

## Valves in sandwich plate design Nominal size 10

### DESCRIPTION

HYDAC valves in sandwich plate design in nominal size 10 enable modular design of the hydraulic control via stacked valve assembly. We offer them as pressure reducing and pressure relief valves for pressure control and as needle or flow valves with bypass check valve for flow control.

Furthermore, the sandwich plates are available as check valve for direction control, pilot-to-open and non-pilot-to-open, and as pressure compensator to realise the flow control function.

Mounting elements are dependent on the modular design of your hydraulic control and are thus not included in delivery.

### FEATURES

- Available with pressure, flow, check and pressure compensator function
- Modular design of the hydraulic control
- Interface to ISO 4401-05-04-0-05 (Cetop 4.2-4-05-350)



Nominal size 10  
up to 120 l/min<sup>2</sup>  
up to 350 bar<sup>2</sup>

### TECHNICAL DATA <sup>1</sup>

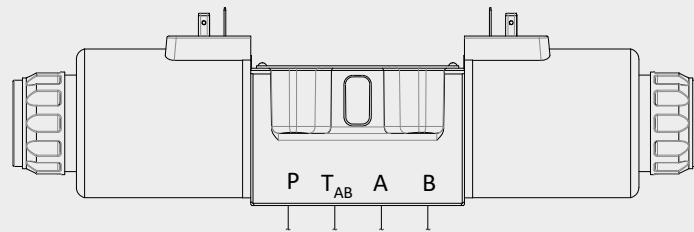
General specifications	
MTTFd	According to EN ISO 13849-1:2015 chart C1 & C2
Ambient temperature	[°C] -20 to +60
Installation	no orientation restrictions
Material	Casing: cast iron
	Casing: steel (ZW-RV10 only)
	Name plate: aluminium
Surface coating	Valve housing: phosphate-plated
Hydraulic specifications	
Operating pressure	[bar] 350 <sup>2</sup>
Operating fluid	Hydraulic oil to DIN 51524 part 1, 2 and 3
Temp. range of operating fluid	[°C] -20 to +70
Viscosity	[mm <sup>2</sup> /s] 10 to 400
Permitted contamination level of operating fluid	class 20/18/15 to ISO 4406
Sealing material	NBR, FKM (standard)

<sup>1</sup> see "Conditions and Instructions for Valves" in brochure 53.000

<sup>2</sup> in consideration of the charts "Supplementary technical data"

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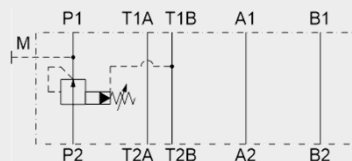
Directional valve



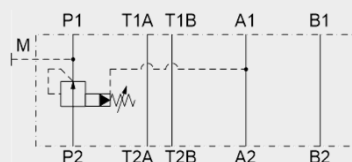
## Pressure reducing valves

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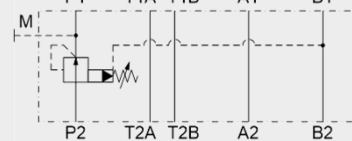
ZW-DM10...PT



ZW-DM10...PB



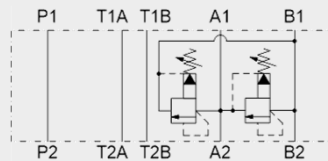
ZW-DM10...PA



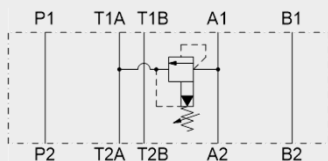
## Pressure relief valves

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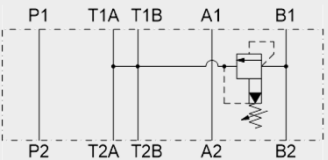
ZW-DB10...AB



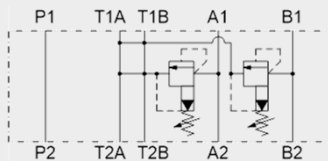
ZW-DB10...AT



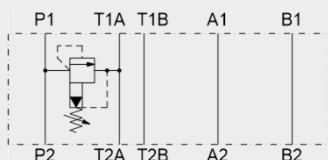
ZW-DB10...BT



ZW-DB10...ABT



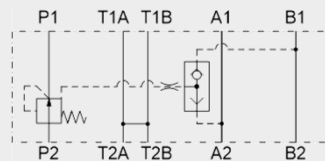
ZW-DB10...PT



## Pressure compensators

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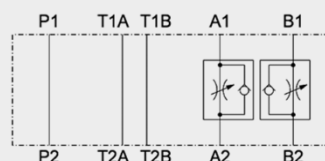
ZW-DW10...PAB



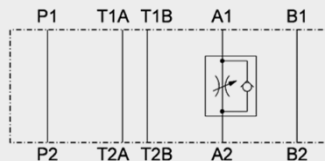
## Needle valves

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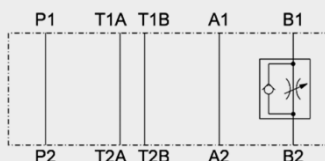
ZW-SDR10...AAB



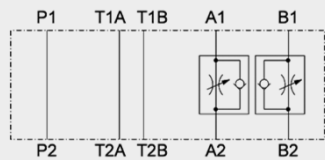
ZW-SDR10...AA



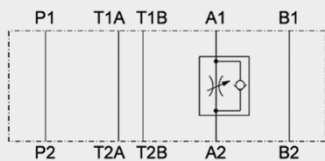
ZW-SDR10...AB



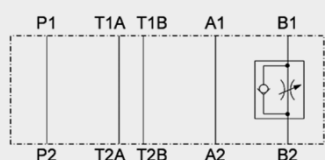
ZW-SDR10...ZAB



ZW-SDR10...ZA

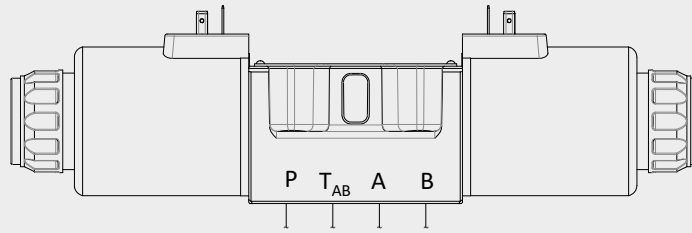


ZW-SDR10...ZB



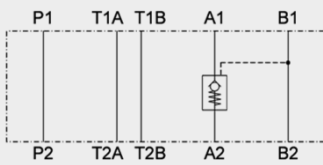
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Directional valve

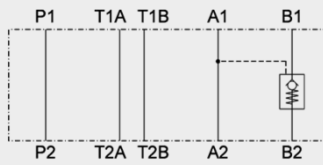


## Check valves pilot-to-open

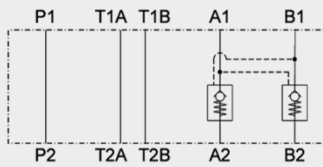
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**ZW-RP10...AA**



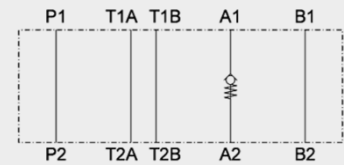
**ZW-RP10...AB**



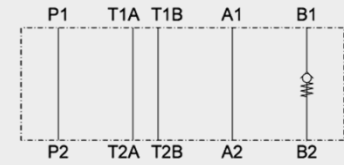
**ZW-RP10...AAB**

## Check valves

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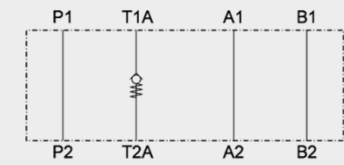
**ZW-RV10...A**



**ZW-RV10...B**



**ZW-RV10...P**



**ZW-RV10...T**

## Accessories

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# PRESSURE REDUCING VALVE IN SANDWICH PLATE DESIGN ZW – DM10



## SUPPLEMENTARY TECHNICAL DATA

### General specifications

Weight [kg] 2.7

### Hydraulic specifications

Pressure symbol PA, PB [bar] 210

Flow rate [l/min] 80 controlled line P  
100 free lines

Leakage [l/min] < 0.7

## MODEL CODE

**ZW-DM 10 - 01 - PA - 070 V - N**

### Type

Pressure reducing valve in sandwich plate design, pilot-operated

### Nominal size

10

### Series

01 = specified by manufacturer

### Spool symbol

PA = pressure control in port A  
PB = pressure control in port B  
PT = pressure control in port P

