



Powering Business Worldwide

Solenoid Operated Directional Valve

DG4V-3-60 Design

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.

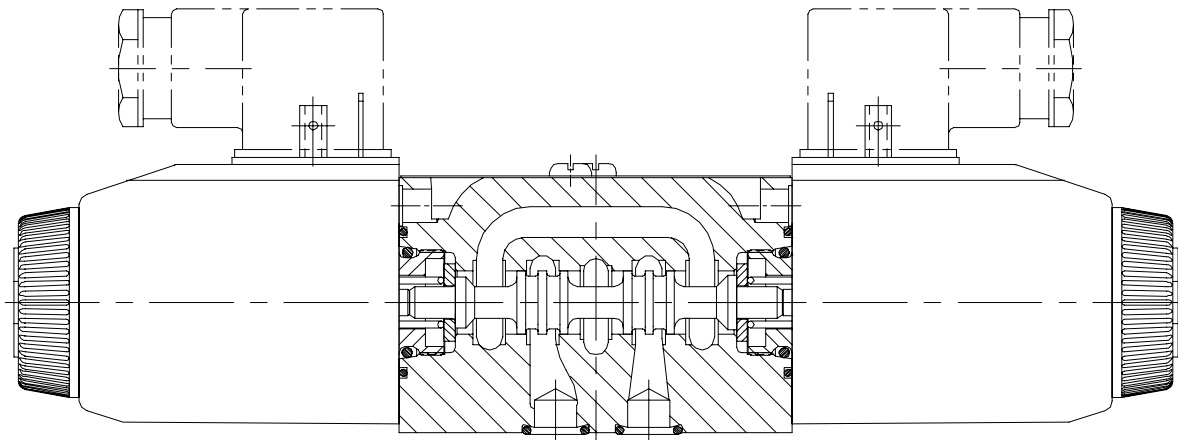
- Range of coil connectors including DIN, Deutsch, AMP and terminal box.

- Range of coil voltages and power options.

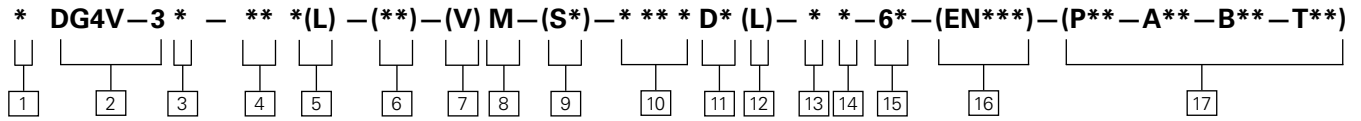
- Up to 80 l/min (21 USgpm) and up to 40 l/min (10.5 USgpm) respectively at 350 bar (5000 psi).

- 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

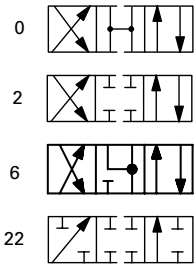
00 – No orifice required
03 – 0.3 mm dia.
06 – 0.6 mm dia.
08 – 0.8 mm dia.
09 – 0.9 mm dia.
10 – 1.0 mm dia.
13 – 1.3 mm dia.
15 – 1.5 mm dia.
20 – 2.0 mm dia.
23 – 2.3 mm dia.

