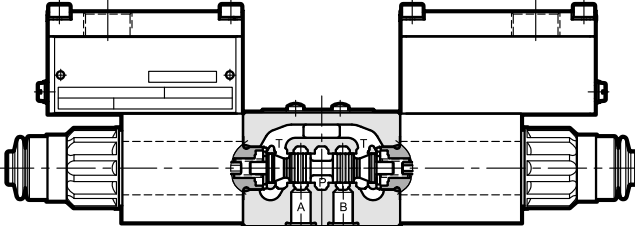


VSD* HL

EXPLOSION-PROOF SOLENOID OPERATED DIRECTIONAL CONTROL VALVES ATEX, IECEX, INMETRO, PESO

VSD03HL	D03 (ISO 4401-03)
VSD05HL	D05 (ISO 4401-05)
VSD05*HL	D05H (alt. A / alt. B)
VSD07HL	D07 (ISO 4401-07)
VSD08HL	D08 (ISO 4410-08)
VSD10HL	D10 (ISO 4401-10)

OPERATING PRINCIPLE



- The direct operated directional valves are available in ISO 4401-03 and ISO 4401-05 size; available pilot operated sizes are: CETOP P05, ISO 4401-05, ISO 4401-07, ISO 4401-08 and ISO 4401-10.
- They are compliant with ATEX, IECEX, INMETRO or PESO requirements and are suitable for use in potentially explosive atmospheres, for surface plants or mines.
- A low temperature version (up to -40 °C) is also available.
- VSD03HL and VSD05HL valves are supplied with a zinc-nickel finishing surface treatment that ensures a salt spray resistance up to 600 h; for pilot operated valves, this treatment is available upon request.
- **Details for classification, operating temperatures and electrical characteristics are in the technical data sheet (Form No. 1027865) 'Explosion proof classification'.**

TYPICAL PERFORMANCE SPECIFICATIONS

		VSD03HL		VSD05HL		VSD05AHL VSD05BHL		VSD07HL		VSD08HL		VSD10HL	
MAXIMUM OPERATING PRESSURE	P - A - B Ports	5000 psi	350 bar	4600 psi	320 bar	4600 psi	320 bar	5000 psi	350 bar	5000 psi	350 bar	5000 psi	350 bar
	T Port (Ext. Drain)	-	-	-	-	3000 psi	210 bar	3000 psi	210 bar	3000 psi	210 bar	3000 psi	210 bar
	T Port (Int. Drain)	3000 psi	210 bar	3000 psi	210 bar	2000 psi	140 bar	2000 psi	140 bar	2000 psi	140 bar	2000 psi	140 bar
PILOT PRESSURE	Minimum	-	-	-	-	72-145 psi	5-10 bar	72-175 psi	5-12 bar	102-204 psi	7-14 bar	87-175 psi	6-12 bar
	Maximum	-	-	-	-	3000 psi	210 bar	3000 psi	210 bar	3000 psi	210 bar	3000 psi	210 bar
MAX FLOW RATE		20 gpm	76 l/min	33 gpm	125 l/min	40 gpm	150 l/min	80 gpm	300 l/min	160 gpm	600 l/min	290 gpm	1100 lpm
MOUNTING SURFACE		NFPA D03 ISO 4401-03-02-0-03		NFPA D05 ISO 4401-05-04-0-05		NFPA D05 alt. A/alt. B ISO 4401-05-05-0-05		NFPA D07 ISO 4401-07-07-0-05		NFPA D08 ISO 4401-08-08-0-05		NFPA D10 ISO 4401-10-09-0-05	
MAX WEIGHT		6.2 lbs	2.8 kg	8.4 lbs	3.8 kg	17.2 lbs	7.8 kg	21.2 lbs	9.6 kg	36.4 lbs	16.5 kg	116.8 lbs	53 kg

1- IDENTIFICATION CODE - HAZARDOUS LOCATION - DIRECT OPERATED

VSD [] HL - [] [] - [] [] [] - K*D*2 [] - [] D - [] — DESIGN LETTER

SOLENOID OPERATED

HAZARDOUS LOCATION

VALVE APPROVAL
See section 1.1

SOLENOIDS
see codes on page 6+7

SIZE	
03	NFPA D03
05	NFPA D05

TEMPERATURE CLASS	
OMIT	T4 (STD)
T5	T5 class (see page 21)

FUNCTION	
1	
	Single operator, 2 Position Spring Offset
2	
	Dual operator, 2 Position Detent (no Spring)
3	
	Dual operator, 3 Position Spring Centered
5	
	Single operator, 2 Position Spring Centered
9	
	Single operator, 2 Position Spring Centered

SEAL	TEMP RANGE
A	Buna (STD) -20 to +80°C -4 to +176°F
G	Viton
AL	Buna (low temp) -40 to +80°C -40 to +176°F

MECHANICAL OPTIONS OMIT IF NOT REQUIRED	
R	Reverse Mode Sol. A supplied
F	Blind Retainer (STD for AL seal) see page 29
H	Lever manual override (see page 29 available only on D03)

TERMINAL BLOCK CONNECT	
T01	TOP: M20 x 1.5 ISO 261
T02	TOP: Gk 1/2 UNI EN 10226-2
T03	TOP: 1/2" NPT ANSI B1.20.1 (ex ANSI B 2.1)
S01	SIDE: M20 x 1.5 ISO 261 (available upon request only)
S04	SIDE: M16 x 1.5 ISO 261 (only for 24V)

TYPICAL ORDERING CODE:
VSD03HL-3A-AT02-KD2-24D-A

NOTE:

The Zinc-Nickel body finishing surface treatment ensures a sal spray resistance up to 600 h (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289).

1.1 - Names of valves per certification

	ATEX		IECEX		INMETRO		PESO	
for gases for dusts	KD2	II 2GD	KXD2	IECEX Gb IECEX Db	KBD2	INMETRO Gb INMETRO Db	KPD2	PESO Gb not applicable for dust
for mines	KDM2	I M2	KXDM2	IECEX Mb	KBDM2	INMETRO Mb	not applicable for mines	

NOTE: Refer to the technical data for marking, operating temperatures and available versions.

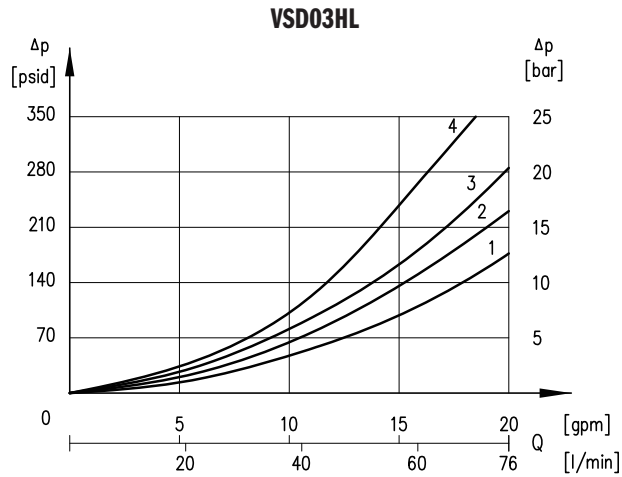
1.2 - Available Function / Spool Type

<p>Code 3*: 2 solenoids - 3 positions with spring centering</p>	<p>Code 5*: 1 solenoid side A 2 positions (central + external) with spring centering</p>	<p>Code 5*- R: 1 solenoid side B 2 positions (central + external) with spring centering</p>
<p>3A</p>	<p>5A</p>	<p>5A*-R</p>
<p>3B</p>	<p>5B</p>	<p>5B*-R</p>
<p>3F</p>	<p>5F</p>	<p>5F*-R</p>
<p>3L</p>	<p>5L</p>	<p>5L*-R</p>
<p>3F1</p>	<p>5F1</p>	<p>5F1*-R</p>
<p>NOTE: F1 spool code only available in VSD03HL.</p>		
<p>Version Code 2*: 2 solenoids - 2 positions with mechanical detent</p>	<p>Version Code 1*: 1 solenoid side A 2 external positions with return spring</p>	<p>Version Code 1*-R: 1 solenoid side B 2 external positions with return spring</p>
<p>2A</p>	<p>1A</p>	<p>1A*-R</p>
<p>1B</p>	<p>1B*-R</p>	<p>1B*-R</p>
<p>9X</p>	<p>9X*-R</p>	<p>9X*-R</p>

2 - CHARACTERISTIC CURVES AND PERFORMANCES OF DIRECT OPERATED SOLENOID VALVES

2.1 - Pressure drops Δp -Q

(values obtained with viscosity 36 cSt at 50 °C)



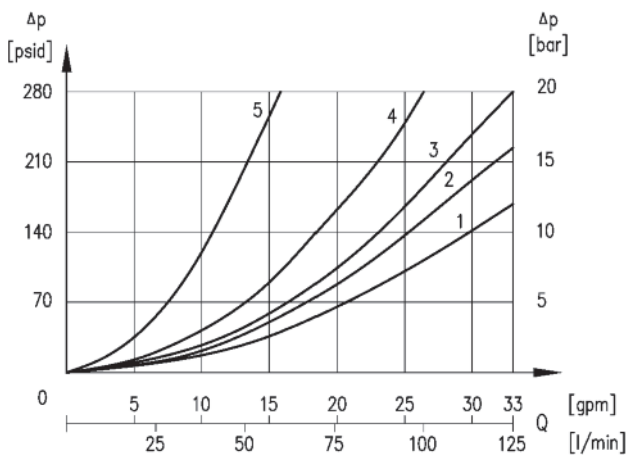
ENERGIZED VALVE

SPOOL	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
3A, 5A	2	2	3	3
3B, 5B	1	1	3	3
3F, 5F	3	3	1	1
3L, 5L	4	4	4	4
3F1, 5F1	2	2	3	3
1A	3	3	3	3
1B	2	2	2	2
9X	3	3	-	-
2A	2	2	2	2

DE-ENERGIZED VALVE

SPOOL	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
3B, 5B	-	-	-	-	2
3F, 5F	-	-	3	3	-
3L, 5L	-	-	-	-	3

VSD05HL



ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPHS			
3A	1	1	2	2
3B	1	1	1	1
3F	1	1	1	1
3L	4	4	4	4
2A	2	2	2	2
1A	2	2	3	3
1B	2	2	1	1
9X	3	3	-	-

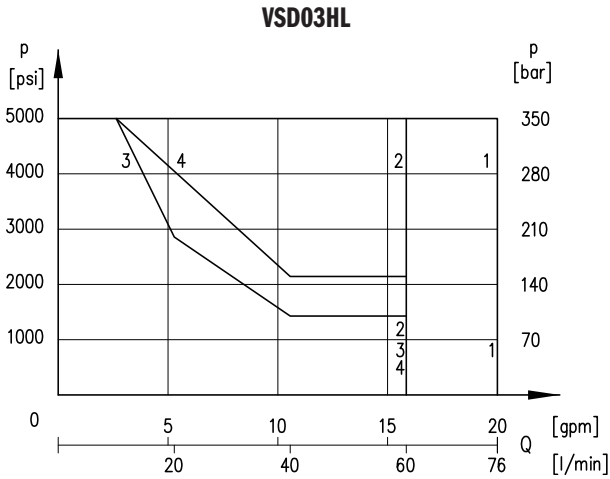
DE-ENERGIZED VALVE

SPOOL	FLOW DIRECTIONS		
	A→T	B→T	P→T
	CURVES ON GRAPHS		
3B	-	-	1
3F	5	5	-
3L	-	-	1

2.2 - Performance limits

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage, with mineral oil with viscosity 36 cSt, temperature 50 °C and filtration according to ISO 4406:1999 class 18/16/13.

The operating limits can be considerably reduced if a 4-way valve is used as 3-way valve with port A or B plugged or without flow.



