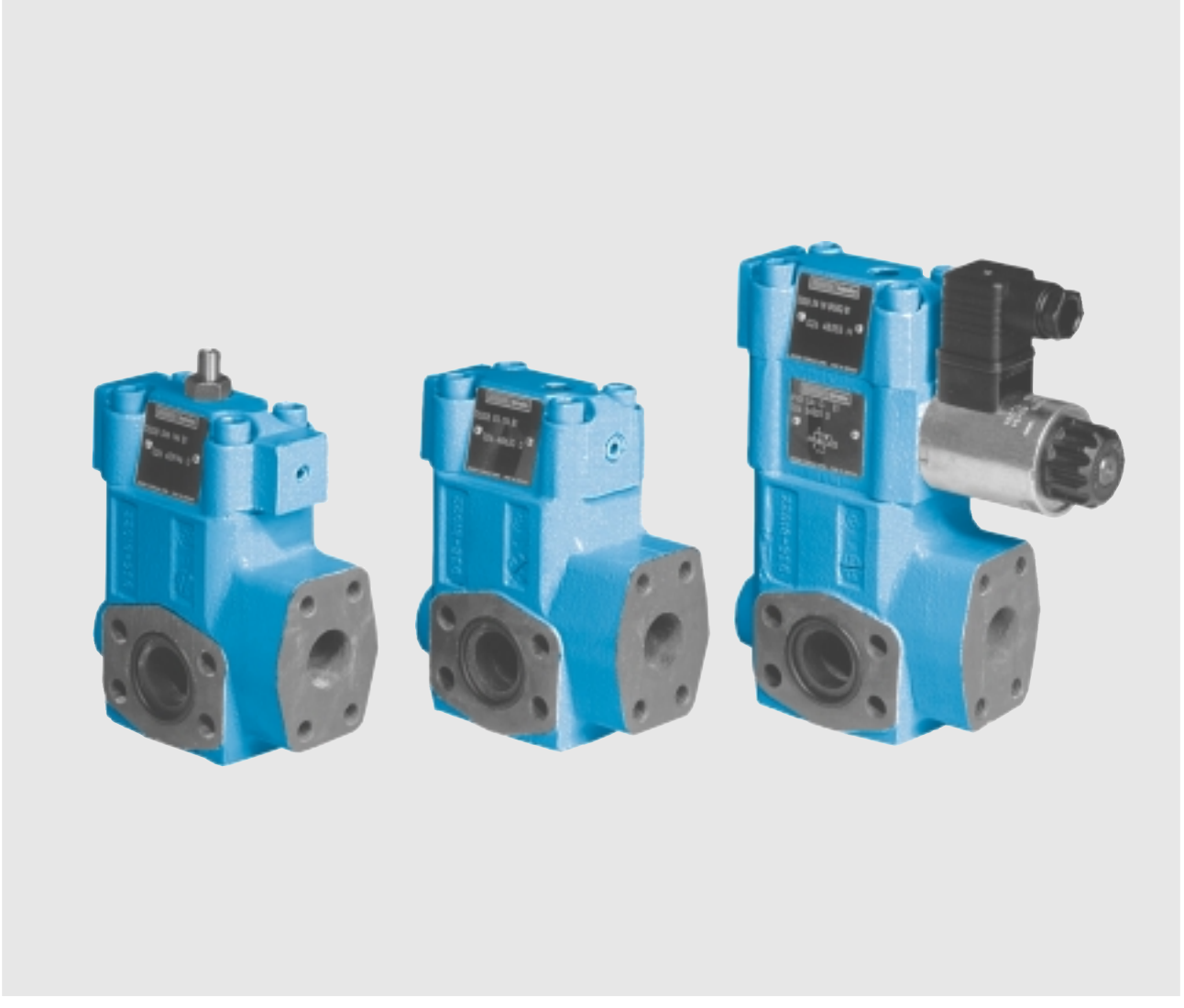
DENISON HYDRAULICS
Seat Valves – SAE Flange Mounting

Series D5S – 3 Port

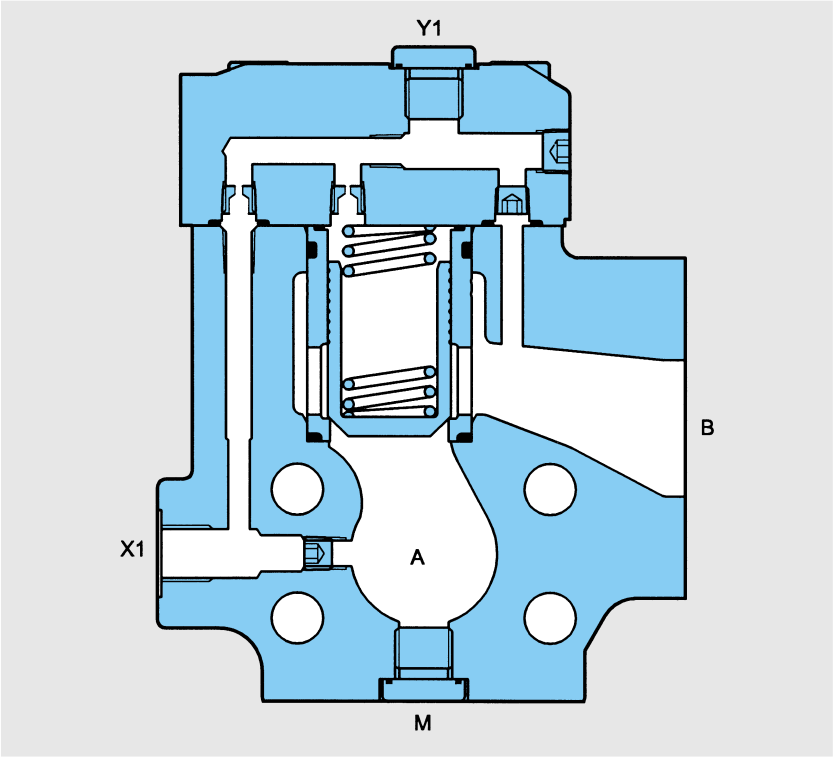


Publ. 7–EN 5300–A (dig.)

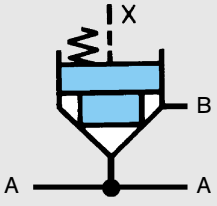
DENISON Hydraulics

FEATURES

- Flange mounted valves according to SAE 61 – bolt on or bolt together – can form complete hydraulic control systems.
- The same modular design is used in all valve sizes and the valves are used for a variety of functions:
  – as a leak proof directional control
  – as a pressure control with external pilot pressure (port X1)
  – 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 D5S are designed for 350 bars operation. Whilst providing extremely fast response they also offer sensitive control without system pressure peaks.
- Worldwide DENISON service.



