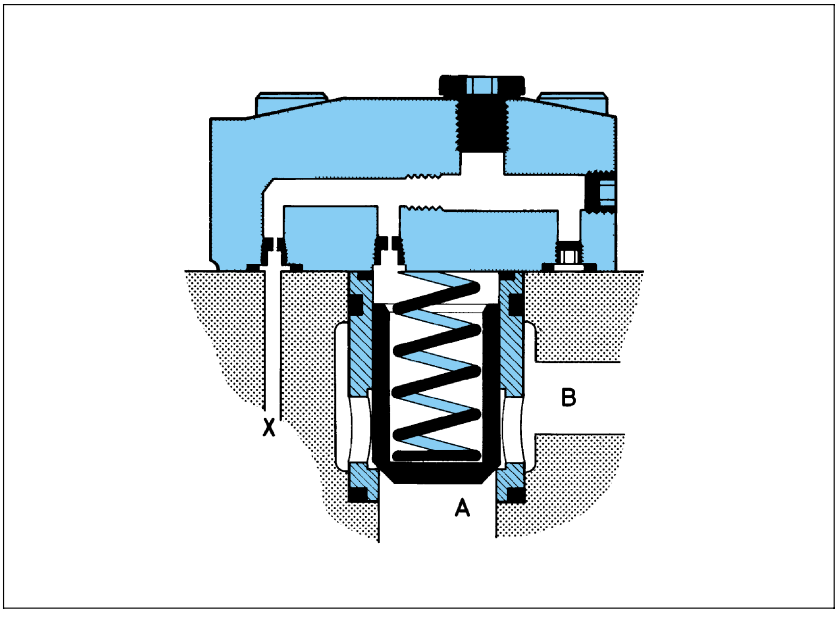
DENISON HYDRAULICS
Seat Valves Cartridges
Series CAR

Publ. 7–EN 5150–B, replaces 7–EN 515–A

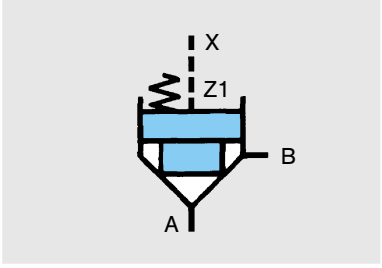
DENISON Hydraulics

FEATURES

- The same modular design is used in all valve sizes and the valve are used for a variety of functions:
  – as a leak proof directional control
  – as a pressure control for the adjustment or limitation of pressure
  – as a check valve to obtain unidirectional flow
  – as a throttle valve to control and limit the rate of flow.
- A variety of standard combinations of internal components are provided as well as additional options to suit special circuitry. Typical of more than sixty options/ additions are: Stroke limiters, vent valve sandwich, shuttle valves, end position control and sleeves with different seat areas.
- Seat valves series CAR are designed for 350 bars operation. Whilst providing extremely fast response they also offer sensitive control without system pressure peaks.
- DENISON seat valves series CAR are provided in a full range of manifold mounted units to supplement the body designs series D4S. Internal components are interchangeable with poppets and sleeves selected to give the desired function.
- Worldwide DENISON service.



SYMBOL



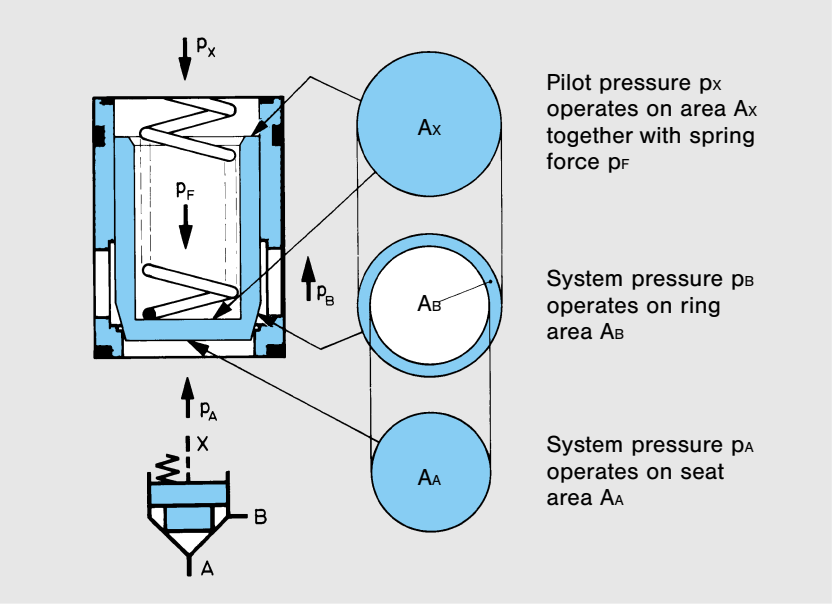
Ordering Code | Back to Content

DESCRIPTION

DENISON Seat valves are hydraulically operated poppet type cartridges design to control flow direction either from Port A to Port B or vice versa depending upon the control circuit.
The cracking pressure is proportional to the ratio of control area to seat or ring area.
Pilot pressure at Port X acting on the control area closes the seat valve thus forces generated by cylinders or hydraulic motors can be decelerated to zero by controlling the differential pressure. Acceleration or deceleration of the fluid which the seat valve is controlling will take place whilst the valve is opening or closing and the time normally necessary to overcome overlap in conventional spool valves is eliminated. In addition to this improved response time the action also ensures that the seat valve functions without introducing system pressure peaks or shock and therefore machine cycle times may be reduced without detriment. Various seat valve combinations are manufactured in quantity to suit a wide variety of specialised industrial applications.

CRACKING PRESSURE

Cracking Pressure depends on the area ratio of individual combination of spool and sleeve.



EXAMPLE

With a ratio of 95 % seat area to 5 % ring area and a spring pressure = 2.2 bars then the following cracking pressures apply.

Direction of flow		supposed pilot pressure p_X (bar)						
		0	9	15	30	100	250	330
p_A	A→B	2.2	11.7	18	34	108	265	350
p_B	B→A	42	222	342	**>350** 646	**>350** 2052	**>350** 5035	**>350** 6650

It is obvious that with flow direction B to A and a control (pilot pressure) at X of 15 bars, pressure in excess of maximum valve rating would be exceeded before the valve would open. Under static conditions the valve would still remain leakproof even at substantially higher pressures.

