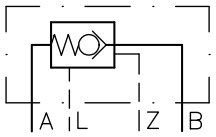
Hydraulically piloted check valves type HRP

with/without hydraulic pre-relief
manifold mounting

Operating pressure p_{max} = 700 bar
Flow Q_{max} = 400 lpm



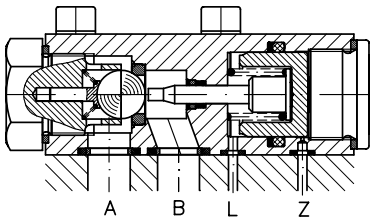
1. General information

These valves enable free flow in the one direction but prevent it in reverse direction when the hydraulic release is not actuated either via an external control line or internally via a directly mounted directional seated valve type G..(W..) 3-0 B 0,4 acc. to D 7300 or type WH 1 H(M) acc. to D 7470 A/1. The check valves feature a ball seated design, are made completely made of steel and are suited for mounting onto customer furnished manifolds.

Versions

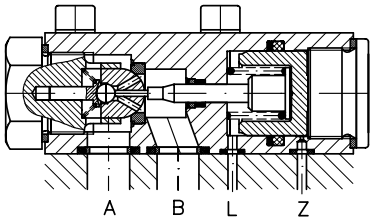
- Valves without hydraulic pre-relief,

  open the full flow cross section area rather quickly when released. They are suited for all standard operation conditions. A throttling section in the control port dampens the switching movement of the releasing piston, which effectively suppresses pressure surges in most cases. When pressure surges show up during initial operation they can be eliminated by installation of an additional orifice which will reduce the opening speed even more (see sect. 3.3).



- Valves with hydraulic pre-relief,

  are more suitable for high pressure and larger consumer volumes. A small ball type check valve located in the spherically ground main valve spool, opens up a small annular gap just prior to the main passage is opened, thereby acting like a throttle enabling a bumpless decompression. The effectiveness of this pre-relief i.e. the smoothness of the decompression depends directly on the open-up speed of the control piston. There is a slight leakage between control port Z and leakage port L, because of the missing control piston sealing at type HRP7V. An additional orifice (see sect. 3.3) installed in the control line may be found advantageous in some cases.



Application

- Blockage of zero-leakage cylinders when used together with leakage prone directional spool valves
- Return flow relief for directional valves during retraction of double acting cylinders
- 2/2-way directional seated valve with hydraulic actuation

2. Available versions, main data

Order examples:

HRP 2 - B 0,4

Optional orifice in the control port Z (see sect. 3.2)

HRP 7V - X

Table 3: Additional control port X, G 1/4 DIN ISO 228/1 (BSPP) (HRP 7V.. only!)

Type HRP 7V:	without port X
HRP 7V - **X:**	with blanking plate and tapped plug
HRP 7V **-** GZ 3-1 B 0,6 - G 24:	port X not plugged

HRP 4V - WG 3-0 B 0,4 - WG 230

Table 2: Optional 3/2-way directional seated valve, directly mounted

For mounting at	HRP shows free flow, while the	3/2-way directional seated valve acc. to D 7300 (Standard, with plug (For other versions, see the corresponding pamphlets))	3/2-way directional seated valve acc. to D 7470 A/1 [1]	Nom. voltage U_N
HRP 4(V) HRP 5(V)	solenoid valve is energized	**G 3-0 B 0,4 - G 24**	**WH 1H B 0,4 - G 24**	24V DC
		WG 3-0 B 0,4 - WG 230	**WH 1H B 0,4 - WG 230**	230V AC 50/60 Hz
HRP 7V		**G 3-1 B 0,6 - G 24**	---	24V DC
		WG 3-1 B 0,6 - WG 230	---	230V AC 50/60 Hz
HRP 4(V) HRP 5(V)	solenoid valve is de-energized	**GZ 3-0 B 0,4 - G 24**	**WH 1M B 0,4 - G 24**	24V DC
		WGZ 3-0 B 0,4 - WG 230	**WH 1M B 0,4 - WG 230**	230V AC 50/60 Hz
HRP 7V		**GZ 3-1 B 0,6 - G 24**	---	24V DC
		WGZ 3-1 B 0,6 - WG 230	---	230V AC 50/60 Hz
HRP 7V - X	---	Blanking plate; Port X blocked with a tapped plug		

Table 1: Basic type, size

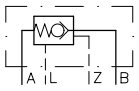
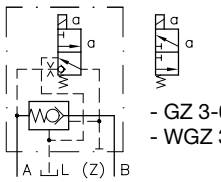
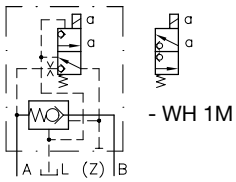
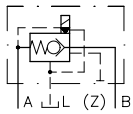
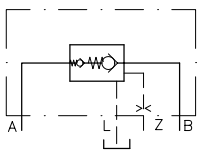
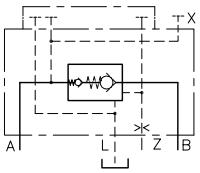
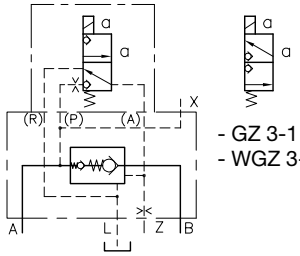
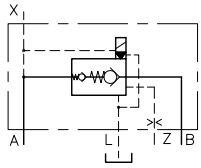
					Provision for optional mounting of a directional seated valve (table 2)		
Standard version		**HRP 1**	**HRP 2**	**HRP 3**	**HRP 4**	**HRP 5**	**---**
With pre-relief		**---**	**---**	**HRP 3V**	**HRP 4V**	**HRP 5V**	**HRP 7V(-X)**
Nom. size approx.		For dimensional drawings, see sect. 4 ++					
Flow Q_{max} approx.	(lpm)	20	35	50	80	140	400
Pressure p_{max} (bar) at port	A, B, Z	700	700	500	500 [3]	500 [3]	500
	L	depressurized to the tank					
Control oil volume	(cm^3)	0.2	0.4	0.5	1.3	2.5	13.8
Mass (weight) approx.	(kg)	0.3	0.4	0.7	1.2 [2]	1.9 [2]	7.9 [2]

[1] Type WN 1H B 0,4.. or WN 1M B 0,4.. may be used also for operating pressure below 320 bar

[2] With directional seated valve:
G 3-0 B 0,4-.. = 0.4 kg
WG 3-0 B 0,4-.. = 0.4 kg
G 3-1 B 0,6-.. = 0.7 kg
WG 3-1B 0,6-.. = 0.7 kg
WH 1H B 0,4-.. = 0.6 kg
WH 1M B 0,4-.. = 0.6 kg

[3] p_{max} = 450 bar with directly mounted valve type WH 1

Table 4: Flow pattern symbols

Basic type	Version with directly mounted 3/2-way directional seated valve
HRP 1, HRP 2 HRP 3(V) HRP 4(V) HRP 5(V) 	HRP 4(5) (V) - G(WG) 3-0 B 0,4 -..  - GZ 3-0 - WGZ 3-0 HRP .. - WH 1H B 0,4 -..  - WH 1M Simplified illustration (for circuit diagrams) 
HRP 7V  HRP 7V - X 	HRP 7V - G(WG) 3-1 B 0,6 -..  - GZ 3-1 - WGZ 3-1 Simplified illustration (for circuit diagrams) 

3. Additional parameters

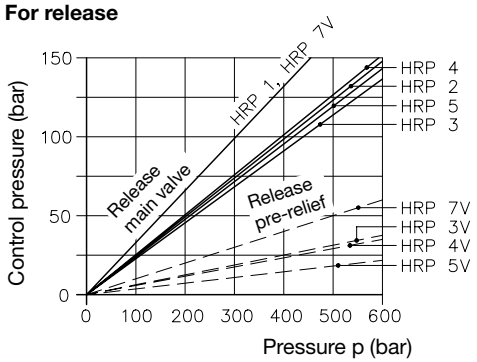
3.1 General and hydraulic

Design	Spring loaded ball seated valve, zero leakage
Pipe connection	Via customer furnished manifold
Ports	A, B = Consumer (main passage) Z = Control port L = Leakage port (piston cavity relief)
Hydraulic fluid	Hydraulic oil acc. to DIN 51524 table 1 to 3; ISO VG 10 to 68 acc. to DIN 51519 Viscosity range: min. approx. 4; max. approx. 1500 mm²/sec Optimal operation range: approx. 10 ... 500 mm²/sec Also suitable are biologically degradable pressure fluids type HEPG (Polyalkylenglykol) and HEES (synth. ester) at operation temperatures up to approx. +70°C.
Temperature	Ambient: approx. -40 ... +80°C Fluid: -25 ... +80°C, pay attention to the viscosity range! Start temperature down to -40°C are allowable (Pay attention to the viscosity range during start!), as long as the operation temperature during subsequent running is at least 20K higher. Biological degradable pressure fluids: Pay attention to manufacturer's information. With regard to the compatibility with sealing materials do not exceed +70°C. **Attention:** Observe the corresponding notes in pamphlets D 7300 or D 7470 A/1, when a directional seated valve is mounted and the operating temperature exceeds 35°C!

Δp-Q-curves

Control pressure p_{contr} (bar) at port Z and P_B = 0 bar (pressure at port B)

For release



For maintaining the valve open

p_{contr} = a Δp + b p_B + c

standing for

Δp = Back pressure (bar) A→B acc. to the Δp-Q-curve (below)

p_B = Pressure (bar) at port B

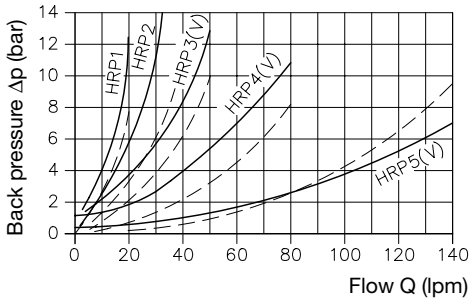
	HRP 1	HRP 2	HRP 3(V)	HRP 4(V)	HRP 5(V)	HRP 7V
a	0.235	0.22	0.21	0.235	0.22	0.32
b	0.03	0.03	0.11	0.07	0.05	0.04
c	4.8	3.7	3.7	3.0	3.7	3.2

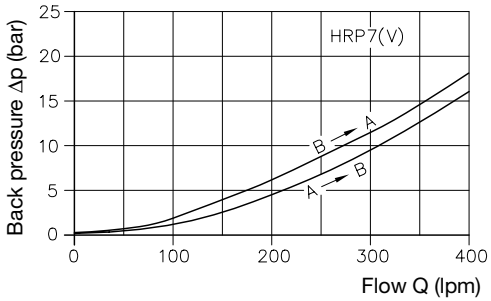
Hydraulically released

——— B → A

– – – – – A → B

Oil viscosity during the measurement 60 mm²/s

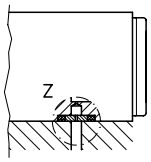


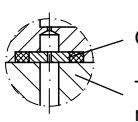


3.2 Orifice inserts at control port Z

Orifice inserts are used to prevent decompression surges (see also sect. 1). It should be kept in mind that a too pronounced damping might cause a prolonged closing time. The optimum orifice diameter can be only found by tests.

