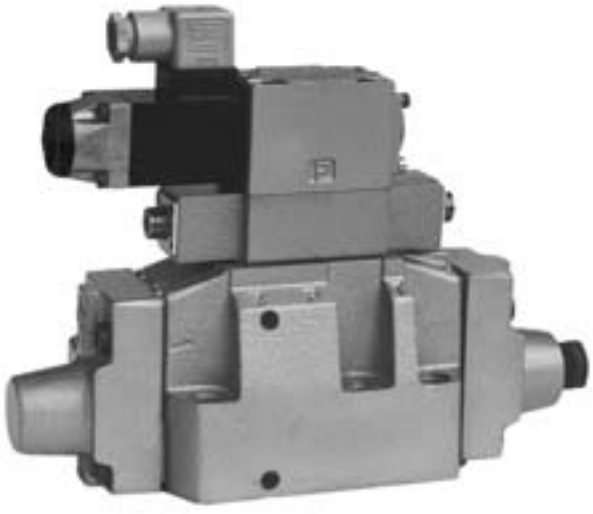
# Directional spool valve type WEH 16 electro-hydraulically operated

**WK 490 950**

| Size 32 | 28/35 MPa | 240 dm³/min |
|---|---|---|

04.2001r.

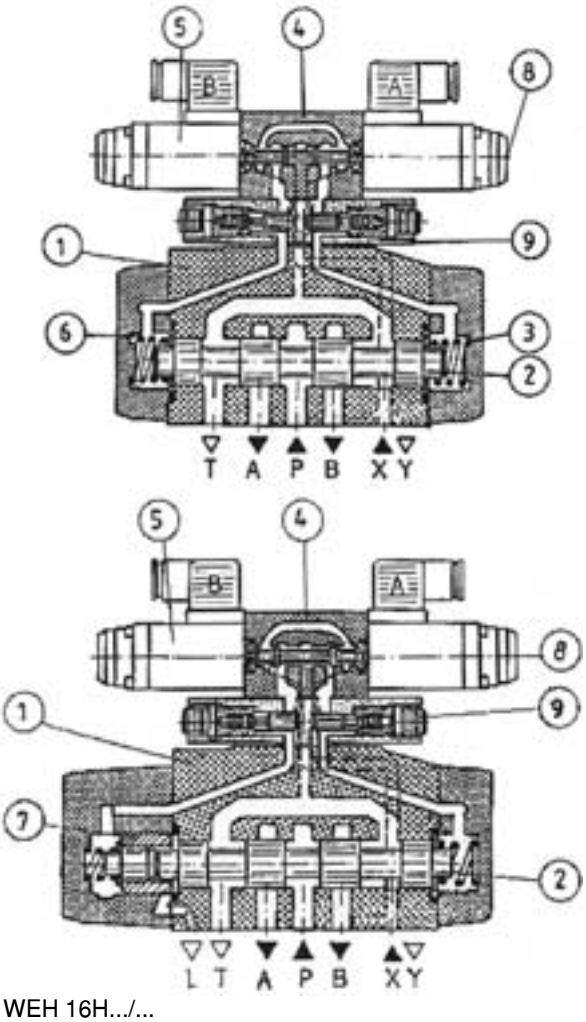
Directional control valves afford possibilities for controlling start, stop and direction of flow of a pressure fluid and thus accordingly start, stop and direction of movement of a user ( cylinder or hydraulic motor ).
The directional valves may be mounted in hydraulic systems in any desired position together with a subplate.
Sealing of mating faces is made by using O-rings which are included with the valve.



type 4 WEH 16.../...

## DESCRIPTION OF OPERATION

The directional valve is switched by changing position of the control spool 2 which moving along its axis separates or connects ports A, B, P or T in the housing 1.
Pressure supplied to one spring chamber 6 via the pilot valve 4 acts on the main spool surface and thus the main spool is shifted from its neutral position.
The main control spool is held in centre position by the spring 4 or hydraulically that is by fluid pressure affecting ( via the pilot valve ) the both spool surfaces.
Centering sleeve 7 serves centering function.
The pilot valve is electrically operated by the solenoids 5, which may be equipped with the emergency button 8. The optional emergency button allows the operation of the pilot valve without energisation subject to the pilot fluid pressure being at disposal.
The directional valve may be provided with the pilot choke adjustment 9.




type 4 WEH 16H.../...

## TECHNICAL DATA

| | |
|---|---|
| Hydraulic fluid | Mineral oil, phosphate ester |
| Required filtration | up to 16 μm |
| Recommended filtration | up to 10 μm |
| Nominal fluid viscosity | 37 $mm^2$ at temp. of 328 K |
| Viscosity range | 2.8 to 380 $mm^2/s$ |
| Optimum working temperature ( fluid in a tank ) | 313 - 328 K |
| Fluid temperature range | 243 - 343 K |
| Maximum operating pressure<br>- in ports A, B, P<br>- in port T<br>pilot fluid return Y = external<br>pilot fluid return Y = internal<br>( 3-position valve spring centered, 2-position valve)<br>internal pilot fluid return<br>( 3-position valve hydraulically centered ) | <br>35 MPa for H-4WEH16, 28 MPa for 4WEH 16<br>25 MPa<br><br><br>16 MPa<br><br>no |
| Minimum pilot pressure<br>pilot fluid supply X = external<br>pilot fluid supply X = internal<br>three-position directional valve<br>two-position directional valve spring centered<br>two-position directional valve hydraulically centered<br>pilot fluid supply X = internal<br>for spool types G, H, F, S, T ( via pre-load valve by suitable high flow rate ) | <br><br><br>pst = 0.8 MPa<br>pst = 1.0 MPa<br>pst = 0.5 MPa<br><br>pst = 0.45 MPa |
| Maximum pilot pressure | 25 MPa |
| Pilot fluid volume for valve operation<br>- three-position directional valve spring centered<br>- two-position directional valve<br>Three-position directional valve hydraulically centered<br>- from neutral to operated position '' a ''<br>- from operated position '' a '' to neutral<br>- from neutral to operated position '' b ''<br>- from operated position '' b '' to neutral | <br>5.75 $cm^3$<br>11.5 $cm^3$<br><br>2.85 $cm^3$<br>5.75 $cm^3$<br>2.9 $cm^3$<br>2.3 $cm^3$ |
| Total operating time of valve from neutral position to operated position at pilot pressure 5 MPa, 15 MPa, 25 MPa<br>three-position valve spring centered<br><br>two-position valve<br><br><br>three-position valve hydraulically centered :<br>solenoid ,,a'' operation<br><br>solenoid ,,b'' operation | <br>30 ms for pst = 5 MPa<br>25 ms for pst = 15 MPa<br>20 ms for pst = 25 MPa<br>35 ms for pst = 5 MPa<br>30 ms for pst = 15 MPa<br>25 ms for pst = 25 MPa<br>20 ms for pst = 5 MPa<br>20 ms for pst = 15 MPa<br>20 ms for pst = 25 MPa<br>30 ms for pst = 5 MPa<br>25 ms for pst = 15 MPa<br>20 ms for pst = 25 MPa |
| Total operating time from neutral to operated position increases for DC supply by | 20 ms |
| Total operating time from operated to neutral position at pilot pressure 5MPa, 15 MPa, 25 MPa<br>three-position valve spring centered<br>two-position valve<br><br><br>three-position valve hydraulically centered<br>solenoid ,,a'' operation<br><br>solenoid ,,b'' operation | <br>40 ms<br>35 ms for pst = 5 MPa<br>30 ms for pst = 15 MPa<br>25 ms for pst = 25 MPa<br>30 ms for pst = 5 MPa<br>25 ms for pst = 15 MPa<br>20 ms for pst = 25 MPa<br>40 ms for pst = 5 MPa<br>35 ms for pst = 15 MPa<br>25 ms for pst = 25 MPa |

Direct solenoid operated valve WE 6 ( size 6 ) is used as a pilot valve. The control spool is held in neutral position by springs and in operated position by solenoid or detent. The spool is shifted by means of DC or AC solenoids.

