510

GENERAL INFO

This informative technical datasheet displays information about **classification and marking** of Duplomatic explosion-proof valves range.

Duplomatic offers valves with the following certifications:

ATEX	**II 2G**	**II 2D**	**I M2**
IECEx	**Gb**	**Db**	**Mb**
INMETRO	**Gb**	**Db**	**Mb**

Instructions for use and maintenance can be found in the related manuals, always supplied toghether with valves.

1 - ATEX CLASSIFICATION AND TEMPERATURES

Duplomatic certificates the combination valve-coil for the valves suitable for application and installation in potentially explosive atmospheres, according to ATEX directive; the supply always includes the declaration of conformity to the directive and the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environments.

Coils assembled on these valves have been separately certified according to ATEX directive and so they are suitable for use in potentially explosive atmospheres.

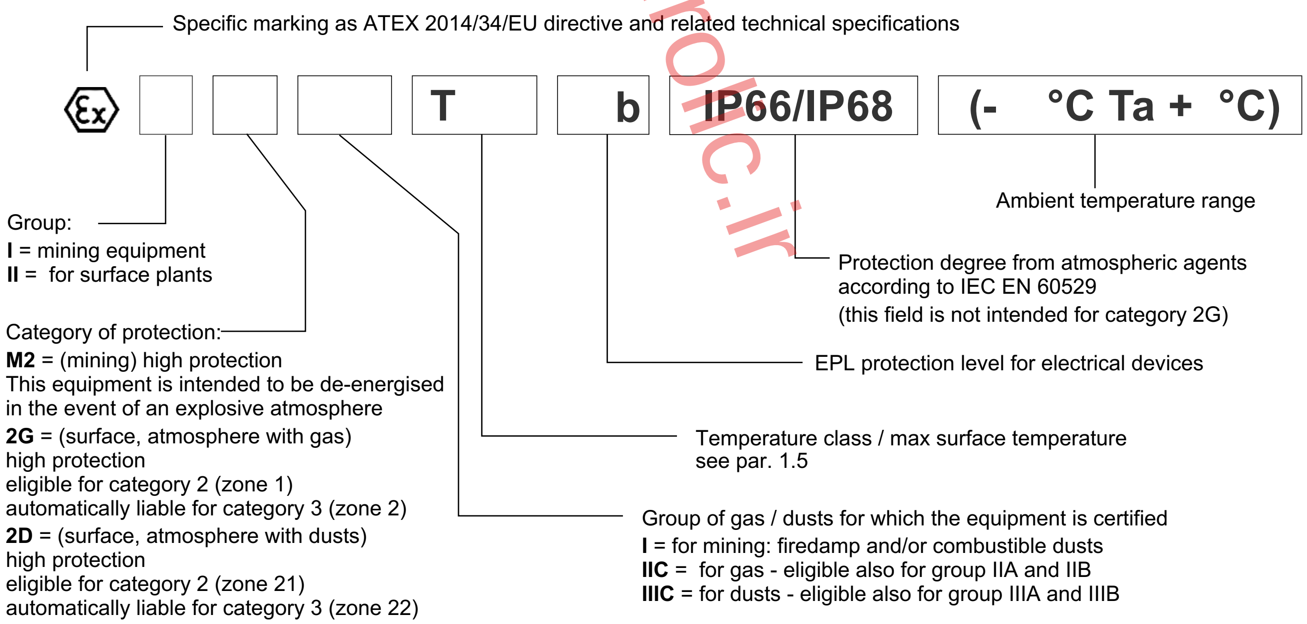
1.1 - ATEX classification for valves

Type examination certificate: CEC 13 ATEX 030-REV.2
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

ATEX II 2G ATEX II 2D	***KD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
ATEX I M2	***KDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

1.2 - ATEX marking for valves

valve code		N and V seals	NL seals
***KD2**	for gas	Ex II 2G IIC T4 Gb (-20°C Ta +80°C)	Ex II 2G IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex II 2D IIIC T154°C Db IP66/IP68 (-20°C Ta +80°C)	Ex II 2D IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
***KD2 /T5**	for gas	Ex II 2G IIC T5 Gb (-20°C Ta +55°C)	Ex II 2G IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex II 2D IIIC T129°C Db IP66/IP68 (-20°C Ta +55°C)	Ex II 2D IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
***KDM2**	mining	Ex I M2 I T150°C Mb IP66/68 (-20°C Ta +75°C)	Ex I M2 I T150°C Mb IP66/68 (-40°C Ta +75°C)



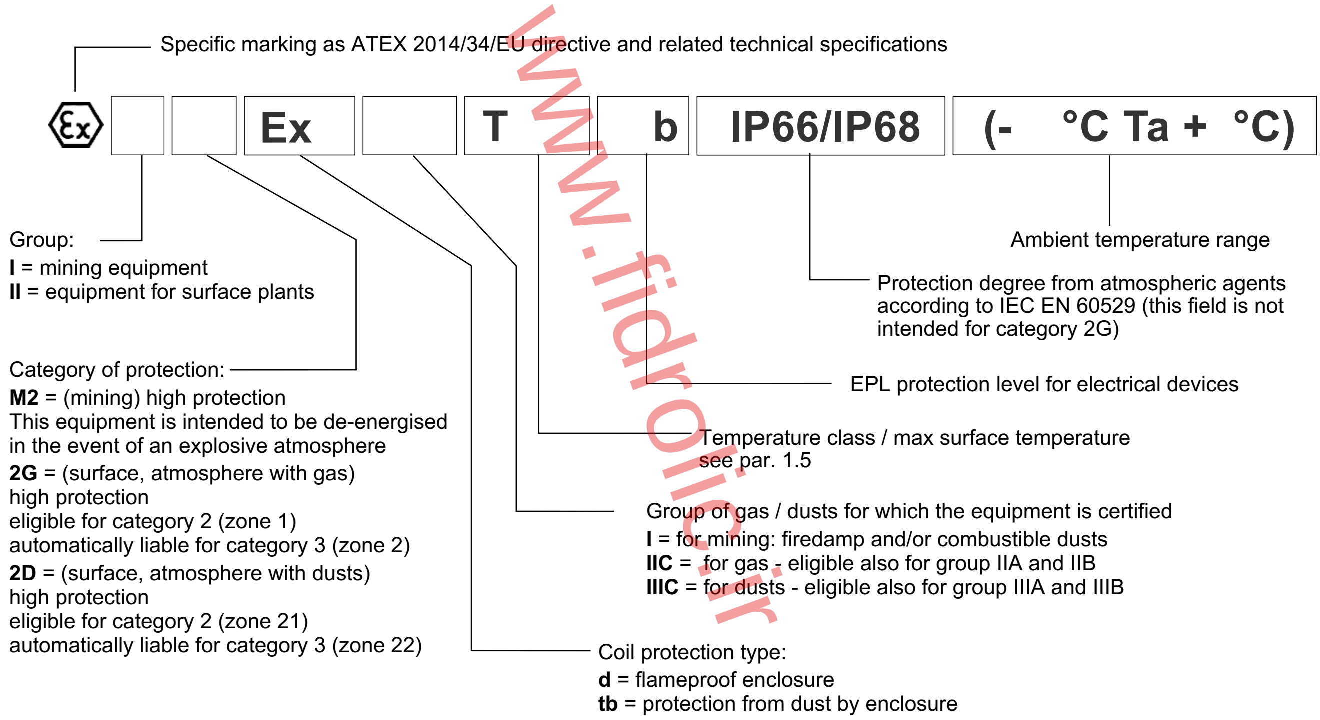
1.3 - ATEX classification of the coils

The coil of the explosion-proof valves is ATEX certified itself an as such is identified with its own tag, carries the relative ATEX marking. **The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an "Ex d" type protection (explosion-proof coil).**

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

1.4 - ATEX marking on coils

for valve type ***KD2**	for gas	II 2G Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	II 2D Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
for valve type ***KD2 /T5**	for gas	II 2G Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	II 2D Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
for valve type ***KDM2**	mining	I M2 Ex d I T150°C Mb IP66/IP68 (-40°C Ta +75°C)



1.5 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

The valves in group II can also be used for less limiting temperature classes (surface temperature allowed higher).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
ATEX II 2G ATEX II 2D	***KD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T154°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T129°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
ATEX I M2	***KDM2**	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				

2 - IECEx CLASSIFICATION AND TEMPERATURES

The IECEx certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with IECEx certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex db” type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

2.1 - IECEx classification

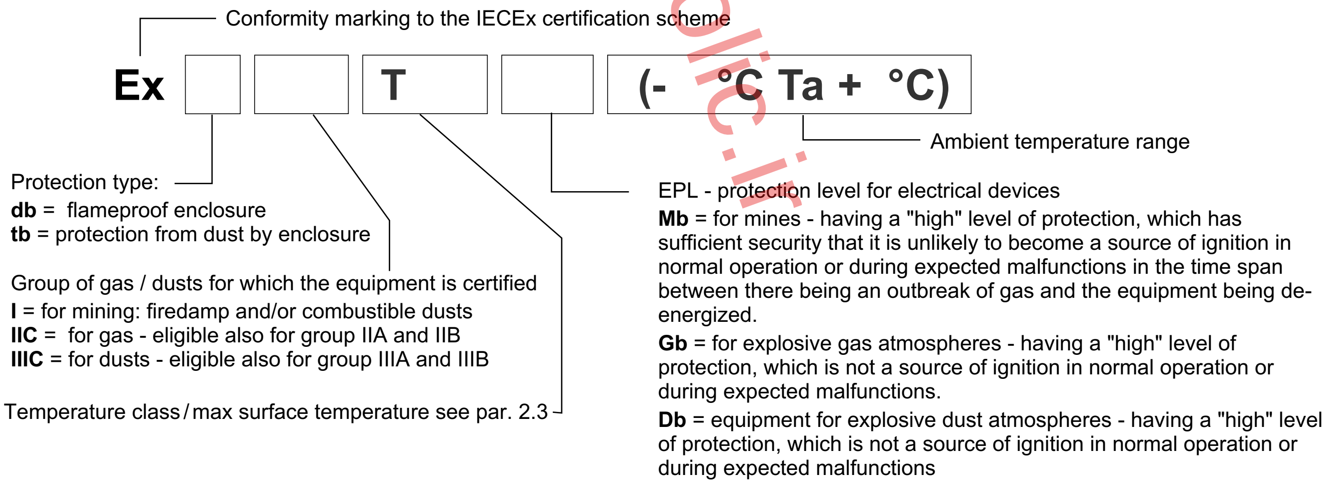
Certificate of conformity (CoC): IECEx TUN 15.0028X
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

IECEx Gb IECEx Db	***KXD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
IECEx Mb	***KXDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

2.2 - IECEx marking

There is a plate with the IECEx mark on each coil.

***KXD2** valves	for gas	Ex db IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T135°C Db (-40°C Ta +80°C)
***KXD2 /T5** valves	for gas	Ex db IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T100°C Db (-40°C Ta +55°C)
***KDM2** valves	mining	Ex db I Mb (-40°C Ta +80°C)



2.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	N and V seals	NL seals	Temperature class	eligible also for
IECEx Gb IECEx Db	***KXD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T135°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KXD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T100°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
IECEx Mb	***KXDM2**	of ambient	-20 / +80 °C	-40 / +80 °C	-	-
		of fluid				

3 - INMETRO CLASSIFICATION AND TEMPERATURES

The INMETRO certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with INMETRO certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex d” type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

3.1 - INMETRO classification

Certificate of conformity: DNV 15.0094 X
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

INMETRO Gb INMETRO Db	***KBD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
INMETRO Mb	***KBDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

3.2 - INMETRO marking

There is a plate with the INMETRO mark on each coil.

***KBD2** valves	for gas	Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
***KBD2 /T5** valves	for gas	Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
***KBDM2** valves	mining	Ex d I T150° Mb IP66/IP68 (-40°C Ta +75°C)

Conformity marking to the INMETRO certification scheme

Ambient temperature range

Ex [ ] [ ] **T** [ ] [ ] **IP66/IP68** **(- °C Ta + °C)**

Protection degree from atmospheric agents according to IEC EN 60529 (this field is not intended for gases)

Protection type:
d = flameproof enclosure
tb = protection from dust by enclosure

Group of gas / dusts for which the equipment is certified
I = for mining: firedamp and/or combustible dusts
IIC = for gas - eligible also for group IIA and IIB
IIIC = for dusts - eligible also for group IIIA and IIIB

Temperature class / max surface temperature see par. 3.3

EPL - protection level for electrical devices
Mb = for mines - having a "high" level of protection, which has sufficient security that it is unlikely to become a source of ignition in normal operation or during expected malfunctions in the time span between there being an outbreak of gas and the equipment being de-energized.
Gb = for explosive gas atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions.
Db = equipment for explosive dust atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions

3.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
INMETRO Gb INMETRO Db	***KBD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T154°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KBD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T129°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
INMETRO Mb	***KBDM2**	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				

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EXPLOSION-PROOF CLASSIFICATION for

SOLENOID AND PROPORTIONAL VALVES

ref. catalogues:

pressure valves	
RQM*K*-P	21 515
PRE(D)*K*	81 315
ZDE3K*	81 515
DZCE*K*	81 605

directional valves	
D*K*	41 515
DS(P)E*K*	83 510

GENERAL INFO

This informative technical datasheet displays information about **classification and marking** of Duplomatic explosion-proof valves range.

Duplomatic offers valves with the following certifications:

ATEX	**II 2G**	**II 2D**	**I M2**
IECEx	**Gb**	**Db**	**Mb**
INMETRO	**Gb**	**Db**	**Mb**

Instructions for use and maintenance can be found in the related manuals, always supplied toghether with valves.

1 - ATEX CLASSIFICATION AND TEMPERATURES

Duplomatic certificates the combination valve-coil for the valves suitable for application and installation in potentially explosive atmospheres, according to ATEX directive; the supply always includes the declaration of conformity to the directive and the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environments.

Coils assembled on these valves have been separately certified according to ATEX directive and so they are suitable for use in potentially explosive atmospheres.

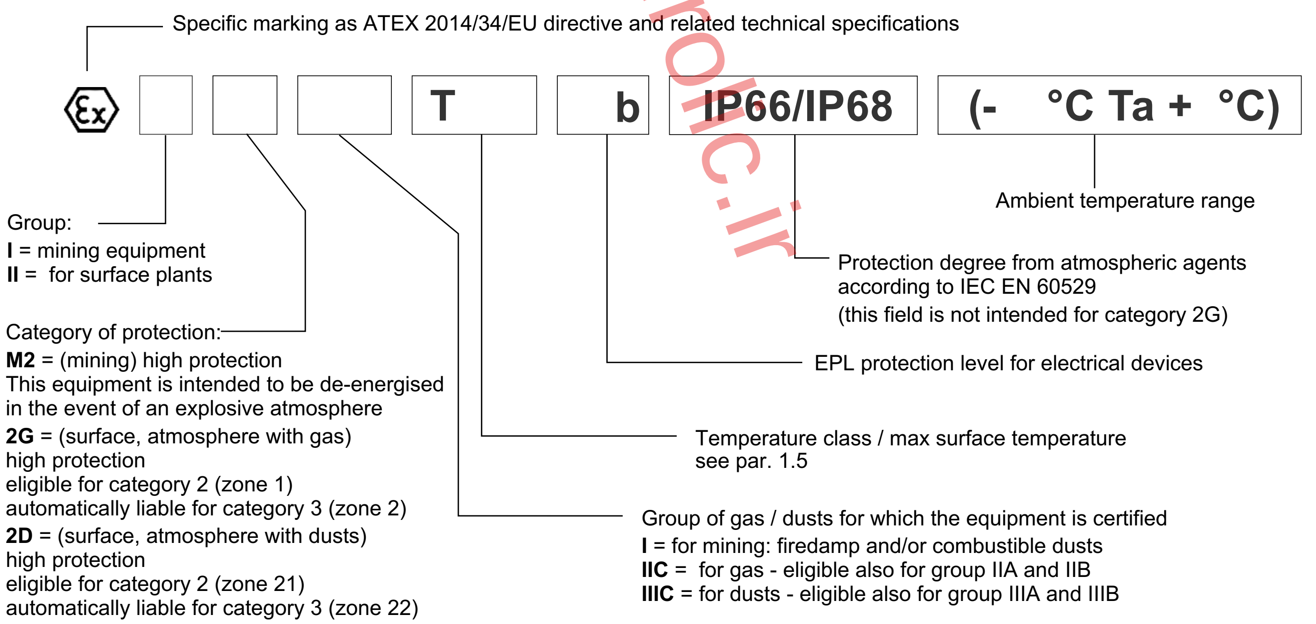
1.1 - ATEX classification for valves

Type examination certificate: CEC 13 ATEX 030-REV.2
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

ATEX II 2G ATEX II 2D	***KD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
ATEX I M2	***KDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

1.2 - ATEX marking for valves

valve code		N and V seals	NL seals
***KD2**	for gas	Ex II 2G IIC T4 Gb (-20°C Ta +80°C)	Ex II 2G IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex II 2D IIIC T154°C Db IP66/IP68 (-20°C Ta +80°C)	Ex II 2D IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
***KD2 /T5**	for gas	Ex II 2G IIC T5 Gb (-20°C Ta +55°C)	Ex II 2G IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex II 2D IIIC T129°C Db IP66/IP68 (-20°C Ta +55°C)	Ex II 2D IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
***KDM2**	mining	Ex I M2 I T150°C Mb IP66/68 (-20°C Ta +75°C)	Ex I M2 I T150°C Mb IP66/68 (-40°C Ta +75°C)



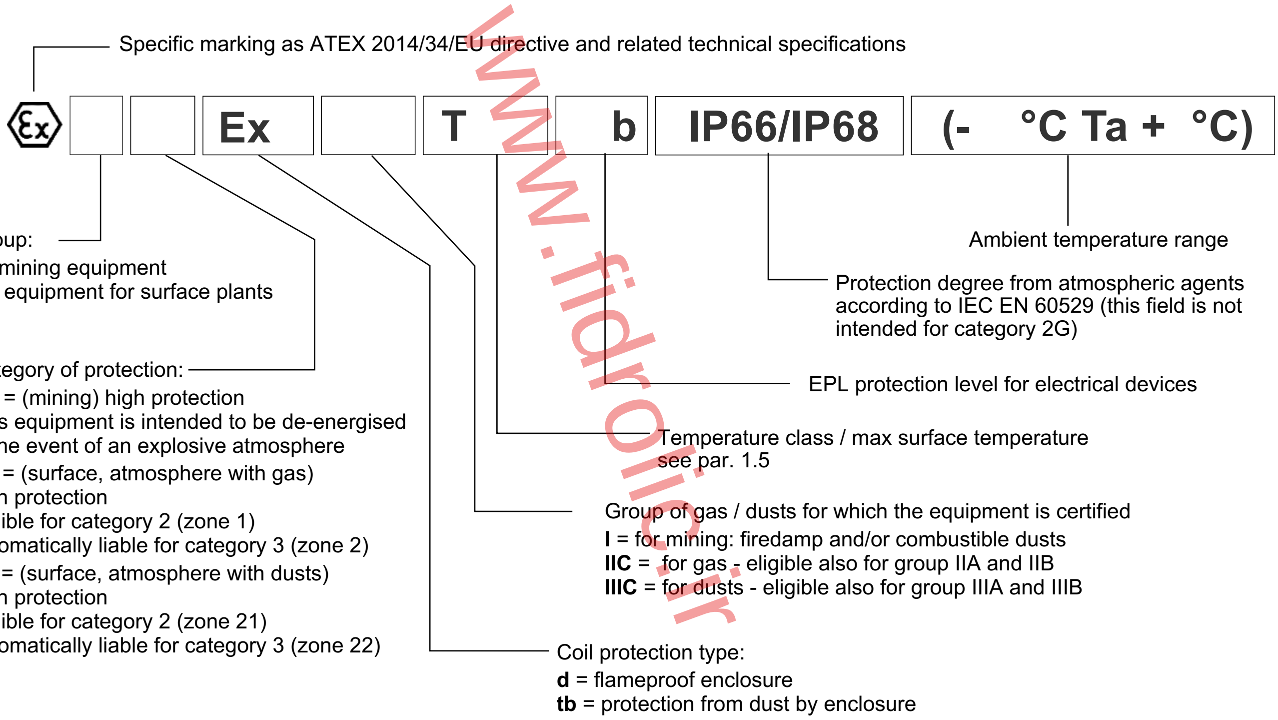
1.3 - ATEX classification of the coils

The coil of the explosion-proof valves is ATEX certified itself an as such is identified with its own tag, carries the relative ATEX marking. **The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex d” type protection (explosion-proof coil).**

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

1.4 - ATEX marking on coils

for valve type ***KD2**	for gas	Ex II 2G Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex II 2D Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
for valve type ***KD2 /T5**	for gas	Ex II 2G Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex II 2D Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
for valve type ***KDM2**	mining	Ex I M2 Ex d I T150°C Mb IP66/IP68 (-40°C Ta +75°C)



1.5 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

The valves in group II can also be used for less limiting temperature classes (surface temperature allowed higher).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
ATEX II 2G ATEX II 2D	***KD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T154°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T129°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
ATEX I M2	***KDM2**	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				

2 - IECEx CLASSIFICATION AND TEMPERATURES

The IECEx certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with IECEx certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex db” type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

2.1 - IECEx classification

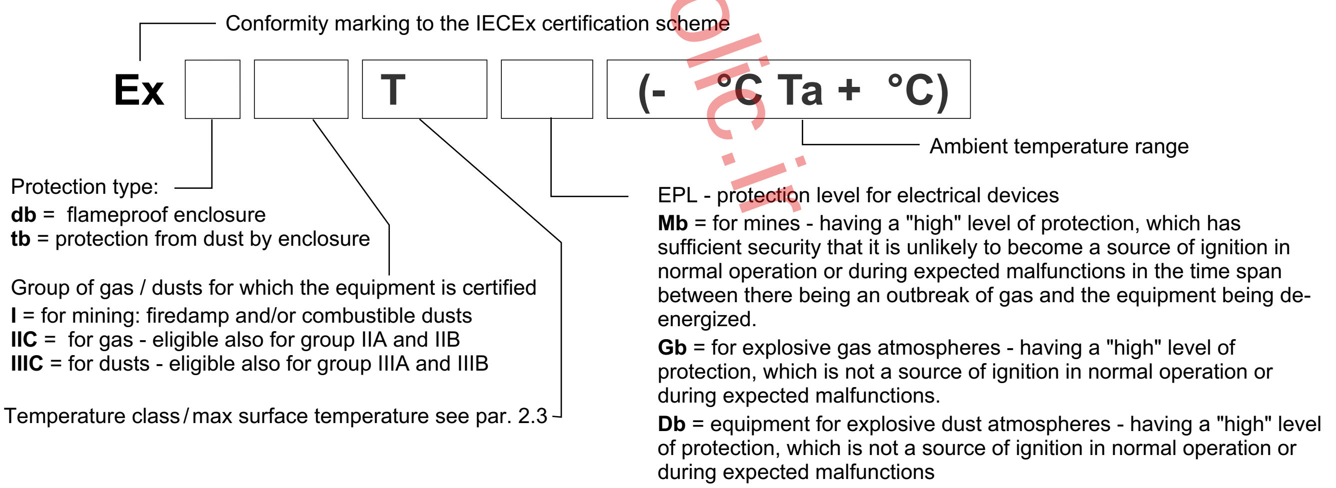
Certificate of conformity (CoC): IECEx TUN 15.0028X
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

IECEx Gb IECEx Db	***KXD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
IECEx Mb	***KXDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

2.2 - IECEx marking

There is a plate with the IECEx mark on each coil.

***KXD2** valves	for gas	Ex db IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T135°C Db (-40°C Ta +80°C)
***KXD2 /T5** valves	for gas	Ex db IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T100°C Db (-40°C Ta +55°C)
***KDM2** valves	mining	Ex db I Mb (-40°C Ta +80°C)



2.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	N and V seals	NL seals	Temperature class	eligible also for
IECEx Gb IECEx Db	***KXD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T135°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KXD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T100°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
IECEx Mb	***KXDM2**	of ambient	-20 / +80 °C	-40 / +80 °C	-	-
		of fluid				

3 - INMETRO CLASSIFICATION AND TEMPERATURES

The INMETRO certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with INMETRO certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex d” type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

3.1 - INMETRO classification

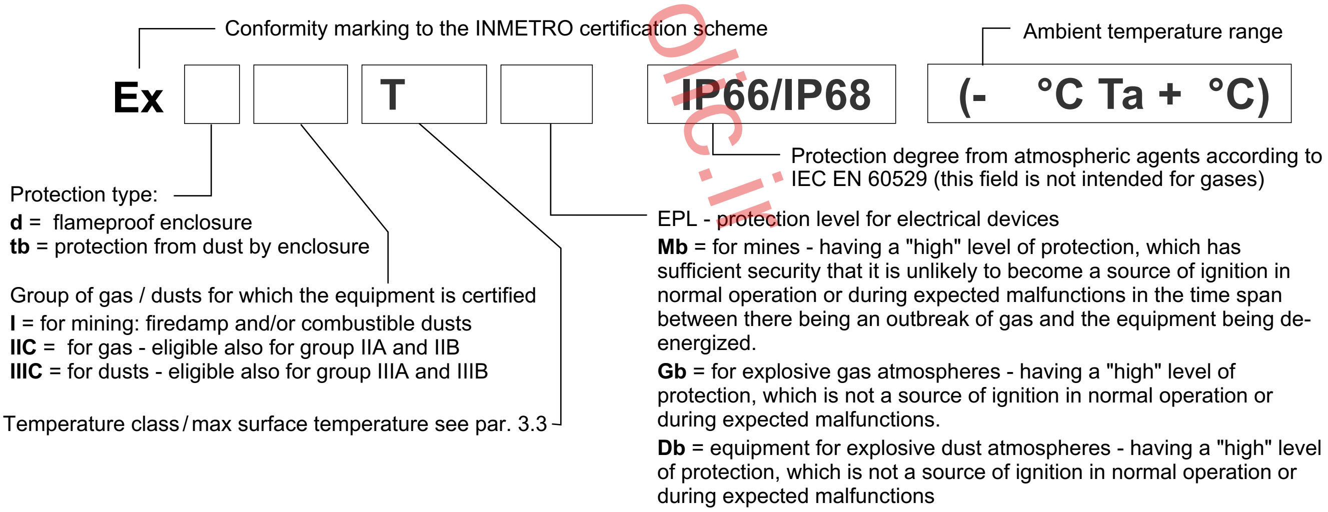
Certificate of conformity: DNV 15.0094 X
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

INMETRO Gb INMETRO Db	***KBD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
INMETRO Mb	***KBDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

3.2 - INMETRO marking

There is a plate with the INMETRO mark on each coil.

***KBD2** valves	for gas	Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
***KBD2 /T5** valves	for gas	Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
***KBDM2** valves	mining	Ex d I T150° Mb IP66/IP68 (-40°C Ta +75°C)



3.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
INMETRO Gb INMETRO Db	***KBD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T154°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KBD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T129°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
INMETRO Mb	***KBDM2**	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				

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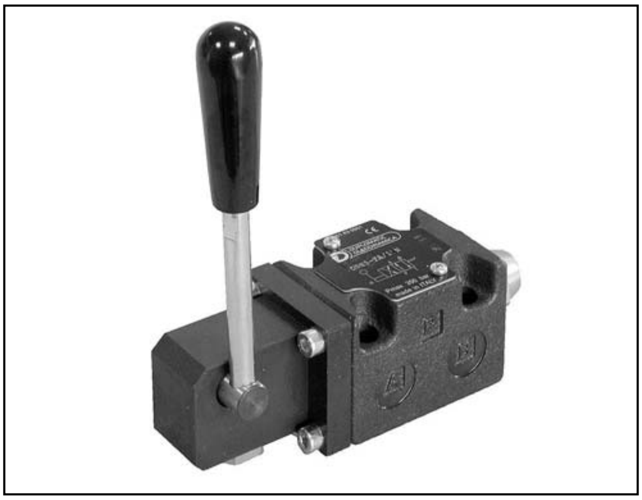


DSH*

LEVER OPERATED DIRECTIONAL CONTROL VALVE

MOUNTING SURFACES

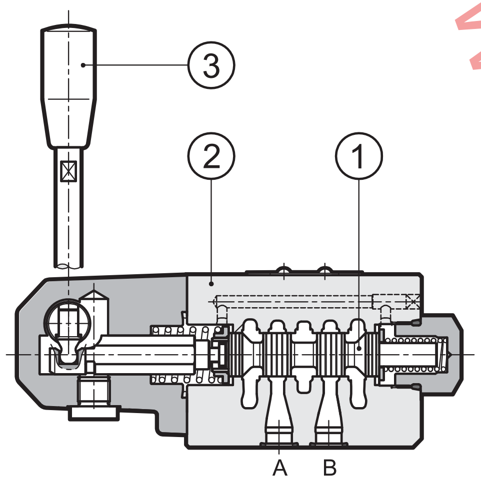
DSH3 **ISO 4401-03** (CETOP 03)

DSH5 **ISO 4401-05** (CETOP 05)

p max (see performances table)

Q nom (see performances table)

OPERATING PRINCIPLE



— The DSH* are lever operated directional control valves, available with 3 or 4 ways and with several types of interchangeable spools (1).

— The valve body (2) is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop.

— They are available with 2 or 3 positions with return spring or mechanical retention.

— On DSH3 version is possible to rotate the lever (3) by 180° compared with the standard position, depending on installation requirements (par. 7).

PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

		DSH3	DSH5
Maximum working pressure: - P - A - B ports - T port	bar	 350 210	 320 160
Nominal flow rate	l/min	75	150
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree		according to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25	
Mass	kg	2.1	4.2

1 - IDENTIFICATION CODE

D	S	H		-		/		

Directional control valve with spool

Lever operated

Size:
3 = ISO 4401-03 (CETOP 03)
5 = ISO 4401-05 (CETOP 05)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

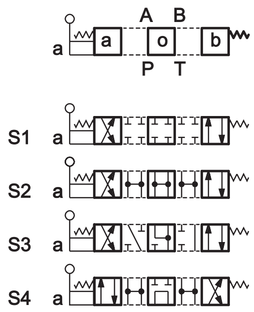
Series No.:
11 for DSH3 (the overall and mounting dimensions remain unchanged from 10 to 19)
30 for DSH5 (the overall and mounting dimensions remain unchanged from 30 to 39)

Spool type (see par. 2)
S* **SK*** **SA*** **SAK***
TA **TAK**
TA23 **TAK23**

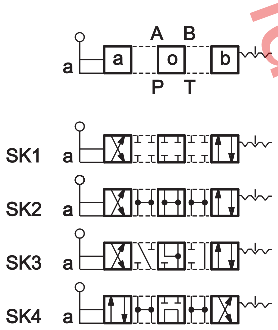
NOTE:
On request it is possible to have the lever mounted in different positions from those in the catalogue. Consult our Technical Department.

2 - SPOOL TYPE

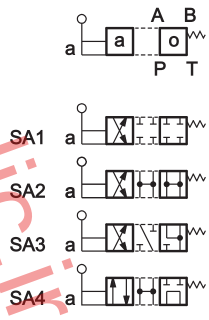
Type **S***:
3 positions
with spring centering



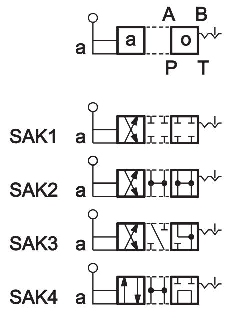
Type **SK***:
3 positions
with mechanical retention



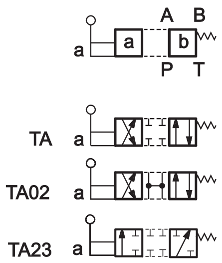
Type **SA***:
2 positions
(central + external)
with spring centering



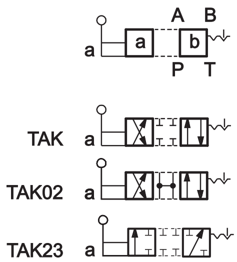
Type **SAK***:
2 positions
(central + external)
with mechanical retention



Type **TA**:
2 external positions
with return spring



Type **TAK**:
2 external positions
with mechanical retention



Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our Technical Department for their identification and operating limits.

NOTE: TA02,TA23, TAK02 and TAK23 spools are available only for DSH3.

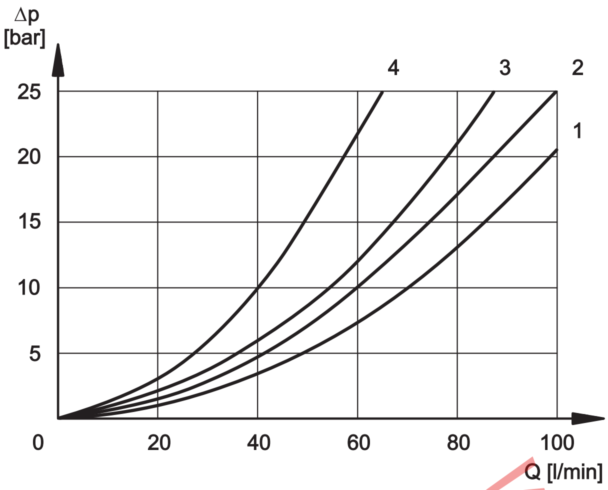
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - PRESSURE DROPS Δp-Q (values obtained with viscosity 36 cSt at 50 °C)

4.1 - DSH3



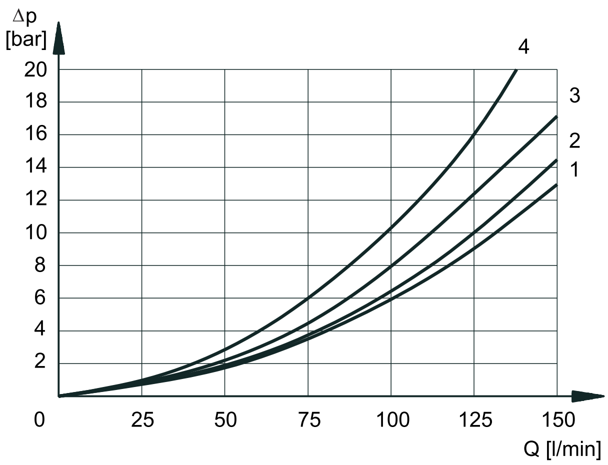
VALVE IN ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SAK1	2	2	3	3
S2, SA2, SAK2	1	1	3	3
S3, SA3, SAK3	3	3	1	1
S4, SA4, SAK4	4	4	4	4
TA, TAK	3	3	3	3
TA02, TAK02	2	2	2	2
TA23, TAK23	3	3		

VALVE IN DE-ENERGIZED POSITION

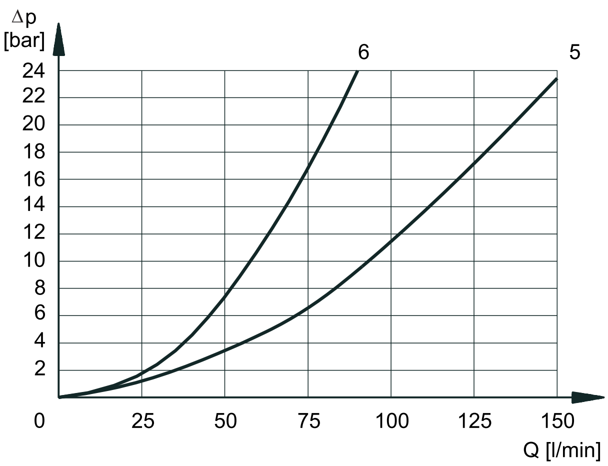
SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SAK2					2
S3, SA3, SAK3			3	3	
S4, SA4, SAK4					3

4.2 - DSH5



VALVE IN ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SK1	2	2	1	1
S2, SK2	3	3	1	1
S3, SK3	3	3	2	2
S4, SK4	1	1	2	2
TA, TAK	3	3	2	2



VALVE IN DE-ENERGIZED POSITION

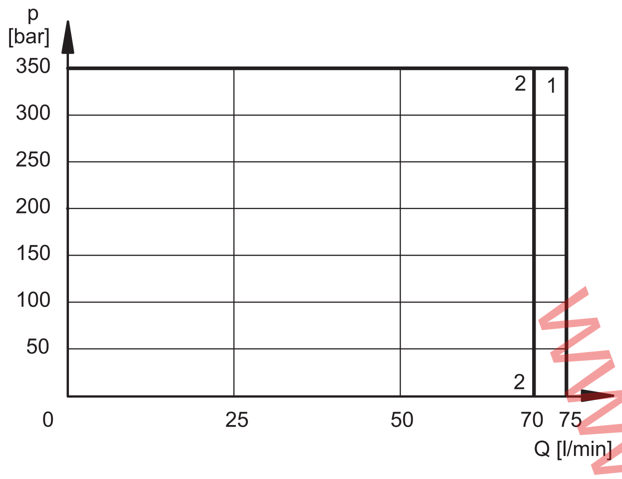
SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SK2					5
S3, SK3			6	6	
S4, SK4					5

5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions.

The values have been obtained according to ISO 6403 norm, with mineral oil viscosity 36 cSt at 50 °C and filtration ISO 4406:1999 class 18/16/13.

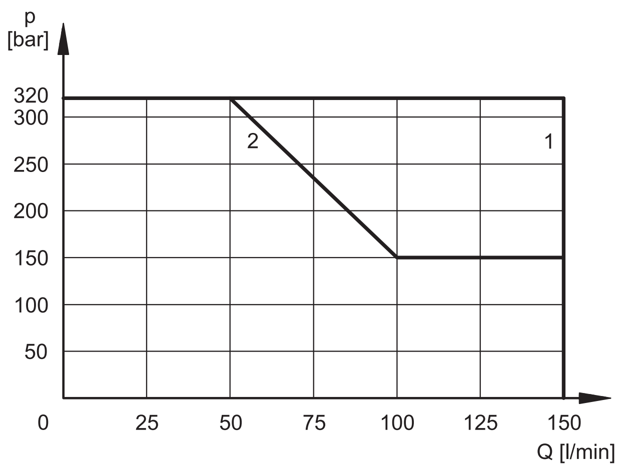
5.1 - DSH3



SPOOL TYPE	CURVE	
	P→A	P→B
S1, SK1, SA1, SAK1	1	1
S2, SK2, SA2, SAK2	1	1
S3, SK3, SA3, SAK3	1	1
S4, SK4, SA4, SAK4	2	2

SPOOL TYPE	CURVE	
	P→A	P→B
TA, TAK	1	1
TA02, TAK02	1	1
TA23, TAK23	1	1

5.2 - DSH5



SPOOL TYPE	CURVE	
	P→A	P→B
S1, SK1, SA1, SAK1	1	1
S2, SK2, SA2, SAK2	1	1
S3, SK3, SA3, SAK3	1	1
S4, SK4, SA4, SAK4	2	2

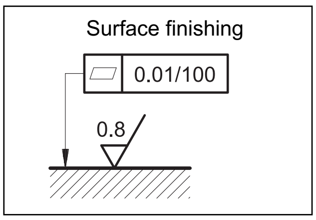
SPOOL TYPE	CURVE	
	P→A	P→B
TA, TAK	1	1

NOTE: Values in the graphs are relevant to the standard valve. The operating limits can be considerably reduced if a 4-way valve is used with port A or B plugged.

6 - INSTALLATION

Configurations with centering and return springs can be mounted in any position; valves with mechanical detent must be mounted with the longitudinal axis horizontal.

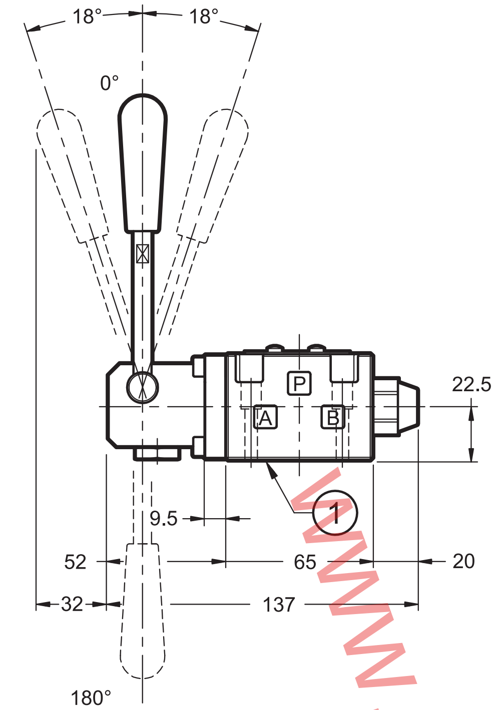
Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.

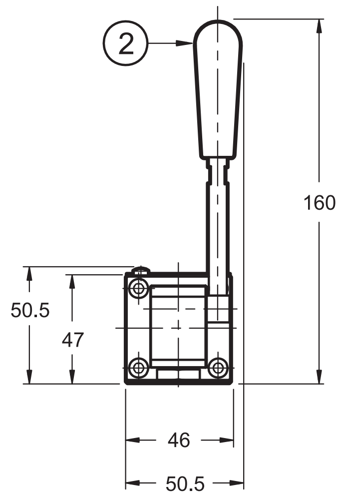


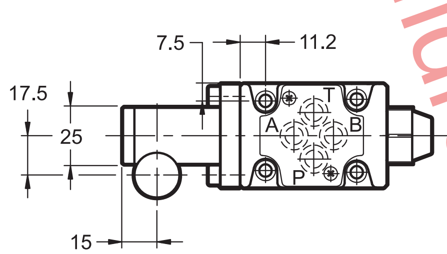
7 - OVERALL AND MOUNTING DIMENSIONS DSH3

dimensions in mm

DSH3 - S*
DSH3 - SK*

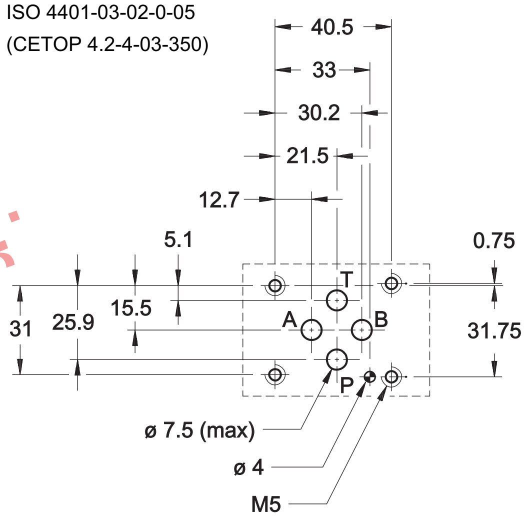






DSH3 MOUNTING SURFACE

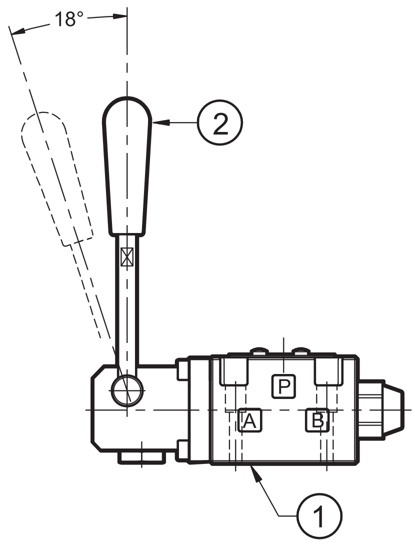
ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



DSH3-TA
DSH3-TAK

DSH3-TA23
DSH3-TAK23

DSH3-SA*
DSH3-SAK*



1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Hand lever (**NOTE**)

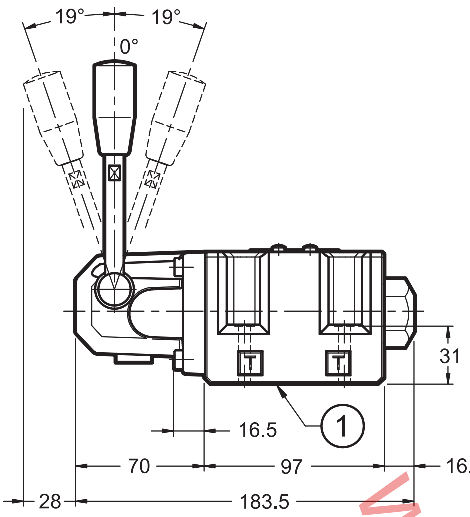
Valve fastening:	N. 4 SHC screws M5x30 ISO 4762
Tightening torque:	5 Nm (bolts A 8.8)
Threads of mounting holes:	M5x10

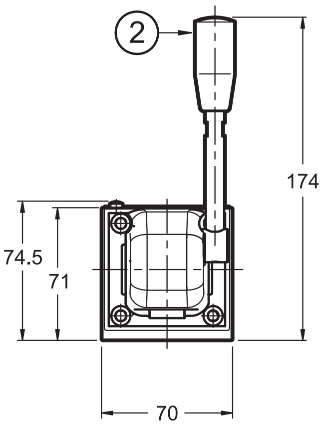
NOTE: The valve is supplied with the hand lever oriented in a perpendicular position with respect to the mounting surface (as indicated in the above drawing). For installation needs the hand lever can be oriented by the user directly at 180° to the standard position, simply by unscrewing the lever and re-screwing it in the desired position.

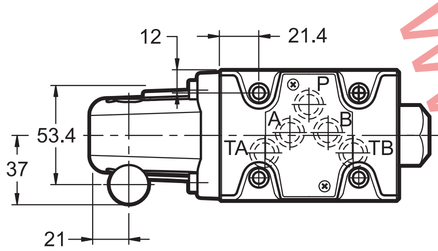
8 - OVERALL AND MOUNTING DIMENSIONS DSH5

dimensions in mm

DSH5-S*
DSH5-SK*

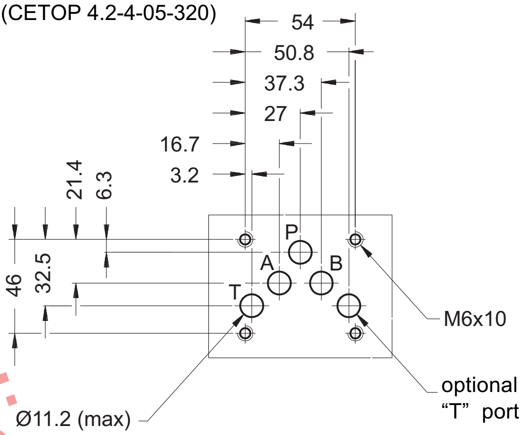






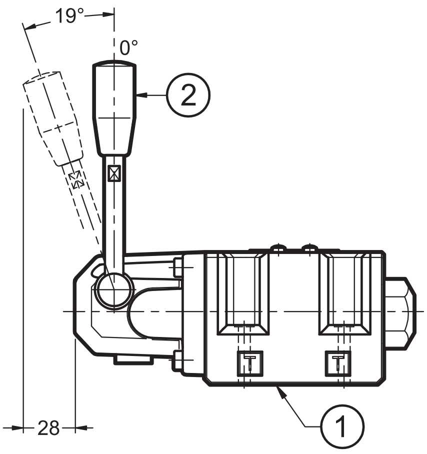
MOUNTING SURFACE DSH5

(CETOP 4.2-4-05-320)



DSH5-TA
DSH5-TAK

DSH5-SA*
DSH5-SAK*



1	Mounting surface with sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore
2	Hand lever (**NOTE**)

Valve fastening:	N. 4 SHC screws ISO 4762 M6x40
Tightening torque:	8 Nm (A 8.8 screws)
Threads of mounting holes:	M6x10

NOTE: the valve can be supplied with hand lever oriented in different positions; ask our technical department for details.

9 - SUBPLATES (See catalogue 51 000)

	DSH3	DSH5
Type with rear ports	PMMD-AI3G	PMD4-AI4G - 3/4" BSP threaded
Type with side ports	PMMD-AL3G	PMD4-AL4G - 1/2" BSP threaded
P, T, A and B threads	3/8" BSP	

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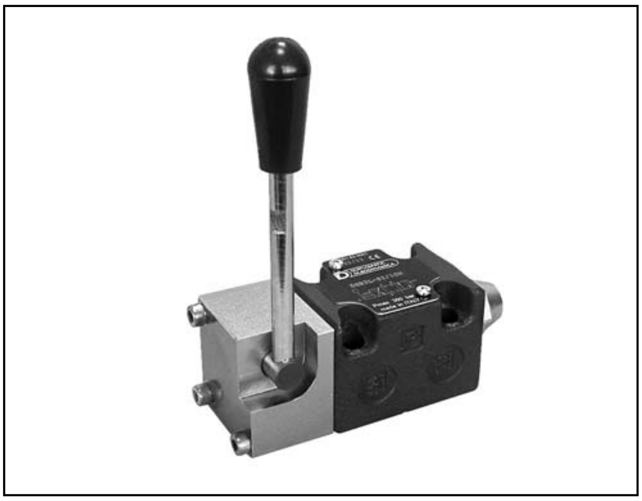
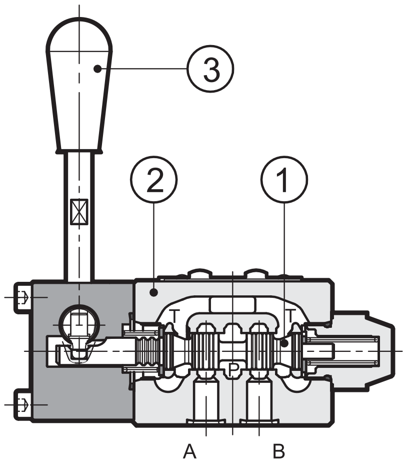


DSH3L
LEVER OPERATED DIRECTIONAL CONTROL VALVE
SERIES 10

MOUNTING SURFACE
ISO 4401-03 (CETOP 03)

p max (see performances table)
Q nom **60** l/min

OPERATING PRINCIPLE



— DSH3L are lever (3) operated directional control valves, available with the more common types of spools (1).

— The valve body (2) is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop.

— They are available with 2 or 3 positions with return spring or mechanical retention.

— Upon request we can supply these valves with zinc-nickel surface treatment.

PERFORMANCES (with mineral oil of viscosity of 36 cSt at 50°C)

Maximum working pressure: - P - A - B ports - T port	bar	 350 210
Nominal flow rate	l/min	60
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree		according to ISO 4406:1999 class 20/18/15
Recommended viscosity	cSt	25
Mass	kg	1.4

1 - IDENTIFICATION CODE

D	S	H	3	L	-		/	10		

Directional control valve with spool

Lever operated

Size: ISO 4401-03 (CETOP 03)

L = compact version

Spool type (see par. 2)

Series No.: the overall and mounting dimensions remain unchanged from 10 to 19

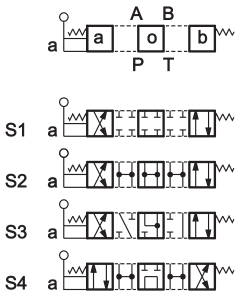
Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Option:
W7surface treatment.
Omit if not required (**NOTE**)

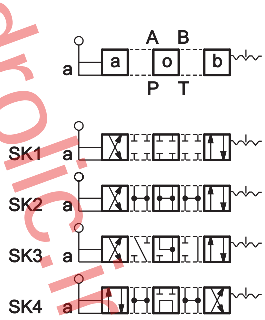
NOTE: Upon request we can supply these valves with zinc-nickel surface treatment.
Add the suffix **/W7** at the end of the identification code.

2 - SPOOL TYPE

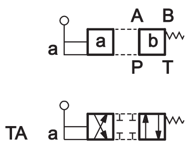
Type **S***:
3 positions
with spring centering



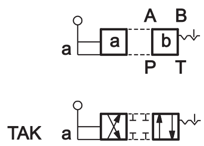
Type **SK***:
3 positions
with mechanical retention



Type **TA**:
2 external positions
with return spring



Type **TAK**:
2 external positions
with mechanical retention

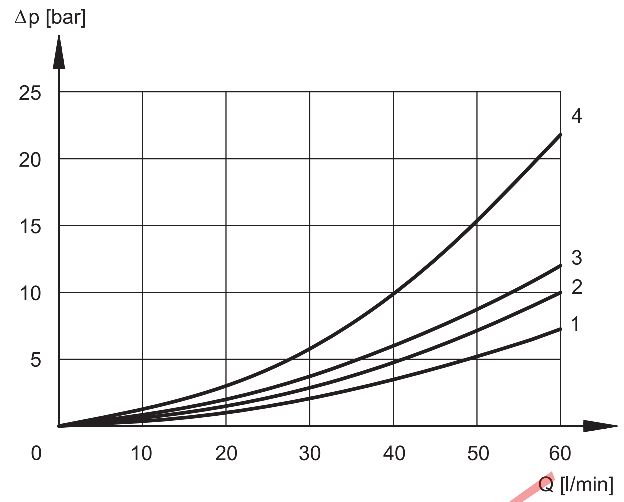


3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - PRESSURE DROPS Δp-Q (values obtained with viscosity 36 cSt at 50 °C)



VALVE IN ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SK1	2	2	3	3
S2, SK2	1	1	3	3
S3, SK3	3	3	1	1
S4, SK4	4	4	4	4
TA, TAK	3	3	3	3

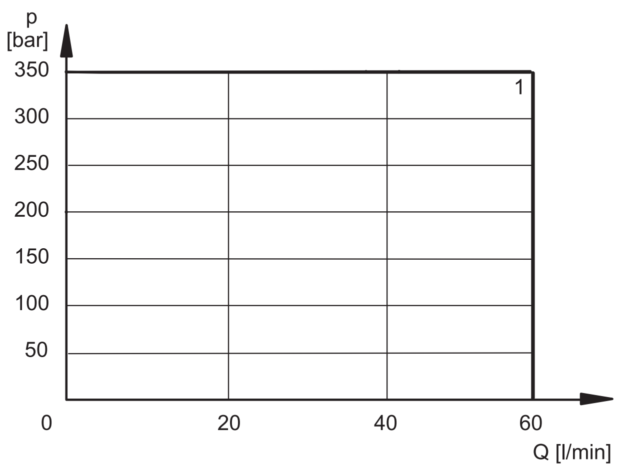
VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SK2					2
S3, SK3			3	3	
S4, SK4					3

5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions.

The values have been obtained according to ISO 6403 norm, with mineral oil viscosity 36 cSt at 50 °C and filtration ISO 4406:1999 class 18/16/13.



SPOOL TYPE	CURVE	
	P→A	P→B
S1, SK1	1	1
S2, SK2	1	1
S3, SK3	1	1
S4, SK4	1	1

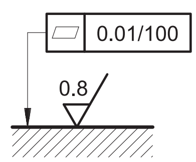
SPOOL TYPE	CURVE	
	P→A	P→B
TA, TAK	1	1

6 - INSTALLATION

Configurations with centering and return springs can be mounted in any position; valves with mechanical detent must be mounted with the longitudinal axis horizontal.

Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.

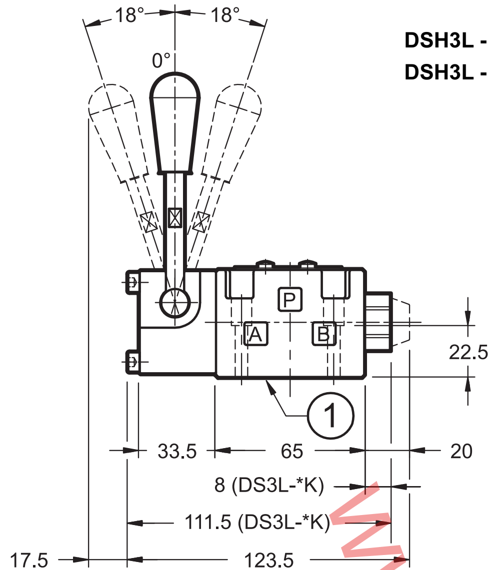
Surface finishing

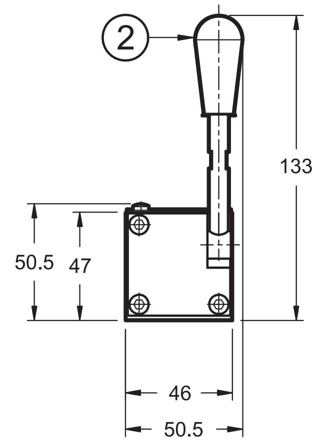


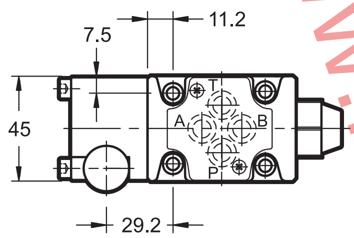
7 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

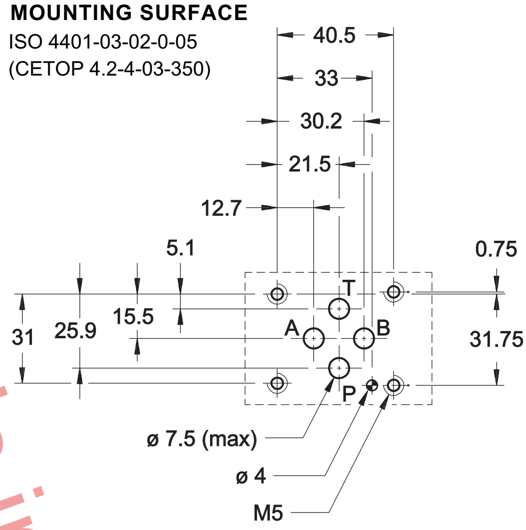
DSH3L - S*
DSH3L - SK*



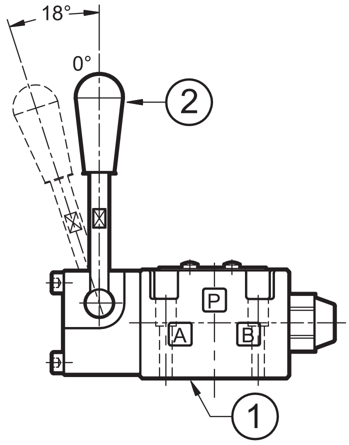




MOUNTING SURFACE
ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



DSH3L-TA
DSH3L-TAK



1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Hand lever

Valve fastening: N. 4 SHC screws M5x30 - ISO 4762
Tightening torque: 5 Nm (A 8.8 screws)
Threads of mounting holes: M5x10

8 - SUBPLATES (see catalogue 51 000)

Type with rear ports: PMMD-AI3G
Type with side ports: PMMD-AL3G
P, T, A and B threads: 3/8” BSP

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DUPLOMATIC OLEODINAMICA

DSR3

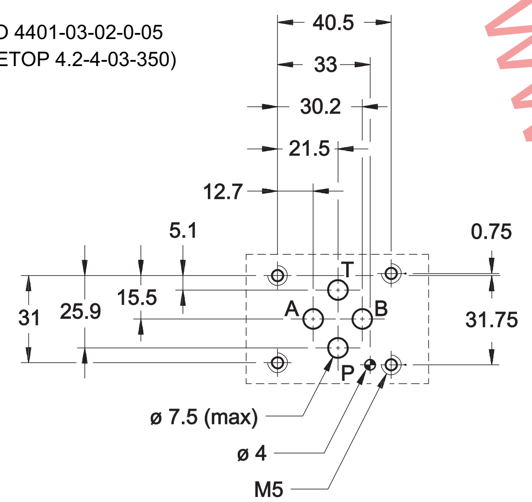
ROLLER CAM OPERATED DIRECTIONAL CONTROL VALVE
SERIES 11

SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

p max **350** bar
Q nom **75** l/min

MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)

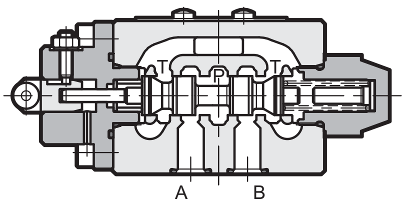


PERFORMANCE RATINGS
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

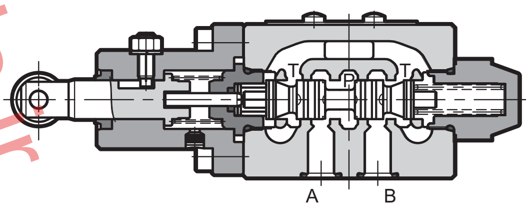
Maximum operating pressure: - P A B ports - T ports	bar	 350 25
Nominal flow rate	l/min	75
Pressure drop Δp-Q	see par. 4	
Operating limits	see par. 5	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406: 1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: DSR3L-TA DSR3L-R DSR3H-TA	kg	1,1 1,2 1,2

OPERATING PRINCIPLE

DSR3L



DSR3H



— The DSR3* are roller cam operated directional control valves, available with 4 ways, with mounting interface according to ISO 4401 (CETOP RP121H) standards.

— The valve body is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop.

— It is available in LIGHT (short) and HEAVY DUTY (long) versions, with 2 positions with return spring or with 2 positions with double mechanical command.

— The roller of the valve operating device can be positioned at 90° with respect to the valve mounting surface, in order to achieve flexible installation.

— This type of valve can be used as a hydraulic stroke end for cylinders, speed selectors (not compensated), hydraulic safety devices, directional control of hydraulic axes.

1 - IDENTIFICATION CODE

D	S	R	3		-		/	11	

- D S: Directional control valve with spool
- R: Roller cam operated
- 3: ISO 4401-03 (CETOP 03) size
- Version:
  L = LIGHT (short)
  H = HEAVY DUTY (long)
- Spool type (see par. 3)
  TA
  R (available only for DSR3L version)
- 11: Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)
- Seals:
  N = NBR seals for mineral oil (**standard**)
  V = FPM seals for special fluids

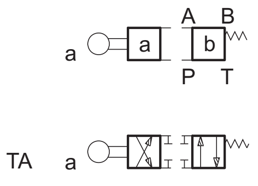
2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

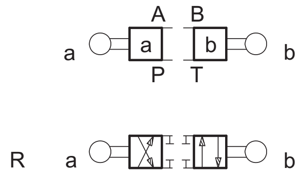
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - SPOOL TYPE

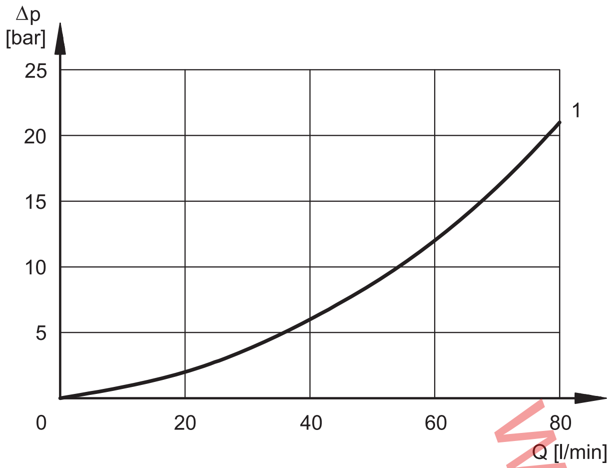
Type **TA**:
2 external positions
with return spring



Type **R**:
2 positions
with double mechanical command



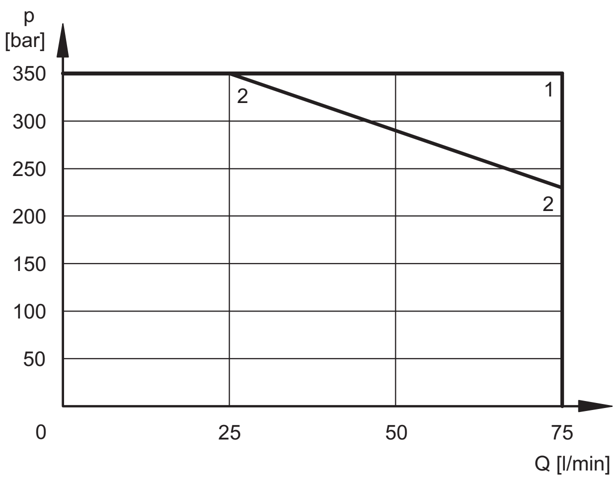
4 - PRESSURE DROPS Δp-Q (obtained with viscosity 36 cSt at 50 °C)



SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
DSR3L-TA	1	1	1	1
DSR3L-R	1	1	1	1
DSR3H-TA	1	1	1	1

5 - OPERATING LIMITS

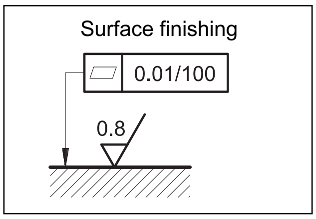
The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm, with mineral oil viscosity 36 cSt at 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



SPOOL TYPE	CURVE	
	P→A	P→B
DSR3L-TA	2	2
DSR3L-R	1	1
DSR3H-TA	1	1

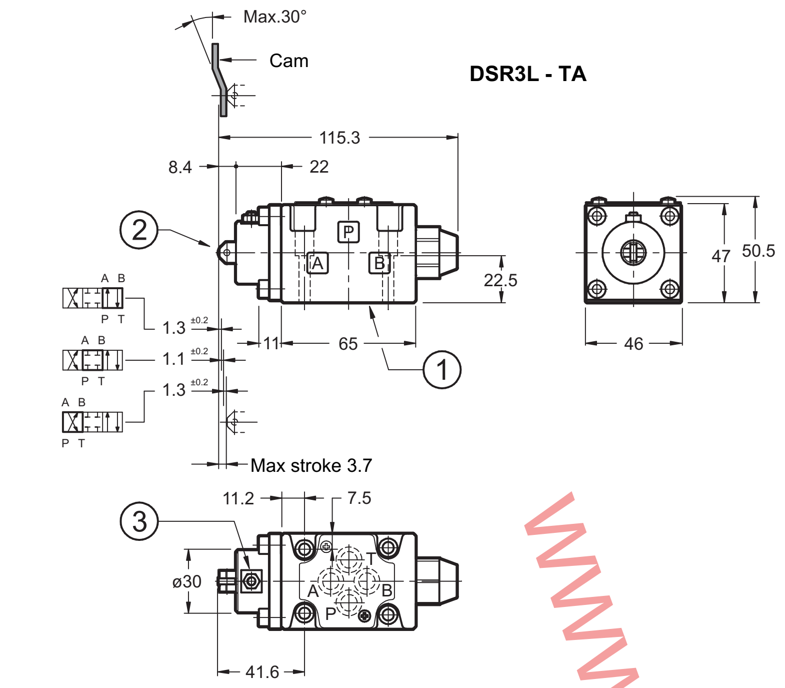
6 - INSTALLATION

Configurations with centering and return springs can be mounted in any position; type R valves - without springs - must be mounted with the longitudinal axis horizontal. Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.

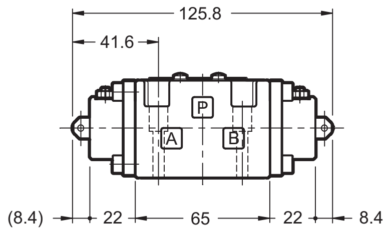


7 - OVERALL AND MOUNTING DIMENSIONS

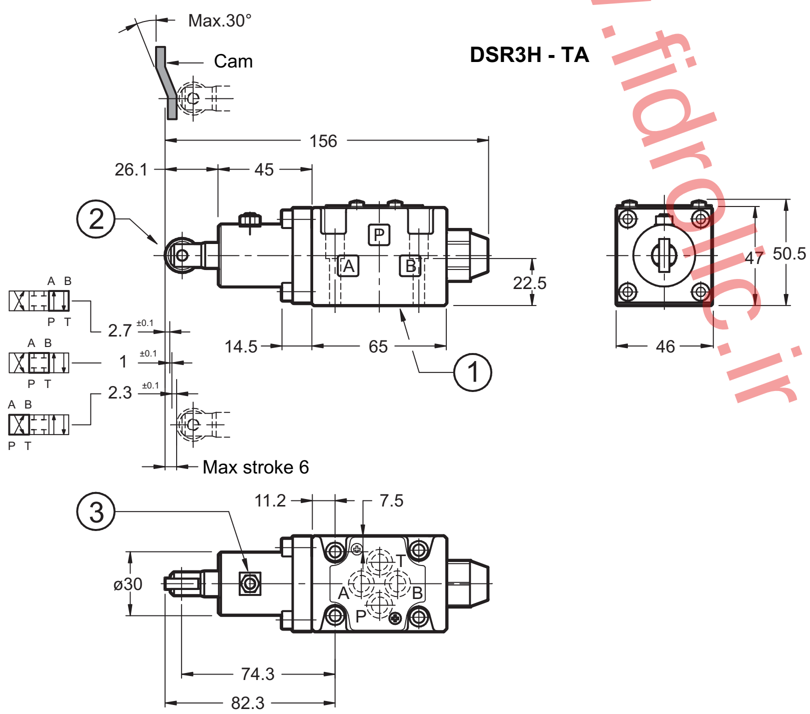
DSR3L - TA



DSR3L - R



DSR3H - TA



dimensions in mm

1	Mounting surface with sealing rings 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Roller for valve operation (see **NOTE**)
3	Countersunk hexagonal screw for roller operation: **DSR3L** spanner 2 **DSR3H** spanner 2,5

NOTE: The valve is supplied as standard with the operating roller oriented in a perpendicular position with respect to the mounting surface. For installation needs the roller can be oriented by the user directly at 90° to the standard position:

- untight the locking nut and the countersunk hexagonal screw (ref. 3) until the spool and the relevant roller can be freely oriented.
- rotate through 90° the spool with the roller
- tighten the fixing screw (ref. 3) being careful that it goes inside the spool anti-rotation slot without preventing the spool movement.

8 - VALVE FASTENING BOLTS

N. 4 fastening bolts SHC ISO 4762 M5x30
Tightening torque 5 Nm (bolts A 8.8)

9 - SUBPLATES (see catalogue 51 000)

Type PMMD-AI3G with rear ports 3/8” BSP
Type PMMD-AL3G with side ports 3/8” BSP

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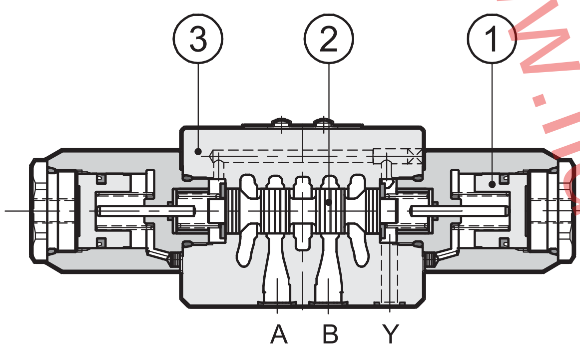
DSA*
PNEUMATICALLY OPERATED DIRECTIONAL CONTROL VALVE

SUBPLATE MOUNTING
DSA3 **ISO 4401-03** (CETOP 03)
DSA5 **ISO 4401-05** (CETOP R05)

p max (see performances table)
Q nom (see performances table)

OPERATING PRINCIPLE



— The DSA* are pneumatically operated (1) directional control valves, available with 3 or 4 ways with several interchangeable spools (2) and with mounting interface according to ISO 4401 (CETOP RP121H) standards.

— The valve body (3) is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop.

— It is available with 2 or 3 positions with return spring, or with 2 positions with mechanical retention.

— The Y external drain is available (standard) for the ISO 4401-05 (CETOP R05) size and it must be connected when there is backpressure higher than 25 bar on the T port.

PERFORMANCES (with mineral oil of viscosity 36 cSt at 50°C)

		DSA3	DSA5
Maximum working pressure: - P, A, B ports - T port without Y external drain - T port with Y external drain (available for DSA5 only)	bar	350 25 -	320 25 320
Piloting pressure: - min - max	bar	4 12	4,5 12
Nominal flow rate	l/min	75	120
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass: single operator valve dual operator valve	kg	1,3 1,7	3,2 4,0

1 - IDENTIFICATION CODE

D	S	A		-		/		

Directional control valve with spool

Air operated

Size:
3 = ISO 4401-03 (CETOP 03)
5 = ISO 4401-05 (CETOP R05)

Spool type (see paragraph 3)

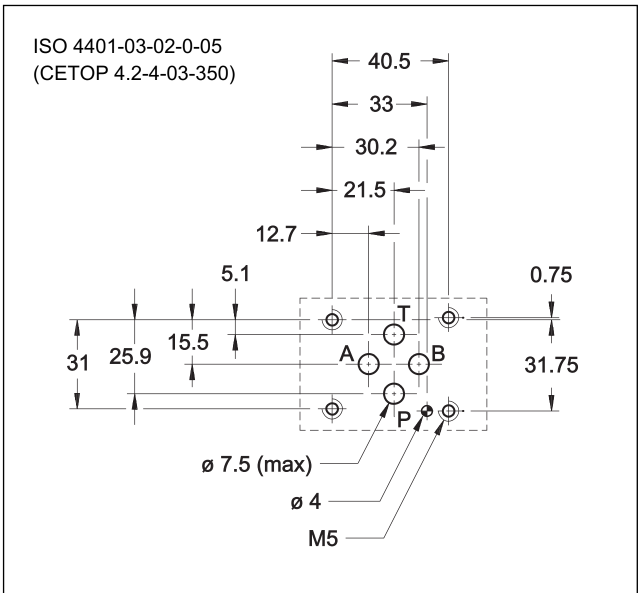
S*	**TA**	**TA23**
SA*	**TB**	**TB23**
SB*	**RK**	

Series No.:
11 for DSA3 (the overall and mounting dimensions remain unchanged from 10 to 19)
20 for DSA5 (the overall and mounting dimensions remain unchanged from 20 to 29)

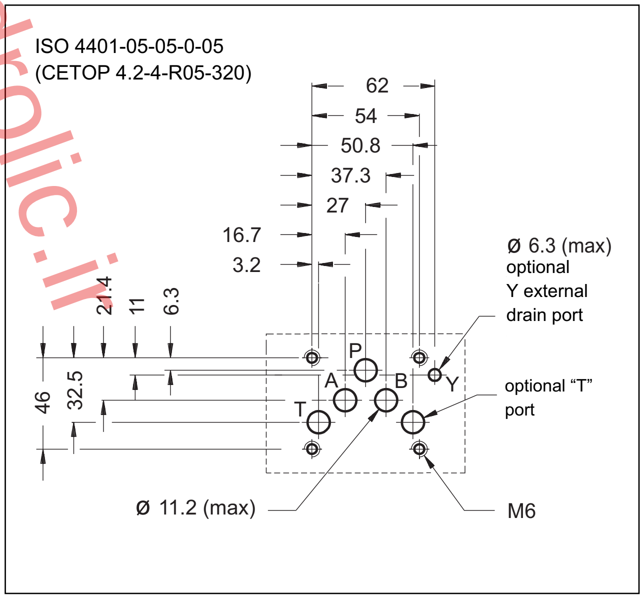
Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

2 - MOUNTING INTERFACE

DSA3



DSA5



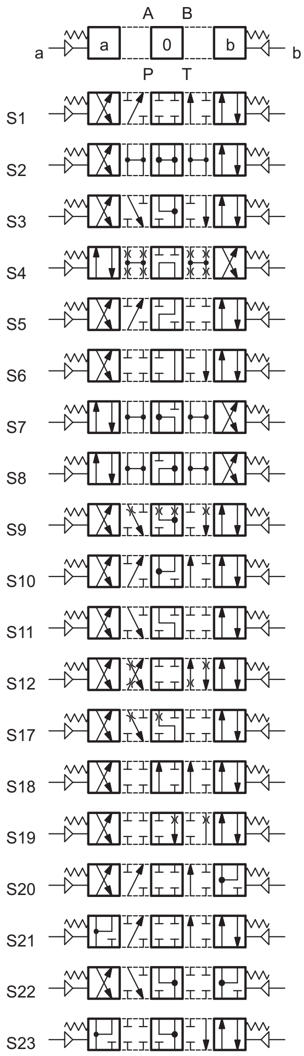
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

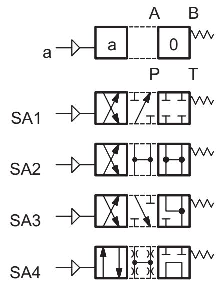
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - SPOOL TYPE

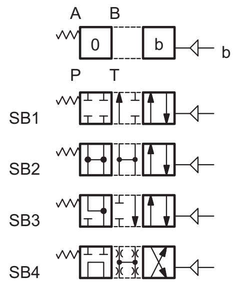
Type **S***:
2 operations - 3 positions
with spring centering



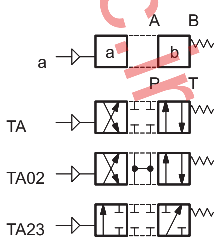
Type **SA***:
1 operation side A
2 positions (central + external)
with spring centering



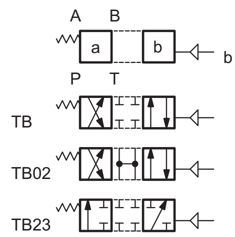
Type **SB***:
1 operation side B
2 positions (central + external)
with spring centering



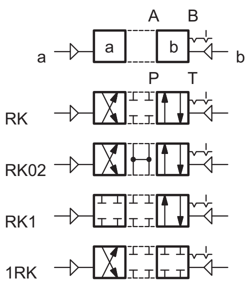
Type **TA**:
1 operation side A
2 external positions
with return spring



Type **TB**:
1 operation side B
2 external positions
with return spring



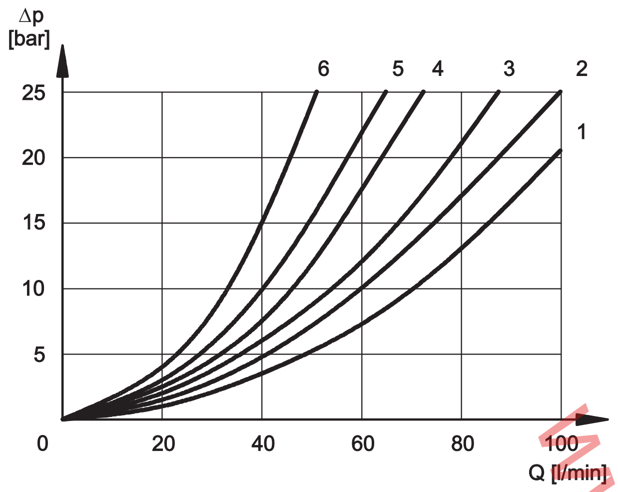
Type **RK**:
2 operations - 2 positions
with mechanical retention



Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our technical department for their identification and operating limits.

5 - PRESSURE DROPS Δp-Q (values obtained with viscosity 36 cSt at 50 °C)

5.1 - DSA3



For pressure drops between A and B lines of spools S10, S20, S21, S22 and S23, which are used in the regenerative diagram, refer to curve 5.

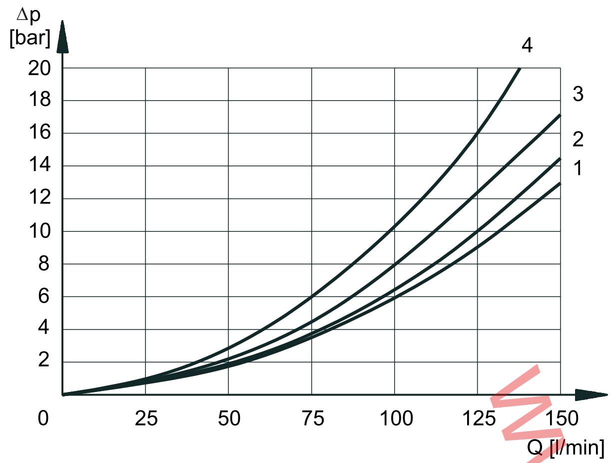
PRESSURE DROPS WITH VALVE IN ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	3	3
S2, SA2, SB2	1	1	3	3
S3, SA3, SB3	3	3	1	1
S4, SA4, SB4	5	5	5	5
S5	2	1	3	3
S6	2	2	3	1
S7, S8	4	5	5	5
S9	2	2	3	3
S10	1	3	1	3
S11	2	2	1	3
S12	2	2	3	3
S17	2	2	3	3
S18	1	2	3	3
S19	2	2	3	3
S20	1	5	2	
S21	5	1		2
S22	1	5	2	
S23	5	1		2
TA, TB	3	3	3	3
TA02, TB02	2	2	2	2
TA23, TB23	3	3		
RK	2	2	2	2
RK02	2	2	2	2
RK1, 1RK	2	2	2	2

PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

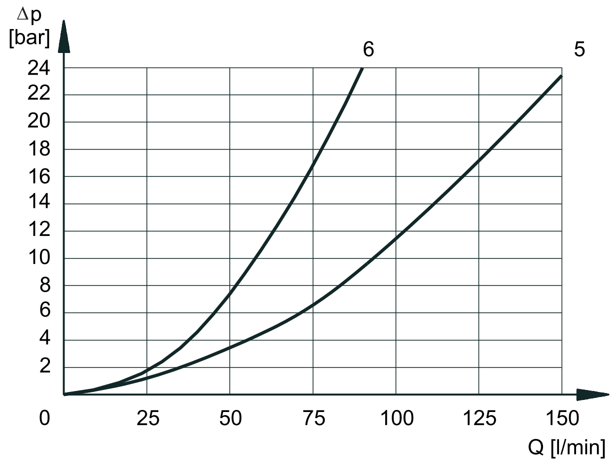
SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2					2
S3, SA3, SB3			3	3	
S4, SA4, SB4					5
S5		4			
S6				3	
S7, S8			6	6	5
S10	3	3			
S11			3		
S18	4				
S22			3	3	
S23			3	3	

5.2 - DSA5



PRESSURE DROPS WITH VALVE IN ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	1	1
S2, SA2, SB2	3	3	1	1
S3, SA3, SB3	3	3	2	2
S4, SA4, SB4	1	1	2	2
S5	2	1	1	1
S6, S11	3	3	2	2
S7, S8	1	1	2	2
S9	3	3	2	2
S10	1	1	1	1
S12	2	2	1	1
S17, S19	2	2	1	1
S18	1	2	1	1
S20, S21				
S22, S23				
TA, TB	3	3	2	2
TA02, TB02	3	3	2	2
TA23, TB23	4	4		
RK	3	3	2	2
RK02	3	3	2	2
RK1, 1RK	3	3	2	2



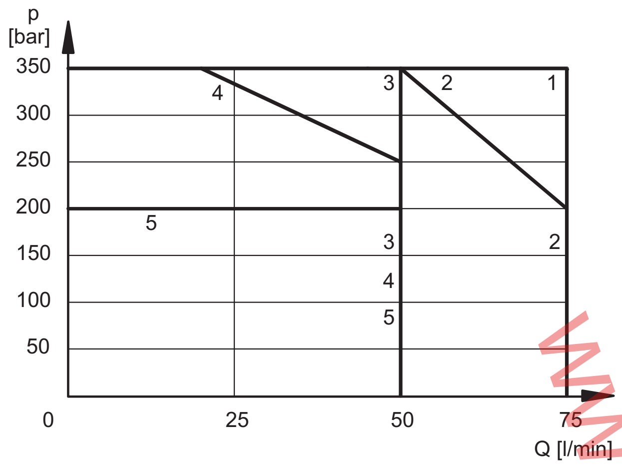
PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2					5
S3, SA3, SB3			6	6	
S4, SA4, SB4					5
S5		3			
S6				6	
S7					5
S10	3	3			
S11			6		
S18	3				
S22					
S23					

6 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm, with mineral oil viscosity 36 cSt at 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

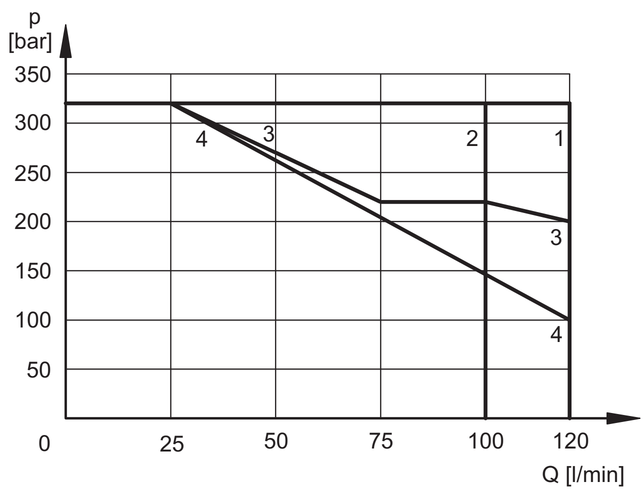
6.1 - DSA3



SPOOL TYPE	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	1	1
S3, SA3, SB3	2	2
S4, SA4, SB4	3	3
S5	1	1
S6	3	2
S7	3	3
S8	3	3
S9	1	1
S10	1	1
S11	2	3
S12	1	1

SPOOL TYPE	CURVE	
	P→A	P→B
S17	1	1
S18	1	1
S19	1	1
S20	4	4
S21	4	4
S22	5	4
S23	4	5
TA, TB	1	1
TA02, TB02	1	1
TA23, TB23	1	1
RK	1	1
RK02	1	1
RK1, 1RK	1	1

6.2 - DSA5



SPOOL TYPE	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	1	1
S3, SA3, SB3	3 *	3 *
S4, SA4, SB4	4	4
S5		
S6		
S7		
S8		
S9		
S10		
S11		
S12		

SPOOL TYPE	CURVE	
	P→A	P→B
S17		
S18		
S19		
S20		
S21		
S22		
S23		
TA, TB	2 *	2 *
TA02, TB02		
TA23, TB23		
RK		
RK02		
RK1, 1RK		

* **NOTE:** for spools S3 and TA, the curve has been obtained with a min. piloting pressure of 4,5 bar. If the minimum piloting pressure used is 5,5 bar, refer to the curve n° 1 (320 bar - 120 l/min).

NOTE: The values indicated in the graphs are relevant to the standard valve. The operating limits can be considerably reduced if a 4-way valve is used with port A or B plugged or without flow.

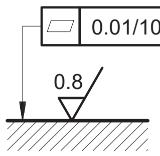
7 - INSTALLATION

Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

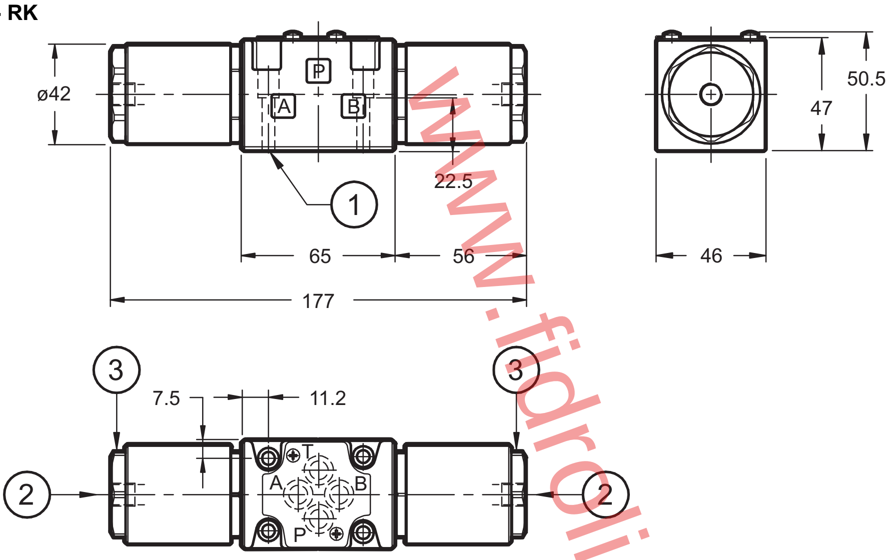
If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.

Surface finishing

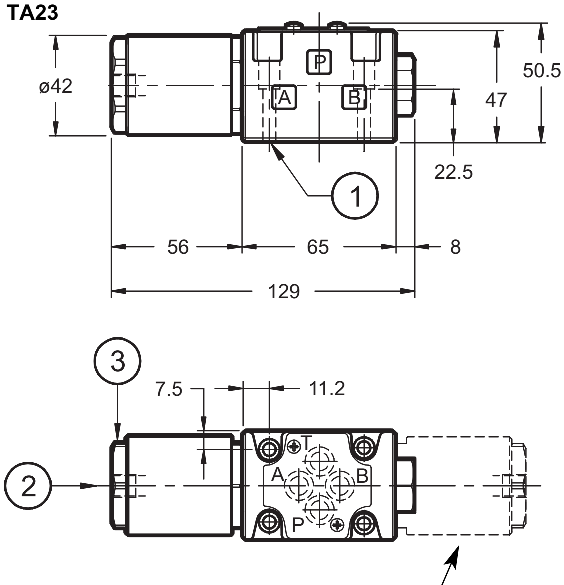


8 - DSA3 OVERALL AND MOUNTING DIMENSIONS

DSA3 - S*
DSA3 - RK



DSA3 - TA
DSA3 - SA*
DSA3 - TA23



operation position configuration SB*, TB and TB23

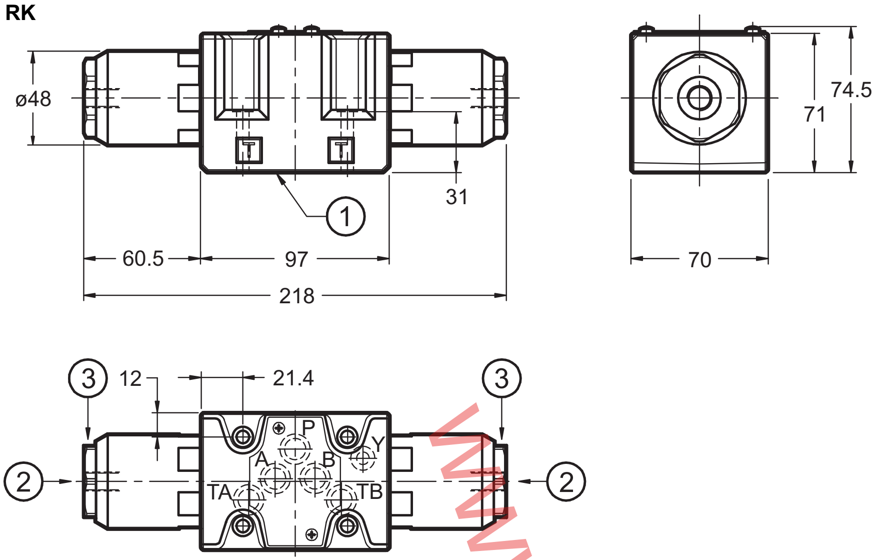
dimensions in mm

1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) 90 Shore
2	1/4" BSP connection for pneumatic operator
3	Hexagon: spanner 38 Tightening torque 35 ÷ 40 Nm

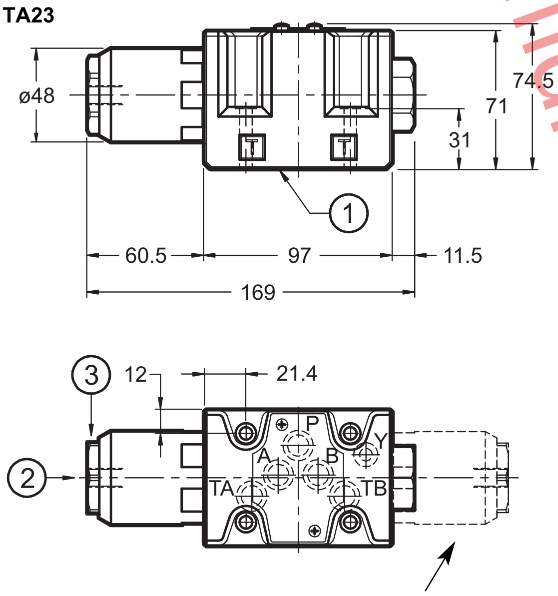
Valve fastening:	N. 4 SHC screws ISO 4762 - M5x30
Tightening torque:	5 Nm (bolts A 8.8)
Threads of mounting holes:	M5x10

9 - DSA5 OVERALL AND MOUNTING DIMENSIONS

DSA5 - S*
DSA5 - RK



DSA5 - TA
DSA5 - SA*
DSA5 - TA23



operation position configuration SB*, TB and TB23

dimensions in mm

1	Mounting surface with sealing rings: N. 5 OR type 2050 (12.42x1.78) 90 Shore N. 1 OR type 2037 (9.25x1.78) 90 Shore
2	1/4" BSP connection for pneumatic operator
3	Hexagon: spanner 38 Tightening torque 35 ÷ 40 Nm

Valve fastening:	N. 4 SHC screws ISO 4762 - M6x40
Tightening torque:	8 Nm (bolts A 8.8)
Threads of mounting holes: M6x10	

10 - SUBPLATES (see catalogue 51 000)

	DSA3	DSA5
Type with rear ports	PMMD-AI3G	PMD4-AI4G - 3/4" BSP threaded
Type with side ports	PMMD-AL3G	PMD4-AL4G - 1/2" BSP threaded
Threading of ports P, T, A and B	3/8" BSP	

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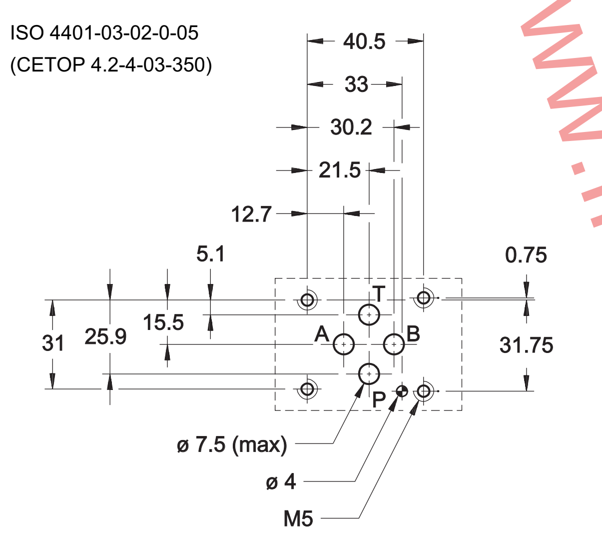
DSC3
HYDRAULICALLY OPERATED DIRECTIONAL CONTROL VALVE
SERIES 11

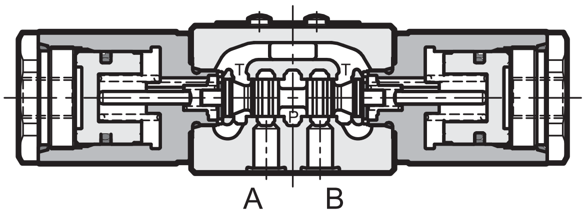
SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

p max (see performances table)
Q nom (see performances table)

MOUNTING SURFACE



OPERATING PRINCIPLE



— The DSC3 are hydraulically operated directional control valves, available with 3 or 4 ways with several interchangeable spools and with mounting interface according to ISO 4401 (CETOP RP121H) standards.

— The valve body is made with high strength iron castings provided with wide internal passages in order to minimize the flow pressure drop.

— It is available with 2 or 3 positions with return spring, or with two positions with mechanical retention.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum working pressure: - P A B ports - T port	bar	350 25
Piloting pressure - min - max	bar	15 (**NOTE 1**) 210
Nominal flowrate	l/min	75
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: single operation valve double operation valve	kg	1,3 1,7

NOTE 1: The piloting pressure must be higher than the counterpressure on T port, of 15 bar at least: to allow the cursor reversal at middle the piloting pressure has to lower quickly at 0 bar.
The piston return spring generates a minimum backpressure of 0.5 bar on the piloting line.

1 - IDENTIFICATION CODE

D	S	C	3	-		/	11	

Directional control valve with spool (D S)

Hydraulically operated (C)

Size:
3 = ISO 4401-03 (CETOP 03)

Spool type (see par. 3)
S* **TA** **TA23**
SA* **TB** **TB23**
SB* **RK**

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

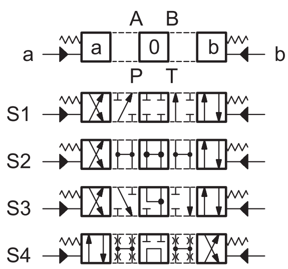
Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

2 - HYDRAULIC FLUIDS

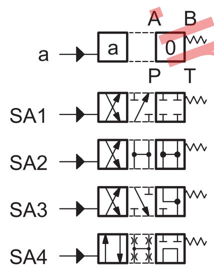
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V).
For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - SPOOL TYPE

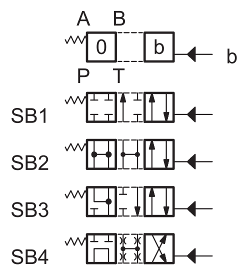
Type **S***:
2 operations - 3 positions
with spring centering



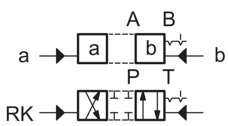
Type **SA***:
1 operation side A
2 positions (central + external)
with spring centering



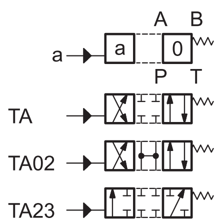
Type **SB***:
1 operation side B
2 positions (central + external)
with spring centering



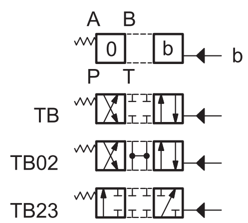
Type **RK**:
2 operations - 2 positions
with mechanical retention



Type **TA**:
1 operation side A
2 external positions
with return spring

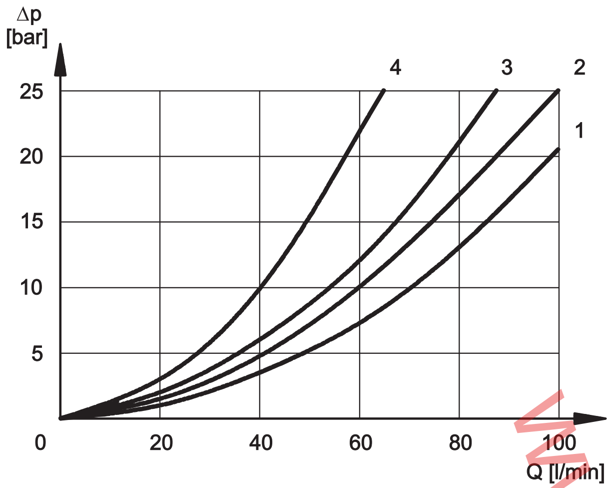


Type **TB**:
1 operation side B
2 external positions
with return spring



Besides the diagrams shown, which are the most frequently used, other special versions are available: consult our technical department for their identification and operating limits.

4 - PRESSURE DROPS Δp-Q (values obtained with viscosity 36 cSt at 50 °C)



PRESSURE DROPS WITH VALVE IN ENERGIZED POSITION

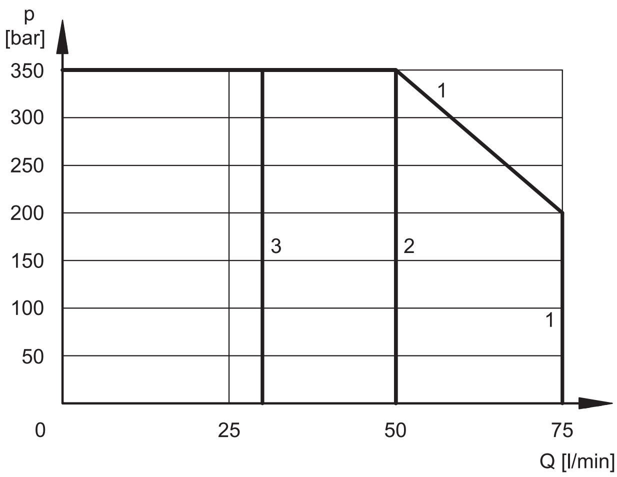
SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
S1, SA1, SB1	2	2	3	3
S2, SA2, SB2	1	1	3	3
S3, SA3, SB3	3	3	1	1
S4, SA4, SB4	4	4	4	4
TA, TB	3	3	3	3
TA02, TB02	2	2	2	2
TA23, TB23	3	3		
RK	2	2	2	2

PRESSURE DROPS WITH VALVE IN DE-ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
S2, SA2, SB2					2
S3, SA3, SB3			3	3	
S4, SA4, SB4					3

5 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values indicated in the graphs are relevant to the standard solenoid valve. The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow. The values have been obtained according to ISO 6403 norm, with mineral oil viscosity 36 cSt at 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



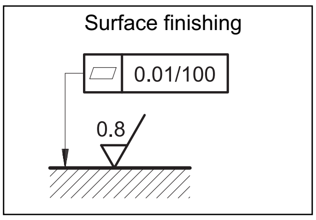
SPOOL TYPE	CURVE	
	P→A	P→B
S1,SA1,SB1	1	1
S2, SA2, SB2	2	2
S3, SA3, SB3	1	1
S4, SA4, SB4	2	2

SPOOL TYPE	CURVE	
	P→A	P→B
TA, TB	1	1
TA02, TB02	2	2
TA23, TB23	1	1
RK	3	3

NOTE: The values indicated in the graphs are relevant to the standard valve. The operating limits can be considerably reduced if a 4-way valve is used with port A or B plugged or without flow.

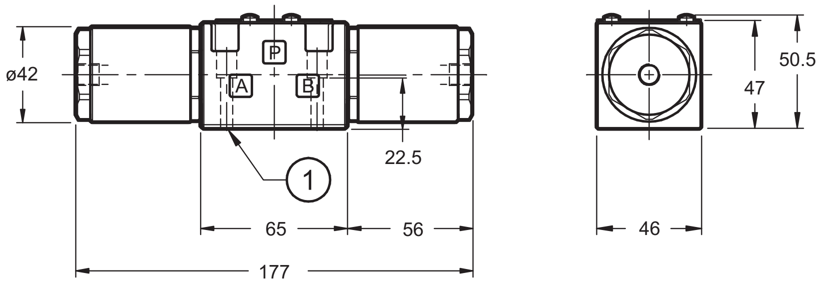
6 - INSTALLATION

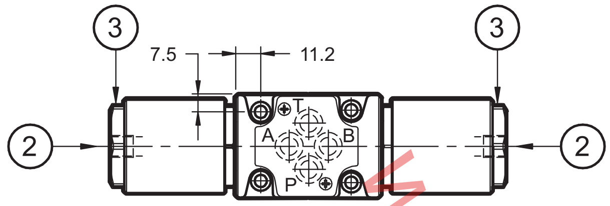
Configurations with centering and return springs can be mounted in any position; type RK valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal. Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.



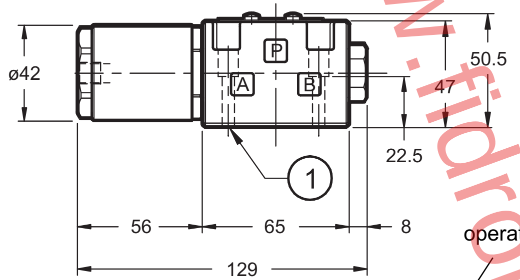
7 - OVERALL AND MOUNTING DIMENSIONS

DSC3 - S*
DSC3 - RK

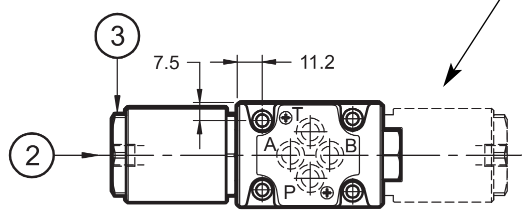




DSC3 - TA
DSC3 - SA*
DSC3 - TA23



operation position configuration SB*, TB and TB23



dimensions in mm

1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) - 90 Shore
2	1/4" BSP connection for hydraulic operation
3	Hexagon: spanner 38 Tightening torque 35 ÷ 40 Nm

8 - VALVE FASTENING BOLTS

N. 4 fastening bolts SHC ISO 4762 M5x30
Tightening torque 5 Nm (bolts A 8.8)

9 - SUBPLATES (see cat. 51 000)

PMMD-AI3G Type with rear ports
PMMD-AL3G Type with side ports
Threading of ports P, T, A, B: 3/8" BSP

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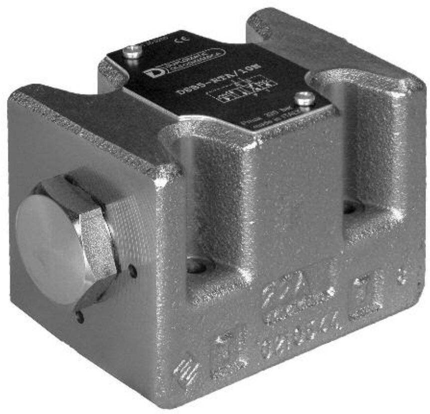
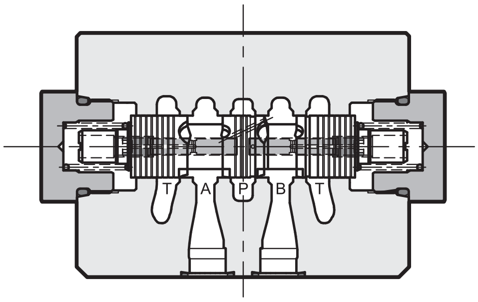


DSB*
SELF-REVERSING VALVE
SERIES 10

MOUNTING SURFACES
DSB3 **ISO 4401-03** (CETOP 03)
DSB5 **ISO 4401-05** (CETOP 05)

p max (see performances table)
Q nom (see performances table)

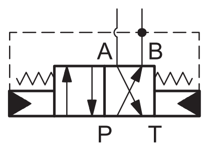
OPERATING PRINCIPLE



— The DSB* are directional control valves with self-reversing spool and mounting interface according to ISO 4401-03 and 4401-05 (CETOP RP121H) standards.

— The valves realize the reciprocation of the flow direction when the flowrate stops in A or B line (f.e., when a cylinder reaches the end stroke). The reversing process is independent of the line pressure.

HYDRAULIC SYMBOL



PERFORMANCES
(measured with mineral oil of viscosity 36 cSt at 50°C)

		DSB3	DSB5
Maximum operating pressure on port P	bar	350	320
Minimum allowed pressure	bar	50	60
Maximum flow rate	l/min	30	100
Minimum allowed flow rate	l/min	3	10
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Recommended viscosity	cSt	25	
Fluid contamination degree		according to ISO 4406:1999 class 20/18/15	
Mass	kg	0,9	2,8
Surface finishing		zinc-nickel surface treatment	

1 - IDENTIFICATION CODE

D	S	B		-	RTA	/	10		/	

Directional control valve with spool

With self reversing spool

Size:
3 = ISO 4401-03 (CETOP 03)
5 = ISO 4401-05 (CETOP 05)

Spool type

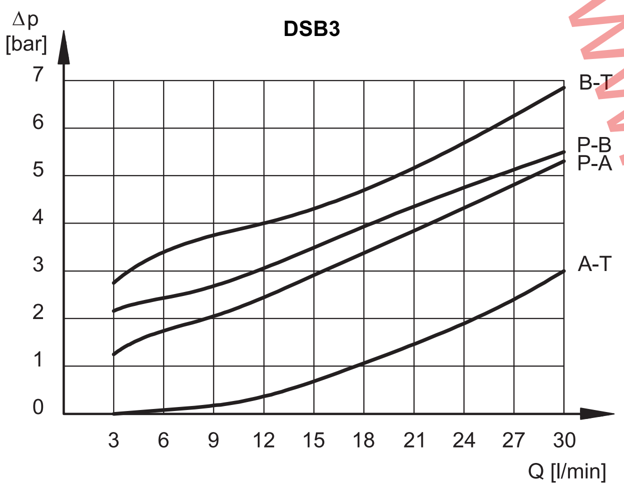
Series No.:
(the overall and mounting dimensions remain unchanged from 10 to 19)

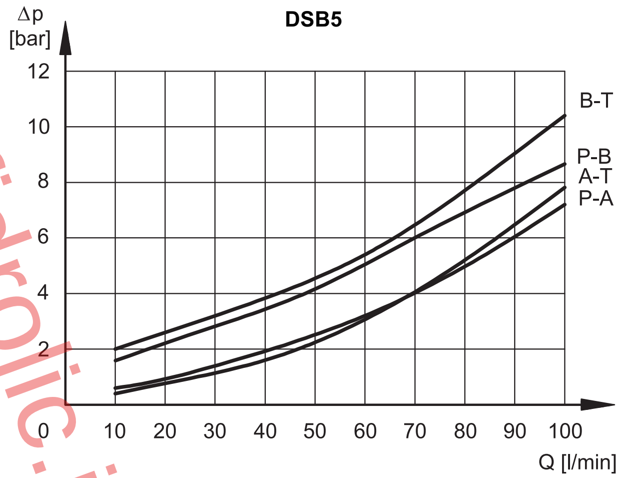
Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Manual override:
CK = knob manual override for the adjustment of the relief valve (see paragraph 6)

2 - PRESSURE DROPS Δp-Q

(values obtained with viscosity 36 cSt at 50 °C)





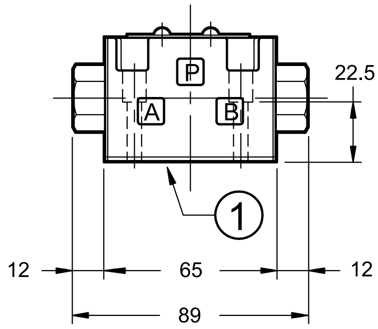
3 - HYDRAULIC FLUIDS

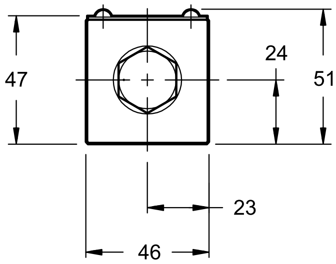
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

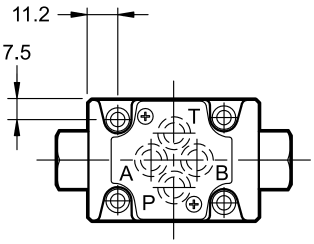
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

5 - OVERALL AND MOUNTING DIMENSIONS DSB3

dimensions in mm

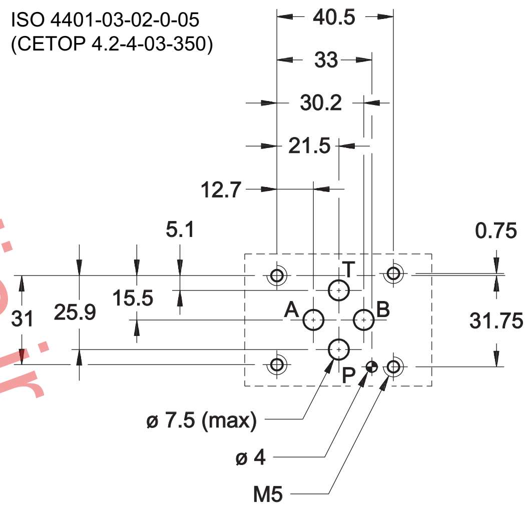






MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)

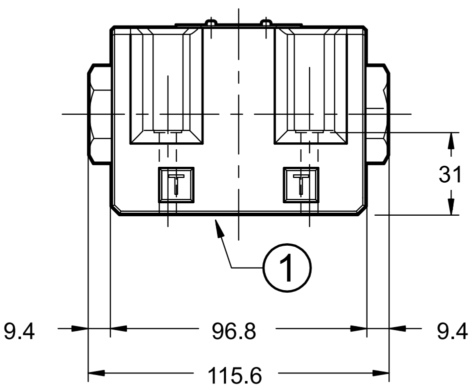


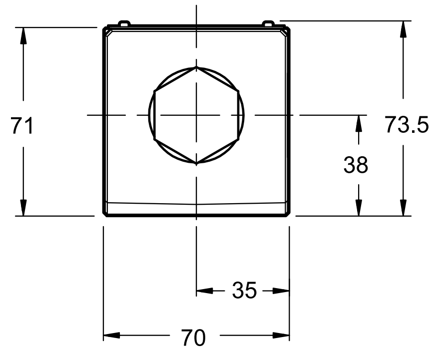
Valve fastening: N. 4 bolts SHC M5x30 - ISO 4762	
Tightening torque: 5 Nm (bolts A 8.8)	
Threads of mounting holes: M5x10	

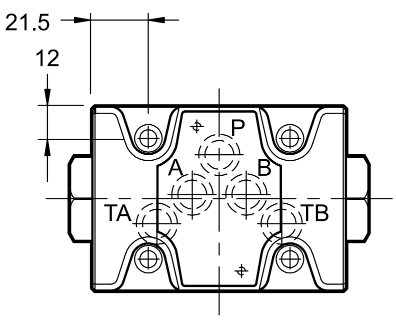
1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) 90 shore

5 - OVERALL AND MOUNTING DIMENSIONS DSB5

dimensions in mm

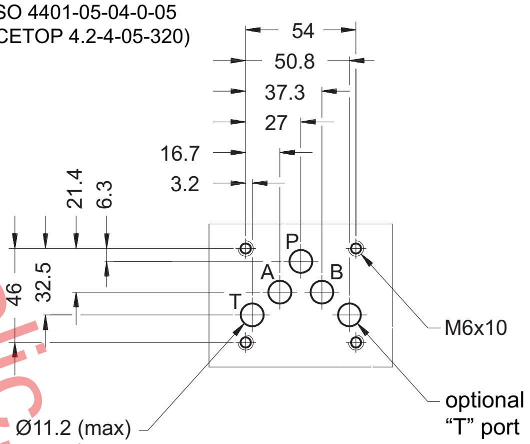






MOUNTING INTERFACE

ISO 4401-05-04-0-05
(CETOP 4.2-4-05-320)



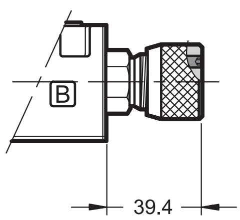
Valve fastening: N. 4 bolts SHC M6x40 - ISO 4762	
Tightening torque: 8 Nm (bolts A 8.8)	
Threads of mounting holes: M6x10	

1	Mounting surface with sealing rings: N. 5 OR type 2050 (12.42x1.78) 90 shore

6 - KNOB MANUAL OVERRIDE

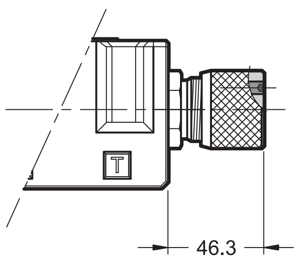
The knob manual override **CK** allows to set the pressure of the relief valve without using shut-off valves.

CK for DSB3



Allen key for set screw: 2,5 mm

CK for DSB5

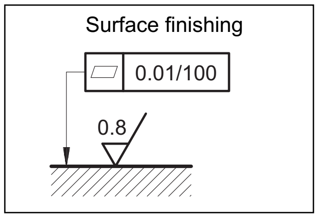


Allen key for set screw: 3 mm

7 - INSTALLATION

The valves can be mounted in any position. Valve fixing is by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity and/or smoothness are not met, fluid leakage between valve and mounting surface can easily occur.

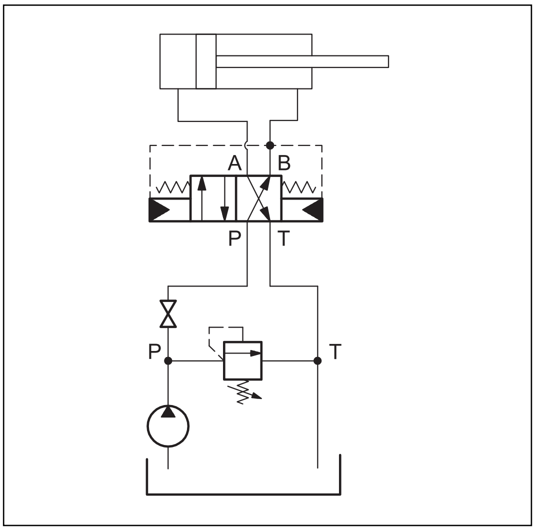


We suggest to use the circuits shown, connecting the A port with the rear chamber of the cylinder. In this way, with the start of the pump, the valve places itself, so as to retract the rod. To work properly the valve needs an area ratio of the cylinder chambers included between 1:1,25 and 1:2.

7.1 - Standard valve

To set the system relief valve correctly, the self-reversing function must be inactive.

To do so, close the shut-off valve, start the pump, set the pressure relief valve and stop the pump. Then, open the shut-off valve and restart the pump.



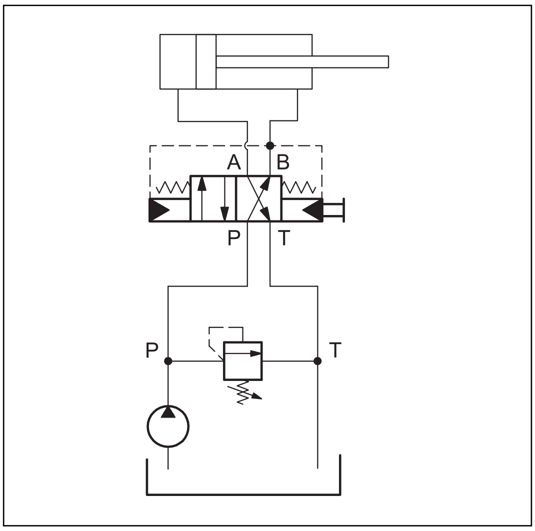
7.2 - Valve with knob manual override

To set the system relief valve correctly, the self-reversing function must be inactive.

To do so, completely unscrew the set screw then tighten the knob until it is at mechanical stop. The spool is now clamped in position P → B and A → T. Start the pump, set the pressure of the relief valve and then stop the pump. Re-establish the working conditions of the valve, unscrewing almost completely the knob and screwing the set screw, until its point is aligned with the edge of the knob.

The valve is in normal working conditions when the knob is tightened and the point of the set screw is aligned with the edge of the knob.

⚠ **Do not use the manual override when the valve is on: if it is necessary stop the pump.**



8 - SUBPLATES (see catalogue 51 000)

	DSB3	DSB5
Type with rear ports	PMMD-AI3G	PMD4-AI4G - 3/4” BSP threaded
Type with side ports	PMMD-AL3G	PMD4-AL4G - 1/2” BSP threaded
Threading of ports P, T, A, B	3/8” BSP	-

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DUPLOMATiC OLEODiNAMiCA

DT03

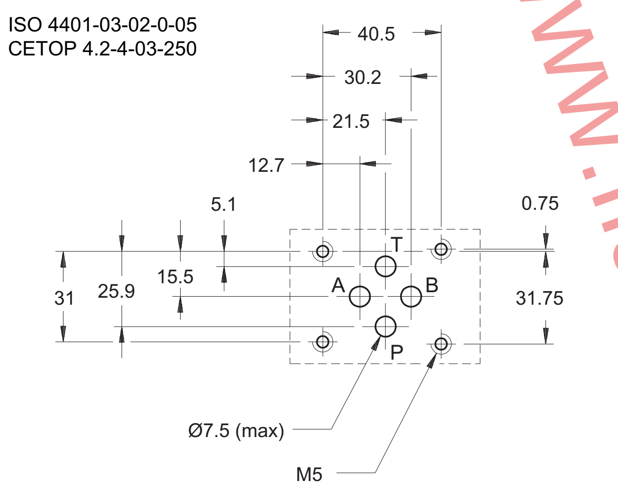
POPPET TYPE SOLENOID OPERATED DIRECTIONAL CONTROL VALVE

SERIES 10

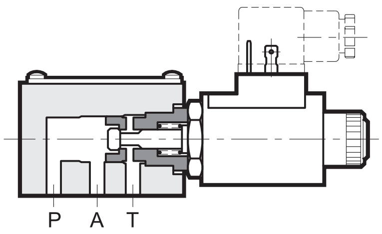
SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

p max **250** bar
Q max **25** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



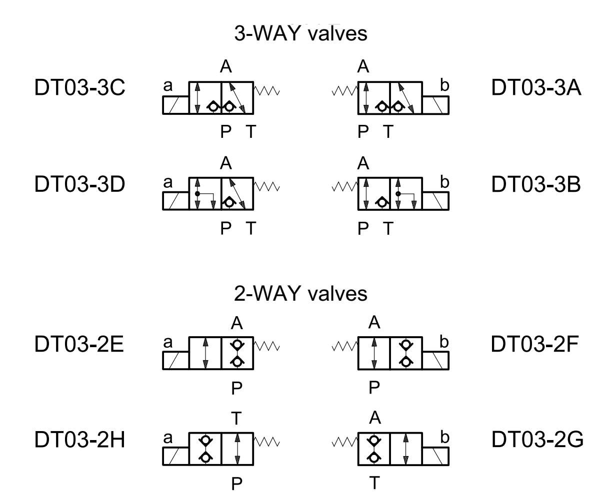
- Direct-acting control valve with conical seat seal.
- Two- or three-way versions with possibility of seal in both directions for two-way valves.
- Leakproof solenoids in oil bath, available in alternating and direct current supply voltages.

PERFORMANCES

(measured with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure	bar	250
Maximum flow rate	l/min	25
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	1,3

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

D	T	03	-			/		/	10	/		/	

Poppet type solenoid operated directional control valve

Size: ISO 4401-03 (CETOP 03)

Number of ways:
2 = 2-way
3 = 3-way

Type of configuration:
A - B - C - D: 3-way, 2-position solenoid valve
E - F - G - H: 2-way, 2-position solenoid valve

Variant on line P (omit if not required):
D08 = orifice Ø0.8
D10 = orifice Ø1.0

Series No.
(The overall and mounting dimensions remain unchanged from 10 to 19)

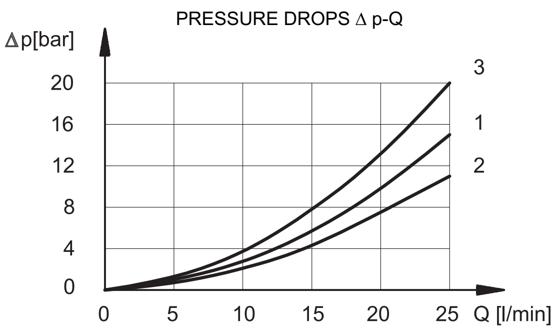
Supply voltage
12V-CC = 12 V
24V-CC = 24 V
} direct current

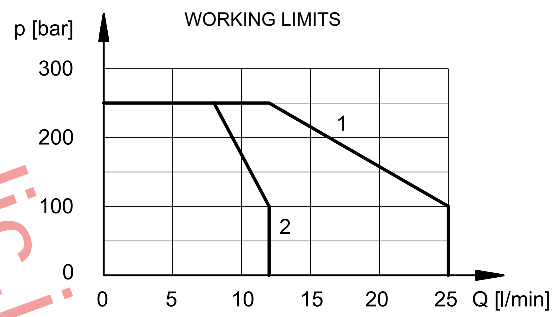
24RAC = 24 V
110RAC = 110 V
220RAC = 220 V
} alternating current

Seals:
omit for mineral oils
V = viton for special fluids

2 - CHARACTERISTIC CURVES

(values obtained with viscosity 36 cSt at 50 °C)





valve	Curve on graph	
	De-energized solenoid	Energized solenoid
DT03-3A	1	3
DT03-3B	2	3
DT03-3C	1	3
DT03-3D	2	3
DT03-2E	-	3
DT03-2F	1	-
DT03-2G	-	3
DT03-2H	1	-

valve	Curve on graph
DT03-3A	2
DT03-3B	1
DT03-3C	1
DT03-3D	1
DT03-2E	1
DT03-2F	2
DT03-2G	1
DT03-2H	1

3 - FLOW LIMITATION

When the solenoid valve is fed by an accumulator or by high delivery pumps it is necessary to limit the flow to the working limits by means of orifices. The orifice must be located on the accumulator side always.

WARNING! During the transition from one to the other end position all ports are interconnected. This means that during the switching the oil will be flowing from the accumulator to the tank through the valve, until the swithing is completed.

That is why the maximum flow should be limited up to 12 l/min by placing orifices.

4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

5 - ELECTRICAL FEATURES

5.1 - Solenoids

These are essentially made up of two parts: tube and coil.

The tube is threaded onto the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation. The coil is fastened to the tube by a threaded nut, and can be turned 360° on its axis, compatible with space available.

The interchangeability of coils of different voltages is allowed within the same type of supply current: alternating or direct (DC / RAC).

NOTE: The protection degree is guaranteed only with connector correctly mated and installed.

VOLTAGE SUPPLY FLUCTUATION	± 10% Vnom
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95/EC
CLASS OF PROTECTION: Atmospheric agents (EN 60529) Coil insulation (VDE 0580) Impregnation	 IP 65 (**NOTE**) class H class F

5.2 - Current and power consumption

The table shows the consumption values for the different coil type.

It is necessary to always use “D” type connectors (with rectifier incorporated) and RAC coils for alternating current supply.

Rectified current supply takes place by using a bridge rectifier bridge, externally or fitted within the “D” type connectors, between the alternating current source (24V or 110V, /50 or /60 Hz) and the coil.

Coil	Voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [W]	Coil code
12V-CC	12	5,6	2,14	25,7	1902050
24V-CC	24	21,8	1,10	26,4	1902051
24RAC	24	17	1,23	26	1902052
110RAC	110	420	0,23	22	1902053
220RAC	220	1750	0,11	22	1902054

5.3 - Switching times

The values indicated refer to a flow rate of Q = 10 l/min, p = 210 bar working with mineral oil at a temperature of 50°C, a viscosity of 36 cSt and supply voltage equal to 90% of the nominal voltage.

TIMES (±10%)	ENERGIZING	DE-ENERGIZING
	30 ms	50 ms

5.4 - Electric connectors

The solenoid valves are never supplied with connector.

Connectors must be ordered separately. See catalogue 49 000.

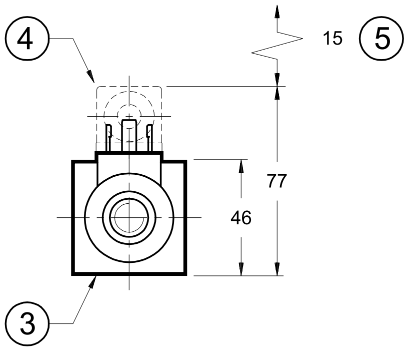
6 - OVERALL AND MOUNTING DIMENSIONS

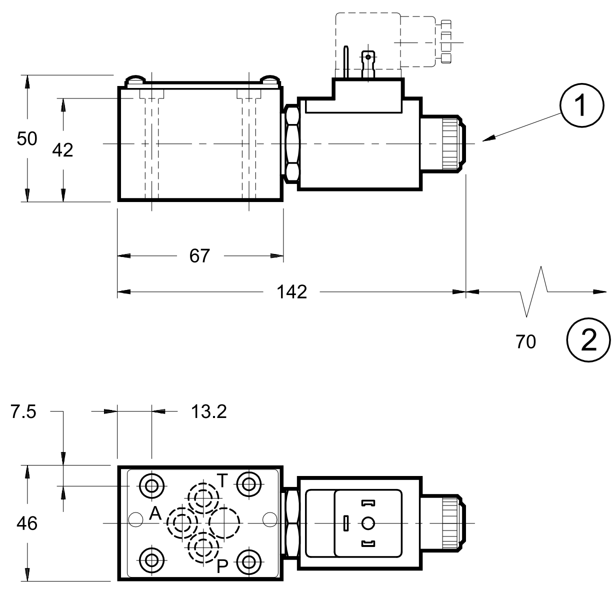
dimensions in mm

NOTE: The solenoid position here shown is for A-B-F-G versions.

For the other versions the solenoid is on the opposite side.

Fastening bolts:
4 bolts M5 x 50
Torque: 5 Nm

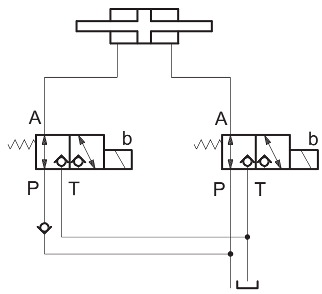




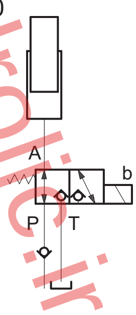
1	Manual override
2	Coil removal space
3	Mounting surface with sealing rings: 4 OR type 2037 (9.25X1.78) - 90 Shore
4	Electric connector to be ordered separately (see cat. 49 000)
5	Connector removal space

7 - APPLICATION EXAMPLES

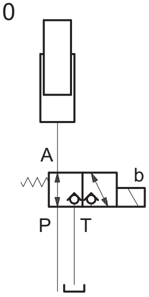
DT03-3A/10



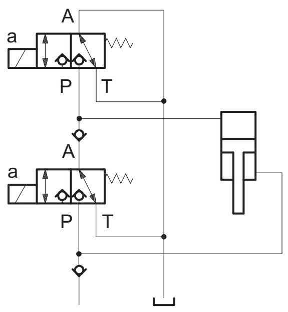
DT03-3A/10



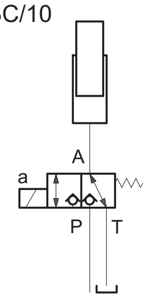
DT03-3A/10



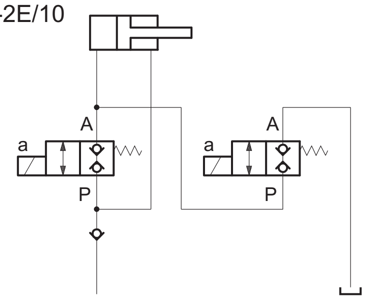
DT03-3C/10



DT03-3C/10



DT03-2E/10



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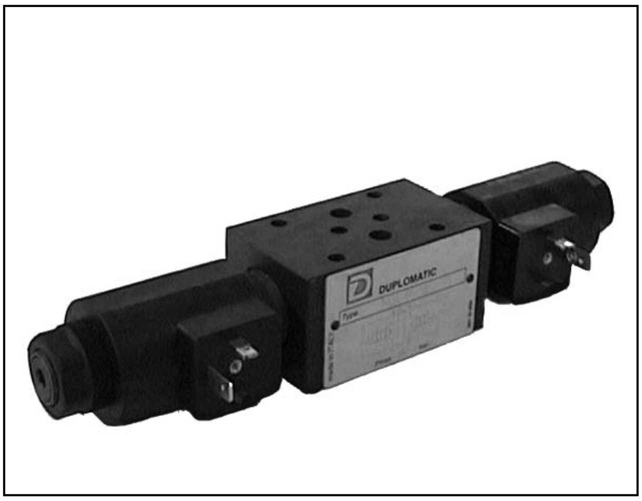


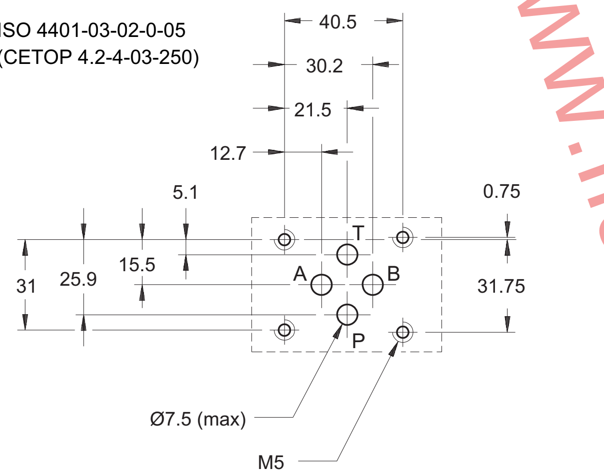
MDT
POPPET TYPE SOLENOID OPERATED DIRECTIONAL CONTROL VALVE
SERIES 10

MODULAR VERSION
ISO 4401-03 (CETOP 03)

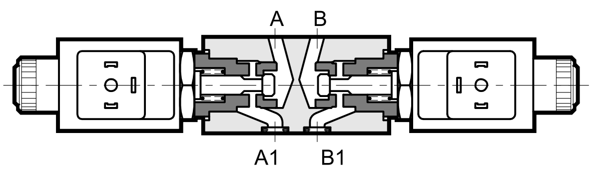
p max **250** bar
Q max **25** l/min

MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-250)



OPERATING PRINCIPLE



- Direct-acting control valve with conical seat seal, for maintaining hydraulic actuators in position.
- Two-way execution, normally closed, with seal in both directions when solenoid is de-energized.
- Leakproof solenoids in oil bath, available in AC and DC supply voltages.

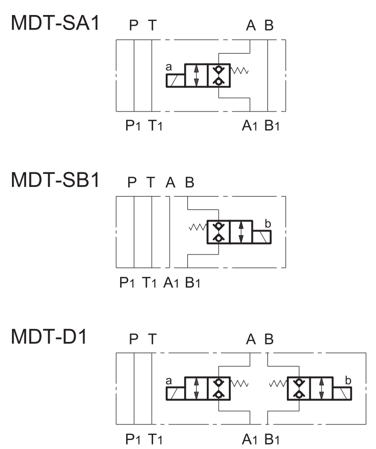
VALVE CONFIGURATIONS (see Hydraulic symbols table)

Configuration “SA”: utilized when line A flow is to be controlled.
Configuration “SB”: utilized when line B flow is to be controlled.
Configuration “D”: utilized when flows of lines A and B are to be controlled

PERFORMANCE RATINGS (working with mineral oil of viscosity of 36 cSt at 50°C)

Maximum operating pressure	bar	250
Maximum flow rate in controlled lines Maximum flow rate in free lines	l/min	25 65
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass MDT-D MDT-SA/SB	kg	1,7 1,2

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

M	D	T	-		1	/	10	-		/	

Modular valve ISO 4401-03 (CETOP 03 size)

Poppet type solenoid operated directional control valve

Configurations: **SA** = control on line A
SB = control on line B
D = control on lines A and B

double seal - normally closed

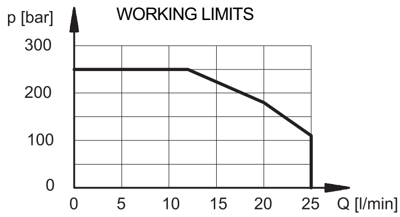
Seals: omit for mineral oils
V = viton for special fluids

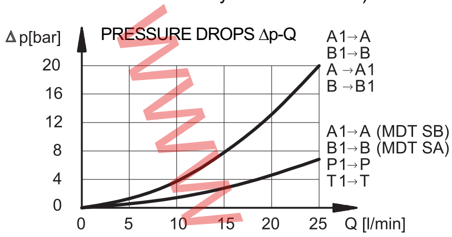
Supply voltages: see par. 3
Direct current: **12V DC**
24V DC
Alternating current: **110 RAC**
220 RAC

Series No.: (the overall and mounting dimensions remain unchanged from 10 to 19)

NOTE: The solenoid valves are never supplied with connector. Connectors must be ordered separately. To identificate the connector type to be ordered, please see catalogue 49 000.

2 - CHARACTERISTIC CURVES (values obtained with viscosity 36 cSt at 50°C)





3 - SUPPLY VOLTAGES

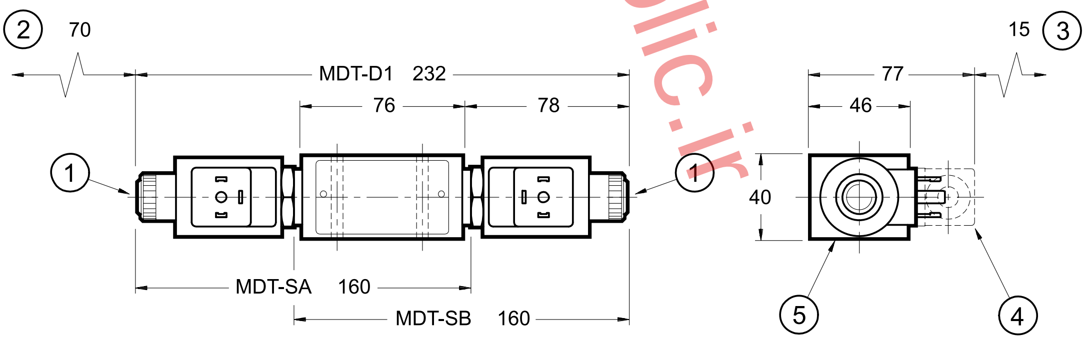
A connector with bridge rectifier and RAC coils are always used for alternating current supply.

Times ±10%	
Energizing	30 ms
De-energizing	50 ms

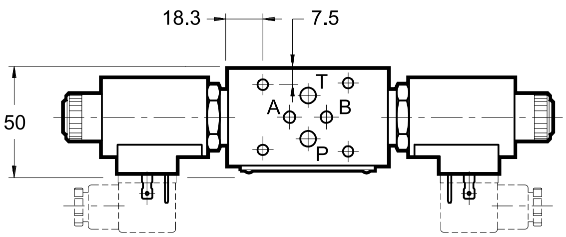
4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

5 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm



1	Manual override
2	Coil removal space
3	Connector removal space
4	Coil with 360° possible orientation
5	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 Shore

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KT08

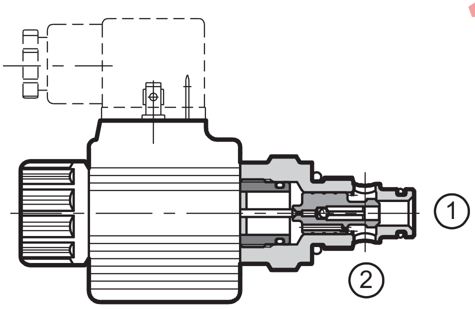
CARTRIDGE SOLENOID VALVE

SERIES 10

CARTRIDGE TYPE
seat 3/4-16 UNF-2B ISO 725

p max **350** bar
Q nom **50** l/min

OPERATING PRINCIPLE



— The KT08 is a 2-ways solenoid valve, poppet type, cartridge execution, available in normally closed version (NC) and normally open version (NO) with nominal flow rate of 50 l/min.

— It ensures a low internal leakage, which decreases while the pressure increases.

— The valve can be ordered with direct current or rectified current solenoids and with five different types of electrical connections, in order to cover many installation requirements (see paragraph 8).

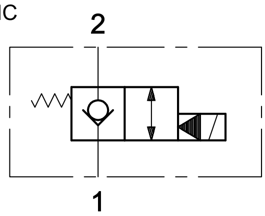
— For every version, the emergency manual override is an available option (see paragraph 7).

PERFORMANCES (working with mineral oil of viscosity of 36 cSt at 50°C)

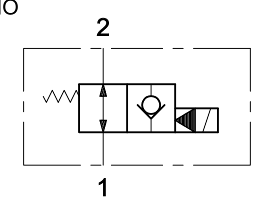
Maximum operating pressure	bar	350
Nominal flow rate	l/min	50
Pressure drops Δp - Q	see paragraph 3	
Electrical characteristics	see paragraph 5	
Electrical connections	see paragraph 8	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,32
Surface treatment with white colour zinc	Fe / Zn 8c 1B UNI ISO 2081/4520	

HYDRAULIC SYMBOLS

KT08-2NC



KT08-2NO



1 - IDENTIFICATION CODE

K	T	08	-		/	10		-			/	

Cartridge solenoid valve

Valve type
T = poppet type

Nominal dimension
08 = mounting interface 3/4-16 UNF-2B ISO 725

Spool types:
2NC = 2-way normally closed
2NO = 2-way normally open

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Coil type:
D12 = 12 V } direct current
D24 = 24 V } (**standard**)

R110 = 110 V } rectified
R230 = 230 V } current
D00 = valve without coil (see **NOTE 1**)

Coil electrical connection (see paragraph 8)
K1 = plug for connector type DIN 43650 (**standard**)
K2 = plug for connector type AMP JUNIOR
K4 = outgoing cables
K7 = plug for connector type DEUTSCH DT04-2P male
K8 = plug for connector type AMP SUPER SEAL

See **NOTE 2**

NOTE 1: The coil locking ring and the relevant seals are included in the supply.
NOTE 2: The manual override **CM** is available as an option (see paragraph 7).

1.1 - Coil identification code

C	14	L3	-			/	10

Power supply
D12 = 12 V } direct current
D24 = 24 V } (**standard**)
R110 = 110 V } rectified
R230 = 230 V } current

Coil electrical connection (see paragraph 8)
K1 = plug for connector type DIN 43650 (**standard**)
K2 = plug for connector type AMP JUNIOR
K4 = outgoing cables
K7 = plug for connector type DEUTSCH DT04-2P male
K8 = plug for connector type AMP SUPER SEAL

Series no.: (the overall and mounting dimensions remain unchanged from10 to 19)

2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

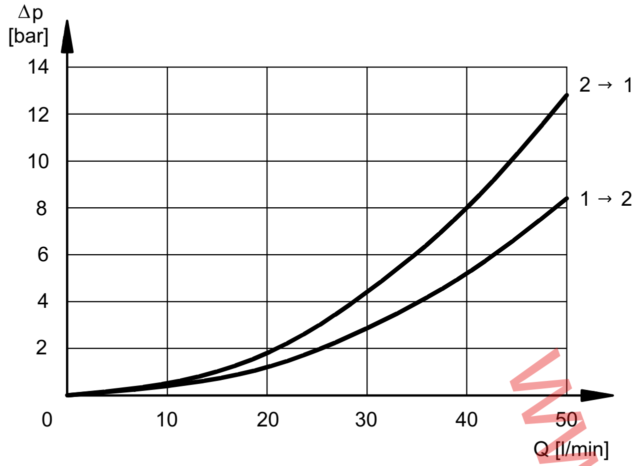
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

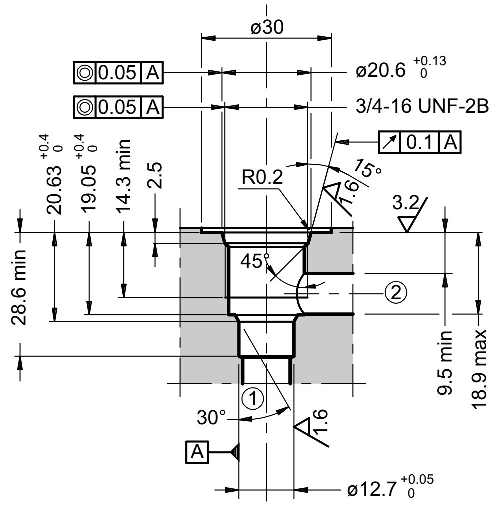
3 - PRESSURE DROPS Δp-Q (obtained with viscosity of 36 cSt at 50 °C)

The values in graphs refer to both NC and NO valves and they differ for the mounting interface used.

standard mounting interface dimensions
3/4-16 UNF-2B ISO 725

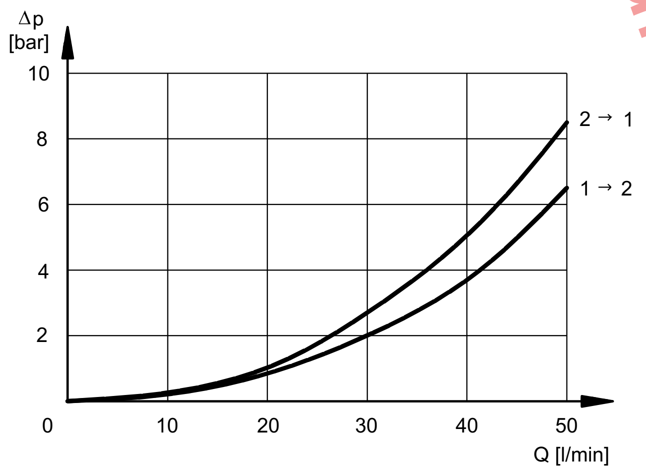
dimensions in mm

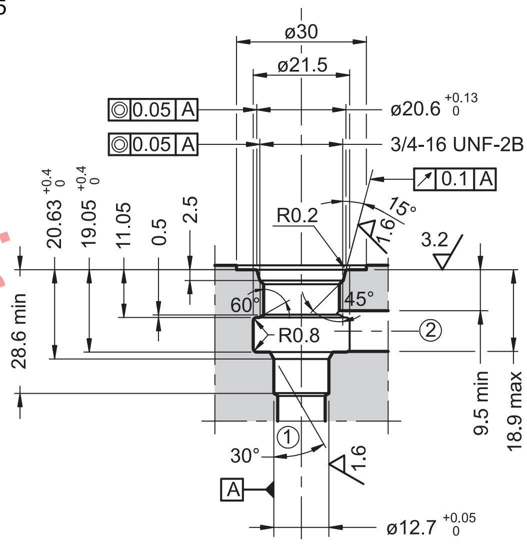




oversize mounting interface dimensions
3/4-16 UNF-2B ISO 725

dimensions in mm





4 - SWITCHING TIMES

The values indicated refer to a valve tested with Q = 25 l/min, p = 350 bar, working with mineral oil at a temperature of 50°C and a viscosity of 36 cSt.

TIMES (±10%)		
	ENERGIZING	DE-ENERGIZING
KT08-2NC	60 ms	85 ms
KT08-2NO	85 ms	60 ms

5 - ELECTRICAL FEATURES

5.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded onto the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation. The coil is fastened to the tube by a threaded nut, and can be rotated according to the available space.

The interchangeability of coils of different voltages both D or R type is possible without removing the tube.

Protection according CEI EN 60529 - atmospheric agents

Connector	IP 65	IP 67	IP 69 K
K1 DIN 43650	x		
K2 AMP JUNIOR	x	x	
K4 outgoing cables	x	x	
K7 DEUTSCH DT04 male	x	x	x
K8 AMP SUPER SEAL	x	x	x

NOTE: The protection degree is guaranteed only if the connector is correctly installed and locked.

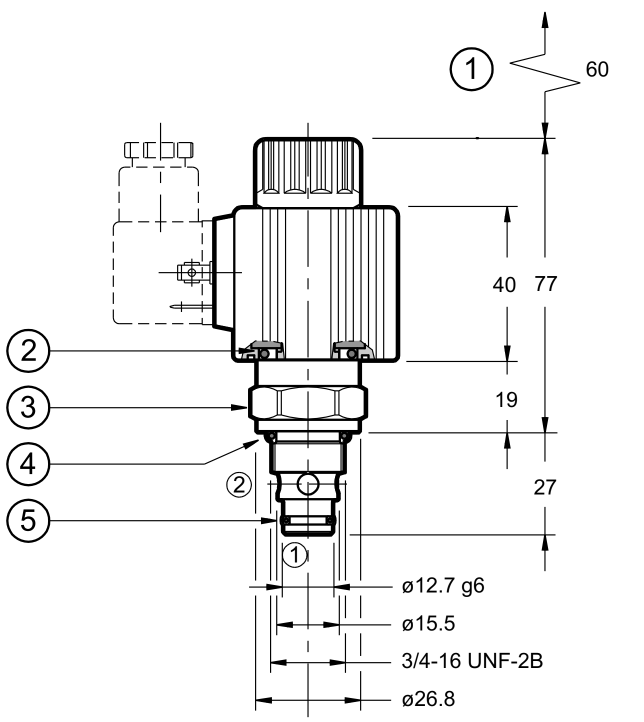
SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	In compliance with 2004/108/CE
LOW VOLTAGE	In compliance with 2006/95/CE
CLASS OF PROTECTION : Coil insulation (VDE 0580) Impregnation	 class H class H

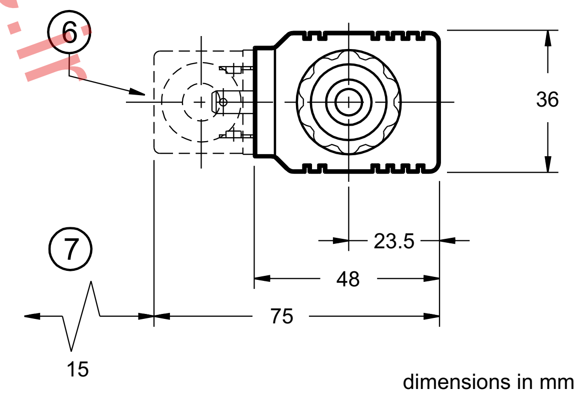
5.2 - Current and absorbed power

In the table are shown current and power consumption values relevant to the different coil types. “R” coil must be used when the valve is fed with AC power supply subsequently rectified by means of rectifier bridge, externally or incorporated in the “D” type connector (see cat. 49 000).

	Resistance at 20°C [Ω] (±1%)	Absorbed current [A] (±5%)	Absorbed power (±5%) [W]	Absorbed power (±5%) [VA]	Coil code K1	Coil code K2	Coil code K4	Coil code K7	Coil code K8
C14L3-D12*	5,4	2,2	26,5		1902740	1902750	1902770	1902980	1903020
C14L3-D24*	20,7	1,16	27,8		1902741	1902751	1902771	1902981	1903021
C14L3-R110*	363	0,25		27,2	1902742				
C14L3-R230*	1640	0,11		26,4	1902743				

6 - OVERALL AND MOUNTING DIMENSIONS



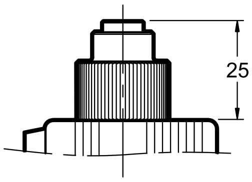


dimensions in mm

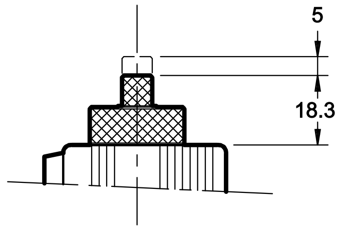
1	Coil removal space
2	OR type 4081 (20.22x3.53)
3	Hexagonal: spanner 27 - tightening torque 50 Nm
4	OR type 3.908 (16.36x2.21)
5	OR type 2037 (9.25x1.78) - 90 Shore
6	Electric connector DIN 43650 (drawing relevant to standard connection K1 - for other types of connection see paragraph 8)
7	Connector removal space

7 - MANUAL OVERRIDE

CM for **NO** version (pushing type)

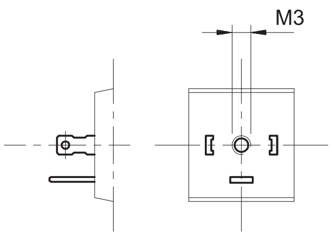


CM for **NC** version (screw type)

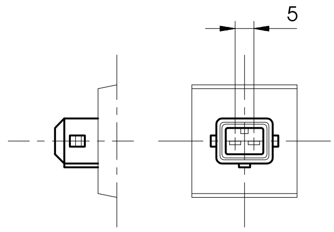


8 - ELECTRIC CONNECTIONS

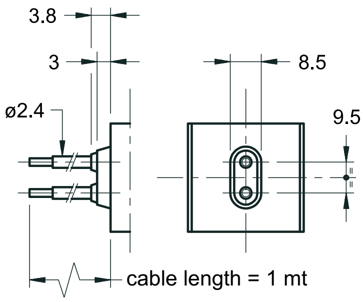
connection for DIN 43650 connector
code **K1** (**standard**)



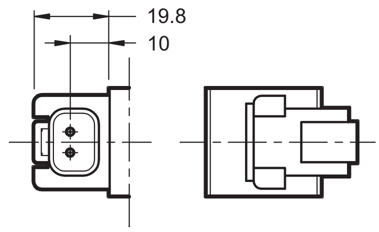
connection for AMP JUNIOR connector
code **K2**



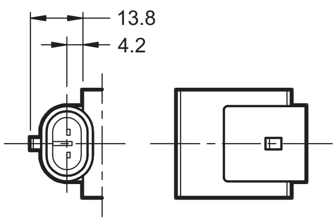
outgoing cables connection
code **K4**



connection for DEUTSCH DT04-2P male connector
code **K7**



connection for AMP SUPER SEAL connector (two contacts)
code **K8**



9 - ELECTRIC CONNECTORS

The solenoid valves are supplied without connectors. For coils with standard electrical connections K1 type (DIN 43650) the connectors can be ordered separately. For the identification of the connector type to be ordered please see catalogue 49 000.

For K2, K7 and K8 connection type the relative connectors are not available.

10 - SUBPLATES FOR MODULAR MOUNTING

10.1 - Identification code

K	T	M	3	-		/	10	

Modular subplate for KT08 cartridge solenoid valves

Size ISO 4401-03 (CETOP 03)

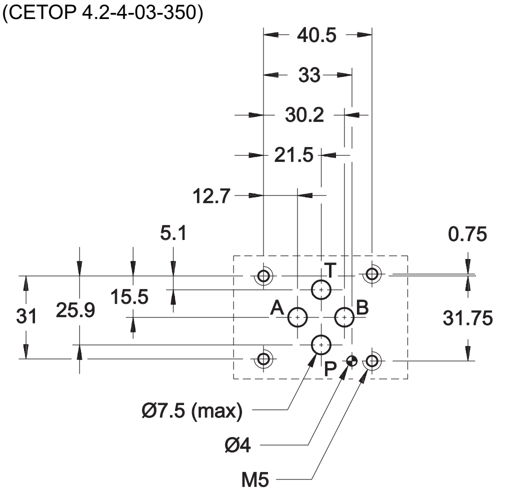
P = delivery interception on P line
PT = interception on P-T lines
D = outgoing interception on A and B lines
RD = incoming interception on A and B lines
SB = outgoing interception on B line

Series no.: (the overall and mounting dimensions remain unchanged from10 to 19)

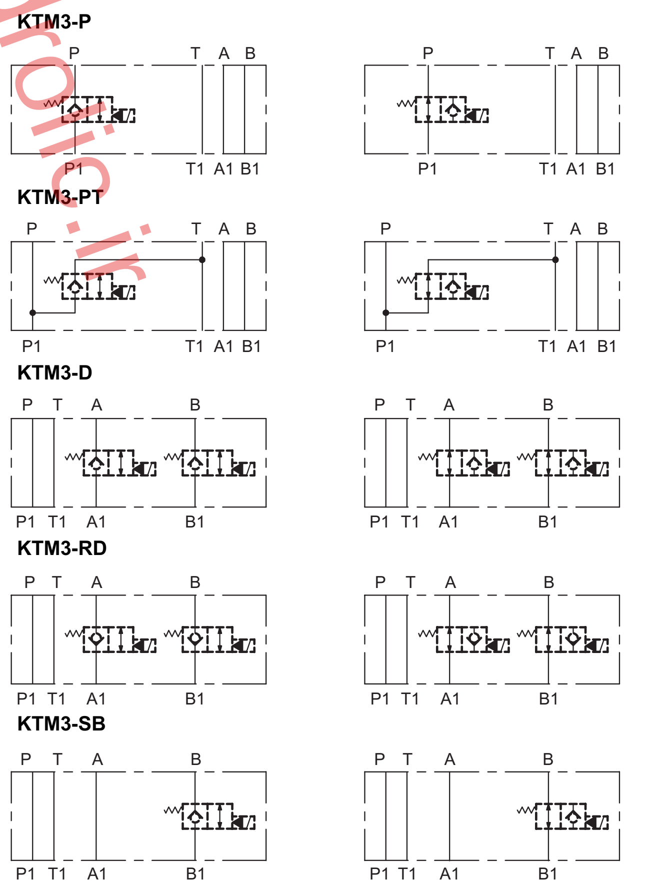
Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)

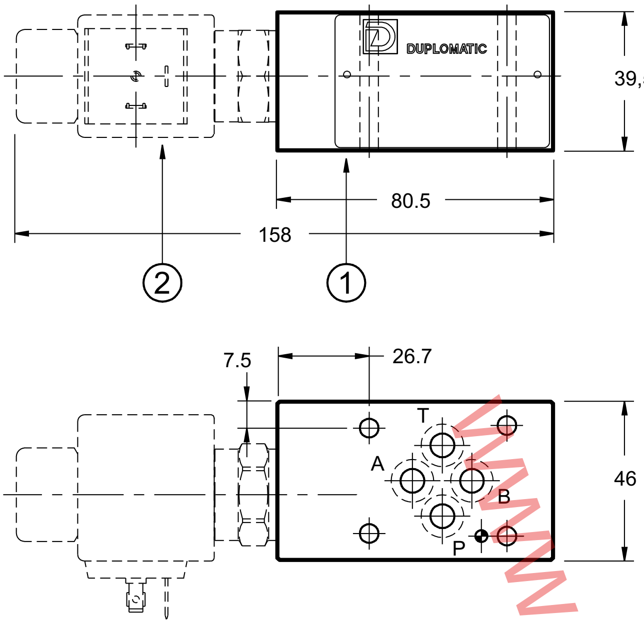


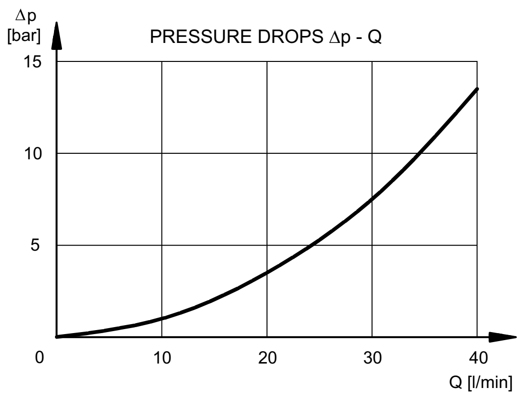
HYDRAULIC SYMBOLS



10.2 - Overall and mounting dimensions KTM3-P

dimensions in mm



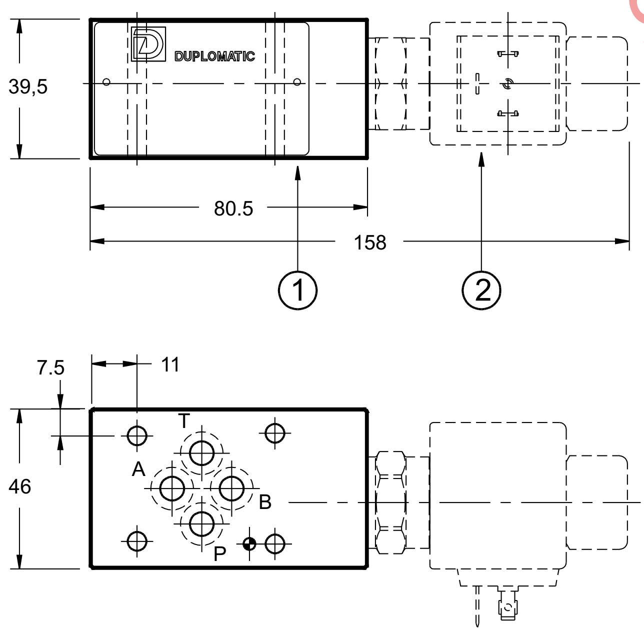


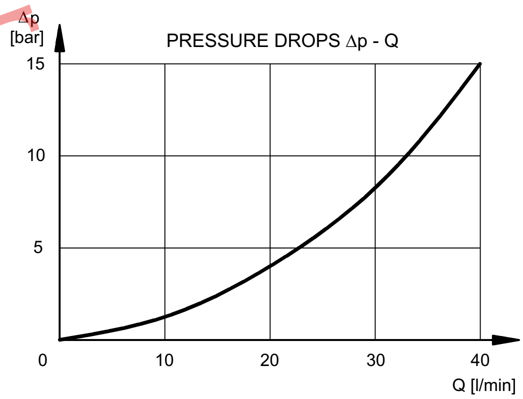
pressure drops relevant to the subplate and the valve mounted with flow rate 2 -1

1	Mounting surface with sealing rings: n. 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Cartridge solenoid valve KT08 (to be ordered separately)

10.3 - Overall and mounting dimensions KTM3-PT

dimensions in mm





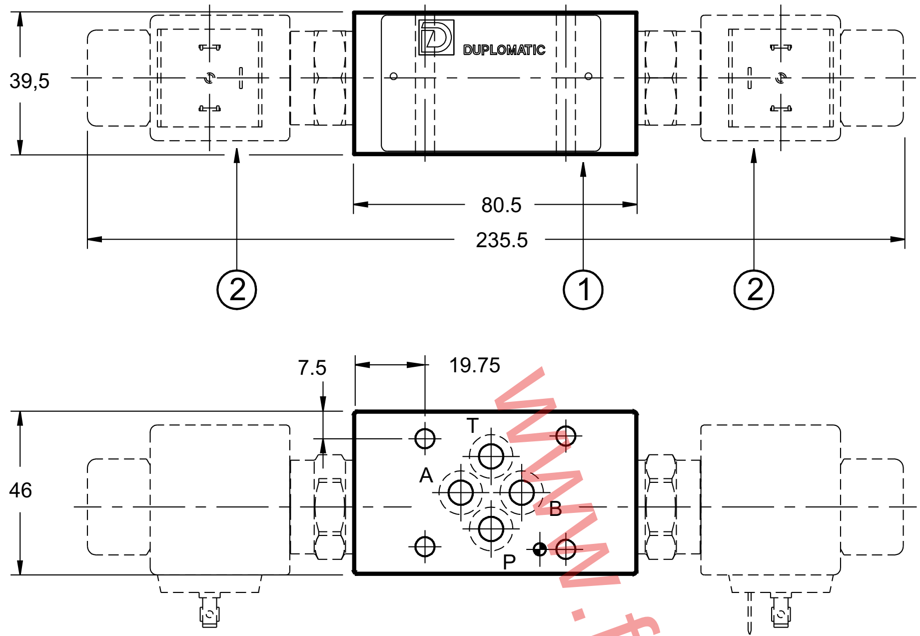
pressure drops relevant to the subplate and the valve mounted with flow rate 2 - 1

1	Mounting surface with sealing rings: n. 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Cartridge solenoid valve KT08 (to be ordered separately)

10.4 - Overall and mounting dimensions KTM3-D, KTM3-RD and KTM3-SB

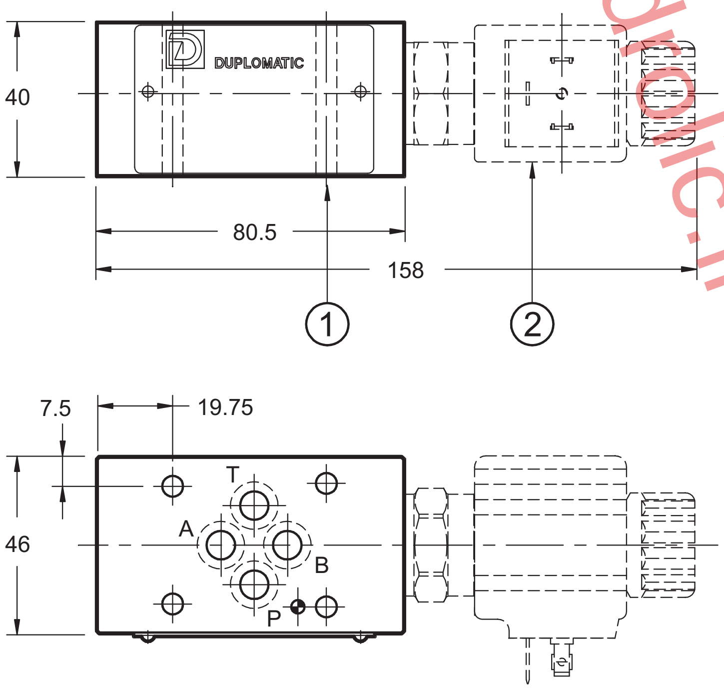
KTM3-D
KTM3-RD

dimensions in mm



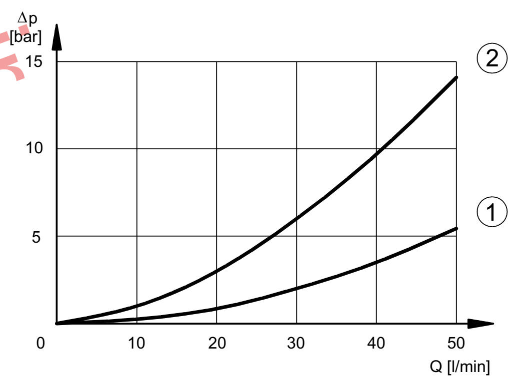
NOTE: In order to use a single port (interception on line A), a plug must be ordered separately.
Code 0266683 for NBR seals (standard) or 0266684 for viton seals.

KTM3-SB



1	Mounting surface with sealing rings: n. 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Cartridge solenoid valve KT08 (to be ordered separately)

PRESSURE DROPS Δp - Q



(1) subplate pressure drops

(2) pressure drops relevant to the subplate and the valve mounted with flow rate 2 - 1

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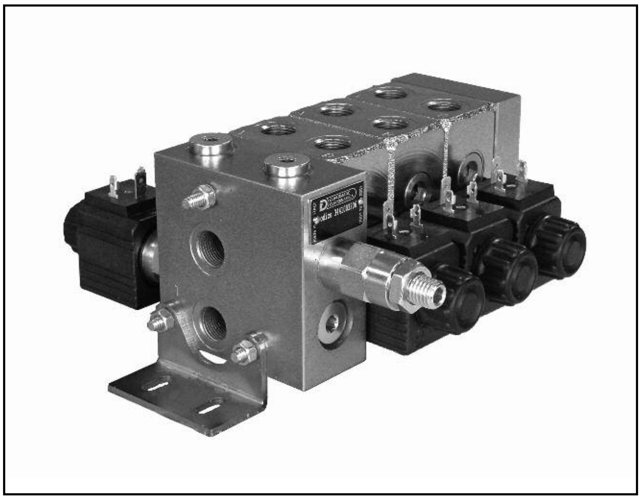


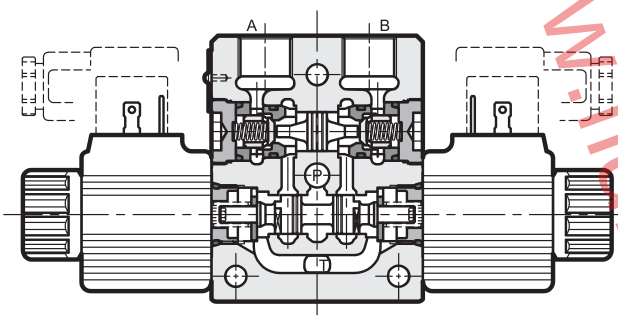
BD6

BANKABLE DIRECTIONAL CONTROL VALVE

SERIES 20

p max **280** bar
Q max **40** l/min

OPERATING PRINCIPLE



— The directional control valve BD6 is a bankable valve very well-rounded thanks to its modular design.

— This valve has been designed to be assembled with series or parallel connection, mounting up to 6 body-modules.

— The BD6 valve is suitable for compact applications in the mobile and mini-power pack industries.

— The intake ports A and B, the inlet P and the outlet T are 3/8” BSP threaded.

— A version with built-in pilot check valves is available for the series configuration.

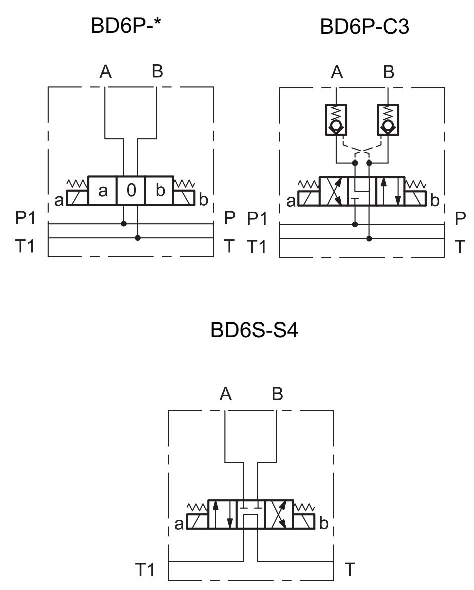
— The series configuration allows a max operating pressure of 250 bar.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Maximum operating pressure: - P-A-B ports (parallel) - P-A-B ports (series) - T and T1 ports	bar	280 250 250
Maximum flowrate: - parallel - series	l/min	40 25
Pressure drops Δp - Q	see paragraph 3	
Electrical characteristics	see paragraph 6	
Operating limits	see paragraph 5	
Electrical connections	see paragraph 9	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Single body mass	kg	1,84
Surface treatment of body and plates	galvanized, zinc-nickel	

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODES FOR LOOSE MODULES

Here below all the loose components identification codes of the bankable valve are shown. To order a whole assembled valve, please use the codes at paragraphs 11 and 12.

The pressure control valve and the poppet type valve with unloading function are briefly described. Fore more detailed information about them please see the 21 100 data sheet for the pressure control valve and the 43 100 for the unloading valve.

1.1 - Valve body

BD	6		-		/	20		-		

Bankable directional control valve

Size

Connection type:
P = parallel
S = series

Spool type
(see paragraph 1.3)

Series no. (the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Coil type
D12 = 12 V } direct current
D24 = 24 V
D28 = 28 V
R110 = 110 V } rectified current
R230 = 230 V
D00 = valve supplied without coils. Locking rings are supplied together with valves.

Coil electrical connection:
(see paragraph 9)
K1 = plug for connector type DIN 43650 (standard)
K2 = plug for connector type AMP JUNIOR
K4 = outgoing cables
K7 = plug for connector type DEUTSCH DT04-2P male
K8 = plug for connector type AMP SUPER SEAL

NOTE: A galvanic surface treatment zinc-nickel is applied to modules and plates, making the valve suitable to withstand a salt spray exposure time of 600 hours (test carried out according to the UNI EN ISO 9227 and assessment test carried out according to the UNI EN ISO 10289).

1.2 - Coil identification code

C	14	L3	-			/	10

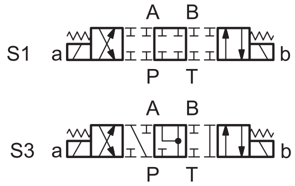
Supply voltage
D12 = 12 V } direct current
D24 = 24 V
D28 = 28 V
R110 = 110 V } rectified current
R230 = 230 V

Coil electrical connection (Dimension at section 9. See paragraph 6.2 for matching voltage-connections)
K1 = plug for connector type DIN 43650
K2 = plug for connector type AMP JUNIOR
K4 = outgoing cables
K7 = plug for connector type DEUTSCH DT04-2P male
K8 = plug for connector type AMP SUPER SEAL

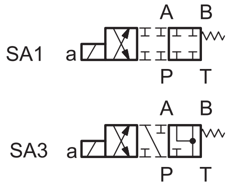
Series no.:
(the overall and mounting dimensions remain unchanged from10 to 19)

1.3 - Available spool type for parallel configuration BD6P

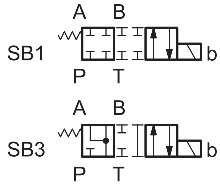
Type **S**:
2 solenoids - 3 positions
spring centering



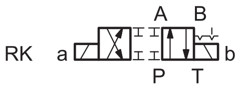
Type **SA***: 1 solenoid side A
2 positions (central + external)
spring centering



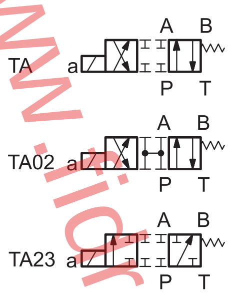
Type **SB***: 1 solenoid side B
2 positions (central + external)
spring centering



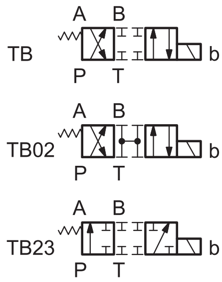
Type **RK**:
2 solenoids - 2 positions
with mechanical retention



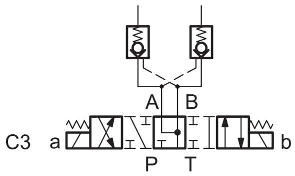
Type **TA***:
1 solenoid side A
2 external positions
with return spring



Type **TB***:
1 solenoid side B
2 external positions
with return spring



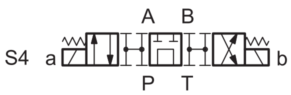
Type **C3**: 2 solenoids 3 positions
with spring centering and check valve on
A and B



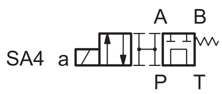
piloting ratio: 3:1
check valve cracking
pressure: 3 bar
Q_{max} 40 l/min

1.4 - Available spool type for series configuration BD6S

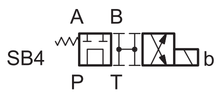
Type **S4**:
2 solenoids 3 positions
spring centering



Type **SA***:
1 solenoid side A
2 positions (central + external)
spring centering



Type **SB***:
1 solenoid side B
2 positions (central + external)
spring centering



1.4 - Inlet plate with pressure control valve for parallel connection

BD	6	P	-	F		/	20	

Bankable directional control valve

Nominal size

Parallel connections

Inlet plate with pressure control valve

Pressure adjustment range:
140 = up to 140 bar
210 = up to 210 bar
280 = up to 280 bar

Series no.: (the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

1.5 - Inlet plate with pressure control valve and unloading for parallel connections

BD	6	P	-	FK		/	20		-		

Bankable directional control valve

Nominal size

Parallel connections

Inlet plate with pressure control valve and unloading

Pressure adjustment range:
140 = up to 140 bar
210 = up to 210 bar
280 = up to 280 bar

Series no.: (the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Coil type
D12 = 12 V
D24 = 24 V
D28 = 28 V
} direct current
R110 = 110 V
R230 = 230 V
} rectified current
D00 = valve supplied without coils. Locking rings are supplied together with valves.

Coil electrical connection:
(see paragraph 9)
K1 = plug for connector type DIN 43650 (standard)
K2 = plug for connector type AMP JUNIOR
K4 = outgoing cables
K7 = plug for connector type DEUTSCH DT04-2P male
K8 = plug for connector type AMP SUPER SEAL

1.6 - End plate module for parallel connections

BD	6	P	-	R	/	20	

Bankable directional control valve

Nominal size

Parallel connection

Blind end plate

Series no.: (the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

1.7 - Inlet module with pressure control valve for series connection

BD	6	S	-	F		/	20	

Bankable directional control valve

Nominal size

Series connection

Inlet module with pressure control valve

Pressure adjustment range:
140 = up to 140 bar
210 = up to 210 bar (**NOTE**)

Series no.: (the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

NOTE: Screwing completely the pressure control valve, the reachable max operating pressure is 240 bar with Q ≥ 5 l/min

1.8 - Outlet end plate for series connection

BD	6	S	-	R1	/	20	

Bankable directional control valve

Nominal size

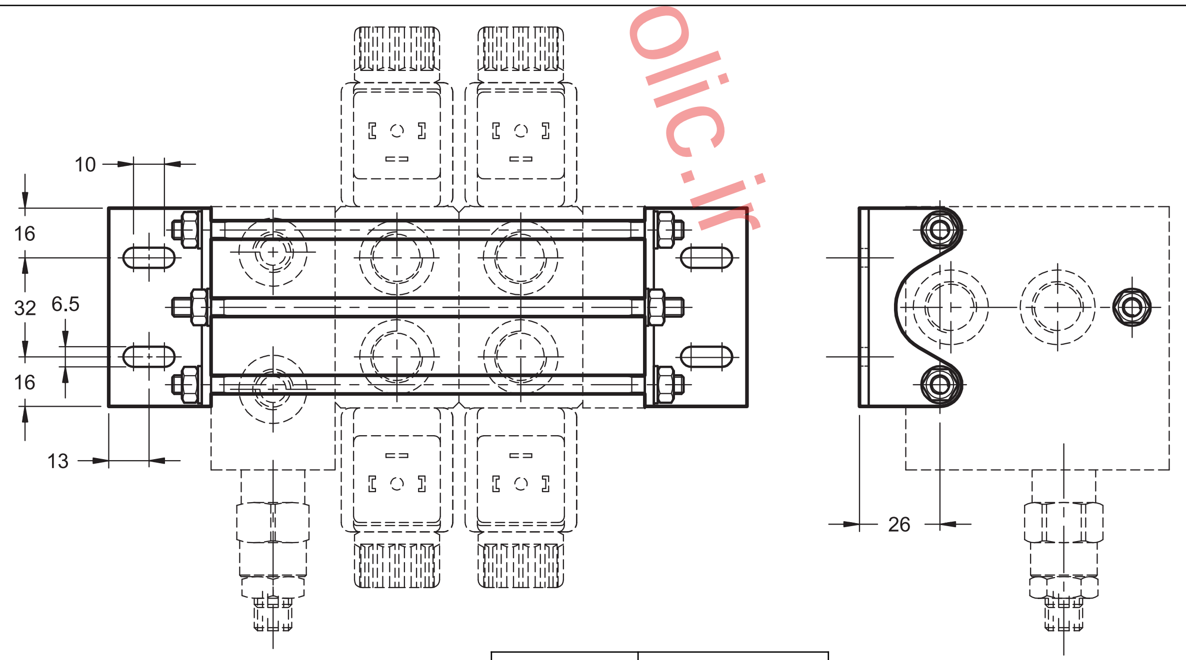
Series configuration

Outlet plate with T1 port 3/8" BSP threaded

Series no.: (the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

1.9 - Studs and fixing kit



no. of body modules	KIT code
2	3404100010
3	3404100011
4	3404100012
5	3404100013
6	3404100014

The kit includes:
3 galvanized studs
6 galvanized nuts
6 galvanized safety washers
2 fixing feet

Fixing feet fastening:
n. 4 bolts M6 (not included)

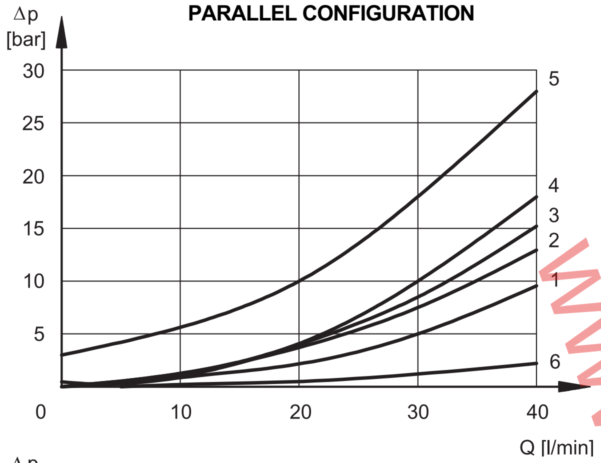
Tightening torque: 5 Nm

2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.The fluid must be preserved in its physical and chemical characteristics.

3 - CHARACTERISTIC CURVES (values obtained with viscosity 36 cSt at 50 °C)

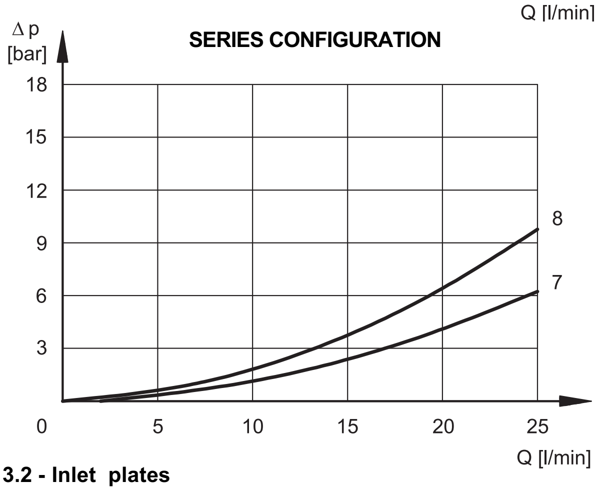
3.1 - Body modules pressure drops Δp-Q



ENERGIZED VALVE

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
S1, SA1, SB1	2	2	1	1
S3, SA3, SB3	2	2	1	1
C3	5	5	3	3
TA, TB	4	4	1	1
TA02, TB02	4	4	1	1
TA23, TB23	4	4		
RK	2	2	1	1
S4, SA4, SB4	8	8	8	8

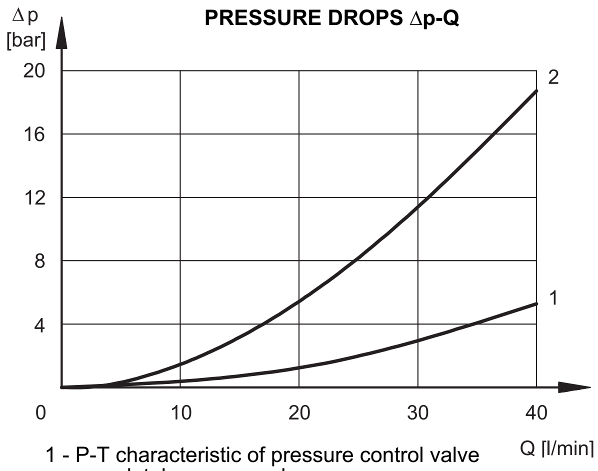
NOTE: The curve 6 shows the pressure drops in path P or T.



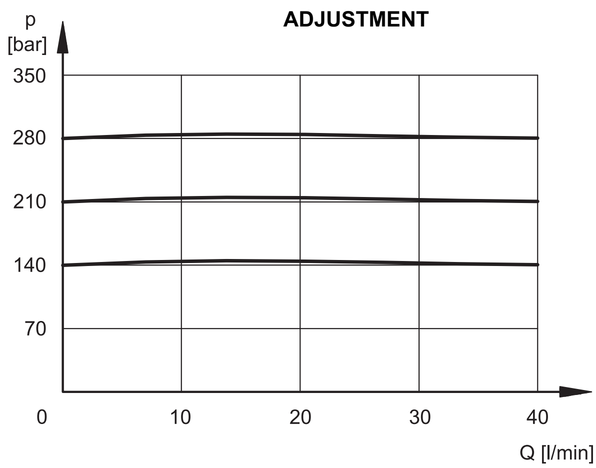
DE-ENERGIZED VALVE (central position)

SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPHS				
S3, SA3, SB3			2	2	
S4, SA4, SB4					7

3.2 - Inlet plates



1 - P-T characteristic of pressure control valve completely unscrewed
2 - P-T characteristic of the unloading valve



4 - SWITCHING TIMES

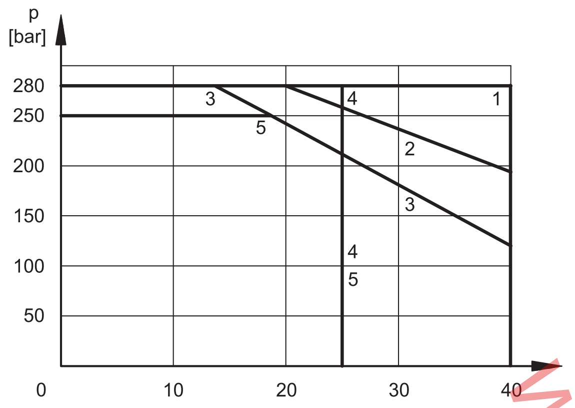
Values obtained according to ISO 6403, with mineral oil with viscosity 36 cSt at 50°C.

TIMES	ENERGIZING	DE-ENERGIZING
ms (±10%)	25 ÷ 75	15 ÷ 25

5 - OPERATING LIMITS OF MODULES

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



SPOOL TYPE	P-A CURVE	P-B CURVE
S1, SA1, SB1	1	1
S3, SA3, SB3	3	3
S4, SA4, SB4	5	5
TA, TB	2	2
TA02, TB02	2	2
TA23, TB23	2	2
RK	4	4
C3	3	3

6 - ELECTRICAL FEATURES

6.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation. The coil is fastened to the tube by a threaded ring, and can be rotated to suit the available space. The interchangeability of coils of different voltages is allowed within the same type of supply current, rectified or direct.

Protection from atmospheric agents IEC 60529

Connector	IP 65	IP 67	IP 69 K
K1 DIN 43650	x		
K2 AMP JUNIOR	x	x	
K4 outgoing cables	x	x	
K7 DEUTSCH DT04 male	x	x	x
K8 AMP SUPER SEAL	x	x	x

NOTE: The protection degree is guaranteed only with the connector correctly wired and installed.

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95/EC
CLASS OF PROTECTION : Coil insulation (VDE 0580) Impregnation:	 class H class H

6.2 - Current and absorbed power

In the table are shown current and power consumption values relevant to the different coil types. “R” coil must be used when the valve is fed with AC power supply subsequently rectified by means of rectifier bridge, externally or incorporated in the “D” type connector (see cat. 49 000).

DC Coils (values ±5 %)

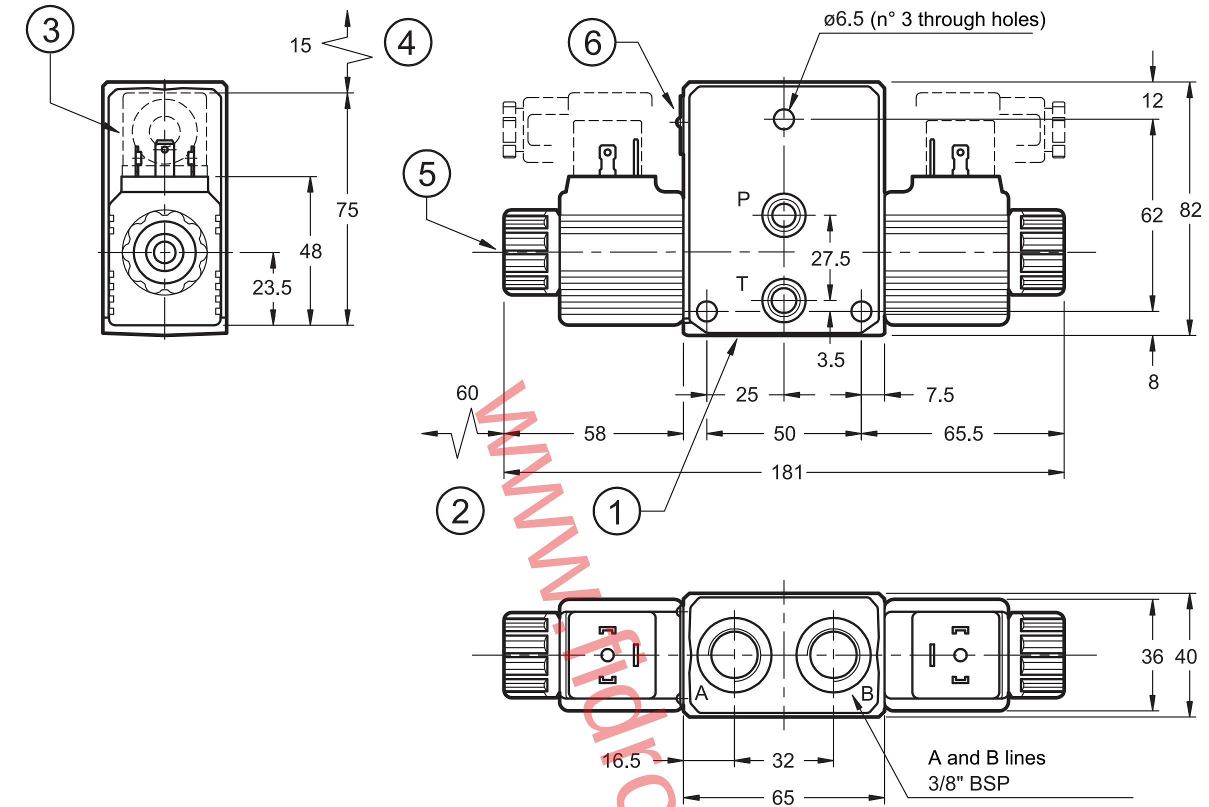
	Resistance 20°C [Ω]	Absorbed current [A]	Absorbed power [W]	Absorbed power [VA]	Coil code K1	Coil code K2	Coil code K4	Coil code K7	Coil code K8
D12	5,4	2,2	26,5		1902740	1902750	1902770	1902980	1903020
D24	20,7	1,16	27,8		1902741	1902751	1902771	1902981	1903021
D28	27,5	1,02	28,5		1902744				
R110	363	0,25		27,2	1902742				
R230	1640	0,11		26,4	1902743				

7 - OVERALL AND MOUNTING DIMENSIONS

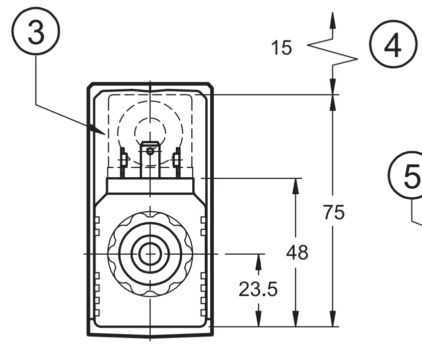
7.1 - Module

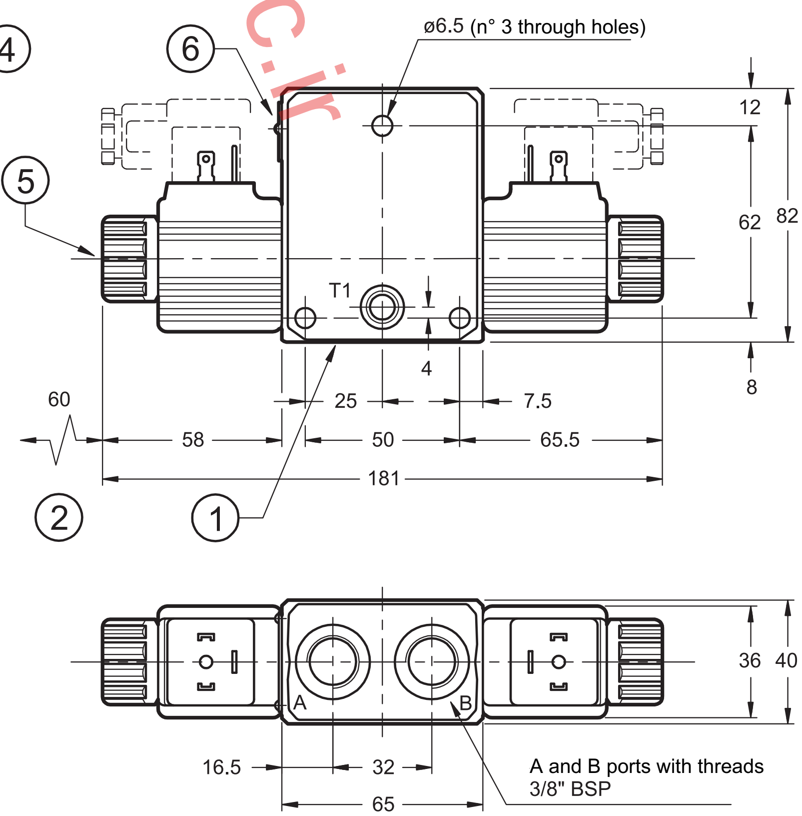
PARALLEL CONFIGURATION **BD6P**

dimensions in mm



SERIES CONFIGURATION **BD6S**





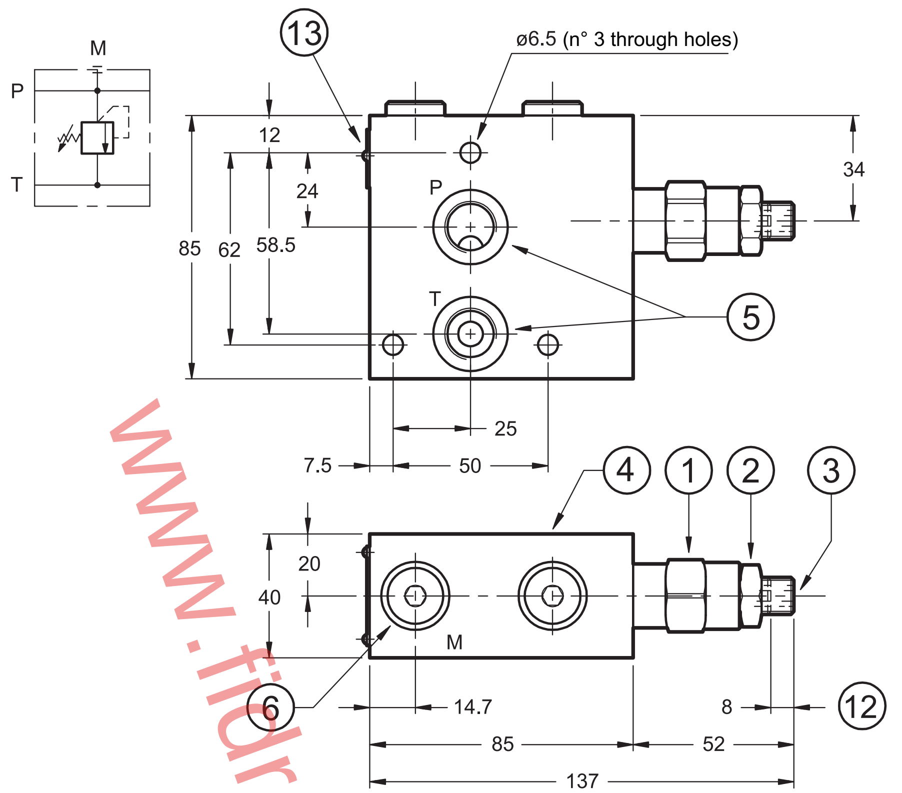
1	Mounting surface with sealing rings: **BD6P** n. 2 OR type 2043 (10.82x1.78) **BD6S** n. 1 OR type 2043 (10.82x1.78)
2	Coil removal space
3	Electrical connector type DIN 43650 (drawing with standard type K1 - for other connections see par. 9)
4	Connector removal space
5	Locking ring with embedded boot protected manual override
6	Label

7.2 - Inlet plates for parallel configuration

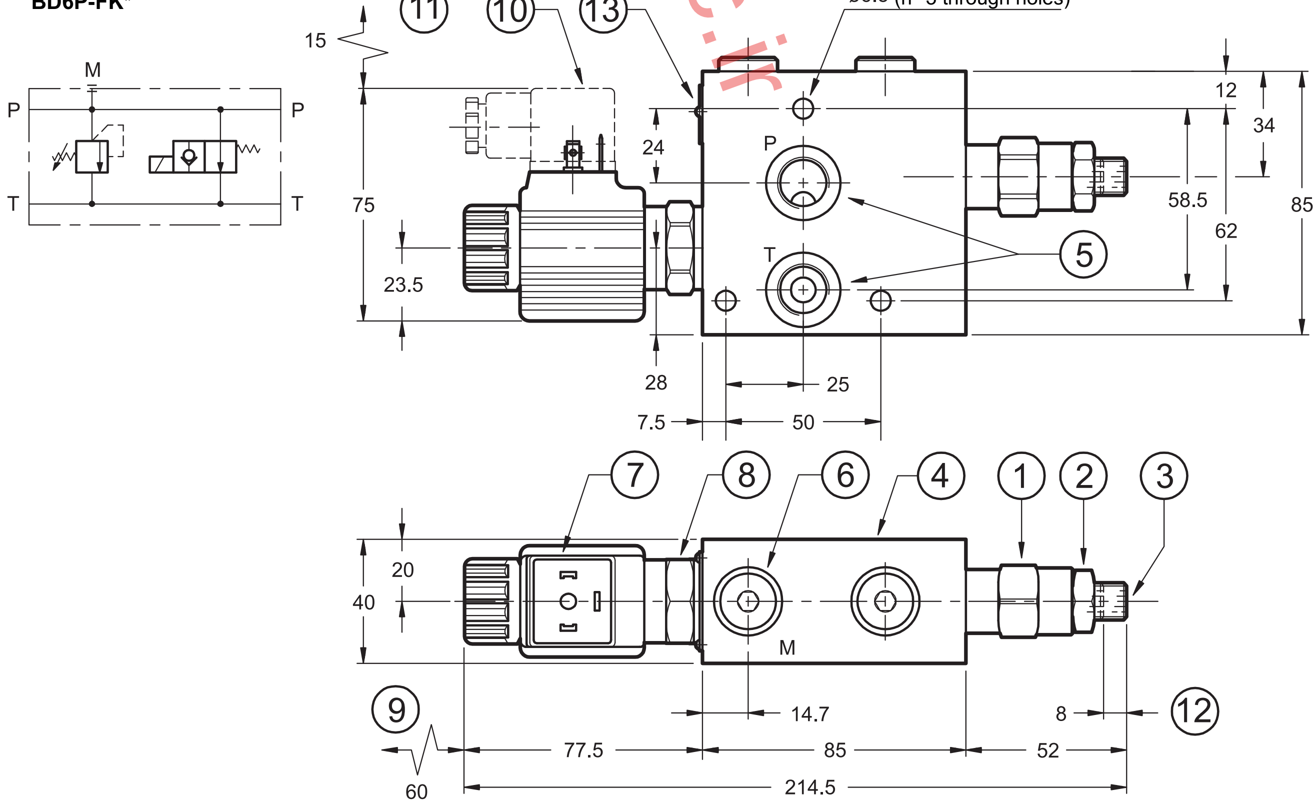
1	Pressure control valve
2	Locking nut: spanner 19
3	Socket hex adjustment screw: Allen key 6 Clockwise rotation to increase pressure
4	Mounting surface without sealing rings: OR on the body module.
5	P and T: 3/8” BSP
6	Pressure gauge port: 1/4” BSP
7	Poppet-type solenoid valve for unloading
8	Hexagonal: spanner 27 tightening torque 50 Nm
9	Coil removal space
10	Electrical connector type DIN 43650 (drawing with standard type K1 - for other connections see paragraph 9)
11	Connector removal space
12	Maximum screw stroke
13	Label

BD6P-F*

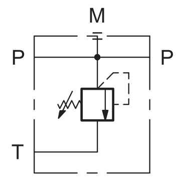
dimensions in mm



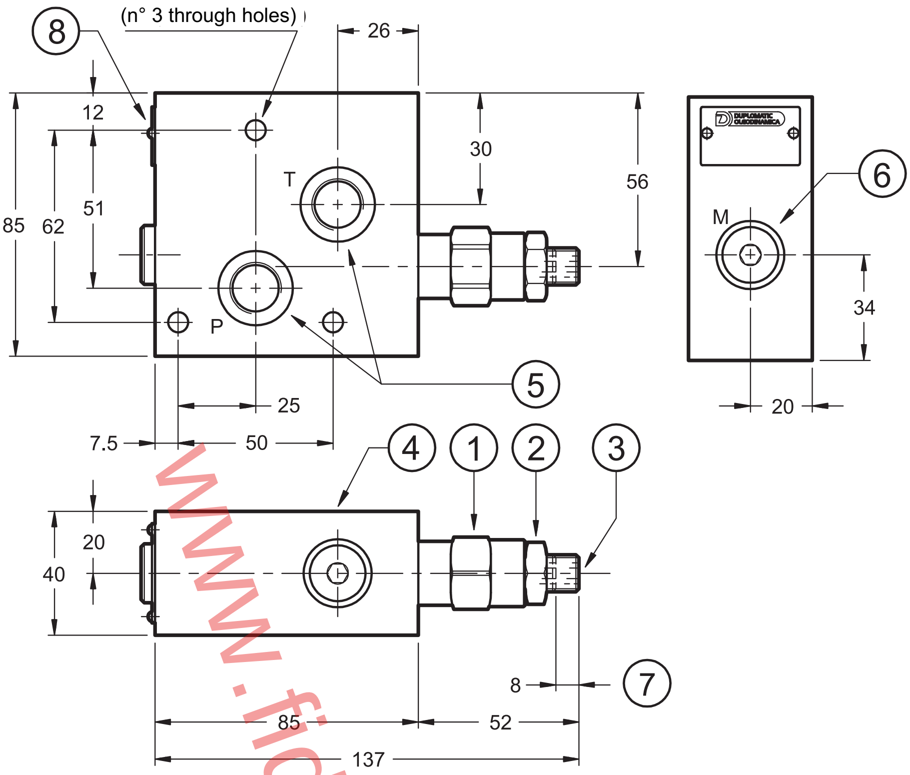
BD6P-FK*



7.3 - Inlet plate BD6S-F* for series configuration



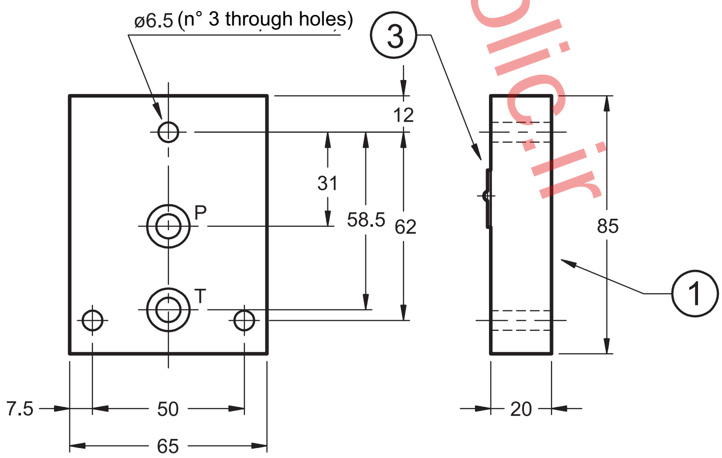
1	Pressure control valve
2	Locking nut: spanner 19
3	Socket hex adjustment screw: Allen key 6 (**standard**) Clockwise rotation to increase pressure
4	Mounting surface without sealing rings: OR on the body module.
5	P and T: 3/8” BSP
6	Pressure gauge port: 1/4” BSP
7	Maximum screw stroke
8	Label



7.4 - End plates

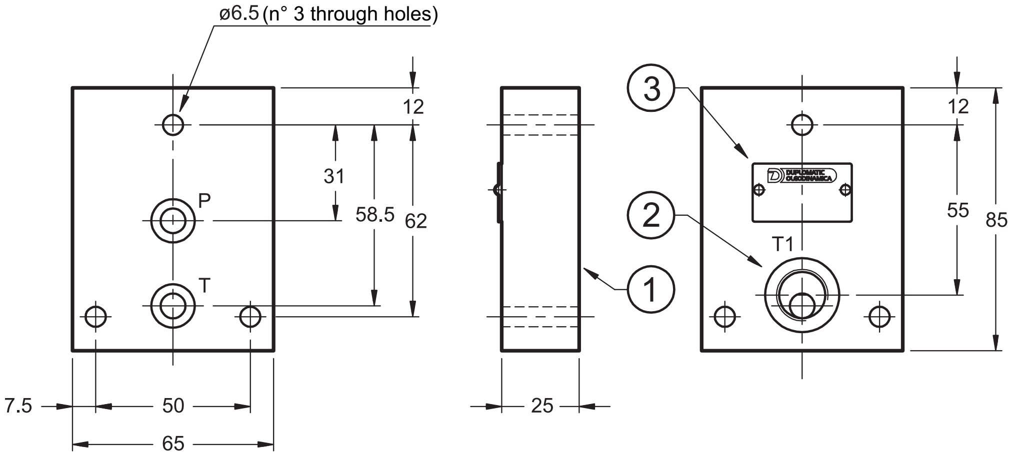
dimensions in mm

PARALLEL CONFIGURATION BD6P-R



1	Mounting surface with sealing rings: N. 2 OR type 2043 (10.82x1.78) 90 Shore
2	T1 outlet: 3/8” BSP
3	Label

SERIES CONFIGURATION BD6S-R1

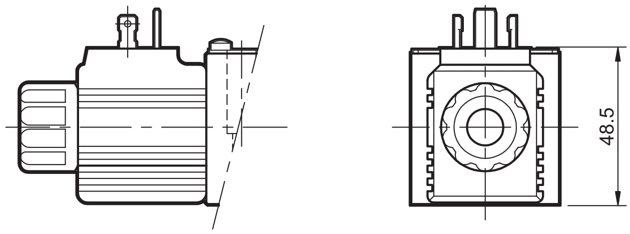


8 - INSTALLATION

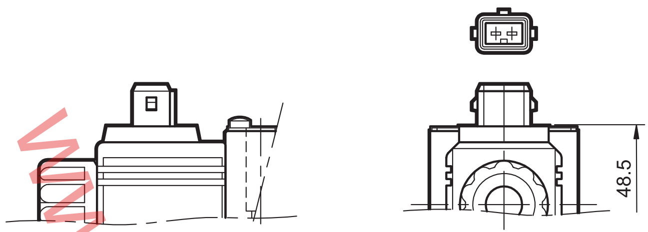
Configurations with centering and return springs can be mounted in any position.

9 - ELECTRIC CONNECTIONS

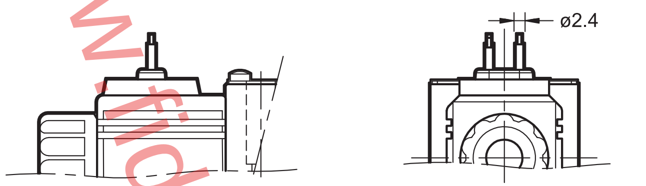
connection for DIN 43650 connector
code **K1** **(standard)**



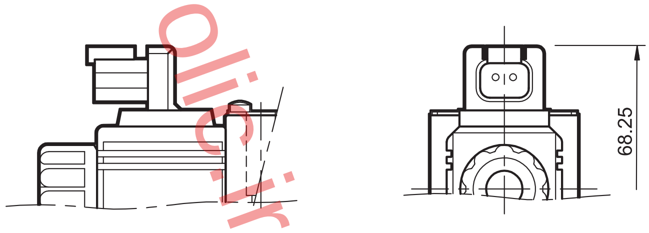
connection for AMP JUNIOR connector
code **K2**



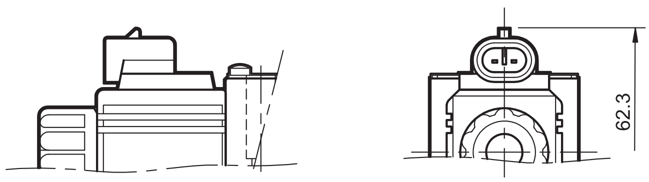
outgoing cable connections (length 100 cm)
code **K4**



DEUTSCH DT04-2P connection for DEUTSCH DT06-2S male connector
code **K7**



connection for AMP SUPER SEAL (two contacts) connector type
code **K8**



10 - ELECTRIC CONNECTORS

The solenoid valves are supplied without connectors. Connectors for standard electrical connection K1 (DIN 43650) can be ordered separately. See catalogue 49 000.

11 - ASSEMBLED VALVE - PARALLEL CONFIGURATION

11.1 - Identification code

BD6	-	P		-			/			/	R	/	20		-		

Bankable directional control valve

Parallel configuration

No. of body modules

Inlet module
F = with pressure control valve
FK = with pressure control valve and unloading valve

Pressure adjustment range:
140 = up to 140 bar
210 = up to 210 bar
280 = up to 280 bar

Spool type:
Enter the spool type.
See the available spools at paragraph 1.3
Repeat for each module.

Blind end plate

Series no.: (the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Coil type
D12 = 12 V } direct current
D24 = 24 V } (**standard**)
R110 = 110 V } rectified current
R230 = 230 V }
D00 = Valve supplied without coils (see par. 1.1 for available coils). Locking rings are supplied together with valves.

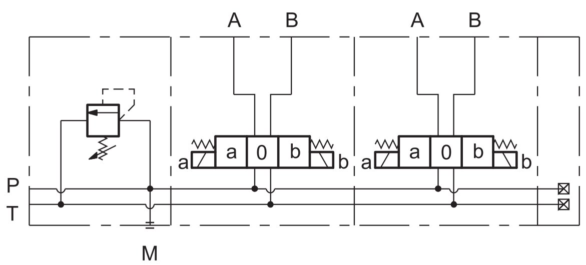
Coil electrical connection:
(see paragraph 9)
K1 = plug for connector type DIN 43650 (standard)
K2 = plug for connector type AMP JUNIOR
K4 = outgoing cables
K7 = plug for connector type DEUTSCH DT04-2P male
K8 = plug for connector type AMP SUPER SEAL

Coding example:

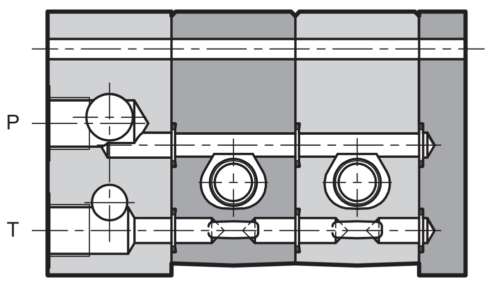
BD6-P4-F140/S1-S1-S1-S1/R/20N-D24K1: assembled valve includes: inlet module with pressure control valve with adjustment up to 140 bar; 4 body modules S1; blind end plate; NBR seals, 24V DC coils and K1 connection**.**

BD6-P3-FK280/S1-C3-S1/R/20N-D24K1: assembled valve includes: inlet module with pressure control valve with adjustment up to 280 bar and unloading valve; 1st body module with spool S1, 2nd body module with spool C3 and 3th body module with spool S1; blind end plate; NBR seals, 24V DC coils and K1 connection.

11.2 - Hydraulic symbols and connection scheme



PARALLEL CONNECTION



12 - ASSEMBLED VALVE - SERIES CONFIGURATION

12.1 - Identification code

BD6	-	S		-	F		/			/	R1	/	20		-		

Bankable directional control valve

Series configuration

No. of body modules

Inlet module with pressure relief control valve

Pressure adjustment range:
140 = up to 140 bar
210 = up to 210 bar (**NOTE**)

Spool type:
Enter the spool type.
See the available spools at paragraph 1.4
Repeat for each module.

Outlet plate with T1 port 3/8” BSP threaded

Series no.: (the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

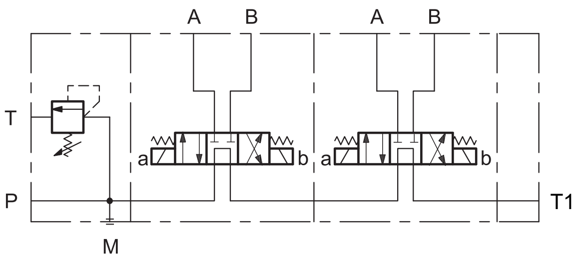
Coil type
D12 = 12 V
D24 = 24 V
D28 = 28 V
direct current
R110 = 110 V
R230 = 230 V
rectified current
D00 = valve supplied without coils. Locking rings are supplied together with valves.

Coil electrical connection:
(see paragraph 9)
K1 = plug for connector type DIN 43650
K2 = plug for connector type AMP JUNIOR
K4 = outgoing cables
K7 = plug for connector type DEUTSCH DT04-2P male
K8 = plug for connector type AMP SUPER SEAL

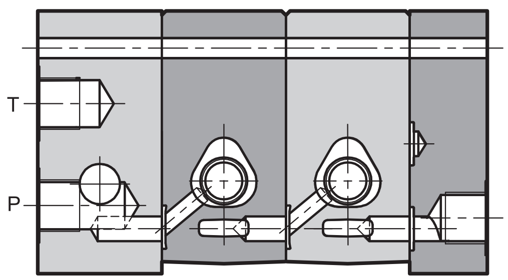
NOTE: Screwing completely the pressure control valve, the reachable max operating pressure is 240 bar with Q ≥ 5 l/min

Coding example:
BD6-S3-F140/S4-SB4-SA4/R1/20N-D24K1: assembled valve includes: inlet module with pressure control relief valve, with adjustment up to 140 bar, 1st body module with spool S4, 2nd body module with spool SB4 and 3th body module with spool SA4; outlet plate; NBR seals, 24V DC coils and K1 connection.

12.2 - Hydraulic symbols and connection scheme

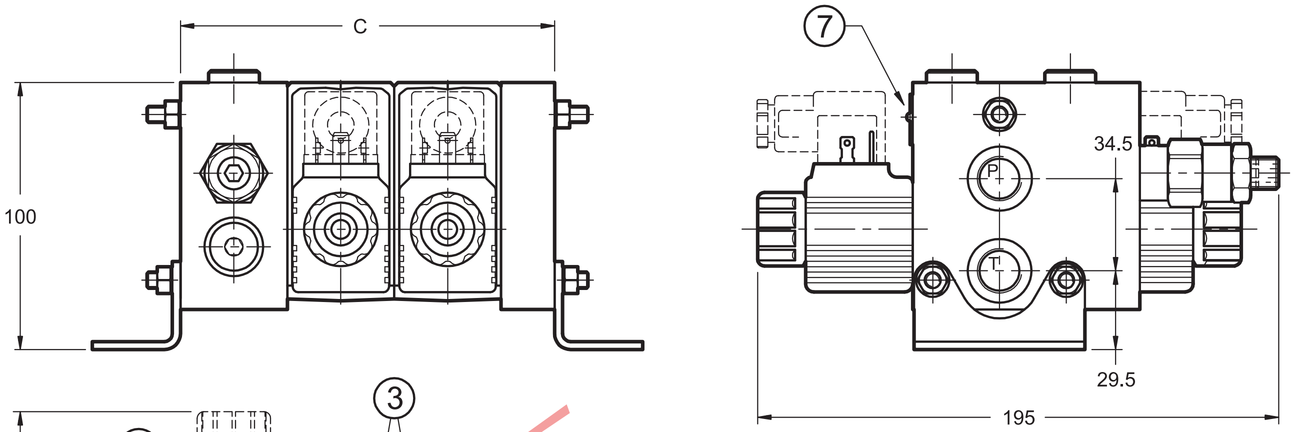


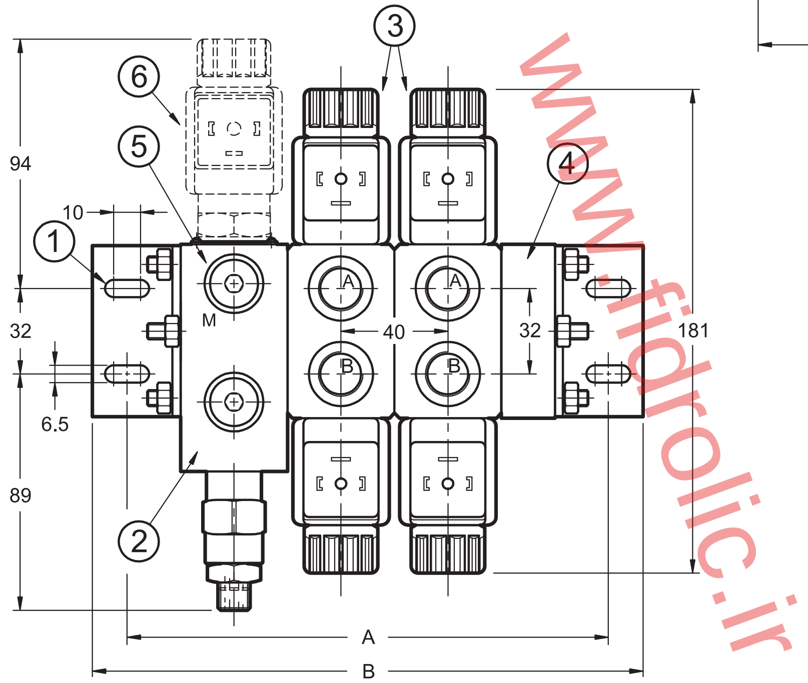
SERIES CONNECTION



13 - OVERALL DIMENSION OF THE ASSEMBLED VALVE IN PARALLEL CONFIGURATION

dimensions in mm



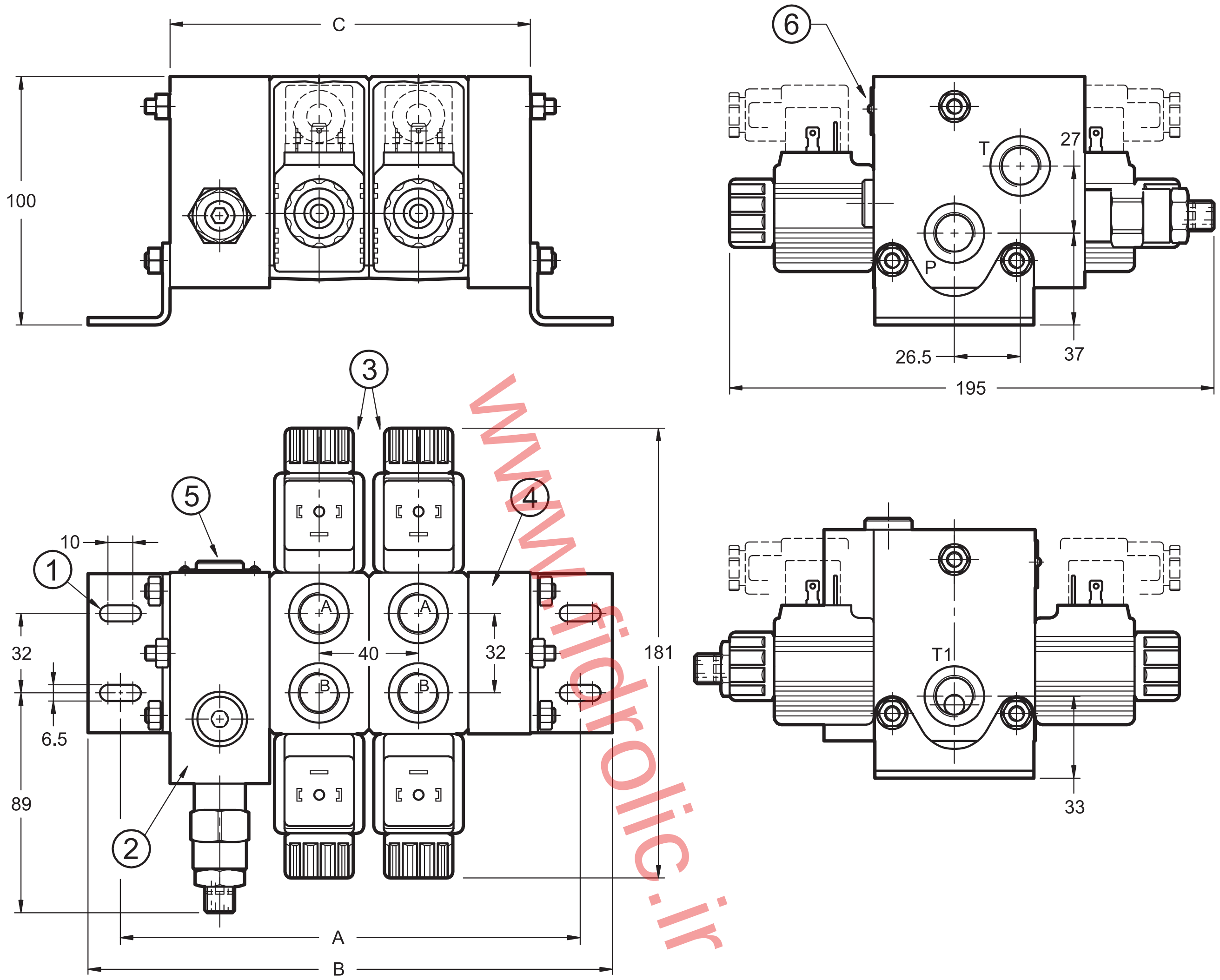


modules	A	B	C
2	180	206	140
3	220	246	180
4	260	286	220
5	300	326	260
6	340	366	300

1	Fixing foot
2	Inlet plate
3	Valve bodies
4	End plate
5	Pressure gauge port: 1/4” BSP
6	Poppet-type solenoid valve for unloading (FK version)
7	Identification label

14 - OVERALL DIMENSION OF THE ASSEMBLED VALVE IN SERIES CONFIGURATION

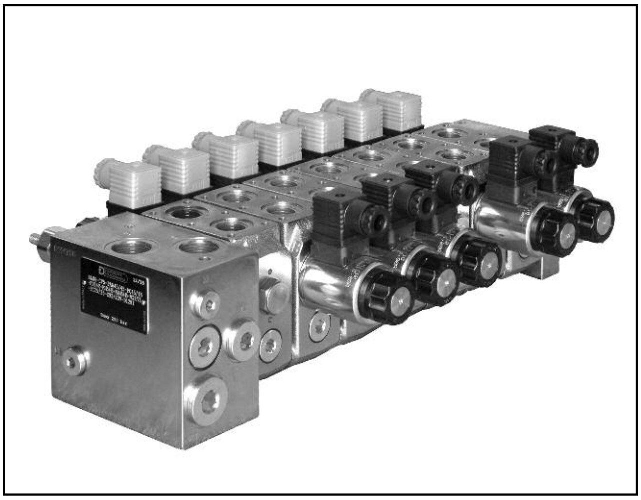
dimensions in mm



modules	A	B	C
2	185	211	145
3	225	241	185
4	265	281	225
5	305	321	265
6	345	361	305

1	Fixing foot
2	Inlet plate
3	Valve bodies
4	Outlet plate
5	Pressure gauge port: 1/4" BSP
6	Identification label

DUPLOMATIC OLEODINAMICA
DUPLOMATIC OLEODINAMICA S.p.A.
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com



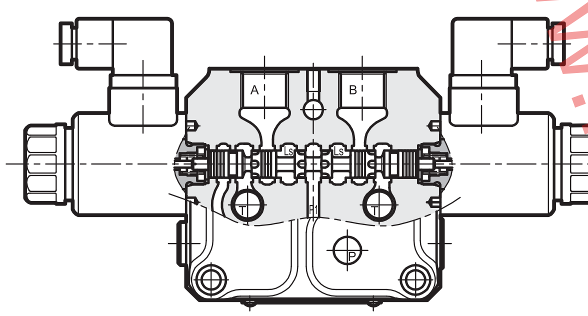
BLS6

BANKABLE LOAD SENSING PROPORTIONAL CONTROL VALVE

SERIES 12

p max **300** bar
Q max **120** l/min

OPERATING PRINCIPLE



— The BLS6 directional control valve is stackable and can be assembled up to 8 different proportional and on/off modules .

— Each module is equipped with a meter-in compensator that keep costant the flow, independently from load changes.

— Sections with pressure compensators are not influenced in any way by other operated functions, provided that sufficient pump capacity is available. To correctly work, the sum of the flows contemporarily used must not overcome the 90% of the inlet flow.

— Working ports A and B are threaded 1/2” BSP. On the inlet module the ports P1, P2 and T1 are threaded 3/4” BSP.

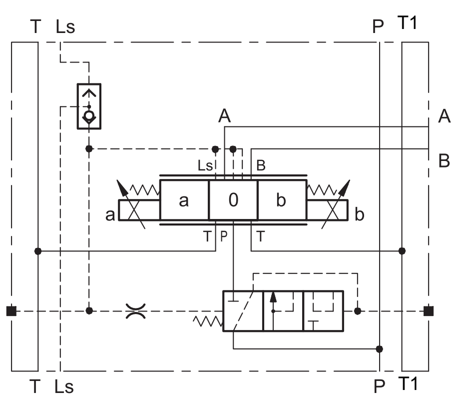
— The manual lever override is available as option.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Maximum operating pressure: - A and B ports - P1 and P2 ports - T1 port	bar	300 250 20
Maximum flowrate: - A and B ports - P1 and P2 ports - T1 port	l/min	45 100 120
Electrical characteristics	see paragraph 4	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Single body mass	kg	4,5
Surface treatment of body and plates	galvanic, zinc-nickel	

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODES FOR LOOSE MODULES

Here below are shown the identification codes of all the loose components of the bankable valve. To order a whole assembled valve, please use the codes at paragraphs 9 and 10.

The inlet section is available in different versions for fixed pumps and for systems with Load Sensing pump.

1.1 - Proportional module

BLS	6	-				/	12	V	-			/	

Compensated direct operated directional valve with proportional control

Size

Spool type:
PC = closed centers
PA = open centers

Solenoid position:
(omit for configuration with two solenoids)
A = 1 solenoid on side A
B = 1 solenoid on side B

Spool nominal flow (see below)

Series no. (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
V = FPM seals (**standard**)

Coil type:
D12 = Nominal solenoid voltage 12V DC
D24 = Nominal solenoid voltage 24V DC

Coil electrical connection:
(see paragraph)
K1 = plug for connector type DIN 43650 (**standard**)
K7 = plug for connector type DEUTSCH DT04-2P male

Manual override
(see par. 11)

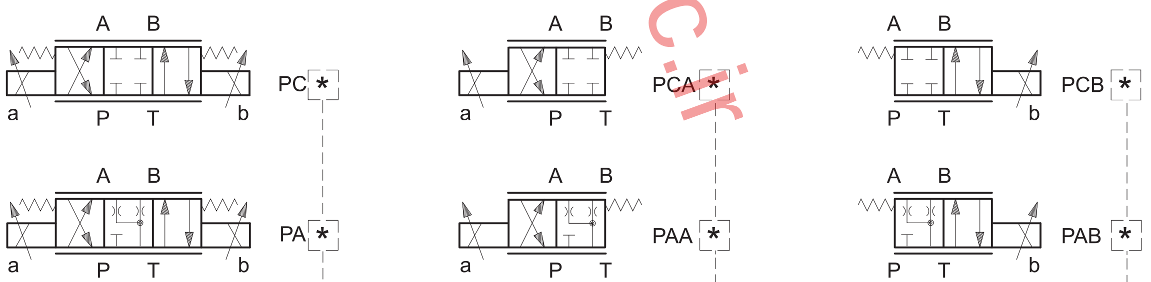
SPOOLS

Valve configuration depends on the combination of the following elements: number of proportional solenoids, spool type, nominal flow rate.

2 solenoids configuration:
3 positions with spring centering

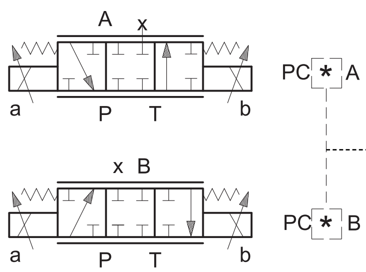
1 solenoid on side A.
2 positions (central + external) with spring centering

1 solenoid on side B.
2 positions (central + external) with spring centering



SYMMETRICAL	
max flow	Δp
05/05	4
09/09	8
15/15	4
25/25	8
30/30	4
45/45	8

ASYMMETRICAL	
max flow	Δp
09/06	8
15/10	4
25/15	8
30/20	4
45/30	8



SINGLE FLOW	
max flow	Δp
30	4
45	8

1.2 - On-off modules

Proportional and on-off modules can be used together. In this case, the description for the spool type in the identification code has to be as follow:

SC = closed center with on-off solenoid
SA = open center with on-off solenoid

Two spools for high flow rates are available: SC60/60 and SA60/60.

1.3 - Inlet plates

The inlet section is available in different versions, for fixed and for variable pumps with load sensing. The version for fixed pump can be easily converted to work with variable pumps and vice versa.

BLS	6	-			/	12	V

Compensated direct operated directional valve with proportional control

Nominal size

C0 = without compensator (**NOTE**)
CF = for fixed pump
CV = for variable pump

Pressure adjustment range:
0 = no relief valve
5 = from 12 to 210 bar
6 = from 15 to 315 bar

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
V = FPM seals (**standard**)

NOTE: On the version C0 the is no pressure relief valve: code BLS6-C00/12V.

1.4 - End plates

BLS	6	-		/	12

Compensated direct operated directional valve with proportional control

Nominal size

C91 = without load sensing port
C92 = with load sensing port

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4 or fluids HFDR type. For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

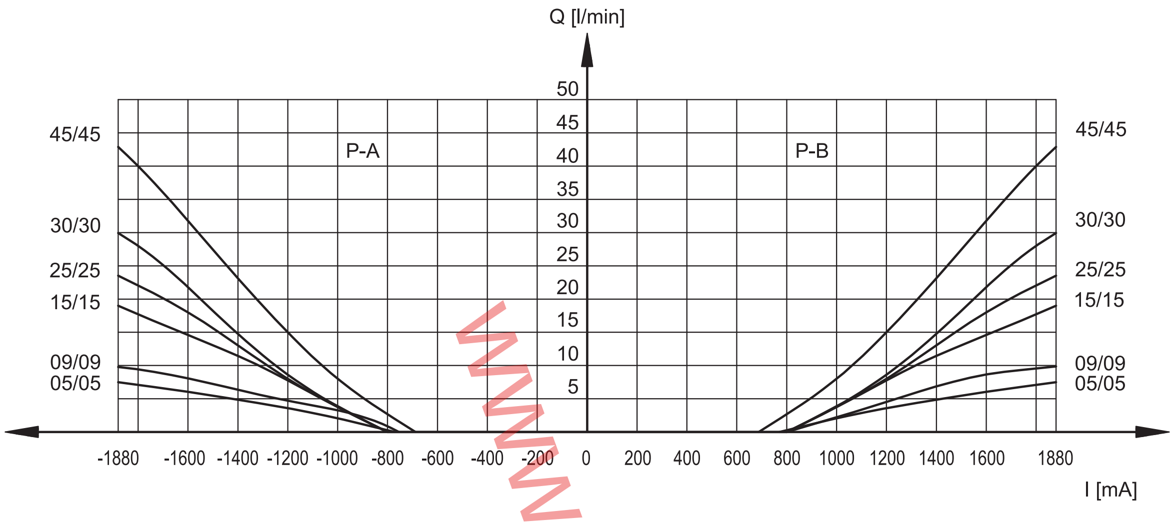
The fluid must be preserved in its physical and chemical characteristics.

3 - CHARACTERISTIC CURVES

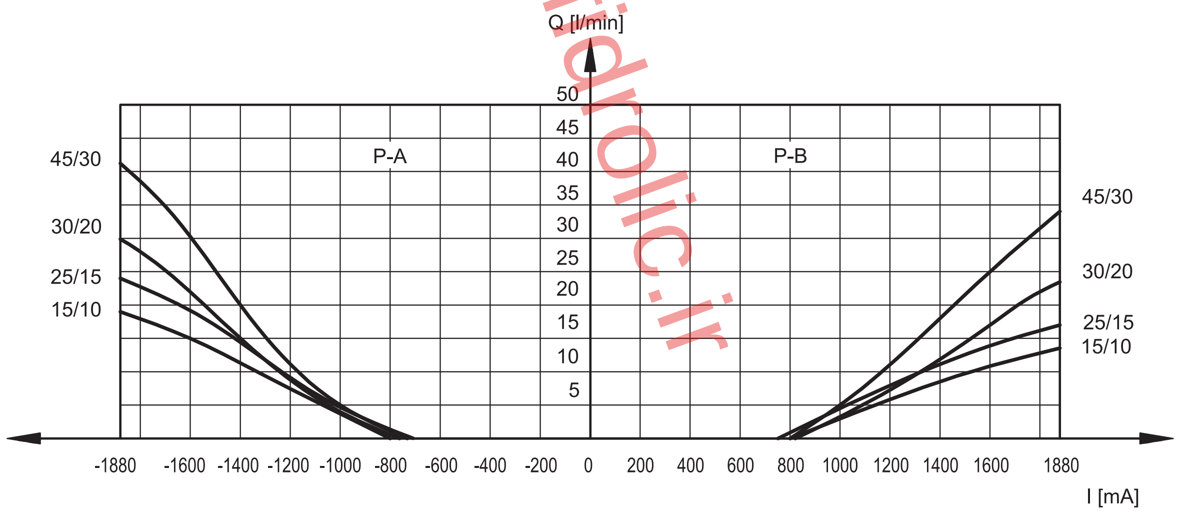
(values obtained with viscosity 36 cSt at 50 °C)

Typical constant flow rate obtained through the embedded compensator, and current with 12V solenoid type (for D24 version the maximum current is 860 mA), measured for the various spool types available.

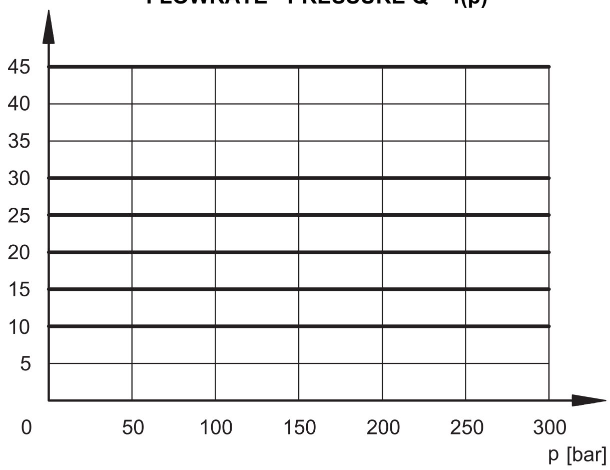
PROPORTIONAL MODULES PRESSURE DROPS Δp-Q
SYMMETRICAL FLOWS - PC AND PA SPOOLS



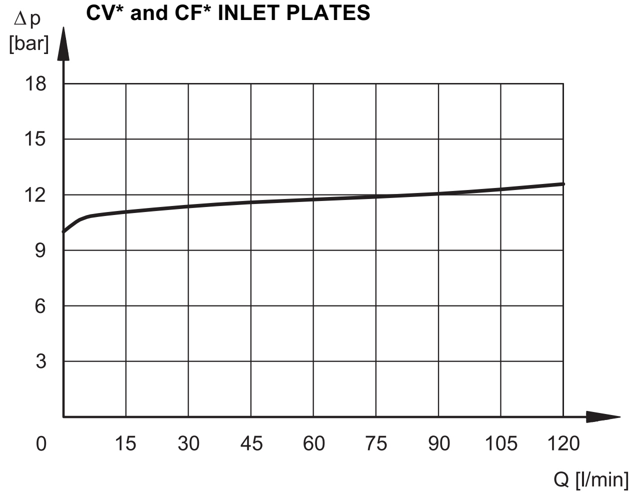
ASYMMETRICAL FLOWS - PC and PA SPOOLS



FLOWRATE - PRESSURE Q = f(p)



PRESSURE DROPS Δp = f(Q) for CV* and CF* INLET PLATES



4 - ELECTRICAL CHARACTERISTICS

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut.

It can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	**12**	**24**
RESISTANCE (at 20°C) **K1 coil** / **K7 coil**	Ω	3.66 4	17.6 19
NOMINAL CURRENT	A	1.88	0.86
DUTY CYCLE		100%	
PWM FREQUENCY	Hz	200	100
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/EC		
CLASS OF PROTECTION : Coil insulation (VDE 0580) Impregnation:	 class H class F		

Protection from atmospheric agents IEC EN 60529

Plug-in type	IP 65	IP 69 K
K1 DIN 43650	x (*)	
K7 DEUTSCH DT04 male	x	x (*)

(*) The protection degree is guaranteed only with the connector correctly connected and installed

5 - STEP RESPONSE

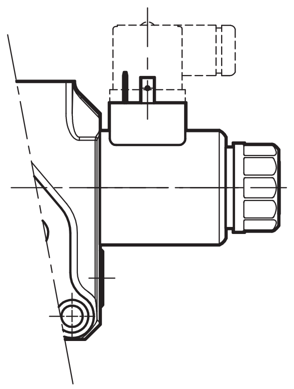
(measured with mineral oil with viscosity of 36 cSt at 50°C with electronic control units)

Step response is the time (delay) taken for the valve to reach 90% of the set position value following a step change of the reference signal.

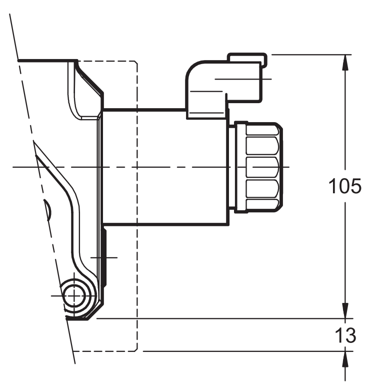
Reference signal step	0 →100%	100 →0%
STEP RESPONSE [ms]		
BLS6	50	40

6 - ELECTRIC CONNECTIONS

connection for DIN 43650 connector
code **K1** (**standard**)



connection for DEUTSCH DT04-2P connector type
code **K7**



7 - ELECTRIC CONNECTORS

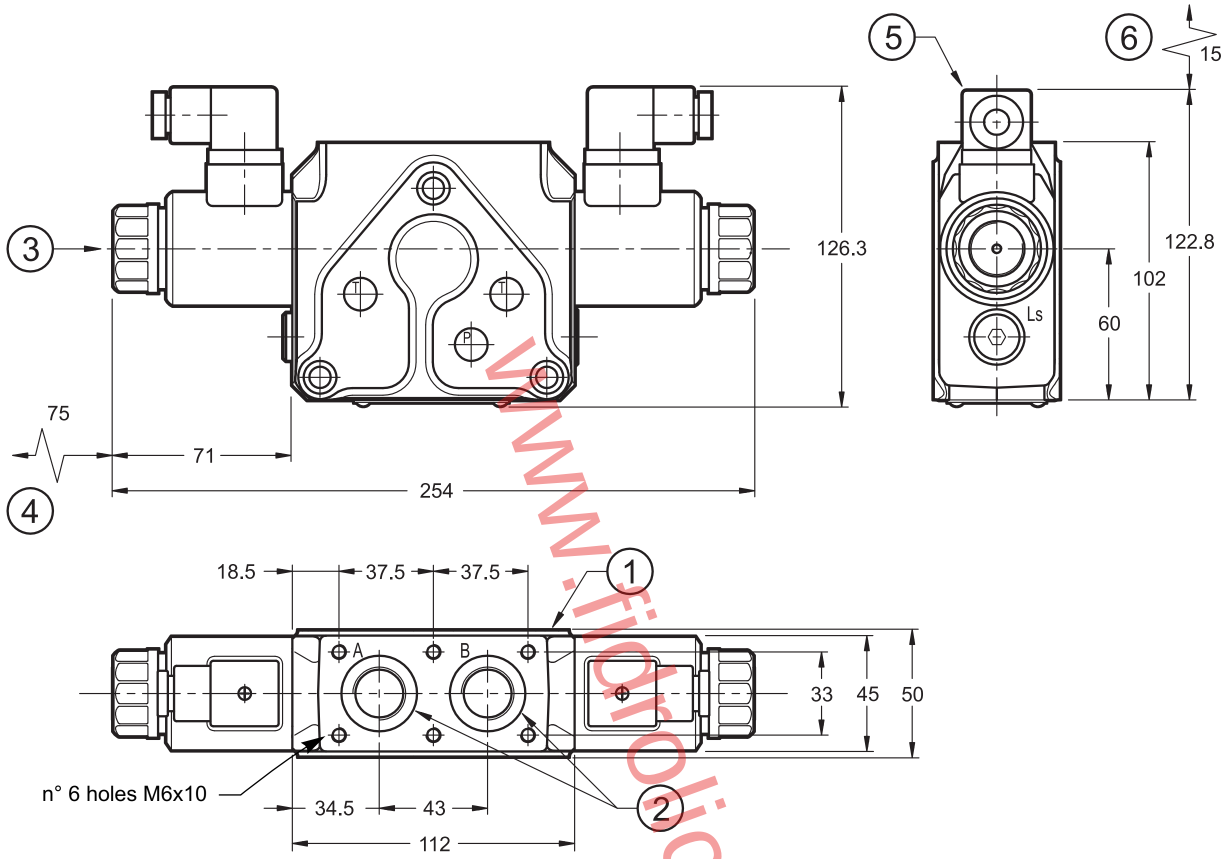
The on-off modules are supplied without connectors. For on-off coils with standard electrical connection K1 type (DIN 43650) the connectors can be ordered separately: see catalogue 49 000.

8 - OVERALL AND MOUNTING DIMENSIONS

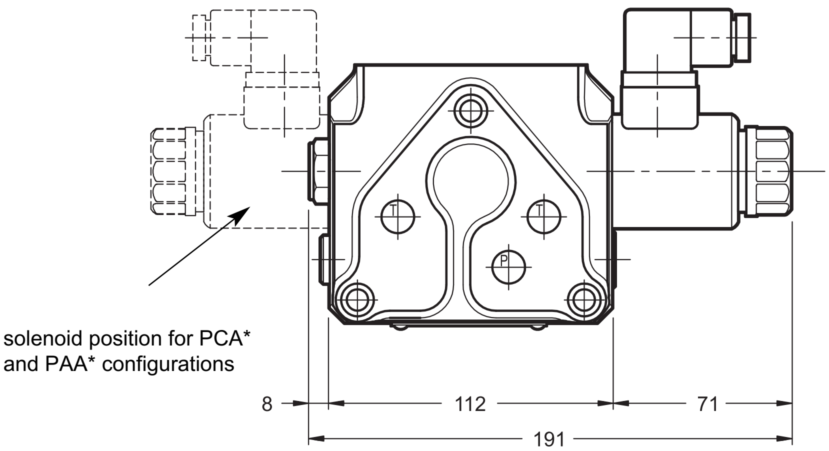
8.1 - Proportional module

dimensions in mm

2 SOLENOIDS **BLS6-PC***
BLS6-PA*



1 SOLENOID **BLS6-PCB***
BLS6-PAB*

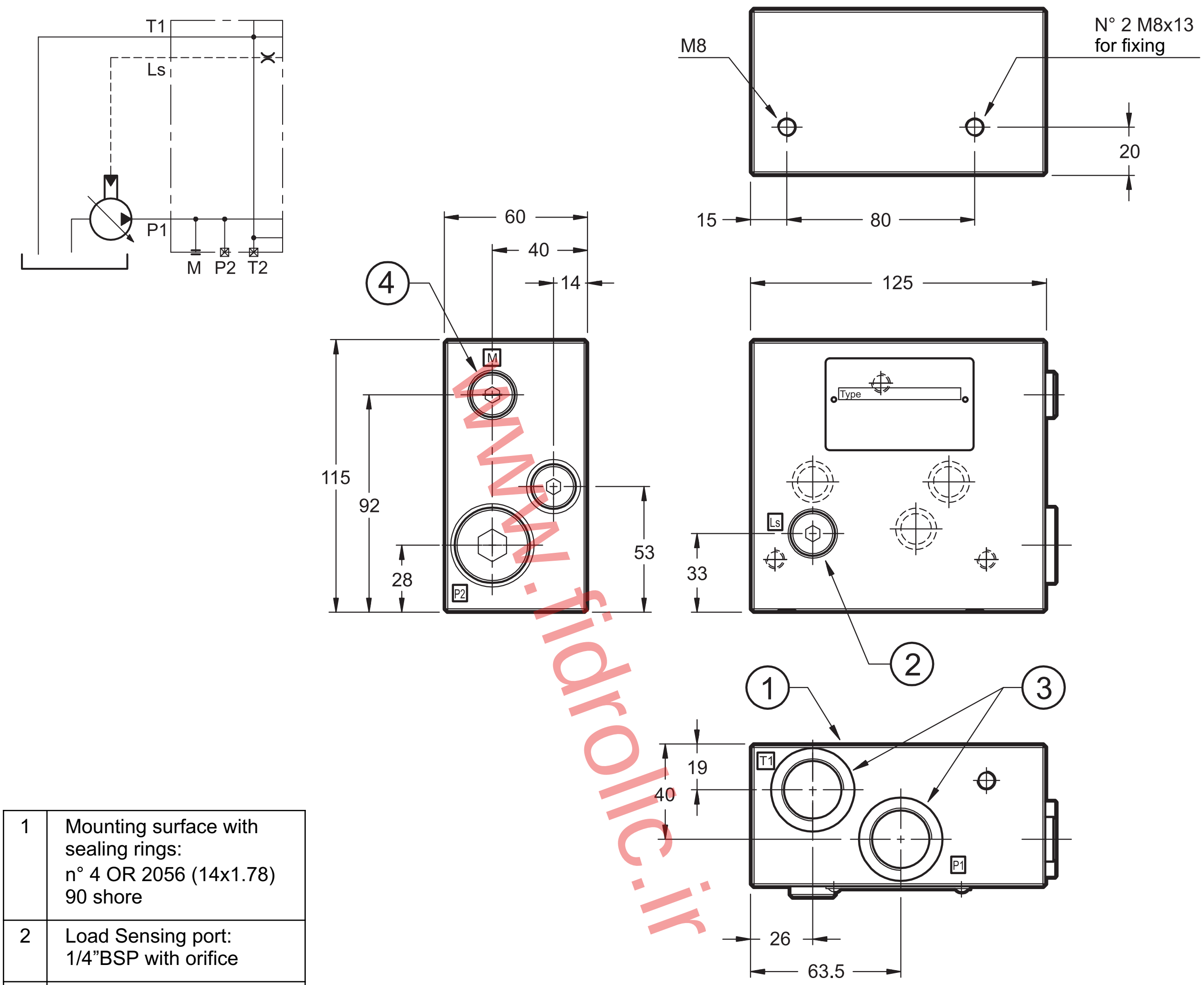


1	Mounting surface with sealing rings: n° 4 OR 2056 (14x1.78) 90 shore
2	A and B ports: 1/2” BSP
3	Locking ring with standard manual override
4	Coil removal space
5	Electrical connector type DIN 43650 (drawing with standard type K1 - for other connections see par. 6)
6	Connector removal space

8.2 - Inlet plates

dimensions in mm

BLS6-C00

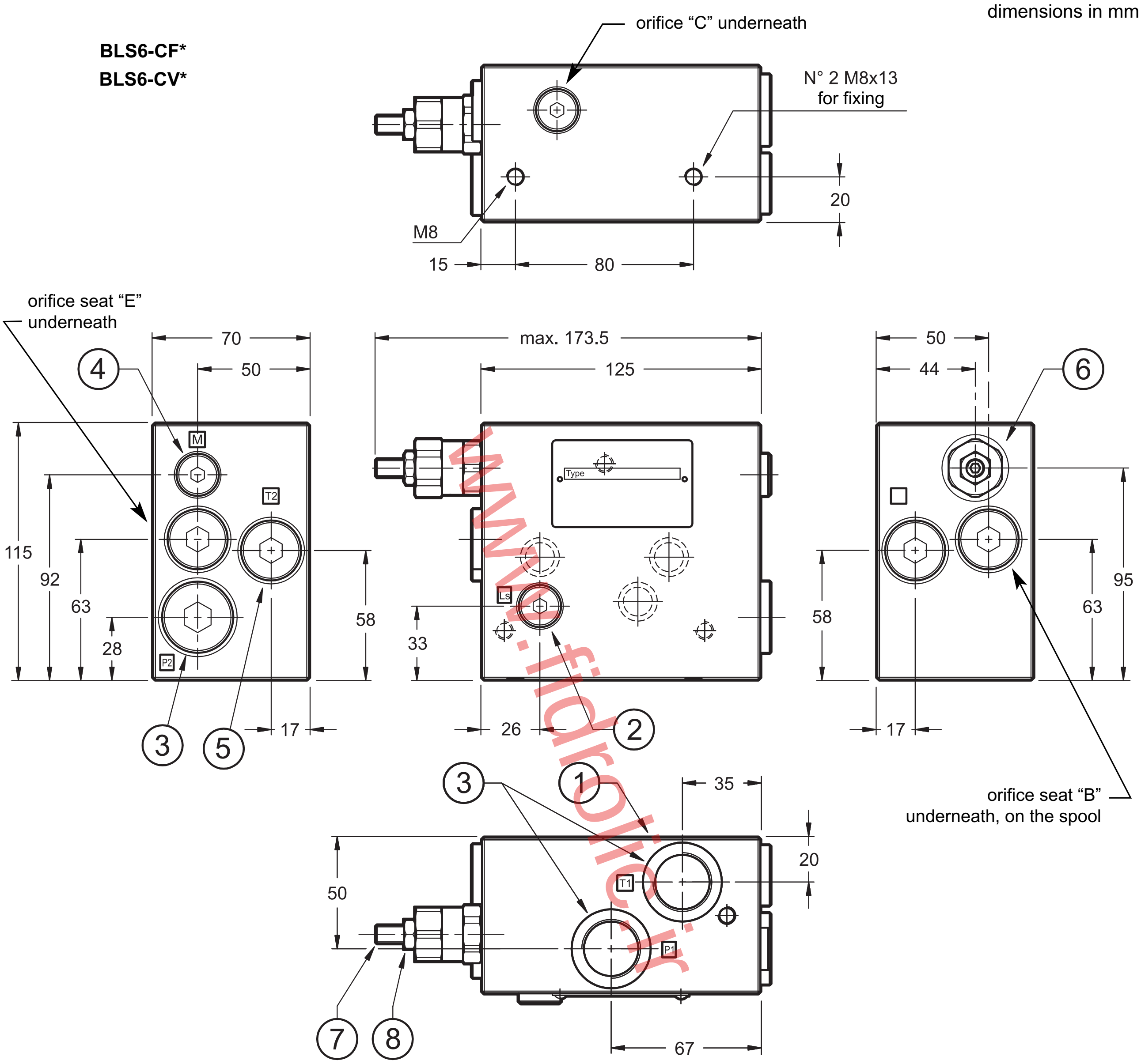


1	Mounting surface with sealing rings: n° 4 OR 2056 (14x1.78) 90 shore
2	Load Sensing port: 1/4"BSP with orifice
3	P1, P2 and T1 ports: 3/4" BSP
4	Pressure gauge port: 1/4" BSP

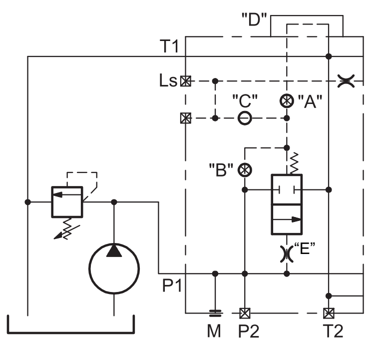
8.2 - Inlet plates

dimensions in mm

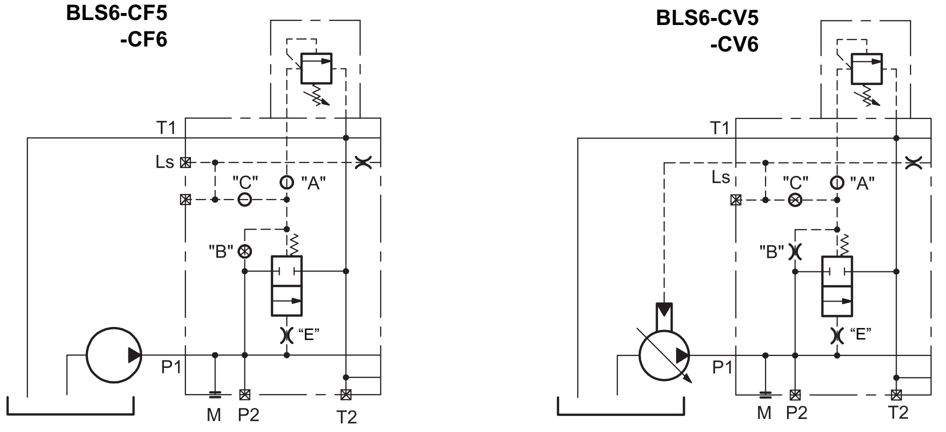
BLS6-CF*
BLS6-CV*



BLS6-CF0

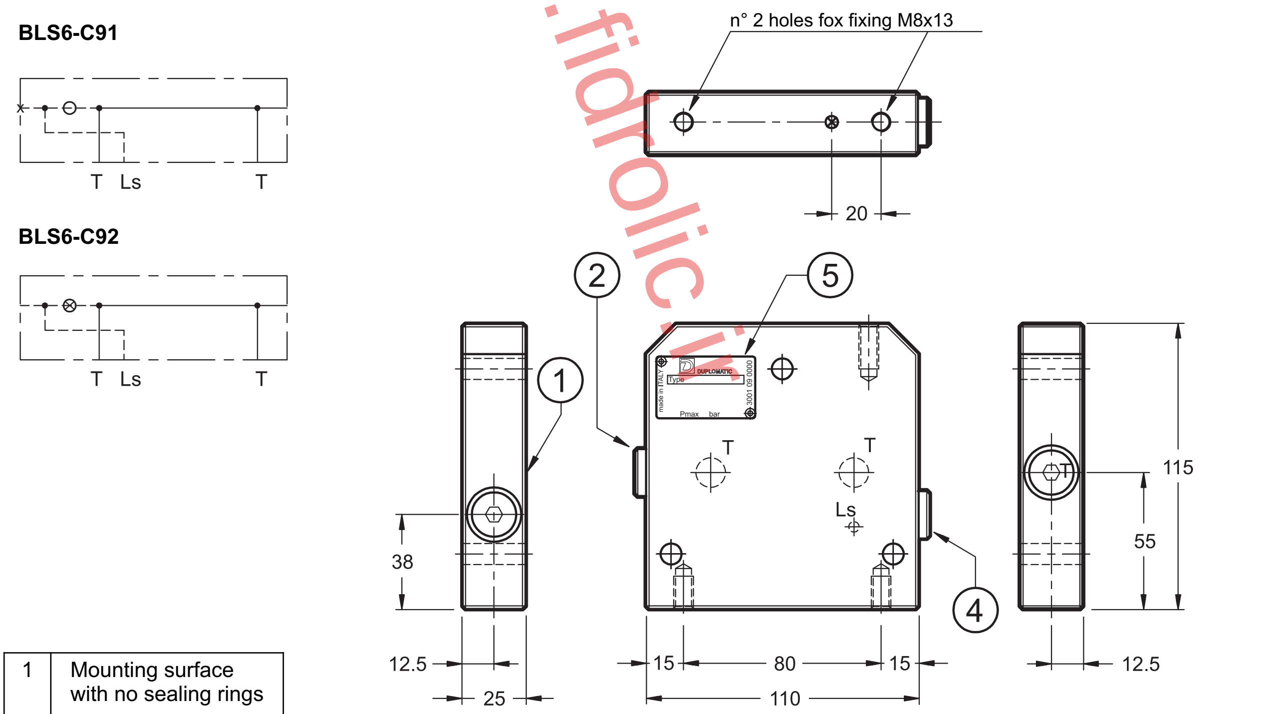


1	Mounting surface with sealing rings: n° 4 OR 2056 (14x1.78) 90 shore
2	Load Sensing port: 1/4" BSP
3	P1, P2 and T1 ports: 3/4" BSP
4	Pressure gauge port: 1/4" BSP
5	T2 port: 1/2" BSP
6	Pressure relief valve 'D'. **For BLS6-CF0 only:** plug 3/4"-16 UNF. Orifice seat "A" underneath.
7	Socket hex adjustment screw: Hex key 4.
8	Locking nut: spanner 13 Tightening torque: 12-17 Nm



8.3 - End plates

dimensions in mm



1	Mounting surface with no sealing rings
2	T1 outlet: 3/8" BSP
4	Load Sensing port: 1/4" BSP
5	Identification label

9 - IDENTIFICATION CODE OF ASSEMBLED VALVE

BLS6	-			-		-		-		/	12	V	-			/	

Compensated direct operated directional valve with proportional control

Inlet module:
C0 = without compensator (**NOTE**)
CF = for fixed pump
CV = for variable pump

Pressure adjustment range:
0 = no relief valve
5 = from 12 to 210 bar
6 = from 15 to 315 bar

Proportional module:
Choose open or closed center, and then the spool type, like code in par. 1.1
Repeat for each proportional module required, max 8 modules.

End plate:
C91 = without load sensing port
C92 = with load sensing port

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
V = FPM seals (**standard**)

Coil type:
D12 = Nominal solenoid voltage 12V DC
D24 = Nominal solenoid voltage 24V DC

Coil electrical connection:
(see paragraph 6)
K1 = plug for connector type DIN 43650 (**standard**)
K7 = plug for connector type DEUTSCH DT04-2P male

Manual override on all proportional modules (see par. 11)

NOTE: The version C0 is available only without the pressure relief valve, with code BLS6-C00/12V.

Coding example:

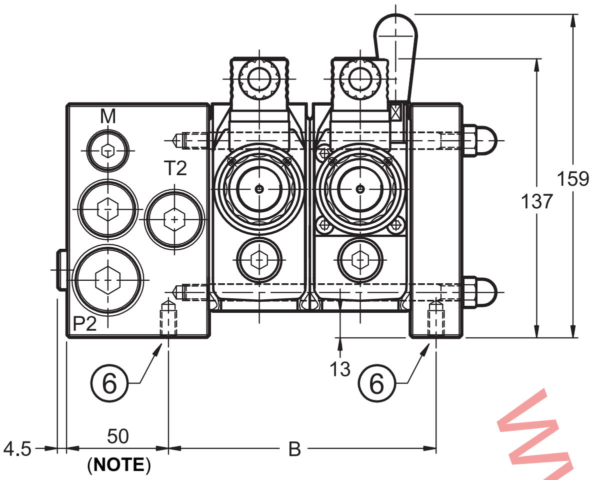
BLS6-C00-PC30/30-PC30/30-C92/12V-D24K1: assembled valve includes: inlet module without 3 way compensator; 2 prop. modules with closed center flow 30/30; end plate without load sensing port; FPM seals, 24V DC coils and K1 connection.

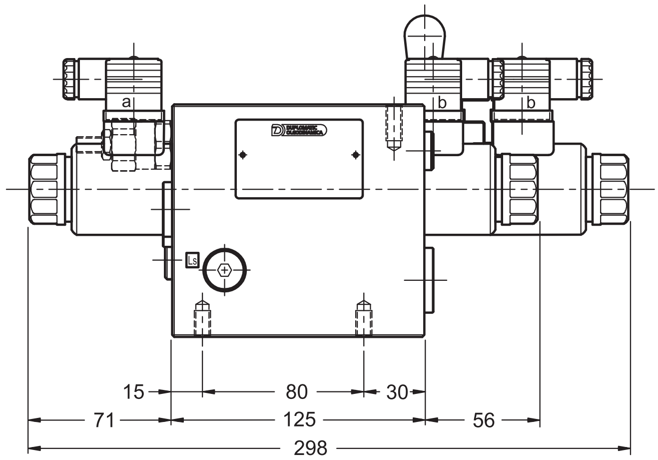
BLS6-CF5-PA45/30-PA45/30-PC30/30-PAB15/15-C91/12V-D12K1: assembled valve includes: inlet module for fixed pump, with pressure max 210 bar; 2 prop. modules with open center flow 45/30, 1 prop. module with close center, flow 30/30 and 1 prop. module with open center and solenoid only on side B, flow 15/15; end plate with load sensing port; FPM seals, 12V DC coils and K1 connection.

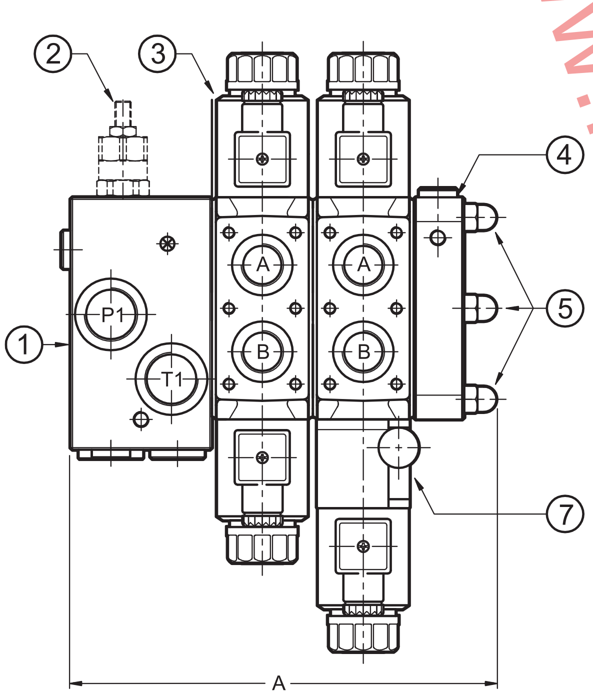
NOTE: To obtain the best performances, we suggest to mount the spool with the max flow first, and then the others decreasing.

10 - INSTALLATION AND OVERALL DIMENSIONS OF THE ASSEMBLED VALVE

dimensions in mm







Modules	A (**NOTE**)	B
2	212	132,5
3	262	182,5
4	312	232,5
5	362	282,5
6	412	332,5
7	462	382,5
8	512	432,5

NOTE: with the inlet plate BLS6-C00 the dimension is 10 mm shorter.

1	Inlet module
2	Pressure relief valve
3	Proportional modules
4	End plate
5	Fixing studs
6	Fixing holes
7	Manual lever override module

Fixing kit

The fixing kit includes, all zinc-coated

3 studs,
3 self locking nuts
3 washers

To order it please use the following codes:

No. of body modules	**Code**
2	3404150010
3	3404150011
4	3404150012
5	3404150013
6	3404150014
7	3404150015
8	3404150016

Tightening torque: 25 Nm

11 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

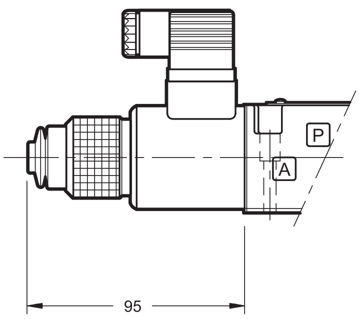
Three different manual overrides are available upon request:

- **CM** manual override, boot protected.

- **CH** lever manual override.

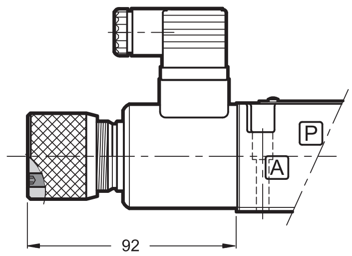
- **CK** knob. When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.

CM Version



Code for proportional module: 3803210003
Code for on-off module: 3401150006

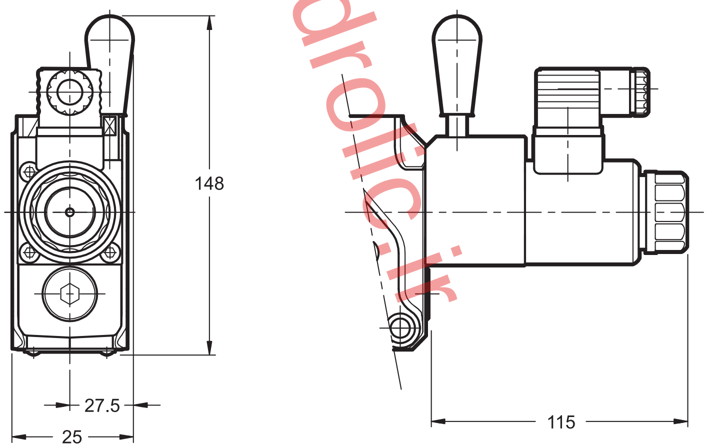
CK Version



Allen key for set screw: 3 mm.

Code for proportional module: 3803210005
Code for on-off module: 3401150009

CH Version



NOTE: The overall dimension shown in the drawings is for the proportional modules; In ON-OFF modules consider an increase of 5 mm compared to the reported dimensions.

12 - ELECTRONIC CONTROL UNITS

One solenoid

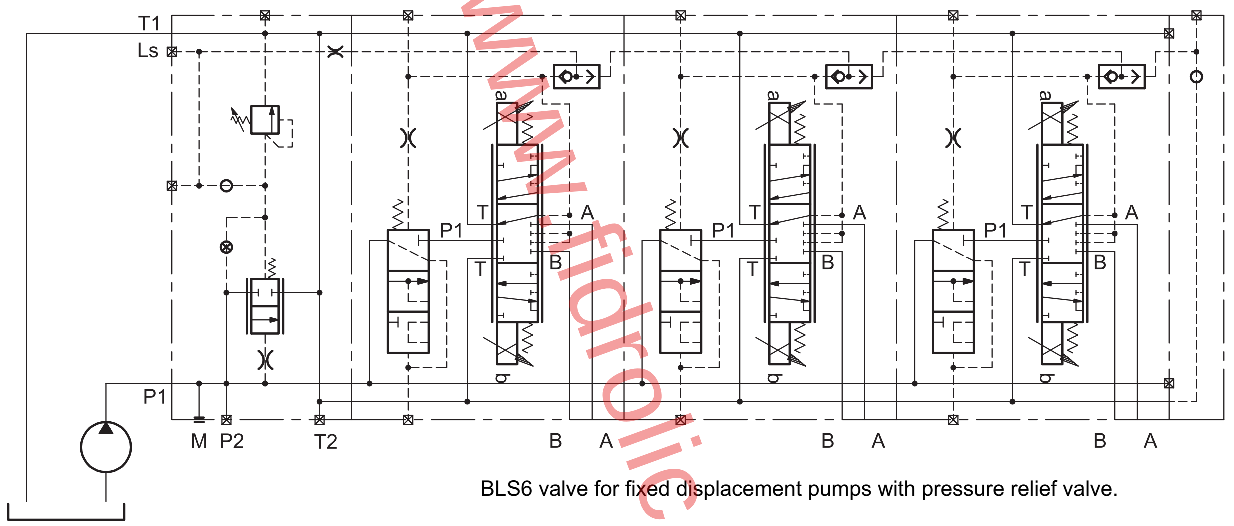
EDC-111	for solenoid 24V DC	plug version	see cat. 89 120
EDC-141	for solenoid 12V DC		
EDM-M111	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M141	for solenoid 12V DC		

These cards drive only a module at once.
Every module to be driven with electronic card must have its one.

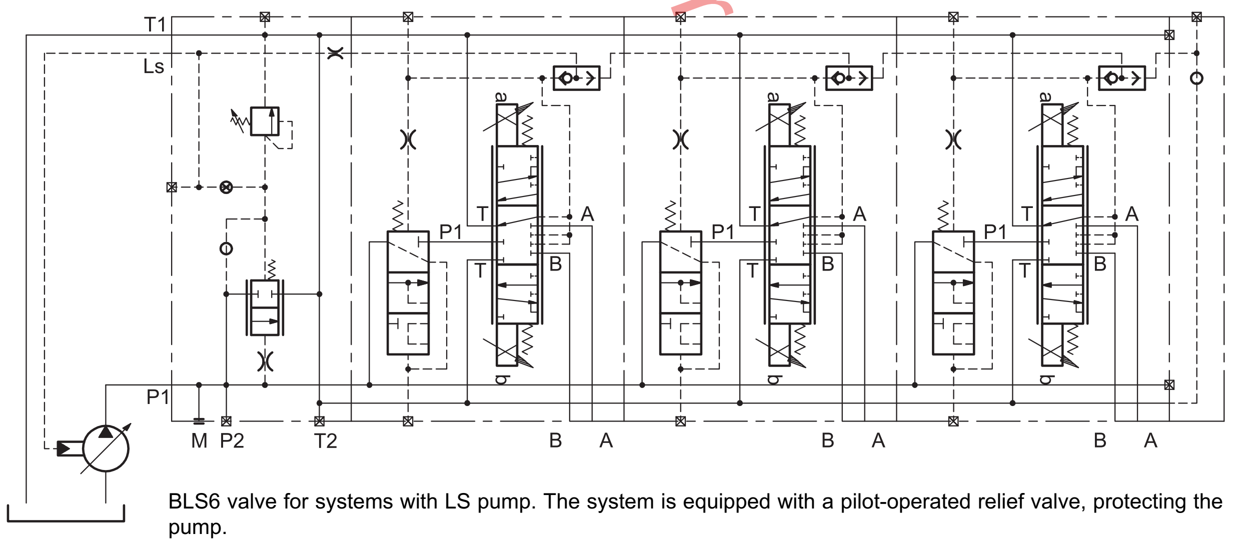
Two solenoids

EDM-M211	for solenoid 24V DC	rail mounting DIN EN 50022	see cat. 89 250
EDM-M241	for solenoid 12V DC		

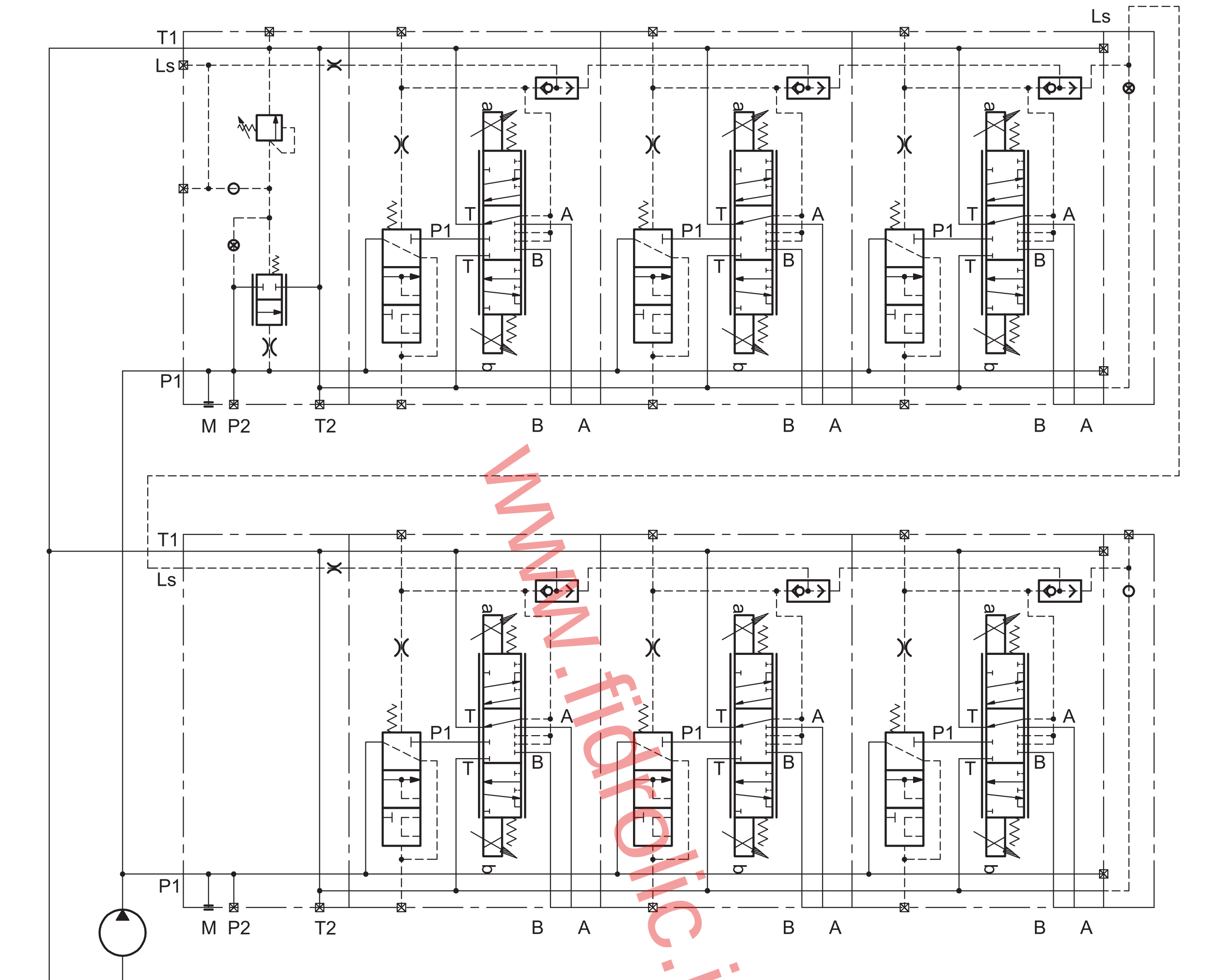
13 - EXAMPLES OF APPLICATION



BLS6 valve for fixed displacement pumps with pressure relief valve.



BLS6 valve for systems with LS pump. The system is equipped with a pilot-operated relief valve, protecting the pump.



Example of two BLS6 valves linked with parallel connection for the pump and serial connection for LS port.

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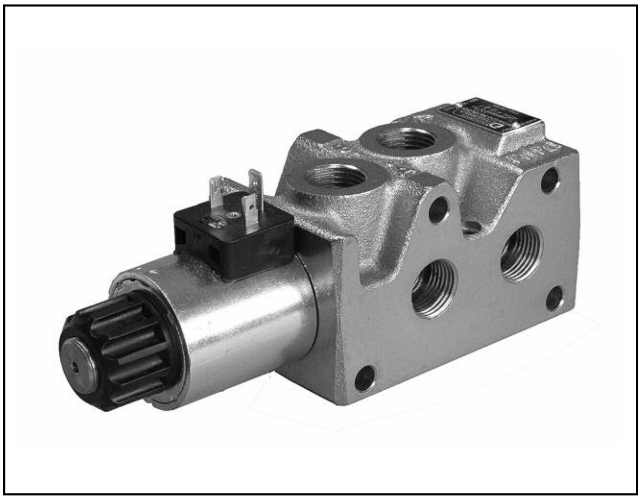


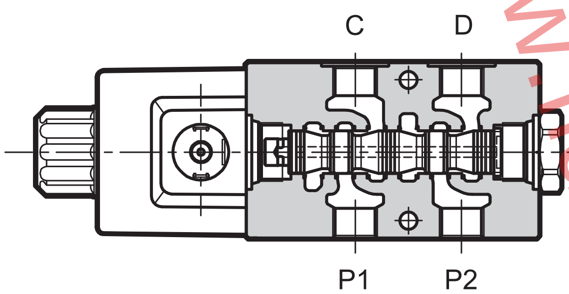
BFD*

SIX WAYS BANKABLE FLOW DIVERTER

SERIES 10

p max **320** bar
Q max **90** l/min

OPERATING PRINCIPLE



— BFD* is a 6 ways bankable flow diverter that allows the simultaneous connection of two utilities, alternating the direction of flow through a solenoid operated directional valve.

— It is available in two sizes, depending on the requested flow, and is used mainly for compact applications for the mobile sector.

— The BFD* valve is also suitable for series mounting, lining up to max 5 modules.

— The external drain is available as an option on both sizes.

— The BFD* diverters are supplied with a finishing surface treatment zinc-nickel, suitable to ensure a salt spray resistance up to 240 hours. Versions with plastic coil or with zinc-nickel finished coil reach 600 hour resistance.

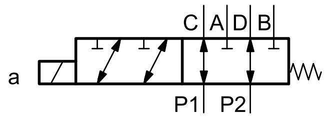
PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

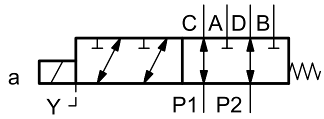
		BFD06	BFD10
Maximum operating pressure: - with drain Y	bar	250 320	
Maximum flow	l/min	60	90
Pressure drops ∆p - Q	see paragraph 3		
Electrical features	see paragraph 6		
Operating limits	see paragraph 4		
Electrical connections	see paragraph 11		
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass	kg	3	4,2
Surface treatment	zinc-nickel		

HYDRAULIC SYMBOL

standard



with external drain



1 - IDENTIFICATION CODE

BFD		-		-	TA6	/	10		-			/		

Bankable 6 ways flow diverter

Nominal size
06 = 60 l/min
10 = 90 l/min

Ports: (see **NOTE 1**)
G038 = 3/8” BSP (for BFD06 only)
G012 = 1/2” BSP

Spool type

Series:
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Coil type
D12 = 12 V
D24 = 24 V
D28 = 28 V (BFD06 only)
D00 = valve without coils (see **NOTE 2**)

Coil electrical connection
K1 = plug for DIN 43650 connector (**standard**)
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S (available only for BFD06)
NOTE fo BFD06: to obtain a salt spray resistance up to 600 hours buy coil type:
WK1 = plug for DIN 43650 connector
WK7D = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S, with diode.
These versions include the CM manual override to protect the solenoid tube.
WK1 e WK7D connections are available for D12 and S24 coils only.
(see sections 6 and 11)

Manual override: (see par. 14)
Omit for override integrated in the tube (**standard**)
CM = boot protected
CK = knob

Option:
Y = External drain (see par. 13.1)

NOTE 1: On BFD06 are available upon request for the threads 3/4” 16 UNF (**S08**).
NOTE 2: The locking rings of the coils and the relevant O-Rings are supplied together with valves.

2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

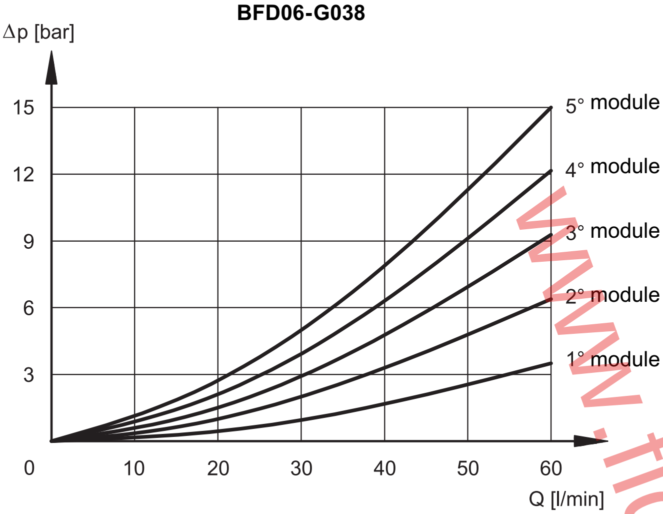
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - CHARACTERISTIC CURVES

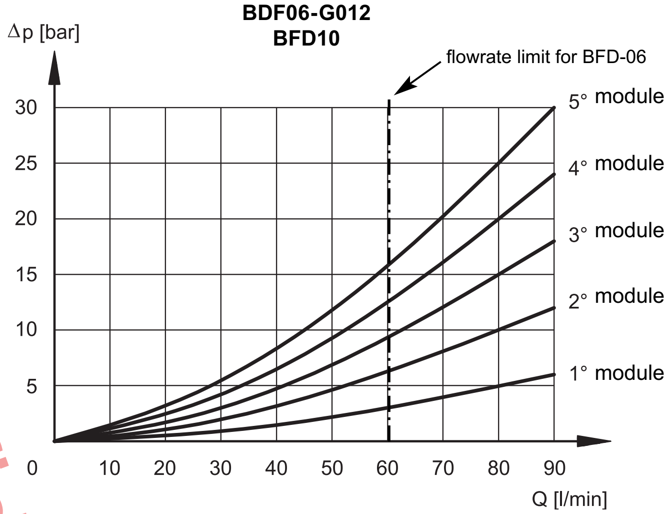
(obtained with viscosity 36 cSt at 50 °C)

3.1 - Pressure drops Δp-Q at initial position

BFD06-G038



BDF06-G012
BFD10

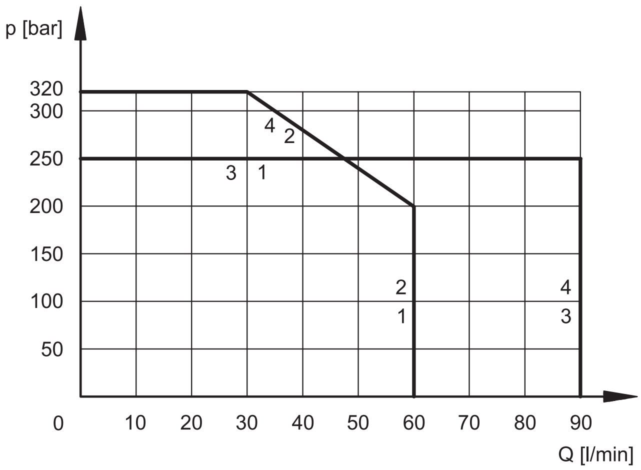


4 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions.

The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.

The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.



VALVE	CURVE
BFD06	1
BFD06*/Y	2
BFD10	3
BFD10*/Y	4

5 - SWITCHING TIMES

The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

TIMES ms (±10%)	ENERGIZING	DE-ENERGIZING
BFD06	25 ÷ 75	20 ÷ 50
BFD10	50 ÷ 100	20 ÷ 40

6 - ELECTRICAL CHARACTERISTICS

6.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation.

Protection from atmospheric agents EN 60529

Plug-in type	IP
K1 DIN 43650	IP 65
K7 DEUTSCH DT04 male	IP 69 K

NOTE: The protection degree is guaranteed only with the connector correctly connected and installed.

NOTE 2: In order to further reduce the emissions, use of type H connectors is recommended. These prevent voltage peaks on opening of the coil supply electrical circuit (see cat. 49 000).

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) (NOTE 2)	In compliance with 2004/108/EC
LOW VOLTAGE	In compliance with 2006/95/EC
CLASS OF PROTECTION : Coil insulation (VDE 0580) Impregnation	 class H class F (BFD06) class H (BFD10)

6.2 - Current and absorbed power

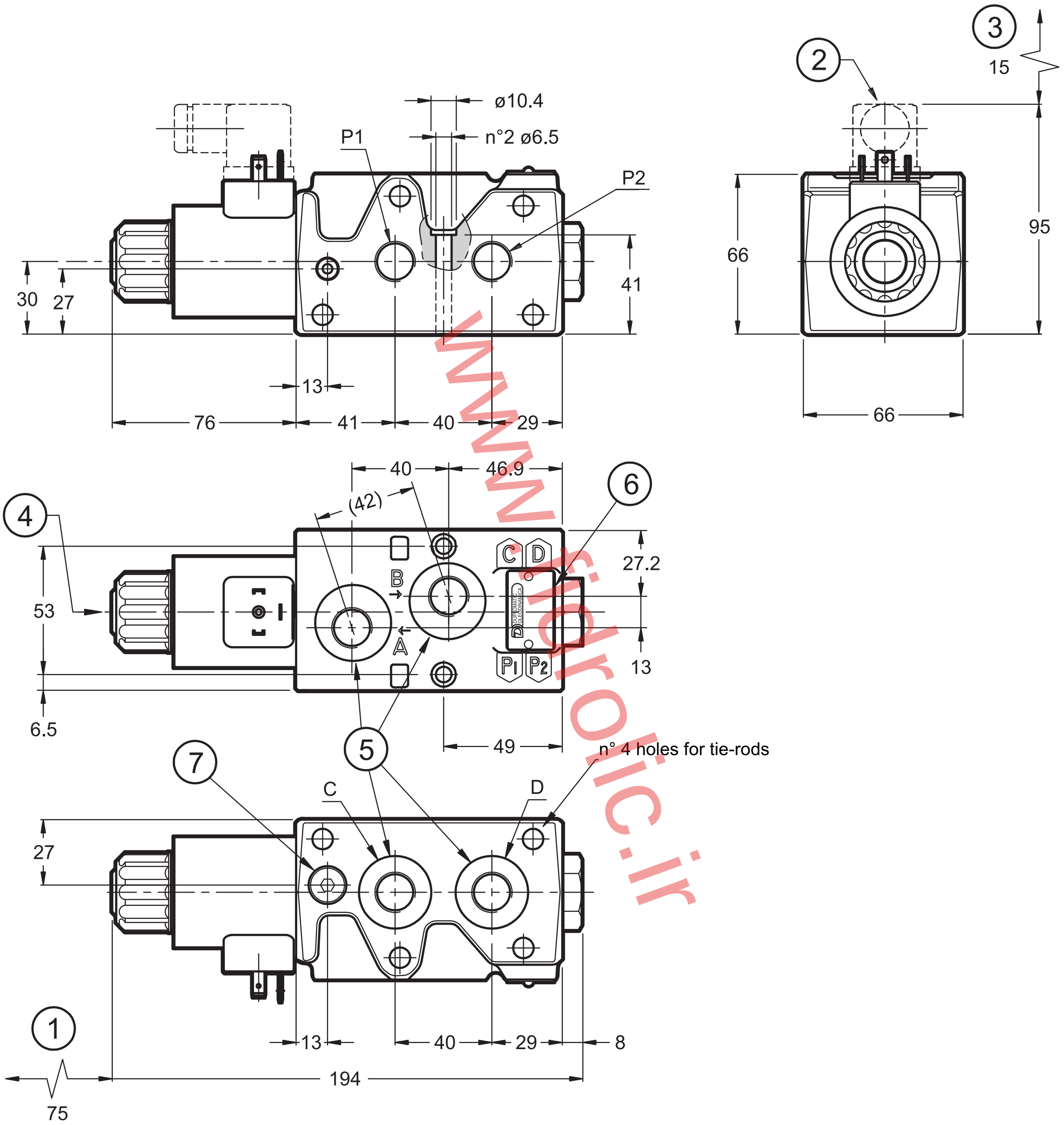
WK1 and WK7D coils have a zinc-nickel surface treatment and are specific for the high resistant version to salt spray.

The WK7D coil includes a suppressor diode of pulses for protection from voltage peaks during switching. During the switching the diode significantly reduces the energy released by the winding, by limiting the voltage to 31.4V in the D12 coil and to 58.9 V in the D24 coil.

Valve	Coil	Resistance at 20°C [Ω] (±5%)	Current consumption [A] (±10%)	Absorbed power [W] (±10%)	Coil code			
					K1	WK1	K7	WK7D
BFD06*	**D12**	4 ÷ 5	2,72	32,7	1903080	1903050	1902940	1903400
	D24	18 ÷ 19,5	1,29	31	1903081	1903051	1902941	1903401
	D28	24,5 ÷ 27	1,11	31	1903082	-		
BFD10*	**D12**	2,9	4,14	50	1903150	-		
	D24	12,3	1,95	47	1903151	-		

7 - BFD06-G038 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

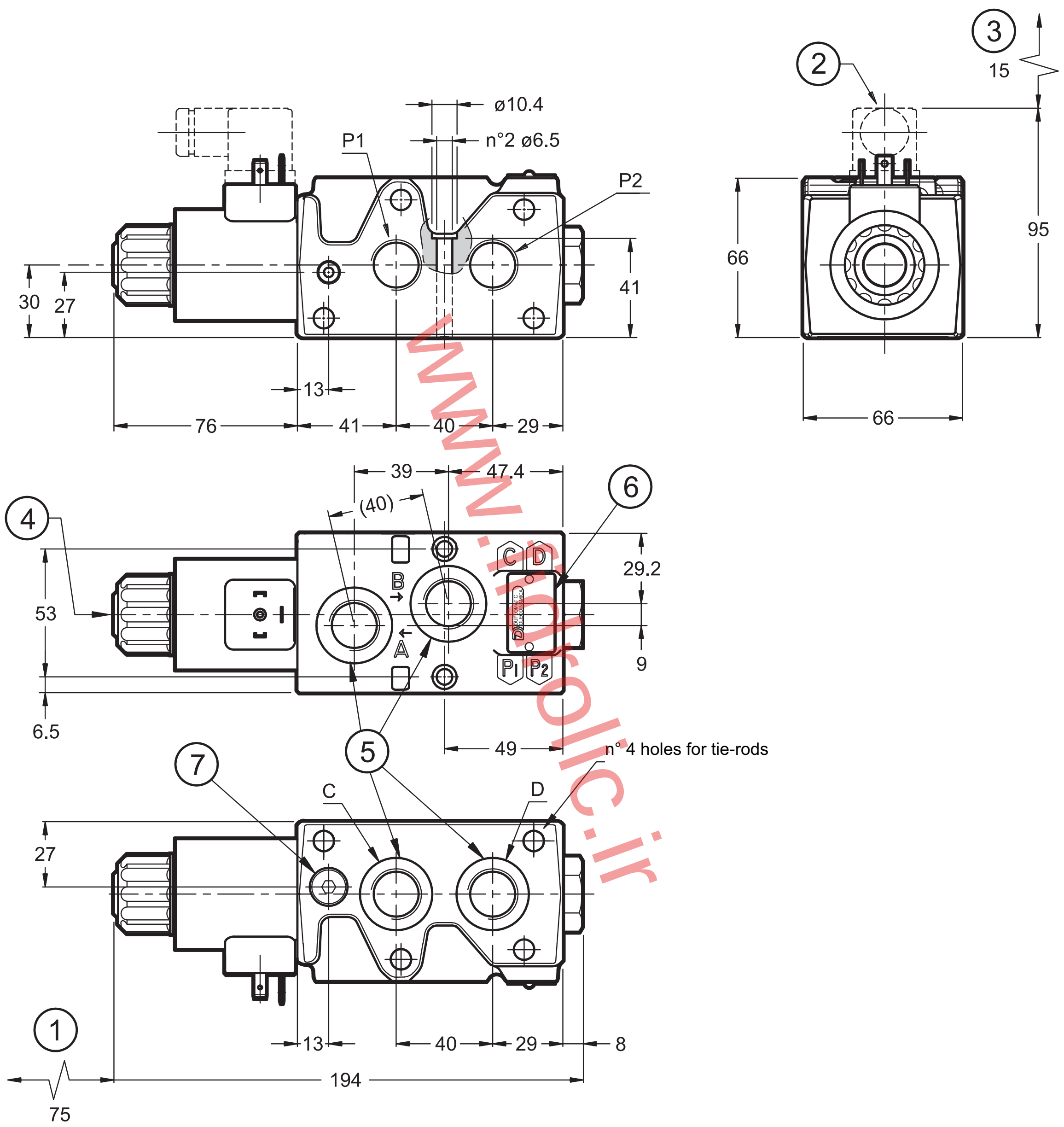


1	Coil removal space
2	DIN 43650 electrical connector
3	Connector removal space (representation with standard connection type K1 - for connection K7 see par. 11)
4	Standard manual override included in the solenoid tube
5	Ports: 3/8" BSP
6	Identification label
7	Option: external drain port Y 1/8" BSP

Fastening of single valve: 4 SHC screws ISO 4762 M6x50
Tightening torque: 8 Nm (A8.8 screws)
Threads of mounting holes: M6x12

8 - BFD06-G012 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

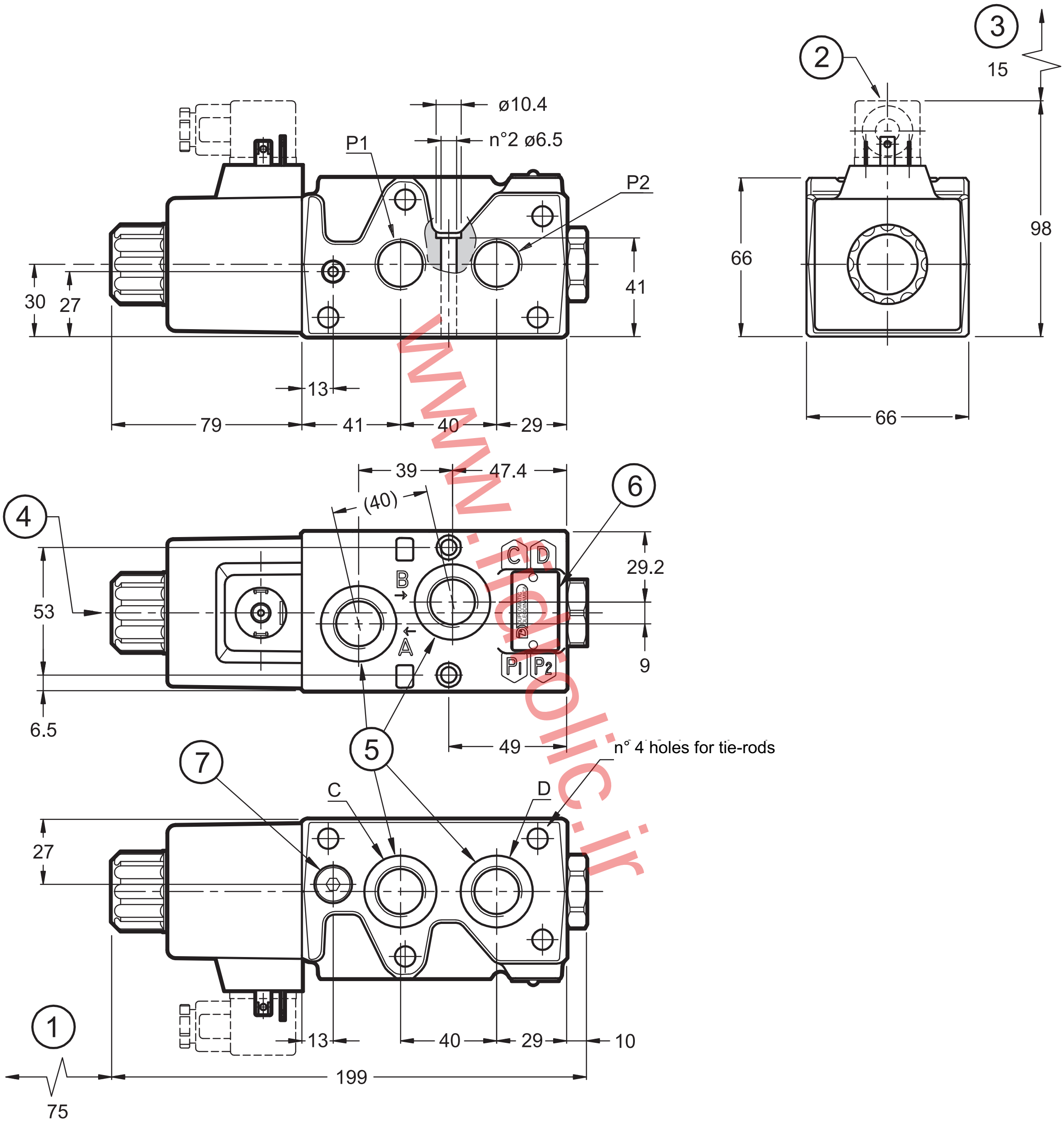


1	Coil removal space
2	DIN 43650 electrical connector
3	Connector removal space (representation with standard connection type K1 - for connection K7 see par. 11)
4	Standard manual override included in the solenoid tube
5	Ports: 1/2” BSP
6	Identification label
7	Option: external drain port Y 1/8” BSP

Fastening of single valve: 4 SHC screws ISO 4762 M6x50
Tightening torque: 8 Nm (A8.8 screws)
Threads of mounting holes: M6x12

9 - BFD10 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Coil removal space
2	DIN 43650 electrical connector
3	Connector removal space
4	Standard manual override included in the solenoid tube
5	Ports: 1/2” BSP
6	Identification label
7	Option: external drain port Y 1/8” BSP

Fastening of single valve: 4 SHC screws ISO 4762 M6x50	
Tightening torque: 8 Nm (A8.8 screws)	
Threads of mounting holes: M6x12	

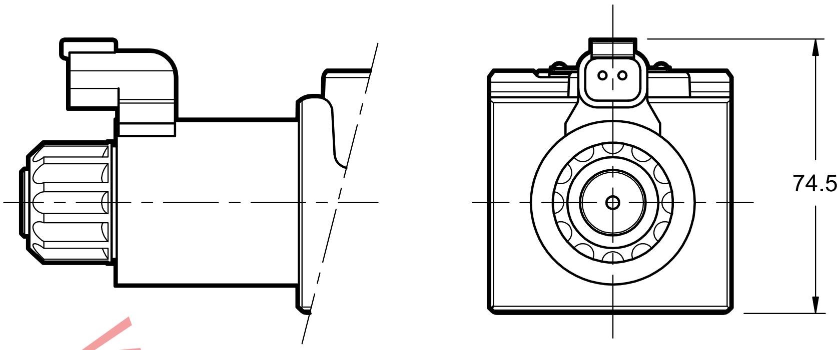
10 - INSTALLATION

The solenoid operated valve can be installed in any position without undermining the proper functioning.

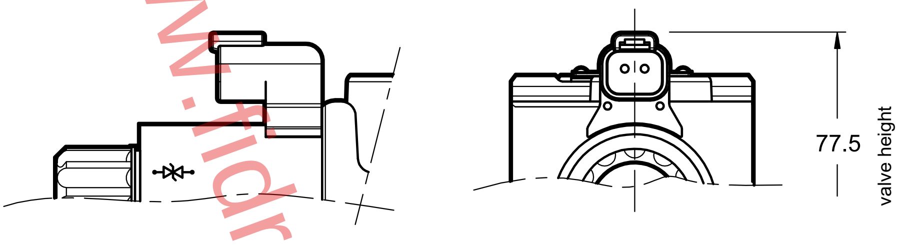
11 - ELECTRICAL CONNECTIONS

The standard connection K1 (for connector DIN 43650) is described in the dimension drawings. The K7 and WK7D connections are only available for BFD06* valves.

connection for plug DEUTSCH DT04-2P
for male connector type DEUTSCH
DT06-2S
code **K7**



connection for plug DEUTSCH DT04-2P
for male connector type DEUTSCH
DT06-2S
code **WK7D** (W7 version only)



12 - ELECTRICAL CONNECTORS

The solenoid valves are supplied without connectors. For coils with standard electrical connection K1 type (DIN 43650) the connectors can be ordered separately: see catalogue 49 000.

13 - OPTIONS

13.1 - Subplate external drain port (option Y)

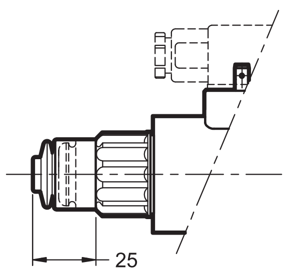
This version allows the operation with pressures up to 320 bar on the ports.

It consists in a Y drain hole realized on the valve coupling interface, where the Y port is connected with the solenoid tubes: in this way the tubes are not stressed by the pressure operating on the valve ports.

14 - MANUAL OVERRIDES

14.1 - Boot manual override

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface. Option is available on both versions.

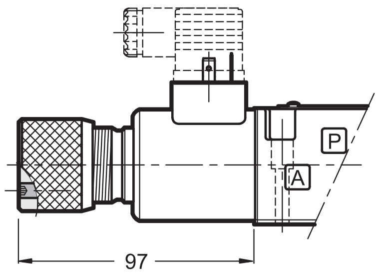


Code: 3401150006

14.2 - Knob

When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.

Spanner: 3 mm



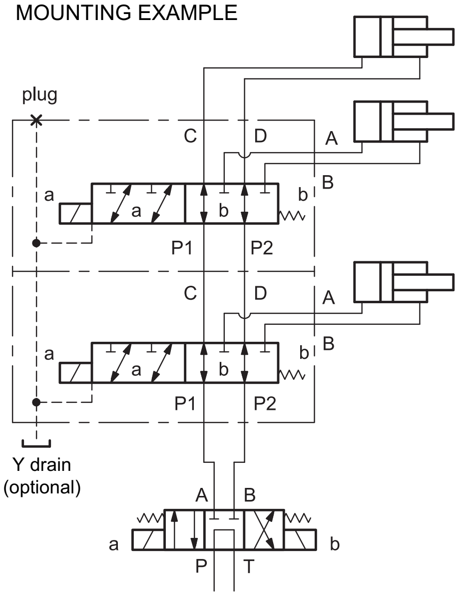
Code: 3401150009

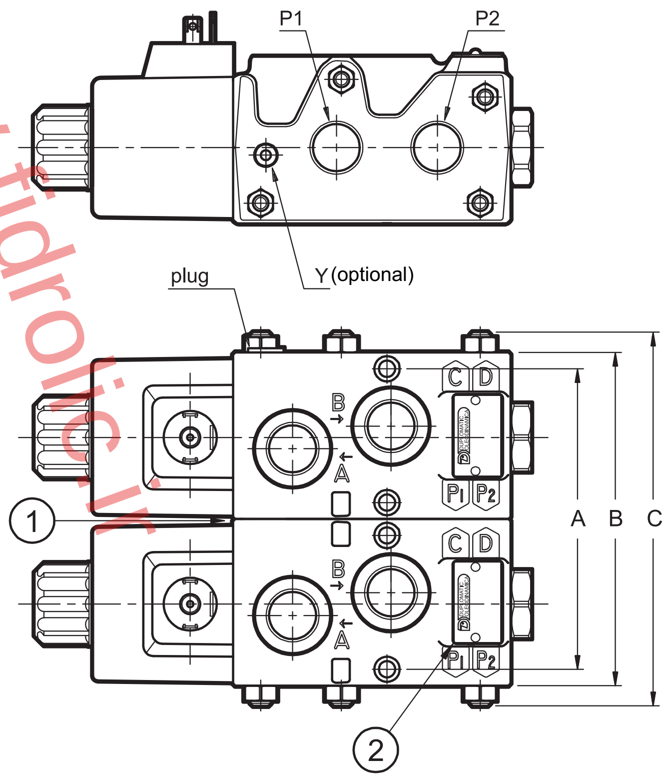
15 - SERIES CONFIGURATION

The BFD* valve can also be assembled in series, bundled up to 5 individual modules. The fixing kit must be ordered separately.
It includes: rods and screws, nuts, security washers and OR, as indicated in the table below.

15.1 - Hydraulic scheme, dimensions and installation

MOUNTING EXAMPLE





1	Mounting surface with sealing rings: OR 2106 (26.7x1.78) 90 shore additional just for Y version: OR 2050 (12,42x1,78) 90 shore
2	Identification label

Tightening torque: 17 Nm

modules no.	ways no.	A	B	C	bolts or tie-rods	nuts & washers	Qty. OR 2106	Qty. OR 2050	kit BFD*/10N	kit BFD*/10V
2	8	119	132	156	4 bolts M8x145	4+4	2	1	3404200002	3404200012
3	10	185	198	220	4 tie-rods M8x200	8+8	4	2	3404200003	3404200013
4	12	251	264	285	4 tie-rods M8x265	8+8	6	3	3404200004	3404200014
5	14	317	330	350	4 tie-rods M8x330	8+8	8	4	3404200005	3404200015

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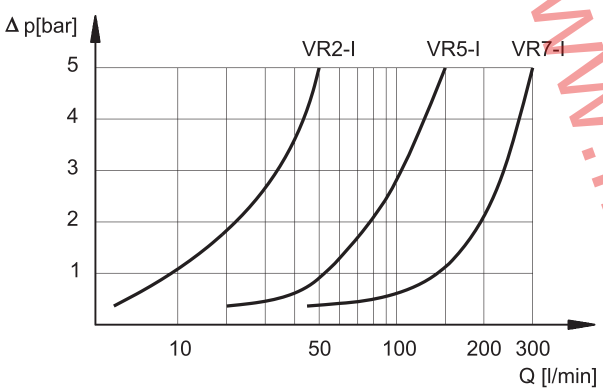
DUPLOMATIC OLEODINAMICA

VR*-I
CHECK VALVES
SERIES 32

CARTRIDGE TYPE

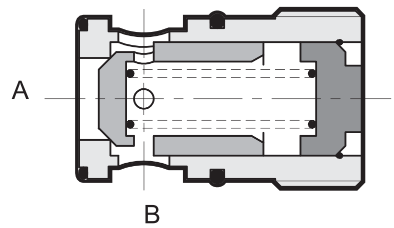
p max (see table of performances)
Q max (see table of performances)

PRESSURE DROP ΔP-Q



– Add the cracking pressure to the values shown in the diagram.
– Curves measured using mineral oil with viscosity of 36 cSt at 50°C.

OPERATING PRINCIPLE



— VR*-I valves are one-way check valves cartridge type construction and can be used in blocks or panels.

— In rest conditions, the valve poppet, which is a cone on edge seal type, is kept closed by a spring with fixed setting.

— The poppet opens when the pressure in the intake line “A” exceeds the set value of the spring, added to any pressure in the outlet line “B”.

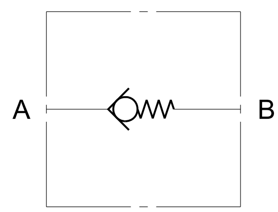
— Available in three sizes for flow rates of up to 300 l/min and with three different cracking pressures.

PERFORMANCES

valve code	nominal dimension	maximum flow rate [l/min]	mass [kg]	max operating pressure [bar]	
				continuous	peak
VR 2- I	1/4”	50	0,1	320	320
VR 5- I	3/4”	150	0,2	250	320
VR 7- I	1¼”	300	0,8		

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15	
Viscosità raccomandata	cSt	25

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

V	R		-	I		/	32	/	

Check valve

Nominal dimension:
2 = 1/4” **5** = 3/4” **7** = 1¼”

Cartridge type

Seals:
omit for mineral oils
V = viton for special fluids

Series No.: (the overall and mounting dimensions remain unchanged from 30 to 39)

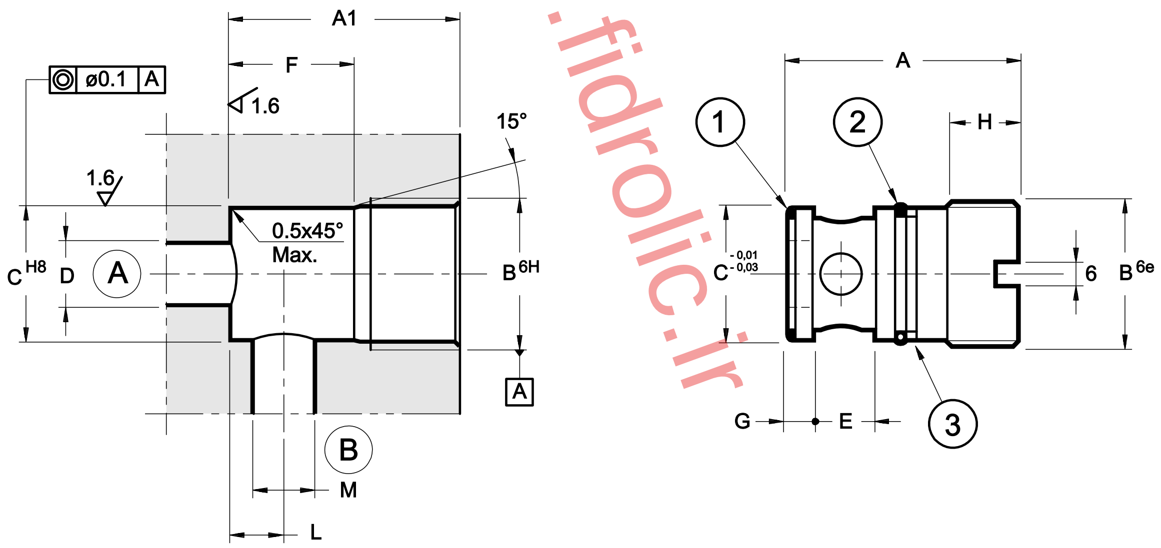
Cracking pressure:
1 = 0,5 bar **3** = 5 bar **4** = 10 bar

2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

3 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



NOTE: the dimension **A1** must be at least 1 mm higher than the dimension **A** indicated in the table herebelow.

	A	B	ØC	ØD max	E	F	G	H	L	ØM max	1	2	3	tightening torque
VR 2 - I	41	M24x1,5	22	9	10	22	4	14	9	9	OR 119 (15.08x2.62)	OR 3068 (17.13x2.62)	Parbak 8-115	25 Nm
VR 5 - I	43	M30x1,5	27	15	13,5	26	4,5	12	11	12	OR 3081 (20.24x2.62) 90 Shore	OR 2093 (23.52x1.78)	Parbak 8-021	50 Nm
VR 7 - I	72	M45x2	41	21	20	40	7,5	22	16,5	16	OR 3137 (34.60x2.62)	OR 4137 (34.52x3.53) 90 Shore	Parbak 8-220	80 Nm

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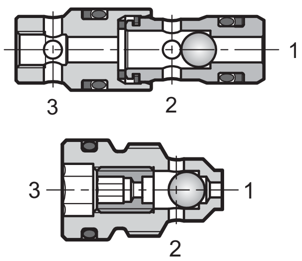
VSK*
SHUTTLE VALVE
SERIES 10

CARTRIDGE TYPE

p max **350** bar

Q max (see table of performances)

OPERATING PRINCIPLE



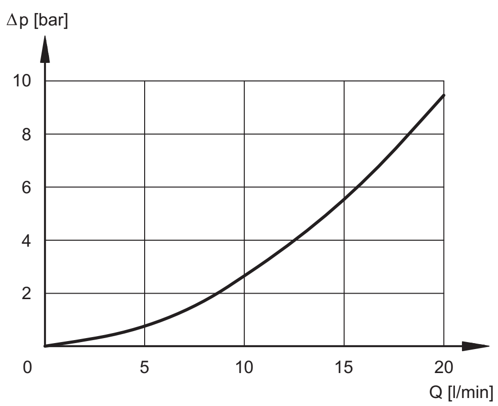
— The VSK* valves are shuttle type, cartridge version and it can be used in panels and blocks.

— The valve select the higher pressure signal between "1" and "3" through the output port "2"

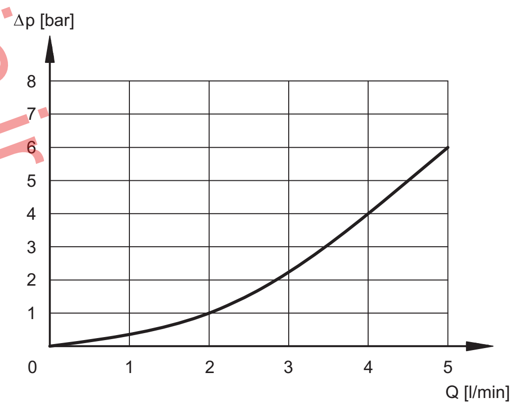
— The VSK1 reachs flows up to 20 l/min.

— The VSK2 is a shuttle valve for pilot signals up to a 3 l/min flows.

VSK1 PRESSURE DROPS Δp-Q



VSK2 PRESSURE DROPS Δp-Q

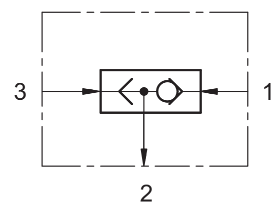


PERFORMANCES

valve	max flow [l/min]	mass [kg]
VSK1	20	0,013
VSK2	3	0,013

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25

HDRAULIC SYMBOL



1 - IDENTIFICATION CODE

V	S	K		/	10	

Shuttle valve (V S)

Cartridge type (K)

Nominal size:
1 = shuttle for flows up to 20 l/min
2 = shuttle for piloting signals up to 3 l/min

Series No.: (the overall and mounting dimensions remain unchanged from 10 to 19)

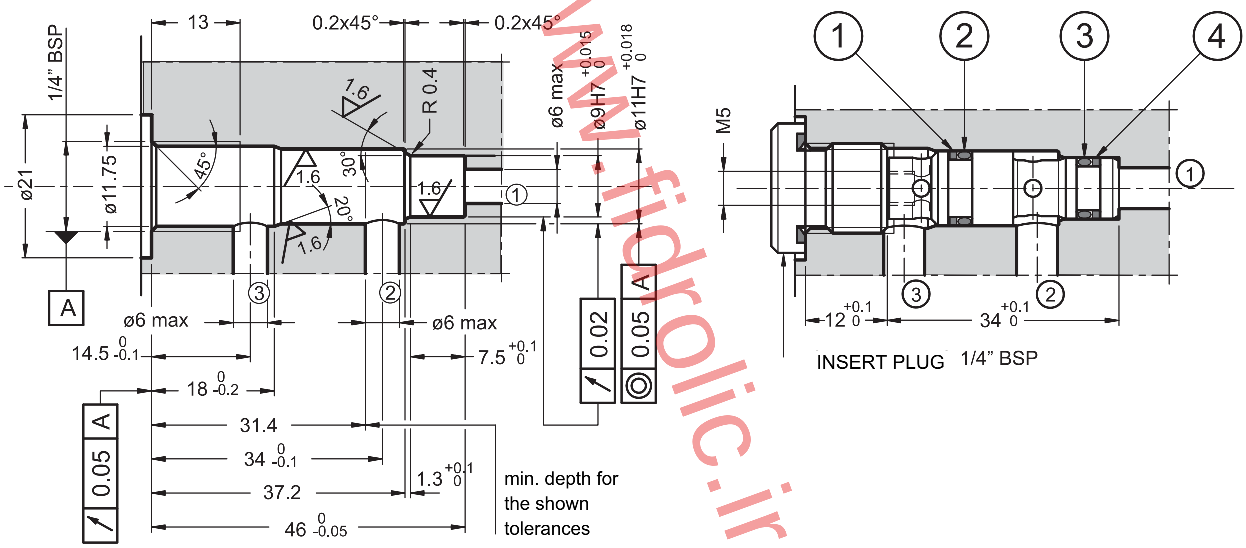
Seals:
N = for mineral oils (**standard**)
V = viton for special fluids

2 - HYDRAULIC FLUIDS

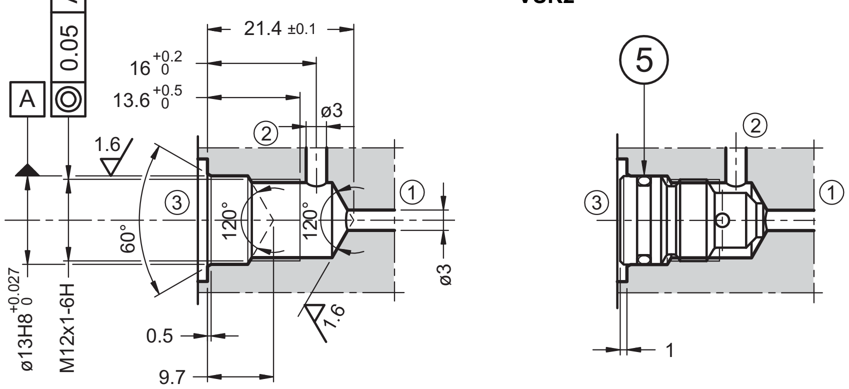
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

3 - OVERALL AND MOUNTING DIMENSIONS

VSK1



VSK2



dimensions in mm

1	Parbak 8-011 (8.36x1.14x1.35)
2	OR type 2031 (7.66x1.78)
3	OR type 2025 (6.07x1.78)
4	Parbak 8-010 (6.78x1.14x1.35)
5	N. 5 OR type 2037 (9.25x1.78)

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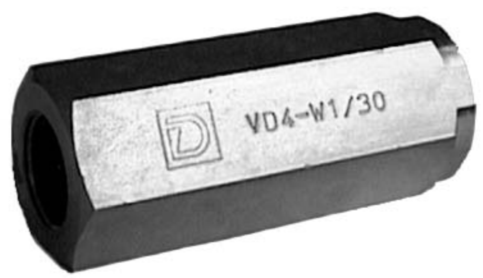
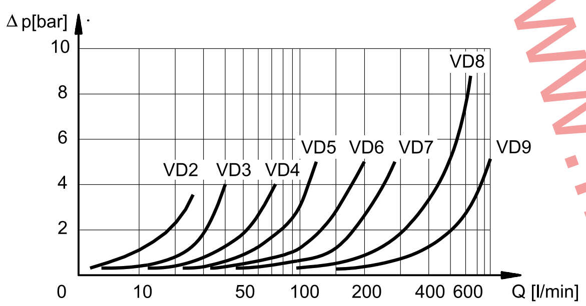


VD*-W*
CHECK VALVES
SERIES 30

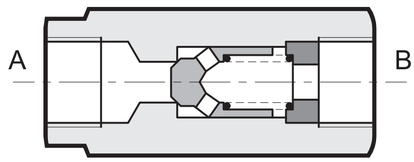
p max **400** bar
Q max (see table of performances)

PRESSURE DROPS Δp-Q



– Add the cracking pressure to the values shown in the diagram.
– Curves measured using mineral oil with viscosity of 36 cSt at 50°C.

OPERATING PRINCIPLE



— VD*-W* valves are check valves with threaded “BSP” ports for mounting in-line on hydraulic lines.

— They allow the flow to pass freely in one direction, blocking it in the opposite direction.

— In rest conditions, the valve poppet is kept closed by a spring. The poppet opens when the pressure in the intake line “A” exceeds the set value of the spring, added to any pressure in the outlet line “B”.

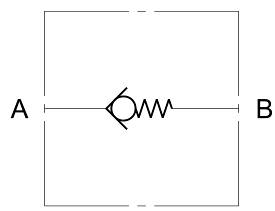
— Available in eight sizes for flow rates of up to 850 l/min and with five different cracking pressures.

PERFORMANCES

Valve	BSP port dimension	Maximum flow rate [l/min]	Mass [kg]	Max operating pressure [bar]
VD2-W*	1/4”	25	0,17	400
VD3-W*	3/8”	40	0,26	
VD4-W*	1/2”	75	0,41	
VD5-W*	3/4”	125	0,6	
VD6-W*	1”	200	1,2	320
VD7-W*	1 ¼”	280	1,8	
VD8-W*	1 ½”	650	3,2	
VD9-W*	2”	850	4,8	

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	cSt	25
Recommended viscosity	acc. to ISO 4406:1999 class 20/18/15	

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

V	D		-	W		/	30

Check valve

Nominal dimension
2 = 1/4”
3 = 3/8”
4 = 1/2”
5 = 3/4”
6 = 1”
7 = 1 ¼”
8 = 1 ½”
9 = 2”

Series No.: (The overall and mounting dimensions remain unchanged from 30 to 39)

Cracking pressure:
1 = 0,35 bar
2 = 2 bar
T4 = 4 bar
3 = 6 bar
4 = 10 bar

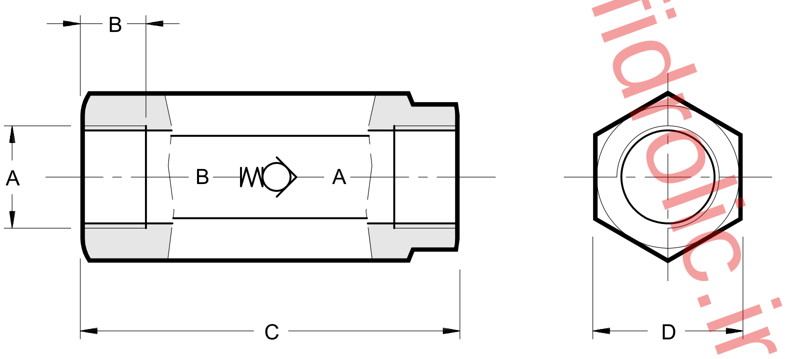
BSP threaded ports

2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4.
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

3 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



Valve	A BSP	B	C	D
VD2-W*	1/4”	12,5	63	22
VD3-W*	3/8”	12,5	69	27
VD4-W*	1/2”	15,5	80,5	32
VD5-W*	3/4”	17	99,5	36
VD6-W*	1”	20	117	46
VD7-W*	1 ¼”	22	134,5	55
VD8-W*	1 ½”	24	159	65
VD9-W*	2”	31	198	75

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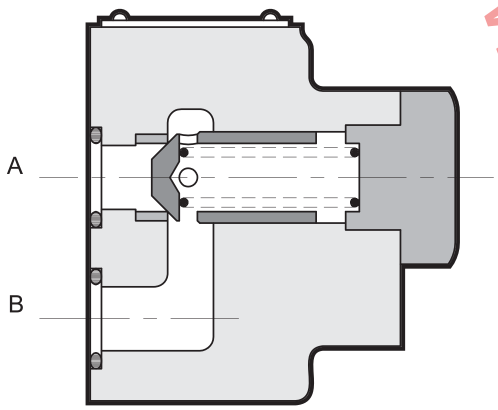
VR*-P
CHECK VALVES

SUBPLATE MOUNTING

p max (see table of performances)
Q max (see table of performances)

OPERATING PRINCIPLE



— VR*-P valves are one-way check valves constructed in the subplate mounting version.

— In rest conditions, the valve poppet, which is a cone on edge seal type, is kept closed by a spring with fixed setting.

— The shutter opens when the pressure in the intake line “A” exceeds the set value of the spring, added to any pressure in the outlet line “B”.

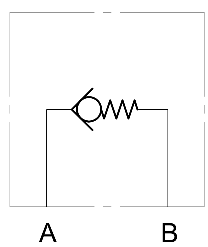
— Available in three sizes for flow rates up to 400 l/min and with three different cracking pressures.

TECHNICAL SPECIFICATIONS

Valve code	Nominal dimension	Maximum flow rate [l/min]	Mass [kg]	Max. operating pressure [bar]
VR3 - P	3/8”	100	2,3	350
VR5 - P	3/4”	200	4,8	350
VR7 - P	1¼”	400	9	250

Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

V R _ - P _ / _ / _

Check valve

Nominal dimension:
3 = 3/8" **5** = 3/4" **7** = 1 ¼"

Subplate mounting

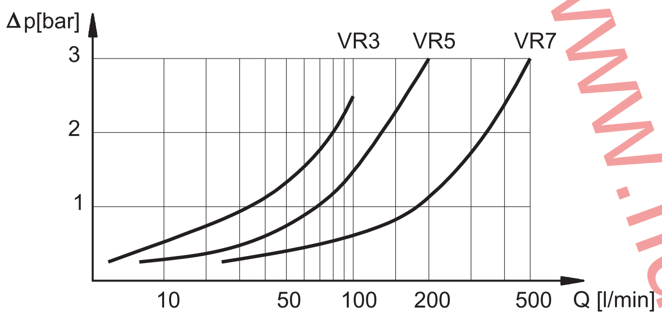
Cracking pressure:
1 = 0,5 bar **3** = 5 bar **4** = 10 bar

Series No.
10 for VR3-P and VR5-P
11 for VR7-P
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
omit for mineral oils
V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosità 36 cSt at 50°C)

PRESSURE DROPS Δp - Q



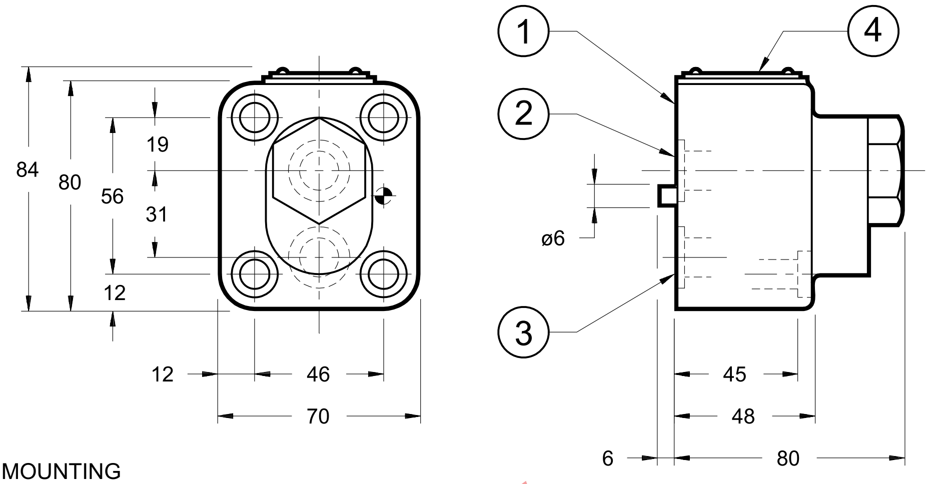
NOTE: Add the cracking pressure to the values shown in the diagram.

3 - HYDRAULIC FLUIDS

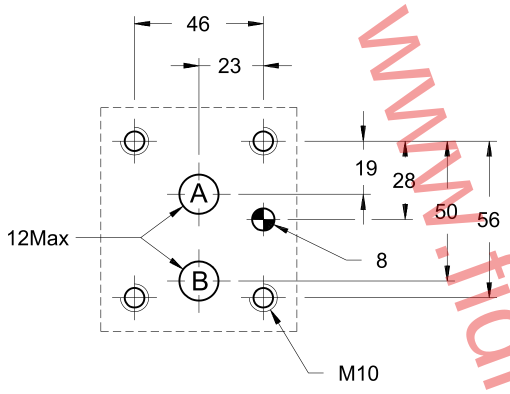
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - VR3-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



MOUNTING
SURFACE

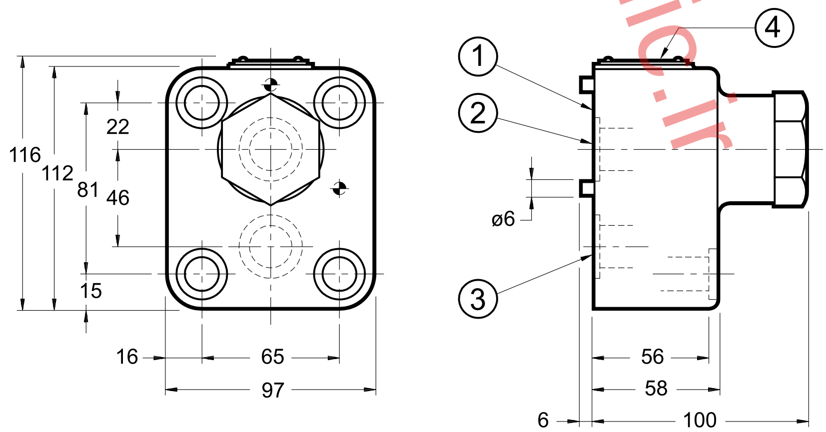


FASTENING BOLTS
4bolts M10x60
Torque: 40 Nm

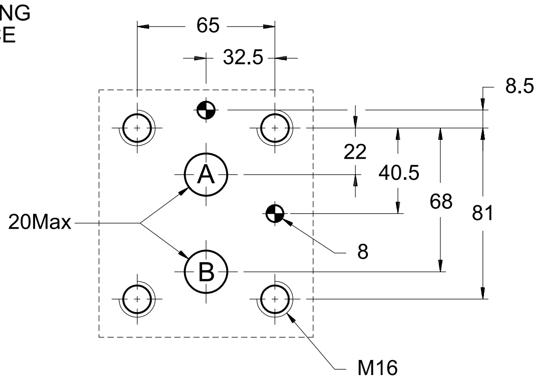
1	Mounting surface with sealing rings: 2 OR type 3068 (17.13x2.62)
2	Intake port A
3	Outlet port B
4	Identification label

5 - VR5-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



MOUNTING
SURFACE

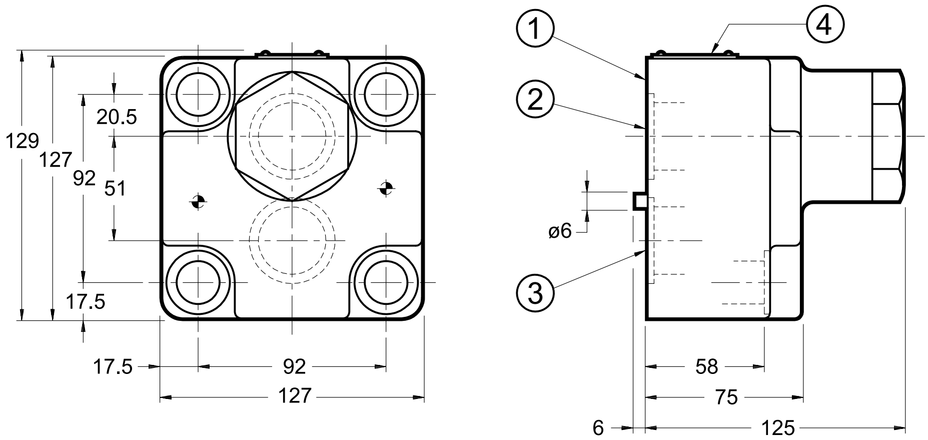


FASTENING BOLTS
4 bolts M16x80
Torque: 170 Nm

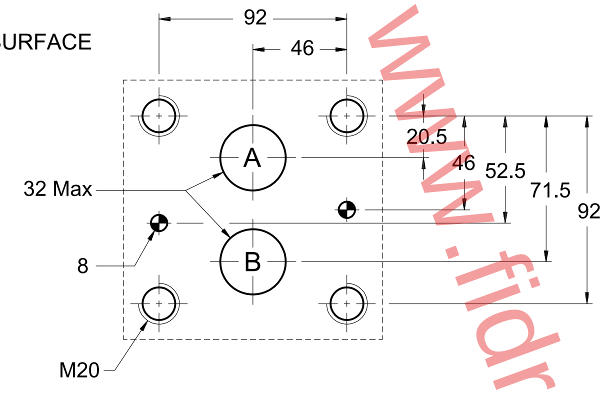
1	Mounting surface with sealing rings: 2 OR type 3100 (25.07x2.62)
2	Intake port A
3	Outlet port B
4	Identification label

6 - VR7-P OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



MOUNTING SURFACE



FASTENING BOLTS
4 bolts M20x90
Torque: 285 Nm

1	Mounting surface with sealing rings: N. 2 OR type 4137 (34.52x3.53) Shore 90
2	Intake port A
3	Outlet port B
4	Identification label

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DUPLOMATIC OLEODINAMICA

VP*-P*-MU

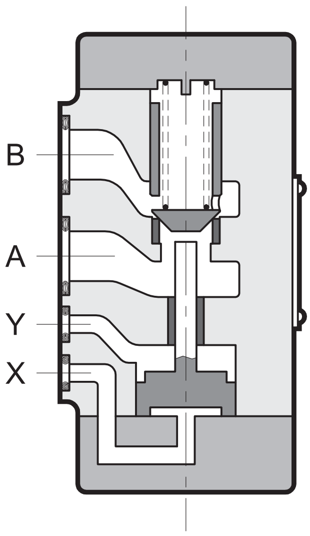
HYDRO-PILOT OPERATED CHECK VALVES

SERIES 12

SUBPLATE MOUNTING
ISO 5781 (CETOP 06 07)

p max **320** bar
Q max (see table of performances)

OPERATING PRINCIPLE



— VP*-P*-MU valves are check valves with hydraulic release, constructed in a version with subplate mounting in accordance with ISO 5781 (CETOP RP 121H) standards.

— They incorporate the functions of a normal one-way check valve with the facility, by means of external piloting, to release the poppet and allow the oil to pass also in the direction opposite to the free flow, from B to A.

— In rest conditions, the valve poppet, which is a cone on edge seal type, is kept closed by a spring with fixed setting. When piloting pressure is sent to port X, the release piston is operated, thus opening the main poppet and allowing the free flow from B to A.

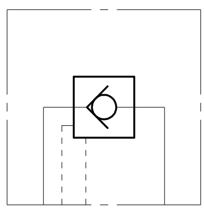
— The drainage port Y isolates the front face of the control piston from chamber A.

— They are available in two sizes for flow rates up to 100 l/min and with different cracking pressures in the free flow direction.

PERFORMANCES (working with mineral oil of viscosity of 36 cSt at 50°C)

		VP3	VP5
Maximum operating pressure	bar	320	320
Nominal flow rate	l/mn	50	100
Piloting ratio between release piston and sealed chamber areas	VP*-P*-MU	3,4:1	2,7:1
Piloting ratio with decompression device	VP*-P*/P-MU	12:1	14:1
Ambient temperature range	°C	-20 / +50	
Fluid temperature range	°C	-20 / +80	
Fluid viscosity range	cSt	10 ÷ 400	
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15		
Recommended viscosity	cSt	25	
Mass	kg	3,7	6

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

V	P		-	P		/		-	M	U	/	12	/	

Hydropilot operated check valve (V P)

Nominal size:
3 = ISO 5781-06 (CETOP 06)
5 = ISO 5781-08 (CETOP 08)

Subplate mounting (P)

Cracking pressure with A→B free flow:
2 = 3,5 bar
3 = 5 bar

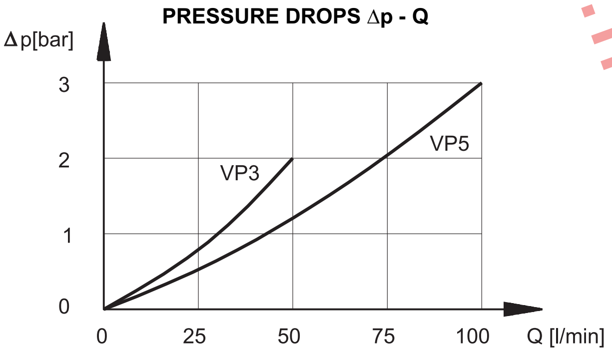
P = decompression device
(omit if not required)

Release piloting with external drainage (M U)

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19) (12)

Seals: omit for mineral oils
V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity 36 cSt at 50°C)



NOTE: The curves shown in the graph refer to B→A and A→B flow with the valve released hydraulically.
For A→B flow, with the valve not released hydraulically, add the cracking pressure to the values shown.

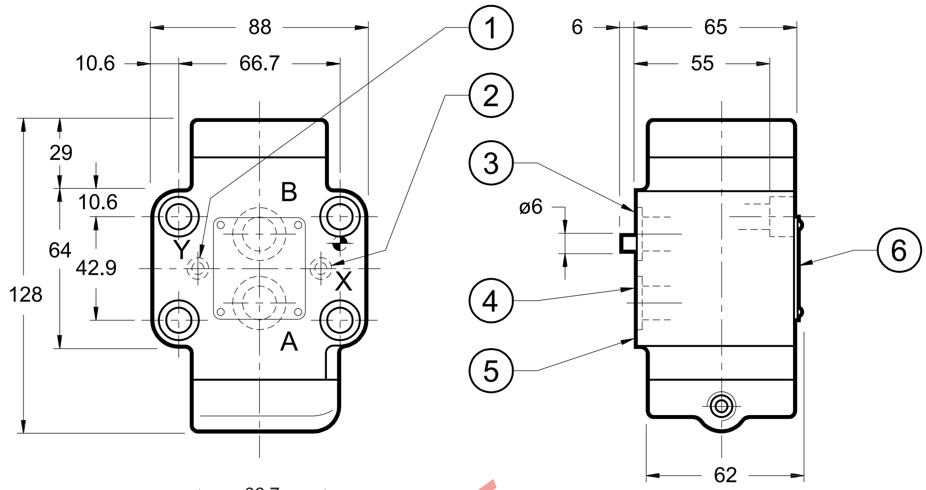
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

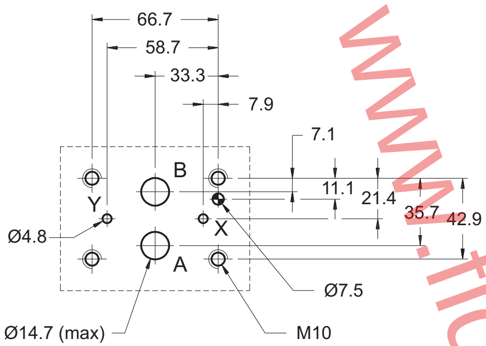
The fluid must be preserved in its physical and chemical characteristics.

4 - VP3-P*-MU OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	External drainage port Y
2	Piloting X
3	Outlet port B
4	Inlet port A
5	Mounting surface with sealing rings: N. 2 OR type 3068 (17.13x2.62) N. 2 OR type 2021 (5.28x1.78) - Shore 90
6	Identification label

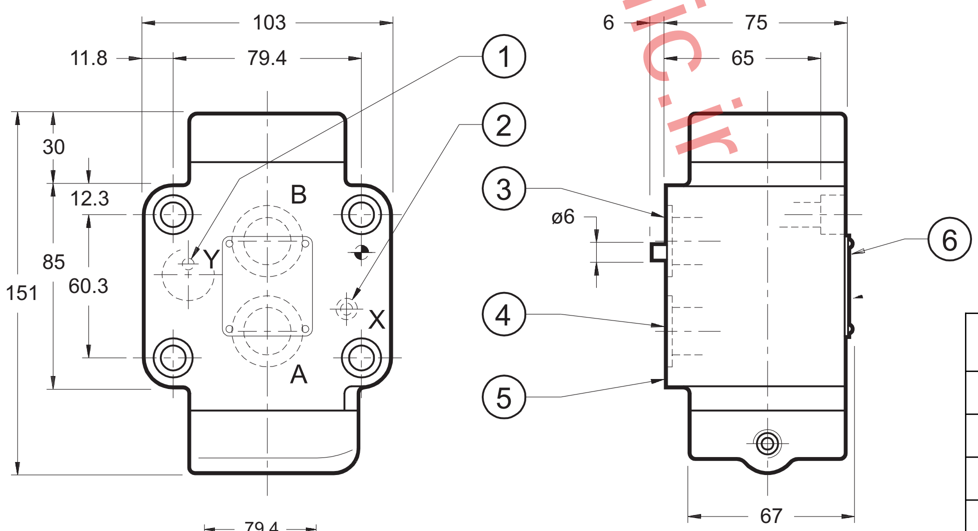


MOUNTING SURFACE
ISO 5781-06-07-*-00
(CETOP 4.3.1-2-06-320)

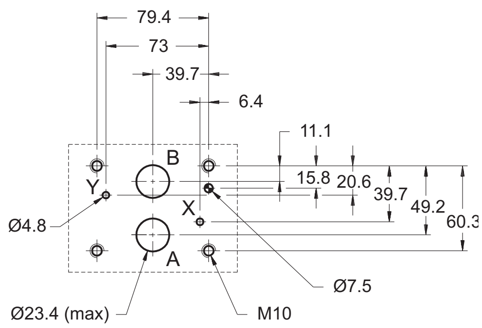
FASTENING BOLTS
4 bolts M10x70
Torque: 40 Nm

5 - VP5-P*-MU OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	External drainage port Y
2	Piloting X
3	Outlet port B
4	Inlet port A
5	Mounting surface with sealing rings: N. 2 OR type 3100 (27.07x2.62) N. 1 OR type 3068 (17.13x2.62) N. 1 OR type 2021 (5.28x1.78) - Shore 90
6	Identification label



MOUNTING SURFACE
ISO 5781-08-10-*-00
(CETOP 4.3.1-2-08-320)

FASTENING BOLTS
4 bolts M10x80
Torque: 40 Nm

6 - USE

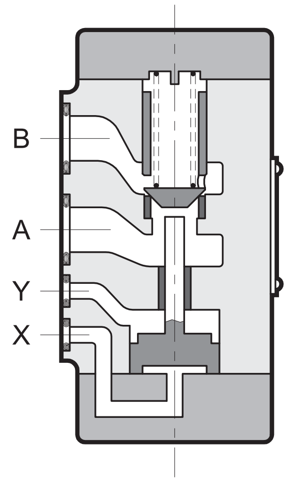
The VP*-P*-MU check valves with hydraulic release are used in circuits where the position of the actuators must be maintained even in the absence of hydraulic power.
They are available in two versions with the following characteristics:

VP*-P*-MU

The VP*-P*-MU valves are check valves with hydraulic release that incorporate the functions of a normal one-way check valve with the possibility to release the poppet by means of external piloting, thus allowing flow of the oil also in the opposite direction of the free flow, from B to A. The valve poppet, a cone on edge seal type, is kept closed by a spring with fixed setting during rest conditions. When pilot pressure is sent to port X, the release piston is activated and opens the main poppet, thus allowing the reverse flow.

These valves have hydraulic isolation of the front face of the release piston from chamber A of the valve, by external drainage Y. This solution eliminates problems which can occur if, during the release phase of the valve, pressure builds up in chamber A near to or greater than the piloting pressure X, causing a backward movement of the piston and thus unwanted closure of the valve.

VP*-P*-MU



VP*-P*/P-MU

The VP*-P*/P-MU valves are check valves with hydraulic release that, in addition to the characteristics of the preceding version, are equipped with a decompression device.

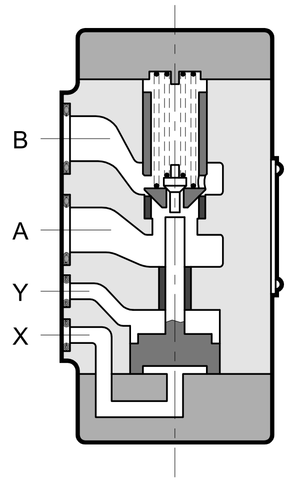
They are recommended when operating with high working pressures or with high loads that act as pressure multipliers.

The circuit (chamber B) is decompressed prior to complete opening of the valve during the release phase.

This prevents pressure shocks in the circuit and because of the high ratio existing between the areas of the control piston and the decompression device, release can occur even at a low piloting pressure.

Pilot pressure to port X operates the release piston which first opens the pre-opening poppet, causing decompression of the sealed chamber, it then opens the main poppet, allowing free flow from B to A.

VP*-P*/P-MU



7 - SUBPLATES (see catalogue 51 100)

	VP 3	VP 5
Type	PMSZ3 - AI 4G with rear ports	PMSZ5 - AI6G with rear ports
A - B port dimensions	1/2” BSP	1” BSP
X - Y port dimensions	1/4” BSP	1/4” BSP

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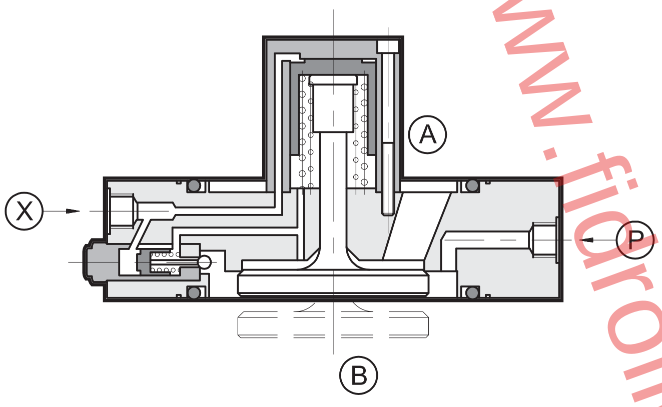
CFP
FILLING VALVES
SERIES 10

SANDWICH MOUNTING

p max **350** bar
Q max (see table of performances)

OPERATING PRINCIPLE



— The CFP valves are pilot operated check valves, expressly designed for hydraulic presses, to allow easy filling and empting of the press cylinder during the fast down and raise strokes.

— They are "sandwich" mounted, to be installed directly between the suction flange (connected to the tank) and the cylinder (see paragraph 6).

— A version with a pre-opening device is available, connected to the X pilot port, that allows circuit decompression before the cylinder raising phase begins.

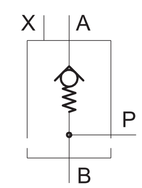
— The CFP valves are available in 7 different sizes with maximum flow up to 2500 l/min.

PERFORMANCES

VALVE CODE			CFP-S032	CFP-S040	CFP-S050	CFP-S063	CFP-S080	CFP-S100	CFP-S125
Nominal size			DN-32	DN-40	DN-50	DN-63	DN-80	DN-100	DN-125
Maximum flow (with Δp =0,3 bar and viscosity 36 cSt)		l/min	160	250	400	600	1000	1600	2500
Maximum pressure	Ports P and B	bar	350						
	Port X	bar	100						
	Port A	bar	16						
Cracking and pilot pressure			see paragraph 4						
Mass		kg	1,2	1,7	2,5	3,5	5,2	12	20

Ambient temperature range	°C	–20 / +50
Fluid temperature range	°C	–20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Recommended viscosity	cSt	25
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15	

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

C	F	P	-	S		/		/	10	

Filling valve (CF)

Hydropilot operated (P)

Sandwich mounting (S)

Nominal size
032 = DN-32
040 = DN-40
050 = DN-50
063 = DN-63
080 = DN-80
100 = DN-100
125 = DN-125

Pre-opening device
0 = without device
P = with device (not available for DN-125)

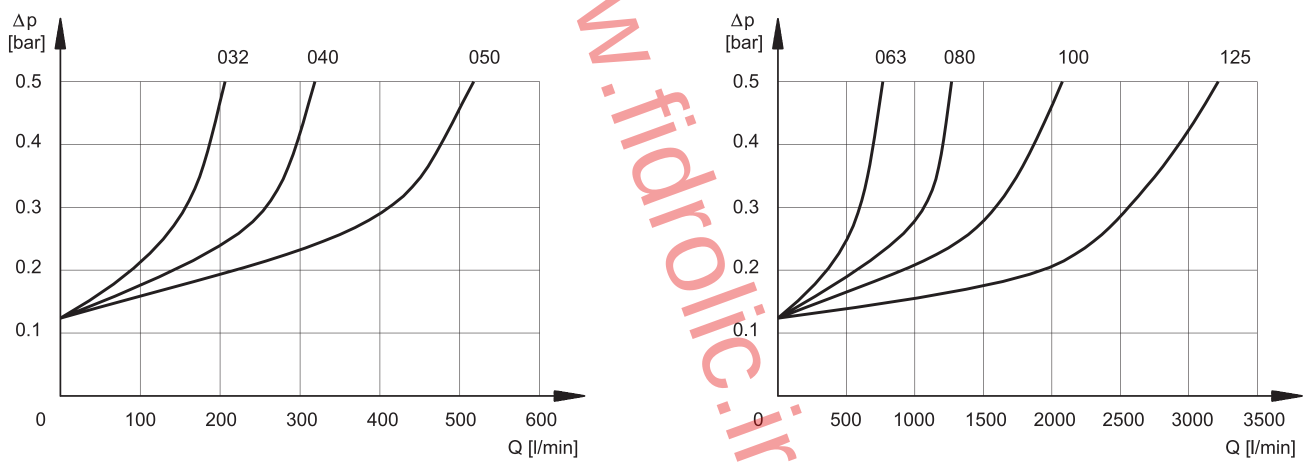
Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

2 - CHARACTERISTIC CURVES

(values measured with viscosity of 36 cSt at 50°C)

Δp - Q characteristic with flow A → B.



3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - OPENING AND PILOTING PRESSURES

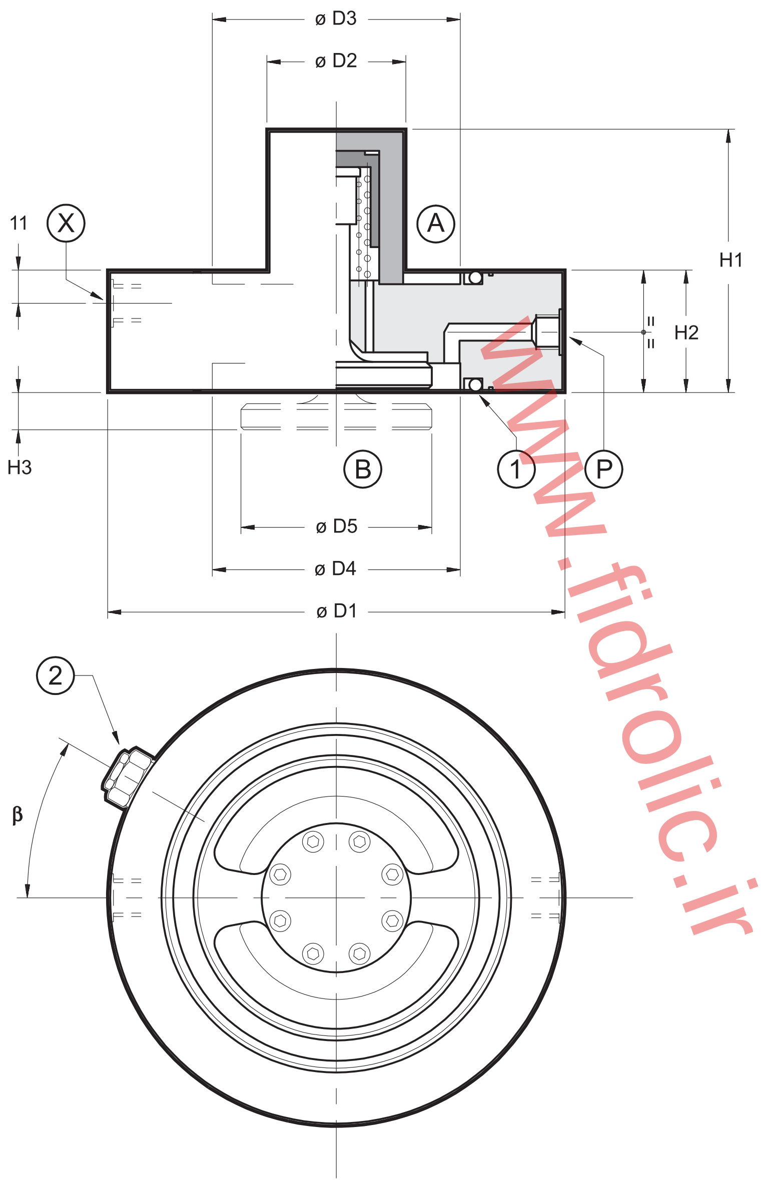
Valve code	Cracking pressure A - B [bar]	Minimum pilot pressure [bar]	Pilot pressure ratio p (B) / p (X)	Pre-opening pressure (option /P) [bar]	Pilot volume for opening valve [cm³]
CFP-S032			3,6		1,22
CFP-S040	0,12		3,9		2,36
CFP-S050			4,2		4,91
CFP-S063		8,0	4,2	p(X) = 0,18 x p(B) +7	8,13
CFP-S080	0,13		4,5		12,72
CFP-S100			4,3		28,63
CFP-S125			4,3	-	67,86

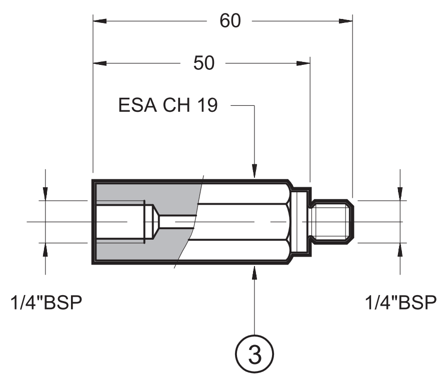
5 - INSTALLATION

The valves up to size 63 can be mounted in any position. For the larger sizes (ND 80, ND 100 and ND 125) is required the vertical mounting.

6 - OVERALL DIMENSIONS

dimensions in mm



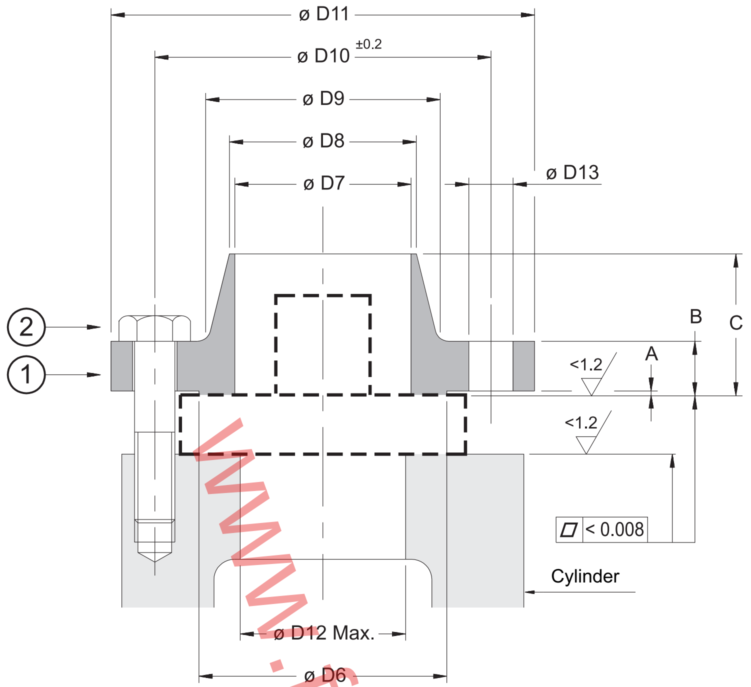


A	Inlet port (tank side)
B	Cylinder side
P	Pressure port
X	Pilot pressure port
1	Seals (see table)
2	Pre-opening device (option /P)
3	Extension for piloting port, including bonded seal - to be ordered separately code 3406400001

	D1 [mm]	D2 [mm]	D3 [mm]	D4 [mm]	D5 [mm]	H1 [mm]	H2 [mm]	H3 [mm]	B	P	X	1 KANTSEAL
CFP-S032	93	32	43	43	32	55	27	8,2	60°	1/4" BSP	1/4" BSP	DKAR00227 (53.57 x 3.40 x 3.40)
CFP-S040	108	39	58	58	41,5	60	28	8,9	45°			DKAR00231 (66.27 x 3.40 x 3.40)
CFP-S050	128	45	73	73	53	72	29	12,9	45°			DKAR00236 (82.14 x 3.40 x 3.40)
CFP-S063	143	50	87	87	63	83	34	13,4	45°			DKAR00343 (94.62 x 5.16 x 5.16)
CFP-S080	169	56	107	107	80	98	38,5	17,8	45°			DKAR00350 (116.84 x 5.16 x 5.16)
CFP-S100	212	70	130	130	100	118	44	23,4	45°	3/8" BSP		DKAR00433 (139.07 x 6.73 x 6.73)
CFP-S125	248	88	151	168	127	154	51	27,4	-			DKAR00442 (183.52 x 6.73 x 6.73)

7 - CONNECTION FLANGE - INSTALLATION AND DIMENSIONS

dimensions in mm



Recommended building material: C22

	(1) Suggested dimensions for connection flange (see **NOTE 2**)											Max pressure on port B [bar]	**(2)**		
	D6 [mm]	D7 [mm]	D8 [mm] **NOTE 1**	D9 [mm]	D10 [mm]	D11 [mm]	D12 [mm]	D13 [mm]	A [mm]	B [mm]	C [mm]		Fastening bolts (type A10.9)	Q.ty	Tightening torque [Nm]
CFP-S032	88	42	48,3	88	110	150	46	18	3	22	45	350	M16	4	285
CFP-S040	102	53	60,3	102	125	165	58	18	3	29	62		M16	4	285
CFP-S050	122	69	76,1	122	145	185	71	18	3	34	68		M16	8	285
CFP-S063	138	82	88,9	138	160	200	86	18	3	43	72		M16	8	285
CFP-S080	162	107	114,3	162	190	235	108	22	3	51	78		M20	8	560
CFP-S100	188	131	139,7	188	240	295	132	29	3	62	105		M27	8	1400
CFP-S125	218	160	168,3	218	280	345	170	32	3	79	115		M30	8	1900

NOTE 1: Calculated diameters for PN 16 - DIN 2448 steel pipes

NOTE 2: For application with standard connection flange type UNI2284 - UNI2285 - UNI2286, special bushings to fit on fastening bolts must be provided in order to ensure a correct valve mounting.

For information about the installation with UNI connector flange, please consult our technical department.

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LOGIC ELEMENTS

LC* CARTRIDGE VALVES ISO 7368 - DIN 24342

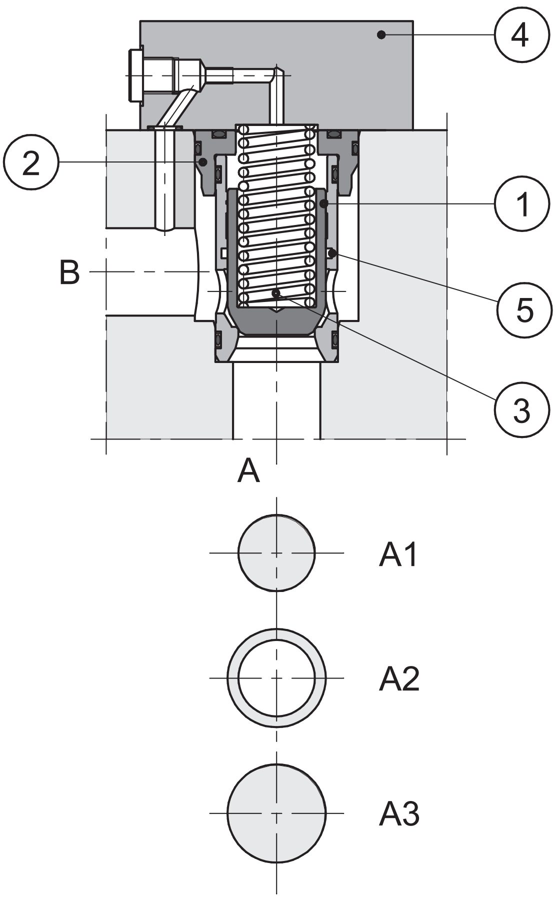
LP* COVERS

LCM* MONITORED LOGIC EL.

ND 16 - 25 - 32 - 40 - 50 - 63

p max **420** bar
Q max (see table of performances)

OPERATING PRINCIPLE



— Logic elements are cartridge valves suitable for installation in blocks or manifolds. They are available in five different sizes: ND 16 - 25 - 32 - 40 - 50 - 63.

— They are designed to perform complex hydraulic circuits, using functional compact blocks, with high flow rates and low pressure drops.

— They are made of a cartridge valve with ISO7368 / DIN 24342 cavity bore and a control cover (4). The cover includes the cartridge valves pilot lines; some versions are designed for the installation of ISO 4401-03 (CETOP 03) valves, to realise different control functions (see paragraph 8 for diagrams and function descriptions). A low leakage version, obtained inserting a seal into the seat no. 5, is also available.

