

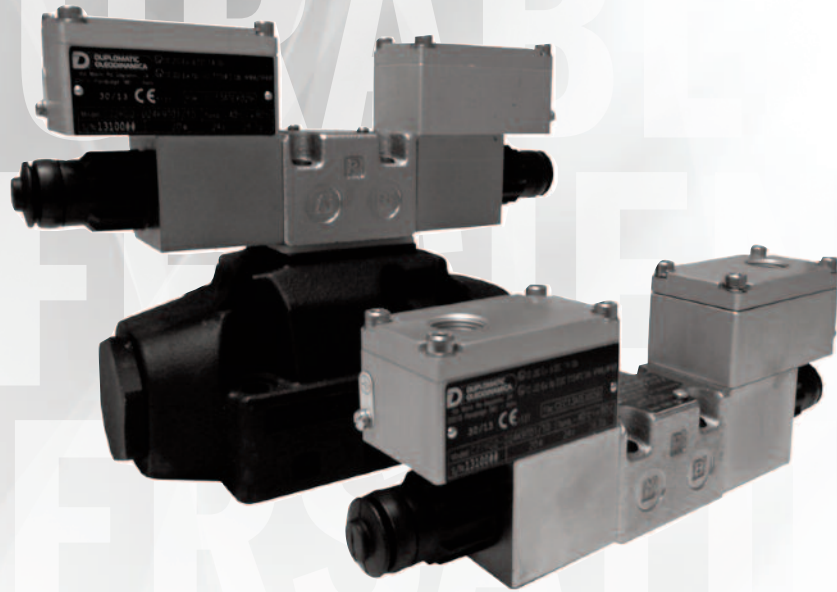


CONTINENTAL HYDRAULICS

# VSD\*HL-\* -KD2

HAZARDOUS LOCATION, SOLENOID, DIRECT & PILOT OPERATED VALVES

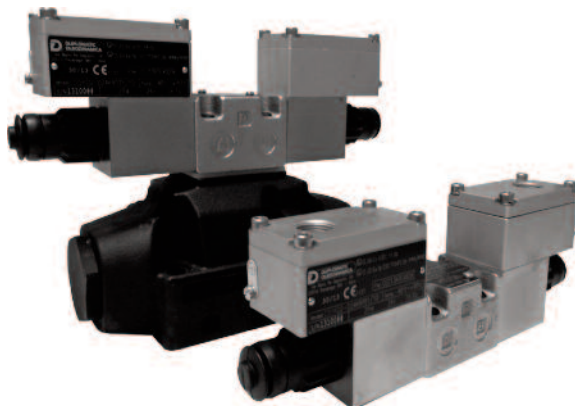
(IN COMPLIANCE WITH ATEX 94/4/EC)



VSD\*HL-\* -KD2 - HAZARDOUS LOCATION, SOLENOID, DIRECT & PILOT OPERATED VALVES

# VSD\*HL-\* -KD2

## HAZARDOUS LOCATION, SOLENOID, DIRECT & PILOT OPERATED VALVES



### DESCRIPTION

The VSD\*\*HL solenoid operated directional control valves are in compliance with ATEX 94/9/EC standards. They are suitable for use in potentially explosive atmospheres which fall within the ATEX II 2GD classification for gas and dust. See pages 20 and 21 for ATEX classification, operating temperatures and electrical characteristics.

These valves are available in both direct operated and pilot operated models in the following sizes:

**DIRECT OPERATED:** NFPA D03 (ISO 4401-03), NFPA D05 (ISO 4401-05)

**PILOT OPERATED:** 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)

The direct operated valves are supplied with a Zinc-Nickel surface treatment to ensure a salt spray resistance of up to 600 h. (test conducted per UNI EN ISO 9227 and evaluated per UNI EN ISO 10289). The Zinc-Nickel surface treatment is available on the pilot operated valves upon request.

A statement of conformity to the applicable standards is supplied with each valve.

The label and electrical box on these valves have a concentration of magnesium lower than the critical value of 7.5% for the Hazardous Environments.

### TYPICAL PERFORMANCE SPECIFICATIONS

		VSD03HL		VSD05HL		VSD05AHL VSD05BHL		VSD07HL		VSD08HL		VSD10HL	
<b>MAXIMUM OPERATING PRESSURE</b>	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
<b>PILOT PRESSURE</b>	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
<b>MAX FLOW RATE</b>		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
<b>MOUNTING SURFACE</b>		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	
<b>MAX WEIGHT</b>		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

# IDENTIFICATION CODE - HAZARDOUS LOCATION - DIRECT OPERATED

**VSD**   **HL** -     -       - **KD2**   -   **D** -   — DESIGN LETTER

SOLENOID OPERATED

HAZARDOUS LOCATION

**VALVE ATEX APPROVAL**

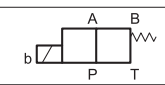
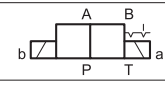
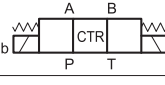
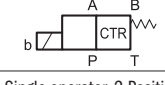
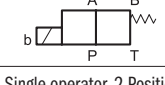
For gases, vapors, mists: EX II 2G IIC T4 Gb  
For dust: EX II 2D IICT 154°C Db  
(protection type of the coil "d")

**SOLENOIDS**

see codes on page 22

SIZE	
<b>03</b>	NFPA D03
<b>05</b>	NFPA D05

TEMPERATURE CLASS	
<b>OMIT</b>	T4 (STD)
<b>T5</b>	T5 class (see page 21)

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

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

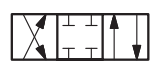
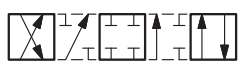
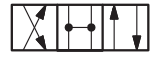
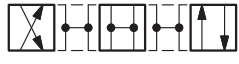




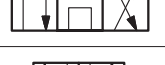


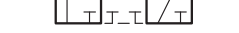
MECHANICAL OPTIONS OMIT IF NOT REQUIRED	
<b>R</b>	Reverse Mode Sol. A supplied
<b>F</b>	Blind Retainer (STD for AL seal) see page 16
<b>H</b>	Lever manual override (see page 17) available only on D03

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

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

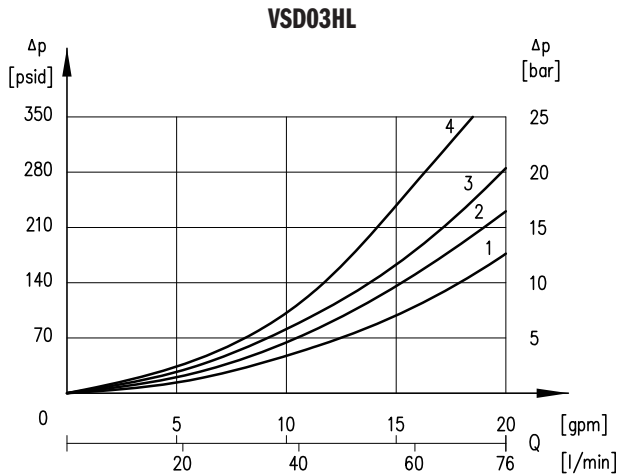
**NOTE:**

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).

SPOOLS					
NAME	SYMBOL	FUNCTION	CENTER POSITION	CROSSOVER	FUNCTION MATCHING
<b>A</b>			All ports blocked	P → B or P → A T blocked	1, 2, 3, 5
<b>B</b>			All ports open	All ports open	3, 5 1 (only with DC coils)
<b>F</b>			P blocked and A → T or B → T	P blocked and A → T or B → T	3, 5
<b>F1</b>			P blocked, A and B restricted to T	P blocked, A and B restricted to T	
<b>L</b>			P → T A and B blocked	All ports open, restricted	
<b>X</b>			NA	All ports blocked	9

# PRESSURE DROPS $\Delta P-Q$

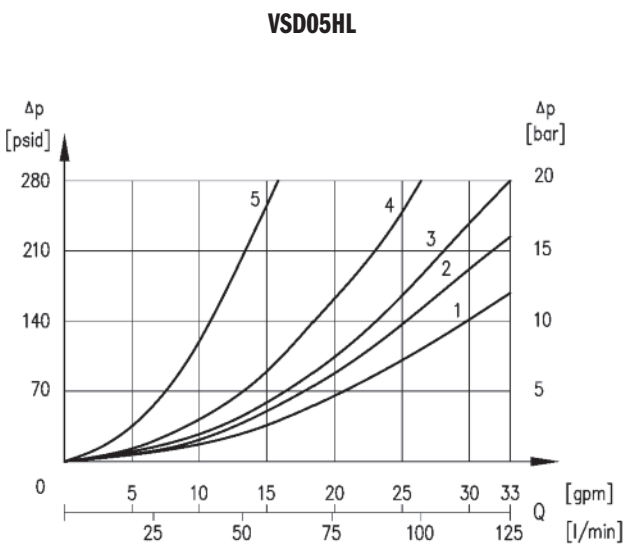
(OBTAINED WITH VISCOSITY OF 170 SUS - 36 CST AT 70°F - 50°C)



SPOOL	FLOW CURVE NUMBER				
	P→A	P→B	A→T	B→T	P→T
A, F1	2	2	3	3	-
B	1	1	3	3	2
F	3	3	1	1	-
L	4	4	4	4	3
1A	3	3	3	3	-
1B, 2A	2	2	2	2	-
X	3	3	-	-	-

**NOTES:**

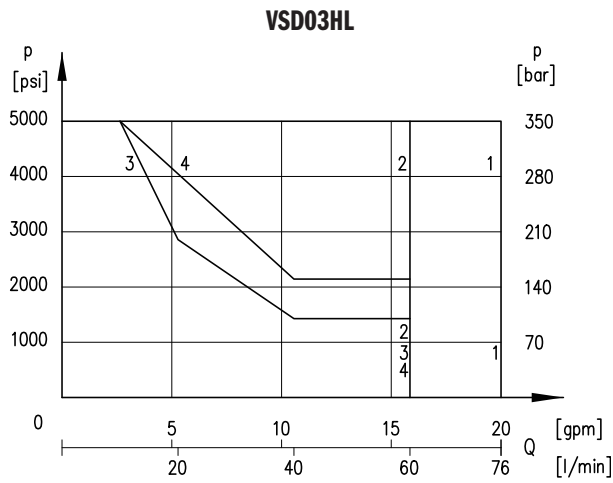
1. The values indicated in the graphs are relevant to the standard solenoid valve, with 42L coils.
2. Valve performance was tested in a four way circuit (full loop). Performances may be reduced from that shown when used in a three-way circuit (half circuit), i.e. A or B port plugged.
3. The values have 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.



