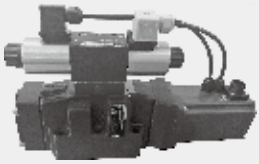
6.13

Pilot operated proportional directional valves

Type 4WRKE...L3X

NG 10 to 35
Up to 350 bar
Up to 3000L/min



Contents

Features

- Pilot operated 2-stage proportional directional valve
- Valve for the control of the size and direction of a flow
- For subplate mounting, porting pattern to DIN 24 340 form A
- Spring centred main spool
- Integrated control electronics

Function and configuration

· Proportional directional valve:
type 4WRKE...L3X...

The type 4WRKE valves are 2-stage proportional directional control valves. They control the size and direction of a flow.
The main stage is closed loop position controlled so that the spool position is also independent of flow forces at larger flows.

Structure

The valves basically consists of the pilot control valve (1), housing (8), main spool (7), covers (5 and 6), centering spring (4), inductive position transducer (9) and the pressure reducing valve (3).

Function

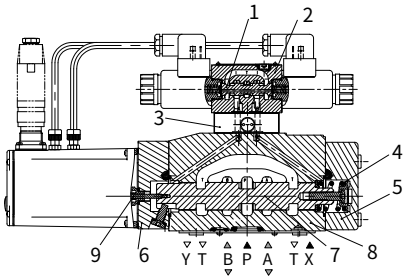
— If no input signal is being applied then the main spool (7) is held in the centere position by the centering spring (4). The two control chambers in the covers (5 and 6) are connected via the valve spool (2) to tank.
— The main spool (7) is connected to suitable control electronics via the inductive position transducer (9). The positional change of the main spool (7) as well as the alteration of the command value at the summation point of the amplifier produces a differential voltage.
With the command value/actual value comparison a possible control deviation is recognised via the electronics and an electrical current is applied to the proportional solenoid of the pilot valve (1).
The current induces, within the solenoid, a force which is passed on to the solenoid pin which in turn actuates the control spool. The flow which is provided via the control cross sections causes the main spool to move.

· Pilot control valve :
type 4WRAP 6 W7...-L3X/G24...(1st stage)

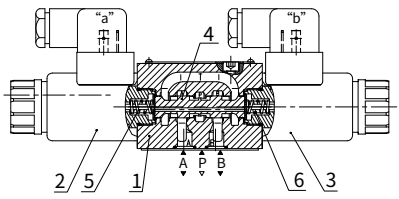
The pilot control valve is a direct operated proportional valve. The control edge geometrics were designed and optimised for the use as a pilot control valve for the proportional directional valves type 4WRKE.
The proportional solenoids are pressure tight, oil-immersed DC solenoids with removable coil. They convert an electrical current proportionally into a mechanical force. An increase in the current strength causes an appropriately higher solenoid force.

Structure

The pilot control valve basically consists of the housing (1), proportional solenoids (2 and 3), valve spool (4) and springs (5 and 6).
In the de-energised condition both actuator ports are connected to tank. If one of the two solenoids (2 or 3) is energised, then the solenoid force moves the valve spool (4) against the spring (6 or 5). Once the overlap area is overcome, the connection to tank of one of the two actuator ports is blocked and the connection to the pressure chamber is established. There is flow from P to the control chamberof the main stage.



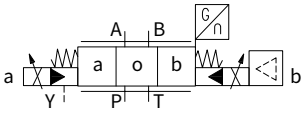
Type 4WRKE 16 ...–L3X...



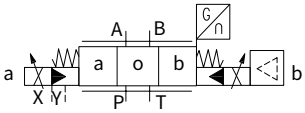
Type 4WRAP 6 W7...L3X/G24...

Symbols (simplified)

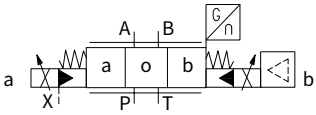
Type 4WRKE...–L3X...E.



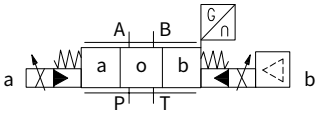
Type 4WRKE...–L3X...



Type 4WRKE ...–L3X ... T .