### Pressure ranges

070 = 5 to 70 bar  
140 = 8 to 140 bar  
210 = 10 to 210 bar  
320 = 15 to 320 bar (symbol PT only)

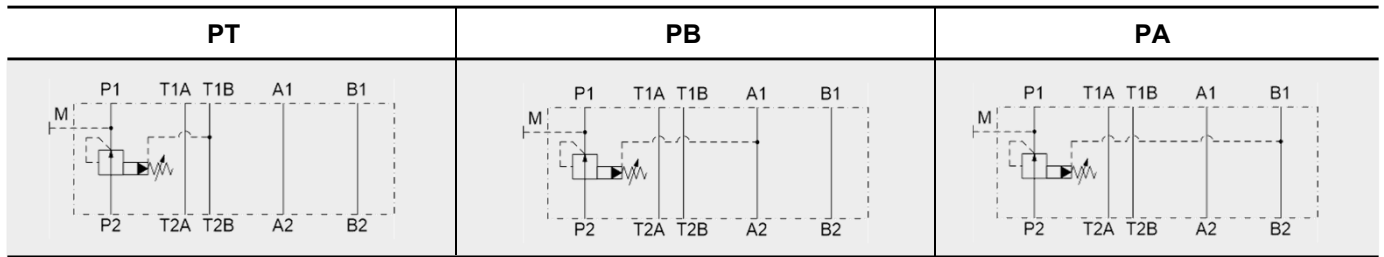
### Adjustment types

V = adjustable using tool

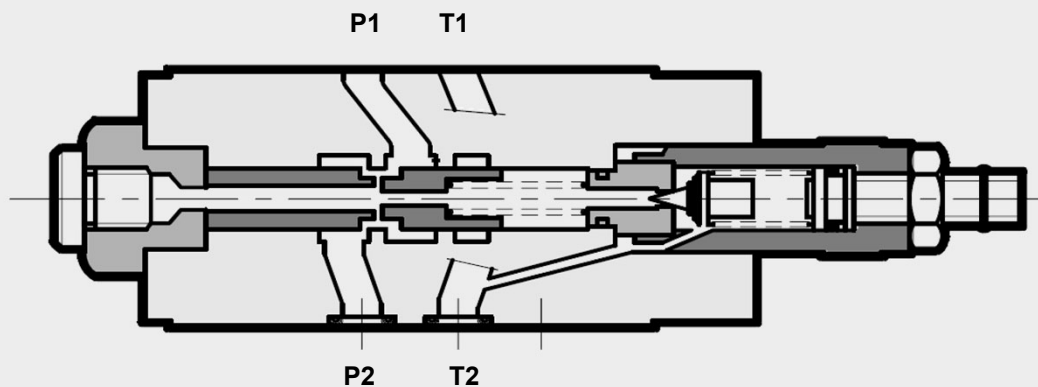
### Sealing material

N = NBR  
V = FKM (standard)

## SPOOL TYPES / SYMBOLS



## SECTION VIEW



## FUNCTION

The direct-acting pressure reducing valve in sandwich plate design in nominal size 10 is used to reduce the inlet pressure at P2 to a smaller outlet pressure P1. The pressure tapping for the reduced pressure is designed differently depending on the symbol:

- reduced pressure in port A → PA
- reduced pressure in port B → PB
- reduced pressure in port P → PT

The outlet pressure P1 can be tapped at measuring port (M).

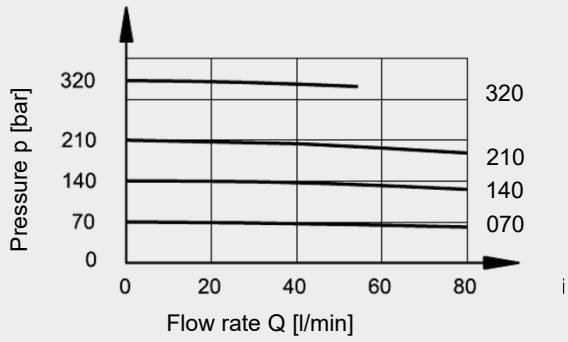
## Hint

In designs PA and PB, the pressure losses of the subsequent components must be considered when selecting the inlet pressure.

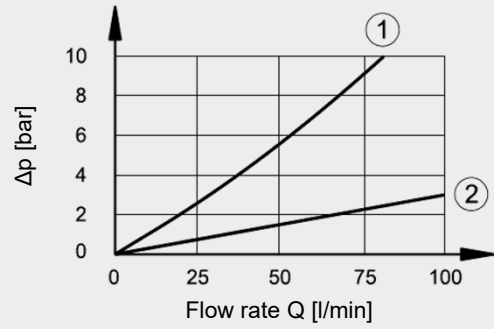
# PERFORMANCE

measured at  $v = 36 \text{ mm}^2/\text{s}$  and  $T_{oil} = 50^\circ\text{C}$

## Control



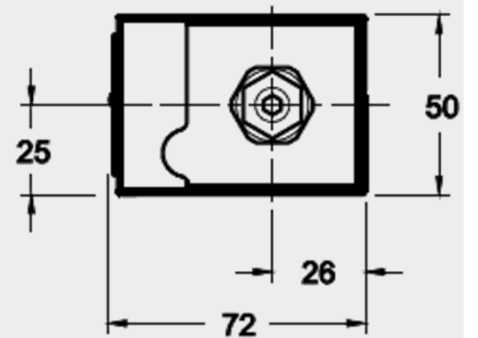
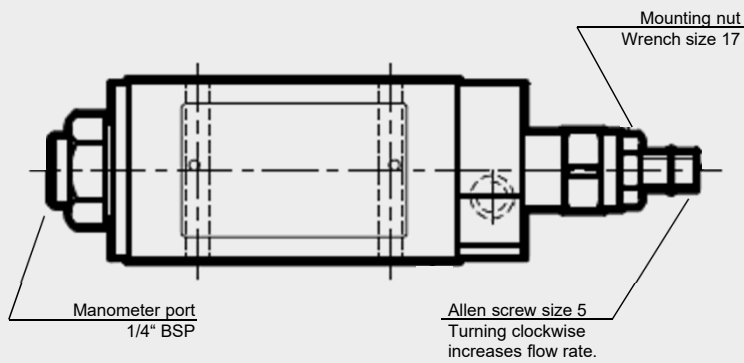
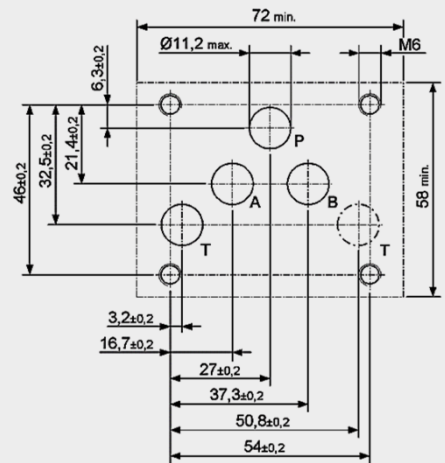
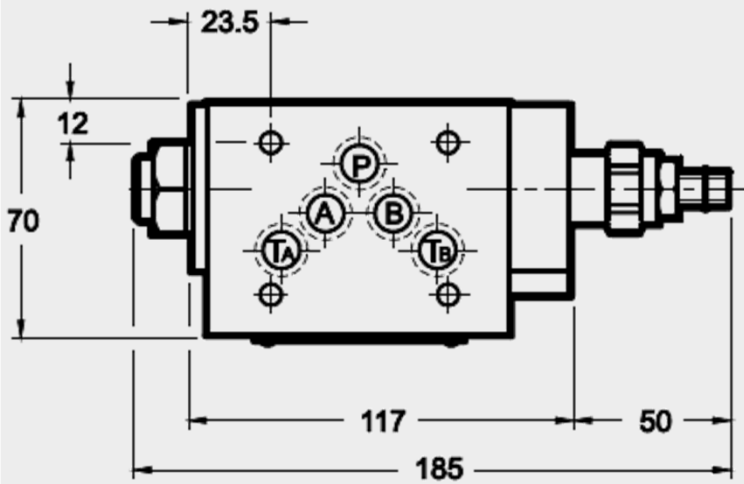
## Pressure drop