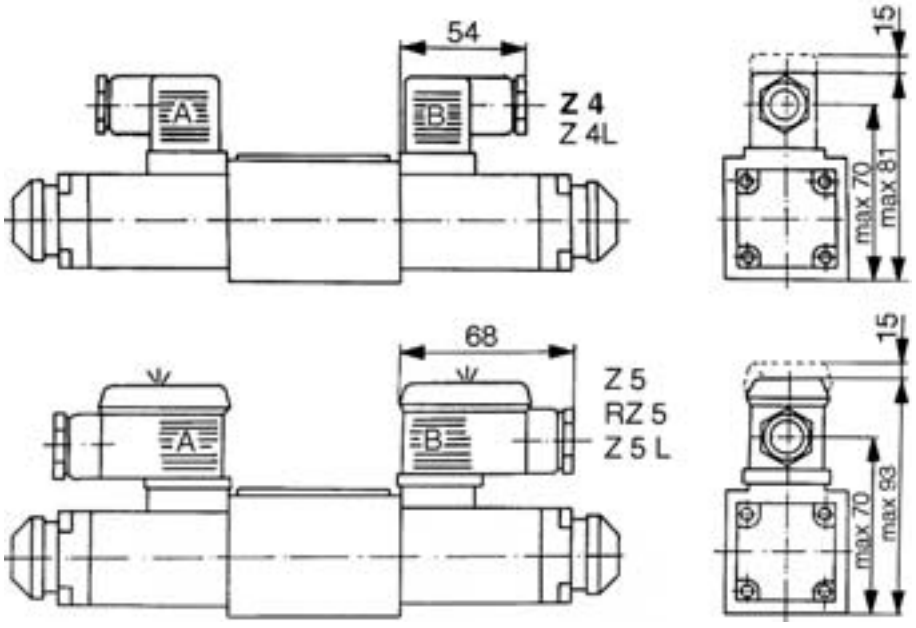
Version A
- power input 26 W for AC
- holding current 46 VA for DC
- in-rush current 130 VA for DC
- duty rating 100 % ED

Version C
- power input 30 W for AC
- holding current 59 VA for DC
- in-rush current 200 VA for DC
- duty rating 100 % ED

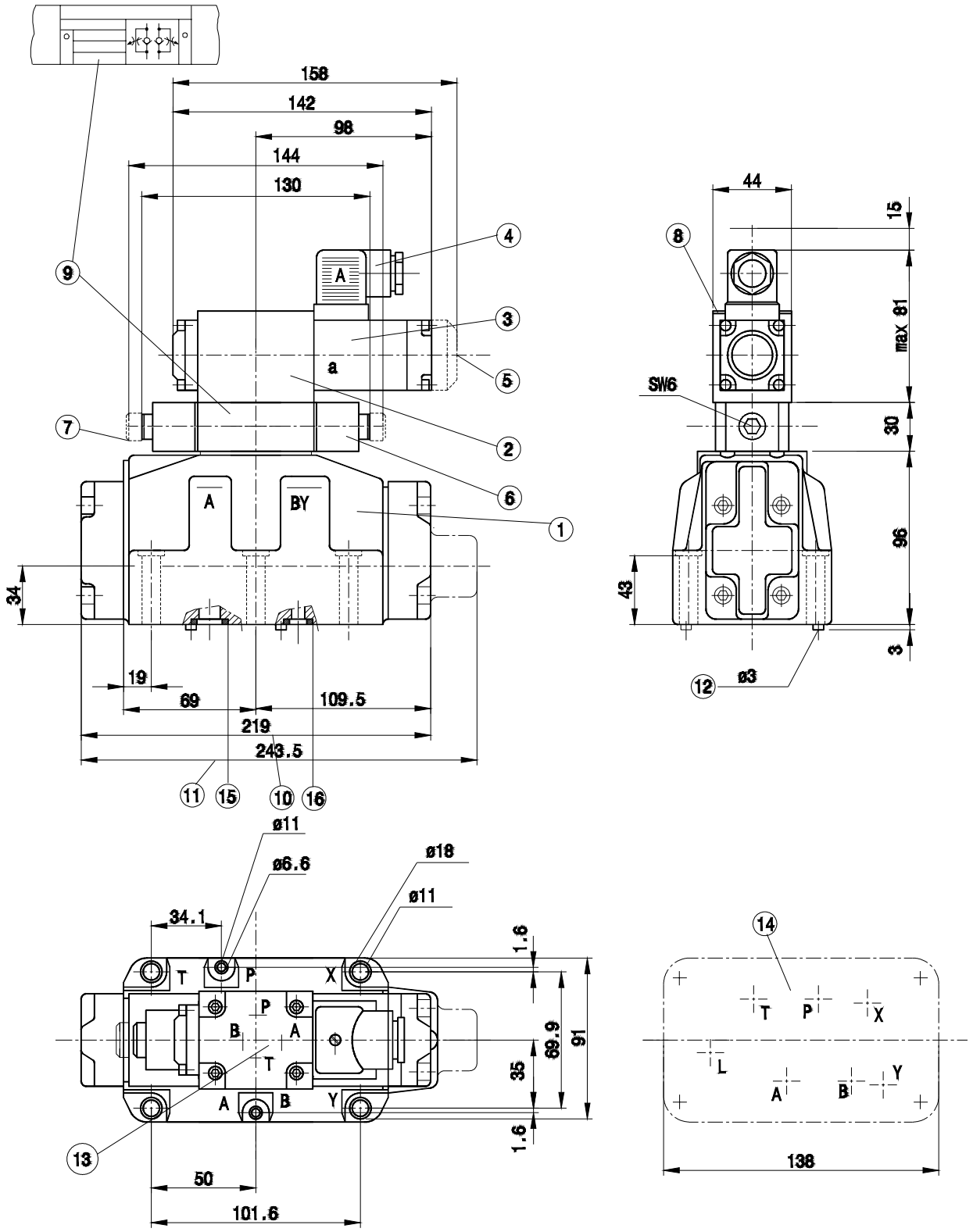
For the particular types of a main directional valve the following spool types of a pilot valve are designed :

- scheme J for three-position directional valve spring centered
- nominal voltage 24 V, 110 V for DC
  220 V - 50 HZ, 110 V - 50 HZ for AC
- insulation to 40050 DIN : IP 65
- central connections :
  with 1 solenoid - solenoid to terminal 1 and 2, earth conductor to terminal 5
  with 2 solenoids - solenoid ,,a'' to terminals 1 and 2, solenoid ,,b'' to terminals 3 and 4, earth conductor to terminal 5
- scheme D/O or D/OF for two-position directional valve
- scheme M for three-position directional valve hydraulically centered