— The cartridge valves are composed of a jacket (2), a poppet (1), and a closing spring (3). The poppet can either be standard (S) or with a damping nose (D), suitable for a smooth flow control during the valve opening and closing phases.

— Two types of cartridge valves are available:

- **Q** type: used for flow and directional control and as a check valve.
  The areas involved are:
  A1 - corresponding to the seat diameter area, considered as reference area = 1
  A3 - corresponding to the jacket internal diameter area.
  A2 - corresponding to the difference between A3 - A1
  The area ratio A1/A3 is 1/1,66.

The valve opens when the pressure acting either on area A1(flow from A to B) or on area A2 (flow from B to A) is higher than the pressure acting on area A3 (added to the spring load value).

- **P** type: used for pressure control.
  In this case the areas A1 and A3 are equivalent (area ratio 1:1) and the valve enables the flow direction from A to B only.

— **LCM*** are monitored logic elements used for directional control, piloting and as a check valve. They are certified by TÜV. Available sizes are DN 16, 25, 32,40 and 50.

1 - IDENTIFICATION CODE FOR CARTRIDGE VALVES

L	C		-			/		N	/	

Cartridge valve (L C)

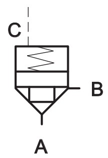
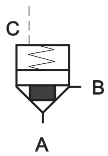
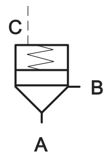
Shutter type:
(area ratio A1 / A3):
QS = flow rate control (1:1,66)
QD = flow rate control with damping nose (1:1,66)
PS = pressure control (1:1)

Nominal cracking pressure on section A1:
Verify the versions availability in the table below. Other cracking pressure values are available on request.
0.5 = 0,5 bar
1 = 1 bar
2 = 2 bar
4 = 4 bar

20 - for ND 16, 25, 32, 40 and 50
21 - for ND 63
(the overall and mounting dimensions remain unchanged from 20 to 29)

Seals:
NBR seals for mineral oil

LL = Low leakage version,with seal between C and B.
Not available for QS0.5 and LC16-PS*
Omit if not required.

AVAILABLE NOMINAL SIZES						VERSIONS	SYMBOL
16 ND16	**25** ND25	**32** ND32	**40** ND40	**50** ND50	**63** ND63		
x	x	x	x	x		**QS0.5**	
x	x	x	x	x	x	**QS2**	
x	x	x	x	x		**QD4**	
					x	**PS1**	
x	x	x	x	x		**PS2**	

2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

3 - TECHNICAL CHARACTERISTICS (cartridge valve with control cover)

Max operating pressure LC cartridge valve	bar	420
Max operating pressure limit of cover type DP*, DPE*, DF1, DF2, LCM	bar	350
Max operating pressure with distributor installed on cover	See technical characteristics of the distributor	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25

3.1 - Cartridge valves type Q performances (flow control function)

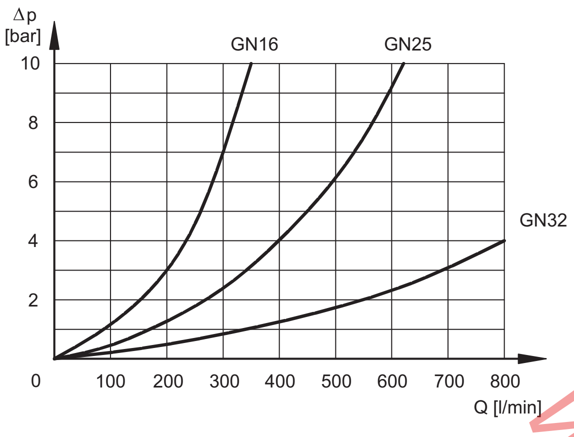
				NOMINAL SIZE					
				16	25	32	40	50	63
Area A1			cm^2	1,54	3	6	8,76	14,8	24,6
Area A2			cm^2	1	2	4	5,76	9,7	16,1
Area A3			cm^2	2,54	4,9	10	14,3	24,3	40,7
Version S:	opening stroke h		cm	0,8	1	1,25	1,6	1,8	2,3
	opening volume		cm^3	2,03	4,9	12,5	22,88	43,74	96,26
	max recommended flow		l/min	250	500	900	1300	2000	3000
Version D:	opening stroke h		cm	0,8	1,15	1,5	1,8	2,2	2,7
	opening volume		cm^3	2,03	5,63	15	25,74	53,46	110
	max recommended flow		l/min	200	450	800	1100	1700	2700
Cracking pressure	A→B	spring 0,5	bar	0,5	0,5	0,5	0,5	0,5	-
		spring 2		2	2	2	2	2	2
		spring 4		4	4	4	4	4	-
	B→A	spring 0,5		0,9	1,1	0,7	0,76	0,8	-
		spring 2		3,1	3	3,1	3	3,2	3,2
		spring 4		6,15	5,9	5,4	5,9	5,9	-
Mass			Kg	0,25	0,5	1,1	1,9	3,9	7,8

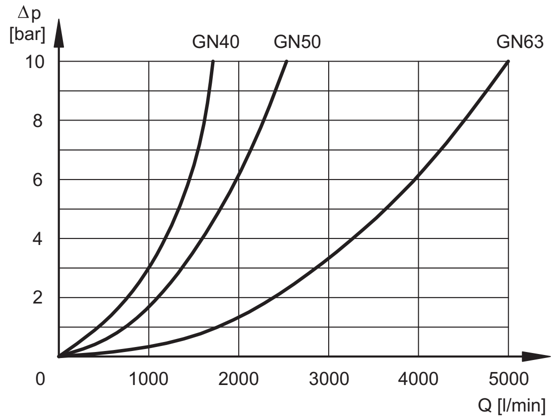
3.2 - Cartridge valves type P performances (pressure control function)

				NOMINAL SIZE					
				16	25	32	40	50	63
Area A1 = Area A3			cm^2	2,54	4,9	10	14,4	24,3	40,7
Version S:	max recommended flow		l/min	200	400	900	1000	1500	2500
Cracking pressure		spring 1	bar	-	-	-	-	-	1
		spring 2		2	2	2	2	2	-
Mass			Kg	0,25	0,5	1,1	1,9	3,9	7,8

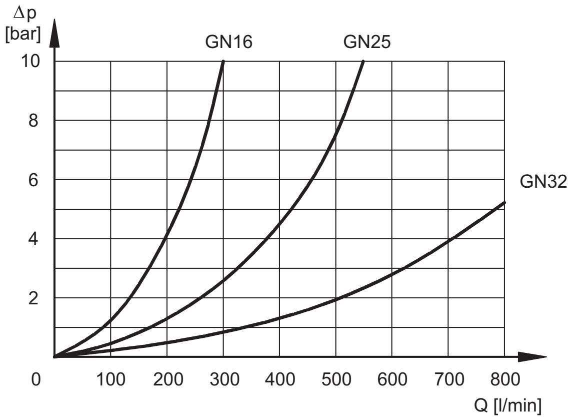
4 - CHARACTERISTIC CURVES (values obtained with viscosity 36 cSt at 50°C)

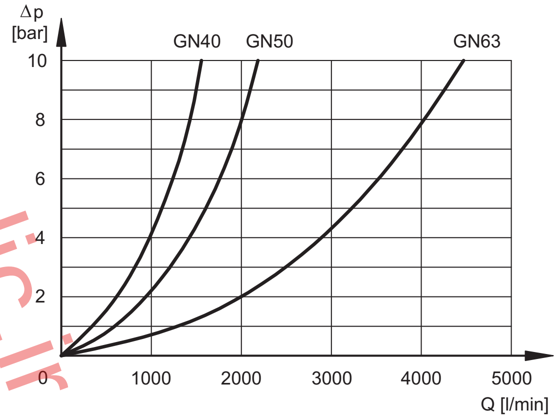
4.1 - LC*-QS flow control function and LC*-PS pressure control function



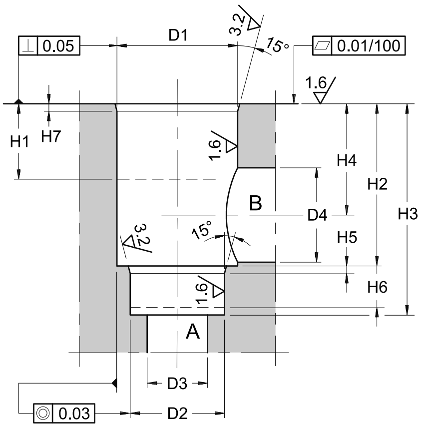


4.2 - Flow control function with damping nose LC*-QD



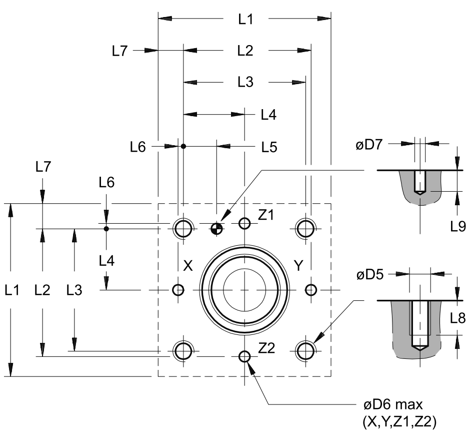


5 - LC CARTRIDGE VALVES SEAT DIMENSIONS ACCORDING TO ISO 7368 / DIN 24342



	LC CARTRIDGE VALVES NOMINAL SIZE					
	16	**25**	**32**	**40**	**50**	**63**
ØD1 ^{H7}	32	45	60	75	90	120
ØD2 ^{H7}	25	34	45	55	68	90
ØD3 max	16	25	32	40	50	63
ØD4	16	25	32	40	50	63
ØD4 max	25	32	40	50	63	80
H1 min	20	30	30	30	35	40
H2 ± 0,1	43	58	70	87	100	130
H3 $^{+0,1}_{0}$	56	72	85	105	122	155
H4 referred to diameter ØD4	34	44	52	64	72	95
H4 referred to diameter ØD4 max	29,5	40,5	48	59	65,5	86,5
H5	2	2,5	2,5	3	3	4
H6 min	11	12	13	15	17	20
H7	2	2,5	2,5	3	4	4

6 - LP CONTROL COVERS INTERFACE DIMENSIONS ACCORDING TO ISO 7368 / DIN 24342



	LP CONTROL COVERS NOMINAL SIZE					
	16	**25**	**32**	**40**	**50**	**63**
ØD5	M8	M12	M16	M20	M20	M30
ØD6 max	4	6	8	10	10	12
ØD7 ^{H13}	4	6	6	6	8	8
L1	*	85	102	125	140	180
L2 ± 0,1	48	62	76	92,5	108	137,5
L3 ± 0,1	46	58	70	85	100	125
L4 ± 0,1	23	29	35	42,5	50	62,5
L5 ± 0,1	12,5	13	18	19,5	20	24,5
L6 ± 0,1	2	4	6	7,5	8	12,5
L7	*	13,5	16	20	20	27,5
L8 min	15	20	28	35	35	52
L9 min	8	8	8	8	8	8

* = cover with special dimensions (see par. 9.2 ÷ 9.7)

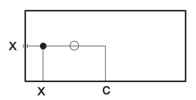
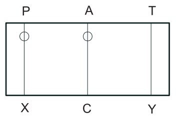
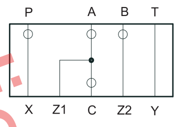
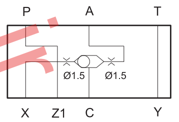
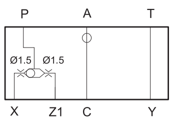
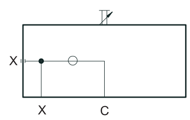
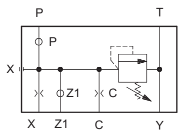
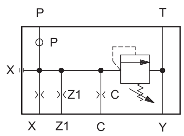
7 - COVERS IDENTIFICATION CODE

L	P			/	20	N

Cartridge valve cover two-way type LC

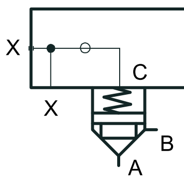
Seals: NBR seals for mineral oil

(the overall and mounting dimensions remain unchanged from 20 to 29)

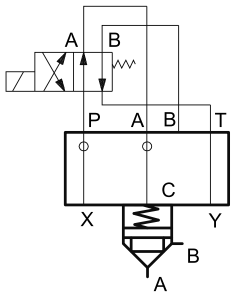
AVAILABLE NOMINAL SIZES						COVER NAME	SYMBOL	DIAGRAM PARAGRAPH	OVERALL DIMENSIONS PARAGRAPH
16 ND16	**25** ND25	**32** ND32	**40** ND40	**50** ND50	**63** ND63				
x	x	x			x	**R**		8.1	9.1
x	x	x	x	x	x	**D**		8.2	9.2
x	x	x	x			**DZ**		8.3	9.3
x	x	x	x	x		**DF1**		8.4	9.4
x	x	x	x			**DF2**		8.5	9.5
x	x	x	x	x	x	**Q**		8.6	9.6
x	x	x	x	x	x	**DP***		8.7	9.7
x	x	x	x	x		**DPE***		8.8	9.7

8 - FUNCTIONAL DIAGRAMS

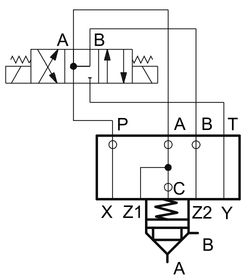
8.1 - R cover for directional control and check valve function with external pilot X

Functional diagrams	Description
	Piloting of the cartridge valve through the X port, available on the mounting surface or with pipe connection 1/4" BSP. For ND 40 and ND 50 sizes, the external piloting function can be realised by using control cover type D, with blanking plate code **1950751** (to be ordered separately).

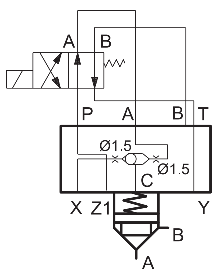
8.2 - D cover for directional control and check valve function

Functional diagrams	Description
	Piloting of the cartridge valve by means of solenoid valve type **DS3-TA** (to be ordered separately - see catalogue 41 150) - solenoid valve OFF = A ↔ B intercepted flow - solenoid valve ON = A ↔ B free flow

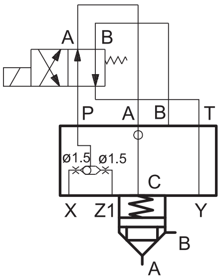
8.3 - DZ cover for directional control with possibility to pilot other cartridges in line

Functional diagrams	Description
	The DZ cover enables the piloting of its cartridge valves and also of other valves connected to Z1 and Z2 pilot lines. The solenoid valve type **DS3-S10** must be ordered separately (see catalogue 41 150).

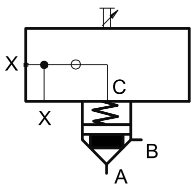
8.4 - DF1 cover for directional control and check function with double pilot line

Functional diagrams	Description
	The DF1 cover gives the possibility of a double pilot line through X and Z1 ports. The solenoid valve type **DS3-TA** must be ordered separately (see catalogue 41 150). - solenoid valve OFF = A↔B intercepted flow - solenoid valve ON = A → B free flow , B → A intercepted (if pilot line X is connected with B and if Z1 is connected with A).

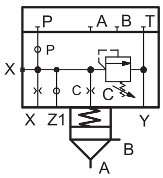
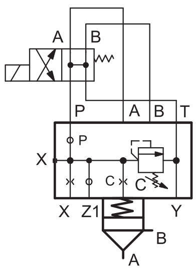
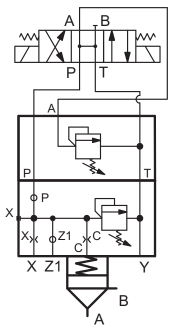
8.5 - DF2 cover for directional control and check function with priority piloting from two external lines

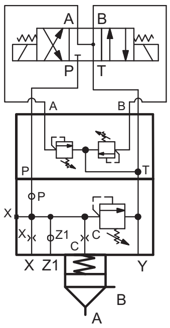
Functional diagrams	Description
	The cartridge valve can be simultaneously piloted from X and Z1 lines. The shuttle valve, integrated in the cover, enables the automatic selection of the pilot line which has the higher pressure (priority line). The solenoid valve type **DS3-TA** must be ordered separately (see catalogue 41 150). - solenoid valve OFF = A ↔ B intercepted flow - solenoid valve ON = A ↔ B free flow

8.6 - Q cover for flow control function

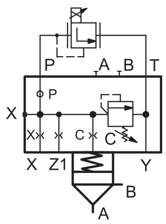
Functional diagrams	Description
	Flow control function by means of cover with stroke limiter. For a better flow control and to avoid the wear of the valve seat, this cover is normally used with a QD4 cartridge type.

8.7 - DP* cover for pressure control function

Functional diagrams	Description
	Pressure control function with a built-in relief valve. - max. adjustment pressure **DP4** = 140 bar - **DP6** = 350 bar The top blanking plate code 1950591 must be ordered separately.
	Pressure control function with electrical unloading by means of **DS3-SA2** solenoid valve (to be ordered separately - see catalogue 41 150). - solenoid valve OFF = unloading at minimum pressure - solenoid valve ON = pressure controlled by the built-in relief valve.
	Pressure control function with electrical unloading and two step pressure by means of the solenoid valves **DS3-S2** (to be ordered separately - see catalogue 41 150), **MCI*-SAT/10** (for 16, 25 and 32 sizes - to be ordered separately) and **MCD*-SAT** (for 40, 50 and 63 sizes to be ordered separately - see catalogue 61 200) - solenoid valve OFF = unloading at minimum pressure - solenoid valve ON side a = pressure controlled by the relief valve integrated in the cover - solenoid valve ON side b = pressure controlled by the relief valve (**MCI*** or **MCD***)

	Pressure control function with electrical control and three steps pressure by means of the solenoid valves **DS3-S3** (to be ordered separately - see catalogue 41 150), **MCI*-DT/10** (for 16 - 25 and 32 sizes - to be ordered separately) and **MCD*-DT/51** (for 40 and 50 sizes - to be ordered separately - see catalogue 61 200) - solenoid valve OFF = pressure controlled by the cover relief valve. - solenoid valve ON side a = pressure controlled by the relief valve on side b. - solenoid valve ON side b = pressure controlled by the relief valve on side a.

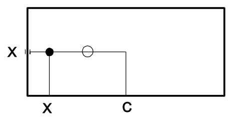
8.8 - DPE* cover for pressure control function

Functional diagram	Description
	Pressure control function by means of **PRED3** proportional valve (to be ordered separately see catalogue 81 210). - max. adjustment pressure **DPE4** = 140 bar - **DPE6** = 350 bar - proportional valve OFF = unloading at minimum pressure - proportional valve ON = proportional control of pressure

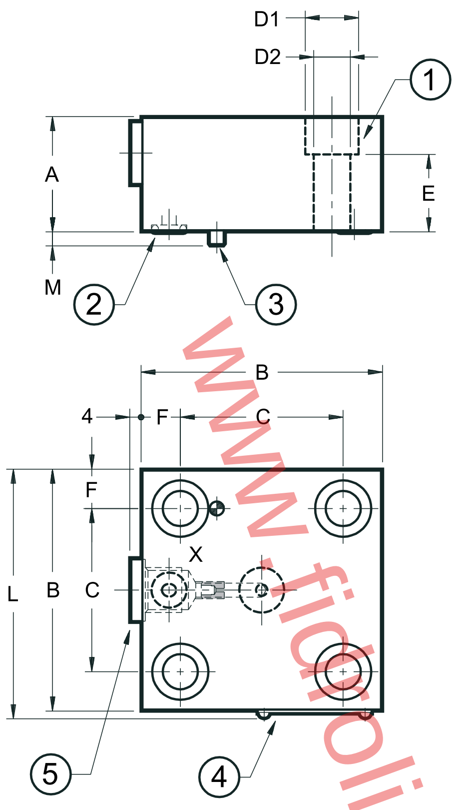
9 - OVERALL AND MOUNTING DIMENSIONS FOR CONTROL COVERS

9.1 - R type covers

dimensions in mm



LP16R
LP25R
LP32R
LP63R



	NOMINAL SIZE			
	16	**25**	**32**	**63**
A	30	30	40	70
B	65	85	102	180
C	46	58	70	125
D1	13,5	19	25	46
D2	8,5	13	17	31
E	19	17	22	35
F	9,5	13,5	16	27,5
L	67,5	87,5	104,5	182,5
M	4	5	5	5

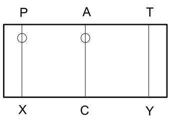
ports ready for restrictors	port X			
restrictors	M6x8			M10x10
Mass [Kg]	1,20	2,30	4,00	17,5

1	N. 4 fastening bolts (**NOTE**): **16** = M8x30 **25** = M12x35 **32** = M16x45 **63** = M30x80
2	N. 1 sealing ring 90 Shore: **16** = OR type 2025 (6.07x1.78) **25** = OR type 2037 (9.25x1.78) **32** = OR type 2043 (10.82x1.78) **63** = OR type 3062 (15.54x2.62)
3	Locating pin: **16** = Ø3x10 **25** = Ø5x14 **32** = Ø5x14 **63** = Ø6x14
4	Identification label
5	Plug X: 1/4” BSP

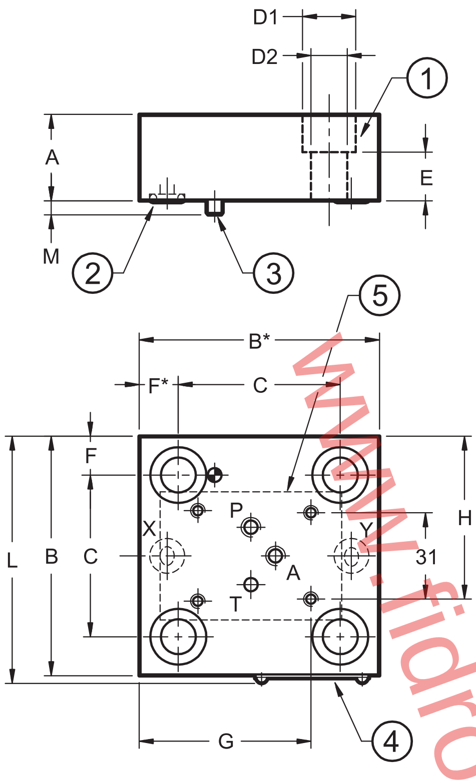
NOTE: Fastening bolts class 10.9 ISO 4762 are recommended for the installation of the cover (to be ordered separately)

9.2 - Covers type D

dimensions in mm



LP16D
LP25D
LP32D
LP40D
LP50D
LP63D



	NOMINAL SIZE					
	16	**25**	**32**	**40**	**50**	**63**
A	30	30	40	40	50	70
B	65	85	102	125	140	180
B*	75	85	102	125	140	180
C	46	58	70	85	100	125
D1	13,5	19	25	31	31	46
D2	8,9	13	17	21	21	31
E	19	17	22	30	30	35
F	9,5	13,5	16	20	20	27,5
F*	19,5	13,5	16	20	20	27,5
G	52	60,2	68.7	73,2	82,7	111,5
H	48	58	66.5	78	85,5	105,5
L	67,5	87,5	104.5	127,5	142,5	182,5
M	4	5	5	5	5	7

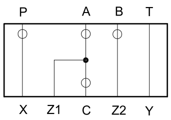
ports ready for restrictors	P, A					
restrictors	M6x8					M8x8
Mass [Kg]	1,20	2,30	4,00	4,80	7,6	17,5

1	N. 4 fastening bolts (**NOTE**): **16** = M8x30 **25** = M12x35 **32** = M16x45 **40** = M20x50 **50** = M20x60 **63** = M30x80
2	n° 2 sealing rings 90 Shore : **16** = OR type 2025 (6.07x1.78) **25** = OR type 2037 (9.25x1.78) **32** = OR type 2043 (10.82x1.78) **40** = OR type 2050 (12.42x1.78) **50** = OR type 2050 (12.42x1.78) **63** = OR type 3062 (15.54x2.62)
3	Locating pin: **16** = Ø3x10 **25** = Ø5x14 **32** = Ø5x14 **40** = Ø5x14 **50** = Ø6x14 **63** = Ø6x14
4	Identification label
5	Mounting surface ISO 4401-03 (CETOP 4.2-4-03-350)

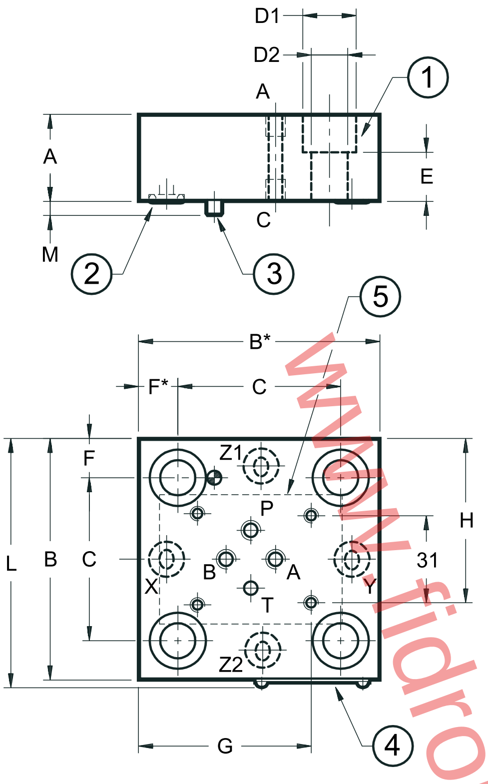
NOTE: Fastening bolts class 10.9 ISO 4762 are recommended for the installation of the cover (to be ordered separately)

9.3 - Covers type DZ

dimensions in mm



LP16DZ
LP25DZ
LP32DZ
LP40DZ



	NOMINAL SIZE			
	16	**25**	**32**	**40**
A	30	30	40	50
B	65	85	102	125
B*	75	85	102	125
C	46	58	70	85
D1	13,5	19	25	31
D2	8,9	13	17	21
E	19	17	22	30
F	9,5	13,5	16	20
F*	19,5	13,5	16	20
G	52	60,2	66.2	84
H	48	58	66.5	78
L	67,5	87,5	104.5	127,5
M	4	5	5	5

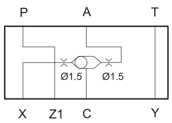
ports ready for restrictors M6x8	P, A, B, C			
Mass [Kg]	1,2	2,3	2,8	4,3

1	N. 4 fastening bolts (**NOTE**): **16** = M8x30 **25** = M12x35 **32** = M16x45 **40** = M20x50
2	n° 4 sealing rings 90 Shore : **16** = OR type 2025 (6.07x1.78) **25** = OR type 2037 (9.25x1.78) **32** = OR type 2043 (10.82x1.78) **40** = OR type 2050 (12.42x1.78)
3	Locating pin: **16** = Ø3x10 **25** = Ø5x14 **32** = Ø5x14 **40** = Ø5x14
4	Identification label
5	Mounting surface ISO 4401-03 (CETOP 4.2-4-03-350)

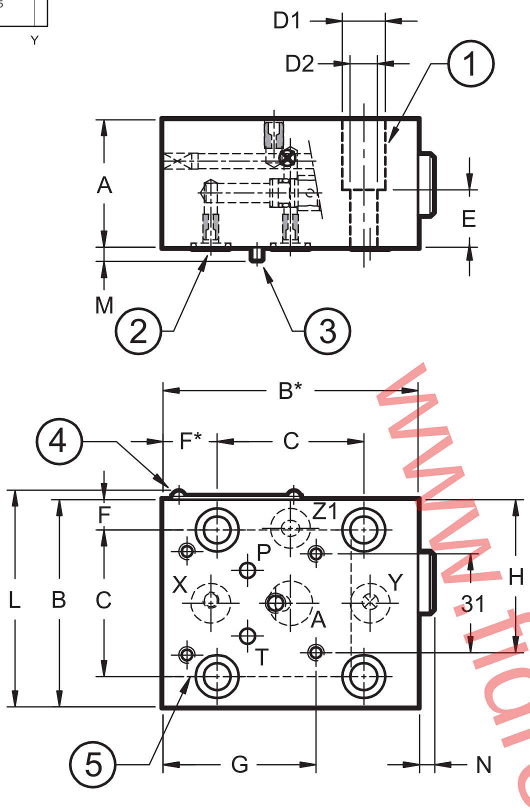
NOTE: Fastening bolts class 10.9 ISO 4762 are recommended for the installation of the cover (to be ordered separately)

9.4 - Covers type DF1

dimensions in mm

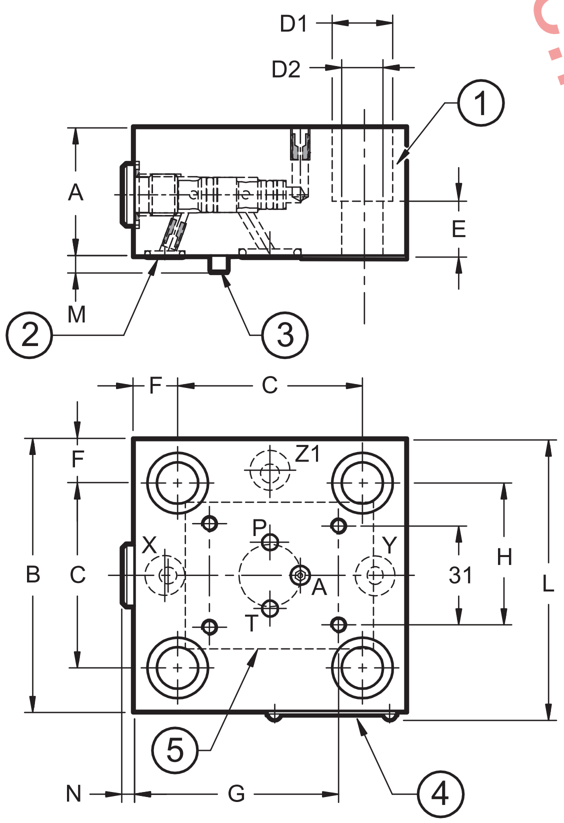


LP16DF1



	NOMINAL SIZE				
	16	**25**	**32**	**40**	**50**
A	40	40	40	50	50
B*	80	85	102	125	140
B	65	85	102	125	140
C	46	58	70	85	100
D1	13,5	19	25	31	31
D2	8,5	13	17	21	21
E	18	17	22	30	30
F*	17	13,5	16	20	20
F	9,5	13,5	16	20	20
G	47,5	64	72,5	84	91,5
H	48	58	66,5	78	85,5
L	67,5	87,5	104,5	127,5	142,5
M	4	5	5	5	5
N	4,5	3,5	3,5	-	-
Mass [Kg]	1,8	2,3	3	6,7	7,6

LP25DF1
LP32DF1
LP40DF1
LP50DF1

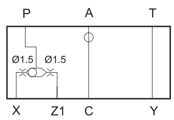


1	N. 4 fastening bolts (**NOTE**): **16** = M8x30 **25** = M12x35 **32** = M16x45 **40** = M20x60 **50** = M20x60
2	N° 3 sealing rings 90 Shore : **16** = OR type 2037 (9.25x1.78) **25** = OR type 2037 (9.25x1.78) **32** = OR type 2043 (10.82x1.78) **40** = OR type 2050 (12.42x1.78) **50** = OR type 2050 (12.42x1.78)
3	Locating pin **16** = Ø3x10 **40** = Ø5x14 **25** = Ø5x14 **50** = Ø6x14 **32** = Ø5x14
4	Identification label
5	Mounting surface ISO 4401-03 (CETOP 4.2-4-03-350)

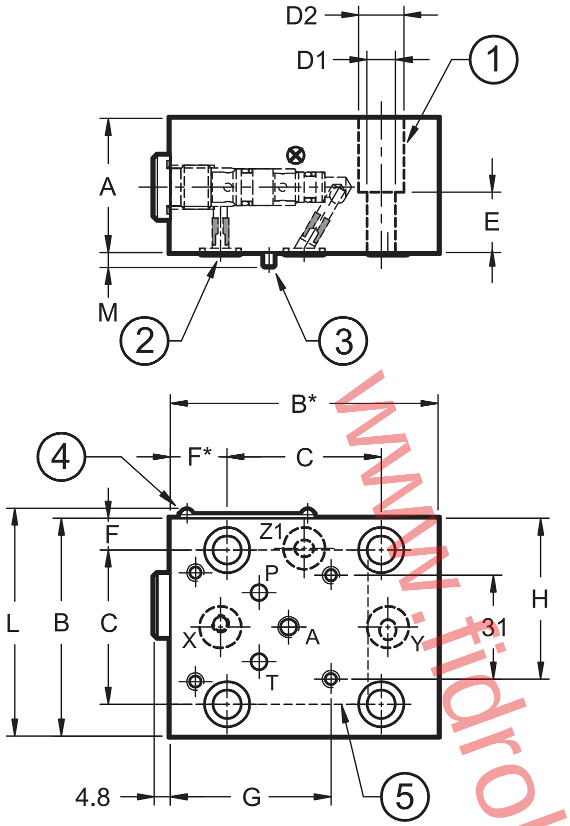
NOTE: Fastening bolts class 10.9 ISO 4762 are recommended for the installation of the cover (to be ordered separately)

9.5 - Covers type DF2

dimensions in mm



LP16DF2
LP25DF2
LP32DF2
LP40DF2



	NOMINAL SIZE			
	16	**25**	**32**	**40**
A	40	40	40	50
B	65	85	102	125
B*	80	85	102	125
C	46	58	70	85
D1	13,5	19	25	31
D2	8,5	13	17	21
E	18	17	22	30
F	9,5	13,5	16	20
F*	17	13,5	16	20
G	48	61	68,7	81
H	48	58	71.2	73
L	67,5	87,5	104.5	127.5
M	4	5	5	5

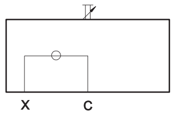
ports ready for restrictors M6x8	A			
Mass [Kg]	1,8	2,3	3	6,7

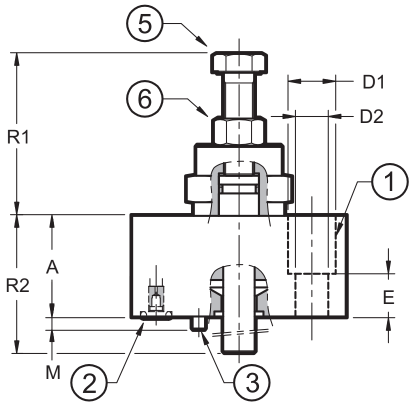
1	N. 4 fastening bolts (**NOTE**): **16** = M8x30 **25** = M12x35 **32** = M16x45 **40** = M20x60
2	N° 3 sealing rings 90 Shore: **16**, **25** = OR type 2037 (9.25x1.78) **32** = OR type 2043 (10.82x1.78) **40** = OR type 2050 (12.42x1.78)
3	Locating pin **16** = Ø3x10 **32** = Ø5x14 **25** = Ø5x14 **40** = Ø5x14
4	Identification label
5	Mounting surface ISO 4401-03 (CETOP 4.2-4-03-350)

NOTE: Fastening bolts class 10.9 ISO 4762 are recommended for the installation of the cover (to be ordered separately)

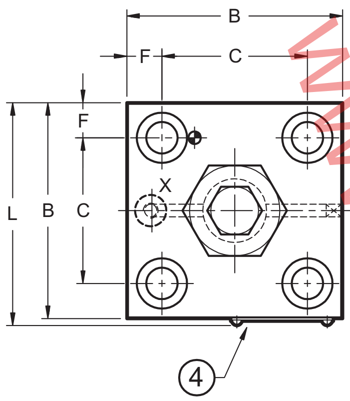
9.6 - Covers type Q

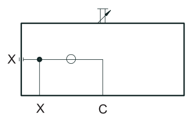
dimensions in mm

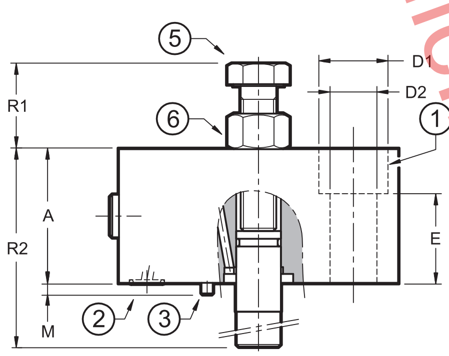




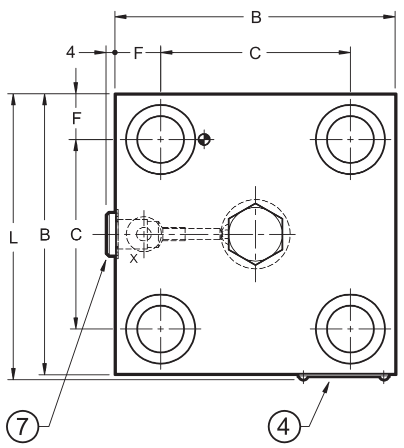
LP16Q
LP25Q
LP32Q







LP40Q
LP50Q
LP63Q



	NOMINAL SIZE					
	16	25	32	40	50	63
A	35	40	40	60	60	80
B	65	85	102	125	140	180
C	46	58	70	85	100	125
D1	13,5	19	25	31	31	46
D2	8,5	13	17	21	21	31
E	18	17	22	30	30	45
F	9,5	13,5	16	20	20	27,5
L	67,5	87,5	104,5	127,5	142,5	182,5
M	4	5	5	5	5	5
R1	55,5 ÷ 63,5	62,5 ÷ 74	58,5 ÷ 73,5	38,5 ÷ 57	44,5 ÷ 66,5	52 ÷ 81
R2	45÷ 51,5	45÷ 51,5	45÷ 51,5	44 ÷ 52	44 ÷ 52	165 ÷ 194

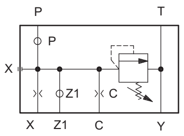
ports ready for restrictors	port X					
	M5x8	M6x8				M10x10
Mass [Kg]	1,6	3	5	8,9	11,7	18

1	N. 4 fastening bolts (**NOTE**): **16** = M8x30 **25** = M12x35 **32** = M16x35 **40** = M20x70 **50** = M20x70 **63** = M30x90
2	n° 1 sealing ring 90 Shore: **16** = OR type 2025 (6.07x1.78) **25** = OR type 2037 (9.25x1.78) **32** = OR type 2043 (10.82x1.78) **40** = OR type 2050 (12.42x1.78) **50** = OR type 2050 (12.42x1.78) **63** = OR type 3062 (15.54x2.62)
3	Locating pin: **16** = Ø3x10 **25** = Ø5x14 **32** = Ø5x14 **40** = Ø5x14 **50** = Ø6x14 **63** = Ø6x14
4	Identification label
5	Stroke limiter clockwise rotation to reduce stroke **16** = 1 turn: 1,25 mm - spanner 18 **25** = 1 turn: 1,25 mm - spanner 18 **32** = 1 turn: 1,25 mm - spanner 18 **40** = 1 turn: 2,00 mm - spanner 24 **50** = 1 turn: 2,50 mm - spanner 30 **63** = 1 turn: 2,00 mm - spanner 36
6	Locking nut: **16** = spanner 18 **25** = spanner 18 **32** = spanner 18 **40** = spanner 24 **50** = spanner 30 **63** = spanner 36
7	Plug X: **40** = 1/4" BSP **50** = 1/4" BSP **63** = 1/4" BSP

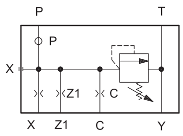
NOTE: Fastening bolts class 12.9 ISO 4762 are recommended for the installation of the cover (to be ordered separately)

9.7 - Covers type DP* and DPE*

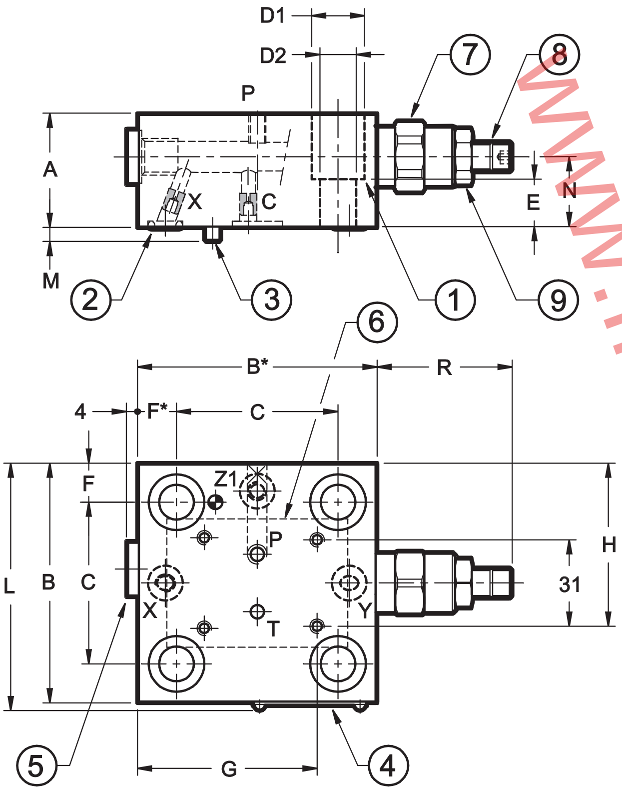
dimensions in mm



LP16DP*
LP25DP*
LP32DP*
LP40DP*
LP50DP*
LP63DP*



LP16DPE*
LP25DPE*
LP32DPE*
LP40DPE*
LP50DPE*



	NOMINAL SIZE					
	16	**25**	**32**	**40**	**50**	**63**
A	40	40	40	50	50	70
B	65	85	102	125	140	180
B*	75	85	102	125	140	180
C	46	58	70	85	100	125
D1	13,5	19	25	31	31	46
D2	8,5	13	17	21	21	31
E	18	17	22	30	30	35
F	9,5	13,5	16	20	20	27,5
F*	19,5	13,5	16	20	20	27,5
G	52	64	72,5	84	91,5	111,5
H	48	58	66,5	78	85,5	105,5
L	67,5	87,5	104,5	127,5	142,5	182,5
M	4	5	5	5	5	5
N	24	25	25	25	25	35
R	45÷ 51,5	45÷ 51,5	45÷ 51,5	44 ÷ 52	44 ÷ 52	44 ÷ 52

Mass [Kg]	1,36	2,46	4,16	7,40	10,50	17,5

DP* restrictors

	M5x6	M6x8				M8x8
X C	Ø1,2 Ø0,7	Ø1,2 Ø0,7	Ø1,2 Ø1,5	Ø2,0 Ø1,2	Ø2,0 Ø1,5	Ø2,0 Ø1,5

DPE* restrictors

	M5x6	M6x8	M6x8	M6x8	M6x8
X C Z1	Ø0,8 Ø0,6 Ø6	Ø0,7 Ø0,6 Ø6	Ø1 Ø0,8 Ø6	Ø1 Ø0,8 Ø6	Ø1 Ø0,8 Ø6

1	N. 4 fastening bolts (**NOTE**): **16** = M8x30 **25** = M12x35 **32** = M16x45 **40** = M20x50 **40** = M20x60 **63** = M30x80
2	n° 3 90 Shore sealing rings : **16** = OR type 2025 (6.07x1.78) **25** = OR type 2037 (9.25x1.78) **32** = OR type 2043 (10.82x1.78) **40** and **50** = n° 3 OR type 2050 (12.42x1.78) **63** = OR type 3062 (15.54x2.62)
3	Locating pin: **16** = Ø3x10 **25, 32** and **40** = Ø5x14 **50** and **63** = Ø6x14

4	Identification label
5	Plug X: 1/4” BSP
6	Mounting surface ISO 4401-03 (CETOP 4.2-4-03-350)
7	Pressure control valve
8	Countersunk hex adjustment screw. Clockwise rotation to increase pressure **16**, **25** and **32** = spanner 5 **40, 50** and **63** = spanner 6
9	Locking nut: **16**, **25** and **32** = spanner 17 **40, 50** and **63** = spanner 19

NOTE: Fastening bolts class 10.9 ISO 4762 are recommended for the installation of the cover (to be ordered separately)

10 - MONITORED LOGIC ELEMENTS

Monitored logic elements are made of a directional function cartridge valve and a cover with built-in inductive proximity sensor. The PNP type sensor with closed contact states the condition of A↔B intercepted flow.

The LCM* monitored logic elements were tested on a voluntary basis by TÜV and found to comply with the applicable requirements of the following standards:

- UNI EN ISO 4413:2012 - Hydraulic fluid power – General rules and safety requirements for systems and their components
- UNI EN 12622:2014 - Safety of machine tools - Hydraulic press brakes
- UNI EN 693:2001+A2:2011 - Machine tools – Safety – Hydraulic presses
- UNI EN 201:2010 - Plastics and rubber machines - Injection moulding machines - Safety requirements
- UNI EN 422:2009 - Rubber and Plastic machines – Safety requirements

Certificate: TÜV IT 14 MAC 0042

WARNING ! These valves must be installed and commissioned by qualified personnel only. Before starting any installation, commissioning or maintenance is mandatory read the *manual of use and maintenance*, delivered together with the valve.

10.1 - Identification code of monitored logic elements

L	C	M			-	Q	D	4	/	21	N	

Logic element (cartridge and cover) with closed position electric monitoring

Nominal dimension:
16 = ND 16
25 = ND 25
32 = ND 32
40 = ND 40
50 = ND 50

Cover functions (for details, see par. 10.3 and 10.4)
D = directional control and check valve function
Z = directional control and piloting of other cartridges (not available for ND 16)

Cartridge valve area ratio (A_1 / A_3) = 1:1,66

Version with damping nose

Nominal cracking pressure on section A_1 = 4 bar

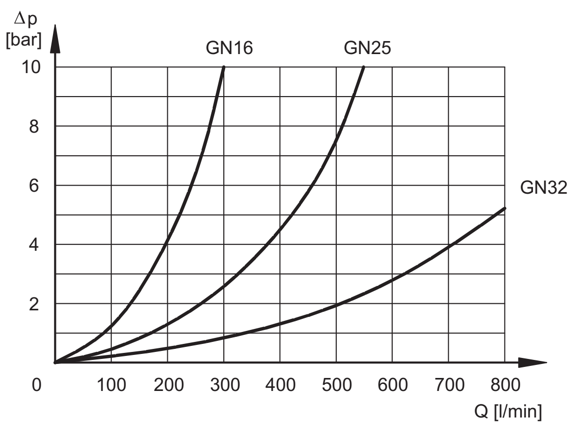
Series no.: (the overall and mounting dimensions remain unchanged from 20 to 29)

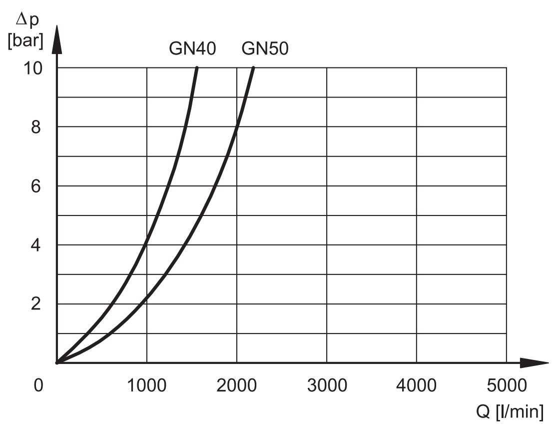
Seals: NBR seals for mineral oil

Option:
LL = Low leakage version, with seal between C and B.
Omit if not required.

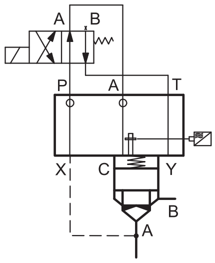
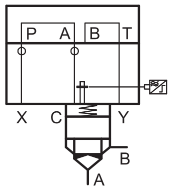
p max 350 bar

10.2 - Characteristic curves (values obtained with viscosity 36 cSt at 50°C)

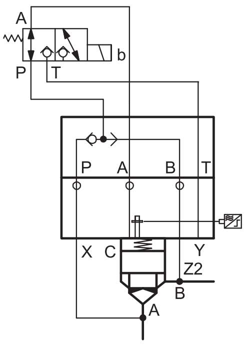
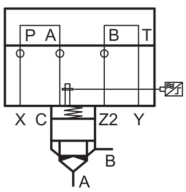




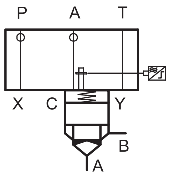
10.3 - Functional diagram of cover D for directional control and check valve function

Functional diagram	Description
	Piloting of cartridge valve by means of solenoid valve type DS3-TA (to be ordered separately - see catalogue 41 150) - solenoid valve OFF = A → B intercepted flow - solenoid valve ON = A ↔ B free flow
	Piloting of cartridge valve by means of connection plate code 1950751 to be ordered separately.

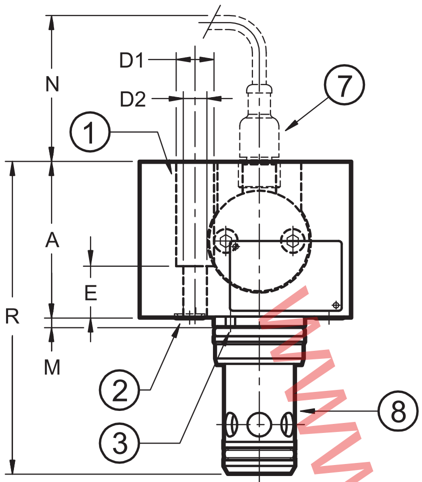
10.4 - Functional diagrams for cover Z for directional control and piloting of other cartridges

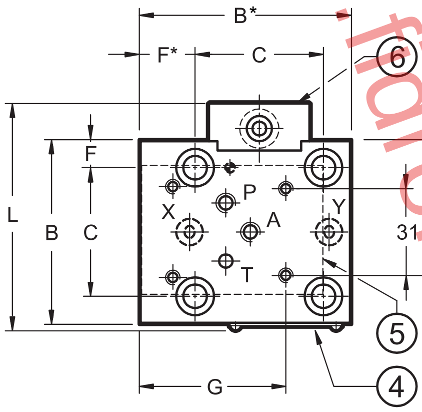
Functional diagram	Description
	Piloting of cartridge valve by means of solenoid poppet valve type **DT03-3A** (to be ordered separately - see catalogue 42 200). ISO 4401-03 manifold type **DN6** (cod.0294329 - to be ordered separately) that allows to intercept the flow from two lines, obtaining a tight or the free flow. - solenoid valve OFF = sealing tight - A ↔ B locked flow - solenoid valve ON = flow A ↔ B free flow
	Piloting of cartridge valve by means of connection plate code 1950751 to be ordered separately.

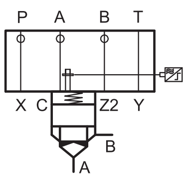
10.5 - overall and mounting dimensions of monitored logic elements



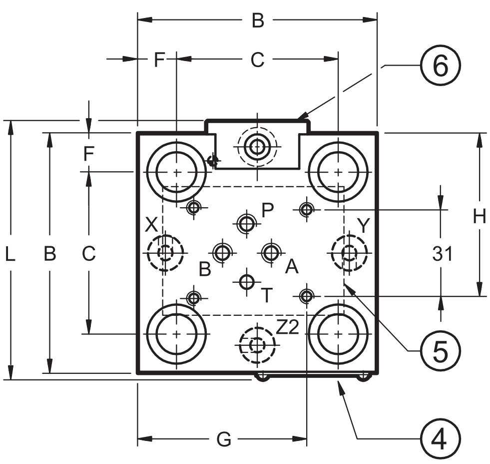
LCM16D-QD4
LCM25D-QD4
LCM32D-QD4
LCM40D-QD4
LCM50D-QD4







LCM25Z-QD4
LCM32Z-QD4
LCM40Z-QD4
LCM50Z-QD4



dimensions in mm

	NOMINAL SIZE				
	16	**25**	**32**	**40**	**50**
A	55	60	70	75	90
B	65	85	102	125	140
B*	75	-	-	-	-
C	46	58	70	85	100
D1	13,5	19	25	31	31
D2	8,5	12,5	17	21	21
E	18	17	22	30	30
F*	19,5	-	-	-	-
F	9,5	13,5	16	20	20
G	52	60,2	68,7	80,2	87,7
H	48	58	66,5	105	85,5
L	81	92	104,5	127,5	142,5
M	4	5	5	5	5
N	70	70	65	60	55
R	111	132	155	180	212

ports ready for restrictors M6x8.5	P, A B (on cover Z only)				
Mass [Kg]	2,1	3,3	5,3	9,5	14,5

1	N. 4 fastening bolts (**NOTE 1**): **16** = M8x30 **40** = M20x60 **25** = M12x35 **50** = M20x60 **32** = M16x45
2	n° 3 sealing rings 90 Shore : **16** = OR type 2025 (6.07x1.78) (for ND 16 there are only 2 OR) **25** = OR type 2037 (9.25x1.78) **32** = OR type 2043 (10.82x1.78) **40** and **50** = OR type 2050 (12.42x1.78)
3	Locating pin: **16** = Ø3x10 **40** = Ø5x14 **25** = Ø5x14 **50** = Ø6x14 **32** = Ø5x14
4	Identification label
5	Mounting surface ISO 4401-03 (CETOP 4.2-4-03-350)
6	Proximity sensor
7	Connector for proximity sensor (to be ordered separately see par. 10.6)
8	Cartridge valve always supplied with the cover

NOTE 1: standard dimensions at par. 6.

NOTE 2: fastening bolts class 10.9 ISO 4762 are recommended for cover installation (to be ordered separately)

NOTE 3: for dimensions of the cartridge valve seat see par. 5

10.6 - Technical characteristics of proximity sensor and connector

PROXIMITY SENSOR
PNP TYPE

Rated voltage	V DC	24
Power supply voltage range	V DC	10 ÷ 30
Absorbed current	mA	200
Output	normally open contact	
Electric protection	polarity inversion short circuit overvoltage	
Electric connection	with connector	
Max operating pressure	bar	350
Operating temperature range	°C	-25 / +80
Class of protection according to IEC EN 60529 standards (atmospheric agents)		IP68
Spool position LED		NO

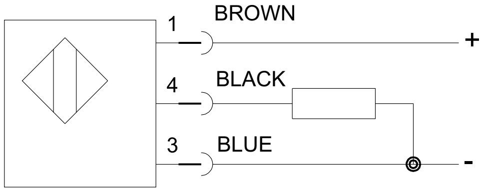
ELECTRIC CONNECTOR (to be ordered separately)
code: ECM3S / M12L / 10

Connector: pre-wired connector M12 - IP68
cable: with 3 conductors 0.34 mm² - length 5 mt
cable material: polyurethane resin (oil resistant)

GREEN LED: LED: indicates that there is power supply voltage to the connector. If the LED is off, the connector is not powered.

YELLOW LED: show the valve status:
- valve at initial position yellow led ON - green led ON
- switched valve yellow led OFF - green led ON

CONNECTION SCHEME



valve closed = closed contact (A↔B intercepted flow)
valve open = open contact (A↔B free flow)

SIGNAL STATUS
According to the safety standards rules, the position signal must change its status before the effective valve opening.

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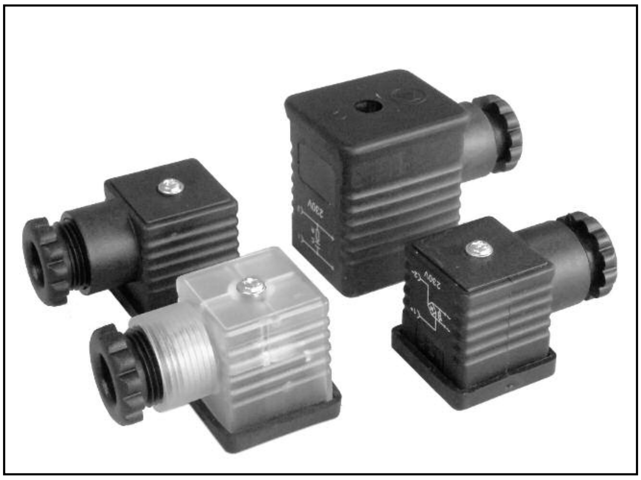
DUPLOMATIC OLEODINAMICA

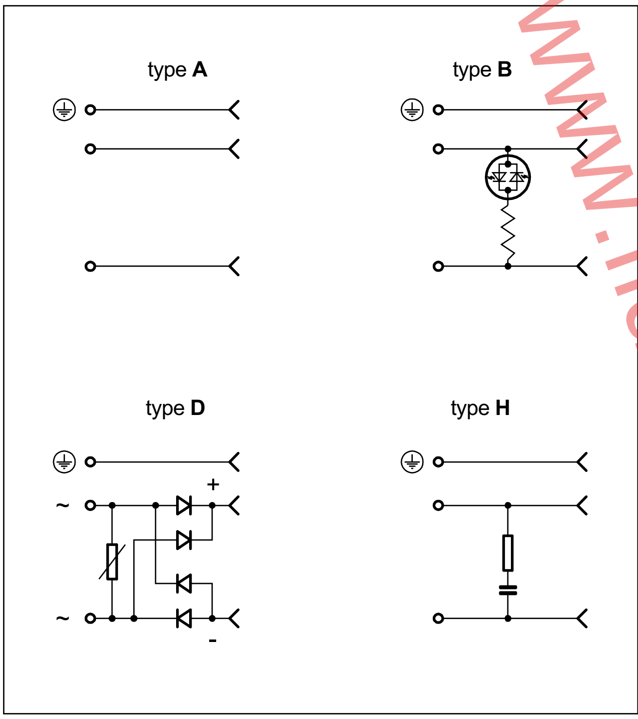
EC
ELECTRIC CONNECTORS
SERIES 10



EN 175301-803
(ex DIN 43650 / ISO 4400)

type A

ELECTRICAL DIAGRAM



DESCRIPTION

— The EC connectors, are according to EN 175301-803 form “A” and are used for the electrical connection of solenoid vaves.

— When they are correctly installed and coupled they provide protection according to IEC EN 60529 standards, class of protection IP65/67.

— The class of insulation is in compliance with IEC 60664-1 2007 specifications, with operating voltage up to 250 V, overvoltage category II, operating degree 3.

— The wire terminal block is removable from the external housing for simplifying the wire connection to the clamps, and it allow the electrical contacts to be turned through 90° (except version H) if required.

— Four different types with specific functions are available:

type **A**, connector two poles + ground
type **B***, with LED
(available voltages: 10 ÷ 50 and 70 ÷ 250V)
type **D**, with bridge rectifier
type **H**, with RC damping circuit

— Type A is also available in gray colour, to differentiate the solenoids mounted on the side “a” or “b”.

— They are supplied with M3 fixing screw and NBR gasket.

TECHNICAL CHARACTERISTICS

		type A	type B*	type D	type H
Voltage supply	V DC/AC	up to 230	10 ÷ 50 / 70 ÷ 250	up to 230	up to 230
Number of poles		2 + ground			
Current on connections: nominal maximum	A	10 16			
Contact resistance	mΩ	≤ 4			
Maximum conductor size	mm	1,5			
Cable exit		Pg9 / Pg11 unified			
Electromagnetic compatibility (EMC)		according to 2004/108/CE			
Low voltage		according to 2006/95/CE			
Protection degree		IP 65/67 - IEC 60529			
Insulation class		class C (IEC 60664-1:2007-04)			
Operating temperature	°C	-40 / +90			

1 - IDENTIFICATION CODE

E	C		/		/	10

Electric connector
EN 175301-803 (ex DIN 43650 / ISO 4400)

Connector type
A = two poles + ground
B1 = two poles + ground with led which burns when the solenoid is energized power supply voltage 10 ÷ 50 V AC/DC
B2 = two poles + ground with led which burns when the solenoid is energized power supply voltage 70 ÷ 250 V AC/DC
D = two poles + ground with Graetz bridge rectifier: for alternating current power supply source with direct current coils with current consumption max 1 ampere.
H = two poles + ground with RC damping circuit, to avoid voltage peaks as circuit opening, suitable for alternating and direct current coils.

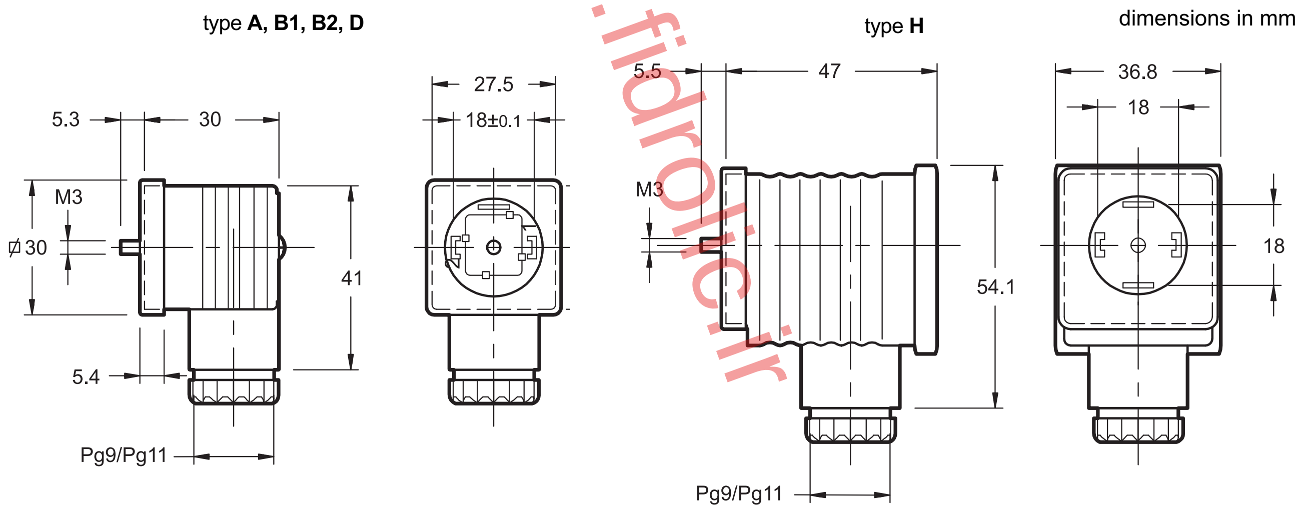
Series No.
(the overall and mounting dimensions remain unchanged from 10 to 19)

Colour:
Type A
B = black (**standard**)
A = grey
Type B
N = transparent
Types D, H
B = black

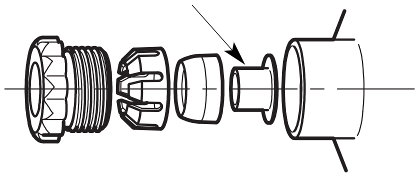
NOTE: For the connectors type A - D - H it is not necessary to specify the operating voltage, as the power supply voltage is up to 230 V.

2 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



remove this seal to obtain a PG11



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DUPLOMATIC OLEODINAMICA

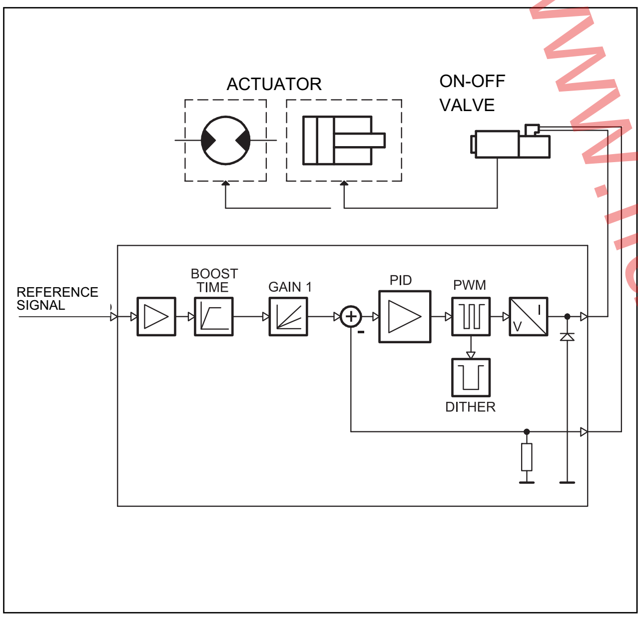
ECL

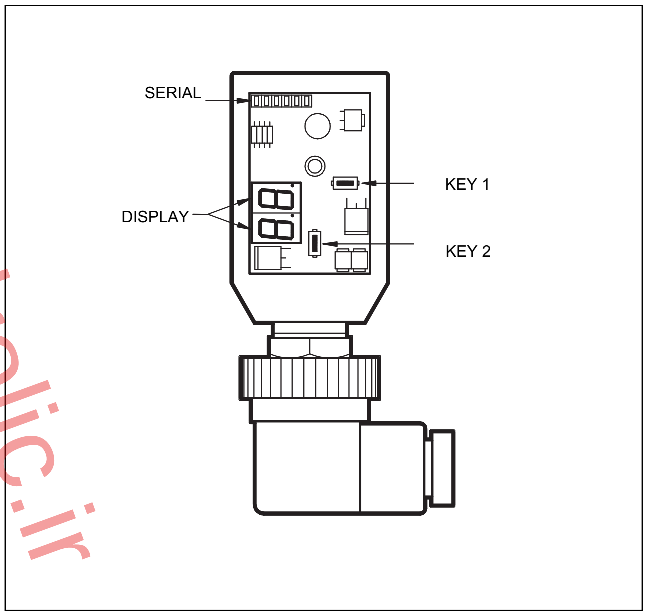
POWER SAVING DEVICE FOR ON-OFF SOLENOID VALVES

SERIES 20

PLUG VERSION

OPERATING PRINCIPLE

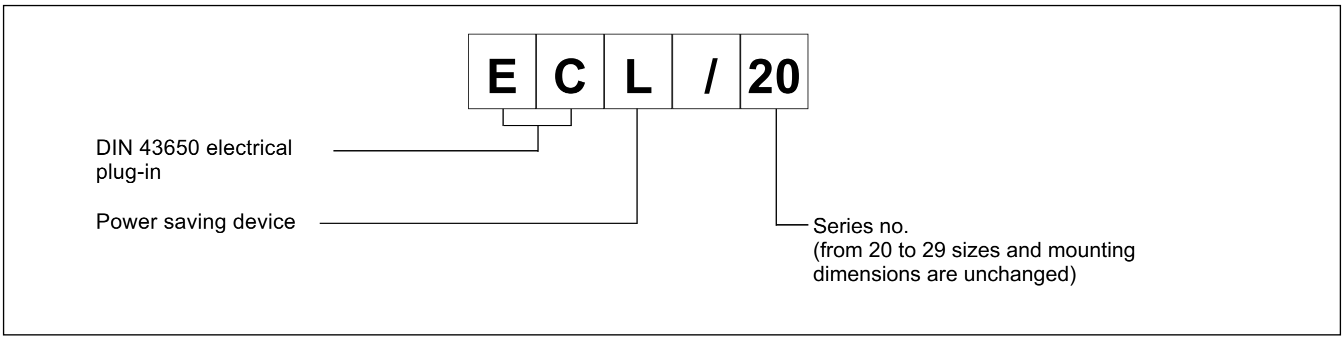




TECHNICAL CHARACTERISTICS

Power supply	V DC	8 ÷ 30 Ripple included
Max current	A	2,60
Absorbed current with valve not switched	mA	40
Current absorbed by the switching command (at 30 VDC)	mA	10 max
Full power feeding time	ms	50
Holding current regulating range	% I MAX	50 ÷ 100
Holding current default	% I MAX	40
Connector type		DIN 43650
Electromagnetic compatibility (EMC) - emissions CEI EN 61000-6-4 - immunity CEI EN 61000-6-2		according to 2004/108/CE standards (see paragraph 5 - **NOTE**)
Protection to atmospheric agents		IP 65 - 67
Operating temperature range	°C	-20 / +70
Mass	kg	0,10

1 - IDENTIFICATION CODE



The ECL connector is a digital amplifier controlling open loop on-off valves directly from PLC.

The unit supplies a set current independently from temperature variations or load impedence.

Setting is possible by buttons and display inside the case, or with a PC by RS232 with the software EDC-PC/10, (see paragraph 6.2).

2 - FUNCTIONAL SPECIFICATIONS

2.1 - Electric power supply

The connector requires a power supply of 24V DC (pin 1 and 2). The power supply voltage must be rectified and filtered, and it has not to be higher than 6A.

N.B. The value of the power supply voltage on the connector must be higher than the rated working voltage of the solenoid to be controlled.

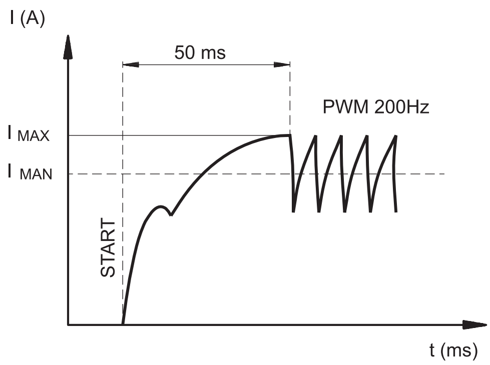
The power required by the card depends on the power supply voltage and on the maximum value of the supplied current.

2.2 - Electrical protection

The connector is protected against overvoltage and polarity inversion. On the output a protection against any short circuit is foreseen.

2.3 - Functioning

This device operates by feeding the solenoid valve at the max current value for a time sufficient to guarantee the complete valve energizing (50 ms). The current is therefore automatically reduced at holding.



IMAX = max current
IMAN = holding current

default vales: IMAN = 1A
threshold : 200 mV
freq: 200 Hz

3 - SIGNALS

3.1 - POWER ON (Power supply)

Displays indicate the connector is ON and with +24 V DC.

4 - ADJUSTMENTS

There are two way adjustments: variables view and parameters editing. The first one enables the real time monitoring of the control values, for both required and read current, on both channels. The second modality enables the operating parameters view and editing.

4.1 - Variables view

The card is switched on at the variables view modality, and it shows the first variable value, that is the C1 parameter, current solenoid.

C1: current supplied from ECL to the solenoid read on real time

U1: Threshold reference signal.
9.9 = Threshold active

4.2 - Parameters editing

To access the parameter editing, press the key (2) for at least 3 seconds.
The first parameter displayed is G1. To modify it, press the key (1) for two seconds, until the display starts blinking. Use the key (2) to increase the value and the key (1) to decrease it. To save the new value, press both the keys. The display stops blinking.
Pressing the key (2) again is possible to scroll all the parameters. To modify the other parameters, repeat the steps above-mentioned for the G1 parameter.

The variables that can be selected are:

G1: "I Max" current, expressed in milliAmpere.
It sets the maximum current to the solenoid, when the reference signal is at the maximum value. It is used to limit the maximum value of the supplied current.
Default value of Imax = 1000 mA
Range = 50 ÷ 100% of Imax

Fr: PWM frequency, in Hertz.
It sets the PWM frequency, which is the pulsating frequency of the solenoid current.
Default value = 200
Range = 100 ÷ 500 Hz

DISPLAY VIEW EXAMPLE:

REFERENCE (V)	VARIABLE (V) U1	VARIABLE C1
0	00	40. (mA)
10	10.	2.6 (A)

5 - INSTALLATION

The connector type electronic unit is suitable for direct assembly on the solenoid of the relative on-off valve. With the 4-core connector for supply and for the reference signal.

NOTE: To observe EMC requirements it's important that the control unit electrical connection is in compliance with the wiring diagram of chapter 7.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources as power wires, electrical motors, inverters and electrical switches.

In environments where there are critical electromagnetic interferences, a complete protection of the connection wires can be requested.

6 - START UP, CONTROL SETTINGS AND SIGNAL

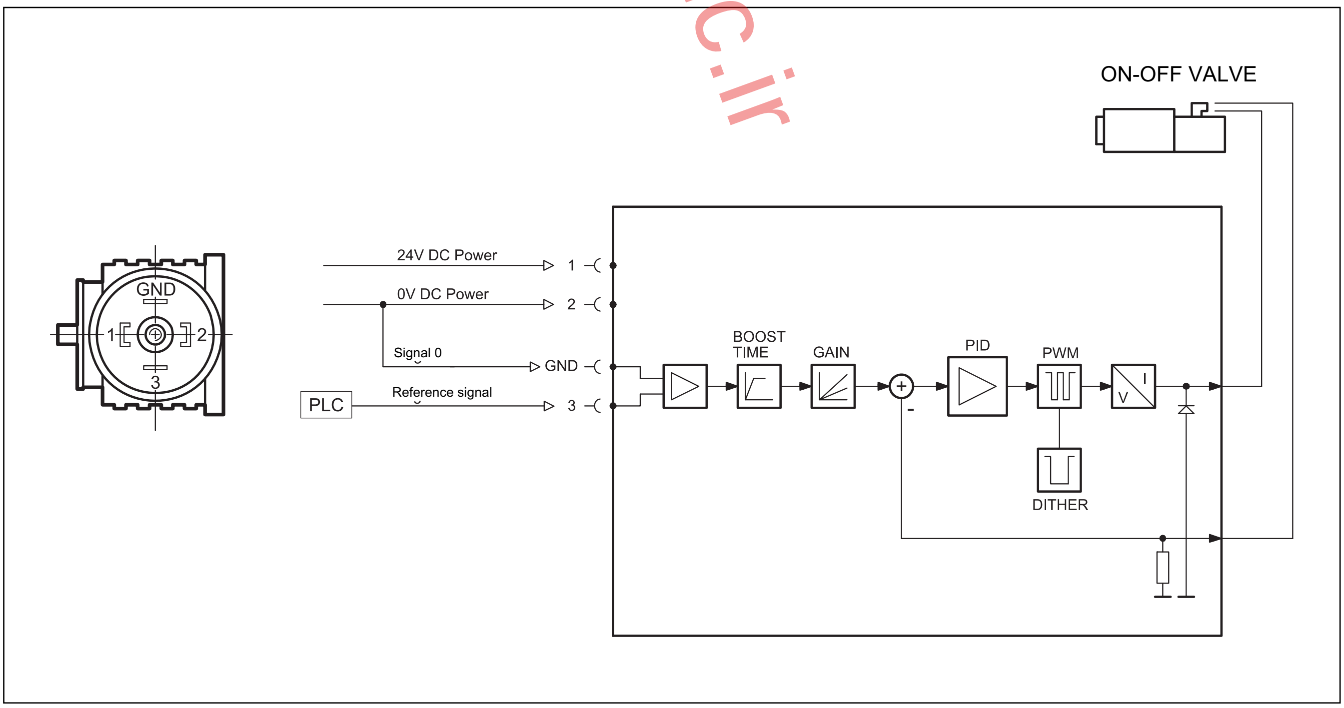
6.1 - Set up
Settings can be changed by either acting on the (1) and (2) keys located on the card front panel, or using the EDC-PC software kit.

6.2 - EDC-PC/10 Software (code 3898301001)
The relevant hardware and software kit (to be ordered separately) allows to read the values and to set the connector easily.

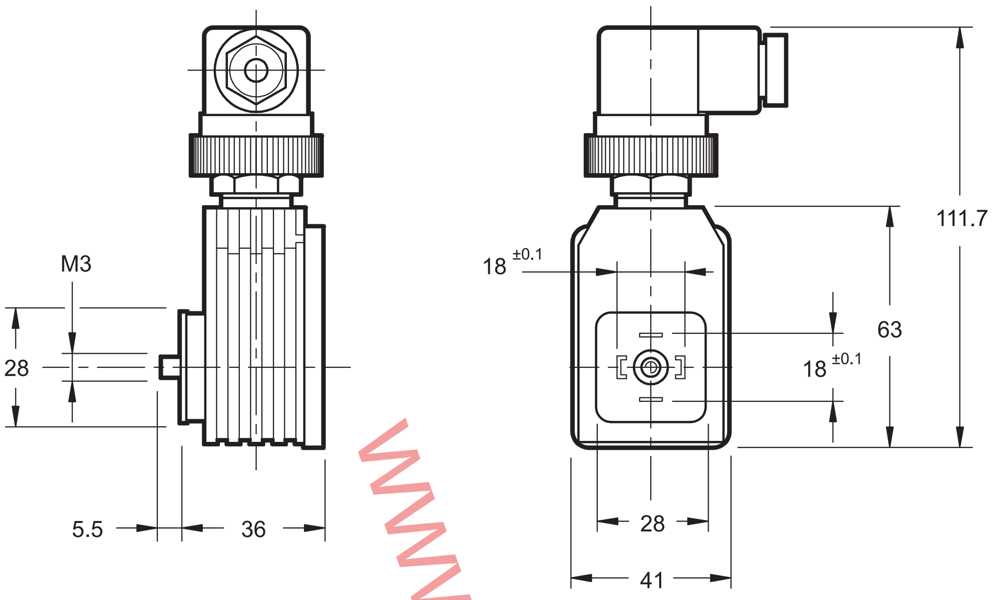
The software communicates, through a flat cable, to the ECL; the connector is behind the protecting gate.

The EDC-PC/10 software compatibility is guaranteed only on Windows XP® operating systems.

7 - WIRING DIAGRAM



8 - OVERALL AND MOUNTING DIMENSIONS



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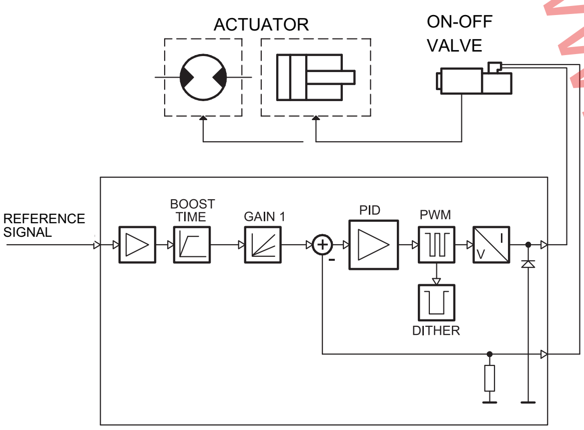
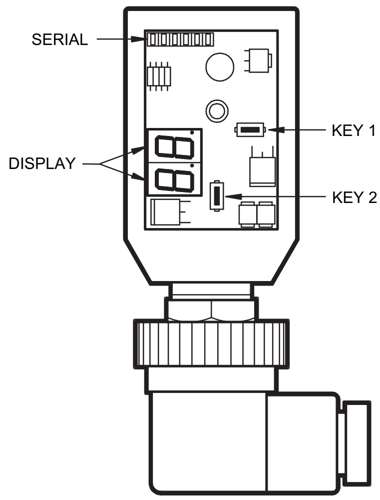
ECF

AMPLIFIED CONNECTOR FOR FAST COMMAND (RAPID) ON-OFF VALVES
SERIES 20

PLUG VERSION

OPERATING PRINCIPLE

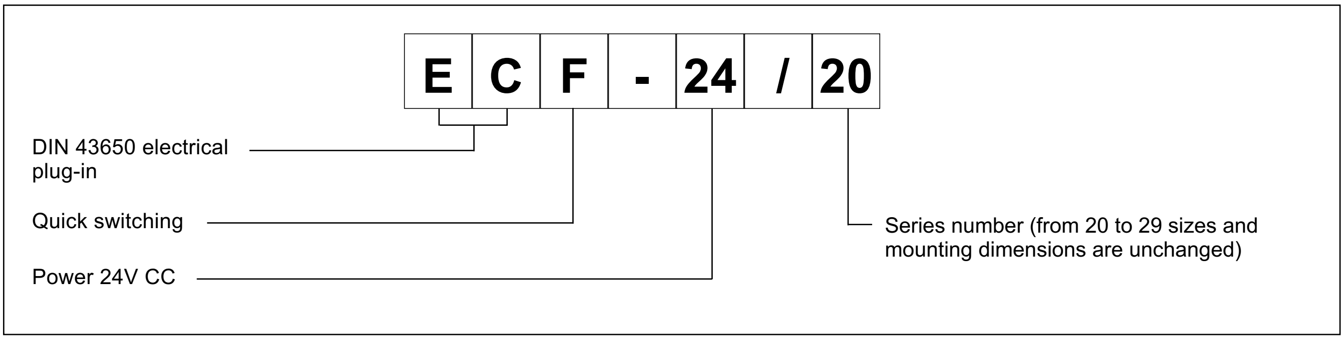




TECHNICAL CHARACTERISTICS

Power supply	V DC	24 ÷ 30 ripple included
Required power	W	min 50 - max 150 (see paragraph 2.1)
Output current	mA	max 3000 (see paragraph 1)
Power supply electrical protections		– overload over 33V – polarity inversion
Output electrical protections		Short-circuit
Analogue electrical protections		up to 30 V DC
Reference signal	V DC	24
Connector type		DIN 43650
Electromagnetic compatibility (EMC) - emissions CEI EN 61000-6-4 - immunity CEI EN 61000-6-2		according to 2004/108/CE standards (see paragraph 5 - **NOTE 1**)
Protection to atmospheric agents		IP 65 - 67
Operating temperature range	°C	-20 / +70
Mass	kg	0,10

1 - IDENTIFICATION CODE



The ECF connector is a digital amplifier controlling open loop on-off valves.

The unit supplies a set current independently from temperature variations or load impedance.

A quick solenoid energizing is possible in two different ways, according to the used coil type (12V o 24V)

Setting is possible by buttons and display inside the case, or with a PC by RS232 with the software EDC-PC, (see paragraph 6.2).

2 - FUNCTIONAL SPECIFICATIONS

2.1 - Electric power supply

The connector requires a power supply of 24V DC (terminals 1 and 2). The power supply voltage must be rectified and filtered, and it has not to be higher than 6A.

N.B. The value of the power supply voltage on the connector must be higher than the rated working voltage of the solenoid to be controlled.

The power required by the card depends on the power supply voltage and on the maximum value of the supplied current.

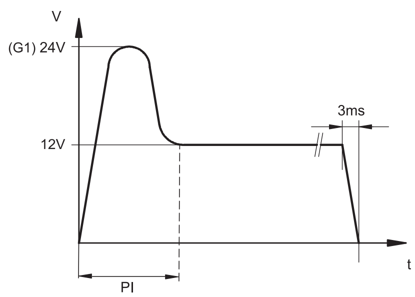
2.2 - Electrical protection

The connector is protected against overvoltage and polarity inversion. On the output a protection against any short circuit is foreseen.

2.3 - Functioning with 12V coils

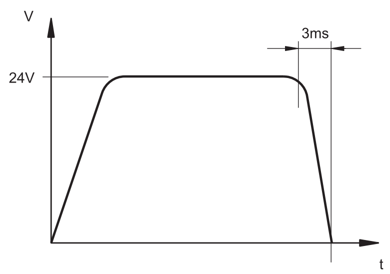
With the employment of 12V coils, the ECF valve allows a quick solenoid energizing (G1), overboosting the solenoid just the time to energize it (PI). Then, the voltage will be lowered at the rated value. The de-energizing is fast, and is 3 ms.

At overboosting time, the power-supply unit must be able to provide a 6 A intensity current strength.



2.4 - Functioning with 24V coils

24V coils do not require overboosting. A quick de-energizing is guaranteed.



3 - SIGNALS

3.1 - POWER ON (Power supply)

Displays indicate the connector is ON and with +24 V DC.

4 - ADJUSTMENTS

There are two way adjustments: variables view and parameters editing. The first one enables the real time monitoring of the control values, for both required and read current, on both channels. The second modality enables the operating parameters view and editing.

4.1 - Variables view

The card is switched on at the variables view modality, and it shows the first variable value, that is the C1 parameter, current solenoid.

C1: current supplied from ECF to the solenoid read on real time

4.2 - Parameters editing

To access the parameter editing, press the key (2) for at least 3 seconds.

The first parameter displayed is G1. To modify it, press the key (1) for two seconds, until the display starts blinking. Use the key (2) to increase the value and the key (1) to decrease it. To save the new value, press both the keys. The display stops blinking.

Pressing the key (2) again is possible to scroll all the parameters. To modify some the parameter, repeat the steps above-mentioned for the G1 parameter.

DISPLAY VIEW EXAMPLE:

REFERENCE (V)	VARIABLES (Ampere)
0	0.0 (mA)
24	2.6 (A)

The variables that can be selected are:

G1: "I Max" current, expressed in Ampere.

It sets the maximum current to the solenoid, when the reference signal is at the maximum value +24 V. It is used to limit the maximum value of the supplied current.

Default value = 2000 mA

Range = 0 ÷ 3000 mA

PI: Overboosting time.

It determines the regulation of solenoid overboosting time and it is measured by milliseconds.

Default value = 40 ms

Range = 0 ÷ 500 ms

Fr: PWM frequency, in Hertz.

It sets the PWM frequency, which is the pulsating frequency of the solenoid current.
Default value = 200

Range = 100 ÷ 500Hz

5 - INSTALLATION

The connector type electronic unit is suitable for direct assembly on the solenoid of the relative on-off valve. With the 4-core connector for supply and for the reference signal.

NOTE: To observe EMC requirements it's important that the control unit electrical connection is in compliance with the wiring diagram of chapter 7.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources as power wires, electrical motors, inverters and electrical switches.

In environments where there are critical electromagnetic interferences, a complete protection of the connection wires can be requested.

6 - START UP, CONTROL SETTINGS AND SIGNAL

6.1 - Set up

Settings can be changed by either acting on the (1) and (2) keys located on the card front panel, or using the EDC-PC software kit.

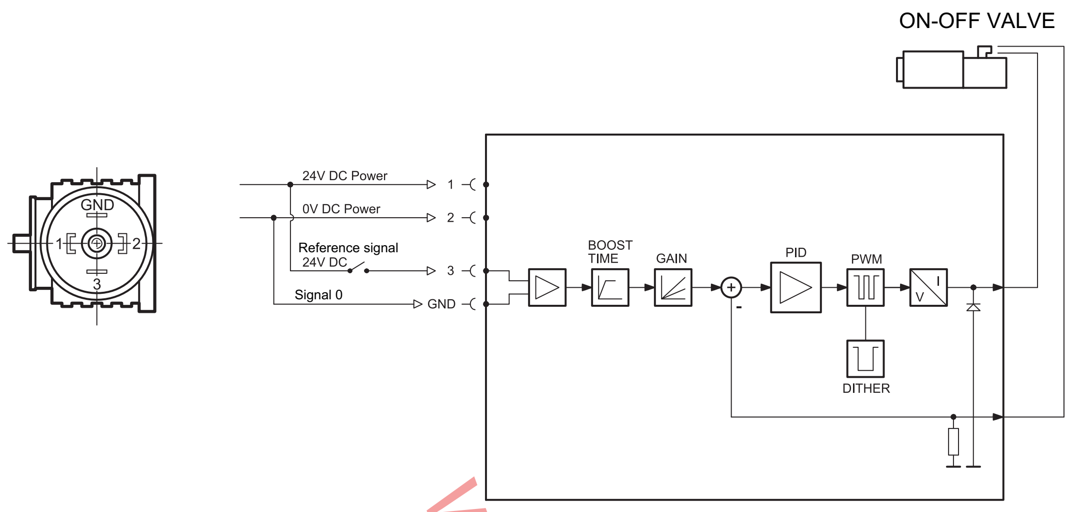
6.2 - EDC-PC Software (code 3898301001)

The relevant hardware and software kit (to be ordered separately) allows to read the values and to set the connector easily.

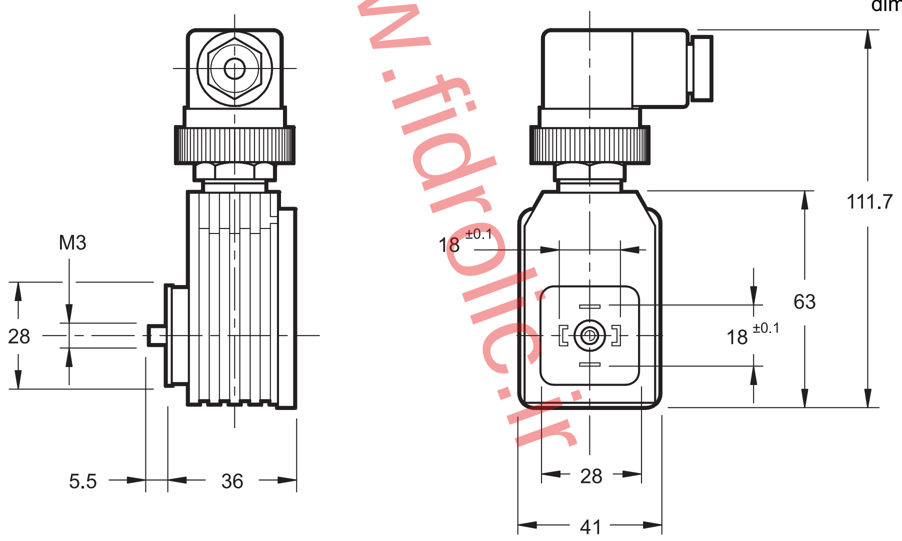
The software communicates, through a flat cable, to the ECF; the connector is behind the protecting gate.

The EDC-PC software compatibility is guaranteed only on Windows XP® operating systems.

7 - WIRING DIAGRAM



8 - OVERALL AND MOUNTING DIMENSIONS



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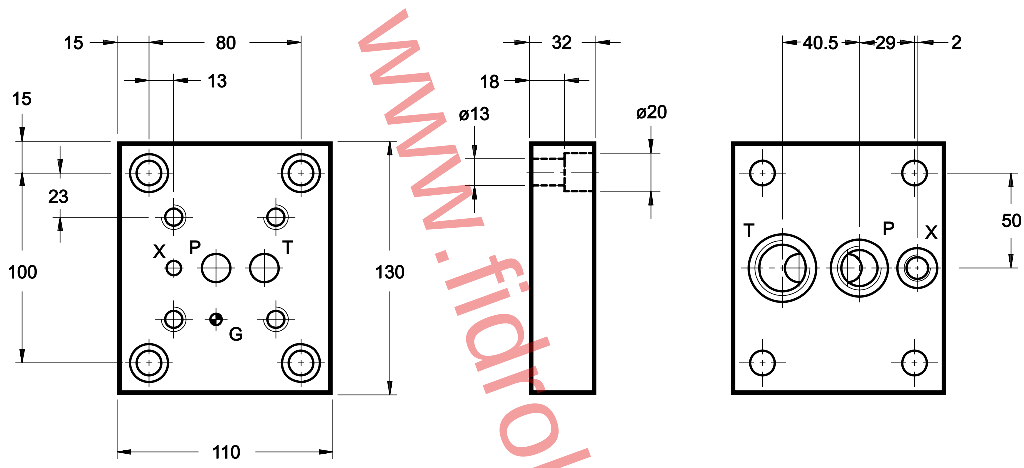
SUBPLATES
PMRQ*
SUBPLATES FOR PRESSURE CONTROL VALVES

1 - OVERALL AND MOUNTING DIMENSIONS PMRQ3-AI4G/20 (cod. 1961211)

ISO 6264-06-09-*-97
(CETOP 4.4.2-2-R06-350)

dimensions in mm



Ports on rear.

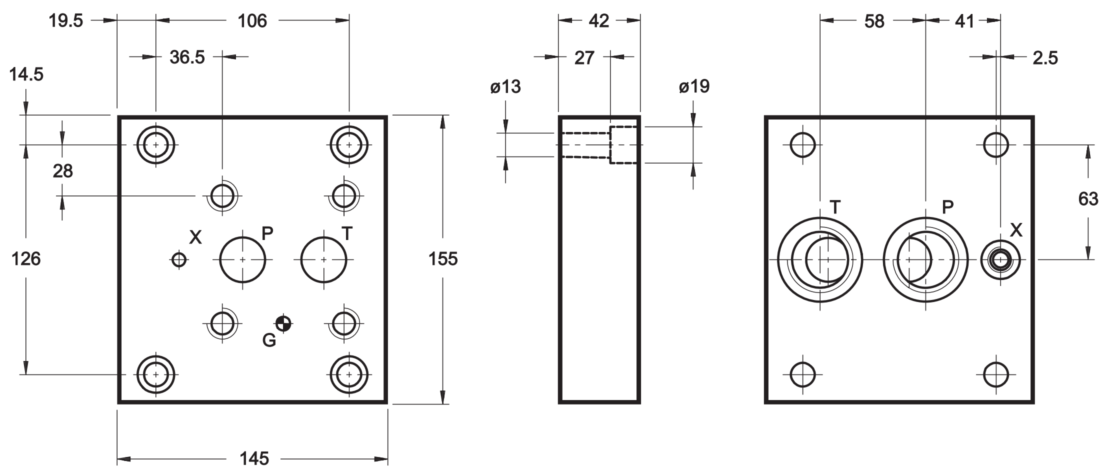
Threading of ports: P 1/2" BSP; T 3/4" BSP; X 1/4" BSP

p max **350** bar   Mass: kg 3,0

2 - OVERALL AND MOUNTING DIMENSIONS PMRQ5-AI5G/20 (cod. 1961221)

ISO 6264-08-13-*-97
(CETOP 4.4.2-2-R08-350)

dimensions in mm

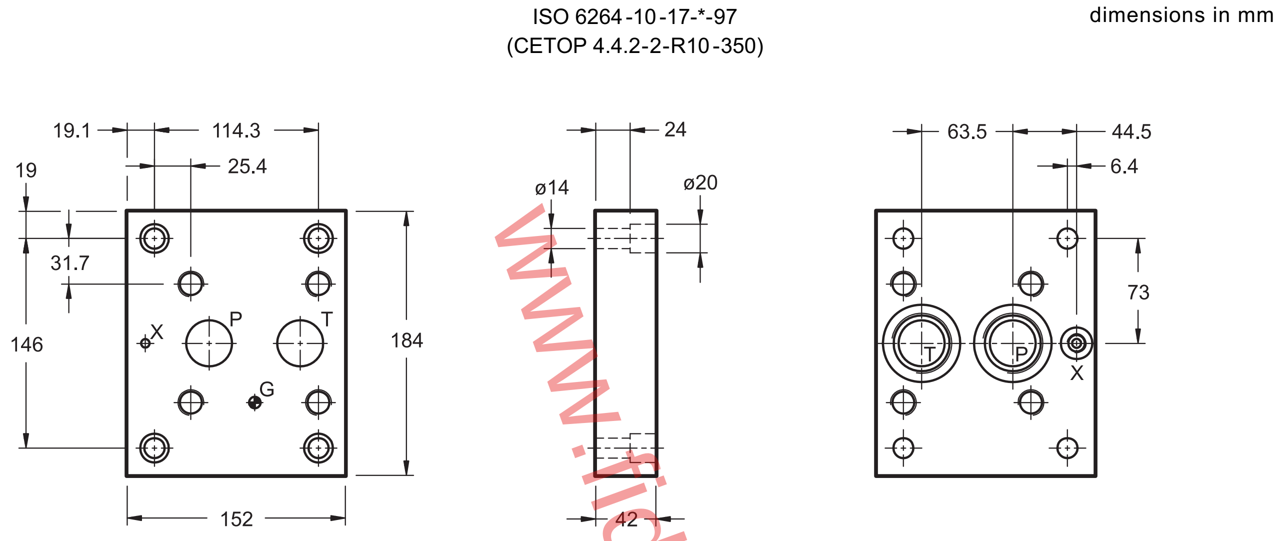


Ports on rear.

Threading of ports: P-T 1" BSP; X 1/4" BSP

p max **350** bar   Mass: kg 6,5

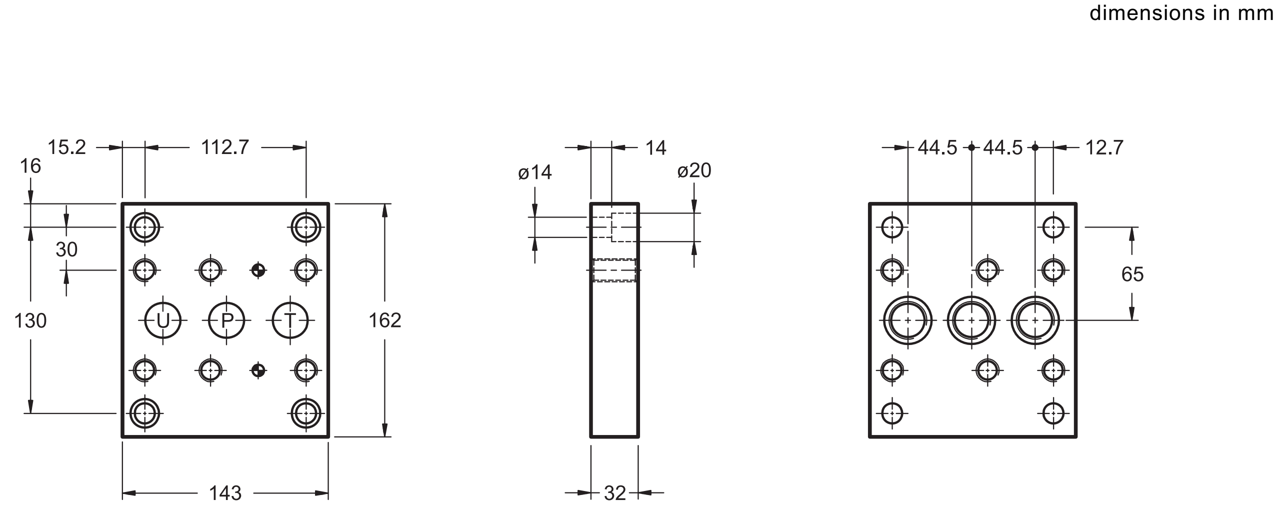
3 - OVERALL AND MOUNTING DIMENSIONS PMRQ7-AI7G/10 (cod. 1960051)



Ports on rear. Threading of ports: P-T 1” 1/4 BSP; X 1/4” BSP

p max **350** bar Mass: kg 7,1

4 - OVERALL AND MOUNTING DIMENSIONS PMRQA5-AI5G/10 (cod. 1960070)



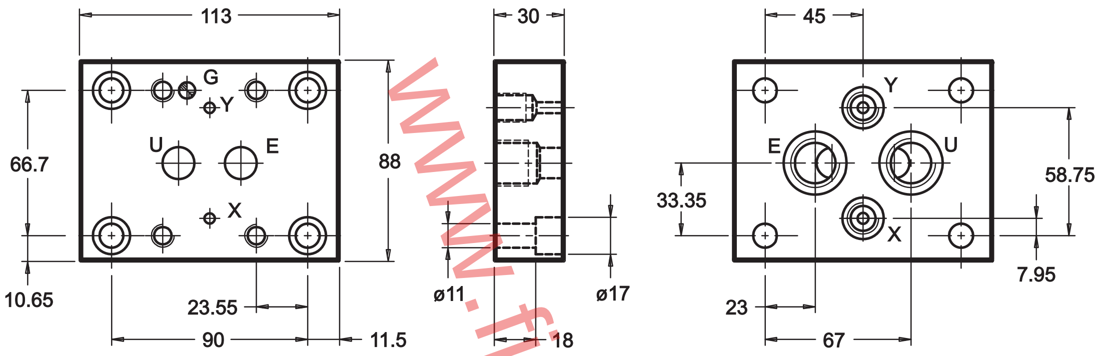
Ports on rear. Threading of ports: P - T - U 3/4” BSP

p max **350** bar Mass: kg 6,5

5 - OVERALL AND MOUNTING DIMENSIONS PMSZ3-AI4G/20 (cod. 1961231)

ISO 5781-06-07-*-00
(CETOP 4.4.4-2-06-320)

dimensions in mm



Ports on rear.

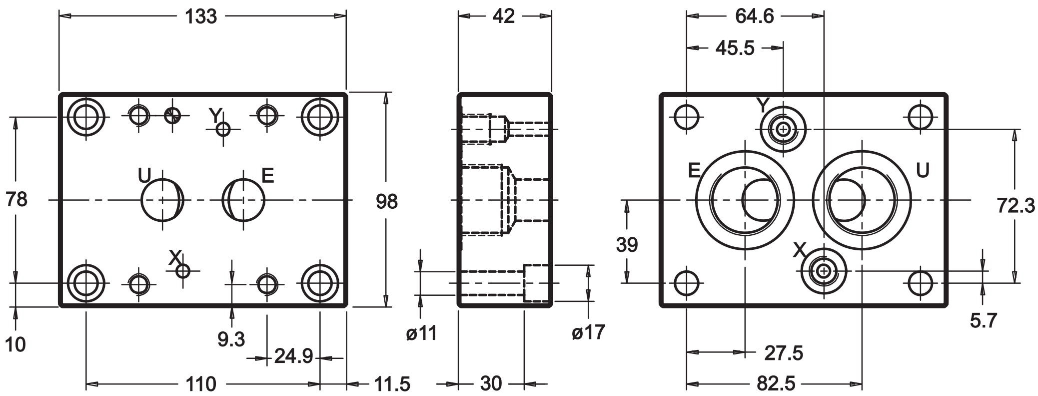
Threading of ports: E-U 1/2” BSP; X-Y 1/4” BSP

p max **320** bar   Mass: kg 2,0

6 - OVERALL AND MOUNTING DIMENSIONS PMSZ5-AI6G/20 (cod. 1961241)

ISO 5781-08-10-*-00
(CETOP 4.4.5-2-08-320)

dimensions in mm



Ports on rear.
Threading of ports: E-U 1” BSP; X-Y 1/4” BSP

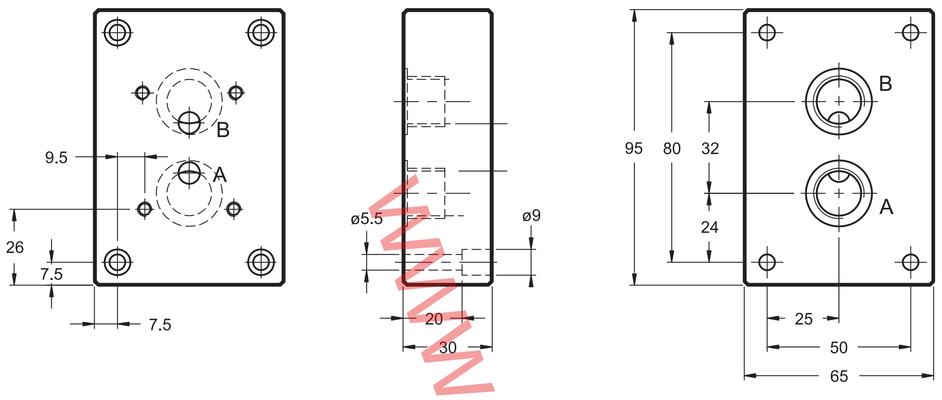
p max **320** bar   Mass: kg 4,0

PMRPC*
SUBPLATES
FOR FLOW CONTROL VALVES

7 - OVERALL AND MOUNTING DIMENSIONS PMRPC1-AI3G/10 (cod. 1961045)

ISO 6263-03-03-*-97
(CETOP 4.5.2-2-03-250)

dimensions in mm



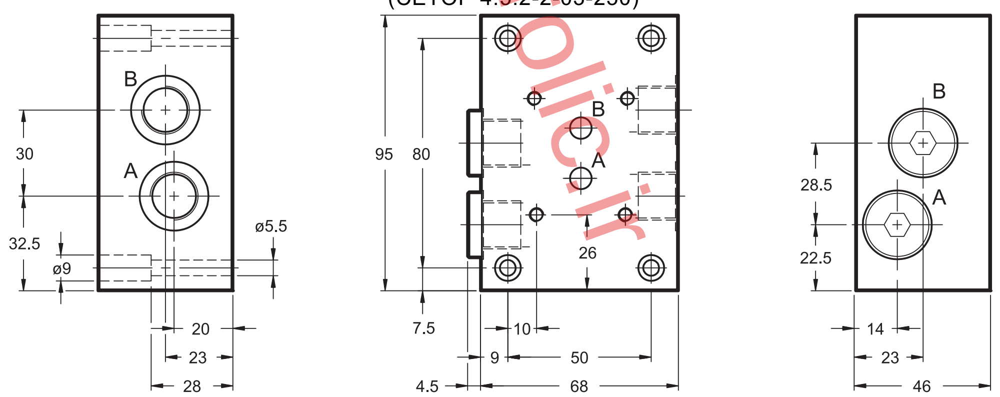
Ports on rear. Threading on ports: A - B 3/8” BSP

p max **250** bar   Mass: kg 1,2

8 - OVERALL AND MOUNTING DIMENSIONS PMRPC1-AL3G/10 (cod. 1961051)

ISO 6263-03-03-*-97
(CETOP 4.5.2-2-03-250)

dimensions in mm



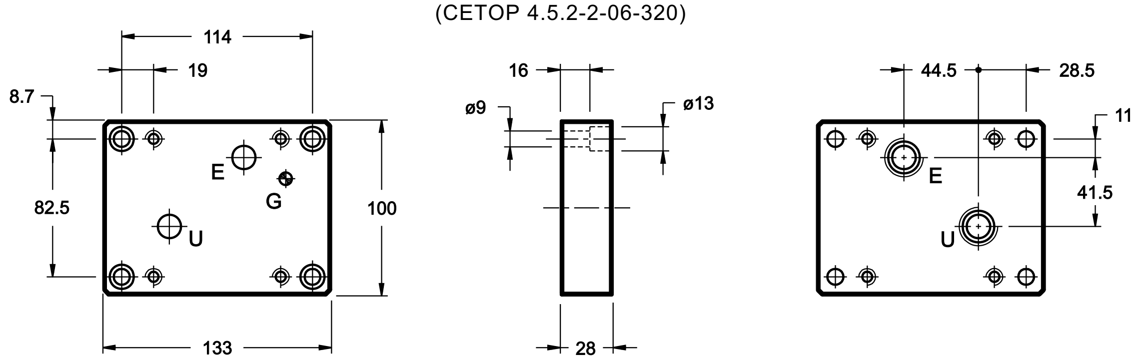
Side ports. Threading on ports: A - B 3/8” BSP

p max **250** bar   Mass: kg 1,9

9 - OVERALL AND MOUNTINGDIMENSIONS PMRPC2-AI4G/10 (cod. 1960330)

ISO 6263-06-05-*-97
(CETOP 4.5.2-2-06-320)

dimensions in mm



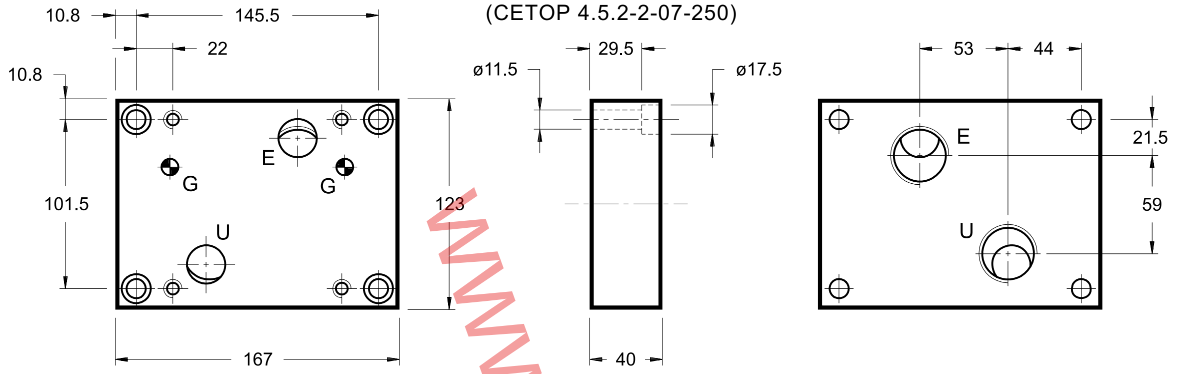
Ports on rear. Threading ports: E - U 1/2” BSP

p max **320** bar   Mass: kg 2,5

10 - OVERALL AND MOUNTING DIMENSIONS PMRPC3-AI6G/10 (cod. 1960511)

ISO 6263-07-09-*-97
(CETOP 4.5.2-2-07-250)

dimensions in mm



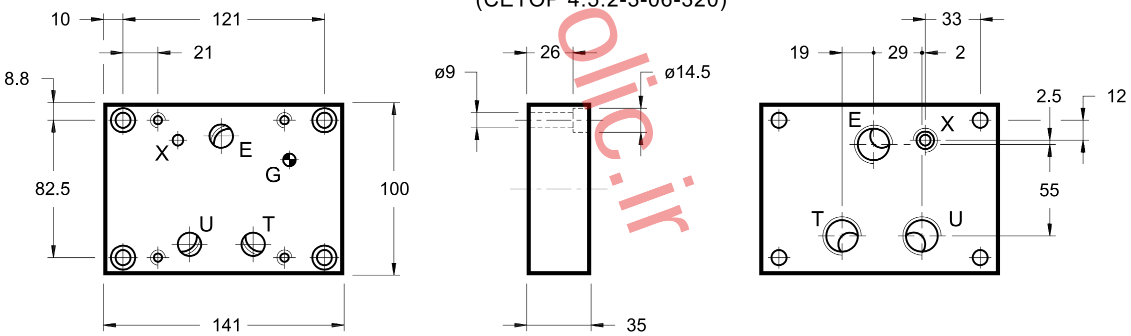
Ports on rear. Threading of ports: E - U 1" BSP

p max **250** bar Mass: kg 5,5

11 - OVERALL AND MOUNTING DIMENSIONS PMRPCQ2-AI4G/10 (cod. 1960526)

ISO 6263-06-07-*-97
(CETOP 4.5.2-3-06-320)

dimensions in mm



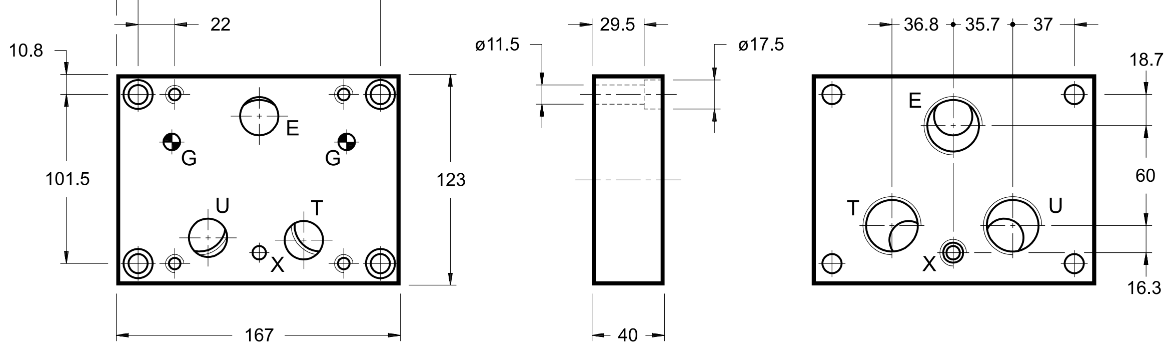
Ports on rear. Threading of ports: E - U - T 1/2" BSP; X 1/4" BSP

p max **320** bar Mass: kg 3,3

12 - OVERALL AND MOUNTING DIMENSIONS PMRPCQ3-AI6G/10 (cod. 1960423)

ISO 6263-07-11-*-97
(CETOP 4.5.2-3-07-250)

dimensions in mm



Ports on rear. Threading of ports: E - U - T 1" BSP; X 1/4" BSP

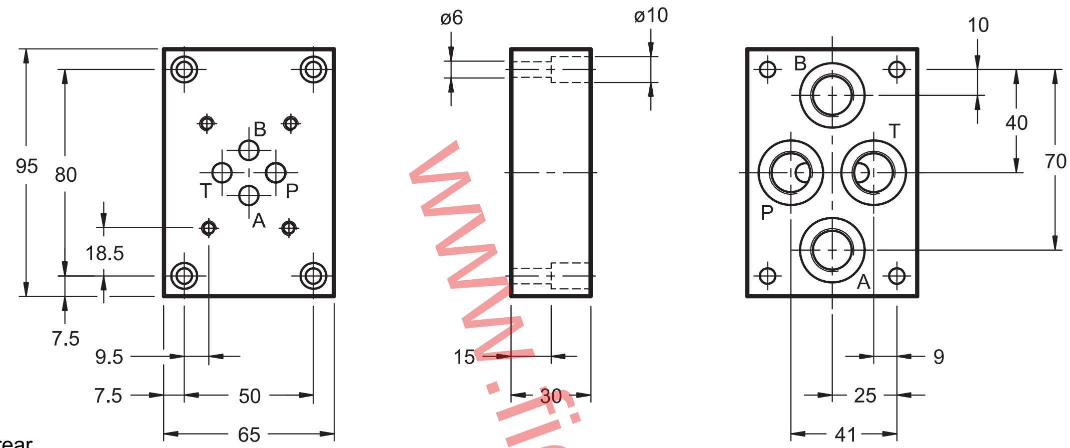
p max **250** bar Mass: kg 5,8

SUBPLATES FOR ISO 4401-03 (CETOP 03) VALVES

13 - OVERALL AND MOUNTING DIMENSIONS PMMD-AI3G/20 (cod. 1961261)

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)

dimensions in mm



Ports on rear.

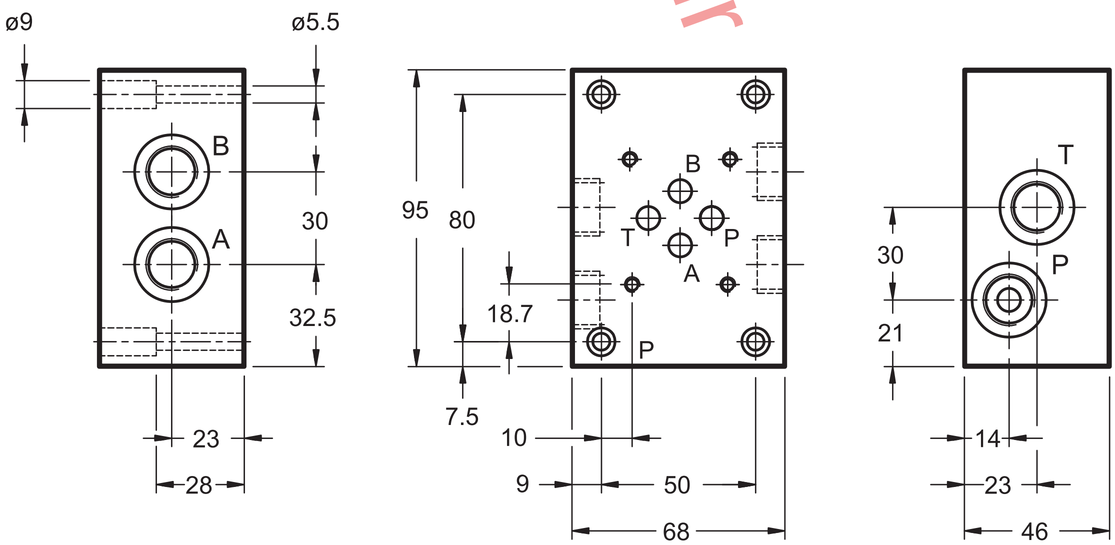
Threading on ports: P - T - A - B 3/8" BSP

p max **350** bar Mass: kg 1,2

14 - OVERALL AND MOUNTING DIMENSIONS PMMD-AL3G/11 (cod. 1961251)

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)

dimensions in mm



Side ports.

Threading of ports: P - T - A - B 3/8" BSP

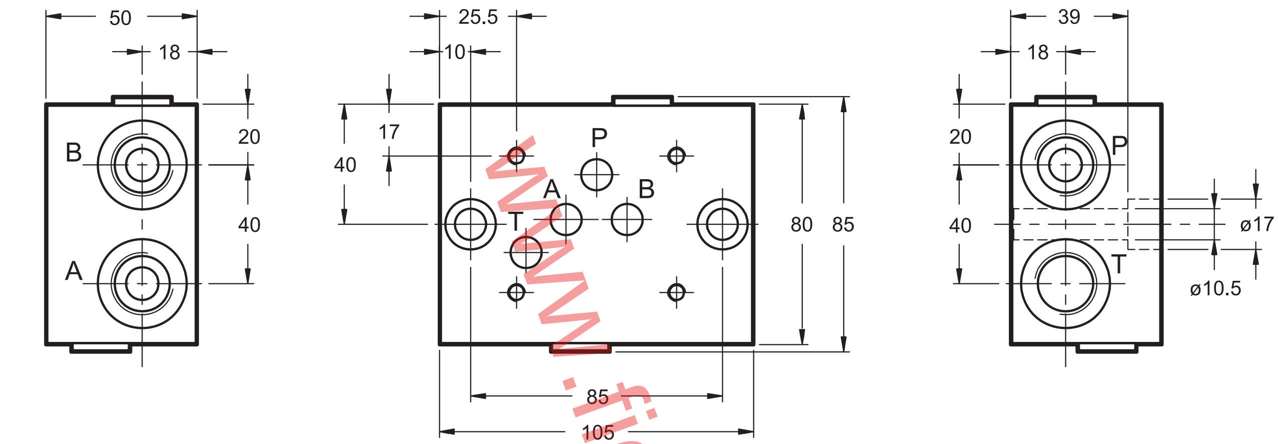
p max **350** bar Mass: kg 2,2

SUBPLATES FOR ISO 4401-05 (CETOP 05) VALVES

15 - OVERALL AND MOUNTING DIMENSIONS PMD4-AL4G/10 (cod. 1960981)

ISO 4401-05-04-0-05
(CETOP 4.2-4-05-350)

dimensions in mm



Side ports.

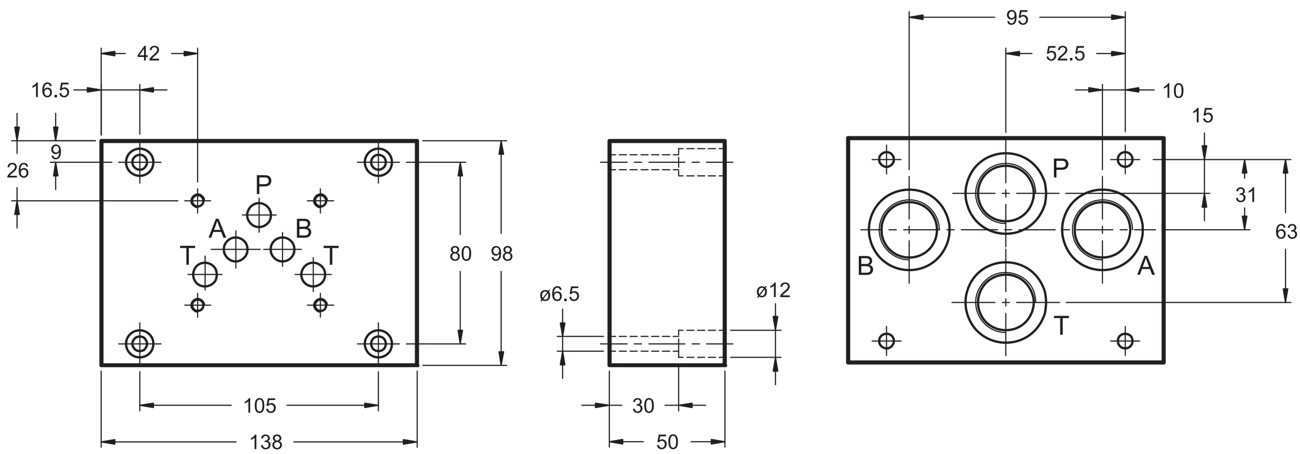
Threading of ports: P - T - A - B   1/2" BSP

p max **350** bar   Mass: kg 2,2

16 - OVERALL AND MOUNTING DIMENSIONS PMD4-AI4G/20 (cod. 1961271)

ISO 4401-05-04-0-05
(CETOP 4.2-4-05-350)

dimensions in mm



Ports on rear.

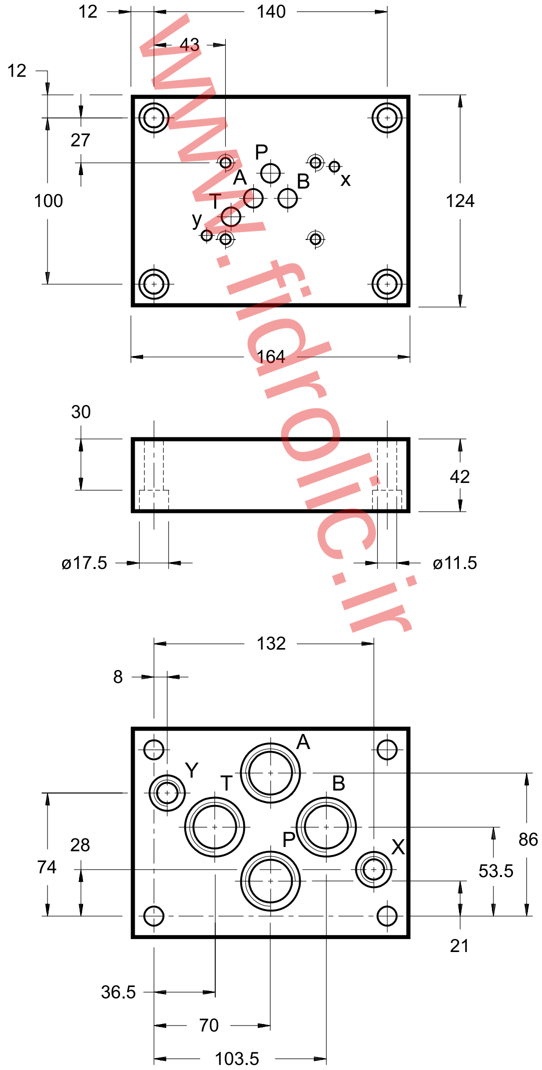
Threading of ports: P - T - A - B   3/4" BSP

p max **350** bar   Mass: kg 4,2

17 - OVERALL AND MOUNTING DIMENSIONS PME4-AI5G/10 (cod. 1961181)

CETOP 4.2-4-P05-320

dimensions in mm



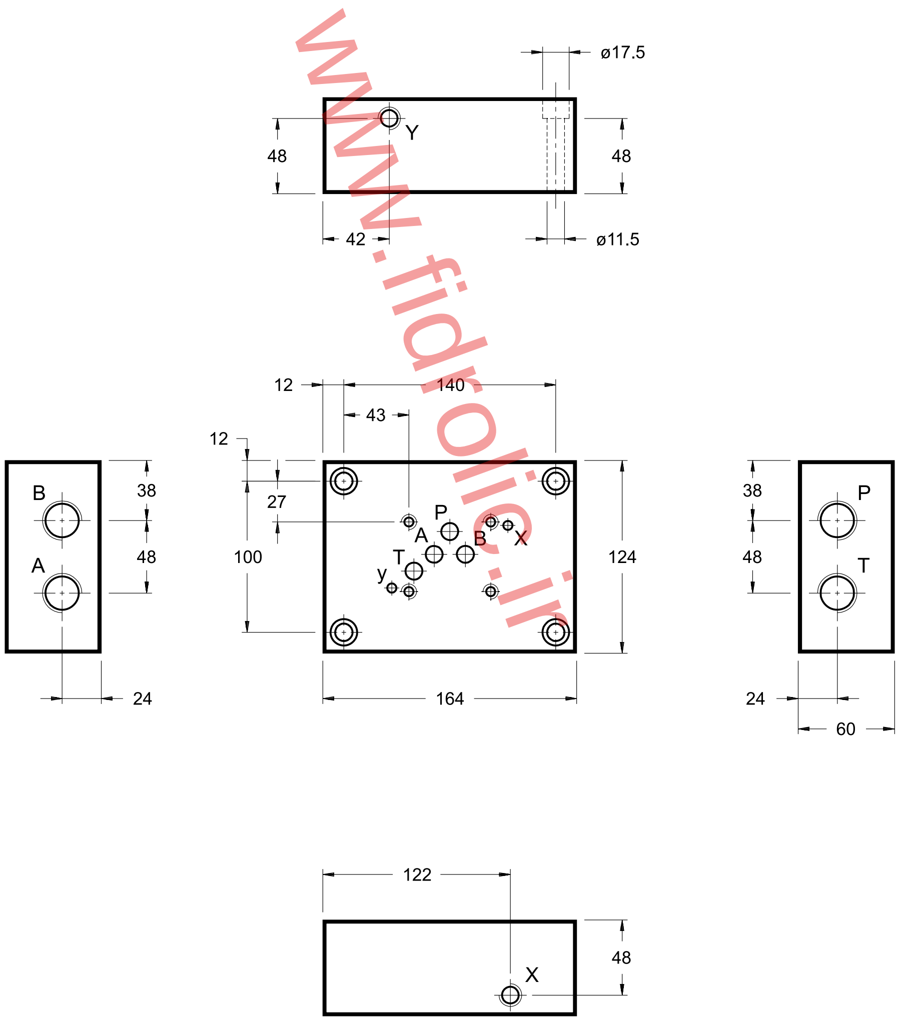
Ports on rear.
Threading of ports:
P-T-A-B 3/4” BSP
X-Y 1/4” BSP

p max **320** bar Mass: kg 5,3

18 - OVERALL AND MOUNTING DIMENSIONS PME4-AL5G/10 (cod. 1961201)

CETOP 4.2-4-P05-320

dimensions in mm



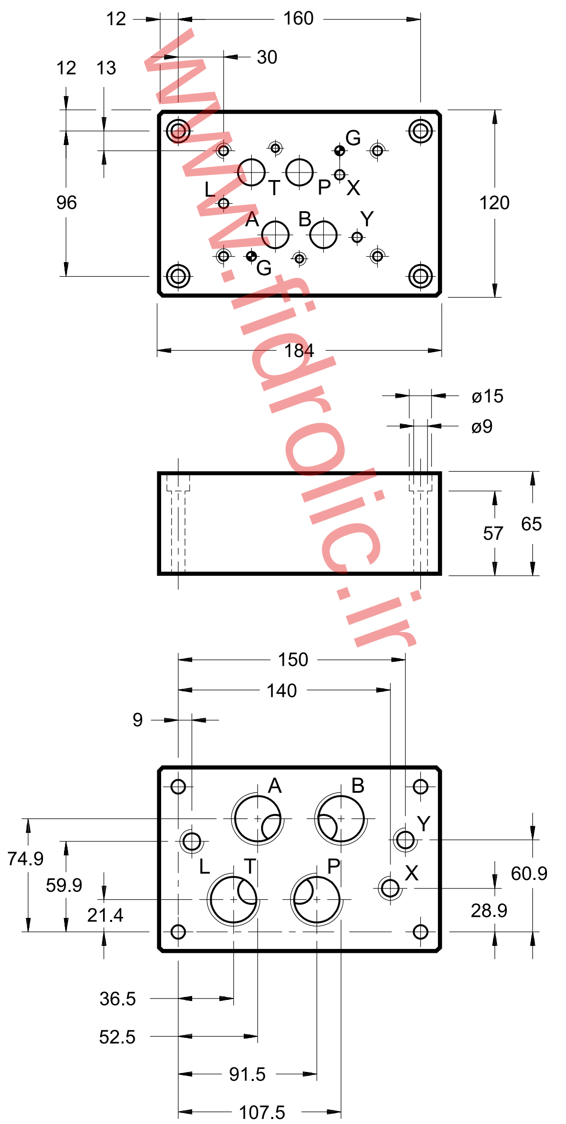
Side ports.
Threading of ports:
P-T-A-B 3/4” BSP
X-Y 1/4” BSP

p max **320** bar Mass: kg 5,3

19 - OVERALL AND MOUNTING DIMENSIONS PME07-AI6G/10 (cod. 1961071)

dimensions in mm

ISO 4401-07-07-0-05
(CETOP 4.2-4-07-350)



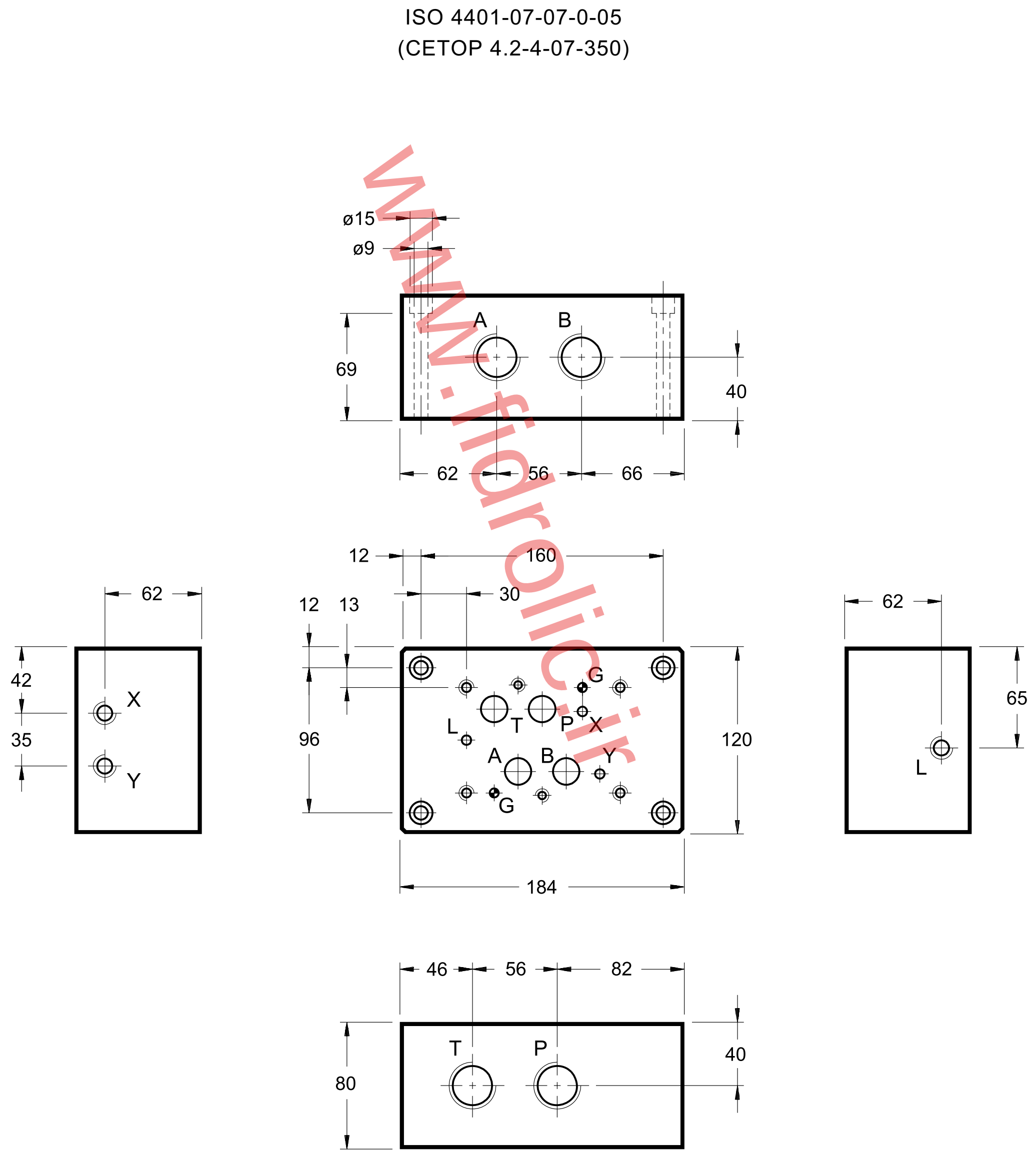
Ports on rear.
Threading of ports:
P-T-A-B 1” BSP
X-Y-L 1/4” BSP

p max **350** bar

Mass: kg 9

20 - OVERALL AND MOUNTING DIMENSIONS PME07-AL6G/10 (cod. 1961111)

dimensions in mm



Side ports.
Threading of ports:
P-T-A-B 1” BSP
X-Y-L 1/4” BSP

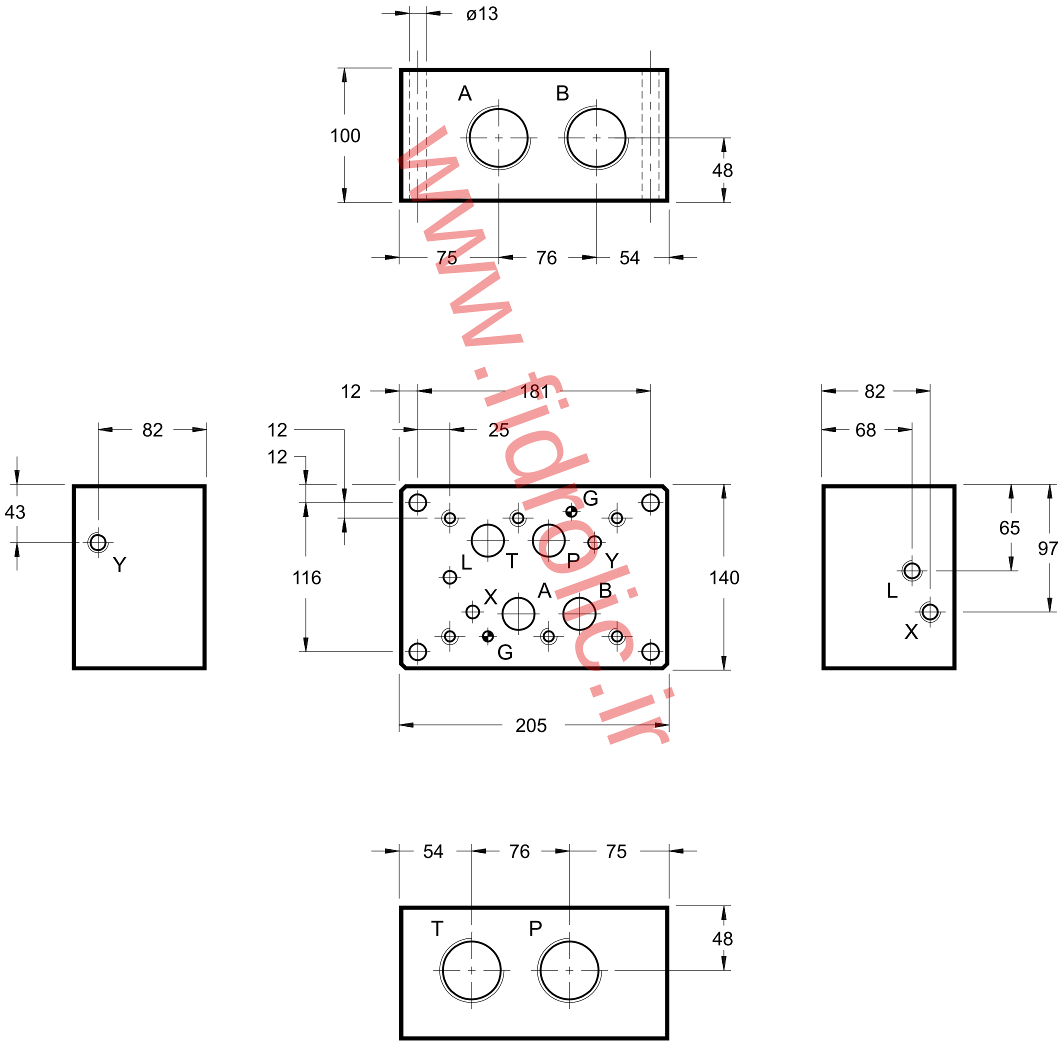
p max **350** bar

Mass: kg 11,5

21 - OVERALL AND MOUNTING DIMENSIONS PME5-AL8G/10 (cod. 1961141)

dimensions in mm

ISO 4401-08-08-0-05
(CETOP 4.2-4-08-320)



Side ports.
Threading of ports:
P-T-A-B 1” 1/2 BSP
X-Y-L 1/4” BSP

Mass: kg 19

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P2*

MODULAR SUBPLATES FOR ISO 4401-03 (CETOP 03) VALVES

This series of modular subplates has been designed to make hydraulic circuits and can be used directly on power packs or on any other section of the machine.

The subplates are assembled by means of 4 tie-rods with seal seats incorporated in the subplate.

The above assembly achieves compact units (including pressure and discharge manifolds): one face per subplate is used for connection to services and the other to mount ISO 4401-03 (CETOP 03) valves.

Complex circuits can also be set up using modular valves.

The recommended mounting configuration for **P2*** subplates on hydraulic power packs is with the main axis positioned vertically to obtain the bundle of pipes to utilities in two vertical rows; however assembly is not restricted to this configuration.

p max **350** bar

Q max **50** l/min

TECHNICAL SPECIFICATIONS

Maximum operating pressure - ports P - A - B - port T	bar	see paragraph 11 140
Maximum flow	l/min	50
Port dimensions: P - pressure T - lower drainage T - upper drainage A/B - users	BSP	3/8” 1/2” 3/8” 3/8”
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	cSt	25
Recommended viscosity	According to ISO 4406:1999 class 20/18/15	

1 - IDENTIFICATION CODE

P	2	D	-		/	21

Subplate

Dimension for ISO 4401-03 (CETOP 03) valves

Single mounting facility

Serial No : (from 20 to 29 and from 30 to 39 overall and mounting dimensions remain unchanged)

Versions: (omit for standard subplate P2D/21)

F = with P - T threaded ports and additional pressure port.

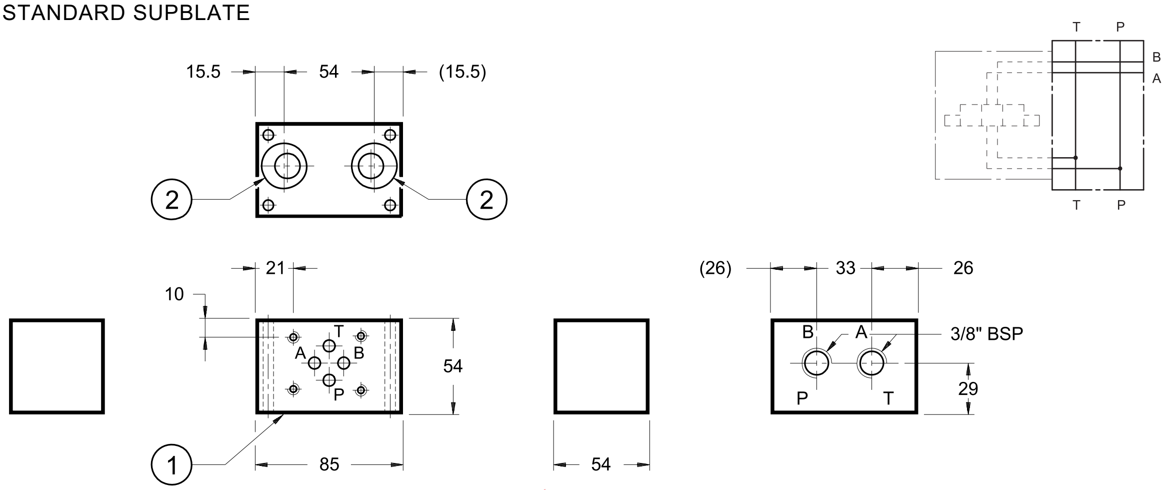
I = intermediate with threaded fastening holes to reduce rods lenght and additional pressure port.

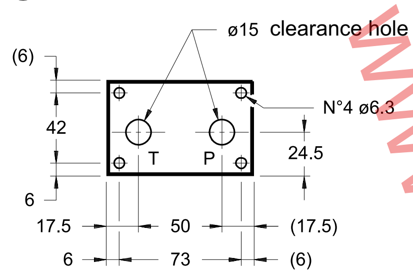
Z = arranged for the installation of an MZD pressure reducing valve

NOTE: identification code of subplates P2*-M*/33 see paragraph 6

2 - OVERALL AND MOUNTING DIMENSIONS P2D/21 (cod. 1560121)

STANDARD SUPBLATE





NOTE: The subplate is supplied with O-Ring made of NBR 90 Shore

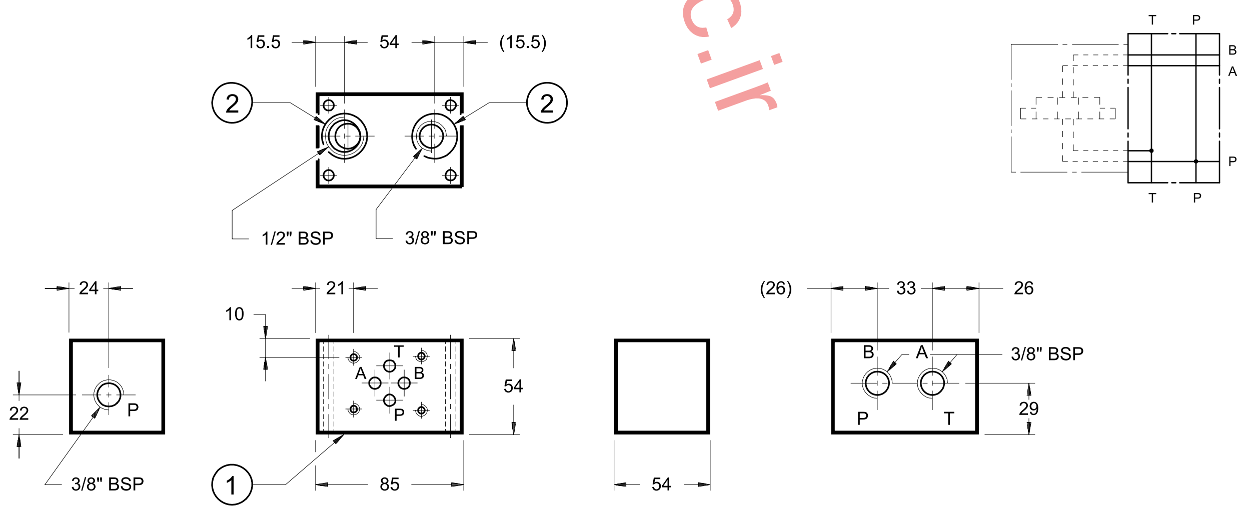
dimensions in mm

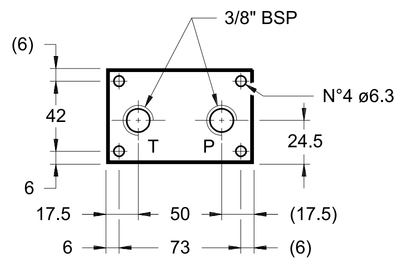
1	Mounting surface
2	OR seats 2093 (23.52x1.78)

Mass: kg 1,5

3 - OVERALL AND MOUNTING DIMENSIONS P2D-F/21 (cod. 1560122)

P - T THREADED PORTS AND ADDITIONAL PRESSURE PORT SUBPLATE





NOTE: The subplate is supplied with O-Ring made of NBR 90 Shore

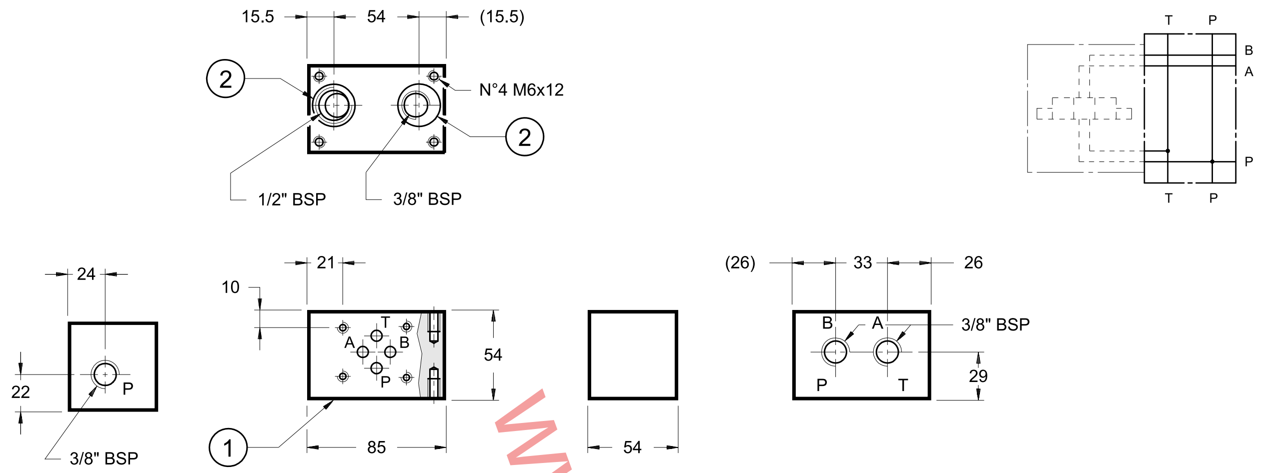
dimensions in mm

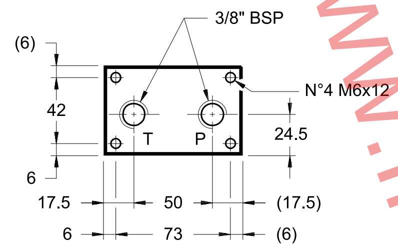
1	Mounting surface
2	OR seats 2093 (23.52x1.78)

Mass: kg 1,5

4 - OVERALL AND MOUNTING DIMENSIONS P2D-I/21 (cod. 1560123)

INTERMEDIATE SUBPLATE WITH THREADED FASTENING HOLES TO REDUCE ROD LENGHT AND ADDITIONAL PRESSURE PORT





Mass: kg 1,5

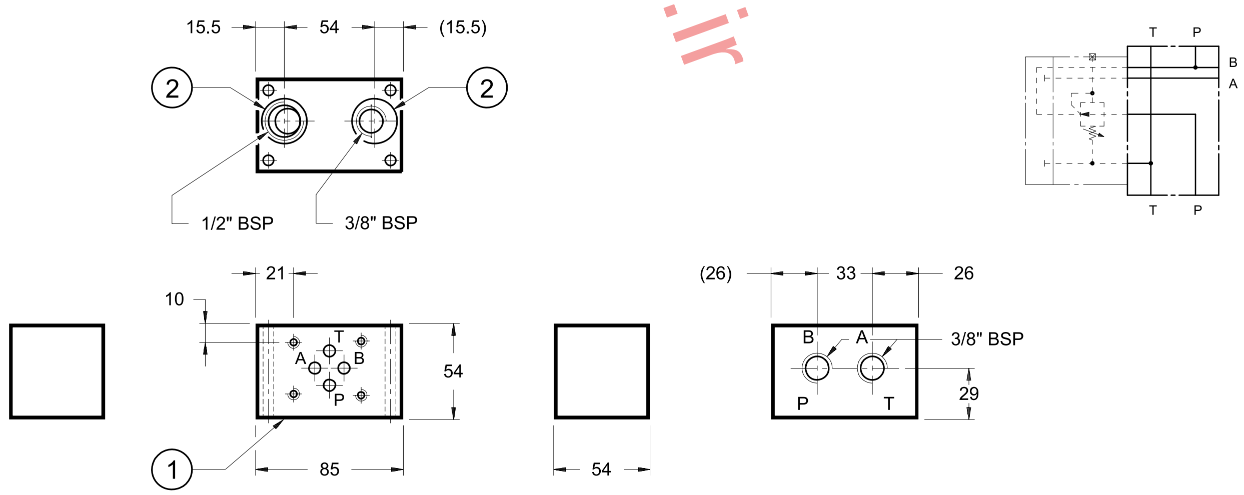
NOTE: The subplate is supplied with O-Ring made of NBR 90 Shore

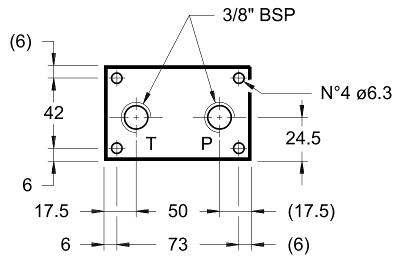
dimensions in mm

1	Mounting surface
2	OR seats 2093 (23.52x1.78)

5 - OVERALL AND MOUNTING DIMENSIONS P2D-Z/21 (cod. 1560025)

SUBPLATE ARRANGED FOR THE INSTALLATION OF AN MZD PRESSURE REDUCING VALVE





Mass: kg 1,5

NOTE: The subplate is supplied with O-Ring made of NBR 90 Shore

dimensions in mm

1	Mounting surface
2	OR seats 2093 (23.52x1.78)

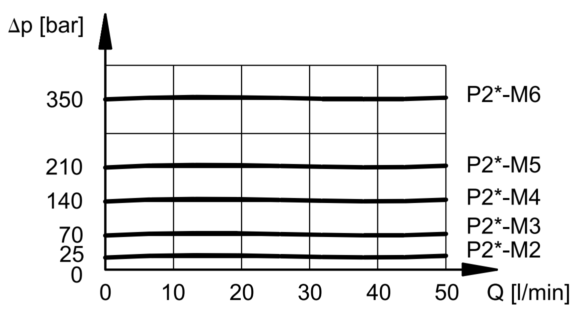
6 - IDENTIFICATION CODE subplates with incorporated pressure control valve

P	2		-		/	33

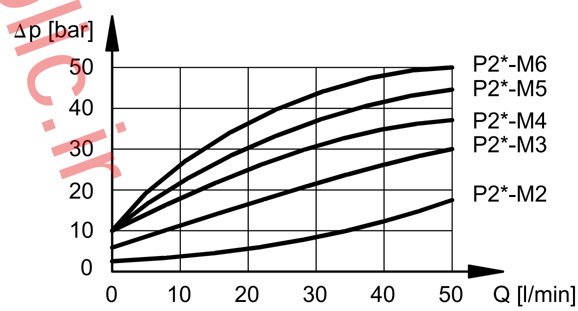
- Subplate
- Dimension for ISO 4401-03 (CETOP 03) valves
- **D** = single mounting facility
  T = double mounting facility
- **M** = with incorporated pressure control valve and P -T threaded ports
  Pressure regulation range:
  M2 = up to 25 bar **M5** = up to 210 bar
  M3 = up to 70 bar **M6** = up to 350 bar
  M4 = up to 140 bar
- Serial No. (from 30 to 39 overall and mounting dimensions remain unchanged)

7 - CHARACTERISTIC CURVES FOR P2D-M* E P2T-M* SUBPLATES WITH PRESSURE CONTROL VALVE INCORPORATED (values obtained with viscosity of 36 cSt at 50°C)

ADJUSTMENT

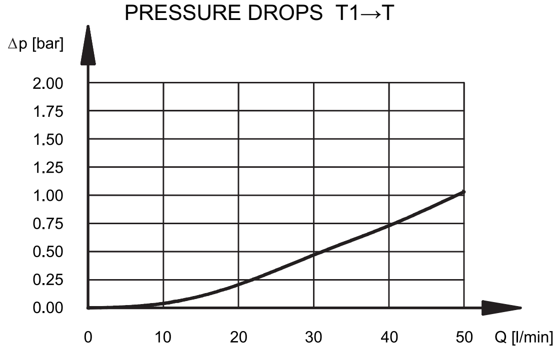


MINIMUM CONTROLLED PRESSURE



pressure drops P-T with calibrated screw at the regulation beginning (minimum controlled pressure)

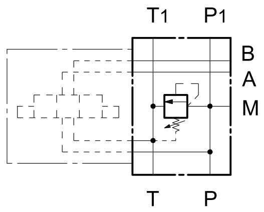
PRESSURE DROPS T1→T

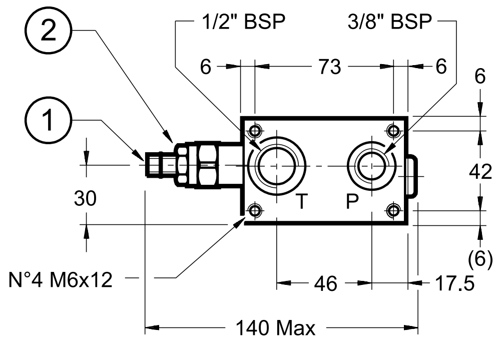


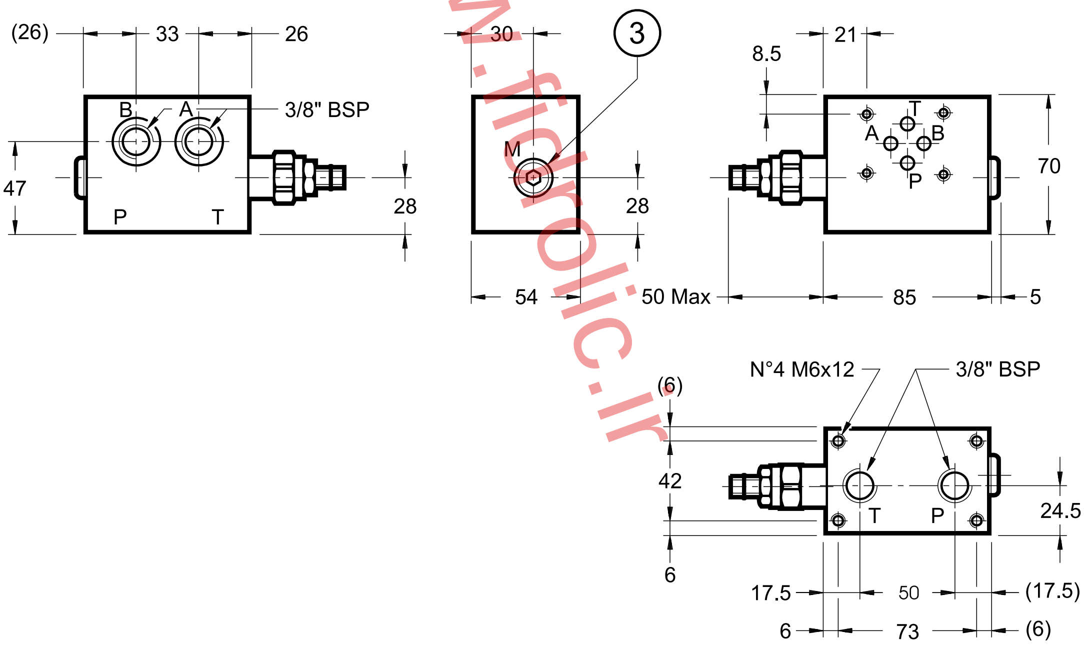
8 - OVERALL AND MOUNTING DIMENSIONS P2D-M*/ 33

SINGLE MOUNTING FACILITY SUBPLATE WITH PRESSURE RELIEF VALVE INCORPORATED

HYDRAULIC SYMBOL







dimensions in mm

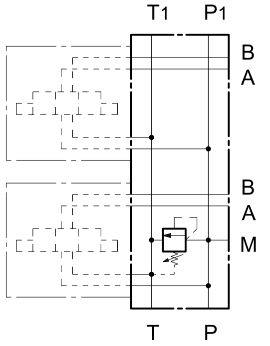
1	Countersunk hex. adjustment screw: spanner 6 Clockwise rotation to increase pressure
2	Locking nut: spanner 19
3	Pressure gauge port 1/4" BSP plugged

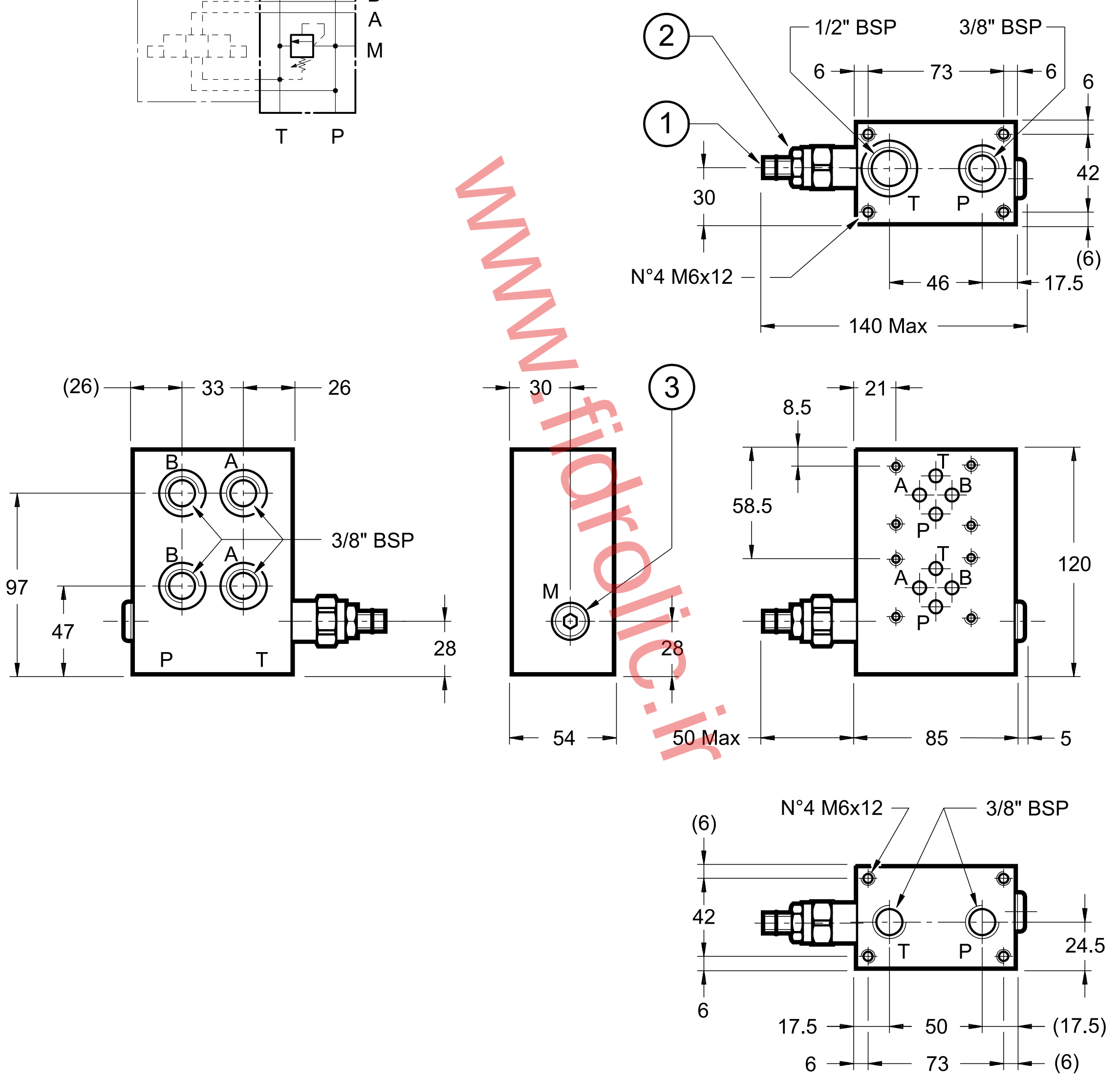
Mass: kg 2,5

9 - OVERALL AND MOUNTING DIMENSIONS P2T-M* /33

DOUBLE MOUNTING FACILITY SUBPLATE WITH PRESSURE RELIEF VALVE INCORPORATED

HYDRAULIC SYMBOL





dimensions in mm

1	Countersunk hex adjustment screw: spanner 6 Clockwise rotation to increase pressure
2	Locking nut: spanner 19
3	Pressure gauge port 1/4” BSP plugged

Mass: kg 5

10 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

11 - PRESSURE LIMIT ON P

Depending on the tie-rod type and on the number of assembled suplates it is necessary to pay attention to the maximum pressure on P in order to avoid extruding the O-Rings.

n° of assembled subplates	Threaded bar class B7 DIN 975	Stud class 8.8 UNI 5911	Stud class 12.9
2	350 bar	350 bar	350 bar
3	300 bar	350 bar	350 bar
4	250 bar	300 bar	350 bar
5	200 bar	250 bar	300 bar
6	150 bar	200 bar	250 bar
Tightening torque	8 Nm	8 Nm	12 Nm

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DUPLOMATIC OLEODINAMICA

P2A*L

MANIFOLDS FOR ISO 4401-03 (CETOP 03) VALVES WITH SIDE PORTS

SERIES 11

— The P2A*L series of manifolds is designed for connection in parallel of two or more ISO 4401-03 (CETOP 03) valves.

— The monocast design enables the simple creation of circuits without the use of pipes and fittings, thereby reducing overall dimensions to a minimum.

— All sections feature a common pressure and discharge fitting on both ends of the subplate.

— Maximum flow rate can be increased up to double the output if the sub-plates are powered at both ends.

— Each section is fitted with work ports A and B positioned on the side of the sub-plate.

— Subplates are available in aluminium.

p max **210** bar

Q max **50** l/min

TECHNICAL SPECIFICATIONS

Maximum operating pressure - ports P - A - B - port T	bar	210 140
Maximum flow	l/min	50
Port dimensions: P - pressure T - lower drainage A/B - users	BSP	1/2” 1/2” 3/8”
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	cSt	25
Recommended viscosity	According to ISO 4406:1999 class 20/18/15	

1 - IDENTIFICATION CODE

P	2	A		L	/	11

Manifold

Dimension 2 for ISO 4401-03 (CETOP 03) valves

Aluminium version

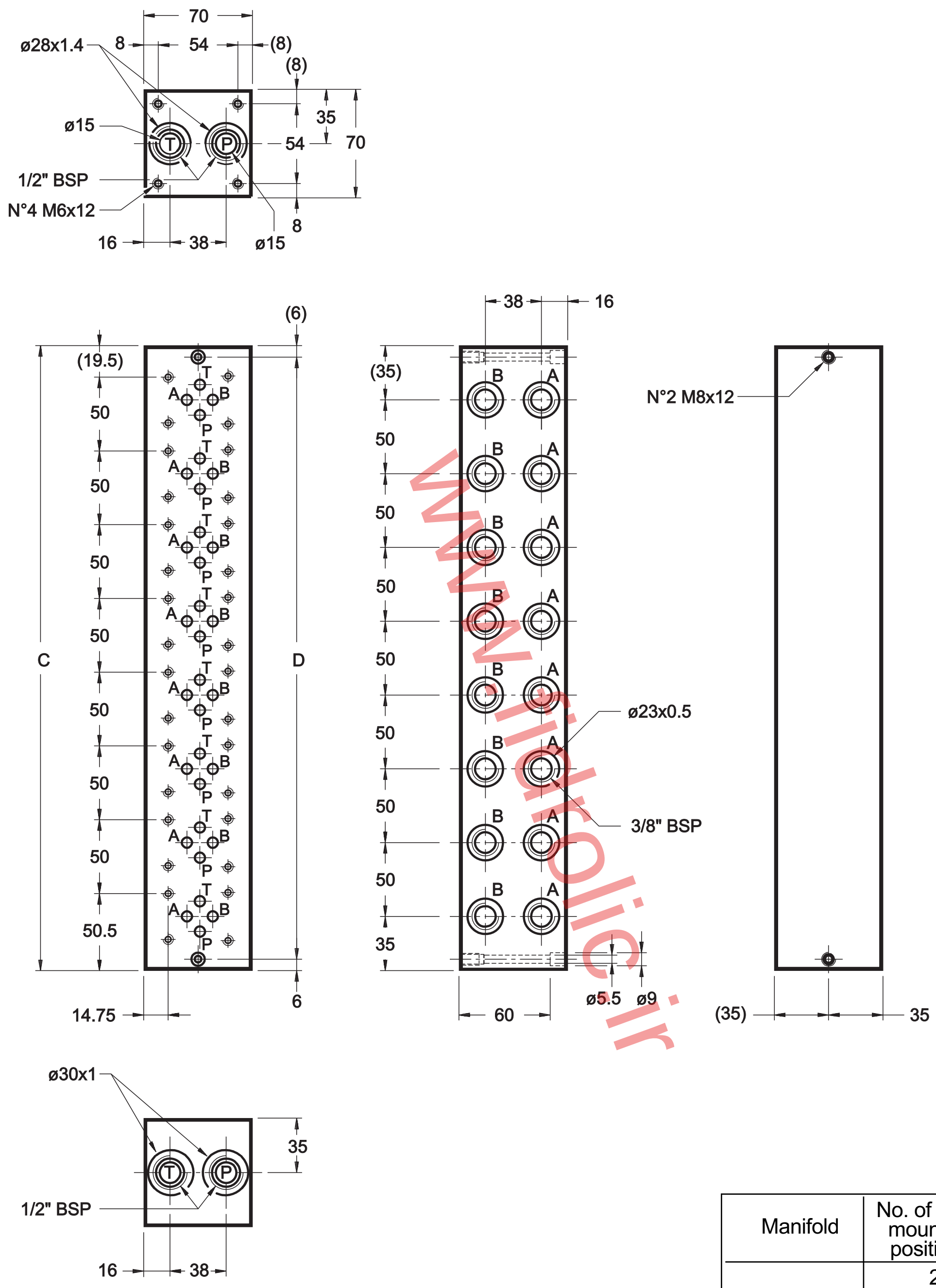
No. of valve mounting positions:

2 = 2 mounting positions
3 = 3 mounting positions
4 = 4 mounting positions
5 = 5 mounting positions
6 = 6 mounting positions
8 = 8 mounting positions

Side ports

Serial No. (from 10 to 19 overall and mounting dimensions remain unchanged)

2 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

Manifold	No. of valve mounting positions	C	E
	2	120	108
P2A3L	3	170	158
P2A4L	4	220	208
P2A5L	5	270	258
P2A6L	6	320	308
P2A8L	8	420	408

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P2X*M

MANIFOLDS FOR ISO 4401-03 (CETOP 03) VALVES WITH PORTS ON REAR

SERIES 10

— The P2X*M series of manifolds is designed for connection in parallel of two or more ISO 4401-03 (CETOP 03) valves.

— The monobloc design enables the simple creation of circuits without the use of pipes and fittings, thereby reducing overall dimensions to a minimum.

— Subplates are arranged for the installation of a pressure control valve with cartridge.

— Each section is fitted with work ports A and B positioned on the rear of the subplate.

— Subplates are fitted with additional rear ports P and T.

— Subplates are made of cast iron.

p max **350** bar

Q max **100** l/min

TECHNICAL SPECIFICATIONS

Maximum operating pressure - ports P - A - B - port T	bar	350 140
Maximum flow	l/min	100
Port dimensions: P - pressure T - drainage B - users A - drainage	BSP	1/2”
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	cSt	25
Recommended viscosity	According to ISO 4406:1999 class 20/18/15	

1 - IDENTIFICATION CODE

P	2	X		M	/	10

Manifold

Dimension 2 for ISO 4401-03 (CETOP 03) valves

Version made of cast iron

No. of mounting positions:
2 = 2 mounting positions
4 = 4 mounting positions
6 = 6 mounting positions

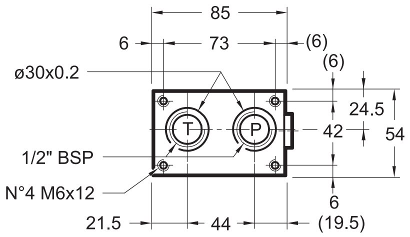
Serial No.
(from 10 to 19 overall and mounting dimensions remain unchanged)

Arrangement for pressure control valve to be ordered separately:

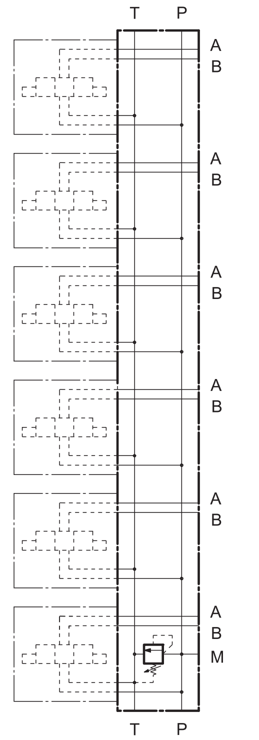
- up to 50 l/min direct operated valve type CR* (see cat. 21100)

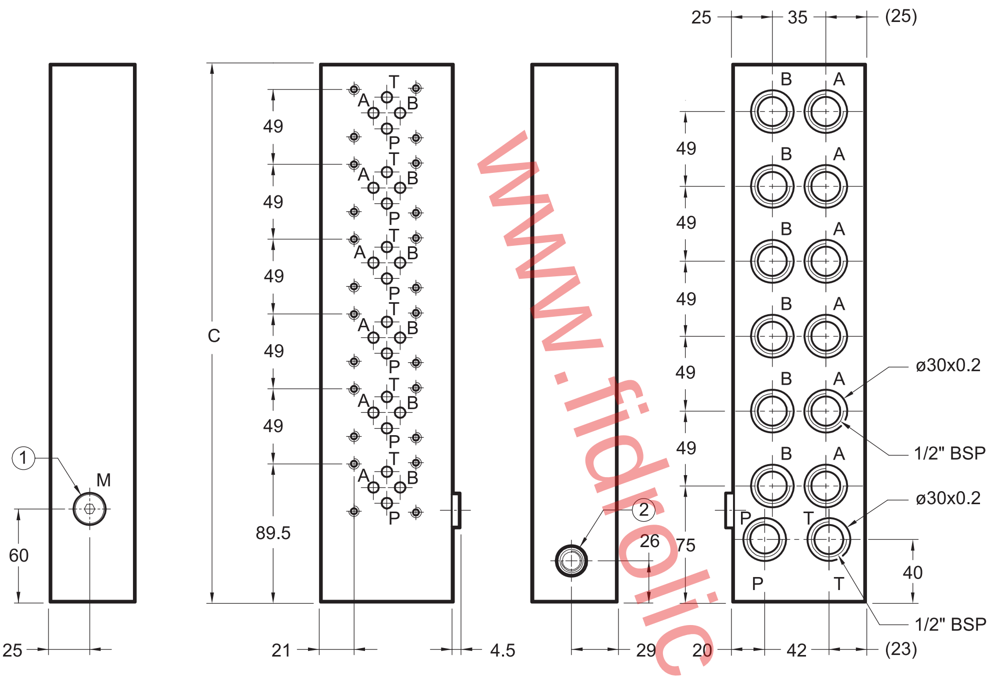
- up to 100 l/min pilot operated valve type CRQ (see cat. 21110)

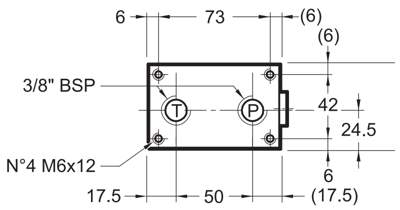
2 - OVERALL AND MOUNTING DIMENSIONS



Es. Subplate with 6 mounting positions and pressure control valve type CR*/21







dimensions in mm

Manifold	No. of valves mounting positions	C
P2X2M/10	2	150
P2X4M/10	4	250
P2X6M/10	6	350

1	Pressure gauge port 1/4” BSP plugged
2	Arranged for the installation of a pressure control valve (to be ordered separately - see par. 1)

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DUPLOMATIC OLEODINAMICA

P4D*

MODULAR SUBPLATES FOR ISO 4401-05 (CETOP 05) VALVES

— This series of modular subplates has been designed to make hydraulic circuits and can be used directly on power packs or on any other section of the machine.

— The subplates are assembled by means of 4 tie-rods with seal seats incorporated in the subplate.

— The above assembly achieves compact units (including pressure and discharge manifolds): one face per subplate is used for connection to services and the other to mount ISO 4401-05 (CETOP 05) or ISO 4401-03 (CETOP 03) valves.

— Complex circuits can also be set up using modular valves.

— The recommended mounting configuration for **P4D** subplates on hydraulic power packs is with the main axis positioned vertically to obtain the bundle of pipes to utilities in two vertical rows; however, assembly is not restricted to this configuration.

p max **350** bar
Q max **100** l/min

TECHNICAL SPECIFICATIONS

Maximum operating pressure - ports P - A - B - port T	bar	see paragraph 8 140
Maximum flow	l/min	100
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	cSt	25
Recommended viscosity	According to ISO 4406:1999 class 20/18/15	

1 - IDENTIFICATION CODE

P	4	D	-		/		

Subplate

Dimension for ISO 4401-05 valves

D = single mounting facility

Versions:
F = with P - T threaded ports, mounting interface ISO 4401-05 (CETOP 05) and side ports of 1/2" BSP.
P = with P - T threaded ports, mounting interface ISO 4401-05 (CETOP 05) and A - B rear ports of 3/4" BSP.
D3 = with P - T threaded ports, mounting interface ISO 4401-03 (CETOP 03) and side ports of 3/8" BSP.
D3P = with P - T threaded ports, mounting interface ISO 4401-03 (CETOP 03) and A - B rear ports of 1/2" BSP
M* = with pressure relief valve included and P - T threaded ports.
Pressure adjustment range:
070 = up to 70 bar
140 = up to 140 bar
210 = up to 210 bar
350 = up to 350 bar

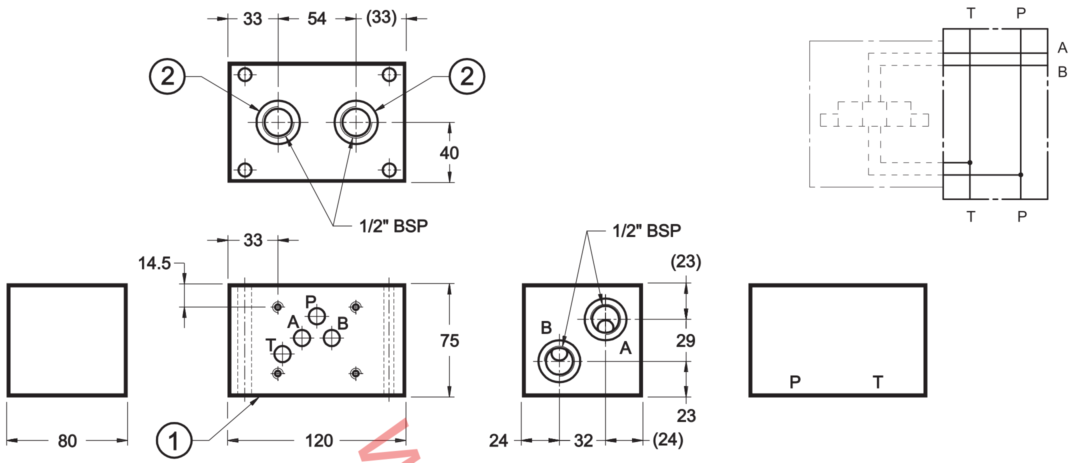
for P4D-M* version only:
Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

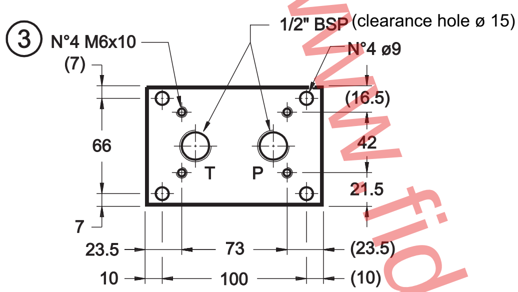
Series No.
30 = for P4D-M*
21 = for all the other versions
(Within the same ten dimensions remain unchanged)

2 - OVERALL AND MOUNTING DIMENSIONS P4D-F/21 (COD. 1561441)

P - T THREADED PORTS SUBPLATE, WITH MOUNTING INTERFACE FOR ISO 4401-05 (CETOP 05) VALVE AND A-B SIDE PORTS OF 1/2" BSP

dimensions in mm





Mass: kg 4,8

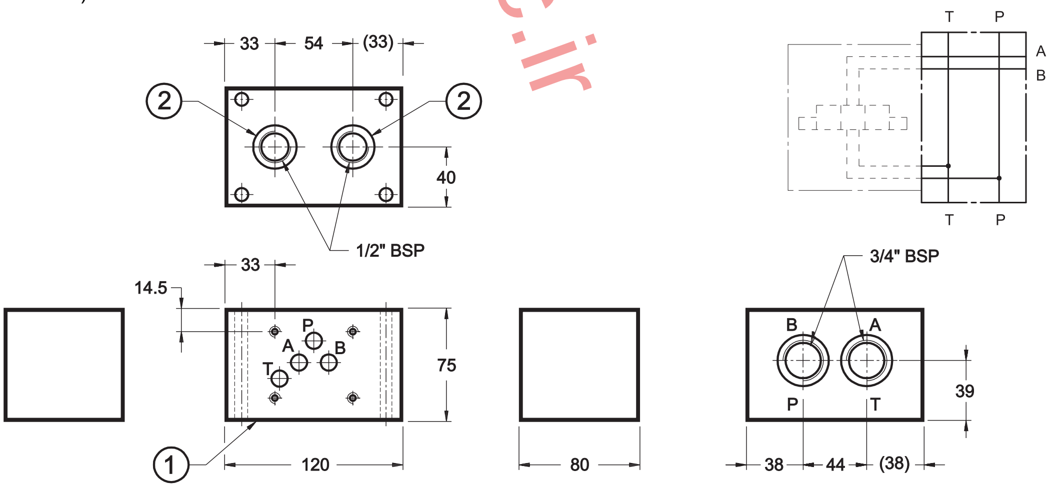
NOTE: The subplate is supplied with O-Ring in NBR 90 Shore

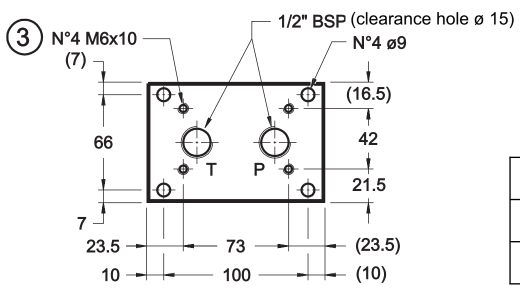
1	Mounting surface
2	OR seat 3100 (25.07x2.72)
3	Holes for possible mounting of P2D subplates

3 - OVERALL AND MOUNTING DIMENSIONS P4D-P/21 (COD. 1561461)

P - T THREADED PORTS SUBPLATE WITH MOUNTING INTERFACE FOR ISO 4401-05 (CETOP 05) VALVE AND A -B REAR PORTS OF 3/4" BSP

dimensions in mm





Mass: kg 4,8

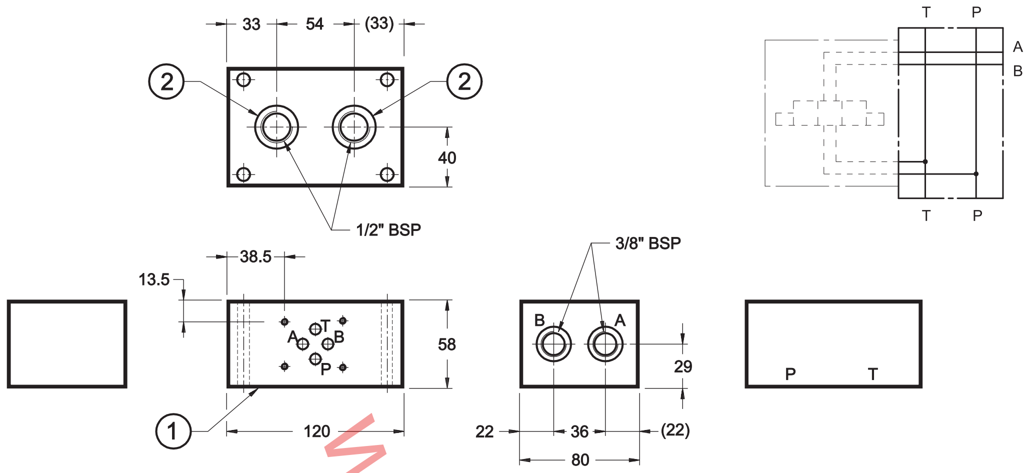
NOTE: The subplate is supplied with O-Ring in NBR 90 Shore

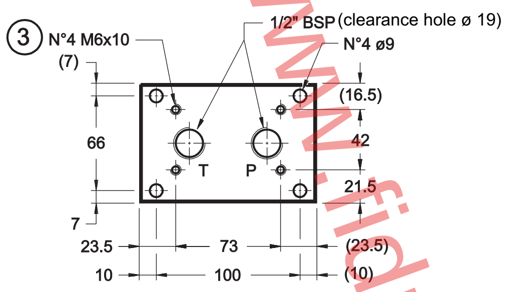
1	Mounting surface
2	OR seat 3100 (25.07x2.72)
3	Holes for possible mounting of P2D subplates

4 - OVERALL AND MOUNTING DIMENSIONS P4D-D3/21 (COD. 1561451)

P - T THREADED PORTS SUBPLATE, WITH MOUNTING INTERFACE FOR ISO 4401-03 (CETOP 03) VALVE AND SIDE PORTS OF 3/8” BSP

dimensions in mm





NOTE: The subplate is supplied with O-Ring in NBR 90 Shore

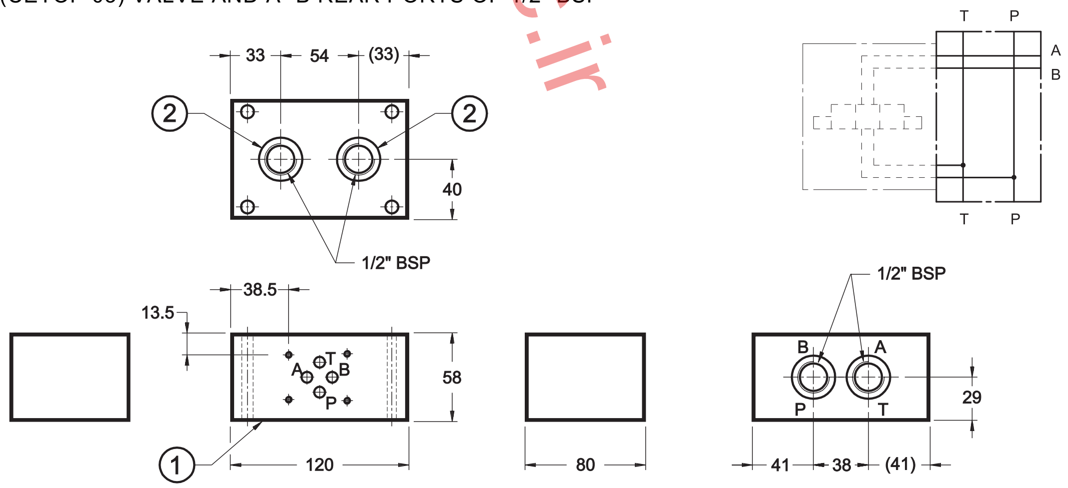
1	Mounting surface
2	OR seat 3100 (25.07x2.72)
3	Holes for possible mounting of P2D subplates

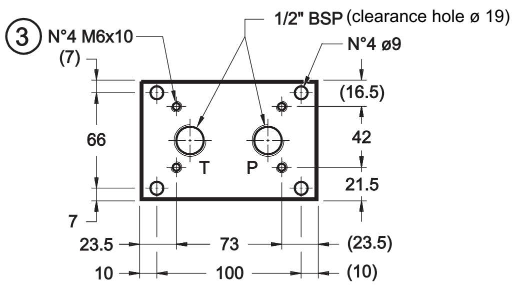
Mass: kg 3,8

5 - OVERALL AND MOUNTING DIMENSIONS P4D-D3P/21 (COD. 1561481)

P - T THREADED PORTS SUBPLATE, WITH MOUNTING INTERFACE FOR ISO 4401-03 (CETOP 03) VALVE AND A -B REAR PORTS OF 1/2” BSP

dimensions in mm



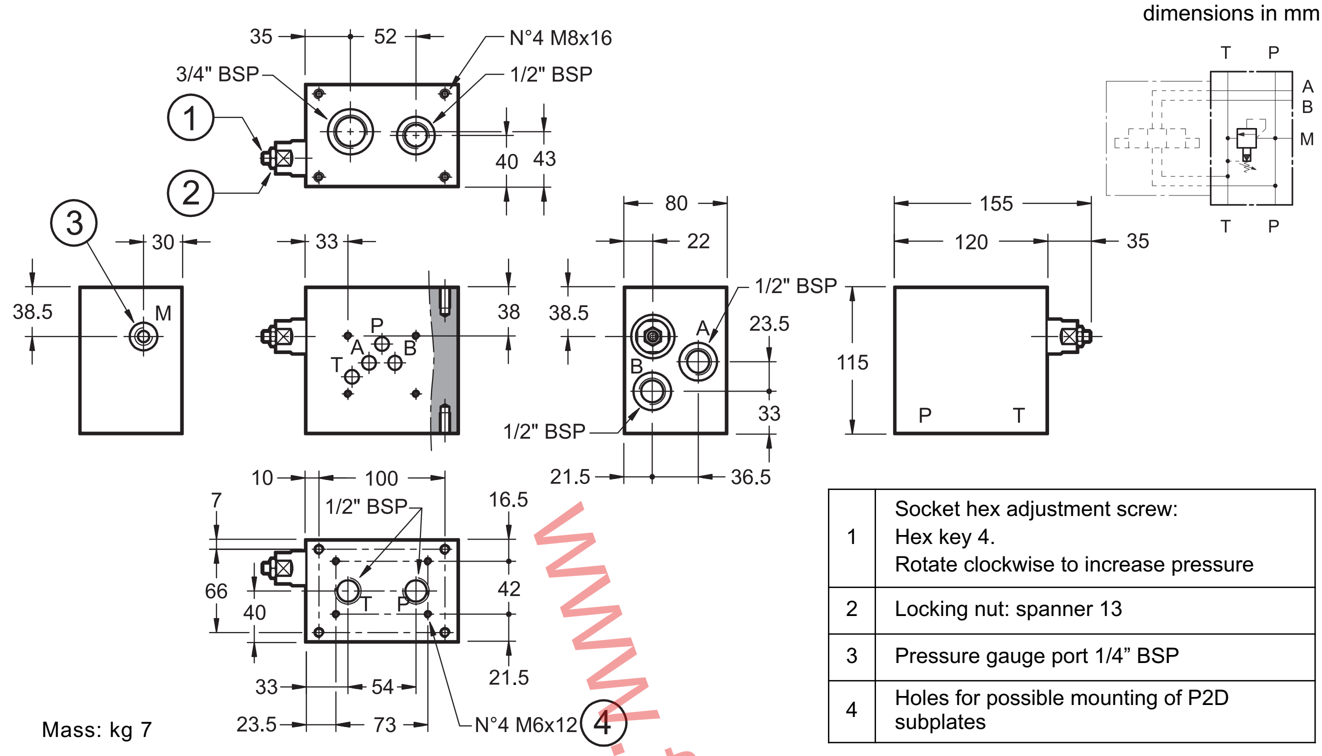


NOTE: The subplate is supplied with O-Ring in NBR 90 Shore

1	Mounting surface
2	OR seat 3100 (25.07x2.72)
3	Holes for possible mounting of P2D subplates

Mass: kg 3,8

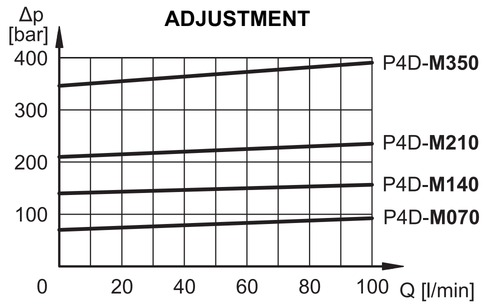
6 - OVERALL AND MOUNTING DIMENSIONS P4D-M*/30

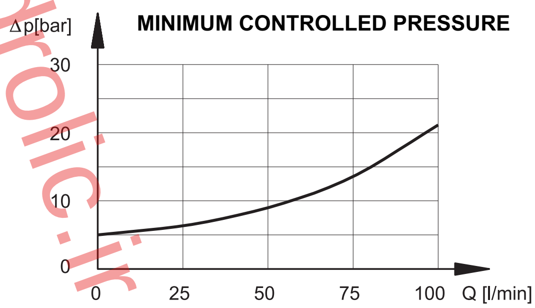


1	Socket hex adjustment screw: Hex key 4. Rotate clockwise to increase pressure
2	Locking nut: spanner 13
3	Pressure gauge port 1/4” BSP
4	Holes for possible mounting of P2D subplates

7 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)





8 - MAXIMUM PRESSURE ON P

Depending on the tie-rod type and on the number of assembled subplates it is necessary to pay attention to the maximum pressure on P in order to avoid extruding the O-Ring.

No. of assembled subplates	Threaded bar class B7 ISO 6547 (DIN 975)	Stud class 8.8 UNI 5911	Stud class 12.9
2	350 bar	350 bar	350 bar
3	300 bar	350 bar	350 bar
4	250 bar	300 bar	350 bar
5	200 bar	250 bar	300 bar
6	150 bar	200 bar	250 bar
Tightening torque	20 Nm	20 Nm	30 Nm

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DUPLOMATIC OLEODINAMICA

RM4-*-MP

SUBPLATE WITH PRESSURE RELIEF VALVE

SERIES 40

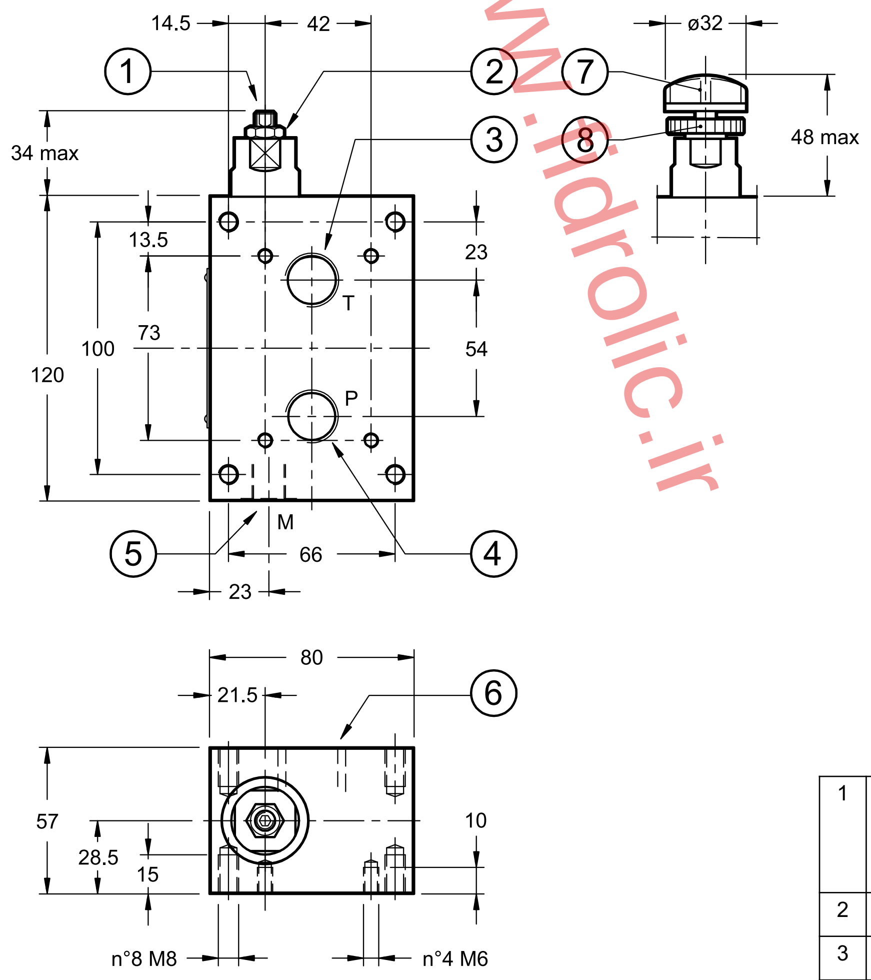
- The RM4-*-MP subplate includes a pressure relief valve with P and T threaded ports.
- It is used as mounting surface for P2D and P4D subplates on power packs.
- It is available in four pressure adjustment ranges up to 350 bar.
- It is supplied with a socket set screw with locking nut, or alternatively with knob and maximum adjustment limiting device.

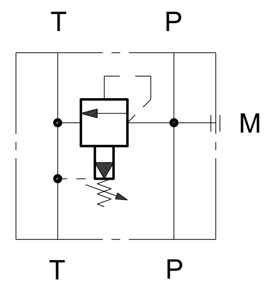
THREADED PORTS

p max **350** bar
Q max **100** l/min

1 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm





1	Socket hex adjustment screw: Hex key 4. Rotate clockwise to increase pressure
2	Locking nut: spanner 13
3	Tank port 1/2" BSP
4	Pressure port 1/2" BSP
5	Pressure gauge port 1/4" BSP
6	Tank port 3/4" BSP
7	Locking ring
8	Adjustment knob: K

Mass: kg 3,5

2 - IDENTIFICATION CODE

R	M	4	-		-	M	P	/	40		/	

Subplate with pressure relief valve

For valves of ISO 4401-05 size

Pressure adjustment range:
070 = up to 70 bar (17 bar/turn)
140 = up to 140 bar (32 bar/turn)
210 = up to 210 bar (47 bar/turn)
350 = up to 350 bar (78 bar/turn)

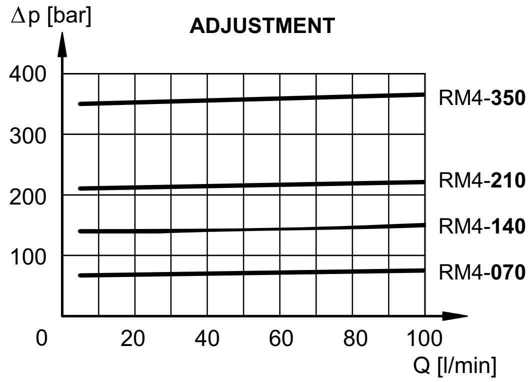
P2 - P4 subplate version

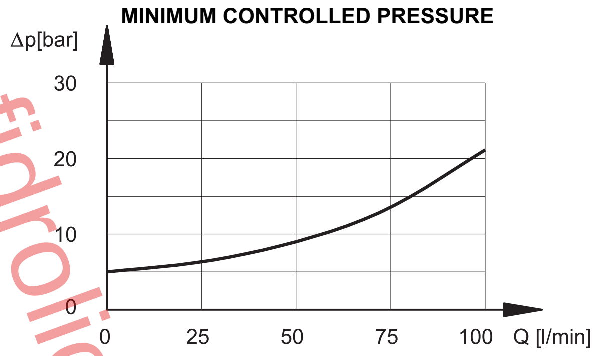
Serial No.
(the overall and mounting dimensions remain unchanged from 40 to 49)

Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

Option:
K = Adjustment knob.
Omit for adjustment with hex socket screw

3 - CHARACTERISTIC CURVES
(values obtained with viscosity of 36 cSt at 50°C)





4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

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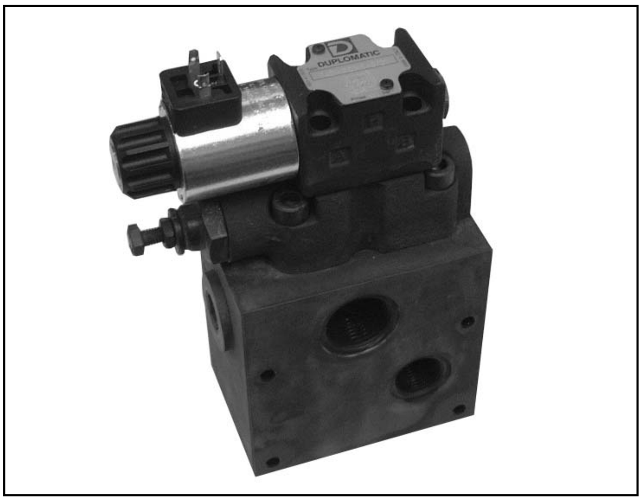


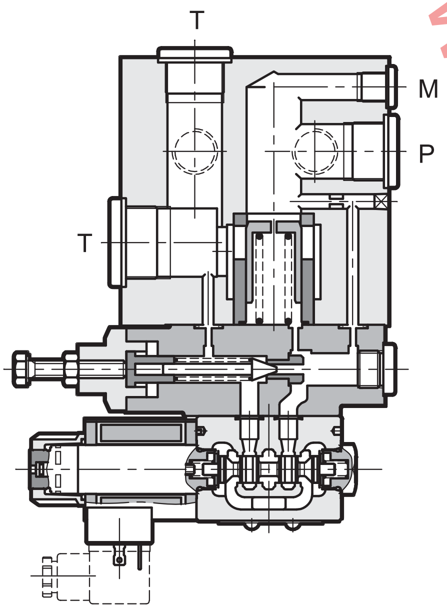
P4D-RQM5

MODULAR SUBPLATE WITH PRESSURE RELIEF VALVE AND UNLOADING SOLENOID VALVE

SERIES 30

p max **350** bar
Q max **250** l/min

OPERATING PRINCIPLE



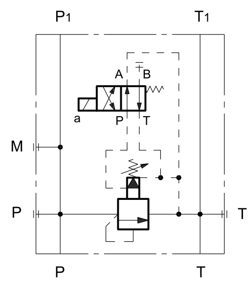
- The P4D-RQM5 is a compact group that includes a pressure relief valve and it is used as mounting surface for P2D and P4D subplates.
- It also includes a solenoid valve for venting of the total flow at a minimum pressure value.
- It is available in two pressure adjustment ranges up to 350 bar.
- It is normally supplied with a hexagonal head adjustment screw. Upon request, it can be equipped with a SICBLOC adjustment knob on the main pressure control.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow on P (3/4”) and T(1”) Maximum flow on P_1 and T_1(1/2”) Minimum flow	l/min	250 120 10
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	10

NOTE: for the solenoid valve DS3 characteristics see catalogue 41 150

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

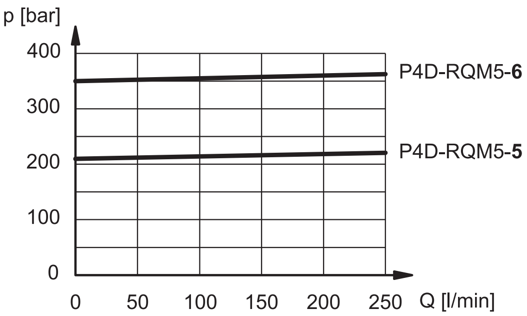
P	4	D	-	R	Q	M	5	-		/		/	30		-		K1	/	

- Subplate ISO 4401-05 (CETOP 05) dimension
- Pressure relief valve with unloading solenoid valve
- DN 25 nominal dimension
- Pressure adjustment range
  5 = 250 bar **6** = 350 bar
- **M** = SICBLOC adjustment knob (omit for hexagonal head adjustment screw)
- Series: (the overall and mounting dimensions remain unchanged from 30 to 39)
- Seals:
  N = NBR seals for mineral oil (**standard**)
  V = FPM seals for special fluids
- DC power supply
  D12 = 12 V
  D24 = 24 V
  D48 = 48 V
  D110 = 110 V
  D220 = 220 V
  D00 = valve without coils (see **NOTE**)
- AC power supply
  A24 = 24 V - 50 Hz
  A48 = 48 V - 50 Hz
  A110 = 110 V - 50 Hz / 120 V - 60 Hz
  A230 = 230 V - 50 Hz / 240 V - 60 Hz
  A00 = valve without coils (see **NOTE**)
  F110 = 110 V - 60 Hz
  F220 = 220 V - 60 Hz
- Coil electrical connection: plug for connector type DIN 43650 (**standard**)
- Manual override: omit for override integrated in the tube (**standard**)
  CM = manual override, boot protected

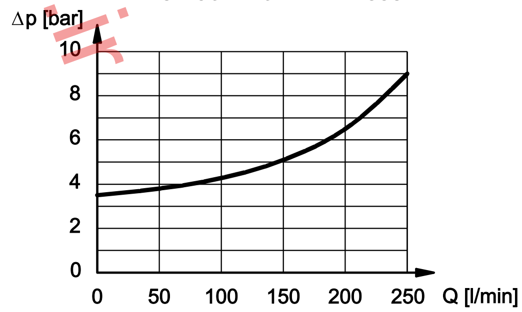
NOTE: The locking rings of the coils and the relevant O-Rings are supplied together with valves.

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

ADJUSTMENT



MINIMUM CONTROLLED PRESSURE



NOTE: The maximum flow deliverable to P1 port is 120 l/min (for P2D and P4D modular subplates).
The maximum flow through the pressure relief valve (additional 3/4" BSP P port) is 250 l/min.

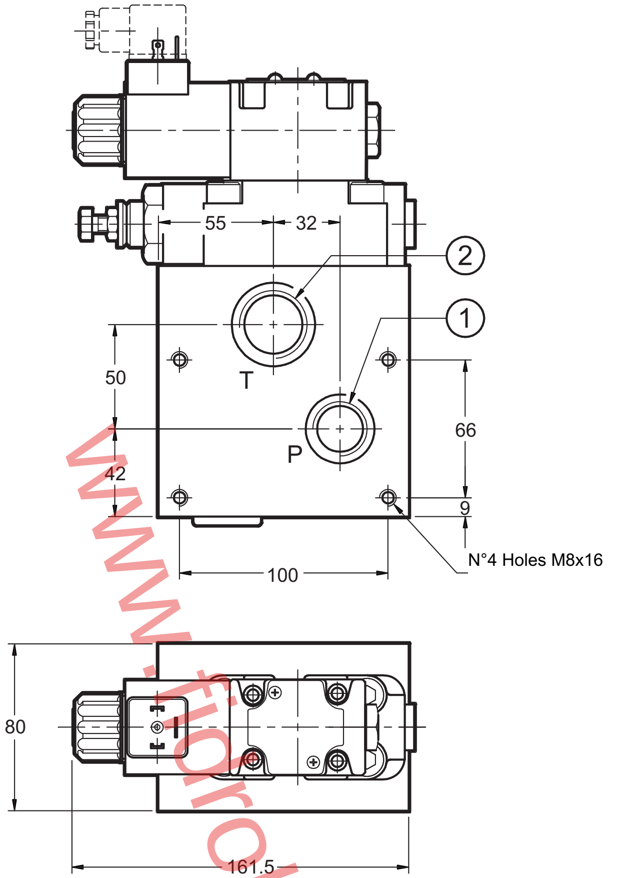
3 - HYDRAULIC FLUIDS

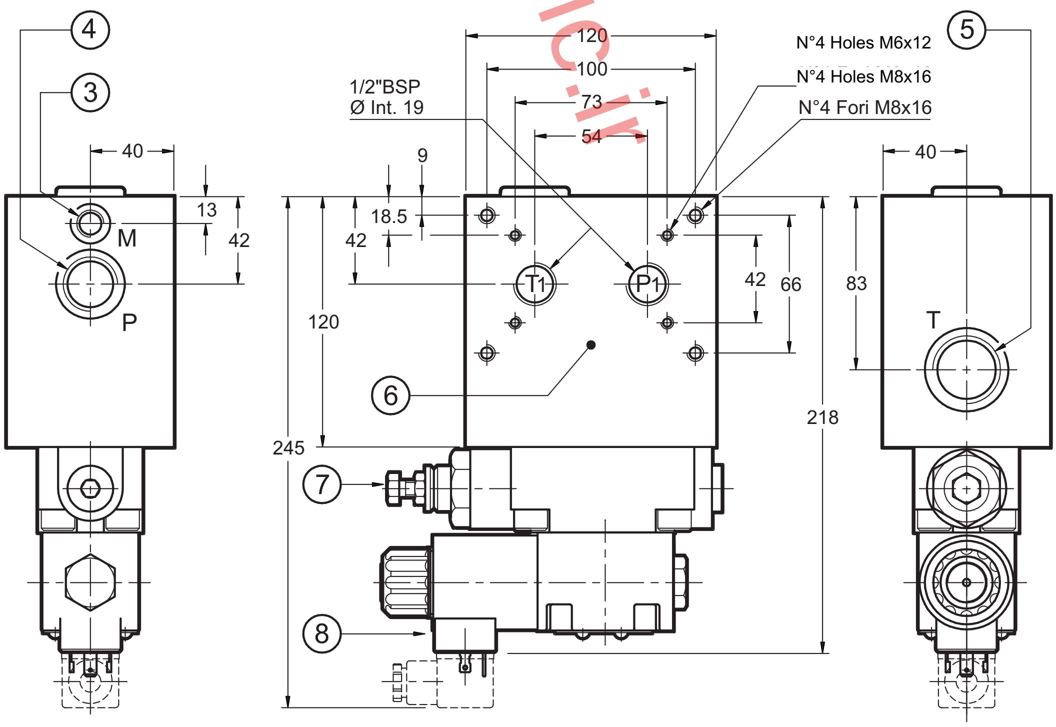
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

1	Pressure port P 3/4" BSP
2	Tank port T 1" BSP
3	Pressure gauge port M 1/4" BSP
4	Additional P port 3/4" BSP
5	Additional T port 1" BSP
6	Mounting surface for: P2D ISO 4401-03 (CETOP 03) P4D ISO 4401-05 (CETOP 05)
7	Hexagonal head pressure adjustment screw: spanner 13 Clockwise rotation to increase pressure
8	Unloading solenoid valve

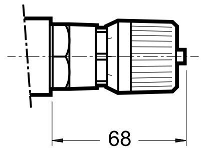
dimensions in mm





5 - ADJUSTMENT KNOB

The P4D-RQM5 valves can be equipped with a SICBLOC adjustment knob.
To operate it, push and rotate at the same time.
To request this option, add: /**M** (see par.1).



6 - ELECTRIC CONNECTORS

The solenoid valves are never supplied with connector. Connectors must be ordered separately. For the identification of the connector type to be ordered, please see catalogue 49 000.

7 - MANUAL OVERRIDE, BOOT PROTECTED: CM

Whenever the solenoid valve installation may involve exposure to atmospheric agents or utilization in tropical climates, use of the manual override, boot protected, is recommended.
Add the suffix **CM** to request this device (see paragraph 1).
For overall dimensions see catalogue 41 150.

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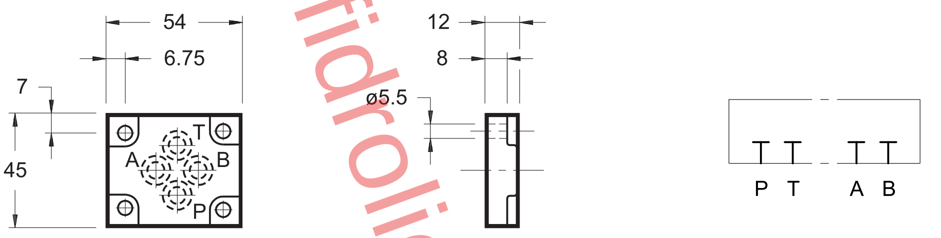
DUPLOMATIC OLEODINAMICA

PE
BLANKING PLATE

p max **350** bar

1 - OVERALL AND MOUNTING DIMENSIONS PE-MD1/20 (cod. 1950591)

dimensions in mm

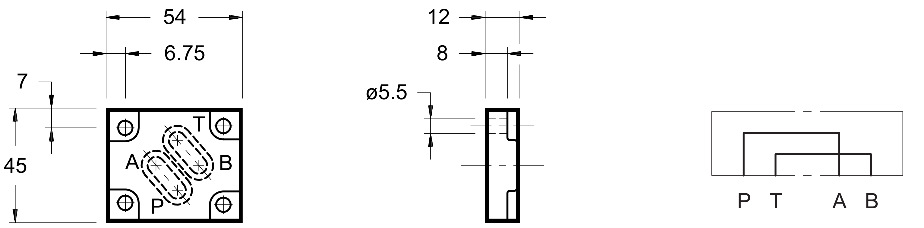


FASTENING BOLTS: 4 bolts M5x16

4 OR type 2037 (9.25x1.78) - 90 Shore

2 - OVERALL AND MOUNTING DIMENSIONS PE-C/PA/MD1/20 (cod. 1950751)

dimensions in mm

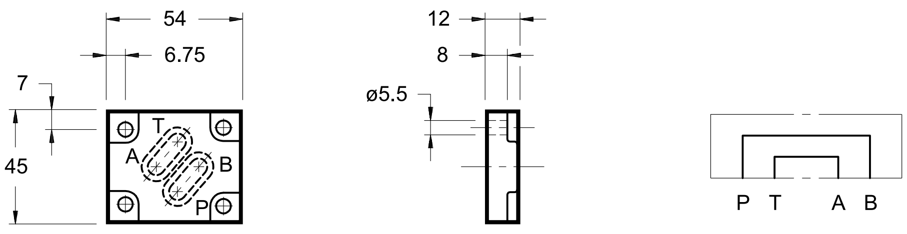


FASTENING BOLTS: 4 bolts M5x16

2 OR type 2068 (17.17x1.78) - 90 Shore

3 - OVERALL AND MOUNTING DIMENSIONS PE-C/PB/MD1/20 (cod. 1950601)

dimensions in mm

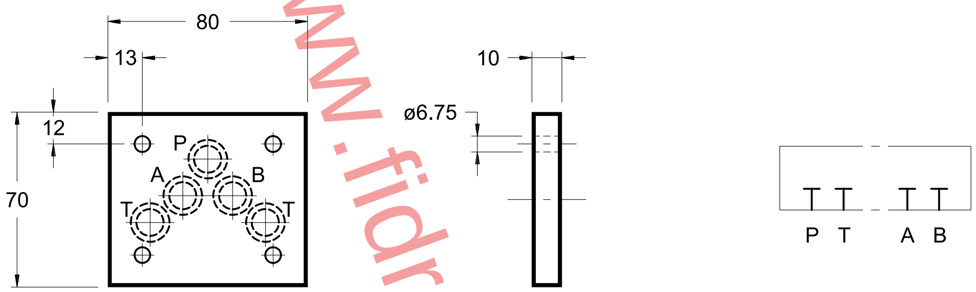


FASTENING BOLTS: 4 bolts M5x16

2 OR type 2068 (17.17x1.78) - 90 Shore

4 - OVERALL AND MOUNTING DIMENSIONS PE/D4-M (cod, 1950042)

dimensions in mm

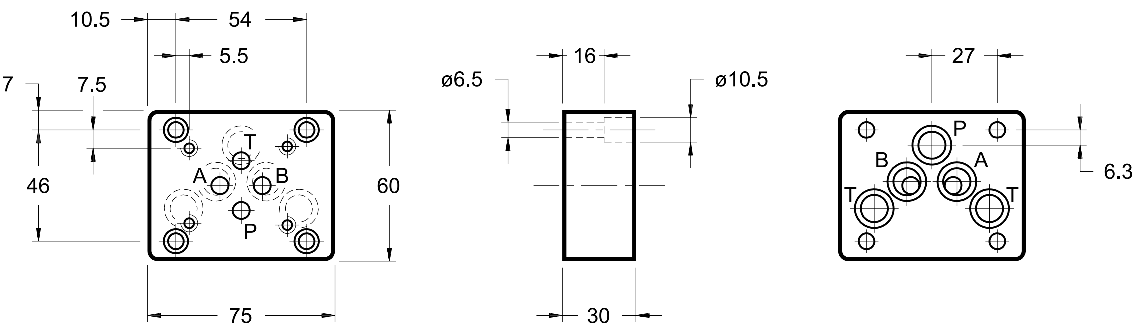


FASTENING BOLTS: 4 bolts M6x20

5 OR type 2050 (12.42x1.78) - 90 Shore

5 - OVERALL AND MOUNTING DIMENSIONS PC-D4/MD1-M (cod. 1950222)

dimensions in mm



FASTENING BOLTS: 4 bolts M6x25

5 OR type 2050 (12.42x1.78) - 90 Shore

NOTE: On request, plates can be supplied with the O-Rings in viton. To order it, please indicate the letter **/V** at the end of the identification code of the plate.

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PRM2

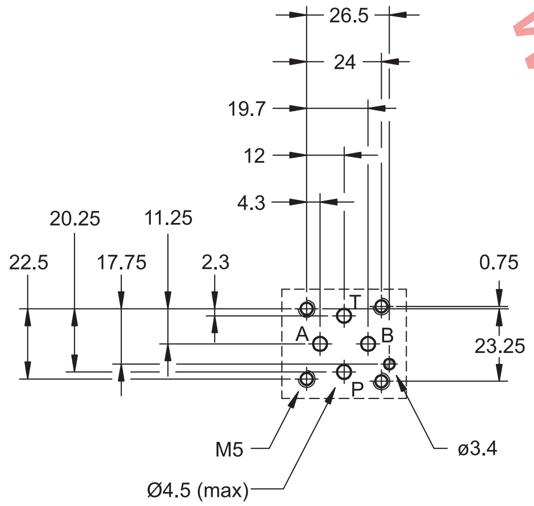
DIRECT OPERATED PRESSURE RELIEF VALVE
SERIES 10

MODULAR VERSION
ISO 4401-02

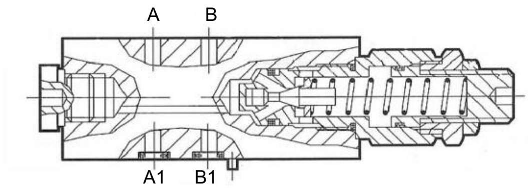
p max **320** bar
Q max **20** l/min

MOUNTING SURFACE

ISO 4401-02-01-0-05
(CETOP 4.2-4-R02-320)



OPERATING PRINCIPLE

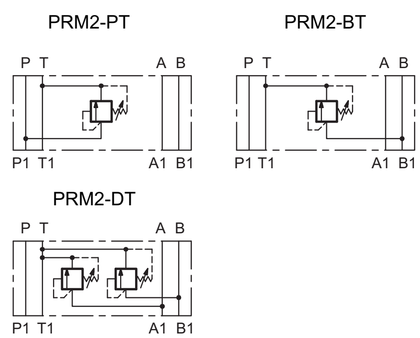


- The PRM2 valve is a direct operated pressure relief valve made as a modular version with mounting surface according to the ISO 4401 standards.
- It can be assembled with all ISO 4401-02 modular valves without use of pipes, using suitable tie-rods or bolts.
- It is available in versions for single relief on P or B with discharge in T, or two independent relief on A and B with discharge in T, all with three different pressure adjustment ranges.
- This valve is normally used as a hydraulic circuit pressure limiting device or as a limiting device of the pressure peaks generated during the movement of hydraulic actuators.
- It is supplied with a countersunk hex adjustment screw and locking nut.

PERFORMANCES
(measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	320
Minimum controlled pressure	see Δp diagram.	
Maximum flow rate	l/min	20
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: PRM2-PT and PRM2-BT PRM2-DT	kg	0.85 1

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

P	R	M	2	-			/	10	

Direct operated pressure relief valve

Modular version

Size: ISO 4401-02

Versions:
PT: single relief on line P with discharge in T
BT: single relief on line B with discharge in T
DT: double relief on lines A-B with discharge in T

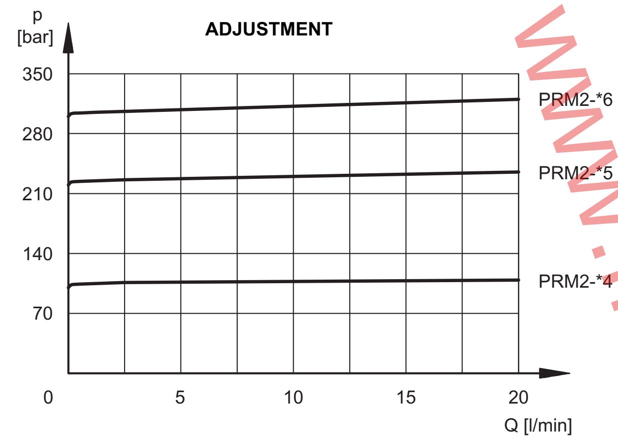
Pressure adjustment range
4 = from 63 to 125 bar (16 bar/turn)
5 = from 80 to 210 bar (26 bar/turn)
6 = from 125 to 320 bar (50 bar/turn)

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

2 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)



3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V).

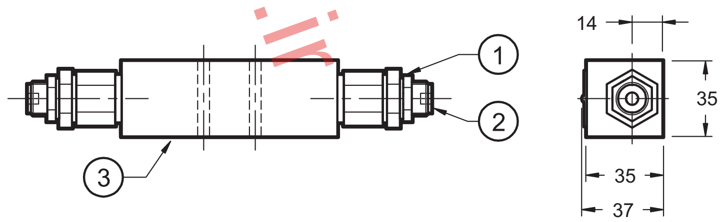
For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

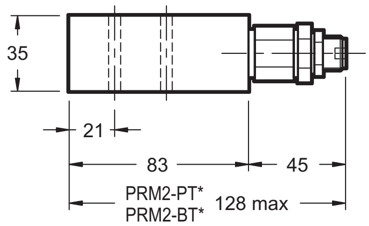
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

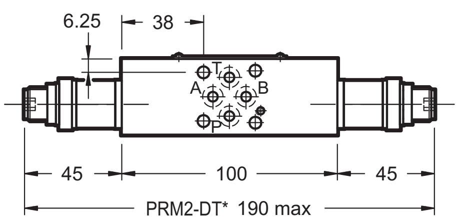
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm







1	Locking nut: spanner 19
2	Countersunk hex adjustment screw: spanner 5 Rotate clockwise to increase pressure
3	Mounting surface with sealing rings: N. 4 OR type 2025 (6.07x1.78) 90 Shore

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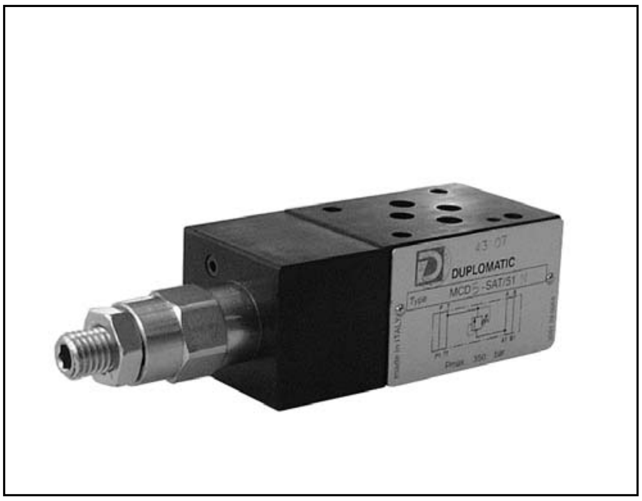


MCD

DIRECT OPERATED PRESSURE RELIEF VALVE

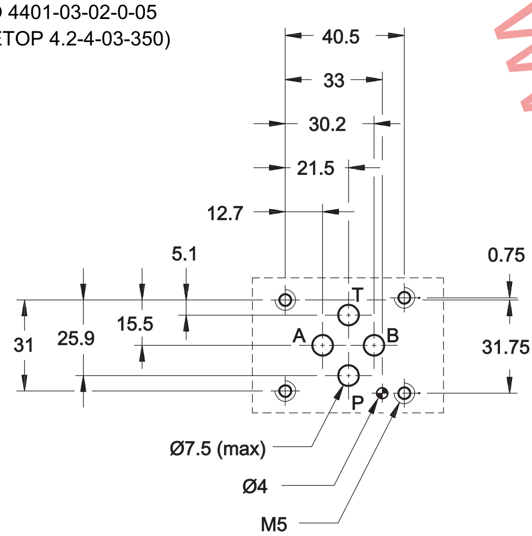
SERIES 51

MODULAR VERSION
ISO 4401-03 (CETOP 03)

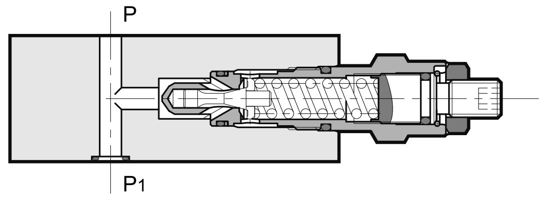
p max **350** bar
Q max (see table of performances)

MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



OPERATING PRINCIPLE



— The MCD valve is a direct operated pressure relief valve made as a modular version with mounting surface according to the ISO 4401 (CETOP RP 121H) standards.

— It can be assembled with all ISO 4401-03 (CETOP 03) modular valves without use of pipes, using suitable tie-rods or bolts.

— It is available in versions for single adjustment on one control line, or dual on two control lines and with four different pressure adjustment ranges.

— This valve is normally used as a hydraulic circuit pressure limiting device or as a limiting device of the pressure peaks generated during the movement of hydraulic actuators.

— It is normally supplied with a hexagonal head adjustment screw, locking nut and limitation of the maximum adjustment travel.

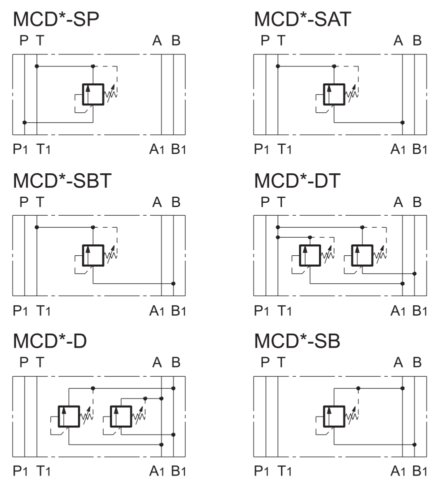
CONFIGURATIONS (see Hydraulic symbols table)

— “SP”: controls the pressure on line P with discharge in T.
— “SAT”: controls the pressure on line A with discharge in T.
— “SBT”: controls the pressure on line B with discharge in T.
— “DT”: controls the pressure on lines A-B with discharge in T.
— “D”: controls the pressure on lines A-B with crossed discharges
— “SB”: controls the pressure on line B with discharge in A.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Minimum controlled pressure	see Δp diagram.	
Maximum flow rate in controlled lines Maximum flow rate in the free lines	l/min	50 75
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: MCD-SP / MCD-SAT / MCD-SBT / MCD-SB MCD-DT / MCD-D	kg	1,4 2,0

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

M	C	D		-		/	51		/	

Size: ISO 4401-03 (CETOP 03). Modular version

Direct operated pressure relief valve

Pressure adjustment range
2 = up to 25 bar
3 = up to 70 bar
4 = up to 140 bar
5 = up to 210 bar
6 = up to 350 bar

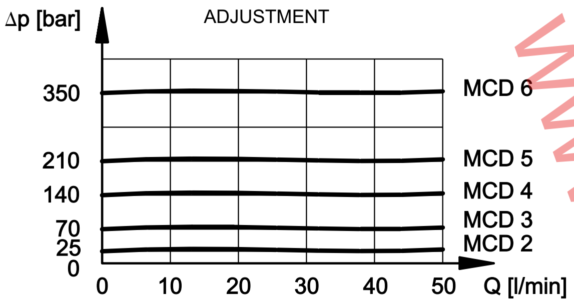
Configurations:
SP: single on line P with discharge in T
SAT: single on line A with discharge in T
SBT: single on line B with discharge in T
DT: double on lines A-B with discharge in T
D: double on lines A-B with crossed discharges
SB: single on line B with discharge in A

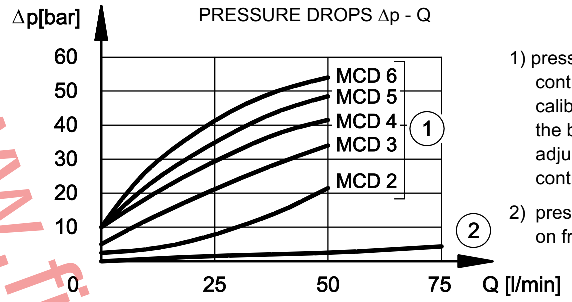
Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)

Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

omit for adjustment with countersunk hex screw - **standard**
K = Adjustment knob

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)





1) pressure drops on controlled lines with calibrated screw at the beginning of the adjustment (minimum controlled pressure)

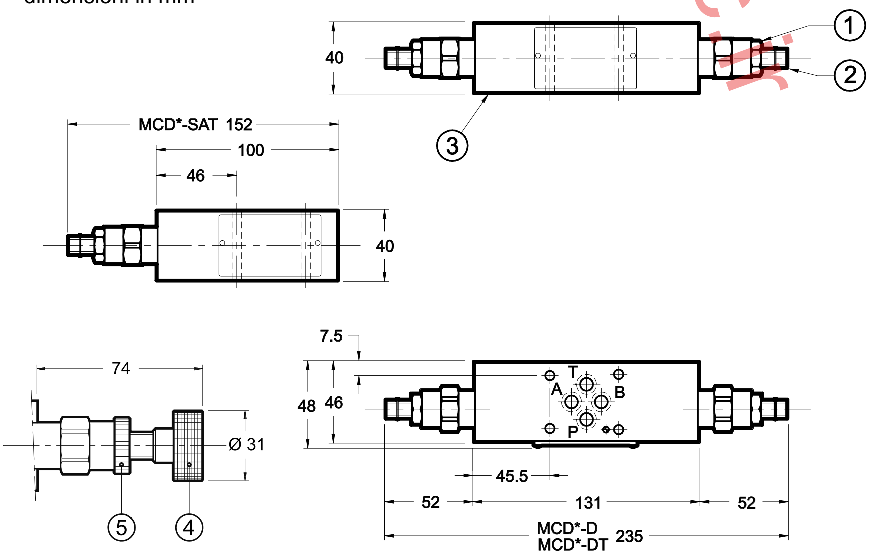
2) pressure drops on free lines

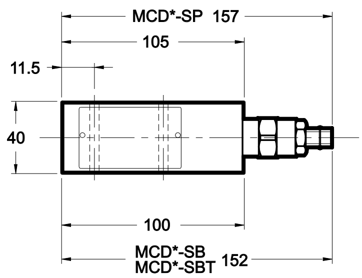
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensioni in mm





1	Locking nut: spanner 19
2	Countersunk hex adjustment screw: spanner 6 (**standard**) Rotate clockwise to increase pressure
3	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) 90 Shore
4	Adjustment knob: K
5	Locking ring

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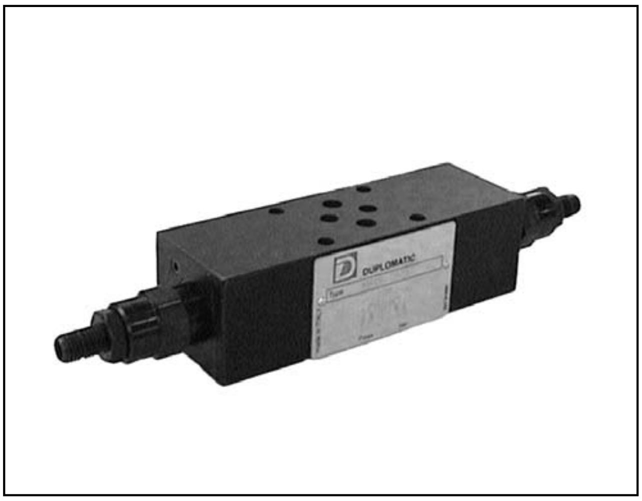
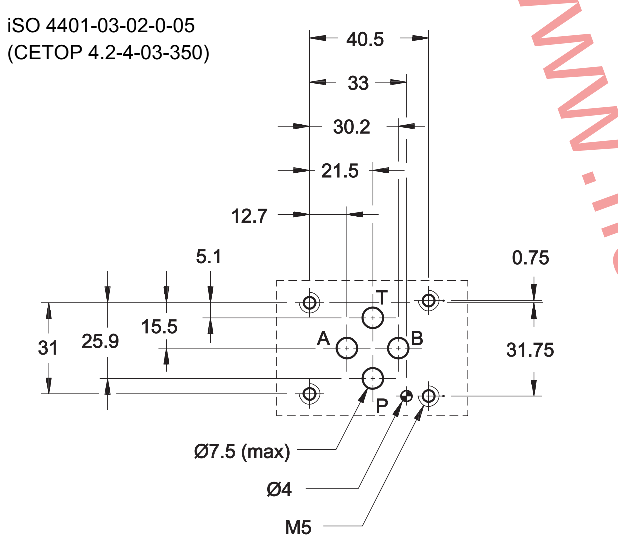
MRQ
PILOT OPERATED PRESSURE RELIEF VALVE
SERIES 51



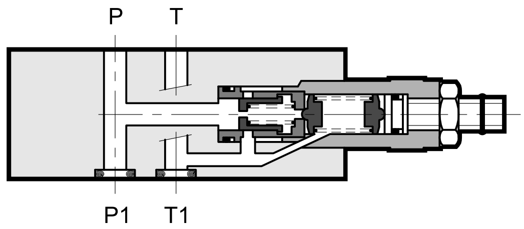
MODULAR VERSION
ISO 4401-03 (CETOP 03)

p max **350** bar
Q max **75** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



— The MRQ valve is a pilot operated pressure relief valve made as a modular version with mounting surface according to ISO 4401 (CETOP RP 121H) standards.

— It can be assembled with all ISO 4401-03 (CETOP 03) modular valves without the use of pipes, using suitable tie-rods or bolts.

— It is available in versions for single adjustment on one control line or dual on two control lines and with four different pressure adjustment ranges.

— This valve is normally used as a hydraulic circuit pressure limiting device.

— It is normally supplied with a hexagonal head adjustment screw, locking nut and limitation of the maximum adjustment travel.

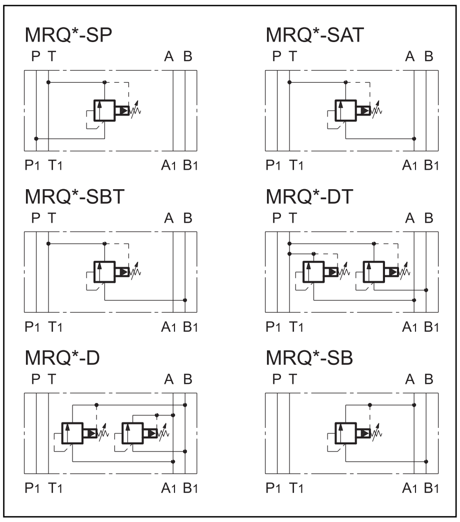
CONFIGURATIONS (see Hydraulic symbols table)

— "SP": controls the pressure on line P with discharge in T.
— "SAT": controls the pressure on line A with discharge in T.
— "SBT": controls the pressure on line B with discharge in T.
— "DT": controls the pressure on lines A-B with discharge in T.
— "D": controls the pressure on lines A-B with crossed discharges.
— "SB": controls the pressure on line B with discharge in A.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Minimum controlled pressure	see Δp diagram.	
Maximum flow rate in controlled lines and in the free lines	l/min	75
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: MRQ-SP / MRQ-SAT / MRQ-SBT / MRQ-SB MRQ-DT / MRQ-D	kg	1,4 2,1

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

M	R	Q		-		/		/	51	/	

ISO 4401-03 (CETOP 03) size. Modular version

Pilot operated pressure relief valve

Pressure adjustment range:
3 = up to 70 bar
4 = up to 140 bar
5 = up to 210 bar
6 = up to 350 bar

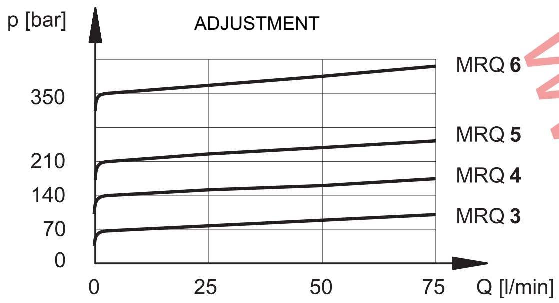
Configurations:
SP: single on line P with discharge in T
SAT: single on line A with discharge in T
SBT: single on line B with discharge in T
DT: double on lines A-B with discharge in T
D: double on lines A-B with crossed discharges
SB: single on line B with discharge in A

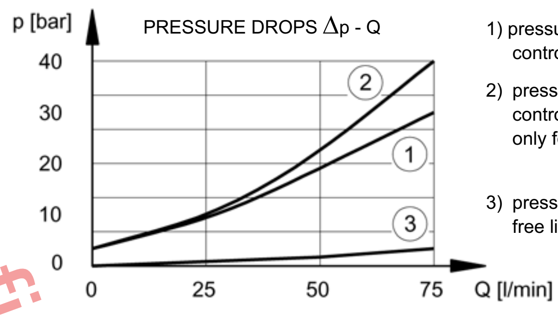
M1 = Adjustment knob
(omit for adjustment with countersunk hex screw)

Series No. (the overall and mounting dimensions remain unchangerd from 50 to 59)

Seals: omit for mineral oils
V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)





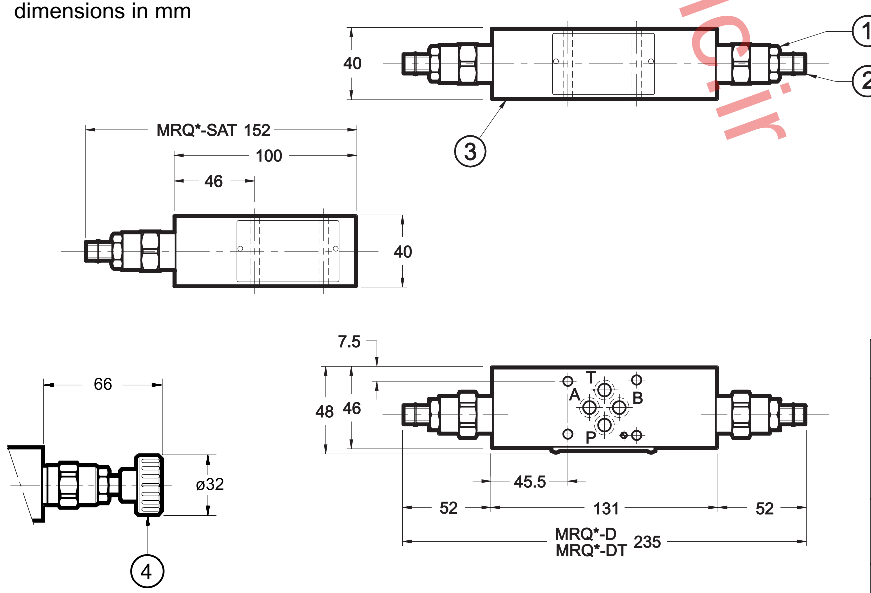
1) pressure drops on controlled lines
2) pressure drops on controlled lines only for MRQ*-D MRQ*-SB
3) pressure drops on free lines

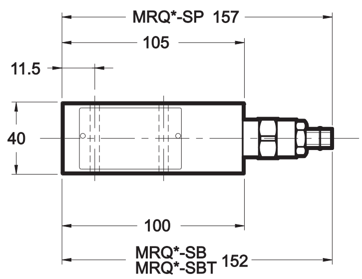
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm





1	Locking nut: spanner 19
2	Countersunk hex adjustment screw: spanner 5 Rotate clockwise to increase pressure
3	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) 90 Shore
4	Adjustment knob: M1

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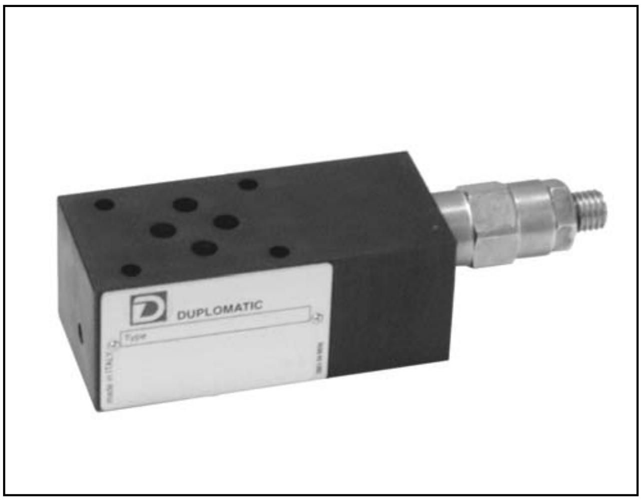
PBM3
BACKPRESSURE VALVE
SERIES 10

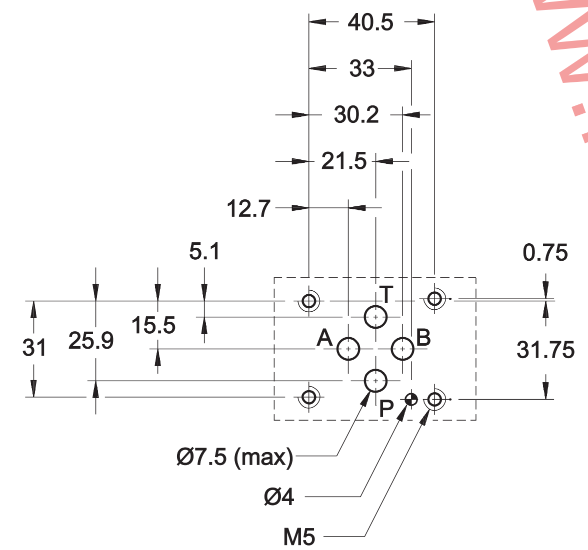


MODULAR VERSION
ISO 4401-03 (CETOP 03)

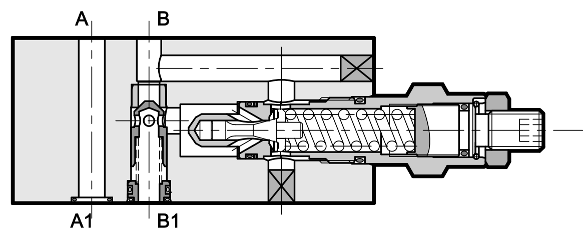
p max **350** bar
Q max (see table of performances)

MOUNTING INTERFACE

ISO 4401-03-02-0-05
CETOP 4.2-4-03-350



OPERATING PRINCIPLE



— The valve PBM3 is a direct operated three-way pressure regulator, developed as a modular version with mounting surface according to the ISO 4401 (CETOP RP121H) standards.

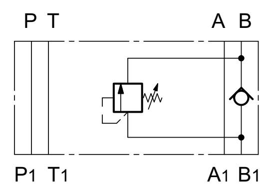
— Its aim is to adjust the output backpressure coming from the actuator, so as to allow the input free flow .

— It is normally used on vertically mounted cylinders where the cancellation of a load weighting on the road of the same cilinder is needed.

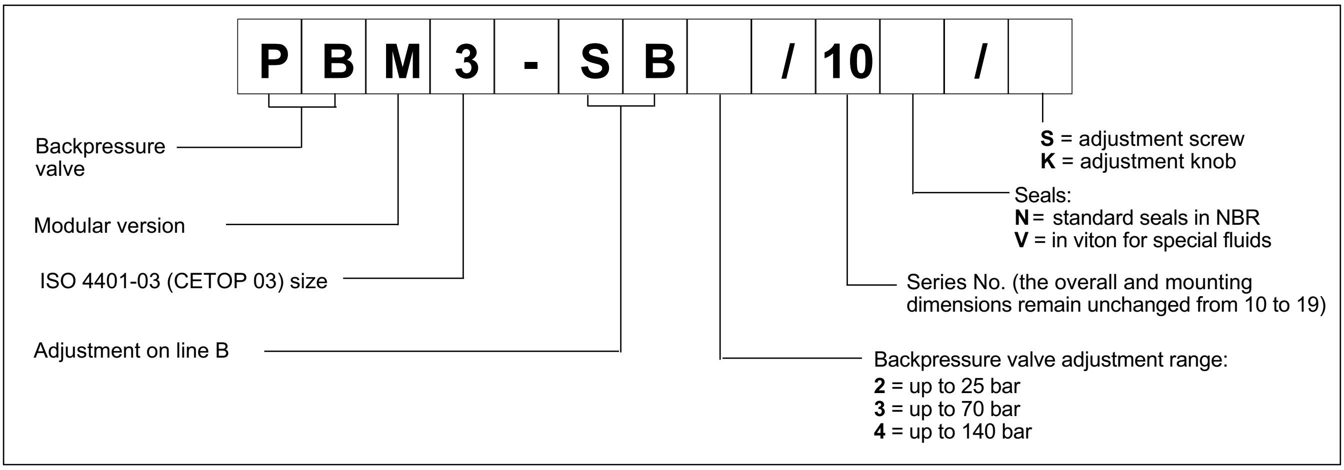
PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Check valve cracking pressure	bar	3,5
Max. flow on check valve B→B1 (Δp 8 bar)	bar	50
Maximum flow rate in controlled line B1→B Maximum flow rate in the free lines P, A, T	l/min	50 75
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	1,6

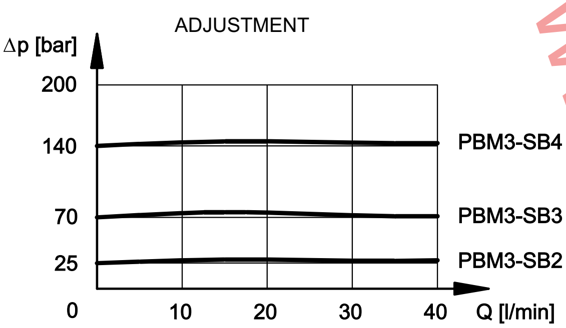
HYDRAULIC SYMBOL

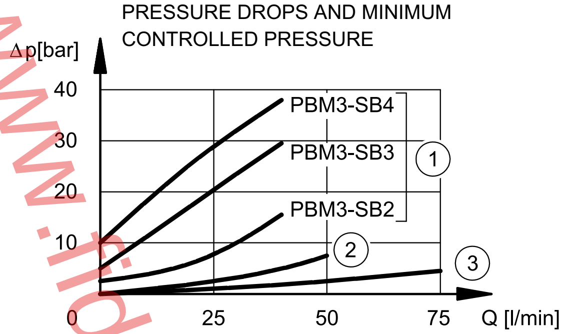


1 - IDENTIFICATION CODE



2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)





1) pressure drops on line B1→B with calibrated screw at the beginning of the adjustment (min. controlled pressure)

2) pressure drops on line B→B1 to which the cracking pressure of the check valve is to be added

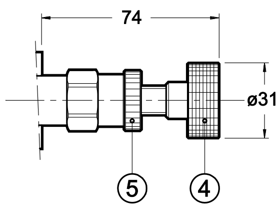
3) pressure drops on free lines

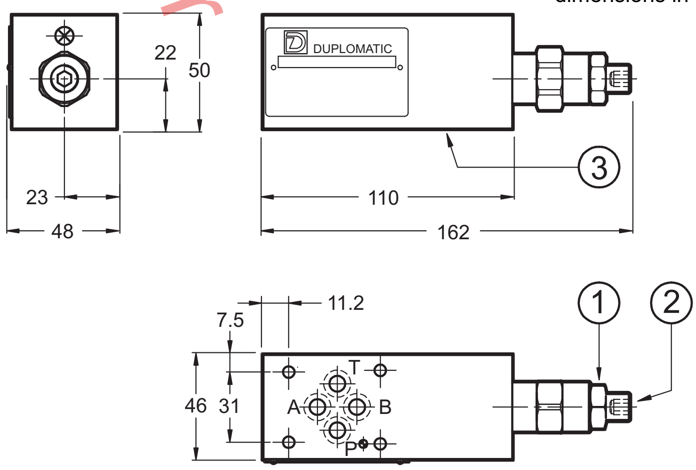
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm





1	Locking nut: spanner 19
2	**S** countersunk hex adjustment screw: spanner 6 Rotate clockwise to increase pressure
3	Mounting surface with sealing rings: 4 OR tipo 2037 - 90 shore (9.25 x 1.78)
4	Adjustment knob: **K**
5	Locking ring

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PRM5

PILOT OPERATED PRESSURE RELIEF VALVE

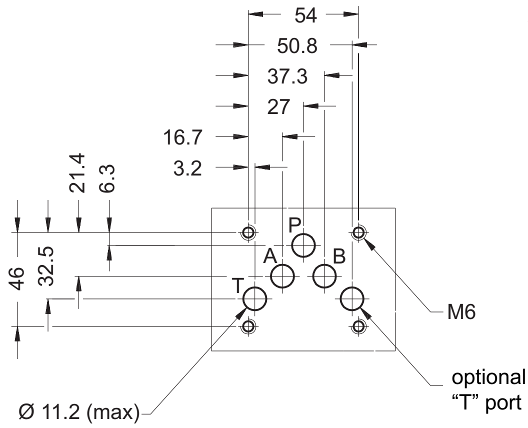
SERIES 10

MODULAR VERSION
ISO 4401-05 (CETOP 05)

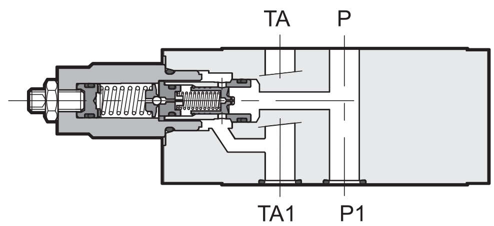
p max **350** bar
Q max **120** l/min

MOUNTING SURFACE

ISO 4401-05-04-0-05
CETOP 4.2-4-05-350



OPERATING PRINCIPLE



— The PRM5 valve is a pilot operated pressure relief valve made as a modular version with mounting surface according to ISO 4401 (CETOP RP121H) standards.

— It can be assembled with all ISO 4401-05 modular valves without the use of pipes, using suitable tie-rods or bolts.

— Versions are available for single adjustment on one control line, or dual on two control lines and with four different pressure adjustment ranges.

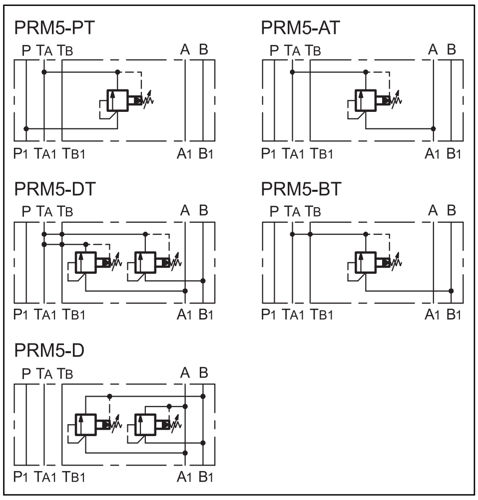
— This valve is used as a hydraulic circuit pressure limiting device.

— It is supplied with an hexagonal head adjustment screw and locking nut. It is also available with knob.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Minimum controlled pressure	bar	see Δp - Q diagram
Max flow	l/min	120
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: PRM5-PT, -AT, -BT PRM5-DT, -D	kg	2,8 3

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

P	R	M	5	-			/	10		/		

Pilot operated pressure relief valve

Modular version

ISO 4401-05 (CETOP 05) size

Versions:
PT: single on line P with discharge in TA
AT: single on line A with discharge in TA
BT: single on line B with discharge in TA and TB
DT: double on lines A-B with discharge in TA and TB
D: double on lines A-B with cross discharge

Pressure adjustment range:
070 = 6 ÷ 70 bar (17 bar/turn)
140 = 6 ÷ 140 bar (32 bar/turn)
210 = 6 ÷ 210 bar (47 bar/turn)
350 = 6 ÷ 350 bar (78 bar/turn)

Option: W7 surface treatment.
Omit if not required (**NOTE**)

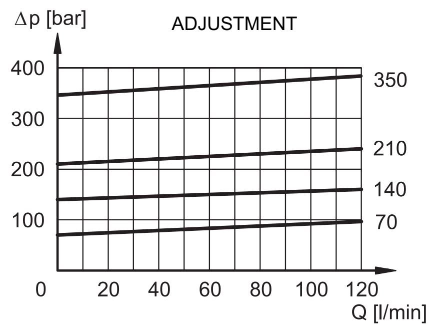
Option:
K = Adjustment knob. Omit for adjustment with hex socket screw (**standard**)

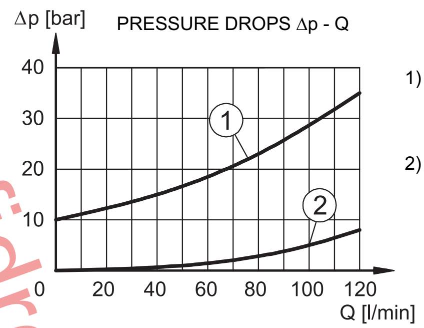
Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

NOTE: Upon request we can supply these valves completely with zinc-nickel surface treatment on the body. Add the suffix **/W7** at the end of the identification code.

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)





1) pressure drop on controlled lines PT, AT, BT, DT

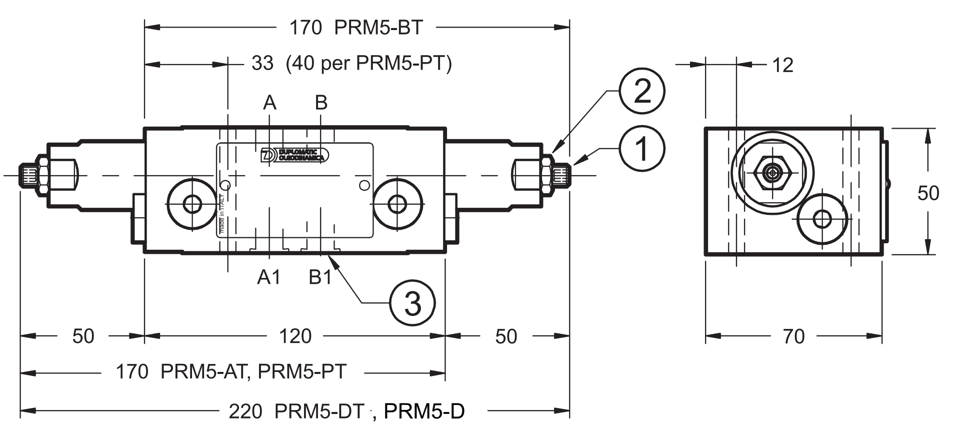
2) pressure drop on free lines

3 - HYDRAULIC FLUIDS

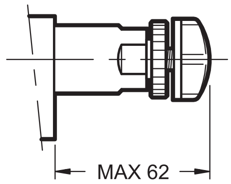
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



K VERSION



1	Socket hex adjustment screw: Hex key 4. Rotate clockwise to increase pressure
2	Locking nut: spanner 13
3	Mounting surface with sealing rings: 5 OR type 2050 (12.42 x 1.78) 90 Shore

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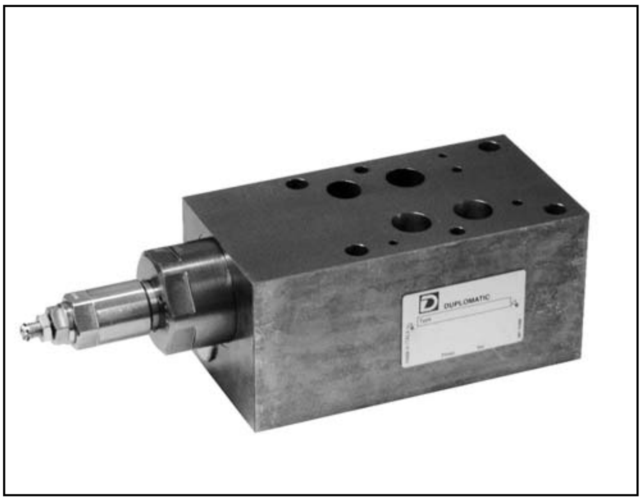


PRM7

PILOT OPERATED PRESSURE RELIEF VALVE

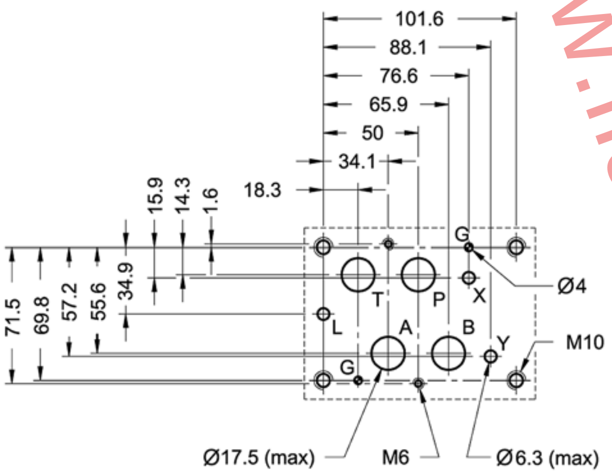
SERIES 10

MODULAR VERSION
ISO 4401-07 (CETOP 07)

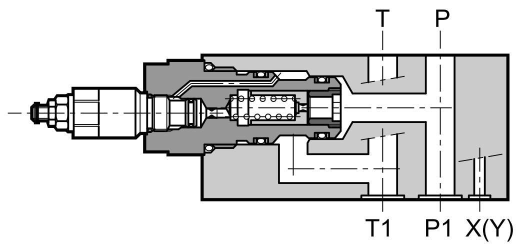
p max **350** bar
Q max **300** l/min

MOUNTING INTERFACE

ISO 4401-07-07-0-05
(CETOP 4.2-4-07)



OPERATING PRINCIPLE



— The PMR7 valve is a pilot operated pressure relief valve made as a modular version with a mounting surface according to ISO 4401 (CETOP RP 121H) standards.

— It can be assembled with all ISO 4401-07 (CETOP 07) modular valves without the use of pipes, using suitable tie-rods or bolts.

— It is available in the type for single adjustment on line P and discharge in T with two pressure adjustment ranges.

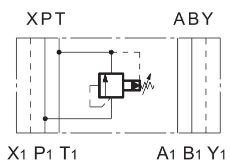
— This valve is normally used as a hydraulic circuit pressure limiting device.

— It is normally supplied with an adjustment screw.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	300
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	8,5

HYDRAULIC SYMBOL



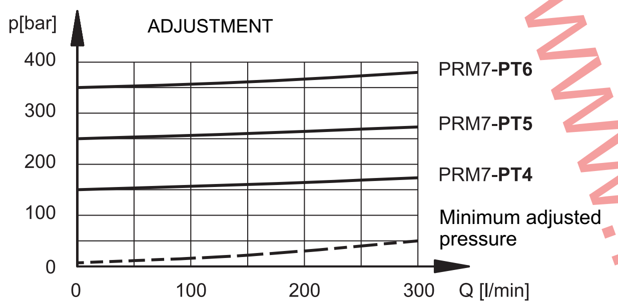
PRM7
SERIES 10

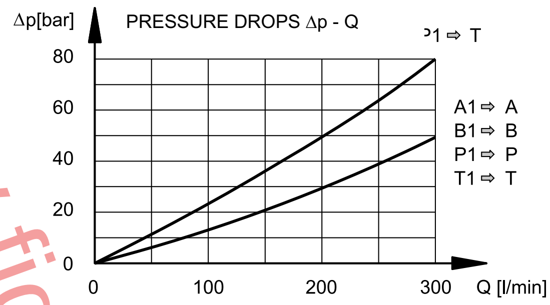
1 - IDENTIFICATION CODE

P R M 7 - PT [ ] / 10 [ ] / [ ]

- Pressure relief valve
- Modular version
- ISO 4401-07 (CETOP 07) size
- Pressure adjustment on line P with discharge in T
- Pressure adjustment range:
  4 = 15 ÷ 160 bar (30 rpm) **5** = 15 ÷ 250 bar (45 rpm)
  6 = 15 ÷ 315 bar (56 rpm)
- Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)
- Seals:
  N = standard seals in NBR **(standard)**
  V = in viton for special fluids
- **S** = adjustment screw **(standard)**
  K = adjustment knob

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



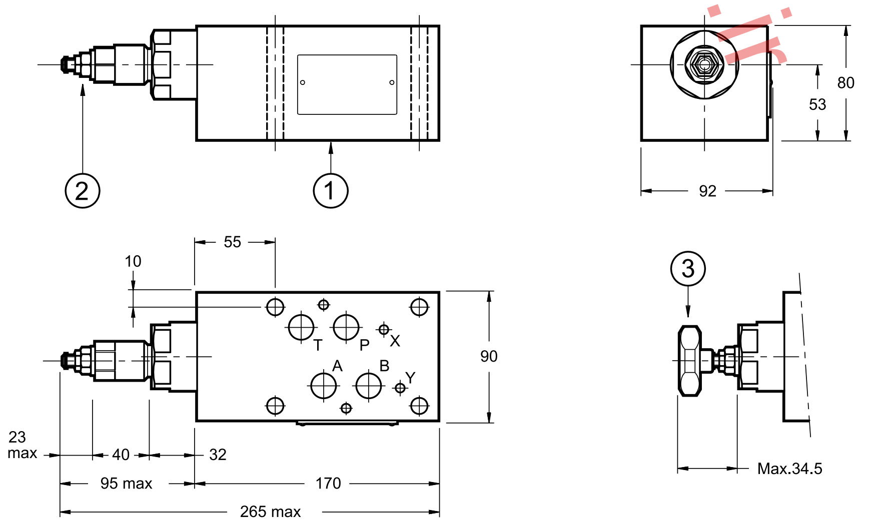


3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: N. 4 OR type 3087 (21.89x2.62) N. 2 OR tipo 2043 (10.82x1.78)
2	Standard adjustment screw Rotate clockwise to increase pressure
3	Adjustment knob **K** (optional) Rotate clockwise to increase pressure

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DUPLOMATiC OLEODiNAMiCA

PZM2

PRESSURE REDUCING VALVE DIRECT OPERATED WITH VARIABLE ADJUSTMENT

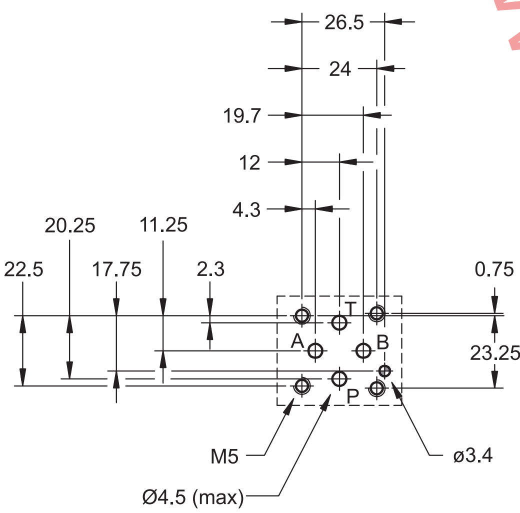
SERIES 10

MODULAR VERSION
ISO 4401-02

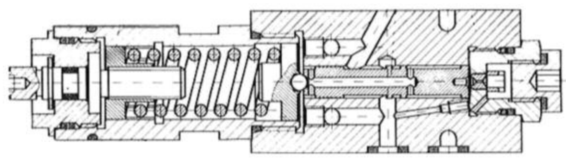
p max **320** bar
Q max **20** l/min

MOUNTING SURFACE

ISO 4401-02-01-0-05
(CETOP 4.2-4-R02-320)



OPERATING PRINCIPLE



— The PZM2 valve is a three-ports pressure reducing valve, direct operated, spool type, made as modular version, with ports according to the ISO 4401 standards and can be assembled quickly, without use of pipes, under the ISO 4401-02 solenoid valves.

— The PZM2 is a normally open valve. The hydraulic fluid flows freely in the pressure line. When the inlet pressure in P exceeds the value set by the spring, the valve opens the outlet port to the tank line until the outlet pressure has been reduced to the set value.

— The valve construction provides good adjustment sensitivity with reduced drainage flow. The drainage to the tank line is internal.

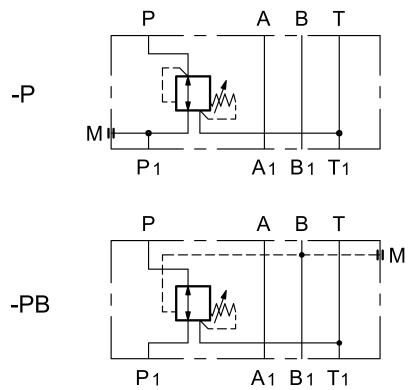
— The three-ports design provides protection of the secondary circuit from pressure surges since it allows a reverse flow from the actuator to the tank line.

PERFORMANCES

(measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure Maximum pressure on port T	bar	320 100
Maximum flow rate in the controlled lines Maximum flow rate in the free lines	l/min	20 30
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,7

HYDRAULIC SYMBOL



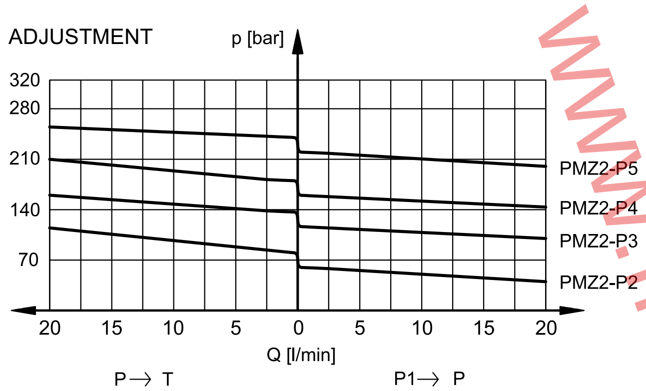
1 - IDENTIFICATION CODE

PZ	M	2	-			/	10		/	S

- **PZ** – Pressure-reducing valve, direct operated
- **M** – Modular version
- **2** – Size: ISO 4401-02
- Versions:
  P = pressure reduction on line P
  PB = pressure reduction on line P with pilot signal from line B
- Pressure adj. range:
  2 = 4 ÷ 32 bar
  3 = 5 ÷ 80 bar
  4 = 10 ÷ 200 bar
  5 = 25 ÷ 250 bar
- **10** – Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)
- Seals:
  N = NBR seals for mineral oils (**standard**)
  V = FPM seals for special fluids
- **S** – Adjustment screw

2 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)



3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N).

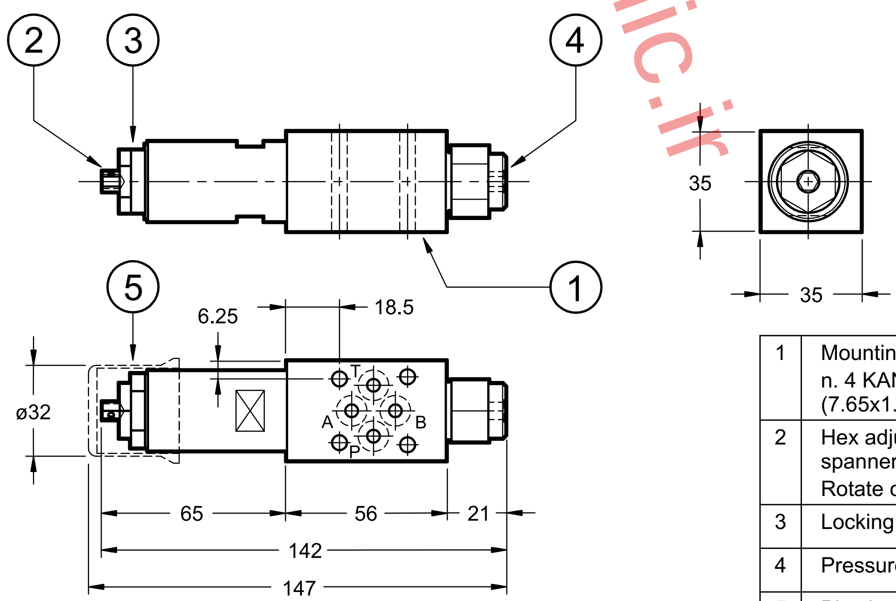
For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: n. 4 KANTSEAL type DKAR00011 (7.65x1.68x1.68) - 70 Shore
2	Hex adjustment screw with lead-sealing hole: spanner 6. Rotate clockwise to increase pressure
3	Locking nut : spanner 20
4	Pressure gauge port 1/4” BSP
5	Plastic cap for sealing

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MZD

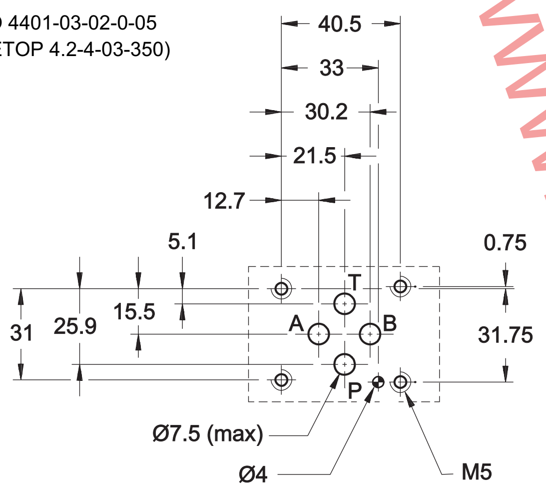
DIRECT OPERATED THREE-WAY PRESSURE REDUCING VALVE WITH FIXED OR VARIABLE ADJUSTMENT

MODULAR VERSION
ISO 4401-03 (CETOP 03)

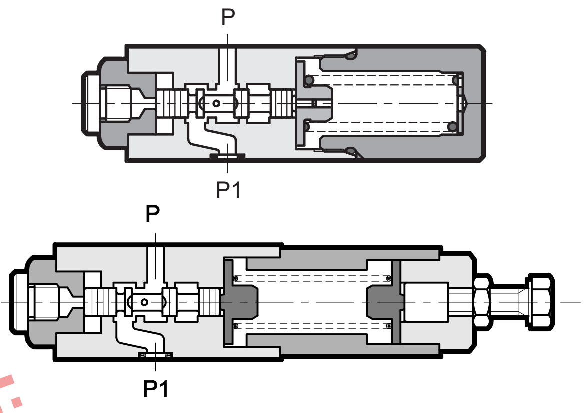
p max **350** bar
Q max (see table of performances)

MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



OPERATING PRINCIPLE



— The MZD valve is a three-way spool type direct operated pressure reducing valve. It is normally open in the rest position and the hydraulic fluid passes freely from the P1 line to the P line.

The spool is subjected to the line P pressure on one side, and on the other side by the adjustment spring. When the pressure in line P exceeds the value set by the spring, the valve closes until the pressure in P (reduced) equals the calibrated value.

— The valve construction provides good adjustment sensitivity with reduced drainage flow. The drainage is connected to line T inside the valve.

— The three-way design provides protection of the secondary circuit from pressure surges since it allows a reverse flow from the actuator to the T discharge line.

— It is made as a modular version with ports according to the ISO 4401 (CETOP RP 121H) standards and can be assembled quickly, without use of pipes, under the ISO 4401-03 (CETOP 03) solenoid valves.

— The variable adjustment version is supplied with a hexagonal head adjustment screw. Upon request, it can be equipped with a SICBLOC adjustment knob.

— The fixed adjustment version is available set at value 20, 25 or 30 bar pressure.

CONFIGURATIONS (see Hydraulic symbols at par.1)

— MZD*: pressure reduction on line P, drainage connected with line T.

— MZD*/A and MZD*/RA: pressure reduction on line A toward the actuator and maximum pressure in line B, drainage connected with line T.

— MZD*/B and MZD*/RB: pressure reduction on line B toward the actuator and maximum pressure in line A, drainage connected with line T.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure Maximum pressure on port T	bar	350 10
Maximum flow rate in the controlled lines Maximum flow rate in the free lines Drainage flow rate	l/min	50 75 ≤ 0,08
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	1,4

1 - IDENTIFICATION CODE OF MZD VARIABLE ADJUSTMENT VERSION

M	Z	D		/		/		/		/	

Size: ISO 4401-03 (CETOP 03)
Modular version

Direct operated pressure reducing valve

Pressure adjustment range:
2 = 3 ÷ 35 bar   **4** = 30 ÷ 140 bar
3 = 10 ÷ 70 bar   **5** = 50 ÷ 280 bar

Configurations
(omit for MZD with pressure reduction on line P and regulation unit on side B)
A: pressure reduction on line A and full pressure on line B with regulation unit on side B
B: pressure reduction on line B and full pressure on line A with regulation unit on side B
RP: pressure reduction on line P with regulation unit on side A
RA: pressure reduction on line A and full pressure on line B with regulation unit on side A
RB: pressure reduction on line B and full pressure on line A with regulation unit on side A

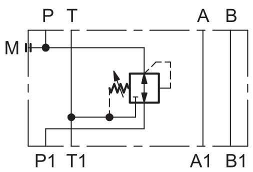
M = Adjustment with SICBLOC knob
(omit for adjustment with hexagonal head screw)

Series No.:
50 - for MZD*, MZD*/RP, MZD*/A, MZD*/RA, MZD*/B valves
51 - for MZD*/RB valves
(the overall and mounting dimensions remain unchanged from 50 to 59)

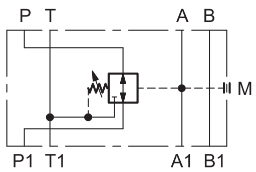
Seals:
omit for mineral oils
V = viton for special fluids

Hydraulic symbols

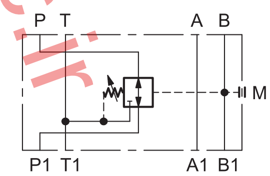
MZD*
MZD*/RP



MZD*/A
MZD*/RA



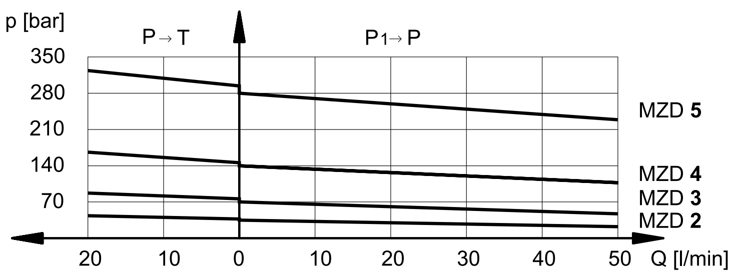
MZD*/B
MZD*/RB



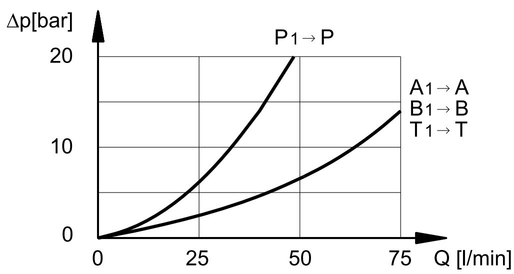
NOTE: the versions RP, RA and RB have been realised with regulation unit on side A, so as to be interchangeable with valves produced by other companies.
The standard version is equipped with regulation unit on side B.

2 - MZD VARIABLE ADJUSTMENT VERSION CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

ADJUSTMENT



PRESSURE DROPS Δp - Q



3 - IDENTIFICATION CODE OF MZD FIXED ADJUSTMENT VERSION

M	Z	D	-		/		/	50	/	

Size: ISO 4401-03 (CETOP 03)
Modular version

Direct operated pressure reducing valve

Adjustment:
020 = 20 bar
025 = 25 bar
030 = 30 bar

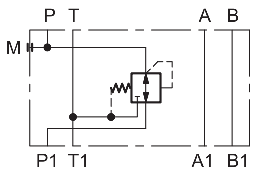
Configurations
(omit for MZD with pressure reduction on line P and regulation unit on side B)
A: pressure reduction on line A and full pressure on line B with regulation unit on side B
B: pressure reduction on line B and full pressure on line A with regulation unit on side B

Seals:
omit for mineral oils
V = viton for special fluids

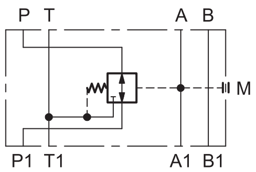
Series No.:
(the overall and mounting dimensions remain unchanged from 50 to 59)

Hydraulic symbols

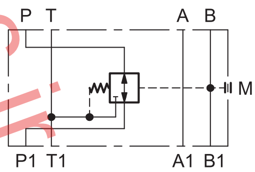
MZD-*



MZD-*/A



MZD-*/B

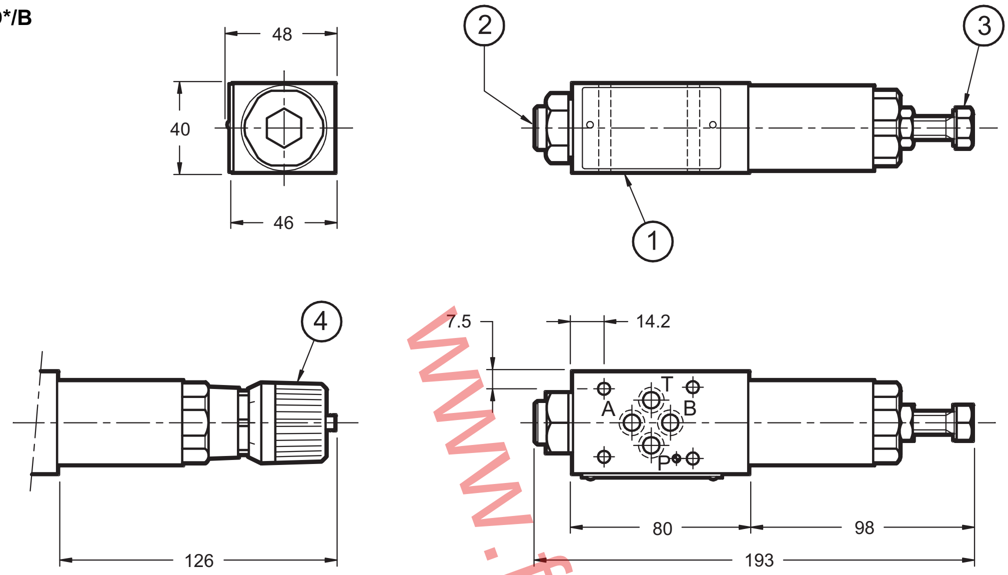


4 - HYDRAULIC FLUIDS

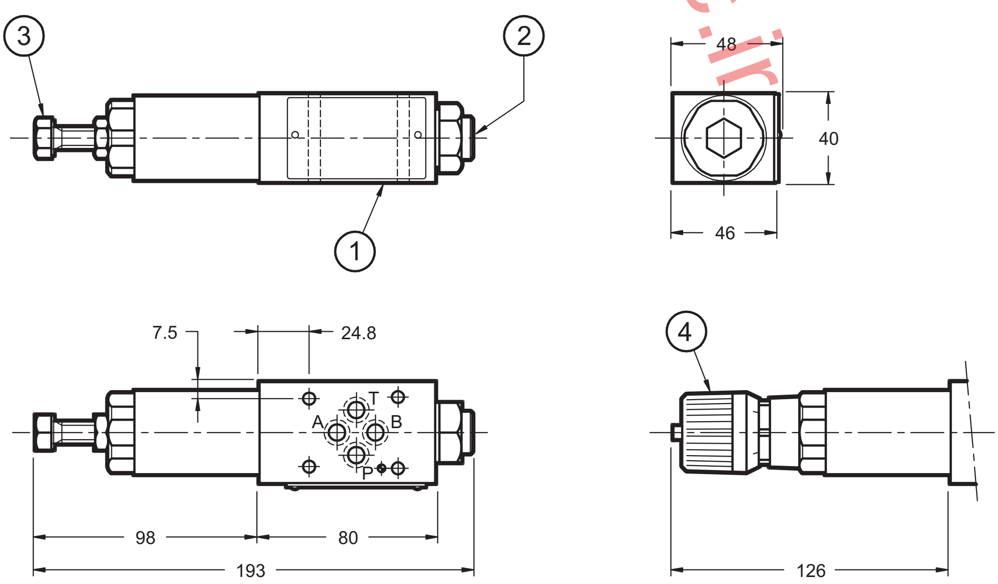
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

5 - OVERALL AND MOUNTING DIMENSIONS VARIABLE ADJUSTMENT VERSION

MZD*
MZD*/A
MZD*/B



MZD*/RP
MZD*/RA
MZD*/RB

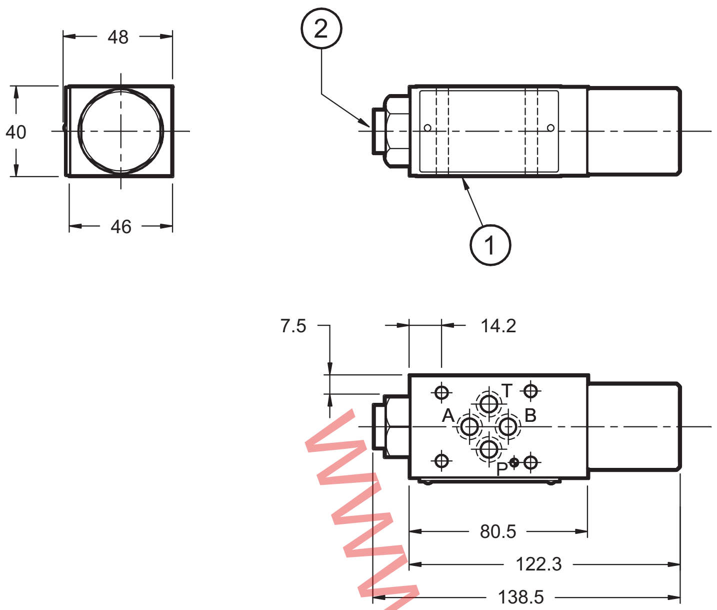


dimensions in mm

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) 90 Shore
2	Pressure gauge port 1/4” BSP
3	Hexagonal head adjustment screw. Spanner 17. Rotate clockwise to increase pressure
4	SICBLOC knob. To operate, push and rotate at the same time.

6 - OVERALL AND MOUNTING DIMENSIONS FIXED ADJUSTMENT VERSION

MZD*/A
MZD*/B



dimensioni in mm

1	MOnunting surface with sealing rings: N. 4 OR tipo 2037 (9.25x1.78) 90 Shore
2	Pressure gauge port: 1/4” BSP

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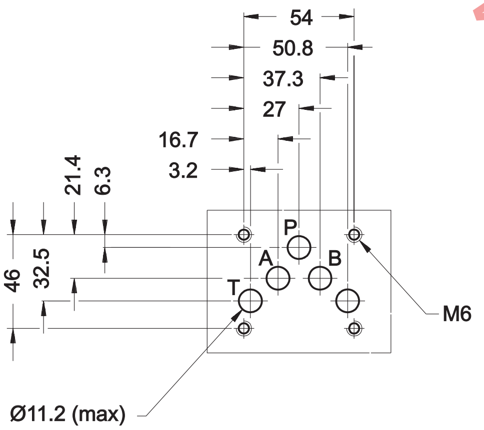
Z4M
PILOT OPERATED PRESSURE REDUCING VALVE
SERIES 50

MODULAR VERSION
ISO 4401-05 (CETOP 05)

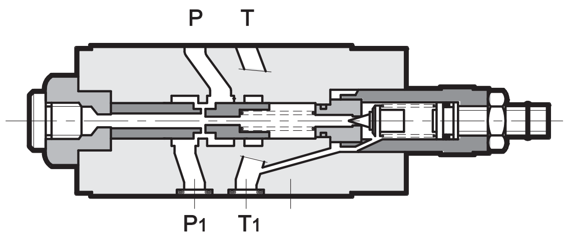
p max **320** bar
Q max (see table of performances)

MOUNTING INTERFACE

ISO 4401-05-04-0-05
(CETOP 4.2-4-05-320)



OPERATING PRINCIPLE



— The Z4M valve is a piloted pressure reducing valve made as a modular version with mounting surface according to the ISO 4401 (CETOP PR 121H) standards.

— It is used to reduce pressure on secondary circuit branches, assuring stability of the controlled pressure and even changing the flow that travels through the valve.

— It can be assembled quickly under the ISO 4401-05 (CETOP 05) directional solenoid valves without use of pipes.

— It is normally supplied with a countersunk hex adjustment screw, locking nut and maximum adjustment travel limiting device.

— It is available in four different pressure adjustment ranges up to 320 bar.

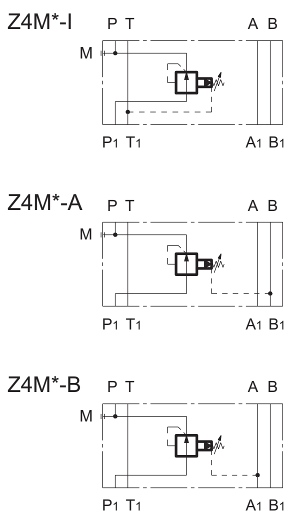
CONFIGURATIONS (see Hydraulic symbols table)

— Z4M*-I: pressure reduction on line P - drainage connected to line T.
— Z4M*-A: pressure reduction on line A and full pressure on line B.
— Z4M*-B: pressure reduction on line B and full pressure on line A.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	320
Maximum flow rate in the controlled line P Maximum flow rate in the free lines Drainage flow rate	l/min	80 100 ≤ 0,07
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	2,7

HYDRAULIC SYMBOLS

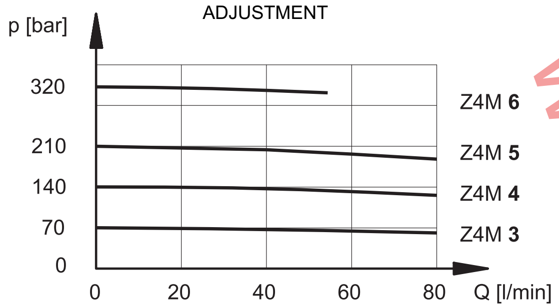


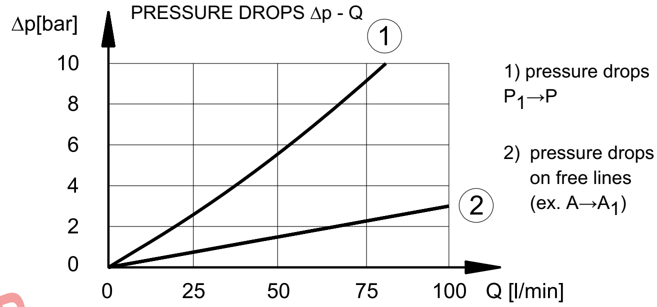
1 - IDENTIFICATION CODE

Z	4	M		-		/		/	50	/	

- Pressure reducing valve → Z
- Size: ISO 4401-05 (CETOP 05) → 4
- Modular version → M
- Pressure adjustment range:
  3 = 5 ÷ 70 bar
  4 = 8 ÷ 140 bar
  5 = 10 ÷ 210 bar
  6 = 15 ÷ 320 bar
- Configurations: **I**: pressure reduction on line P. Internal drainage connected to line T
  A: pressure reduction on line A and full pressure on line B
  B: pressure reduction on line B and full pressure on line A
- **M1** = Adjustment knob
  (omit for adjustment with countersunk hex screw)
- Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)
- Seals: omit for mineral oils
  V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)





1) pressure drops $P_1 \rightarrow P$

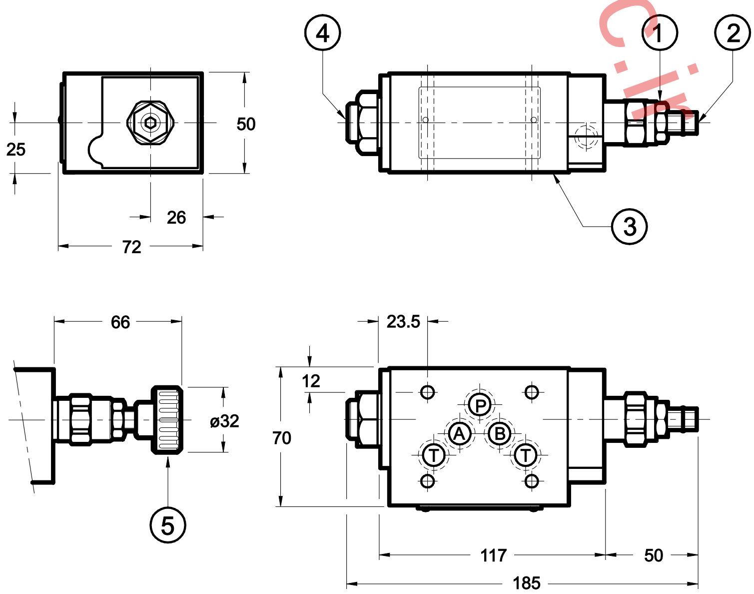
2) pressure drops on free lines (ex. $A \rightarrow A_1$)

3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Locking nut spanner 17
2	Countersunk hex adjustment screw: Spanner 5. Rotate clockwise to increase pressure
3	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) 90 Shore
4	Pressure gauge port 1/4" BSP

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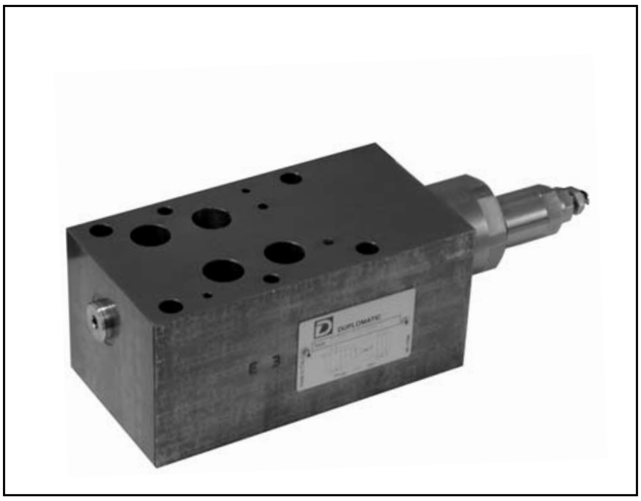


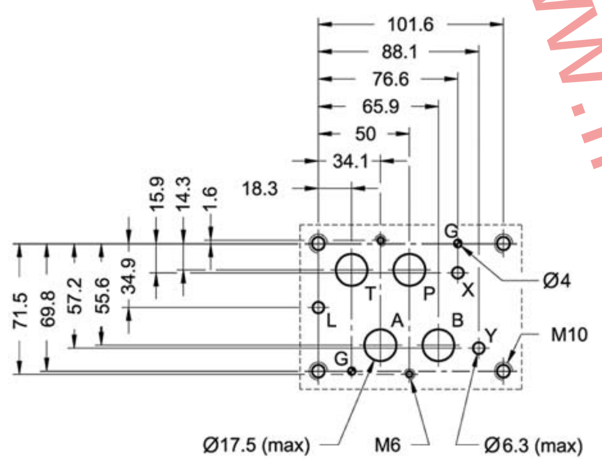
PZM7
PRESSURE REDUCING VALVE
SERIES 10

MODULAR VERSION
ISO 4401-07 (CETOP 07)

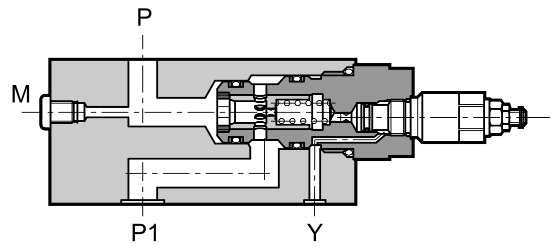
p max **350** bar
Q max **250** l/min

MOUNTING INTERFACE

ISO 4401-07-07-0-05
(CETOP 4.2-4-07)



OPERATING PRINCIPLE



— The PZM7 valve is made as a modular valve and has a mounting surface according to the ISO 4401 (CETOP RP 121H) standards.

— It is a two-stage type and is used to assure stability of the controlled pressure, even changing the flow that travels through the valve.

— The PZM7M valve can be assembled quickly under the DSP7 directional valves (see catalogue 41 420) without use of pipes, using suitable tie-rods or bolts, forming compact modular groups.

– It is normally supplied with an adjustment knob.

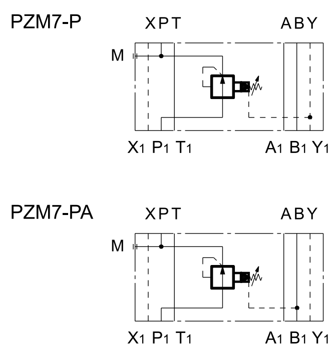
CONFIGURATIONS (see Hydraulic symbols table)

— Configuration “PZM7-P”: pressure reduction on line P - external drainage.
— Configuration “PZM7-PA”: pressure reduction on line A and valve on line P.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	250
Drainage flow rate	l/min	≤ 0,8
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	Secondo ISO 4406:1999 classe 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	8,65

HYDRAULIC SYMBOLS

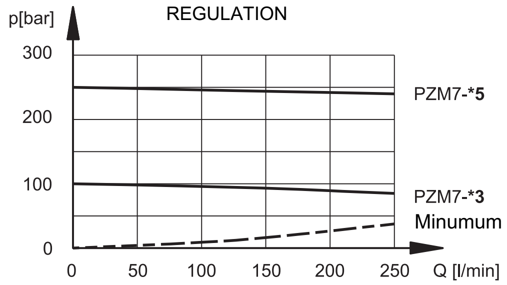


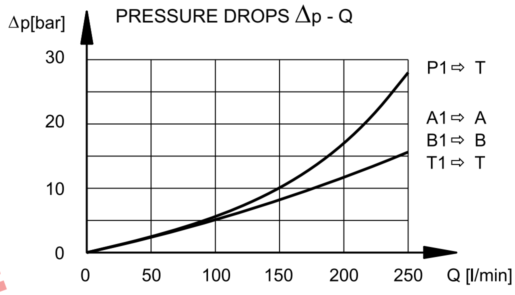
1 - IDENTIFICATION CODE

P	Z	M	7	-			/	10		/	

- **PZ**: Pressure reducing valve
- **M**: Modular version
- **7**: ISO 4401-07 (CETOP 07) size
- **P** = Pressure reduction on line P - external drainage
  PA = Pressure reduction on line A and valve on line P
- Pressure adjustment range:
  3 = 15 ÷ 100 bar (18 rpm) **5** = 15 ÷ 250 bar (45 rpm)
- **10**: Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)
- Seals:
  N = seals in NBR for mineral oils **(standard)**
  V = seals in FPM for special fluids
- **S** = adjustment screw **(standard)**
  K = adjustment knob

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



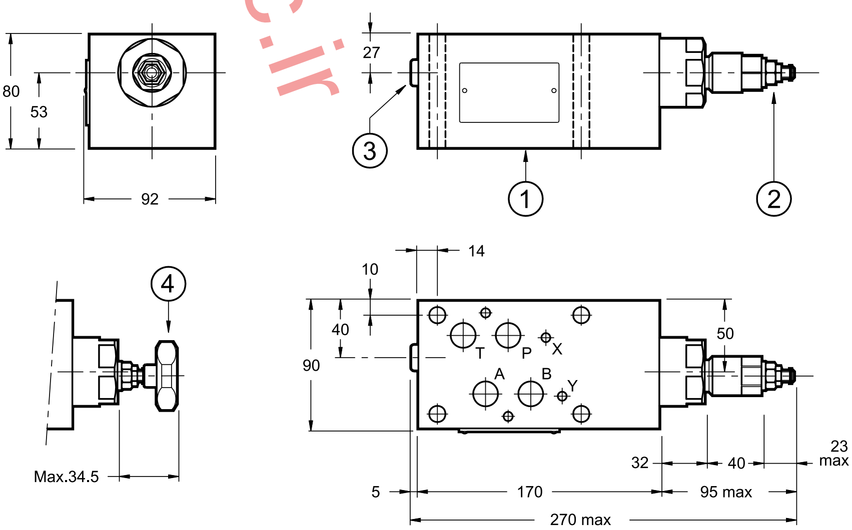


3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: N. 4 OR type 3087 (21.89x2.62) N. 2 OR type 2043 (10.82x1.78)
2	Standard adjustment screw Rotate clockwise to increase pressure
3	Pressure gauge port 1/4” BSP
4	Adjustment knob **K** (optional) Rotate clockwise to increase pressure

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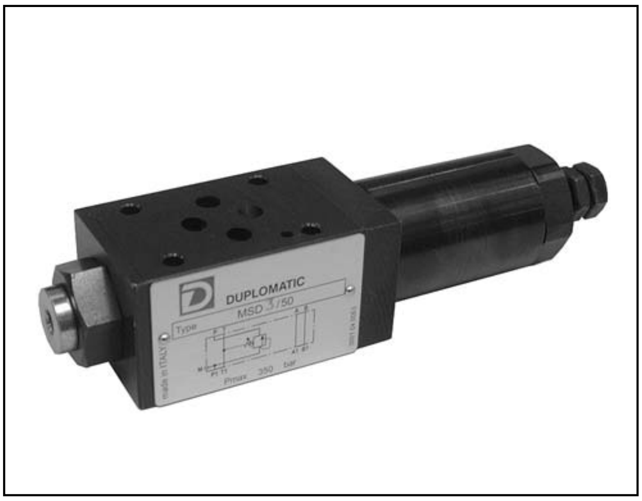


MSD

DIRECT OPERATED SEQUENCE VALVE

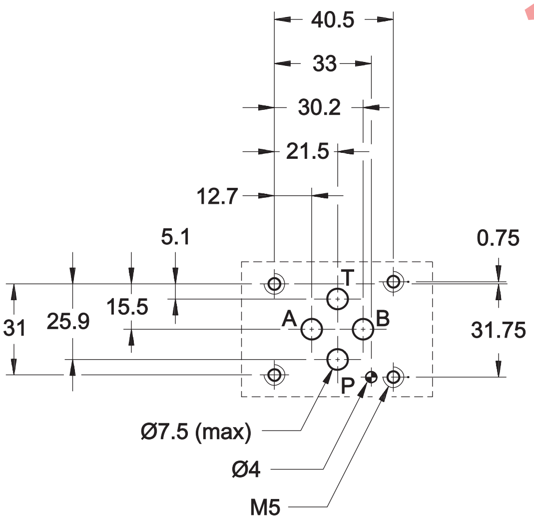
SERIES 50

MODULAR VERSION
ISO 4401-03 (CETOP 03)

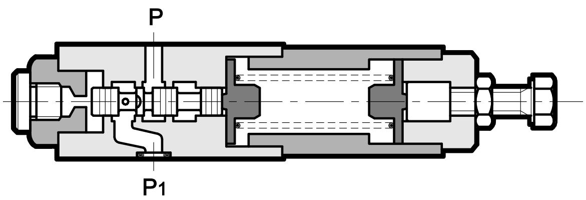
p max **350** bar
Q max (see table of performances)

MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



OPERATING PRINCIPLE



— The MSD valve is a direct operated sequence valve of the spool type and is used to control two or more actuators in succession.

At rest position, it is normally closed and the spool is subject to pressure in line P1 on one side and to the adjustment screw on the other side. When the pressure in line P1 reaches the set value of the screw, the valve opens and allows passage of the fluid in the pressure line of the main circuit.

The valve stays open until the pressure in the circuit drops below the calibrated value set by the spring.

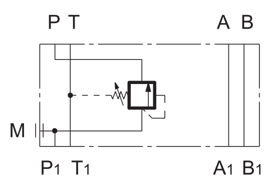
— It is made as a modular version with ports according to the ISO 4401 (CETOP PR 121H) standards and can be assembled quickly without the use of pipes under the ISO 4401-03 (CETOP 03) directional solenoid valves.

— It is normally supplied with a hexagonal head adjustment screw. Upon request, it can be equipped with a SICBLOC adjustment knob with micrometric indication and automatic locking.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure maximum pressure on port T	bar	350 10
Maximum flow rate in the controlled lines Maximum flow rate in the free lines	l/min	50 75
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	1,4

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

M	S	D		/		/	50	/	

ISO 4401-03 (CETOP 03) size
Modular version

Direct operated sequence valve

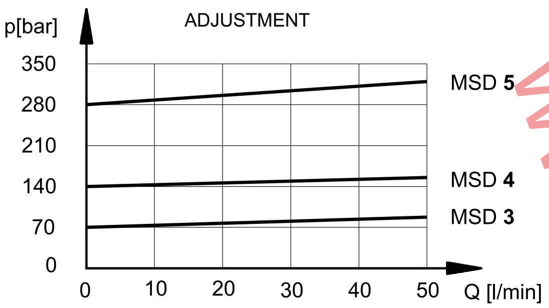
Pressure adjustment range:
3 = 10 ÷ 70 bar
4 = 30 ÷ 140 bar
5 = 50 ÷ 280 bar

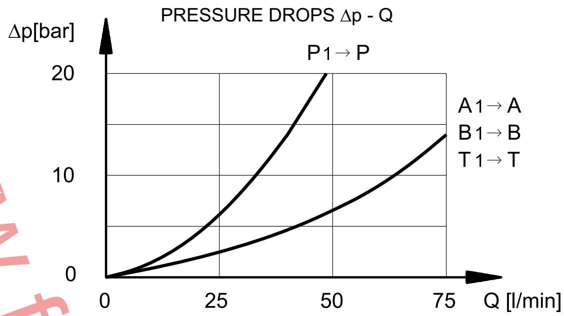
M = adjustment with SICBLOC knob
(omit for adjustment with hexagonal head screw)

Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)

Seals:
omit for mineral oils
V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

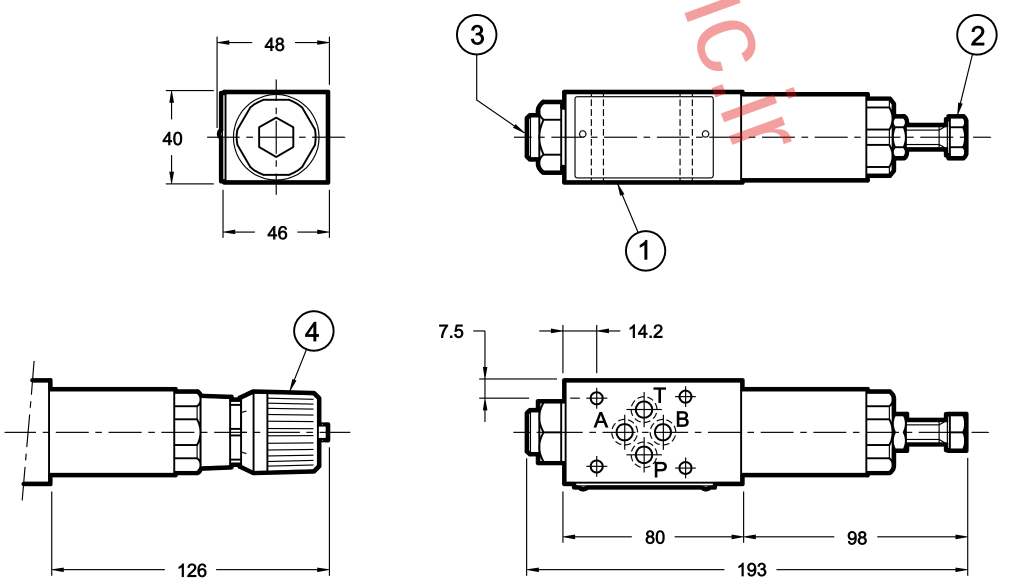




3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) 90 Shore
2	Hexagonal head adjustment screw. Spanner 17 Rotate clockwise to increase pressure.
3	Pressure gauge port 1/4" BSP
4	SICBLOC knob. To operate, push and rotate at the same time.

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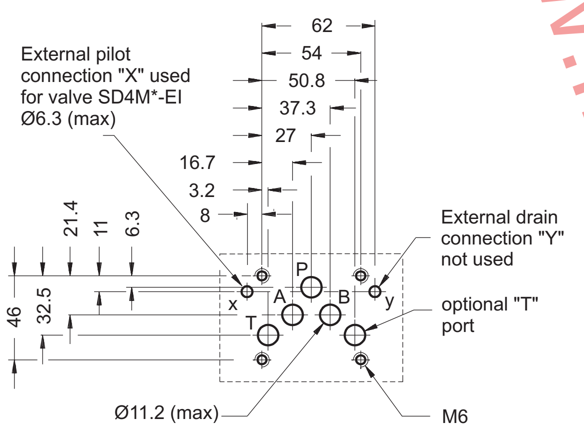
SD4M
DIRECT OPERATED SEQUENCE VALVE
SERIES 50

MODULAR VERSION
ISO 4401-05 (CETOP 05)

p max **320** bar
Q max (see table of performances)

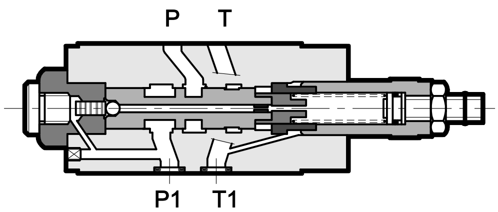
MOUNTING INTERFACE

ISO 4401-05-05-0-05
(CETOP 4.2-4-R05-320)



The internal pilot version of the valve can be installed either on the ISO 4401-05 (CETOP 05) type or ISO 4401-05-05-0-94 (R05) type of mounting interface (ports X and Y of the latter version are not to be used).

OPERATING PRINCIPLE



— The SD4M valve is a direct operated sequence valve of the spool type, made as a modular version with a mounting surface according to the ISO 4401 (CETOP RP 121H) standards.

It is normally used to drive two or more actuators in succession. In the rest position, it is normally closed and, on one side, the spool is subjected to the push of a small piston on which the line (P1) pressure acts and, on the other side, to the adjustment spring. When the pressure in line P1 reaches the calibrated value of the spring, the valve opens and allows passage of the fluid in the controlled line (P). The valve stays open until the pressure in the circuit drops below the set calibration value.

— Made in two versions, with internal or external piloting. The piloting port "X" is according to the CETOP 4.2-4-R05 mounting interface for the latter version.

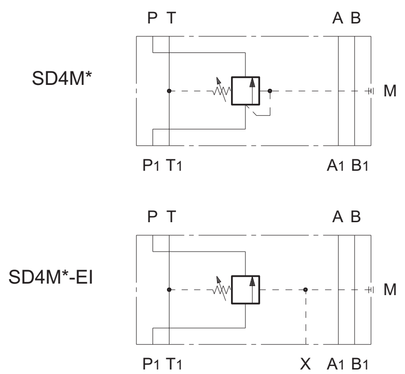
— It can be assembled quickly without use of pipes under the ISO 4401-05 (CETOP 05) directional solenoid valves.

— It is normally supplied with a countersunk hex adjustment screw, locking nut and maximum adjustment travel limiting device.

PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure maximum pressure on port T	bar	320 10
Maximum flow rate in the controlled lines Maximum flow rate in the free lines	l/min	80 100
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	2,7

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

S	D	4	M		-		/		/	50	/	

Direct operated sequence valve

ISO 4401-05 (CETOP 05) size

Modular version

Pressure adjustment range:
3 = up to 70 bar
4 = up to 140 bar
5 = up to 210 bar

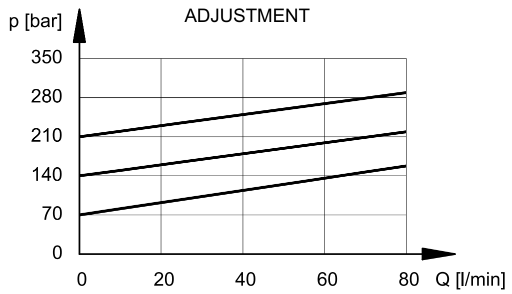
EI = version with external piloting (port "X" position according to mounting interface CETOP 4.2-4-R05)
(omit for standard version with internal piloting)

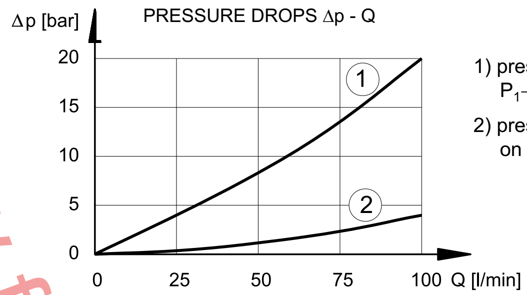
M1 = adjustment knob
(omit for adjustment with hexagonal head screw)

Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)

Seals:
omit for mineral oils
V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)





1) pressure drops $P_1 \rightarrow P$

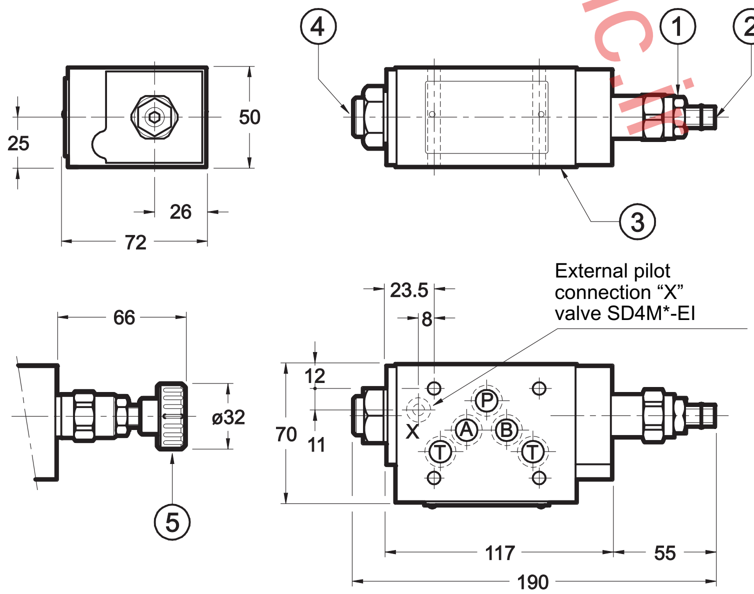
2) pressure drops on free lines

3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Locking nut. Spanner 17.
2	Countersunk hex adjustment screw. Spanner 5. Rotate clockwise to increase pressure.
3	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) 90 Shore; N.1 OR type 2037 (9.25x1.78) 90 Shore (only for SD4M*-EI)
4	Pressure gauge port 1/4" BSP
5	Adjustment knob: M1

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DUPLOMATIC OLEODINAMICA

PCM3

TWO AND THREE-WAY PRESSURE COMPENSATOR WITH FIXED OR VARIABLE ADJUSTMENT

SERIES 10

MODULAR VERSION

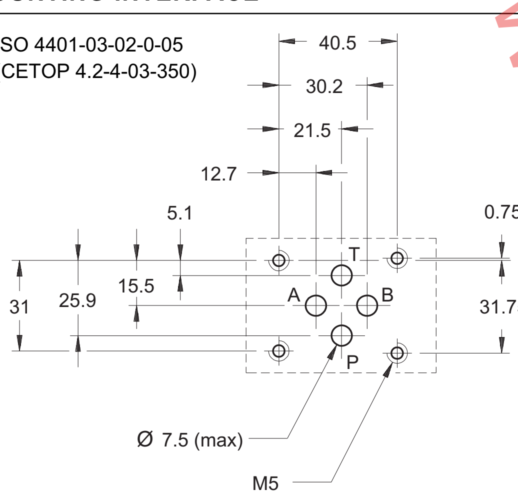
ISO 4401-03 (CETOP 03)

p max **350** bar

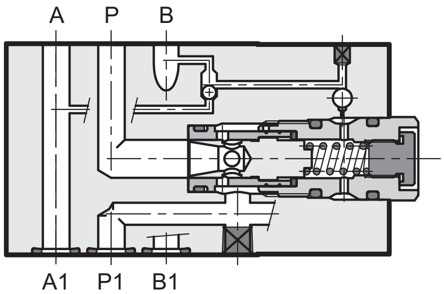
Q max **40** l/min

MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



OPERATING PRINCIPLE



— The PCM3 valve is a two or three-way pressure compensator, developed as a modular version with mounting surface according to the ISO 4401 (CETOP RP121H).

— Its aim is to keep the pressure drop setting (characteristic Δp) between the line P and alternatively the lines A and B, at a constant level.

— It is normally used together with proportional directional valves, in order to control the flow rate independently of the pressure variations.

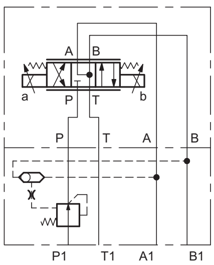
— The selection of the piloting pressure on the lines A and B is carried out automatically via a shuttle check valve built into the compensator.

— The setting of the variable adjustment compensator (characteristic Δp) can be varied from 7 to 33 bar, via a countersunk hex adjustment screw or via an adjustment knob.

— The fixed adjustment compensator is available with setting (characteristic Δp) of 4 and 8 bar.

APPLICATION EXAMPLES

Two-way compensator with fixed adjustment, combined with a proportional valve type DSE3-A*

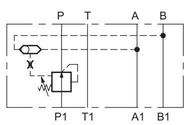


PERFORMANCES (working with mineral oil of viscosity of 36 cSt at 50°C)

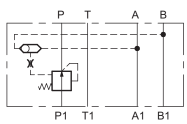
Max operating pressure	bar	350
Characteristic Δp: fixed adjustment variable adjustment	bar	4 - 8 7 ÷ 33
Max flow rate	l/min	40
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	1,5

HYDRAULIC SYMBOLS

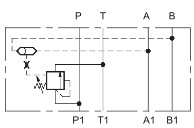
PCM3-PV/10



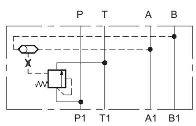
PCM3-P*/10



PCM3-PTV/10



PCM3-PT*/10



1 - IDENTIFICATION CODE

1.1 - Two-way compensator identification code

P	C	M	3	-	P		/	10		/	

Pressure compensator

Modular version

Nominal size ISO 4401-03 (CETOP 03)

2 ways

Adjustment:
V = variable from 7 to 33 bar
4 = 4 bar
8 = 8 bar

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

omit for adjustment with countersunk hex screw **(standard)**
K1 = adjustment knob

1.2 - Three-way compensator identification code

P	C	M	3	-	PT		/	10		/	

Pressure compensator

Modular version

Nominal size ISO 4401-03 (CETOP 03)

3 ways

Adjustment:
V = variable from 7 to 33 bar
4 = 4 bar
8 = 8 bar

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

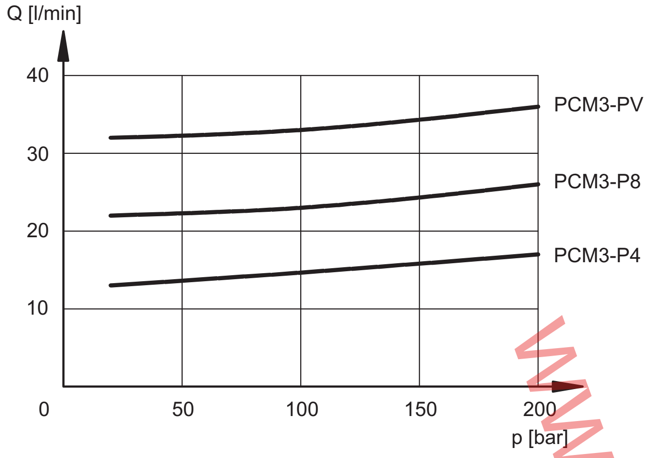
Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

omit for adjustment with countersunk hex screw **(standard)**
K1 = adjustment knob

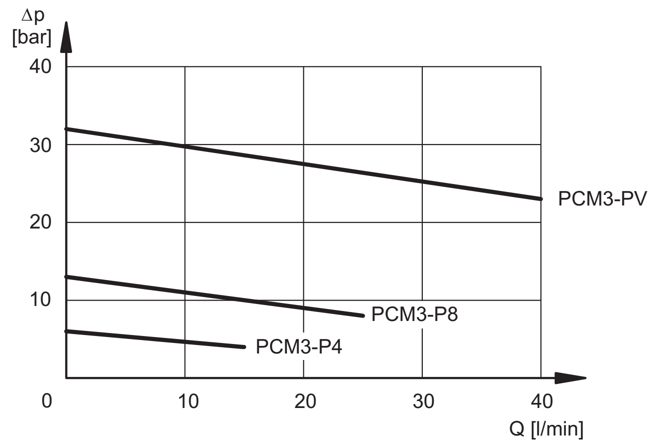
2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

2.1 - Two-way compensator characteristic curves

FLOW RATE - PRESSURE Q = f (p)

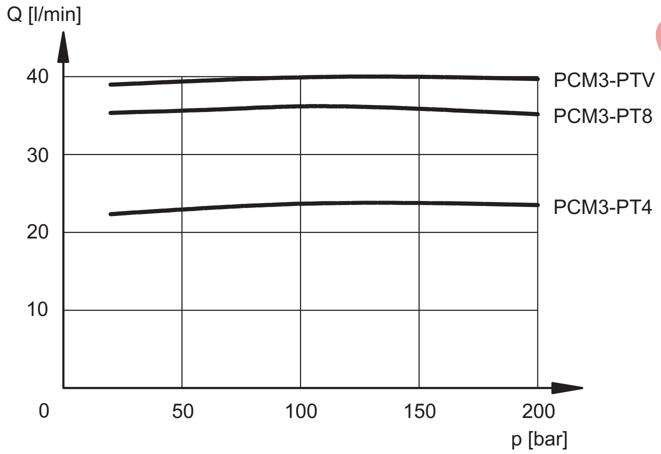


PRESSURE DROPS Δp = f (Q)

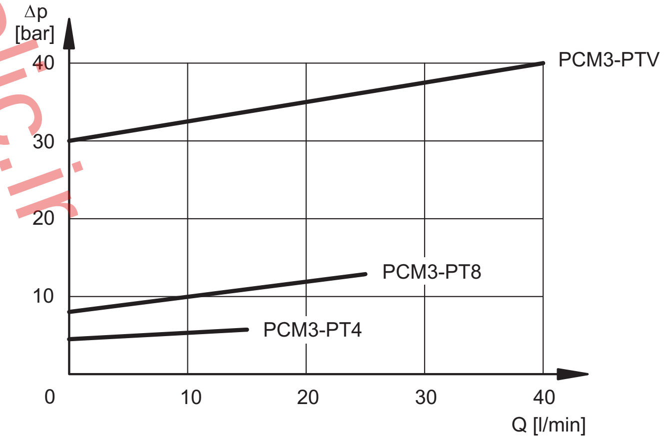


2.2 - Three-way compensator characteristic curves

FLOW RATE - PRESSURE Q = f (p)



PRESSURE DROPS Δp = f (Q)

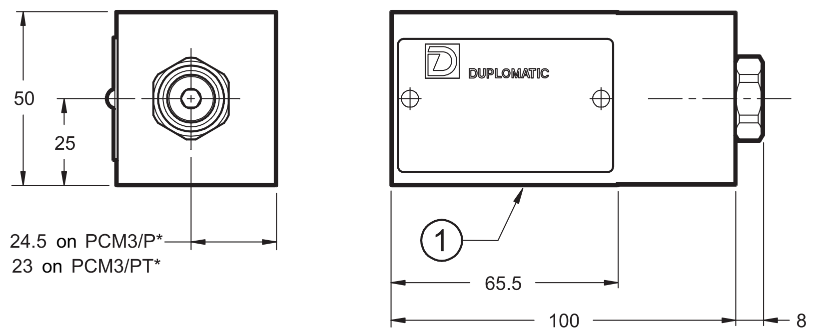


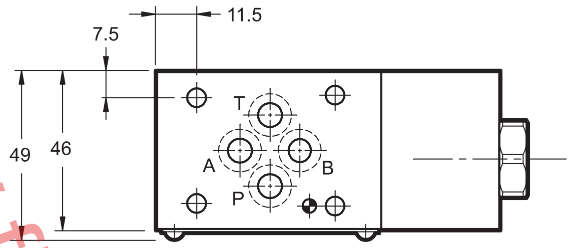
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. With this kind of fluids, use NBR seals type. With fluids HFDR type (phosphate esters) use FPM seals (code V).
Using other fluid types such as HFA, HFB, HFC, please consult our technical department.
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid itself and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

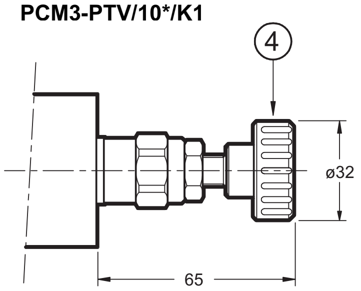
4 - OVERALL AND MOUNTING DIMENSIONS

PCM3-P*/10
PCM3-PT*/10

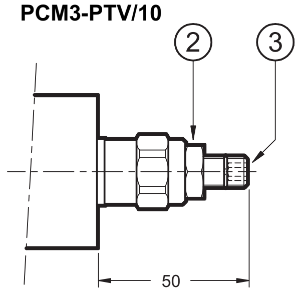




PCM3-PV/10*/K1
PCM3-PTV/10*/K1



PCM3-PV/10
PCM3-PTV/10



dimensions in mm

1	Mounting surface with sealing rings: 4 OR type 2037 - (9.25x1.78) 90 shore
2	Locking nut: spanner 17
3	Countersunk hex adjustment screw: spanner 5 Clockwise rotation to increase pressure
4	Adjustment knob: **K1**

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PCM5

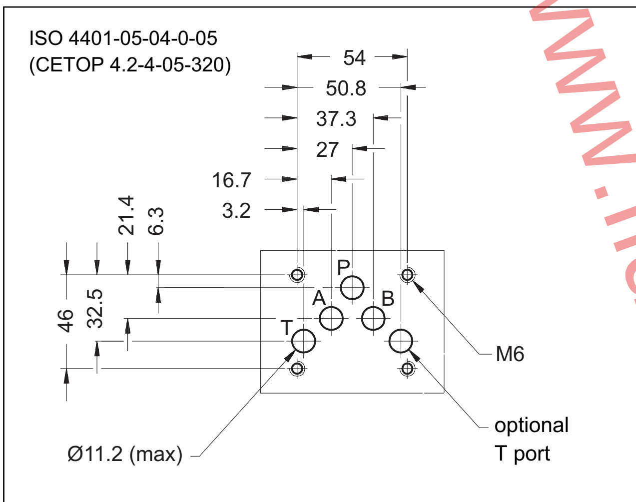
TWO- AND THREE-WAY PRESSURE COMPENSATOR WITH FIXED ADJUSTMENT

SERIES 11

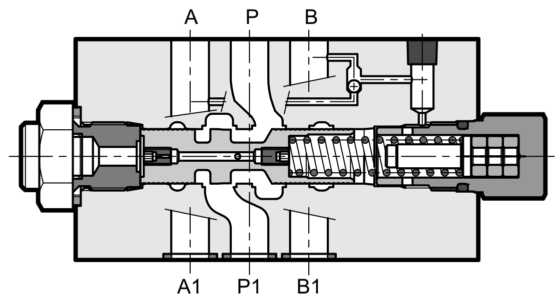
MODULAR VERSION
ISO 4401-05 (CETOP 05)

p max **320** bar
Q max **100** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



— The PCM5 valve is a two- or three- way pressure compensator, designed as a modular version with mounting surface according to ISO 4401-05 (CETOP RP121H).

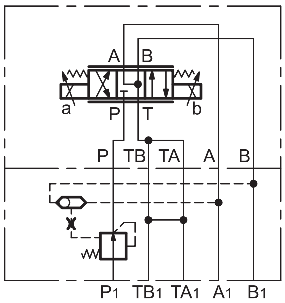
— It keeps the pressure drop setting (characteristic Δp) between the line P and alternatively the lines A and B at a constant level.

— It is used together with proportional directional valves, in order to control the flow rate independently of the pressure variations.

— The selection of the piloting pressure on the lines A and B is carried out automatically via a shuttle check valve built into the compensator.

APPLICATION EXAMPLES

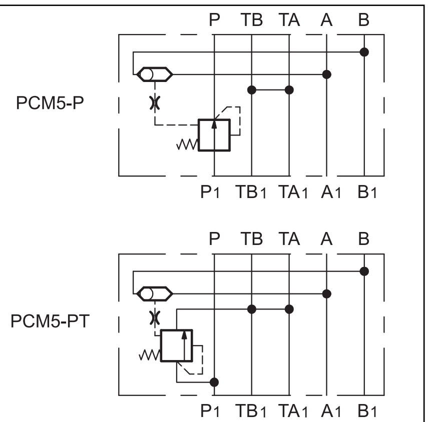
2-way compensator combined with a proportional valve type DSE5-A*



PERFORMANCES (working with mineral oil of viscosity of 36 cSt at 50°C)

Max operating pressure	bar	320
Characteristic Δp	bar	4 - 8
Max flow rate	l/min	100
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	2,7

HYDRAULIC SYMBOL



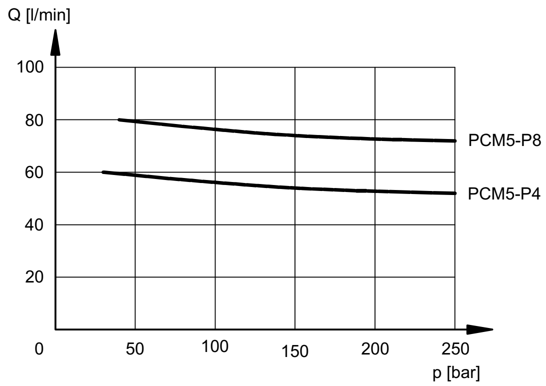
1 - IDENTIFICATION CODE

P	C	M	5	-			/	11	

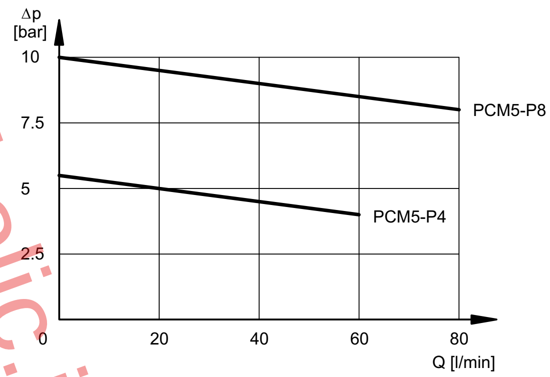
- Pressure compensator (P C)
- Modular version (M)
- Nominal size ISO 4401-05 (CETOP 05) (5)
- **P** = 2 ways; **PT** = 3 ways
- Adjustment: **4** = 4 bar (available on PCM5-P only); **8** = 8 bar
- Series No. (the overall and mounting dimensions remain unchanged from 10 to 19) (/11)
- Seals: **N** = NBR seals for mineral oil (**standard**); **V** = FPM seals for special fluids

2 - CHARACTERISTIC CURVES PCM5-P* (2-way) (values obtained with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE Q = f (p)

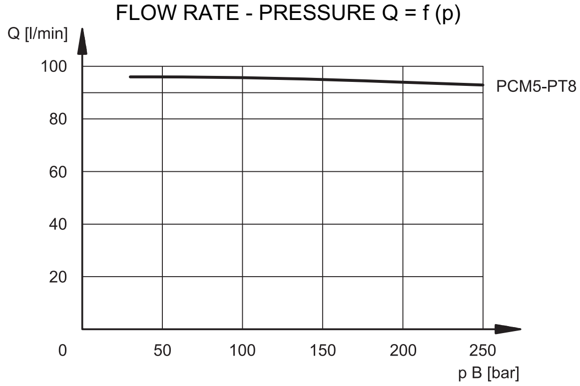


PRESSURE DROPS Δp = f (Q)

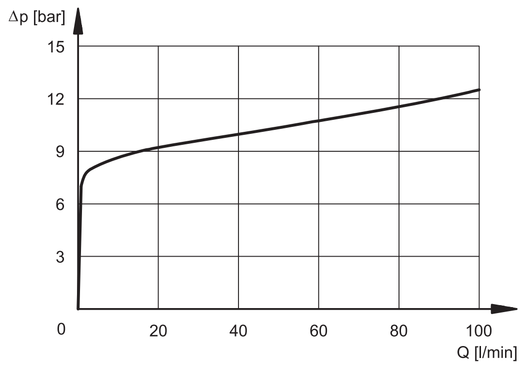


3 - CHARACTERISTIC CURVES PCM5-PT8 (3-way) (values obtained with viscosity of 36 cSt at 50°C)

FLOW RATE - PRESSURE Q = f (p)



PRESSURE DROPS Δp = f (Q)



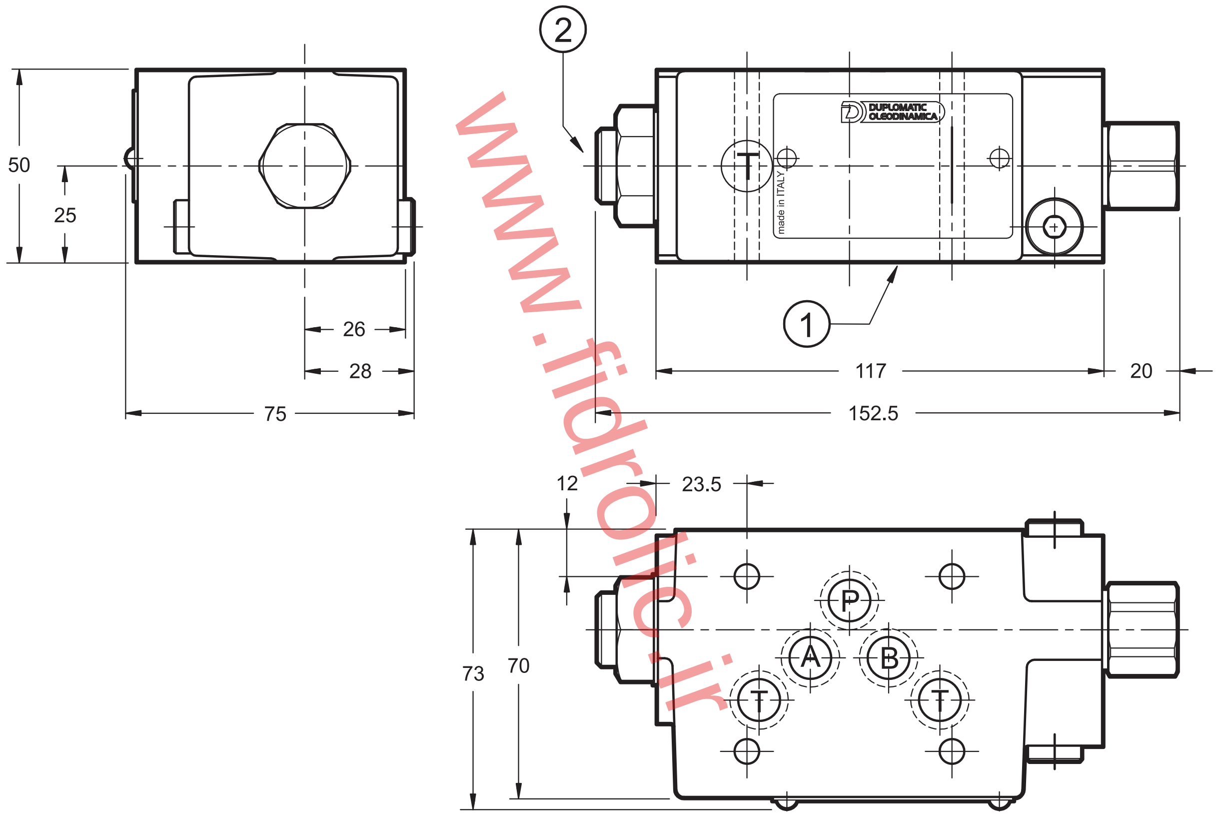
4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

5 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: N. 5 OR type 2050 (12.42x1.78) 90 Shore
2	Pressure gauge port 1/4” BSP

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PCM8

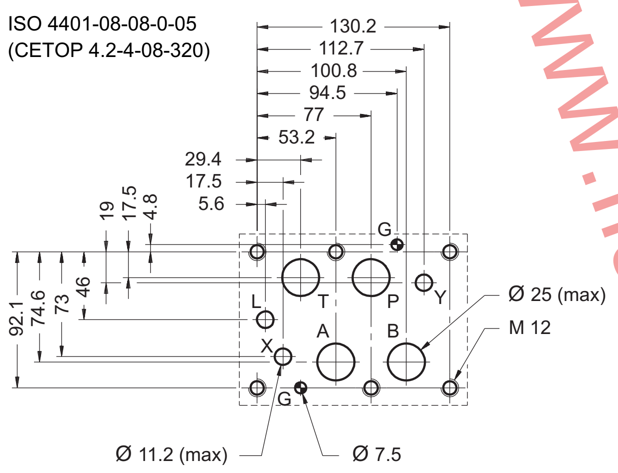
TWO- AND THREE-WAY PRESSURE COMPENSATOR WITH FIXED ADJUSTMENT

SERIES 10

MODULAR VERSION
ISO 4401-08 (CETOP 08)

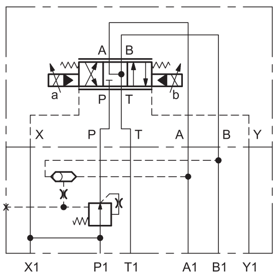
p max **320** bar
Q max **300** l/min

MOUNTING INTERFACE

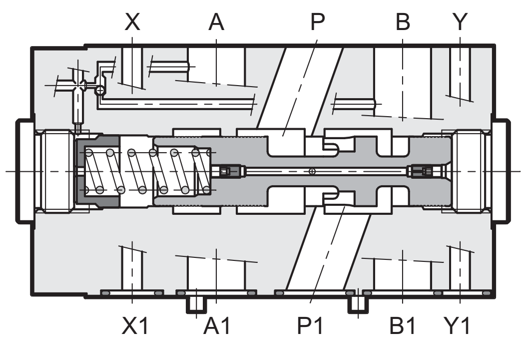


APPLICATION EXAMPLES

Two-way compensator with fixed adjustment and internal piloting, combined with a proportional valve type E5E-S9*/E



OPERATING PRINCIPLE



— The PCM8 valve is a two or three-way pressure compensator, developed as a modular version with mounting surface according to ISO 4401 (CETOP RP 121H).

— Its function is to keep the pressure drop setting (characteristic Δp) between the line P and alternatively the lines A and B at a constant level.

— It is normally used together with proportional directional valves, in order to control the flow rate independently of the pressure variations.

— The selection of the piloting pressure on the lines A and B is carried out automatically via a shuttle check valve built into the compensator.

— They are available with fixed adjustment (characteristic Δp) of 4 and 8 bar.

— The load sensing port can also be used as pressure gauge port or as remote pressure control.

PERFORMANCES (with mineral oil of viscosity of 36 cSt a 50°C)

Max operating pressure	bar	320
Characteristic Δp:	bar	4 - 8
Max flow rate	l/min	300
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	13,5

1 - IDENTIFICATION CODE

1.1 - Two-way compensator identification code

P	C	M	8	-	P		/		E	/	10	

Pressure compensator

Modular version

Nominal size
ISO 4401-08 (CETOP 08)

2 ways

Adjustment: **4** = 4 bar
8 = 8 bar

Piloting: (relevant to the combined directional valve, that must always have external piloting)
I = internal (withdrawn inside the compensator, upstream the narrowing)
E = external (passing line X)

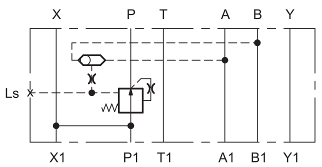
Seals:
N = NBRseals for mineral oils (**standard**)
V = FPM seals for special fluids

Series no.:
(the overall and mounting dimensions remain unchanged from 10 to 19)

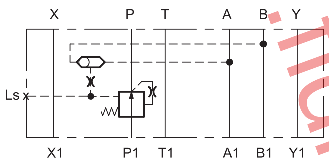
External drain (passing line Y)

Hydraulic symbols

PCM8-P*/IE/10



PCM8-P*/EE/10



1.2 - Three-way compensator identification code

P	C	M	8	-	PT		/		E	/	10	

Pressure compensator

Modular version

Nominal size
ISO 4401-08 (CETOP 08)

3 ways

Adjustment: **4** = 4 bar
8 = 8 bar

Piloting: (relevant to the combined directional valve, that must always have external piloting)
I = internal (withdrawn inside the compensator, upstream the narrowing)
E = external (passing line X)

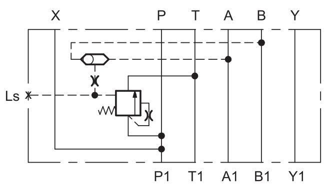
Seals:
N = NBRseals for mineral oils (**standard**)
V = FPM seals for special fluids

Series no.: (the overall and mounting dimensions remain unchanged from 10 to 19)

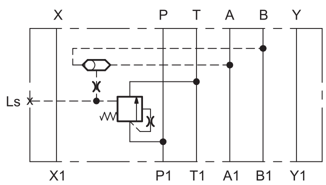
External drain (passing line Y)

Hydraulic symbols

PCM8-PT*/IE/10

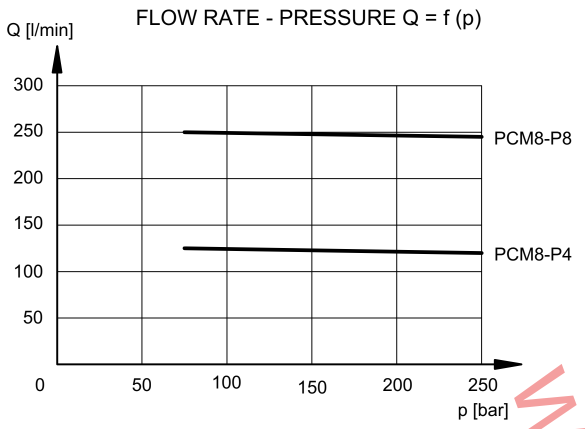


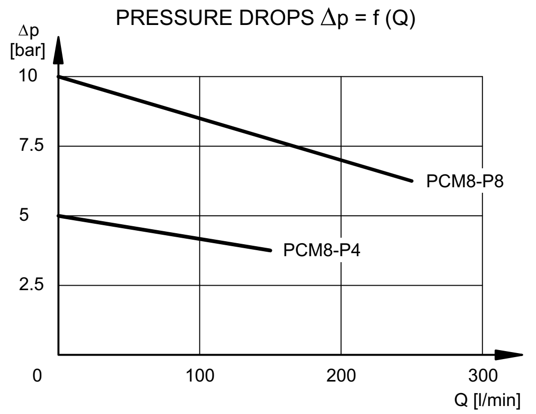
PCM8-PT*/EE/10



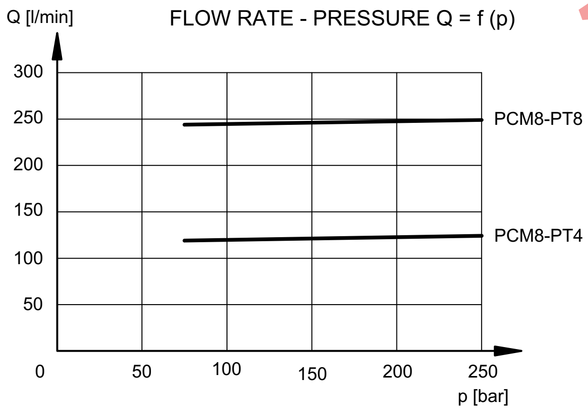
2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

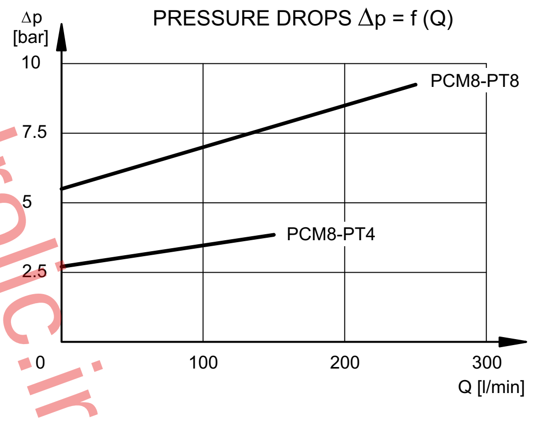
2.1 - Two-way compensator characteristic curves





2.2 - Three-way compensator characteristic curves

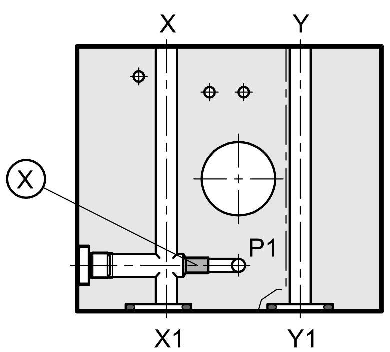




3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - PILOTING AND DRAINAGE



X: plug M6x10 for external piloting
Drainage always external

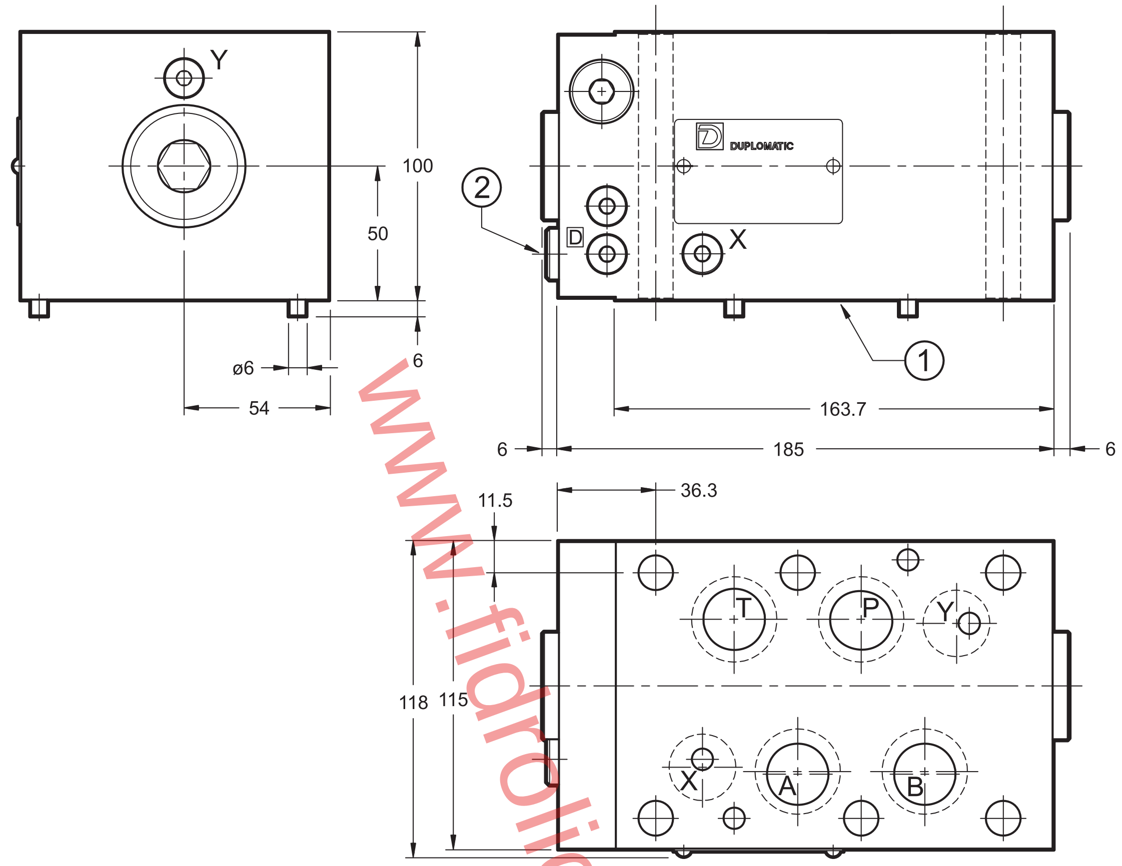
The PCM8 compensators are available with the X piloting line both internal and external. The internal piloting line is withdrawn from the P1 line, upstream the narrowing of the compensator, while the external piloting line comes form a separate piloting circuit. Drainage is always external (passing line Y).
The combined directional valve must always have an external piloting configuration. Drainage can be both internal and external.

VALVE TYPE		X plug
PCM8-P*/IE	INTERNAL PILOTING AND EXTERNAL DRAINAGE	NO
PCM8-P*/EE	INTERNAL PILOTING AND EXTERNAL DRAINAGE	YES

5 - OVERALL AND MOUNTING DIMENSIONS

PCM8-P*/*E/10
PCM8-PT*/*E/10

dimensions in mm



1	Mounting surface with sealing rings: 4 OR type 3106 (25.65 x 2.62) - 90 Shore 2 OR type 3081 (20.24 x 2.62) - 90 Shore
2	Load Sensing Port 1/4" BSP closed

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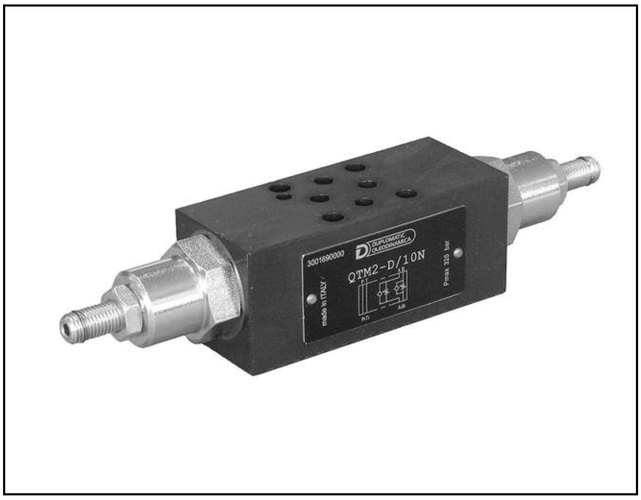


QTM2

FLOW RESTRICTOR VALVE

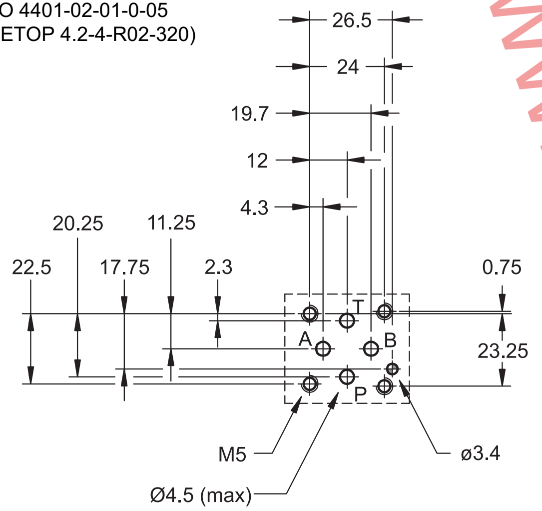
SERIES 10

MODULAR VERSION
ISO 4401-02 (CETOP R02)

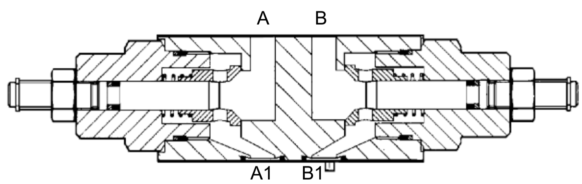
p max **320** bar
Q max **30** l/min

MOUNTING SURFACE

ISO 4401-02-01-0-05
(CETOP 4.2-4-R02-320)



OPERATING PRINCIPLE



— The QTM2 valve is a flow restrictor valve with built in check valve for reverse free flow, made as a modular version with mounting surface according to the ISO 4401 (CETOP RP 12H) standards.

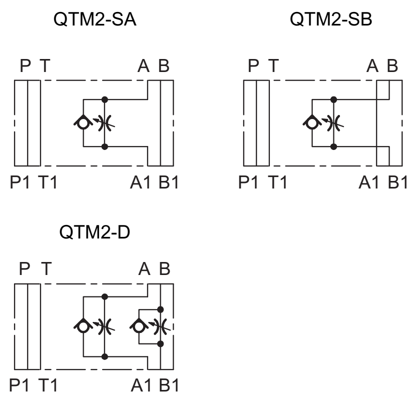
— It can be assembled with all ISO 4401-02 (CETOP R02) modular valves without use of pipes, using suitable tie-rods or bolts.

— It is supplied with countersunk hex adjustment screw and locking nut. Rotate anticlockwise to increase the flow rate.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	320
Maximum flow rate	l/min	30
Ambient temperature range	°C	-20 / +50
Check valve opening pressure	bar	0,4
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,8

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

Q	T	M	2	-		/	10	

Flow restrictor valve (QT)

Modular version (M)

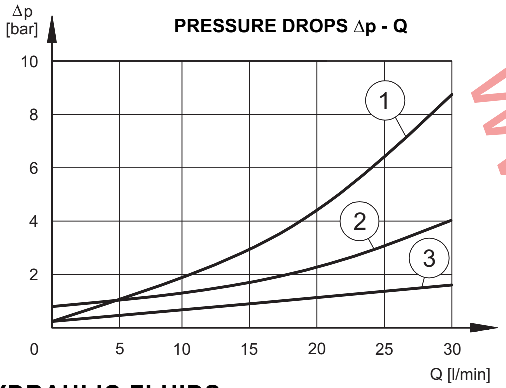
ISO 4401-02 (CETOP R02) size (2)

D: meter out control on lines A and B
SA: meter out control on line A
SB: meter out control on line B

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = Seals in NBR for mineral oils **(standard)**
V = Seals in FPM for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



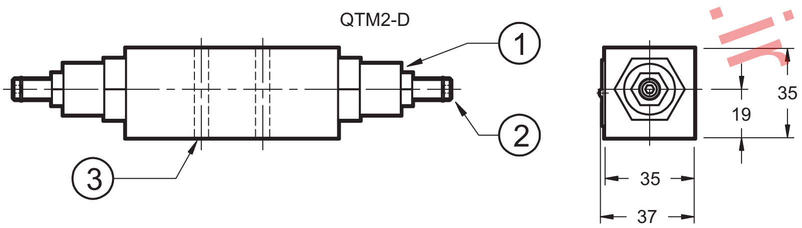
Typical Δp - Q curves obltained with QTM2-D valve, with throttling axis at full retraction.

1) pressure drops A_1 - A (B_1 - B)
2) pressure drops A - A_1 (B - B_1)
3) pressure drops through the free ports

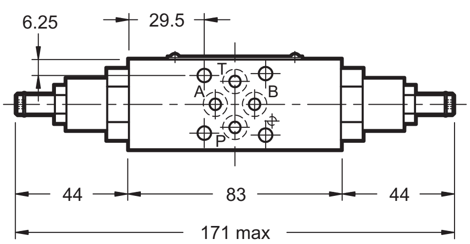
3 - HYDRAULIC FLUIDS

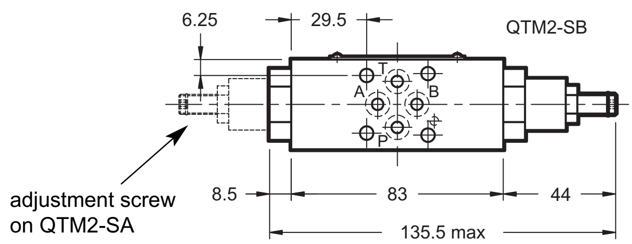
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS



1	Locking nut: spanner 13
2	Countersunk hex adjustment screw: spanner 3 Rotate anticlockwise to increase the flow
3	Mounting surface with sealing rings: N. 4 OR type 2031 (7.66x1.78)





dimensions in mm

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MERS

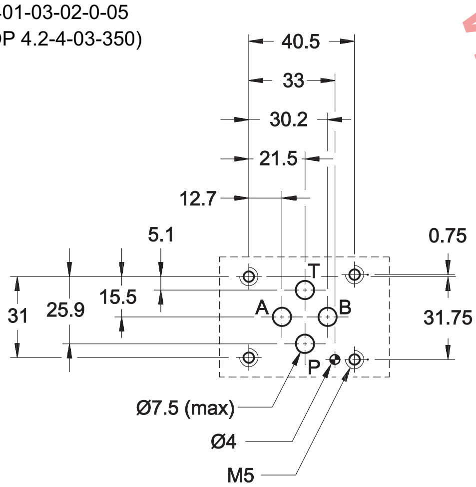
FLOW RESTRICTOR VALVE

SERIES 50

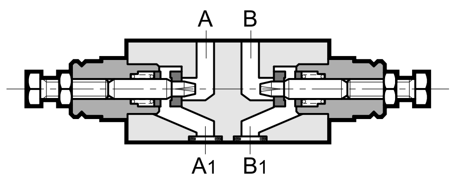
MODULAR VERSION
ISO 4401-03 (CETOP 03)

p max **350** bar
Q max (see table of performances)

MOUNTING INTERFACE



OPERATING PRINCIPLE



— This is a non-compensated flow control valve with a check valve for reverse free flow. It is made in the modular version and with mounting surface according to the ISO 4401 (CETOP RP 121 H) standards; it can be assembled quickly without use of pipes, but using only suitable tie-rods or bolts, thus forming compact modular groups.

— It is also available as a reversible valve (G* versions). Meter-in or meter-out control depending on the way of assembly the valve on the OR subplate.

— All the configurations have an incorporated check valve that allows reverse free flow (cracking pressure of 0,5 bar).

— It is normally supplied with a hexagonal head adjustment screw.

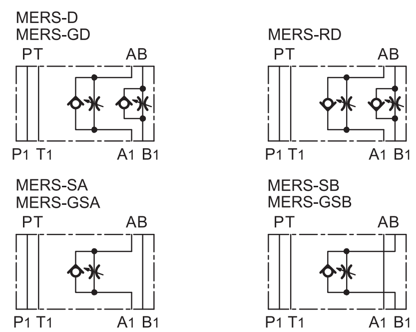
CONFIGURATIONS (see hydraulic symbols table)

— “SA”: control of the flow exiting from the actuator on line A .
— “SB”: control of the flow exiting from the actuator on line B.
— “D”: Allows an indipendent flow control exiting from the two chambers of the actuator. (Standard)
— “RD”: Allows an indipendent flow control entering in the two chambers of the actuator.
— “G*”: Reversible valve. See at par. 1

PERFORMANCES (measured with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure Check valve cracking pressure	bar	350 0,5
Maximum flow rate in the controlled lines Maximum flow rate in the free lines Min. controlled flowrate with Δp 10 bar	l/min	50 75 ≤0,060
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	1,3

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

M	E	R	S	-		/		/	50	/	

ISO 4401-03 (CETOP 03) size
Modular version

Flow restrictor valve with
check valve for reverse free flow

Configurations:
D: meter out control on lines A and B (**standard**)
RD: meter in control on lines A and B
SA: meter out control on line A
SB: meter out control on line B

Configurations G* - reversible valve (**NOTE**)
GD: control on lines A and B
GSA: control on lines A
GSB: control on lines A

M = Adjustment with SICBLOC knob
(omit for adjustment with hexagonal head adjustment screw)

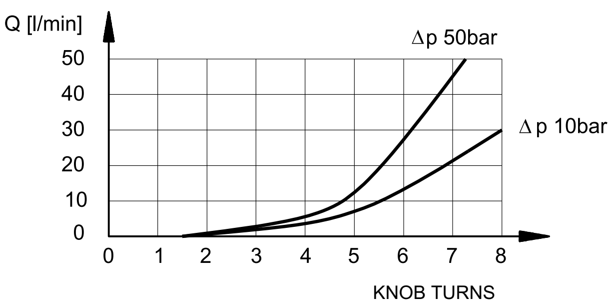
Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)

Seals:
omit for mineral oils
V = viton for special fluids

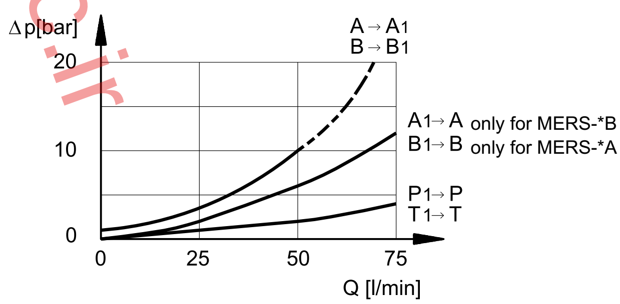
NOTE: the valve body does not provide the OR seats. The mounting interface is achieved by interposition of an OR subplate. The control of flow (meter-in or meter-out) is depending on the way of assembly the valve on the subplate.

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

ADJUSTMENT



PRESSURE DROPS Δp - Q



3 - HYDRAULIC FLUIDS

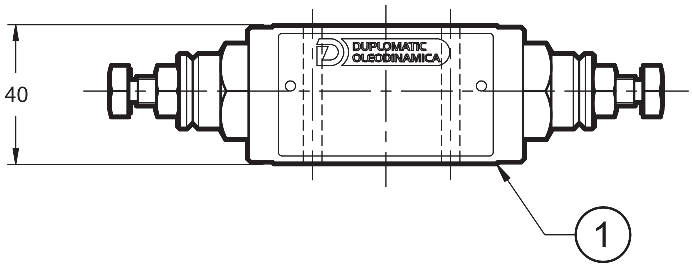
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

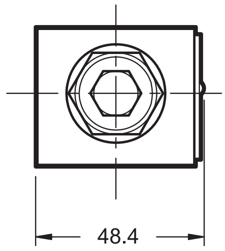
The fluid must be preserved in its physical and chemical characteristics.

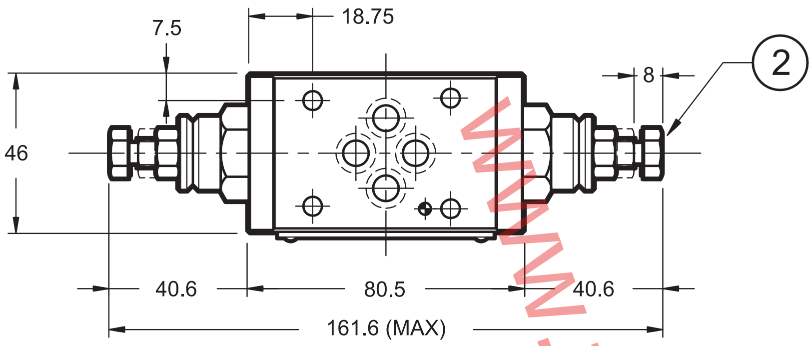
4 - OVERALL AND MOUNTING DIMENSIONS MERS -D, -RD and -S*

dimensions in mm

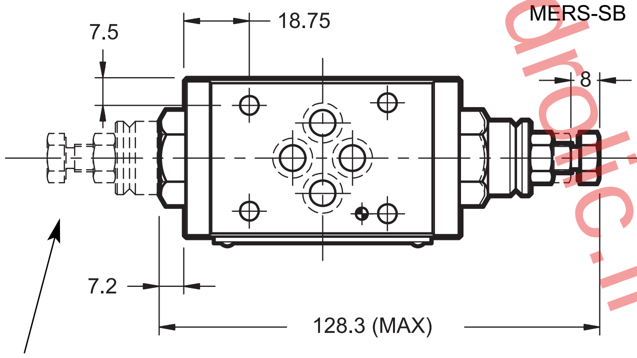
MERS-D
MERS-RD





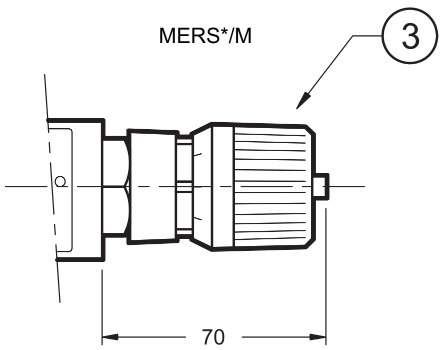


MERS-SB



adjustment screw on MERS-SA

MERS*/M

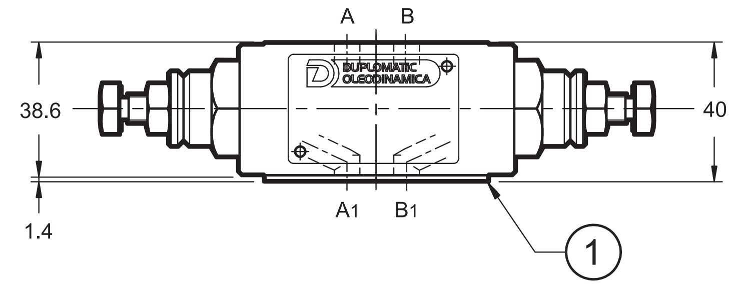


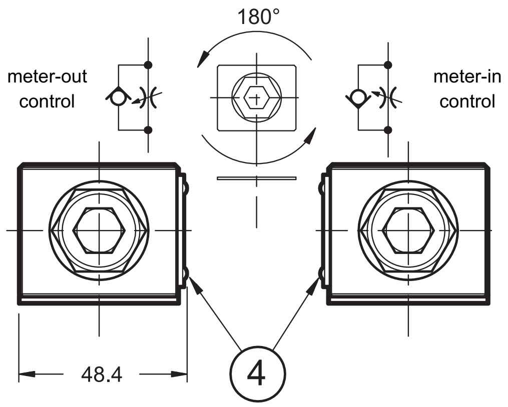
1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) 90 Shore
2	Hexagonal head adjustment screw. Spanner 13 Rotate anticlockwise to increase flow
3	SICBLOC adjustment knob, upon request. To operate, push and rotate at the same time.

