DG4V-3-60 Design

ISO4401 Size 03;
ANSI/B93.7M-D03

Powering Business Worldwide

Solenoid Operated Directional Valve

DG4V-3-60 Design

B

General Description
Solenoid operated directional control valves are for directing and stopping flow at any point in a hydraulic system.

• Efficient control of greater hydraulic powers without increasing solenoid power consumption.

• Installed cost and space savings from higher power/weight-and-size ratios.

• Installation flexibility resulting from choice of numerous combinations of solenoid connectors and locations.

• Viton seals as standard for multi-fluid capability. Nitrile seals available as a model code option.

• Higher sustained machine productivity and higher uptime because of proven fatigue life and endurance, tested over 20 million cycles.

• Solenoid coils can be changed quickly and easily without leakage from hydraulic system.

• Compact, cost effective system design when used with Eaton® SystemStak™ valves and subplates.

DG4V3-S/R- High Performance and Standard Performance Valves

• Minimum pressure drop 2.5 bar at 30 l/min.

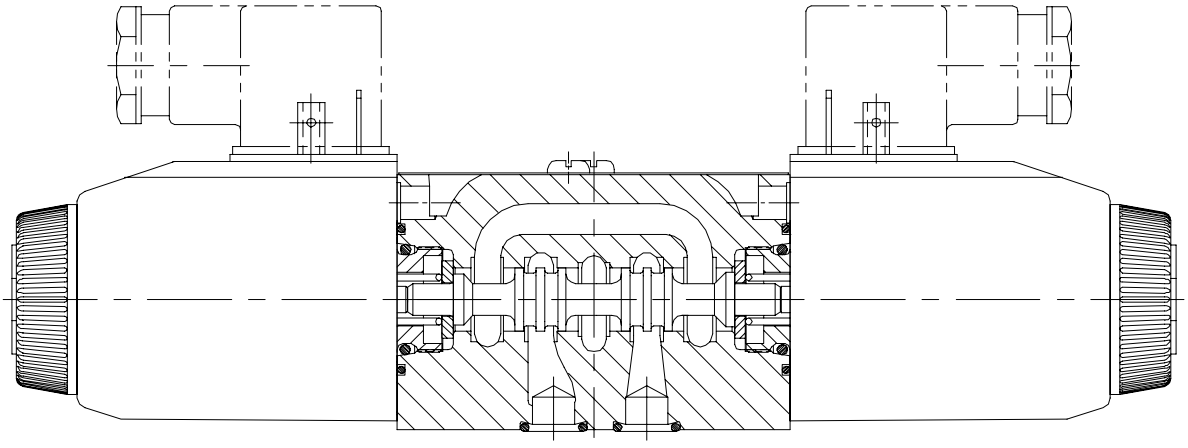
• Range of coil connectors including DIN, Deutsch, AMP and terminal box.

• Range of coil voltages and power options.

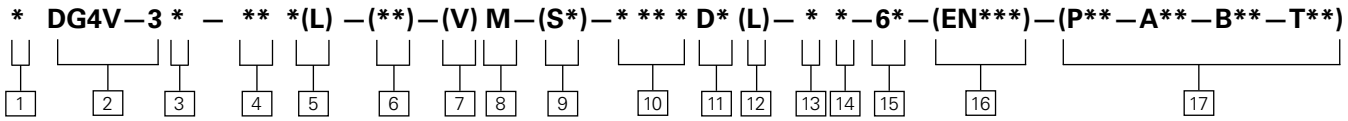
• Up to 80 l/min (21 USgpm) and up to 40 l/min (10.5 USgpm) respectively at 350 bar (5000 psi).

• Offers designers the opportunity to select the optimum value package for each application.

• International standard interface. The valve mounting face conforms to ISO 4401, size 03 and is compatible with related international standards.



DG4V-3 Model Series



1 **Seal Type**
Blank – Viton
F6 – Buna Nitrile/High CAN

2 **Model series**
4 – Solenoid operated
V – Pressure rating 350 bar (5000 psi) on P, A & B ports
3 – ISO4401 Size 03

3 **Performance**
Blank – High performance
S – Standard performance
R – Standard performance with 8 Watt coil

4 **Spool Type**
Please refer functional symbols on Page 5 for spool types.

5 **Spool Spring Arrangement**
A – Spring offset, end-to-end
AL – Same as "A" but left hand build
B – Spring offset, end to center
BL – Same as "B" but left hand build
C – Spring centered
N – No-spring detented

6 **Manual Override Option**
Blank – Plain override(s) in solenoid end(s) only ▲
H – Water-resistant override(s) on solenoid end(s) ▲
Z – No overrides at either end
W – Twist and lock override in solenoid ends•

▲No override in non-solenoid end of single solenoid valves
• DC high performance only

7 **Solenoid Energization Identity**
Blank – None
V – Solenoid "A" is at port "A" end and/ or solenoid "B" is at port "B" end, independent of spool type

NOTE: Used to select the identification of the solenoid. Refer to table on page 4.

8 **Flag Symbol**
M – Electrical options and features

9 **Spool Indicator Switch**
S7 – Spool position monitoring switch. Single solenoid valves only.
NOTE: Refer Page B-6 and B-10 for further details

10 **Coil Type**
U – ISO4400, DIN43650 connector
U1 – ISO4400 fitted with PG11 plug
U6 – ISO4400 with fitted DIN plug with lights
KU – Top exit flying lead (150mm)
KUP4 – Junior timer (Amp) connector
KUP5 – Integral Deutsch connector
KUPM4L- Integral M12, 4-Pin connector
FW – Flying lead with 1/2" NPT thread wiring housing
FTW – Fly. lead wired terminal block & 1/2" NPT thread wiring housing
FPA3W – Fly. lead, 3 Pin connector & 1/2" NPT thread wiring housing
FPA5W – Fly. lead, 5 pin connector & 1/2" NPT thread wiring housing
X5 – Atex approved coil, 'd' type▲
▲Also CSA and UL approved

11 **Surge Suppressor/ Damper**
D1 – Diode positive bias
D2 – Negative bias
D7 – Transorb type

See Page12 for circuit details

12 **Solenoid Indicator Lights**
Blank – None
L – Solenoid indicator lights▲

▲Flying lead coil type only

13 **Coil Rating**
B – 110V AC 50Hz/120V AC 60 Hz
BL – 110V 50 Hz/120V 60 Hz
D – 220V AC 50 Hz/240V AC 60 Hz
DS – 28V DC 30 watt
ER – 120V AC 60 Hz ▲
ES – 240V AC 60 Hz ▲
G – 12V DC
GL – 12V DC
H – 24V DC
HL – 24V DC
HM – 24V DC 8 watt

▲X5 coil type only

14 **Tank Pressure Rating**
Refer to "Operating Data" for port T pressure ratings.
4 – 70 bar (1000 psi) ▲
5 – 100 bar (1500 psi) for standard performance models, DG4V-3S, with AC or DC solenoids.
6 – 207 bar (3000 psi) for AC high performance models, DG4V-3, including spool position indicator type S6.
7 – 207 bar (3000 psi) for DC high performance models, DG4V-3, including spool position indicator type S6.
8 – 160 bar (2300 psi) for AC high performance models with lower tank port rating.