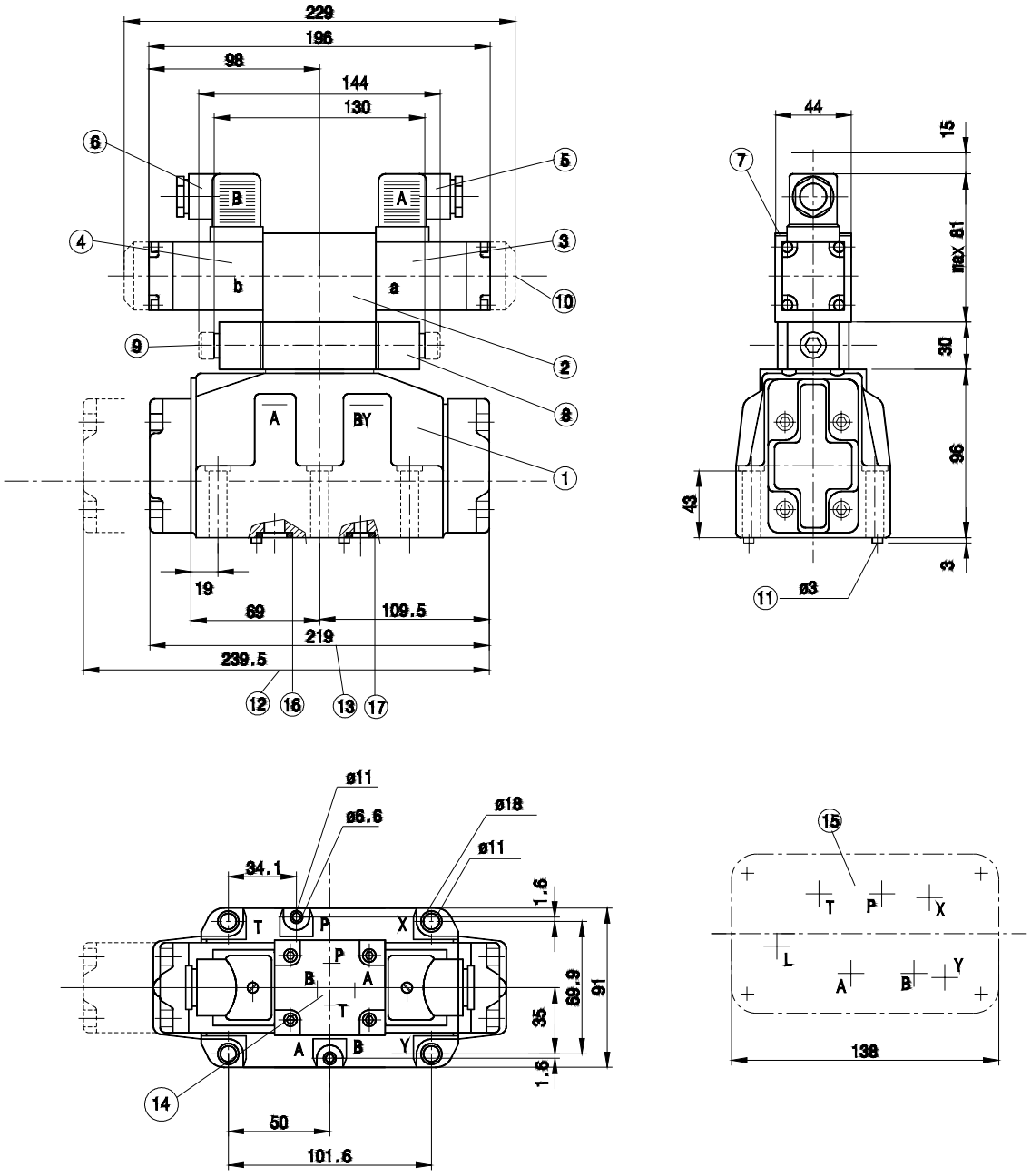
## Electrical connection



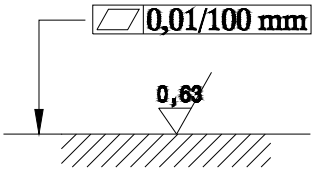
## OVERALL DIMENSIONS




item 1 - main directional valve
item 2 - two-position directional valve ( pilot ) with 1 solenoid and angled plug Z4
item 3 - solenoid ,,a''
item 4 - grey plug
item 5 - emergancy buttom
item 6 - pilot choke adjustment
item 7 - pilot choke adjustment open
item 8 - nameplate
item 9 - adjustment on supply - assembly position for pilot choke adjustment
item 10 - dimension for two-position directional valve hydraulically centered
item 11 - dimension for two-position directional valve spring centered
item 12 - 2 locating pins ∅ 3
item 13 - porting pattern for pilot valve
item 14 - porting pattern for main valve
item 15 - o-ring 22.3 × 2.4 - 4 pieces ( A, B, P, T )
item 16 - o-ring 10 × 2 - 3 pieces ( L, X, Y )




item 1 - main directional valve
item 2 - three-position directional valve ( pilot ) with 1 solenoid and angled plug Z4
item 3 - solenoid ,,a''
item 4 - solenoid ,,b''
item 5 - grey plug
item 6 - black plug
item 7 - nameplate
item 8 - pilot choke adjustment
item 9 - pilot choke adjustment open
item 10 - emergancy button
item 11 - 2 locating pins ∅ 3
item 12 - dimension for three-position directional valve hydraulically centered
item 13 - dimension for two-position directional valve spring centered
item 14 - porting pattern for pilot valve
item 15 - porting pattern for main valve
item 16 - o-ring 22.3 × 2.4 - 4 pieces ( A, B, P, T )
item 17 - o-ring 10 × 2 - 3 pieces ( L, X, Y )

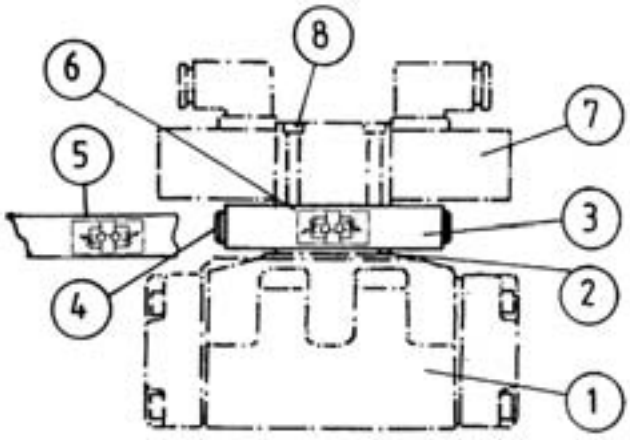



Admissible surface roughness and flatness deviation for a subplate face

### Installation method for pilot choke adjustment

Rotation of the adjusting screw SW 6 to the right increases and to the left decreases switching time of the main valve. The pilot choke adjustment is fixed by means of 4 bolts M5 × 80 - 10.9 ( DIN 912 ) with tightening torque 5 Nm. The change of adjustment on inlet for adjustment on outlet is by rotating the pilot choke adjustment round its longitudinal axis.

