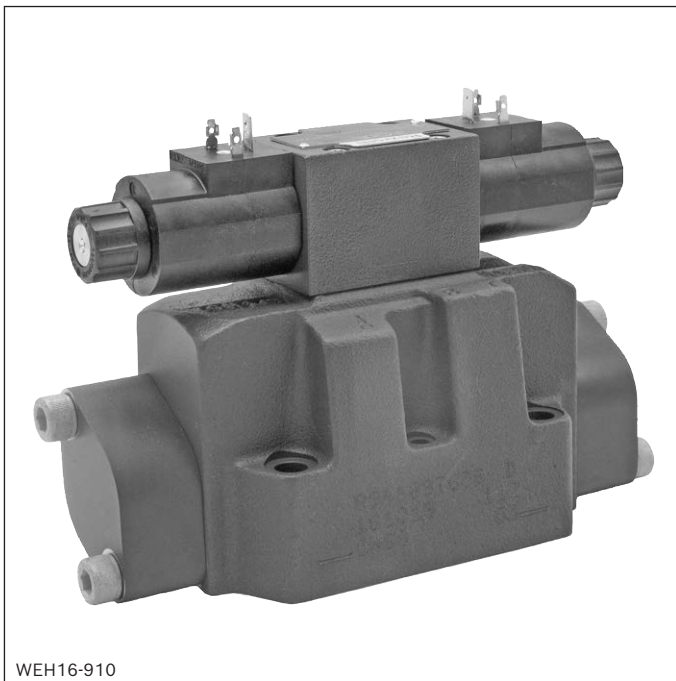


Directional spool valves, pilot-operated, with electro-hydraulic actuation

WEH 16 ... -910



- ▶ Size 16
- ▶ Component series 7X
- ▶ Maximum operating pressure 280 bar [4061 psi]
- ▶ Maximum flow 400 l/min [106 US gpm]

Features

- ▶ 4/3-, 4/2-way version
- ▶ Types of actuation (internal or external pilot control):
 - Electro-hydraulic (type WEH)
- ▶ For subplate mounting
- ▶ Porting pattern according to 4401-07-07-0-05 and NFPAT3.5.1 R2-D07
- ▶ Spring centering, spring end position
- ▶ Wet-pin DC solenoids
- ▶ Electrical connection as individual
- ▶ Manual override
- ▶ Switching time adjustment

Contents

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Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
4	WEH	16			7X	/		6H	G24	N9			K4		/	-910

01	4-way version	4
----	---------------	---

Types of actuation

02	Electro-hydraulic	WEH
----	-------------------	-----

Size

03	NG16	16
----	------	----

Spool return in the main valve

04	By means of springs	no code
----	---------------------	---------

05	For symbols, see page 4 and 5	
----	-------------------------------	--

06	Component series 70 ... 79 (70 ... 79: unchanged installation and connection dimension) – NG16 (from series 72)	7X
----	---	----

Control spool return in the pilot control valve with 2 spool positions and 2 solenoids
(only possible with symbols C, D, K, Z and hydraulic control spool return in the main valve)

07	With spring return	no code
	Only with spool “D” in the main valve	OF

Pilot control valve

08	Pilot valve (data sheet 23164)	6H
----	--------------------------------	----

09	Direct voltage 24 V	G24
----	---------------------	-----

10	With concealed manual override	N9
----	---------------------------------------	----

Pilot oil flow

11	External pilot oil supply, external pilot oil return ¹⁾	no code
	Internal pilot oil supply, external pilot oil return ^{1; 2)}	E
	Internal pilot oil supply, internal pilot oil return ²⁾	ET
	External pilot oil supply, internal pilot oil return ¹⁾	T

Switching time adjustment

12	Without switching time adjustment	no code
	Switching time adjustment as supply control	S
	Switching time adjustment as discharge control	S2

Corrosion resistance (outside)

13	None (valve housing primed)	no code
----	-----------------------------	---------

Electrical connection

14	Individual connection	
	Without mating connector; connector DIN EN 175301-803	K4 ³⁾

Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
4	WEH	16			7X	/		6H	G24	N9			K4		/	-910

Throttle insert

15	Without throttle insert (possible only for external pilot oil supply)	no code
	Throttle Ø1.0 mm [0.0394 inch]	B10

Seal material

16	NBR seals	no code
	Observe compatibility of seals with hydraulic fluid used. (other seals on request)	
17	Up to 280 bar [4061 psi]	-910

¹⁾ Pilot oil supply X or return Y **external**:

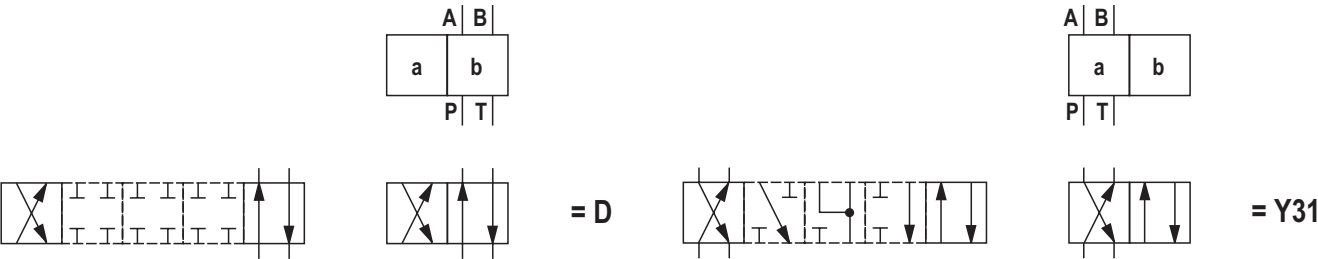
- ▶ The maximum admissible operating parameters of the pilot control valve must be observed (see data sheet 23164).
- ▶ Minimum pilot pressure: please observe page 10.
- ▶ Maximum pilot pressure: please observe page 10.

²⁾ Pilot oil supply **internal** (version "ET" and "E"):

- With this selection the maximum operating pressure reduces to maximum pilot pressure.
- ▶ Minimum pilot pressure: please observe page 10.
 - ▶ Maximum pilot pressure: please observe page 10.
 - ▶ In order to prevent inadmissibly high pressure peaks, a **"B10" throttle insert** has to be provided in port P of the pilot control valve (see page 9).

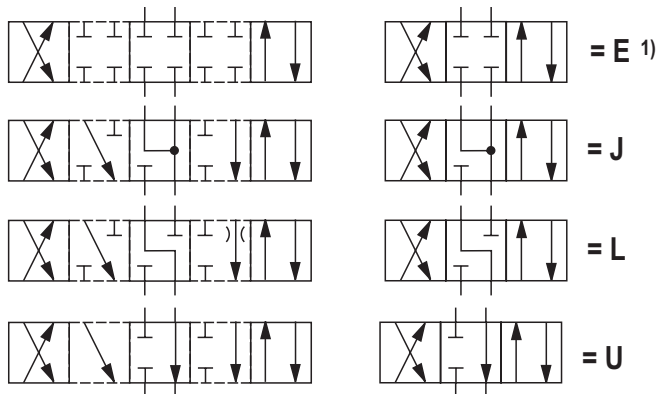
³⁾ Mating connectors, separate order, see data sheet 23164

Symbols: 2 spool positions



Ordering code		Type of actuation
Symbol	Spool return	Type WEH (electro-hydraulic)
D	../..	
	..H../OF	
Y31	../..	

Symbols: 3 spool positions



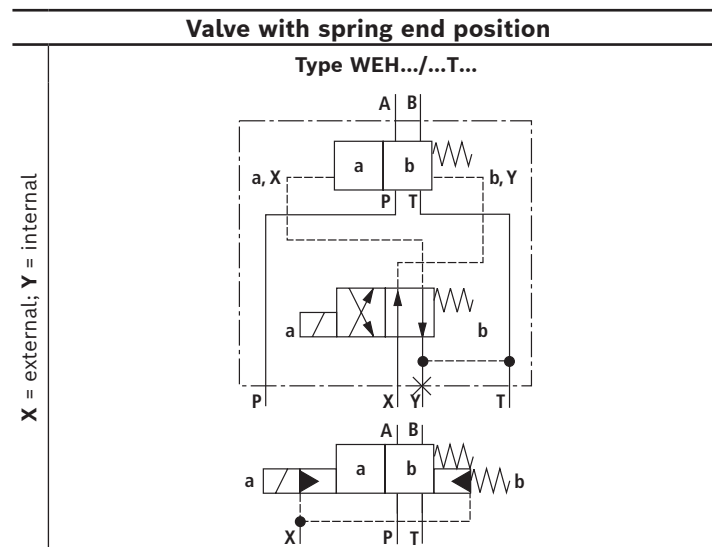
1) **Example:**
Symbol E with actuating side "a" → ordering code ..EA..

Symbol	Ordering code		Type of actuation
	Actuating side	Spool return	Type WEH (electro-hydraulic)
E, U, L, J		../..	
	.A		
	.B		