Order example: HRP 2 **- B 0,4**





Orifice insert

The manifold is not available at HAWE!

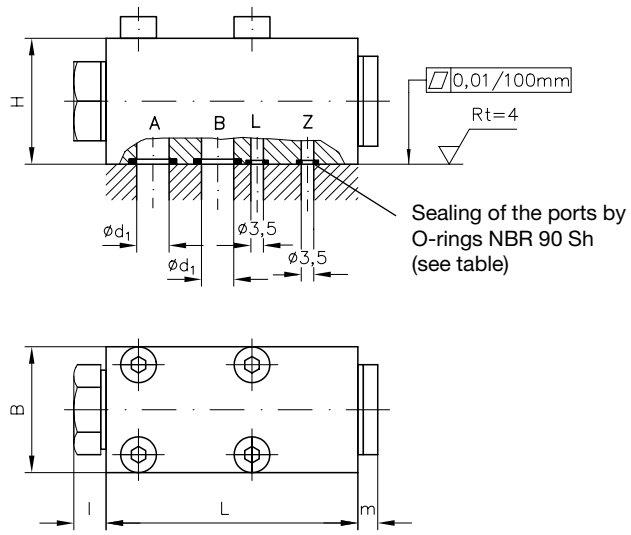
HRP 1 ... 5			HRP 7		
Order No. of orifice insert	∅ (mm)	Coding	Type of orifice insert	∅ (mm)	Coding
B 5585 038	0.4	**B 0,4**	EB 1-0,4	0.4	**B 0,4**
B 5585 037	0.6	**B 0,6**	EB 1-0,6	0.6	**B 0,6**
B 5585 034	0.8	**B 0,8**	EB 1-0,8	0.8	**B 0,8**

4. Unit dimensions

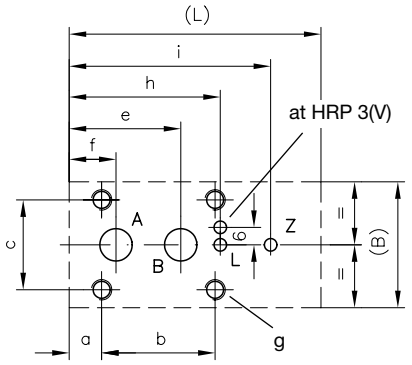
All dimensions in mm, subject to change without notice!

4.1 Basic version

Type HRP 1, HRP 2
HRP 3(V), HRP 4(V), HRP 5(V)

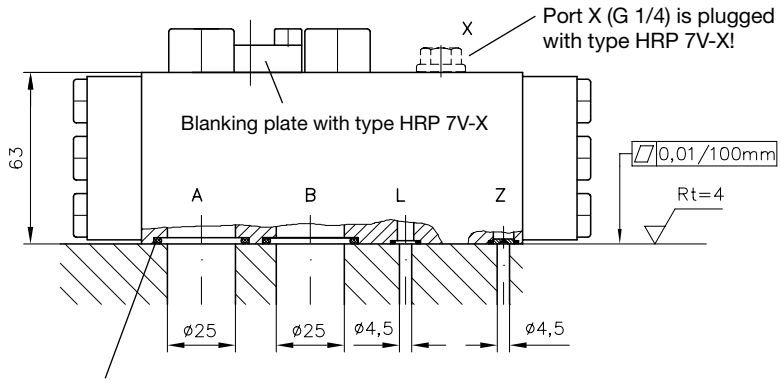


Hole pattern of the manifold (top view)



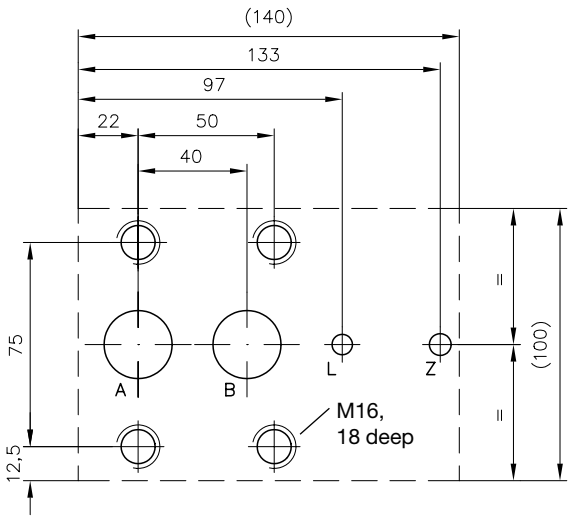
Type	L	B	H	a	b	c	f	e	h	i	l	m	d1	g	Max. torque (Nm)	Sealing by O-rings A and B	L and Z
HRP 1	62	25	20	5.5	26	18	10	21	36	50	9	3.5	5	M4, 5 deep	2.6	6.07x1.78	
HRP 2	65	30	25	7	24	22	12.5	26	38.5	52	9	4	6.5	M5, 5 deep	5	7.65x1.78	
HRP 3(V)	70	35	35	9	26	25	13	31	42	56	9	4	9	M6, 10 deep	9	9.2x2.62	4.47x1.78
HRP 4(V)	88	50	35	7	48	38	17	37	53	71	10.5	5	11	M8, 10 deep	22	12.37x2.62	
HRP 5(V)	102	60	40	10	48	42	21	44	62	85	13.5	5	14	M8, 10 deep	22	15.55x2.62	

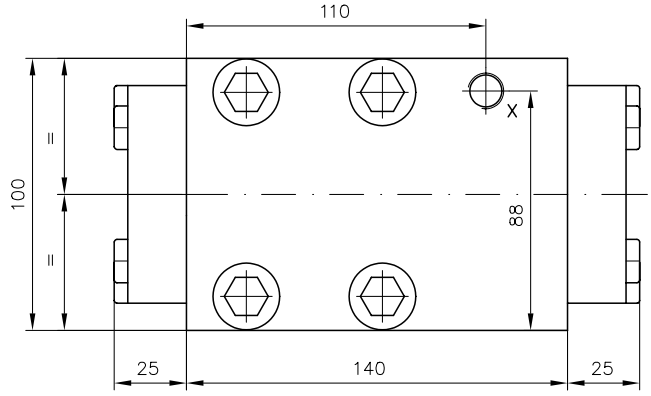
Type HRP 7V
HRP 7V-X



Sealing of the ports by O-rings:
A and B = O-ring 29.2x3 NBR 90 Sh
L and Z = O-ring 8x1.5 NBR 90 Sh

Hole pattern of the manifold (top view)

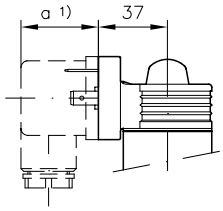




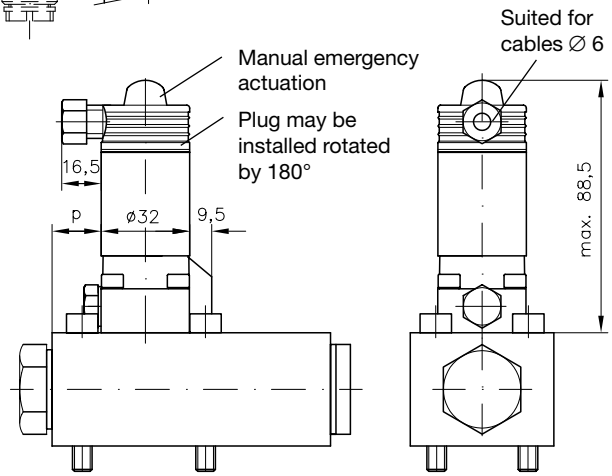
4.2 Version with 3/2-way directional seated valve

Type HRP 4(V) - G(WG)...-0 B 0,4 - G(WG) ...
HRP 5(V) - G(WG)...-0 B 0,4 - G(WG) ...

For missing dimensions of the directional seated valve (size 0), see D 7300 !



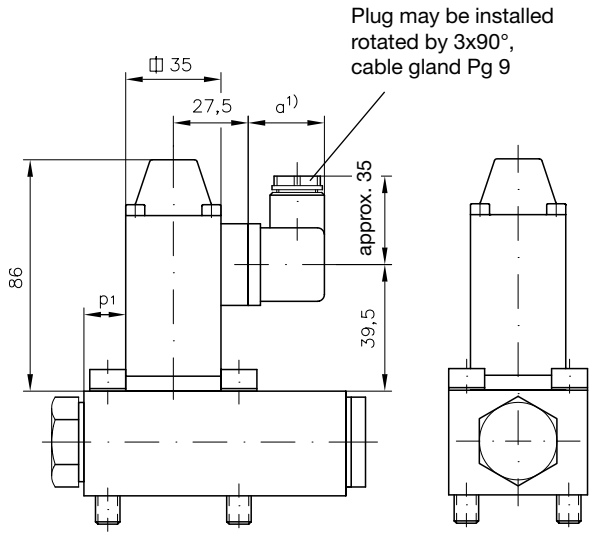
Version with plug adapter



Type	p
HRP 4(V)-G(WG)..	14.5
HRP 5(V)-G(WG)..	17

Type HRP 4(V) - WH 1H(M) - G(WG)...
HRP 5(V) - WH 1H(M) - G(WG)...

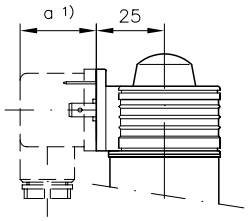
For missing dimensions of the directional seated valve type WH 1 see D 7470 A/1!