Functional Symbols

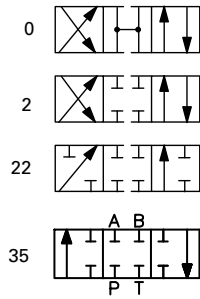
Spool Options

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

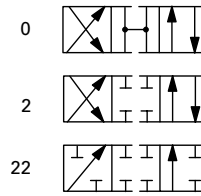
DG4V-3(S)-*NV



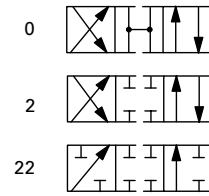
DG4V-3(S)-*AV



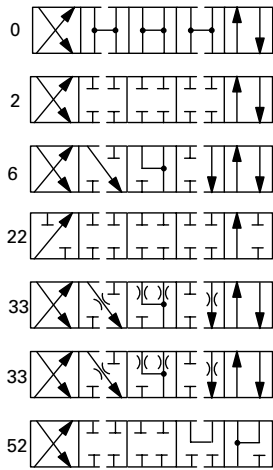
DG4V-3(S)-*ALV



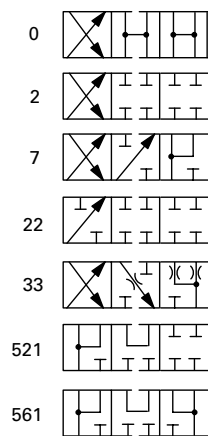
DG4V-3(S)-*ALV



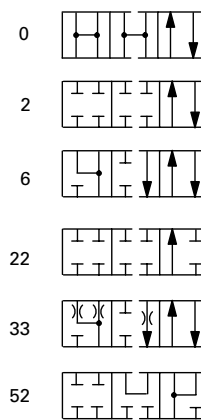
DG4V-3(S)-*CV



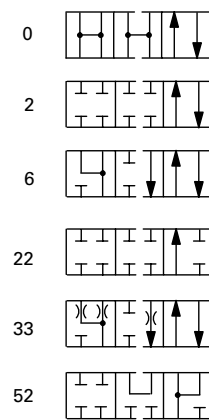
DG4V-3(S)-*BV



DG4V-3(S)-*BLV



DG4V-3(S)-*BLV

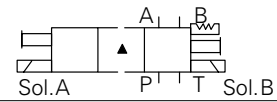
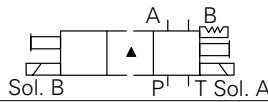


Solenoid Identified to US and European Standards

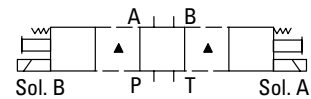
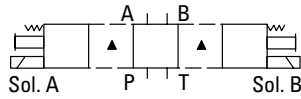
U.S. Solenoid Standard

European Solenoid Standard (specify "V" in the model code at position 7 on page 3)

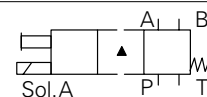
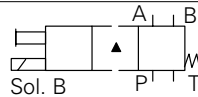
Double solenoid valves, two position, detented



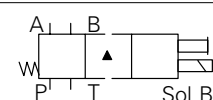
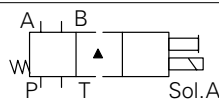
Double solenoid valves, spring centered



Single solenoid valves, solenoid at port A end



Single solenoid valves, solenoid at port B end



▲ Transient condition only

Operating Data

| 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 | | | |
| | Permissible 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.


Operating Data

Spool Position Indicator Models

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

DC model type "S7"



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 |

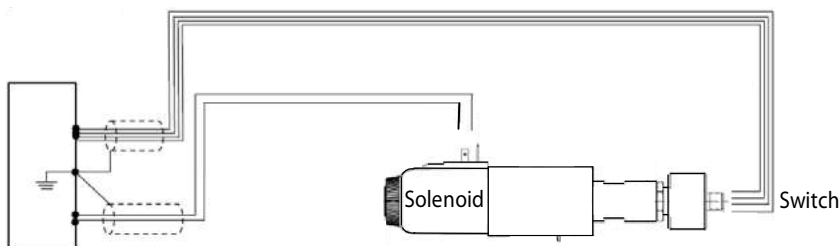
Plug connections:

| | |
|-------|---------------|
| 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.

Pin number 4,
"Normally open"

Pin number 3,
0V

Pin number 1,
Supply +ve

Pin number 2,
"normally closed"



M12 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.

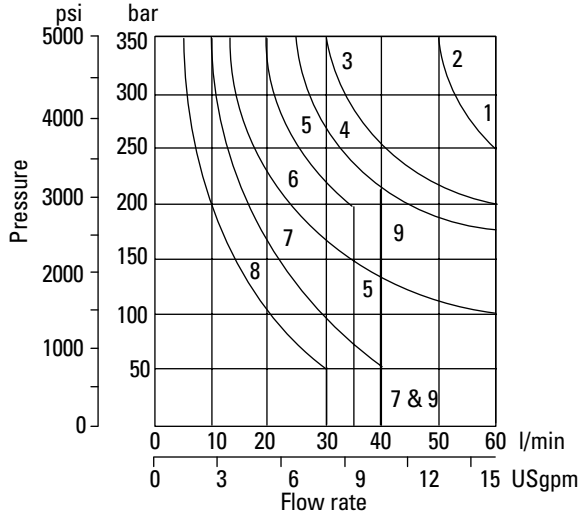
In all cases both valve and cable should be kept as far away as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

Performance Data

DG4V-3 models (high performance)