SYMBOL



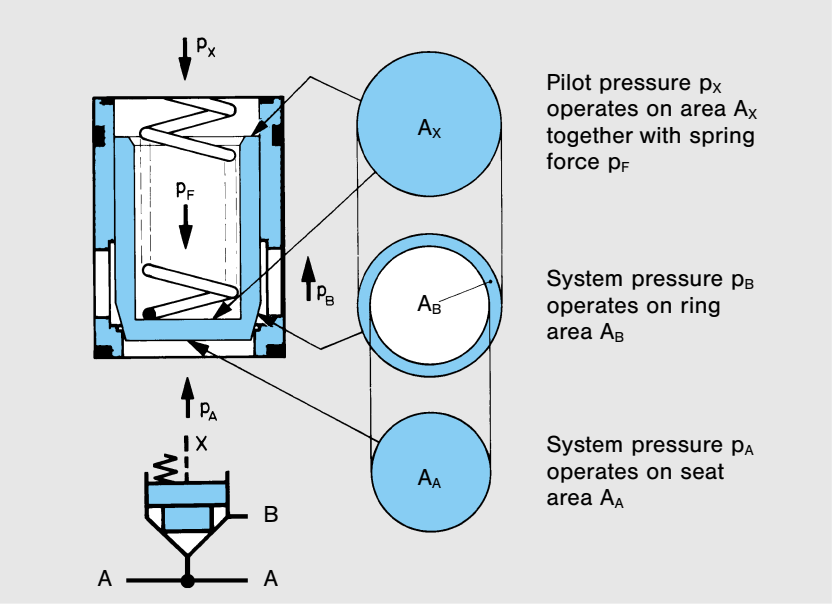
Ordering Code | Back to Content

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	3 Port Flange Mounting
• Port sizes	$^3/_4''$, 1″, $1^1/_4''$, $1^1/_2''$
• Mounting position	Optional
• Direction of flow	A–B or B–A
• Ambient temperature range	– 20 . . . + 60 °C
• Suitability for special working conditions	Consult DENISON

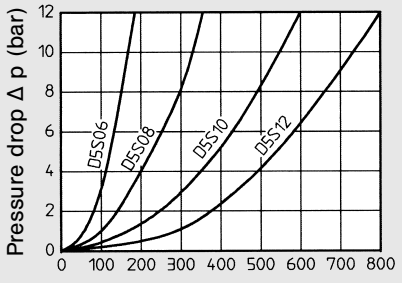
HYDRAULIC CHARACTERISTICS

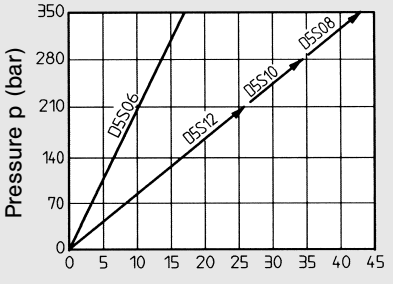
• Operating pressure range		
– port A, B and X	min	0 bar
	max	350 bar for sizes 06/08
		280 bar for size 10
		210 bar for size 12
– port Y1		max 140 bar (with VV01)
• Fluid temperature range		– 18 . . . + 80 °C
• Viscosity range		10 . . . 650 cSt
• Recommended operating viscosity		30 cSt

		D5S06	D5S08	D5S10	D5S12
• Nominal flow	l/min	150	270	450	600
• Max. flow	l/min	180	360	600	800

• Pilot volume	D5S06	D5S08/10/12
– 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 6
• 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 } AC
• Inrush	264 VA } AC
• Relative operating period	100 %
• Type of protection	IP 65

ORDERING CODE

Model Number: D5S .. – . . . – . . . – omit for version without accessories .. – ... – B 1 –

[1] **Series**

D5S = 2-Way-Seat-Valve (Body Mounted Flange SAE 61)

[2] **Size**

06 = ¾″ (CAR4 built in)
08 = 1″ (CAR2 built in)
10 = 1¼″ (CAR2 built in)
12 = 1½″ (CAR2 built in)

[3] **Body Mounting (3 Port)**

5 = Seat Entry, A; X1, Y1, M, Ports = G ¼″ } max. pressure
9 = Seat Entry, A; X1, Y1, M, Ports = SAE-4 (7/16″–20 UNF) } see page 4

[4] **Pilot Oil Line in Body**

1 = internal from A
2 = internal from B
3 = internal from A and B
4 = external from X1
5 = internal from B; external from X1

See also Model Code Explanations pages 7, 8 and 9
For 3 Port Pressure Valves R5* see bulletin 3–EN 2900.

[5] **Cap Version, Pilot Oil Line in the Cap**

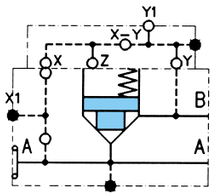
1 = Pilot Oil = Pilot Drain X = ⛔ 1.2 ; Y = ⬛ ; Z = ⛔ 1.2 ; X–Y = ○ ; Y1 = ⬛
2 = Pilot Oil = Pilot Drain X = ⬛ ; Y = ⛔ 1.2 ; Z = ⛔ 1.2 ; X–Y = ○ ; Y1 = ⬛
4 = Internal to B X = ⛔ 1.2 ; Y = ○ ; Z = ⛔ 1.2 ; X–Y = ⬛ ; Y1 = ⬛ ; VV01 = ○ } with VV01
6 = External out of cap X = ⛔ 1.2 ; Y = ○ ; Z = ⛔ 1.2 ; X–Y = ⬛ ; Y1 = ○ ; VV01 = ⬛ } only
A = Pilot Oil = Pilot Drain X = ⛔ 1.2 ; Y = ⬛ ; Z = ⛔ 1.2 ; X1 = ⬛ } stroke limiter only for
B = Pilot Oil = Pilot Drain X = ⬛ ; Y = ⛔ 1.2 ; ; X1 = ⬛ } D5S08, D5S10 and D5S12

[6] **Sleeve**

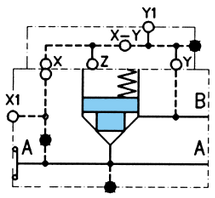
1 = AA = 95 %, AB = 5 %
3 = AA = 60 %, AB = 40 %

Legend:

○ open bore
⬛ closed bore
⛔ orifice ∅ 1.2



Pilot line
internal from A



Pilot line
external from X1

Note: Ensure that flanges meet pressure requirements.
Denison's supply meet rated pressure specified in this leaflet.