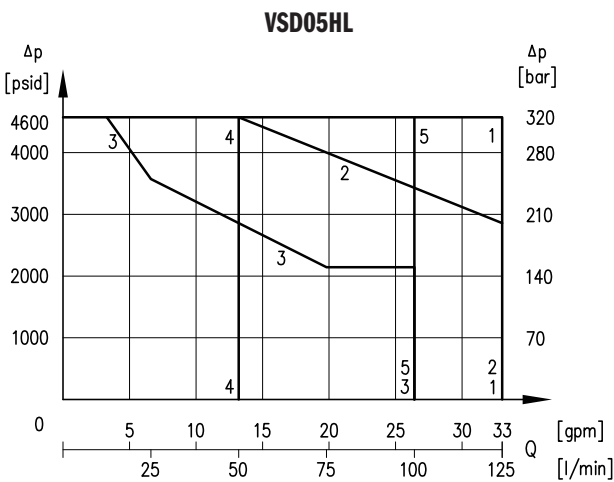
DC SOLENOID VALVE

SPOOL	CURVE	
	P→A	P→B
3A, 5A	1	1
3B, 5B	2	2
3F, 5F	3	3
3L, 5L	2	2
3F1, 5F1	1	1
1A	1	1
1B	4	4
9X	4	4
2A	1	1

AC SOLENOID VALVE

SPOOL	CURVE	
	P→A	P→B
3A, 5A	1	1
3B, 5B	2	2
3F, 5F	3	3
3L, 5L	4	4
3F1, 5F1	1	1
1A	1	1
1B	X	X
9X	4	4
2A	1	1

* not available



SPOOL	CURVE
3A, 3B, 2A	1
1B	2
3F	3
3L	4
1A, 9X	5

2.3 - Switching times

The indicated values are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

TIMES [ms]	VSD03HL		VSD05HL	
	ENERGIZING	DE-ENERGIZING	ENERGIZING	DE-ENERGIZING
DC	60	40	70 ÷ 100	15 ÷ 20
AC	60	140	70 ÷ 100	140

3 - ELECTRICAL CHARACTERISTICS

(values $\pm 5\%$)

Coil type	Nominal voltage [V]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [W]
D12	12	7,2	1,7	20
D24	24	28,7	0,83	20
D48	48	115	0,42	20
D110	110	549	0,2	22

Coil type (NOTE)	Nominal voltage [V]	Freq. [Hz]	Resistance at 20°C [Ω]	Current consumpt. [A]	Power consumpt. [VA]
R120	110V-50Hz 120V-60Hz	50/60	489,6	0,19	21
				0,21	25
R240	230V-50Hz 240V-60Hz	50/60	2067,7	0,098	22,5
				0,1	24

VOLTAGE SUPPLY FLUCTUATION (ripple included)	$\pm 10\% V_{nom}$
MAX SWITCH ON FREQUENCY VSD03HL, VSD05HL VSD05*HL VSD07HL VSD08HL VSD10HL	8.000 ins/hr 6.000 ins/hr 6.000 ins/hr 4.000 ins/hr 3.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	According to 2014/30/EU
CLASS OF PROTECTION: Atmospheric agents Coil insulation (VDE 0580)	IP66 / IP68 class H

NOTE: type R* coils are for alternating current supply for both 50 or 60 Hz. For R* coils the resistance can not be measured in the usual way because of the presence of diodes bridge inside the coil.

3.1 - Wiring

In order to realise the electrical connection of the coil, it is necessary to access the terminal block (1) unscrewing the 4 screws (2) that fasten the cover (3) with the box (4) that contains the terminal block.

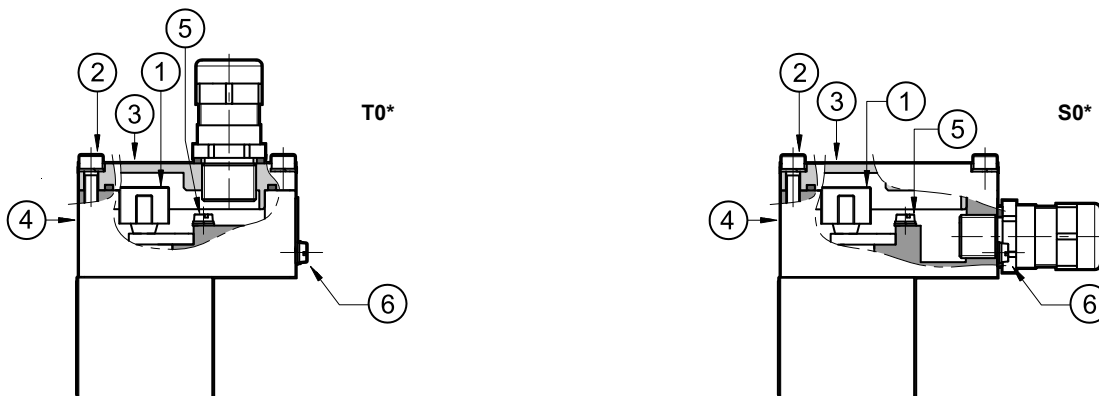
The electrical connection is polarity-independent.

By doing electrical connection it is important to connect also the grounding point (5) in the terminal block box (M4 screws), through suitable conductors with the general grounding line of the system.

On the external body of the coil there is a grounding point (6) (M4 screw) that allow to ensure equipotentiality between the valve and the general grounding line of the system; connecting this point the regulation of the EN 13463-1 standard, that impose to verify the equipotentiality of the elements included in a potentially explosive environment (the maximum resistance between the elements must be 100 Ω), is guaranteed.

At the end of the electrical wiring, it is necessary to reassemble the cover (3) on the box (4), checking the correct positioning of the seal located in the cover seat and fastening the 4 M5 screws with a torque of 4.9+6 Nm.

Electrical wiring must be done following in compliance with standards about protection against explosion hazards.

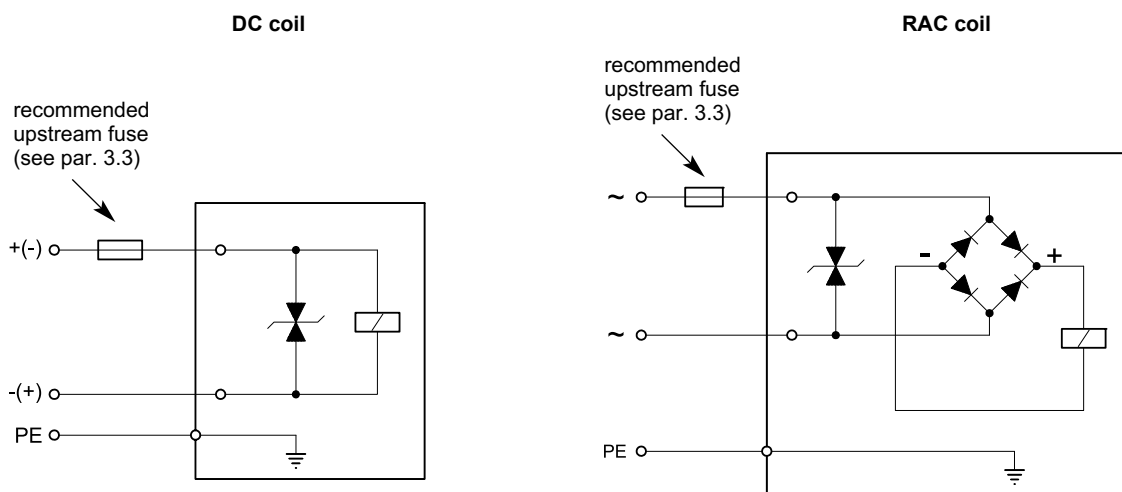


Characteristics of the cables connectable for wiring are indicated in the table below:

Function	Cable section
Operating voltage cables connection	max 2.5 mm ²
Connection for internal grounding point	max 2.5 mm ²
Connection for external equipotential grounding point	max 6 mm ²

Cables for wiring must be non-armoured cables, with external covering sheath and must be suitable for use in environments with temperatures from - 20 °C to +110 °C (for valves either with A or G seals) or from - 40 °C to +110 °C (for valves with AL seals). Cable glands (which must be ordered separately, see point 19) allow to use cables with external diameter between 8 and 10 mm.

3.2 - Electrical diagrams



3.3 - Overcurrent fuse and switch-off voltage peak

Upstream of each valve, an appropriate fuse (max 3 x I_n according to IEC 60127) or a protective motor switch with short-circuit and thermal instantaneous tripping, as short-circuit protection, must be connected. The cut-off power of the fuse must correspond or exceed the short circuit current of the supply source. The fuse or the protective motor must be placed outside the dangerous area or they must be protected with an explosion-proof covering.

In order to safeguard the electronic device to which the valve is connected, there is a protection circuit in the coil, that reduces voltage peaks, which can occur when inductances are switched off.

The table shows the type of fuse recommended according to the nominal voltage of the valve and to the value of the voltage peaks reduction.

Coil type	Nominal voltage [V]	Rated current [A]	Recommended pre-fuse characteristics medium time-lag according to DIN 41571 [A]	Maximum voltage value upon switch off [V]	Suppressor circuit
D12	12	1,7	2,5	- 49	Transient voltage suppressor bidirectional
D24	24	0,83	1,25	- 49	
D48	48	0,42	0,6	- 81	
D110	110	0,2	0,3	- 309	
R120	120	0,21	0,3	- 3	
R240	240	0,1	0,15	- 3	

4. OVERALL AND MOUNTING DIMENSIONS

THREAD OF MOUNTING HOLE

10-24 UNC-2B x 0.50

FASTENING

4 bolts - 10-24 UNC-3A X 1 1/4

TIGHTENING TORQUE

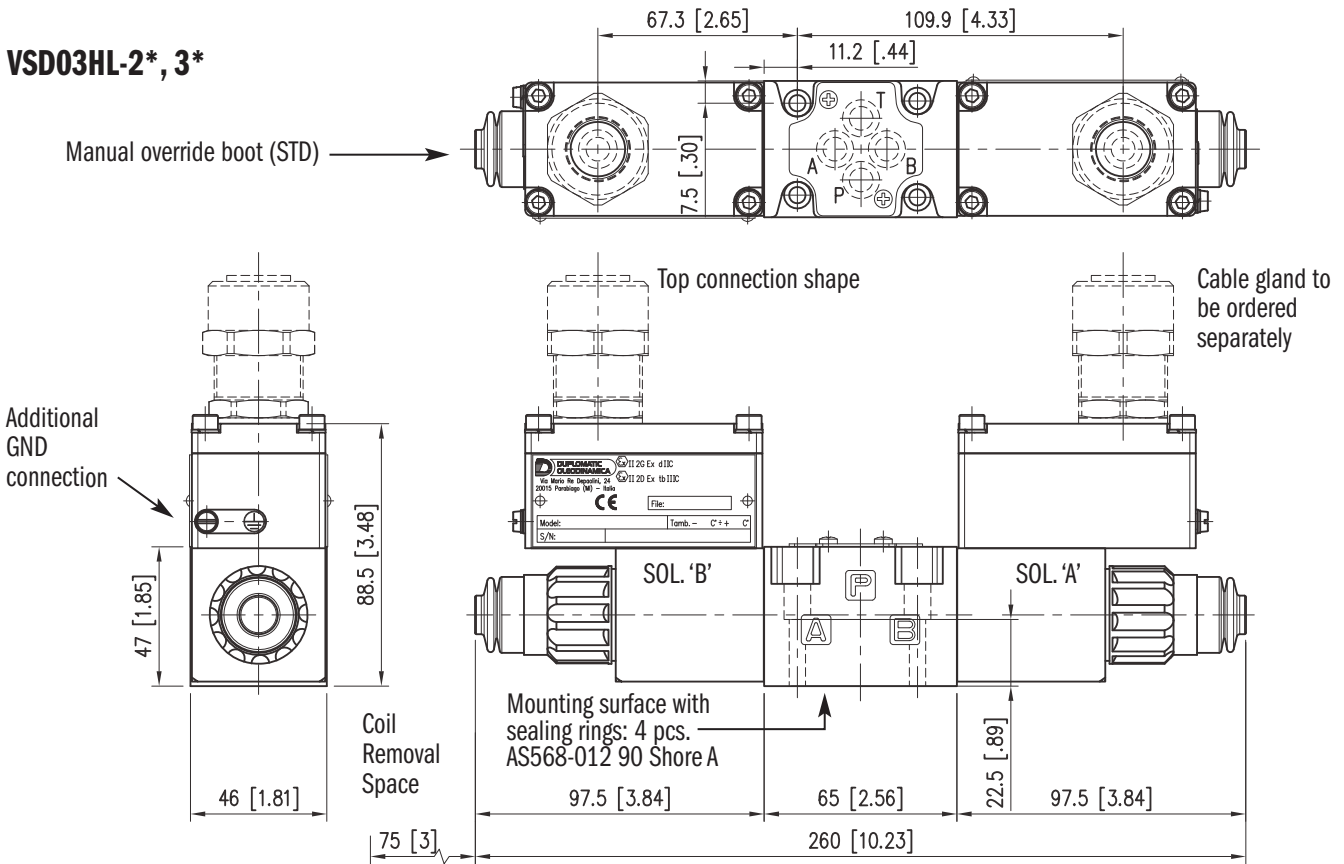
4-5 lbf-ft (5.5-6.8 Nm)

SEALING RINGS

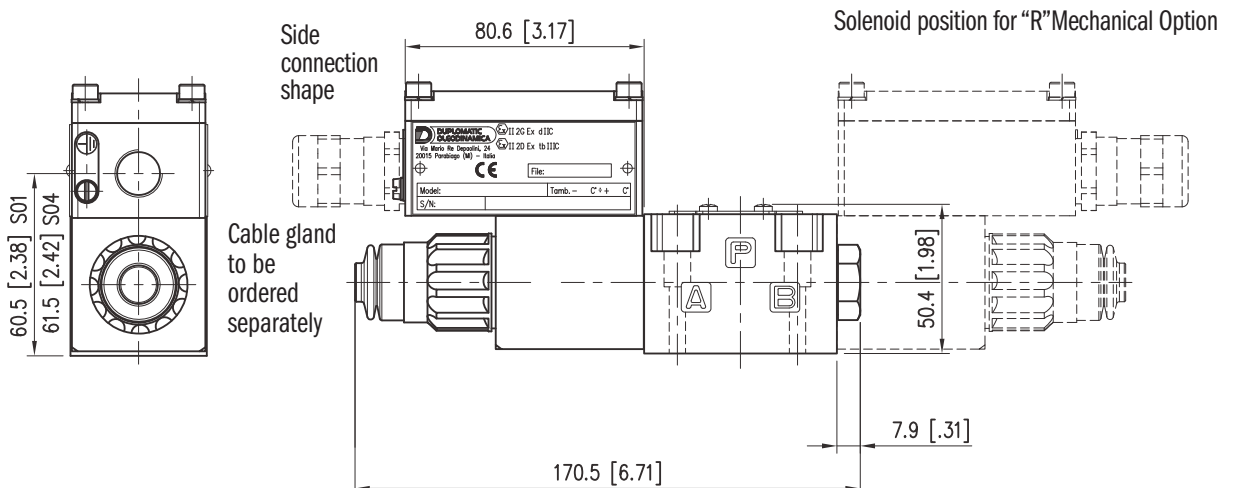
4 O-rings AS568-012 90 Shore A

Dimensions in mm [IN]