Type 4WRKE...-L3X...ET



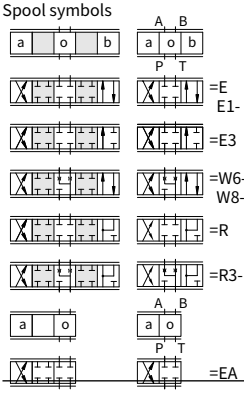
Ordering code

4WRKE [ ] [ ] [ ] – L3X / 6E G24 [ ] / [ ] [ ] [ ] *

Electrically operated
2-stage proportional
directional valve of
4-way design with
integrated electronics

Nominal size 10 =10
Nominal size 16 =16
Nominal size 25 =25
Nominal size 27 =27
Nominal size 32 =32
Nominal size 35 =35

Spool symbols



~~Nominal~~ flow in L/~~min~~ at 10 bar
valve pressure differential

25= or 50= or 100= Nominal size 10
125= or 200= Nominal size 16
220= or 350= Nominal size 25
500= Nominal size 27
400= or 600= Nominal size 32
1000= Nominal size 35

Further information
in plain text

V = FKM Seals
No code = NBR Seals

D3 = With pressure reducing valve
ZDR6DP0-L4X/40YM(fixed setting)

Interface:
C1= Command value input ±10mA
A1= Command value input ±10V
F1= Command value input 4 to 20mA

Electrical connections
K31 = With component plug,
Without plug-in connector
Z31 = With component plug and
plug-in connector

Pilot oil supply and drain
No code =Pilot oil supply external, Pilot oil drain external
E = Pilot oil supply internal, Pilot oil drain external
ET = Pilot oil supply internal, Pilot oil drain internal
T = Pilot oil supply external, Pilot oil drain internal

Supply voltage
G24= + 24 V DC

6E= Proportional solenoid with removable coil

L3X= L30 to L39: unchanged installation and connection dimensions

Characteristic curve form
L= Linear
P= Linear with fine control range

Note: With symbol E1-, W8-:
P → A: $q_{v\,max}$ B → T: $q_v/2$ P → B: $q_v/2$ A → T: $q_{v\,max}$
With the spools W6, W8 there is a connection from A to T and B to T in the zero position with approx. 2 % of the applicable nominal crosssection.

Technical data

General								
Nominal size				10	16	25	27	32	35
Installation and commissioning guidelines				Optional, preferably horizontal					
Storage temperature range			°C	– 20 to + 80					
Ambient temperature range			°C	– 20 to + 50					
Weight			kg	8.7	11.2	16.8	20	37.2	72

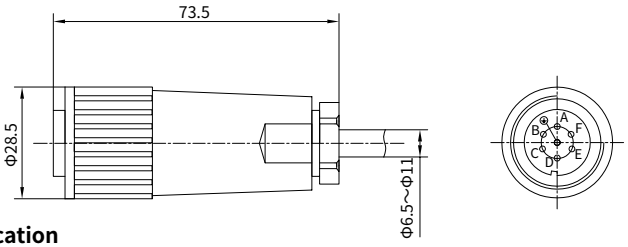
Hydraulic(measured at p=100bar,with HLP46 at ϑ_{oil}=40°C ±5°C)									
Operating pressure	-Pilot control valve	Pilot oil supply	bar	25 to 315					
	-Main valve	Ports P, A, B	bar	Up to 315	Up to 350	Up to 350	Up to 210	Up to 350	Up to 350
Return pressure	Port T (Pilot oil drain)	Internal	bar	Static < 10					
		External	bar	Up to 315	Up to 250	Up to 250	Up to 210	Up to 250	Up to 250
	Port Y		bar	Static < 10					
Nominal flow q_{vnom} ±10% at Δp=10bar (Δp = valve pressure differential)			L/min	25 50	- 125	- 220	- -	- 440	- -
				100	180	350	500	600	1000
Flow of main valve (max. permissible)			L/min	170	460	870	1000	1600	3000
Pilot oil flow at port X or Y with a step form of input signal from 0 to 100 % (315 bar)			L/min	4.1	8.5	11.7	11.7	13	13
Pressure fluid				Mineral oil(HL,HLP)to DIN 51 524 Phosphate ester (HFD-R)					
Pressure fluid temperature range			°C	10 to 80, preferably 40 to 50					
Viscosity range			mm^2/s	20 to 380, preferably 30 to 45					
Degree of contamination	Maximum permissible degree of contamination of the pressure fluid is to NAS 1638.			A filter with a minimum retention rate of βx = 75 is recommended					
	Pilot control valve		Class 7	x = 5					
	Main valve		Class 9	x = 7					
Hysteresis			%	⩽ 1					
Response sensitivity			%	⩽ 0.5					