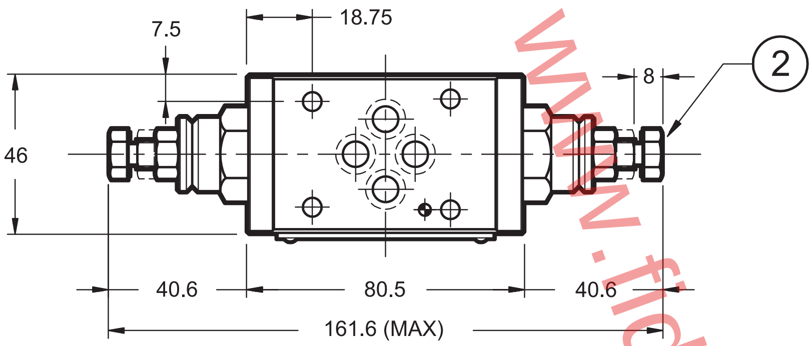
4 - OVERALL AND MOUNTING DIMENSIONS MERS-G*

dimensioni in mm

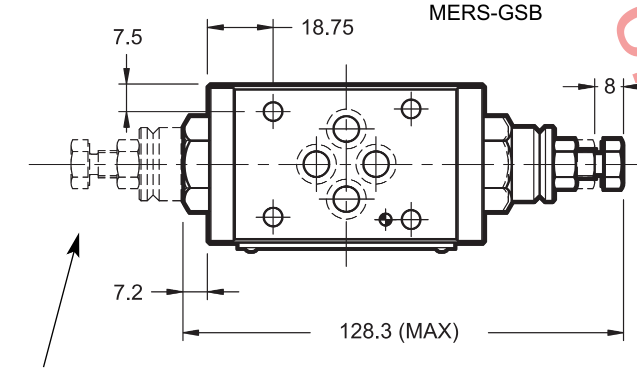
MERS-GD







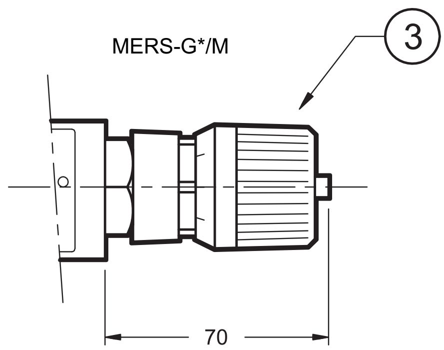
MERS-GSB



adjustmet screw on MERS-GSA

1	OR subplate code 1955131 (included in the delivery): N. 4 KANTSEAL DKAR00012 (70 Shore)
2	Hexagonal head adjustment screw. Spanner 13 Rotate anticlockwise to increase flow
3	SICBLOC adjustment knob, upon request. To operate, push and rotate at the same time.
4	Identification label

MERS-G*/M



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DUPLOMATIC OLEODINAMICA

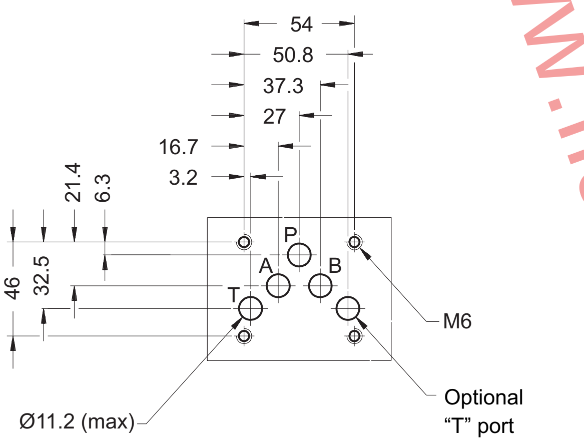
QTM5
FLOW RESTRICTOR VALVE
SERIES 10

MODULAR VERSION
ISO 4401-05 (CETOP 05)

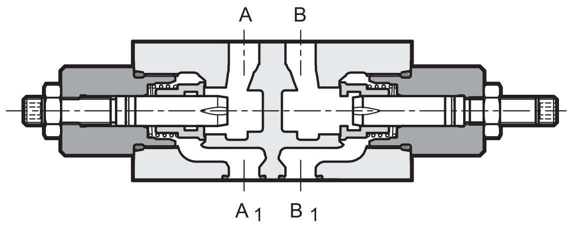
p max **350** bar
Q max **120** l/min

MOUNTING INTERFACE

ISO 4401-05-04-0-05
(CETOP 4.2-4-05)



OPERATING PRINCIPLE

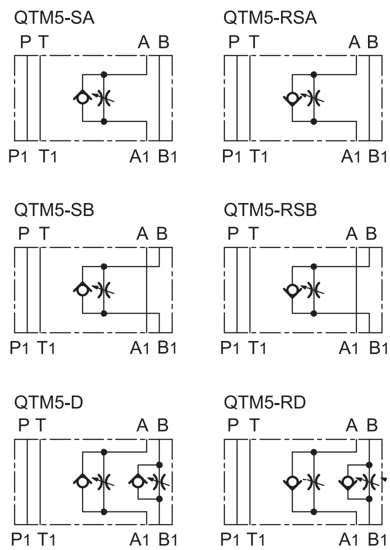


— This is a flow restrictor valve with built in check valve for reverse free flow, made as a modular version with mounting surface according to the ISO 4401 (CETOP RP 12H) standards.

— It can be assembled quickly under all ISO 4401-05 (CETOP 05) modular valves without use of pipes, using suitable tie-rods or bolts, thus forming compact modular groups.

— It is supplied with countersunk hex adjustment screw and locking nut. Rotate anticlockwise to increase the flow rate.

HYDRAULIC SYMBOLS



PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	120
Cracking pressure	bar	0,5
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Recommended viscosity	cSt	25
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Mass: QTM5-SA, -SB, -RSA, -RSB QTM5-D, -RD	kg	2,3 2,5

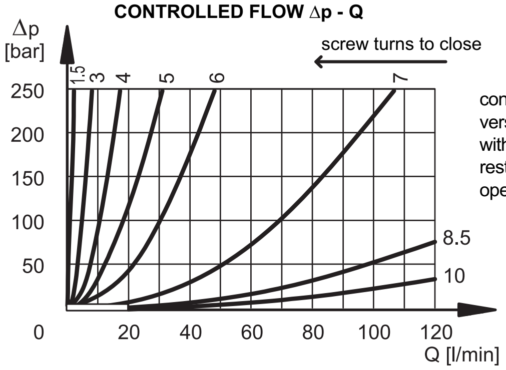
1 - IDENTIFICATION CODE

Q	T	M	5	-		/	10		/	

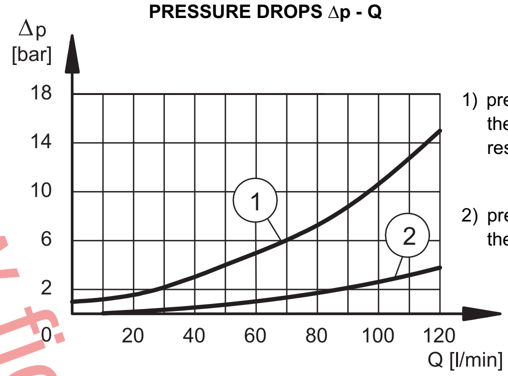
- Flow restrictor valve
- Modular version
- ISO 4401-05 (CETOP 05) size
- Versions for meter-out:
  D = control on lines A and B
  SA = control on line A
  SB = control on line B
- Versions for meter-in:
  RD = control on lines A and B
  RSA = control on line A
  RSB = control on line B
- Series No.
  (the overall and mounting dimensions remain unchanged from 10 to 19)
- Seals:
  N = Seals in NBR for mineral oils **(standard)**
  V = Seals in FPM for special fluids
- **S** = adjustment screw **(standard)**
  K1 = adjustment knob

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

CONTROLLED FLOW Δp - Q



PRESSURE DROPS Δp - Q

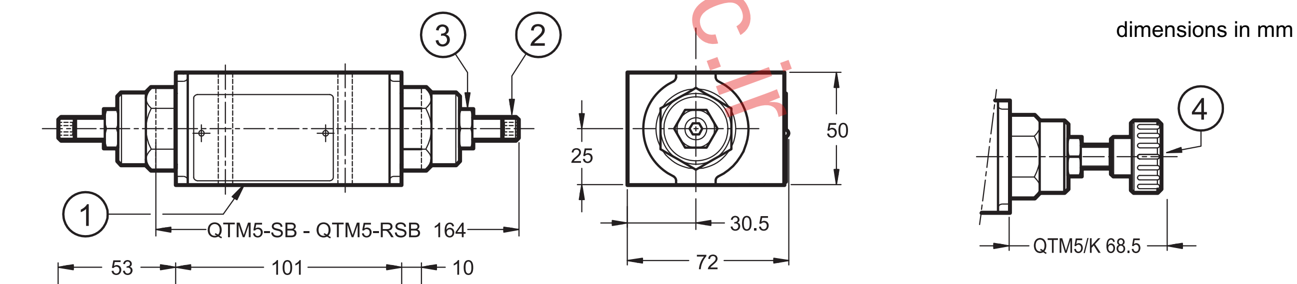


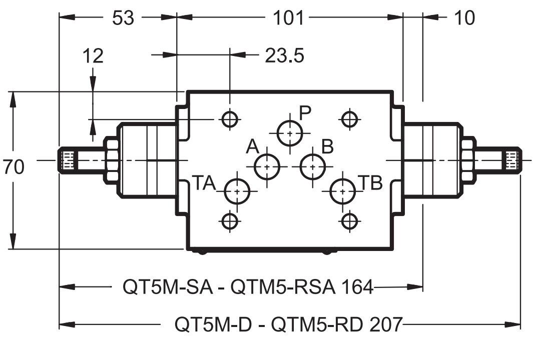
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm





1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore
2	Countersunk hex adjustment screw: spanner 5 (**standard**) Rotate anticlockwise to increase flow
3	Locking nut: spanner 17
4	Adjustment knob **K1** (option) Rotate anticlockwise to increase the flow

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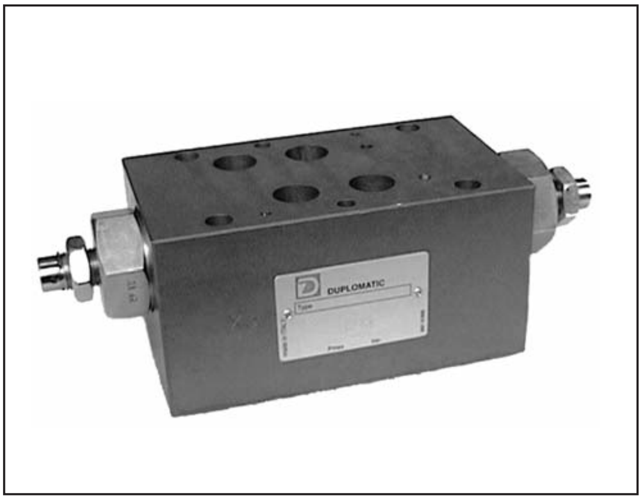
QTM7

FLOW RESTRICTOR VALVE

SERIES 10

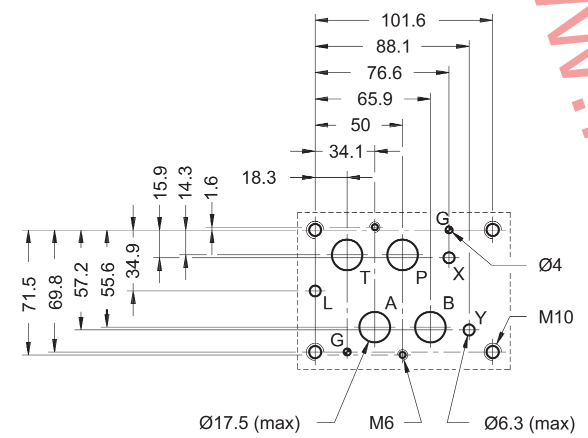


MODULAR VERSION
ISO 4401-07 (CETOP 07)

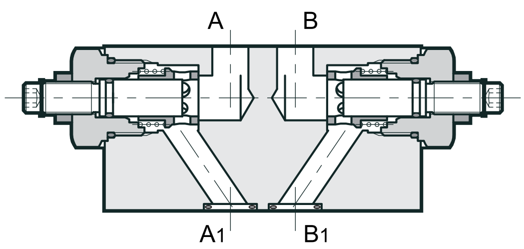
p max **350** bar
Q max **250** l/min

MOUNTING INTERFACE

ISO 4401-07-07-0-05
(CETOP 4.2-4-07)



OPERATING PRINCIPLE



— This is a flow restrictor valve with built in check valve for reverse free flow, made as a modular version with mounting surface according to the ISO 4401 (CETOP RP 12H) standards.

— It can be assembled quickly under all ISO 4401-07 (CETOP 07) modular valves without use of pipes, using suitable tie-rods or bolts, thus forming compact modular groups.

— It is supplied with countersunk hex adjustment screw and locking nut. Rotate anticlockwise to increase the flow rate.

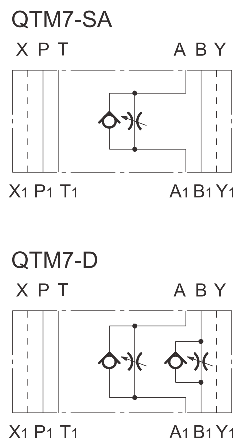
CONFIGURATIONS (see hydraulic symbols table)

— Configuration “SA”: Allows the flow control exiting from the actuator on line A.
— Configuration “D”: Allows independent control of the flow exiting from the chambers A and B of the actuator.
— All the configurations have a built-in check valve that allows free reverse flow (cracking pressure of 0,7 bar).

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	250
Leakage flow with restrictor closed	l/min	≤ 0,5
Check valve opening pressure	bar	0,7
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: QTM7-SA QTM7-D	kg	7,35 7,7

HYDRAULIC SYMBOLS



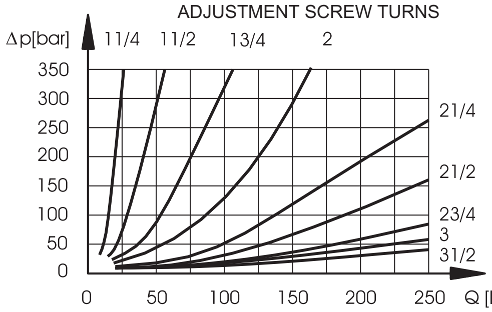
1 - IDENTIFICATION CODE

Q	T	M	7	-		/	10		/	

- Flow restrictor valve
- Modular version
- ISO 4401-07 (CETOP 07) size
- **SA** = meter out control on line A
  D = meter out control on lines A and B
- Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)
- Seals:
  N = Seals in NBR for mineral oils **(standard)**
  V = Seals in FPM for special fluids
- **S** = adjustment screw **(standard)**
  K = adjustment knob

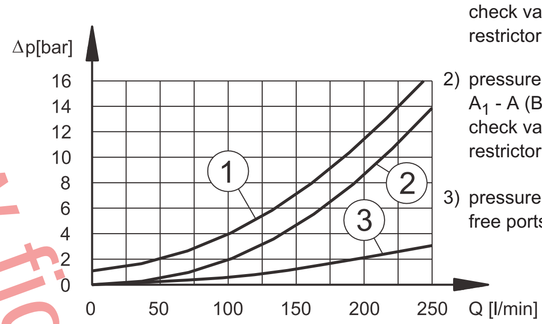
2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

CONTROLLED FLOW



controlled flow versus Δp with different restrictor opening values

PRESSURE DROPS Δp - Q

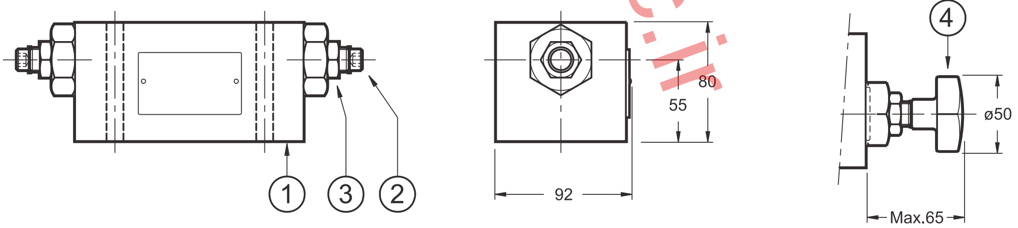


1) pressure drops through the check valve with closed restrictor
2) pressure drops A_1 - A (B_1 - B) through the check valve with open restrictor
3) pressure drops through the free ports

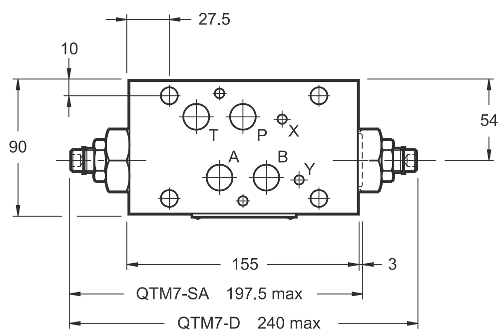
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm



1	Mounting surface with sealing rings: 4 OR type 3087 (21.89x2.62) 2 ORM-0100-20 (10x2)
2	Countersunk hex adjustment screw: spanner 8 (**standard**) Rotate anticlockwise to increase the flow
3	Locking nut: spanner 24
4	Adjustment knob (option): **K** Rotate clockwise to increase the flow

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CHM2

PILOT OPERATED CHECK VALVE

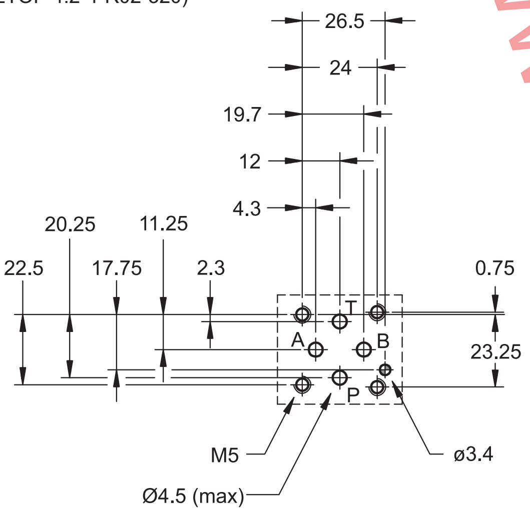
SERIES 10

MODULAR VERSION
ISO 4401-02 (CETOP R02)

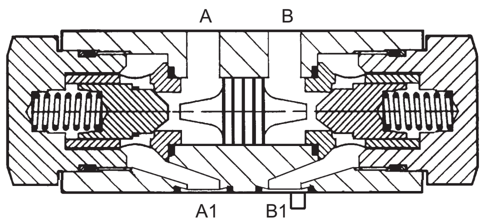
p max **320** bar
Q max **30** l/min

MOUNTING SURFACE

ISO 4401-02-01-0-05
(CETOP 4.2-4-R02-320)



OPERATING PRINCIPLE



— The CHM2 valve is a hydraulically released check valve with spring closing and with cone on edge seals; the mounting surface is according to the ISO 4401 (CETOP RP 121H) standards.

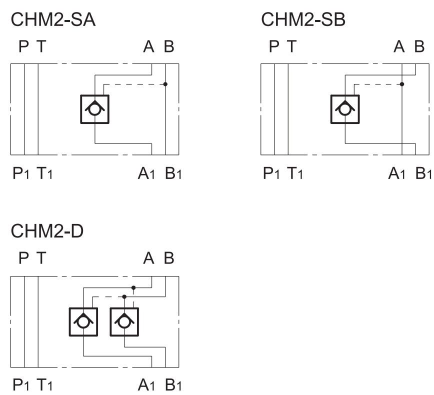
— Its use allows:
- prevention of flow in one direction;
- flow in the same direction, if opened by a pilot pressure;
- free flow in the other direction.

— The CHM2 valves are always mounted downstream of the DL2 type directional solenoid valves (see cat. 41 100) and can be assembled with all other ISO 4401-02 (CETOP R02) valves.

PERFORMANCE RATINGS (measured with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure	bar	320
Maximum flow rate	l/min	30
Ratio between pressure of the sealed chamber and the piloting pressure		3.5 :1
Opening pressure	bar	2
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0.75

HYDRAULIC SYMBOLS



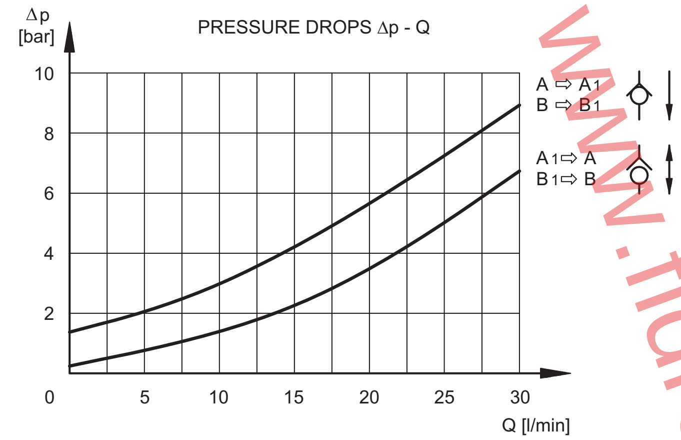
1 - IDENTIFICATION CODE

C	H	M	2	-		/	10	

- CH: Pilot operated check valve
- M: Modular version
- 2: ISO 4401-02 (CETOP R02) size
- Blank after "-": **D**: seal on lines A e B of the actuator; **SA**: seal on line A of the actuator; **SB**: seal on line B of the actuator
- 10: Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)
- Last box: Seals: **N** = Seals in NBR for mineral oils **(standard)**; **V** = Seals in FPM for special fluids

2 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)



3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. With this kind of fluids, use NBR seals type (code N). With HFDR fluids type (phosphate esters) use FPM seals (code V).

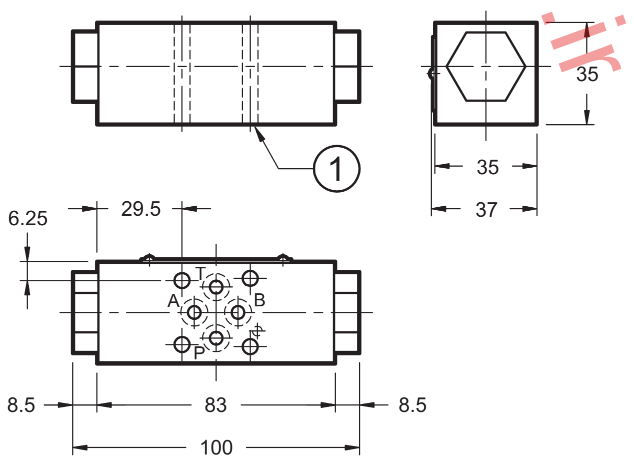
For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid itself and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: N. 4 OR type 2025 (6.07x1.78) 90 Shore

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DUPLOMATIC OLEODINAMICA

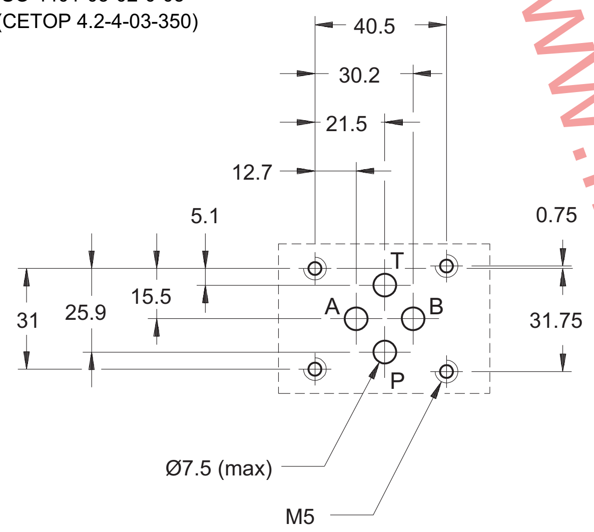
MVR
DIRECT CHECK VALVE
SERIES 51

MODULAR VERSION
ISO 4401-03 (CETOP 03)

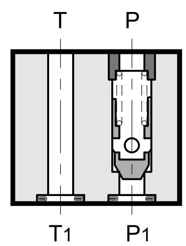
p max **350** bar
Q max (see table of performances)

MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



OPERATING PRINCIPLE



— The MVR valve is a direct check valve made as a modular version with mounting surface according to the ISO 4401 (CETOP RP 121H) standards.

— It is used to avoid oil backflows and self-emptying of lines, or to generate back-pressures.

— It can be assembled quickly under the ISO 4401-03 (CETOP 03) directional solenoid valves without the use of pipes, using suitable tie-rods or bolts.

— It is available in versions with the check valve only on single line (P, T, A or B) or on both lines (P and T or A and B).

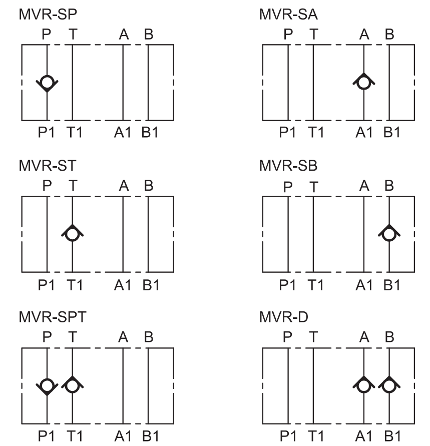
CONFIGURATIONS (see Hydraulic symbols table)

— MVR-SP: check valve on line P.
— MVR-SA: check valve on line A..
— MVR-ST: check valve on line T.
— MVR-SB: check valve on line B.
— MVR-SPT: check valve on lines P and T.
— MVR-D: check valve on lines A and B.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure Check valve cracking pressure	bar	350 3 - 0,5 - 5
Maximum flow rate in controlled lines Maximum flow rate in the free lines	l/min	50 75
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass:	kg	1

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

M	V	R		-		/	51	/	

Size: ISO 4401-03 (CETOP 03). Modular version.

Check valve

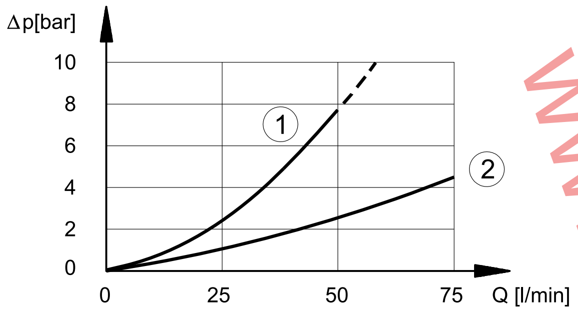
Cracking pressure:
omit for standard cracking pressure = 3 bar
1 = 0,5 bar
3 = 5 bar

Seals: omit for mineral oils
V = viton for special fluids

Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)

SP: check valve on line P
SA: check valve on line A
SB: check valve on line B
ST: check valve on line T
SPT: check valve on lines P and T
D : check valve on lines A and B

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



1) pressure drops on controlled lines
2) pressure drops on free lines

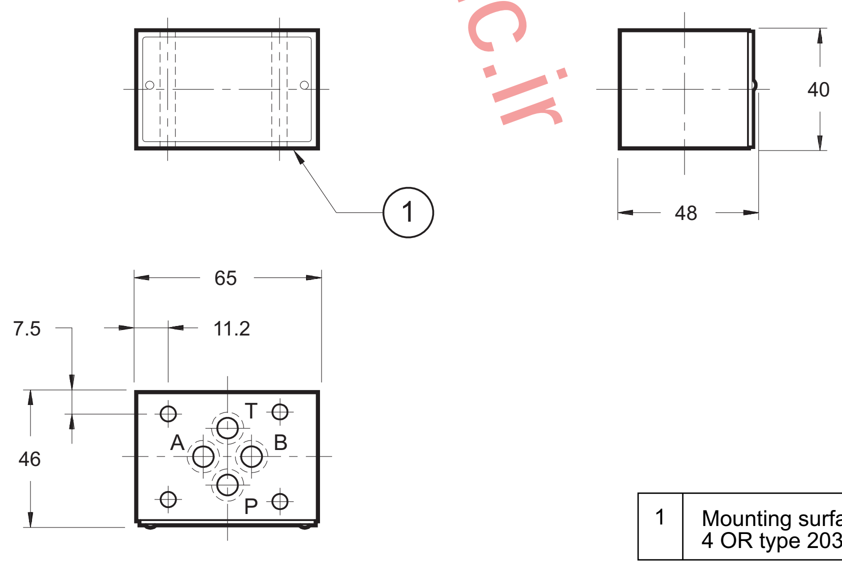
NOTE: check valve cracking pressure must be added to the values indicated in the curve 1 in the diagram

3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 Sh

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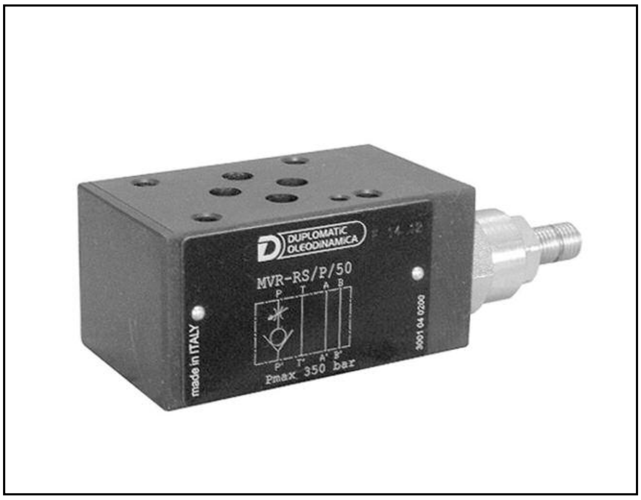
MVR-RS/P

DIRECT CHECK VALVE WITH FLOW RESTRICTOR

SERIES 50

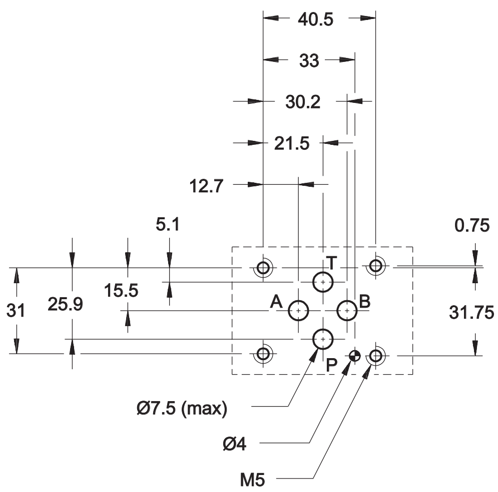


MODULAR VERSION
ISO 4401-03

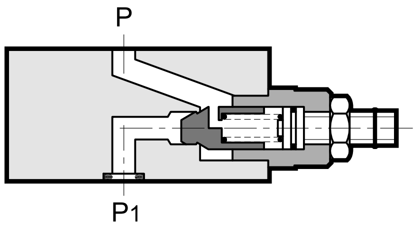
p max **350** bar
Q max (see table of performances)

MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



OPERATING PRINCIPLE

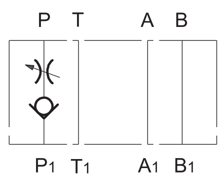


- The MVR-RS/P valve is a check valve that incorporates also the function of flow restriction.
- It is made as a modular version with mounting surface according to the ISO 4401-03 standards.
- It can be quickly assembled under the ISO 4401-03 directional solenoid valves and modular valves, without use of pipes and using suitable tie-rods or bolts.
- It is used when it is necessary to control the flow in a direction and to avoid backflows or the self-emptying of the lines in the opposite direction.
- Control of the flow is obtained with a countersunk hex screw with locking nut.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure Check valve cracking pressure	bar	350 1
Maximum flow rate in controlled lines Maximum flow rate in the free lines	l/min	50 75
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	1,1

HYDRAULIC SYMBOL



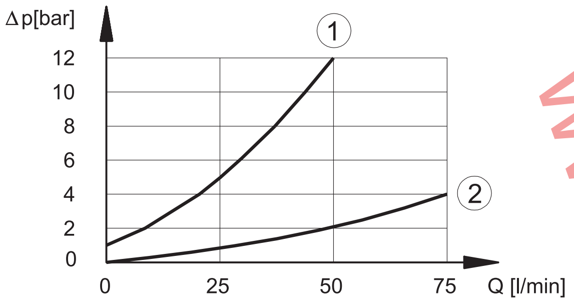
MVR-RS/P
SERIES 50

1 - IDENTIFICATION CODE

M	V	R	-	R	S	/	P	/	50	/	

- ISO 4401-03 size Modular version (M)
- Check valve (VR)
- Flow restrictor valve on line P (RS)
- Check valve on line P (P)
- Series No. (the overall and mounting dimensions remain unchanged from 50 to 59) (50)
- Seals: omit for mineral oils; **V** = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



1) pressure drops $P_1 \rightarrow P$

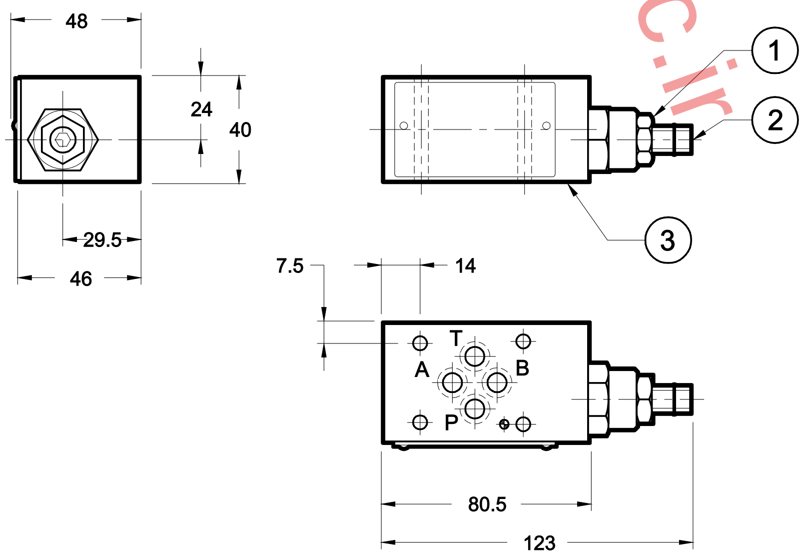
2) pressure drops on free lines (ex. $A \rightarrow A_1$)

3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Locking nut: spanner 17
2	Socket hex adjustment screw: spanner 5 Rotate anticlockwise to increase flow
3	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 Shore

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DUPLOMATIC OLEODINAMICA

MVPP

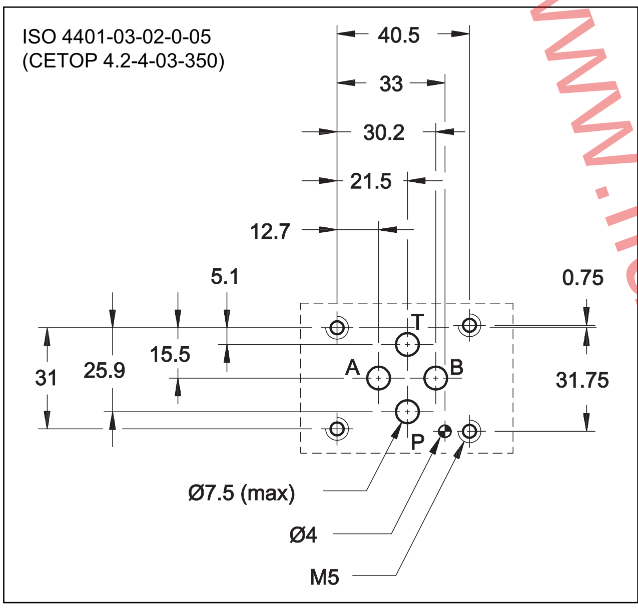
PILOT OPERATED CHECK VALVE

SERIES 50

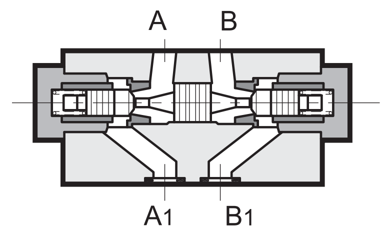
MODULAR VERSION
ISO 4401-03 (CETOP 03)

p max **350** bar
Q max (see table of performances)

MOUNTING SURFACE



OPERATING PRINCIPLE



— This is a check valve (spring closing and cone on edge seals) with a built-in flow control feature. The mounting surface is according to the ISO 4401 (CETOP RP 121H) standards.

— Its use allows:
- prevention of flow one-way;
- flow in one-way, if opened by a pilot pressure;
- free flow in the other way.

— The MVPP are always mounted under the ISO 4401-03 (CETOP 03) directional solenoid valves and can be assembled with all other ISO 4401-03 (CETOP 03) valves.

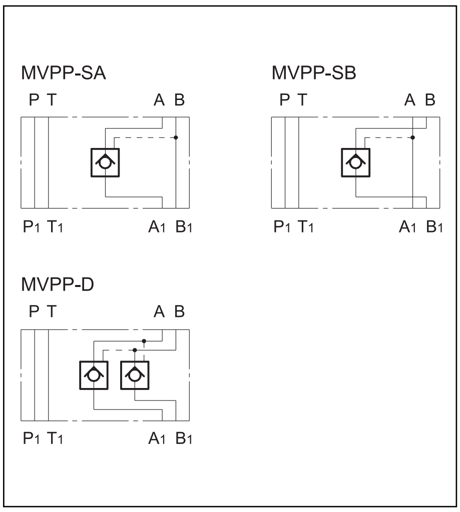
CONFIGURATIONS (see hydraulic symbols table)

— Configurations “SA” - “SB”: are used to lock the actuator in one direction
— Configuration “D”: is used to lock the position of the actuator in both directions

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure Check valve cracking pressure	bar	350 3
Maximum flow rate in controlled lines Maximum flow rate in the free lines	l/min	50 75
Ratio between the pressure in the locked chambers and the piloting pressure		3,4:1
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	1,3

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

M V P P - [ ] / 50 / [ ] [ ]

ISO 4401-03 (CETOP 03) size
Modular version

Pilot operated check valve

Configurations:
SA = seal on line A of the actuator
SB = seal on line B of the actuator
D = seal on lines A and B of the actuator

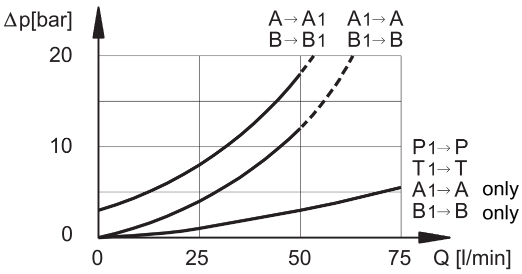
Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)

Seals: omit for mineral oils
V = viton for special fluids

Option:
/ W7 = Zinc-nickel surface treatment (see **NOTE**). Omit if not required.

NOTE: Standard surface treatment: phosphating. The zinc-nickel finishing makes the valve suitable to ensure a salt spray resistance up to 600 hours.

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



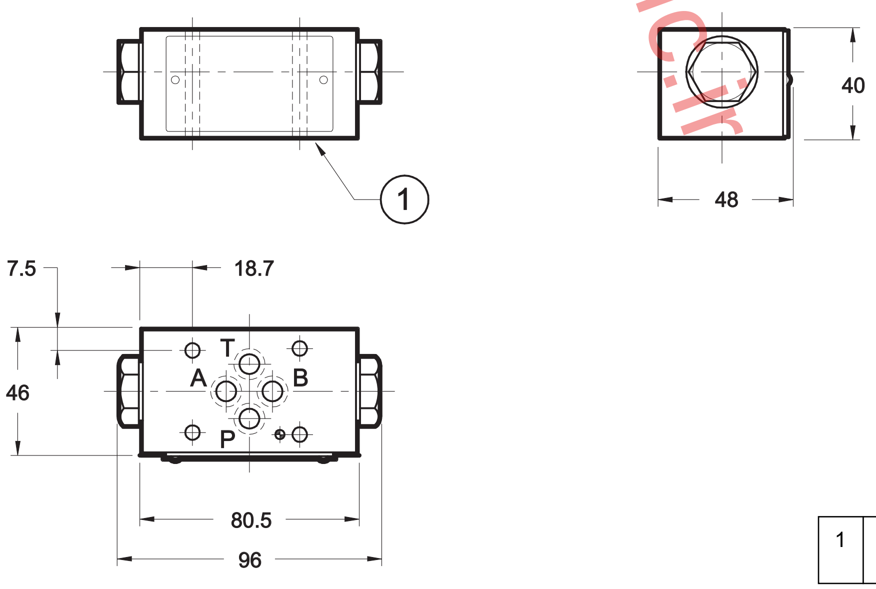
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 Sh

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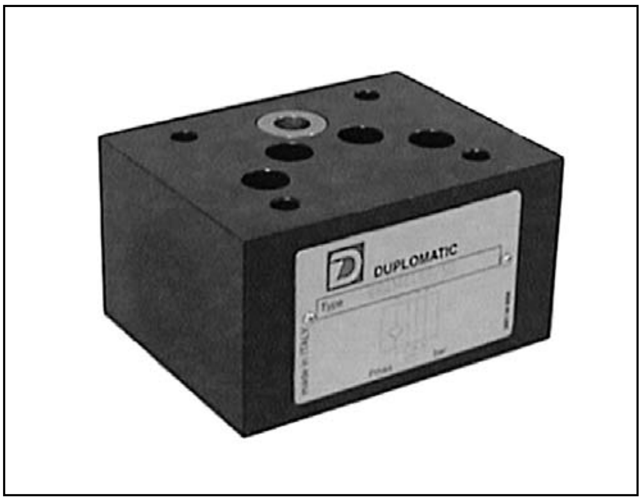


VR4M

DIRECT CHECK VALVE

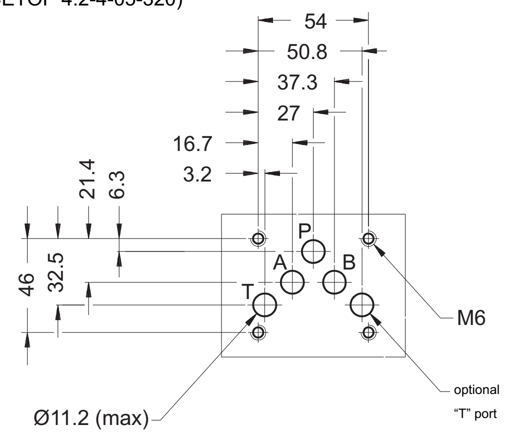
SERIES 50

MODULAR VERSION
ISO 4401-05 (CETOP 05)

p max **320** bar
Q max **100** l/min

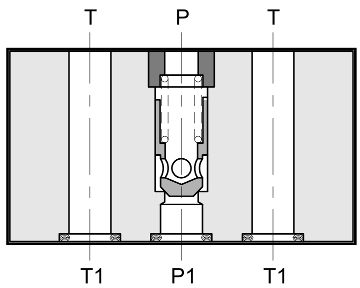
MOUNTING INTERFACE

ISO 4401-05-04-0-05
(CETOP 4.2-4-05-320)



CONFIGURATIONS (see Hydraulic symbols table)
— VR4M-SP: check valve on line P.
— VR4M-ST: check valve on line T.

OPERATING PRINCIPLE



— The VR4M valve is a check valve made as a modular version with mounting surface according to the ISO 4401 (CETOP RP 121H) standards.

— It is used to avoid oil backflows and self-emptying of lines, or to generate backpressures.

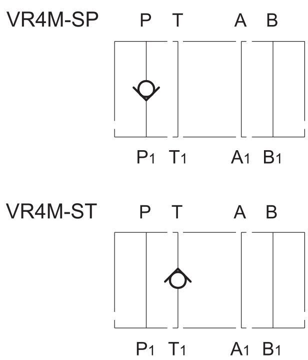
— It can be assembled quickly under the ISO 4401-05 (CETOP 05) directional solenoid valves without use of pipes, using suitable tie-rods or bolts.

— It is available in two versions with check valve on line P or T.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure Check valve cracking pressure	bar bar	320 0,5 - 8
Maximum flow rate in the controlled lines and in the free lines	l/min	100
Ambient temperature range	°C	–20 / +50
Fluid temperature range	°C	–20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Recommended viscosity	cSt	25
Degree of fluid contamination	According to ISO 4406:1999 class 20/18/15	
Mass	kg	2,3

HYDRAULIC SYMBOLS

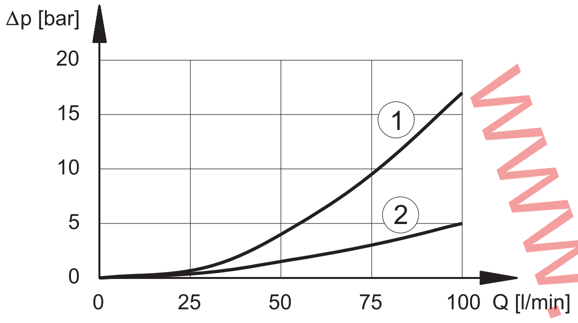


1 - IDENTIFICATION CODE

V	R	4	M		-		/	50	/	

- Check valve (VR)
- ISO 4401-05 (CETOP 05) size (4)
- Modular version (M)
- Cracking pressure:
  1 = 0,5 bar **4** = 8 bar
- **SP** = check valve on line P
  ST = check valve on line T
- Series No. (the overall and mounting dimensions remain unchanged from 50 to 59)
- Seals:
  omit for mineral oils
  V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)



1) pressure drops $P_1 \rightarrow P$ and $T \rightarrow T_1$ (controlled lines)

2) pressure drops on free lines (ex. $A \rightarrow A_1$)

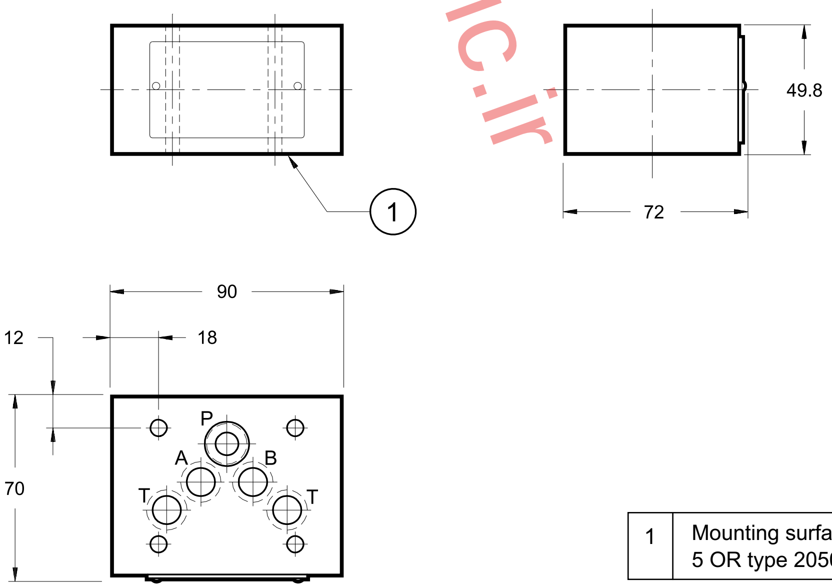
NOTE: Add the valve cracking pressure to the values shown by the curve 1 of the diagram

3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Sh

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CHM5

PILOT OPERATED CHECK VALVE

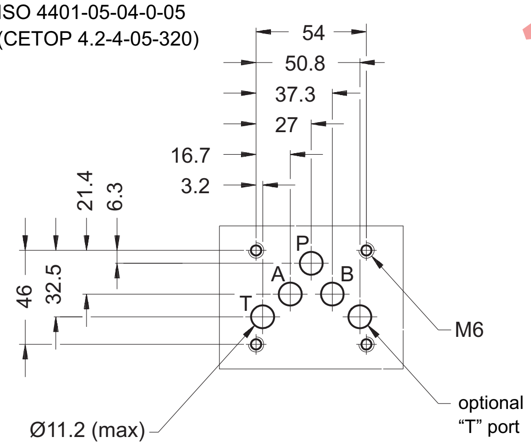
SERIES 10

MODULAR VERSION
ISO 4401-05 (CETOP 05)

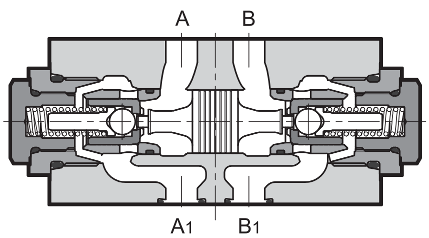
p max **320** bar
Q max **120** l/min

MOUNTING INTERFACE

ISO 4401-05-04-0-05
(CETOP 4.2-4-05-320)



OPERATING PRINCIPLE



— This is a pilot operated check valve (spring closing and cone on edge seals) with a built-in flow control feature. The mounting surface is according to the ISO 4401 (CETOP RP 121H) standard.

— The CHM5 are always mounted under the ISO 4401-05 (CETOP 05) directional solenoid valves and can be assembled with all other ISO 4401-05 (CETOP 05) valves.

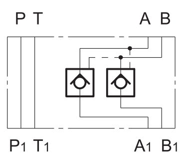
— The pre-opening feature of the valve causes the decompression of the cylinder chamber, leading to a smooth motion.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

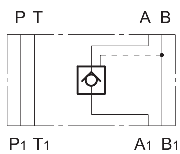
Maximum operating pressure	bar	320
Maximum flow rate	l/min	120
Decompression ratio	14,9:1	
Piloting ratio	2,3:1	
Check valve cracking pressure	bar	2
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Recommended viscosity	cSt	25
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Mass: CHM5-D CHM5-SA e CHM5-SB	kg	2,2 1,9

HYDRAULIC SYMBOLS

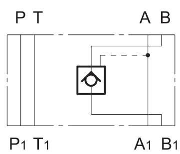
CHM5-D



CHM5-SA



CHM5-SB

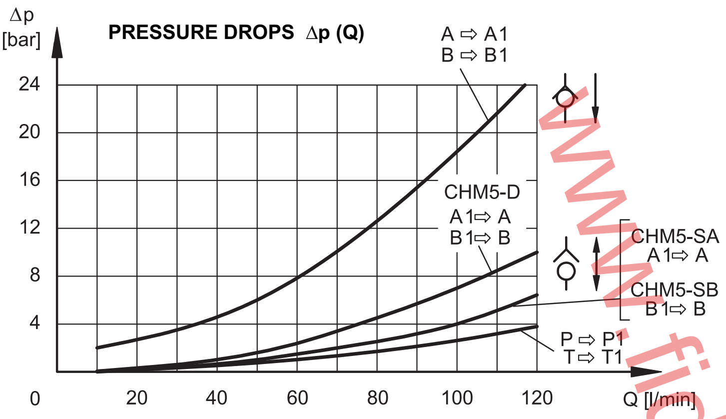


1 - IDENTIFICATION CODE

C H M 5 - [ ] / 10 [ ]

- Pilot operated check valve (CH)
- Modular version (M)
- ISO 4401-05 (CETOP 05) size (5)
- Configurations: **D** = seal on both A and B lines; **SA** = seal on line B of the actuator; **SB** = seal on line B of the actuator
- Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)
- Seals: **N** = NBR seals for mineral oil **(standard)**; **V** = FPM seals for special fluids

2 - CHARACTERISTIC CURVES (obtained with viscosity of 36 cSt at 50°C)



3 - HYDRAULIC FLUIDS

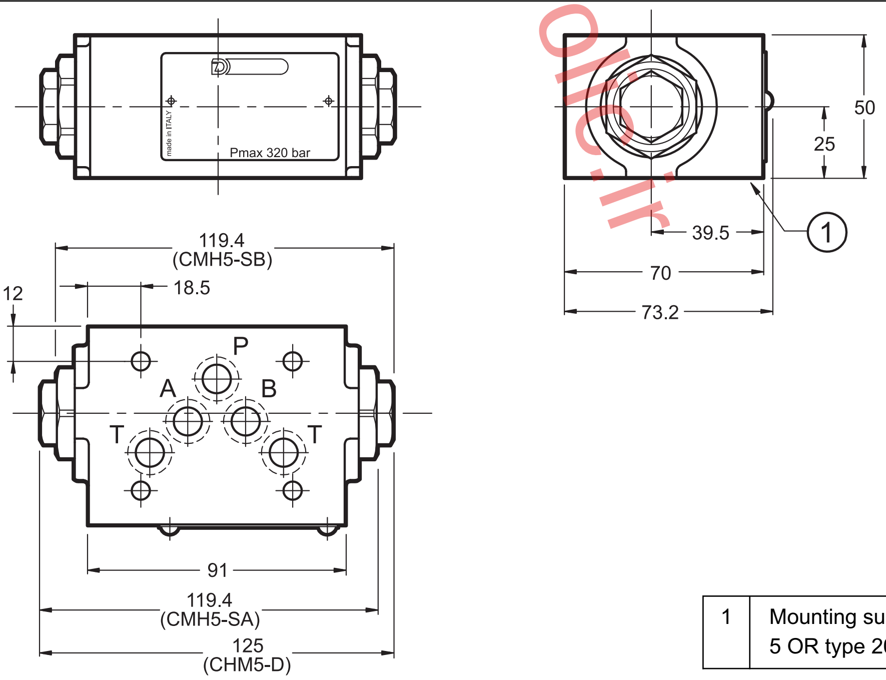
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V).

For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) -90 Shore

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CHM7

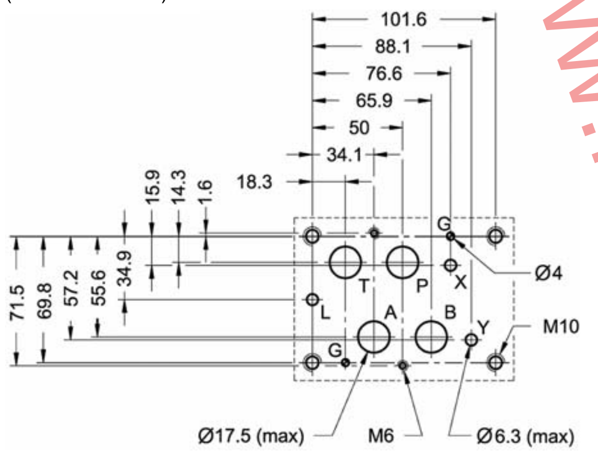
PILOT OPERATED CHECK VALVE
SERIES 11

MODULAR VERSION
ISO 4401-07 (CETOP 07)

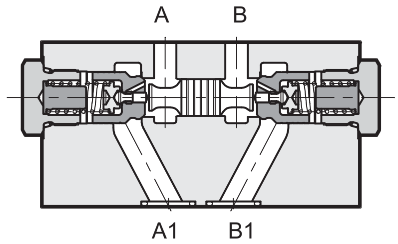
p max **350** bar
Q max **300** l/min

MOUNTING INTERFACE

ISO 4401-07-07-0-05
(CETOP 4.2-4-07)



OPERATING PRINCIPLE



— This is a hydraulically released check valve with spring closing and with cone on edge seals; the mounting surface is according to the ISO 4401 (CETOP RP 121H) standards.

— Its use allows:
- prevention of flow in one direction;
- flow in the same direction, if opened by a pilot pressure;
- free flow in the other direction.

— The CHM7 valves are always mounted downstream of the DSP7 type directional solenoid valves (see cat. 41 420) and can be assembled with all other ISO 4401-07 (CETOP 07) valves.

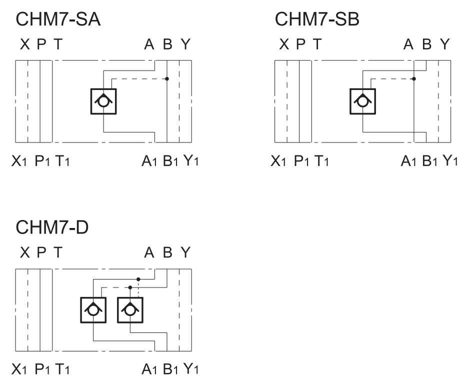
CONFIGURATIONS (see hydraulic symbols table)

— Configuration “SA” -”SB”: is used to lock the actuator in one direction.
— Configuration “D”: is used to lock the actuator position in both directions.
The opening of the valve is gradual and occurs with the pre-opening of the main shutter that permits the plant decompression .

PERFORMANCE RATINGS (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate	l/min	300
Ratio between pressure of the sealed chamber and the piloting pressure		13:1
Opening pressure	bar	2
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: CHM7-S* CHM7-D	kg	7,6 7,7

HYDRAULIC SYMBOLS



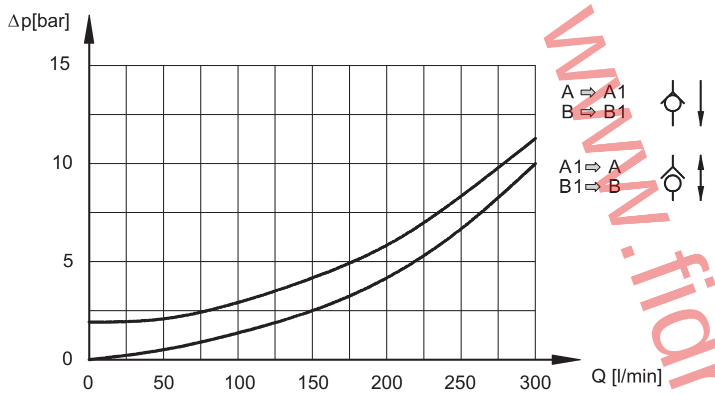
1 - IDENTIFICATION CODE

C	H	M	7	-		/	11	

- Pilot operated check valve (C H)
- Modular version (M)
- ISO 4401-07 (CETOP 07) size (7)
- **D** = seal on lines A e B of the actuator
  SA = seal on line A of the actuator
  SB = seal on line B of the actuator
- Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)
- Seals:
  N = Seals in NBR for mineral oils **(standard)**
  V = Seals in FPM for special fluids

2 - CHARACTERISTIC CURVES

(values obtained with viscosity of 36 cSt at 50°C)



3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. With this kind of fluids, use NBR seals type (code N). With HFDRfluids type (phosphate esters) use FPM seals (code V).

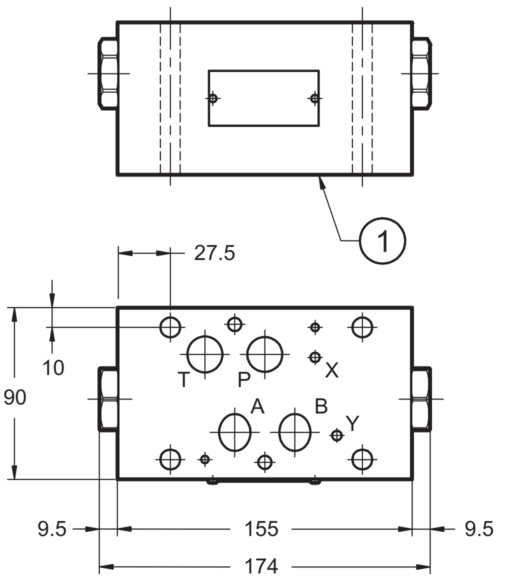
For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

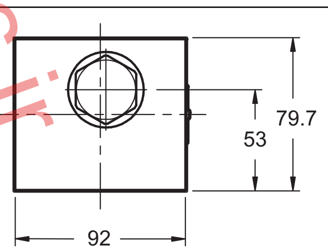
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid itself and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm





1	Mounting surface with sealing rings: n. 4 OR type 3087 (21.89x2.62) n. 2 ORM - 0100 - 20 (10x2)

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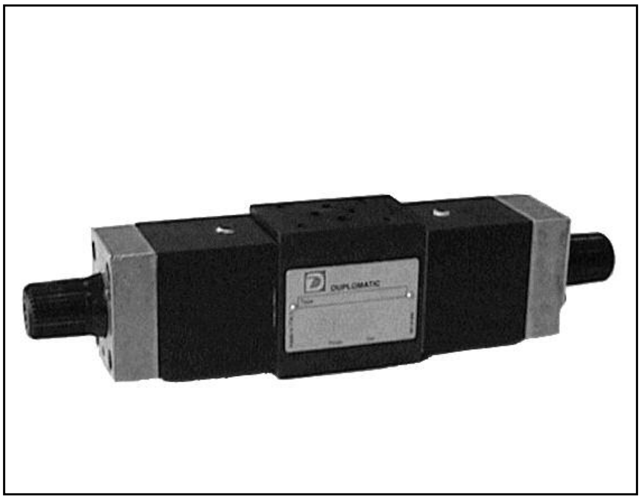
DUPLOMATIC OLEODINAMICA

RPC1*/M

FLOW CONTROL VALVE

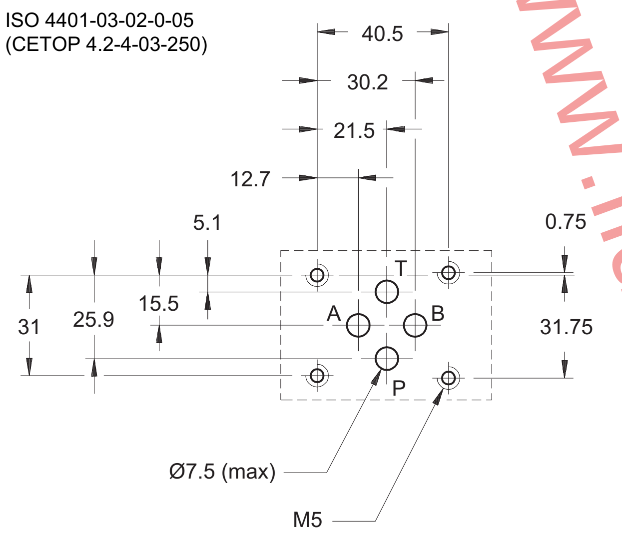
SERIES 10



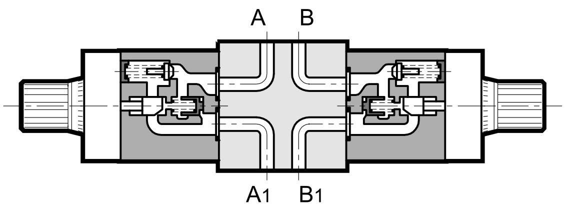
MODULAR VERSION
ISO 4401-03

p max **250** bar
Q max (see table of performances)

MOUNTING INTERFACE



OPERATING PRINCIPLE



— The RPC1*/M valve is a flow control valve with pressure and temperature compensation, made as a modular version with mounting surface according to the ISO 4401 standards.

— It can be assembled quickly under the ISO 4401-03 directional solenoid valves and allows easy execution of hydraulic circuits where control of the speed of the actuators is required.

— It is available in six flow adjustment ranges up to 30 l/min.

— Combined with MDS3 type solenoid operated directional control valves (see cat. 41 251), it's possible to obtain circuits for the fast/slow control of the work actuators.

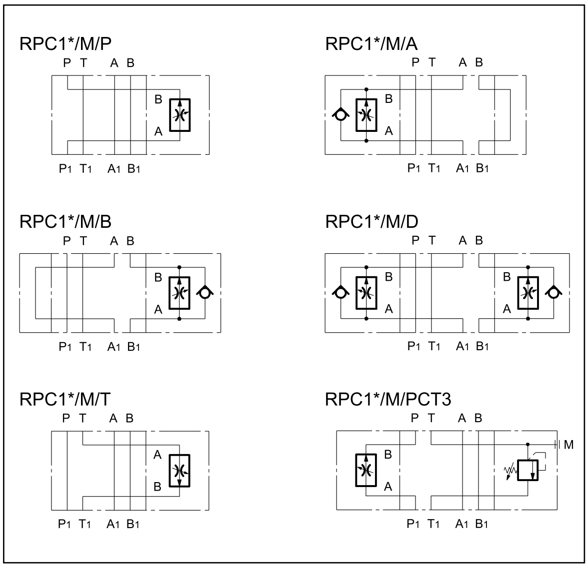
CONFIGURATIONS

(see hydraulic symbols table and identification code - par. 1)

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	250
Maximum flow rate in controlled lines Maximum flow rate in the free lines Reverse free flow maximum flowrate	l/min	1-4-10-16-22-30 65 40
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: RPC1-*/M/ A-B-T-P RPC1-*/M/ D RPC1-*/M/PCT3 only modular block ISO 4401-03 without flow control valves: RPC1-K/M/* RPC1-K/M/PCT3	kg	3 4,1 3,7 1,5 2,4

HYDRAULIC SYMBOLS



NOTE: for detailed information regarding the RPC1 flow control valve, see catalogue 32 200

1 - IDENTIFICATION CODE

R	P	C	1	-		/	M	/		-		/	10	/	

Pressure and temperature compensated flow control valve

Flow adjustment range:
1 = 1 l/min **16** = 16 l/min
4 = 4 l/min **22** = 22 l/min
10 = 10 l/min **30** = 30 l/min
K = only ISO 4401-03 (CETOP 03) modular block supplied without flow control valve

Modular version size ISO 4401-03 (CETOP 03)

Configurations:
P = meter in control on line P
A = control from chamber A of the actuator
B = control from chamber B of the actuator
D = control from chambers A and B of the actuator
T = meter out control on line T
PCT3 = meter in control on line P with backpressure adjustable on line T up to 70 bar
(A and B configurations are not available in **K** version)

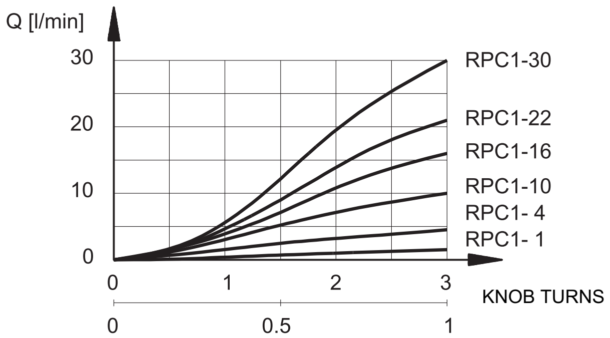
M1 = adjustment knob only for PCT3 version (omit for adjustment with countersunk hex screw)

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

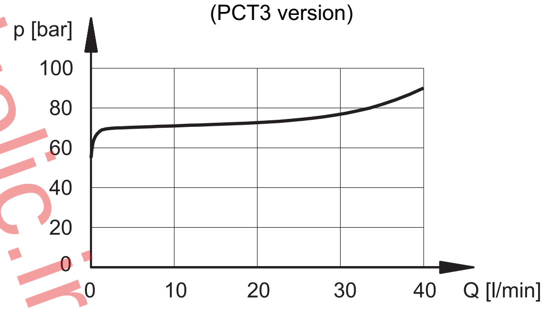
Seals: omit for mineral oils
V = viton for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

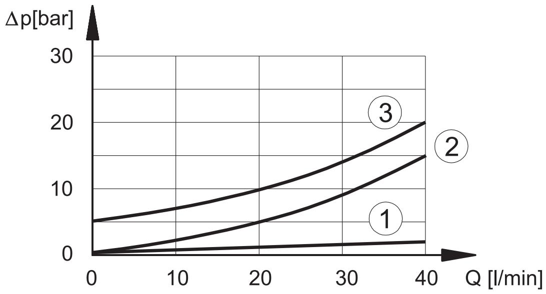
FLOW ADJUSTMENT



PRESSURE ADJUSTMENT
(PCT3 version)



PRESSURE DROPS Δp - Q



1) pressure drops on free lines
2) pressure drops through check valve
3) pressure drops through the backpressure valve (PCT3 version)

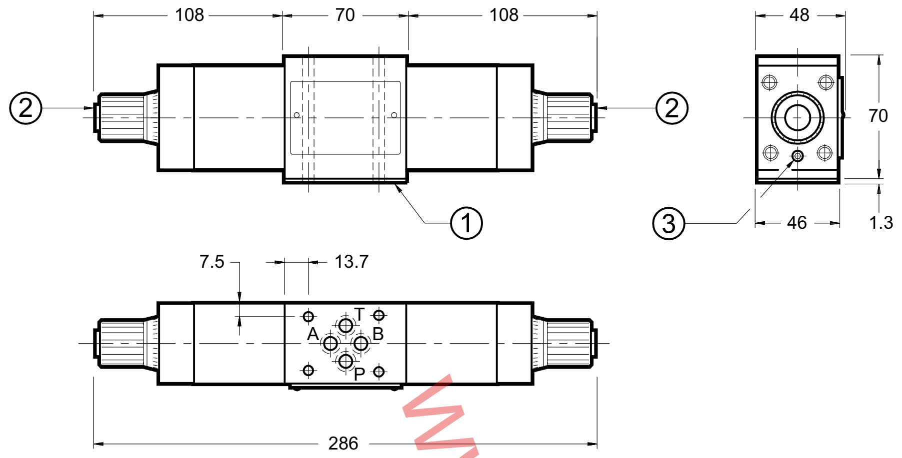
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS RPC1-*/M VALVES

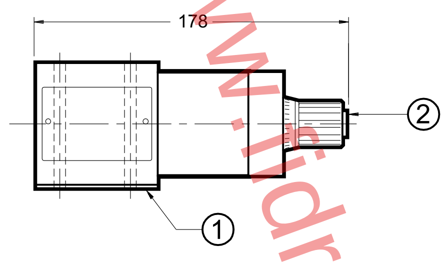
dimensions in mm

RPC1-*/M/D

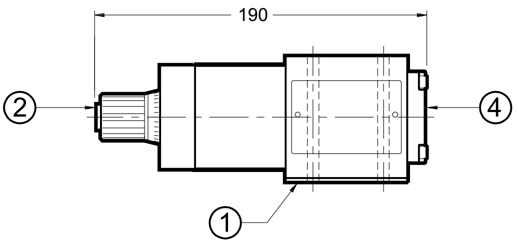


RPC1-*/M/P

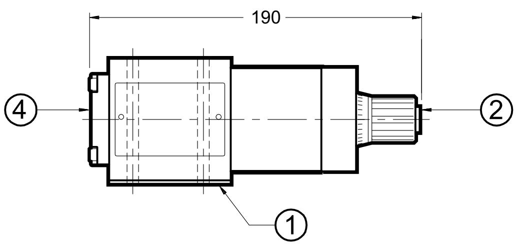
RPC1-*/M/T



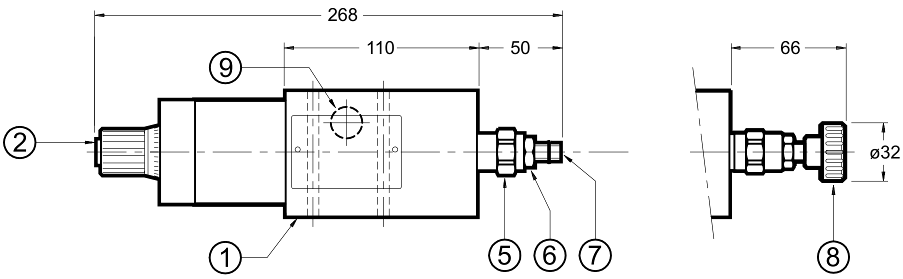
RPC1-*/M/A



RPC1-*/M/B



RPC1-*/M/PCT3

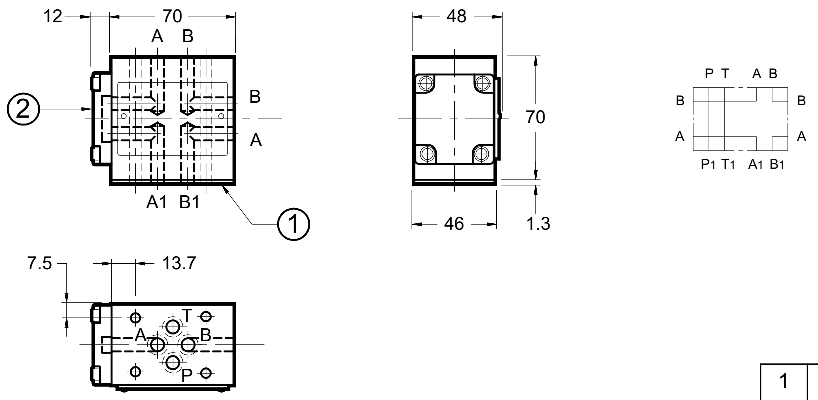


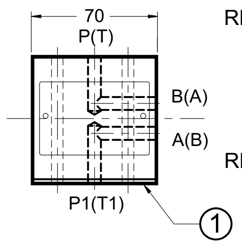
1	Mounting plate with sealing rings: P-OR1L/20N (NBR seals) P-OR1L/20V (Viton seals) For RPC1-*/M/PCT3 without mounting plate: 4 OR 2037 (9.25x1.78) - 90 Shore
2	Flow adjustment knob (3 turns total) Rotate anticlockwise to increase flow.
3	Knob locking screw
4	Cross-connection cover
5	Backpressure valve on line T. Pressure adjustment range up to 70 bar
6	Locking nut: spanner 17
7	Countersunk hex screw: spanner 5 Rotate clockwise to increase pressure
8	Adjustment knob: **M1**
9	Pressure gauge port 1/4” BSP

5 - OVERALL AND MOUNTING DIMENSIONS OF BLOCKS WITHOUT FLOW CONTROL VALVE

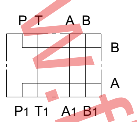
dimensions in mm

RPC1-K/M/D

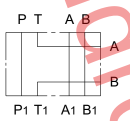




RPC1-K/M/P

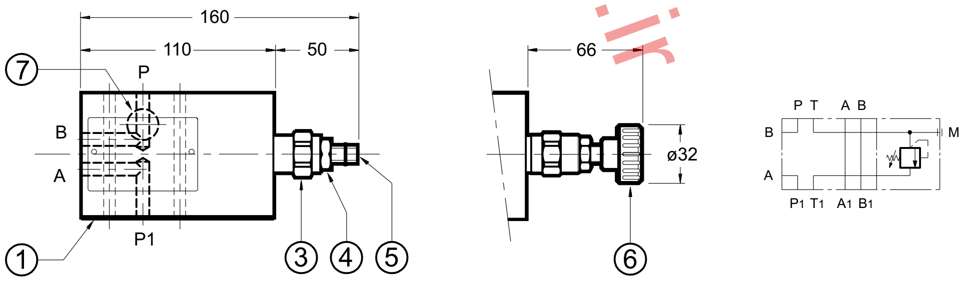


RPC1-K/M/T



1	Mounting plate with sealing rings: P-OR1L/20N (NBR seals) P-OR1L/20V (Viton seals) For RPC1-*/M/PCT3 without mounting plate: 4 OR 2037 (9.25x1.78) - 90 Shore
2	Cross-connection cover
3	Backpressure valve on line T. Pressure adjustment range up to 70 bar
4	Locking nut: spanner 17
5	Countersunk hex screw: spanner 5 Rotate clockwise to increase pressure
6	Adjustment knob: **M1**
7	Pressure gauge port 1/4" BSP

RPC1-K/M/PCT3



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RLM3

ELECTRIC FAST / SLOW SPEED SELECTION VALVE

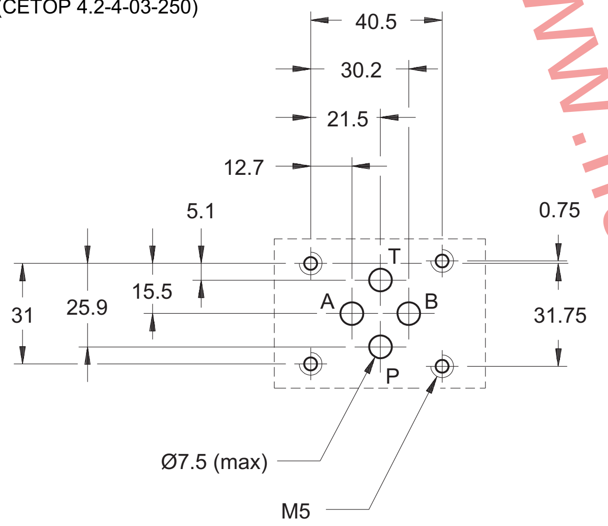
SERIES 10

MODULAR VERSION
ISO 4401-03 (CETOP 03)

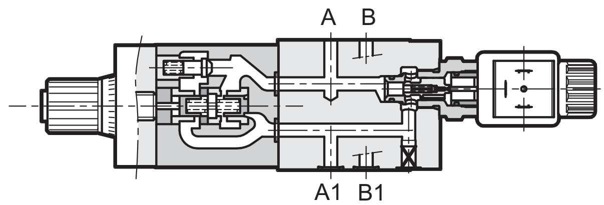
p max **250** bar
Q max (see table of performances)

MOUNTING SURFACE

ISO 4401-03 -02-0-05
(CETOP 4.2-4-03-250)



OPERATING PRINCIPLE



— The RLM3 valve is a compact group that allows control of the fast/slow flow through use of an open/close solenoid valve. The adjustment of the flow is carried out with the RPC1 compensated flow control valves (see catalogue 32 200) with six adjustment ranges.

— The fast/slow speed selection is obtained with the KT08 solenoid cartdrige poppet valve (see catalogue 43100)

— Made as a modular version, the mounting surface is according to iso 4401 (CETOP RP121H) standards.

— The RLM3 valve can be assembled quickly under the ISO 4401-03 (CETOP 03) directional solenoid valves without use of pipes, permitting the construction of directional and speed controls for work actuators in a single mounting position.

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	250
Maximum flow rate in controlled lines Maximum flow rate in the free lines	l/min	1 - 4 - 10 - 16 - 22 - 30 65
Minimum controlled flow rate	l/min	0,025
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	3,1

CONFIGURATIONS

(see Hydraulic symbols)

— Configuration “A”: meter-out control from the actuator on chamber A.

— Configuration “T”: control on discharge T of the directional solenoid valve for speed control in both directions of movement.

1 - IDENTIFICATION CODE

R	L	M	3		-			/	10		-			/	

Electric fast/ slow speed selection valve

Modular version

Size ISO 4401-03 (CETOP 03)

Adjustments:
A = adjustment on chamber A of the actuator;
T = adjustment on discharge T of the directional solenoid valve

A = normally open solenoid valve
C = normally closed solenoid valve

Flow adjustment range:

01 = 1 l/min	**16** = 16 l/min
04 = 4 l/min	**22** = 22 l/min
10 = 10 l/min	**30** = 30 l/min

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR for mineral oils
V = viton for special fluids

Coil type:
D12 = 12 V, **D24** = 24 V — direct current (**standard**)
R110 = 110 V, **R230** = 230 V — rectified current
D00 = valve without coil (see **NOTE 1**))

Coil electrical connection (see paragraph 8)
K1 = plug for connector type DIN 43650 (**standard**)
K2 = plug for connector type AMP JUNIOR
K4 = outgoing cables
K7 = plug for connector type DEUTSCH DT04-2P male
K8 = plug for connector type AMP SUPER SEAL

See **NOTE 2**

NOTE 1: The coil locking ring and the relevant seals are included in the supply.
NOTE 2: The manual override **CM** is available as an option (see paragraph 8).

N.B. : For further informations about the flow control valve see catalogue 32 200; For further informations about the cartridge poppet valve see catalogue 43 100.

NOTE: The solenoid valves are never supplied with connector. Connectors must be ordered separately. To find out the type of connector to be ordered, please see catalogue 49 000.

1.1 - Coil identification code

C14L3	-			/	10

Power supply
D12 = 12 V, **D24** = 24 V — direct current (**standard**)
R110 = 110 V, **R230** = 230 V — rectified current

Series no.: (the overall and mounting dimensions remain unchanged from10 to 19)

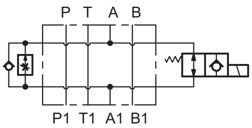
Coil electrical connection (see paragraph 10)
K1 = plug for connector type DIN 43650 (**standard**)
K2 = plug for connector type AMP JUNIOR
K4 = outgoing cables
K7 = plug for connector type DEUTSCH DT04-2P male
K8 = plug for connector type AMP SUPER SEAL

3 - HYDRAULIC FLUIDS

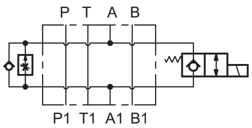
Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

3 - HYDRAULIC SYMBOLS

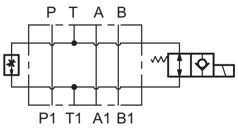
RLM3A-A*



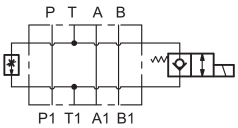
RLM3A-C*



RLM3A-C*

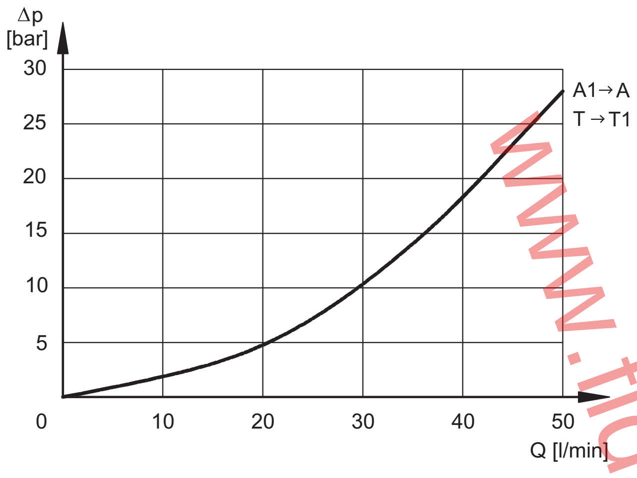


RLM3T-C*



4 - PRESSURE DROPS Δp-Q

(obtained with viscosity of 36 cSt at 50 °C)



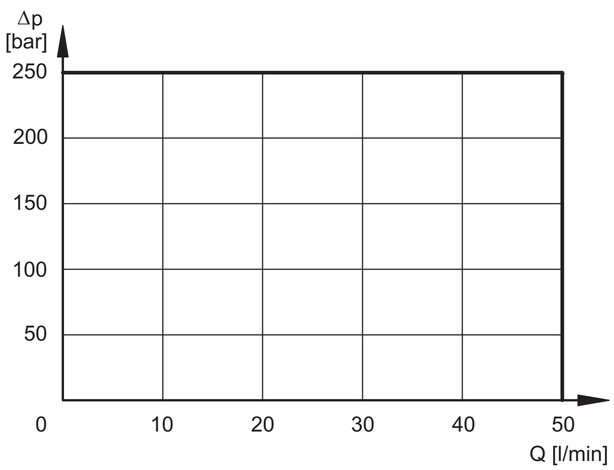
The values in graphs refer to the fast flow through the soleinoid valve and are equal for A (normally open) and C (normally closed) versions.

5 - SWITCHING TIME

The values are obtained according to the ISO 6403 standard, with mineral oil at 50°C, with viscosity of 36 cSt.

TIMES [ms]	ENERGIZING	DE-ENERGIZING
RLM3*-A*	85	60
RLM3*-C*	60	85

6 - OPERATING LIMITS



The curves define the flow rate operating fields according to the valve pressure of the different versions.
The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage.
The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

5 - ELECTRICAL FEATURES

5.1 Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded onto the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation. The coil is fastened to the tube by a threaded nut, and can be rotated according to the available space.
The interchangeability of coils of different voltages both D or R type is possible without removing the tube.

Protection according CEI EN 60529 - atmpspheric agents

Connector	IP 65	IP 67	IP 69 K
K1 DIN 43650	x		
K2 AMP JUNIOR	x	x	
K4 outgoing cables	x	x	
K7 DEUTSCH DT04 male	x	x	x
K8 AMP SUPER SEAL	x	x	x

NOTE: The protection degree is guaranteed only with the connector correctly connected and installed.

VOLTAGE SUPPLY FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	10.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC) (**NOTE 1**)	In compliance with 2004/108/CE
LOW VOLTAGE	In compliance with 2006/95/CE
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529) Coil insulation (VDE 0580) Impregnation:	 IP 65 (**NOTE 2**) class H class H

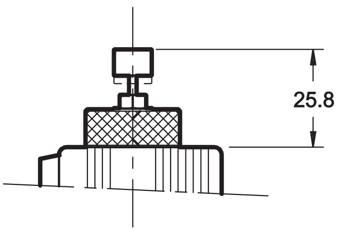
5.2 Current and absorbed power

In the table are shown current and power consumption values relevant to the different coil types. “R” coil must be used when the valve is fed with AC power supply subsequently rectified by means of rectifier bridge, externally or incorporated in the “D” type connector (see cat. 49 000).

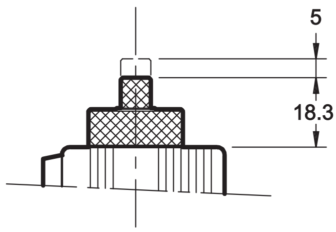
	Resistance at 20°C [Ω] (±1%)	Absorbed current [A] (±5%)	Absorbed power (±5%) [W]	[VA]	Coil code K1	K2	K4	K7	K8
C14L3-D12*	5,4	2,2	26,5		1902740	1902750	1902770	1902980	1903020
C14L3-D24*	20,7	1,16	27,8		1902741	1902751	1902771	1902981	1903021
C14L3-R110*	363	0,25		27,2	1902742				
C14L3-R230*	1640	0,11		26,4	1902743				

8 - MANUAL OVERRIDE

CM for NO version (pushing type)



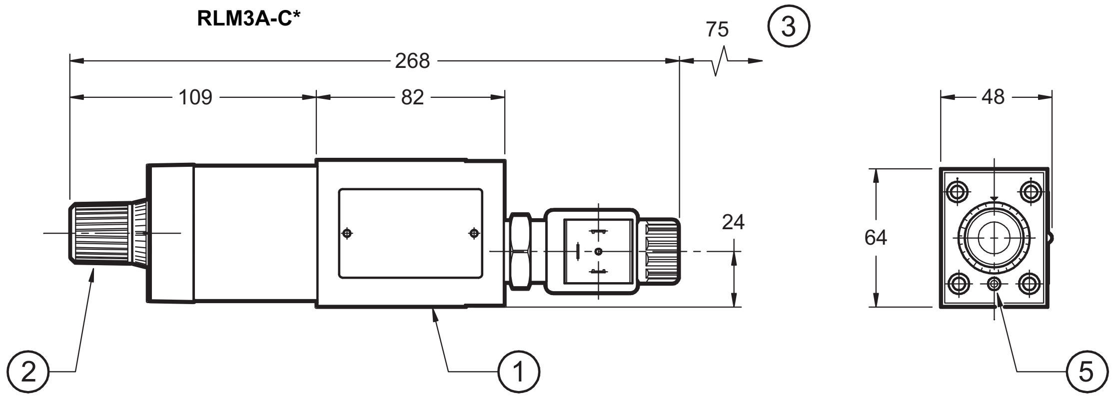
CM for NC version (screw type)

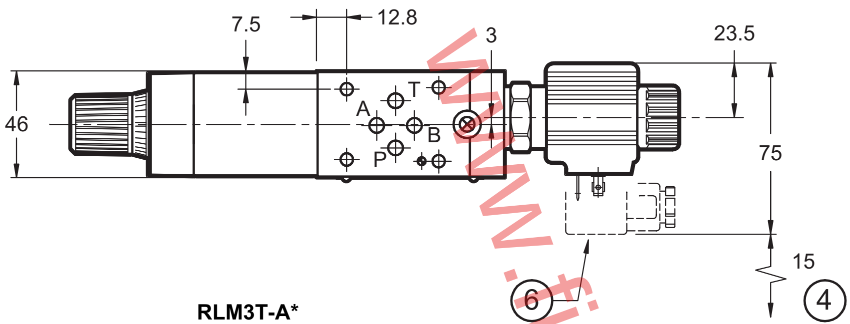


9 - OVERALL AND MOUNTING DIMENSIONS

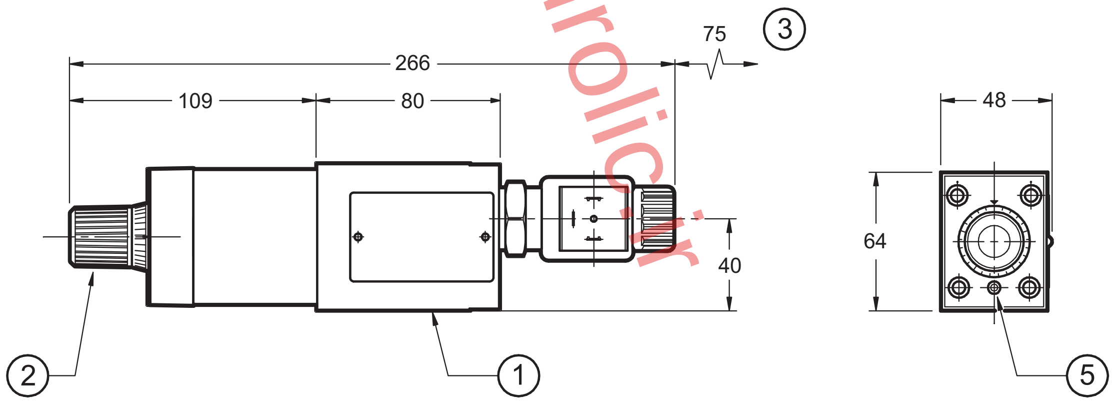
dimensions in mm

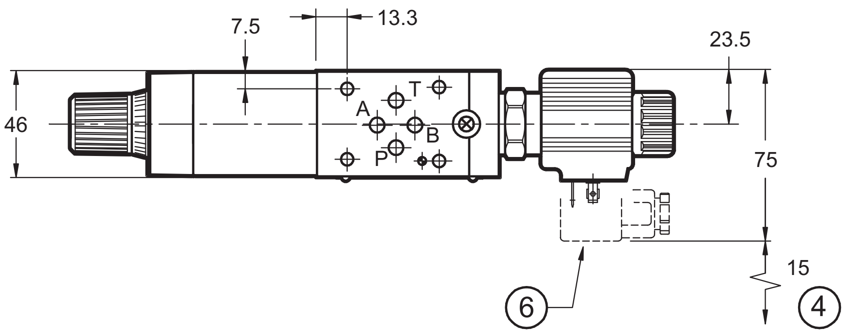
RLM3A-A*
RLM3A-C*





RLM3T-A*
RLM3T-C*

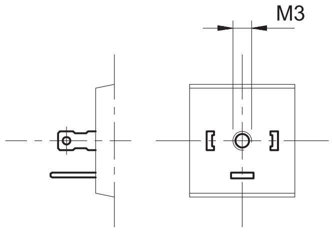




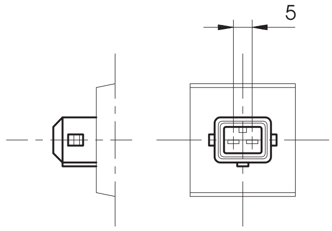
1	Mounting surface with sealing rings: 4 OR 2037 (9.25x1.78) - 90 Shore
2	Flow adjustment knob. Rotate counterclockwise to increase the flow.
3	Coil removal space
4	Connector removal space
5	Knob locking screw
6	Electric connector DIN 43650 (drawing relating to standard connection K1 - for other types of connection see par. 10)

10 - ELECTRIC CONNECTIONS

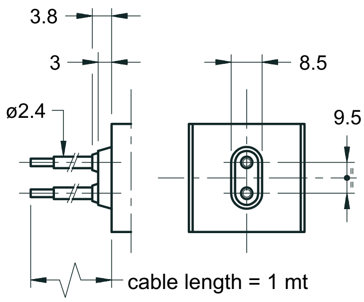
connection for DIN 43650 connector
code **K1** (**standard**)



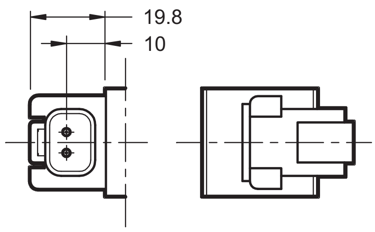
connection for AMP JUNIOR connector
code **K2**



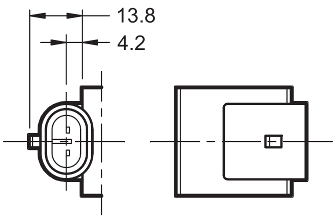
outgoing cables connection
code **K4**



connection for DEUTSCH DT04-2P male connector
code **K7**



connection for AMP SUPER SEAL connector (two contacts)
code **K8**



11 - ELECTRIC CONNECTORS

The solenoid valves are supplied without connectors. For coils with standard electrical connections K1 type (DIN 43650) the connectors can be ordered separately. For the identification of the connector type to be ordered please see catalog 49 000.
For K2, K7 and K8 connection type the relative connectors are not available.

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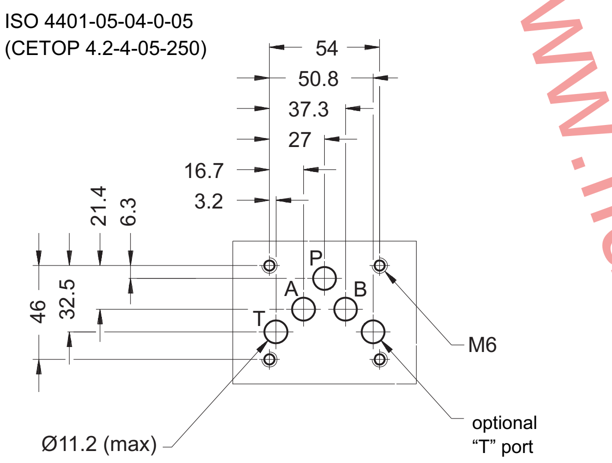
RPC1-*/4M
FLOW CONTROL VALVE
SERIES 10

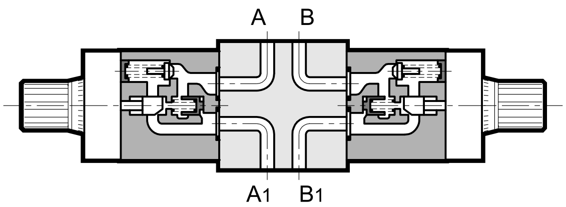
MODULAR VERSION
ISO 4401-05 (CETOP 05)

p max **250** bar
Q max (see table of performances)

MOUNTING INTERFACE



OPERATING PRINCIPLE



— The RPC1-*/4M valve is a flow control valve with pressure and temperature compensation, made as a modular version with mounting surface according to the ISO 4401 (CETOP RP121H) standards.

— It can be assembled quickly under the ISO 4401-05 (CETOP 05) directional solenoid valves and allows easy execution of hydraulic circuits where speed control of the actuators is required.

— It is available in six flow adjustment ranges up to 30 l/min.

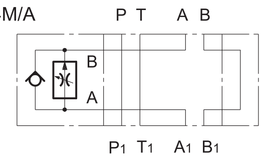
CONFIGURATIONS (see Hydraulic symbols table and Identification Code - par. 1)

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

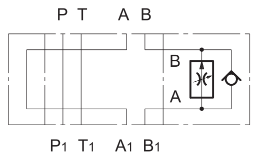
Maximum operating pressure	bar	250
Maximum flow rate in controlled lines Maximum flow rate in the free lines Reverse free flow maximum flowrate	l/min	1-4-10-16-22-30 100 40
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass: RPC1*/4M/ A-B RPC1*/4M/ D only modular block ISO 4401-05 without flow control valves: RPC1-K/4M/D	kg	4,3 5,6 3

HYDRAULIC SYMBOLS

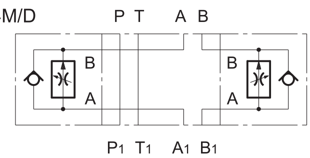
RPC1-*/4M/A



RPC1-*/4M/B



RPC1-*/4M/D



NOTE: for detailed information regarding the RPC1 flow control valve, see catalogue 32 200.

1 - IDENTIFICATION CODE

R	P	C	1	-		/	4	M	/		/	10	/	

Pressure and temperature compensated flow control valve

Flow adjustment range:
1 = 1 l/min **16** = 16 l/min
4 = 4 l/min **22** = 22 l/min
10 = 10 l/min **30** = 30 l/min
K = only for ISO 4401-05 (CETOP 05) modular block supplied without flow control valves

Modular version
ISO 4401-05 (CETOP 05) size

A = control from chamber A of the actuator
B = control from chamber B of the actuator
D = control from chambers A and B of the actuator
(A and B configurations are not available in K version)

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

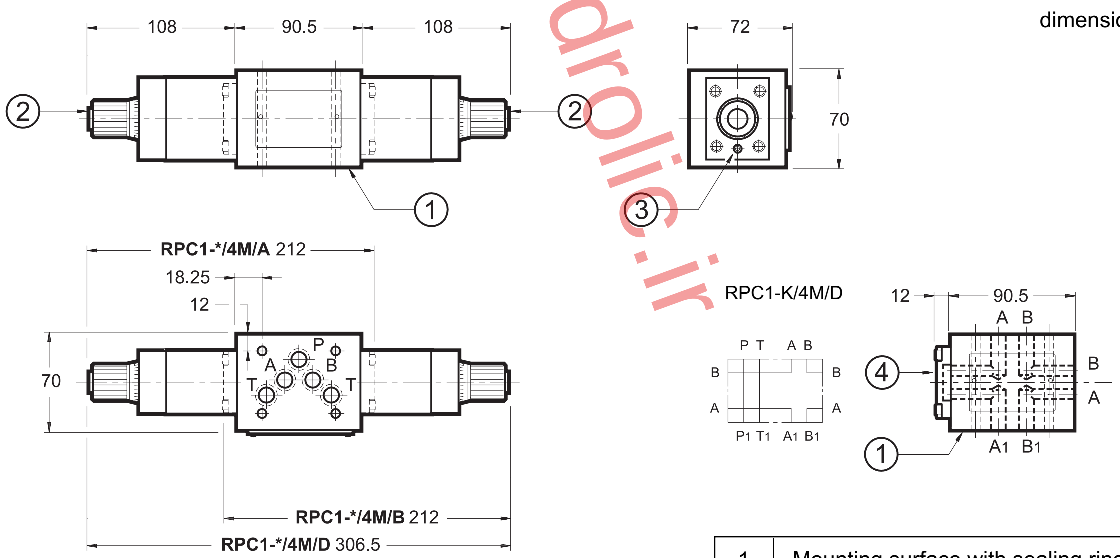
Seals: omit for mineral oils
V = viton for special fluids

2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

3 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore
2	Adjustment knob. Adjustment in 3 turns of the knob. Rotate anticlockwise to increase flow.
3	Knob locking screw
4	Side locking plate

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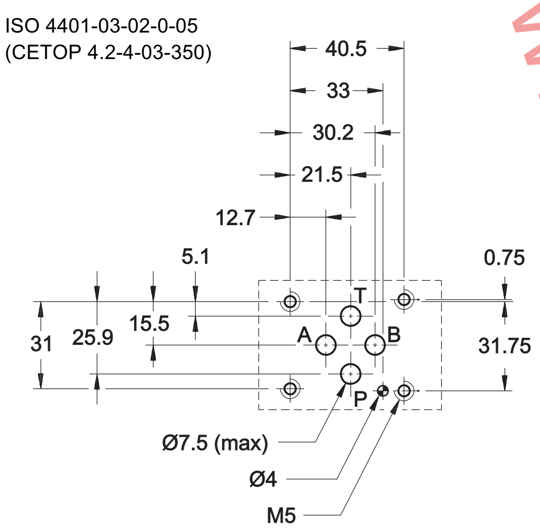
VSM3
SHUTTLE VALVE
SERIES 10

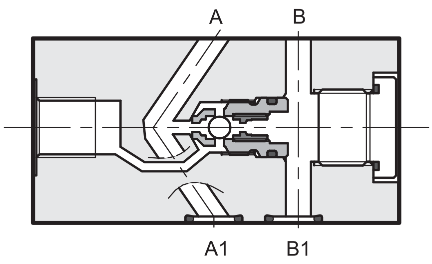
MODULAR VERSION
ISO 4401-03 (CETOP 03)

p max **350** bar
Q max **40** l/min

MOUNTING SURFACE



OPERATING PRINCIPLE



— The VSM3 ia a shuttle valve for pilot signals made as a modular version with mounting surface according to the ISO 4401-03 (CETOP RP 12H) standards.

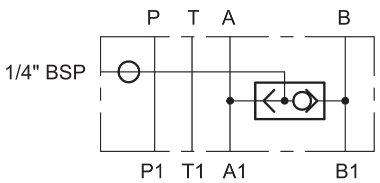
— The valve regulates the passage of the signal with higher pressure between A and B towards the outlet side port 1/4” BSP.

— The shuttle valve VSM3 has been designed with purpose of pilot signal with flowrate up to 3 l/min

PERFORMANCES (measured with mineral oil of viscosity 36cSt at 50°C)

Maximum operating pressure	bar	350
Maximum flow rate thtough the cartridge	l/min	3
Maximum flow rate to A, B, P and T port	l/min	40
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 20/18/15	
Recommended viscosity	cSt	25
Mass	kg	0,95

HYDRAULIC SYMBOL



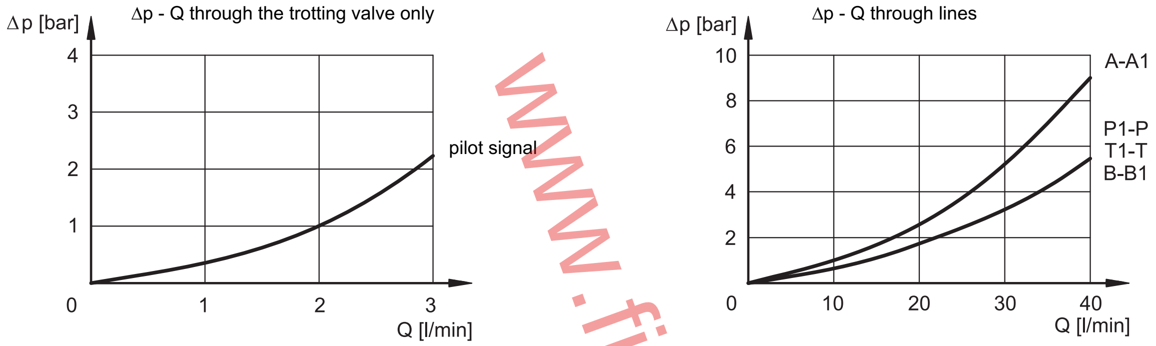
1 - IDENTIFICATION CODE

V	S	M	3	/	10	

- V S: Shuttle valve
- M: Modular version
- 3: ISO 4401-03 (CETOP 03) size
- 10: Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)
- Seals:
  N = Seals in NBR for mineral oils **(standard)**
  V = Seals in FPM for special fluids

2 - CHARACTERISTIC CURVES (values obtained with viscosity of 36 cSt at 50°C)

PRESSURE DROPS Δp - Q



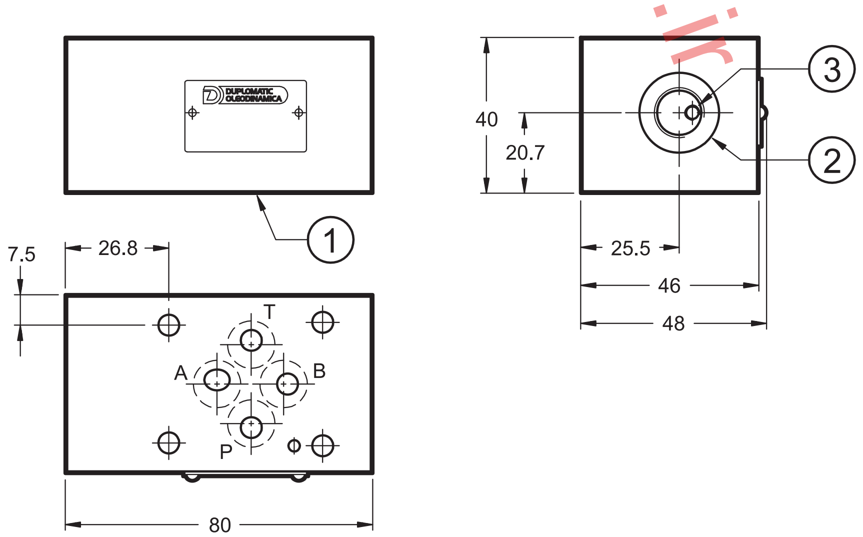
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) 90 Shore
2	Outlet signal port 1/4” BSP
3	Cavity for restrictor M4x6

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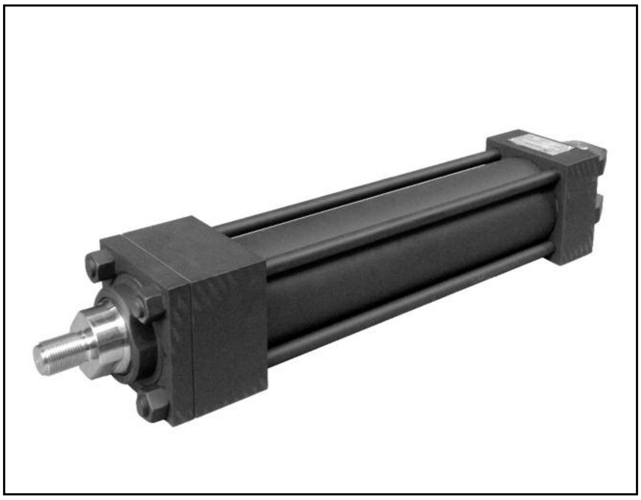
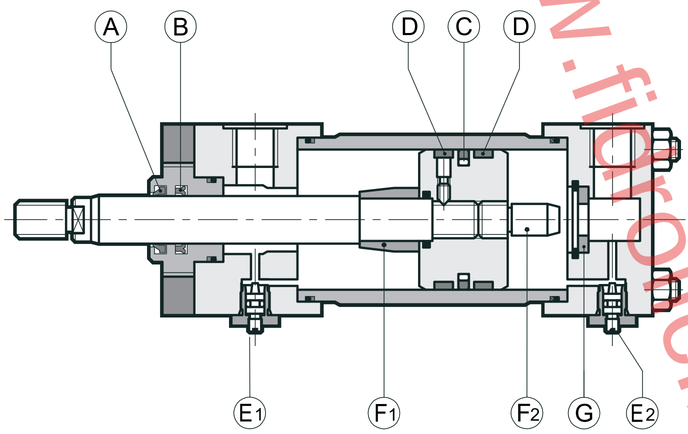


HC2
HYDRAULIC CYLINDERS
HCK2
HYDRAULIC CYLINDERS ATEX 2014/34/EU
SERIES 20

ISO 6020-2
DIN 24554

DESCRIPTION



— Double acting cylinders constructed in compliance with ISO 6020-2 and DIN 24554.

— The compact design of the square ends with tie rods plus the high quality material and seals render these cylinders highly reliable and therefore strongly recommended for all types of industrial applications.

— The cylinder is available with 14 different mounting styles as well as a vast range of accessories to meet all application requirements.

A - scraper ring
B - Piston rod seal
C - Piston seal
D - Guide rings
E_1 - Front cushioning adjustment screw
E_2 - Rear cushioning adjustment screw
F_1 - Front cushion
F_2 - Rear cushion
G - Bushing

ATEX 2014/34/EU rated version for installation in potentially explosive atmospheres is now available. The standard version of cylinders is ATEX II 2GD classified, whereas cylinders with proximity sensors are ATEX II 3GD classified. The declaration of conformity to the up mentioned standards is always supplied with the cylinder. See paragraph 3 for details.

PERFORMANCES

Nominal operating pressure (continuous service)	bar	160
Maximum operating pressure	bar	210
Peak pressure	bar	250
Maximum speed (standard)	m/s	0,5
Maximum stroke (standard)	mm	5000
Fluid temperature range (standard)	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15
Recommended viscosity	cSt	25
Security factor in relation with nominal pressure		≥ 4

1 - CHARACTERISTICS

1.1 Bores and piston rods

Ø 25 to Ø 200 mm bores are available to enable a vast choice according to required force.

Three piston rod diameters are available for each bore (with the exception of the Ø 25 mm bore, for which the intermediate piston rod is not available):

- standard piston rod with 1:1.25 area ratio
- intermediate piston rod with 1:1.45 area ratio
- oversized piston rod with 1:2 area ratio

1.2 Cushioning

On request, gradual and adjustable cushioning devices can be fitted in the front and/or rear ends of the cylinder without affecting overall dimensions.

The special design of the cushions ensures optimal repeatability also in the event of variations in fluid viscosity.

Cushioning devices are always recommended as they ensure impact-free stopping even at high speed thus reducing pressure surges and impact transferred to the mounting supports.

For all the available bores, cushioning is adjustable by means of a needle.

Rapid piston start-up is guaranteed by the bypass system located inside the front cushioning cone and rear cushioning ring.

The table below shows cushioning cone lengths:

Bore (mm)	25	32	40	50	63	80	100	125	160	200
Front cone length (mm)	17	17	28	28	28	28	30	30	38	45
Rear cone length (mm)	17	17	26	26	26	28	31	30	38	55

1.3 Connections

The cylinders are supplied as standard with cylindrical BSP threads and spot facing for seal rings in compliance with ISO 1179. Connections which are oversized compared to those shown in the dimensional tables are available upon request. For further information and for the order identification code, please consult our technical office.

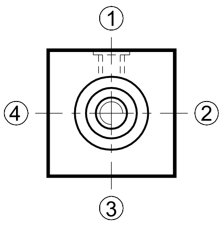
For correct cylinder operation, fluid velocity must not exceed 5 m/s.

1.4 Connection position

Standard positions of the oil ports, cushioning adjustment screws, breathers and end-stroke proximity sensors are shown in the relevant diagram according to the mounting style.

Connection positions different from the standard can be provided upon request.

Other options positions will be rotated accordingly.



Front view - piston rod side

For special requests please consult our technical office.

1.5 Seals

The table below illustrates seal characteristics in relation to hydraulic fluid and operating temperatures.

Type	Seal type	Seal material	Hydraulic fluid	Minimum pressure [bar]	Operating pressure [°C]	Max speed [m/s]
K	Standard	nitrile polyurethane	mineral oil	10	-20 / +80	0,5
M	Low friction	nitrile PTFE	Mineral oil Water glycol	20 (note)	-20 / +80	15
V	high temperature and/or aggressive fluid	Viton PTFE	Special fluids	10	-20 / +150	1

NOTE: for lower pressure use consult our technical office

1.6 Strokes

Standard cylinders are available with strokes up to 6000 mm. Longer cylinder strokes can be supplied on request.

Stroke tolerances are:
0 + 1 mm for strokes up to 1000 mm
0 + 4 mm for strokes up to 6000 mm

1.7 Spacers

If the cylinder stroke exceeds 1000 mm we recommend the use of spacers which can be inserted to reduce loads on the piston rod bushing and prevent the piston from sticking.

Spacers are constructed in hardened and tempered steel with PTFE facing. Every spacer is 50 mm long.

We recommend to insert n° 1 spacer for strokes from 1001 to 1500 mm, with an increment of n° 1 spacer for every 500 mm stroke. Remember that the overall length of the cylinder increases according to the number of inserted spacers (50 mm for each spacer).

1.8 Tie rod tightening torque

If cylinder has been disassembled, re-assemble it and tighten the tie rod lock nuts cross-wise applying a gradual torque up to the value indicated in the table below. The values below refer to dry threads.

Bore [mm]	25	32	40	50	63	80	100	125	160	200
Tie rod	**M5** x0.8	**M6** x1	**M8** x1	**M12** x12.5	**M12** x12.5	**M16** x1.5	**M16** x1.5	**M22** x1.5	**M27** x2	**M30** x2
Torque [Nm]	5	9	20	70	70	160	160	450	820	1150

1.9 Breathers

On request cylinder ends can be supplied with breathers for the elimination of air. This is necessary when the entire stroke is not used or when connections are not facing upwards.

1.10 Surface finish

Standard cylinders are supplied painted with Duplomatic black opaque colour with a paint thickness of 40µ. The rod is chromed.

MOUNTING STYLES

F = front-end T = rear end	A		B		C		D		F		G		H	
	T	F	T	F	T	F	T	F	T	F	T	F	T	F
Connections	**1** 3	**1** 2 3 4	**1** 2 3 4	**1** 3	**1** 2 3 4	**1** 2 3 4	**1** 2 3 4	**1** 2 3 4	**1** 2 3 4	**1** 2 3 4	**1** 3	**1** 3	**1** 3	**1** 2 3 4
Cushioning	1 **3**	1 2 **3** 4	1 2 **3** 4	1 **3**	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4	**2** 4	**2** 4	1 ***3**	1 2 **3** 4
Breathers	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4	1 2 3 **4**	1 2 3 **4**	1 2 3 **4**	1 2 3 **4**	1 2 3 **4**	1 2 3 **4**	2 **4**	2 **4**	1 ***3**	1 2 **3** 4
end-stroke proximity sensors	**2** 4	1 **2** 3 4	1 **2** 3 4	**2** 4	1 **2** 3 4	1 **2** 3 4	1 **2** 3 4	1 **2** 3 4	1 **2** 3 4	1 **2** 3 4	2 **4**	2 **4**	**3**	1 **2** 3 4

F = front-end T = rear end	L		N		P		Q		R		T		U	
	T	F	T	F	T	F	T	F	T	F	T	F	T	F
Connections	**1** 2 3 4	**1** 2 3 4	**1** 2 3 4	**1** 3	**1** 2 3 4	**1** 2 3 4	**1** 2 3 4	**1** 2 3 4	**1** 2 3 4	**1** 2 3 4	**1** 2 3 4	**1** 2 3 4	**1** 2 3 4	**1** 2 3 4
Cushioning	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4	1 ***3**	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4	1 2 **3** 4
Breathers	1 2 3 **4**	1 2 3 **4**	1 2 **3** 4	1 ***3**	1 2 3 **4**	1 2 3 **4**	1 2 3 **4**	1 2 3 **4**	1 2 3 **4**	1 2 3 **4**	1 2 3 **4**	1 2 3 **4**	1 2 3 **4**	1 2 3 **4**
end-stroke proximity sensors	1 **2** 3 4	1 **2** 3 4	1 **2** 3 4		1 **2** 3 4	1 **2** 3 4	1 **2** 3 4	1 **2** 3 4	1 **2** 3 4	1 **2** 3 4	1 **2** 3 4	1 **2** 3 4	1 **2** 3 4	1 **2** 3 4

Positions indicated in bold style are relevant to the standard, the others to the available options.

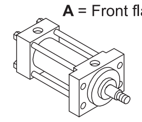
2 - IDENTIFICATION CODE

K = Explosion-proof version according to ATEX 2014/34/EU (paragraph 3). Omit if not required.

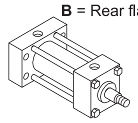
HC		2		-		/			/			-		-			-		-			/			/	20

MOUNTING STYLE

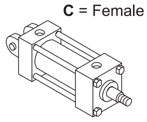
A = Front flange(ME5)



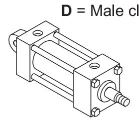
B = Rear flange (ME6)



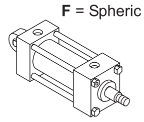
C = Female clevis (MP1)



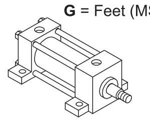
D = Male clevis (MP3)



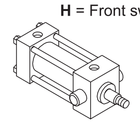
F = Spheric swivel (MP5)



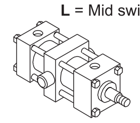
G = Feet (MS2)



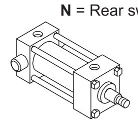
H = Front swinging (MT1)



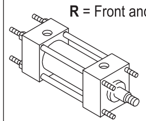
L = Mid swinging (MT4)



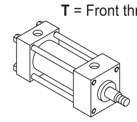
N = Rear swinging (MT2)



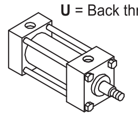
P = Front tie rods (MX3)
Q = Back tie rods (MX2)
R = Front and back tie rods (MX1)



T = Front threaded holes (MX5)



U = Back threaded holes (MX6)



Ø Rod (mm)	Rods available for each bore									
12	•									
14		•								
18	•	•	•							
22		•	•	•						
28			•	•	•					
36				•	•	•				
45					•	•	•			
56						•	•	•		
70							•	•	•	
90								•	•	•
110									•	•
140										•
Bore (mm)	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**

Rod threading: Male thread (**standard**)
W = Female thread
X = Light male thread
Y = Light female thread (see paragraph 4)

Double rod (omit if not required)
See single rod for dimensions.
Not available with mounting style B - C - D - F - N - Q - U

Double rod threading (omit if not required)
See single rod for type and dimensions

Stroke (mm) - (For cylinders with spacers indicate the working stroke)

Seals (see par. 1.5):
K = standard (nitrile + polyurethane)
M = low friction (nitrile + PTFE)
V = high temperature (viton + PTFE)

Cushioning (see paragraph 1.2):
0 = without cushioning
1 = front
2 = back
3 = front and back

Breathers (see paragraph 1.9)
0 = without breathers
S = front and back breathers

Front end connection position (**1-4**)
(see paragraph 1.4)

Rear end connection position (**1-4**)
(see paragraph 1.4)

N° of spacers multiple of 50 mm (omit if not required) see par. 1.7

Dimension XV for "L" mounting (omit for other mounting styles)

Series (put for spare parts requests)

3 - ATEX 2014/34/EU RATED VERSION

ATEX 2014/34/EU rated version cylinders for installation in potentially explosive atmospheres are now available. The standard version of cylinders is ATEX II 2GD classified, whereas cylinders with proximity sensors are ATEX II 3GD classified.

The supply is always delivered accompanied by:

- the ATEX declaration of conformity
- the operating and maintenance user manual, where are described all the information for the proper use of cylinders in potentially explosive environments.

TYPE EXAMINATION CERTIFICATE N°: **CEC 10 ATEX 138**

3.1 - Identification code

To order the ATEX-rated version, simply insert the letter K in the initial part of the identification code. The description becomes HCK2-*.

For cylinders without end-stroke proximity sensors please order with the identification code shown at paragraph 2.

Example: HC**K**2C-200/90-500-K3-S-11/20

For cylinders equipped with end-stroke proximity sensors please refer to the identification code shown at paragraph 22.1.

Example: HC**K**2F-FP22-80/56-200-K3-S-11/20

The ATEX-rated cylinders equipped with end-stroke proximity sensors are compliant with the specifications listed paragraph 22; Also the same limitations described in that paragraph are effective. (NB: for bores Ø160 and Ø200 contact our technical department).

The proximity sensors are compliant with the description and the wiring diagram shown at the paragraph 22.2.

3.2 - Classification

Cylinders without end-stroke proximity sensors have this ATEX mark:

Ex II 2GD ck IIC T4 (-20°C Ta +80°C)

EX: Specific marking of explosion protection as ATEX 2014/34/EU directive and related technical specification requests.
II: Group II for surface plants
2: Category 2 high protection, eligible for zone 1 for gases and zone 21 for dust (automatically be eligible for zone 2 category 3 for gases and zone 22 for dust)
GD: for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures.
ck: protection by constructional safety and by liquid immersion
IIC: Gas group
(automatically eligible for group IIA and IIB)
T4: Temperature class for gas (max surface temperature)
-20°C Ta +80°C: Ambient temperature range

Cylinders with end-stroke proximity sensors have this ATEX mark:

Ex II 3GD ck IIC T4 (-20°C Ta +80°C)

EX: Specific marking of explosion protection as ATEX 2014/34/EU directive and related technical specification requests
II: Group II for surface plants
3: Category 3 standard protection, eligible for zone 2 for gases (zone 22 for dust)
GD: for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures.
ck: protection by constructional safety and by liquid immersion
IIC: Gas group
(automatically eligible for group IIA and IIB)
T4: Temperature class for gas (max surface temperature)
-20°C Ta +80°C: Ambient temperature range

3.3 - Operating temperatures

The operating ambient temperature must be between -20°C and +80 °C.

The fluid temperature for the standard version seals (K) and for low friction seals (M) must be between -20°C and +80°C, as for viton (V) seals must be between -20°C and +120 °C.

The actuators are T4 (T135° C) class temperature classified, so they are eligible for operation also at higher class temperature (T3, T2, T1 (T200° C).

3.4 - Admitted velocities

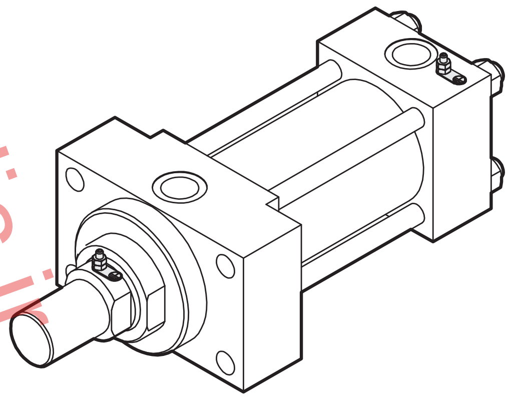
The maximum permissible speed is 0.5 m/s for standard cylinder seals (K) and 1 m/s for actuators with low friction seals (M) or Viton (V).

3.5 - Connectors

The connectors for the end-stroke proximity are available upon request. They are metal, to be wired. The ordering code is **0680961.** One connector per sensor is needed.

3.6 - Grounding points

The ATEX certified actuators are supplied with two grounding points, one on the rear head and one on the rod, for the wire of the cylinder with the ground (M4 screws).

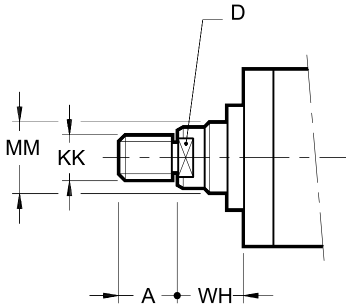


The bottom grounding point must always be connected whereas the connection of the rod grounding point can be avoided in case the whole mechanical stroke is covered during the cylinder operating phase (from the mechanical stop on the cylinder head to the mechanical stop on the bottom), or in case the rod has already been grounded through the mechanical connection between the rod itself and the machine/plan it is installed on.

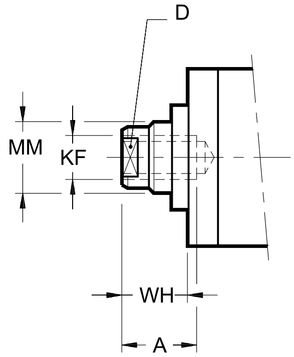
In order to verify such a condition it is necessary to test the equipotentiality of the parts and a maximum resistance equal to 100 Ω as per the EN13463-1 norm.

4 - OVERALL AND MOUNTING DIMENSIONS

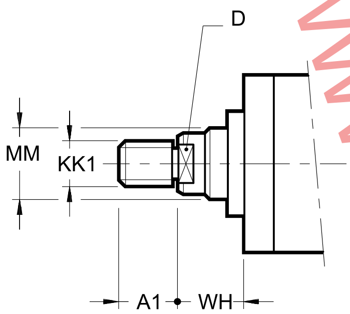
Standard = male thread



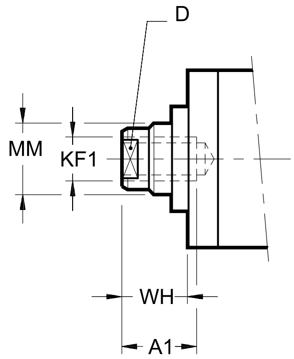
W = female thread



X = light male thread



Y = light female thread

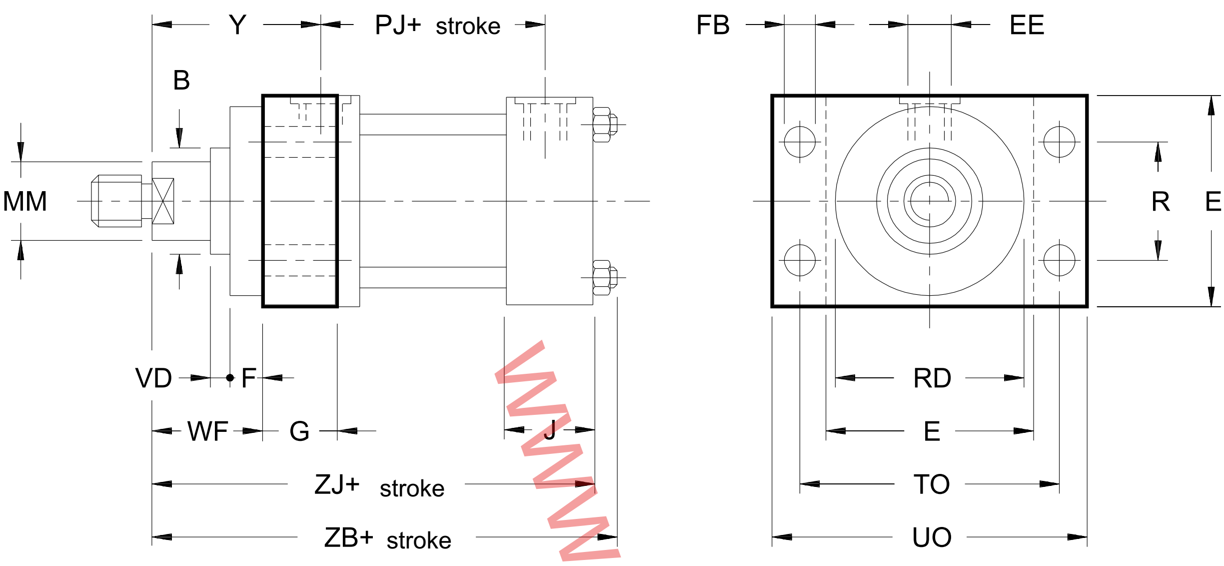


Dimensions in mm

Bore	MM Ø rod	KK	KK1	KF	KF1	A	A1	D	WH
25	12 18	M10x1.25 M14x1.5	- M10x1.25	M8x1 M12x1.25	- M8x1	14 18	- 14	9 14	15
32	14 18 22	M12x1.25 M14x1.5 M16x1.5	- M10x1.25 M12x1.25	M10x1.25 M12x1.25 M16x1.5	- M8x1 M10x1.25	16 18 22	- 14 16	11 14 17	25
40	18 22 28	M14x1.5 M16x1.5 M20x1.5	M10x1.25 M12x1.25 M14x1.5	M12x1.25 M16x1.5 M20x1.5	M8x1 M10x1.25 M12x1.25	18 22 28	14 16 18	14 17 22	25
50	22 28 36	M16x1.5 M20x1.5 M27x2	M12x1.25 M14x1.25 M16x1.5	M16x1.5 M20x1.5 M27x2	M10x1.25 M12x1.25 M16x1.5	22 28 36	16 18 22	17 22 30	26
63	28 36 45	M20x1.5 M27x2 M33x2	M14x1.5 M16x1.5 M20x1.5	M20x1.5 M27x2 M33x2	M12x1.25 M16x1.5 M20x1.5	28 36 45	18 22 28	22 30 36	33
80	36 45 56	M27x2 M33x2 M42x2	M16x1.5 M20x1.5 M27x2	M27x2 M33x2 M42x2	M16x1.5 M20x1.5 M27x2	36 45 56	22 28 36	30 36 50	31
100	45 56 70	M33x2 M42x2 M48x2	M20x1.5 M27x2 M33x2	M33x2 M42x2 M48x2	M20x1.5 M27x2 M33x2	45 56 63	28 36 45	36 50 60	35
125	56 70 90	M42x2 M48x2 M64x3	M27x2 M33x2 M42x2	M42x2 M48x2 M64x3	M27x2 M33x2 M42x2	56 63 85	36 45 56	50 60 80	35
160	70 90 110	M48x2 M64x3 M80x3	M33x2 M42x2 M48x2	M48x2 M64x3 M80x3	M33x2 M42x2 M48x2	63 85 95	45 56 63	60 80 100	32
200	90 110 140	M64x3 M80x3 M100x3	M42x2 M48x2 M64x3	M64x3 M80x3 M100x3	M42x2 M48x2 M64x3	85 95 112	56 63 85	80 100 130	32

5 - OVERALL AND MOUNTING DIMENSIONS ISO/DIN **ME5**

A FRONT FLANGE



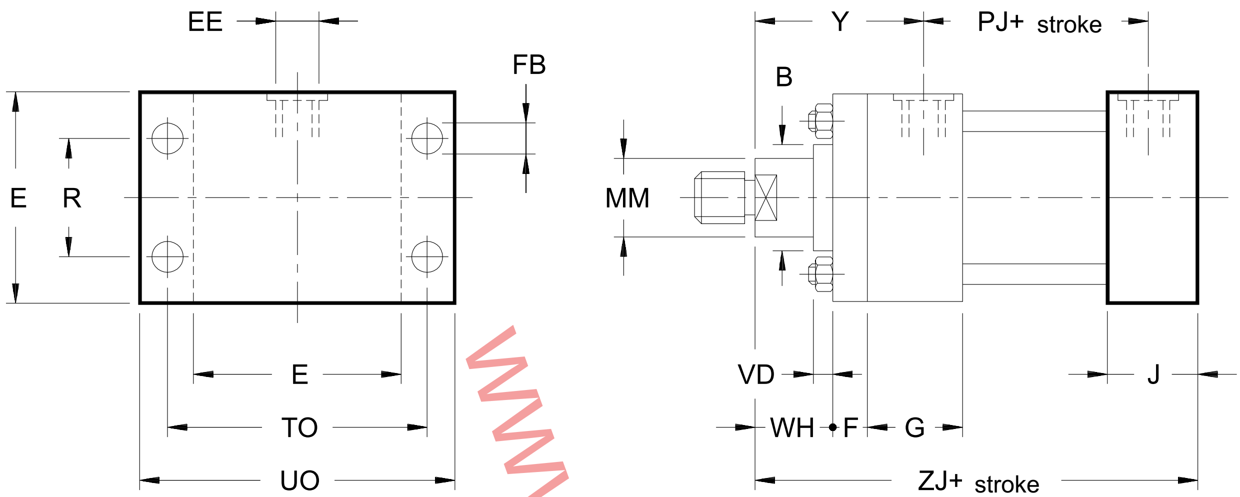
NOTE: The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	E max	EE BSP	F	ØFB	G	J	PJ	R	ØRD f8	TO	UO max	VD	WF	Y	ZB	ZJ
25	12 18	24 30	40 note	1/4"	10	5.5	35	35	54	27	38	51	65	6	25	50	121	114
32	14 18 22	26 30 34	45 note	1/4"	10	6.6	36	36	57	33	42	58	70	12 6 12	35	60	137	128
40	18 22 28	30 34 42	63	3/8"	10	11	45	45	74	41	62	87	110	6 12 10	35	62	166	153
50	22 28 36	34 42 50	75	1/2"	16	14	45	45	76	52	74	105	130	7 7 10	41	68	176	159
63	28 36 45	42 50 60	90	1/2"	16	14	45	45	80	65	75 88 88	117	145	7 10 14	48	71	185	168
80	36 45 56	50 60 72	115	3/4"	20	18	50	52	93	83	82 105 105	149	180	5 9 9	51	77	212	190
100	45 56 70	60 72 88	130	3/4"	22	18	50	55	101	97	92 125 125	162	200	7 7 10	57	82	225	203
125	56 70 90	72 88 108	165	1"	22	22	55	71	117	126	105 150 150	208	250	7 10 10	57	86	260	232
160	70 90 110	88 108 133	205	1"	25	26	63	63	130	155	125 170 170	253	300	7	57	86	279	245
200	90 110 140	108 133 163	245	1.1/4"	25	33	80	80	165	190	150 210 210	300	360	7	57	98	336	299

6 - OVERALL AND MOUNTING DIMENSIONS ISO/DIN **ME6**

B REAR FLANGE



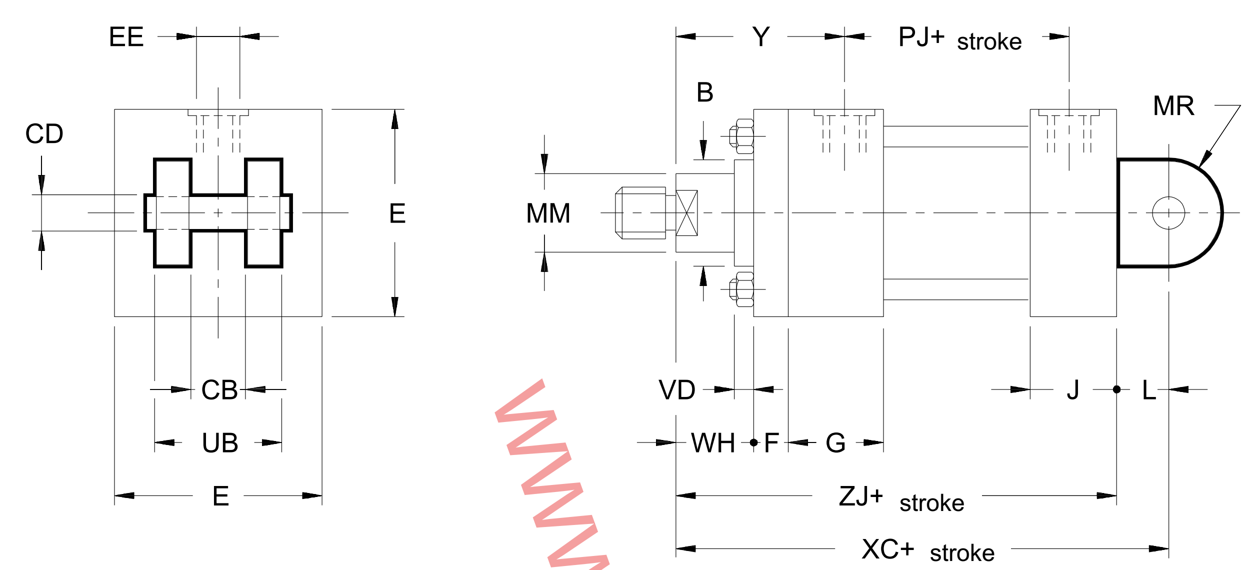
NOTE: The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	E max	EE BSP	F	ØFB	G	J	PJ	R	TO	UO max	VD	WH	Y	ZJ
25	12 18	24 30	40 note	1/4"	10	5.5	45	35	54	27	51	65	6	15	50	114
32	14 18 22	26 30 34	45 note	1/4"	10	6.6	45	36	57	33	58	70	12 6 12	25	60	128
40	18 22 28	30 34 42	63	3/8"	10	11	55	45	74	41	87	110	6 12 10	25	62	153
50	22 28 36	34 42 50	75	1/2"	15	14	55	45	76	52	105	130	7 7 10	26	68	159
63	28 36 45	42 50 60	90	1/2"	15	14	55	45	80	65	117	145	7 10 14	33	71	168
80	36 45 56	50 60 72	115	3/4"	20	18	65	52	93	83	149	180	5 9 9	31	77	190
100	45 56 70	60 72 88	130	3/4"	22	18	69	55	101	97	162	200	7 7 10	35	82	203
125	56 70 90	72 88 108	165	1"	22	22	78	71	117	126	208	250	7 10 10	35	86	232
160	70 90 110	88 108 133	205	1"	25	26	86	63	130	155	253	300	7	32	86	245
200	90 110 140	108 133 163	245	1.1/4"	25	33	103	80	165	190	300	360	7	32	98	299

7 - OVERALL AND MOUNTING DIMENSIONS ISO **MP1**

C FEMALE CLEVIS
(with PIN and spring retainers)



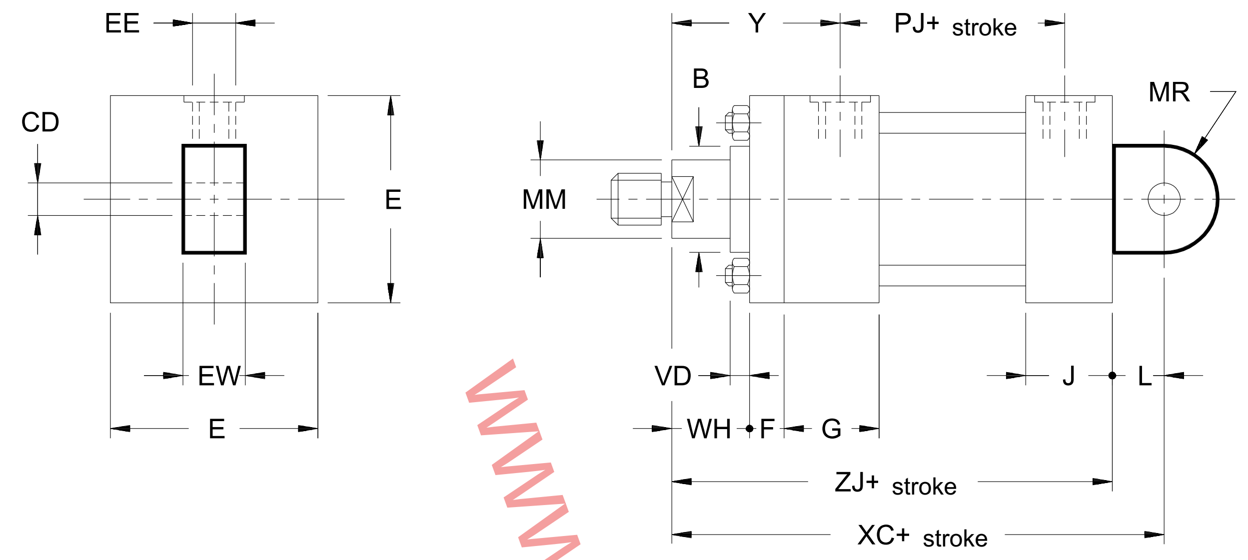
NOTE: The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	CB A16	ØCD f8	E max	EE BSP	F	G	J	L	MR	PJ	UB	VD	WH	XC	Y	ZJ
25	12 18	24 30	12	10	40 note	1/4"	10	45	35	13	12	54	24	6	15	127	50	114
32	14 18 22	26 30 34	16	12	45 note	1/4"	10	45	36	19	17	57	32	12 6 12	25	147	60	128
40	18 22 28	30 34 42	20	14	63	3/8"	10	55	45	19	17	74	40	6 12 10	25	172	62	153
50	22 28 36	34 42 50	30	20	75	1/2"	15	55	45	32	29	76	60	7 7 10	26	191	68	159
63	28 36 45	42 50 60	30	20	90	1/2"	15	55	45	32	29	80	60	7 10 14	33	200	71	168
80	36 45 56	50 60 72	40	28	115	3/4"	20	65	52	39	34	93	80	5 9 9	31	229	77	190
100	45 56 70	60 72 88	50	36	130	3/4"	22	69	55	54	50	101	100	7 7 10	35	257	82	203
125	56 70 90	72 88 108	60	45	165	1"	22	78	71	57	53	117	120	7 10 10	35	289	86	232
160	70 90 110	88 108 133	70	56	205	1"	25	86	63	63	59	130	140	7	32	308	86	245
200	90 110 140	108 133 163	80	70	245	1.1/4"	25	103	80	82	78	165	160	7	32	381	98	299

8 - OVERALL AND MOUNTING DIMENSIONS ISO **MP3**

D MALE CLEVIS



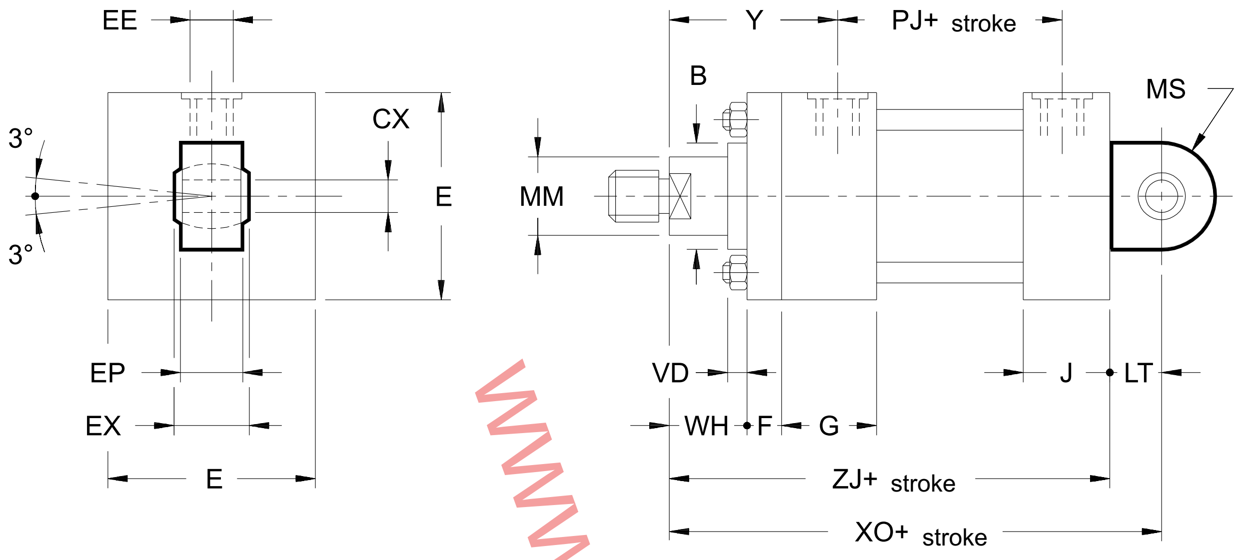
NOTE: The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	ØCD H9	E max	EE BSP	EW h9	F	G	J	L	MR	PJ	VD	WH	XC	Y	ZJ
25	12 18	24 30	10	40 note	1/4"	12	10	45	35	13	12	54	6	15	127	50	114
32	14 18 22	26 30 34	12	45 note	1/4"	16	10	45	36	19	17	57	12 6 12	25	147	60	128
40	18 22 28	30 34 42	14	63	3/8"	20	10	55	45	19	17	74	6 12 10	25	172	62	153
50	22 28 36	34 42 50	20	75	1/2"	30	15	55	45	32	29	76	7 7 10	26	191	68	159
63	28 36 45	42 50 60	20	90	1/2"	30	15	55	45	32	29	80	7 10 14	33	200	71	168
80	36 45 56	50 60 72	28	115	3/4"	40	20	65	52	39	34	93	5 9 9	31	229	77	190
100	45 56 70	60 72 88	36	130	3/4"	50	22	69	55	54	50	101	7 7 10	35	257	82	203
125	56 70 90	72 88 108	45	165	1"	60	22	78	71	57	53	117	7 10 10	35	289	86	232
160	70 90 110	88 108 133	56	205	1"	70	25	86	63	63	59	130	7	32	308	86	245
200	90 110 140	108 133 163	70	245	1.1/4"	80	25	103	80	82	78	165	7	32	381	98	299

9 - OVERALL AND MOUNTING DIMENSIONS ISO/DIN **MP5**

F SPHERIC SWIVEL



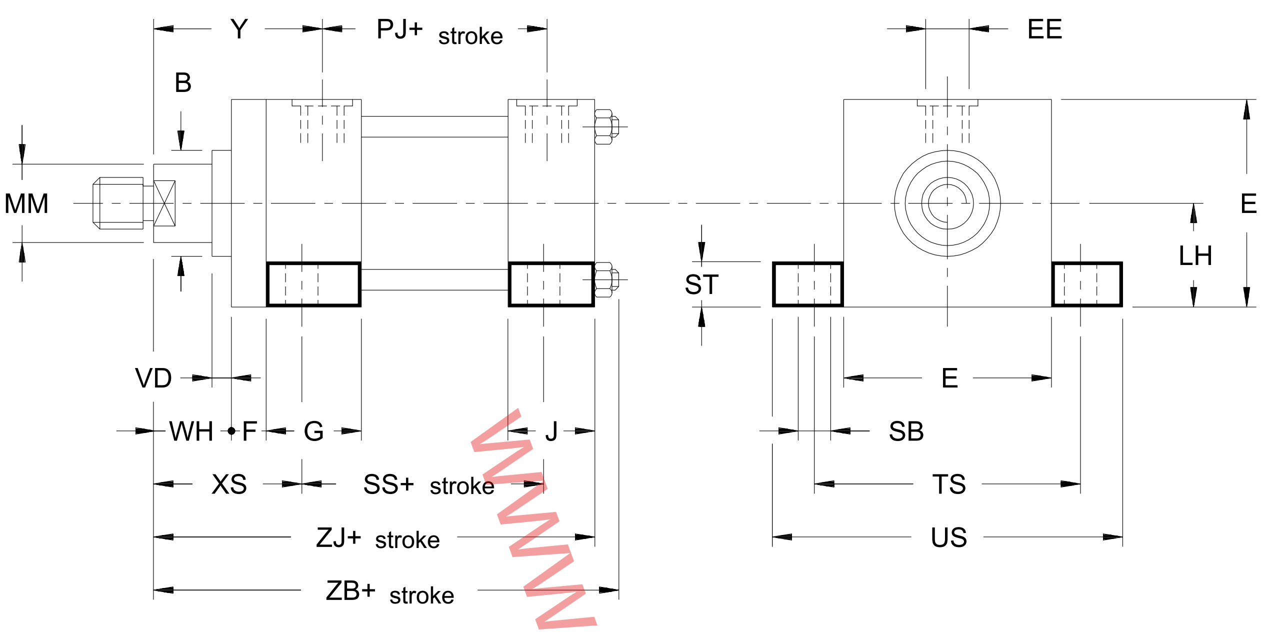
NOTE: The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	ØCX	E max	EE BSP	EP	EX	F	G	J	LT	MS	PJ	VD	WH	XO	Y	ZJ
25	12 18	24 30	12 $^{0}_{-0.008}$	40 note	1/4"	8	10 $^{0}_{-0.12}$	10	45	35	16	20	54	6	15	130	50	114
32	14 18 22	26 30 34	16 $^{0}_{-0.008}$	45 note	1/4"	11	14 $^{0}_{-0.12}$	10	45	36	20	22	57	12 6 12	25	148	60	128
40	18 22 28	30 34 42	20 $^{0}_{-0.012}$	63	3/8"	13	16 $^{0}_{-0.12}$	10	55	45	25	29	74	6 12 10	25	178	62	153
50	22 28 36	34 42 50	25 $^{0}_{-0.012}$	75	1/2"	17	20 $^{0}_{-0.12}$	15	55	45	31	33	76	7 7 10	26	190	68	159
63	28 36 45	42 50 60	30 $^{0}_{-0.012}$	90	1/2"	19	22 $^{0}_{-0.12}$	15	55	45	38	40	80	7 10 14	33	206	71	168
80	36 45 56	50 60 72	40 $^{0}_{-0.012}$	115	3/4"	23	28 $^{0}_{-0.12}$	20	65	52	48	50	93	5 9 9	31	238	77	190
100	45 56 70	60 72 88	50 $^{0}_{-0.012}$	130	3/4"	30	35 $^{0}_{-0.12}$	22	69	55	58	62	101	7 7 10	35	261	82	203
125	56 70 90	72 88 108	60 $^{0}_{-0.015}$	165	1"	38	44 $^{0}_{-0.15}$	22	78	71	72	80	117	7 10 10	35	304	86	232
160	70 90 110	88 108 133	80 $^{0}_{-0.015}$	205	1"	47	55 $^{0}_{-0.15}$	25	86	63	92	100	130	7	32	337	86	245
200	90 110 140	108 133 163	100 $^{0}_{-0.020}$	245	1.1/4"	57	70 $^{0}_{-0.20}$	25	103	80	116	120	165	7	32	415	98	299

10 - OVERALL AND MOUNTING DIMENSIONS ISO/DIN **MS2**

G FEET



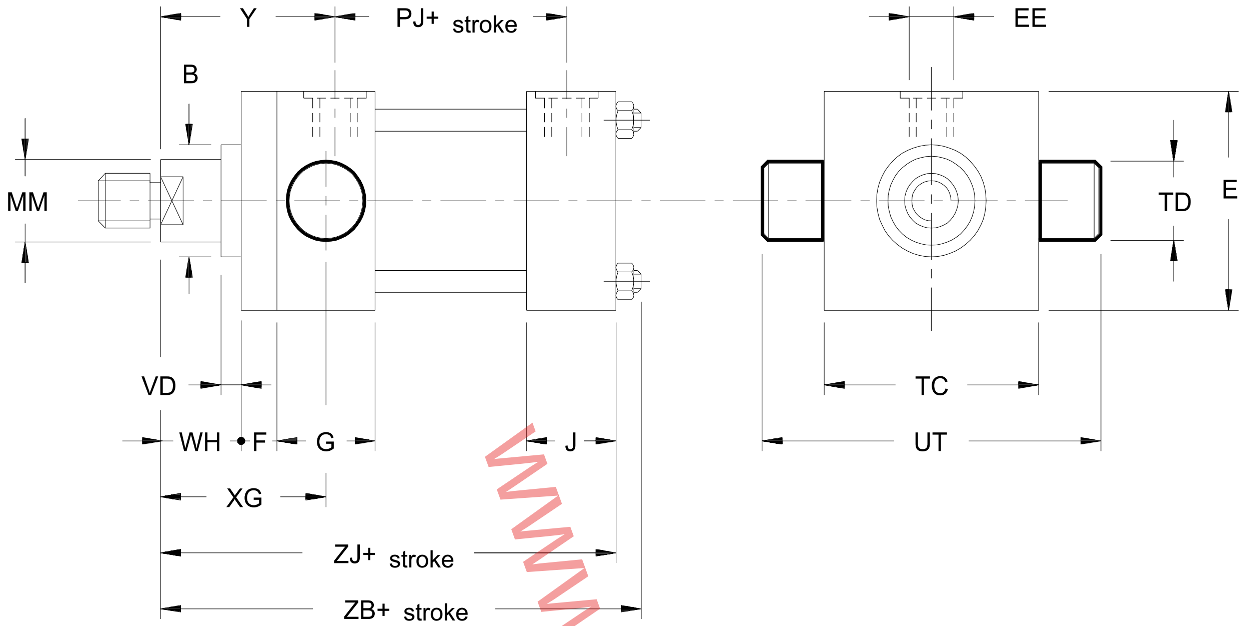
NOTE: The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	E max	EE BSP	F	G	J	LH h10	PJ	ØSB	SS	ST	TS	US max	VD	WH	XS	Y	ZB	ZJ
25	12 18	24 30	40 note	1/4"	10	45	35	19	54	6.6	73	8.5	54	72	6	15	33	50	121	114
32	14 18 22	26 30 34	45 note	1/4"	10	45	36	22	57	9	73	12.5	63	84	12 6 12	25	45	60	137	128
40	18 22 28	30 34 42	63	3/8"	10	55	45	31	74	11	98	12.5	83	103	6 12 10	25	45	62	166	153
50	22 28 36	34 42 50	75	1/2"	15	55	45	37	76	14	92	19	102	127	7 7 10	26	54	68	176	159
63	28 36 45	42 50 60	90	1/2"	15	55	45	44	80	18	86	26	124	161	7 10 14	33	65	71	185	168
80	36 45 56	50 60 72	115	3/4"	20	65	52	57	93	18	105	26	149	186	5 9 9	31	68	77	212	190
100	45 56 70	60 72 88	130	3/4"	22	69	55	63	101	26	102	32	172	216	7 7 10	35	79	82	225	203
125	56 70 90	72 88 108	165	1"	22	78	71	82	117	26	131	32	210	254	7 10 10	35	79	86	260	232
160	70 90 110	88 108 133	205	1"	25	86	63	101	130	33	130	38	260	318	7	32	86	86	279	245
200	90 110 140	108 133 163	245	1.1/4"	25	103	80	122	165	39	172	44	311	381	7	32	92	98	336	299

11 - OVERALL AND MOUNTING DIMENSIONS ISO **MT1**

H FRONT SWINGING



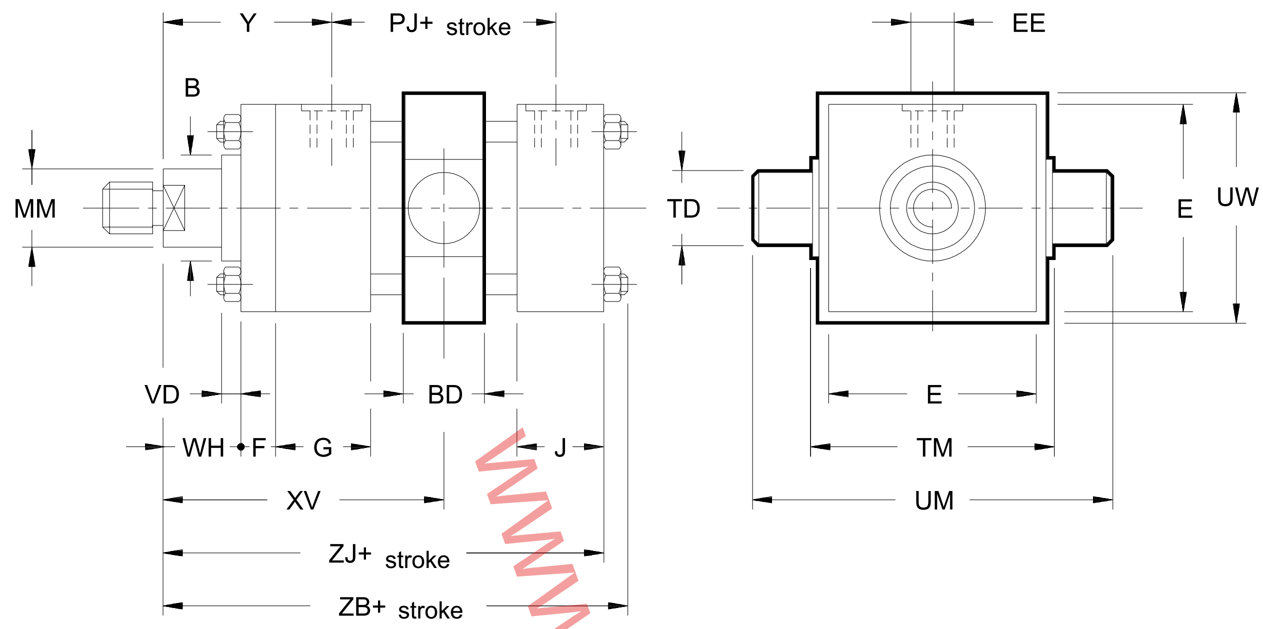
NOTE: The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	E max	EE BSP	F	G	J	PJ	ØTD f8	TC	UT	VD	WH	XG	Y	ZB	ZJ
25	12 18	24 30	40 note	1/4"	10	45	35	54	12	38	58	6	15	44	50	121	114
32	14 18 22	26 30 34	45 note	1/4"	10	45	36	57	16	44	68	12 6 12	25	54	60	137	128
40	18 22 28	30 34 42	63	3/8"	10	55	45	74	20	63	95	6 12 10	25	57	62	166	153
50	22 28 36	34 42 50	75	1/2"	15	55	45	76	25	76	116	7 7 10	26	64	68	176	159
63	28 36 45	42 50 60	90	1/2"	15	55	45	80	32	89	139	7 10 14	33	70	71	185	168
80	36 45 56	50 60 72	115	3/4"	20	65	52	93	40	114	178	5 9 9	31	76	77	212	190
100	45 56 70	60 72 88	130	3/4"	-	91	55	101	50	127	207	7 7 10	35	71	82	225	203
125	56 70 90	72 88 108	165	1"	-	100	71	117	63	165	265	7 10 10	35	75	86	260	232
160	70 90 110	88 108 133	205	1"	-	111	63	130	80	203	329	7	32	75	86	279	245
200	90 110 140	108 133 163	245	1.1/4"	-	128	80	165	100	241	401	7	32	85	98	336	299

12 - OVERALL AND MOUNTING DIMENSIONS ISO/DIN **MT4**

L MID SWINGING



* dimension to be defined in the order (see par. 2)

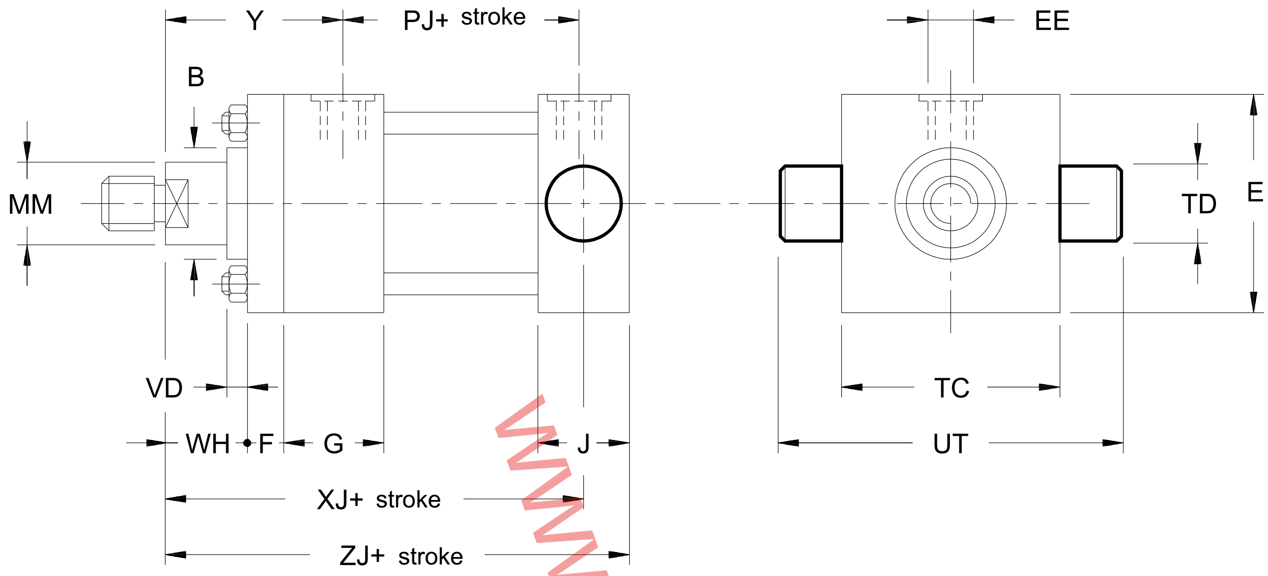
NOTE: The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	BD	E max	EE BSP	F	G	J	PJ	ØTD f8	TM	UM	UW	VD	WH	XV* min	XV max + stroke	Y	ZB	ZJ	min stroke
25	12 18	24 30	20	40 NOTE	1/4"	10	45	35	54	12	48	68	45	6	15	80	69	50	121	114	11
32	14 18 22	26 30 34	25	45 NOTE	1/4"	10	45	36	57	16	55	79	50	12 6 12	25	93	79	60	137	128	13
40	18 22 28	30 34 42	30	63	3/8"	10	55	45	74	20	76	108	70	6 12 10	25	105	93	62	166	153	12
50	22 28 36	34 42 50	40	75	1/2"	15	55	45	76	25	89	129	85	7 7 10	26	116	94	68	176	159	22
63	28 36 45	42 50 60	40	90	1/2"	15	55	45	80	32	100	150	95	7 10 14	33	123	103	71	185	168	20
80	36 45 56	50 60 72	45	115	3/4"	20	65	52	93	40	127	191	120	5 9 9	31	139	115	77	212	190	23
100	45 56 70	60 72 88	60	130	3/4"	22	69	55	101	50	140	220	130	7 7 10	35	156	118	82	225	203	38
125	56 70 90	72 88 108	70	165	1"	22	78	71	117	63	178	278	170	7 10 10	35	170	126	86	260	232	44
160	70 90 110	88 108 133	90	205	1"	25	86	63	130	80	215	341	205	7	32	188	137	86	279	245	51
200	90 110 140	108 133 163	110	245	1¼"	25	103	80	165	100	279	439	275	7	32	215	164	98	336	299	51

13 - OVERALL AND MOUNTING DIMENSIONS ISO **MT2**

N REAR SWINGING



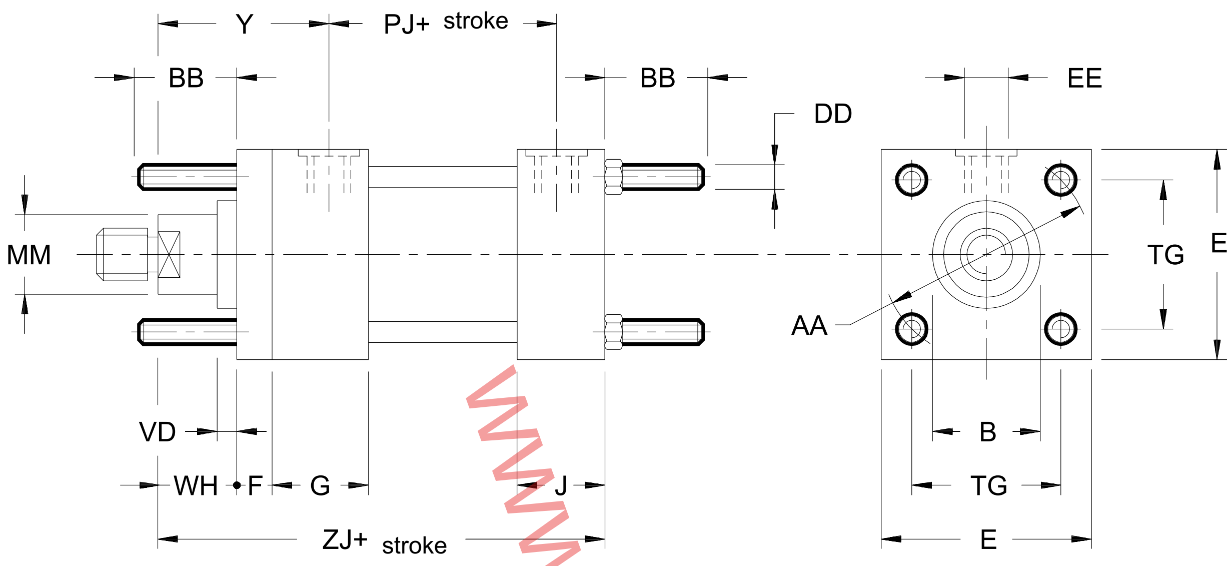
NOTE: The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	ØB f8	E max	EE BSP	F	G	J	PJ	ØTD f8	TC	UT	VD	WH	XJ	Y	ZJ
25	12 18	24 30	40 note	1/4"	10	45	35	54	12	38	58	6	15	101	50	114
32	14 18 22	26 30 34	45 note	1/4"	10	45	36	57	16	44	68	12 6 12	25	115	60	128
40	18 22 28	30 34 42	63	3/8"	10	55	45	74	20	63	95	6 12 10	25	134	62	153
50	22 28 36	34 42 50	75	1/2"	15	55	45	76	25	76	116	7 7 10	26	140	68	159
63	28 36 45	42 50 60	90	1/2"	15	55	45	80	32	89	139	7 10 14	33	149	71	168
80	36 45 56	50 60 72	115	3/4"	20	65	52	93	40	114	178	5 9 9	31	168	77	190
100	45 56 70	60 72 88	130	3/4"	22	69	68	101	50	127	207	7 7 10	35	187	82	216
125	56 70 90	72 88 108	165	1"	22	78	85	117	63	165	265	7 10 10	35	209	86	246
160	70 90 110	88 108 133	205	1"	25	86	95	130	80	203	329	7	32	230	86	277
200	90 110 140	108 133 163	245	1.1/4"	25	103	115	165	100	241	401	7	32	276	98	334

14 - OVERALL AND MOUNTING DIMENSIONS   ISO **MX1-MX2-MX3**

P	FRONT TIE RODS	MX3
Q	REAR TIE RODS	MX2
R	FRONT AND REAR TIE RODS	MX1



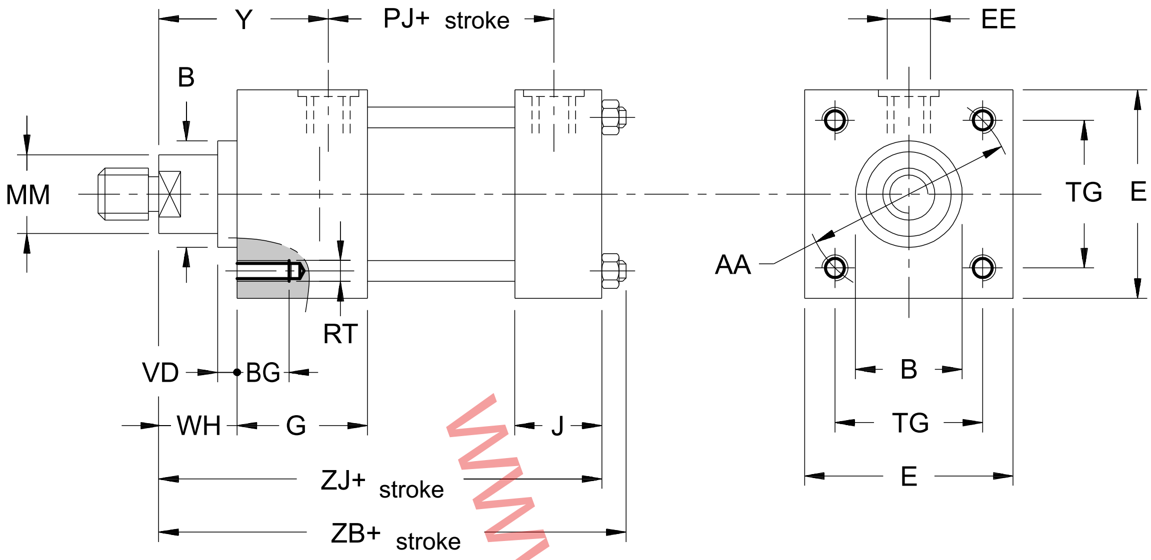
NOTE: The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	AA	ØB f8	BB	DD	E max	EE BSP	F	G	J	PJ	TG	VD	WH	Y	ZJ
25	12 18	40	24 30	19	M5x0.8	40 note	1/4"	10	45	35	54	28.3	6	15	50	114
32	14 18 22	47	26 30 34	24	M6x1	45 note	1/4"	10	45	36	57	33.2	12 6 12	25	60	128
40	18 22 28	59	30 34 42	35	M8x1	63	3/8"	10	55	45	74	41.7	6 12 10	25	62	153
50	22 28 36	74	34 42 50	46	M12x1.25	75	1/2"	15	55	45	76	52.3	7 7 10	26	68	159
63	28 36 45	91	42 50 60	46	M12x1.25	90	1/2"	15	55	45	80	64.3	7 10 14	33	71	168
80	36 45 56	117	50 60 72	59	M16x1.5	115	3/4"	20	65	52	93	82.7	5 9 9	31	77	190
100	45 56 70	137	60 72 88	59	M16x1.5	130	3/4"	22	69	55	101	96.9	7 7 10	35	82	203
125	56 70 90	178	72 88 108	81	M22x1.5	165	1"	22	78	71	117	125.9	7 10 10	35	86	232
160	70 90 110	219	88 108 133	92	M27x2	205	1"	25	86	63	130	154.9	7	32	86	245
200	90 110 140	269	108 133 163	115	M30x2	245	1.1/4"	25	103	80	165	190.2	7	32	98	299

15 - OVERALL AND MOUNTING DIMENSIONS ISO **MX5**

T FRONT THREADED HOLES



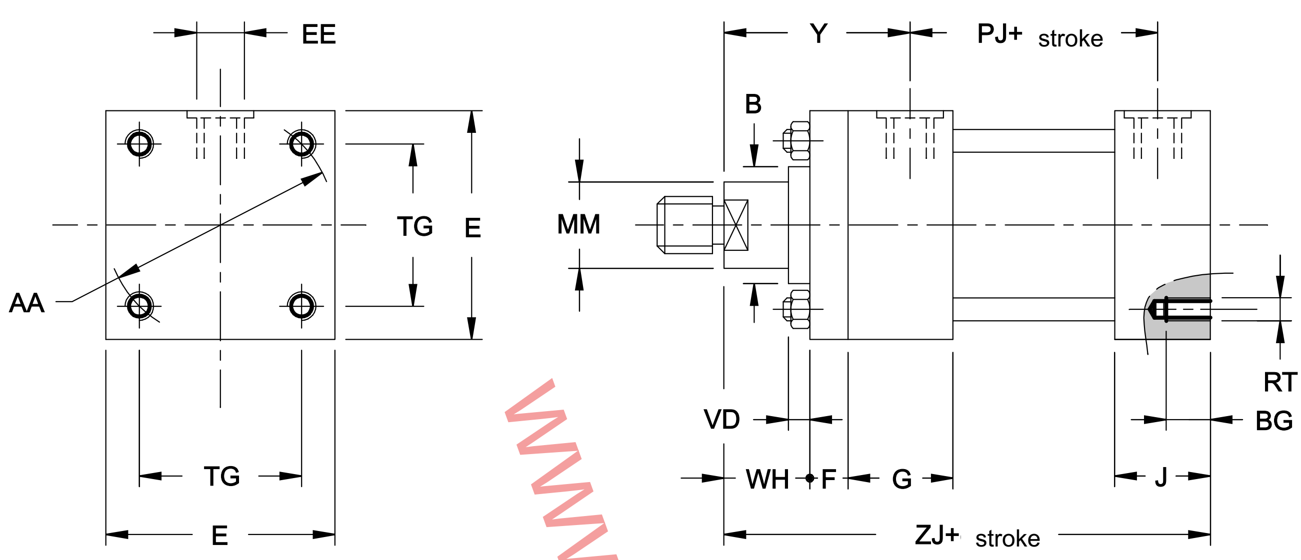
NOTE: The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	AA	ØB f8	BG	E max	EE BSP	G	J	PJ	RT	TG	VD	WH	Y	ZB	ZJ
25	12 18	40	24 30	8	40 **NOTE**	1/4"	45	35	54	M5x0.8	28.3	6	15	50	121	114
32	14 18 22	47	26 30 34	9	45 **NOTE**	1/4"	45	36	57	M6x1	33.2	12 6 12	25	60	137	128
40	18 22 28	59	30 34 42	12	63	3/8"	55	45	74	M8x1.25	41.7	6 12 10	25	62	166	153
50	22 28 36	74	34 42 50	18	75	1/2"	55	45	76	M12x1.75	52.3	7 7 10	26	68	176	159
63	28 36 45	91	42 50 60	18	90	1/2"	55	45	80	M12x1.75	64.3	7 10 14	33	71	185	168
80	36 45 56	117	50 60 72	24	115	3/4"	65	52	93	M16x2	82.7	5 9 9	31	77	212	190
100	45 56 70	137	60 72 88	24	130	3/4"	69	55	101	M16x2	96.9	7 7 10	35	82	225	203
125	56 70 90	178	72 88 108	27	165	1"	78	71	117	M22x2.5	125.9	7 10 10	35	86	260	232
160	70 90 110	219	88 108 133	32	205	1"	86	63	130	M27x3	154.9	7	32	86	279	245
200	90 110 140	269	108 133 163	40	245	1¼"	103	80	165	M30x3.5	190.2	7	32	98	336	299

16 - OVERALL AND MOUNTING DIMENSIONS ISO **MX6**

U REAR THREADED HOLES



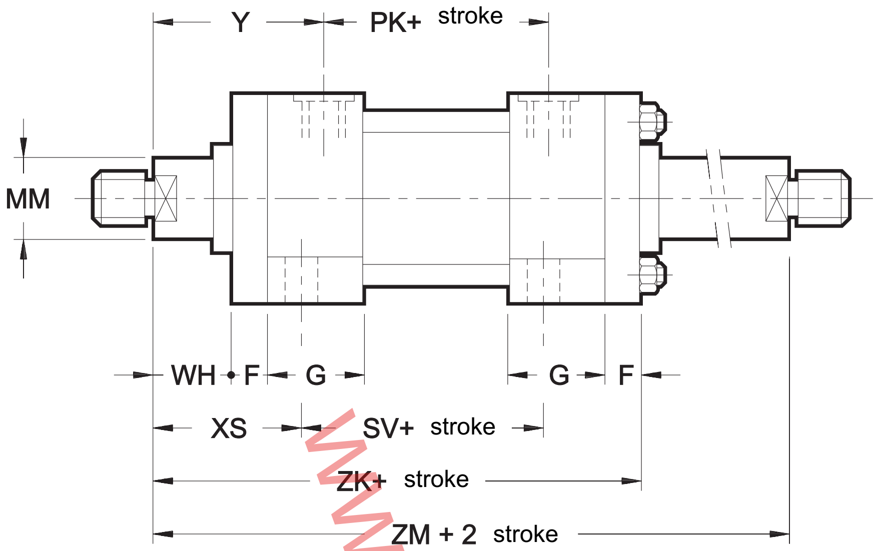
NOTE: The "E" dimension indicated in the table (bores 25 and 32) must be increased of 5 mm, only for the front end, on the oil port side (dimensions not in compliance with ISO standards).

Dimensions in mm

Bore	MM Ø rod	AA	ØB f8	BG	E max	EE BSP	F	G	J	PJ	RT	TG	VD	WH	Y	ZJ
25	12 18	40	24 30	8	40 note	1/4"	10	45	35	54	M5x0.8	28.3	6	15	50	114
32	14 18 22	47	26 30 34	9	45 note	1/4"	10	45	36	57	M6x1	33.2	12 6 12	25	60	128
40	18 22 28	59	30 34 42	12	63	3/8"	10	55	45	74	M8x1.25	41.7	6 12 10	25	62	153
50	22 28 36	74	34 42 50	18	75	1/2"	15	55	45	76	M12x1.75	52.3	7 7 10	26	68	159
63	28 36 45	91	42 50 60	18	90	1/2"	15	55	45	80	M12x1.75	64.3	7 10 14	33	71	168
80	36 45 56	117	50 60 72	24	115	3/4"	20	65	52	93	M16x2	82.7	5 9 9	31	77	190
100	45 56 70	137	60 72 88	24	130	3/4"	22	69	55	101	M16x2	96.9	7 7 10	35	82	203
125	56 70 90	178	72 88 108	27	165	1"	22	78	71	117	M22x2.5	125.9	7 10 10	35	86	232
160	70 90 110	219	88 108 133	32	205	1"	25	86	63	130	M27x3	154.9	7	32	86	245
200	90 110 140	269	108 133 163	40	245	1.1/4"	25	103	80	165	M30x3.5	190.2	7	32	98	299

17 - OVERALL AND MOUNTING DIMENSIONS

DOUBLE ROD



Dimensions in mm

For other dimensions and mounting styles please see single rod cylinder tables.
Not available for mounting styles B-C-D-F-N-Q-U

Bore	MM Ø rod	F	G	PK	SV	WH	XS	Y	ZM	ZK
25	12 18	10	45	49	88	15	33	50	154	134
32	14 18 22	10	45	52	88	25	45	60	178	147
40	18 22 28	10	55	74	105	25	45	62	195	173
50	22 28 36	15	55	76	99	26	54	67	207	184
63	28 36 45	15	55	84	93	33	65	71	223	193
80	36 45 56	20	65	100	110	31	68	77	246	223
100	45 56 70	22	69	110	107	35	79	82	265	239
125	56 70 90	22	78	124	131	35	79	86	288	261
160	70 90 110	25	86	130	130	32	86	86	302	270
200	90 110 140	25	103	160	172	32	92	98	356	324

NOTE: Double rod cylinders are developed with two separate rods, fixed together by means of threading. Because of this mounting style, the rod with female threading is less resistant than the other.

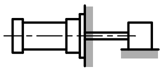
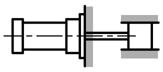
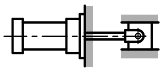
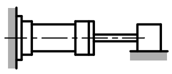
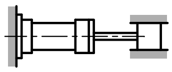
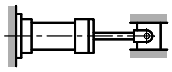
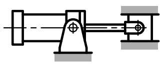
To simplify the identification of the more resistant rod, the "**M**" marking is stamped on its end.

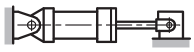
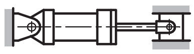
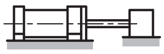
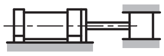
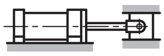
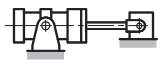
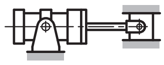
We recommend the use of the weaker rod for the less demanding applications.

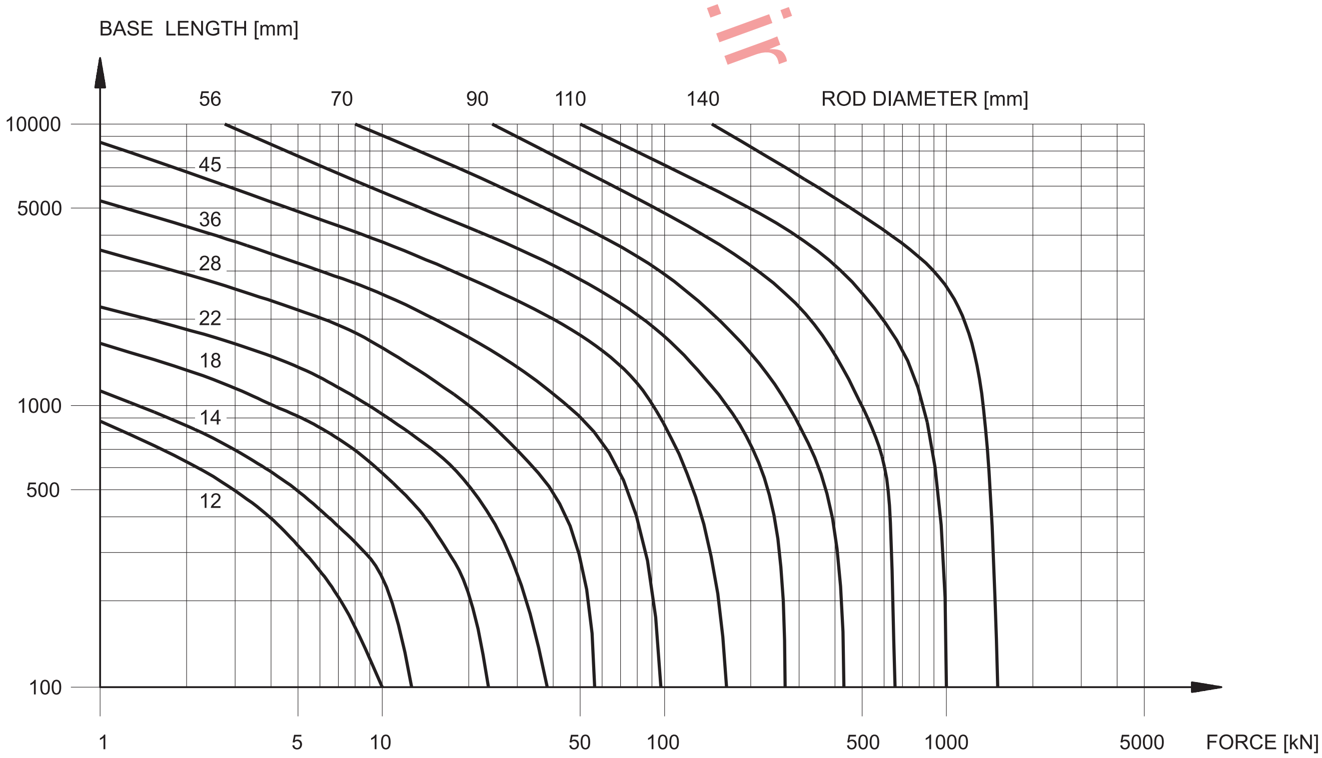
18 - ROD DIAMETER SELECTION

To ensure adequate stability, cylinders must be calculated for maximum compressive load according to the following simplified procedure:
- Refer to the table to identify the stroke factor according to the mounting style.
- To calculate the reference length, multiply the working stroke by the stroke factor.
- To calculate the thrust force, multiply the total cylinder area by the operating pressure.
- On the diagram, find the point of intersection between the thrust force and reference length.
- Identify the minimum rod diameter on the curve above the previous point of intersection.

Cylinders with rod diameters smaller than the value plotted in the diagram will not guarantee sufficient rigidity.

Mounting style	Rod connection	Mounting	Stroke factor
A-P-R-T	Fixed and supported		2
	Fixed and rigidly guided		0.5
	Jointed and rigidly guided		0.7
B-Q-U	Fixed and supported		4
	Fixed and rigidly guided		1
	Jointed and rigidly guided		1.5
H	Jointed and rigidly guided		1

Mounting style	Rod connection	Mounting	Stroke factor
C-D-F-N	Jointed and supported		4
	Jointed and rigidly guided		2
G	Fixed and supported		2
	Fixed and rigidly guided		0.5
	Jointed and rigidly guided		0.7
L	Jointed and supported		3
	Jointed and rigidly guided		1.5



19 - THEORETICAL FORCES

Push force

$Fs = P \cdot At$

Pull force

$Ft = P \cdot Aa$

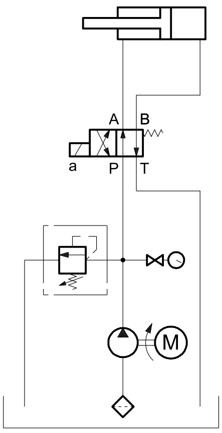
Bore mm	Ø rod mm	Total area mm²	Annular area mm²
25	12	491	378
	18		236
32	14	804	650
	18		550
	22		424
40	18	1 257	1 002
	22		876
	28		641
50	22	1 964	1 583
	28		1 348
	36		946
63	28	3 117	2 502
	36		2 099
	45		1 527
80	36	5 027	4 009
	45		3 437
	56		2 564
100	45	7 854	6 264
	56		5 391
	70		4 006
125	56	12 272	9 809
	70		8 424
	90		5 910
160	70	20 106	16 258
	90		13 744
	110		10 603
200	90	31 416	25 054
	110		21 913
	140		16 022

Fs = Force (extension) in N
Ft = Force (retraction) in N
At = Total area in mm²
Aa = Annular area in mm²
P = Pressure in MPa

1 bar = 0.1 MPa
1 kgf = 9.81 N

20 - THEORETICAL VELOCITY

Configuration 1



The diagram illustrates a conventional cylinder application: the fluid is delivered by means of a directional control valve in alternation to the front chamber while the rear chamber is connected to tank and vice versa.
To calculate velocity and force, proceed as follows:

Velocity (extension) $V = \dfrac{Q \cdot 1000}{At \cdot 60}$

Velocity (retraction) $V = \dfrac{Q \cdot 1000}{Aa \cdot 60}$

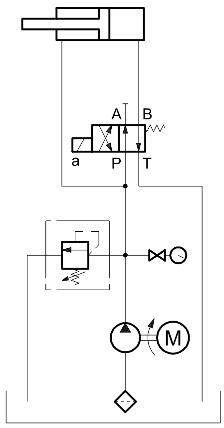
Force (extension) $F = P \cdot At$

Force (retraction) $F = P \cdot Aa$

V = Velocity in m/s
Q = Flow rate in l/min
At = Total area (piston bore) in mm²
Aa = Annular area (At - As) in mm²
F = Force in N
P = Pressure in MPa
As = Rod area (At - Aa) in mm²
Qd = Flow rate through directional control valve (Q+return flow rate from small chamber) in l/min

1 bar = 0.1 MPa
1 kgf = 9.81 N

Configuration 2



When the system requires high velocity with relatively low forces, we recommend using a regenerative circuit. The diagram 2 illustrates the simplest version of this type of set-up.
The annular chamber is permanently connected to the pump while the full bore end is connected alternately to the pump, in which case the piston rod extends as a result of the differential areas (both chambers are supplied at the same pressure), and to tank, in which case the piston rod retracts.

Velocity (extension) $V = \dfrac{Q \cdot 1000}{As \cdot 60}$

Velocity (retraction) $V = \dfrac{Q \cdot 1000}{Aa \cdot 60}$

Force (extension) $F = P \cdot As$

Force (retraction) $F = P \cdot Aa$

NOTE: In regenerative circuits, the sizing of the directional control valve is fundamental. Flow rate through the directional control valve is calculated according to the following formula:

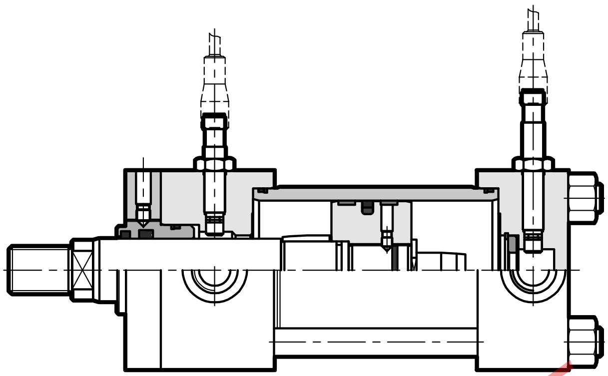
$$Qd = \frac{V \cdot At \cdot 60}{1000}$$

21 - MASSES

Bore	Ø rod	Mass for null stroke						Mass for 10 mm stroke
		Mounting style						
		P-Q-R-T-U	G	A-B	C-D-F	H-N	L	
mm	mm	kg	kg	kg	kg	kg	kg	kg
25	12 18	1.2 1.2	1.3 1.3	1.4 1.4	1.4 1.4	1.4 1.4	1.5 1.5	0.04 0.06
32	14 18 22	1.6 1.6 1.7	1.8 1.8 1.8	1.9 1.9 1.9	1.9 1.9 1.9	1.7 1.7 1.7	1.9 1.9 1.9	0.06 0.07 0.08
40	18 22 28	3.7 3.7 3.8	3.9 3.9 4	4.6 4.6 4.7	4.2 4.2 4.3	3.9 3.9 4	4.6 4.6 4.7	0.1 0.11 0.12
50	22 28 36	5.9 6 6.1	6.4 6.5 6.6	7.1 7.2 7.3	7.1 7.2 7.3	6.3 6.4 6.5	7.9 8 8.1	0.14 0.17 0.18
63	28 36 45	8.5 8.6 8.7	9.7 9.8 9.9	10 10.1 10.2	10.1 10.3 10.4	8.8 8.9 9.1	10.5 10.6 10.7	0.19 0.22 0.26
80	36 45 56	16 16.2 16.3	17.2 17.4 17.6	18.8 19 19.1	19.5 19.6 19.8	16.6 16.7 16.9	19 20 22	0.27 0.32 0.39
100	45 56 70	22 22.5 23	23 24 25	25 25.5 26	28.1 28.5 29	22.8 23.1 23.4	26 27 28	0.4 0.48 0.58
125	56 70 90	41.5 42.5 44	44 44.5 45	47.5 48 49	53 54 55	42.5 43 44	48 49 50	0.65 0.76 0.96
160	70 90 110	69 70 71	72 73 74	79 80 81	89.5 91 92	71 72 72.5	84 85 86	1 1.2 1.4
200	90 110 140	122 123 124	128.5 129.5 131	137 139 140	157 158 159	127 128.5 129.5	152 153 155	1.6 1.8 2.2

22 - END-STROKE PROXIMITY SENSORS

On request, cylinders can be supplied with end-stroke proximity sensors type PNP, with normally open output. They are mounted on the front and rear end of the cylinder and they supply an electric signal when the piston rod reaches the stroke end.



They are available for all cylinder mounting styles, from Ø40, with the following limits:

bore Ø40:

mounting	A-H	available on rear end only
mounting	B-N	available on front end only

bore Ø50:

mounting	H	available on rear end only
mounting	N	available on front end only

bores Ø80 and Ø100:

mounting	N	available on front end only

bores Ø125/56, Ø160 and Ø200:

mounting	A	available on rear end only
mounting	B	available on front end only

In order to ensure the correct functioning of the system, cylinders must be equipped with cushionings.

These sensors can be only used to provide the switching signal and not to control voltage loads.

22.1 - Identification code

K = Explosion-proof version according to ATEX 2014/34/EU (paragraph 3). Omit if not required.

H	C		2		-	F	P			-	

For the remaining part of the code refer to paragraph 2, starting from the definition of bore/rod

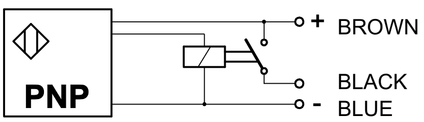
Pos. proximity sensor of the rear end (**1-4**) (see par. 1.4)
0 = without rear proximity sensor

Mounting style (see par. 2)

Pos. proximity sensor of the front end (**1-4**) (see par. 1.4)
0 = without front proximity sensor

End-stroke proximity sensor

22.2 - Technical characteristics and electrical connection



Rated voltage	VDC	24
Power supply voltage range	VDC	10 ÷ 30
Absorbed current	mA	200
Output	normally open contact	
Electric protection	polarity inversion short circuit overvoltage	
Electric connection	with connector	
Maximum operating pressure	bar	500
Operating temperature range	°C	-25 / +80
Class of protection according IEC EN 60529 (atmospheric ag.)		IP68
Piston position LED (**NOTE**)		NO (it's on the connector)

22.3 - Connectors

Connectors for proximity sensors must be ordered separately, by specifying the code: **ECM3S/M12L/10**

NOTE: These connectors are not suitable for ATEX-rated cylinders. The connectors for the ATEX-rated cylinders are described at paragraph 3.5.

Connector: pre-wired connector M12 - IP68
Cable: with 3 conductors 0.34 mm² - length 5 mt.
Cable material: polyurethane resin (oil resistant)

The connector has two LEDs, one green and one yellow.

GREEN: Connector power supply.
The LED burn when the connector is supplied.

YELLOW: position signal.
ON - piston at stroke end
OFF - piston not at stroke end

23 - MAGNETIC END-STROKE SENSORS

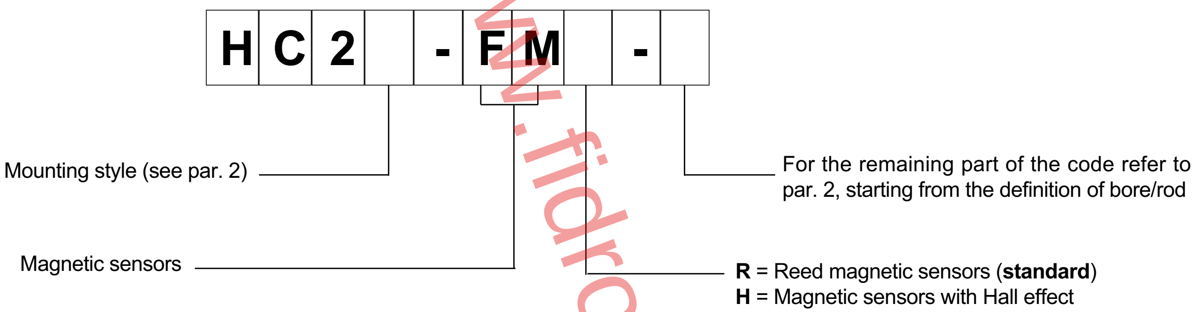
Upon request, cylinders can be supplied with adjustable magnetic sensors, mounted on tie rods, which allow the reading in every position of the piston, both intermediate and end stroke. The “switching zone” of these sensors can reach about 30÷40 mm, depending on piston speed and cylinder bore. Therefore, if the Client needs to read with precision only the signal of the stroke end, and not of other positions, we recommend the use of end-stroke proximity sensors (see par. 22), rather than magnetic sensors.

Magnetic sensors are available for bores Ø25 to Ø125 included. For cylinders with strokes under 80 mm and for cylinders with mid swinging mounting type, we recommend to consult our technical office, because, in some applications, magnetization problems of cylinder parts could happen, affecting the correct functioning of the system. Moreover we recommend to use these cylinders with operating pressure lower than 160 bar (peak free) and not to use them as mechanical stop; for this reason, consider a stroke of 15÷20 mm more than necessary.

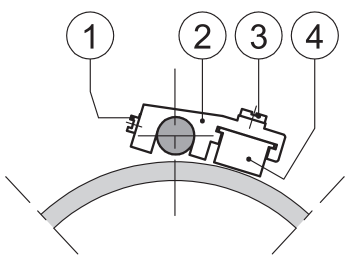
Cylinders are supplied with 2 magnetic sensors, already mounted on tie rods, which can be of two types:

- Reed magnetic sensors (**standard**): they are sensors with normally open contact, which commute exploiting the magnetic field generated by the plastoferrite ring inserted in the piston. They have a long electric life and a switching power which allows to control voltage loads directly.
- Magnetic sensors with Hall effect: they are sensors which read the voltage variation generated by the piston movement, by means of a normally open electronic semiconductor type PNP. Because of the absence of moving parts inside the sensors, they guarantee a much longer electric life than that of Reed sensors, a high sensitivity and switching reliability. As opposed to Reed sensors, these sensors can be used only to provide the switching signal and not to control voltage loads.

23.1 - Identification code



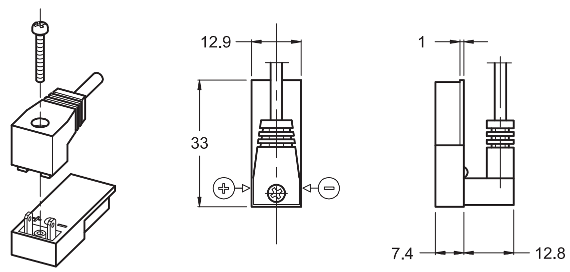
23.2 - Mounting and overall dimensions



1	Bracket fastening screw
2	Socket for fastening to the tie rod
3	Bracket for fastening to the tie rod
4	Sensor fastening screw
5	Magnetic sensor

Reed sensors for Ø 25 and Ø 32 bore and sensors with Hall effect

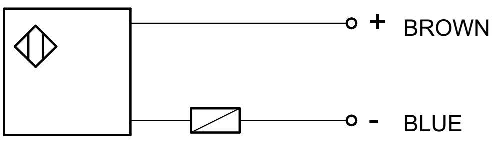
Reed sensors for Ø 40 ÷ Ø 125 bore



23.3 - Technical Characteristics And Electrical Connection

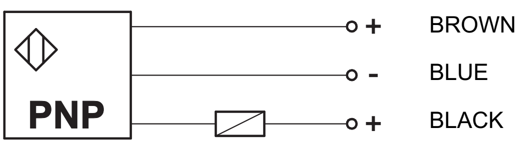
Reed sensors (FMR)

		Reed sensor without connector (for 25 and 32 bores)	Reed sensor with connector (for 40, 50, 63, 80, 100 and 125 bores)
Sensor version		Reed	Reed
Contact		normally open	normally open
Maximum power	W	20	50
Maximum voltage	V AC/DC	130	250
Minimum voltage	V AC/DC	3	3
Voltage drop	V	2,5	2,5
Maximum power	mA	300	1000
Wiring		2 cables	2 cables
Connection		cable (L = 2 m)	connector (with cable L = 2 m)
Cable section	mm^2	0,25	0,25
Varistor	V	-	250
Sheath material		PVC	PVC
Contact indicator		red led	red led
Operating temperature range	°C	-20 / +80	-20 / +80



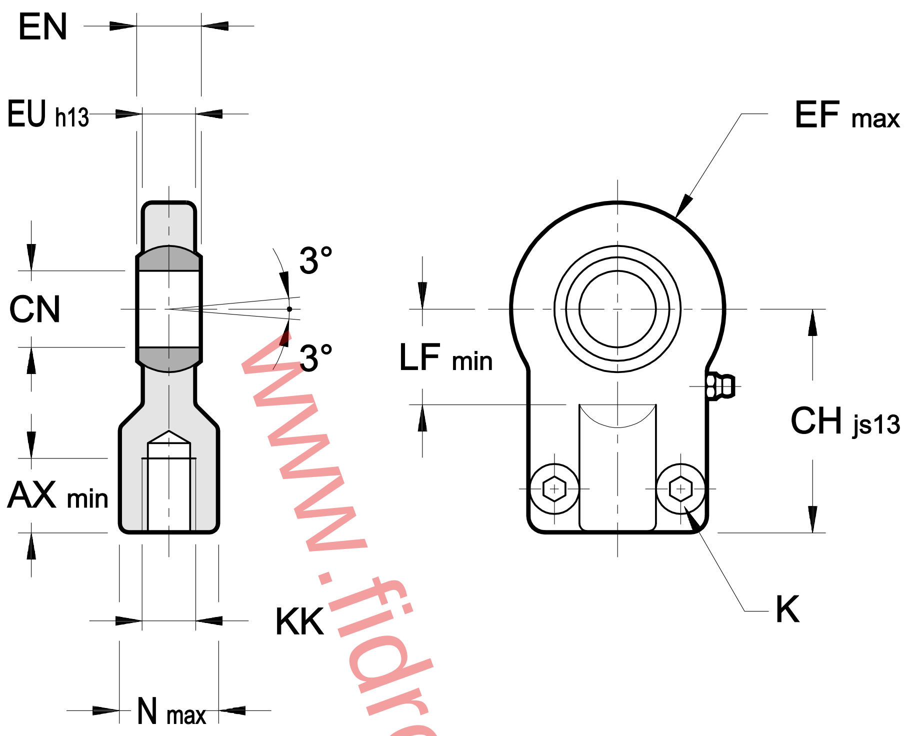
Hall effect sensors (FMH)

Sensor version		Hall effect
Contact		normally open
Sensor type		PNP
Maximum voltage	V AC/DC	30
Minimum voltage	V AC/DC	10
Voltage drop	V	0,5
Maximum power	mA	200
Wiring		3 cables
Connection		cable (L = 2 m)
Cable section	mm^2	0,14
Wire covering material		PVC
Contact indicator		red led
Operating temperature range	°C	-20 / +80



24 - OVERALL AND MOUNTING DIMENSIONS

SPHERICAL SWIVEL ISO 8133 / DIN 24555



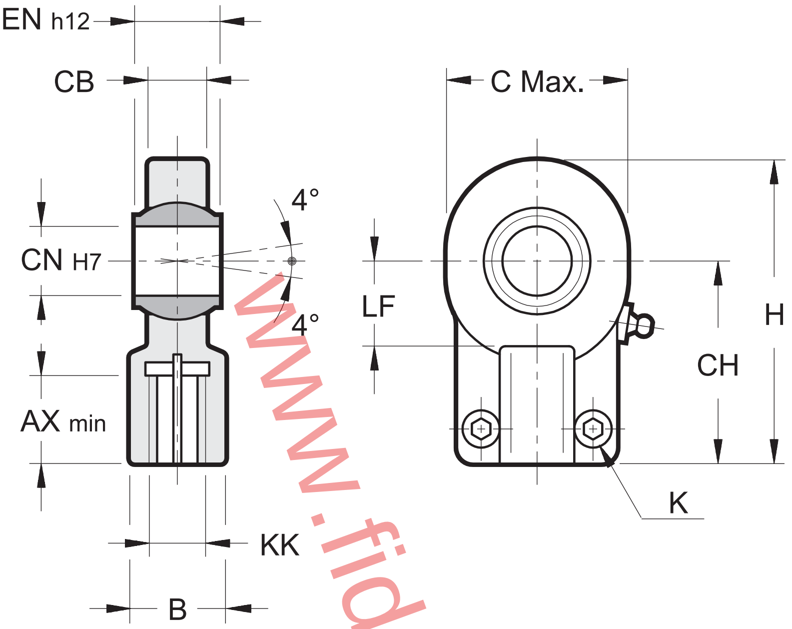
NOTE: no lubricator on SSF-12. On SSF-14 and SSF-18 sizes the injection of the lubricant takes place through a hole.

Dimensions in mm

Type	Ø cylinder rod standard thread	Ø cylinder rod light thread	AX min	CH js13	Ø CN	EF max	EN	EU h13	KK	LF min	N max	K bolt UNI 5931	Torque Nm	Max load kN	Mass kg
SSF-12	12	18	15	42	$12^{0}_{-0.008}$	20	$10^{0}_{-0.12}$	8	M10x1.25	16	17	M6x14	10	8	0.2
SSF-14	14	22	17	48	$16^{0}_{-0.008}$	22.5	$14^{0}_{-0.12}$	11	M12x1.25	20	21	M6x14	10	12.5	0.3
SSF-18	18	28	19	58	$20^{0}_{-0.010}$	27.5	$16^{0}_{-0.12}$	13	M14x1.5	25	25	M8x18	25	20	0.4
SSF-22	22	36	23	68	$25^{0}_{-0.010}$	32.5	$20^{0}_{-0.12}$	17	M16x1.5	30	30	M8x18	25	32	0.7
SSF-28	28	45	29	85	$30^{0}_{-0.010}$	40	$22^{0}_{-0.12}$	19	M20x1.5	35	36	M10x20	49	50	1.2
SSF-36	36	56	37	105	$40^{0}_{-0.012}$	50	$28^{0}_{-0.12}$	23	M27x2	45	45	M10x25	49	80	2.2
SSF-45	45	70	46	130	$50^{0}_{-0.012}$	62.5	$35^{0}_{-0.12}$	30	M33x2	58	55	M12x30	86	125	4.2
SSF-56	56	90	57	150	$60^{0}_{-0.015}$	80	$44^{0}_{-0.15}$	38	M42x2	68	68	M16x40	210	200	8.3
SSF-70	70	110	64	185	$80^{0}_{-0.015}$	102.5	$55^{0}_{-0.15}$	47	M48x2	92	90	M20x50	410	320	19
SSF-90	90	140	86	240	$100^{0}_{-0.020}$	120	$70^{0}_{-0.20}$	57	M64x3	116	110	M24x60	710	500	28

25 - OVERALL AND MOUNTING DIMENSIONS

SPHERICAL SWIVEL ISO 6982 / DIN 24338



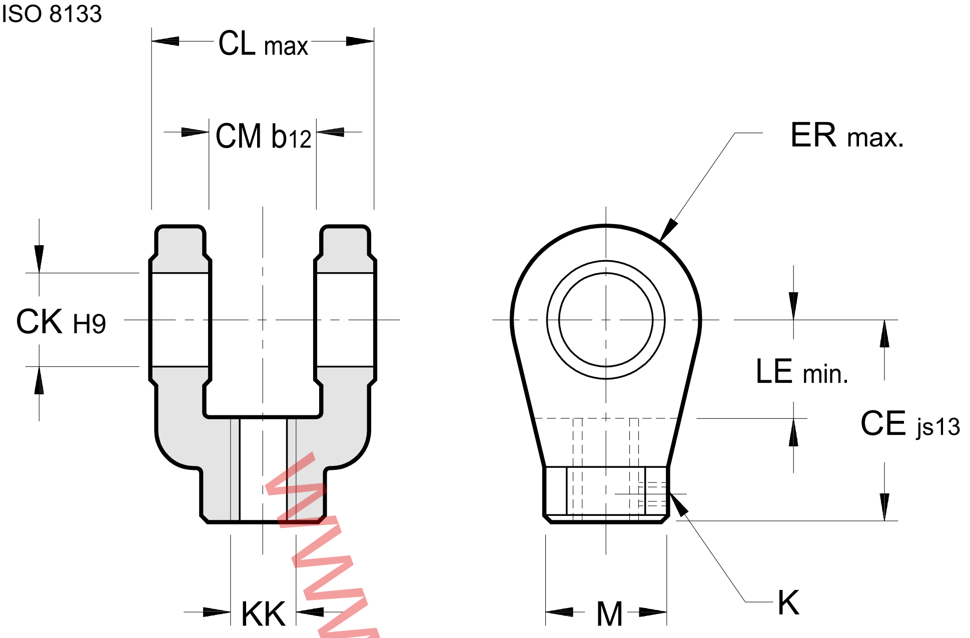
NOTE: no lubricator on LSF-14. On LSF-18 the injection of the lubricant takes place through a hole.

Dimensions in mm

Type	Ø rod standard thread	Ø rod light thread	AX min	B	C max	CB	CH	Ø CN H7	EN h12	H	KK	LF	K bolt UNI 5931	Torque Nm	Max load kN	Mass kg
LSF-14	14	22	17	16	32	11	38	12	12	54	M12x1.25	14	M5x16	6	10.8	0.10
LSF-18	18	28	19	21	40	14	44	16	16	64	M14x1.5	20	M6x14	10	17.6	0.21
LSF-22	22	36	23	25	47	18	52	20	20	75	M16x1.5	22	M8x20	25	30	0.35
LSF-28	28	45	29	30	58	22	65	25	25	96	M20x1.5	27	M8x20	25	48	0.62
LSF-36	36	56	37	38	71	28	80	32	32	119	M27x2	32	M10x25	49	67	1.17
LSF-45	45	70	46	47	90	33	97	40	40	146	M33x2	41	M10x30	49	100	2.15
LSF-56	56	90	57	58	109	41	120	50	50	180	M42x2	50	M12x35	86	156	3.75
LSF-70	70	110	64	70	132	53	140	63	63	212	M48x2	62	M16x40	210	255	7.00
LSF-90	90	140	86	90	170	67	180	80	80	271	M64x3	78	M20x50	410	400	13.8

26 - OVERALL AND MOUNTING DIMENSIONS

FEMALE CLEVIS ISO 8133

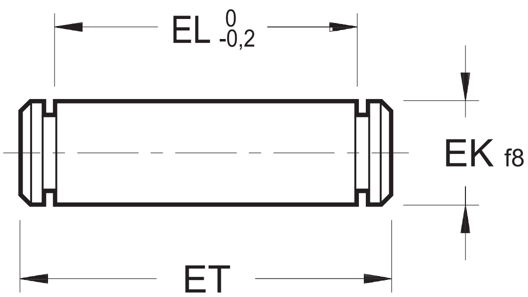


Dimensions in mm

Type	Ø cylinder rod standard thread	Ø cylinder rod light thread	M CH	CE js13	Ø CK H9	CL max	CM b12	ER max	KK	LE min	K bolt	Max load kN	Mass kg
FRC-12	12	18	19	32	10	26	12	12	M10x1.25	13	M5x5	8	0.1
FRC-14	14	22	21	36	12	34	16	17	M12x1.25	19	M5x5	12.5	0.2
FRC-18	18	28	21	38	14	42	20	17	M14x1.5	19	M5x5	20	0.2
FRC-22	22	36	32	54	20	62	30	29	M16x1.5	32	M6x6	32	0.5
FRC-28	28	45	32	60	20	62	30	29	M20x1.5	32	M6x6	50	1
FRC-36	36	56	40	75	28	83	40	34	M27x2	39	M6x6	80	1.8
FRC-45	45	70	55	99	36	103	50	50	M33x2	54	M8x8	125	3.7
FRC-56	56	90	56	113	45	123	60	53	M42x2	57	M8x8	200	5.6
FRC-70	70	110	75	126	56	143	70	59	M48x2	63	M12x12	320	9.3
FRC-90	90	140	95	168	70	163	80	78	M64x3	83	M12x12	500	20

27 - OVERALL AND MOUNTING DIMENSIONS

FEMALE CLEVIS PIN ISO 8133
with spring retainers

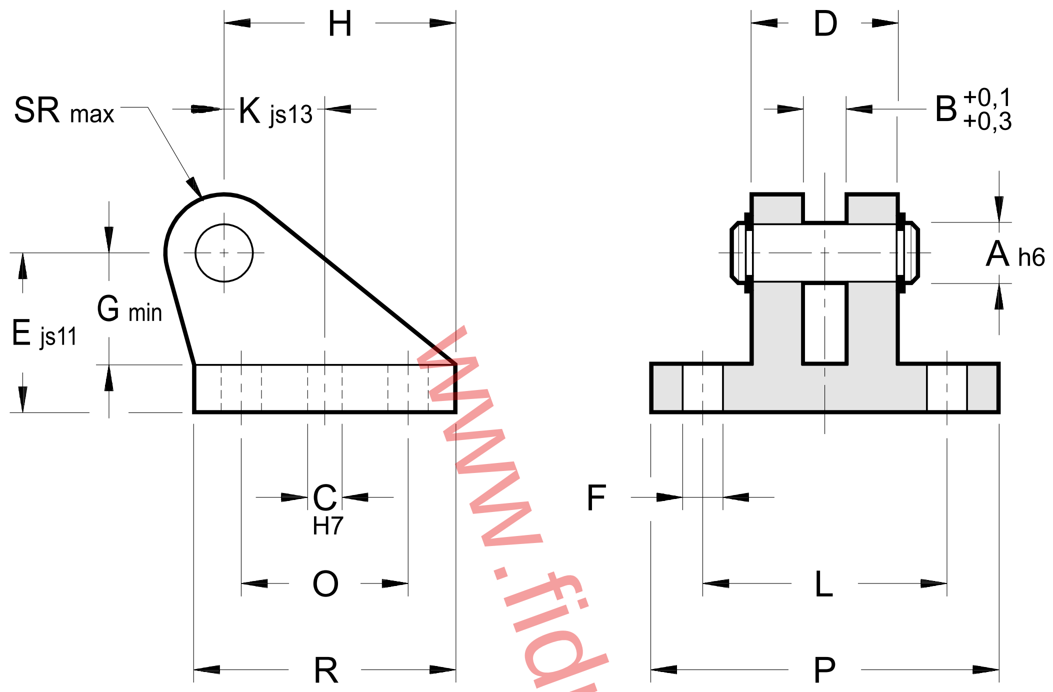


Dimensions in mm

Type	Ø EK f8	EL 0 / - 0.2	ET
PNF-12	10	29	37
PNF-14	12	37	45
PNF-18	14	45	53
PNF-22	20	66	75
PNF-28	20	66	75
PFN-36	28	87	96
PNF-45	36	107	120
PNF-56	45	129	144
PNF-70	56	149	164
PNF-90	70	169	187

28 - OVERALL AND MOUNTING DIMENSIONS

FEMALE CLEVIS FLANGE FOR SPHERIC SWIVEL DIN 24554
(with PIN and spring retainers)

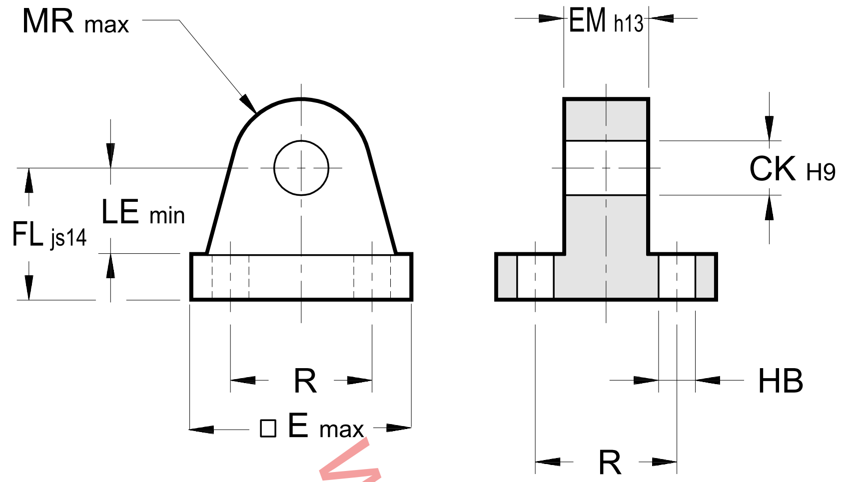


Dimensions in mm

Type	Cylinder bore	ØA h6	B + 0.1 + 0.3	ØC H7	D	E js11	ØF	G min	H	K js13	L	O	P	R	SR max	Max load kN	Mass kg
FLF-25	25	12	10	8	30	40	9	28	56	26	55	40	75	60	12	8	0.5
FLF-32	32	16	14	10	40	50	11	37	74	34	70	55	95	80	16	12.5	1
FLF-40	40	20	16	12	50	55	14	39	80	35	85	58	120	90	20	20	1.7
FLF-50	50	25	20	12	60	65	16	48	98	43	100	70	140	110	25	32	2.7
FLF-63	63	30	22	16	70	85	18	62	120	52	115	90	160	135	30	50	5.2
FLF-80	80	40	28	20	80	100	22	72	148	63	135	120	190	170	40	80	9.3
FLF-100	100	50	35	25	100	125	30	90	190	82	170	145	240	215	50	125	18.5
FLF-125	125	60	44	40	120	150	39	108	225	95	200	185	270	260	60	200	35
FLF-160	160	80	55	40	160	190	45	140	295	125	240	260	320	340	80	320	63
FLF-200	200	100	70	45	200	210	48	150	335	135	300	300	400	400	100	500	110

29 - OVERALL AND MOUNTING DIMENSIONS

MALE CLEVIS FLANGE ISO 8133



Dimensions in mm

Type	Cylinder bore	ØCK H9	E max	EM h13	FL js14	ØHB	LE min	MR max	R	Load max kN	Mass kg
FLC-25	25	10	40	12	23	5.5	13	12	28.3	8	0.3
FLC-32	32	12	45	16	29	6.6	19	17	32.2	12.5	0.5
FLC-40	40	14	63	20	29	9	19	17	41.7	20	0.9
FLC-50	50	20	75	30	48	13.5	32	29	52.3	32	1.3
FLC-63	63	20	90	30	48	13.5	32	29	64.3	50	1.9
FLC-80	80	28	115	40	59	17.5	39	34	82.7	80	4
FLC-100	100	36	130	50	79	17.5	54	50	96.9	125	6.3
FLC-125	125	45	165	60	87	24	57	53	125.9	200	11.4
FLC-160	160	56	205	70	103	30	63	59	154.9	320	20
FLC-200	200	70	245	80	132	33	82	78	190.2	500	38

30 - SEAL KIT IDENTIFICATION CODE

S	K	/	H	C	2	-		/		/		-		/	20

Seal kit (SK)

Bore (mm)

Rod (mm)

Double rod (omit if not required)

Seals: **K** = standard (nitrile + polyurethane)
M = low friction (nitrile + PTFE)
V = high temperature (viton + PTFE)

Series no. indicated on cylinder

NOTE: the seal kit includes all the seals of a cylinder with cushionings.

DUPLOMATIC
OLEODINAMICA

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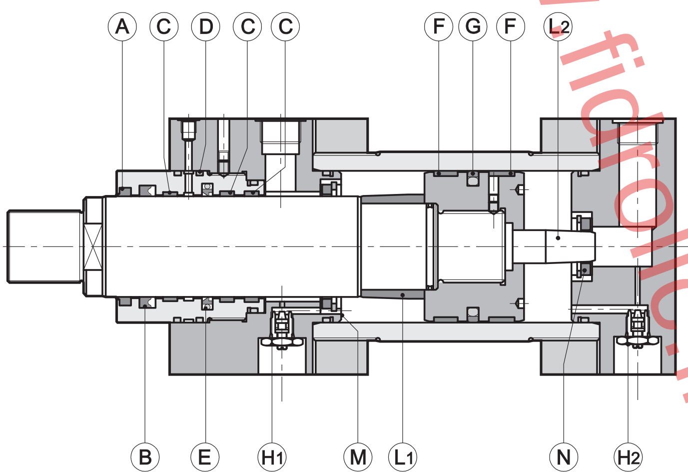
HC3
HYDRAULIC CYLINDERS
HCK3
HYDRAULIC CYLINDERS
ATEX 2014/34/UE
SERIES 10

ISO 6022
DIN 24333

DESCRIPTION



— Double acting cylinders constructed in compliance with ISO 6022 and DIN 24333.

— The materials used to make these cylinders are particularly resistant and make them suitable for applications in the iron and steel sector.

— The cylinder is available with 5 different mounting styles as well as a range of accessories to meet all application requirements.

A - scraper ring
B - piston rod seal
C - guide ring
D - drain seal (O-Ring)
E - piston rod seal
F - guide ring
G - piston seal
H1 - front cushioning adjustment screw
H2 - rear cushioning adjustment screw
L1 - front cushion
L2 - rear cushion
M - front cushioning bushing
N - rear cushioning bushing

ATEX 2014/34/UE rated version for installation in potentially explosive atmospheres is now available. The standard version of cylinders is ATEX II 2GD classified, whereas cylinders with proximity sensors are ATEX II 3GD classified. The declaration of conformity to the up mentioned standards is always supplied with the cylinder. See paragraph 3 for details.

PERFORMANCES

Nominal operating pressure (continuous service)	bar	250
Maximum operating pressure	bar	320
Maximum speed (standard)	m/s	0,5
Maximum stroke (standard)	mm	5000
Fluid temperature range (standard)	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree		According to ISO 4406:1999 class 20/18/15
Recommended viscosity	cSt	25

1 - CHARACTERISTICS

1.1 - Bores and piston rods

Ø 50 to Ø 400 mm bores are available to enable a vast choice according to required force.

Two piston rod diameters are available for each bore:

- reduced piston rod with area ratio 1:1.65
- standard piston rod with area ratio 1:2

1.2 - Cushionings

On request, gradual and adjustable cushioning devices can be fitted in the front and/or rear ends of the cylinder without affecting overall dimensions.

The special design of the cushions ensures optimal repeatability also in the event of variations in fluid viscosity.

Cushioning devices are always recommended as they ensure impact-free stopping even at high speed thus reducing pressure surges and impact transferred to the mounting supports.

The cylinder ends of bores higher than 160mm with cushioning can have an additional port connected directly with the braking chamber. This connection must be used in case of application, near the cylinder, of a pressure relief valve set at 350 bar, to limit overpressures during braking. For further information and for the order identification code, please consult our technical office.

The table below shows cushioning cone lengths:

Bore (mm)	50	63	80	100	125	140	160	180	200	250	320	400
Front cone length (mm)	38	40	50	50	60	60	75	75	80	100	100	110
Rear cone length (mm)	34	42	58	49	64	64	68	73	69	101	99	108

1.3 - Connections

The cylinders are supplied as standard with cylindrical BSP threads and spot facing for seal rings in compliance with ISO 1179.

Connections which are oversized compared to those shown in the dimensional tables are available upon request. For further information and for the order identification code, please consult our technical office.

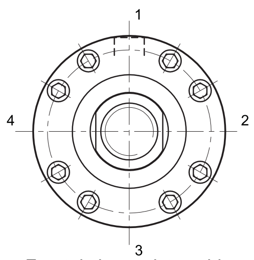
For correct cylinder operation, fluid velocity must not exceed 5 m/s.

1.4 - Connection position

Standard positions of the oil ports, cushioning adjustment screws, breathers, optional external drain and optional end-stroke proximity sensors, are indicated in the table below.

Connection positions different from the standard are available upon request. As a consequence, the other options positions will be rotated.

For special requests, please consult our technical office.



Frontal view - piston side

	POSITION
Connections	1
Cushioning adjustment	3
Breathers	4
Drainage	1
Proximity end stroke	2
Optional port (see par. 1.2)	4

1.5 - Seals

The table below illustrates seal characteristics in relation to hydraulic fluid and operating temperatures.

NOTE: for lower pressure use consult our technical office.

Type	Seal type	Seal material	Hydraulic fluid	Minimum pressure [bar]	Operating pressure [°C]	Max speed [m/s]
K	Standard	nitrile polyurethane	mineral oil	10	-20 / +80	0,5
M	Low friction	nitrile PTFE	Mineral oil Water glycol	20 (note)	-20 / +80	15
V	high temperature and/or aggressive fluid	Viton PTFE	Special fluids	10	-20 / +150	1

1.6 - Strokes

Standard cylinders are available with strokes up to 5000 mm. Longer cylinder strokes can be supplied on request.

Stroke tolerances are:

0 + 1 mm for strokes up to 1000 mm

0 + 4 mm for strokes up to 5000 mm.

1.7 - Spacers

In the case of cylinder strokes above 1000 mm we recommend the use of spacers which can be inserted to reduce loads on the piston rod bushing and prevent the piston from sticking.

Spacers are constructed in hardened and tempered steel with PTFE facing.

Every spacer is 50 mm long. We recommend to insert 1 spacer for strokes from 1001 to 1500 mm, with an increment of 1 spacer for every 500 mm stroke.

You must remember that the overall length of the cylinder increases according to the number of inserted spacers (50 mm for each spacer).

1.8 - Drainage

A connection for external drainage on the front end (even on the back end for double-rod cylinders) can be supplied upon request, for fluid drops recovery of the first seal of the rod, without any modification to the overall dimensions.

Connection: 1/8” BSP for bore up to Ø 100 included - 1/4” BSP for higher bores.

1.9 - Breathers

On request cylinder ends can be supplied with breathers for the elimination of air. This is necessary when the entire stroke is not used or when connections are not facing upwards.

1.10 - Surface finish

The cylinders are supplied painted with Duplomatic black opaque colour with a paint thickness of 40μ. The rod is chromed.

2 - IDENTIFICATION CODE

K = Explosion-proof version according to ATEX 2014/34/UE (paragraph 3). Omit if not required.

HC		3		-		/		/		-		-		-		-		/		-		/		/10

Series (indicate for spare parts requests)

Dimension XV for "L" mounting (omit for other mounting styles)

N. of spacers multiple of 50 mm (omit if not required) (see par. 1.7)

Back end connection position (**1**-**4**) (see par. 1.4)

Front end connection position (**1**-**4**) (see par. 1.4)

Drainage for second rod. Omit if not required (see par. 1.8)
0 = without drainage
E = external drainage with connection on the back end

Drainage (see par. 1.8)
0 = without drainage
E = external drainage with connection on the front end

Breathers (see par. 1.9)
0 = without breathers
S = front and back breathers

Cushioning (see par. 1.2):
0 = without cushioning
1 = front
2 = back
3 = front and back

Seals (see par. 1.5):
K = standard (nitrile + polyurethane)
M = low friction (nitrile + PTFE)
V = high temperature (viton + PTFE)

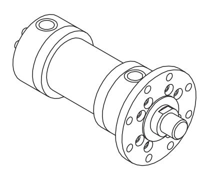
Stroke (mm) - For cylinders with spacers indicate the working stroke.

Double rod threading (omit if not required).
See single rod for dimensions

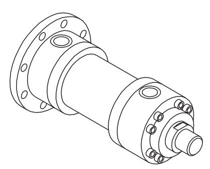
Double rod (omit if not required)
See single rod for dimensions. Not available with mounting style B-D-F.

Rod threading: Male thread (**standard**)
W = Female thread (see par. 4)

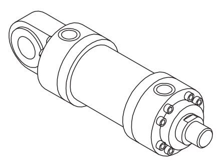
MOUNTING STYLE



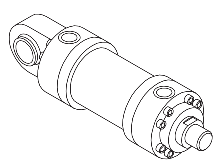
A= Front flange (MF3)



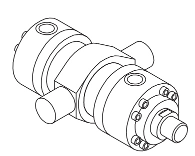
B= Rear flange (MF4)



D= Male clevis (MP3)



F= Spheric swivel (MP5)



L= Mid swinging (MT4)

Ø rod (mm)		Rods available for each bore											
32	**36**	•											
40	**45**		•										
50	**56**			•									
63	**70**				•								
80	**90**					•							
90	**100**						•						
100	**110**							•					
110	**125**								•				
125	**140**									•			
160	**180**										•		
200	**220**											•	
250	**280**												•
Bore (mm)		**50**	**63**	**80**	**100**	**125**	**140***	**160**	**180***	**200**	**250**	**320**	**400**

* Bores not considered by the standard ISO 6022

3 - ATEX 2014/34/UE RATED VERSION

ATEX 2014/34/UE rated version cylinders for installation in potentially explosive atmospheres are now available. The standard version of cylinders is ATEX II 2GD classified, whereas cylinders with proximity sensors are ATEX II 3GD classified.

The supply is always delivered accompanied by:

- the ATEX declaration of conformity
- the operating and maintenance user manual, where are described all the information for the proper use of cylinders in potentially explosive environments.

TYPE EXAMINATION CERTIFICATE N°: **CEC 10 ATEX 138**

3.1 - Identification code

To order the ATEX-rated version, simply insert the letter K in the initial part of the identification code. The description becomes HCK3-*.

For cylinders without end-stroke proximity sensors please order with the identification code shown at paragraph 2.

Example: HC**K**3C-200/125-350-K3-S-0-11/20

For cylinders equipped with end-stroke proximity sensors please refer to the identification code shown at paragraph 16.1.

Example: HC**K**3F-FP22-80/56-225-K3-S-0-11/20

The ATEX-rated cylinders equipped with end-stroke proximity sensors are compliant with the specifications listed paragraph 16; Also the same prescriptions described in that paragraph are effective. (NB: for bores Ø125 and Ø400 feasibility contact our technical department).

The proximity sensors are compliant with the description and the wiring diagram shown at the paragraph 16.2.

3.2 - Classification

Cylinders without end-stroke proximity sensors have this ATEX mark:

Ex II 2GD ck IIC T4 (-20°C Ta +80°C)

EX: Specific marking of explosion protection as ATEX 2014/34/UE directive and related technical specification requests.
II: Group II for surface plants
2: Category 2 high protection, eligible for zone 1 for gases and zone 21 for dust (automatically be eligible for zone 2 category 3 for gases and zone 22 for dust)
GD: for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures.
ck: protection by constructional safety and by liquid immersion
IIC: Gas group
(automatically eligible for group IIA and IIB)
T4: Temperature class for gas (max surface temperature)
-20°C Ta +80°C: Ambient temperature range

Cylinders with end-stroke proximity sensors have this ATEX mark:

Ex II 3GD ck IIC T4 (-20°C Ta +80°C)

EX: Specific marking of explosion protection as ATEX 2014/34/UE directive and related technical specification requests
II: Group II for surface plants
3: Category 3 standard protection, eligible for zone 2 for gases (zone 22 for dust)
GD: for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures.
ck: protection by constructional safety and by liquid immersion
IIC: Gas group
(automatically eligible for group IIA and IIB)
T4: Temperature class for gas (max surface temperature)
-20°C Ta +80°C: Ambient temperature range

3.3 - Operating temperatures

The operating ambient temperature must be between -20°C and +80 °C.

The fluid temperature for the standard version seals (K) and for low friction seals (M) must be between -20°C and +80°C, as for viton (V) seals must be between -20°C and +120 °C.

The actuators are T4 (T135° C) class temperature classified, so they are eligible for operation also at higher class temperature (T3, T2, T1 (T200° C).

3.4 - Admitted velocities

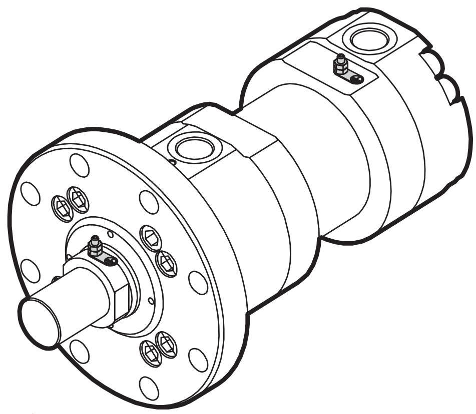
The maximum permissible speed is 0.5 m/s for standard cylinder seals (K) and 1 m/s for actuators with low friction seals (M) or Viton (V).

3.5 - Connectors

The connectors for the end-stroke proximity are available upon request. They are metal, to be wired. The ordering code is **0680961.** One connector per sensor is needed.

3.6 - Grounding points

The ATEX certified actuators are supplied with two grounding points, one on the rear head and one on the rod, for the wire of the cylinder with the ground (M4 screws).



The bottom grounding point must always be connected whereas the connection of the rod grounding point can be avoided in case the whole mechanical stroke is covered during the cylinder operating phase (from the mechanical stop on the cylinder head to the mechanical stop on the bottom), or in case the rod has already been grounded through the mechanical connection between the rod itself and the machine/plan it is installed on.

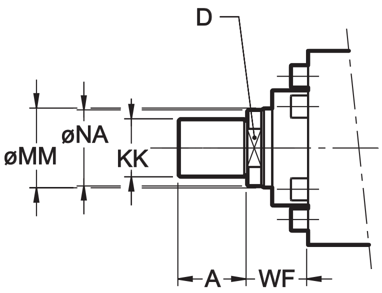
In order to verify such a condition it is necessary to test the equipotentiality of the parts and a maximum resistance equal to 100 Ω as per the EN13463-1 norm.

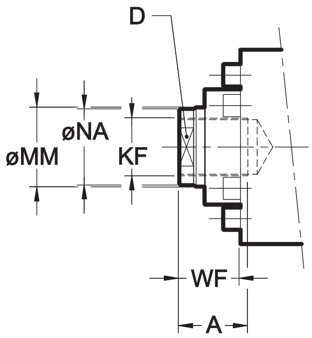
4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

Standard = male thread

W = female thread





* For bores Ø 180 (piston rod Ø 110) and higher, the rod has 4 holes at 90° realized on Ø NA and of Ø shown in the table.

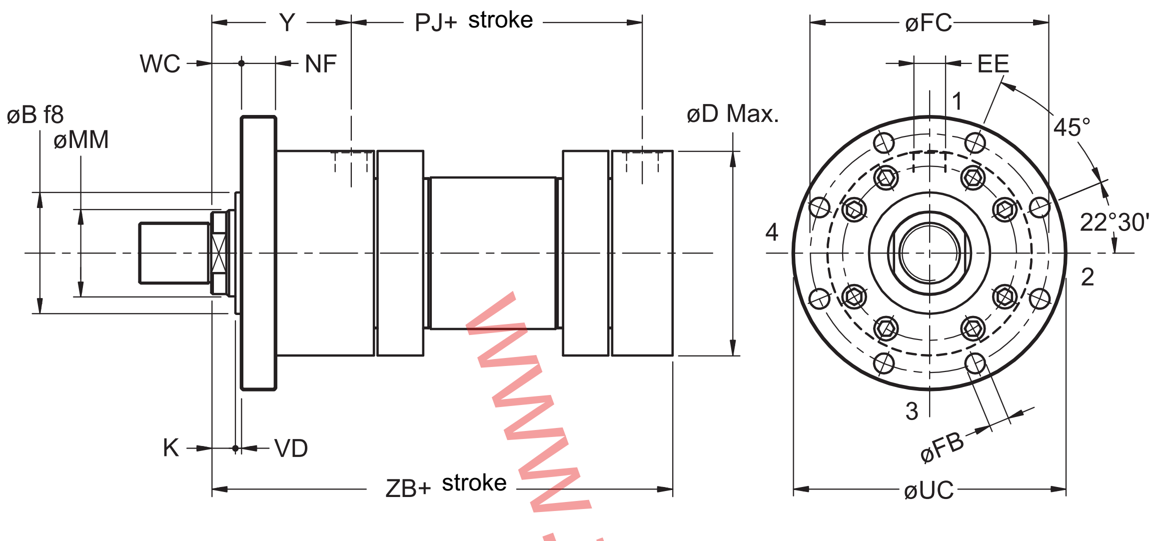
A pin wrench UNI 6752 - DIN 1810 must be used.

Bore	MM Ø rod	KK	Ø NA	KF	A	D	WF
50	32 36	M27x2	31 35	- M27x2	36	28 32	47
63	40 45	M33x2	38 43	- M33x2	45	34 36	53
80	50 56	M42x2	48 54	- M42x2	56	43 46	60
100	63 70	M48x2	60 67	- M48x2	63	53 60	68
125	80 90	M64x3	77 87	- M64x3	85	65 75	76
140	90 100	M72x3	87 96	- M72x3	90	75 85	76
160	100 110	M80x3	96 106	- M80x3	95	85 95	85
180	110 125	M90x3	106 121	- M90x3	105	95 ø 12*	95
200	125 140	M100x3	121 136	- M100x3	112	ø 12*	101
250	160 180	M125x4	155 175	- M125x4	125	ø 15*	113
320	200 220	M160x4	195 214	- M160x4	160	ø 15*	136
400	250 280	M200x4	245 270	- M200x4	200	ø 20*	163

5 - OVERALL AND MOUNTING DIMENSIONS   ISO **MF3**

A   FRONT FLANGE

dimensions in mm



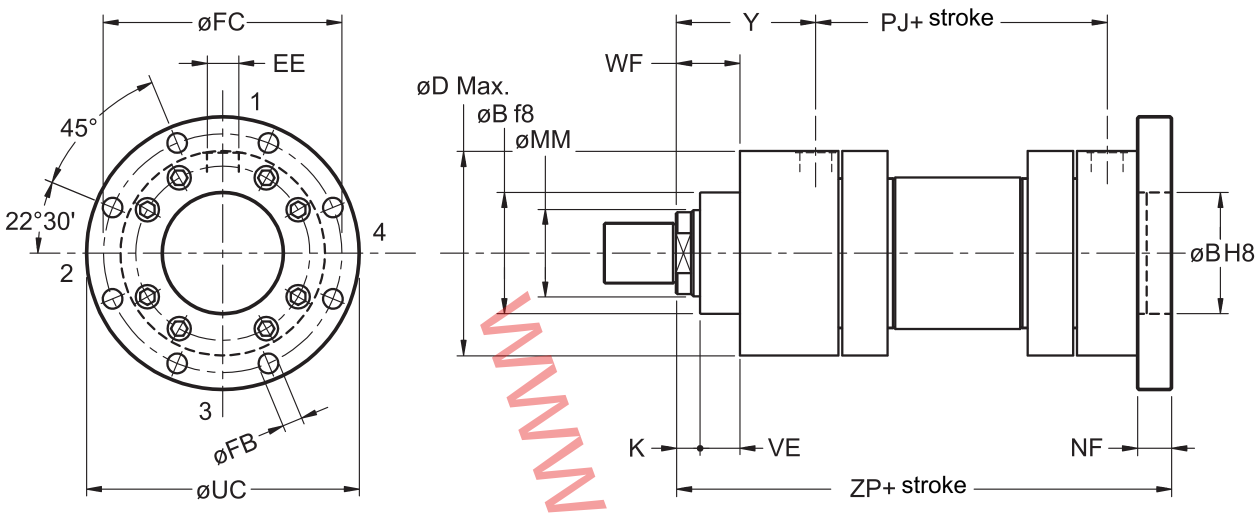
NOTE: Ø 400 bore has 12 equally spaced Ø FB holes in the mounting flange

Bore	MM Ø rod	ØB f8	ØD max	EE BSP	ØFB	ØFC	K	NF	PJ	ØUC	VD	WC	Y	ZB
50	32 36	63	105	1/2"	13,5	132	18	25	120	155	4	22	98	244
63	40 45	75	122	3/4"	13,5	150	21	28	133	175	4	25	112	274
80	50 56	90	145	3/4"	17,5	180	24	32	155	210	4	28	120	305
100	63 70	110	175	1"	22	212	27	36	171	250	5	32	134	340
125	80 90	132	210	1"	22	250	31	40	205	290	5	36	153	396
140	90 100	145	255	1. 1/4"	26	300	31	40	208	340	5	36	181	430
160	100 110	160	270	1. 1/4"	26	315	35	45	235	360	5	40	185	467
180	110 125	185	300	1. 1/4"	33	365	40	50	250	420	5	45	205	505
200	125 140	200	330	1. 1/4"	33	385	40	56	278	440	5	45	220	550
250	160 180	250	410	1. 1/2"	39	475	42	63	325	540	8	50	260	652
320	200 220	320	500	2"	45	600	48	80	350	675	8	56	310	764
400	250 280	400	628	2"	45 **NOTE**	720	53	100	360	800	10	63	333	775

6 - OVERALL AND MOUNTING DIMENSIONS ISO **MF4**

B BACK FLANGE

dimensions in mm



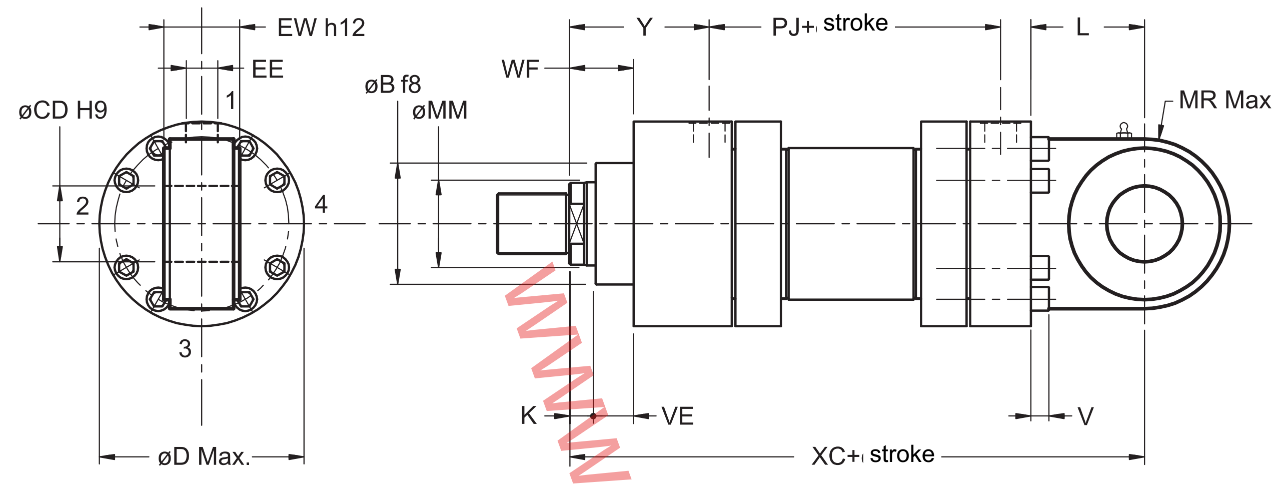
NOTE: Ø 400 bore has 12 equally spaced ØFB holes in the mounting flange

Bore	MM Ø rod	ØB f8	ØD max	EE BSP	ØFB	ØFC	K	NF	PJ	ØUC	VE	WF	Y	ZP
50	32 36	63	105	1/2”	13,5	132	18	25	120	155	29	47	98	265
63	40 45	75	122	3/4”	13,5	150	21	28	133	175	32	53	112	298
80	50 56	90	145	3/4”	17,5	180	24	32	155	210	36	60	120	332
100	63 70	110	175	1”	22	212	27	36	171	250	41	68	134	371
125	80 90	132	210	1”	22	250	31	40	205	290	45	76	153	430
140	90 100	145	255	1. 1/4”	26	300	31	40	208	340	45	76	181	465
160	100 110	160	270	1. 1/4”	26	315	35	45	235	360	50	85	185	505
180	110 125	185	300	1. 1/4”	33	365	40	50	250	420	55	95	205	550
200	125 140	200	330	1. 1/4”	33	385	40	56	278	440	61	101	220	596
250	160 180	250	410	1. 1/2”	39	475	42	63	325	540	71	113	260	703
320	200 220	320	500	2”	45	600	48	80	350	675	88	136	310	830
400	250 280	400	628	2”	45 **NOTE**	720	53	100	360	800	110	163	333	855

7 - OVERALL AND MOUNTING DIMENSIONS ISO **MP3**

D MALE CLEVIS
(with bushing)

dimensions in mm

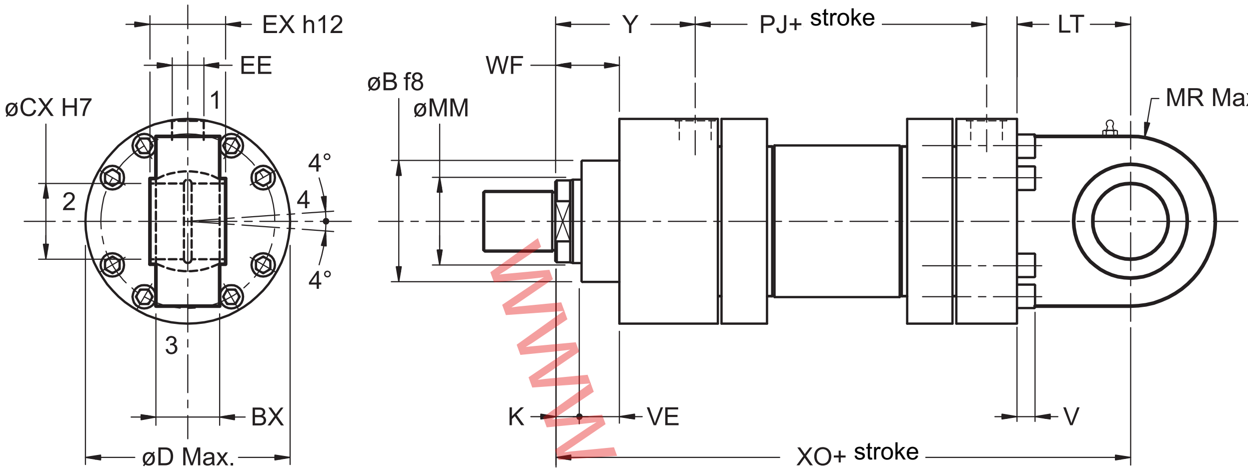


Bore	MM Ø rod	Ø B f8	Ø CD H9	Ø D max	EE BSP	EW h12	K	L	MR max	PJ	V	VE	WF	XC	Y
50	32 36	63	32	105	1/2”	32	18	61	35	120	8	29	47	305	98
63	40 45	75	40	122	3/4”	40	21	74	50	133	10	32	53	348	112
80	50 56	90	50	145	3/4”	50	24	90	61.5	155	12	36	60	395	120
100	63 70	110	63	175	1”	63	27	102	72.5	171	16	41	68	442	134
125	80 90	132	80	210	1”	80	31	124	90	205	16	45	76	520	153
140	90 100	145	90	255	1.1/4”	90	31	150	113	208	24	45	76	580	181
160	100 110	160	100	270	1.1/4”	100	35	150	125	235	24	50	85	617	185
180	110 125	185	110	315	1.1/4”	110	40	185	147.5	250	27	55	95	690	205
200	125 140	200	125	330	1.1/4”	125	40	206	160	278	24	61	101	756	220
250	160 180	250	160	410	1.1/2”	160	42	251	200	325	27	71	113	903	260
320	200 220	320	200	510	2”	200	48	316	250	350	36	88	136	1080	310
400	250 280	400	250	628	2”	250	53	300	320	360	42	110	163	1075	333

8 - OVERALL AND MOUNTING DIMENSIONS ISO MP5

F SPHERIC SWIVEL

dimensions in mm

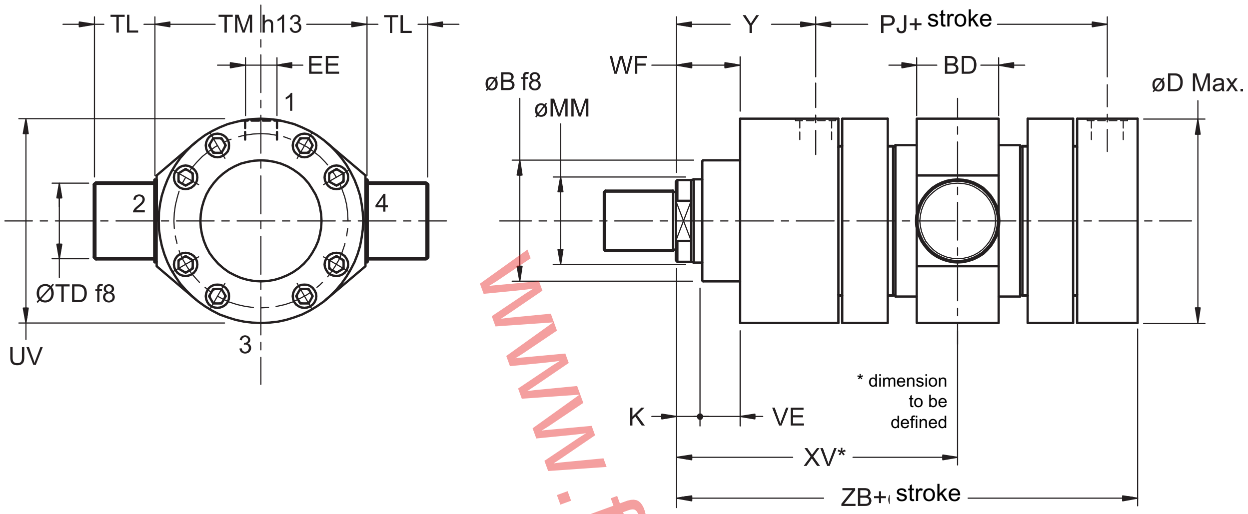


Bore	MM Ø rod	ØB f8	BX	ØCX H7	ØD max	EE BSP	EX h12	K	LT	MS max	PJ	V	VE	WF	XO	Y
50	32 36	63	27	32	105	1/2"	32	18	61	40	120	8	29	47	305	98
63	40 45	75	35	40	122	3/4"	40	21	74	50	133	10	32	53	348	112
80	50 56	90	40	50	145	3/4"	50	24	90	63	155	12	36	60	395	120
100	63 70	110	50	63	175	1"	63	27	102	71	171	16	41	68	442	134
125	80 90	132	60	80	210	1"	80	31	124	90	205	16	45	76	520	153
140	90 100	145	65	90	255	1.1/4"	90	31	150	113	208	24	45	76	580	181
160	100 110	160	70	100	270	1.1/4"	100	35	150	112	235	24	50	85	617	185
180	110 125	185	80	110	300	1.1/4"	110	40	185	147.5	250	27	55	95	690	205
200	125 140	200	102	125	330	1.1/4"	125	40	206	160	278	24	61	101	756	220
250	160 180	250	130	160	410	1.1/2"	160	42	251	200	325	27	71	113	903	260
320	200 220	320	162	200	500	2"	200	48	316	250	350	36	88	136	1080	310
400	250 280	400	192	250	628	2"	250	53	300	320	360	42	110	163	1075	333

9 - OVERALL AND MOUNTING DIMENSIONS ISO **MT4**

L MID SWINGING

dimensions in mm

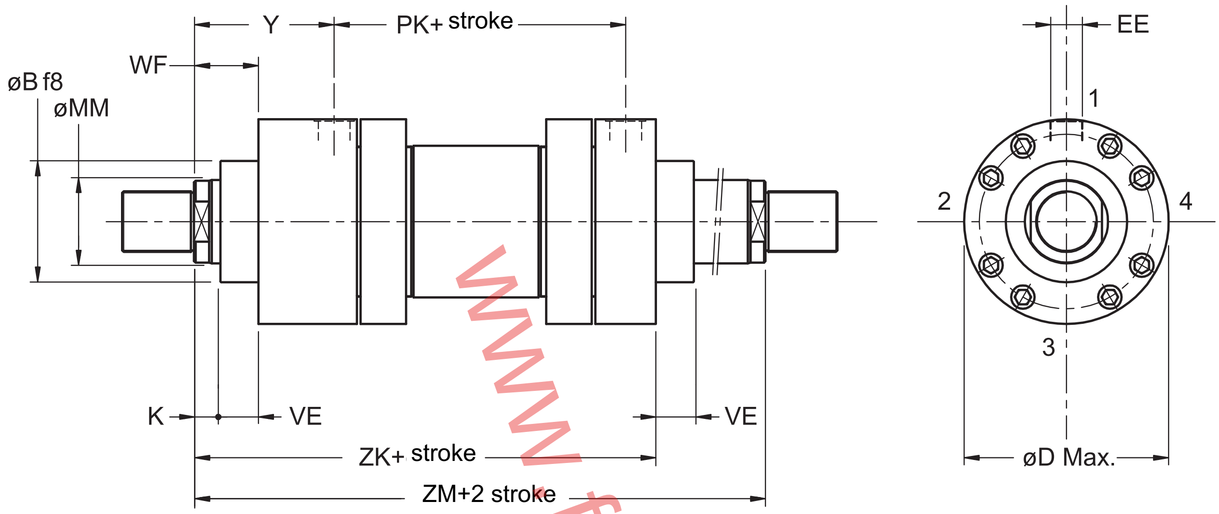


Bore	MM Ø rod	ØB f8	BD	stroke mm	ØD max	EE BSP	K	PJ	ØTD f8	TL	TM h13	ØUV	VE	WF	XV min	XV max + stroke	Y	ZB
50	32 36	63	38	45	105	1/2”	18	120	32	25	112	105	29	47	180	144	98	244
63	40 45	75	48	45	122	3/4”	21	133	40	32	125	122	32	53	195	160	112	274
80	50 56	90	58	60	145	3/4”	24	155	50	40	150	145	36	60	220	175	120	305
100	63 70	110	73	80	175	1”	27	171	63	50	180	175	41	68	245	185	134	340
125	80 90	132	88	95	210	1”	31	205	80	63	224	210	45	76	290	220	153	396
140	90 100	145	98	115	255	1. 1/4”	31	208	90	70	265	255	45	76	330	240	181	430
160	100 110	160	108	115	270	1. 1/4”	35	235	100	80	280	270	50	85	340	255	185	467
180	110 125	185	118	150	300	1. 1/4”	40	250	110	90	320	315	55	95	390	270	205	505
200	125 140	200	133	180	330	1. 1/4”	40	278	125	100	335	330	61	101	430	280	220	550
250	160 180	250	180	220	410	1. 1/2”	42	325	160	125	425	410	71	113	505	320	260	652
320	200 220	320	220	280	500	2”	48	350	200	160	530	510	88	136	590	380	310	764
400	250 280	400	270	420	628	2”	53	360	250	200	630	628	110	163	675	340	333	775

10 - OVERALL AND MOUNTING DIMENSIONS

DOUBLE ROD

dimensions in mm



For other dimensions and mounting styles please see single rod cylinder tables.
Not available for mounting styles B - D - F.

Bore	MM Ø rod	K	ØD max	EE BSP	PK	VE	WF	Y	ZM	ZK
50	32 36	18	105	1/2”	126	29	47	98	322	275
63	40 45	21	122	3/4”	134	32	53	112	358	305
80	50 56	24	145	3/4”	153	36	60	120	393	333
100	63 70	27	175	1”	165	41	68	134	433	365
125	80 90	31	210	1”	204	45	76	153	510	434
140	90 100	31	255	1. 1/4”	208	45	76	181	570	494
160	100 110	35	270	1. 1/4”	225	50	85	185	595	510
180	110 125	40	300	1. 1/4”	250	55	95	205	660	565
200	125 140	40	330	1. 1/4”	271	61	101	220	711	610
250	160 180	42	410	1. 1/2”	308	71	113	260	828	715
320	200 220	48	500	2”	350	88	136	310	970	834
400	250 280	53	628	2”	360	110	163	333	975	812

NOTE: Double rod cylinders are developed with two separate rods, fixed together by means of threading.

Because of this mounting style, the rod with female threading is less resistant than the other. To simplify the identification of the more resistant rod, the “**M**” marking is stamped on its end.

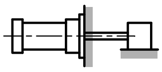
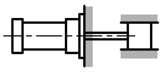
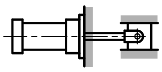
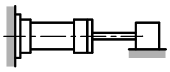
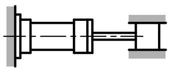
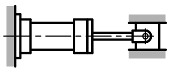
We recommend the use of the weaker rod for the less demanding applications.

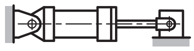
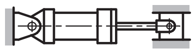
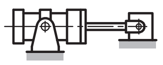
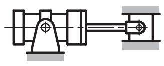
11 - ROD DIAMETER SELECTION

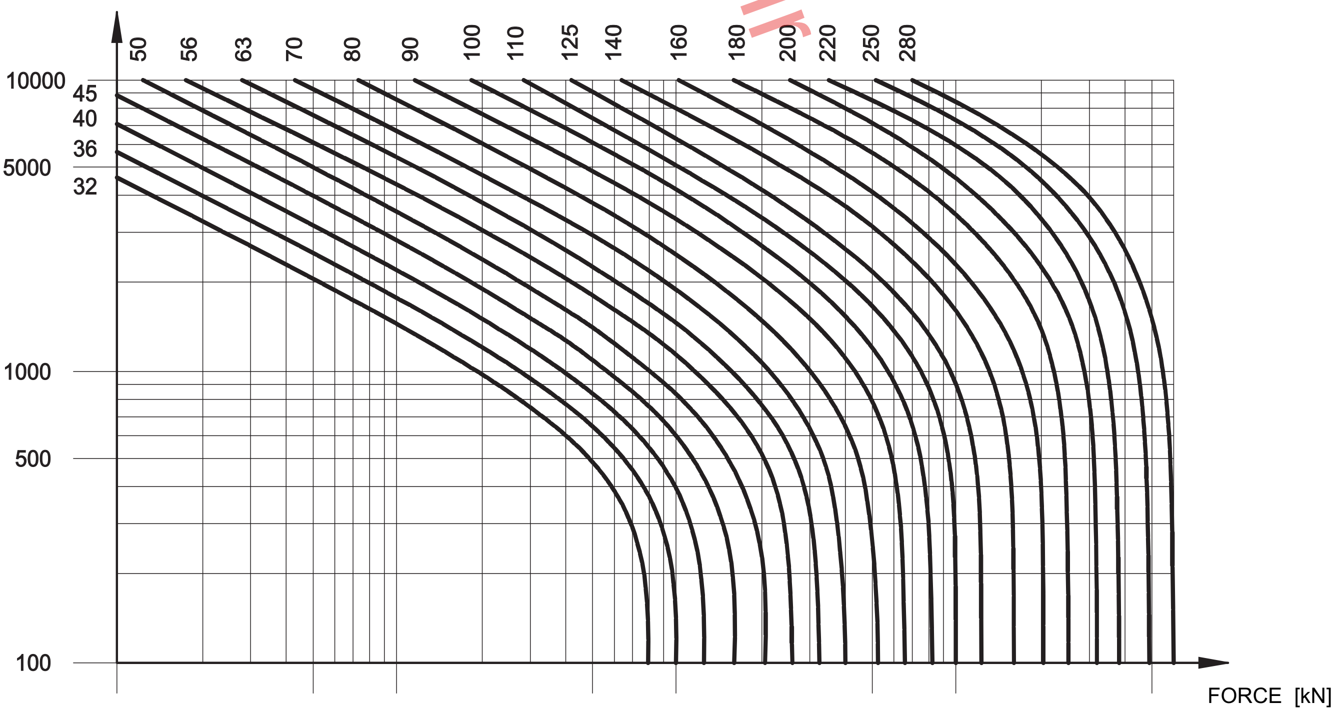
To ensure adequate stability, cylinders must be calculated for maximum compressive load according to the following simplified procedure:

- Refer to the table to identify the stroke factor according to the mounting style.
- To calculate the reference length, multiply the working stroke by the stroke factor.
- To calculate the thrust force, multiply the total cylinder area by the operating pressure.
- On the diagram, find the point of intersection between the thrust force and reference length.
- Identify the minimum rod diameter on the curve above the previous point of intersection.

Cylinders with rod diameters smaller than the value plotted in the diagram will not guarantee sufficient rigidity.

Mounting style	Rod connection	Mounting	Stroke factor
A	Fixed and supported		2
	Fixed and rigidly guided		0.5
	Jointed and rigidly guided		0.7
B	Fixed and supported		4
	Fixed and rigidly guided		1
	Jointed and rigidly guided		1.5

Mounting style	Rod connection	Mounting	Stroke factor
D - F	Jointed and supported		4
	Jointed and rigidly guided		2
L	Jointed and supported		3
	Jointed and rigidly guided		1.5



12 - THEORETICAL FORCES

Push force

$$Fs = P \cdot At$$

Pull force

$$Ft = P \cdot Aa$$

Bore mm	Ø rod mm	Total area mm²	Anular area mm²
50	32 36	1964	1159 946
63	40 45	3117	1861 1527
80	50 56	5027	3063 2564
100	63 70	7854	4737 4006
125	80 90	12272	7245 5910
140	90 100	15394	9032 7540
160	100 110	20106	12252 10603
180	110 125	25447	15943 13175
200	125 140	31416	19144 16022
250	160 180	49087	28981 23640
320	200 220	80425	49009 42412
400	250 280	125664	76576 64089

Fs = Force (extension) in N
Ft = Force (retraction) in N
At = Total area in mm²
Aa = Annular area in mm²
P = Pressure in MPa

1 bar = 0.1 MPa
1 kgf = 9.81 N

13 - THEORETICAL VELOCITIES

Configuration 1
The diagram illustrates a conventional cylinder application: the fluid is delivered by means of a directional control valve in alternation to the front chamber while the rear chamber is connected to tank and vice versa.

To calculate velocity and force, proceed as follows:

Velocity (extension)

$$V = \frac{Q \cdot 1000}{At \cdot 60}$$

Velocity (retraction)

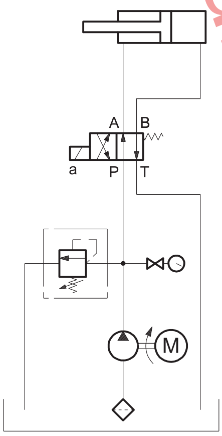
$$V = \frac{Q \cdot 1000}{Aa \cdot 60}$$

Force (extension)

$$F = P \cdot At$$

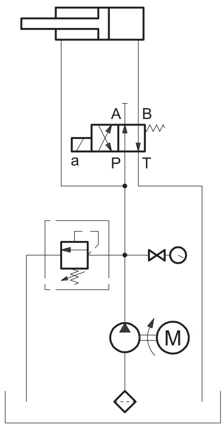
Force (retraction)

$$F = P \cdot Aa$$



Configuration 2
When the system requires high velocity with relatively low forces, we recommend using a regenerative circuit. Diagram 2 illustrates the simplest version of this type of set-up.

The annular chamber is permanently connected to the pump while the full bore end is connected alternately to the pump, in which case the piston rod extends as a result of the differential areas (both chambers are supplied at the same pressure), and to tank, in which case the piston rod retracts.



Velocity (extension)

$$V = \frac{Q \cdot 1000}{As \cdot 60}$$

Velocity (retraction)

$$V = \frac{Q \cdot 1000}{Aa \cdot 60}$$

Force (extension)

$$F = P \cdot As$$

Force (retraction)

$$F = P \cdot Aa$$

V = Velocity in m/s
Q = Flow rate in l/min
At = Total area (piston bore) in mm²
Aa = Annular area (At - As) in mm²
F = Force in N
P = Pressure in MPa
As = Rod area (At - Aa) in mm²
Qd = Flow rate through directional control valve (Q+return flow rate from small chamber) in l/min

1 bar = 0.1 MPa
1 kgf = 9.81 N

NOTE: In the case of regenerative circuits, the sizing of the directional control valve is fundamental. Flow rate through the directional control valve is calculated according to the following formula:

$$Qd = \frac{V \cdot At \cdot 60}{1000}$$

14 - MASSES

Bore	Ø rod	Mass for null stroke			Mass for 10 mm stroke
		Mounting style			
		A -B	D - F	L	
mm	mm	kg	kg	kg	kg
50	32 36	14	16	17	0,2
63	40 45	28	27	27	0,3
80	50 56	39	38	39	0,5
100	63 70	61	62	63	0,6 0,7
125	80 90	103 104	107 108	110	0,9 1
140	90 100	164	173	175	1,1 1,2
160	100 110	198 199	210	208 209	1,6 1,7
180	110 125	289	296 297	298 299	2 2,2
200	125 140	356 357	365 366	364 365	2,2 2,4
250	160 180	666 667	698 700	685 687	3,2 3,6
320	200 220	1200 1250	1314 1365	1259 1310	5,1 5,6
400	250 280	2180 2250	2259 2330	2249 2320	7 7,5

15 - SEAL KIT IDENTIFICATION CODE

S	K	/	H	C	3	-		/		/		-		/	10

Seal kit

Bore (mm)

Rod (mm)

Double rod (omit if not required)

Seals:
K = standard (nitrile + polyurethane)
M = low friction (nitrile + PTFE)
V = high temperature (viton + PTFE)

Series no. indicated on cylinder

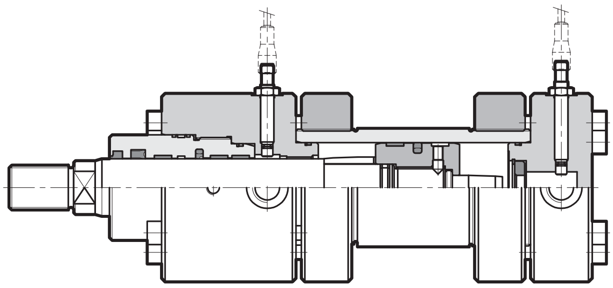
NOTE: the seal kit includes all the seals of a full-options cylinder (cushionings and external drain).

16 - END-STROKE PROXIMITY SENSORS

Upon request, cylinders can be supplied with end-stroke proximity sensors type PNP, with normally open output. They are mounted on the front and rear end of the cylinder and they supply an electric signal when the piston rod reaches the stroke end. They are available for all cylinder mounting styles, on both ends and for every available bore.

In order to ensure the correct functioning of the system, cylinders must be equipped with cushionings.

These sensors can be only used to provide the switching signal and not to control voltage loads.



16.1 - Identification code

K = Explosion-proof version according to ATEX 2014/34/UE (paragraph 3). Omit if not required.

H	C		3		-	F	P			-	

For the remaining part of the code refer to paragraph 2, starting from the definition of bore/rod

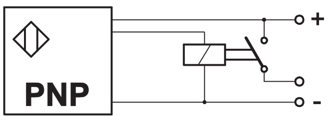
Pos. proximity sensor of the rear end (**1-4**) (see par. 1.4)
0 = without rear proximity sensor

Mounting style (see par. 2)

Pos. proximity sensor of the front end (**1-4**) (see par. 1.4)
0 = without front proximity sensor

End-stroke proximity sensor

16.2 - Technical characteristics and electrical connection



Rated voltage	VDC	24
Power supply voltage range	VDC	10 ÷ 30
Absorbed current	mA	200
Output	normally open contact	
Electric protection	polarity inversion short circuit overvoltage	
Electric connection	with connector	
Maximum operating pressure	bar	500
Operating temperature range	°C	-25 / +80
Class of protection according IEC EN 60529 (atmospheric ag.)		IP 68
Piston position LED (**NOTE**)		NO (it's on the connector)

16.3 - Connectors

Connectors for proximity sensors must be ordered separately, by specifying the code: **ECM3S/M12L/10**

NOTE: These connectors are not suitable for ATEX-rated cylinders. The connectors for the ATEX-rated cylinders are described at paragraph 3.5.

Connector: pre-wired connector M12 - IP68
Cable: with 3 conductors 0.34 mm² - length 5 mt.
Cable material: polyurethane resin (oil resistant)

The connector has two LEDs, one green and one yellow.

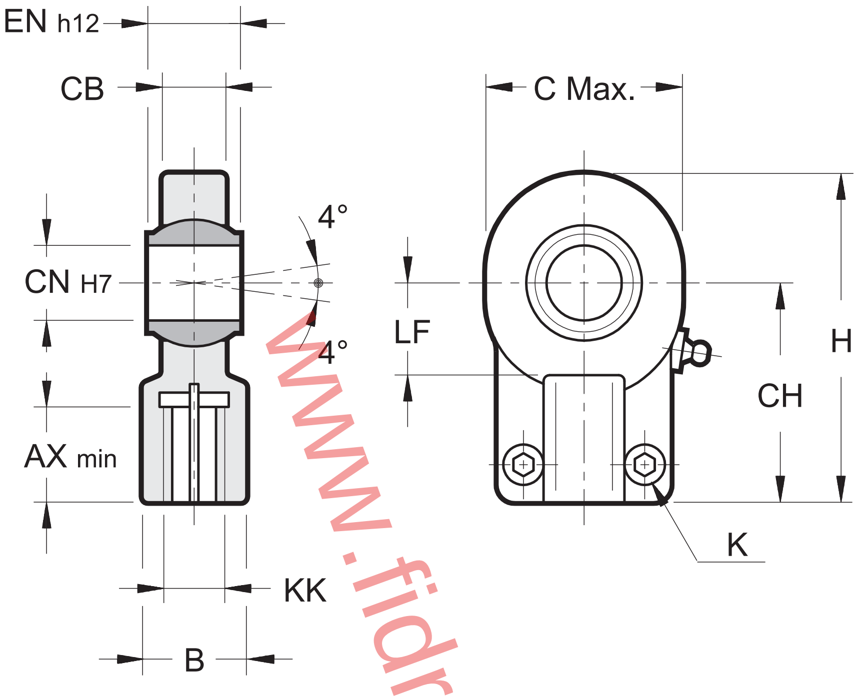
GREEN: Connector power supply.
The LED burn when the connector is supplied.

YELLOW: position signal.
ON - piston at stroke end
OFF - piston not at stroke end

17 - OVERALL AND MOUNTING DIMENSIONS

SPHERIC SWIVEL ISO 6982 / DIN 24338

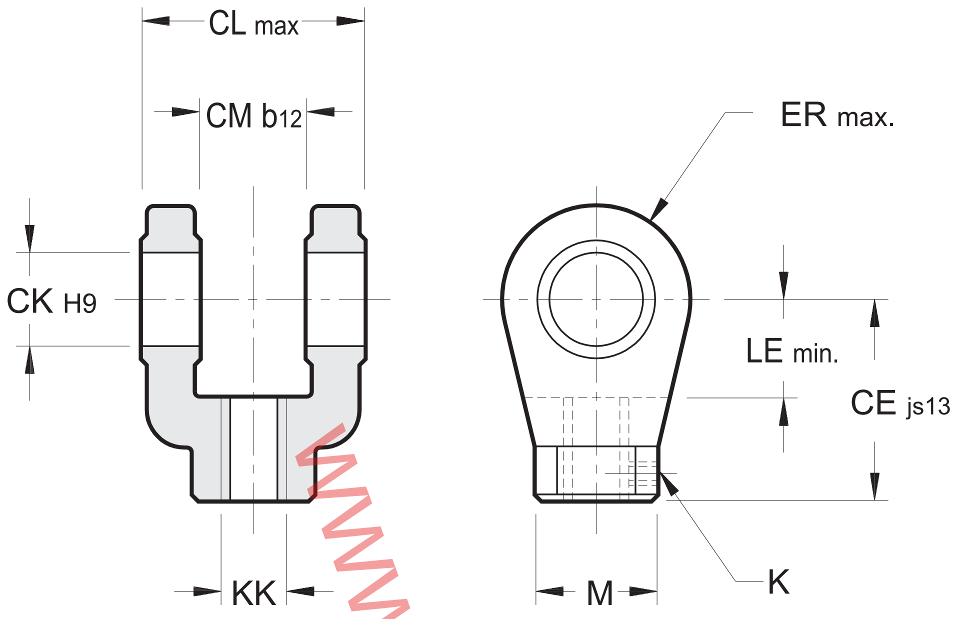
Dimensions in mm



Type	Ø cylinder bore	AX min	B	C max	CB	CH	Ø CN H7	EN h12	H	KK	LF	BOLT K UNI 5931	Torque Nm	Max load kN	Mass Kg
LSF-36	50	37	38	71	28	80	32	32	119	M27x2	32	M10x25	49	67	1.17
LSF-45	63	46	47	90	33	97	40	40	146	M33x2	41	M10x30	49	100	2.15
LSF-56	80	57	58	109	41	120	50	50	180	M42x2	50	M12x35	86	156	3.75
LSF-70	100	64	70	132	53	140	63	63	212	M48x2	62	M16x40	210	255	7
LSF-90	125	86	90	170	67	180	80	80	271	M64x3	78	M20x50	410	400	13.8
LSF-100	140	91	100	185	72	195	90	90	296	M72x3	85	M20x60	410	490	19.1
LSF-110	160	96	110	224	84	210	100	100	322	M80x3	98	M24x60	710	610	25
LSF-125	180	106	125	235	88	235	110	110	364	M90x3	105	M24x60	710	655	32
LSF-140	200	113	135	290	102	260	125	125	405	M100x3	120	M24x70	710	950	46
LSF-180	250	126	165	346	130	310	160	160	480	M125x4	150	M24x80	710	1370	82.5
LSF-220	320	161	215	460	162	390	200	200	620	M160x4	195	M30x100	1500	2120	168

18 - OVERALL AND MOUNTING DIMENSIONS

FEMALE CLEVIS ISO 8133



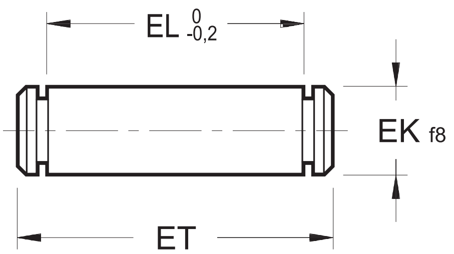
Dimensions in mm

Type	Ø cylinder bore	M CH	CE js13	Ø CK H9	CL max	CM b12	ER max	KK	LE min	K bolt	Max load kN	Mass kg
FRC-36	50	40	75	28	83	40	34	M27x2	39	M6x6	80	1.8
FRC-45	63	56	99	36	103	50	50	M33x2	54	M8x8	125	3.7
FRC-56	80	56	113	45	123	60	53	M42x2	57	M8x8	200	5.6
FRC-70	100	75	126	56	143	70	59	M48x2	63	M12x12	320	9.3
FRC-90	125	95	168	70	163	80	78	M64x3	83	M12x12	500	20
FRC-110	160	95	168	70	163	80	78	M80x3	83	M12x12	500	20

19 - OVERALL AND MOUNTING DIMENSIONS

FEMALE CLEVIS ISO 8133
with spring retainers

Dimensions in mm



Type	Ø EK f8	EL 0 / - 0.2	ET	Mass kg
PNF-36	28	87	96	0.5
PNF-45	36	107	120	1
PNF-56	45	129	144	1.8
PNF-70	56	149	164	3.2
PNF-90	70	169	187	5.6

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CRE

DIRECT OPERATED PRESSURE CONTROL VALVE WITH ELECTRIC PROPORTIONAL CONTROL

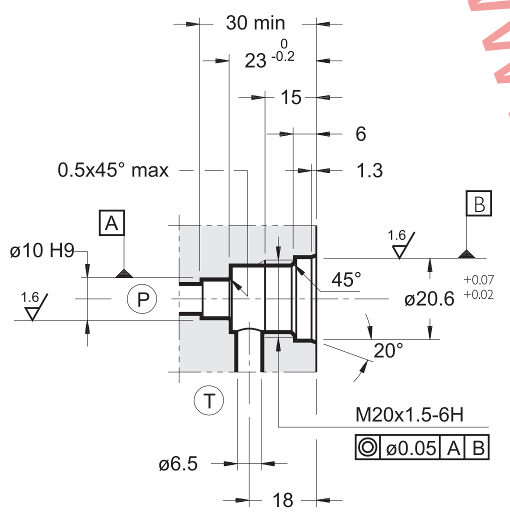
SERIES 20

CARTRIDGE TYPE

p max **350** bar

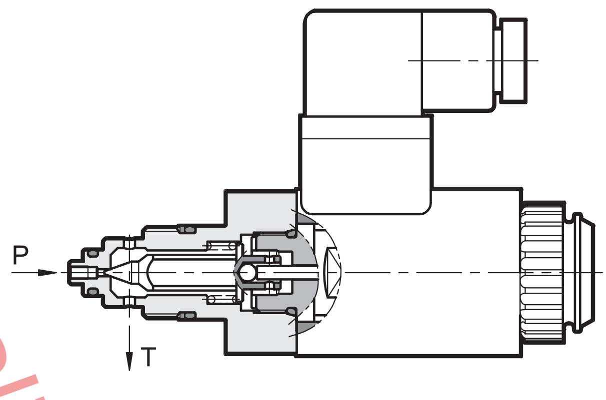
Q max **1,5** l/min

SEAT DIMENSIONS: D-10A



NOTE: Provide seat for optional restrictor in T line

OPERATING PRINCIPLE



— The CRE valve is a direct operated pressure control valve with electric proportional control with cartridge execution which can be used in blocks and panels with type D-10A seat.

— The valve is suitable as a pilot stage for remote control of two stage pressure control and reducing valves.

— Pressure adjustment can be continuous in proportion to the current supplied to the solenoid.

— The valve can be controlled directly by a current control power supply unit or by means of the relative electronic control units to exploit valve performance to the full (see paragraph 8).

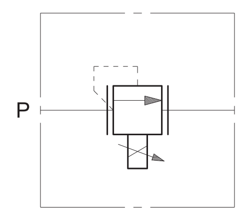
— The valve is available in three pressure control ranges up to 250 bar.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Maximum operating pressure: - P port - T port	bar	 350 2
Minimum controlled pressure	see Δp-Q diagram	
Nominal flow Maximum flow	l/min	0,5 1,5
Step response	see paragraph 5	
Hysteresis (with PWM 200 Hz)	% of p nom	< 5%
Repeatability	% of p nom	< ±1,5%
Electrical characteristic	see paragraph 4	
Ambient temperature range	°C	-10 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass:	kg	0,54

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

C	R	E	-		/	20		-		K1

Pressure control valve cartridge type

Electrical proportional control

Pressure control range
070 = up to 70 bar
140 = up to 140 bar
250 = up to 250 bar

Coil electrical connection: plug for connector type DIN 43650 (**standard**)

D12 = Nominal solenoid voltage 12 VCC
D24 = Nominal solenoid voltage 24 VCC

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

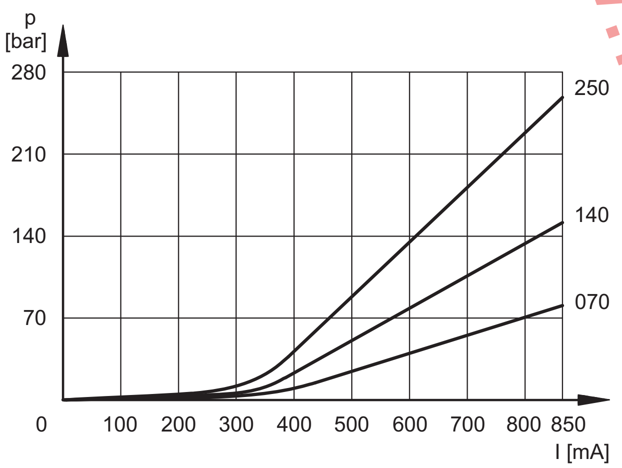
Series No. (from 20 to 29 sizes and mounting dimensions remain unchanged)

2 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

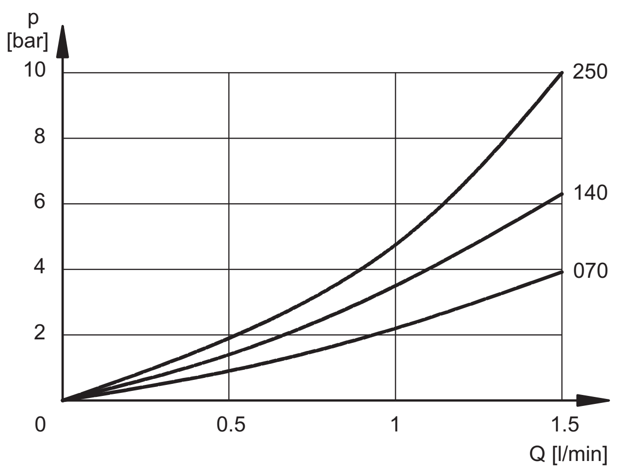
Typical control curves according to the current supplied to the solenoid, measured with input flow rate Q=0,5 l/min.

The curves are obtained without any hysteresis and linearity compensation and they are measured without any backpressure in T.

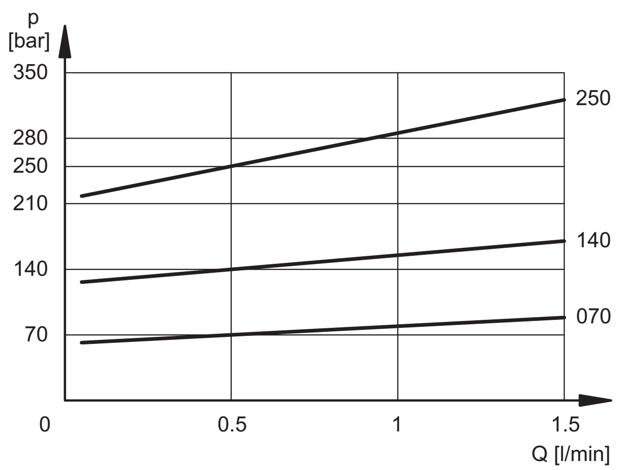
PRESSURE CONTROL p = f (I)



MINIMUM CONTROLLED PRESSURE p min = f (Q)



PRESSURE VARIATION p max = f (Q)



3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N).
For fluids HFDR type (phosphate esters) use FPM seals (code V).

For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - ELECTRICAL CHARACTERISTICS

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	12	24
RESISTANCE (at 20°C)	Ω	3.66	16.6
MAXIMUM CURRENT	A	1.9	0.85
DUTY CYCLE		100%	
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CEE		
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529)	IP 65		

5 - STEP RESPONSE (obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical step response times measured with a valve of pressure range up to 140 bar and with input flow rate Q = 0,5 l/min.

REFERENCE SIGNAL STEP	0 → 100%	100 → 0%
Step response [ms]	80	40

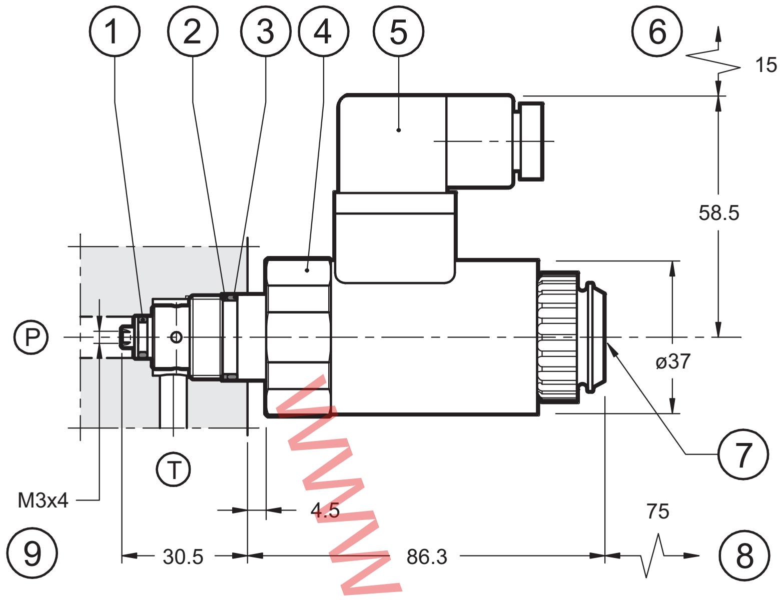
6 - INSTALLATION

We recommend to install the CRE valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 2.

Ensure that there is no air in the hydraulic circuit. In particular applications, it can be necessary to vent the air entrapped in the solenoid tube, by using the apposite drain screw in the solenoid tube. Ensure that the solenoid tube is always filled with oil (see par. 7). At the end of the operation, make sure of having screwed correctly the drain screw.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value. Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

7 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

1	OR type 2025 (6.07x1.78)
2	PARBAK type 8-017 (18.01x1.14x1.35)
3	OR type 2068 (17.17x1.78)
4	Hex: spanner 36, torque 45 ÷ 50 Nm
5	DIN 43650 electric connector
6	Connector removal space
7	Breather (male hexagonal spanner 4)
8	Coil removal space
9	Seat for optional calibrated flow restrictor

NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (7) placed at the end of the solenoid tube.

* The measurement 4,5 mm can be reduced to 0,5 mm by increasing the axial dimensions of the D-10A, seat by 4 mm.

8 - ELECTRONIC CONTROL UNITS

EDC-112	for solenoid 24V DC	plug version	see cat.89 120
EDC-142	for solenoid 12V DC		
EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		
UEIK-11	for solenoid 24V DC	Eurocard type	see cat. 89 300

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DUPLOMATIC OLEODINAMICA

PRED3

DIRECT OPERATED PRESSURE CONTROL VALVE WITH ELECTRIC PROPORTIONAL CONTROL

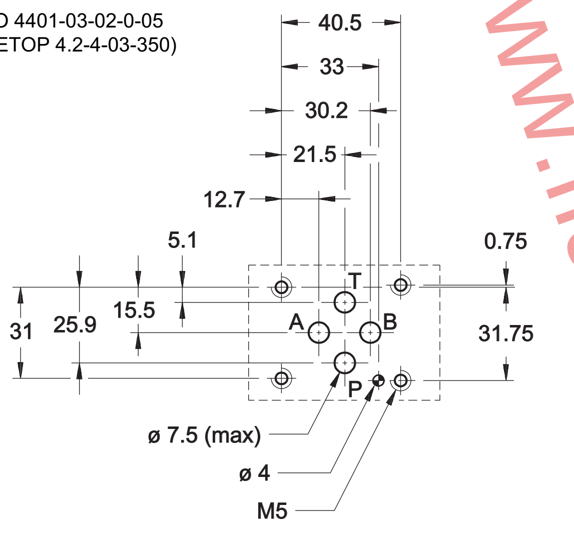
SERIES 10

SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

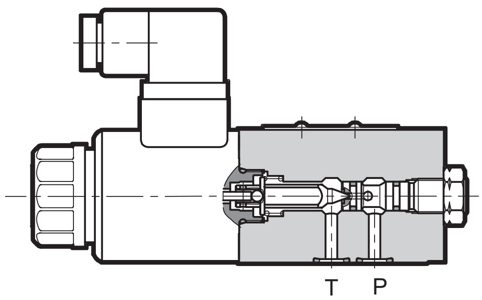
p max **350** bar
Q max **3** l/min

MOUNTING SURFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



OPERATING PRINCIPLE



— The PRED3 valve is a direct operated pressure control valve with electric proportional control and mounting interface in compliance with ISO 4401 (CETOP RP 121H) standards.

— It is suitable to pilot two-stage valves, or for pressure control in hydraulic circuits.

— Pressure can be modulated continuously in proportion to the current supplied to the solenoid.

— The valve can be controlled directly by a current control supply unit or by means of the relative electronic control units to exploit valve performance to the full (see par. 8).

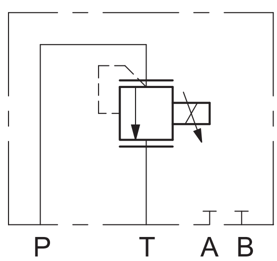
— The valve is available in four pressure control ranges up to 350 bar.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Maximum operating pressure: - P port - T port	bar	350 2
Minimum controlled pressure	see p min = f(Q) diagram	
Nominal flow Maximum flow (see p min = f(Q) diagram)	l/min	1 3
Step response	see paragraph 5	
Hysteresis (with PWM 200 Hz)	% of p nom	< 5%
Repeatability	% of p nom	< ±1,5%
Electrical characteristic	see paragraph 4	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	1,5

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

P R E D 3 - [ ] / 10 [ ] - [ ] K1

- Pressure control valve (PR)
- Electrical proportional control (E)
- direct operated (D)
- Size ISO 4401-03 (CETOP 03) (3)
- Pressure control range:
  - **070** = 0,7 - 70 bar
  - **140** = 1,1 - 140 bar
  - **210** = 1,8 - 210 bar
  - **350** = 2,8 - 350 bar
- Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)
- Seals:
  - **N** = NBR seals for mineral oil (**standard**)
  - **V** = FPM seals for special fluids
- **D12** = Nominal solenoid voltage 12V DC
- **D24** = Nominal solenoid voltage 24V DC
- Coil electrical connection: plug for connector type DIN 43650 (**standard**) (K1)

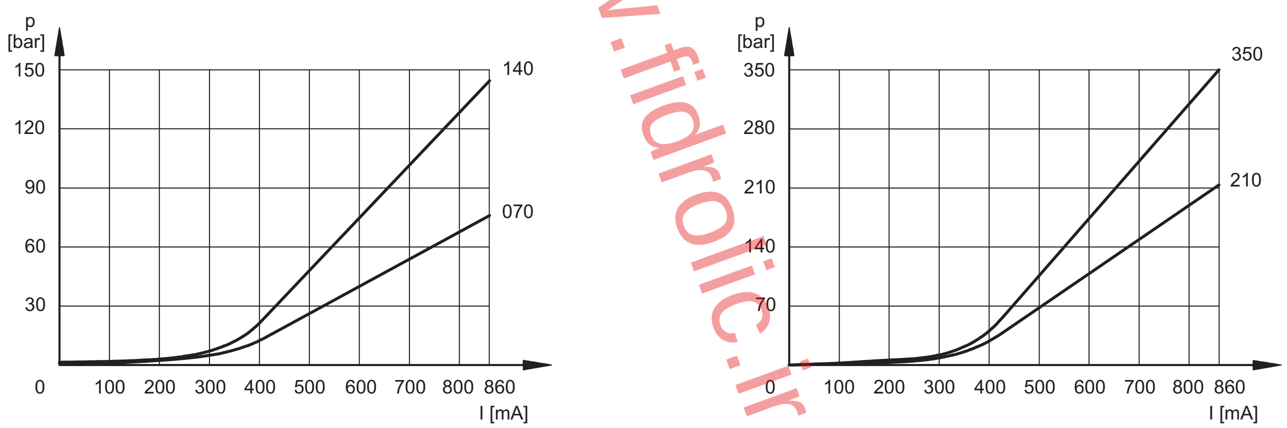
2 - CHARACTERISTIC CURVES

(measured with viscosity of 36 cSt at 50°C)

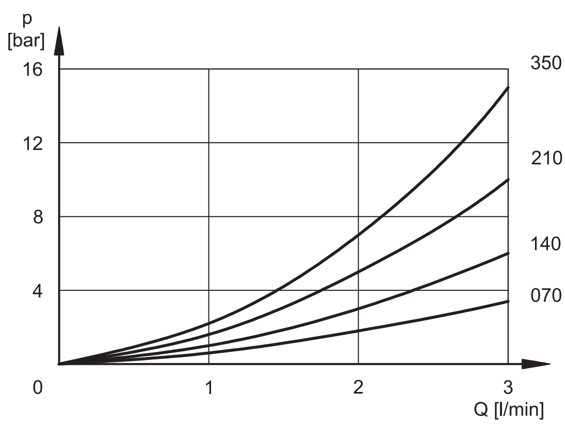
Typical control curves according to the current supplied to the solenoid for pressure control ranges: 070, 140, 210, 350, measured with input flow rate Q =1 l/min.

The curves are obtained without any hysteresis and linearity compensation and they are measured without any backpressure in T. The full scale pressure is set in factory with a flow rate of 1 l/min. In case of higher flow rate, the full scale pressure will increase considerably (see diagram pmax = f (Q)).

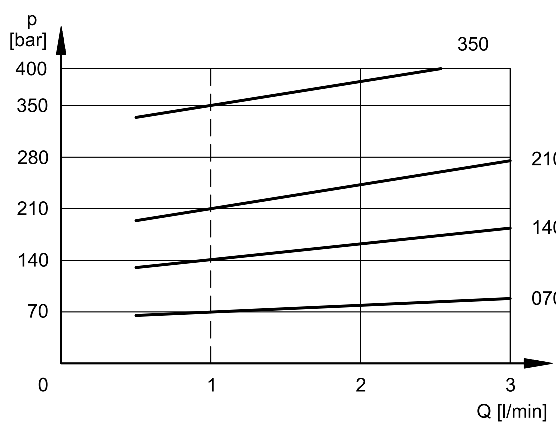
PRESSURE CONTROL p = f(I)



MINIMUM CONTROLLED PRESSURE p min = f (Q)



PRESSURE VARIATION p max = f (Q)



Q = 1 lt/min
factory setting

3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - ELECTRICAL CHARACTERISTICS

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	**12**	**24**
RESISTANCE (at 20°C)	Ω	3.66	17.6
NOMINAL CURRENT	A	1.88	0.86
DUTY CYCLE	100%		
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/EC		
CLASS OF PROTECTION: atmospheric agents (CEI EN 60529) coil insulation (VDE 0580) Impregnation	 IP 65 class H class F		

5 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical step response times measured with a valve of pressure range up to 140 bar and with an input flow rate of Q = 2 l/min.

REFERENCE SIGNAL STEP	0 → 100%	100 → 0%
Step response [ms]	80	40

6 - INSTALLATION

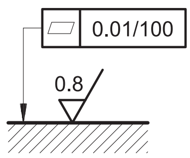
We recommend to install the PRED3 valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 2.

Ensure that there is no air in the hydraulic circuit. In particular applications, it can be necessary to vent the air entrapped in the solenoid tube, by using the apposite drain screw in the solenoid tube. Ensure that the solenoid tube is always filled with oil (see par. 7). At the end of the operation, make sure of having screwed correctly the drain screw.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value. Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

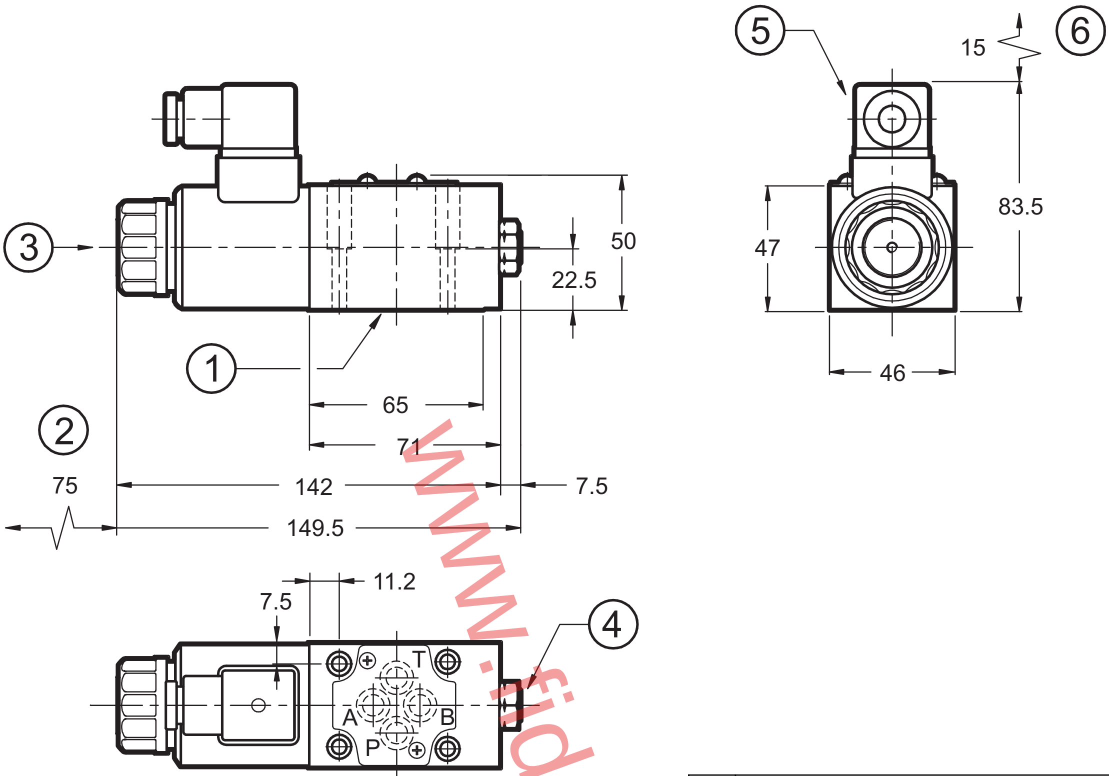
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Surface finishing



7 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (3) placed at the end of the solenoid tube.

Valve fastening: 4 SHC screws M5x30 - ISO 4762
Tightening torque: 5 Nm (A 8.8 screws)
Threads of mounting holes: M5x10

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25 x 1.78) - 90 shore
2	Coil removal space
3	Breather (Allen key 4)
4	Factory setting sealing (we recommend not unscrewing the nut)
5	DIN 43650 electric connector (included in the delivery)
6	Connector removal space

8 - ELECTRONIC CONTROL UNITS

EDC-112	for solenoid 24V DC	plug version	see cat. 89 120
EDC-142	for solenoid 12V DC		
EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		

9 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G with ports on rear
PMMD-AL3G with side ports
Ports dimensions: P, T, A, B: 3/8” BSP thread

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DUPLOMATIC OLEODINAMICA

PRED3G

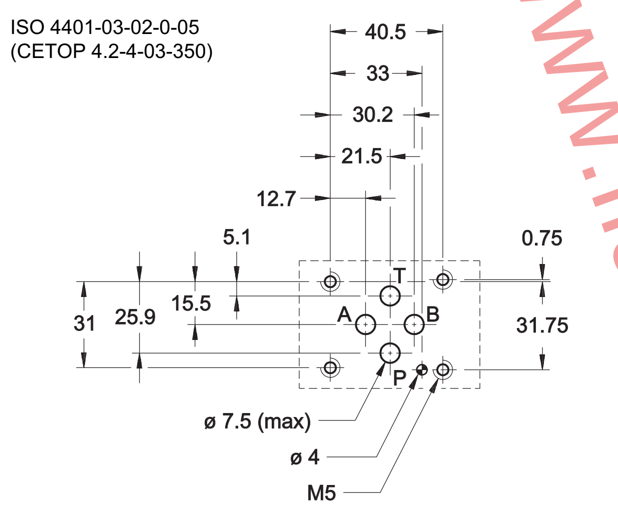
PRESSURE CONTROL VALVE WITH PROPORTIONAL CONTROL AND INTEGRAL ELECTRONICS

SERIES 30

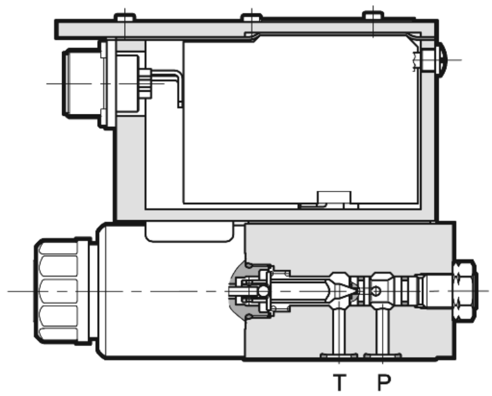
SUBPLATE MOUNTING
ISO 4401-03

p max **350** bar
Q max **3** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



— The PRED3G valve is a direct operated pressure control valve with integrated electric proportional control and mounting interface in compliance with ISO 4401 standards.

— It is suitable to pilot two-stage valves, for pressure control in hydraulic circuits.

— The valves are available with command signal in voltage or current and on board electronics with internal enable, external enable or 0V monitor on pin C.

— A solenoid current monitoring signal is available.

— They are available in four pressure control ranges, up to 350 bar.

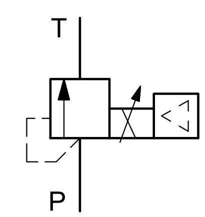
— Some parameters are customizable using the appropriate kit for start-up.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Maximum operating pressure: - P port - T port	bar	350 2
Nominal flow Maximum flow (see diagram p min = f(Q))	l/min	1 3
Step response	see paragraph 6	
Hysteresis	% of p nom	< 3%
Repeatability	% of p nom	< ±1%
Electrical characteristic	see paragraph 2	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	2

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

P	R	E	D	3	G	-		/	30		-		K11	

Pressure control valve

Electro-proportional control

Direct operated

Size ISO 4401-03

Digital integrated electronics for open loop

Pressure control range
070 = 0,7 - 70 bar
140 = 1,1 - 140 bar
210 = 1,8 - 210 bar
350 = 2,8 - 350 bar

Series No.
(the overall and mounting dimensions remain unchanged from 30 to 39)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Reference signal:
E0 = voltage 0 ÷ 10 V
E1 = current 4 ÷ 20 mA

Main connector 6 pin + PE

Pin C function:
A = external enable
B = internal enable
C = 0V monitor

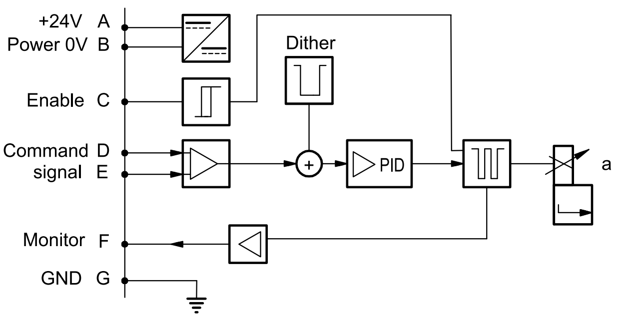
2 - ELECTRICAL CHARACTERISTICS

2.1 - Electrical on board electronics

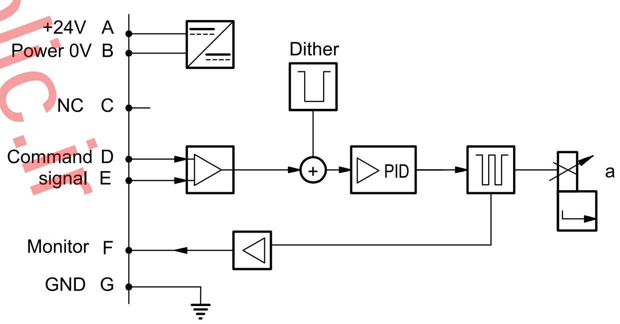
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		2A time lag
Command signals: voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (current to solenoid): voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2004/108/EC standards

2.2 - On-board electronics diagrams

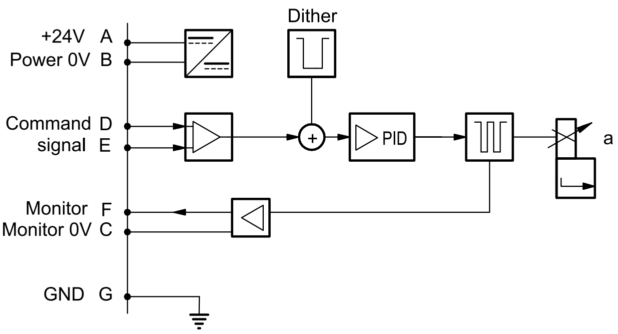
VERSION **A** - External Enable



VERSION **B** - Internal Enable

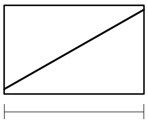


VERSION **C** - 0V Monitor

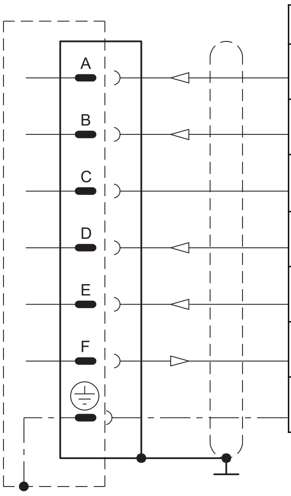


3 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal is between 0…10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**0V**	**+10V**
MONITOR	**0V**	**+10V**

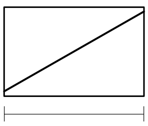


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	0 ÷ 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	0 ÷ 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

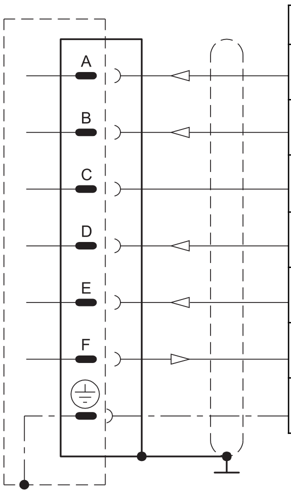
4 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**4 mA**	**20 mA**
MONITOR	**4 mA**	**20 mA**



Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

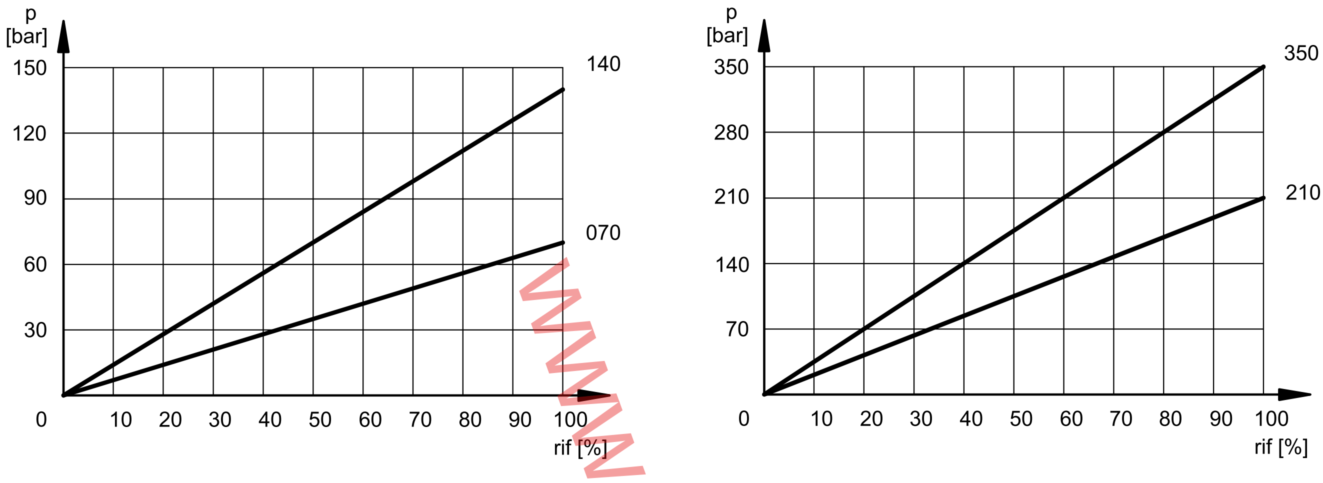
5 - CHARACTERISTIC CURVES

(measured with viscosity of 36 cSt at 50°C)

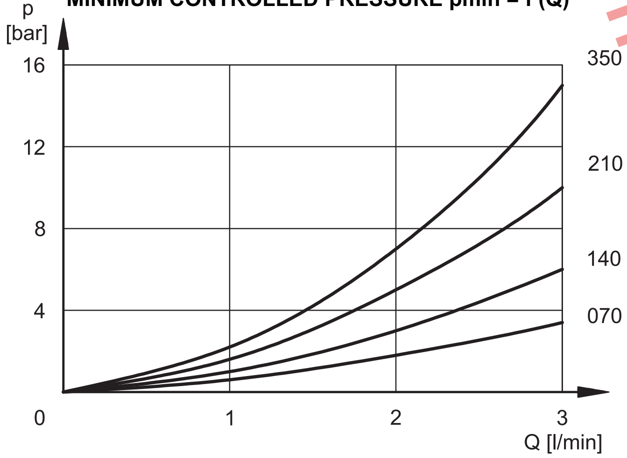
Typical control curves according to the current supplied to the solenoid for pressure control ranges: 070, 140, 210, 350, measured with input flow rate Q = 1 l/min. The curves are obtained after linearization in factory of the characteristic curve through the digital amplifier, and they are measured without any backpressure in T.

The full scale pressure is set in factory with a flow rate of 1 l/min. In case of higher flow rate, the full scale pressure will increase considerably. See diagram pmax = f (Q).

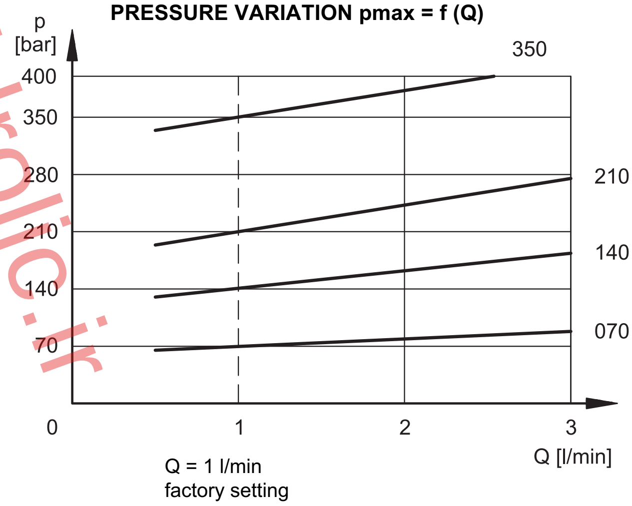
PRESSURE CONTROL p=f (I)



MINIMUM CONTROLLED PRESSURE pmin = f (Q)



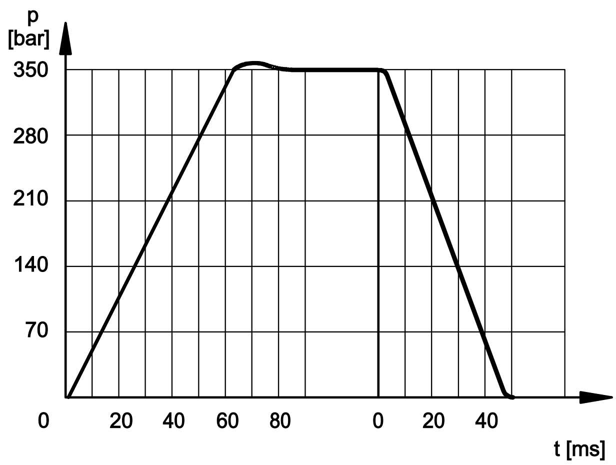
PRESSURE VARIATION pmax = f (Q)



6 - RESPONSE TIMES

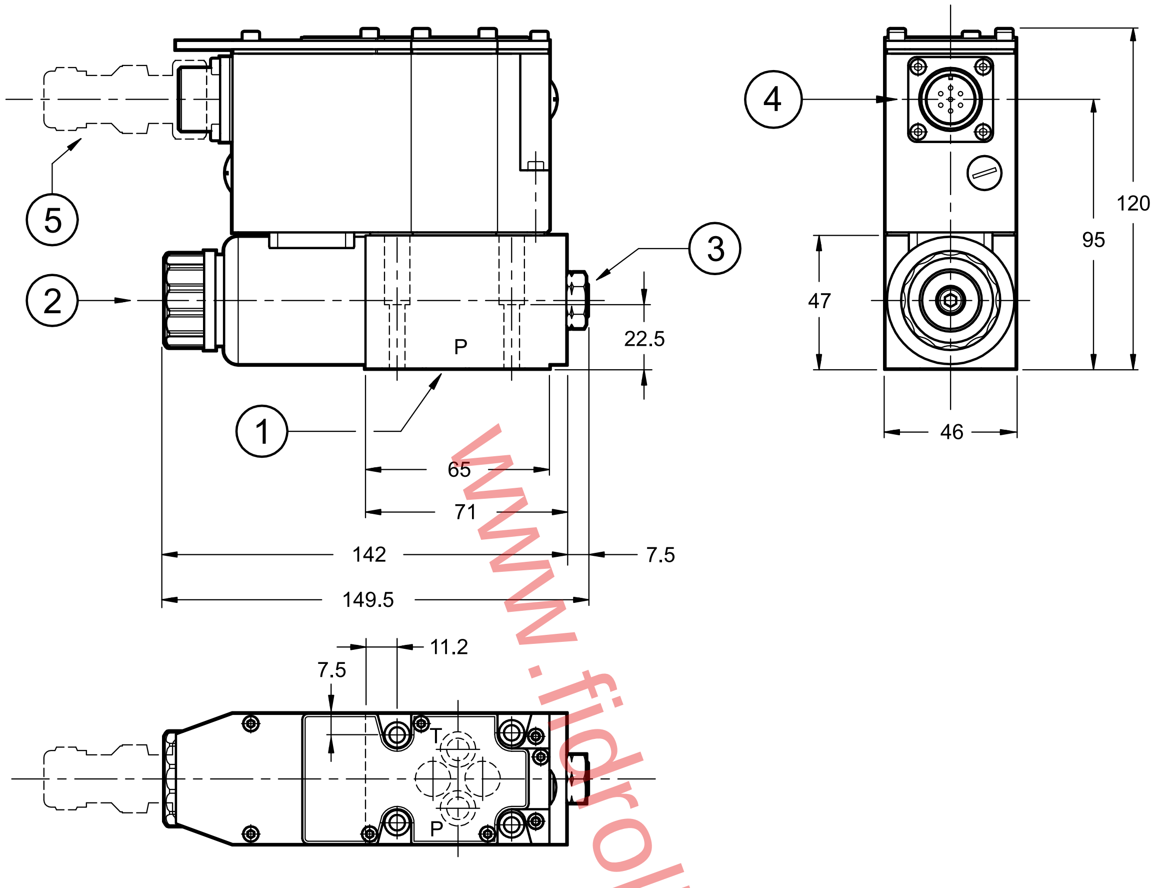
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Response times are obtained by using valves with a full scale of 350 bar, with an input flow rate of 2 l/min and a pressure oil volume of 0,5 lt. The response time is affected both by the flow rate and the oil volume in the pipework.



7 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: 4 OR type 2037 - 90 shore (9.25 x 1.78)
2	Breather: Allen key 4
3	Factory sealing setting (we recommend not unscrewing the nut)
4	Main connection
5	Mating electrical connector **to be ordered separately**. See at section 10

NOTE:
at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M5x30 - ISO 4762
Torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

8 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

9 - INSTALLATION

We recommend to install the valves either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 5.

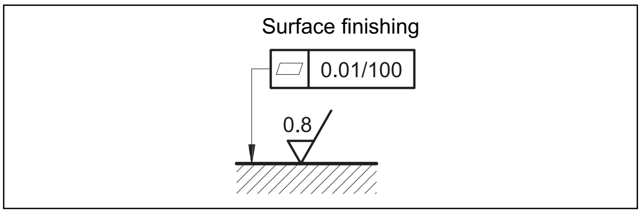
Ensure that there is no air in the hydraulic circuit. In particular applications, can be necessary to vent the air entrapped in the solenoid tube, by using the appropriate drain screw in the solenoid tube.

Ensure the solenoid tube is always filled with oil. At the end of the operation, make sure of having correctly replaced the drain screw.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.

Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



10 - ACCESSORIES

(to be ordered separately)

10.1 Mating connector

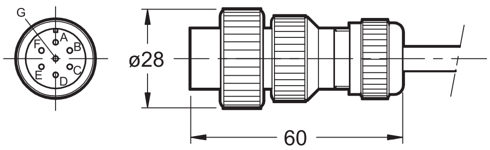
These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

⚠ So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



10.2 - Connection cables size

Power supply:
- up to 20 m cable length : 1,0 mm²
- up to 40 m cable length : 1,5 mm²

Signal: 0,50 mm²

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

10.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

11 - SUBPLATES
(see catalogue 51 000)

PMMD-AI3G rear ports
PMMD-AL3G side ports
Ports dimensions: P, T, A, B: 3/8” BSP

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DUPLOMATIC OLEODINAMICA

PRED3J

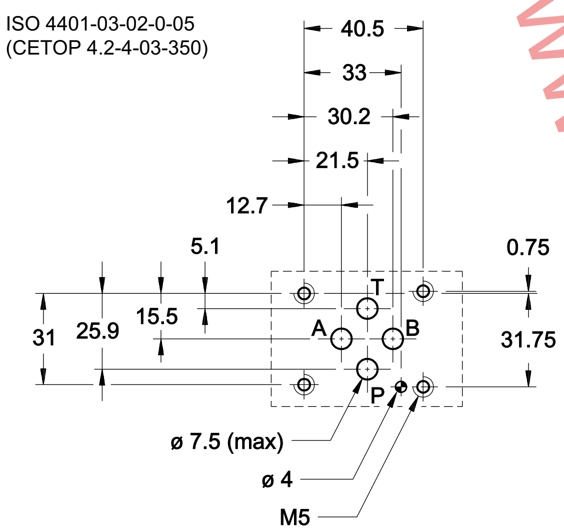
DIRECT OPERATED PRESSURE CONTROL VALVE WITH PROPORTIONAL CONTROL AND INTEGRATED ELECTRONICS IN CLOSED LOOP

SERIES 30

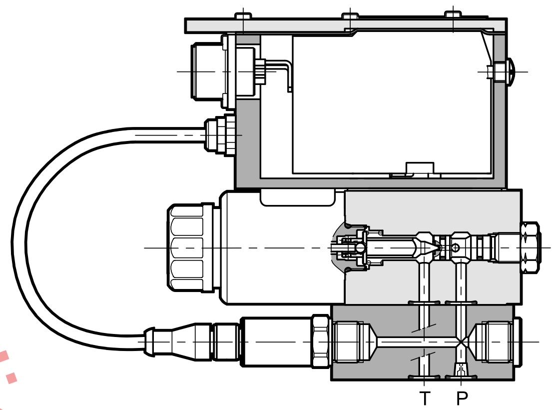
SUBPLATE MOUNTING
ISO 4401-03

p max **350** bar
Q max **3** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



— The PRED3J valve is a direct operated pressure control valve with integrated electric proportional control and mounting interface in compliance with ISO 4401 standards.

— It is suitable to pilot two-stage valves, for pressure control in hydraulic circuits.

— The valves are available with command signal in voltage or current and on board electronics with internal enable, external enable or 0V monitor on pin C.

— The monitoring of the value detected by the pressure transmitter is available on pin F.

— Some parameters are customizable using the appropriate kit for start-up.

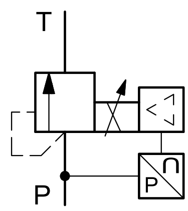
— Three pressure adjustment ranges are available up to 350 bar .

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Maximum operating pressure: - P port - T port	bar	350 2
Nominal flow Maximum flow (see p min= f(Q) diagram)	l/min	1 3
Step response	see paragraph 6	
Hysteresis	% of p nom	< 1%
Repeatability	% of p nom	< ±0,5%
Electrical characteristic	see paragraph 2	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	2,5

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

P	R	E	D	3	J	-		/	30		-		K11	

- **PR**: Pressure control valve
- **E**: Electro-proportional control
- **D**: Direct operated
- **3**: Size ISO 4401-03
- **J**: Digital integrated electronics for pressure control
- Pressure control range:
  140 = 1,1 - 140 bar
  210 = 1,8 - 210 bar
  350 = 2,8 - 350 bar
- **30**: Series No. (the overall and mounting dimensions remain unchanged from 30 to 39)
- Seals:
  N = NBR seals for mineral oil (**standard**)
  V = FPM seals for special fluids
- Reference signal:
  E0 = voltage 0 ÷ 10 V
  E1 = current 4 ÷ 20 mA
- **K11**: Main connector 6 pin + PE
- Pin C function:
  A = external enable
  B = internal enable
  C = 0V monitor

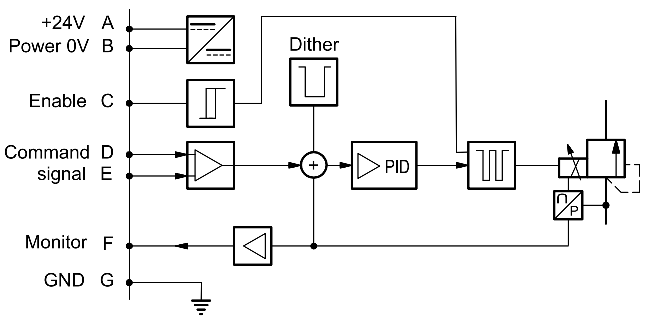
2 - ELECTRICAL CHARACTERISTICS

2.1 - Electrical on board electronics

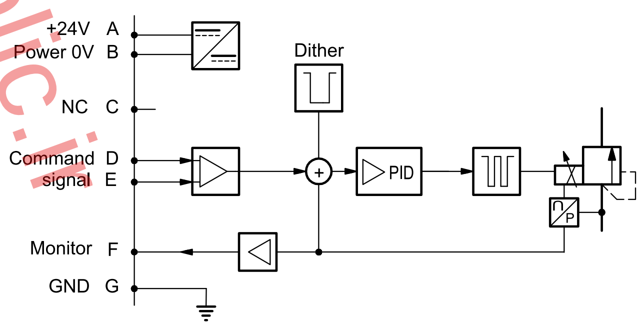
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		2A time lag
Command signals: voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (pressure at transducer): voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2004/108/EC standards

2.2 - On-board electronics diagrams

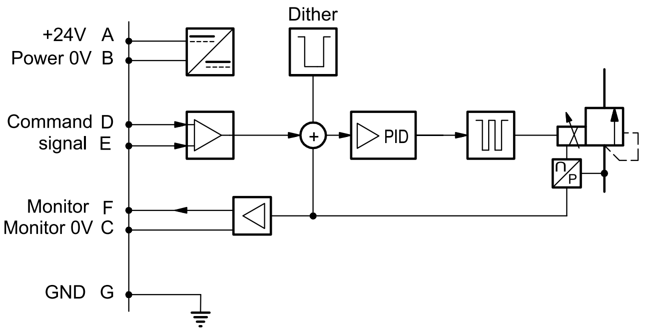
VERSION **A** - External Enable



VERSION **B** - Internal Enable

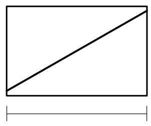


VERSION **C** - 0V Monitor

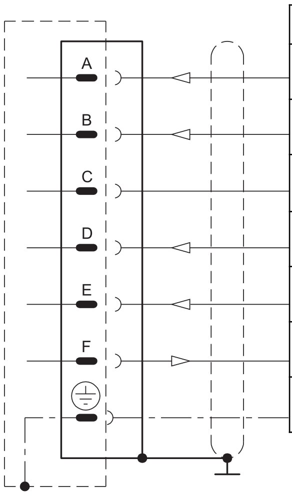


3 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal is between 0…10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**0V**	**+10V**
MONITOR	**0V**	**+10V**

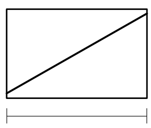


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	0 ÷ 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	0 ÷ 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

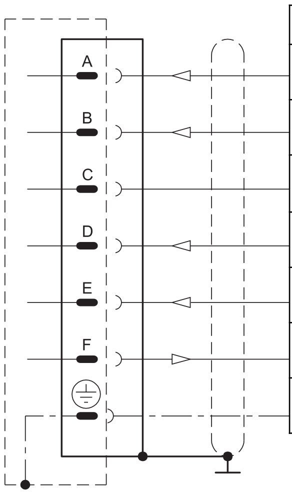
4 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**4 mA**	**20 mA**
MONITOR	**4 mA**	**20 mA**



Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

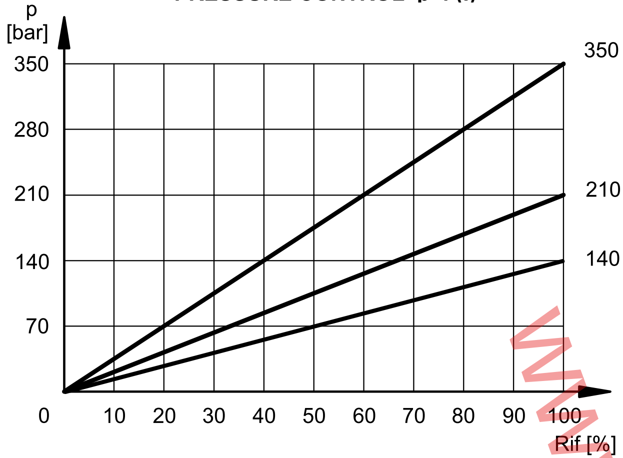
5 - CHARACTERISTIC CURVES

(measured with viscosity of 36 cSt at 50°C)

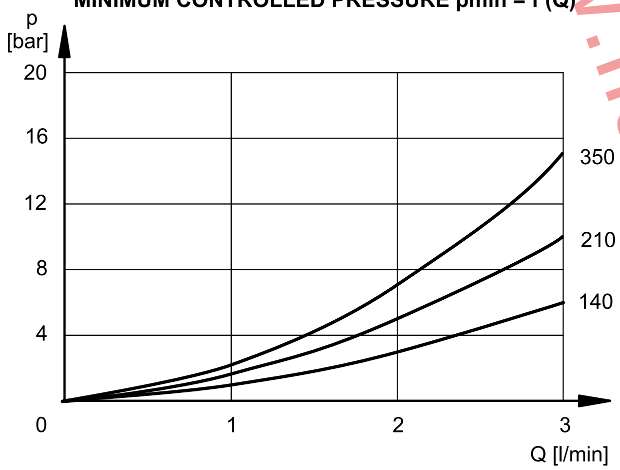
Typical control curves according to the current supplied to the solenoid for pressure control ranges: 140, 210 and 350, measured with input flow rate Q = 1 l/min.

The curves are obtained after linearization in factory of the characteristic curve through the digital amplifier, and they are measured without any backpressure in T.

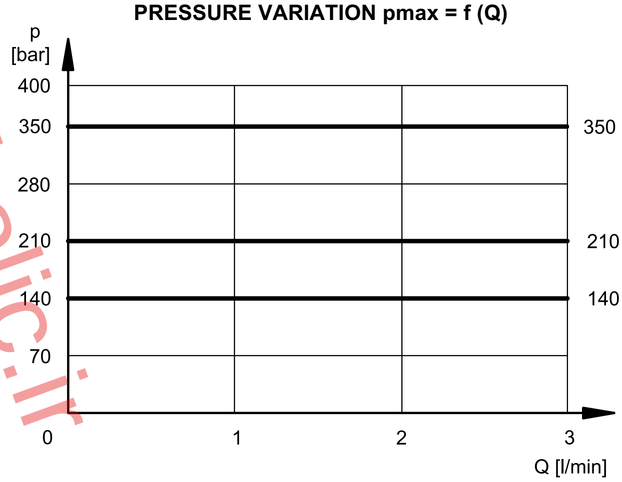
PRESSURE CONTROL p=f (I)



MINIMUM CONTROLLED PRESSURE pmin = f (Q)



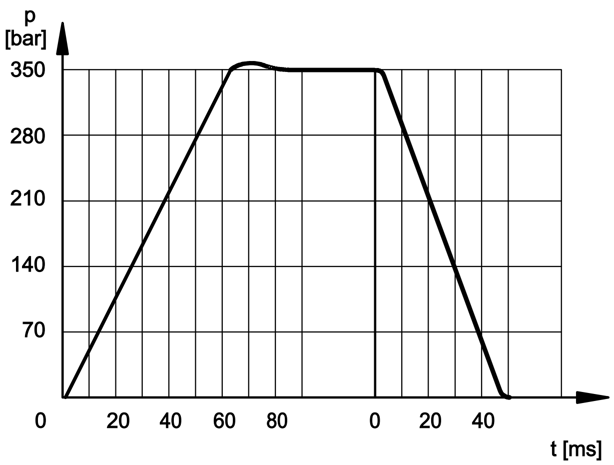
PRESSURE VARIATION pmax = f (Q)



6 - STEP RESPONSE

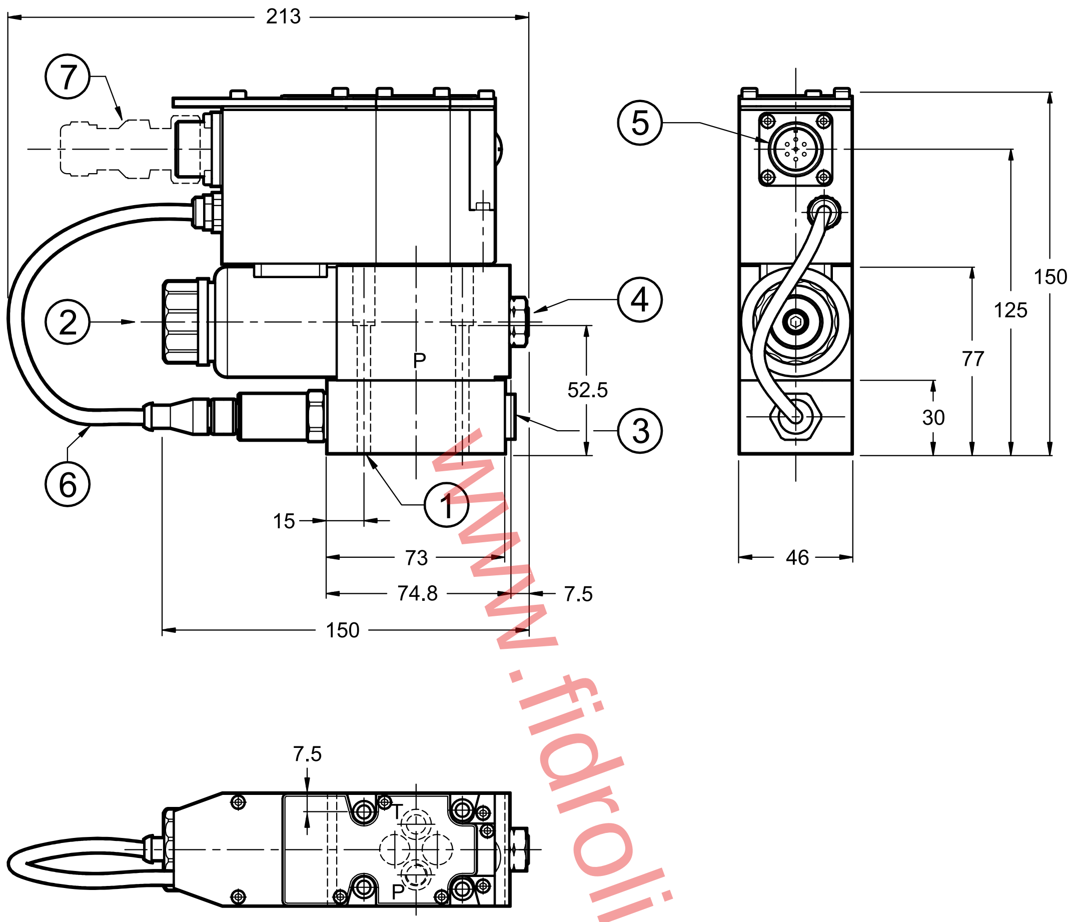
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Response time obtained by using valves with con PRED3J-350, with an input flow rate of 2 l/min and a pressure oil volume of 0,5 lt. The response time is affected both by the flow rate and the oil volume in the pipework.



7 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: 4 OR type 108 - 90 shore (8.73 x 1.78)
2	Breather: Allen key 4
3	Pressure gauge port 1/4” BSP
4	Factory sealing setting (we recommend not unscrewing the nut)
5	Main connection
6	Cable with connector for pressure transducer
7	Mating electrical connector **to be ordered separately.** See at section 10

NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M5x60 - ISO 4762
Torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

8 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

9 - INSTALLATION

We recommend to install the valves either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 5.

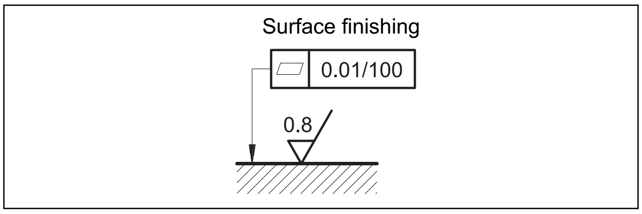
Ensure that there is no air in the hydraulic circuit. In particular applications, can be necessary to vent the air entrapped in the solenoid tube, by using the appropriate drain screw in the solenoid tube.

Ensure the solenoid tube is always filled with oil. At the end of the operation, make sure of having correctly replaced the drain screw.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.

Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



10 - ACCESSORIES

(to be ordered separately)

10.1 Mating connector

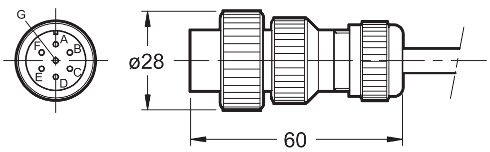
These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

⚠ So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



10.2 - Connection cables size

Power supply:
- up to 20 m cable length : 1,0 mm²
- up to 40 m cable length : 1,5 mm²

Signal: 0,50 mm²

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

10.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

11 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G rear ports
PMMD-AL3G side ports
Ports dimensions: P, T, A, B: 3/8” BSP

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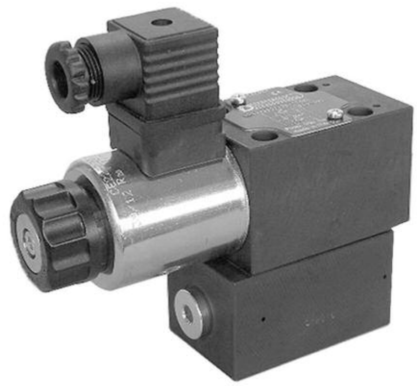
DUPLOMATIC OLEODINAMICA



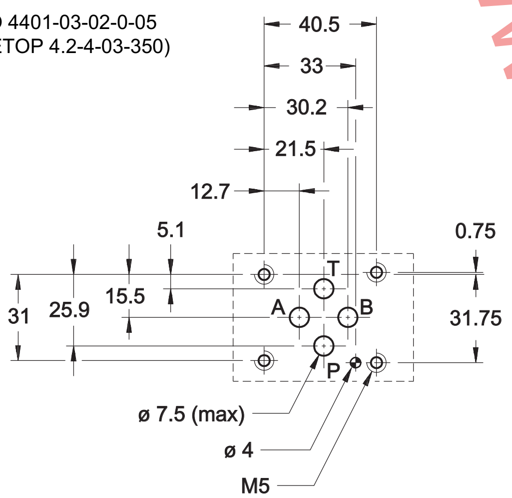
PRE3
PILOT OPERATED PRESSURE CONTROL VALVE WITH ELECTRIC PROPORTIONAL CONTROL
SERIES 12

SUBPLATE MOUNTING
ISO 4401-03

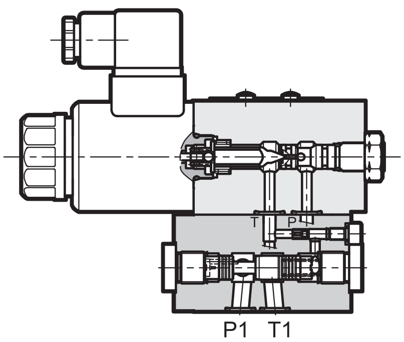
p max **350** bar
Q max **40** l/min

MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



OPERATING PRINCIPLE



— The PRE3 is a pilot operated pressure control valve with electric proportional control and mounting interface in compliance with ISO 4401 standards.

— It is suitable to modulate the pressure in hydraulic circuits.

— The valve can be controlled directly by a current control supply unit or by an electronic control unit to exploit valve performance to the full (see at paragraph 8).

— Pressure adjustment can be continuous in proportion to the current supplied to the solenoid.

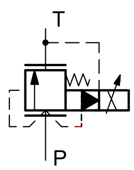
— Four pressure control ranges up to 350 bar are available.

PERFORMANCES
(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

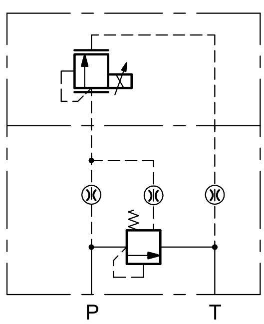
Maximum operating pressure: - P port - T port	bar	 350 2
Minimum controlled pressure	see p min = f(Q) diagram	
Minimum flow Maximum flow (see graph p max= f(Q))	l/min	2 40
Step response	see paragraph 5	
Hysteresis (with PWM 200 Hz)	% of p nom	< 5%
Repeatability	% of p nom	< ±1,5%
Electrical characteristic	see paragraph 4	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	3,5

HYDRAULIC SYMBOL

simplified



detailed



1 - IDENTIFICATION CODE

P	R	E	3	-		/	12		-		K1

Pressure control valve

Electrical proportional control

Size ISO 4401-03

Pressure control range
070 = 7 - 70 bar
140 = 7 - 140 bar
210 = 8 - 210 bar
350 = 10 - 350 bar

Series No.
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

D12 = Nominal solenoid voltage 12V DC
D24 = Nominal solenoid voltage 24V DC

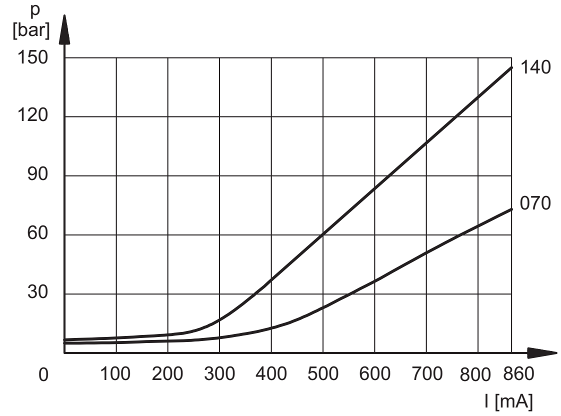
Coil electrical connection:
for connector type DIN 43650
(**standard**)

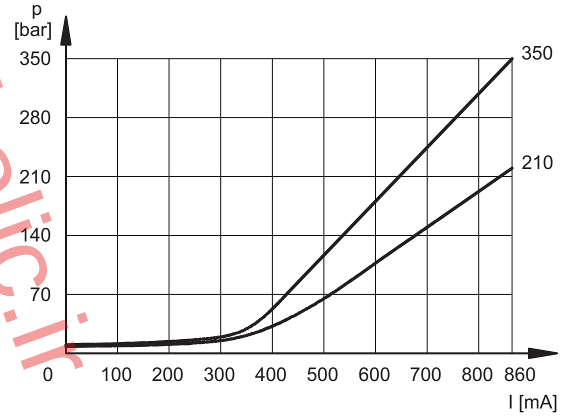
2 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

Typical control curves according to the current supplied to the solenoid (D24 version with maximum current 860 mA) for pressure control ranges: 070, 140, 210, 350, measured with input flow rate Q=10 l/min.

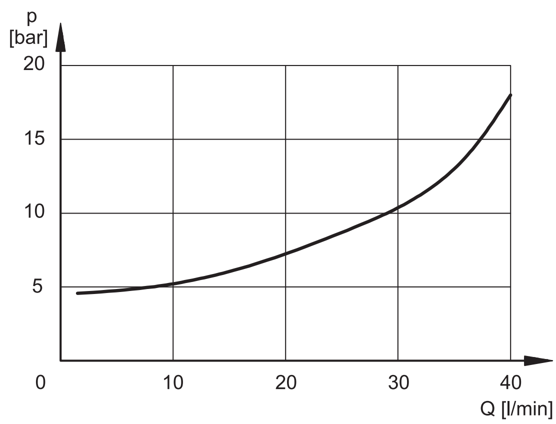
The curves are obtained without any hysteresis and linearity compensation and they are measured without any backpressure in T.
The full scale pressure is set in factory with a flow rate of 10 l/min. In case of higher flow rate, the full scale pressure will increase considerably (see diagram pmax = f (Q)).

PRESSURE CONTROL p=f (I)

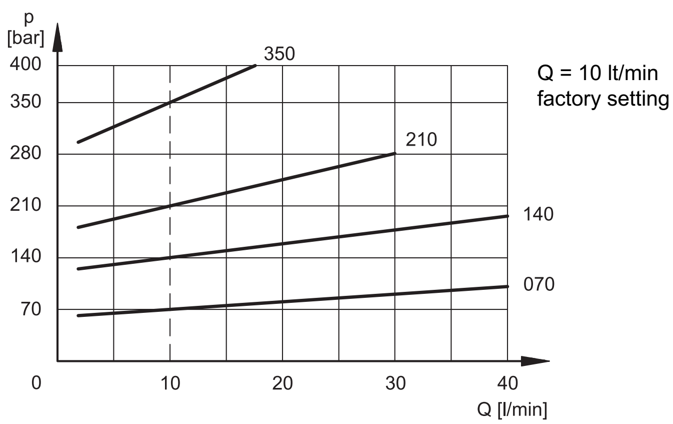




MINIMUM CONTROLLED PRESSURE pmin = f (Q)



PRESSURE VARIATION pmax = f (Q)



3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - ELECTRICAL CHARACTERISTICS

Proportional solenoid
The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	**12**	**24**
RESISTANCE (at 20°C)	Ω	3.66	17.6
MAXIMUM CURRENT	A	1.88	0.86
DUTY CYCLE	100%		
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE		
PROTECTION FROM: Atmospheric agents (CEI EN 60529)	IP 65		
CLASS OF PROTECTION: Coil insulation (VDE 0580) Impregnation	class H class F		

5 - STEP RESPONSE (obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical step response times measured with a valve of pressure range up to 140 bar and with input flow rate Q = 10 l/min.

REFERENCE SIGNAL STEP	0 → 100%	100 → 0%
Step response [ms]	80	40

6 - INSTALLATION

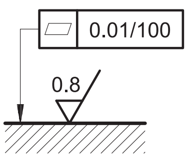
We recommend to install the PRE3 valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 2.

Ensure that there is no air in the hydraulic circuit. In particular applications, it can be necessary to vent the air entrapped in the solenoid tube, by using the apposite drain screw in the solenoid tube. Ensure that the solenoid tube is always filled with oil (see par. 7). At the end of the operation, make sure of having screwed correctly the drain screw.

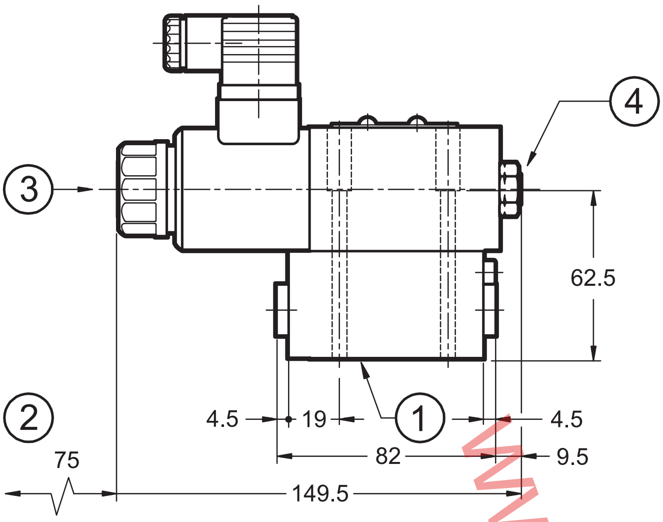
Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value. Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

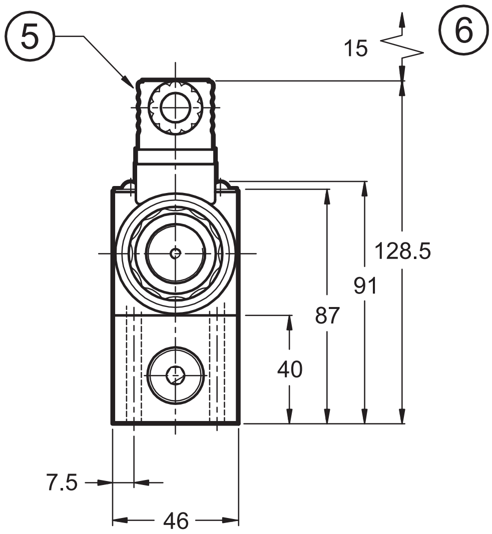
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

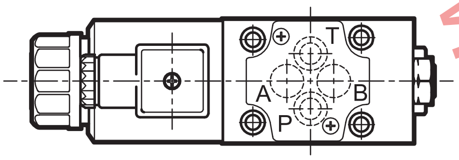
Surface finishing



7 - OVERALL AND MOUNTING DIMENSIONS







dimensions in mm

Fastenings bolts: 4 screws SHC M5x70 - ISO 4762
Tightening torque: 5 Nm

NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (3) placed at the end of the solenoid tube.

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 shore
2	Coil removal space
3	Breather (male hexagonal spanner 4)
4	Factory setting sealing (we recommend not unscrewing the nut)
5	DIN 43650 electric connector (included in the delivery)
6	Connector removal space

8 - ELECTRONIC CONTROL UNITS

EDC-112	for solenoid 24V DC	plug version	see cat. 89 120
EDC-142	for solenoid 12V DC		
EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		
UEIK-11	for solenoid 24V DC	Eurocard type	see cat. 89 300

9 - SUBPLATES (see catalogue 51 000)

PMMD-AI3G with ports on rear
PMMD-AL3G with side ports
Ports dimensions P, T, A and B: 3/8” BSP thread

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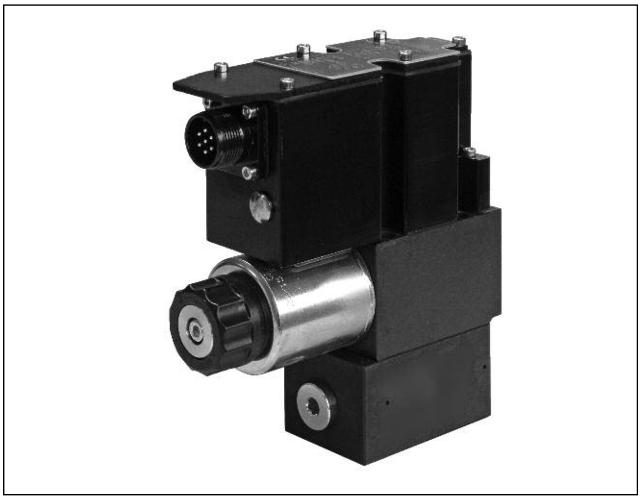


PRE3G

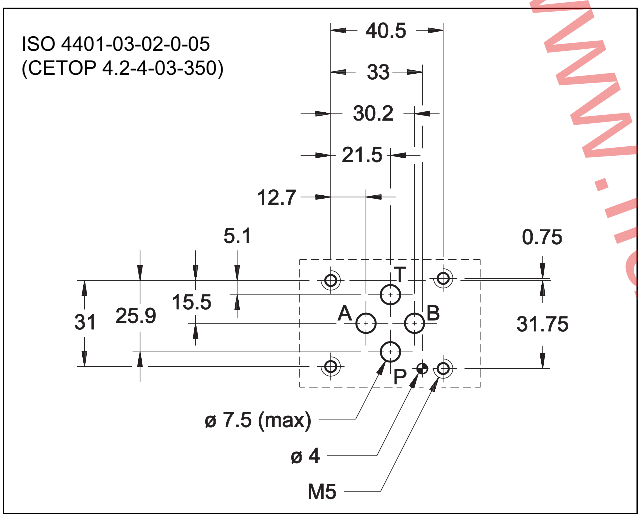
PILOT OPERATED PRESSURE CONTROL VALVE WITH PROPORTIONAL CONTROL AND INTEGRAL ELECTRONICS

SERIES 30

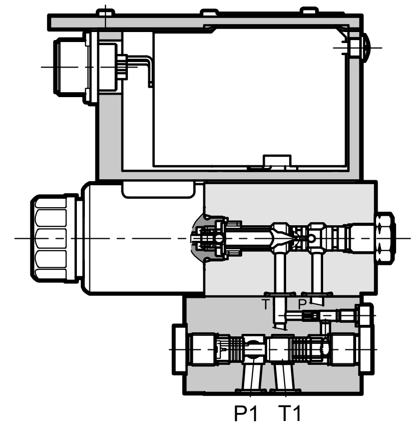
SUBPLATE MOUNTING
ISO 4401-03

p max **350** bar
Q max **40** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



— The PRE3G valve is a pilot operated pressure control valve with electric proportional control and mounting surface in compliance with ISO 4401 standards, controlled by an integral digital amplifier.

— It is suitable to modulate the pressure in hydraulic circuits.

— The valves are available with command signal in voltage or current and on board electronics with internal enable, external enable or 0V monitor on pin C. A solenoid current monitoring signal is available.

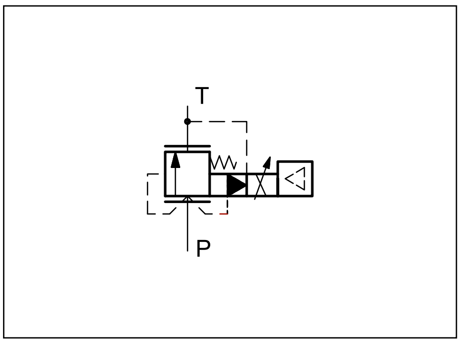
— Valves are easy to install. The driver directly manages digital settings.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Maximum operating pressure: - P port - T port	bar	350 2
Minimum controlled pressure	see p min= f(Q) diagram	
Minimum flow Maximum flow (see p max = f(Q) diagram)	l/min	2 40
Step response	see paragraph 6	
Hysteresis	% of p nom	< 3%
Repeatability	% of p nom	< ±1%
Electrical characteristic	see paragraph 2	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	3,8

HYDRAULIC SYMBOL

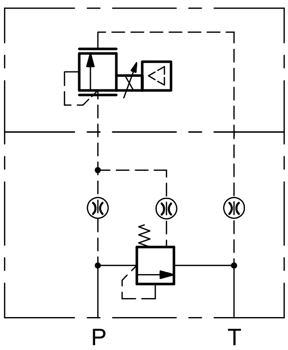


1 - IDENTIFICATION CODE

P	R	E	3	G	-		/	30		-		K11	

- Pressure control valve
- Electrical proportional control
- Size ISO 4401-03 (CETOP 03)
- Digital integrated electronics for open loop
- Pressure control range
  070 = 7 - 70 bar **210** = 8 - 210 bar
  140 = 7 - 140 bar **350** = 10 - 350 bar
- Series No.
  (the overall and mounting dimensions remain unchanged from 30 to 39)
- Seals:
  N = NBR seals for mineral oil (**standard**)
  V = FPM seals for special fluids
- Reference signal:
  E0 = voltage 0 ÷ 10 V
  E1 = current 4 ÷ 20 mA
- Main connector 6 pin + PE
- Pin C function:
  A = external enable
  B = internal enable
  C = 0V monitor

2 - DETAILED SYMBOL



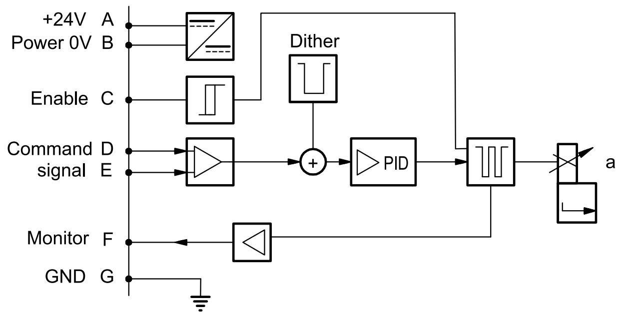
3 - ELECTRICAL CHARACTERISTICS

3.1 - Electrical on board electronics

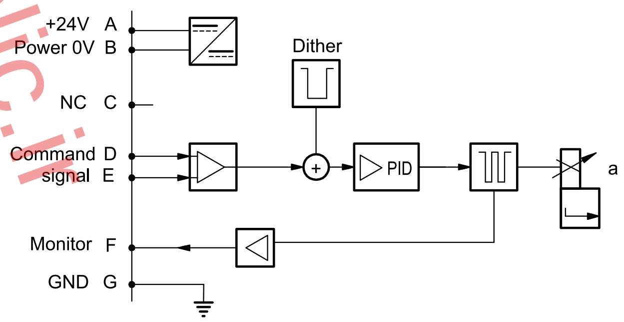
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		2A time lag
Command signals: voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (current to solenoid): voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2004/108/EC standards

3.2 - On-board electronics diagrams

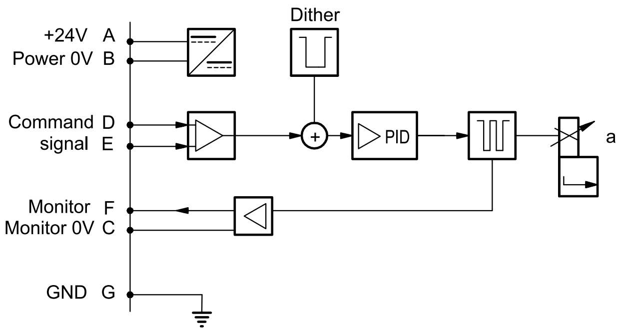
VERSION **A** - External Enable



VERSION **B** - Internal Enable

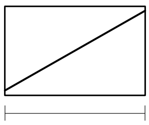


VERSION **C** - 0V Monitor

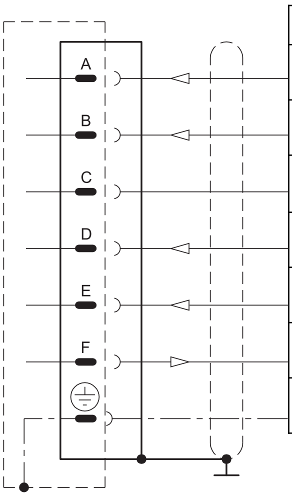


4 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal is between 0 ÷ 10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**0V**	**+10V**
MONITOR	**0V**	**+10V**

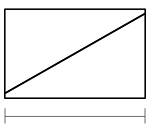


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	± 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	± 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

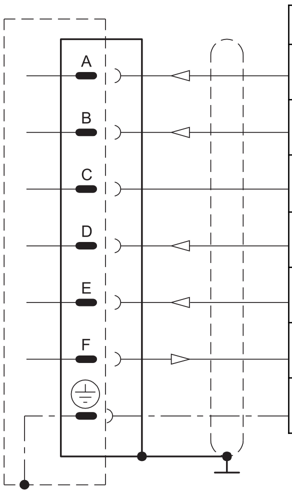
5 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**4 mA**	**20 mA**
MONITOR	**4 mA**	**20 mA**



Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

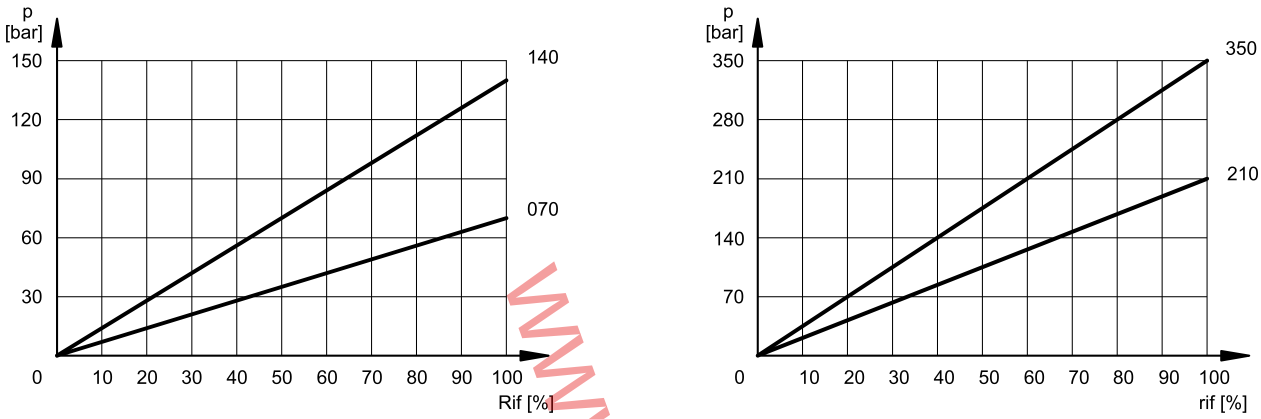
6 - CHARACTERISTIC CURVES

(measured with viscosity of 36 cSt at 50°C)

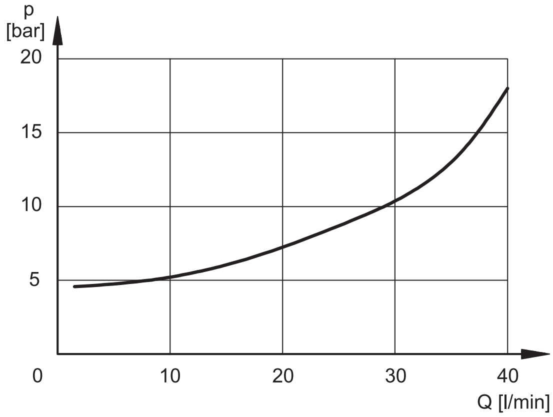
Typical control curves according to the current supplied to the solenoid for pressure control ranges: 070, 140, 210, 350, measured with input flow rate Q = 10 l/min.

The curves are obtained without any hysteresis and linearity compensation and they are measured without any backpressure in T. The full scale pressure is set in factory with a flow rate of 10 l/min. In case of higher flow rate, the full scale pressure will increase considerably (see diagram pmax = f (Q)).

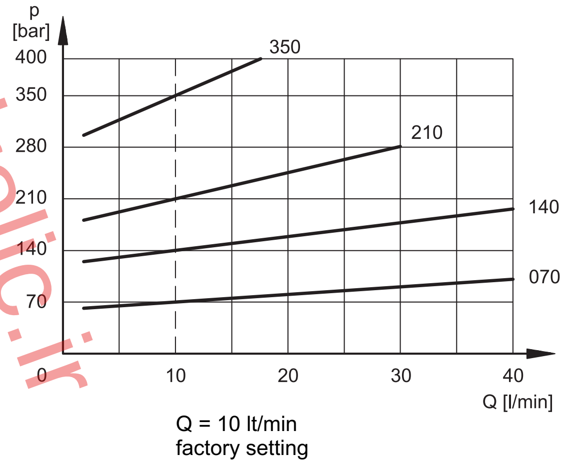
PRESSURE CONTROL p = f (I)



MINIMUM CONTROLLED PRESSURE pmin = f (Q)



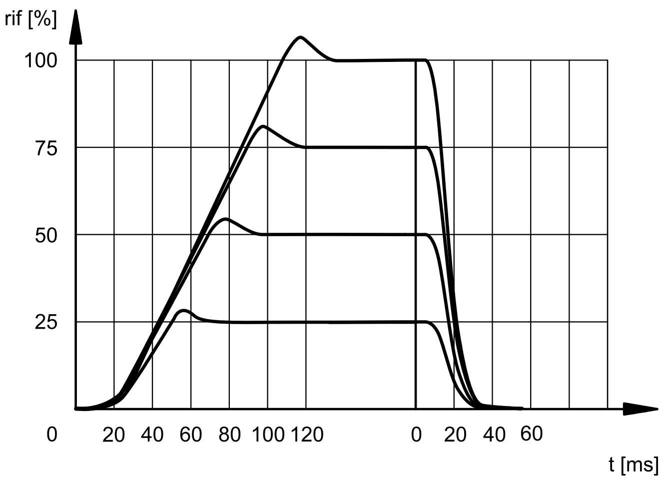
PRESSURE VARIATION pmax = f (Q)



7 - RESPONSE TIMES

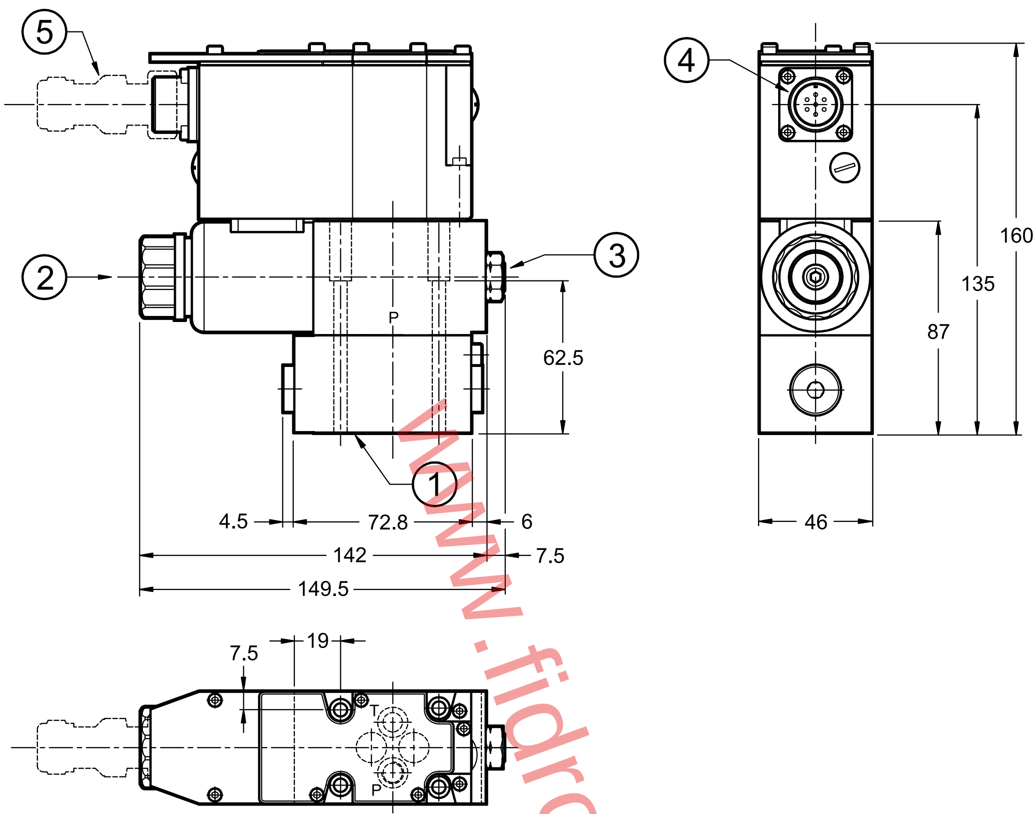
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Response times are obtained by using a PRE3G-210, with an input flow rate of 10 l/min and a pressure oil volume of 0,5 litres. The response time is affected both by the flow rate and the oil volume in the pipework.



