Proportional Directional Valve (BFW/BFWN)

The built-in 4/2-and 4/3-way directly operated
Proportional solenoid valves
Direct operated spool without electrical position feedback
Type BFW and BFWN
Nominal sizes 6 and 10
Series 2X
Maximum operating pressure 315bar
Maximum flow 42L/min (DN6)
Maximum flow 75L/min (DN10)

Technical data (Please consult with us when the application needs higher requirement than the parameter shown below)

Model		BFW	BFWN
Installation position		optional, preferably horizontal	
Storage temperature range	(℃)	-20~80	
Ambient temperature range	(℃)	-20~70	-20~50

Hydraulic

Operating pressure	(bar)	PortsA, B, P	315
		Port T	210
Nominal flow When q_{vnom} at △p=10 bar	(L/min)	DN6	7, 15 and 26
		DN10	30, 60
Flow (Max. Permissible)	(L/min)	DN6	80 (with double flow 80) 80
		DN10	140 (with double flow 140) 140
Pressure fluid			Mineral oil (HL, HLP) to DIN 51 524;For other fluid please consult with us.
Fluid temp. Range	(℃)		-20~80(+40~+50 is preference)
Viscosity range	(mm^2/s)		20~380(30~46 is preference)
Hysteresis	(%)		≤5
Reversal error	(%)		≤1
Response sensitivity	(%)		≤0.5
Cleanliness	Maximum permissible degree of pressure fluid contamination to NAS 1638 to class 9 Recommended filter $\beta_{10}\geq 75$.		

Electrical

Model			BFW[1]	BFWN
Voltage type			Direct voltage	
BFWN Command signal	Voltage input "A1"	(V)	±10	±10
	Current input "F1"	(mA)	4~20	4~20
Max. current per solenoid		(A)	2.5	2.5
Solenoid coil Resistance	(Ω)	Cold value at 20 ℃	6DN2	10DN2
		Max. warm value	6DN3	10DN3
Duty cycle		(%)	100	
Max.Coil temperature[2]		(℃)	up to 150	
Electrical connection			socket as per DIN EN 175 301-803 and ISO 4400 with component plug to DIN EN 175301-803 and ISO 4400	socket as per DIN EN 43 563-AM6-3 with component plug to DIN 43 563-BF6-3/Pg11
Insulation of valve to DIN 40 050			IP 65	

Proportional Directional Valve (BFW/BFWN)

Control electronics

BFW (type)	Analogue amplifier in Eurocard format[3]		Details refer to proportional amplifier	
	Digital amplifier in Eurocard format[3]		Details refer to proportional amplifier	
BFWN (type)	Analogue command value module		Integrated into the valves	
Supply voltage	Nominal voltage	VDC	24	
	BFWN Lower limiting value	V	21/22	19
	BFW[1] Upper limiting value	V	35	
Amplifier current consumption	I_{max}	A	1.8	1.8
	Max. impulse current	A	3	3

1) With HOYEA control amplifier. 2)Due to the occurring surface temperature of the solenoid coils, the European Standards DIN EN 563 and DIN EN 982. 3)separate order.

Model description

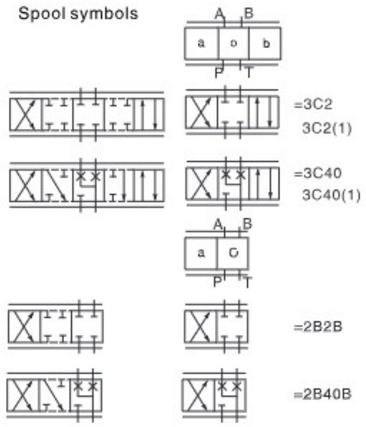
BFW - * - * - * - * - * - 2X - G24 - * - * - * - * - * *

Directional proportional valve

No code Without integrated electronics
N With integrated electronics

02 DN 6
03 DN 10

Spool symbols



With spool symbols: 3C2(1)and 3C40(1)
P → A: q_{vmax} B → T: $q_{vmax}/2$
P → B: $q_{vmax}/2$ A → T: q_{vmax}

Note:
With spools 3C40 and 2B40B, in the neutral position , there is a connection from A to T and B to T with approx. 3 % of the relevant nominal cross section.