- 1) P2 → P1
- 2) Free lines

# DIMENSIONS

Interface to ISO 4401-05-04-0-05  
(Cetop 4.2-4-05-350)



# PRESSURE RELIEF VALVE IN SANDWICH PLATE DESIGN ZW – DB10



## SUPPLEMENTARY TECHNICAL DATA

### General specifications

Weight	[kg]	2.8
		3 (symbol AB and ABT)

### Hydraulic specifications

Flow rate	[l/min]	120
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## MODEL CODE

**ZW-DB 10 - D01 - AB 070 V - N**

### Type

Pressure relief valve in sandwich plate design, pilot-operated

### Nominal size

10

### Series

D01 = specified by manufacturer

### Spool symbol

AB = pressure limiting in port B or A, outflow to port A or B  
 AT = pressure limiting in port A, outflow to port T  
 BT = pressure limiting in port B, outflow to port T  
 PT = pressure limiting in port P, outflow to port T  
 ABT = pressure limiting in port A and B, outflow to port T

### Pressure ranges

070 = 6 to 70 bar  
 140 = 6 to 140 bar  
 210 = 6 to 210 bar  
 350 = 6 to 350 bar

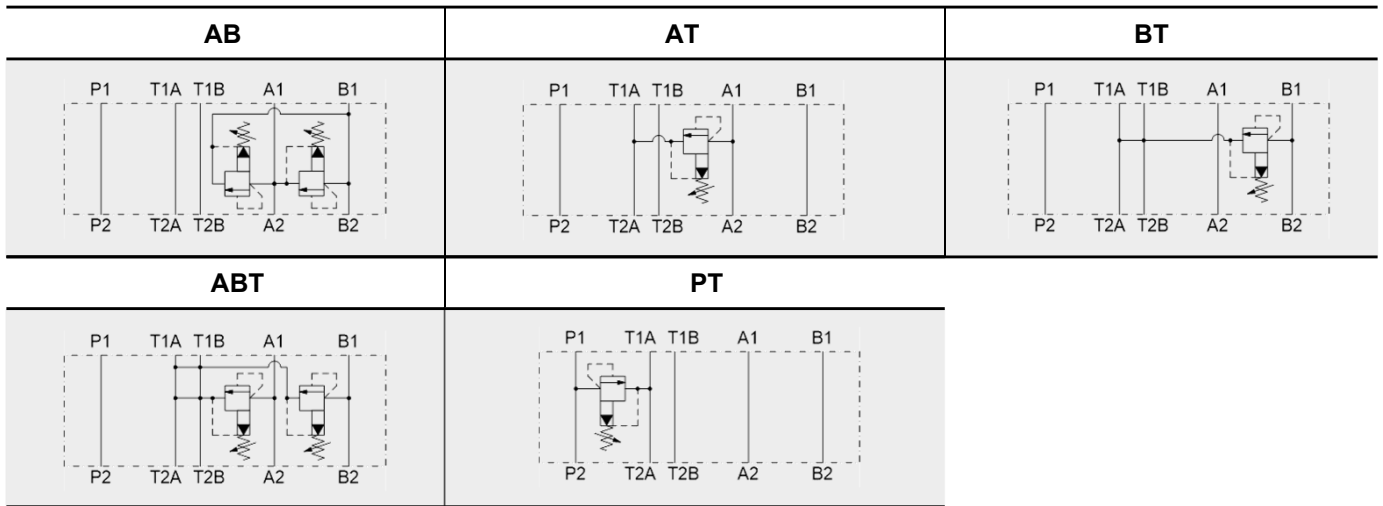
### Adjustment types

V = adjustable using tool

### Sealing material

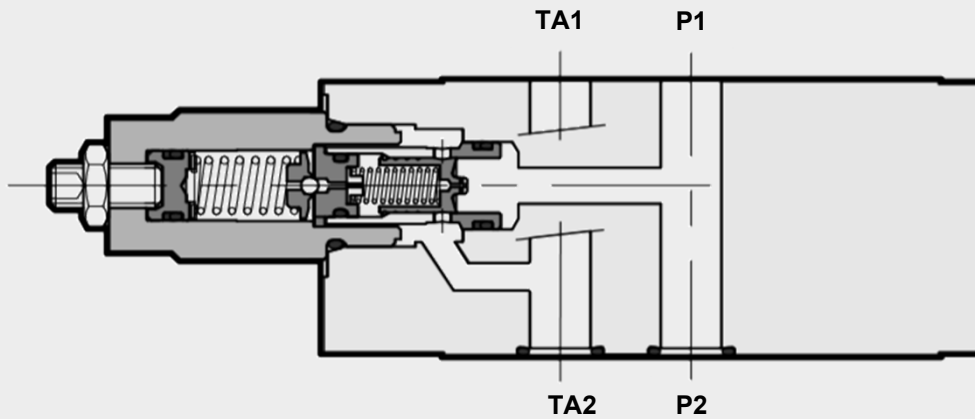
N = NBR  
 V = FKM (standard)

## SPOOL TYPES / SYMBOLS



## SECTION VIEW

Example PT



## FUNCTION

The pressure relief valve in sandwich plate design in nominal size 10 is a pilot-operated spool valve, which limits the pressure in the system.

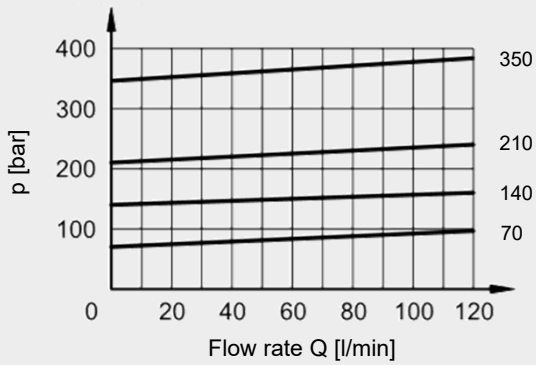
If the pressure at port P exceeds the pressure setting, the pilot poppet opens, so a small flow flows to the tank via pilot stage. Because of the resulting pressure difference, the main piston moves towards the return spring and allows flow from port P to T.



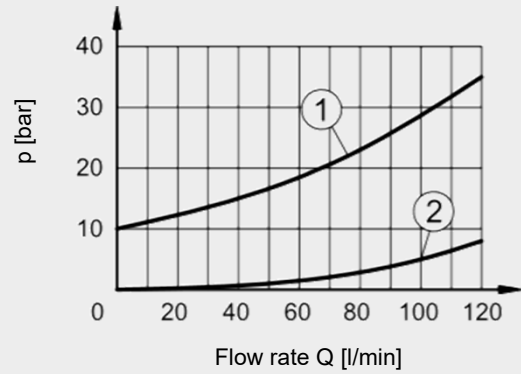
## PERFORMANCE

measured at  $v = 36 \text{ mm}^2/\text{s}$  and  $T_{\text{oil}} = 50^\circ\text{C}$