8 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



Fastenings bolts: 4 SHC screws M5x70 - ISO 4762
Tightening torque: 5 Nm

NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (3) placed at the end of the solenoid tube.

1	Mounting surface with sealing rings: 4 OR type 2037 - 90 shore (9.25 x 1.78)
2	Breather: Allen key 4
3	Factory sealing setting (we recommend not unscrewing the nut)
4	Main connection
5	Mating electrical connector **to be ordered separately**. See at section 10

9 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

10 - INSTALLATION

We recommend to install the valves either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 6.

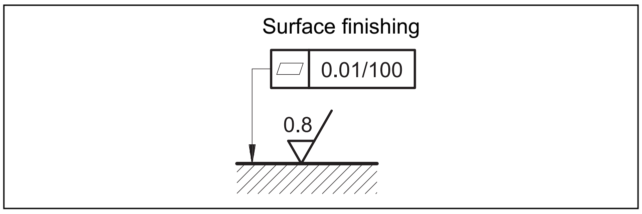
Ensure that there is no air in the hydraulic circuit. In particular applications, can be necessary to vent the air entrapped in the solenoid tube, by using the appropriate drain screw in the solenoid tube.

Ensure the solenoid tube is always filled with oil. At the end of the operation, make sure of having correctly replaced the drain screw.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.

Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



11 - ACCESSORIES

(to be ordered separately)

11.1 Mating connector

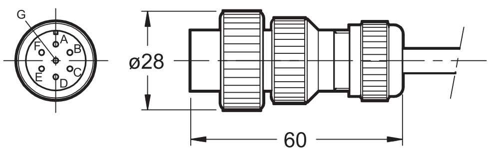
These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

⚠ So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



11.2 - Connection cables size

Power supply:
- up to 20 m cable length : 1,0 mm^2
- up to 40 m cable length : 1,5 mm^2

Signal: 0,50 mm^2

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

11.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

12 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G with ports on rear
PMMD-AL3G with side ports
Ports dimensions P, T, A, B: 3/8” BSP thread

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DUPLOMATIC OLEODINAMICA

PRE*

PILOT OPERATED PRESSURE RELIEF VALVES WITH PROPORTIONAL CONTROL

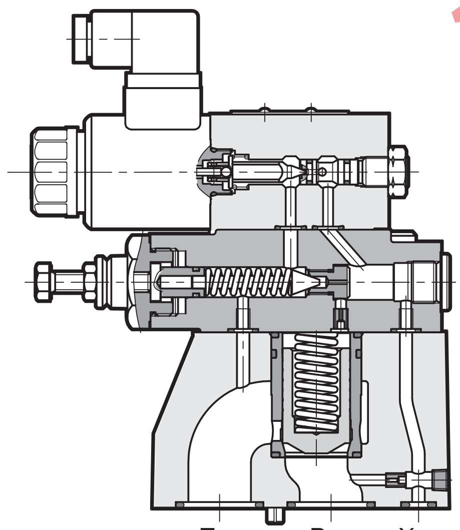
SERIES 10

SUBPLATE MOUNTING

p max **350** bar

Q max (see table of performances)

OPERATING PRINCIPLE



— PRE* valves are pilot operated pressure relief valves with electric proportional control and mounting interface in compliance with ISO 6264 standards (CETOP RP 121H).

— These valves are normally used to control hydraulic circuit pressure and enable the use of the full flow rate of the pump, even with settings approaching calibrated values.

— The two-stage design and wide passages ensure reduced pressure drops thereby improving the system energy performance.

— Pressure can be modulated continuously in proportion to the current supplied to the solenoid.

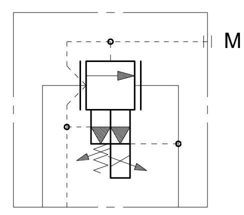
— These valves can be controlled directly by a current control supply unit or by means of the relevant electronic control units to exploit valve performance to the full (see par. 10).

— They are fitted with a manual pressure relief valve which is factory set to ≥15% of the maximum value in the pressure control range.

— They are available in three sizes for flow rates up to 500 l/min and in four pressure control ranges up to 350 bar.

PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)		**PRE10**	**PRE25**	**PRE32**
Maximum operating pressure:	bar	350		
Minimum controlled pressure		see Δp-Q diagram		
Maximum flow	l/min	200	400	500
Step response		see paragraph 5		
Hysteresis	% of p nom	< 5%		
Repeatability	% of p nom	< ±1,5%		
Electrical characteristic		see paragraph 7		
Ambient temperature range	°C	-20 / +60		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13			
Recommended viscosity	cSt	25		
Mass:	kg	5	5,8	8

HYDRAULIC SYMBOL



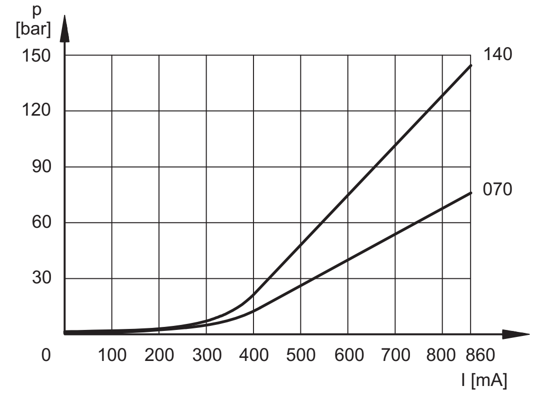
1 - IDENTIFICATION CODE

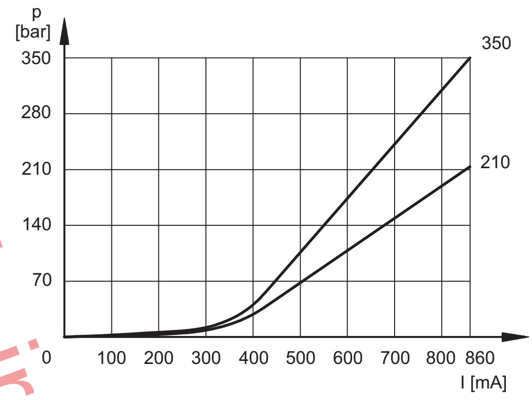
P R E [ ] - [ ] / 10 [ ] - [ ] K1

- Pilot operated pressure relief valve
- Electric proportional control
- Size: **10** = ISO 6264-06 (CETOP R06); **25** = ISO 6264-08 (CETOP R08); **32** = ISO 6264-10 (CETOP R10)
- Pressure control range: **070** = up to 70 bar; **140** = up to 140 bar; **210** = up to 210 bar; **350** = up to 350 bar
- Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)
- Seals: **N** = NBR seals for mineral oil (**standard**); **V** = FPM seals for special fluids
- **D12** = Nominal solenoid voltage 12V DC; **D24** = Nominal solenoid voltage 24V DC
- Coil electrical connection: plug for connector type DIN 43650 (**standard**)

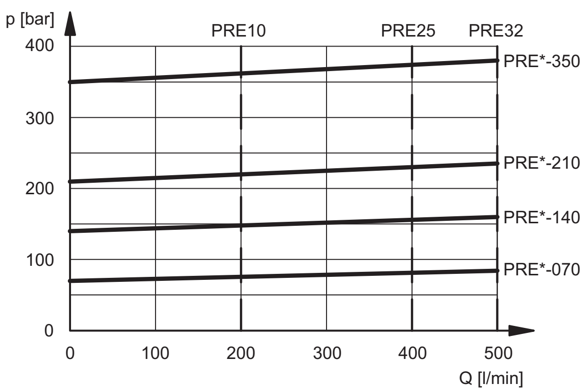
2 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

PRESSURE CONTROL p=f (I)

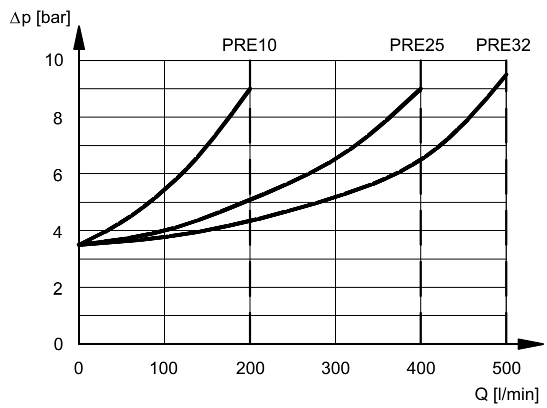




PRESSURE CONTROL p=f (Q)



PRESSURE DROP Δp = f(Q)



3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - ELECTRICAL CHARACTERISTICS

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	12	24
RESISTANCE (at 20°C)	Ω	3.66	17.6
NOMINAL CURRENT	A	1.88	0.86
DUTY CYCLE	100%		
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE		
CLASS OF PROTECTION: atmospheric agents (CEI EN 60529) coil insulation (VDE 0580) Impregnation	 IP 65 class H class F		

5 - STEP RESPONSE (obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical step response times measured with input flow rate of Q = 50 l/min.

REFERENCE SIGNAL STEP	0 → 100%	100 → 0%
Step response [ms]	120	90

6 - INSTALLATION

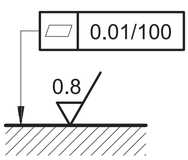
We recommend to install the PRE* valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 2.

Ensure that there is no air in the hydraulic circuit. In particular applications, it can be necessary to vent the air entrapped in the solenoid tube, by using the apposite drain screw in the solenoid tube (see par. 4 - 5 - 6). At the end of the operation, make sure of having correctly screwed the drain screw.

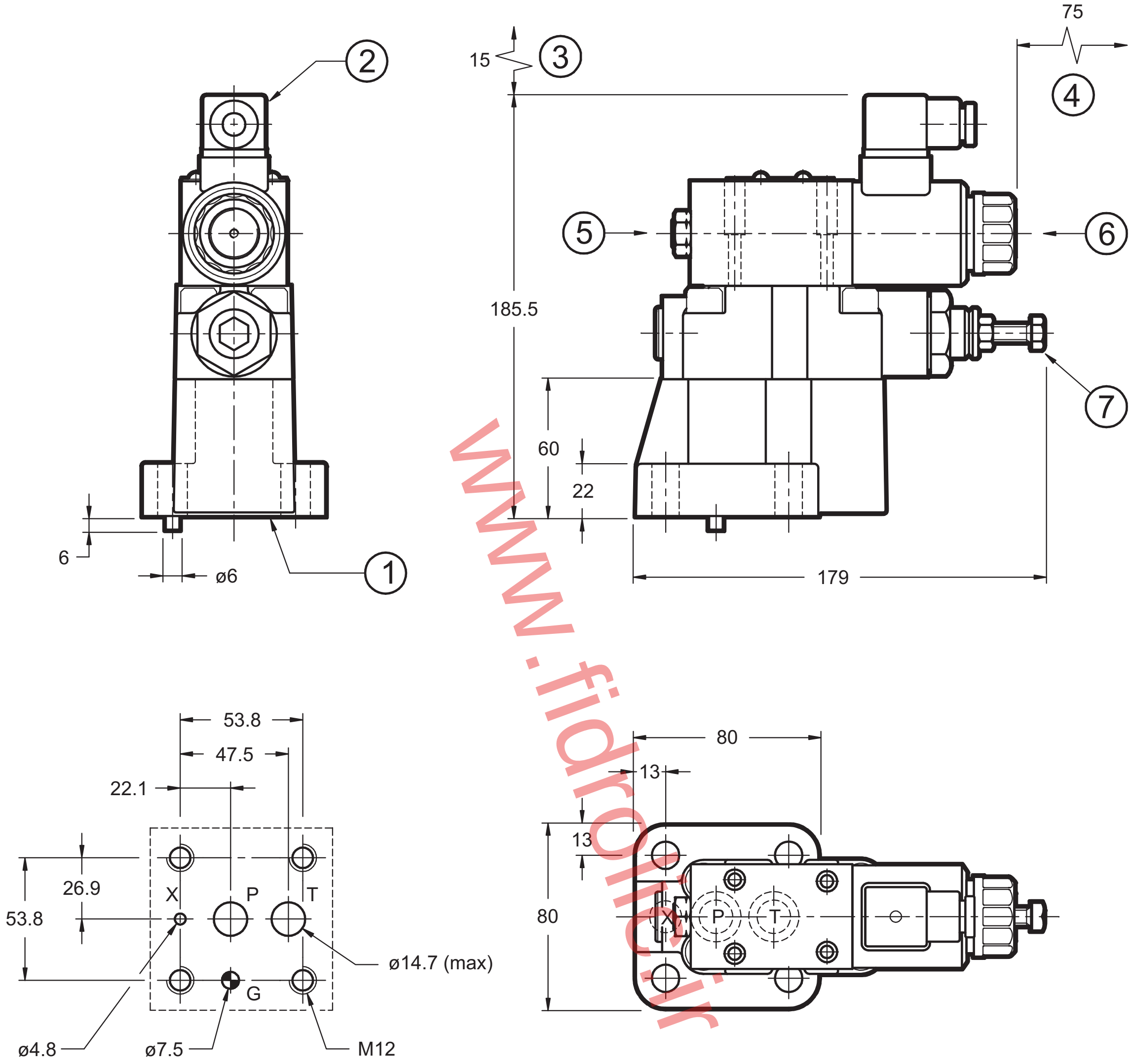
Connect the T port on the valve directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value. Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Surface finishing



7 - PRE10 OVERALL AND MOUNTING DIMENSIONS



Mounting interface: ISO 6264-06-09-*-97
(CETOP 4.4.2-2-R06-350)

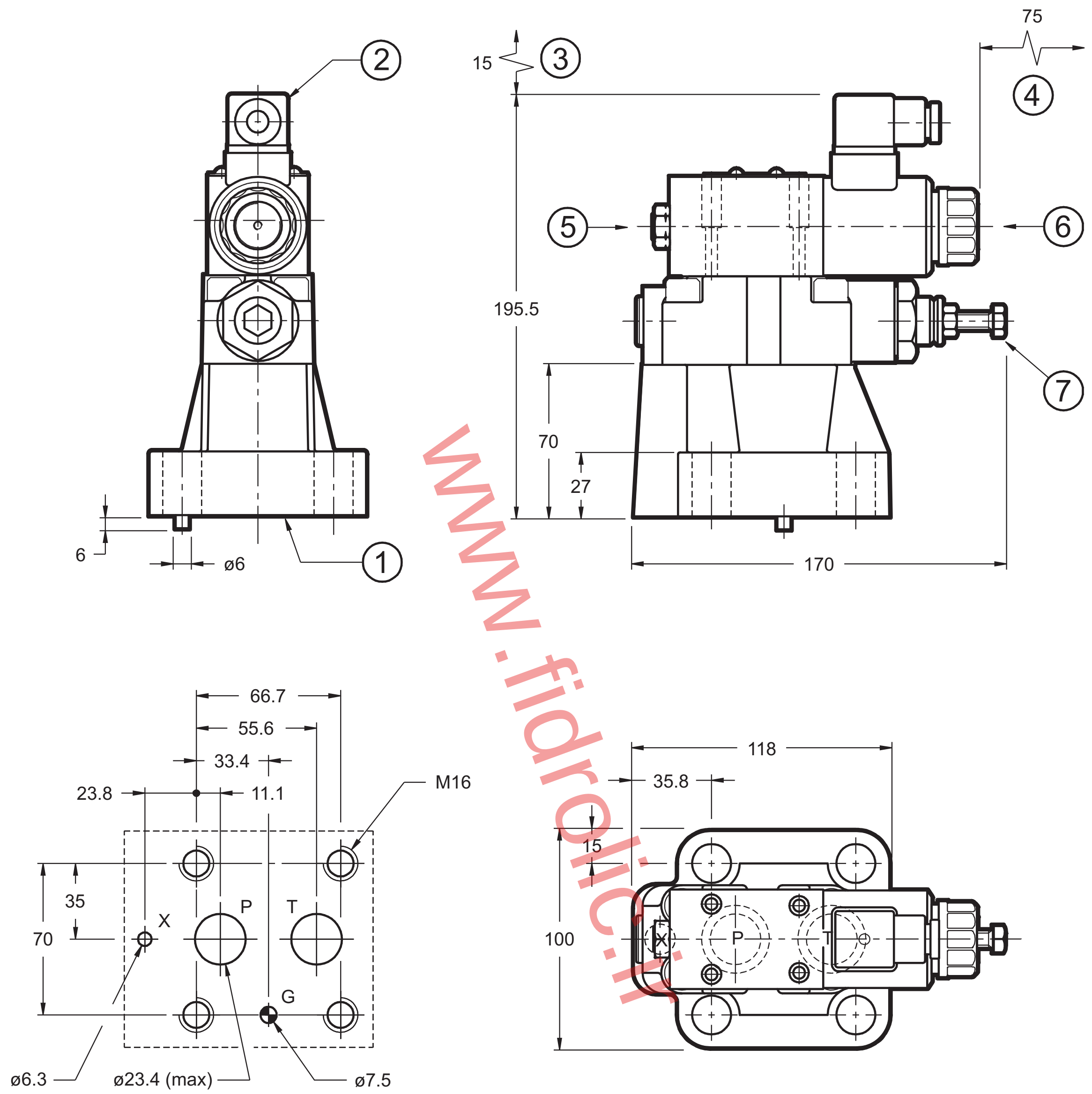
dimensions in mm

1	Mounting surface with sealing rings: n° 2 OR type 123 - 90 shore (17.86 x 2.62) n° 1 OR type 109 - 90 shore (9.13 x 2.62)
2	DIN 43650 electric connector
3	Connector removal space
4	Coil removal space
5	Factory setting sealing (we recommend not unscrewing the nut)
6	Breather (male hexagonal spanner 4)
7	Pressure relief valve (factory set)

Fastening bolts: 4 bolts M12x40 - ISO 4762
Torque: 69 Nm

NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (6) placed at the end of the solenoid tube.

8 - PRE25 OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

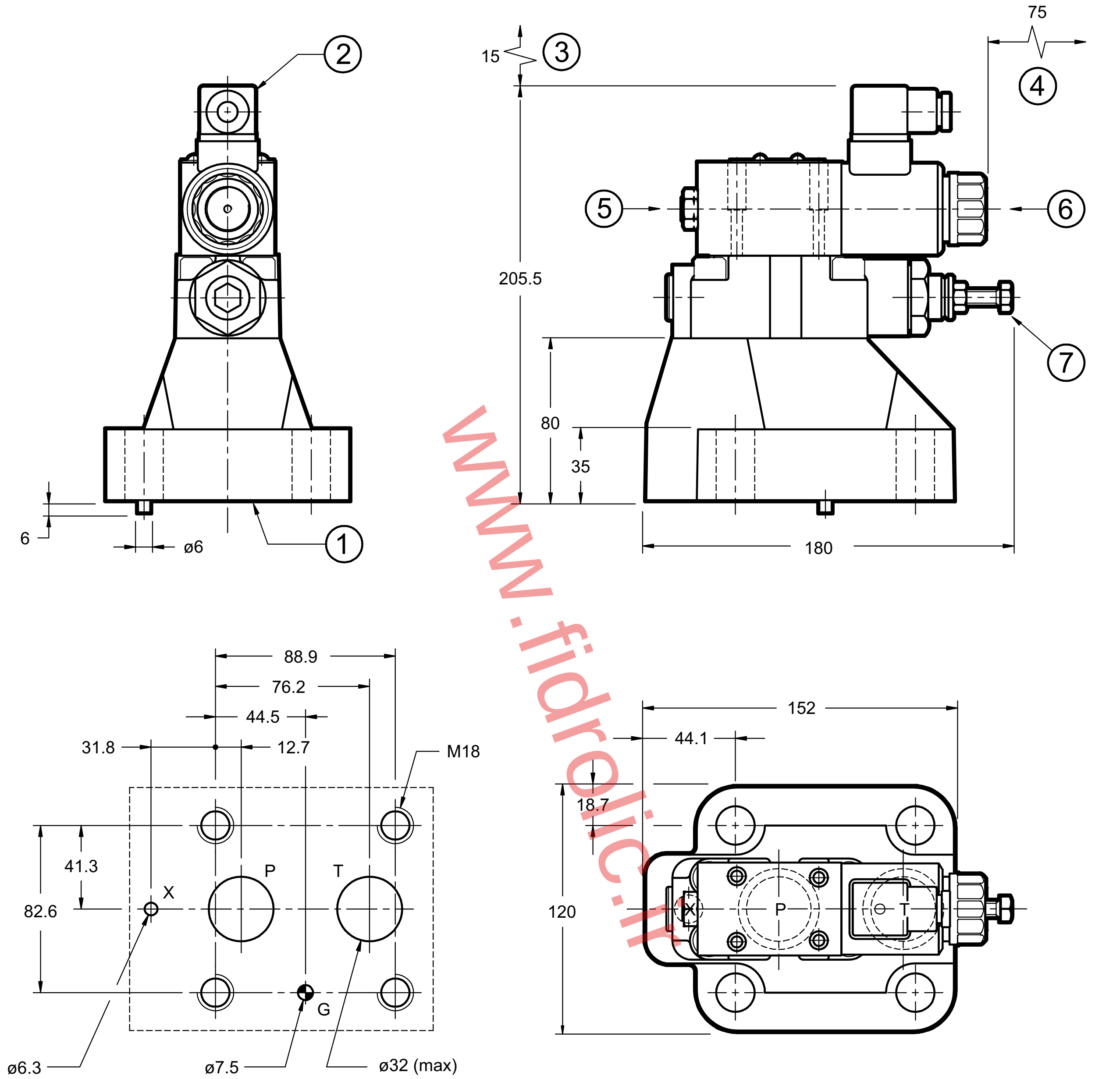
Mounting interface: ISO 6264-08-13-*-97
(CETOP 4.4.2-2-R08-350)

1	Mounting surface with sealing rings: 2 OR type 3118 - 90 shore (29.82 x 2.62) 1 OR type 109 - 90 shore (9.13 x 2.62)
2	DIN 43650 electric connector
3	Connector removal space
4	Coil removal space
5	Factory setting sealing (we recommend not unscrewing the nut)
6	Breather (male hexagonal spanner 4)
7	Pressure relief valve (factory set)

Fastening bolts: 4 bolts M16x50 - ISO 4762
Torque: 170 Nm

NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (6)placed at the end of the solenoid tube.

9 - PRE32 OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

Mounting interface: ISO 6264-10-17-*-97
(CETOP 4.4.2-2-R10-350)

Fastening bolts: N. 4 bolts M18x60 - ISO 4762
Torque: 235 Nm

NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (6) placed at the end of the solenoid tube.

1	Mounting surface with sealing rings: 2 OR type 4137 - 90 shore (34.52 x 3.53) 1 OR type 109 - 90 shore (9.13 x 2.62)
2	DIN 43650 electric connector
3	Connector removal space
4	Coil removal space
5	Factory setting sealing (we recommend not unscrewing the nut)
6	Breather (male hexagonal spanner 4)
7	Pressure relief valve (factory set)

10 - ELECTRONIC CONTROL UNITS

EDC-112	for solenoid 24V DC	plug version	see cat.89 120
EDC-142	for solenoid 12V DC		
EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		
UEIK-11	for solenoid 24V DC	Eurocard type	see cat. 89 300

11 - SUBPLATES (see cat. 51 000)

	PRE10	PRE25	PRE32
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports
P, T ports dimensions	P: 1/2" BSP T: 3/4" BSP	1" BSP	1" ¼ BSP
X port dimensions	1/4" BSP	1/4" BSP	1/4" BSP

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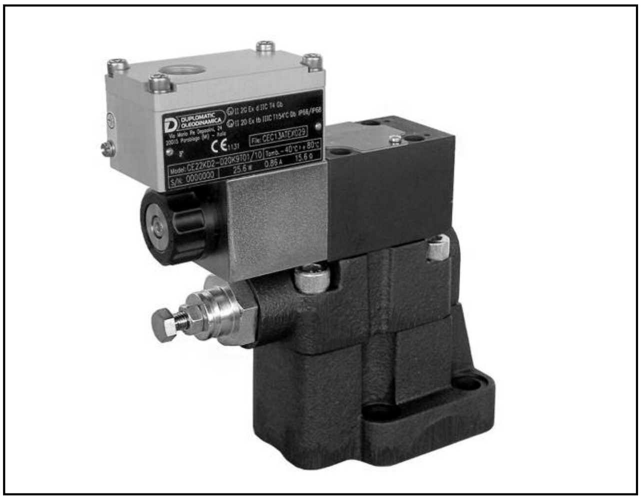


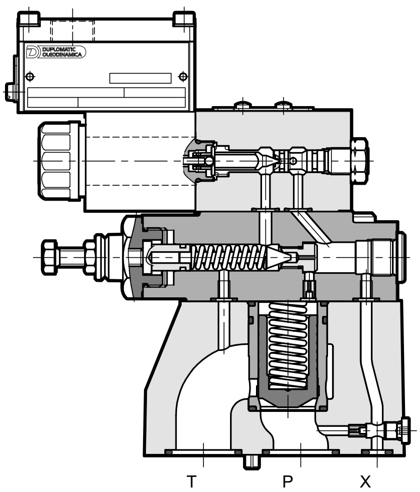
PRE(D)*K*

EXPLOSION-PROOF PROPORTIONAL PRESSURE RELIEF VALVE, PILOT OPERATED ATEX, IECEx, INMETRO

SERIES 10

PRED3K*	**ISO 4401-03**
PRE3K*	**ISO 4401-03**
PRE10K*	**ISO 6264-06**
PRE25K*	**ISO 6264-08**
PRE32K*	**ISO 6264-10**

OPERATING PRINCIPLE



— PRED3K* and PRE*K* are explosion-proof pressure relief valves with proportional control.

— They are compliant with ATEX, IECEx and INMETRO requirements and are suitable for use in potentially explosive atmospheres, for surface plants or mines.

— A low temperature version (up to -40 °C) is also available.

— The valves can be controlled directly by a current power supply or by means of an electronic control unit, to exploit valve performance to the full (see par. 19).

— Upon request, these valves can be supplied with a finishing surface treatment (zinc-nickel) suitable to ensure a salt spray resistance up to 600 hours.

— **Details for classification, operating temperatures and electrical characteristics are in the technical data sheet 02 500 'Explosion proof classification'.**

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

			PRED3K*	PRE3K*	PRE10K*	PRE25K*	PRE32K*
Maximum operating pressure	- P port - T port	bar	350 2				
Minimum flow Nominal flow Maximum flow		l/min	- 1 3	2 10 40	- - 200	- - 400	- - 500
Step response			see paragraph 8				
Hysteresis		% of p nom	< 5%				
Repeatability		% of p nom	< ±1,5%				
Electrical characteristic			see paragraph 9				
Operating temperatures (ambient and fluid)			see data sheet 02 500				
Fluid viscosity range		cSt	10 ÷ 400				
Fluid contamination degree		According to ISO 4406:1999 class 18/16/13					
Recommended viscosity		cSt	25				
Mass		kg	1,8	3,8	5,3	6,1	8,3

1 - IDENTIFICATION CODE OF DIRECT OPERATED PROPORTIONAL VALVE PRED3K*

P	R	E	D	3		-		/	10		-		K9			

Pressure control valve

Electrical proportional control

Direct operated

Size ISO 4401-03

Explosion-proof certification:
See table 1.1

Pressure control range
070 = 0,7 - 70 bar
140 = 1,1 - 140 bar
210 = 1,8 - 210 bar
350 = 2,8 - 350 bar

Series No.
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
For temperature range -20 / +80 °C
N = NBR seals for mineral oil (standard)
V = FPM seals for special fluids
For temperature range -40 / +80 °C
NL = seal for low temperatures (for mineral oil)

Nominal solenoid voltage:
D12 = 12V DC
D24 = 24V DC

Coil electrical connection:
by terminal block

Connection type for cable gland
upper connection:
T01 = M20x1.5 - ISO 261
T02 = Gk 1/2 - UNI EN 10226-2
not available for INMETRO
T03 = 1/2” NPT - ANSI B1.20.1
(ex ANSI B2.1)
side connection:
S01 = M20x1.5 - ISO 261
S02 = Gk 1/2 - UNI EN 10226-2
not available for INMETRO
S03 = 1/2” NPT - ANSI B1.20.1
(ex ANSI B2.1)
S04 = M16x1.5 - ISO 261

Option: **/T5**
version in T5 temperature class.
Omit if not required.

Option:
surface treatment not standard.
Omit if not required
(see **NOTE**)

NOTE: the valves are supplied with standard surface treatment of phosphating black.

Upon request we can supply these valves with full zinc-nickel surface treatment, suitable to ensure a salt spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

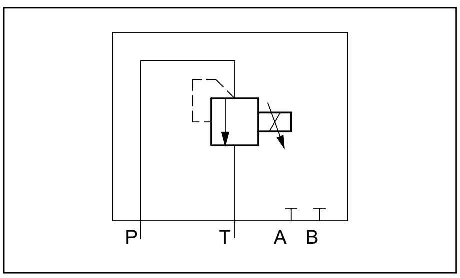
For full zinc-nickel surface treatment add **/W7** at the end of the identification code.

1.1 - Names of valves per certification

	ATEX		IECEx		INMETRO	
for gases for dusts	**KD2**	II 2GD	**KXD2**	IECEx Gb IECEx Db	**KBD2**	INMETRO Gb INMETRO Db
for mines	**KDM2**	I M2	**KXDM2**	IECEx Mb	**KBDM2**	INMETRO Mb

NOTE: Refer to the technical data sheet 02 500 for marking, operating temperatures and available versions.

2 - HYDRAULIC SYMBOL



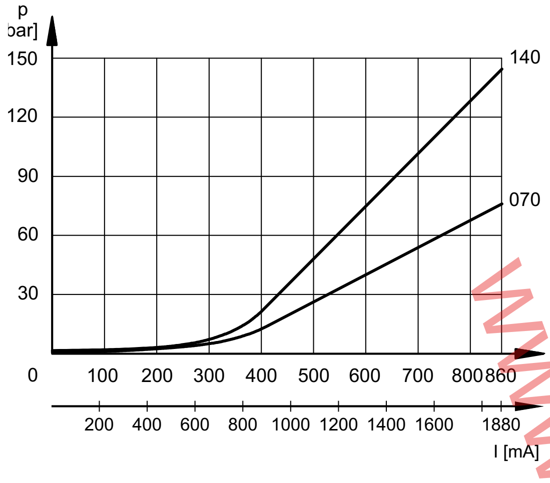
3 - CHARACTERISTIC CURVES FOR DIRECT OPERATED PROPORTIONAL VALVE PRED3K*

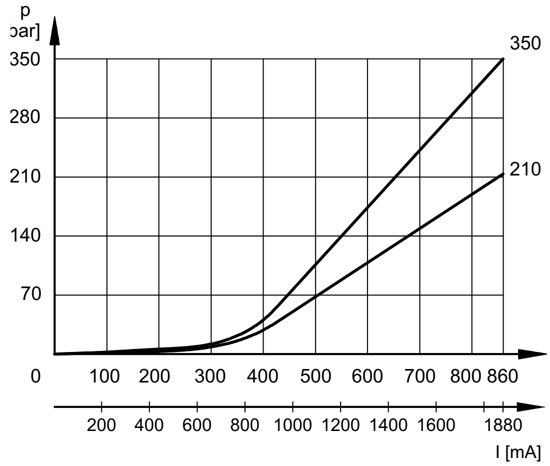
(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Typical control curves according to the current supplied to the solenoid for pressure control ranges: 070, 140, 210, 350, measured with input flow rate Q =1 l/min.

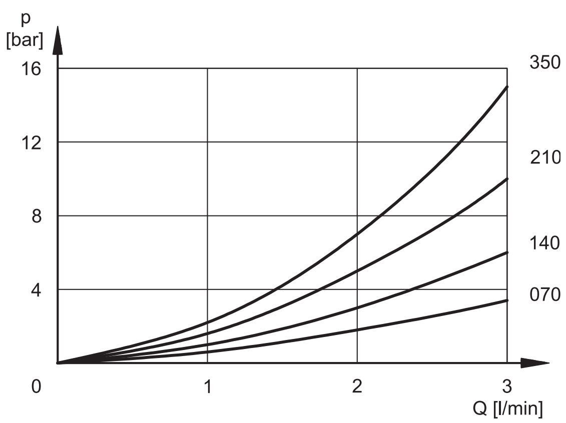
The curves are obtained without any hysteresis and linearity compensation and they are measured without any backpressure in T. The full scale pressure is set in factory with a flow rate of 1 l/min. In case of higher flow rate, the full scale pressure will increase considerably (see diagram pmax = f (Q)).

PRESSURE CONTROL p = f(I)

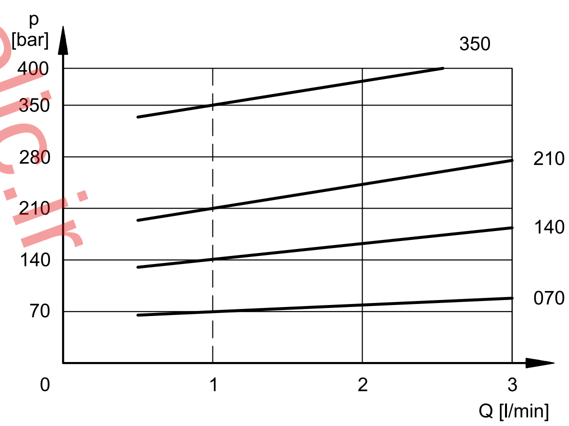




MINIMUM CONTROLLED PRESSURE p min = f (Q)



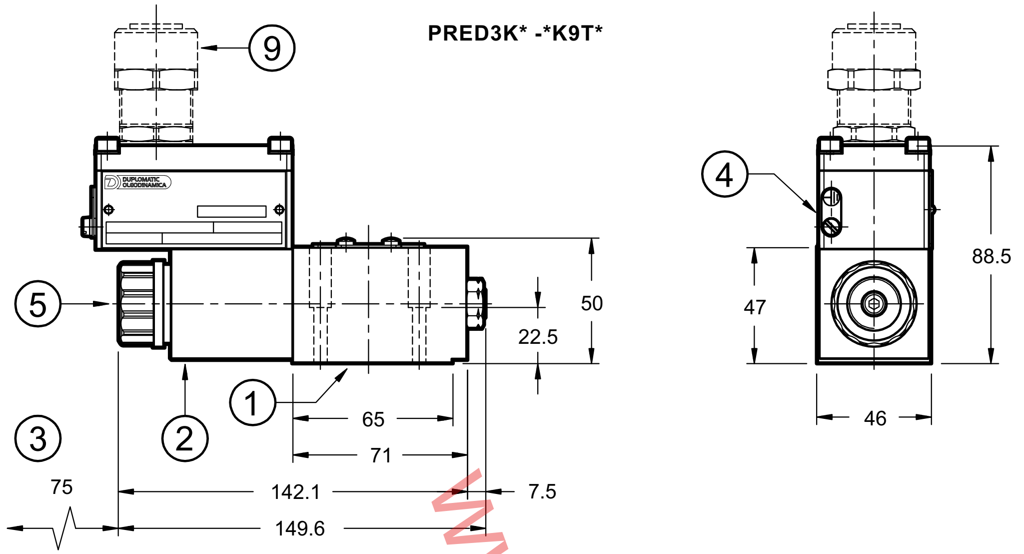
PRESSURE VARIATION p max = f (Q)

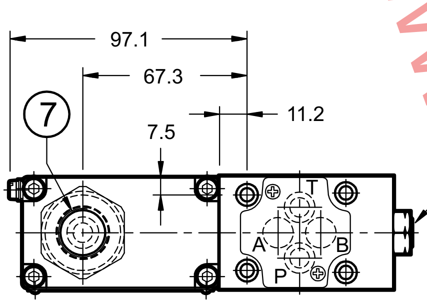


4 - PRED3K* OVERALL AND MOUNTING DIMENSIONS

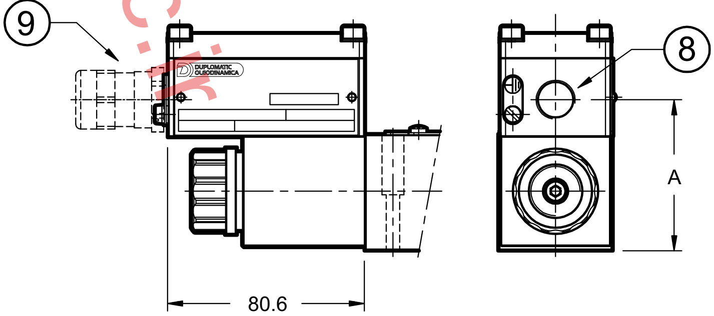
dimensions in mm

PRED3K* -*K9T*





PRED3K* -*K9S*



1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25 x 1.78) - 90 shore
2	Explosion-proof coil
3	Minimum clear space required
4	Terminal for supplementary GND connection
5	Breather (Allen key 4)
6	Factory setting sealing (we recommend not unscrewing the nut)
7	Upper port for cable gland
8	Side port for cable gland
9	Cable gland To be ordered separately, see par.18

Side port type	A
S01, S04	60.5
S02, S03	60

NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (5) placed at the end of the solenoid tube.

Fastening of single valve: 4 SHC screws M5x30 - ISO 4762
Tightening torque: 5 Nm (A 8.8 screws)
Threads of mounting holes: M5x10

5 - IDENTIFICATION CODE OF PILOT OPERATED PROPORTIONAL VALVES PRE*K*

P	R	E			-		/	10		-		K9			

Pilot operated pressure relief valve

Electric proportional control

Size: **3** = ISO 4401-03
10 = ISO 6264-06
25 = ISO 6264-08
32 = ISO 6264-10

Explosion-proof certification:
See table 1.1

Pressure control range:

PRE3K*:
070 = 3.5 - 70 bar
140 = 4 - 140 bar
210 = 4 - 210 bar
350 = 5 - 350 bar

PRE10K*, PRE25K* and PRE32K*
070 = up to 70 bar
140 = up to 140 bar
210 = up to 210 bar
350 = up to 350 bar

Series No.
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
For temperature range -20 / +80 °C
N = NBR seals for mineral oil (standard)
V = FPM seals for special fluids
For temperature range -40 / +80 °C
NL = seal for low temperatures (for mineral oil)

Nominal solenoid voltage:
D12 = 12V DC
D24 = 24V DC

Coil electrical connection: by terminal block

Connection type for cable gland
upper connection:
T01 = M20x1.5 - ISO 261
T02 = Gk 1/2 - UNI EN 10226-2 not available for INMETRO
T03 = 1/2” NPT - ANSI B1.20.1 (ex ANSI B2.1)
side connection:
S01 = M20x1.5 - ISO 261
S02 = Gk 1/2 - UNI EN 10226-2 not available for INMETRO
S03 = 1/2” NPT - ANSI B1.20.1 (ex ANSI B2.1)
S04 = M16x1.5 - ISO 261

Option: **/T5**
version in T5 temperature class.
Omit if not required.

Option:
surface treatment not standard.
Omit if not required
(see **NOTE**)

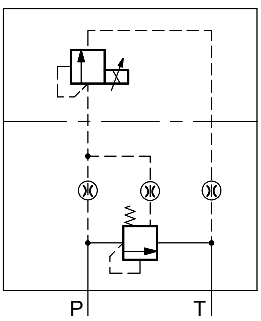
NOTE: the valves are supplied with standard surface treatment of phosphating black.

Upon request we can supply these valves with full zinc-nickel surface treatment, suitable to ensure a salt spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

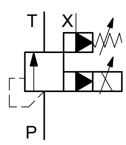
For full zinc-nickel surface treatment add **/W7** at the end of the identification code.

6 - HYDRAULIC SYMBOLS

PRE3K*



PRE10K*, PRE25K* and PRE32K*

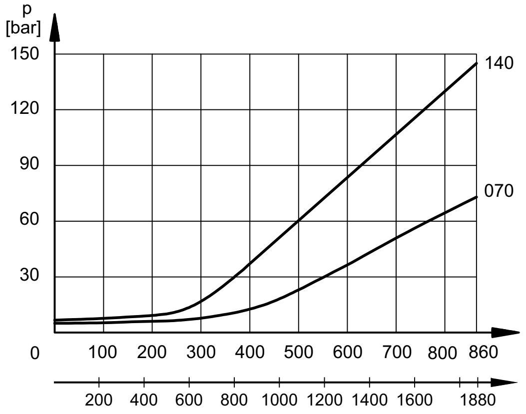


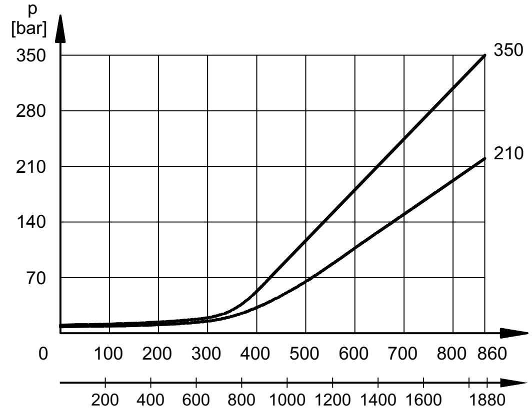
7 - CHARACTERISTIC CURVES OF PILOT OPERATED PROPORTIONAL VALVES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

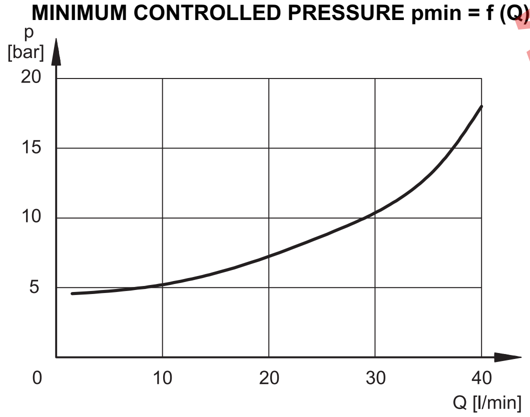
7.1 - PRE3K*

PRESSURE CONTROL p=f (I)

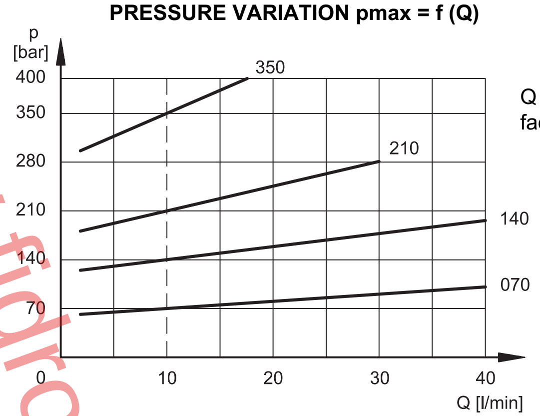




MINIMUM CONTROLLED PRESSURE pmin = f (Q)



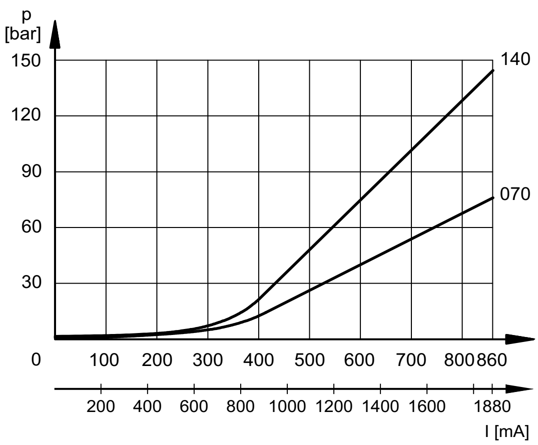
PRESSURE VARIATION pmax = f (Q)

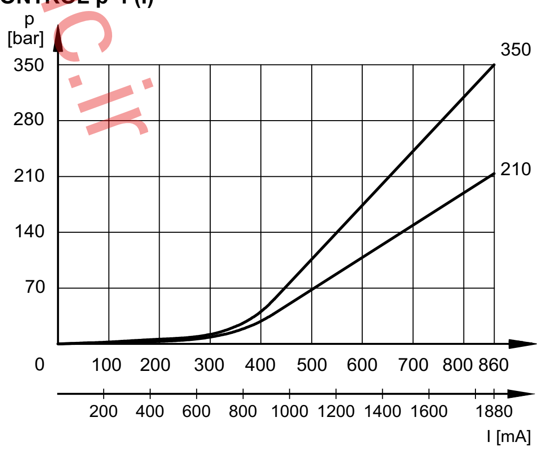


Q = 10 lt/min
factory setting

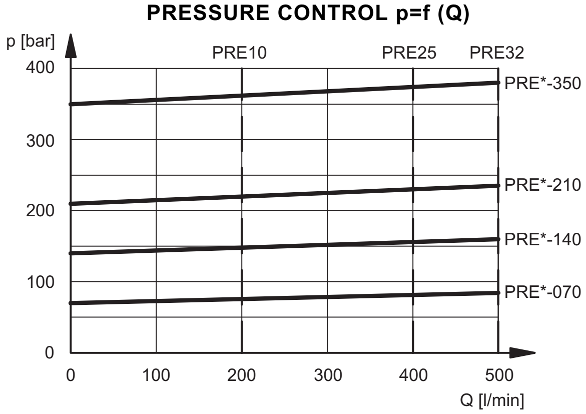
7.2 - PRE10K*, PRE25K* and PRE32K*

PRESSURE CONTROL p=f (I)

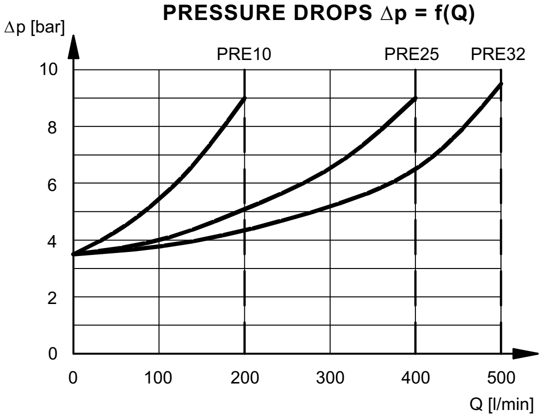




PRESSURE CONTROL p=f (Q)



PRESSURE DROPS Δp = f(Q)



8 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical step response times measured with a valve of pressure range up to 140 bar and with input flow rate of Q = 2 l/min for PRED3K*, Q = 10 l/min for PRE3K* and Q = 50 l/min for PRE10K*, PRE25K* and PRE32K*.

REFERENCE SIGNAL	0 → 100%	100 → 0%
	Step response [ms]	
PRED3K*	80	40
PRE3K*	80	40
PRE10K*, PRE25K* and PRE32K*	120	90

9 - ELECTRICAL CHARACTERISTICS

(values ± 5%)

NOMINAL VOLTAGE	V DC	12	24
RESISTANCE (AT 20°C)	Ω	3,4	15,6
NOMINAL CURRENT	A	1,88	0,86

DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2014/30/EU
CLASS OF PROTECTION: Atmospheric agents Coil insulation (VDE 0580)	 IP66 / IP68 class H

9.1 - Wiring

In order to realise the electrical connection of the coil, it is necessary to access the terminal block (1) unscrewing the 4 screws (2) that fasten the cover (3) with the box (4) that contains the terminal block.

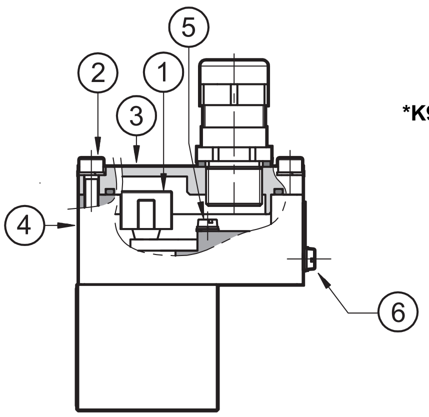
The electrical connection is polarity-independent.

By doing electrical connection it is important to connect also the grounding point (5) in the terminal block box (M4 screws), through suitable conductors with the general grounding line of the system.

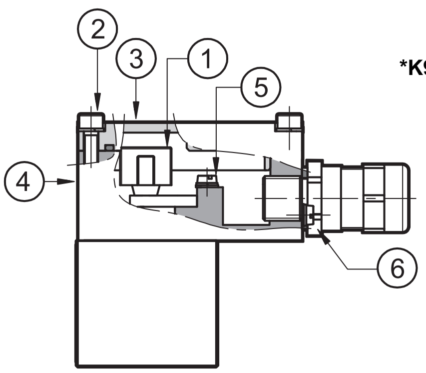
On the external body of the coil there is a grounding point (6) (M4 screw) that allow to ensure equipotentiality between the valve and the general grounding line of the system; connecting this point the regulation of the EN 13463-1 standard, that impose to verify the equipotentiality of the elements included in a potentially explosive environment (the maximum resistance between the elements must be 100 Ω), is guaranteed.

At the end of the electrical wiring, it is necessary to reassemble the cover (3) on the box (4), checking the correct positioning of the seal located in the cover seat and fastening the 4 M5 screws with a torque of 4.9 ÷ 6 Nm.

Electrical wiring must be done following the instructions of the rules in compliance with standard about protection against explosion hazards.



K9T



K9S

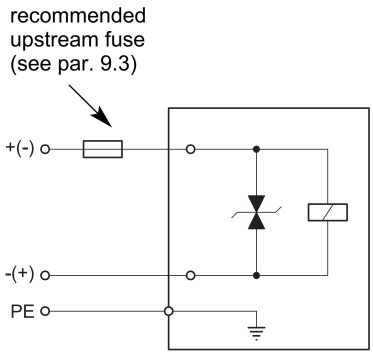
Characteristics of the cables connectable for wiring are indicated in the table below:

Function	Cable section
Operating voltage cables connection	max 2.5 mm²
Connection for internal grounding point	max 2.5 mm²
Connection for external equipotential grounding point	max 6 mm²

Cables for wiring must be non-armoured cables, with external covering sheath and must be suitable for use in environments with temperatures from - 20 °C to +110 °C (for valves either with N or V seals) or from - 40 °C to +110 °C (for valves with NL seals).

Cable glands (which must be ordered separately, see paragraph 18) allow to use cables with external diameter between 8 and 10 mm.

9.2 - Electrical diagrams



9.3 - Overcurrent fuse and switch-off voltage peak

Upstream of each valve, an appropriate fuse (max 3 x In according to IEC 60127) or a protective motor switch with short-circuit and thermal instantaneous tripping, as short-circuit protection, must be connected. The cut-off power of the fuse must correspond or exceed the short circuit current of the supply source. The fuse or the protective motor must be placed outside the dangerous area or they must be protected with an explosion-proof covering.

In order to safeguard the electronic device to which the valve is connected, there is a protection circuit in the coil, that reduces voltage peaks, which can occur when inductances are switched off.

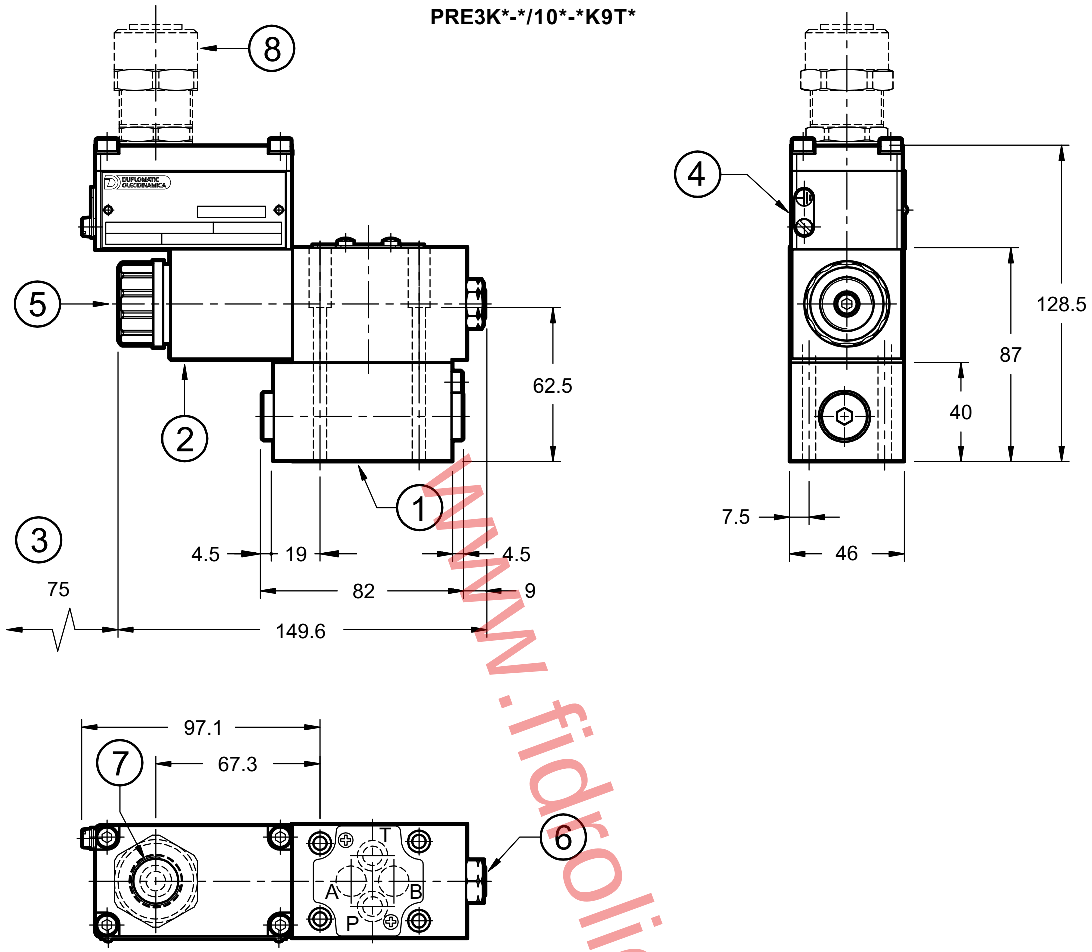
The table shows the type of fuse recommended according to the nominal voltage of the valve and to the value of the voltage peaks reduction.

Coil type	Nominal voltage [V]	Rated current [A]	**Recommended pre-fuse characteristics medium time-lag according to DIN 41571 [A]**	Maximum voltage value upon switch off [V]	Suppressor circuit
D12	12	1,88	2,5	- 49	Transient voltage suppressor bidirectional
D24	24	0,86	1,25	- 49	

10 - PRE3K* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

PRE3K*-*/10*-*K9T*



1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 shore
2	Explosion-proof coil
3	Minimum clear space required
4	Terminal for supplementary GND connection
5	Breather (Allen key 4)
6	Factory setting sealing (we recommend not unscrewing the nut)
7	Upper port for cable gland
8	Cable gland. To be ordered separately, see paragraph 18

NOTE 1: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (5) placed at the end of the solenoid tube.

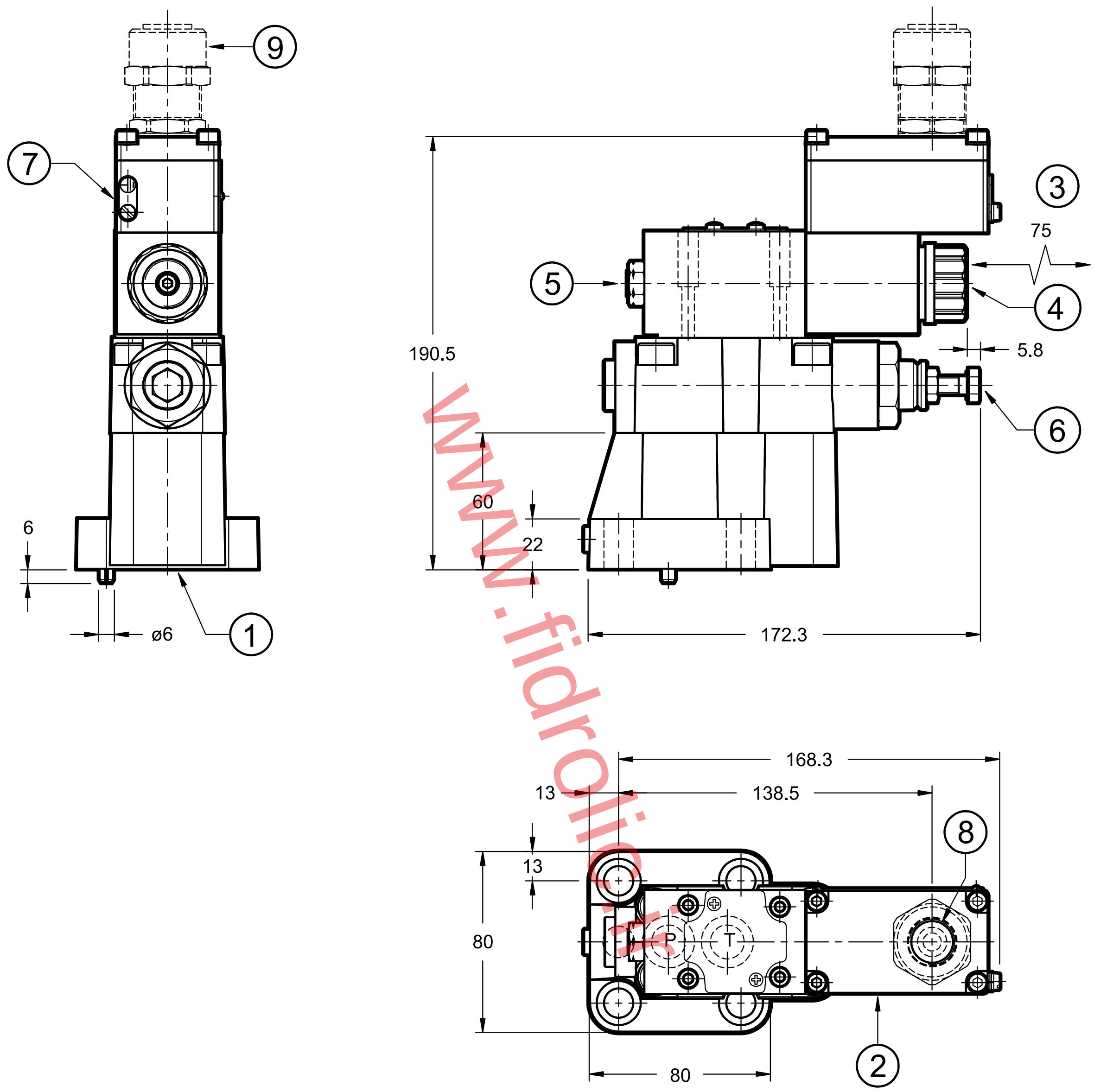
NOTE 2: for side connections see paragraph 14.

Fastening of single valve: 4 screws SHC M5x70 - ISO 4762
Tightening torque: 5 Nm (A 8.8 screws)
Threads of mounting holes: M5x10

11 - PRE10K* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

PRE10K*-*/10*-*K9T*



1	Mounting surface with sealing rings: N. 2 OR type 123 (17.86 x 2.62) - 90 shore N. 1 OR type 109 (9.13 x 2.62) - 90 shore
2	Explosion-proof coil
3	Minimum clear space required
4	Breather (Allen key 4)
5	Factory setting sealing (we recommend not unscrewing the nut)
6	Pressure relief valve (factory set)
7	Terminal for supplementary GND connection
8	Upper port for cable gland
9	Cable gland. To be ordered separately, see paragraph 18

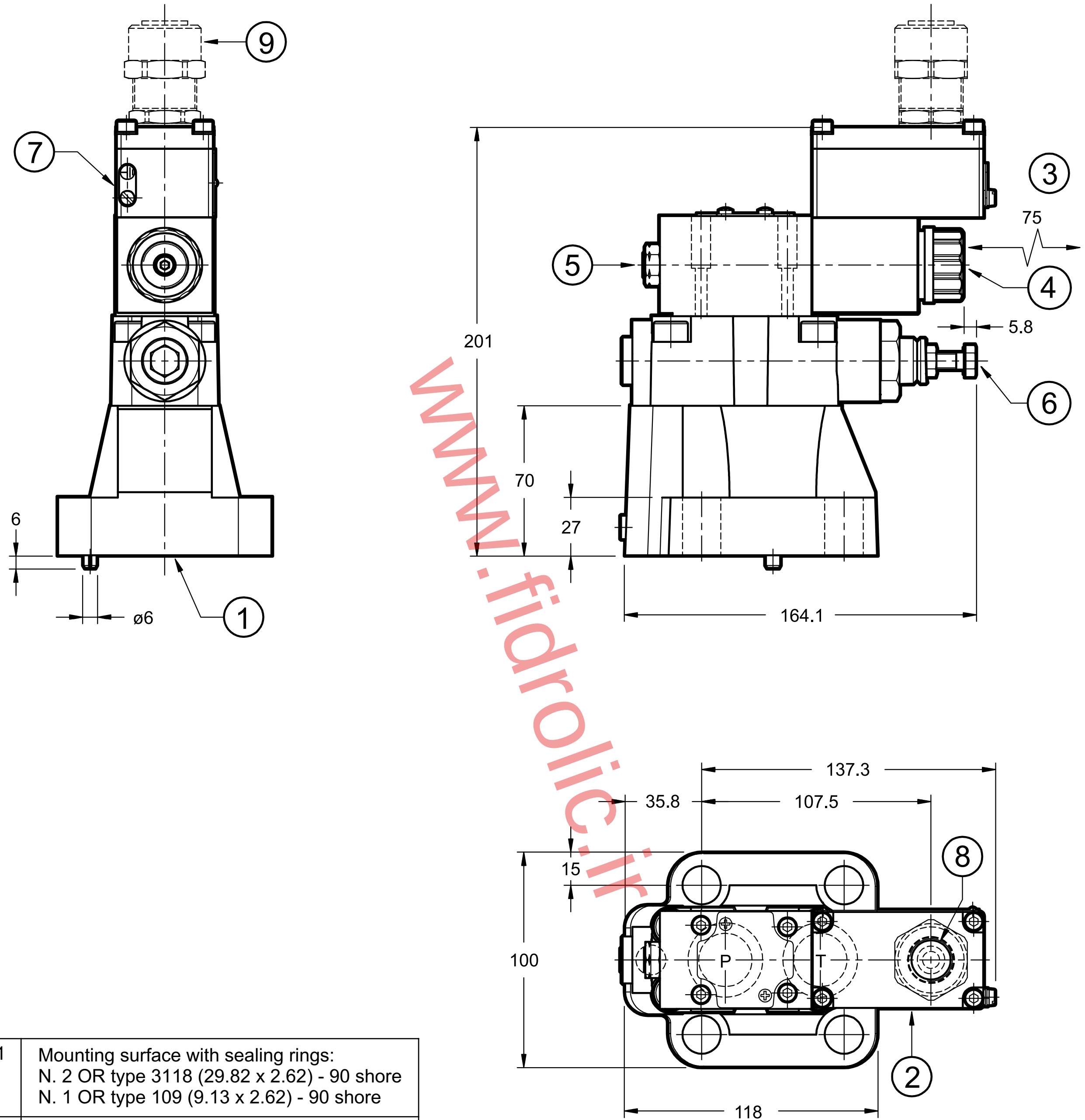
NOTE 1: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.
NOTE 2: for side connections see paragraph 15.

Fastening of single valve: 4 screws M12x40 - ISO 4762
Tightening torque: 69 Nm (A 8.8 screws)
Threads of mounting holes: M12x20

12 - PRE25K* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

PRE25K*-*/10*-*K9T*



1	Mounting surface with sealing rings: N. 2 OR type 3118 (29.82 x 2.62) - 90 shore N. 1 OR type 109 (9.13 x 2.62) - 90 shore
2	Explosion-proof coil
3	Minimum clear space required
4	Breather (Allen key 4)
5	Factory setting sealing (we recommend not unscrewing the nut)
6	Pressure relief valve (factory set)
7	Terminal for supplementary GND connection
8	Upper port for cable gland
9	Cable gland. To be ordered separately, see paragraph 18

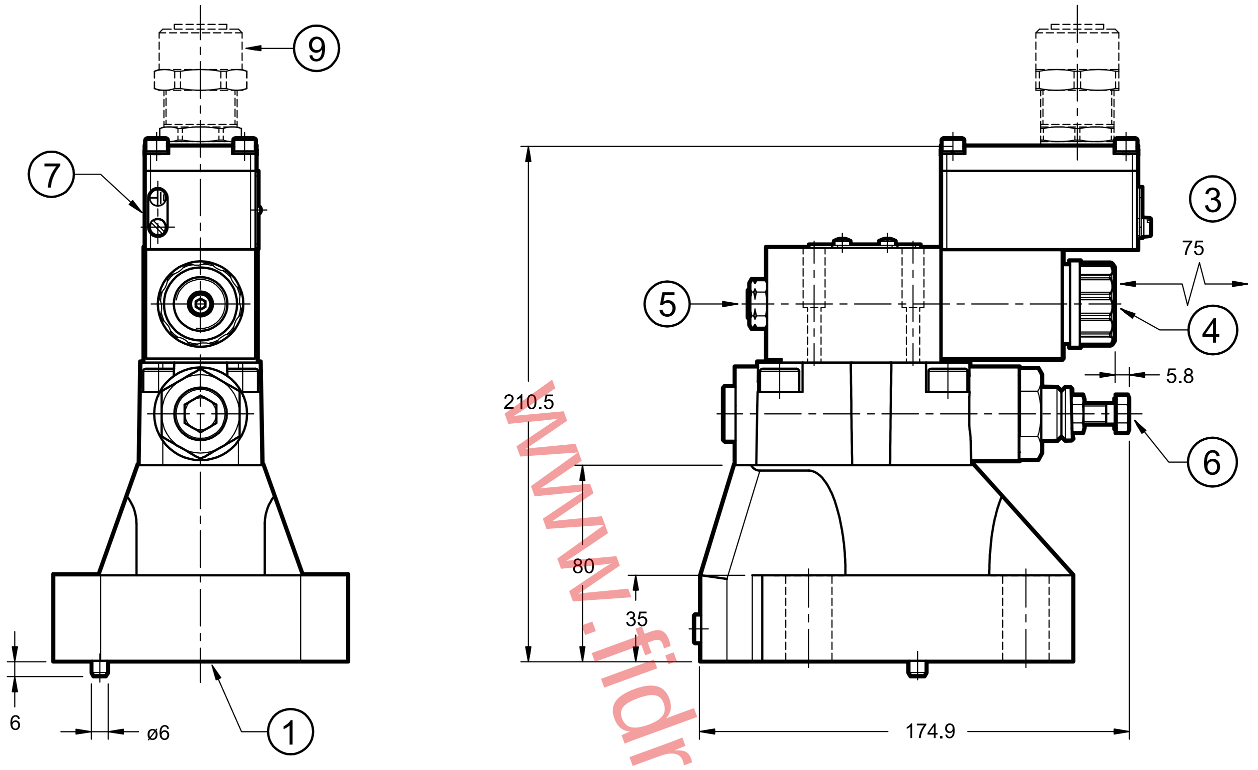
NOTE 1: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.
NOTE 2: for side connections see paragraph 15.

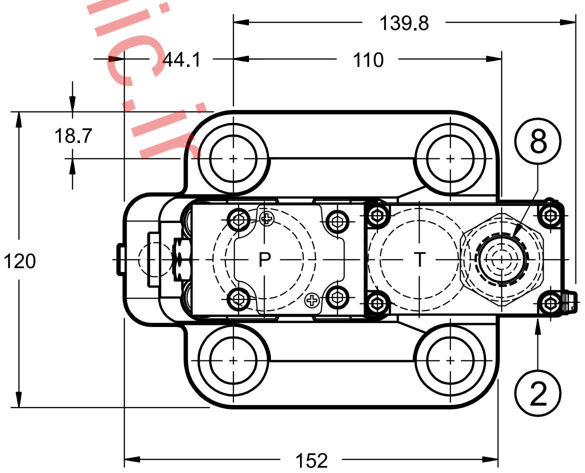
Fastening of single valve: 4 SHC screws M16x50 - ISO 4762
Tightening torque: 170 Nm (A 8.8 screws)
Threads of mounting holes: M16x25

13 - PRE32K* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

PRE32K*-*/10*-*K9T*





1	Mounting surface with sealing rings: N. 2 OR type 4137 (34.52 x 3.53) - 90 shore N. 1 OR type 109 (9.13 x 2.62) - 90 shore
2	Explosion-proof coil
3	Minimum clear space required
4	Breather (Allen key 4)
5	Factory setting sealing (we recommend not unscrewing the nut)
6	Pressure relief valve (factory set)
7	Terminal for supplementary GND connection
8	Upper port for cable gland
9	Cable gland. To be ordered separately, see paragraph 18

NOTE 1: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

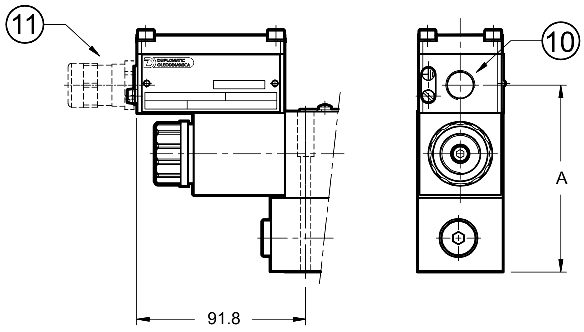
NOTE 2: for side connections see paragraph 14.

Fastening of single valve: N. 4 SHC screws M18x60 - ISO 4762
Tightening torque: 235 Nm (A 8.8 screws)
Threads of mounting holes: M18x27

14 - PRE*K*-*/10*-*K9S* (SIDE CONNECTION) OVERALL AND MOUNTING DIMENSIONS

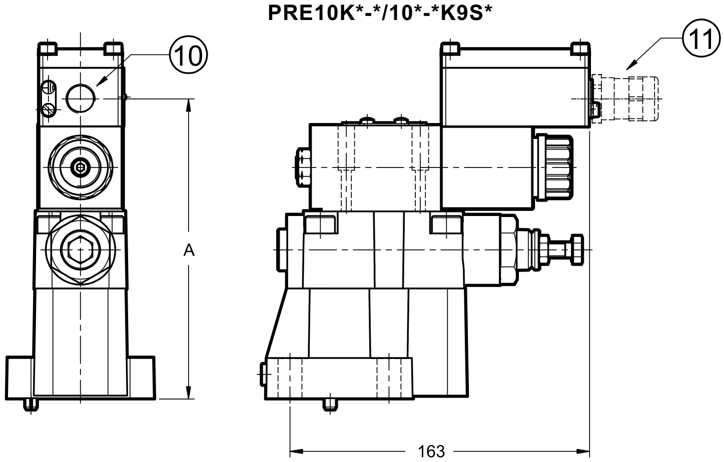
dimensions in mm

PRE3K*-*/10*-*K9S*



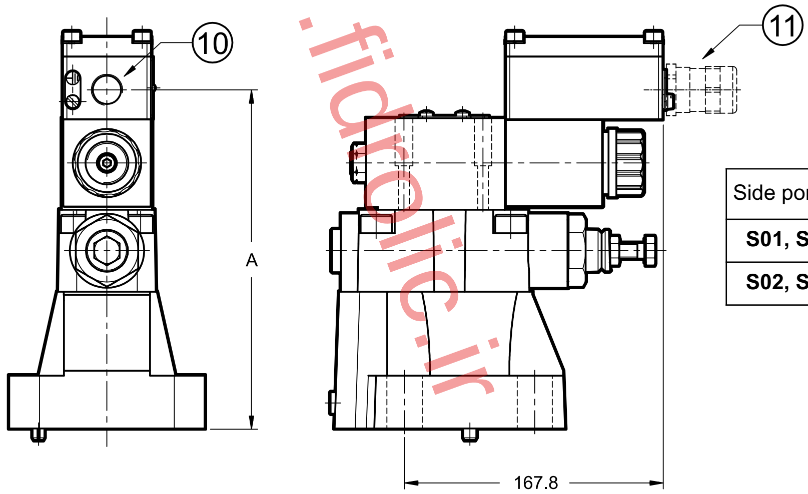
Side port type	A
S01, S04	100.5
S02, S03	100

PRE10K*-*/10*-*K9S*



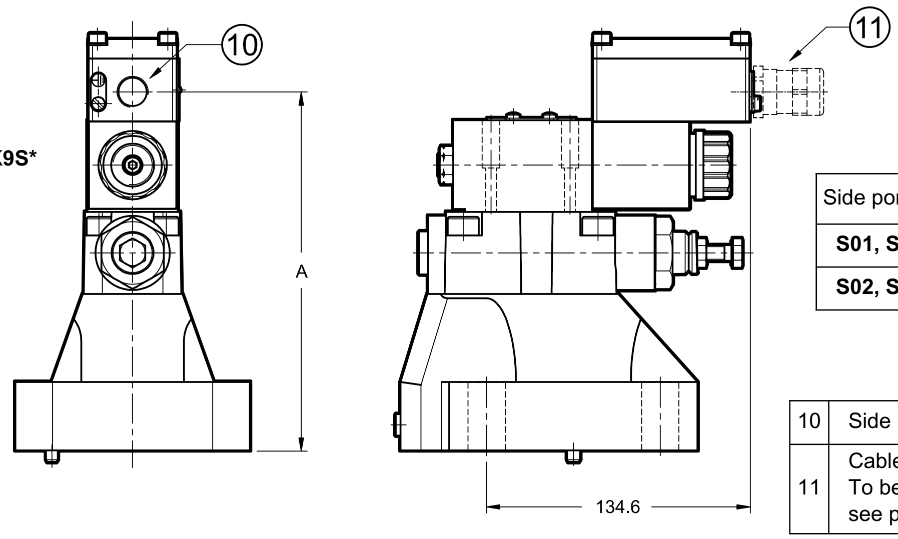
Side port type	A
S01, S04	162.5
S02, S03	162

PRE25K*-*/10*-*K9S*



Side port type	A
S01, S04	172.5
S02, S03	172

PRE32K*-*/10*-*K9S*

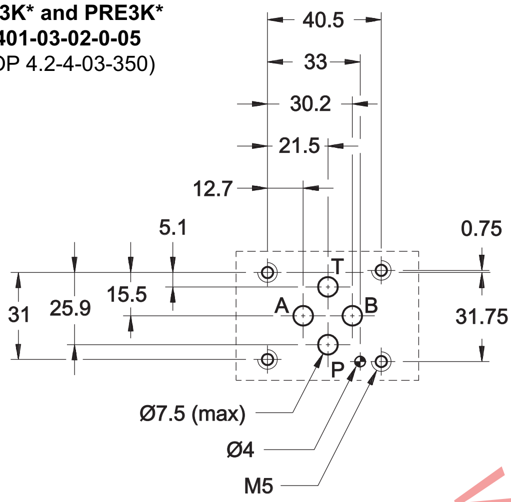


Side port type	A
S01, S04	182.5
S02, S03	182

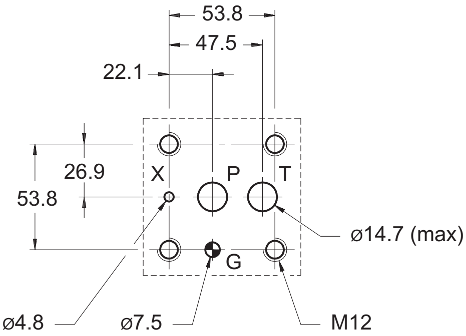
10	Side port for cable gland
11	Cable gland. To be ordered separately, see par. 16

15 - MOUNTING SURFACES

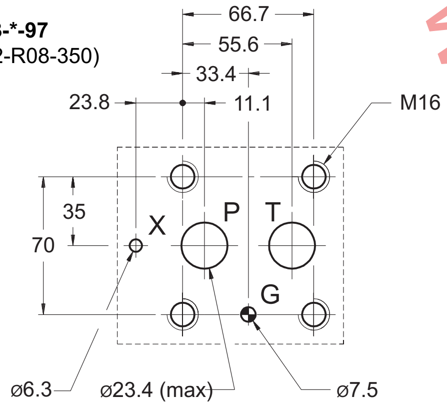
PRED3K* and PRE3K*
ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



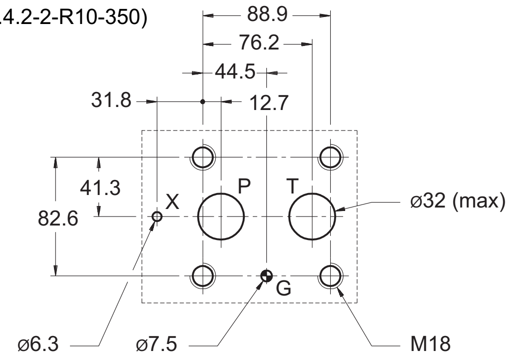
PRE10K*
ISO 6264-06-09-*-97
(CETOP 4.4.2-2-R06-350)



PRE25K*
ISO 6264-08-13-*-97
(CETOP 4.4.2-2-R08-350)



PRE32K*
ISO 6264-10-17-*-97
(CETOP 4.4.2-2-R10-350)



16 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

17 - INSTALLATION

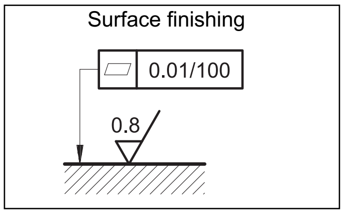
Installation must adheres to instructions reported in the *Use and Maintenance manual*, always attached to the valve. Unauthorized interventions can be harmful to people and goods because of the explosion hazards present in potentially explosive atmospheres.

We recommend to install the valves either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraphs 3 and 7.

Ensure that there is no air in the hydraulic circuit. In particular applications, it can be necessary to vent the air, by using the apposite drain screw in the solenoid tube. At the end of the operation, make sure of having correctly screwed the drain screw.

Connect the T port on the valve directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value. **Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

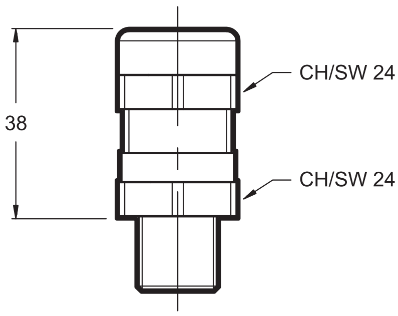
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



18 - CABLE GLANDS

Cable glands must be ordered separately; Duplomatic offers some types of cable glands with the following features:

- version for non-armoured cable, external seal on the cable (suitable for Ø8÷10 mm cables);
- ATEX II 2GD, I M2; IECEx Gb, Db, Mb; INMETRO Gb, Db, Mb certified
- cable gland material: nickel brass
- rubber tip material: silicone
- ambient temperature range: -70ºC ÷ +220ºC
- protection degree: IP66/IP68
- Tightening torque: 15 Nm



To order, list the description and the code of the version chosen from among those listed below:

Description: CGK2/NB-01/10

Code: 3908108001

M20x1.5 - ISO 261 male thread, suitable for coils with T01 and S01 connections. It is supplied equipped with silicone seal, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Description: CGK2/NB-02/10

Code: 3908108002

Gk 1/2 - UNI EN 10226-2 male thread, suitable for coils with T02 and S02 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Description: CGK2/NB-03/10

Code: 3908108003

1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1), suitable for coils with T03 and S03 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Description: CGK2/NB-04/10

Code: 3908108004

M16x1.5 - ISO 261 male thread, suitable for coils with S04 connection. It is supplied equipped with silicone seal, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

19 - ELECTRONIC CONTROL UNITS

EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		

NOTE: electronic control units offered are not explosion-proof certified; therefore, they must be installed outside classified areas.

20 - SUBPLATES

(see catalogue 51 000)

	PRED3K*	PRE3K*	PRE10K*	PRE25K*	PRE32K*
Type with rear ports	PMMD-AI3G	PMMD-AI3G	PMRQ3-AI4G	PMRQ5-AI5G	PMRQ7-AI7G
Type with side ports	PMMD-AL3G	PMMD-AL3G	-	-	-
P, T ports dimensions	3/8” BSP	3/8” BSP	P: 1/2” BSP T: 3/4” BSP	1” BSP	1” ¼ BSP
X port dimensions	-	-	1/4” BSP	1/4” BSP	1/4” BSP

NOTE: Subplates (to be ordered separately) do not contain neither aluminium nor magnesium at a higher rate than the value allowed by norms according to ATEX directive for categories II 2GD and I M2 .

The user must take care and make a complete assessment of the ignition risk, that can occur from the relative use in potentially explosive environments.

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EXPLOSION-PROOF CLASSIFICATION for

SOLENOID AND PROPORTIONAL VALVES

ref. catalogues:

pressure valves

RQM*K*-P	21 515
PRE(D)*K*	81 315
ZDE3K*	81 515
DZCE*K*	81 605

directional valves

D*K*	41 515
DS(P)E*K*	83 510

GENERAL INFO

This informative technical datasheet displays information about **classification and marking** of Duplomatic explosion-proof valves range.

Duplomatic offers valves with the following certifications:

ATEX	**II 2G**	**II 2D**	**I M2**
IECEx	**Gb**	**Db**	**Mb**
INMETRO	**Gb**	**Db**	**Mb**

Instructions for use and maintenance can be found in the related manuals, always supplied toghether with valves.

1 - ATEX CLASSIFICATION AND TEMPERATURES

Duplomatic certificates the combination valve-coil for the valves suitable for application and installation in potentially explosive atmospheres, according to ATEX directive; the supply always includes the declaration of conformity to the directive and the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environments.

Coils assembled on these valves have been separately certified according to ATEX directive and so they are suitable for use in potentially explosive atmospheres.

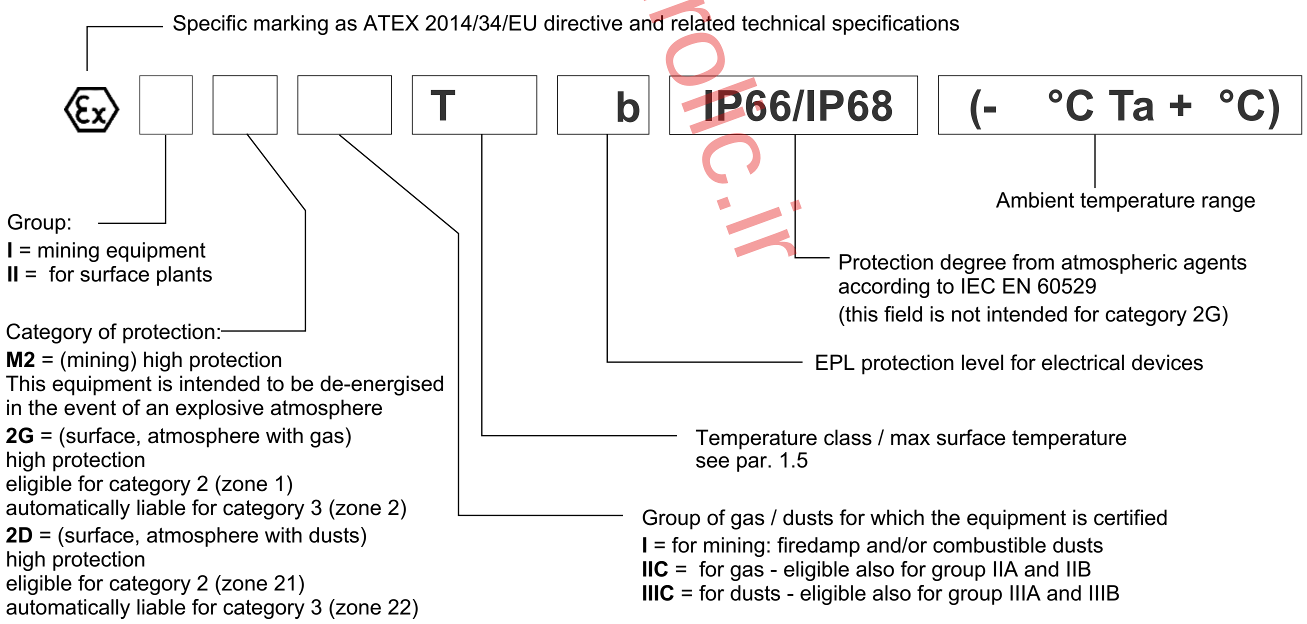
1.1 - ATEX classification for valves

Type examination certificate: CEC 13 ATEX 030-REV.2
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

ATEX II 2G ATEX II 2D	***KD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
ATEX I M2	***KDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

1.2 - ATEX marking for valves

valve code		N and V seals	NL seals
***KD2**	for gas	Ex II 2G IIC T4 Gb (-20°C Ta +80°C)	Ex II 2G IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex II 2D IIIC T154°C Db IP66/IP68 (-20°C Ta +80°C)	Ex II 2D IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
***KD2 /T5**	for gas	Ex II 2G IIC T5 Gb (-20°C Ta +55°C)	Ex II 2G IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex II 2D IIIC T129°C Db IP66/IP68 (-20°C Ta +55°C)	Ex II 2D IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
***KDM2**	mining	Ex I M2 I T150°C Mb IP66/68 (-20°C Ta +75°C)	Ex I M2 I T150°C Mb IP66/68 (-40°C Ta +75°C)



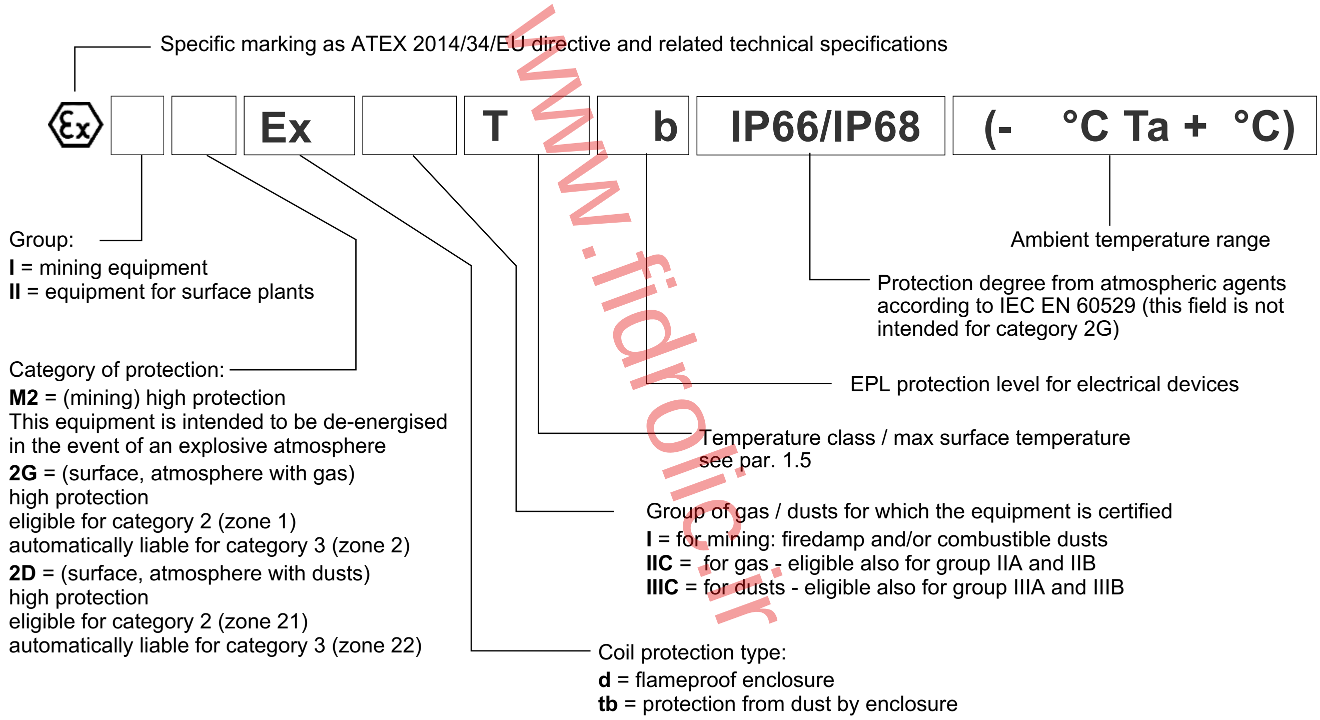
1.3 - ATEX classification of the coils

The coil of the explosion-proof valves is ATEX certified itself an as such is identified with its own tag, carries the relative ATEX marking. **The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex d” type protection (explosion-proof coil).**

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

1.4 - ATEX marking on coils

for valve type ***KD2**	for gas	Ex II 2G Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex II 2D Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
for valve type ***KD2 /T5**	for gas	Ex II 2G Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex II 2D Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
for valve type ***KDM2**	mining	Ex I M2 Ex d I T150°C Mb IP66/IP68 (-40°C Ta +75°C)



1.5 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

The valves in group II can also be used for less limiting temperature classes (surface temperature allowed higher).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
ATEX II 2G ATEX II 2D	***KD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T154°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T129°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
ATEX I M2	***KDM2**	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				

2 - IECEx CLASSIFICATION AND TEMPERATURES

The IECEx certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with IECEx certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex db” type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

2.1 - IECEx classification

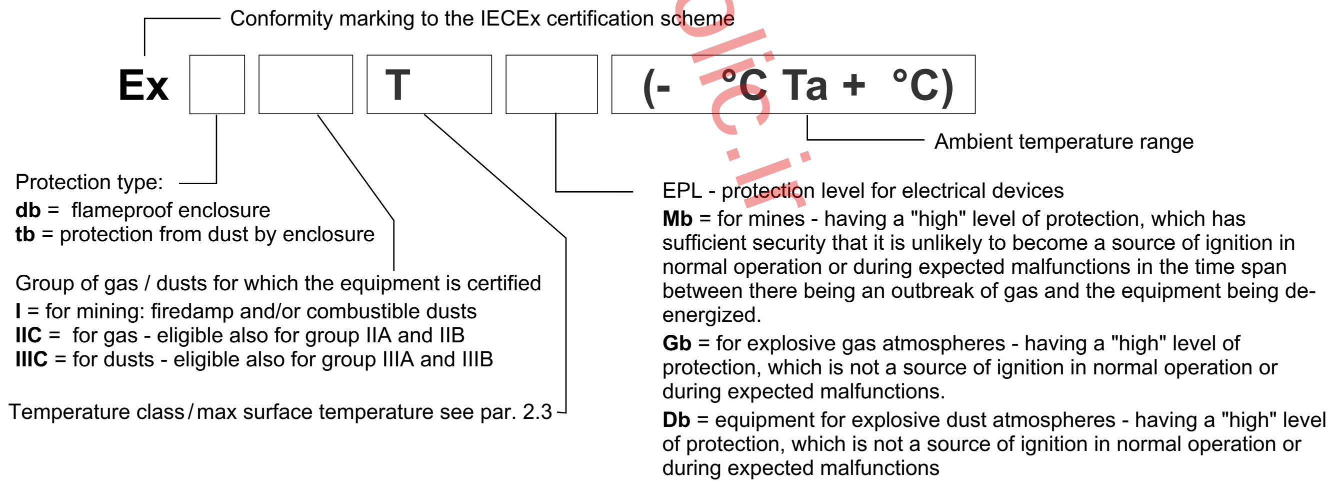
Certificate of conformity (CoC): IECEx TUN 15.0028X
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

IECEx Gb IECEx Db	***KXD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
IECEx Mb	***KXDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

2.2 - IECEx marking

There is a plate with the IECEx mark on each coil.

***KXD2** valves	for gas	Ex db IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T135°C Db (-40°C Ta +80°C)
***KXD2 /T5** valves	for gas	Ex db IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T100°C Db (-40°C Ta +55°C)
***KDM2** valves	mining	Ex db I Mb (-40°C Ta +80°C)



2.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	N and V seals	NL seals	Temperature class	eligible also for
IECEx Gb IECEx Db	***KXD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T135°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KXD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T100°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
IECEx Mb	***KXDM2**	of ambient	-20 / +80 °C	-40 / +80 °C	-	-
		of fluid				

3 - INMETRO CLASSIFICATION AND TEMPERATURES

The INMETRO certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with INMETRO certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex d” type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

3.1 - INMETRO classification

Certificate of conformity: DNV 15.0094 X
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

INMETRO Gb INMETRO Db	***KBD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
INMETRO Mb	***KBDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

3.2 - INMETRO marking

There is a plate with the INMETRO mark on each coil.

***KBD2** valves	for gas	Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
***KBD2 /T5** valves	for gas	Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
***KBDM2** valves	mining	Ex d I T150° Mb IP66/IP68 (-40°C Ta +75°C)

Conformity marking to the INMETRO certification scheme

Ambient temperature range

Ex [ ] [ ] **T** [ ] **IP66/IP68** **(- °C Ta + °C)**

Protection degree from atmospheric agents according to IEC EN 60529 (this field is not intended for gases)

Protection type:
d = flameproof enclosure
tb = protection from dust by enclosure

Group of gas / dusts for which the equipment is certified
I = for mining: firedamp and/or combustible dusts
IIC = for gas - eligible also for group IIA and IIB
IIIC = for dusts - eligible also for group IIIA and IIIB

Temperature class / max surface temperature see par. 3.3

EPL - protection level for electrical devices
Mb = for mines - having a "high" level of protection, which has sufficient security that it is unlikely to become a source of ignition in normal operation or during expected malfunctions in the time span between there being an outbreak of gas and the equipment being de-energized.
Gb = for explosive gas atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions.
Db = equipment for explosive dust atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions

3.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
INMETRO Gb INMETRO Db	***KBD2**	of ambient of fluid	-20 / +80 °C	-40 / +80 °C	T4 (gas) T154°C (dusts)	T3, T2, T1 T200°C and higher
	***KBD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T129°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
INMETRO Mb	***KBDM2**	of ambient of fluid	-20 / +75 °C	-40 / +75 °C	T150°C	-

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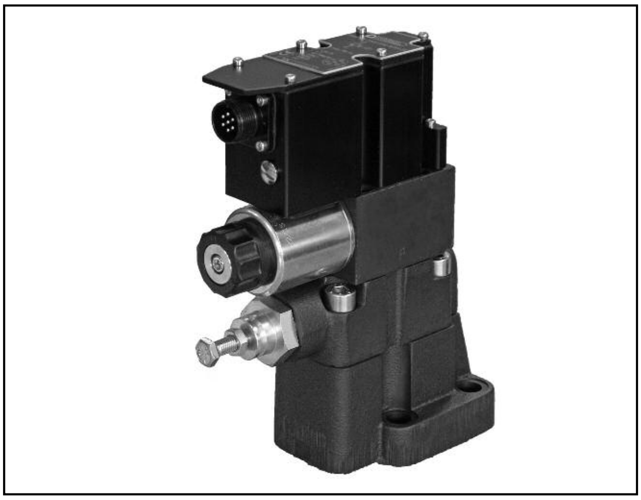


PRE*G

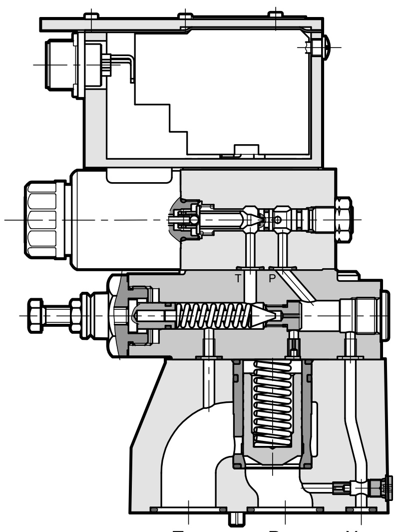
PILOT OPERATED PRESSURE RELIEF VALVES WITH PROPORTIONAL CONTROL AND INTEGRAL ELECTRONICS

SERIES 30

SUBPLATE MOUNTING ISO 6264

p max **350** bar
Q max (see table of performances)

OPERATING PRINCIPLE



— The PRE*G valves are pilot operated pressure relief valves with integrated electric proportional control and mounting interface in compliance with ISO 6264 standards.

— These valves are used to control hydraulic circuit pressure and enable the use of the full flow rate of the pump, even with settings approaching calibrated values.

— The two-stage design and wide passages ensure reduced pressure drops thereby improving the system energy performance.

— They are fitted with a manual pressure relief valve which is factory set to ≥15% of the maximum value in the pressure control range.

— The valves are available with command signal in voltage or current and on board electronics with internal enable, external enable or 0V monitor on pin C.

— A solenoid current monitoring signal is available.

— The valves are easy to install. The driver directly manages digital settings.

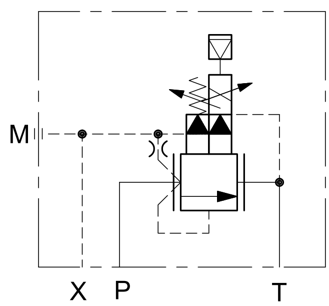
— They are available in three sizes with flow rates up to 500 l/min and in four pressure control ranges up to 350 bar.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

		PRE10G	PRE25G	PRE32G
Maximum operating pressure	bar	350		
Maximum flow	l/min	200	400	500
Step response		see paragraph 6		
Hysteresis	% of p nom	< 3%		
Repeatability	% of p nom	< ±1%		
Electrical characteristic		see paragraph 2		
Ambient temperature range	°C	-20 / +60		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree		According to ISO 4406:1999 class 18/16/13		
Recommended viscosity	cSt	25		
Mass	kg	5,5	6,3	8,5

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

P	R	E		G	-		/	30		-		K11	

Pilot operated pressure relief valve

Electro-proportional control

Size:
10 = ISO 6264-06
25 = ISO 6264-08
32 = ISO 6264-10

Digital integrated electronics for open loop

Pressure control range
070 = up to 70 bar
140 = up to 140 bar
210 = up to 210 bar
350 = up to 350 bar

Series No.
(the overall and mounting dimensions remain unchanged from 30 to 39)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Reference signal:
E0 = voltage 0 ÷ 10 V
E1 = current 4 ÷ 20 mA

Main connector 6 pin + PE

Pin C function:
A = external enable
B = internal enable
C = 0V monitor

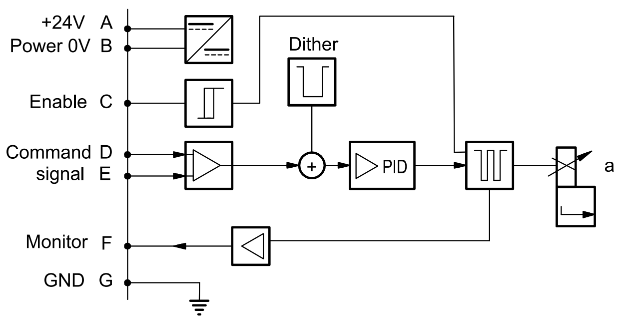
2 - ELECTRICAL CHARACTERISTICS

2.1 - Electrical on board electronics

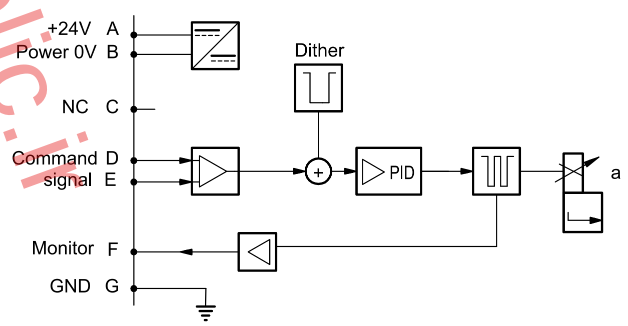
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		2A time lag
Command signals: voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedence Ri > 11 kOhm) 4 ÷ 20 (Impedence Ri = 58 Ohm)
Monitor signal (current to solenoid): voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedence Ro > 1 kOhm) 4 ÷ 20 (Impedence Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2004/108/EC standards

2.2 - On-board electronics diagrams

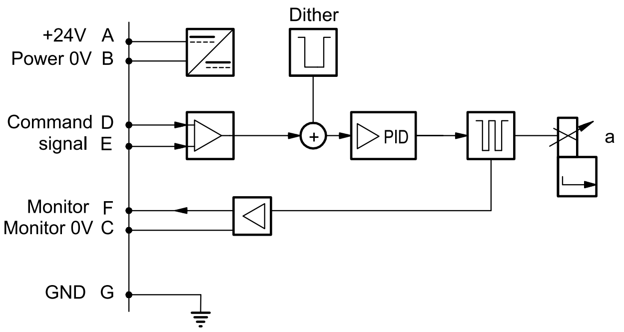
VERSION **A** - External Enable



VERSION **B** - Internal Enable

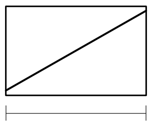


VERSION **C** - 0V Monitor

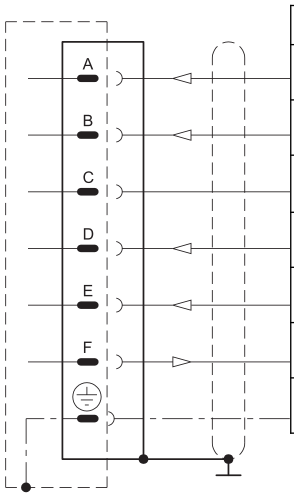


3 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal is between 0 ÷ 10V. The monitor feature of versions B anc C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**0V**	**+10V**
MONITOR	**0V**	**+10V**

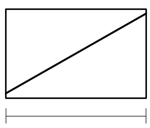


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	± 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	± 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

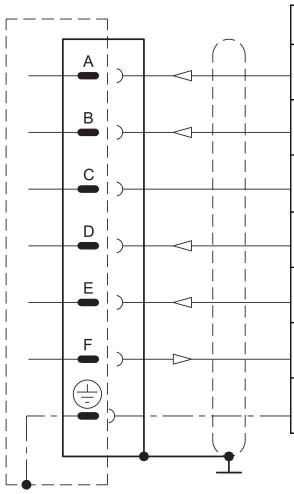
4 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B anc C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**4 mA**	**20 mA**
MONITOR	**4 mA**	**20 mA**

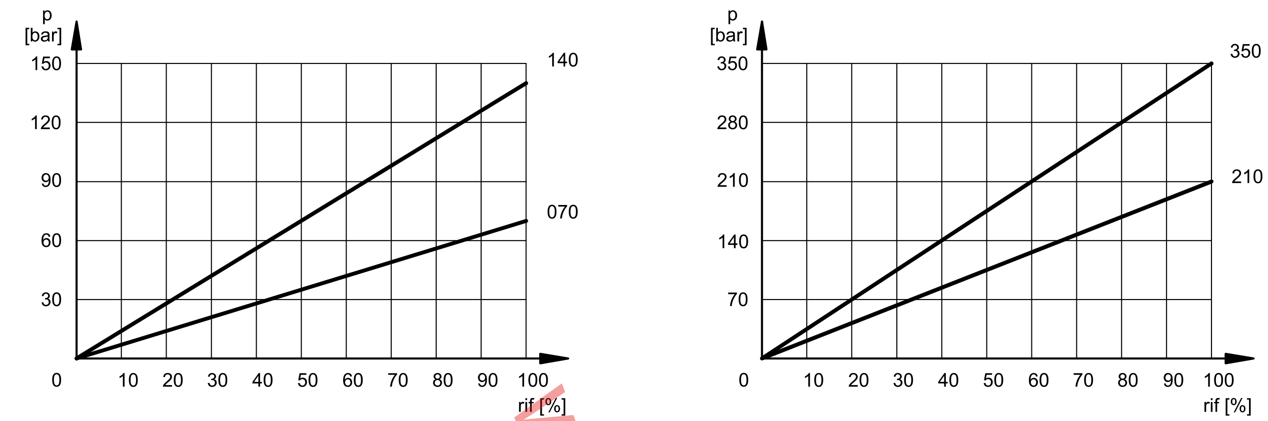


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

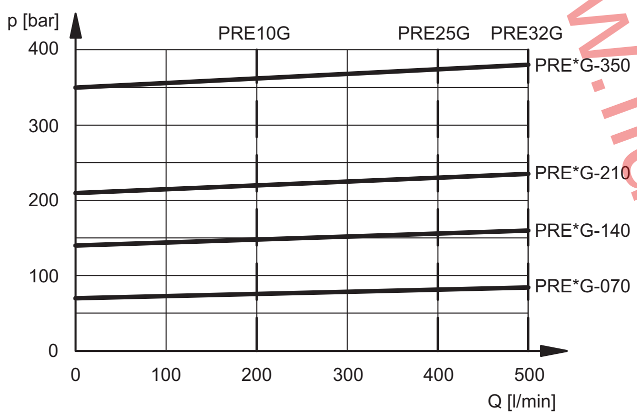
5 - CHARACTERISTIC CURVES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

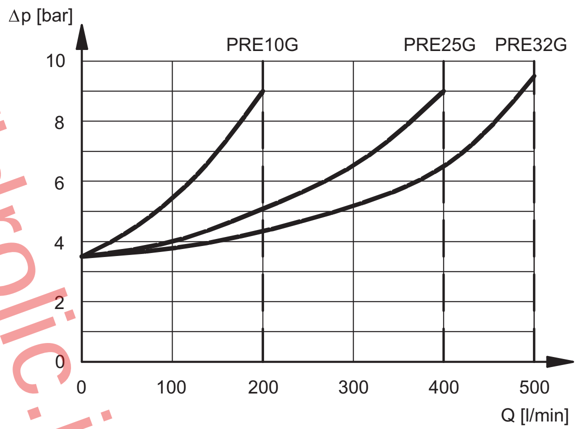
PRESSURE CONTROL p=f (I)



PRESSURE CONTROL p=f (Q)

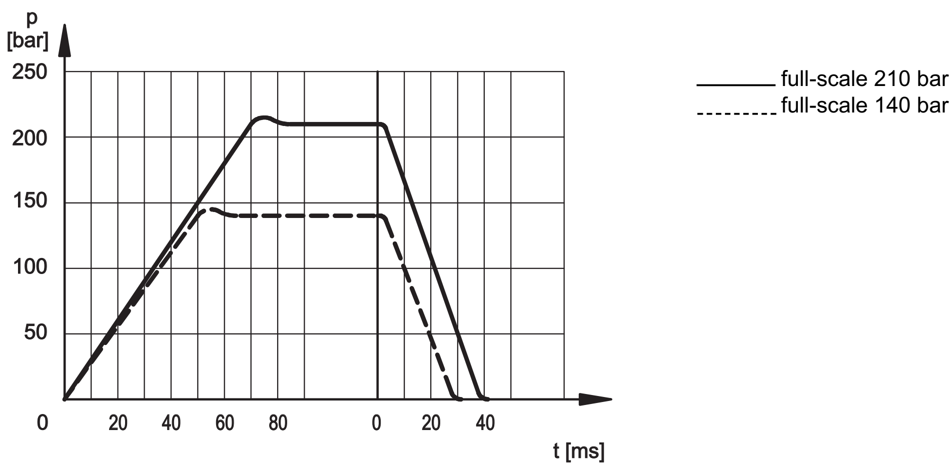


PRESSURE DROPS Δp = f(Q)



6 - STEP RESPONSE

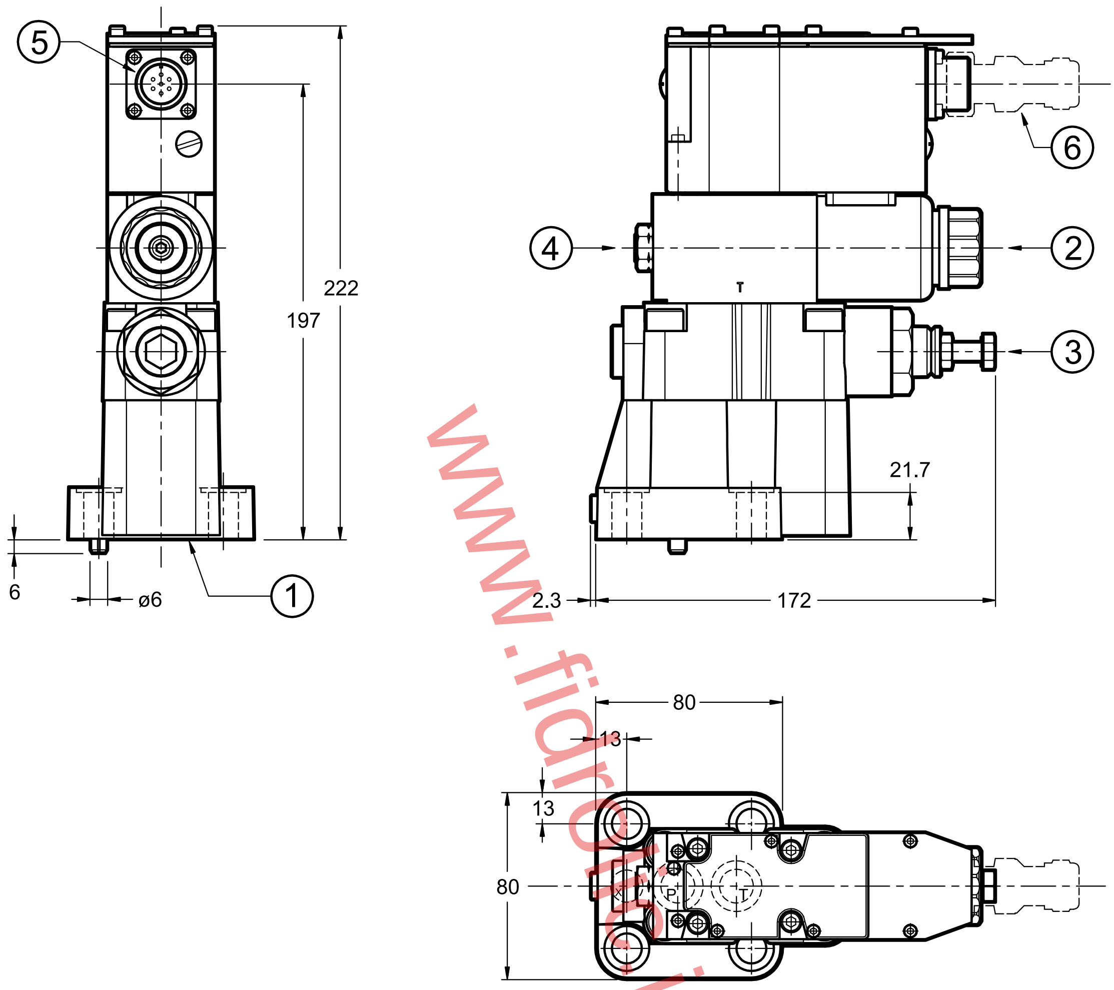
(obtained with mineral oil with viscosity of 36 cSt at 50°C)



NOTE: Response times are obtained with PRE25G valves.

7 - OVERALL AND MOUNTING DIMENSIONS PRE10G

dimensions in mm

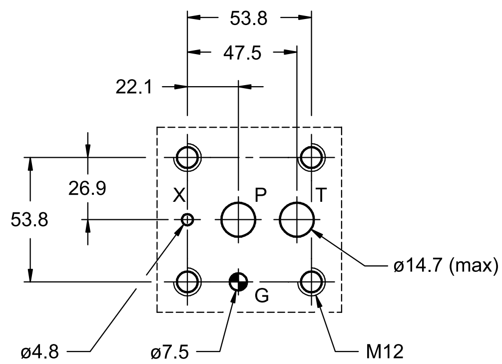


NOTE:
at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

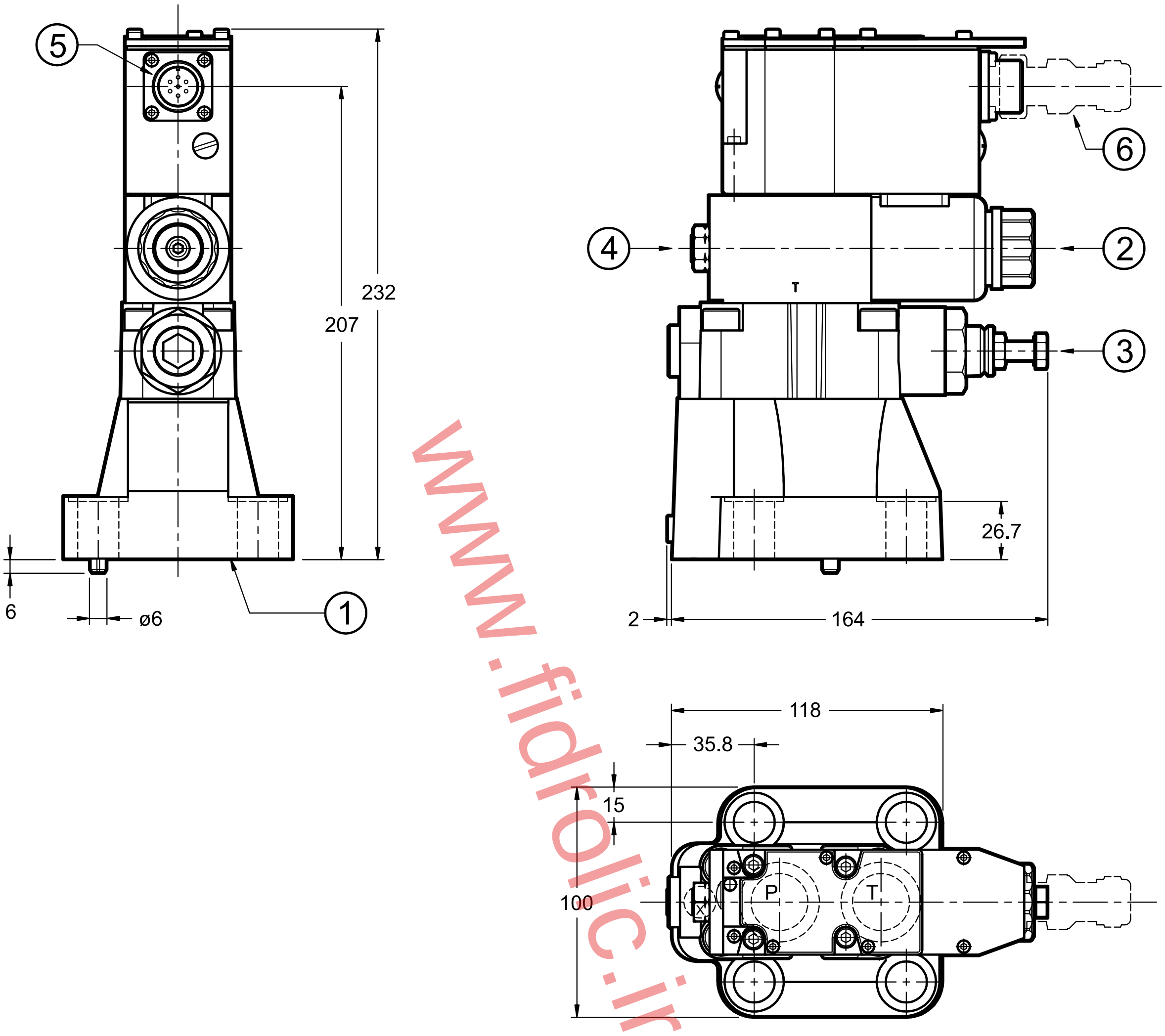
Fastening bolts: 4 SHCS M12x40 - ISO 4762
Torque: 69 Nm (viti A8.8)
Thread of mounting holes: M12x20

MOUNTING SURFACE:
ISO 6264-06-09-*-97
(CETOP 4.4.2-2-R06-350)

1	Mounting surface with sealing rings: 2 OR type 123 (17.86x2.62) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore
2	Breather: Allen key 4
3	Factory-set pressure relief valve
4	Factory sealing setting (we recommend not unscrewing the nut)
5	Main connection
6	Mating electrical connector **to be ordered separately**. See at section 12



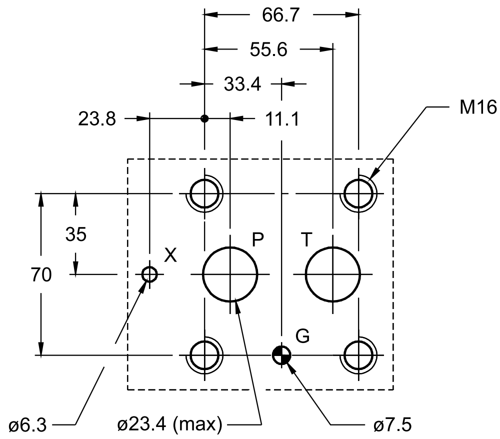
8 - OVERALL AND MOUNTING DIMENSIONS PRE25G



NOTE:
at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M16x60 - ISO 4762
Torque: 170 Nm (viti A8.8)
Thread of mounting holes: M16x25

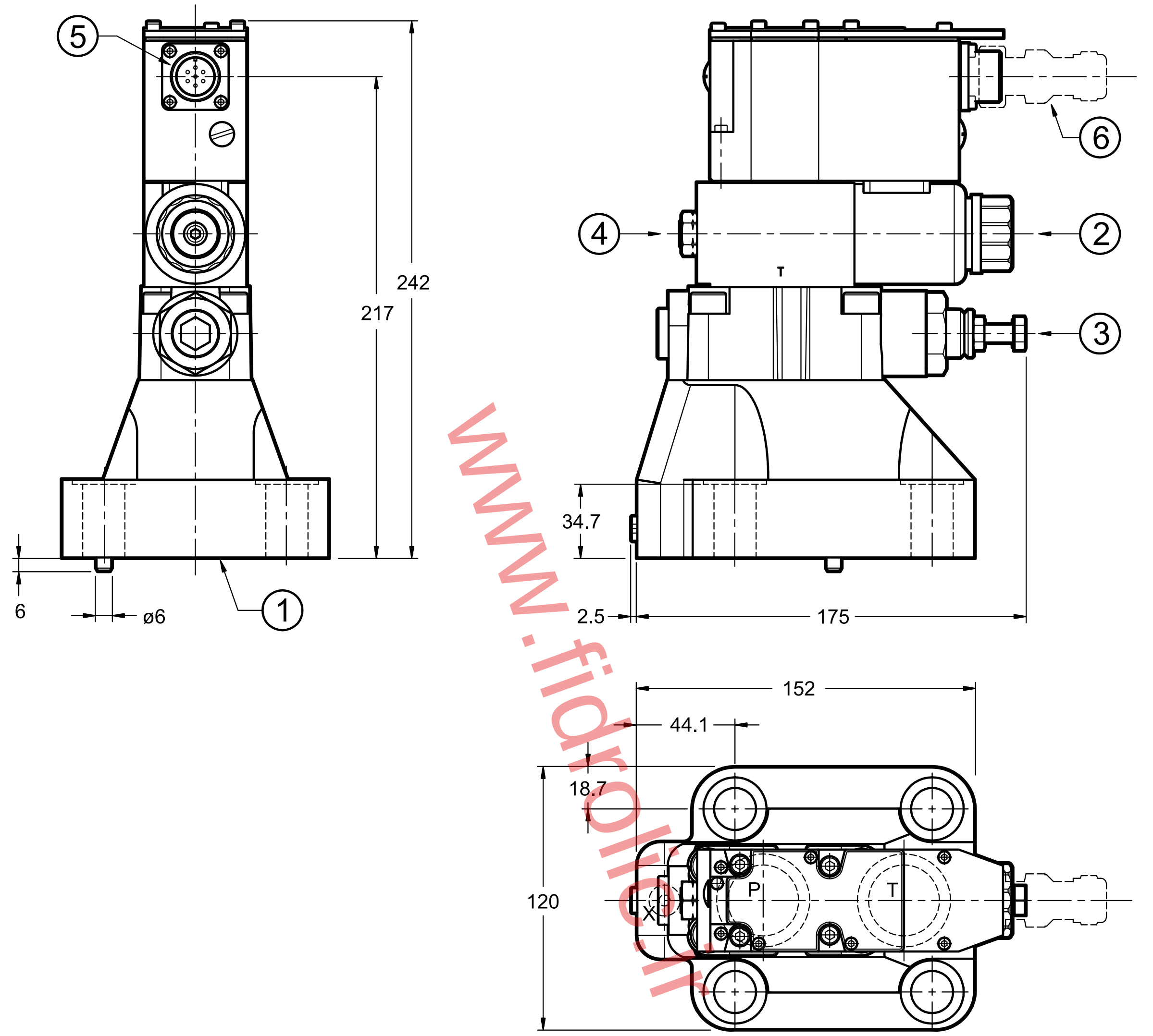
PIANO DI POSA:
ISO 6264-08-13-*-97
(CETOP 4.4.2-2-R08-350)



1	Mounting surface with sealing rings: 2 OR type 3118 (29.82x2.62) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore
2	Breather: Allen key 4
3	Factory-set pressure relief valve
4	Factory sealing setting (we recommend not unscrewing the nut)
5	Main connection
6	Mating electrical connector **to be ordered separately**. See at section 12

9 - OVERALL AND MOUNTING DIMENSIONS PRE32G

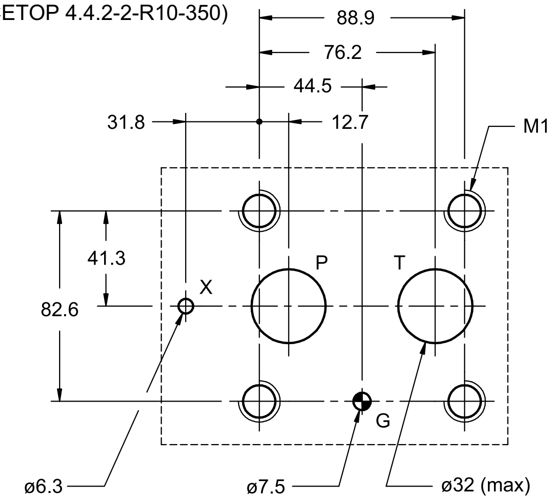
dimensions in mm



NOTE:
at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M18x60 - ISO 4762
Torque: 235Nm (viti A8.8)
Thread of mounting holes: M18x27

PIANO DI POSA:
ISO 6264-10-17-*-97
(CETOP 4.4.2-2-R10-350)



1	Mounting surface with sealing rings: 2 OR type 4137 (34.52x3.53) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore
2	Breather: Allen key 4
3	Factory-set pressure relief valve
4	Factory sealing setting (we recommend not unscrewing the nut)
5	Main connection
6	Mating electrical connector **to be ordered separately**. See at section 12

10 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

11 - INSTALLATION

We recommend to install the valves either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 5.

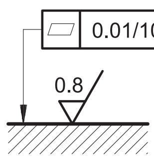
Ensure that there is no air in the hydraulic circuit. In particular applications, can be necessary to vent the air entrapped in the solenoid tube, by using the appropriate drain screw in the solenoid tube.

Ensure the solenoid tube is always filled with oil. At the end of the operation, make sure of having correctly replaced the drain screw.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.

Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



12 - ACCESSORIES
(to be ordered separately)

12.1 Mating connector

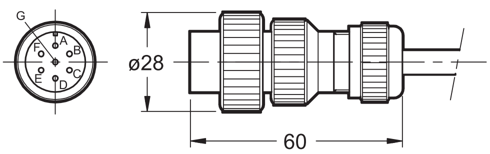
These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

⚠ So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



12.2 - Connection cables size

Power supply:
- up to 20 m cable lenght : 1,0 mm^2
- up to 40 m cable lenght : 1,5 mm^2

Signal: 0,50 mm^2

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

12.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

13 - SUBPLATES

(see catalogue 51 000)

	PRE10G	PRE25G	PRE32G
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports
P, **T** port dimensions	1/2” BSP	1” BSP	1” ¼ BSP
X port dimensions	1/4” BSP	1/4” BSP	1/4” BSP

DUPLOMATIC OLEODINAMICA

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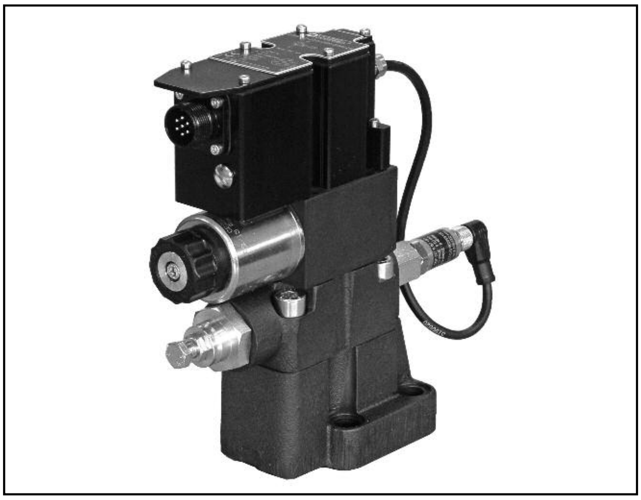
DUPLOMATIC OLEODINAMICA



PRE*J

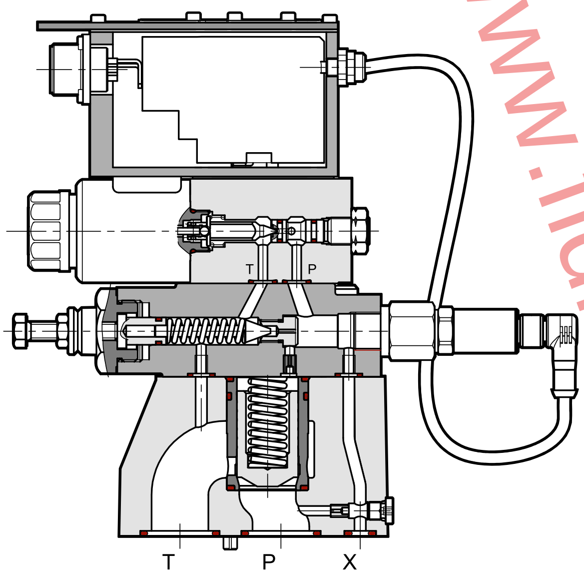
PILOT OPERATED PRESSURE VALVES IN CLOSED LOOP WITH PROPORTIONAL CONTROL AND INTEGRATED ELECTRONICS

SERIES 30

SUBPLATE MOUNTING

p max **350** bar
Q max (see table of performances)

OPERATING PRINCIPLE



— PRE*J valves are pilot operated pressure relief valves with integrated electric proportional control and mounting interface in compliance with ISO 6264 standard.

— These valves are used to control hydraulic circuit pressure and enable the use of the full flow rate of the pump, even with settings approaching calibrated values.

— The two-stage design and wide passages ensure reduced pressure drops thereby improving the system energy performance.

— They are fitted with a manual pressure relief valve which is factory set to ≥15% of the maximum value in the pressure control range.

— The valves are available with command signal in voltage or current and on board electronics with internal enable, external enable or 0V monitor on pin C.

— The monitoring of the value detected by the pressure transmitter is available on pin F.

— They are available in three sizes with flow rates up to 500 l/min and in four pressure control ranges up to 350 bar.

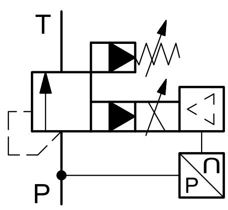
— The valves are easy to install. The driver directly manages digital settings. In the event of special applications, you can customize the settings using the optional kit (see par. 12.3)

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

		PRE10J	PRE25J	PRE32J
Maximum operating pressure	bar	350		
Maximum flow	l/min	200	400	500
Step response		see paragraph 6		
Hysteresis	% of p nom	< 1%		
Repeatability	% of p nom	< ± 0,5%		
Electrical characteristic		see paragraph 2		
Ambient temperature range	°C	-20 / +60		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree		According to ISO 4406:1999 class 18/16/13		
Recommended viscosity	cSt	25		
Mass	kg	5,5	6,3	8,5

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

P	R	E		J	-		/	30		-		K11	

Pilot operated pressure relief valve

Electro-proportional control

Size:
10 = ISO 6264-06
25 = ISO 6264-08
32 = ISO 6264-10

Integrated electronics for pressure control in closed loop

Pressure control range
140 = up to 140 bar
210 = up to 210 bar
350 = up to 350 bar

Series No.
(the overall and mounting dimensions remain unchanged from 30 to 39)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Reference signal:
E0 = voltage 0 ÷ 10 V
E1 = current 4 ÷ 20 mA

Main connector 6 pin + PE

Pin C function:
A = external enable
B = internal enable
C = 0V monitor

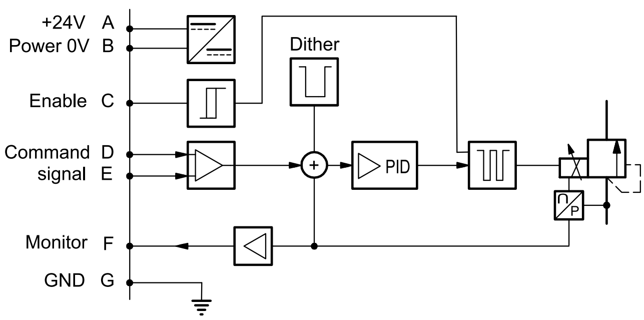
2 - ELECTRICAL CHARACTERISTICS

2.1 - Electrical on board electronics

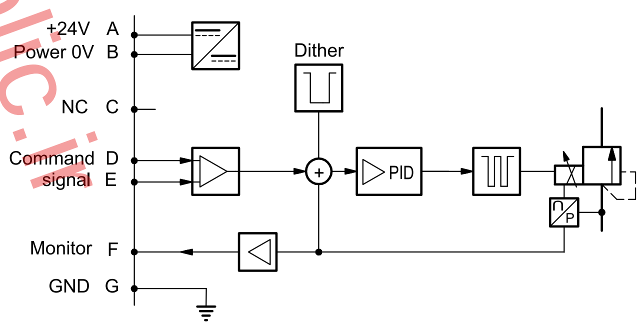
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		2A time lag
Command signals: voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (pressure at transducer): voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2004/108/EC standards

2.2 - On-board electronics diagrams

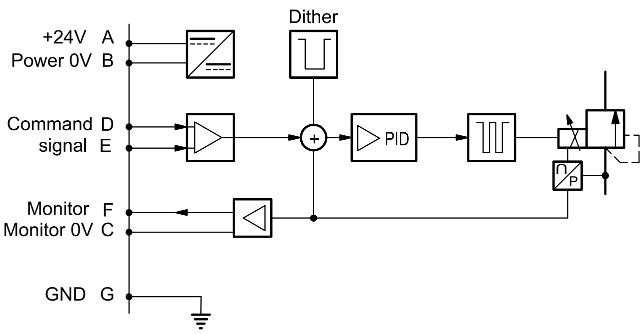
VERSION **A** - External Enable



VERSION **B** - Internal Enable

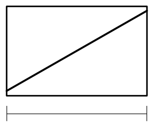


VERSION **C** - 0V Monitor

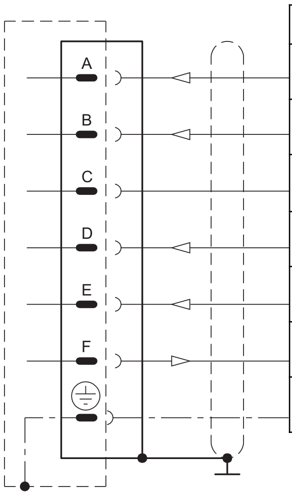


3 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal is between 0 ÷ 10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**0V**	**+10V**
MONITOR	**0V**	**+10V**

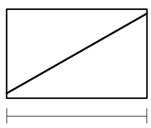


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	0 ÷ 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	0 ÷ 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

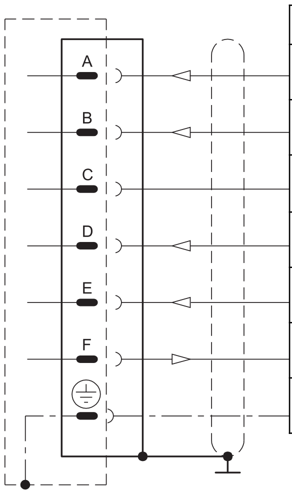
4 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**4 mA**	**20 mA**
MONITOR	**4 mA**	**20 mA**

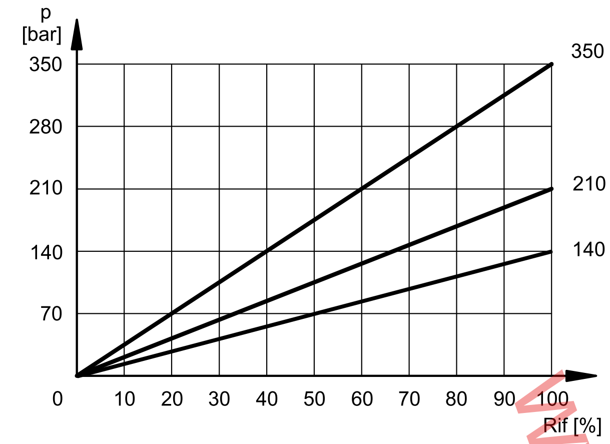


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

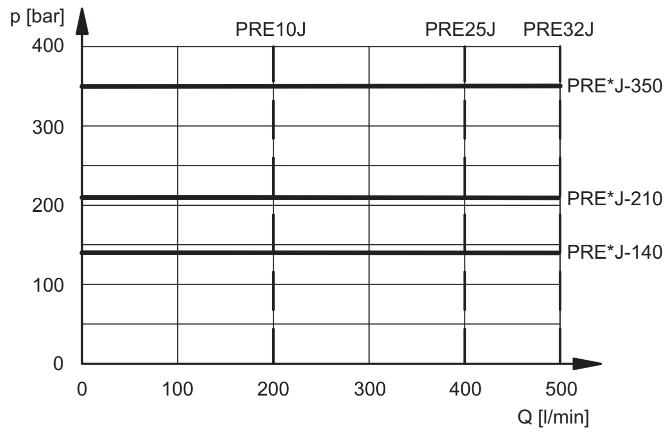
5 - CHARACTERISTIC CURVES

(measured with viscosity of 36 cSt at 50°C)

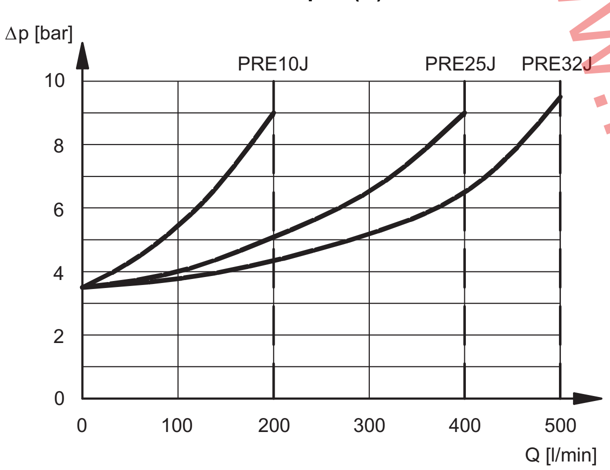
PRESSURE CONTROL p=f (I)



PRESSURE CONTROL p=f (Q)



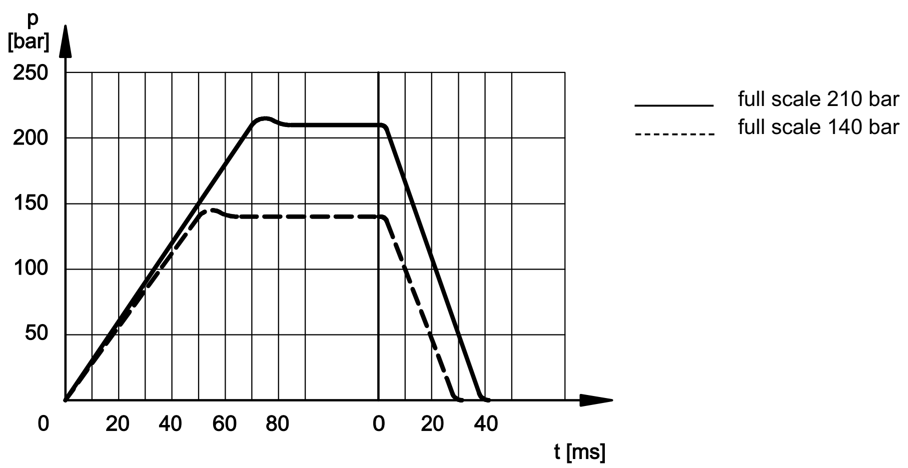
PRESSURE DROPS Δp = f(Q)



6 - STEP RESPONSE

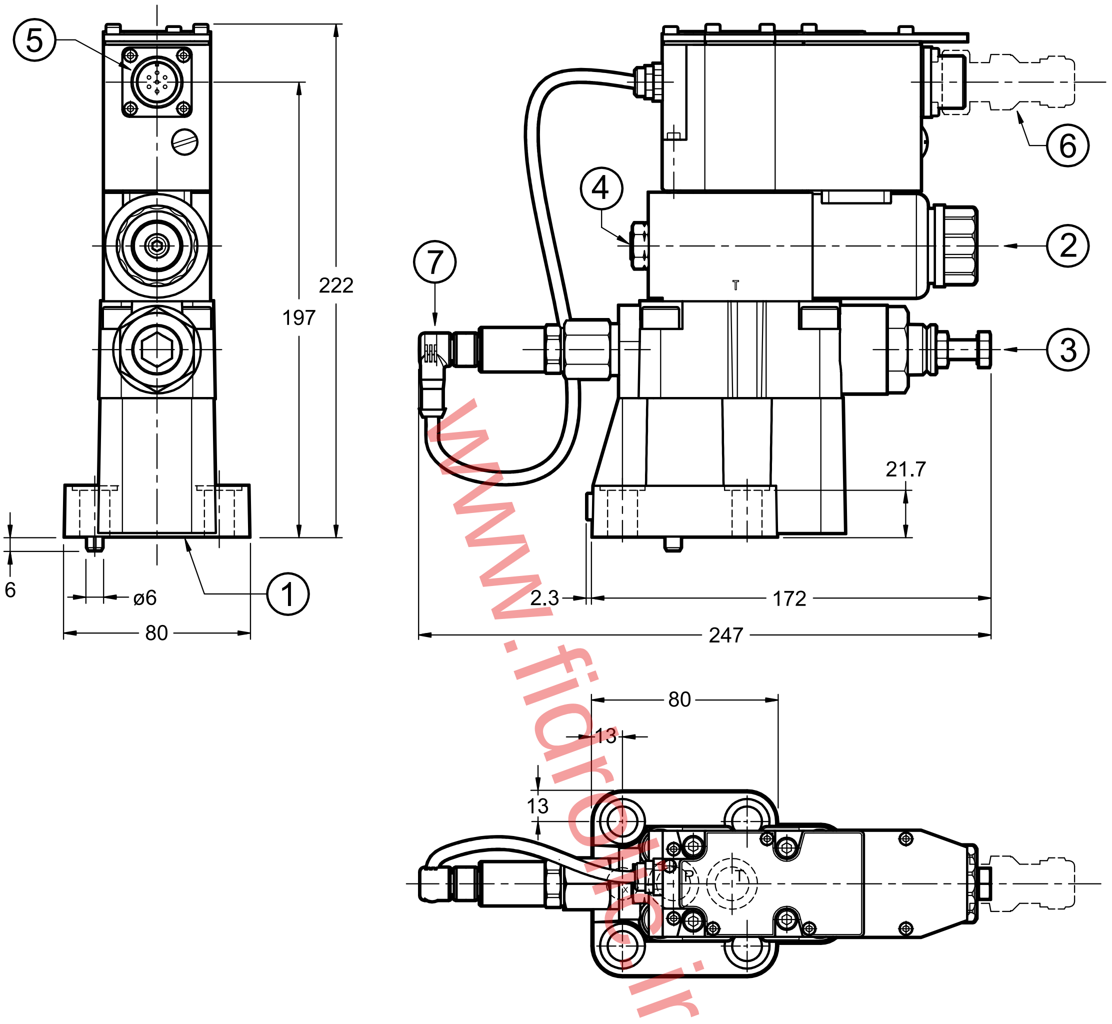
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Response times are obtained from PRE25J valves with a full scale of 140 and 210 bar.



7 - OVERALL AND MOUNTING DIMENSIONS PRE10J

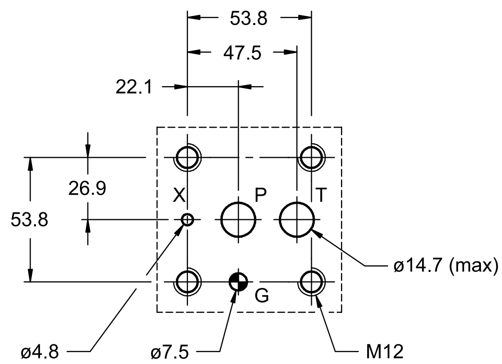
dimensions in mm



NOTE:
at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

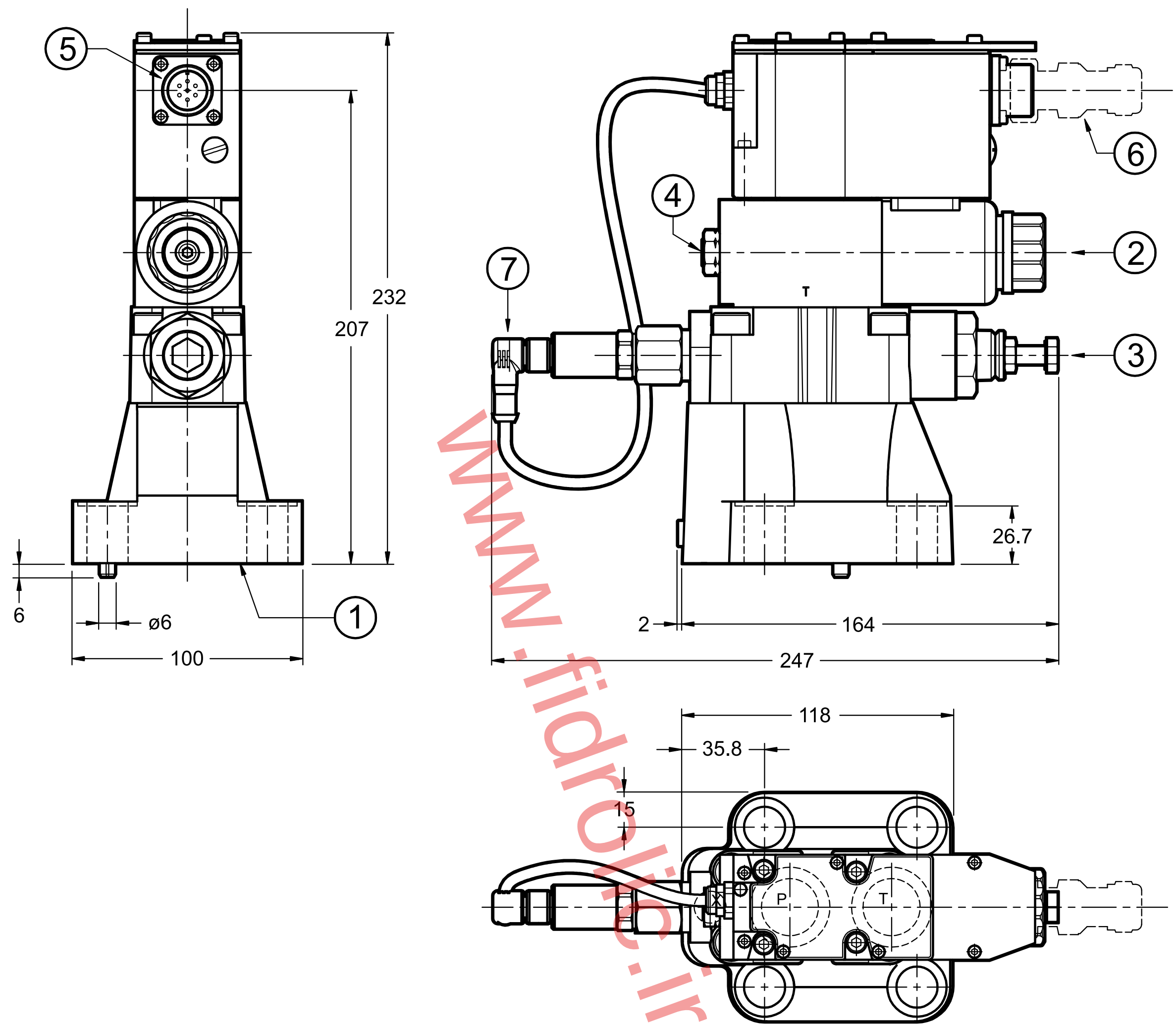
Fastening bolts: 4 SHCS M12x40 - ISO 4762
Torque: 69 Nm (screws A8.8)
Thread of mounting holes: M12x20

MOUNTING SURFACE:
ISO 6264-06-09-*-97
(CETOP 4.4.2-2-R06-350)



1	Mounting surface with sealing rings: 2 OR type 123 (17.86x2.62) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore
2	Breather: Allen key 4
3	Factory-set pressure relief valve
4	Factory sealing setting (we recommend not unscrewing the nut)
5	Main connection
6	Mating electrical connector **to be ordered separately**. See at section 12
7	Connector with cable for pressure transducer

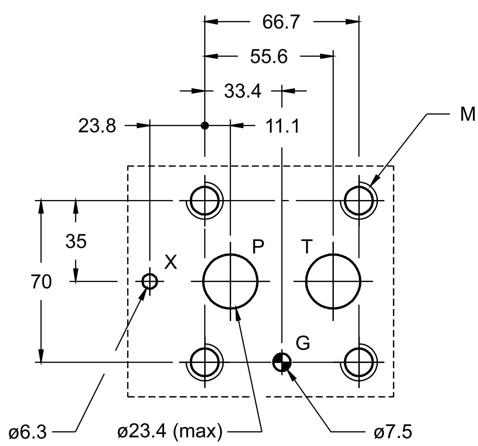
8 - OVERALL AND MOUNTING DIMENSIONS PRE25J



NOTE:
at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M16x60 - ISO 4762
Torque: 170 Nm (screws A8.8)
Thread of mounting holes: M16x25

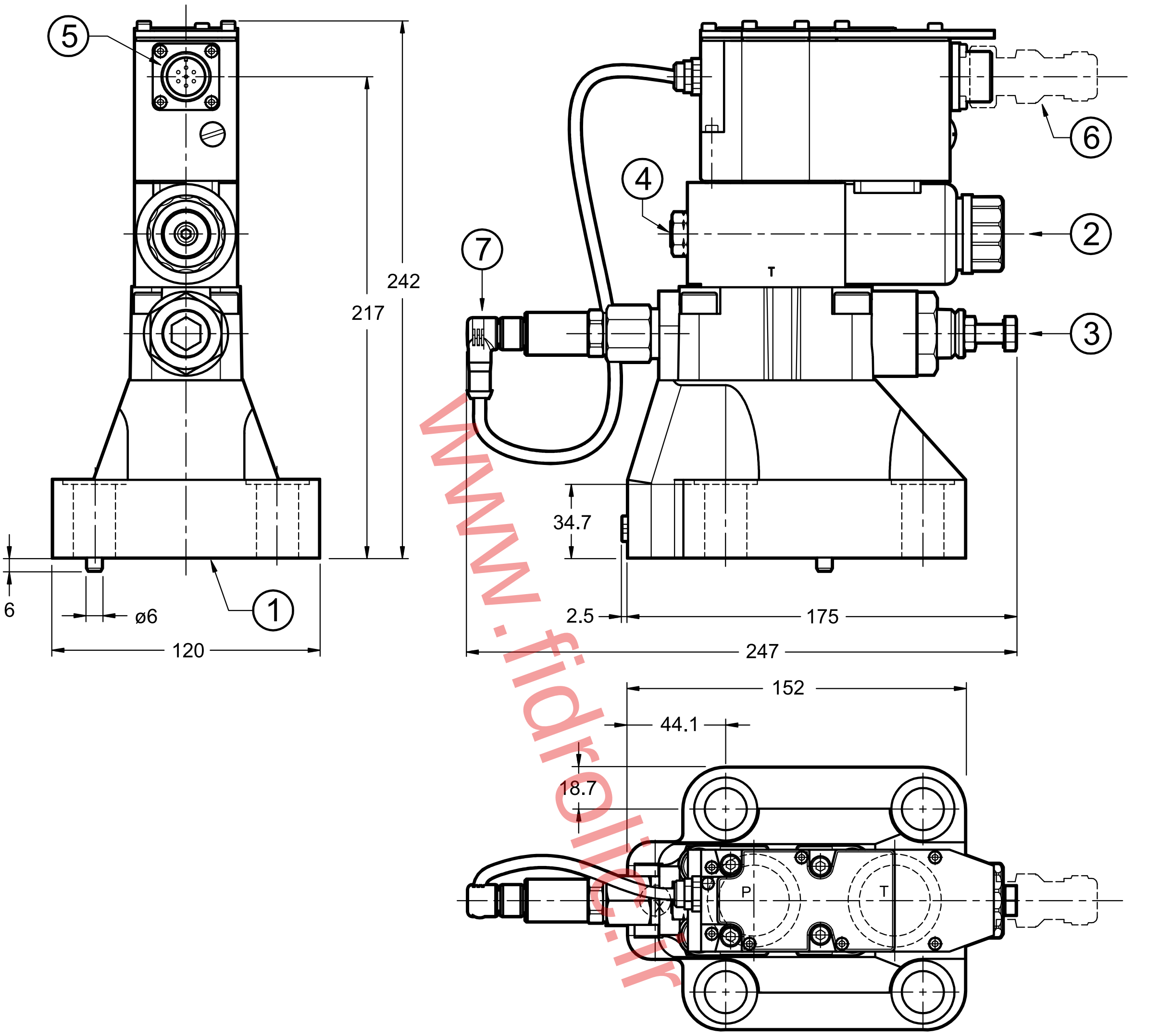
MOUNTING SURFACE:
ISO 6264-08-13-*-97
(CETOP 4.4.2-2-R08-350)



1	Mounting surface with sealing rings: 2 OR type 3118 (29.82x2.62) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore
2	Breather: Allen key 4
3	Factory-set pressure relief valve
4	Factory sealing setting (we recommend not unscrewing the nut)
5	Main connection
6	Mating electrical connector **to be ordered separately**. See at section 12
7	Connector with cable for pressure transducer

9 - OVERALL AND MOUNTING DIMENSIONS PRE32J

dimensions in mm

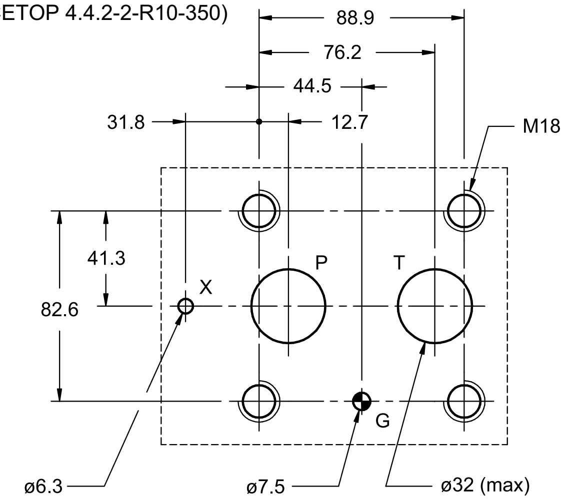


NOTE:
at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

Fastening bolts: 4 SHCS M18x60 - ISO 4762
Torque: 235Nm (screws A8.8)
Thread of mounting holes: M18x27

1	Mounting surface with sealing rings: 2 OR type 4137 (34.52x3.53) - 90 Shore 1 OR type 109 (9.13x2.62) - 90 Shore
2	Breather: Allen key 4
3	Factory-set pressure relief valve
4	Factory sealing setting (we recommend not unscrewing the nut)
5	Main connection
6	Mating electrical connector **to be ordered separately**. See at section 12
7	Connector with cable for pressure transducer

MOUNTING SURFACE:
ISO 6264-10-17-*-97
(CETOP 4.4.2-2-R10-350)



10 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

11 - INSTALLATION

We recommend to install the valves either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 5.

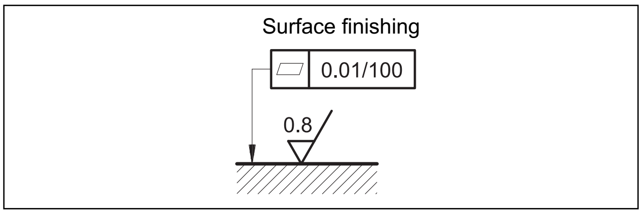
Ensure that there is no air in the hydraulic circuit. In particular applications, can be necessary to vent the air entrapped in the solenoid tube, by using the appropriate drain screw in the solenoid tube.

Ensure the solenoid tube is always filled with oil. At the end of the operation, make sure of having correctly replaced the drain screw.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.

Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



12 - ACCESSORIES

(to be ordered separately)

12.1 Mating connector

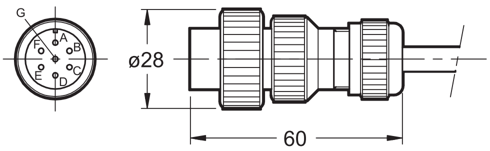
These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

⚠ So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



12.2 - Connection cables size

Power supply:
- up to 20 m cable length : 1,0 mm^2
- up to 40 m cable length : 1,5 mm^2

Signal: 0,50 mm^2

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

12.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

13 - SUBPLATES

(see catalogue 51 000)

	PRE10J	PRE25J	PRE32J
Type	PMRQ3-AI4G rear ports	PMRQ5-AI5G rear ports	PMRQ7-AI7G rear ports
P, **T** port dimensions	P: 1/2" BSP T: 3/4" BSP	1" BSP	1" ¼ BSP
X port dimensions	1/4" BSP	1/4" BSP	1/4" BSP

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Fax +39 0331.895.339
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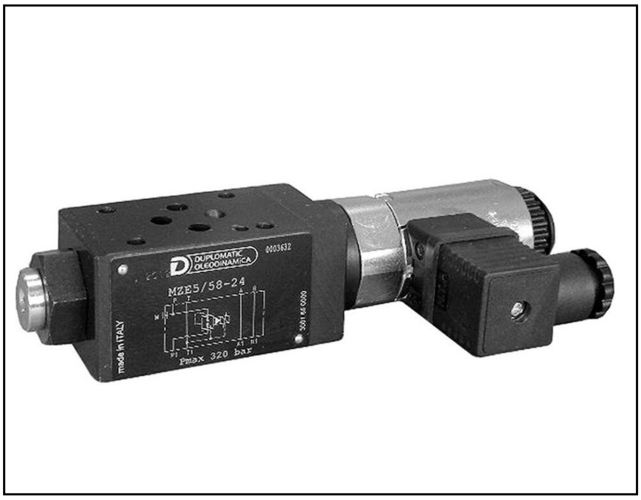
DUPLOMATIC OLEODINAMICA

MZE

PILOT OPERATED PRESSURE REDUCING VALVE WITH ELECTRIC PROPORTIONAL CONTROL

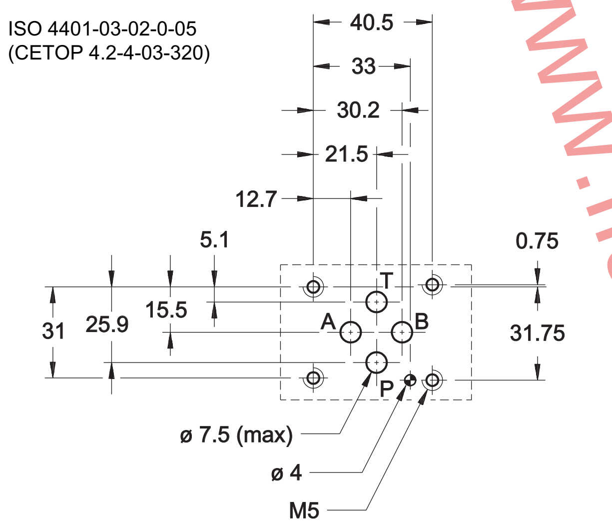
SERIES 58



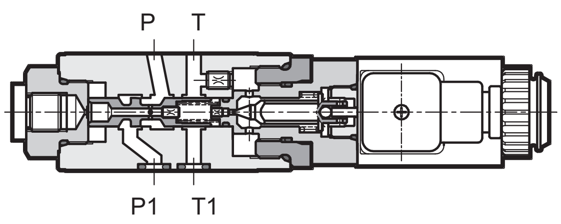
MODULAR VERSION
ISO 4401-03 (CETOP 03)

p max **320** bar
Q max (see table of performances)

MOUNTING SURFACE



OPERATING PRINCIPLE



— MZE valves are 3-way pilot operated pressure reducing valves, with electric proportional control, designed as modular versions with mounting interface in compliance with ISO 4401 (CETOP RP121H) standards.

— The valves are used to reduce pressure in the secondary circuit branches thus ensuring stability of controlled pressure in the event of variations of the flow rate through the valve.

— Pressure can be modulated continuously in proportion to the current supplied to the solenoid.

— The valve can be controlled directly by a current control supply unit or by an electronic control unit, to exploit valve performance to the full (see par. 8).

— The valve is available in three different pressure reduction ranges of up to 230 bar.

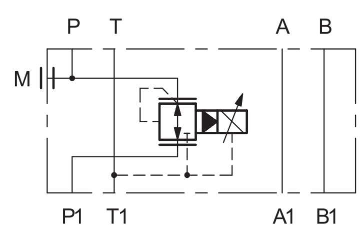
— The valve is available only with internal drain to the T line inside the valve.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Maximum operating pressure: - P-A-B ports - T port	bar	 320 2
Minimum controlled pressure	see Δp-Q diagram	
Maximum flow in P line Maximum flow on passing lines Drain flow	l/min	30 50 0,4
Step response	see paragraph 5	
Hysteresis (with PWM 200 Hz)	% of p nom	< 3%
Repeatability	% of p nom	< ±1,5%
Electrical characteristic	see paragraph 4	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	1,8

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

M	Z	E		/	58	-		/	

Size: ISO 4401-03 (CETOP 03)

3-way pressure reducing valve: Modular version

Electric proportional control

Pressure control range:
3 = 7 ÷ 70 bar
4 = 7.5 ÷ 150 bar
5 = 8 ÷ 230 bar

Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged)

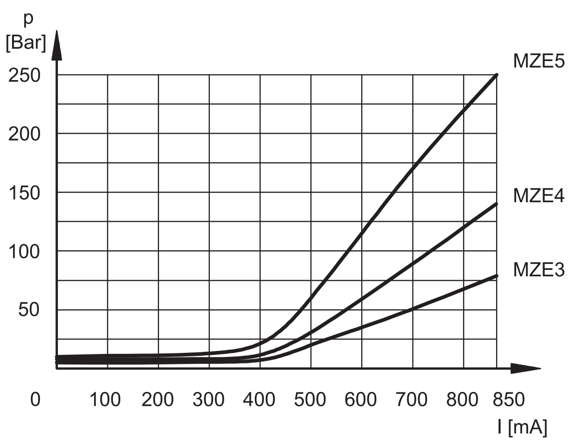
12 = Nominal solenoid voltage 12V DC
24 = Nominal solenoid voltage 24V DC

Seal:
omit for mineral oils
V = FPM seals for special fluids

2 - CHARACTERISTIC CURVES

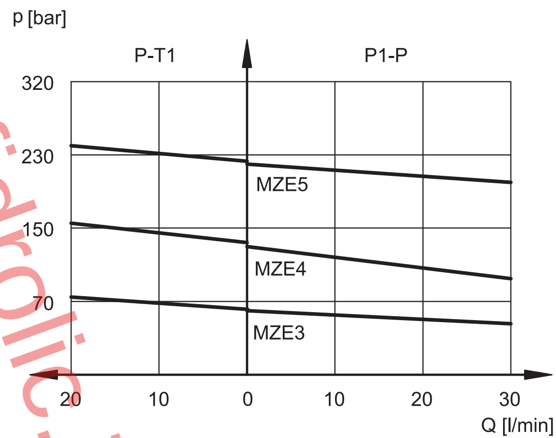
(measured with viscosity 36 cSt at 50°C)

PRESSURE CONTROL p=f (I)



The curves have been obtained with working lines closed (without flow).

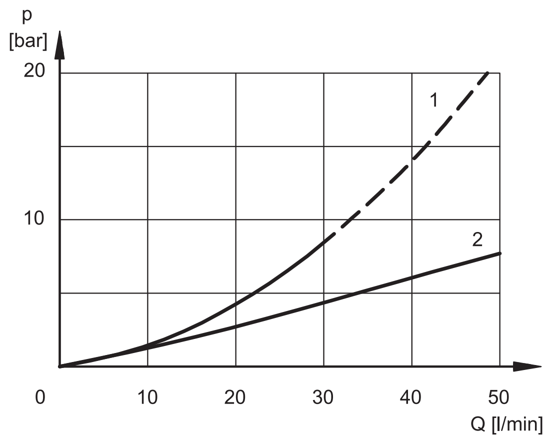
PRESSURE VARIATION p=f(Q)



The curves have been obtained with inlet pressure 50 bar greater than nominal pressure.

Pressure values in P1 greater than 50 bar reduce flow values considerably.

PRESSURE DROP Δp=f(Q)



1. pressure drops P1→ P
2. pressure drop in passing lines (ex. A ↔ A1)

3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals.

For fluids HFDR type (phosphate esters) use FPM seals (code V).

For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - ELECTRICAL CHARACTERISTICS

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	12	24
RESISTANCE (at 20°C)	Ω	3.66	16.6
MAXIMUM CURRENT	A	1.9	0.85
DUTY CYCLE		100%	
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE		
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529)	IP 65		

5 - STEP RESPONSE

(with mineral oil with viscosity of 36 cSt at 50°C in conjunction with the relative electronic control unit)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical step response times measured with input flow rate of Q = 25 l/min.

REFERENCE SIGNAL STEP	0 → 100%	100 → 0%
Step response [ms]	100	80

6 - INSTALLATION

We recommend to install the MZE valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 2.

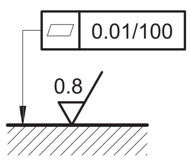
Ensure that there is no air in the hydraulic circuit. In particular applications, it can be necessary to vent the air entrapped in the solenoid tube, by using the apposite drain screw in the solenoid tube. Ensure that the solenoid tube is always filled with oil (see par.7). At the end of the operation, make sure of having screwed correctly the drain screw.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the reduced pressure value.

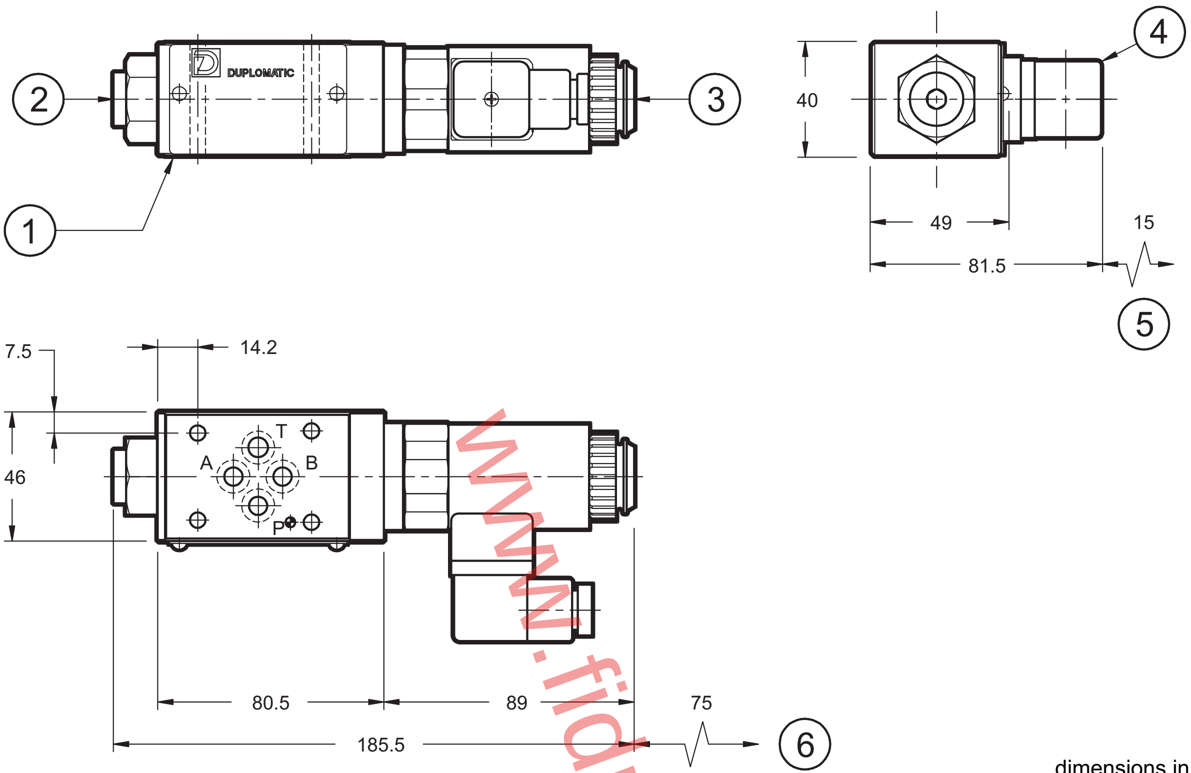
The maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.

Surface finishing



7 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

1	Mounting surface with sealing rings: 4 OR type 2037 - 90 shore (9.25x1.78)
2	Pressure gauge port 1/4” BSP
3	Breather (male hexagonal spanner 4)
4	DIN 43650 electric connector (included in the delivery)
5	Connector removal space
6	Coil removal space

NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (3) placed at the end of the solenoid tube.

8 - ELECTRONIC CONTROL UNITS

EDC-112	for solenoid 24V DC	plug version	see cat. 89 120
EDC-142	for solenoid 12V DC		
EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		

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DUPLOMATIC OLEODINAMICA

PZE3

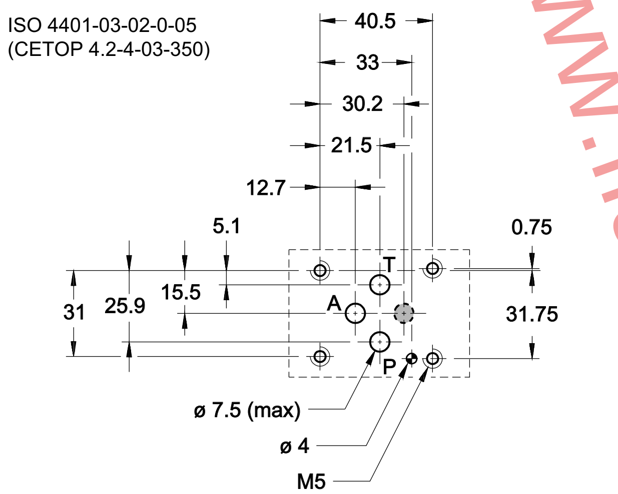
PROPORTIONAL 3-WAY PRESSURE REDUCING VALVE, PILOT OPERATED

SERIES 10

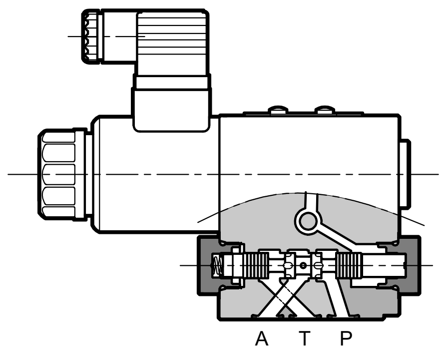
SUBPLATE MOUNTING
ISO 4401-03

p max **350** bar
Q max **50** l/min

MOUNTING SURFACE



OPERATING PRINCIPLE



— The PZE3 valve is a proportional 3-way pressure reducing valve, pilot operated with mounting surface according to ISO 4401-03 standards.

— Its main function is to control continuously the outlet pressure on A reducing the inlet pressure P. However, the valve also prevent outlet pressure exceeding its regulated pressure value discharging in T the exceeding flow (a typical case of hydraulic counterweight or load balancing).

— The pressure is modulated continuously in proportion to the current supplied to the solenoid.

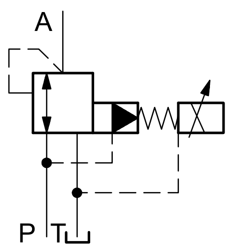
— They can be controlled directly by an amlifier or a proper electronic control unit (par. 12)

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Maximum operating pressure: - P port - T port	bar	 350 2
Pilot / drain flow Maximum flow (see p max = f(Q) diagram)	l/min	2 50
Step response	see paragraph 5	
Hysteresis	% of p nom	< 5%
Repeatability	% of p nom	< ±2%
Electrical characteristic	see paragraph 2	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass	kg	2,2

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

P	Z	E	3	-		/	10		/		K1

3-way pressure reducing valve, pilot operated

Electrical proportional control

Size ISO 4401-03

Pressure control range:
025 = 0 ÷ 25 bar
070 = 0 ÷ 70 bar
140 = 0 ÷ 140 bar
210 = 0 ÷ 210 bar
310 = 0 ÷ 310 bar

Series No.
(the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

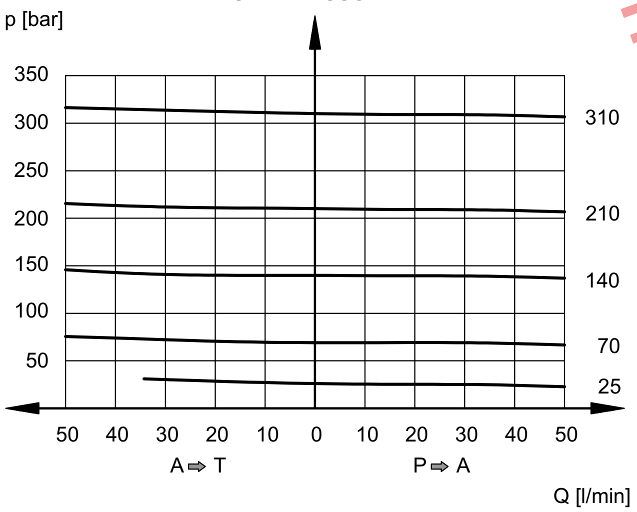
Nominal solenoidy voltage:
D12 = 12 V CC
D24 = 24 V CC

Coil electrical connection:
for connector type DIN 43650
(**standard**)

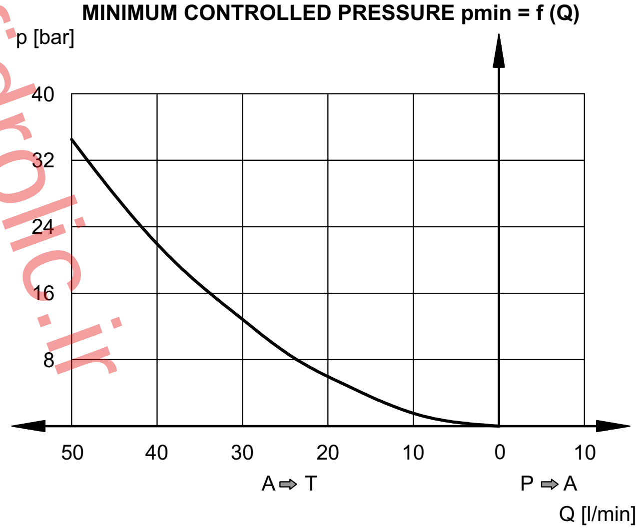
2 - CHARACTERISTIC CURVES

(measured with viscosity of 36 cSt at 50°C)

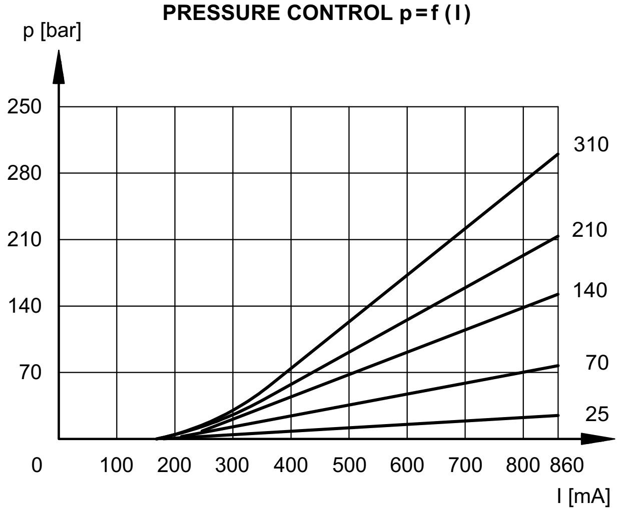
SET PRESSURE



MINIMUM CONTROLLED PRESSURE pmin = f (Q)



PRESSURE CONTROL p = f (I)



3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

4 - ELECTRICAL CHARACTERISTICS

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	**12**	**24**
RESISTANCE (at 20°C)	Ω	3.66	17.6
MAXIMUM CURRENT	A	1.88	0.86
DUTY CYCLE	100%		
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2014/30/EU		
PROTECTION FROM: Atmospheric agents (EN 60529)	IP 65		
CLASS OF PROTECTION: Coil insulation (VDE 0580) Impregnation	class H class F		

5 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

REFERENCE SIGNAL STEP	0 → 100%	100 → 0%
Step response [ms]	90	90

6 - INSTALLATION

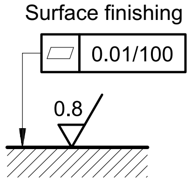
We recommend to install the PZE3 valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what shown in paragraph 2.

Ensure that there is no air in the hydraulic circuit. In particular applications, it can be necessary to vent the air entrapped in the solenoid tube, by using the apposite drain screw in the solenoid tube. Ensure that the solenoid tube is always filled with oil. At the end of the operation, make sure of having screwed correctly the drain screw.

Connect the valve T port directly to the tank. **Add any backpressure value detected in the T line to the controlled pressure value. Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.**

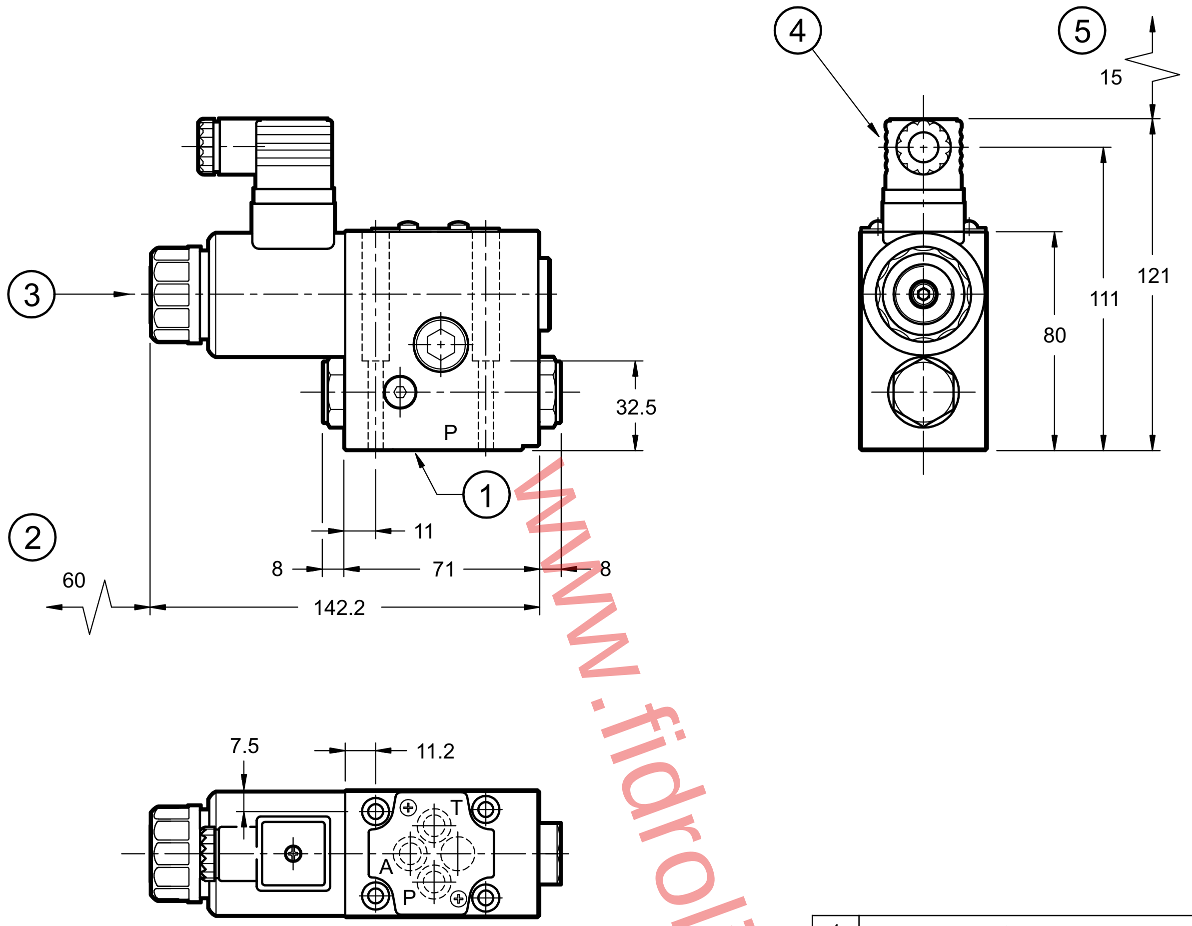
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those shown in the relative symbol. If minimum values are not observed, fluid can easily leaks between valve and support surface.

Surface finishing



7 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



NOTE: at first start up, or after a long period of no use, it is necessary to vent the air through the breather (3) placed at the end of the solenoid tube.

Fastenings bolts: 4 screws SHC M5x40 - ISO 4762
Tightening torque: 5 Nm (A8.8 bolts)
Thread of mounting holes:: M5x10

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 shore
2	Coil removal space
3	Breather (male hexagonal spanner 4)
4	DIN 43650 electric connector (included in the delivery)
5	Connector removal space

8 - ELECTRONIC CONTROL UNITS

EDC-112	for solenoid 24V DC	plug version	see cat. 89 120
EDC-142	for solenoid 12V DC		
EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		

9 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G with ports on rear
PMMD-AL3G with side ports
Ports dimensions P, T, A and B: 3/8” BSP thread

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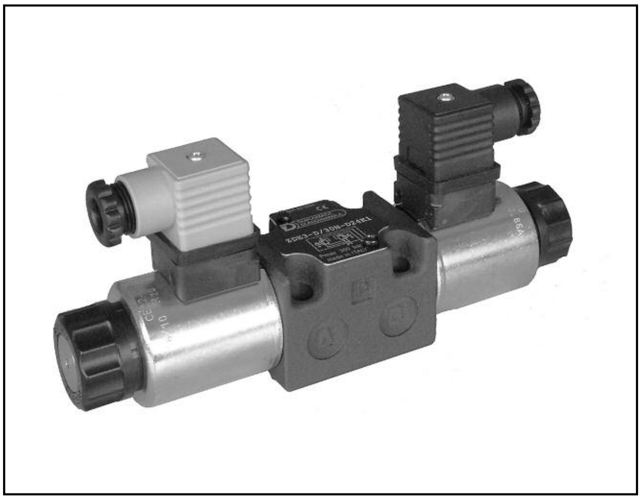
DUPLOMATIC OLEODINAMICA



ZDE3

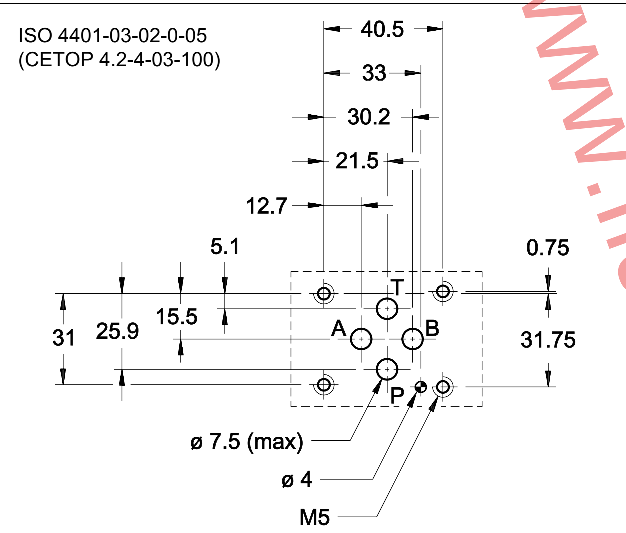
DIRECT OPERATED PRESSURE REDUCING VALVE WITH ELECTRIC PROPORTIONAL CONTROL

SERIES 30

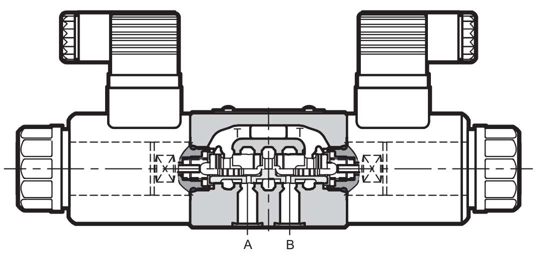
SUBPLATE MOUNTING
ISO 4401-03

p max **100** bar
Q max **15** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



— ZDE3 valves are direct operated pressure reducing valves with electric proportional control, with mounting interface in compliance with ISO 4401 standards.

— The valves are used to reduce pressure in the secondary circuit branches thus ensuring stability of controlled pressure in the event of variations of the flow rate through the valve.

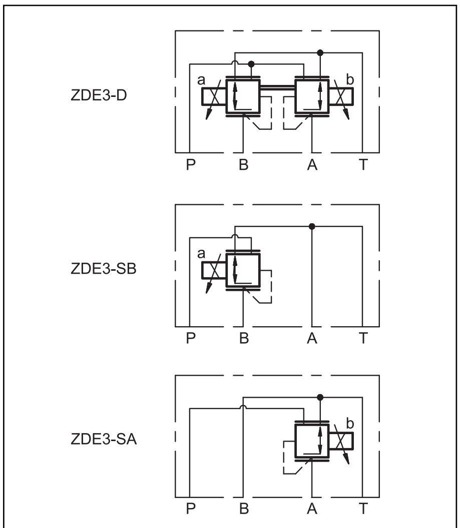
— The valve can be controlled directly by a current control supply unit or by means of the relative electronic control units to exploit valve performance to the full (see par. 10).

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Pressure allowed on P port	bar	30 ÷ 100
Pressure allowed on T port (see par. 6)	bar	0 ÷ 30
Controlled pressure	bar	23
Minimum controlled pressure	see Δp-Q diagram	
Maximum flow	l/min	15
Step response	see paragraph 4	
Hysteresis (with PWM 200 Hz)	% of p nom	< 4%
Repeatability	% of p nom	< ±1%
Electrical characteristic	see paragraph 3	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	1,6 2

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

Z	D	E	3	-		/	30		-			/		

Pressure reducing valve

Electric proportional control

Size ISO 4401-03

Solenoids:
D = pressure reduction in A and B ports
SA = pressure reduction in A port (solenoid on side B)
SB = pressure reduction in B port (solenoid on side A)

Series No.
(from 30 to 39 sizes and mounting dimensions remain unchanged)

NOTE: The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing makes the valve suitable to ensure a salt spray resistance up to 240 hours (test operated according to EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

D12 = Nominal solenoid voltage 12V DC
D24 = Nominal solenoid voltage 24V DC

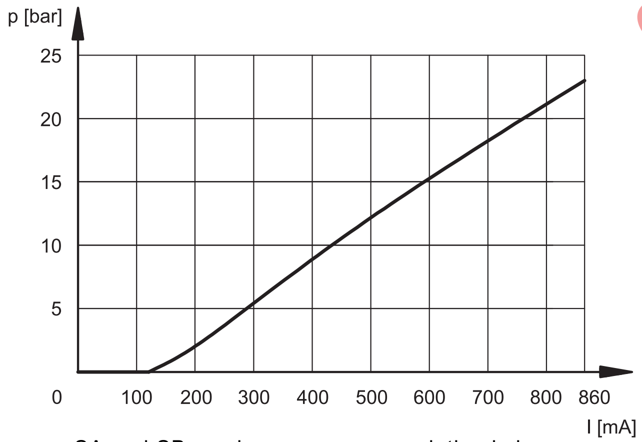
Coil electrical connection:
(see paragraph 5)
K1 = plug for connector type DIN 43650 (**standard**)
K7 = plug for connector type DEUTSCH DT04-2P male

Manual override (see par. 7)

Option:
/ W7 = Zinc-nickel surface treatment (see **NOTE**)
Omit if not required

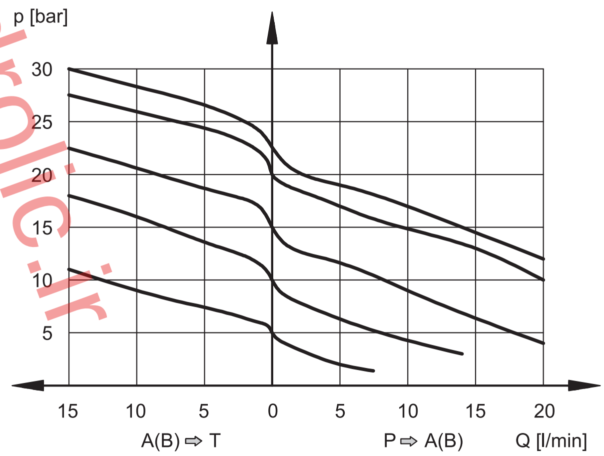
2 - CHARACTERISTIC CURVES (obtained with ZDE3-D/30N-D24K1 and oil with viscosity 36 cSt at 50°C)

PRESSURE CONTROL p=f (I)



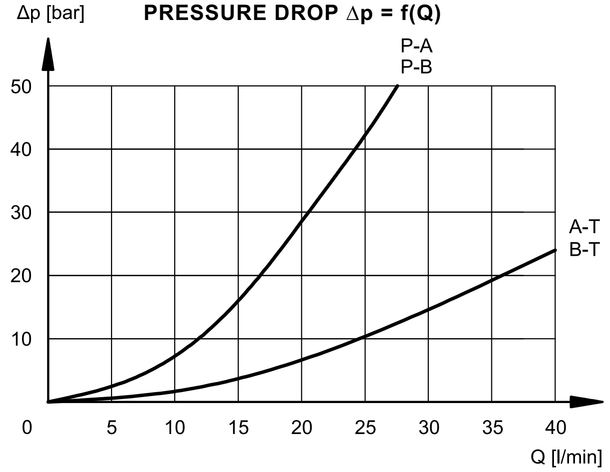
SA and SB versions pressure regulation is less than 0.5 bar.

PRESSURE VARIATION p = f(Q)



The curves have been obtained with inlet pressure 100 bar.

PRESSURE DROP Δp = f(Q)



3 - ELECTRICAL CHARACTERISTICS

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	**12**	**24**
RESISTANCE (at 20°C) K1 coil K7 coil	Ω	3.66 4	17.6 19
MAXIMUM CURRENT	A	1.88	0.86
DUTY CYCLE		100%	
PWM FREQUENCY	Hz	200	100
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/EC		
PROTECTION FROM: Atmospheric agents (EN 60529)	IP 65		
CLASS OF PROTECTION: Coil insulation (VDE 0580) Impregnation	 class H class F		

4 - STEP RESPONSE

(with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

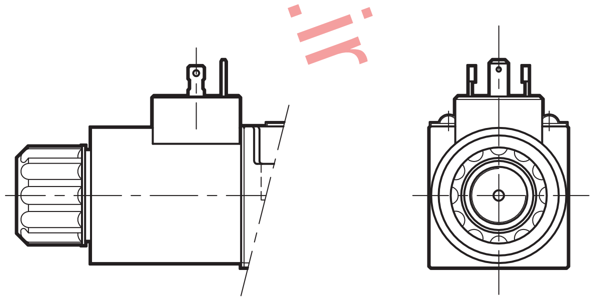
The table illustrates typical step response times measured with input flow rate of Q = 5 l/min and p = 50 bar.

REFERENCE SIGNAL STEP	0 → 100%	100 → 0%
Step response [ms]	30	30

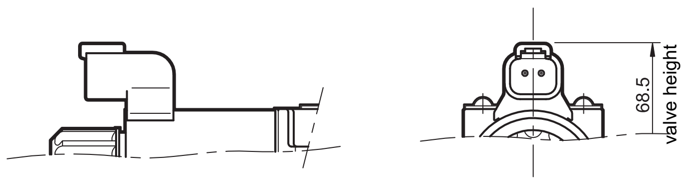
5 - ELECTRIC CONNECTIONS

Connectors for standard K1 connection are always supplied with the valve.

connection for DIN 43650 connector
code **K1** (**standard**)

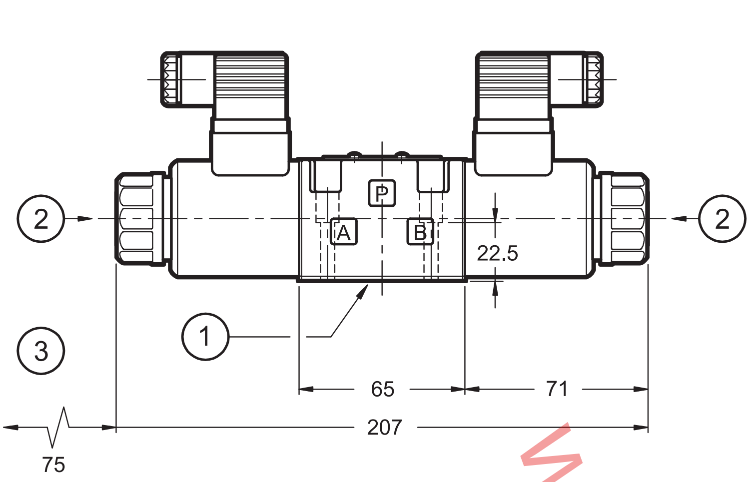


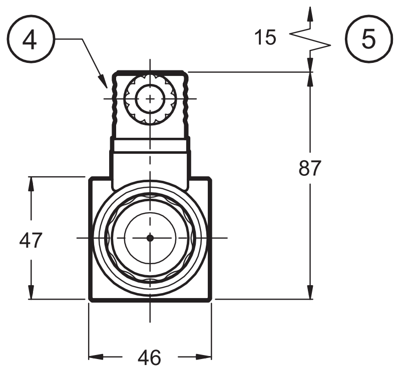
connection for
DEUTSCH DT06-2S male connector
code **K7**

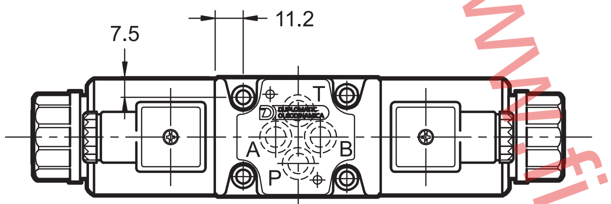


6 - OVERALL AND MOUNTING DIMENSIONS

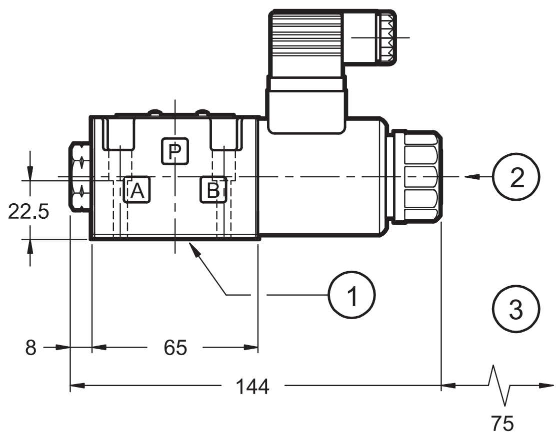
ZDE3-D



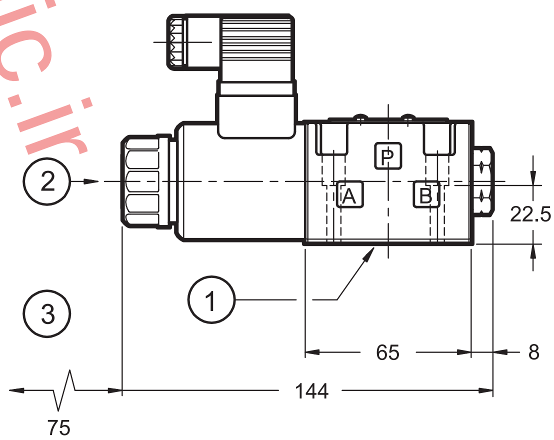




ZDE3-SA



ZDE3-SB



dimensions in mm

1	Mounting surface with sealing rings: 4 OR type 2037 - 90 shore (9.25x1.78)
2	Locking ring with boot protected manual override
3	Coil removal space
4	DIN 43650 electrical connector
5	Connector removal space

Fastening bolts: n° 4 bolts A8.8 M5x30

Torque: 5 Nm

Threads of mounting holes: M5x10

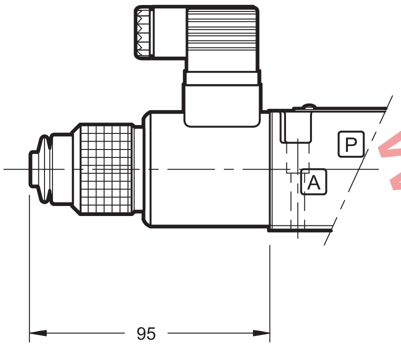
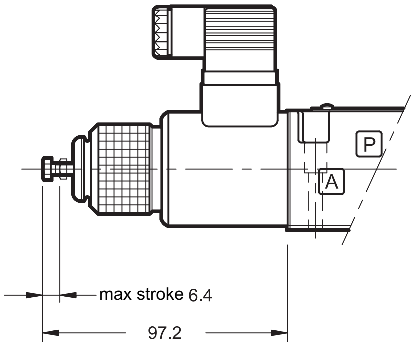
7 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

Two different manual override version are available upon request:

- **CM** version, manual override belt protected
- **CS** version, with metal ring nut provided with a M4 screw and a blocking locknut to allow the continuous mechanical operations.

CAUTION!: The manual override use doesn't allow any proportional regulation; indeed using this kind of override, the main stage spool will open completely and the whole inlet pressure will pass through A or B line.

CM Version	CS Version
	
Code: 3803210003	Code: 3803210004

8 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

9 - INSTALLATION

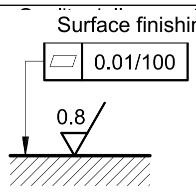
The ZDE3 valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the reduced pressure value.

Maximum admissible backpressure in the T line, under operational conditions, is 30 bar.



10 - ELECTRONIC CONTROL UNITS

ZDE3-SA*   ZDE3-SB*

EDC-111	for solenoid 24V DC	plug version	see cat.89 120
EDC-142	for solenoid 12V DC		
EDM-M111	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		

ZDE3-D*

EDM-M211	for solenoid 24V DC	rail mounting DIN EN 50022	see cat. 89 250
EDM-M242	for solenoid 12V DC		

11 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G with rear ports
Type PMMD-AL3G with side ports
P, T, A, B port threading: 3/8” BSP

DUPLOMATIC OLEODINAMICA

DUPLOMATIC OLEODINAMICA S.p.A.
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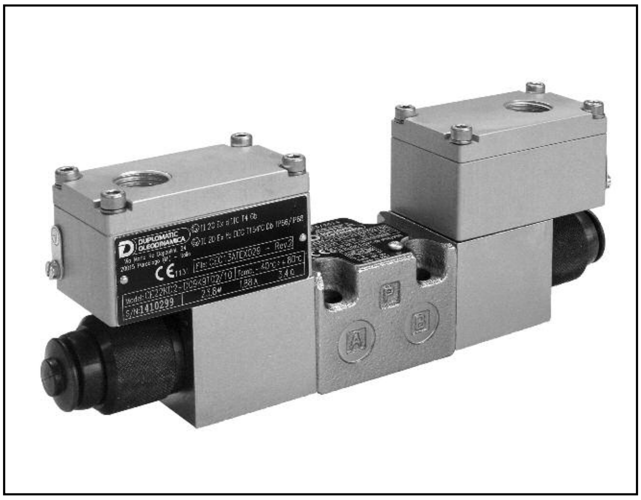
DUPLOMATIC OLEODINAMICA



ZDE3K*

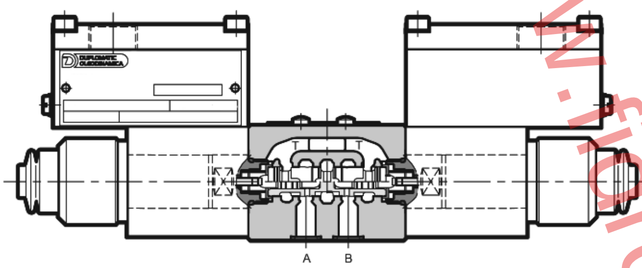
EXPLOSION-PROOF PRESSURE REDUCING VALVES ATEX, IECEx, INMETRO

SERIES 10

SUBPLATE MOUNTING ISO 4401-03

p max **100** bar
Q max **15** l/min

OPERATING PRINCIPLE



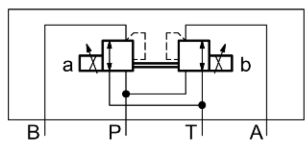
- ZDE3K*are direct operated pressure reducing valves, with electric proportional control, with ISO 4401-03 mounting surface.
- They are compliant with ATEX, IECEx and INMETRO requirements and are suitable for use in potentially explosive atmospheres, for surface plants or mines.
- A low temperature version (up to -40 °C) is also available.
- The valves are used to reduce pressure in the secondary circuit branches thus ensuring stability of controlled pressure in the event of variations of the flow rate through the valve.
- ZDE3K* valves are supplied with a finishing surface treatment (zinc-nickel) suitable to ensure a salt spray resistance up to 600 hours.
- **Details for classification, operating temperatures and electrical characteristics are in the technical data sheet 02 500 'Explosion proof classification'.**

PERFORMANCES
(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

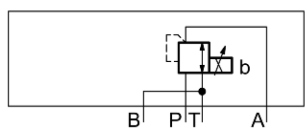
Pressure allowed in P port	bar	30 ÷ 100
Pressure allowed in T port (see par. 3)	bar	0 ÷ 30
Controlled pressure	bar	23
Maximum flow	l/min	15
Step response	ms	30
Hysteresis (with PWM 200 Hz)	% of p nom	< 4%
Repeatability	% of p nom	< ±1%
Electrical characteristic	see paragraph 4	
Operating temperatures (ambient and fluid)	see data sheet 02 500	
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	1,9 2,8

HYDRAULIC SYMBOLS

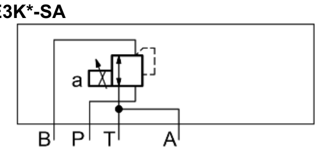
ZDE3K*-D



ZDE3K*-SB



ZDE3K*-SA



1 - IDENTIFICATION CODE

Z	D	E	3		-		/	10		-		K9		/		

Pressure reducing valve: **ZD**

Electric proportional control: **E**

Size ISO 4401-03: **3**

Explosion-proof certification:
See table 1.1

Solenoids:
D = pressure reduction in A and B ports
SA = pressure reduction in A port (solenoid on side B)
SB = pressure reduction in B port (solenoid on side A)

Series No. **10**
(from 30 to 39 sizes and mounting dimensions remain unchanged)

Seals:
For temperature range -20 / +80 °C
N = NBR seals for mineral oil (standard)
V = FPM seals for special fluids
For temperature range -40 / +80 °C
NL = seal for low temperatures (for mineral oil)

Nominal solenoid voltage
D12 = 12 V DC
D24 = 24 V DC

Coil electrical connection: by terminal block **K9**

Connection type for cable gland
upper connection:
T01 = M20x1.5 - ISO 261
T02 = Gk 1/2 - UNI EN 10226-2
not available for INMETRO
T03 = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)
side connection:
S01 = M20x1.5 - ISO 261
S02 = Gk 1/2 - UNI EN 10226-2
not available for INMETRO
S03 = 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)
S04 = M16x1.5 - ISO 261

Manual override:
CM = boot protected
standard for both N and V seals
not available for NL seals
CB = blind ring nut
standard for NL seals
available upon request for both N and V seals
see paragraph 8

Option: **/T5**
version in T5 temperature class.
Omit if not required.

NOTE: zinc-nickel standard finishing surface treatment.
Test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards.

1.1 - Names of valves per certification

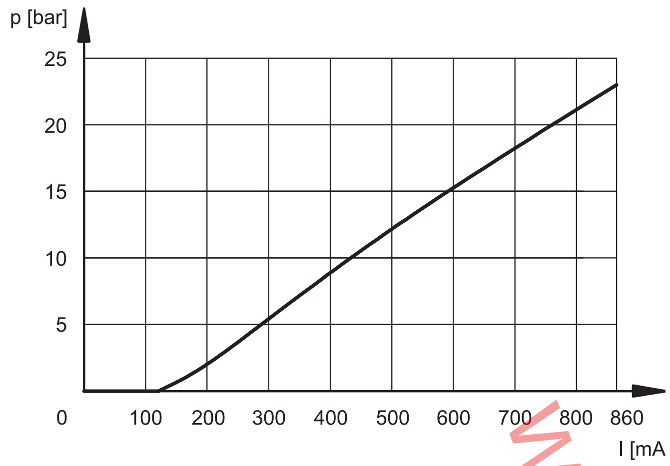
	ATEX		IECEx		INMETRO	
for gases for dusts	**KD2**	II 2GD	**KXD2**	IECEx Gb IECEx Db	**KBD2**	INMETRO Gb INMETRO Db
for mines	**KDM2**	I M2	**KXDM2**	IECEx Mb	**KBDM2**	INMETRO Mb

NOTE: Refer to the technical data sheet 02 500 for marking, operating temperatures and available versions.

2 - CHARACTERISTIC CURVES

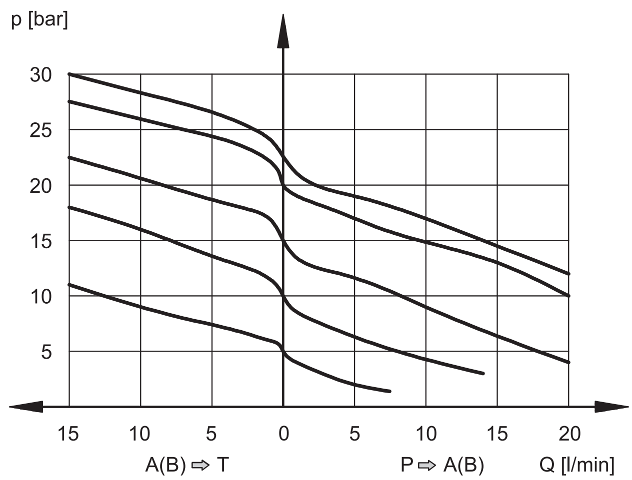
(obtained with ZDE3K*-D/10N-D24K9T01/CM with PWM 100Hz and oil with viscosity 36 cSt at 50°C)

PRESSURE CONTROL p=f (I)



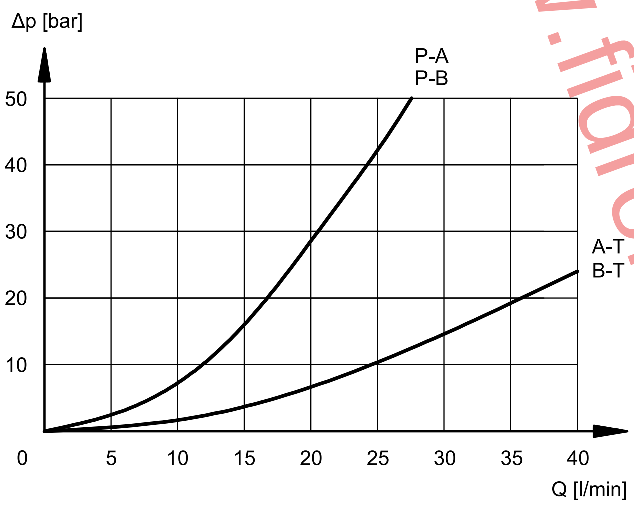
SA and SB versions pressure regulation is less than 0.5 bar.

PRESSURE VARIATION p = f(Q)



The curves have been obtained with inlet pressure 100 bar.

PRESSURE DROP Δp = f(Q)



3 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical step response times measured with input flow rate of Q = 5 l/min and p = 50 bar.

REFERENCE SIGNAL STEP	0 → 100%	100% → 0
response time [ms]	30	30

4 - ELECTRICAL CHARACTERISTICS

(values ± 5%)

NOMINAL VOLTAGE	V DC	**12**	**24**
RESISTANCE (at 20°C)	Ω	3.4	15.6
NOMINAL CURRENT	A	1.88	0.86
PWM FREQUENCY	Hz	200	100

DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2014/30/EU
CLASS OF PROTECTION: Atmospheric agents Coil insulation (VDE 0580)	 IP66 / IP68 class H

4.1 - Wiring

In order to realise the electrical connection of the coil, it is necessary to access the terminal block (1) unscrewing the 4 screws (2) that fasten the cover (3) with the box (4) that contains the terminal block.

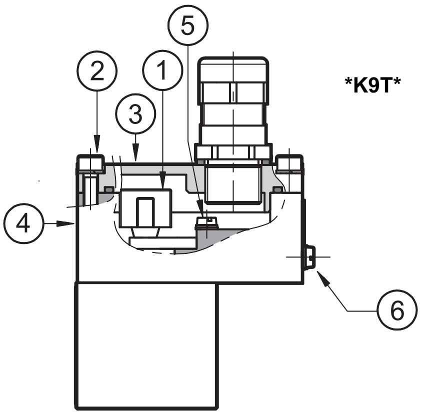
The electrical connection is polarity-independent.

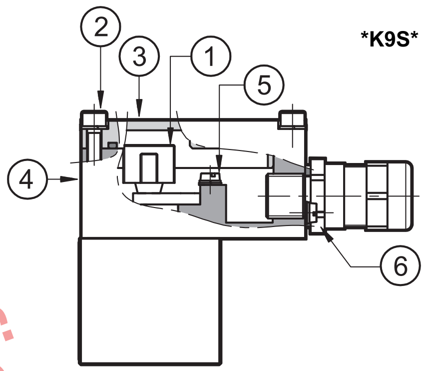
By doing electrical connection it is important to connect also the grounding point (5) in the terminal block box (M4 screws), through suitable conductors with the general grounding line of the system.

On the external body of the coil there is a grounding point (6) (M4 screw) that allow to ensure equipotentiality between the valve and the general grounding line of the system; connecting this point the regulation of the EN 13463-1 standard, that impose to verify the equipotentiality of the elements included in a potentially explosive environment (the maximum resistance between the elements must be 100 Ω), is guaranteed.

At the end of the electrical wiring, it is necessary to reassemble the cover (3) on the box (4), checking the correct positioning of the seal located in the cover seat and fastening the 4 M5 screws with a torque of 4.9 ÷ 6 Nm.

Electrical wiring must be done following in compliance with standards about protection against explosion hazards.





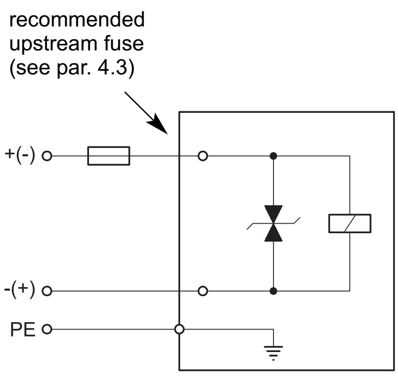
Characteristics of the cables connectable for wiring are indicated in the table below:

Function	Cable section
Operating voltage cables connection	max 2.5 mm²
Connection for internal grounding point	max 2.5 mm²
Connection for external equipotential grounding point	max 6 mm²

Cables for wiring must be non-armoured cables, with external covering sheath and must be suitable for use in environments with temperatures from - 20 °C to +110 °C (for valves either with N or V seals) or from - 40 °C to +110 °C (for valves with NL seals).

Cable glands (which must be ordered separately, see paragraph 10) allow to use cables with external diameter between 8 and 10 mm.

4.2 - Electrical diagram



4.3 - Overcurrent fuse and switch-off voltage peak

Upstream of each valve, an appropriate fuse (max 3 x In according to IEC 60127) or a protective motor switch with short-circuit and thermal instantaneous tripping, as short-circuit protection, must be connected. The cut-off power of the fuse must correspond or exceed the short circuit current of the supply source.

The fuse or the protective motor must be placed outside the dangerous area or they must be protected with an explosion-proof covering.

In order to safeguard the electronic device to which the valve is connected, there is a protection circuit in the coil, that reduces voltage peaks, which can occur when inductances are switched off.

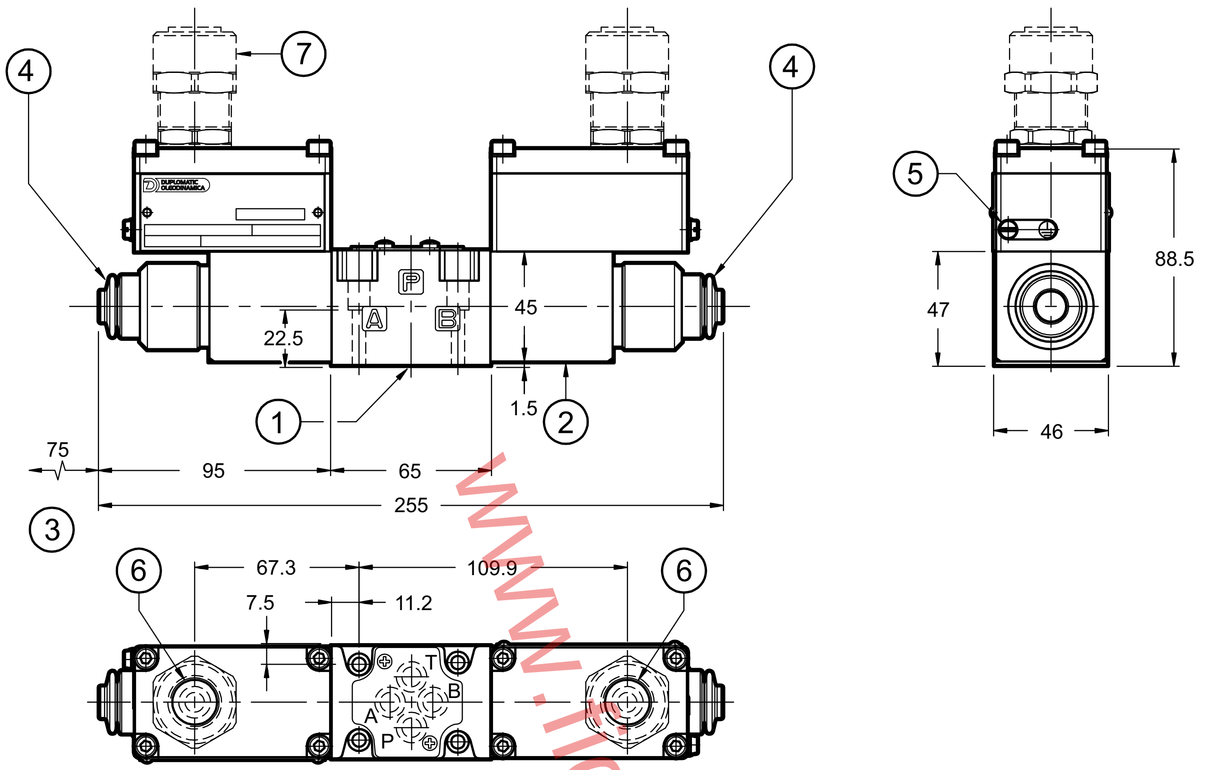
The table shows the type of fuse recommended according to the nominal voltage of the valve and to the value of the voltage peaks reduction.

Coil type	Nominal voltage [V]	Rated current [A]	**Recommended pre-fuse characteristics medium time-lag according to DIN 41571 [A]**	Maximum voltage value upon switch off [V]	Suppressor circuit
D12	12	1,88	2,5	- 49	Transient voltage suppressor bidirectional
D24	24	0,86	1,25	- 49	

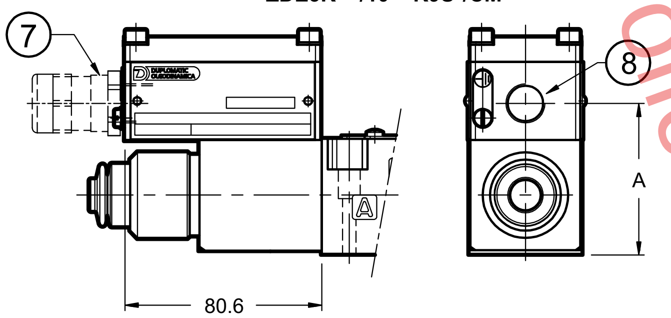
5 - OVERALL AND MOUNTING DIMENSIONS

ZDE3K*- D/10*-*K9T*/CM

dimensions in mm

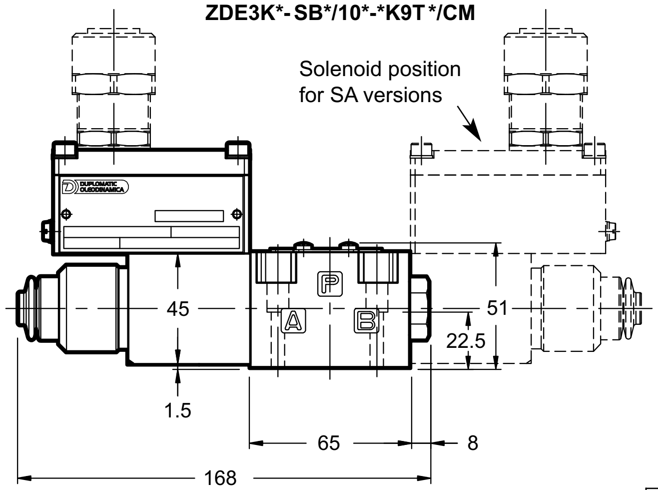


ZDE3K*-*/10*-*K9S*/CM



Side port type	A
S01, S04	60.5
S02, S03	60

ZDE3K*- SB*/10*-*K9T*/CM



1	Mounting surface with sealing rings 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected (**standard for both N and V seals**) for blind ring nut dimensions (standard with NL seals) see par. 8
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland To be ordered separately, see par. 9
8	Side port for cable gland

Fastening of single valve: 4 SHC screws ISO 4762 M5x30
Tightening torque: 5 Nm (A8.8 screws)
Threads of mounting holes: M5x10

6 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

7 - INSTALLATION

Installation must adheres to instructions reported in the *Use and Maintenance manual*, always attached to the valve. Unauthorized interventions can be harmful to people and goods because of the explosion hazards present in potentially explosive atmospheres.

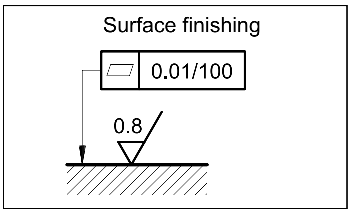
The valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the reduced pressure value.

In the T line the maximum admissible backpressure is 30 bar, under operational conditions.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.



8 - MANUAL OVERRIDE CB

CB - Blind ring nut

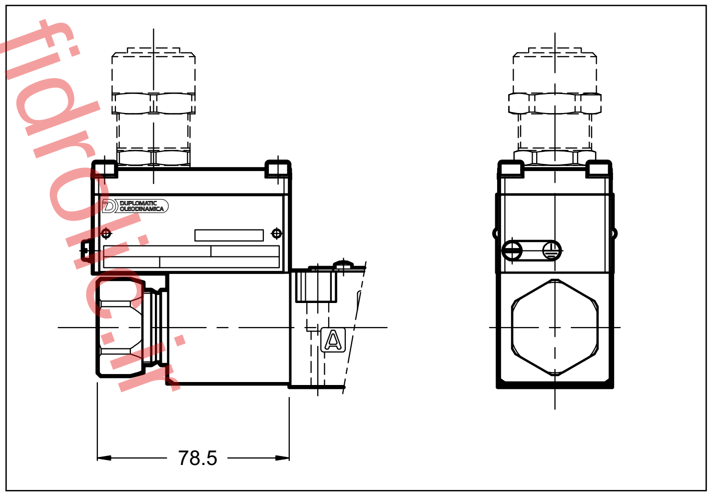
The metal ring nut protects the solenoid tube from atmospheric agents and isolates the manual override from accidental operations. The ring nut is tightened on a threaded fastener that keeps the coil in its position even without the ring nut.

To access the manual override loose the ring nut and remove it; then reassemble hand tightening, until it stops.

Activate the manual override always and only with non-sparking tools suitable for use in potentially explosive atmospheres.

More information on safe use of explosion-proof components are provided in the instruction manual, always supplied with the valve.

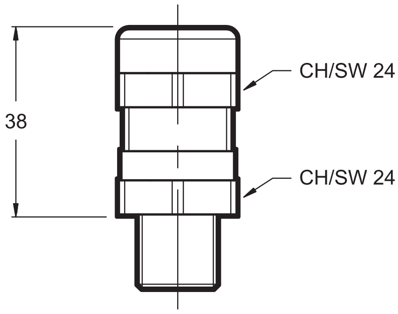
CAUTION!: The manual override doesn't allow any proportional regulation; indeed using this kind of override, the main stage spool will open completely and the whole inlet pressure will pass through A or B line.



9 - CABLE GLANDS

Cable glands must be ordered separately; Duplomatic offers some types of cable glands with the following features:

- version for non-armoured cable, external seal on the cable (suitable for Ø 8 ÷ 10 mm cables);
- ATEX II 2GD, I M2; IECEx Gb, Db, Mb; INMETRO Gb, Db, Mb certified
- cable gland material: nickel brass
- rubber tip material: silicone
- ambient temperature range: -70°C ÷ +220°C
- protection degree: IP66/IP68
- tightening torque: 15 Nm



To order, list the description and the code of the version chosen from among those listed below:

Description: CGK2/NB-01/10

Code: 3908108001

M20x1.5 - ISO 261 male thread, suitable for coils with T01 and S01 connections. It is supplied equipped with silicone seal, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Description: CGK2/NB-02/10

Code: 3908108002

Gk 1/2 - UNI EN 10226-2 male thread, suitable for coils with T02 and S02 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Description: CGK2/NB-03/10

Code: 3908108003

1/2” NPT - ANSI B1.20.1 (ex ANSI B2.1), suitable for coils with T03 and S03 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Description: CGK2/NB-04/10

Code: 3908108004

M16x1.5 - ISO 261 male thread, suitable for coils with S04 connection. It is supplied equipped with silicone seal, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

10 - ELECTRONIC CONTROL UNITS

ZDE3K*- SA*   ZDE3K*- SB*

EDM-M111	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		

ZDE3K*- D*

EDM-M211	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M242	for solenoid 12V DC		

NOTE: electronic control units offered are not explosion proof certified; therefore, they must be installed outside the classified area.

11 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G with rear ports
Type PMMD-AL3G with side ports
P, T, A, B port threading: 3/8” BSP

NOTE: Subplates (to be ordered separately) do not contain neither aluminium nor magnesium at a higher rate than the value allowed by norms according to ATEX directive for categories II 2GD and I M2 .

The user must take care and make a complete assessment of the ignition risk, that can occur from the relative use in potentially explosive environments.

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EXPLOSION-PROOF CLASSIFICATION for

SOLENOID AND PROPORTIONAL VALVES

ref. catalogues:

pressure valves

RQM*K*-P	21 515
PRE(D)*K*	81 315
ZDE3K*	81 515
DZCE*K*	81 605

directional valves

D*K*	41 515
DS(P)E*K*	83 510

GENERAL INFO

This informative technical datasheet displays information about **classification and marking** of Duplomatic explosion-proof valves range.

Duplomatic offers valves with the following certifications:

ATEX	**II 2G**	**II 2D**	**I M2**
IECEx	**Gb**	**Db**	**Mb**
INMETRO	**Gb**	**Db**	**Mb**

Instructions for use and maintenance can be found in the related manuals, always supplied toghether with valves.

1 - ATEX CLASSIFICATION AND TEMPERATURES

Duplomatic certificates the combination valve-coil for the valves suitable for application and installation in potentially explosive atmospheres, according to ATEX directive; the supply always includes the declaration of conformity to the directive and the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environments.

Coils assembled on these valves have been separately certified according to ATEX directive and so they are suitable for use in potentially explosive atmospheres.

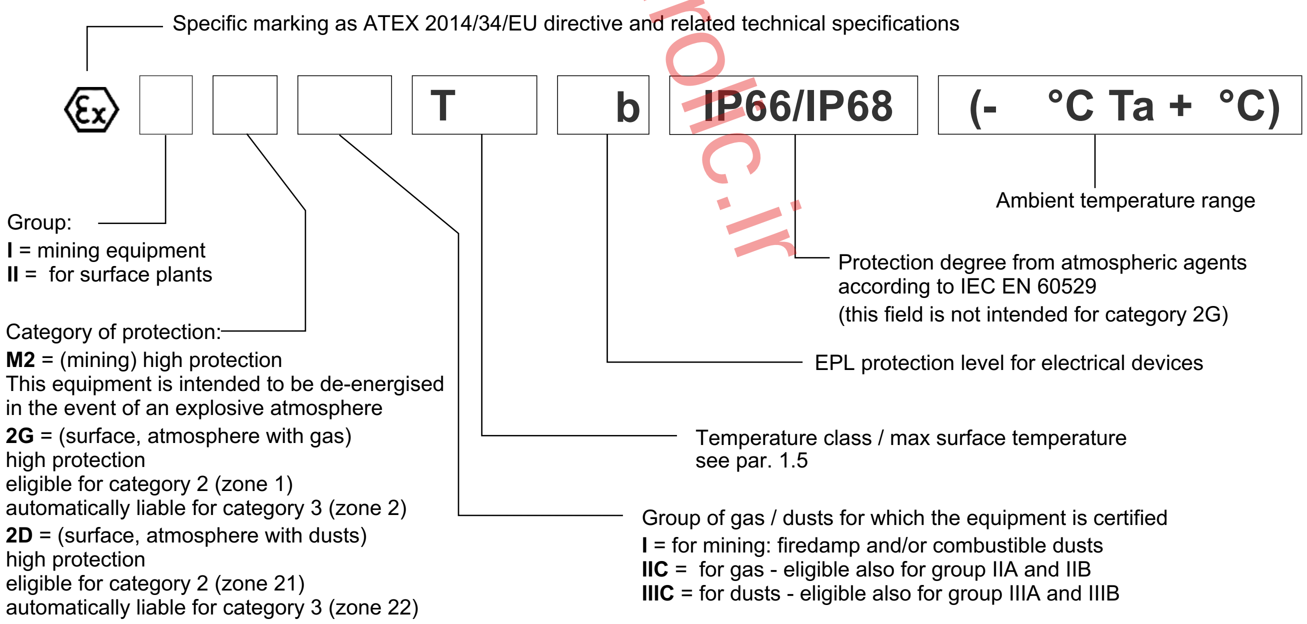
1.1 - ATEX classification for valves

Type examination certificate: CEC 13 ATEX 030-REV.2
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

ATEX II 2G ATEX II 2D	***KD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
ATEX I M2	***KDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

1.2 - ATEX marking for valves

valve code		N and V seals	NL seals
***KD2**	for gas	Ex II 2G IIC T4 Gb (-20°C Ta +80°C)	Ex II 2G IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex II 2D IIIC T154°C Db IP66/IP68 (-20°C Ta +80°C)	Ex II 2D IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
***KD2 /T5**	for gas	Ex II 2G IIC T5 Gb (-20°C Ta +55°C)	Ex II 2G IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex II 2D IIIC T129°C Db IP66/IP68 (-20°C Ta +55°C)	Ex II 2D IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
***KDM2**	mining	Ex I M2 I T150°C Mb IP66/68 (-20°C Ta +75°C)	Ex I M2 I T150°C Mb IP66/68 (-40°C Ta +75°C)



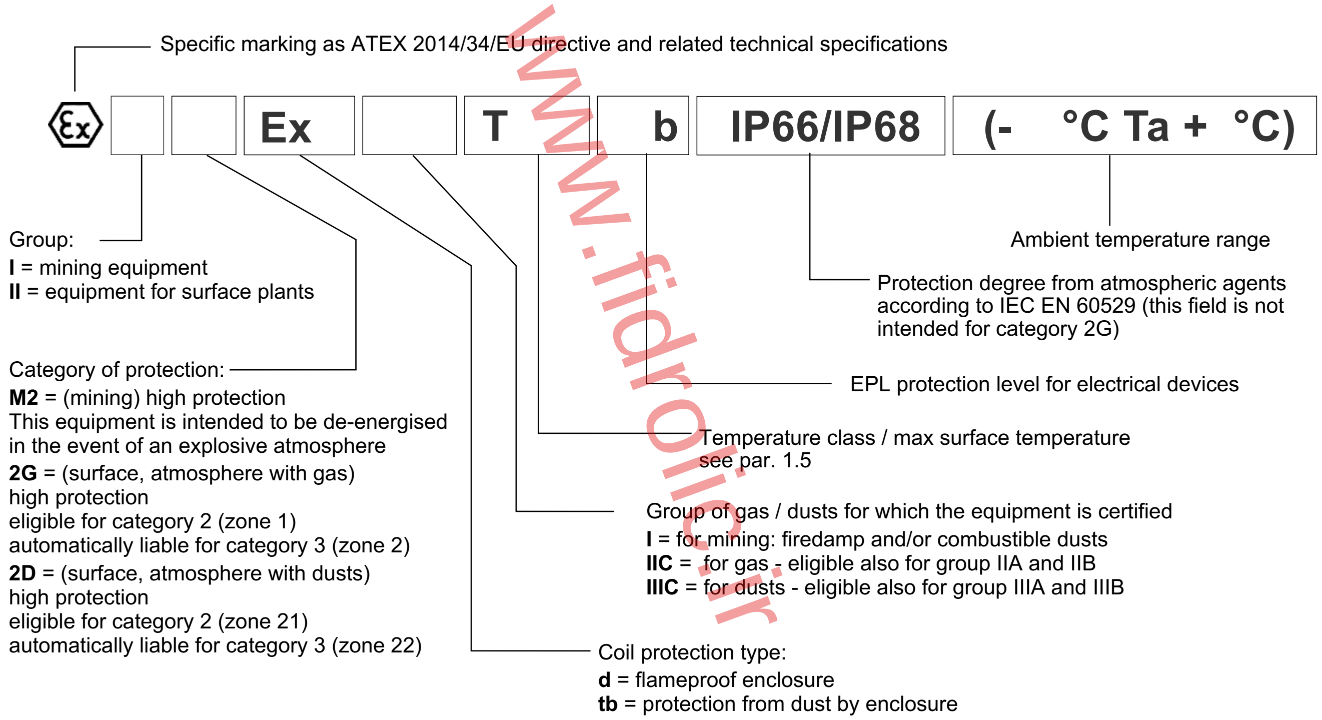
1.3 - ATEX classification of the coils

The coil of the explosion-proof valves is ATEX certified itself an as such is identified with its own tag, carries the relative ATEX marking. **The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex d” type protection (explosion-proof coil).**

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

1.4 - ATEX marking on coils

for valve type ***KD2**	for gas	II 2G Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	II 2D Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
for valve type ***KD2 /T5**	for gas	II 2G Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	II 2D Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
for valve type ***KDM2**	mining	I M2 Ex d I T150°C Mb IP66/IP68 (-40°C Ta +75°C)



1.5 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

The valves in group II can also be used for less limiting temperature classes (surface temperature allowed higher).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
ATEX II 2G ATEX II 2D	***KD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T154°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T129°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
ATEX I M2	***KDM2**	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				

2 - IECEx CLASSIFICATION AND TEMPERATURES

The IECEx certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with IECEx certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex db” type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

2.1 - IECEx classification

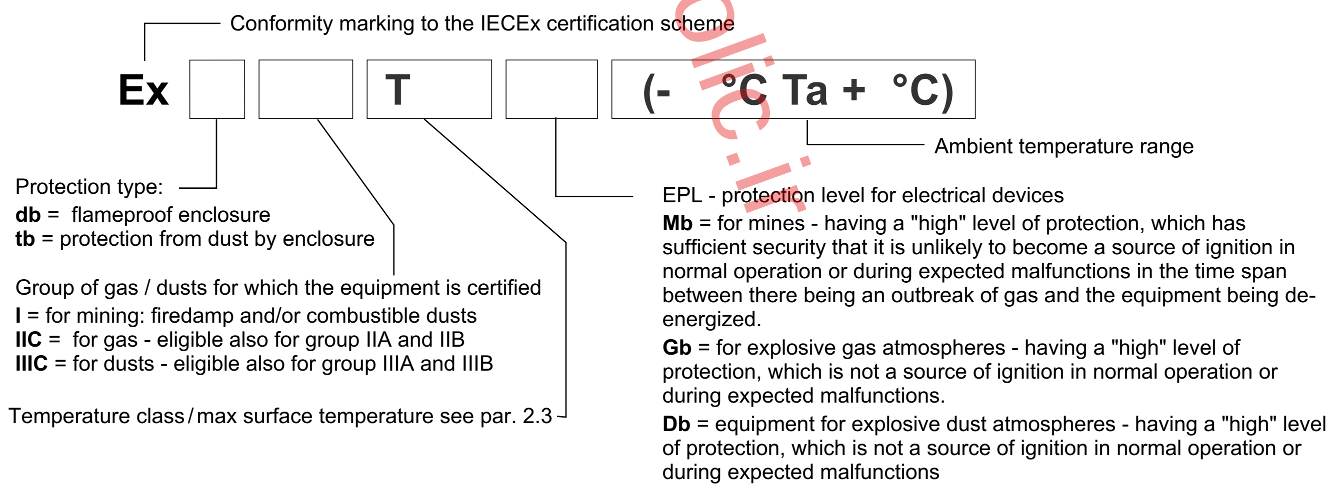
Certificate of conformity (CoC): IECEx TUN 15.0028X
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

IECEx Gb IECEx Db	***KXD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
IECEx Mb	***KXDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

2.2 - IECEx marking

There is a plate with the IECEx mark on each coil.

***KXD2** valves	for gas	Ex db IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T135°C Db (-40°C Ta +80°C)
***KXD2 /T5** valves	for gas	Ex db IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T100°C Db (-40°C Ta +55°C)
***KDM2** valves	mining	Ex db I Mb (-40°C Ta +80°C)



2.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	N and V seals	NL seals	Temperature class	eligible also for
IECEx Gb IECEx Db	***KXD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T135°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KXD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T100°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
IECEx Mb	***KXDM2**	of ambient	-20 / +80 °C	-40 / +80 °C	-	-
		of fluid				

3 - INMETRO CLASSIFICATION AND TEMPERATURES

The INMETRO certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with INMETRO certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex d” type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

3.1 - INMETRO classification

Certificate of conformity: DNV 15.0094 X
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

INMETRO Gb INMETRO Db	***KBD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
INMETRO Mb	***KBDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

3.2 - INMETRO marking

There is a plate with the INMETRO mark on each coil.

***KBD2** valves	for gas	Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
***KBD2 /T5** valves	for gas	Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
***KBDM2** valves	mining	Ex d I T150° Mb IP66/IP68 (-40°C Ta +75°C)

Conformity marking to the INMETRO certification scheme

Ambient temperature range

Ex [ ] [ ] **T** [ ] [ ] **IP66/IP68** **(- °C Ta + °C)**

Protection degree from atmospheric agents according to IEC EN 60529 (this field is not intended for gases)

Protection type:
d = flameproof enclosure
tb = protection from dust by enclosure

Group of gas / dusts for which the equipment is certified
I = for mining: firedamp and/or combustible dusts
IIC = for gas - eligible also for group IIA and IIB
IIIC = for dusts - eligible also for group IIIA and IIIB

Temperature class / max surface temperature see par. 3.3

EPL - protection level for electrical devices
Mb = for mines - having a "high" level of protection, which has sufficient security that it is unlikely to become a source of ignition in normal operation or during expected malfunctions in the time span between there being an outbreak of gas and the equipment being de-energized.
Gb = for explosive gas atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions.
Db = equipment for explosive dust atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions

3.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
INMETRO Gb INMETRO Db	***KBD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T154°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KBD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T129°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
INMETRO Mb	***KBDM2**	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				

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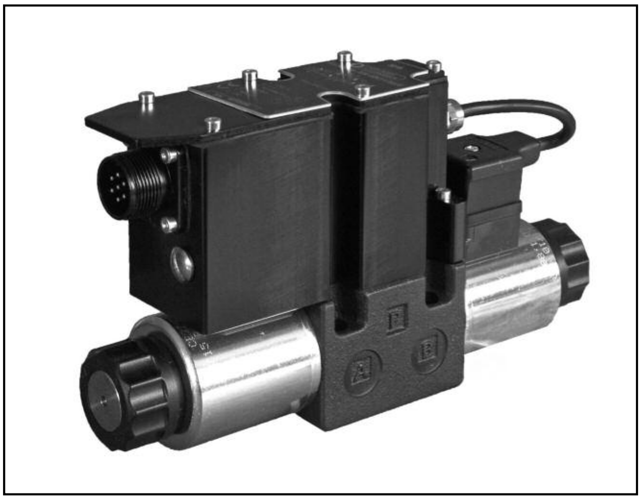
ZDE3G

DIRECT OPERATED REDUCING VALVE WITH PROPORTIONAL CONTROL AND INTEGRATED ELECTRONICS

SERIES 31

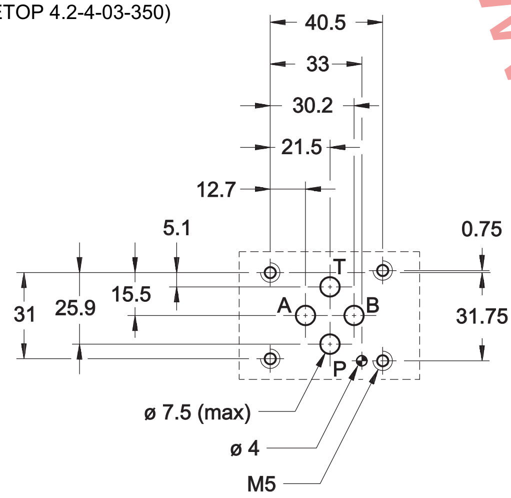


SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

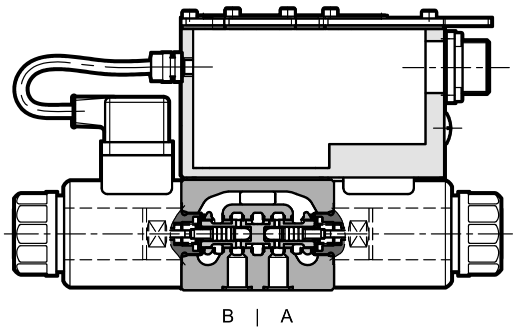
p max **100** bar
Q max **15** l/min

MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



OPERATING PRINCIPLE



— The ZDE3G are direct operated pressure valves with electric proportional control and integrated electronics and with mounting interface in compliance with ISO 4401 standards.

— The valves are used to reduce pressure in the secondary circuit branches thus ensuring stability of controlled pressure in the event of variations of the flow rate through the valve.

— The valve are available with command signal in voltage or current and on board electronics with internal enable, external enable or 0V monitor on pin C.

— A solenoid current monitoring signal is available.

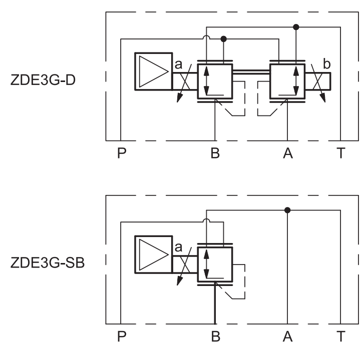
— The valve is easy to install. The driver directly manages digital settings.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Pressure allowed on P port	bar	30 ÷ 100
Pressure allowed on T port (see par. 5)	bar	0 ÷ 30
Controlled pressure	bar	23
Maximum flow	l/min	15
Hysteresis	% Q max	< 3 %
Repeatability	% Q max	< 1 %
Electrical characteristics	see paragraph 2	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	1,9 2,4

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

Z	D	E	3	G	-		/	31		-		K11		/	

Pressure reducing valve

Electric proportional control

Size ISO 4401-03

Integrated electronics for open loop

Solenoids:
D = pressure reduction in A and B ports
SB = pressure reduction in B port (solenoid on side A)

Series No.
(the overall and mounting dimensions remain unchanged from 30 to 39)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Reference signal:
E0 = voltage 0 ÷ 10 V
E1 = current 4 ÷ 20 mA

Main connector 6 pin + PE

Pin C function:
A = external enable
B = internal enable
C = 0V monitor

Option:
manual override
(see paragraph 7)

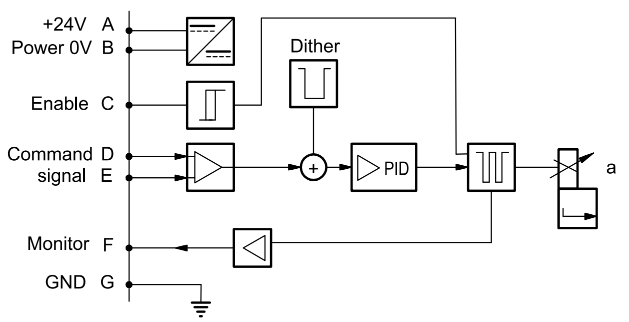
2 - ELECTRICAL CHARACTERISTICS

2.1 - Electrical on board electronics

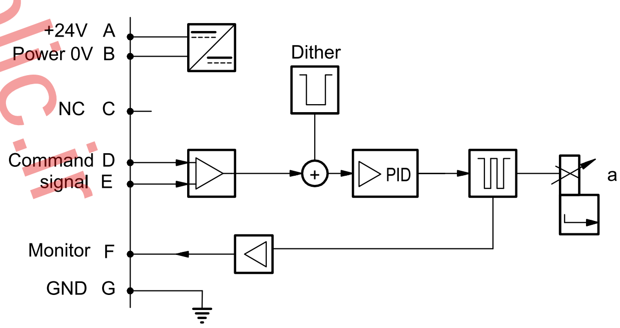
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		2A time lag
Command signals: voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (current to solenoid): voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2004/108/EC standards

2.2 - On-board electronics diagrams

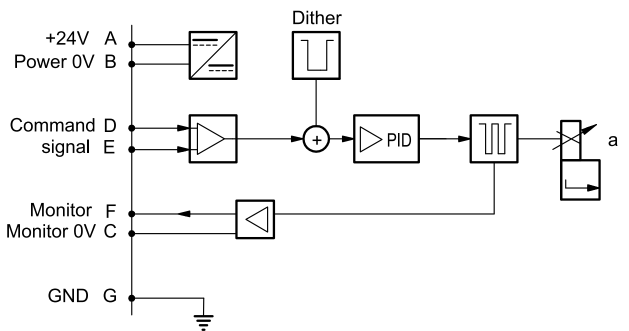
VERSION **A** - External Enable



VERSION **B** - Internal Enable

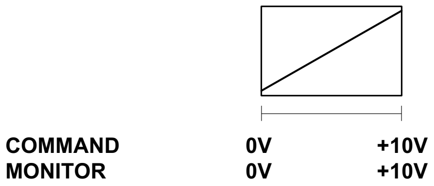


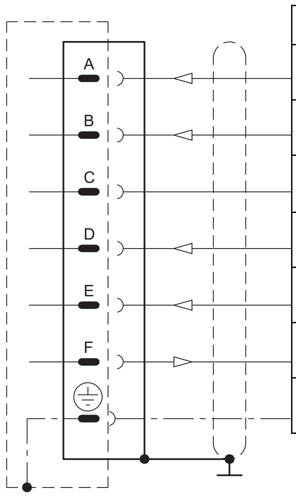
VERSION **C** - 0V Monitor



3 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal is between 0…10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



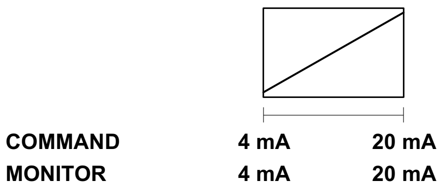


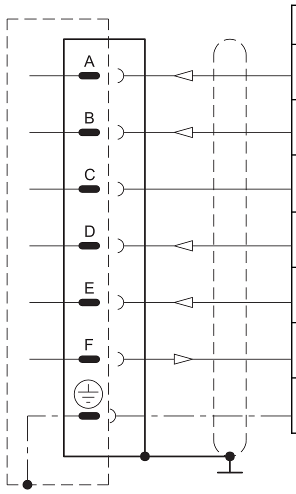
Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	0 ÷ 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	0 ÷ 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

4 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.





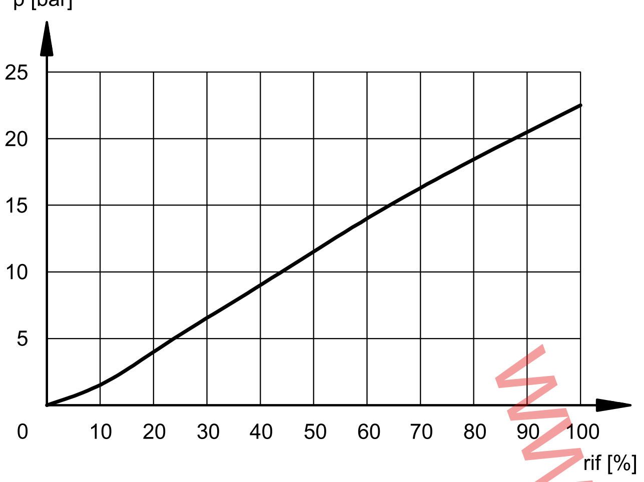
Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

5 - CHARACTERISTIC CURVES

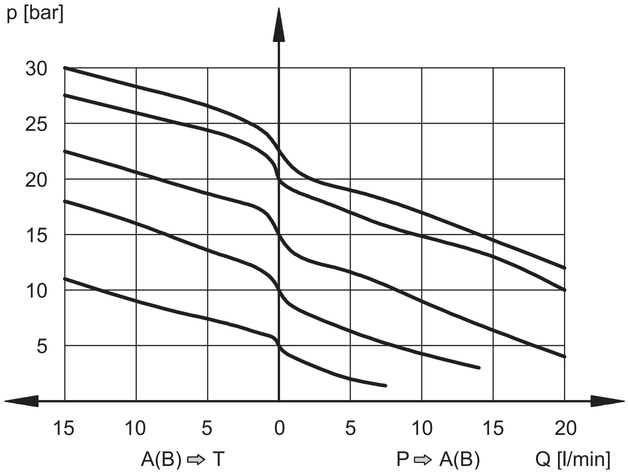
(obtained with oil with viscosity 36 cSt at 50°C)

Adjustment characteristics depending from solenoid current supply, obtained with inlet pressure = 100 bar.

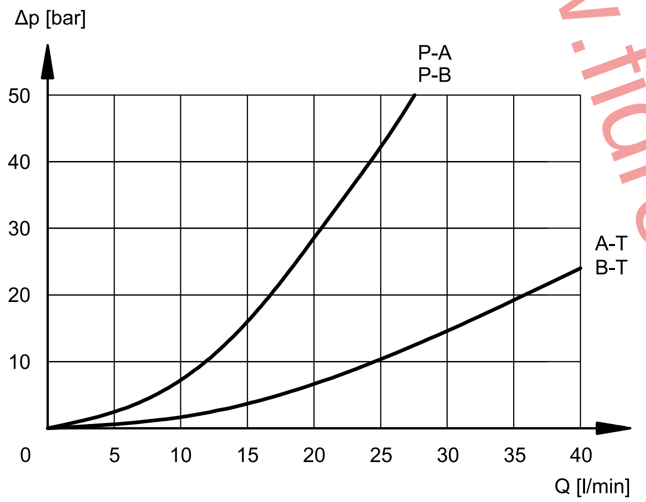
PRESSURE CONTROL p = f (I)



PRESSURE VARIATION p = f(Q)

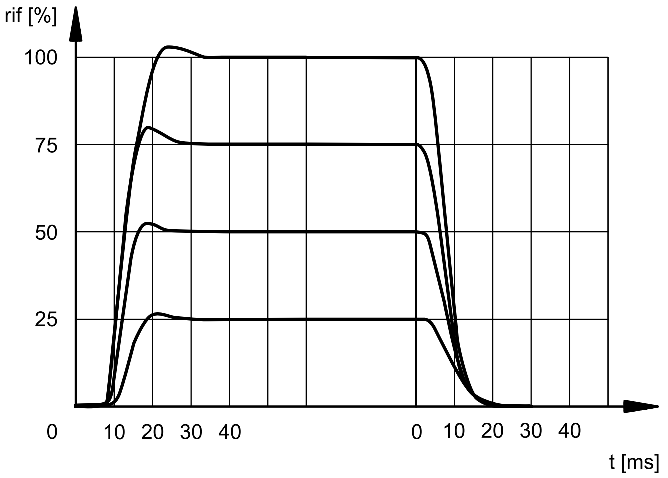


PRESSURE DROP Δp = f(Q)



6 - STEP RESPONSE

Response times are obtained with an inlet pressure of 100 bar and oil volume of 0,3 litres. The response time is affected both by the flow rate and the oil volume in the pipework.



7 - MANUAL OVERRIDE

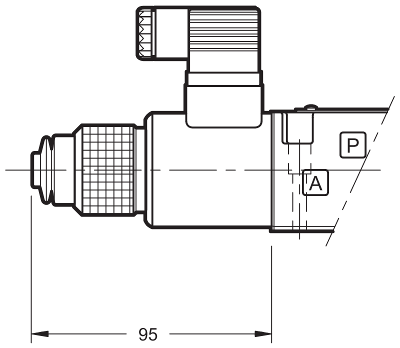
The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

Two different manual override version are available upon request:

- **CM** version, manual override belt protected
- **CS** version, with metal ring nut provided with a M4 screw and a blocking locknut to allow the continuous mechanical operations.

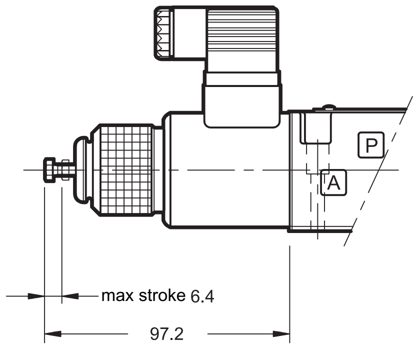
CAUTION!: The manual override use doesn't allow any proportional regulation; indeed using this kind of override, the main stage spool will open completely and the whole inlet pressure will pass through A or B line.

CM Version



Code: 3803210003

CS Version

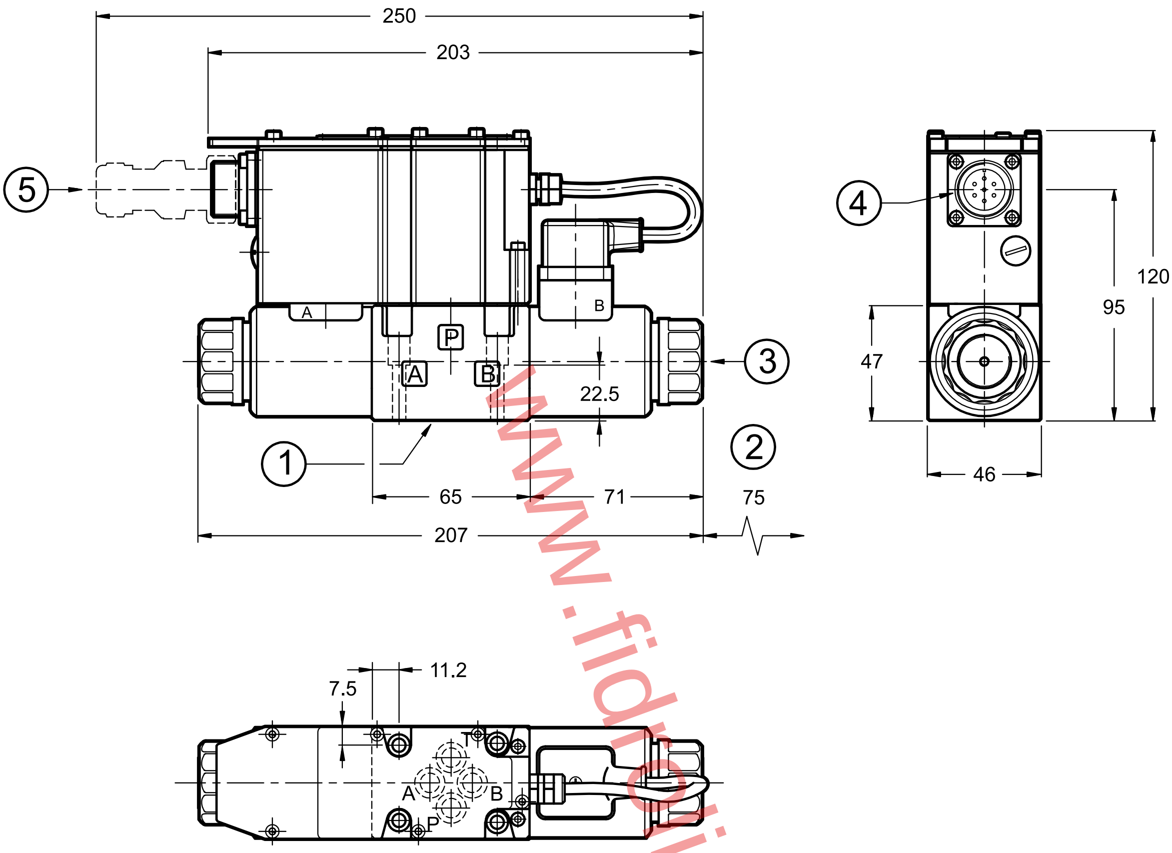


Code: 3803210004

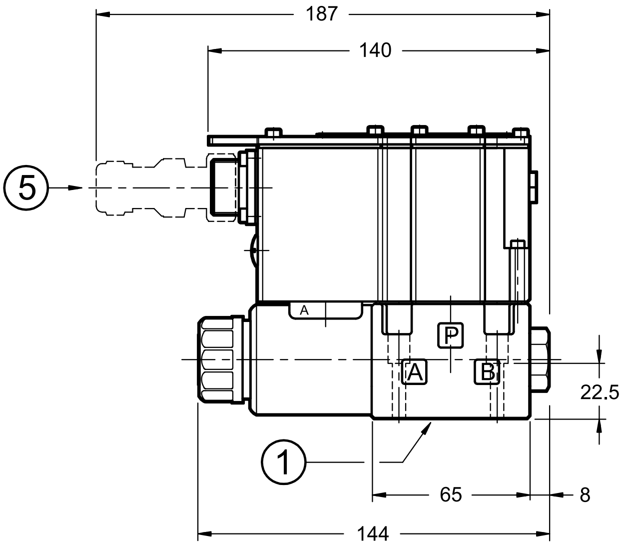
8 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

ZDE3G-D



ZDE3G-SB



1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) 90 Shore
2	Coil removal space (solenoid B only)
3	Standard manual override embedded in the solenoid tube
4	Main connection
5	Mating connector. **To be ordered separately.** See paragraph 11

Fastening bolts: 4 bolts M5x30 - ISO 4762
Torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

9 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

10 - INSTALLATION

ZDE3G valves can be installed in any position without impairing correct operation.

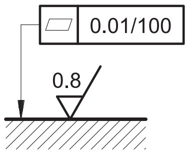
Ensure that there is no air in the hydraulic circuit.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the reduced pressure value.

Maximum admissible backpressure in the T line, under operational conditions, is 30 bar.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Surface finishing



11 - ACCESSORIES

(to be ordered separately)

11.1 - Mating connector

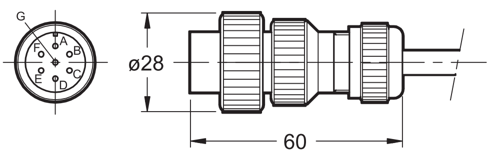
These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



11.2 - Connection cables size

Power supply:
- up to 20 m cable lenght : 1,0 mm²
- up to 40 m cable lenght : 1,5 mm²

Signal: 0,50 mm²

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

11.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

12 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G	rear ports
PMMD-AL3G	side ports
Ports dimensions: P, T, A, B: 3/8" BSP	

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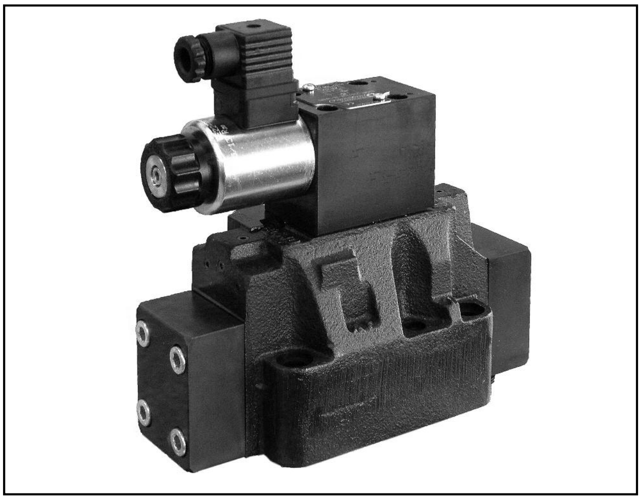
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com



DZCE*

PRESSURE REDUCING VALVE WITH PROPORTIONAL CONTROL

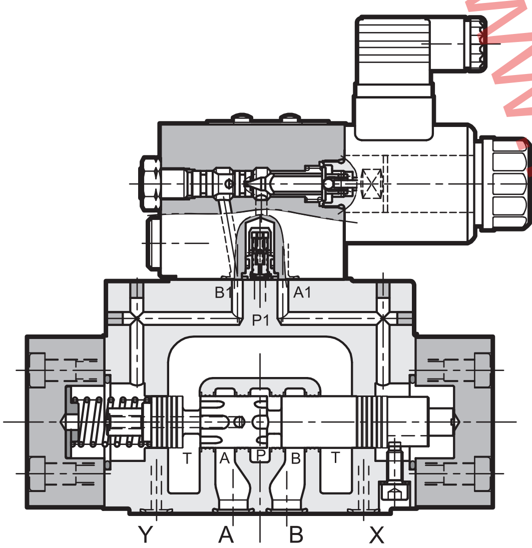
SERIES 11

DZCE5	**CETOP P05**
DZCE5R	**ISO 4401-05** (CETOP R05)
DZCE7	**ISO 4401-07** (CETOP 07)
DZCE8	**ISO 4401-08** (CETOP 08)

p max **350** bar

Q max (see table of performances)

OPERATING PRINCIPLE



— The DZCE* are pressure reducing valves with electric proportional control and mounting interface in compliance with ISO 4401 (CETOP RP121H) standards.

— Those valves, besides reducing the pressure from line P to working line A, allow the flow to return from the line A to the return line T when a pressure greater than the set value is generated in the downstream circuit (flow path A): a typical case of hydraulic counterweight or load balancing.

— The pressure can be modulated continuously in proportion to the current supplied to the solenoid.

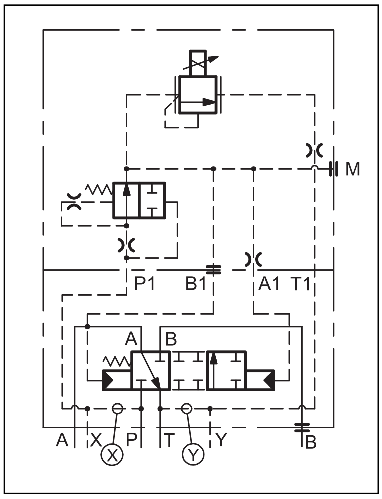
— They can be controlled directly by a current control supply unit or by means of the electronic control units (par. 12) to exploit valve performance to the full .

— They are available in CETOP P05, ISO 4401-05 (CETOP R05), ISO 4401-07 (CETOP 07) and ISO 4401-08 (CETOP 08) sizes.

— Every size can be supplied with several controlled flow rates, up to 500 l/min.

PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)		DZCE5 DZCE5R	DZCE7	DZCE8
Maximum operating pressure	bar	350		
Maximum flow	l/min	150	300	500
Step response		see paragraph 6		
Hysteresis (with PWM 200 Hz)	% of p_{max}	< 4%		
Repeatability	% of p_{max}	< ±2%		
Electrical characteristic		see paragraph 5		
Ambient temperature range	°C	-20 / +60		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13			
Recommended viscosity	cSt	25		
Mass	kg	7	9,2	15,3

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

D	Z	C	E		-		/	11		-			/		K1

Pressure reducing valve

Electric proportional control

Nominal size:
5 = CETOP P05 (**NOTE**)
5R = ISO 4401-05 (CETOP R05)
7 = ISO 4401-07 (CETOP 07)
8 = ISO 4401-08 (CETOP 08)

Pressure control range
070 = 1 ÷ 70 bar
140 = 1 ÷ 140 bar
210 = 1 ÷ 210 bar
300 = 1 ÷ 300 bar

Series N. (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Piloting: **I** = internal
E = external

Drainage: **I** = internal
E = external

Supply voltage:
D12 = voltage 12V DC
D24 = voltage 24V DC

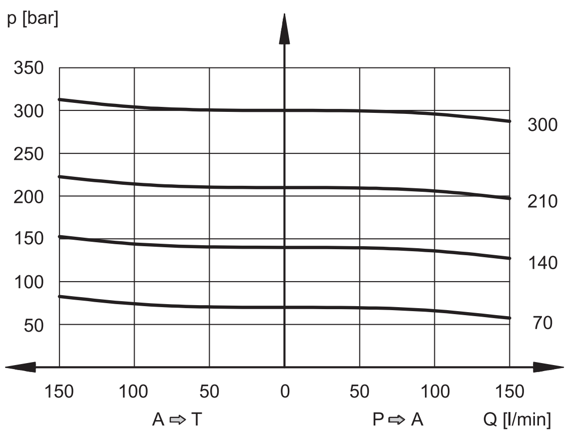
Coil electrical connection: for connector type DIN 43650 (**standard**)

NOTE: This version is interchangeable with the model ZCE4 Duplomatic.

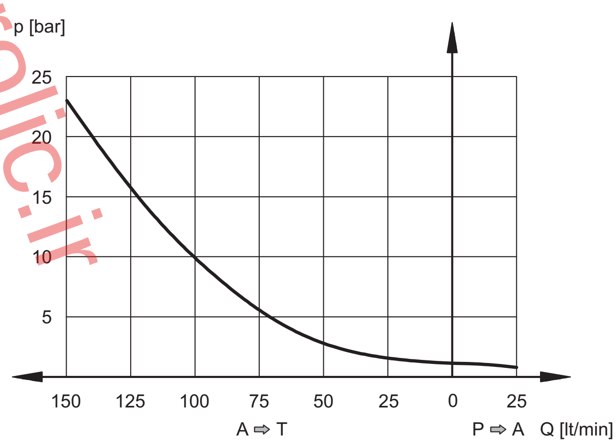
2 - CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

2.1 - Characteristic curves DZCE5 and DZCE5R

ADJUSTMENT

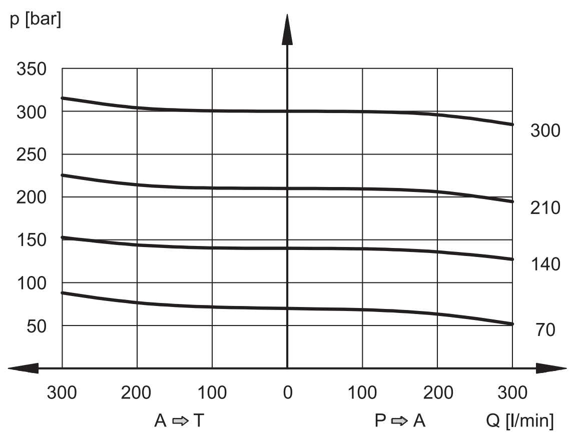


MIN. CONTROLLED PRESSURE p min = f(Q)

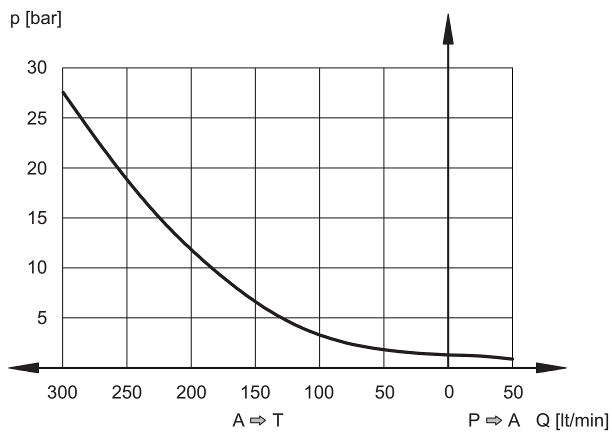


2.2 - Characteristic curves DZCE7

ADJUSTMENT

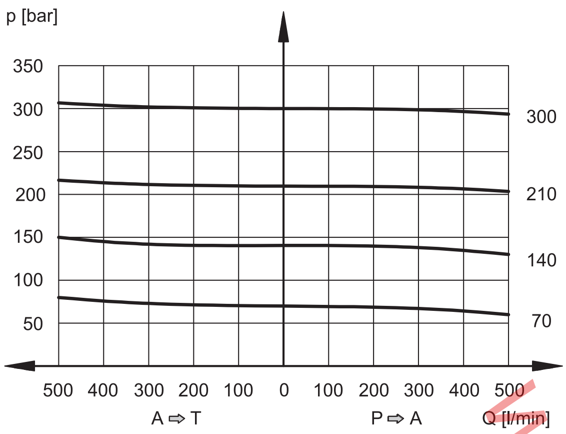


MIN. CONTROLLED PRESSURE p min = f(Q)

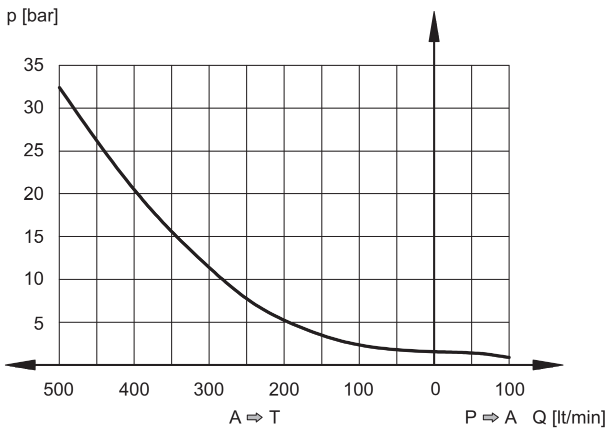


2.3 - Characteristic curves DZCE8

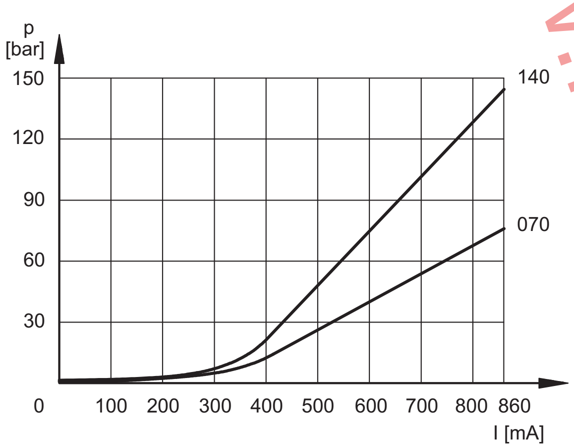
ADJUSTMENT

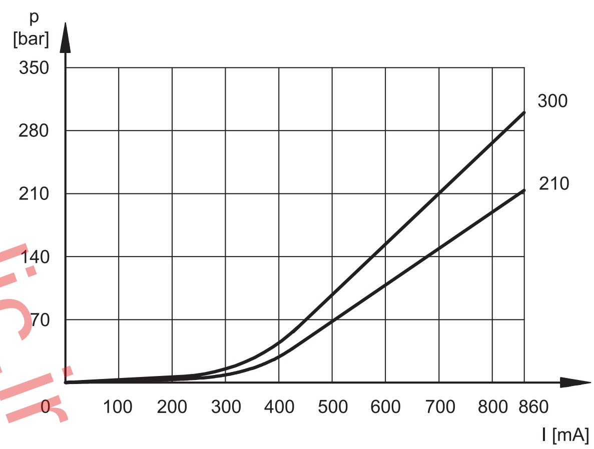


MIN. CONTROLLED PRESSURE p min = f(Q)



2.4 - Pressure control p = f(I) DZCE5, DZCE5R, DZCE7 and DZCE8





3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

6 - PILOTING AND DRAINAGE

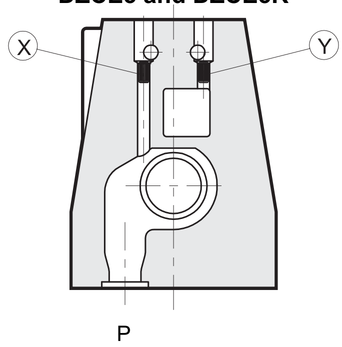
The DZCE* valves are available with piloting and drainage, both internal and external.
We suggest to use the version with external drainage that allows a higher backpressure on the unloading.

VALVE TYPE		Plug assembly	
		X	Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

PRESSURES (bar)

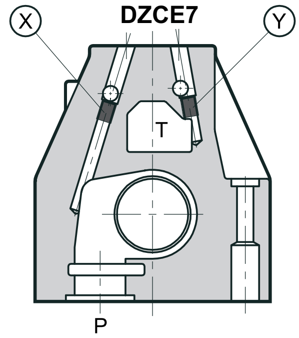
Pressure	MIN	MAX
Piloting pressure on X port	30	350
Pressure on T port with interal drain	–	2
Pressure on T port with external drain	–	250

DZCE5 and DZCE5R



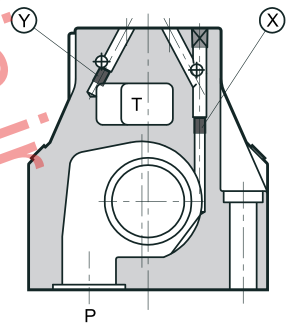
X: M5x6 plug for external pilot
Y: M5x6 plug for external drain

DZCE7



X: M6x8 plug for external pilot
Y: M6x8 plug for external drain

DZCE8



X: M6x8 plug for external pilot
Y: M6x8 plug for external drain

5 - ELECTRICAL CHARACTERISTICS

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut.
It can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	12	24
RESISTANCE (at 20°C)	Ω	3.66	17.6
NOMINAL CURRENT	A	1.88	0.86
DUTY CYCLE	100%		
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE		
CLASS OF PROTECTION: atmospheric agents (CEI EN 60529) coil insulation (VDE 0580) Impregnation	 IP 65 class H class F		

6 - STEP RESPONSE (measured with mineral oil with viscosity of 36 cSt at 50°C with the relative electronic control units)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

REFERENCE SIGNAL STEP	0 →100%	100→0%
response times [ms]		
DZCE5 and DZCE5R	100	70
DZCE7	100	50
DZCE8	100	50

7 - INSTALLATION

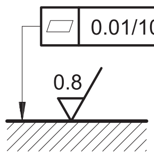
We recommend to install the DZCE* valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 2.

Ensure that there is no air in the hydraulic circuit. In particulars applications,it can be necessary to vent the air entrapped in the solenoid tube, using the special drain screw and then ensure to screwed it correctly.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value. Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

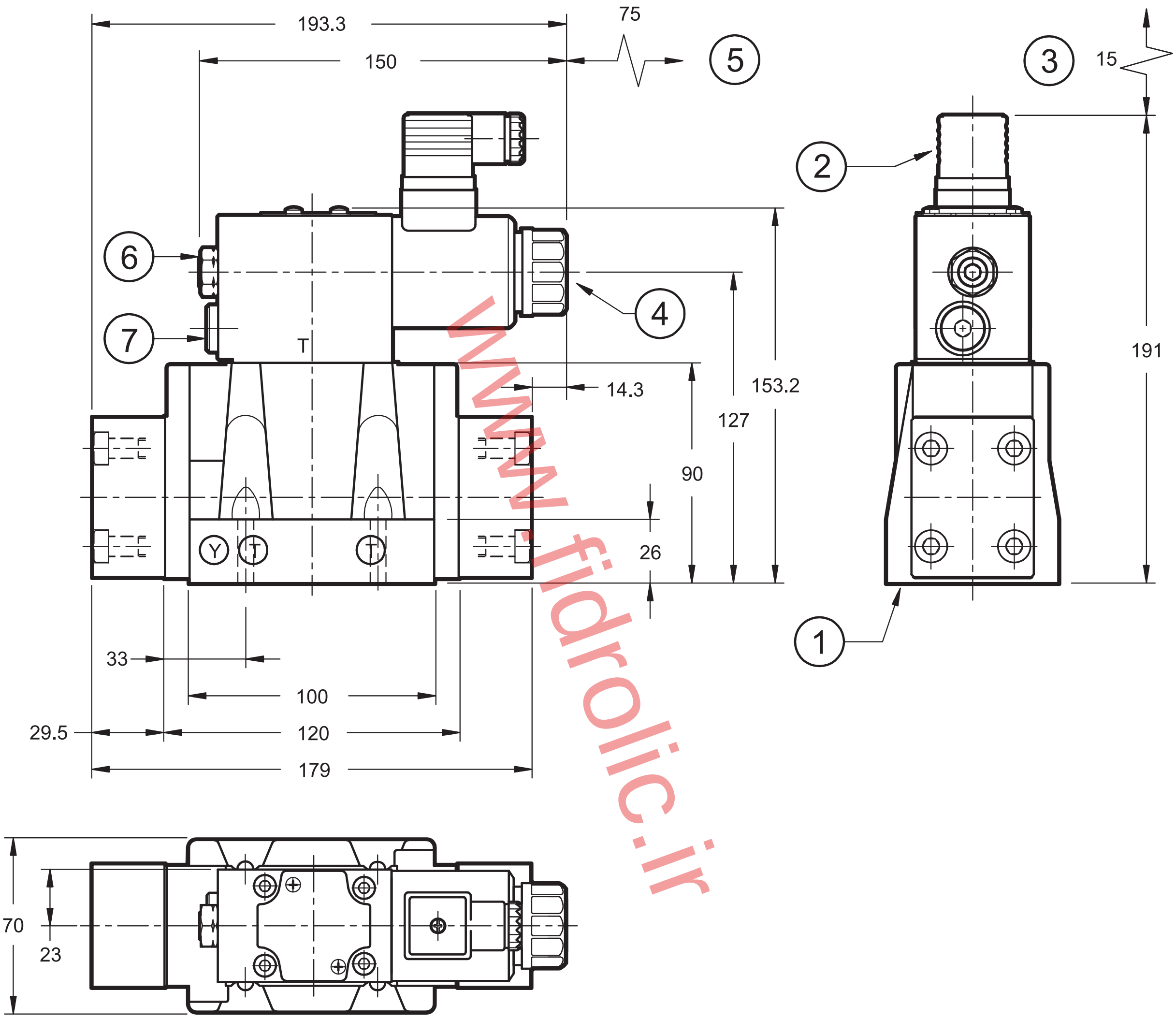
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

surface finishing



8 - DZCE5 and DZCE5R OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



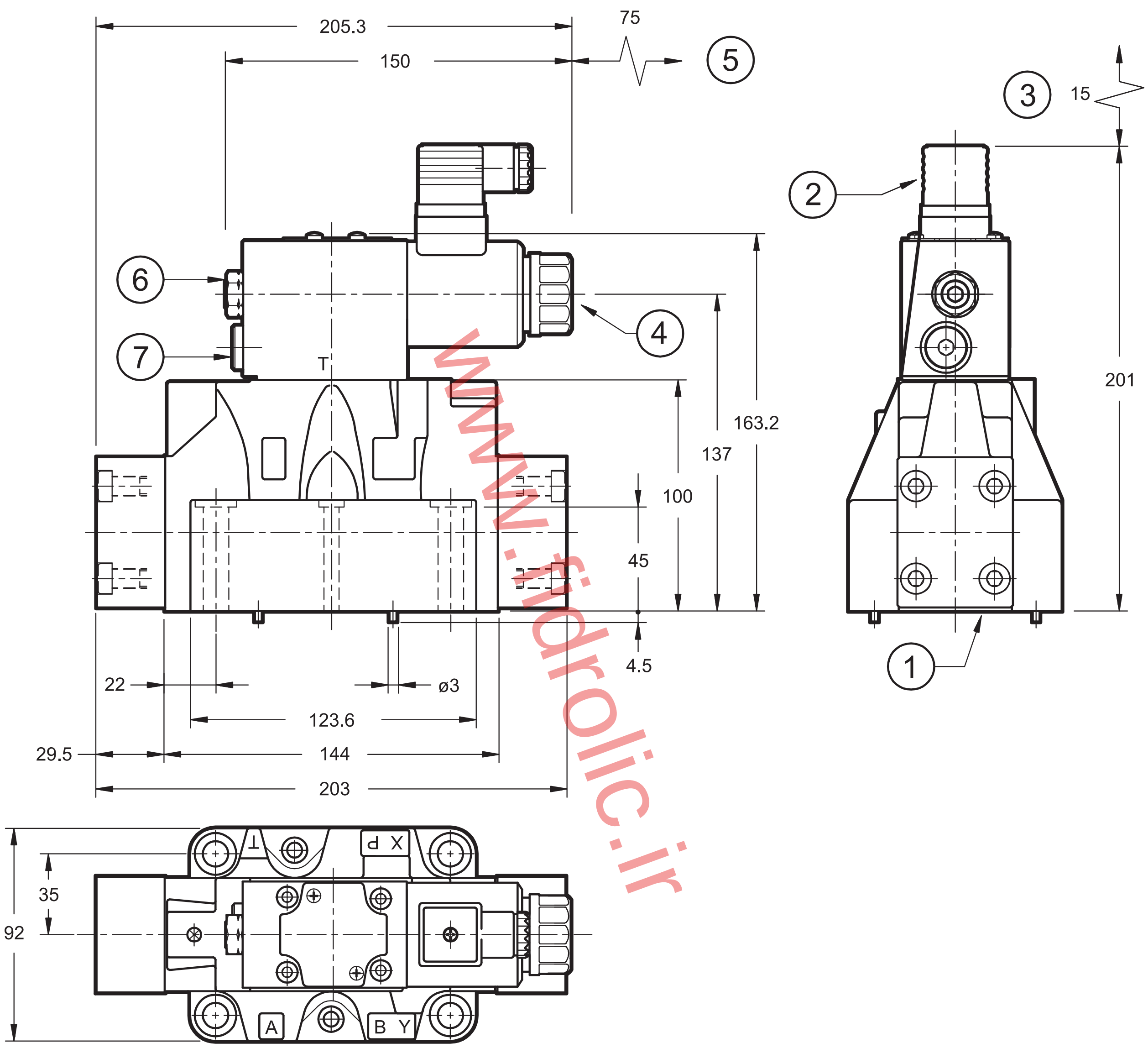
NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

Valve fastening: N. 4 bolts SHC M6x35 - ISO 4762
Tightening torque: 8 Nm (A 8.8 bolts)
Thread of mounting holes: M6x10
Sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore N. 2 OR type 2037 (9.25x1.78) - 90 Shore

1	Mounting surface with sealing rings
2	DIN 43650 electrical connector (included in the supply)
3	Connector removal space
4	Breather (Allen key 4)
5	Coil removal space
6	Adjustment sealing made in factory. Do not unscrew the nut.
7	Pressure gauge port 1/4” BSP

9 - DZCE7 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



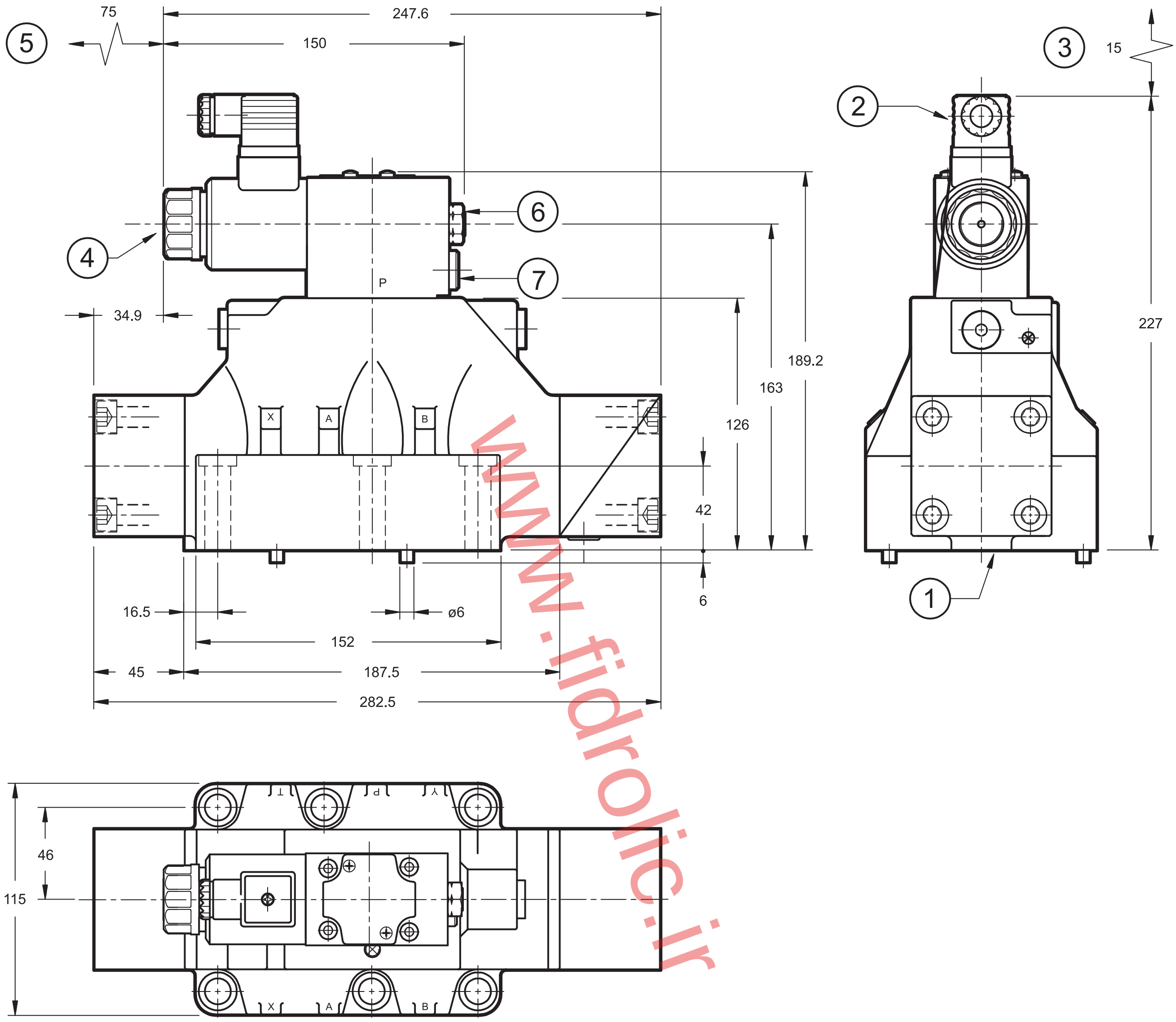
NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

Single valve fastening:	N. 4 SHC M10x60 bolts - ISO 4762 N. 2 SHC M6x60 bolts - ISO 4762
Tightening torque M10x60: 40 Nm (A 8.8 bolts) M6x60: 8 Nm (A 8.8 bolts)	
Thread of mounting holes: M6x18; M10x18	
Sealing rings:	N. 4 OR type 130 (22.22x2.62) - 90 Shore N. 2 OR type 2043 (10.82x1.78) - 90 Shore

1	Mounting surface with sealing rings
2	DIN 43650 electrical connector (included in the supply)
3	Connector removal space
4	Breather (Allen key 4)
5	Coil removal space
6	Adjustment sealing made in factory. Do not unscrew the nut.
7	Pressure gauge port 1/4” BSP

10 - DZCE8 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



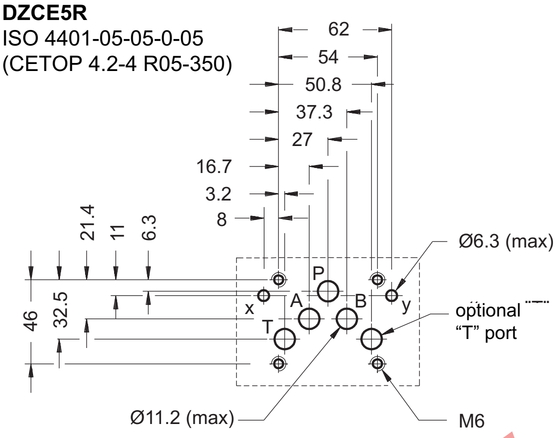
NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

Valve fastening: N. 6 SHC M12x60 screws - ISO 4762
Tightening torque: 69 Nm (A 8.8 bolts)
Thread of mounting holes: M12x20
Sealing rings: N. 4 OR type 3118 (29.82x2.62) - 90 Shore N. 2 OR type 3081 (20.24x2.62) - 90 Shore

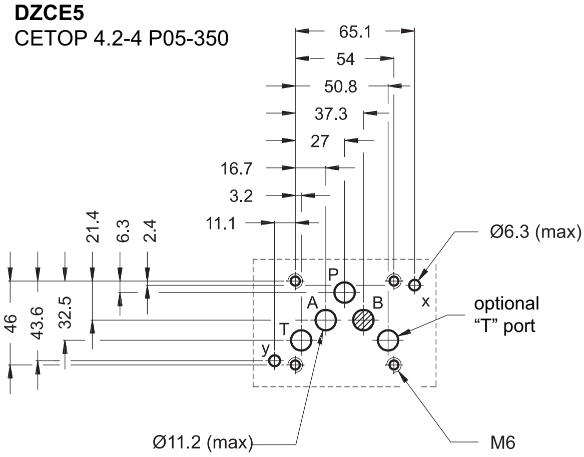
1	Mounting surface with sealing rings
2	DIN 43650 electrical connector (included in the supply)
3	Connector removal space
4	Breather (Allen key 4)
5	Coil removal space
6	Adjustment sealing made in factory. Do not unscrew the nut.
7	Pressure gauge port 1/4” BSP

11 - MOUNTING SURFACES

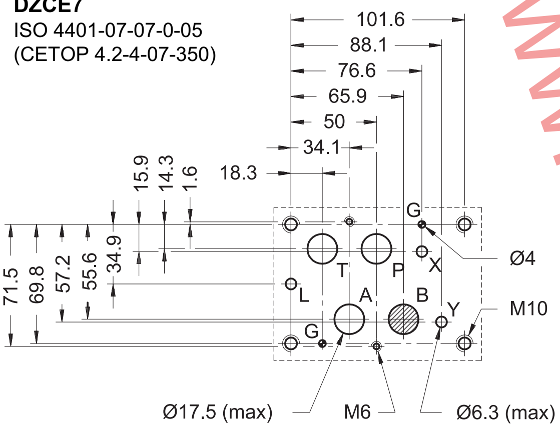
DZCE5R
ISO 4401-05-05-0-05
(CETOP 4.2-4 R05-350)



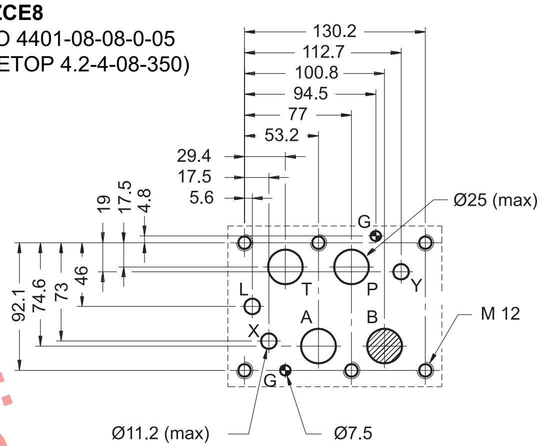
DZCE5
CETOP 4.2-4 P05-350



DZCE7
ISO 4401-07-07-0-05
(CETOP 4.2-4-07-350)



DZCE8
ISO 4401-08-08-0-05
(CETOP 4.2-4-08-350)



12 - ELECTRONIC CONTROL UNITS

EDC-112	for solenoid 24V DC	plug version	see cat.89 120
EDC-142	for solenoid 12V DC		
EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		
UEIK-11	for solenoid 24V DC	Eurocard type	see cat. 89 300

13 - SUBPLATES (see catalogue 51 000)

	DZCE5	DZCE7	DZCE8
Model with rear ports	PME4-AI5G	PME07-AI6G	-
Model with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G
Thread of ports: P - T - A - B X - Y	3/4" BSP 1/4" BSP	1½" BSP 1/4" BSP	1" BSP 1/4" BSP

DUPLOMATIC OLEODINAMICA

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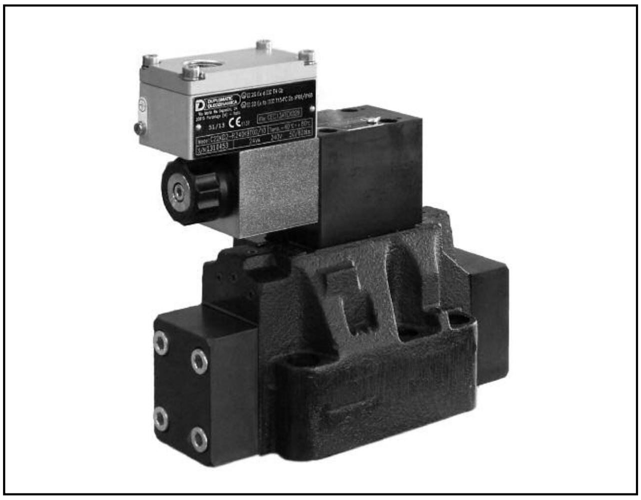
DZCE*K*

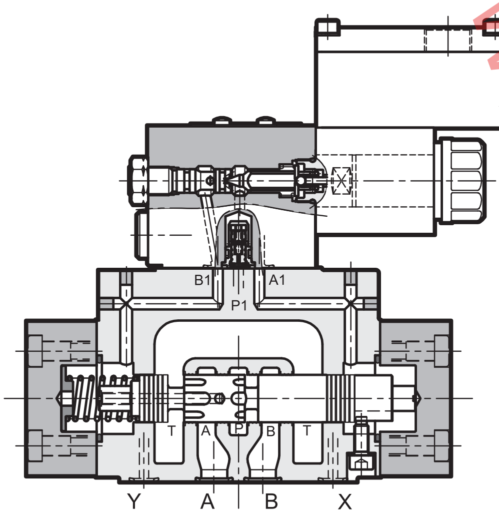
EXPLOSION-PROOF PRESSURE REDUCING VALVE WITH PROPORTIONAL CONTROL ATEX, IECEx, INMETRO

SERIES 11



DZCE5K*	CETOP P05
DZCE5RK*	ISO 4401-05
DZCE7K*	ISO 4401-07
DZCE8K*	ISO 4401-08

OPERATING PRINCIPLE



— The DZCE*K* are explosion-proof pressure reducing valves, pilot operated, with proportional control, available with CETOP P05, ISO 4401-05, ISO 4401-07 and ISO 4401-08 mounting surfaces.

— They are compliant with ATEX, IECEx and INMETRO requirements and are suitable for use in potentially explosive atmospheres, for surface plants or mines.

— A low temperature version (up to -40 °C) is also available.

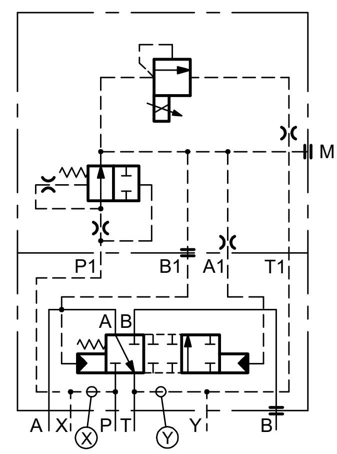
— They can be controlled directly by a current control supply unit or by means of an electronic card to exploit valve performance to the full (see par. 14).

— Upon request, DZCE*K* valves can be supplied with a finishing surface treatment (zinc-nickel) which is suitable to ensure a salt spray resistance up to 600 hours.

— **Details for classification, operating temperatures and electrical characteristics are in the technical data sheet 02 500 'Explosion proof classification'.**

PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C)		DZCE5K* DZCE5RK*	DZCE7K*	DZCE8K*
Maximum operating pressure	bar	350		
Maximum flow	l/min	150	300	500
Step response		see paragraph 4		
Hysteresis (with PWM 200 Hz)	% of p_{max}	< 4%		
Repeatability	% of p_{max}	< ±2%		
Electrical characteristic		see paragraph 7		
Temperature ranges (ambient and fluid)		see data sheet 02 500		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13			
Recommended viscosity	cSt	25		
Mass	kg	7,3	9,5	15,6

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

D	Z	C	E			-		/	11		-			/		K9			

Pressure reducing valve

Electric proportional control

Nominal size:
5 = CETOP P05
5R = ISO 4401-05
7 = ISO 4401-07
8 = ISO 4401-08

Explosion-proof certification:
See table 1.1

Pressure control range
070 = 1 ÷ 70 bar
140 = 1 ÷ 140 bar
210 = 1 ÷ 210 bar
300 = 1 ÷ 300 bar

Series N. (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
For temperature range -20 / +80 °C
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids
For temperature range -40 / +80 °C
NL = seal for low temperatures (for mineral oil)

Piloting: **I** = internal
E = external

Drainage: **I** = internal
E = external

Nominal solenoid voltage:
D12 = 12V DC
D24 = 24V DC

Coil electrical connection:
by terminal block

Connection type for cable gland
upper connection:
T01 = M20x1.5 - ISO 261
T02 = Gk 1/2 - UNI EN 10226-2
not available for INMETRO
T03 = 1/2" NPT - ANSI B1.20.1
(ex ANSI B2.1)
side connection:
S01 = M20x1.5 - ISO 261
S02 = Gk 1/2 - UNI EN 10226-2
not available for INMETRO
S03 = 1/2" NPT - ANSI B1.20.1
(ex ANSI B2.1)
S04 = M16x1.5 - ISO 261

Option: **/T5**
version in T5 temperature class.
Omit if not required.

Option: surface treatment not standard.
Omit if not required
(see **NOTE)**

NOTE: the valves are supplied with standard surface treatment of phosphating black.

Upon request we can supply these valves with full zinc-nickel surface treatment, suitable to ensure a salt spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standard).

For zinc-nickel surface treatment add **/W7** at the end of the identification code.

1.1 - Names of valves per certification

	ATEX		IECEx		INMETRO	
for gases for dusts	**KD2**	II 2GD	**KXD2**	IECEx Gb IECEx Db	**KBD2**	INMETRO Gb INMETRO Db
for mines	**KDM2**	I M2	**KXDM2**	IECEx Mb	**KBDM2**	INMETRO Mb

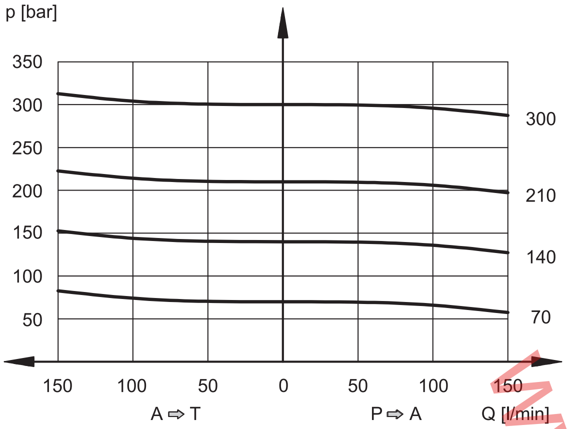
NOTE: Refer to the technical data sheet 02 500 for marking, operating temperatures and available versions.

2 - CHARACTERISTIC CURVES

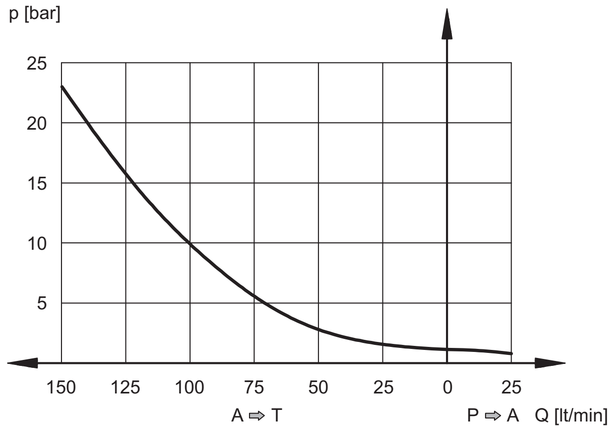
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

2.1 - Characteristic curves DZCE5K* and DZCE5RK*

ADJUSTMENT

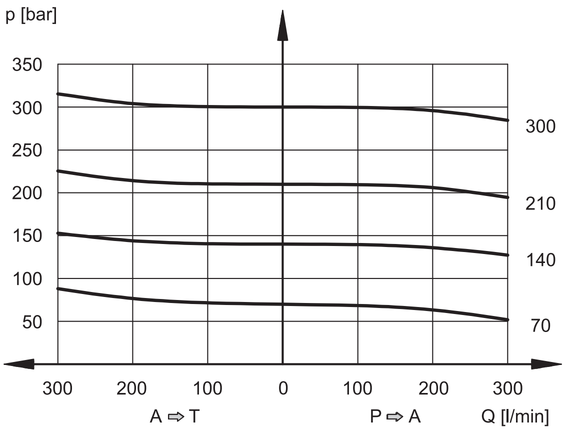


MIN. CONTROLLED PRESSURE p min = f(Q)

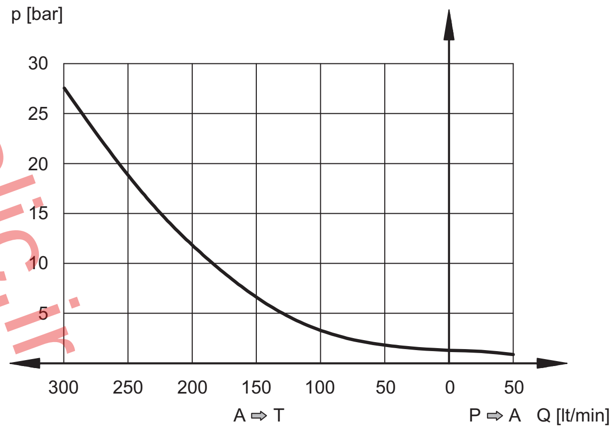


2.2 - Characteristic curves DZCE7K*

ADJUSTMENT

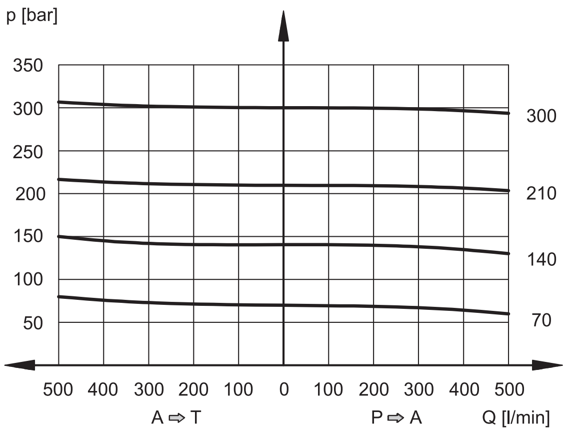


MIN. CONTROLLED PRESSURE p min = f(Q)

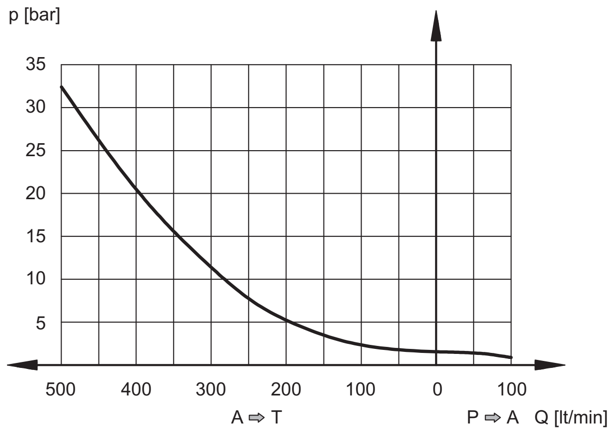


2.3 - Characteristic curves DZCE8K*

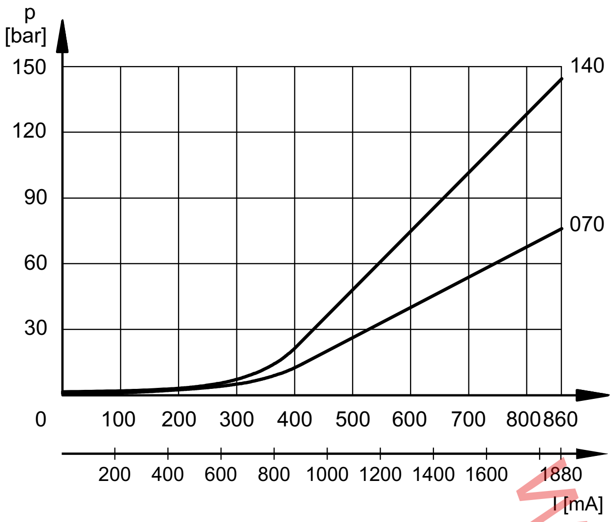
ADJUSTMENT

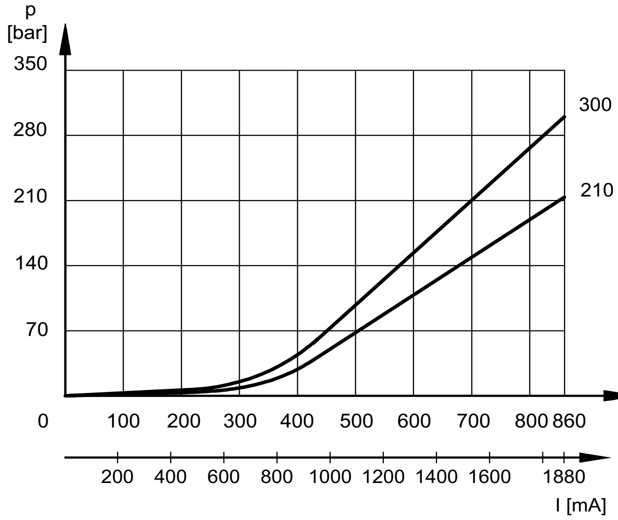


MIN. CONTROLLED PRESSURE p min = f(Q)



2.4 - Pressure control p = f(I) DZCE5K*, DZCE5RK*, DZCE7K* and DZCE8K*





3 - STEP RESPONSE

(measured with mineral oil with viscosity of 36 cSt at 50°C)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

REFERENCE SIGNAL STEP	0 →100%	100→0%
Response times [ms]		
DZCE5K* and DZCE5RK*	100	70
DZCE7K*	100	50
DZCE8K*	100	50

4 - ELECTRICAL CHARACTERISTICS

(values ± 5%)

NOMINAL VOLTAGE	V DC	**12**	**24**
RESISTANCE (AT 20°C)	Ω	3,4	15,6
NOMINAL CURRENT	A	1,88	0,86

DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2014/30/EU
CLASS OF PROTECTION: Atmospheric agents Coil insulation (VDE 0580)	 IP66 / IP68 class H

4.1 - Wiring

In order to realise the electrical connection of the coil, it is necessary to access the terminal block (1) unscrewing the 4 screws (2) that fasten the cover (3) with the box (4) that contains the terminal block.

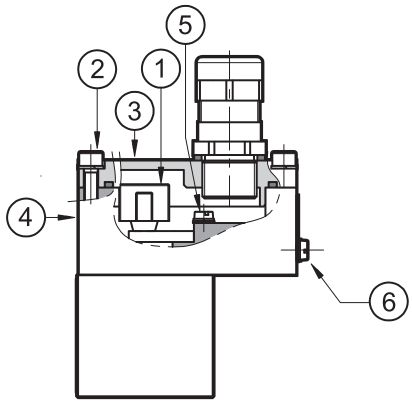
The electrical connection is polarity-independent.

By doing electrical connection it is important to connect also the grounding point (5) in the terminal block box (M4 screws), through suitable conductors with the general grounding line of the system.

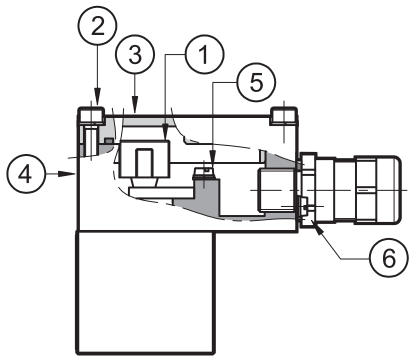
On the external body of the coil there is a grounding point (6) (M4 screw) that allow to ensure equipotentiality between the valve and the general grounding line of the system; connecting this point the regulation of the EN 13463-1 standard, that impose to verify the equipotentiality of the elements included in a potentially explosive environment (the maximum resistance between the elements must be 100 Ω), is guaranteed.

At the end of the electrical wiring, it is necessary to reassemble the cover (3) on the box (4), checking the correct positioning of the seal located in the cover seat and fastening the 4 M5 screws with a torque of 4.9÷6 Nm.

Electrical wiring must be done following in compliance with standards about protection against explosion hazards.



K9T*



K9S*

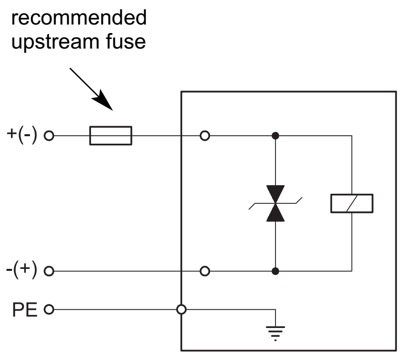
Characteristics of the cables connectable for wiring are indicated in the table below:

Function	Cable section
Operating voltage cables connection	max 2.5 mm²
Connection for internal grounding point	max 2.5 mm²
Connection for external equipotential grounding point	max 6 mm²

Cables for wiring must be non-armoured cables, with external covering sheath and must be suitable for use in environments with temperatures from - 20 °C to +110 °C (for valves either with N or V seals) or from - 40 °C to +110 °C (for valves with NL seals).

Cable glands (which must be ordered separately, see paragraph 14) allow to use cables with external diameter between 8 and 10 mm.

4.2 - Electrical diagram



4.3 - Overcurrent fuse and switch-off voltage peak

Upstream of each valve, an appropriate fuse (max 3 x In according to IEC 60127) or a protective motor switch with short-circuit and thermal instantaneous tripping, as short-circuit protection, must be connected. The cut-off power of the fuse must correspond or exceed the short circuit current of the supply source. The fuse or the protective motor must be placed outside the dangerous area or they must be protected with an explosion-proof covering.

In order to safeguard the electronic device to which the valve is connected, there is a protection circuit in the coil, that reduces voltage peaks, which can occur when inductances are switched off.

The table shows the type of fuse recommended according to the nominal voltage of the valve and to the value of the voltage peaks reduction.

Coil type	Nominal voltage [V]	Rated current [A]	**Recommended pre-fuse characteristics medium time-lag according to DIN 41571 [A]**	Maximum voltage value upon switch off [V]	Suppressor circuit
D12	12	1,88	2,5	- 49	Transient voltage suppressor bidirectional
D24	24	0,86	1,25	- 49	

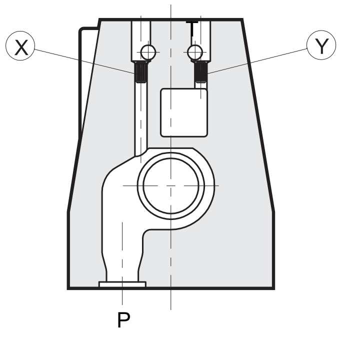
5 - PILOT AND DRAIN

The DZCE*K* valves are available with piloting and drainage, both internal and external.
We suggest to use the version with external drainage that allows a higher backpressure on the unloading.

TYPE OF VALVE		Plug assembly X	Plug assembly Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

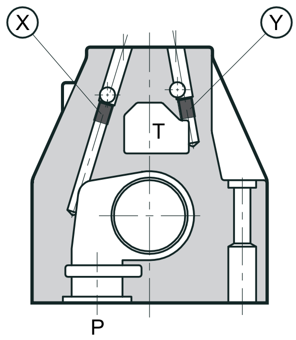
PRESSURES [bar]	MIN	MAX
Piloting pressure on X port	30	350
Pressure in T port with internal drain	-	2
Pressure in T port with external drain	-	250

DZCE5K* and DZCE5RK*



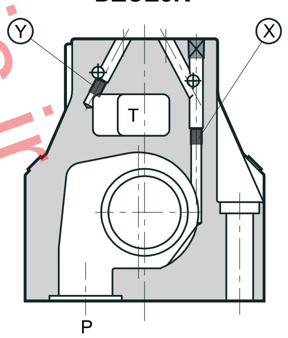
X: M5x6 plug for external pilot
Y: M5x6 plug for external drain

DZCE7K*



X: M6x8 plug for external pilot
Y: M6x8 plug for external drain

DZCE8K*

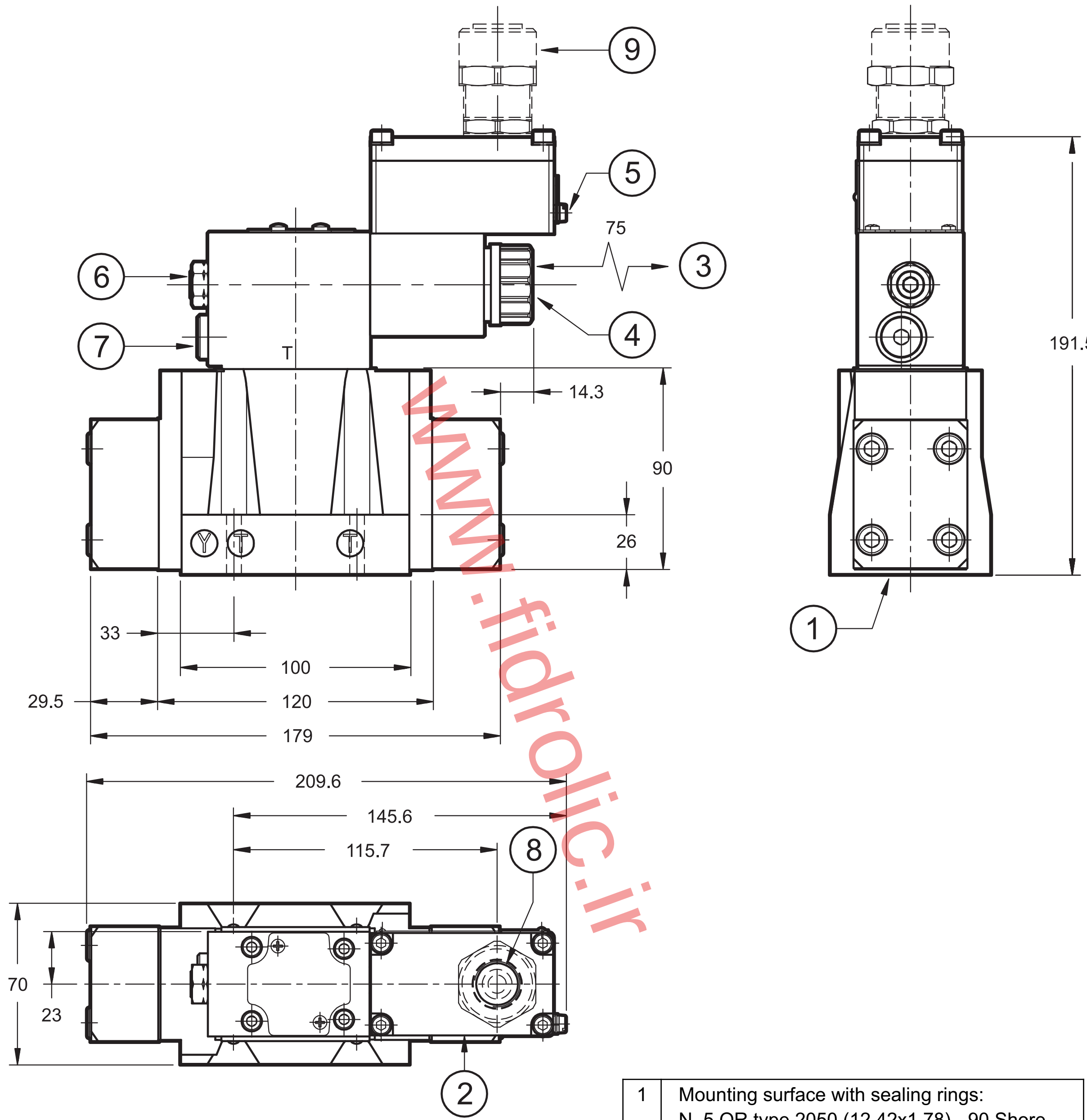


X: M6x8 plug for external pilot
Y: M6x8 plug for external drain

6 - DZCE5K* AND DZCE5RK* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

DZCE5K*-*/11*-*/*K9T*
DZCE5RK*-*/11*-*/*K9T*



1	Mounting surface with sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore N. 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Breather (Allen key 4)
5	Terminal for supplementary earth (GND) connection
6	Adjustment sealing made in factory. Do not unscrew the nut.
7	Pressure gauge port 1/4” BSP
8	Upper port for cable gland
9	Cable gland. To be ordered separately, see paragraph 13

NOTE 1: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

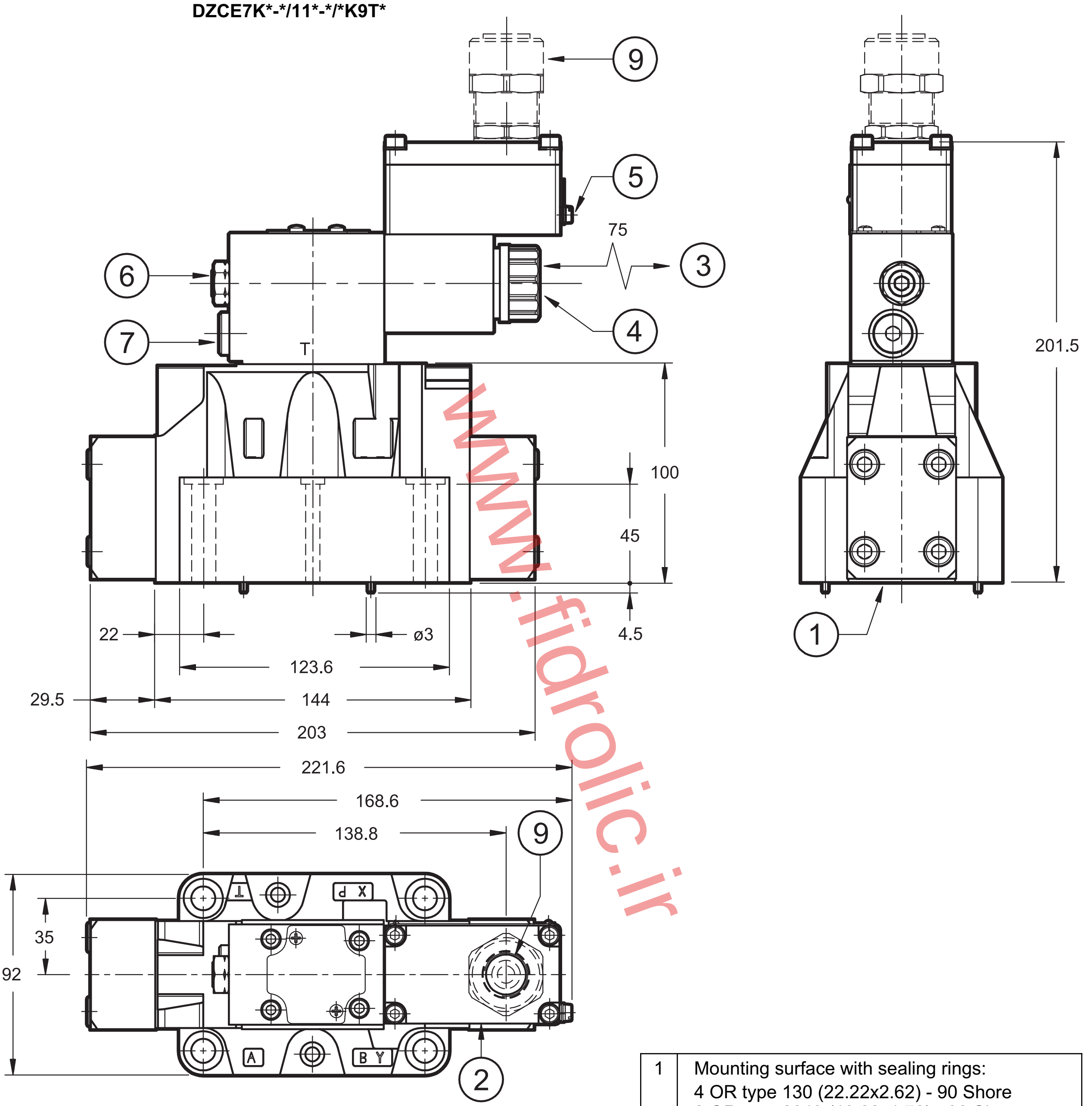
NOTE 2: for side port cable gland see paragraph 9.

Valve fastening: N. 4 SHC screws M6x35 - ISO 4762
Tightening torque: 8 Nm (A 8.8 screws)
Thread of mounting holes: M6x10

7 - DZCE7K* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

DZCE7K*-*/11*-*/*K9T*



NOTE 1: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

NOTE 2: for side port cable gland see paragraph 9.

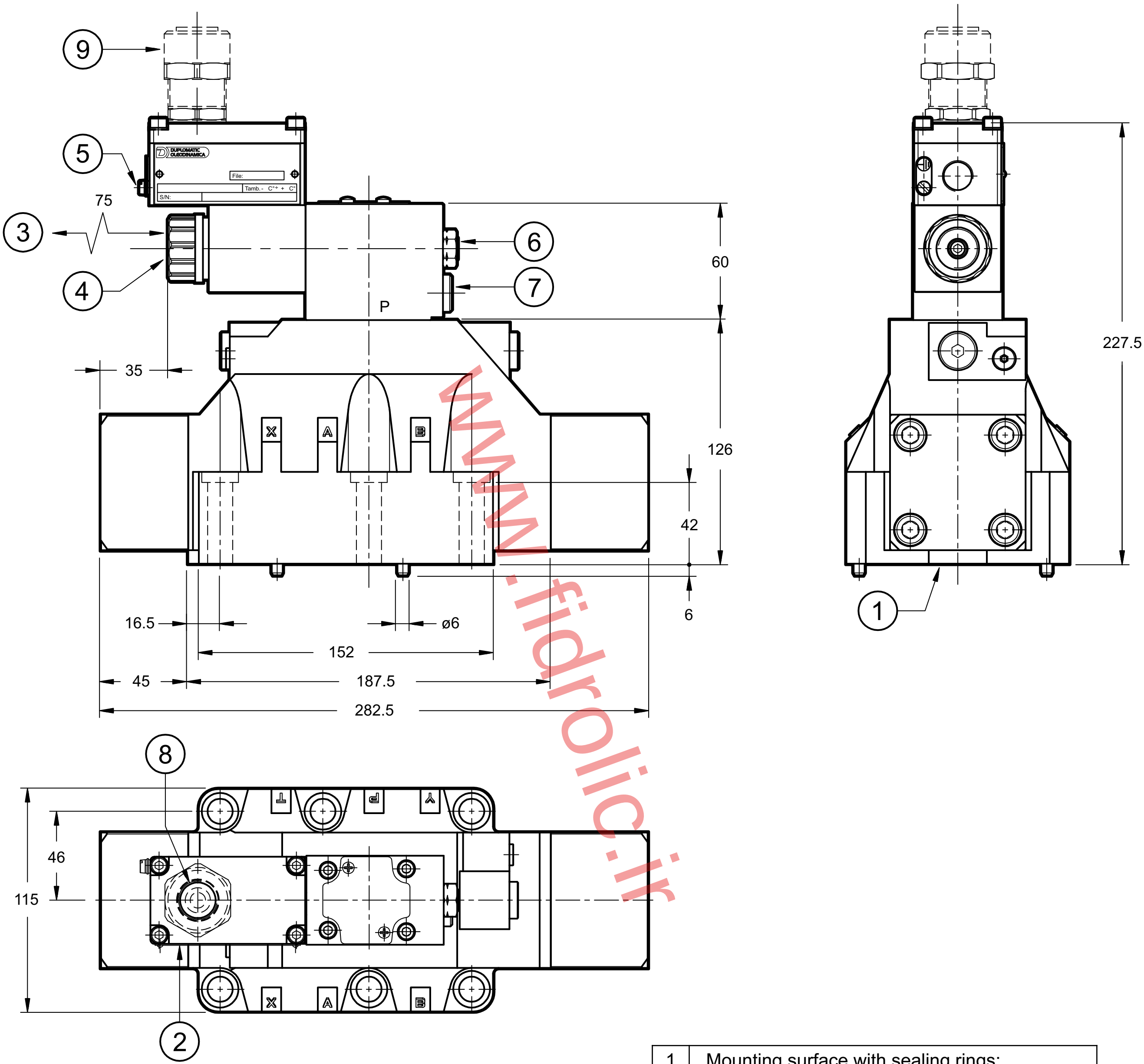
Single valve fastening:	N. 4 SHC screws M10x60 - ISO 4762 N. 2 SHC screws M6x60 - ISO 4762
Tightening torque	M10x60: 40 Nm (A 8.8 screws) M6x60: 8 Nm (A 8.8 screws)
Thread of mounting holes: M6x18; M10x18	

1	Mounting surface with sealing rings: 4 OR type 130 (22.22x2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Breather (Allen key 4)
5	Terminal for supplementary earth (GND) connection
6	Adjustment sealing made in factory. Do not unscrew the nut.
7	Pressure gauge port 1/4” BSP
8	Upper port for cable gland
9	Cable gland. To be ordered separately, see paragraph 13

8 - DZCE8K* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

DZCE8K*-*/11*-*/*K9T*



1	Mounting surface with sealing rings: 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Breather (Allen key 4)
5	Terminal for supplementary earth (GND) connection
6	Adjustment sealing made in factory. Do not unscrew the nut.
7	Pressure gauge port 1/4" BSP
8	Upper port for cable gland
9	Cable gland. To be ordered separately, see paragraph 13

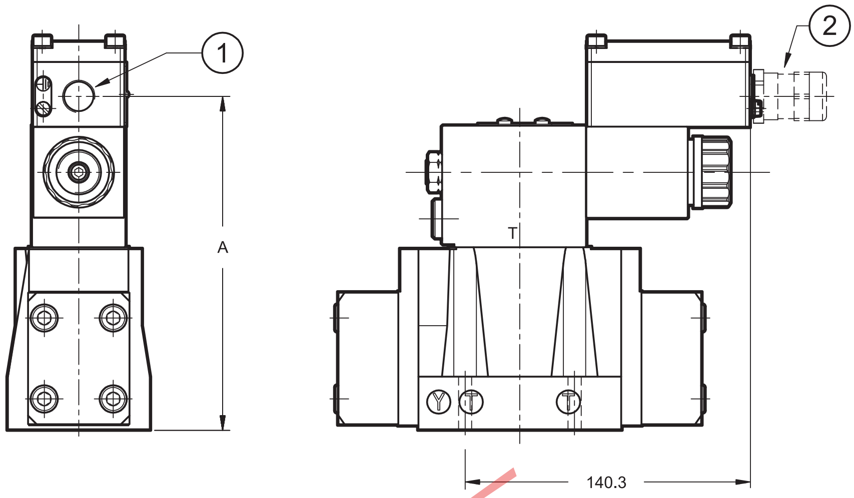
NOTE 1: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (4) placed at the end of the solenoid tube.

NOTE 2: for side port cable gland see paragraph 9.

Valve fastening: N. 6 SHC screws M12x60 - ISO 4762
Tightening torque: 69 Nm (A 8.8 screws)
Thread of mounting holes: M12x20

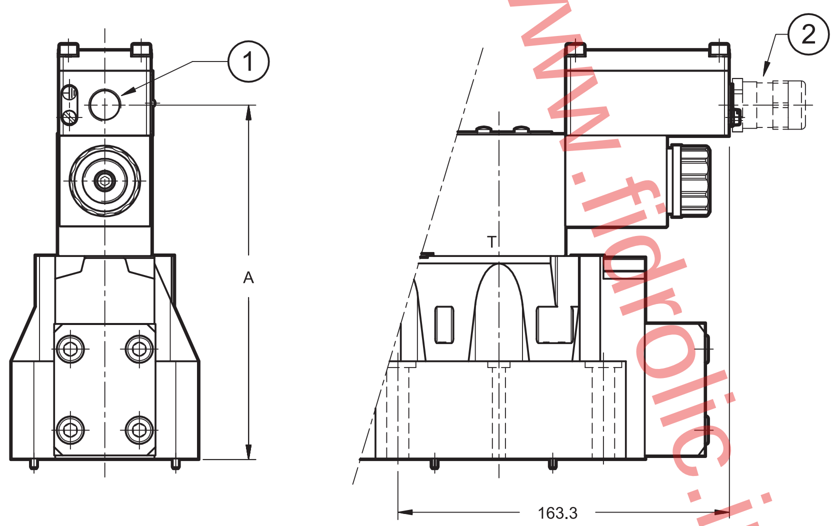
9 - DZCE*K* WITH SIDE CONNECTION OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



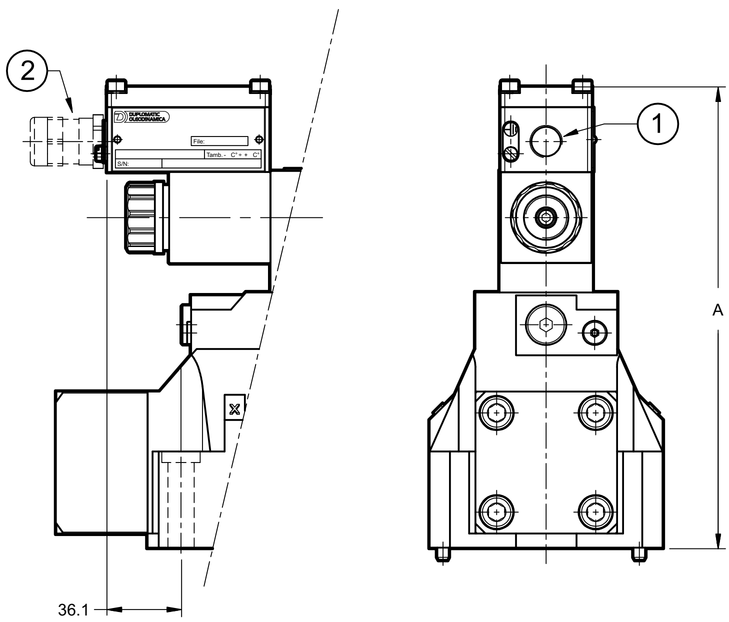
DZCE5K*-*/11*-*/*K9S*
DZCE5RK*-*/11*-*/*K9S*

Side port type	Dimension A
S01, S04	180.5
S02, S03	180



DZCE7K*-*/11*-*/*K9S*

Side port type	Dimension A
S01, S04	190.5
S02, S03	190



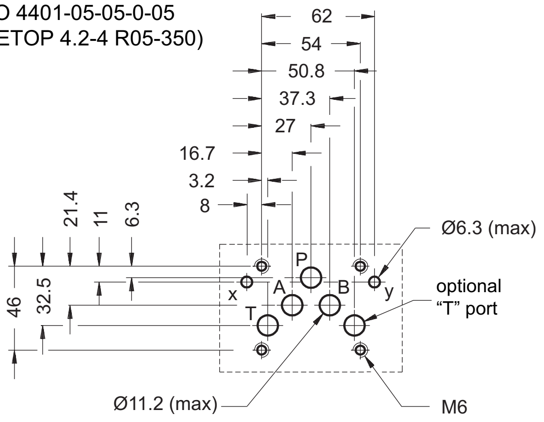
DZCE8K*-*/11*-*/*K9S*

Side port type	Dimension A
S01, S04	226.5
S02, S03	226

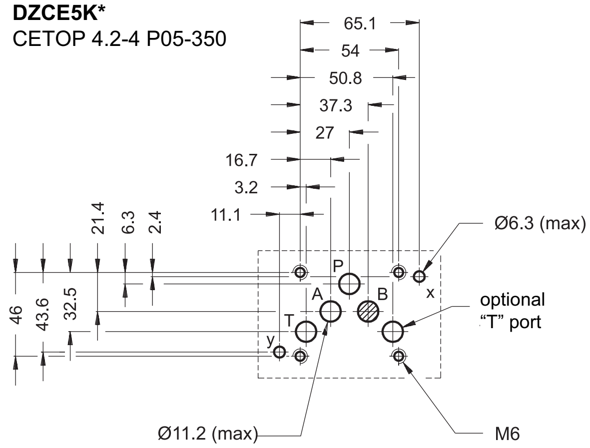
1	Side port for cable gland
2	Cable gland. To be ordered separately, see par. 13

10 - MOUNTING SURFACES

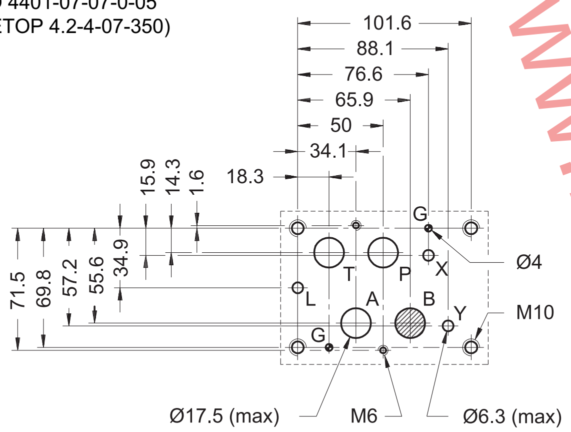
DZCE5RK*
ISO 4401-05-05-0-05
(CETOP 4.2-4 R05-350)



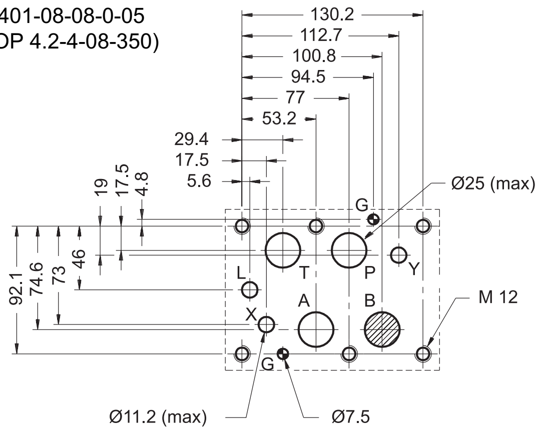
DZCE5K*
CETOP 4.2-4 P05-350



DZCE7K*
ISO 4401-07-07-0-05
(CETOP 4.2-4-07-350)



DZCE8K*
ISO 4401-08-08-0-05
(CETOP 4.2-4-08-350)



11 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

12 - INSTALLATION

Installation must adheres to instructions reported in the Use and Maintenance manual, always attached to the valve. Unauthorized interventions can be harmful to people and goods because of the explosion hazards present in potentially explosive atmospheres.

We recommend to install the DZCE*K* valve either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 2.

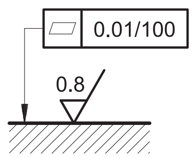
Ensure that there is no air in the hydraulic circuit. In particulars applications,it can be necessary to vent the air entrapped in the solenoid tube, using the special drain screw and then ensure to screwed it correctly.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.

Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

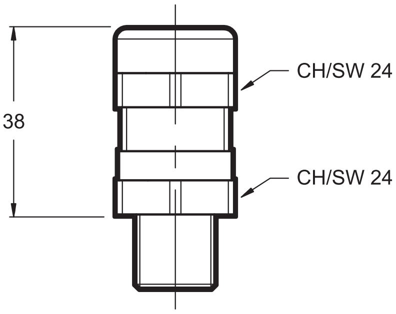
Surface finishing



13 - CABLE GLANDS

Cable glands must be ordered separately; Duplomatic offers some types of cable glands with the following features:

- version for non-armoured cable, external seal on the cable (suitable for Ø 8 ÷ 10 mm cables);
- certified for ATEX II 2GD, ATEX I M2; IECEx Gb, IECEx Db and IECEx Mb
- cable gland material: nickel brass
- rubber tip material: silicone
- ambient temperature range: -70°C ÷ +220°C
- protection degree: IP66/IP68
- tightening torque : 15 Nm



To order, list the description and the code of the version chosen from among those listed below:

Description: CGK2/NB-01/10

Code: 3908108001

M20x1.5 - ISO 261 male thread, suitable for coils with T01 and S01 connections. It is supplied equipped with silicone seal, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Description: CGK2/NB-02/10

Code: 3908108002

Gk 1/2 - UNI EN 10226-2 male thread, suitable for coils with T02 and S02 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Description: CGK2/NB-03/10

Code: 3908108003

1/2” NPT - ANSI B1.20.1 (ex ANSI B2.1), suitable for coils with T03 and S03 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Description: CGK2/NB-04/10

Code: 3908108004

M16x1.5 - ISO 261 male thread, suitable for coils with S04 connection. It is supplied equipped with silicone seal, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

14 - ELECTRONIC CONTROL UNITS

EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		

NOTE: electronic control units offered are not explosion-proof certified; therefore, they must be installed outside classified areas.

15 - SUBPLATES

(see catalogue 51 000)

		DZCE5K*	**DZCE7K***	**DZCE8K***
Type with rear ports		PME4-AI5G	PME07-AI6G	-
Type with side ports		PME4-AL5G	PME07-AL6G	PME5-AL8G
Thread of ports:	P - T - A - B X - Y	3/4” BSP 1/4” BSP	1½” BSP 1/4” BSP	1” BSP 1/4” BSP

NOTE: Subplates (to be ordered separately) do not contain neither aluminium nor magnesium at a higher rate than the value allowed by norms according to ATEX directive for categories II 2GD and I M2.

The user must take care and makes a complete assessment of the ignition risk that can occur from the use in potentially explosive environments.

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EXPLOSION-PROOF CLASSIFICATION for

SOLENOID AND PROPORTIONAL VALVES

ref. catalogues:

pressure valves

RQM*K*-P	21 515
PRE(D)*K*	81 315
ZDE3K*	81 515
DZCE*K*	81 605

directional valves

D*K*	41 515
DS(P)E*K*	83 510

GENERAL INFO

This informative technical datasheet displays information about **classification and marking** of Duplomatic explosion-proof valves range.

Duplomatic offers valves with the following certifications:

ATEX	**II 2G**	**II 2D**	**I M2**
IECEx	**Gb**	**Db**	**Mb**
INMETRO	**Gb**	**Db**	**Mb**

Instructions for use and maintenance can be found in the related manuals, always toghether with valves.

1 - ATEX CLASSIFICATION AND TEMPERATURES

Duplomatic certificates the combination valve-coil for the valves suitable for application and installation in potentially explosive atmospheres, according to ATEX directive; the supply always includes the declaration of conformity to the directive and the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environments.

Coils assembled on these valves have been separately certified according to ATEX directive and so they are suitable for use in potentially explosive atmospheres.

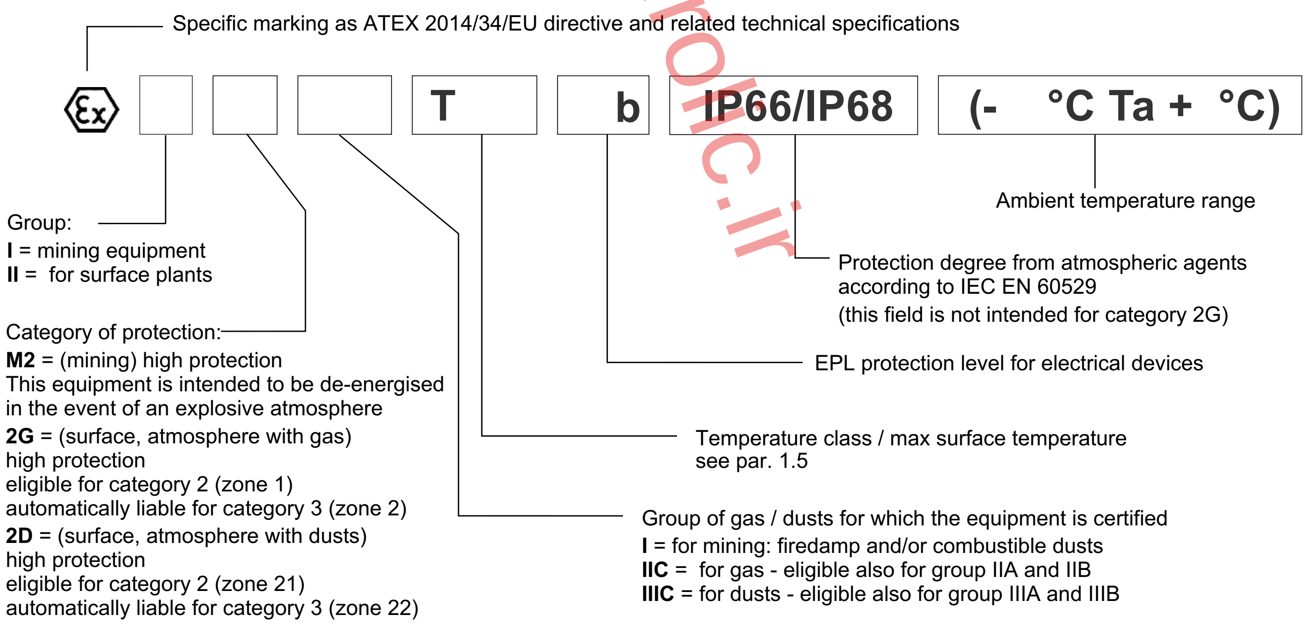
1.1 - ATEX classification for valves

Type examination certificate: CEC 13 ATEX 030-REV.2
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

ATEX II 2G ATEX II 2D	***KD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
ATEX I M2	***KDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

1.2 - ATEX marking for valves

valve code		N and V seals	NL seals
***KD2**	for gas	Ex II 2G IIC T4 Gb (-20°C Ta +80°C)	Ex II 2G IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex II 2D IIIC T154°C Db IP66/IP68 (-20°C Ta +80°C)	Ex II 2D IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
***KD2 /T5**	for gas	Ex II 2G IIC T5 Gb (-20°C Ta +55°C)	Ex II 2G IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex II 2D IIIC T129°C Db IP66/IP68 (-20°C Ta +55°C)	Ex II 2D IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
***KDM2**	mining	Ex I M2 I T150°C Mb IP66/68 (-20°C Ta +75°C)	Ex I M2 I T150°C Mb IP66/68 (-40°C Ta +75°C)



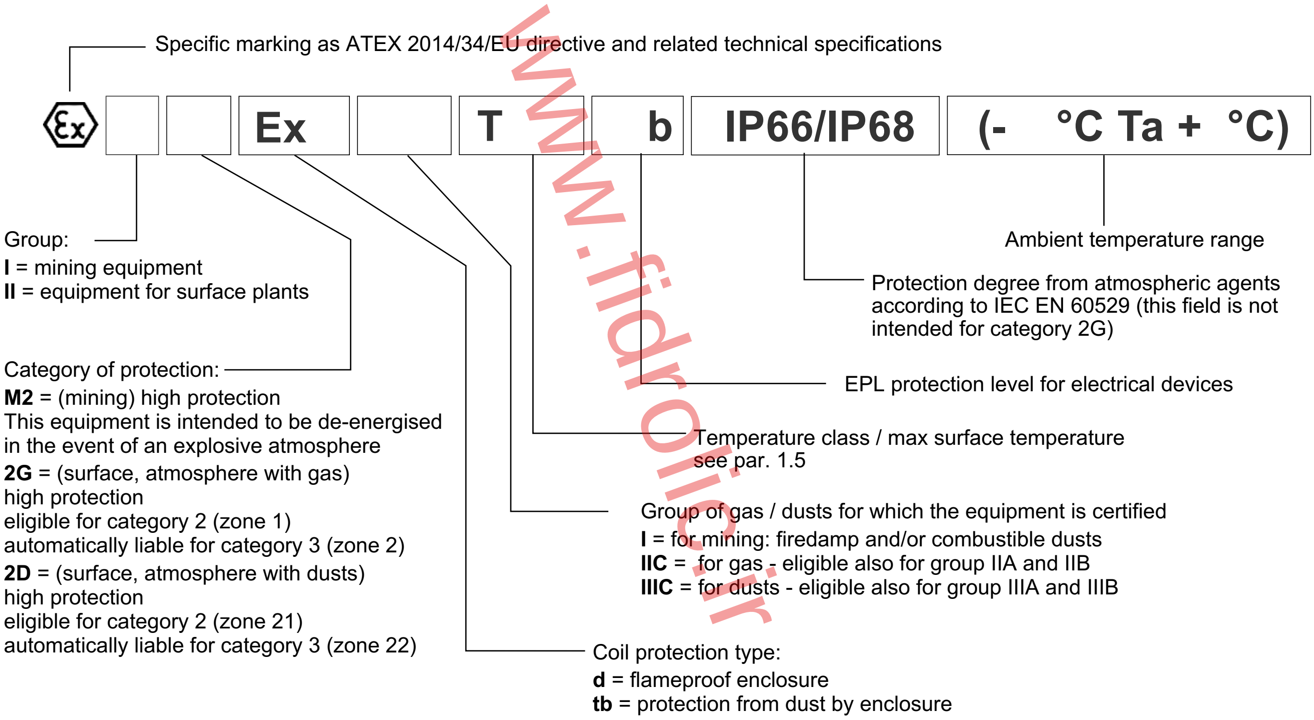
1.3 - ATEX classification of the coils

The coil of the explosion-proof valves is ATEX certified itself an as such is identified with its own tag, carries the relative ATEX marking. **The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex d” type protection (explosion-proof coil).**

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

1.4 - ATEX marking on coils

for valve type ***KD2**	for gas	II 2G Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	II 2D Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
for valve type ***KD2 /T5**	for gas	II 2G Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	II 2D Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
for valve type ***KDM2**	mining	I M2 Ex d I T150°C Mb IP66/IP68 (-40°C Ta +75°C)



1.5 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

The valves in group II can also be used for less limiting temperature classes (surface temperature allowed higher).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
ATEX II 2G ATEX II 2D	***KD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T154°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T129°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
ATEX I M2	***KDM2**	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				

2 - IECEx CLASSIFICATION AND TEMPERATURES

The IECEx certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with IECEx certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex db” type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

2.1 - IECEx classification

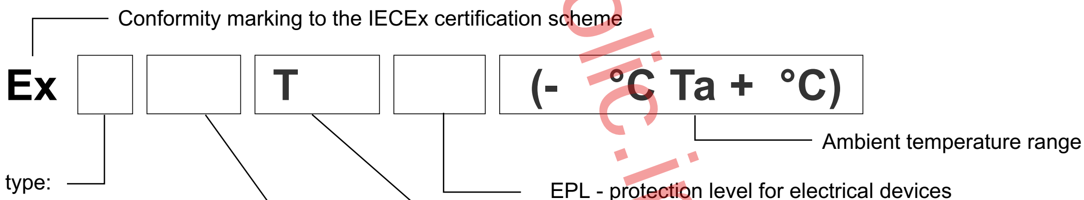
Certificate of conformity (CoC): IECEx TUN 15.0028X
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

IECEx Gb IECEx Db	***KXD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
IECEx Mb	***KXDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

2.2 - IECEx marking

There is a plate with the IECEx mark on each coil.

***KXD2** valves	for gas	Ex db IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T135°C Db (-40°C Ta +80°C)
***KXD2 /T5** valves	for gas	Ex db IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T100°C Db (-40°C Ta +55°C)
***KDM2** valves	mining	Ex db I Mb (-40°C Ta +80°C)



Protection type:
db = flameproof enclosure
tb = protection from dust by enclosure

Group of gas / dusts for which the equipment is certified
I = for mining: firedamp and/or combustible dusts
IIC = for gas - eligible also for group IIA and IIB
IIIC = for dusts - eligible also for group IIIA and IIIB

Temperature class / max surface temperature see par. 2.3

EPL - protection level for electrical devices
Mb = for mines - having a "high" level of protection, which has sufficient security that it is unlikely to become a source of ignition in normal operation or during expected malfunctions in the time span between there being an outbreak of gas and the equipment being de-energized.
Gb = for explosive gas atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions.
Db = equipment for explosive dust atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions

2.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	N and V seals	NL seals	Temperature class	eligible also for
IECEx Gb IECEx Db	***KXD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T135°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KXD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T100°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
IECEx Mb	***KXDM2**	of ambient	-20 / +80 °C	-40 / +80 °C	-	-
		of fluid				

3 - INMETRO CLASSIFICATION AND TEMPERATURES

The INMETRO certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with INMETRO certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex d” type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

3.1 - INMETRO classification

Certificate of conformity: DNV 15.0094 X
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

INMETRO Gb INMETRO Db	***KBD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
INMETRO Mb	***KBDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

3.2 - INMETRO marking

There is a plate with the INMETRO mark on each coil.

***KBD2** valves	for gas	Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
***KBD2 /T5** valves	for gas	Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
***KBDM2** valves	mining	Ex d I T150° Mb IP66/IP68 (-40°C Ta +75°C)

Conformity marking to the INMETRO certification scheme

Ambient temperature range

Ex [ ] [ ] **T** [ ] **IP66/IP68** **(- °C Ta + °C)**

Protection degree from atmospheric agents according to IEC EN 60529 (this field is not intended for gases)

Protection type:
d = flameproof enclosure
tb = protection from dust by enclosure

Group of gas / dusts for which the equipment is certified
I = for mining: firedamp and/or combustible dusts
IIC = for gas - eligible also for group IIA and IIB
IIIC = for dusts - eligible also for group IIIA and IIIB

Temperature class / max surface temperature see par. 3.3

EPL - protection level for electrical devices
Mb = for mines - having a "high" level of protection, which has sufficient security that it is unlikely to become a source of ignition in normal operation or during expected malfunctions in the time span between there being an outbreak of gas and the equipment being de-energized.
Gb = for explosive gas atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions.
Db = equipment for explosive dust atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions

3.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
INMETRO Gb INMETRO Db	***KBD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T154°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KBD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T129°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
INMETRO Mb	***KBDM2**	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				

DUPLOMATIC OLEODINAMICA

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DZCE*G

PRESSURE REDUCING VALVES WITH PROPORTIONAL CONTROL AND INTEGRAL ELECTRONICS

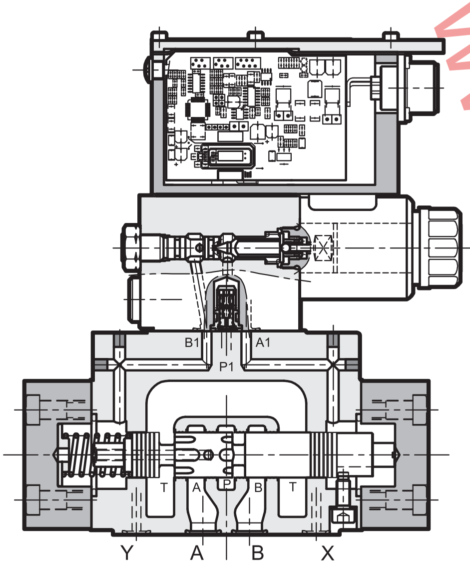
SERIES 30

DZCE5G	**CETOP P05**
DZCE5RG	**ISO 4401-05** (CETOP R05)
DZCE7G	**ISO 4401-07** (CETOP 07)
DZCE8G	**ISO 4401-08** (CETOP 08)

p max **350** bar

Q max (see performance table)

OPERATING PRINCIPLE



— The DZCE*G are pressure reducing valves with electric proportional control with integrated electronics, with mounting interface in compliance with ISO 4401 standards.

— Those valves, besides reducing the pressure from line P to working line A, allow the flow to return from the line A to the return line T when a pressure greater than the set value is generated in the downstream circuit (flow path A): a typical case of hydraulic counterweight or load balancing.

— The valves are available with command signal in voltage or current and on board electronics with internal enable, external enable or 0V monitor on pin C.

— A solenoid current monitoring signal is available.

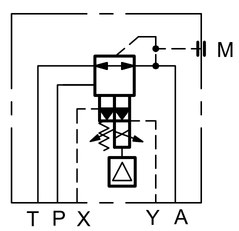
— The valves are easy to install. The driver directly manages digital settings. In the event of special applications, you can customize the settings using the optional kit (see par. 15.3)

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C p = 140 bar)

		DZCE5G DZCE5RG	DZCE7G	DZCE8G
Max operating pressure	bar	350		
Maximum flow	l/min	150	300	500
Step response		see paragraph 7		
Hysteresis	% of p_{max}	< 2%		
Repeatability	% of p_{max}	< ±2%		
Electrical characteristics		see paragraph 3		
Ambient temperature range	°C	-20 / +60		
Fluid temperature range	°C	-20 / +80		
Fluid viscosity range	cSt	10 ÷ 400		
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13			
Recommended viscosity	cSt	25		
Mass	kg	7,3	9,5	15,6

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

D	Z	C	E		G	-		/	30		-			/		K11	

Pressure reducing valve

Electric proportional control

Nominal size:
5 = CETOP P05
5R = ISO 4401-05 (CETOP R05)
7 = ISO 4401-07 (CETOP 07)
8 = ISO 4401-08 (CETOP 08)

Integrated electronics for open loop

Pressure control range:
070 = 1 ÷ 70 bar
140 = 1 ÷ 140 bar
210 = 1 ÷ 210 bar
300 = 1 ÷ 300 bar

Series No.
(the overall and mounting dimensions remain unchanged from 30 to 39)

Seals:
N = NBR seals for mineral oil (standard)
V = FPM seals for special fluids

Piloting: **I** = internal
E = external

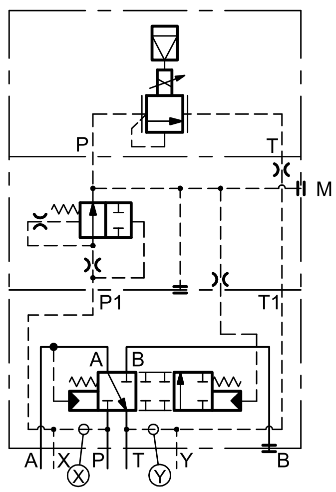
Drainage: **I** = internal
E = external

Reference signal:
E0 = voltage 0÷10 V
E1 = current 4÷20 mA

Main connector
6 pin + PE

Pin C function:
A = external enable
B = internal enable
C = 0V monitor

2 - DETAILED SYMBOL



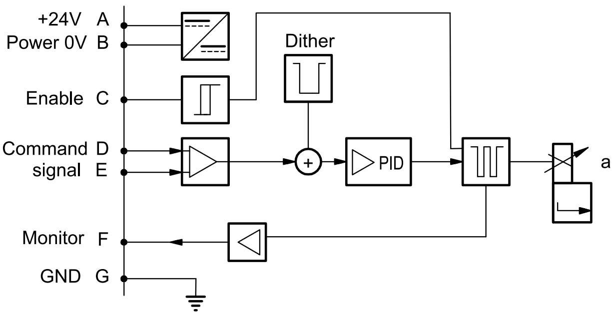
3 - ELECTRICAL CHARACTERISTICS

3.1 - Electrical on board electronics

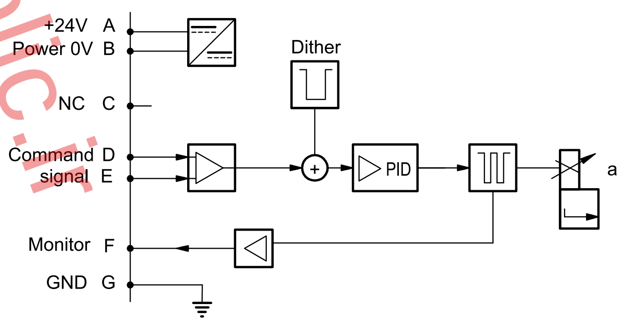
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		2A time lag
Command signals: voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (current to solenoid): voltage (E0) current (E1)	V DC mA	0 ÷ 10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2004/108/EC standards

3.2 - On-board electronics diagrams

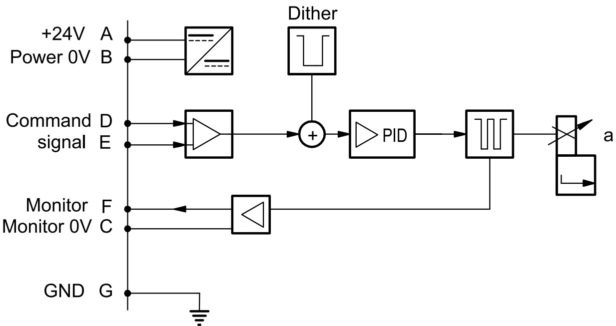
VERSION **A** - External Enable



VERSION **B** - Internal Enable

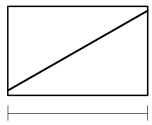


VERSION **C** - 0V Monitor

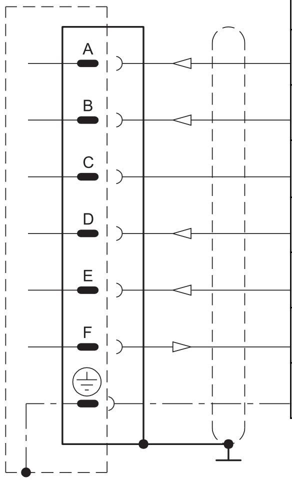


4 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal is between 0…10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**0V**	**+10V**
MONITOR	**0V**	**+10V**

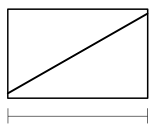


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	0 ÷ 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	0 ÷ 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

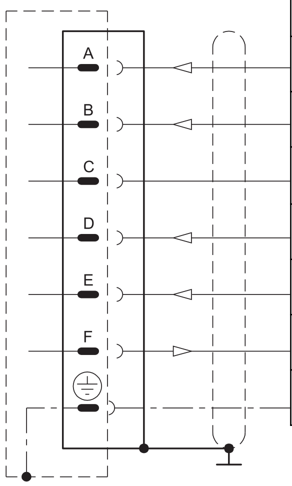
5 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**4 mA**	**20 mA**
MONITOR	**4 mA**	**20 mA**



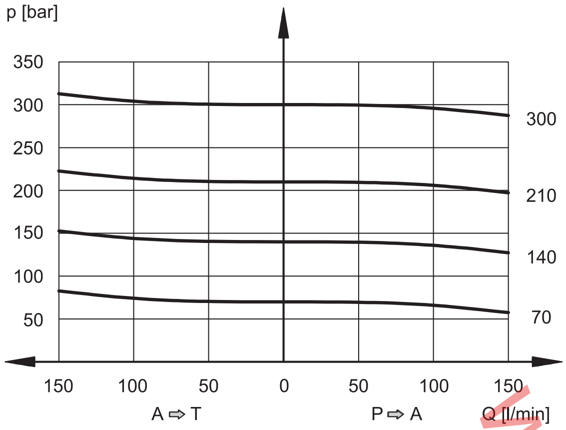
Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

6 - CHARACTERISTIC CURVES

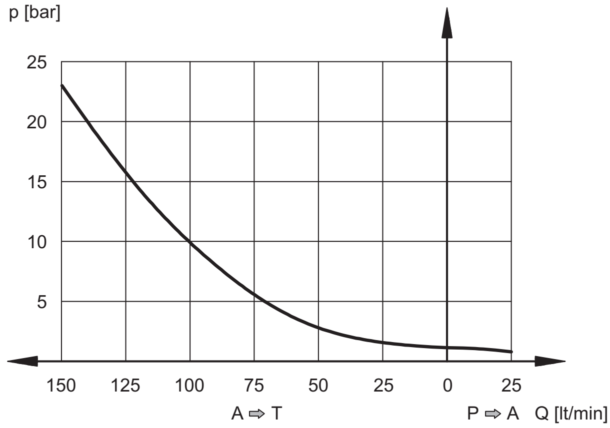
(with mineral oil with viscosity of 36 cSt at 50°C)

6.1 - Characteristic Curves of DZCE5G and DZCE5RG

ADJUSTMENT

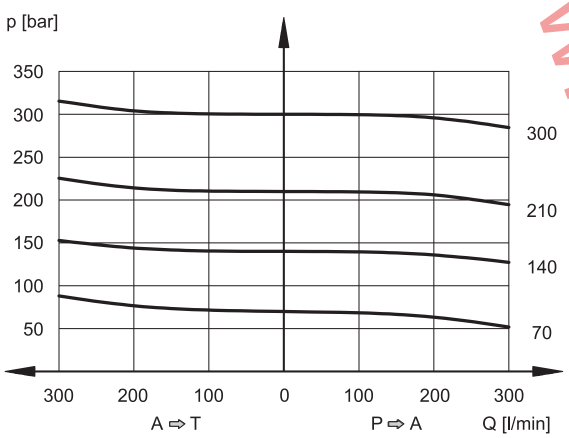


MIN. CONTROLLED PRESSURE p min = f(Q)

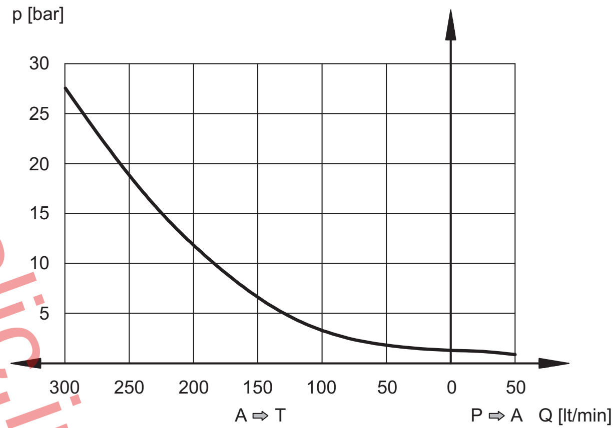


6.2 - Characteristic Curves of DZCE7G

ADJUSTMENT

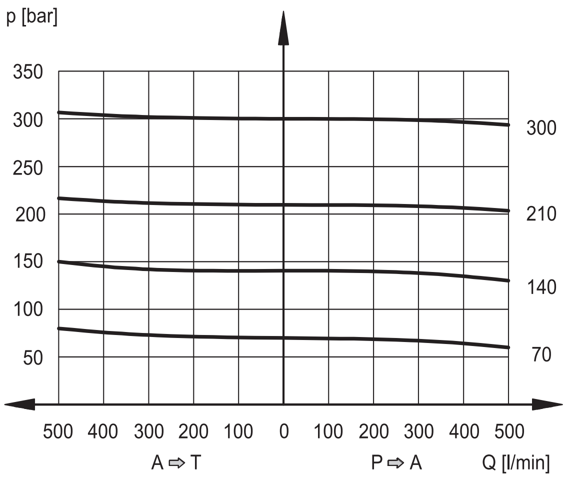


MIN. CONTROLLED PRESSURE p min = f(Q)

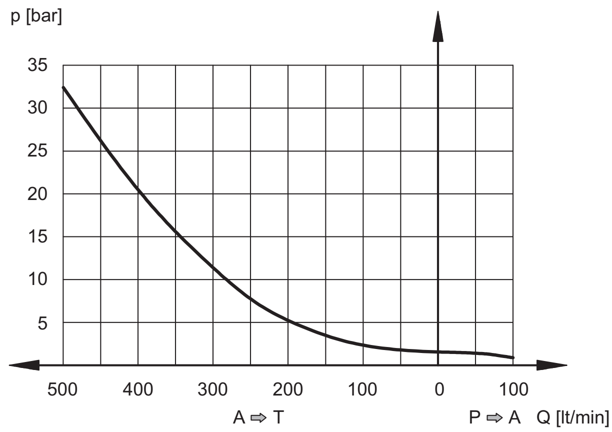


6.3 - Characteristic Curves of DZCE8G

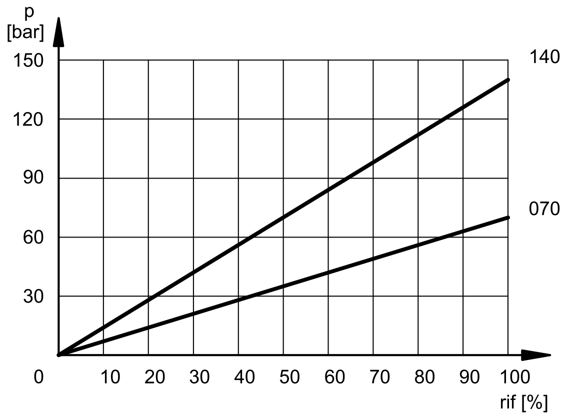
ADJUSTMENT

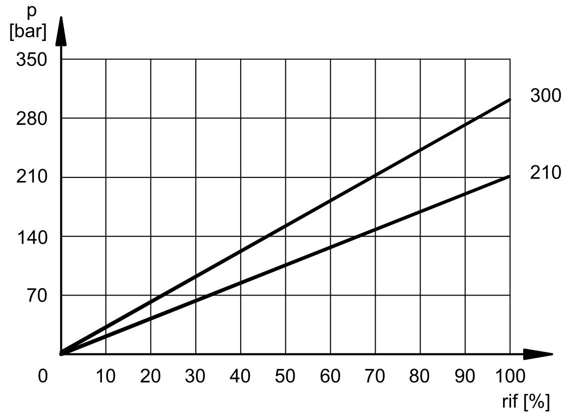


MIN. CONTROLLED PRESSURE p min = f(Q)



6.4 - CONTROLLED PRESSURE p = f(I)



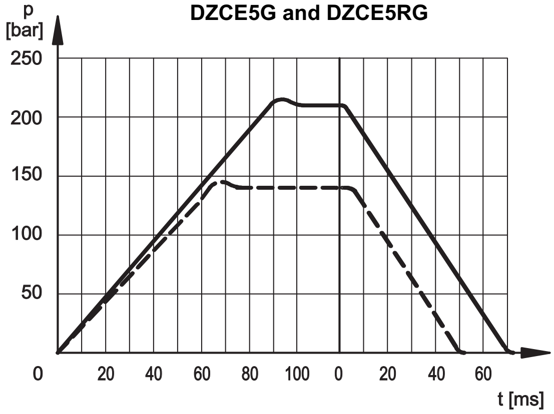


7 - STEP RESPONSE

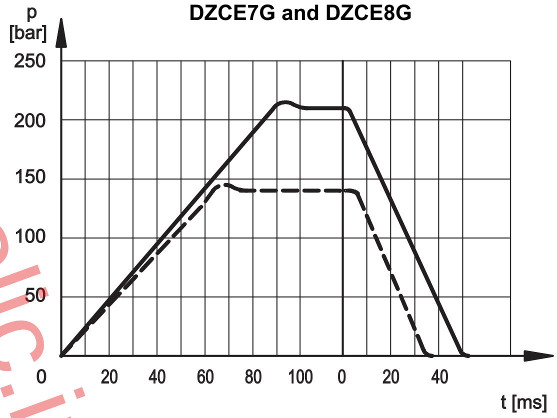
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

The graphs show the typical step response tested with static pressure 100 bar.