▲X5 coil type only

15 **Design Number**
60 – Basic design
61 – Type 8 spool

16 **Special Features**
"EN***" code number assigned as required.
EN21 – CSA approved models with 1/2" NPT entry conduit box, type FW and solenoid coil letter B,D,G, or H.
EN38 - Low leakage version. Typical leakage 5ml/min/land at 100 bar.

NOTE: EN38 valve spools have additional overlap and resulting 2X pressure drop compared to standard valve spools.

17 **Orifice Plug**
00 – No orifice required
03 – 0.3 mm dia.
06 – 0.6 mm dia.
08 – 0.8 mm dia.
09 – 0.9 mm dia.
10 – 1.0 mm dia.
13 – 1.3 mm dia.
15 – 1.5 mm dia.
20 – 2.0 mm dia.
23 – 2.3 mm dia.

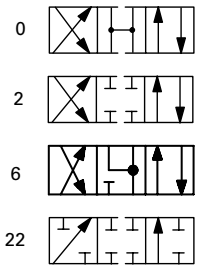
Functional Symbols

Spool Options

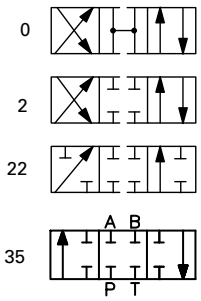
B

The valve function schematics apply to both U.S. and European valves

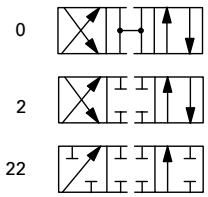
DG4V-3(S)-*NV



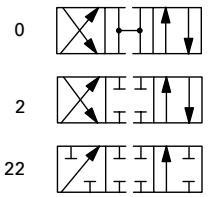
DG4V-3(S)-*AV



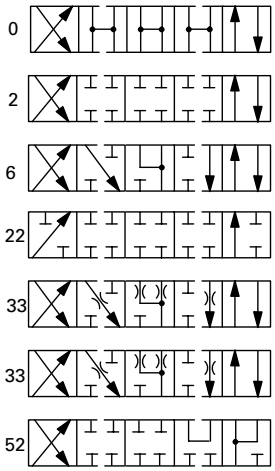
DG4V-3(S)-*ALV



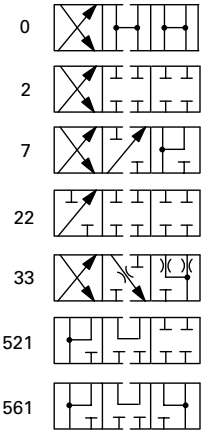
DG4V-3(S)-*ALV



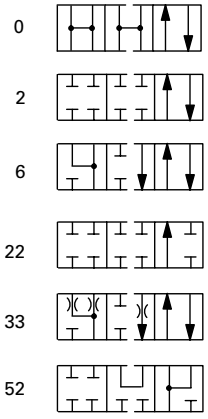
DG4V-3(S)-*CV



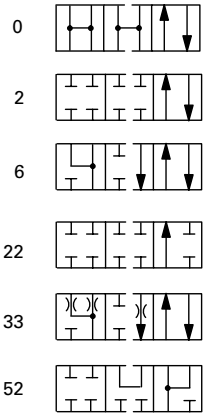
DG4V-3(S)-*BV



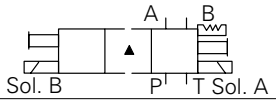
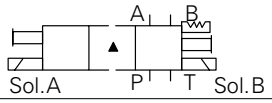
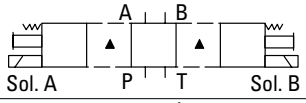
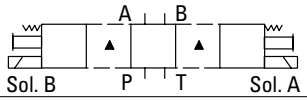
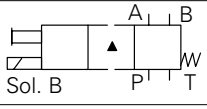
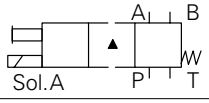
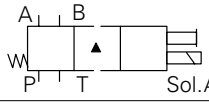
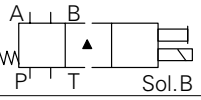
DG4V-3(S)-*BLV



DG4V-3(S)-*BLV



Solenoid Identified to US and European Standards

	U.S. Solenoid Standard	European Solenoid Standard (specify "V" in the model code at position 7 on page 3)
Double solenoid valves, two position, detented		
Double solenoid valves, spring centered		
Single solenoid valves, solenoid at port A end		
Single solenoid valves, solenoid at port B end		

▲ Transient condition only

Feature	DG4V-3		DG4V-3S		DG4V-3R	
Pressure Limits P, A and B ports	350 bar (5075 psi)		350 bar (5075 psi) ■		350 bar (5075 psi)	
T port	210 bar (3045 psi)		100 bar (1450 psi)		210 bar (3045 psi)	
Flow rating	See performance data		See performance data		See performance data	
Relative duty factor	Continuous; ED = 100%		Continuous; ED = 100%		Continuous; ED = 100%	
Type of protection: ISO 4400 coils with plug fitted correctly	IEC 144 class IP65		IEC 144 class IP65		IEC 144 class IP65	
Coil winding	Class H		Class H		Class H	
Lead wires (coils type F***)	Class H		Class H		Class H	
Coil encapsulation	Class F		Class F		Class F	
	Permissable voltage fluctuation:					
Maximum	Refer to temperature limits.		Refer to temperature limits.		Refer to temperature limits.	
Minimum	90% rated		90% rated		90% rated	
Typical response times at 100% rated volts measured from application/removal of voltage to full spool displacement of "2C" spool at:						
Flow rate P-A, B-T	40 l/min (10.6 USgpm)		20 l/min (5.3 USgpm)		20 l/min (5.3 Usgpm)	
Pressure	175 bar (2537 psi)		175 bar (2537 psi)		175 bar (2527 PSI)	
AC (~) energizing	15 ms		18 ms		18 ms	
AC (~) de–energizing	23 ms		32 ms		32 ms	
DC (=) energizing	45 ms		60 ms		60 ms	
DC (=) de–energizing	28 ms		40 ms		40 ms	
Power consumption, AC solenoids (for coils listed in model code).	**Initial VA (RMS) ▲**	**Holding VA (RMS)**	**Initial VA (RMS) ▲**	**Holding VA (RMS)**	**Initial VA (RMS)**	**Holding VA (RMS)**
Full power coils: Dual frequency coils at 50 Hz	280	61	280	61	N/A	
Dual frequency coils at 60 HZ	300	58	300	58	N/A	
Low power coils, "BL" and "DL": (Not available with "N" – No-spring detented models)	Low power coils not usable with DG4V-3S valves.		170	37	N/A	
Dual frequency coils at 50 Hz	–	–	190	37	N/A	
Dual frequency coils at 60 Hz	–	–	–	–	N/A	
Power consumption, DC solenoids at rated voltage and 20 C (68 F).						
Full power coils: 12V, model type "G"	30W	–	30W	–	N/A	
24V, model type "H"	30W	–	30W	–	N/A	
Low power coils: 12V, model type "GL"	Low power coils not usable with DG4V-3S valves.		–	18W	N/A	
24V, model type "HL"			18W	–	N/A	
24V, HM Coil			8W	–	N/A	