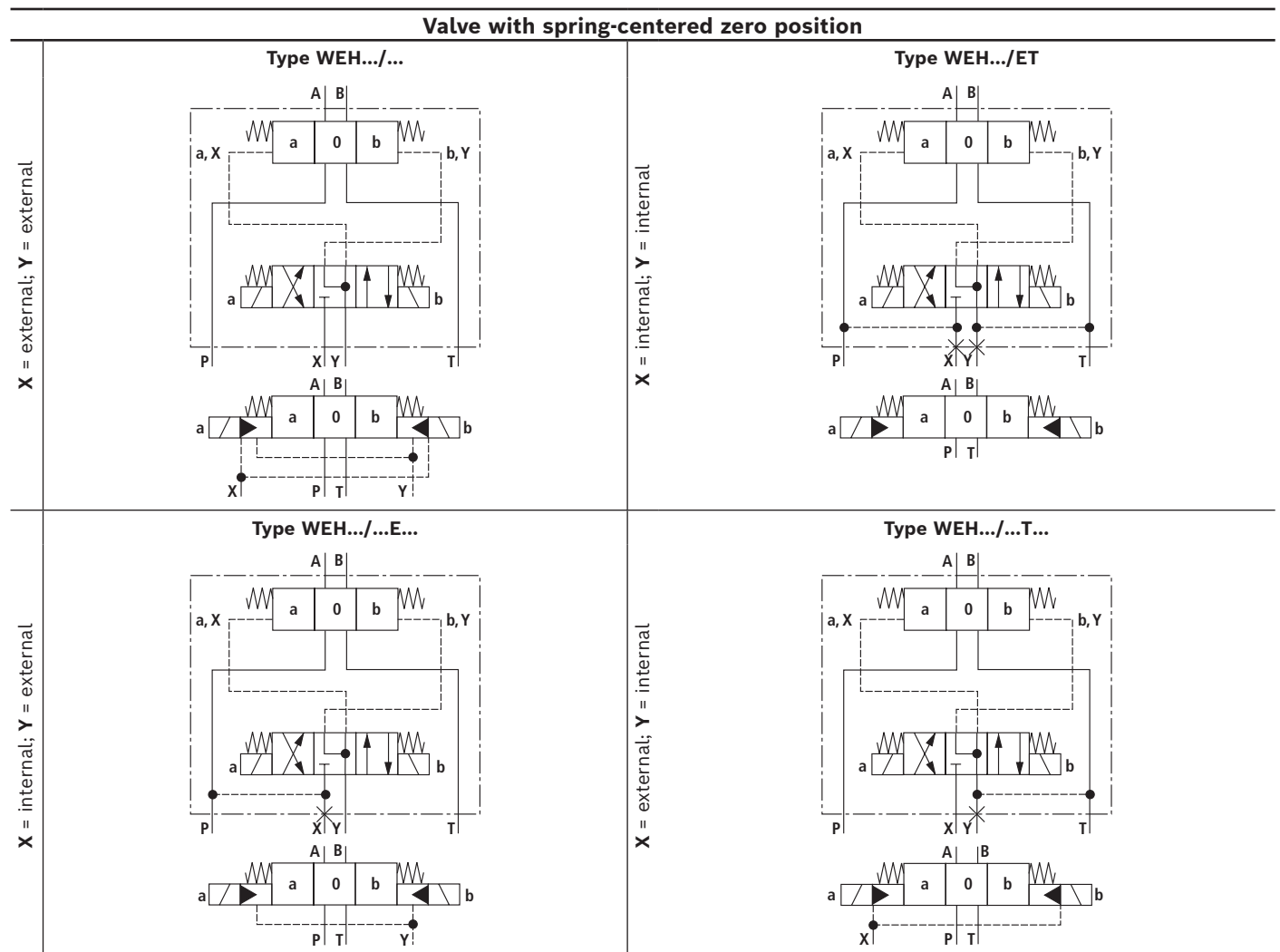
Symbols for valves with 2 spool positions

	Valve with spring end position	Valve with hydraulic end position
X = external; Y = external	<p>Type WEH.../..</p>	<p>Type WEH . H../OF...</p>
X = internal; Y = external	<p>Type WEH.../...E...</p>	<p>Type WEH . H../OF...E...</p>
X = internal; Y = internal	<p>Type WEH.../...ET...</p>	<p>Type WEH . H../OF...ET...</p>