DZCE5G and DZCE5RG



DZCE7G and DZCE8G

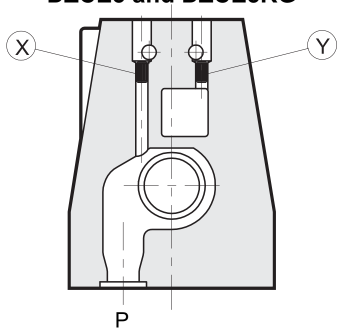


8 - PILOTING AND DRAINAGE

The valves are available with piloting and drainage, both internal and external. The version with external drainage allows a higher backpressure on the unloading.

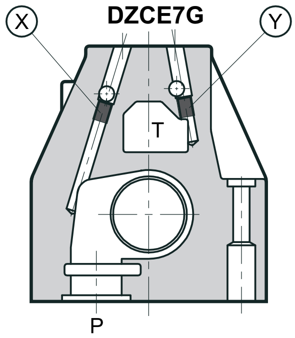
TYPE OF VALVE		Plug assembly X	Plug assembly Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

DZCE5 and DZCE5RG



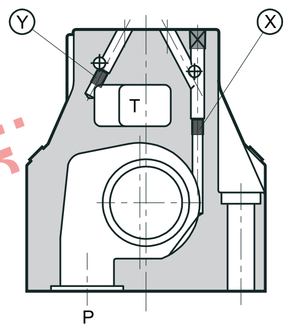
X: M5x6 plug for external pilot
Y: M5x6 plug for external drain

DZCE7G



X: M6x8 plug for external pilot
Y: M6x8 plug for external drain

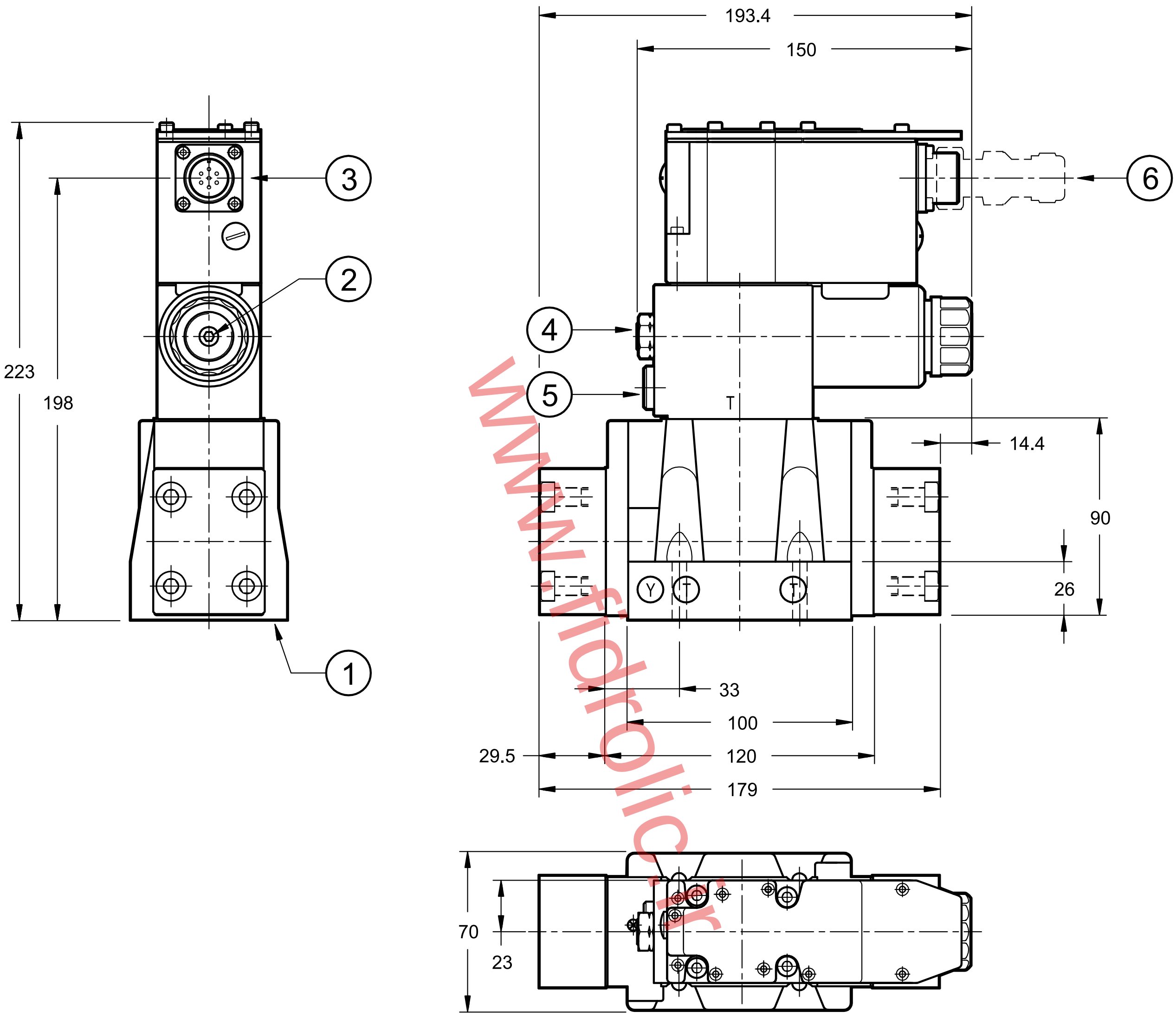
DZCE8G



X: M6x8 plug for external pilot
Y: M6x8 plug for external drain

9 - OVERALL AND MOUNTING DIMENSIONS DZCE5G AND DZCE5RG

dimensions in mm



NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

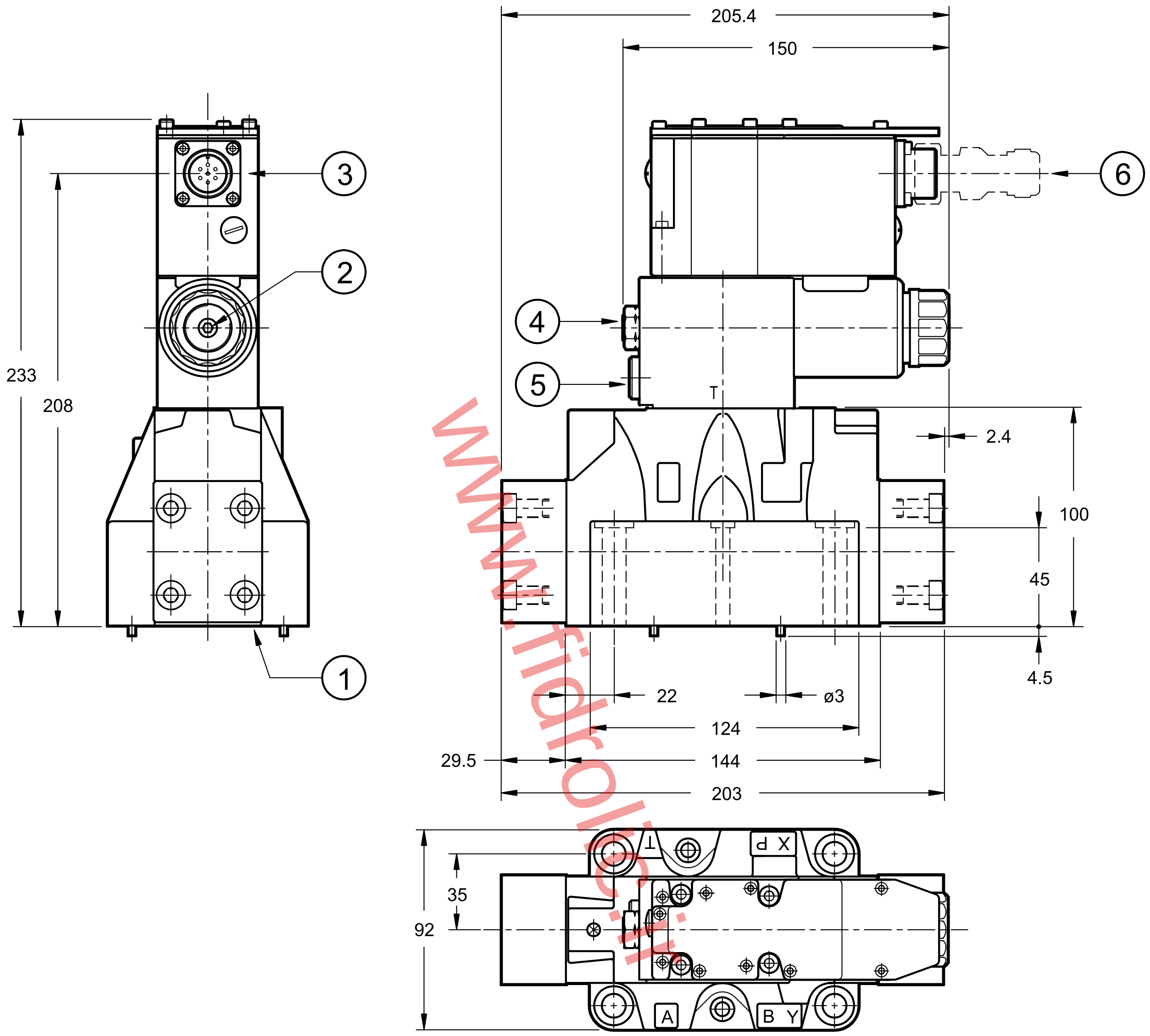
Mounting surface shown at paragraph 12.

1	Mounting surface with sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore N. 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Breather (Allen key 4)
3	Main connection
4	Adjustment seal, set in factory. It is recommended not to unscrew the nut.
5	Pressure gauge port 1/4 BSP”
6	Mating electrical connector **to be ordered separately.** See at section 15

Valve fastening: N. 4 bolts SHC M6x35 - ISO 4762
Tightening torque: 8 Nm (bolts A 8.8)
Thread of mounting holes: M6x10

10 - OVERALL AND MOUNTING DIMENSIONS DZCE7G

dimensions in mm



NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

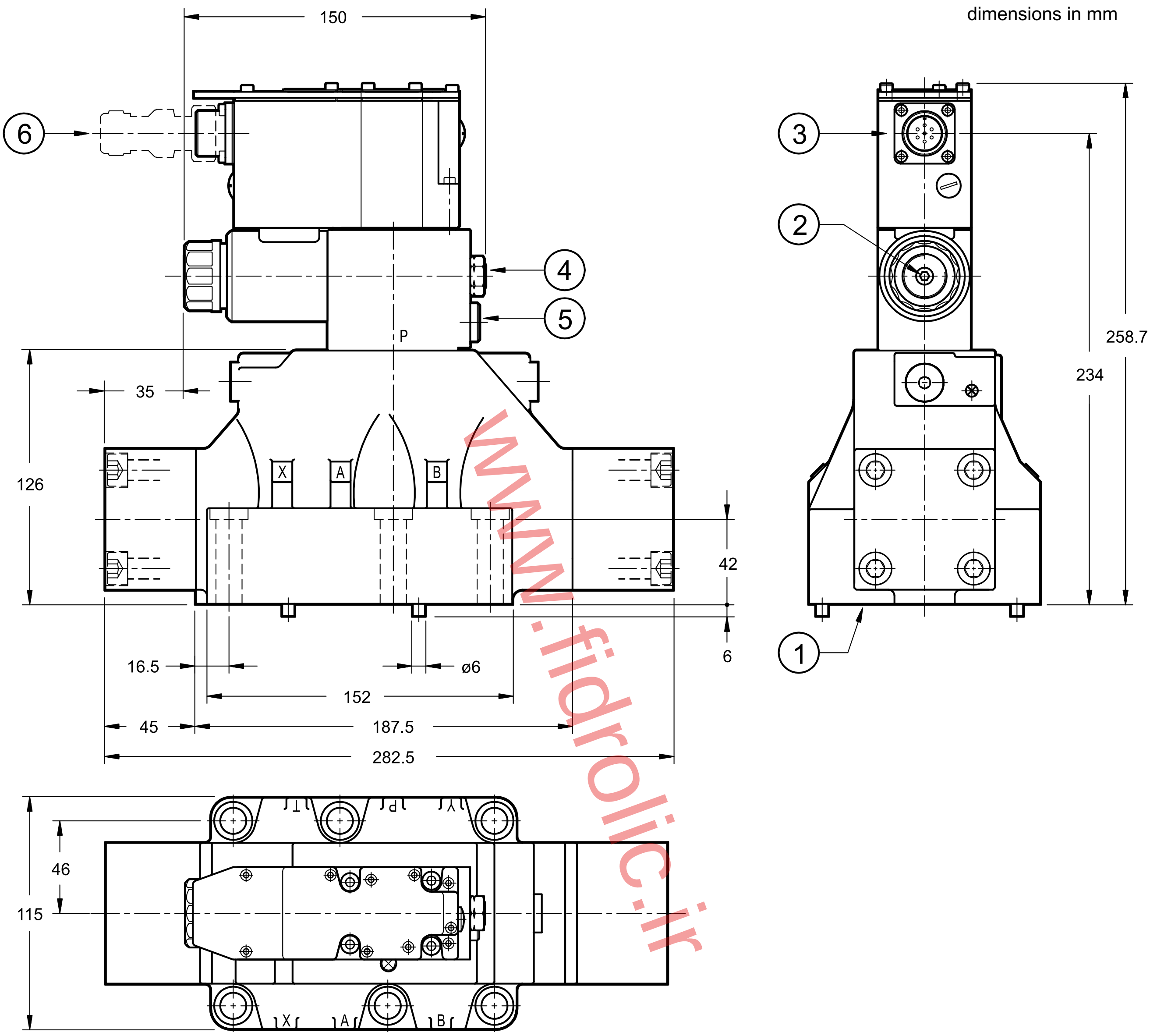
Mounting surface shown at paragraph 12.

Valve fastening:	N. 4 bolts SHC M10x60 - ISO 4762 N. 2 bolts SHC M6x60 - ISO 4762	
Tightening torque:	M10x60: M6x60:	40 Nm (bolts A 8.8) 8 Nm (bolts A 8.8)
Thread of mounting holes:	M6x18; M10x18	

1	Mounting surface with sealing rings: N. 4 OR type 130 (22.22x2.62) - 90 Shore N. 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Breather (Allen key 4)
3	Main connection
4	Adjustment seal, set in factory. It is recommended not to unscrew the nut.
5	Pressure gauge port 1/4 BSP”
6	Mating electrical connector **to be ordered separately.** See at section 15

11 - OVERALL AND MOUNTING DIMENSIONS DZCE8G

dimensions in mm



NOTE: at the first start up, or after a long period of no use, it is necessary to vent the air through the breather (2) placed at the end of the solenoid tube.

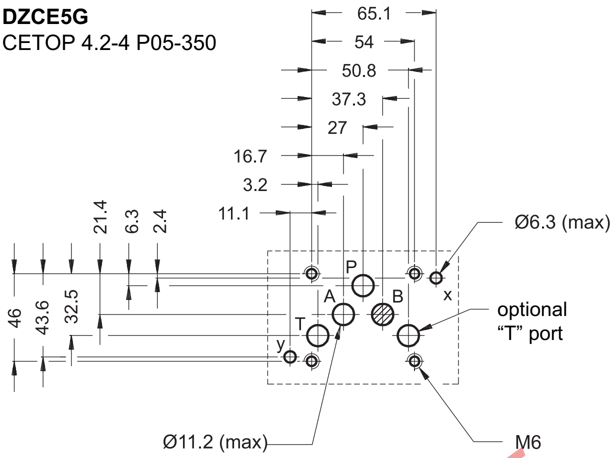
Mounting surface shown at paragraph 12.

Valve fastening: N. 6 bolts SHC M12x60 - ISO 4762
Tightening torque: 69 Nm (bolts A 8.8)
Thread of mounting holes: M12x20

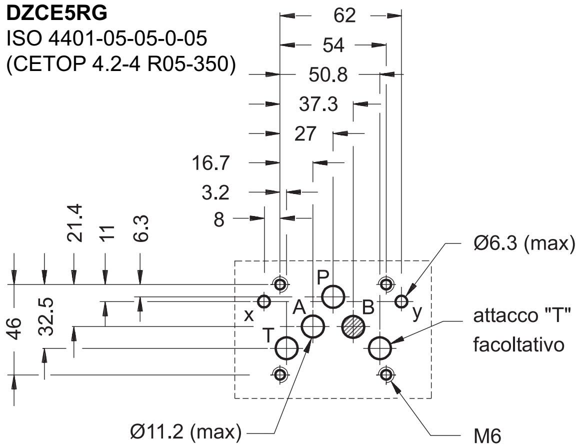
1	Mounting surface with sealing rings: N. 4 OR type 3118 (29.82x2.62) - 90 Shore N: 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Breather (Allen key 4)
3	Main connection
4	Adjustment seal, set in factory. It is recommended not to unscrew the nut.
5	Pressure gauge port 1/4 BSP”
6	Mating electrical connector **to be ordered separately.** See at section 15

12 - MOUNTING SURFACES

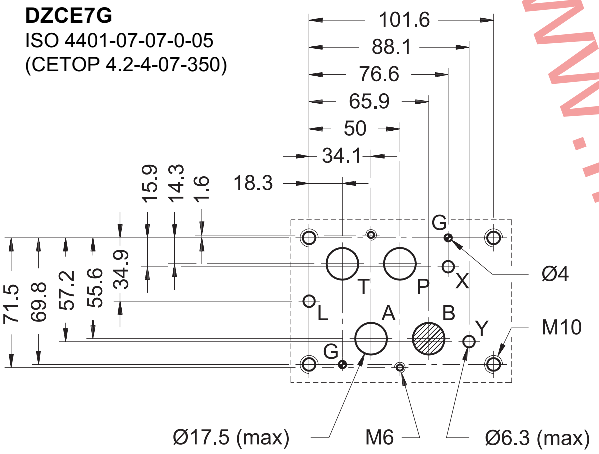
DZCE5G
CETOP 4.2-4 P05-350



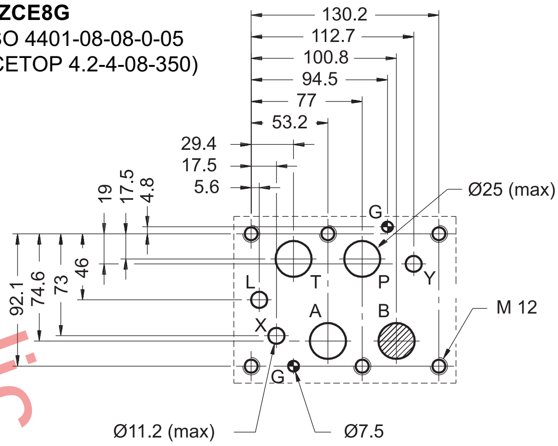
DZCE5RG
ISO 4401-05-05-0-05
(CETOP 4.2-4 R05-350)



DZCE7G
ISO 4401-07-07-0-05
(CETOP 4.2-4-07-350)



DZCE8G
ISO 4401-08-08-0-05
(CETOP 4.2-4-08-350)



13 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

14 - INSTALLATION

We recommend to install the valves either in horizontal position, or vertical position with the solenoid downward. If the valve is installed in vertical position and with the solenoid upward, you must consider possible variations of the minimum controlled pressure, if compared to what is indicated in paragraph 5.

Ensure that there is no air in the hydraulic circuit. In particular applications, can be necessary to vent the air entrapped in the solenoid tube, by using the appropriate drain screw in the solenoid tube.

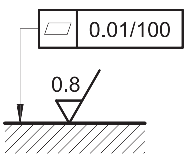
Ensure the solenoid tube is always filled with oil. At the end of the operation, make sure of having correctly replaced the drain screw.

Connect the valve T port directly to the tank. Add any backpressure value detected in the T line to the controlled pressure value.

Maximum admissible backpressure in the T line, under operational conditions, is 2 bar.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Surface finishing

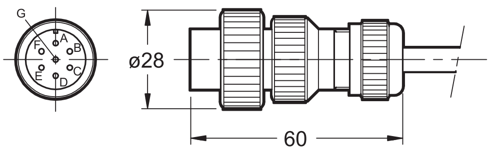


15 - ACCESSORIES

(to be ordered separately)

15.1 Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.



⚠ So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**

15.2 - Connection cables size

Power supply:
- up to 20 m cable length : 1,0 mm²
- up to 40 m cable length : 1,5 mm²

Signal: 0,50 mm²

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

15.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

16 - SUBPLATES

(see catalogue 51 000)

	DZCE5G	DZCE7G	DZCE8G
Type with rear ports	PME4-AI5G	PME07-AI6G	-
Type with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G
Thread of ports: P - T - A - B X - Y	3/4" BSP 1/4" BSP	1" BSP 1/4" BSP	1½" BSP 1/4" BSP

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DUPLOMATIC OLEODINAMICA

RPCED1

DIRECT OPERATED FLOW CONTROL VALVE WITH ELECTRIC PROPORTIONAL CONTROL

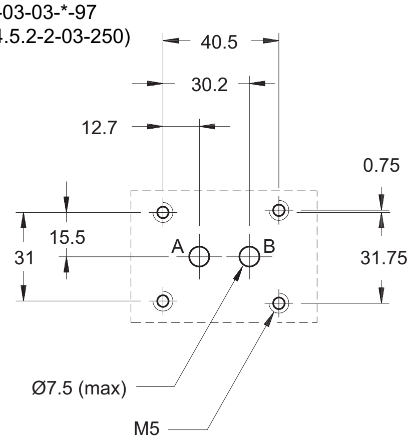
SERIES 52

SUBPLATE MOUNTING
ISO 6263-03

p max **250** bar
Q max (see table of performances)

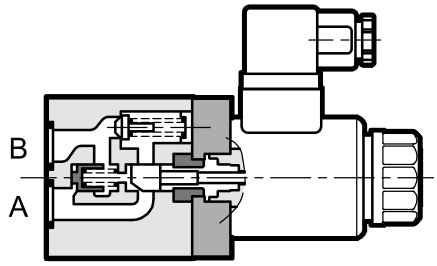
MOUNTING INTERFACE

ISO 6263-03-03-*-97
(CETOP 4.5.2-2-03-250)



NOTE: The RPCED1 mounting interface, with ISO 6263-03 holes, must not have P and T ports or must have the 0113388 subplate (to be ordered separately).

OPERATING PRINCIPLE



— The RPCED1 valve is a two-way flow control valve with pressure and thermal compensation, electric proportional control, and mounting interface in compliance with ISO 6263 standards.

— It is normally used for flow rate control in hydraulic circuit branches or for speed control of hydraulic actuators.

— Flow rate can be modulated continuously in proportion to the current supplied to the solenoid.

— The valve can be controlled directly by a current control supply unit or by means of the relative electronic control units to exploit valve performance to the full (see par. 10).

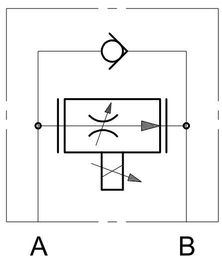
— It is available in five flow rate control ranges up to 25 l/min.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Maximum operating pressure Minimum Δp between A and B port	bar	250 10
Maximum controlled flow Min. controlled flow (for 1 and 4 l/min. reg.) Maximum free-reverse flow	l/min	1,5 - 4 - 8 - 16 - 25 0,025 40
Step response	see paragraph 7	
Hysteresis (with PWM 100 Hz)	% of p nom	< 6%
Repeatability	% of p nom	< ±2,5%
Electrical characteristic	see paragraph 6	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13 (class 17/15/12 for flows < 0,5 l/min)	
Recommended viscosity	cSt	25
Mass	kg	1,5

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODE

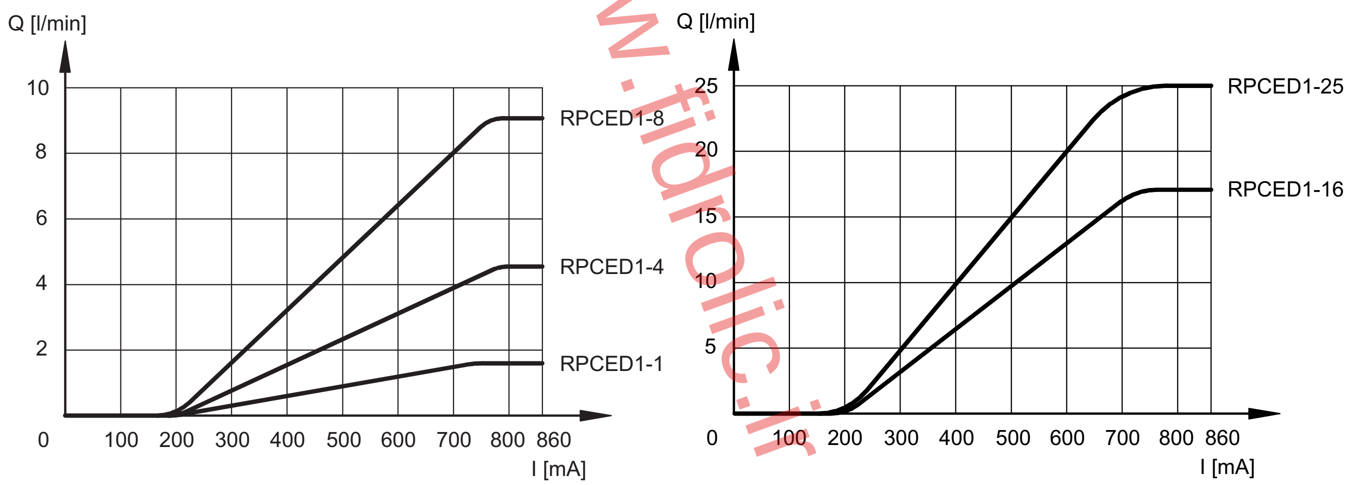
R	P	C	E	D	1	-		/	C	/	52	-	24	/	

- Compensated flow control valve (RPC)
- Electric proportional control (E)
- Open loop control (D)
- Size: ISO 6263-03 (CETOP 03) (1)
- Maximum controlled flow:
  1 = 1,5 l/min **8** = 8 l/min **25** = 25 l/min
  4 = 4 l/min **16** = 16 l/min
- Built-in check valve (C)
- Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged) (52)
- Nominal solenoid voltage 24 V DC (24)
- Seal: omit for mineral oils
  V = viton for special fluids

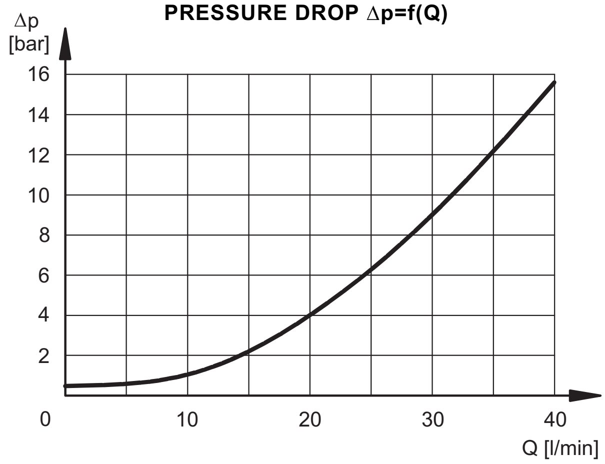
2 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

Typical curves for flow rate A→ B according to the current supplied to the solenoid for controlled flow rate of: 1- 4 - 8 - 16 - 25 l/min.

FLOW CONTROL Q=f(I)



PRESSURE DROP Δp=f(Q)



Pressure drop with free flow B →A through check valve.

3 - PRESSURE COMPENSATION

The valves are equipped with two restrictors in series. The first one is an opening which can be adjusted by the proportional solenoid; the second, controlled by the pressure upstream and downstream of the first restrictor ensures constant pressure drop across the adjustable restrictor. In these conditions, the set flow rate value is maintained constant within a tolerance limit of ± 2% of the full scale flow rate for maximum pressure variation between the valve inlet and outlet chambers.

4 - THERMAL COMPENSATION

Thermal compensation of the valve is obtained by adopting the principle of restricted fluid passage, so that the fluid is not influenced significantly by variations in oil viscosity.
For controlled flow rates of lower than 0.5 l/min and with a temperature change of 30°C, flow rate varies by approx. 13% of the set value.
For higher flow rates and with the same temperature change the flow rate variation is <4% of the set flow rate.

5 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

6 - ELECTRICAL CHARACTERISTICS

6.1 - Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	**24**
RESISTANCE (at 20°C)	Ω	17.6
MAXIMUM CURRENT	A	0.86
DUTY CYCLE		100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE	
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529)	IP 65	

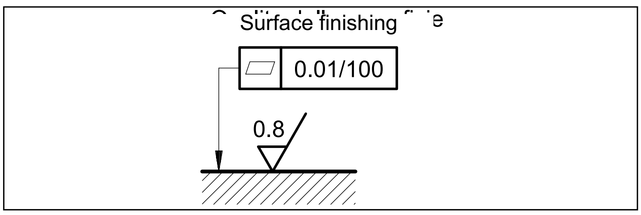
7 - STEP RESPONSE (obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.
The table illustrates typical response times with valve flow rate of 16 l/min and with input pressure of 100 bar.

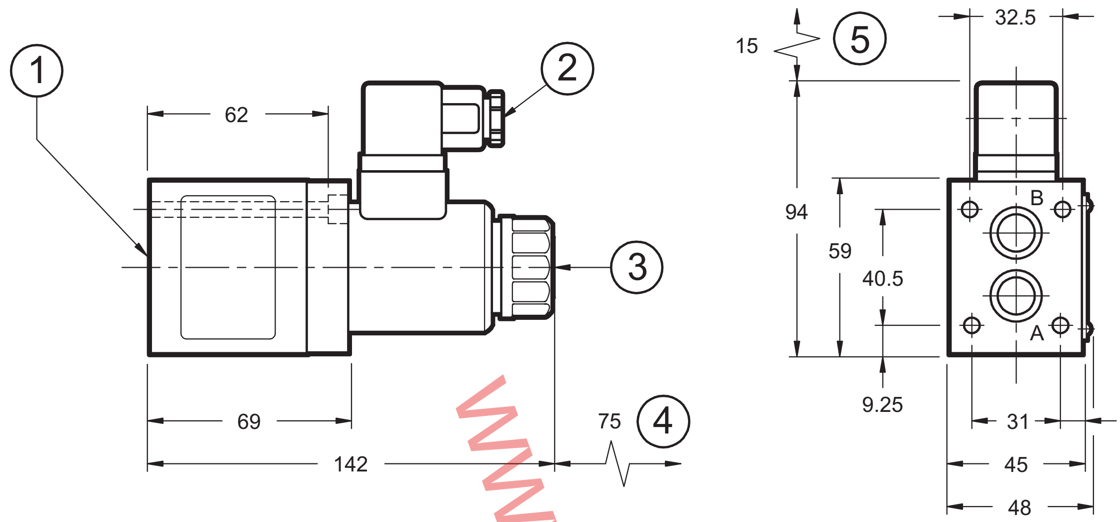
REFERENCE SIGNAL STEP	0 → 100%	100 → 0%	25→75%	75→25%
Step response [ms]	60	80	50	70

8 - INSTALLATION

RPCED1 valves can be installed in any position without impairing correct operation.
Ensure that there is no air in the hydraulic circuit.
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.



9 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

1	Mounting surface with sealing rings: 2 ORM-0140-20 (14x2)
2	Coil electrical connector DIN 43650
3	Manual override control
4	Coil removal space
5	Connector removal space

Fastening bolts: 4 bolts M5x70
Torque: 5 Nm

10 - ELECTRONIC CONTROL UNITS

EDC-111	for solenoid 24V DC	plug version	see cat.89 120
EDM-M111	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250

11 - SUBPLATES (see cat. 51 000)

Type	PMRPC1-AI3G ports on rear PMRPC1-AL3G side ports
Port dimensions	3/8” BSP

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DUPLOMATIC OLEODINAMICA

RPCED1-*/T3

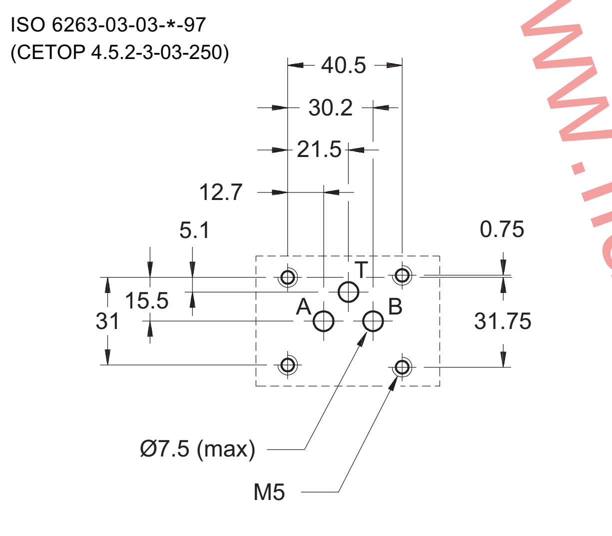
THREE-WAY DIRECT OPERATED FLOW CONTROL VALVE WITH ELECTRIC PROPORTIONAL CONTROL

SERIES 52

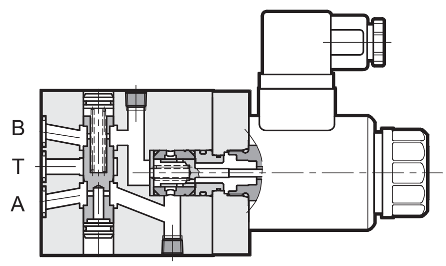
SUBPLATE MOUNTING
ISO 6263-03

p max **250** bar
Q max (see table of performances)

MOUNTING INTERFACE



OPERATING PRINCIPLE



— RPCED1-*/T3 is a three-way flow control valve, pressure and temperature compensated with electric proportional control and mounting interface in compliance with ISO 6263 standards.

— This valve controls the flow to the circuit, by dumping the exceeding oil flow to the tank.

— Flow rate can be modulated continuously in proportion to the current supplied to the solenoid.

— The valve can be controlled directly by a current control supply unit or by means of the relative electronic control units to exploit valve performance to the full (see par. 10).

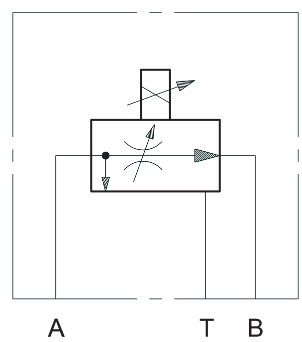
— It is available in five flow rate control ranges up to 25 l/min.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Maximum operating pressure Minimum Δp between A and B port	bar	250 8
Maximum controlled flow Min. controlled flow (for 1 and 4 l/min. reg.)	l/min	1,5 - 4 - 8 - 16 - 25 0,025
Step response	see paragraph 7	
Hysteresis (PWM 100)	% of Q max	< 6%
Repeatability	% of Q max	< ±2,5%
Electrical characteristic	see paragraph 6	
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13 (class 17/15/12 for flows < 0,5 l/min)	
Recommended viscosity	cSt	25
Mass	kg	1,5

HYDRAULIC SYMBOL



RPCED1-*/T3
SERIES 52

1 - IDENTIFICATION CODE

R P C E D 1 - [ ] / T3 / 52 - 24 / [ ]

Compensated flow control valve (RPC)

Electric proportional control (E)

Open loop control (D)

Size ISO 6263 (1)

Maximum controlled flow:
1 = 1,5 l/min **8** = 8 l/min **25** = 25 l/min
4 = 4 l/min **16** = 16 l/min

Three-way version (T3)

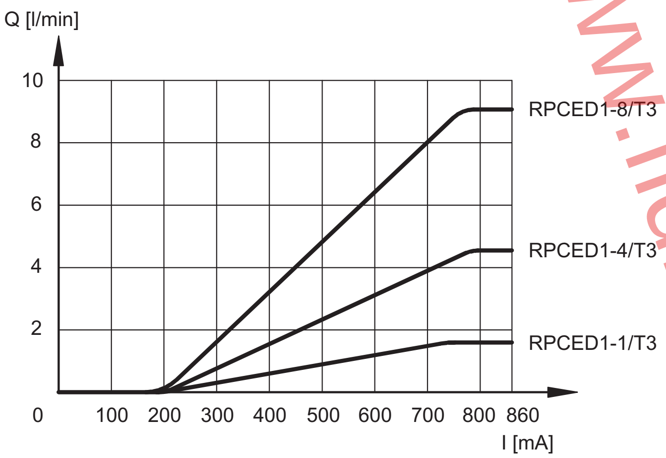
Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged) (52)

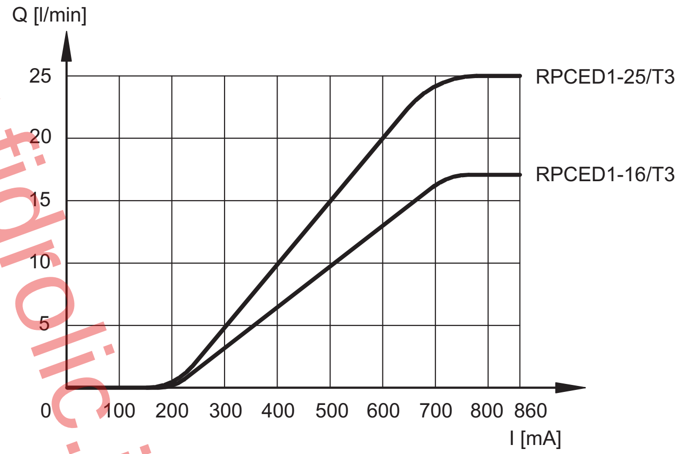
Nominal solenoid voltage 24 V DC (24)

Seal:
omit for mineral oils
V = FPM seals for special fluids

2 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

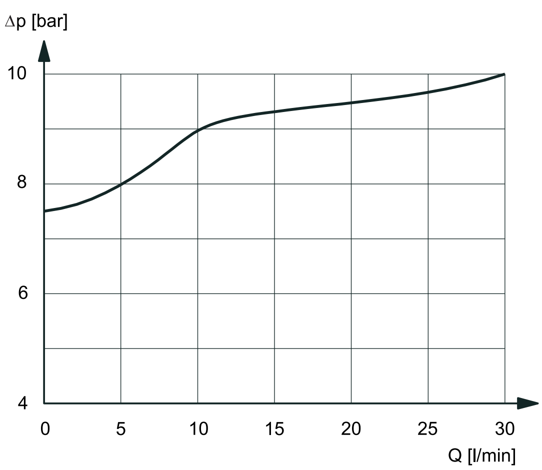
FLOW CONTROL Q = f(I)





Typical curves for flow rate A→B according to the current supplied to the solenoid for controlled flow rate of: 1 - 4 - 8 - 16 - 25 l/min.

PRESSURE DROP Δp = f(Q)



Pressure drop with flow A →T through the compensator.

3 - PRESSURE COMPENSATION

The valves are equipped with two restrictors. The first is an opening which can be adjusted by the proportional solenoid; the second, controlled by the pressure upstream and downstream of the first restrictor ensures constant pressure drop across the adjustable restrictor. In these conditions, the set flow rate value is maintained constant within a tolerance limit of ± 2% of the set flow rate for maximum pressure variation between the valve inlet and outlet chambers.

4 - THERMAL COMPENSATION

Thermal compensation of the valve is obtained by adopting the principle of restricted fluid passage, so that the fluid is not influenced significantly by variations in oil viscosity.
For controlled flow rates of lower than 0.5 l/min and with a temperature change of 30°C, flow rate varies by approx. 13% of the set value.
For higher flow rates and with the same temperature change the flow rate variation is <4% of the set flow rate.

5 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

6 - ELECTRICAL CHARACTERISTICS

6.1 - Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	**24**
RESISTANCE (at 20°C)	Ω	17.6
MAXIMUM CURRENT	A	0.86
DUTY CYCLE		100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE	
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529)	IP 65	

7 - STEP RESPONSE (obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

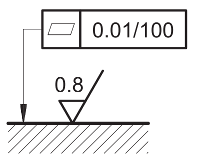
Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.
The table illustrates typical response times with valve flow rate of 16 l/min and with input pressure of 100 bar.

REFERENCE SIGNAL STEP	0 → 100%	100 → 0%	25→75%	75→25%
Step response [ms]	60	80	50	70

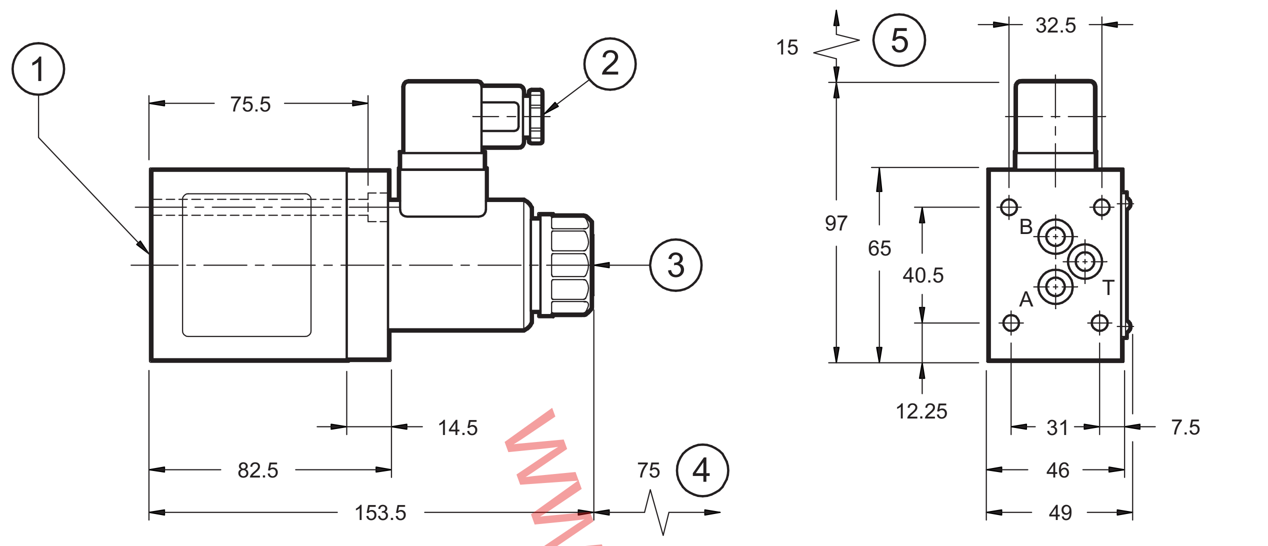
8 - INSTALLATION

RPCED1-*/T3 valves can be installed in any position without impairing correct operation.
Ensure that there is no air in the hydraulic circuit.
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.

Surface finishing



9 - OVERALL AND MOUNTING DIMENSIONS



dimensions in mm

1	Mounting surface with sealing rings: 3 OR type 2037 (9.25x1.78) - 90 Shore
2	Coil electrical connector DIN 43650
3	Manual emergency control
4	Coil removal space
5	Connector removal space

Fastening bolts: 4 bolts M5x85
Torque: 5 Nm

10 - ELECTRONIC CONTROL UNITS

EDC-111	for solenoid 24V DC	plug version	see cat.89 120
EDM-M111	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250

11 - SUBPLATES (see cat. 51 000)

Type	PMMD-AI3G rear ports with user P plugged PMMD-AL3G side ports with user P plugged
Port dimensions	3/8" BSP

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QDE*

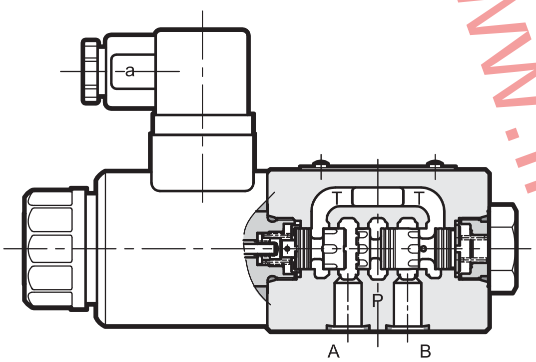
DIRECT OPERATED FLOW CONTROL VALVE WITH PROPORTIONAL CONTROL AND COMPENSATION

SERIES 10

SUBPLATE MOUNTING
ISO 6263-03 (CETOP 03)
ISO 4401-05 (CETOP 05)

p max **250** bar
Q max **80** l/min

OPERATING PRINCIPLE



— The QDE* are a compensated flow control valves with pressure compensation and proportional electric control, with mounting surface according to ISO 6263-03 and ISO 4401-05 (CETOP RP121H), supplied with 2 or 3 way design, depending on the use of port P.

— This valve is used for the regulation of the flow in branches of a hydraulic circuit or for the speed control of hydraulic cylinders.

— The flow can modulated continuously in proportion to the current supplied by the solenoid

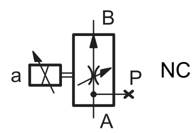
— The valve can be controlled directly from a current controlled power supply or with an integrated electronic, which allow to fully exploit the performance of the valve.

— QDE* valves are available in two sizes, for 5 flow adjustment ranges of up to 80 l/min.

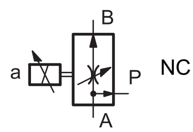
PERFORMANCES (Obtained with mineral oil of viscosity 36 cSt at 50°C and electronic control card)		**QDE3**				**QDE5**
Maximum operating pressure	bar	250				250
Controlled flow (Q_B)	l/min	14	20	30	40	80
Minimum suggested input flow (Q_A)	l/min	40	50	40	50	90
Spring setting in pressure compensator	bar	4	8	4	8	8
Minimum pressure drop A > B	bar	10	22	10	22	22
Hysteresis	% of Q_{max}	< 6 %				< ±2 %
Repeatability	% of Q_{max}	< ± 1,5 %				
Electrical characteristics	see paragraph 6					
Fluid temperature range	°C	-20 / +60				
Fluid temperature range	°C	-20 / +80				
Fluid viscosity range	cSt	10 ÷ 400				
Fluid contamination degree	according to ISO 4406:1999 class 18/16/13					
Recommended viscosity	cSt	25				
Mass	kg	1,6				4,6

HYDRAULIC SYMBOLS

TWO WAYS



THREE WAYS



1 - IDENTIFICATION CODE

Q	D	E	3	-		/	10		-		K1	

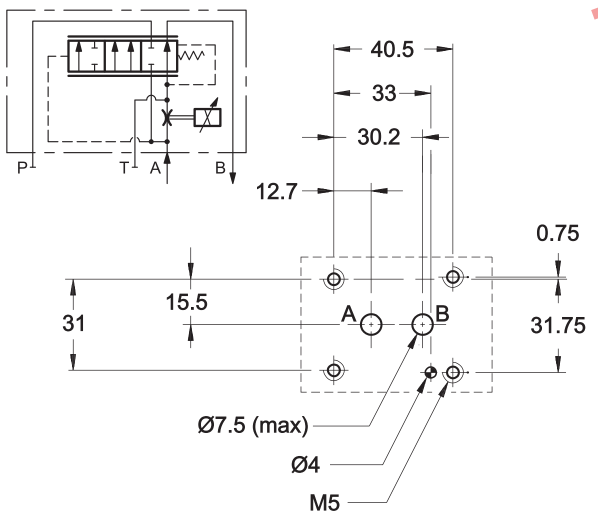
- **QDE**: Direct flow control valve pressure compensated
- **E**: Electric proportional control
- **3** = Size NG06 - ISO 6263-03 (CETOP 03)
  5 = Size NG10 - ISO 4401-05 (CETOP 05)
- Controlled flow:
  QDE3: **14** = 14 l/min; **20** = 20 l/min; **30** = 30 l/min; **40** = 40 l/min
  QDE5: **80** = 80 l/min
- Series no. (from 10 to 19 sizes and mounting dimensions remains unchanged)
- Seals:
  N = NBR seals (**standard**)
  V = FPM seals for special fluids
- **D12** = Nominal solenoid voltage 12V DC
  D24 = Nominal solenoid voltage 24V DC
- Coil electrical connection: plug for connector type DIN 43650 (**standard**)
- Manual override (see par. 12)

2 - CONFIGURATIONS AND MOUNTING INTERFACE

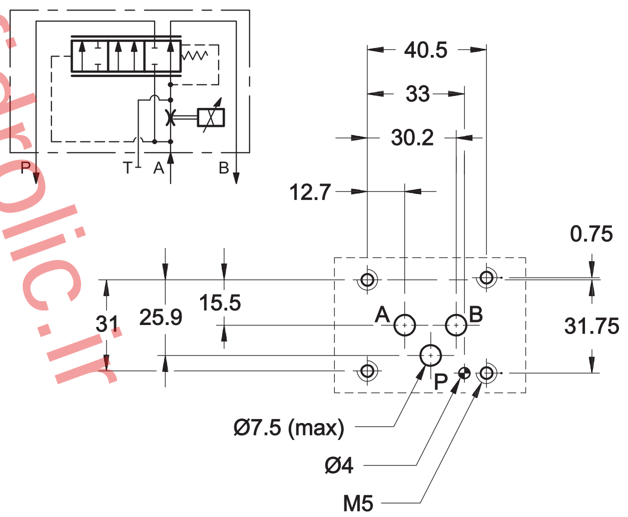
The function of two or three ways is obtained realizing the mounting interface according to ISO 6263-03 (CETOP 03) for QDE3 and ISO 4401-05 (CETOP 05) for QDE5, using the port P for three way configuration only. The port T will never be used.

To use the valve in two ways for QDE3 is also possible to interpose a subplate with plug (code 0113388 and 0530384) be ordered separately.

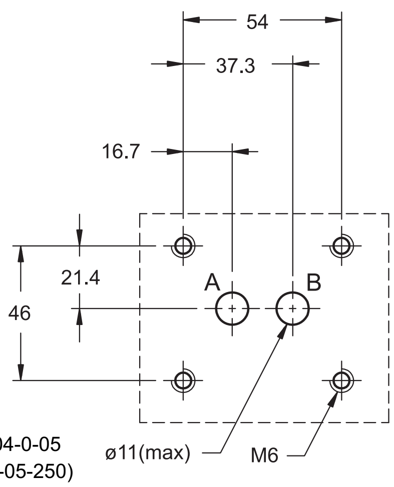
2-WAYS

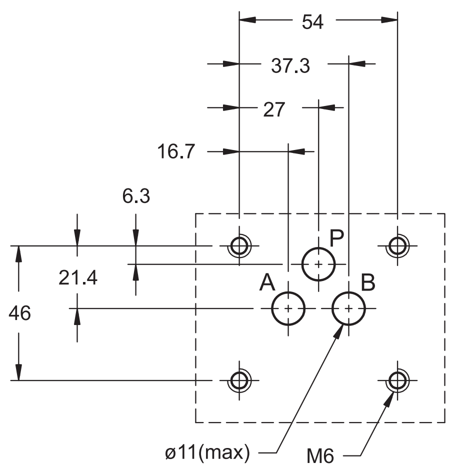


3-WAYS



ISO 6263-03-03-*-97
(CETOP 4.5.2-2-03-250)

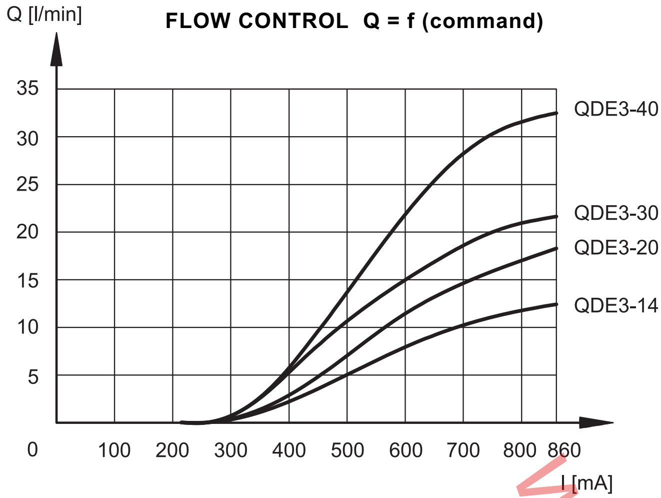


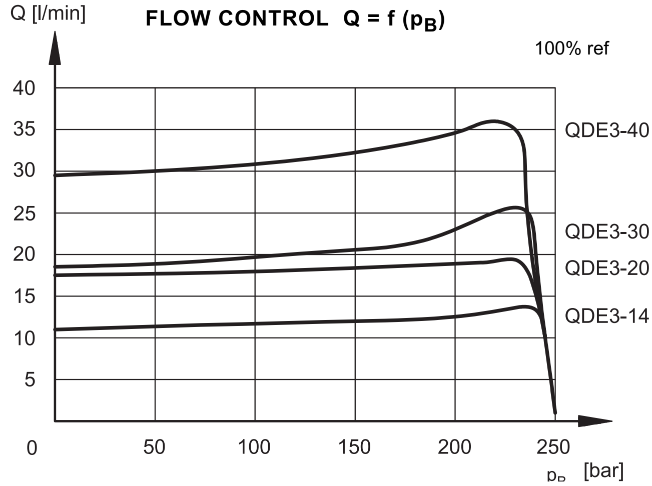


ISO 4401-05-04-0-05
(CETOP 4.5.4-05-250)

4 - CHARACTERISTIC CURVES QDE3 (obtained with viscosity of 36 cSt a 50°C)

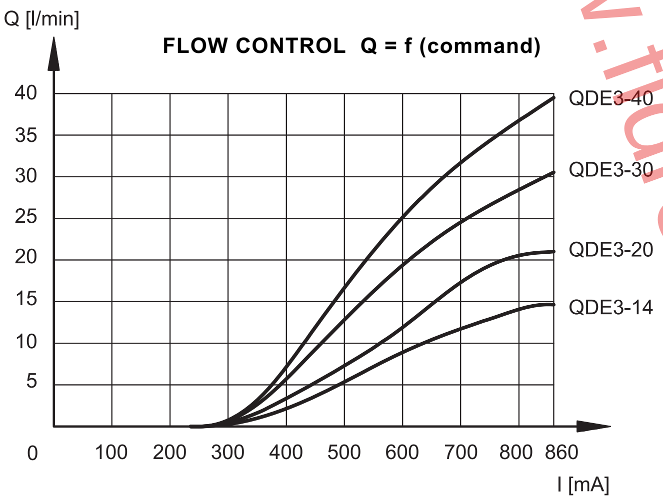
4.1 - Two ways

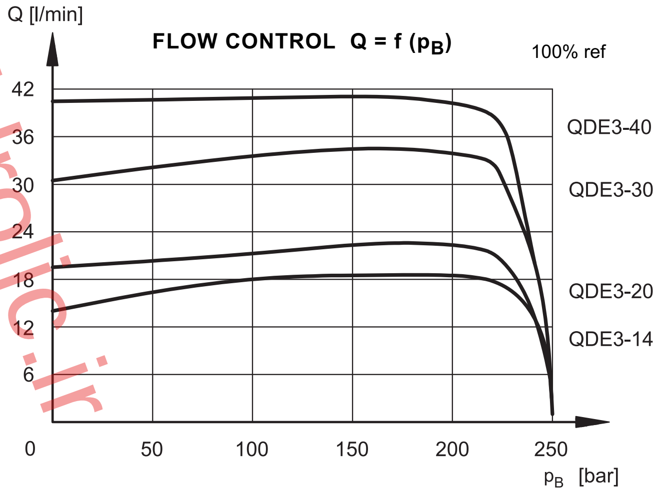




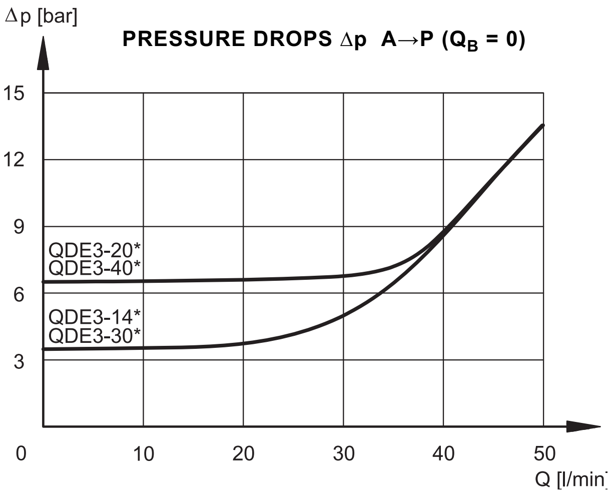
Typical flow rate characteristics A → B for controlled flow rate: 14 - 20 - 30 - 40 l/min in function of the current supplied to the solenoid (D24 version, maximum current 860 mA, PWM 100 Hz)

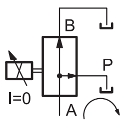
4.2 - Three ways





Typical flow rate characteristics A → B for controlled flow rate: 14 - 20 - 30 - 40 l/min in function of the current supplied to the solenoid (D24 version, maximum current 860 mA, PWM 100 Hz)

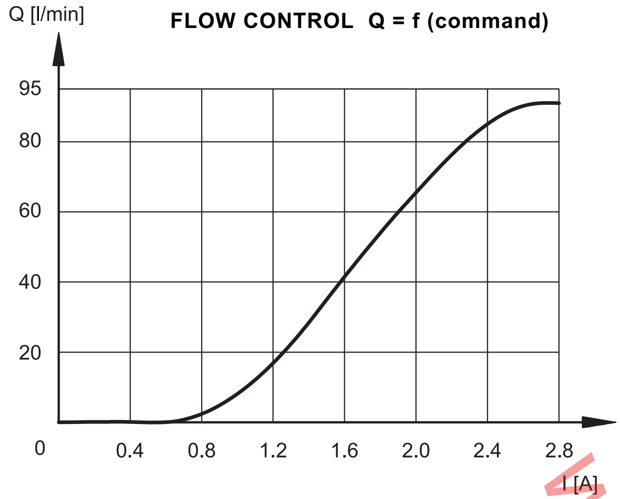


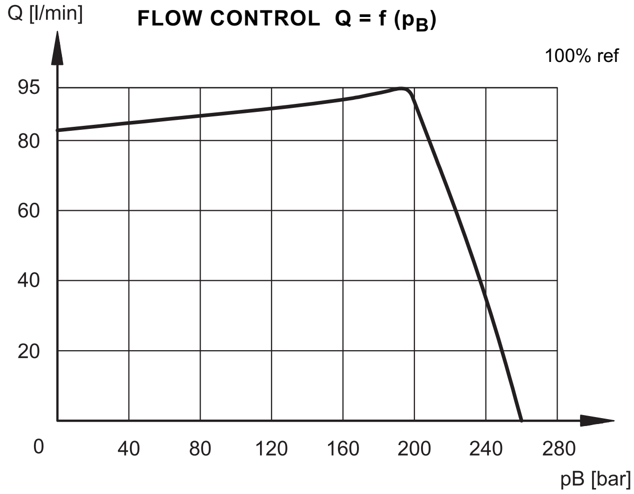


Pressure drops with flow A→P.
Obtained with Q_B = 0 (no current)

4 - CHARACTERISTIC CURVES QDE5 (obtained with viscosity of 36 cSt a 50°C)

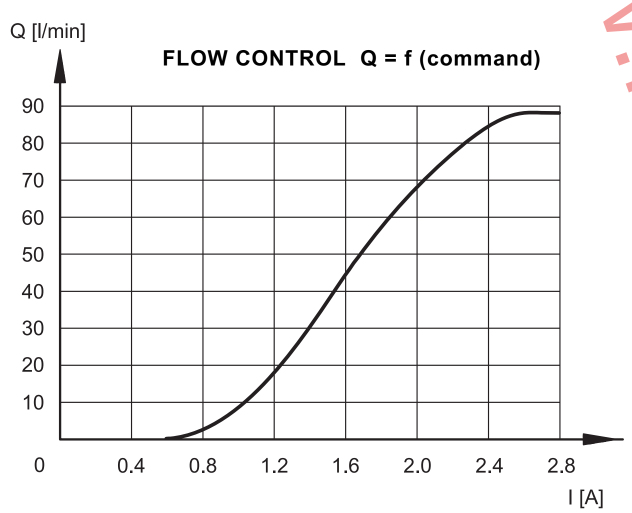
4.1 - Two ways

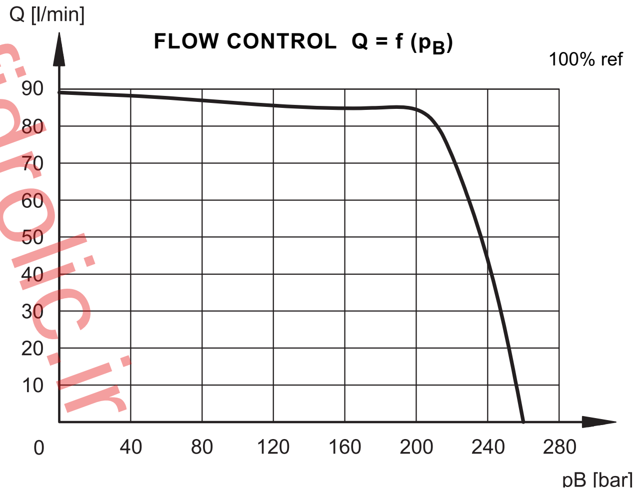




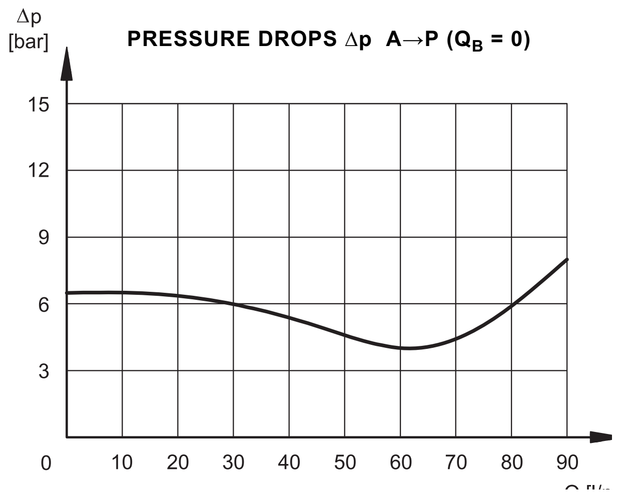
Typical flow rate characteristics A→B in function of the current supplied to the solenoid (D12 version, max current 2.8 A, PWM 100 Hz).

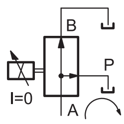
4.2 - Three ways





Typical flow rate characteristics A→B in function of the current supplied to the solenoid (D12 version, max current 2.8 A, PWM 100 Hz).





Pressure drops with flow A→P.
Obtained with Q_B = 0 (no current)

5 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

6 - ELECTRICAL CHARACTERISTIC

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	**12**	**24**
RESISTANCE (at 20°C) QDE3 QDE5	Ω	3,66 3,2	17,6 8,65
NOMINAL CURRENT QDE3 QDE5	A	1,88 2,8	0,86 1,6
PWM FREQUENCY QDE3 QDE5	Hz	200 100	100 100
DUTY CYCLE	100%		
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE		
CLASS OF PROTECTION: atmospheric agents (CEI EN 60529) coil insulation (VDE 0580) Impregnation	IP 65 class H class F		

7 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control cards)

Step response is the time taken for the valve to reach 90% of the set flow value following a step change of reference signal.

The table illustrates typical response times with Δp = 8 bar.

REFERENCE SIGNAL STEP	0 →100%
Step response [ms]	< 70

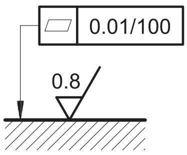
8 - INSTALLATION

QDE* valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

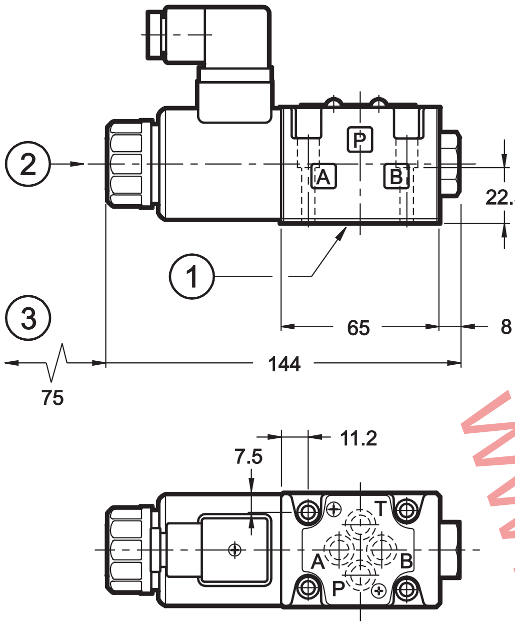
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.

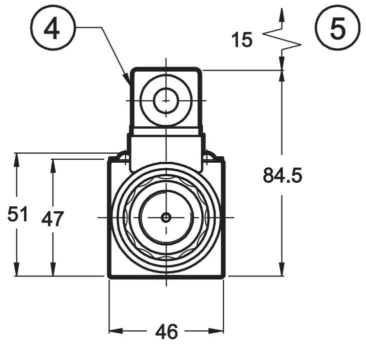
Surface quality



9 - QDE3 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



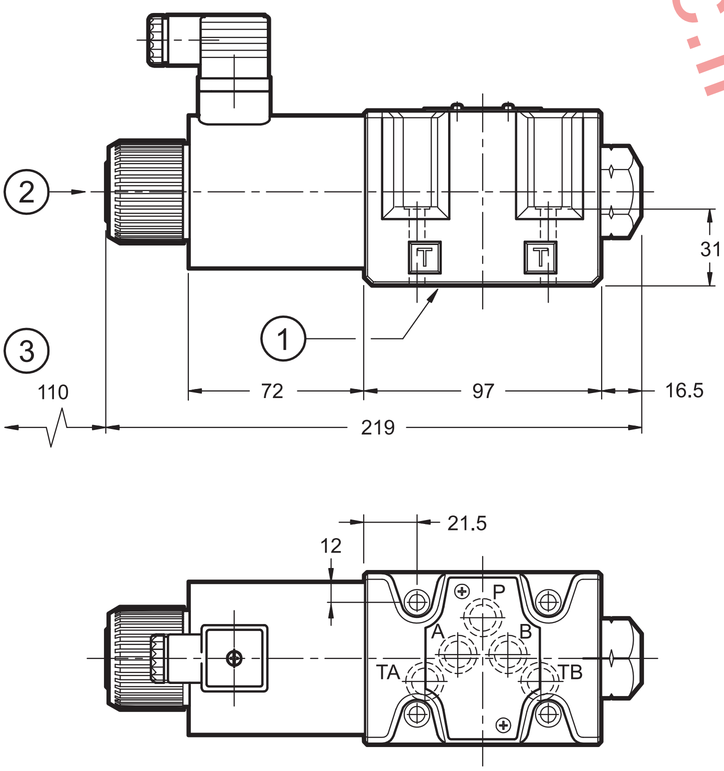


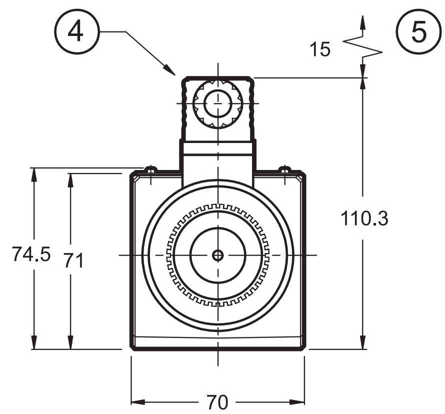
Fastening bolts: N. 4 SHC screws ISO 4762 M5x30
Torque: 5 Nm - A8.8 screws

1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Standard manual override integrated in the solenoid tube
3	Coil removal space
4	DIN 43650 Electrical coil connector
5	Connector removal space

10 - QDE5 OVERALL AND MOUNTING DIMENSIONS

dimensions in mm





Fastening bolts: N. 4 SHC screws ISO 4762 M6x40
Torque: 8 Nm - A8.8 screws

1	Mounting surface with sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore
2	Standard manual override integrated in the solenoid tube
3	Coil removal space
4	DIN 43650 Electrical coil connector
5	Connector removal space

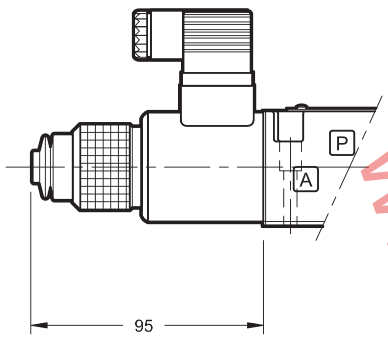
11 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

On demand, there are three types of manual override:

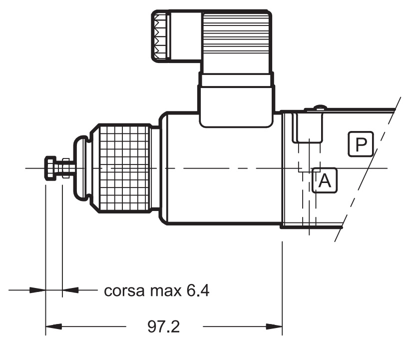
- **CM** version, manual override belt protected (available only for QDE3).
- **CS** version, with metal ring nut provided with a M4 screw and a blocking locknut to allow the continuous mechanical operations (available only for QDE3).
- **CK** version, knob. When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.

CM Version



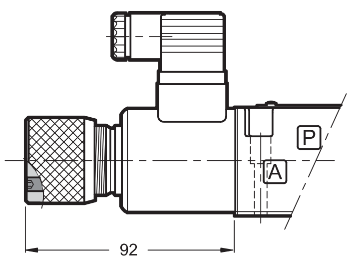
Code: 3803210003

CS Version



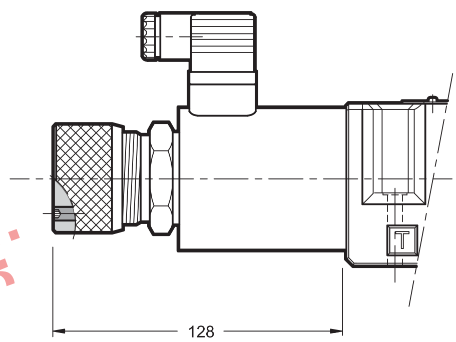
Code: 3803210004

CK Version for QDE3



Spanner for set screw: 3 mm.
Code: 3803210005

CK Version for QDE5



Spanner for set screw : 3 mm.
Code: 3803260003

12 - ELECTRONIC CONTROL UNITS

QDE3

EDC-111	24V DC solenoids	plug version	see cat. 89 120
EDC-142	12V DC solenoids		
EDM-M111	24V DC solenoids	rail mounting DIN EN 50022	see cat. 89 250
EDM-M142	12V DC solenoids		

QDE5

EDC-131	24V DC solenoids	plug version	see cat. 89 120
EDC-151	12V DC solenoids		
EDM-M131	24V DC solenoids	rail mounting DIN EN 50022	see cat. 89 250
EDM-M151	12V DC solenoids		

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DUPLOMATIC OLEODINAMICA

RPCER1

DIRECT OPERATED FLOW CONTROL VALVE WITH ELECTRIC PROPORTIONAL CONTROL AND POSITION FEEDBACK

SERIES 52

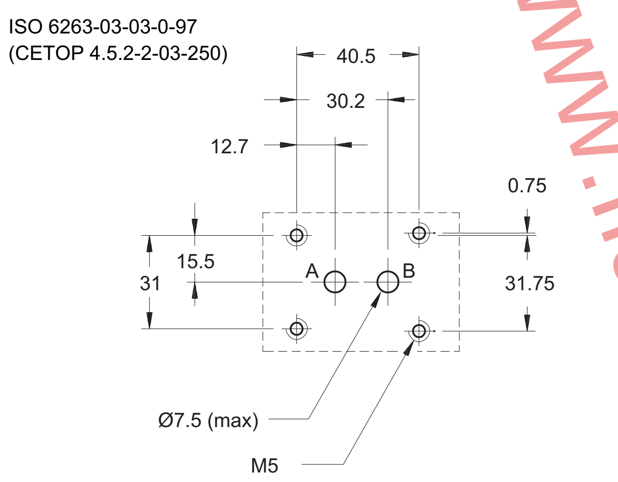
SUBPLATE MOUNTING

ISO 6263-03 (CETOP 03)

p max **250** bar

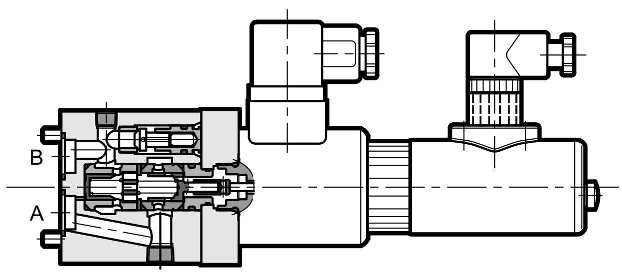
Q max (see performances table)

MOUNTING INTERFACE



NOTE: The RPCER1 mounting interface, with holes according to ISO 6263-03 (CETOP 03), must not have P and T ports

OPERATING PRINCIPLE



— RPCER1 is a pressure and temperature compensated two-way flow control valve, with electric proportional control and mounting interface in accordance with the ISO 6263 (CETOP RP121H) standards.

— The position feedback of the flow rate controlling throttle gives regulation conditions featuring highly reduced hysteresis and high repeatability.

— It is normally used to control the flow rate into an arm of the hydraulic circuit or the speed of the hydraulic actuators.

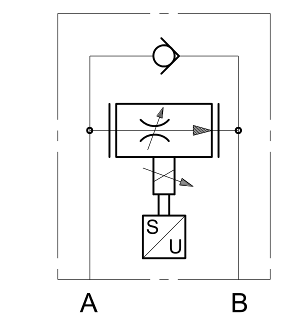
— The flow rate can be modulated continuously in proportion to the reference signal sent to the electronic control unit.

— It is available in five flow rate control ranges up to 25 l/min.

PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C and UEIK-11RSQ/52-24 electronic card)

Maximum operating pressure Minimum Δp between A and B port	bar	250 10
Maximum controlled flow Min. controlled flow (for 1 and 4 l/min. reg.) Maximum free-reverse flow	l/min	1,5 - 4 - 8 - 16 - 25 0,025 40
Step response	see paragraph 7	
Hysteresis	% of Q max	< 2,5%
Repeatability	% of Q max	< ±1%
Electrical characteristic	see paragraph 6	
Ambient temperature range	°C	-10 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13 (class 17/15/12 for flows < 0,5 l/min)	
Recommended viscosity	cSt	25
Mass:	kg	2,2

HYDRAULIC SYMBOLS



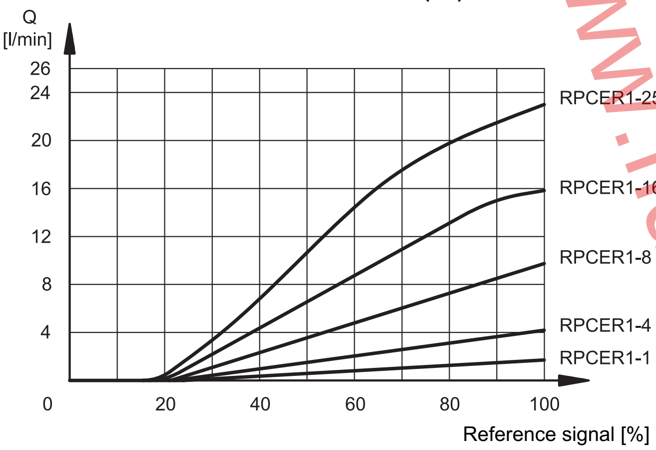
1 - IDENTIFICATION CODE

R	P	C	E	R	1	-		/	C	/	52	-	24	/	

- Compensated flow control valve (RPC)
- Electric proportional control (E)
- Position feedback (R)
- ISO 6263 (CETOP 03) size (1)
- Maximum controlled flow:
  1 = 1.5 l/min
  4 = 4 l/min
  8 = 8 l/min
  16 = 16 l/min
  25 = 25 l/min
- Built-in check valve (C)
- Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged) (52)
- Nominal solenoid voltage 24 V DC (24)
- Seal: omit for mineral oils
  V = FPM seals for special fluids

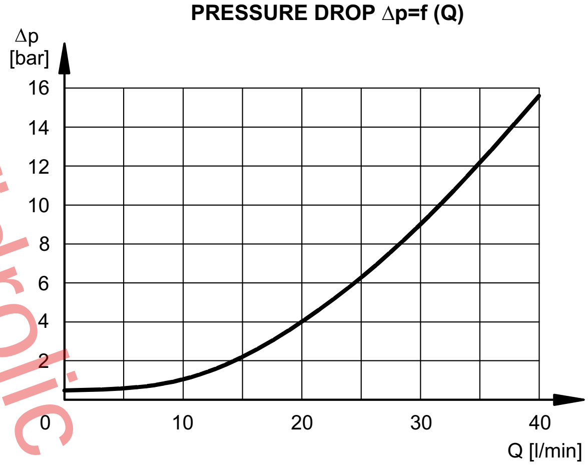
2 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C and UEIK-11RSQ/52-24 card)

FLOW CONTROL Q=f (ref)



Typical curves for flow rate A →B according to the reference signal sent to the electronic control unit.

PRESSURE DROP Δp=f (Q)



Pressure drop with free flow B→A through check valve.

3 - PRESSURE COMPENSATION

The valves are equipped with two restrictors in series. The first is an opening which can be adjusted by the proportional solenoid; the second, controlled by the pressure upstream and downstream of the first restrictor ensures constant pressure drop across the adjustable restrictor. In these conditions, the set flow rate value is maintained constant within a tolerance limit of ± 2% of the full scale flow rate for maximum pressure variation between the valve inlet and outlet chambers.

4 - THERMAL COMPENSATION

Thermal compensation of the valve is obtained by adopting the principle of restricted fluid passage, so that the fluid is not influenced significantly by variations in oil viscosity.

For controlled flow rates of lower than 0.5 l/min and with a temperature change of 30°C, flow rate varies by approx. 13% of the set value.

For higher flow rates and with the same temperature change the flow rate variation is <4% of the set flow rate.

5 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4.

For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

6 - ELECTRICAL CHARACTERISTICS

6.1 - Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to reduce friction to a minimum thereby reducing hysteresis.

The armature connected to the LVDT transducer core sends the position status to the electronic control unit.

NOMINAL VOLTAGE	V DC	**24**
RESISTANCE (at 20°C)	Ω	17.6
MAXIMUM CURRENT	A	0.86
DUTY CYCLE	100%	
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE	
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529)	IP 65	

6.2 - Positional transducer

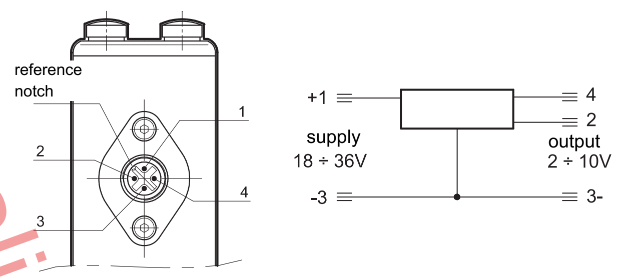
The feedback control version RPCER1 uses an LVDT type positional transducer with amplified signal to enable precise control of the restrictor and the set flow rate, thus improving repeatability and hysterisis characteristics.

The transducer is fitted coaxially on the proportional solenoid and the connector features 360° positioning.

Technical specifications and connections are indicated here beside.

The transducer is protected against polarity inversion on the power line.

Position transducer connection		Electronic card connections (see par. 10)
pin 1	supply 18 ÷ 36 V	pin 8c
pin 2	output 2 ÷ 10 V	pin 24a
pin 3	0 V	pin 22c
pin 4	NC	NC



7 - STEP RESPONSE (measured with mineral oil with viscosity of 36 cSt at 50°C with UEIK-11RSQ/52-24 electronic control unit)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical response times with valve flow rate of 16 l/min and with input pressure of 100 bar.

REFERENCE SIGNAL STEP	0 → 100%	100 → 0%	25→100%	100→25%
Step response [ms]	180	150	150	120

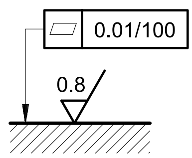
8 - INSTALLATION

RPCER1 valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

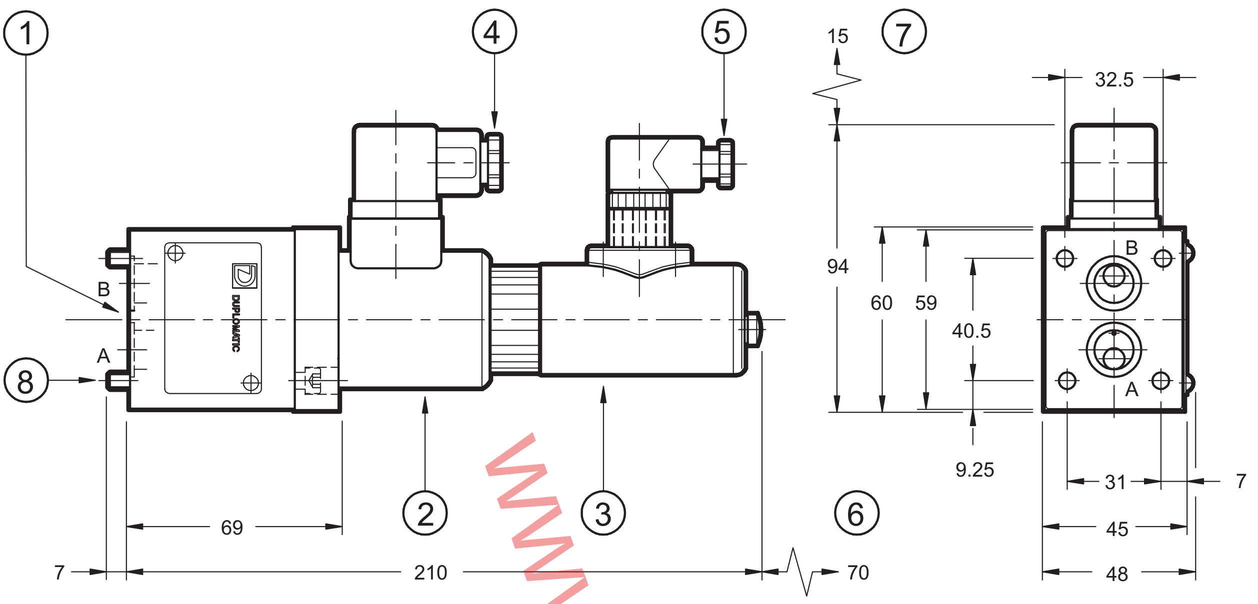
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and mounting surface.

Surface finishing



9 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: 2 ORM-0140-20 (14 x 2)
2	Proportional solenoid
3	Position transducer
4	DIN 43650 electrical connector for proportional solenoid
5	Electrical connector 4 pin M12 - IP67 PG7 for position transducer
6	Position transducer removal space
7	Connector removal space
8	4 bolts M5 x 65 included in the supply Torque: 5 Nm

Torque: 5 Nm

10 - ELECTRONIC CONTROL UNIT

UEIK-11RSQ/52-24	Eurocard format	see cat. 89 315

11 - SUBPLATES (see cat. 51 000)

Type	PMRPC1-AI3G rear ports PMRPC1-AL3G side ports
Port dimensions	3/8” BSP

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RPCE2-*

PILOT OPERATED FLOW CONTROL VALVE WITH ELECTRIC PROPORTIONAL CONTROL

SERIES 52

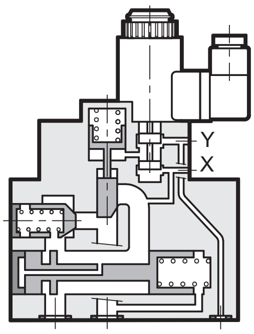
RPCE2-* **two-way**
RPCE2-*-T3 **three-way**

SUBPLATE MOUNTING
ISO 6263-06 (CETOP 06)

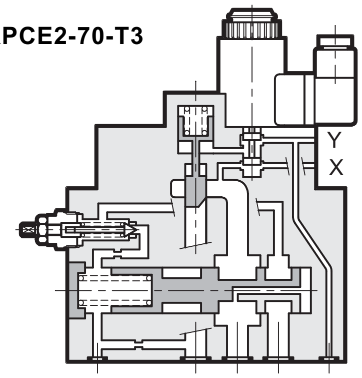
p max **250** bar
Q max (see performaces table)

OPERATING PRINCIPLE

RPCE2-*



RPCE2-70-T3



— RPCE2-* valves are two-way or three-way flow control valves with pressure and thermal compensation and electric proportional control with mounting interface in compliance with ISO 6263 (CETOP RP 121H) standards.

— These valves are normally used for flow rate control in hydraulic circuit branches and for speed control of hydraulic actuators.

— Flow rate can be modulated continuously in proportion to the current supplied to the solenoid.

— The valve can be controlled directly by a current control supply unit or by means of the relative electronic control units which enable optimal valve performance (see par. 12).

— The valves are available in four flow control ranges: three with progressive gain up to 60 l/min and the fourth with differential gain of 35 l/min.

— To ensure correct valve operation, maintain a minimum pilot control flow rate of 2 l/min and minimum pressure of 20 bar.

— Pilot control can be internal, with intake of oil from line E, or external from a line with 1/4" BSP connection on the pilot body.

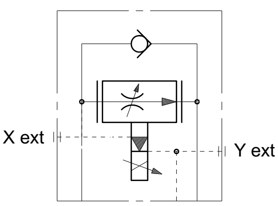
— Drainage is always external and must be connected directly to the tank without backpressure by means of subplate connection Y (OR ø 35) or by means of a line (1/4" BSP coupling) on the pilot body.

— The three-way version RPCE2-70-T3 allows flow control to the circuit by dumping the exceeding flow to the tank. Maximum pressure in the circuit is limited by means of a manual adjustment relief valve which operates on the compensator pilot.

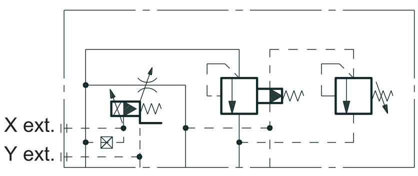
— RPCE2-70-T3 valve is also available in M version, which allows, by means of an electric control, to unload the total flow with a minimum pressure drop.

HYDRAULIC SYMBOLS

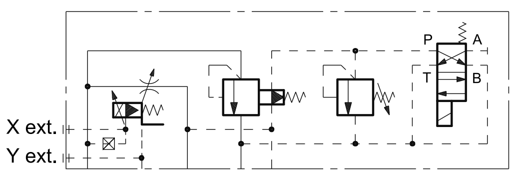
RPCE2-*



RPCE2-70-T3



RPCE2-70-T3M



1 - IDENTIFICATION CODES

1.1 - Identification code for two-way valve: RPCE2-*

R	P	C	E	2	-		/	C	/		/	52	-	24	/	

- Compensated flow control valve
- Electric proportional control
- ISO 6263-06 (CETOP 06) size
- Controlled flow rate:
  35 = 37 l/min **70** = 72 l/min
  30G = 35 l/min (with differential gain)
- Built-in check valve
- Pilot: omit for internal pilot
  E = external pilot
- Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged)
- Nominal solenoid voltage 24 VDC
- Seals:
  omit for NBR seals for mineral oil (**standard**)
  V = FPM seals for special fluids

1.2 - Identification code for three-way valve: RPCE2-70-T3

R	P	C	E	2	-	70	-	T3		/		/	52	-	24	/	

- Compensated flow control valve
- Electric proportional control
- ISO 6263-06 (CETOP 06) size
- Controlled flow rate:
  70 = 80 l/min
- Three-way version
- Unloading device:
  omit for version without device (**standard**)
  M = version with unloading valve
- Pilot: omit for internal pilot
  E = external pilot
- Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged)
- Nominal solenoid voltage 24 V DC
- Seals:
  omit for NBR seals for mineral oil (**standard**)
  V = FPM seals for special fluids

PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C and relevants electronic control units)

Maximum working pressure Minimum Δp across E and U ports Piloting pressures: min max	bar	250 10 20 160 (**NOTE 1**)
Maximum controlled flow E→U (RPCE2-*) Maximum controlled flow (RPCE2-70-T3) Minimum controlled flow with P=100 bar (versions 35 and 70) (version 30G) Maximum free reverse flow U→E	l/min	22 - 35 - 40 - 60 50 - 60 - 90 0,5 0,2 60 (**NOTE 2**)
Step response	see paragraph 8	
Hysteresis (with PWM 100 Hz)	% of Q_{max}	< 8%
Repeatability	% of Q_{max}	< ±3%
Electrical features	see paragraph 7	
Ambient temperature range	°C	-10 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: RPCE2-* RPCE2-70-T3 RPCE2-70-T3M	kg	7,2 9

NOTE 1: Pilot must be external if the valve is used with line pressure over 160 bar.

NOTE 2: Maximum recommended flow U→E through the check valve (only for two-way version).

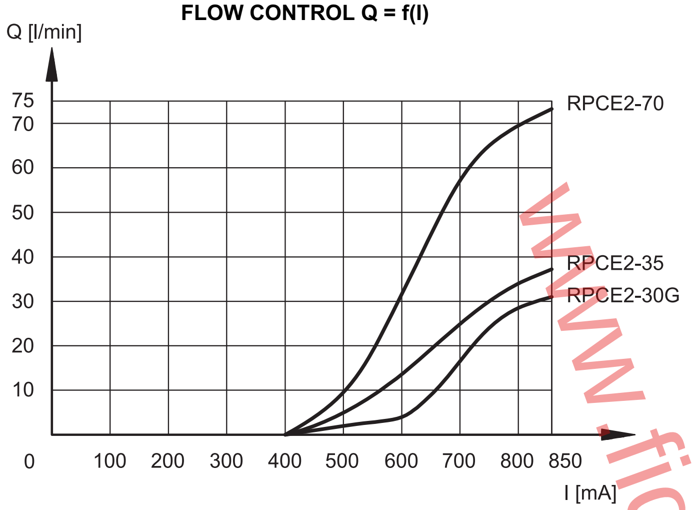
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

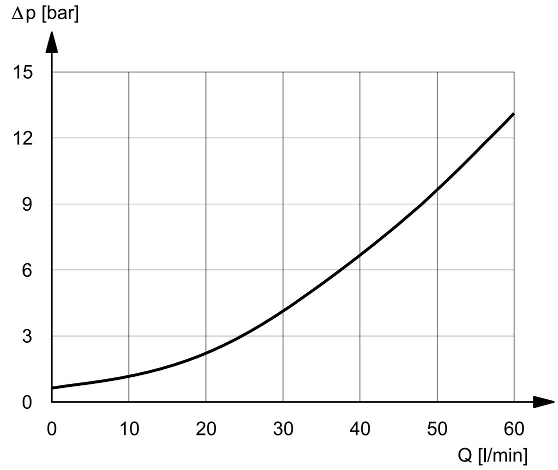
4 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

4.1 2-way valve

FLOW CONTROL Q = f(I)



PRESSURE DROPS Δp= f(Q)

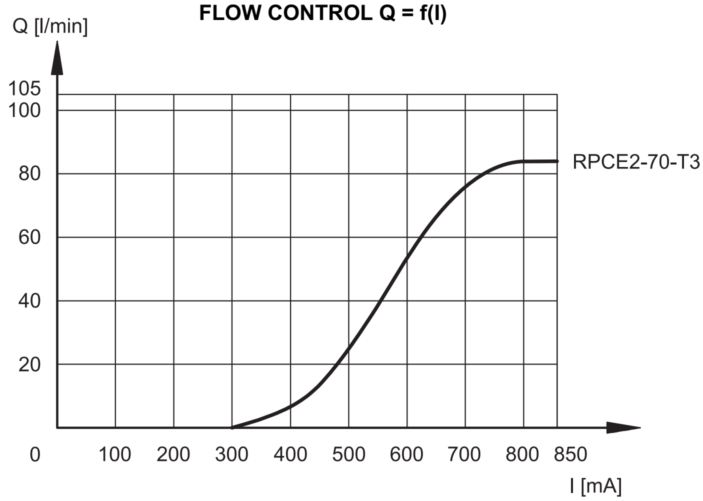


Typical flow control curves for flow rate E → U according to the current supplied to the solenoid.
The RPCE2-G version, featuring differential gain control, is particularly suitable for "FAST-SLOW" flow rate control as it ensures high sensitivity at low flow rates while enabling high flow rates for rapid actuator movement.

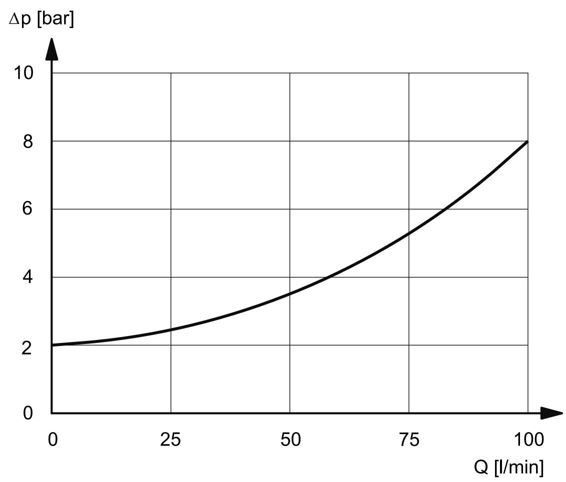
Pressure drops with free flow U → E through check valve.

4.2 - 3-way valve

FLOW CONTROL Q = f(I)



PRESSURE DROPS Δp= f(Q)



Typical flow control curves for flow rate E → T , according to the current supplied to the solenoid.

Pressure drops E → T
Curve obtained with unloading electrical control (RPCE2-70-T3M)

5 - PRESSURE COMPENSATION

The valves are equipped with two restrictors. The first is an opening which can be adjusted by the proportional solenoid; the second, controlled by the pressure upstream and downstream of the first restrictor ensures constant pressure drop across the adjustable restrictor. In these conditions, the set flow rate value is maintained constant within a tolerance range of ±3% of the set flow rate for maximum pressure variation between the valve inlet and outlet chambers.

6 - THERMAL COMPENSATION

A temperature-sensitive device installed on the flow control element corrects the position and maintains the set flow rate virtually unchanged, also in the case of fluid viscosity variation.
Flow rate variation remains within 2,5% of the set flow rate, for a fluid temperature variation of 10°C

7 - ELECTRICAL CHARACTERISTICS

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	**24**
RESISTANCE (at 20°C)	Ω	16.6
MAXIMUM CURRENT	A	0.85
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108 CE	
CLASS OF PROTECTION:		
Atmospheric agents (CEI EN 60529)	IP 65	
Coil insulation (VDE 0580)	class H	
Impregnation	class F	

8 - STEP RESPONSE (with mineral oil with viscosity of 36 cSt at 50°C and relevants electronic control units)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.
The table shows typical response times measured with valves "S" (40 l/min) and with an input pressure of 100 bar.

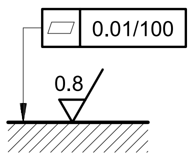
REFERENCE SIGNAL STEP	0 → 100%	100 → 0%
Step response [ms]	250	120

9 - INSTALLATION

The RPCE2-* valve, both two-way or three-way versions, can be installed in any position without impairing correct operation.
Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.

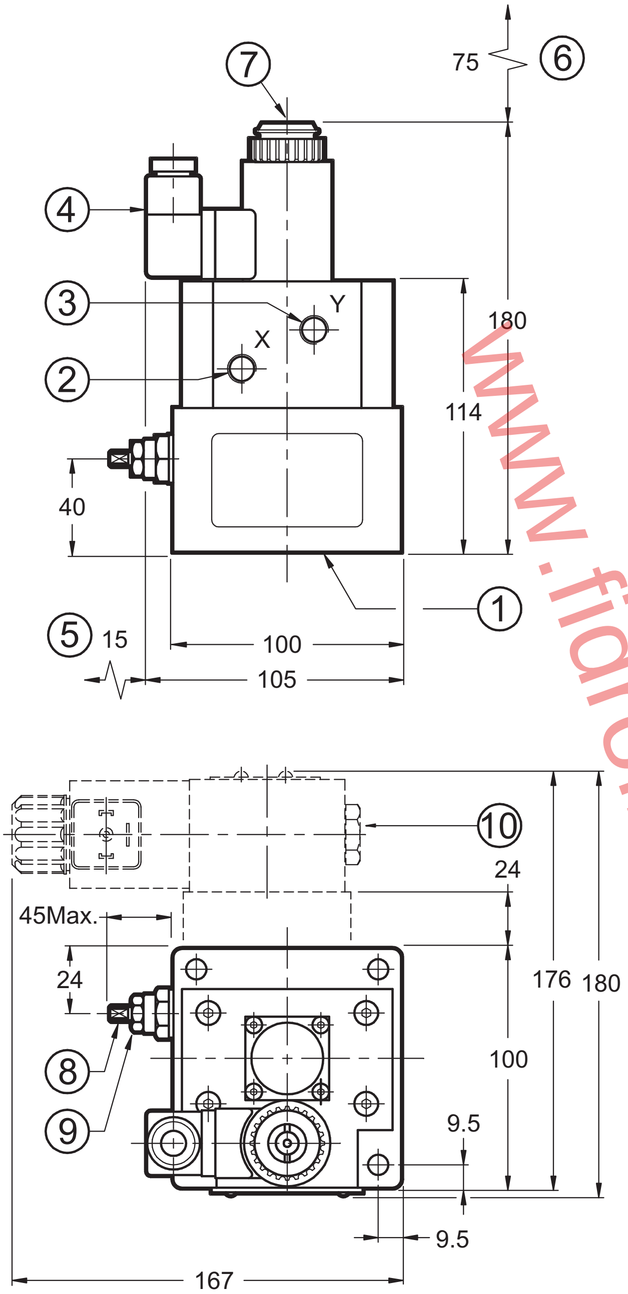
Surface finishing



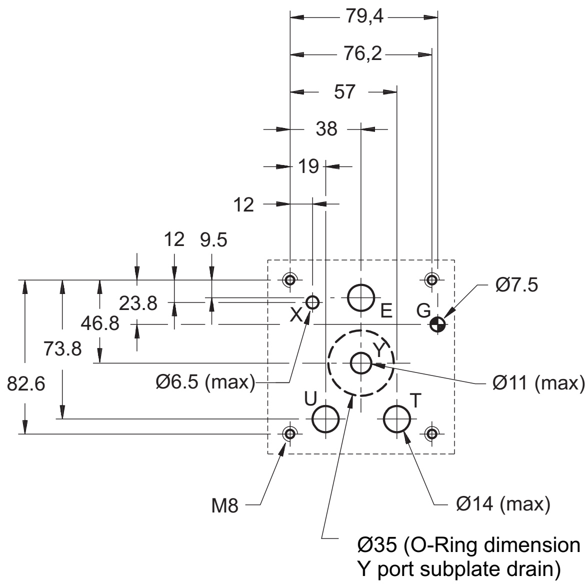
10 - ELECTRONIC CONTROL UNITS

EDC-111	for solenoid 24V DC	plug version	see cat.89 120
EDM-M111	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250

11 - OVERALL AND MOUNTING DIMENSIONS THREE-WAY VALVES RPCE2-70-T3 and RPCE2-70-T3M



MOUNTING SURFACE:
ISO 6263-06-07-*-97 (CETOP 4.5.2-3-06-250)

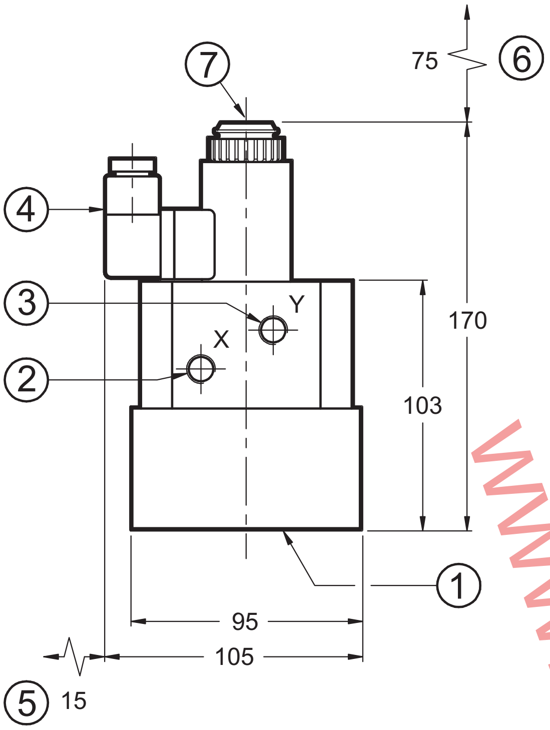


dimensions in mm

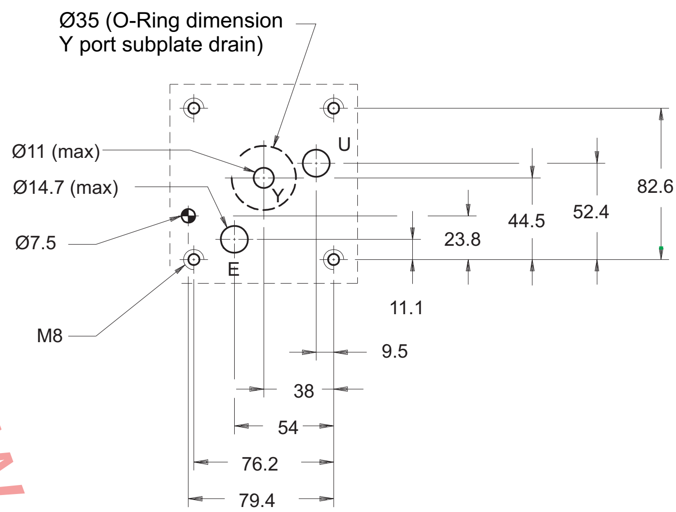
1	Mounting surface with sealing rings: 3 OR type 119 (15.08x2.62) 1 OR type 2125 (31.47x1.78) 1 OR type 109 (19.13x2.62)
2	External pilot port X: 1/4” BSP
3	Drain port Y: 1/4” BSP if mounting interface port is not used
4	DIN 43650 electric connector
5	Connector removal space
6	Coil removal space
7	Breather (male hexagonal spanner 4)
8	Pressure relief valve - adjustment screw: square spanner 6 - pressure adjustment range up to 210 bar - default setting: minimum
9	Locking nut: spanner 13
10	Unloading solenoid valve type DS3-TB (only for version RPCE2 -*-T3M) - solenoid valve OFF = flow unloading at minimum pressure - solenoid valve ON = unloading pressure controlled by pressure relief valve 8

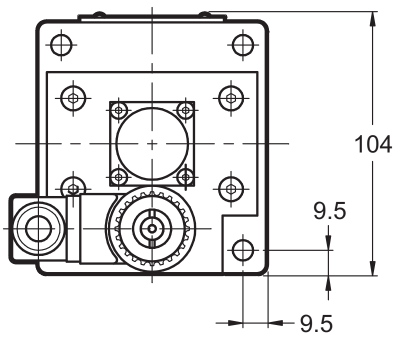
Fastening bolts: 4 bolts M8x75
Torque: 20 Nm

12 - OVERALL AND MOUNTING DIMENSION TWO-WAY VALVE RPCE2-*



MOUNTING SURFACE:
ISO 6263-06-05-*-97 (CETOP 4.5.2-2-06-250)





dimensions in mm

1	Mounting surface with sealing rings: 2 OR type 119 (15.08x2.62) 1 OR type 2125 (31.47x1.78)
2	External pilot port X: 1/4” BSP
3	Drain port Y: 1/4” BSP if mounting interface port is not used
4	DIN 43650 electric connector
5	Connector removal space
6	Coil removal space
7	Breather (male hexagonal spanner 4)

Fastening bolts: 4 bolts M8x60
Torque: 20 Nm

13 - SUBPLATES (see catalogue 51 000)

The valve must have the Y drain with external pipe when using the subplates listed below.

	RPCE2-* two way version	**RPCE2-*-T3** three way version
Type	PMRPC2-AI4G rear ports	PMRPCQ2-AI4G rear ports
E, U, T ports threading	1/2” BSP	1/2” BSP
X port threading	-	1/4” BSP

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RPCE3-*

PILOT OPERATED FLOW CONTROL VALVE WITH ELECTRIC PROPORTIONAL CONTROL

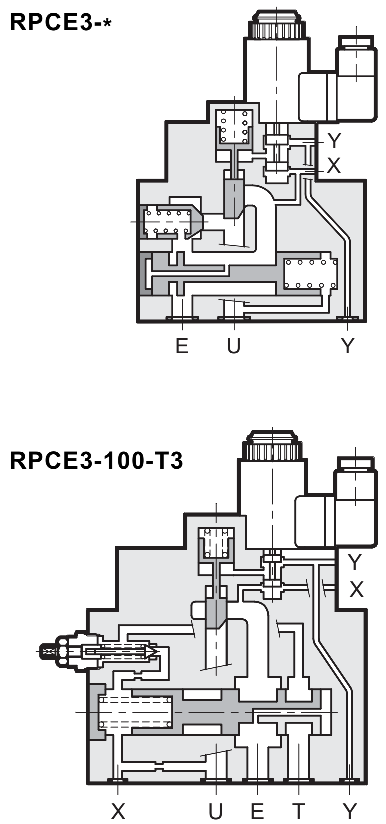
SERIES 52

RPCE3- *	**two-way**
RPCE3-100 -T3	**three-way**

SUBPLATE MOUNTING
ISO 6263-07 (CETOP 07)

p max **250** bar
Q max (see performances table)

OPERATING PRINCIPLE



— RPCE3-* valves are two-way or three-way flow control valves with pressure and thermal compensation and electric proportional control with mounting interface in compliance with ISO 6263 (CETOP RP 121H) standards.

— These valves are normally used for flow rate control in hydraulic circuit branches and for speed control of hydraulic actuators.

— Flow rate can be modulated continuously in proportion to the current supplied to the solenoid.

— The valve can be controlled directly by a current control supply unit or by means of the relative electronic control units which enable optimal valve performance (see paragraph 12).

— The valves are available in two flow control ranges of 100 l/min, with progressive gain or with differential gain.

— To ensure correct valve operation, maintain a minimum pilot control flow rate of 2 l/min and minimum pressure of 20 bar.

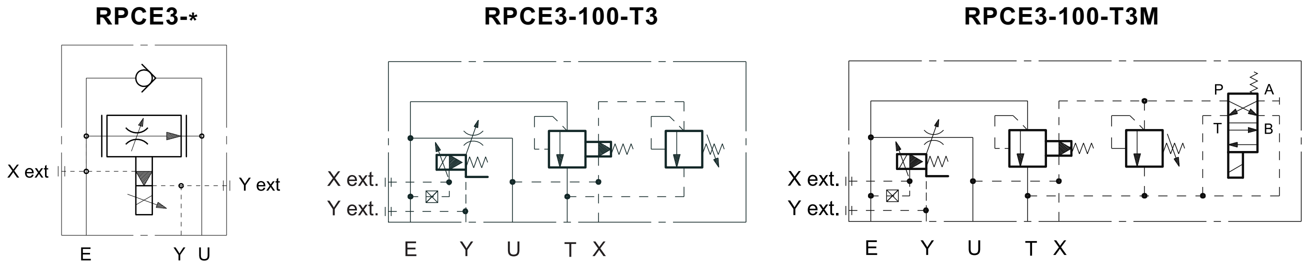
— Pilot control can be internal, with intake of oil from line E, or external from a line with 1/4" BSP connection on the pilot body.

— Drainage is always external and must be connected directly to the tank without backpressure by means of subplate connection Y (OR Ø32) or by means of a line (1/4" BSP coupling) on the pilot body.

— The three-way version RPCE3-100-T3 allows flow control to the circuit by dumping the exceeding flow to the tank. Maximum pressure in the circuit is limited by means of a manual adjustment relief valve which operates on the compensator pilot.

— RPCE3-100-T3 valve is also available in /M version, which allows, by means of an electric control, to unload the total flow with a minimum pressure drop.

HYDRAULIC SYMBOLS



1 - IDENTIFICATION CODES

1.1 - Identification code for two-way valve: RPCE3-*

R	P	C	E	3	-		/	C	/		/	52	-	24	/	

- Compensated flow control valve
- Electric proportional control
- ISO 6263-07 (CETOP 07) size
- Controlled flow rate:
  100 = 100 l/min
  100G = 100 l/min (with differential gain)
- Built-in check valve
- Pilot: omit for internal pilot
  E = external pilot
- Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged)
- Nominal solenoid voltage 24 V DC
- Seals:
  omit for NBR seals for mineral oil (**standard**)
  V = FPM seals for special fluids

1.2 - Identification code for three-way valve: RPCE3-100-T3

R	P	C	E	3	-	100	-	T3		/		/	52	-	24	/	

- Compensated flow control valve
- Electric proportional control
- ISO 6263-07 (CETOP 07) size
- Controlled flow rate:
  100 = 100 l/min
- Three-way version
- Unloading device:
  Omit for version without device (**standard**)
  M = version with unloading valve
- Pilot: omit for internal pilot
  E = external pilot
- Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged)
- Nominal solenoid voltage 24 V DC
- Seals:
  omit for NBR seals for mineral oil (**standard**)
  V = FPM seals for special fluids

PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C and the related electronic control units)

Maximum working pressure Minimum Δp across E and U ports Piloting pressures: min max	bar	250 10 20 160 (**NOTE 1**)
Maximum controlled flow E→U (RPCE3-*) Minimum controlled flow with P=100 bar (version 100) (version 100G) Maximum free reverse flow U→E	l/min	100 1,5 0,5 150 (**NOTE 2**)
Step response	see paragraph 8	
Hysteresis (with PWM 100 Hz)	% of Q_{max}	< 8%
Repeatability	% of Q_{max}	< ±3%
Electrical features	see paragraph 7	
Ambient temperature range	°C	-10 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: RPCE3-* RPCE3-100-T3 RPCE3-100-T3M	kg	10,8 12,6

NOTE 1: Pilot must be external if the valve id used with line pressure over 160 bar.

NOTE 2: Maximum recommended flow U→E through the check valve (only for two-way version)

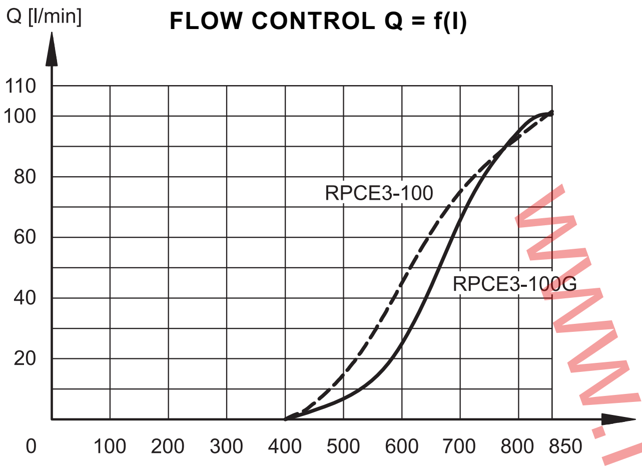
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

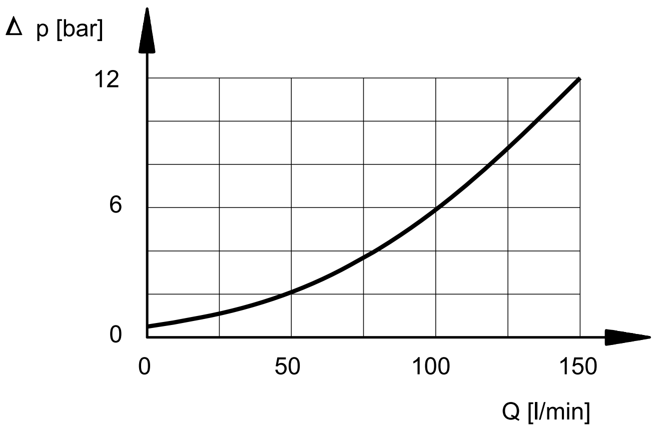
4 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

4.1 2-way valve

FLOW CONTROL Q = f(I)



PRESSURE DROPS Δp= f(Q)

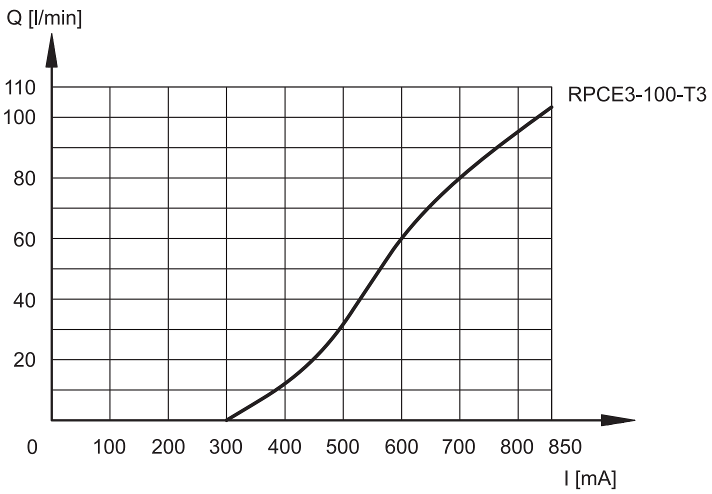


Typical flow control curves for flow rate E→U , according to the current supplied to the solenoid.
The RPCE3-100G version, featuring differential gain control, is particularly suitable for “FAST-SLOW” flow rate control as it ensures high sensitivity at low flow rates while enabling high flow rates for rapid actuator movement.

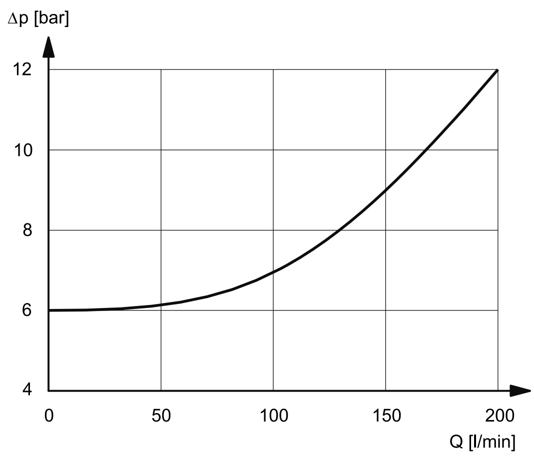
Pressure drops with free flow U→E through the check valve

4.1 3-way valve

FLOW CONTROL Q = f(I)



PRESSURE DROPS Δp= f(Q)



Typical flow control curves for flow rate E→U , according to the current supplied to the solenoid.

Pressure drops E→T (only for three-way versions)
Curve obtained with unloading electrical control (RPCE3-100-T3M)

5 - PRESSURE COMPENSATION

The valves are equipped with two restrictors. The first is an opening which can be adjusted by the proportional solenoid; the second, controlled by the pressure upstream and downstream of the first restrictor ensures constant pressure drop across the adjustable restrictor. In these conditions, the set flow rate value is maintained constant within a tolerance range of ±3% of the set flow rate for maximum pressure variation between the valve inlet and outlet chambers.

6 - THERMAL COMPENSATION

A temperature-sensitive device installed on the flow control element corrects the position and maintains the set flow rate virtually unchanged, also in the case of fluid viscosity variation.
Flow rate variation remains within 2,5% of the set flow rate, for a fluid temperature variation of 10°C.

7 - ELECTRICAL CHARACTERISTICS

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut and can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	**24**
RESISTANCE (at 20°C)	Ω	16.6
MAXIMUM CURRENT	A	0.85
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE	
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529)	IP 65	

8 - STEP RESPONSE (with mineral oil with viscosity of 36 cSt at 50°C with the related electronic control units)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.
The table shows typical response times measured with valves "S" (150 l/min) and with an input pressure of 100 bar.

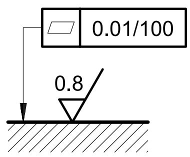
REFERENCE SIGNAL STEP	0 →100%	100% →0
Step response [ms]	250	120

9 - INSTALLATION

The RPCE3 valve, both two-way or three-way versions, can be installed in any position without impairing correct operation.
Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.

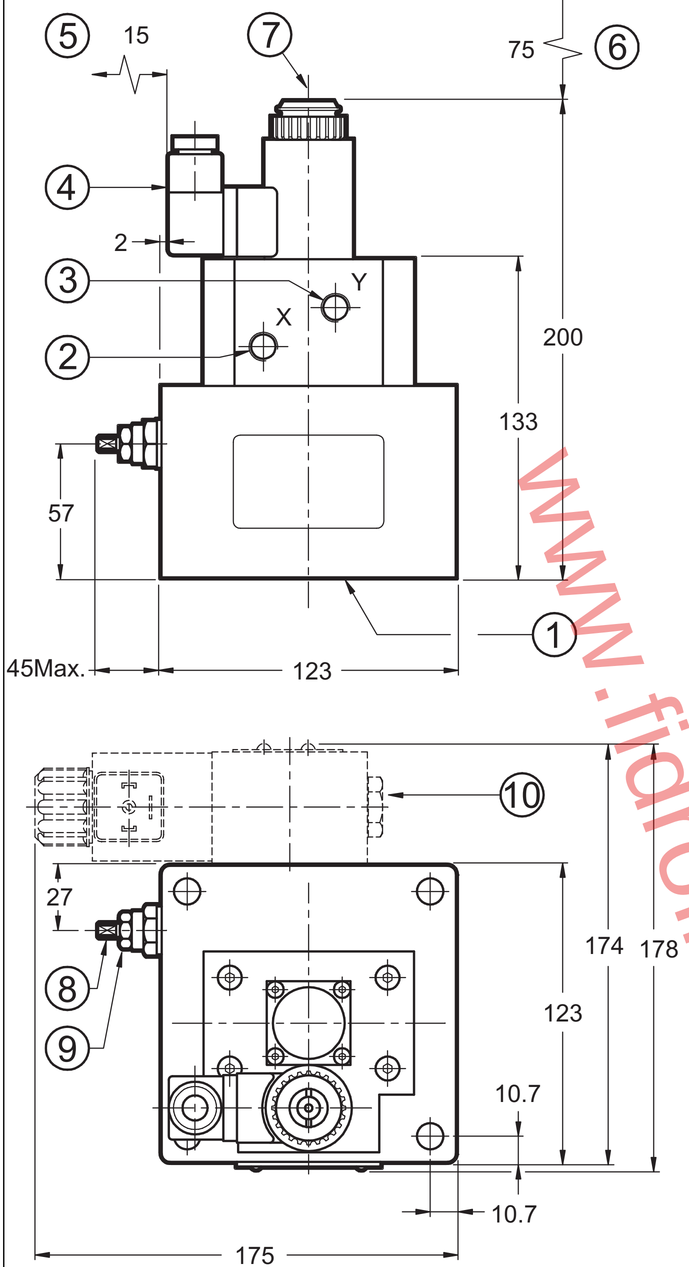
Surface finishing



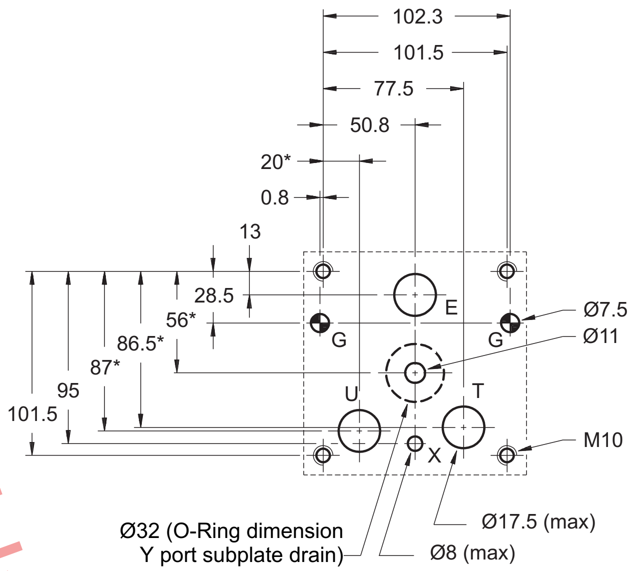
10 - ELECTRONIC CONTROL UNITS

EDC-111	for solenoid 24V DC	plug version	see cat.89 120
EDM-M111	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250

11 - OVERALL AND MOUNTING DIMENSIONS THREE-WAY VALVES RPCE3-100-T3 and RPCE3-100-T3M



MOUNTING SURFACE: ISO 6263-07-11-*-97
(CETOP 4.5.2-3-07-250)



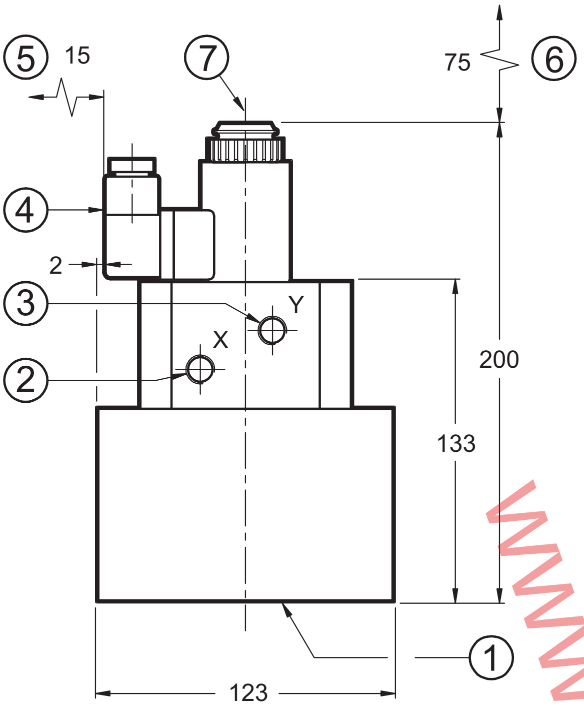
NOTE = The dimension with the asterisk * are slightly different from ISO (CETOP) standards.

dimensions in mm

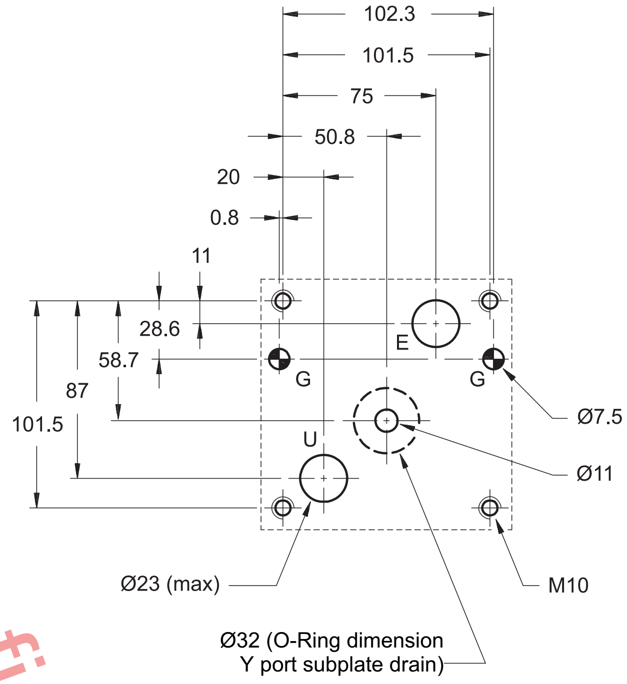
1	Mounting surface with sealing rings: N. 3 OR type 3106 (26.65x2.62) N. 1 OR type 2112 (28.30x1.78) N. 1 OR type 3050 (12.37x2.62)
2	External pilot port X: 1/4” BSP
3	Drain port Y: 1/4” BSP if mounting interface port is not used
4	DIN 43650 electric connector
5	Connector removal space
6	Coil removal space
7	Breather (hexagonal male spanner 4)
8	Pressure relief valve - adjustment screw: square spanner 6 - pressure adjustment range up to 210 bar - default setting: minimum
9	Locking nut: spanner 13
10	Unloading solenoid valve type DS3-TB (only for version RPCE3 -*-T3M) - solenoid valve OFF = flow unloading at minimum pressure - solenoid valve ON = unloading pressure controlled by pressure relief valve 8

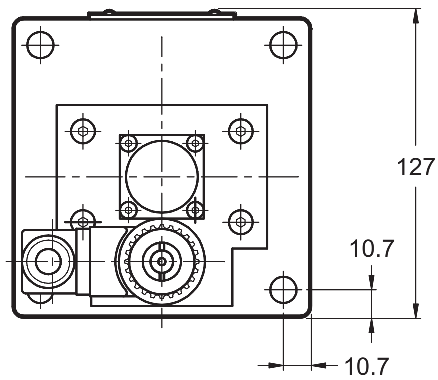
Fastening bolts: 4 bolts M10x90
Torque: 40 Nm

10 - OVERALL AND MOUNTING DIMENSIONS TWO-WAY VALVE RPCE3



MOUNTING SURFACE: ISO 6263-07-09-*-97
(CETOP 4.5.2-2-07-250)





Fastening bolts: 4 bolts M10x90
Torque: 40 Nm

dimensions in mm

1	Mounting surface with sealing rings: N. 2 OR type 3106 (26.65x2.62) N. 1 OR type 2112 (28.30x1.78)
2	External pilot port X: 1/4" BSP
3	Drain port Y: 1/4" BSP if mounting interface port is not used
4	DIN 43650 electric connector
5	Connector removal space
6	Coil removal space
7	Breather (hexagonal male spanner 4)

13 - SUBPLATES (see catalogue 51 000)

The valve must have the Y drain with external pipe when using the subplates listed below.

	RPCE3-* two way version	**RPCE3-*-T3** three way version
Type	PMRPC3-AI6G rear ports	PMRPCQ3-AI6G rear ports
E, U, T ports threading	1" BSP	1" BSP
X port threading	-	1/4" BSP

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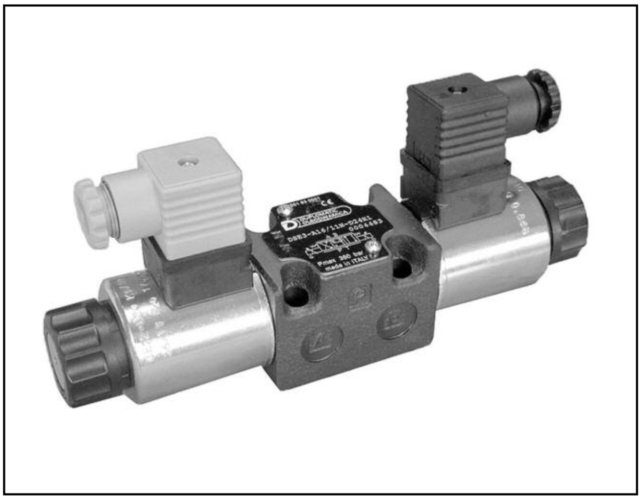
DSE3

DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL

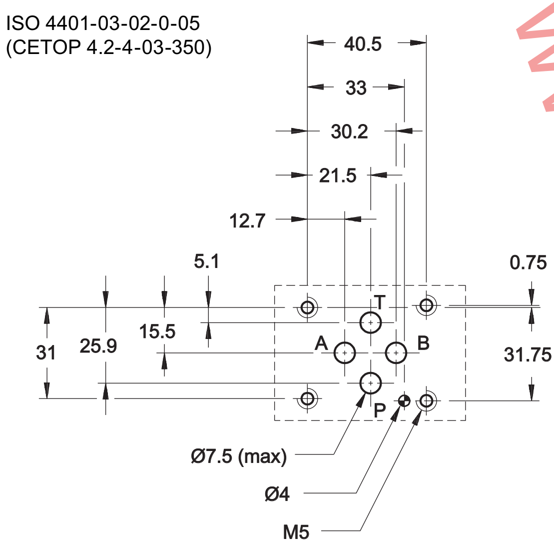
SERIES 11



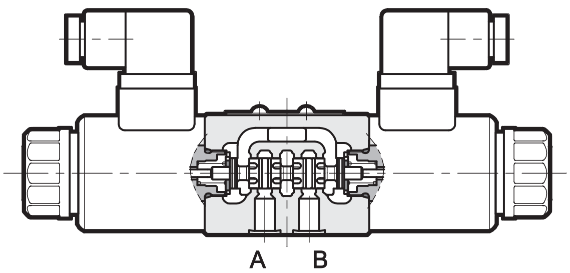
SUBPLATE MOUNTING
ISO 4401-03

p max **350** bar
Q max **40** l/min

MOUNTING SURFACE



OPERATING PRINCIPLE



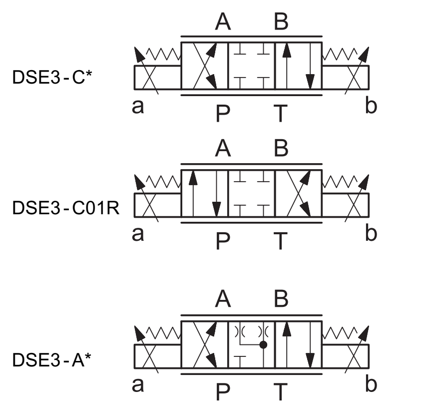
- The DSE3 valve is a direct operated directional control valve with electric proportional control and with ports in compliance with ISO 4401 standards.
- It is used for directional and speed control of hydraulic actuators.
- Valve opening and hence flow rate can be modulated continuously in proportion to the current supplied to the solenoid.
- The valve can be controlled directly by a current control supply unit or by means of the electronic control units to exploit valve performance to the full (see paragraph 11).
- Also available with several manual override.

PERFORMANCES

(values measured with viscosity of 36 cSt at 50°C with electronic control unit)

Max operating pressure: P - A - B ports T port	bar	350 210
Maximum flow with Δp 10 bar P-T	l/min	1 - 4 - 8 - 16 - 26
Step response		see par. 5
Hysteresis (with PWM 200 Hz)	% Q_{max}	< 6%
Repeatability	% Q_{max}	< ± 1,5%
Electrical characteristics		see par. 4
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	1,6 2,0

HYDRAULIC SYMBOLS (typical)



1 - IDENTIFICATION CODE

D	S	E	3	-				/	11		-			/		

Direct operated directional control valve

Electric proportional control

Size ISO 4401-03

Spool type:
C = closed centers
A = open centers

Spool nominal flow. See par. 2

Solenoid position (omit for configuration with two solenoids):
SA = 1 solenoid on A side
SB = 1 solenoid on B side

Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

D12 = Nominal solenoid voltage 12V DC
D24 = Nominal solenoid voltage 24V DC

Coil electrical connection:
K1 = plug for connector type DIN 43650 (**standard**)
K7 = plug for connector type DEUTSCH DT04-2P male

Option: manual override (see at par. 8)

Option:
/ W7 = Zinc-nickel surface treatment (see **NOTE**)
Omit if not required

NOTE: The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing on the valve body makes the valve suitable to ensure a salt spray resistance up to 240 hours. (test operated according to EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

For a salt spray resistance up to 600 hours order the high corrosion resistance version.

1.2 - High corrosion resistance version

This version features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600 hours** (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

The coil are specific for this version, featuring a zinc-nickel surface treatment. Electrical features at paragraph 4.

The boot manual override (CM) is installed as standard in order to protect the solenoid tube.

Follow the indentification code below to order it:

D	S	E	3	-		/	11		-			/		/	W7

Choices as in standard identification code

DC power supply
D12 = 12 V
D24 = 24 V

Coil electrical connection
WK1 = plug for connector type DIN 43650
On request: plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S.

Manual override:
CM = manual override, boot protected (**standard**)
CS = screw override
CH = lever manual overide
CK = knob manual override

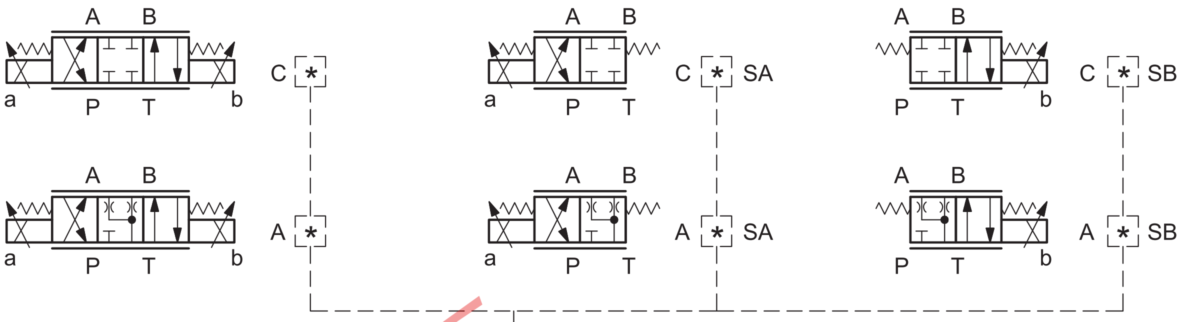
2 - CONFIGURATIONS

Valve configuration depends on the combination of the following elements:
number of proportional solenoids, spool type, nominal flow rate.

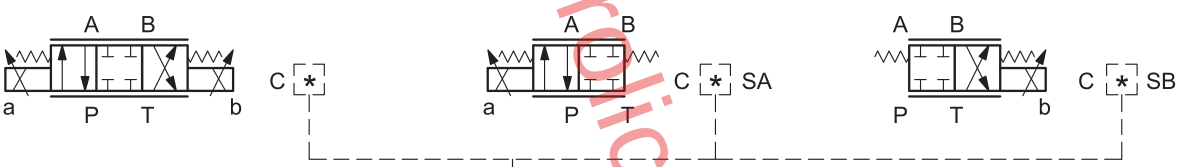
2 solenoids configuration:
3 positions with spring centering

"**SA**" configuration: 1 solenoid on side A.
2 positions (central + external) with
spring centering

"**SB**" configuration: 1 solenoid on side B.
2 positions (central + external) with
spring centering



*	Nominal flow with Δp10 bar P→T
04	4 l/min
08	8 l/min
16	16 l/min
16/08	16 (P→A) / 08 (B→T) l/min
26	26 l/min
26/13	26 (P→A) / 13 (B→T) l/min

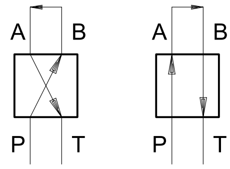


*	Nominal flow with Δp10 bar P→T
01R	1 l/min

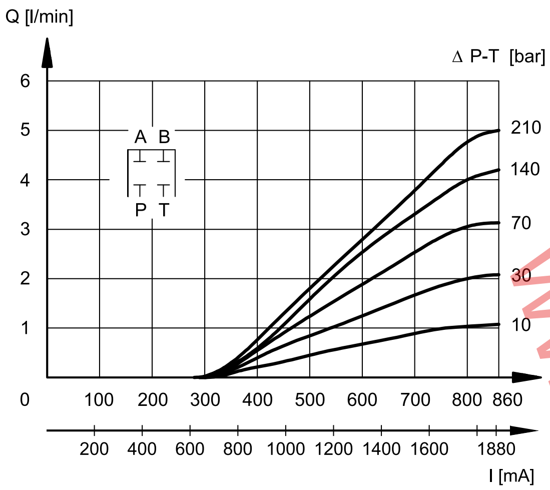
3 - CHARACTERISTIC CURVES

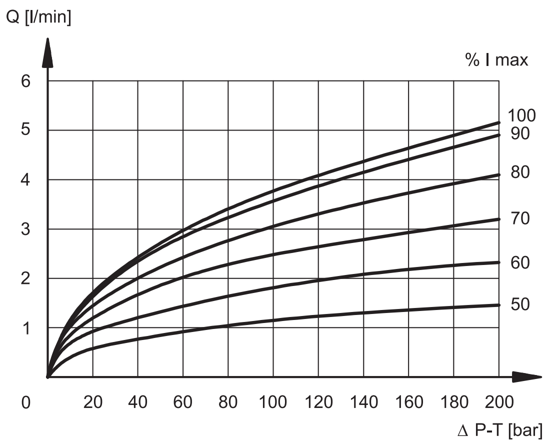
(values measured with viscosity of 36 cSt at 50°C with electronic control unit)

Typical flow rate control curves according to the current supply to solenoid. The reference Δp values are measured between ports P and T on the valve.

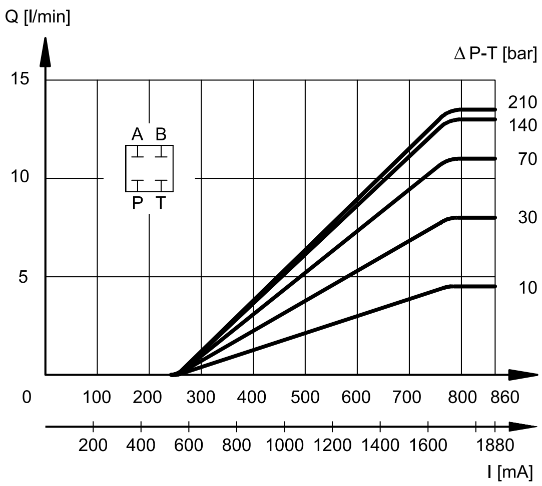


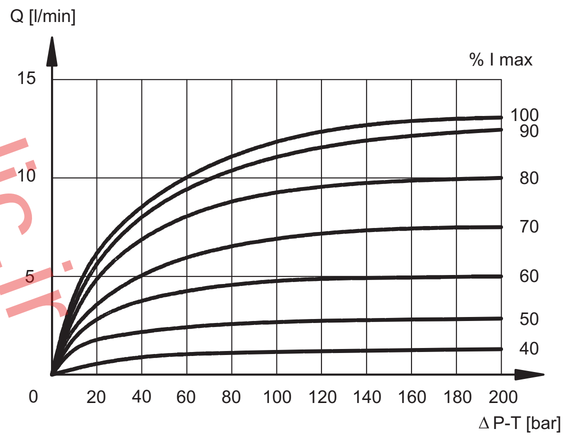
SPOOL TYPE C01R



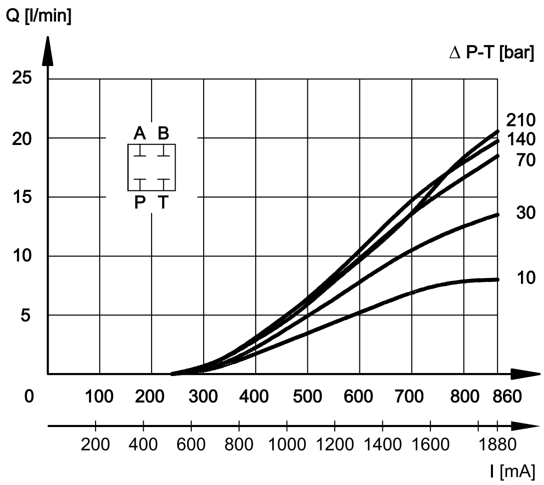


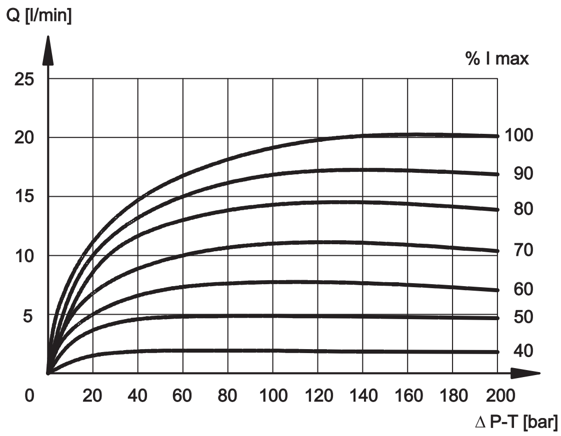
SPOOL TYPE C04



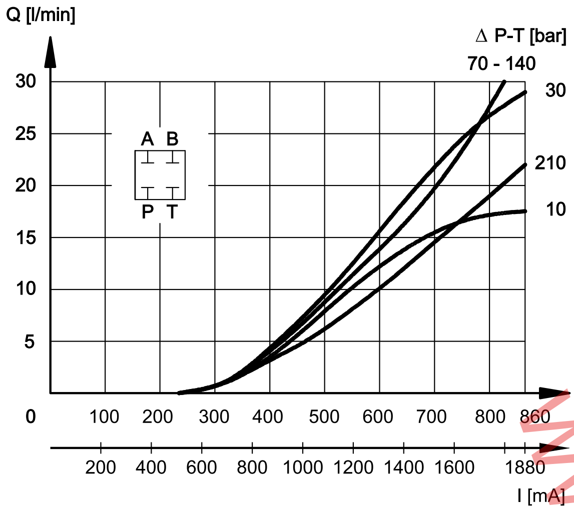


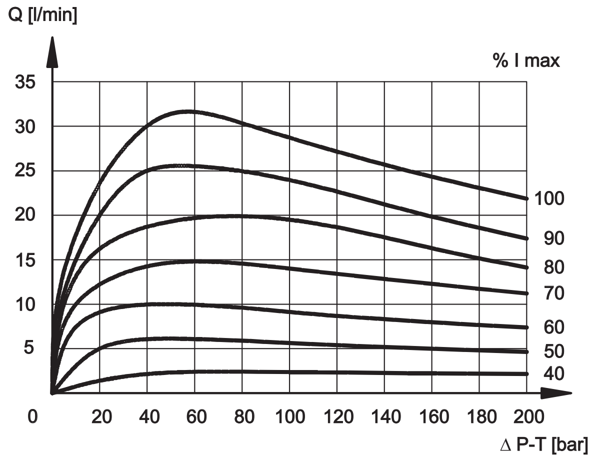
SPOOL TYPE C08



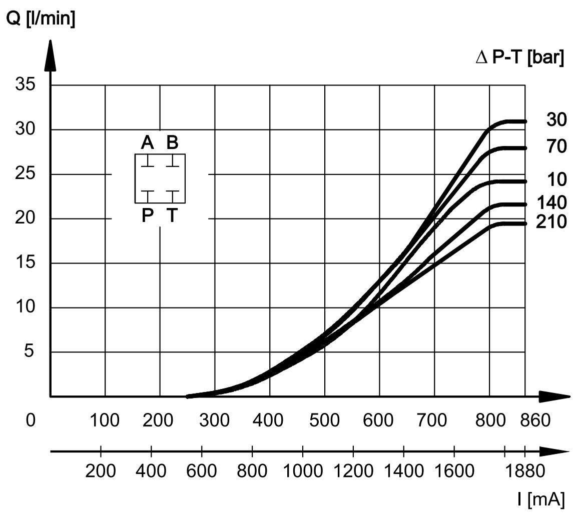


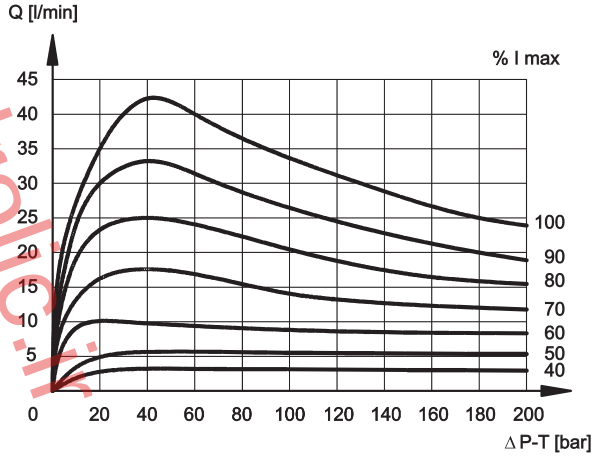
SPOOL TYPE C16



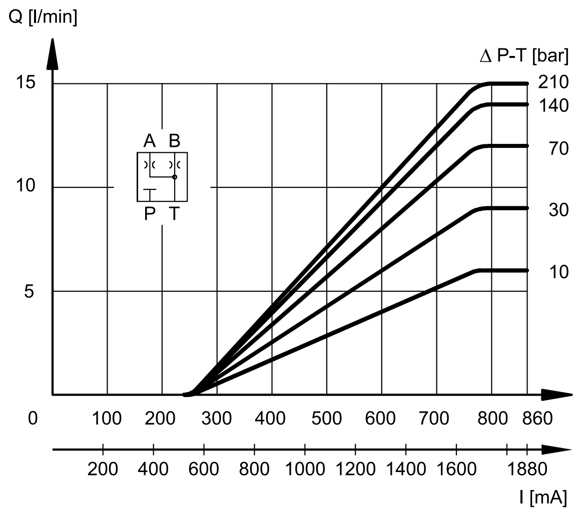


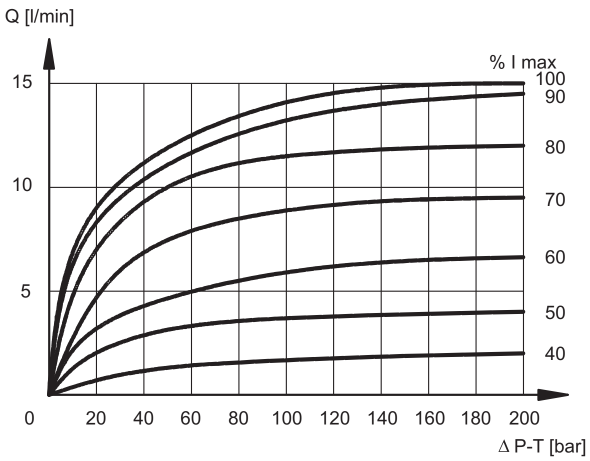
SPOOL TYPE C26



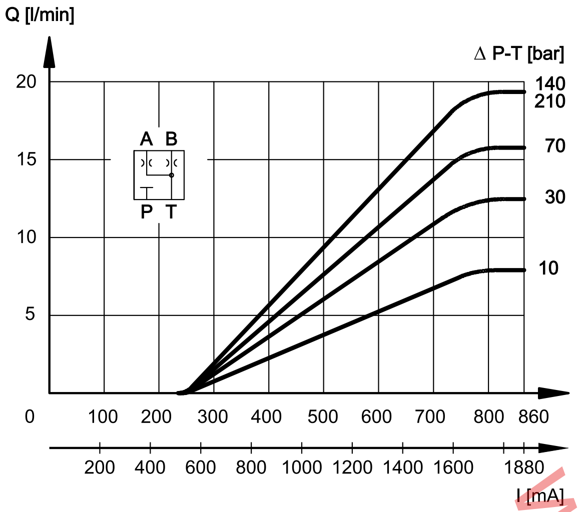


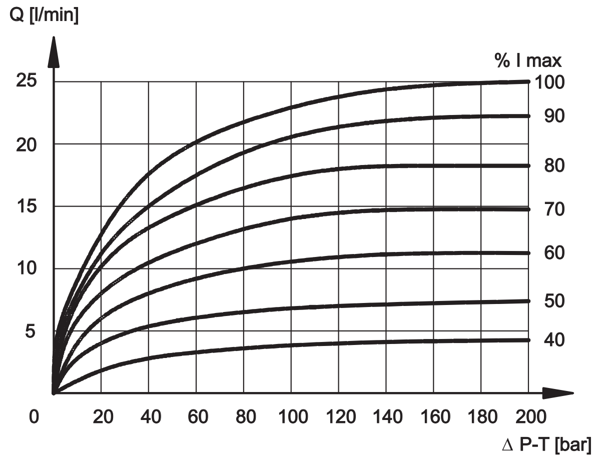
SPOOL TYPE A04



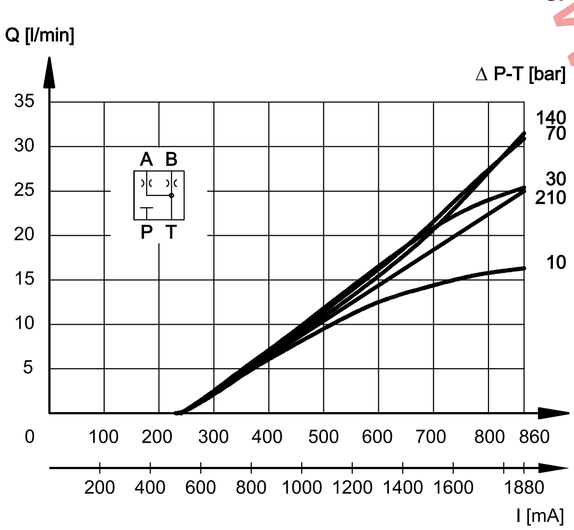


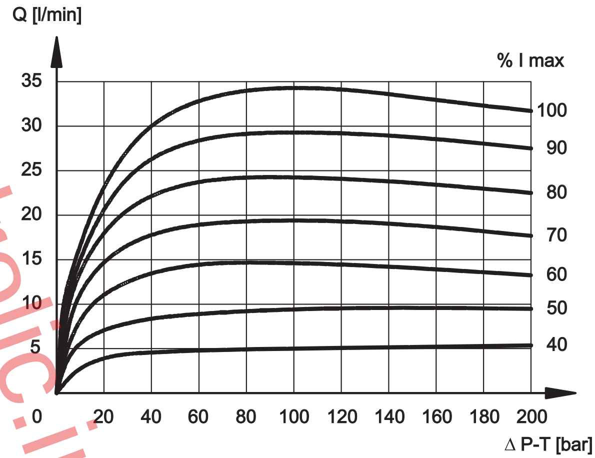
SPOOL TYPE A08



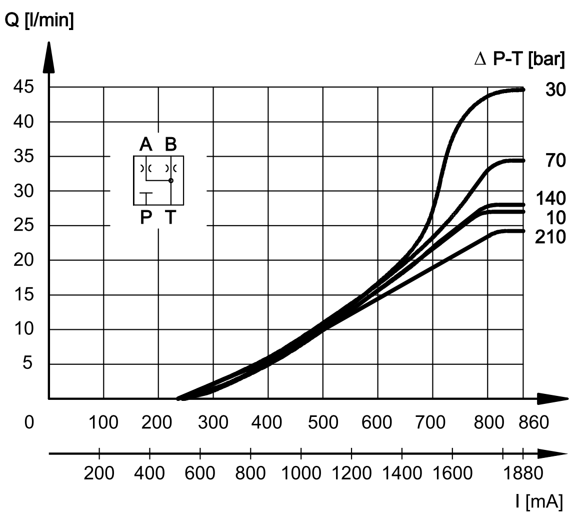


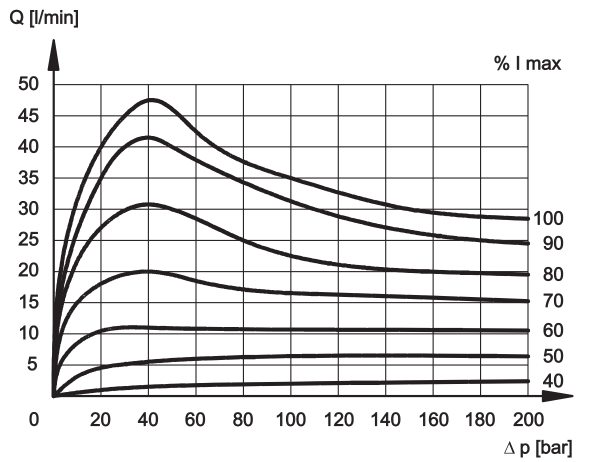
SPOOL TYPE A16





SPOOL TYPE A26





4 - ELECTRICAL CHARACTERISTICS

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut.

It can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	**12**	**24**
RESISTANCE (at 20°C) K1 coil K7 coil	Ω	3.66 4	17.6 19
NOMINAL CURRENT	A	1.88	0.86
DUTY CYCLE		100%	
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/EC		
CLASS OF PROTECTION : Coil insulation (VDE 0580) Impregnation:	class H class F		

Protection from atmospheric agents IEC EN 60529

Plug-in type	IP 65	IP 69 K
K1 DIN 43650	x (*)	
K7 DEUTSCH DT04 male	x	x (*)

(*) The protection degree is guaranteed only with the connector correctly connected and installed

5 - STEP RESPONSE

(measured with mineral oil with viscosity of 36 cSt at 50°C with electronic control unit)

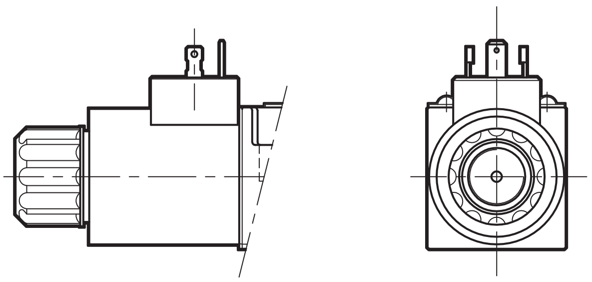
Step response is the time taken for the valve to reach 90% of the setted positioning value, following a step change of reference signal. The table shows typical response times tested with spool type C16 and Δp = 30 bar P-T.

REFERENCE SIGNAL STEP	0→100%	100%→0
Step response [ms]		
DSE3-A* **DSE3-C***	50	40

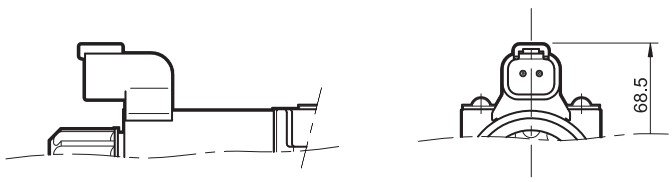
6 - ELECTRIC CONNECTIONS

Connectors for K1 connection are always delivered toghether with the valves.

connection for DIN 43650 connector
code **K1** (**standard**)
code **WK1** (W7 version only)

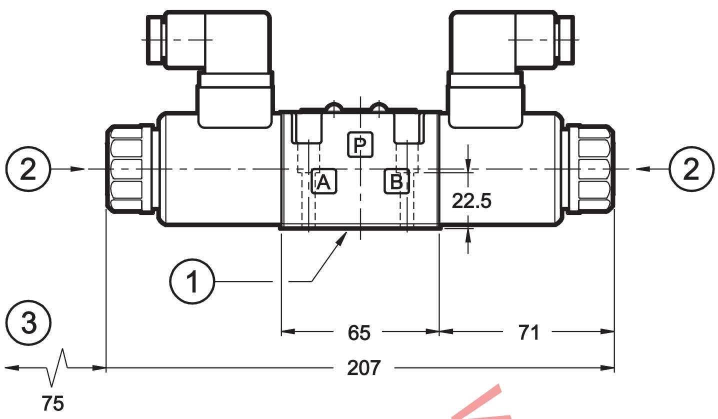


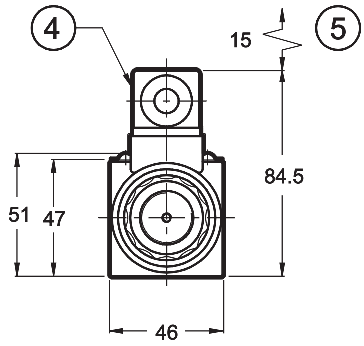
connection for
DEUTSCH DT06-2S male connector
code **K7**

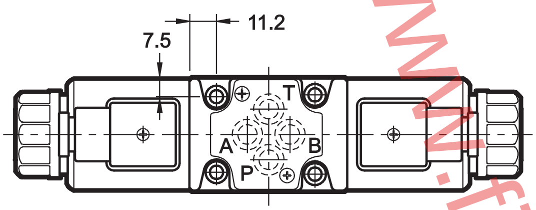


7 - OVERALL AND MOUNTING DIMENSIONS

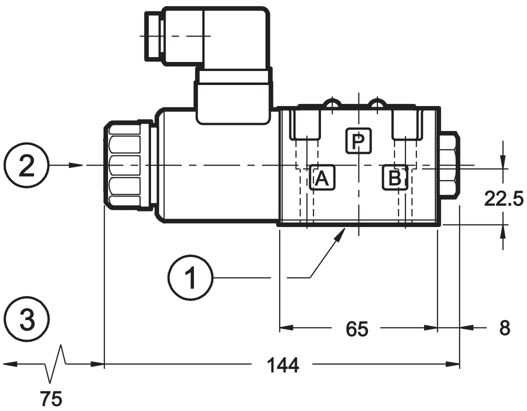
DSE3-A*
DSE3-C*

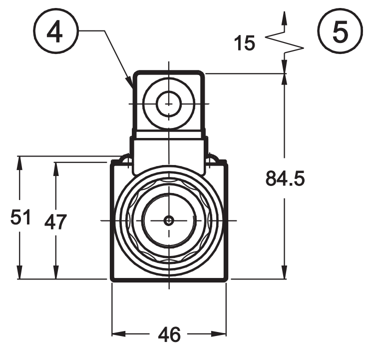




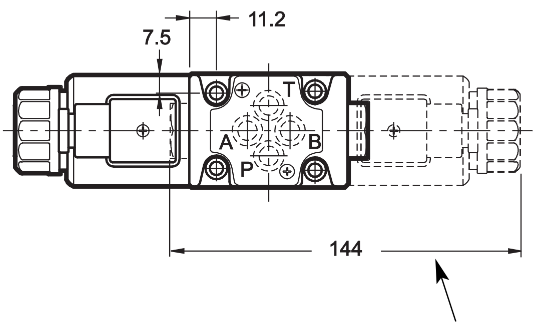


DSE3-A*SA
DSE3-C*SA





dimensions in mm



A*SB and C*SB versions solenoid position

1	Mounting surface with sealing rings: 4 OR type 2037 - 90 shore (9.25 x 1.78)
2	Standard manual override integrated in the solenoid tube see par. 9
3	Coil removal space
4	DIN 43650 electric coil connector
5	Connector removal space

Fastening bolts: 4 SHCS M5x30 - ISO 4762
Torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

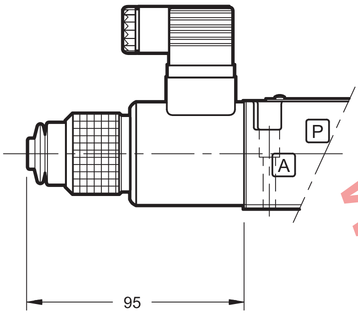
8 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

Four different manual override versions are available upon request:

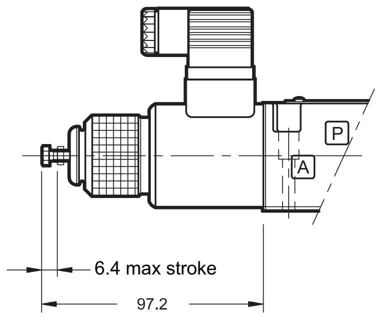
- **CM** version, manual override belt protected.
- **CS** version, with metal ring nut provided with a M4 screw and a blocking locknut to allow the continuous mechanical operations.
- **CH** version, lever manual override. The lever device is always placed at the A side of the valve.
- **CK** version, knob. When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.

CM Version



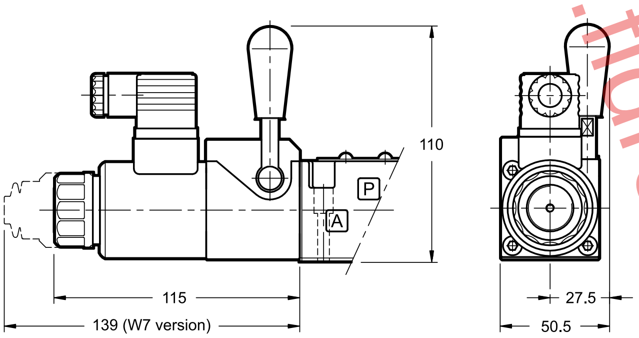
Code: 3803210003

CS Version

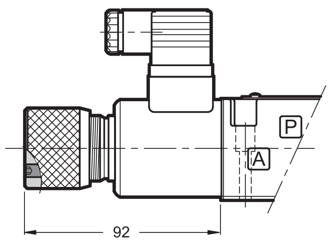


Code: 3803210004

CH Version



CK Version



Allen key for set screw: 3 mm
Code: 3803210005

9 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids like HL or HM type, according to ISO 6743-4. With this kind of fluids, use NBR seals type (code N). For HFDR fluids type (phosphate esters) use FPM seals (code V). For use with other kind of fluids such as HFA, HFB, HFC please consult our technical department.

Operation with fluid temperature exceeding 80°C causes premature deterioration of the quality of the fluid and seals. The physical and chemical properties of the fluid must be maintained.

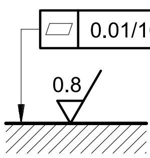
10 - INSTALLATION

DSE3 valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.

Surface finishing



11 - ELECTRONIC CONTROL UNITS

DSE3 - * * SA (SB)

EDC-112	for solenoid 24V DC	plug version	see cat.89 120
EDC-142	for solenoid 12V DC		
EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		

DSE3 - A*   DSE3 - C*

EDM-M212	24V DC solenoids	rail mounting DIN EN 50022	see cat. 89 250
EDM-M242	12V DC solenoids		

12 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G ports on rear
Type PMMD-AL3G side ports
P, T, A, B port threading: 3/8” BSP

DUPLOMATIC OLEODINAMICA

DUPLOMATIC OLEODINAMICA S.p.A.
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

DSE3B

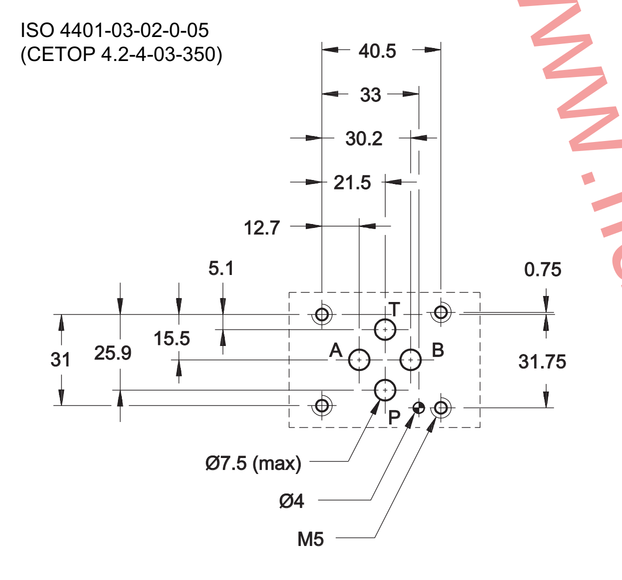
DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL

SERIES 10

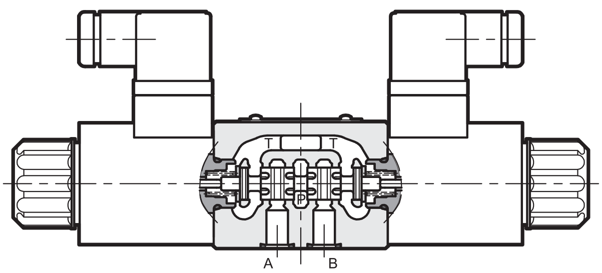
SUBPLATE MOUNTING
ISO 4401-03

p max **350** bar
Q max **40** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE

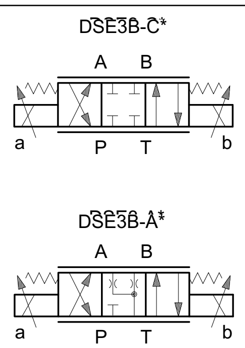


- The DSE3B valve is a directly operated directional control valve with electric proportional control and with ports, in compliance with ISO 4401-03 standards.
- It is used for directional and speed control of hydraulic actuators.
- Valve opening and hence flow rate can be modulated continuously in proportion to the current supplied to the solenoid.
- The valve can be controlled directly by a current control supply unit or combined with an external electronic card to exploit valve performance to the full (see par. 11).

PERFORMANCES (obtained with mineral oil with viscosity of 36 cSt at 50°C and with electronic control unit)

Max operating pressure: P - A - B ports T port	bar	350 160
Nominal flow with Δp 10 bar P-T	l/min	8 - 16 - 26
Step response		see chapter 5
Hysteresis (with PWM 200 Hz)	% Q_{max}	< 6%
Repeatability	% Q_{max}	< ± 2%
Electrical characteristics		see chapter 4
Ambient temperature range	°C	-20 / +50
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	1,6 2,0

HYDRAULIC SYMBOLS (typical)



1 - IDENTIFICATION CODE

D	S	E	3	B	-				/	10		-			/		

Directly operated directional control valve

Electric proportional control

Size ISO 4401-03

Spool type:
C = closed centers
A = open centers

Spool nominal flow (see paragraph 2)

Solenoid position (omit for configuration with two solenoids):
SA = 1 solenoid on side A
SB = 1 solenoid on side B

Option:
/ W7 = Zinc-nickel surface treatment (see **NOTE**)
Omit if not required

Option: manual override (see at par. 8)

Coil electrical connection:
K1 = plug for connector type DIN 43650 (**standard**)
K7 = plug DEUTSCH DT04-2P for male connector type DEUTSCH DT06-2S

D12 = Nominal solenoid voltage 12V DC
D24 = Nominal solenoid voltage 24V DC

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

NOTE: The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing on the valve body makes the valve suitable to ensure a salt spray resistance up to 240 hours. (test operated according to EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

For a salt spray resistance up to 600 hours order the high corrosion resistance version.

1.1 - High corrosion resistance version

This version features the zinc-nickel coating on all exposed metal parts of the valve, making it resistant to exposure to the salt spray for **600 hours** (test performed according to UNI EN ISO 9227 and assessment test performed according to UNI EN ISO 10289).

The coil are specific for this version, featuring a zinc-nickel surface treatment. Electrical features at paragraph 4.

The boot manual override (CM) is installed as standard in order to protect the solenoid tube.

Follow the indentification code below to order it:

D	S	E	3	B	-		/	10		-			/		/	W7

Choices as in standard identification code

DC power supply
D12 = 12 V
D24 = 24 V

Coil electrical connection
WK1 = plug for connector type DIN 43650
On request: plug DEUTSCH DT04-2P, for male connector type DEUTSCH DT06-2S.

Manual override:
CM = manual override, boot protected (**standard**)
CK = knob manual override

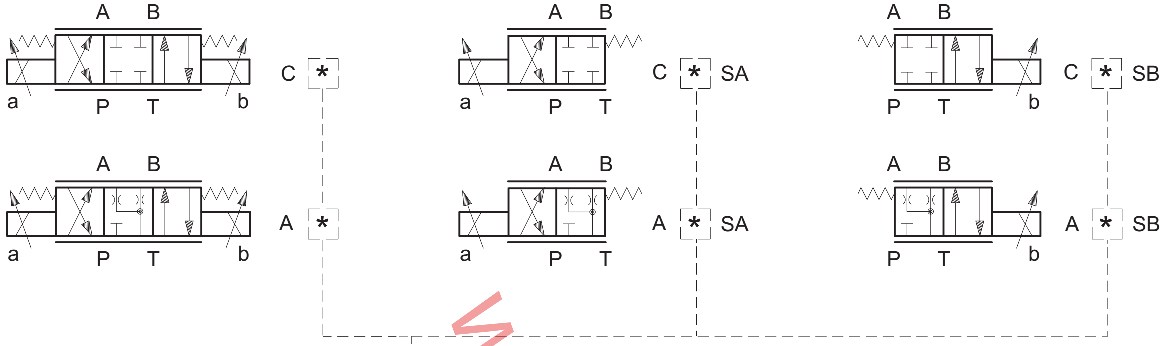
2 - CONFIGURATIONS

Valve configuration depends on the combination of the following elements:
number of proportional solenoids, spool type, nominal flow rate.

2 solenoids configuration:
3 positions with spring centering

"**SA**" configuration: 1 solenoid on side A.
2 positions (central + external) with spring centering

"**SB**" configuration: 1 solenoid on side B.
2 positions (central + external) with spring centering



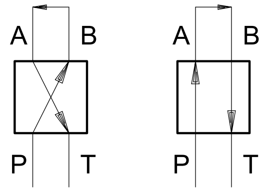
*	Controlled flow with Δp10 bar P-T
08	8 l/min
16	16 l/min
26	26 l/min

3 - CHARACTERISTIC CURVES

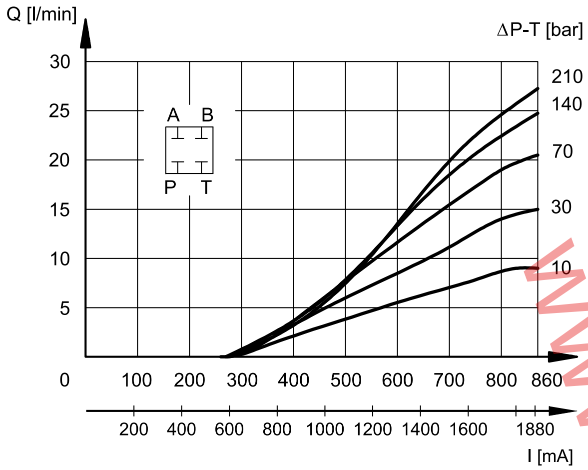
(values measured with viscosity of 36 cSt at 50°C with electronic control unit)

Typical constant flow rate control curves at Δp according to current supply to solenoid (D24 version, maximum current 860 mA), measured for the various spool types available.

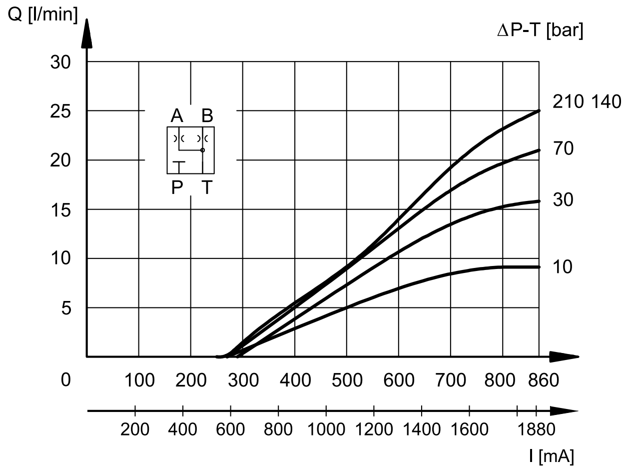
The reference Δp values are measured between ports P and T on the valve.



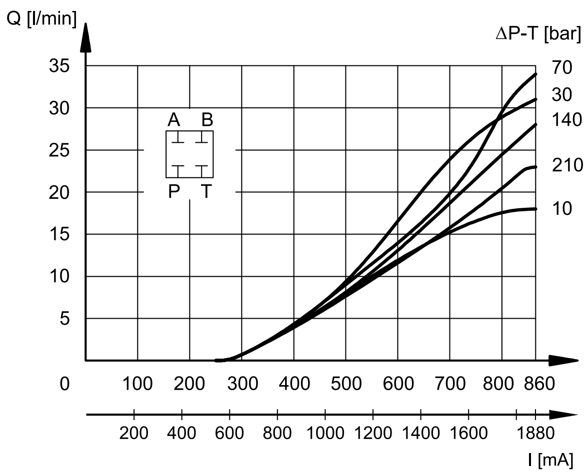
SPOOL TYPE C08



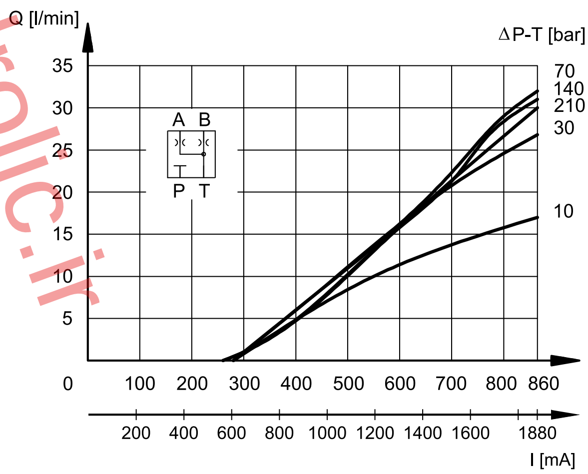
SPOOL TYPE A08



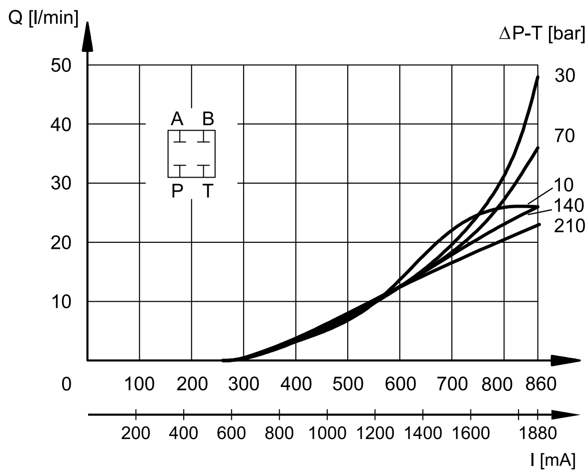
SPOOL TYPE C16



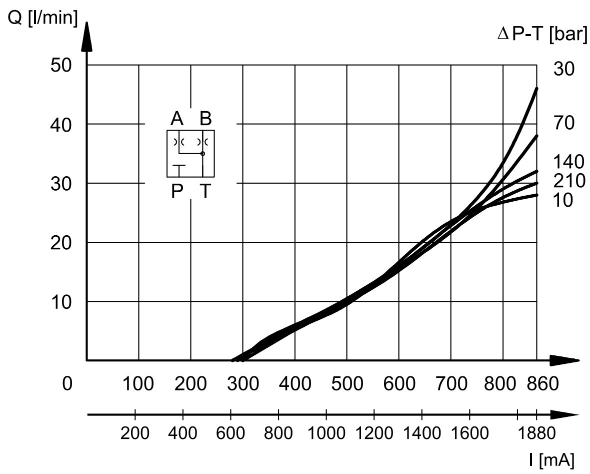
SPOOL TYPE A16



SPOOL TYPE C26



SPOOL TYPE A26



4 - ELECTRICAL CHARACTERISTICS

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut.

It can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	**12**	**24**
RESISTANCE (at 20°C)	Ω	4,4	18,6
MAXIMUM CURRENT	A	1,88	0,86
DUTY CYCLE	100%		
ELECTROMAGNETIC COMPATIBILITY (EMC)	according to 2004/108/EC		
CLASS OF PROTECTION: coil insulation (VDE 0580) impregnation	class H class F		

Protection from atmospheric agents CEI EN 60529

Plug-in type	IP 65	IP 69 K
K1 DIN 43650	x (*)	
K7 DEUTSCH DT04 male	x	x (*)

(*) The protection degree is guaranteed only with the connector correctly connected and installed.

5 - STEP RESPONSE

(measured with mineral oil with viscosity of 36 cSt at 50°C with electronic control units)

Step response is the time taken for the valve to reach 90% of the setted positioning value, following a step change of reference signal.

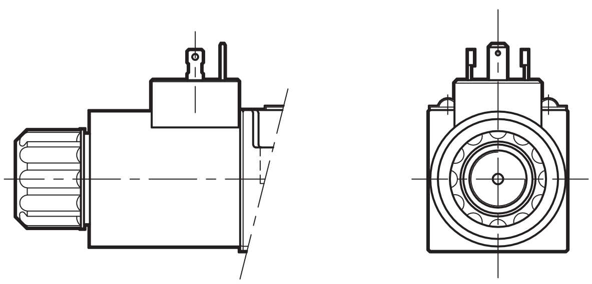
The table shows typical response times tested with spool type C16 and Δp = 30 bar P-T.

REFERENCE SIGNAL STEP	0 →100%	100 →0%
Step response [ms]		
DSE3B-A* **DSE3B-C***	50	40

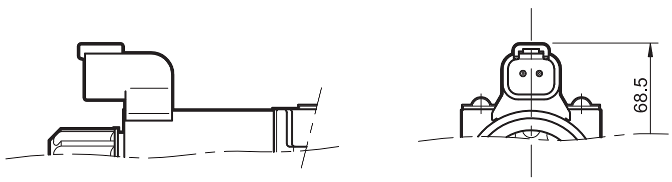
6 - ELECTRIC CONNECTIONS

Connectors for K1 connection are always delivered toghether with the valves.

connection for DIN 43650 connector
code **K1** (**standard**)
code **WK1** (W7 version only)

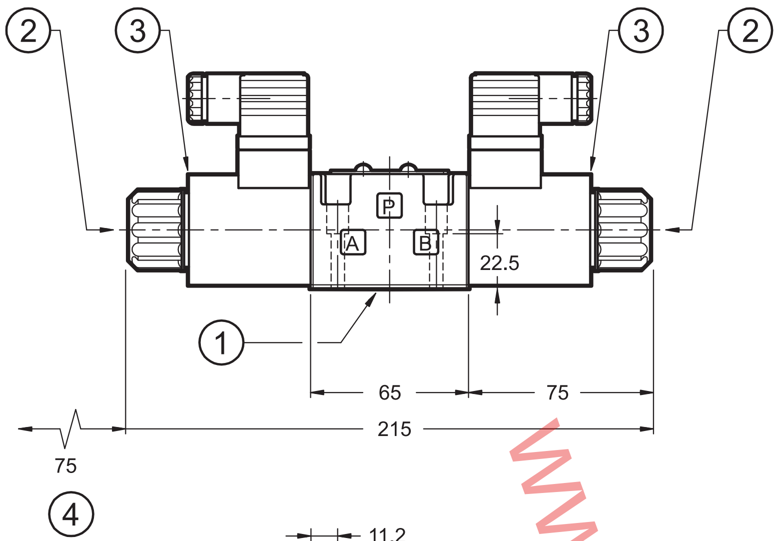


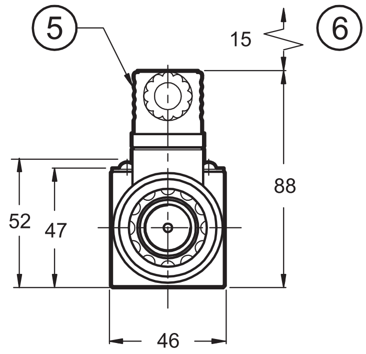
connection for
DEUTSCH DT06-2S male connector
code **K7**

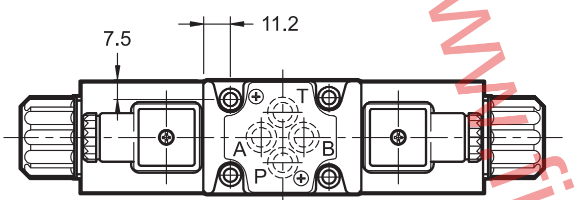


7 - OVERALL AND MOUNTING DIMENSIONS

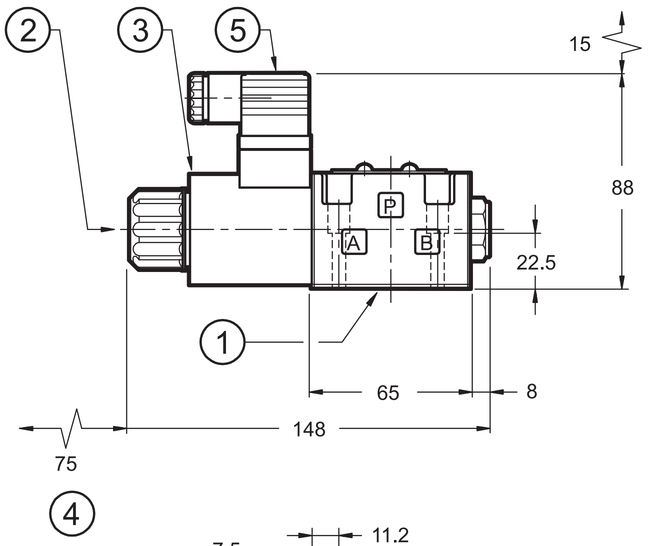
DSE3B-A*
DSEB3-C*

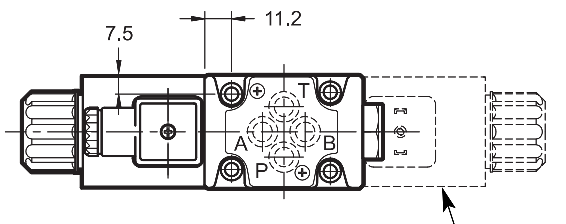






DSE3B-A*SA
DSE3B-C*SA





A*SB and C*SB versions solenoid position

dimensions in mm

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25 x 1.78) 90 shore
2	Standard manual override integrated in the solenoid tube (see par. 8)
3	Coil (360° revolving)
4	Coil removal space
5	DIN 43650 electric coil connector
6	Connector removal space

Fastening bolts: 4 SHCS M5x30
Torque: 5 Nm (A 8.8)
Threads of mounting holes : M5x10

Locking ring tightening torque:
5 ± 0.5 Nm

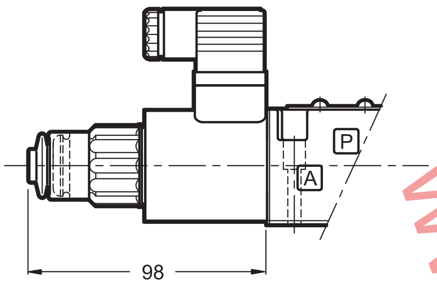
8 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

Two different manual override version are available upon request:

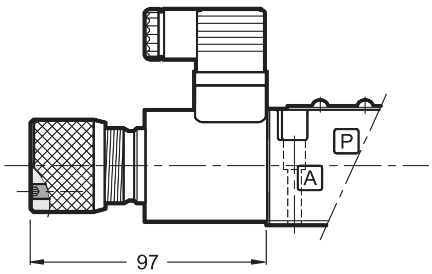
- **CM** version, manual override belt protected.
- **CK** version, knob. When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.

Version CM



Code: 3401150006

Version CK



Code: 3401150009

Spanner for set screw: 3 mm

9 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids like HL or HM type, according to ISO 6743-4. With this kind of fluids, use NBR seals type (code N). For HFDR fluids type (phosphate esters) use FPM seals (code V). For use with other kind of fluids such as HFA, HFB, HFC please consult our technical department.

Operation with fluid temperature exceeding 80°C causes premature deterioration of the quality of the fluid and seals. The physical and chemical properties of the fluid must be maintained.

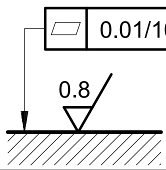
10 - INSTALLATION

DSE3B valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.

Surface finishing



11 - ELECTRONIC CONTROL UNITS

DSE3B - * * SA (SB)

EDC-112	for solenoid 24V DC	plug version	see cat. 89 120
EDC-142	for solenoid 12V DC		
EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		

DSE3B - A* **DSE3B - C***

EDM-M212	24V DC solenoids	rail mounting DIN EN 50022	see cat. 89 250
EDM-M242	12V DC solenoids		

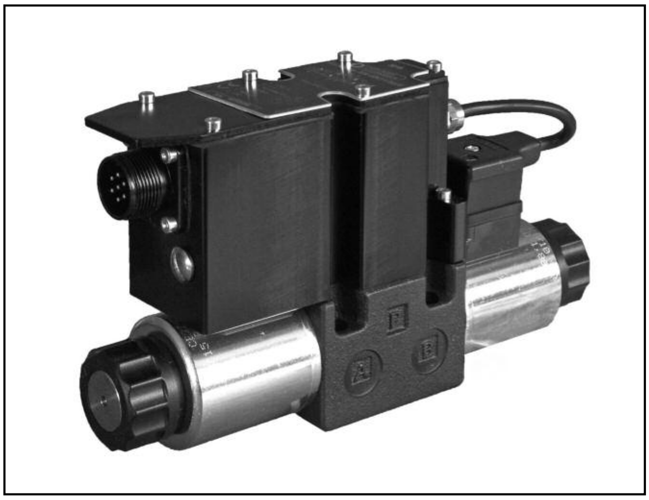
12 - SUBPLATES

(see catalogue 51 000)

Type PMMD-AI3G ports on rear (3/8” BSP threaded)
Type PMMD-AL3G side ports (3/8” BSP threaded)

DUPLOMATIC OLEODINAMICA
DUPLOMATIC OLEODINAMICA S.p.A.
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

DUPLOMATIC OLEODINAMICA



DSE3G

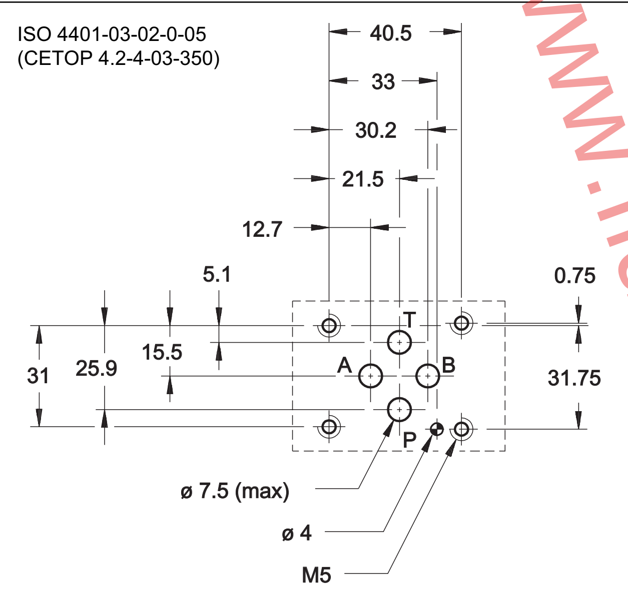
DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL AND INTEGRATED ELECTRONICS

SERIES 30

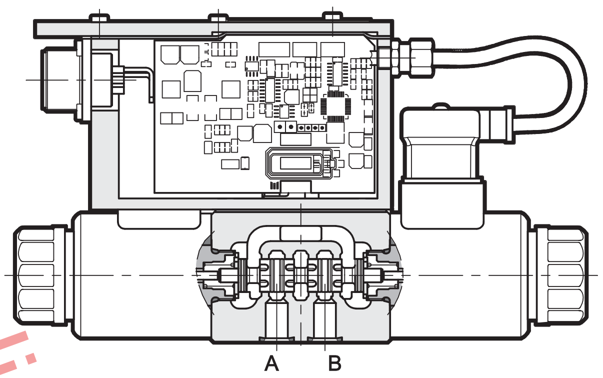
SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

p max **350** bar
Q max **40** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



— The DSE3G is a direct operated directional valve with integrated electric proportional control and mounting interface compliant with ISO 4401-03 standards.

— It is used to control the positioning and the speed of hydraulic actuators.

— The valve are available with command signal in voltage or current and on board electronics with internal enable, external enable or 0V monitor on pin C.

— A solenoid current monitoring signal is available.

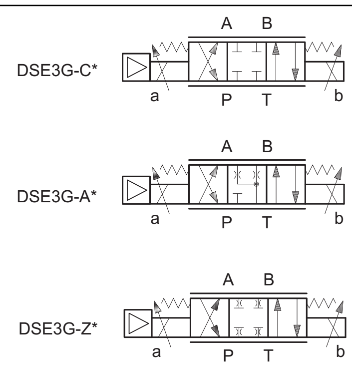
— The valve is easy to install. The driver directly manages digital settings.

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Max operating pressure: - P - A - B ports - T port	bar	350 210
Nominal flow with Δp 10 bar P-T	l/min	1 - 4 - 8 - 16 - 26
Response times	see paragraph 7	
Hysteresis	% of Q max	< 3%
Repeatability	% of Q max	< ±1%
Electrical characteristics	see paragraph 3	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	1,9 2,4

HYDRAULIC SYMBOLS (TYPICAL)



1 - IDENTIFICATION CODE

D	S	E	3	G	-				/	30		-		K11		/	

Direct operated directional control valve

Electric proportional control

Size ISO 4401-03

Digital integrated electronics for open loop

Spool type:
C = closed centres
A = open centres
Z = with overlap jump

Nominal flow rate of the spool (see chart par. 2)

Solenoid position (omit for 2 solenoids configuration):
SA = 1 solenoid on side A

Series No.
(the overall and mounting dimensions remain unchanged from 30 to 39)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Reference signal:
E0 = voltage ±10 V
E1 = current 4 ÷ 20 mA

Main connector 6 pin + PE

Pin C function:
A = external enable
B = internal enable
C = 0V monitor

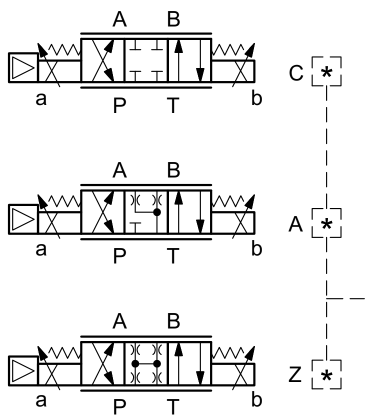
Option:
manual override
(see paragraph 8)

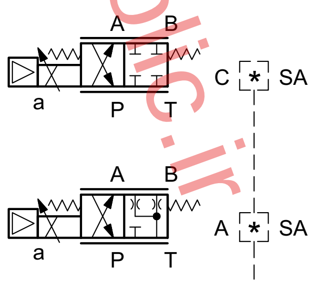
2 - CONFIGURATIONS

Valve configuration depends on the combination of the following elements:
number of proportional solenoids, spool type, rated flow.

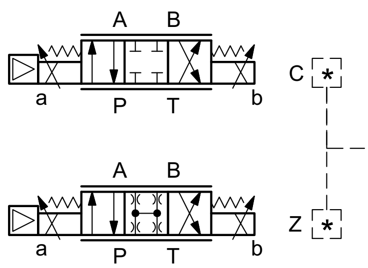
Configuration 2 solenoids :
3 positions with spring centering

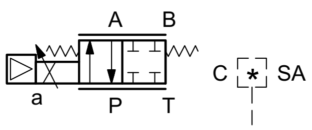
Configuration 1 solenoid on side A "**SA**":
2 positions (central + external) with spring centering





*	Controlled flow with Δp10 bar P-T
04	4 l/min
08	8 l/min
16	16 l/min
16/08	16 (P-A) / 08 (B-T) l/min
26	26 l/min
26/13	26 (P-A) / 13 (B-T) l/min





*	Controlled flow with Δp10 bar P-T
01R	1 l/min

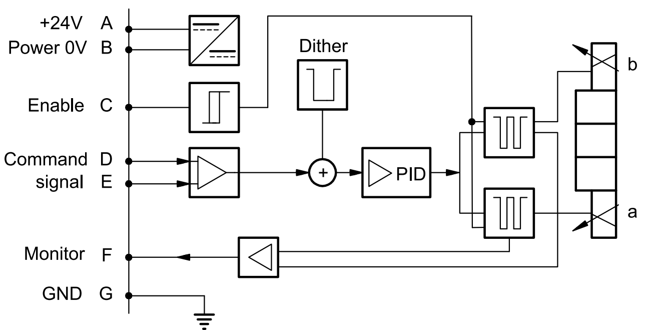
3 - ELECTRICAL CHARACTERISTICS

3.1 - Electrical on board electronics

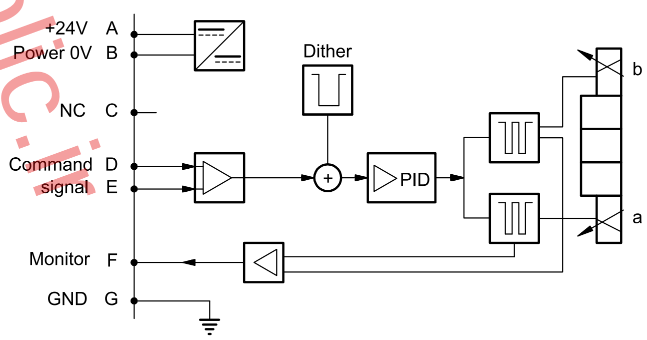
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		3A
Command signals: voltage (E0) current (E1)	V DC mA	±10 (Impedence Ri > 11 kOhm) 4 ÷ 20 (Impedence Ri = 58 Ohm)
Monitor signal (current to solenoid): voltage (E0) current (E1)	V DC mA	±10 (Impedence Ro > 1 kOhm) 4 ÷ 20 (Impedence Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2004/108/EC standards

3.2 - On-board electronics diagrams

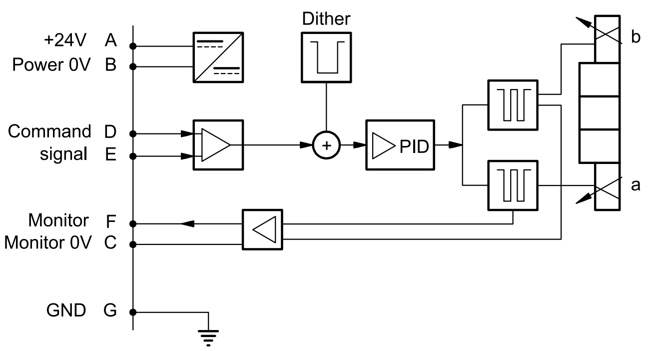
VERSION **A** - External Enable



VERSION **B** - Internal Enable

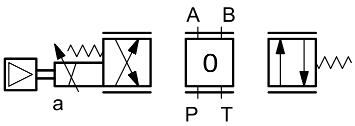


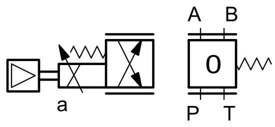
VERSION **C** - 0V Monitor



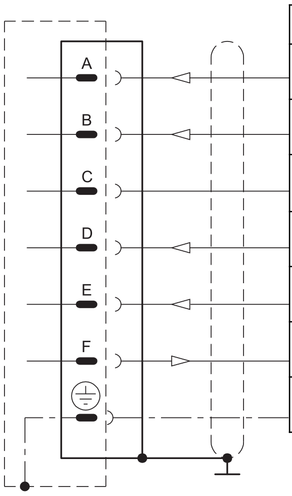
4 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal is between -10V and +10V on double solenoid valve, and 0…10V on single solenoid valves SA. The monitor feature of versions B anc C becomes available with a delay of 0,5 sec from the power-on of the card.





COMMAND	**-10V**	**0V**	**+10V**	**COMMAND**	**+10V**	**0V**
MONITOR	**-10V**	**0V**	**+10V**	**MONITOR**	**+10V**	**0V**

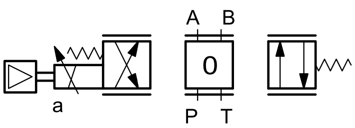


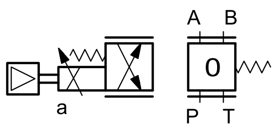
Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	± 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	± 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

5 - VERSIONS WITH CURRENT COMMAND (E1)

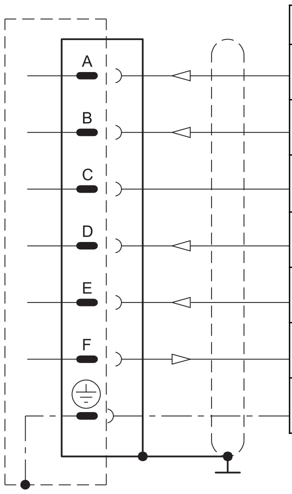
The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B anc C becomes available with a delay of 0,5 sec from the power-on of the card.





COMMAND	**4 mA**	**12 mA**	**20 mA**	**COMMAND**	**20 mA**	**4 mA**
MONITOR	**4 mA**	**12 mA**	**20 mA**	**MONITOR**	**20 mA**	**4 mA**



Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

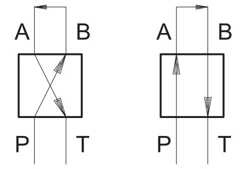
6 - CHARACTERISTIC CURVES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

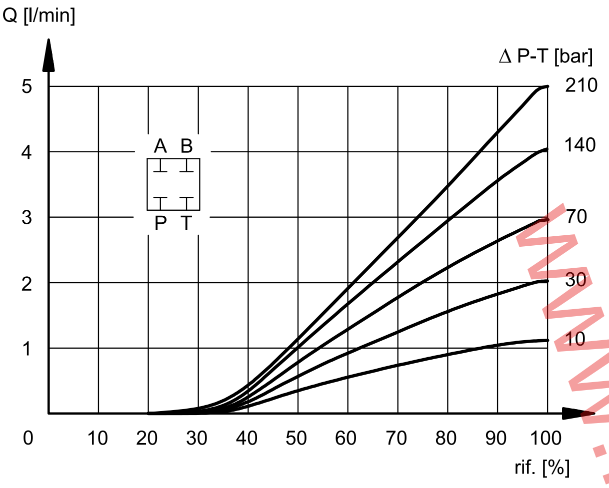
Typical flow rate curves at constant Δp related to the reference signal and measured for the available spools. The Δp values are measured between P and T valve ports.

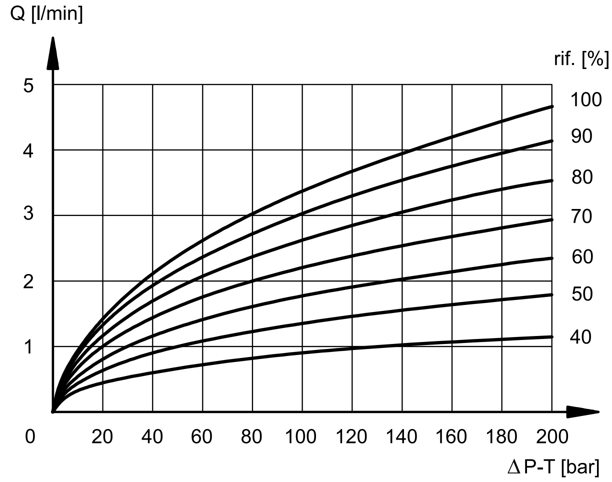
The curves are obtained after linearization in factory of the characteristic curve through the digital amplifier. The linearization of the curve is performed with a constant Δp of 5 bar and by setting the value of flow start at 20% of the reference signal.

NOTE: for the zero overlap spool (Z), please refer to the characteristic curves of C type spool, considering that the starting flow rate value is approx. 150 mV.

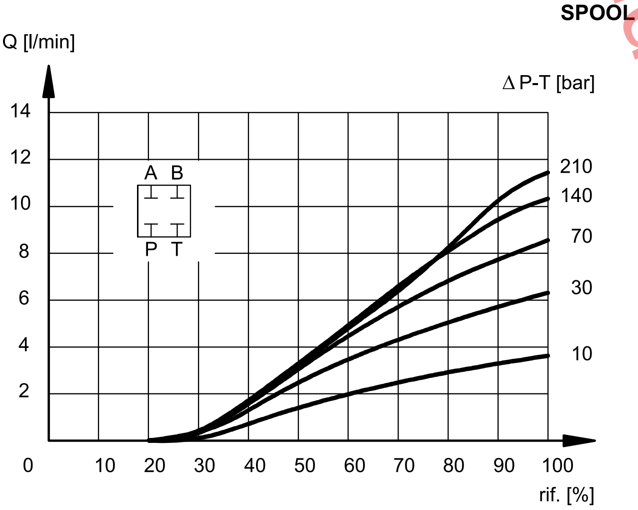


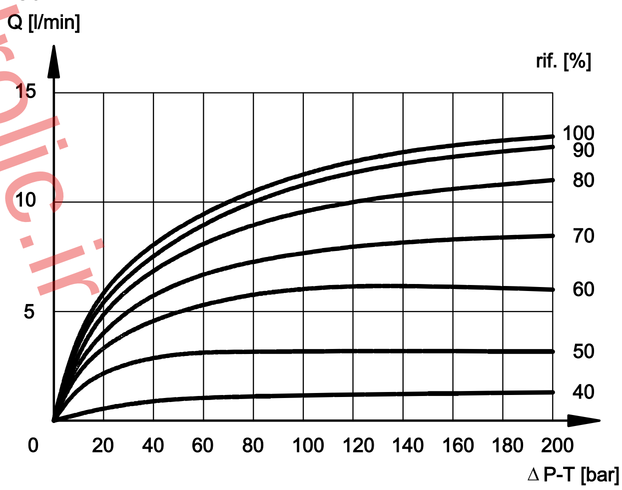
SPOOL TYPE C01R



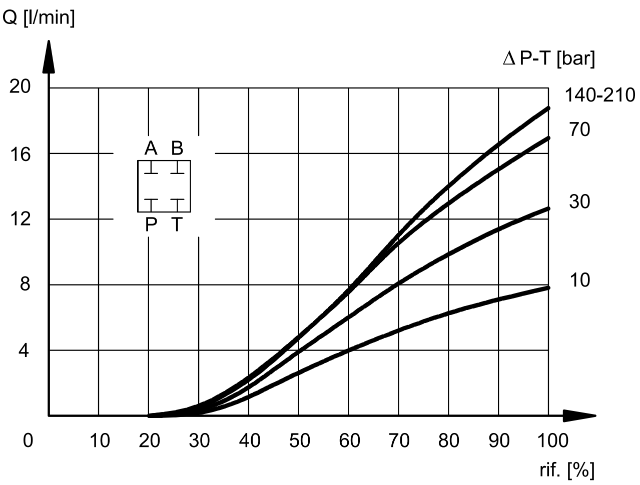


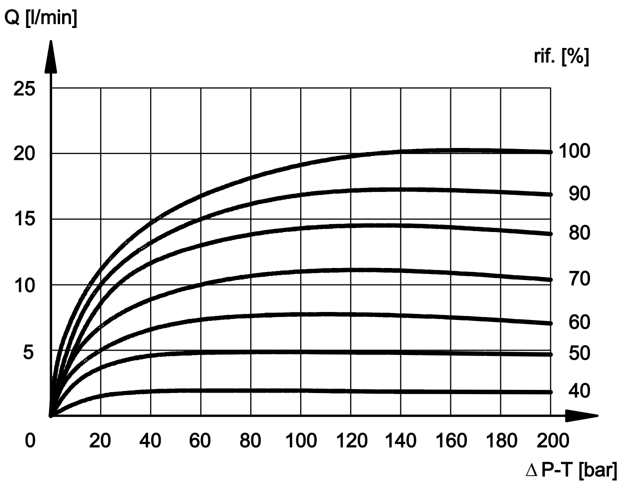
SPOOL TYPE C04



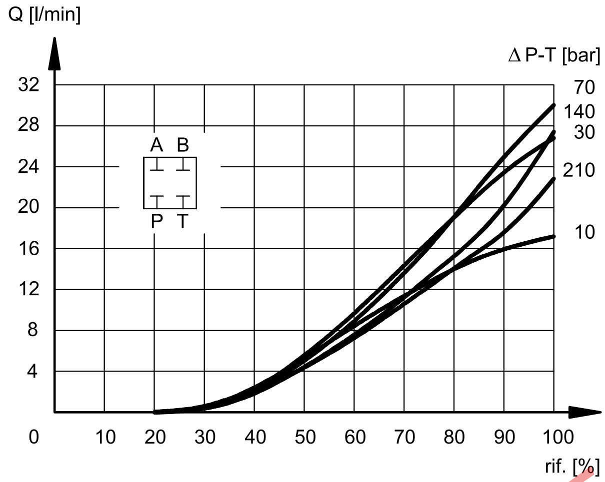


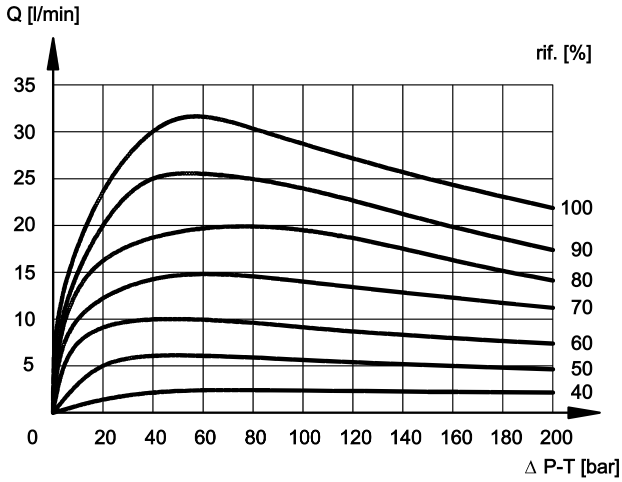
SPOOL TYPE C08



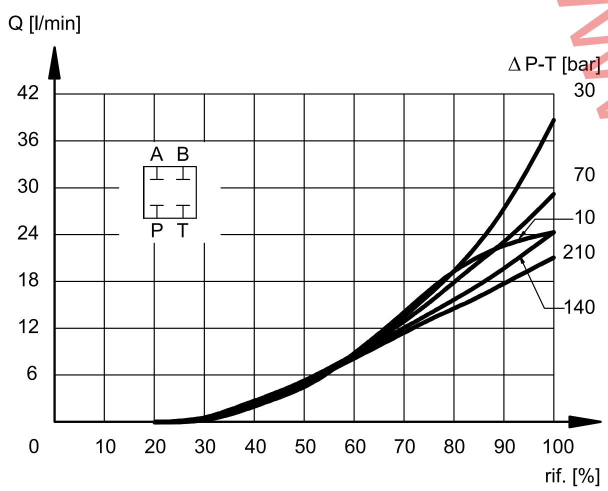


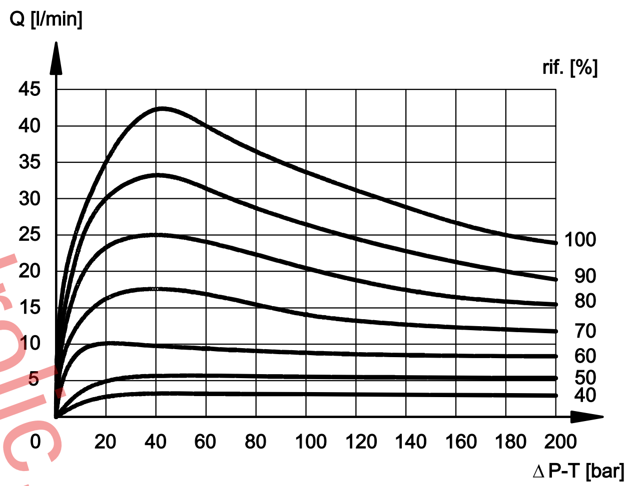
SPOOL TYPE C16



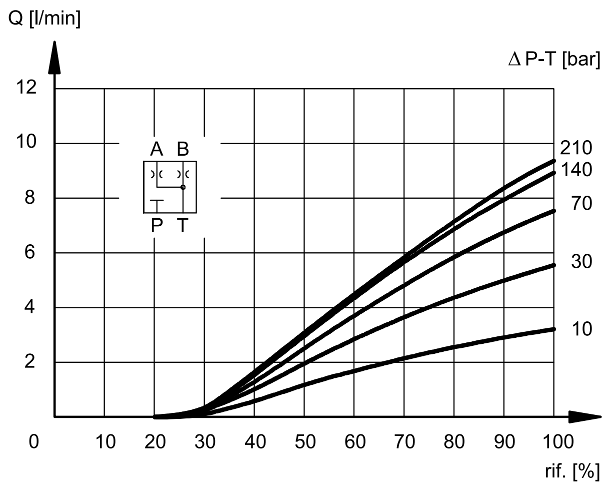


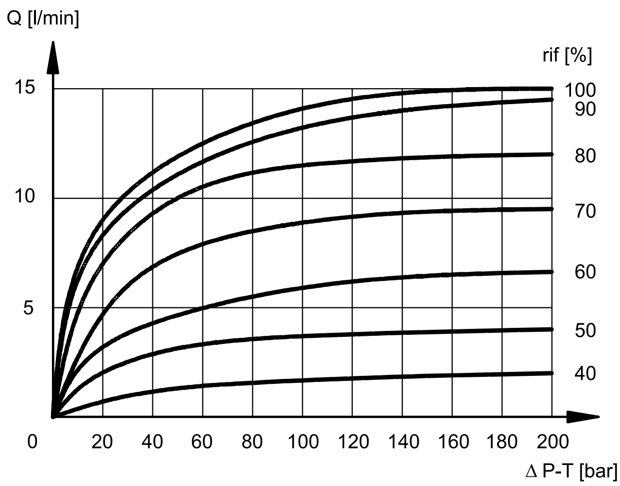
SPOOL TYPE C26



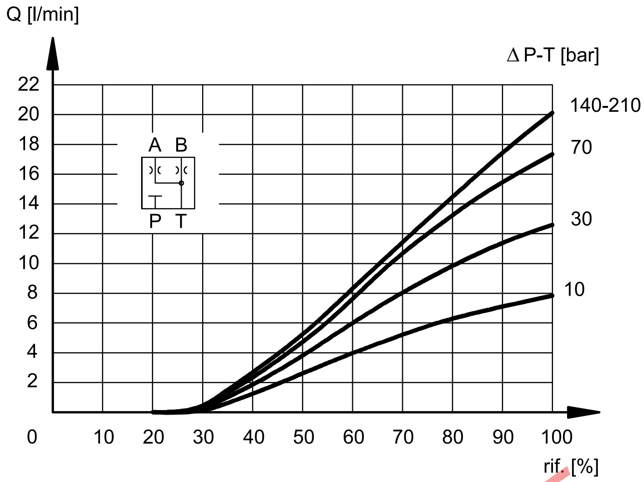


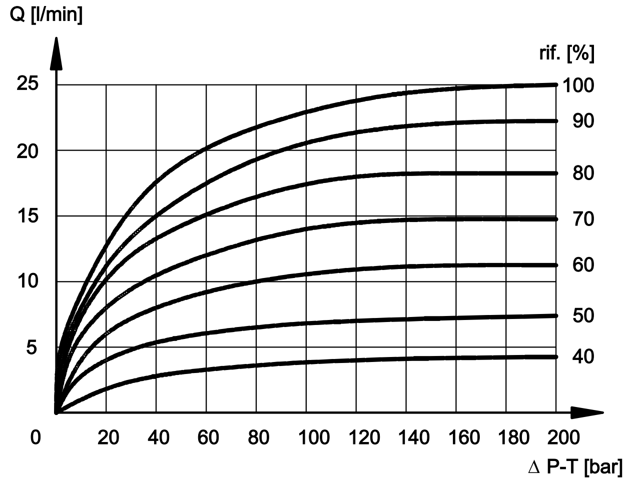
SPOOL TYPE A04



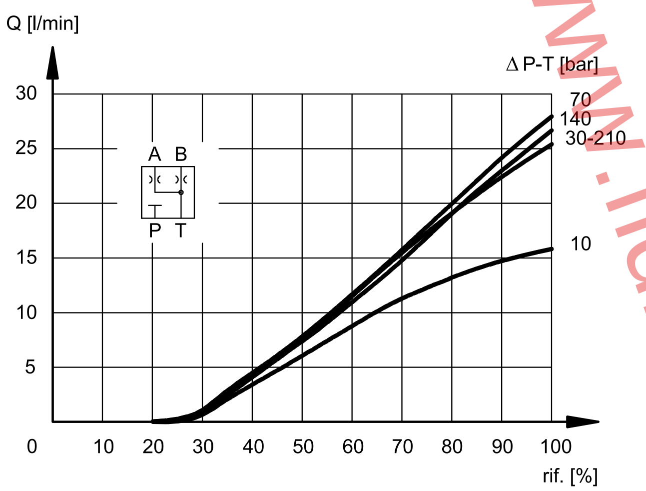


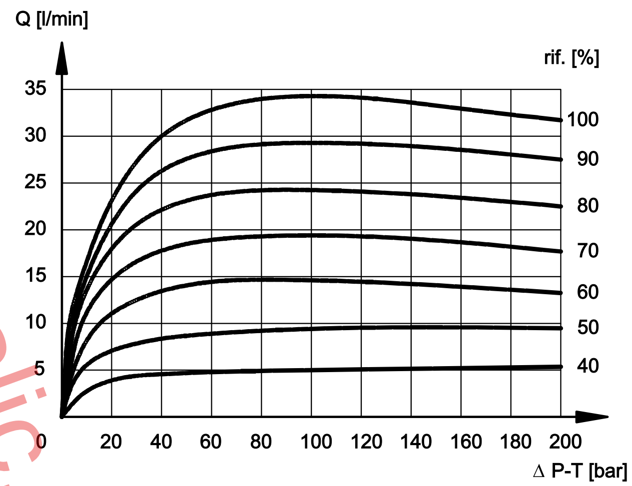
SPOOL TYPE A08



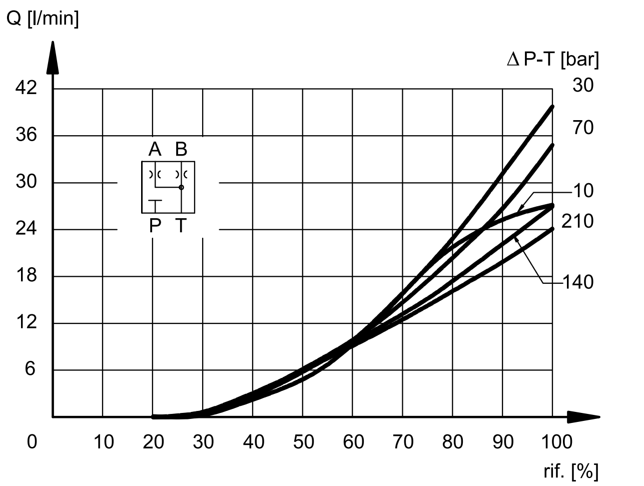


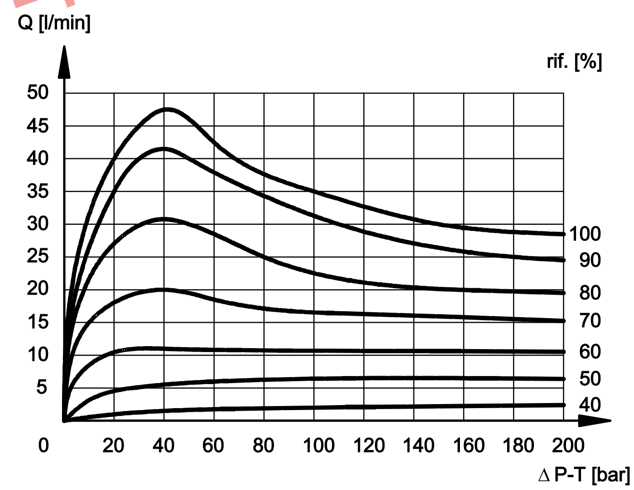
SPOOL TYPE A16





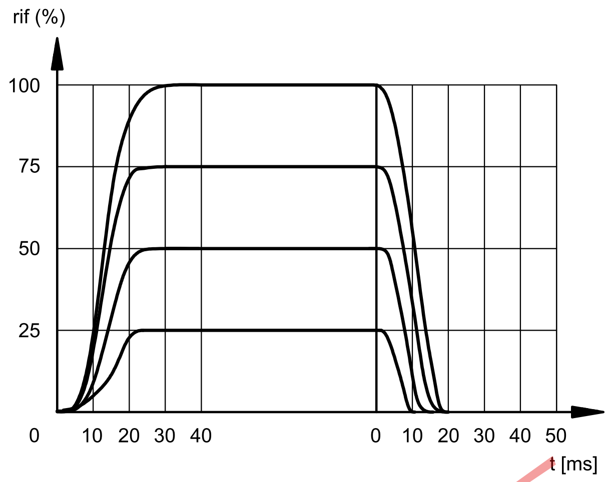
SPOOL TYPE A26





7 - RESPONSE TIMES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

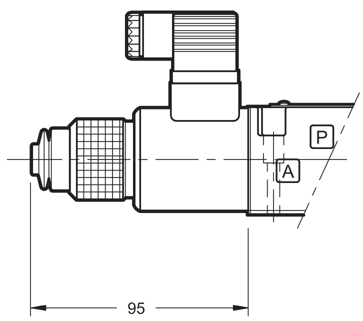
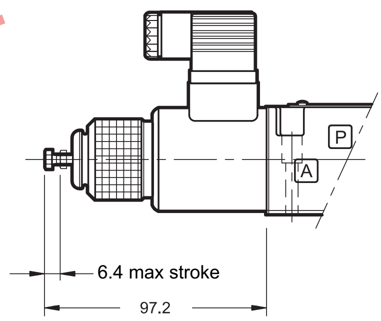


8 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The actuation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

Two versions are available upon request:

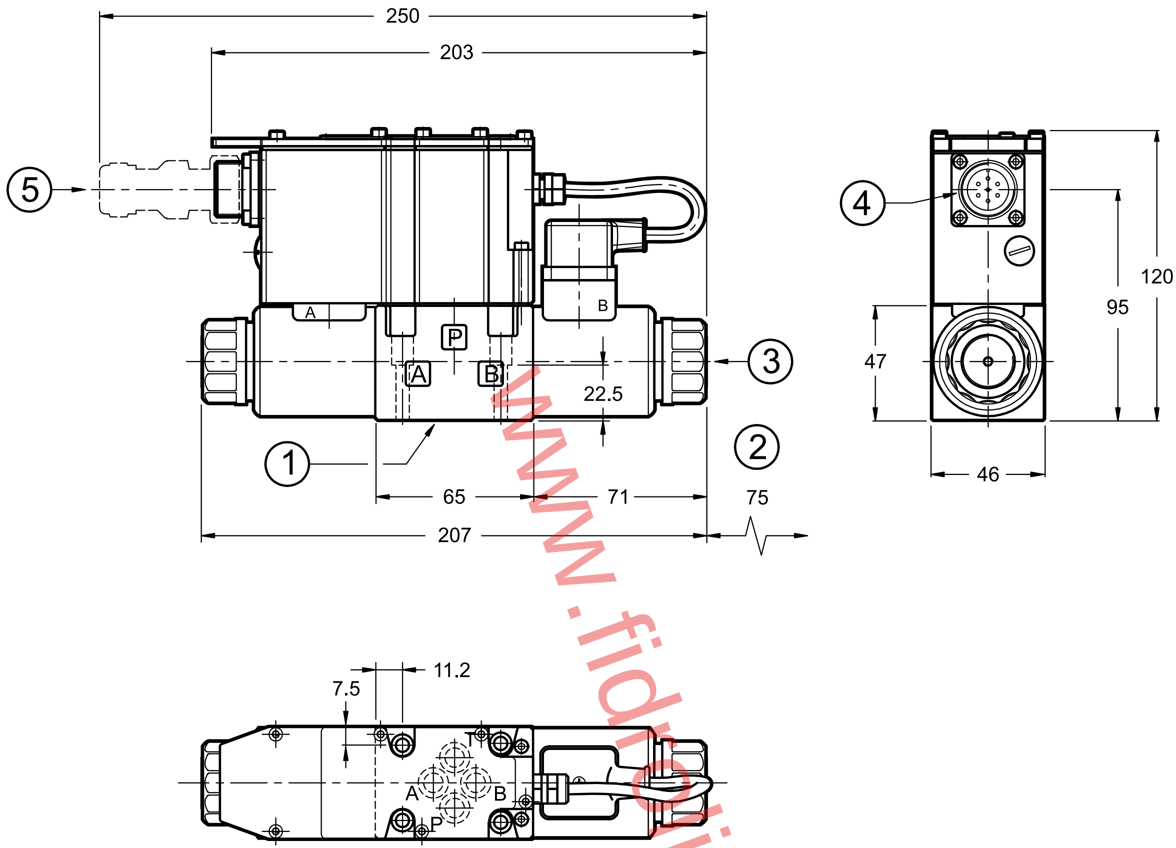
- **CM** version, manual override boot protected.
- **CS** version, with metal locking ring provided with an M4 screw and lock nut to allow the continuous and adjustable mechanical operation.

CM Version	CS Version
	
Code: 3803210003	Code: 3803210004

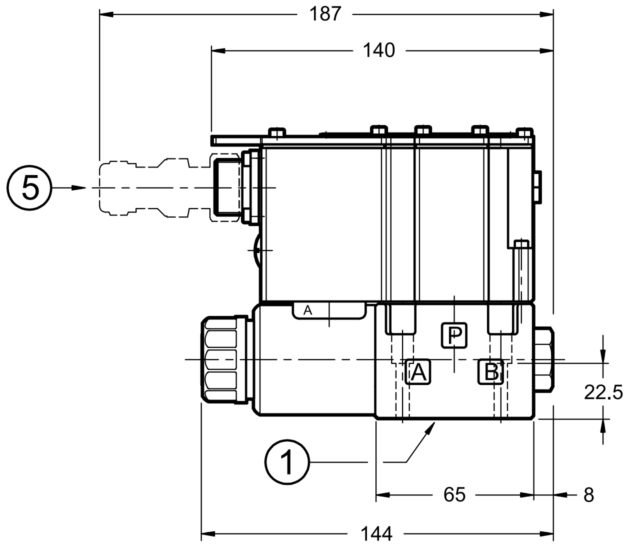
9 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

DSE3G-A*
DSE3G-C*
DSE3G-Z*



DSE3G-A* SA
DSE3G-C* SA



Fastening bolts: 4 bolts M5x30 - ISO 4762
Torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) 90 Shore
2	Coil removal space (solenoid B only)
3	Standard manual override embedded in the solenoid tube
4	Main connection
5	Mating connector. **To be ordered separately.** See paragraph 12

10 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

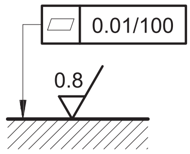
11 - INSTALLATION

DSE3G valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Surface finishing

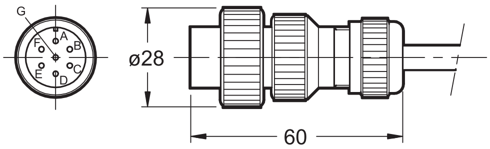


12 - ACCESSORIES

(to be ordered separately)

12.1 Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.



So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**

12.2 - Connection cables size

Power supply:
- up to 20 m cable lenght : 1,0 mm²
- up to 40 m cable lenght : 1,5 mm²

Signal: 0,50 mm²

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

12.3 - Kit for start-up LINPC-USB

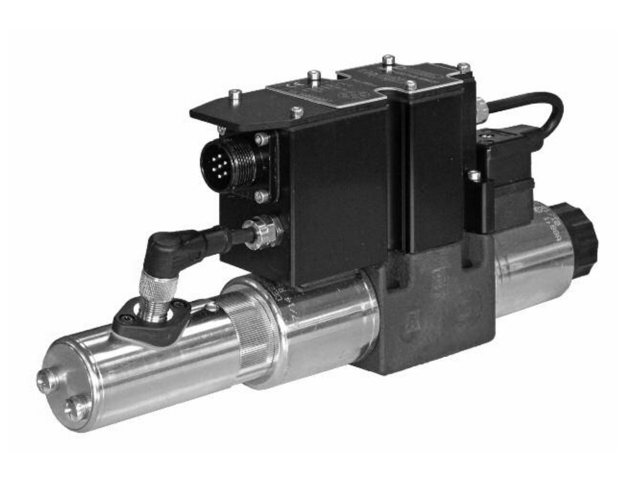
Device for service start-up and diagnostic, see catalogue 89850.

13 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G rear ports
PMMD-AL3G side ports
Ports dimensions: P, T, A, B: 3/8” BSP

DUPLOMATIC OLEODINAMICA
DUPLOMATIC OLEODINAMICA S.p.A.
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com



DSE3J

DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL FEEDBACK AND INTEGRATED ELECTRONICS

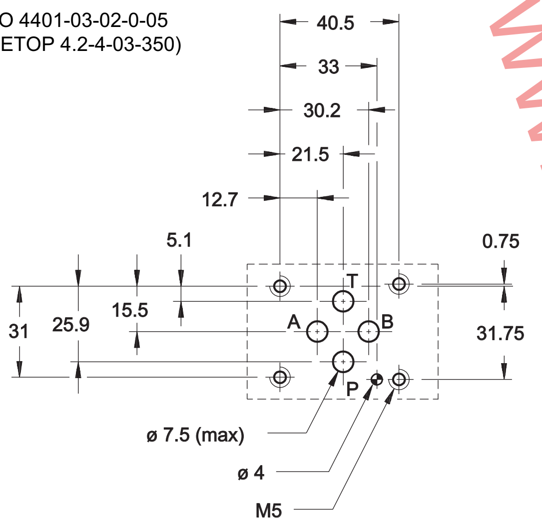
SERIES 30

SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

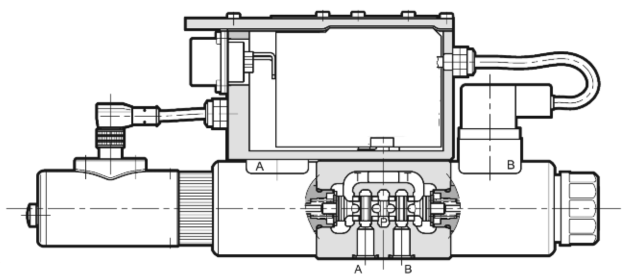
p max **350** bar
Q max **80** l/min

MOUNTING INTERFACE

ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



OPERATING PRINCIPLE



— The DSE3J is a direct operated directional valve with integrated electric proportional control, feedback and mounting interface in compliance with ISO 4401 standards.

— The valve opening and hence flow rate can be modulated continuously in proportion to the reference signal. Transducer and digital card allow a fine control of the positioning of the cursor, reducing hysteresis and response time and optimizing the performance of the valve.

— It is available with fail safe function.

— The valve is easy to install. The driver directly manages digital settings. It's possible to customize the settings for special applications using the optional kit (see at par. 11).

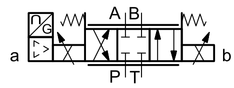
PERFORMANCES

(Mineral oil with viscosity of 36 cSt at 50°C and p =140 bar)

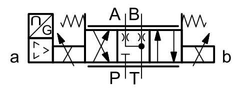
Max operating pressure: - P - A - B ports - T port	bar	350 210
Nominal flow with Δp 10 bar P-T	l/min	1 - 4 - 12 - 30
Response times	see paragraph 7	
Hysteresis	% of Q max	< 0,2%
Repeatability	% of Q max	< 0,2%
Threshold		< 0,1%
Valve reproducibility		≤ 5%
Electrical characteristics	see paragraph 3	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	2,2 2,7

HYDRAULIC SYMBOLS (typical)

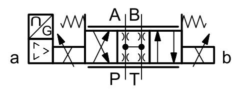
DSE3J-C*



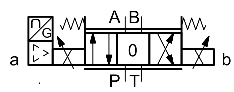
DSE3J-A*



DSE3J-Z*



DSE3J-*01R*



1 - IDENTIFICATION CODE

D	S	E	3	J	-					/	30		-		K11	

Direct operated directional control valve

Electric proportional control

Size ISO 4401-03

Digital integrated electronics for valves with feedback

Spool type:
C = closed centres
A = open centres
Z = zero overlap

Nominal flow rate of the spool (see chart par. 2)

FS = Fail safe option. (omit if not required).
Available on spool Z04, Z12 and Z30 only.

Solenoid position (omit for 2 solenoids configuration):
SA = 1 solenoid on side A

Series No. (the overall and mounting dimensions remain unchanged from 30 to 39)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Reference signal:
E0 = voltage ±10V
E1 = current 4…20mA

Main connector 6 pin + PE

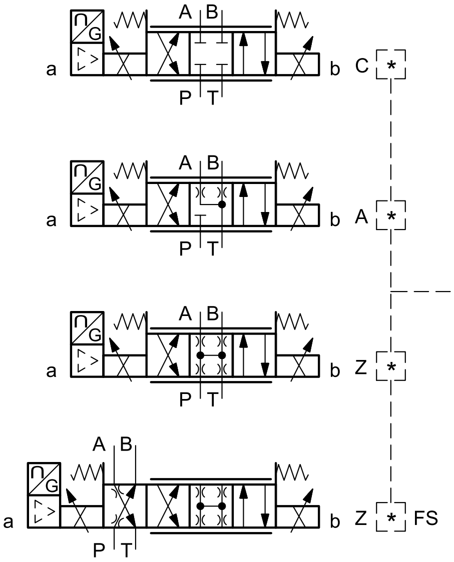
Pin C function:
A = external enable
B = internal enable
C = 0V monitor

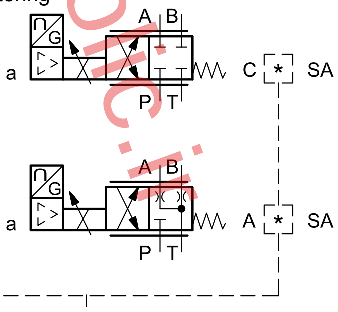
2 - CONFIGURATIONS

Valve configuration depends on the combination of the following elements: number of proportional solenoids, spool type, rated flow.

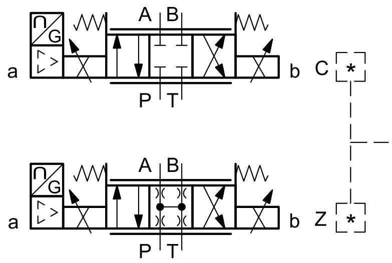
Configuration 2 solenoids :
3 positions with spring centering

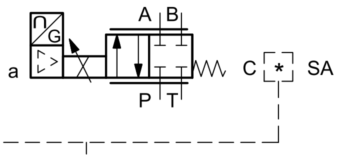
Configuration 1 solenoid on side A "**SA**":
2 positions (central + external) with spring centering





*	Controlled flow with Δp10 bar P-T
04	4 l/min (available for spools Z only)
12	12 l/min
30	30 l/min
30/15	30 (P-A) / 15 (P-B) l/min





*	Controlled flow with Δp10 bar P-T
01R	1 l/min

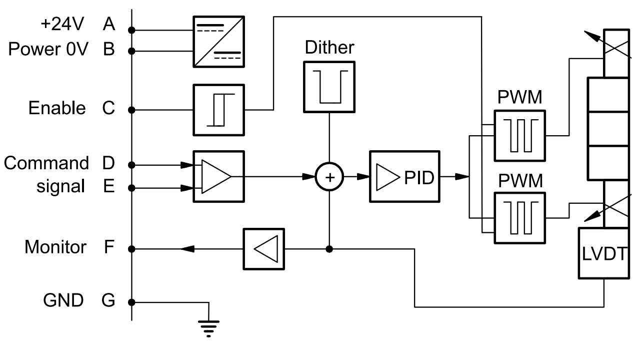
3 - ELECTRICAL CHARACTERISTICS

3.1 - Electrical on board electronics

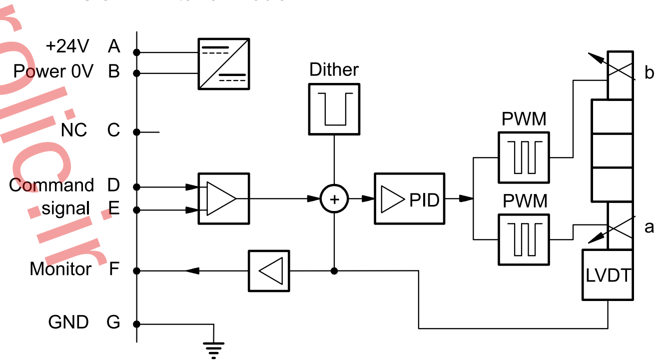
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		3A
Command signals: voltage (E0) current (E1)	V DC mA	±10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signals: voltage (E0) current (E1)	V DC mA	±10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, LVDT sensor error, cable breakdown, supply voltage failure
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2004/108/EC standards

3.2 - On-board electronics diagrams

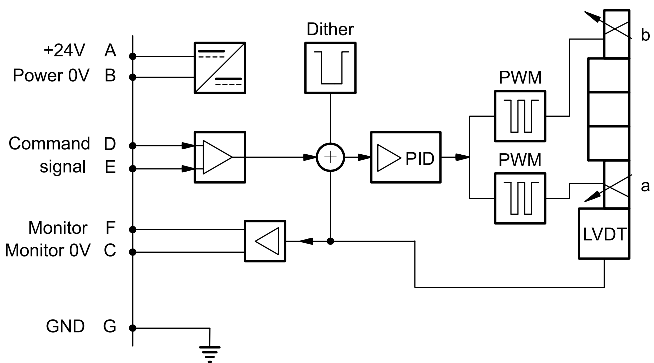
VERSION **A** - External Enable



VERSION **B** - Internal Enable

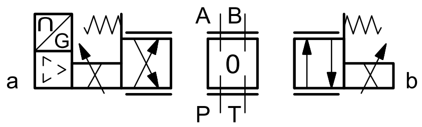


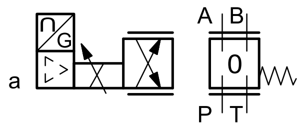
VERSION **C** - 0V Monitor



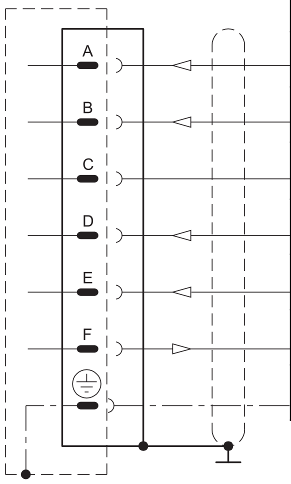
4 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal is between -10V and +10V on double solenoid valve, and 0…10V on single solenoid valves SA. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.





COMMAND	**-10V**	**0V**	**+10V**	**COMMAND**	**+10V**	**0V**
MONITOR	**-10V**	**0V**	**+10V**	**MONITOR**	**+10V**	**0V**

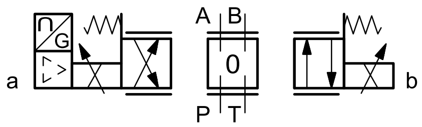


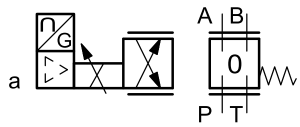
Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	± 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	± 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

5 - VERSIONS WITH CURRENT COMMAND (E1)

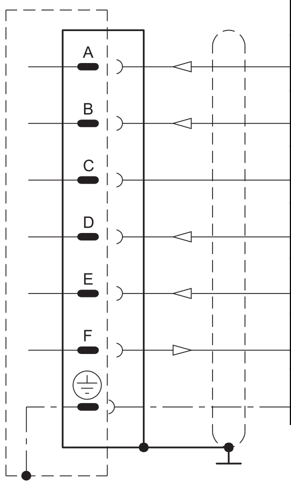
The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.





COMMAND	**4 mA**	**12 mA**	**20 mA**	**COMMAND**	**20 mA**	**4 mA**
MONITOR	**4 mA**	**12 mA**	**20 mA**	**MONITOR**	**20 mA**	**4 mA**

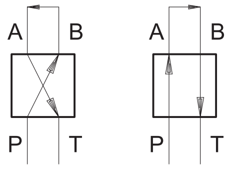


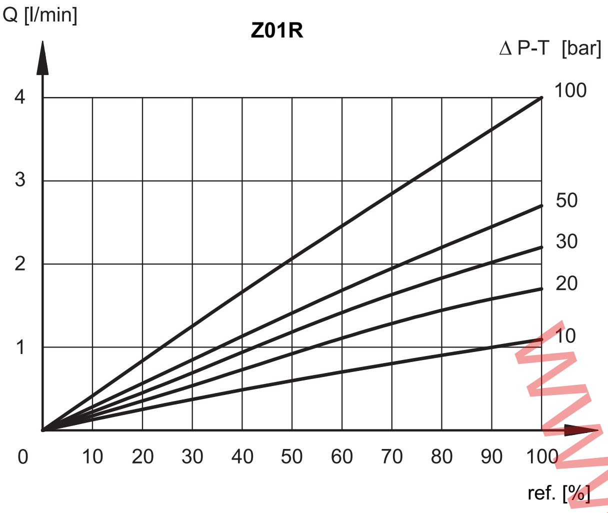
Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

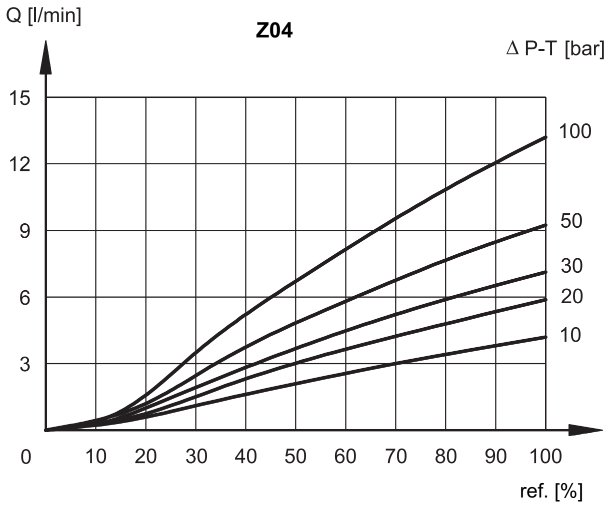
6 - CHARACTERISTIC CURVES

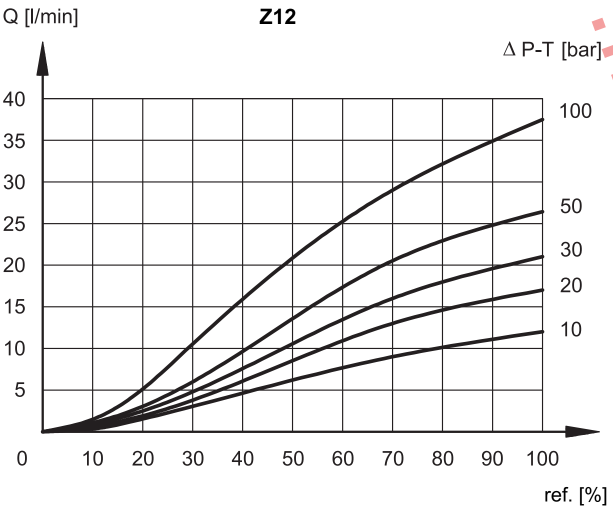
(obtained with mineral oil with viscosity of 36 cSt at 50°C and with digital integrated electronics)

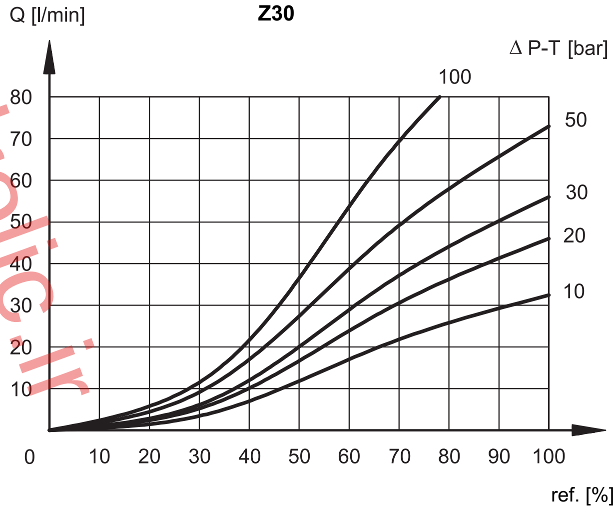
Typical flow rate curves related to the reference signal and measured for the available spools. The Δp values are measured between P and T valve ports.

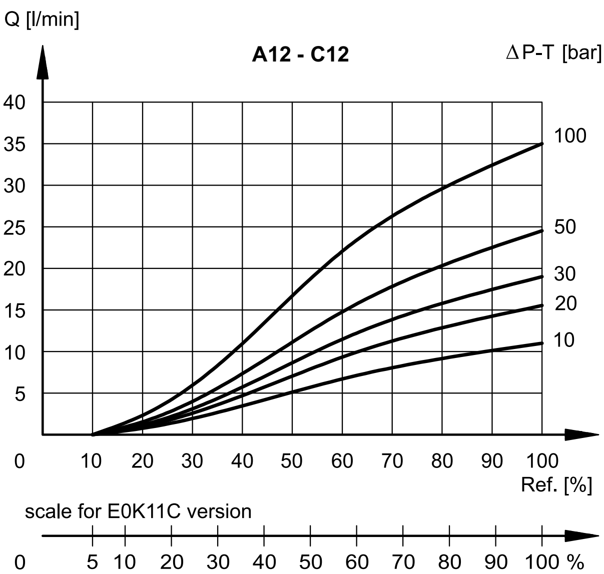


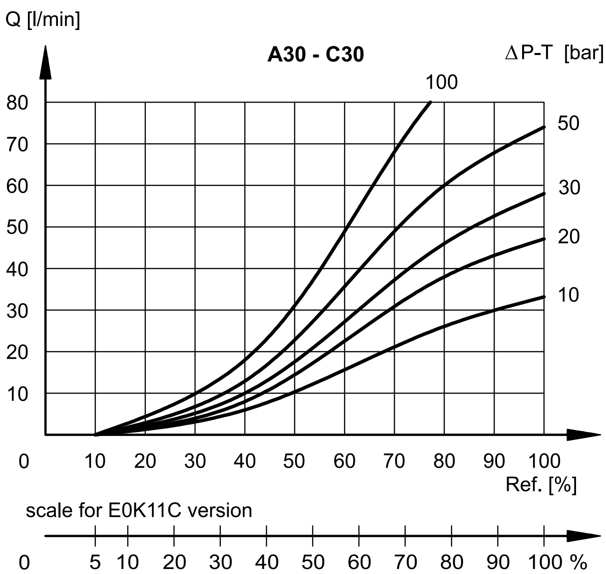




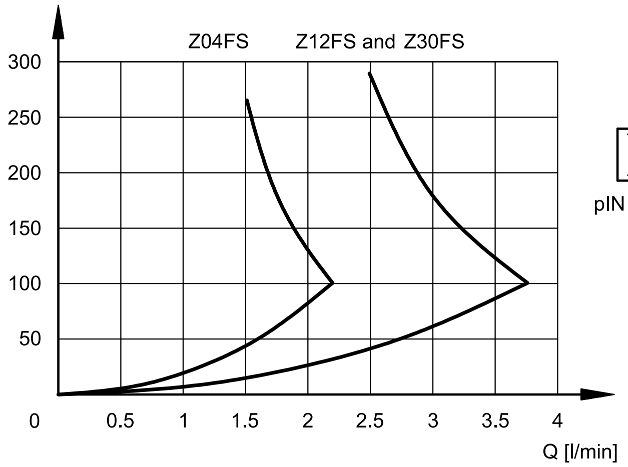


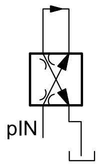






Z*FS SPOOLS - FAIL SAFE FEATURE



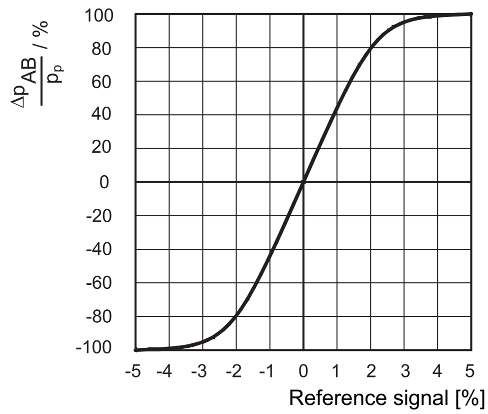


Flow P→B / A→T with valve in fail safe position, depending on the incoming pressure.

When a power failure (enabling OFF) occurs, the valve moves in 'fail safe' position by maintaining a minimum flow that allows the actuator to return slowly to a safety position.

During the black-out the centering springs retain the spool in fail safe-position.

Z SPOOLS - PRESSURE GAIN



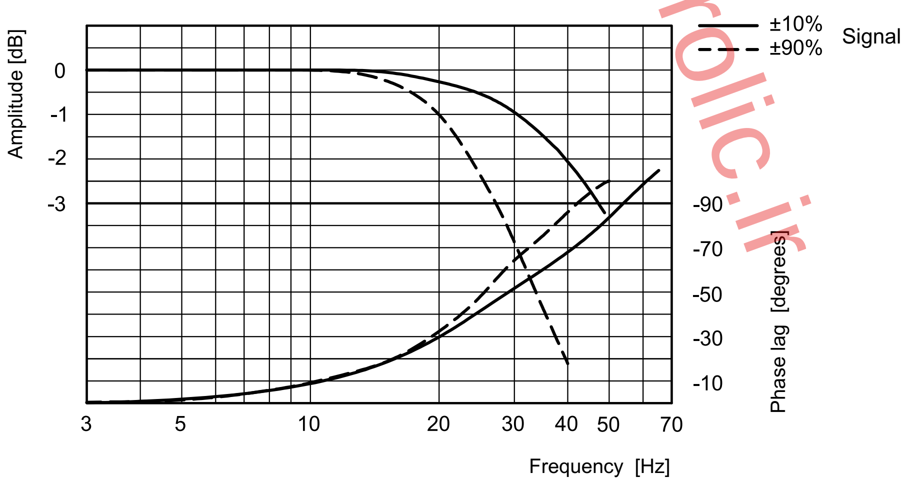
The diagram shows the valve pressure gain, expressed as % of the ratio between the port pressure variation in A or B (Δp AB) and the P system pressure, according to the reference signal.

In practice, the pressure gain states the valve reaction towards external disturbances aimed at changing the actuator position.

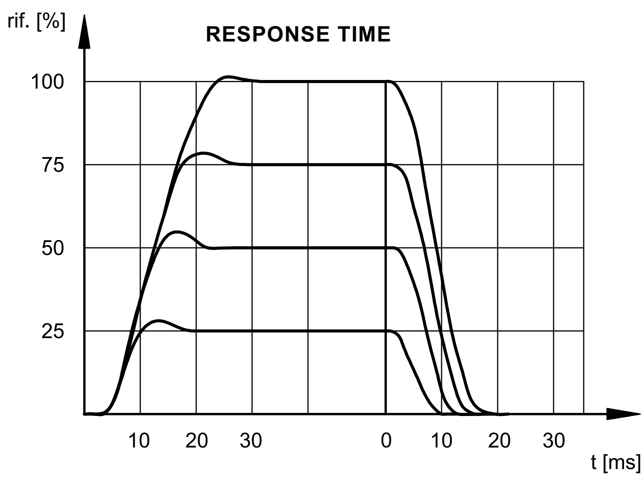
7 - RESPONSE TIMES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and 140 bar Δp P→T)

FREQUENCY RESPONSE (SPOOL Z)



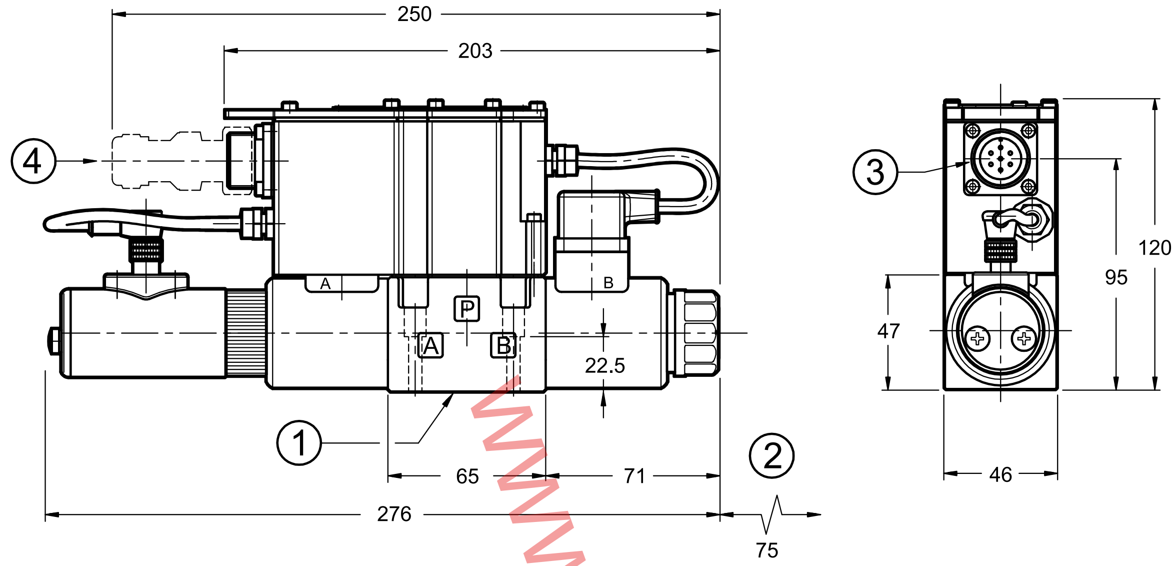
RESPONSE TIME

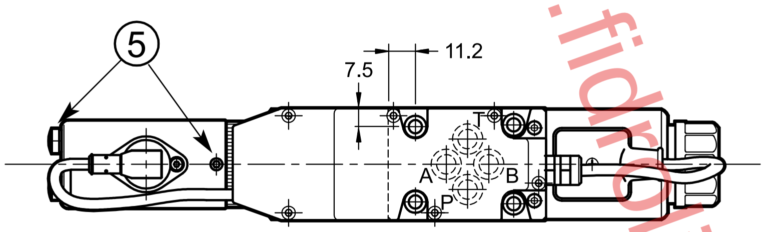


8 - OVERALL AND MOUNTING DIMENSIONS

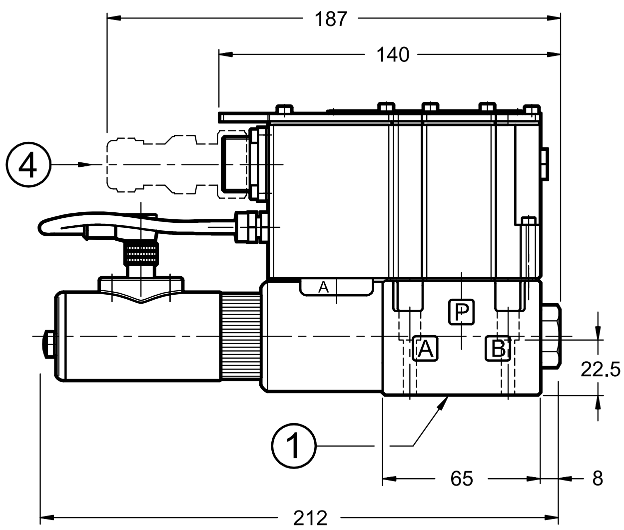
dimensions in mm

DSE3J-A*
DSE3J-C*
DSE3J-Z*





DSE3J-A* SA
DSE3J-C* SA



Fastening bolts: 4 bolts M5x30 - ISO 4762
Torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) 90 Shore
2	Coil removal space (solenoid B only)
3	Main connection
4	Mating connector. **To be ordered separately.** See paragraph 11
5	Adjustment sealing performed at factory. Do not disassemble the transducer.

9 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

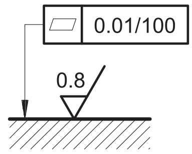
10 - INSTALLATION

DSE3J valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Surface finishing

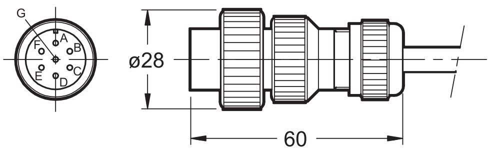


11 - ACCESSORIES

(to be ordered separately)

11.1 Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.



⚠ So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic can provide a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**

11.2 - Connection cables size

Power supply:
- up to 20 m cable length : 1,0 mm²
- up to 40 m cable length : 1,5 mm²

Signal: 0,50 mm²

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

11.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

12 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G rear ports
PMMD-AL3G side ports
Ports dimensions: P, T, A, B: 3/8” BSP

DUPLOMATIC OLEODINAMICA

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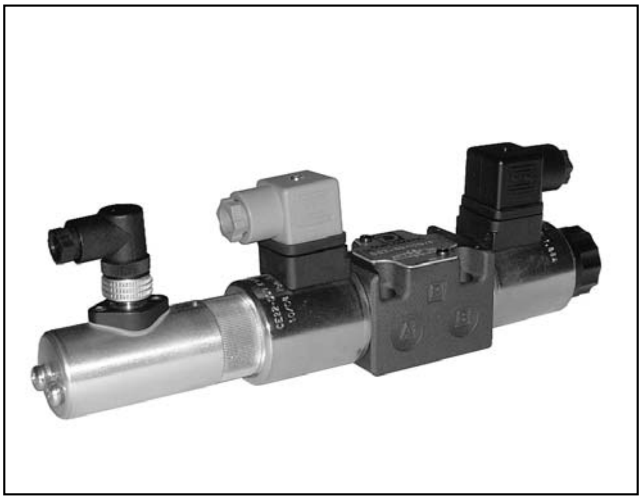
www.duplomatic.com • e-mail: sales.exp@duplomatic.com



DSE3F

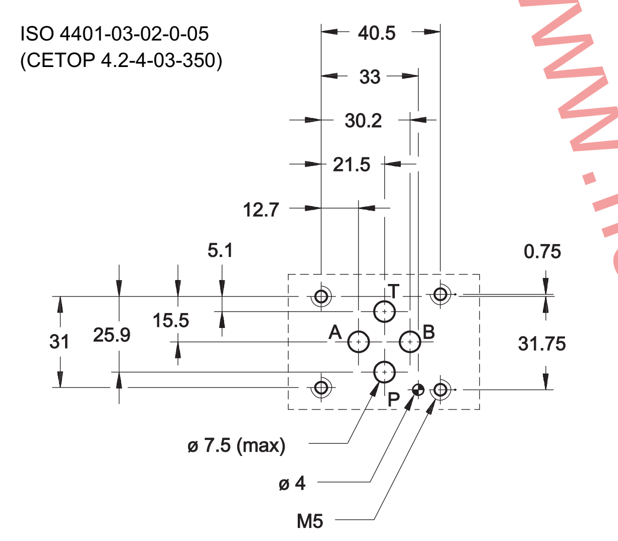
DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL AND ELECTRICAL FEEDBACK

SERIES 11

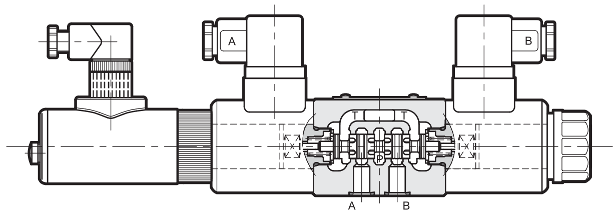
SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

p max **350** bar
Q max **40** l/min

MOUNTING SURFACE



OPERATING PRINCIPLE



The DSE3F is a direct operated directional valve with proportional control, electrical feedback and mounting interface in compliance with ISO 4401 (CETOP RP 121H) standards.

— It is normally used to control position and the speed of hydraulic actuators.

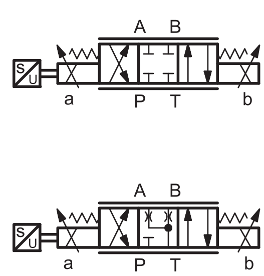
— The valve opening and hence flow rate can be modulated continuously in proportion to the reference signal.

— The valve must be controlled directly by the UEIK-*RSD digital card (see par.9), that maximize the valve performances: the input signal and the signal from the valve are compared to obtain an accurate positioning and a reduces hysteresis.

PERFORMANCES (Obtained with mineral oil with viscosity of 36 cSt at 50°C and with digital integrated electronic)

Max operating pressure: - P - A - B ports - T port	bar	 350 210
Nominal flow with Δp 10 bar P-T	l/min	8 - 16 - 26
Response times	see paragraph 6	
Hysteresis	% of Q_{max}	< 1,5 %
Repeatability	% of Q_{max}	< 1 %
Electrical characteristics, IP	see paragraph 5	
Valve reproducibility		< 5%
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	1,9 2,3

HYDRAULIC SYMBOLS (typical)



1 - IDENTIFICATION CODE

D	S	E	3	F	-				/	11		-	D12	K1

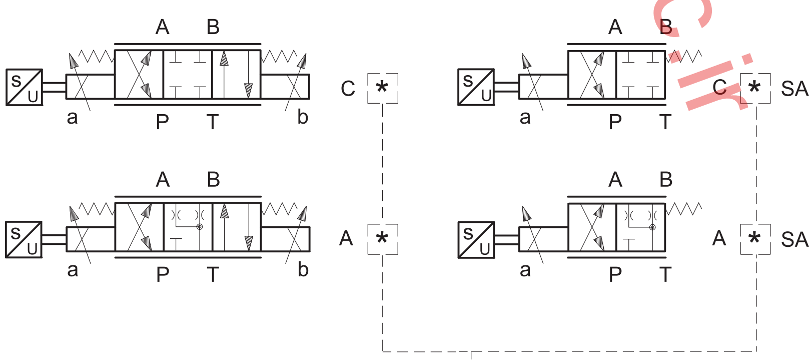
- **DS**: Direct operated directional control valve
- **E**: Electric proportional control
- **3**: Size ISO 4401-03 (CETOP 03)
- **F**: Position feedback
- Spool type:
  C = closed centres
  A = open centres
- Nominal flow rate:
  08 = 8 l/min
  16 = 16 l/min
  26 = 26 l/min
- Solenoid position (omit for configuration with two solenoids):
  SA = 1 solenoid on side A
- **11**: Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)
- Seals:
  N = NBR seals for mineral oil (**standard**)
  V = FPM seals for special fluids
- **D12**: Nominal solenoid voltage 12 VDC
- **K1**: Coil electrical connection: plug for connector type DIN 43650 (**standard**)

2 - CONFIGURATIONS

Valve configuration depends on the combination of the following elements:
number of proportional solenoids, spool type, rated flow.

Configuration 2 solenoids :
3 positions with spring centering

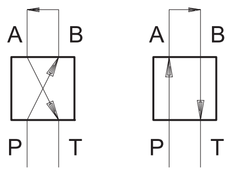
Configuration 1 solenoid on side A "**SA**":
2 positions (central + external) with spring centering



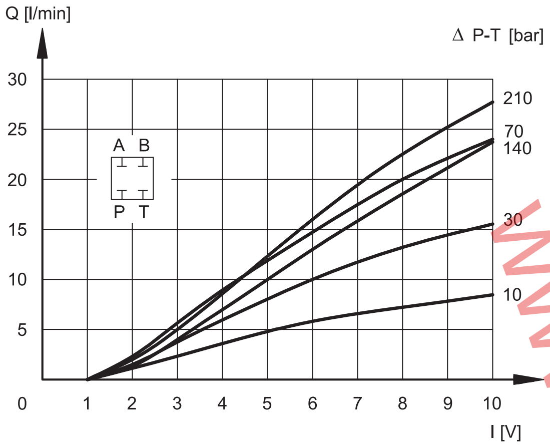
*	Controlled flow with Δp10 bar P-T
08	8 l/min
16	16 l/min
26	26 l/min

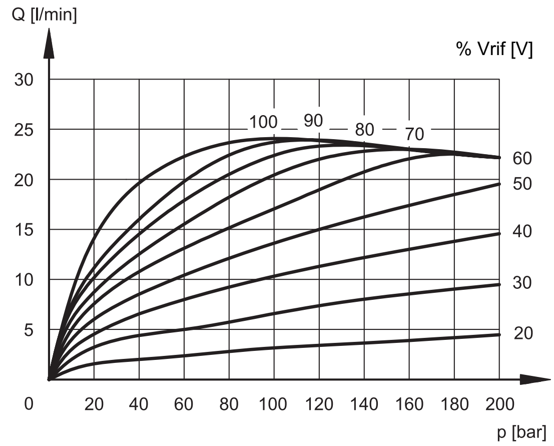
3 - CHARACTERISTIC CURVES (obtained with mineral oil with viscosity of 36 cSt at 50°C and with digital integrated electronics)

Typical flow rate curves at constant Δp related to the reference signal and measured for the available spools. The Δp values are measured between P and T valve ports.

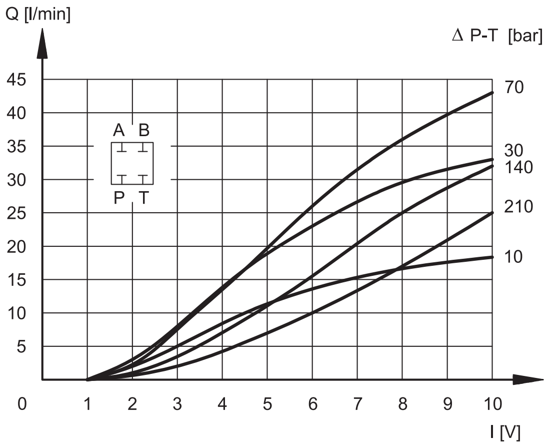


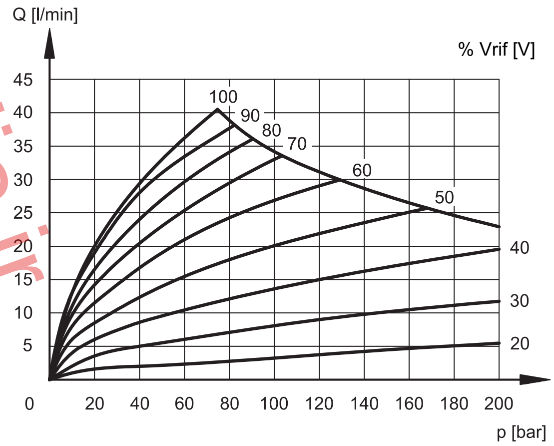
SPOOL C08



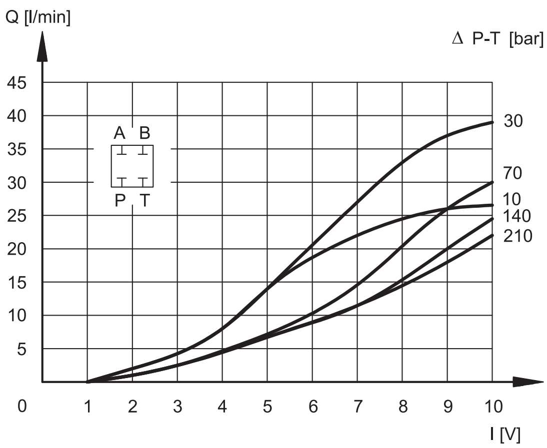


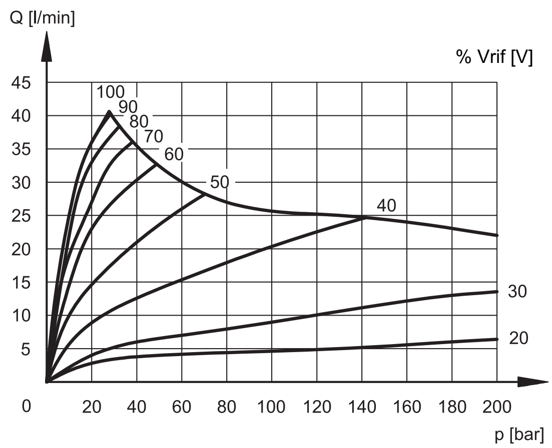
SPOOL C16



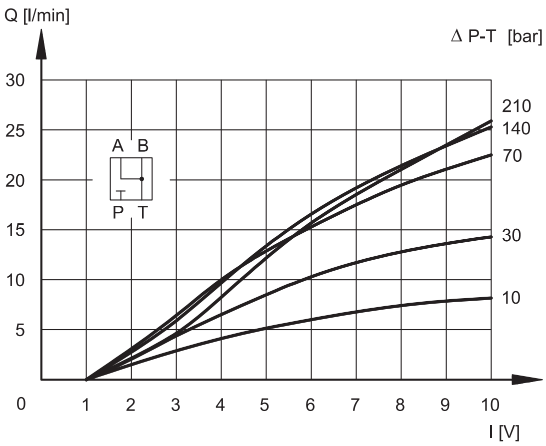


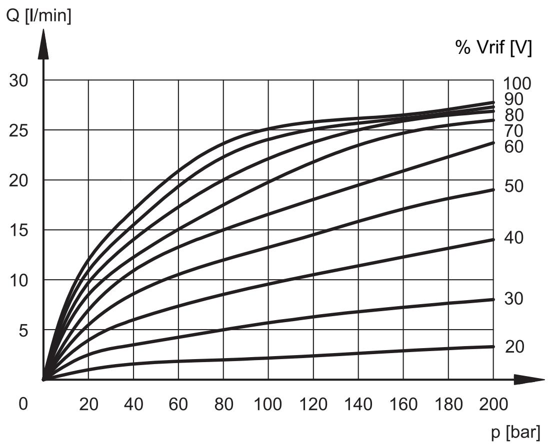
SPOOL C26



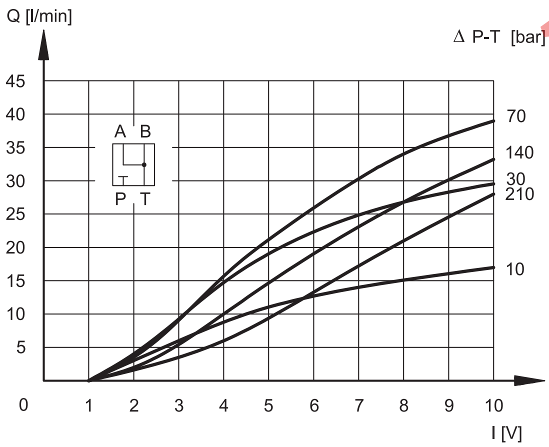


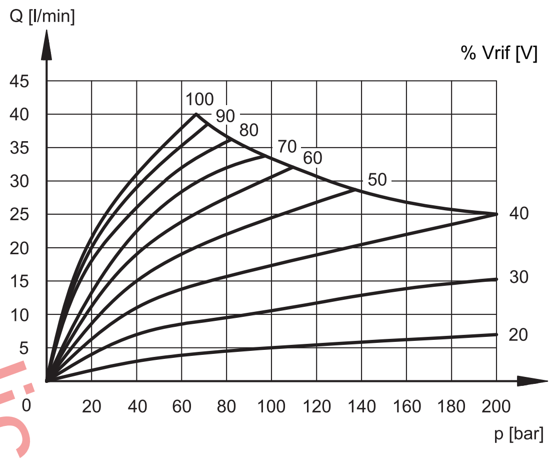
SPOOL A08



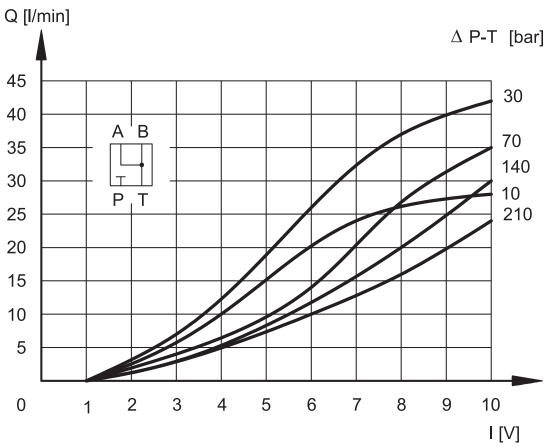


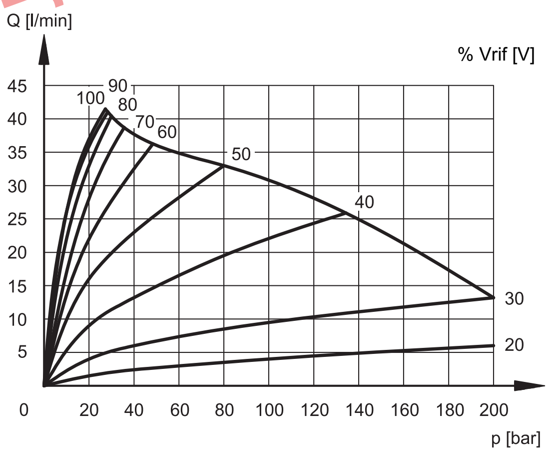
SPOOL A16





SPOOL A26





4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

5 - ELECTRICAL CHARACTERISTICS

5.1 - Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to reduce friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube and secured by means of a lock nut and can be rotated through 360°depending on installation clearances.

NOMINAL VOLTAGE	V DC	**12**
RESISTANCE (at 20°C)	Ω	3.66
MAXIMUM CURRENT	A	1.88
DUTY CYCLE		100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE	
CLASS OF PROTECTION: Atmospheric agents (CEI EN 60529)	IP 65	

5.2 - Positional transducer

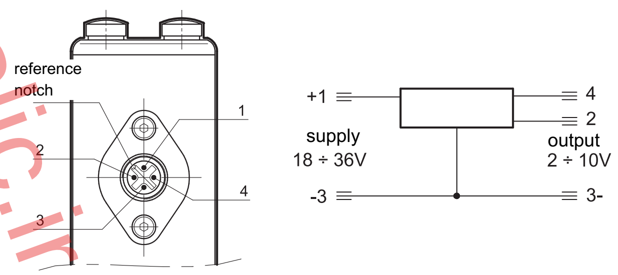
The DSE3F valve mounts an LVDT type positional transducer with amplified signal to enable precise control of the restrictor and the set flow rate, thus improving repeatability and hysteresis characteristics.

The transducer is fitted coaxially on the proportional solenoid and the connector features 360° positioning.

We recommend to use a screened cable to avoid interferences. Technical specifications and connections are indicated here beside.

The transducer is protected against polarity inversion on the power line.

Position transducer connection		Electronic card connections (see par. 9)
pin 1	supply 18 ÷ 36 V	pin 8c
pin 2	output 2 ÷ 10 V	pin 24a
pin 3	0 V	pin 22c
pin 4	NC	NC



6 - STEP RESPONSE (measured with mineral oil with viscosity of 36 cSt at 50°C with electronic control unit)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table illustrates typical response times with the C13 spool and with Δp = 30 bar P-T.

REFERENCE SIGNAL STEP	0 → 100%	100 → 0%
Step response [ms]	30	25

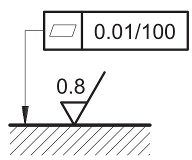
7 - INSTALLATION

DSE3F valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

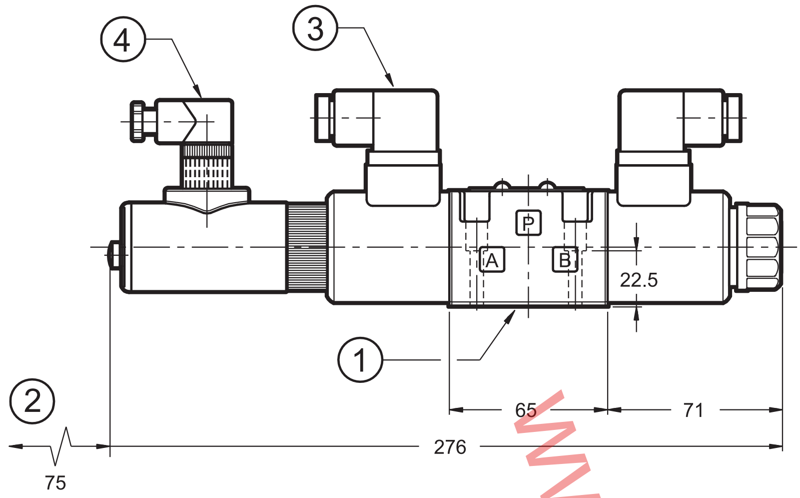
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and mounting surface.

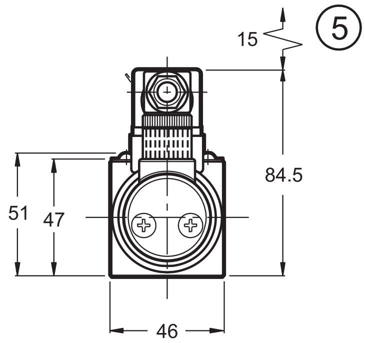
Surface finishing

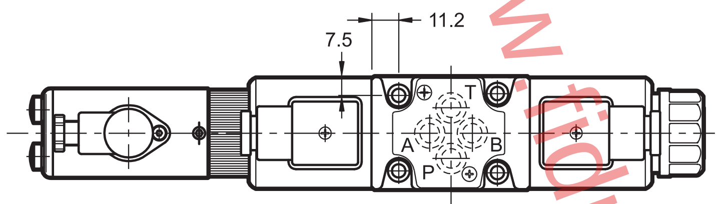


9 - OVERALL AND MOUNTING DIMENSIONS

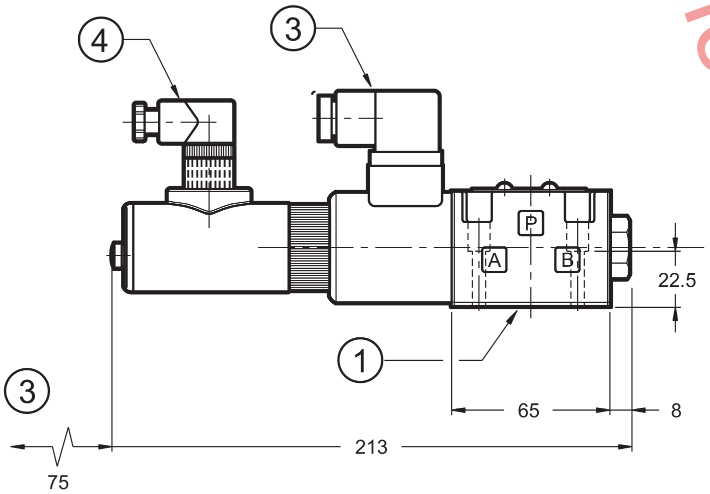
DSE3F-A*
DSE3F-C*

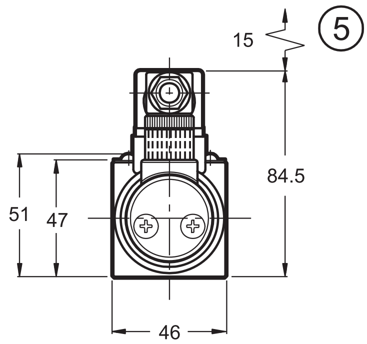


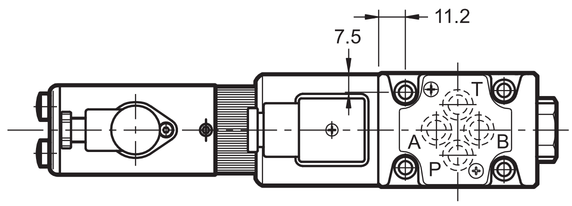




DSE3F-A* SA
DSE3F-C* SA







dimensions in mm

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25 x 1.78) - 90 shore
2	Transducer and coil removal space
3	Main electrical connector DIN 43650
4	Electrical connector 4 pin EC4S/M12S/10 code 3491001002 for position transducer (included)
5	Removal space of the main electrical connector

Fastening bolts: 4 bolts M5x30 - ISO 4762
Torque: 5 Nm

9 - ELECTRONIC CONTROL UNITS

UEIK-21RSD	for two solenoids valves 12V DC	Eurocard format	see cat. 89 335
UEIK-11RSD	for single solenoid valve 12V DC	Eurocard format	see cat. 89 315

A card holder, PSC-32D/20 is available, to be ordered separately with code 3899000001.

10 - SUBPLATES (see catalogue 51 000)

PMMD-AI3G rear ports
PMMD-AL3G side ports
Ports dimensions: P, T, A, B: 3/8" BSP

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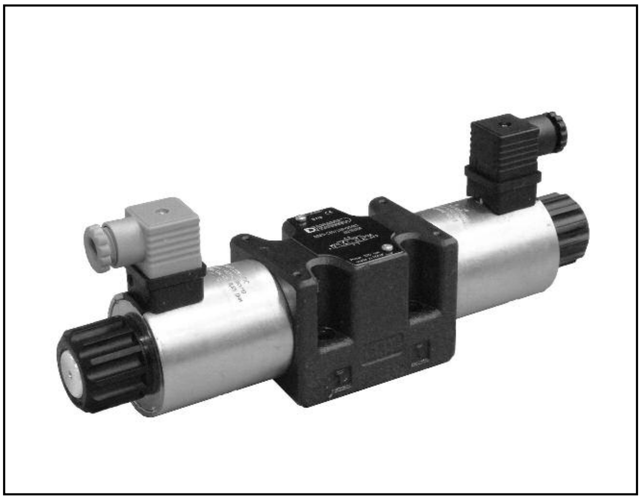
DSE5

DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL

SERIES 10

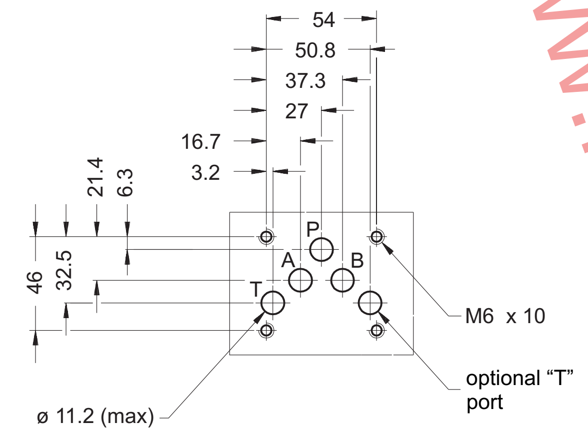


SUBPLATE MOUNTING
ISO 4401-05

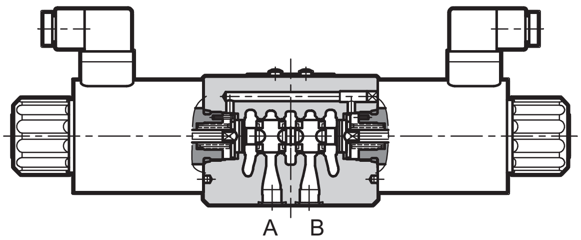
p max **320** bar
Q max **90** l/min

MOUNTING INTERFACE

ISO 4401-05-04-0-05
(CETOP 4.2-4-05-320)



OPERATING PRINCIPLE



— The DSE5 valve is a directly operated directional control valve with electric proportional control and with ports in compliance with ISO 4401 standards.

— It is used for directional and speed control of the hydraulic actuators.

— Valve opening and hence flow rate can be modulated continuously in proportion to the current supplied to the solenoid.

— The valve can be controlled directly by a current control supply unit or by means of the relative electronic control units to exploit valve performance to the full (see paragraph 11).

— Other two versions with external subplate drain port are available (see paragraph 9).

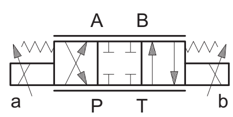
PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

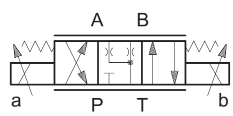
Maximum operating pressure: - P - A - B ports - T port : standard version version with Y port	bar	320 210 320
Maximum flow with Δp 10 bar P-T	l/min	30 - 60
Step response	see paragraph 6	
Hysteresis (with PWM 100 Hz)	% of Q max	< 6%
Repeatability	% of Q max	< ±1,5%
Electrical characteristics	see paragraph 5	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	4,4 5,9

HYDRAULIC SYMBOLS (typical)

DSE5-C*



DSE5-A*



1 - IDENTIFICATION CODE

D	S	E	5	-				/	10		-			/		

Directly operated directional control valve

Electric proportional control

Size ISO 4401-05

Spool type:
C = closed centers
A = open centers

Spool nominal flow (see table 2)

Solenoid position (omit for configuration with two solenoids):
SA = 1 solenoid on side A
SB = 1 solenoid on side B

Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

D12 = Nominal solenoid voltage 12V DC
D24 = Nominal solenoid voltage 24V DC

Coil electrical connection:
plug for connector type DIN 43650 (**standard**)

Option: manual override (see at par. 9)

Option:
/ W7 = Zinc-nickel surface treatment (see **NOTE**)
Omit if not required

NOTE: The standard valve is supplied with surface treatment of phosphating black.

The zinc-nickel finishing makes the valve suitable to ensure a salt spray resistance up to 240 hours (test operated according to EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

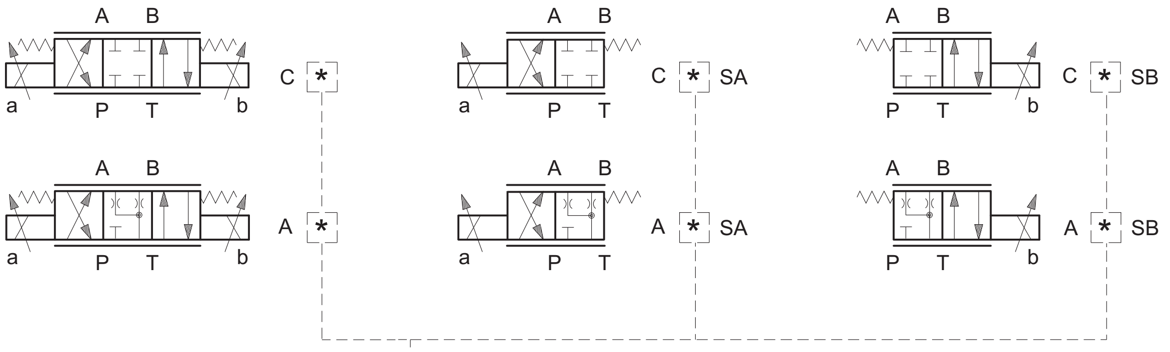
2 - CONFIGURATIONS

Valve configuration depends on the combination of the following elements: number of proportional solenoids, spool type, nominal flow rate.

2 solenoids configuration:
3 positions with spring centering

"**SA**" configuration: 1 solenoid on side A.
2 positions (central + external)
with spring centering

"**SB**" configuration: 1 solenoid on side B.
2 positions (central + external)
with spring centering



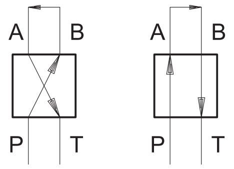
*	Controlled flow with Δp 10 bar P-T
30	30 l/min
60	60 l/min
60/30	60 (P-A) / 30 (B-T) l/min

3 - CHARACTERISTIC CURVES

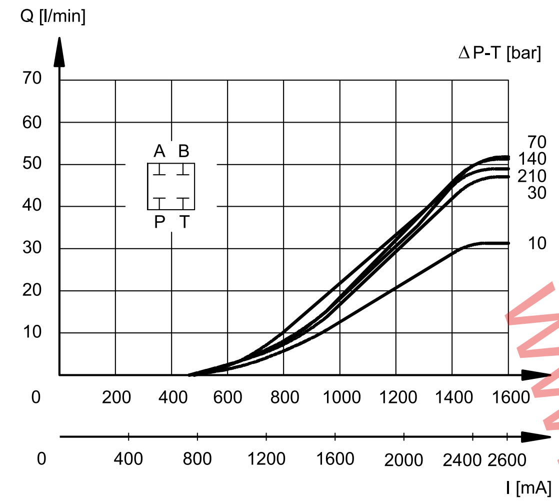
(values measured with oil viscosity of 36 cSt at 50°C and with electronic control unit)

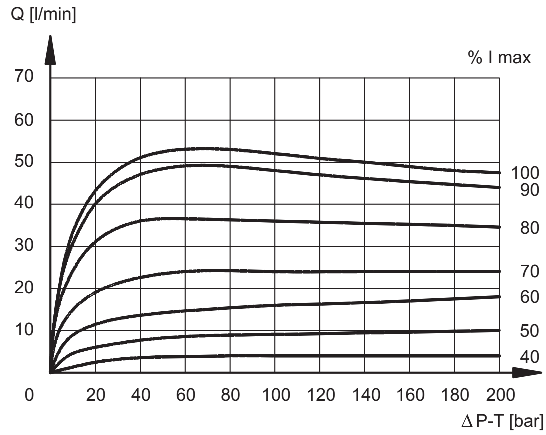
Typical constant flow rate control curves at Δp according to current supply to solenoid (D24 version, maximum current 1600 mA), measured for the various spools types available.

The reference Δp values are measured between ports P and T on the valve.

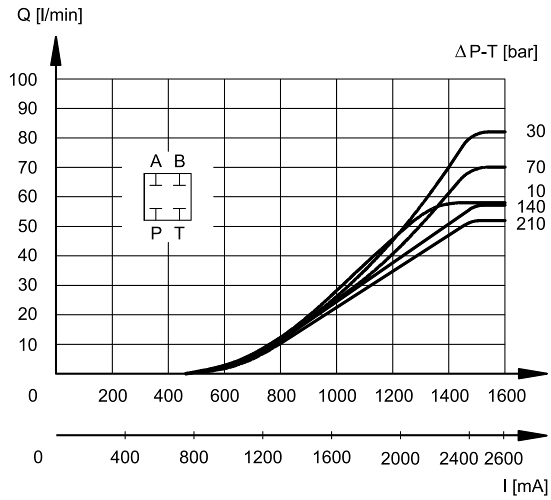


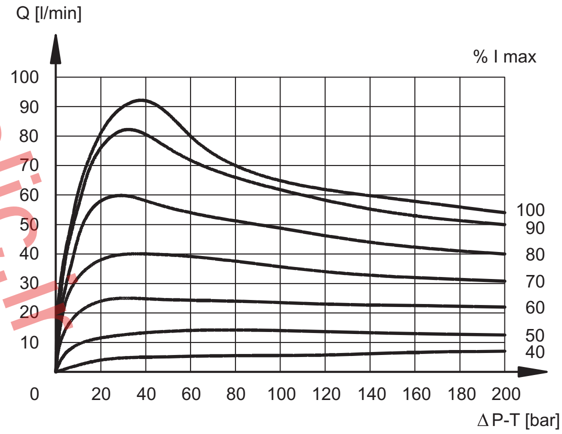
SPOOL TYPE C30



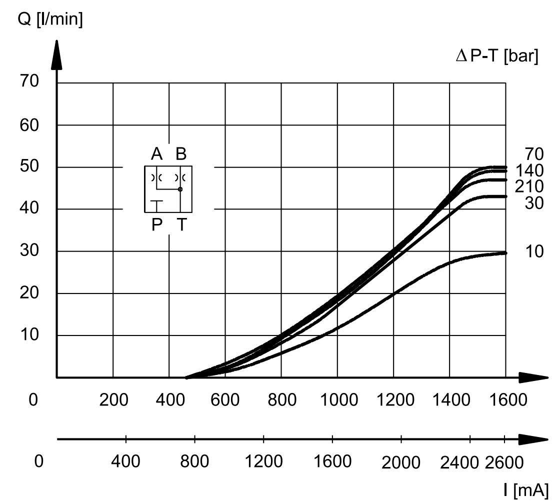


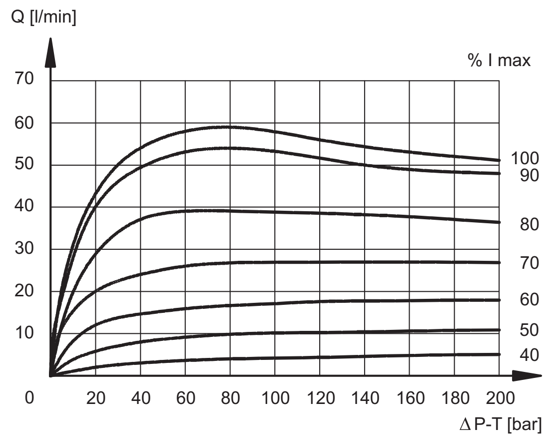
SPOOL TYPE C60



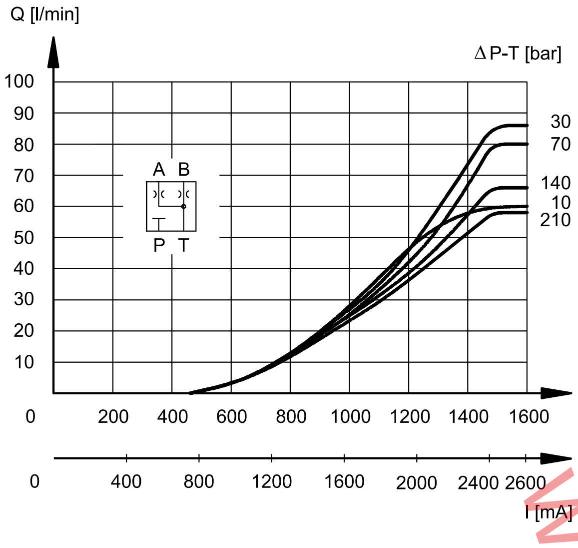


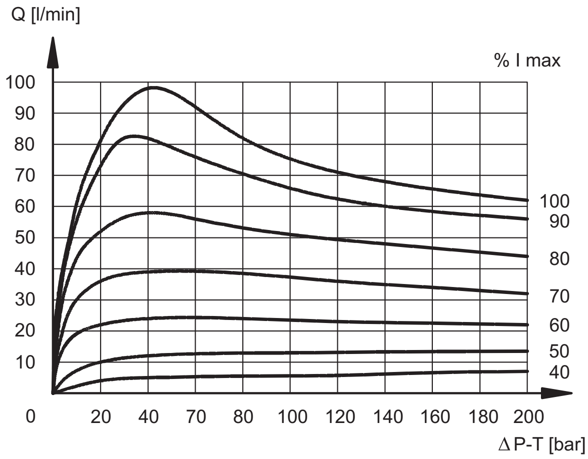
SPOOL TYPE A30





SPOOL TYPE A60





4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

5 - ELECTRICAL CHARACTERISTICS

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut.

It can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	VDC	**12**	**24**
RESISTANCE (at 20°C)	Ω	3 - 3.4	8.65
MAXIMUM CURRENT	A	2.6	1.6
DUTY CYCLE	100%		
ELECTROMAGNETIC COMPATIBILITY (EMC)	according to 2004/108/EC		
CLASS OF PROTECTION: atmospheric agents (IEC 60529) coil insulation (VDE 0580) Impregnation	 IP 65 class H class F		

6 - STEP RESPONSE

(measured with mineral oil with viscosity of 36 cSt at 50°C and with electronic control unit)

Step response is the time taken for the valve to reach 90% of the set position value following a step change of reference signal.

The table shows typical response times tested with spool type C60 and ∆p = 20 bar P-T.

REFERENCE SIGNAL STEP	0→100%	100%→0
Step response [ms]		
DSE5-A* **DSE5-C***	50	40

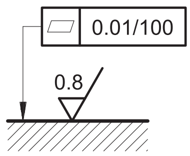
7 - INSTALLATION

DSE5 valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed fluid can easily leak between the valve and support surface.

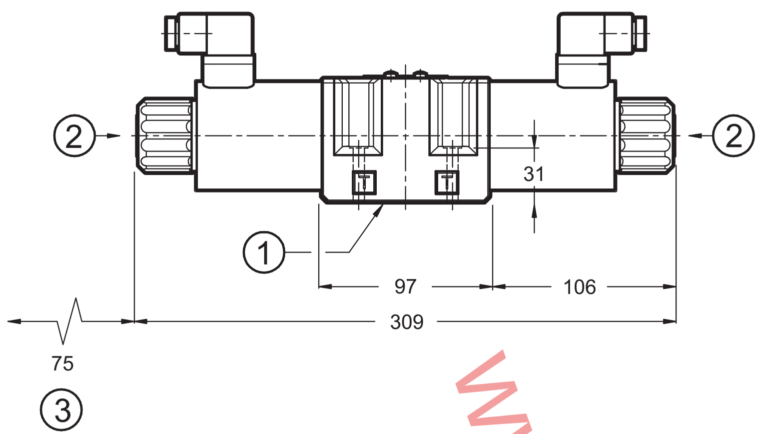
Surface finishing

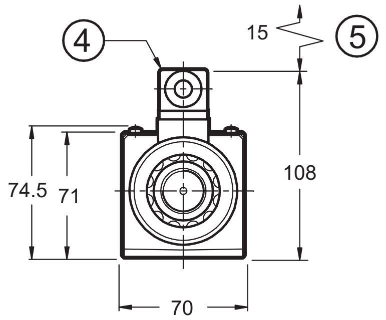


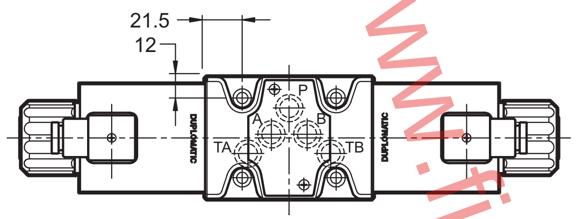
8 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

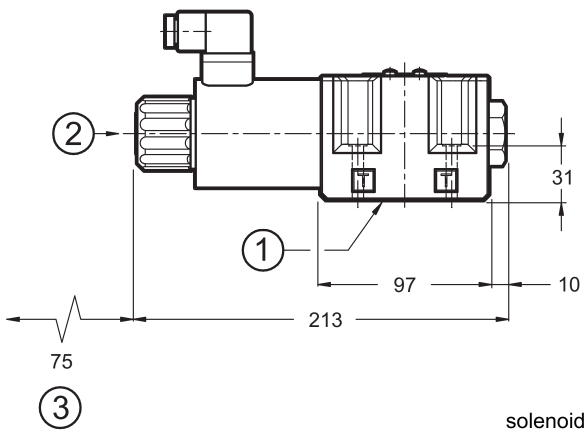
DSE5-A*
DSE5-C*

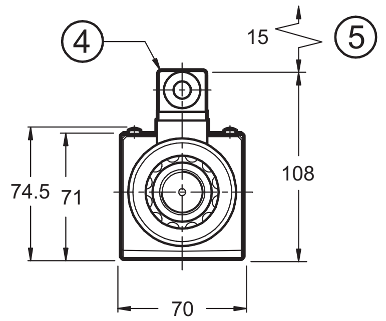


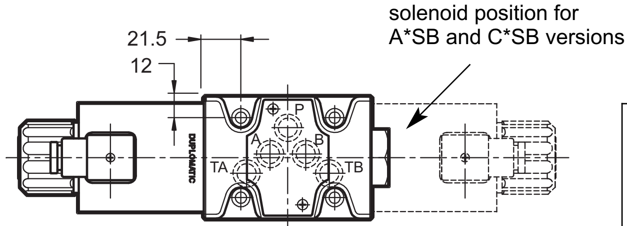




DSE5-A*SA
DSE5-C*SA







1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore Additional for version Y: 1 OR 2037 (9.25x1.78) - 90 Shore Additional for version L: 1 OR 2025 (6.07x1.78) - 90 Shore
2	Standard manual override integrated in the solenoid tube
3	Coil removal space
4	DIN 43650 electric connector
5	Connector removal space

Fastening bolts: 4 SHC screws ISO 4762 M6x40
Torque: 8 Nm (bolts A8.8)
Threads of mounting holes: M6x10

9 - VERSIONS WITH EXTERNAL DRAIN PORT

9.1 - Identification Code

D	S	E	5	-				/	10		-		K1	/	

Directly operated directional control valve

Electric proportional control

ISO 4401-05 size

Spool type:
C = closed centers
A = open centers

Spool nominal flow (see table 2)

Solenoid position (omit for configuration with two solenoids):
SA = 1 solenoid on side A
SB = 1 solenoid on side B

Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

D12 = Nominal solenoid voltage 12V DC
D24 = Nominal solenoid voltage 24V DC

Coil electrical connection: plug for connector type DIN 43650 (**standard**)

Port for subplate external drain
Y = according to ISO 4401-05-05-0-05
L = according to I ISO 4401-05-06-0-05

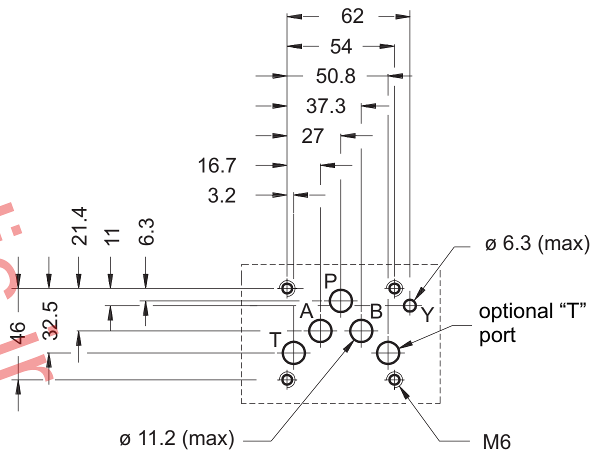
These versions allow the operation with pressures up to 320 bar on T port of the valve .

The additional drain port is connected with the solenoid chamber: in this way the tubes are not stressed by the pressure operating on the T port of the valve.

9.2 - Y Version

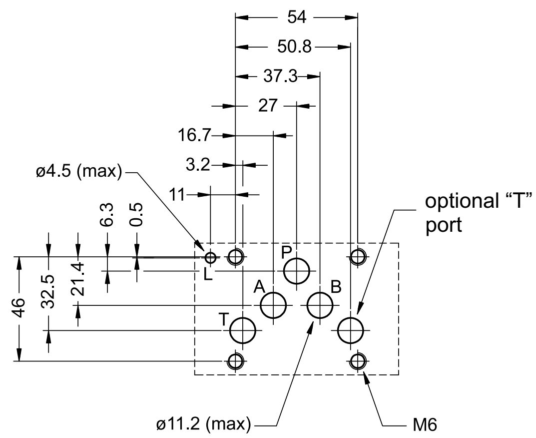
The drain port Y is realized on the valve mounting surface in compliance with ISO 4401-05-05-0-05 standard.

There is no X port.



9.3 - L version

It consists of a drain port on the mounting surface of the valve according to ISO 4401-05-06-0-05 standard



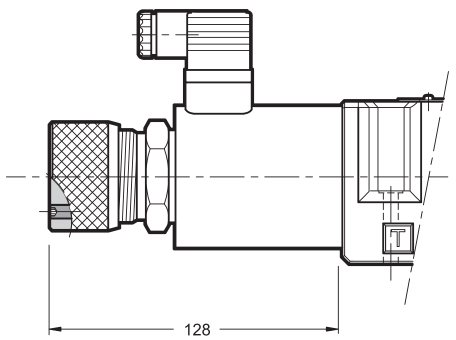
10 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

The following manual override is available upon request:

- **CK** version, knob. When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.

CK Version



Spanner for set screw: 3 mm
Code: 3803260003

11 - ELECTRONIC CONTROL UNITS

DSE5- * *SA (SB)

EDC-131	for solenoid 24V DC	plug version	see catalogue 89 120
EDC-151	for solenoid 12V DC		
EDM-M131	for solenoid 24V DC	DIN EN 50022 rail mounting	see catalogue 89 250
EDM-M151	for solenoid 12V DC		

DSE5- A* **DSE5-C***

EDM-M231	for solenoid 24V DC	DIN EN 50022 rail mounting	see catalogue 89 250
EDM-M251	for solenoid 12V DC		

12 - SUBPLATES

(see cat. 51 000)

Type PMD4-AI4G with rear ports 3/4” BSP
Type PMD4-AL4G with side ports 1/2” BSP

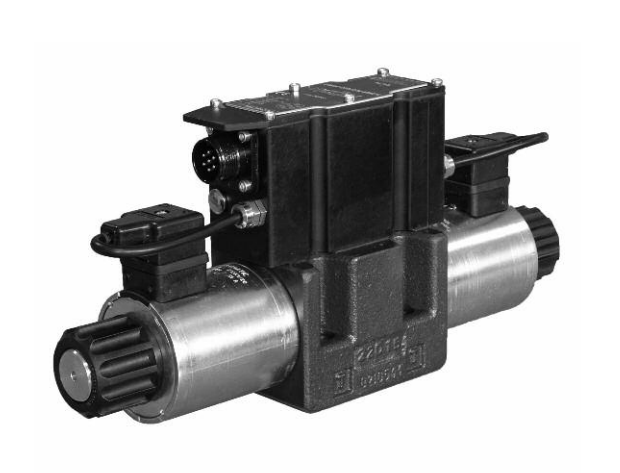
DUPLOMATIC OLEODINAMICA

DUPLOMATIC OLEODINAMICA S.p.A.
20015 PARABIAGO (MI) • Via M. Re Depaolini 24
Tel. +39 0331.895.111
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

DSE5G

DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL AND INTEGRATED ELECTRONICS

SERIES 30

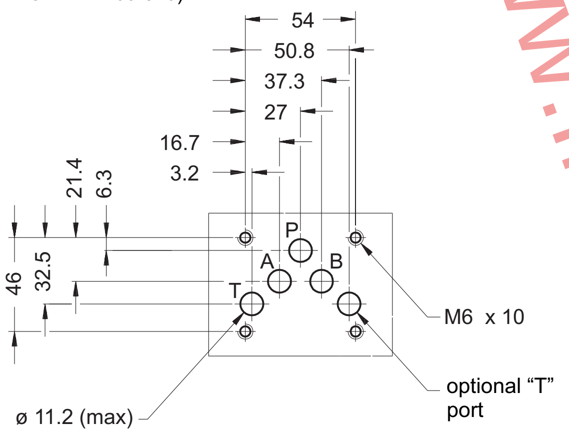


SUBPLATE MOUNTING
ISO 4401-05 (CETOP 05)

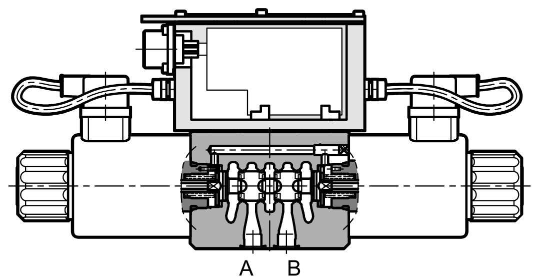
p max **320** bar
Q max **90** l/min

MOUNTING SURFACE

ISO 4401-05-04-0-05
(CETOP 4.2-4-05-320)



OPERATING PRINCIPLE



— The DSE5G is a direct operated directional valve with integrated electric proportional control and mounting interface in compliance with ISO 4401 standards.

— It is used for control the positioning and the speed of hydraulic actuators.

— The valves are available with command signal in voltage or current, and on-board electronics with internal enable, external enable or 0V monitor on pin C.

— A solenoid current monitoring signal is available.

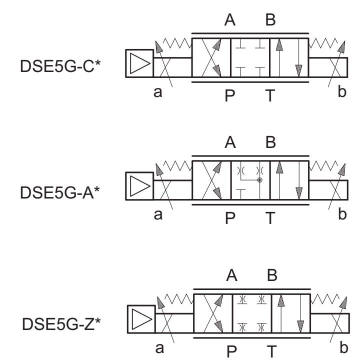
— The valve is easy to install. The driver directly manages digital settings. In the event of special applications, you can customize the settings using the optional kit (see par. 11.3)

PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

Maximum operating pressure: - P - A - B ports - T port	bar	320 140
Maximum flow with Δp 10 bar P-T	l/min	30 - 60
Response times	see paragraph 7	
Hysteresis	% of Q max	< 3%
Repeatability	% of Q max	< ±1%
Electrical characteristics	see paragraph 3	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	5,1 6,6

HYDRAULIC SYMBOLS (typical)



1 - IDENTIFICATION CODE

D	S	E	5	G	-				/	30		-		K11	

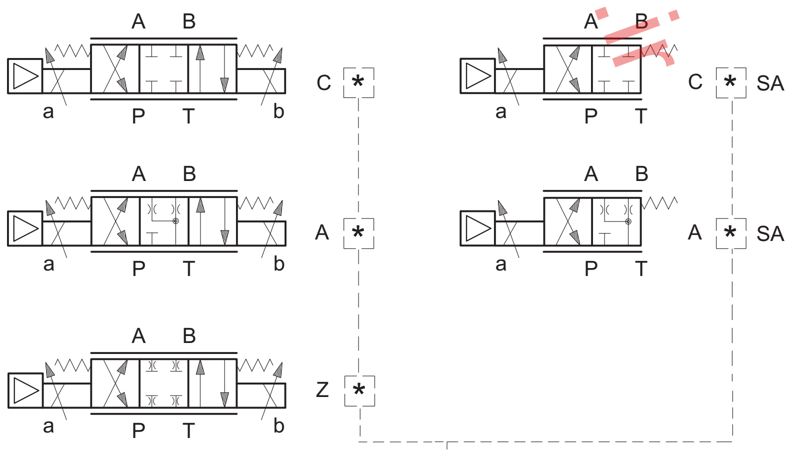
- Direct operated directional control valve (D S)
- Electric proportional control (E)
- Size ISO 4401-05 (CETOP 05) (5)
- Digital integrated electronics for open loop (G)
- Spool type:
  C = closed centres
  A = open centers
  Z = with overlap jump
- Nominal flow rate of the spool (see chart par. 2)
- Solenoid position (omit for 2 solenoids configuration):
  SA = 1 solenoid on side A
- Series No. (the overall and mounting dimensions remain unchanged from 30 to 39)
- Seals:
  N = NBR seals for mineral oil (**standard**)
  V = FPM seals for special fluids
- Reference signal:
  E0 = voltage ±10 V
  E1 = current 4 ÷ 20 mA
- Main connector 6 pin + PE (K11)
- Pin C function:
  A = external enable
  B = internal enable
  C = 0V monitor

2 - CONFIGURATION

Valve configuration depends on the combination of the following elements: number of proportional solenoids, spool type, rated flow.

Configuration 2 solenoids : 3 positions with spring centering

Configuration 1 solenoid on side A "**SA**": 2 positions (central + external) with spring centering



*	Controlled flow with 10 bar P-T
30	30 l/min
60	60 l/min
60/30	60 (P-A) / 30 (B-T) l/n

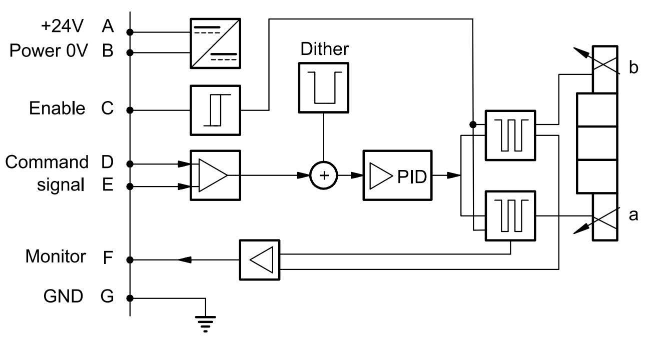
3 - ELECTRICAL CHARACTERISTICS

3.1 - Electrical on board electronics

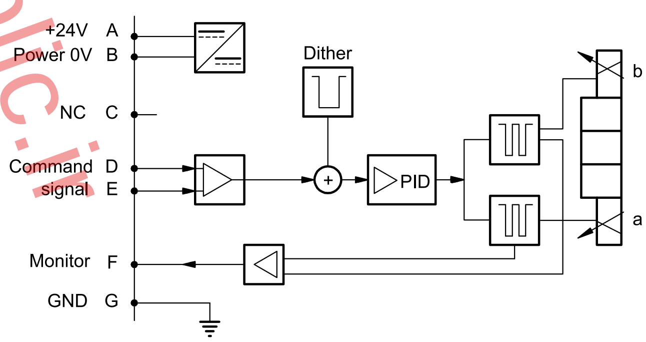
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 35 VDC), ripple max 3 Vpp
Power consumption	VA	40
Maximum solenoid current	A	2.8
Fuse protection, external		3A
Command signals: voltage (E0) current (E1)	V DC mA	±10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signals: voltage (E0) current (E1)	V DC mA	±10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failure
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2004/108/EC standards

3.2 - On-board electronics diagrams

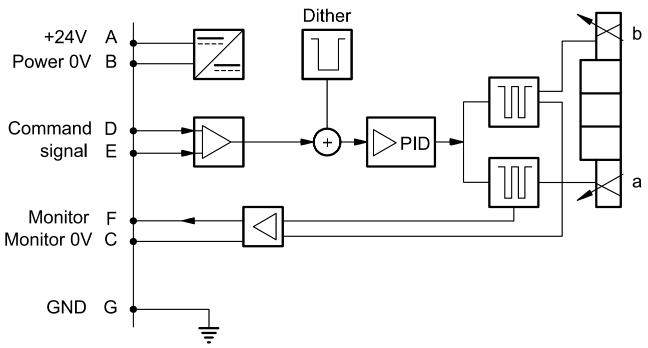
VERSION **A** - External Enable



VERSION **B** - Internal Enable

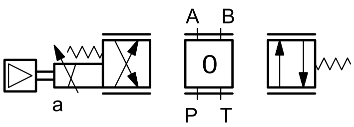


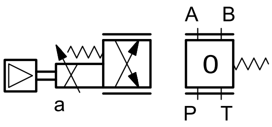
VERSION **C** - 0V Monitor



4 - VERSIONS WITH VOLTAGE COMMAND (E0)

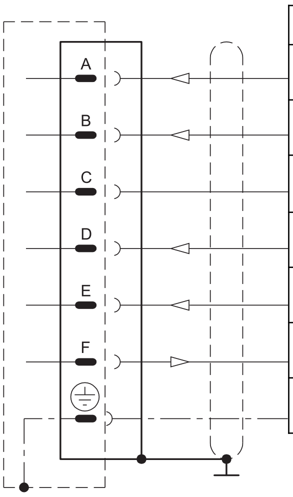
The reference signal is between -10V and +10V on double solenoid valve, and 0…10V on single solenoid valves SA. The monitor feature of versions B anc C becomes available with a delay of 0,5 sec from the power-on of the card.





COMMAND	**-10V**	**0V**	**+10V**
MONITOR	**-10V**	**0V**	**+10V**

COMMAND	**+10V**	**0V**
MONITOR	**+10V**	**0V**

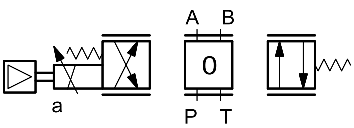


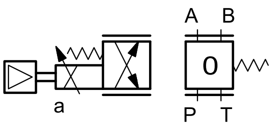
Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	± 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	± 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

5 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

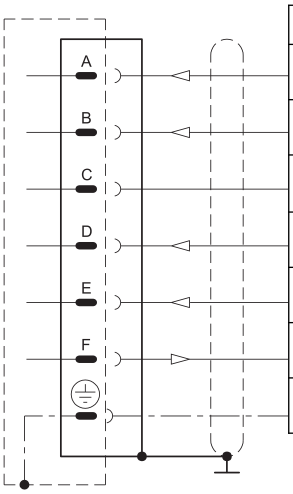
The monitor feature of versions B anc C becomes available with a delay of 0,5 sec from the power-on of the card.





COMMAND	**4 mA**	**12 mA**	**20 mA**
MONITOR	**4 mA**	**12 mA**	**20 mA**

COMMAND	**20 mA**	**4 mA**
MONITOR	**20 mA**	**4 mA**



Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

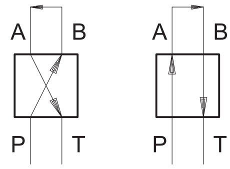
6 - CHARACTERISTIC CURVES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

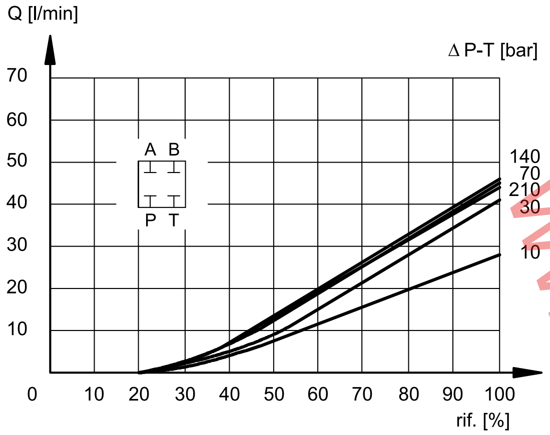
Typical flow rate curves at constant Δp related to the reference signal and measured for the available spools.

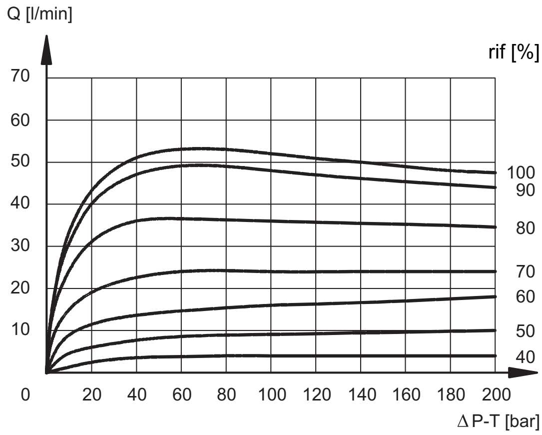
The curves are obtained with a constant meter-in with Δp of 5 bar and by setting the value of flow start at 20% of the reference signal.

NOTE: for spools with overlap jump (Z), please refer to the characteristic curves of spools C type, considering that the starting flow rate value is approx. 150 mV.

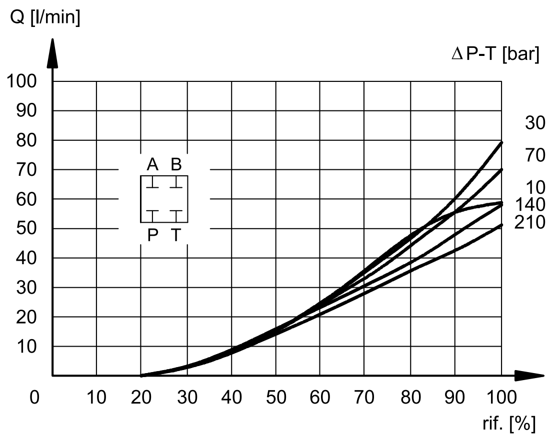


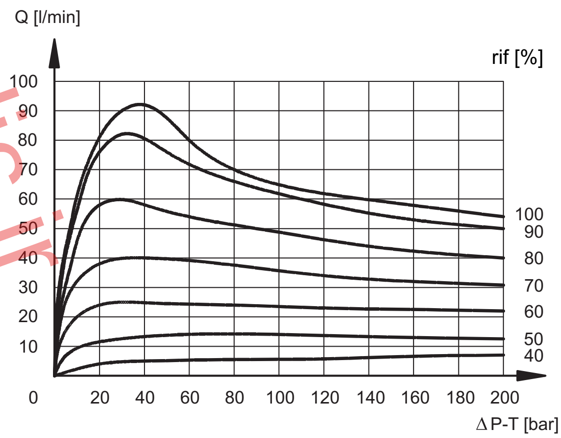
SPOOL TYPE C30



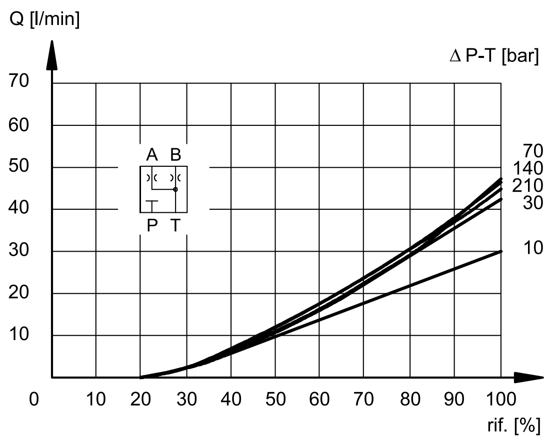


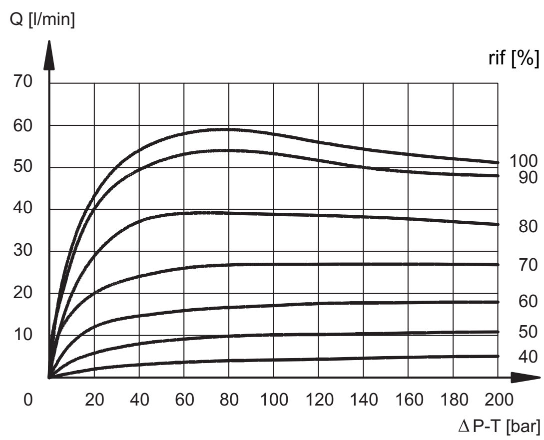
SPOOL TYPE C60



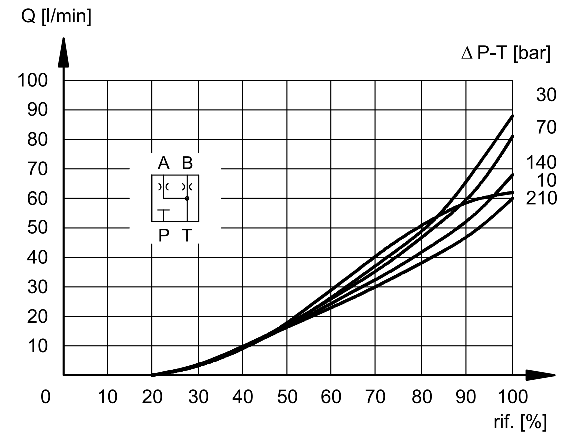


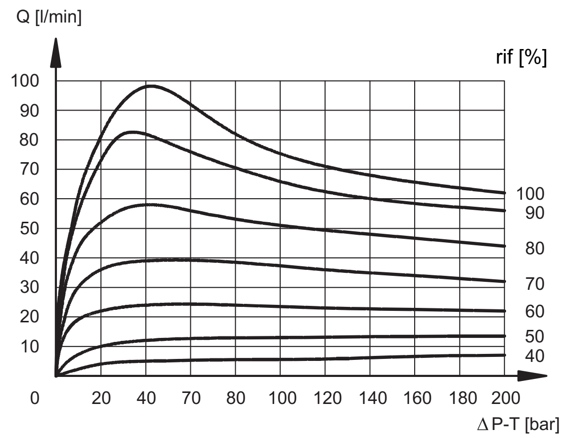
SPOOL TYPE A30





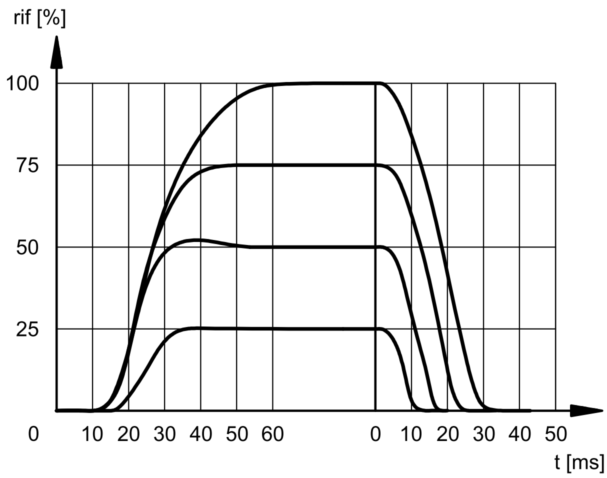
SPOOL TYPE A60





7 - RESPONSE TIMES

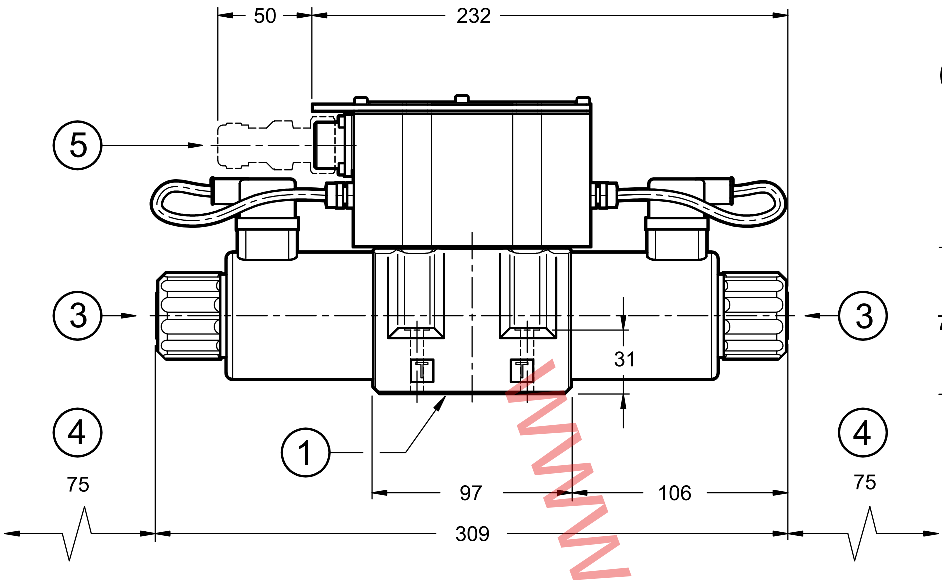
(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

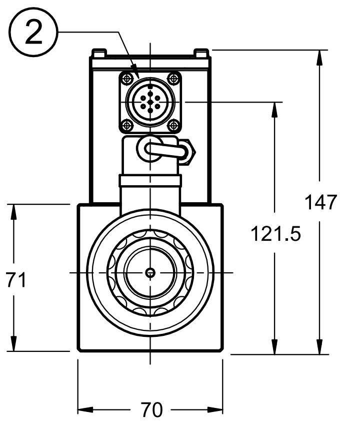


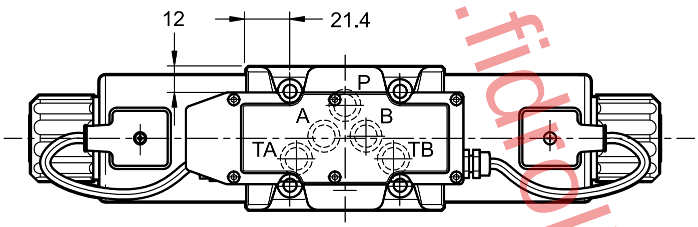
8 - OVERALL AND MOUNTING DIMENSIONS

DSE5G-A*
DSE5G-C*
DSE5G-Z*

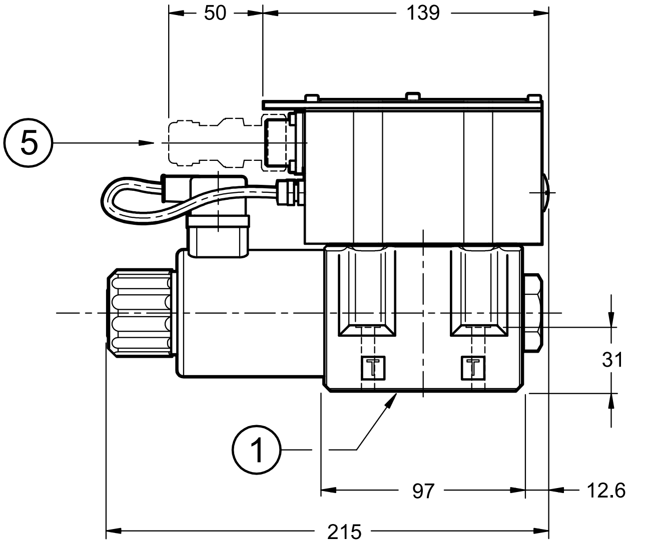
dimensions in mm







DSE5G-A* SA
DSE5G-C* SA



Fastening bolts: 4 bolts M6x40 - ISO 4762
Torque: 8 Nm (A8.8)
Threads of mounting holes: M6x10

1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) 90 Shore
2	Main connection
3	Standard manual override embedded in the solenoid tube
4	Coil removal space
5	Mating connector. **To be ordered separately.** See paragraph 11

9 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

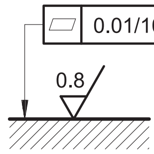
10 - INSTALLATION

DSE5G valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Surface finishing

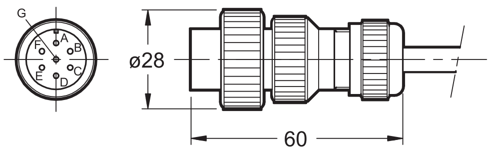


11 - ACCESSORIES

(to be ordered separately)

11.1 Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.



⚠ So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**

11.2 - Connection cables size

Power supply:
- up to 20 m cable length : 1,0 mm²
- up to 40 m cable length : 1,5 mm²

Signal: 0,50 mm²

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

11.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

12 - SUBPLATES

(see catalogue 51 000)

PMD4-AI4G rear ports 3/4” BSP
PMD4-AL4G side ports 1/2” BSP

DUPLOMATIC OLEODINAMICA
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Fax +39 0331.895.339
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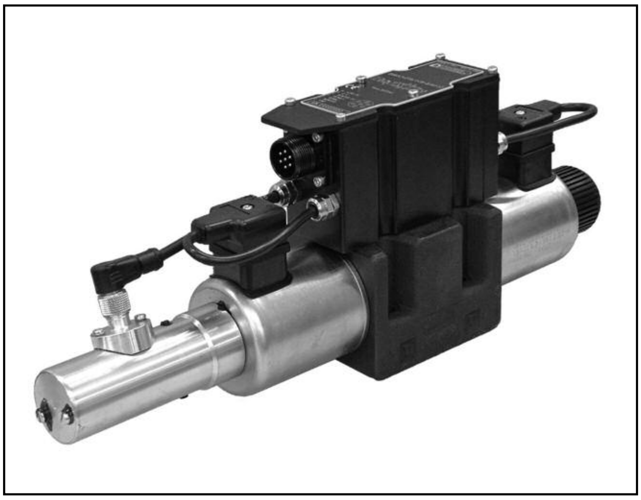


DSE5J

DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL FEEDBACK AND INTEGRATED ELECTRONICS

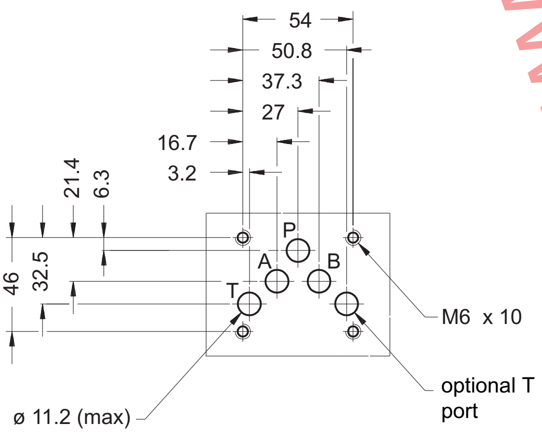
SERIES 30

SUBPLATE MOUNTING
ISO 4401-05

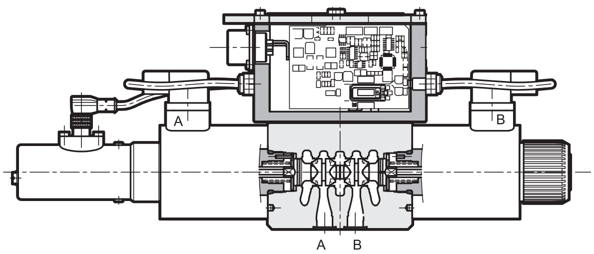
p max **320** bar
Q max **180** l/min

MOUNTING INTERFACE

ISO 4401-05-04-0-05
(CETOP 4.2-4-05-320)



OPERATING PRINCIPLE



— The DSE5J is a direct operated directional valve with electric proportional control, on-board electronics and feedback, with mounting interface in compliance with ISO 4401 standards.

— It is used to control the direction and the speed of hydraulic actuators.

— Transducer and digital card allow a fine control of the positioning of the cursor, reducing hysteresis and response time and optimizing the performance of the valve.

— The valves are available with command signal in voltage or current and on board electronics with internal enable, external enable or 0V monitor on pin C.

— The monitoring of the spool position is available on pin F.

— The valve is easy to install. The driver directly manages digital settings (see par. 6). In the event of special applications, you can customize the settings using the optional kit (see par. 11).

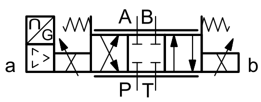
PERFORMANCES

(Obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

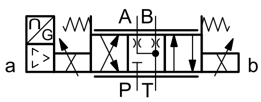
Max operating pressure: - P - A - B ports - T port	bar	320 210
Nominal flow with Δp 10 bar P-T	l/min	50 - 75
Response times	see paragraph 7	
Hysteresis	% of Q max	< 0,2%
Repeatability	% of Q max	< ± 0,1%
Threshold		< 0,1%
Valve reproducibility		≤ 5%
Electrical characteristics, IP	see paragraph 3	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	5,6 7,1

HYDRAULIC SYMBOLS (typical)

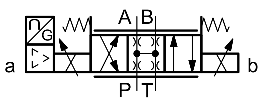
DSE5J-C*



DSE5J-A*



DSE5J-Z*



1 - IDENTIFICATION CODE

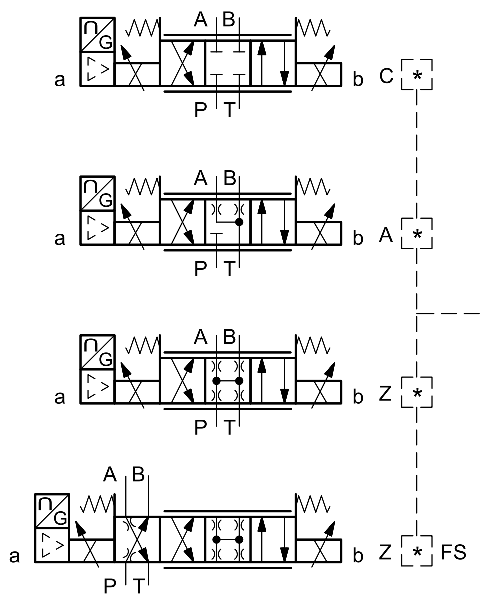
D	S	E	5	J	-					/	30		-		K11	

- Direct operated directional control valve (DS)
- Electric proportional control (E)
- Size ISO 4401-05 (5)
- Digital integrated electronics for valves with feedback (J)
- Spool type:
  C = closed centres
  A = open centres
  Z = zero overlap
- Nominal flow rate of the spool (see par. 2)
- **FS** = Fail safe option. (omit if not required).
- Solenoid position (omit for 2 solenoids configuration):
  SA = 1 solenoid on side A
- Series N. (the overall and mounting dimensions remain unchanged from 30 to 39)
- Seals:
  N = NBR seals for mineral oil (**standard**)
  V = FPM seals for special fluids
- Reference signal:
  E0 = voltage ±10 V
  E1 = current 4 ÷ 20 mA
- Main connector 6 pin + PE (K11)
- Pin C function:
  A = external enable
  B = internal enable
  C = 0V monitor

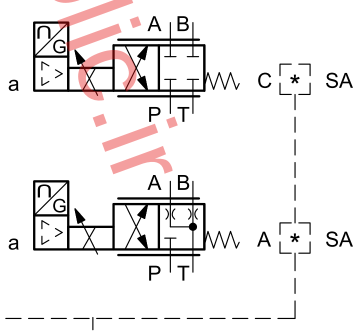
2 - CONFIGURATIONS

The valve configuration depends on the combination of the following elements:
number of proportional solenoids, spool type, rated flow.

Configuration 2 solenoids :
3 positions with spring centering



Configuration 1 solenoid on side A “**SA**”:
2 positions (central + external) with spring centering



*	Controlled flow with Δp 10 bar P-T
50	50 l/min
75	75 l/min
70/35	70 (P-A) / 35 (P-B) l/min

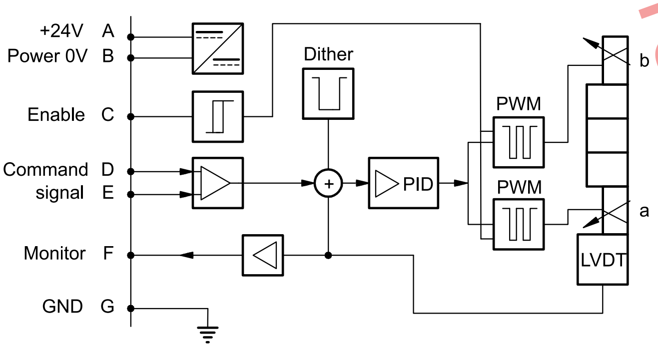
3 - ELECTRICAL CHARACTERISTICS

3.1 - Electrical on board electronics

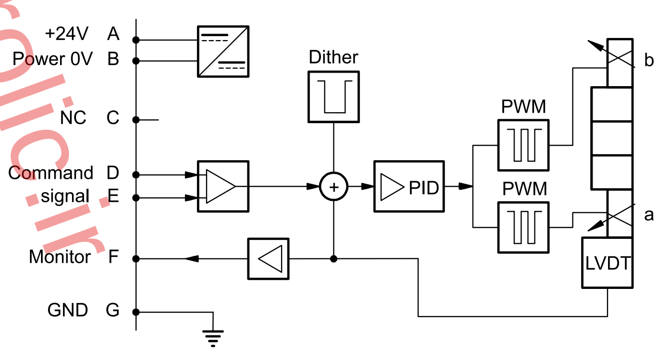
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	40
Maximum solenoid current	A	2.8
Fuse protection, external		3A
Command signals: voltage (E0) current (E1)	V DC mA	±10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signals: voltage (E0) current (E1)	V DC mA	±10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, LVDT sensor error, cable breakdown, supply voltage failure
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2004/108/EC standards

3.2 - On-board electronics diagrams

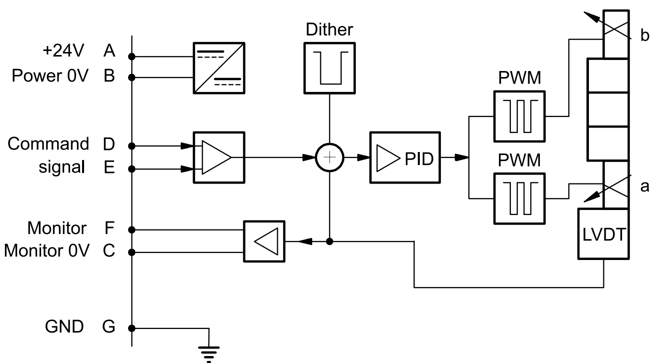
VERSION **A** - External Enable



VERSION **B** - Internal Enable

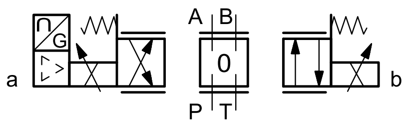


VERSION **C** - 0V Monitor

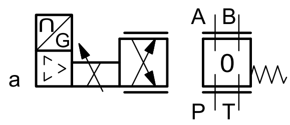


4 - VERSIONS WITH VOLTAGE COMMAND (E0)

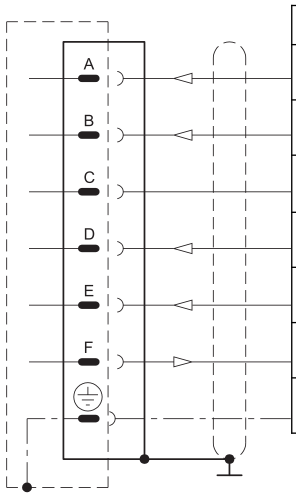
The reference signal is between -10V and +10V on double solenoid valve, and 0…10V on single solenoid valves SA. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**-10V**	**0V**	**+10V**
MONITOR	**-10V**	**0V**	**+10V**



COMMAND	**+10V**	**0V**
MONITOR	**+10V**	**0V**

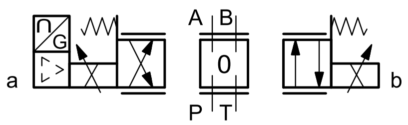


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	± 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	± 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

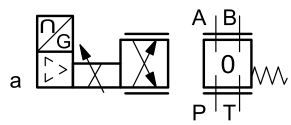
5 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

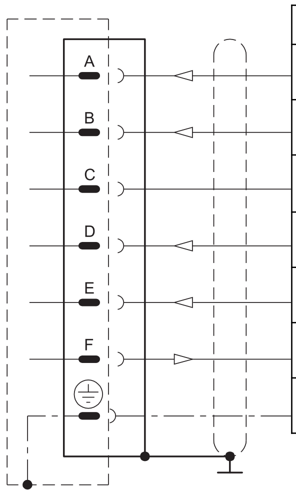
The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**4 mA**	**12 mA**	**20 mA**
MONITOR	**4 mA**	**12 mA**	**20 mA**



COMMAND	**20 mA**	**4 mA**
MONITOR	**20 mA**	**4 mA**

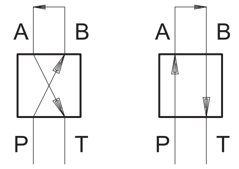


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

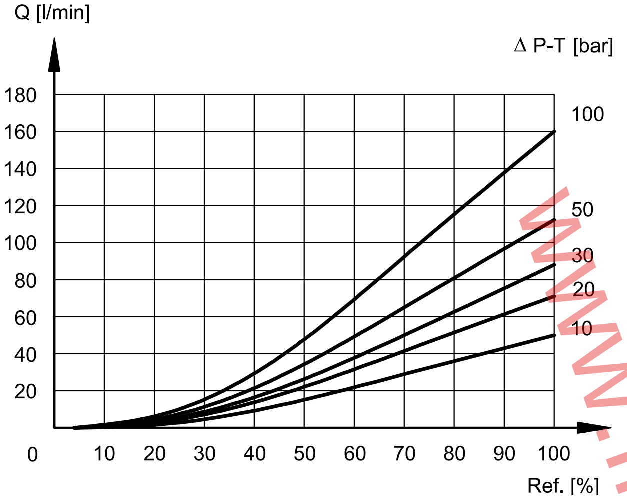
6 - CHARACTERISTIC CURVES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

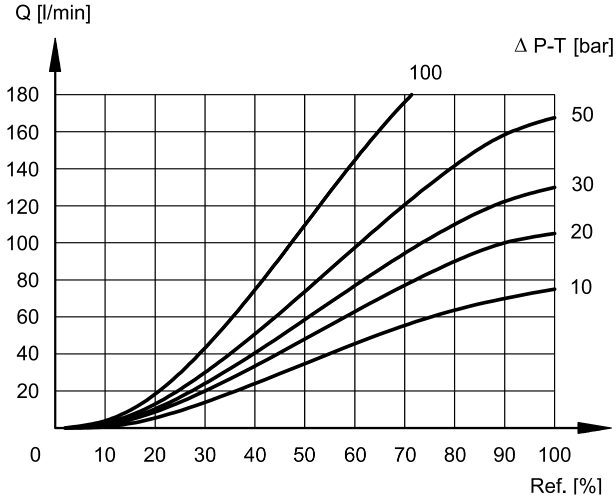
Typical flow rate curves at constant Δp related to the reference signal and measured for the available spools. The Δp values are measured between P and T valve ports.



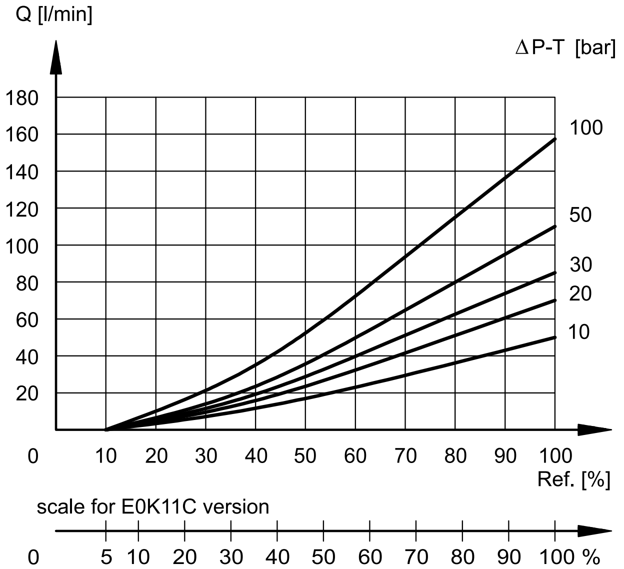
SPOOL Z50



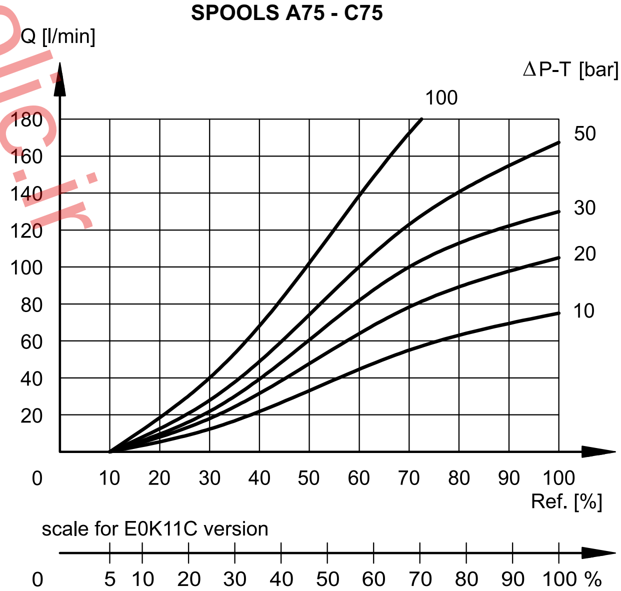
SPOOL Z75



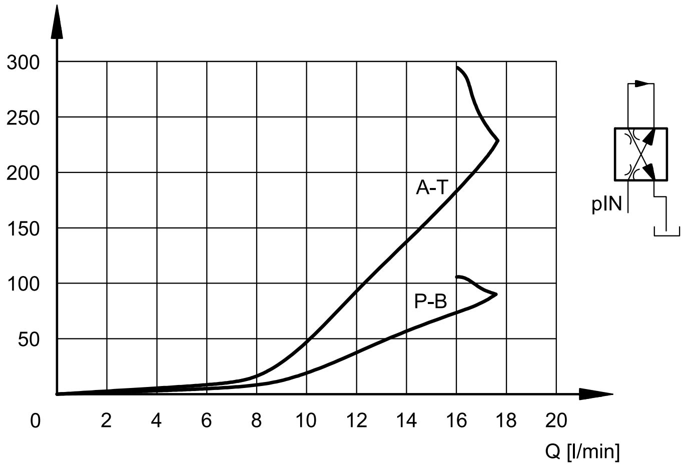
SPOOLS A50 - C50



SPOOLS A75 - C75



Z*FS SPOOLS - FAIL SAFE FEATURE

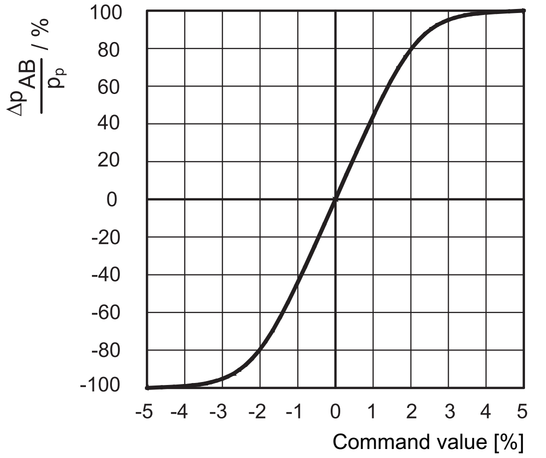


Flow P→B / A→T with valve in fail safe position, depending on the incoming pressure.

When a power failure (enabling OFF) occurs, the valve moves in 'fail safe' position by maintaining a minimum flow that allows the actuator to return slowly to a safety position.

During the black-out the centering springs retain the spool in fail safe-position.

Z SPOOLS - PRESSURE GAIN



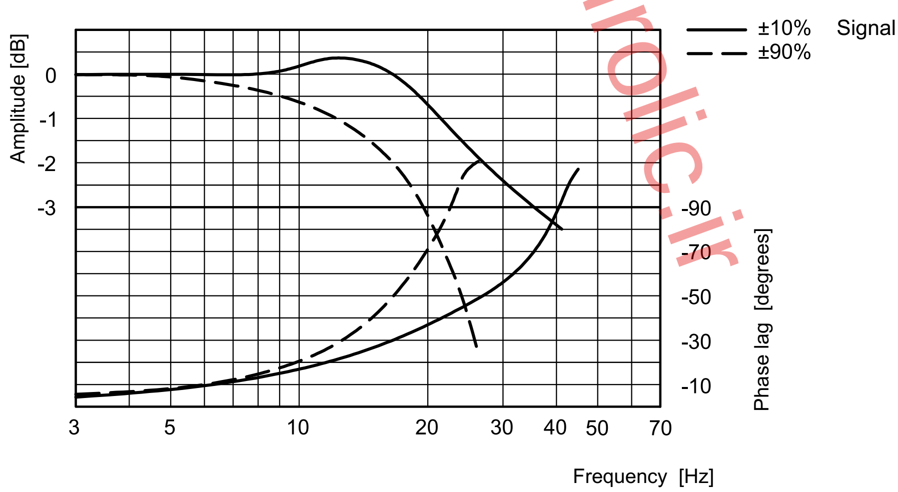
The diagram shows the valve pressure gain, expressed as % of the ratio between the port pressure variation in A or B (Δp AB) and the P system pressure, according to the reference signal.

In practice, the pressure gain states the valve reaction towards external disturbances aimed at changing the actuator position.

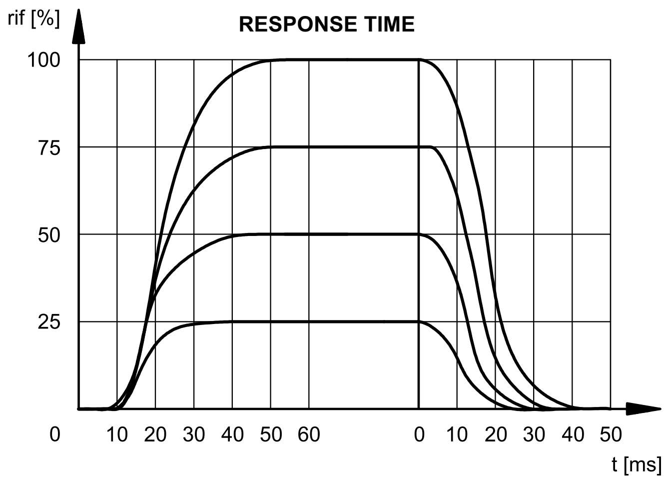
7 - RESPONSE TIMES

(obtained with mineral oil with viscosity of 36 cSt at 50°C 140 bar Δp P→T)

FREQUENCY RESPONSE (SPOOL Z - 4/3 valve)



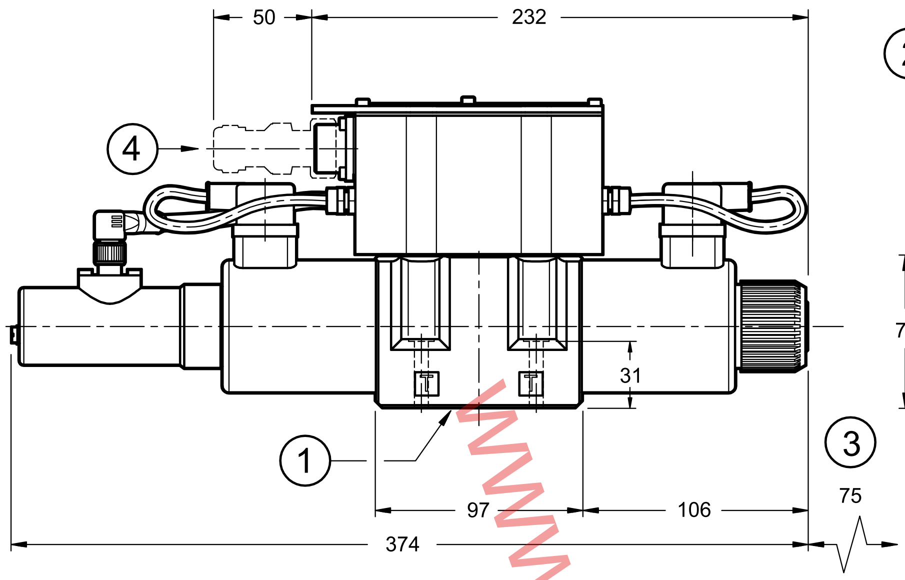
RESPONSE TIME

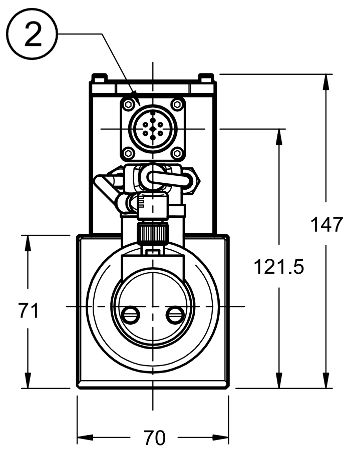


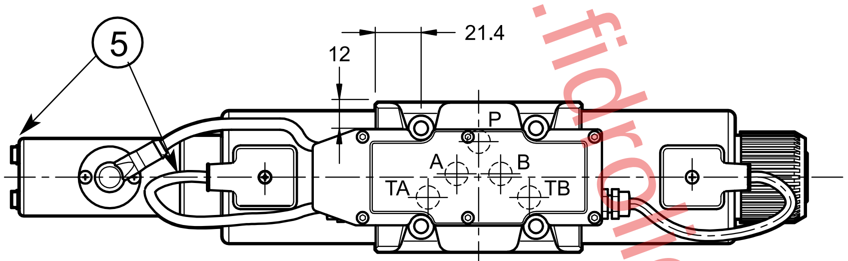
8 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

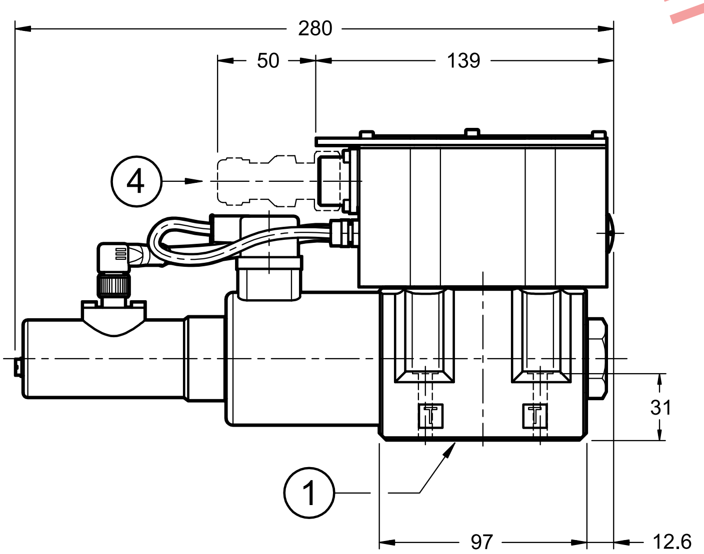
DSE5J-A*
DSE5J-C*
DSE5J-Z*







DSE5J-A* SA
DSE5J-C* SA



1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) 90 Shore
2	Main connection
3	Coil removal space (solenoid B only)
4	Mating connector. **To be ordered separately.** See paragraph 11
5	Adjustment sealing performed at factory. Do not disassemble the transducer.