■ For applications where valves are to remain pressurized (either energized or de-energized) at pressures over 210 bar (3045 psi) without frequent switching, it is recommended to use the high performance model, DG4V-3.

▲ 1st half cycle; armature fully retracted.

Spool Position Indicator Models

Spool/spring arrangement types 0A, 0B, 2A, 2B, 22A, 23A, 35A, 52B, 3B, 6B

DC model type "S7"

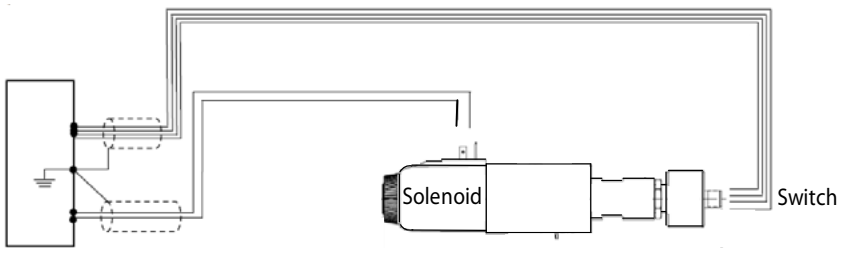
CE

This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 2004/108/EC. For instructions on installation requirements to achieve effective protection levels see this leaflet and the Installation Wiring Practices for Vickers Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by
⚠ Electromagnetic Compatibility (EMC).

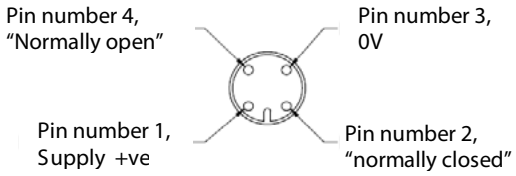
Input:	
Supply Voltage	20-32 VDC
Reverse Pol. Protection	Yes
	outputs with alternating function - PNP
Output:	
Max output load	<=400mA ; Duty Ratio 100%
Short Circuit Protection	Yes
Hysteresis	<=0.05mm
Electrical connector	M12x1 4-Pole
Thermal shift	<=±0.1mm
Plug connections:	
Pin 1	+ Supply
Pin 2	Normal Closed
Pin 3	0V
Pin 4	Normal Open
EMC	Protection DIN EN 61000-6-1/2/3/4, Aug 2002
Humidity	0-95% rel. (nach DIN 40040)
Protection Class	IP65 DIN 40050
Vibration 0-500Hz	Max. 20g
Shock	Max. 50g

• Factory setting ensures this condition under all combinations of manufacturing tolerance and of temperature drift (see "Temperature Limits") .

Wiring Connections



Warning
All power must be switched off before connecting or disconnecting any plugs.



MI2 _4 PIN CONNECTOR DETAILS

Customer's protective ground connection

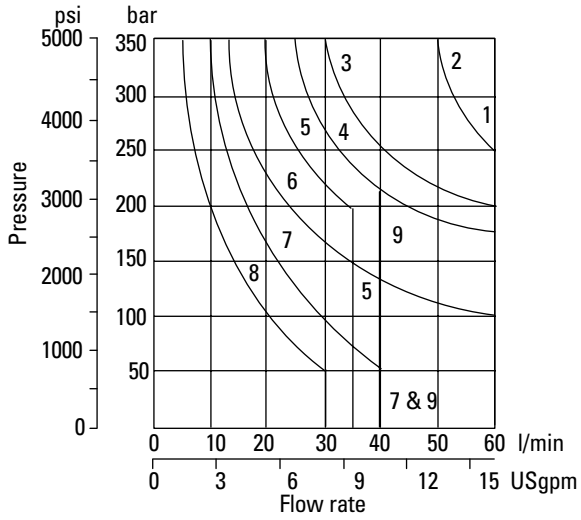
WARNING: Electromagnetic Compatibility (EMC)
It is necessary to ensure that the unit is wired up in accordance with the connection arrangements shown above. For effective protection the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points.
In all cases both valve and cable should be kept as far away as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

Performance Data

DG4V-3 models (high performance)