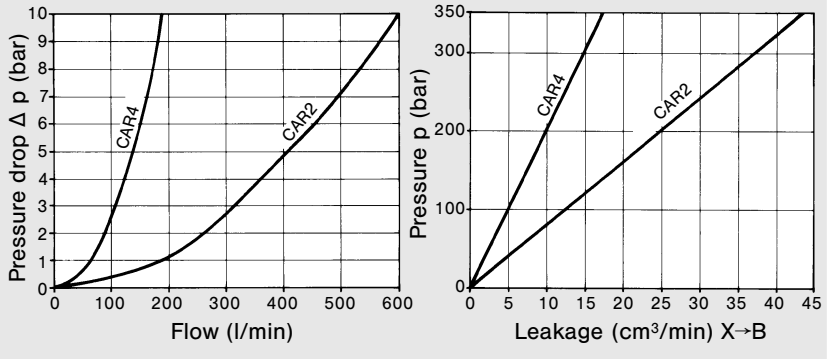
GENERAL

• Type of unit	Seat valve
• Design	Poppet type
• Type of mounting	Manifold mounted
• Port sizes	½″, 1½″
• Mounting position	Optional
• Direction of flow	A–B or B–A
• Ambient temperature range	– 20 . . . + 60 °C
• Suitability for special working conditions	Consult DENISON

HYDRAULIC CHARACTERISTICS

• Operating pressure range		
– port A, B and X	0 . . . 350 bar	
– port Y	without pressure to tank	
• Fluid temperature range	– 18 . . . + 80 °C	
• Viscosity range	10 . . . 650 cSt	
• Recommended operating viscosity	30 cSt	
	CAR4 (½″)	CAR2 (1½″)
• Nominal flow	150 l/min	450 l/min
• Max. flow	180 l/min	600 l/min
• Pilot volume	CAR4	CAR2
– sleeve 95 % seat area, spool 15 ° chamfer	1.00 cm³	4.75 cm³
– sleeve 95 % seat area, spool 45 ° chamfer	1.11 cm³	5.60 cm³
– sleeve 60 % seat area, spool 45 ° chamfer	0.77 cm³	3.75 cm³

• Diagrams



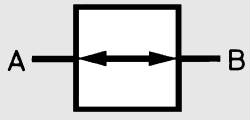
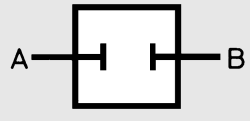
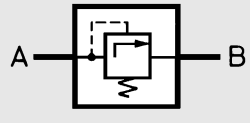
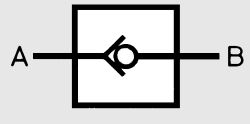
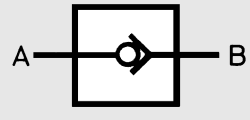
Oil temperature 50 °C; oil viscosity 38 cSt

TYPE OF ADJUSTMENT

• Electric (Vent valve VV01)	by solenoid
• Nominal voltage	Refer to ordering code page 12
• Permissible voltage difference	+ 5 . . . – 10 %
• Max. coil temperature	+ 180 °C, class H
• Type of current	Alternating current (AC) Direct current (DC)
• Input power	31 W
• Holding	78 VA
• Inrush	264 VA
• Relative operating period	100 %
• Type of protection	IP 65

CONTROL FUNCTIONS AVAILABLE

The following are typical of the functions which can be achieved in a circuit incorporating single or multiple seat valves.

	Area Z1	Pilot pressure p_X	Direction of flow	Notes
 Way function	vented	= 0	A–B B–A	Area Z1 may be vented via X, or a DENISON VV01 three way vent valve. When vented, the cracking pressure equals the spring force.
 Way function	connected with port A and B	= p_A or = p_B	A & B blocked	Area Z1 may be connected via a shuttle valve to ports A and B. The holding pressure on Z1 will be supplied from port A or Port B, depending upon which is the greater.
 Flow function	vented	= 0	A–B B–A	An adjustable stroke limiter can be selected to limit the spool aperture, which produces flow restriction in either direction.
 Pressure function	external pilot pressure	> 0	A–B	Pressure is limited by application of external pilot pressure p_X to port X1.
 Check function	connected with port B	= p_B	A–B blocked to A	Plug may be fitted between A and X leaving X connected to B (leakproof check valve function from B–A).
 Check funktion	connected with port A	= p_A	B–A blocked to B	Plug may be fitted between B and X leaving X connected to A (check valve function from A–B, not leakproof).

Further control functions on request

Model Number: CAR . – . – . . . – 1

1 **Cartridge**
CAR 4 = ½″
CAR 2 = 1½″

2 **Type of mounting**
K = main valve (spool, sleeve, spring)
H = main valve with cap (port Y¹ = G ¼″)
O* = main valve and plug on top (G-thread)
T* = main valve and plug on top 1⅛″–12 UNF thread (only CAR4)
U = main valve and plug at the bottom (G-thread)
B = main valve and plug at the bottom 1⅛″–12 UNF thread (only CAR4) (for O, T, U, B with spacer)

3 **Type of sleeve** **
1 = seat area A_A = 95 %
3 = seat area A_A = 60 %

4 **Type of spool** **
1 = with closed bottom and 15° chamfer
2 = with 0.8 mm dia. orifice at the bottom and 15° chamfer (only CAR4)
with 1.2 mm dia. orifice at the bottom and 15° chamfer (only CAR2)
4 = with closed bottom and 45° chamfer
5 = with closed bottom and 45° chamfer and two holes in line
B = throttle spool with 10° chamfer } only CAR2
C = throttle spool with 3° chamfer }