Fastening bolts: 4 bolts M6x40 - ISO 4762
Torque: 8 Nm (A8.8)
Threads of mounting holes: M6x10

9 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

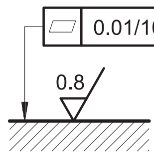
The fluid must be preserved in its physical and chemical characteristics.

10 - INSTALLATION

DSE5J valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



11 - ACCESSORIES
(to be ordered separately)

11.1 Mating connector

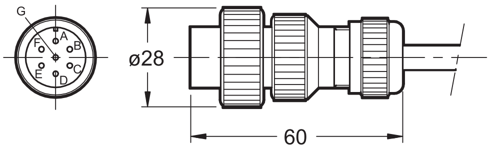
These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

⚠ So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic can provide a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



11.2 - Connection cables size

Power supply:
- up to 20 m cable length : 1,0 mm²
- up to 40 m cable length : 1,5 mm²

Signal: 0,50 mm²

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

11.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

12 - SUBPLATES
(see catalogue 51 000)

PMD4-AI4G rear ports 3/4" BSP	
PMD4-AL4G side ports 1/2" BSP	

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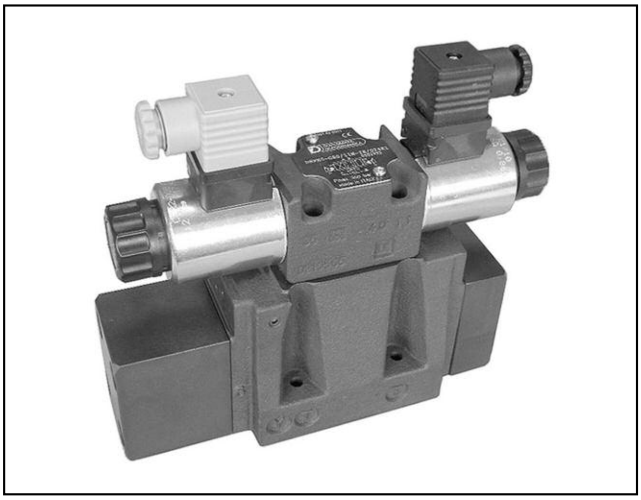
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

DUPLOMATIC OLEODINAMICA



DSPE*

PILOT OPERATED DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL

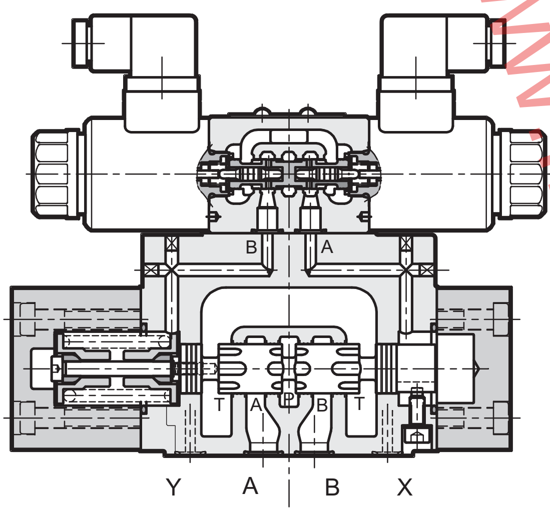
SERIES 11

DSPE5	**CETOP P05**
DSPE5R	**ISO 4401-05** (CETOP R05)
DSPE7	**ISO 4401-07** (CETOP 07)
DSPE8	**ISO 4401-08** (CETOP 08)
DSPE10	**ISO 4401-10** (CETOP 10)

p max (see performances table)

Q max (see performances table)

OPERATING PRINCIPLE



— The DSPE* are pilot operated directional control valves with electric proportional control and mounting interface in compliance with ISO 4401 standards.

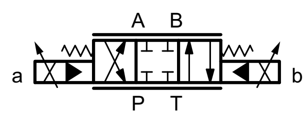
— The valve opening (and hence the flow rate) can be modulated continuously in proportion to the current supplied to the proportional solenoids of the pilot valve.

— They can be controlled directly by a current control supply unit or by means of the relative electronic control units to exploit valve performance to the full (see par. 15).

— They are available in CETOP P05, ISO 4401-05 (CETOP R05), ISO 4401-07 (CETOP 07), ISO 4401-08 (CETOP 08) and ISO 4401-10 (CETOP 10) sizes. Every size can be supplied with different controlled flow rates, up to 1600 l/min.

PERFORMANCES (obtained with viscosity of 36 cSt at 50°C with electronic control unit)		DSPE5 DSPE5R	DSPE7	DSPE8	DSPE10
Max operating: - P - A - B ports - T port	bar	350 see paragraph 6			
Controlled flow rate with Δp 10 bar P-T	l/min	see paragraph 2			
Step response		see paragraph 8			
Hysteresis (with PWM 100 Hz)	% Q_{max}	< 4%			
Repeatability	% Q_{max}	< ±2%			
Electrical characteristics		see paragraph 7			
Ambient temperature range	°C	-20 / +60			
Fluid temperature range	°C	-20 / +80			
Fluid viscosity range	cSt	10 ÷ 400			
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13				
Recommended viscosity	cSt	25			
Mass: single solenoid valve double solenoid valve	kg	7,1 7,5	9,3 9,7	15,6 16	52,5 53

HYDRAULIC SYMBOL (typical)



1 - IDENTIFICATION CODE

D	S	P	E		-				/	11		-			/		K1	/	

Pilot operated directional control valve

Electric proportional control

Nominal size:
5 = CETOP P05 (**NOTE**)
5R = ISO 4401-05 (CETOP R05)
7 = ISO 4401-07 (CETOP 07)
8 = ISO 4401-08 (CETOP 08)
10 = ISO 4401-10 (CETOP 10)

Spool type:
C = closed centres
A = open centres
RC = regenerative closed centres
RA = regenerative open centres

Spool nominal flow rate (see table par. 2)

Configurations for single solenoid version (omit for double solenoid version):
SA = 1 solenoid for cross configuration
SB = 1 solenoid for parallel configuration

Series No. (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Piloting: **I** = internal
E = external
Z = internal piloting with 30 bar fixed adj. pressure reducing valve (see par. 6)

Drainage: **I** = internal
E = external

D12 = voltage 12V DC
D24 = voltage 24V DC

Coil electrical connection: for connector type DIN 43650

Manual override: (see par. 15)

NOTE: This version is interchangeable with the model E4E Duplomatic

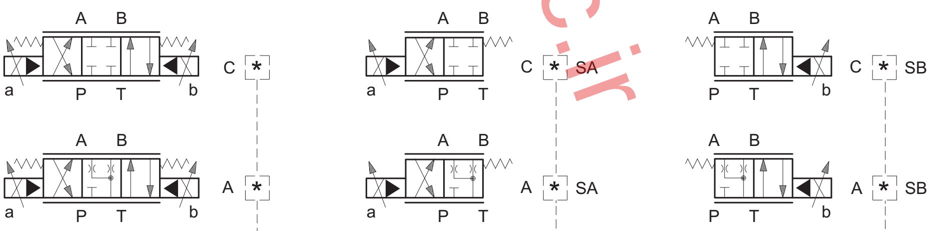
2 - AVAILABLE CONFIGURATIONS

The valve configuration depends on the combination of the following elements: number of proportional solenoids, spool type, rated flow.

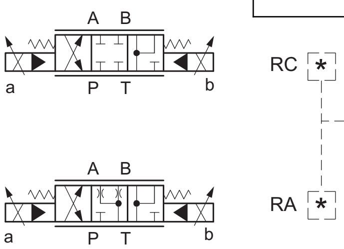
Configuration 2 solenoids:
3 positions with spring centering

1 solenoid for cross configuration "**SA**":
2 positions (central + external)
with spring centering

1 solenoid for parallel configuration "**SB**":
2 positions (central + external)
with spring centering



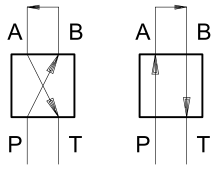
valve type	*	nominal flow rate with Δp 10 bar P-T
DSPE5 DSPE5R	**80**	80 l/min
	80/40	80 (P-A) / 40 (B-T) l/min
DSPE7	**100**	100 l/min
	150	150 l/min
	150/75	150 (P-A) / 75 (B-T) l/min
DSPE8	**200**	200 l/min
	300	300 l/min
	300/150	300 (P-A) / 150 (B-T) l/min
DSPE10	**350**	350 l/min
	500	500 l/min
	500/250	500 (P-A) / 250 (B-T) l/min



valve type	*	nominal flow rate with Δp 10 bar P-T
DSPE7	**150/75**	150 (P-A) / 75 (B-T) l/min
DSPE8	**300/150**	300 (P-A) / 150 (B-T) l/min
DSPE10	**500/250**	500 (P-A) / 250 (B-T) l/min

3 - CHARACTERISTIC CURVES

(values measured with viscosity of 36 cSt at 50°C with electronic control unit)

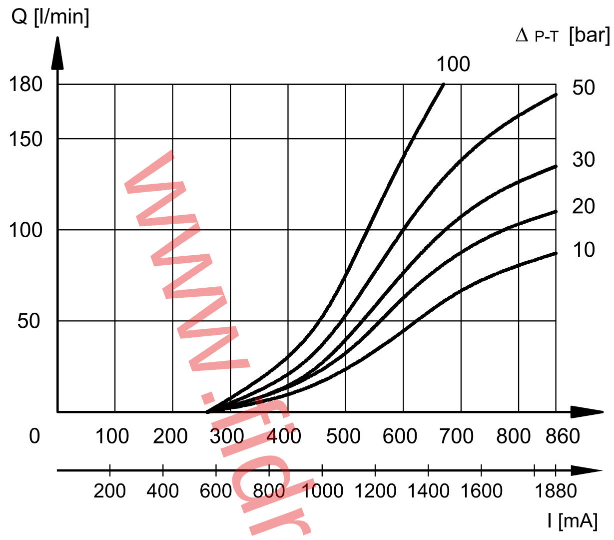


Typical flow rate control curves at constant Δp according to current supply to the solenoid (D24 version, 860 mA max current), measured for the available spool types.

The reference Δp values are measured between valve ports P and T.

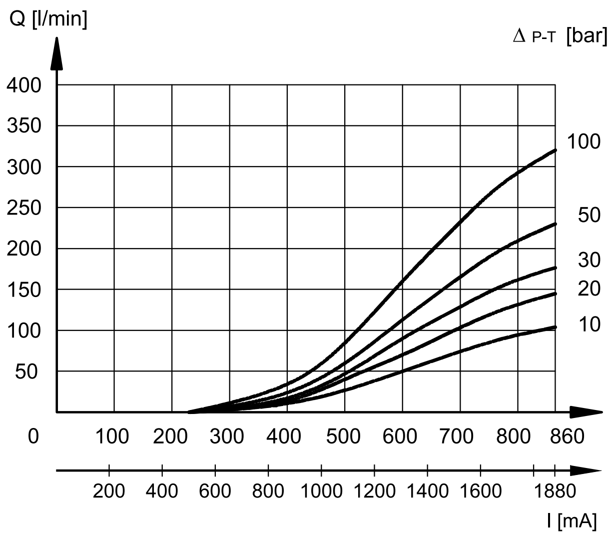
3.1 - Characteristic curves DSPE5 e DSPE5R

SPOOL C80 - A80

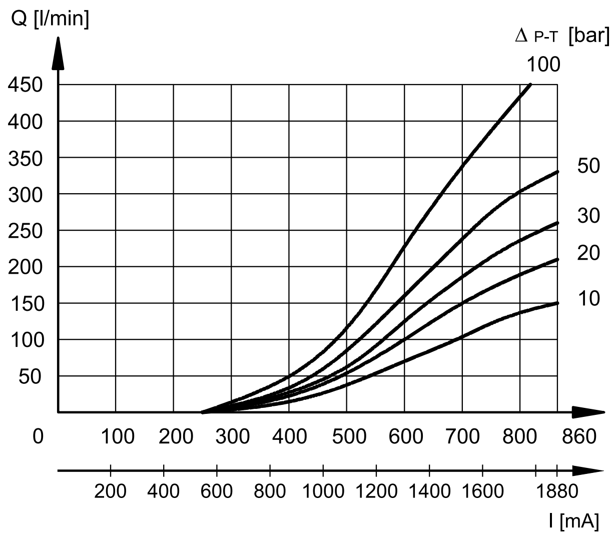


3.2 - Characteristic curves DSPE7

SPOOL C100 - A100

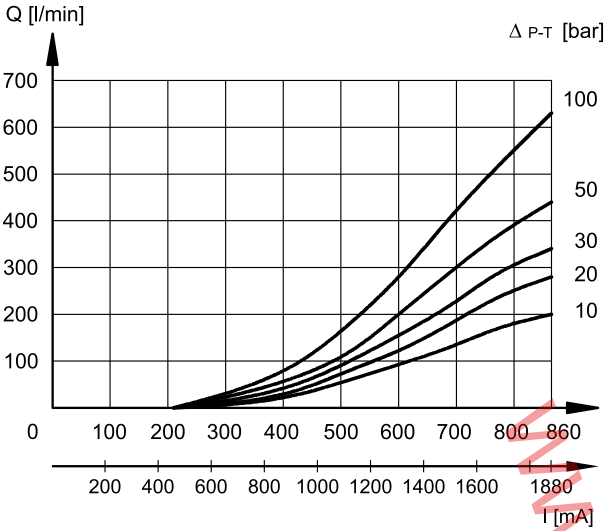


SPOOL C150 - A150

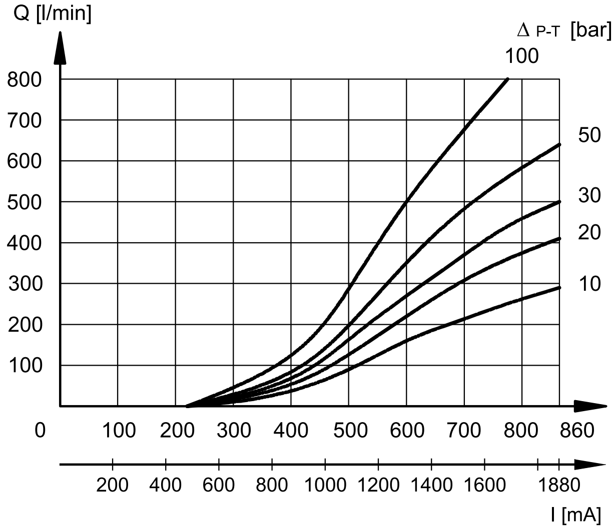


3.3 - Characteristic curves DSPE8

SPOOL C200 - A200

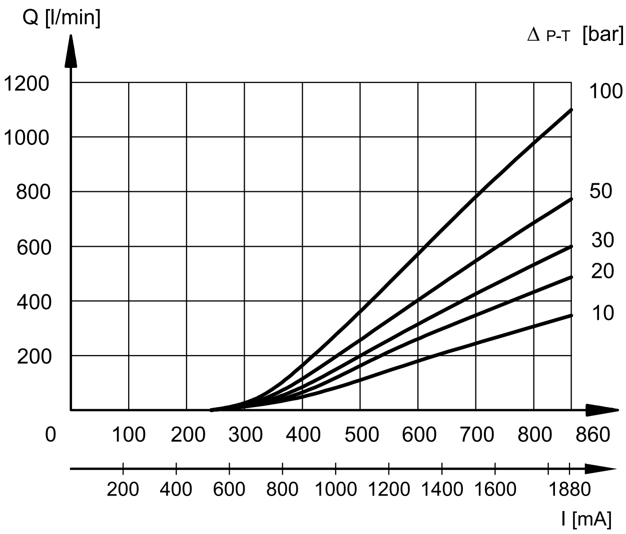


SPOOL C300 - A300

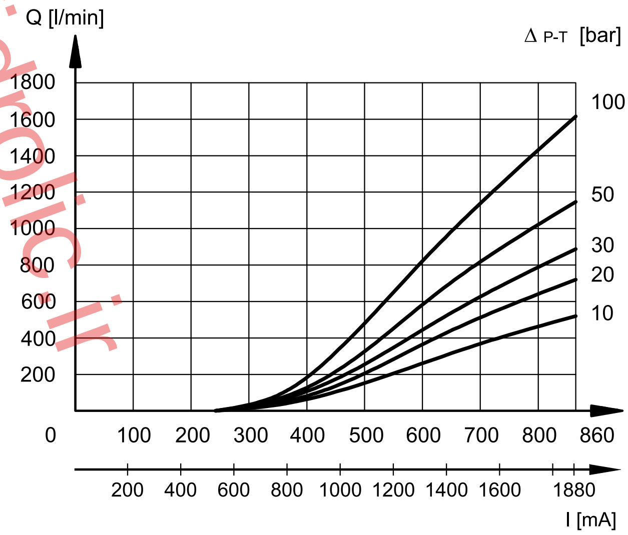


3.4 - Characteristic curves DSPE10

SPOOL C350 - A350



SPOOL C500 - A500



4 - HYDRAULIC CHARACTERISTICS

(values measured with viscosity of 36 cSt at 50°C with electronic control unit)

		DSPE5 DSPER5	DSPE7	DSPE8	DSPE10
Max flow rate	l/min	180	450	800	1600
Piloting flow requested with operation 0 →100%	l/min	3	5	9	13
Piloting volume requested with operation 0 →100%	cm^3	1,7	3,2	9,1	21,6

5 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

6 - PILOTING AND DRAINAGE

The DSPE valves are available with piloting and drainage, both internal and external.

The version with external drainage allows a higher backpressure on the unloading.

VALVE TYPE		Plug assembly	
		X	Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

PRESSURES (bar)

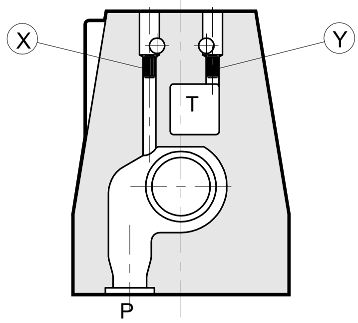
Pressure	MIN	MAX
Piloting pressure on X port	30	210 (**NOTE**)
Pressure on T port with interal drain	–	10
Pressure on T port with external drain	–	250

NOTE: the version with external pilot with reduced pressure must be used when higher pressures are needed.

Otherwise the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered.

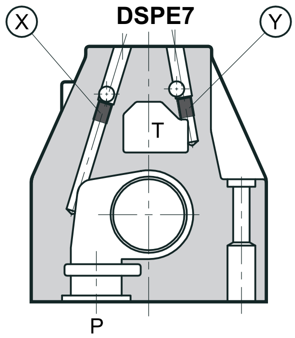
Add the letter Z to the identification code to order this option (see par. 1).

DSPE5 and DSPER5



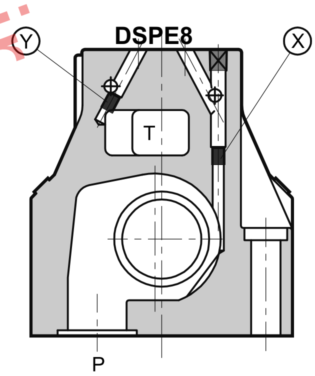
X: M5x6 plug for external pilot
Y: M5x6 plug for external drain

DSPE7



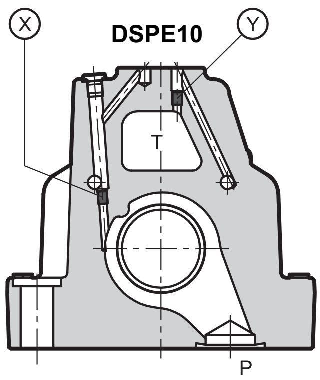
X: M6x8 plug for external pilot
Y: M6x8 plug for external drain

DSPE8



X: M6x8 plug for external pilot
Y: M6x8 plug for external drain

DSPE10



X: M6x8 plug for external pilot
Y: M6x8 plug for external drain

7 - ELECTRICAL CHARACTERISTICS

Proportional solenoid

The proportional solenoid comprises two parts: tube and coil.

The tube, screwed to the valve body, contains the armature which is designed to maintain friction to a minimum thereby reducing hysteresis.

The coil is mounted on the tube secured by means of a lock nut.
It can be rotated through 360° depending on installation clearances.

NOMINAL VOLTAGE	V DC	**12**	**24**
RESISTANCE (at 20°C)	Ω	3.66	17.6
NOMINAL CURRENT	A	1.88	0.86
DUTY CYCLE		100%	
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2004/108/CE		
CLASS OF PROTECTION: atmospheric agents (CEI EN 60529) coil insulation (VDE 0580) Impregnation	IP 65 class H class F		

8 - STEP RESPONSE

(measured with mineral oil with viscosity of 36 cSt at 50°C with electronic control unit)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table shows the typical step response tested with static pressure 100 bar.

REFERENCE SIGNAL	0 → 100%	100 → 0%
	Step response [ms]	
DSPE5 and DSPE5R	50	40
DSPE7	80	50
DSPE8	100	70
DSPE10	200	120

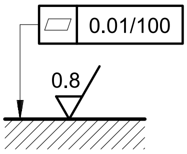
9 - INSTALLATION

The DSPE* valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

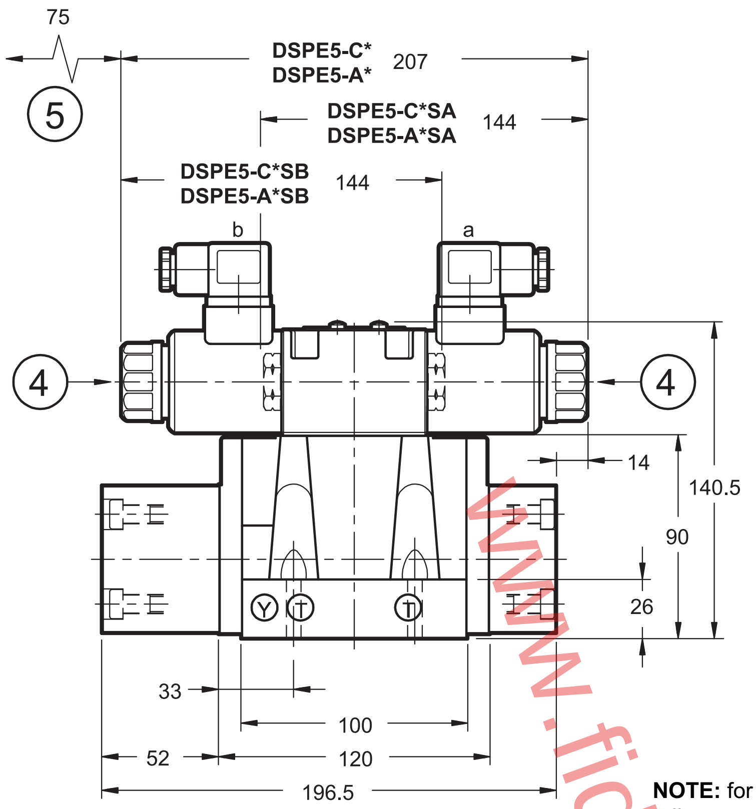
Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

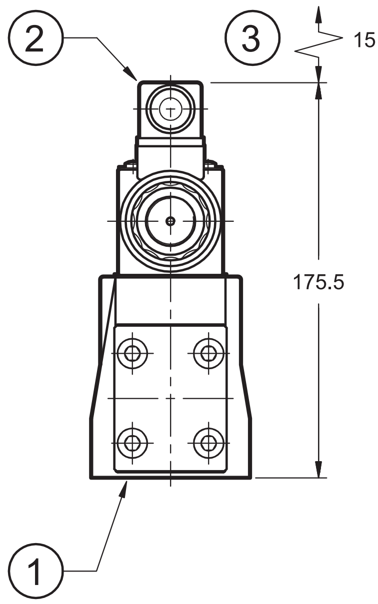
Surface finishing



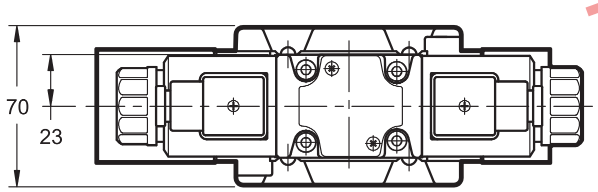
10 - OVERALL AND MOUNTING DIMENSIONS DSPE5 AND DSPE5R

dimensions in mm

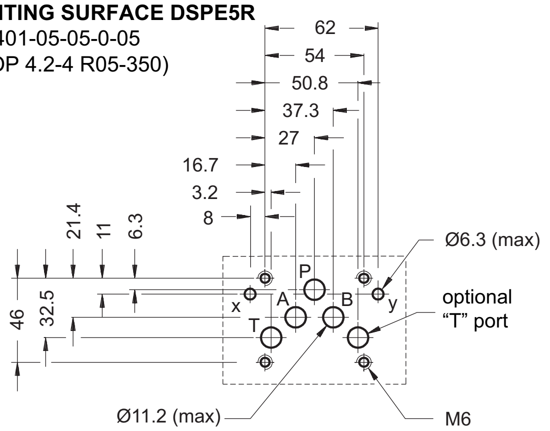




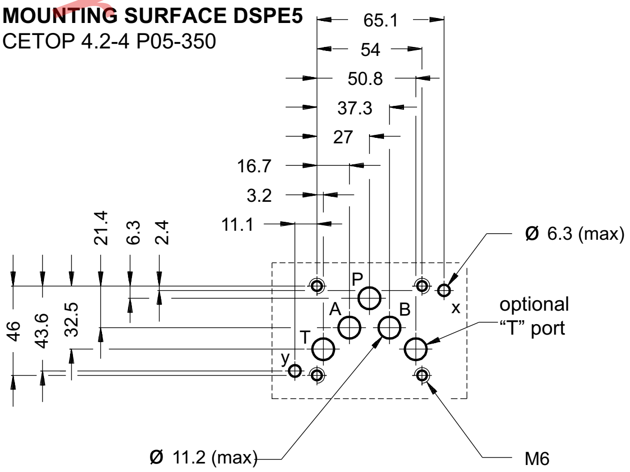
NOTE: for overall dimensions with Z option (fixed adjustment pressure reducing valve) see par. 14.



MOUNTING SURFACE DSPE5R
ISO 4401-05-05-0-05
(CETOP 4.2-4 R05-350)



MOUNTING SURFACE DSPE5
CETOP 4.2-4 P05-350

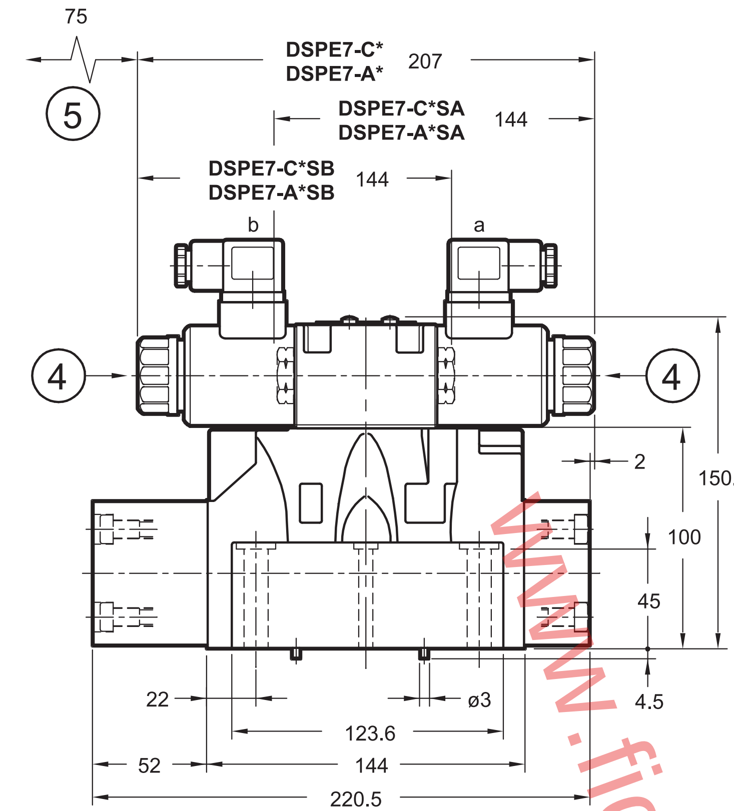


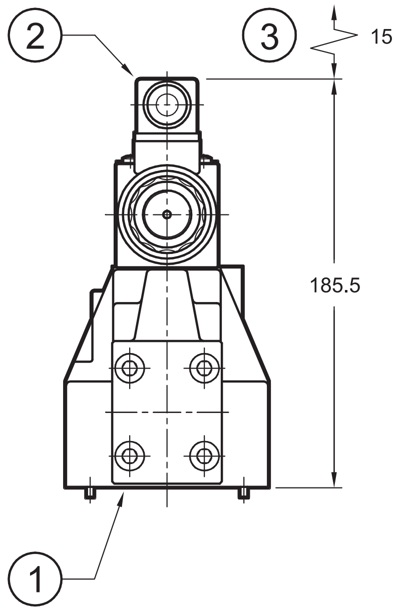
Valve fastening: N. 4 SHC screws M6x35 - ISO 4762
Tightening torque: 8 Nm (A 8.8 bolts)
Thread of mounting holes: M6x10
Sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore N. 2 OR type 2037 (9.25x1.78) - 90 Shore

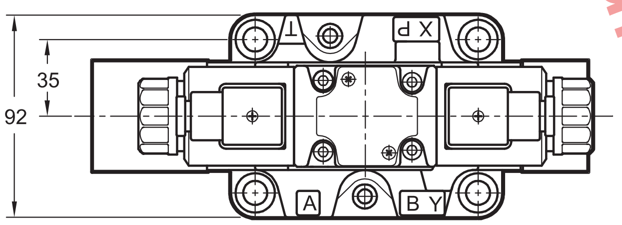
1	Mounting surface with sealing rings
2	DIN 43650 electrical connector
3	Connector removal space
4	Standard manual override integrated inside the solenoid tube (included in the supply - see par. 15).
5	Coil removal space

11 - OVERALL AND MOUNTING DIMENSIONS DSPE7

dimensions in mm

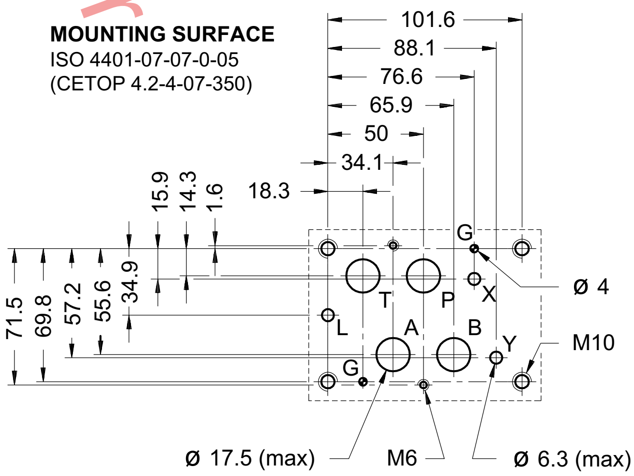






NOTE: for overall dimensions with Z option (fixed adjustment pressure reducing valve) see par. 14.

MOUNTING SURFACE
ISO 4401-07-07-0-05
(CETOP 4.2-4-07-350)

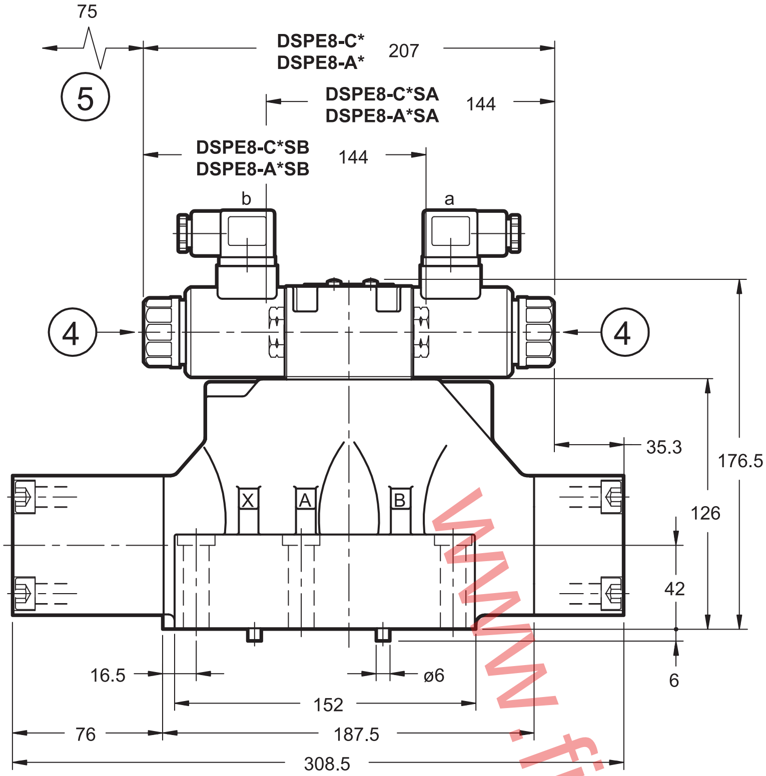


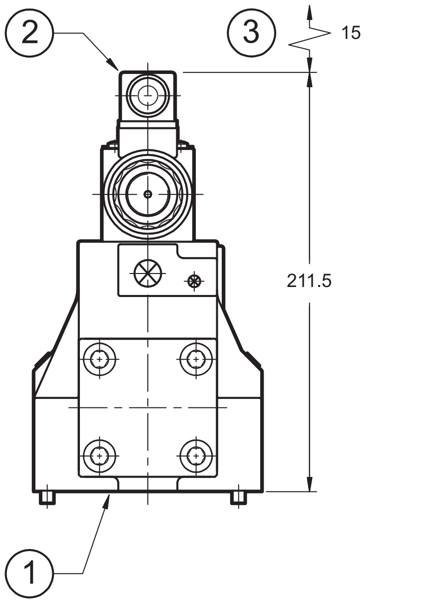
Single valve fastening:	N. 4 TCEI M10x60 bolts - ISO 4762 N. 2 TCEI M6x60 bolts - ISO 4762
Tightening torque M10x60: 40 Nm (A 8.8 bolts) M6x60: 8 Nm (A 8.8 bolts)	
Thread of mounting holes:	M6x18; M10x18
Sealing rings:	N. 4 OR type 130 (22.22x2.62) - 90 Shore N. 2 OR type 2043 (10.82x1.78) - 90 Shore

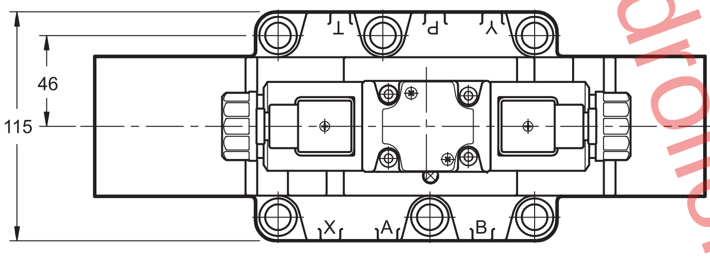
1	Mounting surface with sealing rings
2	DIN 43650 electrical connector
3	Connector removal space
4	Standard manual override integrated inside the solenoid tube (included in the supply - see par. 15).
5	Coil removal space

12 - OVERALL AND MOUNTING DIMENSIONS DSPE8

dimensions in mm

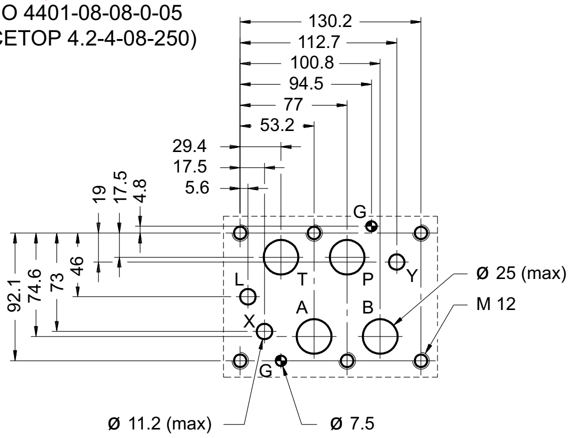






NOTE: for overall dimensions with Z option (fixed adjustment pressure reducing valve) see par. 14.

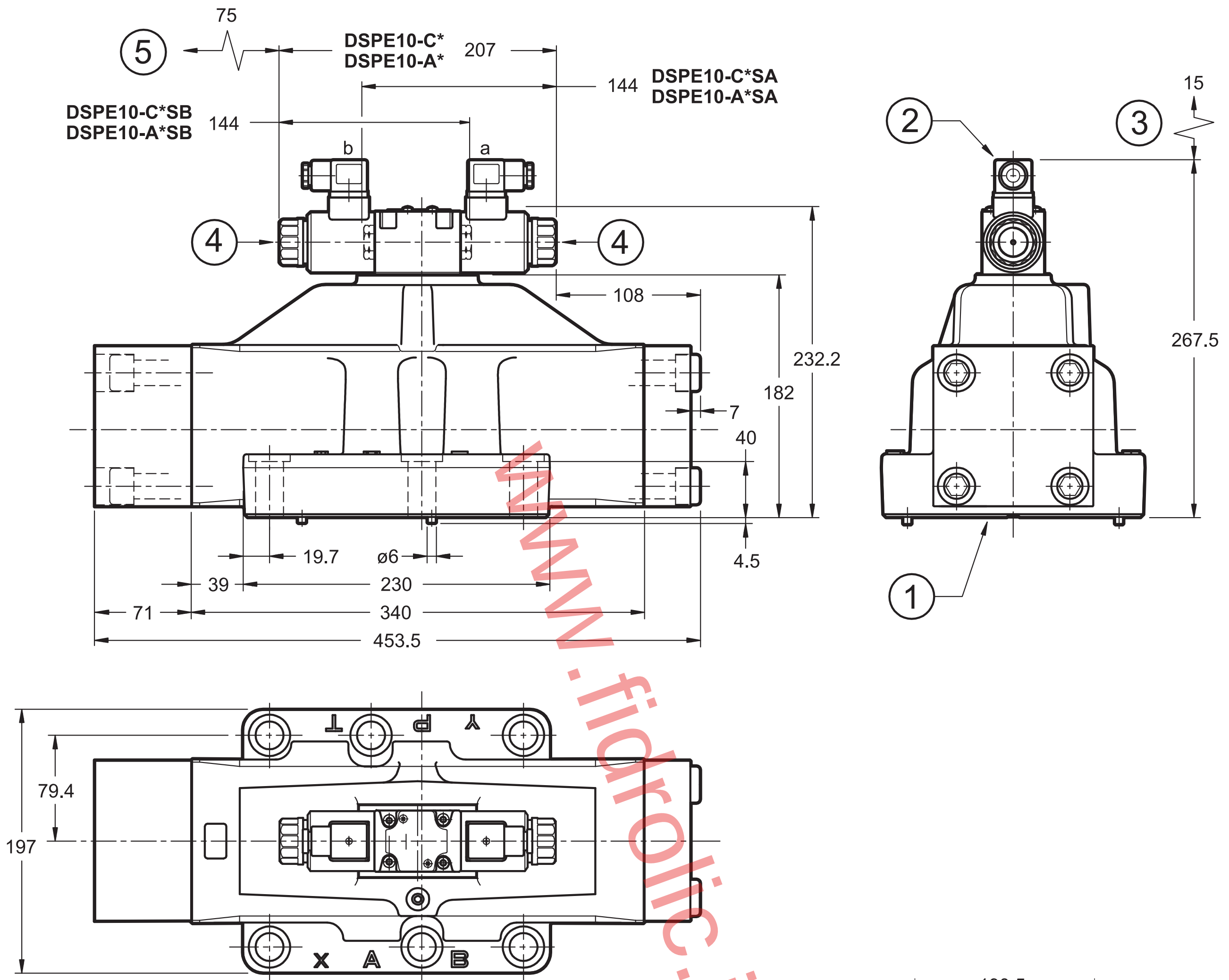
MOUNTING SURFACE
ISO 4401-08-08-0-05
(CETOP 4.2-4-08-250)



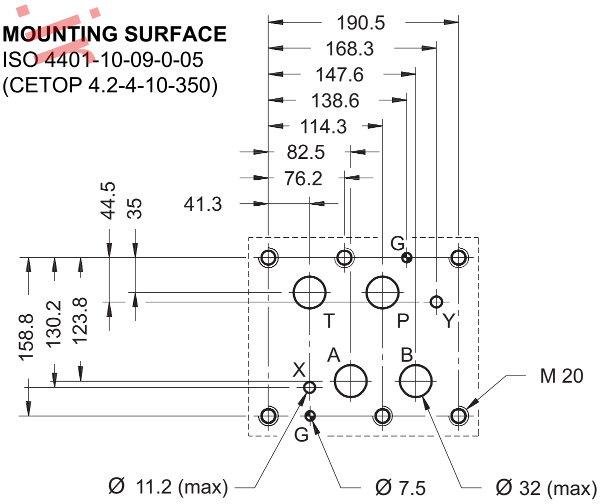
Valve fastening: N. 6 TCEI M12x60 bolts - ISO 4762
Tightening torque: 69 Nm (A 8.8 bolts)
Thread of mounting holes: M12x20
Sealing rings: N. 4 OR type 3118 (29.82x2.62) - 90 Shore N: 2 OR type 3081 (20.24x2.62) - 90 Shore

1	Mounting surface with sealing rings
2	DIN 43650 electrical connector
3	Connector removal space
4	Standard manual override integrated inside the solenoid tube (included in the supply - see par. 15).
5	Coil removal space

13 - OVERALL AND MOUNTING DIMENSIONS DSPE10



MOUNTING SURFACE
ISO 4401-10-09-0-05
(CETOP 4.2-4-10-350)



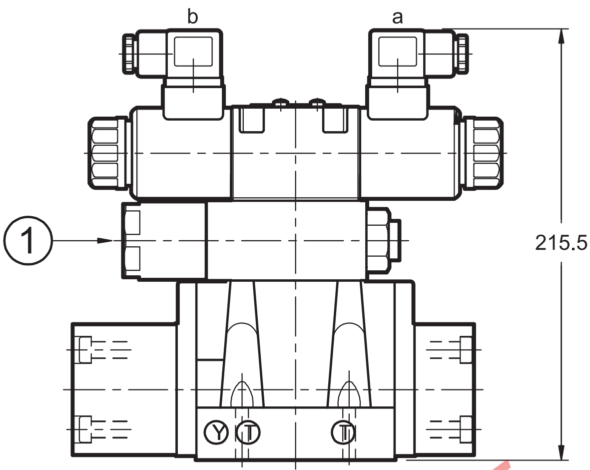
NOTE: for overall dimensions with Z option (fixed adjustment pressure reducing valve) see par. 14.

Valve fastening: N. 6 TCEI M12x70 bolts - ISO 4762
Tightening torque: 330 Nm (A 8.8 bolts)
Thread of mounting holes: M20x40
Sealing rings: N. 4 OR type 4150 (37.59x3.53) - 90 Shore N: 2 OR type 3081 (20.24x2.62) - 90 Shore

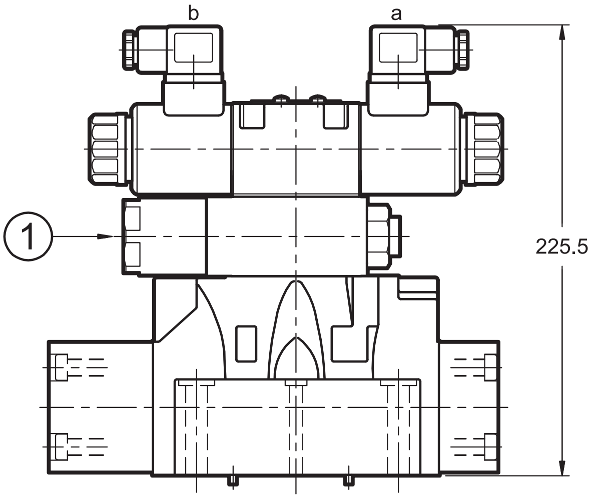
1	Mounting surface with sealing rings
2	DIN 43650 electrical connector
3	Connector removal space
4	Standard manual override integrated inside the solenoid tube (included in the supply - see par. 15).
5	Coil removal space

14 - OVERALL AND MOUNTING DIMENSIONS DSPE*-*/11*-Z*/*

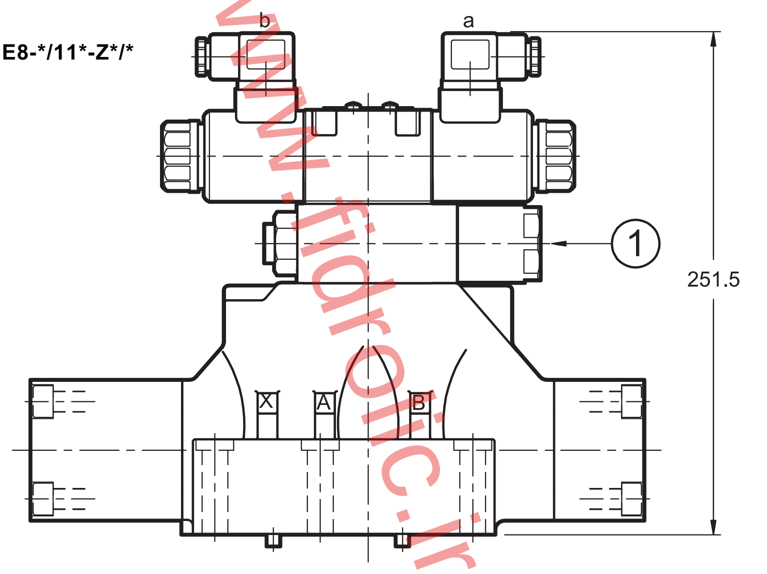
DSPE5-*/11*-Z*/*



DSPE7-*/11*-Z*/*



DSPE8-*/11*-Z*/*

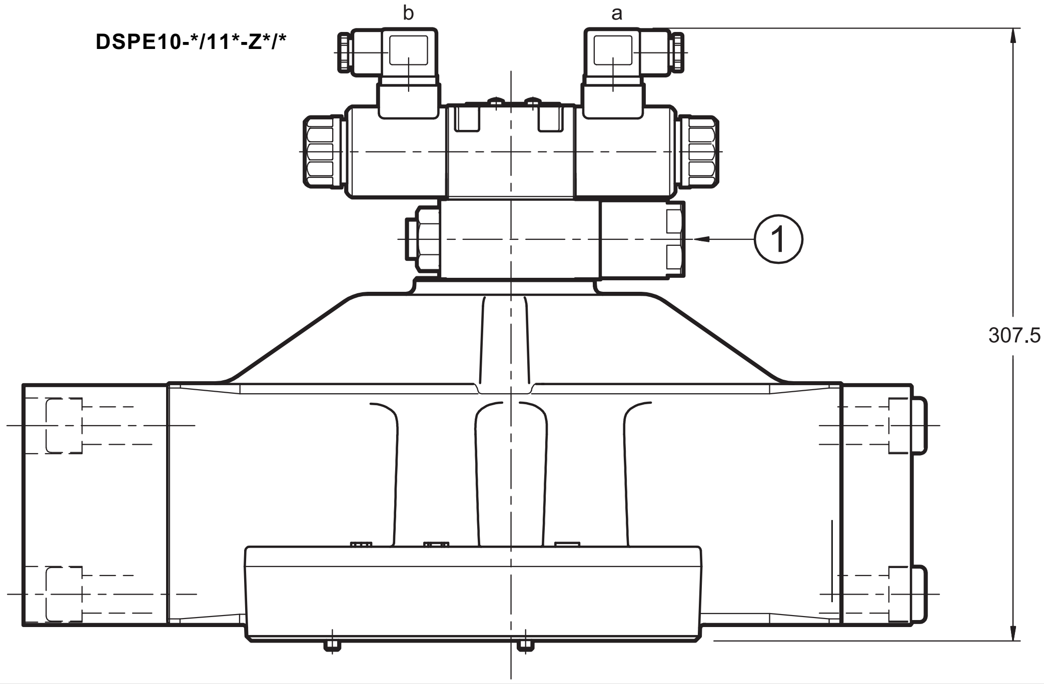


NOTE: for missing overall dimensions and characteristics see par. 10 - 11 - 12 - 13

dimensions in mm

1	30 bar fixed adjustment pressure reducing valve

DSPE10-*/11*-Z*/*



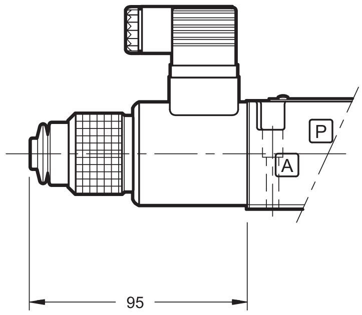
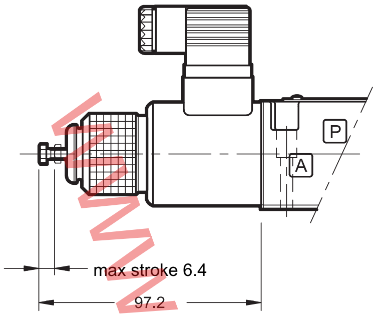
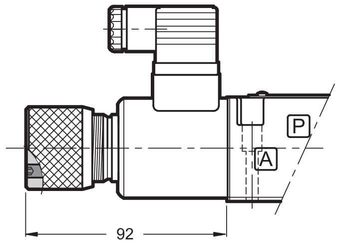
15 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

THree different manual override version are available upon request:

- **CM** version, manual override belt protected
- **CS** version, with metal ring nut provided with a M4 screw and a blocking locknut to allow the continuous mechanical operations.
- **CK** version, knob. When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing.

NOTE: The manual override use doesn't allow any proportional regulation; in fact using this kind of override, the main stage spool will open completely and the valve will behave as an on-off valve.

Versione CM	Versione CS	Versione CK
		 Allen key for set screw: 3 mm
Code: 3803210003	Code: 3803210004	Code: 3803210005

16 - ELECTRONIC CONTROL UNITS

DSPE* - * * SA (SB)

EDC-111	for solenoid 24V DC	plug version	see cat.89 120
EDC-141	for solenoid 12V DC		
EDM-M111	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M141	for solenoid 12V DC		

DSPE* - A* **DSPE* - C***

EDM-M211	for solenoid 24V DC	rail mounting DIN EN 50022	see cat. 89 250
EDM-M241	for solenoid 12V DC		

17 - SUBPLATES

(see catalogue 51 000)

		DSPE5	DSPE7	DSPE8	DSPE10
Model with rear ports		PME4-AI5G	PME07-AI6G	-	-
Model with side ports		PME4-AL5G	PME07-AL6G	PME5-AL8G	-
Thread of ports:	P - T - A - B X - Y	3/4” BSP 1/4” BSP	1” BSP 1/4” BSP	1½” BSP 1/4” BSP	-

DUPLOMATIC OLEODINAMICA

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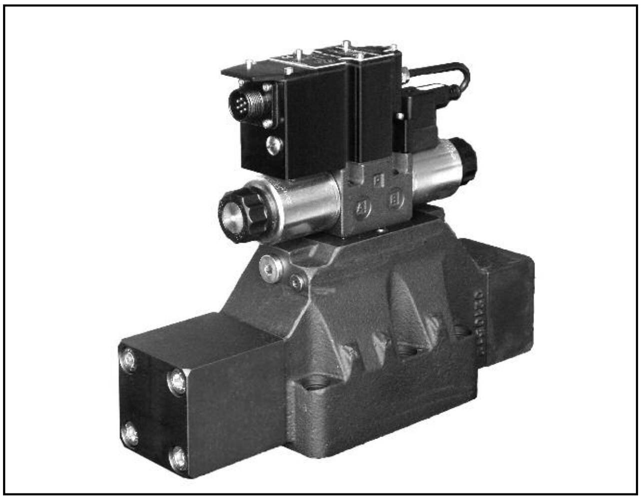
Fax +39 0331.895.339
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

DUPLOMATIC OLEODINAMICA



DSPE*G

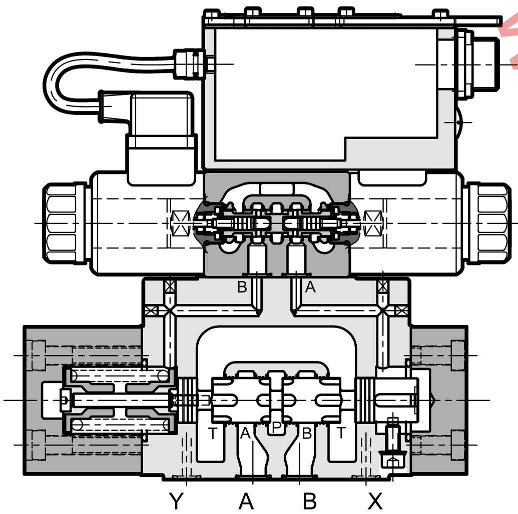
PROPORTIONAL DIRECTIONAL VALVES, PILOT OPERATED WITH INTEGRATED ELECTRONICS

SERIES 30

SUBPLATE MOUNTING

DSPE5R	**CETOP P05**
DSPE5RG	**ISO 4401-05**
DSPE7G	**ISO 4401-07**
DSPE8G	**ISO 4401-08**
DSPE10G	**ISO 4401-10**
DSPE11G	**ISO 4401-10** oversize ports

OPERATING PRINCIPLE



— The DSPE*G are pilot operated directional control valves with electric proportional control and integrated electronics and with mounting interface in compliance with ISO 4401 standards.

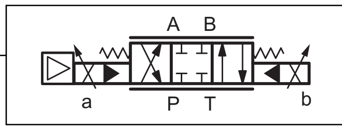
— They are controlled directly by an integrated digital amplifier.

— The valves are available with command signal in voltage or current, and on-board electronics with internal enable, external enable or 0V monitor on pin C.

— A solenoid current monitoring signal is available.

— The valves are easy to install. The driver directly manages digital settings. In the event of special applications, you can customize the settings using the optional kit (see par. 19)

HYDRAULIC SYMBOL (typical)



PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

		DSPE5G DSPE5RG	DSPE7G	DSPE8G	DSPE10G	DSPE11G
Max operating pressure: P - A - B ports T port	bar	350 see paragraph 8				
Max flowrate	l/min	180	450	800	1600	2800
Hysteresis	% Q max	< 2 %				
Repeatability	% Q max	< ± 1%				
Electrical characteristics		see paragraph 3				
Ambient temperature range	°C	-20 / +60				
Fluid temperature range	°C	-20 / +80				
Fluid viscosity range	cSt	10 ÷ 400				
Fluid contamination degree		According to ISO 4406:1999 class 18/16/13				
Recommended viscosity	cSt	25				
Mass: single solenoid valve double solenoid valve	kg	7,4 7,9	9,6 10,1	15,9 16,4	52,8 53,3	52,5 53

1 - IDENTIFICATION CODE

D	S	P	E		G	-				/	30		-			/		K11		

Pilot operated directional valve

Electric proportional control

Nominal size:
5 = CETOP P05
5R = ISO 4401-05 (CETOP R05)
7 = ISO 4401-07 (CETOP 07)
8 = ISO 4401-08 (CETOP 08)
10 = ISO 4401-10 (CETOP 10)
11 = ISO 4401-10 (CETOP 10) with oversize ports

Integrated electronics for open loop

Spool type:
C = closed centres
A = open centres
RC = regenerative closed centers
RA = regenerative open centers

Spool nominal flow rate (see table par. 2)

Configurations for single solenoid version (omit for double solenoid version) :
SA = 1 solenoid for cross configuration (for DSPE5G, DSPE5RG and DSPE7G only)
SB = 1 solenoid for parallel configuration (for DSPE8G, DSPE10G and DSPE11G only)

Series No. (the overall and mounting dimensions remain unchanged from 30 to 39)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Piloting: **I** = internal
E = external
Z = internal piloting with 30 bar fixed adjustment pressure reducing valve (see par. 8 and 15)

Drainage: **I** = internal
E = external

Reference signal:
E0 = voltage ± 10 V
E1 = current 4 ÷ 20 mA

Main connector 6 pin + PE

Pin C function:
A = external enable
B = internal enable
C = 0V monitor

Option: manual override (see par. 10)

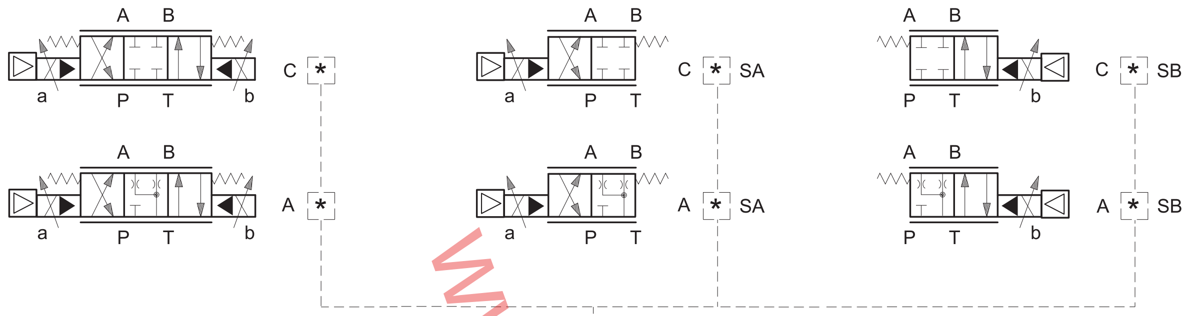
2 - AVAILABLE VERSIONS

The valve configuration depends on the combination of number of proportional solenoids, spool type, rated flow.

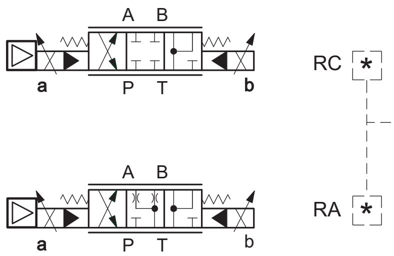
2 solenoids:
3 positions with spring centering

1 solenoid for cross configuration “**SA**”:
2 positions (central + external)
with spring centering
for DSPE5G, DSPE5RG and DSPE7G only

1 solenoid for parallel configuration “**SB**”:
2 positions (central + external)
with spring centering
for DSPE8G, DSPE10G and DSPE11G only



valve type	*	Nominal flow with Δp 10 bar P-T
DSPE5G DSPE5RG	**80**	80 l/min
	80/40	80 (P-A) / 40 (B-T) l/min
DSPE7G	**100**	100 l/min
	150	150 l/min
	150/75	150 (P-A) / 75 (B-T) l/min
DSPE8G	**200**	200 l/min
	300	300 l/min
	300/150	300 (P-A) / 150 (B-T) l/min
DSPE10G	**350**	350 l/min
	500	500 l/min
	500/250	500 (P-A) / 250 (B-T) l/min
DSPE11G	**800**	800 l/min
	800/500	800 (P-A) / 500 (B-T) l/min



valve type	*	Nominal flow with Δp 10 bar P-T
DSPE7G	**150/75**	150 (P-A) /75 (B-T) l/min
DSPE8G	**300/150**	300 (P-A) /150 (B-T) l/min
DSPE10G	**500/250**	500 (P-A) /250 (B-T) l/min

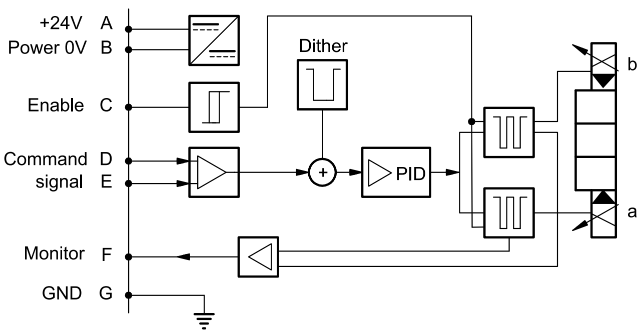
3 - ELECTRICAL CHARACTERISTICS

3.1 - Electrical on board electronics

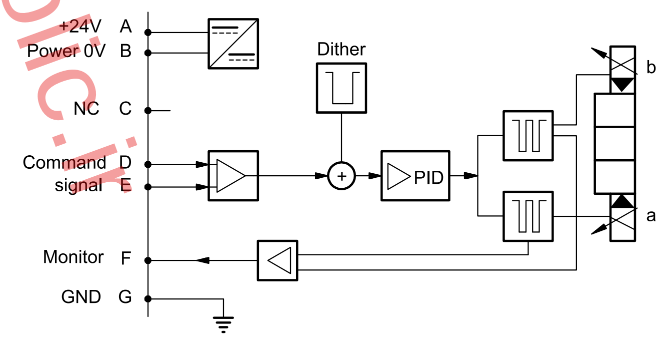
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		3A
Command signals: voltage (E0) current (E1)	V DC mA	±10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (current to solenoid): voltage (E0) current (E1)	V DC mA	±10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2004/108/EC standards

3.2 - On-board electronics diagrams

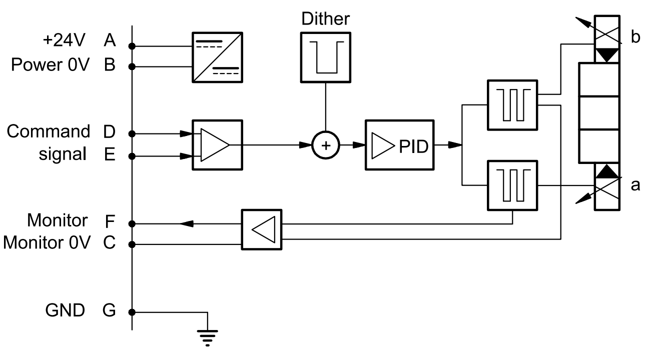
VERSION **A** - External Enable



VERSION **B** - Internal Enable

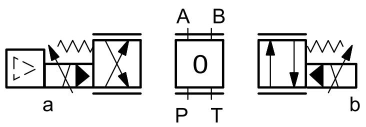


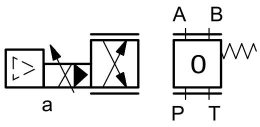
VERSION **C** - 0V Monitor



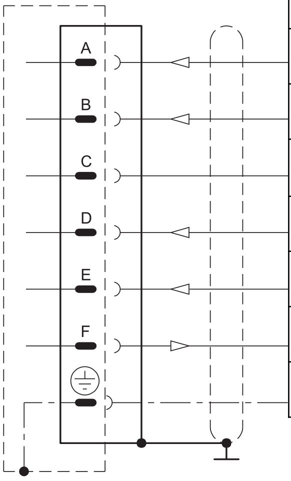
4 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal is between -10V and +10V on double solenoid valve, and 0…10V on single solenoid valves. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.





COMMAND	**-10V**	**0V**	**+10V**	**COMMAND**	**+10V**	**0V**
MONITOR	**-10V**	**0V**	**+10V**	**MONITOR**	**+10V**	**0V**

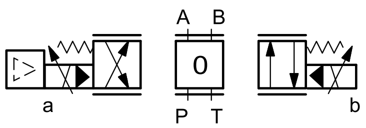


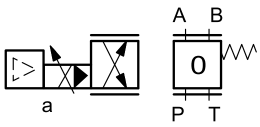
Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	± 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	± 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

5 - VERSIONS WITH CURRENT COMMAND (E1)

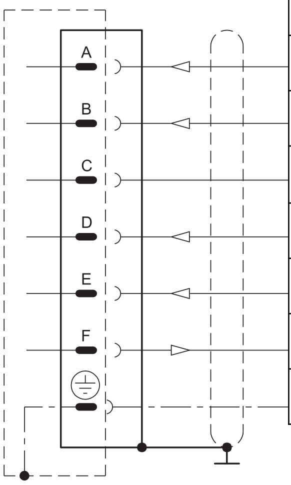
The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.





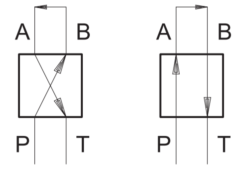
COMMAND	**4 mA**	**12 mA**	**20 mA**	**COMMAND**	**20 mA**	**4 mA**
MONITOR	**4 mA**	**12 mA**	**20 mA**	**MONITOR**	**20 mA**	**4 mA**



Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

6 - CHARACTERISTIC CURVES

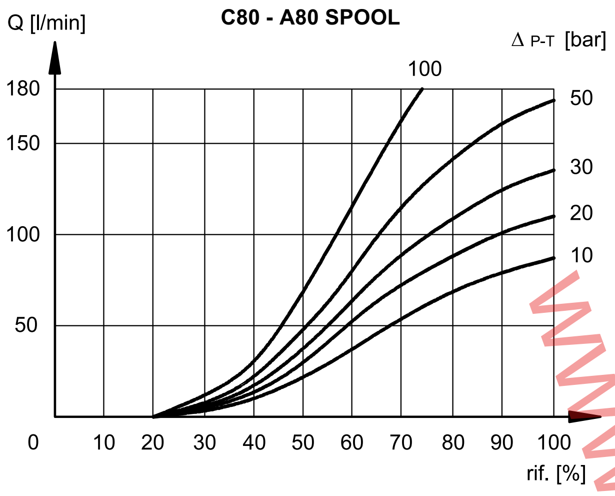
(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)



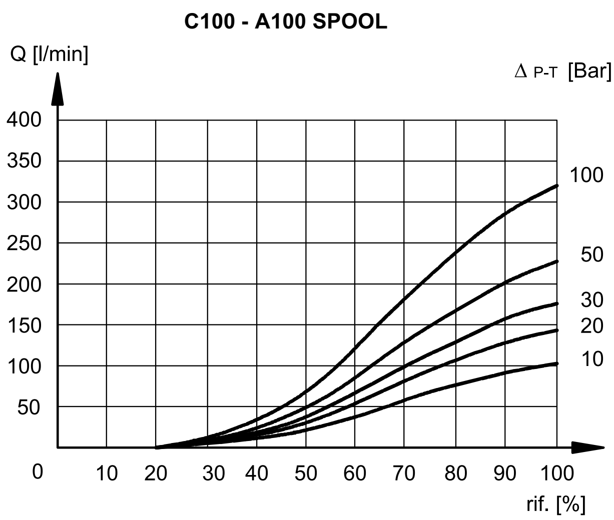
Typical flow rate curves at constant Δp related to the reference signal and measured for the available spools. The Δp values are measured between P and T valve ports.

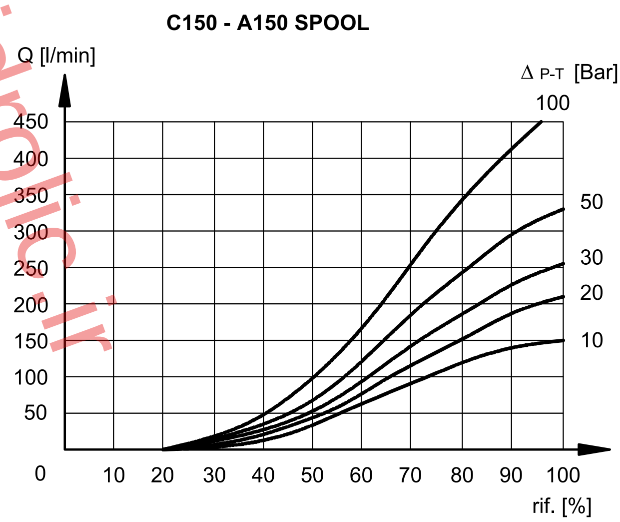
The adjustment of the curve is performed with a constant Δp of 30 bar by setting the value of flow start at 20% of the reference signal.

6.1 - Characteristic curves DSPE5G and DSPE5RG

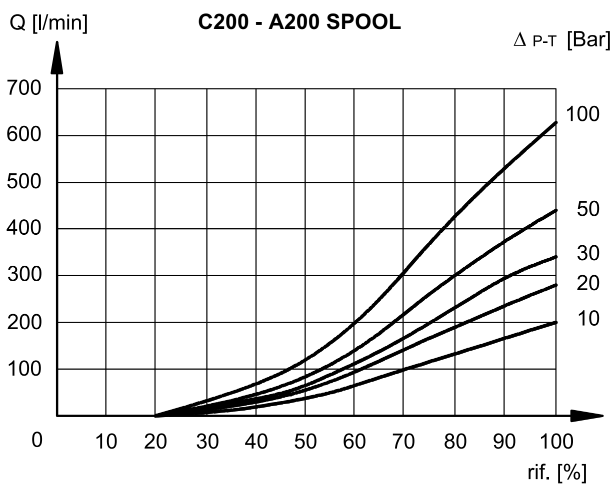


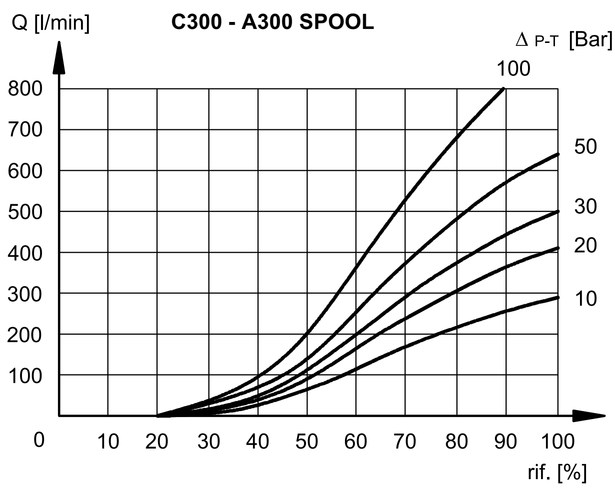
6.2 - Characteristic curves DSPE7G



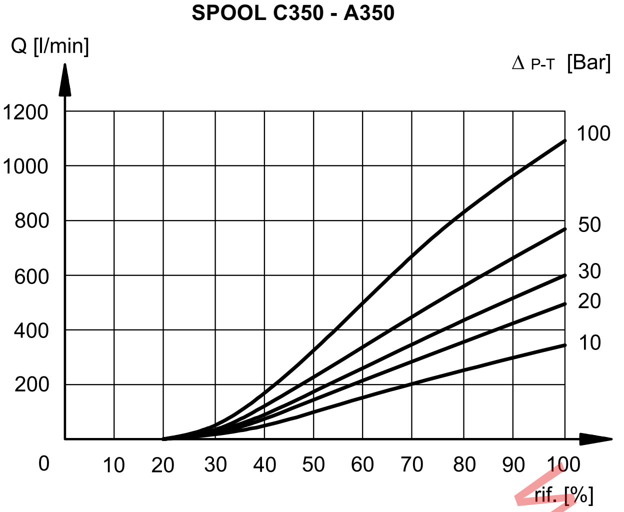


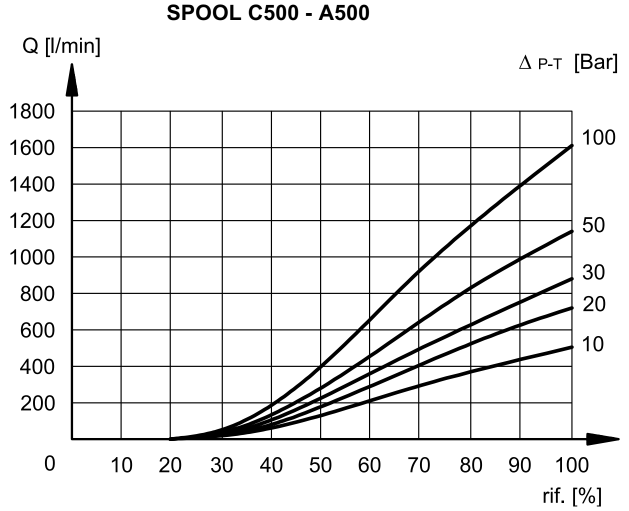
6.3 - Curve Characteristic DSPE8G



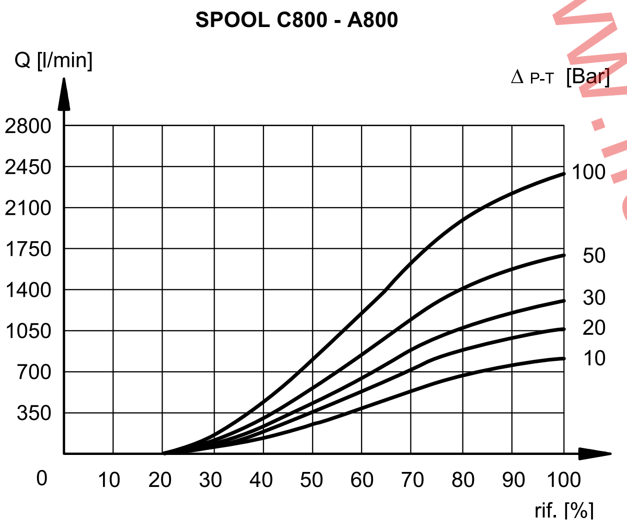


6.4 - Characteristic curves DSPE10G





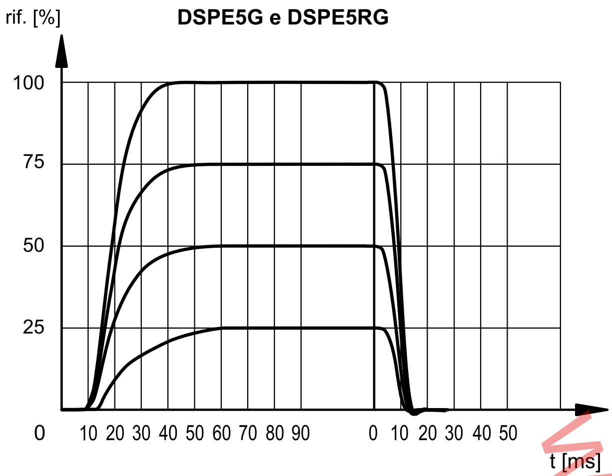
6.5 - Characteristic curves DSPE11G



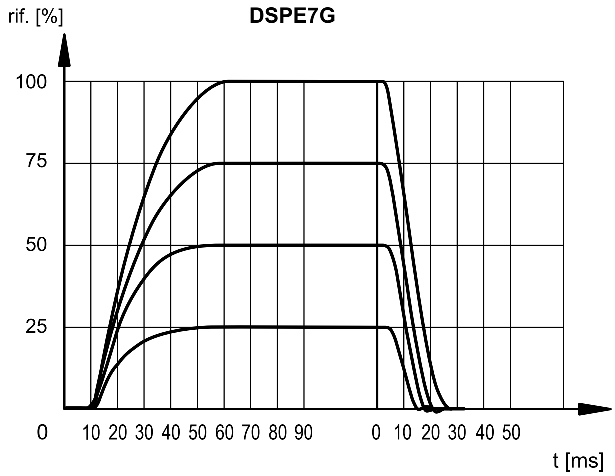
7 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and static pressure = 100 bar)

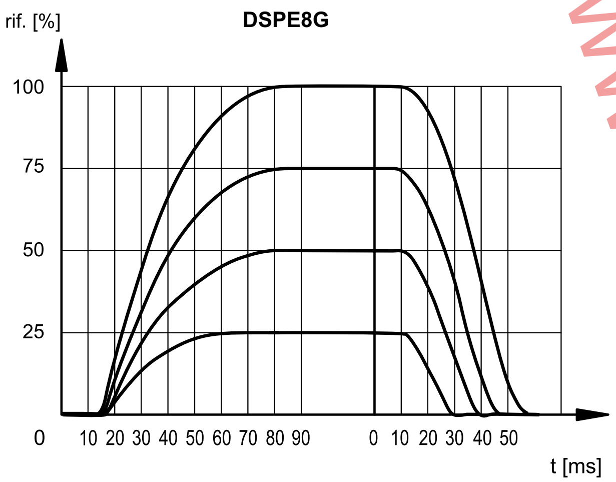
DSPE5G e DSPE5RG



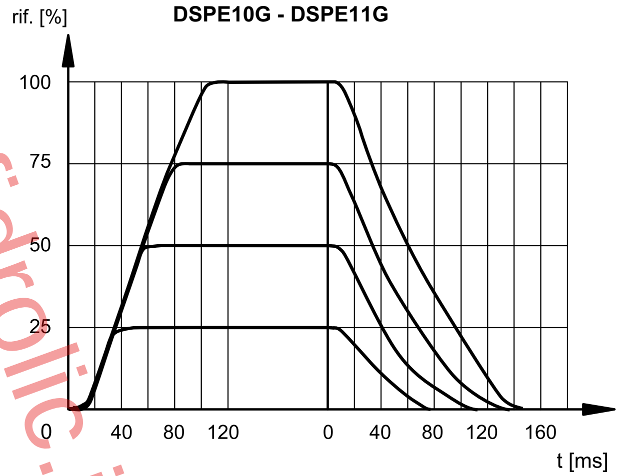
DSPE7G



DSPE8G



DSPE10G - DSPE11G



8 - HYDRAULIC CHARACTERISTICS

(with mineral oil with viscosity of 36 cSt at 50°C and static pressure = 100 bar)

FLOWRATES		**DSPE5G DSPER5G**	**DSPE7G**	**DSPE8G**	**DSPE10G**	**DSPE11G**
Max flow rate	l/min	180	450	800	1600	2800
Piloting flow requested with operation 0 →100%	l/min	3,5	4,1	9,2	13,7	13,7
Piloting volume requested with operation 0 →100%	cm^3	1,7	3,2	9,1	21,6	21,6

PRESSURES (bar)	MIN	MAX
Piloting pressure on X port	30	210 (**NOTE**)
Pressure on T port with interal drain	–	10
Pressure on T port with external drain	–	250

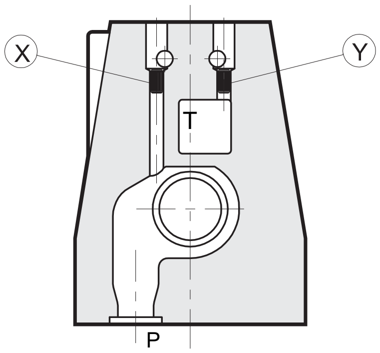
NOTE: if the valve operates with higher pressures it is necessary to use the version with external pilot and reduced pressure.

Otherwise, the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered (piloting type: Z, see section 1).

9 - PILOTING AND DRAINAGE

DSPE*G valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.

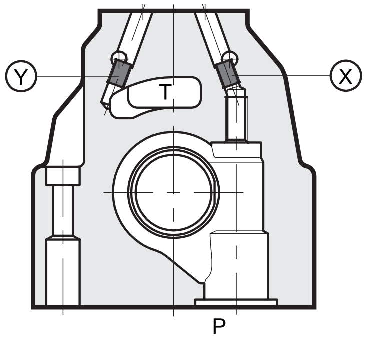
DSPE5G
DSPE5RG



X: plug M5x6 for external pilot
Y: plug M5x6 for external drain

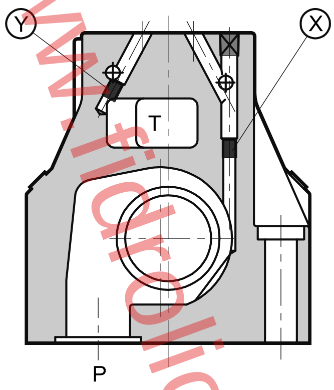
TYPE OF VALVE		Plug assembly	
		X	Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

DSPE7G



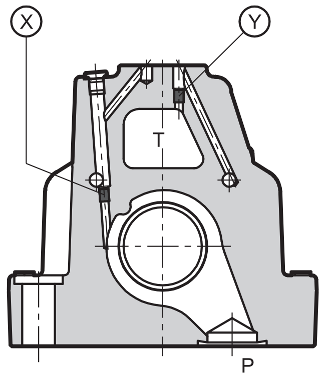
X: plug M6x8 for external pilot
Y: plug M6x8 for external drain

DSPE8G



X: plug M6x8 for external pilot
Y: plug M6x8 for external drain

DSPE10G
DSPE11G



X: plug M6x8 for external pilot
Y: plug M6x8 for external drain

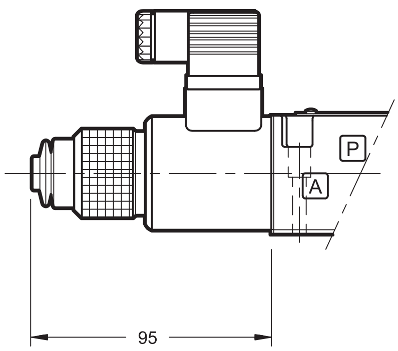
10 - MANUAL OVERRIDE

The standard valve has solenoids whose pin for the manual operation is integrated in the tube. The operation of this control must be executed with a suitable tool, minding not to damage the sliding surface.

Two different manual override version are available upon request:

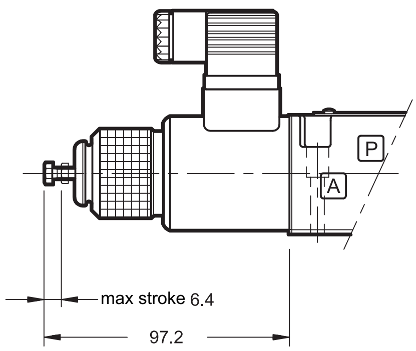
- **CM** version, manual override belt protected
- **CS** version, with metal ring nut provided with a M4 screw and a blocking locknut to allow the continuous mechanical operations.

CM Version



Code: 3803210003

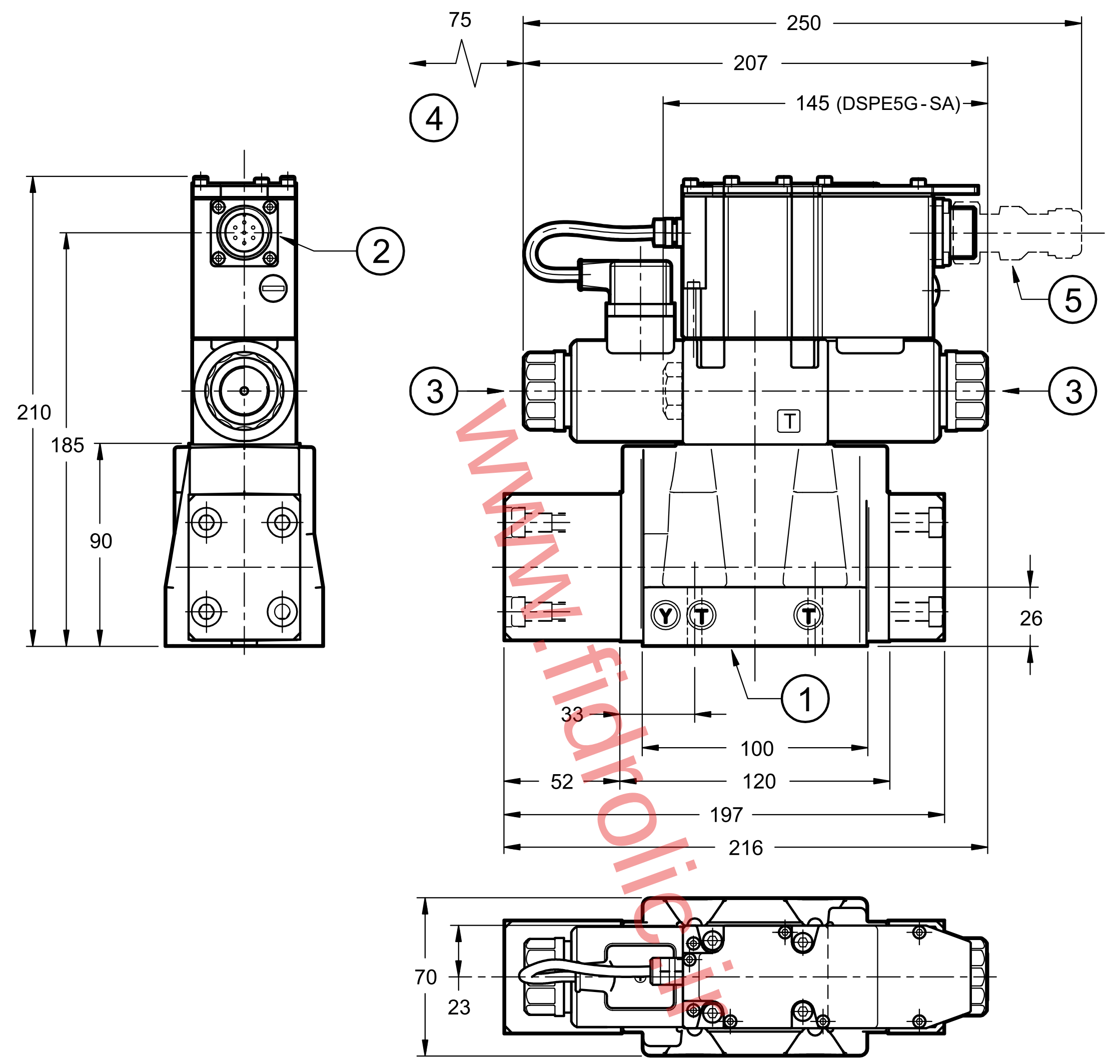
CS Version



Code: 3803210004

11 - OVERALL AND MOUNTING DIMENSIONS DSPE5G AND DSPE5RG

dimensions in mm



NOTES:

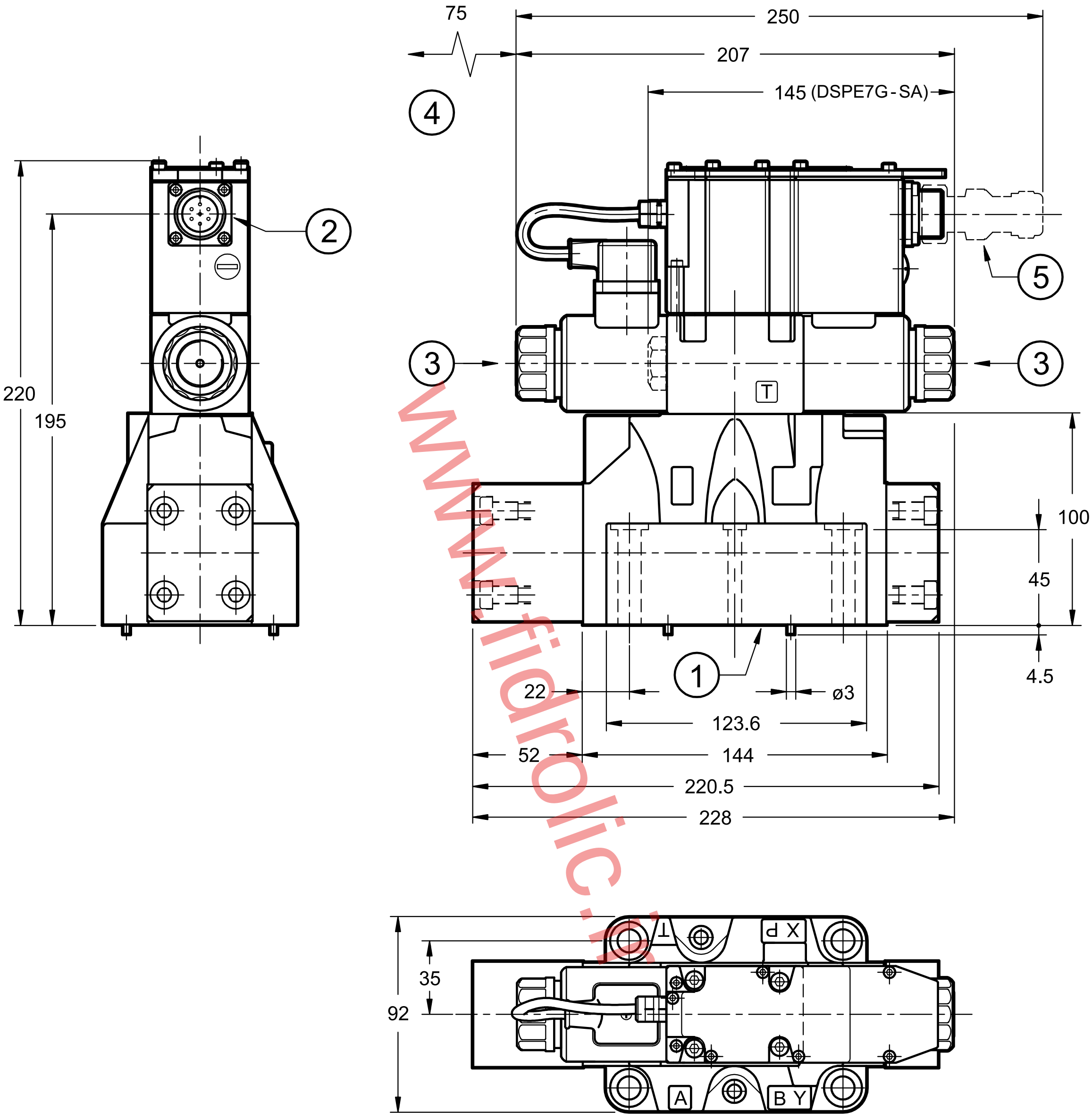
- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 15.
- Mounting surface at par. 16.

1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Main connection
3	Standard manual override embedded in the solenoid tube
4	Coil removal space
5	Mating connector. **To be ordered separately.** See paragraph 19

Valve fastening: 4 SHC ISO 4762 screws M6x35
Tightening torque: 8 Nm (A8.8 screws)
Threads of mounting holes: M6x10

12 - OVERALL AND MOUNTING DIMENSIONS DSPE7G

dimensions in mm



NOTES:

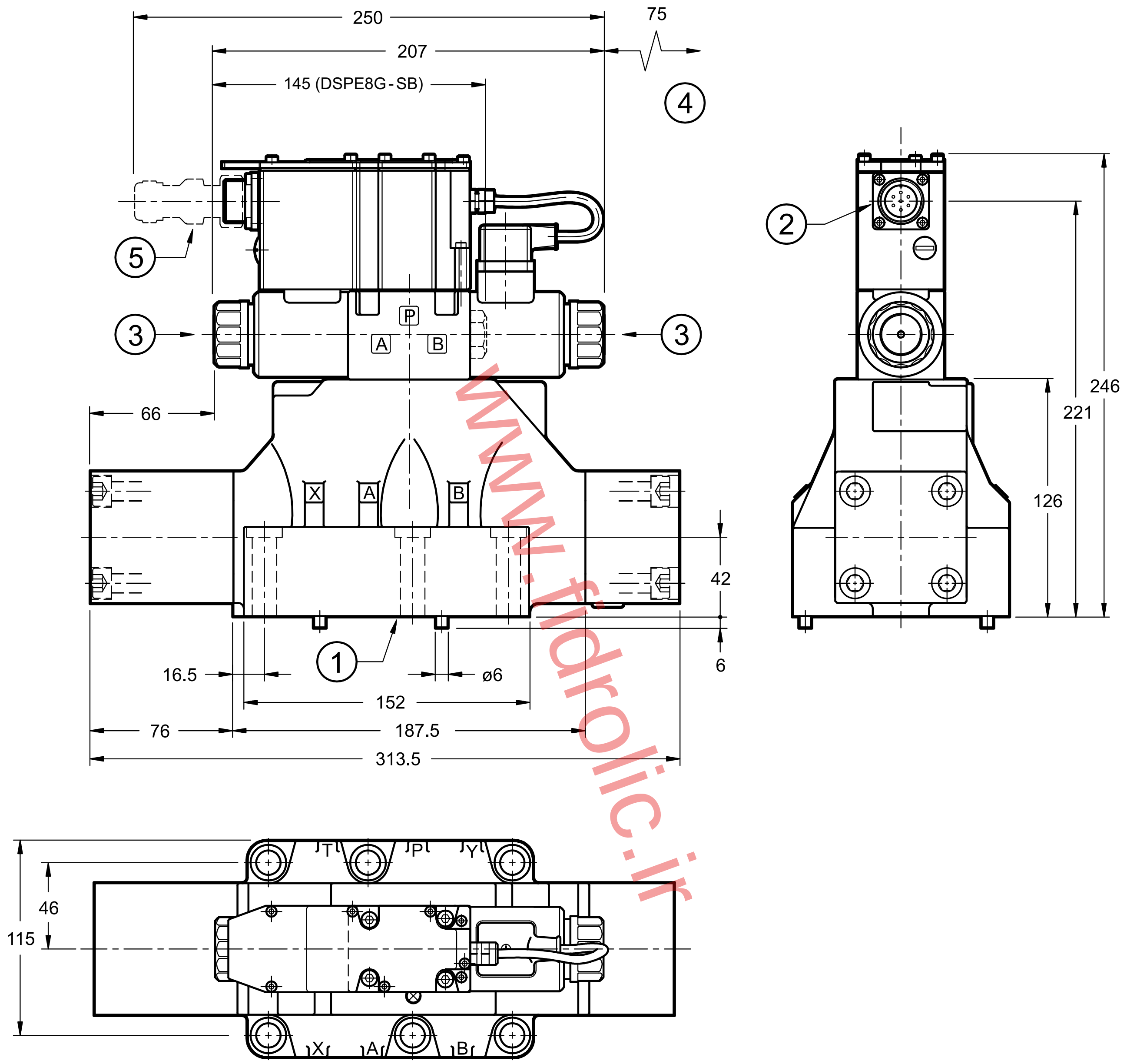
- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 15.
- Mounting surface at par. 16.

1	Mounting surface with sealing rings: 4 OR type 130 (22.22x2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Main connection
3	Standard manual override embedded in the solenoid tube
4	Coil removal space
5	Mating connector. **To be ordered separately.** See paragraph 19

Valve fastening: 4 SHC screws ISO 4762 M10x60 2 SHC screws ISO 4762 M6x60
Tightening torque: M10x60: 40 Nm (A8.8 screws) M6x60: 8 Nm (A8.8 screws)
Threads of mounting holes: M6x18; M10x18

13 - OVERALL AND MOUNTING DIMENSIONS DSPE8G

dimensions in mm



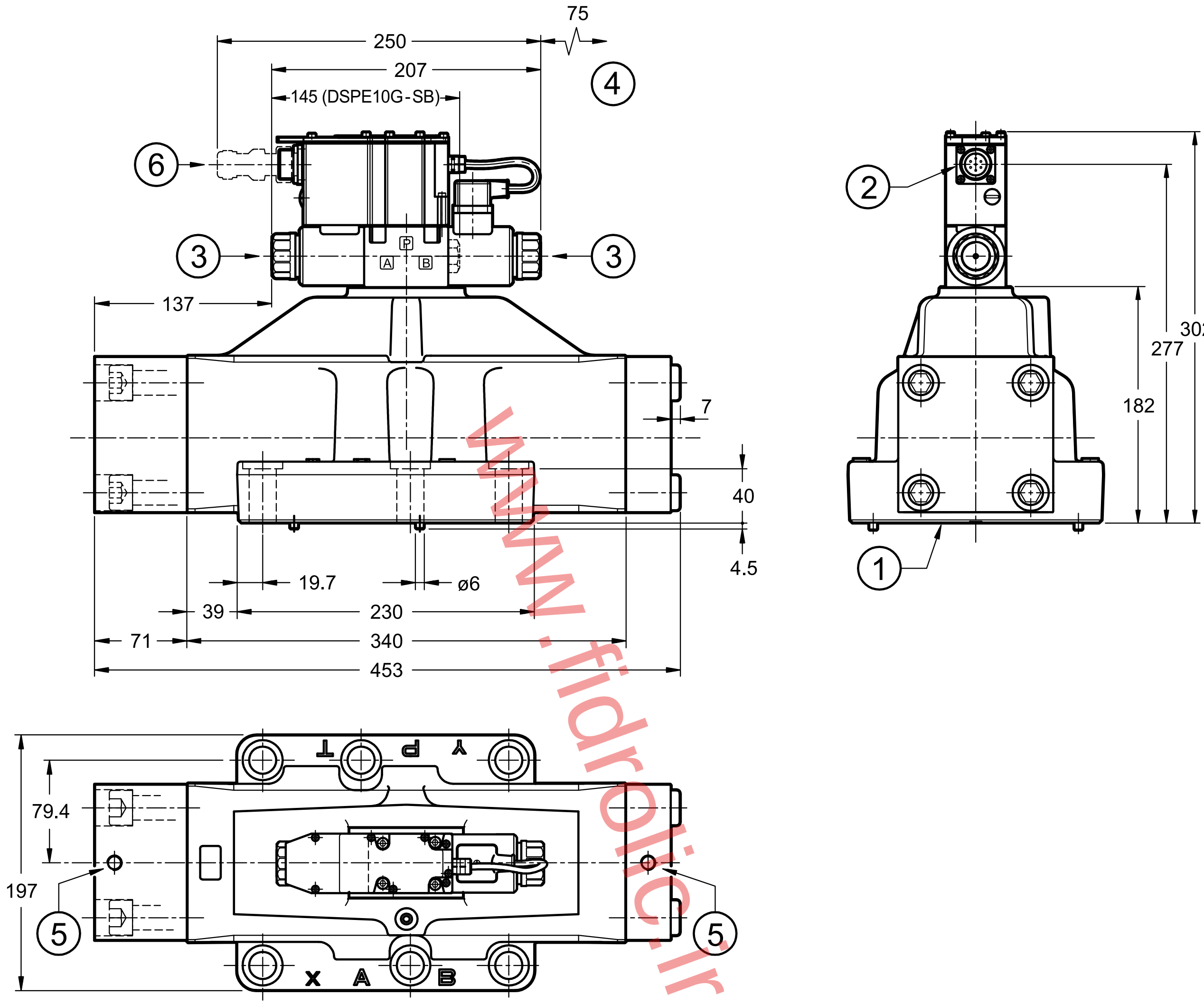
NOTES:
- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 15.
- Mounting surface at par. 16.

1	Mounting surface with sealing rings: 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Main connection
3	Standard manual override embedded in the solenoid tube
4	Coil removal space
5	Mating connector. **To be ordered separately.** See paragraph 19

Valve fastening: 6 SHC ISO 4762 screws M12x60
Tightening torque: 69 Nm (A8.8 screws)
Threads of mounting holes: M12x20

14 - OVERALL AND MOUNTING DIMENSIONS DSPE10G / DSPE11G

dimensions in mm



NOTES:

- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 15.
- Mounting surface at par. 16.

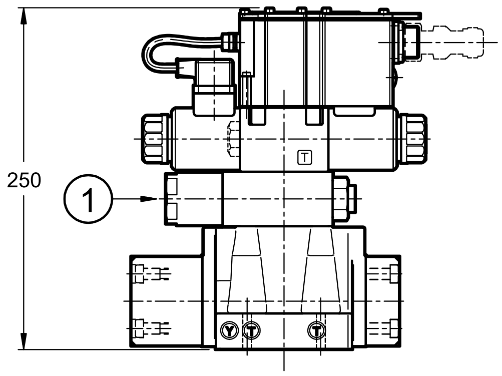
1	Mounting surface with sealing rings: **DSPE10G** 4 OR type 4150 (37.59x3.53) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore **DSPE11G** 4 OR type 4212 (53.57x3.53) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Main connection
3	Standard manual override embedded in the solenoid tube
4	Coil removal space
5	N. 2 M12 holes for eyebolts lifting
6	Mating connector. **To be ordered separately.** See paragraph 19

Valve fastening: 6 SHC screws ISO 4762 M20x70
Tightening torque: 330 Nm (A8.8 screws)
Threads of mounting holes: M20x40

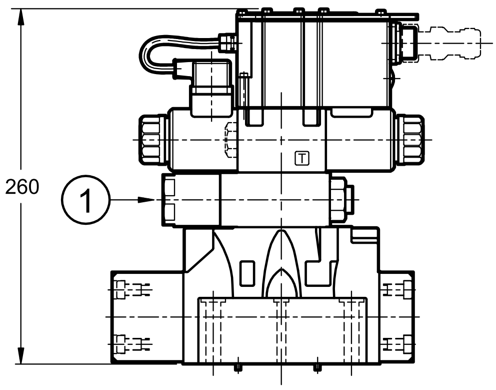
15 - OVERALL AND MOUNTING DIMENSIONS OF DSPE*G WITH PILOTING TYPE Z

dimensions in mm

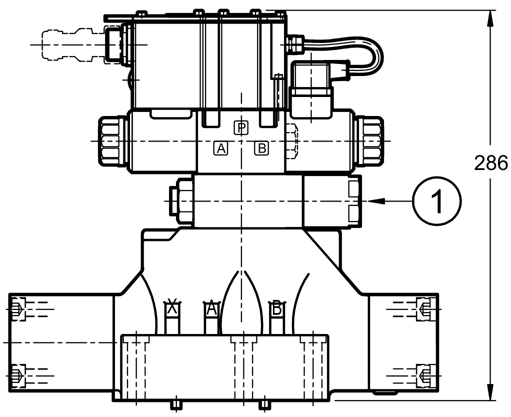
DSPE5G



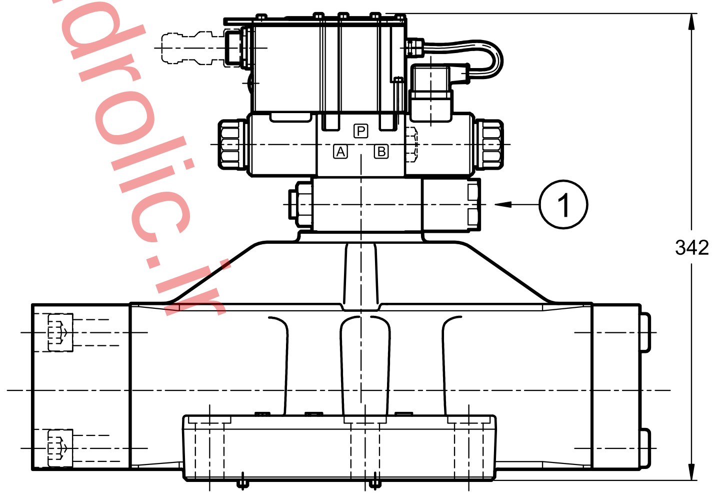
DSPE7G



DSPE8G



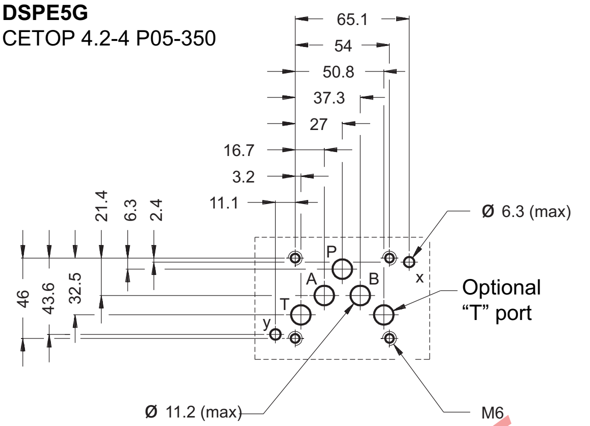
DSPE10G



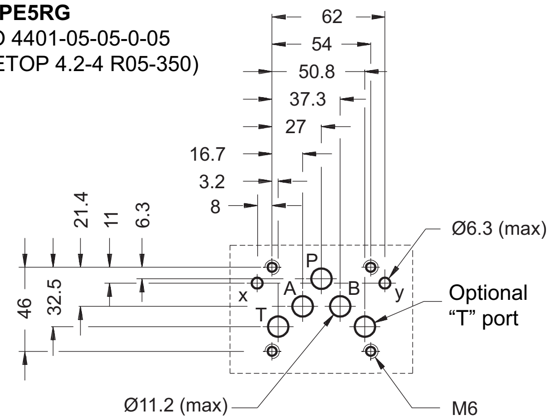
1	30 bar fixed adjustment pressure reducing valve

16 - MOUNTING SURFACES

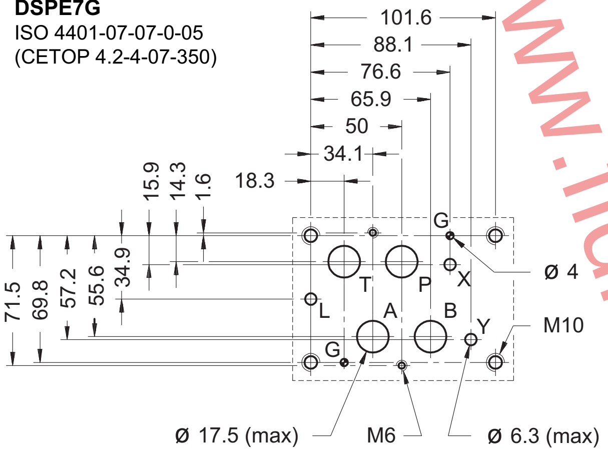
DSPE5G
CETOP 4.2-4 P05-350



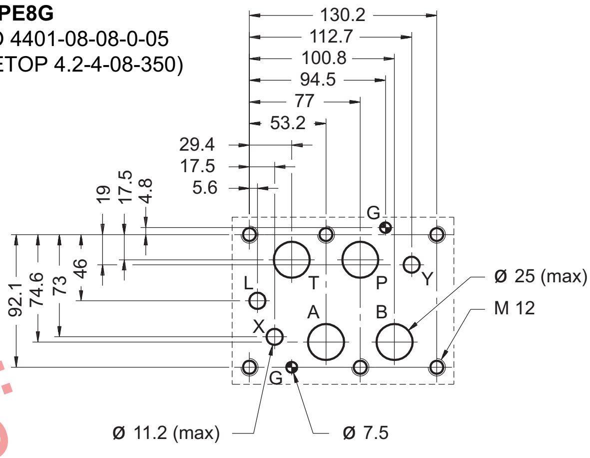
DSPE5RG
ISO 4401-05-05-0-05
(CETOP 4.2-4 R05-350)



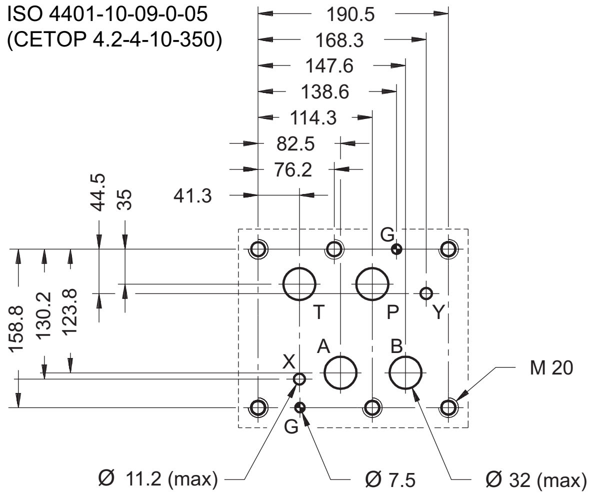
DSPE7G
ISO 4401-07-07-0-05
(CETOP 4.2-4-07-350)



DSPE8G
ISO 4401-08-08-0-05
(CETOP 4.2-4-08-350)

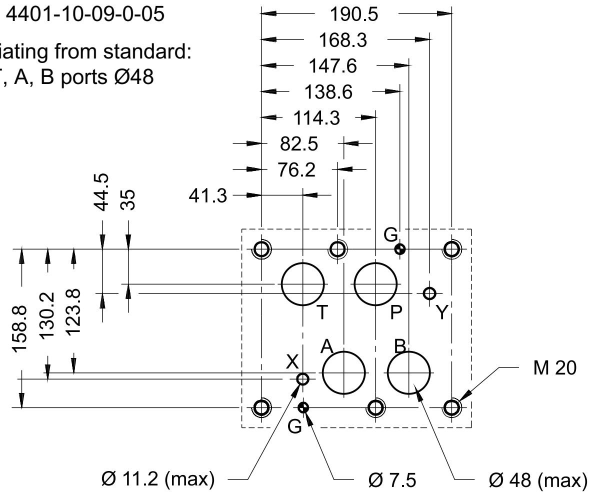


DSPE10G
ISO 4401-10-09-0-05
(CETOP 4.2-4-10-350)



DSPE11G
ISO 4401-10-09-0-05

deviating from standard:
P, T, A, B ports Ø48



17 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

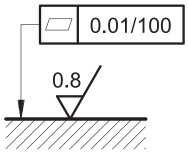
18 - INSTALLATION

The valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Surface finishing



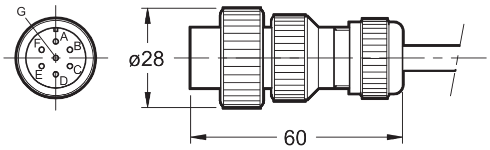
19 - ACCESSORIES

(to be ordered separately)

19.1 - Mating connector

These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

⚠ So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.



If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**

19.2 - Connection cables size

Power supply:
- up to 20 m cable length : 1,0 mm²
- up to 40 m cable length : 1,5 mm²

Signal: 0,50 mm²

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

19.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

20 - SUBPLATES

(see catalogue 51 000)

	DSPE5G	DSPE7G	DSPE8G	DSPE10G DSPE11G
Type with rear ports	PME4-AI5G	PME07-AI6G	-	-
Type with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G	-
P, T, A, B ports dimensions X, Y ports dimensions	3/4" BSP 1/4" BSP	1" BSP 1/4" BSP	1 ½" BSP 1/4" BSP	-

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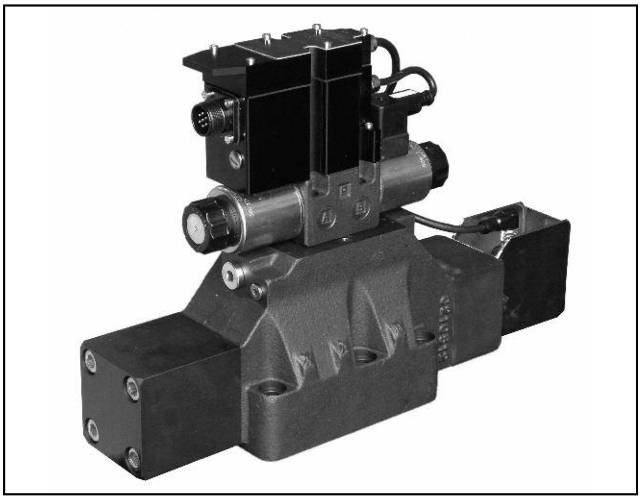
DUPLOMATIC OLEODINAMICA



DSPE*J

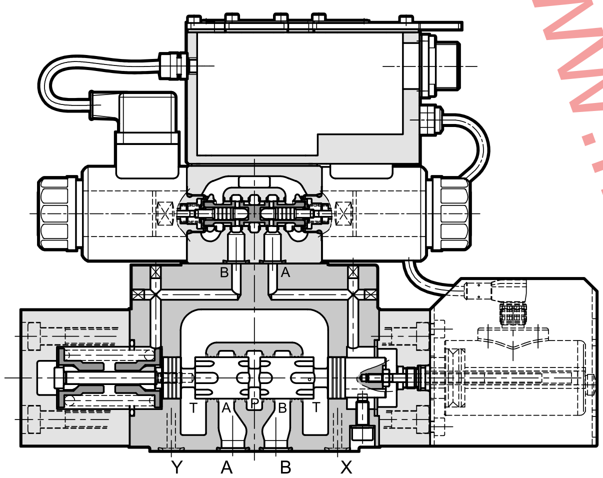
PROPORTIONAL DIRECTIONAL VALVE PILOT OPERATED WITH FEEDBACK AND INTEGRATED ELECTRONICS

SUBPLATE MOUNTING

SERIES 30

DSPE5J	**CETOP P05**
DSPE5RJ	**ISO 4401-05**
DSPE7J	**ISO 4401-07**
DSPE8J	**ISO 4401-08**
DSPE10J	**ISO 4401-10**
DSPE11J	**ISO 4401-10** oversize ports

OPERATING PRINCIPLE



— The DSPE*J are pilot operated directional control valves with electric proportional control, feedback and integrated electronics and with mounting interface in compliance with ISO 4401 standards.

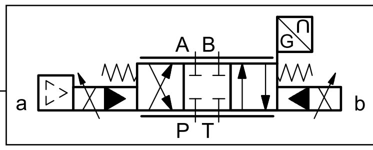
— They are controlled directly by an integrated digital amplifier. Transducer and digital card allow a fine control of the positioning of the cursor, reducing hysteresis and response times.

— The valves are available with command signal in voltage or current, and on-board electronics with internal enable, external enable or 0V monitor on pin C.

— A monitoring signal of the main spool position is available.

— The valves are easy to install. The driver directly manages digital settings. In the event of special applications, you can customize the settings using the optional kit (see par. 18)

HYDRAULIC SYMBOL (typical)



PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p =140 bar)

		DSPE5J DSPE5RJ	DSPE7J	DSPE8J	DSPE10J	DSPE11J
Max operating pressure: P - A - B ports T port	bar	350 see paragraph 8				
Max flowrate	l/min	180	450	800	1600	2800
Hysteresis	% Q_{max}	< 0,5%				
Repeatability	% Q_{max}	< ± 0,2%				
Electrical characteristics		see paragraph 3				
Ambient temperature range	°C	-20 / +60				
Fluid temperature range	°C	-20 / +80				
Fluid viscosity range	cSt	10 ÷ 400				
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13					
Recommended viscosity	cSt	25				
Mass: single solenoid valve double solenoid valve	kg	8,5 9	10,5 11	17 17,5	56 56,5	54,5 55

1 - IDENTIFICATION CODE

D	S	P	E		J	-				/	30		-			/		K11	

- Pilot operated directional valve (DSP)
- Electric proportional control (E)
- Nominal size:
  - **5** = CETOP P05
  - **5R** = ISO 4401-05 (CETOP R05)
  - **7** = ISO 4401-07 (CETOP 07)
  - **8** = ISO 4401-08 (CETOP 08)
  - **10** = ISO 4401-10 (CETOP 10)
  - **11** = ISO 4401-10 (CETOP 10) with oversize ports
- Integrated electronics for closed loop (J)
- Spool type:
  - **C** = closed centres
  - **A** = open centres
  - **RC** = regenerative closed centers
  - **RA** = regenerative open centers
- Spool nominal flow rate (see table par. 2)
- Configurations for single solenoid version (omit for double solenoid version) :
  - **SA** = 1 solenoid for cross configuration (for DSPE5J, DSPE5RJ and DSPE7J only)
  - **SB** = 1 solenoid for parallel configuration (for DSPE8J, DSPE10J and DSPE11J only)
- Series No. (the overall and mounting dimensions remain unchanged from 30 to 39)
- Seals:
  - **N** = NBR seals for mineral oil (**standard**)
  - **V** = FPM seals for special fluids
- Piloting:
  - **I** = internal
  - **E** = external
  - **Z** = internal piloting with 30 bar fixed adjustment pressure reducing valve (see par. 8 and 14)
- Drainage:
  - **I** = internal
  - **E** = external
- Reference signal:
  - **E0** = voltage ± 10 V
  - **E1** = current 4 ÷ 20 mA
- Main connector 6 pin + PE (K11)
- Pin C function:
  - **A** = external enable
  - **B** = internal enable
  - **C** = 0V monitor

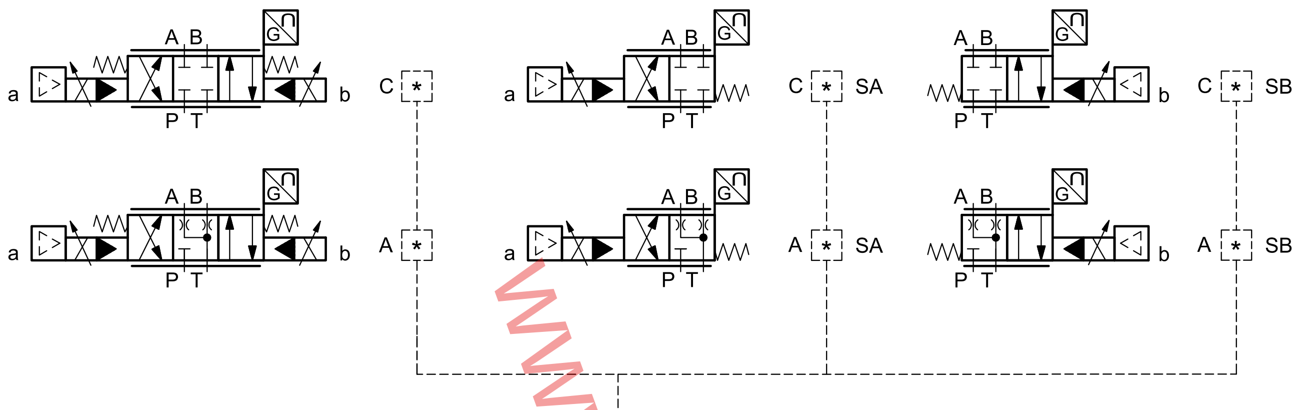
2 - AVAILABLE CONFIGURATIONS

The valve configuration depends on the combination of number of proportional solenoids, spool type, rated flow.

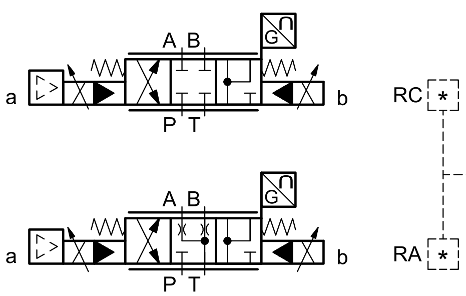
2 solenoids:
3 positions with spring centering

1 solenoid for cross configuration “**SA**”:
2 positions (central + external)
with spring centering
for DSPE5J, DSPE5RJ and DSPE7J only

1 solenoid for parallel configuration “**SB**”:
2 positions (central + external)
with spring centering
for DSPE8J, DSPE10J and DSPE11J only



valve type	*	Nominal flow with Δp 10 bar P-T
DSPE5J DSPE5RJ	**80**	80 l/min
	80/40	80 (P-A) / 40 (B-T) l/min
DSPE7J	**100**	100 l/min
	150	150 l/min
	150/75	150 (P-A) / 75 (B-T) l/min
DSPE8J	**200**	200 l/min
	300	300 l/min
	300/150	300 (P-A) / 150 (B-T) l/min
DSPE10J	**350**	350 l/min
	500	500 l/min
	500/250	500 (P-A) / 250 (B-T) l/min
DSPE11J	**800**	800 l/min
	800/500	800 (P-A) / 500 (B-T) l/min



valve type	*	Nominal flow with Δp 10 bar P-T
DSPE7J	**150/75**	150 (P-A) /75 (B-T) l/min
DSPE8J	**300/150**	300 (P-A) /150 (B-T) l/min
DSPE10J	**500/250**	500 (P-A) /250 (B-T) l/min

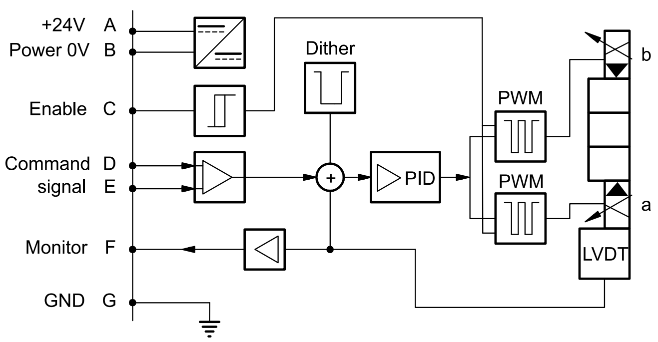
3 - ELECTRICAL CHARACTERISTICS

3.1 - Electrical on board electronics

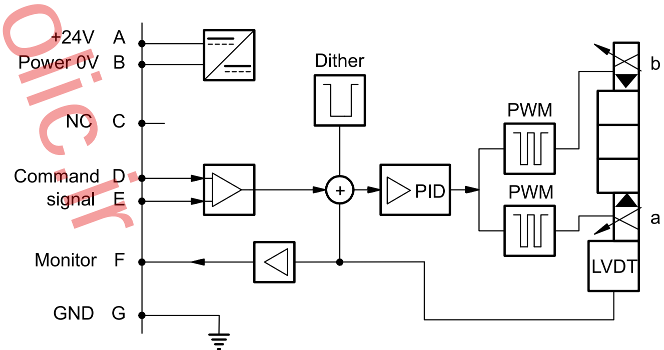
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external		3A
Command signals: voltage (E0) current (E1)	V DC mA	±10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal (spool position): voltage (E0) current (E1)	V DC mA	±10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, cable breakdown, sensor errors, supply voltage failures
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2004/108/EC standards

3.2 - On-board electronics diagrams

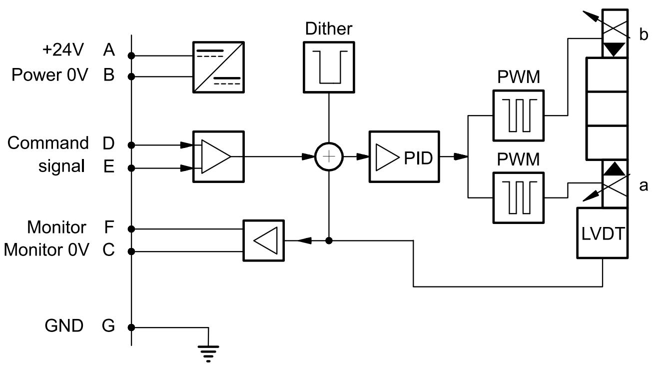
VERSION **A** - External Enable



VERSION **B** - Internal Enable

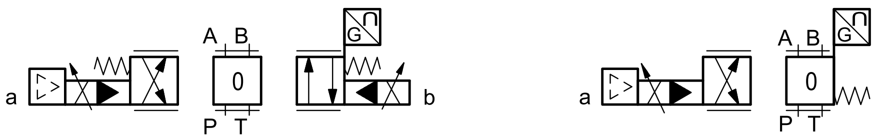


VERSION **C** - 0V Monitor



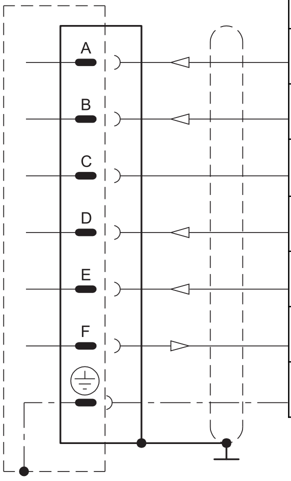
4 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal is between -10V and +10V on double solenoid valve, and 0…10V on single solenoid valves. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**-10V**	**0V**	**+10V**
MONITOR	**-10V**	**0V**	**+10V**

COMMAND	**+10V**	**0V**
MONITOR	**+10V**	**0V**

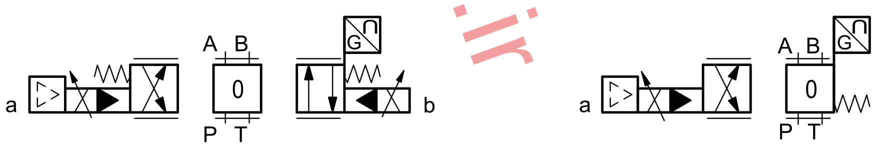


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	± 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	± 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

5 - VERSIONS WITH CURRENT COMMAND (E1)

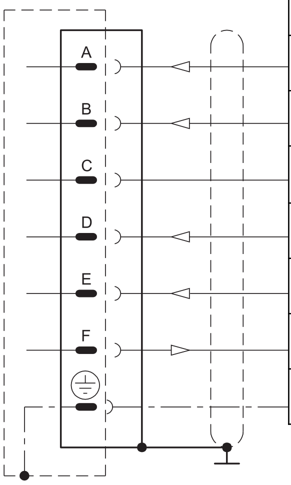
The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**4 mA**	**12 mA**	**20 mA**
MONITOR	**4 mA**	**12 mA**	**20 mA**

COMMAND	**20 mA**	**4 mA**
MONITOR	**20 mA**	**4 mA**

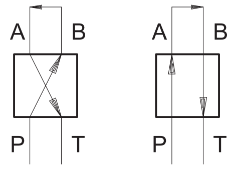


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

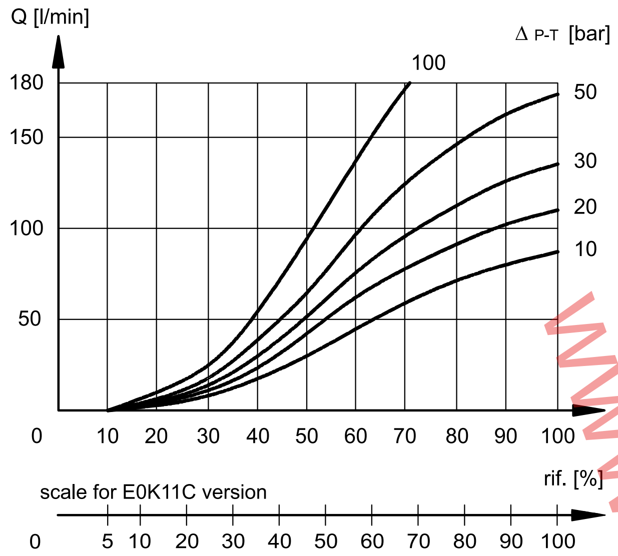
6 - CHARACTERISTIC CURVES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

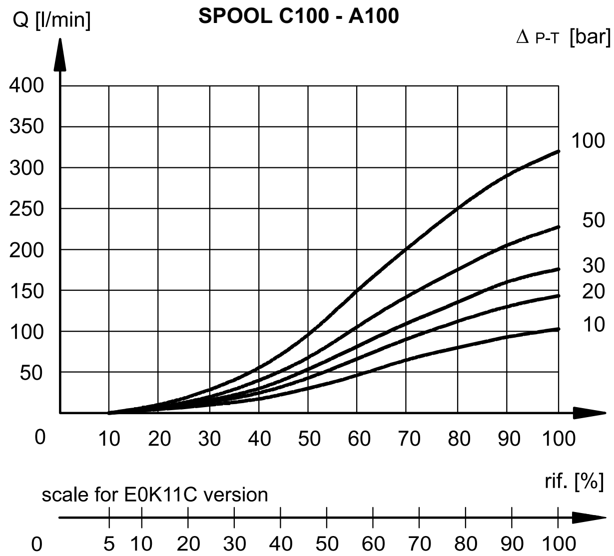
Typical flow rate curves at constant Δp related to the reference signal and measured for the available spools. The Δp values are measured between P and T valve ports.

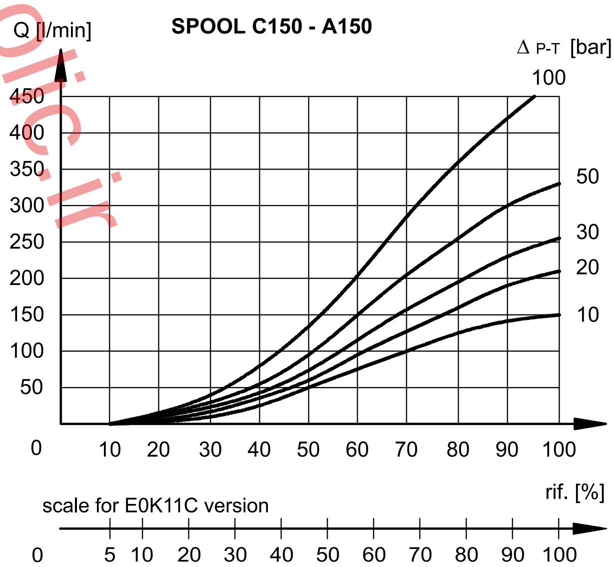


6.1 - Characteristic curves DSPE5J and DSPE5RJ

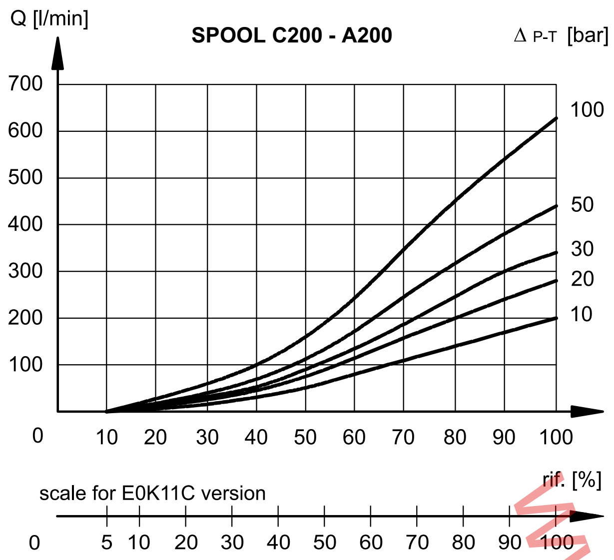


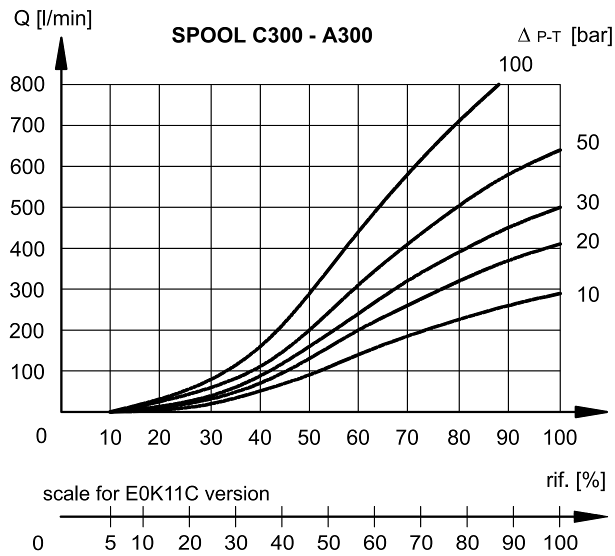
6.2 - Characteristic curves DSPE7J



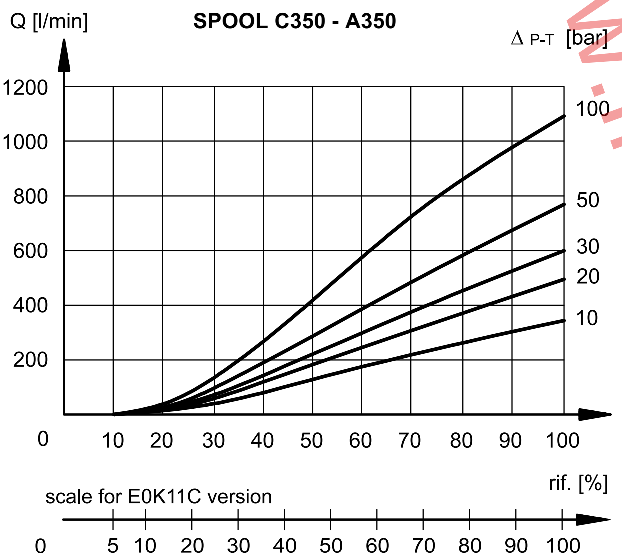


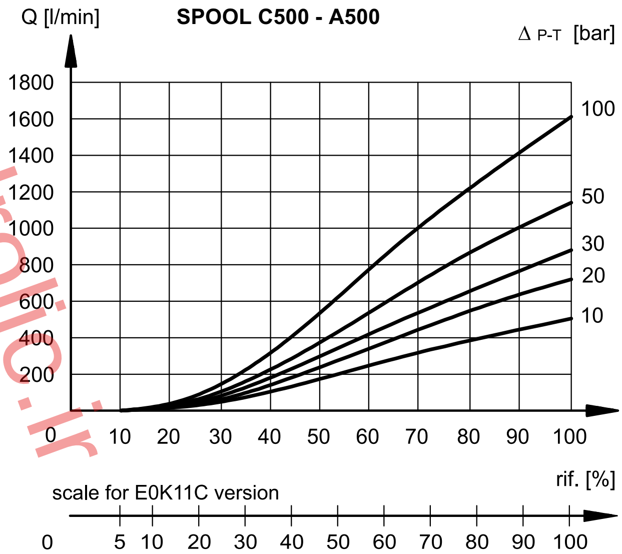
6.3 - Characteristic curves DSPE8J



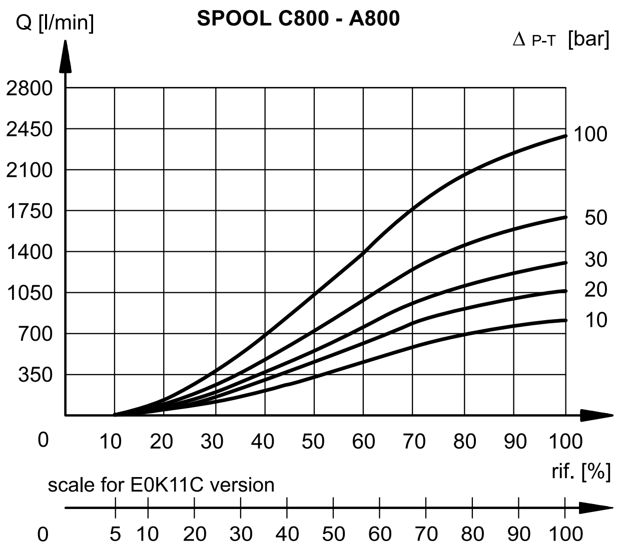


6.4 - Characteristic curves DSPE10J





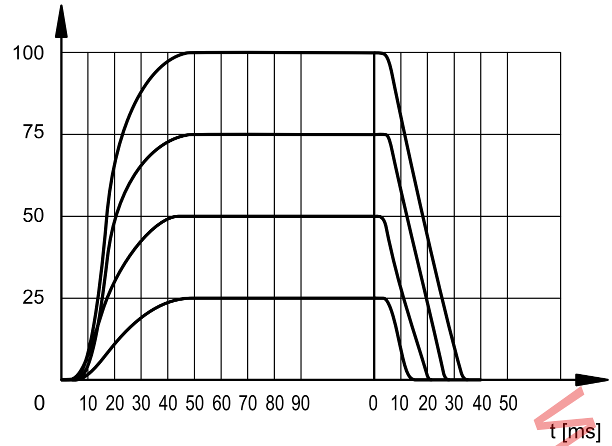
6.5 - Characteristic curves DSPE11J



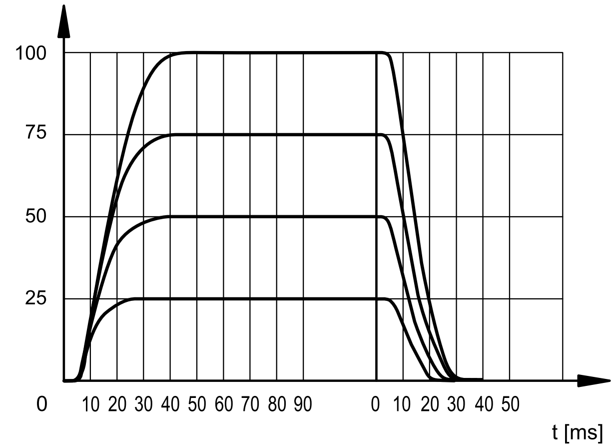
7 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and static pressure 100 bar)

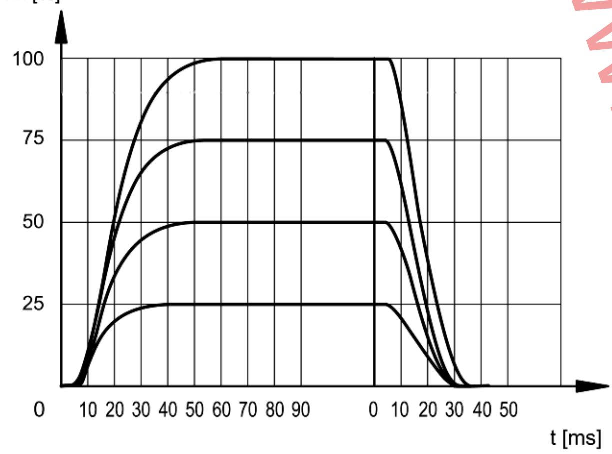
rif. [%] **DSPE5J e DSPE5RJ**



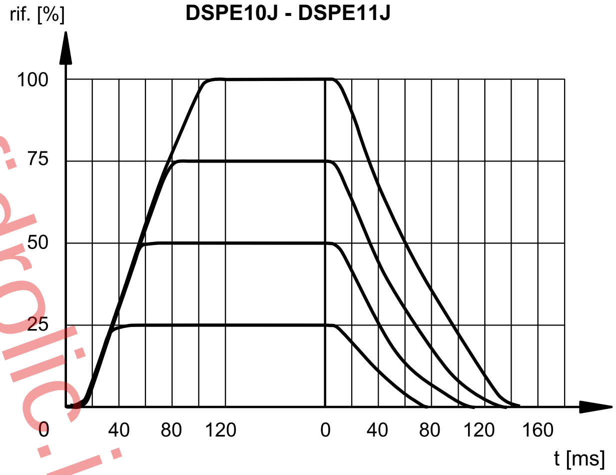
rif. [%] **DSPE7J**



rif. [%] **DSPE8J**



rif. [%] **DSPE10J - DSPE11J**



8 - HYDRAULIC CHARACTERISTICS

(with mineral oil with viscosity of 36 cSt at 50°C)

FLOWRATES		DSPE5J DSPE5RJ	DSPE7J	DSPE8J	DSPE10J	DSPE11J
Max flow rate	l/min	180	450	800	1600	2800
Piloting flow requested with operation 0 →100%	l/min	3,5	6,4	15,3	13,7	13,7
Piloting volume requested with operation 0 →100%	cm^3	1,7	3,2	9,2	21,6	21,6

PRESSURES (bar)	MIN	MAX
Piloting pressure on X port	30	210 (**NOTE**)
Pressure on T port with interal drain	–	10
Pressure on T port with external drain	–	250

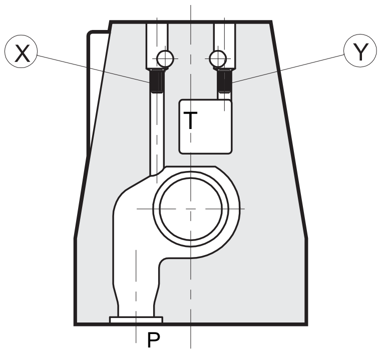
NOTE: if the valve operates with higher pressures it is necessary to use the version with external pilot and reduced pressure.

Otherwise, the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered (piloting type: Z, see section 1).

9 - PILOTING AND DRAINAGE

DSPE*J valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.

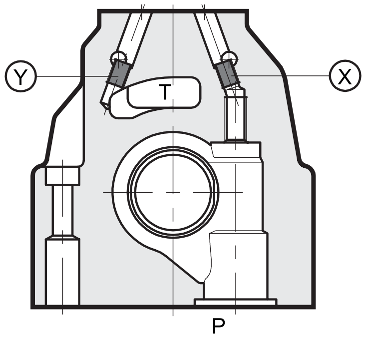
DSPE5J
DSPE5RJ



X: plug M5x6 for external pilot
Y: plug M5x6 for external drain

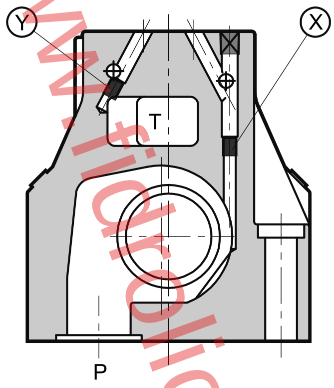
TYPE OF VALVE		Plug assembly X	Plug assembly Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

DSPE7J



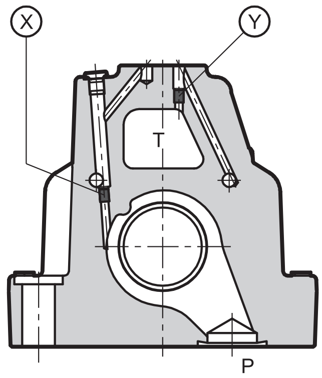
X: plug M6x8 for external pilot
Y: plug M6x8 for external drain

DSPE8J



X: plug M6x8 for external pilot
Y: plug M6x8 for external drain

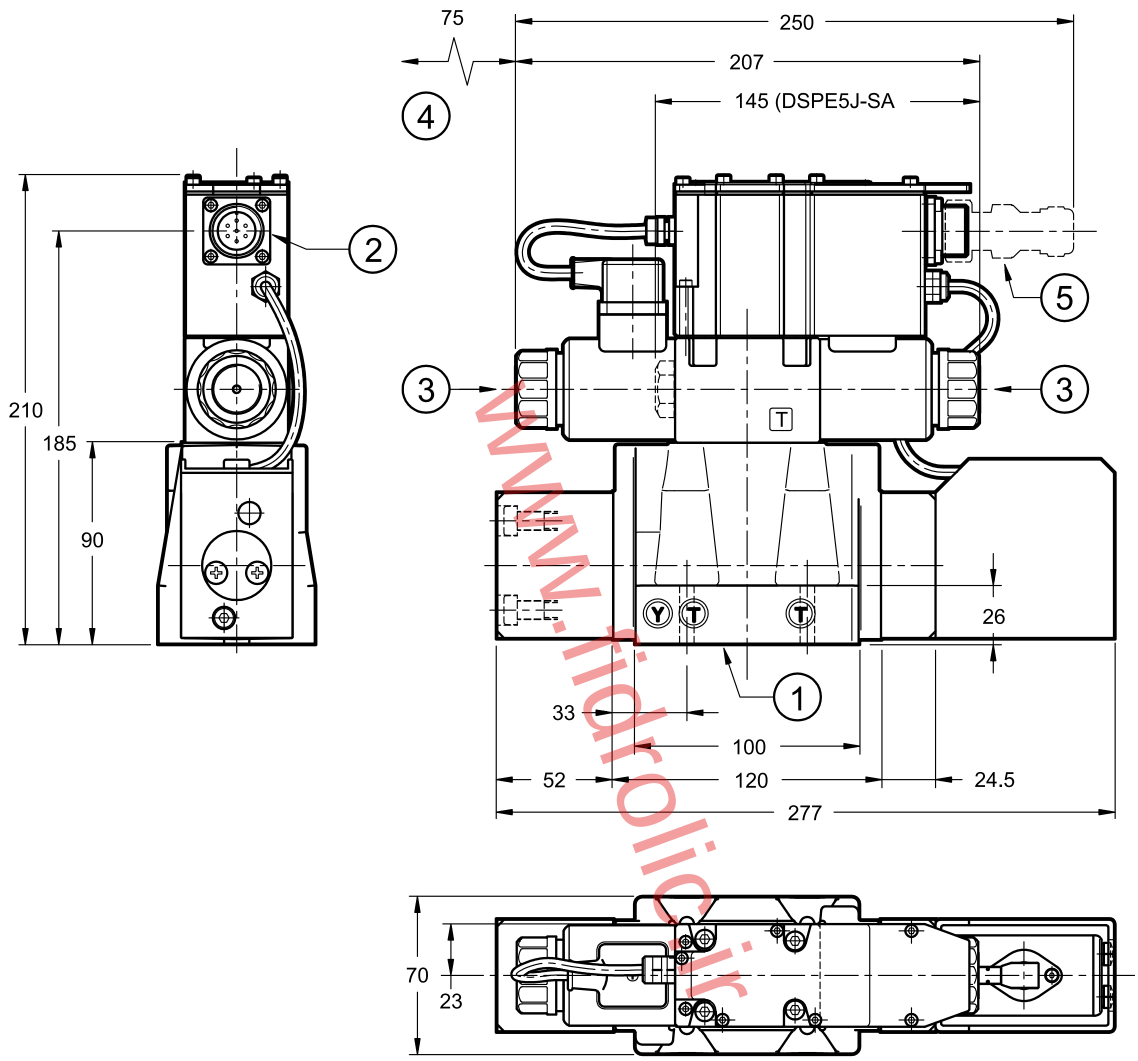
DSPE10J
DSPE11J



X: plug M6x8 for external pilot
Y: plug M6x8 for external drain

10 - OVERALL AND MOUNTING DIMENSIONS DSPE5J AND DSPE5RJ

dimensions in mm



NOTES:

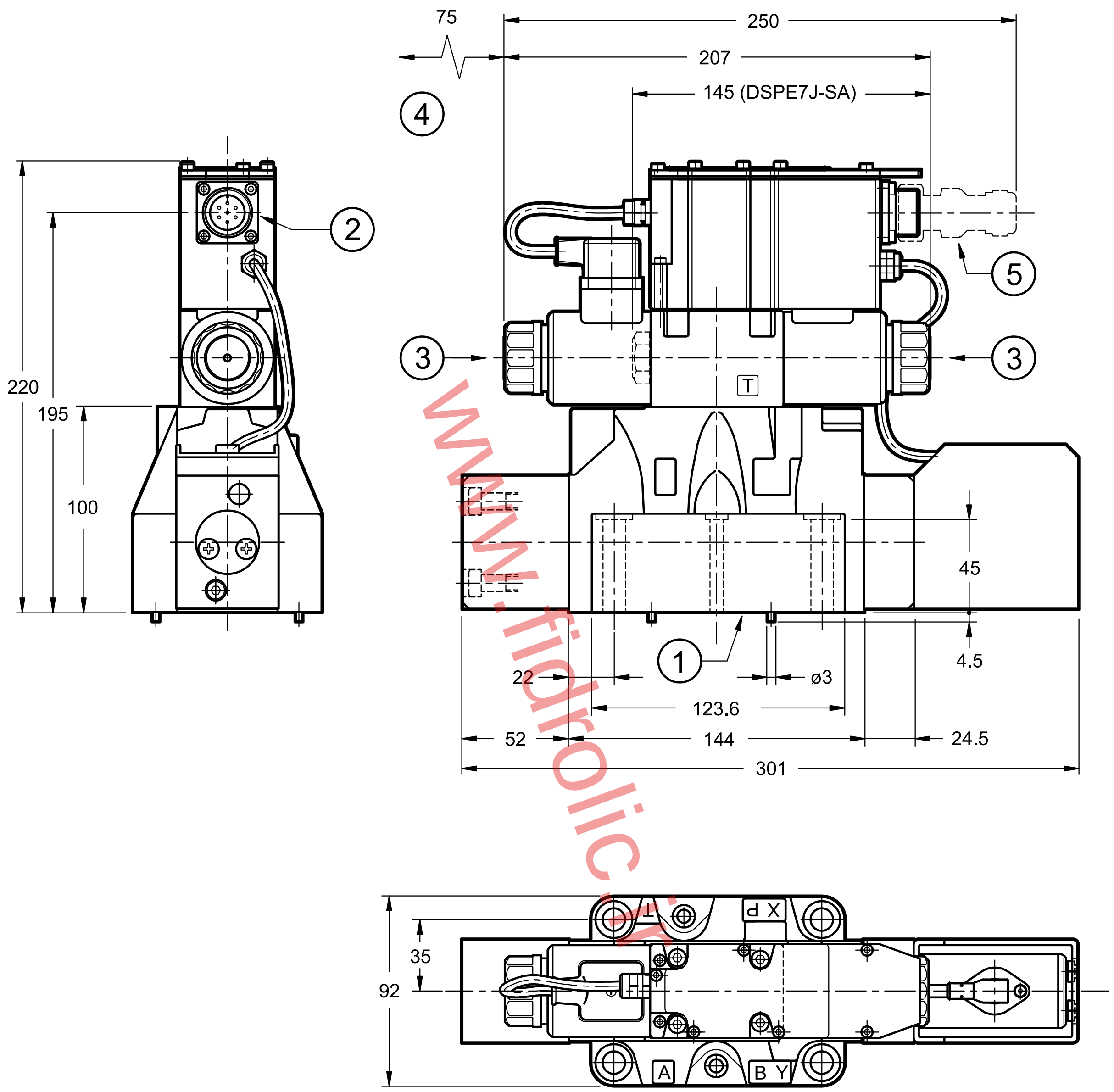
- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 14.
- Mounting surface at par. 15.
- It is recommended to not disassemble the transducer.

1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Main connection
3	Manual override embedded in the solenoid tube
4	Coil removal space
5	Mating connector. **To be ordered separately.** See paragraph 18

Valve fastening: 4 SHC ISO 4762 screws M6x35
Tightening torque: 8 Nm (A8.8 screws)
Threads of mounting holes: M6x10

11 - OVERALL AND MOUNTING DIMENSIONS DSPE7J

dimensions in mm



NOTES:

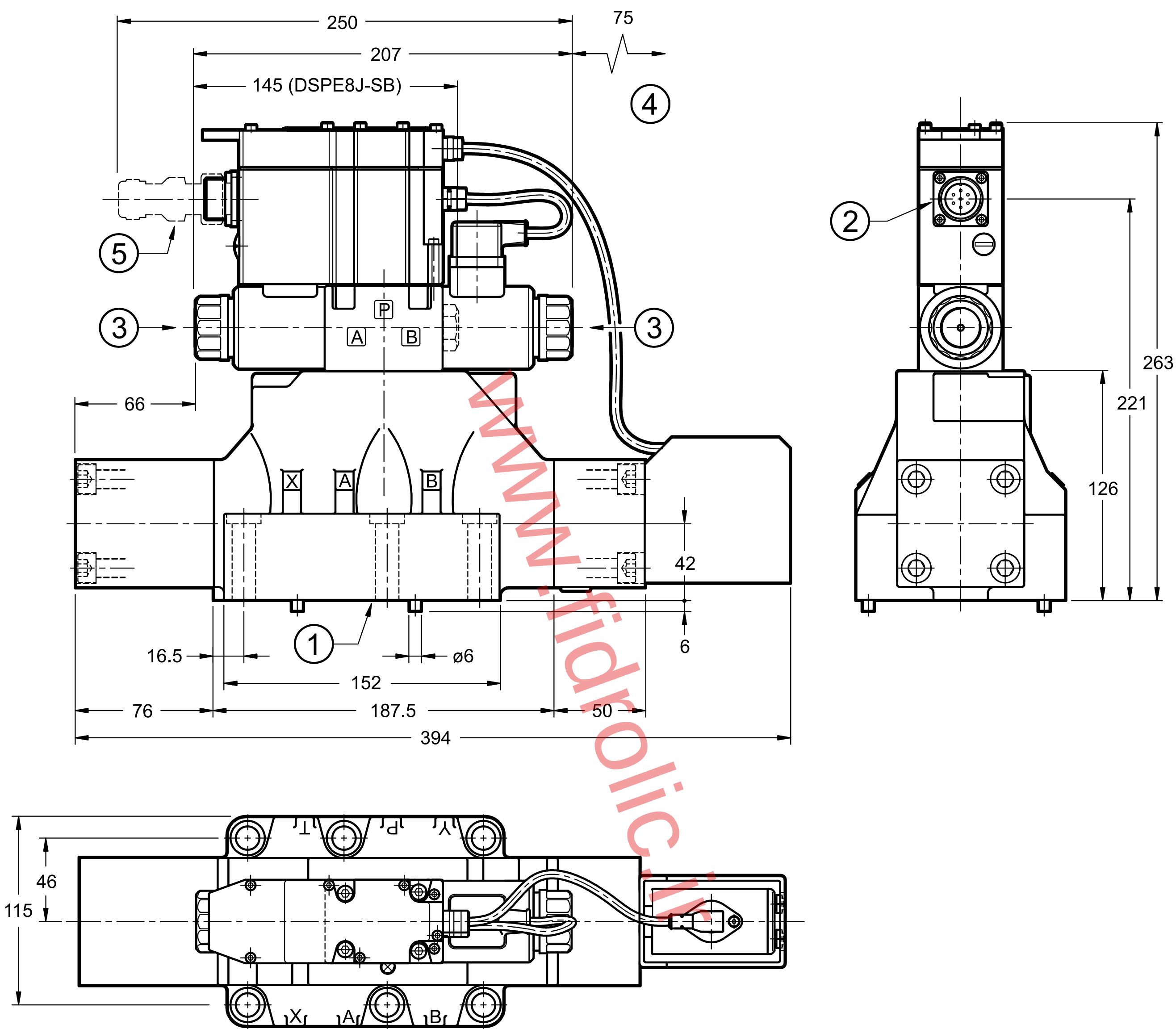
- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 14.
- Mounting surface at par. 15.
- It is recommended to not disassemble the transducer.

Valve fastening: 4 SHC screws ISO 4762 M10x60 2 SHC screws ISO 4762 M6x60
Tightening torque: M10x60: 40 Nm (A8.8 screws) M6x60: 8 Nm (A8.8 screws)
Threads of mounting holes: M6x18; M10x18

1	Mounting surface with sealing rings: 4 OR type 130 (22.22x2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Main connection
3	Manual override embedded in the solenoid tube
4	Coil removal space
5	Mating connector. **To be ordered separately.** See paragraph 18

12 - OVERALL AND MOUNTING DIMENSIONS DSPE8J

dimensions in mm



NOTES:

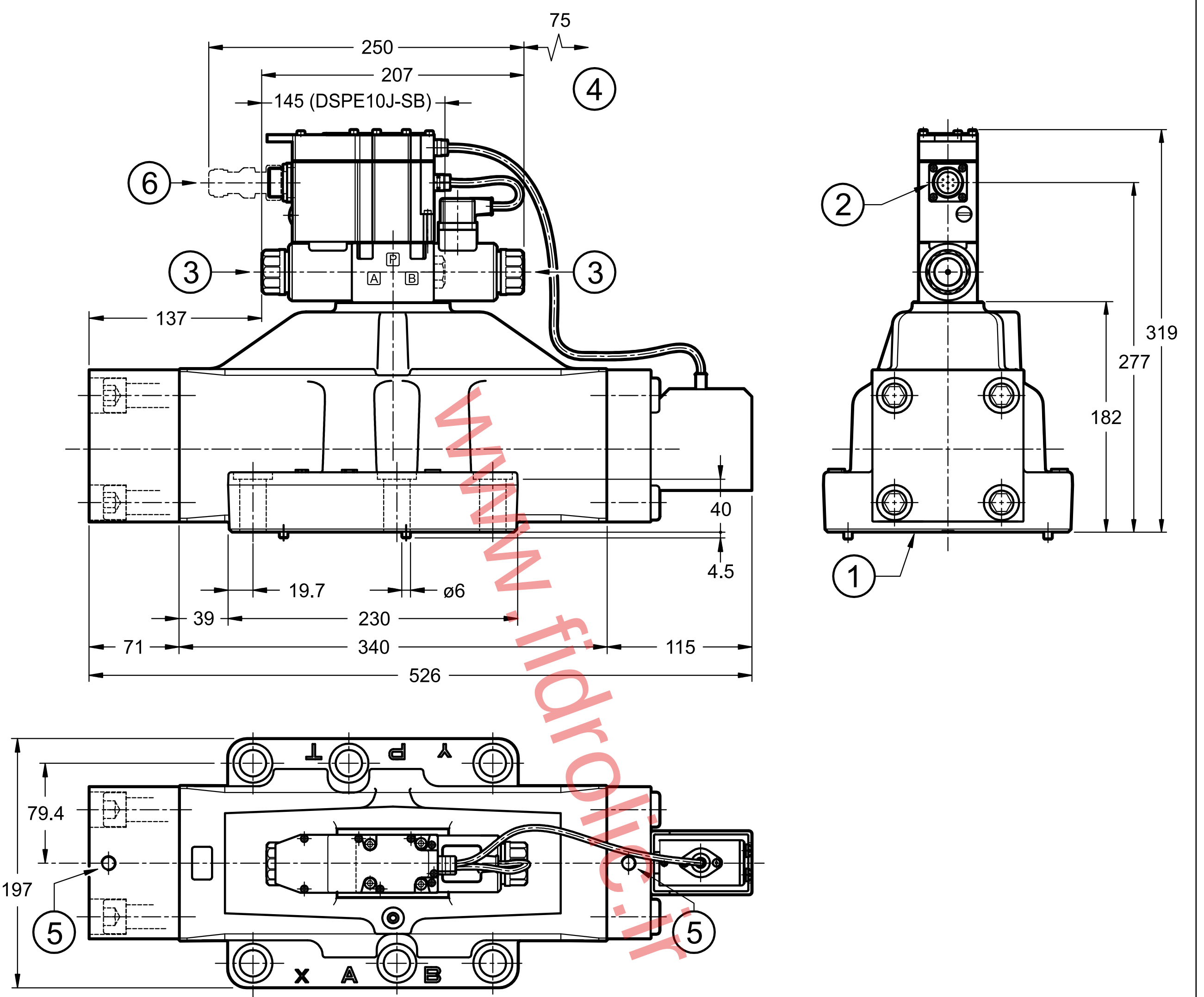
- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 14.
- Mounting surface at par. 15.
- It is recommended to not disassemble the transducer.

1	Mounting surface with sealing rings: 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Main connection
3	Manual override embedded in the solenoid tube
4	Coil removal space
5	Mating connector. **To be ordered separately.** See paragraph 18

Valve fastening: 6 SHC ISO 4762 screws M12x60
Tightening torque: 69 Nm (A8.8 screws)
Threads of mounting holes: M12x20

13 - OVERALL AND MOUNTING DIMENSIONS DSPE10J / DSPE11J

dimensions in mm



NOTES:

- Overall dimensions with Z option (fixed adjustment pressure reducing valve) at par. 14.
- Mounting surface at par. 15.
- It is recommended to not disassemble the transducer.

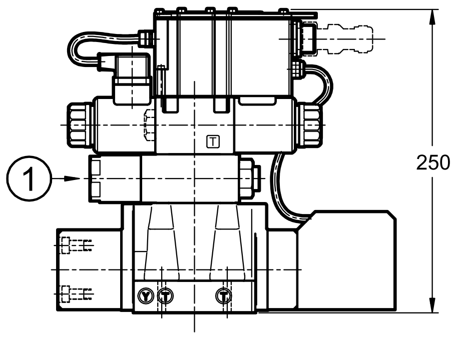
Valve fastening: 6 SHC screws ISO 4762 M20x70
Tightening torque: 330 Nm (A8.8 screws)
Threads of mounting holes: M20x40

1	Mounting surface with sealing rings: **DSPE10J** 4 OR type 4150 (37.59x3.53) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore **DSPE11J** 4 OR type 4212 (53.57x3.53) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Main connection
3	Manual override embedded in the solenoid tube
4	Coil removal space
5	N. 2 M12 holes for eyebolts lifting
6	Mating connector. **To be ordered separately.** See paragraph 18

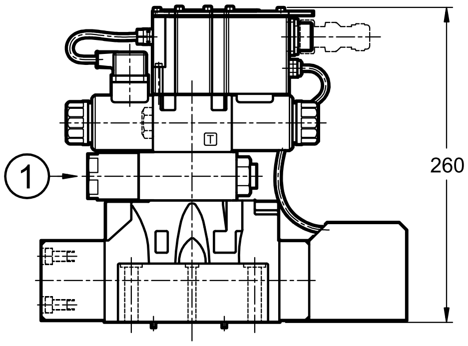
14 - OVERALL AND MOUNTING DIMENSIONS OF DSPE*J WITH PILOTING TYPE Z

dimensions in mm

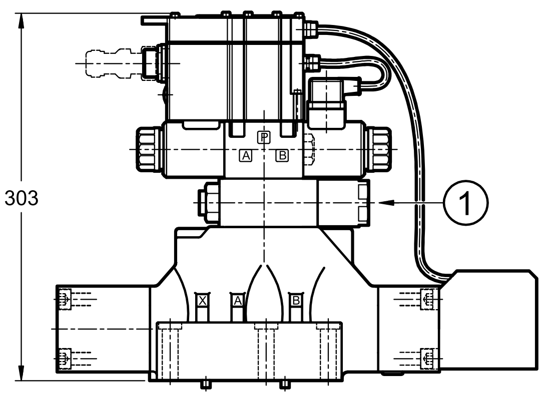
DSPE5J



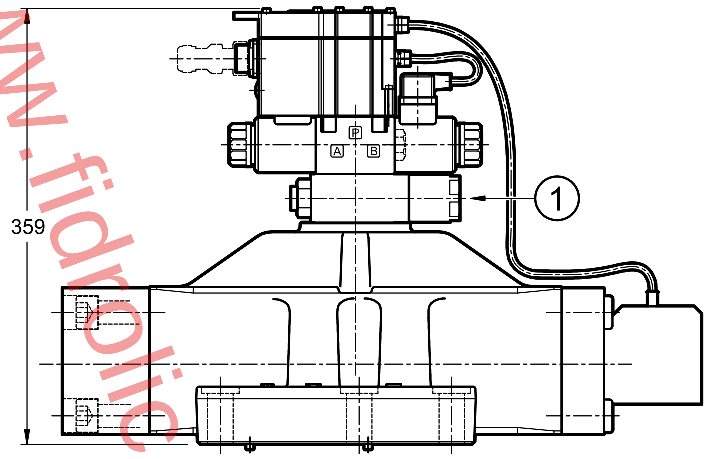
DSPE7J



DSPE8J



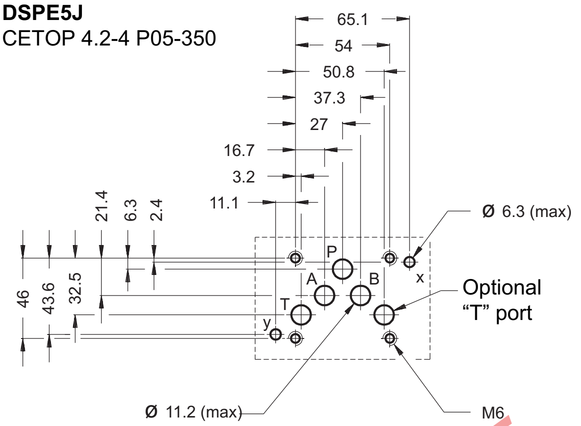
DSPE10J / DSPE11J



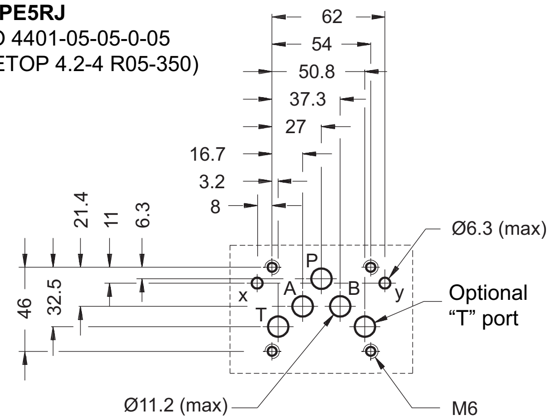
1	30 bar fixed adjustment pressure reducing valve

15 - MOUNTING SURFACES

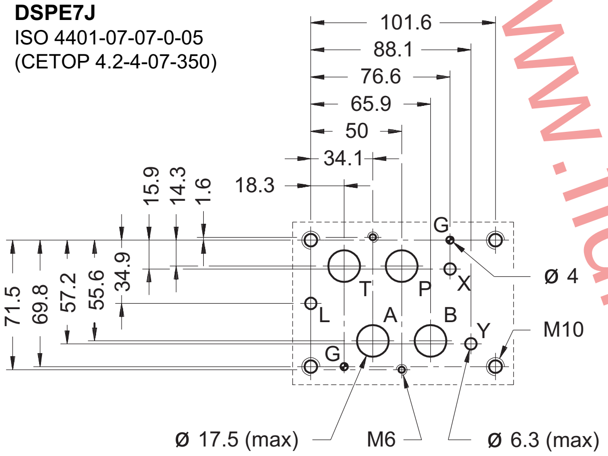
DSPE5J
CETOP 4.2-4 P05-350



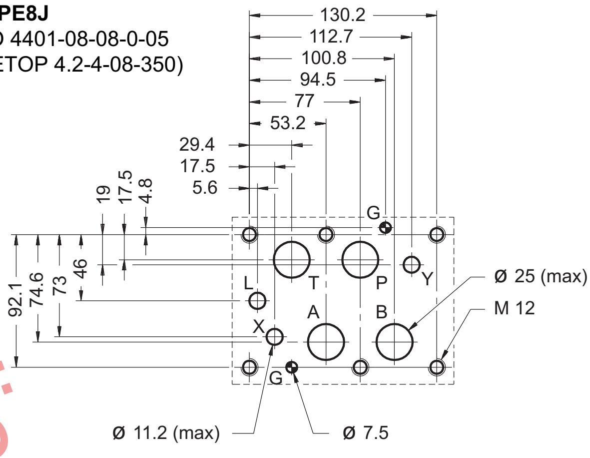
DSPE5RJ
ISO 4401-05-05-0-05
(CETOP 4.2-4 R05-350)



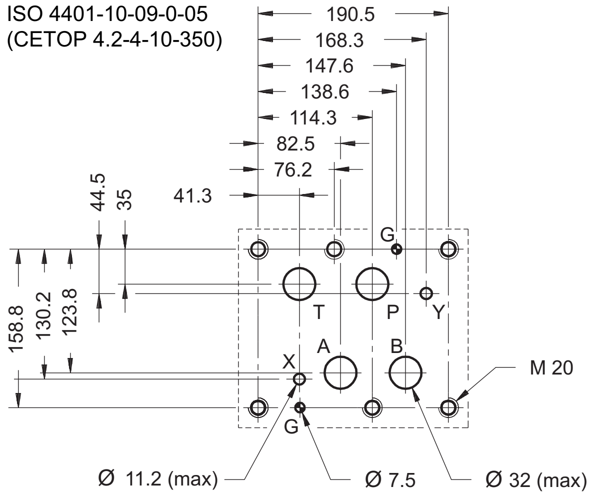
DSPE7J
ISO 4401-07-07-0-05
(CETOP 4.2-4-07-350)



DSPE8J
ISO 4401-08-08-0-05
(CETOP 4.2-4-08-350)

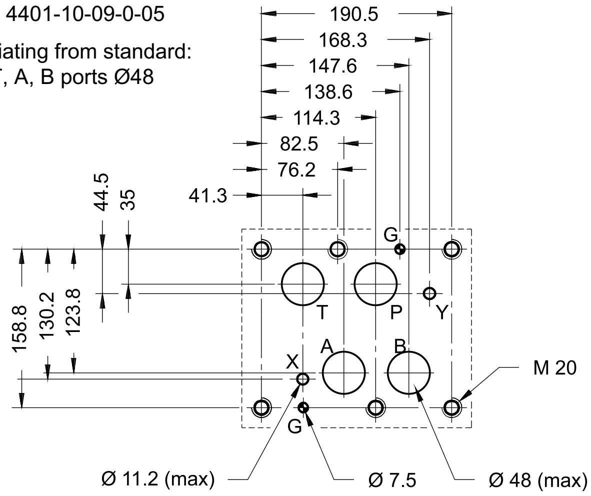


DSPE10J
ISO 4401-10-09-0-05
(CETOP 4.2-4-10-350)



DSPE11J
ISO 4401-10-09-0-05

deviating from standard:
P, T, A, B ports Ø48



16 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

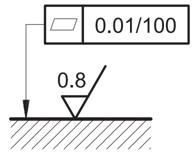
17 - INSTALLATION

The valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Surface finishing



18 - ACCESSORIES

(to be ordered separately)

18.1 - Mating connector

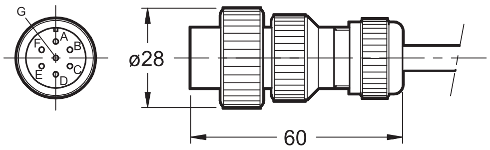
These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

⚠ So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic offers a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



18.2 - Connection cables size

Power supply:
- up to 20 m cable length : 1,0 mm²
- up to 40 m cable length : 1,5 mm²

Signal: 0,50 mm²

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

18.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

19 - SUBPLATES

(see catalogue 51 000)

	DSPE5J	DSPE7J	DSPE8J	DSPE10J DSPE11J
Type with rear ports	PME4-AI5G	PME07-AI6G	-	-
Type with side ports	PME4-AL5G	PME07-AL6G	PME5-AL8G	-
P, T, A, B ports dimensions X, Y ports dimensions	3/4" BSP 1/4" BSP	1" BSP 1/4" BSP	1 ½" BSP 1/4" BSP	-

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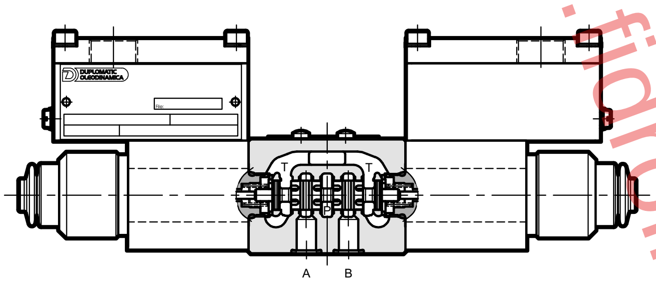
www.duplomatic.com • e-mail: sales.exp@duplomatic.com

DS(P)E*K*

EXPLOSION-PROOF PROPORTIONAL DIRECTIONAL VALVES ATEX, IECEx, INMETRO

DSE3K*	**ISO 4401-03**
DSPE5K*	**CETOP P05**
DSPE5RK*	**ISO 4401-05**
DSPE7K*	**ISO 4401-07**
DSPE8K*	**ISO 4401-08**
DSPE10K*	**ISO 4401-10**

OPERATING PRINCIPLE



— These explosion proof directional valves are available in size ISO 4401-03 for direct operated type. Pilot operated valves are available in CETOP P05, ISO 4401-05, ISO 4401-07, ISO 4401-08 and ISO 4401-10 sizes.

— They are compliant with ATEX, IECEx and INMETRO requirements and are suitable for use in potentially explosive atmospheres, for surface plants or mines.

— A low temperature version (up to -40 °C) is also available.

— The DSE3K* valves are supplied with a finishing surface treatment (zinc-nickel) suitable to ensure a salt spray resistance up to 600 hours; for DSPE*K* valves, this finishing is available upon request.

— **Details for classification, operating temperatures and electrical characteristics are in the technical data sheet 02 500 'Explosion proof classification'.**

PERFORMANCES (obtained with viscosity of 36 cSt at 50°C and electronic control card)		DSE3K*	DSPE5K* DSPE5RK*	DSPE7K*	DSPE8K*	DSPE10K*
Max operating pressure: P - A - B ports T ports	bar	350 210	350 see paragraph 7			
Controlled flow rate with Δp 10 bar P-T	l/min	see par. 2	see paragraph 5			
Step response		see paragraph. 6				
Hysteresis	% of Q_{max}	<6% (PWM 200Hz)	< 4% (PWM 100 Hz)			
Repeatability	% of Q_{max}	< ±1,5%	< ± 2%			
Electrical characteristics		see paragraph 9				
Temperature ranges (ambient and fluid)	°C	see data sheet 02 500				
Fluid viscosity range	cSt	10 ÷ 400				
Fluid contamination degree	According to ISO 4406:1999 class 18/16/13					
Recommended viscosity	cSt	25				
Mass single solenoid valve double solenoid valve	kg	1,9 2,8	7,5 8,3	9,9 10,7	16,1 16,9	52,8 53,5

1 - IDENTIFICATION OF DIRECT OPERATED VALVE DSE3K*

1.1 - Identification code

D	S	E	3		-				/	10		-		K9		/		

Direct operated solenoid valve

Electric proportional control

Size: ISO 4401-03

Explosion-proof certification:
See table 1.2

Spool type:
C = closed centers
A = open centers

Spool nominal flow rate (see table par. 1.2)

Solenoid position
(omit for double solenoid version):
SA = 1 solenoid for cross configuration
SB = 1 solenoid for parallel configuration

Series No.:
(the overall and mounting dimensions do not change from 10 to 19)

Seals:
For temperature range -20 / +80 °C
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids
For temperature range -40 / +80 °C
NL = seal for low temperatures (for mineral oil)

Nominal solenoid voltage:
D12 = 12V DC
D24 = 24V DC

Coil electrical connection: by terminal block

Connection type for cable gland
upper connection:
T01 = M20x1.5 - ISO 261
T02 = Gk 1/2 - UNI EN 10226-2
not available for INMETRO
T03 = 1/2" NPT - ANSI B1.20.1
(ex ANSI B2.1)
side connection:
S01 = M20x1.5 - ISO 261
S02 = Gk 1/2 - UNI EN 10226-2
not available for INMETRO
S03 = 1/2" NPT - ANSI B1.20.1
(ex ANSI B2.1)
S04 = M16x1.5 - ISO 261

Manual override:
CM = boot protected
standard for both N and V seals
not available for NL seals
CB = blind ring nut
standard for NL seals
available upon request for both N and V seals
CK = knob manual override
(only for DC version)
CH = lever manual override.
Dimensions for CB and CH at par. 18

Option: **/T5**
version in T5 temperature class.
Omit if not required.

NOTE: The zinc-nickel standard finishing surface treatment is suitable to ensure a salt spray resistance up to 600 hours (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards)

1.2 - Names of valves per certification

	ATEX		IECEx		INMETRO	
for gases for dusts	**KD2**	II 2GD	**KXD2**	IECEx Gb IECEx Db	**KBD2**	INMETRO Gb INMETRO Db
for mines	**KDM2**	I M2	**KXDM2**	IECEx Mb	**KBDM2**	INMETRO Mb

NOTE: Refer to the technical data sheet 02 500 for marking, operating temperatures and available versions.

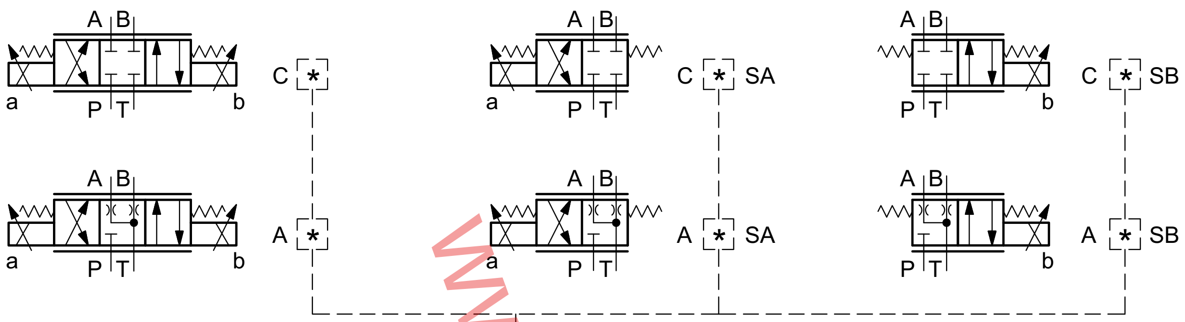
1.3 - Available configurations

Valve configuration depends on the combination of the following elements:
number of proportional solenoids, spool type, nominal flow rate.

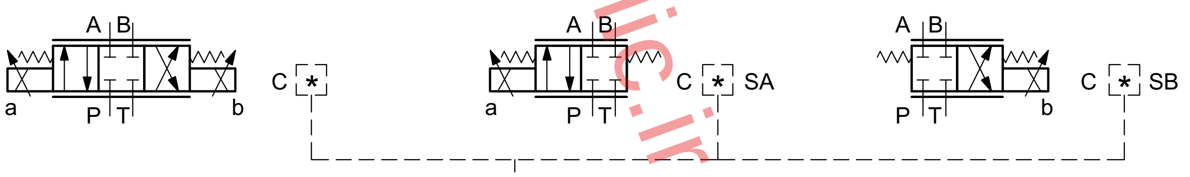
2 solenoids configuration:
3 positions with spring centering

"**SA**" configuration: 1 solenoid on side A.
2 positions (central + external) with spring centering

"**SB**" configuration: 1 solenoid on side B.
2 positions (central + external) with spring centering



*	Nominal flow with Δp10 bar P→T
04	4 l/min
08	8 l/min
16	16 l/min
16/08	16 (P→A) / 08 (B→T) l/min
26	26 l/min
26/13	26 (P→A) / 13 (B→T) l/min



*	Nominal flow with Δp10 bar P→T
01R	1 l/min

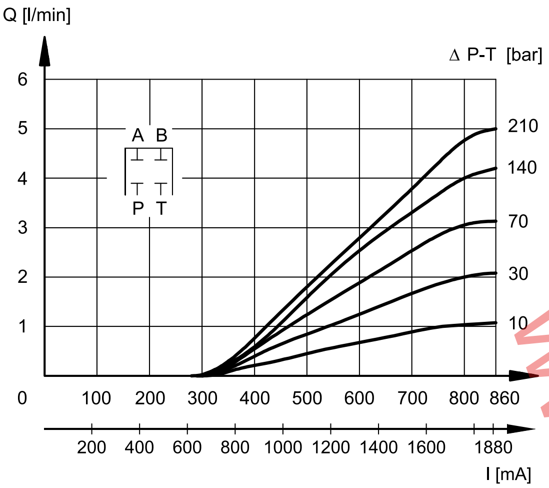
2 - DSE3K* CHARACTERISTIC CURVES

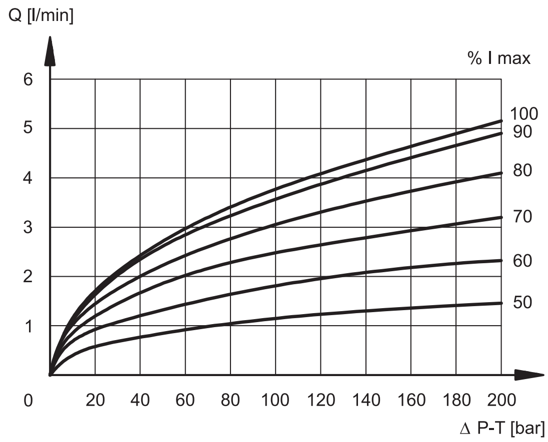
(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Typical flow control characteristics, according to current supply to the solenoid.

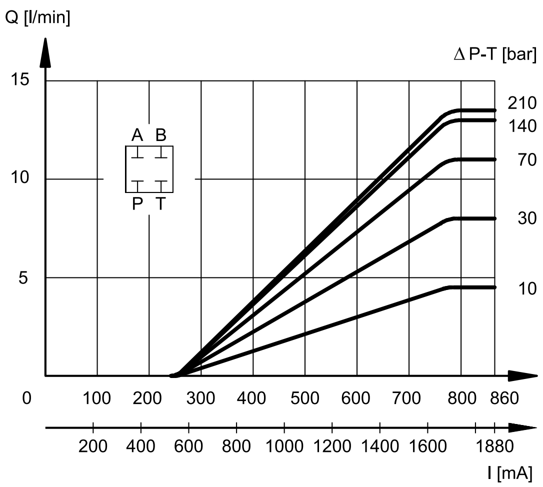
The reference Δp values are measured between ports P and T on the valve.

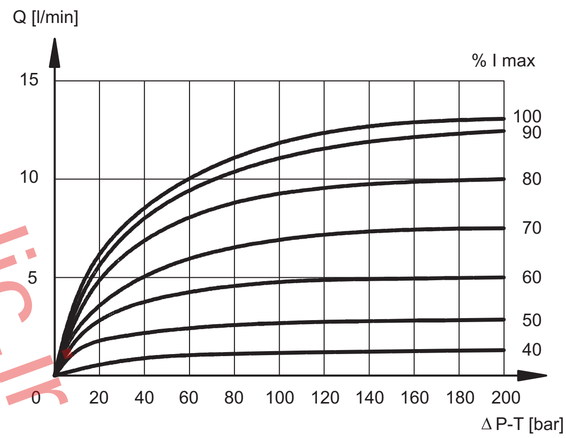
SPOOL TYPE C01R



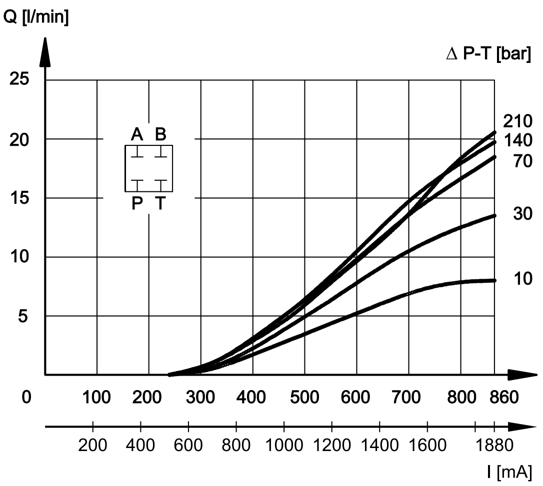


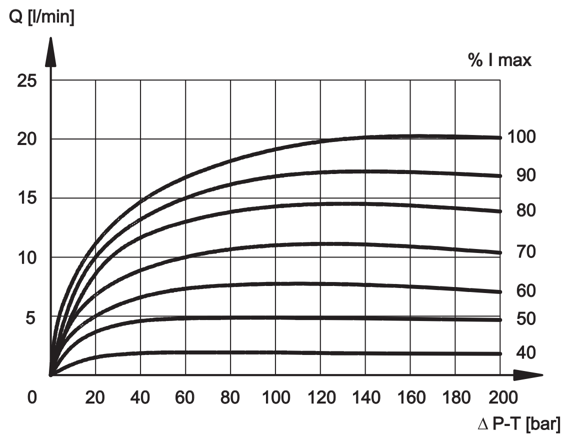
SPOOL TYPE C04



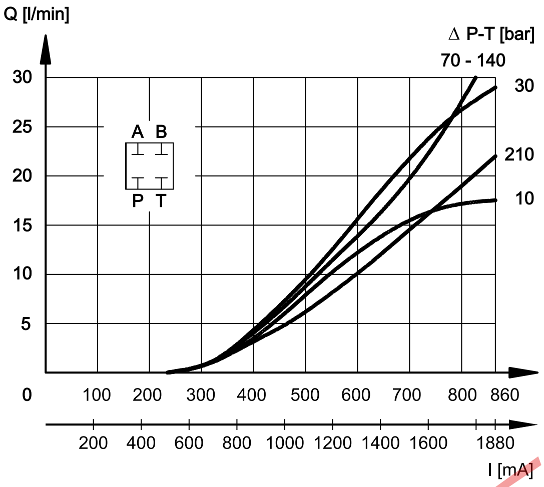


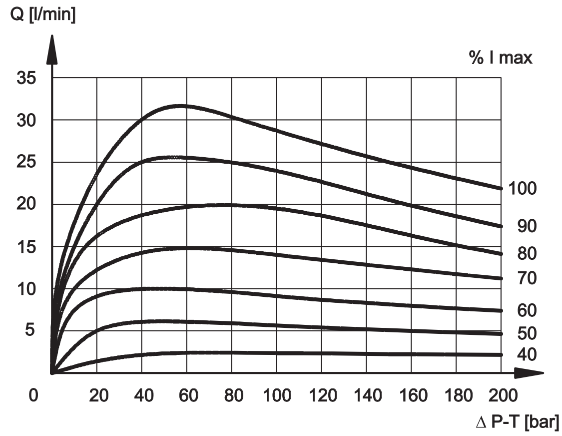
SPOOL TYPE C08



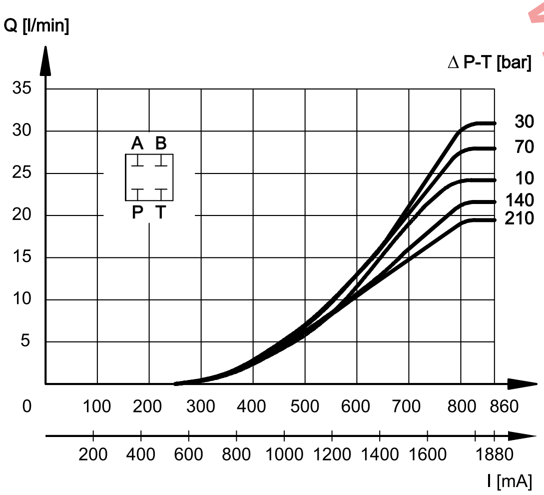


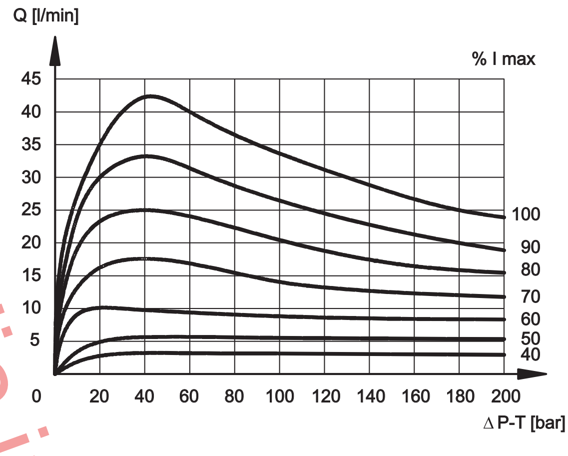
SPOOL TYPE C16



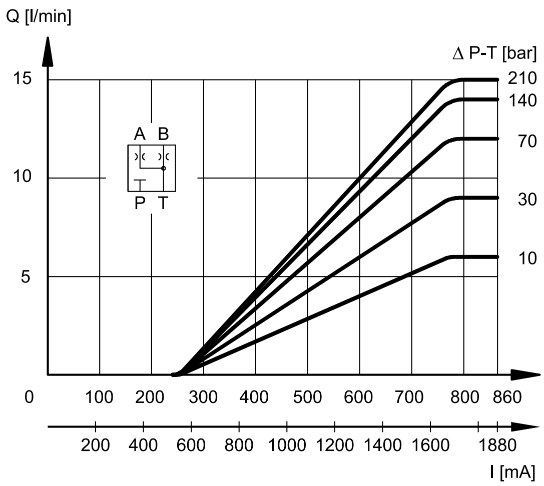


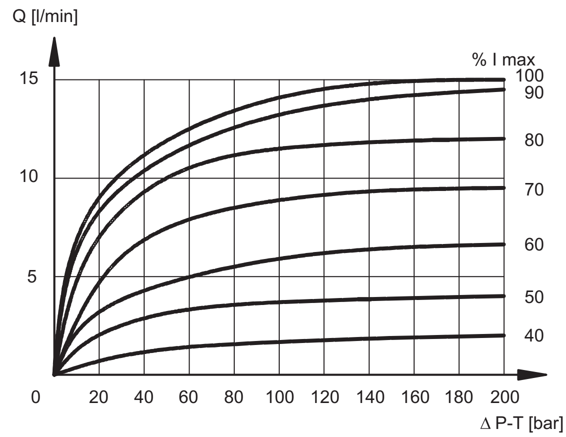
SPOOL TYPE C26



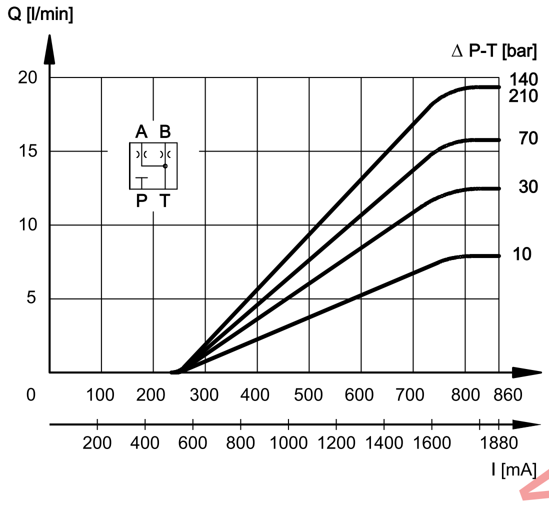


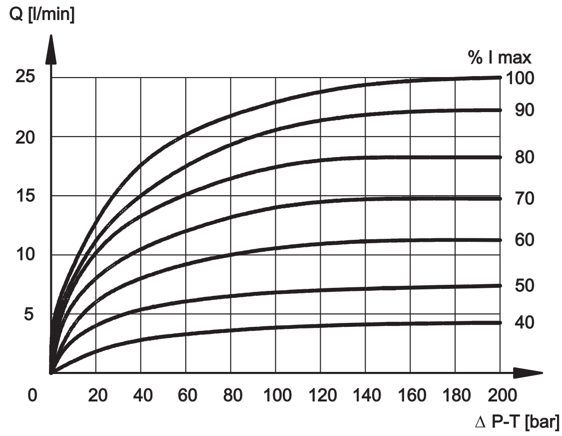
SPOOL TYPE A04



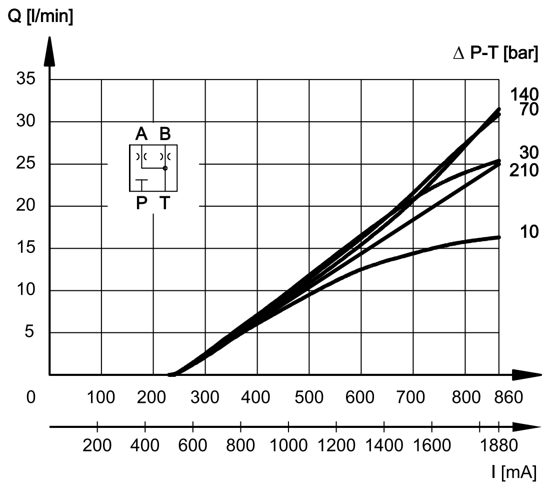


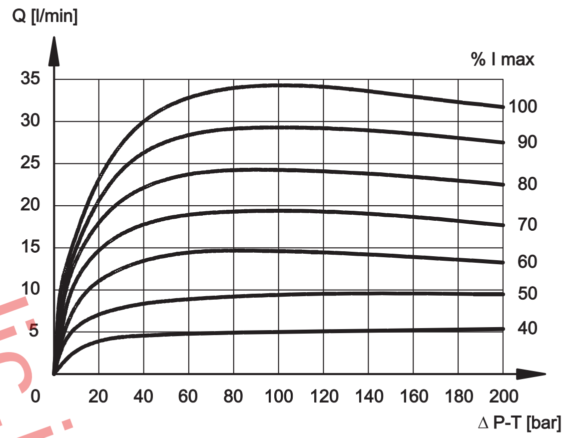
SPOOL TYPE A08



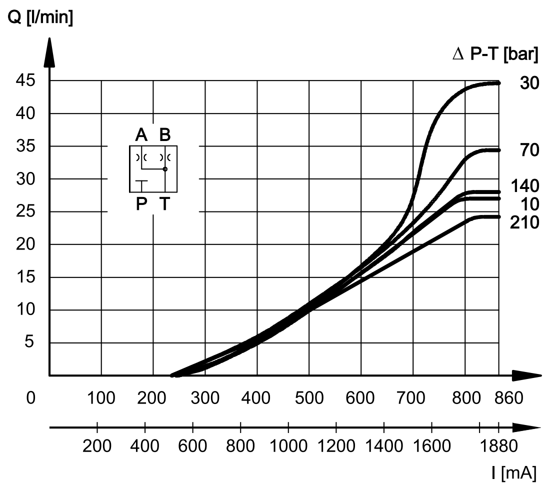


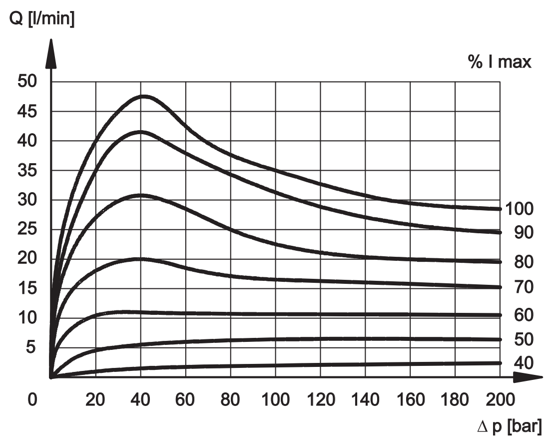
SPOOL TYPE A16





SPOOL TYPE A26

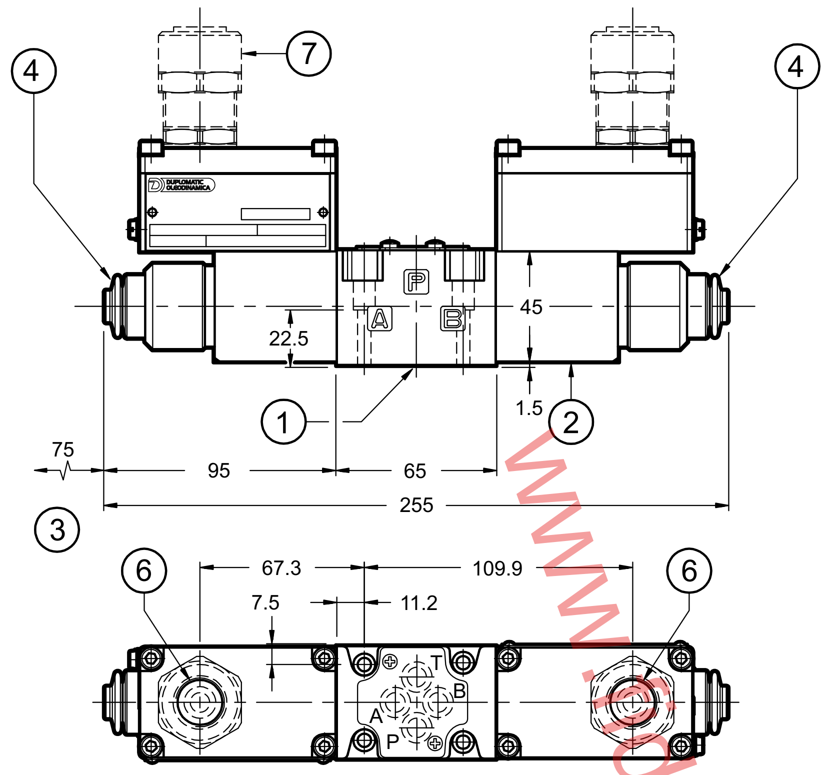


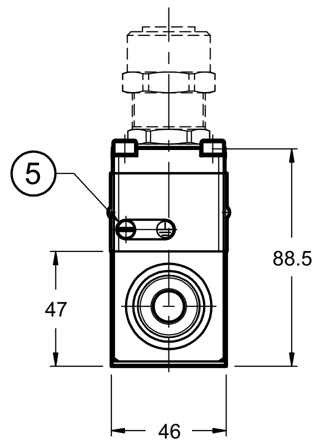


3 - DSE3K* OVERALL AND MOUNTING DIMENSIONS

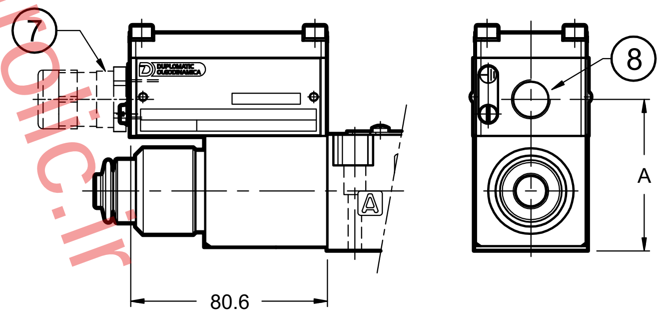
DSE3K*-A*/10*-*K9T*/CM
DSE3K*-C*/10*-*K9T*/CM

dimensions in mm

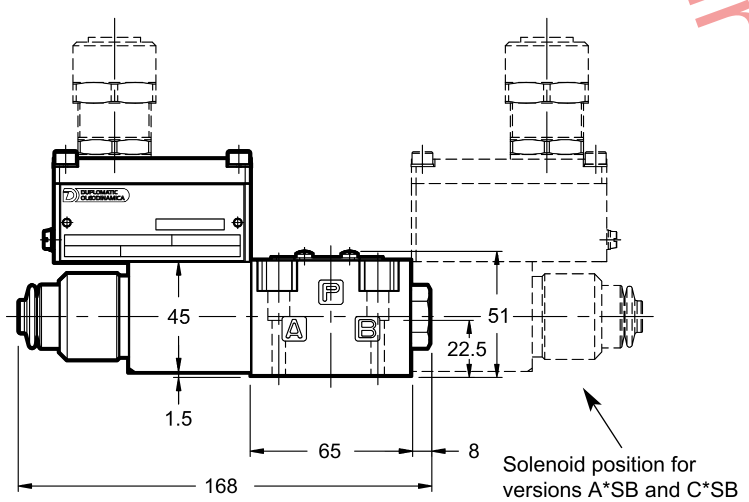




DSE3K*-*/10*-*K9S*/CM



DSE3K*-A*SA/10*-*K9T*/CM
DSE3K*-C*SA/10*-*K9T*/CM



Solenoid position for versions A*SB and C*SB

Side port type	Dimension A
S01, S04	60.5
S02, S03	60

1	Mounting surface with sealing rings: 4 OR type 2037 (9.25x1.78) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected (**standard for both N and V seals**) for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see par. 19
8	Side port for cable gland

Valve fastening: 4 SHC screws ISO 4762 M5x30
Tightening torque: 5 Nm (A8.8 screws)
Threads of mounting holes: M5x10

4 - IDENTIFICATION OF PILOT OPERATED SOLENOID VALVES DSPE*K*

4.1 - Identification code

D	S	P	E			-				/	10		-			/		K9		/			

Pilot operated directional valve

Electric proportional control

Size:
5 = CETOP P05
5R = ISO 4401-05
7 = ISO 4401-07
8 = ISO 4401-08
10 = ISO 4401-10

Explosion-proof certification:
See table 1.2

Spool type:
C = closed centres
A = open centres
RC = regenerative closed centres
RA = regenerative open centres

Spool nominal flow rate (see table par. 4.2)

Configurations for single solenoid version (omit for double solenoid version):
SA = 1 solenoid for cross configuration
SB = 1 solenoid for parallel configuration

Series No.: (the overall and mounting dimensions remain unchanged from 10 to 19)

Seals:
For temperature range -20 / +80 °C
N = NBR seals for mineral oil (standard)
V = FPM seals for special fluids
For temperature range -40 / +80 °C
NL = seal for low temperatures (for mineral oil)

Piloting:
I = internal
E = external
Z = internal piloting with 30 bar fixed adjustment pressure reducing valve

Drainage:
I = internal
E = external

Nominal solenoid voltage:
D12 = 12V DC
D24 = 24V DC

Coil electrical connection: by terminal block

Connection type for cable gland
upper connection:
T01 = M20x1.5 - ISO 261
T02 = Gk 1/2 - UNI EN 10226-2
not available for INMETRO
T03 = 1/2" NPT - ANSI B1.20.1
(ex ANSI B2.1)
side connection:
S01 = M20x1.5 - ISO 261
S02 = Gk 1/2 - UNI EN 10226-2
not available for INMETRO
S03 = 1/2" NPT - ANSI B1.20.1
(ex ANSI B2.1)
S04 = M16x1.5 - ISO 261

Manual override:
CM = boot protected
standard for both N and V seals
not available for NL seals
CB = blind ring nut
standard for NL seals
available upon request for both N and V seals
see dimensions at paragraph 18

Option: **/T5**
version in T5 temperature class.
Omit if not required.

Option: surface treatment not standard.
Omit if not required
(see **NOTE**)

NOTE: the valves are supplied with standard surface treatment of phosphating black for the main body and zinc-nickel for the pilot body. Upon request we can supply these valves with full zinc-nickel surface treatment, suitable to ensure a salt spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

For full zinc-nickel surface treatment add **/W7** at the end of the identification code.

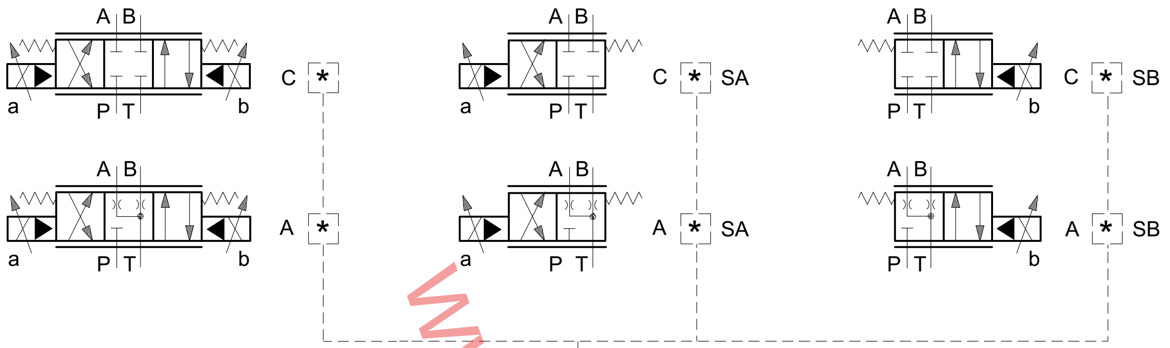
4.2 - Configurations

The valve configuration depends on the combination of the following elements: number of proportional solenoids, spool type, rated flow.

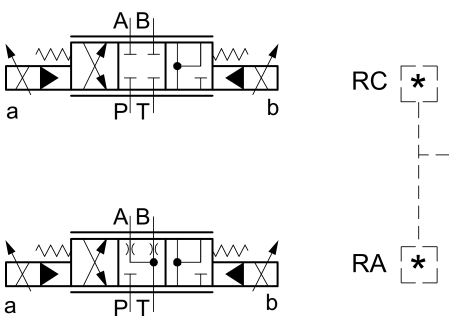
Configuration 2 solenoids:
3 positions with spring centering

1 solenoid for cross configuration “**SA**”:
2 positions (central + external)
with spring centering

1 solenoid for parallel configuration “**SB**”:
2 positions (central + external)
with spring centering



valve type	*	nominal flow rate with Δp 10 bar P-T
DSPE5K* DSPE5RK*	**80**	80 l/min
	80/40	80 (P-A) / 40 (B-T) l/min
DSPE7K*	**100**	100 l/min
	150	150 l/min
	150/75	150 (P-A) / 75 (B-T) l/min
DSPE8K*	**200**	200 l/min
	300	300 l/min
	300/150	300 (P-A) / 150 (B-T) l/min
DSPE10K*	**350**	350 l/min
	500	500 l/min
	500/250	500 (P-A) / 250 (B-T) l/min



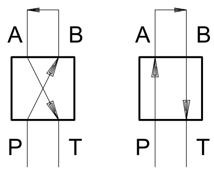
valve type	*	nominal flow rate with Δp 10 bar P-T
DSPE7K*	**150/75**	150 (P-A) / 75 (B-T) l/min
DSPE8K*	**300/150**	300 (P-A) / 150 (B-T) l/min
DSPE10K*	**500/250**	500 (P-A) / 250 (B-T) l/min

5 - CHARACTERISTIC CURVES OF PILOT OPERATED SOLENOID VALVES DSPE*K*

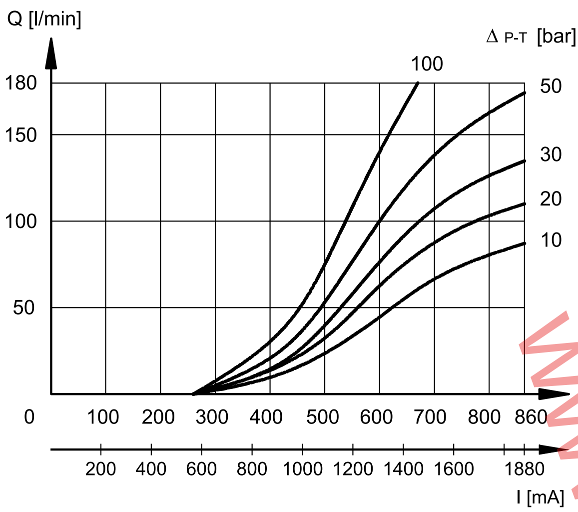
(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Typical flow rate control curves at constant Δp according to current supply to the solenoid, measured for the available spool types.

The reference Δp values are measured between valve ports P and T.

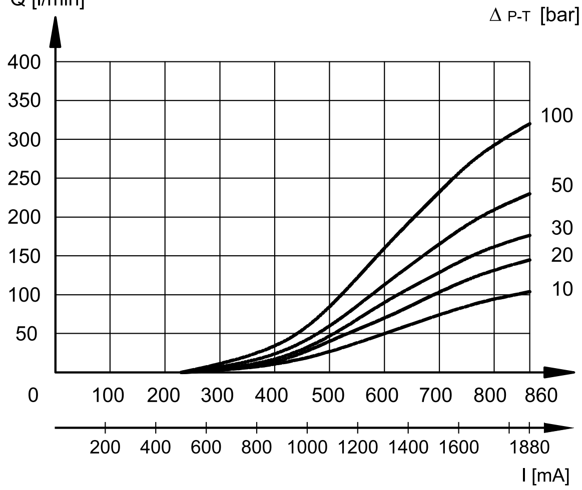


5.1 - Characteristic curves DSPE5K* and DSPE5RK

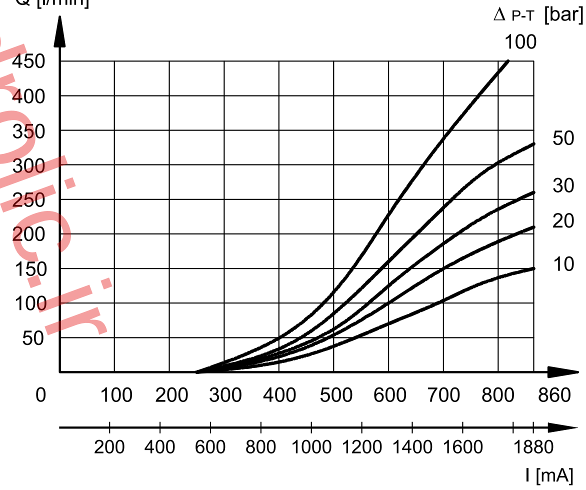


5.2 - Characteristic curves DSPE7K*

SPOOL C100 - A100

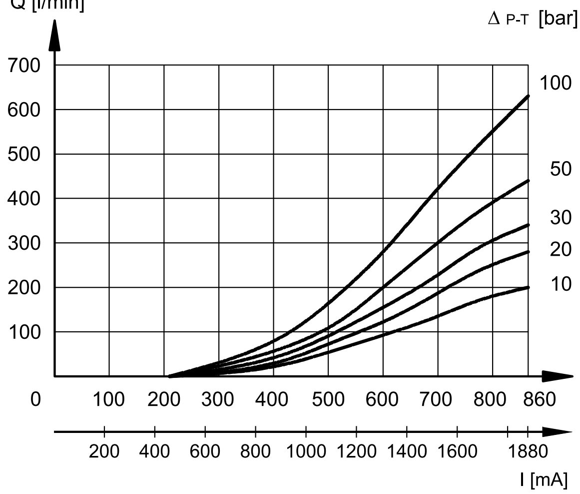


SPOOL C150 - A150

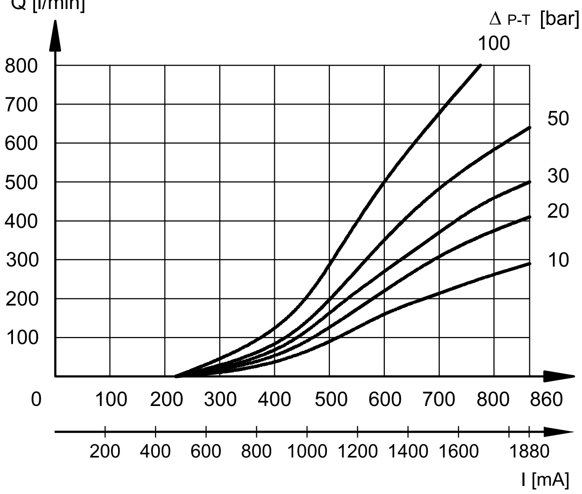


5.3 - Characteristic curves DSPE8K*

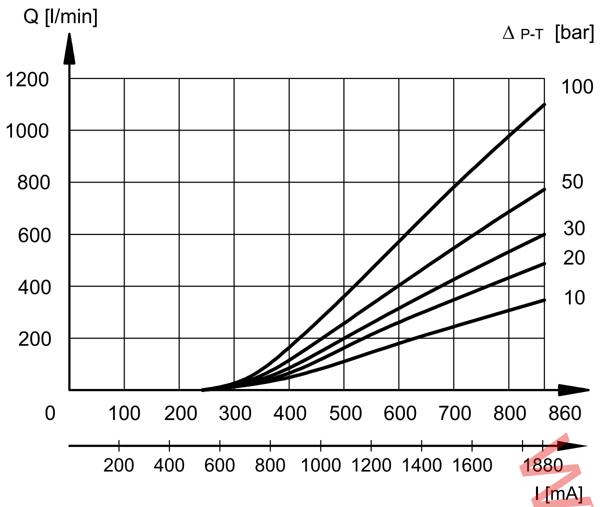
SPOOL C200 - A200

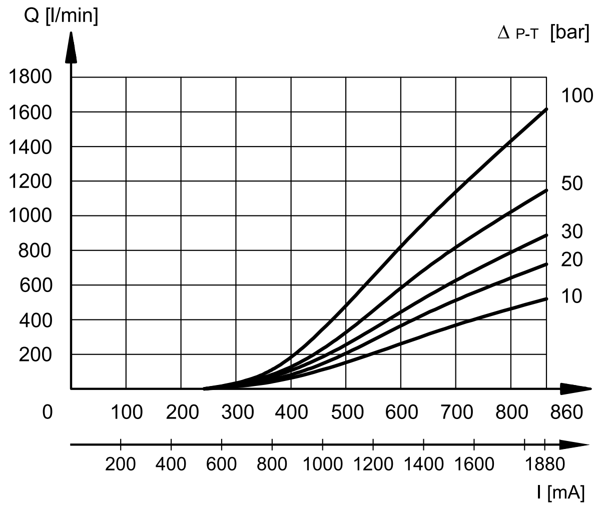


SPOOL C300 - A300



5.4 - Characteristic curves DSPE10K*





6 - STEP RESPONSE

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

Step response is the time taken for the valve to reach 90% of the set pressure value following a step change of reference signal.

The table shows the typical step response tested with static pressure 100 bar.

REFERENCE SIGNAL	0 → 100%	100 → 0%
	Step response [ms]	
DSE3K*	50	40
DSPE5K* and DSPE5RK*	50	40
DSPE7K*	80	50
DSPE8K*	100	70
DSPE10K*	200	120

7 - HYDRAULICS CHARACTERISTICS

(obtained with mineral oil with viscosity of 36 cSt at 50°C and electronic control card)

FLOWS		DSPE5K* DSPER5K*	DSPE7K*	DSPE8K*	DSPE10K*
Max flow rate	l/min	180	450	800	1600
Piloting flow requested with operation 0 →100%	l/min	3	5	9	13
Piloting volume requested with operation 0 →100%	cm^3	1,7	3,2	9,1	21,6

PRESSURES	MIN	MAX
Piloting pressure on X port	30	210 (**NOTE**)
Pressure on T port with interal drain	–	10
Pressure on T port with external drain	–	250

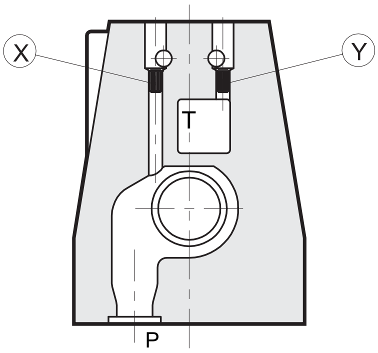
NOTE: if the valve operates with higher pressures it is necessary to use the version with external pilot and reduced pressure. Otherwise, the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered.

Add the letter **Z** to the identification code to order this option (see par. 4.1). Consider that, by adding the pressure reducing valve, the overall dimensions increase 40 mm in height.

8 - PILOTING AND DRAINAGE

DSPE*K* valves are available with piloting and drainage, both internal and external. The version with external drainage allows for a higher back pressure on the outlet.

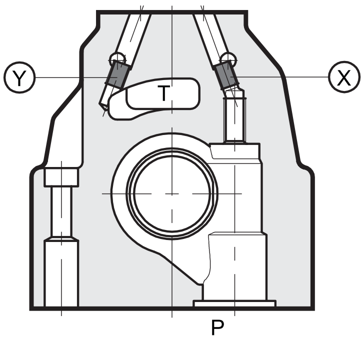
DSPE5K*
DSPE5RK*



X: plug M5x6 for external pilot
Y: plug M5x6 for external drain

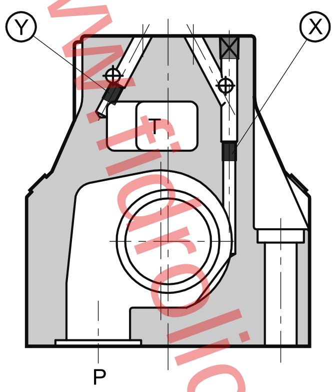
TYPE OF VALVE		Plug assembly X	Plug assembly Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

DSPE7K*



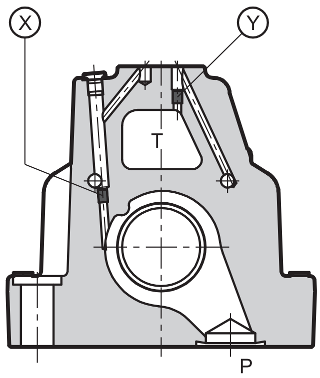
X: plug M6x8 for external pilot
Y: plug M6x8 for external drain

DSPE8K*



X: plug M6x8 for external pilot
Y: plug M6x8 for external drain

DSPE10K*



X: plug M6x8 for external pilot
Y: plug M6x8 for external drain

9 - ELECTRICAL CHARACTERISTICS

(values ± 5%)

NOMINAL VOLTAGE	V DC	**12**	**24**
RESISTANCE (AT 20°C)	Ω	3,4	15,6
NOMINAL CURRENT	A	1,88	0,86

DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2014/30/EU
CLASS OF PROTECTION: Atmospheric agents Coil insulation (VDE 0580)	 IP66 / IP68 class H

9.1 - Wiring

In order to realise the electrical connection of the coil, it is necessary to access the terminal block (1) unscrewing the 4 screws (2) that fasten the cover (3) with the box (4) that contains the terminal block.

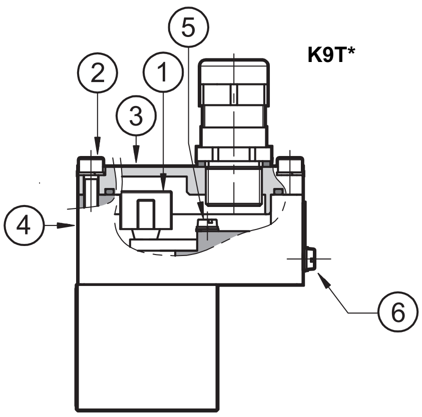
The electrical connection is polarity-independent.

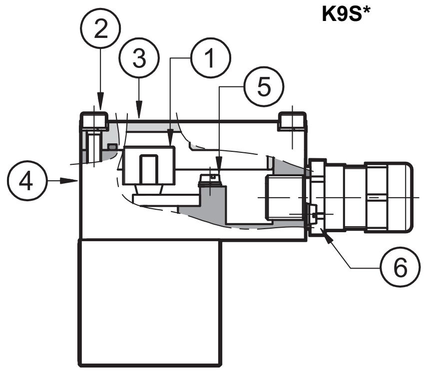
By doing electrical connection it is important to connect also the grounding point (5) in the terminal block box (M4 screws), through suitable conductors with the general grounding line of the system.

On the external body of the coil there is a grounding point (6) (M4 screw) that allow to ensure equipotentiality between the valve and the general grounding line of the system; connecting this point the regulation of the EN 13463-1 standard, that impose to verify the equipotentiality of the elements included in a potentially explosive environment (the maximum resistance between the elements must be 100 Ω), is guaranteed.

At the end of the electrical wiring, it is necessary to reassemble the cover (3) on the box (4), checking the correct positioning of the seal located in the cover seat and fastening the 4 M5 screws with a torque of 4.9÷6 Nm.

Electrical wiring must be done following in compliance with standards about protection against explosion hazards





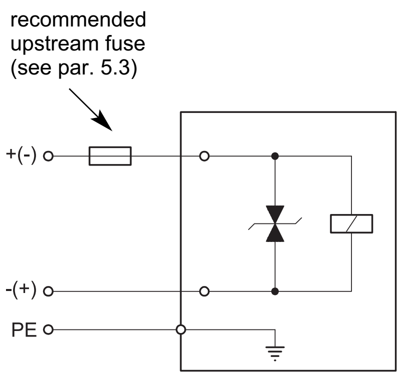
Characteristics of the cables connectable for wiring are indicated in the table below:

Function	Cable section
Operating voltage cables connection	max 2.5 mm²
Connection for internal grounding point	max 2.5 mm²
Connection for external equipotential grounding point	max 6 mm²

Cables for wiring must be non-armoured cables, with external covering sheath and must be suitable for use in environments with temperatures from - 20 °C to +110 °C (for valves either with N or V seals) or from - 40 °C to +110 °C (for valves with NL seals).

Cable glands (which must be ordered separately, see paragraph 19) allow to use cables with external diameter between 8 and 10 mm.

9.2 - Electrical diagrams



9.3 - Overcurrent fuse and switch-off voltage peak

Upstream of each valve, an appropriate fuse (max 3 x In according to IEC 60127) or a protective motor switch with short-circuit and thermal instantaneous tripping, as short-circuit protection, must be connected. The cut-off power of the fuse must correspond or exceed the short circuit current of the supply source. The fuse or the protective motor must be placed outside the dangerous area or they must be protected with an explosion-proof covering.

In order to safeguard the electronic device to which the valve is connected, there is a protection circuit in the coil, that reduces voltage peaks, which can occur when inductances are switched off.

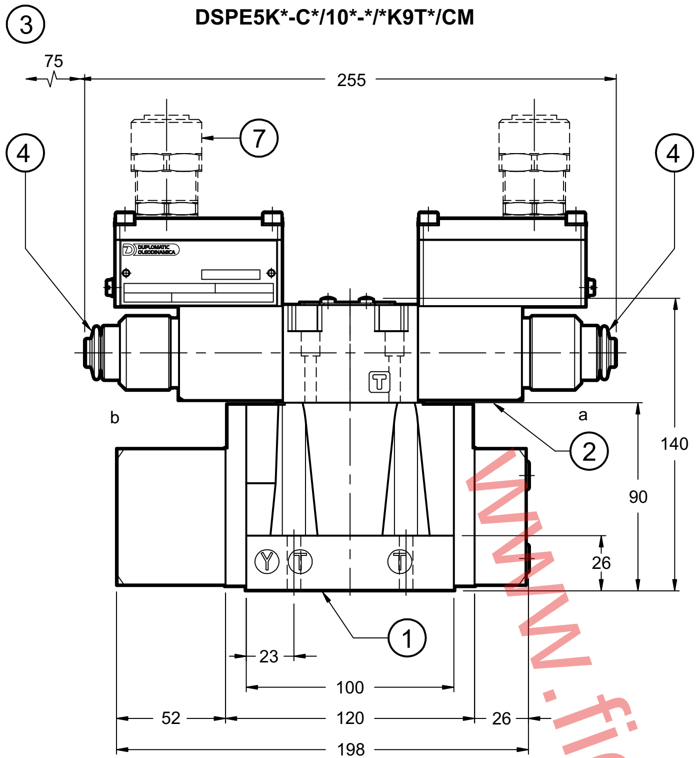
The table shows the type of fuse recommended according to the nominal voltage of the valve and to the value of the voltage peaks reduction.

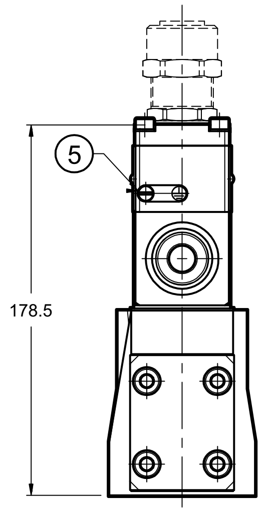
Coil type	Nominal voltage [V]	Rated current [A]	**Recommended pre-fuse characteristics medium time-lag according to DIN 41571 [A]**	Maximum voltage value upon switch off [V]	Suppressor circuit
D12	12	1,88	2,5	- 49	Transient voltage suppressor bidirectional
D24	24	0,86	1,25	- 49	

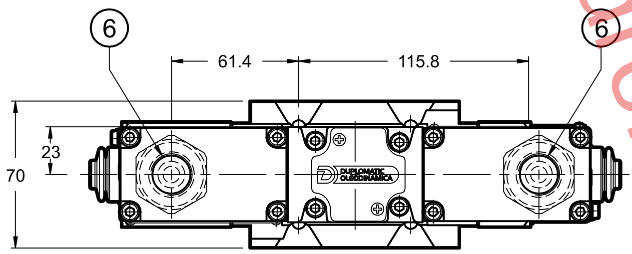
10 - DSPE5K* AND DSPE5RK* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

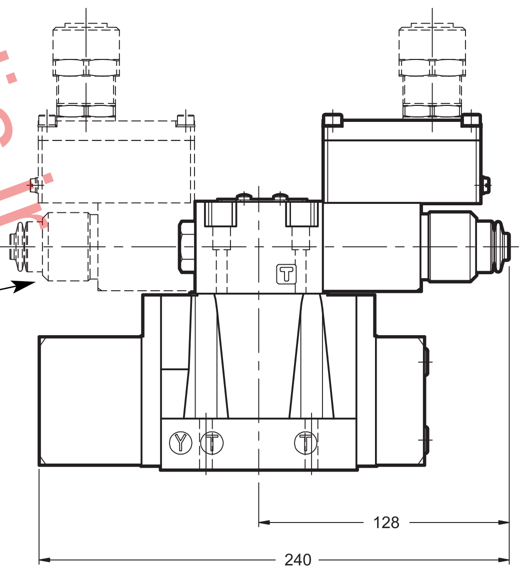
DSPE5K*-A*/10*-*/*K9T*/CM
DSPE5K*-C*/10*-*/*K9T*/CM







DSPE5K*-A*SA/10*-*/*K9T*/CM
DSPE5K*-C*SA/10*-*/*K9T*/CM



1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore 2 OR type 2037 (9.25x1.78) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected (**standard for both N and V seals**) - for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see paragraph 19

NOTE 1: for overall dimensions with Z option (fixed adjustment pressure reducing valve) consider an increase of 40 mm in height.

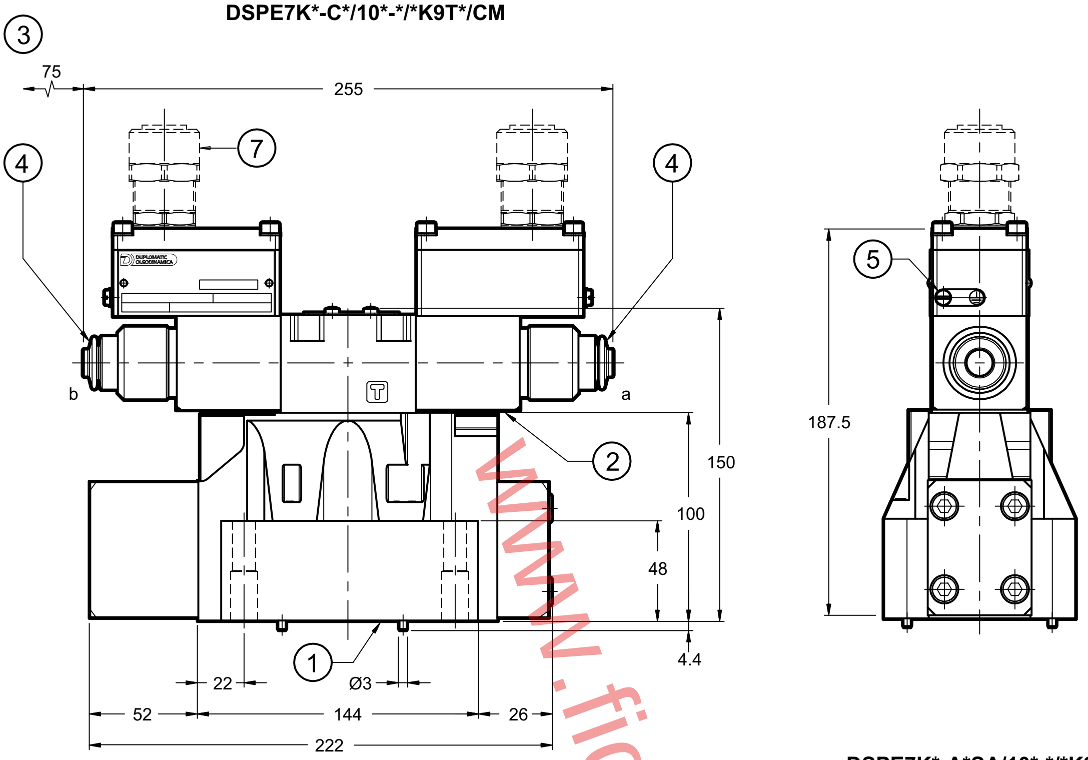
NOTE 2: for side port cable gland see paragraph 14.

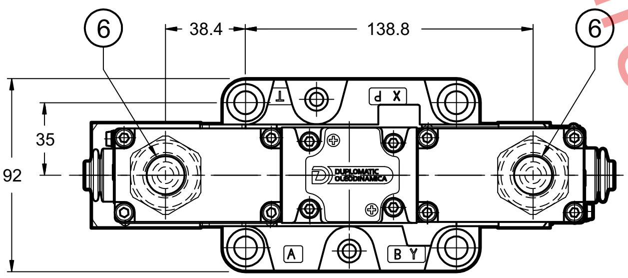
Valve fastening: 4 SHC ISO 4762 screws M6x35
Tightening torque: 8 Nm (A8.8 screws)
Threads of mounting holes: M6x10

11 - DSPE7K* OVERALL AND MOUNTING DIMENSIONS

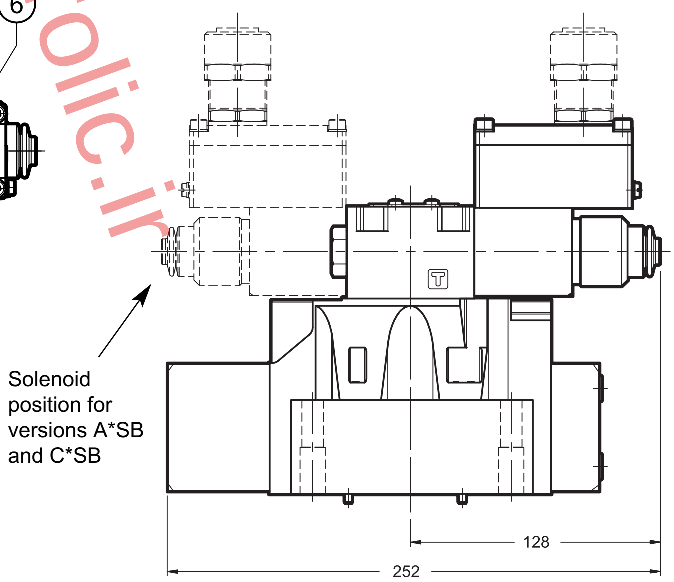
dimensions in mm

DSPE7K*-A*/10*-*/*K9T*/CM
DSPE7K*-C*/10*-*/*K9T*/CM





DSPE7K*-A*SA/10*-*/*K9T*/CM
DSPE7K*-C*SA/10*-*/*K9T*/CM



NOTE 1: for overall dimensions with Z option (fixed adjustment pressure reducing valve) consider an increase of 40 mm in height.

NOTE 2: for side port cable gland see paragraph 14.

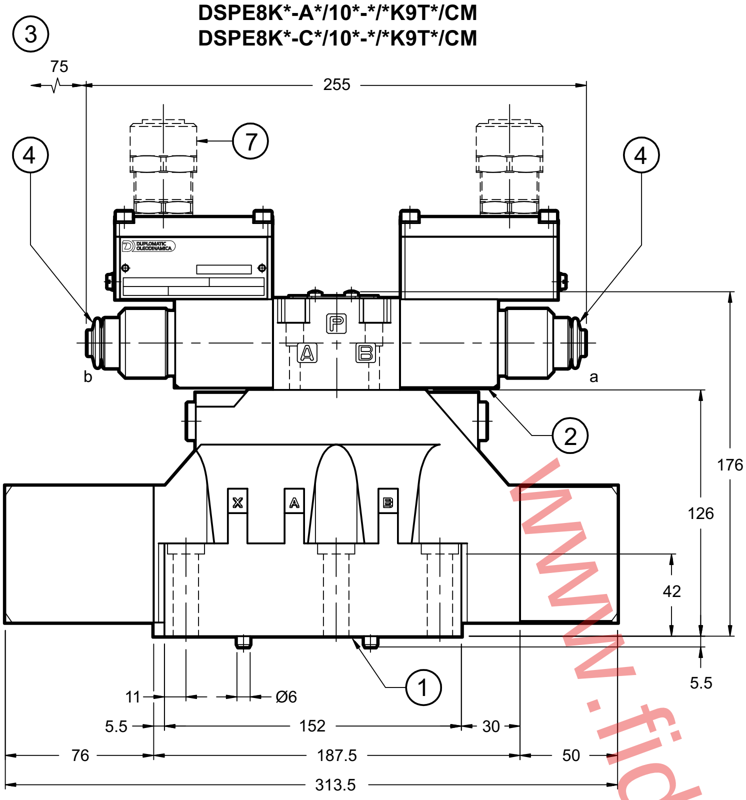
1	Mounting surface with sealing rings: 4 OR type 130 (22.22X2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected (**standard for both N and V seals**) - for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see paragraph 19

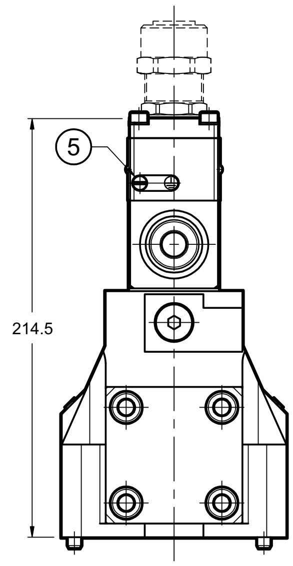
Valve fastening: 4 SHC screws ISO 4762 M10x60 2 SHC screws ISO 4762 M6x60
Tightening torque: M10x60: 40 Nm (A8.8 screws) M6x60: 8 Nm (A8.8 screws)
Threads of mounting holes: M6x18; M10x18

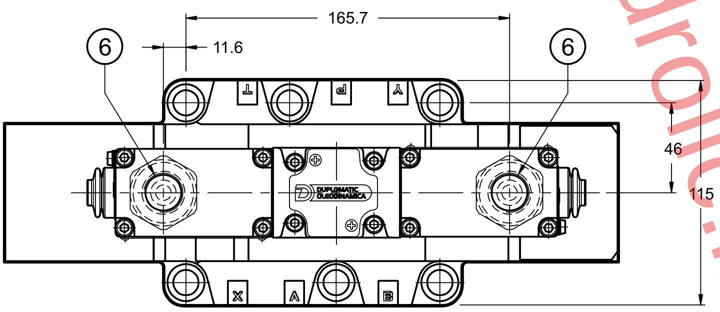
12 - DSPE8K* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

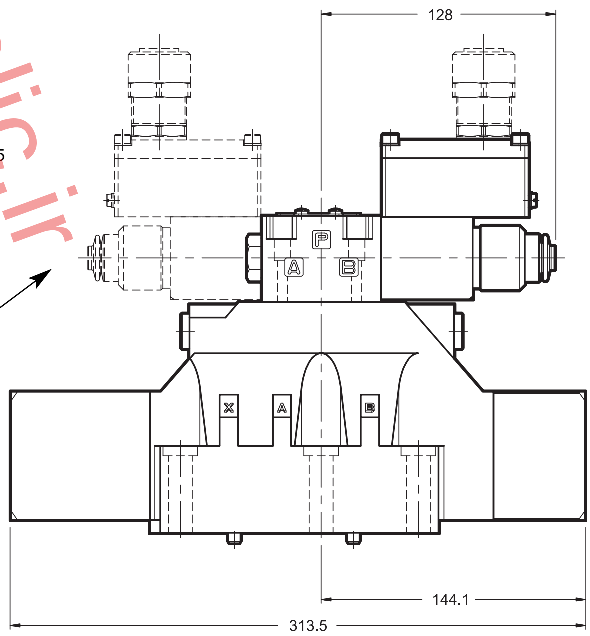
DSPE8K*-A*/10*-*/*K9T*/CM
DSPE8K*-C*/10*-*/*K9T*/CM







DSPE8K*-A*SA/10*-*/*K9T*/CM
DSPE8K*-C*SA/10*-*/*K9T*/CM



Solenoid position for versions A*SB and C*SB

NOTE 1: for overall dimensions with Z option (fixed adjustment pressure reducing valve) consider an increase of 40 mm in height.

NOTE 2: for side port cable gland see paragraph 14.

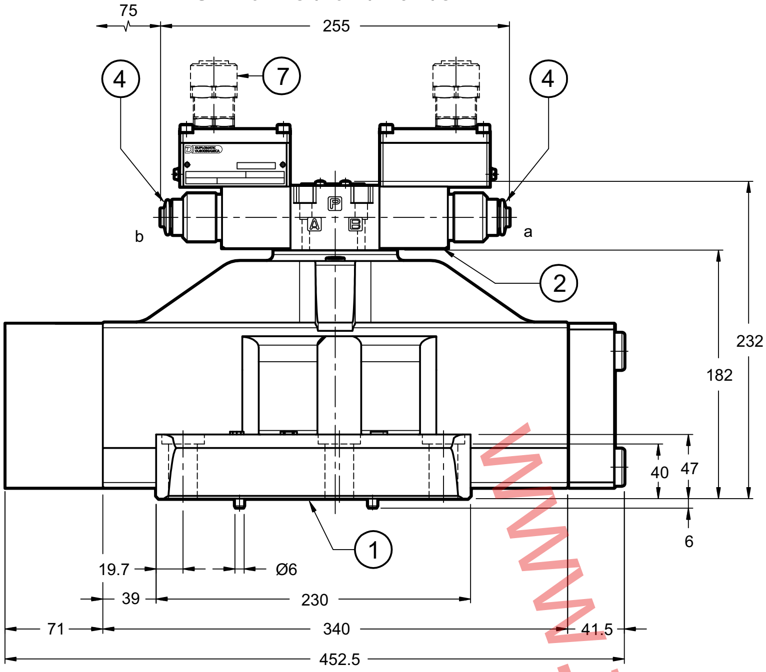
1	Mounting surface with sealing rings: 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected (**standard for both N and V seals**) - for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see paragraph 19

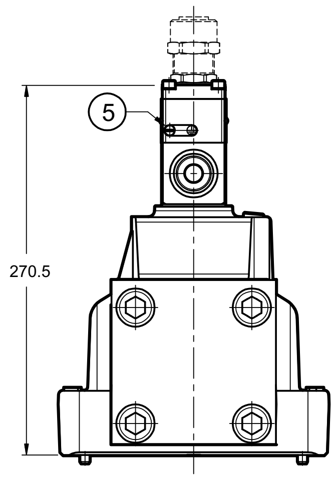
Valve fastening: 6 SHC ISO 4762 screws M12x60
Tightening torque: 69 Nm (A8.8 screws)
Threads of mounting holes: M12x20

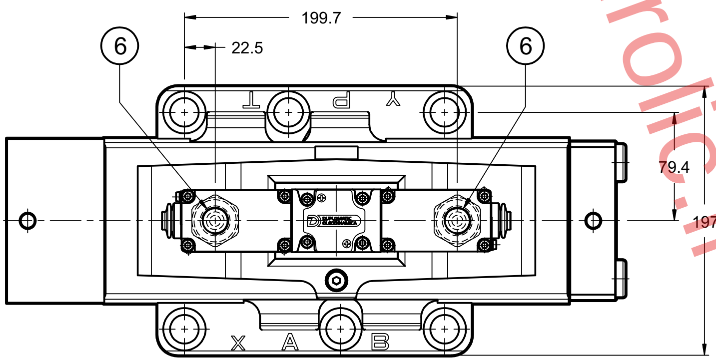
13 - DSPE10K* OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

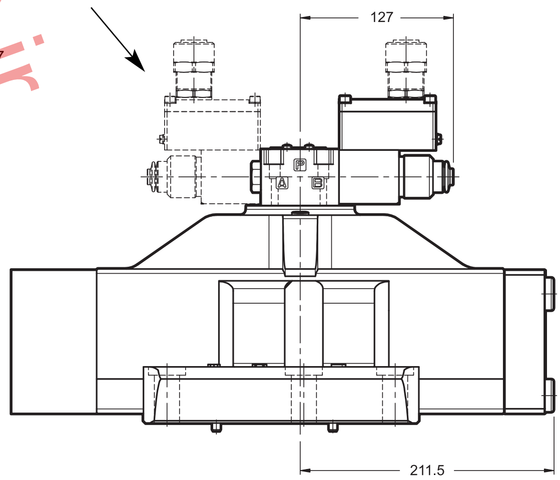
DSPE10K*-A*/10*-*/*K9T*/CM
DSPE10K*-C*/10*-*/*K9T*/CM







DSPE10K*-A*SA/10*-*/*K9T*/CM
DSPE10K*-C*SA/10*-*/*K9T*/CM



1	Mounting surface with sealing rings: 4 OR type 4150 (37.59x3.53) - 90 shore 2 OR type 3081 (20.24x2.62) - 90 shore
2	Explosion-proof coil
3	Minimum clear space required
4	Manual override, boot protected (**standard for both N and V seals**) - for blind ring nut dimensions (standard for NL seals) see par. 18
5	Terminal for supplementary GND connection
6	Upper port for cable gland
7	Cable gland. To be ordered separately, see paragraph 19

NOTE 1: for overall dimensions with Z option (fixed adjustment pressure reducing valve) consider an increase of 40 mm in height.

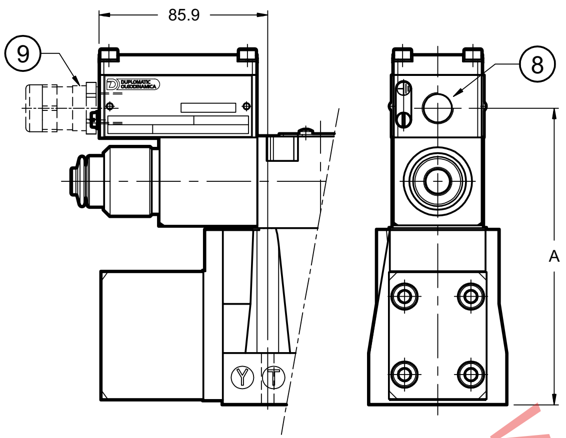
NOTE 2: for side port cable gland see paragraph 14.

Valve fastening: 6 SHC screws ISO 4762 M20x70
Tightening torque: 330 Nm (A8.8 screws)
Threads of mounting holes: M20x40

14 - DSPE*K*-*K9S* (SIDE CONNECTION) OVERALL AND MOUNTING DIMENSIONS

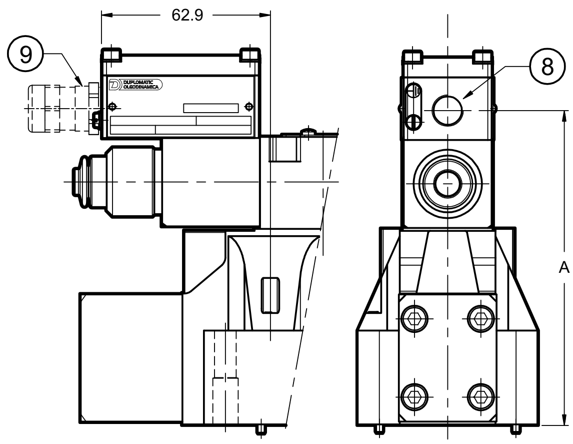
dimensions in mm

DSPE5K*-*K9S*
DSPE5RK*-*K9S*



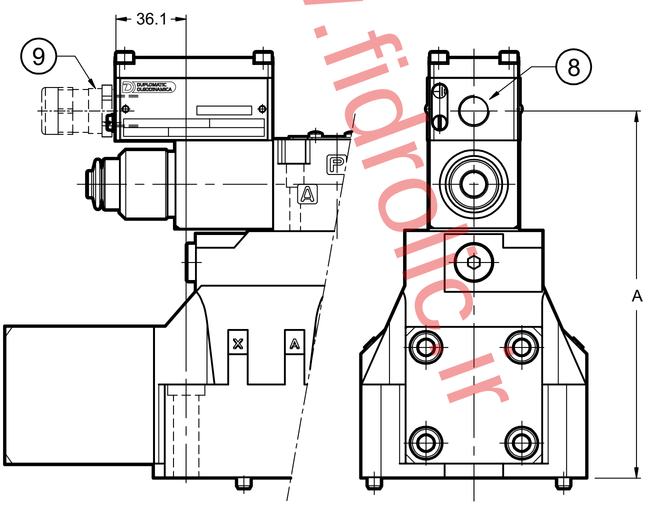
Side port type	Dimension A
S01, S04	150.5
S02, S03	150

DSPE7K*-*K9S*



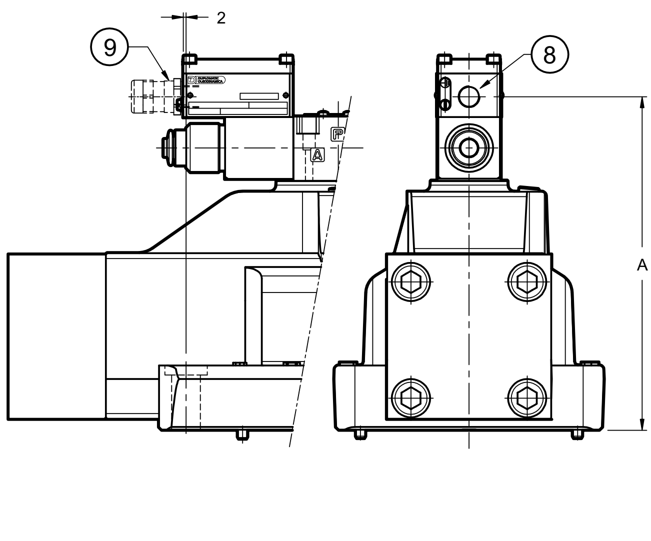
Side port type	Dimension A
S01, S04	157.5
S02, S03	157

DSPE8K*-*K9S*



Side port type	Dimension A
S01, S04	186.5
S02, S03	186

DSPE10K*-*K9S*

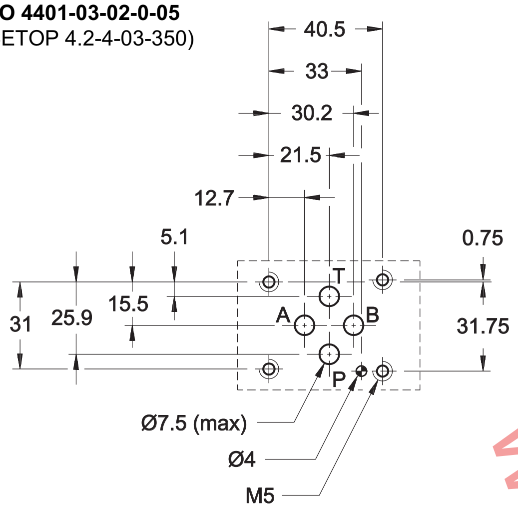


Side port type	Dimension A
S01, S04	242.5
S02, S03	242

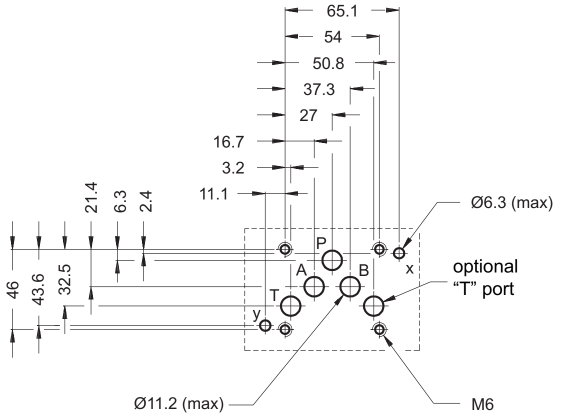
8	Side port for cable gland
9	Cable gland. To be ordered separately, see par. 19

15 - MOUNTING SURFACES

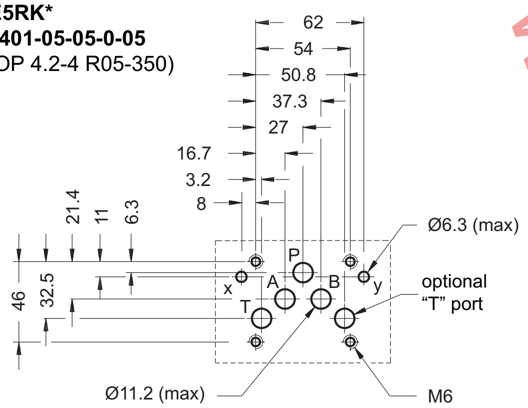
DSE3K*
ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



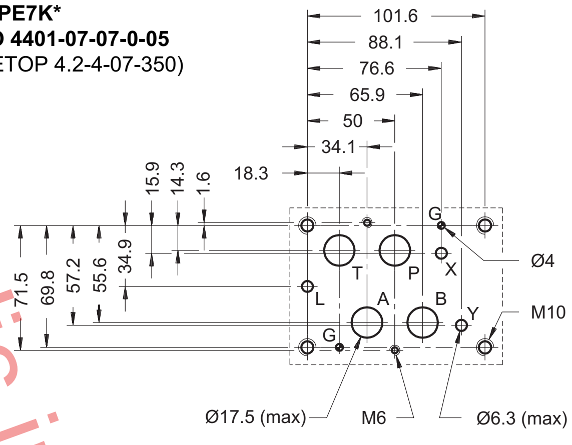
DSPE5K*
CETOP 4.2-4 P05-350



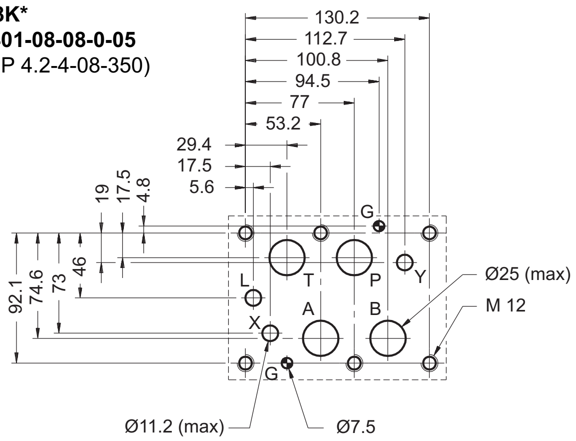
DSPE5RK*
ISO 4401-05-05-0-05
(CETOP 4.2-4 R05-350)



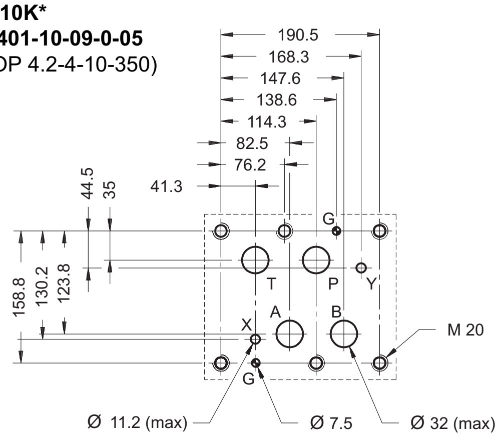
DSPE7K*
ISO 4401-07-07-0-05
(CETOP 4.2-4-07-350)



DSPE8K*
ISO 4401-08-08-0-05
(CETOP 4.2-4-08-350)



DSPE10K*
ISO 4401-10-09-0-05
(CETOP 4.2-4-10-350)



16 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

17 - INSTALLATION

Installation must adheres to instructions reported in the *Use and Maintenance manual*, always attached to the valve. Unauthorized interventions can be harmful to people and goods because of the explosion hazards present in potentially explosive atmospheres.

The valves can be installed in any position without impairing correct operation.

Valve fastening takes place by means of screws or tie rods, laying the valve on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing.

If the minimum values of planarity or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

18 - MANUAL OVERRIDES

18.1 - CB - Blind ring nut

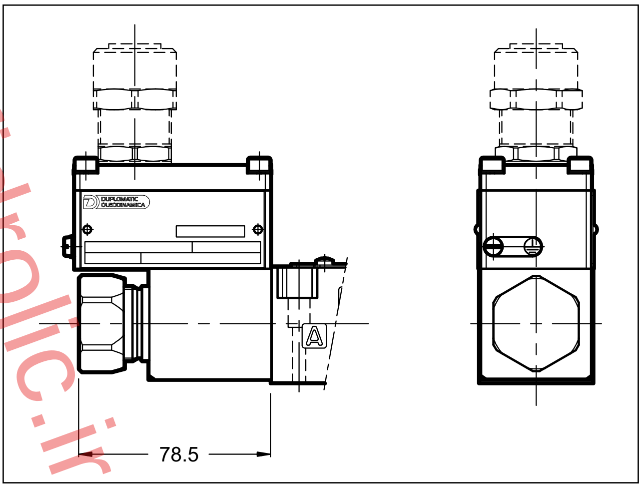
The metal ring nut protects the solenoid tube from atmospheric agents and isolates the manual override from accidental operations. The ring nut is tightened on a threaded fastener that keeps the coil in its position even without the ring nut.

To access the manual override loose the ring nut and remove it; then reassemble hand tightening, until it stops.

Activate the manual override always and only with non-sparking tools suitable for use in potentially explosive atmospheres.

More information on safe use of explosion-proof components are provided in the instruction manual, always supplied with the valve.

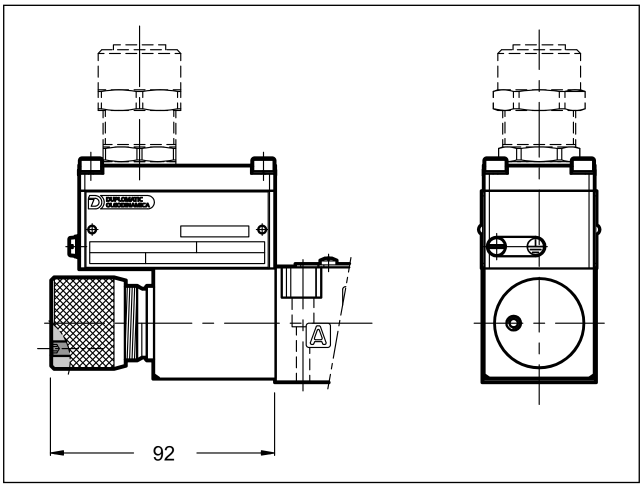
CAUTION!: The manual override doesn't allow any proportional regulation; indeed using this kind of override, the main stage spool will open completely and the whole inlet pressure will pass through A or B line.



18.2 - CK Knob manual override

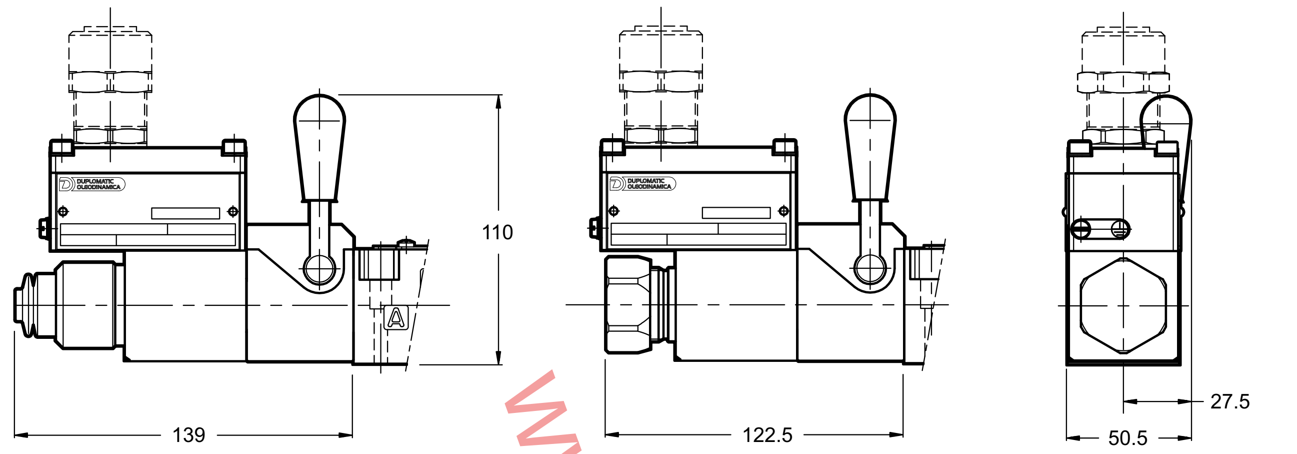
When the set screw is screwed and its point is aligned with the edge of the knob, tighten the knob till it touches the spool: in this position the override is not engaged and the valve is de-energized. After adjusting the override, tighten the set screw in order to avoid the knob loosing. Available for DC valves only.

Spanner: 3 mm



18.3 - CH - Lever manual override

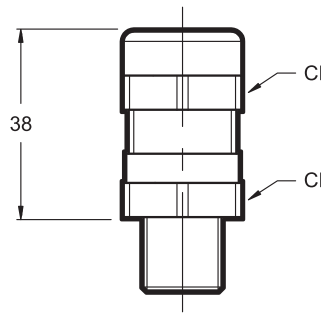
The seals choice leads the type of the standard ring nut to be mounted. The lever device is always placed at valve side A.



19 - CABLE GLANDS

Cable glands must be ordered separately; Duplomatic offers some types of cable glands with the following features:

- version for non-armoured cable, external seal on the cable (suitable for Ø8÷10 mm cables);
- ATEX II 2GD, I M2; IECEx Gb, Db, Mb; INMETRO Gb, Db, Mb certified
- cable gland material: nickel brass
- rubber tip material: silicone
- ambient temperature range: -70 °C ÷ +220 °C
- protection degree: IP66/IP68
- Tightening torque: 15 Nm



To order, list the description and the code of the version chosen from among those listed below:

Description: CGK2/NB-01/10

Code: 3908108001

M20x1.5 - ISO 261 male thread, suitable for coils with T01 and S01 connections. It is supplied equipped with silicone seal, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

Description: CGK2/NB-02/10

Code: 3908108002

Gk 1/2 - UNI EN 10226-2 male thread, suitable for coils with T02 and S02 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Description: CGK2/NB-03/10

Code: 3908108003

1/2” NPT - ANSI B1.20.1 (ex ANSI B2.1), suitable for coils with T03 and S03 connections. The customer must apply LOCTITE® 243™ threadlocker or similar between the cable gland connection thread and the coil in order to ensure IP66/IP68 protection degree.

Description: CGK2/NB-04/10

Code: 3908108004

M16x1.5 - ISO 261 male thread, suitable for coils with S04 connection. It is supplied equipped with silicone seal, that must be assembled between the cable gland and the coil, so as to ensure IP66/IP68 protection degree.

20 - ELECTRONIC CONTROL UNITS

NOTE: electronic control units offered are not explosion proof certified; therefore, they must be installed outside the classified area.

DSE3K* - * * SA **DSE3K* - * * SB**

EDM-M112	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M142	for solenoid 12V DC		

DSE3K* - A* **DSE3K* - C***

EDM-M212	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M242	for solenoid 12V DC		

DSPE*K* - * * SA **DSPE*K* - * * SB**

EDM-M111	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M141	for solenoid 12V DC		

DSPE*K* - A* **DSPE*K* - C***

EDM-M211	for solenoid 24V DC	DIN EN 50022 rail mounting	see cat. 89 250
EDM-M241	for solenoid 12V DC		

21 - SUBPLATES

(see catalogue 51 000)

	DS3K*	DSP5K*	DSP7K*	DSP8K*
Type with rear ports	PMMD-AI3G	PME4-AI5G	PME07-AI6G	-
Type with side ports	PMMD-AL3G	PME4-AL5G	PME07-AL6G	PME5-AL8G
P, T, A, B ports dimensions X, Y ports dimensions	3/8” BSP -	3/4” BSP 1/4” BSP	1” BSP 1/4” BSP	1 ½” BSP 1/4” BSP

NOTE: Subplates (to be ordered separately) do not contain neither aluminium nor magnesium at a higher rate than the value allowed by norms according to ATEX directive for categories II 2GD and I M2.

The user must take care and make a complete assessment of the ignition risk, that can occur from the relative use in potentially explosive environments.

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EXPLOSION-PROOF CLASSIFICATION for

SOLENOID AND PROPORTIONAL VALVES

ref. catalogues:

pressure valves

RQM*K*-P	21 515
PRE(D)*K*	81 315
ZDE3K*	81 515
DZCE*K*	81 605

directional valves

D*K*	41 515
DS(P)E*K*	83 510

GENERAL INFO

This informative technical datasheet displays information about **classification and marking** of Duplomatic explosion-proof valves range.

Duplomatic offers valves with the following certifications:

ATEX	**II 2G**	**II 2D**	**I M2**
IECEx	**Gb**	**Db**	**Mb**
INMETRO	**Gb**	**Db**	**Mb**

Instructions for use and maintenance can be found in the related manuals, always supplied toghether with valves.

1 - ATEX CLASSIFICATION AND TEMPERATURES

Duplomatic certificates the combination valve-coil for the valves suitable for application and installation in potentially explosive atmospheres, according to ATEX directive; the supply always includes the declaration of conformity to the directive and the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environments.

Coils assembled on these valves have been separately certified according to ATEX directive and so they are suitable for use in potentially explosive atmospheres.

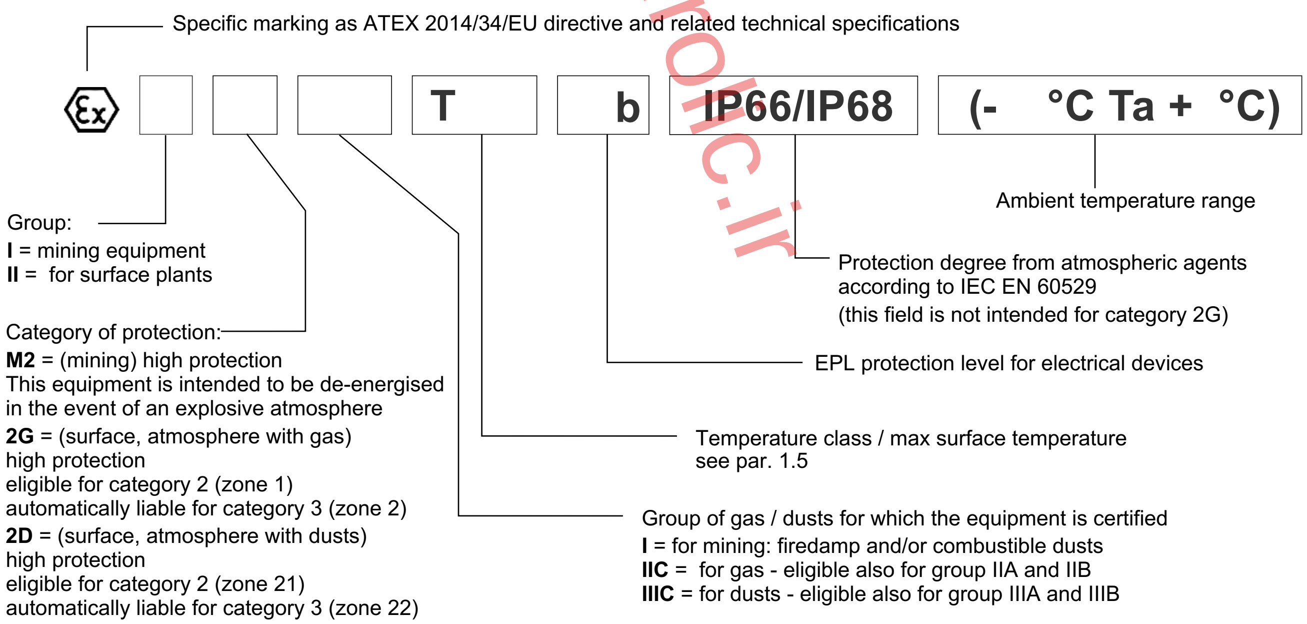
1.1 - ATEX classification for valves

Type examination certificate: CEC 13 ATEX 030-REV.2
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

ATEX II 2G ATEX II 2D	***KD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
ATEX I M2	***KDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

1.2 - ATEX marking for valves

valve code		N and V seals	NL seals
***KD2**	for gas	Ex II 2G IIC T4 Gb (-20°C Ta +80°C)	Ex II 2G IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex II 2D IIIC T154°C Db IP66/IP68 (-20°C Ta +80°C)	Ex II 2D IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
***KD2 /T5**	for gas	Ex II 2G IIC T5 Gb (-20°C Ta +55°C)	Ex II 2G IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex II 2D IIIC T129°C Db IP66/IP68 (-20°C Ta +55°C)	Ex II 2D IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
***KDM2**	mining	Ex I M2 I T150°C Mb IP66/68 (-20°C Ta +75°C)	Ex I M2 I T150°C Mb IP66/68 (-40°C Ta +75°C)



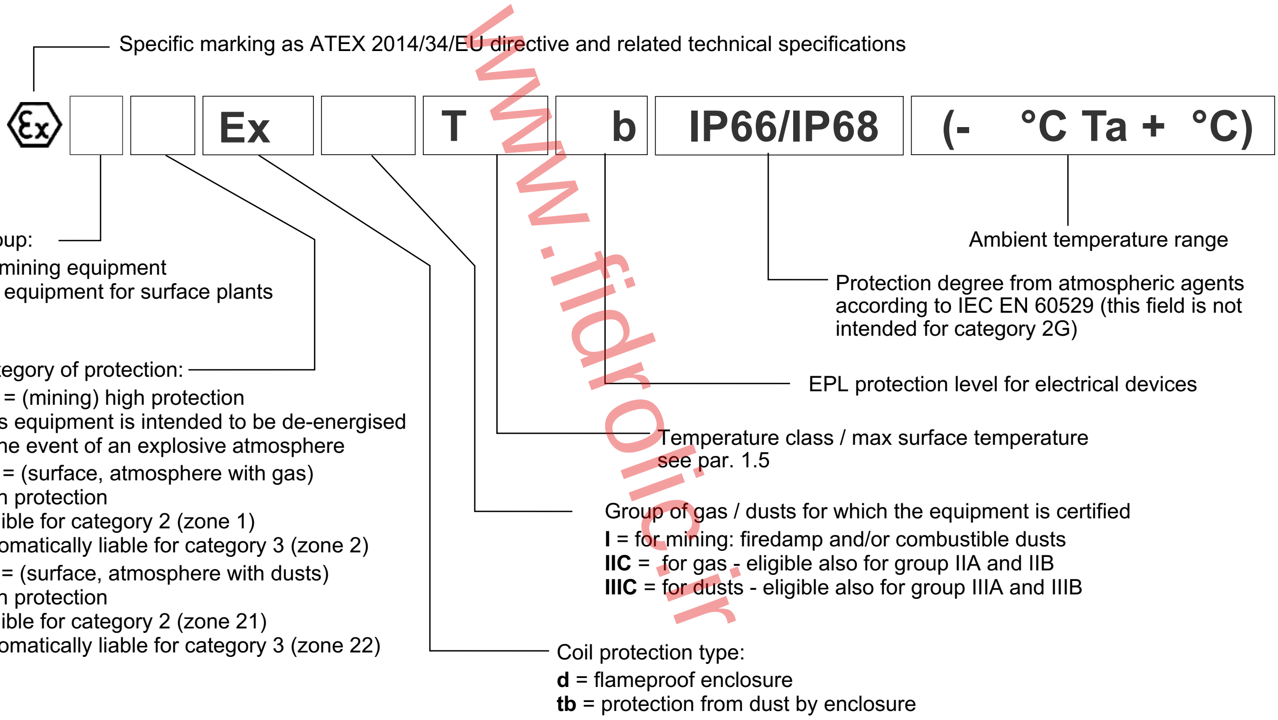
1.3 - ATEX classification of the coils

The coil of the explosion-proof valves is ATEX certified itself an as such is identified with its own tag, carries the relative ATEX marking. **The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex d” type protection (explosion-proof coil).**

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

1.4 - ATEX marking on coils

for valve type ***KD2**	for gas	II 2G Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	II 2D Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
for valve type ***KD2 /T5**	for gas	II 2G Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	II 2D Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
for valve type ***KDM2**	mining	I M2 Ex d I T150°C Mb IP66/IP68 (-40°C Ta +75°C)



1.5 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

The valves in group II can also be used for less limiting temperature classes (surface temperature allowed higher).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
ATEX II 2G ATEX II 2D	***KD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T154°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T129°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
ATEX I M2	***KDM2**	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				

2 - IECEx CLASSIFICATION AND TEMPERATURES

The IECEx certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with IECEx certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex db” type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

2.1 - IECEx classification

Certificate of conformity (CoC): IECEx TUN 15.0028X
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

IECEx Gb IECEx Db	***KXD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
IECEx Mb	***KXDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

2.2 - IECEx marking

There is a plate with the IECEx mark on each coil.

***KXD2** valves	for gas	Ex db IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T135°C Db (-40°C Ta +80°C)
***KXD2 /T5** valves	for gas	Ex db IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T100°C Db (-40°C Ta +55°C)
***KDM2** valves	mining	Ex db I Mb (-40°C Ta +80°C)

Conformity marking to the IECEx certification scheme

Ex [ ] [ ] T [ ] (- °C Ta + °C)

Ambient temperature range

Protection type:
db = flameproof enclosure
tb = protection from dust by enclosure

Group of gas / dusts for which the equipment is certified
I = for mining: firedamp and/or combustible dusts
IIC = for gas - eligible also for group IIA and IIB
IIIC = for dusts - eligible also for group IIIA and IIIB

Temperature class / max surface temperature see par. 2.3

EPL - protection level for electrical devices
Mb = for mines - having a "high" level of protection, which has sufficient security that it is unlikely to become a source of ignition in normal operation or during expected malfunctions in the time span between there being an outbreak of gas and the equipment being de-energized.
Gb = for explosive gas atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions.
Db = equipment for explosive dust atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions

2.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	N and V seals	NL seals	Temperature class	eligible also for
IECEx Gb IECEx Db	***KXD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T135°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KXD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T100°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
IECEx Mb	***KXDM2**	of ambient	-20 / +80 °C	-40 / +80 °C	-	-
		of fluid				

3 - INMETRO CLASSIFICATION AND TEMPERATURES

The INMETRO certification requires the classification of the electrical equipment only.

Duplomatic supplies valves with INMETRO certified coils, suitable for application and installation in potentially explosive atmospheres. The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an “Ex d” type protection (explosion-proof coil).

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

The supply always includes the operating and maintenance manual, that contains all the information needed for a correct use of the valve in potentially explosive environment.

3.1 - INMETRO classification

Certificate of conformity: DNV 15.0094 X
The valves are suitable for applications and installations in potentially explosive atmospheres that fall within:

INMETRO Gb INMETRO Db	***KBD2**	equipment intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally.
INMETRO Mb	***KBDM2**	equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines likely to be endangered by firedamp and/or combustible dust. This equipment is intended to be de-energised in the event of an explosive atmosphere.

3.2 - INMETRO marking

There is a plate with the INMETRO mark on each coil.

***KBD2** valves	for gas	Ex d IIC T4 Gb (-40°C Ta +80°C)
	for dusts	Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)
***KBD2 /T5** valves	for gas	Ex d IIC T5 Gb (-40°C Ta +55°C)
	for dusts	Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)
***KBDM2** valves	mining	Ex d I T150° Mb IP66/IP68 (-40°C Ta +75°C)

Conformity marking to the INMETRO certification scheme

Ambient temperature range

Ex [ ] [ ] **T** [ ] **IP66/IP68** **(- °C Ta + °C)**

Protection degree from atmospheric agents according to IEC EN 60529 (this field is not intended for gases)

Protection type:
d = flameproof enclosure
tb = protection from dust by enclosure

Group of gas / dusts for which the equipment is certified
I = for mining: firedamp and/or combustible dusts
IIC = for gas - eligible also for group IIA and IIB
IIIC = for dusts - eligible also for group IIIA and IIIB

Temperature class / max surface temperature see par. 3.3

EPL - protection level for electrical devices
Mb = for mines - having a "high" level of protection, which has sufficient security that it is unlikely to become a source of ignition in normal operation or during expected malfunctions in the time span between there being an outbreak of gas and the equipment being de-energized.
Gb = for explosive gas atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions.
Db = equipment for explosive dust atmospheres - having a "high" level of protection, which is not a source of ignition in normal operation or during expected malfunctions

3.3 - Operating temperatures

These valves are classified according to their maximum surface temperature (EN 13463-1), which must be lower than the ignition temperature of the gases, vapors and dusts for which the area in which they will be used is classified.

Valves for surface plants can also be used for less limiting temperature classes (higher surface temperature allowed).

		temperature range	**N and V seals**	**NL seals**	Temperature class	eligible also for
INMETRO Gb INMETRO Db	***KBD2**	of ambient	-20 / +80 °C	-40 / +80 °C	T4 (gas) T154°C (dusts)	T3, T2, T1 T200°C and higher
		of fluid				
	***KBD2 /T5**	of ambient	-20 / +55 °C	-40 / +55 °C	T5 (gas) T129°C (dusts)	T4, T3, T2, T1 T135°C and higher
		of fluid	-20 / +60 °C	-40 / +60 °C		
INMETRO Mb	***KBDM2**	of ambient	-20 / +75 °C	-40 / +75 °C	T150°C	-
		of fluid				

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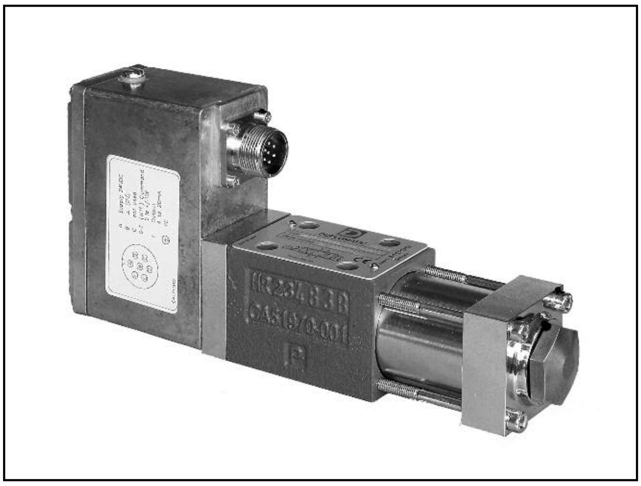
DUPLOMATIC OLEODINAMICA

DXJ3

ELECTRO-HYDRAULIC SERVOVALVE WITH INTEGRATED ELECTRONICS

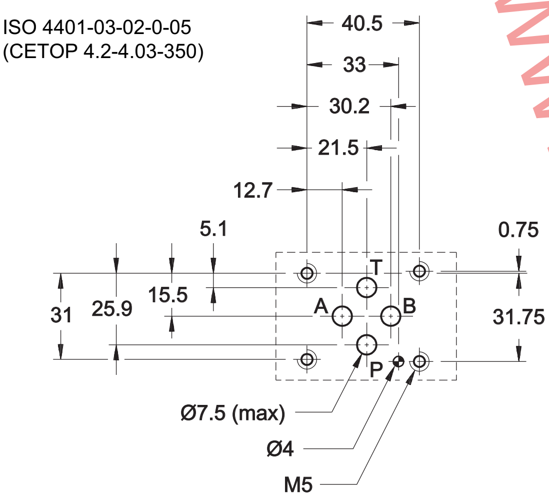
SERIES 10



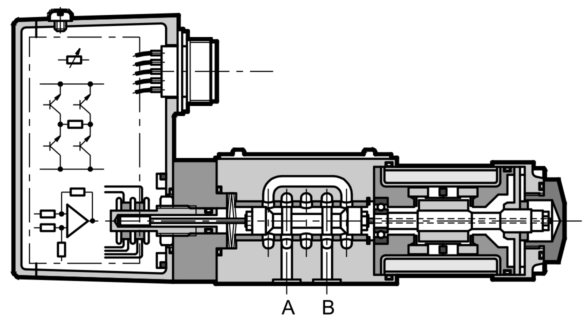
SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

p max **350** bar
Q max (see performances table)

MOUNTING SURFACE



OPERATING PRINCIPLE



— The DXJ3 valve is a four-way servo-proportional valve where the spool moves inside a sleeve. This valve has a direct drive with a linear force motor resulting in high dynamic performances which are independent of system pressure. The spool position is controlled by a linear transducer (LVDT) with closed loop which ensures high precision and repeatability.

— It is available in four different flow rate control ranges up to 40 l/min, with spools with zero overlap and a mounting surface in compliance with ISO 4401 (CETOP RP 121H) standards.

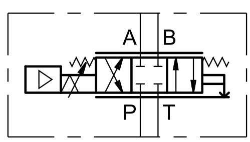
— The valve is featured by integrated electronic based on SMD technology which ensures standard regulations and simplifies the electric wiring. The unit does not require any adjustment other than the possible electronic regulation of the zero.

— Suitable for control applications with closed loop of position, velocity and pressure. With a loss of power or with a zero reference signal, the spool goes automatically at rest-position. In this position the valve has a minimum leakage, depending on the operating pressure (see the performances table).

PERFORMANCES (with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure Ports P - A - B Port T	bar	350 50
Rated flow Q nom (with Δp 70 bar P - T)	l/min	5 - 10 - 20 - 40
Null leakage flow (with p = 140 bar)	l/min	≤ 3% of Q nom
Hysteresis	% In	< 0,2
Threshold	% In	< 0,1
Thermal drift (with ΔT= 50°C)	% In	< 1,5
Response time	ms	≤ 12
Vibration on the three axes	g	30
Electric features	see paragraph 3	
Protection degree according CEI EN 60529	IP 65	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	5 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 17/15/12 (16/14/11 for longer life)	
Recommended viscosity	cSt	25
Mass	kg	2,5

HYDRAULIC SYMBOL



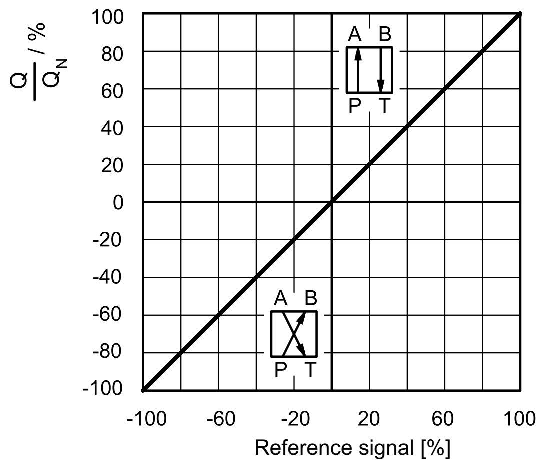
1 - IDENTIFICATION CODE

D	X	J	3	-	D	0	L		/	10		/	E0	K11

- DX: Servo-proportional valve with bushing spool
- J: Integrated electronics and position feedback
- 3: Rated size ISO 4401-03 (CETOP 03)
- D: Symmetric spool
- 0: Spool with zero overlap
- L: Spool with a linear flow rate curve
- Rated flow (with p = 70 bar P - T)
  - **05** = 5 l/min
  - **10** = 10 l/min
  - **20** = 20 l/min
  - **40** = 40 l/min
- 10: Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)
- Seals:
  - **N** = NBR seals for mineral oil (**standard**)
  - **V** = FPM seals for special fluids
- E0: Reference signal: ±10V (other signals available on request)
- K11: 6 + PE pole connector

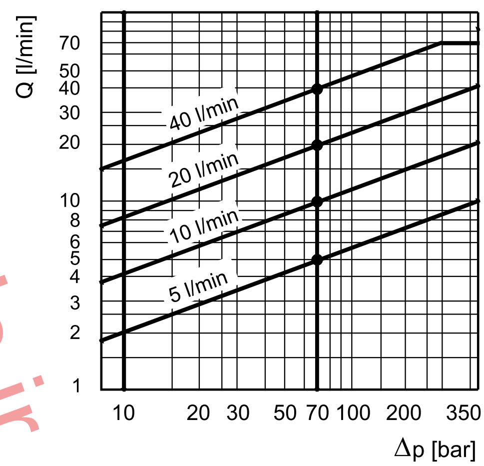
2 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

REFERENCE / FLOW RATE CURVE



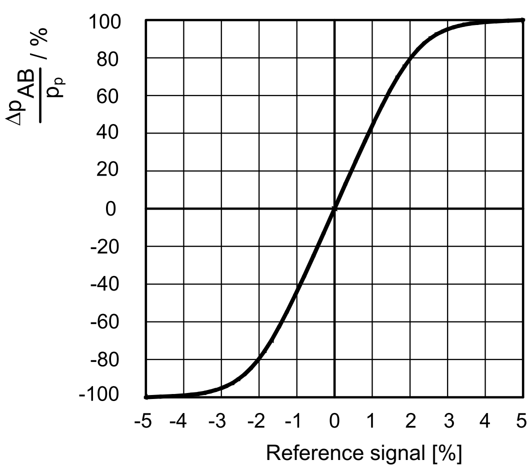
Typical flow rate curves at constant Δp = 70 bar P-T according to the reference signal.
NOTE: with positive reference signal connected to pin D the valve regulates P - A / B - T.

FLOW RATE CURVE ACCORDING TO ΔP



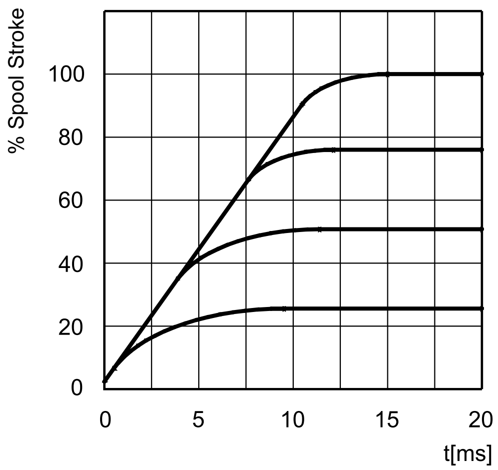
The diagram states the maximum valve controlled flow rate according to the pressure drop between the P and T ports.

PRESSURE GAIN

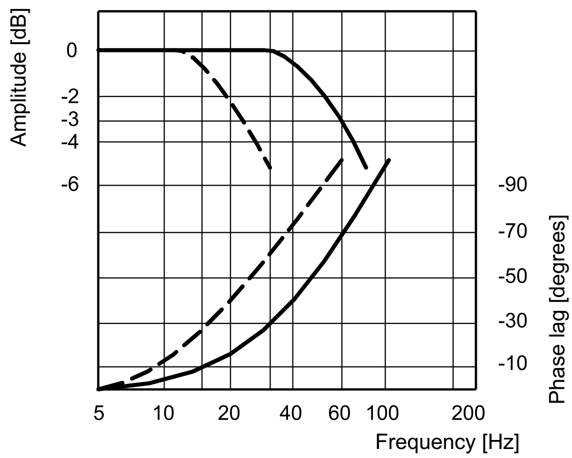


The diagram shows the valve pressure gain, expressed as % of the ratio between the port pressure variation in A or B (Δp AB) and the P system pressure, according to the reference signal. In practice, the pressure gain states the valve reaction towards external disturbances aimed at changing the actuator position.

RESPONSE TIME

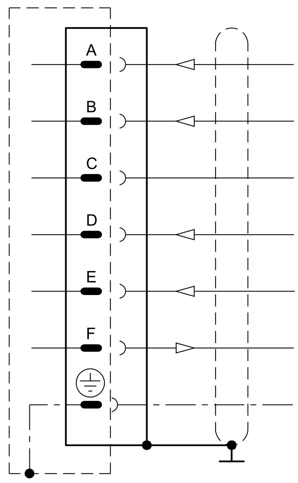


FREQUENCY RESPONSE



3 - ELECTRICAL FEATURES

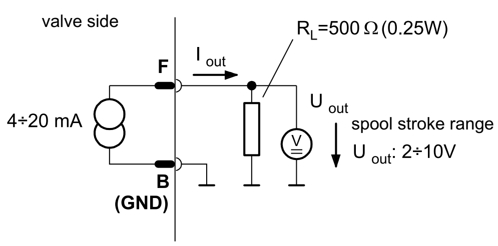
CONNECTION WIRING



Pin	Values	Function	NOTES
A	24 VDC	Supply	From 19 to 32 VDC $I_{A\ MAX}$ = 1,2 A
B	0 V	Signal ground	0 V
C	----	Not used	----
D	± 10 V	Input rated command	R_e = 10 kΩ (see **NOTE 1**)
E	0 V	Input rated command	----
F	4 ÷ 20 mA	Spool position	R_L = from 300 to 500 Ω (see **NOTE 2**)
PE	----	Protective earth	----

NOTE 1: The input stage is a differential amplifier. With positive reference signal connected to pin D, valve opening P - A e B - T is achieved. With a zero reference signal the spool is in centred position. The spool stroke is proportional to U_D - U_E. If only one command signal is available (single-end), pin E must be connected to pin B (0V ground).

NOTE 2: The spool position value can be measured at pin F (see diagram right). The position signal output goes from 4 to 20 mA. The centered position is at 12 mA, while 20 mA corresponds to 100% valve opening P - A and B - T. This monitoring allows to detect a cable break when I_F = 0V.



General requirements:

- External fuse = 1,6 A
- Minimum cross-section of all leads ≈0,75 mm²
- When making electric connections to the valve (shield, protective earth) appropriate measures must be taken to ensure that locally different earth potentials do not results in excessive ground currents.
- The differential and the spool position signal lines must be connected to the mating connector housing at valve side and to the 0V (signal ground) at cabinet side.
- **EMC**: meets the requirements of EN 55011:1998, class B, and the immunity regulation according to EN 61000-6-2:1998

4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

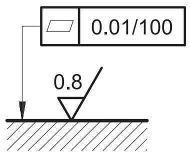
The fluid must be preserved in its physical and chemical characteristics.

5 - INSTALLATION

The DXJ3 valve can be installed in any position without impairing its correct operation.

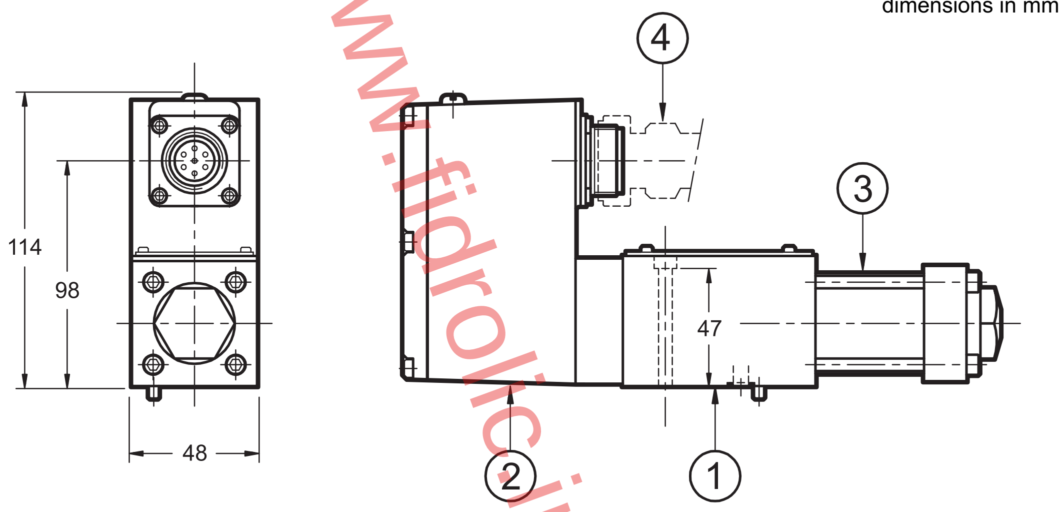
The valve is fixed by means of screws on a flat surface with planarity between 0,01 mm over 100 mm and roughness R_a <0,8 µm. If the minimum values are not observed, the fluid can easily leak between the valve and the mounting surface. While mounting pay attention to the environment and valve cleanliness.

Surface finishing



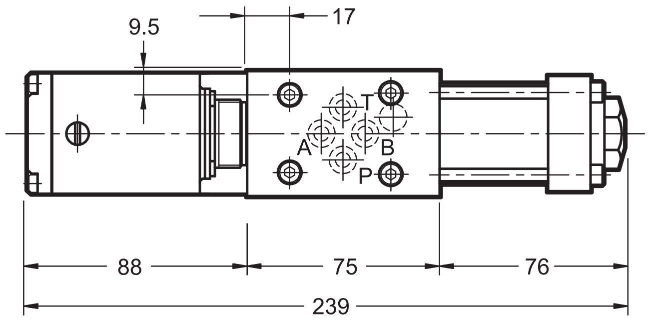
6 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) - 90 Shore N. 1 OR type 2031 (7.66x1.78) - 90 Shore
2	Integrated electronics
3	Linear force motor
4	Electric connector 7 pins DIN 43563 - IP67 PG11 EX7S/L/10 cod. 3890000003 **(to be ordered separately)**

Fastening bolts: 4 bolts SHC M5 x 55 - ISO 4762
Torque: 8,5 Nm



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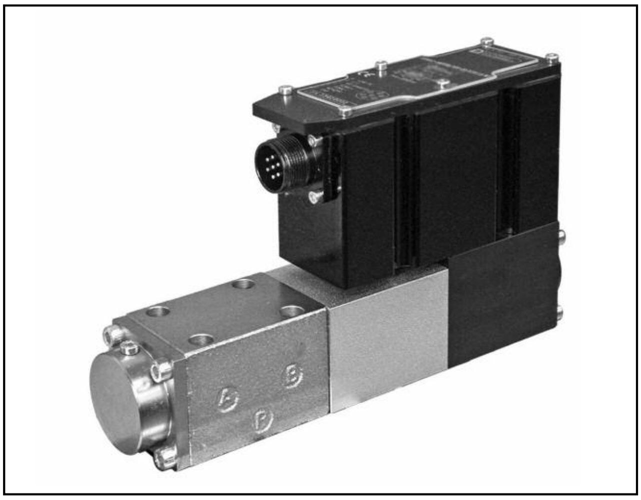


DXE3J

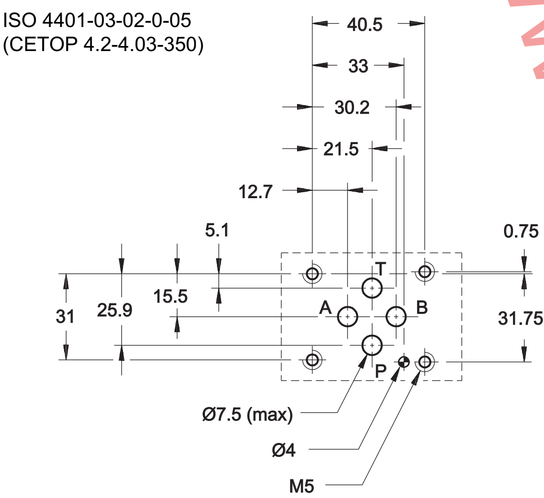
HIGH RESPONSE SERVO-PROPORTIONAL VALVE WITH FEEDBACK AND INTEGRATED ELECTRONICS

SERIES 30

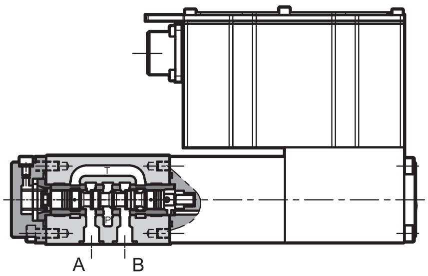
SUBPLATE MOUNTING
ISO 4401-03 (CETOP 03)

p max **350** bar
Q max **70** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



— The DXE3J valve is a four-way (3 + fail-safe position) servo-proportional valve where the spool moves inside a sleeve. It is operated by a proportional solenoid highly dynamic, which achieves high performance and not requires pilot pressure. The spool position is controlled by a linear transducer (LVDT) in closed loop which ensures high precision and repeatability.

— It is available in four different flow ranges up to 40 l/min, with spools with zero overlap.

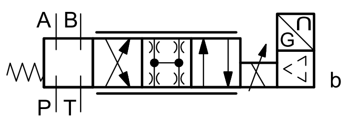
— The valve is featured by integral electronic based on SMD technology which ensures standard regulations and simplifies the electric wiring. The unit does not require any adjustment other than the possible electronic regulation of the zero.

— Suitable for control applications with closed loop of position, velocity and pressure. With a power down or without the enable input, the spool moves automatically at fail-safe position.

PERFORMANCES
(with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure Ports P - A - B Port T	bar	 350 250
Rated flow Q nom (with Δp 70 bar P - T)	l/min	5 - 10 - 20 - 40
Hysteresis	% In	< 0,2
Threshold	% In	< 0,1
Thermal drift (with ΔT= 40 °C)	% In	< 1,0
Response time (0-100%)	ms	≤ 10
Vibration on the three axes	g	30
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	5 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 17/15/12 (16/14/11 for longer life)	
Recommended viscosity	cSt	25
Mass	kg	2,6

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

D	X	E	3	J	-				/	30		-		K11	

Servo-proportional valve with spool in sleeve

Electric proportional control

Size ISO 4401-03

On-board electronic and position feedback

Spools with linear flowrate curve
LZ = zero overlap for low leakage (**standard**)
LU = zero overlap for higher gain

Rated flow (with Δp = 70 bar P - T)
05 = 5 l/min **20** = 20 l/min
10 = 10 l/min **40** = 40 l/min

Fail safe type
F1 = closed centre
F3 = float
FC = cross centre

Pin C function:
A = external enable
B = internal enable
C = 0V monitor

6 + PE pole connector

Command value:
E0 = voltage ±10 V
E1 = current 4 ÷ 20 mA

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

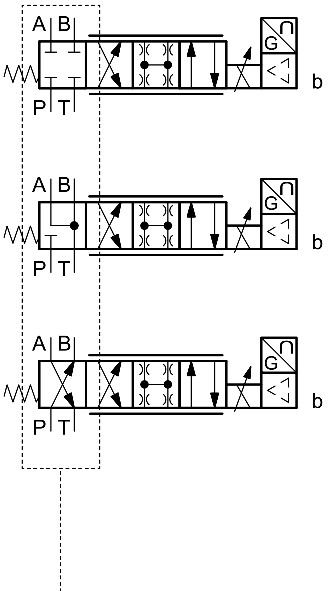
Series No.
(from 30 to 39 sizes and mounting dimensions remain unchanged)

2 - SPOOLS

F1

F3

FC



leakage flow in fail safe position at 100 bar [cm^3/min]		
F1	P → A	20
	P → B	30
	A → T	30
	B → T	30
F3	P → A	20
	P → B	30

flow rate	spool type	fail safe type		
		F1	**F3**	**FC**
05	LZ	■	■	-
	LU	□	□	-
10	LZ	■	■	-
	LU	□	□	-
20	LZ	■	■	■
	LU	□	□	-
40	LZ	■	■	■
	LU	□	□	-

■ available □ on request
- not available

FAIL SAFE POSITION
When a power failure occurs, the electronics de/energize the solenoid and the spool will take the fail safe position by means of the centering springs.

3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

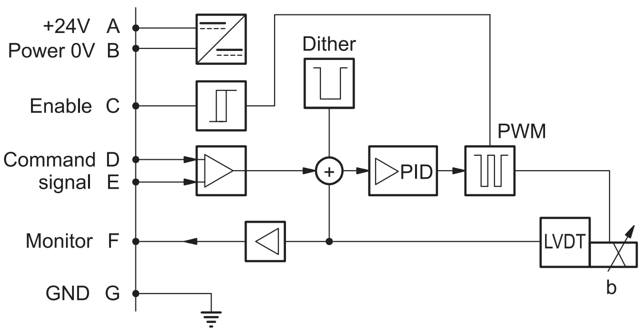
4 - ELECTRICAL CHARACTERISTICS

4.1 - Electrical on board electronics

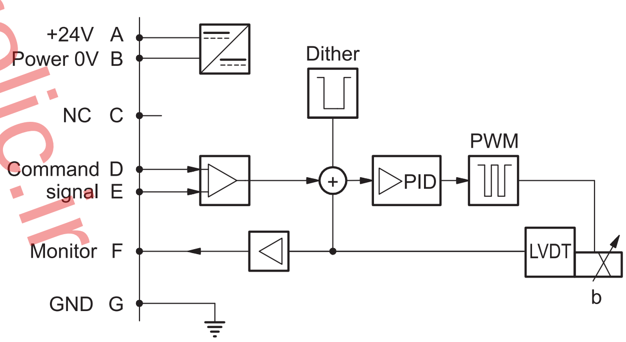
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 35 VDC), ripple max 3 Vpp
Power consumption	VA	35
Maximum solenoid current	A	2.6
Fuse protection, external		(fast), max current 4A
Command signals: voltage (E0) current (E1)	V DC mA	±10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signals: voltage (E0) current (E1)	V DC mA	±10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, LVDT sensor error, cable breakdown, supply voltage failure
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2004/108/EC standards

4.2 - On-board electronics diagrams

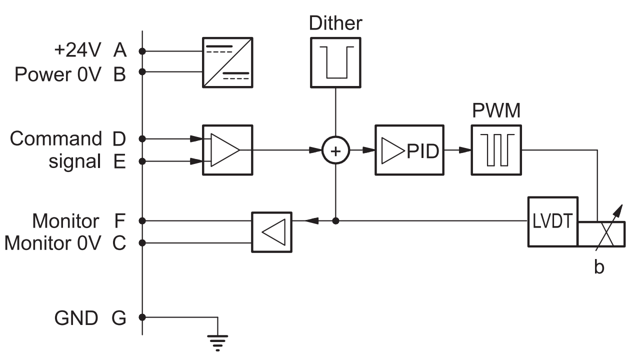
VERSION **A** - External Enable



VERSION **B** - Internal Enable

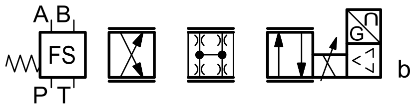


VERSION **C** - 0V Monitor

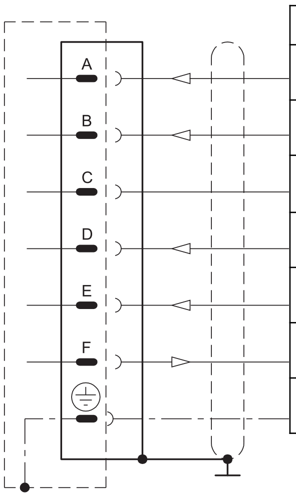


5 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal must be between -10V and +10V. The monitor feature of versions B anc C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**-10V**	**0V**	**+10V**
MONITOR	**-10V**	**0V**	**+10V**

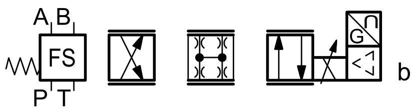


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	± 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	± 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

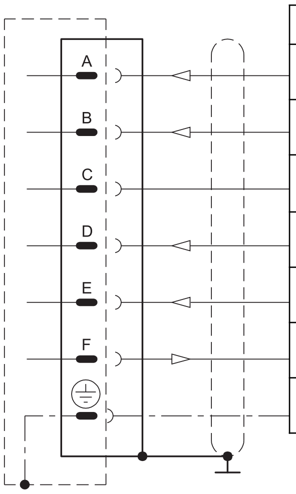
6 - VERSIONS WITH CURRENT COMMAND (E1)

The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B anc C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**4 mA**	**12 mA**	**20 mA**
MONITOR	**4 mA**	**12 mA**	**20 mA**

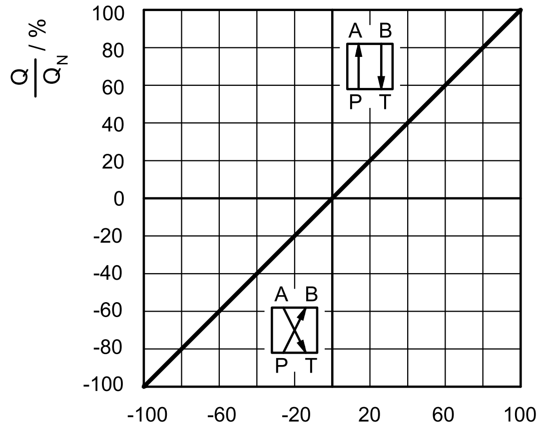


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

7 - CHARACTERISTIC CURVES

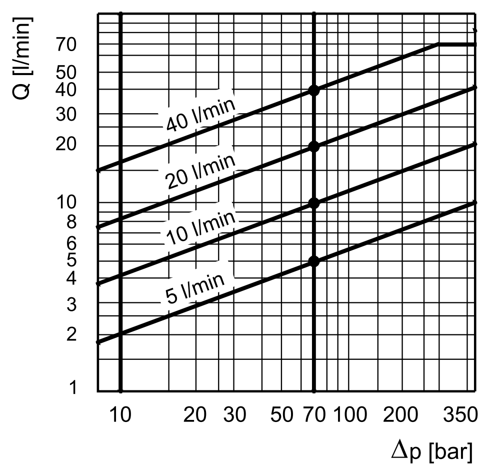
(measured with viscosity of 36 cSt at 50°C)

REFERENCE / FLOW RATE CURVE



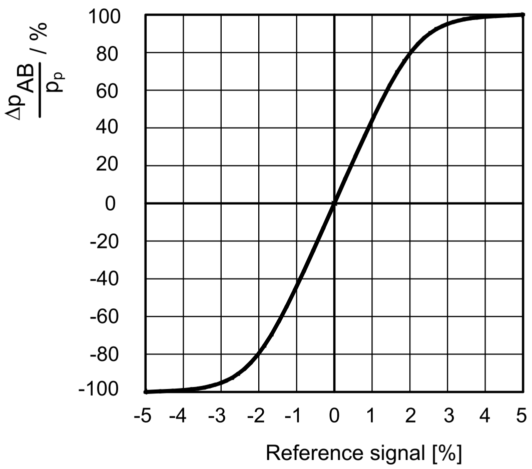
Typical flow rate curves at constant Δp = 70 bar P-T according to the reference signal.
NOTE: with positive reference signal connected to pin D the valve regulates P - A / B - T.

FLOW RATE CURVE ACCORDING TO Δp



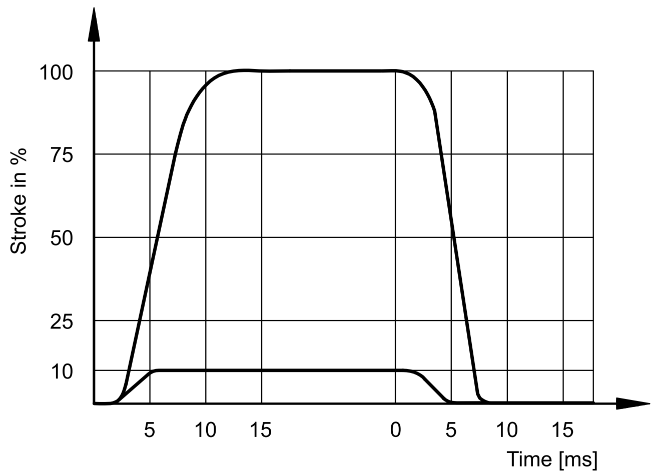
The diagram states the maximum valve controlled flow rate according to the pressure drop between the P and T ports.

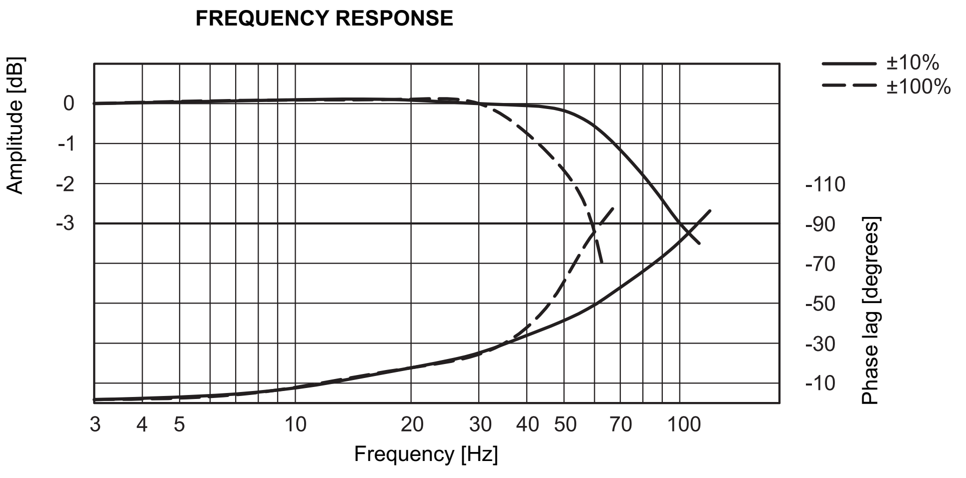
PRESSURE GAIN (LZ)



The diagram shows the valve pressure gain, expressed as % of the ratio between the port pressure variation in A or B (Δp AB) and the P system pressure, according to the reference signal. In practice, the pressure gain states the valve reaction towards external disturbances aimed at changing the actuator position.

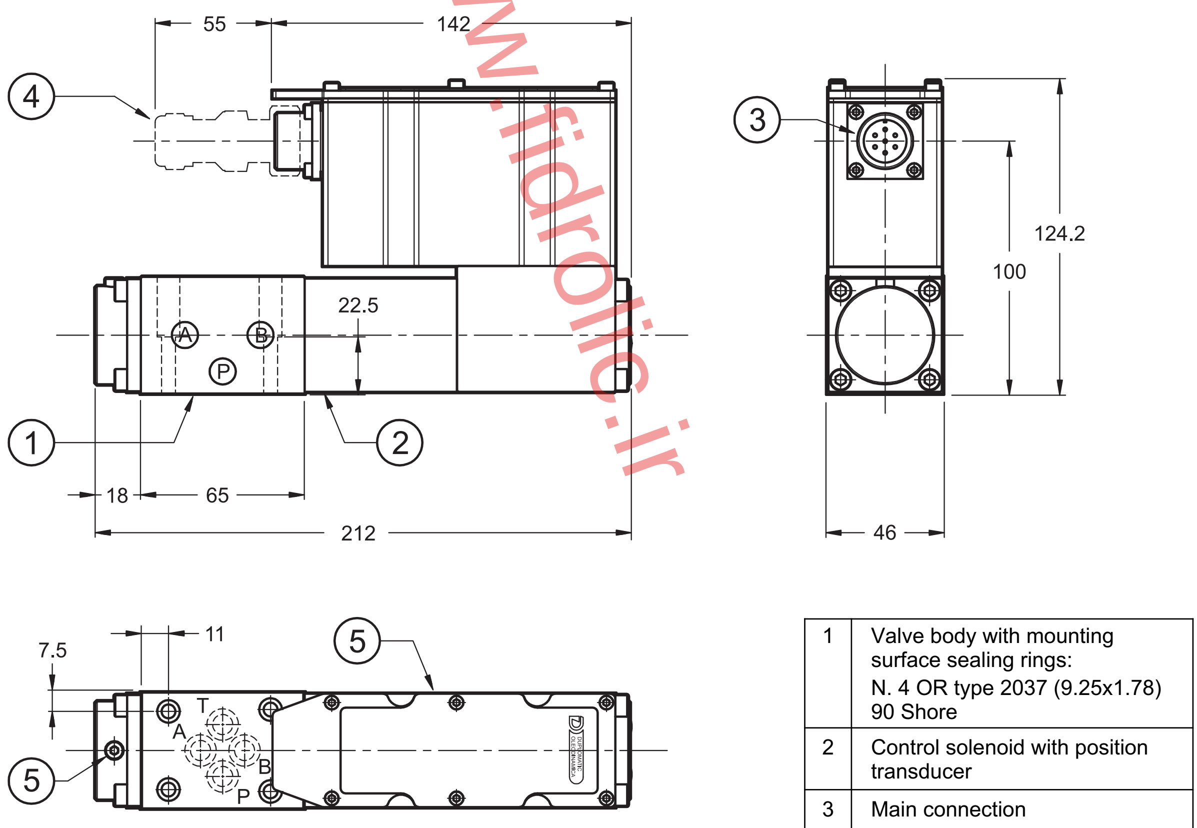
RESPONSE TIME





8 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



Fastening bolts: 4 SHC screws M5 x 30
Torque: 5 Nm ± 10% (A8.8)

1	Valve body with mounting surface sealing rings: N. 4 OR type 2037 (9.25x1.78) 90 Shore
2	Control solenoid with position transducer
3	Main connection
4	Mating connector. **To be ordered separately.** See paragraph 9
5	Air breather. Allen key: 3 Tightening torque 2.5 Nm

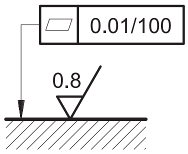
9 - INSTALLATION

The valves can be installed in any position without impairing correct operation.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Take care to the cleanliness of the mounting surfaces and surrounding environment upon installation.

Surface finishing



10 - ACCESSORIES

(to be ordered separately)

10.1 Mating connector

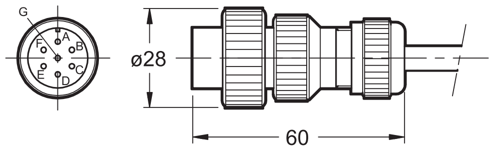
These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

⚠ So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic can provide a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**



10.2 - Connection cables size

Power supply:
- up to 20 m cable length : 1,0 mm²
- up to 40 m cable length : 1,5 mm²

Signal: 0,50 mm²

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

10.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

11 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G rear ports
PMMD-AL3G side ports
Ports dimensions: P, T, A, B: 3/8" BSP

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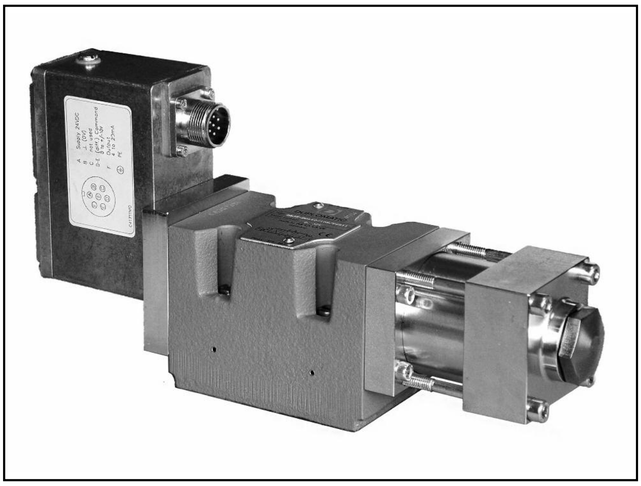
DXJ5

ELECTRO-HYDRAULIC SERVOVALVE WITH INTEGRATED ELECTRONICS

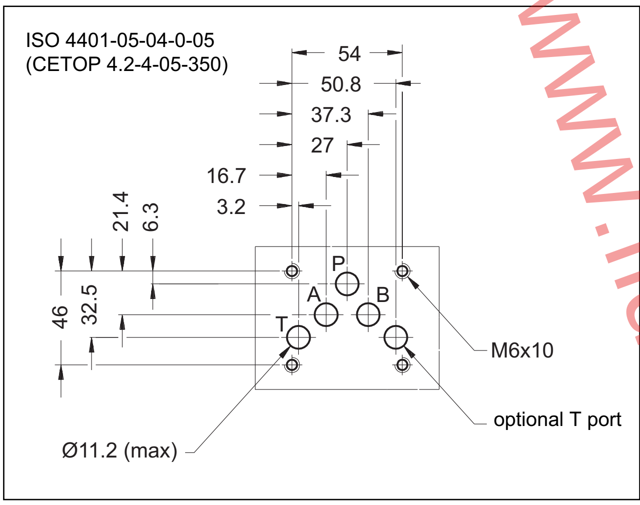
SERIES 10



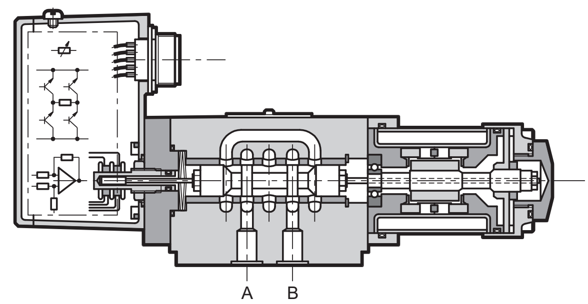
SUBPLATE MOUNTING
ISO 4401-05 (CETOP R05)

p max **350** bar
Q max (see performances table)

MOUNTING SURFACE



OPERATING PRINCIPLE



— The DXJ5 is a four-way servo-proportional valve where the spool moves inside a sleeve. This valve has a direct drive with a linear force motor resulting in high dynamic performances independent of system pressure. A linear transducer (LVDT) with closed loop controls the spool position, ensuring high precision and repeatability.

— It is available in four different flow rate control ranges up to 100 l/min, with spools with zero overlap and a ISO 4401 (CETOP RP 121H) mounting surface.

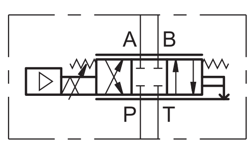
— The valve is featured by integrated electronic based on SMD technology which ensures standard regulations and simplifies the electric wiring. The unit does not require any adjustment other than the possible electronic regulation of the zero.

— Suitable for control applications with closed loop of position, velocity and pressure. With a loss of power or with a zero reference signal, the spool goes automatically at rest-position. In this position the valve has a minimum leakage, depending on the operating pressure (see the performances table).

PERFORMANCES (with mineral oil of viscosity 36 cSt at 50°C)

Maximum operating pressure Ports P - A - B Port T	bar	 350 50
Rated flow Q nom (with Δp 70 bar P - T)	l/min	60 ÷ 100
Null leakage flow (with p=140 bar)	l/min	≤ 3% of Q nom
Hysteresis	% In	< 0,2
Threshold	% In	< 0,1
Thermal drift (with ΔT= 50°C)	% In	< 1,5
Response time	ms	≤ 20
Vibration on the three axes	g	30
Electric features	see paragraph 3	
Protection degree according CEI EN 60529	IP 65	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	5 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 17/15/12 (16/14/11 for longer life)	
Recommended viscosity	cSt	25
Mass	kg	6,3

HYDRAULIC SYMBOL



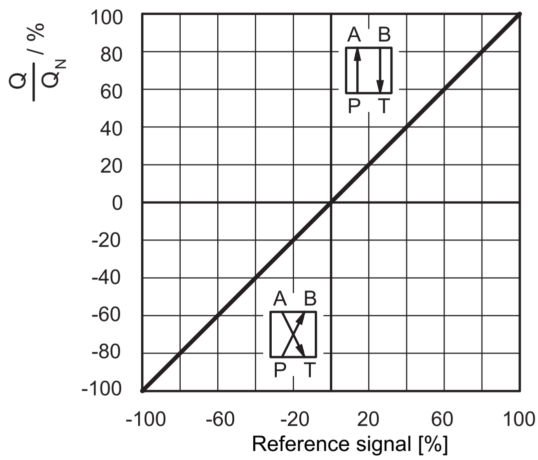
1 - IDENTIFICATION CODE

D	X	J	5	-	D	0	L		/	10		/	E0	K11

- **DX**: Servo-proportional-valve with bushing spool
- **J**: Integrated electronics and position feedback
- **5**: Rated size ISO 4401-05 (CETOP 05)
- **D**: Symmetric spool
- **0**: Spool with zero overlap
- **L**: Spool with a linear characteristic of flow
- Rated flow (with Δp = 70 bar P - T)
  060 = 60 l/min **100** = 100 l/min
- **10**: Series N. (from 10 to 19 sizes and mounting dimensions remain unchanged)
- Seals:
  N = NBR seals for mineral oil (**standard**)
  V = FPM seals for special fluids
- **E0**: Reference signal: ±10V (other signals available on request)
- **K11**: 6 + PE pole connector

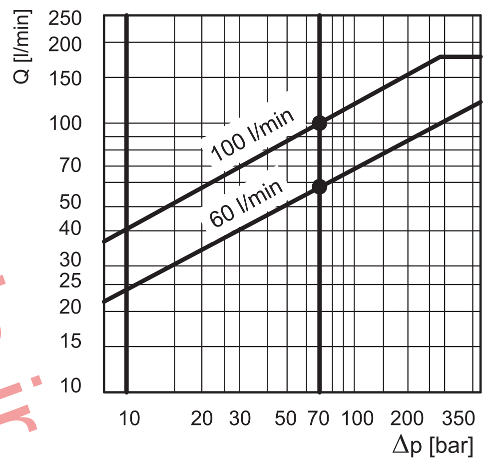
2 - CHARACTERISTIC CURVES (measured with viscosity of 36 cSt at 50°C)

REFERENCE / FLOW RATE CURVE



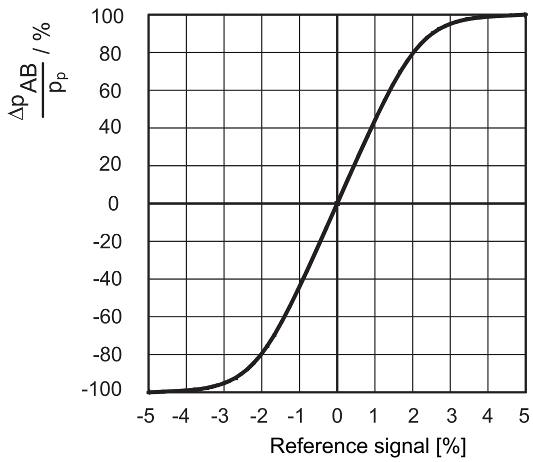
Typical flow rate curves at constant Δp = 70 bar P-T according to the reference signal.
NOTE: with positive reference signal connected to pin D the valve regulates P - A / B - T.

FLOW RATE CURVE ACCORDING TO ΔP



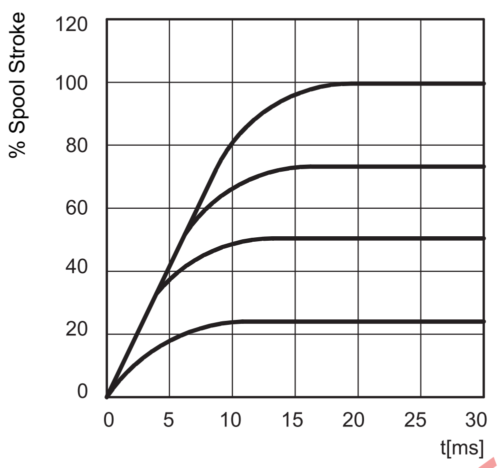
The diagram states the maximum valve controlled flow rate according to the pressure drop between the P and T ports.

PRESSURE GAIN

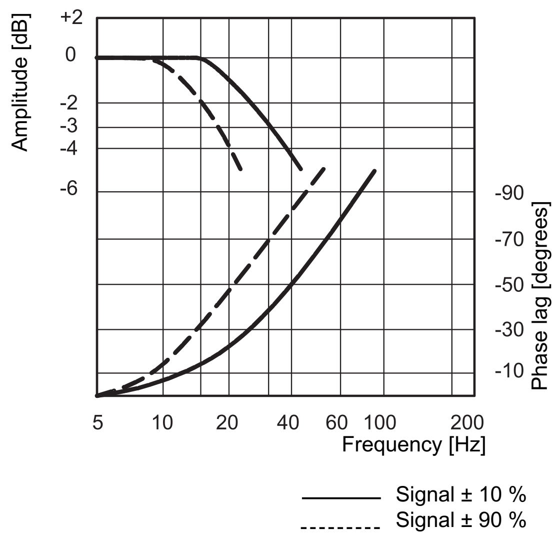


The diagram on the left shows the valve pressure gain, expressed as % of the ratio between the port pressure variation in A or B (Δp AB) and the P system pressure, according to the reference signal. Practically, the pressure gain states the valve reaction towards external disturbances aimed at changing the actuator position.

STEP RESPONSE

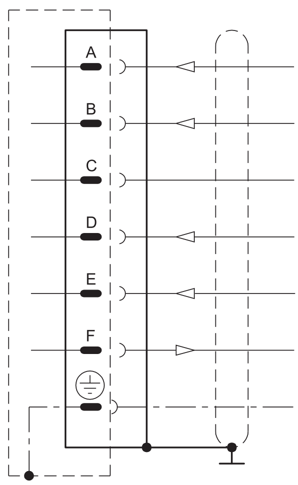


FREQUENCY RESPONSE



3 - ELECTRICAL FEATURES

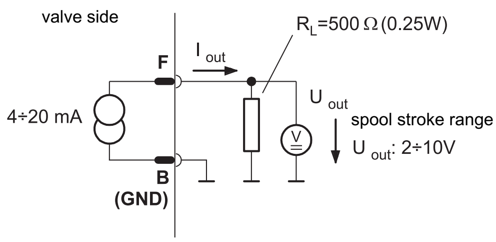
CONNECTION WIRING



Pin	Values	Function	NOTES
A	24 VDC	Supply	From 19 to 32 VDC $I_{A\ MAX.}$ = 2,2 A
B	0 V	Signal ground	0 V
C	----	Not used	----
D	± 10 V	Input rated command	R_e = 10 kΩ (see **NOTE 1**)
E	0 V	Input rated command	----
F	4 ÷ 20 mA	Spool position	R_L = from 300 to 500 Ω (see **NOTE 2**)
PE	----	Protective earth	----

NOTE 1: The input stage is a differential amplifier. With positive reference signal connected to pin D, valve opening P - A e B - T is achieved. With a zero reference signal the spool is in centred position. The spool stroke is proportional to U_D - U_E. If only one command signal is available (single-end), pin E must be connected to pin B (0V ground).

NOTE 2: The spool position value can be measured at pin F (see diagram right). The position signal output goes from 4 to 20 mA. The centered position is at 12 mA, while 20 mA, corresponds to 100% valve opening P - A and B - T. This monitoring allows to detect a cable break when I_F = 0V.



General requirements:

- External fuse = 2,5 A
- Minimum cross-section of all leads ≈ 0,75 mm²
- When making electric connections to the valve (shield, protective earth) appropriate measures must be taken to ensure that locally different earth potentials do not results in excessive ground currents.
- The differential and the spool position signal lines must be connected to the mating connector housing at valve side and to the 0V (signal ground) at cabinet side.
- **EMC**: meets the requirements of EN 55011:1998, class B, and the immunity regulation according to EN 61000-6-2:1998

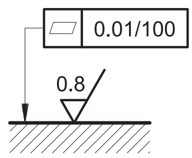
4 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

5 - INSTALLATION

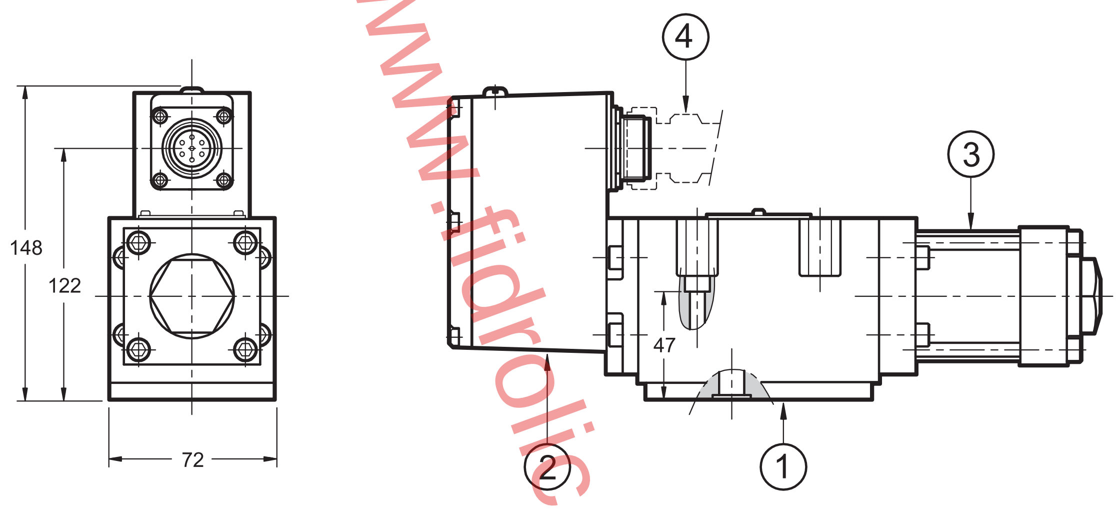
The DXJ5 valve can be installed in any position without impairing its correct operation.
The valve is fixed by means of screws on a flat surface with planarity between 0,01 mm over 100 mm and roughness R_a < 0,8 μm. If the minimum values are not observed, the fluid can easily leak between the valve and the mounting surface. While mounting pay attention to the environment and valve cleanliness.

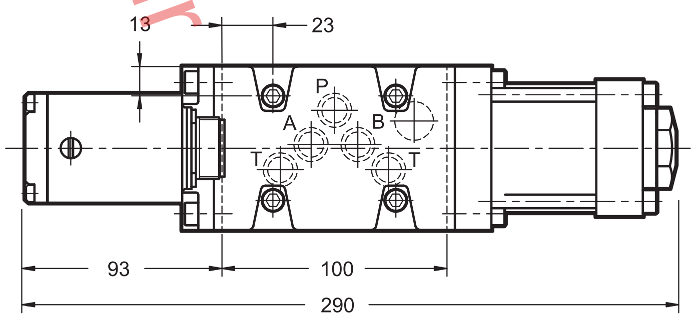
Surface finishing



7 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm





1	Mounting surface with sealing rings: N. 5 OR type 2050 (12.42x1.78) - 90 Shore N. 1 OR type 2037 (9.25x1.78) - 90 Shore
2	Integrated electronics
3	Linear force motor
4	Electric connector 7 pins DIN 43563 - IP67 PG11 EX7S/L/10 cod. 3890000003 **(to be ordered separately)**

Fastening bolts: 4 bolts SHC M6 x 60 - ISO 4762
Torque: 13 Nm

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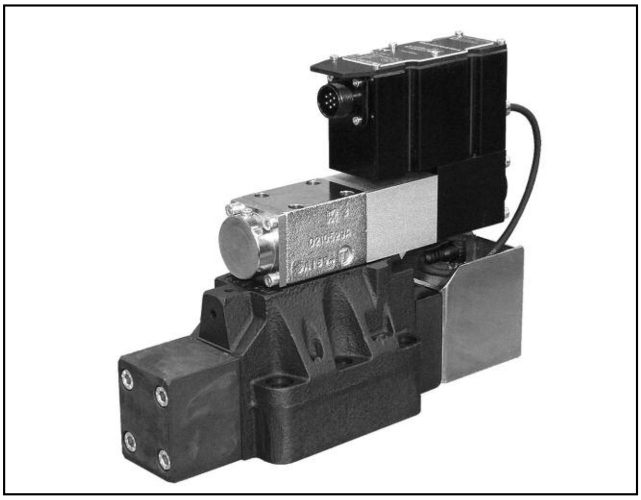


DXPE*J

DIRECTIONAL CONTROL VALVE PILOT OPERATED, WITH OBE AND FEEDBACK

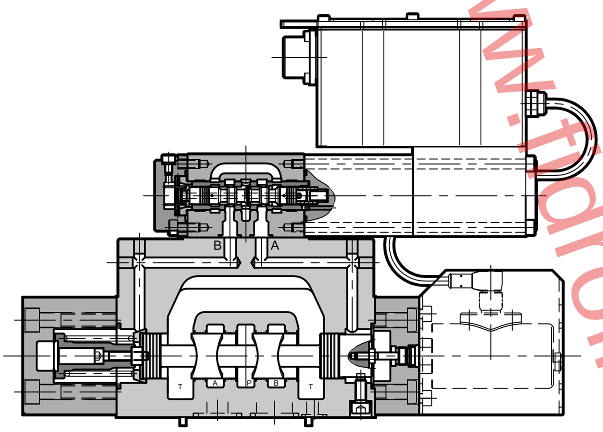
SERIES 30

SUBPLATE MOUNTING

DXPE5J	**CETOP P05**
DXPE5RJ	**ISO 4401-05**
DXPE7J	**ISO 4401-07**
DXPE8J	**ISO 4401-08**

p max (see performance table)
Q max (see performance table)

OPERATING PRINCIPLE



— DXPE*J are directional control valves operated by a servo-proportional pilot, with mounting surface compliant with ISO 4401 standards.

— The spool position is controlled by a linear transducer LVDT in closed loop, which ensures high precision and repeatability. In the event of switch-off or inactive electronics the main spool is set to a fail-safe position by springs.

— The valve is featured by integral electronic based on SMD technology which ensures standard regulations and simplifies the electric wiring. The unit does not require any adjustment.

— The valve is easy to install. The driver directly manages digital settings. In the event of special applications, you can customize the settings using the optional kit (see par. 15.3).

PERFORMANCES

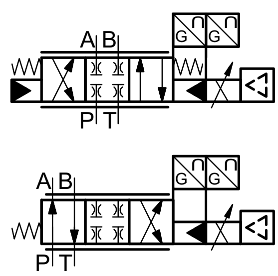
(obtained with mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

		DXPE5J DXPE5RJ	DXPE7J	DXPE8J
Max operating pressure: P - A - B ports T - X - Y ports	bar		350 250	
Controlled flow with Δp 10 bar P-T	l/min	100	220	400
Hysteresis	% Q max		< 0,2%	
Repeatability	% Q max		± 0,1%	
Electrical characteristics			see paragraph 3	
Ambient temperature range	°C		-20 / +60	
Fluid temperature range	°C		-20 / +80	
Fluid viscosity range	cSt		10 ÷ 400	
Fluid contamination degree			according to ISO 4406:1999 class 17/15/12 (16/14/11 for longer life)	
Recommended viscosity	cSt		25	
Mass	kg	8	10,5	17

HYDRAULIC SYMBOLS (typical)

Z

Z*TA



1 - IDENTIFICATION CODE

D	X	P	E		J	-				/	30		-			/		K11		

Proportional directional valve with high-response pilot

Nominal size:
5 = CETOP P05
5R = ISO 4401-05 (CETOP R05)
7 = ISO 4401-07 (CETOP 07)
8 = ISO 4401-08 (CETOP 08)

Digital integrated electronics for valves with feedback

Spool type:
Z* = zero overlap
Z*TA = zero overlap
See paragraph 2 for operation and available flow rates.
Other spool types (C, A..) are available upon request.

Series No.
(the overall and mounting dimensions remain unchanged from 30 to 39)

Seals:
N = NBR seals for mineral oil (**standard**)
V = FPM seals for special fluids

Piloting: **I** = internal
E = external

Drainage: **I** = internal
E = external

Reference signal:
E0 = voltage ± 10 V
E1 = current 4÷20 mA

Main connector:
6 pin + PE

Pin C function:
A = external enable
B = internal enable
C = 0V monitor

Option:
/ W7 = Zinc-nickel surface treatment
Omit if not required.
(see par. 1.1)

1.1 - Surface treatments

The standard valve is supplied with surface treatment of phosphating black.

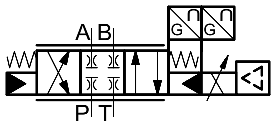
The zinc-nickel finishing makes the valve suitable to ensure a salt spray resistance up to **600** hours (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

2 - AVAILABLE CONFIGURATIONS

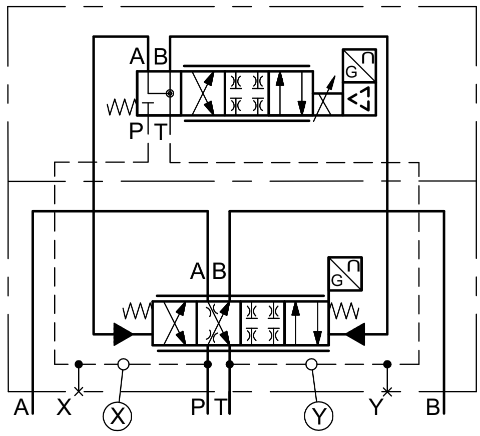
The valve configuration depends on the combination of spool type and rated flow.

3 positions with spring centering

Z



detailed symbol



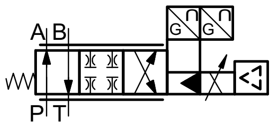
valve type	Z*	Controlled flow with Δp 10 bar P-T
DXPE5J DXPE5RJ	**100**	100 l/min
DXPE7J	**120**	120 l/min
	220	220 l/min
DXPE8J	**250**	250 l/min
	400	400 l/min

OFFSET POSITION

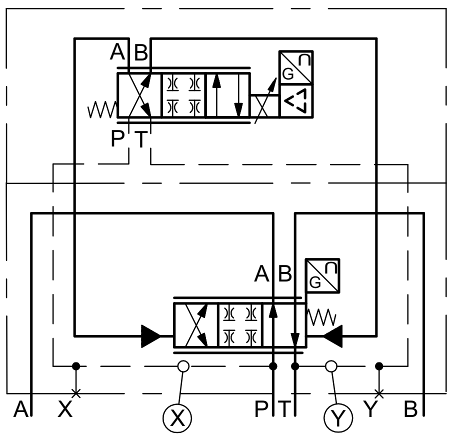
After electrical swith-off or Enable signal swich-off (version K11A) the main spool moves to springs offset position, with limited opening (1%... 6% of main spool stroke in direction P-B / A-T)

3 positions with spring offset

Z*TA



detailed symbol



valve type	Z*TA	Controlled flow with Δp 10 bar P-T
DXPE5J DXPE5RJ	**100**	100 l/min
DXPE7J	**120**	120 l/min
	220	220 l/min
DXPE8J	**250**	250 l/min
	400	400 l/min

FAIL SAFE POSITION

After electrical swith-off or Enable signal swich-off (version K11A) the main spool moves by spring to the fail-safe position P - A / B -T, wide open.

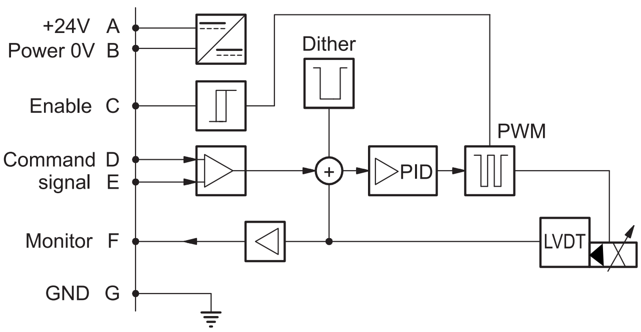
3 - ELECTRICAL CHARACTERISTICS

3.1 - Electrical on board electronics

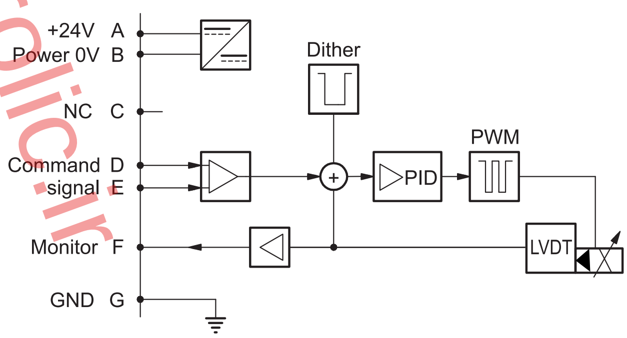
Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	35
Maximum solenoid current	A	2.6
Fuse protection, external		(fast), max current 4A
Command signals: voltage (E0) current (E1)	V DC mA	±10 (Impedance Ri > 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signals: voltage (E0) current (E1)	V DC mA	±10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Managed breakdowns		Overload and electronics overheating, LVDT sensor error, cable breakdown, supply voltage failure
Communication		LIN-bus Interface (with the optional kit)
Connection		7 - pin MIL-C-5015-G (DIN-EN 175201-804)
Electromagnetic compatibility (EMC) emissions EN 61000-6-4 immunity EN 61000-6-2		According to 2014/30/UE standard

3.2 - On-board electronics diagrams

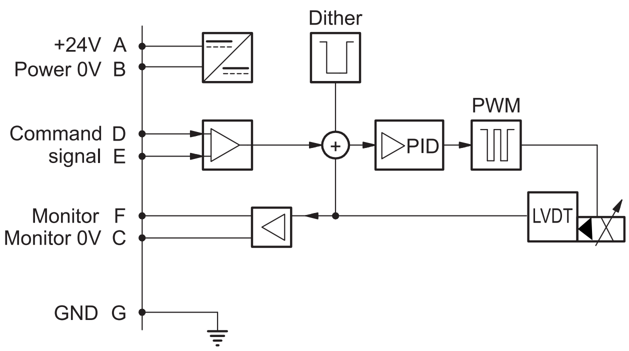
VERSION **A** - External Enable



VERSION **B** - Internal Enable

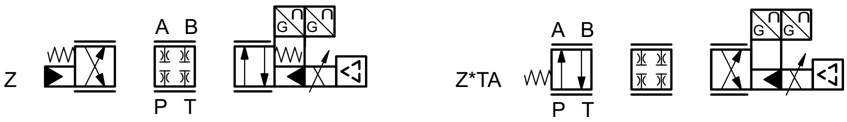


VERSION **C** - 0V Monitor



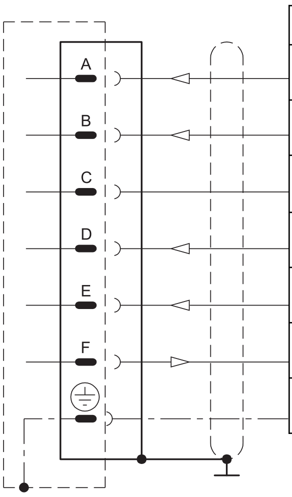
4 - VERSIONS WITH VOLTAGE COMMAND (E0)

The reference signal must be between -10V and +10V. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	-10V	0V	+10V
MONITOR	-10V	0V	+10V

COMMAND	-10V	0V	+10V
MONITOR	--10V	0V	+10V

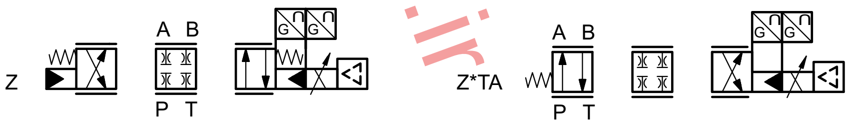


Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	± 10 V	Command (differential input)		
E	0 V	PIN D reference		
F	± 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

5 - VERSIONS WITH CURRENT COMMAND (E1)

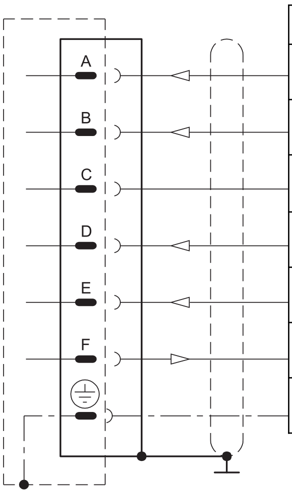
The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	4 mA	12 mA	20 mA
MONITOR	4 mA	12 mA	20 mA

COMMAND	4 mA	12 mA	20 mA
MONITOR	4 mA	12 mA	20 mA



Pin	Values	version A	version B	version C
A	24 V DC	Supply Voltage		
B	0 V			
C		Enable 24 V DC	not used -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	PIN D reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

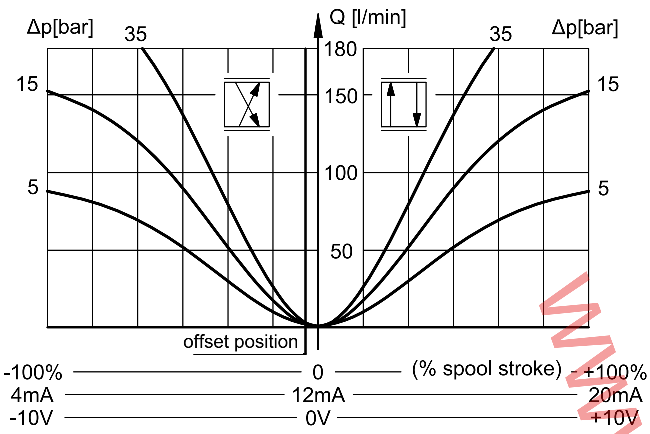
6 - CHARACTERISTIC CURVES

(with mineral oil with viscosity of 36 cSt at 50°C)

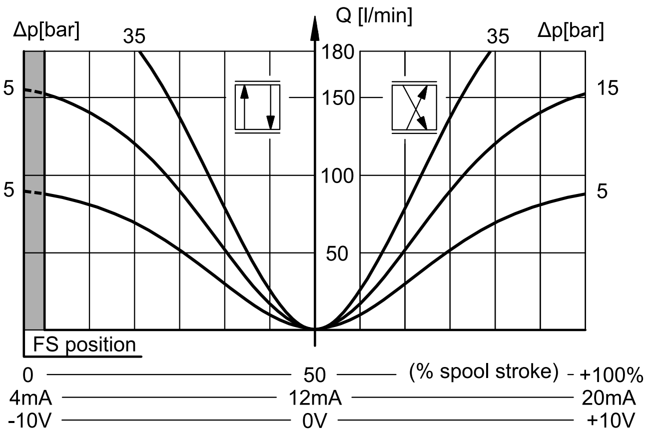
Typical flow rate curves at constant Δp related to the reference signal and measured for the available spools.
The Δp values are measured per land.

6.1 - Characteristic curves DXPE5J and DXPE5RJ

SPOOL Z100

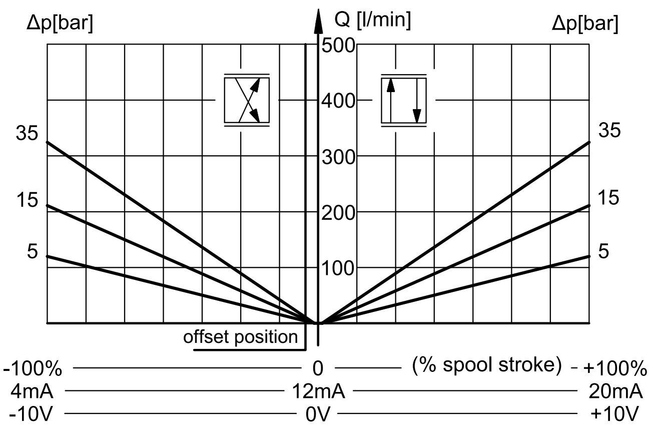


SPOOL Z100TA

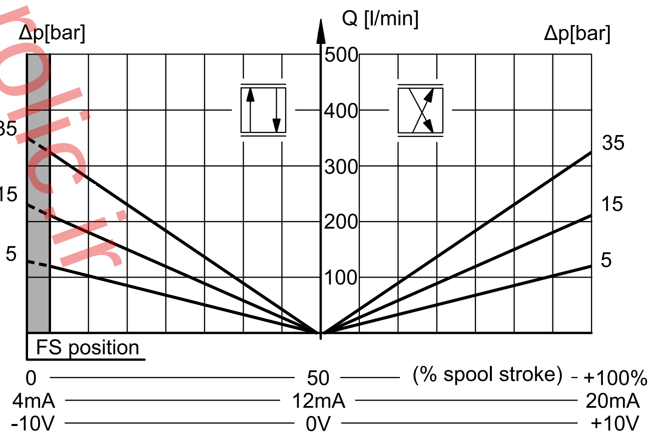


6.2 - Characteristic curves DXPE7J

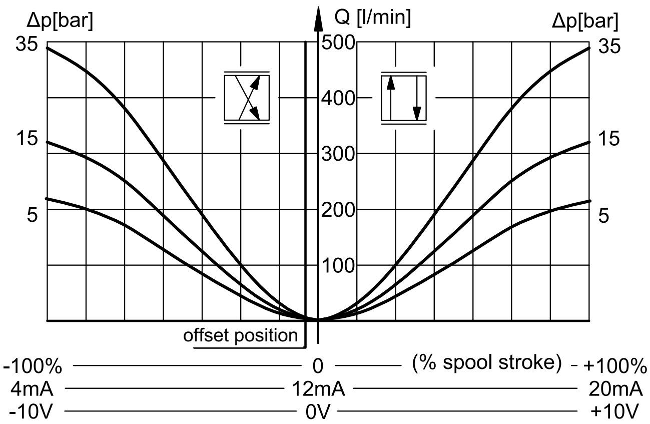
SPOOL Z120



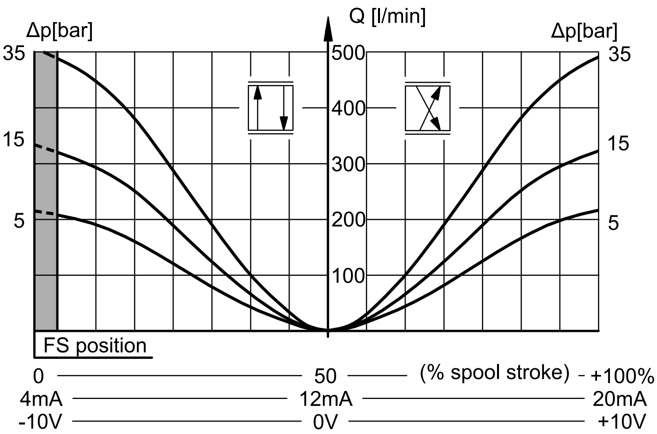
SPOOL Z120TA



SPOOL Z220

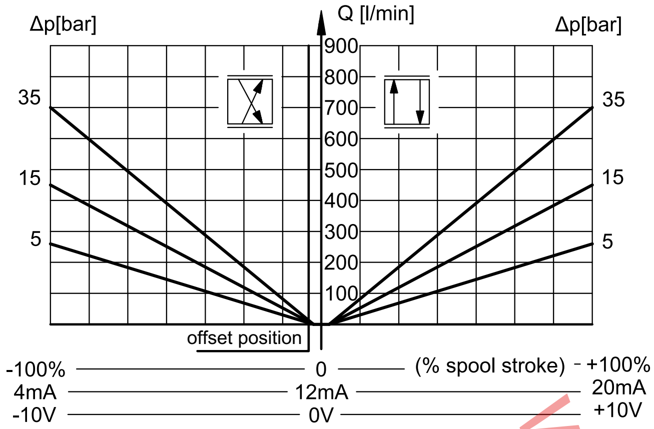


SPOOL Z220TA

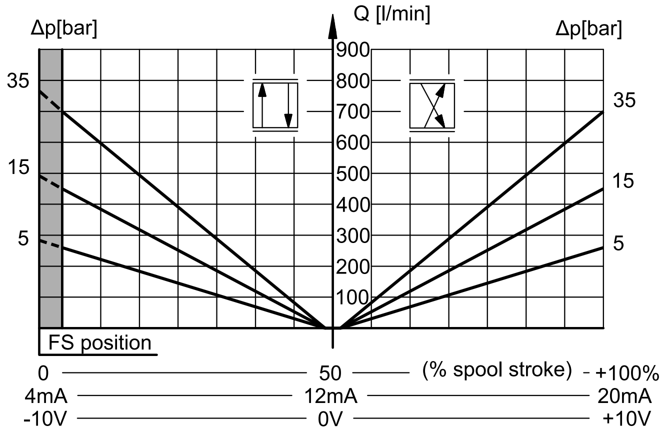


6.3 - Characteristic curves DXPE8J

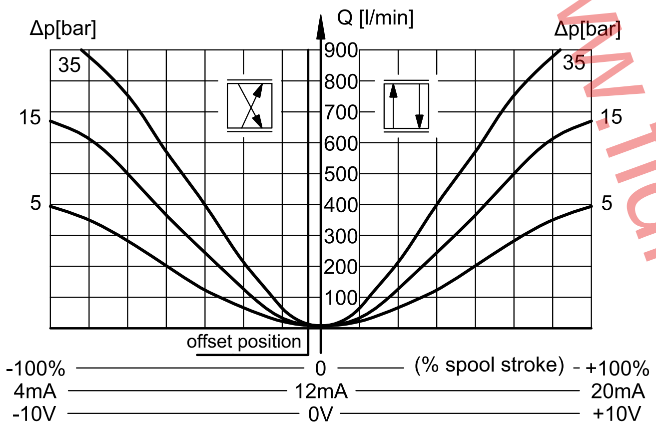
SPOOL Z250



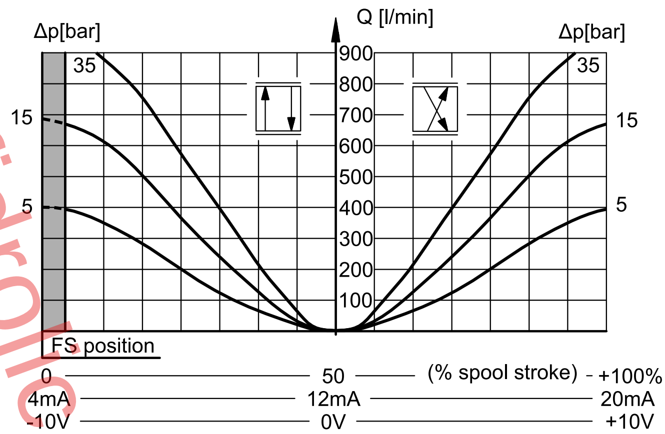
SPOOL Z250TA



SPOOL Z400



SPOOL Z400TA



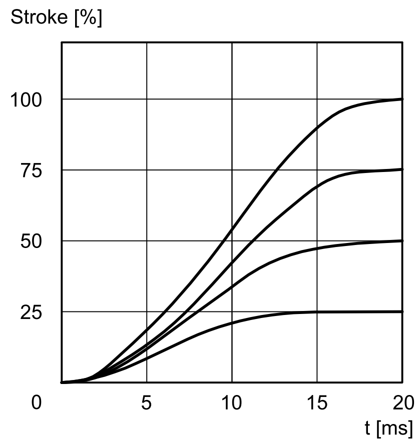
7 - RESPONSE TIMES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

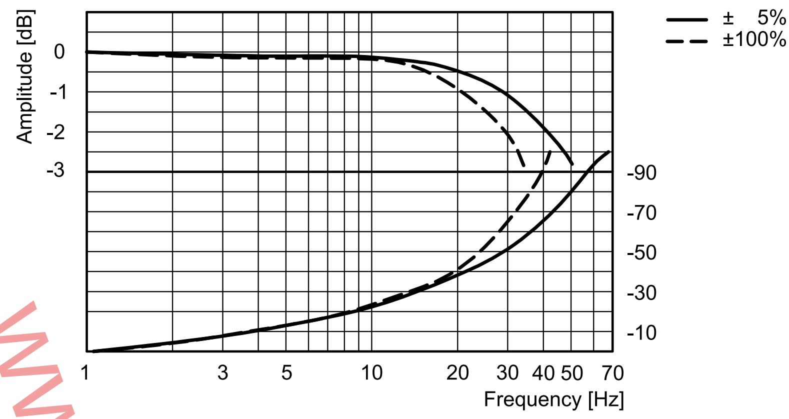
The tables shows the typical step response tested with static pressure 100 bar.

7.1 - DXPE5J and DXPE5RJ

RESPONSE TIME

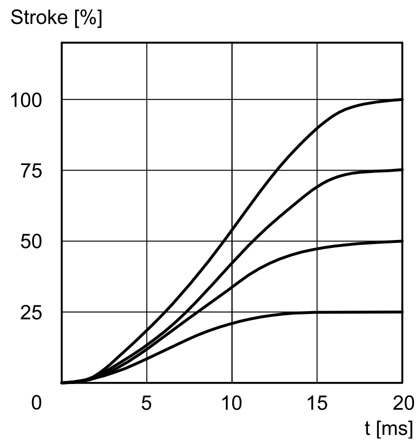


FREQUENCY RESPONSE

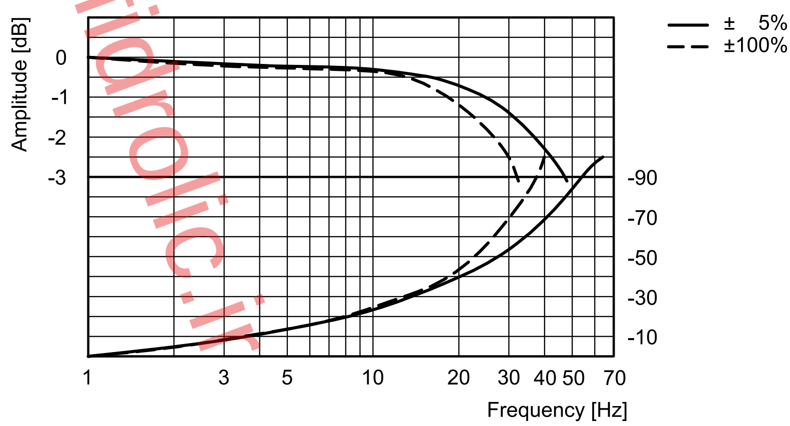


7.2 - DXPE7J

RESPONSE TIME

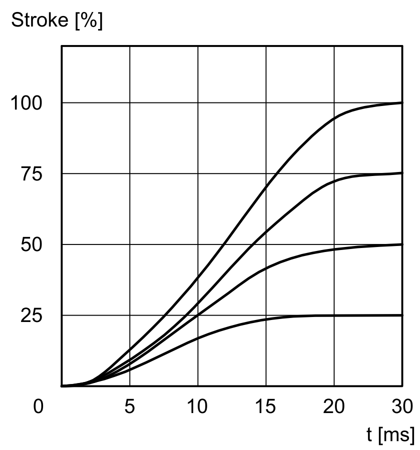


FREQUENCY RESPONSE

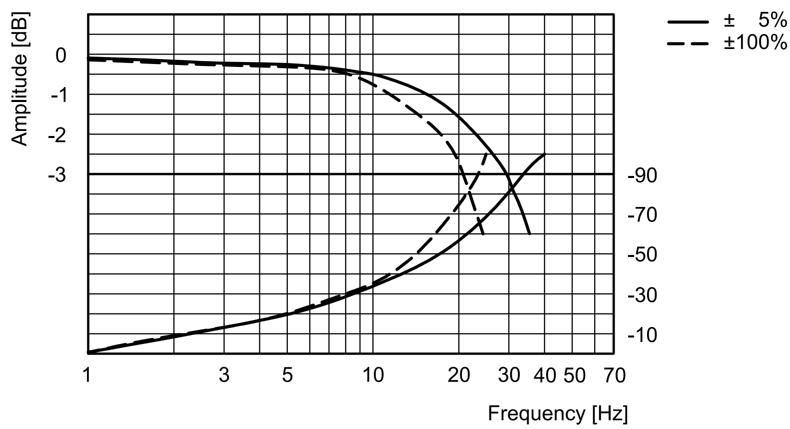


7.3 - DXPE8J

RESPONSE TIME



FREQUENCY RESPONSE



8 - HYDRAULIC CHARACTERISTICS

(with mineral oil with viscosity of 36 cSt at 50°C)

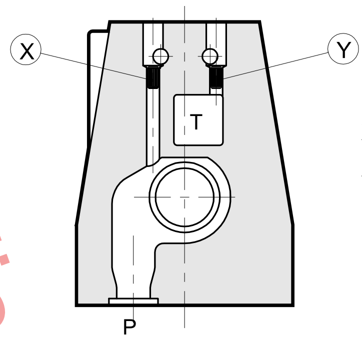
		DXPE5J DXPER5J	DXPE7J	DXPE8J
Max flow rate	l/min	180	450	900
Piloting flow requested with operation 0 →100%	l/min	7	13	28
Piloting volume requested with operation 0 →100%	cm^3	1,7	3,2	10

8.1- Piloting and drainage

The DXPE*J valves are available with piloting and drainage, both internal and external. The version with external drainage allows a higher back pressure on the unloading. The version with external pilot with reduced pressure must be used when higher pressures are needed.