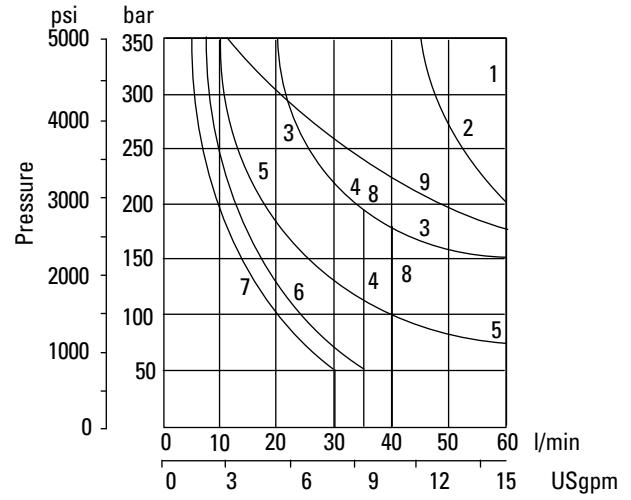
Graph 1

AC solenoid valves operating at 50 Hz



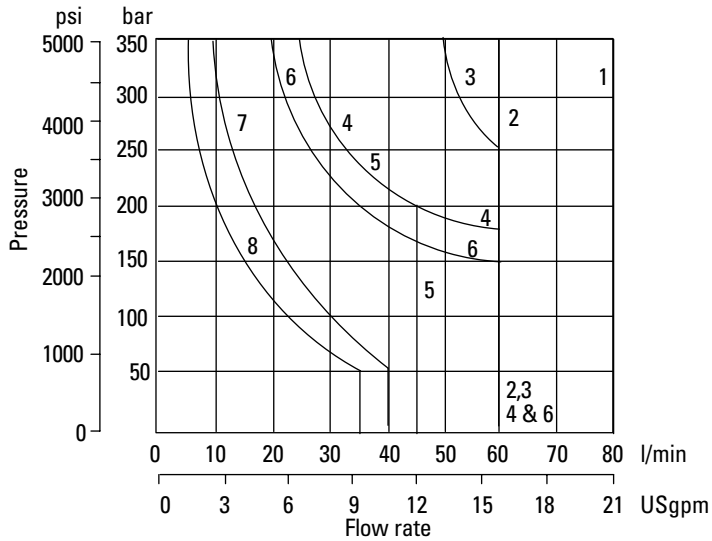
Graph 2

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.

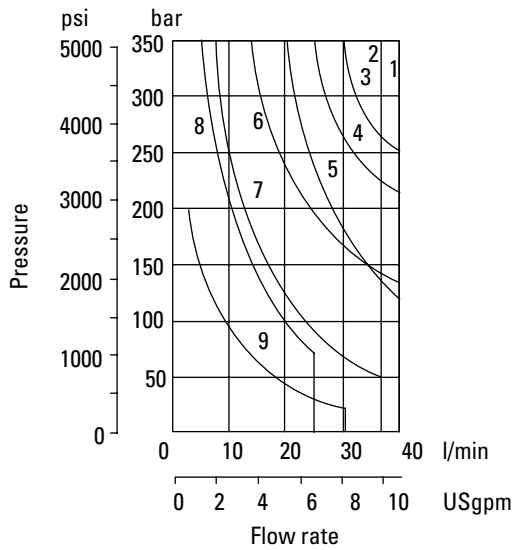
See note at bottom of next page when using low power coils (DG4V-3 models only).

B

DG4V-3S models (standard performance)