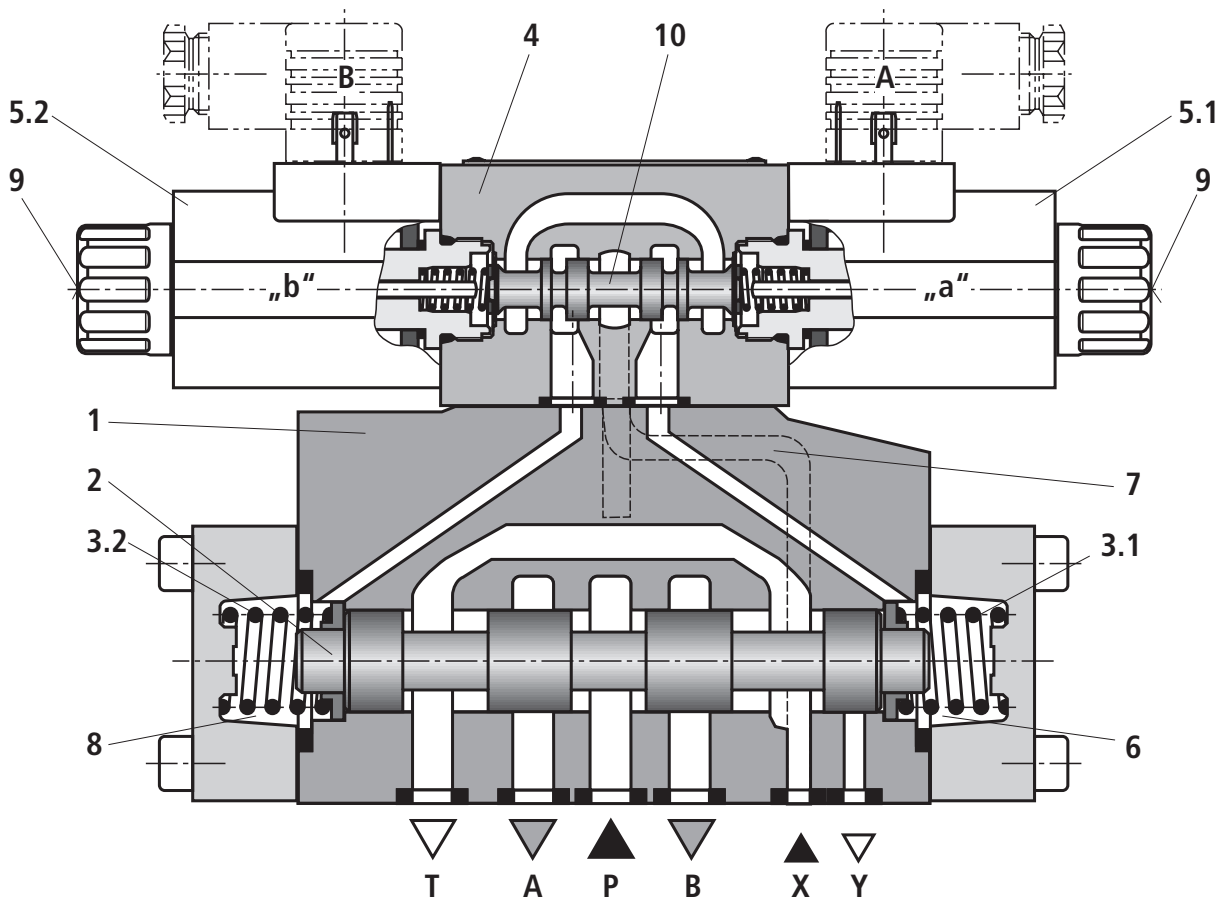
Symbols for valves with 2 spool positions



Symbols for valves with 3 spool positions



Function, section



The valve type WEH is a directional spool valve with electro-hydraulic actuation. It controls the start, stop and direction of a flow.

The directional valve basically consists of the main valve with housing (1), the main control spool (2), one or two return springs (3.1) and (3.2), as well as the pilot control valve (4) with one or two solenoids "a" (5.1) and/or "b" (5.2).

The main control spool (2) in the main valve is held in the zero or initial position by the springs or by means of pressurization. In the initial position, the two spring chambers (6) and (8) are connected with the tank in a depressurized form via the pilot control valve (4). Via the control line (7), the pilot control valve is supplied with pilot oil. Supply can be implemented internally or externally (externally via port X). Upon actuation of the pilot control valve, e.g. solenoid "a", the pilot control spool (10) is moved to the left and thus, the spring chamber (8) is pressurized with pilot pressure. The spring chamber (6) remains depressurized.

The pilot pressure acts on the left side of the main control spool (2) and moves it against the spring (3.1). This connects port P with B and A with T in the main valve.

On switching off of solenoid, the pilot control spool (10) returns to its initial position (except impulse spool). The spring chamber (8) is unloaded to the tank.

The pilot oil return is implemented internally (via channel T) or externally (via channel Y).

An optional manual override (9) allows for moving of the pilot control spool (10) without solenoid energization.

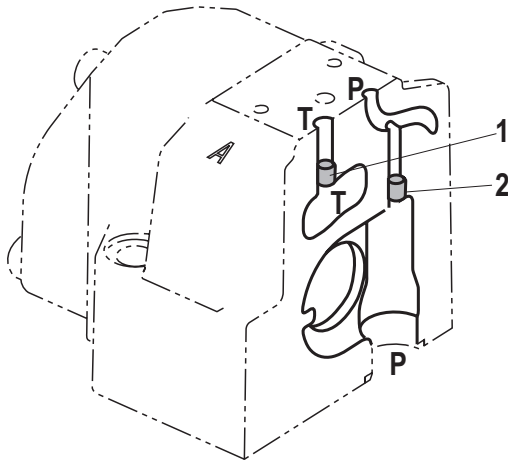
Notices:

The return springs (3.1) and (3.2) in the spring chambers (6) and (8) hold the main control spool (2) in central position without pilot pressure even with, for example, vertical valve positioning.

Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.

For pilot oil supply, see page 9.

Pilot oil supply (schematic illustration)



- 1 Plug screw M6 according to DIN 906, wrench size 3
– pilot oil return
- 2 Plug screw M6 according to DIN 906, wrench size 3
– pilot oil supply

Pilot oil supply

external: 2 closed
internal: 2 open

Pilot oil return

external: 1 closed
internal: 1 open

Type WEH...