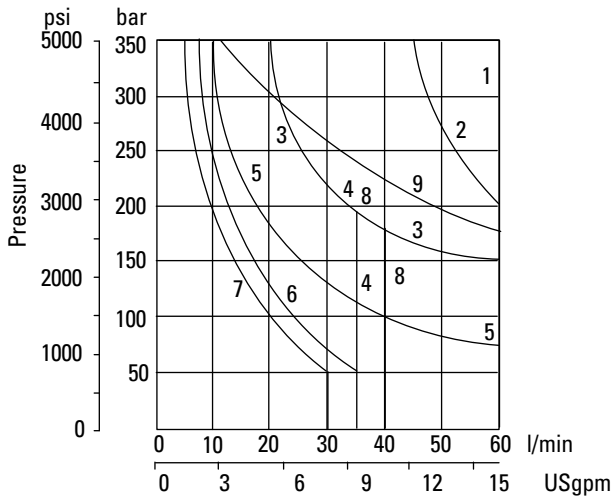
Graph 1

AC solenoid valves operating at 50 Hz



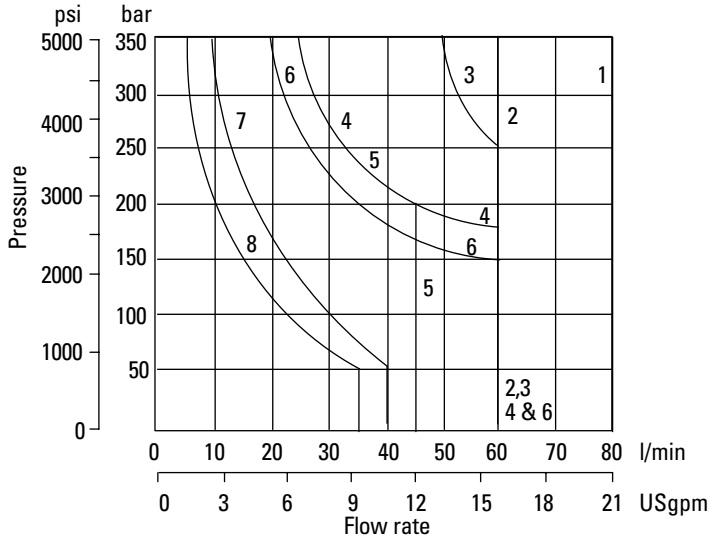
Graph 2

AC solenoid valves operating at 60 Hz



Graph 3

DC solenoid valves



Spool / spring code	Graph 1 curve	Graph 2 curve	Graph 3 curve
0A(L)	2	2	3
0B(L) & 0C	1	1	2
2A(L)	2	2	3
2B(L) & 2C	1	1	1
2N	1	1	2
6B(L) & 6C	6	5	6
8B(L) & 8C	5 ▲	4 ▲	5 ▲
22A(L)	8	7	8
22B(L) & 22C	7	6	7
33B(L) & 33C	4	3	4
52BL, 52C	6	5	6
521B	6	5	6

▲ Consult Eaton regarding each application that will jointly have flow rates approaching this curve and a pressurized volume exceeding 2000 cm3 (122 cu.in.)

Performance Data

Typical with mineral oil at 36 cSt (168.6 SUS) and a specific gravity of 0.87.

Maximum flow rates

Performance based on full power solenoid coils warm and operating at 90% rated voltage.

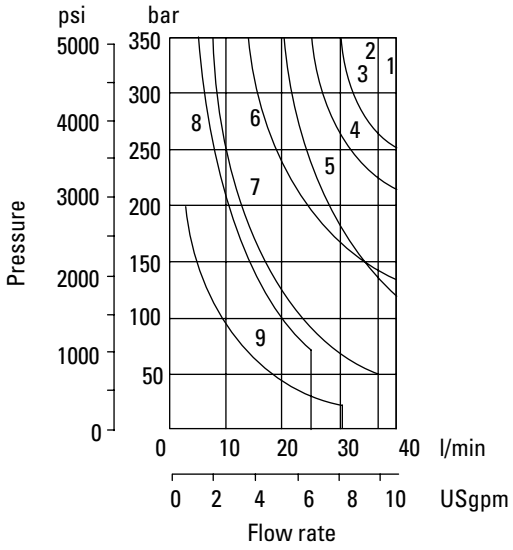
See note at bottom of next page when using low power coils (DG4V-3 models only).

B

DG4V-3S models (standard performance)

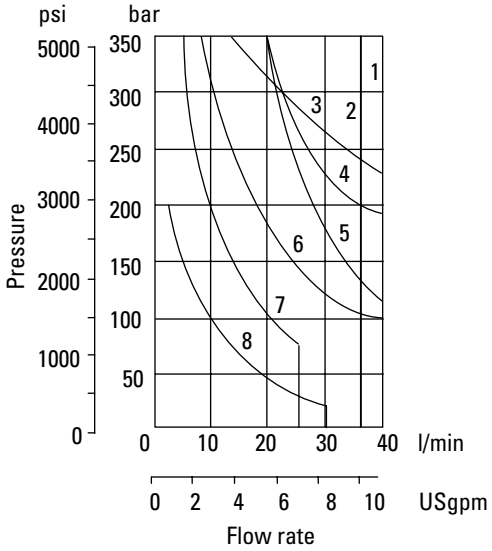
Graph 4

AC solenoid valves operating at 50 Hz



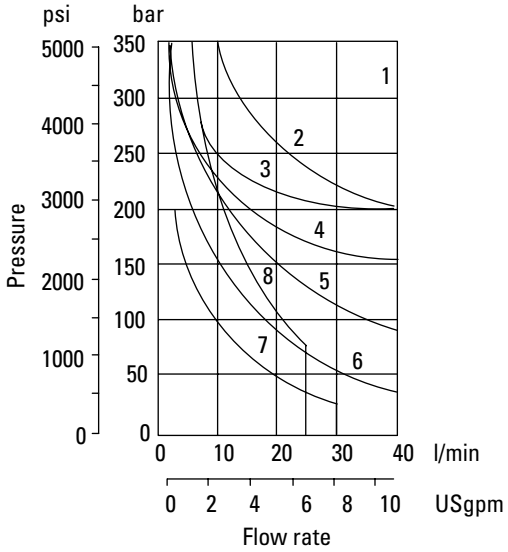
Graph 5

AC solenoid valves operating at 60 Hz



Graph 6

DC solenoid valves

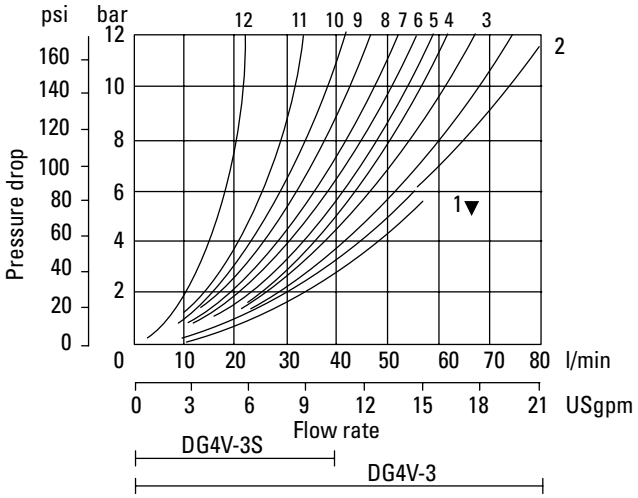


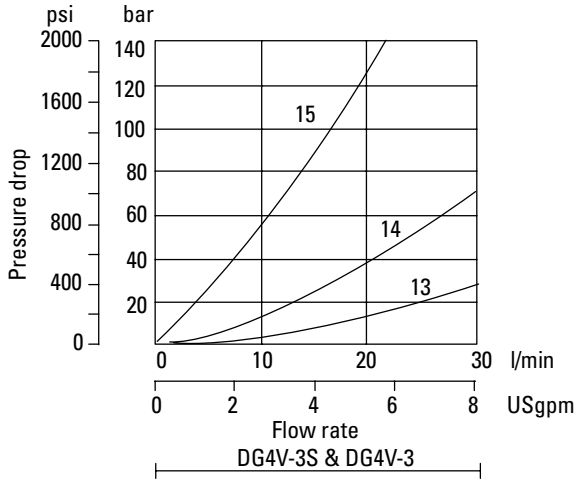
Spool / spring code	Graph 1 curve	Graph 2 curve	Graph 3 curve
0A(L)	1	1	3
0B(L) & 0C	1	1	1
2A(L)	5	5	3
2B(L) & 2C	2	2	3
2N	1	1	1
6B(L) & 6C	6	6	5
8B(L) & 8C	8 ▲	7 ▲	8 ▲
22A(L)	9	8	7
22B(L) & 22C	7	7	6
33B(L) & 33C	4	4	4
52BL, 52C	6	6	5
521B	6	6	5

▲ Consult Eaton regarding each application that will jointly have flow rates approaching this curve and a pressurized volume exceeding 2000 cm3 (122 cu.in.)

