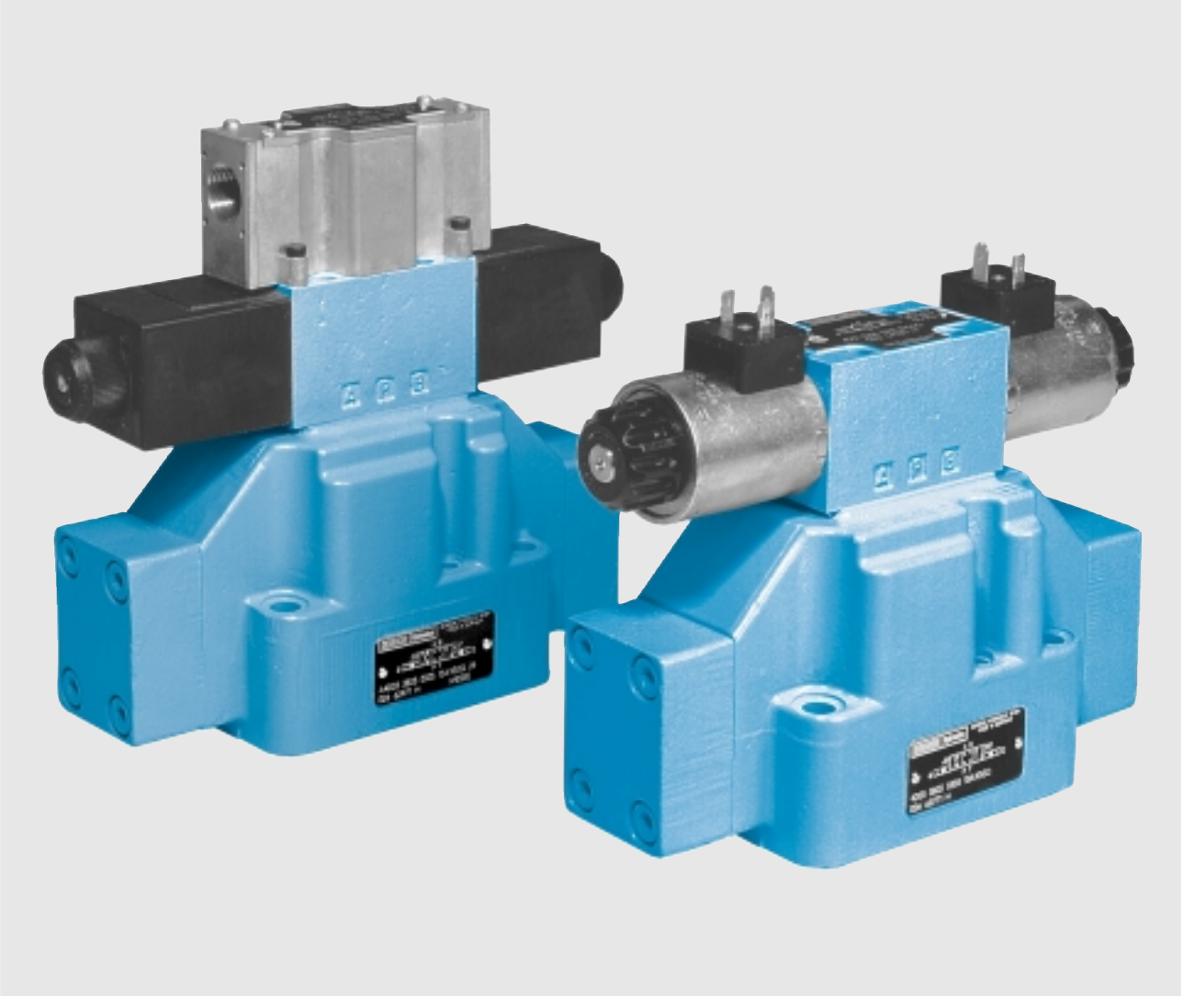
DENISON HYDRAULICS
Directional Control Valves

Series A4D03 – NFPA D07, Cetop 7



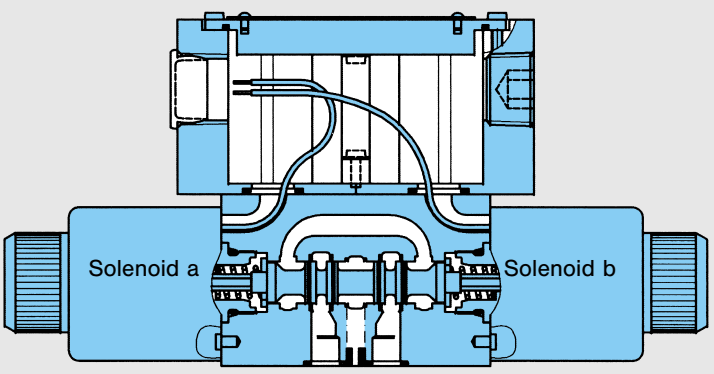
Publ. 4-AM 3510-B, replaces 4-AM 3510-A

DENISON Hydraulics

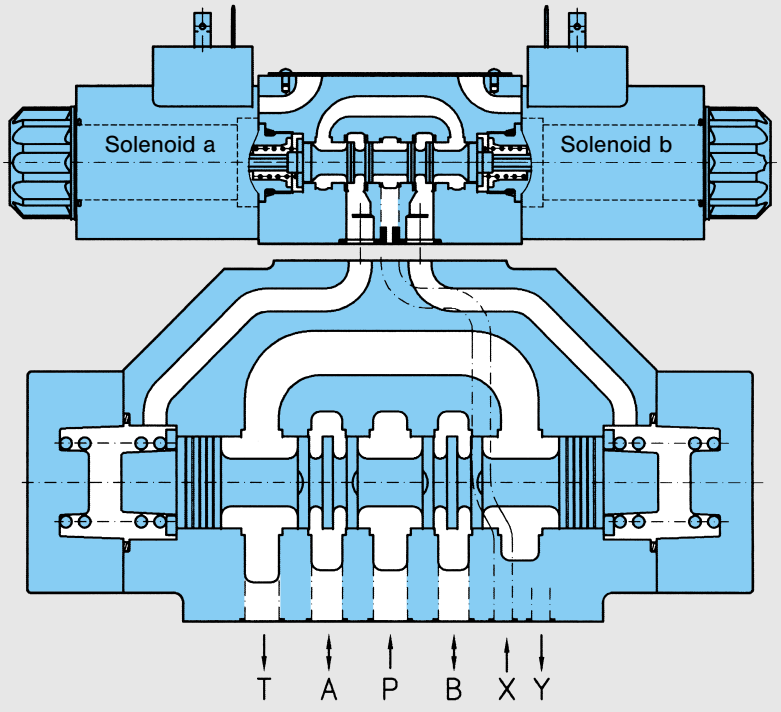
FEATURES

- Directional control valve solenoid or hydraulically controlled.
- Extremely low pressure drop – energy saving.
- High functional limit up to 300 l/min (80 gpm) at nominal pressure.
- Nominal operating pressure 350 bar (5000 psi).
- Wide variety of spool types available.
- Permissible pressure in the tank port up to 350 bar (5000 psi) with external drain, up to 210 bar (3000 psi) with internal drain (see characteristics).
- Coils are easily replaced without any oil leakage.
- Interchangeability of spools and bodies due to high precision manufacturing processes.
- Mounting configuration conform to ISO 4401.
- Every valve is factory tested prior to delivery.
- Worldwide DENISON Service.