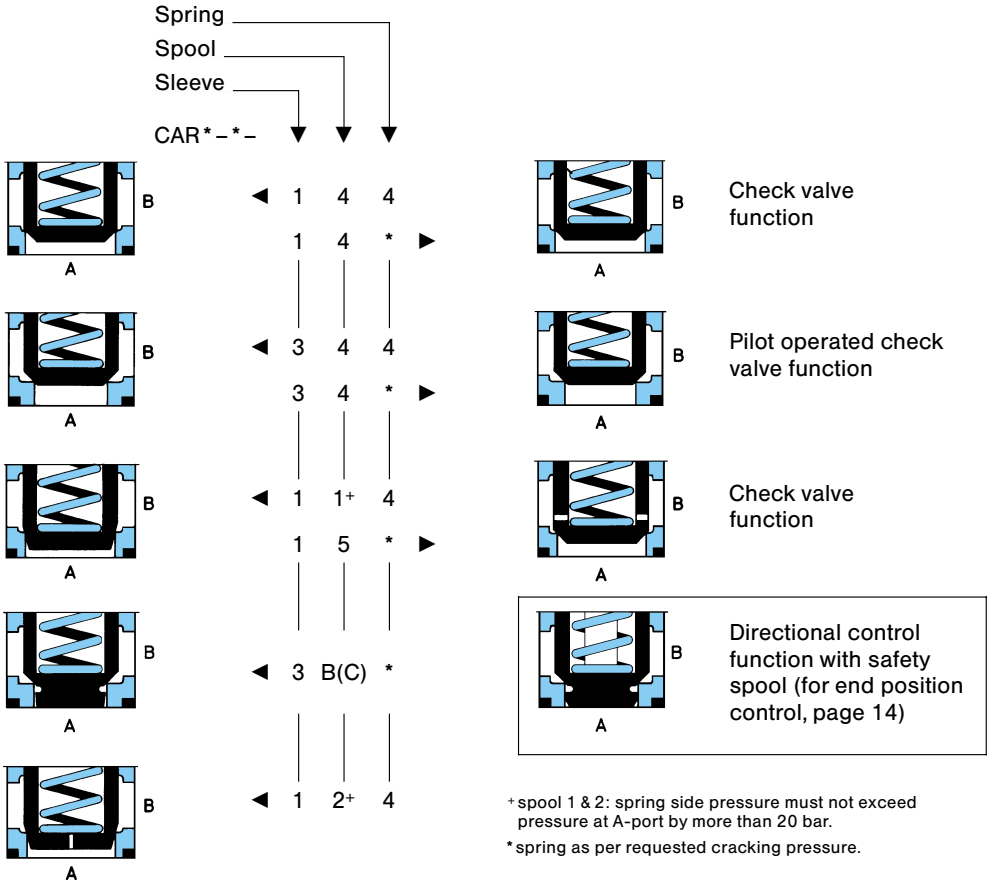
6 **Seal class**
1 = NBR-seal (Standard)
4 = EPR
5 = FPM-seals (Viton®)

5 **Spring** (approx. cracking pressure, bar)

	Sleeve 1 AA = 95 % AB = 5 %		Sleeve 3 AA = 60 % AB = 40 %			
	A→B		A→B		B→A	
	CAR 4	CAR 2	CAR 4	CAR 2	CAR 4	CAR 2
1 =	2.8	3.5	6.5	6.5	9.5	11.0
2 =	0.5	0.5	1.0	1.0	1.5	1.7
3 =	0.3	0.3	0.6	0.6	0.9	1.0
4 =	2.2	2.2	4.0	3.5	5.5	6.0
5 =	–	9.0	–	16.0	–	28.0
6 =	1.2	1.2	2.0	2.2	3.0	3.8
7 =	3.0	–	8.0	–	12.0	–

* Series CAR4 only with spool type 5
** for spool/sleeve combination see below

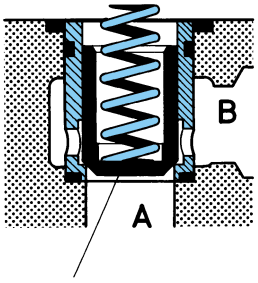
RECOMMENDED SPRING, SPOOL, SLEEVE COMBINATIONS



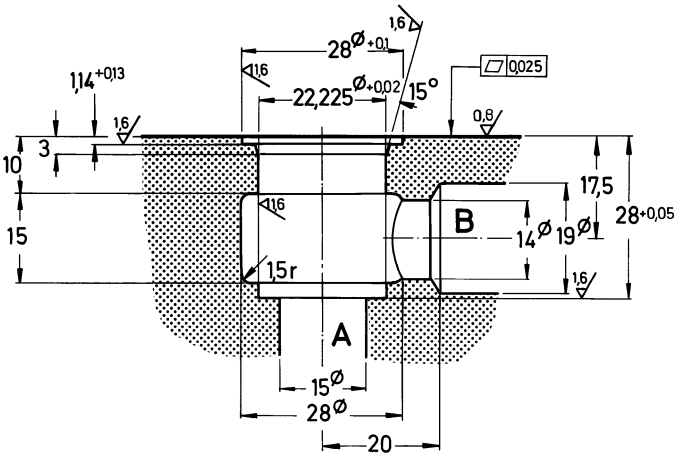
+ spool 1 & 2: spring side pressure must not exceed pressure at A-port by more than 20 bar.
* spring as per requested cracking pressure.

CAR 4-K

Weight: 0.07 kg



Example of spool code 4
spool with closed bottom and 45° chamfer

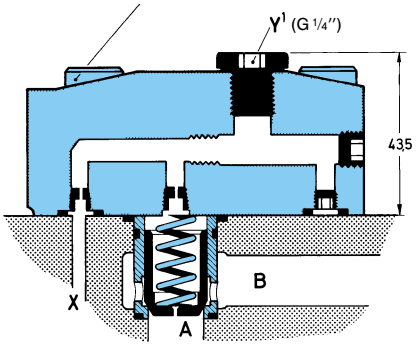


Ports	Function
A	Inlet or Outlet
B	Outlet or Inlet

CAR 4-H

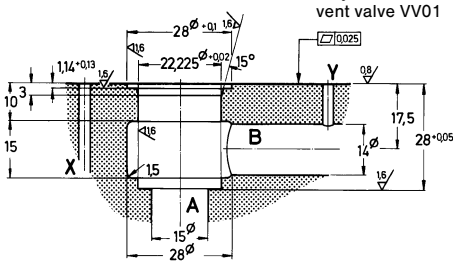
Weight: 1.0 kg

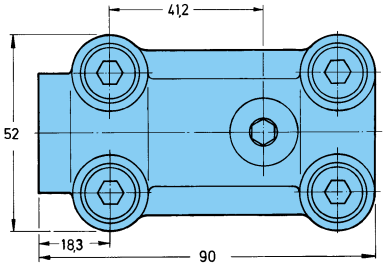
Mounting screws must be ordered separately: Order no.
4 Screws 3/8″–24 UNF x 1 3/4″ lg. 359–15220–0
or M 10 x 45; DIN 912-10.9 700–71602–8
4 Lock washer 700–72166–8