Performance Data

Pressure drops





▼ Curve for spool type 6: not recommended for flows in excess of 60 l/min (15.8 USgpm).

Pressure drops in offset positions except where otherwise indicated

Spool / spring code	Spool positions covered	P to A	P to B	A to T	B to T	P to T	B to A or A to B
0A(L)	Both	5	5	2	2	-	-
0B(L) & 0C	De-energized	-	-	-	-	4 ▲ Δ	-
	Energized	4	4	2	2	-	-
2A(L)	Both	6	6	5	5	-	-
2B(L) & 2C	Energized	5	5	2	2	-	-
2N	Both	6	6	3	3	-	-
6B(L) & 6C	De-energized	-	-	3 ▲	3 Δ	-	-
	Energized	6	6	1	1	-	-
	Energized	4	4	3 ▲	3	-	-
8B(L) & 8C	All	9	9	5	5	3	-
22A(L), 22B(L) & 22C	All	6	6	-	-	-	-
33B(L) & 33C	De-energized	-	-	15 ▲	15 Δ	-	-
	Energized	5	5	2	2	-	-
52BL & 52C	Energized	6 ▲	6 Δ	2	-	-	10 ❍
	Energized	6 ▲	6 Δ	2	-	-	10 ❍
521B	All	6 ▲	6 Δ	-	-	-	10 ❍
	De-energized	-	-	10 ▲	11 Δ	-	10 ❍
	Energized	6	6 Δ	-	-	-	10 ❍

▲B" plugged Δ "A" plugged ❍ "P" plugged

Viscosity cSt (SUS)

14 (71.75)	20 (97.8)	43 (200)	54 (251)	65 (302)	76 (352)	85 (399)
% of ΔP (Approx.)						
81	88	104	111	116	120	124

For other viscosities, pressure drops approximate to:

A change to another specific gravity will yield an approximately proportional change in pressure drop. The specific gravity of a fluid may be obtained from its producer. Fire resistant fluids usually have higher specific gravities than oil.

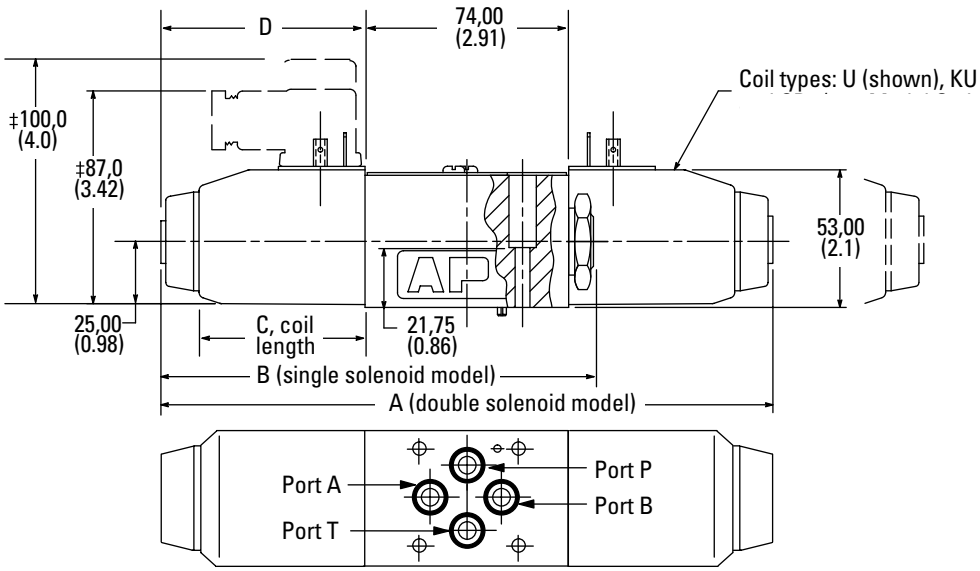
Installation Dimension

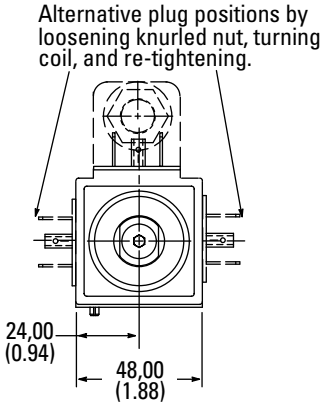
Models for use with ISO 4400 (DIN 43650) connectors

3rd angle projection

B

Double solenoid models	Single solenoid models			
DG4V-3(S)-*C-**-(V)M-U-**-60	DG4V-3(S)-*A(-**) ■	As shown	DG4V-3(S)-*AL(-**) ■	Solenoid and end cap interchanged
DG4V-3(S)-*N-**-(V)M-U-**-60	DG4V-3(S)-*B(-**) ■		DG4V-3(S)-*BL(-**) ■	
	DG4V-3(S)-8BL(-**)		DG4V-3(S)-8B(-**)	





■ Not applicable to type "8" spool.

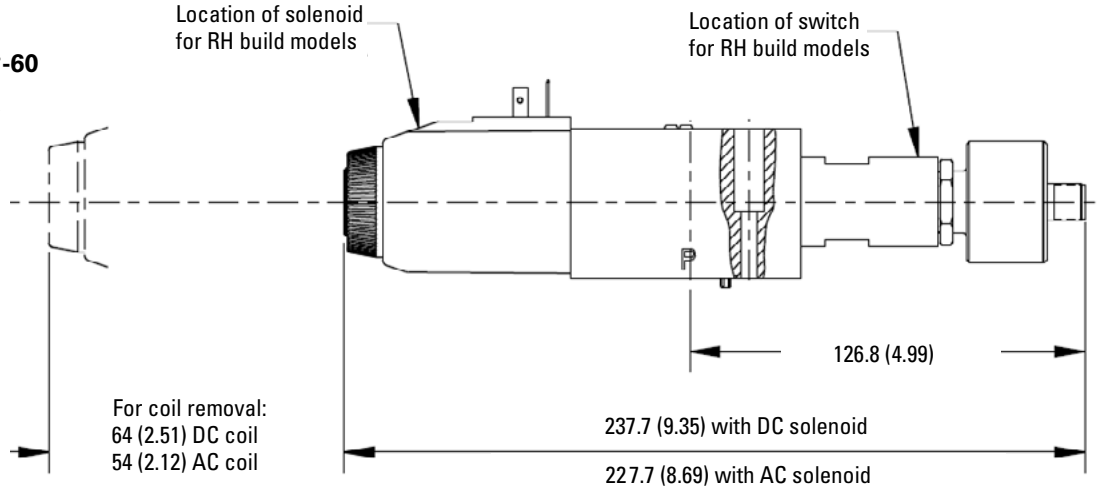
‡ Can vary dependent on source of plug.