AC Pilot Valve with Wiring Box

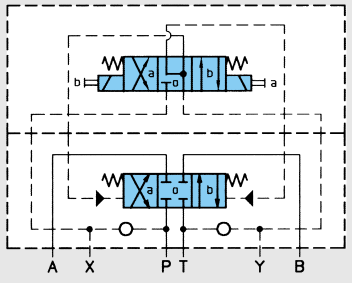


DC Pilot Valve with 3 Pin Socket



Example: solenoid operation

SYMBOL



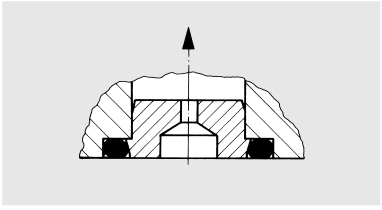
GENERAL

The DENISON A4D03 is a pilot operated directional control valve controlled by solenoids or hydraulic pressure.
The A4D03 valve controls the flow direction in a hydraulic circuit. It delivers the performance demanded of modern hydraulic systems. Streamlined internal channels ensure minimum pressure drop at maximum flow.
Subplate or manifold mount as standard.

OPERATION

The electrically operated 4-way valve A4D03 consists of a main body and a solenoid operated pilot valve. The energized solenoid shifts the pilot control spool, thus directing fluid to one end of the main spool, and moving it to the desired position. Fluid can then flow e.g. from port P to either port A or B whilst the alternate port (B or A) is connected to the tank line. The necessary pilot pressure can be obtained internally from the system port P or from an external pressure supply connected to port X.
De-energizing the solenoid allows both the pilot control and the main spool to return to their neutral positions.
The hydraulically operated version may be remotely controlled by an external pilot valve.

PILOT VALVE ORIFICE



In certain operating conditions, a flow greater than the functional limit of the pilot valve may be generated. In this case, it is recommended that one orifice be fitted in the P port of the pilot valve (code 10 for solenoid operation) or two orifices in the A & B ports of the pilot cap (code P3 for hydraulic operation).

CHARACTERISTICS

• Design	Sliding spool valve
• Type of mounting	Subplate conform to NFPA D07, CETOP 7, ISO 4401
• Mounting position	Optional
• Ambient temperature range	−20 . . . +50 °C (0 . . . 120 ° F)
• Operating pressure (A, B, P, X)	up to 350 bar (5000 psi)
• Operating pressure (T, Y)	see pages 9 and 10
• External pilot pressure (at 300 l/min) (80 gpm)	
− min	8.5 bar (125 psi) for spools with open center position 9.5 bar (140 psi) for spools with closed center position
− max	350 bar (5000 psi) > 250 bar . . . 350 bar (>3.625 psi . . . 5000 psi) a pilot orifice dia. 1.0 mm in P-port is recommended (code 10 or P3)
• Max. flow	300 l/min (80 gpm) (see diagrams)
• Max. leakage	300 . . . 650 ml/min (18 . . . 40 in^3/min) (depends on spool type)
• Fluid	Mineral oil according to DIN 51524 and 51525 (For other fluids please consult DENISON)
• Viscosity range	10 . . . 650 cSt, optimum 30 cSt
• Fluid temperature range	−18 . . . +80 °C (0 . . . 176 ° F)
• Contamination level	Max. permissible contamination level according to NAS 1638 Class 8 (Class 9 for 15 Micron and smaller) or ISO 17/14

ORDERING CODE

Model No.: A4D03 – 3 . .. – .. 03 – . . A 1 ... – 10 .. ..

1 2 3 4 5 6 7 8 9 10 11 12

1 Series
03 = Cetop 7

2 Control
A = Pilot operated, 1 solenoid (A4D01)
B = Pilot operated, 2 solenoids (A4D01)
C = Pilot operated, 2 solenoids (A4D01)
pilot valve: 2 pos. detents
0 = Hydraulic operation

3 Spool Type
refer to pages 5, 6 and 7

4 Spool Position
01 = 2 (a, b), Spring offset to pos. "b", energized to "a"
02 = 2 (a, b), Spring offset to pos. "a", energized to "b"
03 = 3 (a, o, b), Spring centered pos. "o"
04 = 2 (a, b), Spool is not centered, energized to "a" or "b"
(pilot valve with detents)
05 = 2 (o, b), Spring centered pos. "o", energized to "b"
06 = 2 (o, a), Spring centered pos. "o", energized to "a"

5 Pilot Connection
0 = External PP, external PD (for control code 0)
1 = Internal PP, internal PD [1)]
2 = Internal PP, external PD [1)]
3 = External PP, internal PD
4 = External PP, external PD

6 Main Valve Accessories
0 = without
1 = Shifting time adjustment (meter-in control)
2 = Shifting time adjustment (meter-out control)
6 = Shifting time adjustment (meter-in control) & integral check in "P" [1)]
8 = Shifting time adjustment (meter-out control) & integral check in "P" [1)]
4 = Integral check in "P" [1)]

7 Design Letter

8 Seal Class
1 = NBR-seals (Standard)
4 = EPR-seals
5 = FPM-seals (Viton®)

9 Solenoid Voltage

W01 = 115 V / 60 Hz	AC	G0R = 12 V	DC
W02 = 230 V / 60 Hz		G0Q = 24 V	
W06 = 115 V / 50 Hz		[1)] G0D = 27 V	
W07 = 230 V / 50 Hz		[1)] for DIN connector only	

Order information for plug-in connectors see page 14

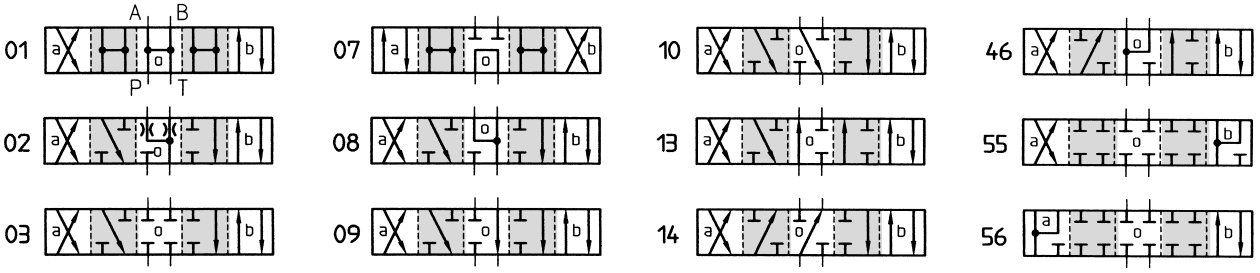
1* Pilot Accessories / Modifications [2)]
10 = 1.0 mm orifice in P-port; for solenoid with manual override
1028 = 1.0 mm orifice in P-port; wiring box with 6" flying leads
1032 = 1.0 mm orifice in P-port; for solenoid without manual override
1052 = 1.0 mm orifice in P-port; for solenoid with manual override; with rubber cover
102852 = 1.0 mm orifice in P-port; wiring box with 6" flying leads & rubber cover
1081 = 1.0 mm orifice in P-port; wiring box with 6" flying leads & terminal strips
108152 = 1.0 mm orifice in P-port; wiring box with 6" flying leads & terminal strips & rubber cover
P3 = 1.0 mm orifices in A & B-ports of the cap; for hydraulic operation only (control code 0)