TYPE OF VALVE		Plug assembly	
		X	Y
IE	INTERNAL PILOT AND EXTERNAL DRAIN	NO	YES
II	INTERNAL PILOT AND INTERNAL DRAIN	NO	NO
EE	EXTERNAL PILOT AND EXTERNAL DRAIN	YES	YES
EI	EXTERNAL PILOT AND INTERNAL DRAIN	YES	NO

DXPE5J and DXPE5RJ

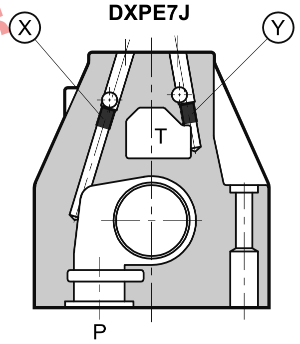


X: M5x6 plug for external pilot
Y: M5x6 plug for external drain

PRESSURES (bar)

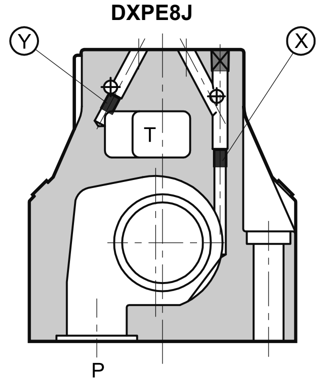
Pressure	MIN	MAX
Piloting pressure on X port	15	250
Pressure on T port with internal drain	-	30
Pressure on T port with external drain	-	250

DXPE7J

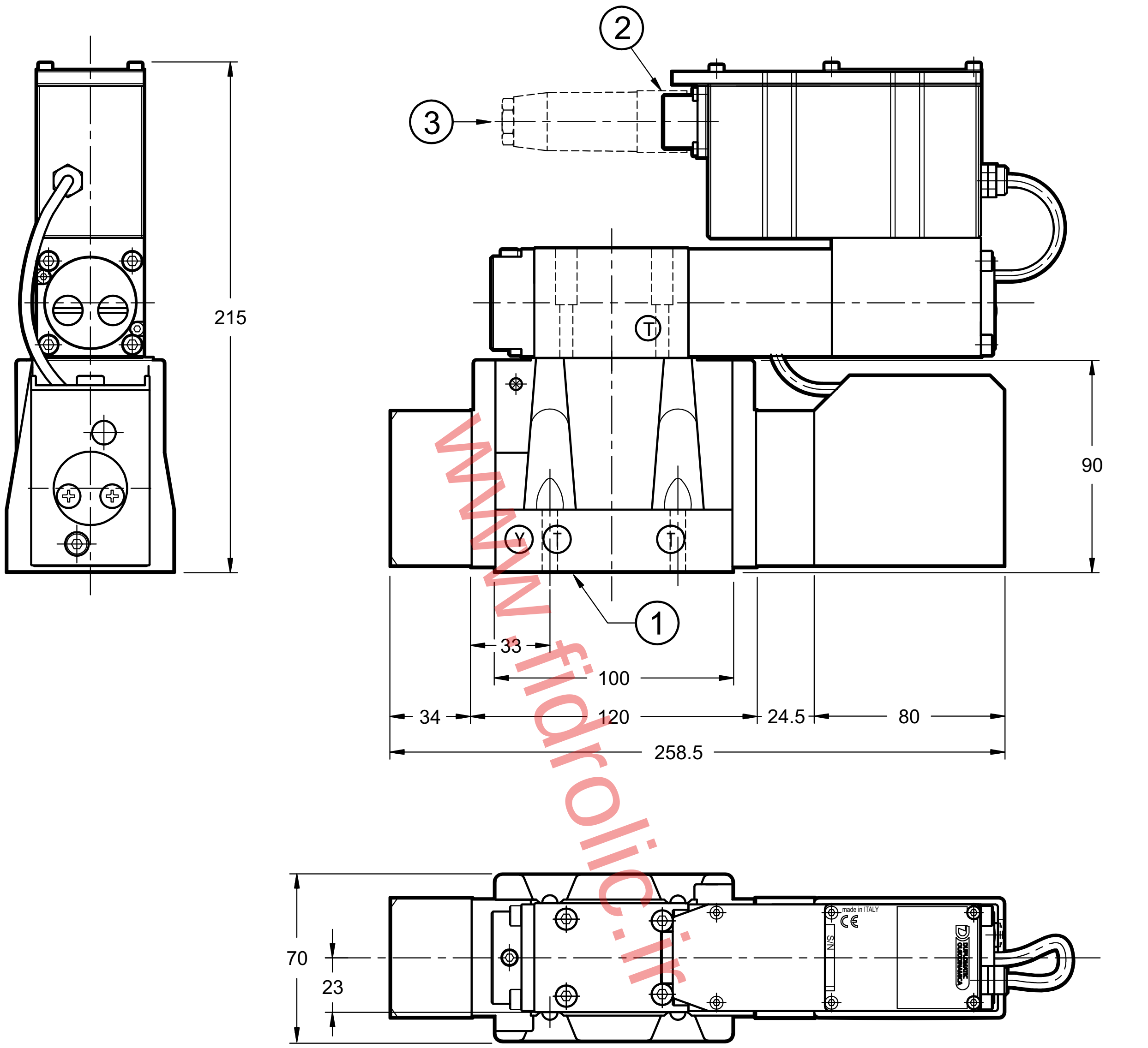


X: M6x8 plug for external pilot
Y: M6x8 plug for external drain

DXPE8J



9 - OVERALL AND MOUNTING DIMENSIONS DXPE5J AND DXPE5RJ



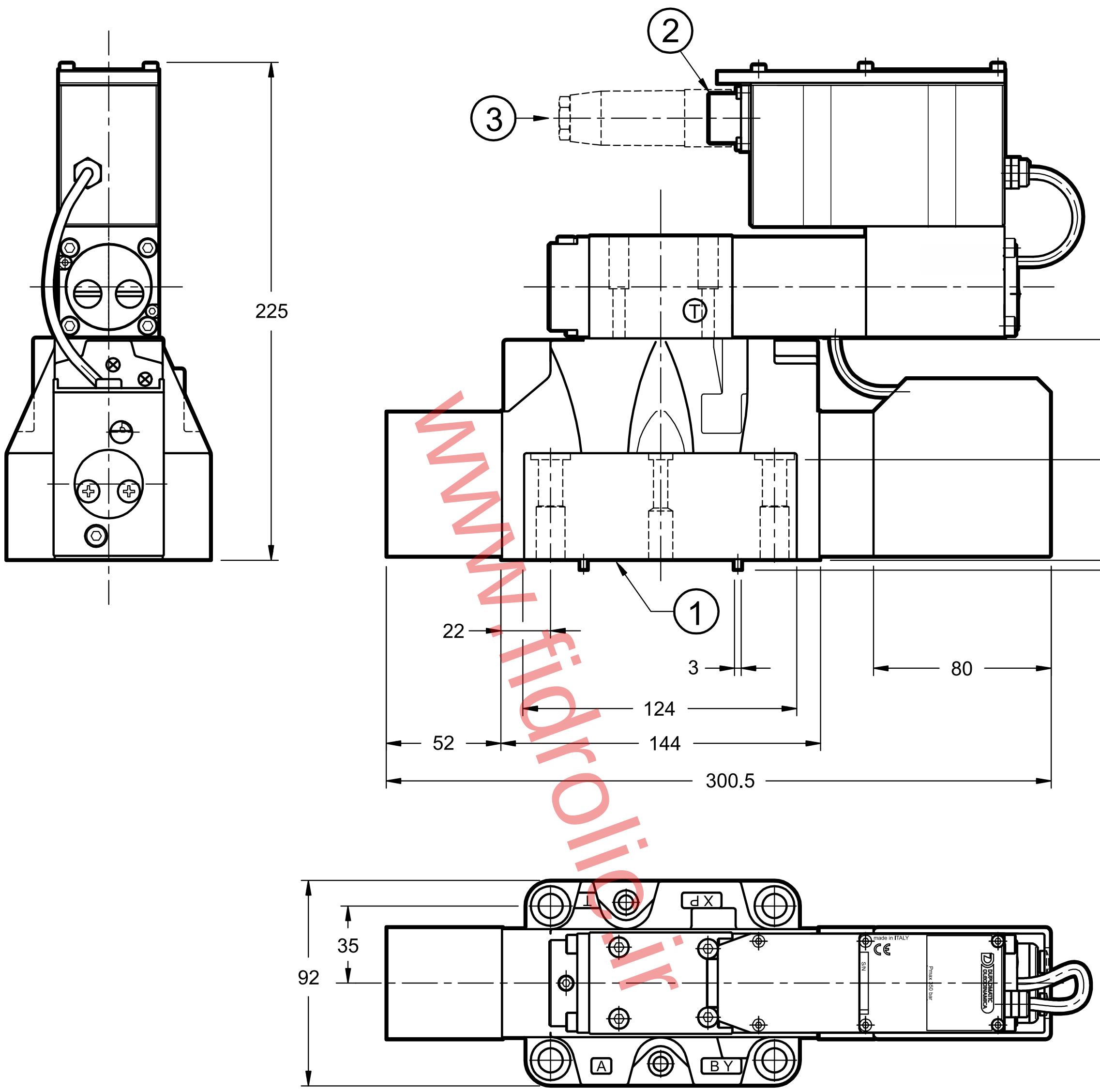
NOTES:
See mounting surface at section 12.
- Do not dismantle the transducers.

Valve fastening: N. 4 bolts M6x35 - ISO 4762
Tightening torque: 8 Nm (bolts A 8.8)
Threads of mounting holes: M6x10

1	Mounting surface with sealing rings: 5 OR type 2050 (12.42x1.78) - 90 Shore 1 OR type 2037 (9.25x1.78) - 90 Shore
2	Main connection
3	Electrical connector 7 pin DIN 43563 - IP67 PG11 EX7S/L/10 code 3890000003 **(to be ordered separately)**

10 - OVERALL AND MOUNTING DIMENSIONS DXPE7J

dimensions in mm



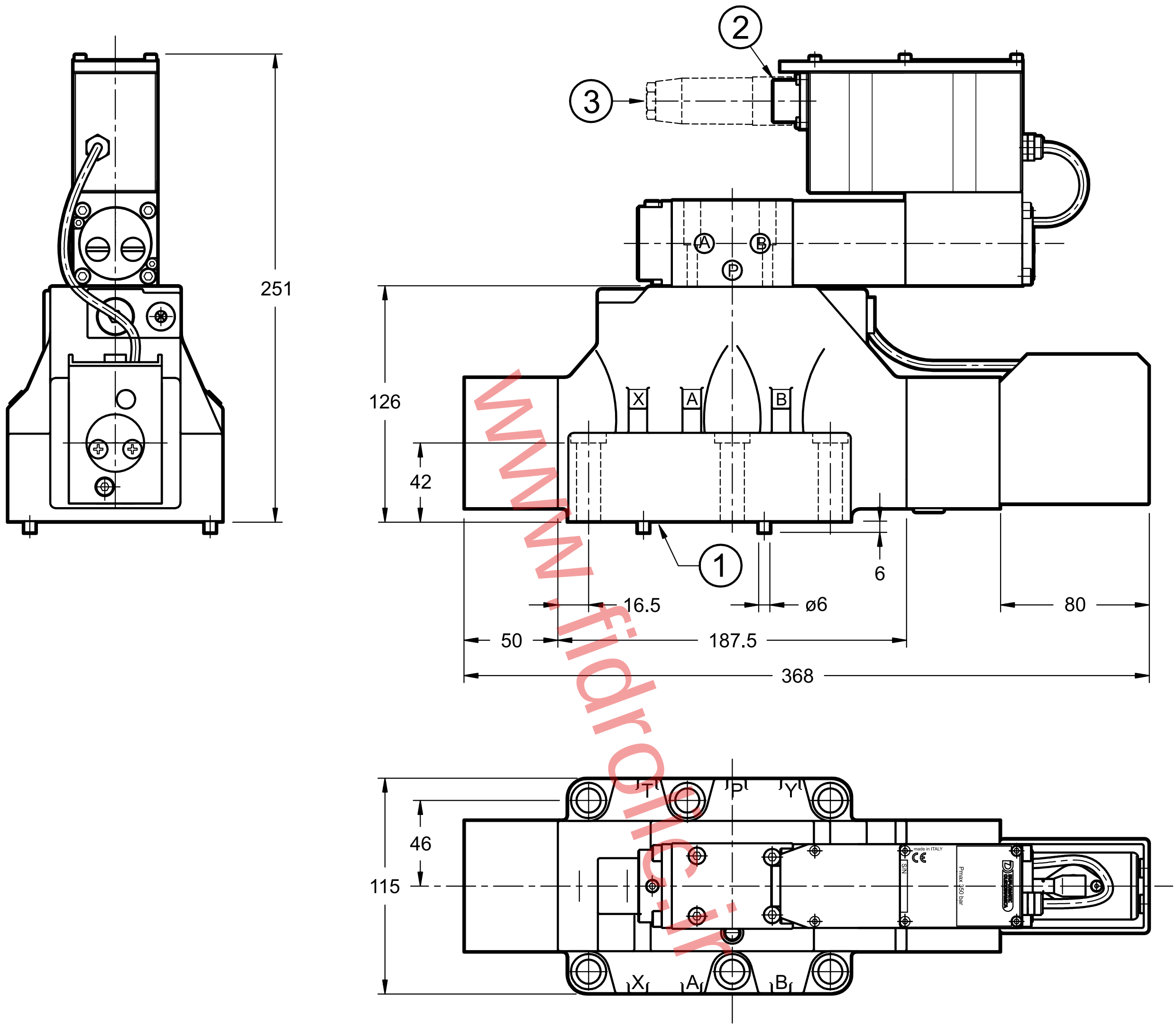
NOTES:
See mounting surface at section 12.
- Do not dismantle the transducers.

Valve fastening:	N. 4 bolts M10x60 - ISO 4762 N. 2 bolts M6x60 - ISO 4762
Tightening torque	M10x60: 40 Nm (bolts A 8.8) M6x60: 8 Nm (bolts A 8.8)
Threads of mounting holes: M6x18; M10x18	

1	Mounting surface with sealing rings. 4 OR type 130 (22.22X2.62) - 90 Shore 2 OR type 2043 (10.82x1.78) - 90 Shore
2	Main connection
3	Electrical connector 7 pin DIN 43563 - IP67 PG11 EX7S/L/10 code 3890000003 **(to be ordered separately)**

11 - OVERALL AND MOUNTING DIMENSIONS DXPE8J

dimensions in mm



NOTES:

See mounting surface at section 12.

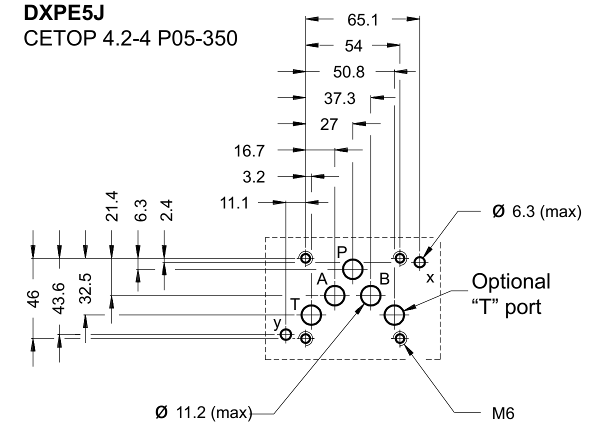
- Do not dismantle the transducers.

Fastening of single valve: N. 6 bolts M12X60 - ISO 4762
Tightening torque: 69 Nm (bolts A 8.8)
Threads of mounting holes: M12X20

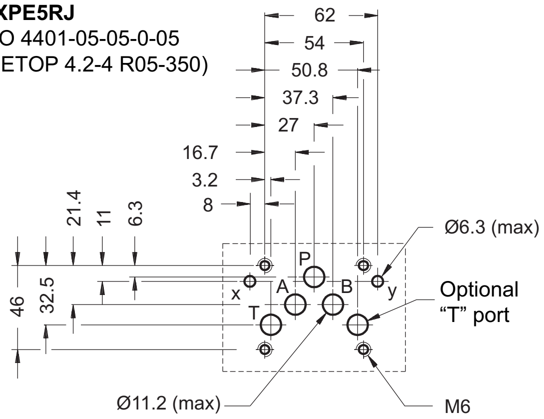
1	Mounting surface with sealing rings: 4 OR type 3118 (29.82x2.62) - 90 Shore 2 OR type 3081 (20.24x2.62) - 90 Shore
2	Main connection
3	Electrical connector 7 pin DIN 43563 - IP67 PG11 EX7S/L/10 code 3890000003 **(to be ordered separately)**

12 - MOUNTING SURFACES

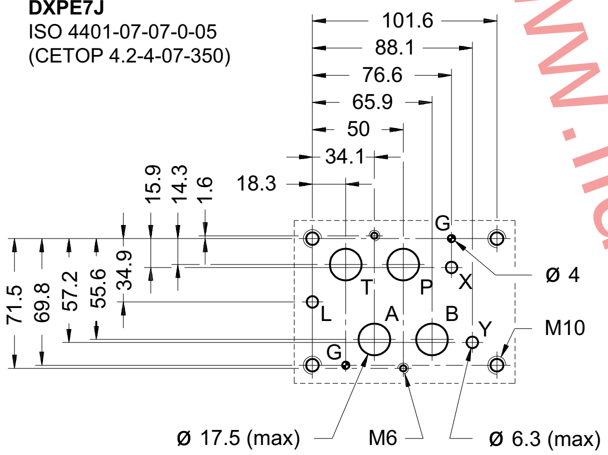
DXPE5J
CETOP 4.2-4 P05-350



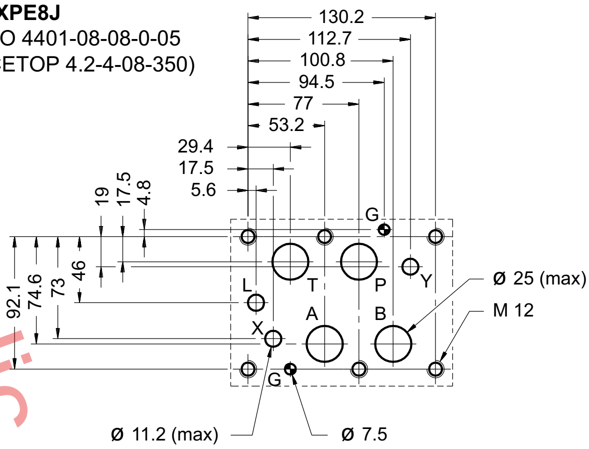
DXPE5RJ
ISO 4401-05-05-0-05
(CETOP 4.2-4 R05-350)



DXPE7J
ISO 4401-07-07-0-05
(CETOP 4.2-4-07-350)



DXPE8J
ISO 4401-08-08-0-05
(CETOP 4.2-4-08-350)



13 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

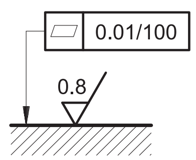
14 - INSTALLATION

The valves can be installed in any position without impairing correct operation.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

Take care to the cleanliness of the mounting surfaces and surrounding environment upon installation.

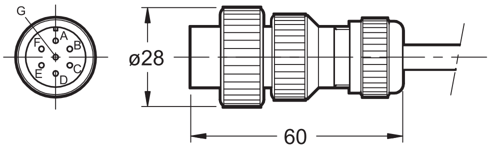
Surface finishing



15 - ACCESSORIES

(to be ordered separately)

15.1 Mating connector



These valves have a plug for 7-pin mating connector, that is placed on the box of the integral motion control.

So as to avoid electromagnetic troubles and comply with the electromagnetic compatibility regulation EMC, it is recommended the use of a metal connector.

If a plastic connector is used, make sure that the protection characteristics IP and EMC of the valve are guaranteed.

Duplomatic can provide a metal cable connector type MIL-C-5015-G (EN 175201-804).

name: **EX7S/L/10** code **3890000003**

15.2 - Connection cables size

Power supply:
- up to 20 m cable length : 1,0 mm²
- up to 40 m cable length : 1,5 mm²

Signal: 0,50 mm²

A suitable cable would have 7 isolated conductors, a separate screen for the signal wires and an overall screen.

15.3 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, see catalogue 89850.

16 - SUBPLATES

(see catalogue 51 000)

		DXPE5J	DXPE7J	DXPE8J
with rear ports		PME4-AI5G	PME07-AI6G	-
with side ports		PME4-AL5G	PME07-AL6G	PME5-AL8G
thread of ports:	P - T - A - B X - Y	3/4” BSP 1/4” BSP	1” BSP 1/4” BSP	1½” BSP 1/4” BSP

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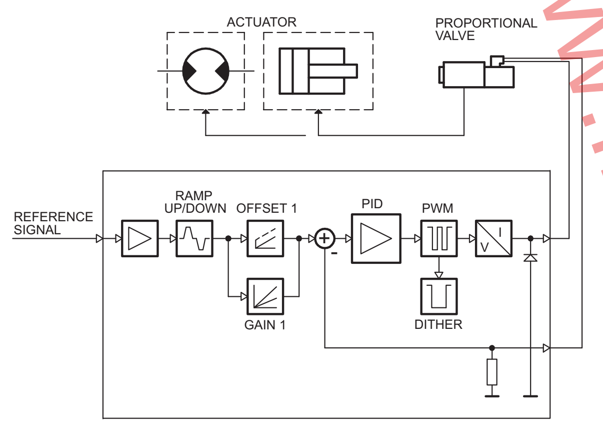
EDC-1

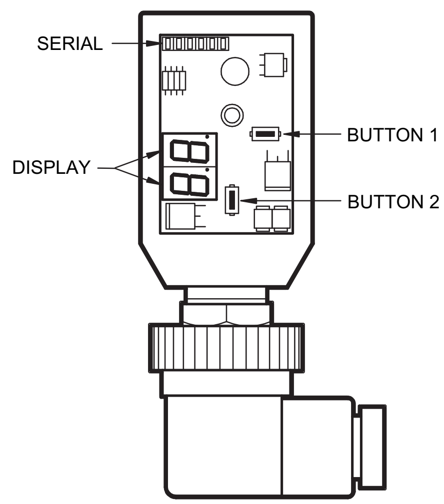
DIGITAL ELECTRONIC CONTROL UNIT FOR OPEN-LOOP SINGLE SOLENOID PROPORTIONAL VALVES

SERIES 10

PLUG VERSION

OPERATING PRINCIPLE





TECHNICAL CHARACTERISTICS

Power supply	V DC	10 ÷ 30 - ripple included
Required power	W	min 20 - max 40 (see paragraph 2.1)
Output current	mA	min 800 - max 2600 (see paragraph 1)
Power supply electrical protections		overload over 33V polarity inversion
Output electrical protections		short-circuit
Analogue electrical protections		up to 30 V DC
Available reference signals (selectable from the jumper)	0 ÷ 10V 0 ÷ 5V 4 ÷ 20 mA	input impedance 100 kΩ input impedance 100 kΩ input impedance max 500 Ω
Connector type		DIN 43650
Electromagnetic compatibility (EMC): - EMISSIONS CEI EN 61000-6-4 - IMMUNITY CEI EN 61000-6-2		according to 2004/108/CEE standards (see paragraph 5 - **NOTE 1**)
Protection to atmospheric agents (CEI EN 60529)		IP 65 - 67
Operating temperature range	°C	-20 / +70
Mass	kg	0,10

1 - IDENTIFICATION CODE

E	D	C	-	1			/	10	

Digital amplifier (E D)

DIN 43650 electric plug (C)

One channel version (1)

Maximum current (Imax):
1 = 860 mA
2 = 1200 mA
3 = 1600 mA
4 = 1880 mA
5 = 2600 mA

Switching frequency (PWM):
1 = 100 Hz
2 = 200 Hz
3 = 300 Hz
4 = 400 Hz
5 = 500 Hz

Series number (from 10 to 19 sizes and mounting dimensions are unchanged)

Reference signal:
E0 = voltage 0 / +10V (**standard**)
E1 = current 4 ÷ 20 mA
E2 = voltage 0 / +5V

The EDC-1 connector is a digital amplifier controlling open loop proportional valves. The unit supplies a variable current proportionally to the reference signal and independently of temperature variations or load impedance, with a resolution of 1% on 2600 mA (the full scale value).
The PWM stage on the solenoid power supply makes it possible to reduce the valve hysteresis thus optimising control precision. The connector is customizable with different maximum current sizes and switching frequencies (PWM), optimized according to the valve to be controlled.
Setting is possible by buttons and display inside the case, or with a notebook by RS232 with the software EDC-PC, (see par. 6.2)

2 - FUNCTIONAL SPECIFICATIONS

Electric power supply

The connector requires a power supply of 10 ÷ 30 V DC (terminals 1 and 2).

NOTE: The value of the power supply voltage on the connector must be higher than the rated working voltage of the solenoid to be controlled.

The power supply voltage must be rectified and filtered, with maximum admissible ripple within the above voltage range.

The power required by the connector depends on the power supply voltage and on the maximum value of the supplied current (it is determined by the card version). In general a conservative value of the required power can be considered as the product of V x I.

Example: a connector with a maximum current = 800 mA and a power supply voltage of 24 V DC requires a power of about 20W. In case of a card with a maximum current =1600 mA and a power supply voltage of 24 V DC the used power is equal to 38.5 W.

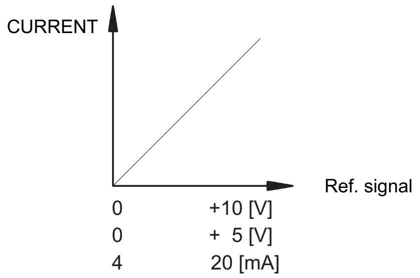
2.2 - Electrical protection

The connector is protected against overvoltage and polarity inversion.

On the output a protection against any short circuit is foreseen.

2.3 - Reference signal

The connector accepts voltage reference signals with 0 ÷ 10V and 0 ÷ 5V, in 4 ÷ 20 mA current, from an external generator (PLC, CNC) or external potentiometer.
See paragraph 7 for electric connections referring to the different connector versions.



3 - SIGNALS

3.1 - POWER ON (Power supply)

Display indicate the connector is ON and with +24V DC.

4 - ADJUSTMENTS

There are two way adjustments: variables view and parameters editing. The first one enables the real time monitoring of the control values, for both required and read current, on both channels. The second modality enables the operating parameters view and editing.

4.1 - Variables view

The card is switched on at the variables view modality, and it shows the first variable value, that is the U1 parameter (reference signal).
Pushing button (1) the current to solenoid is displayed. By means of (1) key, the different variables can be selected. Each time a variable is selected, its short name appears for approximately one second.
By briefly pressing the keys, the current variable name appears for approximately one second.

The variables that can be selected are:

U1: Reference signal:
0 + 10V
0 + 5V
4 ÷ 20mA (displayed as 2 ÷ 10)

C1: current required according to the applied reference signal, expressed in ampere, ranging between 0 and 2.6 A

All the mentioned parameters can be viewed on the two digits display, located on the connector front panel.
The selected value has to be read as follows (example for EDC-15*/10E* card):

REFERENCE (V)	REFERENCE (mA)	DISPLAY U1 (V)		DISPLAY C1 (Ampere)
0	4	0.0	2.0	40 (mA)
5	12	5.0	6.0	13 (A)
10	20	10.	10.	26 (A)

4.2 - PARAMETERS EDITING

To access the parameter editing, press the key (2) for at least 3 seconds.
The first parameter displayed is G1. To modify it, press the key (1) for two seconds, until the display starts blinking. Use the key (2) to increase the value and the key (1) to decrease it. To save the new value, press both the keys. The display stops blinking.
Pressing the key (2) again is possible to scroll all the parameters. To modify some parameters, repeat the steps above-mentioned for the G1 parameter.

The parameters that can be selected are:

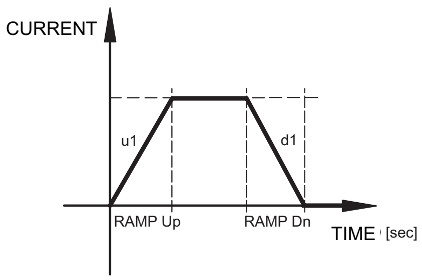
G1: "I Max" current, expressed in milliampere.
It sets the maximum current to the solenoid, when the reference signal is at the maximum value of +10 V (or 20 mA). It is used to limit the maximum value of the hydraulic size controlled by the valve.
Default value = Imax
Range = 50 ÷ 100% of Imax

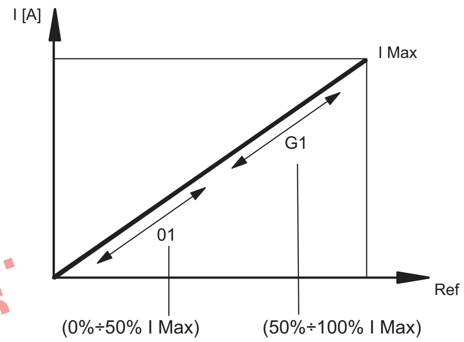
o1: "I Min" current, expressed in milliampere.
It sets the offset current to the solenoid, when the reference signal exceeds the limit of 0,1 V (or 0,1 mA). It is used to null the insensitiveness area of the valve (dead band).
Default value = 0%
Range = 0 ÷ 50% of Imax

u1: "Ramp Up" increasing ramp time, expressed in seconds.
It sets the current increasing time, for a variation from 0 to 100% of the input reference.
It is used to slow down the valve response time in the case of a sudden variation of the reference signal.
Default value = 00 sec.
Range = 00 ÷ 50 sec.

d1: "Ramp Dn" decreasing ramp time, expressed in seconds.
It sets the current decreasing time, for a variation from 100% to 0 of the input reference. It is used to slow down the valve response time in the case of a sudden variation of the reference signal.
Default value = 00 sec.
Range = 00÷ 50 sec.

Fr: PWM frequency, in Hertz.
It sets the PWM frequency, which is the pulsating frequency of the control current. The PWM decrease improves the valve accuracy, decreasing the regulation stability. The PWM increase improves the regulation stability, causing a higher hysteresis.
Default value = PWM (according to version card)
Range = 50 ÷ 500Hz





4.3 - ERROR SIGNAL

EE: breakdown cable error on 4 ÷ 20 mA signal (threshold 3 mA).
Reset the alarm turning off the +24 V DC cable.

5 - INSTALLATION

The connector type electronic unit is suitable for direct assembly on the solenoid of the relative proportional valve. The 4-core connection cable (0,5 mm² individual wire section) is supplied pre-wired and in a standard length of 2.5 m (DIN 47100 standard).

NOTE 1
To observe EMC requirements it's important that the control unit electrical connection is in compliance with the wiring diagram of chapter 7. As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electrical motors, inverters and electrical switches).

In environments where there are critical electromagnetic interferences, a complete protection of the connection wires can be requested.

6 - START UP, CONTROL SETTINGS AND SIGNAL MEASUREMENT

6.1 - Set up

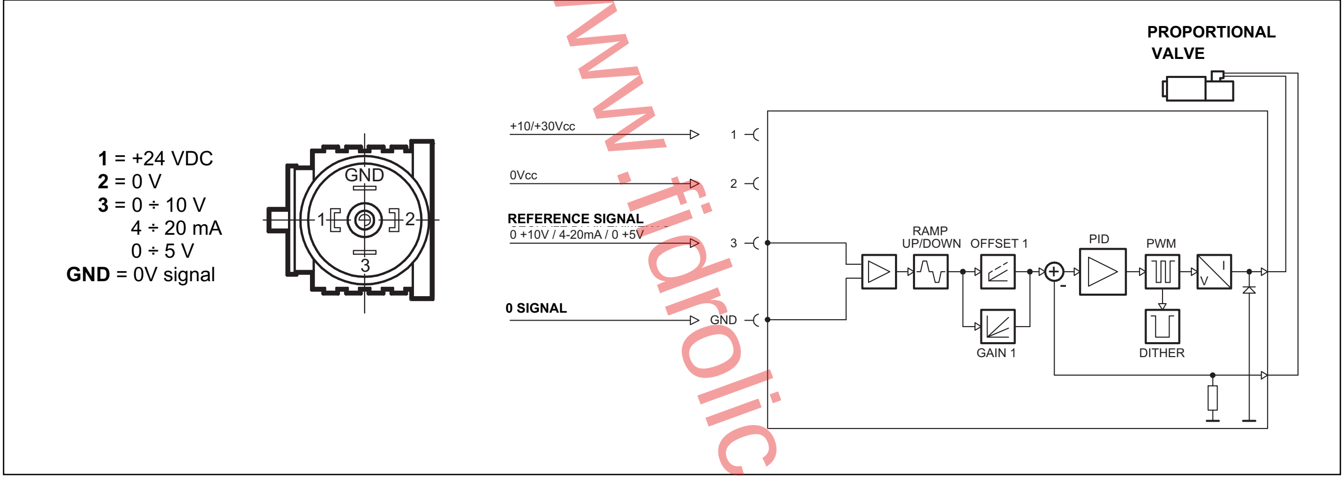
Settings can be changed by either acting on the (1) and (2) keys located on the card front panel, or using the EDC-PC hardware and software kit.

6.2 - EDC-PC Software

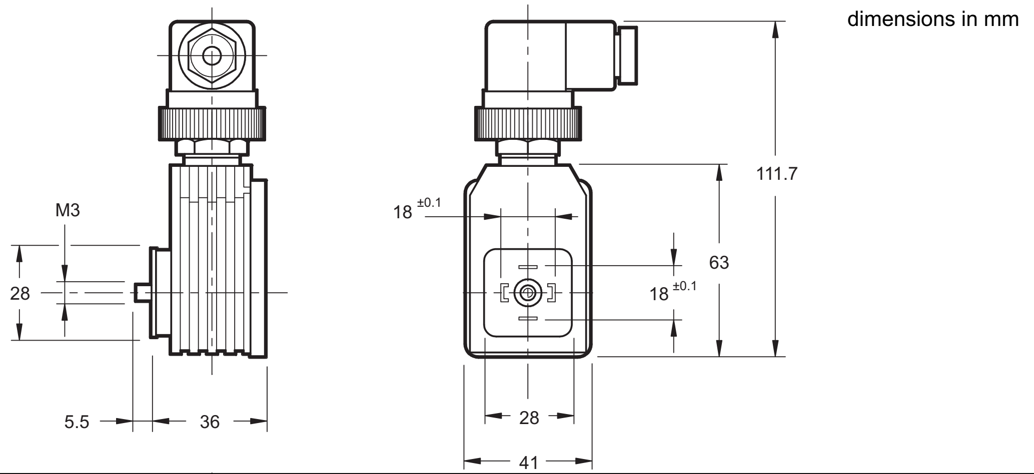
The relevant hardware and software kit (to be ordered separately) allows to read the values and to set the connector easily.

The software communicates, through a flat cable, to the relevant connector placed in the EDC-1 panel, behind the protecting gate. The EDC-PC software compatibility is guaranteed only on Windows 2000 and Windows XP operating systems.

7 - WIRING DIAGRAM



8 - OVERALL AND MOUNTING DIMENSIONS



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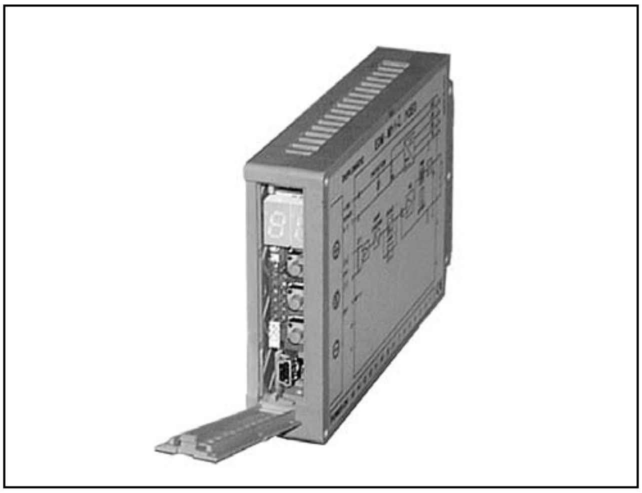


EDM-M*

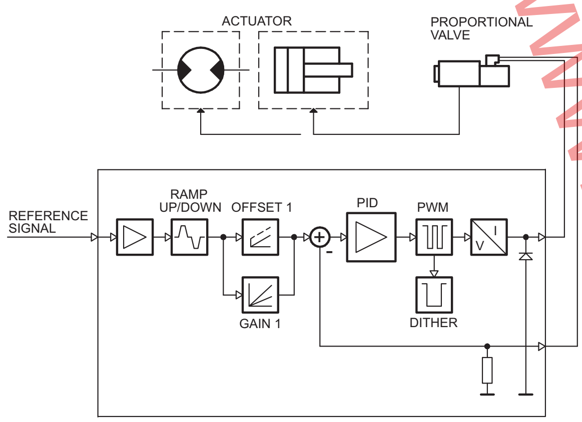
DIGITAL AMPLIFIER FOR OPEN LOOP PROPORTIONAL VALVES

SERIES 20

EDM-M1 single solenoid
EDM-M2 double solenoid
EDM-M3 two single solenoids independent channels

RAIL MOUNTING TYPE: DIN EN 50022

OPERATING PRINCIPLE



The EDM-M* card is a digital amplifier for open loop proportional valves control. It is designed for rail mounting type: DIN EN 50022.

The unit supplies a variable current in proportion to the reference signal and independently of temperature variations or load impedance.

The PWM stage on the solenoid power supply allows the reduction of the valve hysteresis, thus optimising control precision. The unit is available in three main versions, to control single solenoid valves (M1), double solenoid valves (M2) and valves with two independent channels controlling two single solenoid valves (M3). Each version is available with different maximum current settings and switching frequencies (PWM), optimised according to the relevant valve.

The parameters adjustment is carried out either through keyboard and display, placed on the front panel, or with a notebook, via RS232 or via USB converter (EDMPC/20 software).

TECHNICAL CHARACTERISTICS

Power supply	V DC	10 ÷ 30 ripple included
Required power	W	min 20 - max 40 (see paragraph 3.1)
Output current	mA	min 800 - max 2600 (see paragraph 1)
Power supply electrical protections		over load over 33V polarity inversion
Output electrical protections		short-circuit
Analogue electrical protections		up to 30V DC due to incorrect power supply connection
Available reference signals	0 ÷ 10V ±10V 4 ÷ 20 mA	input impedance 10-100 kΩ input impedance 10-100 kΩ input impedance max 500 Ω
Additional output ports		±10V DC to supply 50 + 50 mA to external potentiometer
Electromagnetic compatibility (EMC)		according to 2004/108/CE standards (see paragraph 6 - **NOTE 1**)
Housing material		thermoplastic polyamide
Housing dimensions	mm	120 x 93 x 23
Connector		Plug-in terminal block with tightening screws: 15 poles
Operating temperature range	°C	-20 / +70
Mass	kg	0,15

1 - IDENTIFICATION CODE

E	D	M	-	M					/	20	

Digital amplifier for rail mounting DIN EN 50022

for open loop

Versions:
1 = for single solenoid proportional valves
2 = for double solenoid proportional valves
3 = 2 channels for an independent control of two single solenoid valves

Max current (I Max):
(first channel for EDM - M3 version)
1 = 860 mA
2 = 1200 mA
3 = 1600 mA
4 = 1880 mA
5 = 2600 mA

Only for EDM-M3 version, omit for other versions
Max current (I Max) second channel:
1 = 860 mA
2 = 1200 mA
3 = 1600 mA
4 = 1880 mA

Switching frequency (PWM):
1 = 100 Hz
2 = 200 Hz
3 = 300 Hz
4 = 400 Hz

Series N. (from 20 to 29 sizes and mounting dimensions remain unchanged)

Reference signal:
E0 = voltage 0 ÷ ±10V (standard)
E1 = current 4 ÷ 20 mA

2 - EDM-M, DUPLOMATIC VALVES AND DEFAULT SETTINGS

The card is preset at factory. The following table shows the default settings for the standard EDM versions and the Duplomatic valve to be coupled to. As shown at par. 1 different settings are possible. Apply for them at our Technical Dept.

CARDS FOR 24V VALVES

CARD					COUPLING VALVES (you can find the matches between valves names and catalogue numbers in the group 8 index)		
Name	**I Min** [mA]	**I Max** [mA]	**I Lim** [mA]	**PWM** [Hz]	**Name**	**single coil**	**double coil**
EDM-M111	200	860	1350	100	DSPE*, RPCED1, RPCED1-T3, RPCE2, RPCE3, BLS6, ZDE3, QDE3	▪	
EDM-M112	200	860	1350	200	DSE3, CRE, PRE*, PRE3, PRED3, MZE, DZCE*	▪	
EDM-M131	200	1600	2350	100	DSE5, QDE5	▪	
EDM-M211	200	860	1350	100	DSPE*, ZDE3, BLS6		▪
EDM-M212	200	860	1350	200	DSE3		▪
EDM-M231	200	1600	2350	100	DSE5		▪
EDM-M3312	200 200	1600 860	2350 1350	200	VPPM-*PQCE regulator	▪ ▪	

CARDS FOR 12V VALVES

CARD					COUPLING VALVES (you can find the matches between valves names and catalogue numbers in the group 8 index)		
Name	**I Min** [mA]	**I Max** [mA]	**I Lim (#)** [mA]	**PWM** [Hz]	**Name**	**single coil**	**double coil**
EDM-M141	300	1880	2700	100	DSPE*, BLS6	▪	
EDM-M142	300	1880	2700	200	DSE3, CRE, PRE*, PRE3, PRED3, MZE, DZCE*, ZDE3, QDE3	▪	
EDM-M151	500	2600	4000	100	DSE5, QDE5	▪	
EDM-M241	300	1880	2700	100	DSPE*, BLS6		▪
EDM-M242	300	1880	2700	200	DSE3, ZDE3		▪
EDM-M251	500	2600	4000	100	DSE5		▪

I Lim: Max output current from the card.

3 - FUNCTIONAL SPECIFICATIONS

3.1 - Power supply

The card requires a power supply of between 10 and 30V DC ripple included (terminals 1 and 2).

NOTE: The value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoid to be controlled.

The power supply voltage must be rectified and filtered, with maximum admissible ripple within the above voltage range.
The power required by the card depends on the power supply voltage and on the maximum value of the supplied current (it is determined by the card version).
In general a conservative value of the required power can be considered as the product of V x I.
Example: a card with a maximum current = 860 mA and a power supply voltage of 24V DC requires a power of about 20W. With a card with a maximum current =1600 mA and a power supply voltage of 24V DC, the used power is equal to 38,5W.

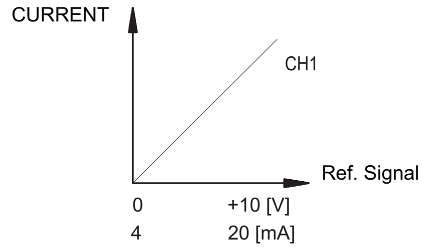
3.2 - Electrical protections

The card is protected against overvoltage and polarity inversion.
On the output a protection against any short circuit is foreseen.

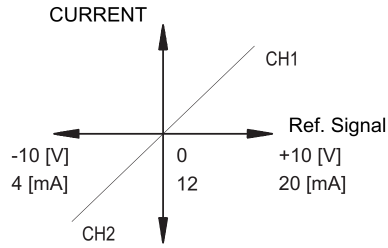
3.3 - Reference signal

The card accepts voltage reference signals 0 ÷ 10 V and ± 10 V, current reference signal 4 ÷ 20 mA, coming from an external generator (PLC, CNC) or from an external potentiometer powered by the card itself. The reference value depends on the card version as stated in the diagrams along side.
See paragraph 12 for the electric connections referring to the different card versions.

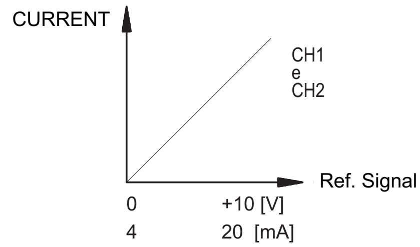
EDM-M1 VERSION



EDM-M2 VERSION



EDM-M3 VERSION



4 - SIGNALS

4.1 - Power ON (Power supply)

The two red displays indicates the card power supply:
ON - normal power supply
OFF - no power supply
FLASHING - see table at paragraph 12.

4.2 - Card ok output

The state of the card can be checked by means of the output “card ok OUTPUT”, located on pin 9 (referred to zero power supply, pin 15) with load resistance of 220 KΩ and max current 100 mA . When the card works normally, on this pin there is the same voltage as the power supply; when there is an anomaly, the output voltage is zero.

The anomalies could be:

- low voltage (lower than 10V)
- short circuit
- unconnected coil

If the output pin 9 is low, the control logic forbids the power outputs towards the solenoids. When the anomaly is settled, the card resets automatically.

5 - ADJUSTMENTS

There are two adjustments modalities: variables view and parameters editing. The first one enables the real time monitoring of the control values, for both the required and the read current, on both channels. The second modality enables the operating parameters view and editing.

5.1 - Variables view

The card is switched on at the variables view modality, and it shows the first variable value, that is the reference signal to channel 1.
By means of (+) and (-) keys, the different variables can be selected. Each time a variable is selected, its short name appears for approximately one second.
By briefly pressing the (E) key, the current variable name appears for approximately one second.

The variables that can be selected are:

U1:	Reference signal to channel 1:	
	0 + 9,9 V 4 ÷ 20 mA	for single solenoid
	- 9,9 / 0 / +9,9 V 4 / 12 / 20 mA	for double solenoid

C1: current required for channel 1, according to the applied reference signal, expressed in ampere, ranging between 0 and 3.0 A

E1: current actually supplied by channel 1, expressed in ampere, ranging between 0 and 3.0 A

U2: Reference signal to channel 2:

0 + 9,9 V 4 ÷ 20 mA	for single solenoid
- 9,9 / 0 / +9,9 V 4 / 12 / 20 mA	for double solenoid

C2: current required for channel 2, according to the applied reference signal, expressed in ampere, ranging between 0 and 3.0 A

E2: current actually supplied by channel 1, expressed in ampere, ranging between 0 and 3.0 A

Only the variables of channel 1 (U1, C1 ed E1) will be viewed, if the card is set for a single solenoid valve.

All the mentioned parameters can be viewed on the display located on the card front panel. It is a two digits display.
The selected value has to be read as follows (example for EDM-M15*/20E* card):

REFERENCE (V)	(mA)	VAR. U1 (V)	VAR. C1/E1	VAR. U2 (V)	VAR. C2/E2
+10	20	10.	18. (A)		
+5	16	5.0	1.0 (A)		
0	12	00	40.(mA)		
0	12			0.0	40.(mA)
-5	8			5.0	1.0 (A)
-10	4			10.	1.8 (A)

5.2 - Parameters editing

By pressing the (-) key for longer than 1,5 seconds, it is possible to switch from the variables view modality to the parameters editing modality, and vice versa.
In the parameters editing modality, the different parameters can be selected, as in the previous modality, by briefly pressing (+) and (-) keys. Each time a parameter is selected, its short name appears for approximately one second.
By briefly pressing the (E) key, the current parameter name appears for approximately one second.

By pressing the (E) key for longer than 1,5 seconds, the parameters name flashes for approximately one second: by means of (+) and (-) keys, the parameter value can be edited. Each time one of these keys is pressed, the value is either increased or decreased of one unit; by holding the key pressed, the value is continuously increased.
Once the desired value is edited, exit by pressing the (E) key. The value is recorded in the EEPROM, the (+) and (-) keys resume their parameters selection function.
Once the parametrization cycle is completed, by pressing the (+) key more than 2 seconds and until displays blinking, all parameters are saved in EEPROM and the visualization goes back to variables view modality.

The parameters that can be selected are:

G1: "I Max" current, expressed in milliampere.
It sets the maximum current to the solenoid of channel 1, when the reference signal is at the maximum value of +10 V (or 20 mA). It is used to limit the maximum value of the hydraulic size controlled by the valve.
Default value = see paragraph 2

o1: "I Min" current, expressed in milliampere.
It sets the offset current to the solenoid of channel 1, when the reference signal exceeds the limit of 0,1 V (or 0,1 mA). It is used to null the insensitiveness area of the valve (dead band).
Default value = see paragraph 2
Range = 0 ÷ 50% of I Max

r1 "Max Ramp" - Ramp time, expressed in seconds.
It sets the time it takes to the current supplied by channel 1 to go from zero to the maximum value, in the case of a reference signal variation from zero to 100% and vice versa. It is used to slow down the valve response time in the case of a sudden variation of the reference signal.
Default value = see paragraph 2
Range = 00 ÷ 20 sec.

u1: "Ramp Up" increasing time, expressed in % of the r1 ramp time. It sets the current increasing time on channel 1, for a variation from 0 to 100% of the input reference.
Default value = 99%
Range = 00 ÷ 99%

d1: "Ramp Dn" - decreasing time, expressed in % of the ramp time. It sets the current decreasing time on channel 1, for a variation from 100% to 0 of the input reference.
Default value = 99%
Range = 00 ÷ 99%

G2: "I Max" - current, expressed in milliampere.
It sets the maximum current to the solenoid of channel 2, when the reference signal is at the maximum value.
Default time = see paragraph 2

o2: "I Min" - current, expressed in milliampere.
It sets the offset current to the solenoid of channel 2.
Default value = see paragraph 2
Range = 0 ÷ 50% of Imax

r2: "Max Ramp" - Ramp time, expressed in seconds.
It sets the time it takes to the current supplied by channel 1 to go from zero to the max value, in the case of a reference signal variation from zero to 100% and vice versa. It is used to slow down the valve response time in the case of a sudden variation of the reference signal.
Default value = see paragraph 2
Range = 00 ÷ 20 sec.

u2: "Ramp Up" increasing time, expressed in % of the r2 ramp time. It sets the current increasing time on channel 2, for a variation from 0 to 100% of the input reference.
Default value = 99%
Range = 00 ÷ 99%

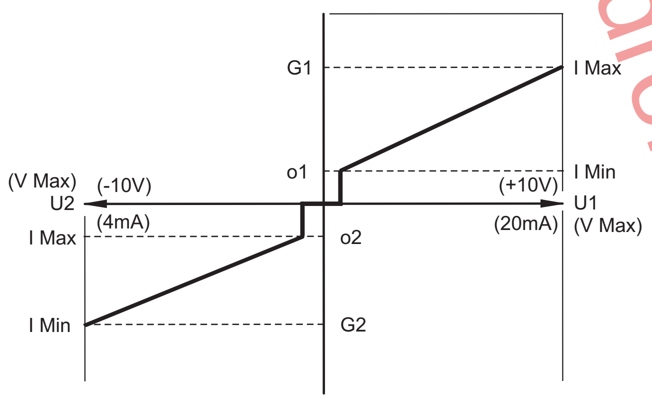
d2: "Ramp Dn" decreasing time, expressed in % of the r2 ramp time. It sets the current decreasing time on channel 2, for a variation from 100% to 0 of the input reference.
Default value = 99%
Range = 00 ÷ 99%

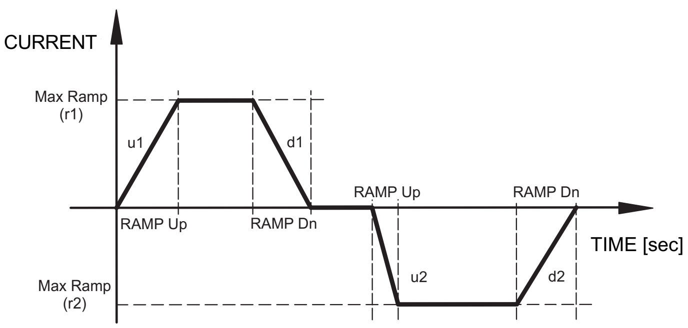
Fr: "PWM Freq" - PWM expressed in Hertz.
It sets the PWM frequency, which is the pulsating frequency of the control current. The PWM decrease improves the valve accuracy, decreasing the regulation stability. The PWM increase improves the regulation stability, causing a higher hysteresis.
Default value = PWM (according to card version)
Range = 50 ÷ 400Hz

U1 and **U2**: They represent the set point full scale.
By means of this parameter (that is modifiable only via software) it is possible to keep the same resolution, even if the set point is lower than 10V.
Example: with a card EDM-M121 with command 10V and with parameter set as standard, the output current charge is 1200 mA. If "U" is set with a value of 500, the output current charge will be 600 mA.

If the card is set for a single solenoid valve, only the channel 1 parameters will be viewed.

Parameters that can be modified in EDM-M2 version





6 - INSTALLATION

The card is designed for rail mounting type DIN EN 50022.
The wiring connections are on the terminal strip located on the bottom of the electronic control unit.
It is recommended to use cable sections of 0.75 mm^2, up to 20 m length and of 1.00 mm^2 up to 40m length, for power supply and solenoid connections. For other connections it is recommended to use cables with a screened sheath connected to earth only on the card side.

NOTE 1
To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram of paragraphs 8 - 9 - 10 and 11 of this catalogue.
As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).
In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

7 - CONTROL SETTINGS AND SIGNAL MEASUREMENT

7.1 - Setting device

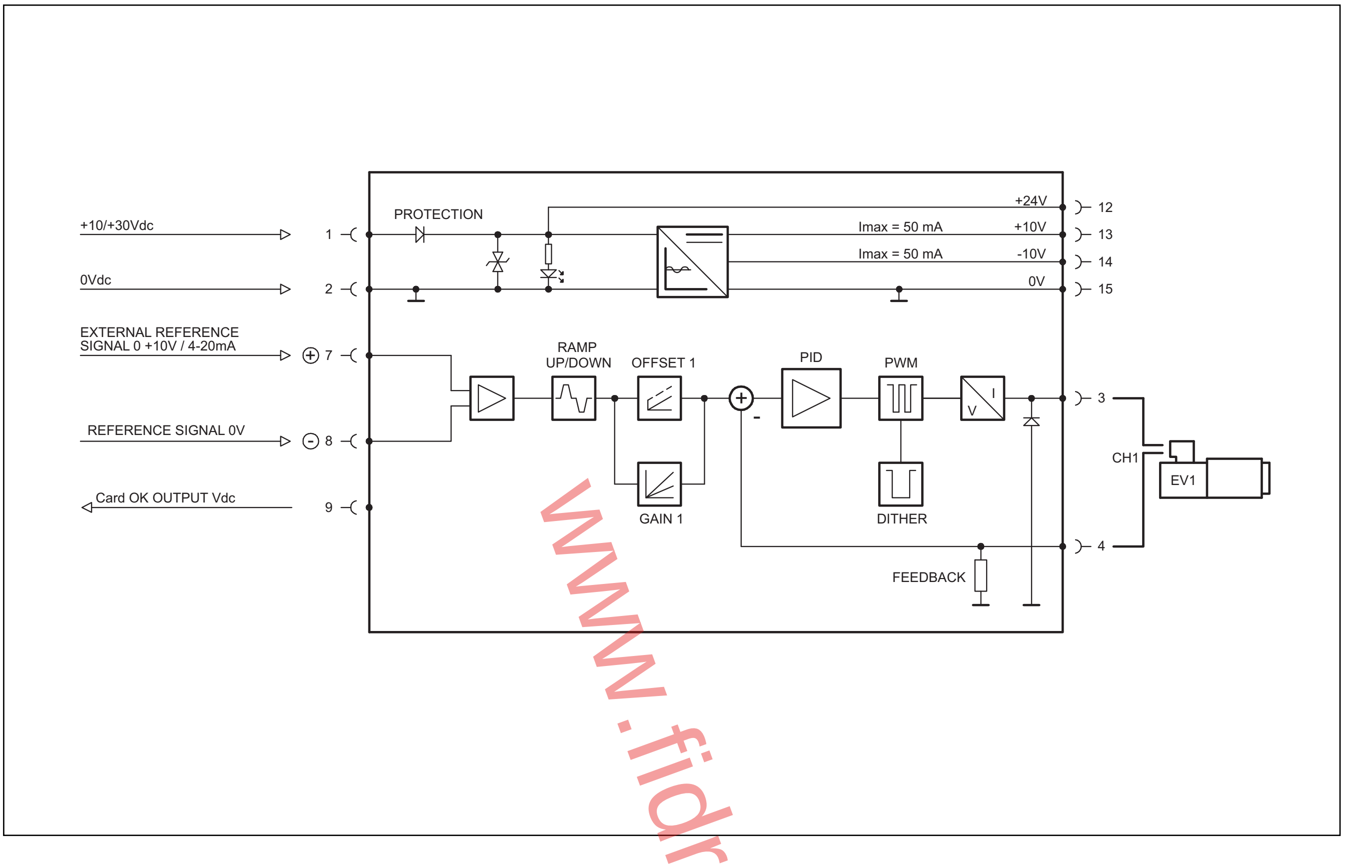
Settings can be changed by either acting on the (+) (E) (-) keys located on the card front panel, or by means of the EDMPC/20 hardware and software kit.

7.2 - EDMPC/20 hardware and software kit (code 3898201010)

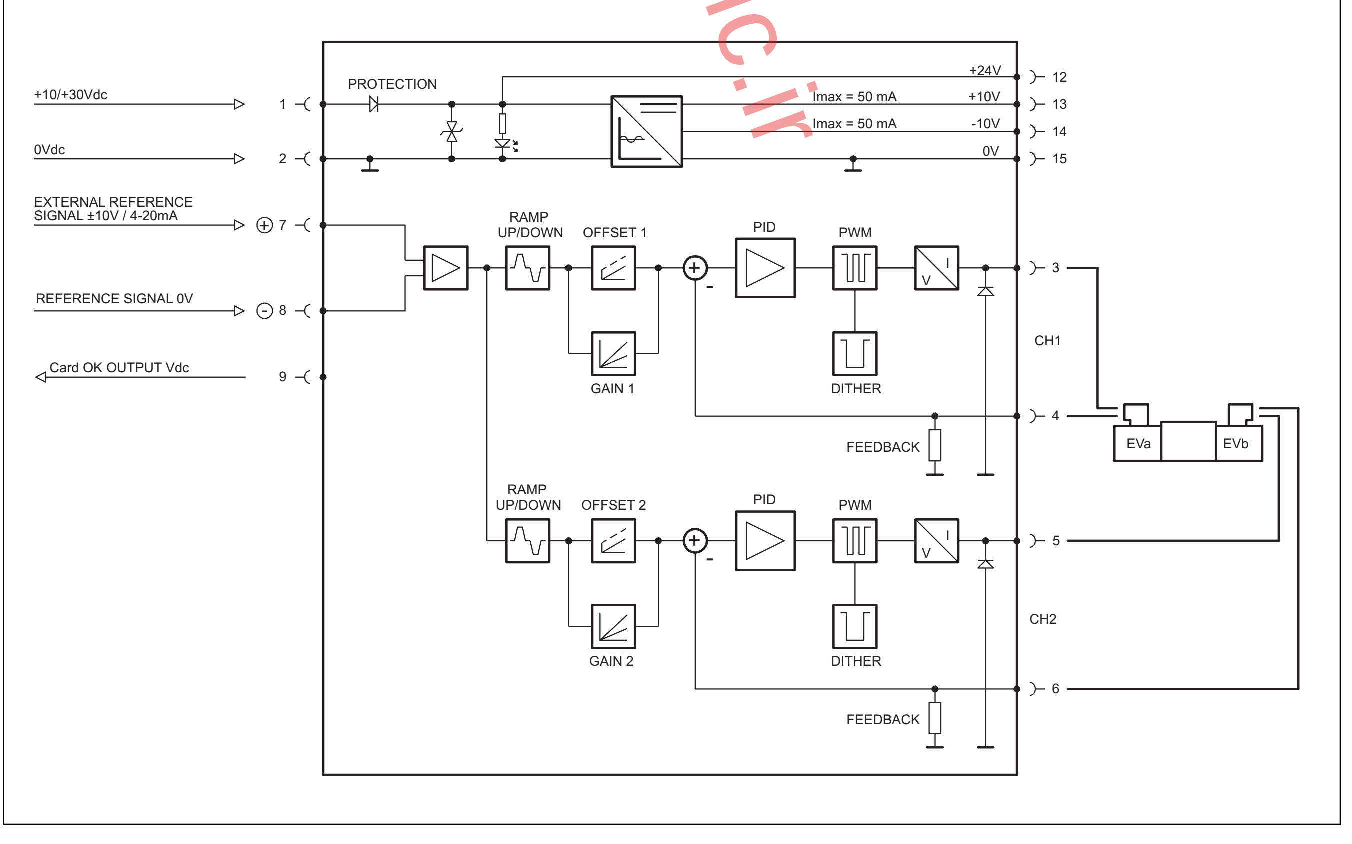
The relevant hardware and software kit (to be ordered separately) enables the signals measurement and the card operations.
The software communicates, through a flat cable, to the relevant mini USB connector on the EDM card front panel, behind the protecting gate.
The supply includes:
- a communication cable (L=1 meter) for connecting the EDM card to the PC RS232 port;
- a converter from RS232 to USB.

The EDM-PC software compatibility is guaranteed only on Windows 2000 and Windows XP operating systems.

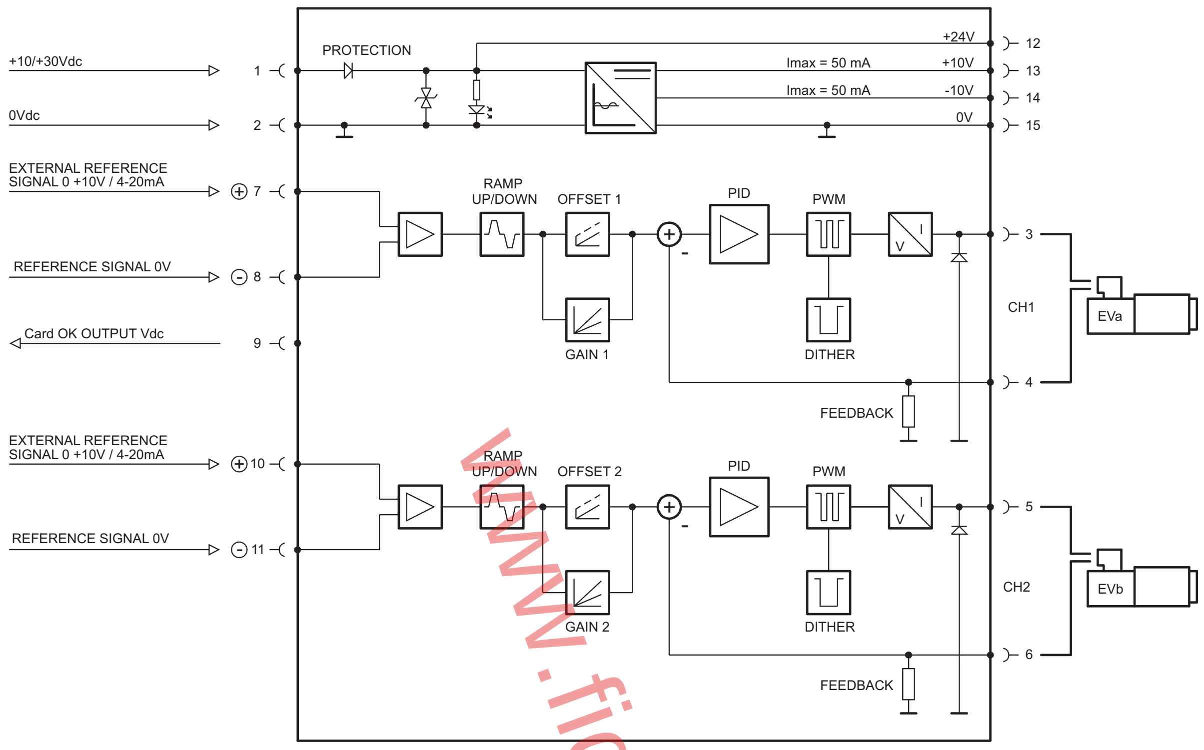
8 - EDM-M1 CARD CIRCUIT AND WIRING DIAGRAM



9 - EDM-M2 CARD CIRCUIT AND WIRING DIAGRAM

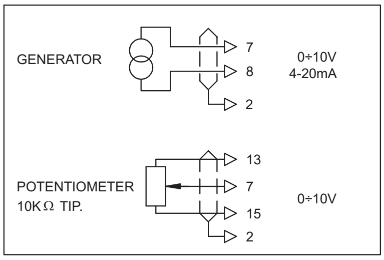


10 - EDM-M3 CARD CIRCUIT AND WIRING DIAGRAM

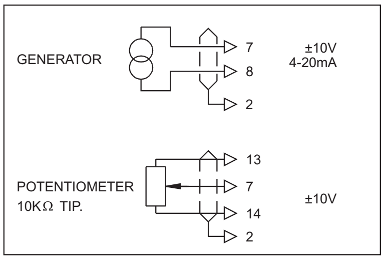


11 - WIRING DIAGRAM FOR REFERENCE SIGNAL

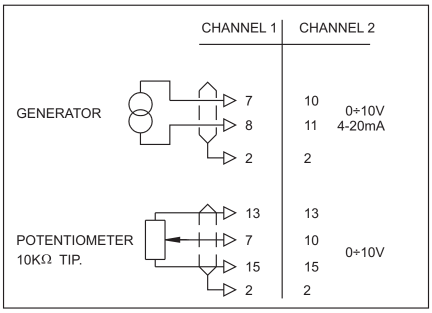
EDM-M1



EDM-M2

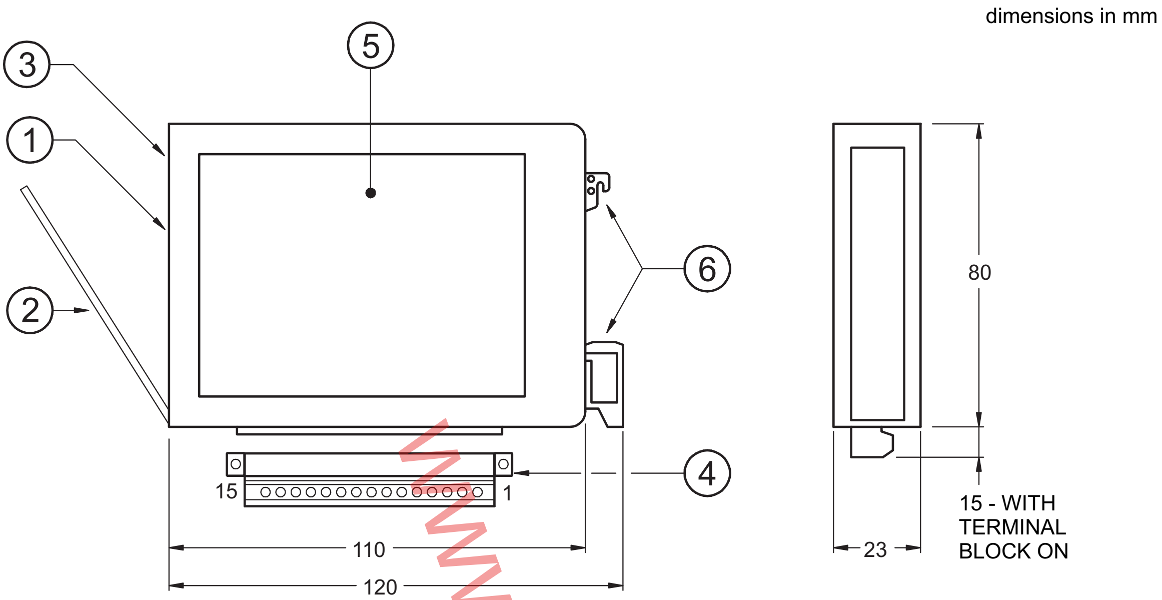


EDM-M3

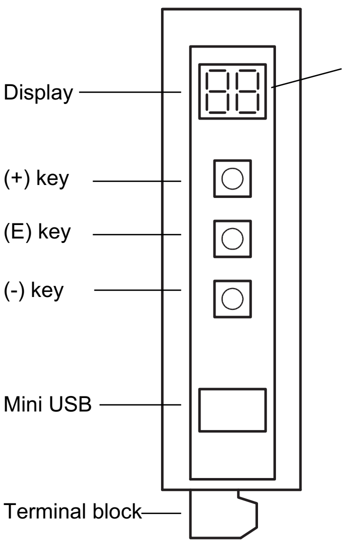


NOTE: the pin 8 (and 11 for EDM-M3 version) must be connected to pin 15 (0V), when the potentiometer is used as reference signal. This is recommended also when the generator has a pure differential output (not connected to ground).

12 - OVERALL AND MOUNTING DIMENSIONS



FRONT PANEL



DISPLAYED CODE:

A1 current lower than 3,5 mA on input 1

A2 current lower than 3,5 mA on input 2

A3 output 1 in short circuit

A4 output 2 in short circuit

A5 output 1 solenoid disconnected

A6 output 2 solenoid disconnected

A7 power supply voltage lower than 10V

NOTE: the displayed code is eliminated removing the cause.

1	Display and mini USB side
2	Buttons protecting gate
3	Display - for card power supply and faults displaying
4	Plug-in 15-pole terminal strip with downwards cables output and fastening bolts
5	Screen printing with card circuit and wiring diagram
6	Connection for rails DIN EN 50022

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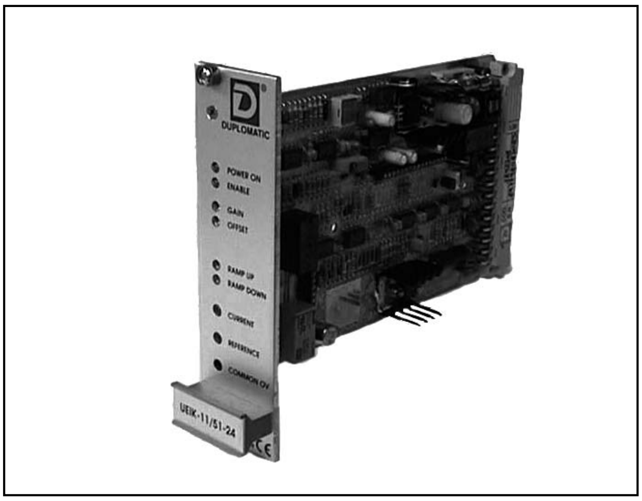
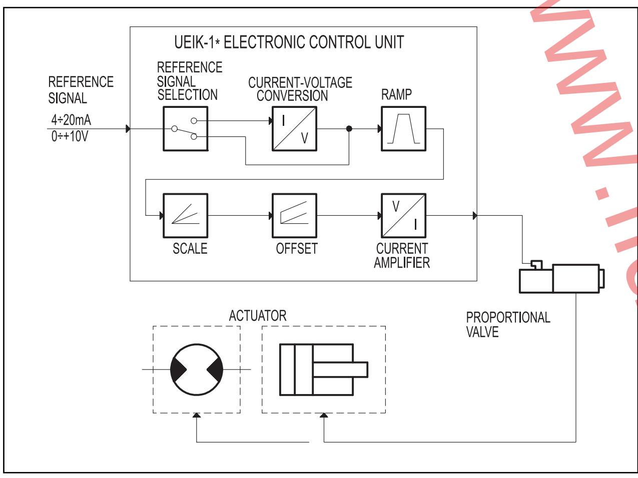


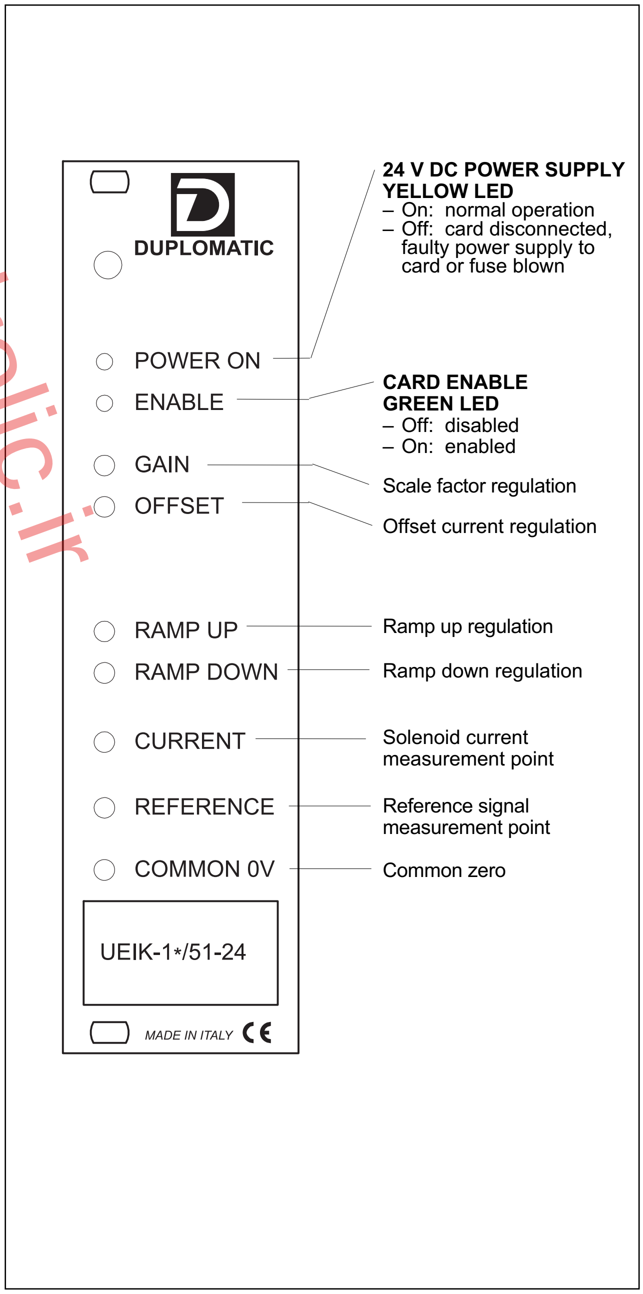
UEIK-1*
ELECTRONIC CONTROL UNIT FOR OPEN LOOP SINGLE SOLENOID PROPORTIONAL VALVE
SERIES 51

EUROCARD TYPE

FUNCTIONAL BLOCK DIAGRAM



FRONT PANEL



TECHNICAL CHARACTERISTICS

Power supply	V DC	22 ÷ 30 Ripple included
Required power	See par. 2.1	
Output current	See par. 3.3	
Power supply electrical protection	– overload – polarity inversion	
Reference signal: – Voltage – Current	 V mA	 0 / +10 4 ÷ 20
Input reference signal impedance: – Voltage – Current	 kΩ Ω	 10 250
Electromagnetic compatibility (EMC) (see par. 5 - **NOTE** 1)		in compliance with 2004/108/CE
Card size	Eurocard 100x160x35	
Connector interface	DIN 41612-D 32 Male	
Operating temperature range	°C	0 ÷ 50
Mass	kg	0,20

1 - IDENTIFICATION CODE

U	E	I	K	-	1		/	51	-	24

Eurocard type electronic control unit

For open loop single solenoid proportional valves

Maximum current: **1** = 800 mA **2** = 1.200 mA

Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged)

Power supply voltage = 24 V DC

The UEIK-1* card is an electronic control unit Eurocard type for open loop single solenoid proportional valves.

The unit supplies a variable current in proportion to the reference signal and independently of temperature variations or load impedance.

The PWM stage on the solenoid power supply makes it possible to reduce valve hysteresis thus optimising control precision. The front panel is fitted with LEDs to indicate card functions and potentiometers to optimize control.

2 - FUNCTIONAL SPECIFICATIONS

2.1 - Electric power supply

The card requires a power supply of between 22 and 30 V DC (pin 2a/2c - 4a/4c) and a power of: 20W (UEIK-11) - 29W (UEIK-12). Power supply voltage must be rectified and filtered, with maximum admissible ripple within the above voltage range.

2.2 - Electrical protection

The card is protected against overvoltage and polarity inversion.
A 2A fast-acting fuse is fitted for power circuit protection.

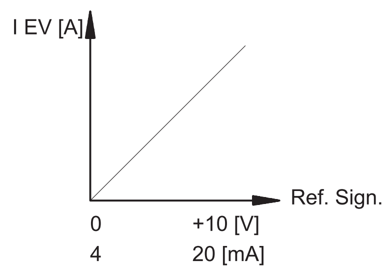
2.3 - Reference signal

The card accepts voltage reference signals (0 to +10V) or current reference signals (4÷20 mA).

N.B: If the signal is transmitted by potentiometer, please verify that this has a load of at least 200 Ω.

See para. 9 for electrical connections.

The diagram shows characteristics of current supplied according to the reference signal.



3 - SIGNALS AND ADJUSTMENT

3.1 - POWER ON

The green LED indicates card power supply:
ON - normal power supply
OFF - no power supply, faulty power supply or blown fuse

3.2 - ENABLE

A 22 to 30 V DC enable command on pin 24c is required for card operation.
The condition of the card enable is shown by both a visible LED on the front panel and as a contact available for the user on pins 6a and 6c.

The green LED indicates:
ON - card enabled
OFF - card disabled or failed

3.3 - GAIN (Scale factor regulation)

The "GAIN" potentiometer enables regulation of the relation between the set reference value and maximum current supplied to the solenoid and therefore the hydraulic parameter controlled by the valve.

The maximum current of the card is limited to 1,0A (UEIK-11) - 1,2A (UEIK-12). See par. 6 for default values.

Rotate clockwise to increase current.

3.4 - OFFSET (Offset current regulation)

The "OFFSET" potentiometer enables regulation of the offset current of the valve. It is used to eliminate the insensitivity zone (dead zone) of the valve.
The regulation field is from 0 to 0,5A (UEIK-11) - from 0 to 0,65A (UEIK-12).

The offset current is activated when the reference signal exceeds the threshold of + 150 mV (or 4,25 mA).
The offset is not active and only the polarization current equal to 25 mA is present beneath this threshold.

NOTE: The variation of the set value of the offset current causes a corresponding variation of the scale factor value.

Rotate clockwise to increase current.

3.5 - RAMP UP / RAMP DOWN (Ramp regulation)

"RAMP UP" and "RAMP DOWN" potentiometers, in a range from 0,03 to 7 sec., regulates the time required to reach the supplied current according to a step change of the reference signal up or down.

It is possible, in this way, to control the valve response time, adjusting it to the requirements of the hydraulic circuit and the machine cycle.

Ramps can be inhibited by transmitting a 22 to 30 V DC exclusion command to pin 16a. In this case, the ramp residual time is 10 ms.

Rotate clockwise to increase ramp time.

4 - SIGNAL MEASUREMENT

4.1 - CURRENT (Solenoid current measurement point)

Enables voltage reading of current supplied to the solenoid.
Reading conversion: 1V DC = 1A (UEIK-11)
0,82V DC = 1A (UEIK-12).

4.2 - REFERENCE (Reference signal measurement point)

Enables reading in voltage of reference signal sent to the card. Reading is direct, but of opposite sign, with voltage reference while current conversion is: 4 mA = 0 V   20 mA = - 10V.

5 - INSTALLATION

The card is suitable for assembly on a rack or a card holder with interface for connector types DIN 41612 - size D - 32 pole.

It is recommended to use cable sections of 1 to 2,5 mm^2, depending on their length, for power supply and solenoid connections. For other connections it is recommended to use cables with a screened sheath connected to earth only on the card side.

NOTE 1: To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram of par. 9.
As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

6 - DEFAULT CONDITIONS

The electronic unit is supplied factory set.
The setting conditions are:

– "GAIN" regulation: +10V (or 20 mA) reference signal corresponding to a current supply of 0,7 A to the solenoid.
– "OFFSET" regulation: zero
– "RAMP UP" and "RAMP DOWN" regulation: minimum
– position SW1 on V
– position SW2 on S
– position SW3 on AA
– switching frequency (PWM) = 200Hz (UEIK-11)
100Hz (UEIK-12).

7 - START-UP AND CONTROL SETTINGS

If required, it is possible to change the settings as follows:

a) OFFSET CURRENT ADJUSTMENT

– Set "GAIN" potentiometer to minimum.
– Enter reference signal at maximum value (+10V or 20 mA).
– Set the "OFFSET" potentiometer so that the valve is positioned at the start of the work zone.

b) SCALE FACTOR ADJUSTMENT

– Enter the reference signal at maximum value (+10V or 20 mA).
– Set "GAIN" potentiometer so that the controlled hydraulic parameter reaches the maximum required value.

NOTE: The maximum current value must be compatible with the maximum current prescribed by the technical table of the connected proportional valve.

c) RAMP REGULATION

– Regulate the "RAMP UP" and "RAMP DOWN" potentiometers to obtain gradual valve operation required with a reference signal variation.

8 - CARD CIRCUIT SETTINGS

The overall and mounting dimensions diagram in par. 10 shows three switch banks: SW 1 - SW 2 - SW 3 which enable the card to be set up as required.

NOTE: Each modification to switch settings must be carried out with the card disconnected from the power supply. The individual switches inside each bank must all be set in the same position.

SELECTION OF VOLTAGE OR CURRENT REFERENCE SIGNAL (SW 1 bank comprising three individual switches)

– select V for voltage reference signal
– select I for current reference signal.

SELECTION OF SINGLE ENDED OR DIFFERENTIAL REFERENCE SIGNAL (SW 2 bank comprising one individual switch)

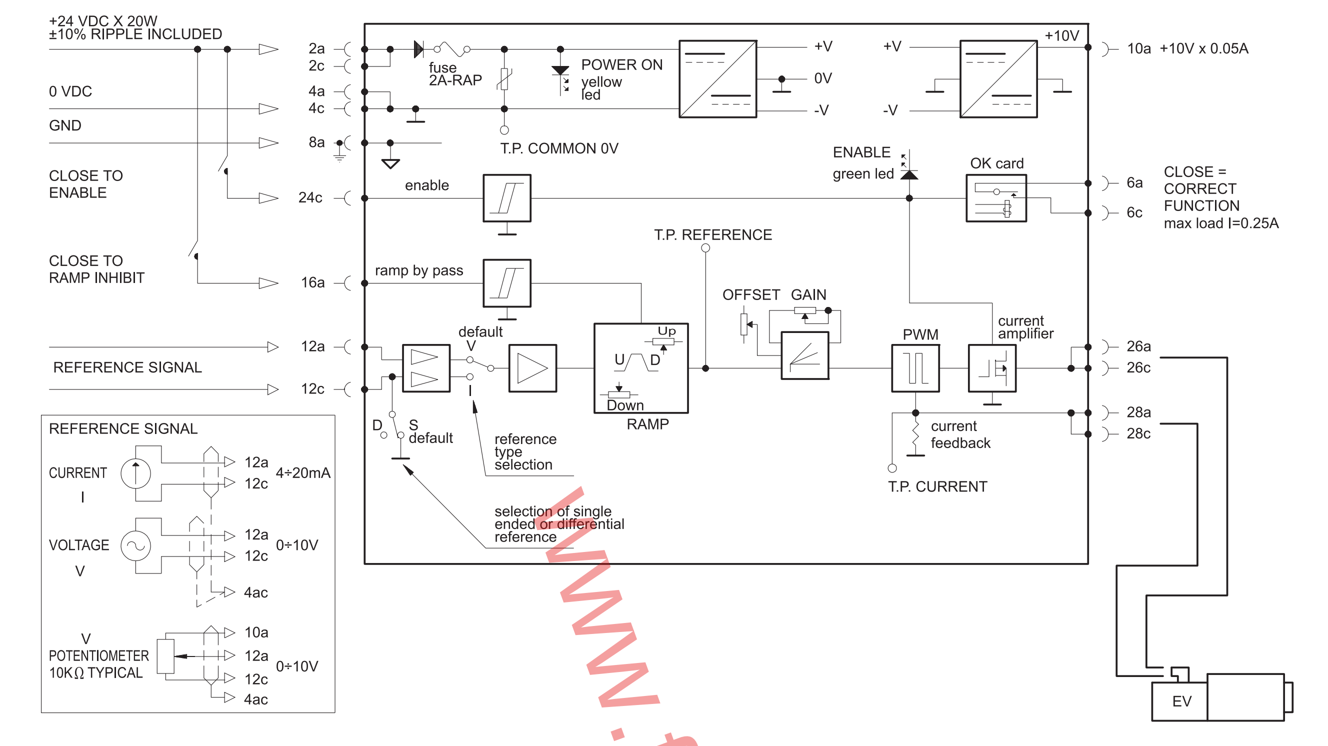
– select S for single ended reference signal. This condition is obligatory in the case where the reference signal is generated with an external potentiometer fed by the card itself.
– select D for differential reference signal. This condition is preferable in the case where the reference signal comes from a PLC or CNC analogic outlet.

NOTE: The SW 3 bank, comprising two individual switches, must always be set at AA as per standard default conditions.

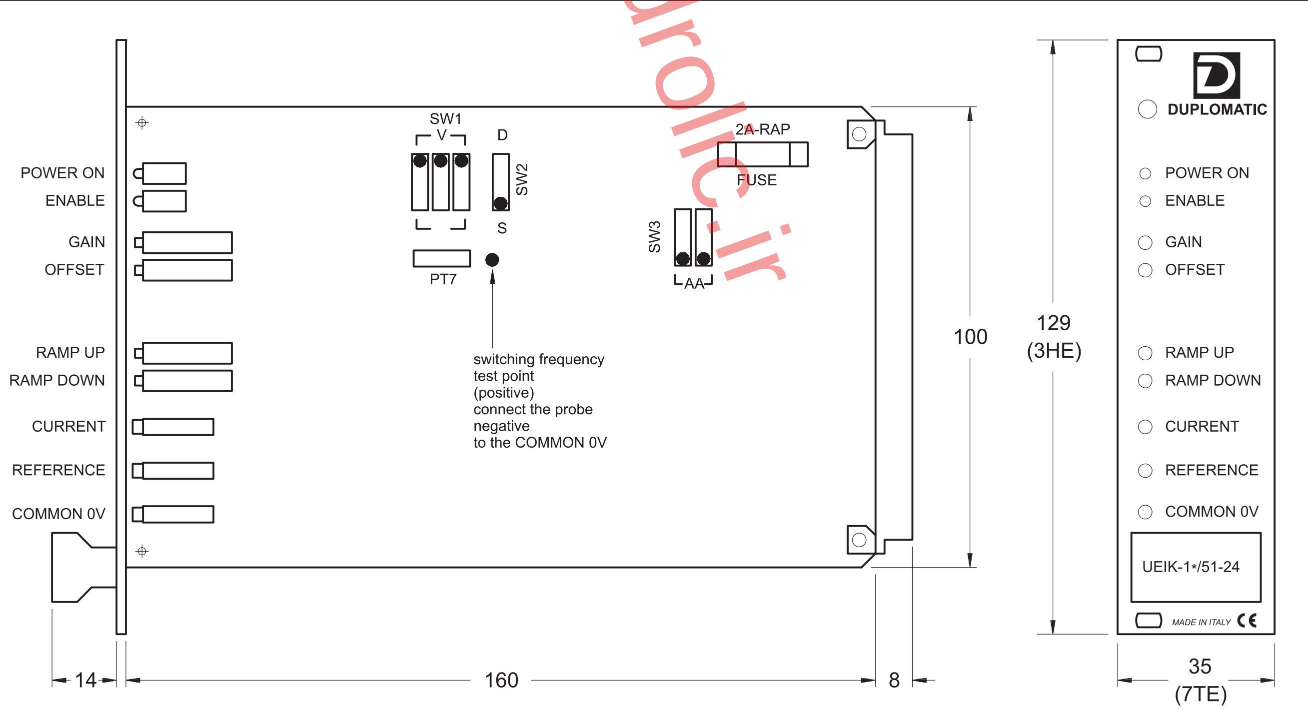
SWITCHING FREQUENCY ADJUSTMENT

It is possible to change the switching frequency (PWM) by acting on the trimmer PT7 (see par. 10).
The setting range is from 80 to 370 Hz.
An appropriate switching frequency adjustment allows reduction of the valve hysteresis value.
Clockwise rotation to increase the frequency.

9 - CARD CIRCUIT AND WIRING DIAGRAMS



10 - OVERALL AND MOUNTING DIMENSIONS



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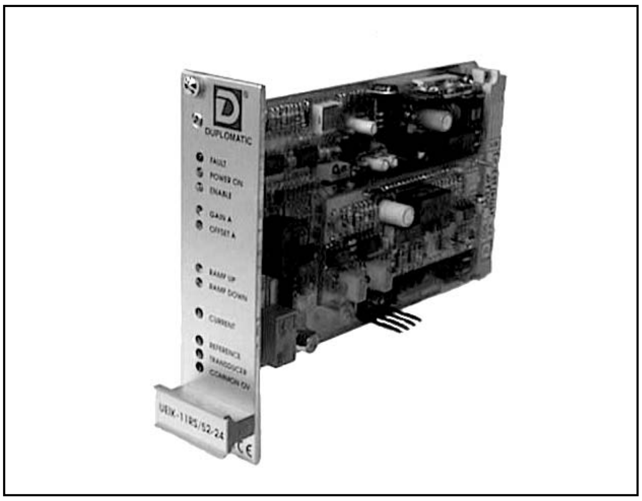


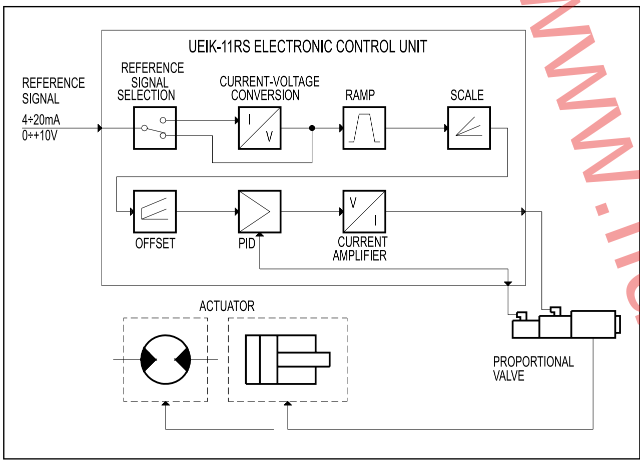
UEIK-11RS*

ELECTRONIC CONTROL UNIT FOR SINGLE SOLENOID PROPORTIONAL VALVE WITH POSITION FEEDBACK

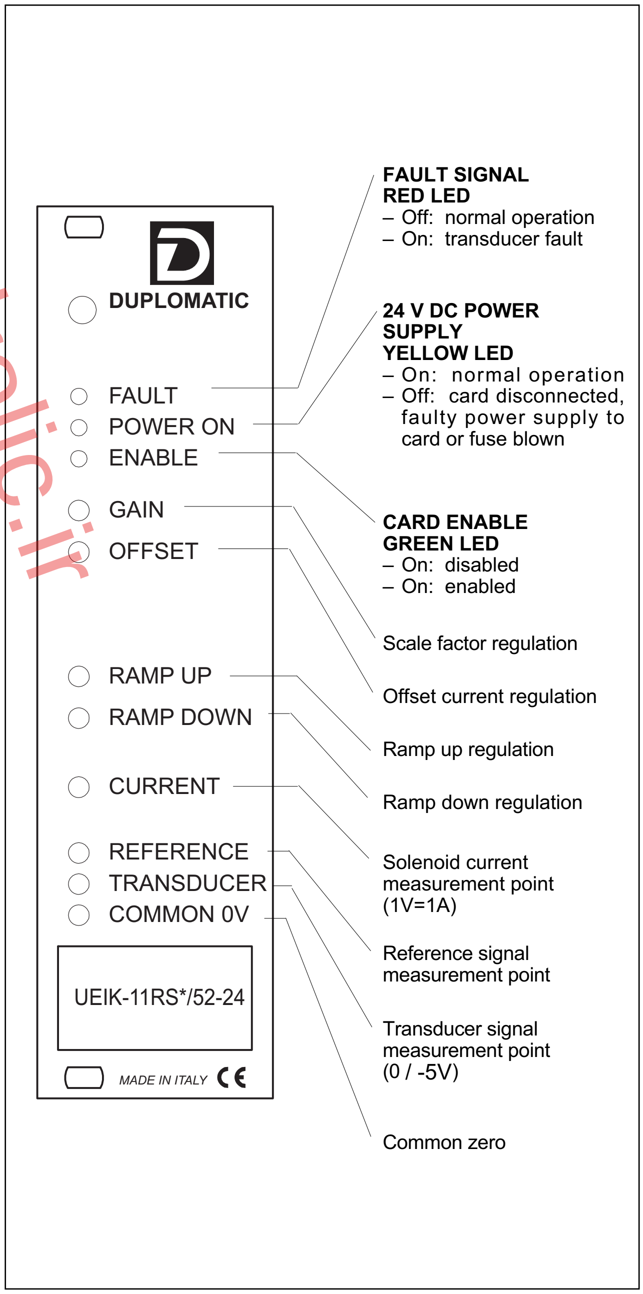
SERIES 52

EUROCARD TYPE

FUNCTIONAL BLOCK DIAGRAM



FRONT PANEL



TECHNICAL CHARACTERISTICS

Power supply	V DC	22 ÷ 30 Ripple included
Required power	W	20 ÷ 45
Output current	see par. 3.4	
Power supply electrical protections	– overload – polarity inversion	
Reference signal: – Voltage – Current	 V mA	 0 ÷ +10 4 ÷ 20
Input reference signal impedance: – Voltage – Current	 KΩ Ω	 10 250
Electromagnetic compatibility (EMC) (see par. 5 - **NOTE 1**)		in compliance with 2004/108/CE
Card size	Eurocard 100x160x35	
Connector edge	DIN 41612-D 32 Male	
Operating temperature range	°C	0 ÷ 50
Mass	kg	0,20

1 - IDENTIFICATION CODE

U	E	I	K	-	11	R	S		/	52	-	24

Eurocard type electronic control unit (UEIK)

For single solenoid proportional valves (11)

Position feedback control (RS)

Q: version for flow control valves type RPCER1/52
D: version for directional valves type DSE3F-S*

Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged) (52)

Power supply voltage = 24 V DC (24)

The UEIK-11RS*/52 card is an electronic control unit Eurocard type for closed loop control of single solenoid proportional valves with positional feedback control.

The card controls the position of the valve spool according to the reference input signal enabling linear regulation and reduced hysteresis.

The front panel is fitted with LEDs to indicate card functions and potentiometers to optimise control.

2 - FUNCTIONAL SPECIFICATIONS

2.1 - Electric power supply

The card requires a power supply of 22-30 V DC and 20 ÷ 45 W (pin 2a/2c - 4a/4c).

Power supply voltage must be rectified and filtered, with maximum admissible ripple within the above voltage range.

2.2 - Electrical protection

The card is protected against overvoltage and polarity inversion.

A 3,15A fast-acting fuse is fitted for power circuit protection.

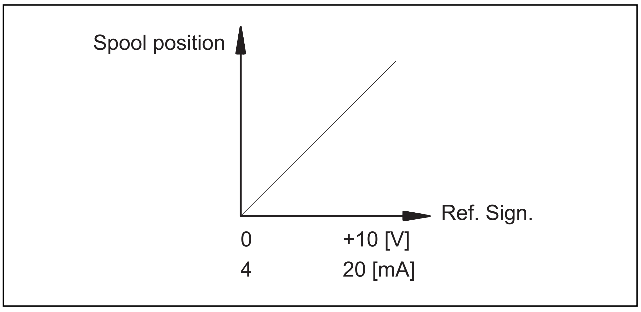
2.3 - Reference signal

The card accepts voltage reference signals (0 ÷ +10V) or current signals (4÷20 mA).

N.B: If the signal is transmitted by potentiometer, please verify that this has a load of at least 200 Ω.

See par. 9 for electrical connections.

The diagram shows characteristics of valve spool position according to the reference signal.



3 - SIGNALS AND ADJUSTMENT

3.1 - FAULT

The red LED indicates operation of the position transducer:
OFF - normal operation
ON - transducer fault or electrical connection failure. In this case the current supply to the solenoid is shut off and the valve is set at the rest position, the ENABLE LED switches off and the OK card relay contact opens (6a - 6c pin)

3.2 - POWER ON

The yellow LED indicates card power supply:
ON - normal power supply
OFF - no power supply, faulty power supply or blown fuse

3.3 - ENABLE

From 22 to 30 V DC (pin 24c) enable command is required for card operation.
The condition of the card enable is shown by both a visible LED on the front panel and as a contact available for the user on pins 6a and 6c.
The green LED indicates:
ON - card enabled
OFF - card disabled

3.4 - GAIN (Scale factor regulation)

The "GAIN" potentiometer enables regulation of the relation between the set reference value and maximum current supplied to the solenoid and therefore the hydraulic parameter controlled by the valve.
The maximum current of the card is limited to 1A for RSQ version and to 1,8A for RSD version. See par. 6 for default values.
Rotate clockwise to increase current.

3.5 - OFFSET (Offset current regulation)

The "OFFSET" potentiometer enables regulation of the offset current of the valve. It is used to eliminate the insensitivity zone (dead zone) of the valve.
The regulation field is from 0 to 0,5A for RSQ version and from 0 to 0,9A for RSD version.

The offset current is activated when the reference signal exceeds the threshold of + 150 mV (or 4,25 mA).
The offset is not active and only the polarization current equal to 25 mA is present beneath this threshold.

NOTE: The variation of the set value of the offset current causes a corresponding variation of the scale factor value.

Rotate clockwise to increase current.

3.6 - RAMP UP / RAMP DOWN (Ramp regulation)

"RAMP UP" and "RAMP DOWN" potentiometers, in a range from 0,03 to 7 sec., regulates the time required to achieve the supplied current according to a step change of the reference signal up or down.
It is possible, in this way, to control the valve response time, adjusting it to the requirements of the hydraulic circuit and the machine cycle.
Ramps can be inhibited by transmitting a 22 to 30 V DC exclusion command to pin 16a. In this case, the ramp residual time is 10 ms.
Rotate clockwise to increase ramp time.

4 - SIGNAL MEASUREMENT

4.1 - CURRENT (Solenoid current measurement point)

Enables voltage reading of current supplied to the solenoid.
Reading conversion: 1V DC = 1A.

4.2 - REFERENCE (Reference signal measurement point)

Enables reading of reference signal sent to the card.
Reading is direct, but of opposite sign, with voltage reference while current conversion is: 4 mA = 0V 20 mA = -10V.

4.3 - TRANSDUCER (Transducer signal measurement point)

Enables voltage reading of the valve spool position (0 / -5V).

5 - INSTALLATION

The card is designed for assembly on a rack or a card holder with interface for connector types DIN 41612 - size D - 32 pole.
It is recommended to use cable sections of 1 to 2,5 mm^2, depending on their length, for power supply and solenoid connections. For other connections it is recommended to use cables with a screened sheath connected to earth only on the card side.

NOTE 1: To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram of par. 9.
As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).
In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

6 - DEFAULT CONDITIONS

The electronic control unit is supplied factory-set. Standard settings are:

– "GAIN" regulation: +10V (or 20 mA) reference signal corresponding to maximum valve opening (transducer = -5V). In open loop "GAIN" regulation corresponds to a current supply of 1 A for RSQ version and 1,8 A for RSD version, to the solenoid with maximum reference signal.
– "OFFSET" regulation: zero
– "RAMP UP" and "RAMP DOWN" regulation: minimum
– position SW1 on V
– position SW2 on S
– position SW3 on AC
– position S1 on N
– switching frequency (PWM) = 230 Hz

7 - START-UP AND CONTROL SETTINGS

If required, settings can be adjusted as follows:

a) OFFSET CURRENT REGULATION

– Set "GAIN" potentiometer to minimum.
– Enter reference signal at maximum value (+10V or 20 mA).
– Set the "OFFSET" potentiometer so that the valve is positioned at the start of the work zone.

b) SCALE FACTOR REGULATION

– Enter the reference signal at maximum value (+10V or 20 mA).
– Set "GAIN" potentiometer so that the controlled hydraulic parameter reaches the maximum required value.

c) RAMP REGULATION

– Regulate the "RAMP UP" and "RAMP DOWN" potentiometers to obtain the gradual valve operation required with a reference signal variation.

8 - CARD CIRCUIT SETTINGS

The overall and mounting dimension diagram in par. 10 shows four switch banks: SW 1 - SW 2 - SW 3 and S1 which enable the card to be set up as required.

NB. Each modification to switch settings must be carried out with the card disconnected from the power supply. The individual switches inside each bank must all be set in the same position.

SELECTION OF VOLTAGE OR CURRENT REFERENCE SIGNAL
(SW 1 bank comprising three individual switches)

– select V for voltage signal
– select I for current signal.

SELECTION OF SINGLE ENDED OR DIFFERENTIAL REFERENCE SIGNAL
(SW 2 bank comprising one individual switch)

– select S for single ended reference signal. This condition is obligatory in the case where the reference signal is generated with an external potentiometer fed by the card itself.
– select D for differential reference signal. This condition is preferable in the case where the reference signal comes from a PLC or CNC analogic outlet.

OPEN OR CLOSED LOOP SELECTION
(SW 3 bank comprising two individual switches)

– select AC for closed loop
– select AA for open loop.

TRANSDUCER POLARITY SELECTION
(SW 1 bank comprising one individual switch)

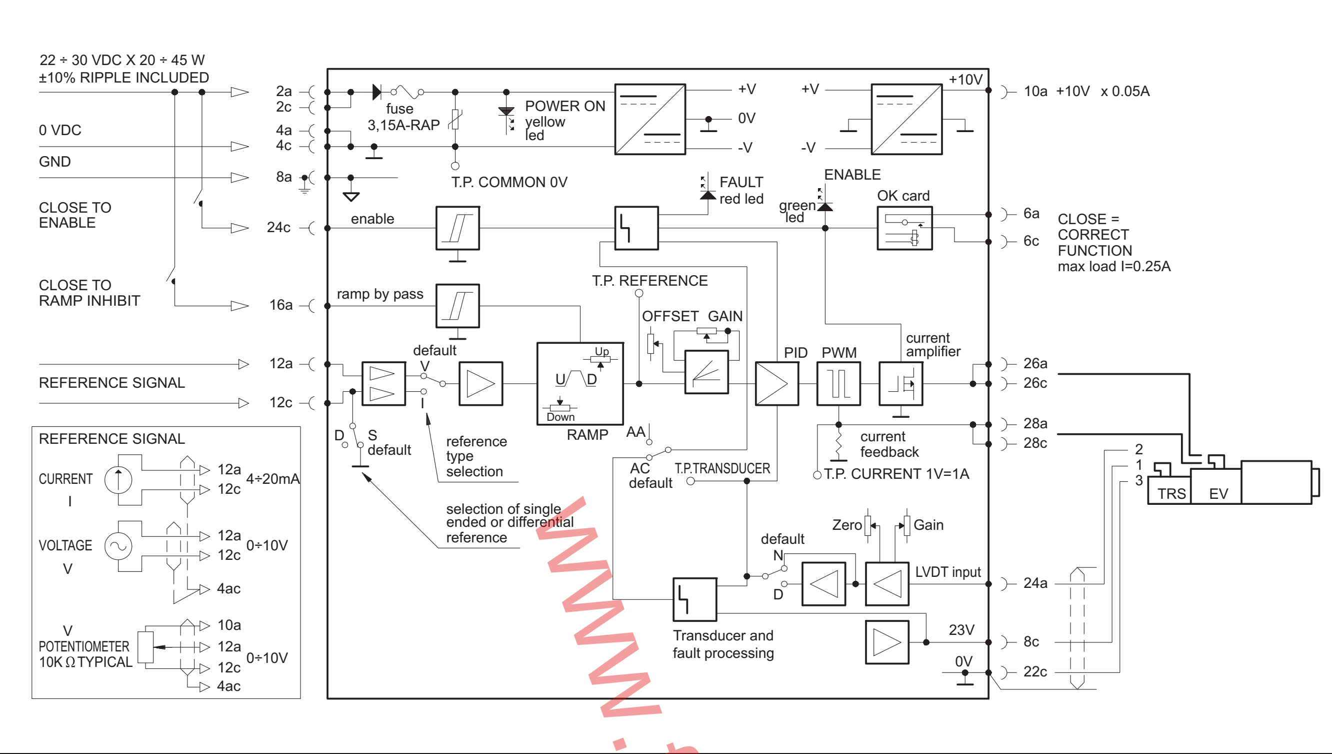
– select N for direct operated valve types DSE3F - RPCER1/52
– select D for piloted valves.

NB. In the event of transducer malfunction, AA can be selected to proceed with open loop operation. In this case, the ENABLE LED illuminates and the OK relay card contacts close and the FAULT LED remains lit to indicate alarm status.

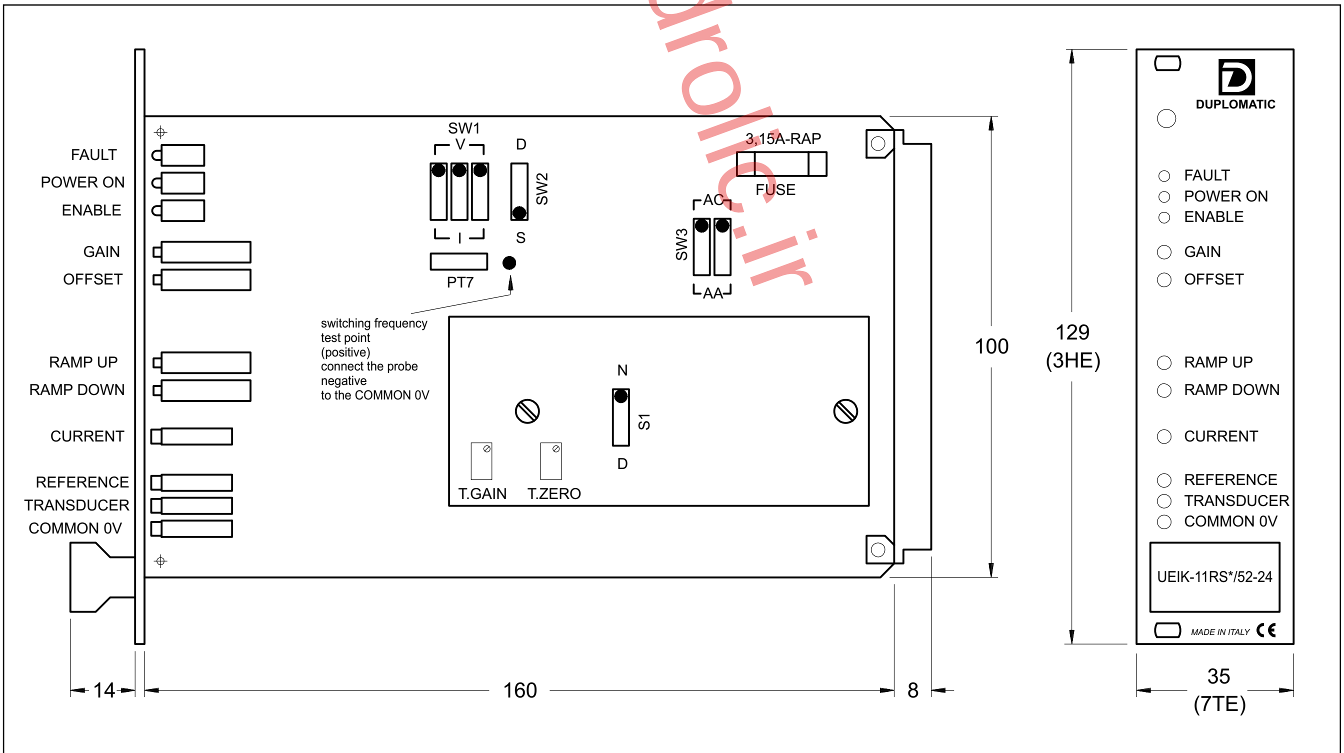
SWITCHING FREQUENCY ADJUSTMENT

It is possible to change the switching frequency (PWM) by acting on the trimmer PT7 (see par. 10).
The setting range is from 80 to 1600 Hz.
An appropriate switching frequency adjustment allows reduction of the valve hysteresis value.
Clockwise rotation to increase the frequency.

9 - CARD CIRCUIT AND WIRING DIAGRAMS



10 - OVERALL AND MOUNTING DIMENSIONS



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DUPLOMATIC OLEODINAMICA

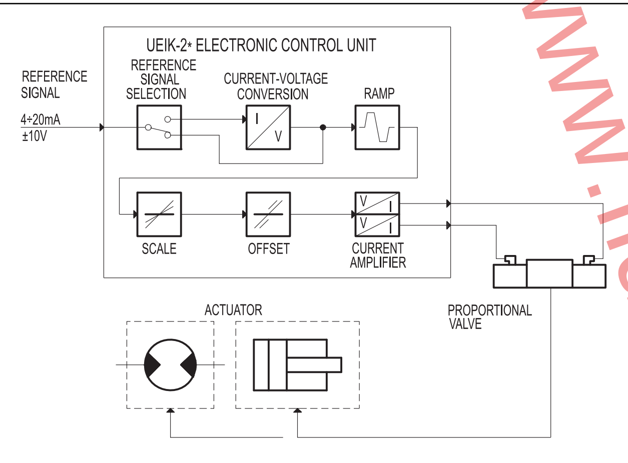
UEIK-2*

ELECTRONIC CONTROL UNIT FOR OPEN LOOP DOUBLE SOLENOID PROPORTIONAL VALVE

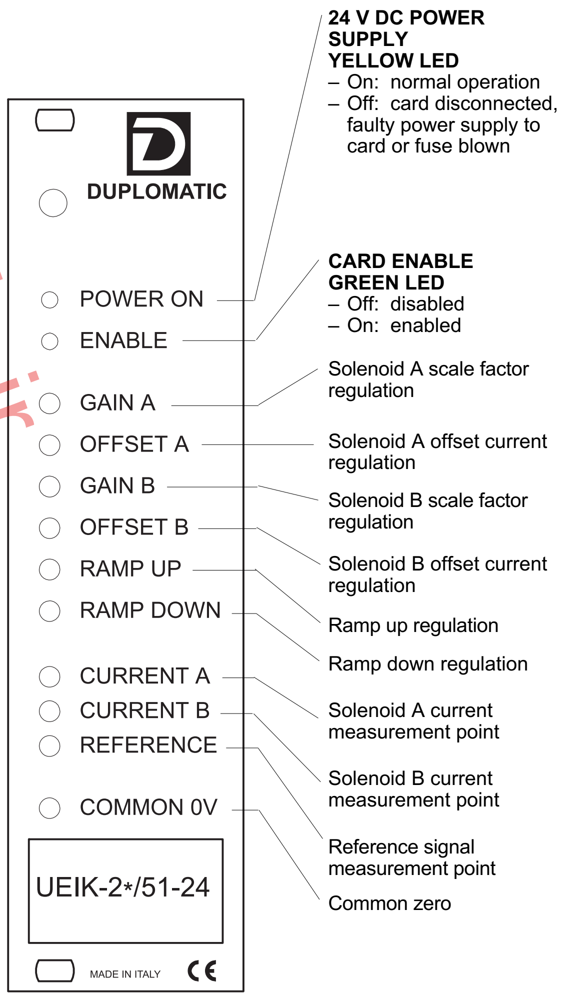
SERIES 51

EUROCARD TYPE

FUNCTIONAL BLOCK DIAGRAM



FRONT PANEL



TECHNICAL CHARACTERISTICS

Power supply	V DC	22 ÷ 30 Ripple included
Required power		See par. 2.1
Output current		See par. 3.3
Power supply electrical protections		– overload – polarity inversion
Reference signal: – Voltage – Current	 V mA	 ± 10 4 ÷ 20
Input reference signal impedance: – Voltage – Current	 kΩ Ω	 10 250
Electromagnetic compatibility (EMC) (see par. 5 - **NOTE 1**)		in compliance with 2004/108/CE
Card size		Eurocard 100x160x35
Connector interface		DIN 41612-D 32 Male
Operating temperature range	°C	0 ÷ 50
Mass	kg	0,27

1 - IDENTIFICATION CODE

U	E	I	K	-	2		/	51	-	24

- Eurocard type electronic control unit (UEIK)
- For open loop double solenoid proportional valves (2)
- Maximum current: **1** = 800 mA **2** = 1.200 mA
- Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged) (51)
- Power supply voltage = 24 V DC (24)

The UEIK-2* card is an electronic control unit Eurocard type for open loop of double solenoid proportional valves.

The unit supplies a variable current in proportion to the input reference signal and independently of temperature variations or load impedence.

The PWM stage on the solenoid power supply makes it possible to reduce valve hysteresis thus optimising control precision. The front panel is fitted with LEDs to indicate card functions and potentiometers to optimize control.

2 - FUNCTIONAL SPECIFICATIONS

2.1 - Electric power supply

The card requires a power supply of between 22 and 30 V DC (pin 2a/2c - 4a/4c) and 20 W (UEIK-21) - 29 W (UEIK-22).

Power supply voltage must be rectified and filtered, with maximum admissible ripple within the above voltage range.

2.2 - Electrical protection

The card is protected against overvoltage and polarity inversion.

A 2A fast-acting fuse is fitted for power circuit protection.

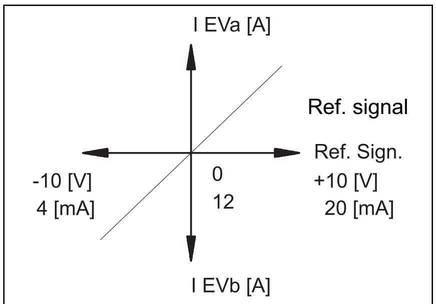
2.3 - Reference signal

The card accepts voltage reference signals (±10V) or current reference signals (4 ÷ 20 mA).

N.B: If the signal is transmitted by potentiometer, please verify that this has a load of at least 200Ω.

See paraagraph 9 for electrical connections.

The diagram shows characteristics of current supplied according to the reference signal.



3 - SIGNALS AND ADJUSTMENT

3.1 - POWER ON

The yellow LED indicates card power supply:
ON - normal power supply
OFF - no power supply, faulty power supply or blown fuse

3.2 - ENABLE

A 22 to 30 V DC on pin 24c enable command is required for card operation.
The condition of the enable card is shown by both a visible LED on the front panel and as a contact available for the user on pins 6a and 6c.

The green LED indicates:
ON - card enabled
OFF - card disabled or failed

3.3 - GAIN A / GAIN B
(Scale factor regulation of solenoids A and B)

"GAIN A" and "GAIN B" potentiometers enable regulation of the ratio between the set reference value and current supplied to solenoids A and B respectively. This enables independent regulation of the controlled parameter in the two valve hydraulic configurations.

The maximum current of the card is limited to 1,0A (UEIK-21) - 1,2A (UEIK-22). See par. 6 for default values.

Rotate clockwise to increase current.

3.4 - OFFSET A / OFFSET B
(Polarization current regulation of solenoids A and B)

"OFFSET A" and "OFFSET B" potentiometers enable regulation of the offset current of the valve solenoids A and B respectively.
They are used to eliminate the valve insensitivity zone (dead zone) in the two valve hydraulic figures.

The regulation range is from 0 to 0,5A (UEIK-21) - from 0 to 0,65A (UEIK-22).

The offset current is activated when the reference signal exceeds the threshold of ±150 mV.
The offset is not active and only the polarization current equal to 25 mA is present beneath this threshold.

NOTE: The variation of the set value of the offset current causes a corresponding variation of the scale factor value.

Rotate clockwise to increase current.

3.5 - RAMP UP / RAMP DOWN (Ramp regulation)

"RAMP UP" and "RAMP DOWN" potentiometers, in a range from 0,03 to 7 sec., regulate the time taken to achieve the current for a step change of the reference signal up or down. They are independently adjusted and serve both solenoids.

This makes it possible to smooth valve response and adapt it to the requirements of the hydraulic system and the machine cycle.

Rotate clockwise to increase ramp time.

Ramps can be inhibited by transmitting a 22 to 30 V DC command to pin 16a. In this case, the ramp residual time is 10 ms.

4 - SIGNAL MEASUREMENT

4.1 - CURRENT A / CURRENT B

(Current measurement points of solenoids A and B)

Measurement points for voltage readings of current supplied to solenoids A and B. Reading conversion is 1V DC = 1A (UEIK-21) and 0,82V DC = 1A (UEIK-22).

4.2 - REFERENCE (Reference signal measurement point)

Enables reading in voltage of reference signal sent to the card.

Reading is direct, but of opposite sign, with voltage reference while current conversion is: 4 mA = +10V   20 mA = -10V.

5 - INSTALLATION

The card is suitable for assembly on a rack or a card holder with interface for connector types DIN 41612 - size D - 32 pole.

It is recommended to use cable sections of 1 to 2,5 mm^2, in function with their length, for power supply and solenoid connections. For other connections, it is recommended to use cables with a screened sheath connected to earth only on the card side.

NOTE 1

To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram of para.6.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

6 - DEFAULT CONDITIONS

The electronic control unit is supplied factory-set.

Standard settings are:

- "GAIN A" regulation: +10V (or 20 mA) reference signal corresponding to a current supply of 0,82 A to solenoid A.
- "GAIN B" regulation: -10V (or 4 mA) reference signal corresponding to a current supply of 0,82 A to solenoid B.
- "OFFSET A" or "OFFSET B" regulation: zero
- "RAMP UP" and "RAMP DOWN" regulation: minimum
- position SW1 on V
- position SW2 on S
- position SW3 on AA
- switching frequency (PWM) = 200Hz (UEIK-21)
  100Hz (UEIK-22)

7 - START-UP AND FRONTAL SETTINGS

If required, settings can be adjusted as follows:

a) OFFSET CURRENT REGULATION
(Note: the same procedure applies to channels A and B on the card)

- Set "GAIN A" or "GAIN B" potentiometer to minimum.
- Enter reference signal at maximum value:
  +10V (or 20 mA) for solenoid A
  - 10V (or 4 mA) for solenoid B.
- Regulate "OFFSET A" or "OFFSET B" potentiometer so that the valve is positioned at the start of the relative hydraulic configuration work zone.

b) SCALE FACTOR REGULATION
(**NOTE**: the same procedure applies to channels A and B on the card)

- Enter the reference signal at maximum value
  +10V (or 20 mA) for solenoid A
  - 10V (or 4 mA) for solenoid B.
- Adjust "GAIN A" and "GAIN B" potentiometers until the size controlled in the relative hydraulic configuration reaches the maximum required value.

NOTE: The maximum current value must be compatible with the maximum current prescribed by the technical table of the connected proportional valve.

c) RAMP REGULATION

- Regulate the "RAMP UP" and "RAMP DOWN" potentiometers to obtain the required valve smoothness of movement with a reference variation.

8 - CARD CIRCUIT SETTINGS

The overall dimension diagram in par. 10 shows three switch banks: SW 1 - SW 2 - SW 3 which enable card set up as required.

NB. Each modification to switch settings must be carried out with the card disconnected from the power supply. The individual switches inside each bank must all be set in the same position.

SELECTION OF VOLTAGE OR CURRENT REFERENCE SIGNAL (SW 1 bank comprising three individual switches)

- select V for voltage reference signal
- select I for current reference signal.

SELECTION OF SINGLE ENDED OR DIFFERENTIAL REFERENCE SIGNAL (SW 2 bank comprising one individual switch)

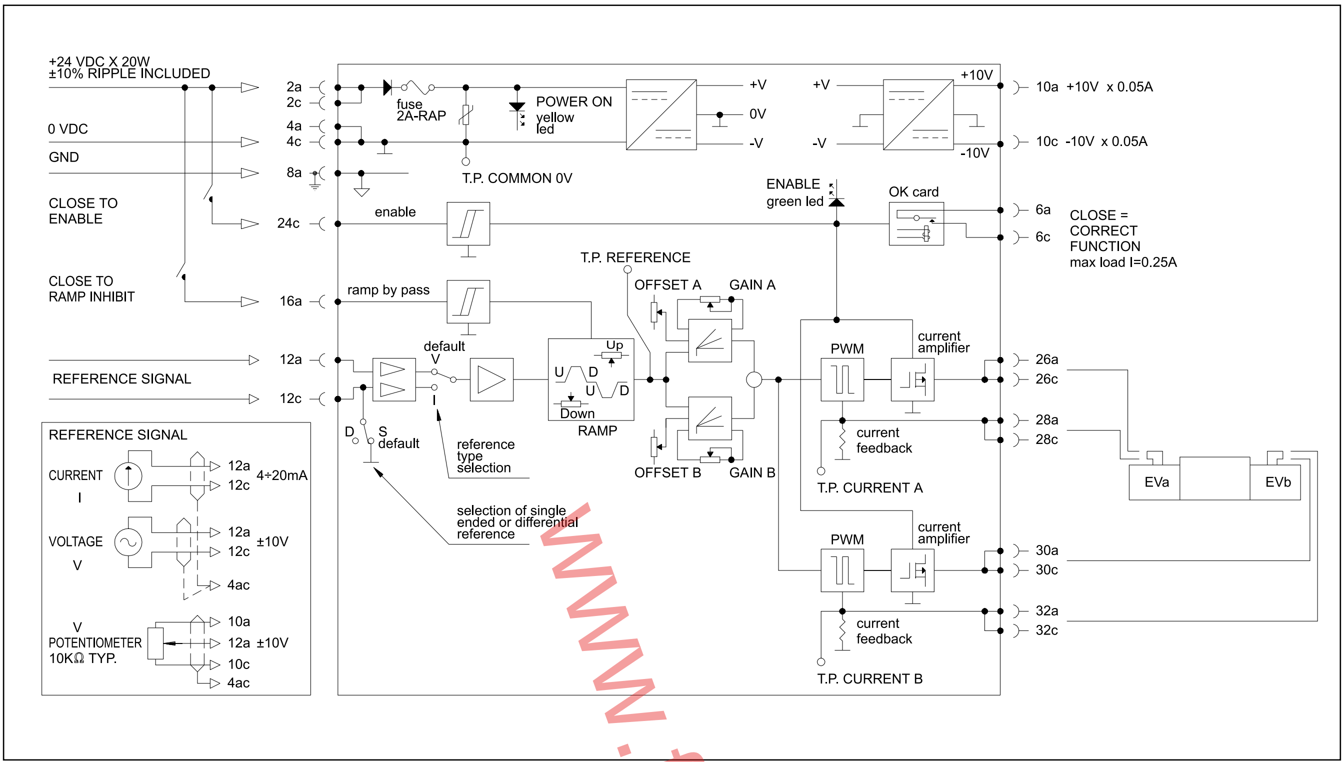
- select S for single ended reference signal. This condition is obligatory in the case that the reference signal is generated with an external potentiometer fed by the card itself.
- select D for differential reference signal. This signal is preferable in the case that the reference signal comes from a PLC or CNC analogic outlet.

NOTE: The SW 3 bank, comprising two individual switches, must always be set at AA as per standard supply conditions.

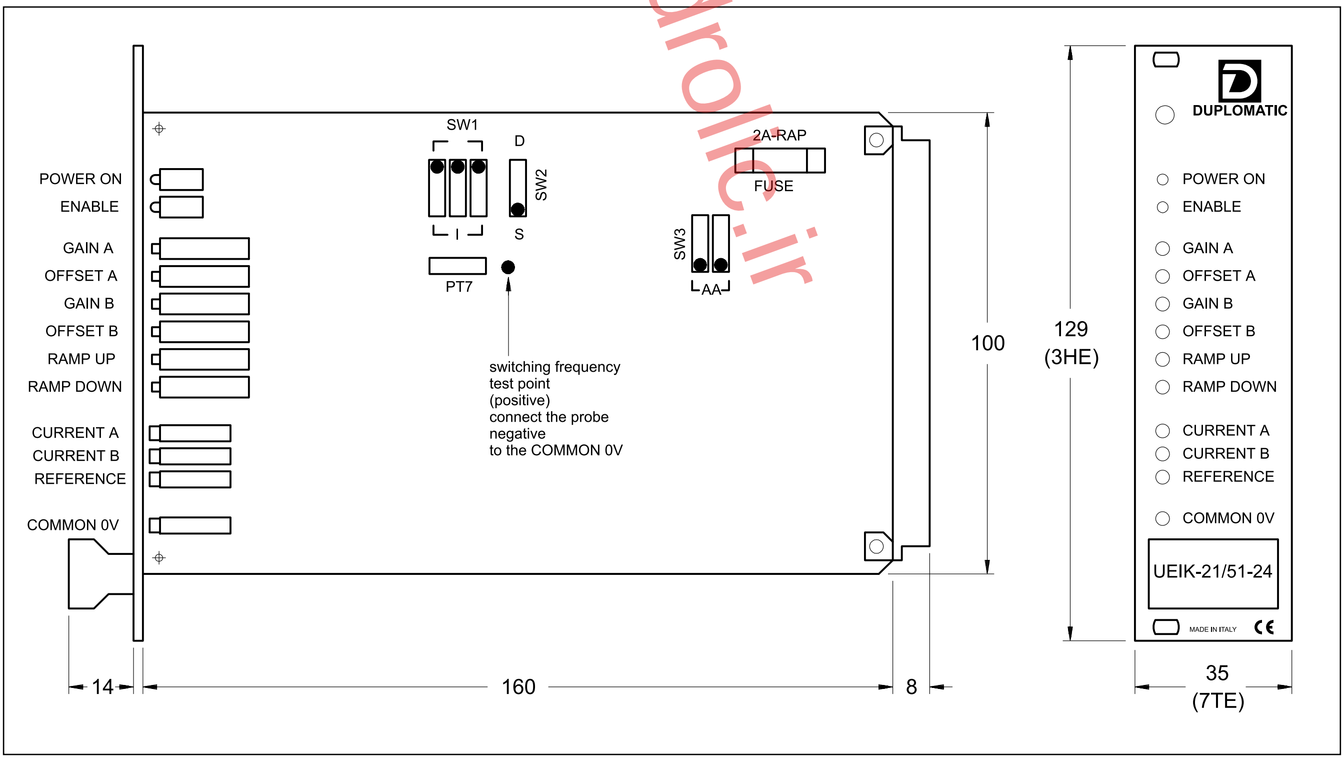
SWITCHING FREQUENCY ADJUSTMENT

It is possible to change the switching frequency (PWM) by acting on the trimmer PT7 (see par. 10).
The setting range is from 80 to 370 Hz.
An appropriate switching frequency adjustment allows reduction of the valve hysterisis value.
Clockwise rotation to increase thefrequency.

9 - CARD CIRCUIT AND WIRING DIAGRAMS



10 - OVERALL AND MOUNTING DIMENSIONS



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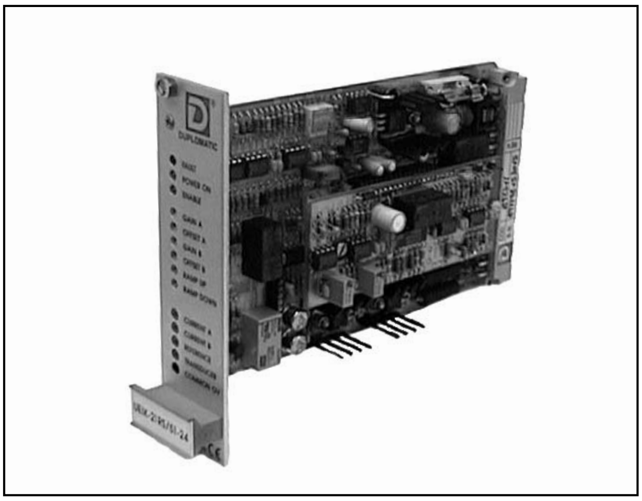
DUPLOMATIC OLEODINAMICA

UEIK-21RSD

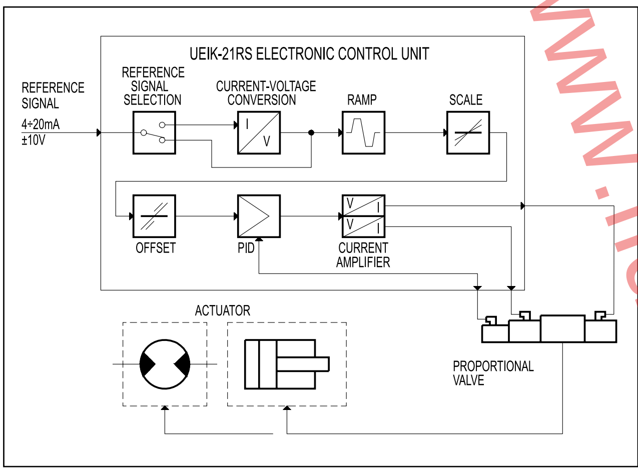
ELECTRONIC CONTROL UNIT FOR DOUBLE SOLENOID PROPORTIONAL VALVES WITH POSITION FEEDBACK

SERIES 52

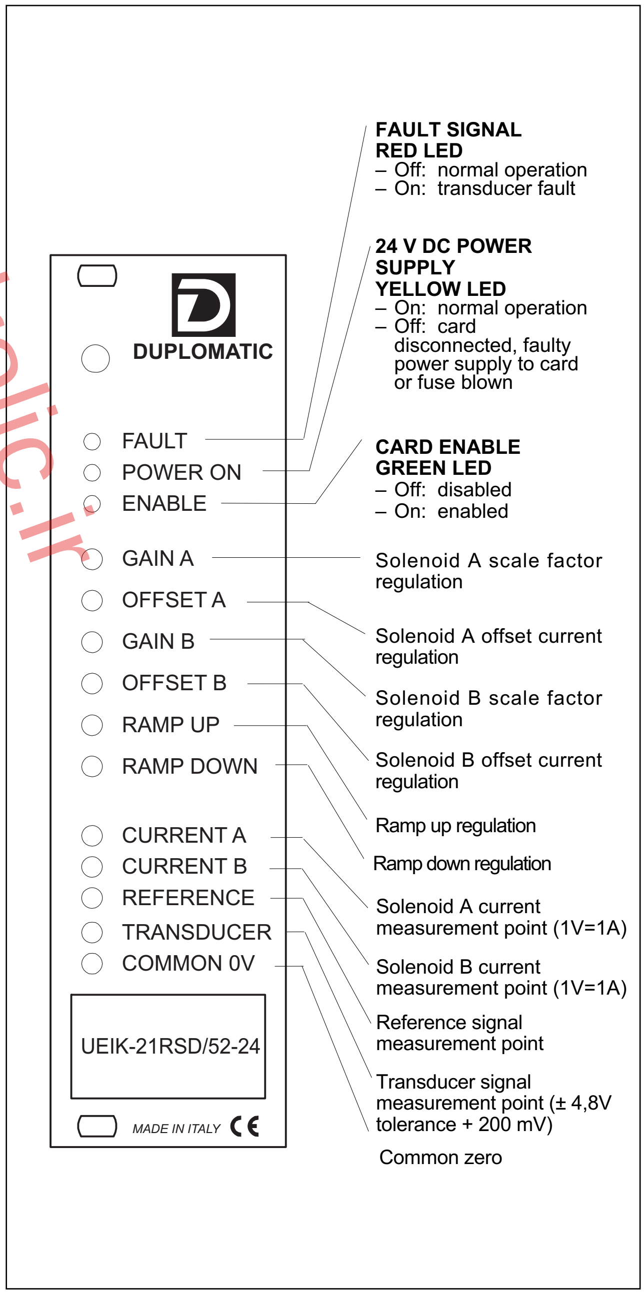


EUROCARD TYPE

FUNCTIONAL BLOCK DIAGRAM



FRONT PANEL



TECHNICAL CHARACTERISTICS

Power supply	V DC	22 ÷ 30 Ripple included
Required power	W	45
Output current	see par. 3.4	
Power supply electrical protections	– overload – polarity inversion	
Reference signal: – Voltage – Current	 V mA	 ±10 4 ÷ 20
Input reference signal impedance: – Voltage – Current	 kΩ Ω	 10 250
Electromagnetic compatibility (EMC) (see par. 5 - **NOTE 1**)		in compliance with 2004/108/CE
Card size	Eurocard 100x160x35	
Connector interface	DIN 41612-D 32 Male	
Operating temperature range	°C	0 ÷ 50
Mass	kg	0,27

1 - IDENTIFICATION CODE

U	E	I	K	-	21	R	S	D	/	52	-	24

- UEIK: Eurocard type electronic control unit
- 21: For double solenoid proportional valves
- RS: Positional feedback control
- D: for directional valves type DSE3F
- 52: Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged)
- 24: Power supply voltage = 24 VDC

The UEIK-21RS card is an electronic control unit Eurocard type for closed loop control of double solenoid proportional valves with positional feedback control.

The unit controls the position of the valve spool according to the reference input signal ensuring linear regulation with minimum hysteresis.

The front panel is fitted with LEDs to indicate card functions and potentiometers to optimise performance.

2 - FUNCTIONAL SPECIFICATIONS

2.1 - Electric power supply

The card requires a power supply of 22 - 30 V DC and 45 W (pin 2a/2c - 4a/4c).

Power supply voltage must be rectified and filtered, with maximum admissible ripple within the above voltage range.

2.2 - Electrical protection

The card is protected against overvoltage and polarity inversion.
A 3,15A fast-acting fuse is fitted for power circuit protection.

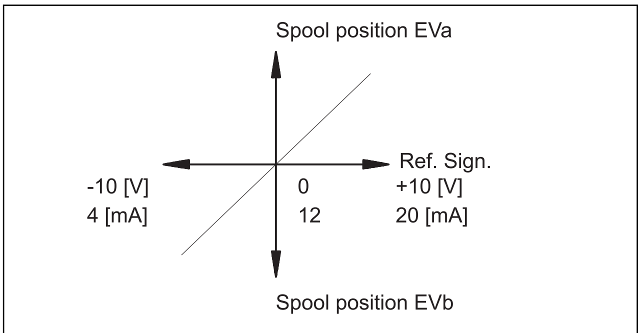
2.3 - Reference signal

The card accepts voltage reference signals (±10V) or current reference signals (4-20 mA).

N.B: If the signal is transmitted by potentiometer, please verify that this has a load of at least 200 Ω.

See par. 9 for electrical connections.

The diagram shows valve spool position characteristics according to the reference signal.



3 - SIGNALS AND ADJUSTMENT

3.1 - FAULT (Fault signal)

The red LED indicates operation of the positional transducer:
OFF - normal operation
ON - transducer fault or power supply failure. In the event of a FAULT, current to the solenoid is shut off and the valve is set at the hydraulic rest configuration, the ENABLE LED switches off and the OK card relay contact opens (6a and 6c pins).

3.2 - POWER ON

The yellow LED indicates card power supply:
ON - normal power supply
OFF - no power supply, faulty power supply or blown fuse

3.3 - ENABLE

A 22 to 30 V DC on pin 24c enable command is required for card operation.
The condition of the enable card is shown by both a visible LED on the front panel and as a contact available for the user on pins 6a and 6c.

The green LED indicates:
ON - card enabled
OFF - card disabled or failed

3.4 - GAIN A / GAIN B
(Scale factor regulation of solenoids A and B)

"GAIN A" and "GAIN B" potentiometers enable regulation of the ratio between the set reference value and the valve spool position in the two hydraulic configurations controlled by solenoids A and B.
The maximum current of the card is limited to 1,8A.
See par. 6 for default values.
Rotate clockwise to increase current.

3.5 - OFFSET A / OFFSET B
(Offset current regulation of solenoids A and B)

"OFFSET A" and "OFFSET B" potentiometers enable regulation of the offset current of the solenoids A and B respectively with reference signal set at zero. They are used to eliminate the valve insensitivity zone (dead zone).

The regulation range is from 0 to 0,9A.

The offset current is activated when the reference signal exceeds the threshold of ±150 mV.
The offset is not active and only the polarization current equal to 25 mA is present beneath this threshold.

NOTE: The variation of the set value of the offset current causes a corresponding variation of the scale factor value.

Rotate clockwise to increase current.

3.6 - RAMP UP / RAMP DOWN (Ramp regulation)

"RAMP UP" and "RAMP DOWN" potentiometers, in a range from 0,03 to 7 sec., regulate the time taken to achieve the current for a step change of the reference signal up or down. They are independently adjusted and serve both solenoids.
This makes it possible to smooth valve response and adapt it to the requirements of the hydraulic system and the machine cycle.

Rotate clockwise to increase ramp time.

Ramps can be inhibited by transmitting a 22 to 30 V DC command to pin 16a. In this case, the ramp residual time is 10 ms.

4 - SIGNAL MEASUREMENT

4.1 - CURRENT A / CURRENT B
(Current measurement points of solenoids A and B)

Measurement points for voltage readings of current supplied to solenoids A and B. Reading conversion is 1V DC = 1A.

4.2 - REFERENCE (Reference signal measurement point)

Enables reading in voltage of reference signal sent to the card.
Reading is direct, but of opposite sign, with voltage reference while current conversion is: 4 mA = +10V   20 mA = -10V.

4.3 - TRANSDUCER (Transducer signal measurement point)

Enables voltage reading of the valve spool position (± 4,8V - tolerance +200 mV).

5 - INSTALLATION

The card is suitable for assembly on a rack or a card holder with interface for connector types DIN 41612 - size D - 32 pole.
It is recommended to use cable sections of 1 to 2,5 mm^2, in function with their length, for power supply and solenoid connections. For other connections, it is recommended to use cables with a screened sheath connected to earth only on the card side.

NOTE 1: To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the connection scheme of par. 9.
As a general rule, the valve and the electronic unit connection wires must be keeped as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).
In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

6 - DEFAULT CONDITIONS

The electronic control unit is supplied factory-set. Standard settings are:
- "GAIN A" regulation: +10V (or 20 mA) reference signal corresponding to maximum valve opening in the hydraulic configuration controlled by solenoid A (transducer = -5V) .
- "GAIN B" regulation: -10V (or 4 mA) reference signal corresponding to maximum valve opening in the hydraulic configuration controlled by solenoid B (transducer = +5V).
  In open loop "GAIN A" and "GAIN B" regulations correspond to a current supply of 1,8 A to the solenoids A and B with maximum reference signal.
- "OFFSET A" or "OFFSET B" regulation: zero
- "RAMP UP" and "RAMP DOWN" regulation: minimum
- position SW1 on V
- position SW2 on S
- position SW3 on AC
- position S1 on N
- switching frequency (PWM) = 300 Hz

7 - START-UP AND CONTROL SETTINGS

a) OFFSET CURRENT REGULATION
(Note: the same procedure applies to channels A and B on the card)

- Set "GAIN A" and "GAIN B" potentiometers to minimum.
- Enter reference signal at maximum value:
  +10V (or 20 mA) for solenoid A
  - 10V (or 4 mA) for solenoid B.
- Regulate "OFFSET A" and "OFFSET B" potentiometers so that the valve is positioned at the start of the corresponding hydraulic configuration work zone.

b) SCALE FACTOR REGULATION
(Note: the same procedure applies to channels A and B on the card)

- Enter the reference signal at maximum value
  +10V (or 20 mA) for solenoid A
  - 10V (or 4 mA) for solenoid B.
- Set "GAIN A" and "GAIN B" potentiometers so that the controlled parameter in the relative hydraulic configuration reaches the maximum required value.

c) RAMP REGULATION

- Regulate the "RAMP UP" and "RAMP DOWN" potentiometers to obtain the required valve smoothness od movement with a reference position.

8 - CARD CIRCUIT SETTINGS

The overall dimension diagram in par. 10 shows four switch banks: SW 1 - SW 2 - SW 3 and S1 which enable card set up as required.

NB. Each modification to switch settings must be carried out with the card disconnected from the power supply. The individual switches inside each bank must all be set in the same direction.

SELECTION OF VOLTAGE OR CURRENT REFERENCE SIGNAL
(SW 1 bank comprising three individual switches)

- select V for voltage signal
- select I for current signal.

SELECTION OF SINGLE ENDED OR DIFFERENTIAL REFERENCE SIGNAL (SW 2 bank comprising one individual switch)

- select S for single ended reference signal. This condition is obligatory in the case that the reference signal is generated with an external potentiometer fed by the card itself.
- select D for differential reference signal. This signal is preferable in the case that the reference signal comes from a PLC or CNC analogic outlet.

OPEN OR CLOSED LOOP SELECTION
(SW 3 bank comprising two individual switches)

- select AC for closed loop
- select AA for open loop.

TRANSDUCER POLARITY SELECTION
(SW 1 bank comprising one individual switch)

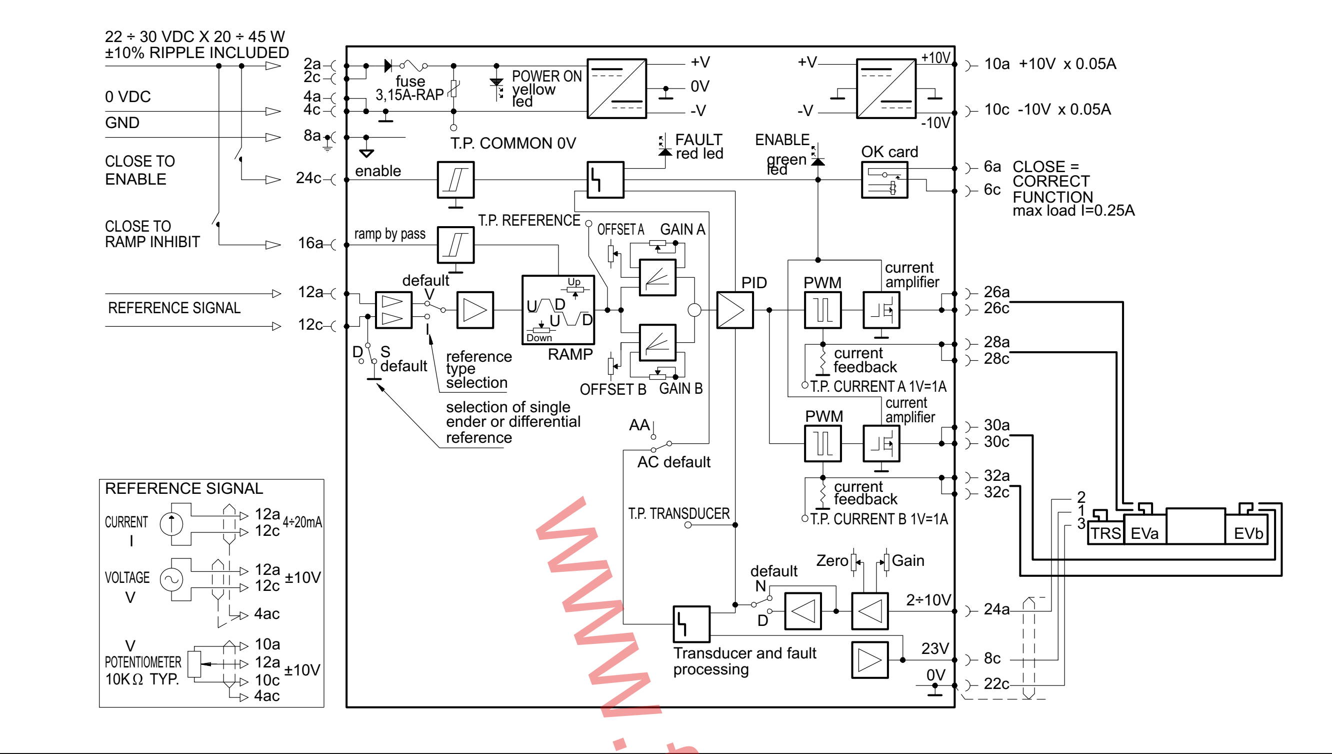
- select N for direct operated valve types DSE3F
- select D for piloted valves.

NB. In the event of transducer malfunction, AA can be selected to proceed with open loop operation. In this case, the ENABLE LED illuminates and the OK relay card contacts close and the FAULT LED remains lit to indicate alarm status.

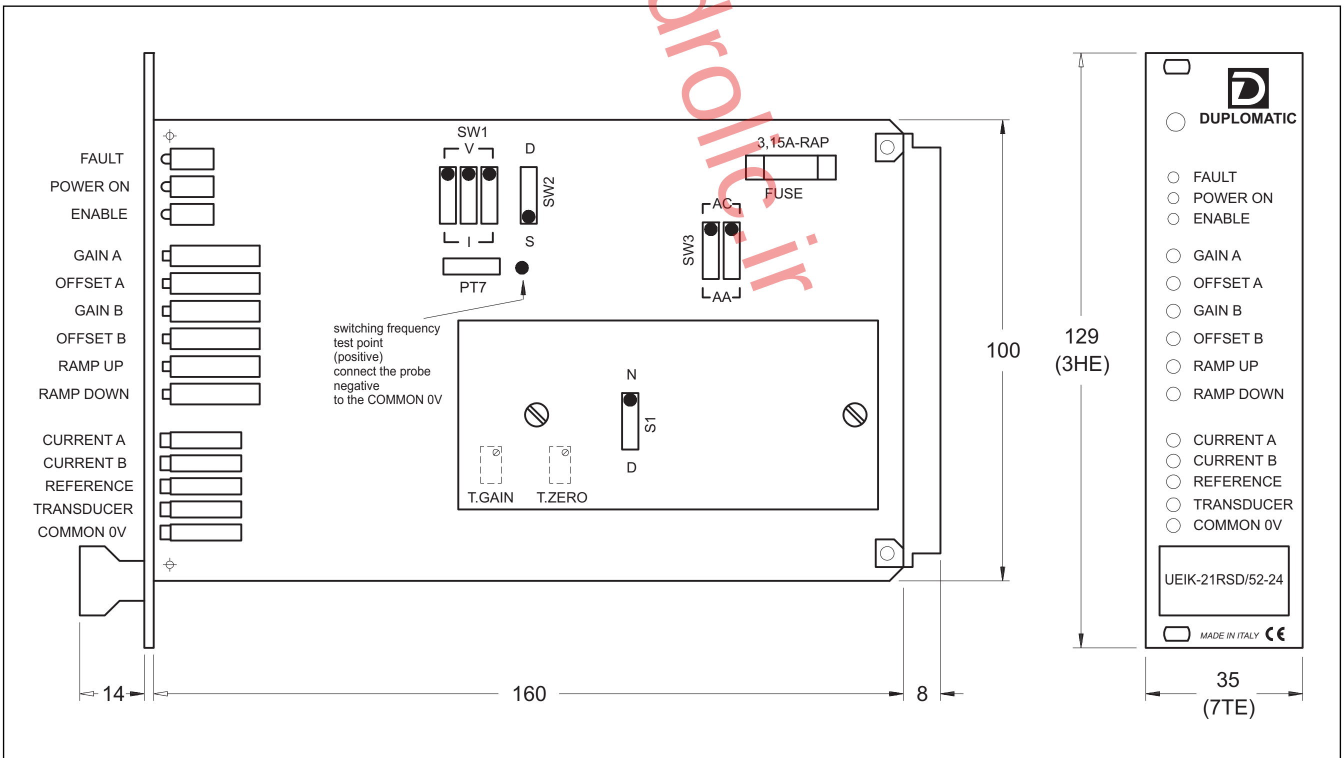
SWITCHING FREQUENCY ADJUSTMENT

It is possible to change the switching frequency (PWM) by acting on the trimmer PT7 (see par. 10). The setting range is from 80 to 1600 Hz.
An appropriate switching frequency adjustment allows reduction of the valve hysterisis value. Clockwise rotation to increase the frequency.

9 - CARD CIRCUIT AND WIRING DIAGRAMS



10 - OVERALL AND MOUNTING DIMENSIONS



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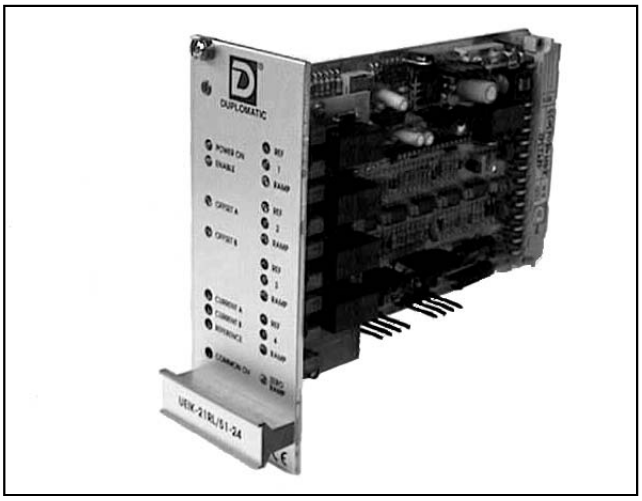


UEIK-2*RL

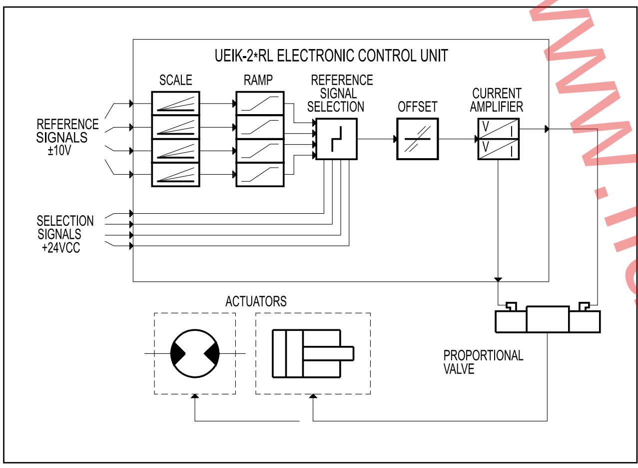
ELECTRONIC CONTROL UNIT FOR OPEN LOOP DOUBLE SOLENOID PROPORTIONAL VALVE

SERIES 51

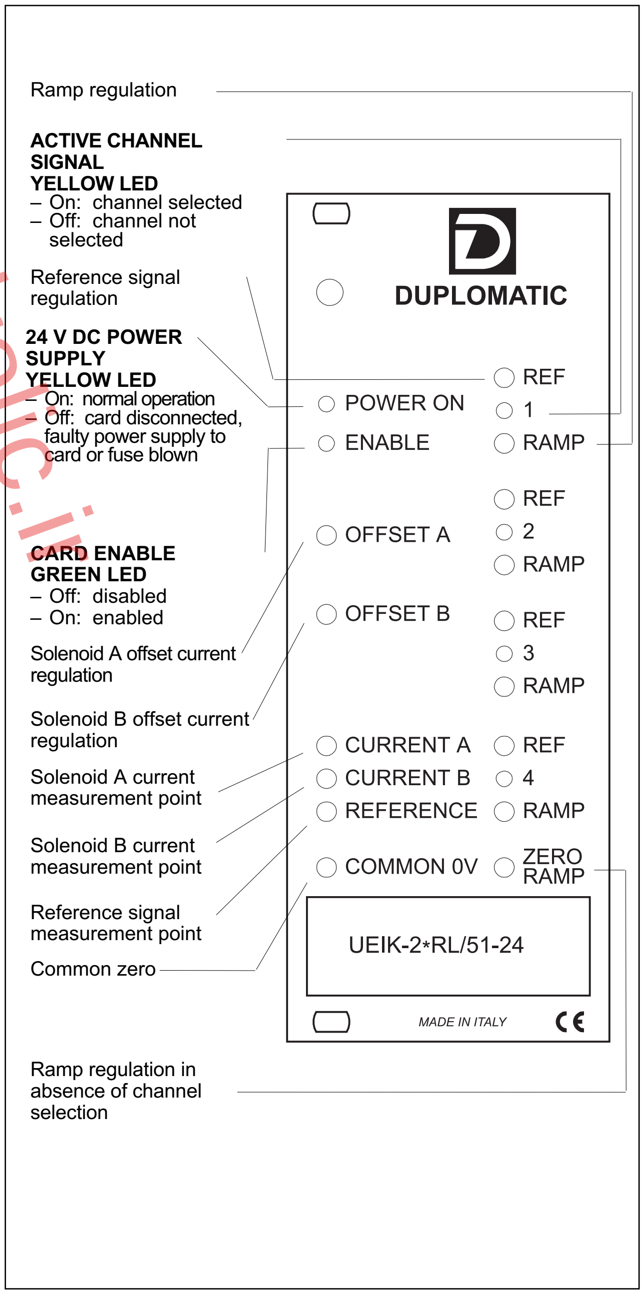
WITH REFERENCE SIGNAL AND RAMP SELECTION

EUROCARD TYPE

FUNCTIONAL BLOCK DIAGRAM



FRONT PANEL



TECHNICAL CHARACTERISTICS

Power supply	V DC	22 ÷ 30 Ripple included
Required power		see par. 2.1
Output current		see par. 3.4
Power supply electrical protections		– overload – polarity inversion
No. of selectable channels		4
Reference signal	V	± 10 adjustable for each channel
Electromagnetic compatibility (EMC) (see par. 5 - **NOTE 1**)		in compliance with 2004/108/CE
Card size		Eurocard 100x160x50
Connector interface		DIN 41612-D 32 Male
Operating temperature range	°C	0 ÷ 50
Mass	kg	0,3

UEIK-2*RL

SERIES 52

1 - IDENTIFICATION CODE

U	E	I	K	-	2		R	L	/	51	-	24

- UEIK: Eurocard type electronic control unit
- 2: For double solenoid proportional valves
- Maximum current: **1** = 800 mA **2** = 1.200 mA
- RL: Ramp and reference signal selection
- 51: Series No. (from 50 to 59 sizes and mounting dimensions remain unchanged)
- 24: Power supply voltage = 24 V DC

The UEIK-2*RL card is an electronic control unit in Eurocard format for open loop control of double solenoid proportional valves, with selection in sequence of four different reference and ramp time regulation signals.

The unit is suitable for management of “fast-slow” work cycles.

The front panel is fitted with LEDs to indicate card functions and potentiometers to optimise performance.

2 - FUNCTIONAL SPECIFICATIONS

2.1 - Electric power supply

The card requires a power supply of between 22 and 30 V DC (pin 2a/2c - 4a/4c) and 20 W (UEIK21-RL) - 29 W (UEIK-22-RL).

Power supply voltage must be rectified and filtered, with maximum admissible ripple within the above voltage range.

2.2 - Electrical protection

The card is protected against overvoltage and polarity inversion.

A 2A fast-acting fuse is fitted for power circuit protection.

3 - SIGNALS AND ADJUSTMENT

3.1 - POWER ON

The yellow LED indicates card power supply:
ON - normal power supply
OFF - no power supply, faulty power supply or blown fuse

3.2 - ENABLE

A 22 to 30 V DC on pin 24c enable command is required for card operation.
The condition of the enable card is shown by both a visible LED on the front panel and as a contact available for the user on pins 6a and 6c.

The green LED indicates:
ON - card enabled
OFF - card disabled or failed

3.3 - OFFSET A / OFFSET B
(Polarization current regulation of solenoids A and B)

“OFFSET A” and “OFFSET B” potentiometers enable regulation of thepolarization current of the solenoids A and B respectively. They are used to eliminate the valve insensitivity zone (dead zone) in the two valve hydraulic configurations.

The regulation field is up between 0 and 0,5 A (UEIK-21-RL) and between 0 and 0,65 A (UEIK-22-RL).
The default value is zero.

The offset current is activated when the reference signal exceeds the threshold of ± 150 mV.
The offset is not active and only the polarization current equal to 25 mA is present beneath this threshold.

NOTE: The variation of the set value of the offset current causes a corresponding variation of the scale factor value.

Rotate clockwise to increase current.

3.4 - REF (Reference signal regulation)

The card enables settings by means of multi-turn potentiometers on the front panel (indicated by “REF”) of four different reference signal values (one per channel).

Solenoid A is controlled with positive reference of 0÷+10V, and solenoid B is controlled with negative reference signal of 0÷-10V.

Maximum output current, corresponding to the maximum potentiometers regulation, is limited to 1 A. See par. 6 for default settings.

Rotate clockwise to increase the reference signal by absolute values. See par. 9 for electrical connections.

One of the four channels can be selected automatically by transmitting a +24 V DC command to pin 18c (channel 1) - 18a (channel 2) - 20c (channel 3) - 20a (channel 4).

To obtain correct signal switching and continuous regulation with the selection of channels from 1 to 4, select the new channel before deactivating the previous one. A yellow LED illuminates on the front panel in correspondence to the channel selected.

NB. The system manages reference signals and ramp values of the channel with the highest selected number. To enable channel selection in reverse order (4 to 1) all previous channels must be deactivated.

3.5 - RAMP (Ramp regulation)

A “RAMP” potentiometer is associated with each of the channels to enable regulation of the time required to reach the current supplied according to the selected reference signal.
The regulation range is from 0,03 to 7 sec.
This makes it possible to smooth valve response and adapt it to the requirements of the hydraulic system and the machine cycle.
The “ZERO RAMP” potentiometer enables regulation of the valve deactivation time (current=0) when all channels are switched off.
Rotate clockwise to increase ramp time.

Ramps can be inhibited by transmitting a 22 to 30 V DC exclusion command to pin 16a. In this case, the ramp residual time is 10 ms.

4 - SIGNAL MEASUREMENT

4.1 - CURRENT A / CURRENT B
(Current measurement points of solenoids A and B)

Measurement points for voltage readings of current supplied to solenoids A and B.
Reading conversion is 1V DC = 1A (UEIK-21-RL) and
0,82 V DC = 1A (UEIK-22-RL).

4.2 - REFERENCE (Reference signal measurement point)

Enables reading of reference signal related to the selected channel, in voltage, but of the opposite sign.

5 - INSTALLATION

The card is suitable for assembly on a rack or a card holder with interface for connector types DIN 41612 - size D - 32 pole.

It is recommended to use cable sections of 1 to 2,5 mm^2, in function with their length, for power supply and solenoid connections. For other connections, it is advisable to use cables with a screened sheath connected to earth only on the card side.

NOTE 1
To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram of par. 9.
As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electricmotors, inverters and electrical switches).

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

6 - DEFAULT CONDITIONS

The electronic control unit is supplied factory-set.

Standard settings are:

– “OFFSET” regulation: zero
– “REF” regulation:corresponding to 0,82A to A and B solenoids
– “RAMP” regulation: minimum
– position SW1 on V
– position SW2 on S
– position SW3 on AA
– switching frequency (PWM) = 200Hz (UEIK-21-RL) - 100Hz (UEIK-22-RL)

7 - START-UP AND FRONTAL SETTINGS

Settings can be modified and references can be regulated according to specific work cycles as follows:

a) OFFSET CURRENT REGULATION

– Select one of the channels connected to positive reference +10V (pin 10a).
– Regulate the relative potentiometer “REF” at a value between 200 and 300 mV (for reference signal see par. 4.2)
– Regulate the “OFFSET A” potentiometer so that the valve is positioned at the start of the work zone controlled by solenoid “A”.

Repeat the procedure by selecting a channel connected to the negative reference -10V (pin 10c) and regulate the “OFFSET B” potentiometer.

b) REFERENCE REGULATION

– Select a channel and regulate the relative “REF” potentiometer to obtain the required actuator speed.
– Repeat the procedure for all four channels to obtain the required speed cycle.

c) RAMP REGULATION

– Regulate the four “RAMP” potentiometers to obtain the required regulation smoothness during passage from one channel to another.
– Regulate the “ZERO RAMP” potentiometer to obtain regulation smoothness when all four channels are deactivated.

8 - CARD CIRCUIT SETTINGS

The overall dimension diagram in par. 10 shows three switch banks: SW 1 - SW 2 - SW 3 which enable card set mup as required.

NB. Each modification to switch settings must be carried out with the card disconnected from the power supply. The individual switches inside each bank must all be set in the same position.

SELECTION OF SINGLE ENDED OR DIFFERENTIAL REFERENCE SIGNAL (SW 2 bank comprising one individual switch)

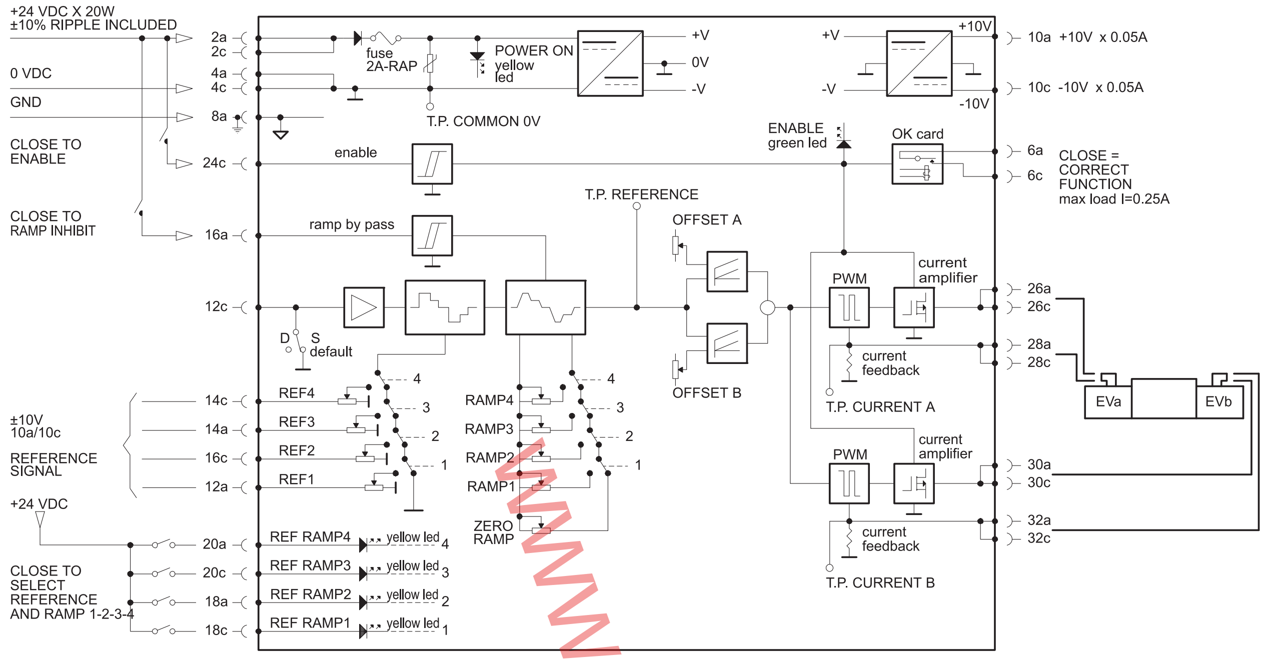
– select S for single ended. This condition is obligatory in the case that the reference signal is generated with the four potentiometers inside the card.
– by selecting D (differential), it is possible to add an external reference signal that can control the valve during the manual cycle.

- **SW 1 bank (comprising three individual switches) must always be set on V, as per standard supply conditions.**
- **SW 3 bank (comprising two individual switches) must always be set on AA, as per standard supply conditions.**

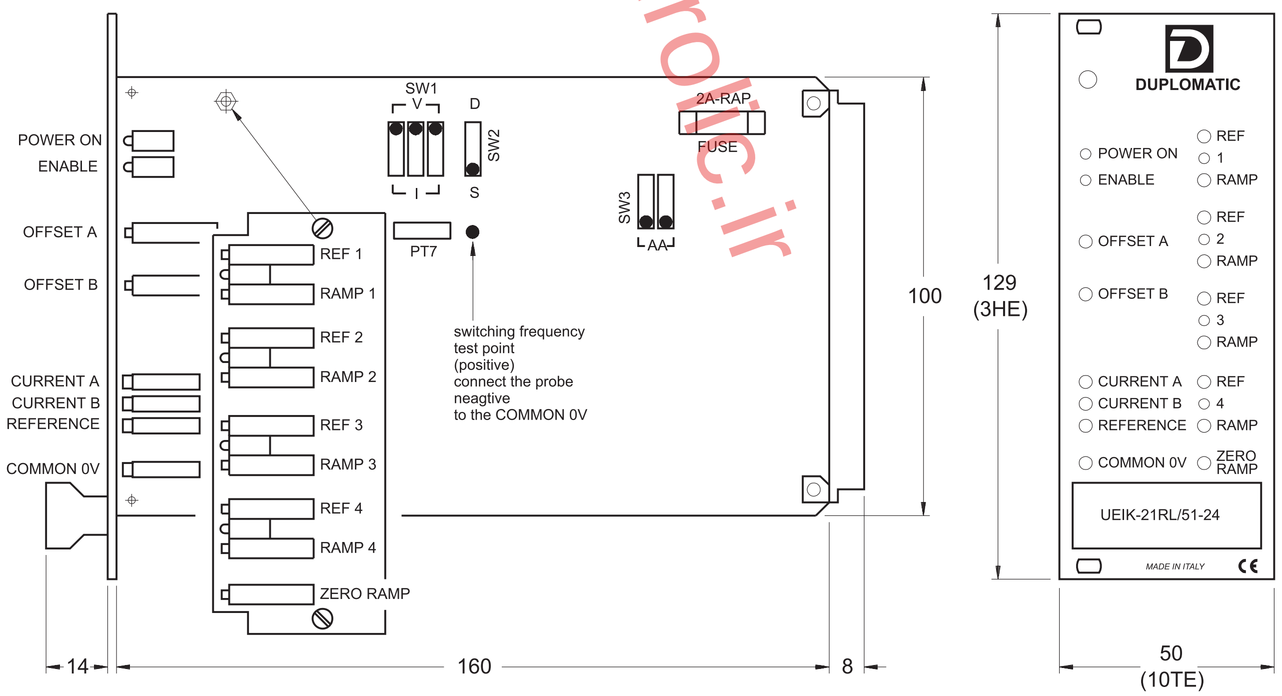
SWITCHING FREQUENCY ADJUSTMENT

It is possible to change the switching frequency (PWM) by acting on the trimmer PT7 (see par. 10).
The setting range is from 80 to 370 Hz.
An appropriate switching frequency adjustment allows reduction of the valve hysterisis value.
Clockwise rotation to increase the frequency.

9 - CARD CIRCUIT AND WIRING DIAGRAM



10 - OVERALL AND MOUNTING DIMENSIONS



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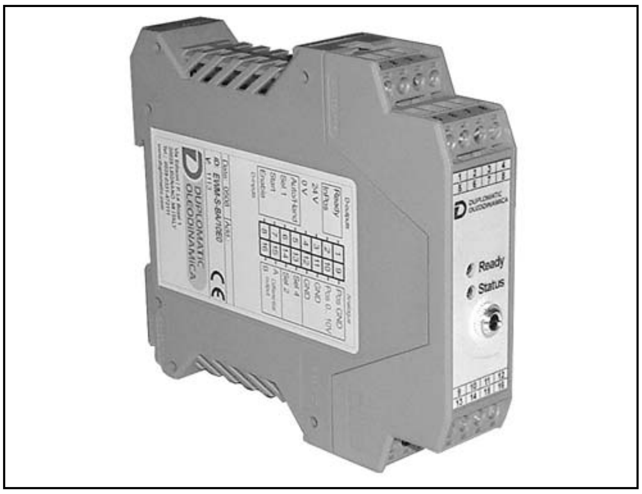
EWM-S-B*

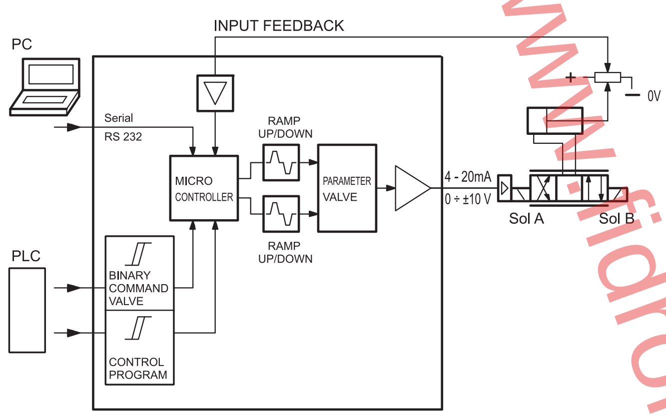
DIGITAL CARD FOR STROKE CONTROL IN CLOSED LOOP SYSTEMS

SERIES 10



RAIL MOUNTING TYPE: DIN EN 50022

OPERATING PRINCIPLE



— The EWM-S-B* cards are designed for an easy stroke control of hydraulic actuators connected to a simple PLC with only I/O functions. The target position can be selected by a binary input up to 8 different position.

— Typical applications are positioning drives, handling axis and fast transportable drives (adaptation of non-linear valve characteristics).The card controls a directional proportional valve with integrated electronics. As option, an integrated power amplifier is available.

— This card allows an optimal use of overlapped and zero overlapped proportional valves.

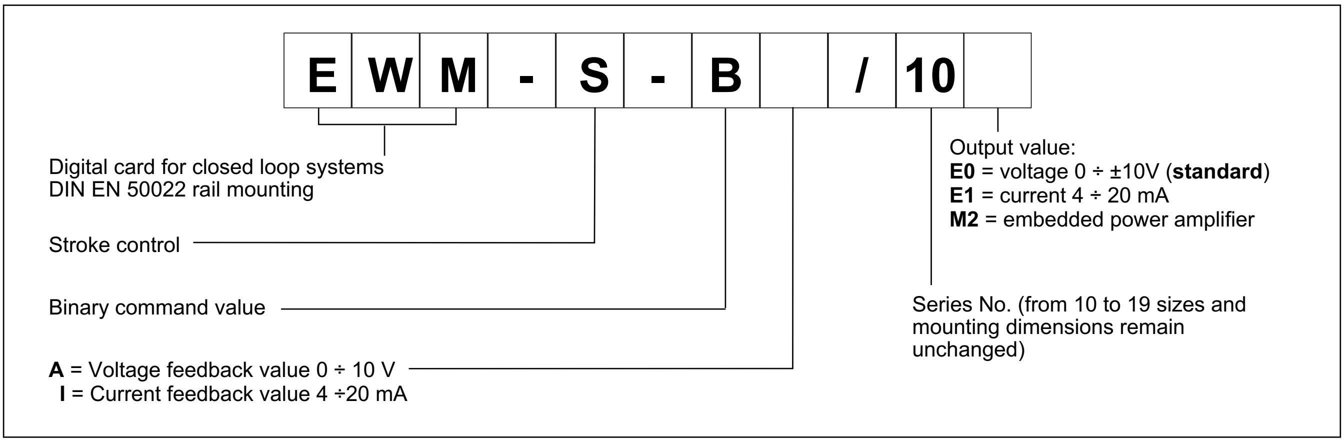
— Internal function and failure are monitored with two digital output easy to read.

— The card use the RS232C interface, and is settable via notebook, using the kit (EWMPC).

TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ÷ 30 ripple included external fuse 1,0 A (5 A for M2 version)
Current consumption: - E0 and E1 version - M2 version	mA A	100 + sensor power consumption depending from solenoid current. max 5A
Command value		binary command with 3 bit
Feedback value: - BA version - BI version	V mA	0 ÷ 10 (R_I = 90 kΩ) 4 ÷ 20 (R_I = 250 kΩ)
Output values: - E0 version - E1 version - M2 version	V mA A	±10 (max load 5 mA) 4 ÷ 20 (max load 390 Ω) 1,0 - 1,6 - 2,6
Position accuracy	%	0,01
Interface		RS 232 C
Electromagnetic compatibility (EMC) according to 2004/108/CE		Emissions EN 61000-6-3 Immunity EN 61000-6-2
Housing material		thermoplastic polyamide PA6.6 -combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w) or 46 on M2 version
Connector		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

1 - IDENTIFICATION CODE



This module supports the simple point-to-point positioning with hydraulic drives. Up to eight target positions (with related velocities) can be selected. The deceleration characteristics can be defined with the command CTRL, choosing between linear (LIN) or nearly square root (SQRT1) parameters. See at par.4, Adjustments.

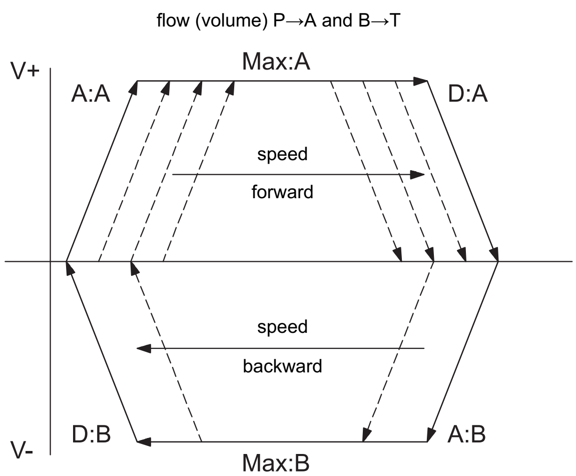
The sampling time of the control loop is 1 ms.

Two operating modes can be selected:

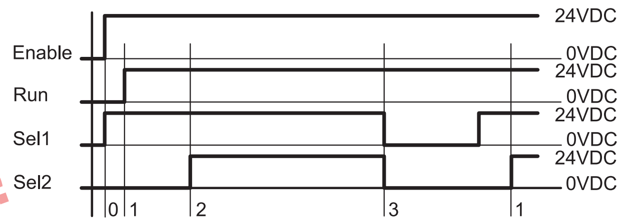
A - stroke depending deceleration, that means the control gain will be adjusted with the parameters D:A and D:B This is a time-optimal positioning structure with vey high stability.

B - NC mode, where the position value is generated from the following error.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two contradictory requirements (short positioning time and high accuracy) have to be considered in the system design.



Sequence of the positioning with 3 target position achievable with the EWM-S-B* cards :



S:0 and V:0 - Switching on and placement to parking position.
S:1 and V:1 - Initial positioning in the work cycle
S:2 and V:2 - Second target position
S:3 and V:3 - Return to the first position;
To begin, the external input START (RUN) must be enabled.

2 - FUNCTIONAL SPECIFICATIONS

2.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards.
All inductivity at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).
It is recommended to use a regulated power supply (linear or switching mode) for the card supply and the sensors.

NOTE: in the type M2 the value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoid to be controlled.

2.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

2.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V , Low level: <4V, high level >12V with current <0,1A. See the block diagram at paragraph 8 for the electric connections.

2.4 - Feedback input values

The card accepts analogue feedback input. The feedback value must be 0 ÷ 10 V for EWM-S-BA*, and 4 ÷ 20 mA for EWM-S-BI* version.

2.5 - Output values

E0 version: output voltage 0 ±10 V
E1 version: output current 4 ÷ 20 mA
M2 version: Embedded power stage configurable via software with a value of 1, 1.6 or 2.6 A.

2.6 - Digital Output

Two digital output are available, INPOS and READY, that are displayed via LEDs on the front panel
Low level <4V High Level > 10 V Max 50 mA with load 200 Ω

3 - LED FUNCTIONS

There are two leds on the card: GREEN and YELLOW.

GREEN: Shows if the card is ready (READY output).

ON - The card is supplied
OFF - No power supply
FLASHING - Failure detected (internal or 4… 20 mA).
Only if SENS = ON

YELLOW: Signal of the control error monitoring. (STATUS output)

ON - No control error
OFF - Error detected, depending of a parameter error.

4 - ADJUSTMENTS

On the EWM cards, the adjustment setting is possible only via software. Connecting the card to the PC, the software automatically recognises the card model and shows a table with all the available commands, with their parameters, the default setting, the measuring unit and an explanation of the command and its uses. The parameters changes depending on the card model.

STANDARD PARAMETERS TABLE

Commands	Parameter	Defaults	Units	Description
s:i x	i= 0..7 x= 0..10000	- :0	- 0,01%	Definition of the target positions. The value **i** is related to the input selection (SEL1, SEL2 and SEL4; binary coded).
vc:i x	i= 0..7 x= 0..10000	- :5000	- 0,01%	Definition of the target speeds. The value i is related to the input selection (SEL1, SEL2 and SEL4; binary coded).
dsel x	x= on|off	off	-	Mode of the digital selection inputs. OFF: activation of the target position by a signal change (low to high) of the START input. ON: direct activation by the SELx inputs.
a:i x	i= A|B x= 1… 2000	:A 100 :B 100	ms ms	Acceleration time depending on direction. **A** indicates analogue output 15 and **B** indicates analogue output 16. Normally **A** = flow p-A, B-T and **B** = flow P-B, A-T.
d:i x	i= A|B x= 10… 10000	:A 2500 :B 2500	0,01% 0,01%	Deceleration stroke depending on direction. The loop gain is calculated by the deceleration stroke. The shorter the higher. In case of instabilities longer deceleration stroke will be sufficient.
ctrl x	x= lin|sqrt1 |sqrt2	sqrt1	-	Selection of the control function: **lin** = standard linear P-control, (**NOTE**) **sqrt1** = progressive time optimized deceleration curve **sqrt2** = sqrt1 with a higher gain in position
vramp x	x= 1… 2000	50	ms	Ramp time for velocity input.
vmode x	x= on|off	off	-	Activation of the NC-generator. The command position is generated by a velocity profile (internal or external preset of v). The axis drives more or less speed controlled.
th x	x= 100… 60000	5000	ms	Stroke time for 100% velocity and 100% nominal sensor stroke.
hand:i x	i= A|B x= -10000… 10000	:A 3300 :B -3300	0,01% 0,01%	Degree of output signal in manual mode
min:i x	i= A|B x= 0… 5000	:A 0 :B 0	0,01% 0,01%	Deadband compensation of positive overlapped proportional valves. Good adjustment will increase positioning accuracy.
max:i x	i= A|B x= 5000… 10000	:A 10000 :B 10000	0,01% 0,01%	Maximum output range for adapting control range to maximum flow range.
trigger x	x= 0… 2000	200	0,01%	Point to activate the deadband compensation (**min**). Also useful for reduced sensitivity in position with control valves.
inpos x	x= 2… 2000	200	0,01%	Range for the InPos signal (status output). (**NOTE**)
offset x	x= -2000… 2000	0	0,01%	The offset will be added to the command value.
pol x	x= +|-	+	-	For changing the output polarity. All **A** and **B** adjustments depend on the output polarity. The right polarity should be defined first.
save	-	-	-	Storing the programmed parameter in E²PROM.
loadback	-	-	-	Reloading the parameter from E²PROM in working RAM

help	-	-	-	Help to the commands, for terminal programs only
para	-	-	-	Parameter list with programmed data, for terminal programs only
din	-	-	-	Status of the digital inputs.
w, x, xw, u ,v	-	-	-	Actual signals: command value, actual value, process data, control divergence and reference value.
default	-	-	-	Preset values will be set.

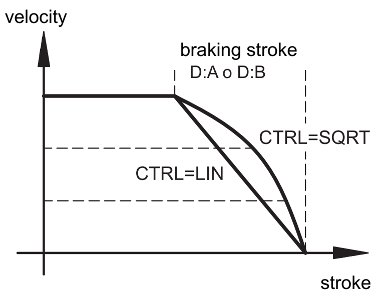
NOTE about the INPOS command: The INPOS command defines the window in relation to the stroke where the INPOS message is indicated. The monitored area is derived from the setpoint value minus the half "Inpos" value until setpoint value plus the half "Inpos" value. The positioning process is not influenced by this message. The controller remains active. In NC-mode this message has to be interpreted alternatively as following error.

NOTE about the CTRL command:: This command controls the braking characteristic of the hydraulic axis. With positive overlapped proportional valves one of both SQRT braking characteristics should be used because of the linearization of the non-linear flow curve typical of these valves If zero overlapped proportional valves (control valves) are used, you can choose between LIN and SQRT1 according to the application. The progressive gain characteristic of SQRT1 has the better positioning accuracy.

According to the application there is maybe a longer braking distance, so that the total stroke time will be longer.

LIN: Linear braking characteristics (control gain corresponds to: 10000 / d:i).

SQRT*: Root function for the calculation for the braking curve. SQRT1: with small control error. control gain corresponds to 30000 / d:i ; SQRT2: control gain corresponds to 50000 / d:i



ADDITIONAL PARAMETERS ON VERSION BI*

Commands	Parameters	Defaults	Unit	Description
ain:i **a, b, c, x**	i= X a= 0… 10000 b= 0… 10000 c= -10000… 10000 x= V|C	 : 1000 : 1000 : 0 : V	 - - 0,01% -	Analogue output selection. **W** and **X** for the inputs and **V** = voltage, **C** = current. With the parameters **a**, **b** and **c** the inputs can be scaled (output = a / b * (input - c)). Because of the programming of the **x**-value (x = C) the corresponding input will be switched over to current automatically.

ADDITIONAL PARAMETERS ON VERSION *M2

Command	Parameter	Defaults	Unit	Description
current x	x=0… 2	0	-	Selection of the output current range: **0** = 1,0 A **1** = 1,6 A **2** = 2,6 A
dfreq x	x= 60… 400	120	Hz	Dither frequency
dampl x	x= 0… 3000	500	0,01%	Dither amplitude. Typical values between 500 and 1200 (good experience were made with 700).
pwm x	x= 100… 7700	2600	Hz	PWM Frequency. PWM Frequencies of ≥2000 Hz improve the current loop dynamics. PWM Frequencies in the range of 100… 500 Hz will be used for low dynamic valves with high hysteresis. In this case, DAMPL must be zero.
ppwm x **ipwm x**	x= 0… 30 x= 1… 500	3 40	- -	PI-compensator for the current controller. Changes should be only done with good experience in optimizing of current loops. In some cases a PWM Frequency of >2500 Hz; PPWM can be increased to 7… 15. ATTENTION: The dither amplitude must be optimized after that.

5 - INSTALLATION

The card is designed for rail mounting type DIN EN 50022.

It is recommended to use cable sections of 0.75 mm², up to 20 m length and of 1.00 mm² up to 40m length, for power supply and solenoid connections on version M2. For other connections it is recommended to use cables with a screened sheath connected to earth only on the card side.

NOTE 1

To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

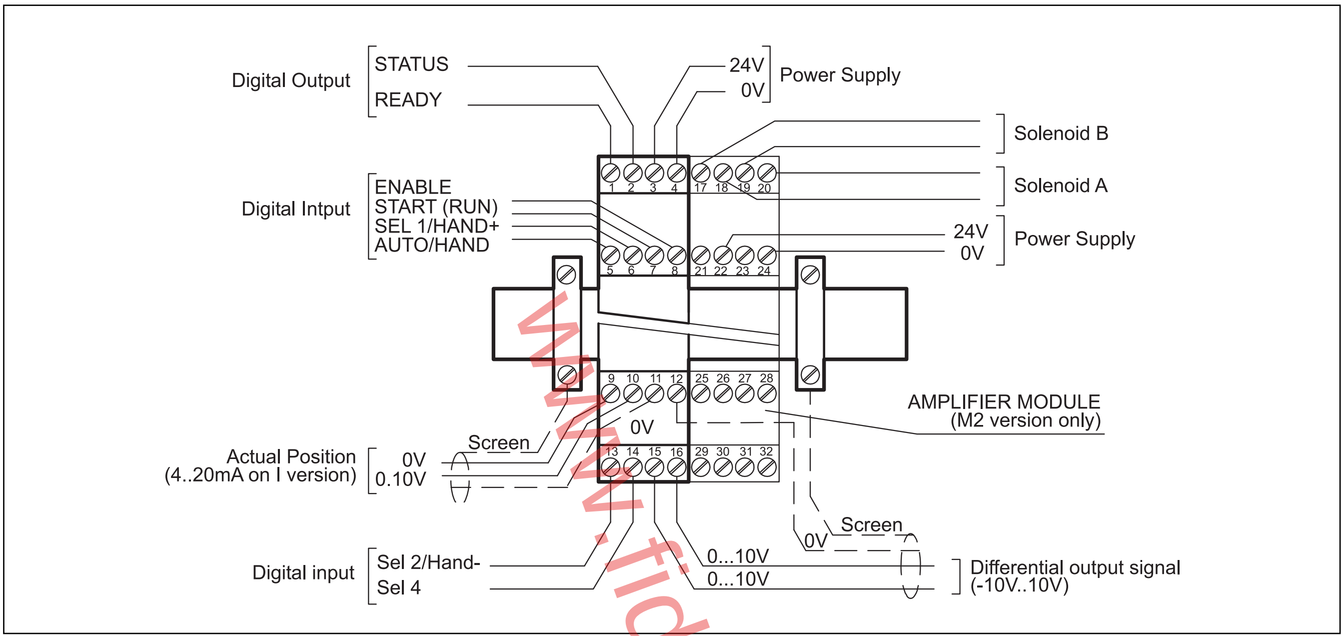
In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

6 - SOFTWARE KIT EWMPC/10 (code 3898401001)

The software kit includes a USB cable (2.70 mt length) to connect the card to a PC or notebook and the software. During the identification all information are read out of the module and the table input will be automatically generated. Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft XP® operating systems.

7 - WIRING DIAGRAM OF EWM-S-B*



DIGITAL INPUT AND OUTPUT

PIN 1 — READY output.
This output is high when ENABLE is active and there is no sensor error. This output corresponds with the green led.

PIN 2 — STATUS output.
Monitoring of the control error (INPOS). Depending on the INPOS command, the status output will be deactivated, if the position difference is greater then the adjusted window.
The output is only active if START = ON.

PIN 5 — AUTO/HAND input
ACTIVATED = automatic mode
DEACTIVATED = hand mode.

PIN 6 — SEL 1/HAND+ input:
SEL 1 = Selection input 1
HAND+ = Hand mode (START = OFF), the axis drives with the programmed speed (parameter HAND:A). After the deactivation the command position is set to the actual position.

PIN 7 — START (RUN) input:
The positioning controller is active; the external analogue command position is taken over as command value. If the input is switched off during movement, the command position is set to the actual position plus a defined emergency deceleration stroke

PIN 8 — ENABLE input:
This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. Target position is set to actual position and the drive is closed loop controlled.

PIN 13 — SEL 2 / HAND- input:
SEL 2 = Selection input 2
HAND- = (START = OFF), the axis drives with the programmed speed (parameter HAND:B). After the deactivation the command position is set to the actual position.

PIN 14 — SEL 4- input:
Selection input 4 - See schemes in the BINARY TABLE below

Address	0	1	2	3	4	5	6	7
SEL 1	0	1	0	1	0	1	0	1
SEL 2	0	0	1	1	0	0	1	1
SEL 4	0	0	0	0	1	1	1	1

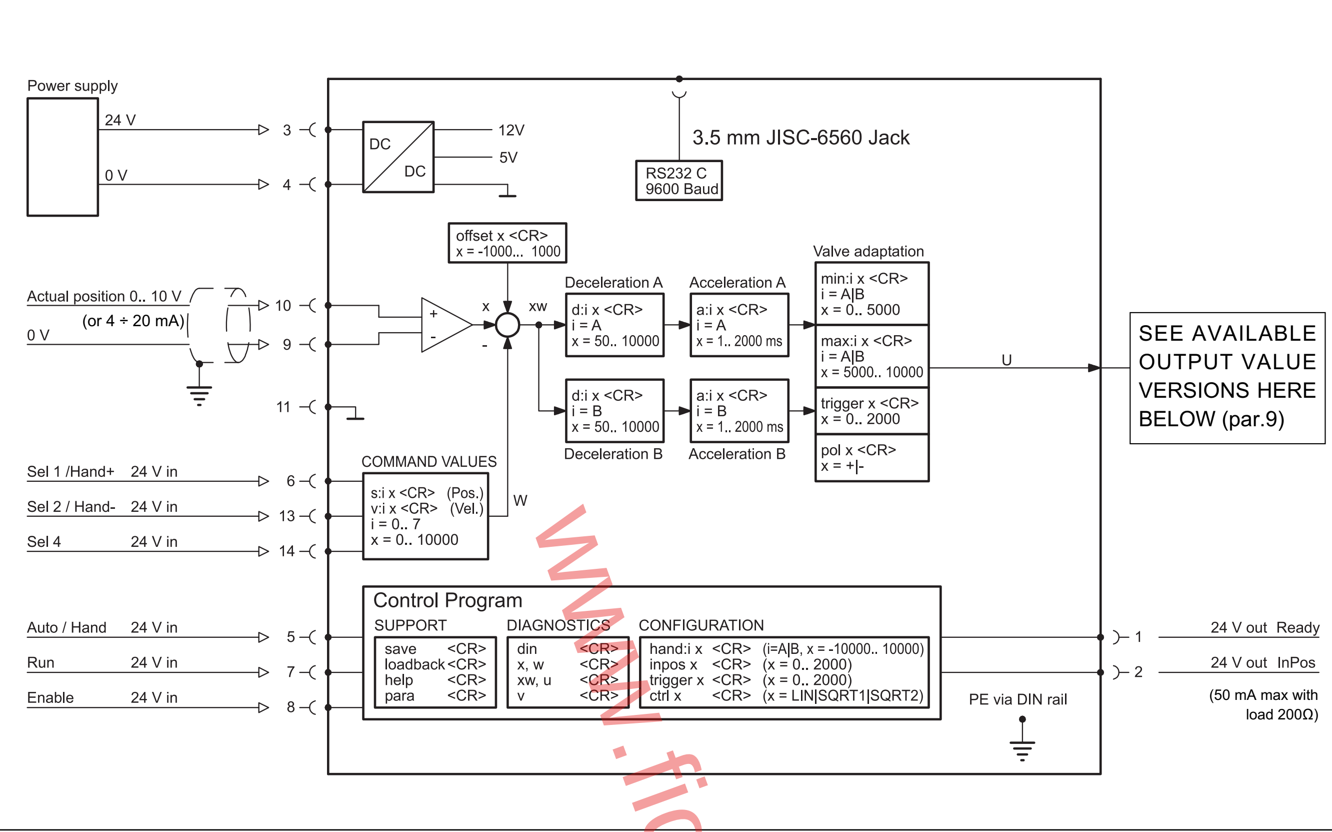
ANALOGUE INPUT

PIN 9/10 — Actual position (feedback) value (X)
range 0 ÷ 100% corresponds to 0 ÷ 10V (or 4 ÷ 20 mA)

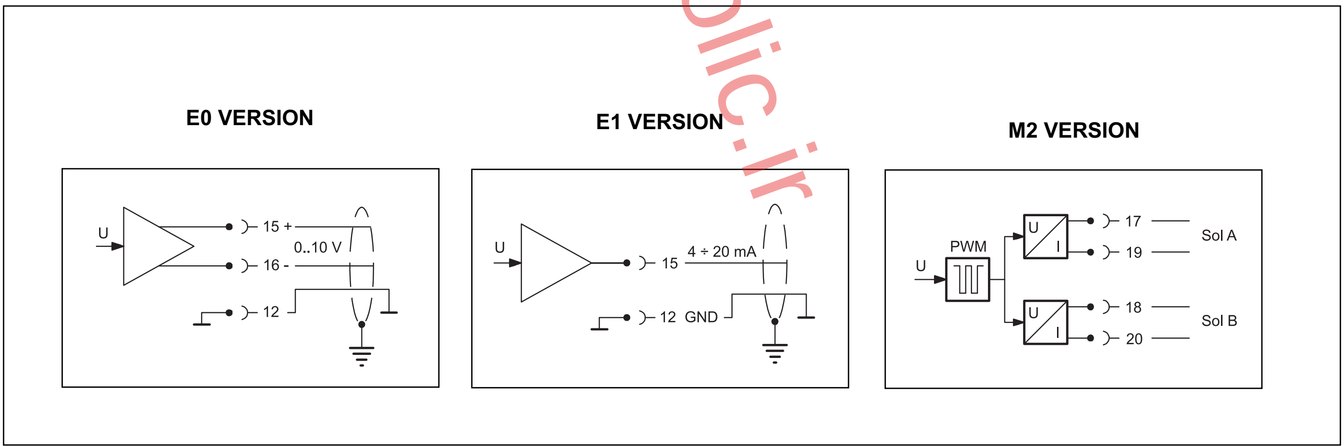
ANALOGUE OUTPUT

PIN 15/16 — Differential output signal (U)
± 100% corresponds to ± 10V differential voltage, optionally (I-version) current output ±100% corresponds to 4 ÷ 20 mA (PIN 15 to PIN 12)

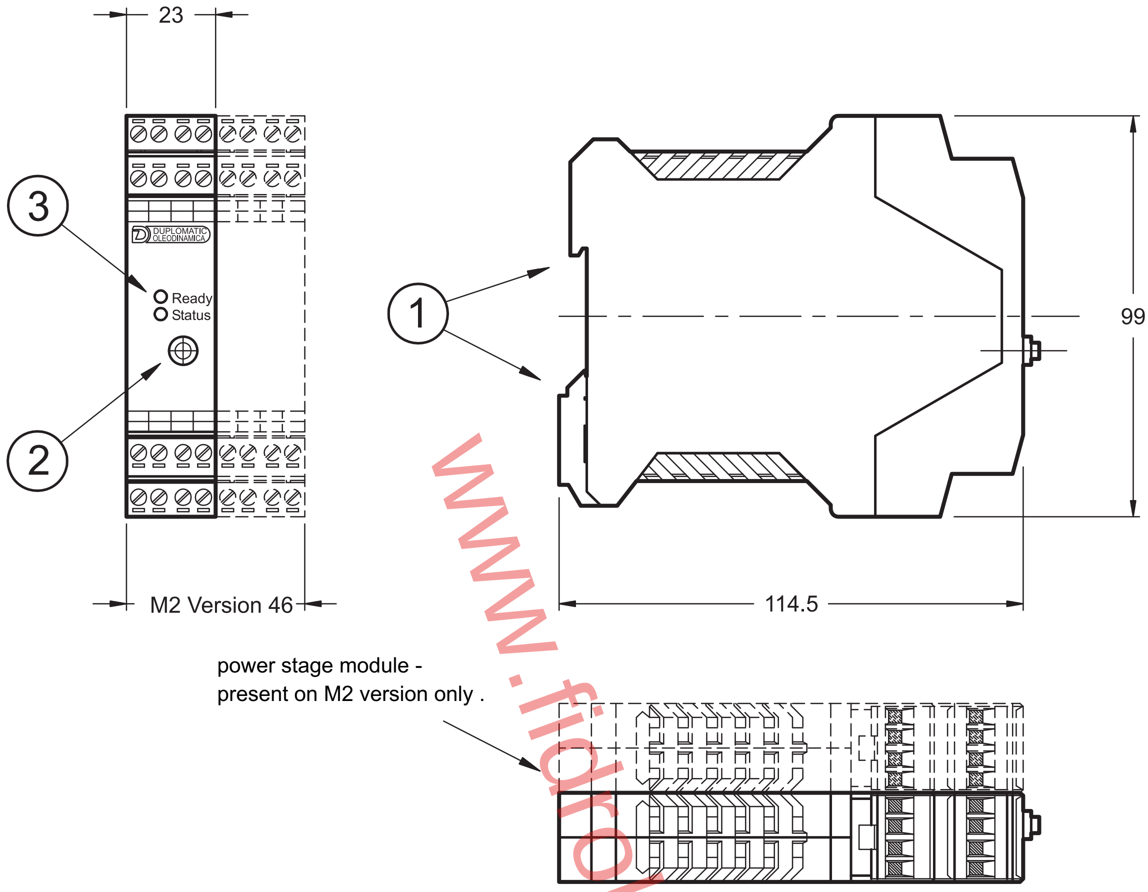
8 - CARD BLOCK DIAGRAM



9 - AVAILABLE OUTPUT VALUE VERSIONS



10 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	Plug for PC cable connection
3	LED for output signals

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DUPLOMATIC OLEODINAMICA

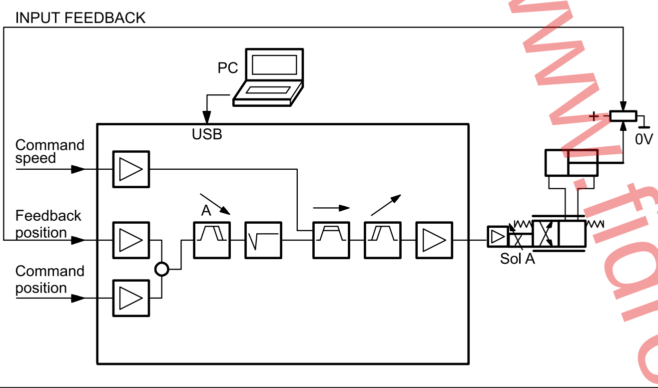
EWM-S-AA

ANALOGUE POSITIONING CARD FOR STROKE CONTROL IN CLOSED LOOP SYSTEMS WITH ANALOGUE FEEDBACK

SERIES 20

RAIL MOUNTING TYPE: DIN EN 50022

OPERATING PRINCIPLE



— This card is designed for positioning drive applications. It allows easy stroke positioning control of hydraulic actuators in closed loop systems.

— Velocity can be defined also by an external speed command.

— Card setup via software only, through an on-board USB-B port.

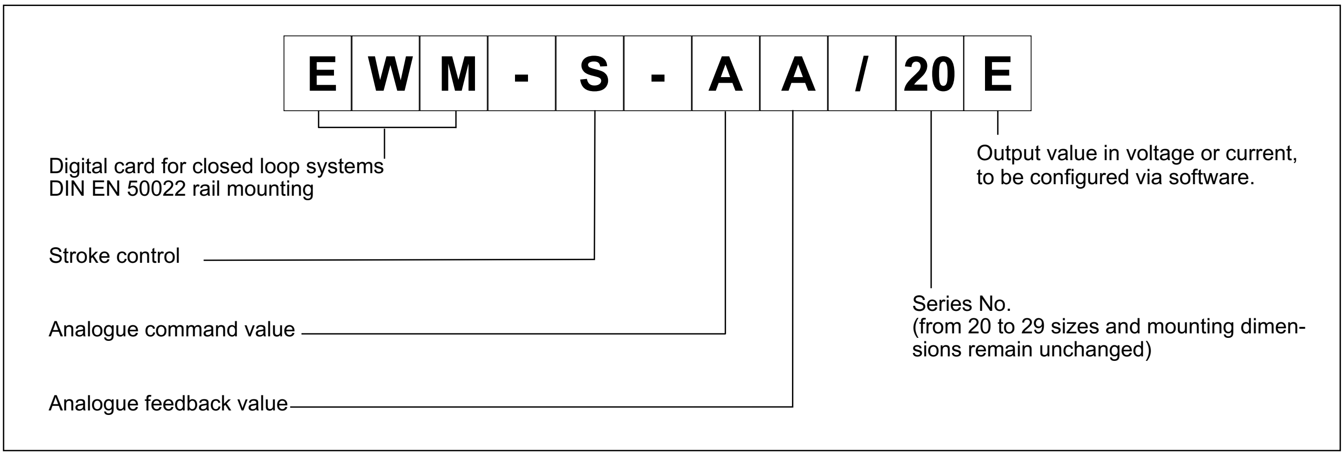
— The output value, voltage or current type, is configurable via software.

TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ÷ 30 ripple included
Fuse, external:		1A medium time lag
Current consumption:	mA	100
Command position	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Position accuracy	%	0,003 incl. Oversampling
Command speed	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 90 kΩ)
Feedback value	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Output values	V mA	2x 0 ÷ 10 (max load 10 mA 2 kΩ) 4 ÷ 20 (max load 390 Ω)
Sample time	ms	1
Interface		USB-B 2.0
Electromagnetic compatibility (EMC) 2004/108/EC		Immunity EN 61000-6-2: 8/2005 Emissions EN 61000-6-4: 6/2007; A1:2011
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w)
Connections		USB-B (2.0) - 4x poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

EWM-S-AA
SERIES 20

1 - IDENTIFICATION CODE



2 - FEATURES OVERVIEW

Controller Functions

- Stroke positioning control in closed loop system
- Fine positioning - an accuracy of approx. 0.01% of the sensor stroke can be achieved
- 2 different operating modes:
  SDD – Stroke Depending Deceleration - time-optimal positioning structure with very high stability
  NC – Numerically Controlled - To follow the position profile
- Gain adjustment made via software
- PT1 filter to stabilize the control behaviour
- Emergency function (EOUT)
- Analogue signal command
- Analogue feedback input
- Velocity limited internally or by analogue input
- Simple and intuitive scaling of the sensor

Adaptation of the valve characteristic curve

- CTRL function to adapt the braking characteristics to positive and zero overlapped proportional valves
- Advanced deadband compensation: non-linearity compensation by a double-gain characteristics
- Drift compensation

Monitoring functions

- In-position error
- Cable break for feedback sensor and command signal
- 2 Digital output to read the status

Other characteristics

- Current or voltage output to be set via software
- Card configuration via software, through on-board USB port

3 - FUNCTIONAL SPECIFICATIONS

3.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

3.4 - External command position

The card accepts an analogue input signal. The command value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.5 - External command speed

The card accepts an analogue input signal. The command speed can be 0 ÷ 10 V (RI = 90 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.6 - Feedback value

The card accepts analogue feedback input. The feedback value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.7 - Analogue output values

Output values can be in voltage or current, to be configured via software (parameter SIGNAL:U). The same parameter defines the polarity also.

Voltage: ± 10 V Differential output
(0÷10 V at PIN 15 and 0÷10 V at PIN 16).

Current: 4 ÷ 20 mA (PIN 15 to PIN 12).

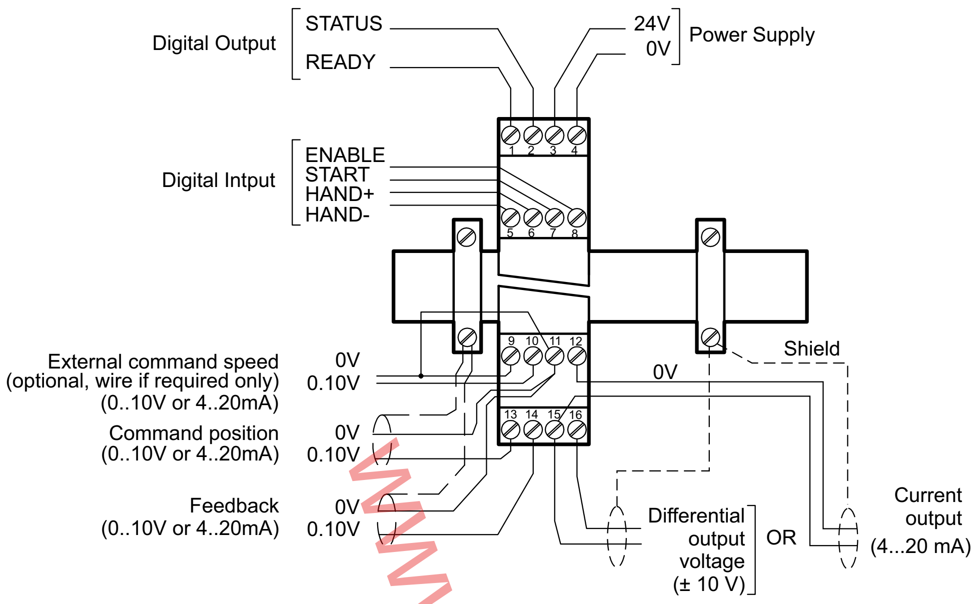
All analogue output have to be wired with screened cables.

3.8 - Digital Output

Two digital output are available, INPOS and READY, that are displayed via LEDs on the front panel.

Low level < 2 V High Level > 12 V (max 50 mA).

4 - WIRING DIAGRAM



DIGITAL INPUT AND OUTPUT

PIN 1 — READY output.
General operationality, ENABLE is active and there is no sensor error (by use of 4÷20 mA sensors). This output corresponds with the green LED.

PIN 2 — STATUS output.
Monitoring of the control error (INPOS). Depending on the INPOS command, the status output will be deactivated, if the position difference is greater than the adjusted window.
The output is only active if START = ON.

PIN 5 — HAND- input
Hand mode (START = OFF), driving with the programmed velocity. After deactivation the actual value is taken over as command position.

PIN 6 — HAND+ input:
Hand mode (START = OFF), driving with the programmed velocity. After deactivation the actual value is taken over as command position.

PIN 7 — START (RUN) input:
The positioning controller is active; the external analogue command position is taken over as command value. If the input is switched off during movement, the command position is set to the actual position plus a defined emergency deceleration stroke.

PIN 8 — ENABLE input:
This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. Target position is set to actual position and the drive is closed loop controlled.

ANALOGUE INPUT

PIN 9/10 — External command speed (V),
range 0 ÷ 100 % corresponds to 0 ÷ 10 V or 4 ÷ 20 mA

PIN 11/13 — Command position (W),
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

PIN 11/14 — Actual (feedback) value (X),
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

ANALOGUE OUTPUT

voltage

PIN 16/15 — Differential output (U)
± 100% corresponds to ± 10V differential voltage

current

PIN 12/15 — ±100% corresponds to 4 ÷ 20 mA

5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm^2 up to 20 m length, and of 1.00 mm^2 up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

NOTE : To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

▪ Signal cable and power cable have to be wired separately.

▪ Analogue signal cables must be shielded.

▪ Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE “protected earth” and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

6 - DEVICE SETUP

Card set-up is possible via software only.

The system can be controlled in open loop, moving up and down the servo-cylinder with commands HAND+ and HAND- to facilitate the adjustment of the card and its calibration. With these functions the setting-up and the adjustments become easy.

6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7 and 8.

⚠ **WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.**

6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at *standard* level, easier, or *expert*, where a greater number of parameters is displayed and can be customized.

For a complete list of the parameters and their settings please refer to the Technical Manual *89410 ETM*.

7 - MAIN FEATURES

7.1 - Sequence of the positioning

The positioning process will be controlled by switching inputs. After enabling (ENABLE input), the command position is set to the actual position of the sensor and the axis is in closed loop position control mode.

The READY output indicates a general ready to operate.

The axis can be driven in manual mode with the digital inputs HAND+ or HAND- , at programmed velocity.

When the manual mode are switched off, the command position is set to the actual position and the system is in closed loop position control mode.

With START input, the analogue command input is active and new command positions will be taken over. The axis is immediately driving to this new position and indicates on the Inpos Output when the axis reaches the position. This output is active as long as the axis is within the InPos window or the START input is active.

The operating mode can be:

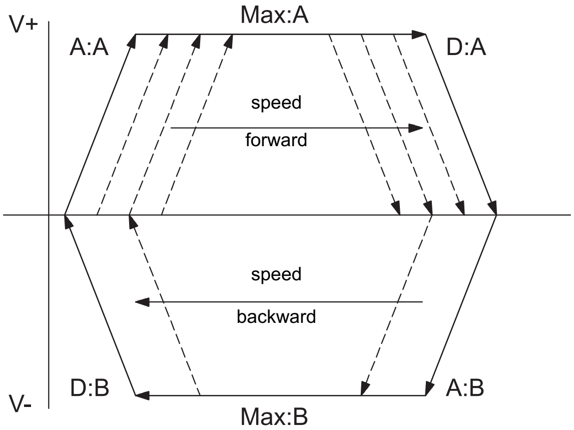
SDD - stroke depending deceleration - means the control gain will be adjusted. This is a time-optimal positioning structure with very high stability.

NC mode - the position value is generated from the following error.

The actuator position is measured by an analogue transducer and compared with a specified target position. The target position is adjusted with an external potentiometer or preset by an analogue input from an external controller (PLC). It's possible to define the axis speed also by an external command speed.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two clashing requirements (short positioning time and high accuracy) have to be considered in the system design.

flow (volume) P→A and B→T



7.2 - Gain

The gain is settable and it's related with the braking distance (parameters available via software). Lower is the braking distance, higher is the gain.

7.3 - Emergency Output (EOUT)

This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The function can be deactivate.

7.4 - Adaptation of the braking characteristic to the valve type (CTRL).

The command CTRL controls the braking characteristic curve of the hydraulic axis. The deceleration can be set with linear or nearly square root characteristic.

With positive overlapped proportional valves one of the SQRT characteristics should be used, because of the linearization of the non-linear flow curve typical of these valves; if zero overlapped proportional valves (control valves) are used, you can choose between LIN and SQRT1 according to the application.

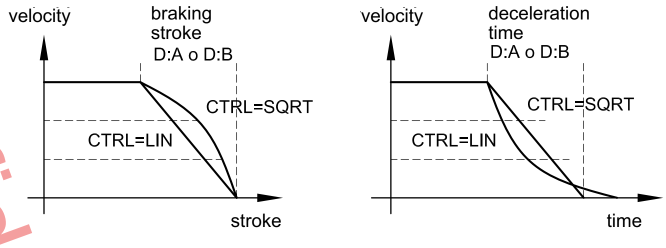
The progressive gain characteristic of SQRT1 has the better positioning accuracy.

According to the application there is maybe a longer braking distance, so that the total stroke time will be longer.

LIN: Linear characteristic (control gain corresponds to: 10000 / d:i).

SQRT1: Root function with small control error. (corresponds to 30000 / d:i);

SQRT2: Root function with higher gain corresponds to 50000 / d:i



7.5 - Adaptation of the output signal to the valve characteristic (TRIGGER).

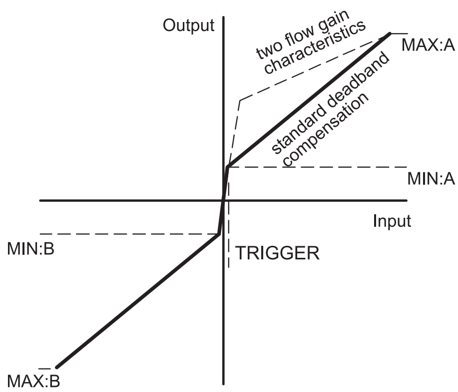
With TRIGGER command, the output signal is adapted to the valve characteristics.

The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

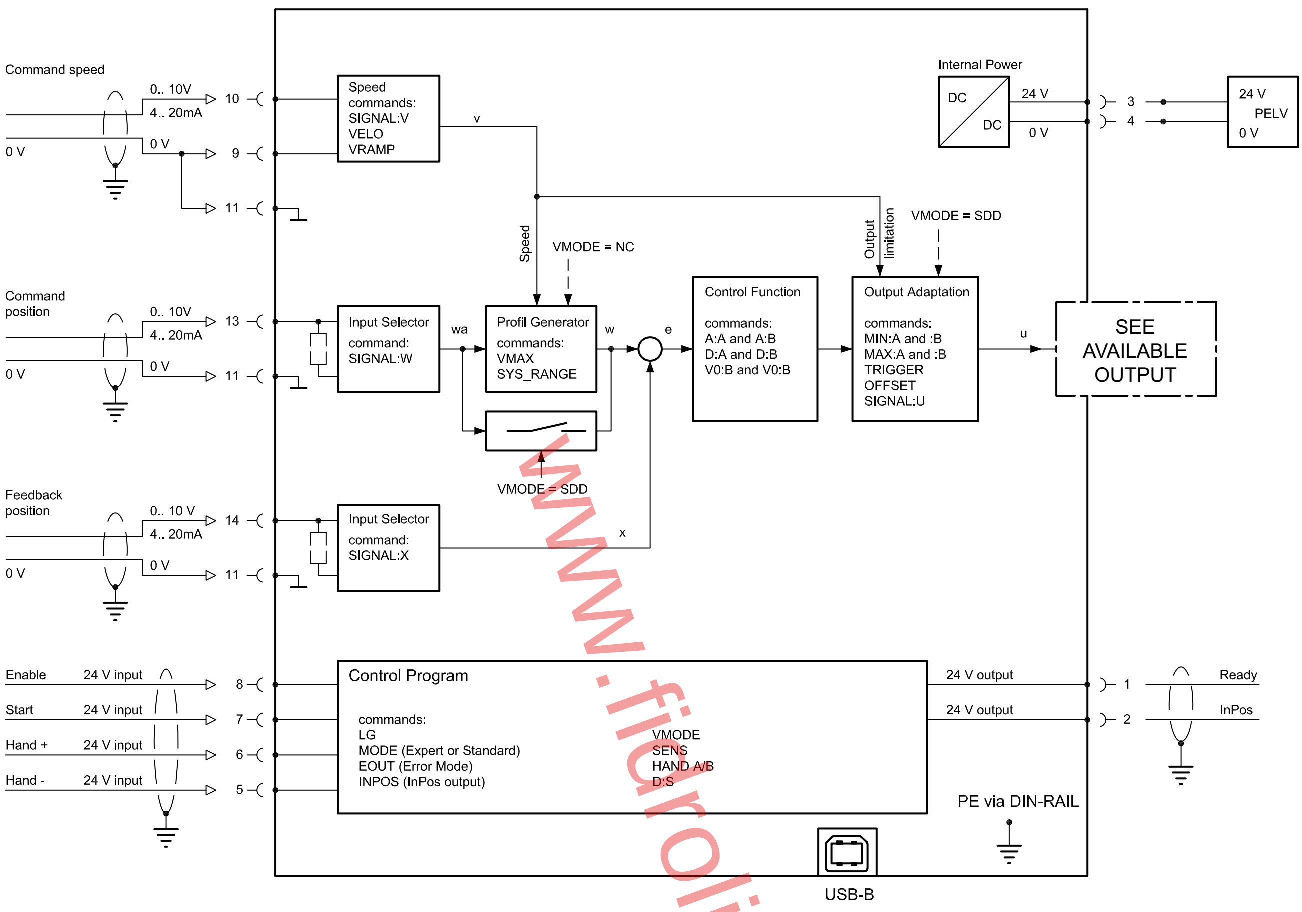
If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out at the power amplifier or at the positioning module.

If the deadband compensation value (MIN) is set too high, it influences the minimal velocity which cannot be adjusted any longer.

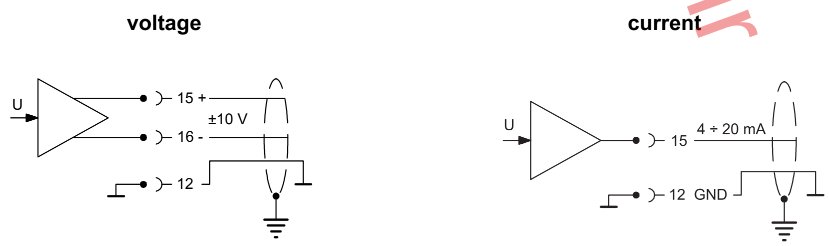
In extreme cases this causes to an oscillating around the closed loop controlled position.



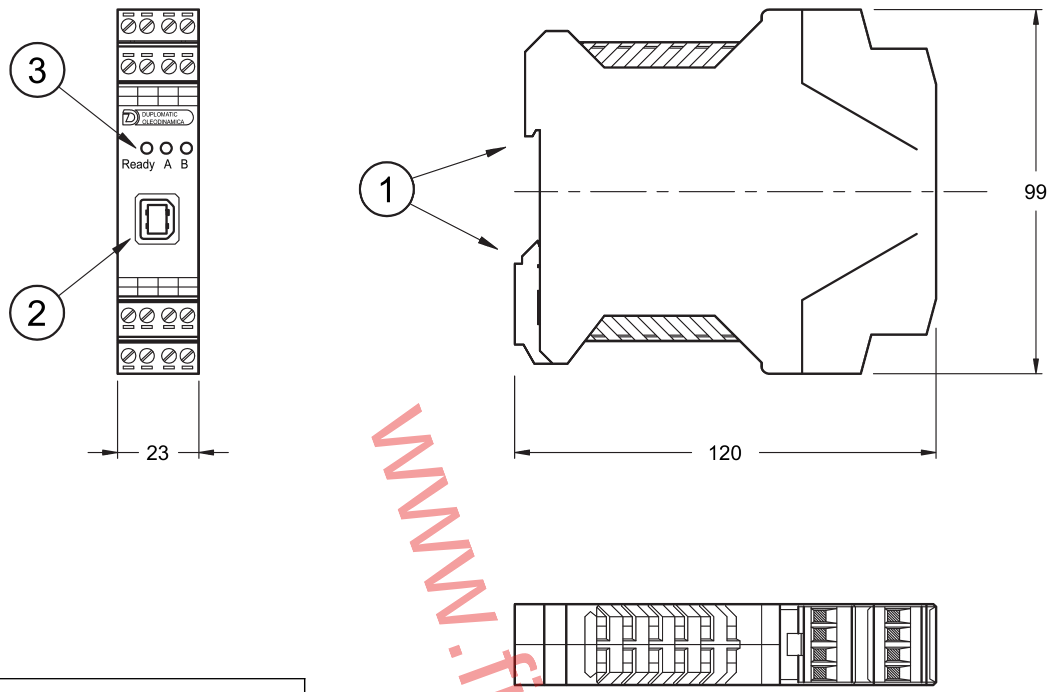
8 - CARD BLOCK DIAGRAM



Output signals



9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	USB interface, for setup
3	LEDs for output signals

DUPLOMATIC OLEODINAMICA

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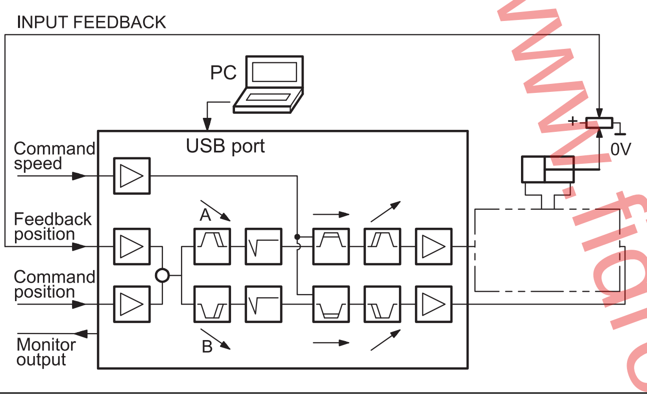
EWM-ST-AA

ANALOGUE POSITIONING CARD FOR STROKE CONTROL IN CLOSED LOOP SYSTEMS WITH ANALOGUE FEEDBACK AND DIGITAL SET-UP

SERIES 21

RAIL MOUNTING TYPE: DIN EN 50022

OPERATING PRINCIPLE



- This card is designed for steam turbine application. It allows easy stroke positioning control of hydraulic actuators in closed loop systems.
- Card setup via software only, through an on-board USB-B port.
- The card has a monitor output to DCS.
- It's available with integral power amplifier or current output.

TECHNICAL CHARACTERISTICS

Power supply		V DC	12 ÷ 30 ripple included
Fuse, external:	M1 and M2 E1		3A medium time lag 1A medium time lag
Current consumption:	M1 and M2 E1	A mA	3 < 100
Command position		mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Position accuracy		%	0,01
Command speed		mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 90 kΩ)
Feedback value		mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Output value	M1 and M2 E1	mA	500 ÷ 2600 4 ÷ 20
Sample time		ms	1
Interface			USB-B (2.0)
Electromagnetic compatibility (EMC)	2004/108/EC		Immunity EN 61000-6-2 Emissions EN 61000-6-4
Housing material			thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions		mm	120(d) x 99(h) x 46(w)
Connections			USB - 7x4 poles screw terminals - PE direct via DIN rail
Operating temperature range		°C	-20 / +60
Protection degree			IP 20

EWM-ST-AA
SERIES 21

1 - IDENTIFICATION CODE

E	W	M	-	ST	-	A	A	/	21	

Digital card for closed loop systems
DIN EN 50022 rail mounting

Steam turbine

Analog command value

Analog feedback value

Output value:
M1 = embedded power amplifier for proportional valves with **single solenoid**
M2 = embedded power amplifier for directional proportional valves with **double solenoid**
E1 = current 4 ÷ 20 mA

Series No.
(from 20 to 29 sizes and mounting dimensions remain unchanged)

2 - FEATURES OVERVIEW

Controller Functions

- Stroke positioning control in closed loop system
- Fine positioning - an accuracy of approx. 0.01% of the sensor stroke can be achieved
- Control mode: SDD – Stroke Depending Deceleration time-optimal positioning structure with very high stability
- Gain adjustment made via software
- PT1 filter to stabilize the control behaviour
- Special functions for steam turbines control (CUTOFF)
- Emergency function (EOUT)
- Analog signal command
- Analog feedback input
- Velocity limited internally or by analog input
- Simple and intuitive scaling of the sensor

Adaptation of the valve characteristic curve

- CTRL function to adapt the braking characteristics to positive and zero overlapped proportional valves
- Advanced deadband compensation: non-linearity compensation by a double-gain characteristics
- Drift compensation

Monitoring functions

- In-position error
- Cable break for feedback sensor and command signal
- Solenoids monitored for M versions
- 2 Digital output to read the status
- Monitor output to DCS

Other characteristics

- Available with current output or integrated power amplifier
- Card configuration is made via software, through on-board USB

3 - FUNCTIONAL SPECIFICATIONS

3.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, freewheeling diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

NOTE: the value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoid to be controlled.

3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

3.4 - External command position

The card accepts an analogue input signal. The command value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.5 - External command speed

The card accepts an analogue input signal. The command speed can be 0 ÷ 10 V (RI = 90 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.6 - Feedback value

The card accepts analogue feedback input. The feedback value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.7 - Analog output values

E1 version: analog signal 4 ÷ 20 mA (Rmax = 390 Ω).

M1 and M2 versions: embedded power stage configurable via software with values between 500 and 2600 mA.

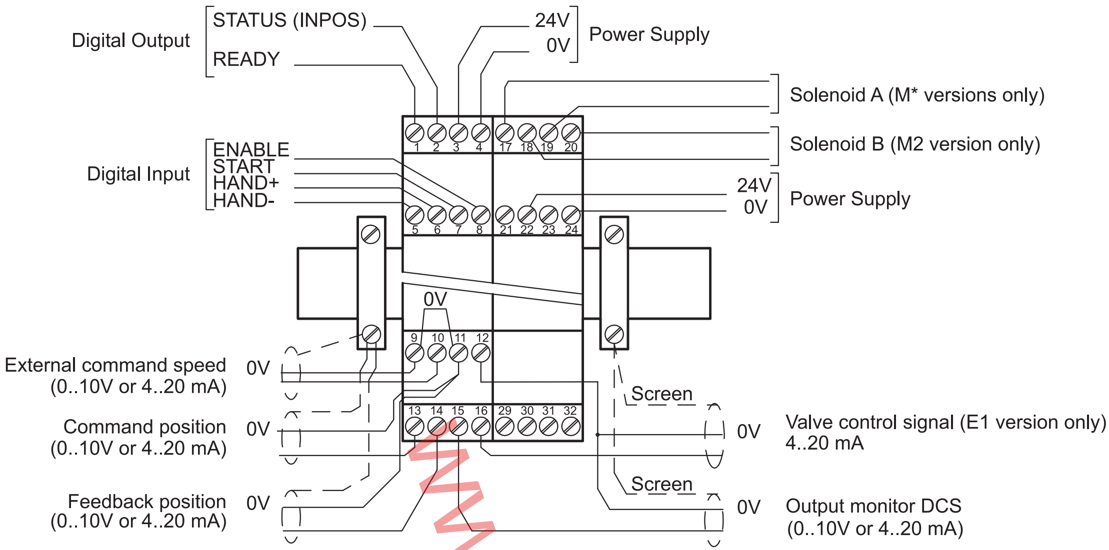
All analogue output have to be wired with screened cables.

3.8 - Digital Output

Two digital output are available, INPOS and READY, that are displayed via LEDs on the front panel.

Low level < 2 V High Level > 12 V (50 mA).

4 - WIRING DIAGRAM



DIGITAL INPUT AND OUTPUT

PIN 1 — READY output
ENABLE is active and there is no sensor errors. This output corresponds with the 'Ready' LED.

PIN 2 — STATUS output
Monitoring of the control error (INPOS). Depending on the INPOS command, the status output will be deactivated, if the position difference is greater than the adjusted window.
The output is only active if START = ON.

PIN 5 — HAND- input
Hand mode (START = OFF), driving with the programmed velocity. After deactivation the actual value is taken over as command position.

PIN 6 — HAND+ input
Hand mode (START = OFF), driving with the programmed velocity. After deactivation the actual value is taken over as command position.

PIN 7 — START (RUN) input
The positioning controller is active; the external analogue command position is taken over as command value. If the input is switched off during movement, the system stops within the set emergency stopping distance.

PIN 8 — ENABLE input:
This digital input initializes the application and clear the errors. The analogue output is active and the READY signal indicates that all components are working correctly. Target position is set to actual position and the drive is closed loop controlled.

ANALOGUE INPUT

PIN 9/10 — External command speed (V)
range 0 ÷ 100 % corresponds to 0 ÷ 10 V or 4 ÷ 20 mA

PIN 11/13 — Command position (W)
range 0 ÷ 100% corresponds to 0 ÷ 10 V or 4 ÷ 20 mA

PIN 11/14 — Actual (feedback) value (X)
range 0 ÷ 100% corresponds to 0 ÷ 10 V or 4 ÷ 20 mA

ANALOGUE OUTPUT

PIN 12/15 — Monitor output to DCS
current output ±100% corresponds to 0 ÷ 10 V or 4 ÷ 20 mA

PIN 12/16 — **For E1 version only**:
current output ±100% corresponds to 4 ÷ 20 mA

5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm^2 up to 20 m length, and of 1.00 mm^2 up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

NOTE : To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

WARNING! Plugs with free-wheeling diodes and LED indicators cannot be used with current controlled power outputs. They interfere with the current control and can destroy the output stage.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE "protected earth" and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

6 - DEVICE SETUP

Card set-up is possible via software only.

The system can be controlled in open loop, moving up and down the servo-cylinder with commands HAND+ and HAND- to facilitate the adjustment of the card and its calibration. With these functions the setting-up and the adjustments become easy.

6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7, 8 and 10.

WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.

6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at standard level, easier, or expert, where a greater number of parameters is displayed and can be customized.

For a complete list of the parameters and their settings please refer to the Technical Manual *89411 ETM* for series 21.

7 - MAIN FEATURES

7.1 - Sequence of the positioning

The positioning process will be controlled by switching inputs. After enabling (ENABLE input), the command position is set to the actual position of the sensor and the axis is in closed loop position control mode.

The READY output indicates a general ready to operate.

The axis can be driven in manual mode with the digital inputs HAND+ or HAND- , at programmed velocity.

When the manual mode are switched off, the command position is set to the actual position and the system is in closed loop position control mode.

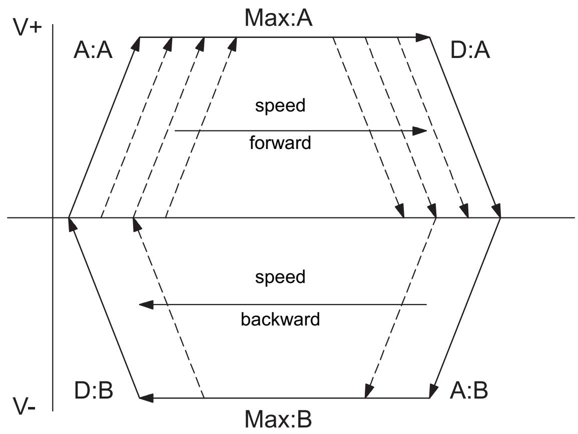
With START input, the analogue command input is active and new command positions will be taken over. The axis is immediately driving to this new position and indicates on the Inpos Output when the axis reaches the position. This output is active as long as the axis is within the InPos window or the START input is active.

The operating mode is SDD - stroke depending deceleration - means the control gain will be adjusted. This is a time-optimal positioning structure with very high stability.

The actuator position is measured by an analog transducer and compared with a specified target position. The target position is adjusted with an external potentiometer or preset by an analog input from an external controller (PLC). It's possible to define the axis speed also by an external command speed.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two clashing requirements (short positioning time and high accuracy) have to be considered in the system design.

flow (volume) P→A and B→T



7.2 - Gain

The gain is settable and it's related with the braking distance (parameters available via software). Lower is the braking distance, higher is the gain.

7.3 - Forced closure/opening of the cylinder (CUTOFF)

This function handles the forced closure/opening of the cylinder, allowing you to set speed, direction and working area of the function.

7.4 - Emergency Output (EOUT and EOUTMODE)

This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The EOUTMODE parameter selects events which generate the EOUT ouput.

7.5 - Adaptation of the braking characteristic to the valve type (CTRL).

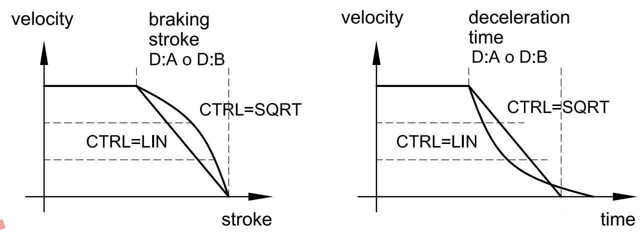
The deceleration characteristic is set with this parameter. In case of positively overlapped proportional valves the SQRT function should be used. The non-linear flow function of these valves is linearized by the SQRT function.

In case of zero lapped valves (control valves and servo valves) the LIN or SQRT1 function should be used regardless of the application. The progressive characteristic of the SQRT1 function has better positioning accuracy but can also lead to longer positioning times in individual cases.

LIN: Linear deceleration characteristic
(gain is increased by a factor of 1).

SQRT1: Root function for braking curve calculation.
The gain is increased by a factor of 3 (in the target position). This is the default setting.

SQRT2: Root function for braking curve calculation.
The gain is increased by a factor of 5 (in the target position). This setting should only be used with a significantly progressive flow through the valve.



7.6 - Adaptation of the output signal to the valve characteristic (TRIGGER).

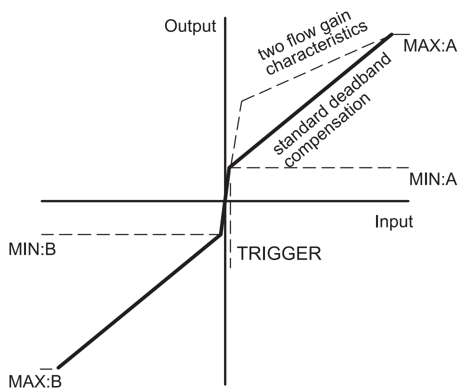
With TRIGGER command, the output signal is adapted to the valve characteristics.

The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

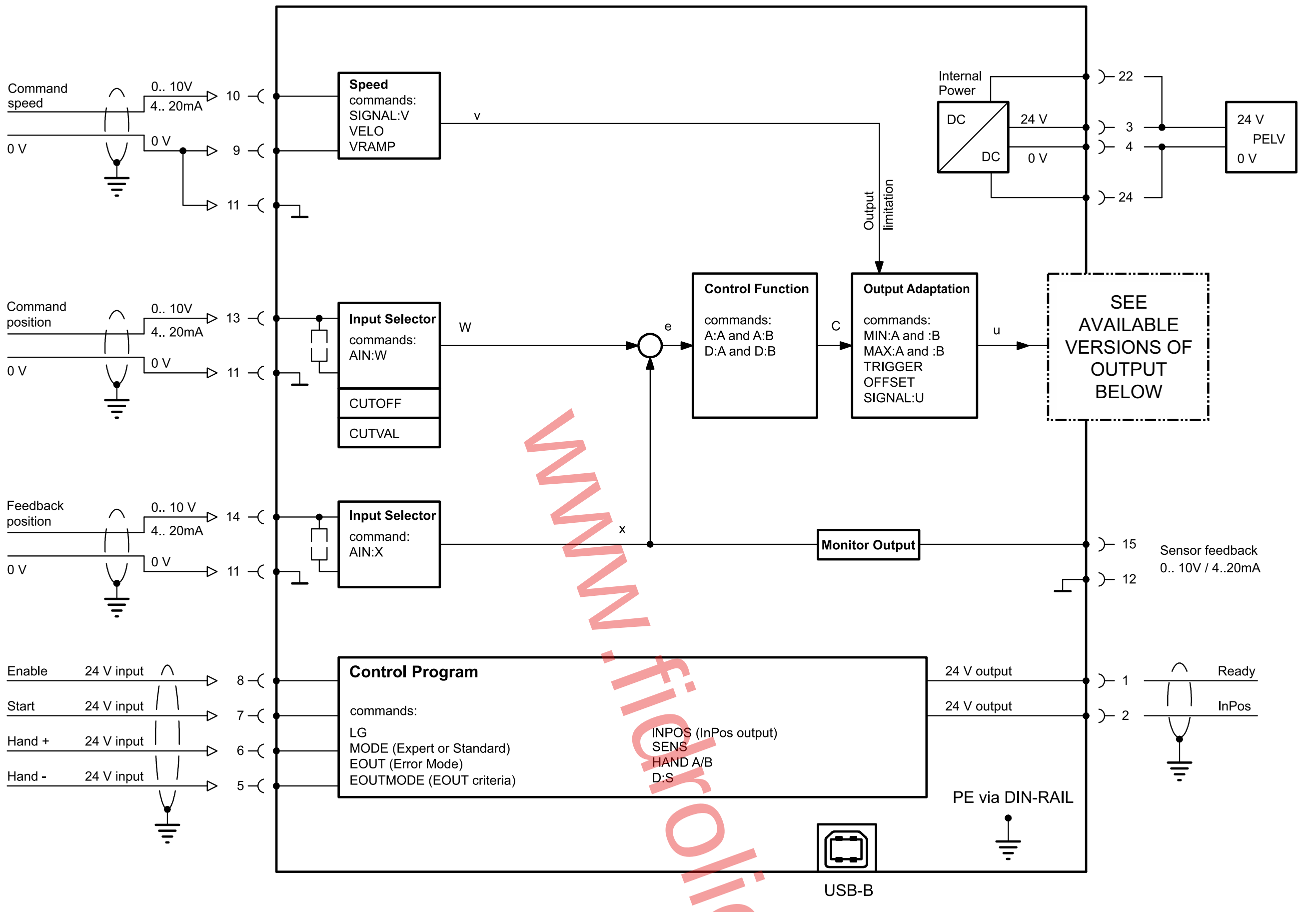
If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out at the power amplifier or at the positioning module.

If the deadband compensation value (MIN) is set too high, it influences the minimal velocity which cannot be adjusted any longer.

In extreme cases this causes to an oscillating around the closed loop controlled position.

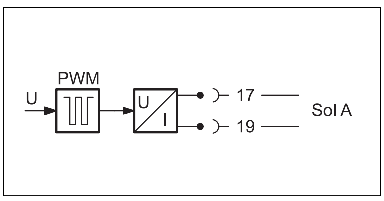


8 - CARD CIRCUIT DIAGRAM

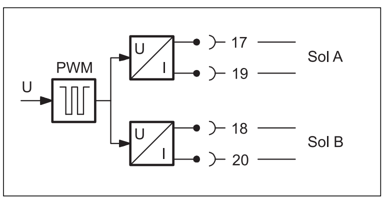


VERSIONS OF OUTPUT SIGNAL

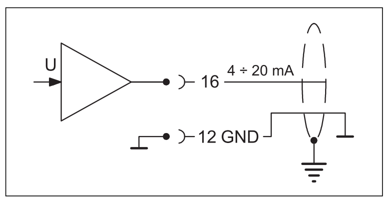
M1



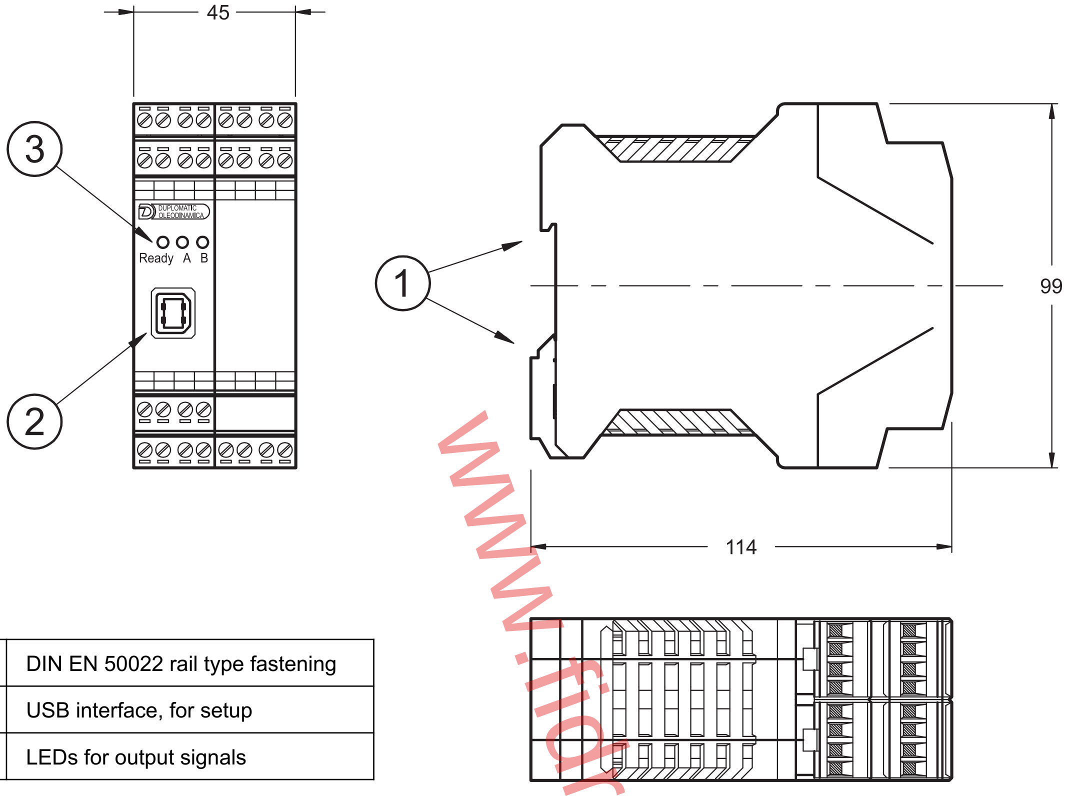
M2



E1



9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	USB interface, for setup
3	LEDs for output signals

DUPLOMATIC OLEODINAMICA

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DUPLOMATIC OLEODINAMICA

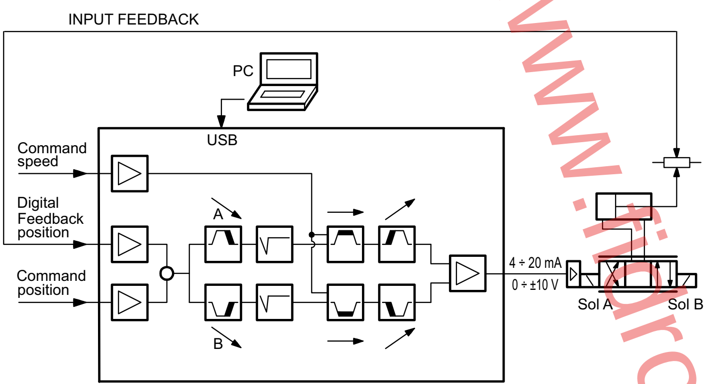
EWM-S-AD

ANALOGUE POSITIONING CARD FOR STROKE CONTROL IN CLOSED LOOP SYSTEMS WITH DIGITAL FEEDBACK

SERIES 20

RAIL MOUNTING TYPE: DIN EN 50022

OPERATING PRINCIPLE



— This card is designed for closed loop positioning of hydraulics actuators where an high accuracy is needed by means of a digital SSI sensor.

— The card controls a directional proportional valve with integrated electronics and allows an optimal use of overlapped and zero-overlapped proportional valves.

— The card has a monitor output to DCS.

— An additional input for analogue sensors is available.

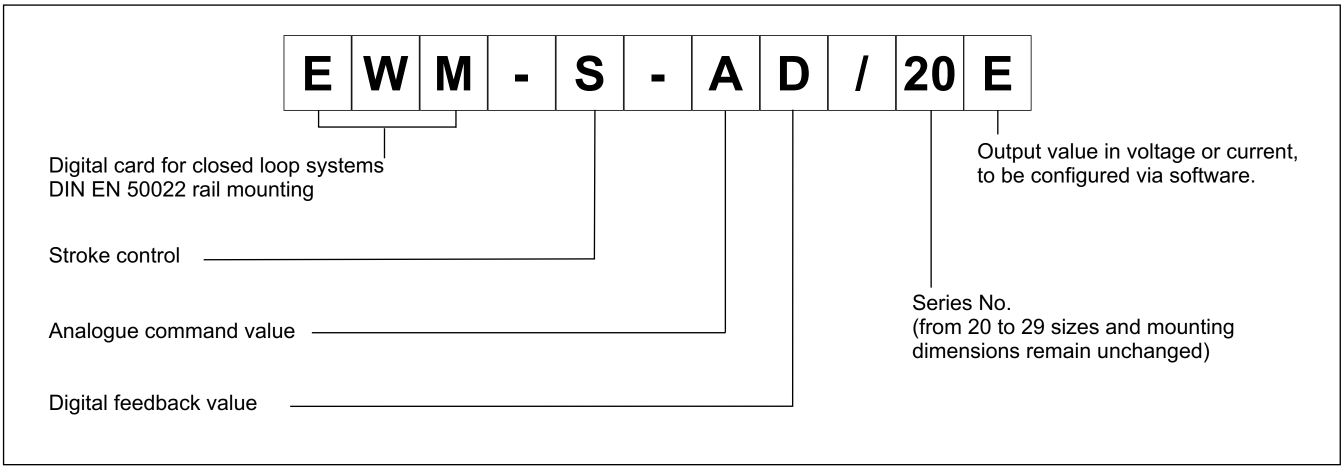
— The output value, voltage or current type, has to be configured via software.

— Card setup via software only, through an USB-B port.

TECHNICAL CHARACTERISTICS

Power supply	V DC	24 ÷ 30 ripple included
Fuse, external	A	1A medium time lag
Current consumption	mA	350 (technical data of the sensor have to be considered)
Command position	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Max position accuracy	µm	1
Command speed	V	0 ÷ 10 (RI = 90 kΩ) 4 ÷ 20 (RI = 240 Ω)
Feedback value		Digital sensor with SSI interface RS-422, 150kBaud
Output value	V mA	differential, ±10 (max load 10 mA 2 kΩ) 4 ÷ 20 (max load 390 Ω)
Interface		USB - B 2.0
Electromagnetic compatibility (EMC) 2004/108/EC		Immunity EN 61000-6-2: 8/2005 Emissions EN 61000-6-4: 6/2007; A1:2011
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 46(w)
Connections		USB-B (2.0) - 7x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

1 - IDENTIFICATION CODE



2 - FEATURES OVERVIEW

Controller Functions

- Stroke positioning control in closed loop system
- Fine positioning - 1µm resolution
- 2 different operating mode:
  SDD – Stroke Depending Deceleration - time-optimal positioning structure with very high stability
  NC – Numerically Controlled - To follow the position profile
- Gain adjustment made via software
- PT1 filter to stabilize the control behaviour
- Emergency function (EOUT)
- Analog signal command
- Digital feedback input
- Velocity limited internally or by analog input
- Safe and error-free data transmission
- As an alternative, the card can be set via software for operate with analogue sensors.
- Simple and intuitive scaling for analogue sensors

Adaptation of the valve characteristic curve

- CTRL function to adapt the braking characteristics to positive and zero overlapped proportional valves
- Advanced deadband compensation: non-linearity compensation by a double-gain characteristics
- Drift compensation

Monitoring functions

- In-position error
- Cable break for command signal and fault of feedback sensor
- 2 Digital output to read the status
- Monitor output to DCS

Other characteristics

- Output value in voltage or current, to be configured via software.
- Card configuration is made via software, through on-board USB

3 - FUNCTIONAL SPECIFICATIONS

3.1 - Power supply

This card is designed for 24 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

3.4 - External command position

The card accepts an analogue input signal. The command value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.5 - External command speed

The card accepts an analogue input signal. The command speed can be 0 ÷ 10 V (RI = 90 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.6 - Feedback value

The card accepts a digital feedback input from a sensor with any SSI interface with RS422 specifications. Bit, code and resolution are settable via software.

The max sensor resolution is 0,001 mm.

Eventually an analog input could be used as feedback. The card accepts a 0 ÷ 10 V (Ri 25 kOhm) or 4 ÷ 20 mA (Ri = 240 Ohm)

3.7 - Analog output values

Output values can be in voltage or current, to be configured via software (parameter SIGNAL:U). The same parameter defines the polarity also.

Voltage: ± 10 V Differential output
(0 ÷ 10 V at PIN 15 and 0 ÷ 10 V at PIN 16).

Current: 4 ÷ 20 mA (PIN 15 to PIN 12).

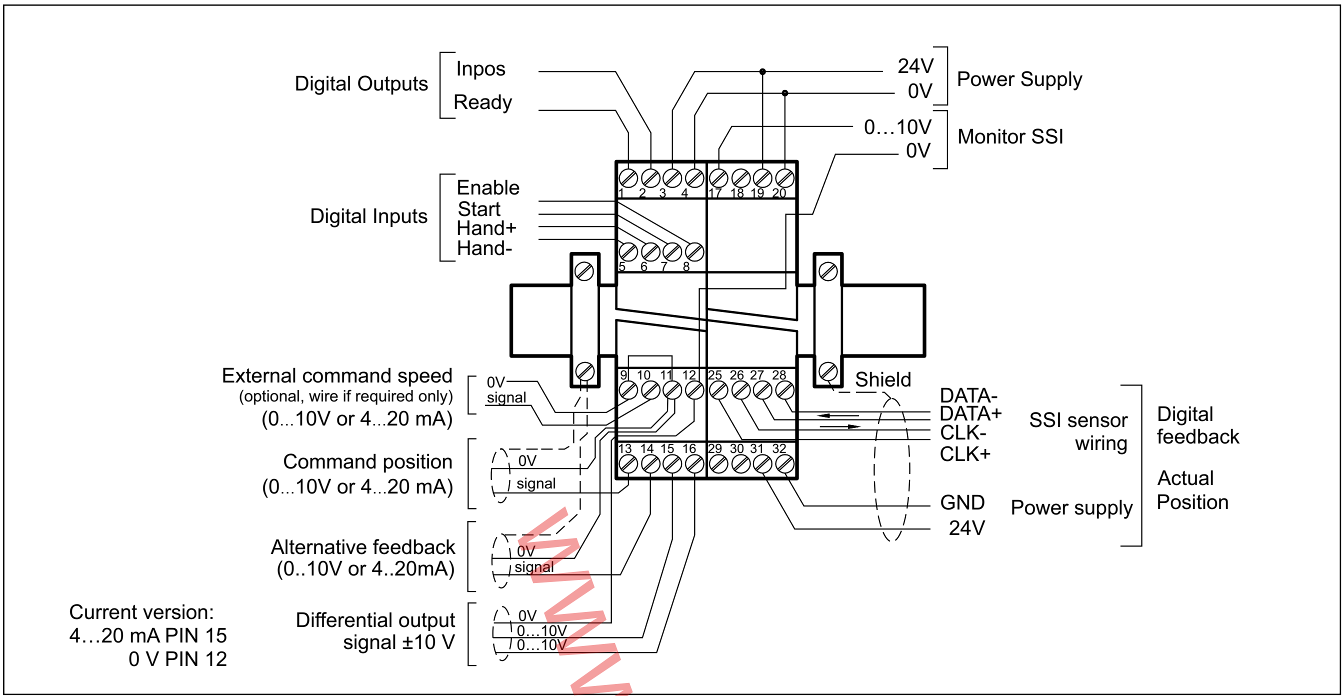
An analogue position value 0 ÷ 10 V (max load 10mA) is available at PIN 17 as sensor monitor reference.

3.9 - Digital Output

Two digital output are available, INPOS and READY, that are displayed by LED on the front panel.

Low level < 2 V High Level > 12 V (50 mA).

4 - WIRING DIAGRAM



DIGITAL INPUT AND OUTPUT

PIN 1 READY output.
General operationality, ENABLE is active and there is no sensor error. This output corresponds with the green led.

PIN 2 STATUS output.
Monitoring of the control error (INPOS). Depending on the INPOS command, the status output will be deactivated, if the position difference is greater than the adjusted window.
The output is only active if START = ON.

PIN 5 HAND- input
Hand mode (START = OFF), driving with the programmed velocity. After deactivation the actual value is taken over as command position.

PIN 6 HAND+ input:
Hand mode (START = OFF), driving with the programmed velocity. After deactivation the actual value is taken over as command position.

PIN 7 START input:
The positioning controller is active; the external analogue command position is taken over as command value. If the input is switched off during movement, the command position is set to the actual position plus a defined emergency deceleration stroke.

PIN 8 Enable input:
This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. Target position is set to actual position and the drive is closed loop controlled.

ANALOGUE INPUT

PIN 9/10 External command speed (V)
range 0 ÷ 100 %
corresponds to 0 ÷ 10V or 4 ÷ 20 mA

PIN 13/11 Command position (WA)
range 0 ÷ 100%
corresponds to 0 ÷ 10V or 4 ÷ 20 mA

PIN 11/14 Alternative: analogue feedback value (X)
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

ANALOGUE OUTPUT

voltage

PIN 16/15 Differential output (U)
± 100% corresponds to ± 10V differential voltage

current

PIN 12/15 ±100% corresponds to 4 ÷ 20 mA

PIN 12/17 Monitor of the SSI sensor position
0 ÷ 10V

5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm^2 up to 20 m length, and of 1.00 mm^2 up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

NOTE : To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE “protected earth” and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

6 - DEVICE SETUP

Card set-up is possible via software only.

The system can be controlled in open loop, moving up and down the servo-cylinder with commands HAND+ and HAND- to facilitate the adjustment of the card and its calibration. With these functions the setting-up and the adjustments become easy.

6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7 and 8.

WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.

6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at standard level, easier, or expert, where a greater number of parameters is displayed and can be customized.

For a complete list of the parameters and their settings please refer to the Technical Manual *89420-115 ETM*.

7 - MAIN FEATURES

7.1 - Sequence of the positioning

The positioning process will be controlled by switching inputs. After enabling (ENABLE input), the command position is set to the actual position of the sensor and the axis is in closed loop position control mode.

The READY output indicates a general ready to operate.

The axis can be driven in manual mode with the digital inputs HAND+ or HAND- , at programmed velocity.

When the manual mode are switched off, the command position is set to the actual position and the system is in closed loop position control mode.

With START input, the analogue command input is active and new command positions will be taken over. The axis is immediately driving to this new position and indicates on the Inpos Output when the axis reaches the position. This output is active as long as the axis is within the InPos window or the START input is active.

Two operating modes can be selected:

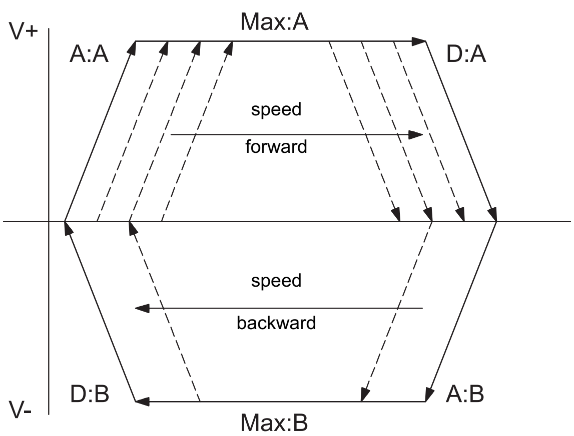
SDD - stroke depending deceleration - means the control gain will be adjusted. This is a time-optimal positioning structure with very high stability.

NC mode - the position value is generated from the following error.

The actuator position is measured by a transducer and compared with a specified target position. The target position is adjusted with an external potentiometer or preset by an analog input from an external controller (PLC). It's possible to define the axis speed also by an external command speed.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two clashing requirements (short positioning time and high accuracy) have to be considered in the system design.

flow (volume) P→A and B→T



7.2 - Gain

The gain is settable and it's related with the braking distance (parameters available via software). Lower is the braking distance, higher is the gain.

7.3 - Emergency Output (EOUT)

This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The function can be deactivate.

7.4 - Adaptation of the braking characteristic to the valve type (CTRL).

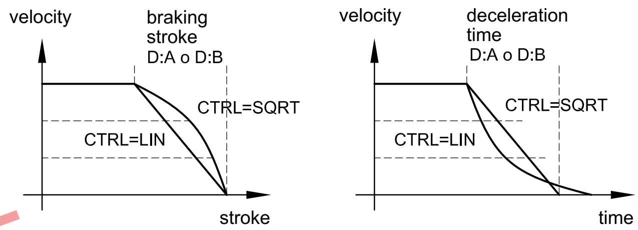
The deceleration characteristic is set with this parameter. In case of positively overlapped proportional valves the SQRT function should be used. The non-linear flow function of these valves is linearized by the SQRT function.

In case of zero lapped valves (control valves and servo valves) the LIN or SQRT1 function should be used regardless of the application. The progressive characteristic of the SQRT1 function has better positioning accuracy but can also lead to longer positioning times in individual cases.

LIN: Linear deceleration characteristic (gain is increased by a factor of 1).

SQRT1: Root function for braking curve calculation. The gain is increased by a factor of 3 (in the target position). This is the default setting.

SQRT2: Root function for braking curve calculation. The gain is increased by a factor of 5 (in the target position). This setting should only be used with a significantly progressive flow through the valve.



7.5 - Adaptation of the output signal to the valve characteristic (TRIGGER).

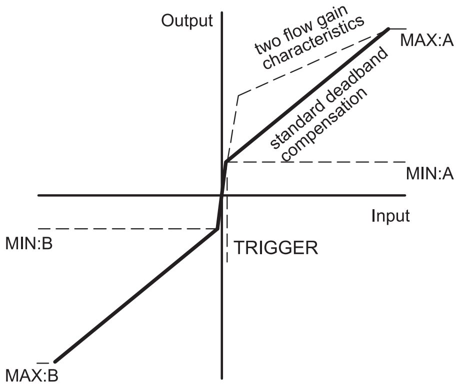
With TRIGGER command, the output signal is adapted to the valve characteristics.

The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

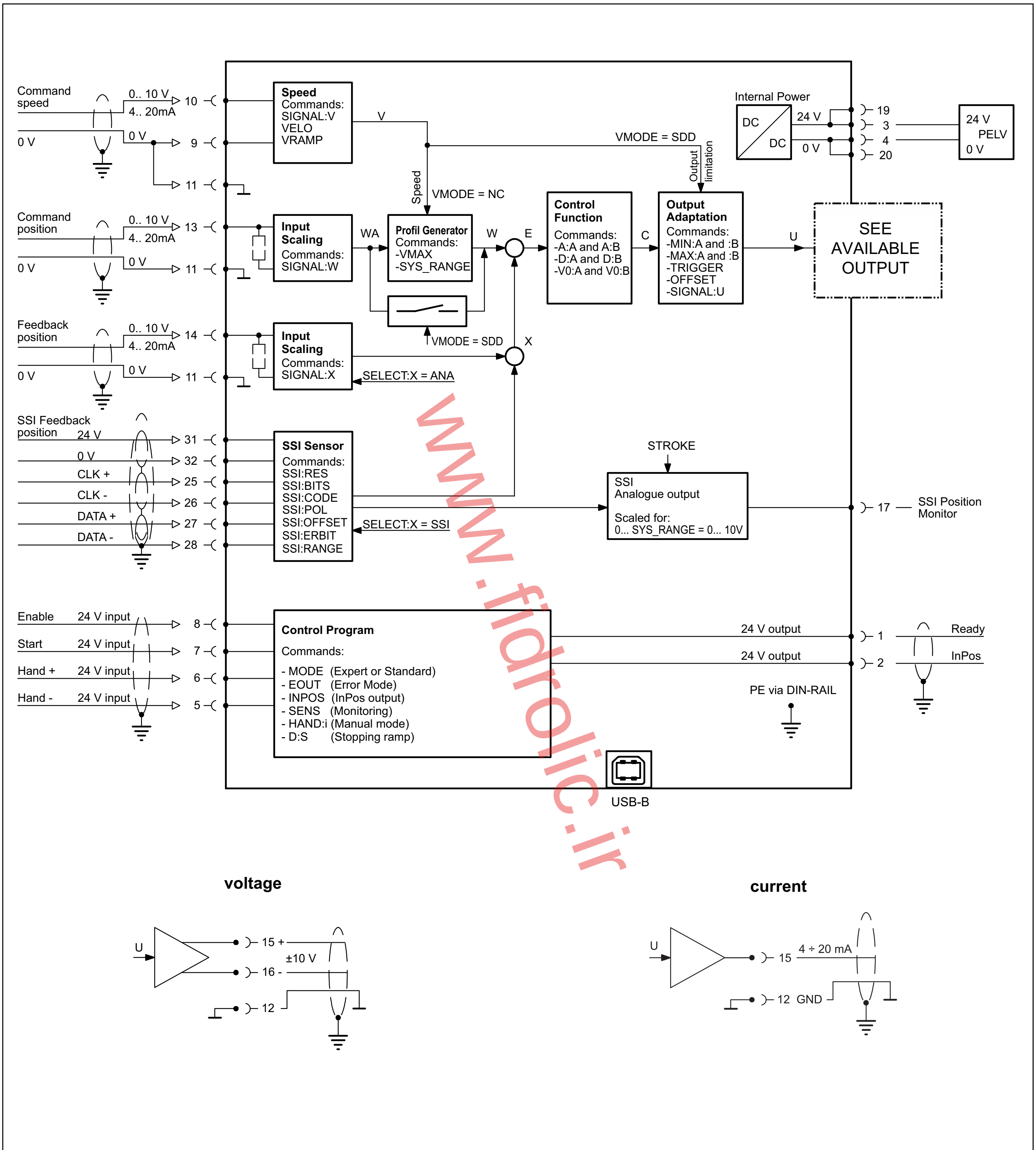
If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out at the power amplifier or at the positioning module.

If the deadband compensation value (MIN) is set too high, it influences the minimal velocity which cannot be adjusted any longer.

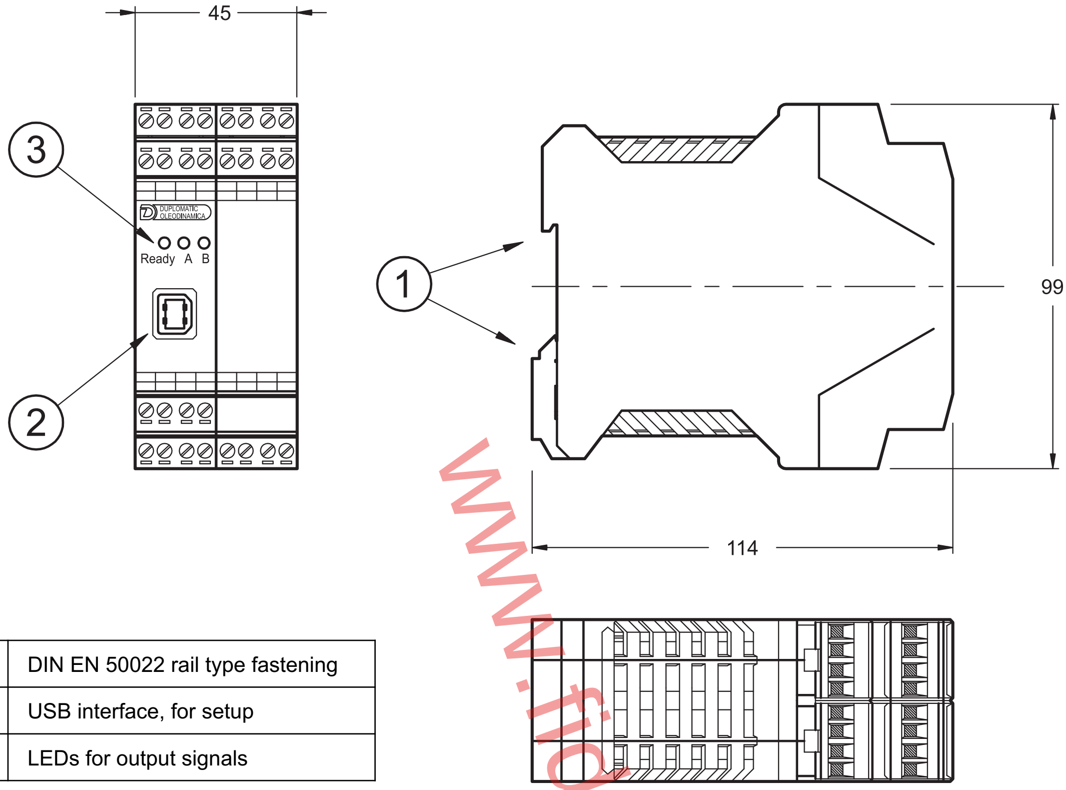
In extreme cases this causes to an oscillating around the closed loop controlled position.



8 - STANDARD CARD BLOCK DIAGRAM



9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	USB interface, for setup
3	LEDs for output signals

DUPLOMATIC OLEODINAMICA

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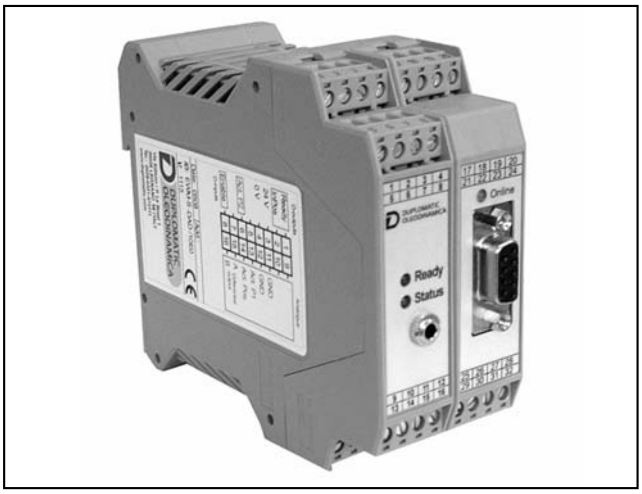
DUPLOMATIC OLEODINAMICA



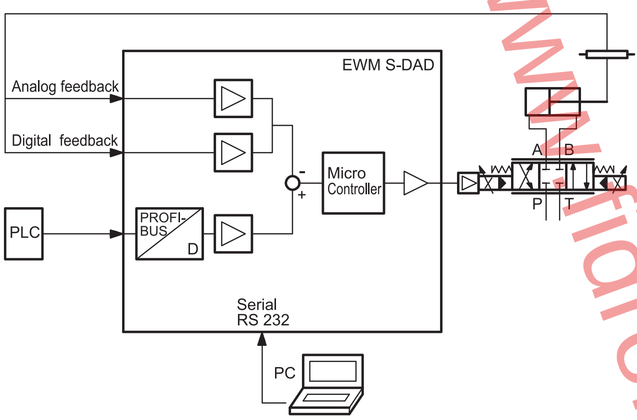
EWM-S-DAD

CARD FOR POSITIONING AND VELOCITY STROKE CONTROL WITH PROFIBUS COMMUNICATION INTERFACE

SERIES 10

RAIL MOUNTING TYPE:
DIN EN 50022

OPERATING PRINCIPLE



— This card has been developed to drive the positioning of the hydraulics actuators where an high accuracy is needed, using a digital sensor with SSI interface to measure the positions, or an analog sensor with an accuracy of up to 0,01%

— The card works as an axis controller and communicates with the PLC via the integrated Profibus interface.

— The card works in two ways: stroke depending deceleration or NC mode.

— The card allows an optimal use of overlapped and zero overlapped proportional valves.

— The card use the RS232C interface, and is settable via notebook, using the software kit (EWMPC).

TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ÷ 30 ripple included - external fuse 1,0 A
Current consumption	mA	100+ sensor power consumption
Command value		via Profibus DP - ID number 1810h
Feedback value: - digital - analogue	SSI V mA	digital sensor with any interface SSI 0 ÷ 10 (R_I = 25 kΩ) 4 ÷ 20 (R_I = 250 Ω)
Position accuracy: - digital - analogue	%	± 2 bits of sensor resolution 0.01
Output value: - E0 version - E1 version	V mA	±10 (max load 5 mA) 4 ÷ 20 (max load 390 Ω)
Interface		RS 232 C
Electromagnetic compatibility (EMC): according to 2004/108/CE standards		Emissions EN 61000-6-3 Immunity EN 61000-6-2
Housing material		thermoplastic polyamide PA6.6 combustibility class V0 (UL94)
Housing dimensions	mm	120 (d) x 99(h) x 46(w)
Connector		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

EWM-S-DAD
SERIES 10

1 - IDENTIFICATION CODE

E W M - S - D AD / 10 [ ]

Digital card for closed loop systems
DIN EN 50022 rail mounting

Stroke control

Digital command value

Analog and digital feedback values

Output value:
E0 = voltage ±10V (**standard**)
E1 = current 4 ÷ 20 mA

Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

The card EWM-S-DAD is an evolution of an analog model (EWM-S-AD). The customer can choose between two sensor types: analog or digital and the communication with the PLC is via Profibus DP.

With only a few parameters the controller can be optimized and the movement profile is preset via Profibus (position and velocity).

Sample time is 1 ms.

Here below an example of profile with a switch speed:

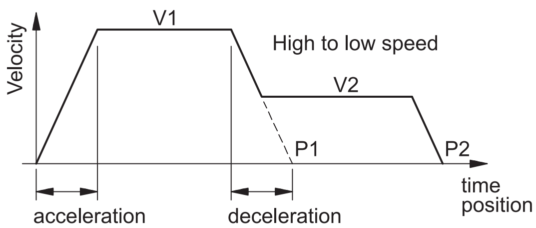
- the target position is command value 2 (P2) combined with velocity 2 (V2).

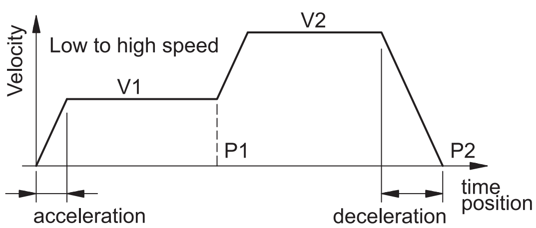
- the switch over position is command value 1 (P1), combined with velocity 1 (V1).

Switching over position from a high to a lower speed is calculated by the deceleration function and V2.

Switching over from a low to a high velocity is carried out at the position (P1) via the acceleration ramp; see below.

- If the positioning command value 2 (P2) is between the actual and the position command value 1 (P1), to position 2 (P2) can only be driven with speed 1 (V1).





2 - FUNCTIONAL SPECIFICATIONS

2.1 - Power supply
This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes). It is recommended to use a regulated power supply (linear or switching mode) for the card supply and the sensors.

2.2 - Electrical protections
All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

2.3 - Digital Input (ENABLE)
The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V with current <50mA. See the block diagram at paragraph 8 for the electric connections.

2.4 - Command value
The card accepts the input via Profibus, ID number 1810h (see paragraph 4).

2.5 - Input feedback values
The card accepts analogue or digital feedback input. The digital sensor parameters are settable via software (see parameters table). with analogue feedback the signal must can be 0 ÷ 10 V (R_I = 25 kΩ) or 4 ÷ 20 mA (R_I = 250Ω) Analogue sensor max resolution is 0.001 mm.

2.6 - Output values
E0 version: output voltage 0 ±10 V (standard).
E1 version: output current 4 ÷ 20 mA with max load 390Ω.

2.7 - Digital Output
Two digital output are available, INPOS and READY, that are displayed via LEDs on the front panel.
Low level <2V High Level > 10 V Max 50 mA with load 200Ω.

3 - LED FUNCTIONS

There are three leds on the card: one on the profibus module, that shows the online status of Profibus connection, and two on the other module:

GREEN: Shows if the card is ready.

ON - The card is supplied
OFF - No power supply
FLASHING - Failure detected (internal or 4… 20 mA).
Only if SENS = ON

YELLOW: Is the signal of the control error monitoring.

ON - No control error

4 - ADJUSTMENTS

On the EWM cards, the adjustment setting is possible only via software.

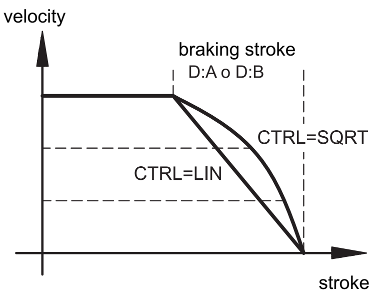
Connecting the card to the PC, the software automatically recognises the card model and shows a table with all the available commands, with their parameters, the default settings, the measuring unit and an explanation of the commands and its uses. The parameters change depending on the card model.

EXAMPLE OF PARAMETERS TABLE

Command	Parameters	Defaults	Units	Group	Description
LG x	x= DE|GB	GB	-	STD	Changing language help texts.
MODE x	x=STD|EXP	STD	-	STD	Mode parameter.
TS x	x= 5..30	10	0,1 ms	EXP	Changing the controller sample time.
STROKE x	x= 10..10000	100	mm	STD	Working stroke or the sensor.
VS x	x= EXT|INT	INT	-	STD	Switch over between internal and external velocity preset.
VELO x	x= 1..10000	10000	0,01%	STD	Here the max velocity can be limited internally. The limitation function corresponds to the external velocity preset if VS was parameterized with EXT
VRAMP x	x= 10..5000	200	ms	VS=EXT	Ramp time for velocity input.
VMODE x	x= SDD|NC	SDD	-	EXP	Control structure for positioning process. SDD: stroke-dependent deceleration is activated. From the set deceleration point the drive then switches to control mode and moves accurately to the desired position. NC: In this mode a position profile is generated internally. The system always works under control and uses the following error to follow the position profile.
VMAX x	x= 1..3000	50	mm/s	VMODE=NC	Max velocity in NC mode.
EOUT x	x= -10000..10000	0	0,01%	EXP	When an input error occurs the adjusted value of 'EOUT' will be displayed at the output pin 15/16. A value less than 100 deactivates this function.
POL x	x= -|+	+	-	STD	For changing the output polarity. All **A** and **B** adjustments depend on the output polarity. The right polarity should be defined first.
SENS x	x= ON|OFF|AUTO	AUTO	-	STD	Activation of the sensor and internal failure monitoring.
AIN:W **AIN:X**	A= -10000..10000 B= -10000..10000 C= -500..10000 X= V|C	A: 1000 B: 1000 C: 0 X: V	-	STD	Analogue output selection. **W** and **X** for the inputs and **V** = voltage, **C** = current. With the parameters **a**, **b** and **c** the inputs can be scaled (output = a / b * (input - c)). Because of the programming of the **x**-value (**x** = **C**) the corresponding input will be switched over to current automatically.
A:A x **A:B x**	x= 1..5000 x= 1..5000	100 100	ms ms	STD	Acceleration time depending on direction. **A** indicates analogue output 15 and **B** indicates analogue output 16. Normally **A** = flow P-A, B-T and **B** = flow P-B, A-T.
D:A x **D:B x** **D:S x**	x= 1..10000 x= 1..10000 x= 1..10000	25 25 10	mm mm mm	VMODE=SDD	Deceleration stroke dependent from direction. The loop gain is calculated by the deceleration stroke. The shorter the higher. In case of instabilities longer deceleration stroke should be set Loop Gain = STROKE / D:A o STROKE / D:B.
V0:A x **V0:B x**	x= 1..200 x= 1..200	10 10	1/s 1/s	VMODE=NC	Loop Gain for NC mode: D:A = VMAX / V0:A e D:B = VMAX / V0:B Loop Gain = STROKE / D:A o STROKE / D:B.
CTRL x	x= lin|sqrt1|sqrt2	sqrt1	-	STD	Selection of the control function: (see **NOTE**) **lin** = standard linear P-control, **sqrt1** = progressive time optimized deceleration curve. **sqrt2** = sqrt1 with a higher gain in position.
HAND:A x **HAND:B x**	x= -10000..10000 x= -10000..10000	3330 -3330	0,01% 0,01%	STD	Hand speed (in manual mode) For the corresponding switch input the direction can be defined by the sign.
MIN:A x **MIN:B x**	x= 0..6000 x= 0..6000	0 0	0,01% 0,01%	STD	Zero point setting /following error compensation.
MAX:A x **MAX:B x**	x= 3000..10000 x= 3000..10000	10000 10000	0,01% 0,01%	STD	Maximum output signal limitation.
TRIGGER x	x= 0..4000	200	0,01%	STD	Trigger threshold for activating the following error compensation (MIN).
OFFSET x	x= -4000..4000	0	0,01%	STD	Offset value added to the output signal. (setpoint - actual value + offset).
INPOS x	x= 2..200000	200	µm	STD	Range for InPos signal. (See **NOTE**)

INPX x	x= ANA|SSI	ANA	-	STD	Sensor input changeover.
SSI:OFFSET x	x= -1000000… 1000000	0	µm	INPX=SSI	Position Offset.
SSI:POL x	x= +|-	+	-	INPX=SSI	Sensor polarity. To reverse the sensor working direction its polarity can be changed with this command.
SSI:RES x	x= 100… 10000	500	10 nm	INPX=SSI	Resolution of the sensor. The highest resolution (1000) corresponds to 1 µm. This sensor resolution is always used for the input data via Profibus and is needed for the internal calculations. (see **NOTE**)
SSI:BITS x	x= 8… 31	24	bits	INPX=SSI	Number of bits transmitted.
SSI:CODE x	x= GREY|BIN	GREY	-	INPX=SSI	Transmission coding.

NOTE about the CTRL command:: This command controls the braking characteristic of the hydraulic axis. With positive overlapped proportional valves one of both SQRT braking characteristics should be used because of the linearization of the non-linear flow curve typical of these valves If zero overlapped proportional valves (control valves) are used, you can choose between LIN and SQRT1 according to the application. The progressive gain characteristic of SQRT1 has the better positioning accuracy.



According to the application there is maybe a longer braking distance, so that the total stroke time will be longer.

LIN: Linear braking characteristics (control gain corresponds to: 10000 / d:i).

SQRT*: Root function for the calculation for the braking curve.
SQRT1: with small control error. Control gain corresponds to 30000 / d:i ;
SQRT2: control gain corresponds to 50000 / d:i

NOTE about the INPOS command: The INPOS command defines the window in relation to the stroke where the INPOS message is indicated. The monitored area is derived from the setpoint value minus the half “Inpos” value until setpoint value plus the half “Inpos” value. The positioning process is not influenced by this message. The controller remains active. In NC-mode this message has to be interpreted alternatively as following error.

NOTE about the SSIRES command: the standard of measurement is defined as increment/mm (inkr/mm). The maximum available resolution is equal to 1 µm that corresponds to a value 1000.

Example: A sensor with resolution 5µm has a resolution (0.005 mm) 5 times lower than the maximum set.
The SSIRES value is calculated as follows: *1000* (full scale ink) */ n* (sensor resolution in µm) = *1000 / 5 = 200*

5 - PROFIBUS COMMUNICATION

The module supports all baud rates from 9,6 kbit/s up to 12000 kbit/s with auto detection of the baud rate. The functionality is defined in IEC 61158. The Profibus address can be programmed with the EWMPC/10 software or online via the Profibus. A diagnostic LED indicates the online status.

5.1 - Data Sent

The card is set as follows:

Byte	Function	Comment
0	control word Hi	
1	control word Lo	actual not used
2	command position 1 Hi	
3	command position 1	
4	command position 1	
5	command position 1 Lo	
6	velocity 1 Hi	
7	velocity 1 Lo	
8	command position 2 Hi	active, if a second velocity is programmed (Bytes 13 and 14)
9	command position 2	
10	command position 2	
11	command position 2 Lo	
12	velocity 2 Hi	
13	velocity 2 Lo	
14	-	reserved
15	-	reserved

5.1.2 - Control words

The control words contain the following informations:

ENABLE: Must be activated in addition to the hardware signal.

START: In case of increasing edge the current command position is taken over, in case of deactivated START the system about a brake ramp is stopped.

HAND-: Hand mode (START = OFF), driving with the velocity programmed with the HAND:B parameter according to the hydraulic symbol of the valve. After deactivation the actual value is taken over as command position.

HAND+: Hand mode (START = OFF), driving with the velocity programmed with the HAND:A parameter according to the hydraulic symbol of the valve. After deactivation the actual value is taken over as command position.

Byte 0 - control word Hi		
bit	**Function**	
0		
1		
2		
3		
4	Hand-	1 = active
5	Hand+	1 = active
6	Start	1 = active
7	Enable (with hardware enable)	

The ENABLE bit is combined with the external enable input; that means that both signals must exist, in order to enable the axes..

5.1.3 - Position setpoint description

Command position: according to the sensor resolution.

Byte 2 to 5 - command position 1		
bit	**Function** defined by the sensor resolution	
from 0 to 7	Command position Lo byte	Byte 5
from 8 to 15	Command position	Byte 4
from 16 to 23	Command position	Byte 3
from 24 to 31	Command position Hi byte	Byte 2

Byte 8 to 11 - command position 2		
bit	**Function** defined by the sensor resolution	
from 0 to 7	Command position Lo byte	Byte 11
from 8 to 15	Command position	Byte 10
from 16 to 23	Command position	Byte 9
from 24 to 31	Command position Hi byte	Byte 8

Example of calculation of position control for SSI sensor resolution = 5 µm and 100% stroke = 300 mm.

Position setpoint = 150 mm (= 50% stroke)

STROKE • SSIRES = 100% stroke (dec)

300 • 200 = 60.000 (dec) → EA60 (hex)
50% di 60.000 = 30.000 (dec) → 7530 (hex)

Example of calculation of position control for ANA sensor with 100% stroke = 300 mm. With analog sensors SSIRES value is preset and unchangeable.

Position setpoint = 150 mm (= 50% stroke)

STROKE • SSIRES = 100% stroke (dec)

300 • 1000 = 300.000 (dec) → 493E0 (hex)
50% di 300.000 = 150.000 (dec) → 249F0 (hex)

Position setpoint to be sent
with decimal value 150,000 :

hex **00 02 49 F0**

Byte 2 Byte 3 Byte 4 Byte 5

10.1.4 - Speed setpoint description

Command velocity: 0x3fff corresponds to 100 %.

Byte 6 and 7 - command velocity 1		
bit	**Function** max value 0x3FFF	
from 0 to 7	velocity Lo byte	Byte 7
from 8 to 15	velocity Hi byte	Byte 6

Byte 12 and 13 - command velocity 2		
bit	**Function** max value 0x3FFF	
from 0 to 7	velocity Lo byte	Byte 13
from 8 to 15	velocity Hi byte	Byte 12

5.2 - Updating data

The card send back to the bus-card a totally of 24 bytes of data.

Byte	Function	Comment
0	status word Hi	
1	status word Lo	not used
2	actual position Hi	
3	actual position	
4	actual position	
5	actual position Lo	
6	internal command position Hi	
7	internal command position	
8	internal command position	
9	internal command position Hi	
10	Control deviation Hi	in resolution of the positioning sensor
11	Control deviation	
12	Control deviation	
13	Control deviation Lo	
14		
15		

5.2.1 - Status word description

The status words are:

READY: System is ready.

INPOS: Depending on the mode set, can transmit a target reached information or, in NC mode, the following error control information.

Byte 1 - status word Hi		
bit	**Function**	
0		
1		
2		
3		
4		
5		
6	INPOS	1 = actual value in position window
7	READY	1 = ready to operate

5.2.2 - Positioning description

Bytes 2 to 5 - Actual position		
byte	**Function** defined by the sensor resolution	
from 0 to 7	Actual position Lo-Byte	Byte 5
from 8 to 15	Actual position	Byte 4
from 16 to 23	Actual position	Byte 3
from 24 to 31	Actual position Hi-Byte	Byte 2

Current command position: is interpreted according to mode differently.

SDD mode : target command position

NC-mode : (V_{MODE} = ON) calculated command position of the generator.

Actual position: according to the sensor resolution.

The stroke of the cylinder is obtained by applying the following formula:

received data / SSIRES = stroke

hex **00** **04** **90** **F3** = dec **299251**

Byte 5

Byte 2 Byte 4

Byte 3

so, with SSIRES = 1000

299251 / 1000 = 299,251 (millimetres)

Bytes 6 to 9 - Internal command position		
byte	**Function** defined by the sensor resolution	
from 0 to 7	Command position Lo-Byte	Byte 9
from 8 to 15	Command position	Byte 8
from 16 to 23	Command position	Byte 7
from 24 to 31	Command position Hi-Byte	Byte 6

Bytes 10 to 13 - Control deviation		
byte	**Function** defined by the sensor resolution	
from 0 to 7	Control deviation Lo-Byte	Byte 13
from 8 to 15	Control deviation	Byte 12
from 16 to 23	Control deviation	Byte 11
from 24 to 31	Control deviation Hi-Byte	Byte 10

6 - INSTALLATION

The card is designed for rail mounting type DIN EN 50022.

The wiring connections are on the terminal strip located on the bottom of the electronic control unit. It is recommended to use cable sections of 0.75 mm^2, up to 20 m length and of 1.00 mm^2 up to 40m length, for power supply and solenoid connections. For other connections it is recommended to use cables with a screened sheath connected to earth only on the card side.

NOTE: To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram. As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

A typical screened Profibus plug (D-Sub 9pol with switchable termination) is mandatory. Also the Profibus cable must be screened.

Every Profibus segment must be provided with an active bus termination at the beginning and at the end. The termination is already integrated in all common Profibus plugs and can be activated by DIL switches.

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

7 - SOFTWARE KIT EWMPC/10 (code 3898401001)

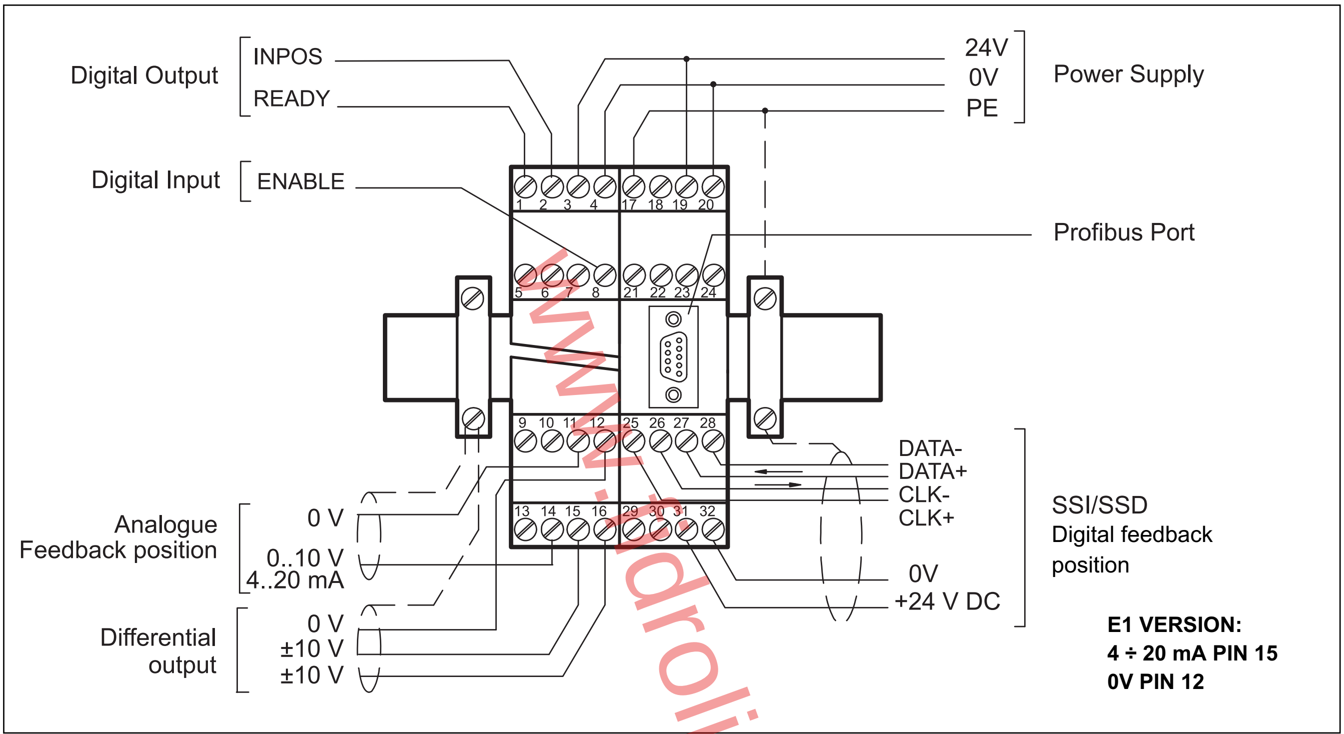
The software kit comprising a USB cable (1.8 mt length) to connect the card to a PC or notebook and the software.

During the identification all information are read out of the module and the table input will be automatically generated.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft XP® and Windows7 operating systems.

8 - WIRING DIAGRAM



DIGITAL INPUT AND OUTPUT

PIN 1 — READY output.
General operationality, ENABLE is active and there is no sensor error (by use of 4÷20 mA sensors). This output corresponds with the green LED.

PIN 2 — INPOS output.
Monitoring of the control error (INPOS). Depending on the INPOS command, the status output will be deactivated, if the position difference is greater then the adjusted window.
The output is only active if START = ON.

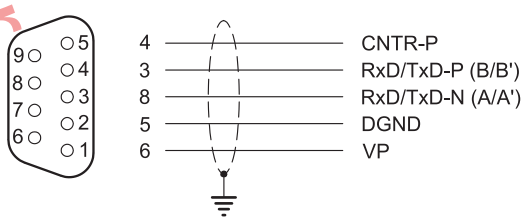
PIN 8 — ENABLE input:
This digital input signal initializes the application.
The analogue output is active and the READY signal indicates that all components are working correctly.
Target position is set to actual position and the drive is closed loop controlled.

ANALOGUE INPUT AND OUTPUT

PIN 14 — Analogue feedback value (XL),
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

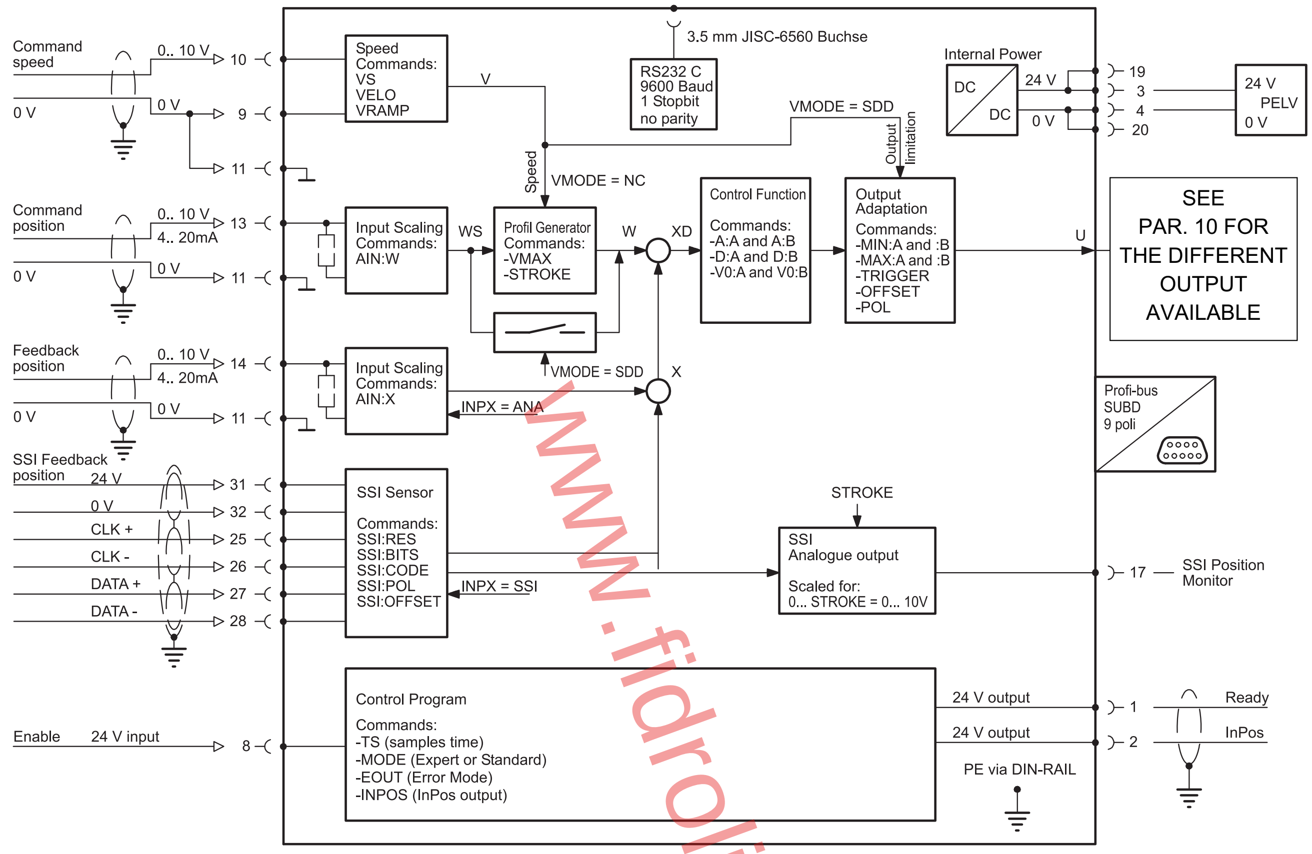
PIN 15/16 — Differential output (U)
±100% corresponds to ± 10V differential voltage,
optionally (E1 version) current output ±100% corresponds to 4 ÷ 20 mA (PIN 15 to PIN 12)

PROFIBUS PORT WIRING AND LINKING CONFIGURATION



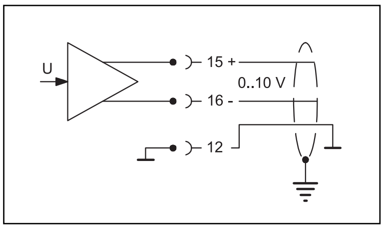
pin	Signal name	Function
1-2-7-9	not used	-
3	RxD/TxD-P (B-Line)	Receive/Send P data
4	CNTR-P/RTS	Request to Send
5	DGND	Data ground
6	VP	+5 V DC for external bus termination
8	RxD/TxD-N (A-Line)	Receive/Send N data

9 - CARD BLOCK DIAGRAM

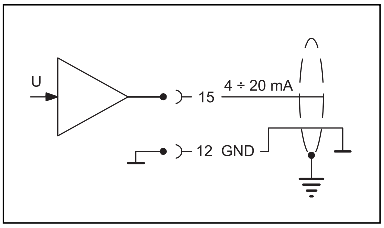


10 - OUTPUT SIGNALS AVAILABLE FOT DIFFERENT VERSIONS

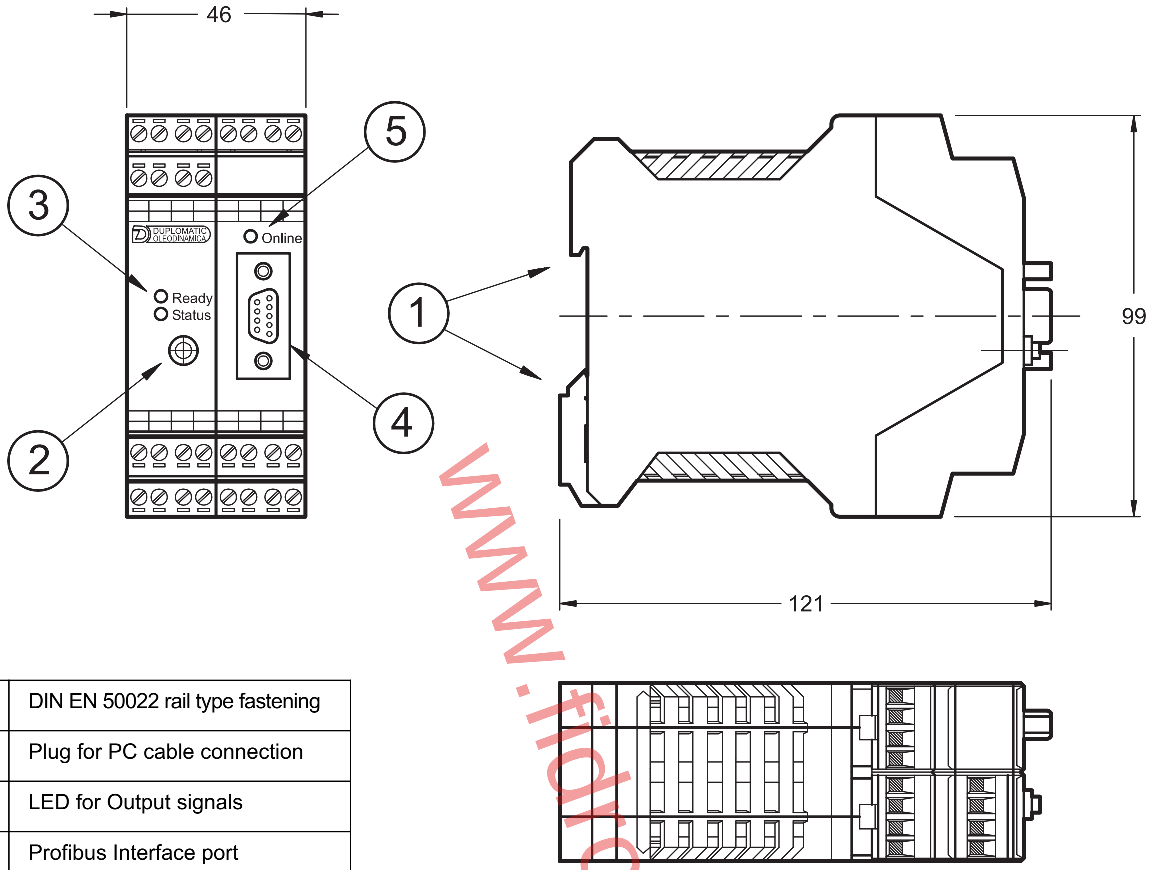
E0 VERSION



E1 VERSION



10 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	Plug for PC cable connection
3	LED for Output signals
4	Profibus Interface port
5	Profibus LED

DUPLOMATIC OLEODINAMICA

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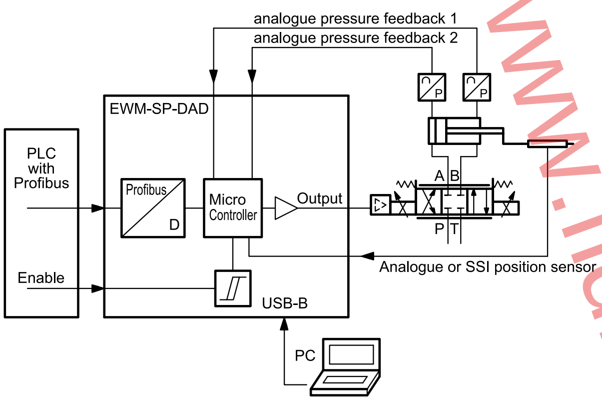
EWM-SP-DAD

CARD FOR AXIS CONTROL WITH PRESSURE LIMITATION IN CLOSED LOOP. PROFIBUS INTERFACE

SERIES 20

RAIL MOUNTING TYPE: DIN EN 50022

OPERATING PRINCIPLE



— This card has been developed for positioning control with integrated closed loop pressure where an high accuracy is needed, using a digital sensor for positioning, and analogue sensors for pressure sensing.

— The card is an axis controller with two positioning control mode, SDD and NC. It communicates with the PLC via the integrated Profibus interface.

— An integrated control for pressure limitation for one or two sensors (differential pressure), completes the card.

— The output value, voltage or current type, has to be configured via software.

— Card setup is via software only, through an USB-B port

TECHNICAL CHARACTERISTICS

Power supply	V DC	24 ÷ 30 ripple included
Fuse, external	A	1A medium time lag
Current consumption	mA	<350 (technical data of the sensors have to be considered)
Command position		via Profibus DP
Profibus DP data rate	kbit/s	9.6, 19.2, 93.75, 187.5, 500, 1500, 3000, 6000, 12000 - ID number 1810h
Max position accuracy	µm	1
Position feedback values	SSI V mA	digital sensor with any interface SSI - 150 kbit/s 4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Pressure feedback values	V mA	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Output value	V mA	differential, ±10 (max load 10 mA) 4 ÷ 20 (max load 390 Ω)
Interface		USB - B 2.0 / Profibus
Electromagnetic compatibility (EMC) 2004/108/EC		Immunity EN 61000-6-2: 8/2005 Emissions EN 61000-6-4: 6/2007; A1:2011
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 46(w)
Connections		USB-B (2.0) - 7x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

EWM-SP-DAD
SERIES 20

1 - IDENTIFICATION CODE

E	W	M	-	SP	-	D	AD	/	20	E

- EWM: Digital card for closed loop systems DIN EN 50022 rail mounting
- SP: Stroke and pressure control
- D: Digital command value
- AD: Analog and digital feedback values
- 20: Series No. (from 20 to 29 sizes and mounting dimensions remain unchanged)
- E: Output value in voltage or current, to be configured via software.

2 - FEATURES OVERVIEW

Controller Functions

- Stroke or stroke + pressure limitation control in closed loop system
- Fine positioning - 1µm resolution
- 2 method for positioning control:
  SDD – Stroke Depending Deceleration - time-optimal positioning structure with very high stability
  NC – Numerically Controlled - To follow the position profile
- Second position and second speed commands available for fast approach / test speed
- Data for lengths and pressures in mm and bar / % respectively
- Gain adjustment made via software
- PT1 filter to stabilize the control behaviour
- Emergency function (EOUT)
- Safe and error-free data transmission
- For digital position sensors
- Internal limitation of velocity for position sensors
- As an alternative, the card can be set via software for operate with analogue position sensors.
- Two analogue feedback for differential pressure measurement
- Two sets of PID and ramp parameters for pressure control
- Simple and intuitive scaling for analogue sensors

Adaptation of the valve characteristic curve

- CTRL function to adapt the braking characteristics to positive and zero overlapped proportional valves
- Advanced deadband compensation: non-linearity compensation by a double-gain characteristics
- Drift compensation

Monitoring functions

- In-position error
- Cable break, in-pressure error and fault of feedback sensors
- 2 Digital output to read the status

Other characteristics

- Output value in voltage or current, to be configured via software.
- Card configuration is made via software, through on-board USB

3 - FUNCTIONAL SPECIFICATIONS

3.1 - Power supply

This card is designed for 24 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

3.4 - Reference signals

The reference signals run via Profibus, ID number 1810h.

3.5 - Position feedback values

The card accepts a digital feedback input from a sensor with any SSI interface with RS422 specifications. Bit, code and resolution are settable via software.

The max sensor resolution is 0,001 mm.

Eventually an analog input could be used as feedback. The card accepts a 0 ÷ 10 V (Ri 25 kOhm) or 4 ÷ 20 mA (Ri = 240 Ohm).

The analogue resolution is of 0,003 incl. oversampling for a max res. of 1 µm.

⚠ Using analog sensors, the SSI parameters in the software assume default preset values that the user must not change.

3.6 - Pressure feedback values

Pressure feedback can be analogue only, 0 ÷ 10 V (Ri 25 kOhm) or 4 ÷ 20 mA (Ri = 240 Ohm).

3.7 - Analog output values

Output values can be in voltage or current, to be configured via software (parameter SIGNAL:U). The same parameter defines the polarity also.

Voltage: ± 10 V Differential output PIN 15 and 16

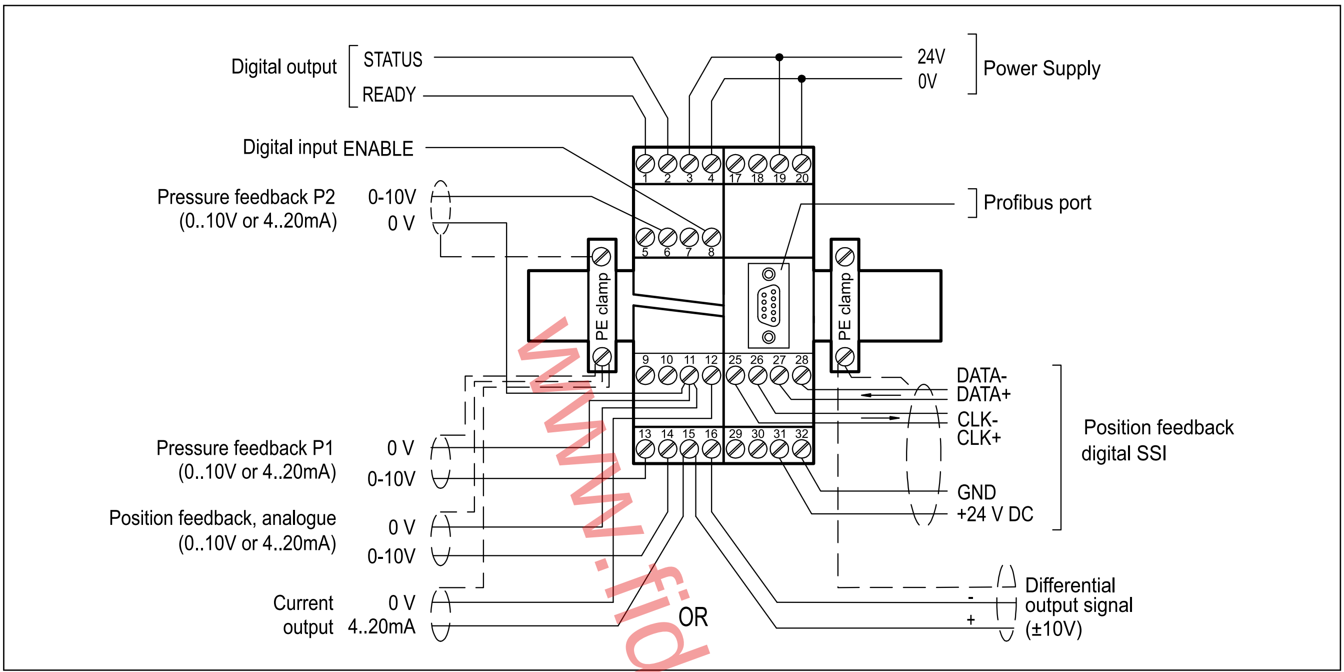
Current: 4 ÷ 20 mA (PIN 15 to PIN 12).

3.8 - Digital Output

Two digital output are available, STATUS and READY, that are displayed by LED on the front panel.

Low level < 2 V High Level > 12 V (50 mA).

4 - WIRING DIAGRAM



DIGITAL INPUT AND OUTPUT

PIN 1 — READY output.
General operationality, ENABLE (PIN 8 and profibus bit) is active and there are no sensor errors.
This output corresponds with the green led.

PIN 2 — STATUS output.
Monitoring of the control error (INPOS). Depending on the INPOS command, the status output will be deactivated, if the position difference is greater than the adjusted window.
The output is only active if START bit (Profibus) = ON.

PIN 8 — ENABLE input:
This digital input signal initializes the application.
The controller and the READY signal are activated. The output signal to the control element is enabled.
Target position is set to actual position and the drive stays stationary, in closed loop.
The Enable bit via profibus must be active, too.

ANALOGUE INPUT

PIN 6 — Analogue pressure feedback value (P2), range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

PIN 13 — Analogue pressure feedback value (P1), range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

PIN 14 — Analogue position feedback value , range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

ANALOGUE OUTPUT

voltage

PIN 16/15 — Differential output (U)
± 100% corresponds to ± 10V differential voltage

current

PIN 12/15 — ±100% corresponds to 4 ÷ 20 mA

SSI SENSOR INTERFACE

PIN 25	CLK+ output
PIN 26	CLK- output
PIN 27	DATA+ input
PIN 28	DATA- input
PIN 31	24V Power supply of the SSI sensor
PIN 32	0V Power supply of the SSI sensor

5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm^2 up to 20 m length, and of 1.00 mm^2 up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

NOTE : To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE “protected earth” and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

6 - DEVICE SETUP

Card set-up is possible via software only.

The system can be controlled in open loop, moving up and down the servo-cylinder with commands HAND:x, via Profibus only, to facilitate the adjustment of the card and its calibration. With these functions the setting-up and the adjustments become easy.

6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7 and 8.

WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.

6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at standard level, easier, or expert, where a greater number of parameters is displayed and can be customized.

For a complete list of the parameters and their settings please refer to the Technical Manual *89440-115 ETM*.

7 - MAIN FEATURES

The EWM-SP-DAD is a card for positioning control loop (POS), that can operate also with a pressure limitation control (POS_PQ).

With only few parameters the controller can be optimized and the movement profile is preset via Profibus (position and velocity).

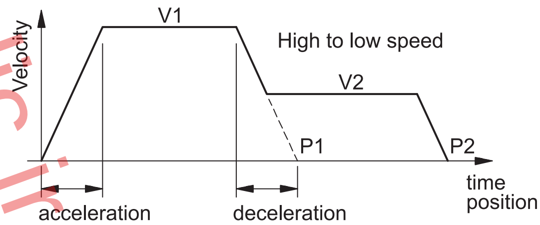
Here below an example of profile with a switch speed:

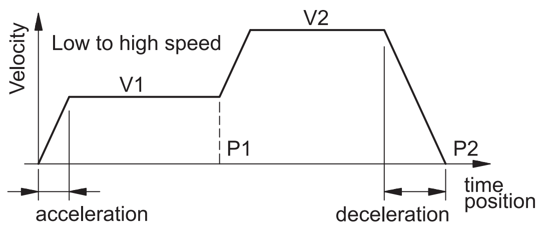
- the target position is command value 2 (P2) combined with velocity 2 (V2).
- the switch over position is command value 1 (P1), combined with velocity 1 (V1).

The switchpoint from high to low velocity is calculated depending on the speed V2 and the braking.

The switchpoint from low to high speed is made in the P1 position with the ramp acceleration, as shown below.

If the command position P2 is between the current position and the position value of P1, the positioning in P2 can only be driven with V1 velocity.





7.1 - Sequence of the positioning

You can switch from the positioning in closed loop to the manual movement in open loop and back via Profibus.

With READY active the system is ready. The open loop control is achieved by using the HAND bits and the speed parameter. When the bit HAND goes low the card assumes the current position as the request and the card is ready to work in closed loop.

With also START bit enabled, the command position parameter (profibus) become active and the new command position will be taken over as a new target.

The axis moves immediately to this new position and indicates on the Inpos Output when it reaches the position. This output is active as long as the axis is within the InPos window or the START bit is active.

Two methods for positioning are available:

SDD - stroke depending deceleration - means the control gain will be adjusted. This is a time-optimal positioning structure with very high stability.

NC mode - the position value is generated from the following error.

The actuator position is measured by a transducer and compared with a specified target position. The target position and speed are set by Profibus.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two clashing requirements (short positioning time and high accuracy) have to be considered in the system design.

7.2 - Pressure limitation control function:

The pressure limitation control requires a dynamic zero-overlapped control valve.

The pressure loop is managed according to the value of pressure measured just in one or in both the two chambers of the cylinder.

The control value for the pressure loop is set via profibus. If the pressure (or force) exceeds, the controller reduces the output signal to the valve (only in a negative scale) until it reaches the preset pressure value.

The switch from 'positioning mode' to 'pressure limitation' is handled automatically.

7.3 - Emergency Output (EOUT)

This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The function can be deactivate.

7.4 - Adaptation of the braking characteristic to the valve type (CTRL).

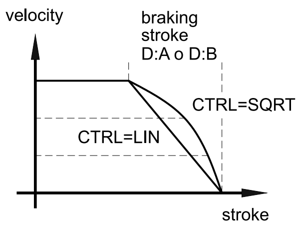
The deceleration characteristic is set with this parameter. In case of positively overlapped proportional valves the SQRT function should be used. The non-linear flow function of these valves is linearized by the SQRT function.

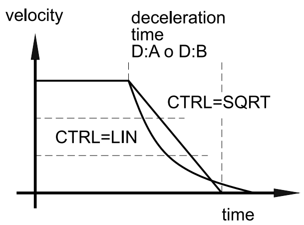
In case of zero lapped valves (control valves and servo valves) the LIN or SQRT1 function should be used regardless of the application. The progressive characteristic of the SQRT1 function has better positioning accuracy but can also lead to longer positioning times in individual cases.

LIN: Linear deceleration characteristic (gain is increased by a factor of 1).

SQRT1: Root function for braking curve calculation. The gain is increased by a factor of 3 (in the target position). This is the default setting.

SQRT2: Root function for braking curve calculation. The gain is increased by a factor of 5 (in the target position). This setting should only be used with a significantly progressive flow through the valve.





characteristic (TRIGGER).

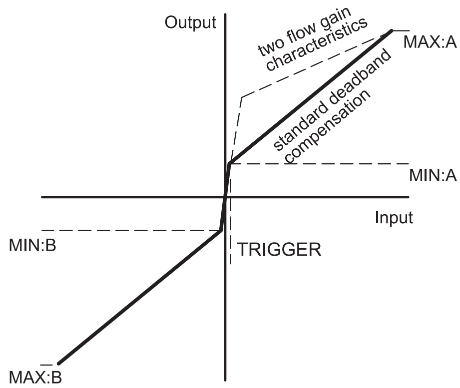
With TRIGGER command, the output signal is adapted to the valve characteristics.

The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

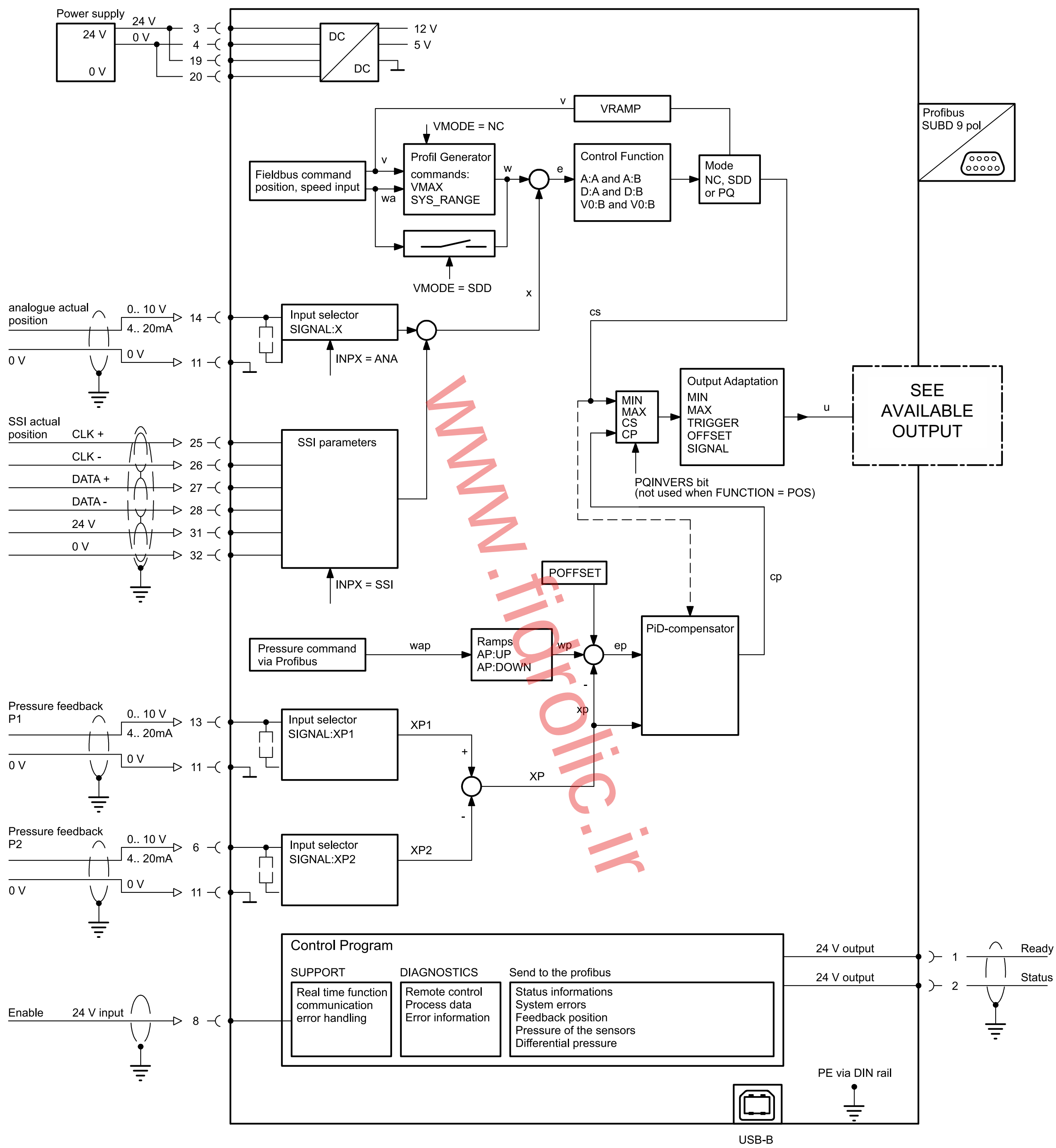
If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out either at the power amplifier or at the positioning module.

If the deadband compensation value (MIN) is set too high, it influences the minimal velocity which cannot be adjusted any longer.

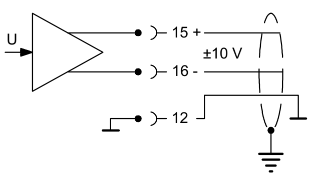
In extreme cases this causes to an oscillating around the closed loop controlled position.



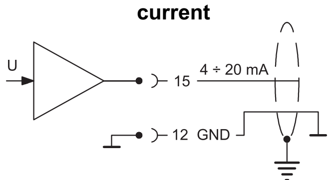
8 - CARD BLOCK DIAGRAM



voltage

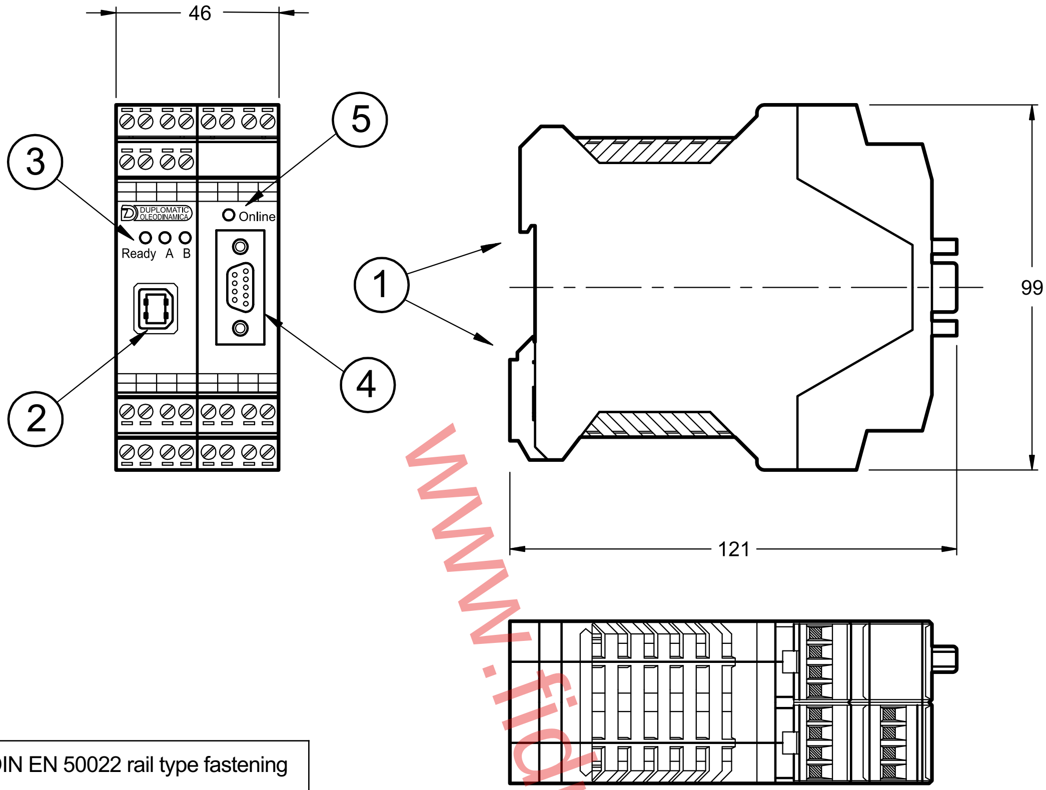


current



NOTE: If the card is configured as simple positioning control without pressure limitation then the output value is calculated just from the output of the position controller (CS) instead of apply MIN and MAX parameters. MIN/MAX are selected by the PQINVERS bit (Profibus).

9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	USB port
3	LED for output signals
4	Profibus Interface port
5	Profibus LED

DUPLOMATIC
OLEODINAMICA

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DUPLOMATiC OLEODiNAMiCA

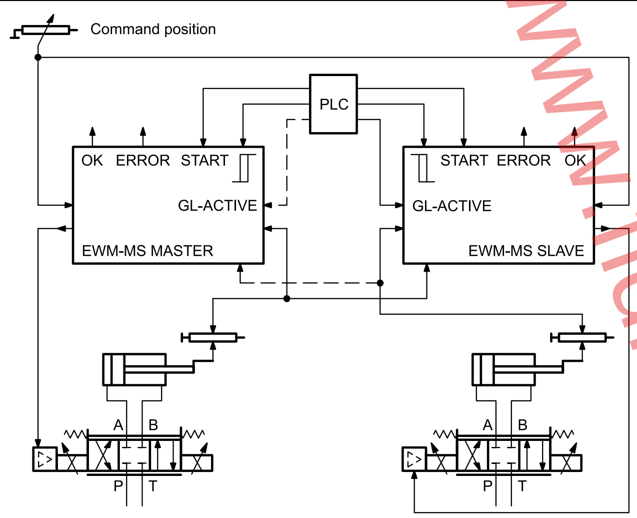
EWM-MS-AA

CARD FOR SYNCHRONIZATION CONTROL WITH ANALOGUE SIGNALS

SERIES 20

RAIL MOUNTING TYPE: DIN EN 50022

OPERATING PRINCIPLE



— This card has been developed for an easy synchronization of two actuators (up to 6 axes in master-slave mode) with an overriding synchronization controller.

— The card can drive only an axis; one card per axis is needed.

— Proportional valves with integrated electronics can be driven by the differential output. A version with amplifier is also available.

— Analogue feedback sensors (scalable via software)

— Analogue position input. The axes speed can be limited by an external analogue speed input.

— 2 control mode: SDD and NC

— Card setup via software only, through an on-board USB-B port.

TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ÷ 30 ripple included external fuse 1,0 A (3A for M2 version)
Current consumption: - E versions - M2 version	mA W	<100 60 depending on the solenoid
Command value	V mA	0 ÷ 10 (R_I = 25 kΩ) 4 ÷ 20 (R_I = 240 Ω)
Position input value resolution	%	0,003, 1um max
Speed input value	V mA	0 ÷ 10 (R = 90 kΩ) 4 ÷ 20 (R_I = 240 Ω)
Feedback value	V mA	0 ÷ 10 (R_I = 25 kΩ) 4 ÷ 20 (R_I = 240 Ω)
Output value: - E version, voltage - E version, current - M2 version	V mA A	±10 (max load 10 mA) 4 ÷ 20 (max load 390 Ω) 0,5 - 2,6 stepless
Interface		USB B type 2.0
Electromagnetic compatibility (EMC)		Immunity EN 61000-6-2: 8/2005 Emissions EN 61000-6-4: 6/2007; A1:2011
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w) (M2 version: w = 46)
Connector		4x4 (4x7 M2 version) poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

1 - IDENTIFICATION CODE

E	W	M	-	MS	-	A	A	/	20	

Digital card for closed loop systems
DIN EN 50022 rail mounting (E W M)

Master and slave control (MS)

Analog command value (A)

Analog feedback value (A)

Series No.
(from 20 to 29 size and mounting dimensions remain unchanged) (20)

Output value:
E = Output value in voltage or current, to be configured via software.
M2 = embedded power amplifier

NOTE: one card per axis is needed. To synchronize 2 axes, 2 cards are needed.

2 - FEATURES

Controller functions

- stroke control and synchronization of axes
- 2 different working mode for syncronization:
  - master-master (2 axis maximum)
  - master-slave (up to 6 axis)
- 2 method for positioning control:
  SDD – Stroke Depending Deceleration - time-optimal positioning structure with very high stability
  NC – Numerically Controlled - To follow the position profile
- Different gain parameters available via software for SDD and NC control modes
- PT1 filter to stabilize the control behaviour
- Command, feedaback and speed in mm and mm/s respectively
- Analogue feedback scalable via software
- Analogue command position scalable via software
- Speed limit managed by analogue input or internally
- Emergency function (EOUT)

Adaptation of the valve characteristic curve

- CTRL function to adapt the braking characteristics to positive and zero overlapped proportional valves
- Advanced deadband compensation: non-linearity compensation by a double-gain characteristics

Monitoring functions

- In-position error
- Cable break, in-position error and fault of feedback sensors
- Solenoids monitored for M2 version
- 2 Digital output to read the status

Other characteristics

- Output value in voltage or current, to be configured via software.
- Card configuration is made via software, through on-board USB

3 - FUNCTIONAL SPECIFICATIONS

3.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, freewheeling diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

NOTE: in the M2 version the value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoids to be controlled.

3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

3.4 - External command position

The card accepts an analogue input signal. The command value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.5 - External command speed

The card accepts an analogue input signal. The command speed can be 0 ÷ 10 V (RI = 90 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.6 - Feedback value

The card accepts analogue feedback input. The feedback value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.7 - Analogue output values

Output values can be in voltage or current, to be configured via software (parameter SIGNAL:U). The same parameter defines the polarity also.

E Voltage: ± 10 V Differential output (PIN 15 to PIN 16).

E Current: 4 ÷ 20 mA (PIN 15 to PIN 12).

M2: embedded power stage configurable via software. Value range 0,5 ÷ 2.6 A stepless.

All analogue output have to be wired with screened cables.

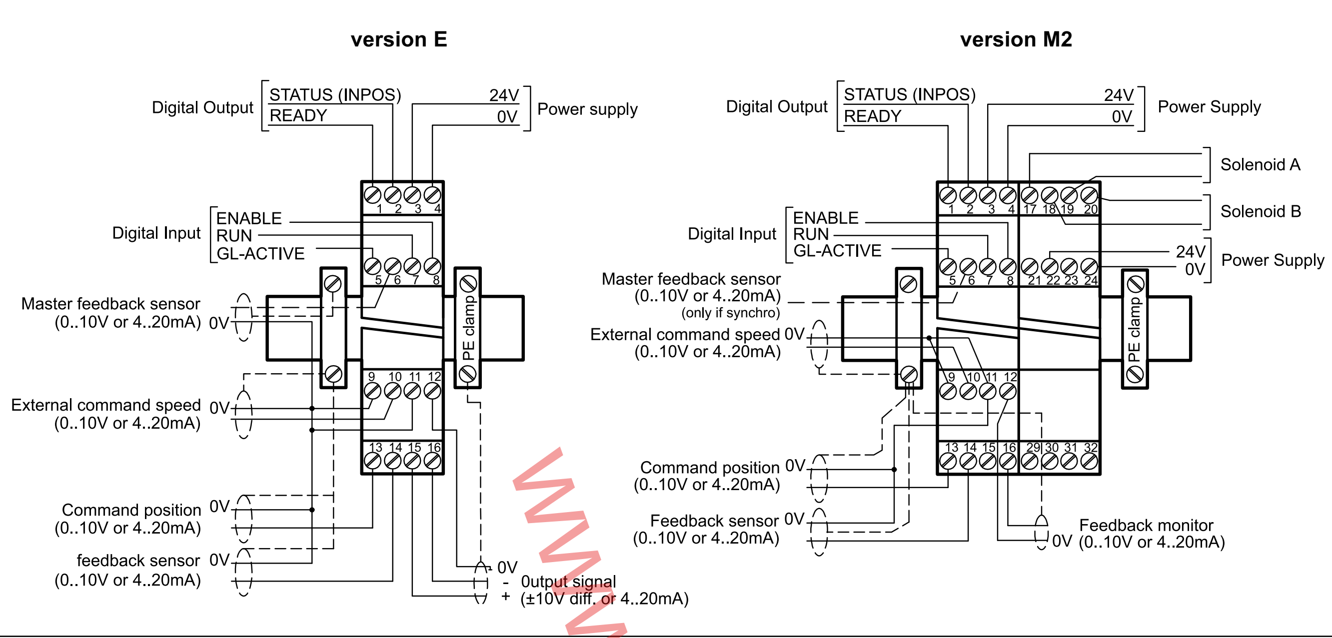
3.8 - Digital output

Two digital output are available, STATUS and READY, that are displayed via LEDs on the front panel.

Low level < 2 V High Level > 12 V (max 50 mA).

4 - WIRING DIAGRAMS

4.1 - Basic wiring



DIGITAL INPUT AND OUTPUT

PIN 1 — READY output.
General operationality, ENABLE is active and there is no sensor error (by use of 4 ÷ 20 mA sensors).
This output corresponds with the green LED.

PIN 2 — STATUS output.
Monitoring of the control error (INPOS). Depending on the INPOS command, the status output will be deactivated, if the position difference is greater then the adjusted window. If SC-ACTIVE (pin 5) is on, this output is used to monitor the synchronization error.
The output is only active if START = ON.

PIN 5 — GL-ACTIVE:
Synchronisation controller. If this input is not active, the module works as normal positioning controller.

PIN 7 — START input:
The positioning controller is active; the external analogue command position is taken over as command value.
If the input is switched off during movement, the command position is set to the actual position plus a defined emergency deceleration stroke.

PIN 8 — ENABLE input:
This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. Target position is set to actual position and the drive is closed loop controlled.

for M2 version only:

PIN 16 — Feedback monitor (scaled)
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

ANALOGUE INPUT

PIN 6 — Feedback value (K) of the master axis
range 0÷100% corresponds to 0 ÷ 10V or 4 ÷20 mA

PIN 9/10 — External command speed (V),
range 0 ÷ 100 % corresponds to 0 ÷ 10 V

PIN 13 — Command position (W),
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

PIN 14 — Feedback value (X),
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

E version - ANALOGUE OUTPUT voltage

PIN 16/15 — Differential output (U)
± 100% corresponds to ± 10V differential voltage

current

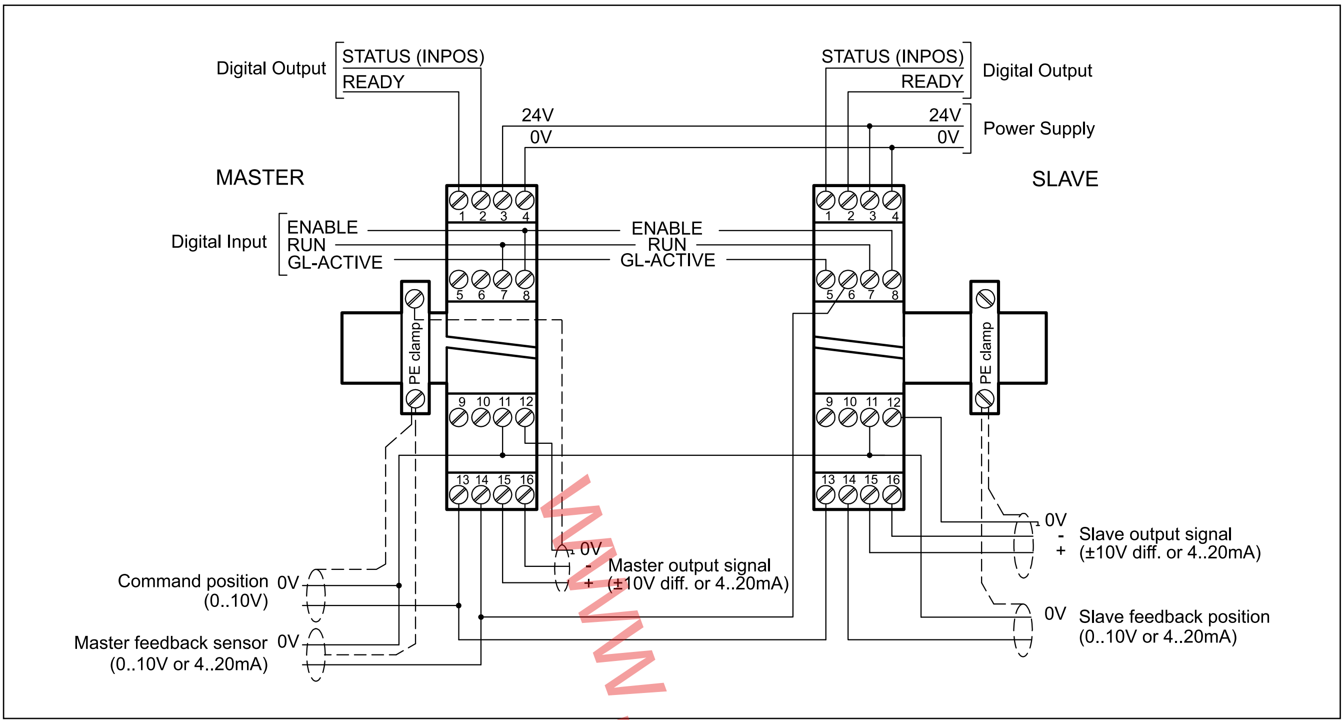
PIN 12/15 — ±100% corresponds to 4 ÷ 20 mA

M2 version - ANALOGUE OUTPUT current

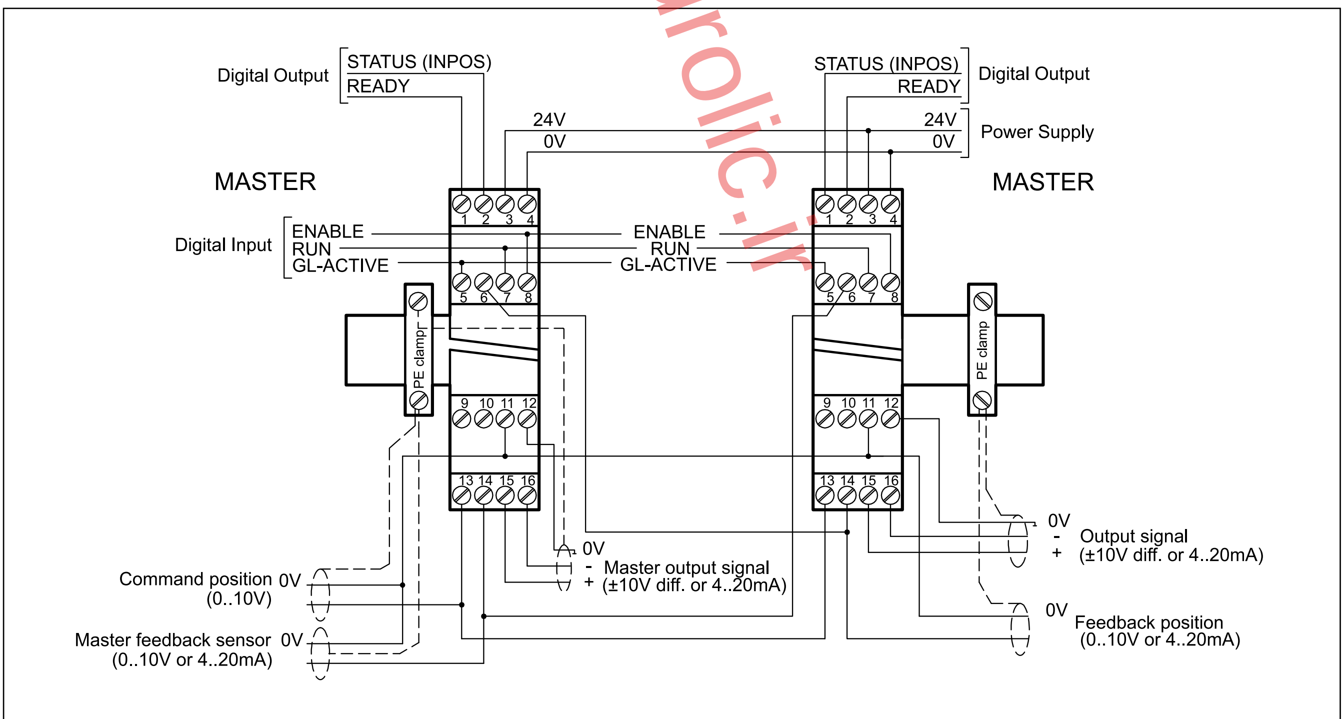
PIN 17+19 — Solenoid output A

PIN 18+20 — Solenoid output B

4.2 - Wiring example for MASTER / SLAVE configuration, output value type E*, up to 6 axes



4.3 - Wiring example for MASTER / MASTER configuration, output value type E, 2 axes only.



5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm^2 up to 20 m length, and of 1.00 mm^2 up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

NOTE : To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

⚠ **WARNING! Plugs with free-wheeling diodes and LED indicators cannot be used with current controlled power outputs.**

They interfere with the current control and can destroy the output stage.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE “protected earth” and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

6 - DEVICE SETUP

Card set-up is possible via software only.

6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7, 8 and 10.

⚠ **WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.**

6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at *standard* level, easier, or *expert*, where a greater number of parameters is displayed and can be customized.

For a complete list of the parameters and their settings please refer to the Technical Manual *89450 ETM*.

7 - MAIN FEATURES

This module can be configured for:

- MASTER / MASTER positioning control for 2 axes (both GL input are active) where the positions information will be linked crosswise.
- MASTER / SLAVE positioning control, for up 6 axes, with selectable master function by deactivating of the GL input.
  If the synchronisation controller is active, it overrides the position control process. When the actual position of the master axis is given to the slave axis all slave axes will follow the master axis.
- INDEPENDENT POSITIONING by deactivation of both GL input and separate command positions at PIN 13.

The function of the STATUS output is - depending on GL input - in position signal or synchronisation error signal

For a reliable function of the synchronisation control the speed of the master axis should be limited to app. 70 / 80% of maximum speed. The slave axis must be able to increase the speed against the master axis to compensate position failures.

NOTE: If using positioning sensors with current input (4…20 mA) PIN 6 of the slave and with PIN 14 of the master have to be connected parallel. The right current input is set automatically.

If using more modules for synchronous axes, the others analog inputs (command, speed) if supplied in current must be managed with separate current signals for each module.

The card sample time is 1 ms.

7.1 - Sequence of the positioning

After the pre-parameterization and a successfully electrical verification of the control signals the system can switched on.
The positioning process will be controlled by switching the digital inputs.

After enabling (ENABLE input) the drive stays in the current position (i.e. the actual position is accepted as the required position). If the drive moves to an end position, the polarity is probably wrong.

The READY output indicates a general ready to operate.

The speed can be limited by means of the VELO parameter or the external speed demand (SIGNAL:V).

With the RUN signal the demand value of the analogue input is accepted and the axis moves to the predefined target position. STATUS output indicates if the axis is inside the "in position window".

GL-ACTIVE input has to be activated when a synchronized control is requested.

If each axis can be started-up indiviually this input has to be activated after the optimisation of the axes.

The operating mode can be:

SDD - stroke depending deceleration - means the control gain will be adjusted. This is a time-optimal positioning structure with very high stability.

NC mode - the position value is generated from the following error.

The actuator position is measured by an analogue transducer and compared with a specified target position. The target position is adjusted with an external potentiometer or preset by an analogue input from an external controller (PLC). It's possible to define the axis speed also by an external command speed.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two clashing requirements (short positioning time and high accuracy) have to be considered in the system design.

7.2 - Gain

The gain is settable and it's related with the braking distance (parameters available via software). Lower is the braking distance, higher is the gain.

7.3 - Emergency Output (EOUT)

This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The function can be deactivate.

7.4 - Adaptation of the braking characteristic to the valve type (CTRL).

The command CTRL controls the braking characteristic curve of the hydraulic axis. The deceleration can be set with linear or nearly square root characteristic.

With positive overlapped proportional valves one of the SQRT characteristics should be used, because of the linearization of the non-linear flow curve typical of these valves; if zero overlapped proportional valves (control valves) are used, you can choose between LIN and SQRT1 according to the application.

The progressive gain characteristic of SQRT1 has the better positioning accuracy.

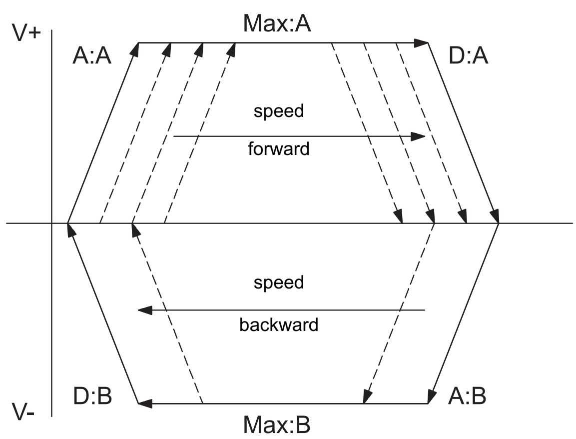
According to the application there is maybe a longer braking distance, so that the total stroke time will be longer.

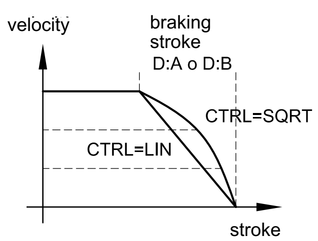
LIN: Linear characteristic (control gain corresponds to: 10000 / d:i).

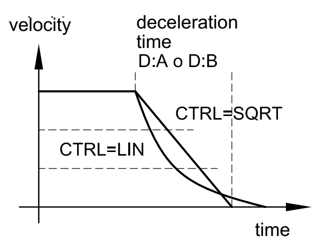
SQRT1: Root function with small control error. (corresponds to 30000 / d:i);

SQRT2: Root function with higher gain corresponds to 50000 / d:i

flow (volume) P→A and B→T







7.5 - Adaptation of the output signal to the valve characteristic (TRIGGER).

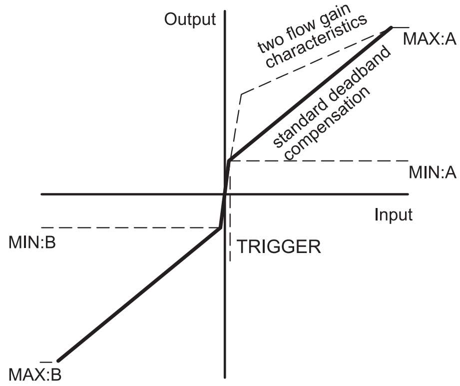
With TRIGGER command, the output signal is adapted to the valve characteristics.

The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out at the power amplifier or at the positioning module.

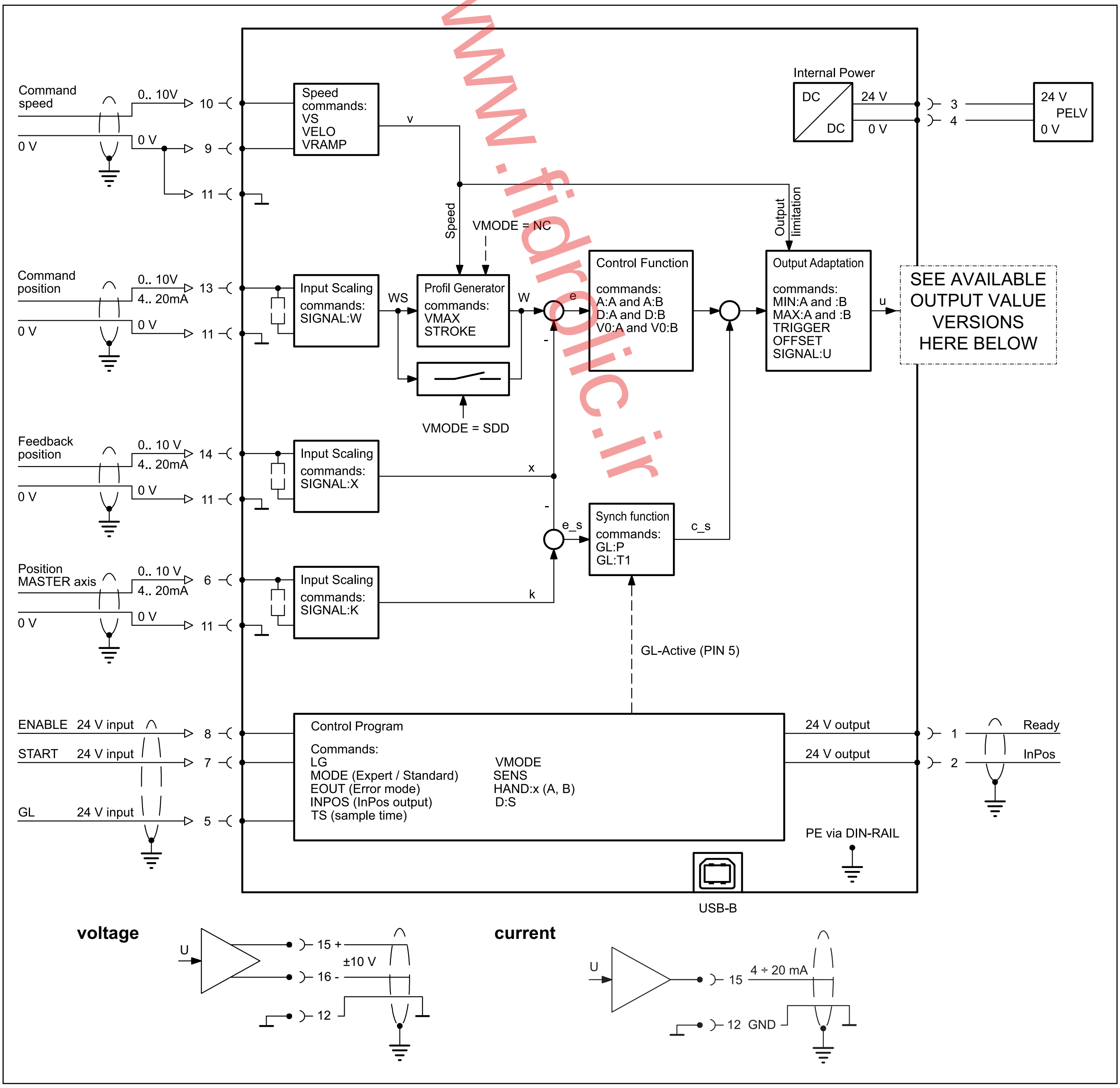
If the deadband compensation value is set too high, it influences the minimal velocity which cannot be adjusted any longer.

In extreme cases this causes to an oscillating around the closed loop controlled position.

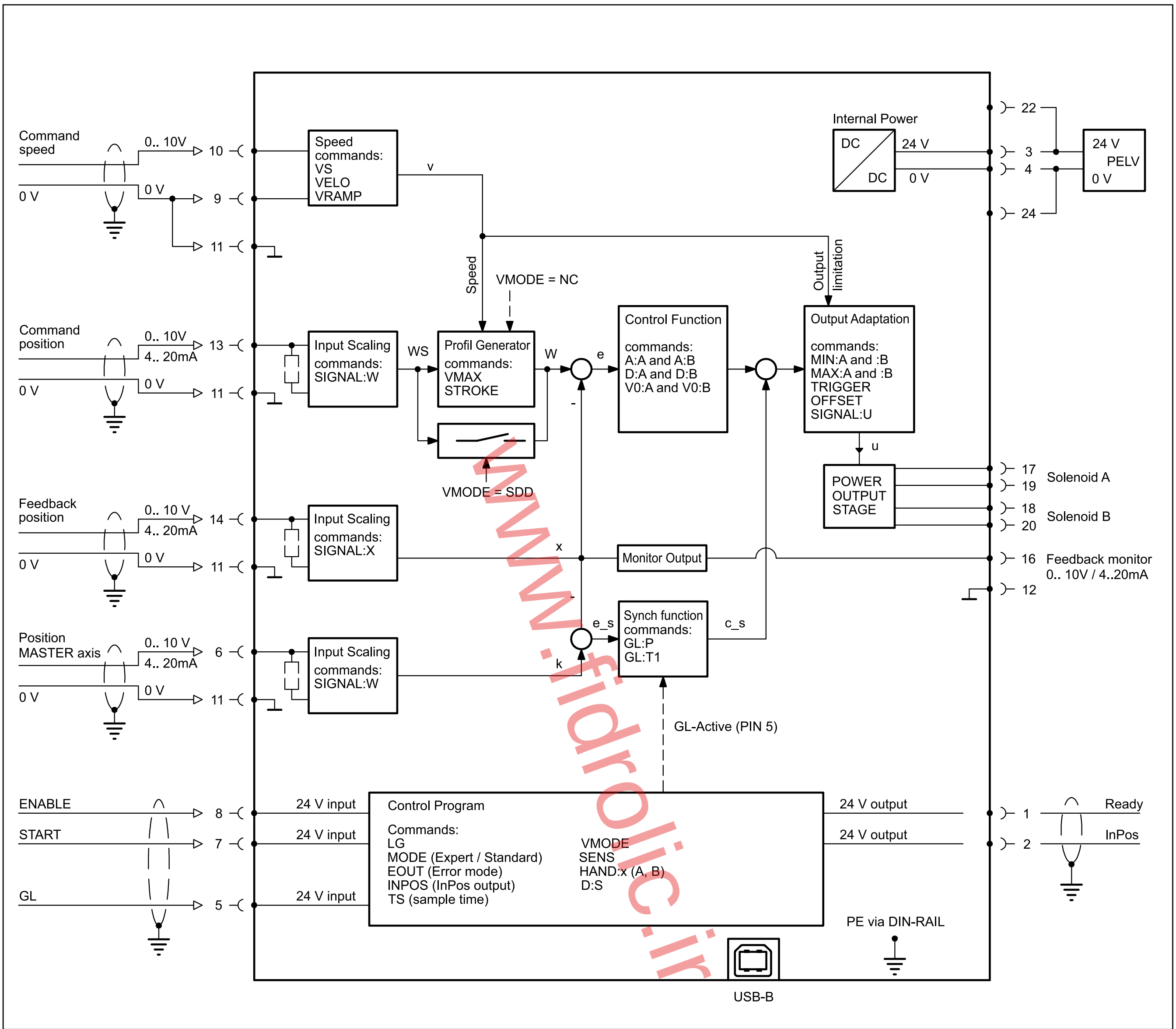


8 - CARD BLOCK DIAGRAMS

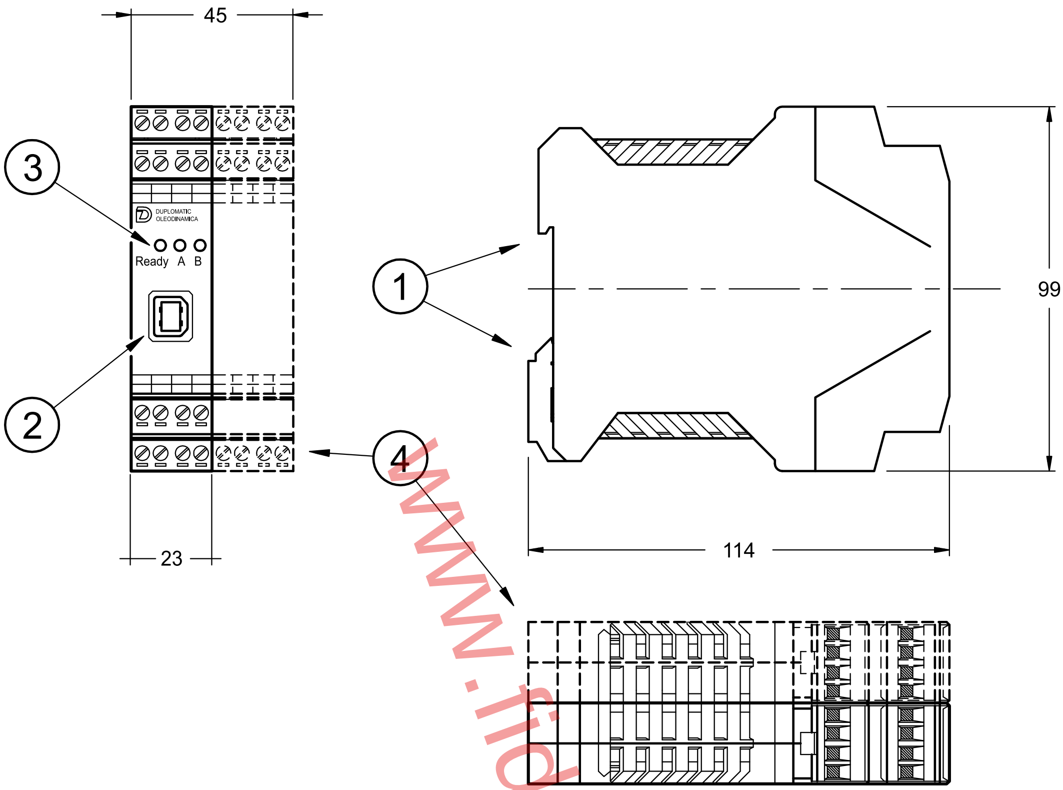
8.1 - ‘E’ version



8.2 - M2 version - with output stage



9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN rail fastening EN 50022
2	USB interface, for setup
3	LED for output signals
4	Power stage module - present on M2 version only .

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DUPLOMATiC OLEODiNAMiCA

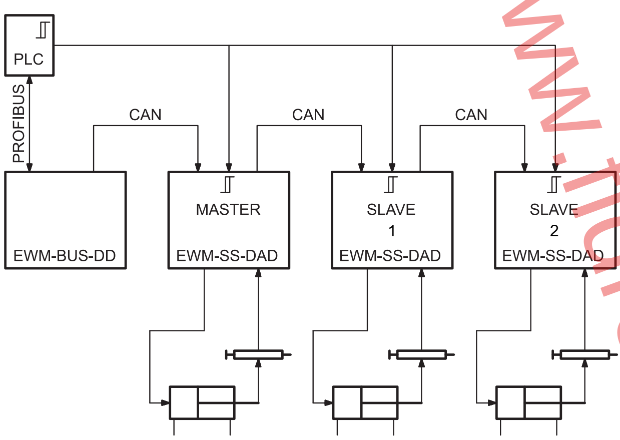
EWM-SS-DAD

AXIS SYNCHRONIZATION CONTROL FOR SYSTEMS FROM 2 TO 9 AXES WITH PROFIBUS/CAN COMMUNICATION INTERFACE

SERIES 11

RAIL MOUNTING TYPE: DIN EN 50022

OPERATING PRINCIPLE



— This system for the axis synchronization control consists of an interface PLC Profibus DP and axis control cards with interconnection via CanBus. The control consists of a bus adapter EWM-BUS-DAD per the system and one EWM-SS-DAD module for each axis to be controlled, to be ordered separately.

— The EWM-SS-DAD synchronizes the axes through a position sensor, digital SSI type (a high accuracy) or analogue type.

— The synchronization controller correct the speed of the slave axis. Positioning failures during the movement will increase or reduce the slave axis velocity, so the synchronization failure will be compensated.

— The cards are, programmable only via software, with EWMPC software kit, and a laptop.

TECHNICAL CHARACTERISTICS

Power supply	V DC	24 ÷ 30 ripple included - external fuse 1,0 A
Current consumption	mA	< 350 + sensor power consumption
Command value		via Profibus DP - ID number 1810h
Speed input value		via Profibus DP - ID number 1810h
Feedback value	SSI V mA	digital sensor with SSI interface 0 ÷ 10 (R_I = 25 kΩ) 4 ÷ 20 (R_I = 250 Ω)
Output value - E0 version - E1 version	V mA	±10 differential (max load 5 mA) 4 ÷ 20 (max load 390 Ω)
Position accuracy		± 2 bits of digital sensor resolution
Interface		RS 232 C
Electromagnetic compatibility (EMC): according to 2004/108/CE standards		Emissions EN 61000-6-3:2005 Immunity EN 61000-6-2:2002
Housing material		thermoplastic polyamide PA6.6 combustibility class V0 (UL94)
Housing dimensions - EWM-SS-DAD - EWM-BUS-DD	mm	114 x 99(h) x 46(w) 120 x 99(h) x 23(w)
Connectors		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

1 - IDENTIFICATION CODES

1.1 - Profibus / CAN coupler code

E	W	M	-	BUS	-	DD	/	10

EWM: Digital card for closed loop systems DIN EN 50022 rail mounting

BUS: Profibus / CAN coupler

DD: Digital command and output value

10: Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

NOTE: The Bus handles the communication of the whole system. Just one coupler per system is needed.

1.2 - Code of the axis drive card

E	W	M	-	SS	-	D	AD	/	11	

EWM: Digital card for closed loop systems DIN EN 50022 rail mounting

SS: Synchro stroke control

D: Digital command value

AD: Analog and digital feedback values

11: Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

Output value:
E0 = voltage ±10 V (**standard**)
E1 = current 4 ÷ 20 mA

NOTE: One card per axis is needed.

This electronic module is developed for controlling of hydraulic drives in synchronization. The communication with the PLC is solved by a standard Profibus DP interface.

This system can synchronize up to 9 axes.

A typical repeatable positioning accuracy of > 0,01% with analogue sensors or up to 0,001 mm with digital SSI sensors can be achieved. Proportional valves with integrated electronics (typically with control valves) can be driven by the analogue differential output.

Internal profile generation (acceleration time, max. velocity and stroke depended deceleration) provides fast and excellent positioning. The drive works in open loop mode and is switched over in closed loop during deceleration. This is a time-optimal positioning structure with very high stability.

Even the Numeric Control mode can be used, for a speed controlled internal profile generation (VMODE = ON).

The synchronization control works as a second overriding velocity/position controller. Failure between the axes will be compensated by adjusting the speed of the slave axis.

The card sample time is 2 ms, up to 5 ms with 9 axes to drive.

2 - EWM-SS-DAD FUNCTIONAL SPECIFICATIONS

2.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the existing EMC standards.

All inductivity at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

2.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

2.3 - Digital Input (ENABLE)

The digital input must have a voltage from 12 to 24 V with current 50 mA; Low level: <2V, high level >10V.

Keep to the block diagram at paragraph 7 for the electric connections. Apply to PIN 8 the 24V to enable hardware.

2.4 - Reference signal

The reference signal is run through the card-bus and addressed to the individual modules via Profibus, ID number 1810h (see par. 7 / 8).

2.5 - Input feedback values

The card works both with digital (SSI) or analog (ANA) sensors.

SSI: parameters are settable via software (see SSI parameters in the table on next page).

ANA: The analogue signal must be voltage 0 ÷ 10V with RI = 25 kΩ or current 4 ÷ 20 mA, with RI = 250 Ω
The analogue resolution is of 0,01% of the sensor stroke.

⚠ Using analog sensors, the SSI parameters in the software assume default preset values that the user must not change.

2.6 - Output values

E0 version: output voltage 0 ±10 V (max load 5 mA).
E1 version: output current 4 ÷ 20 mA. (max load 390 Ω)

2.7 - Digital Output

Two digital output are available, INPOS and READY, that are displayed via LEDs on the front panel.

Low level <4V; High level >10V (I_{max} 50 mA with load of 250 Ω)

3 - LED FUNCTIONS

There are two leds on the EWM-SS-DAD card:

GREEN: Shows if the card is ready.

ON - The card is supplied and ENABLE, hardware, software ON
OFF - No power supply or the ENABLE HW/SW is inactive
FLASHING - Error detected (internal or 4 ÷ 20 mA).
Only if the parameter SENS is ON

YELLOW: Status signal. Axes position.

ON - Axis within position.
OFF - Axis outside position.

4 - ADJUSTMENTS

On the EWM cards the adjustment setting is possible only via software. Connecting the card to the PC, the software automatically recognises the card model and shows a table with all the available commands, with their parameters, the default setting, the measuring unit and an explanation of the commands and its uses.

The parameters changes depending on the hardware and mechanic configuration. The hardware setting must be the same for all the axis. The use of symmetrical structures it is strongly recommended.