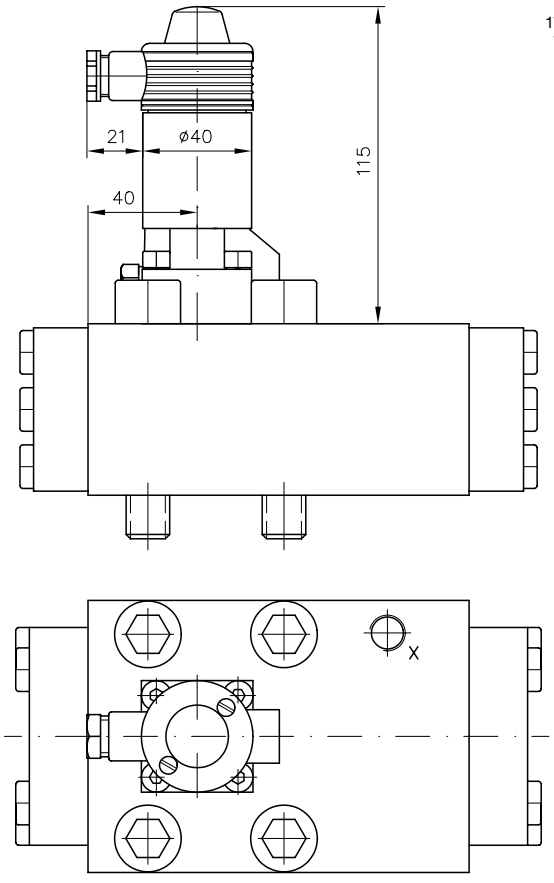
Type	p1
HRP 4(V)-WH 1..	13.5
HRP 5(V)-WH 1..	17

Type HRP 7V - G(Z) 3-1 B 0,6 - G ...
HRP 7V - WG(Z) 3-1 B 0,6 - WG ...

For missing dimensions of the directional seated valve (size 1), see D 7300 !



Version with plug adapter



1) This dimension depends on the manufacturer and may be max. 40 mm (conf. DIN 43650)

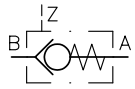
Coding	a
G..	29
WG..	34
L..	40

Hydraulic pilot operated check valves type RH

with central, favourable-flow design

Pressure p_{max} = 700 bar
Flow Q_{max} = 160 lpm

Symbol



1. General

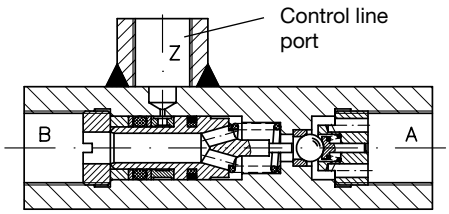
These devices belong to the category of stop valves according to DIN ISO 1219-1, with blocked flow A → B, and free flow B → A . The blocked flow direction A → B can be re-opened by a hydraulic control system.

Application:

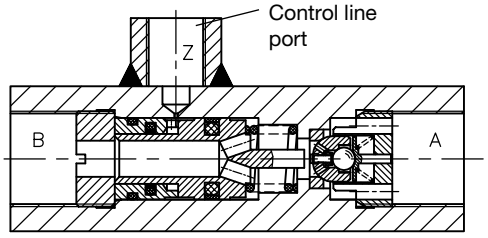
- Shutting off zero leakage hydraulic cylinders, when used together with directional spool valves (design related leakage)
- Return flow aid, when the return flow of cylinders with uneven area ratio exceeds the perm. flow rate of the connected directional valve.
- Hydraulically-actuated drain or circulation valve

These valves are available both with and without hydraulic pre-relief

The designs without pre-relief have a ball as valve element, which relatively quickly clears the full flow cross section area after deblocking. These valves are suited for most standard applications. An orifice in the control ports dampens the progression movement of the deblocking piston, adequately suppressing pressure surges (decompression shocks). If, despite this, such surges do occur during the test run, the use of a control line wound onto the throttle coil will provide such additional damping as may be necessary.



Designs with pre-relief are fitted with a spherically-ground valve piston instead of the ball (performing the function of a seated valve), plus a small, integrated ball check valve. When deblocking takes place, this ball check valve is forced up even before the valve piston opens, and clears an orifice area to provide surge-free decompression of the consumer volume. These valves are used mostly for high pressure and large consumer volume applications. The pre-relief effect is more effective, i.e. gentler, the lower the opening speed of the control piston becomes. This is achieved in this case too, as required, by means of a control line designed as a throttle coil. For further details, see section 3.1. (Maintaining the pressure).



HAWE HYDRAULIK GMBH & CO. KG
STREITFELDSTR. 25 • 81673 MÜNCHEN

2. Types available, characteristic data

Coding, main data

Basic type	with pre-relief	Pressure p_{max} (bar)	Flow Q_{max} aprox. (lpm)	Control volumes approx. (cm^3)	Ports DIN ISO 228/1 (BSPP) A, B	Ports DIN ISO 228/1 (BSPP) Z	Mass (weight) approx. (kg)
RH 1	**---**	700	15	0.15	G 1/4	G 1/4	0.4
RH 2	**---**		35	0.22	G 3/8		0.4
RH 3	**RH 3 V**	500	55	0.4	G 1/2		0.6
RH 4	**RH 4 V**		100	1	G 3/4		1.3
RH 5	**RH 5 V**		160	1.8	G 1		1.8

Design: Spring-loaded ball seated valve, zero leakage

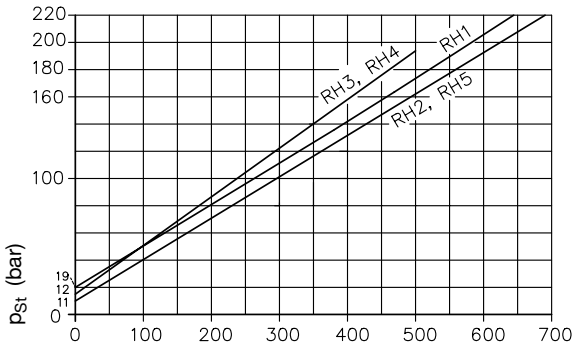
Mounting: Any, in the pipe work

Installed position: Any

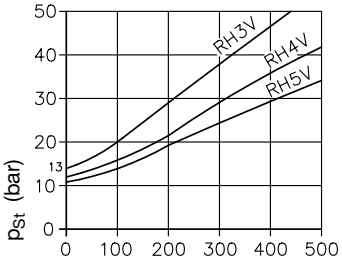
Surface coating: zinc galvanized

Control pressure p_{St} (bar)

For deblocking (p_B = 0 bar)



For deblocking the pre-relief



p_A (bar) Pressure at connection A →

to hold open: $p_{St} = p_B + \Delta p + k$

p_B (bar) = Pressure on side B

Δp (bar) = Back pressure A → B according to Δp-Q curve

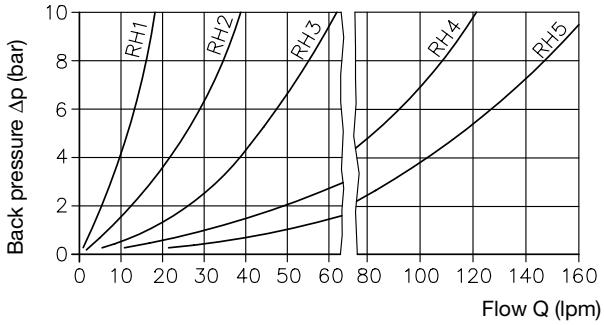
= 10 at RH 1 and RH 2
7 at RH 3(V)
8 at RH 4(V) and RH 5(V)

Pressure fluid: Hydraulic oil conforming DIN 51514 part 1 to 3: ISO VG 10 to 68 conforming DIN 51519.
Viscosity limits: min. approx. 4, max. approx. 1500 mm^2/s;
opt. operation approx. 10... 500 mm^2/s.
Also suitable are biologically degradable pressure fluids types HEPG (Polyalkylenglycol) and HEES (Synth. Ester) at service temperatures up to approx. +70 °C.

Temperature: Ambient: approx. -40 ... +80 °C
Fluid: -25 ... +80°C, Note the viscosity range !
Permissible temperature during start: -40°C (observe start-viscosity!), as long as the service temperature is at least 20K higher for the following operation.
Biologically degradable pressure fluids: Observe manufacturer's specifications. By consideration of the compatibility with seal material not over +70 °C.

Δp-Q curves: Apply to flow direction B → A and deblocked direction A → B
Opening pressure B → A 0.2 ... 0.3 bar

Oil viscosity during measurement 60mm^2/s

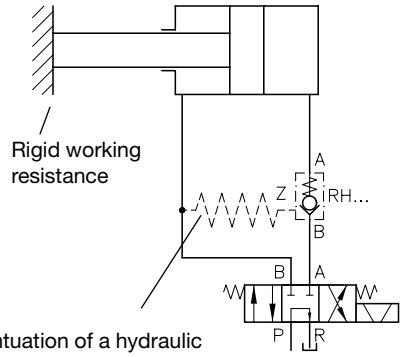


With viscosities exceeding approx. 500 mm^2/s, a greater Δp rise must be taken into account with the smaller types (RH 1...RH3).

3. Function modes

- **Maintaining the pressure**

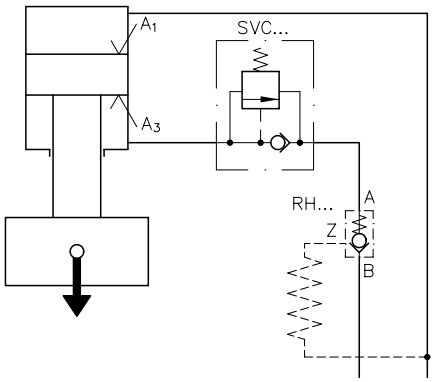
Preventing a pressure loss at the pressurized cylinder side when directional spool valves with design related leakage are used. To avoid decompression shock, which can occur in particular with large pressurized oil volumes if deblocking takes place suddenly, an orifice is provided in the control port. If this throttling effect is inadequate due to special operating conditions, then a suitable large control line wound onto the throttle coil can be used to reduce the decompression shock. The primary hydraulic pre-relief on types RH. . .V only takes effect if the control line is designed as described in the form of a throttle coil, and is thus capable of slowing down the switching speed sufficiently.



Control line attentuation of a hydraulic throttle coil
(2.. .4m hydraulic pipe 6 x 1.5 or 6 x 2)

- **Holding raised loads**

In cases involving upright cylinders or cylinders hanging downwards in particular, the weight of the load may cause a piston speed equal to or greater than that determined by the pump delivery flow. The effect of this may be that the control pressure required to keep the system open, as shown in sect. 2.1, cannot be built up. The result of this is valve flutter due to periodic opening and closing. Depending on the load conditions, this can be remedied by exploiting the dampening effect of the control line (as shown in sect. 3.1) or by braking the load by means of a sequence valve (e.g. type SVC...to pamphlet 7000/1) or a throttle valve (type RD to pamphlet 2570). See also pamphlet 7100 for special load retention valves. Caution: There is a risk that, with cylinders working down wards, in certain circumstances pressure rises may occur on the load side which exceed the load pressure until the stop valve actuates. The reason for this is that the control pressure adds to the load side pressure in a ratio A1/A3. If necessary, our Technical Department should be consulted for recommendations aimed at avoiding this.