[13] **Modifications**

0013 = Cover for end position control (see page 15)

[12] **Seal Class**

1 = NBR-seals (Standard), 4 = EPDM-seals, 5 = FPM-seals (Viton®)

[11] **Design Letter**

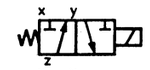
[10] **Solenoid Voltage and Current** (for vent valve VV01)

W01 = 115 V / 60 Hz } AC
W02 = 230 V / 60 Hz } AC
W06 = 115 V / 50 Hz } AC
W07 = 230 V / 50 Hz } AC

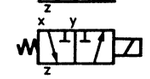
G0R = 12 V } DC
G0Q = 24 V } DC
G0H = 48 V } DC

[9] **Accessories**

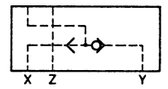
09 = VV01 with manual override } de-energized: power component open
10 = VV01 without manual override } de-energized: power component open



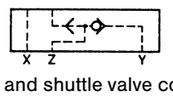
11 = VV01 with manual override } de-energized: power component closed
12 = VV01 without manual override } de-energized: power component closed



CA = Shuttle valve



DA = Shuttle valve



CB = VV01 code 09 } and shuttle valve code CA
CD = VV01 code 11 } and shuttle valve code CA
DB = VV01 code 09 } and shuttle valve code DA
DD = VV01 code 11 } and shuttle valve code DA
BH = VV01 code 10 } and shuttle valve code CA and end position control[1] with amplifier
BK = VV01 code 12 } and shuttle valve code CA and end position control[1] with amplifier
BN = VV01 code 10 } and shuttle valve code DA and end position control[1] with amplifier
BQ = VV01 code 12 } and shuttle valve code DA and end position control[1] with amplifier
BC = VV01 code 10 and end position control[1] with amplifier
BE = VV01 code 12 and end position control[1] with amplifier
BA = End position control[1] with amplifier
BF = End position control[1] with amplifier and shuttle valve code CA
BL = End position control[1] with amplifier and shuttle valve code DA

[1]) end position control for D5S08/10/12 only. Spring 2 or 4. Spool A and sleeve 3.

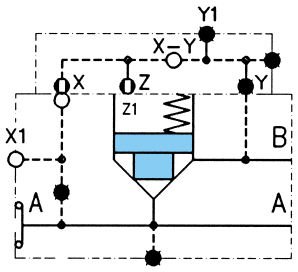
[8] **Spring** (approx. cracking pressure, bar)

	Sleeve 1 (AA = 95%, AB = 5%)		Sleeve 3 (AA = 60%, AB = 40%)			
	A→B		A→B		B→A	
	D5S06	D5S08/10/12	D5S06	D5S08/10/12	D5S06	D5S08/10/12
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	–

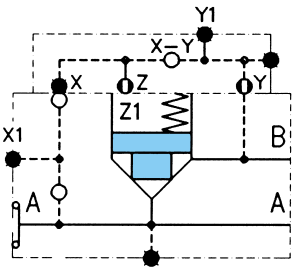
[7] **Spool**

1 = with closed bottom and 15° chamfer (pZ max = pA + 20 bar)
2 = with 0.8 mm dia. orifice at the bottom and 15° chamfer (only D5S06)
with 1.2 mm dia. orifice at the bottom and 15° chamfer (only D5S08/10/12) } with sleeve 1 only
4 = with closed bottom and 45° chamfer
A = Safety spool (for end position control only)
B = Throttle spool (10° chamfer)
C = Throttle spool (3° chamfer) } D5S08/10/12 & Sleeve 3 & Springs 2, 3, 6 only

Cap

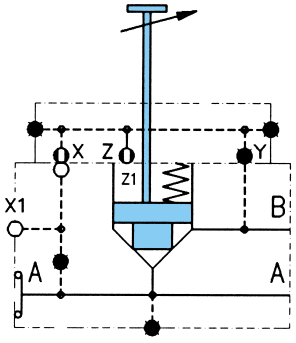


D5S..–541–
9
Pilot oil: internal from X1

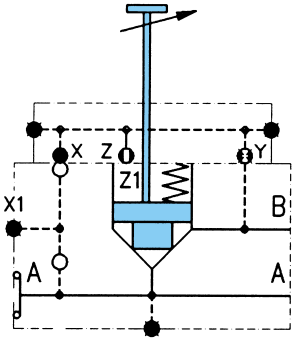


D5S..–522–
9
Pilot oil: internal from B

Stroke Limiter

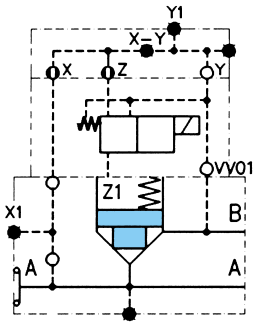


D5S08–54A–
10 9
12
Pilot oil: internal from X1



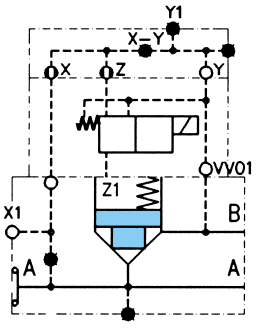
D5S08–52B–
10 9
12
Pilot oil: internal from B

with Vent Valve VV01



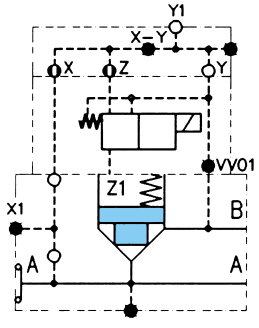
D5S .. – 5 1 4 – ... – 09 –
9 10
11
12

Pilot oil: internal from A
Pilot drain: internal to B



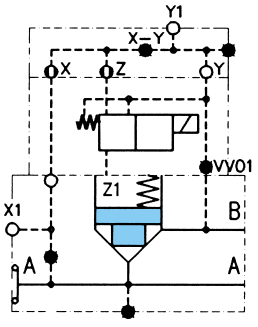
D5S .. – 5 4 4 – ... – 09 –
9 10
11
12

Pilot oil: external from X1
Pilot drain: internal to B



D5S .. – 5 1 6 – ... – 09 –
9 10
11
12

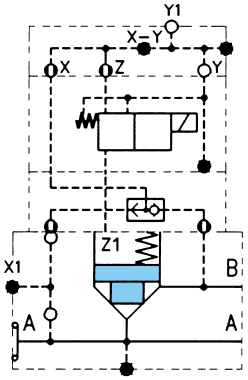
Pilot oil: internal from A
Pilot drain: external out of Y1



D5S .. – 5 4 6 – ... – 09 –
9 10
11
12

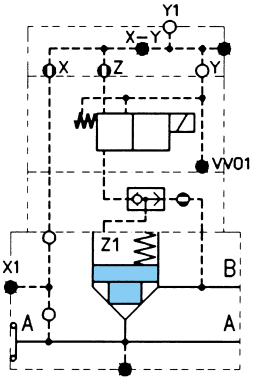
Pilot oil: external from X1
Pilot drain: external out of Y1

with VV01 + Shuttle Valve



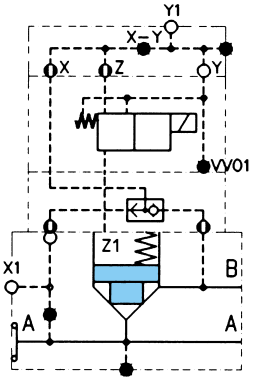
D5S .. – 5 3 6 – ... – CB –
9 CD

Pilot oil: internal from A +
internal from B
Pilot drain: external out of Y1



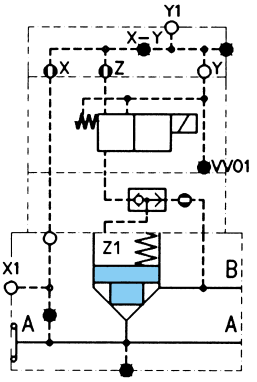
D5S .. – 5 3 6 – ... – DB –
9 DD

Pilot oil: internal from A +
internal from B
Pilot drain: external out of Y1



D5S .. – 5 5 6 – ... – CB –
9 CD

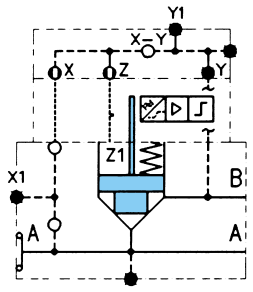
Pilot oil: external from X1 +
internal from B
Pilot drain: external out of Y1