VSD03HL-2*, 3*



VSD03HL-1*, 5*, 9*



4.1 OVERALL AND MOUNTING DIMENSIONS

THREAD OF MOUNTING HOLE

1/4-20 UNC-2B x 0.60

FASTENING

4 bolts - 1/4-20 UNC 2B X 1 1/2

TIGHTENING TORQUE

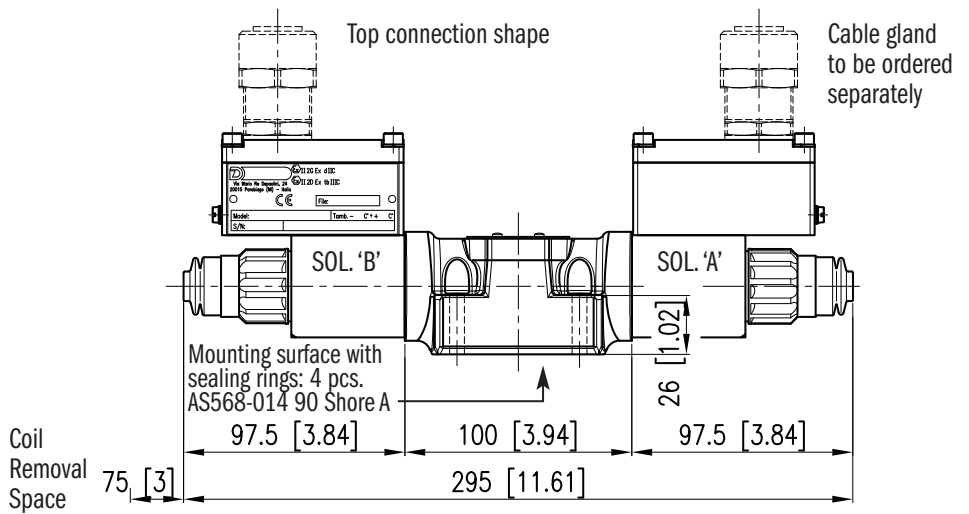
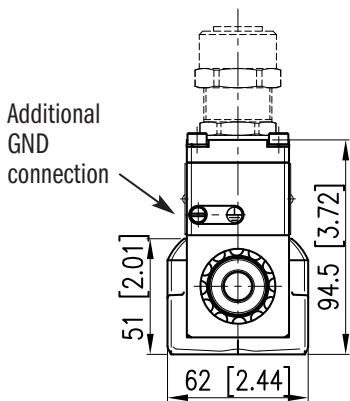
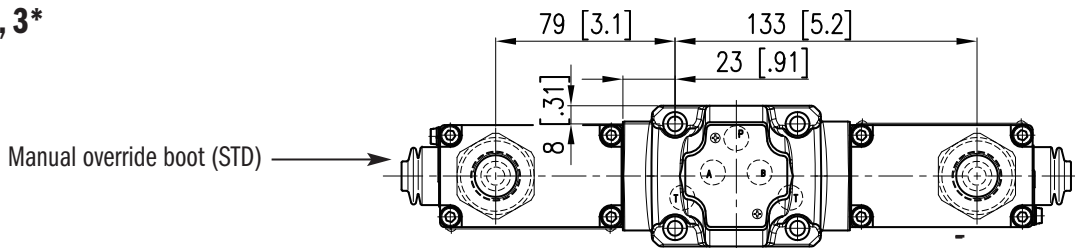
6 lbf-ft (8 Nm)

SEALING RINGS

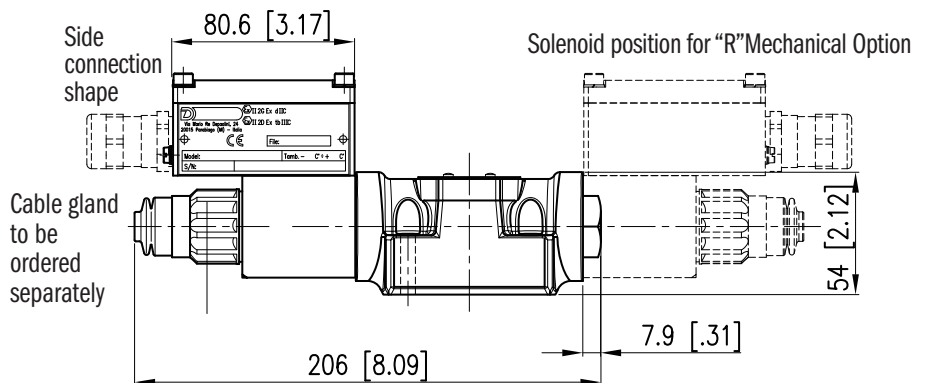
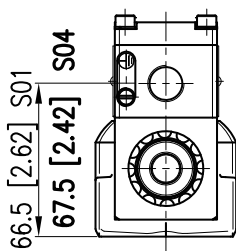
5 O-rings AS568-014 90 Shore A

Dimensions in mm [IN]

VSD05HL-2*, 3*



VSD05HL-1*, 5*, 9*



5. IDENTIFICATION CODE - HAZARDOUS LOCATION - PILOT OPERATED

VSD **HL** - - **- K* D*** - **D** - — DESIGN LETTER

SOLENOID OPERATED

HAZARDOUS LOCATION

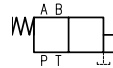
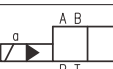
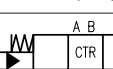
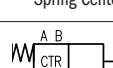
SOLENOIDS see codes on page 6+7

SIZE	
05A	NFPA D05 alt. A
05B	NFPA D05 alt. B
07	NFPA D07
08	NFPA D08
10	NFPA D10

SEAL	
A	Buna (STD)
G	Viton
AL	Buna (low temp)

TEMPERATURE CLASS	
OMIT	T4 (STD)
T5	T5 class (Last 6 pages)

INTERNAL PILOT OPTIONS available only with pilot/drain 1 and 3 (omit if not required)	
Z	PILOT PRESSURE REDUCER Mandatory when pressure is higher than 3000 psi (210 bar)
C70	Check valve on P port Cracking pressure: 70 psi (5 bar) Available for D07 and D08 sizes only

FUNCTION	
1	 <p>Single operator, 2 Position Spring Offset</p>
2	 <p>Dual operator, 2 Position Detent (no Spring)</p>
3	 <p>Dual operator, 3 Position Spring Centered</p>
5	 <p>Single operator, 2 Position Spring Centered</p>

MECHANICAL OPTIONS OMIT IF NOT REQUIRED	
R	Reverse Mode Sol. A supplied
JJ	Stroke adjustment on main stage
JA	Stroke adjustment on A port end
JB	Stroke adjustment on B port end
KK	Adjustable pilot Chokes
P	Restrictor subplate on P port between main and pilot valve
F	Blind Retainer (STD for AL seal) see page 29

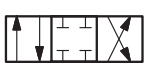
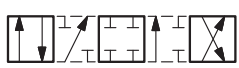
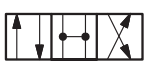
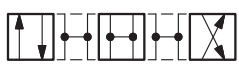
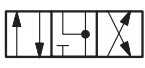
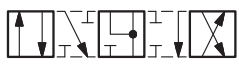

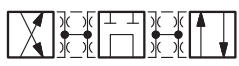
PILOT / DRAIN	
1	Internal Pilot External Drain (not available with B, L spools)
2	External Pilot External Drain
3	Internal Pilot Internal Drain (not available with B, L spools)
4	External Pilot Internal Drain

TERMINAL BLOCK CONNECT	
T01	TOP: M20 x 1.5 ISO 261
T02	TOP: Gk 1/2 UNI EN 10226-2
T03	TOP: 1/2" NPT ANSI B1.20.1 (ex ANSI B 2.1)
S01	SIDE: M20 x 1.5 ISO 261 (available upon request only)
S04	SIDE: M16 x 1.5 ISO 261 (only for 24V)

TYPICAL ORDERING CODE:
VSD07HL-3A-A2T01-KD2-24D-A

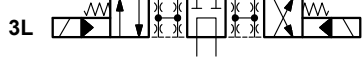
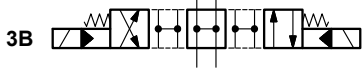
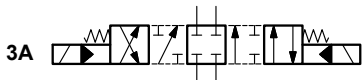
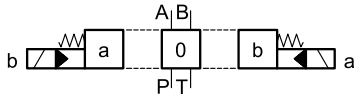
NOTE:

The valve is supplied with STD surface treatment of phosphating black for the main body and Zinc-Nickel for the D03 pilot valve.

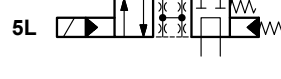
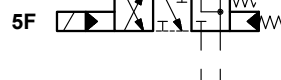
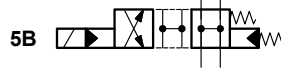
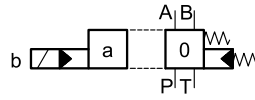
SPOOLS					
NAME	SYMBOL	FUNCTION	CENTER POSITION	CROSSOVER	FUNCTION MATCHING
A			All ports blocked	P → B or P → A T blocked	1, 2, 3, 5
B			All ports open	All ports open	1, 3, 5
F			P blocked and A → T or B → T	P blocked and A → T or B → T	3, 5
L			P → T A and B blocked	All ports open, restricted	

5.1 - Spool types

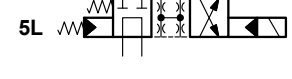
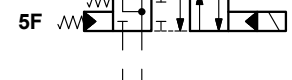
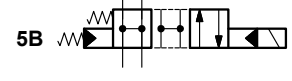
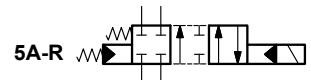
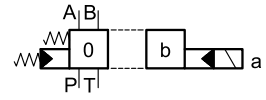
Version 3*:
2 solenoids - 3 positions
with spring centering



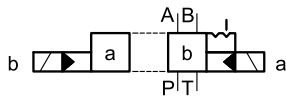
Version 5*:
1 solenoid b
2 positions (central + external)
with spring centering



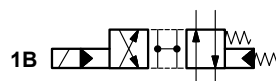
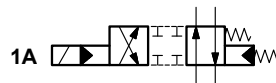
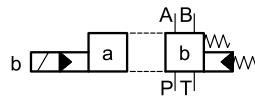
Version 5*-R:
1 solenoid a
2 positions (central + external)
with spring centering



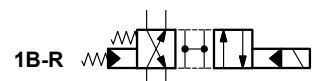
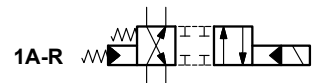
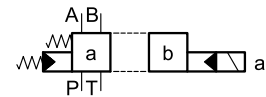
Version Code 2:
2 solenoids - 2 positions
with mechanical retention



Version Code 1*:
1 solenoid b 2
external positions
with return spring



Version Code 1*-R:
1 solenoid side a
2 external positions
with return spring

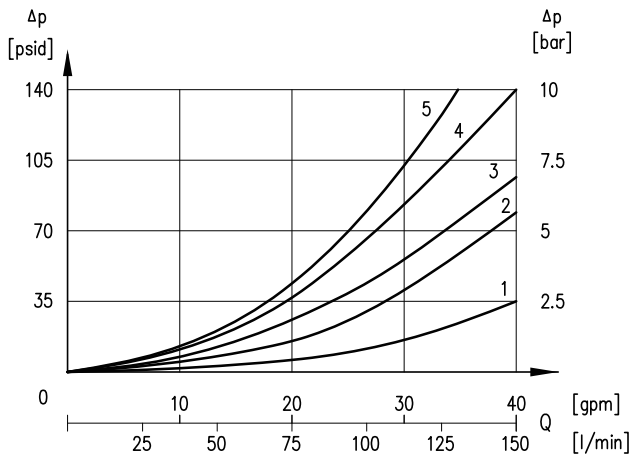


6 - CHARACTERISTIC CURVES AND PERFORMANCES OF PILOT OPERATED SOLENOID VALVES

6. PRESSURE DROPS Δp -Q - PILOT OPERATED VALVES

(OBTAINED WITH VISCOSITY OF 170 SUS (36 cSt) AT 120°F (50°C))

VSD05*HL

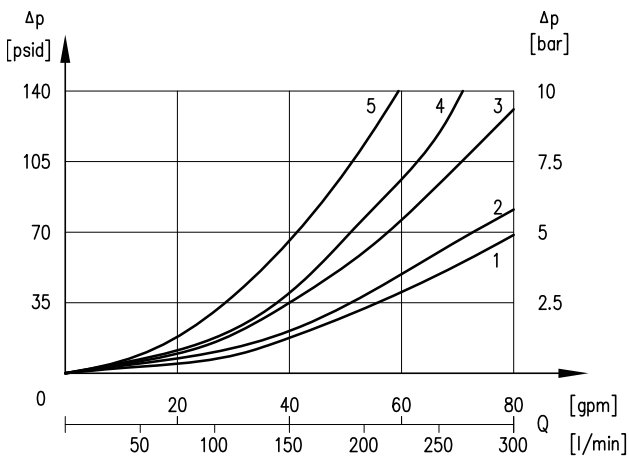


SPOOL	FLOW CURVE NUMBER					
					CTR	
	P→A	P→B	A→T	B→T	P→T	A→T B→T
A, 1A, 2A	4	4	1	1	-	-
B	3	3	1	2	5	-
F	4	4	1	1	-	4
L	5	5	2	3	5	-
1B	3	3	1	1	-	-

NOTES:

1. The values indicated in the graphs are relevant to the standard solenoid valve, with 24 volt DC coils.
2. Valve performance was tested in a four way circuit (full loop). Performances may be reduced from that shown when used in a three-way circuit (half circuit), i.e. A or B port plugged.
3. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with filtration according to ISO 4406:1999 class 18/16/13.