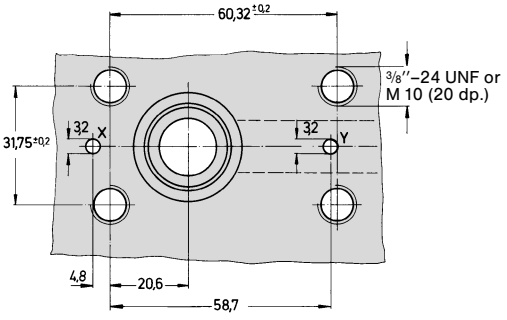


Example of spool code 2
spool with 0.8 mm dia. orifice at the bottom and 15° chamfer

Port Y:
only in connection with
vent valve VV01





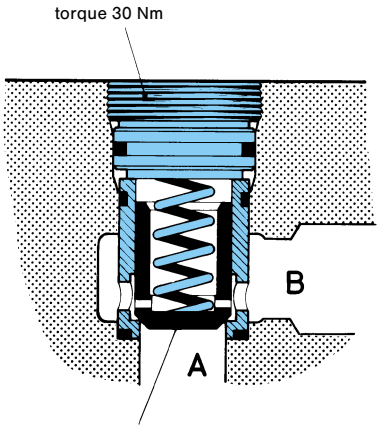


Ports	Function
A & B	Inlet or Outlet (optional)
X & Y	pilot holes [1])

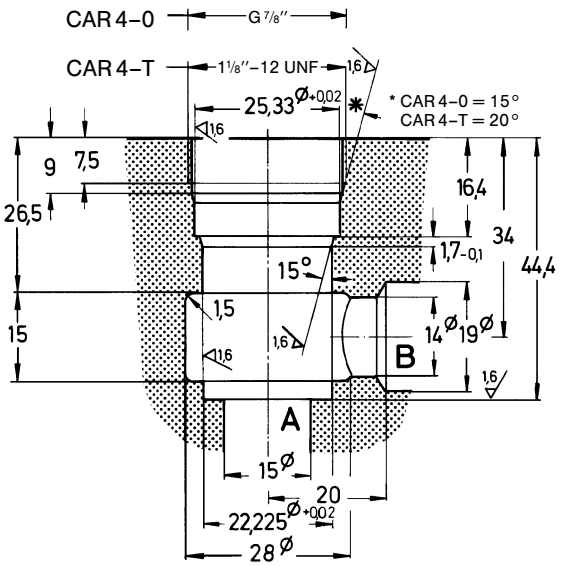
[1]) drilled according to function

CAR 4-0/T

Weight: 0.1 kg



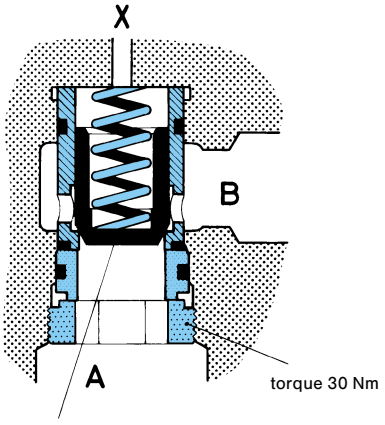
Series CAR 4-O/T
only with spool type 5,
with closed bottom, 45 ° chamfer
and two holes in line



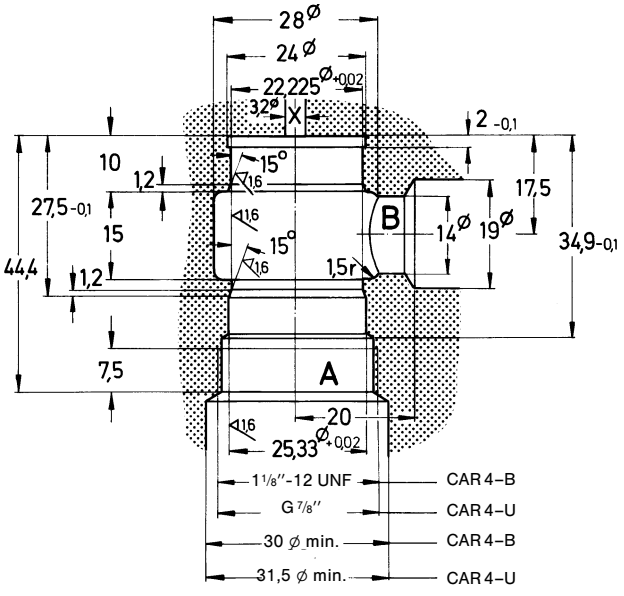
Ports	Function
A & B	Inlet or Outlet (optional)

CAR 4-U/B

Weight: 0.1 kg



Example of spool code 1
spool with closed bottom and 15° chamfer

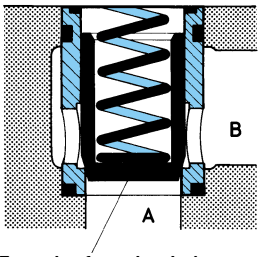


Ports	Function
A & B	Inlet or Outlet (optional)
X	pilot hole [1])

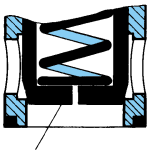
[1]) drilled according to function

CAR2-K

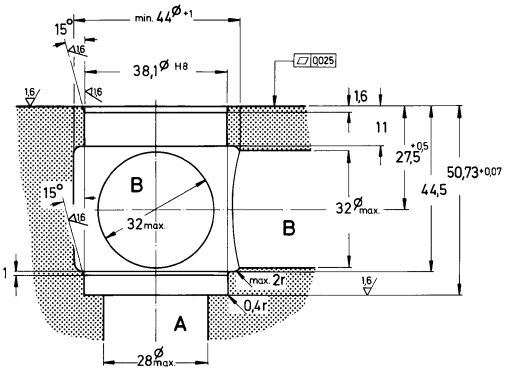
Weight: 0.25 kg

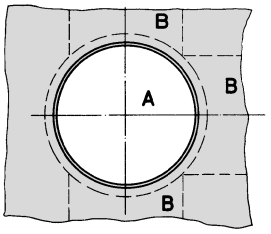


Example of spool code 1
spool with closed bottom
and 15° chamfer



Example of spool code 2
spool with 1.2 mm dia. orifice at the bottom
and 15° chamfer