Notes:

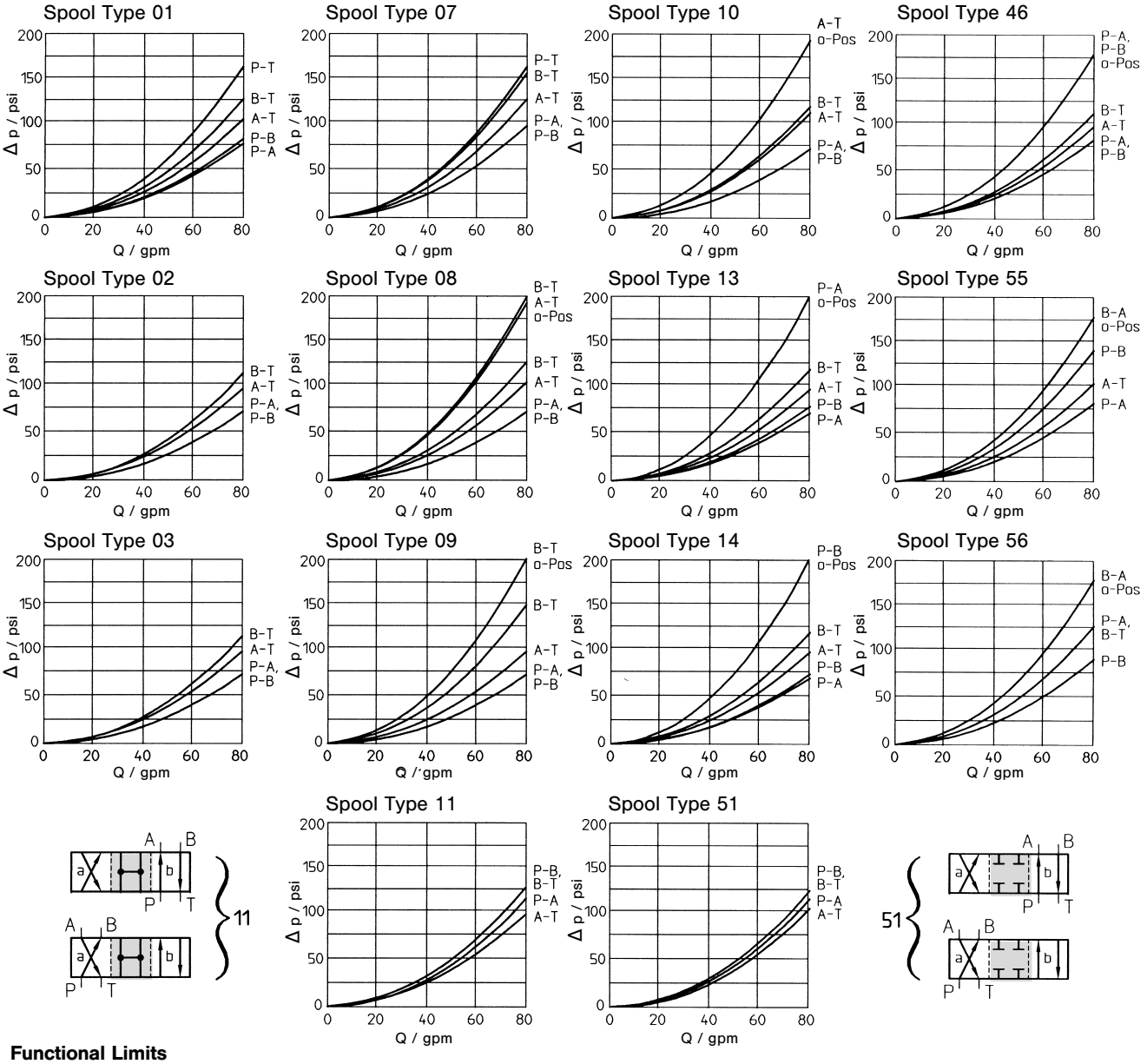
[1)] For valves with spools 01, 07, 11 and internal PP an integral check is recommended in P-port of the main body to obtain the minimum pilot pressure. The integral check is not provided for load pressure holding back to P-port.

[2)] For standard applications orifice in P-port always recommended.