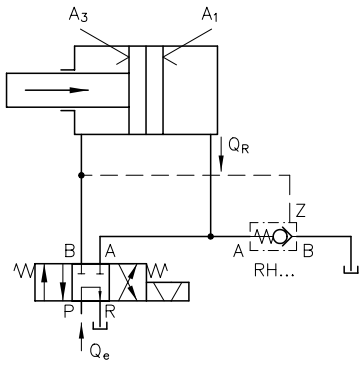


- **Return relief**

This is used if the return flow $Q_R = Q_e \frac{A_1}{A_3}$

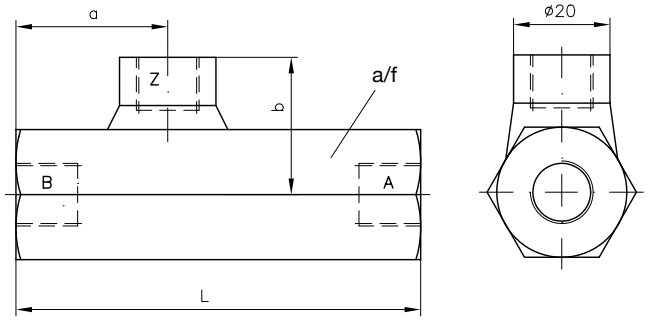
the directional valve becomes too great when the piston moves in.

The most favourable dimension for the stop valve is determined by taking the flow resistance value Δp for A $\rightarrow$ R from the directional valve data sheet, which would occar at Q_e. Then look for the Δp-Q-characteristic for the RH valve on the reverse side of the page which most closely approximates the Δp value (A $\rightarrow$ B) already found at the flow rate Q_R - Q_e.



---

4. Unit dimensions



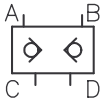
Type	Ports DIN ISO 228/1 (BSPP)					
	A, B	Z	L	a	b	a/f
RH 1	G 1/4	G 1/4	84	31.5	27	24
RH 2	G 3/8		90	32	28.5	27
RH 3 (V)	G 1/2		100	36.5	31	32
RH 4 (V)	G 3/4		126	45	35.5	41
RH 5 (V)	G 1		143	52	38	46

All dimensions are in mm. Subject to change without notice !

Twin check valves with hydraulic release type DRH

for oil-hydraulic installations

Pressure p_{max} = 500 bar
Flow Q_{max} = 140 lpm



Symbols
(for basic version)

1. General

Twin check valves with hydraulic release (check valve) belong to that group of stop valves which stop the flow preferably in one direction and permit free flow in the opposite direction. This unit consist of two check valves for two separate flows where automatic closure is alternately offset by the feed pressure (DIN ISO 1219-1). They are used mainly to cut off (pressure retention) the operating positions or to fix the neutral position, with zero leakage, at double-acting, non-leaking consumers in conjunction with directional spool valves that show design related leakage.

- **Check valves**

  Used in all customary applications in which a consumer is controlled via a directional spool valve with a blocked or free pump through-flow or when several consumers are selectively actuated via directional spool valves in a parallel connection. Refer to the block diagram in section 5. To release the pressure blocked off at A or B, approximately 0.4 times the pressure is required on the other side.
  Models with integrated pressure limiting valves facilitate use in conjunction with hydraulic motors, pivoting or rotating cylinders (type DRHS resp. DRHCS with shock valves) or with miniature pressure limiting valves, making it possible to avoid slow pressure build-up, e.g. by expansion of volume with a rise in temperature (type DRH..SS).

- **Check valves with leakage port**

  For all application cases where several directional spool valves (internal leakage) are connected in series. If a downstream directional spool valve is actuated, all upstream valves are loaded with the system pressure of the actuated consumer in the P → R through-flow so that leakage oil slowly penetrates into the consumer connections and lines (see example sect. 5).
  The continuous drain of leakage oil via the separate leakage oil line prevents a gradual pressure build-up with uncontrollable release and possible drifting of the consumers. The leakage oil port is closed when the check valve is in the released position.

- **Check valves with pre-release**

  For all application cases, where the basic valve version cannot be released due to a unfavorable area ratio or load conditions at the hydraulic cylinder (rod side). Relieving the pre-release takes approx. 10% of the pressure on the opposing side.
  The pre-release can be single sided (type DRH..V) or on both sides (type DRH .. VV).

2. Available versions, main data

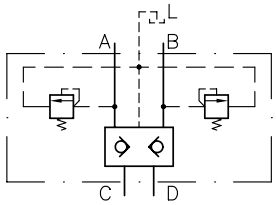
Order examples:
DRH 3 — Basic version (standard)
DRH 3 LSS - 250 — Valves with additional functions
DRHCS 2 - 30/100 — Desired pressure setting (bar); see also sect. 3 "Adjustable pressure ranges"
Pre-load pressure (bar)

Table 1:
Basis type, size, function

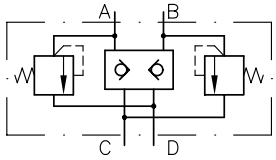
Basic version (tapped ports)	DRH 1	DRH 2	DRH 3	DRH 4	DRH 5
With shock valves (e.g. for hydraulic motors with additional sequence valves)	--	**DRHS 2** **DRHCS 2**	--	--	--
Safeguard for slow pressure build-up	--	--	**DRH 3 SS**	--	--
Manifold mounting	--	--	**DRH 3 P**	--	--
Additional leakage port, see sect. 1			**DRH 3 L** **DRH 3 LSS**	**DRH 4 L**	**DRH 5 L**
Version with pre-relief (one-sided A-C)	--	--	**DRH 3 V** **DRH 3 PV** **DRH 3 LV** **DRH 3 SSV-..** **DRH 3 LSSV-..**	**DRH 4 V** **DRH 4 LV**	**DRH 5 V** **DRH 5 LV**
Version with pre-relief (both sides A-C and B-D)	--	--	**DRH 3 VV** **DRH 3 PVV** **DRH 3 LVV** **DRH 3 SSVV-..** **DRH 3 LSSVV-..**	**DRH 4 VV** **DRH 4 LVV**	**DRH 5 VV** **DRH 5 LVV**
Flow Q_{max} (lpm)	16	30	60	90	140
Pressure	500	500	500	400	400

Symbols

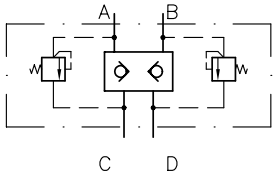
DRH 3 LSS-..



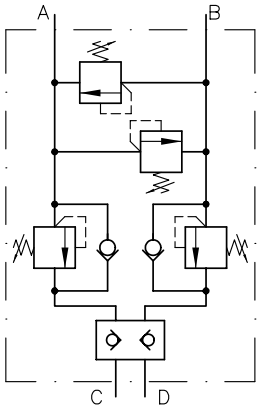
DRHS 2..



DRH 3 SS-..

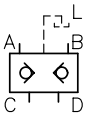


DRHCS 2

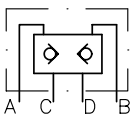


DRH 1(2...5)

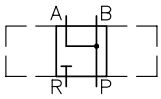
DRH 3(4, 5) L



DRH 3 P



Functioning for all designs: Check valve cannot be used in conjunction with directional control valves with the symbols of the differential circuit in any (arbitrary) switching position, e.g. with coding C, Y or B acc. to D 5650/1 etc.



3. Additional characteristic data

Design	spring-loaded ball-type seat valve	
Mounting	tapped hole (refer to dimensions of units)	
Installed position	optional	
Surface termination	Zinc galvanized	
Pressure medium	DRHS 2, DRHCS 2	DRH 3(L) SS
	20 ... 80 bar 80 ... 160 bar 160 ... 315 bar 315 ... 500 bar The pressure cited when ordering determines the spring installed and thus the pressure range	up to 500 bar, factory setting only
Pressure fluid	Hydraulic oil conforming DIN 51514 part 1 to 3: ISO VG 10 to 68 conforming DIN 51519. Viscosity limits: min. approx. 4, max. approx. 1500 mm^2/s; opt. operation approx. 10... 500 mm^2/s. Also suitable are biologically degradable pressure fluids types HEPG (Polyalkylenglycol) and HEES (Synth. Ester) at service temperatures up to approx. +70 °C.	
Temperature	Ambient: approx. -40 ... +80 °C Fluid: -25 ... +80°C, Note the viscosity range ! Permissible temperature during start: -40°C (observe start-viscosity!), as long as the service temperature is at least 20K higher for the following operation. Biologically degradable pressure fluids: Observe manufacturer's specifications. By consideration of the compatibility with seal material not over +70 °C.	

Mass (weight)

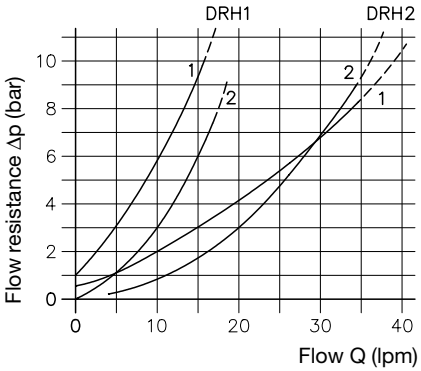
Type	DRH 1	DRH 2	DRHS 2	DRHCS	DRH 3...	DRH 4 (L)	DRH 5 (L)
approx. (kg)	0.5	1.2	1.5	1.8	1.6	2.9	5.5

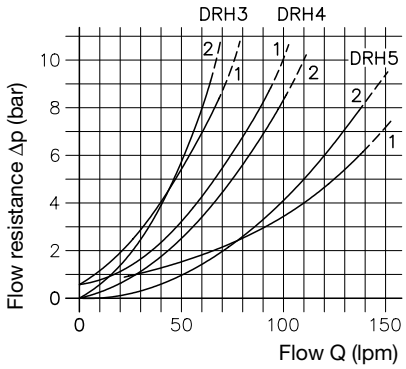
Δp-Q-curves

Curve 1: C → A
D → B

Curve 2: A → C
B → D
(released)

Viscosity during measurements approx. 60 mm²/s





Control pressure p_{St} (bar) on the feed side (recommended value)

to release:

p_{St} ≈ 0.4 $p_{A(B)}$ + 3

$p_{A(B)}$ Pressure (bar) on the closed side A or B

Pre-relief for release:

p_{StV} ≈ 0.1$p_{A(B)}$ +12

to open: [1]

p_{St} ≈ 0.5 $\Delta p_{A(B)}$ + $p_{C(D)}$ + k

$\Delta p_{A(B)}$ Flow resistance curve 2 at released connection A or B

$p_{C(D)}$ Pressure on the outflow side C or D

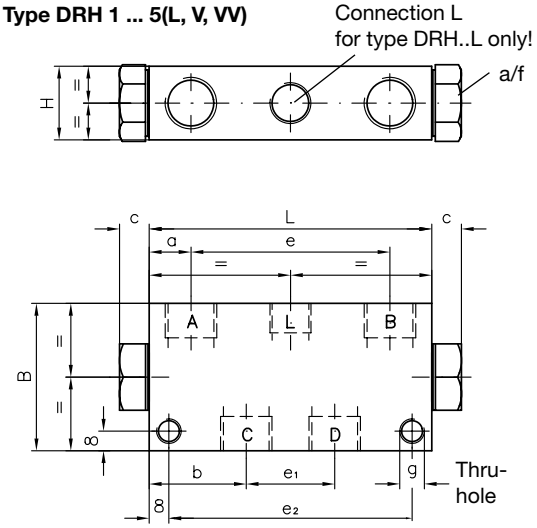
k ≈ 6 DRH 1 and DRH 2
4 DRH 3
3 DRH 4 and DRH 5

[1]) A dragging load in direction of the consumer movement might cause squealing of the check valve. This can be preventing by installing a restrictor check valve between check valve and consumer. Suitable for that purpose are type QR, QV acc .to D 7730 or type RD acc .to D 7540. Alternatively type DRHCS ... could be used.