Further details in clear text

V Omit Nitrile rubber sealing
NBR seals suitable for mineral oil (HL, HLP) to DIN 51 524

No code BFW(type)
BFWN(type)
A1 Command value input ± 10V
F1 Command value input4~20mA

Electrical connection For BFW (type)
2)K4 with plug component DIN EN 175301-803 See page A.1.3
BFWN (type)
2)K31 with plug component DIN 43 650-AM2 See page A.1.4

Special protection
No code Without special protection
1)J Seawater-resistant(only for DN6)

24V 24 VDC

2X Component series 20 to 29 (20 to 29 unchanged installation and connection dimensions)

Nominal flow at valve pressure differential p = 10 bar

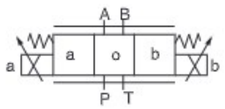
DN 6
07 7 L/min
15 15 L/min
30 26 L/min
DN 10
30 30 L/min
60 60 L/min

1.Other types of electrical protection on request 2.Only for DN6; for versian "3C40" sea water resistant only state "K31"!

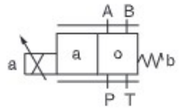
Proportional Directional Valve (BFW/BFWN)

Model description

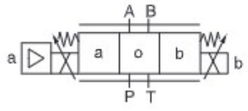
Model BFW···



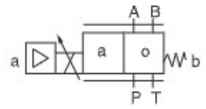
Model BFW···2B2B (2B40B)



Model BFWN···



Model BFWN···2B2B (2B40B)



Structure and function description, section

The 4/2–way and 4/3–way proportional directional valves are designed as direct operated components for subplate mounting. They are actuated by means of proportional solenoid with central removable coil. The solenoid are controlled either by external control electronics (type BFW) or integrated control electronics (type BFWN).

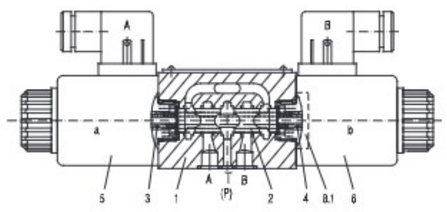
Design:

The valves basically consist of:
- —Body (1) with mounting surface
- —Control spool (2) with compression springs (3 and 4)
- —Solenoids (5 and 6) with central coil
- —Optional integrated electronics (7)

Function:

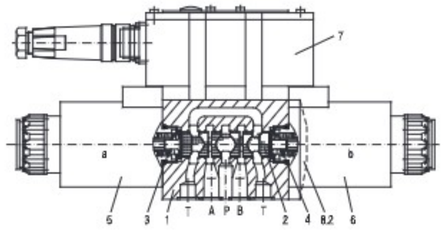
- — When solenoids (5 and 6) do not work, the control spool (2) is held in the central position by compression springs (3 and 4)
- — Direct actuation of the control spool (2) by energising a proportional solenoid E.g. When the solenoid "b" power is on (6)
  - → The control spool (2) is moved to the left in proportion to the electrical input signal
  - →connection from P to A and B to T via orifice–like crosssections with progressive flow characteristics
- — When the solenoid power is off (6)
  - → The control spool (2) is returned to the central position by compression spring (3)

Model BFW–02···2x/···



In theory, the function of this valve is the same to the valve with 3 positions. However, the valves with 2 positions are only fitted with solenoid "a".
For DN6 valve, there is a plug (8.1) fixed in the second solenoid,but for DN10, it is a cover (8.2) instead.

Model BFWN–03···2x/···

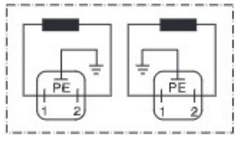


Note for type BFW–02···2X/···:
Draining of tank line is to be avoided. With the appropriate installation conditions, a back pressure valve is to be installed (back pressure approx. 2 bar).

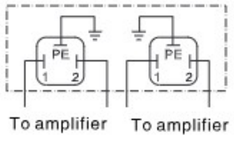
Electrical connection, plug–in connectors

BFW type (Without integrated electronics not for version "J"=sea water– resistant)

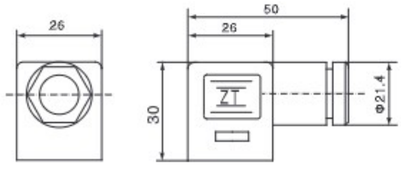
Connection on component plug



Connection on plug–in connector



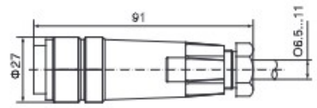
Plug–in connector: CECC 75 301–803–A002FA–H3D08–G/DIN EN 175 301–803 and ISO 4400



Proportional Directional Valve (BFW/BFWN)