Electrical		
Voltage type		DC
Electrical connection		Plug-in connector to DIN EN175 201-804
Power, max.	W	72 (average = 24W)
Control electronics		Integrated into the valve

Electrical connections, plug-in connector

For pin allocation also
see block circuit diagram.

Plug-in connector to
DIN EN 175201-804



Component plug allocation

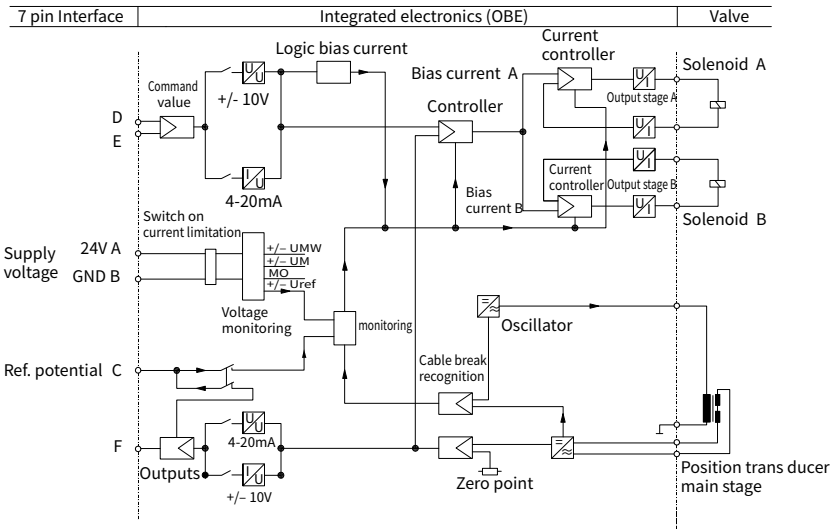
	Contact	Signal
Supply voltage	A	24 VDC (18 to 35 VDC); I_{max} = 1, 5 A; impulse load ⩽ 3 A
	B	0V
Ref. (actual value)	C	Ref. potential for actual value (contact F)
Differential amplifierinput (command value)	D	±10V or 4 – 20mA
	E	0V ref. potentional
Measurement output (act. value)	F	±10V or 4 – 20 mA
	PE	Connected with cooling body and valve housing

Command value:
Referance potential at E and a positive command value at D results in a flow from P to A and B to T.
Referance potential at E and a negative command value at D results in a flow from P to B and A to T.

Connection cable:
Recommendation: – Up to 25m cable length type LiYCY 7×0.75 mm^2
– Up to 50m cable length type LiYCY 7×1.0 mm^2
External diameter: – 6.5 to 11mm (plastic plug-in connection)
– 8 to 12mm (metal plug-in connector)
Connect screen to ⊥ only on supply side.

06

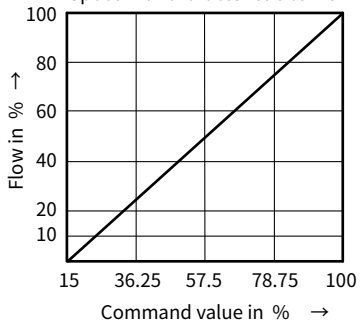
Blockcircuit diagram / connection allocation of the integrated control electronics for type 4WRKE



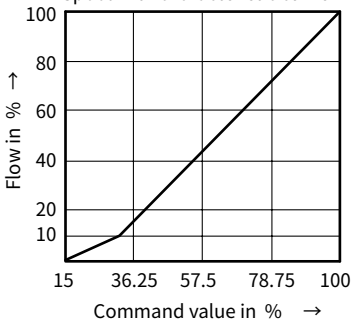
Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C)