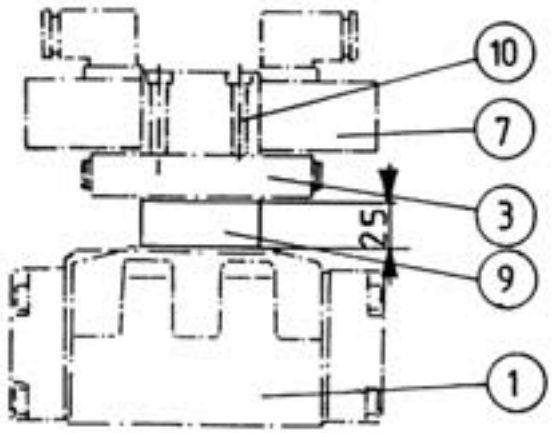
item 1 - main valve
item 2 - intermediate plate with sockets for o-rings.
item 3 - pilot choke adjustment
adjustment on inlet - scheme 5
adjustment on outlet - scheme 6
item 7 - pilot valve
item 8 - fixing screws




### Installation method for pressure ratio valve

When pilot pressure exceeds 25 MPa, the pressure ratio valve must be used. It causes reducing the pilot pressure in the ratio 1 : 0.66 to the main pressure. In this case the main pilot pressure must be increased by the factor 1 : 0.66 = 1.515. The pressure ratio valve is mounted by means of 4 bolts M5 × 100 - 10.9 ( DIN 912 ) with tightening torque 5 Nm

item 1 - main directional valve
item 3 - pilot choke adjustment
item 7 - pilot valve
item 9 - pressure ratio valve
item 10 - fixing screws

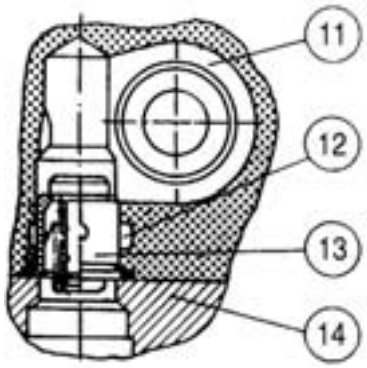



### Installation method for pre-load valve

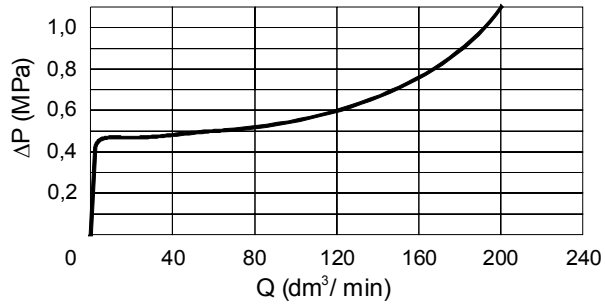
In valves with a low pressure bypass and internal pilot fluid feed the pre-load valve must be fixed in port P to obtain minimum pilot pressure.
When using the pressure ratio valve D1 the valve P7 should be installed.

Cracking pressure - from 0.45 MPa to 0.7 MPa

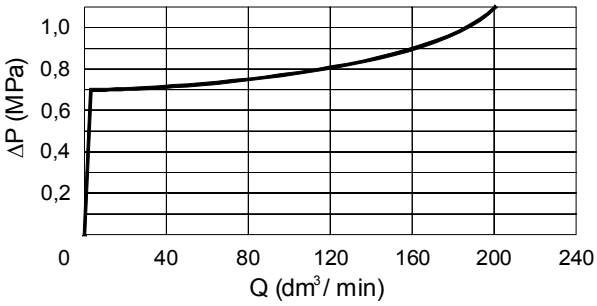
item 11 - port P
item 12 - pilot fluid inlet ( port X )
item 13 - valve
item 14 - connection plate




**Operating curve for valve P 4.5** measured
at $\nu$ = 41 mm²/s and T = 323 K

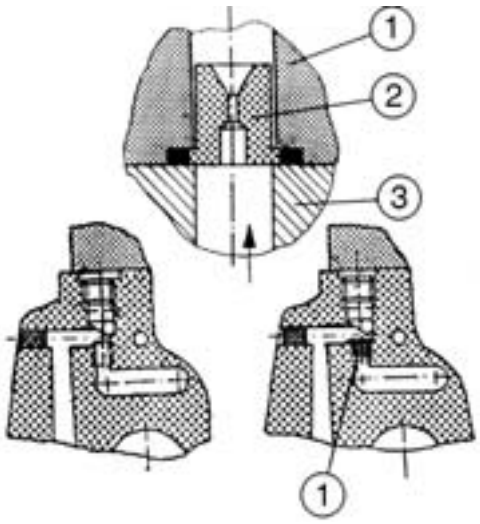



**Operating curve for valve P 7** measured
at $\nu$ = 41 mm²/s and T = 323 K



**Mounting method for throttle insert**

item 1 - pilot valve
item 2 - throttle insert
item 3 - main valve



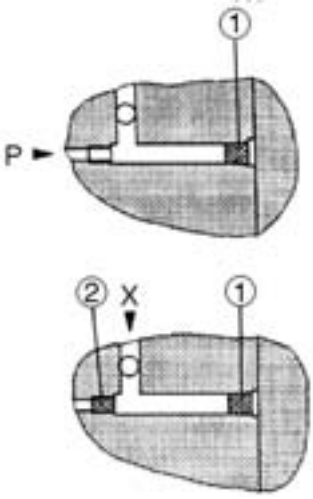

**The method of changing pilot fluid return change „internal'' - „external''**

„a'' - pilot fluid return internally ( non applicable to hydraulically centered valves )
In this case remove screw 1 and plug port 4 in a main valve.
„b'' - pilot fluid return externally
- item 1 - screw plug M6 per ZN-09.010 (DIN 906-8.8) SW 3

**The method of changing pilot fluid return change „external'' - „internal''**

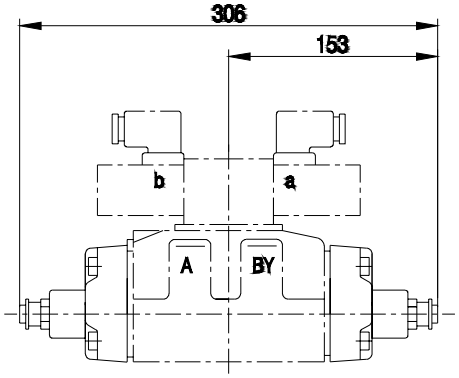
„a'' - pilot fluid feed internally
In this case plug port X in the housing.

„b'' - pilot fluid feed externally
To change, remove the cover of the main valve from port B site, rotate the pin and refit the cover.

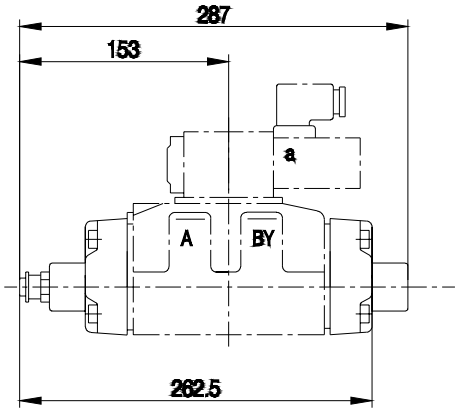



## OVERALL DIMENSIONS FOR DIRECTIONAL VALVE WITH ACCESSORIES

Optional accessories

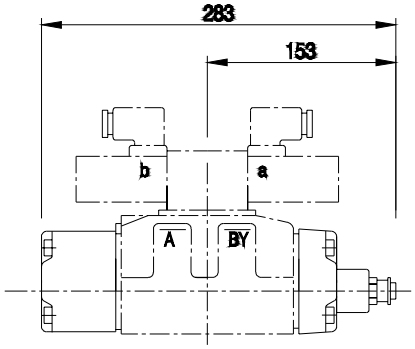



- 2-position valve hydraulically centered and 3-position valve spring centered, optional accessories 10, 11, 12