VSD07HL

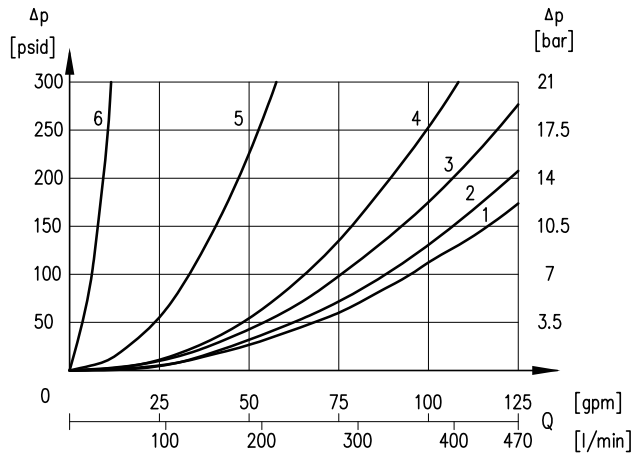


SPOOL	FLOW CURVE NUMBER					
					CTR	
	P→A	P→B	A→T	B→T	P→T	A→T B→T
A, 1A, 2A	1	1	3	4	-	-
B	1	1	4	4	2	-
F	1	1	4	4	-	4
L	2	2	4	5	4	-

6.1 PRESSURE DROPS Δp -Q - PILOT OPERATED VALVES

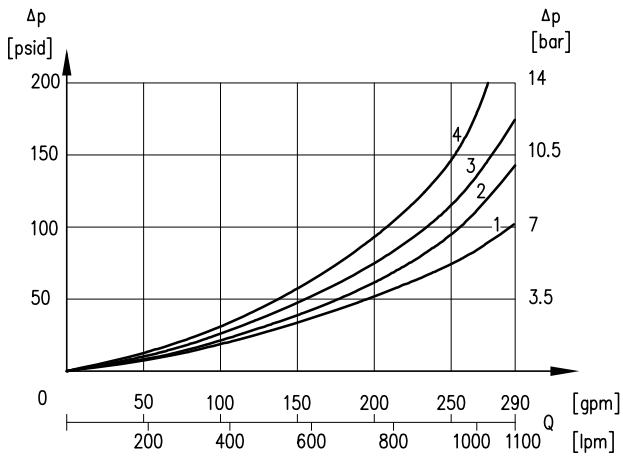
(OBTAINED WITH VISCOSITY OF 170 SUS (36 cSt) AT 120°F (50°C))

VSD08HL



SPOOL	FLOW CURVE NUMBER					
					CTR	
	P→A	P→B	A→T	B→T	P→T	A→T B→T
A, 1A, 2A, 1B	2	2	3	3	-	-
B	1	1	2	1	4	-
F	2	2	2	1	-	4
L	4	4	3	5	6	-

VSD10HL



SPOOL	FLOW CURVE NUMBER					
					CTR	
	P→A	P→B	A→T	B→T	P→T	A→T B→T
A, 1B	1	1	1	1	-	-
B	2	2	2	2	3	-
F	1	1	4	4	-	4
L	2	2	2	2	4	-

6.2 - Switching times

The values indicated refer to a solenoid valve working with piloting pressure of 100 bar, with mineral oil at a temperature of 50°C, at viscosity of 36 cSt and with PA and BT connections.

The energizing and de-energizing times are obtained at the pressure variation which occurs on the lines.

TIMES (± 10%) [ms]	ENERGIZING	DE- ENERGIZING	
	DC - AC	DC	AC
VSD05*HL	70	60	160
VSD07HL	80	70	170
VSD08HL	90	70	170
VSD10HL	120	90	190

7 - HYDRAULIC CHARACTERISTICS

PRESSURES PSI (bar)	VSD05*	VSD07HL	VSD08HL	VSD10HL
Max pressure in P, A, B ports	320 (4600)	350 (5000)	350 (5000)	350 (500)
Max pressure in T line with external drainage	210 (3000)	250 (3600)	210 (3000)	210 (3000)
Max pressure in T line with internal drainage	210 (3000)	210 (3000)	210 (3000)	210 (3000)
Max pressure in Y line with external drainage	210 (3000)	210 (3000)	210 (3000)	210 (3000)
Min piloting pressure NOTE 1	78-175 (5 ÷ 12)			90-175 (6 ÷ 12)
Max piloting pressure NOTE 2	210 (3000)	210 (3000)	210 (3000)	280 (4000)

NOTE 1: minimum piloting pressure can be the lower range value at low flows rates, but with higher flow rates the higher value is needed.

NOTE 2: if the valve operates with higher pressures it is necessary to use the version with external pilot and reduced pressure. Otherwise, the valve with internal pilot and pressure reducing valve with 30 bar fixed adjustment can be ordered.

Add the letter **Z** to the identification code to order this option (see par. 5). Consider that, by adding the pressure reducing valve, the overall dimensions increase 40 mm in height.

MAXIMUM FLOW RATES		VSD05*HL		VSD07HL		VSD08HL		VSD10HL	
Spool type	[l/min]	PRESSURES							
		3000 PSI at (210 bar)	4600 PSI at (320 bar)	3000 PSI at (210 bar)	5000 PSI at (350 bar)	3000 PSI at (210 bar)	5000 PSI at (350 bar)	3000 PSI at (210 bar)	5000 PSI at (350 bar)
3L, 5L		32 (120)	26 (100)	52 (200)	40 (150)	130 (500)	118 (450)	198 (750) (NOTE)	158 (600) (NOTE)
Other spools		40 (150)	32 (120)	80 (300)	80 (300)	158 (600)	130 (500)	232 (900)	185 (700)

NOTE: for the VSD10HL valve these values are the same even for 3B and 5B spools.

8. PILOT AND DRAIN CONFIGURATION

The VSD*HL valves are available with four pilot/drain configurations: internal/internal, internal/external, external/internal and external/external.

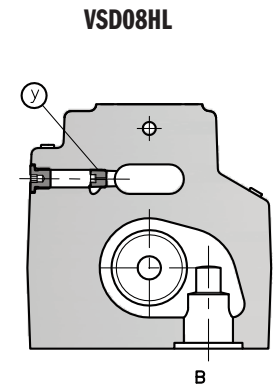
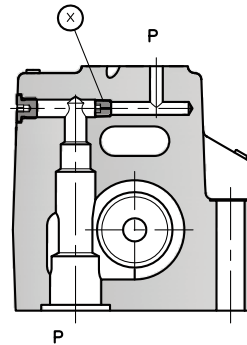
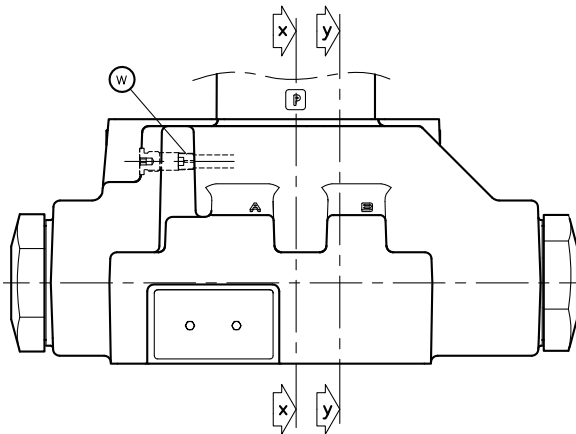
When internal pilot and/or drain are used, the corresponding 'x' and 'y' ports in the manifold must be plugged. Pilot pressure must be at least 70 psi (5 bar) greater than the pressure in the 'T' line.

It may be desirable to use external pilot when system pressure is subject to wide fluctuations. It is required to use external pilot or internal pilot with a pressure reducing valve when system pressure exceeds 3000 psi (210 bar) for the VSD05*HL, VSD07HL and VSD10HL.

An external drain must be used when an open center (B) or a tandem center (L) spool is used, and is also recommended when using pilot checks. The version with external drain allows for higher tank line pressure in series circuits.

CODE	DESIGN	VSD05*HL, VSD07HL, VSD10HL		VSD08HL	
		Pilot (X)	Drain (Y)	Pilot (X) (W)	Drain (Y)
1	Internal Pilot / External Drain	□	■	■ ■	■
2	External Pilot / External Drain	■	■	■ ■	■
3	Internal Pilot / Internal Drain	□	□	■ ■	□
4	External Pilot / Internal Drain	■	□	■ ■	□

■ Plugged □ Unplugged ■ Restricted



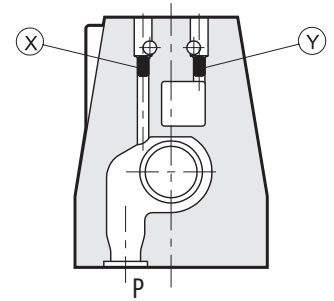
PLUG SIZE:

VSD05*HL	M5x6 mm
VSD07HL	M6x8 mm
VSD10HL	M6x8 mm
VSD08HL	1/16" NPT Pipe Plug 1/16" NPT Pipe Plug with 0.070 (1.78mm) Orifice

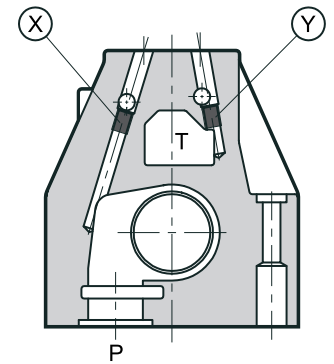
VSD* HL

PLUG MOUNTING

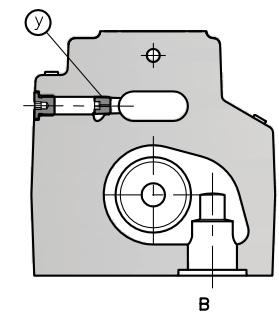
VSD05*HL



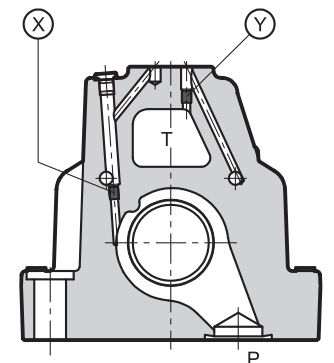
VSD07HL



VSD08HL



VSD10HL



8.1 INTERNAL PILOT OPTIONS

PRESSURE REDUCING (Z)

THE PRESSURE REDUCING MODULE IS DESIGNED TO PROTECT THE VALVE FROM PILOT PRESSURES EXCEEDING 3000 PSI (210 BAR).

When the system pressure exceeds 3000 psi (210 bar) the use of the version with external pilot is mandatory, or alternatively, the version with optional Z internal pilot.

The pressure reducer has fixed adjustment of 430 psi (30 bar). This device is not available for the VSD05*HL.

To request this option add the letter “Z” into the internal pilot option box, in the identification code.

BACK PRESSURE VALVE (C70)

The back pressure valve is for valves with internal pilot and B or L spool types where system pressure may drop below the 70 psi (5 bar) required for pilot operation.

This device is available only for VSD07HL and VSD08HL.

NOTE: The back pressure valve can't be used as check because it doesn't assure the seal.

To request this option add the letters 'C70' in the internal pilot options box, in the identification code.

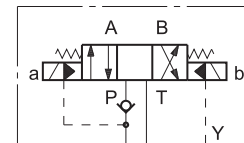
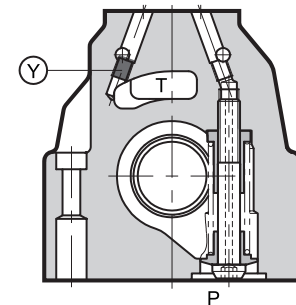
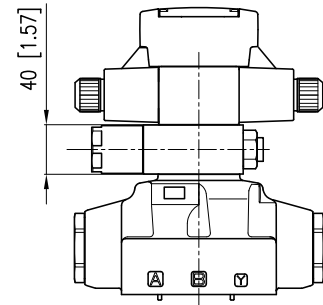
The backpressure valve is also available as a field conversion kit and can be easily mounted in the P port of the main control valve.