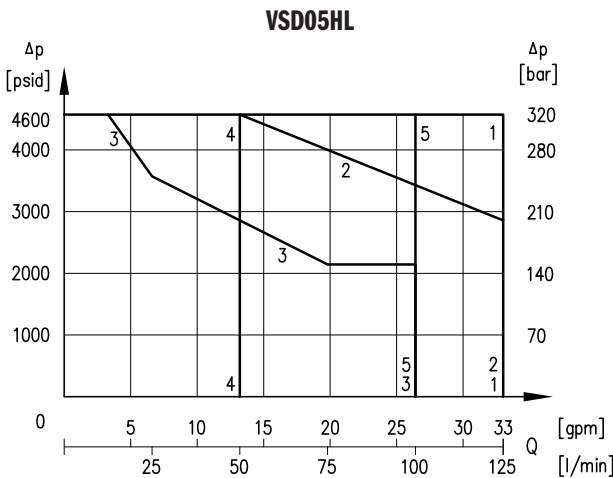
SPOOL	FLOW CURVE NUMBER				
	SHIFTED				CENTER
	P→A	P→B	A→T	B→T	P→T
3A	1	1	2	2	-
B	1	1	1	1	1
F, F1	1	1	1	1	-
L	4	4	4	4	1
2A	2	2	2	2	-
1A	2	2	3	3	-
1B	2	2	1	1	-
X	3	3	-	-	-

# PERFORMANCE CURVES

Curves obtained with mineral oil viscosity of 170 sus (36 cSt) at 122°F (50°C); the  $\Delta p$  values are measured between P and T (full loop) valve ports.



SPOOL	CURVE NUMBER			
	DC		RAC COILS	
	P→A	P→B	P→A	P→B
A, F1	1	1	1	1
B	2	2	2	2
F	3	3	3	3
L	2	2	4	4
1B	4	4	-	-
X	4	4	4	4



CURVE	SPOOL
1	A, 2A, B
2	1B
3	F
4	L
5	1A
6	F1

# RESPONSE TIMES

		TIME [ms]	
		ENERGIZING 0→100%	DE-ENERGIZING 100%→0
VSD03HL	VDC COILS	60	40
	RECTIFIED COILS	60	140
VSD05HL	VDC COILS	70 to 100	15 to 20
	RECTIFIED COILS	70 to 100	140



# 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

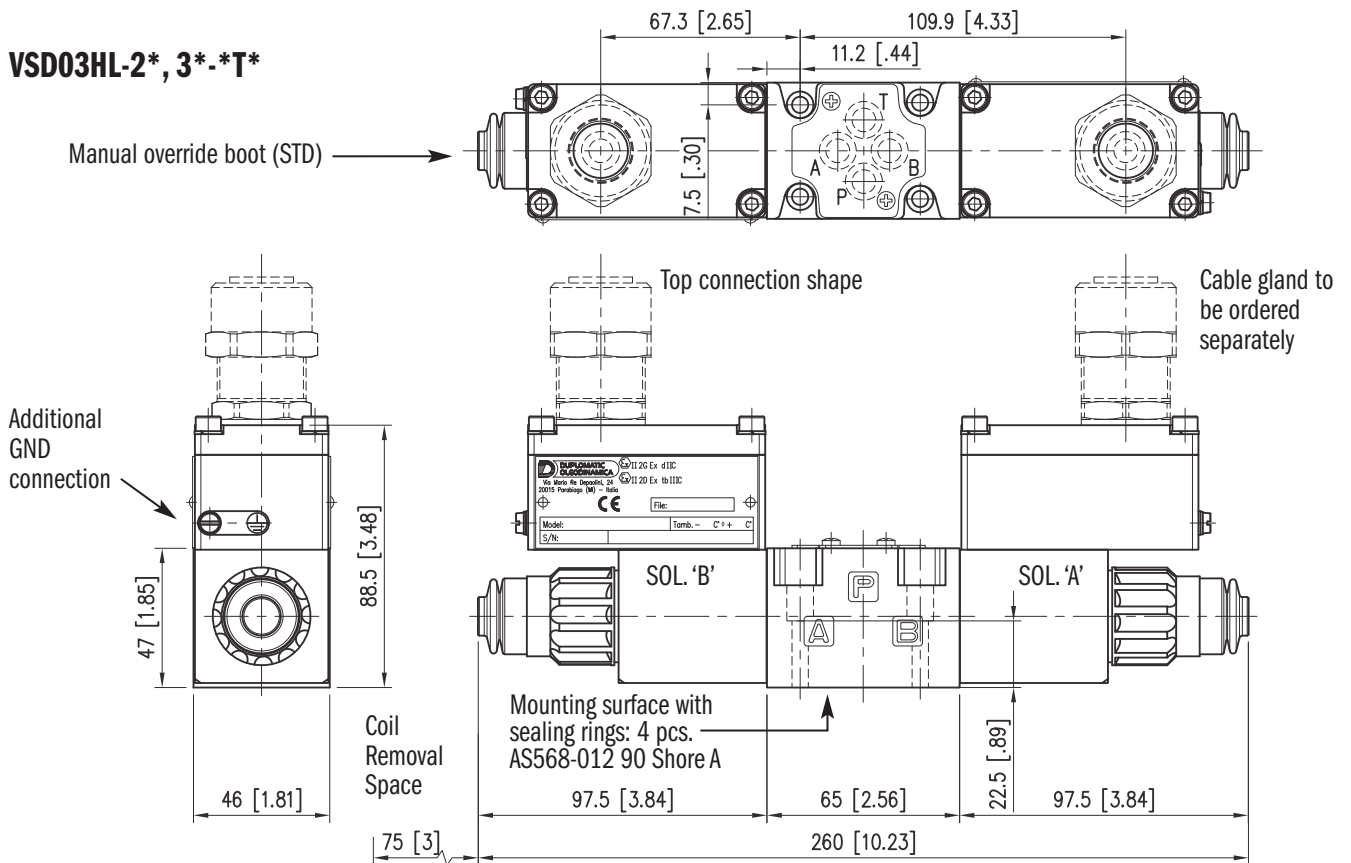
4-5 lbf-ft (5.5-6.8 Nm)

## SEALING RINGS

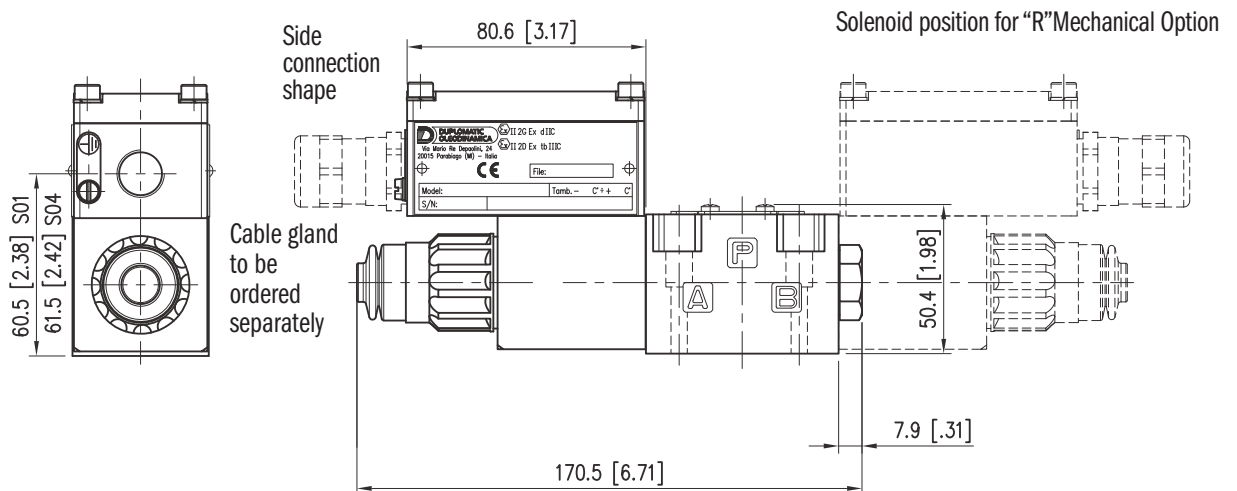
4 O-rings AS568-012 90 Shore A

Dimensions in mm [IN]

### VSD03HL-2\*, 3\*-\*T\*



### VSD03HL-1\*, 5\*, 9\*-\*S\*



# 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

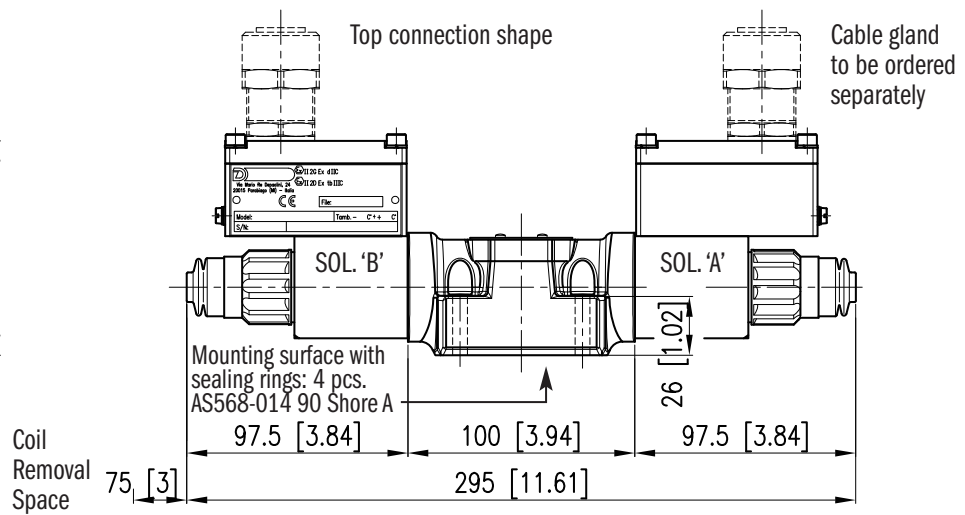
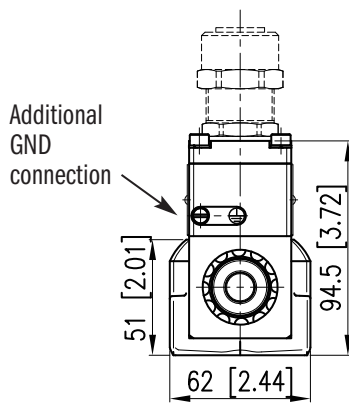
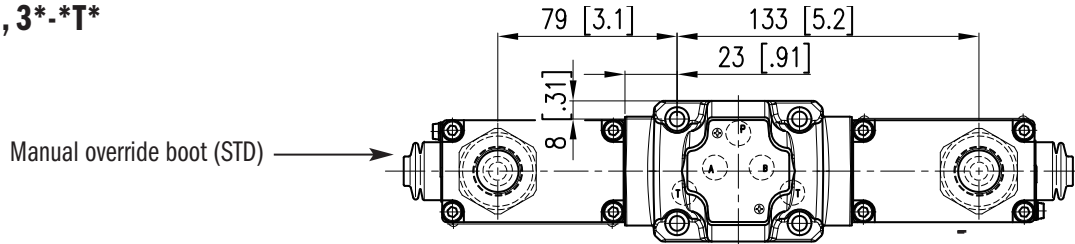
6 lbf-ft (8 Nm)