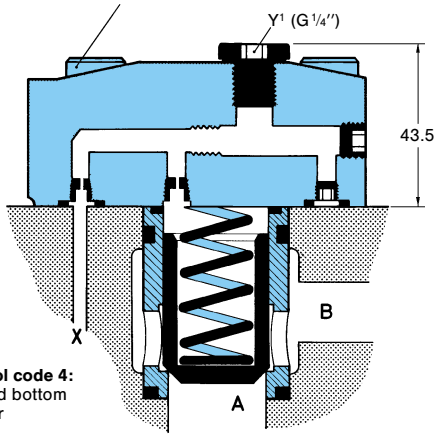


Ports	Function
A	Inlet or Outlet
B	Outlet or Inlet

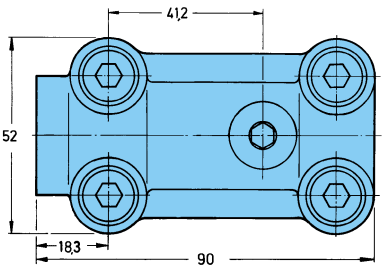
CAR 2–H

Weight: 1.1 kg

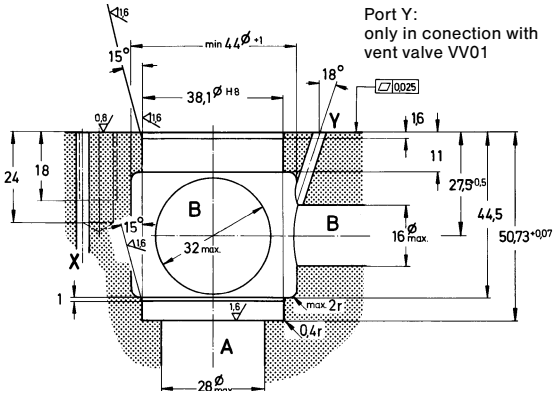
Mounting screws must be ordered separately: Order no.
4 Screws 3/8"–24 UNF x 1 3/4" lg. 359–15220–0
or M 10 x 45; DIN 912-10.9 700–71602–8
4 Lock washer 700–72166–8

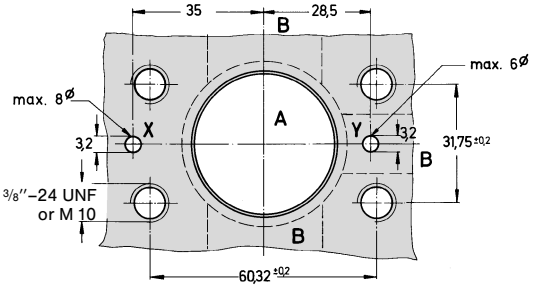


Example of spool code 4:
spool with closed bottom
and 45° chamfer



Port Y:
only in conection with
vent valve VV01



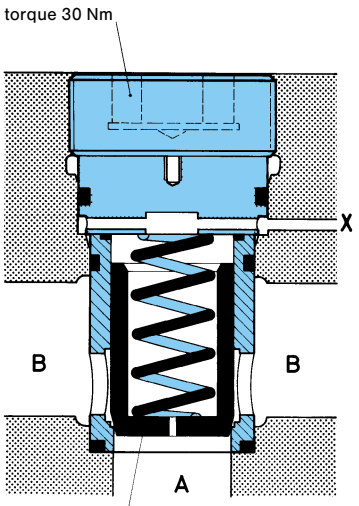


Ports	Function
A & B	Inlet or Outlet (optional)
X & Y	pilot holes [1])

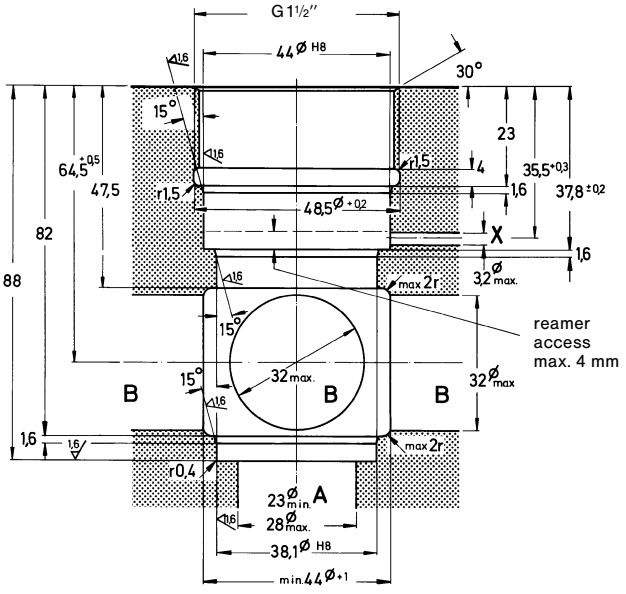
[1]) drilled according to function

CAR2-0

Weight: 0.7 kg



Example of spool code 2
spool with 1.2 mm dia. orifice at the bottom and 15° chamfer