4. Dimensions

All dimensions in mm, subject to change without notice!

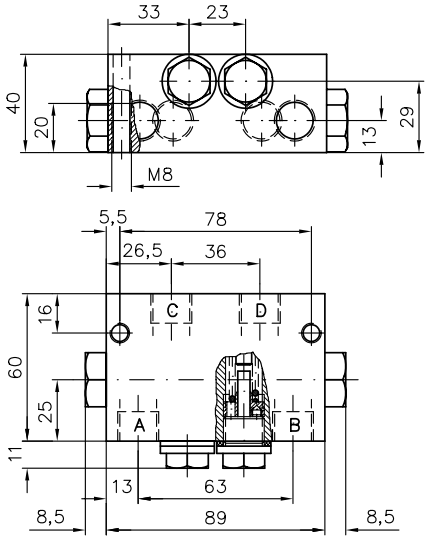
Type DRH 1 ... 5(L, V, VV)



Type	Connection acc. to DIN ISO 228/1 (BSPP) A, B, C, D	L	L	B	H	a/f
DRH 1	G 1/4	---	70	45	20	19
DRH 2	G 3/8	---	89	60	30	22
DRH 3	G 1/2	---	115	60	30	27
DRH 3L		G 3/8				
DRH 4	G 3/4	---	150	70	40	32
DRH 4L		G 1/2				
DRH 5	G 1	---	195	80	50	41
DRH 5L		G 3/4				

Type	a	b	c	e	e_1	e_2	g
DRH 1	10	21	8	50	28	54	M6
DRH 2	13	26.5	10	63	36	73	M8
DRH 3(L)	17	39.5	13	81	36	99	M10
DRH 4(L)	22	47.5	15.5	106	55	134	M10
DRH 5(L)	27.5	65	17	140	65	179	M10

Type DRHS 2

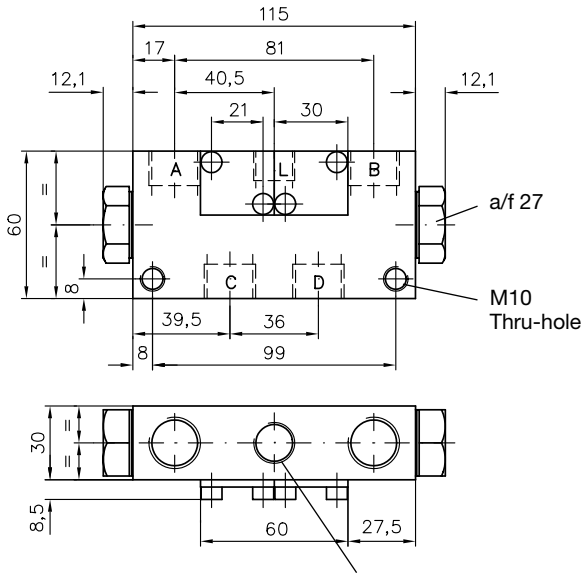


Pressure adjustment for type DRHS 2:
After removing the tapped plug and loosening the grub screw, the pressure can be adjusted by a threaded disc within the respective pressure range (check with a pressure gauge!):

Pressure range sect. 3	Δp (bar) per 1 turn	Adjust. value lowest
20 ... 80 bar	≈ 9.5 bar	approx. 15 bar
80 ... 160 bar	≈ 19 bar	approx. 30 bar
100 ... 315 bar	≈ 55 bar	approx. 90 bar
315 ... 500 bar	≈ 100 bar	approx. 150 bar

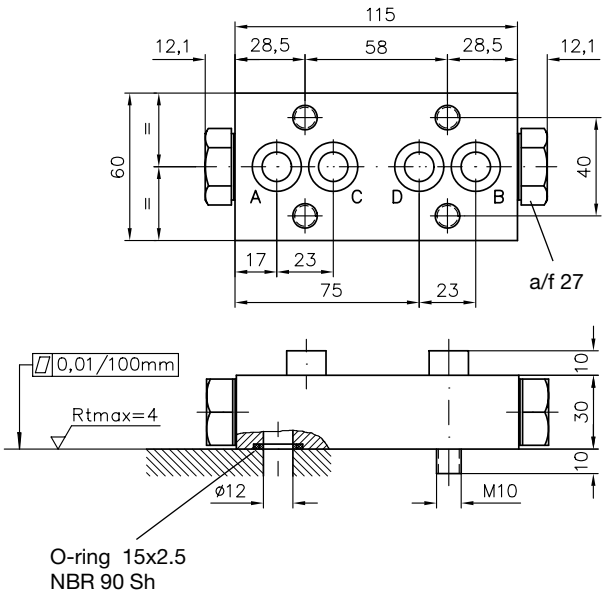
Connections acc. to DIN ISO 228/1: (BSPP)
A, B, C and D = G 3/8

Type DRH 3 SS (V, VV) and DRH 3 LSS (V, VV)

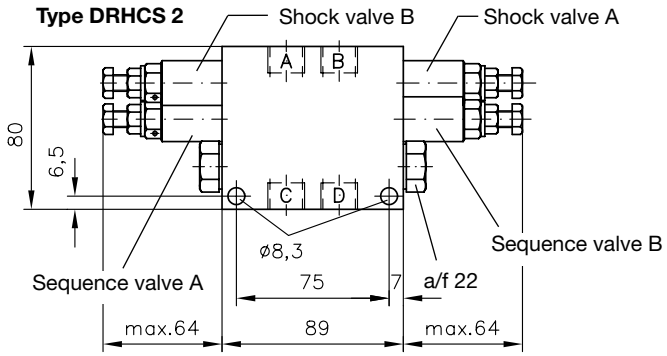


Connections acc. to
DIN ISO 228/1 (BSPP):
A, B, C, and D = G 1/2
L = G 3/8

Type DRH 3P (V, VV)

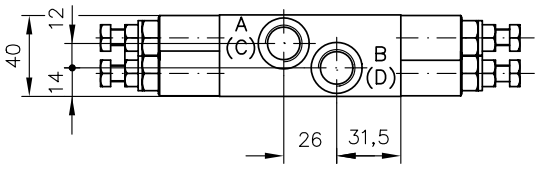


Type DRHCS 2



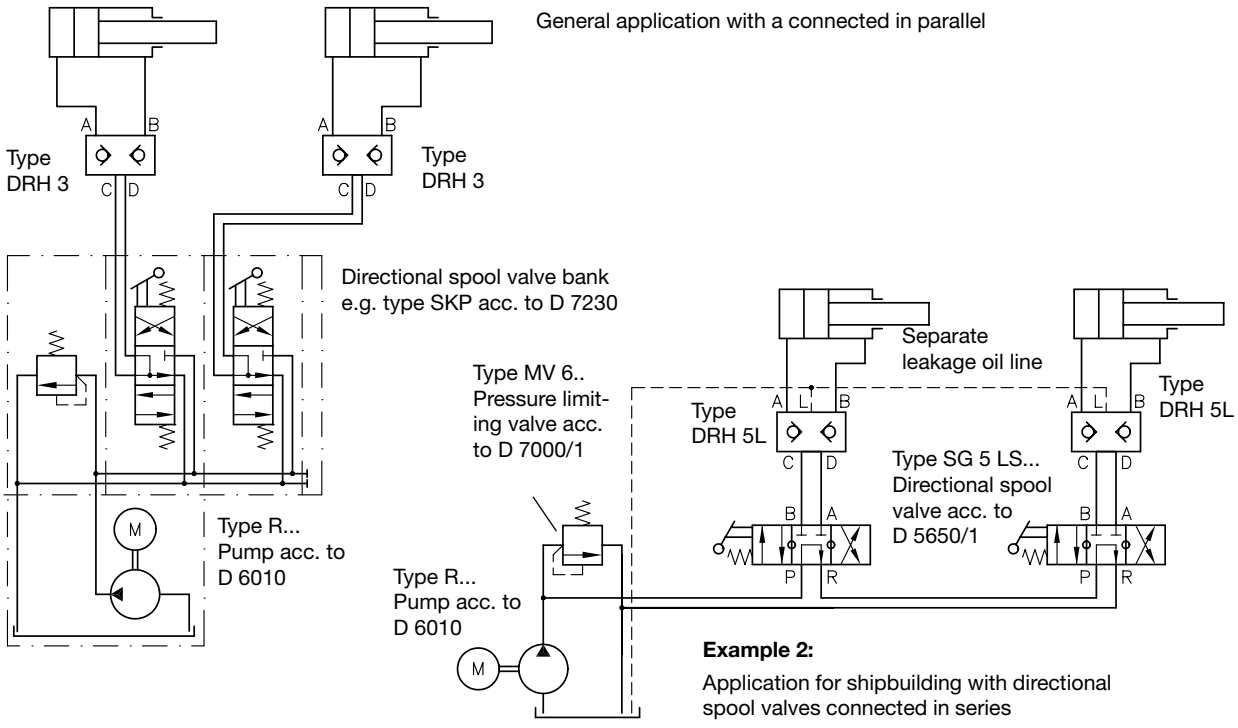
Pressure adjustment at type DRHCS 2: Identical for shock and sequence valve (check with a pressure gauge always!)