### Control

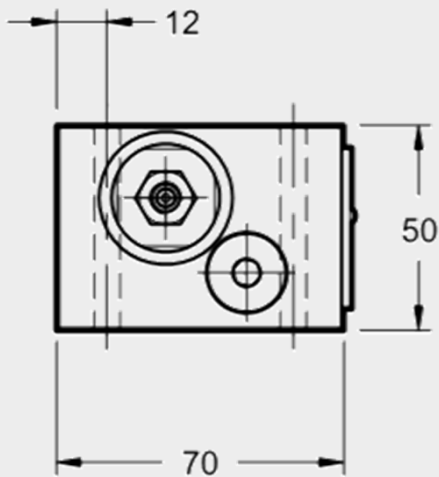


### Pressure drop

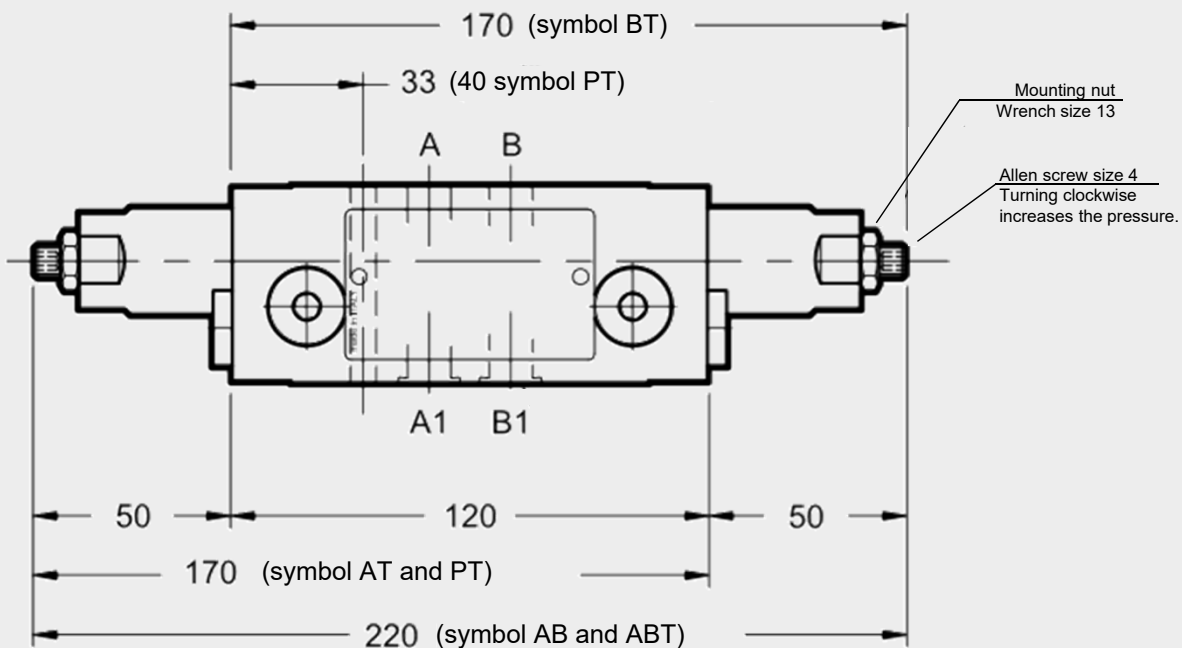
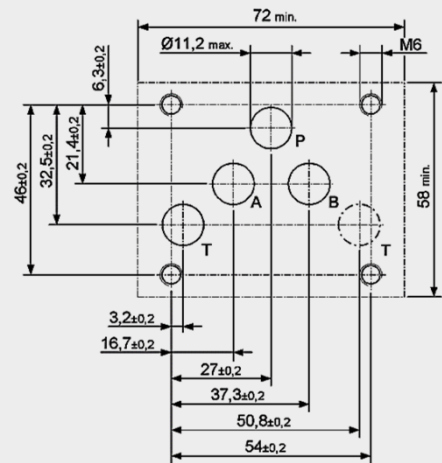


- 1) Controlled line symbol PT, AT, BT, ABT
- 2) Free line

## DIMENSIONS



### Interface to ISO 4401-05-04-0-05 (Cetop 4.2-4-05-350)



# PRESSURE COMPENSATOR IN SANDWICH PLATE DESIGN ZW – DW10



## SUPPLEMENTARY TECHNICAL DATA

### General specifications

Weight [kg] 2.7

### Hydraulic specifications

Flow rate [l/min] 100

## MODEL CODE

**ZW-DW 10 - 01 - PAB 4 - V**

### Type

Pressure compensator in sandwich plate design

### Nominal size

10

### Series

01 = specified by manufacturer

### Spool symbol

PAB = 2-way pressure compensator

### Pressure ranges

4 = 4 bar

8 = 8 bar

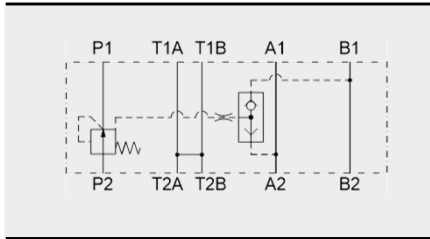
### Sealing material

N = NBR

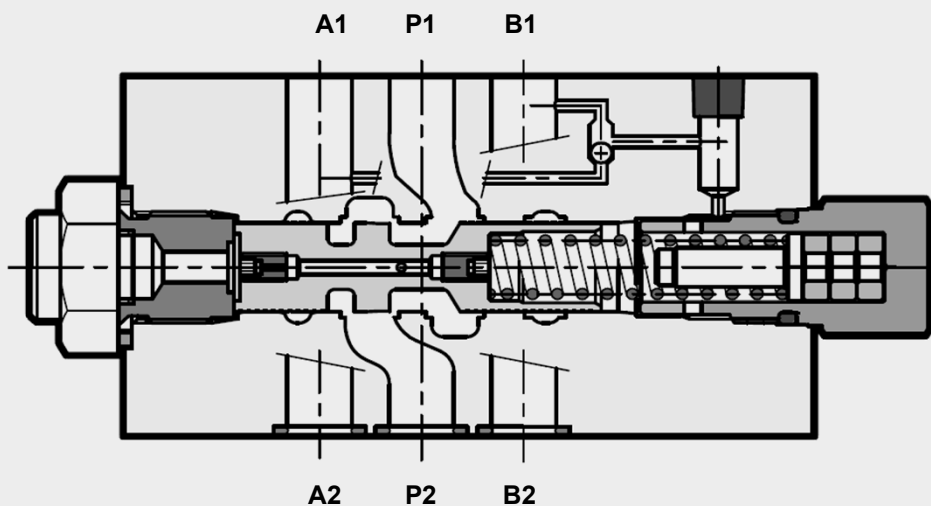
V = FKM (standard)

## SPOOL TYPES / SYMBOLS

### PAB



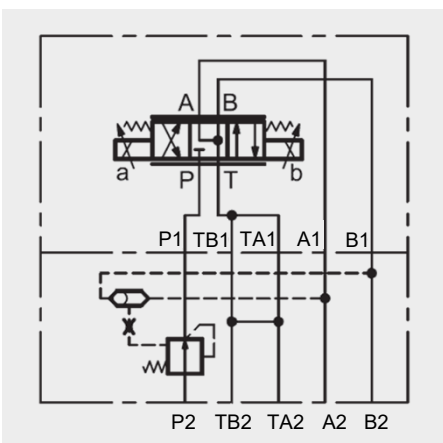
### SECTION VIEW



### FUNCTION

The pressure compensator in sandwich plate design in nominal size 10 keeps the pressure loss constant between inlet P and – depending on the remote control of the integrated shuttle valve – the inlet to either consumer port A or B. In combination with a needle valve or proportional directional valve results in a constant flow rate to the consumer at port A or B. The control pressure of the pressure compensator can be specified between 4 and 8 bar depending on the design.

Application example for meter-in flow control at cylinder port A or B with a proportional directional valve:

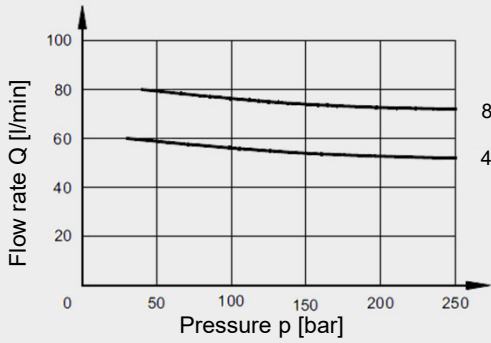


## PERFORMANCE

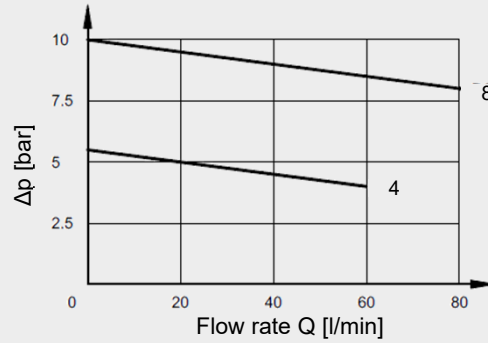
measured at  $v = 36 \text{ mm}^2/\text{s}$  and  $T_{\text{oil}} = 50^\circ\text{C}$