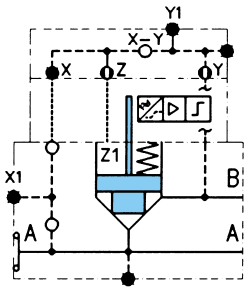
D5S .. – 5 5 6 – ... – DB –
9 DD

Pilot oil: external from X1 +
internal from B
Pilot drain: external out of Y1

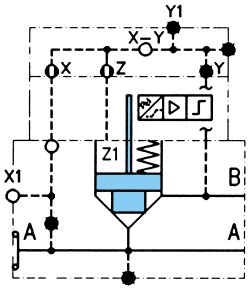
Examples for End Position Control



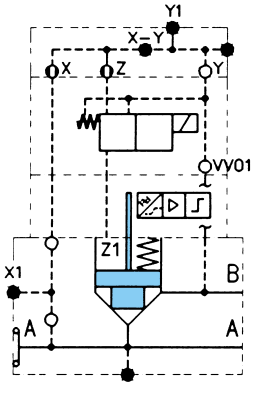
D5S08-511-3A.-BA-
10 9
12
Pilot oil: internal from A



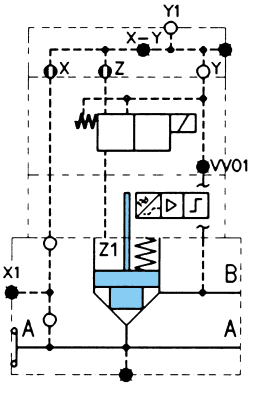
D5S08-522-3A.-BA-
10 9
12
Pilot oil: internal from B



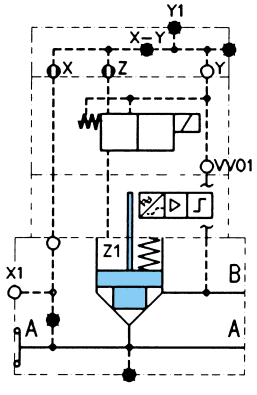
D5S08-521-3A.-BA-
10 9
12
Pilot oil: external from X1



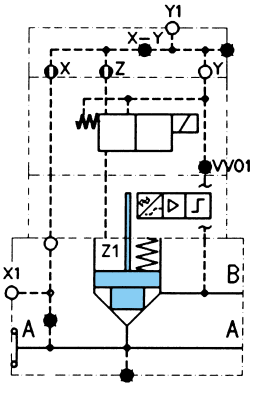
D5S08-514-3A.-BC-
10 9 BE
12
Pilot oil: internal from A
Pilot drain: internal to B



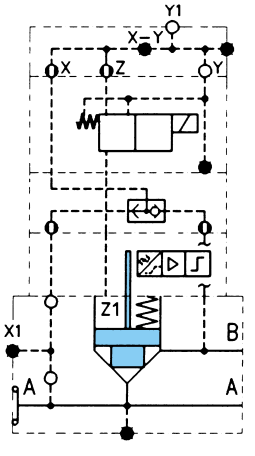
D5S08-516-3A.-BC-
10 9 BE
12
Pilot oil: internal from A
Pilot drain: external out of Y1



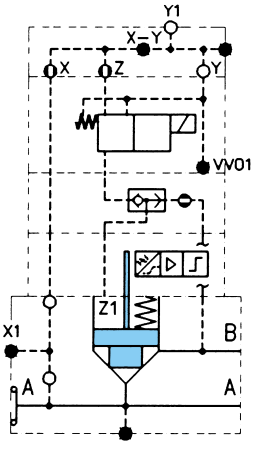
D5S08-544-3A.-BC-
10 9 BE
12
Pilot oil: external from X1
Pilot drain: internal to B



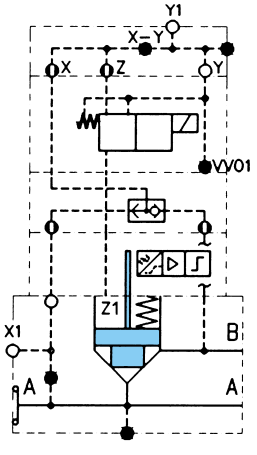
D5S08-546-3A.-BC-
10 9 BE
12
Pilot oil: external from X1
Pilot drain: external out of Y1



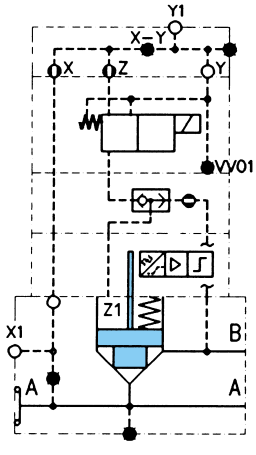
D5S08-536-3A.-BH-
10 9 BK
12
Pilot oil: internal from A +
internal from B
Pilot drain: external out of Y1



D5S08-536-3A.-BN-
10 9 BQ
12
Pilot oil: internal from A +
internal from B
Pilot drain: external out of Y1



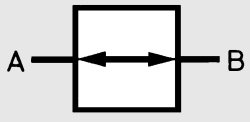
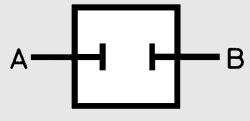
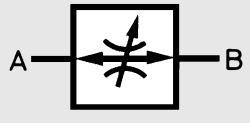
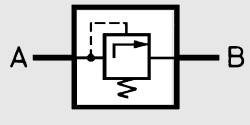
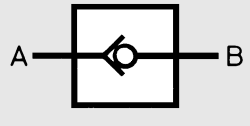
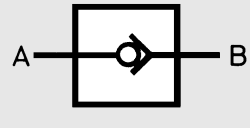
D5S08-556-3A.-BH-
10 9 BK
12
Pilot oil: external from X1 +
internal from B
Pilot drain: external out of Y1



D5S08-556-3A.-BN-
10 9 BQ
12
Pilot oil: external from X1 +
internal from B
Pilot drain: external out of Y1