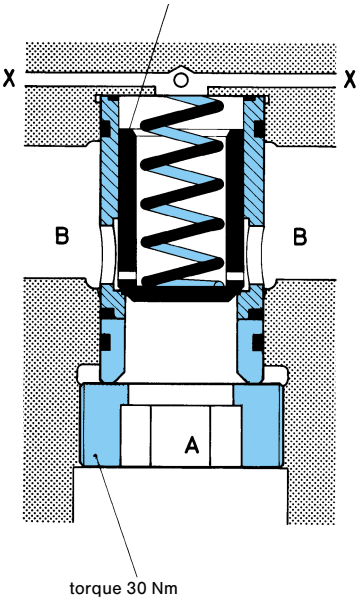


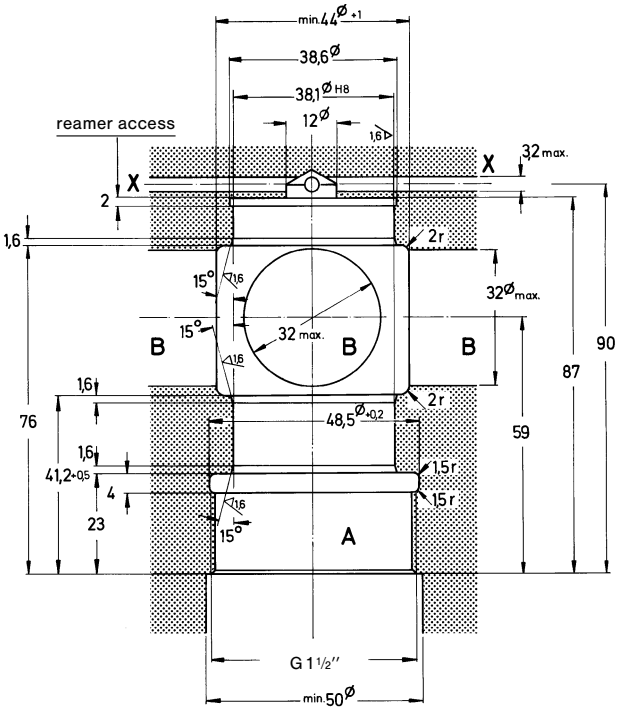
Ports	Function
A & B	Inlet or Outlet (optional)
X	pilot port

CAR 2–U

Weight: 0.7 kg

Example of spool code 5
spool with closed bottom, 45° chamfer and two holes in line





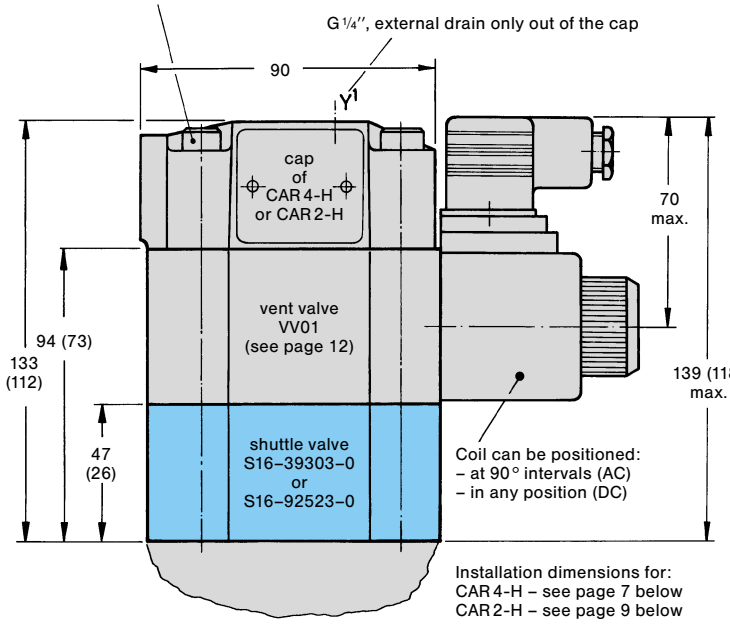
Ports	Function
A & B	Inlet or Outlet (optional)
X	pilot port

Order no. S16–39303–0 / Weight: 1.2 kg

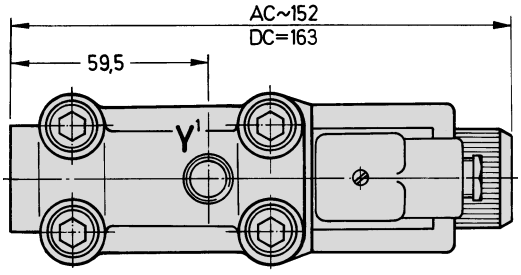
S16–92523–0 / Weight: 0.8 kg

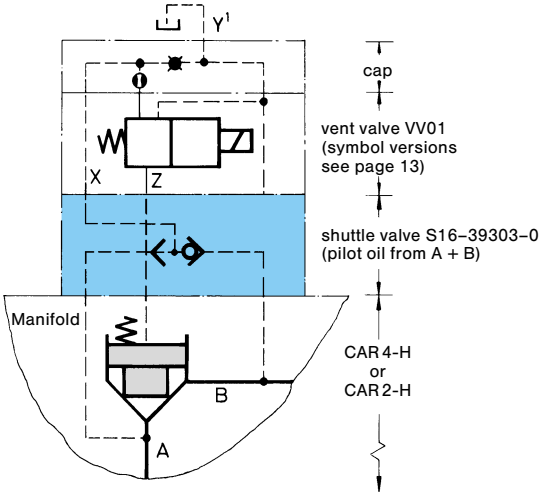
4 Mounting screws must be ordered separately: Order no.

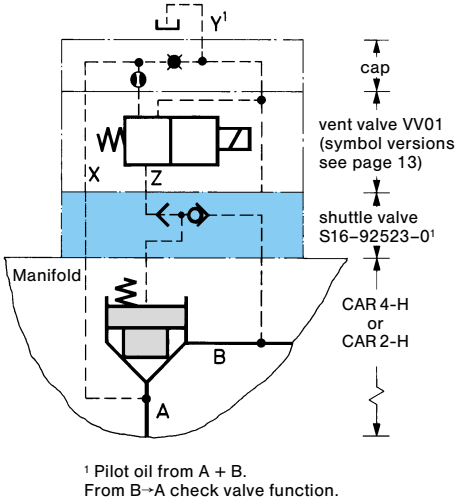
3/8″–24 UNF x 5½″ lg. or M 10 x 140; DIN 912–12.9	359–15420–8 361–11424–8	} for version with shuttle valve S16–39303–0
3/8″–24 UNF x 4½″ lg. or M 10 x 120; DIN 912–10.9	359–15380–8 700–71456–8	} for version with shuttle valve S16–92523–0



( ) Dimensions in brackets are for version with shuttle valve S16–92523–0







[1] Pilot oil from A + B.
From B→A check valve function.