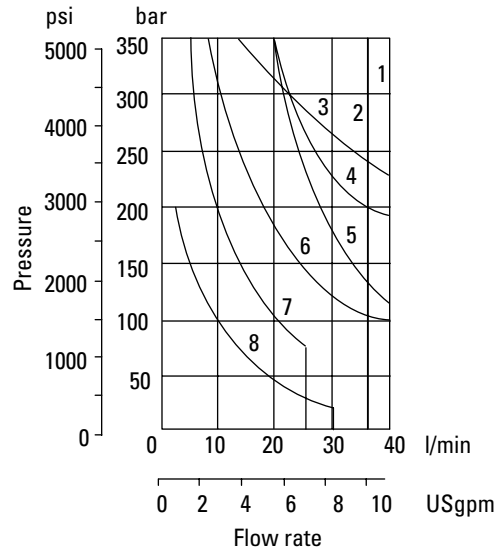
Graph 4

AC solenoid valves operating at 50 Hz



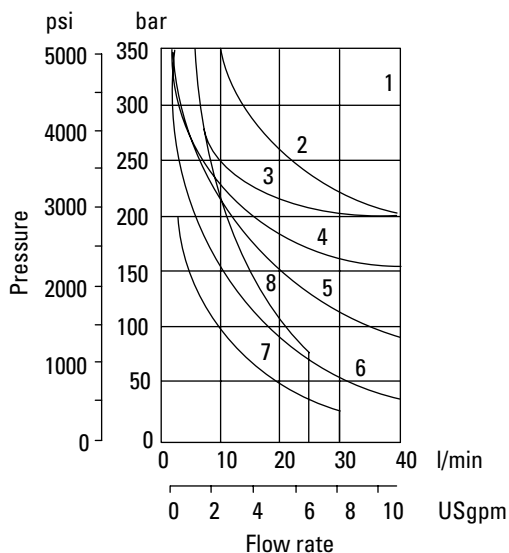
Graph 5

AC solenoid valves operating at 60 Hz



Graph 6

DC solenoid valves

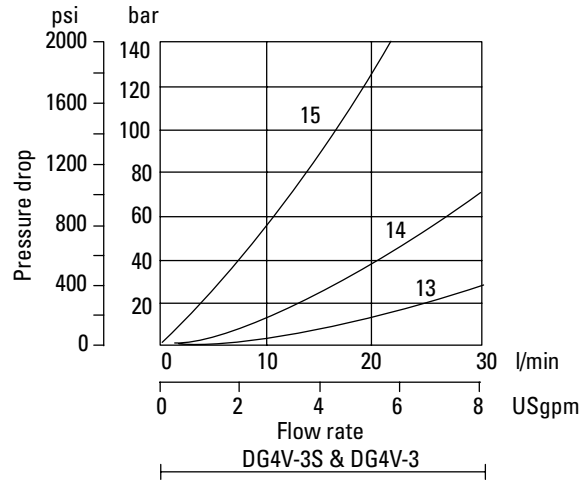
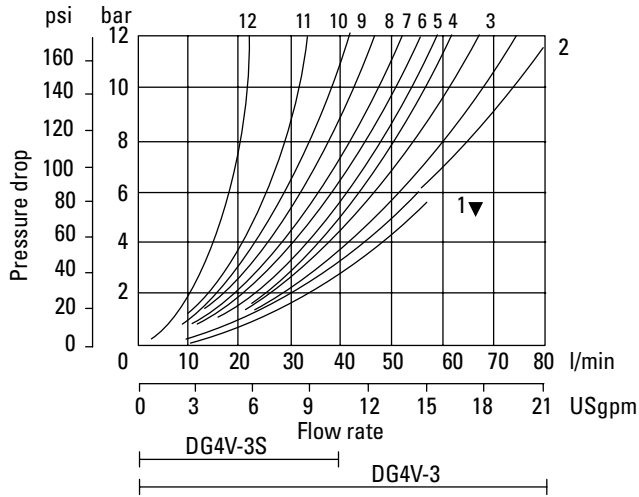


| Spool / spring code | Graph 1 curve | Graph 2 curve | Graph 3 curve |
|---------------------|---------------|---------------|---------------|
| 0A(L) | 1 | 1 | 3 |
| 0B(L) & 0C | 1 | 1 | 1 |
| 2A(L) | 5 | 5 | 3 |
| 2B(L) & 2C | 2 | 2 | 3 |
| 2N | 1 | 1 | 1 |
| 6B(L) & 6C | 6 | 6 | 5 |
| 8B(L) & 8C | 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 