Flow - command value curve

Spool with characteristic curve L

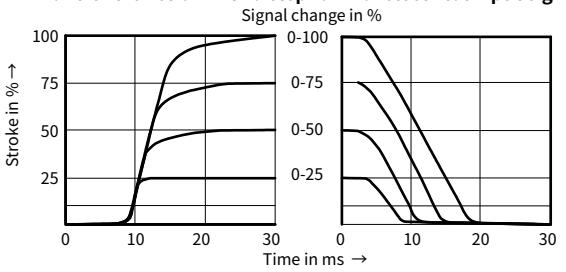


Spool with characteristic curve P



NG 10

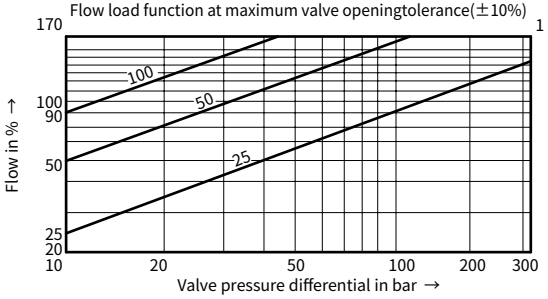
Transient function with a step form of electrical input signal



measured at
p =100bar

Flow-pressure differential curve

Flow load function at maximum valve openingtolerance(±10%)

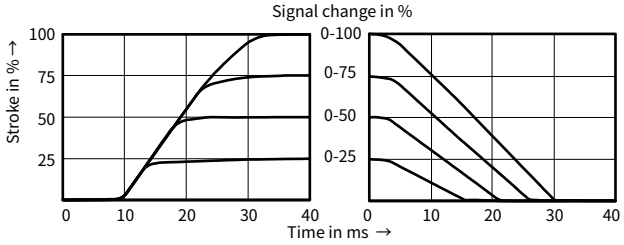


1= Recommended
flow limitation
(flow velocity 30 m/s)

Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C)

NG 16

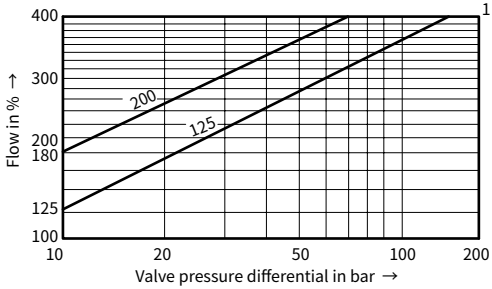
Transient function with a step form of electrical input signal



measured at p =100bar

Flow-pressure differential curve

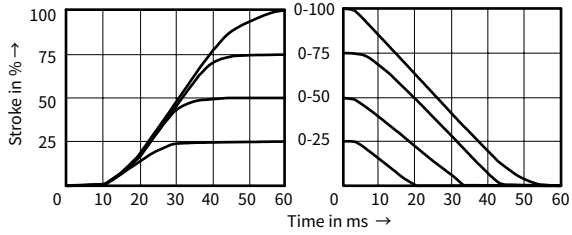
Flow load function at maximum valve openingtolerance(±10%)



1= Recommended flow limitation (flow velocity 30 m/s)

NG 25, 27

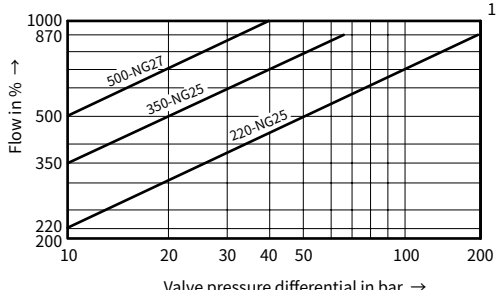
Transient function with a step form of electrical input signal



measured at p =100bar

Flow-pressure differential curve

Flow load function at maximum valve openingtolerance(±10%)



