

6.8

Proportional directional valves

Type 4WRA and 4WRAE

NG 6 and 10
Up to 315 bar
Up to 75 L/min



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Features

- Direct operated proportional directional valve to control the direction and magnitude of a flow
- For subplate mounting: Porting pattern conforms to ISO4401
- Actuation by means of proportional solenoids with central thread and removable coil
- Spring centred control spool
- Control electronics 4WRAE...L2X: integrated electronics (OBE) with voltage input or current input (A1 resp. F1)
- 4WRA...L2X: available module amplifier

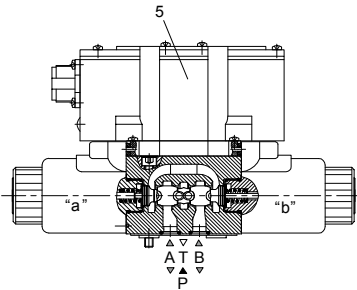
Function and configurations

The 4/2- and 4/3-way proportional directional valves are designed as direct operated components for subplate mounting. They are actuated by means of proportional solenoids with central thread and removable coil. The solenoids are controlled either by external control electronics (type 4WRA...L2X) or by integrated control electronics (type 4WRAE...L2X).

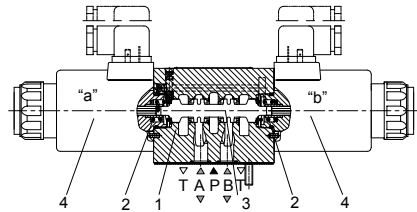
The valves basically consist of: Body (1) with mounting surface, Control spool (3) with compression springs (2), Solenoids (4) with central thread, Optional integrated electronics (5).

With the solenoids (4), de-energised, the control spool (3) is held in the central position by the compression springs (2).

Direct operation of the control spool (3) by energising one of the proportional solenoids(4) e.g. control of solenoid right, then movement of the control spool (3) to the left in proportion to the electrical input signal, and connection from P to A and B to T via orifice-like crosssections with progressive flow characteristics.



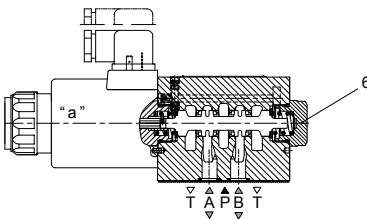
Type 4WRAE 6...-L2X/...



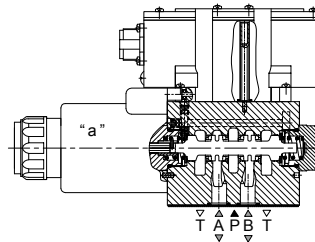
Type 4WRA 10...-L2X/...

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4WRA(E)...A-L2X the 2 switched position valves are however only fitted with solenoid "a". A plug (6) is fitted in place on the "b" proportional solenoid.



Type 4WRA 10...A-L2X/...



Type 4WRAE 10...A-L2X/...

Technical data

1. Hydraulic					
Installation			Optional, preferably horizontal		
Nominal size			6	10	
Weight	4WRA...L2X	Kg	2.0	6.6	
	4WRAE...L2X		2.2	6.8	
Nominal flow Q_{vnom} at $\Delta p = 10$ bar			L/min	7,15,26	30,60
Hysteresis			%	≤ 5	
Reversal span			%	≤ 1	
Response sensitivity			%	≤ 0.5	
Max.operating pressure	Ports A, B, P	bar	315		
	Port T	bar	210		
Pressure fluid			Mineral oil (HL, HLP) to DIN 51524 Other pressure fluids on request!		
Ambient air temperature range	4WRA...L2X	$^{\circ}\text{C}$	-20 $^{\circ}\text{C}$ to 70 $^{\circ}\text{C}$ (-4 $^{\circ}\text{F}$ to 158 $^{\circ}\text{F}$)		
	4WRAE...L2X	$^{\circ}\text{C}$	-20 $^{\circ}\text{C}$ to 50 $^{\circ}\text{C}$ (-4 $^{\circ}\text{F}$ to 122 $^{\circ}\text{F}$)		
Viscosity range			mm^2/s	20 to 380 (preferably 30 to 46)	
Fluid Cleanliness Class			NAS1638 class9 or ISO 4406 class 20/18/15		