2-way pressure compensator

Flow pressure  $Q = f(p)$

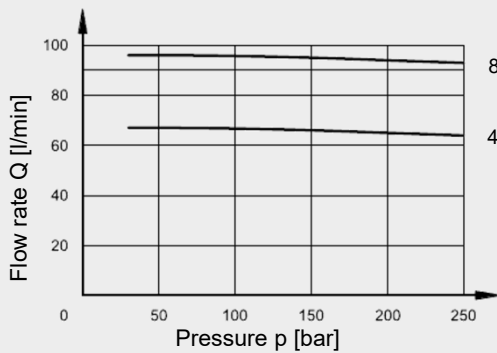


Pressure drop  $\Delta p = f(Q)$

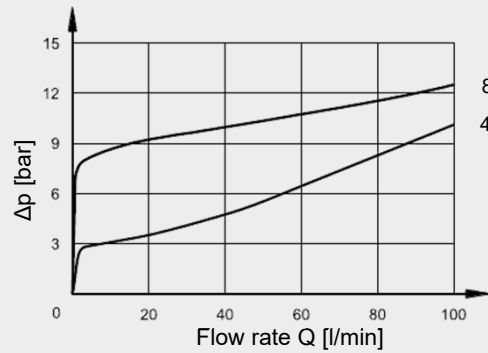


3-way pressure compensator

Flow pressure  $Q = f(p)$

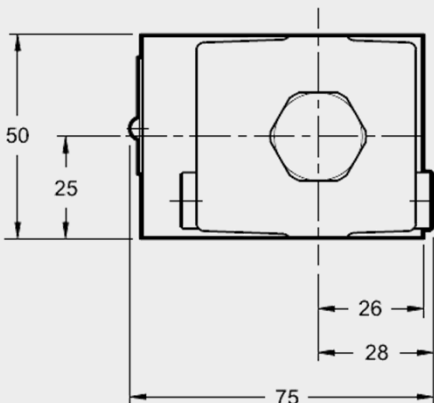
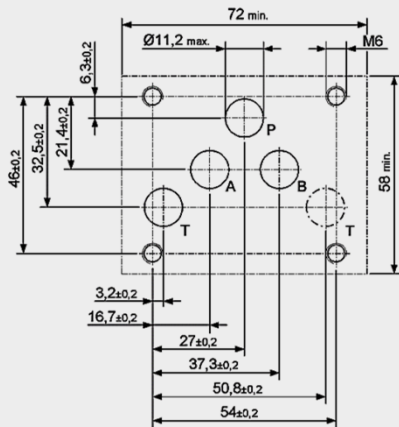


Pressure drop  $\Delta p = f(Q)$

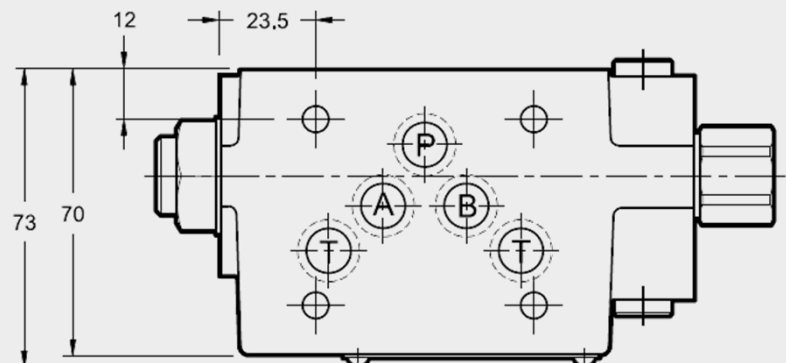
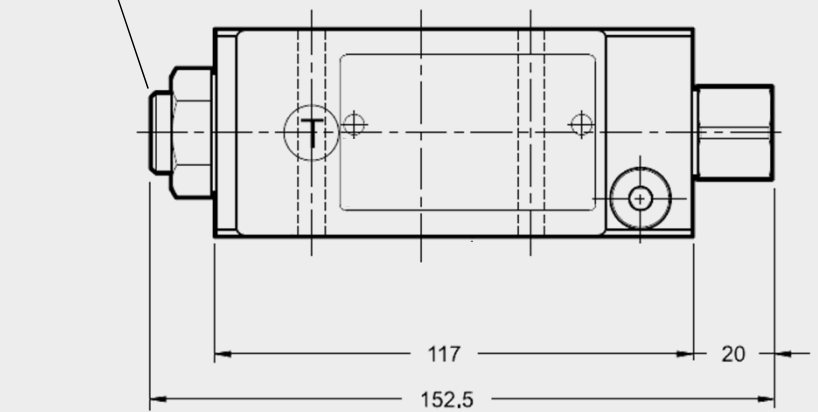


## DIMENSIONS

Interface to ISO 4401-05-04-0-05  
(Cetop 4.2-4-05-350)



Mounting nut 1/4" BSP



# NEEDLE VALVE IN SANDWICH PLATE DESIGN ZW – SDR10



## SUPPLEMENTARY TECHNICAL DATA

### General specifications

Weight	[kg]	2.3
		2.5 (symbol AAB and ZAB only)

### Hydraulic specifications

Cracking pressure check valve	[bar]	0.5
Flow rate	[l/min]	120

## MODEL CODE

**ZW-SDR 10 - D01 - AAB - K - N**

### Type

Needle valve in sandwich plate design

### Nominal size

10

### Series

D01 = specified by manufacturer

### Spool symbol

AAB = meter-out in port A and B  
 AA = meter-out in port A  
 AB = meter-out in port B  
 ZAB = meter-in in port A and B  
 ZA = meter-in in port A  
 ZB = meter-in in port B

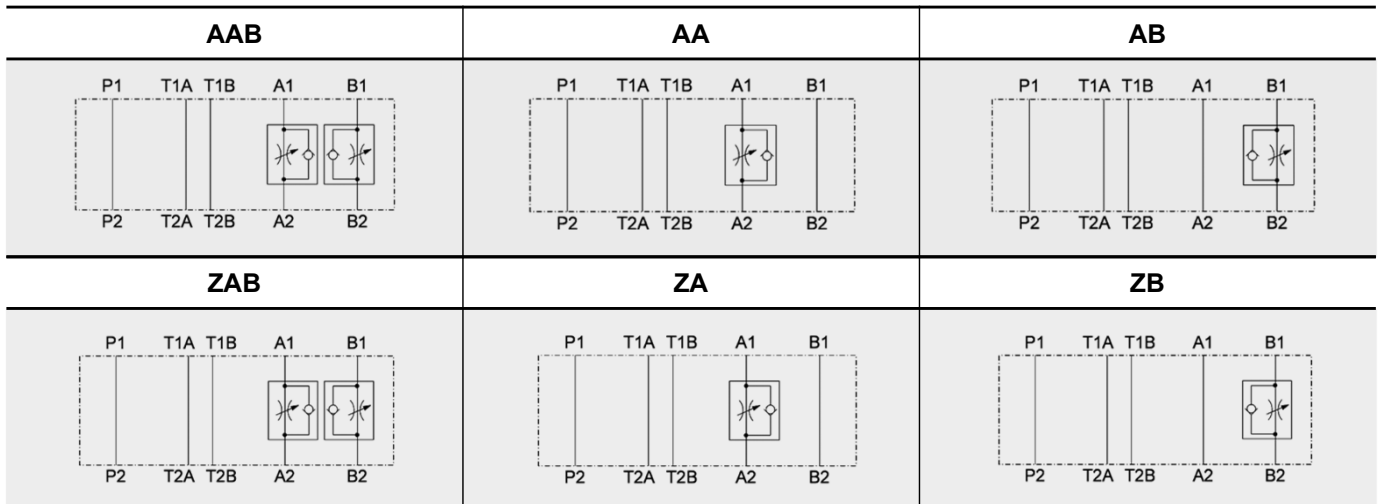
### Type of adjustment

not specified = adjustment screw (standard)  
 K = adjustment knob (optional)

### Sealing material

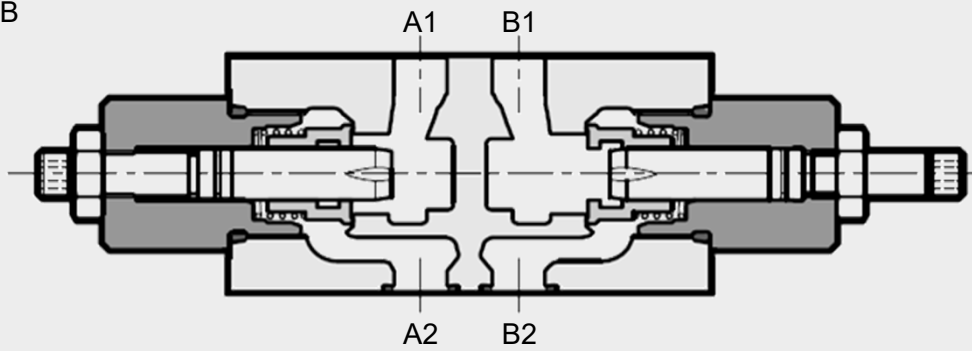
N = NBR  
 V = FKM (standard)

## SPOOL TYPES / SYMBOLS



## SECTION VIEW

Example AAB



## FUNCTION

The needle valve in sandwich plate design in nominal size 10 is used to control a flow rate in flow direction.