Dimensions in mm(in).

Model type	AC or DC	A Dim.	B Dim.	C Dim.	D Dim.
All	DC =	220 (8.66)	156 (6.14)	61 (2.5)	73 (2.87)
DG4V-3	AC ~	200 (7.87)	146 (5.75)	51 (2.1)	63 (2.48)
DG4V-3S	AC ~	200 (7.87)	146 (5.75)	45 (1.7)	63 (2.48)

DG4V-3-*A(L)-(V)M-S7-U--60**

Single solenoid models with Inductive type switch indicating when the spool is in the spring off-set position. Refer Pg6 connection to switch.



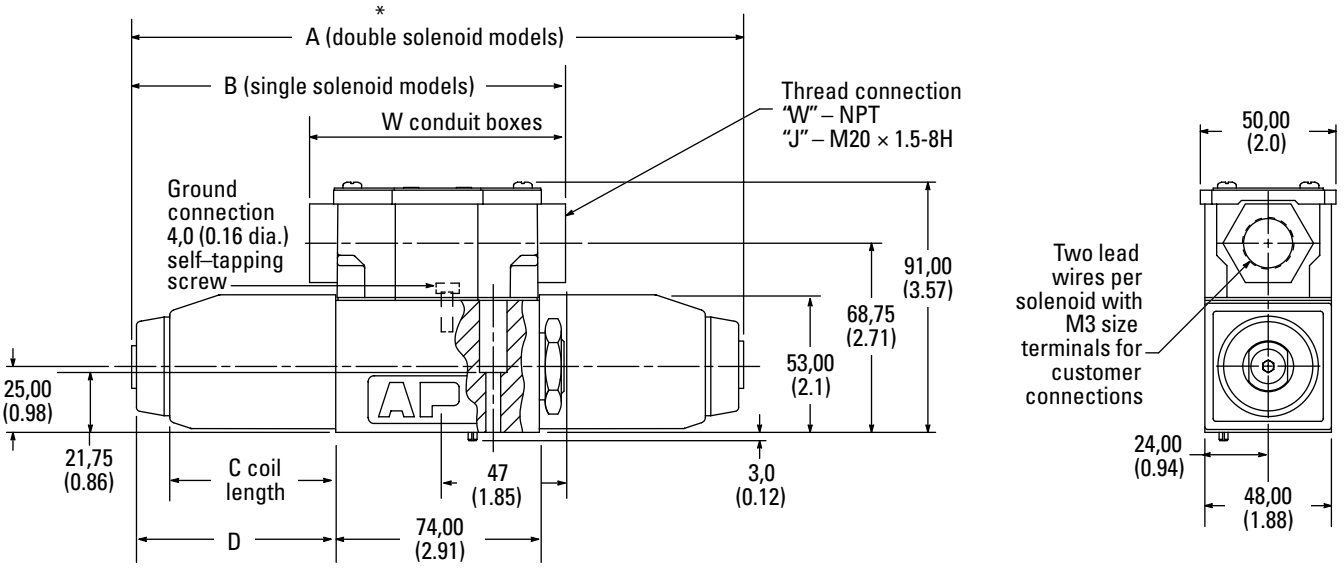
Installation Dimension

Models with "F" type coils (lead wires) and conduit box.

Double solenoid models
DG4V-3(S)-*C-**-(V)M-F-**-60
DG4V-3(S)-*N-**-(V)M-F-**-60

Single solenoid models
DG4V-3(S)-*A(-**)●
DG4V-3(S)-*B(-**)●
DG4V-3(S)-8BL(-**)
As shown

DG4V-3(S)-*AL(-**)●
DG4V-3(S)-*BL(-**)●
DG4V-3(S)-8B(-**)
Spolenoid and end cap interchanged



* 89 (3.5) for FPB – W conduit boxes
104 (4.0) All plug-in conduit boxes

Dimensions in mm(in).

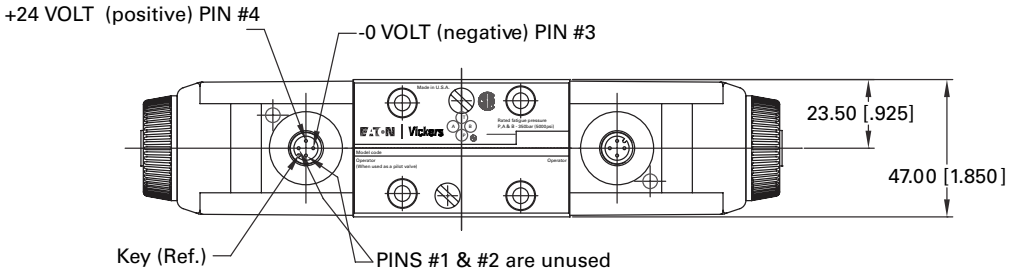
Model type	AC or DC	A Dim.	B Dim.	C Dim.	D Dim.
All	DC =	220 (8.66)	156,5 (6.14)	61 (2.5)	73 (2.87)
DG4V-3	AC ~	200 (7.87)	146,5 (5.75)	51 (2.1)	63 (2.48)
DG4V-3S	AC ~	200 (7.87)	146,5 (5.75)	45 (1.7)	63 (2.48)

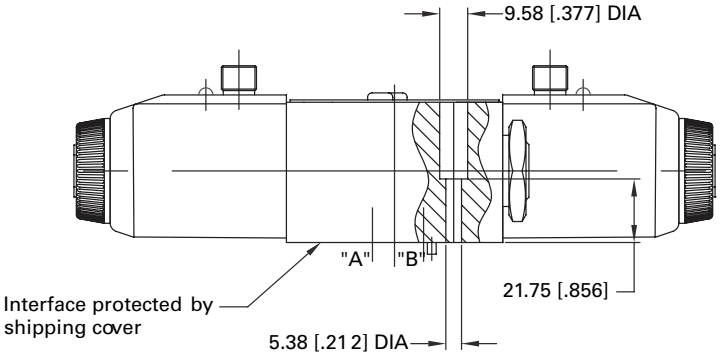
Codes "FW": 2 lead wires for each solenoid, approximately 150,00 (6.00) long. M3 (#6) terminals provided for customer connection.

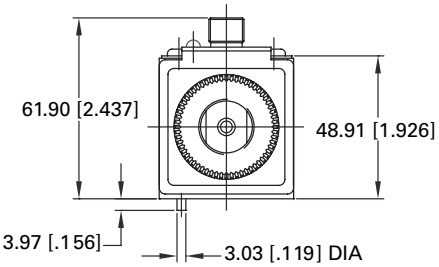
Codes "FTW": Valve supplied with lead wires connected into terminal strip suitable for M3 (#6) terminals for customer connection.