Spool Types



Pressure Drop

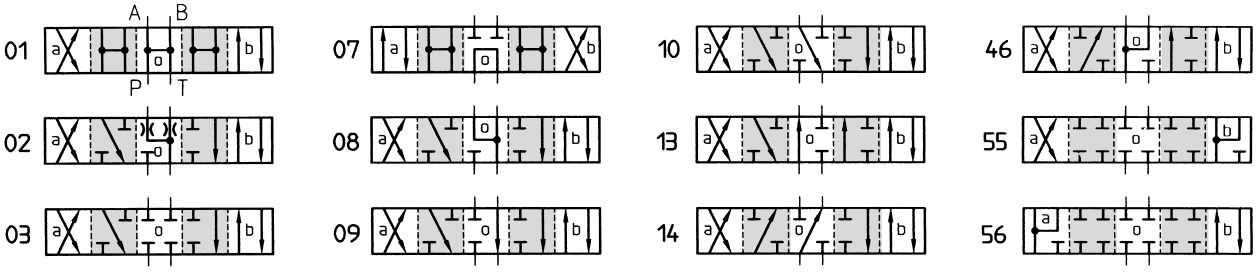


Functional Limits

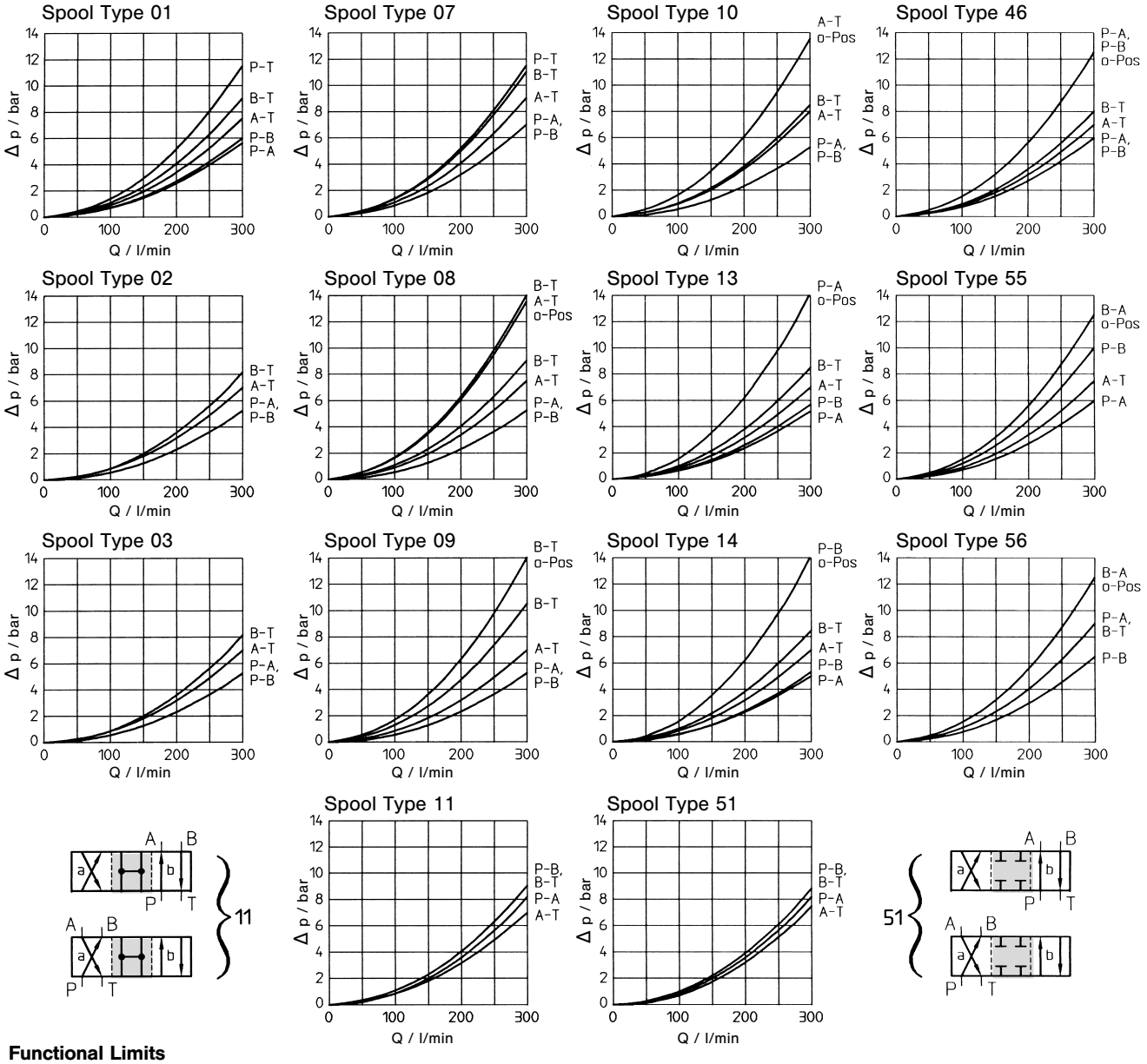
Spool Type	max. Flow (gpm) versus Pressure (psi)				
	1000	2000	3000	4000	5000
01, 02, 03, 08, 09, 10, 13, 14, 46, 55, 56	80	80	80	80	80
07	80	80	74	61	48
11	80	80	80	80/53*	80/50*
51	80	80/53*	80/45*	80/42*	80/26*

* The "fail safe" flow limits of the spool types 11 & 51 must be reduced at higher operating pressure to comply with "safety regulations" where applicable.
Means: The main spool returns to "spring offset" position only by spring force **(without** pilot pressure).

Spool Types



Pressure Drop



Functional Limits

Spool Type	max. Flow (l/min) versus Pressure (bar)				
	70	140	210	280	350
01, 02, 03, 08, 09, 10, 13, 14, 46, 55, 56	300	300	300	300	300
07	300	300	280	230	180
11	300	300	300	300/200*	300/190*
51	300	300/200*	300/170*	300/160*	300/100*

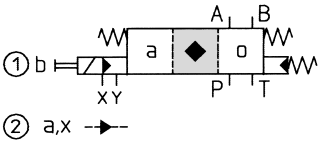
* The ”fail safe” flow limits of the spool types 11 & 51 must be reduced at higher operating pressure to comply with ”safety regulations” where applicable.
Means: The main spool returns to ”spring offset” position only by spring force **(without** pilot pressure).