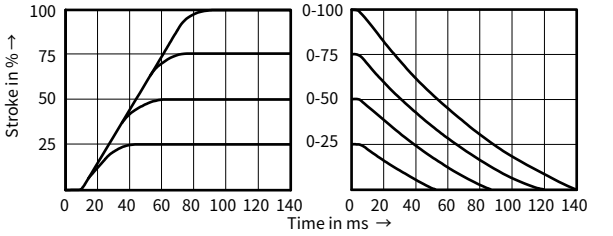
1= Recommended flow limitation (flow velocity 30 m/s)

Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C)

NG 32

Transient function with a step form of electrical input signal

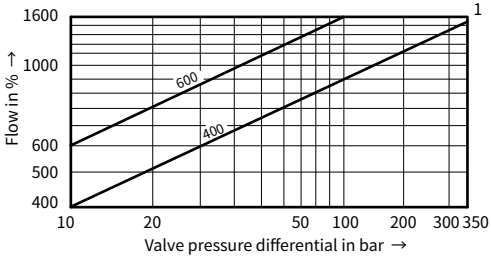
Signal change in %



measured at p =100bar

Flow-pressure differential curve

Flow load function at maximum valve openingtolerance(±10%)



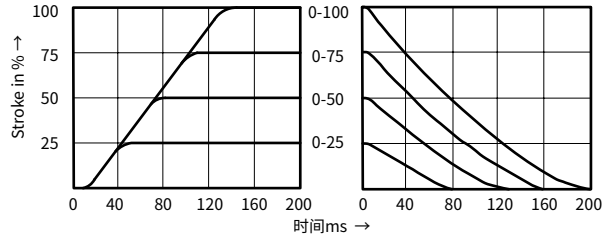
1= Recommended flow limitation (flow velocity 30 m/s)

06

NG 35

Transient function with a step form of electrical input signal

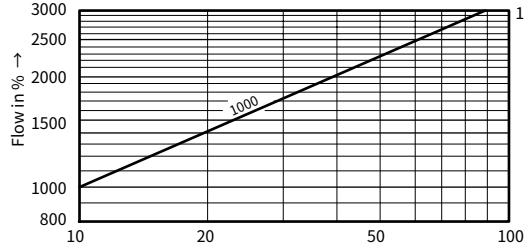
Signal change in %



measured at p =100bar

Flow-pressure differential curve

Flow load function at maximum valve openingtolerance(±10%)

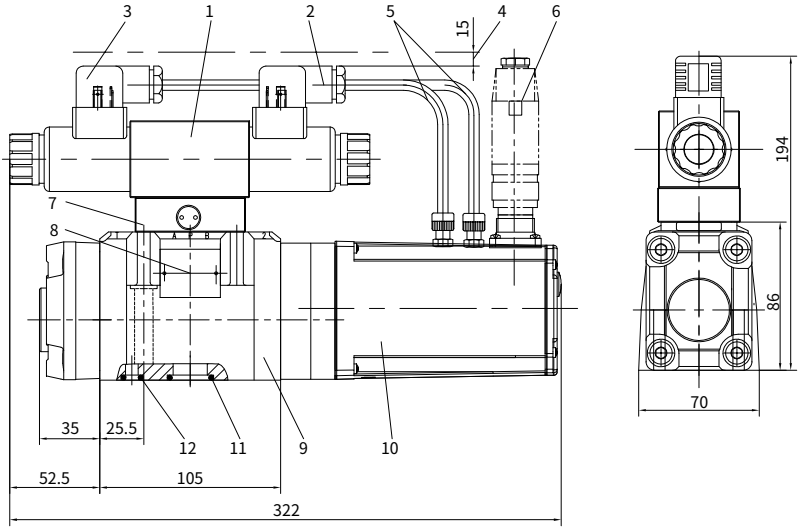


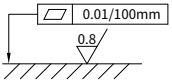
1= Recommended flow limitation (flow velocity 30 m/s)

Unit dimensions

(Dimensions in mm)