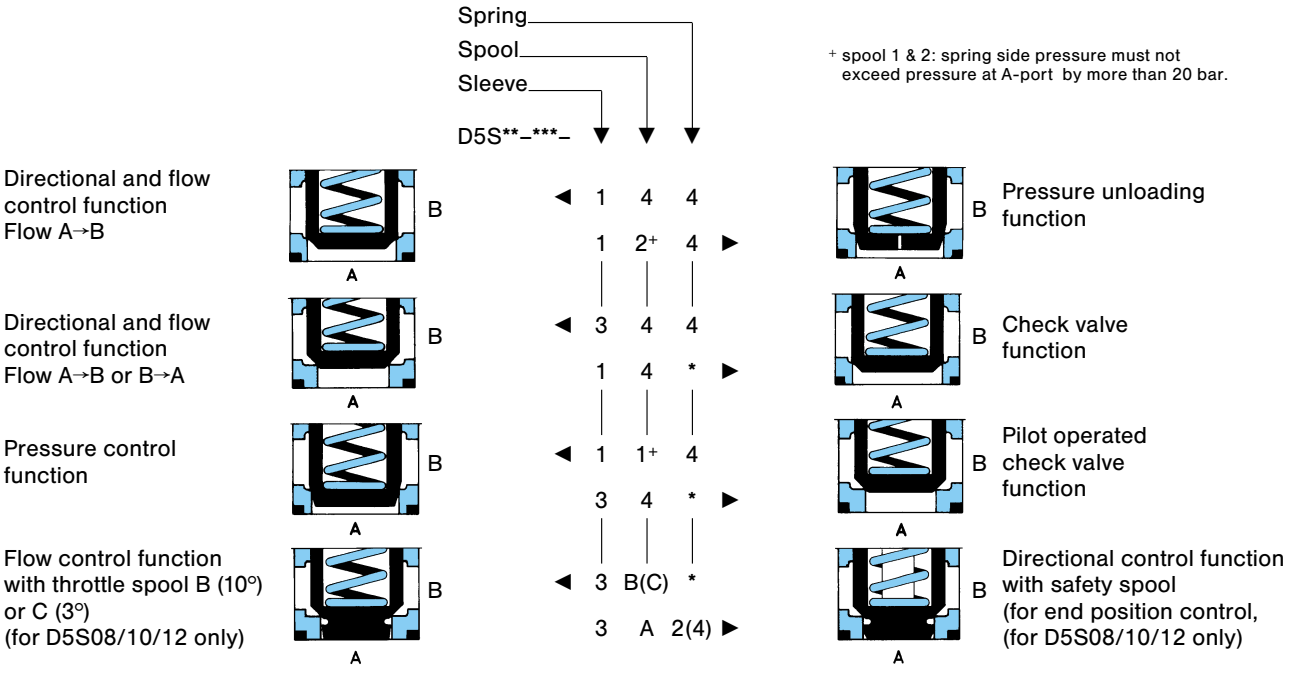
CONTROL FUNCTIONS AVAILABLE

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 X1 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 free, 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 free, blocked to B	Plug may be fitted between B and X leaving X connected to A (check valve function from A–B, not leakproof).

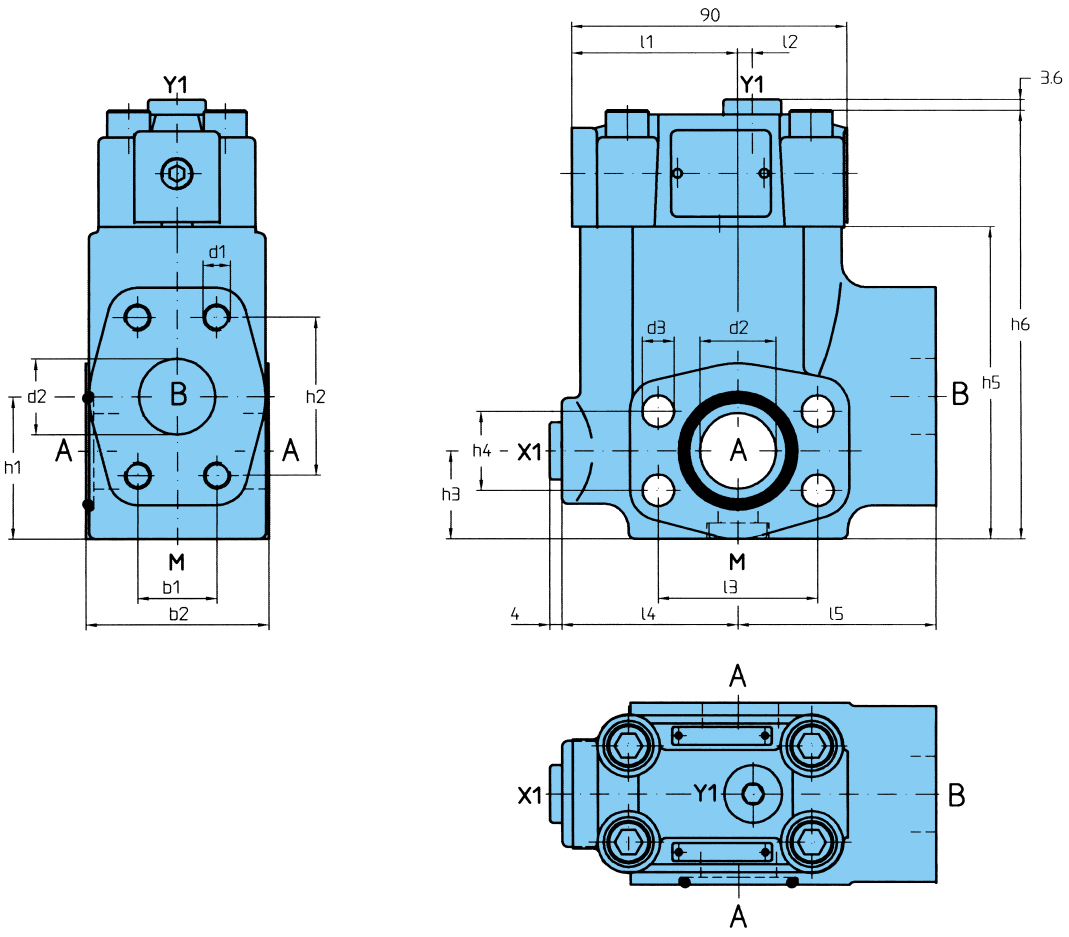
Further control functions on request

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



Ports	Function	Port Sizes			
		D5S06	D5S08	D5S10	D5S12
A (2x)	Inlet or outlet	¾″ SAE–61	1″ SAE–61	1¼″ SAE–61	1½″ SAE–61
B	Outlet or inlet	¾″ SAE–61	1″ SAE–61	1¼″ SAE–61	1½″ SAE–61
X1	external pilot port	G ¼″ or SAE–4			
Y1	external pilot drain				
M	Pressure gauge				