2. Electrical					
1) Solenoid data					
Voltage type			DC		
Command value signal for 4WRAE			$\pm 10\text{V}$ or 4 ~ 20mA		
Max.current per solenoid		A	2.5	1.5	0.8
Solenoid coil resistance	Cold value at 20 $^{\circ}\text{C}$	Ω	2	4.8	19.5
	Max.warm value		3	7.2	28.8
Duty		%	ED100%		
Max.coil temperature		$^{\circ}\text{C}$	150		
Valve protection to EN 60529			IP 65		
2) Control electronics					
Amplifier	4WRA...L2X	VT-VSPA2-...-L2X			
	4WRAE...L2X	Integrated in the valve(OBE)			
Supply voltage	Nominal voltage	VDC	24		
	Lower limiting value	V	21/22(4WRA), 19(4WRAE)		
	Upper limiting value	V	35		
Amplifier power consumption	I_{max}	A	<1.8		
	Impulse current	A	3		

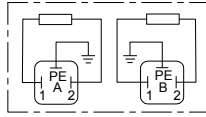
Electrical connections, plug-in connectors

nominal dimensions in mm

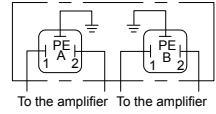
For type 4WRE...L2X (without integrated electronics)

Connections on the component plug

Plug-in connector to DIN EN 175301-803 or ISO 4400



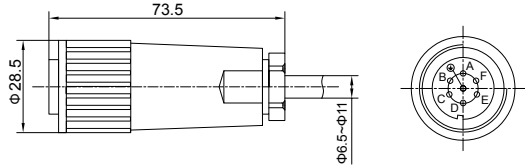
Connections on the plug-in connector



For type 4WRAE...L2X (with integrated electronics (OBE))

For pin allocation also see block circuit diagram.

Plug-in connector to DIN EN 175201-804



Integrated control electronics for type 4WRAE

Component plug allocation

	Contact	Interface A1 signal	Interface F1 signal
Supply voltage	A	24 VDC (U(t)=19V to 35V)	
	B	GND	
	C	n.c. ¹⁾	
Differential amplifier input	D	±10V, Re>50KΩ	4 to 20mA, Re>100Ω
	E	reference potential command value	
	F	n.c. ¹⁾	

Connection cable:

Recommended:
 - up to 25 m cable length type LiYCY 7x0.75 mm²;
 - up to 50 m cable length type LiYCY 7x1.0 mm².
 For outside diameter see plug-in connector sketch. Only connect screen to PE on the supply line.

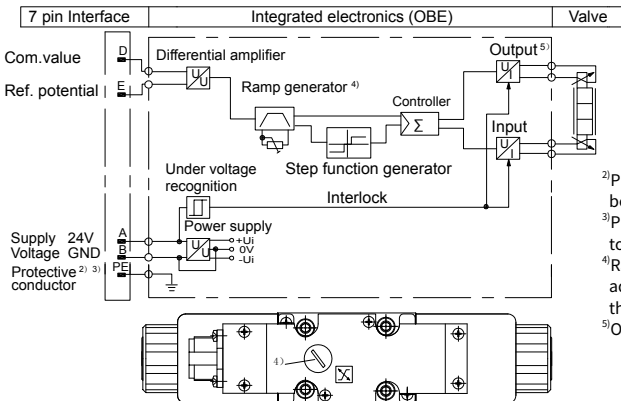
¹⁾Contacts C and F must not be connected!

Command value:

A positive command value 0 to +10 V (or 12 to 20 mA) at D and the reference potential at E results in a flow from P to A and B to T. A negative command value 0 to -10 V (or 12 to 4 mA) at D and the reference potential at E results in a flow from P to B and A to T.

For a valve with 1 solenoid on side a (e.g. spool variants EA and WA) a positive command value at D and the reference potential at E results in a flow from P to B and A to T.

Integrated electronics (OBE) for type 4WRAE...L2X



²⁾PE is connected to the cooling body and the valve housing!

³⁾Protective conductor screwed to the valve housing and cover.

⁴⁾Ramp can be externally adjusted from 0 to 2.5s, the same applies for T_{up} and T_{down}.