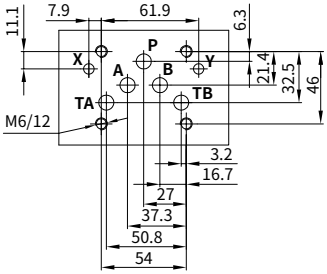
NG 10





Required surface finish of mating piece

Machined valve mounting surface



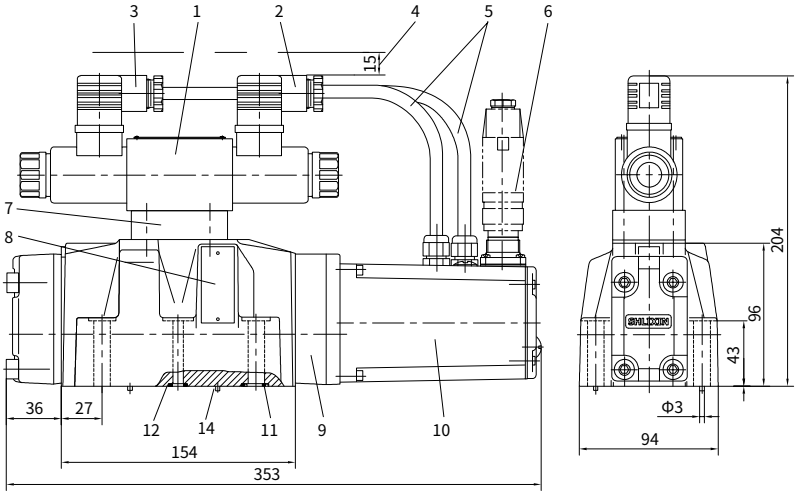
1 Pilot control valve
2 Plug-in connector "A"
3 Plug-in connector "B"
4 Space required to remove the plug-in connector
5 Cable
6 Plug-in connector
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated control electronics
11 R-ring 13×1.6×2, ports A, B, P, T
12 R-ring 11.18×1.6 ×1.78, ports X and Y

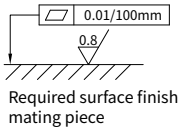
Valve mounting screws:
4- M6×45 GB/T 70.1-10.9;
M_A =13.5 Nm

Unit dimensions

(Dimensions in mm)

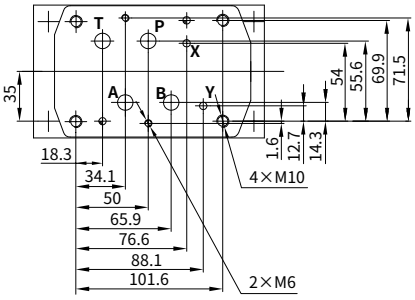
NG 16





Required surface finish of mating piece

Machined valve mounting surface



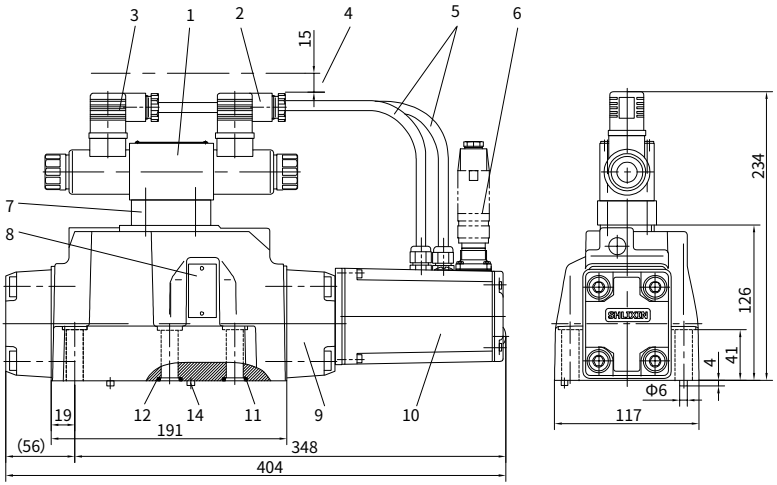
1 Pilot control valve
2 Plug-in connector "A"
3 Plug-in connector "B"
4 Space required to remove the plug-in connector
5 Cable
6 Plug-in connector
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated control electronics
11 R-ring 22.53×2.3×2.62, ports A, B, P, T
12 R-ring 10×2×2, ports X and Y
14 Locating pin