The pilot oil supply is implemented **externally** - via channel X - from a separate pressure supply.
The pilot oil return is implemented **externally** - via channel Y - into the tank.

Type WEH...E...

The pilot oil supply is implemented **internally** from channel P of the main valve. (see page 10, footnotes ⁵⁾ and ⁶⁾)

The pilot oil return is implemented **externally** - via channel Y - into the tank. In the subplate, port X is closed.

Type WEH...ET...

The pilot oil supply is implemented **internally** from channel P of the main valve.

The pilot oil return is implemented **internally** - via channel T - into the tank. In the subplate, ports X and Y are closed.

Type WEH...T...

The pilot oil supply is implemented **externally** - via channel X - from a separate pressure supply.

The pilot oil return is implemented **internally** - via channel T - into the tank. In the subplate, port Y is closed.



Notices:

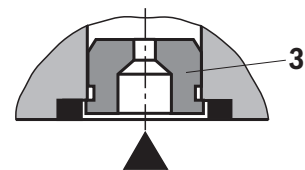
The modification of the pilot oil supply may only be performed by authorized specialists or at the factory.

- Pilot oil supply X or return Y **external**:
 - The maximum admissible operating parameters of the pilot control valve must be observed (see data sheet 23164).
 - Maximum pilot pressure: please observe page 10.
- Pilot oil supply **internal** (version "ET" and "E"):
 - Minimum pilot pressure: please observe page 10.
 - In order to prevent inadmissibly high pressure peaks, a **"B10" throttle insert** has to be provided in port P of the pilot control valve (see above).

Throttle insert

Use of the throttle insert (3) is necessary if the pilot oil supply in channel P of the pilot control valve is to be limited (see below).

The throttle insert (3) is inserted in channel P of the pilot control valve.



Technical data

(For application outside these values, please consult us!)

general			
Sizes		NG	16
Weight, approx.	▶ Valve with one solenoid	kg [lbs]	8.7 [19]
	▶ Valve with two solenoids, spring-centered	kg [lbs]	9.2 [20]
	▶ Switching time adjustment "S" and "S2"	kg [lbs]	0.8 [1.8]
Installation position		Any; With suspended installation, higher sensitivity to contamination – horizontal is recommended.	
Ambient temperature range		°C [°F]	–20 ... +70 [–4 ... +158]
Storage temperature range		°C [°F]	+5 ... +40 [+41 ... +104]
Surface protection (valve body)		Coating, layer thickness max. 100 µm	
MTTF _D values according to EN ISO 13849		Years	100 (for further details, see data sheet 08012)
hydraulic			
Maximum operating pressure			
▶ Port P, A, B		bar [psi]	280 [4061]
▶ Port T	– External pilot oil return Y	bar [psi]	250 [3626]
	– Internal pilot oil return Y	bar [psi]	160 [2320]
▶ Port Y	– External pilot oil return	bar [psi]	160 [2320]
Hydraulic fluid		see table on page 11	
Hydraulic fluid temperature range (at the valve working ports)		°C [°F]	–20 ... +80 [–4 ... +176]
Viscosity range		mm ² /s [SUS]	2.8 ... 500 [35 ... 2320]
Maximum admissible degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)		Class 20/18/15 ¹⁾	
Maximum pilot pressure	▶ without orifice	bar [psi]	210 [3046]
	▶ with orifice „B10“	bar [psi]	260 [3771]
Minimum pilot pressure			
▶ External pilot oil supply X (all symbols) internal pilot oil supply (only symbols D, E, J, L, U, Y31)			
	– 3-spool position valve, spring-centered	bar [psi]	14 [203]
	– 2-spool position valve with spring end position	bar [psi]	14 [203]
Pilot volume for switching process			
▶ 3-spool position valve, spring-centered		cm ³ [inch ³]	5.72 [0.349]
▶ 2-spool position valve		cm ³ [inch ³]	11.45 [0.699]
Pilot flow for shortest switching time, approx.		l/min [US gpm]	35 [9.2]

¹⁾ The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

For selecting the filters, see www.boschrexroth.com/filter.

Technical data

(For applications outside these parameters, please consult us!)

Hydraulic fluid	Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils	HL, HLP, HLPD, HVLP, HVLDP	NBR, FKM	DIN 51524	90220
Bio-degradable	► Insoluble in water	HETG	ISO 15380	90221
		HEES		
	► Soluble in water	HEPG	ISO 15380	
Flame-resistant	► Water-free	HFDU (glycol base)	ISO 12922	90222
		HFDU (ester base)		
		HFDR		
	► Containing water	HFC (Fuchs: Hydrotherm 46M, Fuchs Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	ISO 12922	90223



Important notices on hydraulic fluids:

- For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- **Bio-degradable and flame-resistant – containing water:** If this hydraulic fluid is used, small amounts of dissolved zinc may get into the hydraulic system.