In the reverse direction there is free flow through the valve if the cracking pressure is exceeded. The valve opens when the inlet pressure at the check valve is higher than the outlet pressure including the pressure spring force.

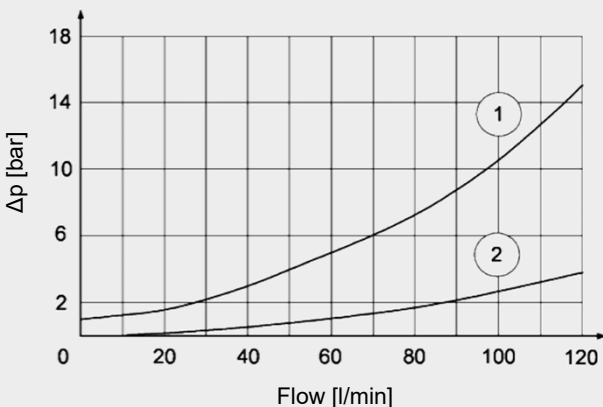
The throttling of the flow rate depends on the version:

- flow from consumer to directional valve in port A and/ or B
- flow from consumer valve to actuator in port A and/ or B

## PERFORMANCE

measured at  $v = 36 \text{ mm}^2/\text{s}$  and  $T_{\text{oil}} = 50^\circ\text{C}$

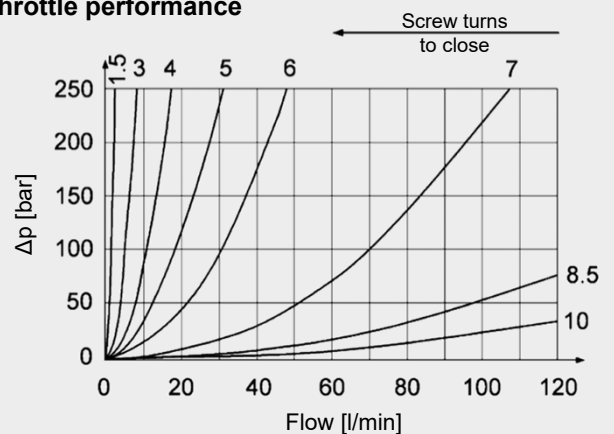
### Pressure drop without throttle function



① Pressure drop through the check valve.

② Pressure drop through free ports.

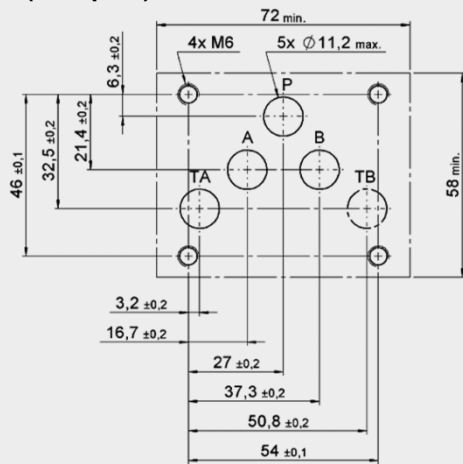
### Throttle performance



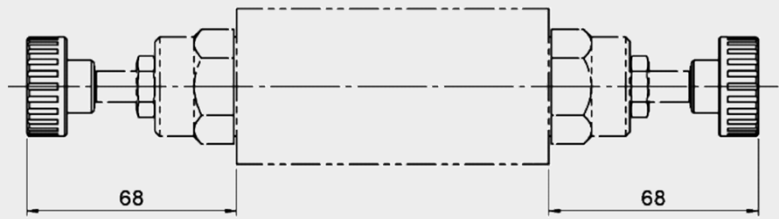
Pressure drop depending on flow and screw turns.

# DIMENSIONS

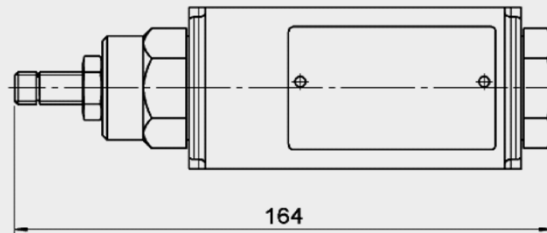
Interface to ISO 4401-05-04-0-05  
(Cetop 05)



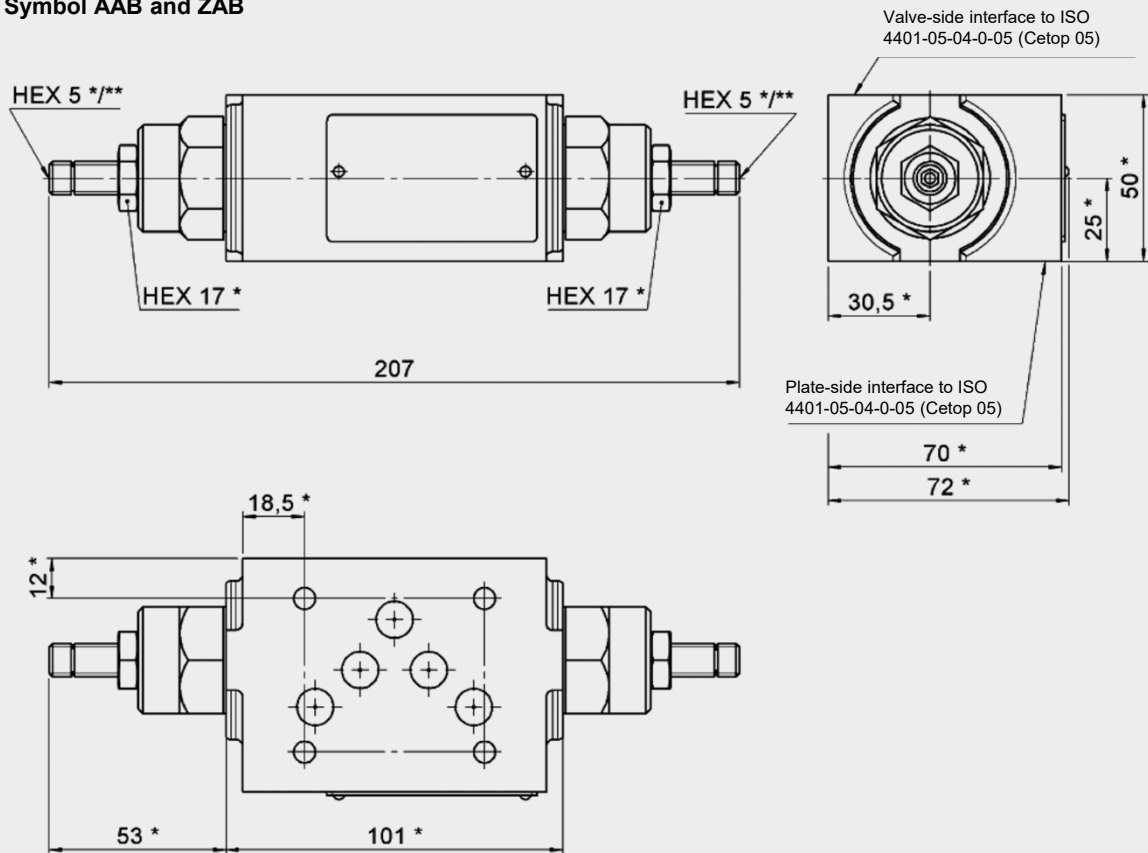
Optional with adjustment type K (adjustment knob)  
(Roate anticlockwise to increase flow)



Symbol AA, AB, ZA and ZB



Symbol AAB and ZAB



\* for all symbols  
\*\* adjustment screw HEX 5 (standard)  
(Roate anticlockwise to increase flow)

# CHECK VALVE PILOT-TO-OPEN IN SANDWICH PLATE DESIGN ZW – RP10



## SUPPLEMENTARY TECHNICAL DATA

General specifications		
Weight	[kg]	1.9
		2.2 (symbol AAB only)
Hydraulic specifications		
Cracking pressure check valve	[bar]	2
Flow rate	[l/min]	120
Pilot ratio		2,3:1