Electrical connection, plug–in connectors

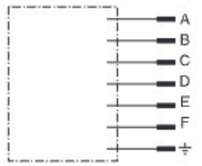
For type BFWN (with integrated electronics (OBE) and for version "J" = sea water–resistant) Plug–in connector see the block circuit diagram below



Plug–in connector:
DIN 43 563–BF6–3/Pg11

Integrated electronics for type BFWN

Pin allocation of the component plug

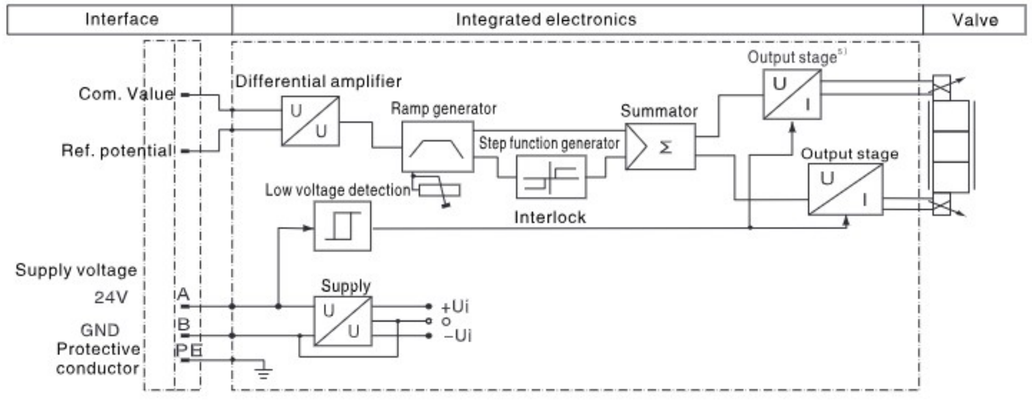


	Contact	Signal
Supply voltage	A	24VDC(19~35VDC)
	B	GND
	C	n.c.[1]
Differential amplifier input	D	Com. value (±10V/4–20mA)
	E	reference potential
	F	n.c.[1]

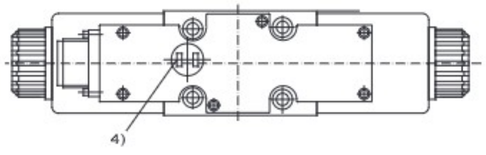
Com. value: Positive command value (0 to 10 V or 12 to 20 mA) at D and reference potential to E causes flow from P to A and B to T.
Negative command value (0 to 10 V or 12 to 4 mA) at D and reference potential to E causes flow from P to B and A to T.
For valves with a solenoid on side "a" (spool variants 2B2B and 2B40B) a positive command value at D and reference potential to E (NS 6: 4 to 20 mA and NS 10: 12 to 20 mA) causes flow from P to B and A to T.

Recommendation:
–up to 25 m cable length type LiYCY 5 x 0.75 mm²
–up to 50 m cable length type LiYCY 5 x 1.0 mm²
External diameter 6.5 to 11 mm
Connect screen to PE only on the supply side

Block circuit diagram / connection allocation



1) Contacts C and F must not be connected!
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 2.5 s; the same applies for Tup and Tdown
5) Output stages current regulated
6) Low voltage detection is not carried out for component type BFWN–03–2X

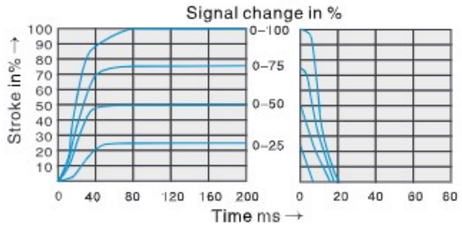


Proportional Directional Valve (BFW/BFWN)

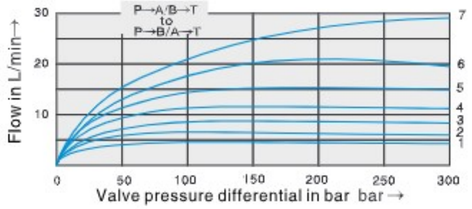
Characteristic curves

DN6

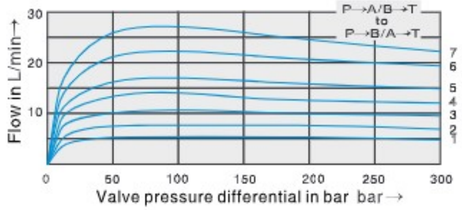
Transient functions with stepped form of electrical input signa