The kit includes 1 check assembly and related seals.

USE THE CODE BELOW TO ORDER THE KIT.

VALVE SERIES	SEAL MATERIAL	ORDERING NUMBER
VSD07HL	Buna N	VMA-4F1-A
	Viton	VMA-4F2-A
VSD08HL	Buna N	VMA-5F1-A
	Viton	VMA-5F2-A

VSD* HL

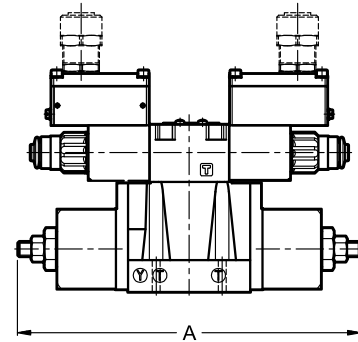


9 - OPTIONS

9.1 - Control of the main spool stroke: J

With the help of special side plugs, it is possible to introduce stroke controls in the heads of the piloted valve so as to vary the maximum spool clearance opening.

This solution allows control of the flow rate from the pump to the actuator and from the actuator to the outlet, obtaining a double adjustable control on the actuator.

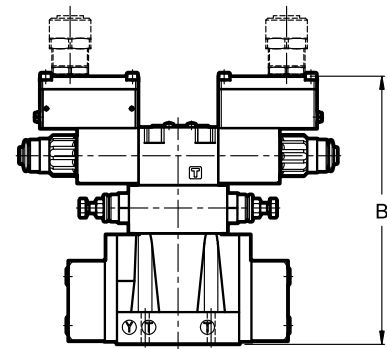


dimensions in mm (inches)

	VSD05*	VSD07	VSD08	VSD10
A	280 (11.02)	319 (12.56)	401.5 (15.81)	520 (20.47)

9.2 - Control of the main spool shifting speed: KK

By placing a D03 type double flow control valve between the pilot solenoid valve and the main distributor, the piloted flow rate can be controlled and therefore the changeover smoothness can be varied.



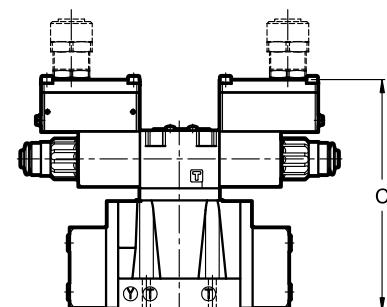
dimensions in mm (inches)

	VSD05*	VSD07	VSD08	VSD10
B	218.5 (8.60)	225.5 (8.88)	254.5 (10.02)	310.5 (12.22)

9.3 - Subplate with throttle on line P

It is possible to introduce a subplate with a restrictor on line P between the pilot solenoid valve and the main distributor.

restrictor $\varnothing 0.8$ for VSD05*, VSD07, VSD08
restrictor $\varnothing 1.5$ for VSD10



dimensions in mm (inches)

	VSD05*	VSD07	VSD08	VSD10
C	188.5 (7.42)	195.5 (7.70)	224.5 (8.84)	280.5 (11.04)

10. OVERALL AND MOUNTING DIMENSIONS FOR VSD05*HL

VSD* HL

Dimensions in mm [IN]

THREAD OF MOUNTING HOLE

1/4 - 20 UNC-2B x 0.60

FASTENING

4 bolts - 1/4 - 20 UNC-2B X 1 1/2

Grade 8 or stronger

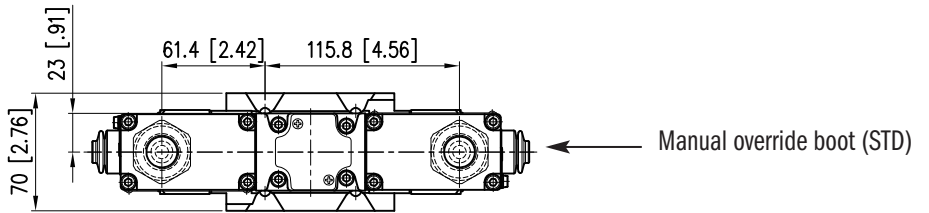
TIGHTENING TORQUE

6 lbf-ft (8 Nm)

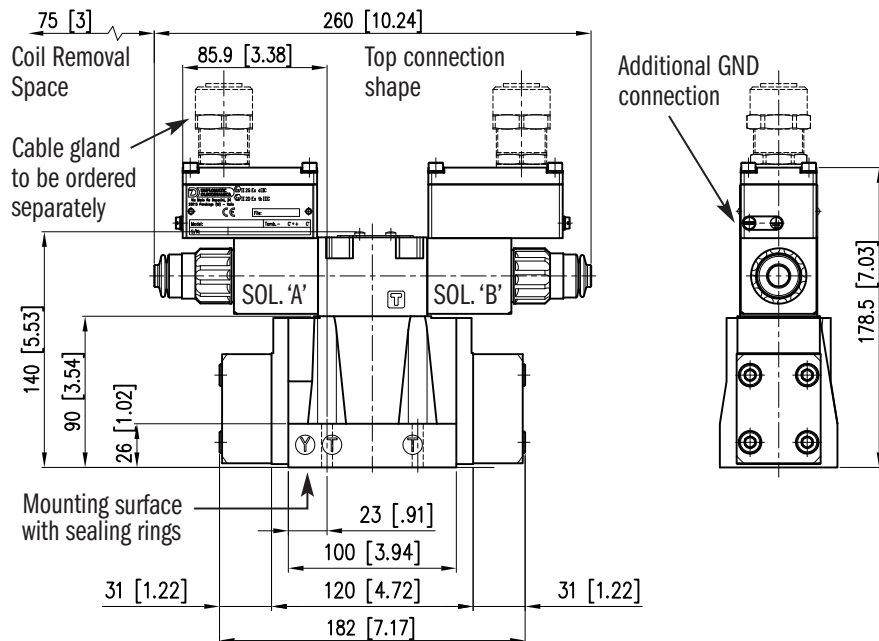
SEALING RINGS

5 O-rings AS568-014 90 Shore A

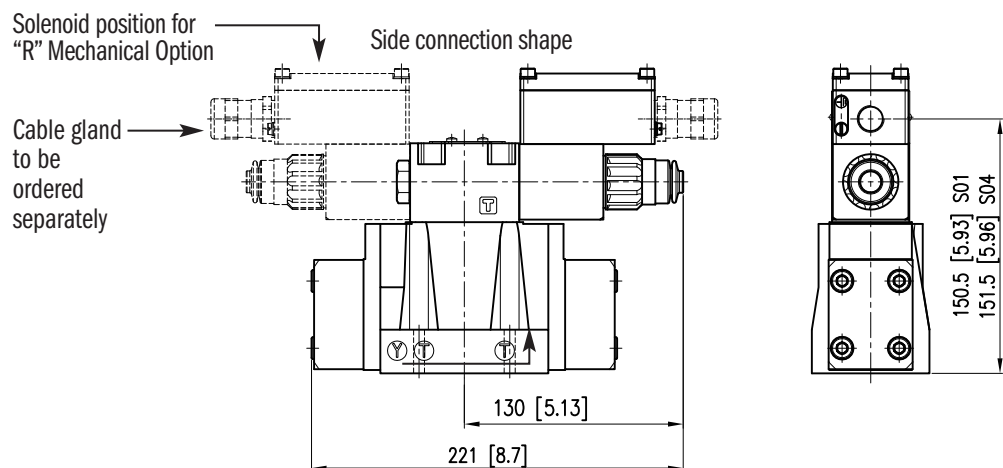
2 O-rings AS568-012 90 Shore A



VSD05*HL-2*, 3*



VSD05*HL-1*, 5*



11. OVERALL AND MOUNTING DIMENSIONS FOR VSD07HL

VSD* HL

Dimensions in mm [IN]

THREAD OF MOUNTING HOLE

1/4 - 20 UNC-2B x 0.50

3/8 - 16 UNC-2B x 0.90

FASTENING

2 bolts - 1/4 - 20 UNC-2B X 2

Grade 8 or stronger

4 bolts - 3/8 - 16 UNC-2B X 2 1/2

Grade 8 or stronger

TIGHTENING TORQUE

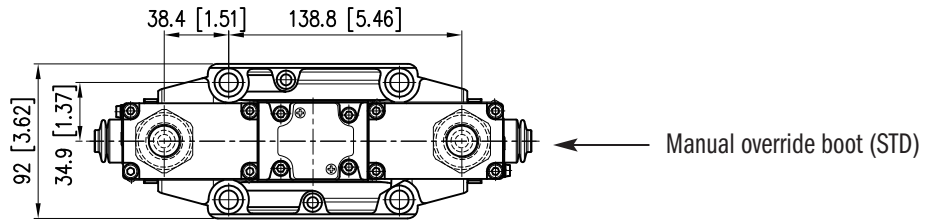
1/4 - 20 UNC-2B: 6 lbf-ft (8 Nm)

3/8 - 16 UNC-2B: 30 lbf-ft (40 Nm)

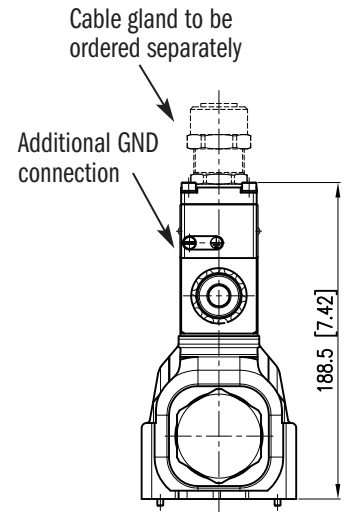
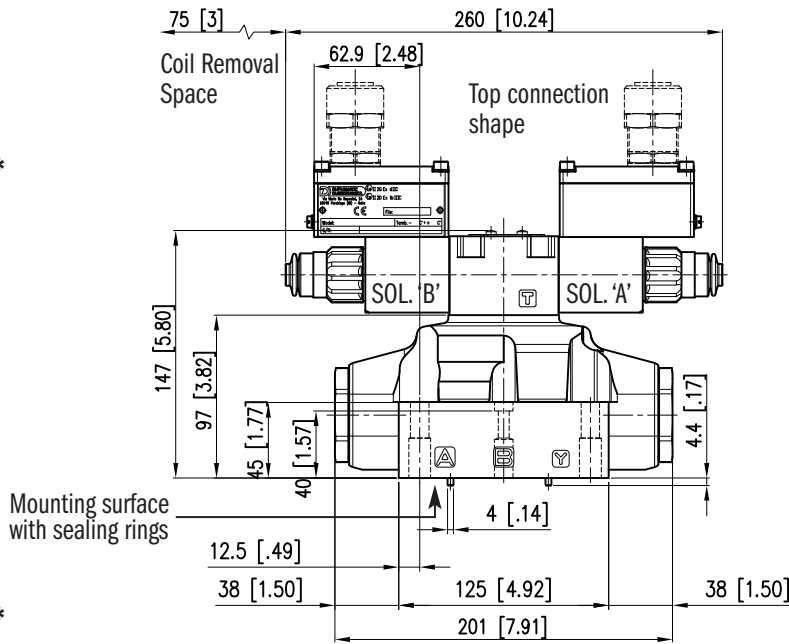
SEALING RINGS

4 O-rings 22.22 mm ID x 2.62 mm CS90 Shore 90A

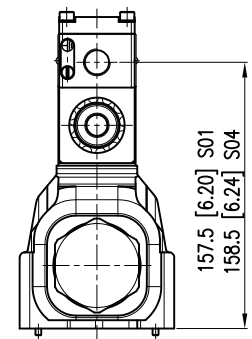
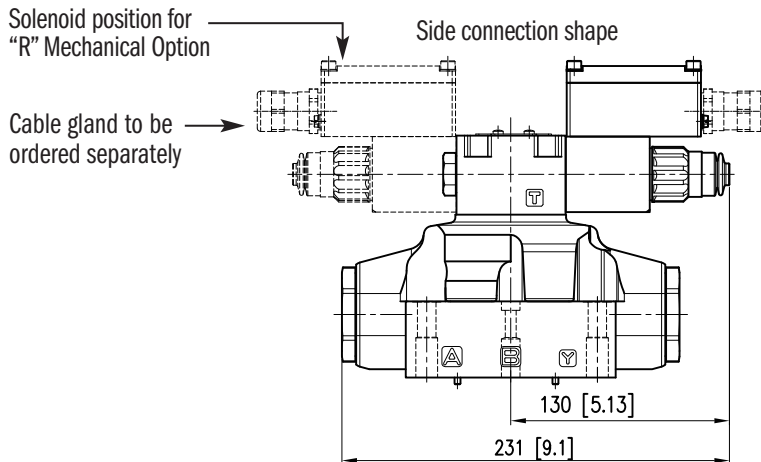
2 O-rings AS568-013 90 Shore A



VSD07HL-2*, 3*



VSD07HL-1*, 5*



12. OVERALL AND MOUNTING DIMENSIONS FOR VSD08HL VSD* HL

Dimensions in mm [IN]