## MODEL CODE

**ZW-RP 10 - D01 - AA - N**

### Type

Check valve, pilot-to-open in sandwich plate design

### Nominal size

10

### Series

D01 = specified by manufacturer

### Spool symbol

AA = meter-out in port A

AB = meter-out in port B

AAB = meter-out in port A and B

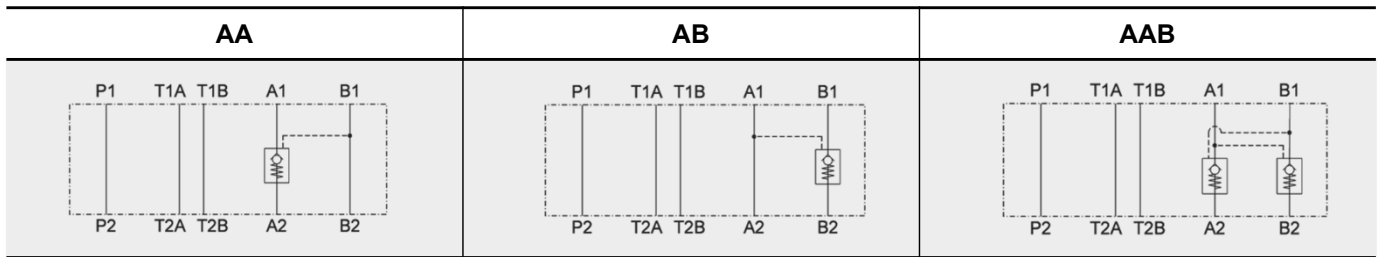
### Sealing material

N = NBR

V = FKM (standard)

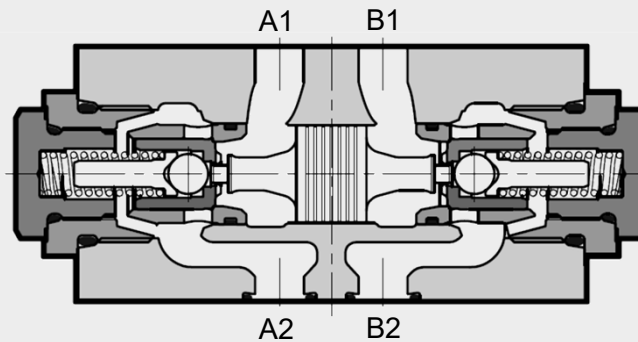


## SPOOL TYPES / SYMBOLS



### SECTION VIEW

Example AAB



### FUNCTION

The check valve, pilot-to-open in sandwich plate design in nominal size 10 is a direct-acting, spring-loaded poppet valve. It releases flow from the directional valve to the consumer and blocks flow from the consumer to the directional valve. To achieve this, the valve poppet is pressed into the seat and blocks the flow. If sufficiently high pilot pressure is built up in the relevant pilot port, the valve is unblocked and flow passes from the consumer to the directional valve. The required pilot pressure is based on the pressure difference between the ports to be unblocked.

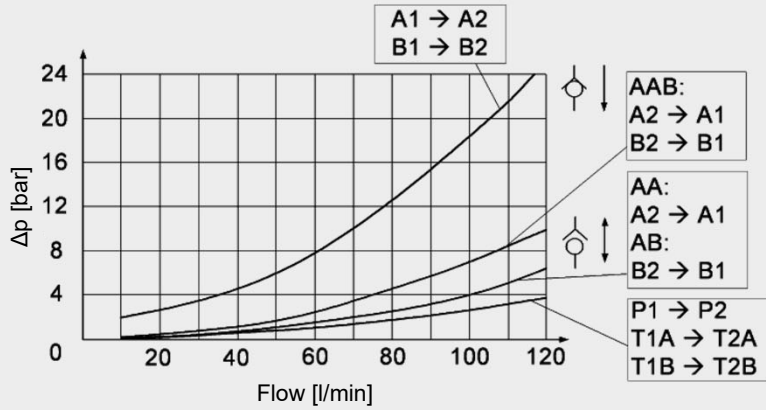
### Hint

A pressure in the port of the directional valve influences the required control pressure.

# PERFORMANCE

measured at  $v = 32 \text{ mm}^2/\text{s}$  and  $T_{oil} = 50^\circ\text{C}$

## Pressure drop



Use the following formula to calculate the min. required pilot pressure in port B:

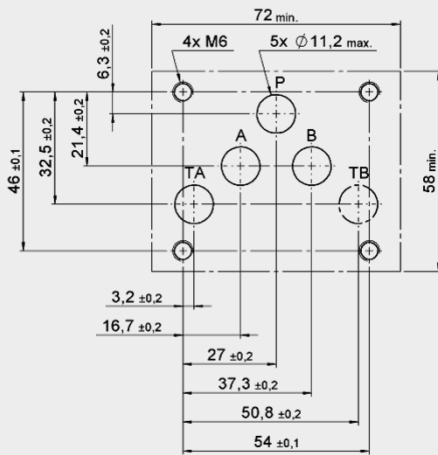
$$p_{control} = \frac{p_{A2} - p_{A1}}{\phi} + p_{A1}$$

Use the following formula to calculate the min. required pilot pressure in port A:

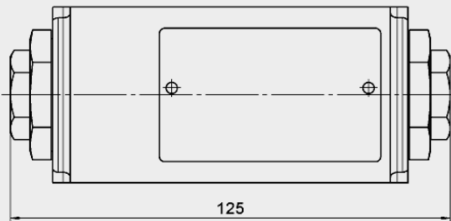
$$p_{control} = \frac{p_{B2} - p_{B1}}{\phi} + p_{B1}$$

## DIMENSIONS

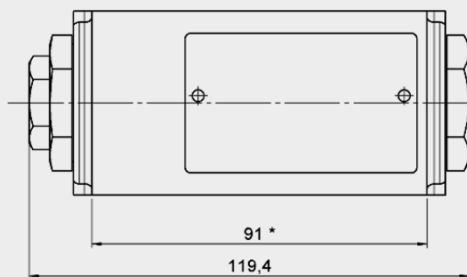
Interface to ISO 4401-05-04-0-05  
(Cetop 05)



Symbol AAB



Symbol AA and AB



Valve-side Interface to ISO 4401-05-04-0-05 (Cetop 05)

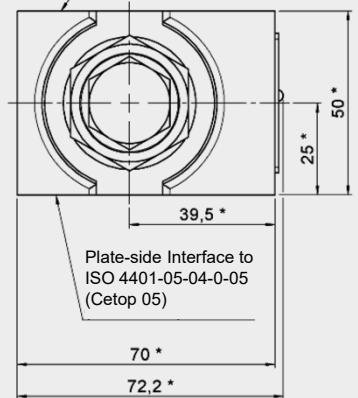
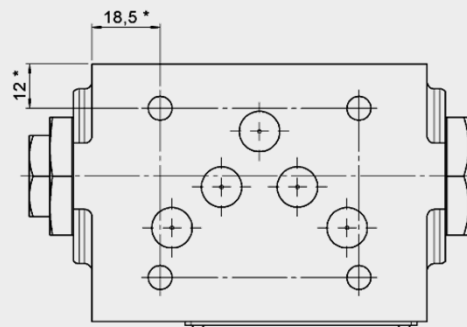


Plate-side Interface to ISO 4401-05-04-0-05 (Cetop 05)

\*even for symbol AAB



# CHECK VALVE IN SANDWICH PLATE DESIGN ZW – RV10



## SUPPLEMENTARY TECHNICAL

### General specifications

Weight [kg] 2.3

### Hydraulic specifications

Cracking pressure [bar] 0.5 bis 8  
check valve

Flow rate [l/min] 100

## MODEL CODE

**ZW-RV 10 - D01 - A 0,4 - N**

### Type

Check valve in sandwich plate design

### Nominal size

10

### Series

D01 = specified by manufacturer

### Spool symbol

A = check valve in port A  
B = check valve in port B  
P = check valve in port P  
T = check valve in port T