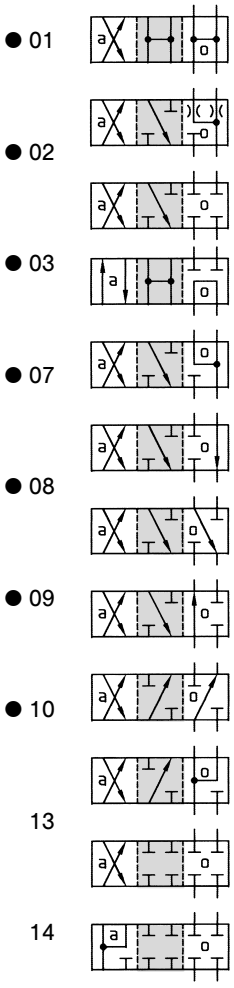
SIMPLIFIED SYMBOLS & SPOOL TYPES AVAILABLE

① 1-Solenoid operation (Sol. B-Side)
② hydraulic operation

Spool Position 06

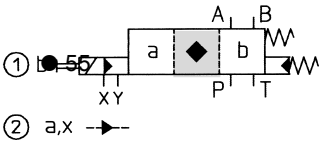
Spring Centering

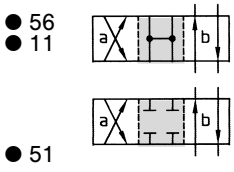




Spool Position 01

Spring Offset

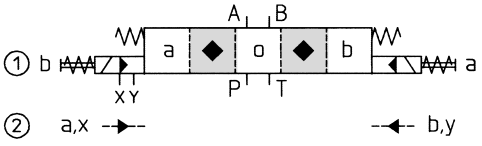


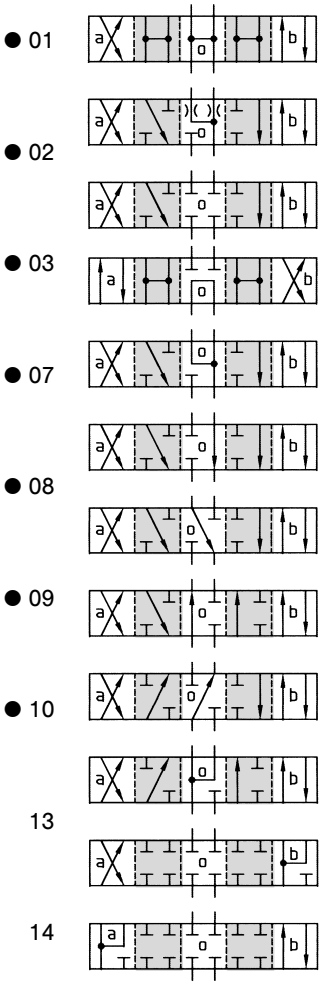


① 2-Solenoid operation
② hydraulic operation

Spool Position 03

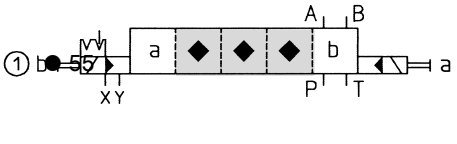
Spring Centering





Spool Position 04

Pilot Valve with Detents

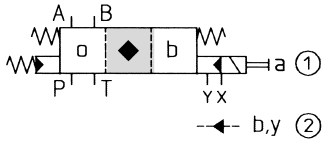


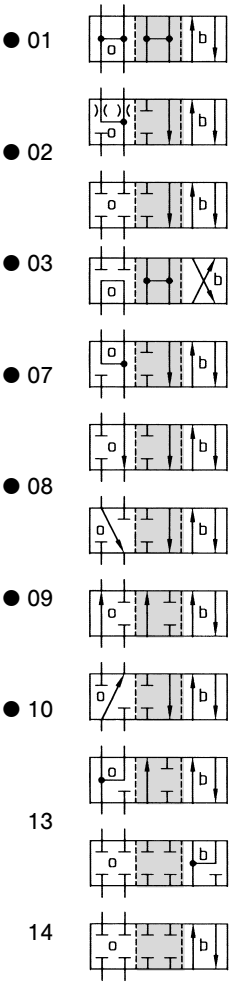
All spool types
as shown above!

① 1-Solenoid operation (Sol. A-Side)
② hydraulic operation

Spool Position 05

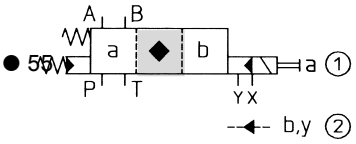
Spring Centering

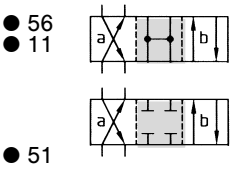




Spool Position 02

Spring Offset





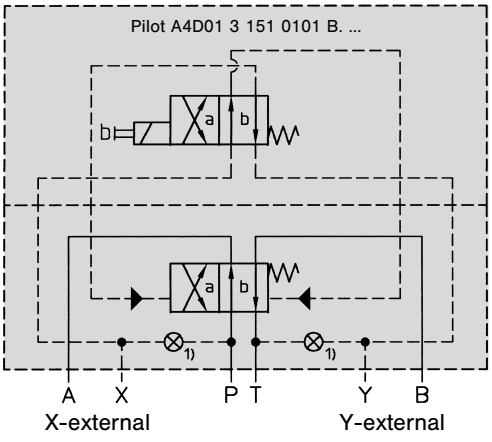
● Standard Spool

Transfer configuration only (not switched position)

A4D03 3 A51 0103 40A. ...

Spool Position 01

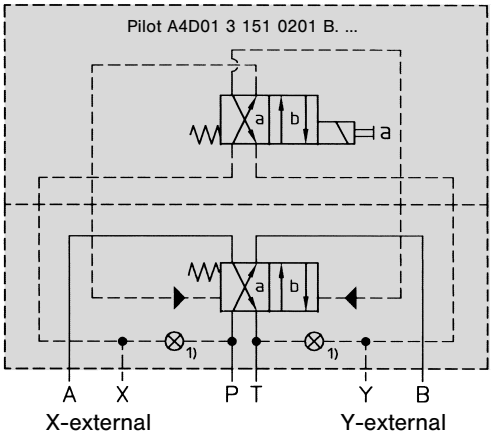
2 (a, b), Spring Offset



A4D03 3 A51 0203 40A. ...

Spool Position 02

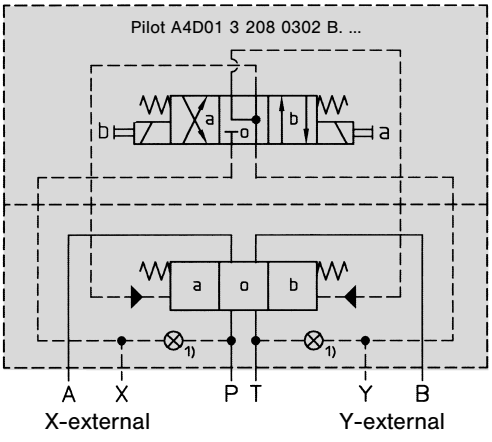
2 (a, b), Spring Offset



A4D03 3 B.. 0303 40A. ...

Spool Position 03

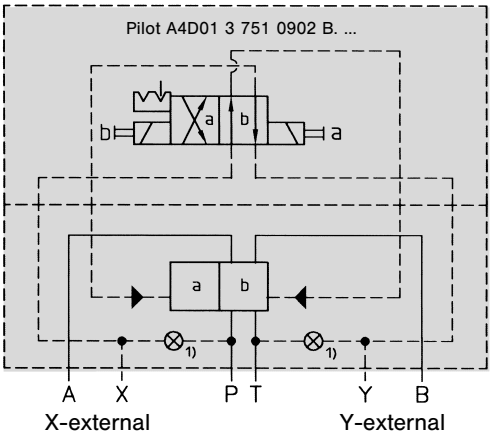
3 (a, o, b), Spring Centering



A4D03 3 C.. 0403 40A. ...

Spool Position 04

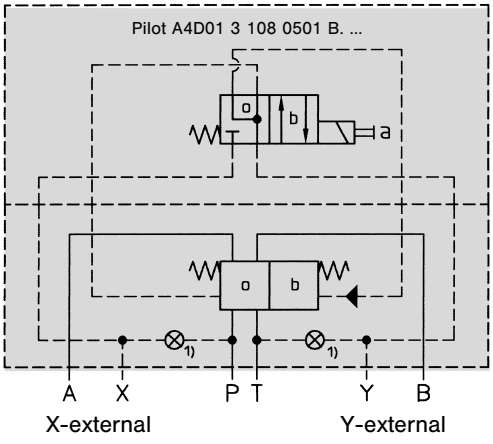
2 (a, b), Pilot Valve with detents



A4D03 3 A.. 0503 40A. ...

Spool Position 05

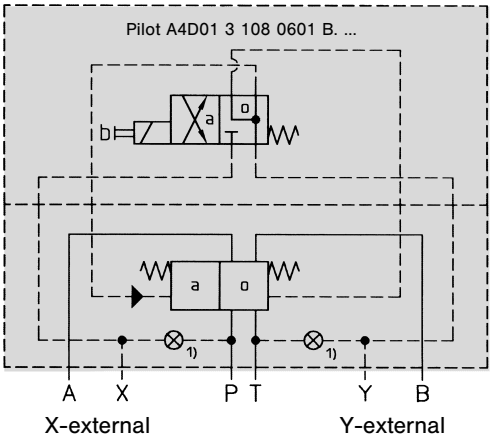
2 (o, b), Spring Centering



A4D03 3 A.. 0603 40A. ...