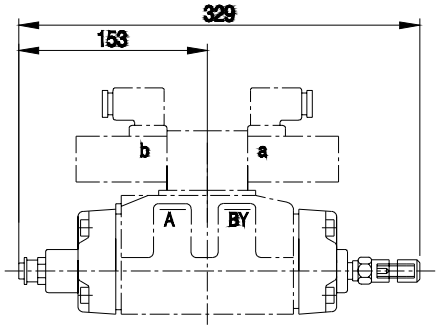



- 2-position valve ( spool schemes C - D - K - Z ), optional accessory 11

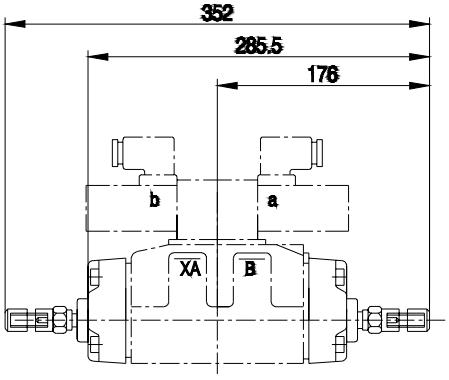
- 3-position valve, hydraulically centered, optional accessory 12



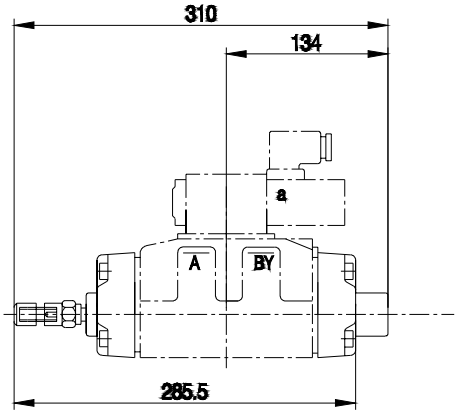

- 2-position valve, hydraulically centered and 3-position valve spring centered, optional accessory 16



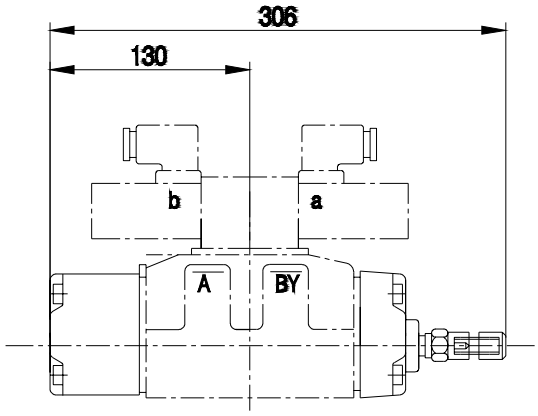

- 2-position valve, hydraulically centered and 3-position valve spring centered, optional accessories 13, 14, 15



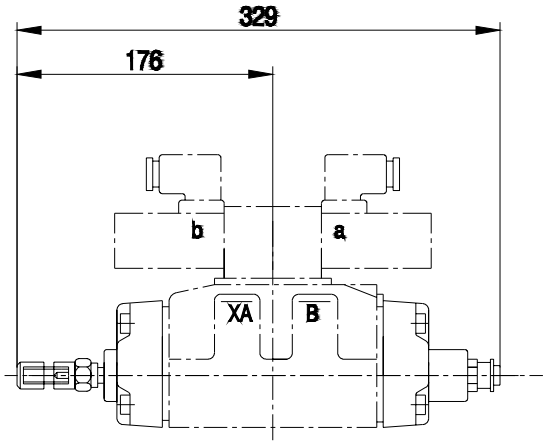

- 2-position valve ( spool schemes C - D- K - Z ), optional accessory 14



- 3-position valve, hydrauliacally centered, optional accessory 15

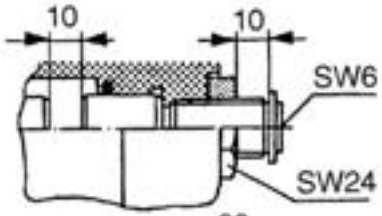



- 2-position valve, hydraulically centered and 3-position valve
spring centered, optional accessory 17



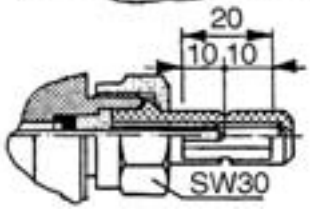

## Main spool stroke adjustment

Adjustment of a stroke of the main spool is by loosining the locknut SW 24 and rotating the pin SW 6. Rotating to the right reduces the stroke of the spool ( 1 turn = 1.5 mm ).
While adjusting the stroke the control chamber must be at 0 pressure.




## End position monitor

By loosing the clamp nut SW 30, the sleeve with viewing window may be rotated through 360° and set up in any position.
While loosing the nut, the control chamber must be at 0 pressure.

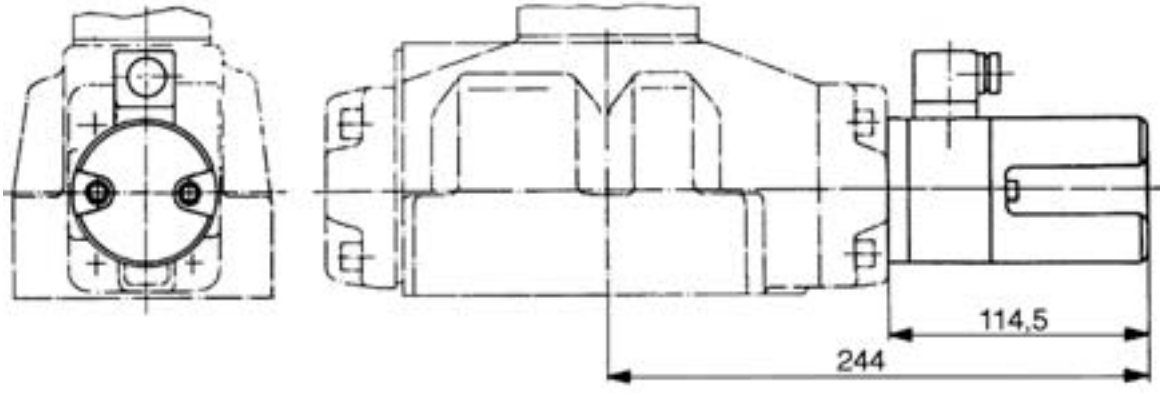



## Limit switch

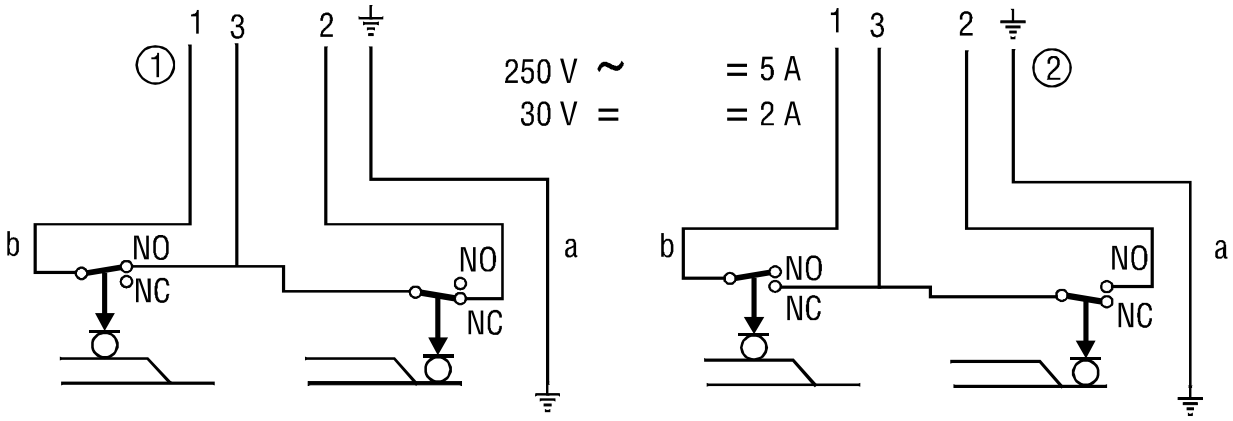
Installation of limit switch, optional ( accessory )