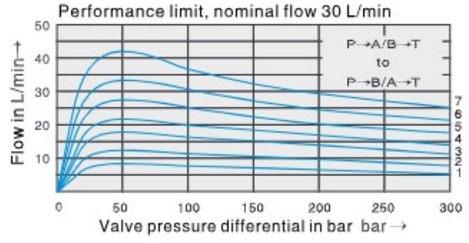
Performance limit, nominal flow 7 L/min



Performance limit, nominal flow 15 L/min



Performance limit, nominal flow 30 L/min

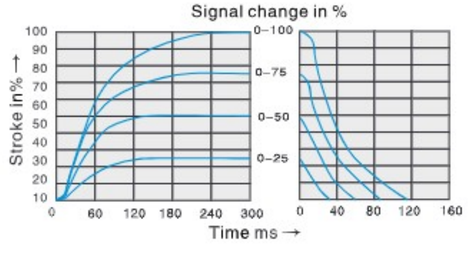


1 Com. Value=40%
2 Com. Value=50%
3 Com. Value=60%
4 Com. Value=70%
5 Com. Value=80%
6 Com. Value=90%
7 Com. Value=100%

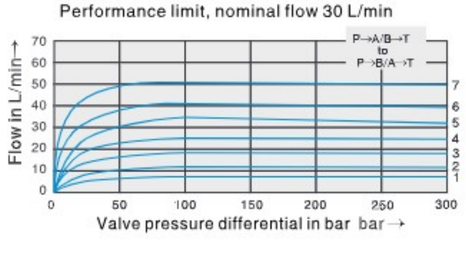
If the performance limits are exceeded, then the movement of spool will be unstable.

DN10

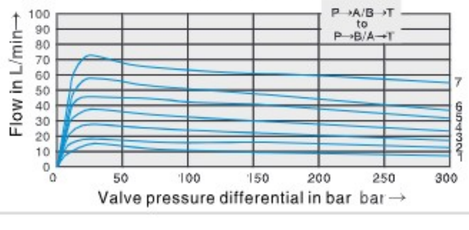
Transient functions with stepped form of electrical input signa



Performance limit, nominal flow 30 L/min



Performance limit, nominal flow 60 L/min



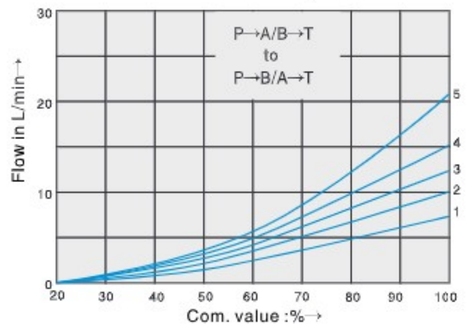
1 Com. Value=40%
2 Com. Value=50%
3 Com. Value=60%
4 Com. Value=70%
5 Com. Value=80%
6 Com. Value=90%
7 Com. Value=100%

If the performance limits are exceeded, then the movement of spool will be unstable.

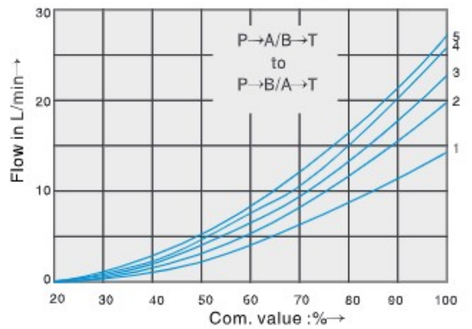
Proportional Directional Valve (BFW/BFWN)

Characteristic curves (measured with HLP46, Qoil = 40 ± 5℃) DN6

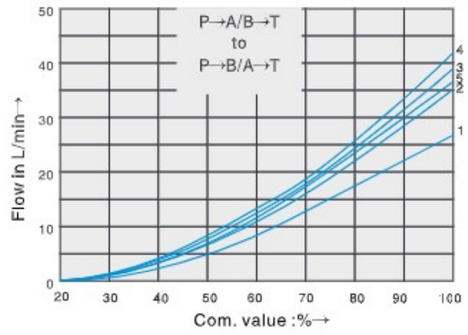
7 l/min nominal flow at differential pressure 10 bar