Spool Position 06

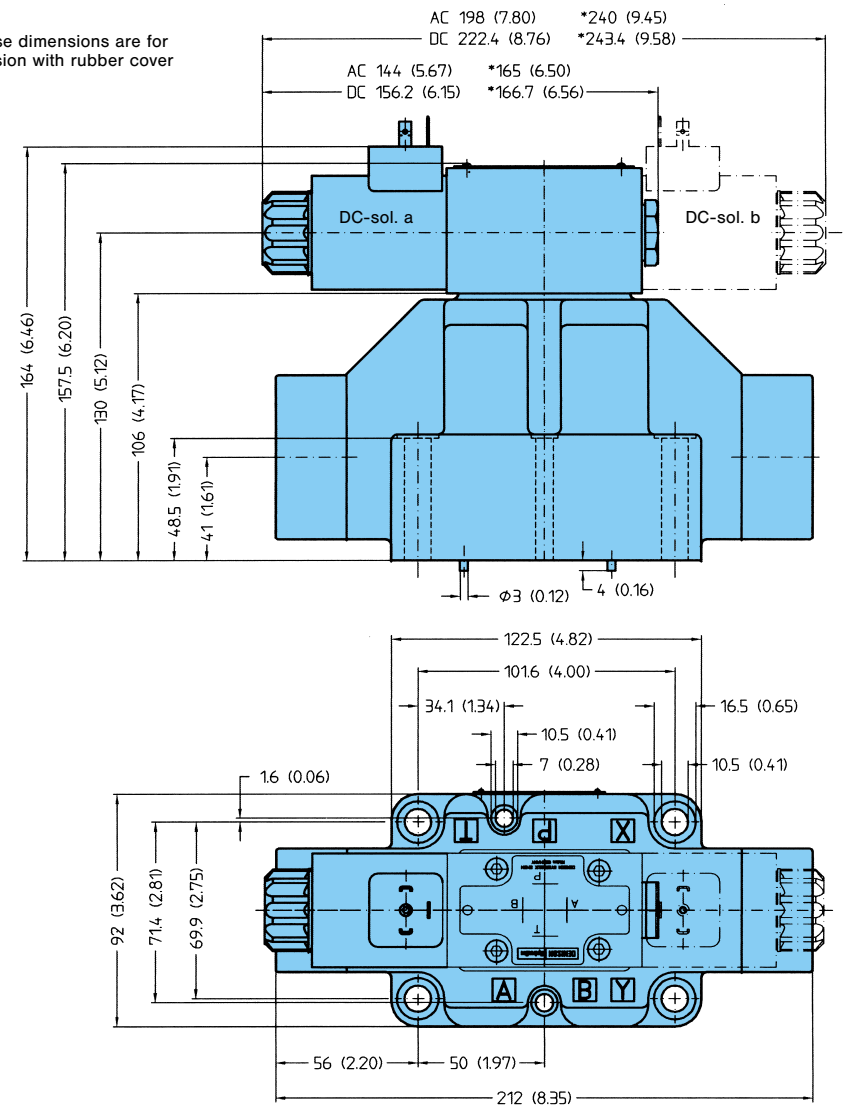
2 (o, a), Spring Centering

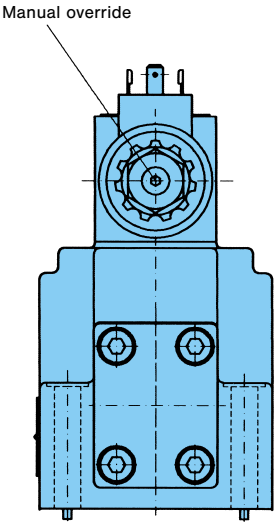


[1] Plug mounted according to desired internal or external PP or PD.

		DC	AC
• Nominal voltage		See ordering code on page 4	
• Power input		31 W	31 W
• Permissible tank pressure (T)			
– with internal drain		up to 210 bar (3000 psi)	up to 140 bar (2000 psi)
– with external drain		up to 350 bar (5000 psi)	up to 350 bar (5000 psi)
• Permissible drain pressure (Y)		up to 210 bar (3000 psi)	up to 140 bar (2000 psi)
• Holding		–	78 VA
• Inrush		–	264 VA
• Permissible voltage difference		+ 5 %...– 10 %	+ 5 %...– 10 %
• Response times			
(at 200 l/min & without pilot orifice)			
– energized	at 50 bar (725 psi)	40...45 ms	27...30 ms
	at 150 bar (2175 psi)	40...50 ms	22...26 ms
	at 250 bar (3625 psi)	45...50 ms	20...24 ms
– de-energized	at 50 bar (725 psi)	45 ms	32...38 ms
	at 150 bar (2175 psi)	40...45 ms	30...35 ms
	at 250 bar (3625 psi)	40...45 ms	30...35 ms
• Max. coil temperature		+ 180 °C (350 ° F)	+ 180 °C (350 ° F)
• Temperature class		H	H
• Relative operating period		100 %	100 %
• Type of protection		IP 65	IP 65
• Weight 1 solenoid version		9.5 kg (21 lbs)	9.3 kg (20.5 lbs)
2 solenoid version		10.0 kg (22 lbs)	9.7 kg (21.4 lbs)

* these dimensions are for version with rubber cover

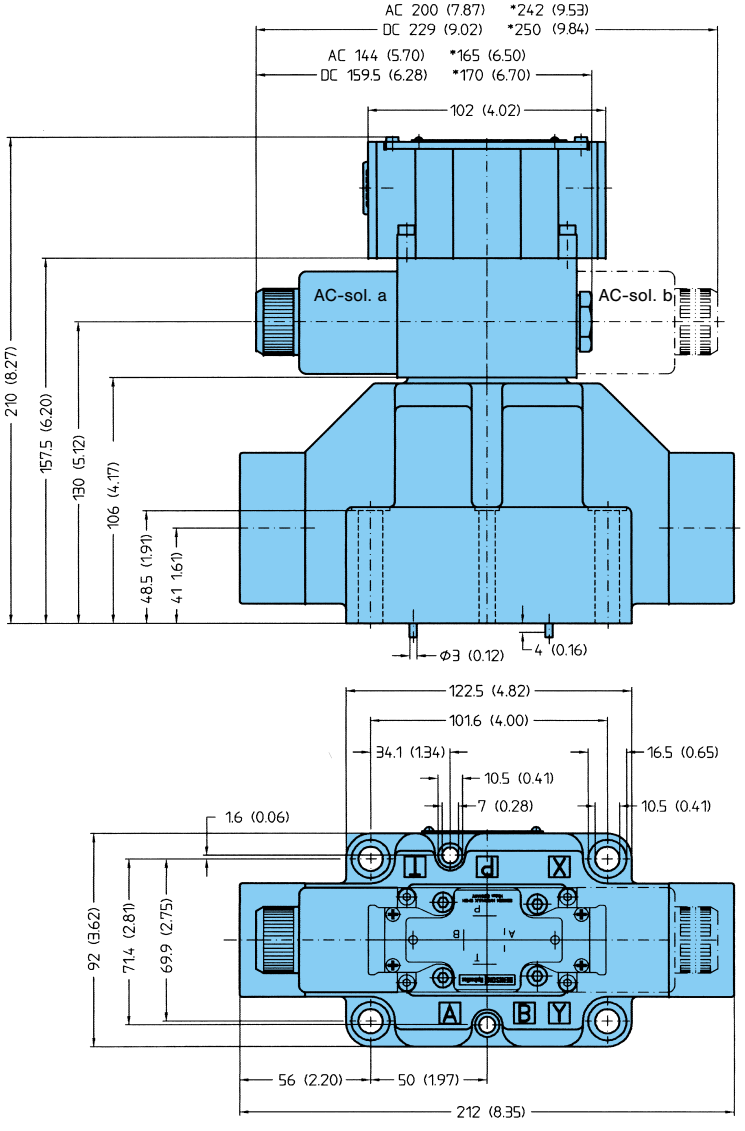




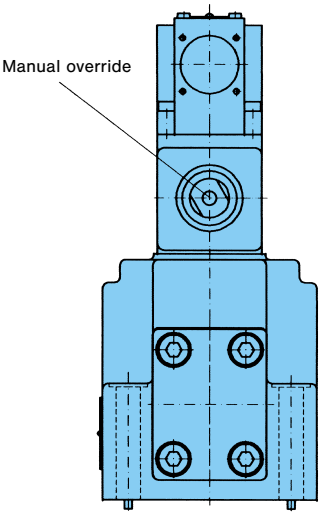
Note:
For replacement of port seals (NBR) see page 13