Double solenoid models

Single solenoid models

DG4V-3(S)-*C-**-*(V)M-U-**-60

DG4V-3(S)-*A(-**) ■

DG4V-3(S)-*AL(-**) ■

DG4V-3(S)-*N-**-*(V)M-U-**-60

DG4V-3(S)-*B(-**) ■

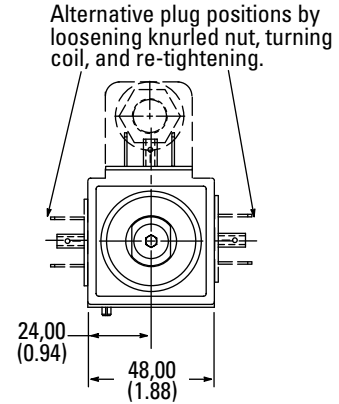
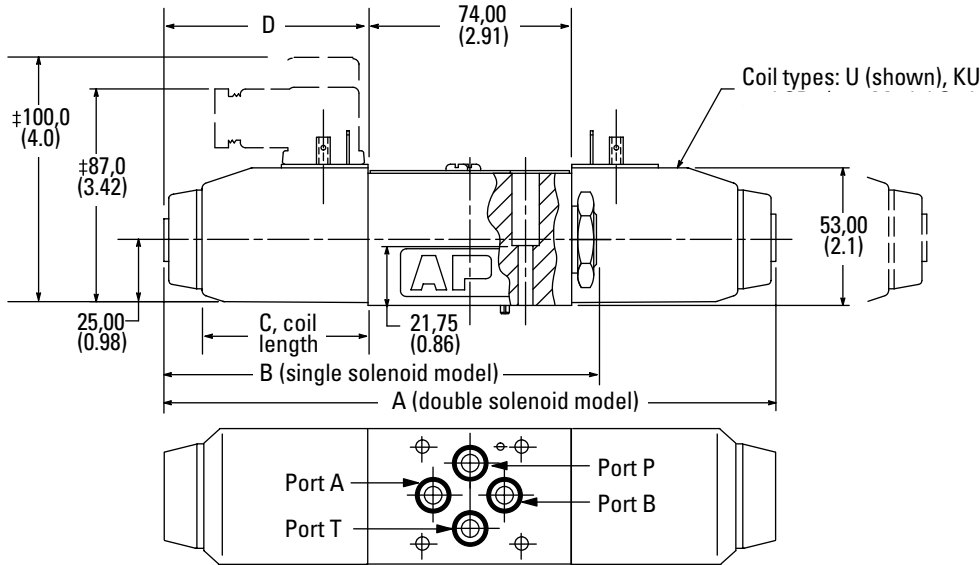
DG4V-3(S)-*BL(-**) ■

DG4V-3(S)-8BL(-**) ■

DG4V-3(S)-8B(-**) ■

As shown

Solenoid and end cap interchangeable



■ Not applicable to type "8" spool.

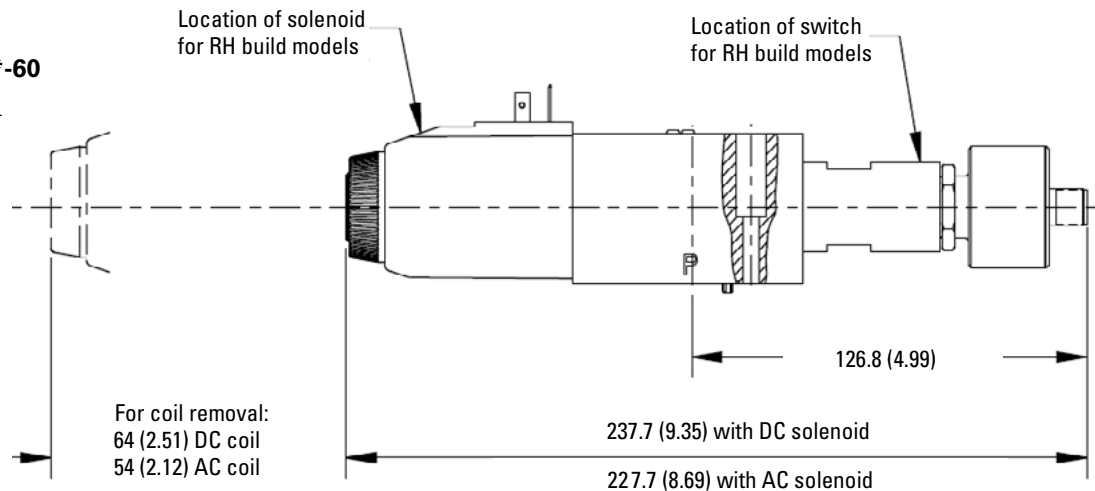
‡ Can vary dependent on source of plug.