15 l/min nominal flow at differential pressure 10 bar



30 l/min nominal flow at differential pressure 10 bar

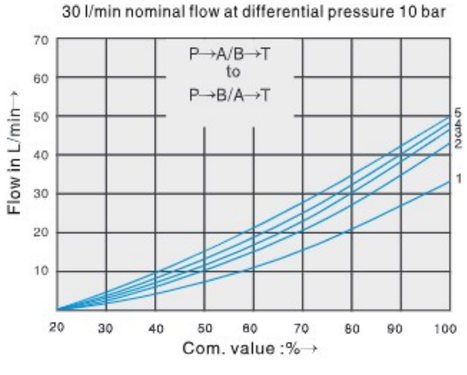


1 △p=10 bar Constant
2 △p=20 bar Constant
3 △p=30 bar Constant
4 △p=50 bar Constant
5 △p=100 bar Constant

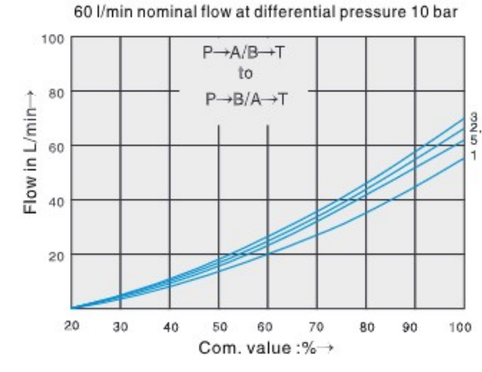
△p= Valve pressure differential
(inlet pressure P_s minus load
pressure P_L and minus return pressure P_T)

Characteristic curves (measured with HLP46, Qoil = 40 ± 5℃) DN10

30 l/min nominal flow at differential pressure 10 bar



60 l/min nominal flow at differential pressure 10 bar



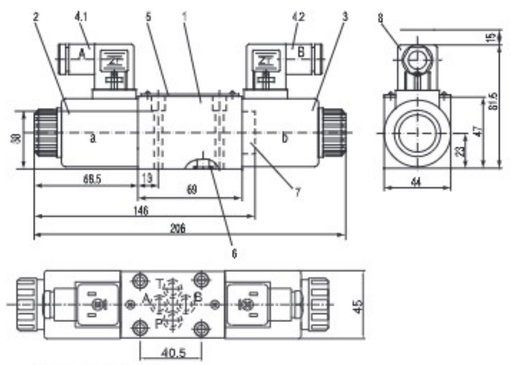
1 △p=10 bar Constant
2 △p=20 bar Constant
3 △p=30 bar Constant
4 △p=50 bar Constant
5 △p=100 bar Constant

△p= Valve pressure differential
(inlet pressure P_s minus load
pressure P_L and minus return pressure P_T)

Proportional Directional Valve (BFW/BFWN)

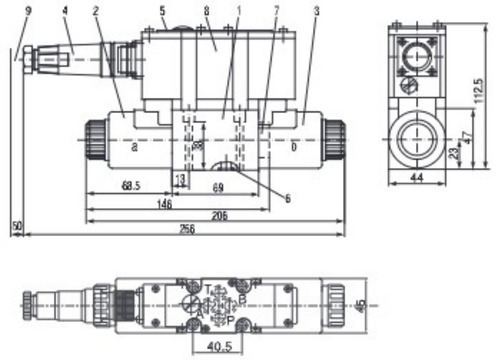
Unit dimensions

BFW–02 type



1 Valve body
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4.1 4.2 Plug–in connector , colour black, separate order
5 Nameplate
6 8.73 x 1.78 I seal rings for ports A, B, P and T
7 Plug for valves with one solenoid (2 positions spool type 2B2B or 2B40B)
8 Space required to remove the plug–in connector
9 Machined valve mounting surface, connection location to DIN 24 340A，IS04401 (and) CETOP–RP 121 H

BFWN–02···/···K31···V type

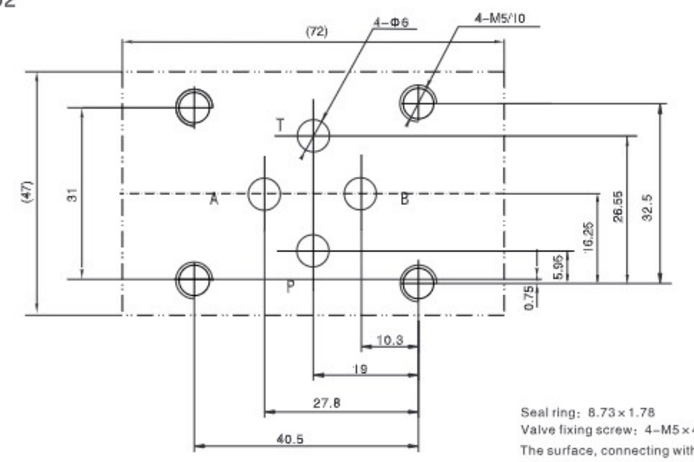


1 Valve body
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4 Plug–in connector to E DIN 43 563–BF6–3/Pg11
5 Nameplate
6 8.73 x 1.78 O Identical seal rings for ports A, B, P and T
7 Plug for valves with one solenoid (2 switched positions, spool type 2B2B or 2B40B)
8 Integrated electronics
9 Space required for the connection cable and to remove the plug–in connector
10 Machined valve mounting surface, connection location DIN 24 340A，ISO 440 and CETOP–RP 121 H