Ordering Code | Back to Content

		DC	AC
• Nominal voltage		See ordering code on page 4	
• Power input		31 W	31 W
• Permissible tank pressure (T)			
– with internal drain		up to 210 bar (3000 psi)	up to 140 bar (2000 psi)
– with external drain		up to 350 bar (5000 psi)	up to 350 bar (5000 psi)
• Permissible drain pressure (Y)		up to 210 bar (3000 psi)	up to 140 bar (2000 psi)
• Holding		–	78 VA
• Inrush		–	264 VA
• Permissible voltage difference		+ 5 %...– 10 %	+ 5 %...– 10 %
• Response times			
(at 200 l/min & without pilot orifice)			
– energized	at 50 bar (725 psi)	40...45 ms	27...30 ms
	at 150 bar (2175 psi)	40...50 ms	22...26 ms
	at 250 bar (3625 psi)	45...50 ms	20...24 ms
– de-energized	at 50 bar (725 psi)	45 ms	32...38 ms
	at 150 bar (2175 psi)	40...45 ms	30...35 ms
	at 250 bar (3625 psi)	40...45 ms	30...35 ms
• Max. coil temperature		+ 180 °C (350 ° F)	+ 180 °C (350 ° F)
• Temperature class		H	H
• Relative operating period		100 %	100 %
• Type of protection		IP 65	IP 65
• Weight 1 solenoid version		9.7 kg (21.4 lbs)	9.5 kg (20.9 lbs)
2 solenoid version		10.2 kg (22.4 lbs)	9.9 kg (21.8 lbs)



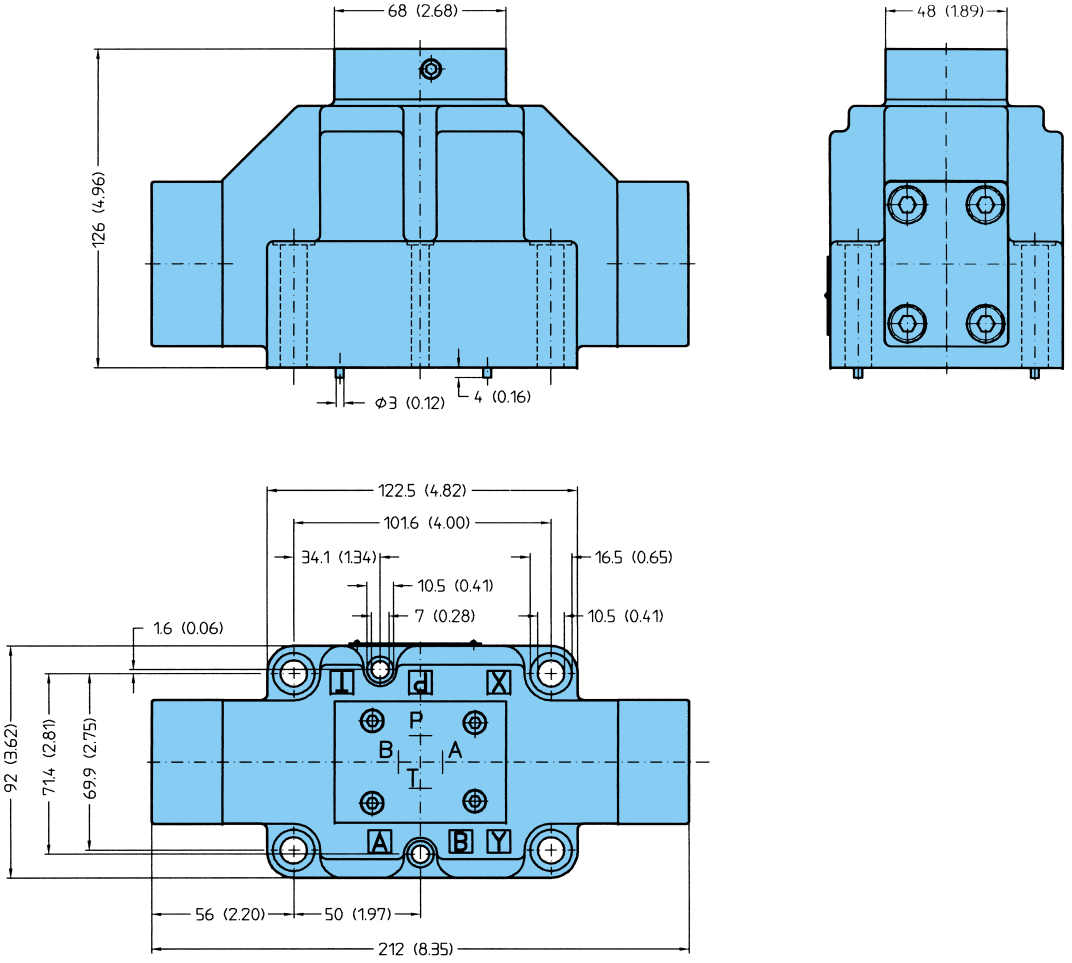
* these dimensions are for version with rubber cover



Note:
For replacement of port seals (NBR) see page 13

Ordering Code | Back to Content

• Response time	
– pressurerized	e.g. 50 ms with pilot flow 6.5 l/min (1.72 gpm)
– unpressurerized	e.g. 40 ms with pressureless return line
• Permissible pressure (ports T, X, Y)	...350 bar (5000 psi)
• Weight	8.2 kg (18 lbs)