Note: Shuttle valves only use in connection with vent valve VV01.
Ordering code for VV01 see page 12.

ORDERING CODE & DIMENSIONS FOR VENT VALVE VV01

Model Number: VV01 – 3 . . ... – . – 1

(1) (2) (3) (4) (5) (6)

(1) **Series**

(2) **Spool position**
1 = solenoid de-energized: free flow from Z to Y (CAR = open)
solenoid energized: X to Z (CAR = blocked)
2 = solenoid de-energized: X to Z (CAR = blocked)
solenoid energized: free flow from Z to Y (CAR = open)

(3) **Control**
1 = solenoid with manual override
2 = solenoid without manual override

(4) **Solenoid voltage and current**

W01 = 115 V / 60 Hz W02 = 230 V / 60 Hz W06 = 115 V / 50 Hz W07 = 230 V / 50 Hz	AC	G0R = 12 V G0Q = 24 V G0H = 48 V	DC

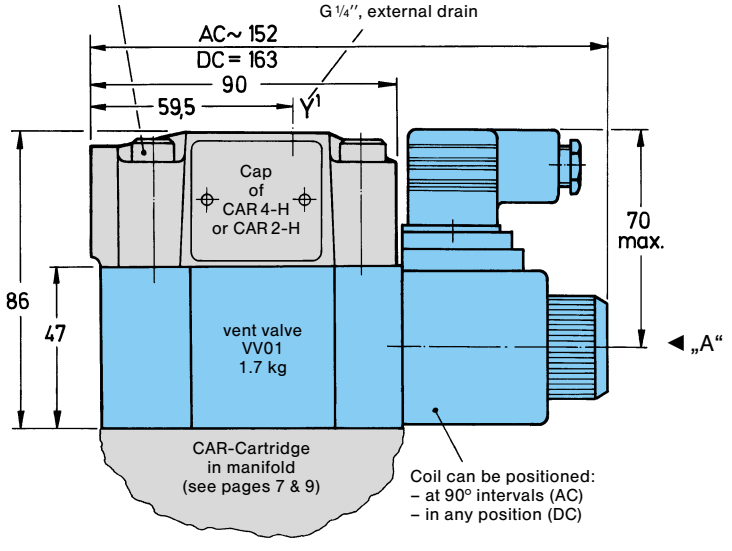
(5) **Design letter**
D = for AC solenoid
E = for DC solenoid

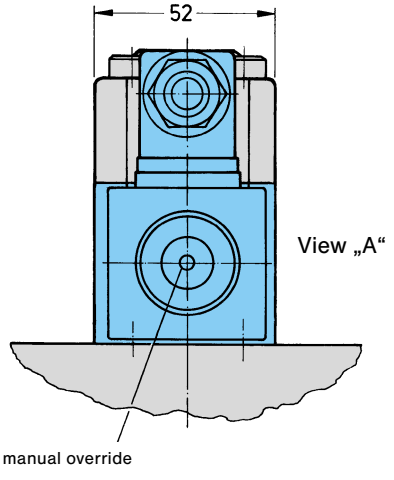
(6) **Seal class**
1 = NBR-seals (Standard)
4 = EPR
5 = FPM-seals (Viton®)

Please note:
For valve version CAR combined with vent valve VV01, the vent valve must be ordered separately.

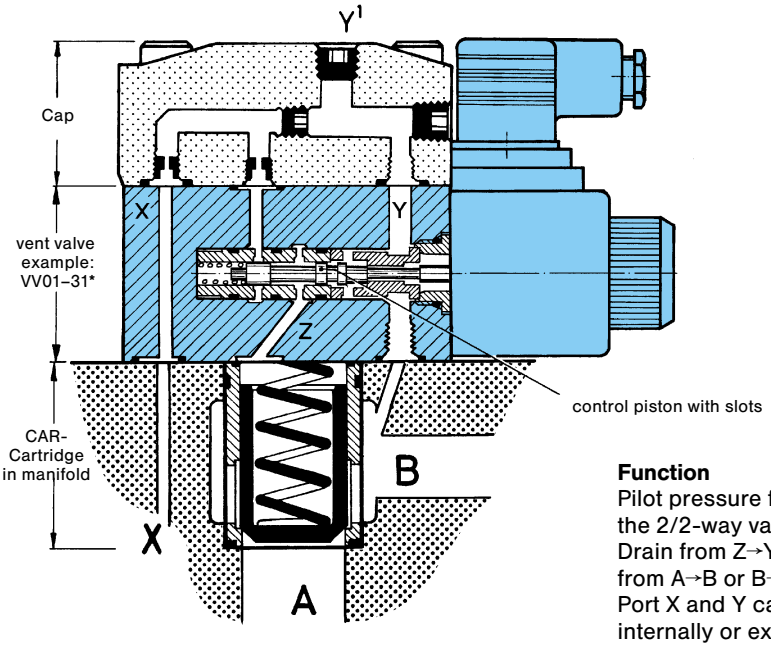
For VV01 with DC solenoid, plug-in connector must be ordered separately. Order no. 167–01008–8.

Screws for installation with vent valve:
4 Screws 3/8"–24 UNF x 3½" lg. or M10 x 90 (DIN 912-10.9)
Order no. 359–15340–0 Order no. 700–70808–8

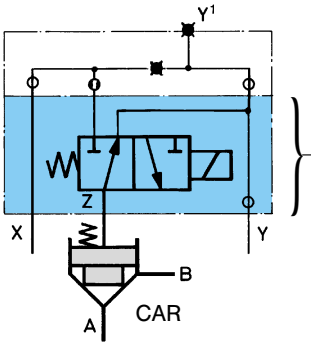




Note:
Further details for vent valve VV01 see publ. 3-EN 215.

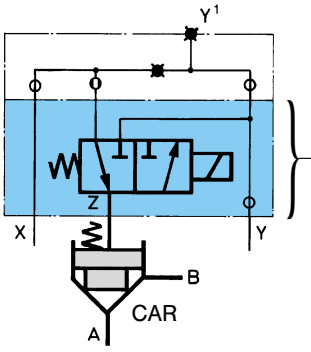


Function
Pilot pressure from X→Z blocks the 2/2-way valve CAR.
Drain from Z→Y effects free flow from A→B or B→A.
Port X and Y can be connected internally or externally.
When port B is pressurised drain must be connected externally (port Y¹).
Port Y in VV01 then must be plugged.