Pressure range sect. 3	Δp (bar) per 1 turn
20 ... 80 bar	≈ 9.5 bar
80 ...160 bar	≈ 9 bar
160 ... 315 bar	≈ 55 bar
315 ... 500 bar	≈ 100 bar



5. Example circuit

Type P... cylinder acc. to D 2055/1



Example 1:

General application with a connected in parallel

Example 2:

Application for shipbuilding with directional spool valves connected in series

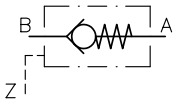
Hydraulically pilot operated cartridge check valves Type RHC and RHCE

without and with hydraulic pre-relief

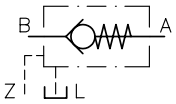
Pressure p_{max} = 700 bar
Flow Q_{max} = 200 lpm

Symbols

Type RHC



Type RHCE



1. General

These devices are designed as seated valves and belong to the group of stop valves according to DIN ISO 1219-1. Flow is blocked in the direction A → B and possible in the direction B → A. The closed passage, flow direction A → B, can be opened (released) by hydraulic control.

Application

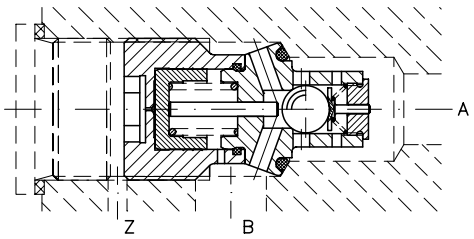
- Blockage of zero-leakage cylinders when used together with leakage prone directional spool valves
- Return relief for directional valves during retraction of double acting cylinders
- as a hydraulically operated drain or circulation valve

The valve housings are designed as screw-in cartridges. These valves are to be screwed into simply shaped tapped holes of a manifold body. The sealing of the consumer side A and B is via an O-ring and takes place at the contact area between the stepped valve body and the stepped shoulder of the core diameter at the location thread. Any standard steel drill (point angle 118°) automatically forms this stepped shoulder when the core diameter is drilled. Therefore reaming of the hole and bevels to help the seals slip in are not necessary. The control side Z is generally sufficiently sealed to the consumer side B via an appropriate thread tolerances of valve screw and core hole (see table with dimensions).
There are versions with sealed thread and control piston available if this (minimum) leakage is disturbing.
Another version features a control piston relief where a an additional leakage port is apparent. This enables opening without any damping via the pressure apparent at port A (see examples in sect. 5).
The following schematic illustrations show the design and a typical installation example where the mounting hole is blocked to the outside with a tapped plug (conf. DIN 908 or 910) and seal ring (conf. DIN 7603).

Versions

- Valves without a pre-relief (type RHC..)

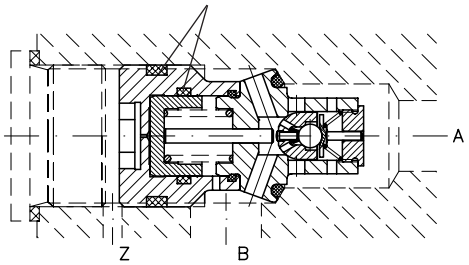
  The valve element is a ball. These valves allow full flow through the complete cross section A → B once they are released. The rate of operation of the piston is moderated. Abrupt opening and possible resultant relief shocks are substantially avoided. If shocks do occur during the trial run, however, an auxiliary restrictor must be provided in the control oil inlet, or a valve with a pre-relieving system must be used.



- Valves with a pre-relieving system (type RHC..V)

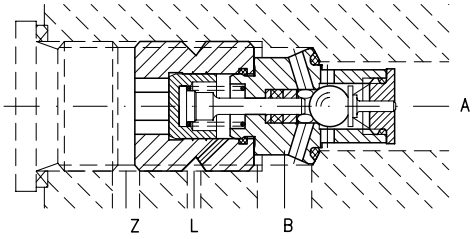
  The valve component is a spherically ground piston (ball seat) with a built-in ball check valve which opens during valve relief prior to the main piston, thereby releasing a restrictor cross section for the shock-free relief, of the consumer capacities. They are used predominantly for high operating pressures and for large consumer capacities. An auxiliary restrictor in the control oil inlet amplifies the efficacy of the pre-relieving feature.

Additional sealing of the control pressure side



- Valves with control piston relief (type RHCE..)

  Available with/without pre-relief (see above).
  The opening pressure is rather independent from the return pressure (p_B) with this version. This is possible because of the additional control piston relief via leakage port L.



HAWE HYDRAULIK GMBH & CO. KG
STREITFELDSTR. 25 • 81673 MÜNCHEN

D 7165
Check valves type RHC, RHCE

October 2001-05

2. Types available, main data

2.1. Type RHC

Order example: **RHC 4 V**

Basic type — Optionally with pre-relief

Size and version		Nominal pilot operation ratio 2.5:1						Nominal pilot operation ratio 4.5:1				
		Standard version										
Without pre-relief		**1**	**2**	**3**	**4**	**5**	**6**	**1/0**	**2/1**	**3/2**	**4/3**	**5/4**
With pre-relief		**--**	**--**	**3V**	**4V**	**5V**	**6V**	**--**	**--**	**--**	**4/3V**	**5/4V**
		Version with thread and control piston sealing (direct replacement for standard versions)										
Without pre-relief		**11**	**21**	**31**	**41**	**51**	**--**	**11/0**	**21/1**	**31/2**	**41/3**	**51/4**
With pre-relief		**--**	**--**	**31V**	**41V**	**51V**	**--**	**--**	**--**	**--**	**41/3V**	**51/4V**
		Version with thread and control piston sealing (simple installation, non standard mounting hole)										
Without pre-relief		**13** [1])	**23**	**33**	**43**	**53**	**--**	**13/0**	**23/1**	**33/2**	**43/3**	**53/4**
With pre-relief		**--**	**--**	**33V**	**43V**	**53V**	**--**	**--**	**--**	**--**	**43/3V**	**53/4V**
Flow Q_{max}	(lpm)	15	35	55	100	150	200	8	15	35	55	100
Pressure p_{max} (bar) at port	A, B, Z	700	700	500	500	400	400	500	500	500	500	400
True pilot operation ratio ψ	Main valve	2.6:1	2.6:1	2.5:1	2.5:1	2.8:1	2.5:1	4.2:1	4.3:1	4.5:1	4.3:1	4.3:1
	Pre-relief	--	--	10:1	12:1	19:1	12.9:1	--	--	--	26:1	21:1
Control volume	(cm^3)	0.1	0.2	0.4	0.8	1.5	2.65	0.1	0.2	0.4	0.8	1.5
Mass (weight) approx.	(g)	20	40	70	140	250	500	20	40	70	140	250

[1]) Type RHC 13 also available with thread M18x1.5; Order coding: RHC 13 M18x1.5

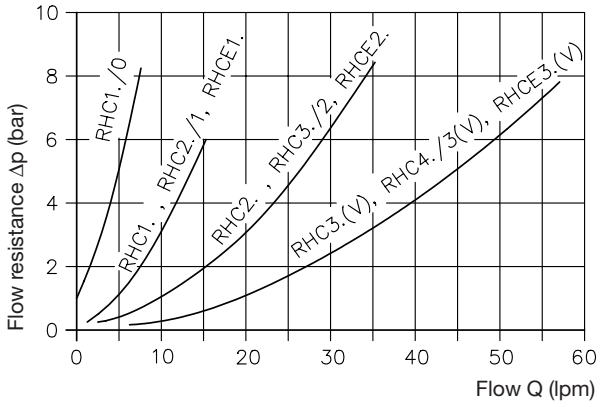
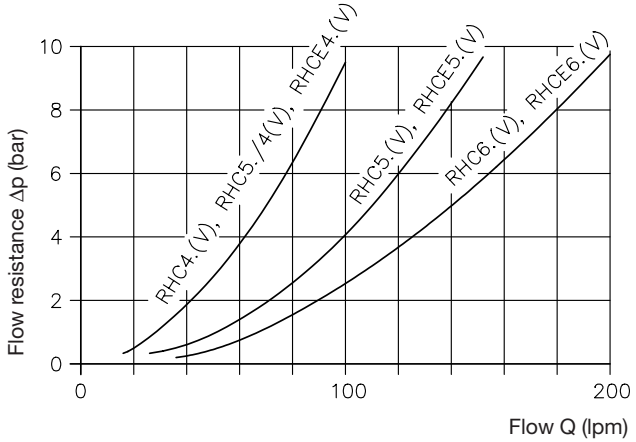
2.2. Type RHCE with control piston relief via additional leakage port

Order example: **RHCE 33 V**

Basic type — Optionally with pre-relief

Size and version		Nominal pilot operation ratio 2.5:1					
		Standard version					
Without pre-relief		**1**	**2**	**3**	**4**	**5**	**6**
With pre-relief		**--**	**--**	**3V**	**4V**	**5V**	**6V**
		Version with thread and control piston sealing (simple installation, non standard mounting hole)					
Without pre-relief		**13**	**23**	**33**	**43**	**53**	**63**
With pre-relief		**--**	**--**	**33V**	**43V**	**53V**	**63V**
Flow Q_{max}	(lpm)	15	35	55	100	150	200
Pressure p_{max} (bar) at port	A, B, Z	500	500	500	500	400	400
	L	Non-pressurized to the tank					
True pilot operation ratio ψ	Main valve	2.6:1	2.6:1	2.5:1	2.5:1	2.8:1	2.5:1
	Pre-relief	--	--	10:1	12:1	19:1	12.9:1
Control volume	(cm^3)	0.1	0.2	0.4	0.8	1.5	2.65
Mass (weight) approx.	(g)	20	40	70	140	250	500