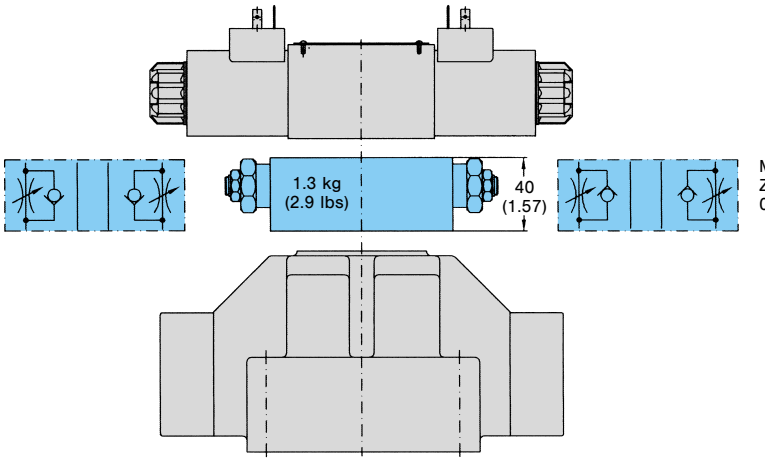


Note: For replacement of port seals (NBR) see page 13

Ordering Code | Back to Content

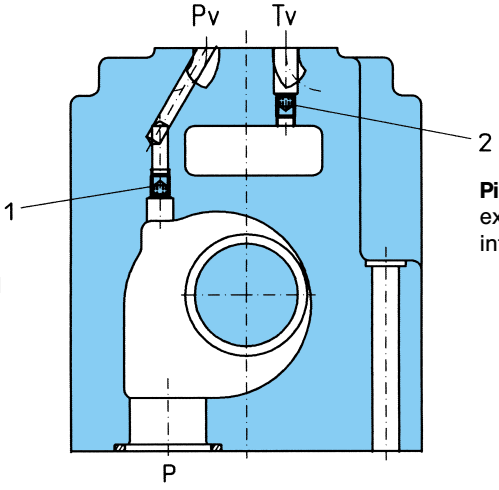
Version with shifting time adjustment

Meter-in control in A and B
ZRD-ABZ01-S0-D1
098-91058-0



Meter-out control in A and B
ZRD-ABA01-S0-D1
098-91014-0

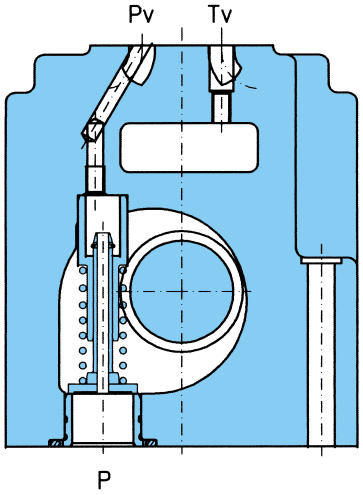
Pilot connections



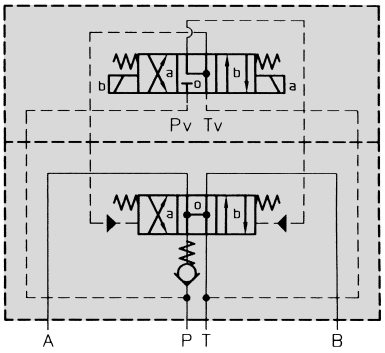
Pilot Pressure PP
external: 1 closed
internal: 1 open

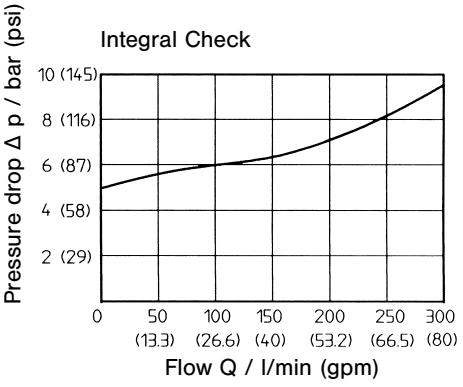
Pilot Drain PD
external: 2 closed
internal: 2 open

Version with integral check



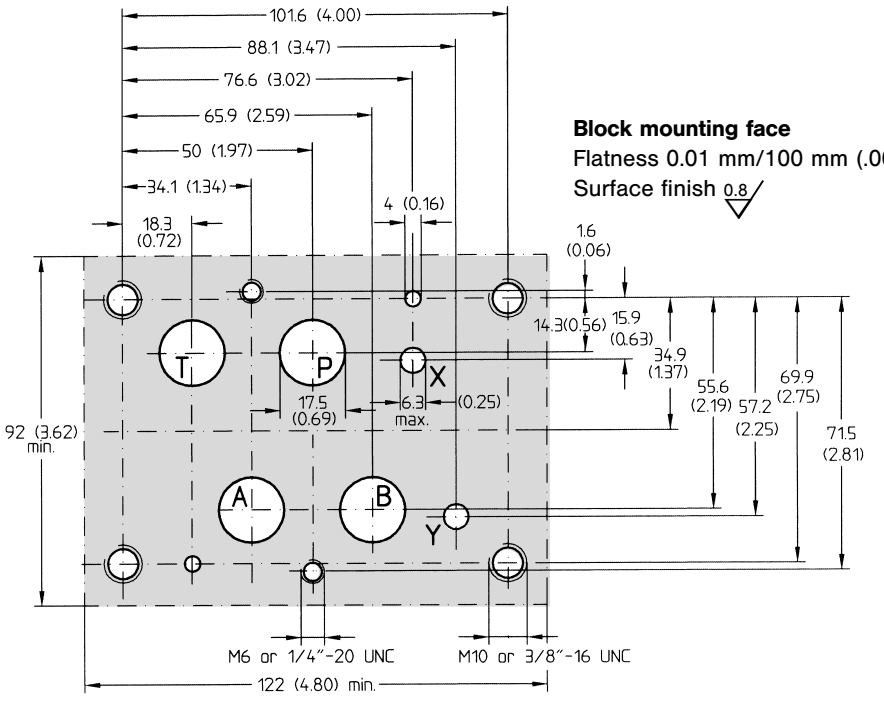
Symbol with Integral Check
(Example)





Note: For valves with no-load flow (spools 01, 07) and internal PP an integral check is recommended in P-port of the main body to obtain the minimum pilot pressure. The integral check is not provided for load pressure holding back to P-port.

Mounting configuration conform to ISO 4401



Block mounting face
Flatness 0.01 mm/100 mm (.003/3.93 inches) length
Surface finish 0.8

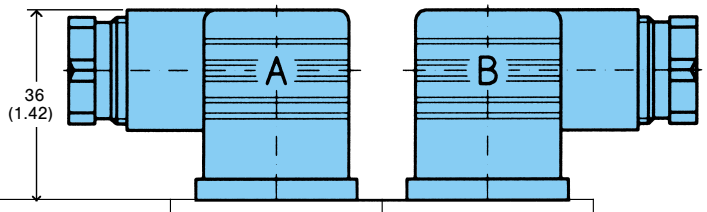
Portings

P = Pressure port
T = Tank port
A & B = Actuator ports
X = Pilot port for external PP: pilot operated valves
= Pilot port for hydr. operated valves
Y = Drain port for external PD: pilot operated valves
= Pilot port for hydr. operated valves

NBR-Seals

A, B, P, T	23.47 x 2.62 mm	691-00119-0
X, Y	9.25 x 1.78 mm	691-00012-0

PLUG-IN CONNECTORS CONFIRMING TO ISO 4400



Versions	A-Side (grey)	B-Side (black)
Standard <250 V PG 11	167-01007-8	167-01008-8
with LED (red) 15…30 V	167-01100-8	167-01101-8
with bridge rectifier 12…250 V	167-01076-8	167-01014-8

Note: Plug-in connectors to be ordered as separate items.