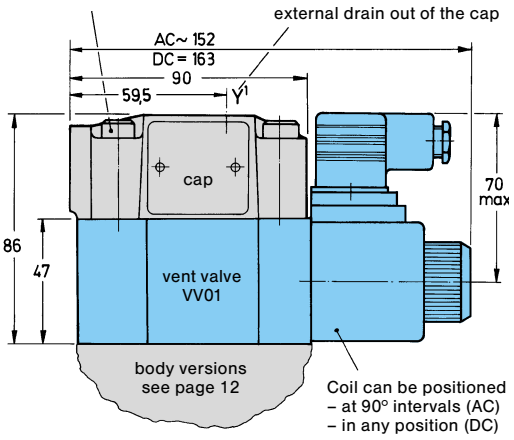
Dimensions

	l_1	l_2	l_3	l_4	l_5	b_1	b_2	h_1	h_2	h_3	h_4	h_5	h_6	d_1	d_2	d_3	Weight
D5S06	48.5	11	47.6	56	63	22.2	60	41	47.6	28	22.2	82	119	⅜″ UNC x 20 lg.	19	10.5	3.4 kg
D5S08	54.5	5	52.4	58	65	26.2	60	47	52.4	29	26.2	103	141	⅜″ UNC x 23 lg.	25	10.5	4.4 kg
D5S10	56.5	3	58.7	62	61	30.2	75	64	58.7	35	30.2	112	149	7/16″ UNC x 22 lg.	32	12.5	5.0 kg
D5S12	36.0	23	69.8	55	93	35.7	80	73	69.8	34	35.7	140	178	½″ UNC x 27 lg.	38	13.5	7.8 kg

SAE-Flanges see page 16
Mounting screws see page 17

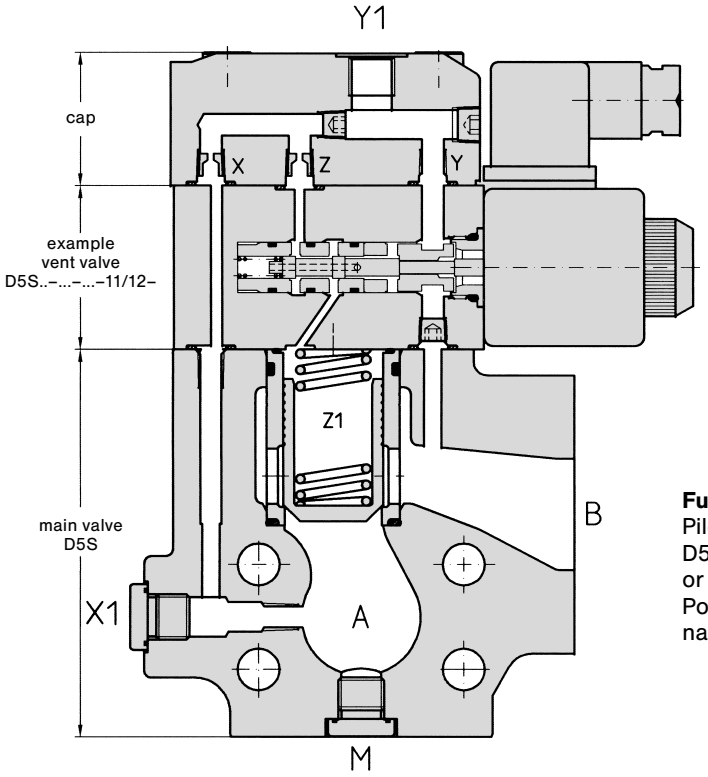
Weight (VV01): 1.5 kg

Screws for additional installation:
4 x 3/8"–24 UNF x 3½"
Order-no. 359–15340–0

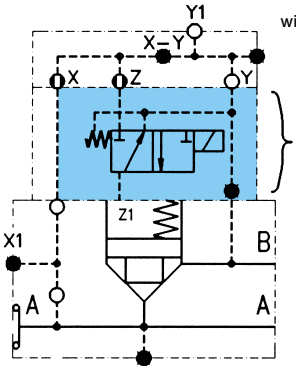


Note:
Further details for vent valve VV01
see information 3–EN 215.

Example: Pilot oil internal from A
Pilot drain external out of Y1

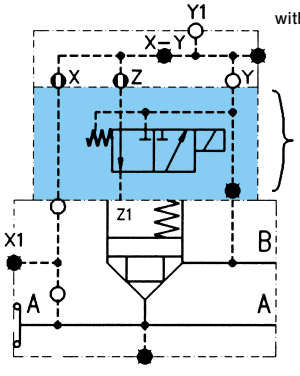


Function
Pilot pressure from X to Z blocks the 2-way valve D5S. Drain from Z to Y effects free flow from A to B or B to A.
Port X and Y can be connected internally or externally (refer to pilot oil line).



with manual override | without manual override

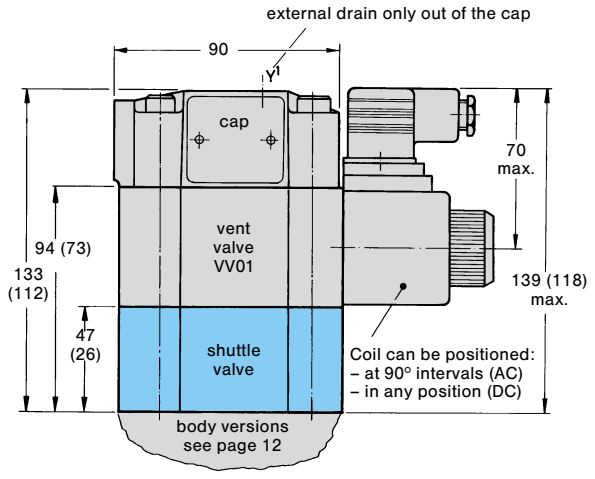
D5S..–...–...–09/10–
Solenoid energized:
Blocked flow from A to B
or B to A.
Solenoid de-energized:
Free flow from A to B
or B to A.



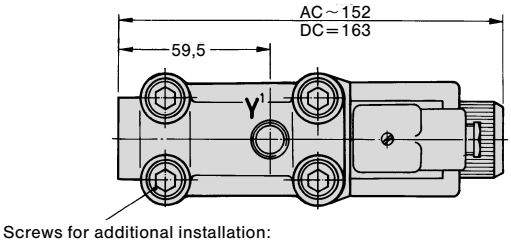
with manual override | without manual override

D5S..–...–...–11/12–
Solenoid energized:
Free flow from A to B
or B to A.
Solenoid de-energized:
Blocked flow from A to B
or B to A.

Weight: 1.2 / 0.7 kg



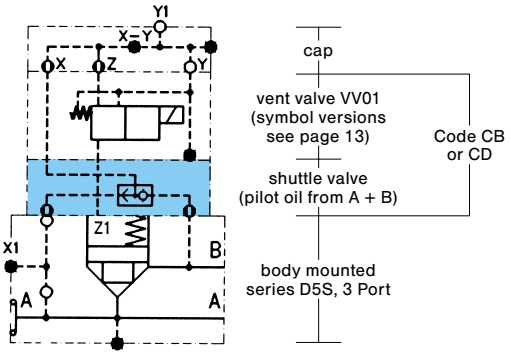
() Dimensions in brackets are for version VV01 with shuttle valve Code DB or DD.