## SEALING RINGS

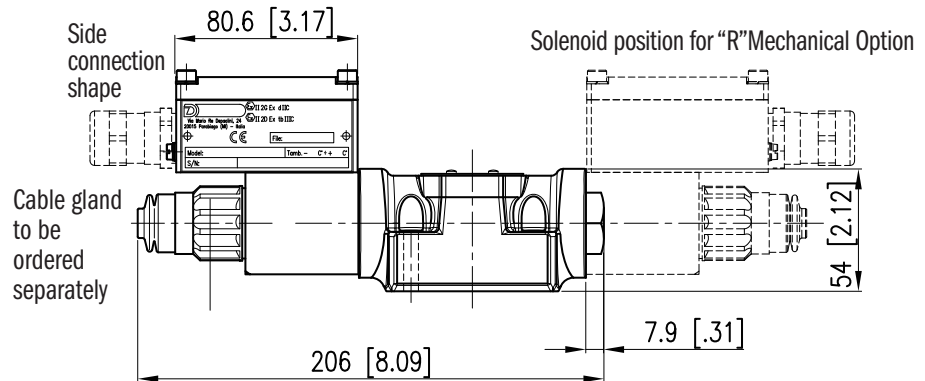
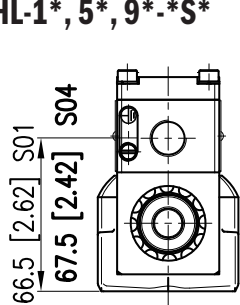
5 O-rings AS568-014 90 Shore A

Dimensions in mm [IN]

### VSD05HL-2\*, 3\*-\*T\*



### VSD05HL-1\*, 5\*, 9\*-\*S\*



VSD\*HL\*-KD2 - HAZARDOUS LOCATION, SOLENOID, DIRECT & PILOT OPERATED VALVES

# IDENTIFICATION CODE - HAZARDOUS LOCATION - PILOT OPERATED

**VSD**    **HL** -       -                   **- KD2**    -    **D** -    — DESIGN LETTER

SOLENOID OPERATED

HAZARDOUS LOCATION

SOLENOIDS  
see codes on page 22

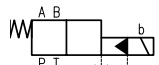
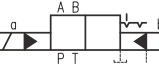
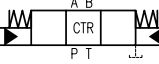
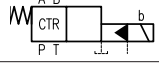
SIZE	
<b>05A</b>	NFPA D05 alt. A
<b>05B</b>	NFPA D05 alt. B
<b>07</b>	NFPA D07
<b>08</b>	NFPA D08
<b>10</b>	NFPA D10

SEAL	
<b>A</b>	Buna (STD)
<b>G</b>	Viton
<b>AL</b>	Buna (low temp)

**VALVE ATEX APPROVAL**  
For gases, vapors, mists: EX II 2G IIC T4 Gb  
For dust: EX II 2D IICT 154°C Db  
(protection type of the coil "d")

TEMPERATURE CLASS	
<b>OMIT</b>	T4 (STD)
<b>T5</b>	T5 class (see page 21)

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

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


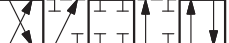


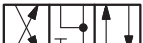

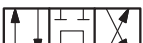

MECHANICAL OPTIONS OMIT IF NOT REQUIRED	
<b>R</b>	Reverse Mode Sol. A supplied
<b>JJ</b>	Stroke adjustment on main stage
<b>JA</b>	Stroke adjustment on A port end
<b>JB</b>	Stroke adjustment on B port end
<b>KK</b>	Adjustable pilot Chokes
<b>P</b>	Restrictor subplate on P port between main and pilot valve
<b>F</b>	Blind Retainer (STD for AL seal) see page 16

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

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

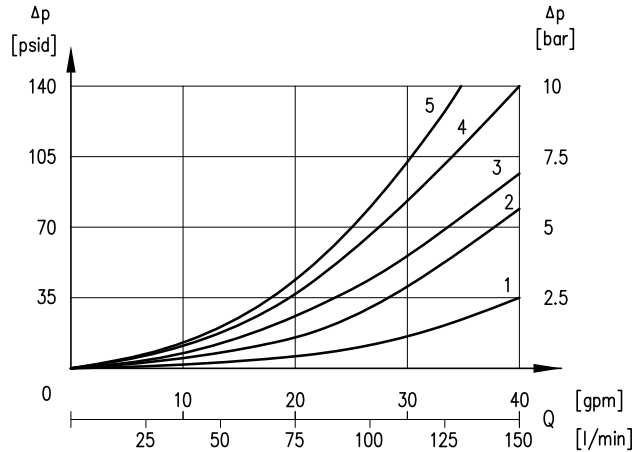
SPOOLS					
NAME	SYMBOL	FUNCTION	CENTER POSITION	CROSSOVER	FUNCTION MATCHING
<b>A</b>			All ports blocked	P → B or P → A T blocked	1, 2, 3, 5
<b>B</b>			All ports open	All ports open	1, 3, 5
<b>F</b>			P blocked and A → T or B → T	P blocked and A → T or B → T	3, 5
<b>L</b>			P → T A and B blocked	All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



# PRESSURE DROPS $\Delta p$ -Q - PILOT OPERATED VALVES

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

## VSD05\*HL

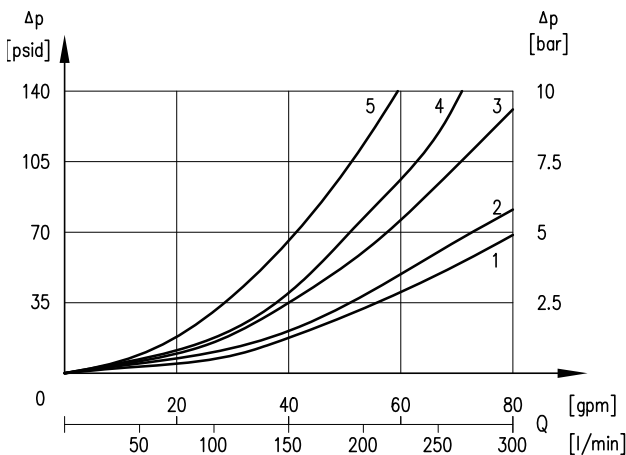


SPOOL	FLOW CURVE NUMBER					
					CTR	
	P→A	P→B	A→T	B→T	P→T	A→T B→T
<b>A, 1A, 2A</b>	4	4	1	1	-	-
<b>B</b>	3	3	1	2	5	-
<b>F</b>	4	4	1	1	-	4
<b>L</b>	5	5	2	3	5	-
<b>1B</b>	3	3	1	1	-	-

### NOTES:

1. The values indicated in the graphs are relevant to the standard solenoid valve, with 42L 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



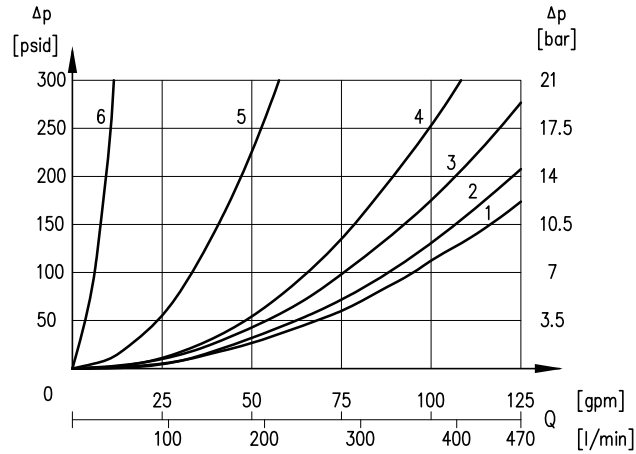
SPOOL	FLOW CURVE NUMBER					
					CTR	
	P→A	P→B	A→T	B→T	P→T	A→T B→T
<b>A, 1A, 2A</b>	1	1	3	4	-	-
<b>B</b>	1	1	4	4	2	-
<b>F</b>	1	1	4	4	-	4
<b>L</b>	2	2	4	5	4	-

VSD\*HL\*-KD2 - HAZARDOUS LOCATION, SOLENOID, DIRECT & PILOT OPERATED VALVES

# PRESSURE DROPS $\Delta p$ -Q - PILOT OPERATED VALVES

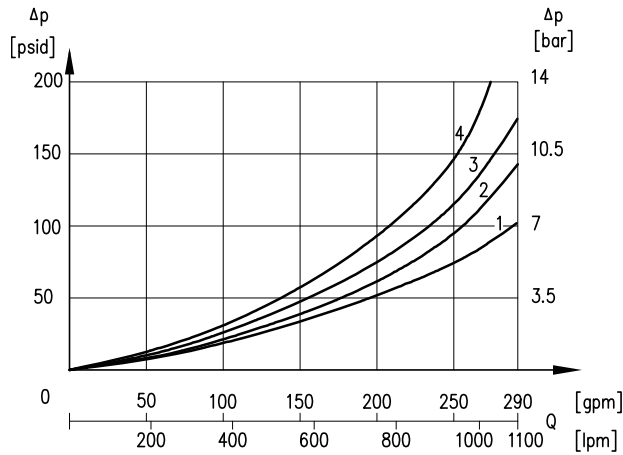
(OBTAINED WITH VISCOSITY OF 170 SUS (36 cSt) AT 120°F (50°C))

## VSD08HL



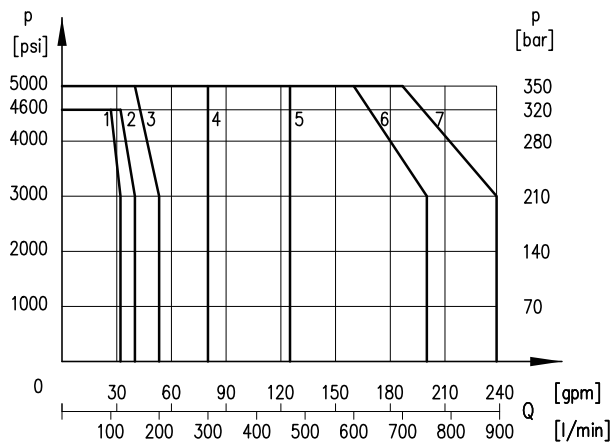
SPOOL	FLOW CURVE NUMBER					
					CTR	
	P→A	P→B	A→T	B→T	P→T	A→T B→T
A, 1A, 2A, 1B	2	2	3	3	-	-
B	1	1	2	1	4	-
F	2	2	2	1	-	4
L	4	4	3	5	6	-

## 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	-

# PERFORMANCE



SPOOL	VSD05*HL	VSD07HL	VSD08HL	VSD10HL
A, F	2	4	5	7
B	2	4	5	6
L	1	3	5	6

# RESPONSE TIMES

The values shown below refer to a solenoid valve working with piloting pressure of 1,450 PSI (100 bar), with mineral oil at a temperature of 122°F (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.