THREAD OF MOUNTING HOLE

1/2 - 13 UNC x 0.70

FASTENING

6 bolts - 1/2 - 20 UNC X 2 1/2

Grade 8 or stronger

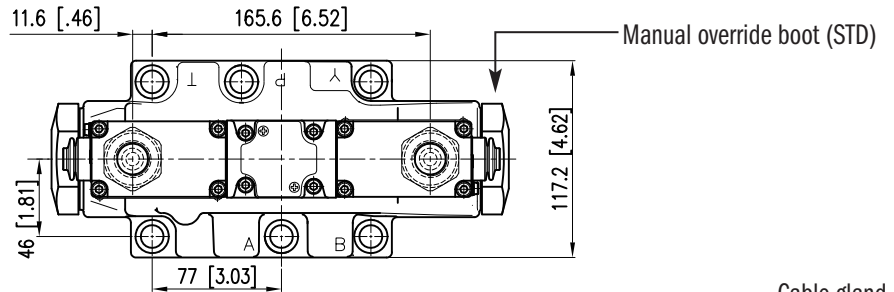
TIGHTENING TORQUE

90 to 100 lbf-ft (122 to 136 Nm)

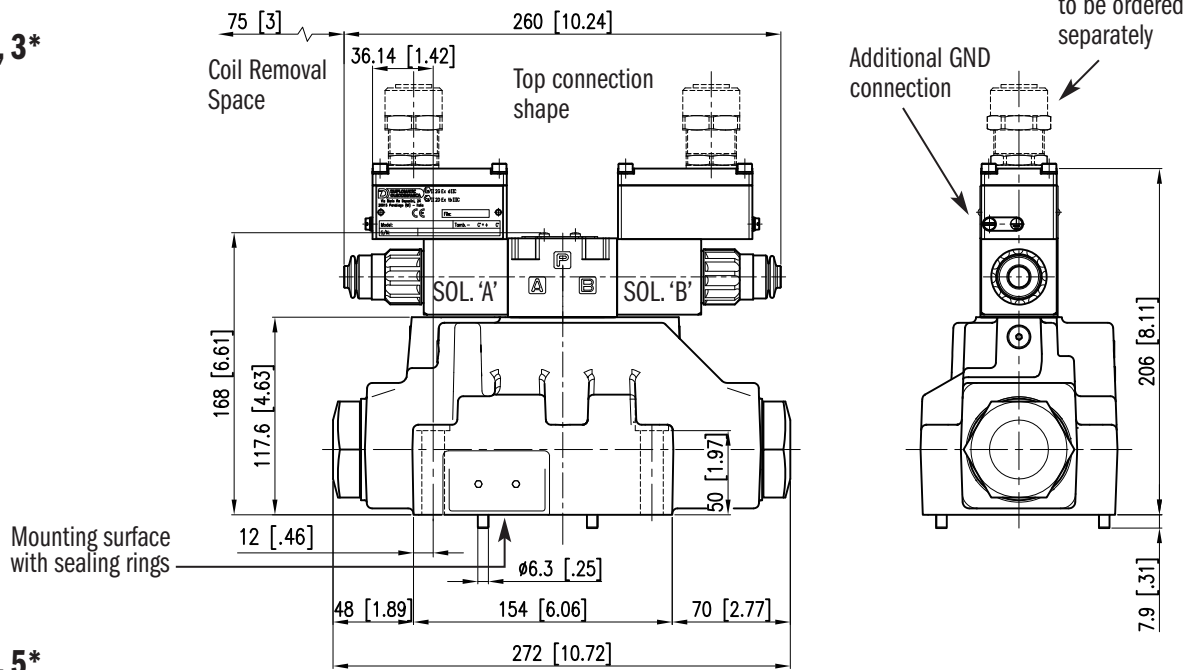
SEALING RINGS

4 O-rings AS568-215 90 Shore A

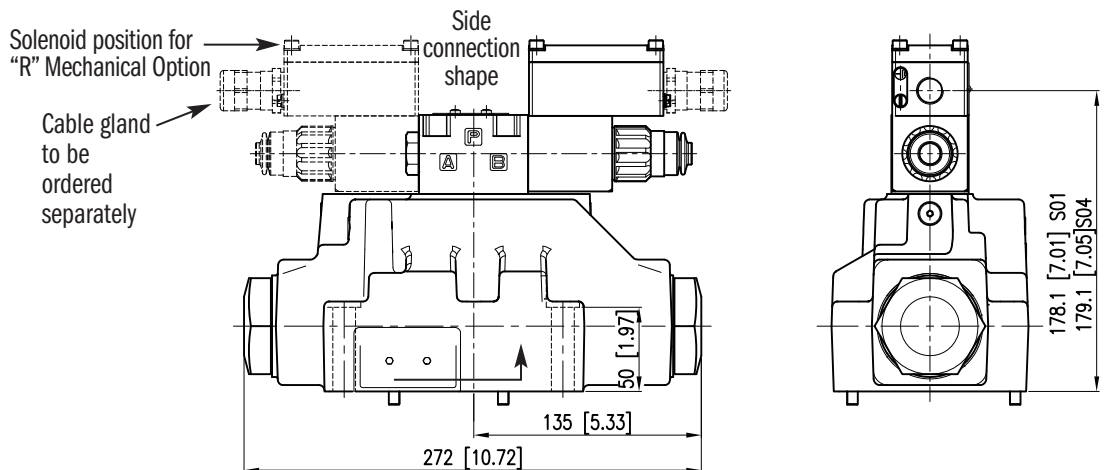
2 O-rings AS568-210 90 Shore A



VSD08HL-2*, 3*



VSD08HL-1*, 5*



13. OVERALL AND MOUNTING DIMENSIONS FOR VSD10HL

VSD* HL

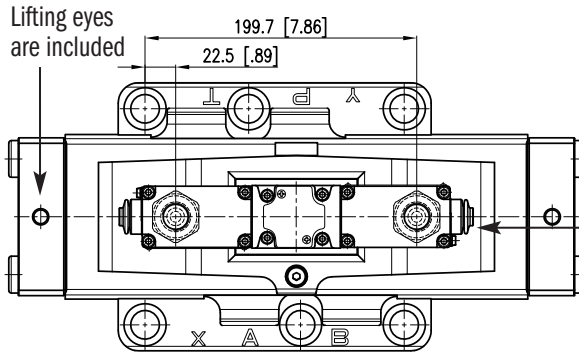
Dimensions in mm [IN]

THREAD OF MOUNTING HOLE
3/4 - 10 UNC-2B x 1.30

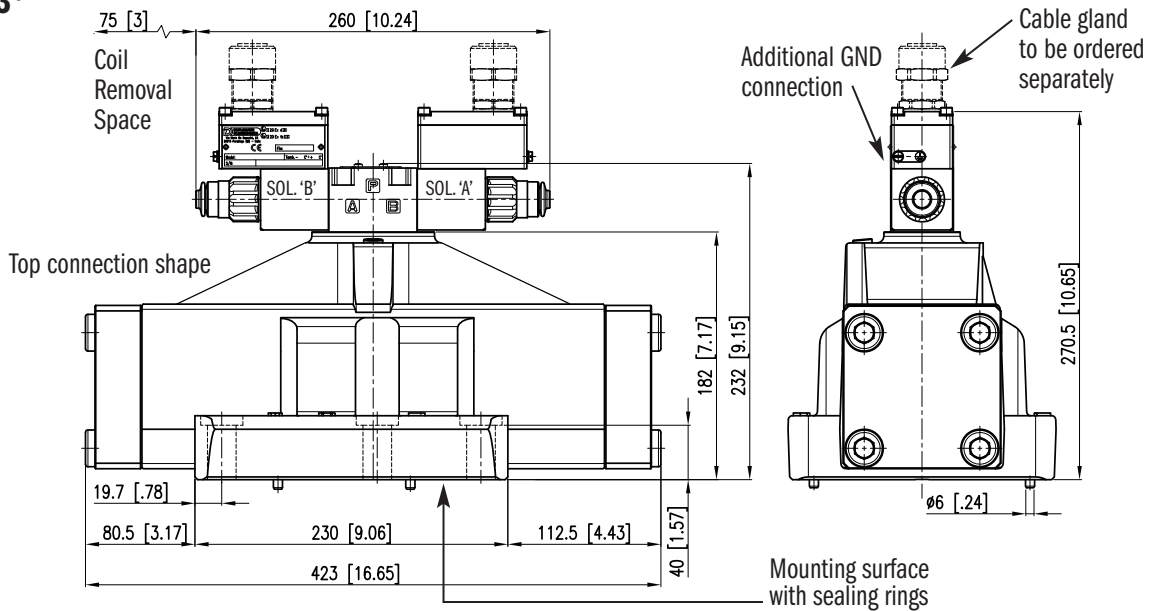
FASTENING
6 bolts - 3/4 - 10 UNC-2B X 2 3/4
Grade 8 or stronger or higher strength

TIGHTENING TORQUE
240 lbf-ft (325 Nm)
415 lbf-ft (565 Nm) High strength

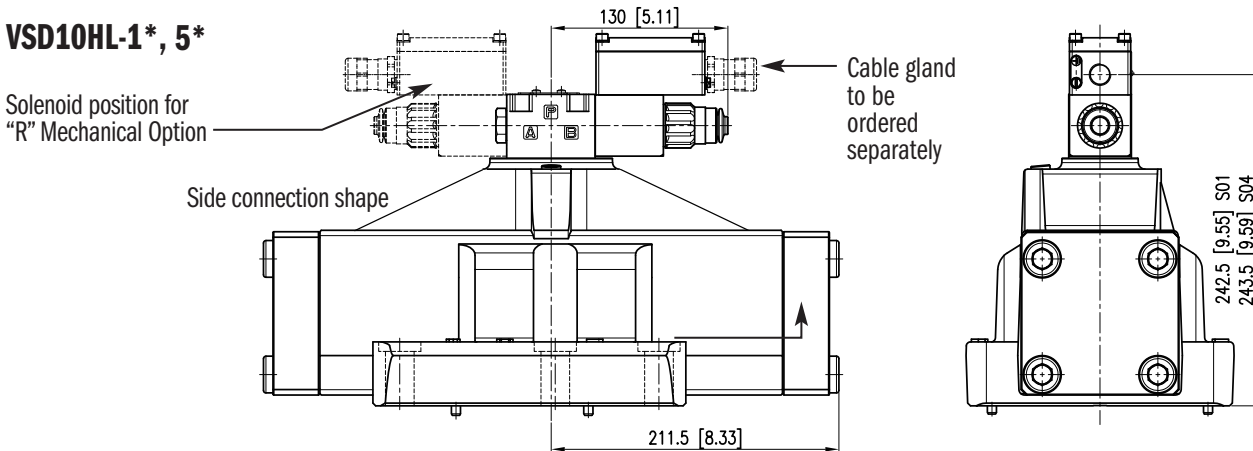
SEALING RINGS
4 O-rings AS568-222 90 Shore A
2 O-rings AS568-117 90 Shore A



VSD10HL-2*, 3*

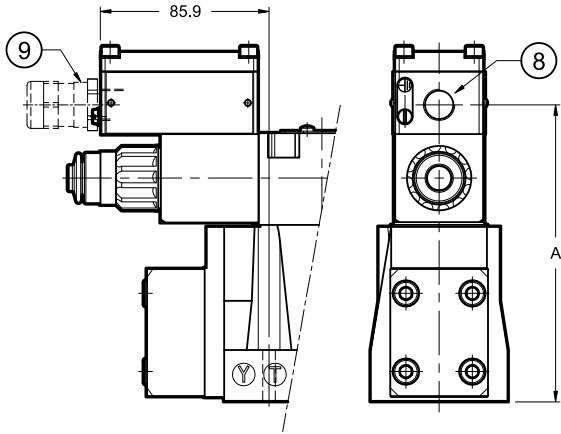


VSD10HL-1*, 5*



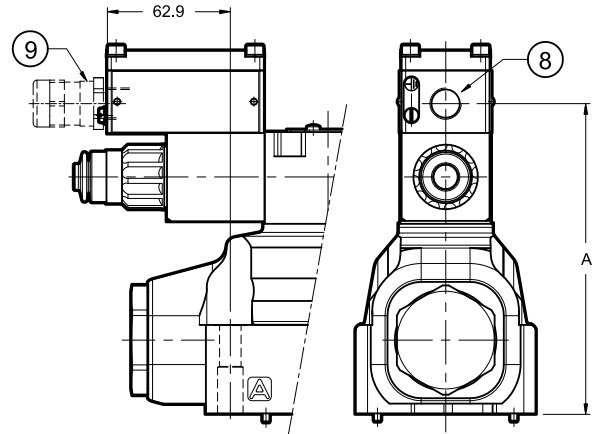
14 - VSD0*HL WITH SIDE CONNECTION - OVERALL AND MOUNTING DIMENSIONS

VSD05*HL



Side port type	A
S01, S04	150.5 (5.93)
S02, S03	150 (5.90)

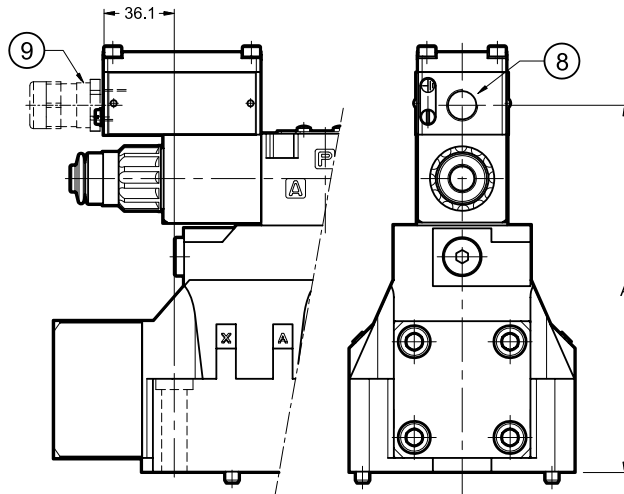
VSD07HL



Side port type	A
S01, S04	157.5 (6.20)
S02, S03	157 (6.18)

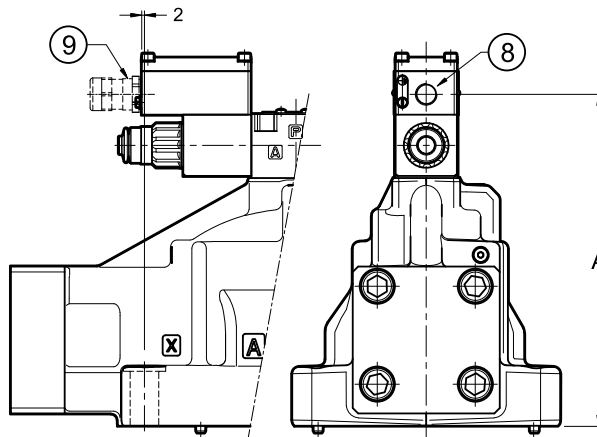
dimensions in mm (in)

VSD08HL



Side port type	A
S01, S04	186.5 (7.34)
S02, S03	186 (7.32)

VSD10HL



Side port type	A
S01, S04	242.5 (9.55)
S02, S03	242 (9.52)

8	Side port
9	Cable gland. To be ordered separately

15. MOUNTING SURFACES

ALL THE MOUNTING SURFACES REFER TO NFPA T3.5.1 R2-2002 AND ISO 4401:2005 STANDARDS.