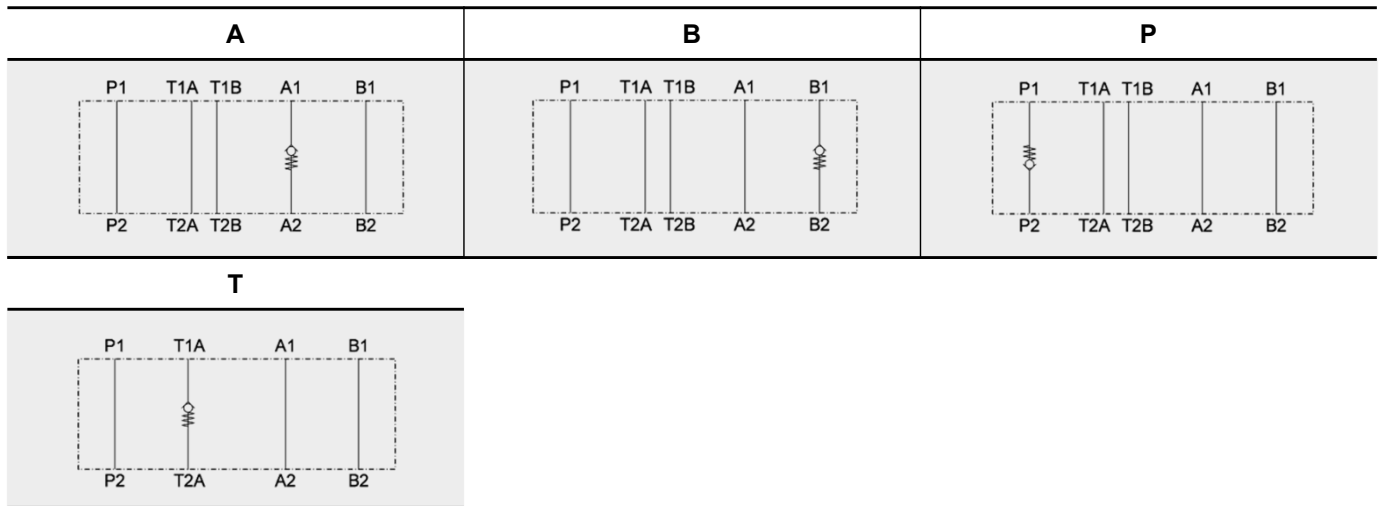
### Cracking pressure

0,4 = 0,4 bar  
Other cracking pressures on request

### Sealing material

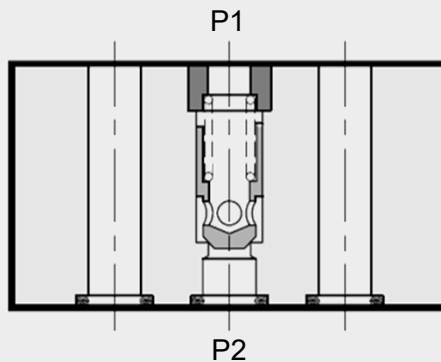
N = NBR  
V = FKM (standard)

## SPOOL TYPES / SYMBOLS



## SECTIONS VIEW

Example P



## FUNCTION

The check valve in sandwich plate design in nominal size 10 is a direct-acting, spring-loaded poppet valve. It releases the flow in one direction after exceeding the pilot spring force and blocks it in the opposite direction. To achieve this, the valve poppet is pressed into the seat and blocks the flow.

- flow blocked in port A from consumer to directional valve → A
- flow blocked in port B from consumer to directional valve → B
- return flow blocked to fluid power supply → P
- preload of meter-out to tank → T

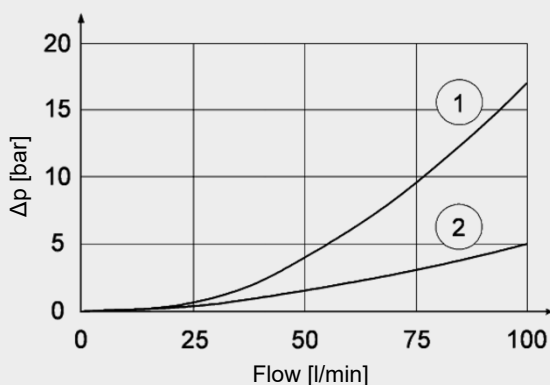
## Hint

Spring-side pressures at the check element add to its cracking pressure.

## PERFORMANCE

measured at  $v = 36 \text{ mm}^2/\text{s}$  and  $T_{\text{oil}} = 50^\circ\text{C}$

### Pressure drop



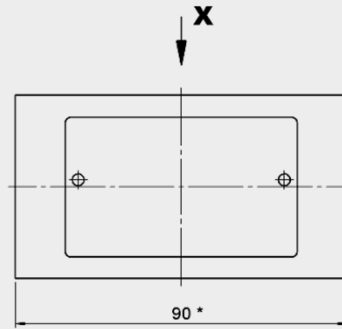
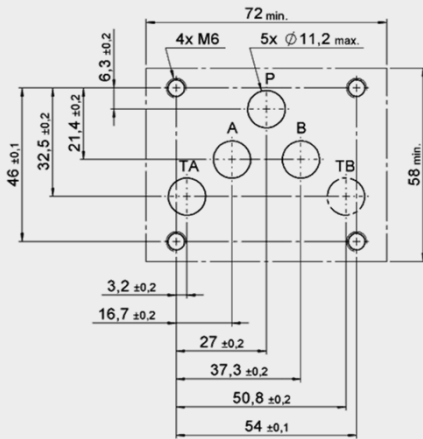
- ① Pressure drop through open check valve  $P2 \rightarrow P1$ ,  $T1A \rightarrow T2A$  and  $T1B \rightarrow T2B$

Hint: The cracking pressure of the check valve must be added to curve 1.

- ② Pressure drop through free ports (eg.  $A1 \rightarrow A2$ )

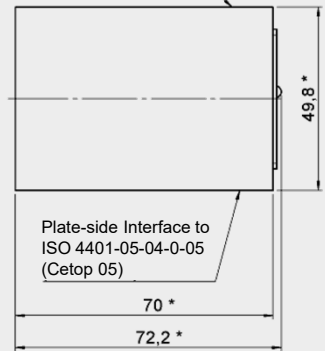
# DIMENSIONS

## Interface to ISO 4401-05-04-0-05 (Cetop 05)

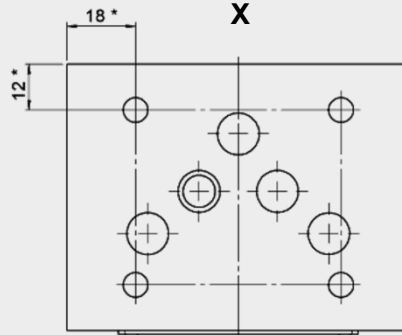


\* for all symbols

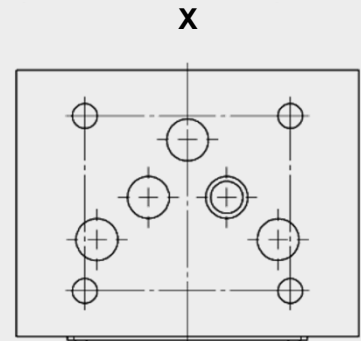
Valve-side Interface to ISO 4401-05-04-0-05 (Cetop 05)



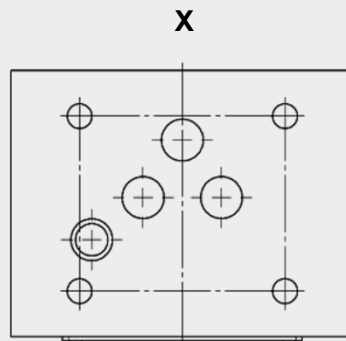
Symbol A



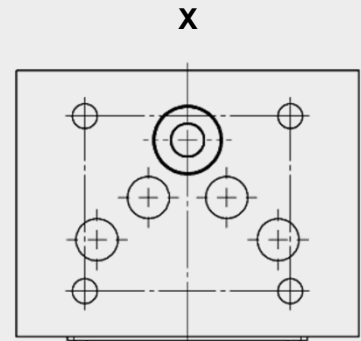
Symbol B



Symbol T



Symbol P



### Note

The information in this brochure relates to the operating conditions and applications described. For applications or operating conditions not described, please contact the relevant technical department. Subject to technical modifications.

## ACCESSORIES

	Designation	Part no.
Seal kits (5-part set)	12.42 x 1.78 80 Sh NBR	3492434
	12.42 x 1.78 80 Sh FKM	3492433

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