SIZE	ENERGIZING [ms]	DE-ENERGIZING [ms]	
	VDC / RECTIFIED	VDC	RECTIFIED
D05*	70	60	160
D07	80	70	170
D08	90	70	170
D10	120	90	190

VSD\*HL\* - KD2 - HAZARDOUS LOCATION, SOLENOID, DIRECT & PILOT OPERATED VALVES

# OVERALL AND MOUNTING DIMENSIONS FOR VSD05\*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

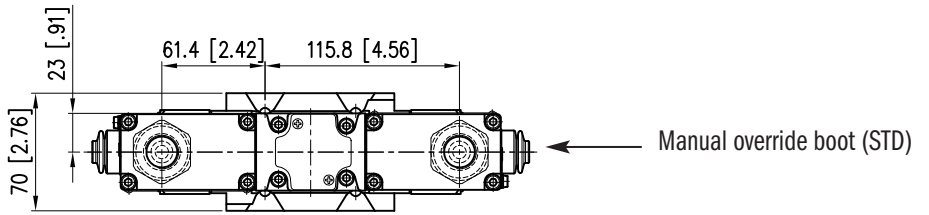
## TIGHTENING TORQUE

6 lbf-ft (8 Nm)

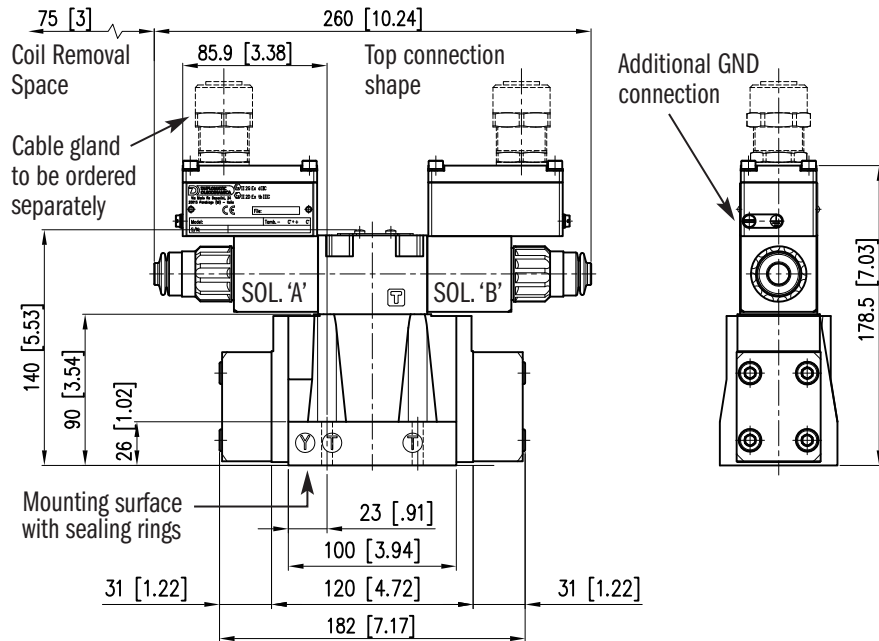
## SEALING RINGS

5 O-rings AS568-014 90 Shore A

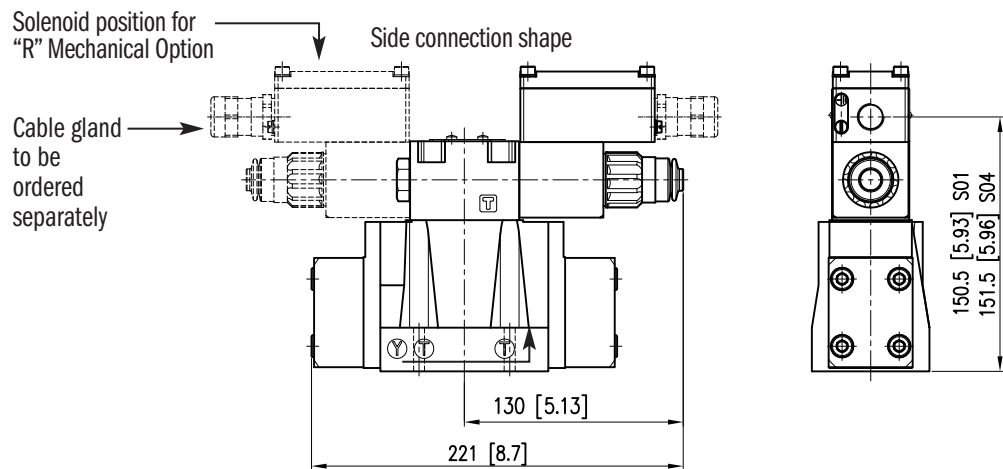
2 O-rings AS568-012 90 Shore A



## VSD05\*HL-2\*, 3\*-\*T\*



## VSD05\*HL-1\*, 5\*-\*S\*



# OVERALL AND MOUNTING DIMENSIONS FOR VSD07HL

## 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)

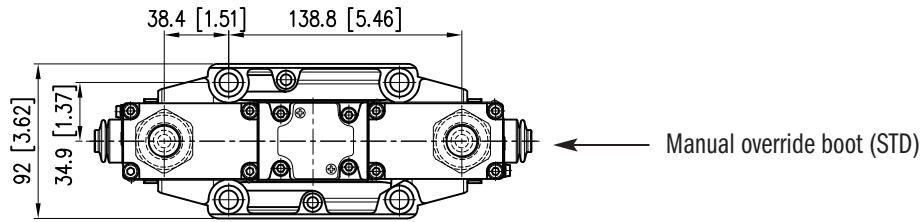
3/8 - 16 UNC-2B: 30 lbf-ft (40 Nm)

## SEALING RINGS

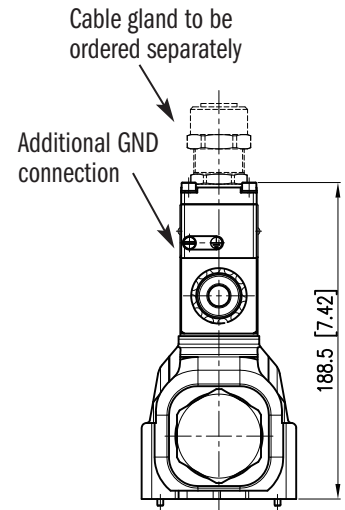
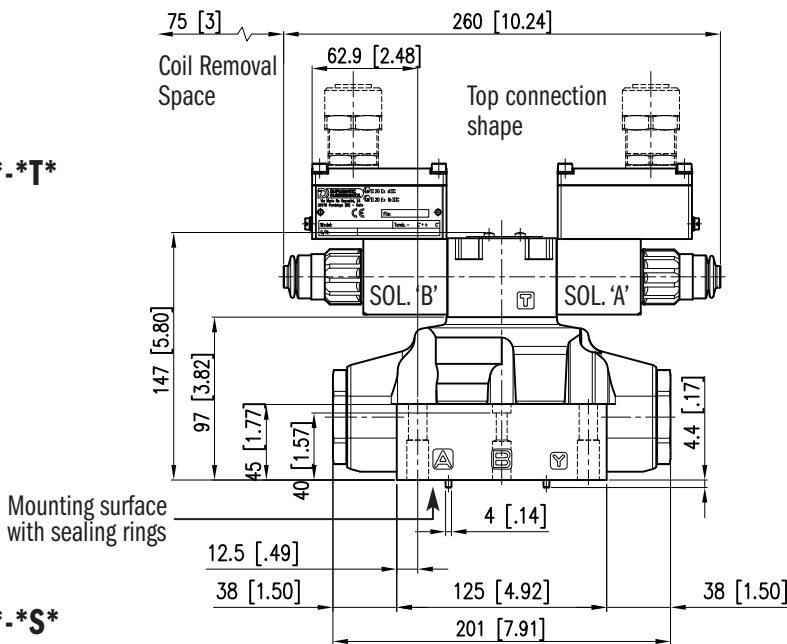
4 O-rings 22.22 mm ID x 2.62 mm CS90 Shore 90A

2 O-rings AS568-013 90 Shore A

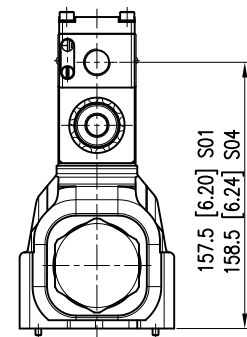
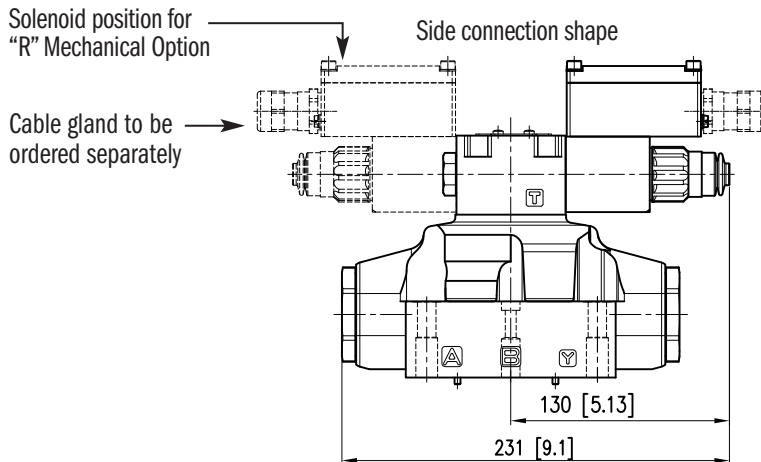
Dimensions in mm [IN]