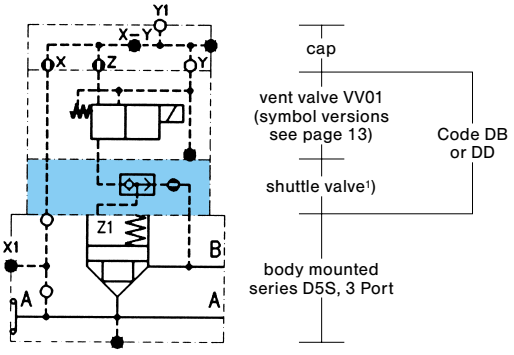


Screws for additional installation:
4 x 3/8''–24 UNF x 5½'' lg. = Code CB or CD
Order-no. 359–15420–8
4 x 3/8''–24 UNF x 4½'' lg. = Code DB or DD
Order-no. 359–15380–8

Note:
Shuttle valves only use in connection with vent valve VV01.

Examples with Shuttle Valves:





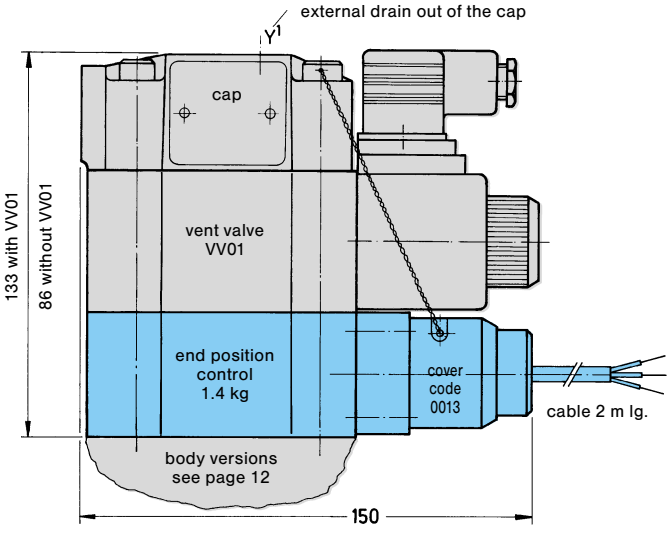
[1] Pilot oil from A + B.
From B→A check valve function.

Ordering Code | Back to Content

END POSITION CONTROL

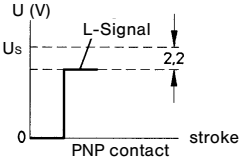
End position control by proximity switch (incl. amplifier).
Valve open: proximity switch activated.
This proximity switch is pressure proof and has no wearing parts.

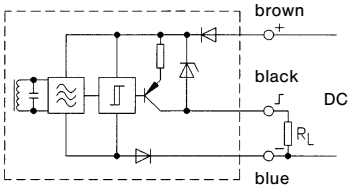
Note:
End position control for D5S08/10/12 only.



Technical Data (Proximity switch):

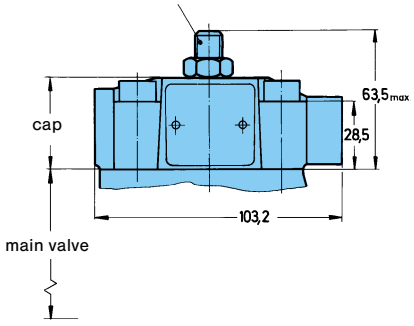
Function:	PNP, Contact
Supply voltage (U_S):	10 . . . 30 VDC
Supply voltage ripple:	≦ 10 %
Current consumption:	max. 8 mA
Residual voltage L-Signal:	U_S – 2.2 V at I_{max}
Output current (I):	≦ 200 mA
Type of protection:	IP 67
Ambient temperature:	– 25 . . . + 70 °C
Wire cross-sectional area:	3 x 0.5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



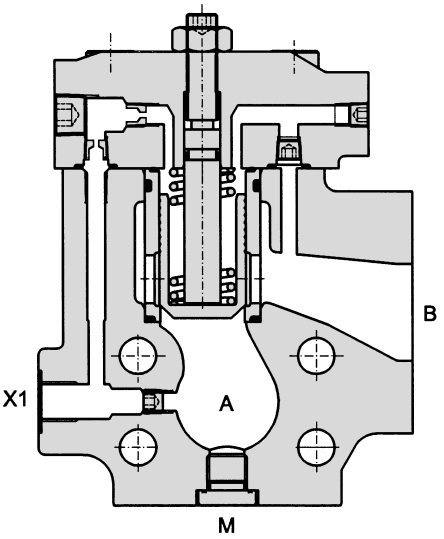


STROKE LIMITER

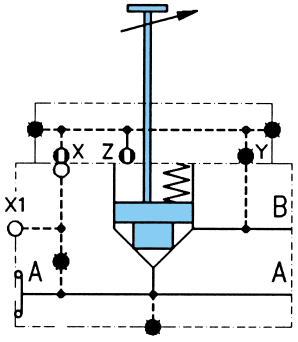
Stroke limiter (Adjustment should take place at minimum pressure)



X1 = external pilot oil (optional)



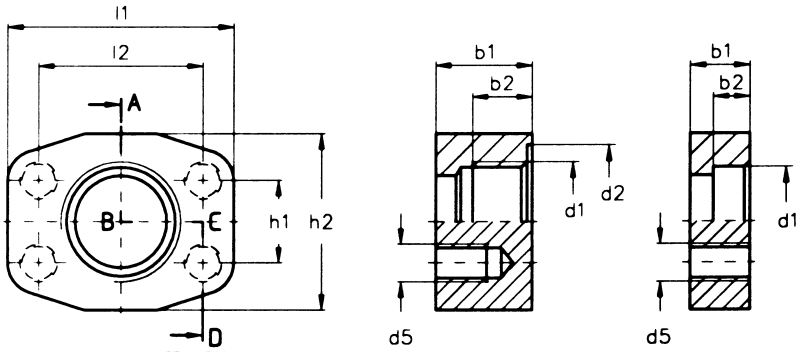
Example: D5S$^{08}_{10}_{12}$–54A–...



Note:
Stroke limiter not for use with D5S06, vent valve VV01, shuttle valve and end position control.

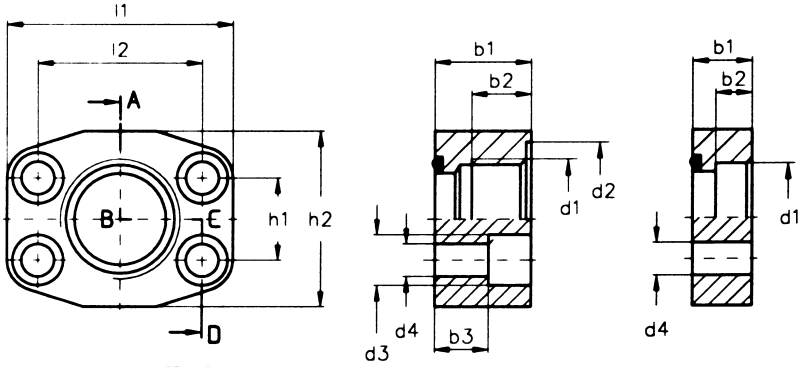
Ordering Code | Back to Content

Inlet flange
(only for pipe mounting and only with UNC thread)