PARAMETERS TABLE

Commands	Parameter	Defaults	Units	Description
inpx	X= SSI|ANA	SSI	-	Selection of the sensor input channel. The standard is a digital sensor with SSI specification at the corresponding connections (clamps 25 to 28 and 31, 32). Alternatively an analogue input which is indicated in the command as parameters “ANA” can be used. The command AIN is used for input scaling of the analogue input.
ain:i a b c x	i= XL a= -10000… 10000 b= -10000… 10000 c= -10000… 10000 x= V|C	 : 1000 : 1000 : 0 : V	 - - 0,01% -	Analogue input scaling for **XL** (actual value) analog input signal. **V** = voltage input and **C** = current input. With the parameters **a**, **b** and **c** the input can be scaled (output = a / b * (input - c)). Because of the programming of the **x**-value (x = **C**) the corresponding input will be switched over to current automatically. (see **NOTE**)
num	X= 0… 24	2	-	Number of axes connected to the Profibus (see **NOTE** at paragraph 9.1.1)
stroke x	X= 2… 5000	200	mm	Full stroke of the sensor (100% of input signal). The stroke of the sensor is needed for the scaling of the analogue input and for the calculation of the braking stroke.
ssioffset x	X= -30000… 30000	0	0,01 mm	Zero point adjustment of the sensor.
ssires x	X= 10… 1000	1000	µm (micron)	Definition of the sensor resolution. The highest resolution (1000) corresponds to 1 µm (0,001 mm). This sensor resolution is always used for the input data via Profibus and is needed for the internal calculations. (see **NOTE**)
ssibits x	X= 8… 32	24	-	Data protocol length in bits
ssicode x	X= GRAY|BIN	GRAY	-	Transmitting code of the sensor.
ssipol x	X= +|-	+	-	Sensor polarity. In order to reverse the working direction of the sensor, the polarity can be changed via this command. In any case also the SSIOFFSET has to be adjusted. Ex: Sensor length = 200 mm opposite working direction. SSIPOL is set on “-“ and SSIOFFSET on 20000.
a:i x	i= A|B x= 1… 2000	:A 200 :B 200	ms ms	Acceleration time depending on direction. The ramp time is separately set for driving out (**A**) and for driving in (**B**). Normally **A** = flow P-A, B-T and **B** = flow P-B, A-T.
d:i x	i= A|B|S X= 50… 10000	:A 2500 :B 2500 :S 1000	0,01% 0,01% 0,01%	Deceleration stroke depending on direction. This parameter is set in 0,01% units of the maximum length of the sensor. The braking distance is set dependent from the direction. The controller gain will be calculated by means of the braking distance. The shorter the braking distance the higher the gain (see command CTRL). In case of instabilities a longer braking distance should be set. The parameter **D** indicates the ratio between the maximum sensor length and and a indicated stopping point;will become active after the removal of the ‘START’ signal only .
ctrl x	x= lin|sqrt1 |sqrt2	sqrt1	-	Deceleration curve (see **NOTE**): **lin** = linear curve **sqrt1** = optimized curve **sqrt2** = curve optimized for high gain in positioning
syncmode x	X= MS|AV	MS		Synchronization mode. **MS** - Master/Slave:all axes follow the master axis (MASTER = 1) **AV** - Averages calculation: the command position will be calculated by the averages of all axes.
glp x **t1 x**	X= -10000… 10000 X= 0… 100	500 10	0,01 ms	Parameters for optimization of the synchronisation controller. (see **NOTE**) The SYNC-controller works as a PT1 compensator for optimized controlling of hydraulic drives. Critical drives can be stabilized with the T1 factor.
vramp x	x= 10… 2000	200	ms	Ramp time for the command speed.

vmode x	x= on|off	off	-	Switching over the control mode. **OFF**: stroke depended deceleration mode (SDD); It's the default mode. The drive comes to a controlled stop at the target position, then switches to control mode and moves accurately to the desired position. The speed varies with the fluctuating pressure as the system runs under open-loop control. **ON:** numeric control (NC). A position profile is generated internally. The system always works under control and uses the following error to follow the position profile. For a properly operating it is necessary not to run at 100 % speed, as otherwise the errors cannot be corrected. 80 % of the maximum speed is typical The stroke time is defined by the parameter VEL.
vel x	X= 1… 20000	50	mm/s	Internal maximum velocity preset when VMODE = ON (numeric control mode).
inpos mode x	X= EPC|TRC	TRC	-	Choosing signal for "inpos" message (LED) in NC mode (VMODE = ON only) On master modules yellow led are activated by the INPOS signal. EPC = positioning error in endposition TRC = monitor the tracing error generated by the positioning profile.
min:i x	i= A|B x= 0… 5000	:A 0 :B 0	0,01% 0,01%	Deadband compensation for positive overlapped proportional valves. Good adjustment will increase positioning accuracy
max:i x	i= A|B X= 5000… 10000	:A 10000 :B 10000	0,01% 0,01%	Limitation / Gain. Maximum output signal. Adapt the control range to maximum flow range.
trigger x	X= 0… 2000	200	0,01%	Response threshold for the MIN parameter. Also useful for reduced sensitivity in position with positive overlapped proportional valves. (see **NOTE**)
inpos x **glerror x**	X= 0… 5000 x= 0… 5000	32 32	0,01mm 0,01mm	Defined windows for creating status signals. INPOS = Definition of the range (window) of the related signal in which the INPOS message will be generated. The positioning process will not be influenced by it. The controller remains active. GLERROR = defines the range of the allowed synchronization error for generating this message. In slave modules this signal is given to the status outputs (PIN 2 and corresponding LED) Working in NC mode GLERROR defines the window synchronization error; INPOS the tracking error.
offset x	x= -2000… 2000	0	0,01%	Zero point adjustment. The corresponding OFFSET will be added to the control error (demand value - actual value + offset). With this parameter the zero point failure can be compensated.
pol x	x= +|-	+	-	Output polarity. All **A** and **B** adjustments depend on the output polarity. The right polarity should be defined first.
sens x	x= on|off	on	-	The sensor monitoring can be activated.
save	-	-	-	Storing the programmed parameter in E²PROM.
loadback	-	-	-	Reloading the parameter from E²PROM in working RAM
help	-	-	-	Listing of all available commands.
copy	-	-	-	Transfer of the parameters into all other modules at the node CAN. The parameters are stored in the EEPROM.
st	-	-	-	Status of the profibus communication, actual sent/received values.
wl **xl** **xw** **kx** **kxw** **v** **u** **x:i**	Command position Actual position Position error Master position Synchro error Speed limitation Control signal Axis position via index	-	mm mm mm mm mm % % mm	The process data can be read out via software. They show the actual and command values
default	-	-	-	Preset values will be set.

NOTE about the AIN command: This command is for analogue sensors only.

With this command each input can be scaled individually. For the scaling function the following linear equation is taken: output signal = *a / b * (input signal - c)*.

At first the offset (c) will be subtracted from the input signal, then the signal will be multiplied with factor **a** / **b**. **a** and **b** should always be positive. With these both factors every floating-point value can be simulated (for example: 1.345 = 1345 / 1000).

With the x parameter value the internal measuring resistance for the current measuring (4… 20 mA) will be activated (V for voltages input and C for current input). ATTENTION: This resistor is never activated at the k input.

	AIN:X	a	b	c	x
i with voltage:	AIN:i	1000	1000	0	V
i with current:	AIN:i	2000	1600	2000	C

NOTE about the SSIRES command: the standard of measurement is defined as increment/mm (inkr/mm). The maximum available resolution is equal to 1 µm that corresponds to a value 1000.

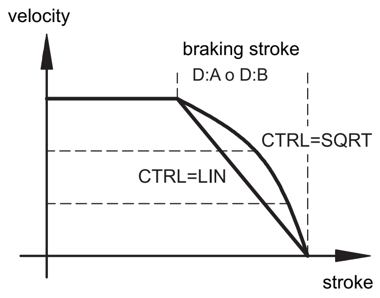
Example: A sensor with resolution 5µm has a resolution (0.005 mm) 5 times lower than the maximum set.
The SSIRES value is calculated as follows: *1000* (full scale ink) */ n* (sensor resolution in µm) = *1000 / 5 = 200*
with a 2µm sensor resolution the value will be = *1000 / 2 = 500* :

NOTE about the CTRL command: This command controls the braking characteristic of the hydraulic axis. With positive overlapped proportional valves one of both SQRT braking characteristics should be used because of the linearization of the non-linear flow curve typical of these valves If zero overlapped proportional valves (control valves) are used, you can choose between LIN and SQRT1 according to the application. The progressive gain characteristic of SQRT1 has the better positioning accuracy.

According to the application there is maybe a longer braking distance, so that the total stroke time will be longer.

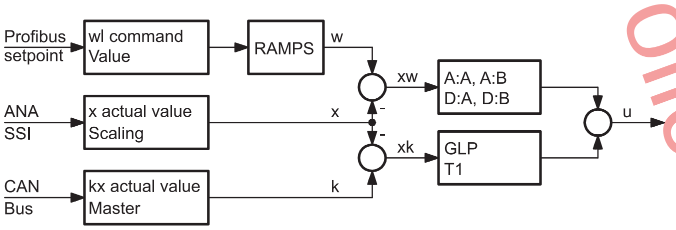
LIN: Linear braking characteristics (control gain corresponds to: 10000 / d:i).

SQRT*: Root function for the calculation for the braking curve.
SQRT1: with small control error. control gain corresponds to 30000 / d:i ;
SQRT2: control gain corresponds to 50000 / d:i



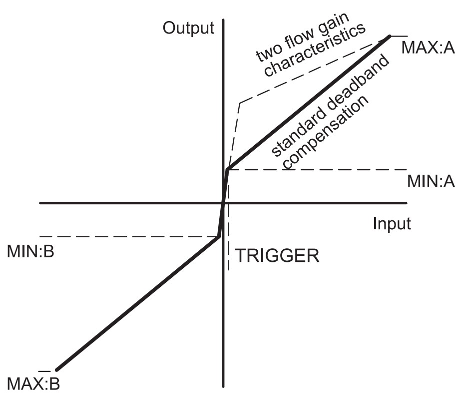
NOTE about the GLP and T1 command: Both controllers (sync and positioning) are working parallel. The higher the sync-gain the lower must be the gain of the positioning controller. A time constant value (T1) can be used to damp the sync-controller for better stability.

Simplified control structure:



NOTE about the TRIGGER command: With this command, the output signal is adjusted to the valve characteristics. The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stabile positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out at the power amplifier or at the positioning module. If the MIN value is set too high, it influences the minimal velocity, which cannot be adjusted any longer. In extreme case this causes to an oscillating around the closed loop controlled position.



5 - INSTALLATION

The card is designed for rail mounting type DIN EN 50022.

The wiring connections are on the terminal strip located on the bottom of the electronic control unit. It is recommended to use cable sections of 0.75 mm^2, up to 20 m length and of 1.00 mm^2 up to 40m length, for power supply and solenoid connections. For other connections it is recommended to use cables with a screened sheath connected to earth only on the card side.

NOTE: To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram. As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

In environments that are critical for the electromagnetic interference, a complete protection of the connection wires can be requested.

A typical screened Profibus plug (D-Sub 9pol with switchable termination) is mandatory. Also the Profibus cable must be screened.

Every Profibus segment must be provided with an active bus termination at the beginning and at the end. The termination is already integrated in all common Profibus plugs and can be activated by a DIL switch.

5.1 - EWM-BUS-DD settings and installation

The module supports all baud rates from 9,6 kbit/s up to 12000 kbit/s with auto detection of the baud rate. The functionality is defined in IEC 61158. The Profibus address can be programmed by a terminal program, EWMPC/10 or online via the Profibus (default address 3). A display shows the status of the commu-nication between the nodes.

The CAN-side installation of the EWM-BUS-DD is easy and only few steps are necessary.

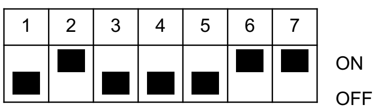
Wire the CAN Bus of the coupler with the CAN Bus line of the EWM-SS-DAD cards, as shown below:

EWM-BUS-DD	EWM-SS-DAD
pin 1	pin 23
pin 3	pin 21
pin 4	pin 22

Connect the power supply: pin 5 and pin 6 = 24 V
pin 7 and pin 8 = 0 V

The reference values are preset over the digital Profibus / CAN-Bus that worked with full internal resolution. The position resolution corresponds to the sensor resolution.

The module EWM-BUS-DD is preconfigured for proper communication with the cards EWM-SS-DAD. The address of the node Canbus (2) and the transmission speed rate (1MBd) must comply with the following configuration:



The DIL switch is inside the module and it gives the possibility to set address and data transmission speed.

The tables below show the meaning of DIL Switches:

DIL-SWITCH						
1	**2**	3	4	5	6	7
CANBUS ADDRESS NODE					**TRANSMISSION SPEED**	

TRANSMISSION SPEED	DIL-SWITCH	
	6	**7**
125 Kbaud	OFF	OFF
250 Kbaud	ON	OFF
500 Kbaud	OFF	ON
1 Mbaud	**ON**	**ON**

5.1.1 - Display

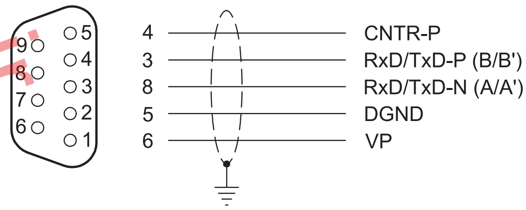
The EWM-BUS-DD has a display that shows the module status:

- everything OK, Profibus and CAN Bus in data exchange
1 Error, CAN Bus no data exchange
2 Error, Profibus no communication
3 Error, Profibus no communication, CAN Bus no data exchange
4 Error, Profibus OK, not connected CAN Bus
5 Error, Profibus no communication, not connected CAN Bus
6 Error, hardware fault

5.1.2- ProfiBUS socket

A shielded typical Profibus connector (9-poles) with internal terminal resistors to be set properly, must be used. The pre addressing of the module can be changed only by Profibus (DEFAULT is 3). The cable is not included.

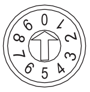
PROFIBUS SOCKET WIRING AND LINKING CONFIGURATION



pin	Signal name	Function
1-2-7-9	not used	-
3	RxD/TxD-P (B-Line)	Receive/Send P data
4	CNTR-P/RTS	Request to Send
5	DGND	Data ground
6	VP	+5 V DC for external bus termination
8	RxD/TxD-N (A-Line)	Receive/Send N data

5.2 - EWM-SS-DAD - CAN interface

The CAN interface is wired on all modules in parallel. The terminating resistors have to be activated in the EWM-SS-DAD at the first and last module. Termination is enabled by a bridge between pin 22 and pin 24.



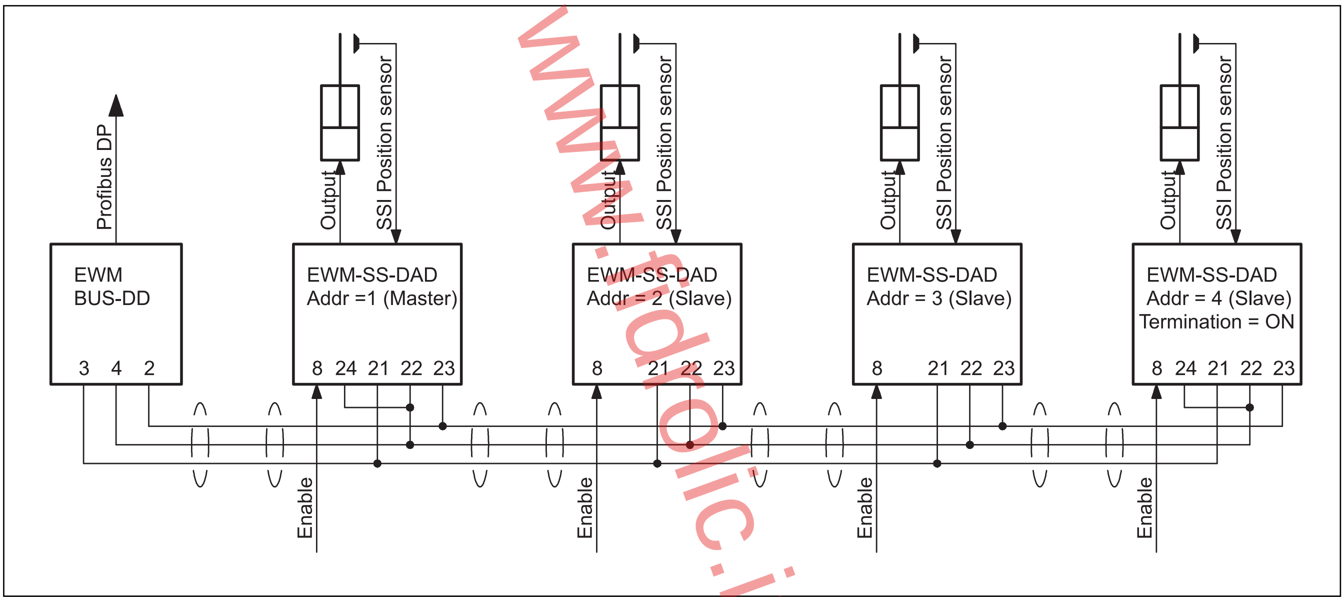
Start the addressing of the EWM-SS-DAD from the number 1, that set the card as MASTER, using the rotary switch on the front panel of the card (use a screwdriver or a small knob of appropriate size).

The MASTER module drives the main axis and takes over the communication with the interface converter EWM-BUS-DD.

The other addresses (2 to 9) set the card as SLAVE.

Upon delivery, the switch is set to zero (no address); you must configure the addressing on each card in the series, depending on the number of axes to be synchronized (see example below).

5.3 - Wiring for 4-axes synchronization



6 - SOFTWARE

6.1 - KIT EWMPC/10 (code 3898401001)

The software kit comprising a USB cable (2 m length) to connect the card to a PC or notebook and the software.

Verify the software version. For correct operating version 3.3 or higher is needed. Lastest version is downloadable from our website.

During the identification all information are read out of the module and the table input will be automatically generated.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

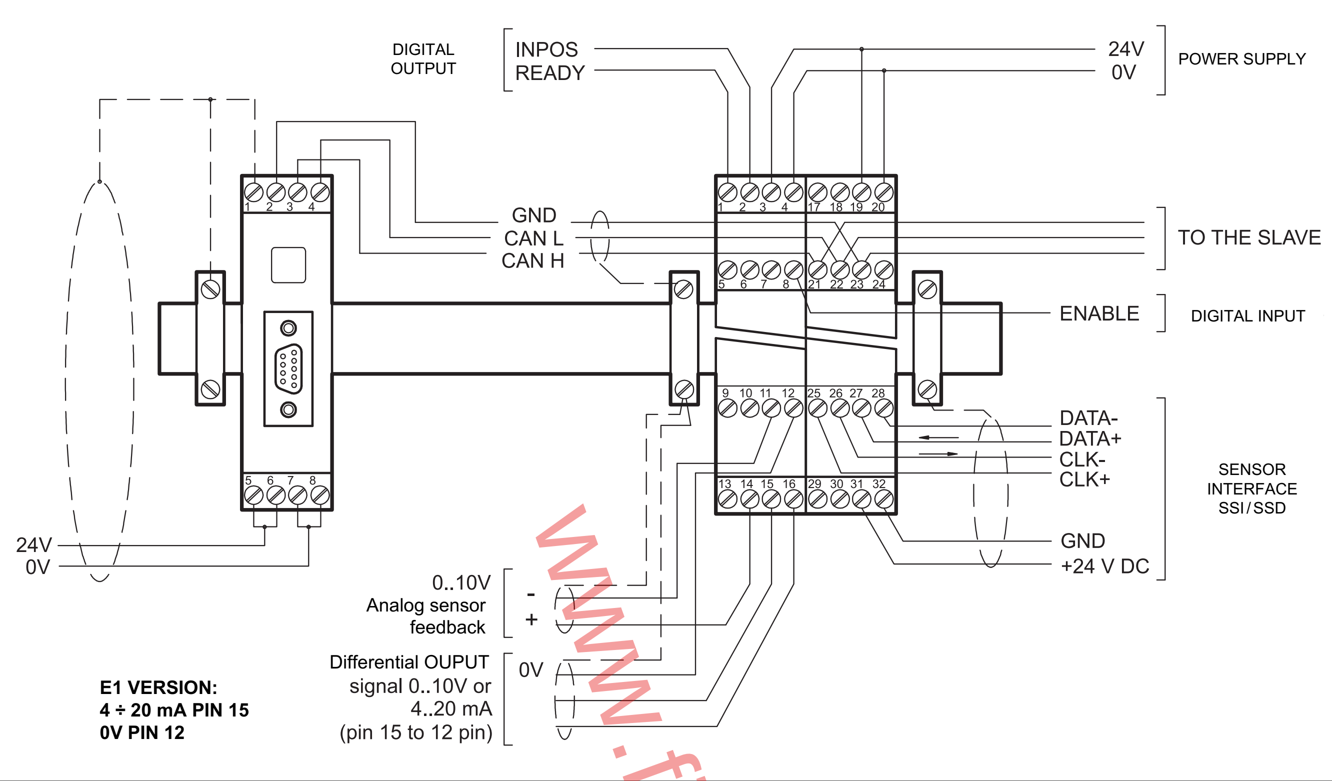
The software is compliant with Microsoft XP® operating systems.

6.2 - .GSD file for ProfiBus module

The file is downloadable from our website .

www.duplomatic.com , download section.

7 - WIRING DIAGRAM FOR EWM-SS-DAD*E0 AND EWM-BUS-DD



DIGITAL INPUT AND OUTPUT

PIN 1 — READY output:
General operationally, ENABLE is active and there is no sensor error (by use of 4 ÷ 20 mA sensors). This output corresponds with the green LED.

PIN 2 — STATUS output:
STATUS is active when the axis is within the INPOS window of positioning or synchronisation.

PIN 8 — ENABLE input:
This digital input signal initializes the application.
The analogue output is active and the READY signal indicates that all components are working correctly.
Target position is set to actual position and the drive is closed loop controlled.

ANALOGUE SIGNALS

PIN 14 — Analogue feedback value (X),
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

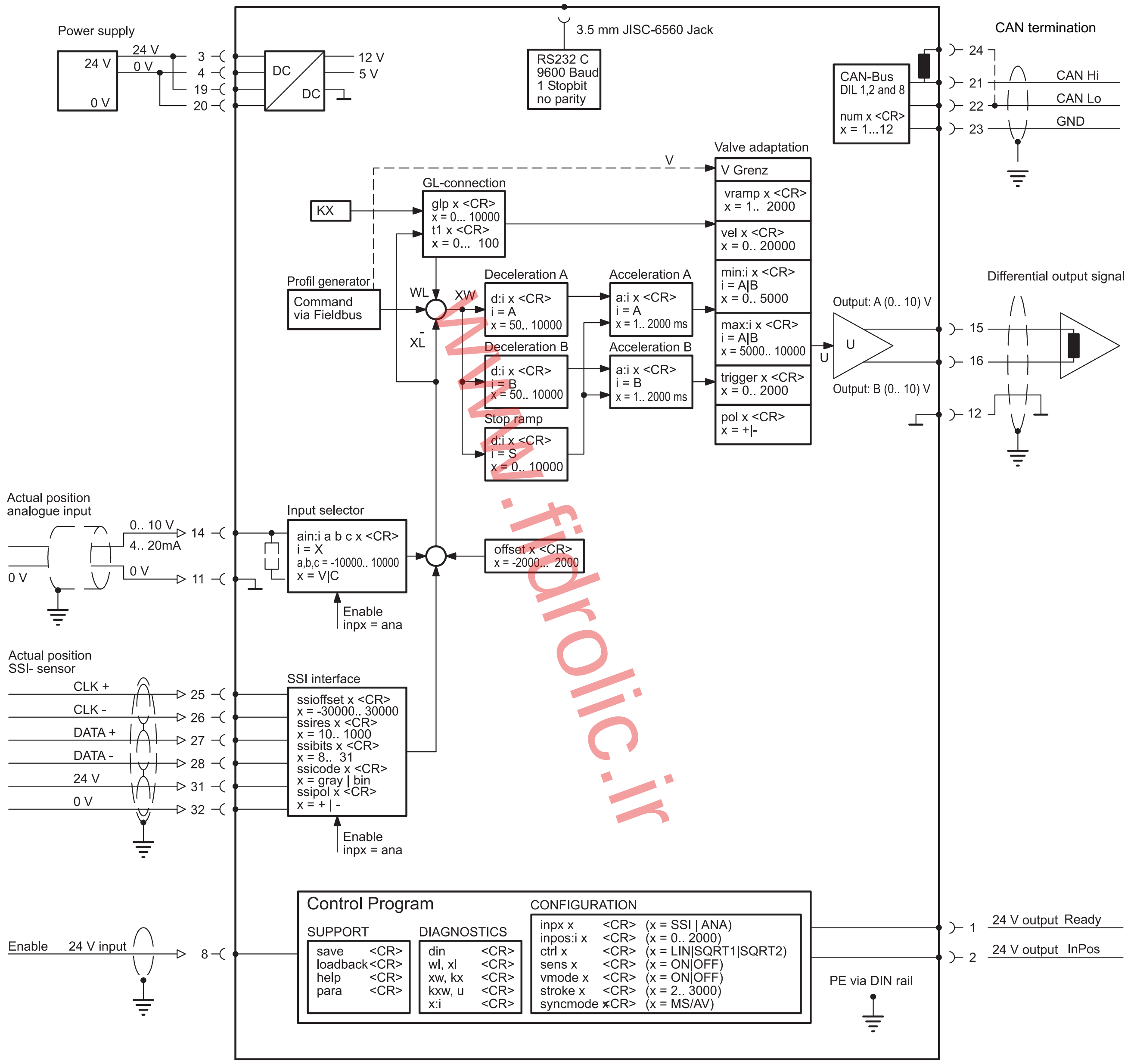
PIN 15/16 — Differential output (U)
±100% corresponds to ± 10V differential voltage,
optionally (E1 version) current output ±100% corresponds to 4 ÷ 20 mA (PIN 15 to PIN 12)

LOCAL CAN-BUS

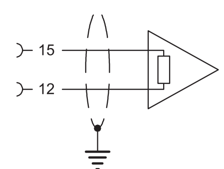
PIN 21..23 — CAN LO, CAN HI, and GND

PIN 24 — Termination of the CAN-Bus
a bridge to pin 22 at 1st (master) and last module is necessary.

8 - EWM-SS-DAD - CARD BLOCK DIAGRAM E0 version



OUTPUT SIGNAL - E1 VERSION



9 - PROFIBUS COMMUNICATION

The Profibus board controls the modules by sending 8 bytes of data, which contain information on two control words, the command position (position setpoint) and speed control (speed setpoint). The EWM-SS-DAD cards send back to the bus-card two status words, the nominal current position and current actual position, for a total of 24 bytes of data.

Using ST command in EWMPC, those data can be read out. and they appearing in this way:

	(high byte / low byte)
control word :	1110 1000 / 0000 0000
control word 2 :	0010 0000 / 0010 0000
status word :	1101 0000 / 1101 0000
status word 2 :	0010 0000 / 0010 0000

position setpoint: 22400 (command position in HEX via Profibus)
speed setpoint: lfff (command speed in HEX via Profibus)

Enable: enabled (module = enabled (Profibus & Hardware-enable))

9.1 - Data sent to the axes

The EWM-BUS-DD card is set as follows:
(Hi = High byte; Lo = low byte)

Byte	Function	Comment
0	control word Hi	unsigned int
1	control word Lo	
2	command position Hi	unsigned long
3	command position..	
4	command position ..	
5	command position Lo	
6	velocity Hi	unsigned int
7	velocity Lo	
8	control word 2 Hi	unsigned int
9	control word 2 Lo	
10 - 23	reserved	no function

9.1.1 - Axes control

Only the first four axes may be activated individually, the further axes must be enabled in groups of four axes at a time, by the x SEL indicator, according to the following:

Address	Controlled axes					
SEL	**1 to 4**	**5 to 8**	**9 to 12**	13 to 16	17 to 20	21 to 24
2	0	0	0	0	1	1
1	0	0	1	1	0	0
0	0	1	0	1	0	1

NOTE: The module EWM-BUS is a module used also in other synchronization systems that manage a greater number of axes.

The system with EWM-SS-DAD cards described in this documentation allows to manage max 9 axes.

9.1.2 - Control words

The control words contain the following informations:

ENABLE: Must be activated in addition to the hardware signal.

START: In case of increasing edge the current command position is taken over, in case of deactivated START the system about a brake ramp is stopped.

GL-ACTIVE: Over this bit the overlapped synchronism controller is activated.

SEL x: Groups of each four modules with the information about status and positions can be read - by the control of the three select-bits -back.

Byte 0 - control word Hi		
bit	**Function**	
0	Axis START 4	start 1 = active
1	Axis START 3	start 1 = active
2	Axis START 2	start 1 = active
3	Axis START 1	start 1 = active
4	SEL 2	selection 1 = active
5	SEL 1	selection 1 = active
6	SEL 0	selection 1 = active
7	Enable (with which enable hardware links)	operation 1 = active

Byte 1 - control word Lo		
bit	**Function**	
0	GL- Active ext 2 (axis 9 to 12)	1 = GL active (group 2)
1	GL- Active ext 1 (axis 5 to 8)	1 = GL active (group 1)
2	START ext 2 (axis 9 to 12)	1 = start (group 2)
3	START ext 1 (axis 5 to 8)	1 = start (group 1)
4	GL- Active axis 4	synch 1 = active
5	GL- Active axis 3	synch 1 = active
6	GL- Active axis 2	synch 1 = active
7	GL- Active axis 1	synch 1 = active

Byte 8 - control word 2 Hi		
bit	**Function**	
0	Reserved	
1	Reserved	
2	Reserved	
3	START ext 5 (start of axis 13 to 16)	1 = start (group 5)
4	START ext 4 (start of axis 17 to 20)	1 = start (group 4)
5	START ext 3 (start of axis 13 to 16)	1 = start (group 3)
6	Reserved	
7	Reserved	

Byte 9 - control word 2 Lo		
bit	**Function**	
0	Reserved	
1	Reserved	
2	Reserved	
3	GL- Active ext 5 (axis 21 to 24)	1 = GL active (group 5)
4	GL- Active ext 4 (axis 17 to 20)	1 = GL active (group 4)
5	GL- Active ext 3 (axis 13 to 16)	1 = GL active (group 3)
6	Reserved	
7	Reserved	

9.1.3 - Position setpoint description

Command position: according to the sensor resolution.

Byte 2 to 5 - command position		
bit	**Function** defined by the sensor resolution	
from 0 to 7	Command position Lo byte	Byte 5
from 8 to 15	Command position	Byte 4
from 16 to 23	Command position	Byte 3
from 24 to 31	Command position Hi byte	Byte 2

Example of calculation of position control for SSI sensor resolution = 5 μm and 100% stroke = 300 mm.

Position setpoint = 150 mm (= 50% stroke)

STROKE • SSIRES = 100% stroke (dec)

300 • 200 = 60.000 (dec) → EA60 (hex)
50% di 60.000 = 30.000 (dec) → 7530 (hex)

Example of calculation of position control for ANA sensor with 100% stroke = 300 mm. With analog sensors SSIRES value is preset and unchangeable.

Position setpoint = 150 mm (= 50% stroke)

STROKE • SSIRES = 100% stroke (dec)

300 • 1000 = 300.000 (dec) → 493E0 (hex)
50% di 300.000 = 150.000 (dec) → 249F0 (hex)

Position setpoint to be sent
with decimal value 150,000 :
hex **00 02 49 F0**

Byte 2 Byte 3 Byte 4 Byte 5

9.1.4 - Speed setpoint description

Command velocity: 0x3fff corresponds to 100 %.

Byte 6 and 7 - command velocity		
bit	**Function** max value 0x3FFF	
from 0 to 7	velocity Lo byte	Byte 7
from 8 to 15	velocity Hi byte	Byte 6

9.2 - Updating data

The EWM-SS-DAD cards send back to the bus-card two status words, the received setpoint command and the current actual position, totally of 24 bytes of data.

Byte	Function	Comment
0	status word Hi	unsigned int
1	status word Lo	
2	control position* Hi	unsigned long
3	control position*	
4	control position*	
5	control position* Lo	
6	status word 2 Hi	unsigned int
7	status word 2 Lo	
8	actual pos. axes 1,5,9,13,17,21 Hi	unsigned long
9	actual pos. axes 1,5,9,13,17,21	
10	actual pos. axes 1,5,9,13,17,21	
11	actual pos. axes 1,5,9,13,17,21 Lo	
12	actual pos. axes 2,6,10,14,18,22 Hi	unsigned long
13	actual pos. axes 2,6,10,14,18,22	
14	actual pos. axes 2,6,10,14,18,22	
15	actual pos. axes 2,6,10,14,18,22 Lo	
16	actual pos. axes 3,7,11,15,19,23 Hi	unsigned long
17	actual pos. axes 3,7,11,15,19,23	
18	actual pos. axes 3,7,11,15,19,23	
19	actual pos. axes 3,7,11,15,19,23 Lo	
20	actual pos. axes 4,8,12,16,20,24 Hi	unsigned long
21	actual pos. axes 4,8,12,16,20,24	
22	actual pos. axes 4,8,12,16,20,24	
23	actual pos. axes 4,8,12,16,20,24 Lo	

(*) If the average-value control is active (SYNCMODE = AV) the acknowledged value is the calculated position; If the MASTER / SLAVE (SYNCMODE = MS) is active the acknowledged value will be the command position.

Current command position: is interpreted according to mode differently.
Standard mode : target command position
NC-mode : (VMODE = ON) calculated command position of the generator.

Actual position: according to the sensor resolution.

Example: reading the value of stroke 299251:
hex **00 04 90 F3**

Byte 9 Byte 10 Byte 11 Byte 12

9.2.1 - Status word descriptions

READY: System is ready.
INPOS: Depending on the mode set, can transmit a position or, in NC mode, the following error control information.
GL-ERROR: The synchronism error is indicated over this bit by the parameter GLERROR dependently.
SENSOR ERROR: When the sensor monitoring is activated, the READY signal is deactivated with a sensor error.
COMERROR: Communication error on the CAN Bus. This message will be sent only from the module No. 1. if general communication problems are found or if a module is faulty

Always the hardware enable signal has to be deactivated at a sensor error (READY Signal) or when a COM error appear.

Byte 0 - status word Hi		
bit	Function	
0	INPOS axis 4	1= in position
1	INPOS axis 3	1= in position
2	INPOS axis 2	1= in position
3	INPOS axis 1	1= in position
4	READY axis 4	1= ready
5	READY axis 3	1= ready
6	READY axis 2	1= ready
7	READY axis 1	1= ready

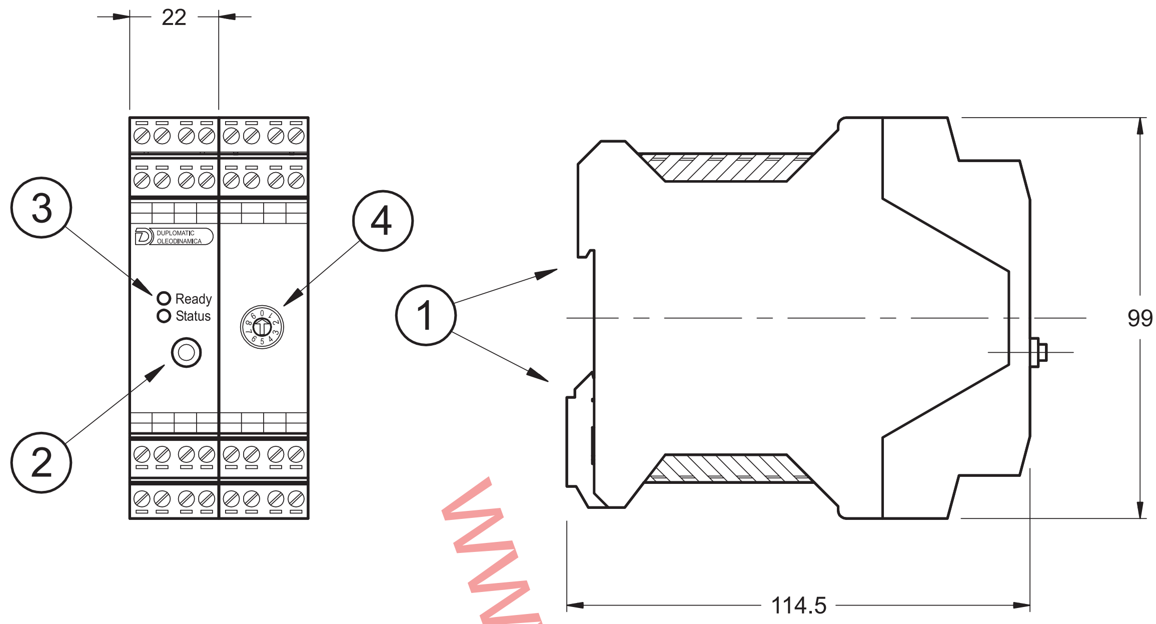
Byte 1 - status word Lo		
bit	Function	
0	COMerror	1 = no error
1	reserved	
2	reserved	
3	reserved	
4	axis GL-Error 4	1 = no error
5	axis GL-Error 3	1 = no error
6	axis GL-Error 2	1 = no error
7	axis GL-Error 1	1 = no error

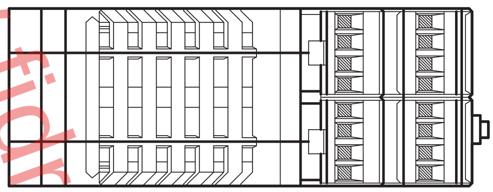
Byte 6 - status word 2 Hi		
bit	Function	
0	INPOS axis 4, 8, 12, 16, 20, 24	1= no error Corresponding signal indicator through selection bits Sel_0 to Sel_2 in the control word Hi
1	INPOS axis 3, 7, 11, 15, 19, 23	
2	INPOS axis 2, 6, 10, 14, 18, 22	
3	INPOS axis 1, 5, 9, 13, 17, 21	
4	READY axis 4, 8, 12, 16, 20, 24	1= Ready Corresponding signal indicator through selection bits Sel_0 to Sel_2 in the control word Hi
5	READY axis 3, 7, 11, 15, 19, 23	
6	READY axis 2, 6, 10, 14, 18, 22	
7	READY axis 1, 5, 9, 13, 17, 21	

Byte 7 - status word 2 Lo		
bit	Function	
0	reserved	
1	reserved	
2	reserved	
3	reserved	
4	GL-Error axis 4, 8, 12, 16, 20, 24	1= no error Corresponding signal indicator through selection bits Sel_0 to Sel_2 in the control word Hi
5	GL-Error axis 3, 7, 11, 15, 19, 23	
6	GL-Error axis 2, 6, 10, 14, 18, 22	
7	GL-Error axis 1, 5, 9, 13, 17, 21	

The status word 2 concerns the messages in the EXTENDED mode.

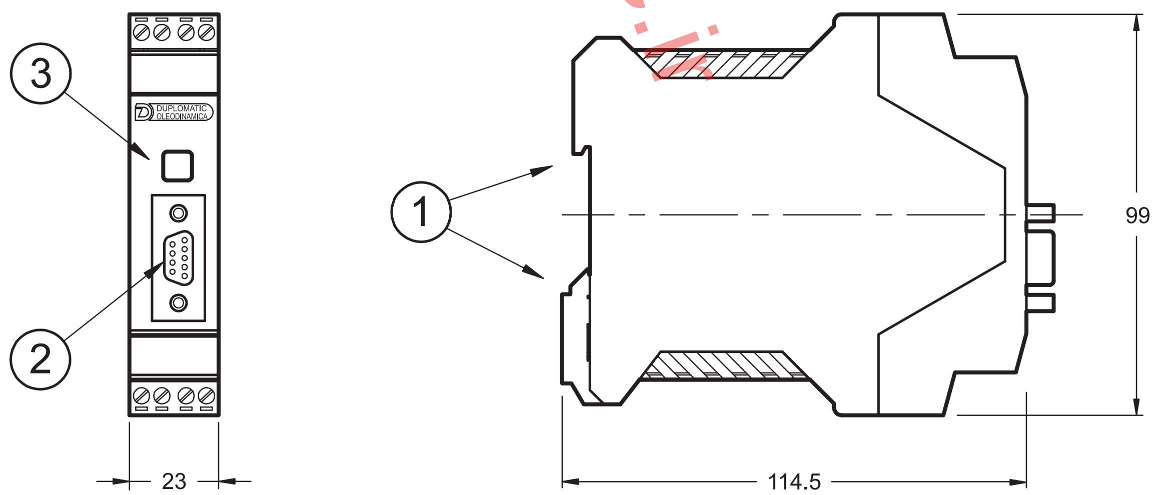
10 - OVERALL AND MOUNTING DIMENSIONS OF EWM-SS-DAD





1	DIN EN 50022 rail type fastening
2	Plug for PC cable connection
3	LED for output signals
4	Rotative switch for pre - addressing

11 - OVERALL AND MOUNTING DIMENSIONS OF EWM-BUS-DD



1	DIN EN 50022 rail type fastening
2	Profibus interface port
3	Display

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DUPLOMATIC OLEODINAMICA

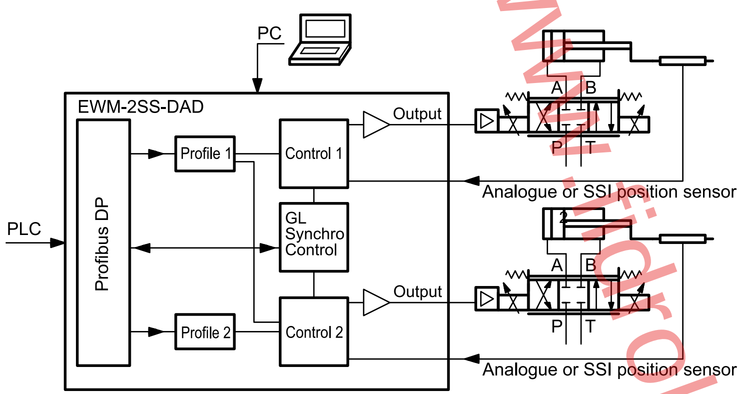
EWM-2SS-DAD

CARD FOR 2 AXES POSITIONING AND SYNCHRONIZATION IN CLOSED LOOP CONTROL. EMBEDDED PROFIBUS INTERFACE

SERIES 20

RAIL MOUNTING TYPE: DIN EN 50022

OPERATING PRINCIPLE



— The EWM-2SS-DAD card is designed for controlling the stroke position of 2 axes

— Additionally, the synchronized control of the axes is available

— Both SSI or analogue sensor input are available

— The module communicates with the PLC via the embedded Profibus interface

— Card configuration is made via software, via USB

TECHNICAL CHARACTERISTICS

Power supply	V DC	24 (±10%)
Fuse, external	A	1A medium time lag
Current consumption	mA	< 500
Command position value		via Profibus DP
Profibus DP data rate	kbit/s	9.6, 19.2, 93.75, 187.5, 500, 1500, 3000, 6000, 12000 - ID number 1810h
Max position accuracy	µm	1
Feedback values	SSI V mA	digital sensor with any interface SSI - 150 kbit/s 4 ÷ 20 (RI = 250 Ω) 0 ÷ 10 (RI = 33 kΩ)
Output value - voltage - current	V mA	±10 differential (max load 5 mA) 4 ÷ 20 (max load 390 Ω)
Resolution of output value	%	0.024
Interface		USB B type 2.0 , Profibus
Electromagnetic compatibility (EMC):		Immunity EN 61000-6-2: 8/2002 - Emissions EN 61000-6-4: 6/2005
Housing material		thermoplastic polyamide PA6.6 combustibility class V0 (UL94)
Housing dimensions	mm	121(d) x 99(h) x 68(w)
Connectors		11x4 poles screw terminals PE direct via DIN rail USB-B 2.0 - Profibus D-Sub 9 poles
Operating temperature range	°C	-10 / +50
Protection degree		IP 20

EWM-2SS-DAD
SERIES 20

1 - IDENTIFICATION CODE

E	W	M	-	2SS	-	D	AD	/	20	E

- EWM: Digital card for closed loop systems DIN rail mounting EN 50022
- 2SS: Synchro stroke control of two axes
- D: Digital command value
- AD: Analog and digital feedback values
- 20: Series No. (from 20 to 29 sizes and mounting dimensions remain unchanged)
- E: Output value: **E** = Output value in voltage or current, to be configured via software.

2 - FEATURES OVERVIEW

Controller Functions

- Synchronized or independent positioning control of two axes in closed loop
- Command position, speed parameters and actual value response via Profibus DP
- Fine positioning - 1µm resolution
- 2 methods for positioning control:
  SDD – Stroke Depending Deceleration - time-optimal positioning structure with very high stability
  NC – Numerically Controlled - To follow the position profile
- 2 methods for synchronized control:
  Master-slave
  Average value controller
- Data for lengths in mm
- Digital SSI sensor
- As an alternative, the card can be set via software for operate with analogue position sensors
- Analogue sensors scalable via software
- Gain adjustment made via software with independent parameters for SDD and NC modes
- PT1 compensator for optimized control of hydraulic drives
- Emergency function (EOUT)
- Safe and error-free data transmission
- Manual mode available via Profibus.

Adaptation of the valve characteristic curve

- CTRL function to adapt the braking characteristics to positive and zero overlapped proportional valves
- Advanced deadband compensation: non-linearity compensation by a double-gain characteristics

Monitoring functions

- In-position error
- Cable break, in-pressure error and fault of feedback sensors
- 2 Digital output to read the status

Other characteristics

- Card configuration is made via software, USB-B socket on the module

3 - FUNCTIONAL SPECIFICATIONS

3.1 - Power supply

This card is designed for 24 VDC of a power supply. This power supply must correspond to the existing EMC standards.

All inductivity at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, freewheeling diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

3.4 - Reference signal

The reference signals run via Profibus, ID number 1810h.

3.5 - Position feedback values

The card accepts a digital feedback input from a sensor with any SSI interface with RS422 specifications. Bit, code and resolution are settable via software.

Use SSI sensors with the same resolution (max 1 µm)

Eventually an analogue input could be used as feedback. The card accepts a 0 ÷ 10 V (Ri 33 kOhm) or 4 ÷ 20 mA (Ri = 250 Ohm).

The analogue resolution is of 0,01 % incl. oversampling.

⚠ Using analog sensors, the SSI parameters in the software assume default preset values that the user must do not change.

3.6 - Output values

Output values can be in voltage or current and need to be configured via software (SIGNAL parameter).

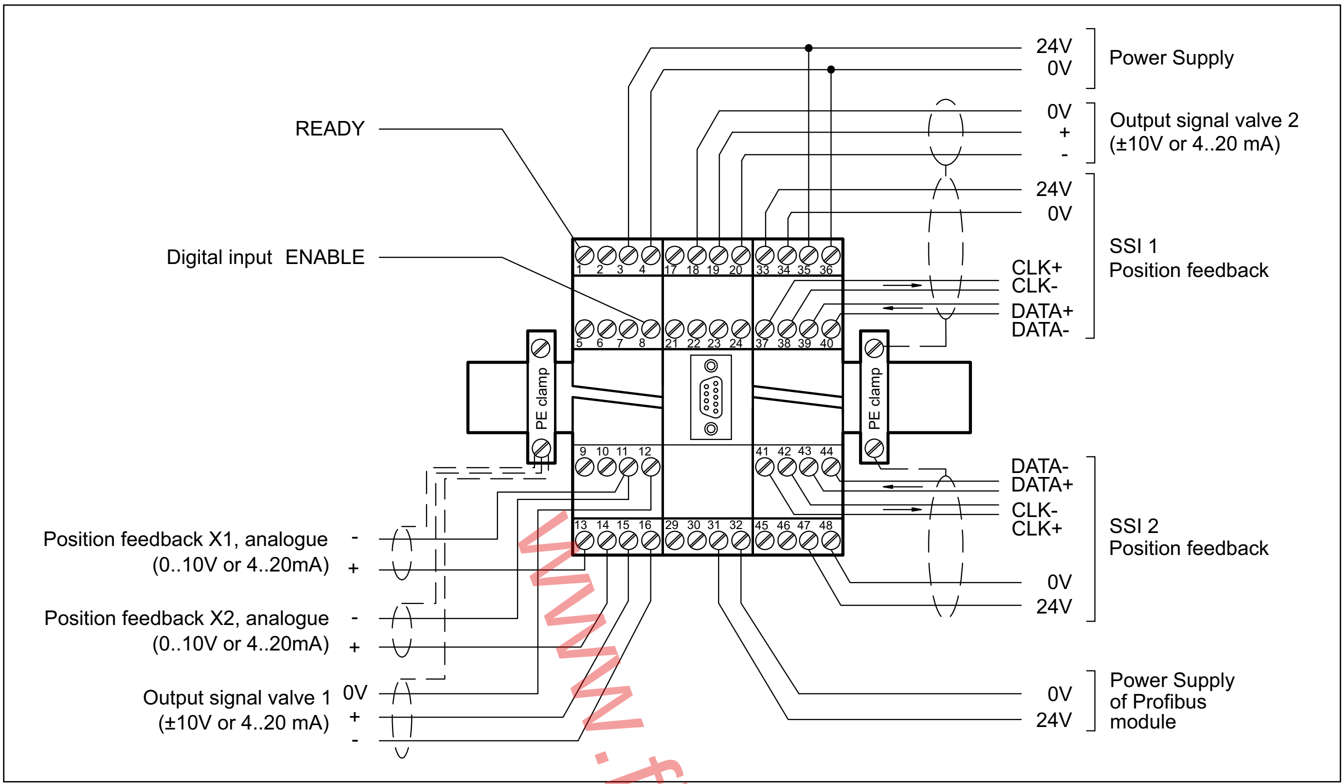
voltage :	± 10 V Differential output	PIN 15 and 16 PIN 19 and 20
current:	4 ÷ 20 mA	PIN 15 to PIN 12 PIN 19 to PIN 18.

3.7 - Digital Output

Two digital output are available, STATUS and READY, that are displayed by LED on the front panel.

Low level < 2 V High Level > = Vsupply (max current 50 mA).

4 - WIRING DIAGRAM



DIGITAL INPUT AND OUTPUT

PIN 1 — READY output.
General operationality, It's on when ENABLE (PIN 8 and profibus bit) is active and there are no sensor errors.
This output corresponds with the green led.

PIN 8 — ENABLE input:
This digital input signal initializes the application.
The controller and the READY signal are activated. The output signal to the control element is enabled.
Target position is set to actual position and the drive stays stationary, in closed loop.
The Enable bit via profibus must be active, too.

ANALOGUE INPUT

PIN 13 — Analogue position feedback value (X1), range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

PIN 14 — Analogue position feedback value (X2) , range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

ANALOGUE OUTPUT

voltage

PIN 16/15 — Differential output (U1)
± 100% corresponds to ± 10V differential voltage

PIN 29/20 — Differential output (U2)
± 100% corresponds to ± 10V differential voltage

current

PIN 12/15 — current output U1: ±100% corresponds to 4 ÷ 20 mA

PIN 18/19 — current output U2: ±100% corresponds to 4 ÷ 20 mA

SSI SENSOR INTERFACE

	position 1		position 2
PIN 37	CLK+ output	PIN 41	CLK+ output
PIN 38	CLK- output	PIN 42	CLK- output
PIN 39	DATA+ input	PIN 43	DATA+ output
PIN 40	DATA- input	PIN 44	DATA- output
PIN 33	24V Power supply of the SSI sensor	PIN 47	24V Power supply of the SSI sensor
PIN 34	0V Power supply of the SSI sensor	PIN 48	0V Power supply of the SSI sensor

5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm^2 up to 20 m length, and of 1.00 mm^2 up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

NOTE : To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE “protected earth” and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

5.2 - Profibus DP interface

Profibus has to be used to control the axis and can also be utilized to set the parameters.

The module supports all baud rates from 9,6 kbit/s up to 12000 kbit/s with auto detection of the baud rate.

The functionality is defined in IEC 61158. The Profibus address can be programmed using the EWMPC/20 or online via the Profibus.

A diagnostic LED indicates the online status.

5.2.1 - Installation and setting

A typical screened Profibus plug (D-Sub 9pol with switchable termination) is mandatory. Every Profibus segment must be provided with an active bus termination at the beginning and at the end. The termination is already integrated in all common Profibus plugs and can be activated by DIL switches.

The Profibus cable must be screened at determined contact clips in the Profibus plug.

The GSD data configuration files are available for download on our website. The communication parameters are 16 bytes (8 words) for IN/OUT variables.

6 - DEVICE SETUP

Card set-up is possible via software only.

The system can be controlled in open loop, moving up and down the servo-cylinder with commands HAND:x, via Profibus only, to facilitate the adjustment of the card and its calibration.

6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7, 8 and 10.

WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.

6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at *standard* level, easier, or *expert*, where a greater number of parameters is displayed and can be customized.

For a complete list of the parameters and their settings please refer to the Technical Manual *89470 ETM*.

7 - MAIN FEATURES

The EWM-2SS-DAD is a card for positioning control loop

With only few parameters the controller can be optimized and the movement profile is preset via Profibus (position and velocity).

7.1 - Sequence of the positioning

The positioning is controlled via Profibus.

You can switch from the positioning in closed loop to the manual movement in open loop and back via Profibus.

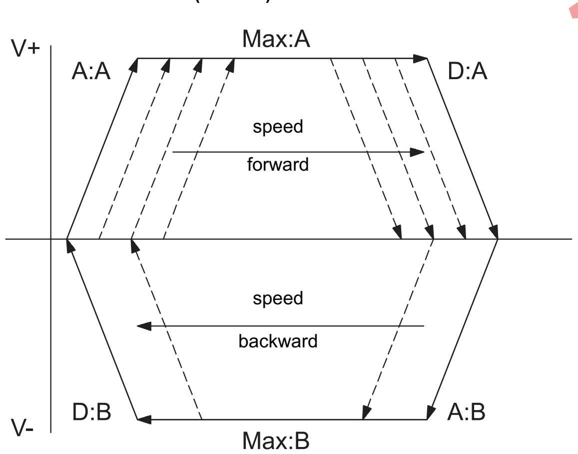
With READY active the system is ready. The open loop control is achieved by using the HAND bits and the speed parameter. When the bit HAND goes low the card assumes the current position as the request and the card is ready to work in closed loop.

With also START bit enabled, the command position parameter (profibus) become active and the new command position will be taken over as a new target.

The axis moves immediately to this new position and indicates on the POSWIN status bit when it reaches the position. This output is active as long as the axis is within the InPos window or the START bit is active.

Setting the synchronous bit (SC) will synchronize both axes and the synchronization controller will work according with the FUNCTION mode selected (Master-slave, Average or Multiplicative Recursive Controller). Axis 2 is now following axis 1 according to the master-slave-principle.

flow (volume) P→A and B→T



Two methods for positioning are available:

SDD - stroke depending deceleration - means the control gain will be adjusted. This is a time-optimal positioning structure with very high stability.

NC mode - the position value is generated from the following error.

The actuator position is measured by a transducer and compared with a specified target position. The target position and speed are set by Profibus.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two clashing requirements (short positioning time and high accuracy) have to be considered in the system design.

7.2 - Emergency Output (EOUT)

This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The function can be deactivate. Different parameters available for each axes.

7.3 - Adaptation of the braking characteristic to the valve type (CTRL).

The deceleration characteristic is set with this parameter. In case of positively overlapped proportional valves the SQRT function should be used. The non-linear flow function of these valves is linearized by the SQRT function.

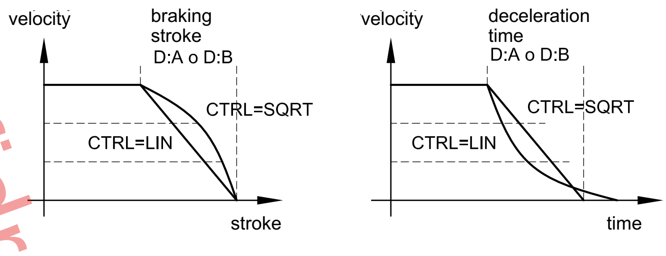
In case of zero lapped valves (control valves and servo valves) the LIN or SQRT1 function should be used regardless of the application. The progressive characteristic of the SQRT1 function has better positioning accuracy but can also lead to longer positioning times in individual cases.

Different parameters available for each axes.

LIN: Linear deceleration characteristic
(gain is increased by a factor of 1).

SQRT1: Root function for braking curve calculation.
The gain is increased by a factor of 3 (in the target position). This is the default setting.

SQRT2: Root function for braking curve calculation.
The gain is increased by a factor of 5 (in the target position). This setting should only be used with a significantly progressive flow through the valve.



7.4 - Adaptation of the output signal to the valve characteristic (TRIGGER).

With TRIGGER command, the output signal is adapted to the valve characteristics.

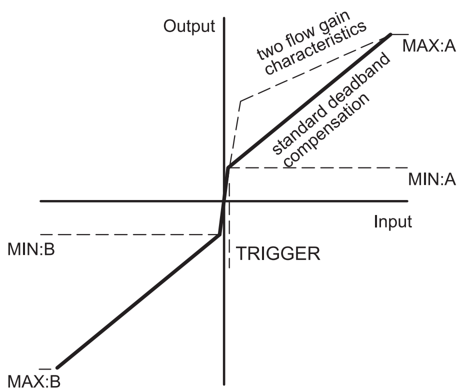
The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out either at the power amplifier or at the positioning module.

If the deadband compensation value (MIN) is set too high, it influences the minimal velocity which cannot be adjusted any longer.

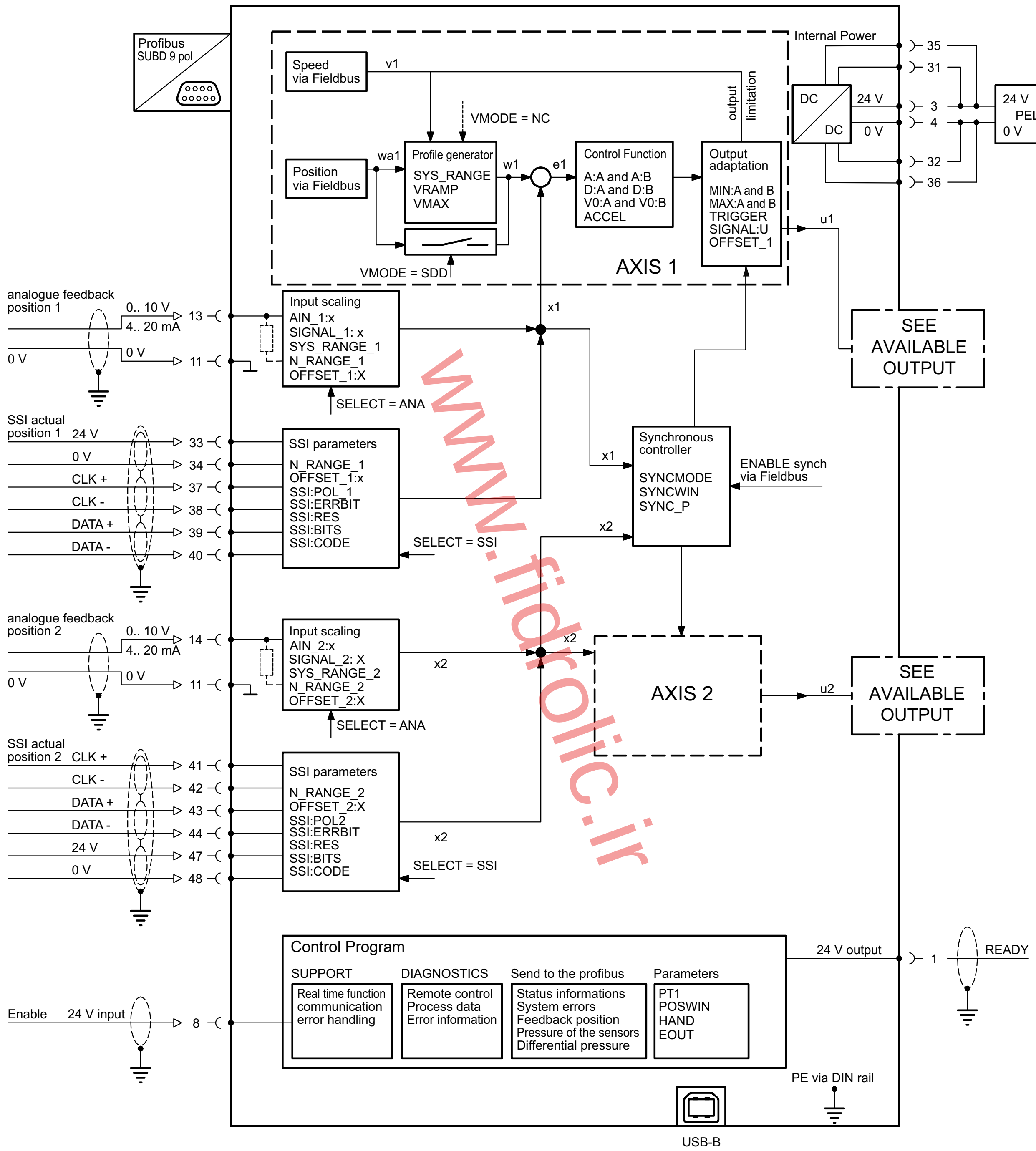
In extreme cases this causes to an oscillating around the closed loop controlled position.

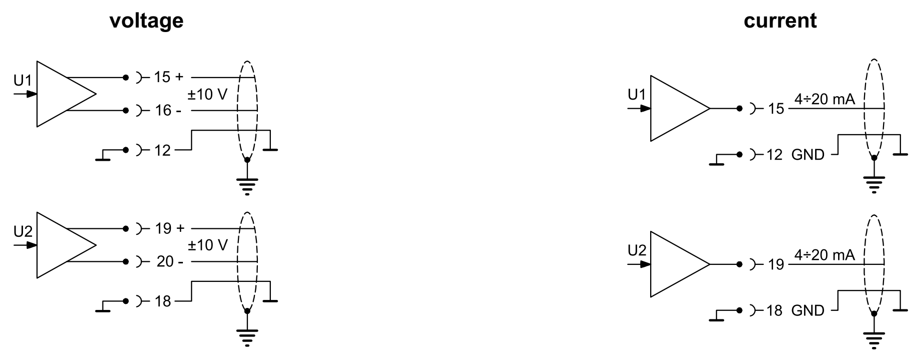
Different parameters available for each axes.



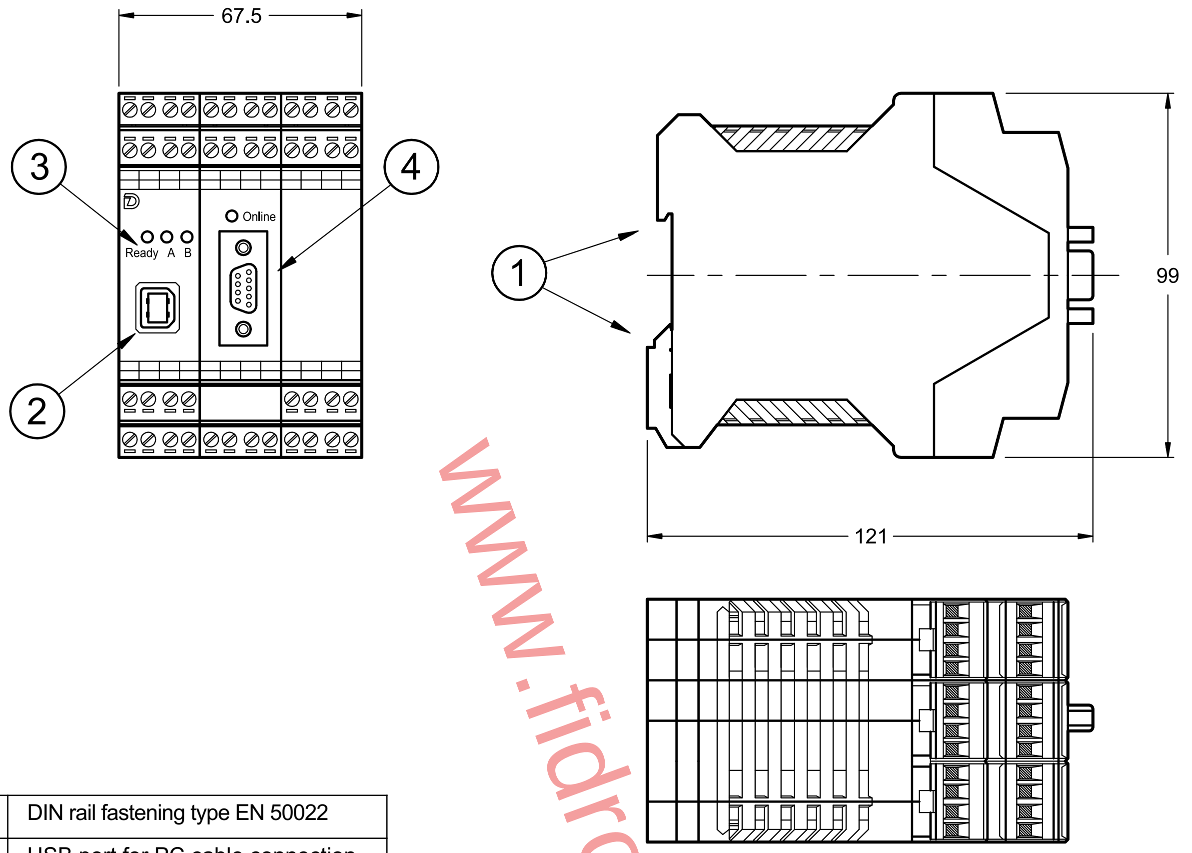
8 - CARD BLOCK DIAGRAM

Caution!, PIN 4 is connected internally to PIN 11 (and also possibly to PIN 12 depending on the model). These connections serve as a reference potential for the analogue sensor or demand value signals.





9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN rail fastening type EN 50022
2	USB port for PC cable connection
3	LED for output signals
4	Profibus interface port

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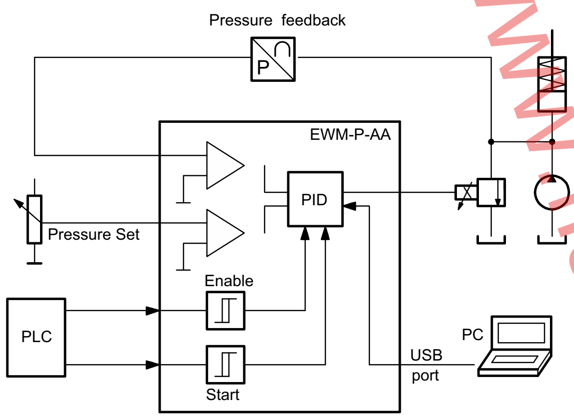
EWM-P-AA

DIGITAL CARD FOR PRESSURE (FORCE) CONTROL IN CLOSED LOOP SYSTEMS

SERIES 20

RAIL MOUNTING TYPE:
DIN EN 50022

OPERATING PRINCIPLE



— This card is designed for pressure controlled servo pumps. It manages closed loop control of pressure reducing and pressure relief valves.

— The card works as a bypass control module. The command value is directly transferred to the control output (pressure valve) and the closed loop compensates only the linearity failures. In most of cases the optimization is possible without any measuring instruments (a pressure sensor is necessary only).

— It has an integral power amplifier for direct control of proportional valves.

— Card setup via software only, through an on-board USB-B port. Customizable parameters are: ramp up, ramp down, PID parameters, dither, frequency and amplitude, PWM, maximum and minimum pressure.

TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ÷ 30 ripple included
External fuse	A	3,0 (medium time lag)
Current consumption	A	60 + current for solenoid
Command (pressure) value	V mA	0 ÷ 10 (R_I = 150 kΩ) 4 ÷ 20 (R_I = 390 Ω)
Pressure signals accuracy	%	0,006 oversampling included
Feedback value	V mA	0 ÷ 10 (R_I = 90 k Ω) 4 ÷ 20 (R_I = 390 Ω)
Output current	A	0.5 ÷ 2.6 stepless
Sample time (pressure)	ms	1
Interface		USB-B (2.0)
Electromagnetic compatibility (EMC)		Immunity EN 61000-6-2 Emissions EN 61000-6-4
Housing material		thermoplastic polyamide PA6.6 combustibility class V0 (UL94)
Housing dimensions	mm	120 (d) x 99(h) x 23(w)
Connector		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

EWM-P-AA
SERIES 20

1 - IDENTIFICATION CODE

E	W	M	-	P	-	A	A	/	20	M1

- EWM: Digital card for closed loop systems for DIN rail mounting
- P: Pressure control
- A: Analogue command value
- A: Analogue feedback value
- 20: Series No. (from 20 to 29 sizes and mounting dimensions remain unchanged)
- M1: Embedded power amplifier

2 - FEATURES OVERVIEW

Controller Functions
- Pressure control in closed loop system
- Fine regulation – capable of accuracy not achievable with open loop set-up
- Highly dynamic control loop
- Adjustable PID controller
- Ability to modify command signal ramp times
- Emergency function (EOUT)
- Analog signal command
- Analog feedback input
- Simple and intuitive scaling of the input

Adaptation to the valve characteristics
- Advanced dead-band compensation – able to define output range and position
- Adjustable sampling time, PWM, dither
- Adjustable command signal response time

Power amplifier
- Embedded power amplifier
- Fine control of output signal
- PWM current output of up to 2.6A

Other characteristics
- Card configuration is made via software, through on-board USB

3 - FUNCTIONAL SPECIFICATIONS

3.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, freewheeling diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

NOTE: the value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoid to be controlled.

3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

3.4 - Command input (pressure)

The card accepts analogue command input, with voltage 0÷10V (R_I= 150 Ω) and current 4 ÷ 20 mA (R_I= 390 Ω).

3.5 - Feedback value

The card accepts analogue feedback input. The feedback value must be 0 ÷ 10V (R_I = 90 kΩ) or 4 ÷ 20 mA (R_I = 390 Ω).

The parameters are settable via software (see the parameter table)

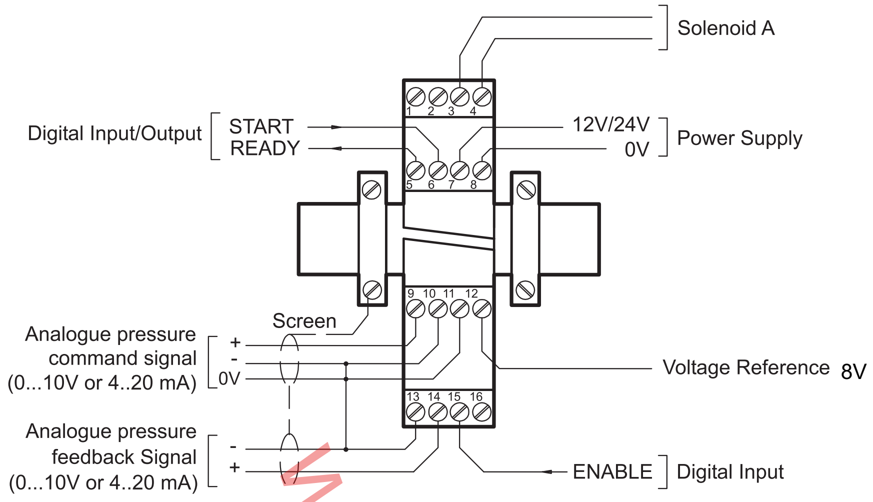
3.6 - Output values

The output current value for this card is settable via software. The value range is 0.5 ÷ 2.6 stepless. Broken wire and short circuit monitored. PWM frequency 61 ÷ 2604 Hz.

3.7 - Digital Output

A digital output is available (READY) and its signal is displayed from the green led. Low level: <2V, high level >10V (50 mA)

4 - WIRING DIAGRAM



DIGITAL INPUT AND OUTPUT

PIN 5 — READY output:
If the ENABLE is active and there are no discernable errors then the output is on. Otherwise it is off.
This output corresponds with the ‘Ready’ LED.
If the 4÷ 20 mA sensor is open an error is generated.

PIN 6 — START Input:
The controller is active; the external analogue command value is taken over.

PIN 15 — ENABLE Input:
If the signal is applied (>10V) then the module is active and the power stage is active in closed loop.

ANALOGUE INPUT

PIN 9/10 — Pressure command (W)
range 0 ÷ 100%
corresponds to 0 ÷ 10V or 4 ÷20 mA

PIN 13/14 — Pressure feedback (X)
range 0 ÷ 100%
corresponds to 0 ÷ 10V or 4 ÷20 mA

ANALOGUE OUTPUT

PIN 12 — 8V reference output (max. 25mA)

PIN 3/4 — PWM output for valve control.

5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm^2 up to 20 m length, and of 1.00 mm^2 up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

NOTE : To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

WARNING! Plugs with freewheeling diodes and LED cannot be used with current controlled power outputs.

They interfere with the current control and they can destroy the output stage.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and the signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE “protected earth” and DIN rail should be provided. Transient interference voltages at the terminals are discharged via DIN rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

6 - DEVICE SETUP

Card set-up is possible via software only.

The system is controlled in closed loop. The integrated power stage makes it easy to set up the system quickly as it can be connected directly to a pressure valve.

6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7, 8 and 10.

WARNING! In card series 20, the default baud rate to be selected in the software has changed from 9600 baud to 57600 baud.
This can be set in OPTION / SETTINGS / INTERFACE.

6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameters setting can be done at *standard* level, easier, or *expert*, where a greater number of parameters is displayed and can be customized.

For a complete list of parameters and their settings please refer to the Technical Manual 89500 ETM.

7 - MAIN FEATURES

7.1 - Applications

This module is useful for a variety of pressure control applications. The control is accomplished by a PID controller carefully optimized for this application. Because of the high stability of this controller, the module is recommended for closed loop applications where an open loop control structure is incapable of achieving the desired accuracy.

The output signal (of up to 2.6A) can control a variety of pressure valves, such as pressure relieve valves and pressure control valves and as such no On-Board Electronics are needed.

Examples of such applications can be pressure control with constant pumps, remote controllable servo pumps and/or force & torque control with cylinders and motor drives.

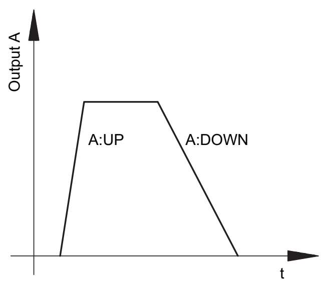
7.2 - Emergency Output (EOUT)

This function is able to set the output at a specific value (degree of valve opening) when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with the programmed ramp. The function can be deactivated.

The output value defined here is stored permanently (independently of the parameter set). The use of this feature should be carefully evaluated according to safety procedures in the system.

7.3 - Command Signal Ramp time (RA)

The parameters for ramp up and ramp down can be set in milliseconds. These values are the amount of time that the command signal will take to follow a step change in the reference signal.



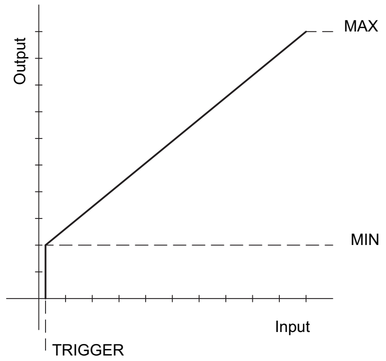
7.4 - PID Controller

The PID controller can be parameterized by modifying the relevant parameters, in order to suppress high-frequency noise and a value is also present in order to control the output by the input signal directly.

7.5 - Adaption of the output signal to the valve characteristics (TRIGGER)

With the MAX value, the maximum output can be easily defined. With the MIN value, the overlap (dead band of the valve) can be compensated. Via the TRIGGER the activation point of the MIN function is set and so a non-sensitive range around the zero-point can be specified.

If the MIN value is set too high, it influences the minimal pressure, which cannot be adjusted any longer. In extreme case this causes to an oscillating at small input values.



7.6 - Sample Time (TS)

The control dynamics can be influenced with the sample time. Changes should only be made by persons who have sufficient knowledge of dynamic systems behavior.

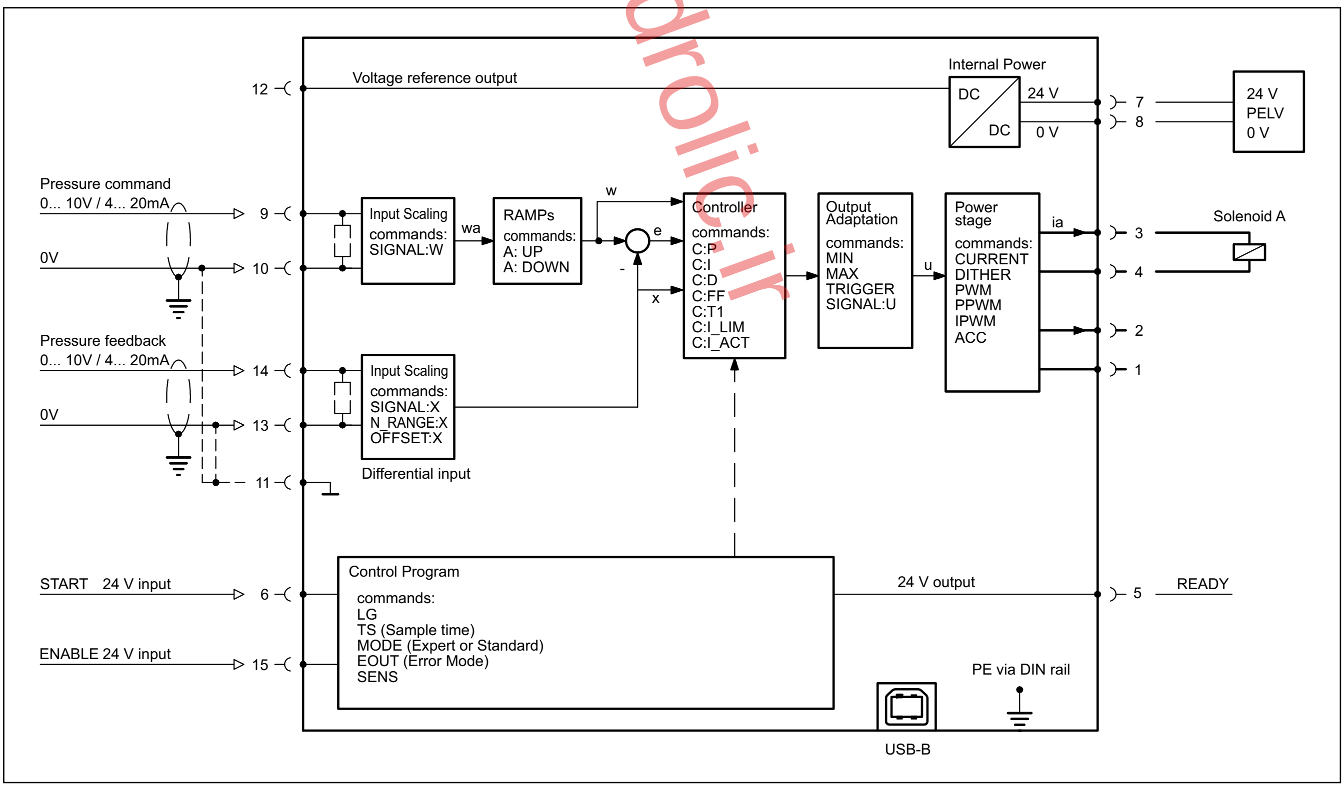
Note that after changing this value all time-dependent parameters must be checked and reset if necessary.

7.7 - Power Amplifier

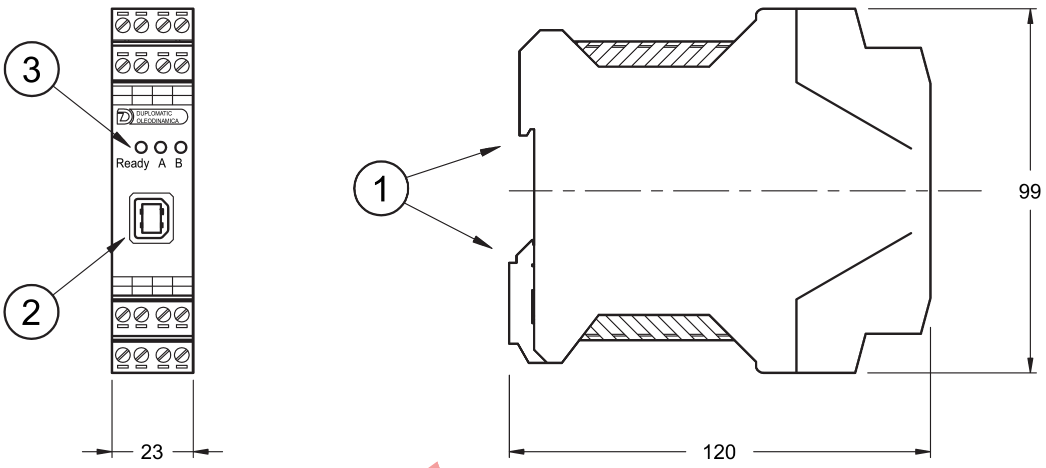
The module comes with an embedded power amplifier that is capable to generate a PWM current signal of up to 2.6A in order to control a pressure valve.

As such the nominal current, dither, frequency and the various parameters of the current loop can be accessed and modified.

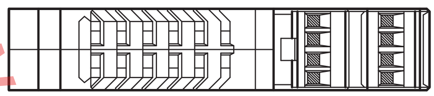
8 - CARD BLOCK DIAGRAM



9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN rail fastening EN 50022
2	USB interface, for setup
3	LEDs for output signals



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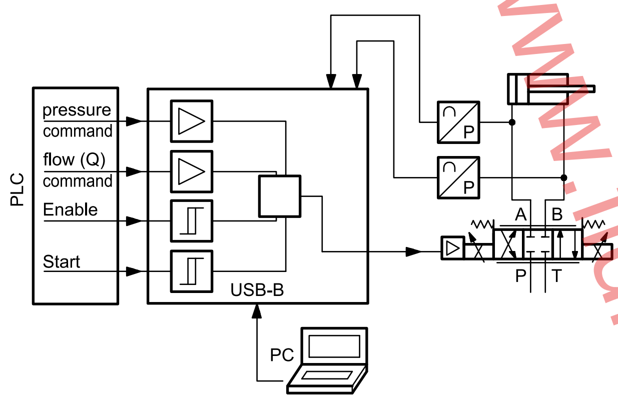
EWM-PQ-AA

DIGITAL CARD
FOR PRESSURE/FLOW CONTROL
IN CLOSED LOOP SYSTEMS
SERIES 20

RAIL MOUNTING TYPE:
DIN EN 50022

OPERATING PRINCIPLE



- The EWM-PQ-AA has been developed as a classic p/Q controller but it work well also with high response valves (zero overlap) via analogue command inputs for pressure and flow.
- The p/Q controller automatically switches over between Q and p control modes to assure that the set point limits for pressures has not to exceed.
- The pressure feedback are analogue type.
- The output value, voltage or current type, is configurable via software.
- Card setup via software only, through an on-board USB-B port.

TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ÷ 30 ripple included
Fuse, external:		1A medium time lag
Current consumption:	mA	<100
Pressure command (p)	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Flow command (Q)	mA V	4 ÷ 20 (RI = 240 Ω) ± 10 (RI = 90 kΩ)
Pressure feedback values	mA V	4 ÷ 20 (RI = 240 Ω) 0 ÷ 10 (RI = 25 kΩ)
Sensor resolution	%	0,003 incl. oversampling
Output values	V mA	± 10 (max load 10 mA 2 kΩ) differential 4 ÷ 20 (max load 390 Ω)
Sample time	ms	1
Interface		USB-B 2.0
Electromagnetic compatibility (EMC) 2004/108/EC		Immunity EN 61000-6-2: 8/2005 Emissions EN 61000-6-4: 6/2007; A1:2011
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w)
Connections		USB-B (2.0) - 4x poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

1 - IDENTIFICATION CODE

E	W	M	-	PQ	-	A	A	/	20	E

- E W M: Digital card for closed loop systems DIN EN 50022 rail mounting
- PQ: Pressure and flow control
- A: Analogue command value
- A: Analogue feedback value
- 20: Series No. (from 20 to 29 sizes and mounting dimensions remain unchanged)
- E: Output value in voltage or current, to be configured via software.

2 - FEATURES OVERVIEW

Controller Functions

- Analogue Q– and p-command signals
- Classical p/Q controller with pressure limitation (automatic switch over)
- PID-controller with 2 sets of parameters switchable by digital input
- Data for pressure set in bar
- Ramps for pressure up and down optionally activated by a digital input
- Force / pressure controller with one sensor
- Differential pressure control with two pressure sensors
- D - gain filter to stabilize the control behaviour
- Emergency function for output signal (EOUT)
- Analogue feedback input
- Flow value (Q) alternative to the analogue input as parameter to be entered via software
- Simple and intuitive scaling and offset of the sensors.

Monitoring functions

- Monitoring error
- Cable break for feedback sensor and current command signal
- 2 digital outputs to read the status

Other characteristics

- Current or voltage output to be set via software
- Card configuration via software, through on-board USB port

3 - FUNCTIONAL SPECIFICATIONS

3.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

3.4 - Pressure command (p)

The card accepts an analogue input signal. The command value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.5 - Flow command (Q)

The card accepts an analogue input signal. The command speed can be ±10 V (RI = 90 kΩ) or 4…12…20 mA (RI = 240 Ω).

3.6 - Feedback values

The card accepts up to two analogue feedback inputs, values can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.7 - Analogue output values

Output values can be in voltage or current, to be configured via software (parameter SIGNAL:U). The same parameter defines the polarity also.

Voltage: ± 10 V Differential output (PIN 15 / PIN 16).

Current: 4 ÷ 20 mA (PIN 15 to PIN 12).

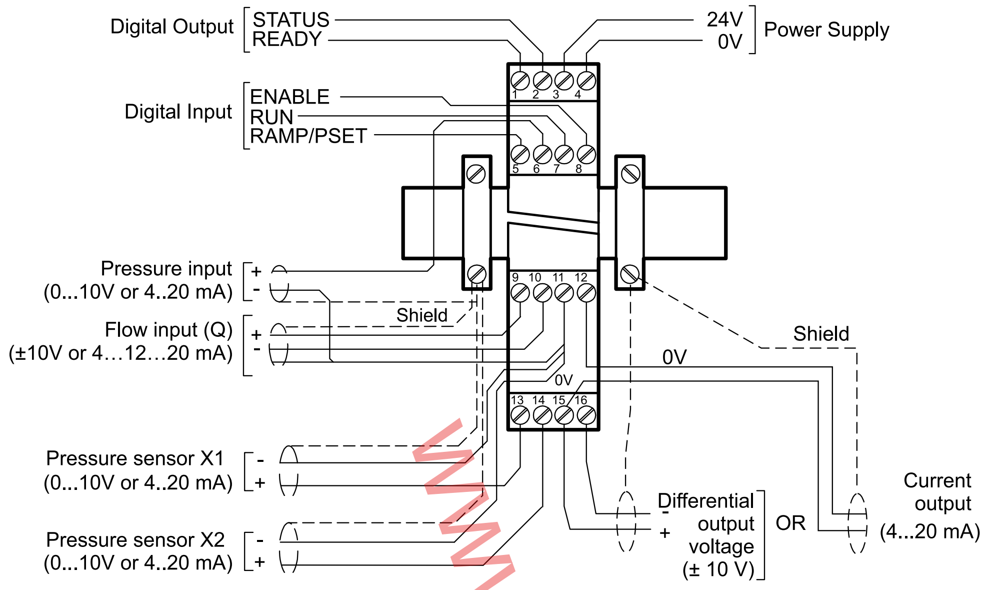
All analogue output have to be wired with screened cables.

3.8 - Digital output

Two digital output are available, STATUS and READY, that are displayed by the READY and A leds on the front panel.

Low level < 2 V High Level > 12 V (max 50 mA).

4 - WIRING DIAGRAM



DIGITAL INPUT AND OUTPUT

PIN 1 — READY output:
General operationality, ENABLE is active and there are no sensor / command errors (by use of 4… 20 mA sensors). This output corresponds with the LED READY.

PIN 2 — STATUS output:
Error monitoring. The status output will be deactivated if the error is greater than the acceptability range.
This output corresponds with the LED A.

PIN 5 — RAMP/PSET input:
According to the setup of the parameter PIN:5, it can be configured as:
- ramp activation / deactivation
- switching between the 2 available sets of parameters

PIN 7 — RUN input:
Controller activation; if the input is OFF and ENABLE is active, the flow command (PIN 9 / 10) is taken over as valve command value.

PIN 8 — ENABLE input:
This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly.
The Q command signal is controlling the output.

ANALOGUE INPUT

PIN 6 — Pressure / force command value (p)
range 0 ÷100% of system nominal pressure corresponds to 0 ÷ 10V or 4 ÷ 20 mA

PIN 9/10 — Flow command value (Q)
range ±100 % corresponds to ±10V or 4…12…20 mA

PIN 13 — Pressure sensor (feedback) value (X1)
range 0 ÷ 100% of nominal pressure of sensor corresponds to 0 ÷ 10V or 4 ÷20 mA

PIN 14 — Pressure sensor (feedback) value (X2)
range 0 ÷ 100% of nominal pressure of sensor corresponds to 0 ÷ 10V or 4 ÷20 mA

ANALOGUE OUTPUT

voltage

PIN 16/15 — Differential output (U)
± 100% corresponds to ± 10V differential voltage

current

PIN 12/15 — ±100% corresponds to 4 ÷ 20 mA

5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm^2 up to 20 m length, and of 1.00 mm^2 up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

NOTE : To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE “protected earth” and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

6 - DEVICE SETUP

Card set-up is possible via software only.

The system can be controlled in open loop with the control signal Q, moving the servo cylinder forward and backward, for easy programming of the card and of the system calibration.

6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up. Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7 and 8.

WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.

6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at *standard* level, easier, or *expert*, where a greater number of parameters is displayed and can be customized.

For a complete list of the parameters and their settings please refer to the Technical Manual *89550 ETM*.

7 - MAIN FEATURES

This module serves to control pressures and forces on hydraulic actuators.

7.1 - Sequence of the positioning

The ENABLE signal initializes the application and error messages are deleted. The READY signal gets activated. The output signal to the control element is enabled. The drive can be controlled by the Q value or input. Setting RUN will start the PID controller.

A dynamic zero-overlap control valve is necessary for p/Q control. If the B-side of the cylinder can not be relieved, pressure in both cylinder sides has to be measured.

The cylinder can be driven in both directions (flow control in open loop) with the analogue Q command input value and limits the max velocity.

The pressure limitation control function is only active with a positive Q signal with a closed loop function.

The p command value pre-sets the max differential pressure. If this pressure (or force) exceeds the controller reduces the output signal to the valve (also in the negative range), so that the preset pressure will be kept. To go backwards for keeping the force is possible.

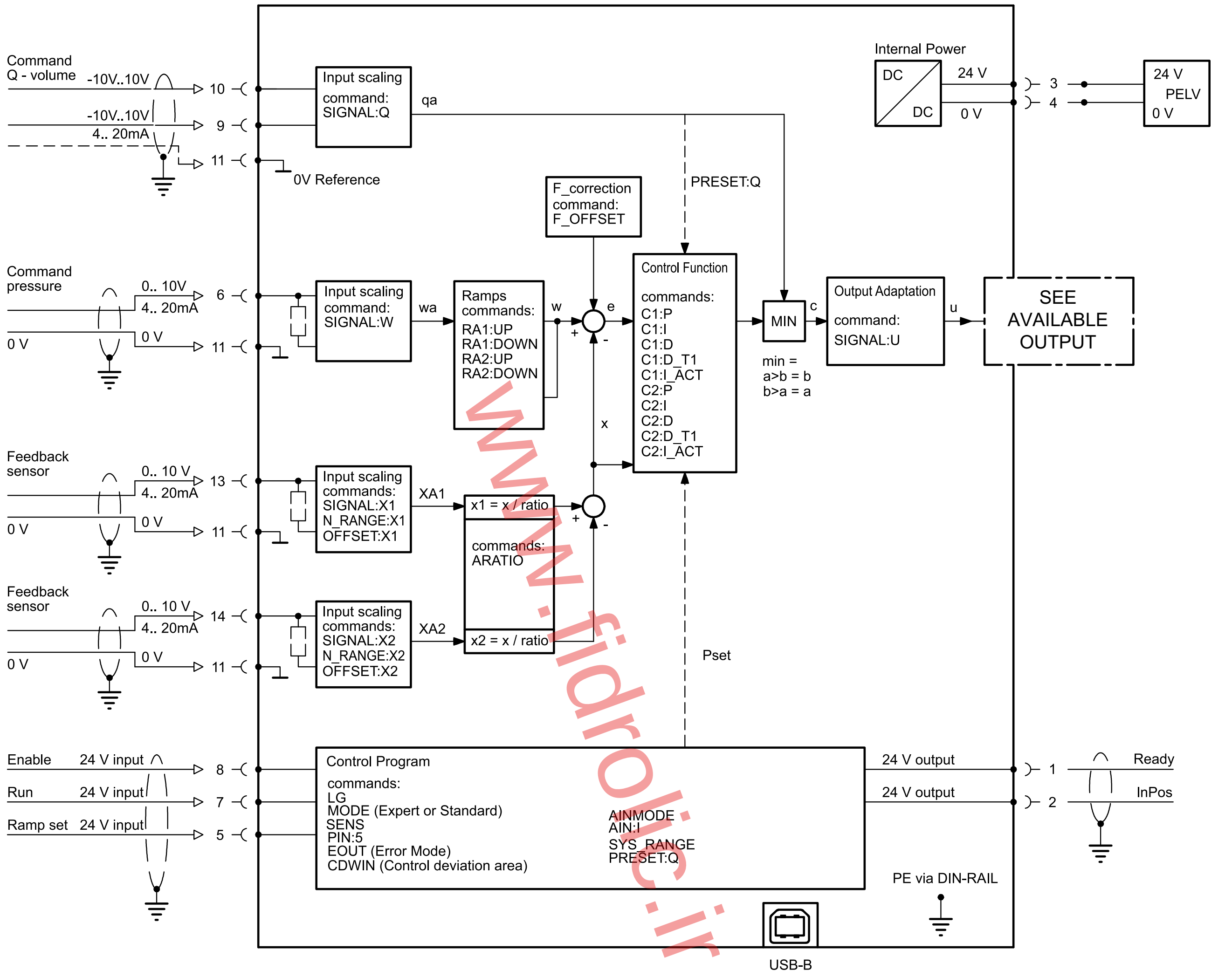
The pressure/force control is determined via the analogue inputs X1 and X2. For differential pressure control the actual value is calculated as X1 – X2.

The output signal is available as a differential output for connection of control valves with integrated electronics.

7.2 - Emergency Output (EOUT)

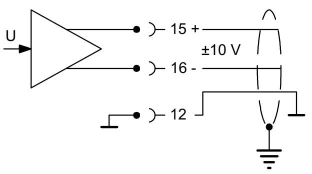
This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The function can be deactivate.

8 - CARD BLOCK DIAGRAM

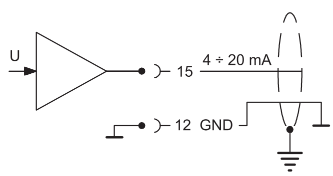


Output signals

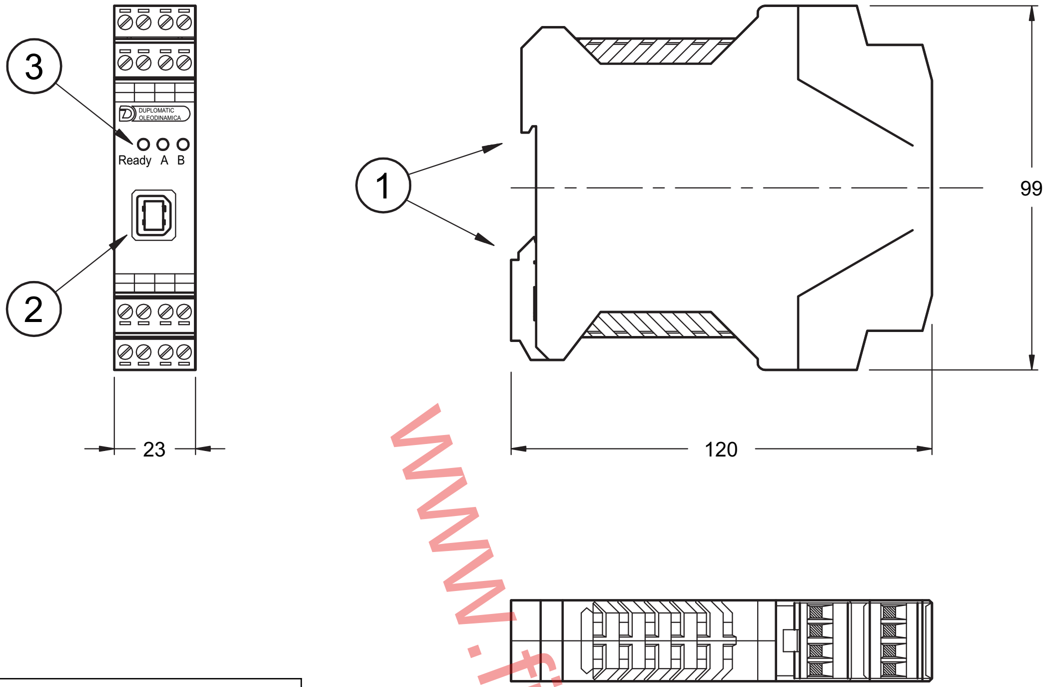
voltage



current



9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	USB interface, for setup
3	LEDs for output signals

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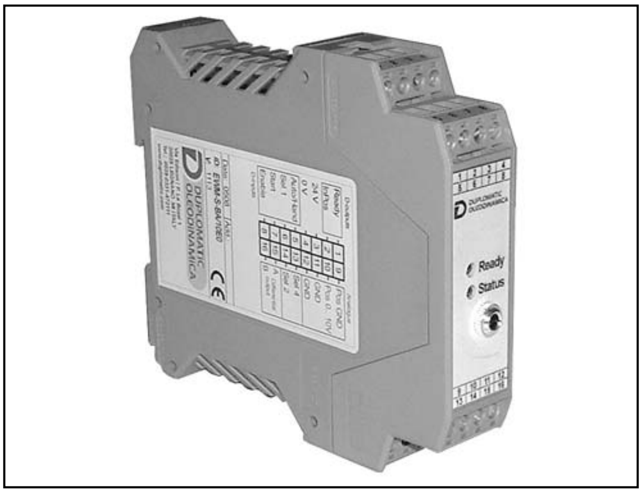


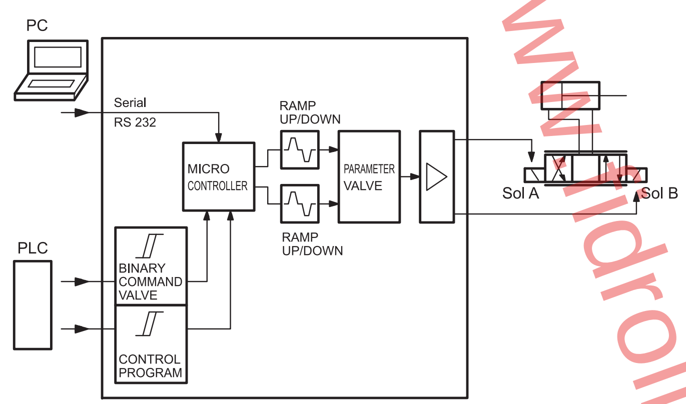
EWM-A-RL

DIGITAL CARD FOR FAST/SLOW SPEED CONTROL IN OPEN LOOP SYSTEMS

SERIES 10

RAIL MOUNTING TYPE:
DIN EN 50022

OPERATING PRINCIPLE



— This card is designed to control proportional valves with one or two solenoids, with the current output controlled in open loop.

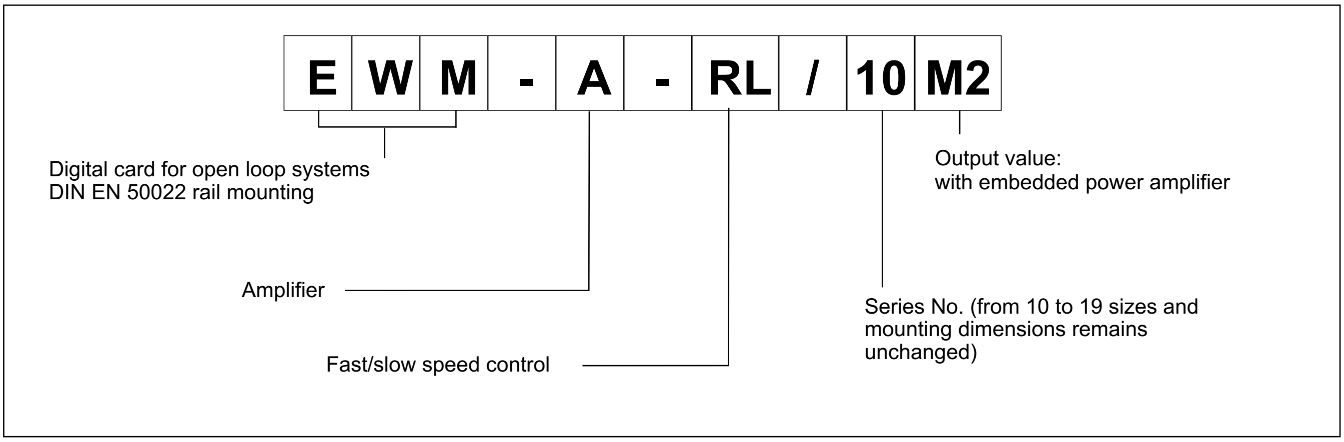
— The card moves the proportional valve via preset value input. Eight demand value input can be activated in binary mode, so it is possible to control speed, directional and ramp values without any analog card into the PLC.

— The card use the RS232C interface, and is settable via notebook, using the kit (EWMPC).

TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ÷ 30 ripple included external fuse 5 A
Current consumption	mA	100 + solenoid current consumption
Command value		binary command with 8 bit
Output current	A	max 2,6
Interface		RS 232 C
Electromagnetic compatibility (EMC): according to 2004/108/CE standards		Emissions EN 61000-6-4 Immunity EN 61000-6-2
Housing material		thermoplastic polyamide PA6.6 -combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w)
Connector		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

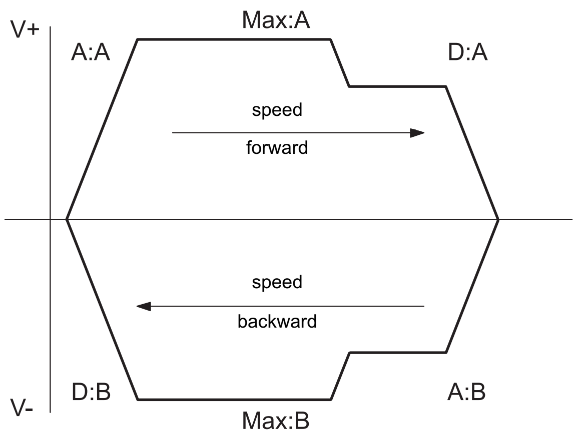
1 - IDENTIFICATION CODE



The power amplifier is controlled by an enable input and three switch signals. Therefore 8 demand values can be activated binary.

In case of direct control (non binary) it is par example possible to preset the directions with two inputs and to switch over between rapid and slow speed with the third input.

The output current is closed loop controlled and therefore independent from the supply voltage and the solenoid resistance.



2 - FUNCTIONAL SPECIFICATIONS

2.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards.
All inductivity at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).
It is recommended to use a regulated power supply (linear or switching mode) for the card supply and the sensors.

NOTE: in the type M2 the value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoid to be controlled.

2.2 - Electrical protections

All inputs and outputs are protected against overvoltage and have filters.

2.3 - Reference signal

The card accepts digital input. The digital input must have a voltage from 12 to 24 V with current <0,1A. See the block diagram at paragraph 8 for the electric connections.

2.4 - Output values

The card has output values in current, settable via software between 1, 1,6 and 2,6 A.

2.5 - Digital Output

The digital output is READY signal, displayed from the green led.

3 - LED FUNCTIONS

There are two leds on the card: GREEN and YELLOW.

GREEN: Shows if the card is ready.

ON - The card is supplied
OFF - No power supply
FLASHING - Failure detected
Only if SENS = ON

YELLOW: Indicates the intensity of the output current.

4 - ADJUSTMENTS

On the EWM card family, the adjustment setting is possible only via software. Connecting the card to the PC, the software automatically recognises the card model, and shows a table (see example on next page) with all the available parameters, with their commands, the default setting, the measuring unit and an explanation of the command and its uses.

The parameters changes depending on the card model, and they are fully described in the *Overhaul manual*.

EXAMPLE OF PARAMETERS TABLE

Commands	Parameter	Defaults	Units	Description
s:i x	i= 0..7 x= 0..10000	- :0	- 0,01%	Definition of the target positions. The value **i** is related to the input selection (SEL1, SEL2 and SEL4; binary coded).
rmode x	x= SD|4Q	SD	-	Ramp function: **SD** = ramp time related to the setpoint value **4Q** = Four quadrants ramp, ramp-variable RA:1 to RA:4 is used
ra:i x	i= 0… 7 x= 0..600000	100	ms	**4Q** Ramp **RA:1** up (solenoid A), **RA:2** down (solenoid A) **RA:3** up (solenoid B), **RA:4** down (solenoid B) **SD** Ramp **RA:0** to **RA:7**
mode x	x= on|off	off	-	Activation or deactivation of the linearization defined by the CC command.
cc:i x y	i= -10… 10 x -10000… 10000 y -10000… 10000	5000	0,01% 0,01%	Characteristic linearization.
rcurr x	i= A|B x= -10000… 10000	off	-	Real current input. **MIN** and **MAX** will be typed in, in mA. If *rcurr* = on; the command "current" should not be used.
min:i x	i= A x= 0… 5000	0	0,01% / mA	Deadband compensation of positive overlapped proportional valves.
max:i x	i= A x= 300..10000	10000	0,01% / mA	Maximum output range for adapting control range to maximum flow range.
trigger x	x= 0… 2000	200	0,01%	Point to activate the deadband compensation (min). Also useful for reduced sensitivity in position with control valves.
sens x	x= ON|OFF	ON	-	Activation of the sensor and internal failure monitoring.
solenoids x	x= 1|2	2	-	Number of used solenoids. Two for directional valves, one for pressure or throttle valves.
current:i x	i= A x= 0, 1, 2	0		Output current range. **0** = 1,0 A range **1** = 1,6 A range **2** = 2,6 A range DO NOT USE THIS COMMAND IF *rcurr* = ON.
dampl:i x	i= A x= 0..2000	400	0,01%	Parametering of the dither amplitude in 0,01 % units of the nominal current range. Typical values between 500 and 1200 (with 700 we always had good experience).
dfreq:i x	i= A x= 60… 400	120	Hz	Preset of the dither frequency
pwm:i x	i= A x= 100..7700	2600	Hz	Preset of the PWM frequency
ppwm:i x **ipwm:i x**	x= 1… 20 x= 5… 100	7 40	-	P-gain for control dynamics of the current control loop. Changing of these parameters should only be done by expert know how. A higher P-gain increases the control dynamics of the current control and also the effect of the dither adjustment. I-gain for control dynamics of the current control loop. Changing of these parameters should only be done by expert know how.
cmode x	X= ON|OFF	ON	-	Function of the output stage: OFF: function for closed loop positioning drives, ON: standard and for only one return line by two solenoids
save	-	-	-	Storing the programmed parameter in E²PROM.
loadback	-	-	-	Reloading the parameter from E²PROM in working RAM
help	-	-	-	Help to the commands, for terminal programs only
para	-	-	-	Parameter list with programmed data, for terminal programs only
din	-	-	-	Status of the digital inputs.
id	-	-	-	Display the module type, version and revision.
w, c, u, ia, ib	-	-	0,01%	Actual signals: command value, actual value, process data…
default	-	-	-	Preset values will be set.

5 - INSTALLATION

The card is designed for rail mounting type DIN EN 50022.

The wiring connections are on the terminal strip located on the bottom of the electronic control unit. It is recommended to use cable sections of 0.75 mm^2, up to 20 m length and of 1.00 mm^2 up to 40m length, for power supply and solenoid connections on versions it is recommended to use cables with a screened sheath connected to earth only on the card side.

NOTE 1

To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

6 - SOFTWARE KIT EWMPC/10 (code 3898401001)

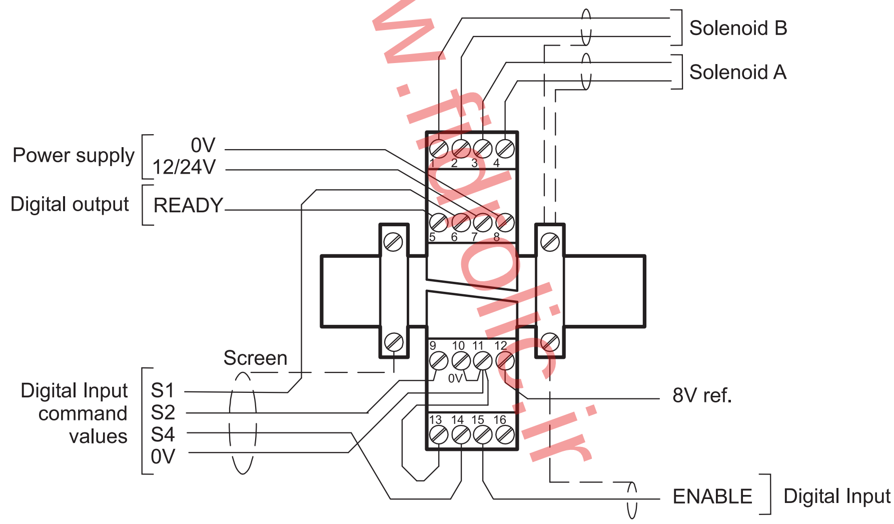
The software kit includes a USB cable (2.70 mt length) to connect the card to a PC or notebook and the software.

During the identification all information are read out of the module and the table input will be automatically generated.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft XP® operating systems.

7 - WIRING DIAGRAM



DIGITAL INPUT AND OUTPUT

PIN 1/2 — PWM outputs for solenoid control. Solenoid B

PIN 3/4 — PWM outputs for solenoid control. Solenoid A
STATUS output.

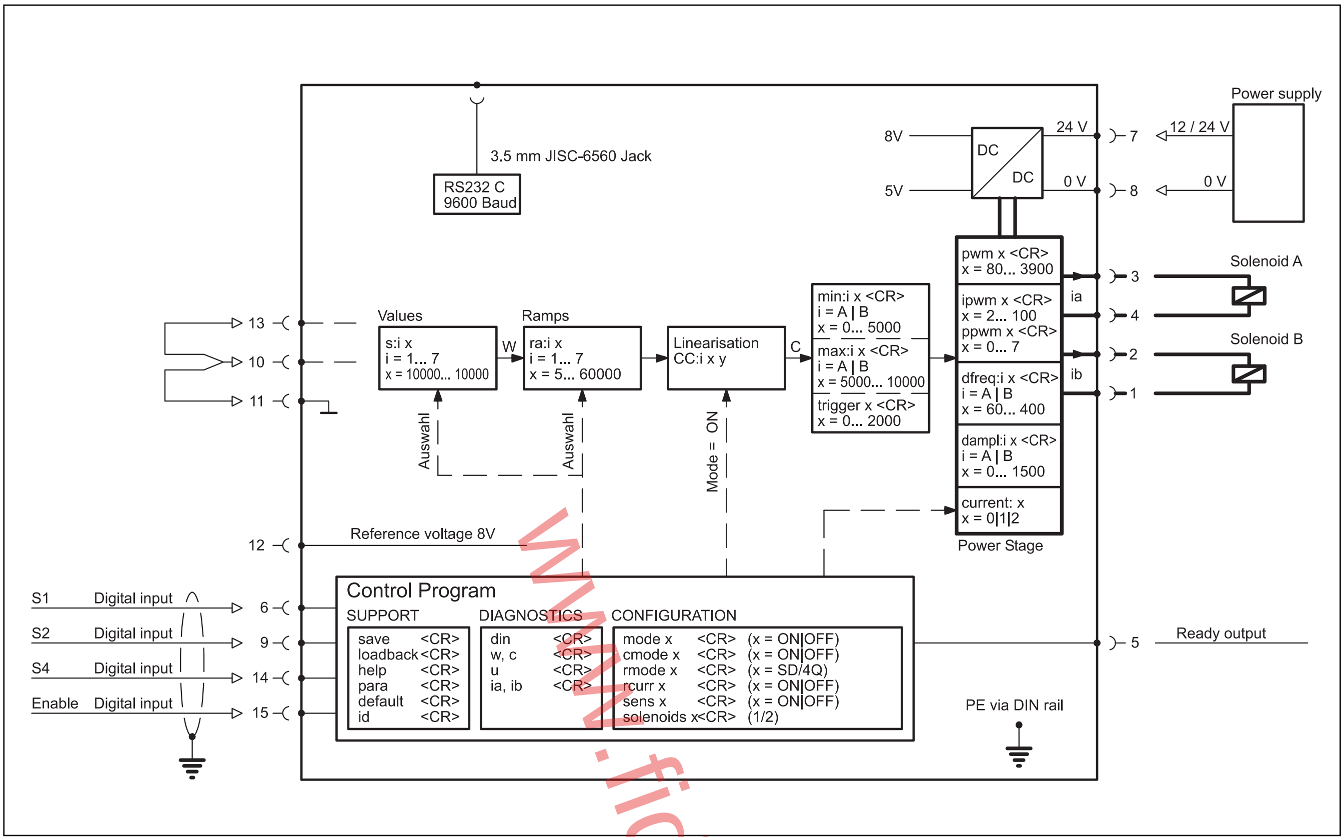
PIN 5 — READY output.
This output is high when ENABLE is active and there is no sensor error. This output corresponds with the green LED.

PIN 15 — ENABLE input:
This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. Error conditions are disabling by the ENABLE command.

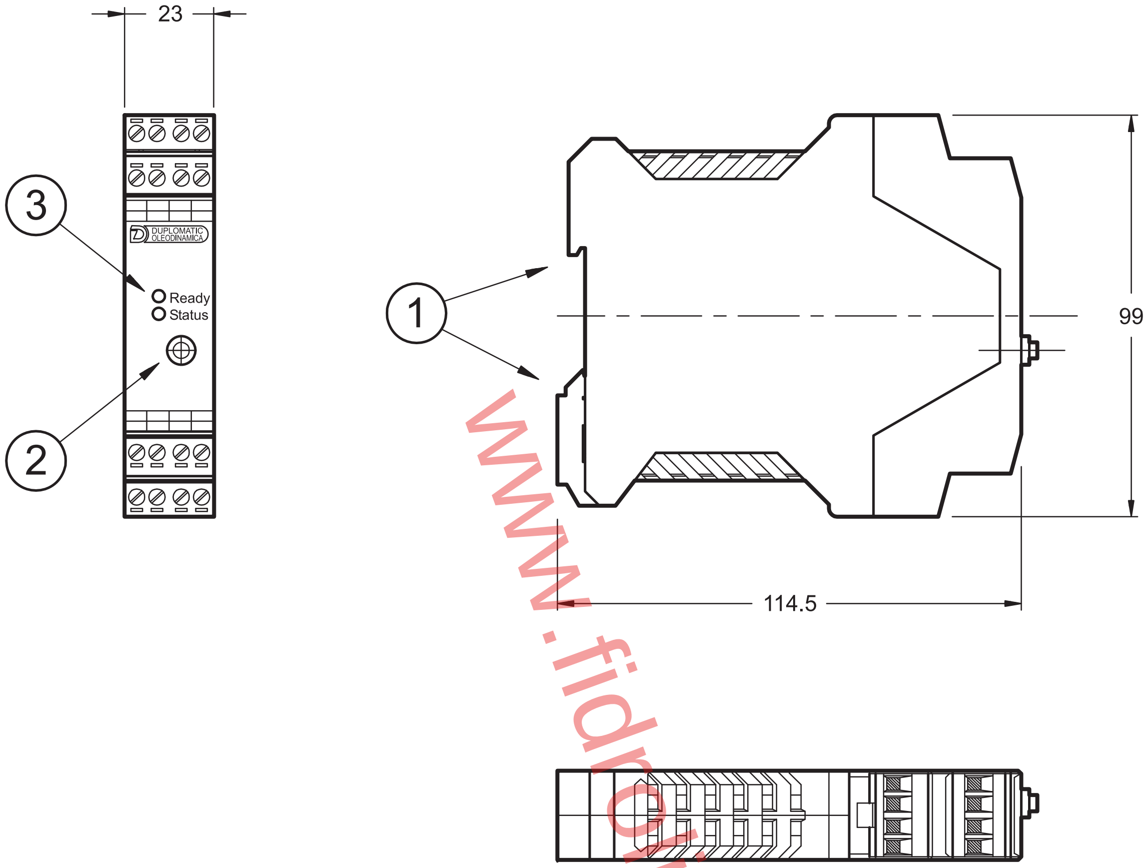
PIN 6 9 14 — Digital control inputs to retrieve the appropriate setpoints. All setpoints, in a storage area be deposited, can be linked binary. S1: Pin 6, S2: Pin 9, S4: Pin 14.
see the table below.

Address	0	1	2	3	4	5	6	7
SEL 1	0	1	0	1	0	1	0	1
SEL 2	0	0	1	1	0	0	1	1
SEL 4	0	0	0	0	1	1	1	1

8 - CARD BLOCK DIAGRAM



9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	Plug for PC cable connection
3	LED for output signals

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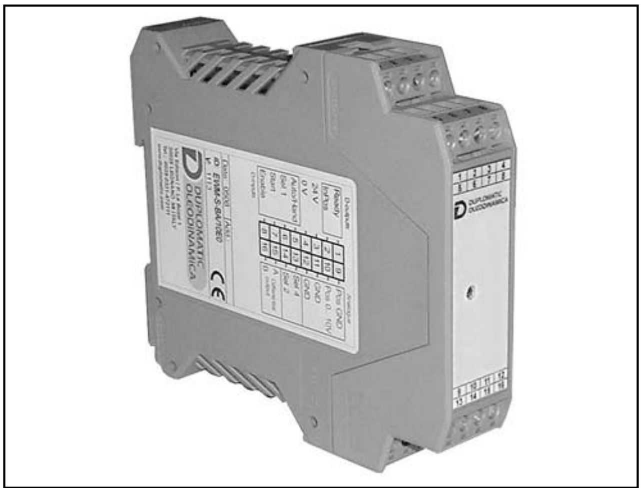


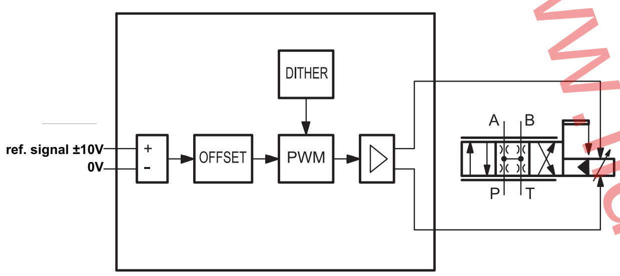
EWM-A-SV

ANALOG AMPLIFIER CARD SERVOVALVE CONTROL

SERIES 10

RAIL MOUNTING TYPE:
DIN EN 50022

OPERATING PRINCIPLE



— This card is designed for a dynamic control of servovalves with the current output controlled in closed loop.

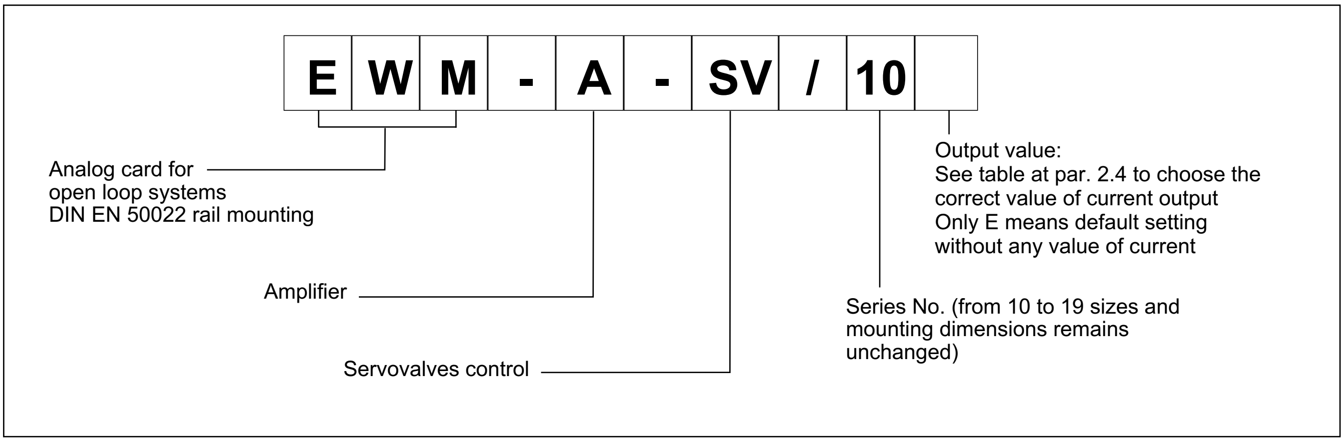
— This card is an analog amplifier that receive an analog input ±10V to move the servovalves via different values of current adjustable by DIL switches on board with steps of 10mA.

— This card has embedded an auxiliary supply positive and negative to power an external potentiometer.

TECHNICAL CHARACTERISTICS

Power supply	V DC	18 ÷ 30 ripple included
Current consumption	mA	100 + solenoid current consumption (max 300 mA)
Command position value	V	± 10 (R_I = 100 kΩ)
Output current	mA	10 to 200 (DIL switches internal selection) (R_I = 33 Ω for max I)
Dither Amplitude	Hz %	250 / 100 (DIL switch internal selection S6) 0...15 (5% pre-adjusted) of current
Offset	%	± 10
Auxiliary supply	V mA	± 10 10
Electromagnetic compatibility (EMC): according to 2004/108/EU standards		Emissions EN 61000-6-4 Immunity EN 61000-6-2
Housing material		thermoplastic polyamide PA6.6 -combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w)
Connector		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	0 / 50
Protection degree		IP 20

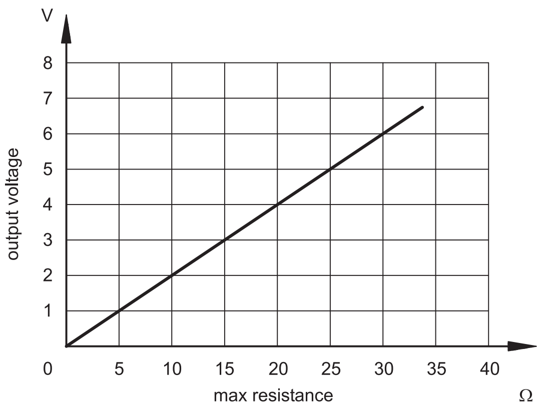
1 - IDENTIFICATION CODE



The power amplifier is controlled by an analog input ± 10 Volt.

The output current is closed loop controlled and therefore independent from the supply voltage and the solenoid resistance.

The diagram below shows as resistence changes in function of output to keep constant current (I = 200mA)



2 - FUNCTIONAL SPECIFICATIONS

2.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards.
All inductivity at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).
It is recommended to use a regulated power supply (linear or switching mode).

2.2 - Electrical protections

All inputs and outputs are protected against overvoltage and have filters.

2.3 - Reference signal

The card accepts an analogue input signal. The command value can be ± 10 V (R_I = 100kΩ).

2.4 - Output values

The card has different output values in current between 10mA to 200mA. It is necessary to open the case and inside the card there are internal DIL switches (S1…S5) for the adjustements:

	Current	S1	S2	S3	S4	S5
E	0 mA	OFF	OFF	OFF	OFF	OFF
E10	10 mA	ON	OFF	OFF	OFF	OFF
E20	20 mA	OFF	ON	OFF	OFF	OFF
E30	30 mA	ON	ON	OFF	OFF	OFF
E40	40 mA	OFF	OFF	ON	OFF	OFF
E50	50 mA	ON	OFF	ON	OFF	OFF
E60	60 mA	OFF	ON	ON	OFF	OFF
E70	70 mA	ON	ON	ON	OFF	OFF
E80	80 mA	OFF	OFF	OFF	ON	OFF
E90	90 mA	ON	OFF	OFF	ON	OFF
E100	100 mA	OFF	ON	OFF	ON	OFF
E110	110 mA	ON	ON	OFF	ON	OFF
E120	120 mA	OFF	OFF	ON	ON	OFF
E130	130 mA	ON	OFF	ON	ON	OFF
E140	140 mA	OFF	ON	ON	ON	OFF
E150	150 mA	ON	ON	ON	ON	OFF
E160	160 mA	OFF	OFF	OFF	OFF	ON
E170	170 mA	ON	OFF	OFF	OFF	ON
E180	180 mA	OFF	ON	OFF	OFF	ON
E190	190 mA	ON	ON	OFF	OFF	ON
E200	200 mA	OFF	OFF	ON	OFF	ON

2.5 - Digital Output

The digital output is the POWER ON signal, displayed from the green led.

3 - LED FUNCTIONS

There is only one green led.

GREEN: Shows if the card is ready.

ON - The card is supplied
OFF - No power supply

4 - ADJUSTMENTS

For these cards it is possible the regulation of offset and dither amplitude. It is necessary to open the case and inside the card there are offset and dither potentiometers for the adjustements.

4.1 - Offset

With this potentiometer it is possible to adjust the zero point. This module is pre-adjusted, often no further adjustment is necessary.

4.2 - Dither

With this potentiometer it is possible to adjust the dither amplitude. The dither amplitude have to be optimised to get best valve or drive performance. Dither adjustment will reduce hysteresis. The frequency range has to be selected by internal DIL switch S6:

S6	Dither
ON	250 Hz
OFF	100 Hz

5 - INSTALLATION

The card is designed for rail mounting type DIN EN 50022.

The wiring connections are on the terminal strip located on the bottom of the electronic control unit. It is recommended to use cable sections of 0.75 mm^2, up to 20 m length and of 1.00 mm^2 up to 40m length, for power supply and solenoid connections on versions it is recommended to use cables with a screened sheath connected to earth only on the card side.

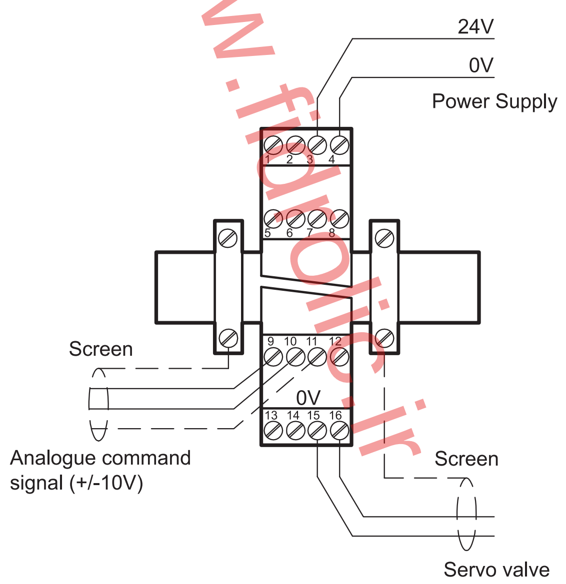
NOTE

To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

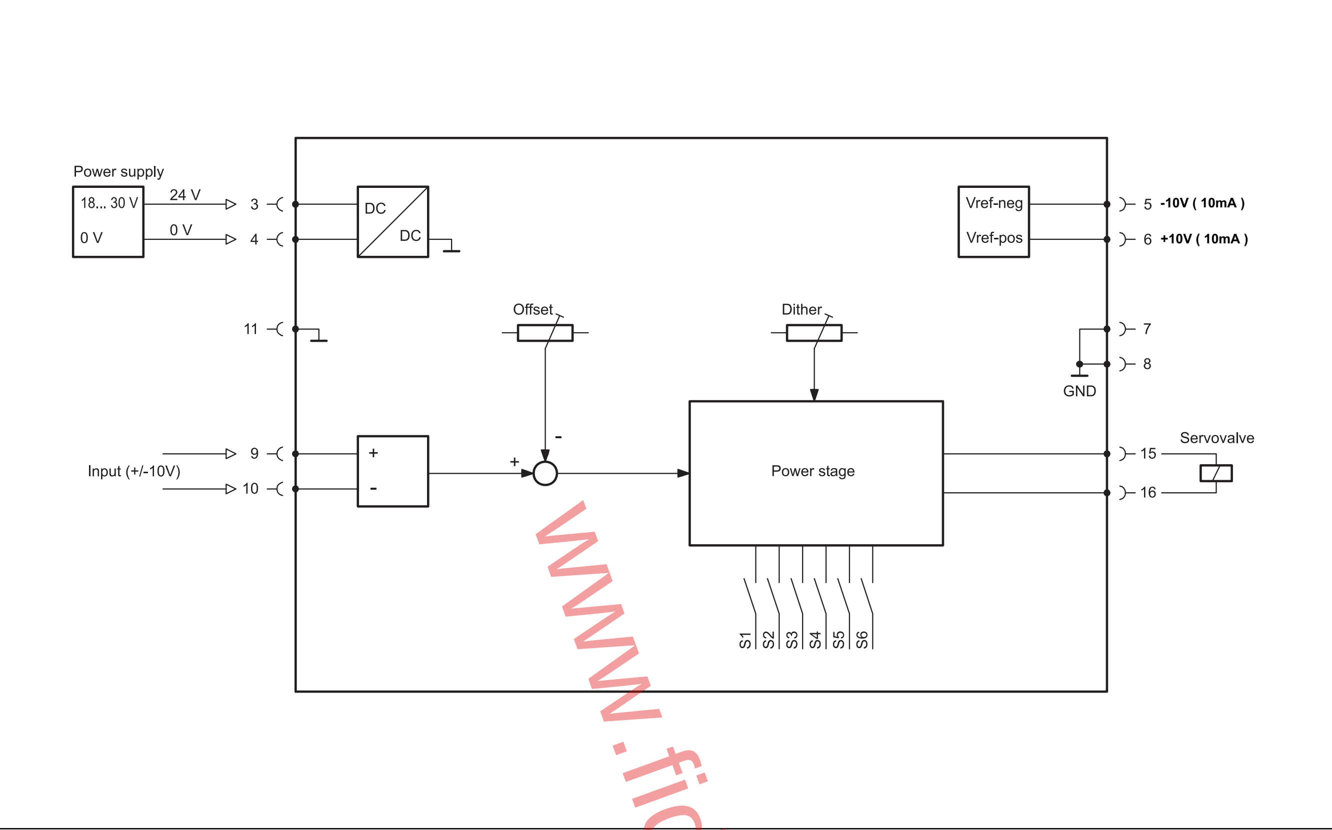
6 - WIRING DIAGRAM



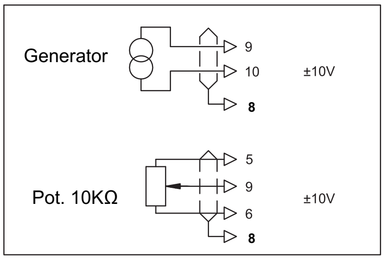
ANALOG INPUT AND OUTPUT

PIN 15/16	PWM outputs for coils control.
PIN 5/6	Auxiliary supply +10V (PIN 6) and -10V (PIN 5) to power external potentiometer.
PIN 9/10	Reference signal ±10V

7 - CARD BLOCK DIAGRAM

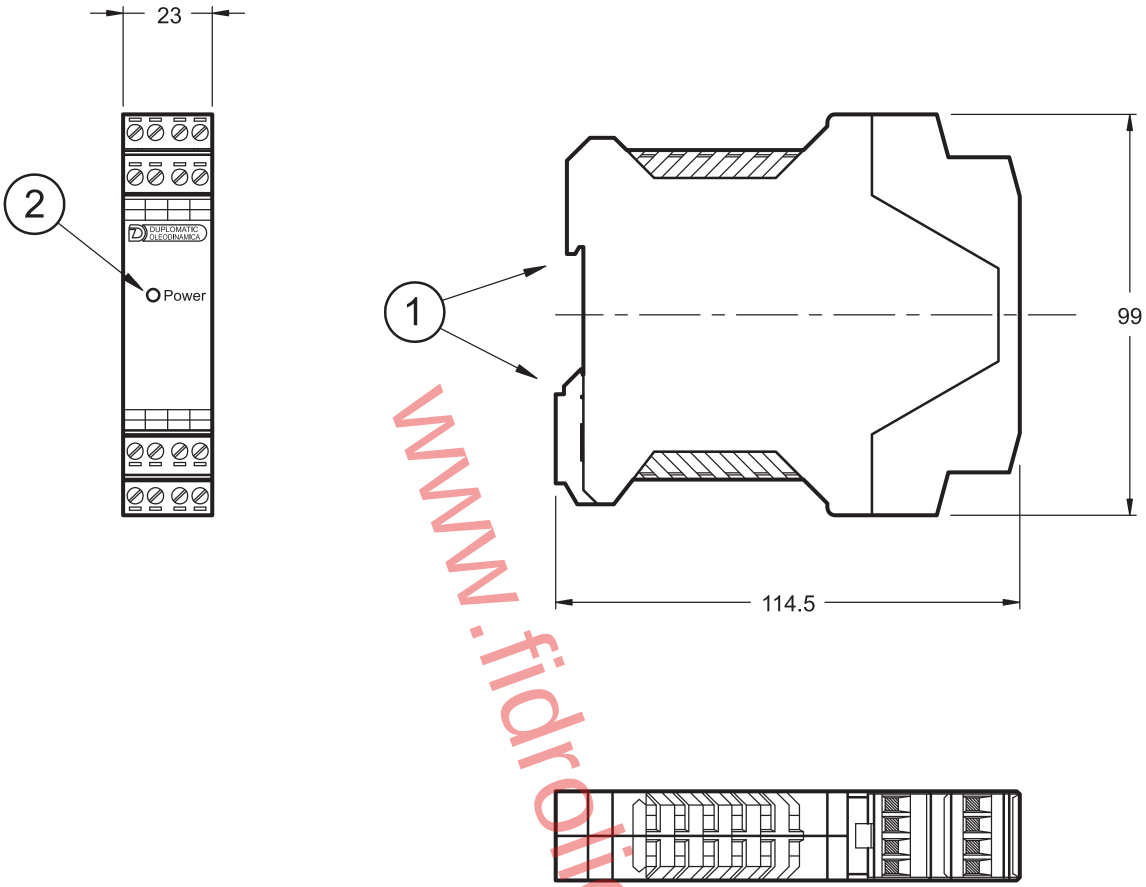


AVAILABLE COMMAND SIGNALS



NOTE: with the potentiometer as reference signal it is necessary to connect PIN 10 with PIN 11.

8 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	LED for power on signal

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89 620/116 ED

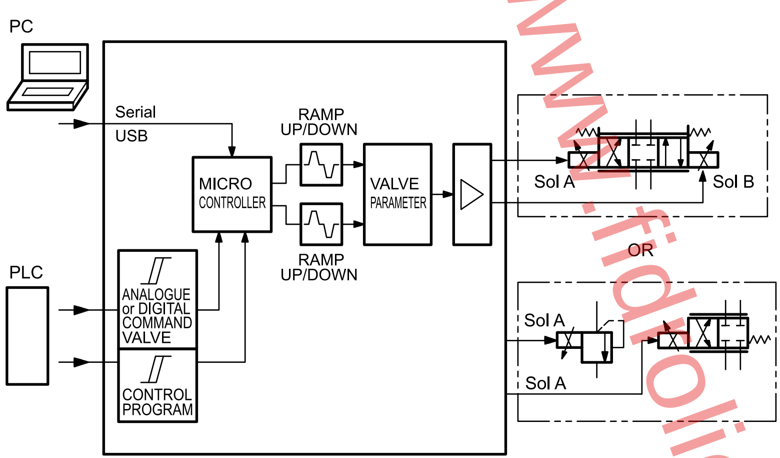
EWM-A-PV

UNIVERSAL AMPLIFIER FOR PROPORTIONAL VALVES

SERIES 20

RAIL MOUNTING TYPE:
DIN EN 50022

OPERATING PRINCIPLE



— This card is designed for proportional valves control: directional, pressure or throttle valves. Current output controlled in closed loop.

— Function control mode as parameter to be configured:
- for dual solenoids proportional valves,with analogue command signal ± 10V or 4 ÷ 20 mA.
- for one or two single solenoid proportional valves (throttle, pressure, directional..), with analogue input signal 0 ÷ 10V or 4 ÷ 20 mA.
- for proportional valves, single or dual solenoids either, with pre-programmed values, selectable by 3 digital inputs.

— Card setup via software only, through an on-board USB-B port.

TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ÷ 30 ripple included
Fuse, external	A	3 medium time lag
Current consumption	W	60 depending on type of solenoid, number of operating solenoids
Analogue command values	V mA	±10, 0 ÷ 10 (R_I = min 90 kΩ) 4 ÷ 20 (R_I = 390 Ω)
Analogue inputs value resolution	%	< 0,01
Digital command values	V	OFF: <2V, ON >10V (R_I = 25 kΩ)
Sample time of solenoid current control	ms	0.125
Sample time	ms	1
Output current	mA	500 ÷ 2600
PWM frequency	Hz	61 ÷ 2604 adjustable in prearranged steps
Interface		USB B type 2.0
Electromagnetic compatibility (EMC) 2004/108/EC		Immunity EN 61000-6-2: 8/2005 Emissions EN 61000-6-4: 6/2007; A1:2011
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w)
Connector		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

1 - IDENTIFICATION CODE

E	W	M	-	A	-	PV	/	20

- Digital card DIN EN 50022 rail mounting (EWM)
- Amplifier (A)
- For proportional valves (PV)
- Series No. (from 20 to 29 sizes and mounting dimensions remain unchanged) (20)

2 - FEATURES

Controller functions

General power amplifier for 3 different applications:

- control of one proportional directional valve (2 solenoids) with current controlled by analog input signal
- control of one or two single solenoid proportional valves (throttle, pressure, directional..) with output current controlled by analog input signal
- control of proportional valves (with single or double solenoids either) by three digital input signals to select up to eight pre-programmed command and ramp values

- The output current is closed loop controlled: the current to solenoid is closed loop controlled, so is independent from supply and solenoid resistance.
- Parameters programmable via software: Ramps, Dither frequency and amplitude, PWM frequency and PWM gains
- Free scaling of analogue inputs
- Nominal current selectable stepless via software
- The power stage is controlled by an enable input (ENABLE)

Adaptation of the valve characteristic curve

- Characteristics linearization of current output via 10 XY-points per direction
- Deadband compensation

Monitoring functions

- The output stage is monitored for cable breakdown, is short circuit proof and disables the power stage in case of an error
- Failure monitoring for current analog inputs
- Range monitoring of the input signals (e. g. detecting failures of joystick)

Other characteristics

- GL-certification
- Output value in voltage or current, to be configured via software
- Card configuration is made via software, through on-board USB

3 - FUNCTIONAL SPECIFICATIONS

3.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, free-wheel diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

NOTE: The value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoids to be controlled.

3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; OFF: <2V, ON >10V. Input resistance 25 kΩ. See the block diagrams for the electric connections.

3.4 - Reference signals

This card is broadly customizable and the command value depends on the function mode selected. (FUNCTION parameter). Once the function has been set and the data saved, the input will be configured automatically

3.4.1 - A-PV function, analogue:

±10V or 4÷20 mA (one channel, 2 solenoids)

3.4.2 - 2A-PV function, analogue:

0÷10V or 4÷20 mA (two indipendent channels)

3.4.3 -D-RL digital, to be pre-parameterized by parameter

8 pre-programmed values (units %), selectable by 3 digital inputs (8 binary targets).

For both single or dual solenoids proportional valve either.

3.5 - Output value

Output value is in current, value range 500 ÷ 2600 mA.

All cables which lead outside must be screened.

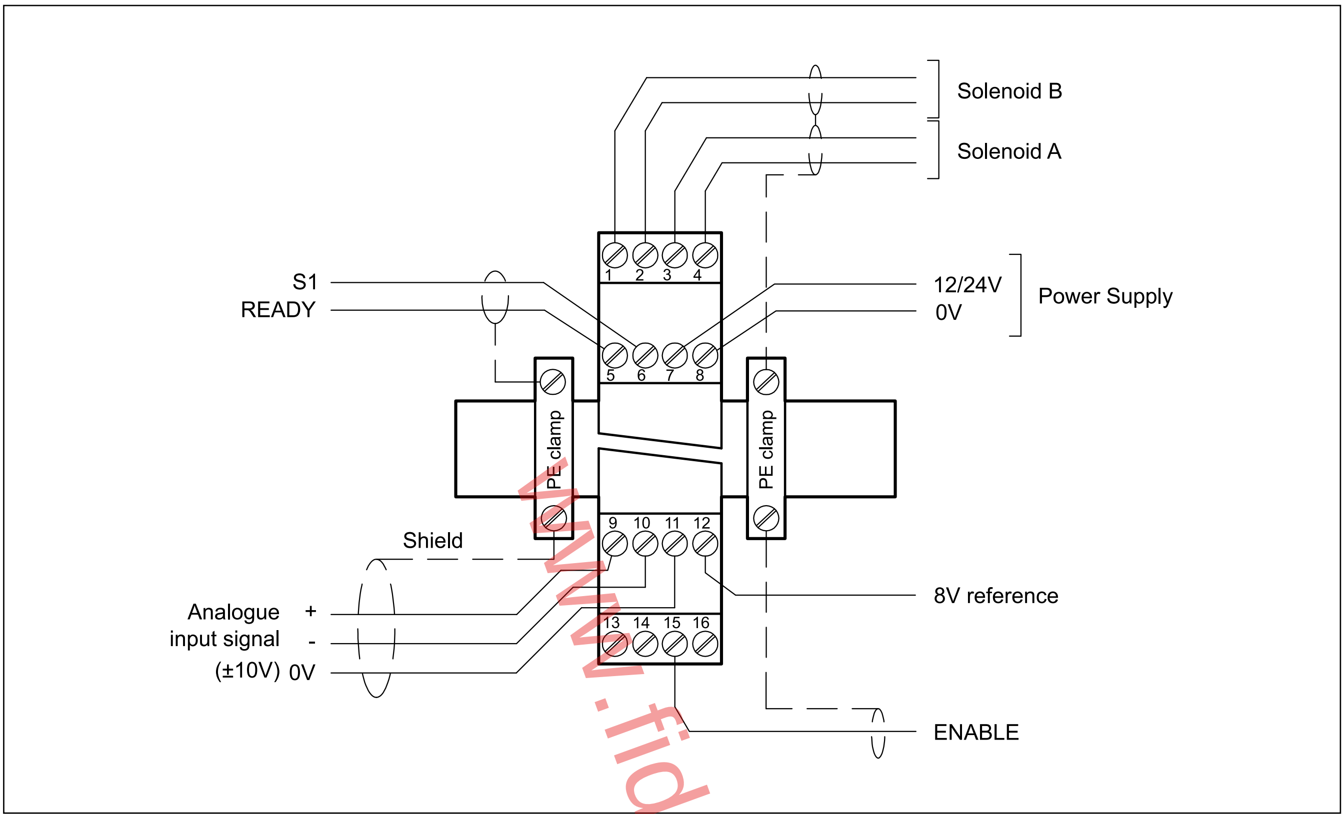
3.6 - Digital outputs

The digital output is READY signal, displayed by the green LED on the front panel.

Low level < 2 V High Level > max V+, where V+ = power supply (max 50 V).

4 - WIRING DIAGRAMS

4.1 - FUNCT A-PV: analogue signal for dual solenoids directional valve



DIGITAL INPUT AND OUTPUT

PIN 5 — READY output.
ON: No internal or external errors are detected
OFF: ENABLE (PIN 15) is deactivated or an error is detected

PIN 6 — S1 input:
Function dependent on parameter PIN:6 (USCALE/RAMP).
OFF: Output current depends on parameter USCALE / ramp function is deactivated.
ON: Output current is not scaled by USCALE / ramp function is activated.

PIN 15 — ENABLE input
This digital input signal initializes the application.
The analogue output is active and the READY signal indicates that all components are working correctly.
By deactivating this input the errors signals are reset.

ANALOGUE INPUT

PIN 11 — 0V reference for the signal inputs.
Warning! PIN 11 and PIN 8 are connected internally

PIN 10/9 — Command input signal (w)
range -100...+100%
corresponds to ±10V or 4 ÷20 mA

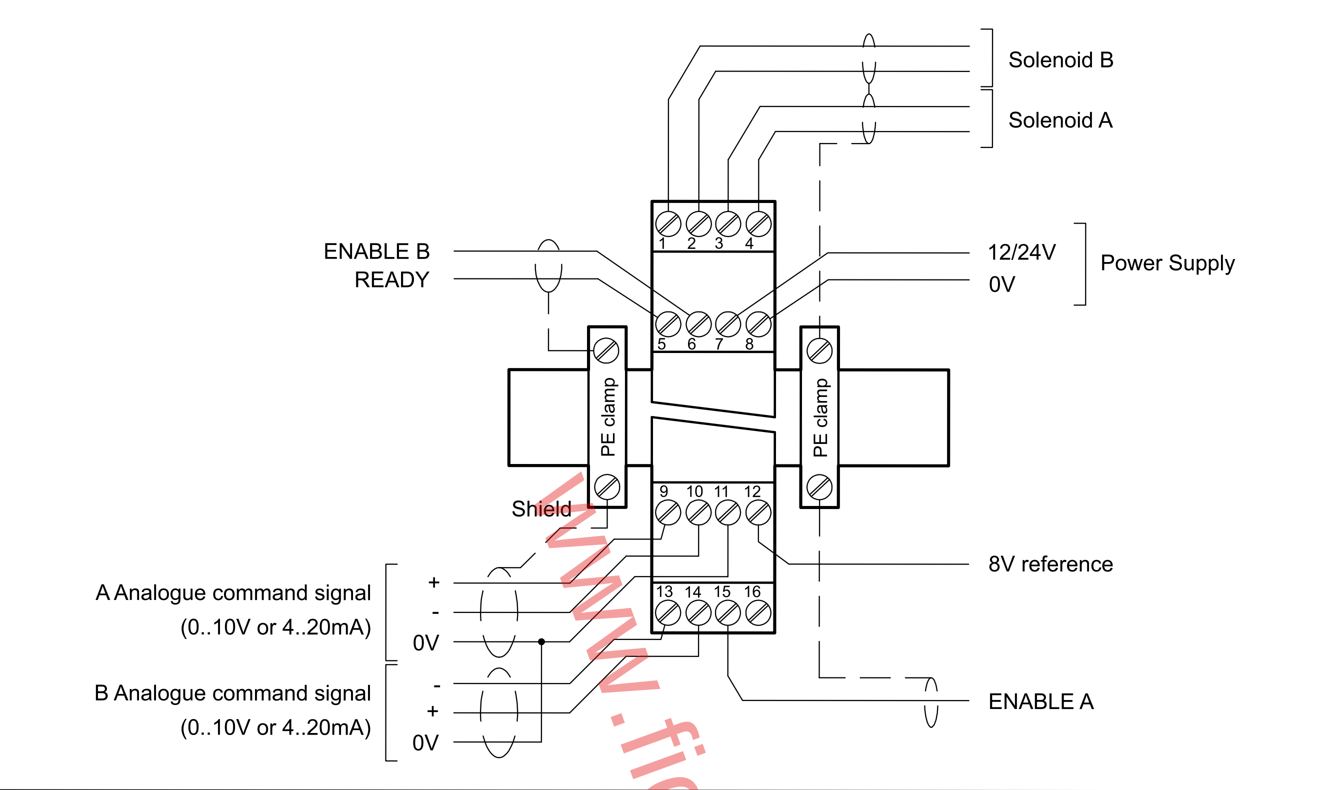
POWER OUTPUT

PIN 1/2 — PWM outputs for solenoid control. Solenoid B

PIN 3/4 — PWM output for valve control.

PIN 12 — 8V reference output (max. 25mA)

4.2 - FUNCTION 2A-PV: analogue signal, two independent channels, for up to two single solenoid valves



DIGITAL INPUT AND OUTPUT

PIN 5	READY output. ON: No internal or external errors are detected. OFF: Both power stages are deactivated or an error is detected. This output is visible on the green LED
PIN 6	ENABLE Input Channel B (dependent on ENABLE_B parameter): This digital input signal initializes the application. The output and the READY signal will be activated. By deactivating error signals are reset.
PIN 15	ENABLE Input channels A/B or channel A either (dependent on ENABLE_B parameter: if set to OFF, digital input PIN 15 enables both output channels. if ON, the two enable are independent) This digital input signal initializes the application. The output and the READY signal will be activated. By deactivating this input the errors signals are reset.

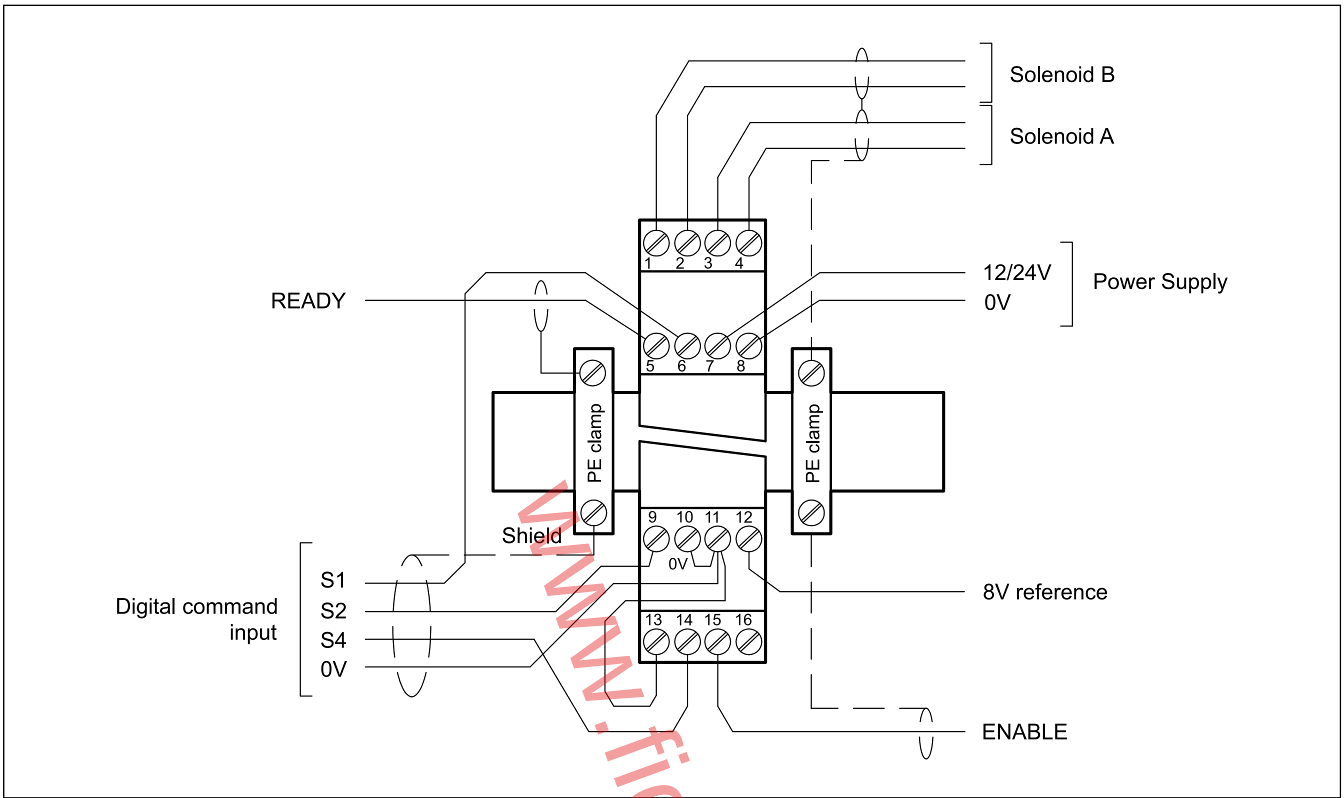
ANALOGUE INPUT

PIN 11	0V reference for the signal inputs. **Warning**! PIN 11 and PIN 8 are connected internally
PIN 10/9	Command input signal A (wa) range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA
PIN 13/14	Command input signal B (wb) range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

POWER OUTPUT

PIN 1/2	PWM outputs for solenoid control. Solenoid B
PIN 3/4	PWM outputs for solenoid control. Solenoid A
PIN 12	8V reference output (max. 25 mA)

4.3 - FUNCT D-RL: preset digital inputs



DIGITAL INPUT AND OUTPUT

PIN 5
READY output.
ON: No internal or external errors are detected
OFF: ENABLE (PIN 15) is deactivated or an error is detected

PIN 6, 9, 14
Digital gate inputs for selecting the command value:
PIN 6: S1 PIN 9: S2 PIN 14: S4
The whole range of set points can be chosen by binary coding of these inputs.
see the table below.

Address	0	1	2	3	4	5	6	7
S1	0	1	0	1	0	1	0	1
S2	0	0	1	1	0	0	1	1
S4	0	0	0	0	1	1	1	1

PIN 15
ENABLE input
This digital input signal initializes the application.
The output and the READY signal will be activated.
By deactivating this input the errors signals are reset.

POWER OUTPUT

PIN 1/2
PWM outputs for solenoid control. Solenoid B

PIN 3/4
PWM output for valve control.

PIN 12
8V reference output (max. 25mA)

5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm^2 up to 20 m length, and of 1.00 mm^2 up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

NOTE : To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.

⚠ **WARNING! Plugs with free-wheeling diodes and LED indicators cannot be used with current controlled power outputs. They interfere with the current control and can destroy the output stage.**

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE “protected earth” and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

6 - DEVICE SETUP

Card set-up is possible via software only.

6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Duplomatic Oleodinamica website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7 and 8.

⚠ **WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.**

6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at standard level, easier, or expert, where a greater number of parameters is displayed and can be customized.

For a complete list of the parameters and their settings please refer to the ***Technical Manual 89620 ETM***.

7 - MAIN FEATURES

7.1 - Applications

The power amplifier (D-RL function) is controlled by an enable input and three switch signals. Therefore 8 demand values can be activated binary.

In the event of analogue control (A-PV function) it’s possible to preset the directions with two inputs and switch over between rapid and slow speed with the third input.

The output current is closed loop controlled and therefore independent from the supply voltage and the solenoid resistance.

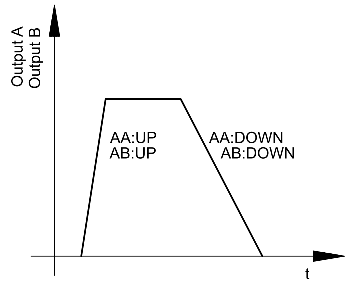
The output signal (of up to 2.6A) can control a variety of valves which need a flexible adaptation of the solenoid control, such as pressure relieve valves and pressure control valves, directional and throttle valves as such no on-board electronics are needed.

7.2 - Ramp function /acceleration time

The parameters for ramp up and ramp down can be set in milliseconds. These values are the amount of time that the command signal will take to follow a step change in the reference signal.

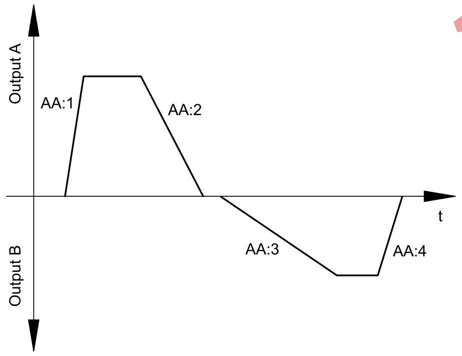
for 2A-PV

Two quadrant ramp function.



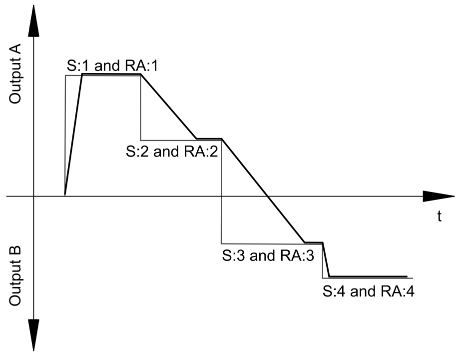
for A-PV

Four quadrants ramp function.



for D-RL

This configuration can take advantage either of the same four quadrant ramp function of A-PV or assign a ramp time for every command value (parameter RMODE)

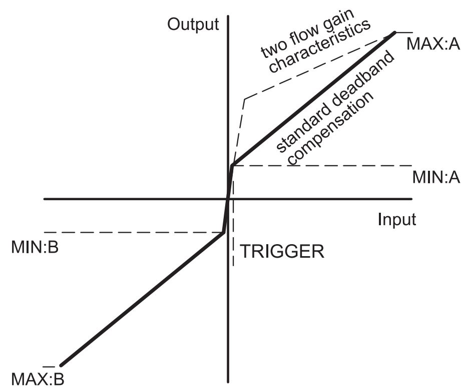


7.3 - Adaption of the output signal to the valve characteristics (TRIGGER)

With the MAX value, the maximum output can be easily defined. With the MIN value, the overlap (dead band of the valve) can be compensated. Via the TRIGGER the activation point of the MIN function is set and so a non-sensitive range around the zero-point can be specified.

If the MIN value is set too high, it influences the minimal pressure, which cannot be adjusted any longer. In extreme case this causes to an oscillating at small input values.

The diagram below is valid for A-PV and D-RL configuration. For 2A -PV please consider just the 1st quadrant.



7.4 - Linearization (CCA, CCB, CC)

A user defined signal characteristic can be set by switching on the CCMODE parameter.

The influence of the user defined linearization can be estimated via the process data on the monitor or on the oscilloscope on EWMPC/20 software.

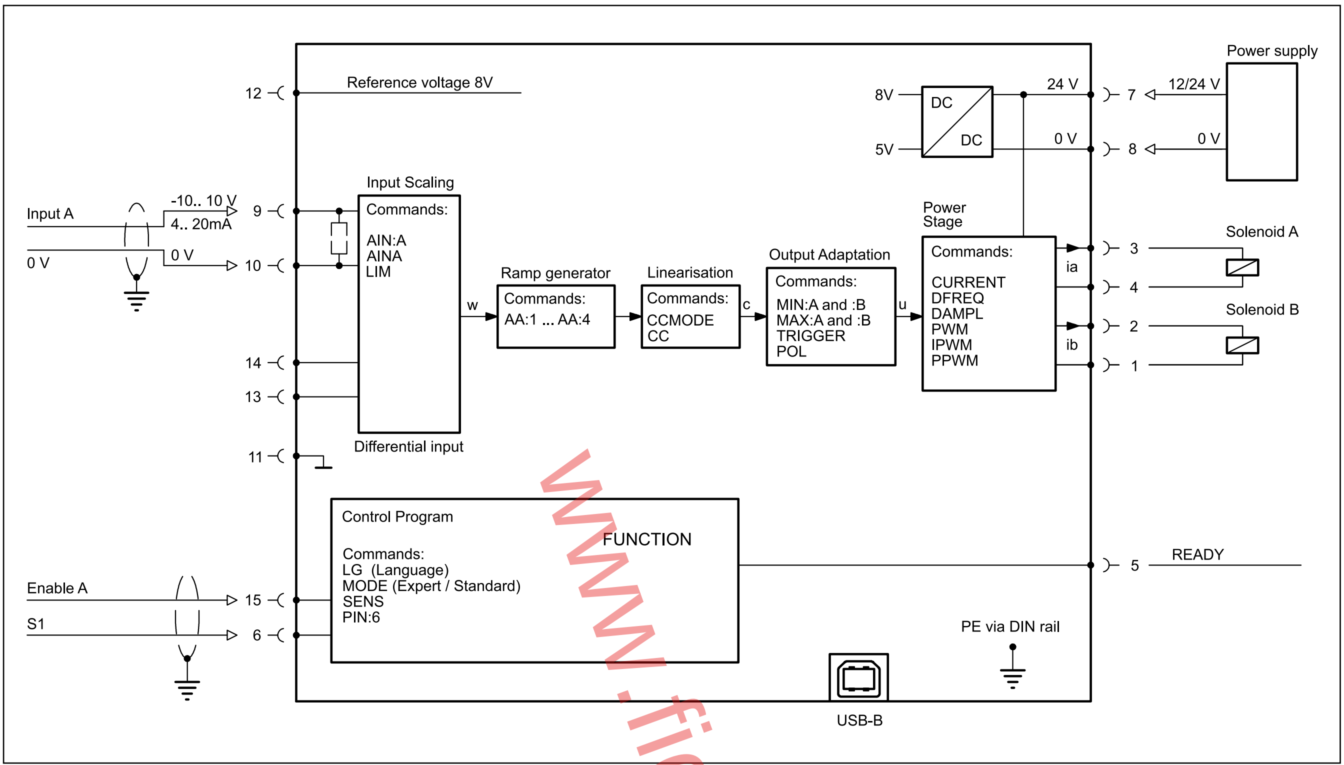
By deactivating CCMODE a simple and quick estimation of the linearization is possible

7.5 - Power Amplifier

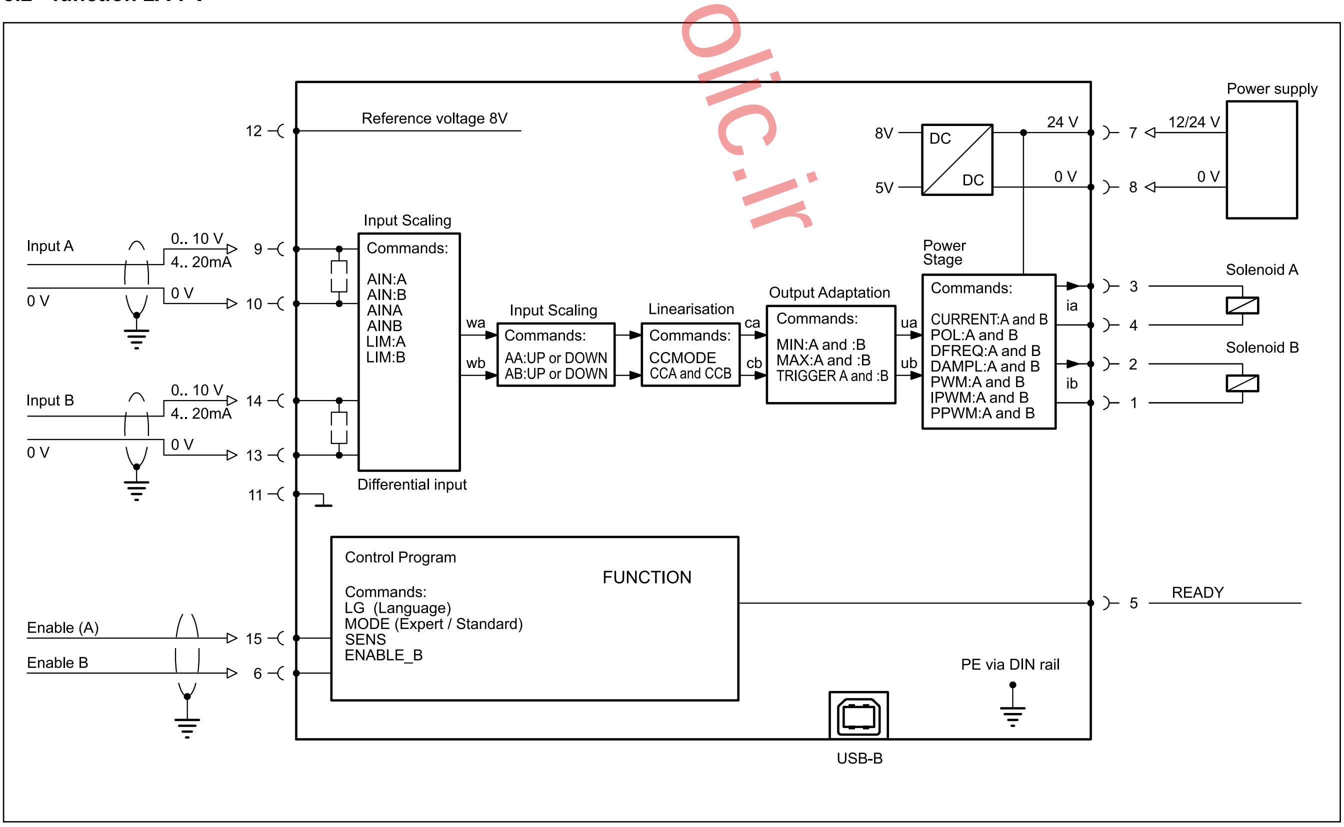
The module comes with an embedded power amplifier that is capable to generating a PWM current signal of up to 2.6A. As such the nominal current, dither, frequency and the various parameters of the current loop can be accessed and modified.

8 - CARD BLOCK DIAGRAMS

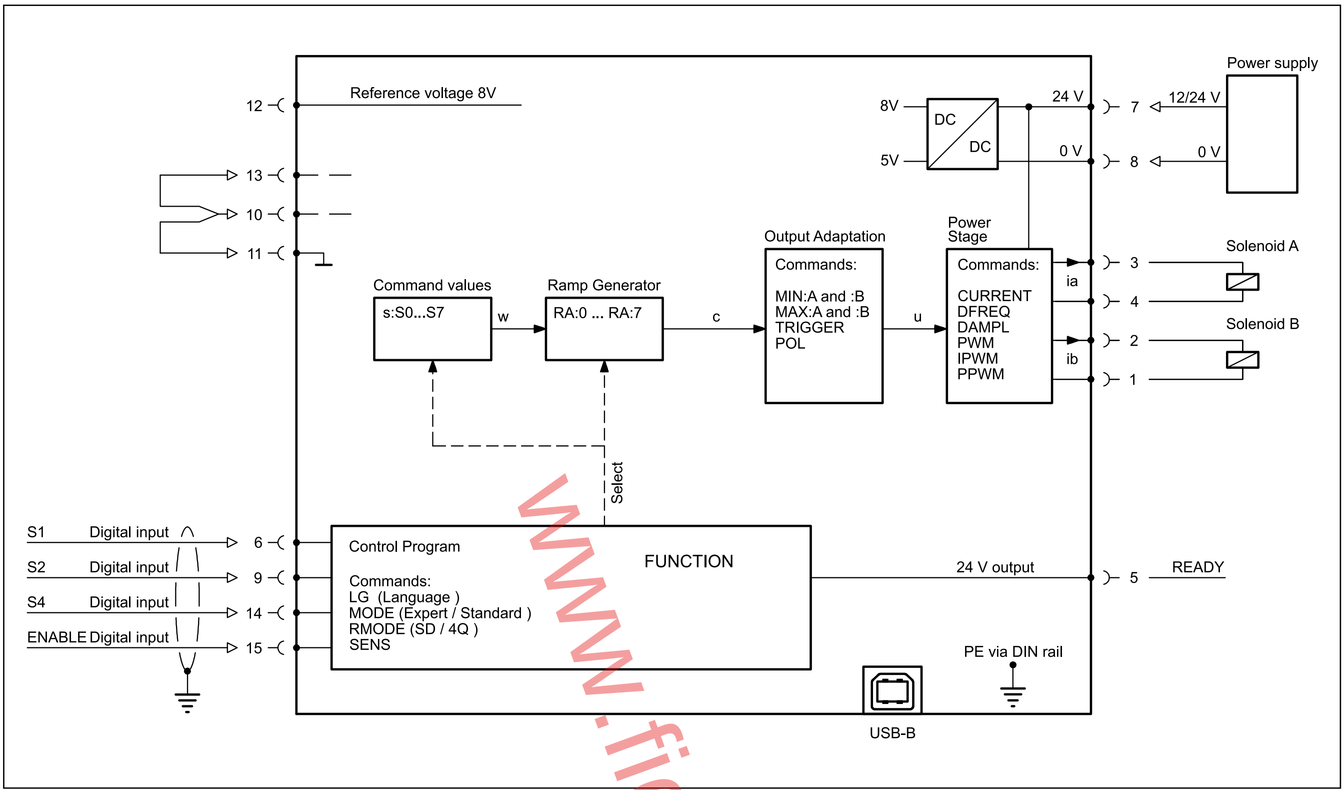
8.1 - function A-PV



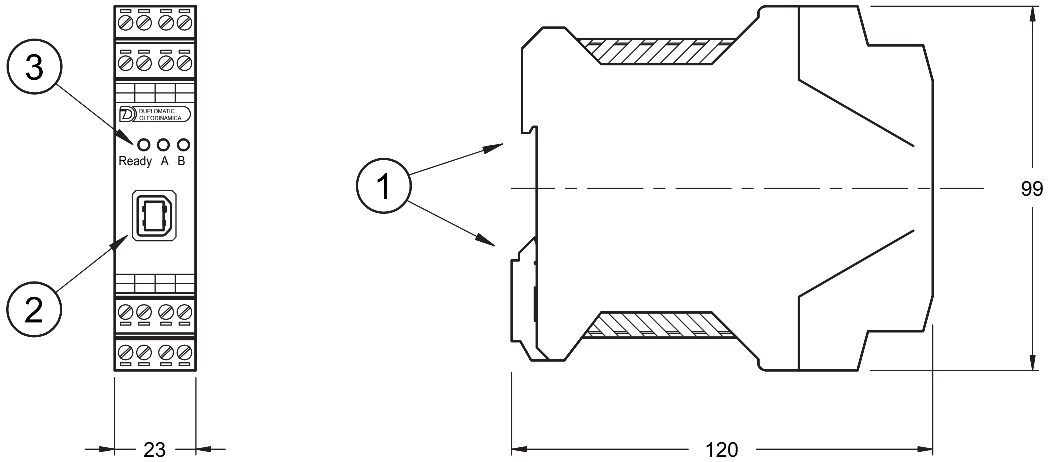
8.2 - function 2A-PV



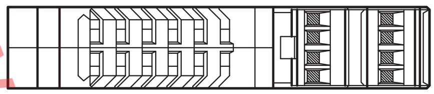
8.3 - function D-RL



9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	USB interface, for setup
3	LEDs for output signals



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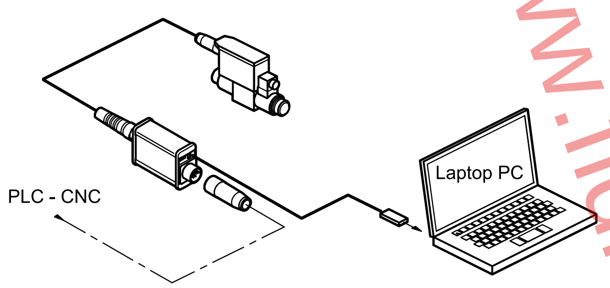
LINPC-USB

TEST DEVICE FOR PROPORTIONAL VALVES WITH INTEGRATED ELECTRONICS

SERIES 30

OPERATING PRINCIPLE



— The kit contains a test device with embedded connection cable 7 pin and a USB cable for connection to the PC. The dedicated software are available for download from our web site.

— The device is suitable for troubleshooting and functional testing of Duplomatic proportional valves with LIN-bus interface, for open loop (type G) and closed loop (type J), series 20, 30 and 31.

— The software allow the check of settings, display the diagnostic and permit to make changes on the standard parameter setting made in factory, adapting it to your system.

— No additional power supply is required: the device uses the supply source from the 7 pin system cable.

TECHNICAL CHARACTERISTICS

Power supply	V CC	24 (19 ÷ 30)
Current consumption	mA	50
Connector to the valve		7 - pin MIL-C-5015-G (DIN 43563)
Connection cable		USB 2.0
Electromagnetic compatibility (EMC) :		according to 2004/108/EC EN 61000-6-4 (emissions) EN 61000-6-2 (immunity)
Housing dimensions	mm	104x63x38 + 2000 outgoing cable
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

1 - IDENTIFICATION CODE

LIN	PC	-	USB	/	30

LIN: Serial communication protocol type LIN-bus

PC: Interface

USB: Computer interface type

30: Series number

2 - DESCRIPTION

The device acts as interface between the PC and the valve on-board electronics. It allows the customization of the parameters via software and diagnostics and troubleshooting, by means of the internal monitors available in the software (EBC for series 30, EWMPC for series 20).

The kit contains:

- test device with integrated 7-pin cable to be connected to the valve
- USB Cable 2.0 A - Male to Micro B (3 m).

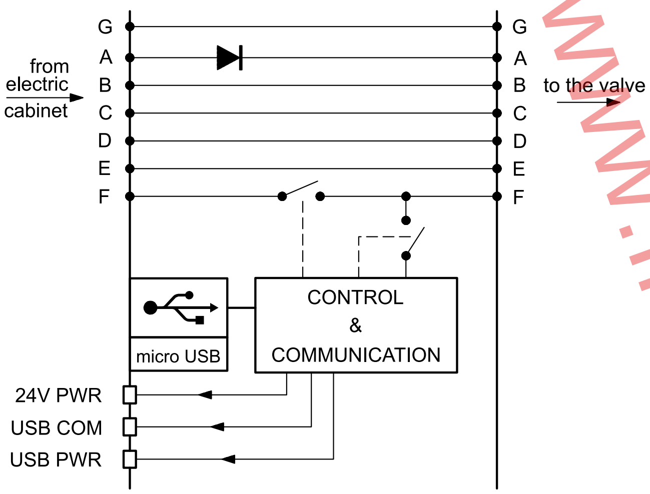
⚠ **The USB cable cannot be longer than 3 m, in order to maintain the communication quality.**

Software and customization Guide are available for download at www.duplomatic.com , 'Documents & downloads'.

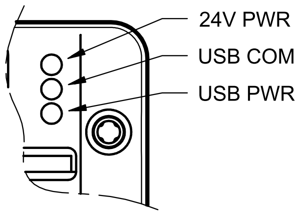
The EBC software is compliant with Windows OS 7, 8 and 10.

More details on device operation are available in the Software Guide.

3 - BLOCK DIAGRAM



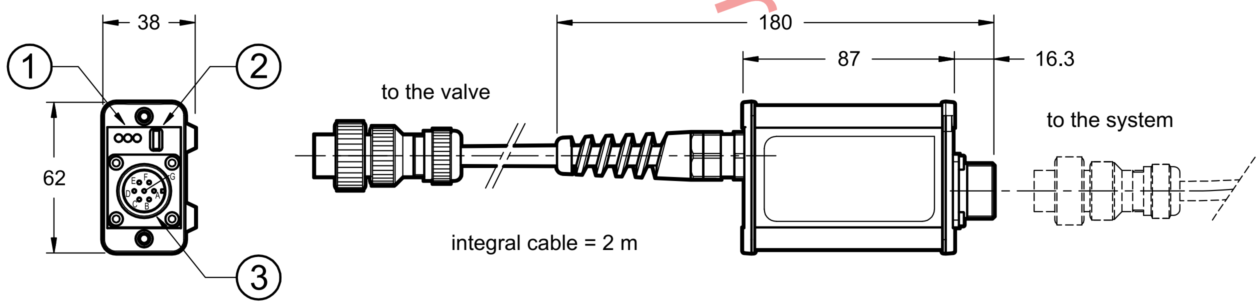
4 - LED



function	description
24V PWR (24V powered)	Main power supply via 24V (pin A) green LED indicates the device is powered by 24 V source on pin A of the 7-pin connector.
USB COM	USB communication red = [TX] transmission green = [RX] receiving
USB PWR (USB powered)	USB supply yellow indicates that the USB section is powered.

⚠ **WARNING! Connecting the device will cut off the pin F monitor signal from the valve, in order to allow the LINbus communication. This behaviour can be managed via software.**

5 - OVERALL DIMENSIONS



1	LED
2	USB micro B socket (cable included - length = 3 m)
3	Main connection 7 pin

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DUPLOMATIC OLEODINAMICA

PSC

CARD HOLDERS FOR ELECTRONIC CONTROL UNITS IN EUROCARD FORMAT

SERIES 20

IEC 60603-2 (DIN 41612)

TECHNICAL CHARACTERISTICS

CARD HOLDER TYPE		32D	48F
Connector type		IEC 603 / DIN 41612 female	
Number of poles		32	48
Connector shape		D	F
Nominal voltage	V	250	
Nominal current	A	4	
Flexible conductors max section	mm^2	2,5	
Stiff conductors max section	mm^2	4	
Conductors wiring		terminal block with fastening bolts	

DESCRIPTION

— The card holders type PSC are accessories suitable to be installed on electronic control units type UEIK.

— They are available with a IEC 603 / DIN 41612 connector, with a female fitting, either D shape 32 poles, or F shape 48 poles.

— They are supplied with a special safety locking, which blocks the electronic control unit and prevents any accidental contact loss between the two used connectors.

— The conductor wiring is carried out via a terminal block with fastening bolts.

— They can be installed inside a switchboard and be fixed directly on a plate.

1 - IDENTIFICATION CODE

P	S	C	-		/	20

Card holders for electronic control units in Eurocard format (PSC)

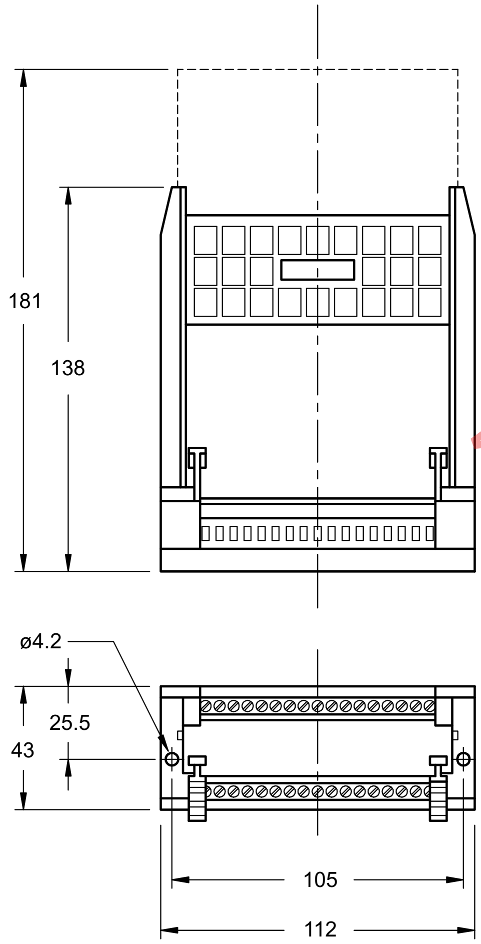
Series No. (from 20 to 29 sizes and mounting dimensions remain unchanged) (20)

Number of poles and connector shape:
32D = 32 poles, D shape
48F = 48 poles, F shape

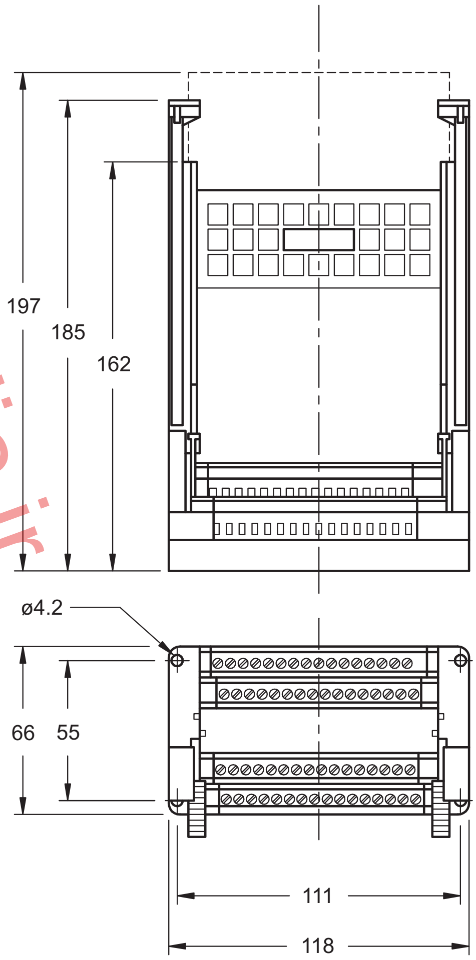
2 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

PSC-32D/20



PSC-48F/20



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DUPLOMATIC OLEODINAMICA

M63
PRESSURE GAUGE
SERIES 10

according to EN 837-1

TECHNICAL CHARACTERISTICS

Nominal diameter	mm	63
Nominal pressure	bar	0 ÷ 6 0 ÷ 10 0 ÷ 16 0 ÷ 25 0 ÷ 60 0 ÷ 100 0 ÷ 160 0 ÷ 250 0 ÷ 400
Static pressure		3/4 of the end scale value
Dynamic pressure		2/3 of the end scale value
Limit pressure		end scale value for short period
Precision class according to EN 837-1/6		1.6
Thermal drift		± 0,4% / 10K in the measure range
Protection class according to EN 60529 - IEC 529		IP 65
Ports according to EN 837-1/6		1/4” BSP
Ports material		copper alloy
Sensible element: 0 ÷ 6, 0 ÷ 10, 0 ÷ 16, 0 ÷ 25, 0 ÷ 60.		copper alloy, type-C, braze welding spring
0 ÷ 100, 0 ÷ 160, 0 ÷ 250, 0 ÷ 400.		copper alloy, helical, braze welding spring
Movements		copper alloy
Dial		white plastic with lock pins in black plastic
Case		stainless steel with natural finishing, and OR between case and shank
Display		transparent plastic
Filling liquid		glycerin 85% + distilled water 15%
CE Marking		in compliance with 97/23/CE of 29.05.97 art. 3 par. 3
Working temperature range	°C	-20 / +60
Mass	kg	0,24

DESCRIPTION

— The pressure gauges M63 are pressure indicators used on hydraulic systems.

— They guarantee a correct pressure measurement also with pulsations and vibrations.

— They are available in 9 different pressure scales and with 2 connection types for mounting with radial port or rear port with flange connector.

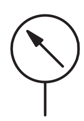
— The case is made of stainless steel and the connection is made of copper alloy.

— The filling in liquid is made of 85% glycerin and 15% distilled water.

— As they are realised in compliance with 97/23/CE of the 29-05-97 art. 3 par. 3, only the ones with the end scale of 250 and 400 bar have the marking CE on the dial.

— The construction and the realisation have been done according to EN 837-1.

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

M	63	-		/	10	

Pressure gauge

Dial nominal diameter
63 = 63 mm

Pressure gauge scale

006 = 0 ÷ 6 bar
010 = 0 ÷ 10 bar
016 = 0 ÷ 16 bar
025 = 0 ÷ 25 bar
060 = 0 ÷ 60 bar
100 = 0 ÷ 100 bar
160 = 0 ÷ 160 bar
250 = 0 ÷ 250 bar
400 = 0 ÷ 400 bar

Series N. (the overall and mounting dimensions remain unchanged from 10 to 19)

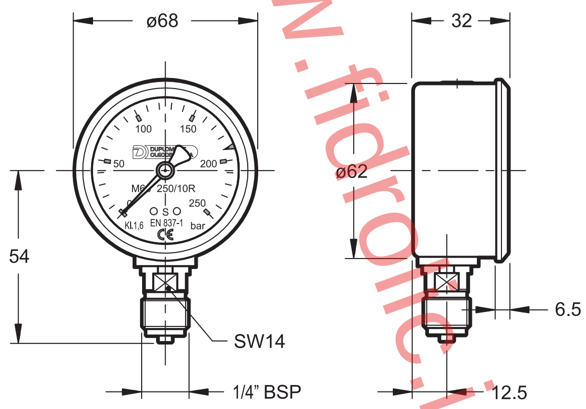
Connection type:
R = radial connector
PF = flange connector

NOTE: the models N. 006, 010, 016 and 025 are available with radial connector (**R**) only.

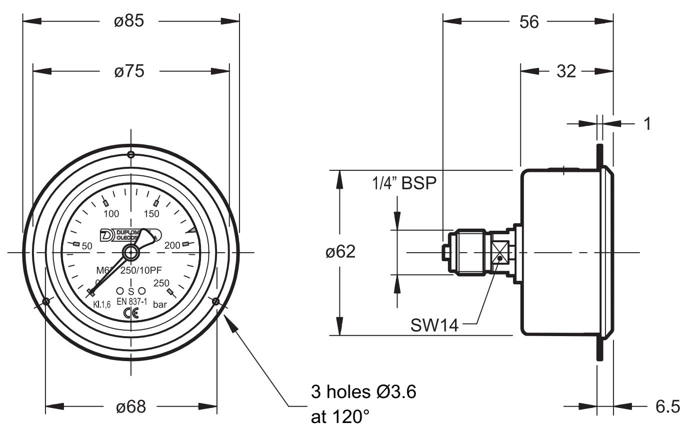
2 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

M63-*/10R



M63-*/10PF



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DUPLOMATIC OLEODINAMICA

PS*

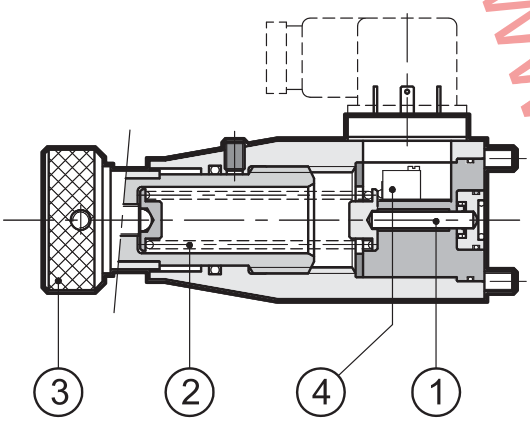
PISTON TYPE PRESSURE SWITCH

SERIES 21

p max **650** bar

max adjustable **p 35 - 140 - 350 - 630** bar

OPERATING PRINCIPLE



— PS* are piston type, hydro-electrical pressure switches.
The internal electrical contact is switched when the operating pressure reaches the set value.

— The line pressure acts on piston (1) which is directly loaded by a spring (2) on the opposite side. The spring load is adjustable by means of the knob (3). When the line pressure reaches the set valve, the piston (1) moves and switches the micro-contact (4).

— The pressure switches are available in four pressure ranges, from 35 up to 630 bar, and they can be subplate mounting or 1/4” BSP threaded port type.

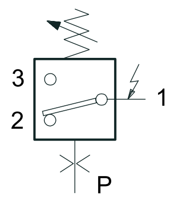
— Standard supply is with adjustment knob and with pressure scale.

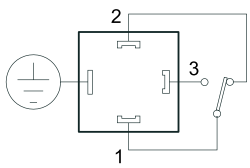
TECHNICAL CHARACTERISTICS

PRESSURE SWITCH		PS*2	PS*4	PS*6	PS*8
Pressure adjustment range	bar	3 ÷ 35	6 ÷ 140	10 ÷ 350	20 ÷ 630
Max operating pressure	bar	350	350	650	650
Hysteresis	see par. 5				
Repeatability	< ± 1 % of set pressure				
Electrical characteristics	see par. 3				
Ambient temperature range	°C	–20 / +50			
Fluid temperature range	°C	–20 / +80			
Fluid viscosity range	cSt	10 ÷ 400			
Recommended viscosity	cSt	25			
Fluid contamination degree	according to ISO 4406:1999 class 20/18/15				
Mass	kg	0,67			

SYMBOLS

HYDRAULIC SYMBOL





CONNECTION SCHEME

1 - IDENTIFICATION CODE

P	S			/	21		-	K1	/	K

Piston type pressure switch

Mounting type:
P = subplate mounting
T = threaded port 1/4” BSP

Pressure adjustment range:
2 = 3 ÷ 35 bar
4 = 6 ÷ 140 bar
6 = 10 ÷ 350 bar
8 = 20 ÷ 630 bar

Series N. (the overall and mounting dimensions remain unchanged from 20 to 29)

Seals: **N** = standard NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

Electrical connection: for DIN 43650 connector (included in the supply)

Adjustment knob

2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N).
For fluids HFDR type (phosphate esters) use FPM seals (code V).
For the use of other fluid types such as HFA, HFB, HFC, please consult our technical department.
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

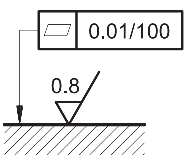
3 - ELECTRICAL CHARACTERISTICS

		AC		DC	
Power supply	V	125	250	30	250
Max load on contacts - resistive - inductive	A	7 4	5 2	5 3	0,2 0,02
Electrical insulation (according to CEI EN 60204)		> 1 M Ω at 500 Vdc			
Max switching rate	switches/min	120			
Protection class (according to CEI EN 60529)		IP 65			

4 - INSTALLATION

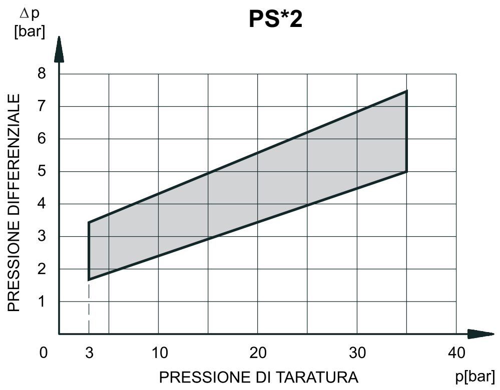
The pressure switches can be installed in any position without impairing its correct operation. Ensure that there is no air in the hydraulic circuit.
The subplate mounting pressure switch PSP type is fixed by means of screws on a flat surface with planarity and roughness values equal to or better than those indicated in the relative symbols. If the minimum values are not observed, the fluid can easily leak between the valve and the mounting surface.

Surface finishing

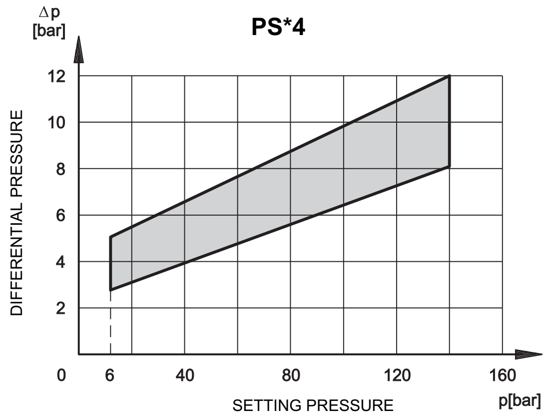


5 - HYSTERESIS CHARACTERISTICS (values measured with viscosity of 36 cSt at 50°C)

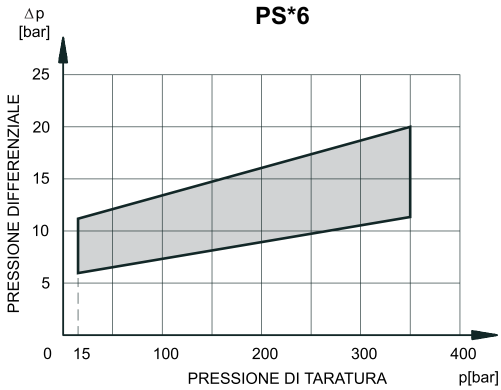
PS*2



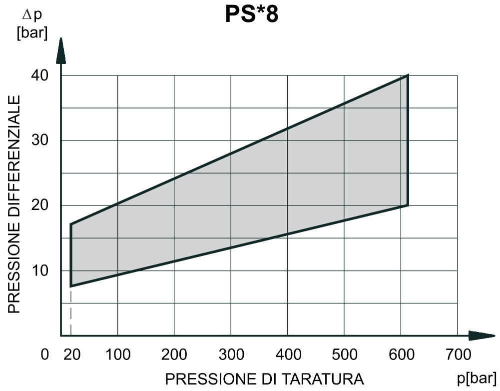
PS*4



PS*6



PS*8

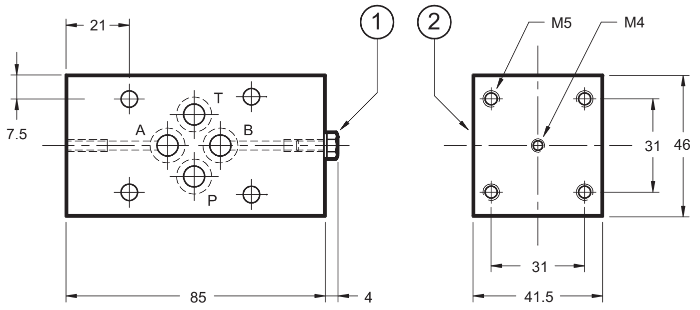


6 - SUBPLATES FOR STACK MOUNTING

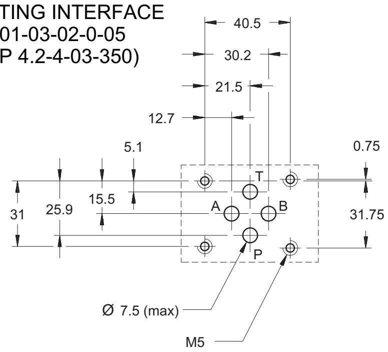
The PSP pressure switches can be stack mounted by means of ISO 4401-03 (CETOP 03 subplates), code 1950611 and 1950621.
The subplate code 1950611 permits the connection between the pressure switch and A and/or B ports, depending on where the bolt (1) is installed. The subplate code 1950621 permits the connection between the pressure switch and the P port.

SUBPLATE CODE 1950611 (A and B ports connection)

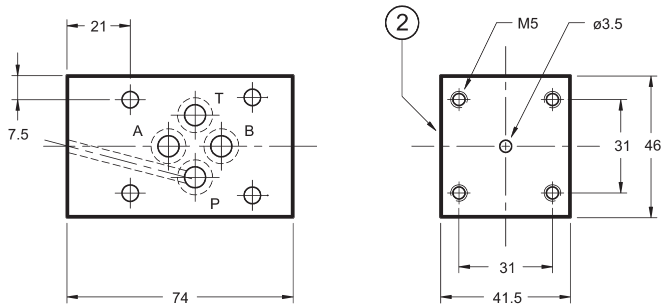
MAX PRESSURE 350 BAR



MOUNTING INTERFACE
ISO 4401-03-02-0-05
(CETOP 4.2-4-03-350)



SUBPLATE CODE 1950621 (P port connection)

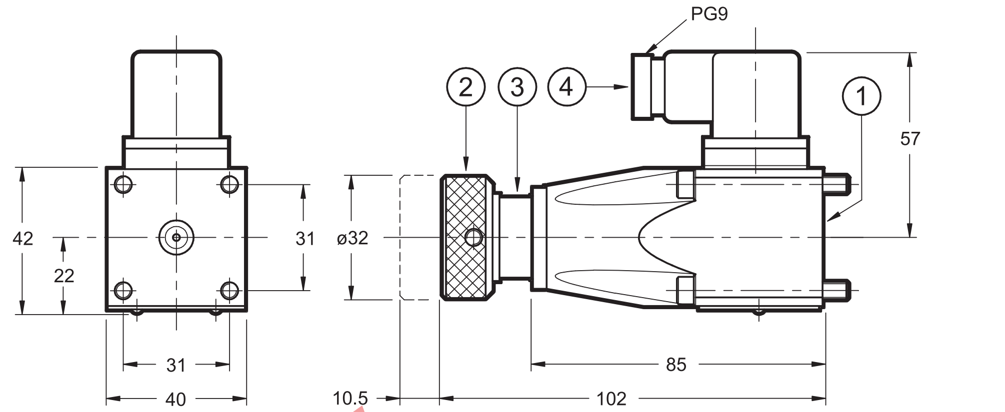


dimensions in mm

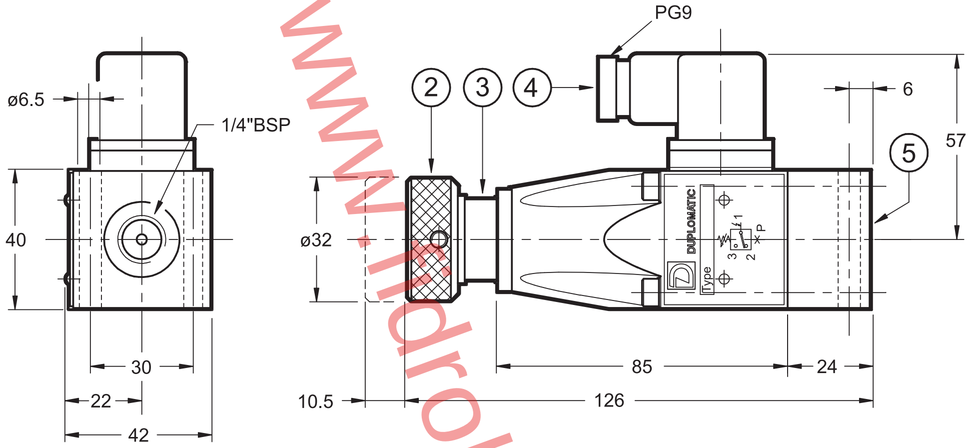
1	Hexagonal head M4x12 bolt with "bonded seal" type 400-002 (Dowty) Unscrew the bolt and its seal from the side where the switch is installed
2	Mounting surface with sealing rings 4 OR type 2037 (9.25x1.78) - 90 Shore

7 - OVERALL AND MOUNTING DIMENSIONS

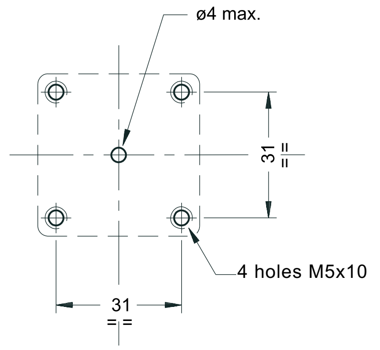
PSP



PST



MOUNTING INTERFACE (PSP version)



dimensions in mm

1	Mounting surface with sealing rings: N. 1 OR type 2025 (6.07x1.78) - 90 shore (PSP version)
2	Adjustment knob Clockwise rotation to increase pressure
3	Graduated scale with indication of setting pressure in [bar]
4	DIN 43650 electrical connector 3 poles + ground supplied with pressure switch
5	Interface plate for pipe connection: - 1/4” BSP threaded female connection - 2 clearance holes for possible fixing by means of bolts M5x50 **NOTE: the interface plate is already installed on the PST type pressure switch only.**

fastening bolts (PSP version)
N. 4 bolts M5x45 - ISO 4762 12.9 resistance class (included in the supply)
Tightening torque: 8 Nm

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PTH
PRESSURE TRANSMITTERS
SERIES 30

p nom **40 - 100 - 250 - 400** bar

DESCRIPTION

This series of pressure transmitters has been designed in order to be used for the main industrial applications and on moving machines.

The main feature of this transmitter is to ensure its functioning also in harsh environements, especially for what concerns the fluid temperature range which can go from a minimum of - 40 °C up to a maximum of + 120 °C

The basis of this transmitter is the strain-gauge, which is powered by an electric circuit developed according to the SMT technology which ensures a high reliability and maximum resistance to vibrations and mechanical stress.

Every component into contact with the fluid is made of stainless steel and the pressure sensor is completely fluid-proof.

It's available with current output signal 4 ÷ 20 mA or with voltage output signal 0÷10 V. Versions also available upon request are 0÷5 V and 0.5÷4.5 V, ratiometric. They all are reverse polarity protected.

The protection class of the electrical connection for the version with DIN connector is IP65, while the version with the M12 connector has a protection class IP67.

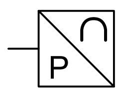
These transmitters are available in 4 different pressure ranges, from 40 to 400 bar.

TECHNICAL SPECIFICATIONS

Nominal pressure P_N	bar	**40**	**100**	**250**	**400**
Overpressure - max working pressure	x P_N	x 3	x 3	x 3	x 2.5
Burst pressure	x P_N	x 7	x 5	x 4	x 5

Accuracy typical at 25 °C	% P_N	± 0,5
Output signal : current voltage	mA V	4 ÷ 20 0÷10, 0÷5, 0.5÷4.5
Sensor temperature range:	°C	-40 / +120
Ambient and fluid temperature range: sealing in FPM (standard) NBR EPDM	°C	-20 / +120 -25 / +100 -40 / +125
Rise time (10%…90% of P_N)	ms	1
Hydraulic connection		1/4" BSP with seal
Housing and pressure connection		AISI 304
Mass	g	50

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

P	T	H	-		/	30		-		

Pressure transmitter

High dynamic performance

Nominal pressure
040 = 40 bar **250** = 250 bar
100 = 100 bar **400** = 400 bar
(other pressure values are available upon request)

Series N.
(the overall and mounting dimensions remain unchanged from 30 to 39)

Seals:
V = FPM seals for special fluids (**standard**)
N = NBR seals for mineral oil
EP = EPDM seals

WARNING! The EPDM is not suitable for use with mineral oil. Verify the compatibility of EPDM with the used fluid!

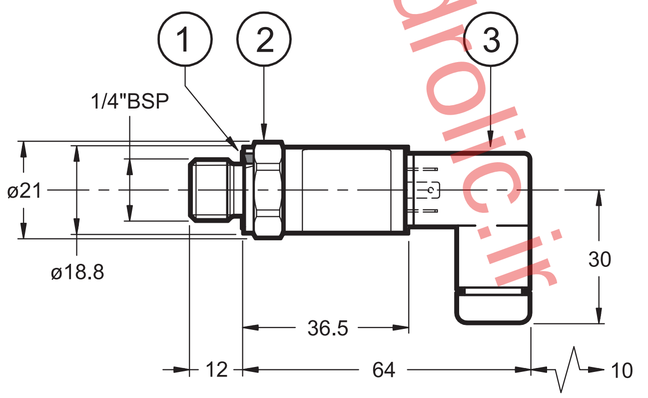
Analogue output signal (**standard**)
E0 = 0 ÷ 10 V
E1 = 4 ÷ 20 mA
upon request only:
E2 = 0 ÷ 5 V
E5= 0.5 ÷ 4.5 V ratiometric

Electrical connection
K10 = Reduced electrical connector DIN 43650
K12 = electrical connector M12 5 pin

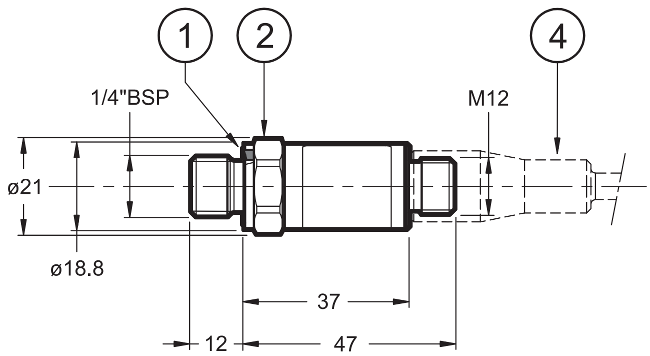
2 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

PTH-*/30*- * K10



PTH-*/30*- * K12



1	Integral seal DIN 3869
2	Key: spanner 19 Tightening torque: 25 Nm
3	Electrical connector EN 17301-803 (ex DIN 43650) Micro C - PG7 **Included in delivery**
4	Electrical connector 5 pin EC5S/M12L/10 (**to be ordered separately**) code 3491001001 IP67 - PG7

3 - TECHNICAL CHARACTERISTICS

Electrical data

		E0	E1	E2	E5
Output signal		0 ÷ 10 V	4 ÷ 20 mA	0 ÷ 5 V	0.5 ÷ 4.5 V ratiometric
Supply voltage	V CC	24 (15 ÷ 32)	24 (9 ÷ 32)	24 (9 ÷ 32)	5 (4.75 ÷ 5.25)
Max current consumption	mA	≤ 15	-	≤ 20	≤ 10
Load resistance	kΩ	≥ 5.0	see par. 4.2	≥ 5.0	≥ 5.0

Accuracy

Accuracy (typical at 25 °C)	% P_N	± 0.5
TEB Total error band (-25…+85 °C)	% P_N	± 1.75
NLH Non linearity and hysteresis (at 25 °C)	% P_N	± 0.2
TC Temperature coefficient	% P_N	± 0.03
Stability after 1 million cycles	% P_N	± 0.2

Environmental conditions

Electromagnetic compatibility (EMC): according to 2004/108/IEC		Immunity 61000-6-2 Emissions 61000-6-4
Vibrations		50 G / 11 ms
Class protection according to EN 60529 with connector proprerly installed.	K10 K12	IP65 IP67

4 - TRANSMITTERS SUPPLY

4.1 - Versions in voltage (E0, E2, E5 ratiometric)

These transmitters are equipped with voltage stabilizer which supplies the electric circuit with constant voltage, independently from power supply voltage.

We recommend a stabilized power supply voltage, within proper ranges as in table at par. 3 .

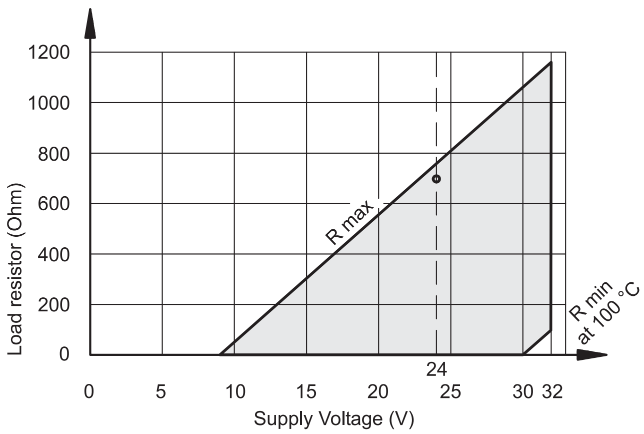
4.2 - Version in current 4 ÷ 20 mA (E1)

The transmitter works properly within an operating area (see diagram) that depends on both the voltage supply value and the external load resistance used to convert the signal.

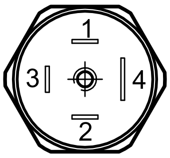
Is recommended to choose values close to the limit Rmax, in order to have a wide signal easier to read.

We suggest supply voltage of 24 VDC and a load resistance of 700 Ohm

min./max resistor vs. supply voltage E1 version
with Pmax = 100%

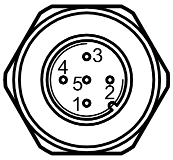


5 - ELECTRIC CONNECTIONS



K10

Connection DIN 43650 reduced
3 pin + GND

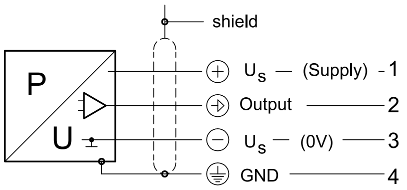


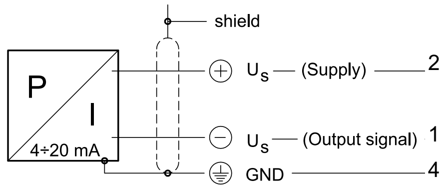
K12

Connection M12x1
5 pin

WARNING! Check that the connection cables are suitable for the temperature range intended for use of the device.

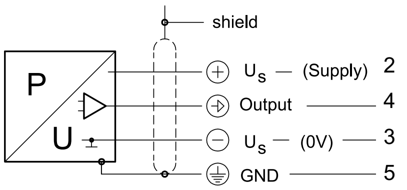
6 - WIRING DIAGRAMS - K10 CONNECTION

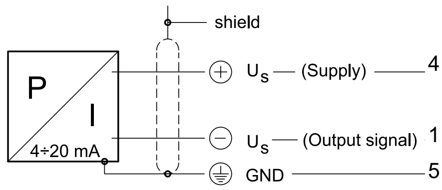
voltage output - 3 wires + GND	Version		
	E0	**E2**	**E5**
	24 V 0÷10 V 0 V GND	24 V 0÷5 V 0 V GND	5 V 0.5÷4.5 V 0 V GND

current output - 2 wires + GND	Vers.
	E1
	24 V 4 ÷ 20 mA GND

WARNING! The pin assignment for the transducer PTH - */30*- E0K10 (DIN 43650 connection) differs from that of the previous series!

7 - WIRING DIAGRAMS - K12 CONNECTION

voltage output - 3 wires + GND	Versione		
	E0	**E2**	**E5**
	24 V 0÷10 V 0 V GND	24 V 0÷5 V 0 V GND	5 V 0.5÷4.5 V 0 V GND

current output - 2 wires + GND	Vers.
	E1
	24 V 4 ÷ 20 mA GND

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DUPLOMATIC OLEODINAMICA

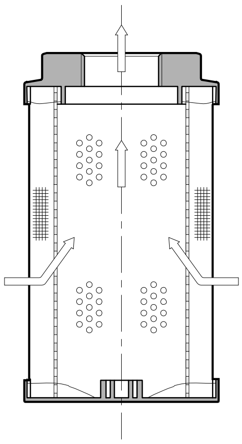
FSI

SUCTION FILTER FOR SUBMERGED MOUNTING

SERIES 10

Q max (see performance ratings table)

OPERATING PRINCIPLE



- FSI filters are filter elements which function being completely submerged in the tank. They are installed directly at the end of the pump suction line.
- They are aimed at protecting the pump from any possible gross contamination present inside the tank.
- The filter element is a metallic strainer with a 90 μm filtration degree,which grants a good pump protection without compromising the correct fluid supply.
- The filters are designed with a threaded BSP connection, available in the sizes from 3/8" to 3". They are supplied with a hexagonal shank, which allows the filter element to be connected by spanner to the pump suction line.

TECHNICAL SPECIFICATIONS

Filter code	BSP port dimensions	Rated flow [l/min] (**NOTE 1**)	Rated filtration degree [μm]
FSI-TB038	3/8"	9	90
FSI-TB012	1/2"	14	
FSI-TB034	3/4"	25	
FSI-TB100	1"	45	
FSI-TB114	1 ¼"	75	
FSI-TB112	1 ½"	100	
FSI-TB200	2 "	160	
FSI-TB212	2 ½"	250	
FSI-TB300	3"	350	

NOTE 1: The flow rates stated in the table correspond to a 0.02 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C

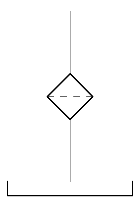
As for fluids whose viscosity degree at a specific operating pressure is different from 36 cSt, the real pressure drop has to be changed according to the following ratio:

$$\text{real } \Delta p \text{ value} = 0.02 \cdot \frac{\text{real Q}}{\text{table Q}} \cdot \frac{\text{real viscosity degree (cSt)}}{36}$$

The filter size has to be selected so that with the nominal flow rate the pressure drop is lower than 0.02 bar.

Collapsing differential pressure of the filter element	bar	1.0
Ambient temperature range	°C	–25 / +50
Fluid temperature range	°C	–25 / +110
Fluid viscosity range	cSt	10 ÷ 400

HYDRAULIC SYMBOL



1 - IDENTIFICATION CODE

F	S	I	-	T	B				-	M	90	S	/	10	-	0

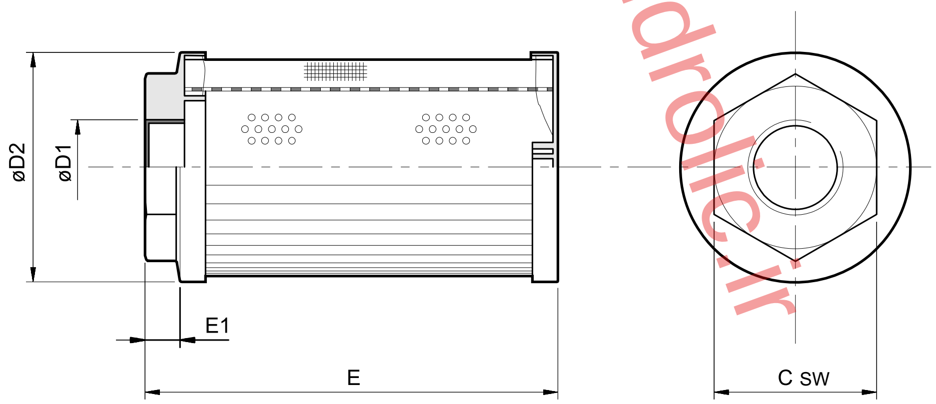
- FSI: Submerged suction filter
- TB: BSP threaded port
- Nominal dimension:
  - **038** = 3/8”
  - **012** = 1/2”
  - **034** = 3/4”
  - **100** = 1”
  - **114** = 1¼”
  - **112** = 1½”
  - **200** = 2”
  - **212** = 2 ½”
  - **300** = 3”
- M90: Filter element metallic strainer. 90 µm filtration degree
- S: Standard filter element
- 10: Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)
- 0: Without a by-pass valve

2 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



D1	D2	E	E1	SW
3/8”	52	73	12	30
1/2”	70	92	13	42
3/4”	70	137	13	42
1”	70	137	13	42
1 ¼”	99	135	15	70
1½”	99	218	15	70
2”	130	201	15	70
2 ½”	130	253	15	101
3”	130	253	15	101

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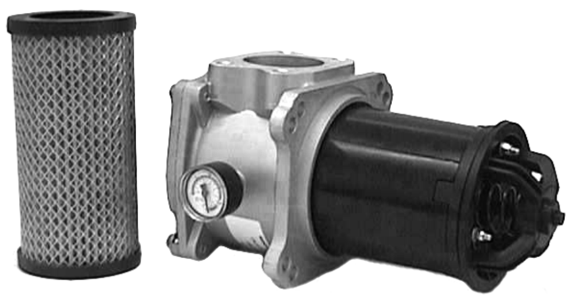


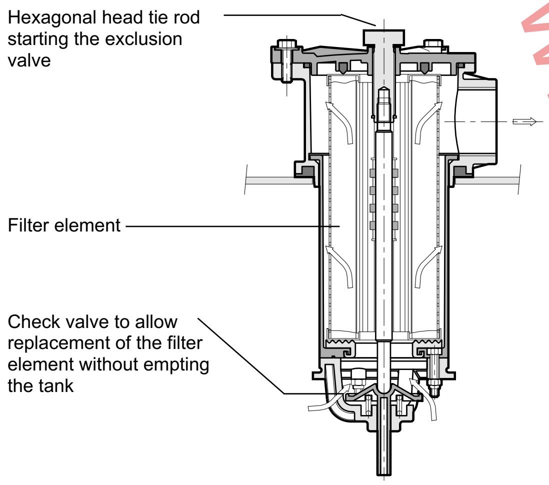
FST

SUCTION FILTER WITH SEALED FLANGE MOUNTING

SERIES 10

Q max (see performances table)

OPERATING PRINCIPLE



— FST filters are designed for sealed flange mounting. They are assembled directly on to the hydraulic power unit.

— They are aimed at protecting the pump from any possible gross contamination present inside the tank.

— The filter element is made of a metallic strainer with a 90 µm filtration degree, which grants a good pump protection without compromising the correct fluid flow. It can be easily replaced without empting the tank. See paragraph 6 for its identification code.

— The filters are designed with a SAE flange port with the exception of the smallest size, which uses a BSP threaded port.

— All the FST filters are designed to incorporate an electric or visual clogging indicator, to be ordered separately (see paragraph 5).

PERFORMANCES

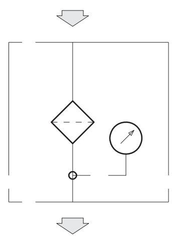
Filter code	port dimensions		Mass [kg]	Rated flow (indicative) [l/min]	Rated filtration degree [µm]
	BSP	SAE flange			
FST-TB114	1 ¼”	-	1,6	70	90
FST-FS212	-	2 ½”	3,0	100	
FST-FS300	-	3”	13,0	200	
FST-FS400	-	4”	16,0	300	

NOTE 1: the flow rates stated in the table correspond to a 0.02 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C.
As for a different viscosity range, see NOTE 2 - paragraph 2.2.

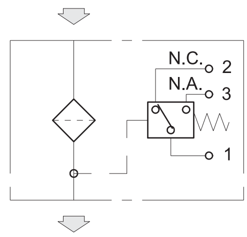
Collapsing differential pressure of the filter element	bar	1,0
Ambient temperature range	°C	-25 / +50
Fluid temperature range	°C	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

HYDRAULIC SYMBOL

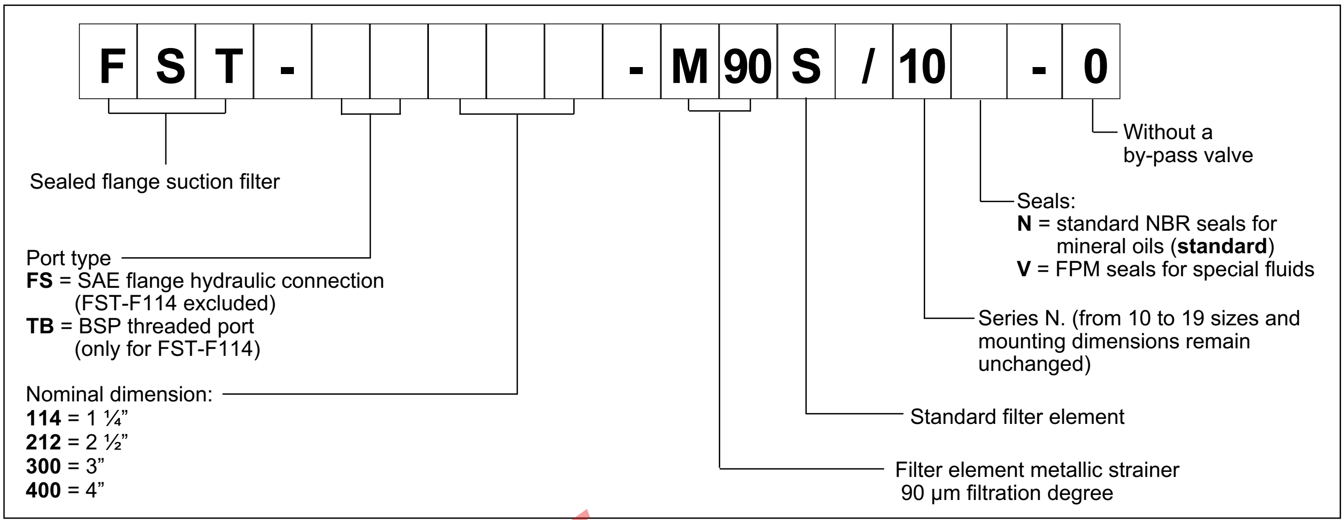
Filter with indicator VS type



Filter with indicator ES type

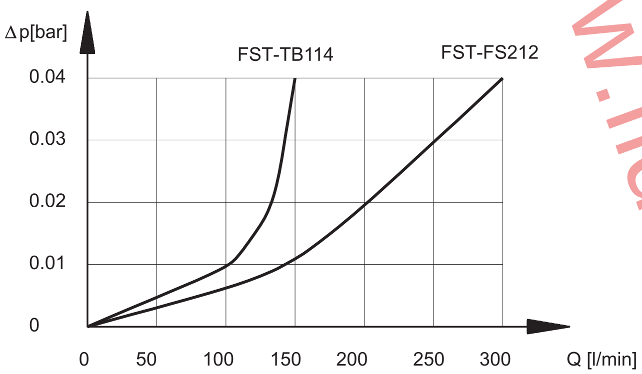


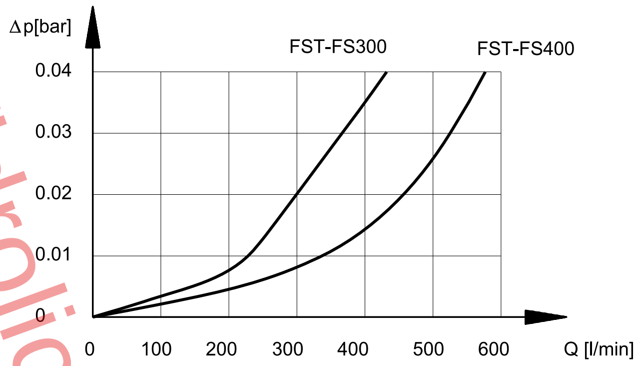
1 - IDENTIFICATION CODE



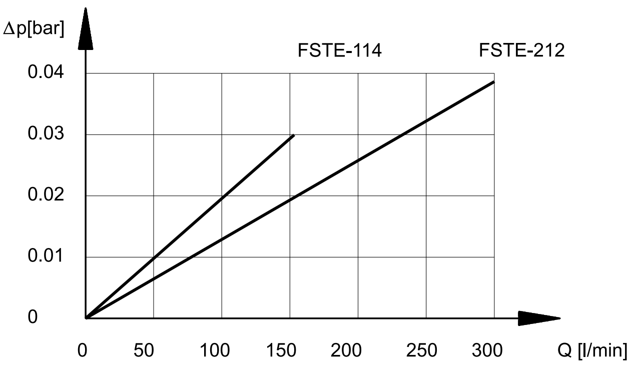
2 - CHARACTERISTIC CURVES (values measured with viscosity of 36 cSt at 50°C)

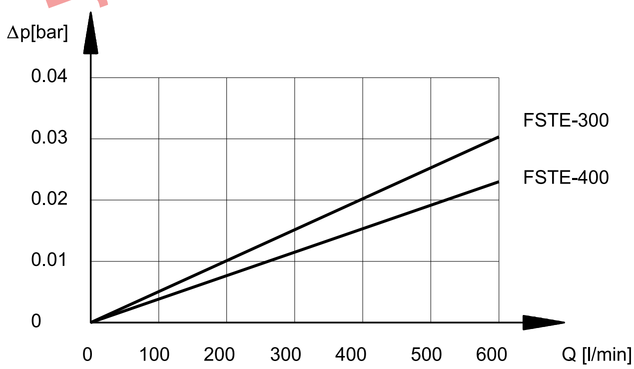
2.1 - Pressure drops through the filter body





2.2 - Pressure drops through the FSTE filter element





NOTE 2: the filter size has to be selected so that with the nominal flow rate the pressure drop is lower than 0,02 bar.

The total pressure drop through the filter is given by adding the body pressure drop values to those of the filter element.

As for fluids whose viscosity degree at a specific operating pressure is different from 36 cSt, the filter total pressure drop has to be changed according to the following ratio:

total Δpl value = body Δp value + (real Δp value of the filter element x real viscosity value (cSt) / 36)

real Δp value of the filter element = value obtainable through the diagrams in paragraph 2.2

Such ratio is valid for a viscosity value up to 200 cSt.

For a higher viscosity please consult our technical department.

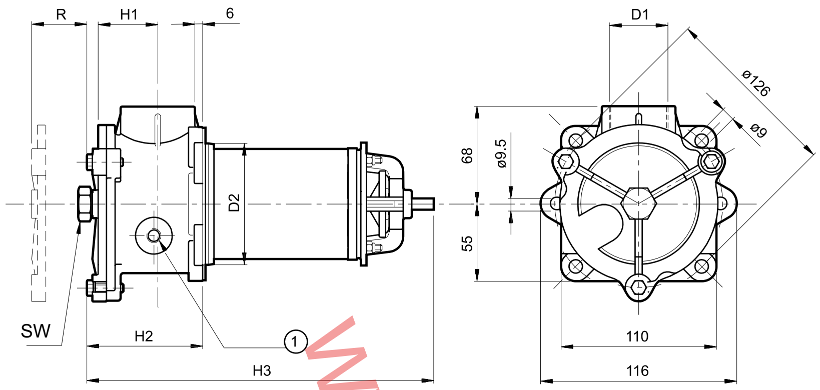
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

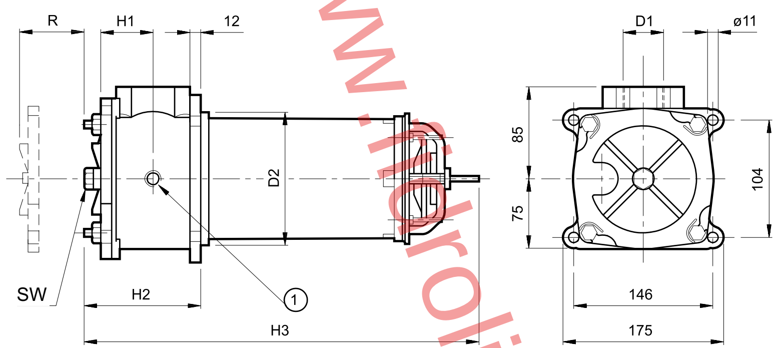
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

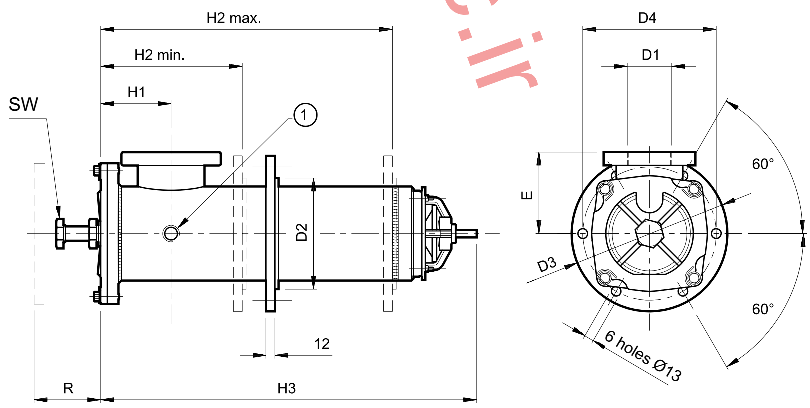
dimensions in mm



FST-TB114



FST-FS212



FST-FS300

FST-FS400

1	Clogging indicator port: 1/8" BSP usually plugged

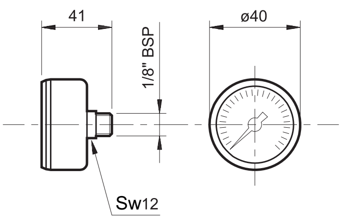
Filter code	D1	D2 NOTE 3	D3	D4	E	H1	H2 NOTE 4	H3	R*	Ch
FST-TB114	1 ¼" BSP	86	-	-	-	42	80	275	250	22
FST-FS212	2 ½" SAE	130	-	-	-	66	120	322	300	22
FST-FS300	3" SAE	150	210	180	110	95	174÷355	480	500	32
FST-FS400	4" SAE	180	242	210	120	122	250÷405	470	500	32

NOTE 3: tank hole = D2 + 1 (mm)
NOTE 4: for filters FSU-FS300 and FSU-FS400 the flange is not welded
R* = filter element removal space

5 - CLOGGING INDICATORS

The filters are designed to incorporate clogging indicators, which have to be ordered separately.

5.1 - Visual indicator for suction filters
Identification code: VS/10

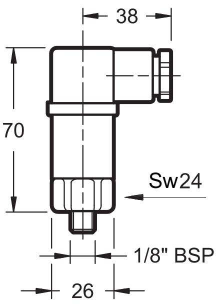


This indicator is a vacuum gauge sensitive to the suction depression.

The indicator is supplied with a 0 ÷ -1 relative bar graduated scale and with a three-colour reading scale, which informs you about the clogging condition of the filter element:

GREEN: efficient filter element (0 / -0.15 bar)
YELLOW: the filter element is wearing out (-0.15 / -0.25 bar)
RED: the filter element has to be replaced (> -0.25 bar)

5.2 - Electric indicator for suction filters
Identification code: ES/10



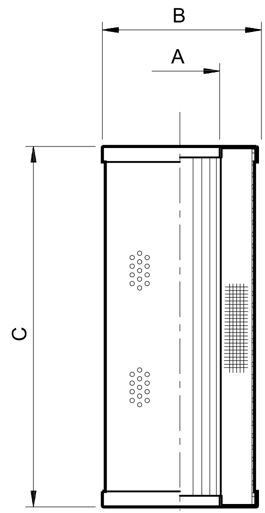
This indicator is a vacuum gauge sensitive to the suction depression, which operates by switching an electric contact when the filter element has reached the clogging limit.

The contact can be wired in an open or closed condition (see the hydraulic symbol).

TECHNICAL SPECIFICATIONS

Operating pressure	bar	- 0,2
AC power supply		
Max. operating voltage	VAC	250 50/60 Hz
Max. load on the contacts (inductive or resistive) with V at 125 VAC with V at 250 VAC	A	 3 0,5
DC power supply		
Max. operating voltage	VDC	30
Max. load on the contacts resistive inductive	A	 3 1
Electric connector	DIN 43650	
Class of protection according to CEI EN 60529 (atmospheric agents)	IP65	
Atex classification	3 GD EEx e T6	

6 - FILTER ELEMENTS



Filter element code	ØA	ØB	C	Average filter surface [cm²]
FSTE - 114	29,5	70	163	1600
FSTE - 212	65	99	198	1845
FSTE - 300	65	99	375	3545
FSTE - 400	93	136	375	5065

FILTER ELEMENT IDENTIFICATION CODE

F	S	T	E	-				-	M	90	S	/	10

Filter element for a FST filter

Nominal dimensions
114 = 1 ¼” **300** = 3”
212 = 2 ½” **400** = 4”

Filter element metallic strainer 90 µm filtration degree

Standard filter element

Series N. (from 10 to 19 sizes and mounting dimensions remain unchanged)

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FRT

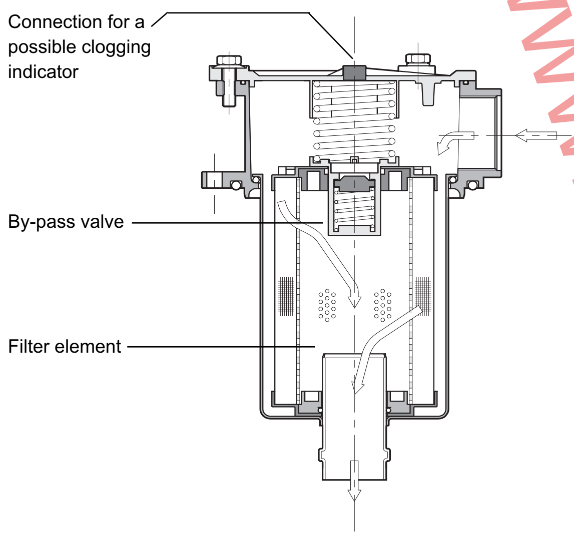
RETURN FILTER FOR FLANGE MOUNTING ON THE TANK

SERIES 10

p max **3** bar

Q max (see performance table)

OPERATING PRINCIPLE



— FRT filters are designed to be flange-mounted on the tank cover; the BSP threaded port for the input connection is positioned on the filter head and is therefore very accessible.

— The inspection cover fixed with three or four screws allows easy maintenance; the filter element is supplied with a screw, which makes its removal together with the container easier. In this way, by replacing the filter element, it is possible to clean the contamination present in the bowl of the filter.

— The filter element is made of high efficiency filtering materials and is able to hold high quantities of contamination material. It is available with three different filtration degrees:

F10 = 10 µm absolute (β_{10} > 100) - ISO 4406:1999 class 18/16/13
F25 = 25 µm absolute (β_{25} > 100) - ISO 4406:1999 class 19/17/14
P10 = 10 µm nominal (β_{10} > 2) - ISO 4406:1999 class 21/19/16

— FRT filters are always supplied with a by-pass valve.

— All the FRT filters are designed to incorporate an electric or visual clogging indicator, to be ordered separately (see par. 5).

PERFORMANCES

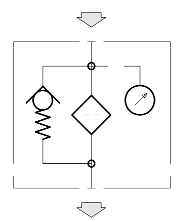
Filter code	BSP port dimensions	Mass [kg]	Rated flow (indicative) [l/min]		
			F10	F25	P10
FRT-TB012	1/2”	0,45	18	25	30
FRT-TB034	3/4”	0,95	50	70	85
FRT-TB100	1”	1,1	65	110	130
FRT-TB114	1 ¼”	2,1	150	190	210
FRT-TB112	1 ½”	3,1	160	250	290
FRT-TB200	2”	4,1	280	400	430

Maximum pressure	bar	3
Collapsing differential pressure of the filter element	bar	3
Differential pressure for the opening of the by-pass valve (±10 %)	bar	1,7
Ambient temperature range	°C	-25 / +50
Fluid temperature range	°C	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

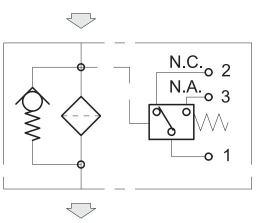
NOTE: the flow rates stated in the table correspond to a 0.5 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C.
As for a different viscosity range, see **NOTE 2** - par. 2.2.

HYDRAULIC SYMBOL

Filter with indicator VR type



Filter with indicator ER type



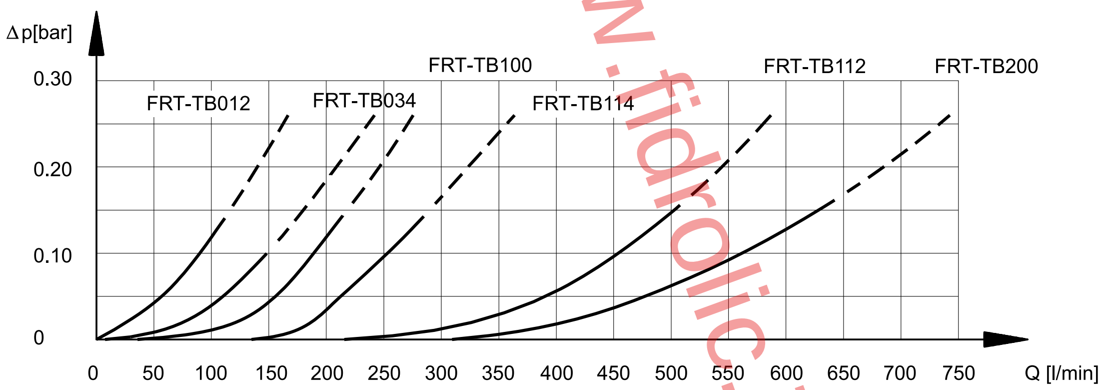
1 - IDENTIFICATION CODE

F R T - T B _ _ _ - _ _ S / 10 _ - B

- Return filter tank-top mounted
- BSP threaded ports
- Nominal dimension:
  012 = 1/2" **114** = 1 ¼"
  034 = 3/4" **112** = 1 ½"
  100 = 1" **200** = 2"
- Filtration degree:
  F10 = 10 µm fibre (β_{10} > 100) - ISO 4406:1999 class 18/16/13
  F25 = 25 µm fibre (β_{25} > 100) - ISO 4406:1999 class 19/17/14
  P10 = 10 µm paper (β_{10} > 2) - ISO 4406:1999 class 21/19/16
- Standard filtering element
- Series N. (from 10 to 19 sizes and mounting dimensions remain unchanged)
- Seals:
  N = NBR seals for mineral oils (**standard**)
  V = FPM seals for special fluids
- By-pass valve
  Opening pressure: 1.7 bar

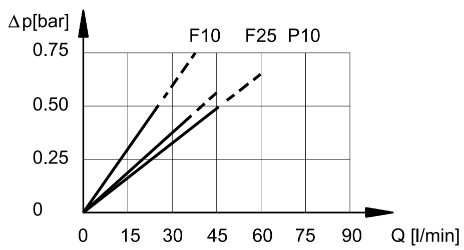
2 - CHARACTERISTIC CURVES (values measured with viscosity of 36 cSt at 50°C)

2.1 - Pressure drops through the filter body

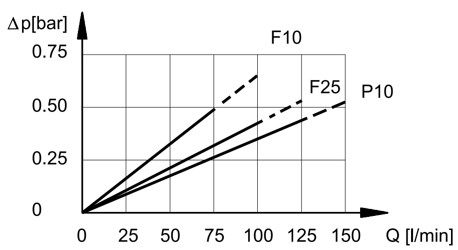


2.2 - Pressure drops through the FRTE filtering element

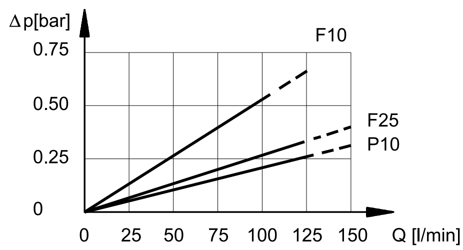
FRTE-012



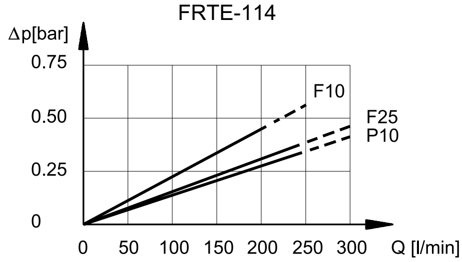
FRTE-034



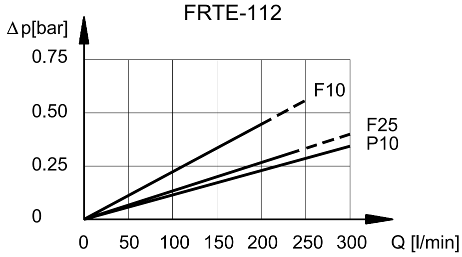
FRTE-100



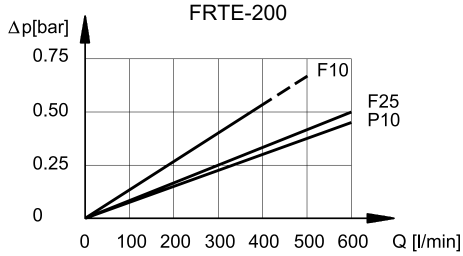
FRTE-114



FRTE-112



FRTE-200



NOTE 2: the filter size has to be calculated so that with the nominal flow rate the pressure drop is lower than 0.5 bar.

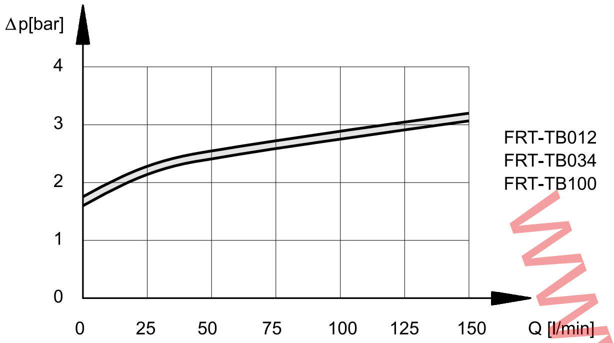
The total pressure drop through the filter is given by adding the body pressure drop values to those of the filter element. As for fluids whose viscosity degree at a specific operating pressure is different from 36 cSt, the filter total pressure drop has to be changed according to the following ratio:

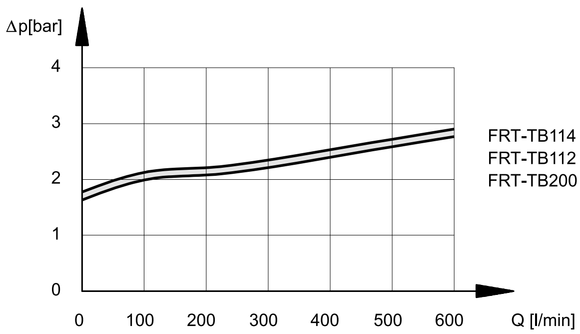
total Δp value = body Δp value + (real Δp value of the filter element x real viscosity value (cSt) / 36)

real Δp value of the filter element = value obtainable through the diagrams in par. 2.2

Such ratio is valid for a viscosity value up to 200 cSt. For a higher viscosity please consult our technical department.

2.3 - Pressure drops through the by-pass valve





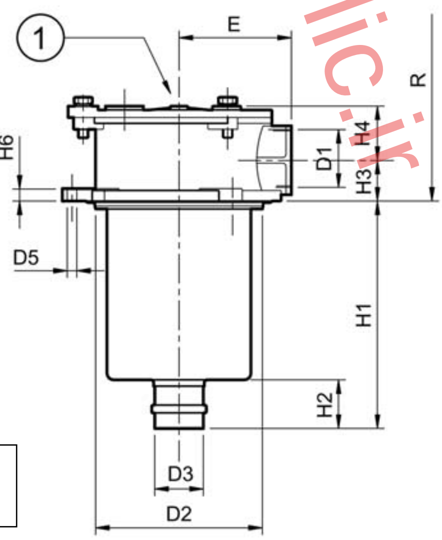
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code N). For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

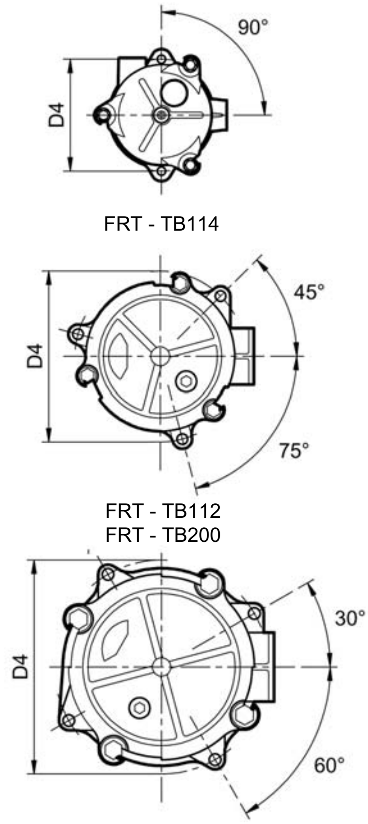
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



1	Clogging indicator port: 1/8" BSP usually plugged



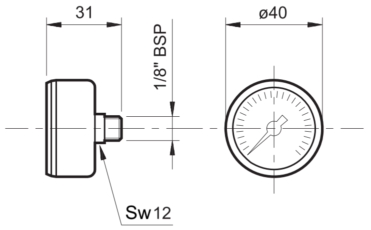
filter	D1	D2	D3	D4	D5	E	H1	H2	H3	H4	H6	R*
FRT - TB012	1/2"	67	24	90	6.5	50	80	20	22	33	9	120
FRT - TB034	3/4"	89	28	115	9	67	150	25	28	47	10	190
FRT - TB100	1"	89	40	115	9	67	234	30	28	47	10	270
FRT - TB114	1 ¼"	126	40	175	10.5	95	248	50	35	56	13	289
FRT - TB112	1 ½"	174	20	220	10.5	115	178	50	55	69	13	250
FRT - TB200	2"	174	63.5	220	10.5	115	285	50	55	69	13	355

R * = Filter element removal space starting from the tank surface

5 - CLOGGING INDICATORS

The filters are designed to incorporate clogging indicators, which have to be ordered separately.

5.1 - Visual indicator for return filters
Identification code: VR/10

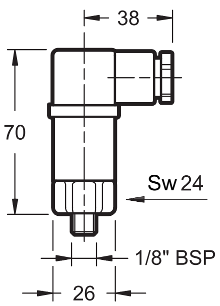


This indicator is a pressure gauge sensitive to the filter input pressure.

The indicator is supplied with a 0 ÷ 6 bar graduated scale and with a two-colour reading scale, which informs you about the clogging condition of the filter element:

GREEN: efficient filter element (0 ÷ 1.7 bar)
RED: the filter element has to be replaced (> 1.7 bar)

5.2 - Electric indicator for return filters
Identification code: ER/11



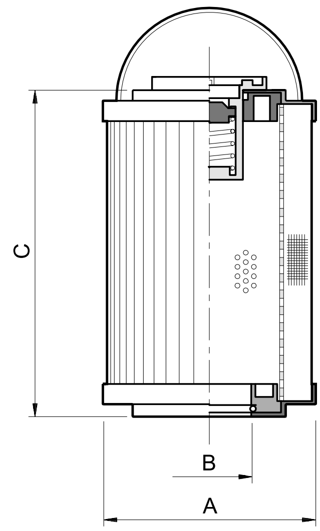
This indicator is a pressure switch sensitive to the filter input pressure, which switches an electrical contact when the filter element has reached the clogging limit.

The contact can be wired in an open or closed condition (see the hydraulic symbol).

TECHNICAL SPECIFICATIONS

Operating pressure	bar	1,5
AC power supply		
Max. operating voltage	VAC	250 50/60 Hz
Max. load on the contacts (inductive or resistive) with V at 125 VAC with V at 250 VAC	A	 3 0,5
DC power supply		
Max. operating voltage	VDC	30
Max. load on the contacts resistive inductive	A	 3 1
Electric connector	DIN 43650	
Class of protection according to CEI EN 60529 (atmospheric agents)	IP65	
Atex classification	3 GD EEx e T6	

6 - FILTER ELEMENTS



Filter element code	ØA	ØB	C	Average filtering surface [cm²] P10	Average filtering surface [cm²] F12/F25
FRTE - 012	52	24	70	310	380
FRTE - 034	70	28	130	1000	1600
FRTE - 100	70	40	210	1660	2670
FRTE - 114	99	40	211	3800	4280
FRTE - 112	130	51	140	4140	4360
FRTE - 200	130	63	251	7930	8350

FILTER ELEMENT IDENTIFICATION CODE

F R T E - [ ] [ ] - [ ] [ ] S / 10 [ ]

Filter element for a FRT filter

Nominal dimension
012 = 1/2" **114** = 1 ¼"
034 = 3/4" **112** = 1 ½"
100 = 1" **200** = 2"

Filtration degree: **F10** = fibre 10 µm
F25 = fibre 25 µm
P10 = paper 10 µm

Standard filter element

Series N. (from 10 to 19 sizes and mounting dimensions are unchanged)

N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids (upon request)

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DUPLOMATIC OLEODINAMICA

95 160/112 ED

FRC

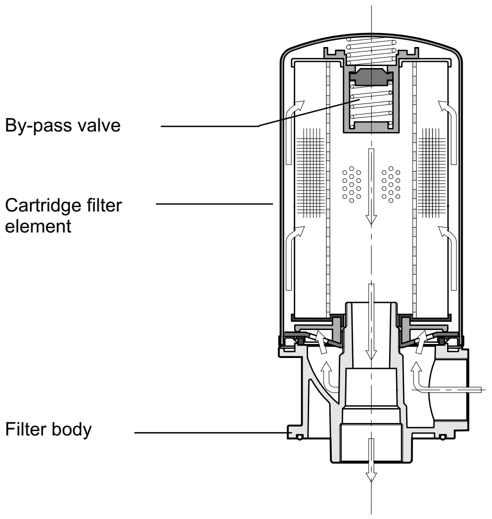
RETURN LINE FILTER FOR TANK TOP OR LINE MOUNTING

SERIES 10

p max **7** bar

Q max (see table of performances)

OPERATING PRINCIPLE



— FRC filters can be mounted both on the tank cover by using a 4-hole flange fixing system with a direct bottom discharge, or on the return line.

— The filter element with a screw on cartridge allows easy and practical replacement; a suitable membrane inside the cartridge prevents the residual oil from coming out.

— The filter element is made of high efficiency filtering materials and is able to accumulate high quantities of contamination material. It is available with three different filtration degrees:

F25 = 25 μm: absolute (β_{25} > 100) - ISO 4406:1999 class 19/17/14

P10 = 10 μm: nominal (β_{10} > 2) - ISO 4406:1999 class 21/19/16

P25 = 25 μm: nominal (β_{25} > 2) - ISO 4406:1999 class 24/22/19

— FRC filters are always supplied with a by-pass valve.

— All the FRC filters are designed to incorporate an electric or visual clogging indicator, to be ordered separately (see paragraph 5).

PERFORMANCES

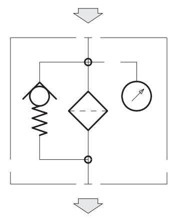
Filter code	BSP port dimensions	Mass [kg]	Rated flow (indicative) [l/min]				
			F25L	P10S	P10L	P25S	P25L
FRC-TB034	3/4”	1.6	65	65	70	70	75
FRC-TB112	1 ½”	2.2	180	150	200	200	200

NOTE 1: the flow rates stated in the table correspond to a 0.5 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C.
As for a different viscosity range, see NOTE 2 - par. 2.2.

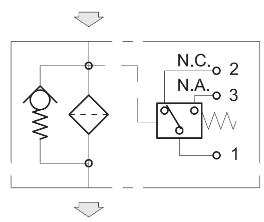
Maximum pressure	bar	7
Collapsing differential pressure of the filter element	bar	3.0
Differential pressure for the opening of the by-pass valve (±10 %)	bar	1,7
Ambient temperature range	°C	-25 / +50
Fluid temperature range	°C	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

HYDRAULIC SYMBOL

Filter with indicator VR type



Filter with indicator ER type



1 - IDENTIFICATION CODE

F R C - T B ☐ ☐ ☐ - ☐ ☐ ☐ / 10 ☐ - B

Return filter for tank top or line mounting

BSP threaded ports

Nominal dimension:
034 = 3/4”
112 = 1½”

Filtration degree:
F25 = fibre 25 µm (β_{25} > 100) - ISO 4406:1999 class 19/17/14
P10 = paper 10 µm (β_{10} > 2) - ISO 4406:1999 class 21/19/16
P25 = paper 25 µm (β_{25} > 2) - ISO 4406:1999 class 24/22/19

By-pass valve
Opening pressure: 1.7 bar

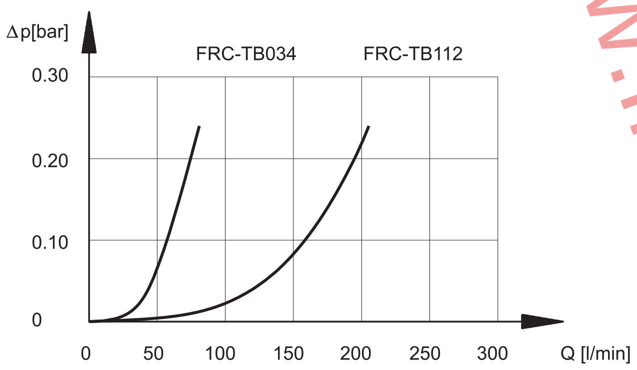
Seals:
N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids

Series N.
(from 10 to 19 sizes and mounting dimensions remain unchanged)

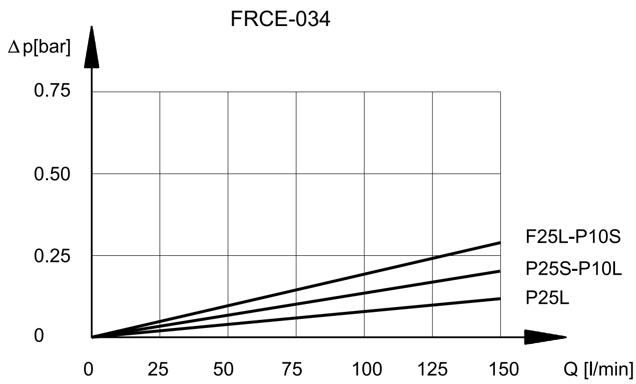
Type of filter element:
S = standard (not available for a F25 filtration degree)
L = long-lasting element

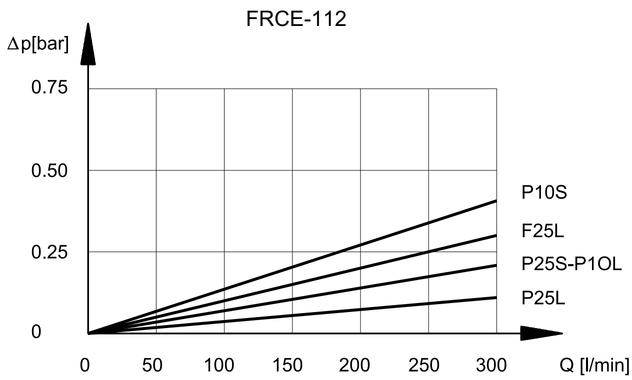
2 - CHARACTERISTIC CURVES (values measured with viscosity of 36 cSt at 50°C)

2.1 - Pressure drops through the filter body



2.2 - Pressure drops through the FRCE filter element



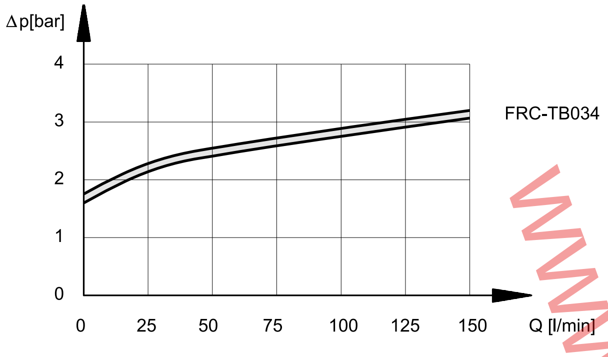


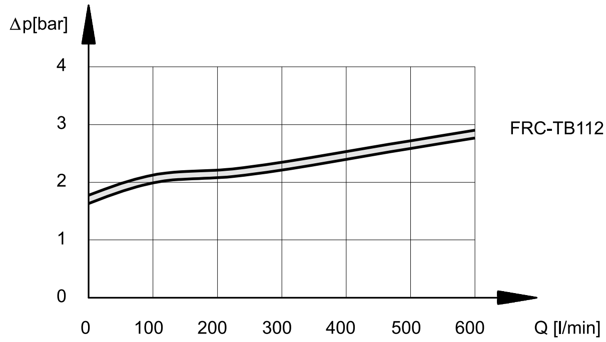
NOTE 2: The filter size has to be selected so that with the nominal flow rate the pressure drop is lower than 0.5 bar.
The total pressure drop through the filter is given by adding the body pressure drop values to those of the filter element.
As for fluids whose viscosity degree at a specific operating pressure is different from 36 cSt, the filter total pressure drop has to be changed according to the following ratio:
total Δpl value = body Δp value + (real Δp value of the filter element x real viscosity value (cSt) / 36)

real Δp value of the filter element = value obtainable through the diagrams in paragraph 2.2

Such ratio is valid for a viscosity value up to 200 cSt.
For a higher viscosity please consult our technical department.

2.3 - Pressure drops through the by-pass valve



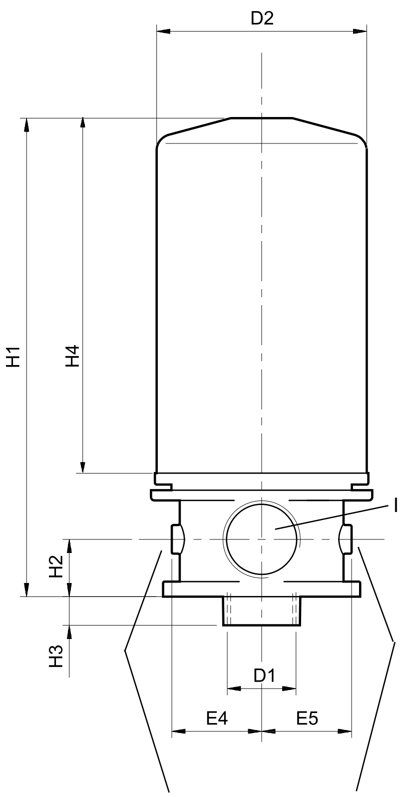


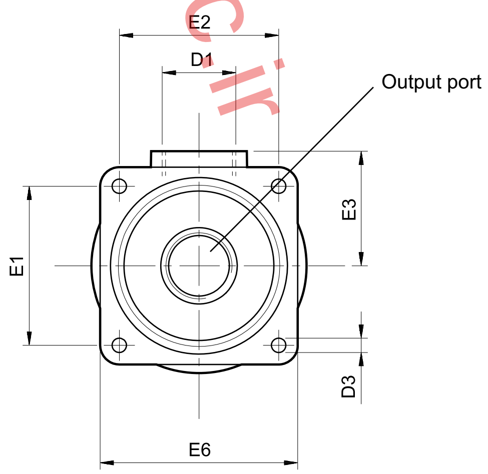
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm





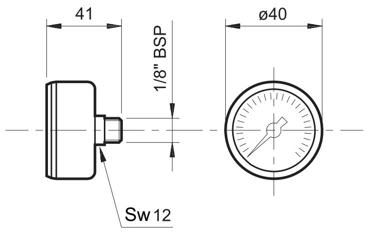
Filter	filter element	D1 (BSP)	D2	D3	H1	H2	H3	H4	E1	E2	E3	E4	E5	E6	R*
FRC-TB034	S	3/4"	95	7	196	25	18	146	70	70	50	38	38	108	211
	L				241			191							256
FRC-TB112	S	1 ½"	130	9	252	36	18	181	100	100	72	56	56	140	282
	L				297			226							327

R* = Filter element removal space above the tank surface

5 - CLOGGING INDICATORS

The filters are designed to incorporate clogging indicators, which have to be ordered separately.

5.1 - Visual indicator for return filters
Identification code: VR/10

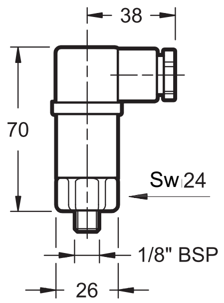


This indicator is a pressure gauge sensitive to the filter input pressure.

The indicator is supplied with a 0 ÷ 6 bar graduated scale and with a two-colour reading scale, which informs you about the clogging condition of the filter element:

GREEN: efficient filter element (0 ÷ 1.7 bar)
RED: the filter element has to be replaced (> 1.7 bar)

5.2 - Electric indicator for return filters
Identification code: ER/11



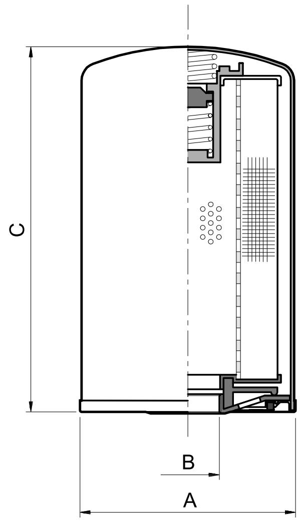
This indicator is a pressure switch sensitive to the filter input pressure, which switches an electric contact when the filter element has reached the clogging limit.

The contact can be wired in an open or closed condition (see the hydraulic symbol).

TECHNICAL SPECIFICATIONS

Operating pressure	bar	1,5
AC power supply		
Max. operating voltage	VAC	250 50/60 Hz
Max. load on the contacts (inductive or resistive) with V at 125 VAC with V at 250 VAC	A	 3 0,5
DC power supply		
Max. operating voltage	VDC	30
Max. load on the contacts resistive inductive	A	 3 1
Electric connector	DIN 43650	
Class of protection according to CEI EN 60529 (atmospheric agents)	IP65	
Atex classification	3 GD EEx e T6	

6 - FILTER ELEMENTS



Filter element code	ØA	ØB	C	Average filtering surface [cm²]
FRCE - 034 -P*S	96,5	3/4" BSP	146	3305
FRCE - 034 -P*L	96,5	3/4" BSP	191	4745
FRCE - 034 -F25L	96,5	3/4" BSP	191	3630
FRCE - 112 -P*S	129	1 ¼" BSP	181	5560
FRCE - 112 -P*L	129	1 ¼" BSP	226	7360
FRCE - 112 -F25L	129	1 ¼" BSP	226	5890

FILTER ELEMENT IDENTIFICATION CODE

F R C E - [ ] [ ] [ ] - [ ] [ ] [ ] / 10 [ ]

Cartridge filter element for FRC filters

Nominal dimension
034 = 3/4" **112** = 1 ½"

Filtration degree : F25 = fibre 25 μm
P10 = paper 10 μm
P25 = paper 25 μm

Type of filter element:
S = standard (not available with a F25 filtration degree)
L = long-lasting element

Series N. (from 10 to 19 sizes and mounting dimensions remain unchanged)

N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids upon request

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DUPLOMATIC OLEODINAMICA

FPH

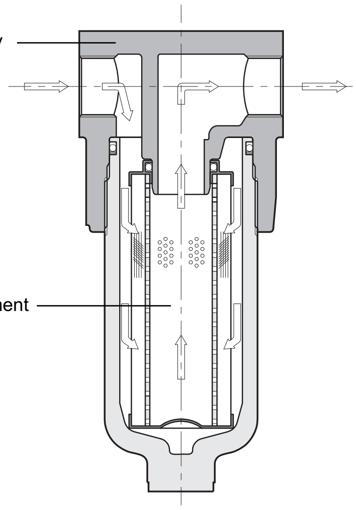
PRESSURE FILTER FOR LINE MOUNTING

SERIES 11

p max **420** bar

Q max (see table of performances)

OPERATING PRINCIPLE



— FPH filters are designed to be line-mounted with BSP threaded ports for hydraulic connections. Threaded holes are machined on the head for possible filter bracket fixing.

— The replacement of the filter element can be easily carried out by using a normal hexagon spanner to unscrew the bowl of the filter, which has a suitably shaped end.

— FPH filters are designed to be installed on pressure lines up to 420 bar; the filter elements are made of high efficiency filtering materials and are capable of holding high quantities of contamination particles. They are available with three different filtration degrees:

H05 = 5 µm: absolute (β_5> 100 - ISO 4406:1999 class 17/15/12) cartridge with a collapsing differential pressure = 210 bar to be used without a by-pass valve.
F10 = 10 µm: absolute (β_{10}> 100 - ISO 4406:1999 class 18/16/13)
F25 = 25 µm: absolute (β_{25}> 100 - ISO 4406:1999 class 19/17/14)

— Those filters with a F10 and F25 filtration degree are supplied with a by-pass valve and have a cartridge with a collapsing differential pressure = 20 bar.

— All the FPH filters are designed to incorporate a visual-differential or a visual-electric clogging indicator to be ordered separately (see par. 5).

PERFORMANCES

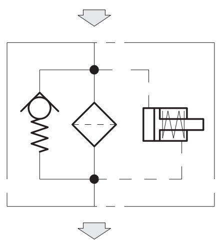
Filter code	BSP port dimensions	Mass [Kg]	Rated flow (indicative) [l/min]		
			H05	F10	F25
FPH-TB012	1/2”	4.4	10	27	33
FPH-TB034	3/4”	5.2	19	42	65
FPH-TB100	1”	8.2	40	95	105
FPH-TB114	1 ¼”	14	88	190	230
FPH-TB112	1 ½”	17.2	120	260	320

NOTE 1: The flow rates stated in the table correspond to a 0.8 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C.
As for a different viscosity range, see NOTE 2 - par. 2.2.

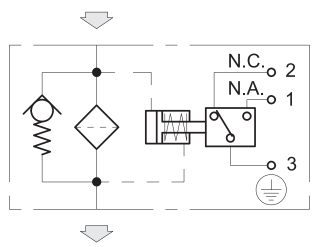
Maximum operating pressure	bar	420
Collapsing differential pressure of the filter element: H05 F-10-F25	bar	210 20
Differential pressure for the opening of the by-pass valve (±10 %)	bar	6
Ambient temperature range	°C	-25 / +50
Fluid temperature range	°C	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

HYDRAULIC SYMBOL

Filter with indicator VPM type



Filter with indicator EPM type



1 - IDENTIFICATION CODE

F	P	H	-	T	B				-			S	/	11		-	

High pressure delivery filter

BSP threaded ports

Nominal dimension:
012 = 1/2” **100** = 1” **112** = 1 1/2”
034 = 3/4” **114** = 1 1/4”

Filtration degree: **H05** = fibre 5 µm (β_5> 100) - ISO 4406:1999 class 17/15/12
F10 = fibre 10 µm (β_{10}> 100) - ISO 4406:1999 class 18/16/13
F25 = fibre 25 µm (β_{25}> 100) - ISO 4406:1999 class 19/17/14

Standard filter element

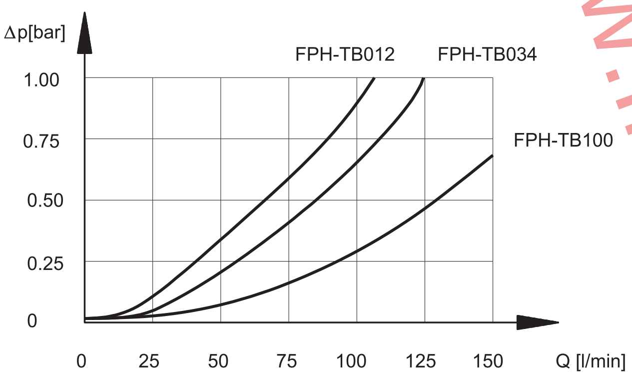
Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

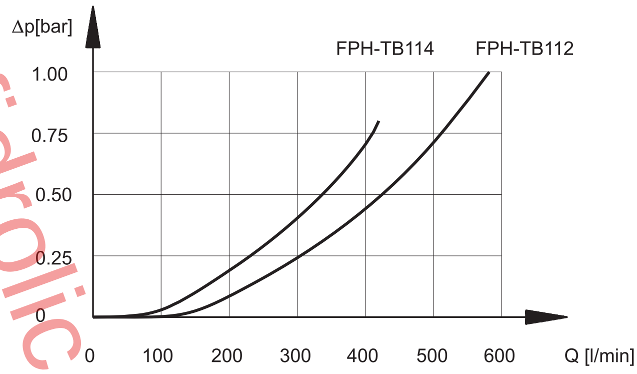
Seals:
N = NBR standard seals for mineral oils (**standard**)
V = FPM seals for special fluids

B = with by-pass valve
Opening pressure: 6 bar
0 = without by-pass valve (compulsory for a H05 filtration degree)

2 - CHARACTERISTIC CURVES (values measured with viscosity of 36 cSt at 50°C)

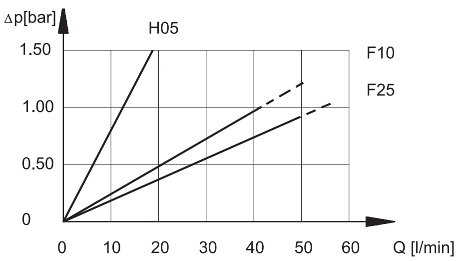
2.1 - Pressure drops through the filter body



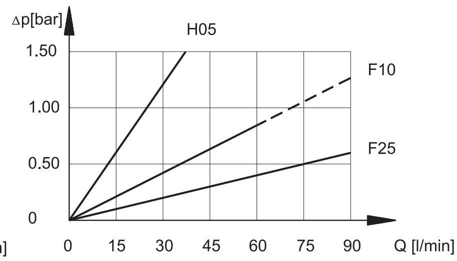


2.2 - Pressure drops through the FPHE filter element

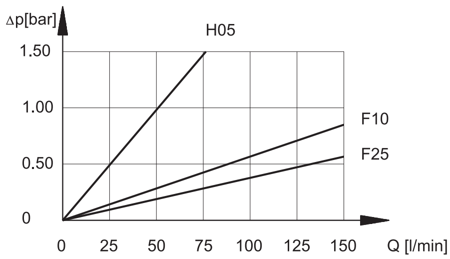
FPHE-TB012



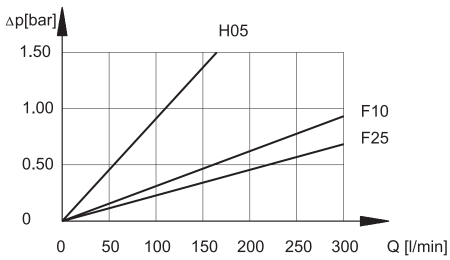
FPHE-TB034



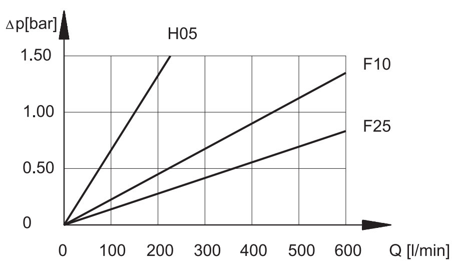
FPHE-TB100



FPHE-TB114



FPHE-TB112



NOTE 2: The filter size has to be selected so that with the nominal flow rate the pressure drop is lower than 0.8 bar.

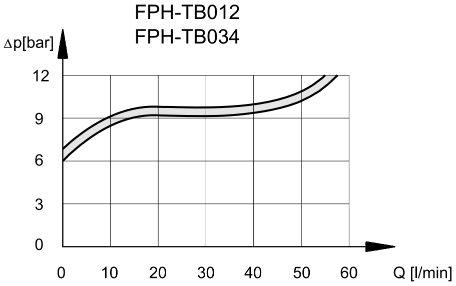
The total pressure drop through the filter is given by adding the body pressure drop values to those of the filter element. As for fluids whose viscosity degree at a specific operating pressure is different from 36 cSt, the filter total pressure drop has to be changed according to the following ratio:

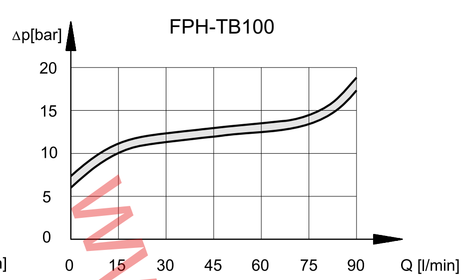
total Δpl value = body Δp value + (real Δp value of the filter element x real viscosity value (cSt) / 36)

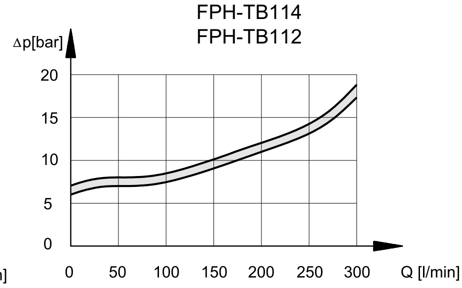
real Δp value of the filter element = value obtainable through the diagrams in par. 2.2

Such ratio is valid for a viscosity value up to 200 cSt. For a higher viscosity please consult our technical department.

2.3 - Pressure drops through the by-pass valve





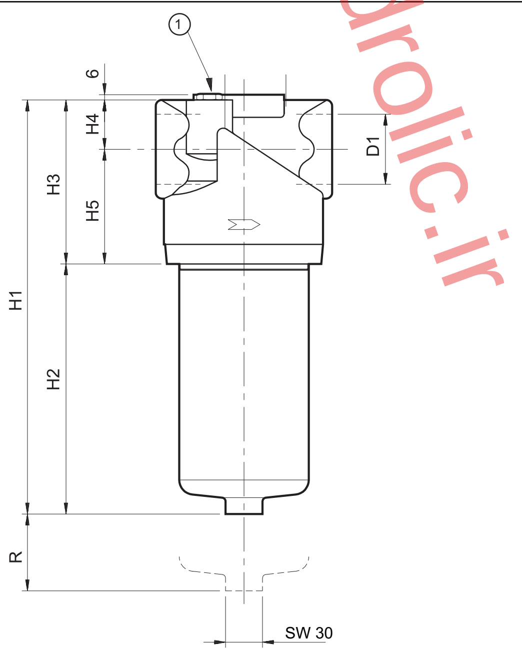


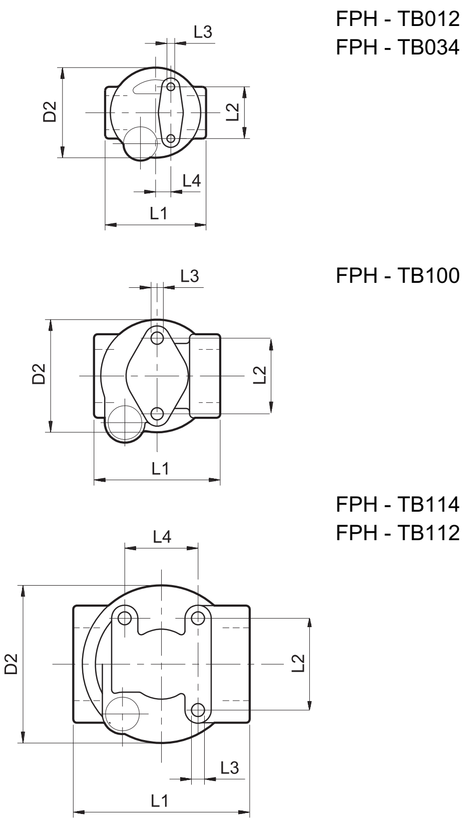
3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS





dimensions in mm

filter	D1	D2	H1	H2	H3	H4	H5	L1	L2	L3	L4	R*
FPH- TB012	1/2”	82	166	79	86	23	63	85	46	M8	12,5	100
FPH- TB034	3/4”	82	296	209	86	23	63	85	46	M8	12,5	100
FPH- TB100	1”	94	317	207	112	35	77	107	65	M8	-	100
FPH- TB114	1 ¼”	128	337	199	137	44	93	143	88	M10	43	100
FPH- TB112	1 ½”	128	457	319	137	44	93	143	88	M10	43	100

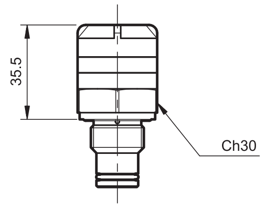
R* = removal space for filter element

1	Clogging indicator port: M20 x 1,5

5 - CLOGGING INDICATORS

The filters are all designed to incorporate clogging indicators, which have to be ordered separately.

5.1 - Visual indicator for delivery filters
Identification code: VPM/10

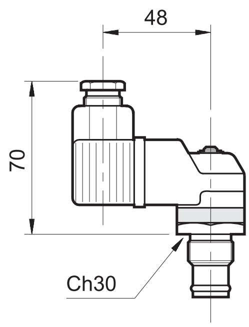


This indicator measures the differential pressure between the filter input and output.

The indicator is supplied with coloured bands, which informs you about the clogging condition of the filter element:

WHITE: efficient filter element Δp <5 bar (± 10%)
RED: the filter element has to be replaced Δp >5 bar (± 10%)

5.2 - Electric-visual indicator for delivery filters
Identification code: EPM/10



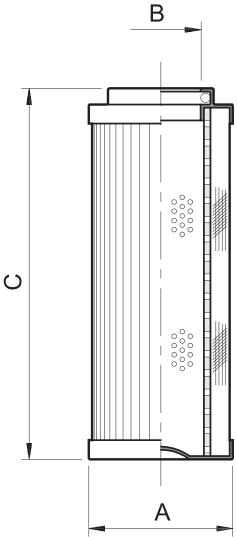
This indicator, apart from giving a visual indication, for example the VPM model, operates by switching an electric contact when the filter element has reached the clogging limit.

The contact can be wired in an open or closed condition (see the hydraulic symbol).

TECHNICAL SPECIFICATIONS

Differential operating pressure	bar	5
AC power supply		
Max. operating voltage	VAC	250 50/60 Hz
Max. load on the contacts (inductive or resistive)	A	1
DC power supply		
Max. operating voltage	VDC	125
Max. load on the contacts (with V at 30-50-75-125 VDC) resistive / inductive	A	2 - 0,5 - 0,25 - 0,2 / 2 - 0,5 - 0,25 - 0,03
Electric connector	DIN 43650	
Class of protection according to CEI EN 60529 (atmospheric agents)	IP65	

6 - FILTER ELEMENTS



filter element code	ØA	ØB	C	Average filtering surface [cm²] H05	Average filtering surface [cm²] F12/F25
FPHE - 012	45	25	85	340	355
FPHE - 034	45	25	211	915	935
FPHE - 100	52	23,5	210	1785	1830
FPHE - 114	78	42,5	210	2695	3695
FPHE - 112	78	42,5	330	4325	5025

FILTER ELEMENT IDENTIFICATION CODE

F P H E - _ _ _ - _ _ S / 10 _

Filter element for FPH filters

Nominal dimension:
012 = 1/2” **114** = 1 1/4”
034 = 3/4” **112** = 1 1/2”
100 = 1”

Filtration degree: H05 = fibre 5 µm
F10 = fibre 10 µm
F25 = fibre 25 µm

Standard filter element

Series N. (from 10 to 19 sizes and mounting dimensions remain unchanged)

N = NBR seals for mineral oils (**standard**)
V = FPM seals for special fluids (upon request)

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DUPLOMATIC OLEODINAMICA

FPM

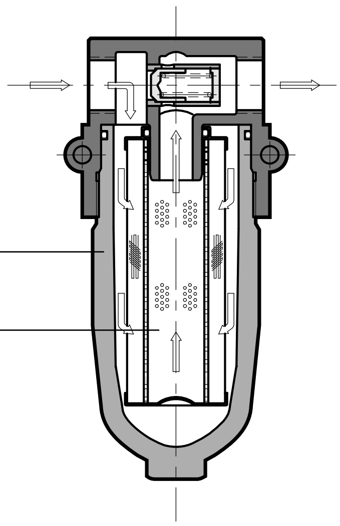
MEDIUM PRESSURE FILTER FOR LINE MOUNTING

SERIES 10

p max **210** bar

Q max (see table of performances)

OPERATING PRINCIPLE



— The FPM filters are designed to be line-mounted with BSP threaded ports for hydraulic connections. Threaded holes are machined on the head for possible filter bracket fixing .

— The replacement of the filter element can be easily carried out by using a normal hexagon spanner to unscrew the bowl of the filter, which has a suitably shaped end.

— FPM filters are designed to be installed on medium pressure lines up to 210 bar; the filter elements are made of high efficiency filtering materials and are available with three different filtration degrees:
F05 = 5 µm absolute (β_5 >100 - ISO 4401:1999 class 17/15/12)
F10 = 10 µm absolute (β_{10}>100 - ISO 4401:1999 class 18/16/13)
F25 = 25 µm absolute (β_{25} >100 - ISO 4401:1999 class 19/17/14)

— The filters are always supplied with a by-pass valve.

— The filter elements are available in the standard version (S) or in the long-lasting version (L) is able to hold high quantities of contamination material. For all filter elements the collapsing differential pressure is 20 bar.

— All the FPM filters are designed to incorporate a visual-differential or a visual-electric clogging indicator to be ordered separately (see paragraph 5).

PERFORMANCES

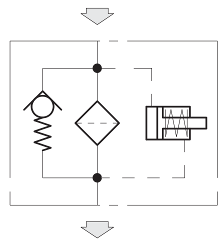
Filter code	BSP port dimensions	Mass [Kg]		Rated flow (indicative) [l/min]					
		type S	type L	F05S	F05L	F10S	F10L	F25S	F25L
FPM-TB012	1/2"	1,5	2,0	25	40	35	50	45	60
FPM-TB034	3/4"			35	50	50	65	65	80
FPM-TB100	1"			40	60	60	85	85	100

NOTE 1: the flow rates stated in the table correspond to a 0.8 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C.
As for a different viscosity range, see NOTE 2 - par. 2.2.

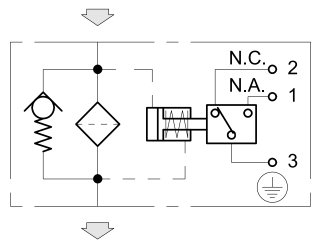
Maximum operating pressure	bar	210
Collapsing differential pressure of the filter element	bar	20
Differential pressure for the opening of the by-pass valve (±10 %)	bar	6
Ambient temperature range	°C	-25 / +50
Fluid temperature range	°C	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

HYDRAULIC SYMBOL

Filter with indicator VPM type



Filter with indicator EPM type



1 - IDENTIFICATION CODE

F	P	M	-	T	B				-				/	10		-	

Medium pressure delivery filter

BSP threaded ports

Nominal dimension:
012 = 1/2" **034** = 3/4" **100** = 1"

Filtration degree:
F05 = fibre 5 µm (β_5 > 100) - ISO 4401:1999 class 17/15/12
F10 = fibre 10 µm (β_{12} > 100) - ISO 4401:1999 class 18/16/13
F25 = fibre 25 µm (β_{25} > 100) - ISO 4401:1999 class 19/17/14

Type of filter element:
S = standard **L** = long-lasting element

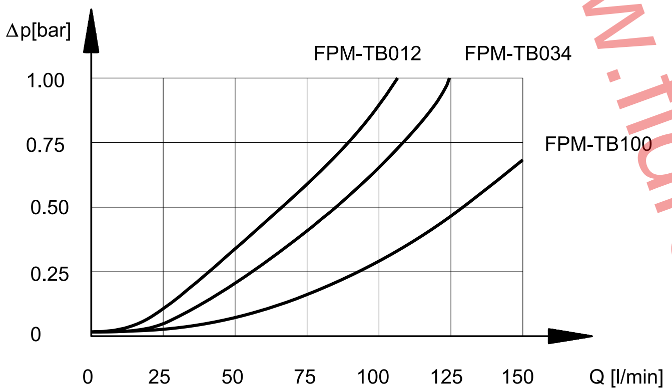
Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

Seals:
N = NBR standard seals for mineral oils (**standard**)
V = FPM seals for special fluids

B = with by-pass valve
Opening pressure 6 bar
0 = without by-pass valve
(upon request only)

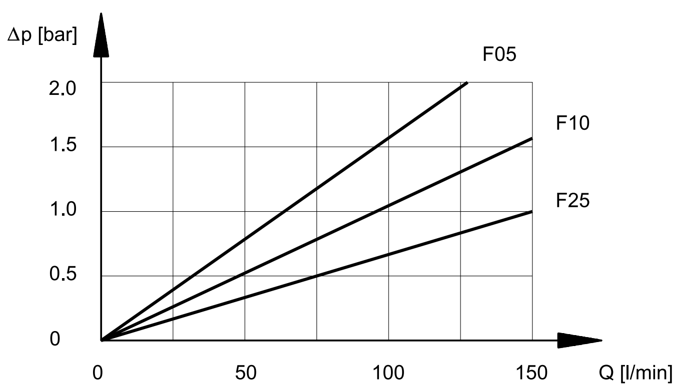
2 - CHARACTERISTIC CURVES (values measured with viscosity of 36 cSt at 50°C)

2.1 - Pressure drops through the filter body

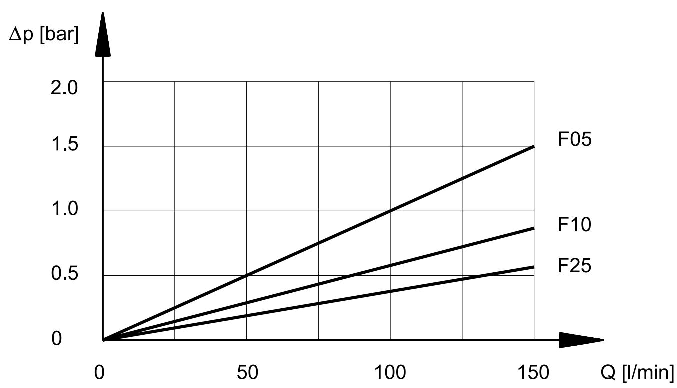


2.2 - Pressure drops through FPME filter element

FPME-*S
(standard filter element)



FPME-*L
(long-lasting filter element)



NOTE 2: The filter size has to be selected so that with the nominal flow rate the pressure drop is lower than 0.8 bar.

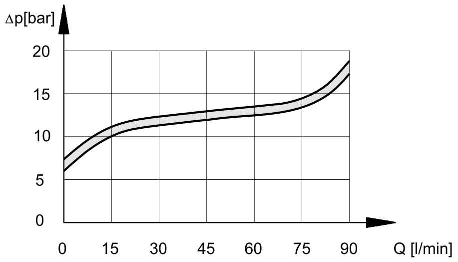
The total pressure drop through the filter is given by adding the body pressure drop values to those of the filter element. As for fluids whose viscosity degree at a specific operating pressure is different from 36 cSt, the filter total pressure drop has to be changed according to the following ratio:

total Δpl value = body Δp value + (real Δp value of the filter element x real viscosity value (cSt) / 36)

real Δp value of the filter element = value obtainable through the diagrams in paragraph 2.2

Such ratio is valid for a viscosity value up to 200 cSt. For a higher viscosity please consult our technical department.

2.3 - Pressure drops through by-pass valve



3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

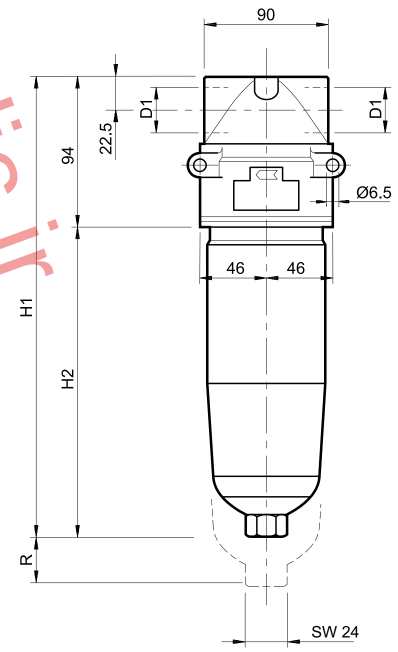
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

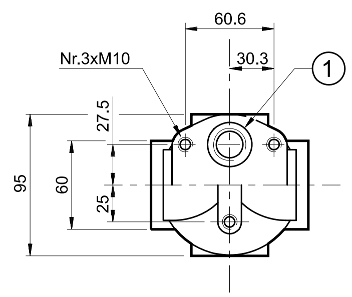
dimensions in mm

Filter code	D1	H1	H2	R*
FPM-TB012-*S	1/2"	205	111	100
FPM-TB034-*S	3/4"	205	111	100
FPM-TB100-*S	1"	205	111	100
FPM-TB012-*L	1/2"	298	197	100
FPM-TB034-*L	3/4"	298	197	100
FPM-TB100-*L	1"	298	197	100

R* = Filter element removal space



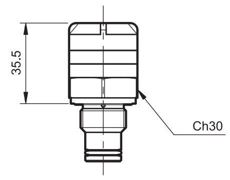
1	Clogging indicator port: M20 x 1,5



5 - CLOGGING INDICATORS

The filters are all designed to incorporate clogging indicators, which have to be ordered separately

5.1 - Visual indicator for medium pressure delivery filters
Identification code: VPM/10

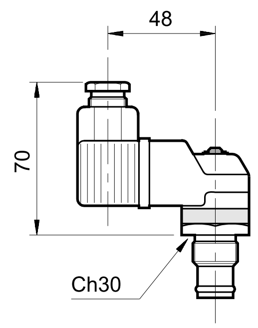


This indicator measures the differential pressure between the filter input and output.

The indicator is supplied with coloured bands, which informs you about the clogging condition of the filter element:

WHITE: efficient filter element Δp <5 bar (± 10%)
RED: the filter element has to be replaced p >5 bar (± 10%)

5.2 - Electric-visual indicator for delivery filters
Identification code: EPM/10



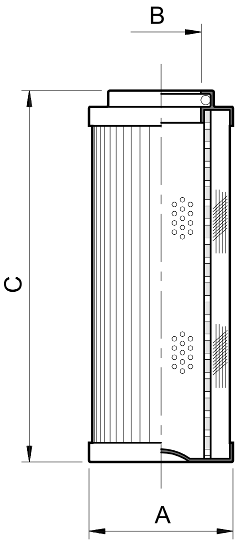
This indicator, apart from giving a visual indication, for example the VPM model, operates by switching an electric contact when the filter element has reached the clogging limit.

The contact can be wired in an open or closed condition (see the hydraulic symbol).

TECHNICAL SPECIFICATIONS

Differential operating pressure	bar	5
AC power supply		
Max. operating voltage	VAC	250 50/60 Hz
Max. load on the contacts (inductive or resistive)	A	5
DC power supply		
Max. operating voltage	VDC	125
Max. load on the contacts (with V at 30-50-75-125 VDC) resistive inductive	A	2 - 0,5 - 0,25 - 0,2 2 - 0,5 - 0,25 - 0,03
Electric connector	DIN 43650	
Class of protection according to CEI EN 60529 (atmospheric agents)	IP65	

6 - FILTER ELEMENTS



filter element code	ØA	ØB	C	Average filtering surface [cm²]
FPME - *S	52	23,5	115	975
FPME - *L	52	23,5	210	1830

FILTER ELEMENT IDENTIFICATION CODE

F	P	M	E	-				/	10	

Filter element for FPM filters

Filtration degree:
F05 = fibre 5 µm
F10 = fibre 10 µm
F25 = fibre 25 µm

Filter element type:
S = standard
L = long-lasting

Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

N = NBR seals for mineral oils **(standard)**
V = FPM seals for special fluids (upon request)

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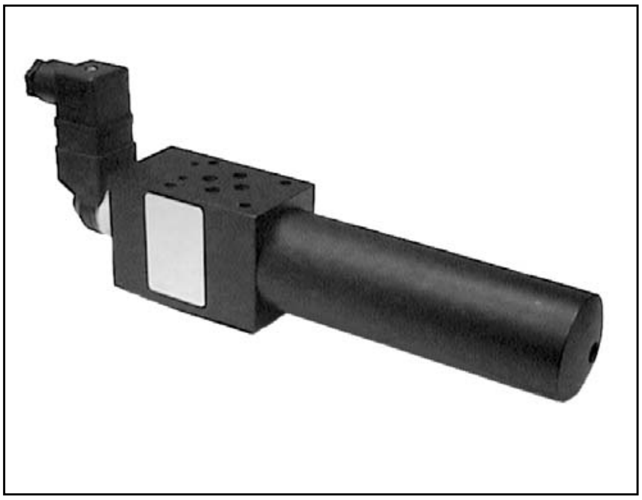


FPHM

PRESSURE FILTER

SERIES 10

MODULAR VERSION

p max **320** bar

Q max (see table of performances)

OPERATING PRINCIPLE

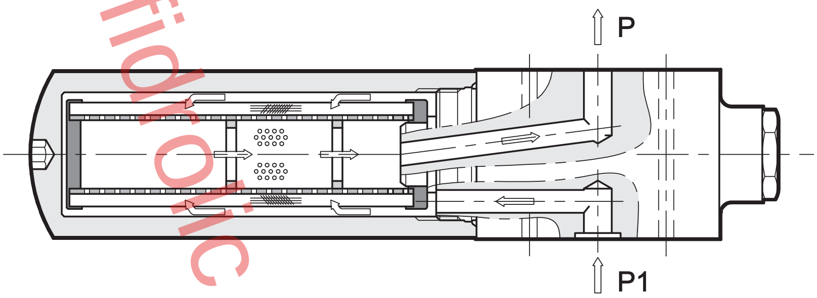
— The FPHM filters are designed for the modular mounting directly under proportional valves or servovalves with ISO 4401 (CETOP RP 121H) interfaces.

— They are available in two nominal dimensions with ISO 4401-03 (CETOP 03) e ISO 4401-05 (CETOP 05) mounting surface.

— FPHM filters are designed for working pressures up to 320 bar. The filter elements are made of high efficiency filtering materials and are available with three different filtration degrees and with a collapsing differential pressure = 210 bar:

F05 = 5 µm absolute
($ß_5$>100 - ISO 4406:1999 class 17/15/12)
F10 = 10 µm absolute
($ß_{10}$>100 - ISO 4406:1999 class 18/16/13)
F25 = 25 µm absolute
($ß_{25}$>100 - ISO 4406:1999 class 19/17/14)

— All the FPHM filters are supplied without by-pass valve and are designed to incorporate a visual-differential or a visual-electric clogging indicator to be ordered separately (see paragraph 5).



PERFORMANCES

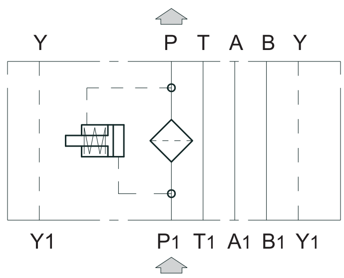
Filter	Dimensions	Mass [Kg]	Rated flow (indicative) [l/min]		
			F05	F10	F25
FPHM3	ISO 4401-03	2,5	12	13,5	16
FPHM5	ISO 4401-05	4,2	22	25	28

NOTE 1: The flow rates stated in the table correspond to a 3 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C.
As for a different viscosity range, see NOTE 2 - par. 2.2.

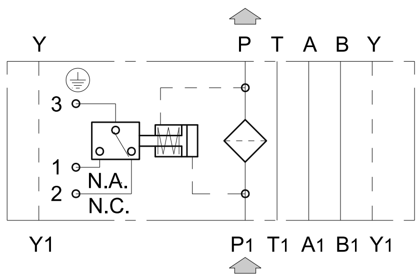
Maximum operating pressure	bar	320
Collapsing differential pressure of the filter element	bar	210
Ambient temperature range	°C	-25 / +50
Fluid temperature range	°C	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

HYDRAULIC SYMBOL

Modular filter with indicator VM type



Modular filter with indicator EM type



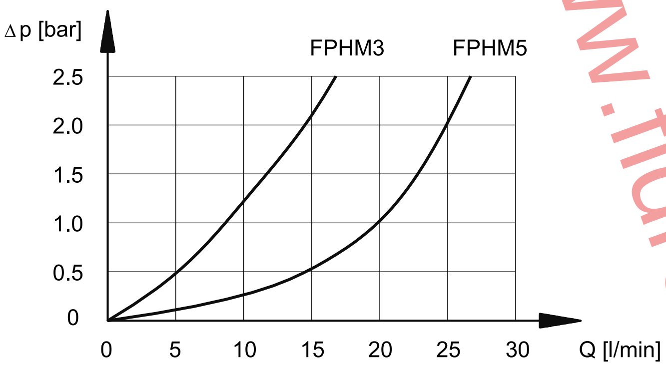
1 - IDENTIFICATION CODE

F P H M _ - _ _ S / 10 _ - 0

- High pressure delivery filter (F P H)
- Modular version (M)
- Nominal dimension: **3** = ISO 4401-03 **5** = ISO 4401-05
- Filtration degree:
  - **F05** = fibre 5 µm (β_5>100 - ISO 4406:1999 class 17/15/12)
  - **F10** = fibre 10 µm (β_{10}>100 - ISO 4406:1999 class 18/16/13)
  - **F25** = fibre 25 µm (β_{25}>100 - ISO 4406:1999 class 19/17/14)
- Standard filter element (S)
- Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)
- Seals: **N** = NBR standard seals for mineral oils (**standard**) **V** = FPM seals for special fluids
- without by-pass valve (0)

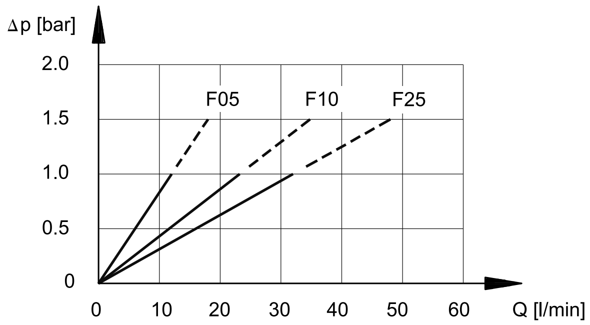
2 - CHARACTERISTIC CURVES (values measured with viscosity of 36 cSt at 50°C)

2.1 - Pressure drops through the filter body

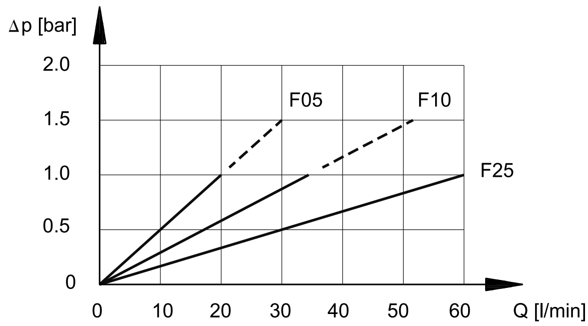


2.2 - Pressure drops through FPHME filter element

FPHME3



FPHME5



NOTE 2: The filter size has to be selected so that with the nominal flow rate the pressure drop is lower than 0.8 bar.

The total pressure drop through the filter is given by adding the body pressure drop values to those of the filter element. As for fluids whose viscosity degree at a specific operating pressure is different from 36 cSt, the filter total pressure drop has to be changed according to the following ratio:

total Δpl value = body Δp value + (real Δp value of the filter element x real viscosity value (cSt) / 36)

real Δp value of the filter element = value obtainable through the diagrams in par. 2.2

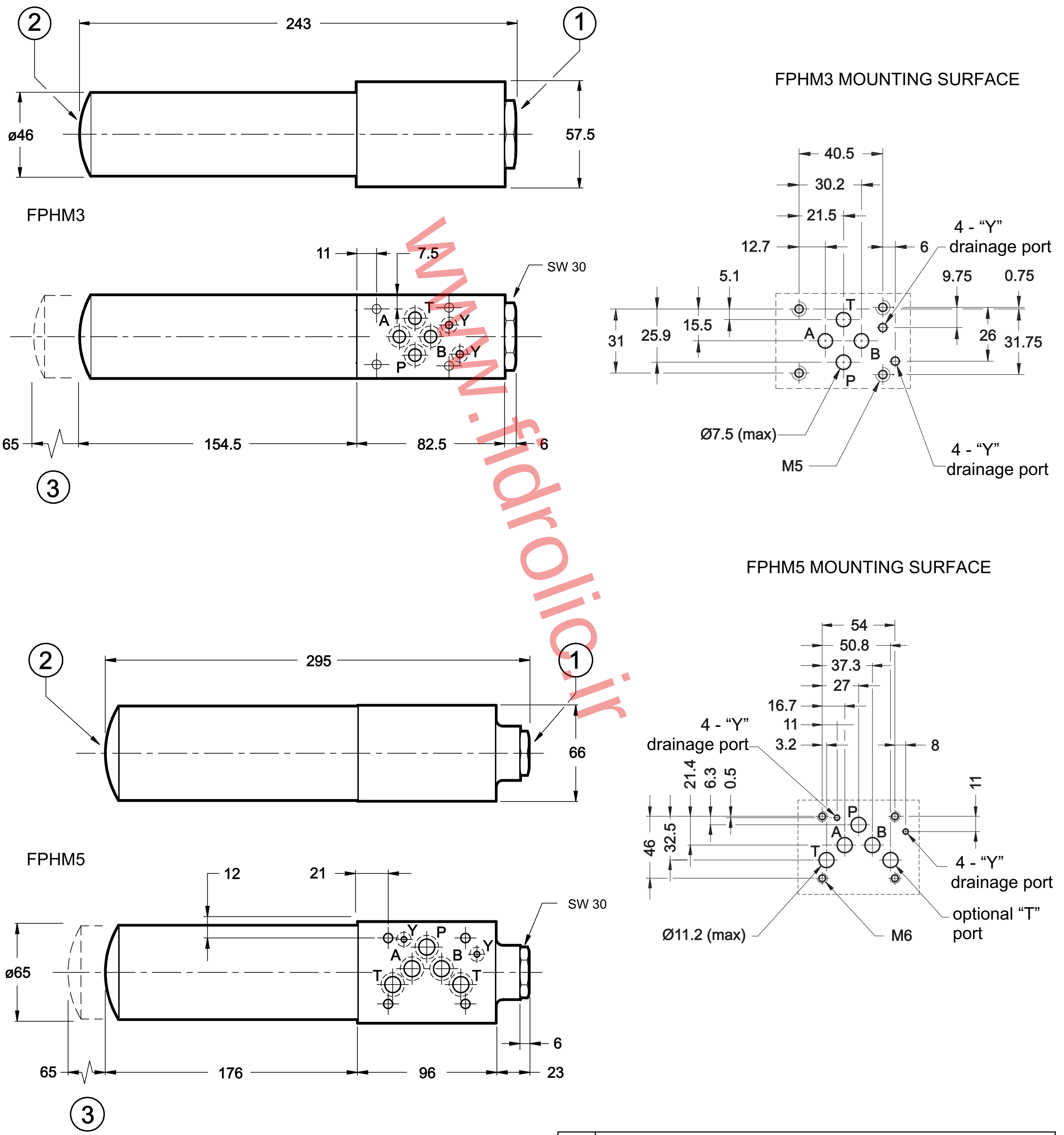
Such ratio is valid for a viscosity value up to 200 cSt. For a higher viscosity please consult our technical department.

3 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.
The fluid must be preserved in its physical and chemical characteristics.

4 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm



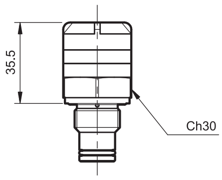
1	Clogging indicator port: M20x1,5
2	Wrench seat facility for housing removal: countersunk hex spanner 10

3	Mounting surface with sealing rings: **FPHM3**: 4 OR 108 (8.73x1.78) 2 OR 2025 (6.07x1.78) **FPHM5**: 5 OR 2050 (12.42x1.78) 2 OR 106 (6.75x1.78)
4	Filter element removal space

5 - CLOGGING INDICATORS

The filters are all designed to incorporate clogging indicators, which have to be ordered separately.

5.1 - Visual indicator for modular filters
Identification code: VM/10

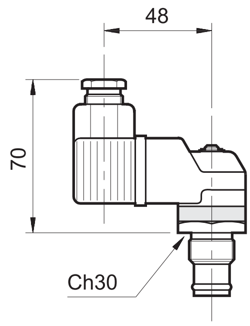


This indicator measures the differential pressure between the filter input and output.

The indicator is supplied with coloured bands, which informs you about the clogging condition of the filter element:

WHITE: efficient filter element Δp < 8 bar (± 10%)
RED: the filter element has to be replaced Δp > 8 bar (± 10%)

5.2 - Electric-visual indicator for modular filters
Identification code: EM/10



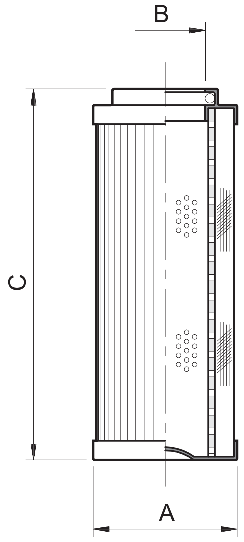
This indicator, apart from giving a visual indication, for example the VPM model, operates by switching an electric contact when the filter element has reached the clogging limit.

The contact can be wired in an open or closed condition (see the hydraulic symbol).

TECHNICAL SPECIFICATIONS

Differential operating pressure	bar	8
AC power supply		
Max. operating voltage	VAC	250 50/60 Hz
Max. load on the contacts (inductive or resistive)	A	5
DC power supply		
Max. operating voltage	VDC	125
Max. load on the contacts (with V at 30-50-75-125 VDC) resistive inductive	A	2 - 0,5 - 0,25 - 0,2 2 - 0,5 - 0,25 - 0,03
Electric connector	DIN 43650	
Class of protection according to CEI EN 60529 (atmospheric agents)	IP65	

6 - FILTER ELEMENTS



filter element code	ØA	ØB	C	Average filtering surface [cm²]
FPHME3	33	16	100	270
FPHME5	45	25	115	475

FILTER ELEMENTS IDENTIFICATION CODE

F	P	H	M	E		-			S	/	10	

FPHME: Filter element for FPHM modular filter

Nominal dimension:
3 = ISO 4401-03
5 = ISO 4401-05

Filtration degree : **F05** = fibre 5 μm
F10 = fibre 10 μm
F25 = fibre 25 μm

S: Standard filter element

10: Series No. (from 10 to 19 sizes and mounting dimensions remain unchanged)

N = NBR seals for mineral oils **(standard)**
V = FPM seals for special fluids (upon request)

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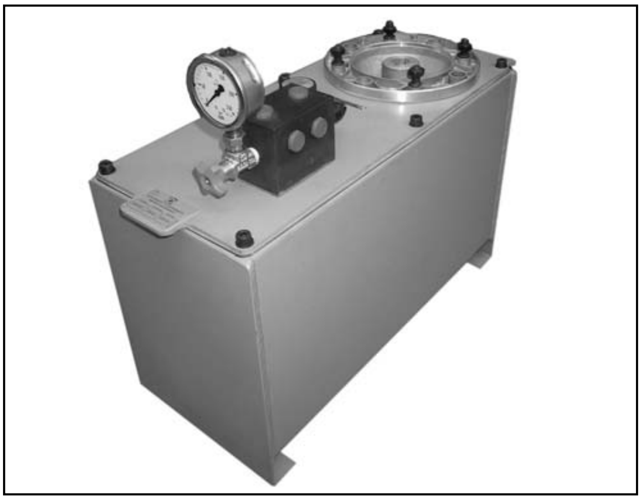


CTR*

HYDRAULIC POWER UNITS

TANK CAPACITY
from 8 lt to 150 lt

PUMP FLOW RATE
from 1,6 lt to 41lt

DESCRIPTION

The CTR* power units, are realised with a soaked gear pump and a vertically mounted electric motor.
The tank cover can be rotated of 180° without disassembling the installed components.
The standard components are intake filter, gear pump, motor - pump connection group, arrangement for the electric motor, pressure relief valve, a position for one electro-valve (not included in the supplying), manometer with the shut-off cock, oil charge cover and oil visual indicator.
The electric motor supplied is a eurotension4-poles three-phase asynchronous motor with shape B5 according to UNEL-MEC standards.
The available paintings are dull black RAL 9005 (**standard**), Grey RAL 7037 and Green RAL 6011.
The power units works with mineral oil (not included in the supplying).
To work with other hydraulic fluids, please consult our Technical Department.

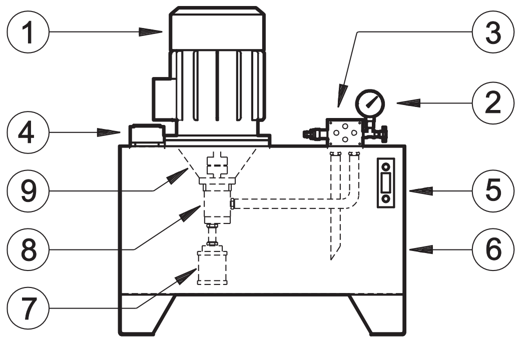
OPTIONALS
The standard power unit can be equipped with the following components:

CTR 0 - 1 - 2
- other settings for electro-valves ISO 4401-03 (CETOP 03) with P2D modular subplates
- thermostat
- level gauge
- return filter for line mounting
- other colour paintings under request

CTR 3 - 4
- high pressure pumps H version
- other settings for electrovalves ISO 4401-03 (CETOP 03) with P2D modular subplates.
- thermostat
- level gauge
- a return filter for line mounting
- an heat exchanger air/oil or water/oil
- other colour paintings under request

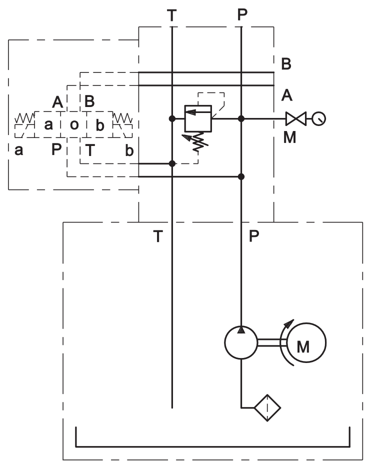
The standard power unit is delivered without the functional diagram.

STANDARD COMPONENTS



1) Electric motor
2) Manometer with shut-off selector
3) Pressure relief valve
4) Charge cover
5) Level gauge
6) Oil reservoir
7) intake filter
8) Gear pumps
9) Motor - pump connection group

HYDRAULIC SYMBOL



1 - CTR0 power unit

1.1 - Identification code

C	T	R	0	-	008	/				/	1P	-		/					/	40

power unit with soaked pump (CTR)

Cover size (0)

Tank capacity 8 dm^3 (008)

Electric motor shape B5
P = arrangement for motor mounting
M = electric motor already mounted

4-poles electric motor power:
0.25 = 0.25 kW
0.37 = 0.37 kW

Electric motor voltage
(omit for P version)
A = 230-400V / 50-60 Hz

Pump type **1P**
(see cat. 11 110 for the pump technical characteristics)

Pump flow rate(l/min) at 1500 rpm
(see flow rate / pressure table)

Standard panel with 3/8” rear ports
A = P2D-M* with 1 pos. ISO 4401-03 (CETOP 03)
B = P2T -M* with 2 pos. ISO 4401-03 (CETOP 03)

0 = without level gauge
1 = with level gauge

0 = without thermostat
1 = with thermostat

N = Dull black RAL 9005 **(standard)**
G = Grey RAL 7037
V = Green RAL 6011

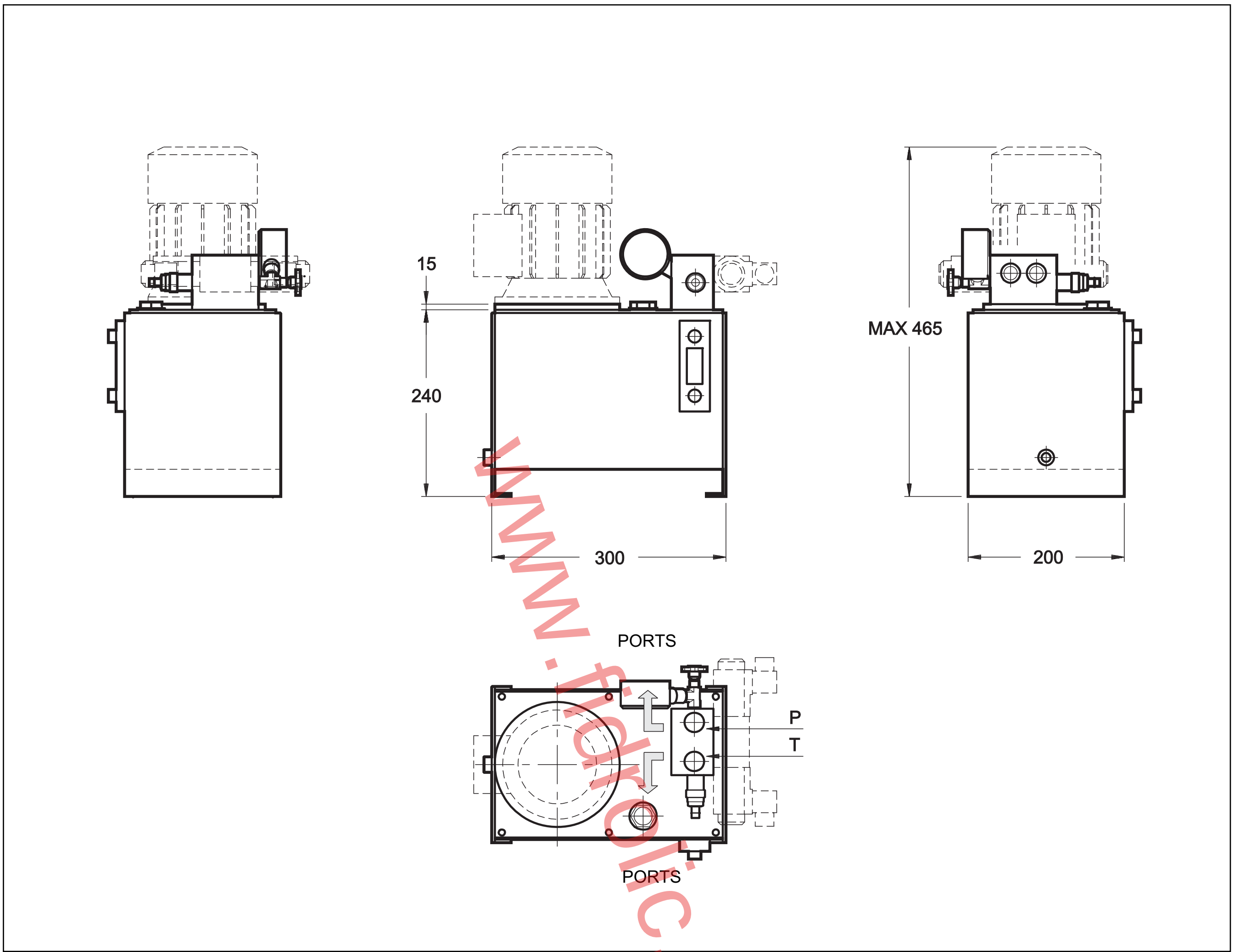
Series No. (from 40 to 49 sizes and mounting dimensions remain unchanged)

1.2 - Flowrate / pressure table

Electric motor flange size			Ø = 160	
			Electric motor power [kW]	
CTR0	Pump type	Flow rate at 1500 rpm [lt/min]	**0,25**	**0,37**
			Max pressure [bar]	
008	1P 1,6 R	**1,6** *	80	115
	2 R	**2,0**	65	95
	2,5 R	**2,4** *	55	80
	3,3 R	**3,2**	40	60
	4,2 R	**3,9** *	30	50
	5 R	**4,8**	25	40
	5,8 R	**5,5** *	20	35
	6,7 R	**6,3**	15	30
	7,5 R	**7,1**	10	25

* pumps for preferential choice

1.3 - Overall and mounting dimensions for CTR0



2 - POWER UNITS CTR1

2.1 - Identification code

C	T	R	1	-		/				/	1P	-		/						/	40

power unit with soaked pump

Cover size

Tank capacity
013 = 13 dm^3
020 = 20 dm^3

Electric motor B5 shape
P = Predisposition for motor assembly
M = Mounted electric motor

4-poles power electric motor:
0.55 = 0.55 kW
0.75 = 0.75 kW
1.1 = 1.1 kW
1.5 = 1.5 kW

Electric motor voltage
(omit for P version)
A = 230-400V / 50-60 Hz

Pump type **1P**
(see cat. 11 110 for the pump technical characteristics)

Flowrate pump (l/min)at 1500 rpm
(see flowrate / pressure table)

Standard panel with rear ports G 3/8”
A = P2D-M* with 1 pos. ISO 4401-03 (CETOP 03)
B = P2T-M* with 2 pos. ISO 4401-03 (CETOP 03)

0 = without level gauge
1 = with level gauge

0 = without thermostat
1 = with thermostat

Return filter:
0 = without filter
1 = filter with visual indicator
2 = filter with electric indicator

N = Dull black RAL 9005 **(standard)**
G = Grey RAL 7037
V = Green RAL 6011

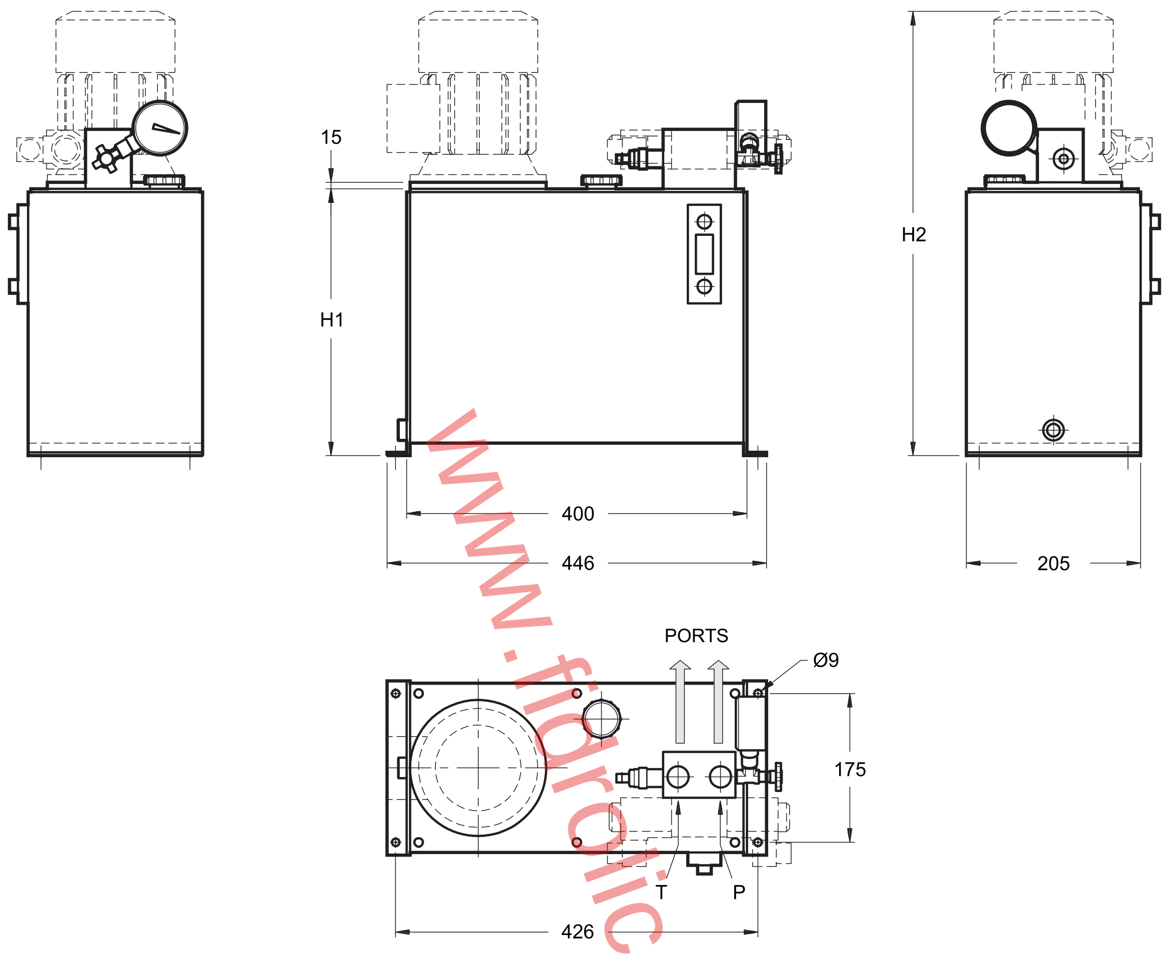
Series No. (from 40 to 49 sizes and mounting dimensions remain unchanged)

2.2 - Flowrate / pressure table

Electric motor flange size				Ø = 200			
CTR1		Pump type	Flow a 1500 rpm [lt/min]	Electric motor power [kW]			
				0,55	**0,75**	**1**	**1,5**
				max pressure [bar]			
020	013	1P 1,6 R	**1,6** *	180	-	-	-
		2 R	**2,0**	145	195	-	-
		2,5 R	**2,4** *	120	160	-	-
		3,3 R	**3,2**	90	120	160	-
		4,2 R	**3,9** *	75	100	130	200
		5 R	**4,8**	60	80	110	160
		5,8 R	**5,5** *	50	70	95	140
		6,7 R	**6,3**	45	60	80	120
		7,5 R	**7,1**	40	55	70	110
	X	9,2 R	**8,7** *	35	45	60	90
	X	11,5 R	**11,9**	25	30	45	65

* pumps for preferential choice

2.3 - Overall and mounting dimensions for CTR1



	013	020
H1	235	315
H2 (max)	535	615

3 - POWER UNITS CTR2

3.1- Identification code

C	T	R	2	-	025	/				/	1P	-		/						/	40

power unit with soaked pump

Cover size

Tank capacity
025 = 25 dm^3

Electric motor B5 shape
P = Predisposition for motor assembly
M = Mounted electric motor

4-poles power electric motor:
0.55 = 0.55 kW
0.75 = 0.75 kW
1.1 = 1.1 kW
1.5 = 1.5 kW

Electric motor voltage
(omit for P version)
A = 230-400V / 50-60 Hz

Pump type **1P**
(see cat. 11 110 for the pump technical characteristics)

Flowrate pump (l/min) at 1500 rpm
(see flowrate / pressure table)

Standard panel with rear ports G 3/8”
A = P2D-M* with 1 pos. ISO 4401-03 (CETOP 03)
B = P2T-M* with 2 pos. ISO 4401-03 (CETOP 03)

0 = without level gauge
1 = with level gauge

0 = without thermostat
1 = with thermostat

Return filter:
0 = without filter
1 = filter with visual indicator
2 = filter with electric indicator

N = Dull black
RAL 9005 **(standard)**
G = Grey RAL 7037
V = Green RAL 6011

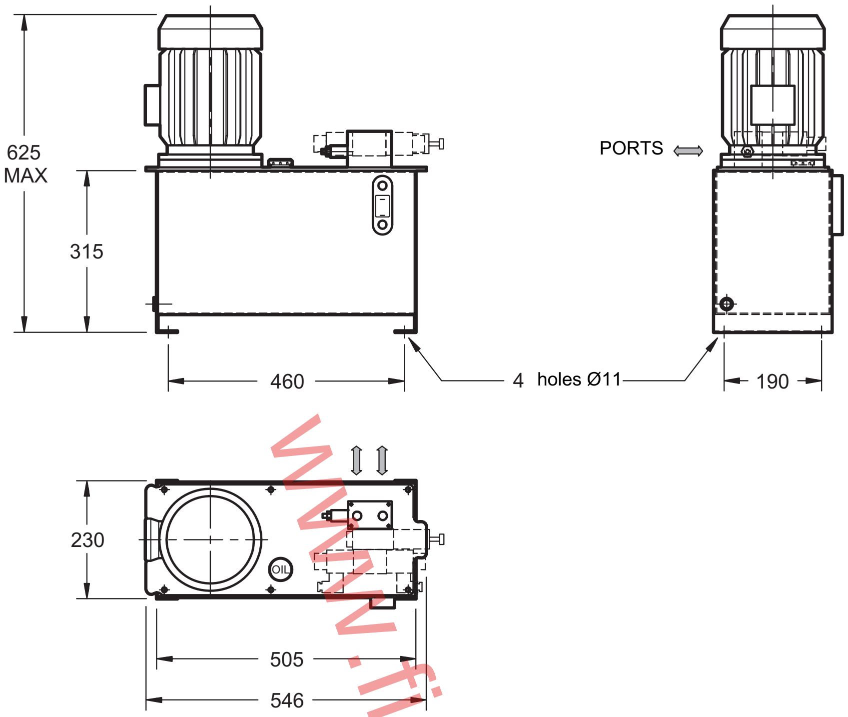
Series No. (from 40 to 49 sizes and mounting dimensions remain unchanged)

3.2 - Flowrate / pressure table

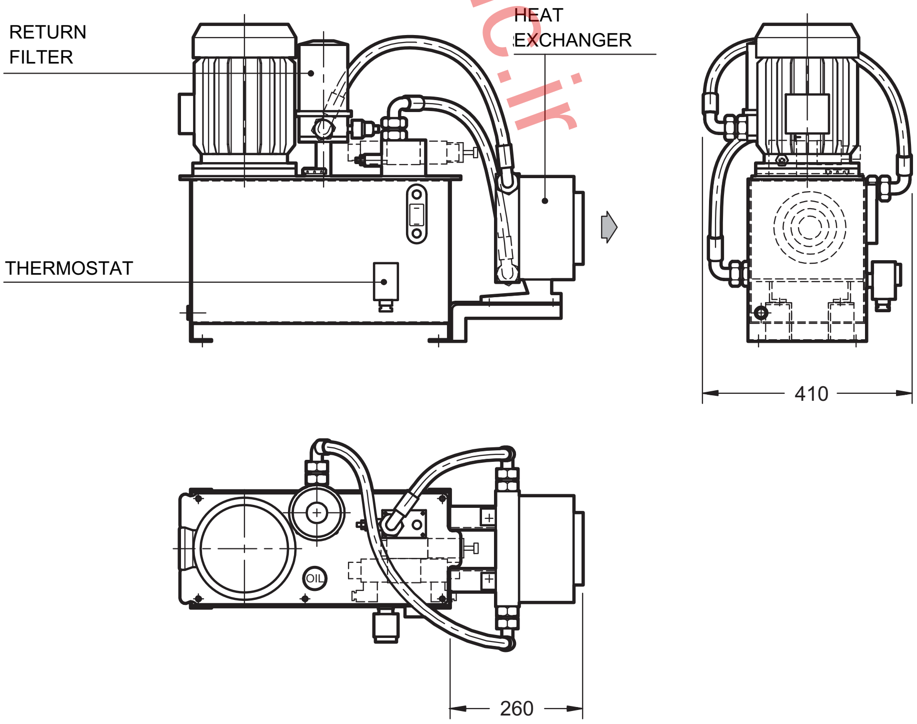
Electric motor flange size			Ø = 200			
CTR2	Pump type	Flowrate at 1500 rpm [lt/min]	Electric motor power [kW]			
			0,55	**0,75**	**1**	**1,5**
			max pressure [bar]			
025	1P 1,6 R	**1,6** *	180	-	-	-
	2 R	**2,0**	145	195	-	-
	2,5 R	**2,4** *	120	160	-	-
	3,3 R	**3,2**	90	120	160	-
	4,2 R	**3,9** *	75	100	130	200
	5 R	**4,8**	60	80	110	160
	5,8 R	**5,5** *	50	70	95	140
	6,7 R	**6,3**	45	60	80	120
	7,5 R	**7,1**	40	55	70	110
	9,2 R	**8,7** *	35	45	60	90
	11,5 R	**11,9**	25	30	45	65
	GP1-0013	**2,0** *	140	190	250	-
	0020	**3,0** *	95	130	170	250

* pumps for preferential choice

3.3 - Overall and mounting dimensions for basic CTR2



3.4 - CTR2 with optionals



4 - POWER UNITS CTR3

4.1 - Identification code

C	T	R	3	-		/			/		-		/						/	40

power unit with soaked pump

Cover size

Tank capacity
035 = 35 dm^3
050 = 50 dm^3
075 = 75 dm^3

Electric motor B5 shape
P = Predisposition for motor assembly
M = Mounted electric motor

4-poles power electric motor:
0.55 = 0.55 kW
0.75 = 0.75 kW
1.1 = 1.1 kW
1.5 = 1.5 kW
2.2 = 2.2 kW
3 = 3 kW
4 = 4 kW

Electric motor voltage
(omit for P version)
A = 380-420V / 50Hz-440-480V/60Hz for motors from 2.2 kW to 7.5 kW
B = 230-400V/50-60 Hz for motors from 0.55 kW to 1.5 kW

Pump type :
GP1 **GP2**
(see cat. 11 100 for the pumps technical characteristics)

Flowrate pump (l/min) at 1500 rpm
(see flowrate / pressure table)

Standard panel with rear ports G 3/8”
A = P2D-M* with 1 pos. ISO 4401-03 (CETOP 03)
B = P2T-M* with 2 pos. ISO 4401-03 (CETOP 03)

0 = without level gauge
1 = with level gauge

0 = without thermostat
1 = with thermostat

Return filter:
0 = without filter
1 = filter with visual indicator
2 = filter with electric indicator

Heat exchanger:
0 = without exchanger
1 = oil/water exchanger 2010K
2 = oil/water exchanger 2020K

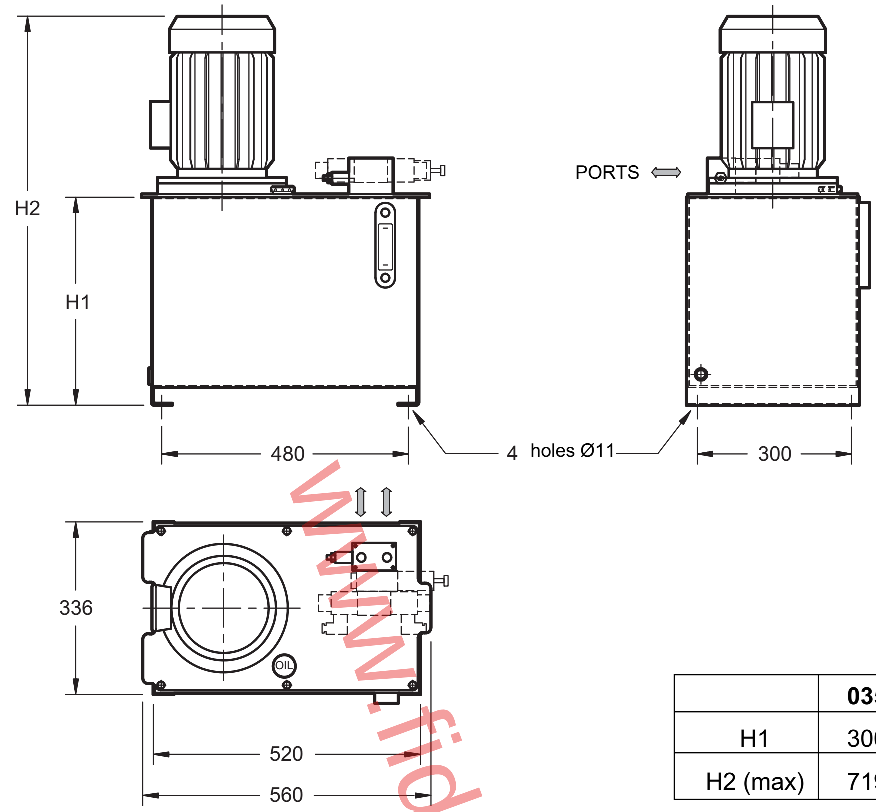
N = Dull black RAL 9005 **standard)**
G = Grey RAL 7037
V = Green RAL 6011

Series No. (from 40 to 49 sizes and mounting dimensions does not change)

4.2 - Flowrate / pressure table

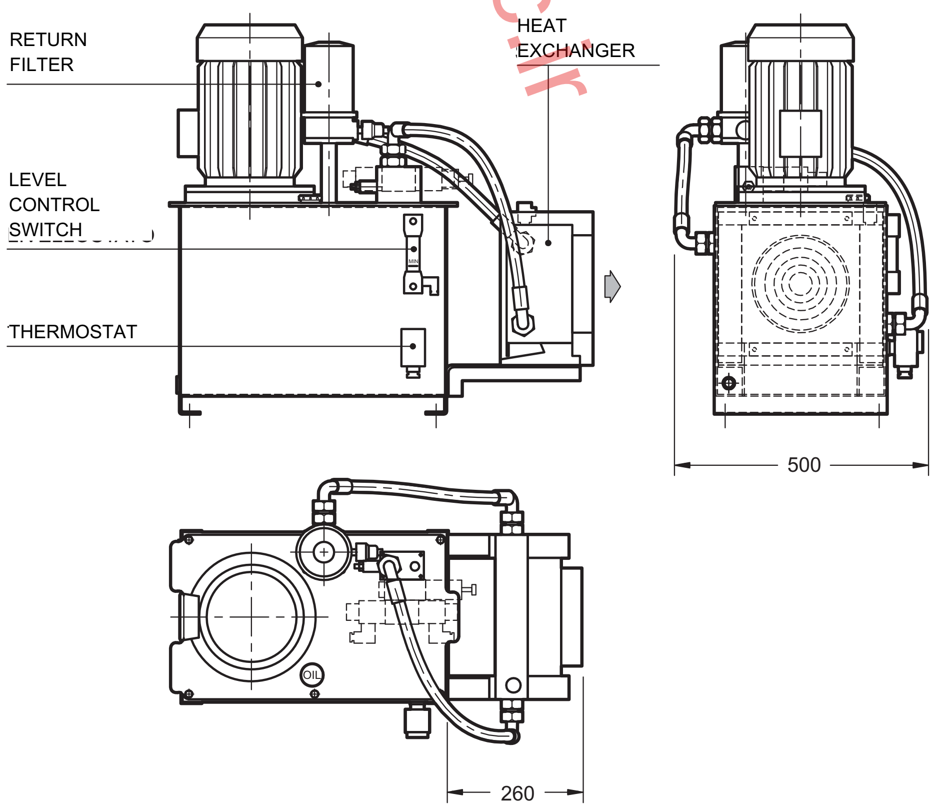
Electric motor flange size					Ø = 200				Ø = 250		
CTR3			Pump type	Flow rate at 1500 rpm [lt/min]	Electric motor power [kW]						
					0,55	**0,75**	**1,1**	**1,5**	**2,2**	**3**	**4**
					max pressure [bar]						
075	050	035	GP1-0013	**2,0**	145	195	-	-	-	-	-
			0020	**3,0**	90	120	160	-	-	-	-
			0027	**4,0**	75	100	130	200	-	-	-
			0034	**5,1**	60	80	110	160	-	-	-
			0041	**6,1 ***	45	60	80	120	185	-	-
			0051	**7,6 ***	35	50	65	105	150	200	-
			0061	**9,1**	30	40	55	85	125	170	-
			0074	**11,1 ***	25	30	45	65	100	140	180
			0091	**13,6**	20	25	40	55	85	115	150
			0108	**15,7**	15	20	35	50	70	95	130
			GP2-0113	**16,9 ***	10	15	30	45	65	90	120
			0140	**21,0 ***	-	10	25	35	55	75	100
			0158	**23,7**	-	-	20	30	45	65	85
			0178	**26,7 ***	-	-	15	25	40	55	75
			0208	**31,2**	-	-	10	20	35	50	65
			0234	**35,1 ***	-	-	-	15	30	45	60
			0279	**41,8**	-	-	-	10	25	35	50

4.3 - Overall and mounting dimensions for basic CTR3



	035	050	075
H1	300	405	550
H2 (max)	719	814	969

4.4 - CTR3 with optionals



5 - POWER UNITS CTR4

5.1 - Identification code

C	T	R	4	-		/			/		-		/						/	40

power unit with soaked pump

Cover size

Tank capacity
100 = 100 dm^3
120 = 120 dm^3
150 = 150 dm^3

Electric motor B5 shape
P = Predisposition for motor assembly
M = Mounted electric motor

4-poles power electric motor:
2.2 = 2.2 kW
3 = 3 kW
4 = 4 kW
5.5 = 5.5 kW
7.5 = 7.5 kW
9 = 9 kW

Electric motor voltage
(omit for P version)
A = 230/400V / 50/60 Hz

Pump type :
GP1 **GP2**
(see cat. 11 100 for the pumps technical characteristics)

Flowrate pump (l/min) at 1500 rpm
(see flowrate / pressure table)

Standard panel with rear ports G 3/8”
A = P2D-M* with 1 pos. ISO 4401-03 (CETOP 03)
B = P2T -M* with 2 pos. ISO 4401-03 (CETOP 03)

P2X*M multi-station manifold ISO 4401-03 (CETOP 03) to use with GP2 pumps (rear ports G 1/2”)
C2 = 2 positions **C4** = 4 positions **C6** = 6 positions

0 = without level gauge
1 = with level gauge

0 = without thermostat
1 = with thermostat

Return filter:
0 = without filter
1 = filter with visual indicator
2 = filter with electric indicator

Heat exchanger:
0 = without exchanger
1 = oil/water exchanger 2010K
2 = oil/water exchanger 2020K

N = Dull black RAL 9005 **(standard)**
G = Grey RAL 7037
V = Green RAL 6011

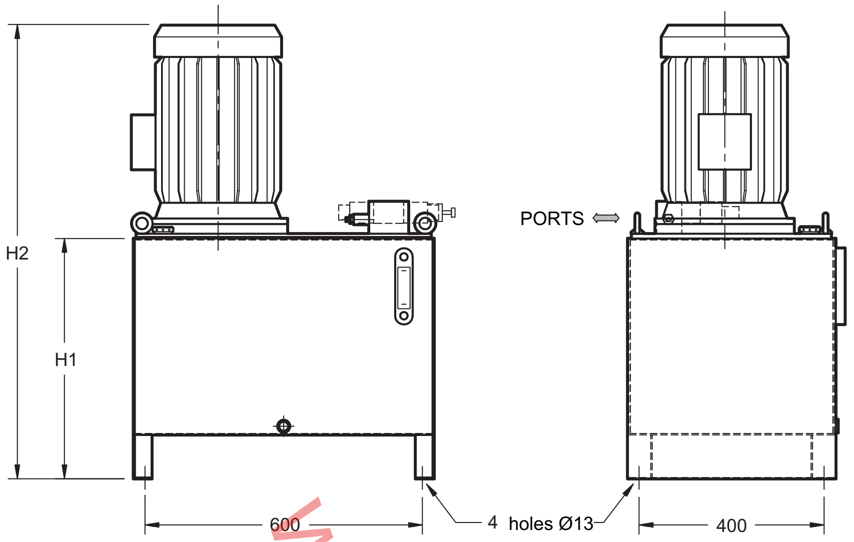
Series No. (from 40 to 49 sizes and mounting dimensions does not change)

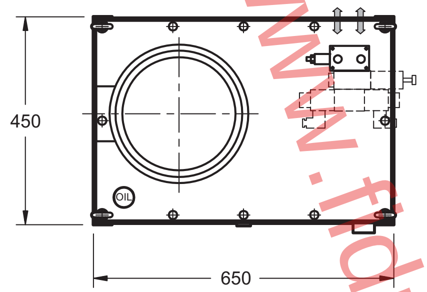
5.2 - Flowrate / pressure table

Electric motor flange size					Ø = 250			Ø = 300		
CTR4			Pump type	Flow rate at 1500 rpm [lt/min]	Electric motor power [kW]					
					2,2	**3**	**4**	**5,5**	**7,5**	**9**
					max pressure [bar]					
150	120	100	GP1-0041	**6,1**	185	-	-	-	-	-
			0051	**7,6**	150	200	-	-	-	-
			0061	**9,1**	125	170	-	-	-	-
			0074	**11,1**	100	140	180	-	-	-
			0091	**13,6**	85	115	150	-	-	-
			GP2-095	**14,2 ***	80	110	145	200	-	-
			0113	**16,9 ***	65	90	120	170	-	-
			0140	**21 ***	55	75	100	135	185	-
			0158	**23,7 ***	45	65	85	120	165	-
			0178	**26,7 ***	40	55	75	105	145	-
			0208	**31,2 ***	35	50	65	90	125	150
			0234	**35,1 ***	30	45	60	80	110	130
			0279	**41,8**	25	35	50	70	95	110

* pumps for preferential choice

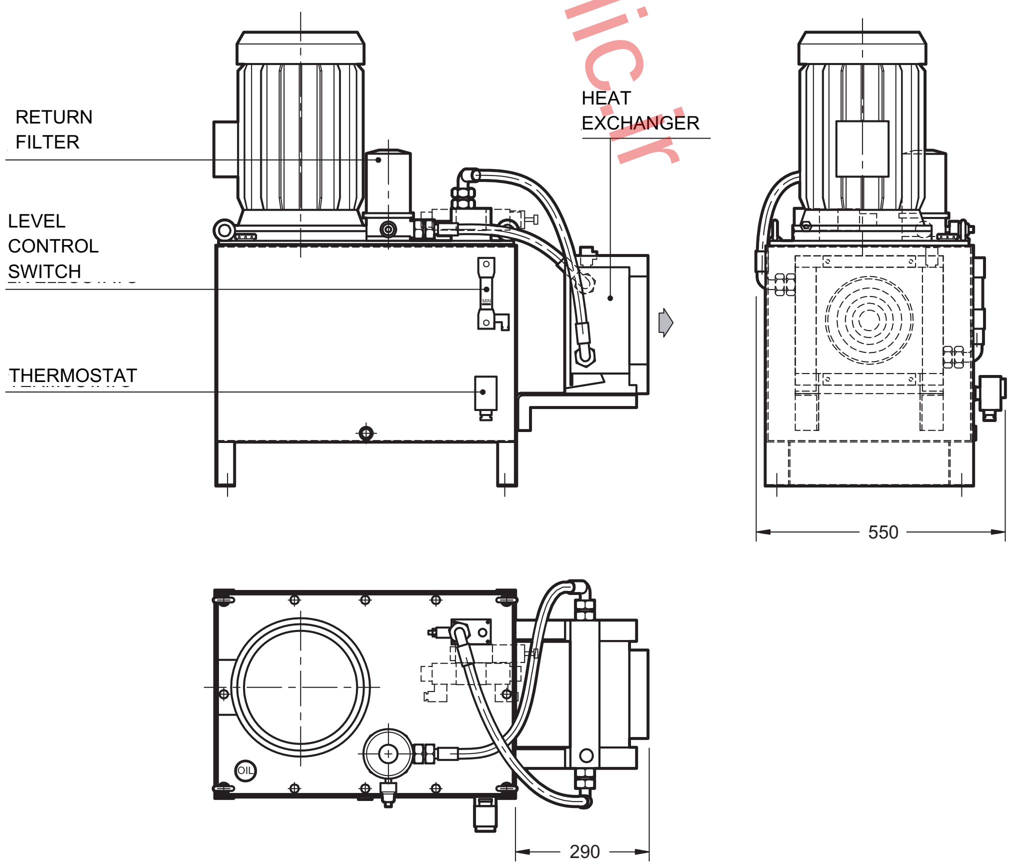
5.3 - Overall and mounting dimensions for CTR4-P2





	100	120	150
H1	520	590	690
H2 (max)	1117	1187	1287

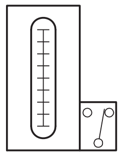
5.4 - Overall and mounting dimensions for CTR4-P2X*M

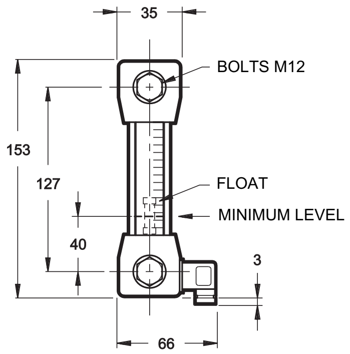


6 - ACCESSORIES

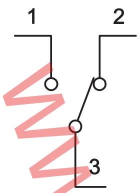
6.1 - Level gauge LV/E1-127-M12-SC cod. 0770764

Maximum pressure	bar	1
Working temperature	°C	-20 / +70
Transparent tube material	/	Nylon + glass 35%
Seals material	/	NBR
Reed in exchange	/	1A, 20W, 20VA, 200V

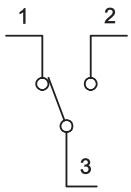




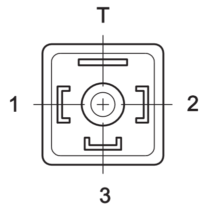
ELECTRIC DIAGRAM
(WITH FLUID)



ELECTRIC DIAGRAM
(WITHOUT FLUID)

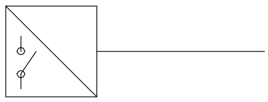


CONNECTOR CE DIN 40050
IP65 PG7

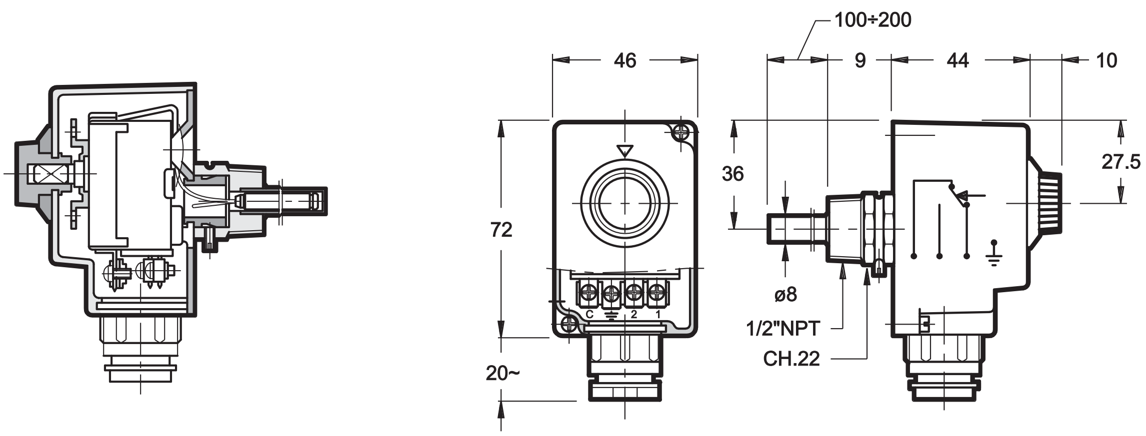


6.2 - Thermostat TC2 cod. 0630285

External sensor temperature range	°C	0/90
Degree of protection	/	IP40
Contacts	A	10
Max. voltage	V AC	250
Max. working temperature	°C	50
Cable guide	/	PG9
Housing material	/	Plastic
Contacts material	/	Silver
Capillary material	/	Copper
Pocket material	/	Brass
Mass	Kg	0.3



6.2.1 - Overall dimensions



6.3 - FRC return line filter for tank top or line mounting cod. 3951600004

6.3.1 - Technical data

Filter code	BSP port dimensions	Mass [kg]	Rated flow (indicative) [l/min] P25L
FRC-TB034	3/4”	1,6	75

NOTE 1: The flow rate stated in the table correspond to a 0.5 bar pressure drop measured with mineral oil of viscosity 36 cSt at 50°C.
As for a different viscosity range, see the catalogue 95160.

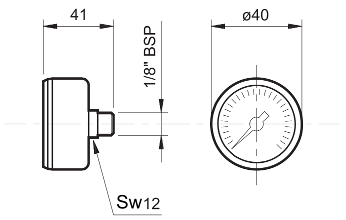
Maximum pressure	bar	7
Collapsing differential pressure of the filter element	bar	3.0
Differential pressure for the opening of the by-pass valve (±10 %)	bar	1,7
Ambient temperature range	°C	-25 / +50
Fluid temperature range	°C	-25 / +110
Fluid viscosity range	cSt	10 ÷ 400

For further detailed informations and overall dimensions please consult the catalogue 95160.

6.3.2 - Clogging indicators

The filters are all designed to incorporate clogging indicators, which have to be ordered separately.

1 - VR/10 Visual indicator for return filters
Identification code: 3959000003

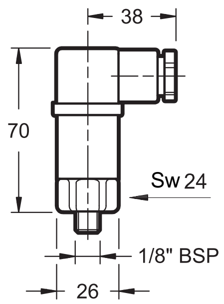


This indicator is a pressure gauge sensitive to the filter input pressure.

The indicator is supplied with a 0 ÷ 6 bar graduated scale and with a two-colour reading scale, which informs you about the clogging condition of the filter element:

GREEN: efficient filter element (0 ÷ 1.7 bar)
RED: the filter element has to be replaced (> 1.7 bar)

2 - ER/11 Electric indicator for return filters
Identification code: 3959000016



This indicator is a pressure switch sensitive to the filter input pressure, which switches an electric contact when the filter element has reached the clogging limit.

The contact can be wired in an open or closed condition (see the hydraulic symbol).

TECHNICAL SPECIFICATIONS

Operating pressure	bar	1,5
AC power supply		
Max. operating voltage	VAC	250 50/60 Hz
Max. load on the contacts (inductive or resistive) with V at 125 VAC with V at 250 VAC	A	 3 0,5
DC power supply		
Max. operating voltage	VDC	30
Max. load on the contacts resistive inductive	A	 3 1
Electric connector	DIN 43650	
Class of protection according to CEI EN 60529 (atmospheric agents)	IP65	
Atex classification	3 GD EEx e T6	

6.4 - Heat Exchanger oil/water with fixed blowing air flow .

6.4.1 - Technical data

		2010K	2020K
Code		**0713268**	**0712078**
Operating pressure	bar	20	
Test pressure	bar	35	
Maximum operating pressure	°C	120	
Air Flow	m^3/h	190	645
Capacity	litre	0,3	0,7
Three-phase supply voltage	V	230 - 400	
Frequency	Hz	50 / 60	
Rpm	kW	0,045	0,068
Thermostat regulation field	°C	40 - 28	50 - 38
Oil threaded inlet / outlet connections	-	1/2” BSP	1” BSP
Mass	kg	6	8
IP protection degree		IP54	IP44

CLEANING AND MAINTENANCE

As a general rule verify that the voltage supply correspond to those shown on the plate.

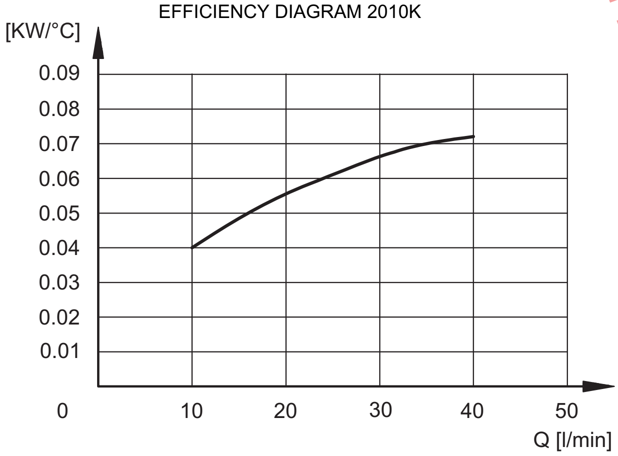
<u>Cleaning oil side</u>: The exchanger must be dismounted. Dirt can be removed by a detergent product as perchloride, in the opposite direction to normal. At the end it must be washed out with hot water.

<u>Cleaning air side</u>: This can be done means of compressed air or water. The direction of the jet must be parallel to the fins, to avoid damaging them. If the dirt is oil or greasy it must be cleaned by a jet of steam or hot water.

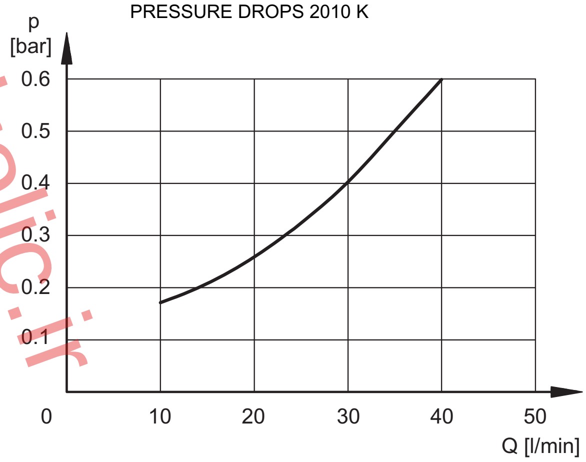
The electric motor must be protected during the cleaning operation.

6.4.2 - Characteristics

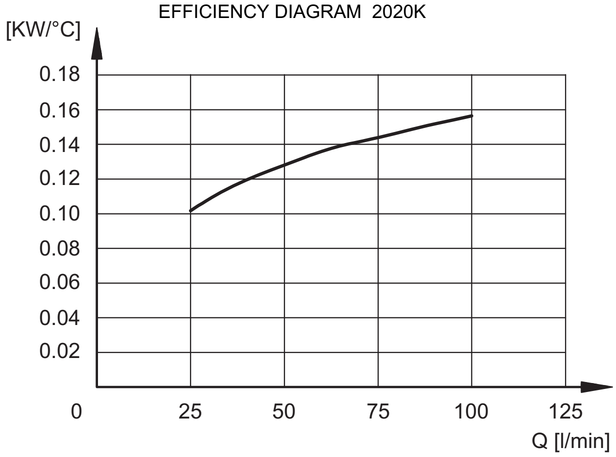
EFFICIENCY DIAGRAM 2010K



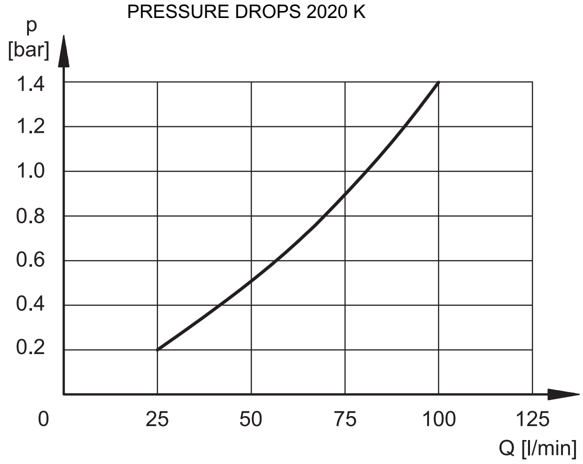
PRESSURE DROPS 2010 K



EFFICIENCY DIAGRAM 2020K

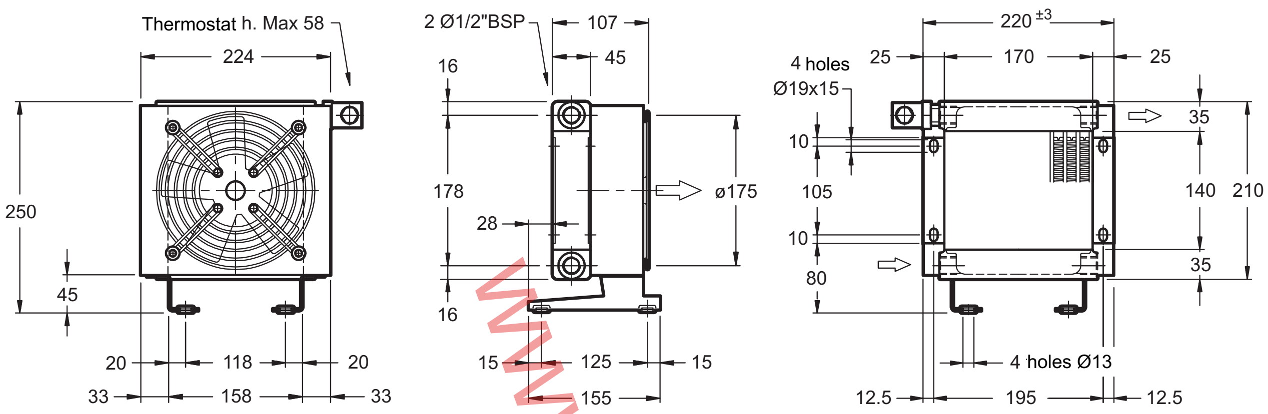


PRESSURE DROPS 2020 K

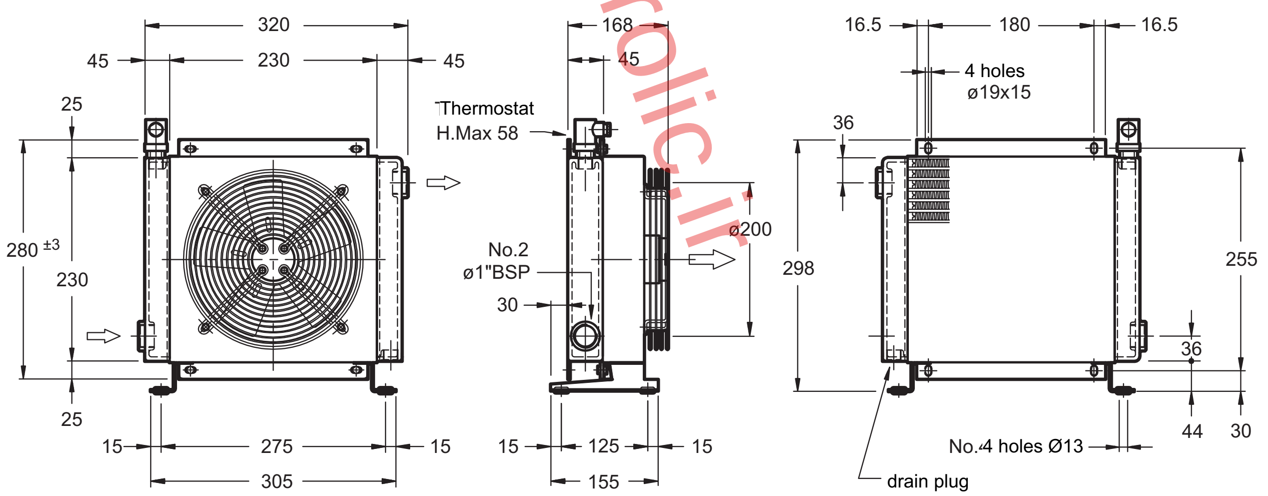


6.4.3 - Overall dimensions

HEAT EXCHANGER 2010 K



HEAT EXCHANGER 2020 K



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