⁵⁾Output stages current regulated.

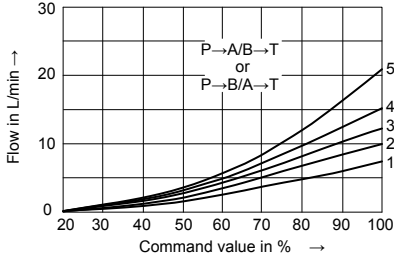
Characteristic curves

(measured with HLP46, $\vartheta_{oil}=40^{\circ}\text{C} \pm 5^{\circ}\text{C}$)

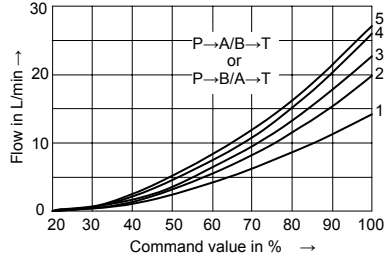
· Type 4WRAE (NG 6 and 10)

NG 6

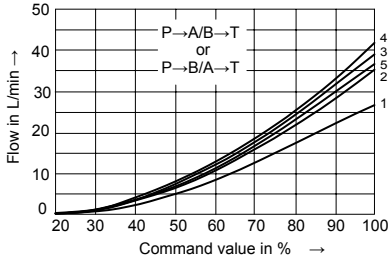
7 L/min nominal flow at a 10 bar valve pressure differential



15 L/min nominal flow at a 10 bar valve pressure differential



30 L/min nominal flow at a 10 bar valve pressure differential

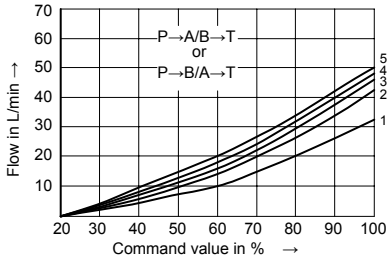


- 1 $\Delta p=10\text{bar}$ constant
- 2 $\Delta p=20\text{bar}$ constant
- 3 $\Delta p=30\text{bar}$ constant
- 4 $\Delta p=50\text{bar}$ constant
- 5 $\Delta p=100\text{bar}$ constant

Δp =Valve pressure differential
(inlet pressure p_p minus load pressure p_L minus return pressure p_r)

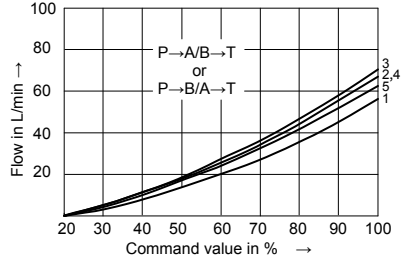
NG 10

30 L/min nominal flow at a 10 bar valve pressure differential



- 1 $\Delta p=10\text{bar}$ constant
- 2 $\Delta p=20\text{bar}$ constant
- 3 $\Delta p=30\text{bar}$ constant
- 4 $\Delta p=50\text{bar}$ constant
- 5 $\Delta p=100\text{bar}$ constant

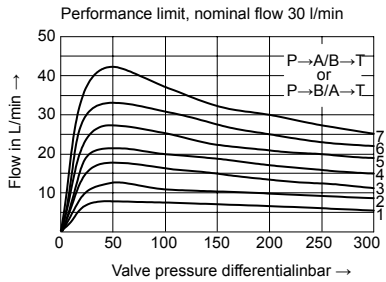
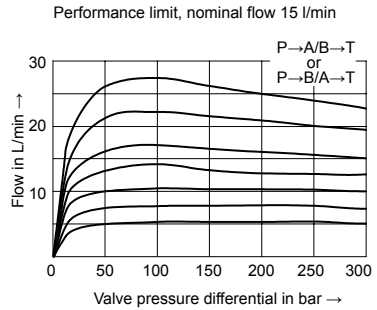
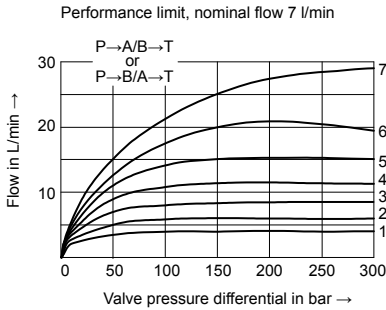
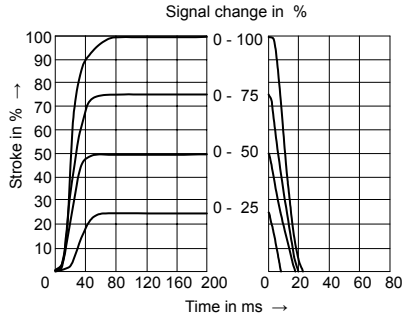
60 L/min nominal flow at a 10 bar valve pressure differential