- 2-position valve and 3-position valve, spring centered, optional limit switcg 18, 22
- 2-position valve, hydraulically centered and 3-position valve,
optional limit switch 19, 23

- 2-position valve, hydraulically centered and 3-position valve,
spring centered, optional limit switch 20, 21, 24, 25

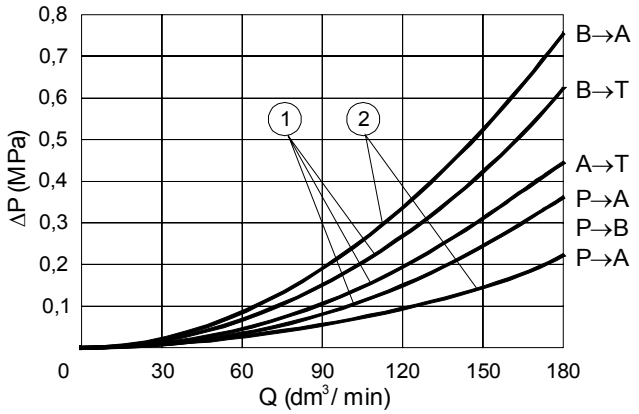


Electrical scheme for limit switch

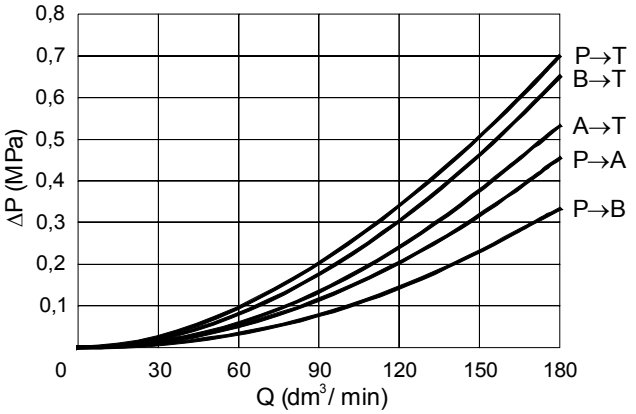



item 1 - scheme for limit switch, normally closed
item 2 - scheme for limit switch, normally open

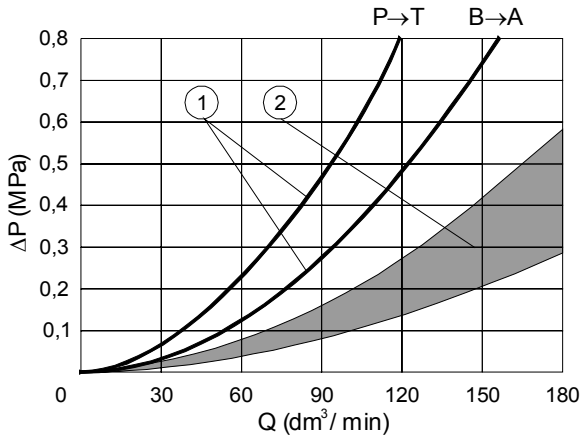
## PERFORMANCE CURVES measured at $\nu$ = 41 mm²/s and T = 323 K




Spool types E, R
1 - Spool types E, R
2 - Spool type R ( P to A and B to A )




Spool types G, T



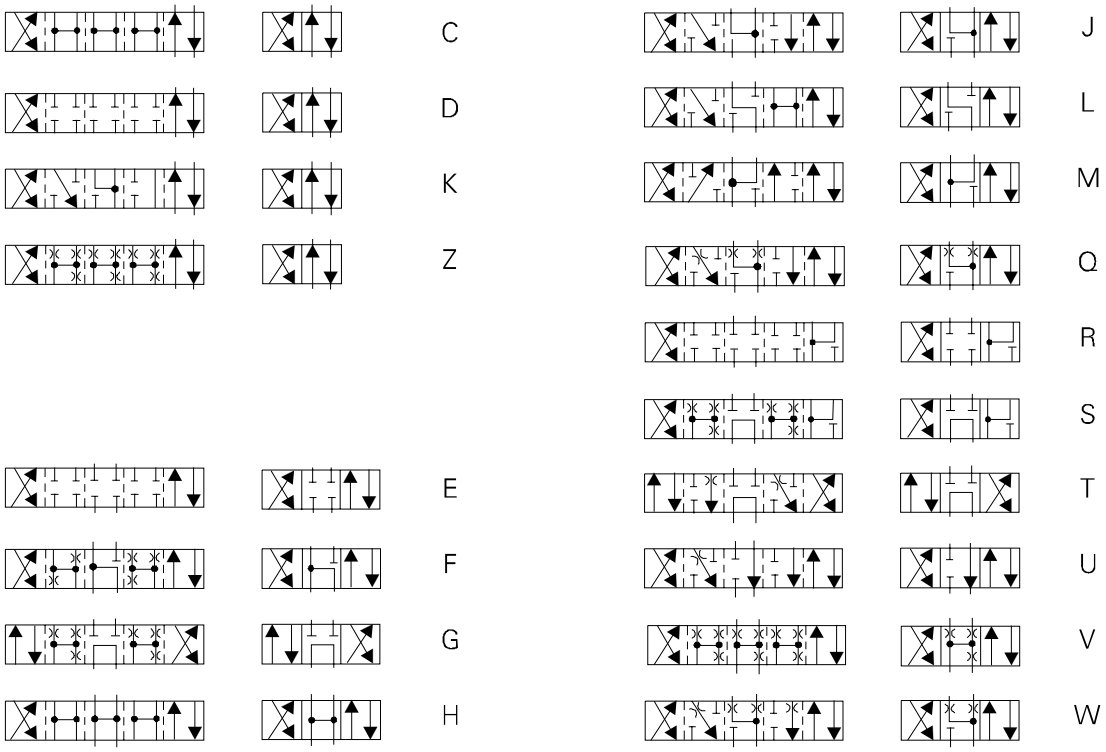

Spool type S and others
1 - Spool type S
2 - Other spool types

| 2 and 3-position valves, spring centered | | | | | |
|---|---|---|---|---|---|
| Spool types | Pressure ( MPa ) | | | | |
| | 7 | 14 | 21 | 28 | 35 |
| E, J, L, M, Q, R, U, V, W, C, D, K, Z | 240 | 240 | 205 | 180 | 170 |
| F | 200 | 145 | 115 | 100 | 90 |
| G, H, S, T | 220 | 160 | 130 | 110 | 100 |

Note:
The flow limits referto typical application of 4-way directional control valve i.e. with using two lines e.g. P to A and B to T at the same time. In case of using 4-way directional control valve with one flow line e.g. P to A ( B plugged ) or A to T ( B plugged ) actual flow limits are considetably lower.