The mounting surface standards recommends metric coarse threads. However, subplates are commercially available with UNC threads. Select a bolt size that matches the threads in the mounting surface.

Dimensional tolerances are ± 0.1 mm (0.004") for bolt and pin location; ± 0.2 mm (0.008") for the other quotes.

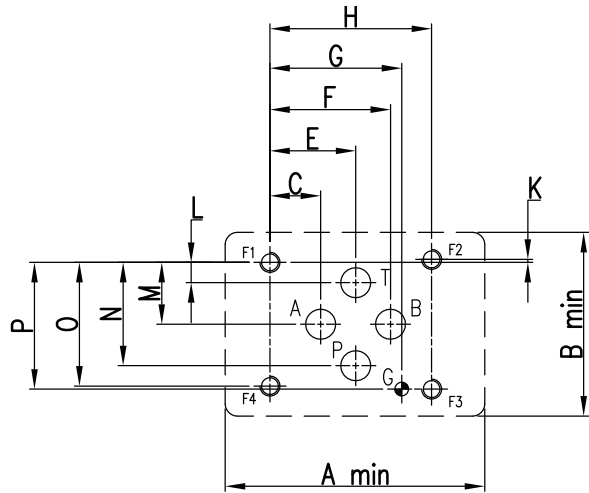
The minimum depth of the blind hole G where required is 8 mm (0.31 in).

D03

	MM	INCH
P, A, B, T MAX	∅ 7.0	∅ 0.276
G MAX	∅ 4.0	∅ 0.16
MOUNTING BOLT THREAD SIZE	M5	10-24 UNC 2B

	MM	INCH
A	51.0	2.00
B	43.0	1.70
C	12.7	0.50
E	21.5	0.85
F	30.2	1.19
G	33.0	1.30
H	40.5	1.594

	MM	INCH
K	0.75	0.03
L	5.10	0.20
M	15.5	0.61
N	25.9	1.02
O	31.0	1.22
P	31.8	1.25



D05

PORT FUNCTION:

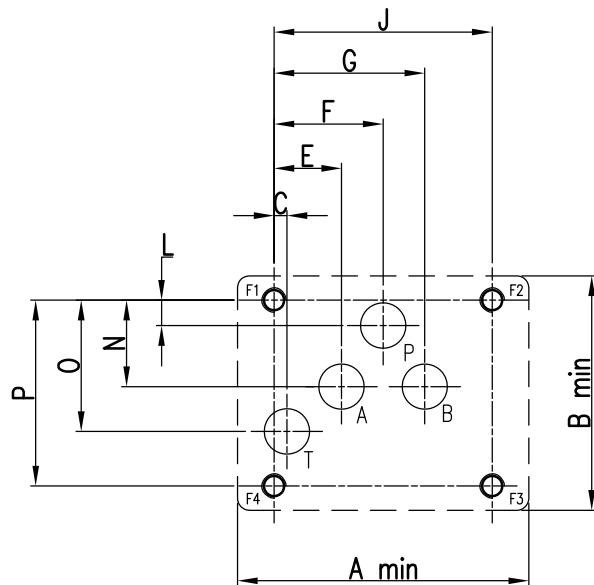
P = PRESSURE PORT
T = TANK PORT

A = FIRST CYLINDER PORT
B = SECOND CYLINDER PORT

	MM	INCH
P, A, B, T MAX	∅ 11.2	∅ 0.44
MOUNTING BOLT THREAD SIZE	M6	1/4 - 20 UNC

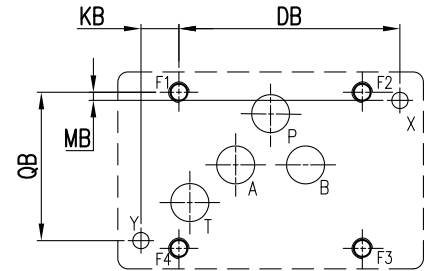
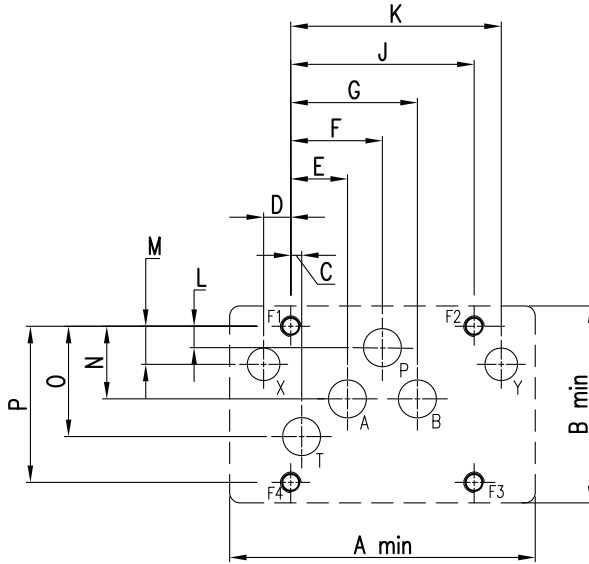
	MM	INCH
A	90.0	3.54
B	58.0	2.28
C	3.20	0.126
E	16.7	0.66
F	27.0	1.06
G	37.3	1.47

	MM	INCH
J	54.0	2.125
L	6.30	0.25
M	11.2	0.44
N	21.4	0.84
O	32.5	1.28
P	46.0	1.82



D05 - ALTERNATIVE A

D05 - ALTERNATIVE B



PORT FUNCTION:

P = PRESSURE PORT
T = TANK PORT

A = FIRST CYLINDER PORT
X = PILOT PORT

B = SECOND CYLINDER PORT
Y = DRAIN PORT

	MM	INCH
P, A, B, T MAX	∅ 11.2	∅ 0.44
X, Y ALT. A	∅ 6.30	∅ 0.25
X, Y ALT. B	∅ 4.80	∅ 0.19
MOUNTING BOLT THREAD SIZE	M6	1/4 - 20 UNC

	MM	INCH
A	90.0	3.54
B	58.0	2.28
C	3.20	0.126
D	8.00	0.31
E	16.7	0.66
F	27.0	1.06
G	37.3	1.47

	MM	INCH
J	54.0	2.125
K	62.0	2.44
L	6.30	0.25
M	11.2	0.44
N	21.4	0.84
O	32.5	1.28
P	46.0	1.82

	MM	INCH
DB	65.1	2.563
KB	11.2	0.44
MB	2.40	0.09
QB	43.7	1.72

NOTES:

NFPA D05 and ISO 4401-05 indicates different diameters for X and Y holes:

NFPA: ∅ 9.6 max in D05 alt A
∅ 4.8 max in D05 alt B

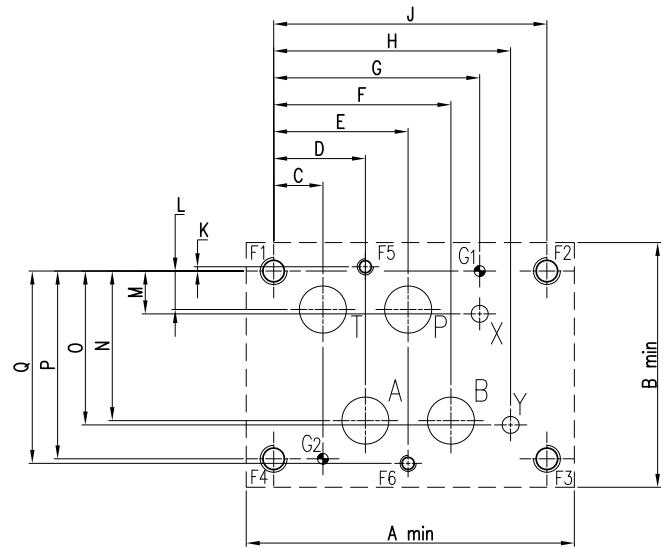
ISO: ∅ 6.3 max both

D07

	MM	INCH
P, A, B, T MAX	Ø 17.5	Ø 0.69
X, Y MAX	Ø 6.30	Ø 0.25
G MAX	Ø 4.00	Ø 0.16
MOUNTING BOLT THREAD SIZE F1 - F4	M10	3/8 - 16 UNC
MOUNTING BOLT THREAD SIZE F5 - F6	M6	1/4 - 20 UNC

	MM	INCH
A	122.0	4.80
B	91.0	3.58
C	18.3	0.72
D	34.1	1.34
E	50.0	1.97
F	65.9	2.60
G	76.6	3.016
H	88.1	3.47

	MM	INCH
J	101.6	4.00
K	1.60	0.063
L	14.3	0.56
M	15.9	0.626
N	55.6	2.19
O	57.2	2.25
P	69.9	2.75
Q	71.5	2.815

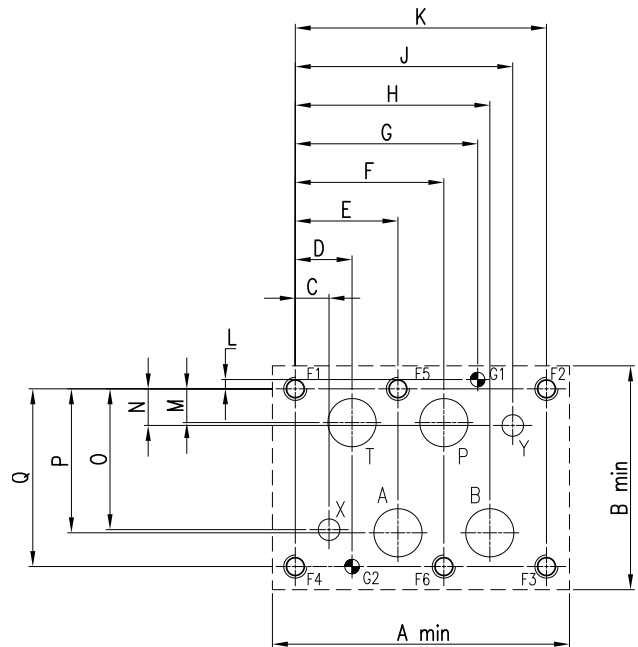


D08

	MM	INCH
P, A, B, T MAX	Ø 25.0	Ø 0.98
X, Y MAX	Ø 11.2	Ø 0.44
G MAX	Ø 7.50	Ø 0.30
MOUNTING BOLT THREAD SIZE	M12	1/2 - 13 UNC

	MM	INCH
A	154.0	6.00
B	116.0	4.57
C	17.5	0.69
D	29.4	1.157
E	53.2	2.09
F	77.0	3.03
G	94.5	3.719
H	100.8	3.97

	MM	INCH
J	112.7	4.44
K	130.2	5.125
L	4.80	0.187
M	17.5	0.69
N	19.0	0.75
O	73.0	2.874
P	74.6	2.93
Q	92.1	3.625

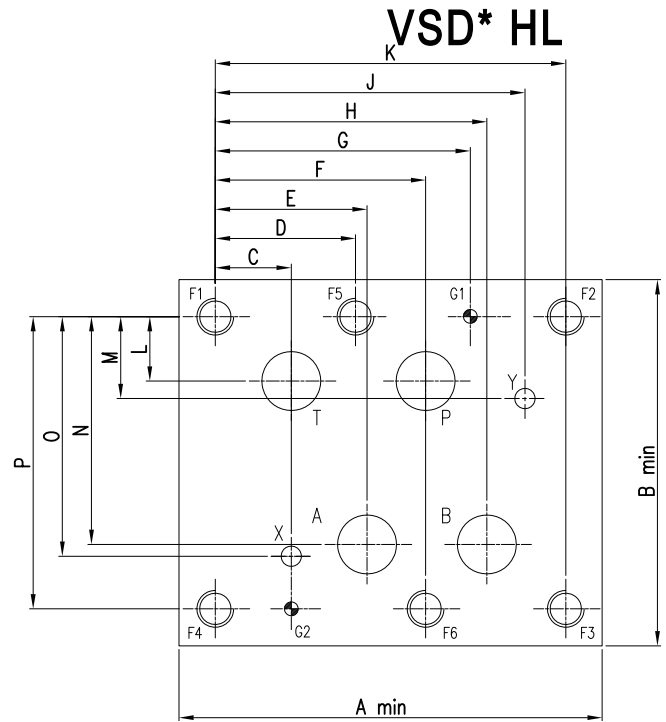


D10

	MM	INCH
P, A, B, T MAX	∅ 32	∅ 1.25
X, Y MAX	∅ 11.2	∅ .44
G MAX	∅ 7.5	∅ .30
MOUNTING BOLT THREAD SIZE	M20	3/4-10 UNC

	MM	INCH
A	230.0	9.06
B	199.0	7.83
C	41.3	1.63
D	76.2	3.00
E	82.5	3.25
F	114.3	4.50
G	138.6	5.457
H	147.6	5.81

	MM	INCH
J	168.3	6.63
K	190.5	7.50
L	35.0	1.38
M	44.5	1.75
N	123.8	4.87
O	130.2	5.13
P	158.8	6.25



16. APPLICATION DATA

FLUIDS

All pressure drops shown on these data pages are based on 170 SUS fluid viscosity and 0.87 specific gravity. For any other specific gravity (G1) the pressure drop (ΔP) will be approx. $\Delta P_1 = \Delta P (G1/G)$. See the chart for other viscosities.