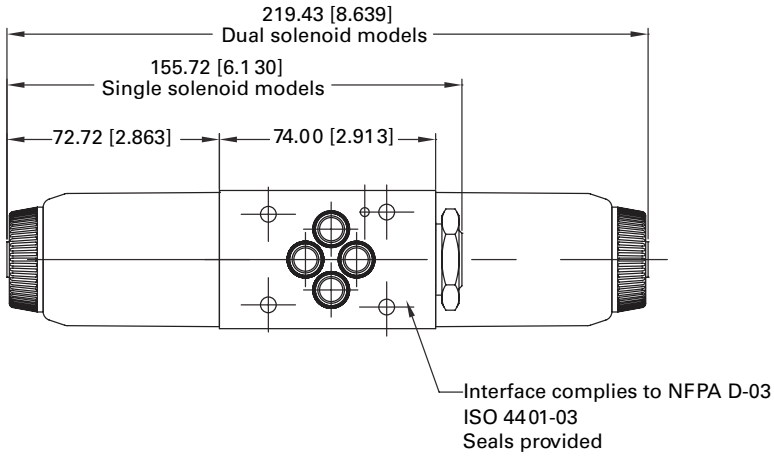
Installation Dimension

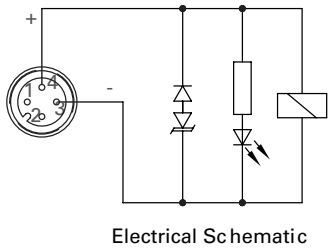
M12 Connector type





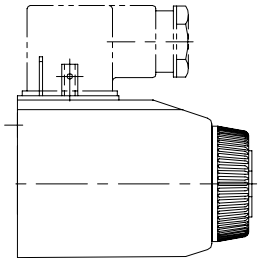




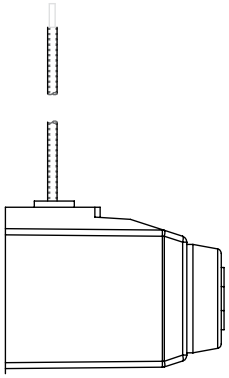


Electrical Plugs and Connectors

U/U1/U6

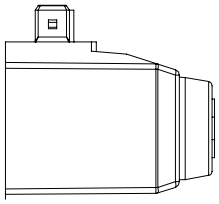


KU



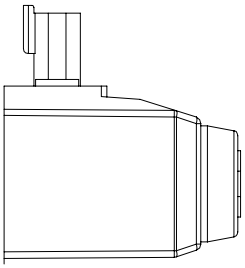
Top exit flying lead

KUP4



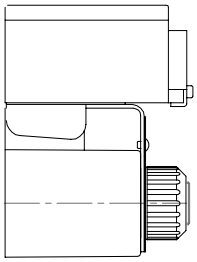
Junior timer AMP

KUP5



Deutsh

X5



Explosion Proof

DIN 43650 Connector

Cable diameter range: Ø6–10 mm (0.24–0.40 in)

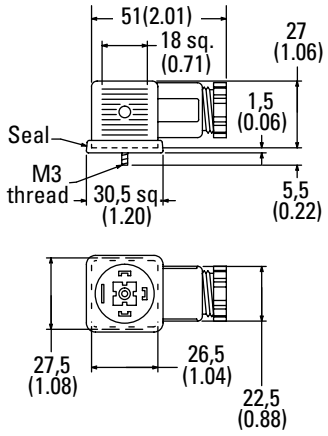
Wire section range: Ø,5–1,5 mm2 (0.0008–0.0023 in2)

Terminals: Screw type

Type of protection: IEC144 class IP65, when plugs are fitted correctly to the valves with interface seals (supplied with plugs) in place.

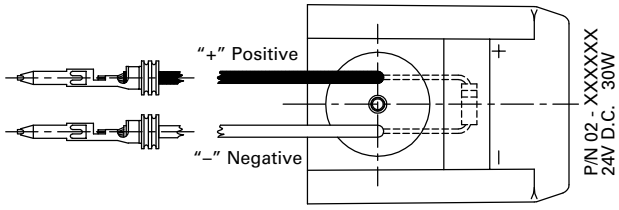
Connector can be positioned at 90° intervals on valve by re-assembling contact holder into appropriate position inside connector housing.

Connectors with and without indicator lights are available (order separately).



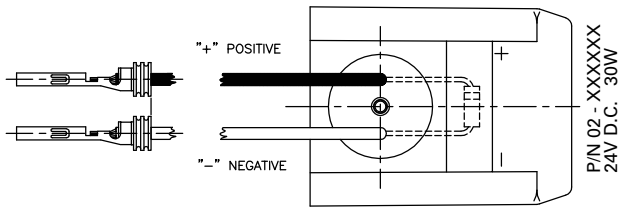
KUP 7

Packard connector pins - Male



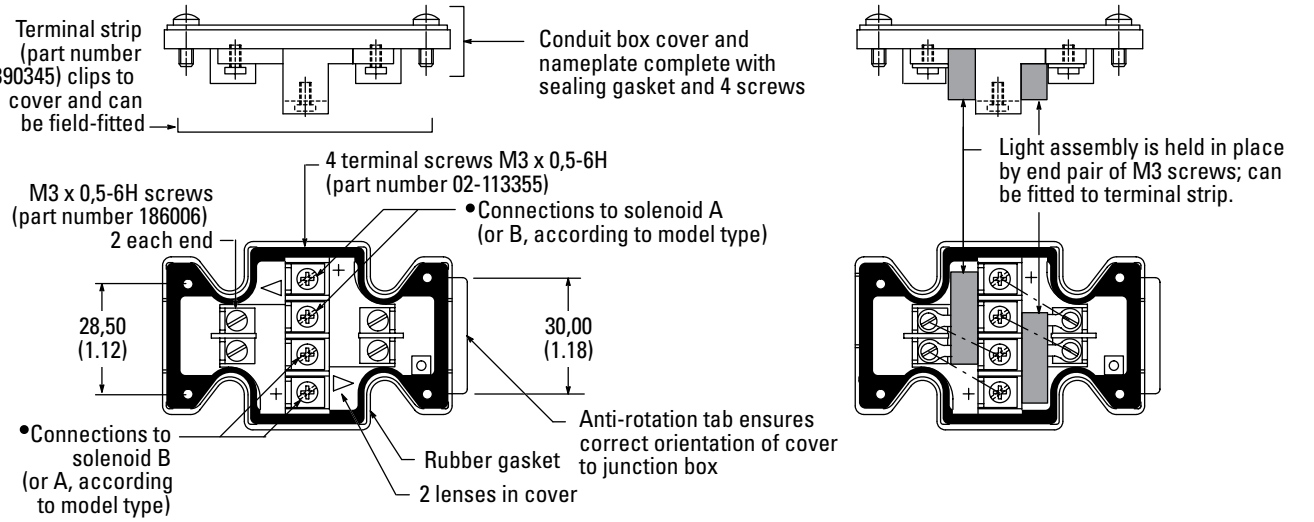
KUP 8

Special packard connector pins with seals - Female



Terminal strip and lights

For valves with type "F" coils.