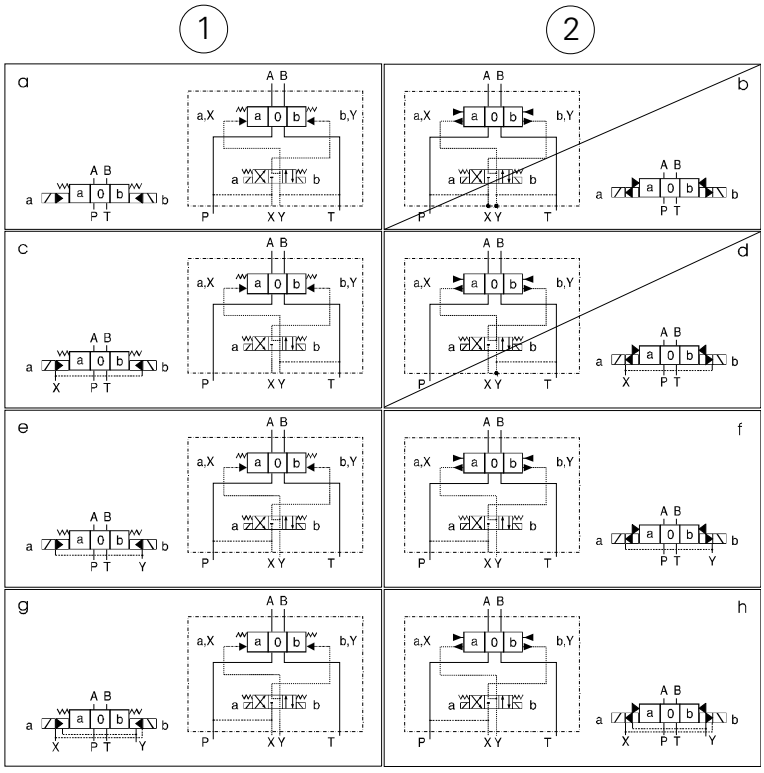
# SCHEMES

## Spool schemes




Flow section in position ,,0'' for spool type W - 3%, Q, V - 16%

Detailed and simplified schemes for directional valves




Schemes for 3-position valves

1. Valves spring centered

2. Valves hydraulically centered

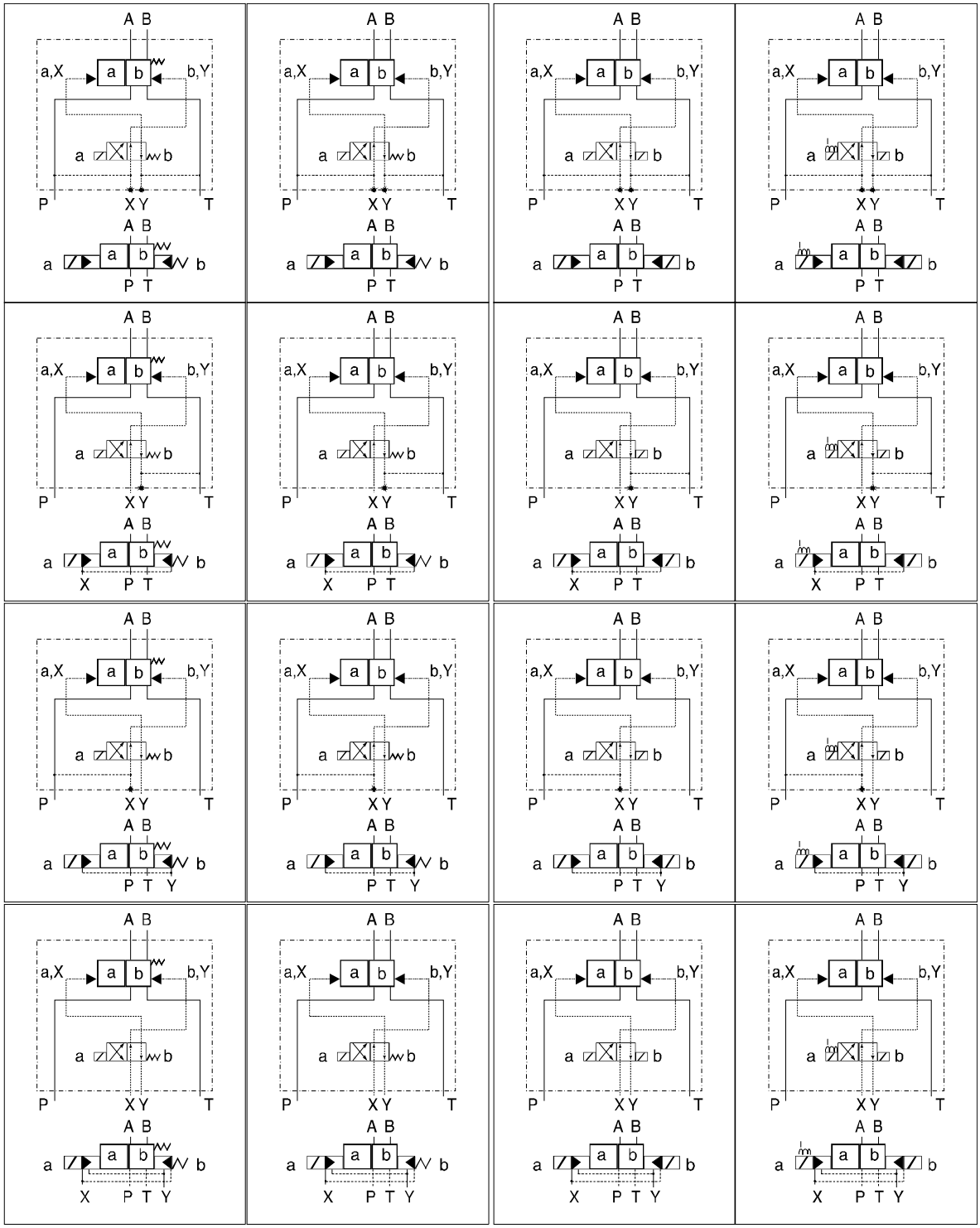
a, b - X = internal feed Y = internal return
c, d - X = external feed Y = internal return
e, f - X = internal feed Y = external return
g, h - X = external feed Y = external return
b, d - impossible

1

2

3

4




Schemes for 2-position valve

1.

X = internal feed Y = internal return

Type : ... 4WEH ..../.... ET
Type : ... 4WEH ....H/.... ET
Type : ... 4WEH ....H./.O.. ET
Type : ... 4WEH ....H./.OF.. ET

2.

X = external feed Y = internal return

Type : ... 4WEH ..../.... T
Type : ... 4WEH ....H../...T
Type : ... 4WEH ....H./.O...T
Type : ... 4WEH ....H./..OF...T

3.

X = internal feed Y = external return

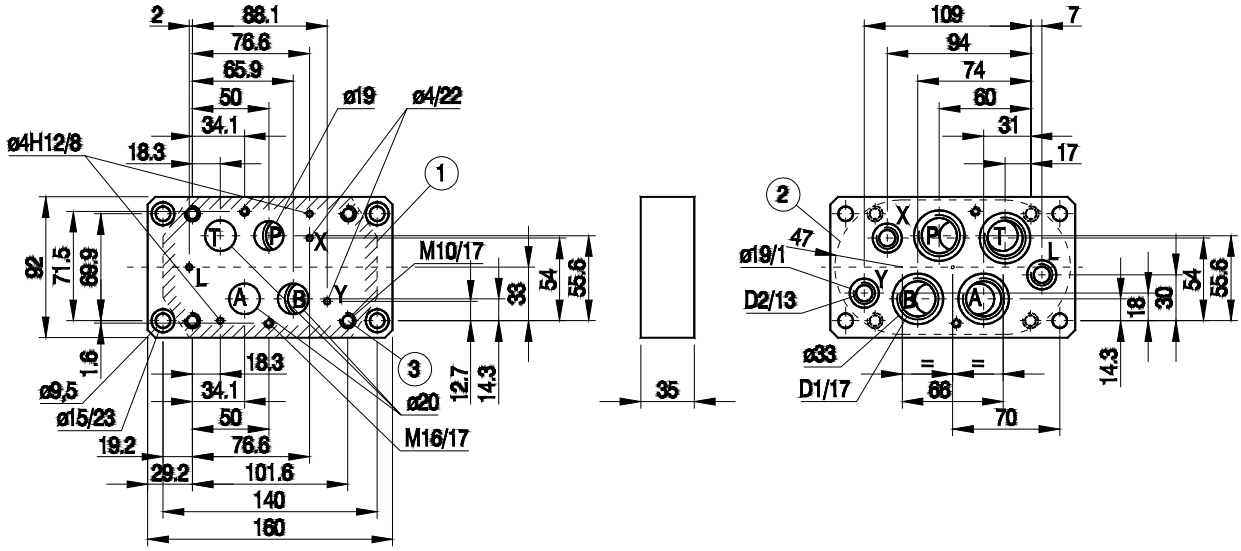
Type : ... 4WEH ..../.... E
Type : ... 4WEH ...H./... E
Type : ... 4WEH ...H./..O... E
Type : ... 4WEH ...H/.. OF... E

4.