► Flame-resistant – containing water:

- Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended - if possible specific to the installation - to back up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
- Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, a maximum duty cycle of 50% in continuous operation has to be set for on/off valves (measuring period 300 s). If this is not possible due to the function, an energy-reducing control of these components is recommended, e.g. via a PWM plug-in amplifier.

Switching times

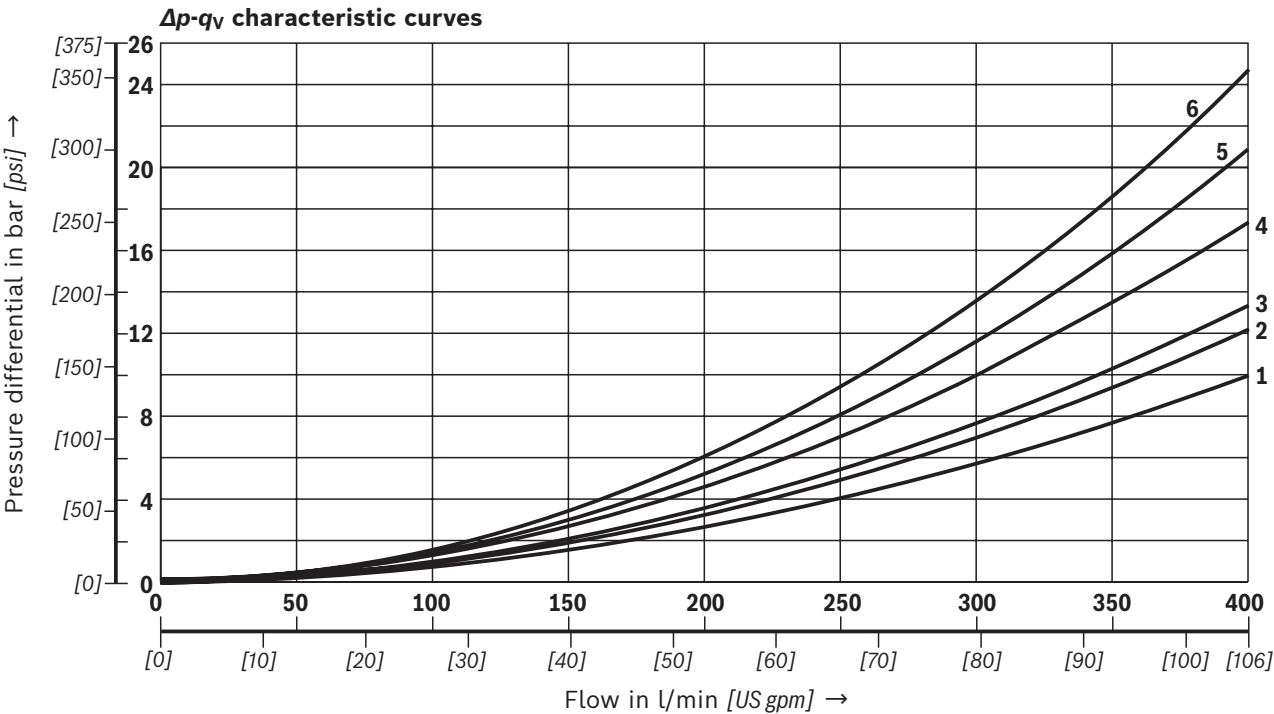
Pilot pressure		bar [psi]	70 [1015]	210 [3046]	260 [3626]	Spring
			ON			OFF
NG16	► Without throttle insert	ms	50 ... 80	–	40 ... 60	50 ... 80
	► With throttle insert	ms	110 ... 130	–	80 ... 100	50 ... 80



Notices:

- Switching times = Contacting at the pilot control valve until start of opening of the control edge in the main valve and change in the control spool stroke by 95%)
- The switching times are measured according to ISO 6403 with HLP46, $\vartheta_{oil} = 40\text{ °C} \pm 5\text{ °C}$ [$104\text{ °F} \pm 9\text{ °F}$]. With different oil temperatures, variations are possible!
- The switching times were determined using DC solenoids.
- The shut-off of the solenoids creates voltage peaks, which can be reduced by the use of suitable diodes.
- The switching times have been determined under ideal conditions and may differ in the system, depending on the application conditions.

Characteristic curves
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$ [$104 \pm 9 \text{ }^{\circ}\text{F}$])



Symbol	Characteristic curves		
	P – AB	A – T	B – T
E, D	1	3	4
L	2	5	6
U	3	5	4
J, Y31	3	3	6

Performance limits
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$ [$104 \pm 9 \text{ }^{\circ}\text{F}$])

Notice (applies to all sizes):
The specified switching power limits apply to the use with two directions of flow (e. g. from P to A and simultaneous return flow from B to T at a ratio of 1:1). Due to the flow forces acting within the valves, the

admissible switching power limit may be considerably lower with only one direction of flow (e. g. from P to A while port B is blocked, with flow in the same or in different directions)!
In such cases of application, please consult us!