Δp =Valve pressure differential
(inlet pressure p_p minus load pressure p_L minus return pressure p_r)

Characteristic curves (measured with HLP46, $\vartheta_{oil} = 40^\circ\text{C} \pm 5^\circ\text{C}$)

NG 6 Transient function with a stepped form of electrical input sign



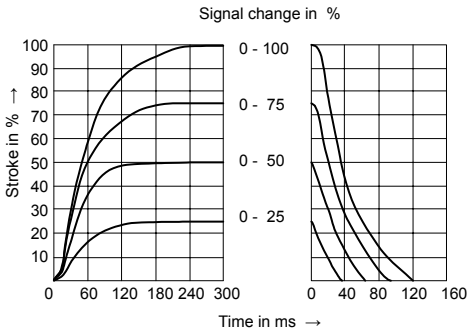
1. Com. value = 40 %
2. Com. value = 50 %
3. Com. value = 60 %
4. Com. value = 70 %
5. Com. value = 80 %
6. Com. value = 90 %
7. Com. value = 100 %

If the performance limits are exceeded then flow forces occur which lead to uncontrolled spool movements.

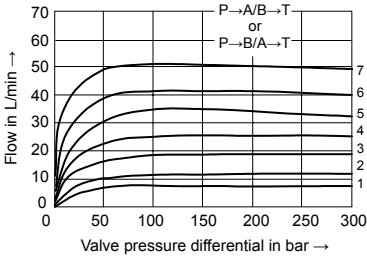
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Characteristic curves (measured with HLP46, $\vartheta_{oil}=40^{\circ}\text{C} \pm 5^{\circ}\text{C}$)

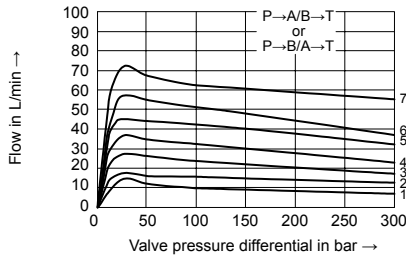
NG 10 Transient function with a stepped form of electrical input sign



Performance limit, nominal flow 30l/min



Performance limit, nominal flow 60 l/min



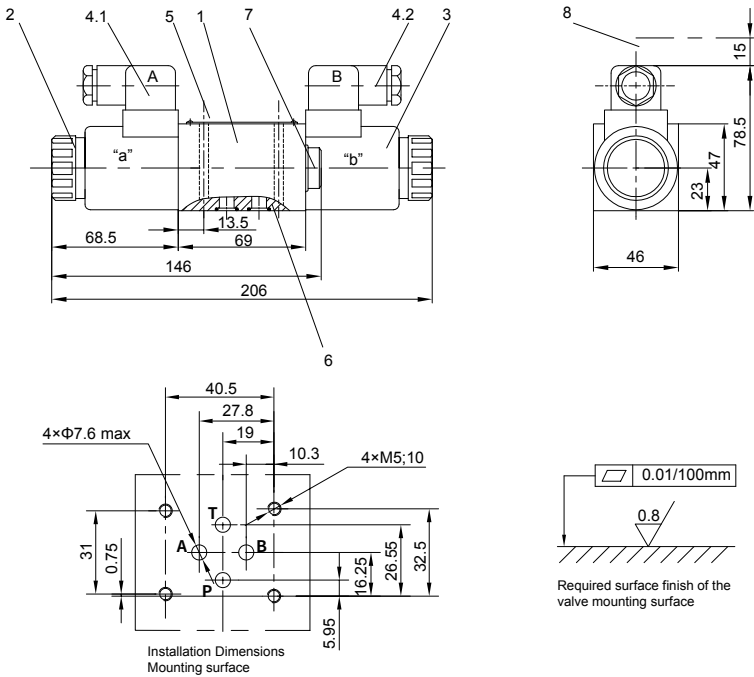
- 1.Com. value = 40 %
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- 5.Com. value = 80 %
- 6.Com. value = 90 %
- 7.Com. value = 100 %

If the performance limits are exceeded then flow forces occur which lead to uncontrolled spool movements.