X = external feed Y = external return

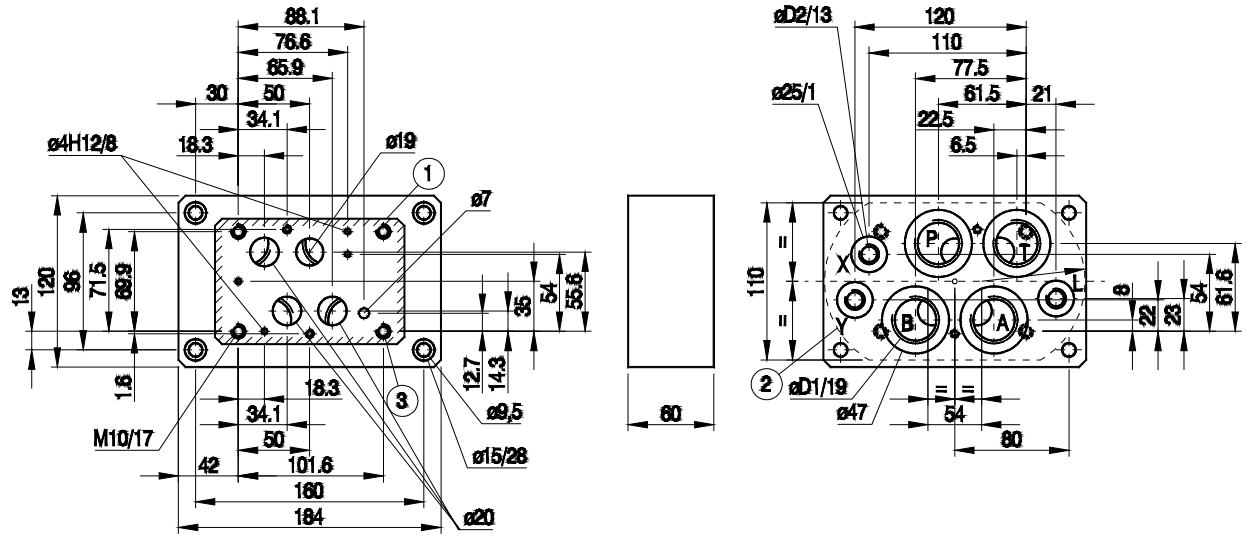
Type : ... 4WEH ..../....
Type : ... 4WEH ....H../....
Type : ... 4WEH ....H./..O...
Type : ... 4WEH ..../... OF ...

## MOUNTING DIMENSIONS FOR SUBPLATE




Weight approx. 2.8 kg

| Subplate type | D1 | D2 |
|---|---|---|
| G 172/01 | G3/4 | G1/4 |
| G 172/02 | M27 x 2 | M14 x 1.5 |




| Subplate type | D1 | D2 |
|---|---|---|
| G 174/01 | G1 | G1/4 |
| G 174/02 | M33 x 2 | M14 x 1.5 |

Weight approx. 5.5 kg

## HOW TO ORDER

Orders coded in the way showed below should be forwarded to the manufacturer.


**Version**
High pressure up to 35 MPa = H
Normal pressure up to 28 MPa = no code

**Spool positioning**
Spring centering = with no designation
Hydraulic off-set = H

**Control spool type**
See spool schemes on page 13

**Series number**
52 = 52
( 50 - 59 ) - installation and connection dimensions unchanged

**Spool positioning ( applicable to 2-position spools hydraulically centered HC, HD, HK, HZ only )**
Without return spring = O
Without return spring with detent ( detent in pilot valve only ) = OF
Spring return = with no code

**Pilot valve type**
Directional spool valve size 6 with wet solenoids ∅ 35 or ⍁ 35 = 6A
* Directional spool valve size 6 with wet solenoids ∅ 44 or ⍁ 44 = 6C

**Power supply ( for pilot valve )**
DC 24 V = G 24
DC 110 V = G 110
AC 110 V, 50 Hz = W 110-50
AC 220 V, 50 Hz = W 220-50

**Emergency operation for solenoids**
Without emergency button = with no code
With emergency button = N

**Pilot fluid feed**
External pilot fluid feed, external pilot fluid return = with no code
Internal pilot fluid feed, external pilot fluid return = E
Internal pilot fluid feed, internal pilot fluid return = ET
External pilot fluid feed, internal pilot fluid return = T

**Pilot choke adjustment**
Without pilot choke adjustment = no designation
Adjustment, meter-in = S
Adjustment, meter-out = S2

* Recommended for use when pilot pressure exceeds 20 MPa

| * | | | | | | * |
|---|---|---|---|---|---|---|

Additional requirements in clear text ( to be agreed with the manufacturer )

**Sealing**

| | |
|---|---|
| For fluids on mineral oil base | = with no designation |
| For fluids on phosphate ester base | = V |

**Pressure ratio valve**

| | |
|---|---|
| Without pressure ratio valve | = with no designation |
| With pressure ratio valve | = D1 |

**Pre - load valve**

| | |
|---|---|
| Without pre - load valve | = with no designation |
| Pre - load valve with cracking pressure 0.45 MPa | = P 4.5 |
| Pre - load valve with cracking pressure | = P 7 |

**Throttle insert**

| | |
|---|---|
| Without throttle insert | = with no designation |
| Throttle insert ∅ 0.8 mm | = B 08 |
| Throttle insert ∅ 1.0 mm | = B10 |
| Throttle insert ∅ 1.2 mm | = B12 |

**Accessories**

| | |
|---|---|
| Without accessories | = with no designation |
| Stroke limiter on valve ends A and B | = 10 |
| Stroke limiter on valve end A | = 11 |
| Stroke limiter on valve end B | = 12 |
| End position monitor on valve ends A and B | = 13 |
| End position monitor on valve end A | = 14 |
| End position monitor on valve end B | = 15 |
| Stroke limiter on valve end A and end position monitor | = 16 |
| Stroke limiter on valve end B and end position monitor on valve end A | = 17 |
| Limit switch on end A normally closed | = 18 |
| Limit switch on end B normally closed | = 19 |
| Stroke limiter on valve end A, limit switch on valve end B normally closed | = 20 |
| Stroke limiter on valve end B, limit switch on valve end A normally closed | = 21 |
| Limit switch on valve end A normally open | = 22 |
| Limit switch on valve end B normally open | = 23 |
| Stroke limiter on valve end A, limit switch on valve end B normally open | = 24 |
| Stroke limiter on valve end B, limit switch on valve end A normally open | = 25 |

**Electrical connections**

see schemes on page 3

Coding example : 4WEH 16 E 52/ 6 AG 24 NET Z4

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