with G-thread | socket weld

Outlet and tank port flange



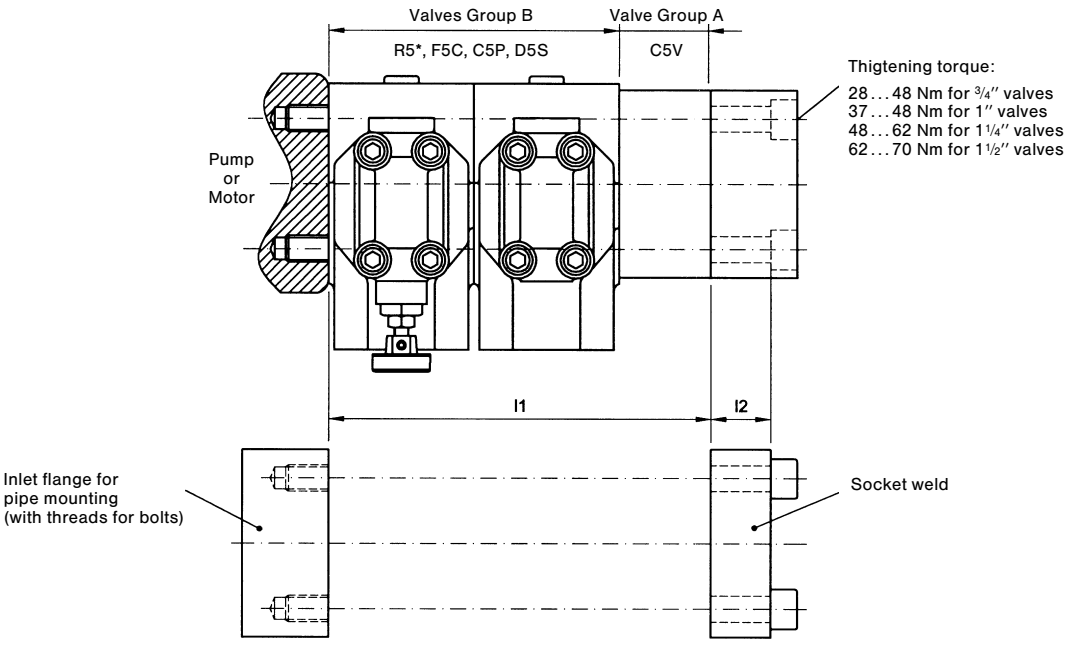
with G-thread | socket weld

Port sizes d_1	**Inlet flange** (without screws*) only for pipe mounting	**Outlet flange** (without screws*)	**Tank port flange** (with screws)											
	Order No.	Order No.	Order No.	l_1	l_2	b_1	b_2	b_3	h_1	h_2	d_2 Ø	d_3 Ø	d_4 Ø	d_5
G 3/4″	S16-86520-0	S16-86529-0	S14-66933-0	67	47.6	34	15.9	22	22.2	52	40	16.5	10.5	3/8″ UNC
3/4″ socket weld	S16-86519-0	S16-86528-0	S14-66941-0			19	12	–			–	–		
G 1″	S16-86523-0	S16-86532-0	S14-66934-0	72	52.4	34	20	22	26.2	58	46	16.5		
1″ socket weld	S16-86522-0	S16-86531-0	S14-66942-0			24	14	–			–	–		
G 1 1/4″	S16-86526-0	S16-86535-0	S14-66935-0	80	58.7	39	22	24	30.2	73	54	17.5	12.5	7/16″ UNC
1 1/4″ socket weld	S16-86525-0	S16-86534-0	S14-66943-0			24	14	–			–	–		
G 1 1/2″	S26-52364-0	S26-52215-0	S14-66936-0	94	69.8	39	24	24	35.7	82	60	20	14.5	1/2″ UNC
1 1/2″ socket weld	S26-52366-0	S26-52217-0	S14-66944-0			26	16	–			–	–		

* see page 17 for screws

Ordering Code | Back to Content

Example



	Qty. of valves and group for each stack	l1	l2	UNC-Screws (12.9)		Metric Screws (12.9)	
				Dimension	Order No.	Dimension	Order No.
3/4" SAE 61	1 x A	45	16...22	3/8"–16 x 3 1/4"	358–16330–0	M10 x 80	361–11324–8
	1 x B	60		3/8"–16 x 3 3/4"	358–16350–0	M10 x 95	361–11354–8
	(1 x A) + (1 x B)	105		3/8"–16 x 5 1/2"	358–16420–0	M10 x 140	361–11424–8
	2 x B	120		3/8"–16 x 6"	358–16440–0	M10 x 160	700–70836–8
	(1 x A) + (2 x B)	165		3/8"–16 x 8"	358–16520–0	M10 x 200	700–70821–8
	3 x B	180		3/8"–16 x 8 1/2"	358–16540–0	M10 x 220	361–11494–8
1" SAE 61	1 x A	45	18...24	3/8"–16 x 3 1/4"	358–16330–0	M10 x 80	361–11324–8
	1 x B	60		3/8"–16 x 3 3/4"	358–16350–0	M10 x 95	361–11354–8
	(1 x A) + (1 x B)	105		3/8"–16 x 5 3/4"	358–16430–0	M10 x 140	361–11424–8
	2 x B	120		3/8"–16 x 6 1/4"	358–16450–0	M10 x 160	700–70836–8
	(1 x A) + (2 x B)	165		3/8"–16 x 8"	358–16520–0	M10 x 200	700–70821–8
	3 x B	180		3/8"–16 x 8 1/2"	358–16540–0	M10 x 220	361–11494–8
1 1/4" SAE 61	1 x A	50	21...25	7/16"–14 x 3 1/2"	358–18340–0	M12 x 90	361–12344–8
	1 x B	75		7/16"–14 x 4 1/2"	358–18380–0	M12 x 120	361–12404–8
	(1 x A) + (1 x B)	125		7/16"–14 x 6 1/2"	358–18460–0	M12 x 170	361–12454–8
	2 x B	150		7/16"–14 x 7 1/2"	358–18500–0	M12 x 190	361–12474–8
	(1 x A) + (2 x B)	200		7/16"–14 x 9 1/2"	358–18580–0	M12 x 240	361–12504–8
	3 x B	225		7/16"–14 x 10 1/2"	358–18590–0	M12 x 270	361–12664–8
1 1/2" SAE 61	1 x A	50	25...27	1/2"–13 x 3 3/4"	358–20350–0	M12 x 90	361–12344–8
	1 x B	80		1/2"–13 x 5"	358–20400–0	M12 x 130	361–12414–8
	(1 x A) + (1 x B)	130		1/2"–13 x 6 3/4"	358–20470–0	M12 x 170	361–12454–8
	2 x B	160		1/2"–13 x 8"	358–20520–0	M12 x 200	361–12484–8
	(1 x A) + (2 x B)	210		1/2"–13 x 10"	358–20600–0	M12 x 250	361–12674–8
	3 x B	240		1/2"–13 x 11 1/4"	358–20650–0	M12 x 290	361–12684–8