Unit dimensions

(nominal dimensions in mm)

Type 4WRA6...L2X



- 1 Valve housing
- 2 Proportional solenoid "a"
- 3 Proportional solenoid "b"
- 4.1 Plug-in connector "A"
- 4.2 Plug-in connector "B"
- 5 Name plate
- 6 Identical seal rings for ports A, B, P and T
(R-ring 9.81×1.5×1.78 or O-ring 9.25×1.78)
- 7 Plug for valves with one solenoid
(2 switching positions, versions EA or WA)
- 8 Space required to remove the plug-in connector

Valve mounting screws

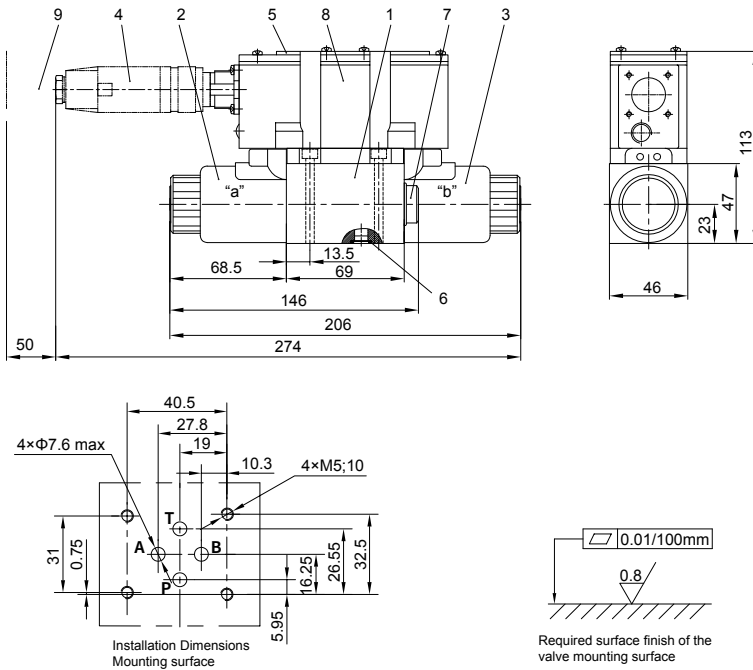
The following valve fixing screws are recommended:

- 4 S.H.C.S.ISO 4762 - M5×50 - 10.9
- 4 GB / T 70.1 - M5×50 - 10.9
- Tightening torque $M_A = 8.9 \text{ Nm} \pm 10\%$

Unit dimensions

(nominal dimensions in mm)

Type 4WRAE6...L2X



- 1 Valve housing
- 2 Proportional solenoid "a"
- 3 Proportional solenoid "b"
- 4 Plug-in connector
- 5 Name plate
- 6 Identical seal rings for ports A, B, P and T
(R-ring $9.81 \times 1.5 \times 1.78$ or O-ring 9.25×1.78)
- 7 Plug for valves with one solenoid
(2 switching positions, versions EA or WA)
- 8 Integrated electronics (OBE)
- 9 Space required to remove
the plug-in connector