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

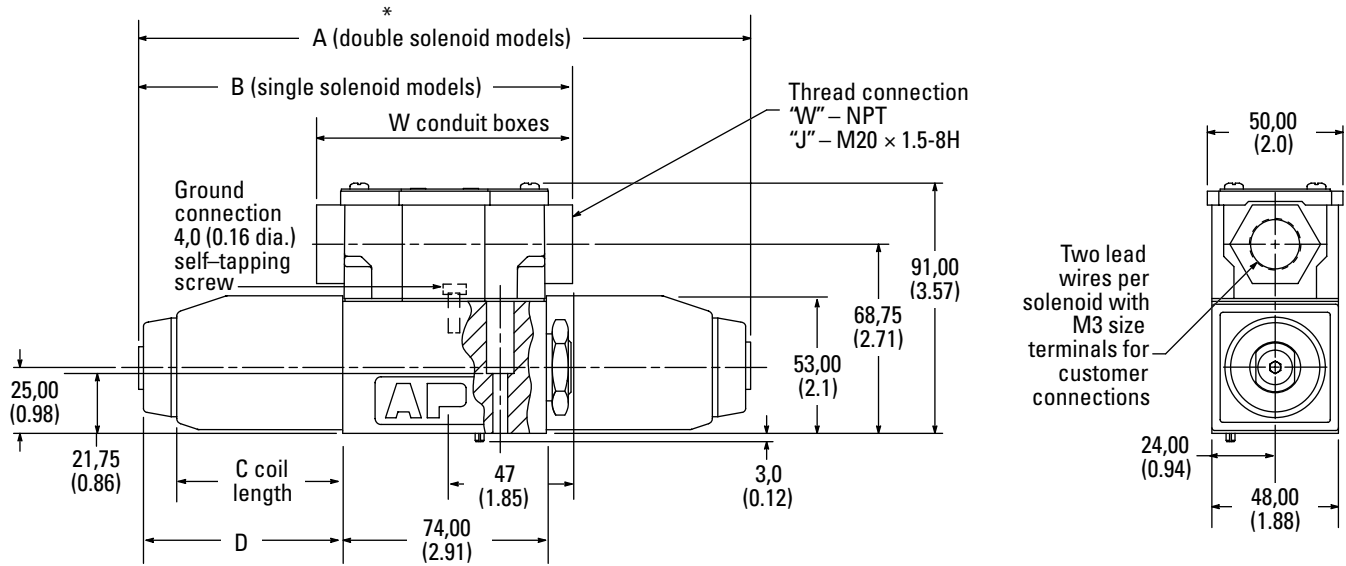
Single solenoid models

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(-**)

Solenoid 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.

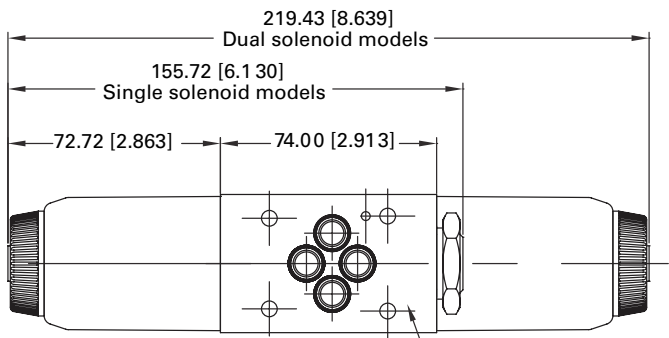
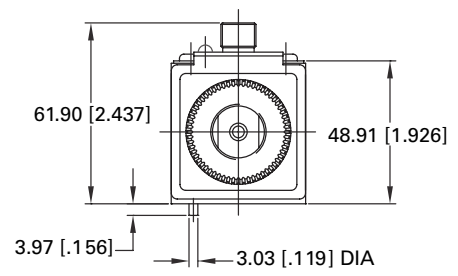
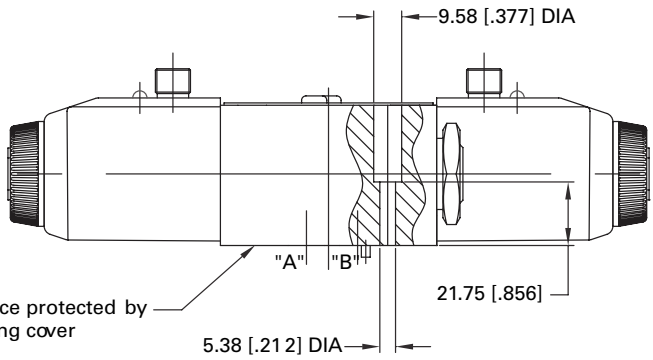
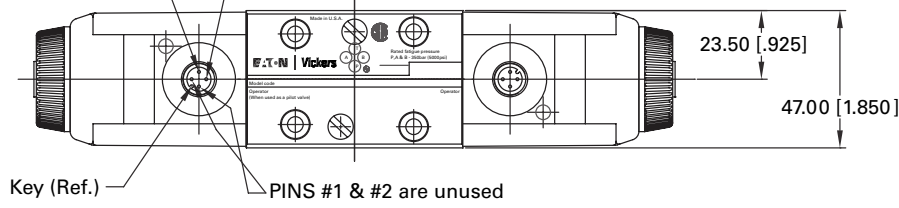
Codes "FTW": Valve supplied with lead wires connected into terminal strip suitable for M3 (#6) terminals for customer connection.