1. For DC coils the +ve lead(s) must be connected to the terminal(s) marked +. When using 3-wire incoming leads to double solenoid valves (i.e. common neutral) the inner pair of terminals must be interconnected.

2. For correct light indication of energized solenoid ensure that solenoid leads are correctly connected: light terminals are common with each outer pair of solenoid terminals according to the side with + mark.

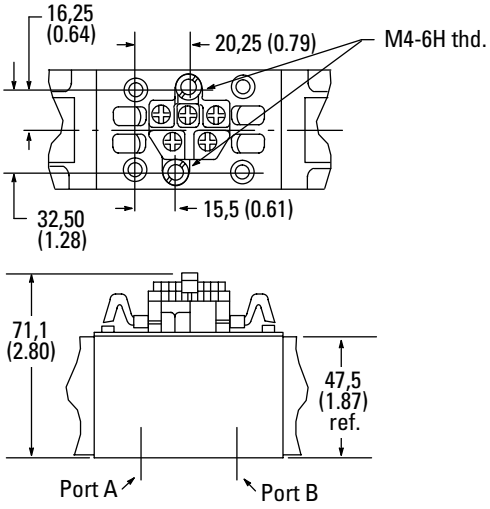
Insta-Plug

DG4V-3(S)---FPA---60
DG4V-3(S)---FPBW---60

Eaton 2-part "Insta-Plug" eliminates breaking electrical inputs for valve disconnect. A male half is pre-wired to the valve body. The mating plug is inside a wire housing with external terminals for machine wire connections.

Captive thumb screws, when loosened, permit the wire housing to be pulled clear of the valve for disconnect. A longer ground post provides first make/last break ground connection.

PA configuration



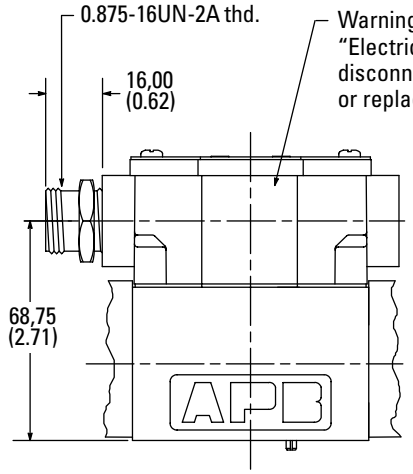
Dimensions in mm(in).

NFPA Connector T3.5.29-1980

DG4V-3(S)–FPA3W(L)-**-60
DG4V-3(S)–FPA5W(L)-**-60

The receptacle is a standard three or five pole connector with shortened leads and terminals added. The five pole plug has four leads 101,6 (4.0) long and one 177,8 (7.0) long. The three pole plug has two leads 101,6 (4.0) long and one 177,8 (7.0). All wires have underwriters recognized non-solder insulated eyelet terminals. The green wire is used for the ground (earth) connection (No. 8 screw furnished). Valves are supplied pre-wired.

Connection details and model type/model code references

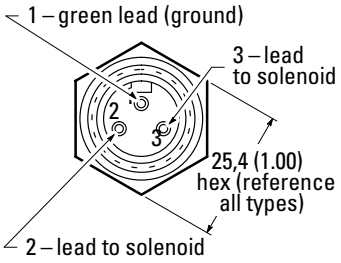


3 pin connector
Use with single solenoid valve

Key model code designations:

DG4V-3(S)-*A(L)(-**)-(V)M-FPA3W(L)

DG4V-3(S)-*B(L)(-**)-(V)M-FPA3W(L)

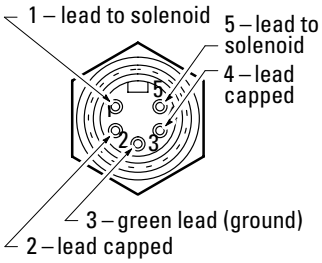


5 pin connector
Use with single solenoid valve

Key model code designations:

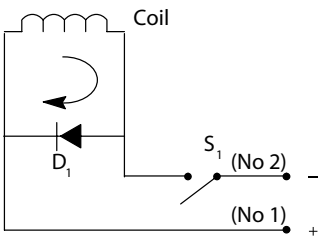
DG4V-3(S)-*A(L)(-**)-(V)M-FPA5W(L)

DG4V-3(S)-*B(L)(-**)-(V)M-FPA5W(L)



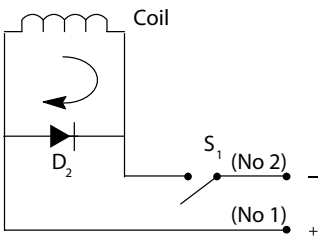
Surge Suppression Devices (For DC Valves)
Standard diode (D1), (D2)
Diode in parallel with coil, positive bias. When switch (S1) is opened, the energy stored in the coil is trapped and dissipated by the diode (D1), (D2).

- Works only with DC voltage
- Polarity dependent
- Increase drop out time



Surge Suppression Devices (For DC Valves)
Standard diode (D2)
Diode in parallel with coil, negative bias. When switch (S1) is opened, the energy stored in the coil is trapped and dissipated by the diode (D2).

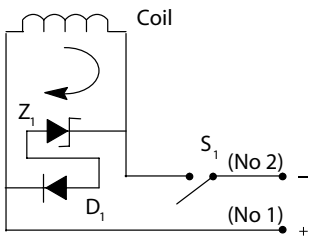
- Works only with DC voltage
- Polarity dependent
- Increase drop out time



Transzorb (D7)

Diode and Zener diode in parallel with coil. When switch (S1) is opened, the energy stored in the coil is trapped and dissipated by the diode (D1) and Zener diode (Z1) and the coil resistance.

- The Zener makes exact limitation of inductive spikes.
- Works only with DC voltage
- Polarity dependent



NOTE: These surge suppression devices are "Polarity Dependent." Proper biasing conditions must be met when installing/connecting a coil in a system. Times represent cessation/application of voltage to coil versus velocity (start/stop) of a cylinder using a single solenoid, spring offset valve (time in milliseconds).

Valve Shift and Dropout Times with and without Surge Suppression

Shift	Dropout	
CETOP 3		
Do Diode	23	60
Diode Alone	23	131
Diode/Zener	23	78

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