FLUID VISCOSITIES	Cst	10	14.5	32	36	43	54	65	76	86	108	216	324	400
	SUS	60	75	150	170	200	250	300	350	400	500	1000	1500	1900
MULTIPLIER	0.77	0.81	0.97	1.00	1.04	1.10	1.15	1.20	1.24	1.31	1.56	1.72	1.83	

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code G). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department. Using fluids at temperatures higher than 180 degrees F causes the accelerated degradation of seals as well as degradation of the fluids physical and chemical properties.

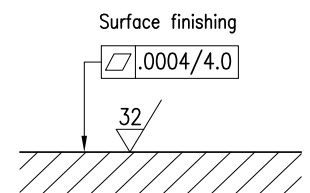
From a safety standpoint, temperatures above 130 degrees F are not recommended.

RANGE TEMPERATURES:	Ambient	-4 to +176°F	-20 to +80°C
	Fluid	-40 to +176°F	-40 to +80°C
FLUID VISCOSITY	Range	60 -1900 SUS	10 - 400 cSt
	Recommended	120 SUS	25 cSt
FLUID CONTAMINATION	ISO 4406:1999 Class 20/18/15		

INSTALLATION

The configurations with centering and offset springs can be mounted in any position without impairing correct operation; instead, those without springs and with mechanical detent must be mounted with the longitudinal axis horizontal.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.

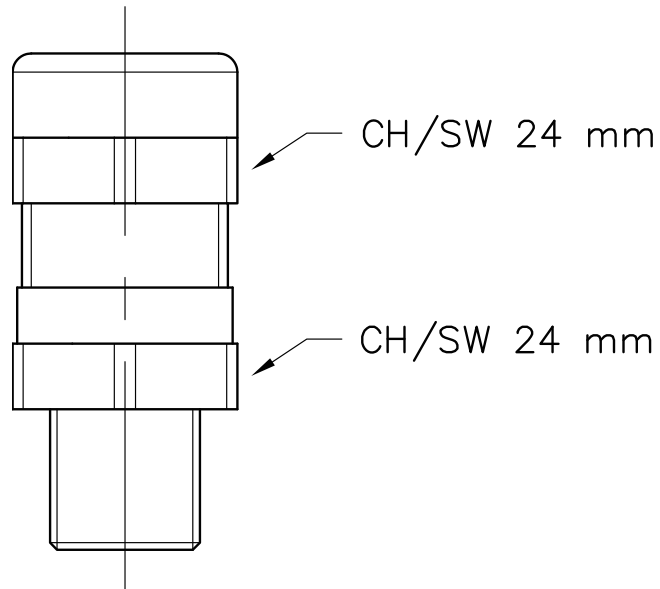


17. WIRING

CABLE GLANDS

Cable glands must be ordered separately; Continental Hydraulics offers some types of cable glands with the following features:

- Version for non-armoured cable, external seal on the cable (suitable for diameter 8 to 10 mm cables)
- According to ATEX II 2GD, IM2, IECExGb, Db, Mb certified
- Cable gland material: Nickel and Brass
- Rubber tip material: Silicone
- Ambient temperature range: -70°C [-94°F] to +220°C [+428°F]
- Protection degree: IP66/IP68



DESCRIPTION	NOTES	CONNECTION TYPE	ITEM
CGK2/NB-01/10	M20 x 1.5 - ISO 261 Male Tread	T01 - S01	M3908108001
CGK2/NB-02/10	Version with Gk 1/2 - UNI EN 10226-2 Male Tread	T02	M3908108002
CGK2/NB-03/10	Version with 1/2" NPT - ANSI B1.20.1 (ex ANSI B2.1)	T03	M3908108003
CGK2/NB-04/10	Version with M16 x 1.5 - ISO 261 Male Thread	S03	M3908108004

NOTES:

CGK2/NB-01/10 & CGK2/NB-04/10

It is supplied equipped with silicone seal, that must be assembled between the cable gland and the coil cover, so as to ensure IP66/IP68 protection degree.

CGK2/NB-02/10 & CGK2/NB-03/10

In order to ensure IP66/IP68 protection degree, the customer must apply LOCTITE 243™ Threadlocker or similar between the cable gland connection thread and the coil cover.

BOLT KITS

D03 SIZE	BD03-125	Valve Only	1008406
D05 SIZE	BD05-138 - B	Valve Only	1019657
D05* SIZE	BD05H-150 - B	Valve Only	1009397
D07 SIZE	BD07-250	Valve Only	1009400
D08 SIZE	BD08-250	Valve Only	1009401
D10 SIZE	BD10-275	Valve Only	1013038

SEAL KIT

D03 SIZE	Buna Seal Kit	1013188
	Viton Seal Kit	1013096
D05 SIZE	Buna Seal Kit	1019658
	Viton Seal Kit	
D05* SIZE	Buna Seal Kit	1013174
	Viton Seal Kit	1013175
D07 SIZE	Buna Seal Kit	1013176
	Viton Seal Kit	1013177
D08 SIZE	Buna Seal Kit	1013178
	Viton Seal Kit	1013179
D10 SIZE	Buna Seal Kit	1013972
	Viton Seal Kit	1013973

SUBPLATES

D05 alt. A SIZE	AD05JESPS16S	Aluminium	SAE-16	351716AJ
	DD05JESPS16S	Ductile	SAE-16	351716AK
D07 SIZE	AD07SPS016S	Aluminium	SAE-16	1013039AB
	DD07SPS016S	Ductile	SAE-16	1013039AC
D08 SIZE	AD08SPS020S	Aluminium	SAE-20	265803AP
	DD08SPS020S	Ductile	SAE-20	265803AL
D10 SIZE	AD10SPS032S	Aluminium	SAE-32	1013040AB
	DD10SPS032S	Ductile	SAE-32	1013040AC

NOTES:

1. Max pressure for aluminum subplates: 3000 psi (210 bar)
2. Max pressure for ductile subplates: 5000 psi (350 bar)
3. Always verify subplate port size is proper for the application

18 - MANUAL OVERRIDES

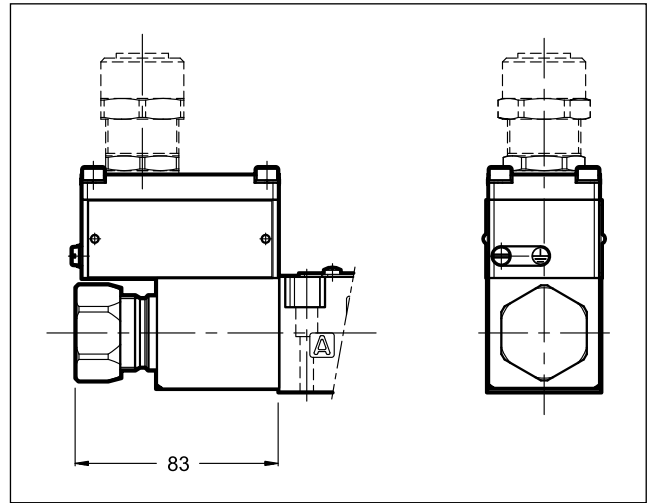
18.1 - CB - Blind ring nut

The metal ring nut protects the solenoid tube from atmospheric agents and isolates the manual override from accidental operations. The ring nut is tightened on a threaded fastener that keeps the coil in its position even without the ring nut.

To access the manual override loosen the ring nut and remove it; then reassemble hand tightening, until it stops.

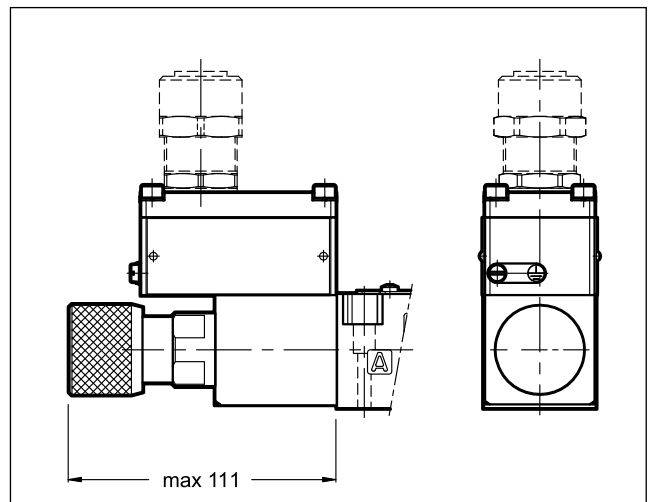
Activate the manual override always and only with non-sparking tools suitable for use in potentially explosive atmospheres.

More information on safe use of explosion-proof components are provided in the instruction manual, always supplied with the valve.



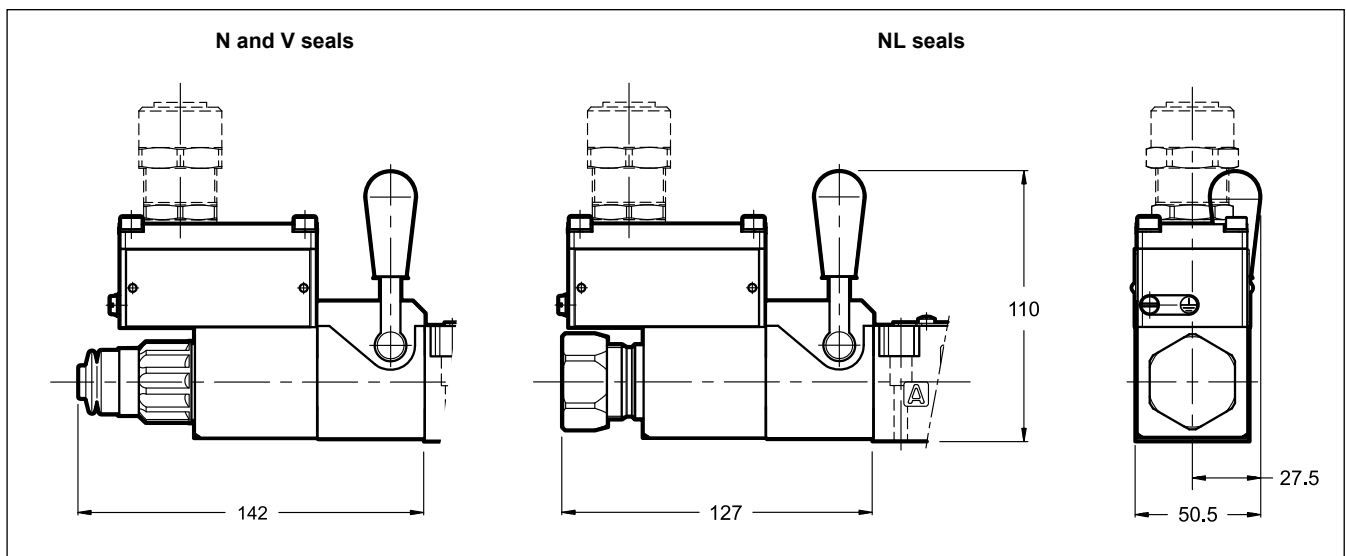
18.2 - CK1 - Knob manual override

This turning knob is available for DC valves only.



18.3 - CH - Lever manual override

The lever manual override is available for DS3K only. The seals choice leads the type of the standard ring nut to be mounted. The boot isn't a redundant manual override, instead acts as protection for the tube. The lever device is always placed at side A.





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