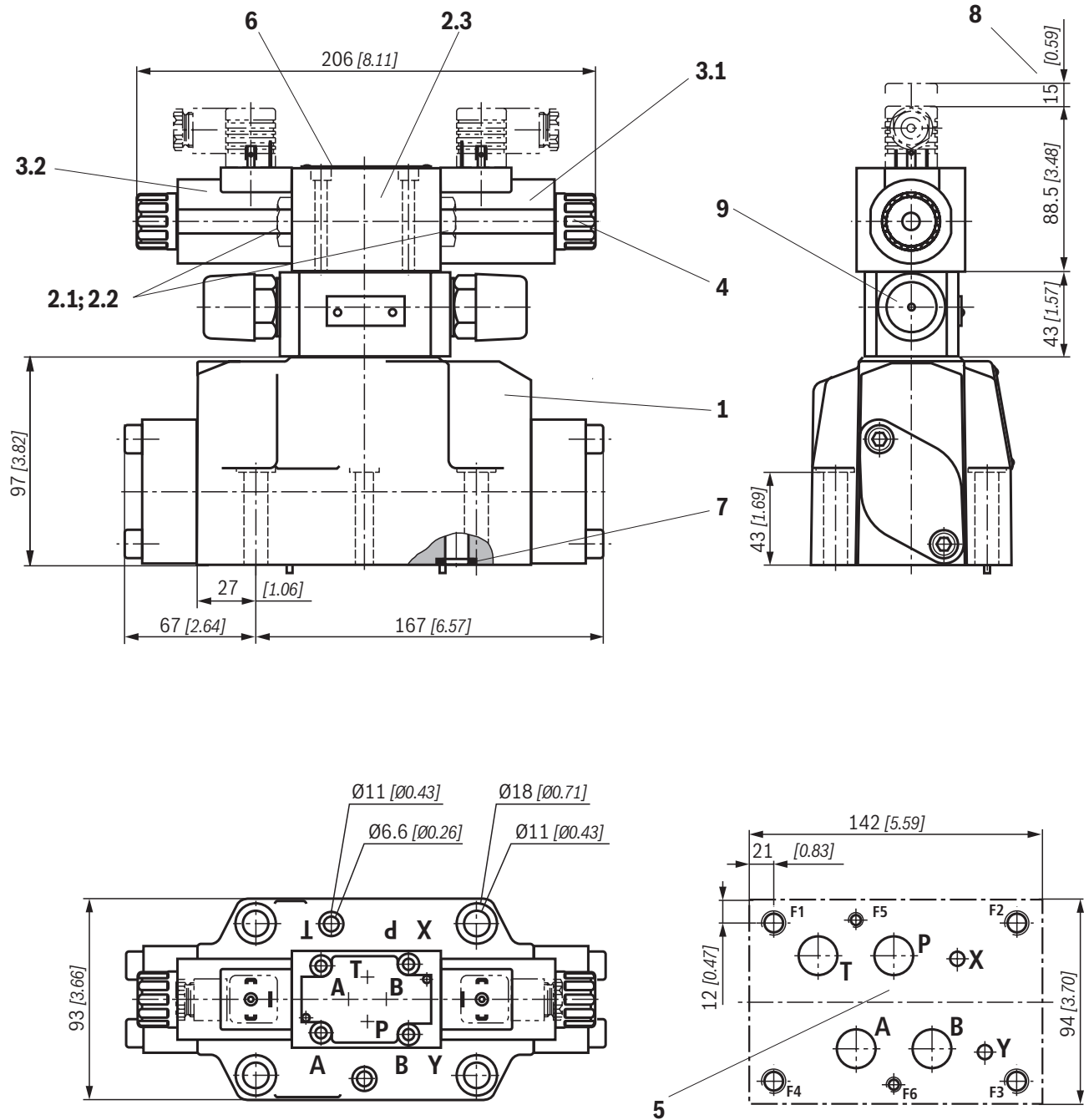
2-spool position valves – $q_{V \max}$ in l/min [US gpm]				
Symbol	Operating pressure p_{\max} in bar [psi]			
	90 [1300]	140 [2030]	210 [3046]	280 [4061]
X external – spring end position in the main valve (with $p_{\text{pilot min}} = 14 \text{ bar [200 psi]}$)				
D, Y31	400 [106]			
X external – spring end position in the main valve ¹⁾				
D	400 [106]	101 [27]	70 [19]	50 [13]
Y31	400 [106]	105 [28]	85 [23]	65 [17]

3-spool position valves – $q_{V \max}$ in l/min [US gpm]				
Symbol	Operating pressure p_{\max} in bar [psi]			
	90 [1300]	140 [2030]	210 [3046]	280 [4061]
X external – spring-centered				
E, J, L, U	400 [106]			

¹⁾ If the specified flow values are exceeded, the function of the return spring is no longer guaranteed if the pilot pressure fails.

Dimensions

(dimensions in mm [inch])



For item explanations, subplates and valve mounting screws see page 14.

Notice:

The dimensions are nominal dimensions which are subject to tolerances.