## VSD07HL-2\*, 3\*-\*T\*



## VSD07HL-1\*, 5\*-\*S\*



# OVERALL AND MOUNTING DIMENSIONS FOR VSD08HL

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

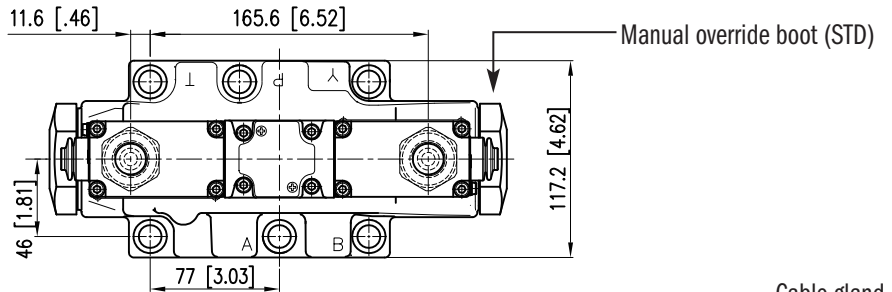
## TIGHTENING TORQUE

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

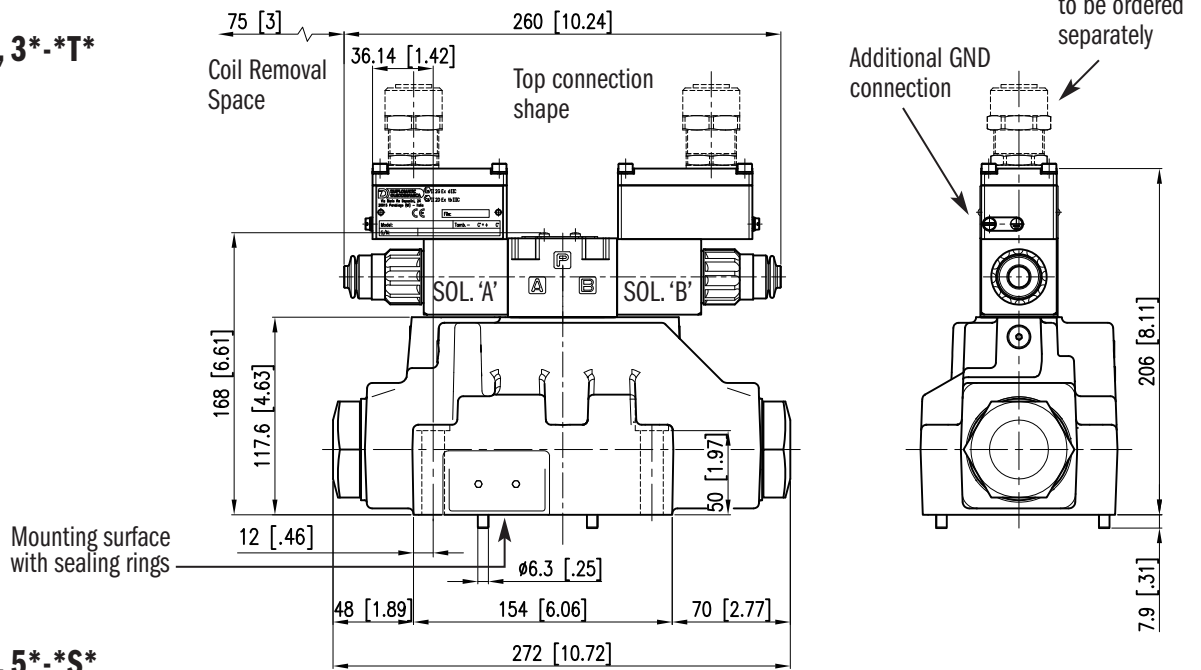
## SEALING RINGS

4 O-rings AS568-215 90 Shore A

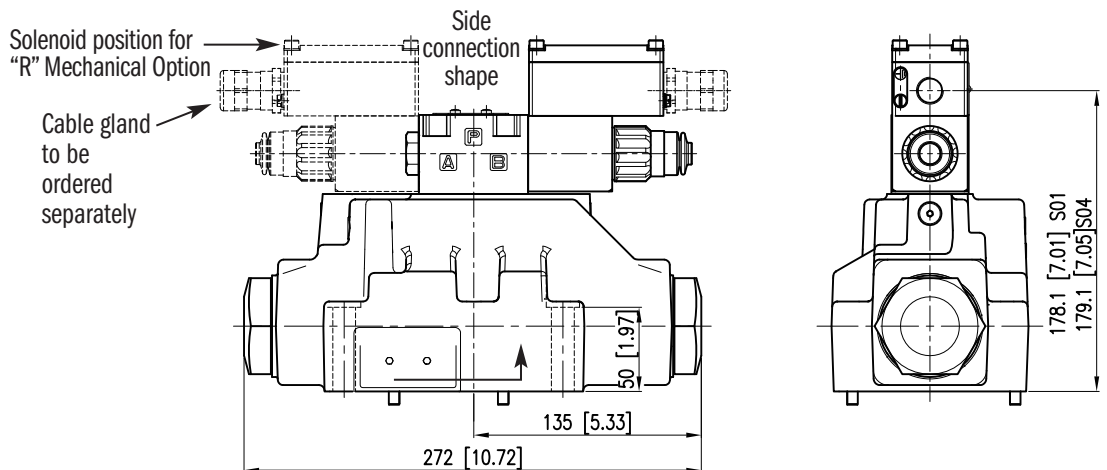
2 O-rings AS568-210 90 Shore A



## VSD08HL-2\*, 3\*-\*T\*



## VSD08HL-1\*, 5\*-\*S\*



# OVERALL AND MOUNTING DIMENSIONS FOR VSD10HL

Dimensions in mm [IN]

### THREAD OF MOUNTING HOLE

3/4 - 10 UNC-2B x 1.30

### FASTENING

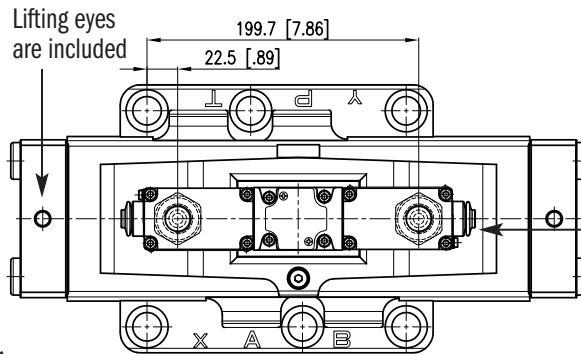
6 bolts - 3/4 - 10 UNC-2B X 2 3/4  
Grade 8 or stronger or higher strength

### TIGHTENING TORQUE

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

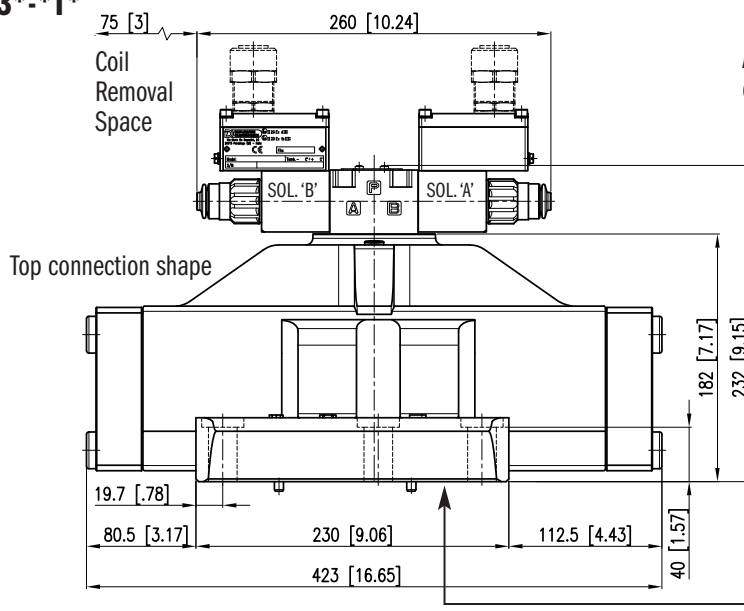
### SEALING RINGS

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

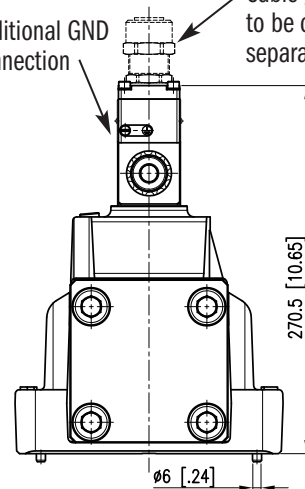


Manual override boot (STD)

## VSD10HL-2\*, 3\*-\*T\*



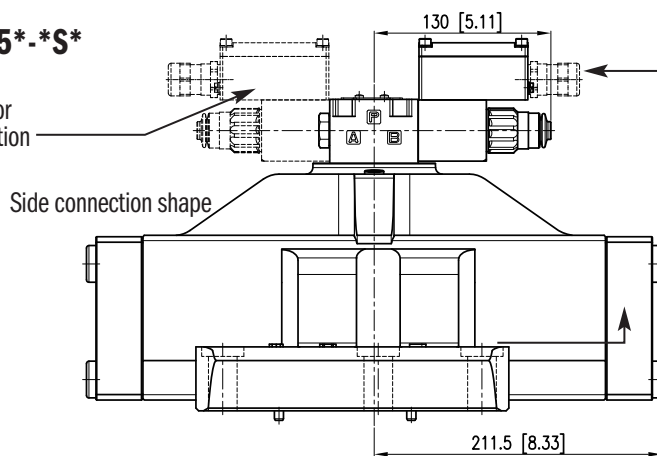
Additional GND connection  
Cable gland to be ordered separately



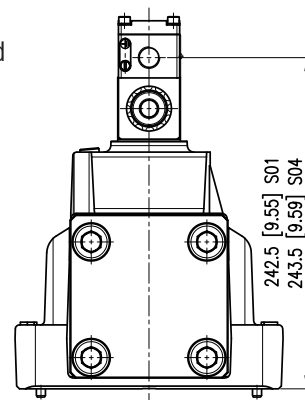
Mounting surface with sealing rings

## VSD10HL-1\*, 5\*-\*S\*

Solenoid position for "R" Mechanical Option



Cable gland to be ordered separately



## MECHANICAL OPTIONS

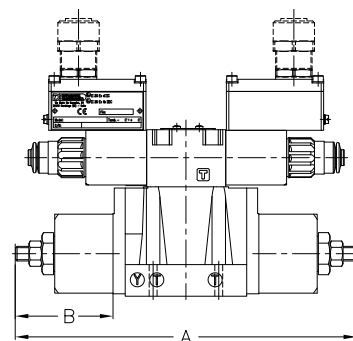
### STROKE ADJUSTMENT (JJ)

This modification controls the flow of oil through the valve by limiting spool movement. It is used in hydraulic systems to govern the speed of system components.

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

It is possible to order the valve with the stroke adjustment on the side only. To request these options add the letters "JA" or "JB" in the Mechanical Options Box in the identification code.

The stroke adjustment kit is also available as an accessory. It includes 1 stroke assembly (one end only) and related seals. This kit is suitable even for the hydraulic operated version.



DIMENSION	VSD05*HL	VSD07HL	VSD08HL	VSD10HL
<b>A</b>	280 [11.00]	320 [12.60]	417 [16.40]	520 [20.50]
<b>B</b>	80 [3.15]	69 [2.72]	89 [3.50]	90 [3.54]

### USE THE CODE BELOW TO ORDER STROKE ADJUSTMENT KIT

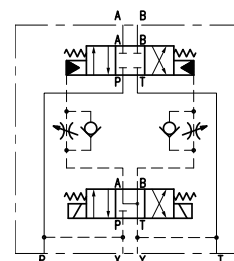
VALVE SERIES	SEAL MATERIAL	ORDERING NUMBER
<b>VSD05*HL</b>	Buna N	VMA-3A1
	Viton	VMA-3A2
<b>VSD07HL</b>	Buna N	VMA-4A1
	Viton	VMA-4A2
<b>VSD08HL</b>	Buna N	VMA-5A1
	Viton	VMA-5A2
<b>VSD10HL</b>	Buna N	VMA-7A1
	Viton	VMA-7A2

### ADJUSTABLE PILOT CHOKES (KK)

Hydraulic shock may occur when stopping or reversing flow. This can be reduced and controlled by lowering the spool shift velocity. The chokes operate by metering out (returning) on all 2 position valves, and when going to center position on 3-position valves.