3. Additional data

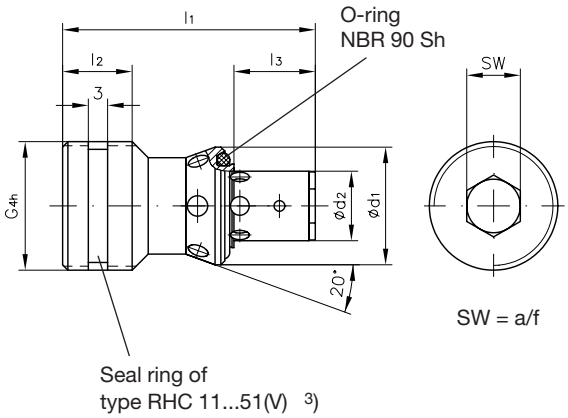
Type	Spring-loaded seated ball valve
Material Mounting	All steel design; housing part on the valve side hardened, valve seat ground Screwed into location hole of a housing element Observe the dimensional tolerance of the thread core diameter D_1 in sect. 4, as well as footnote [1])
Installation position	Any
Connections	A, B = Main opening Z = Control oil connection L = Leakage oil connection, non-pressurized to the tank
Flow direction	B → A Free A → B Blocked without zero leakage in neutral position (connection Z non-pressurized) if there is no pressure at B or a lower pressure than at A A → B Open, if the valve is pilot operated by a control pressure at Z (also see control pressure p_{St})
Opening pressure	B → A approx. 0.5 bar; approx. 1 bar for RHC 1/0
Control pressure p_{st} (bar) (Recommended value calculation)	for pilot operation $p_{St} = \frac{p_A}{\psi} + 2.5$ for holding open $p_{St} \approx k p_B + \frac{\Delta p}{\psi} + 4.5$ ψ Pilot-operation ratio see table Section 2 p_A = Pressure at A p_B = Pressure at B Δp see following characteristic k = 1 for Type RHC = 0.05 ... 0.1 for Type RHCE
Pressure fluid	Hydraulic oil conforming DIN 51524 part 1 to 3: ISO VG 10 to 68 conforming DIN 51519. Viscosity limits: min. approx. 4, max. approx. 1500 mm²/s; opt. operation approx. 10... 500 mm²/s. Also suitable for biological degradable pressure fluids types HEPG (Polyalkylenglycol) and HEES (Synth. Ester) at service temperatures up to approx. +70 °C.
Temperature	Ambient: approx. -40 ... +80 °C Fluid: -25 ... +80°C, Note the viscosity range! Permissible temperature during start: -40°C (Note start-viscosity!), as long as the service temperature is at least 20K higher for the following operation. Biological degradable pressure fluids: Note manufacturer's specifications. By consideration of the compatibility with seal material not over +70 °C.
Δp-Q curves	
Oil viscosity during the measurement approx. 60 mm²/s	

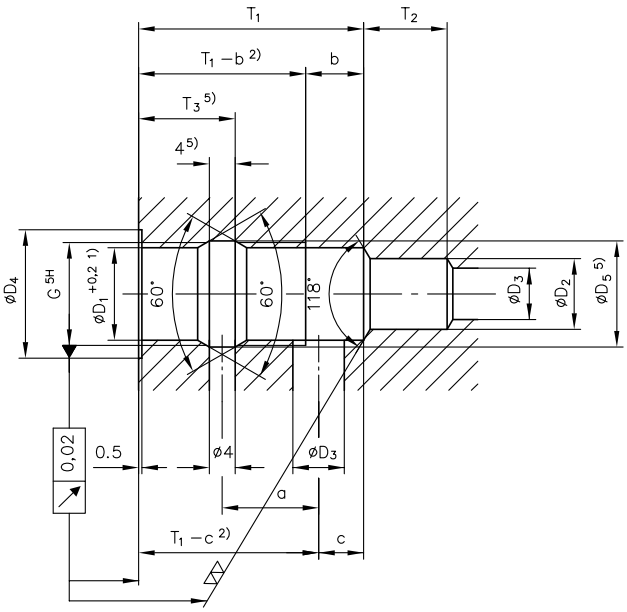
4. Unit dimensions

All dimensions are in mm, subject to change without notice!

4.1. Type RHC 1 ... 6(V), RHC 11 ... 51(V) RHC 1/0 ... 5/4V and RHC 11/0 ... 51/4(V)

Location hole
The mounting hole is blocked to the outside via a tapped plug (conf. DIN 908 or 910) and seal ring (conf. DIN 7603).





Type		G 4)	l1	l2	l3	d1	d2	a/f	O-ring	Max. torque M_{max} (Nm)
RHC 1,	RHC 11	M 16x1.5	32.2	10	10.7	14	9	6	10x1.5	55
RHC 1/0,	RHC 11/0		29.5		7.7					
RHC 2,	RHC 21	M 20x1.5	37.9	12	12.9	18	11	8	12.42x1.78	90
RHC 2/1,	RHC 21/1		36.2		11.2		10			
RHC 3(V),	RHC 31(V)	M 24x1.5	47.2	13.5	15.2	22	13	10	15.3x2.4	120
RHC 3/2,	RHC 31/2		45.4		13.4		11			
RHC 4(V),	RHC 41(V)	M 30x1.5	56	15	20.5	28	17.5	12	20.29x2.62	160
RHC 4/3(V),	RHC 41/3(V)		51.7		16.2		16			
RHC 5(V),	RHC 51(V)	M 36x1.5	67.5	18.5	24	34	21.5	14	25.07x2.62	200
RHC 5/4(V),	RHC 51/4(V)		64.2		20.7		20			
RHC 6(V)		M 42x1.5	97	23	41	39.5	27	19	31.42x2.62	280

Type	a	b	c	D_1 1)	D_2	D_3	D_4	D_5 5)	T_1	T_2	T_3 5)	Seal ring at the tapped plug
RHC 1(11) RHC 1/0(11/0)	15	9	7	14.4	11	8	20	16.5	35	13	15	16x20x1.5
RHC 2(21) RHC 2/1(21/1)	18	10	6	18.4	14	10	24	20.5	38	17	16	20x24x1.5
RHC 3(31) (V) RHC 3/2(31/2)	22	15	9	22.4	16	12	29	24.5	45	19	16	24x29x2
RHC 4(41) (V) RHC 4/3(41/3) (V)	24	15	10	28.4	22	15	36	30.5	50	24	18	30x36x2
RHC 5(51) (V) RHC 5/4(51/4) (V)	30	18	12	34.4	27	18	42	36.5	58	27	18	36x42x2
RHC 6 (V)	42	28	12	40.4	32	20	50	42.5	71	42	19	42x49x2

1) D_1 determines the leakage of the control line with type RHC 1...6(V)
Leakage 0.05 lpm at 300 bar, when all tolerances are maintained.

2) The thread depth T_1-b and the distance of the hole ∅D_3 (connection side B) T_1-c depend on the thread core hole depth T_1.
The fixed dimensions b, c, and a have to be maintained therefore.

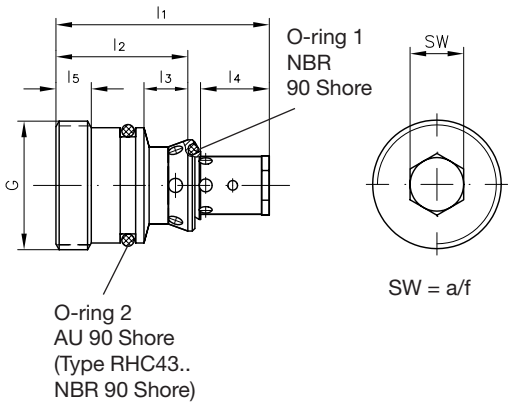
3) **Attention:** Applies to type RHC 11 ... 51(V)
All PTFE-swarf generated while screwing the valve in have to be thoroughly removed

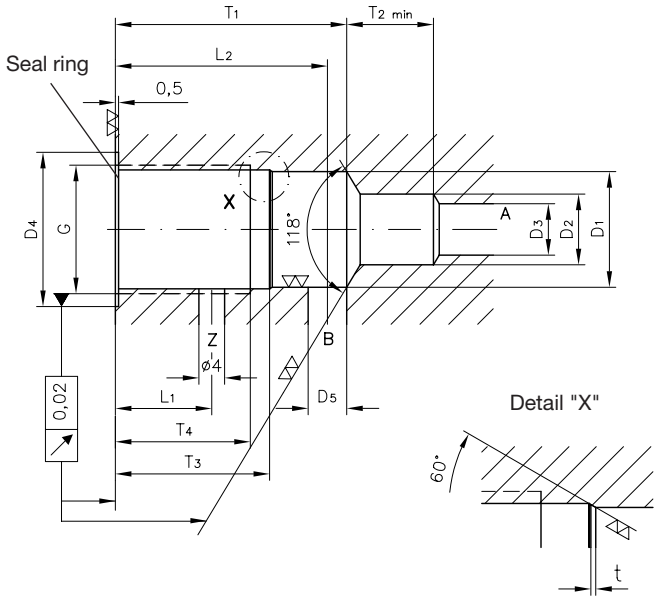
4) Thread G fine tolerance 4h/5H DIN 13 pages 21/22

5) This recess is only required with type RHC .1 to prevent damage of the seal ring

4.2. Type RHC 13 ... 53(V) and RHC 13/0 ... 53/4(V)

Location hole
The mounting hole is blocked to the outside via a tapped plug (conf. DIN 908 or 910) and seal ring (conf. DIN 7603).



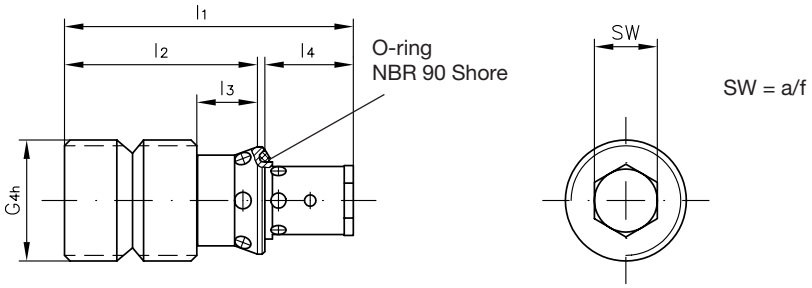


Type	G [1]	l1	l2	l3	l4	l5	a/f	O-ring 1	O-ring 2	Max. torque M_{max} (Nm)
RHC 13	M 20x1.5	33	21.5	7.5	10.5	5.5	6	10x1.5	14x1.78	55
RHC 13/0		29	20.5	6.5	7	5				
RHC 23	M 22x1.5	38.5	25	9	13	6.5	8	12.42x1.78	15.6x1.78	90
RHC 23/1		36	23	8.5	11	5.5				
RHC 33(V)	M 26x1.5	47	30	12	15	7.5	10	15.3x2.4	20.35x1.78	120
RHC 33/2		46	28.5	11	13.5					
RHC 43(V)	M 36x1.5	55.5	33	14	20.5	9	12	20.29x2.62	28.3x1.78	160
RHC 43/3(V)		52	32.5	13	16					
RHC 53(V)	M 38x1.5	67.5	41.5	18.5	24	12	14	25.07x2.62	29.82x2.62	200
RHC 53/4(V)		65	40	16	21					