Solenoid energized: CAR blocked.
Solenoid de-energized: free flow from A→B or B→A.

VV01–31.–

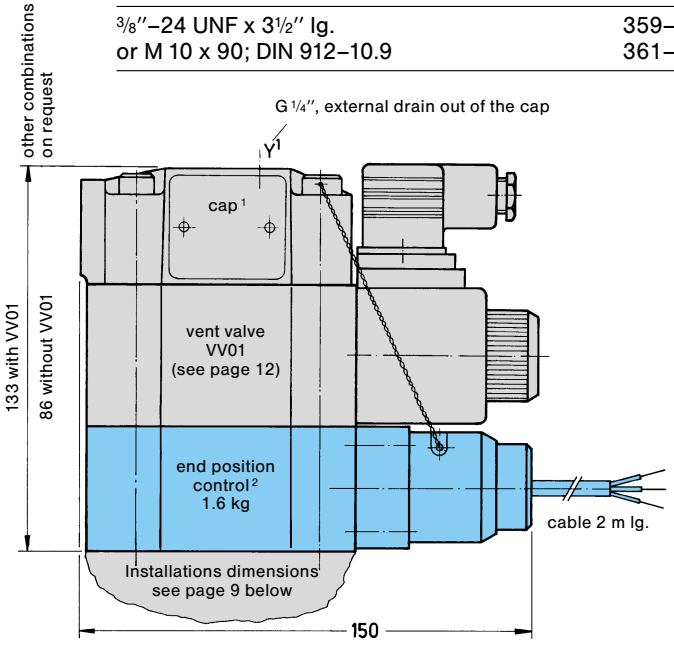


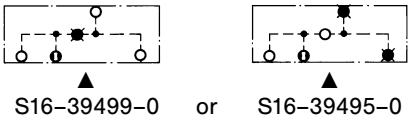
Solenoid energized: free flow from A→B or B→A.
Solenoid de-energized: CAR blocked.

VV01–32.–

End position control by proximity switch (incl. amplifier).
Valve open: proximity switch activated.
This proximity switch is pressure proof and has no wearing parts.

4 Mounting screws must be ordered separately:	Order no.	
3/8″–24 UNF x 5½″ lg. or M 10 x 140; DIN 912–12.9	359–15420–8 361–11424–8	} for version with VV01
3/8″–24 UNF x 3½″ lg. or M 10 x 90; DIN 912–10.9	359–15340–0 361–11343–8	} for version without VV01



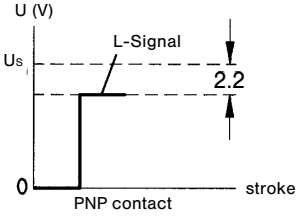


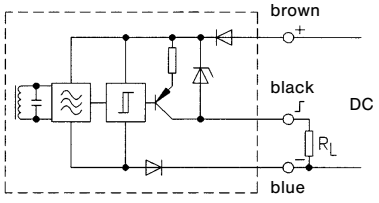
[1] Order no. cap: S16–39499–0 or S16–39495–0

[2] Order no. end position control: S26–58109–0 (incl. sleeve 3, spool A, spring 4)

Technical Data (Proximity switch):

Function:	PNP, Contact
Supply voltage (U_S):	10…30 VDC
Supply voltage ripple:	≦ 10 %
Current consumption:	max. 8 mA
Residual voltage L-Signal:	U_S – 2.2 V at I_{max}
Output current (I):	≦ 200 mA
Type of protection:	IP 67
Ambient temperature:	–25 … +70 °C
Wire cross-sectional area:	3 x 0.5 mm²



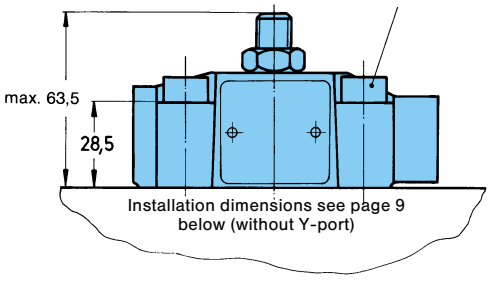


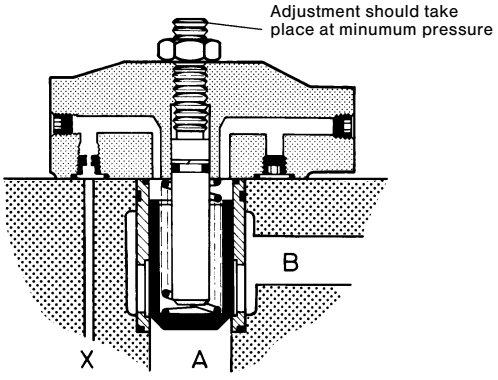
Ordering Code | Back to Content

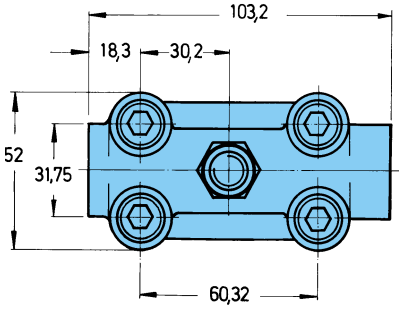
Order no. S16–39490–0

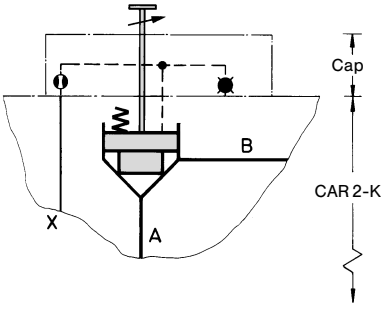
Weight: 1 kg

Mounting screws must be ordered separately:	Order no.
4 Screws 3/8″–24 UNF x 1 3/4″ lg.	359–15220–0
or M 10 x 45; DIN 912–12.9	700–71602–8









Note:
Stroke limiter not in connection with vent valve VV01, shuttle valve and end position control.

Note:
Stroke limiters are used to throttle the oil flow in both directions (from A→B and B→A).