To request this option add the letters "KK" in the Mechanical Option Box in the identification code.

Consult with Continental Hydraulics for other metering configurations.

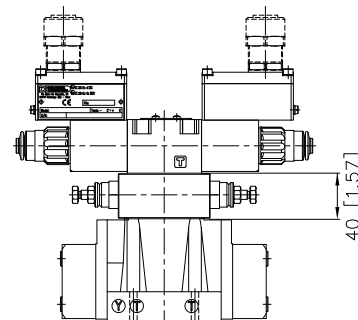


### RESTRICTOR SUBPLATE (P)

It is possible to introduce a subplate with a restrictor of 0.80 mm [0.03 in] for D05\*, D07, D08 sizes and 1.50 mm [0.06 in] for the D10 size on line P between the pilot solenoid valve and the main distributor with the purpose of increasing the switching time.

This part is 10 mm [0.39 in] tall.

To request this option add the letter "P" in the Mechanical Options Box in the identification code.

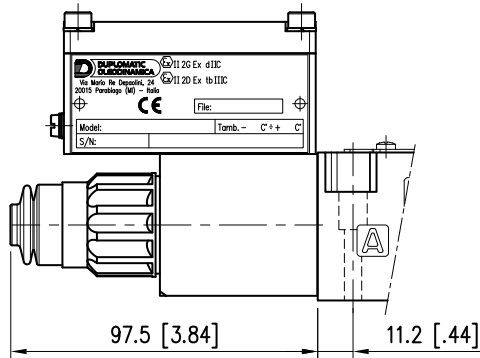




# MECHANICAL OPTIONS

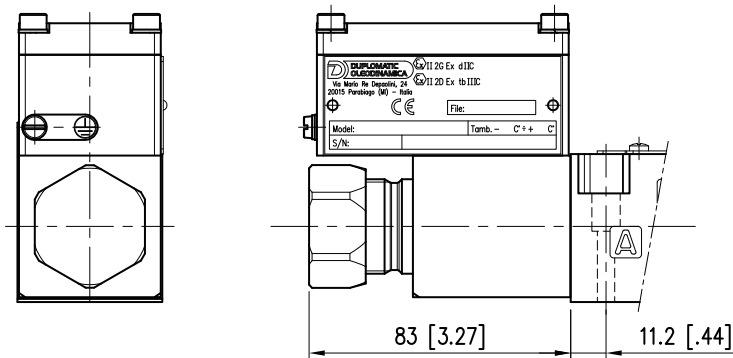
## MANUAL OVERRIDE BOOT

The manual override boot is standard on valves with seal codes A and G. It is not available with seal code AL (low temp).



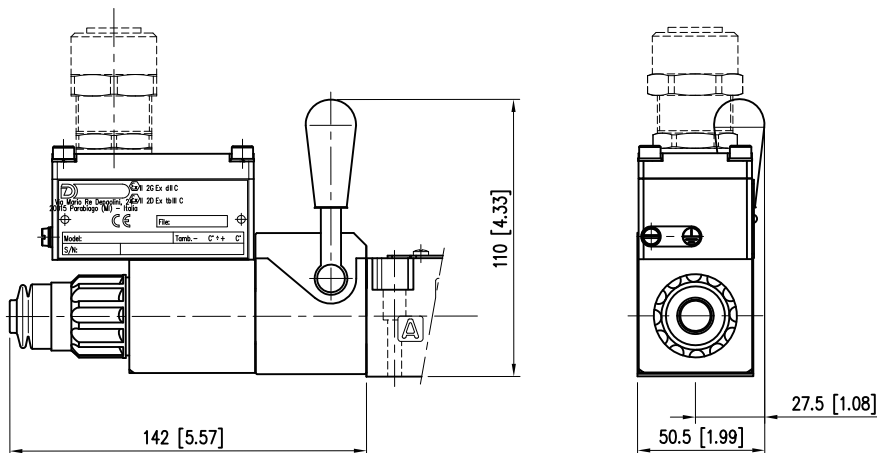
## BLIND RETAINER (CODE F)

The blind retainer is standard on valves with seal code AL. It is available as an option with seal code A and G.



## LEVER MANUAL OVERRIDE (CODE H)

This device can be installed either on single or dual solenoid valves, on port end A only. Option available just on direct operated VSD03HL valve.



# PILOT AND DRAIN CONFIGURATION

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

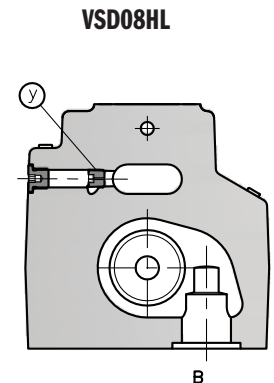
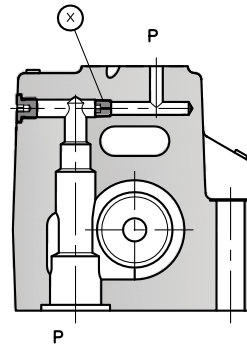
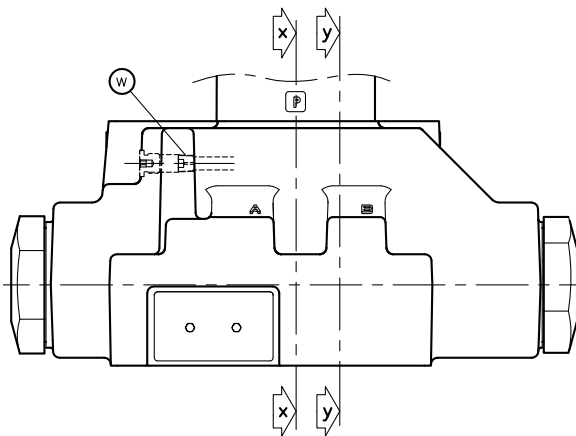
When internal pilot and/or drain are used, the corresponding 'x' and 'y' ports in the manifold must be plugged. Pilot pressure must be at least 70 psi (5 bar) greater than the pressure in the 'T' line.

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.

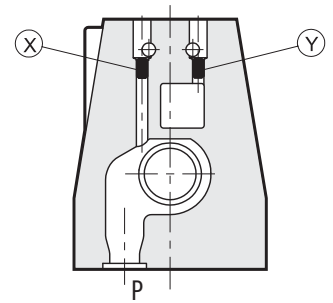
CODE	DESIGN	VSD05*HL, VSD07HL, VSD10HL		VSD08HL	
		Pilot (X)	Drain (Y)	Pilot (X) (W)	Drain (Y)
1	Internal Pilot / External Drain	□	■	■ ■	■
2	External Pilot / External Drain	■	■	■ ■	■
3	Internal Pilot / Internal Drain	□	□	■ ■	□
4	External Pilot / Internal Drain	■	□	■ ■	□

■ Plugged □ Unplugged ■ Restricted

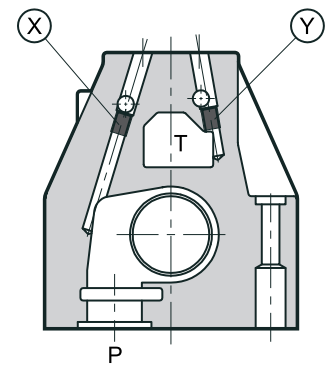


## PLUG MOUNTING

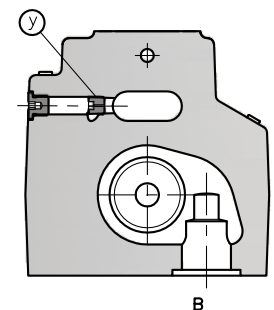
### VSD05\*HL



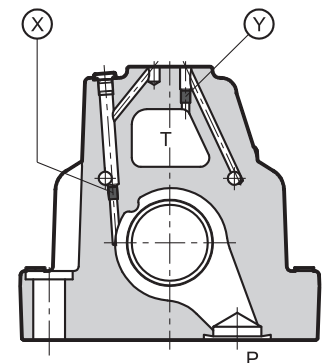
### VSD07HL



### VSD08HL



### VSD10HL



## 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

# INTERNAL PILOT OPTIONS

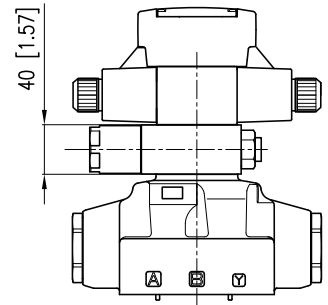
## PRESSURE REDUCING (Z)

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.

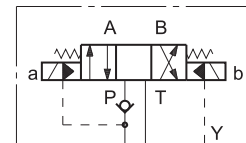
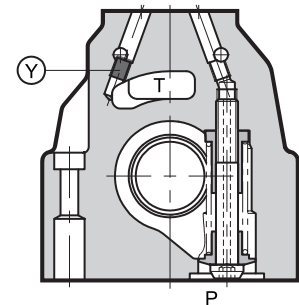
This device is available only for VSD07HL and VSD08HL.

**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


## HAZARDOUS LOCATION


Continental Hydraulics certified the valve/coil combination which are suitable for application and installation in potentially explosive atmospheres according to ATEX directives. **The product always includes the declaration of conformity to the directive and the operating and maintenance manual, which includes all the information needed to properly apply the valve in potentially explosive environments.** Coils assembled on these valves are separately certified according to ATEX directive and are suitable for use in potentially explosive atmospheres.

## VALVE ATEX CLASSIFICATION

The valves can be used for applications and installations in potentially explosive atmospheres that fall within either the ATEX II 2G or the ATEX II 2D classification, with the following markings:

### MARKING FOR GASES, VAPOURS & MISTS

 II 2G IIC T4 Gb (-20°C Ta +80°C) for both A and G seals

 II 2G IIC T4 Gb (-40°C Ta +80°C) for AL seals

EX: Specific marking of explosion protection as ATEX 94/9/EC directive and related technical specification requests.

II: Group II for surface plants

2: Category 2 high protection, eligible for zone 1 (therefore also eligible for category 3 zone 2)

G: Type of atmosphere with gases, vapours and mists

IIC: Gas group (therefore also eligible for group IIA and IIB)

T4: Temperature class (max surface temperature)

Gb: EPL protection level for electrical devices

-20°C Ta +80°C: Ambient temperature range for valves with both A and G seals.

-40°C Ta +80°C: Ambient temperature range for valves with AL seals

### MARKING FOR DUSTS

 II 2D IIIC T154°C Db IP66/IP68 (-20°C Ta +80°C) for both A and G seals

 II 2D IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C) for AL seals

EX: Specific marking of explosion protection as ATEX 94/9/EC directive and related technical specification requests.

II: Group II for surface plants

2: Category 2 high protection, eligible for zone 21 (therefore also eligible for category 3 zone 22)

D: Type of atmosphere with dusts

IIIC: Dust group (therefore also eligible for group IIIA and IIIB)

T154°C: Temperature class (max surface temperature)

Db: EPL protection level for electrical devices

IP66/IP68: Protection degree from atmospheric agents according to IEC EN 60529

-20°C Ta +80°C: Ambient temperature range for valves with both A and G seals.