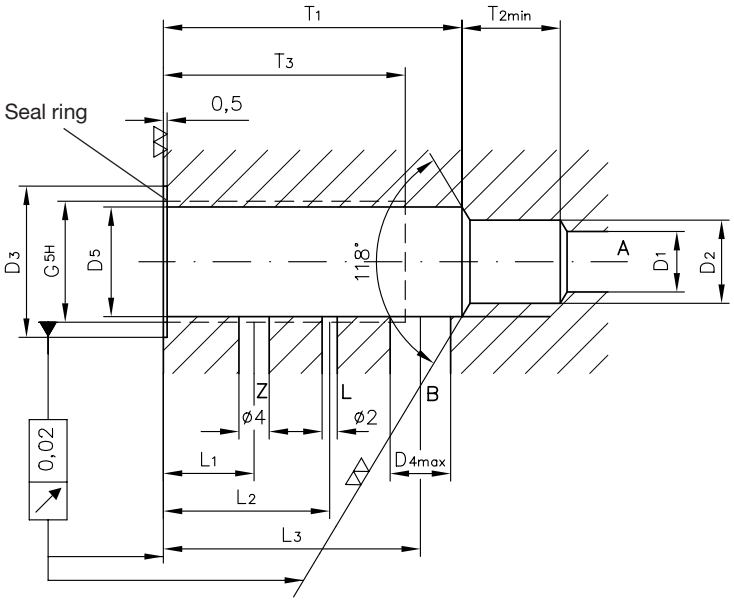
[1]) Core diameter = G -1.5

Type	L1	L2	D_1^{H8}	D2	D3	D4	D5 max	T1	T2	$T_3^{+0.5}$	T4	t	Seal ring at the tapped plug
RHC 13	15	33	18	11	8	24	6	36	13.5	24	21	0.5	20x24x1.5
RHC 13/0		33											
RHC 23	14	34	19	14	10	27	8.5	39	17	24	21	1	22x27x1.5
RHC 23/1	13	33						38		23	20		
RHC 33(V)	16	40	24	16	12	31	11	46.5	20	28	25	0.5	26x31x2
RHC 33/2		40											
RHC 43(V)	18	45	32	22	15	42	13	52	28	32	29	1	36x42x2
RHC 43/3(V)		45							24				
RHC 53(V)	16	49.5	35	27	18	44	15	58	27	32	29	1	38x44x2
RHC 53/4(V)		49.5											

4.3. Type RHCE 1 ... 6(V)



Location hole
The mounting hole is blocked to the outside via a tapped plug (conf. DIN 908 or 910) and seal ring (conf. DIN 7603).

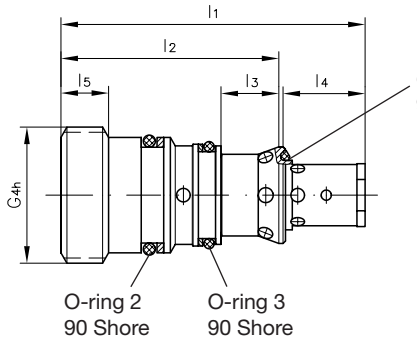


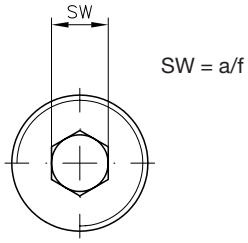
Type	G [1]	l1	l2	l3	l4	a/f	O-ring	Max. torque M_{max} (Nm)
RHCE 1	M 16x1.5	38	26	8.5	11	6	10x1.5	55
RHCE 2	M 20x1.5	45	30.5	10.5	12	8	12x2	90
RHCE 3(V)	M 24x1.5	56	38	14	16	10	15.3x2.4	120
RHCE 4(V)	M 30x1.5	63	40.5	14.5	20	12	20.29x2.62	160
RHCE 5(V)	M 36x1.5	77	50.5	16.5	25	14	25.07x2.62	200
RHCE 6(V)	M 42x1.5	103	59	15	41	19	31.42x2.62	280

Type	L_1 ±0.1	L_2 ±0.1	L_3 ±0.1	T_1 +0.5	T_2	T_3 +0.5	D_1	D_2	D_3	D_4	D_5	Seal ring at the tapped plug
RHCE 1	12	22	35	39.5	13	32	8	11	20	8	14.4	16x20x1.5
RHCE 2	14	24	41	46	16	36	10	14	25	10	18.4	20x24x1.5
RHCE 3(V)	16	29	48	55	19	42	12	16	29	12	22.5	24x29x2
RHCE 4(V)	16	31	50	58	24	45	14	22	36	14	28.4	30x36x2
RHCE 5(V)	16	36.5	59	68.5	28	52	18	27	42	18	34.4	36x42x2
RHCE 6(V)	16	43	67	77.5	42	60	20	32	50	20	40.4	42x49x2

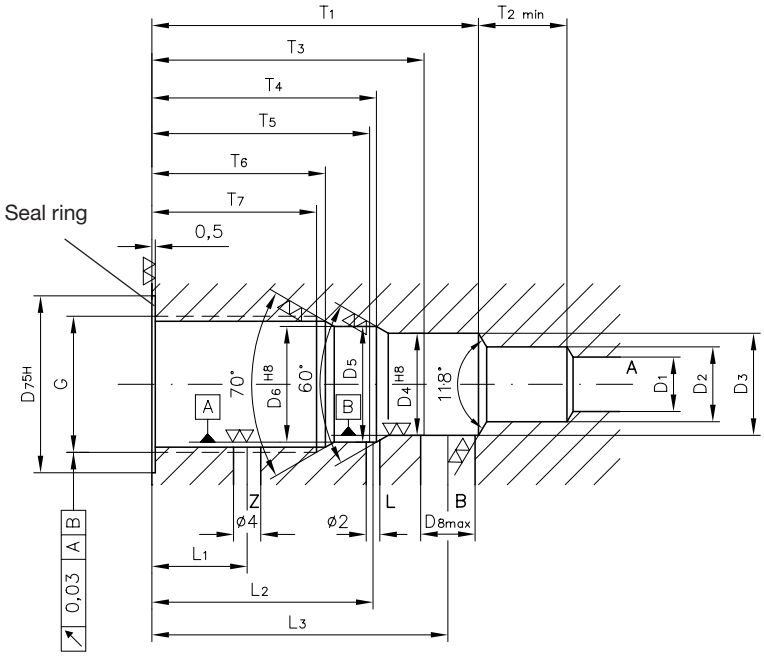
[1] Thread G
Fine tolerance 4h/5H DIN 13, pages 21/22

4.4. Type RHCE 13 ... 63(V)





Location hole
The mounting hole is blocked to the outside via a tapped plug (conf. DIN 908 or 910) and seal ring (conf. DIN 7603).



[1]) Thread G
Fine tolerance 4h/5H DIN 13, pages 21/22

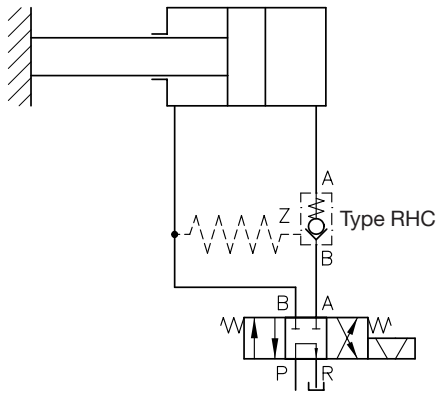
Type	G [1])	l1	l2	l3	l4	l5	a/f	O-ring 1	O-ring 2	O-ring 3	Max. torque M_{max} (Nm)
RHCE 13	M 20x1.5	45	32.5	8.5	11	7	8	10x1.5	14x1.78	12x1.5	55
RHCE 23	M 24x1.5	52	37	10.5	12	7.5	8	12x2	15.55x2.62	15.6x1.78	90
RHCE 33(V)	M 27x2	59	41.5	14	16	7.5	10	15.3x2.4	18.72x2.62	18x2.5	120
RHCE 43(V)	M 33x2	65	43.5	14.5	20	8	12	20.29x2.62	25.07x2.62	23.47x2.62	160
RHCE 53(V)	M 42x1.5	78	50	16.5	25	11	14	25.07x2.62	31.42x2.62	29.82x2.62	200
RHCE 63(V)	M 45x1.5	103	59	15	41	15.5	19	31.42x2.62	36x3	34x3	280

Type	L1	L2	L3	T1	T2	T3	T4	T5	T6	T7	D1	D2	D3	D4
RHCE 13	14	32.5	43.5	48	13	40	33	32	25.5	22.5	8	11	14.7	15
RHCE 23	14	34	47	52	16	43	35	34	26.5	22.5	10	14	18.7	19
RHCE 33(V)	16	36.5	52	59	19	46	38.5	37.5	29	25	12	16	22.7	23
RHCE 43(V)	16	37	53	60	24	48	38	37	30	25.5	14	22	27.7	28
RHCE 53(V)	16	42	59	68.5	28	52	43	41	31	28	18	27	34.7	35
RHCE 63(V)	16	48	67	77.5	42	59	49	47.5	38.5	33.5	20	32	39.7	40

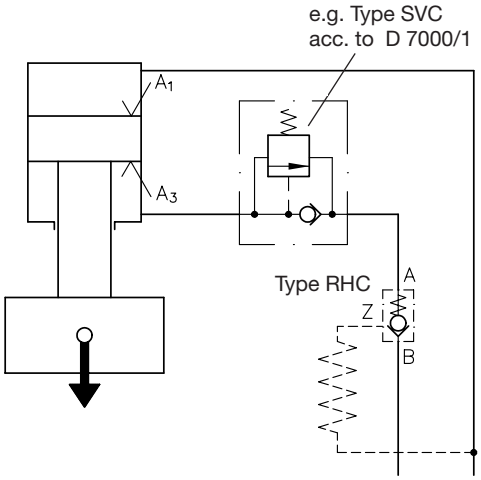
Type	D5	D6	D7	D8	Seal ring at the tapped plug
RHCE 13	16.7	17	26	8	20x24x1.5
RHCE 23	20.7	21	29	10	24x29x2
RHCE 33(V)	23.7	24	32	12	27x32x2
RHCE 43(V)	29.7	30	39	14	33x39x2
RHCE 53(V)	36.7	37	49	18	42x49x2
RHCE 63(V)	41.7	42	52	20	52x45x2

5. Examples

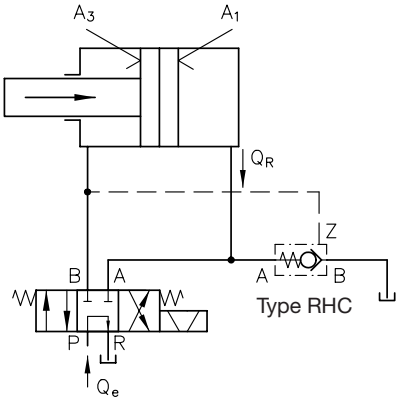
For blocking hydraulic cylinders with zero leakage
(illustrated here with additional damping of the control line)



Use at dragging loads



Additional return relief for high flow
(A_1/A_3 are very big)



Use as idle circulation valve