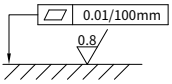
Valve mounting screws:
2- M6×55 GB/T 70.1-10.9; M_A =14 Nm
4- M10×60 GB/T 70.1-10.9; M_A =58 Nm

Unit dimensions

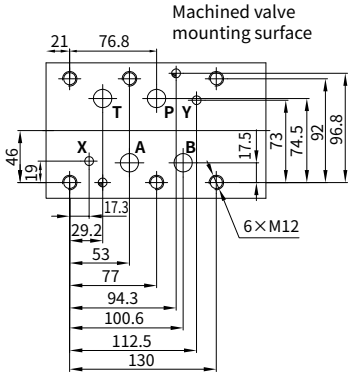
(Dimensions in mm)

NG 25





Required surface finish of mating piece



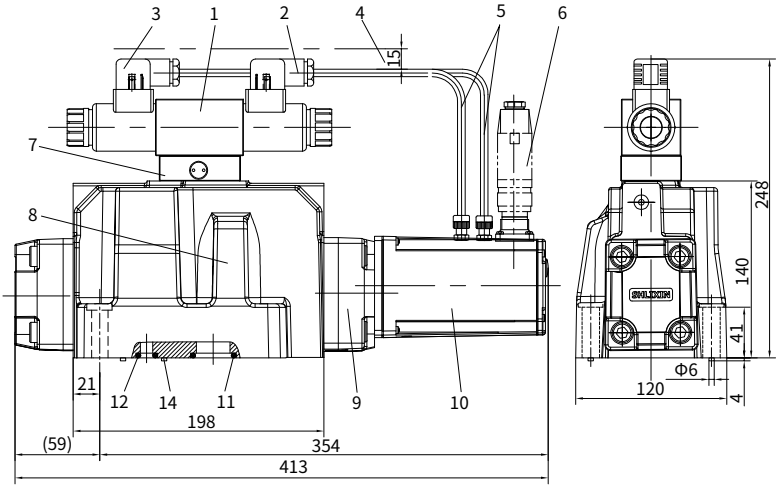
1 Pilot control valve
2 Plug-in connector "A"
3 Plug-in connector "B"
4 Space required to remove the plug-in connector
5 Cable
6 Plug-in connector
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated control electronics
11 R-ring 27.8×2.6×3, ports A, B, P, T
12 R-ring 19×3×3, ports X and Y
13 Locating pin

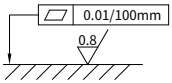
Valve mounting screws:
6- M12×60 GB/T 70.1-10.9;
M_A =100 Nm

Unit dimensions

(Dimensions in mm)

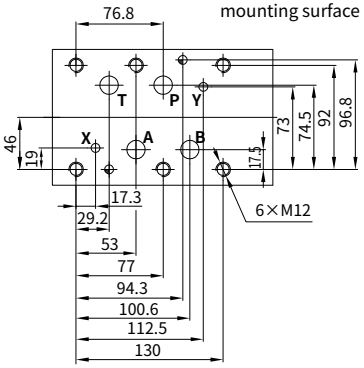
NG 27





Required surface finish
of mating piece

Machined valve
mounting surface



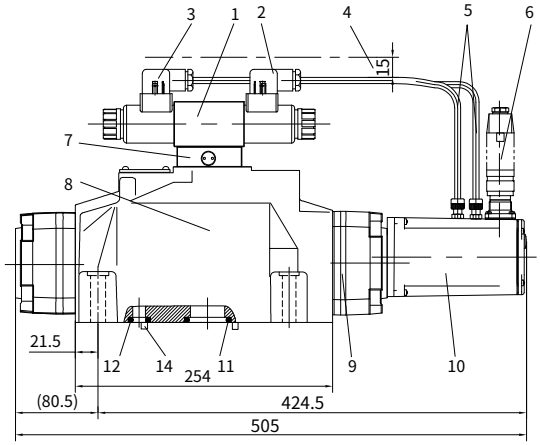
1 Pilot control valve
2 Plug-in connector "A"
3 Plug-in connector "B"
4 Space required to remove the plug-in connector
5 Cable
6 Plug-in connector
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated control electronics
11 R-ring 34.52×3.53×3.53, ports A, B, P, T
12 R-ring 19×3×3, ports X and Y
14 Locating pin