Mounting plate: please refer to below drawing
Subplates: Valve fixing screws :4–M5x 45 DIN 912–12.9; M_A=8.9 Nm

Subplate size

BFW–02
BFWN–02

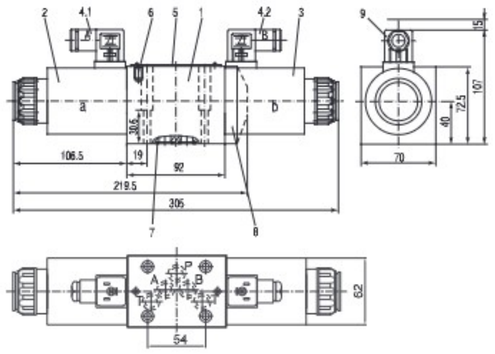


Seal ring：8.73×1.78
Valve fixing screw：4–M5×45–12.9(GB70–85)
The surface, connecting with the valve, should be Ra0.8 roughness, and 0.01/100mm flatness.

Proportional Directional Valve (BFW/BFWN)

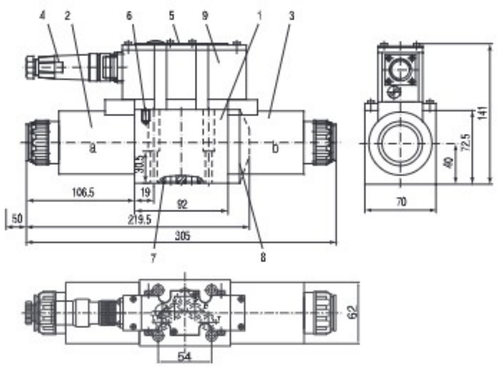
Unit dimensions

BFW–03 type



1 Valve body
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4.1 4.2 Plug–in connector , colour black, separate order
5 Nameplate
6 Valve deflation screw
7 12 x 2 seal rings for ports A, B, P and T
8 Plug for valves with one solenoid (2 positions, spool type 2B2B or 2B40B)
9 Space required to remove the plug–in connector
10 Machined valve mounting surface, connection location to DIN 24 340A，IS04401 (and) CETOP–RP 121 H

BFWN–03 type

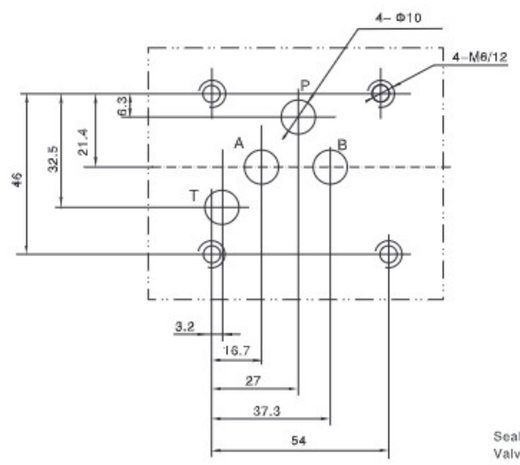


1 Valve body
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4 Plug–in connector, to E DIN43563–BF6–3/Pg11
5 Nameplate
6 Valve deflation screw
7 12 x 2 I O dentical seal rings for ports A, B, P and T
8 Plug for valves with one solenoid (2 positions, spool type 2B2B or 2B40B)
9 Integrated electronics
10 Space required for theconnection cable and to remove the plug–in connector
11 Machined valve mounting surface, connection location to DIN 24 340A,IS04401(and)CETOP–RP 121 H

Mounting plate: please refer to below drawing
Subplates : Valve fixing screws: 4 M6x 40 DIN 912–12.9; M_A=15.5 Nm

Subplate size

BFW–03
BFWN–03



Seal ring：8.73×1.78
Valve fixing screw：4–M5×45–12.9(GB70–85)
The surface, connecting with the valve, should be Ra0.8 roughness, and 0.01/100mm flatness.