0,01/100
[0.0004/4.0]

Rzmax 4

Required surface quality of the valve contact surface

Dimensions

- 1 Main valve
- 2 Pilot control valve type 4WE 6 ... (data sheet 23164):
- 2.1 ► Pilot control valve type 4WE 6 D... (1 solenoid) for main valves with symbol D
 - Pilot control valve type 4WE 6 JA... (1 solenoid "a") for main valves with symbols EA, LA, etc., spring return
- 2.2 ► Pilot control valve type 4WE 6 Y (1 solenoid) for main valves with symbol Y31
 - Pilot control valve type 4WE 6 JB... (1 solenoid "b") for main valves with symbols EB, LB, etc., spring return
- 2.3 ► Pilot control valve type 4WE 6 J... (2 solenoids) for main valves with 3 spool positions, spring-centered
- 3.1 Solenoid "a"
- 3.2 Solenoid "b"
- 4 Solenoid with concealed manual override "N9"
- 5 Machined valve contact surface; porting pattern according to ISO 4401-07-07-0-05 and NFPAT3.5.1 R2-D07
Deviation from the standard: Port L1 and G1, G2 are not existing
- 6 Name plate complete valve
- 7 Seal rings
- 8 Space required for removing the mating connector
- 9 Switching time adjustment (wrench size 6), optional

Subplates (separate order) with porting pattern according to ISO 4401-07-07-0-05 and NFPAT3.5.1 R2-D07 see data sheet 45100.

Valve mounting screws (separate order)

4 metric hexagon socket head cap screws

ISO 4762 - M10 x 60 - 10.9-fLZn-480h-L

(friction coefficient $\mu_{\text{total}} = 0.09 \dots 0.14$);
tightening torque $M_A = 58 \text{ Nm}$ [42.8 ft-lbs] $\pm 10\%$,
material no. **R913014770**

2 metric hexagon socket head cap screws

ISO 4762 - M6 x 60 - 10.9-fLZn-480h-L

(friction coefficient $\mu_{\text{total}} = 0.09 \dots 0.14$);
tightening torque $M_A = 12,5 \text{ Nm}$ [9.2 ft-lbs] $\pm 10\%$,
material no. **R913000115**

4 hexagon socket head cap screws

UNC 3/8-16 UNC x 2 1/4" ASTM-A574 and

4 support washers DIN 988 - S10 x 16 x 1.2 on request

2 hexagon socket head cap screws

UNC 1/4-20 UNC x 2 1/4" ASTM-A574 on request

Switching time adjustment

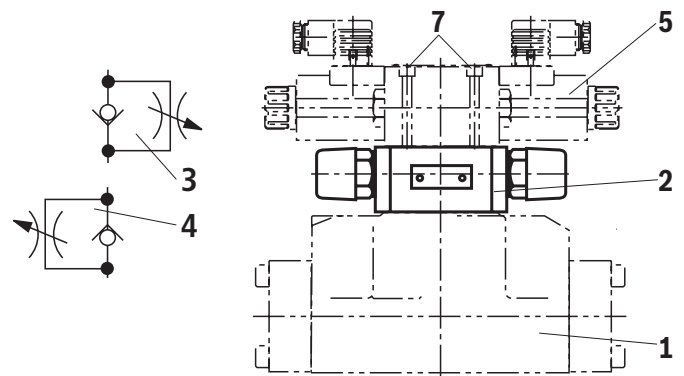
The switching time of the main valve (1) is influenced by using a twin throttle check valve (2) (type Z2FS 6; data sheet 27506).

Modification of supply (3) to discharge control (4):

Remove the pilot control valve (5) – Turn the switching time adjustment (2) around its longitudinal axis and put it back, install the pilot control valve (5).

Notice:

The modification may only be performed by authorized specialists or at the factory.



Type 4WEH ...S
Type 4WEH ...S2

Project planning information

The stipulations of the Machinery Directive 2006/42/EC are to be adhered to!

Please also note data sheet 08012 with information on MTTFd values and shock and vibration loads!

Further information

- ▶ Directional spool valve
- ▶ Subplates
- ▶ Hydraulic fluids on mineral oil basis
- ▶ Environmentally compatible hydraulic fluids
- ▶ Flame-resistant, water-free hydraulic fluids
- ▶ Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)
- ▶ Reliability characteristics according to EN ISO 13849
- ▶ Hexagon socket head cap screw, metric/UNC
- ▶ Hydraulic valves for industrial applications
- ▶ General product information on hydraulic products
- ▶ Assembly, commissioning and maintenance of industrial valves
- ▶ Selection of filters
- ▶ Information on available spare parts

Data sheet 23164

Data sheet 45100

Data sheet 90220

Data sheet 90221

Data sheet 90222

Data sheet 90223

Data sheet 08012

Data sheet 08936

Operating instructions 07600-B

Data sheet 07008

Data sheet 07300

www.boschrexroth.com/filter

www.boschrexroth.com/spc

Notes

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52/ 18-0
documentation@boschrexroth.de
www.boschrexroth.de

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