Valve mounting screws

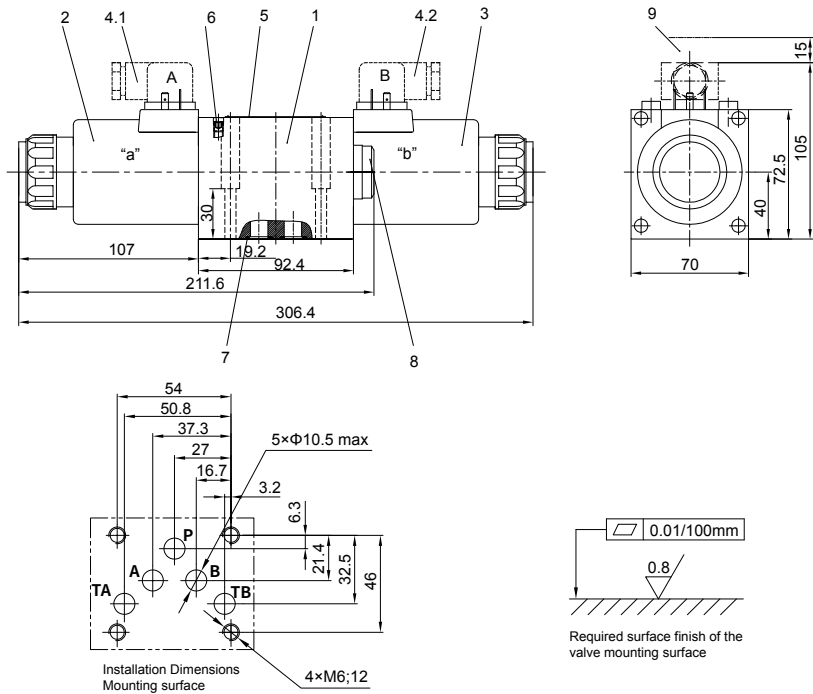
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- 4 GB / T 70.1 - M5×50 - 10.9
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Unit dimensions

(nominal dimensions in mm)

Type 4WRA10...L2X



- 1 Valve housing
- 2 Proportional solenoid "a"
- 3 Proportional solenoid "b"
- 4.1 Plug-in connector "A"
- 4.2 Plug-in connector "B"
- 5 Name plate
- 6 Valve bleed screw
- 7 Identical seal rings for ports A, B, P and T
(R-ring 13×1.6×2 or O-ring 12×2)
- 8 Plug for valves with one solenoid
(2 switching positions, versions EA or WA)
- 9 Space required to remove the plug-in connector

Valve mounting screws

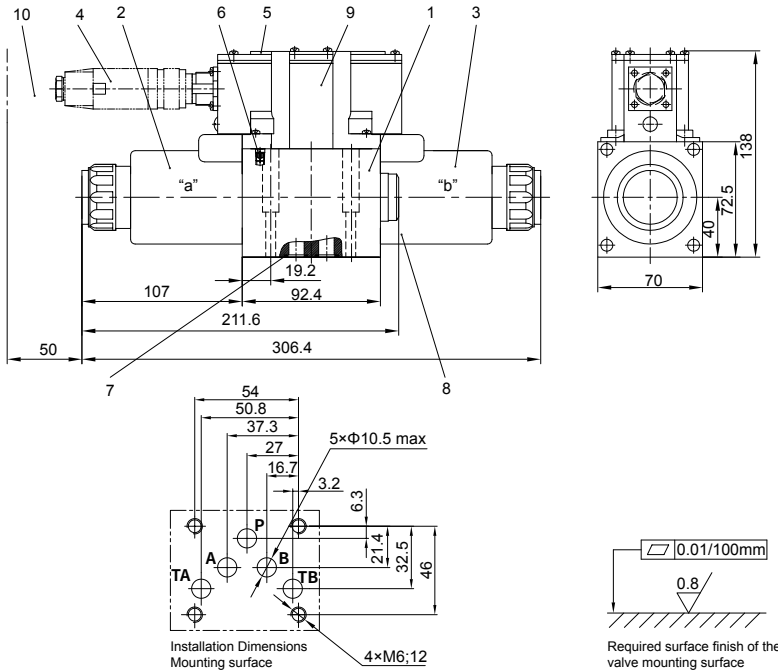
The following valve fixing screws are recommended:

- 4 S.H.C.S ISO 4762 - M6×40 - 10.9
- 4 GB / T 70.1 - M6×40 - 10.9
- Tightening torque
 $M_A = 15.5 \text{ Nm} \pm 10\%$

Unit dimensions

(nominal dimensions in mm)

Type 4WRAE10...L2X



- 1 Valve housing
- 2 Proportional solenoid "a"
- 3 Proportional solenoid "b"
- 4 Plug-in connector
- 5 Name plate
- 6 Valve bleed screw
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