-40°C Ta +80°C: Ambient temperature range for valves with AL seals

## COIL ATEX CLASSIFICATION

The coil of the explosion-proof valves is identified with its own tag, which carries the relative ATEX marking. **The mechanical construction of the coil housing is made in order to ensure its resistance to possible internal explosion and to avoid any explosion propagation to the outside environment, matching an "Ex d" type protection (explosion-proof coil).**

Moreover, the solenoid is designed to maintain its surface temperature below the limits specified to the relevant class.

Here below you find the coils marking:

### MARKING FOR GASES, VAPOURS & MISTS

 II 2G Ex d IIC T4 Gb (-40°C Ta +80°C)

EX: Specific marking of explosion protection as ATEX 94/9/EC directive and related technical specification requests.

II: Group II for surface plants

2: Category 2 high protection, eligible for zone 1 (therefore also eligible for category 3 zone 2)

G: Type of atmosphere with gases, vapours and mists

Ex d: "d" protection type, explosion-proof case

IIC: Gas Group (therefore also eligible for group IIA and IIB)

T4: Temperature class (max surface temperature)

Gb: EPL protection level for electrical devices

-40°C Ta +80°C: Ambient temperature range

### MARKING FOR DUSTS

 II 2D Ex tb IIIC T154°C Db IP66/IP68 (-40°C Ta +80°C)

EX: Specific marking of explosion protection as ATEX 94/9/EC directive and related technical specification requests.

II: Group II for surface plants

2: Category 2 high protection, eligible for zone 21 (therefore also eligible for category 3 zone 22)

D: Type of atmosphere with dusts

Ex tb: "tb" protection type

IIIC: Dust groups (therefore also eligible for group IIA and IIB)

T154°C: Temperature class (max surface temperature)

Db: EPL protection level for electrical devices

IP66/IP68: Value IP degree

-40°C Ta +80°C: Ambient temperature range

## OPERATING TEMPERATURE

The operating ambient temperature must be between -20°C [-4°F]/+80°C [+176°F] for valves with both A and G seals and -40°C [-40°F]/+80°C [+176°F] for valves with AL seals. The fluid temperature must be between -20°C [-4°F]/+80°C [+176°F] for valves with both A and G seals and -40°C [-40°F]/+80°C [+176°F] for valves with AL seals. The valves are classified in T4 temperature class (T154°C = 309°F), therefore they are eligible for operation also at higher class temperatures (T3, T2, T1 for gas and T200°C = 392°F for dust).

## T5 OPTION: VERSION FOR T5 TEMPERATURE CLASS

The valves classified for T5 temperature class are suitable for operation in potentially explosive atmospheres with ambient temperatures between -20 °C [+4 °F] / +55 °C [+131 °F], for both valves with A and G seals and -40 °C [40 °F] / +55 °C [+131 °F], for valves with AL seals. The fluid temperature must be between -20 °C [-4 °F] / +60 °C [+140 °F], for both valves with A and G seals and -40 °C [40 °F] / +55 °C [+131 °F], for valves with AL seals. The valves are classified in T5 temperature class (T129 °C), therefore they are eligible for operation also at higher class temperature (T4, T3, T2, T1 for gas and T135 °C for dusts).

The marking for T5 class temperature versions are:

### VALVE MARKING FOR GASES, VAPOURS & MISTS


 II 2G IIC T5 Gb (-20°C Ta +55°C) for both A & G seals

 II 2G IIC T5 Gb (-40°C Ta +55°C) for AL seals

### COIL MARKING FOR GASES, VAPOURS, MISTS

 II 2G Ex d IIC T5 Gb (-40°C Ta +55°C)

### VALVE MARKING FOR DUSTS

 II 2D IIIC T129°C Db IP66/IP68 (-20°C Ta +55°C) for both A & G seals

 II 2D IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C) or AL seals

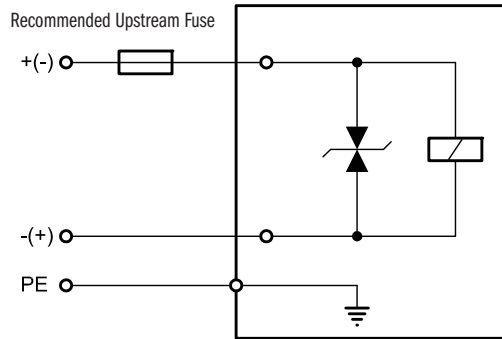
### COIL MARKING FOR DUSTS

 II 2D Ex tb IIIC T129°C Db IP66/IP68 (-40°C Ta +55°C)

# SOLENOIDS

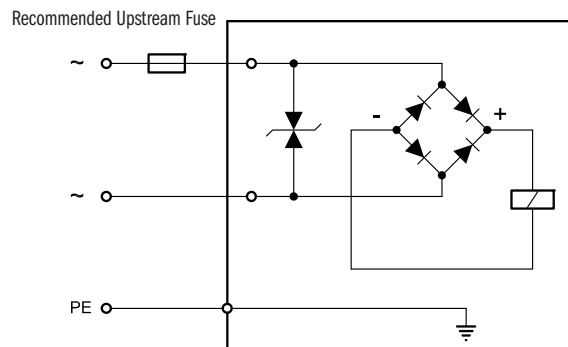
Listed below the types of solenoids available and the numbers to be added in the solenoid box on page 3 or 8.

## VDC COILS



COIL CODE	VOLTAGE ±5% [VDC]	RESISTANCE ±5% [OHM]	HOLDING CURRENT [A]	POWER CONSUMPTION [VA]	PRE-FUSE [A]	MAX VOLTAGE UPON SWITCH OFF [V]
12	12	7.2	1.7	20	2.5	-49
24	24	28.7	0.83	20	1.25	-49
48	48	115	0.42	20	0.6	-81
110	110	549	0.2	22	0.3	-309

## RECTIFIED COILS



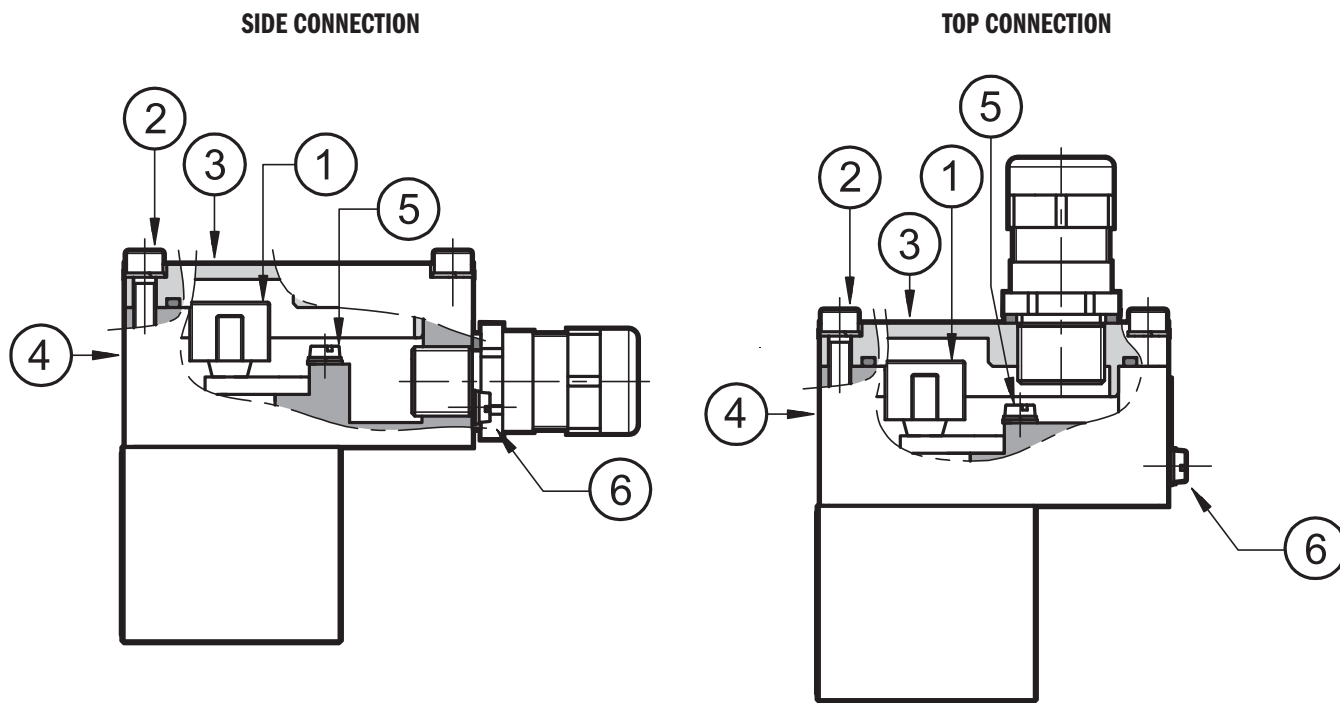
COIL CODE	VOLTAGE [VAC]	FREQUENCY [Hz]	RESISTANCE ±5% [OHM]	HOLDING CURRENT [A]	POWER CONSUMPTION [VA]	PRE-FUSE [A]	MAX VOLTAGE UPON SWITCH OFF [V]
R120	120	60	489.6	0.21	25	0.30	-3
	110	50		0.19	21		
R240	240	60	2067.7	0.10	24	0.15	-3
	230	50		0.10	22.5		

Upstream of each valve, an appropriate fuse (max 3 x I<sub>n</sub> 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 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 chart above show the type of fuse recommended according to the nominal voltage of the valve and to the value of the voltage peaks reduction.

# WIRING



You must gain access to the terminal block (1) to wire the valve. Remove the 4 cover screws (2) that secure the cover (3) to the box (4). Remove the cover.

The electrical connection is polarity-independent.

It is important to connect the grounding points (5) in the terminal box (M4 screws), through suitable conductors, to the general grounding line of the system. There is a grounding point (6) (M4 screws) on the external body of the coil to ensure the valve and general grounding line are equal in potential. Connecting this point to the general grounding line verifies that, per standard EN13463-1, the equipotentiality of the elements included in a potentially explosive environment is guaranteed.

Maximum allowable resistance between elements is 100 Ω.

After the electrical wiring is complete, reassemble the cover (3) on to the box (4), checking to be sure the seal is correctly positioned in the cover seat. Fasten the 4 M5 screws with a torque of 4.9-6 Nm [3.6-4.4 lb/ft].

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

FUNCTION	CABLE SECTION
Operating voltage cables connection	Max 2.5 mm <sup>2</sup>
Connection for internal grounding point	Max 2.5 mm <sup>2</sup>
Connection for external equipotential grounding point	Max 6.0 mm <sup>2</sup>

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 [-4°F] to +110°C [+230°F] (for valves either with A or G seals) or from -40°C [-40°F] to +110°C [+230°F] (for valves with AL seals).