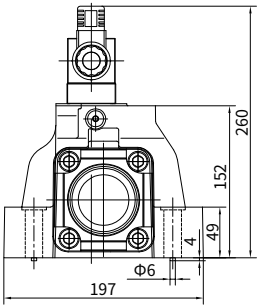
Valve mounting screws:
6- M12×60 GB/T 70.1-10.9;
M_A =100 Nm

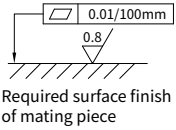
Unit dimensions

(Dimensions in mm)

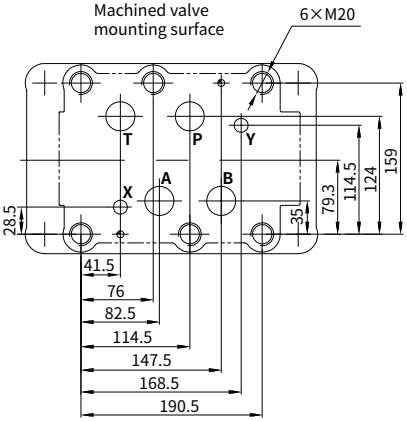
NG 32







Required surface finish of mating piece



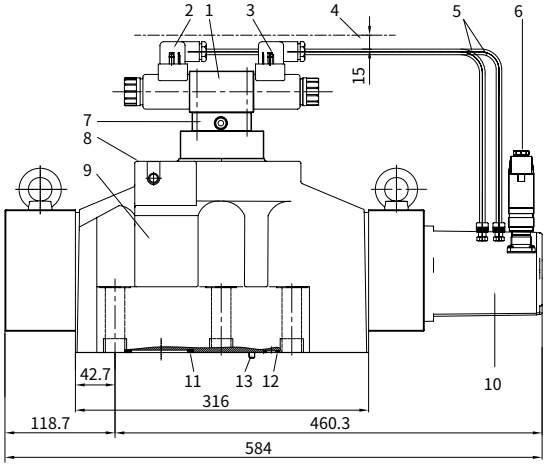
1 Pilot control valve
2 Plug-in connector "A"
3 Plug-in connector "B"
4 Space required to remove the plug-in connector
5 Cable
6 Plug-in connector
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated control electronics
11 R-ring 42.5×3×3, ports A, B, P, T
12 R-ring 19×3×3, ports X and Y
13 Locating pin

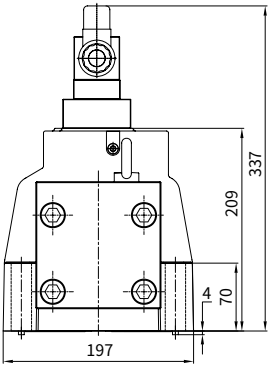
Valve mounting screws:
6- M20×80 GB/T 70.1-10.9;
M_A =340 Nm

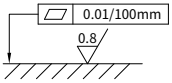
Unit dimensions

(Dimensions in mm)

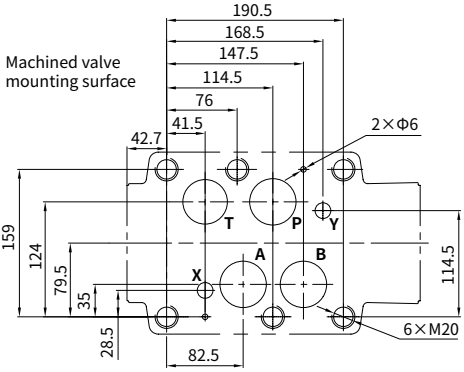
NG 35







Required surface finish of mating piece



1 Pilot control valve
2 Plug-in connector "A"
3 Plug-in connector "B"
4 Space required to remove the plug-in connector
5 Cable
6 Plug-in connector
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated control electronics
11 O-ring 53.57×3.53, ports A, B, P, T
12 O-ring 12.1×2.65, ports X and Y
13 Locating pin

Valve mounting screws:
6- M20×100 GB/T 70.1-10.9;
M_A =360 Nm