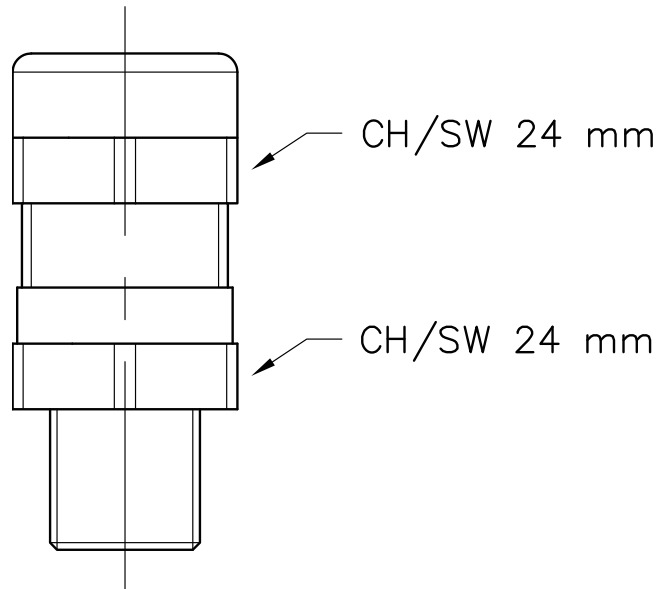
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# WIRING

## 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 directive 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.



# 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  $\pm 0.1$  mm (0.004") for bolt and pin location;  $\pm 0.2$  mm (0.008") for the other quotes.

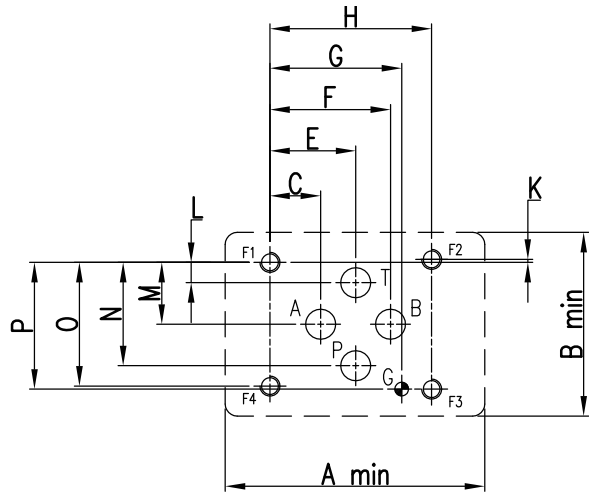
The minimum depth of the blind hole G where required is 8 mm (0.31 in).

## D03

	MM	INCH
P, A, B, T MAX	$\varnothing 7.0$	$\varnothing 0.276$
G MAX	$\varnothing 4.0$	$\varnothing 0.16$
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:

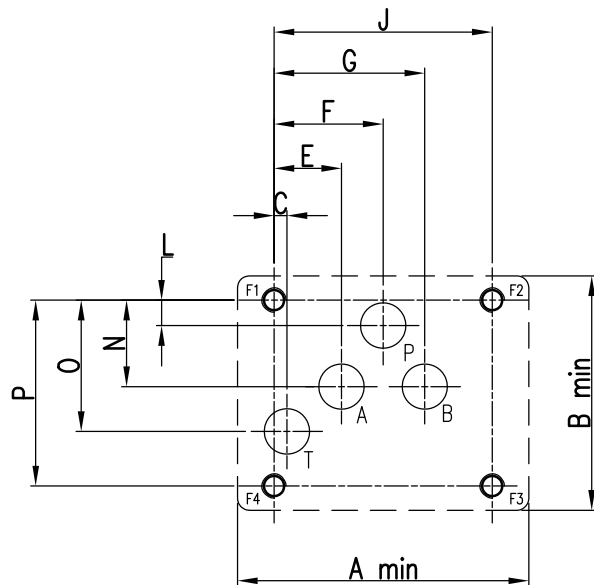
P = PRESSURE PORT  
T = TANK PORT

A = FIRST CYLINDER PORT  
B = SECOND CYLINDER PORT

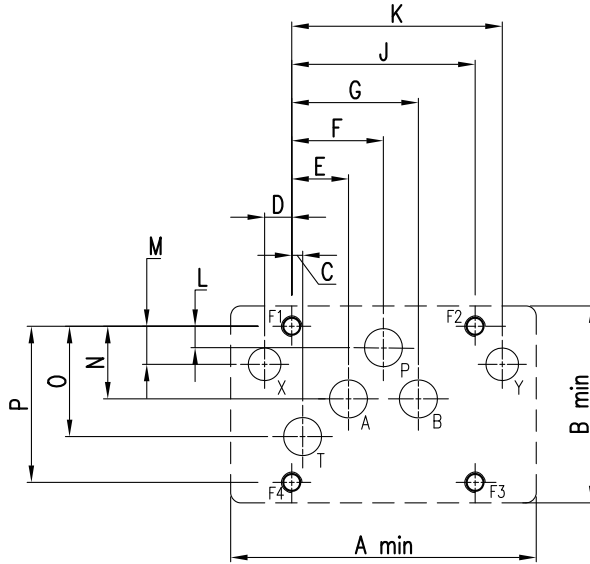
	MM	INCH
P, A, B, T MAX	$\varnothing 11.2$	$\varnothing 0.44$
MOUNTING BOLT THREAD SIZE	M6	1/4 - 20 UNC

	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

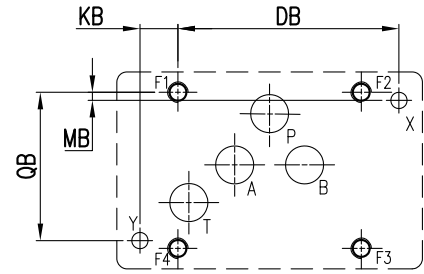
	MM	INCH
J	54.0	2.125
L	6.30	0.25
M	11.2	0.44
N	21.4	0.84
O	32.5	1.28
P	46.0	1.82



**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
<b>P, A, B, T MAX</b>	Ø 11.2	Ø 0.44
<b>X, Y ALT. A</b>	Ø 6.30	Ø 0.25
<b>X, Y ALT. B</b>	Ø 4.80	Ø 0.19
<b>MOUNTING BOLT THREAD SIZE</b>	M6	1/4 - 20 UNC

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

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

	MM	INCH
<b>DB</b>	65.1	2.563
<b>KB</b>	11.2	0.44
<b>MB</b>	2.40	0.09
<b>QB</b>	43.7	1.72

**NOTES:**

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

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

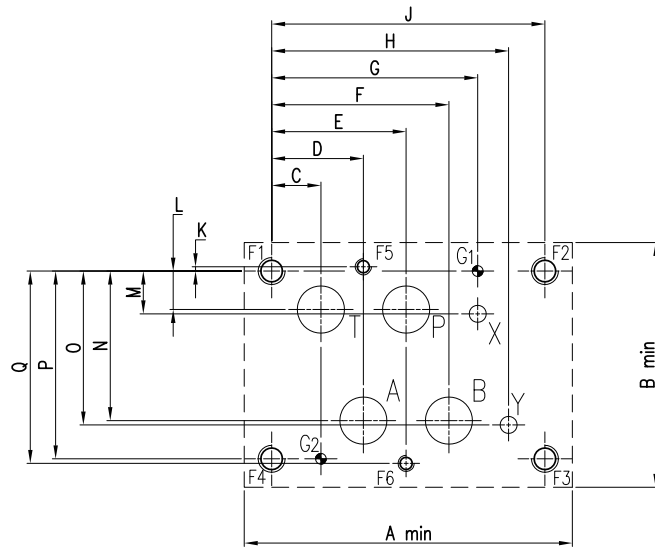
ISO: Ø 6.3 max both

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

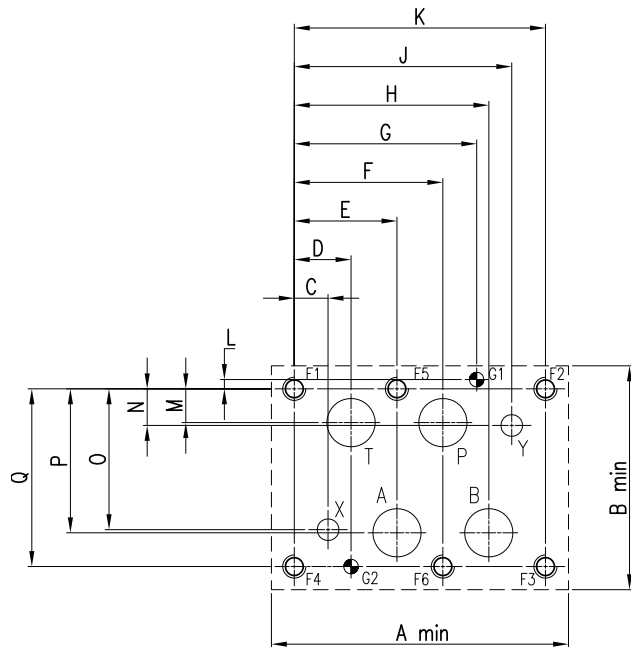


D08

	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



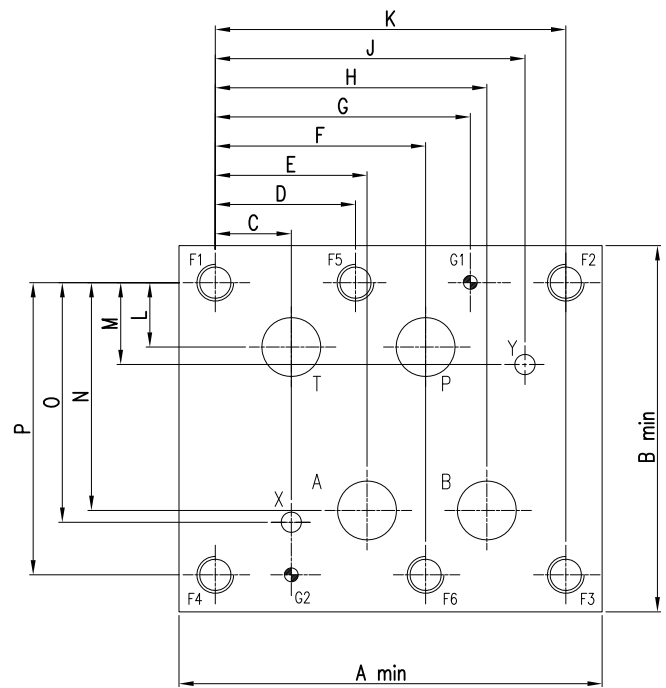
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**D10**

	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



**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.

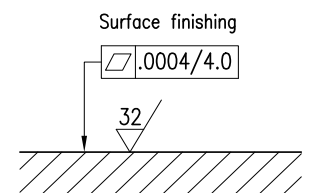
From a safety standpoint, temperatures above 130 degrees F are not recommended.

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.



## 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

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