Installation Dimension

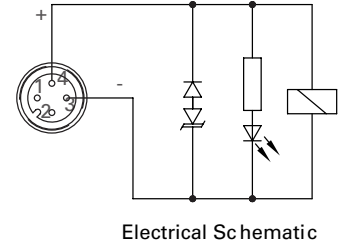
M12 Connector type

+24 VOLT (positive) PIN #4

-0 VOLT (negative) PIN #3

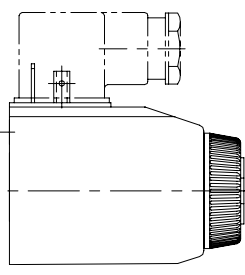
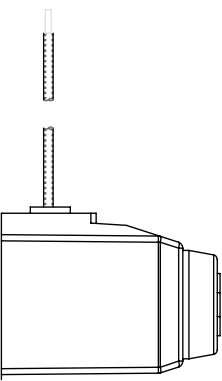
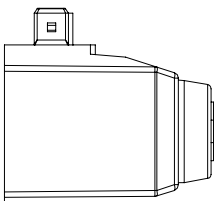
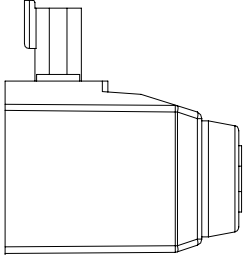
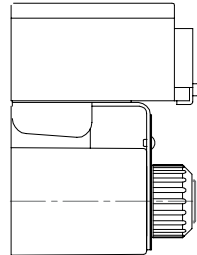


Interface complies to NFPA D-03
ISO 4401-03
Seals provided



Electrical Plugs and Connectors

B

| | | |
|--|---|---|
| <p>U/U1/U6</p>  | <p>KU</p>  <p>Top exit flying lead</p> | <p>KUP4</p>  <p>Junior timer AMP</p> |
| <p>KUP5</p>  <p>Deutsch</p> | <p>X5</p>  <p>Explosion Proof</p> | |

DIN 43650 Connector

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

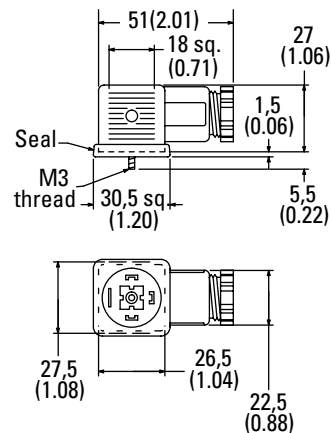
Wire section range: Ø,5–1,5 mm² (0.0008–0.0023 in²)

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.

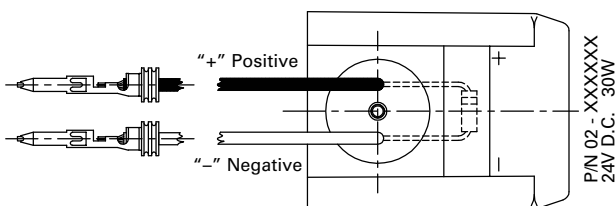
Connector can be positioned at 90° intervals on valve by re-assembling contact holder into appropriate position inside connector housing.

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



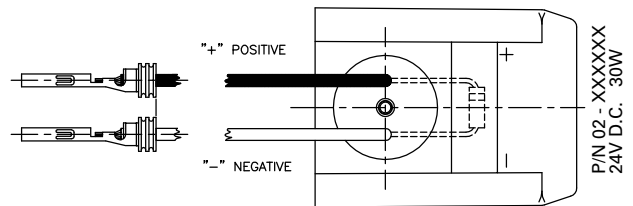
KUP 7

Packard connector pins - Male



KUP 8

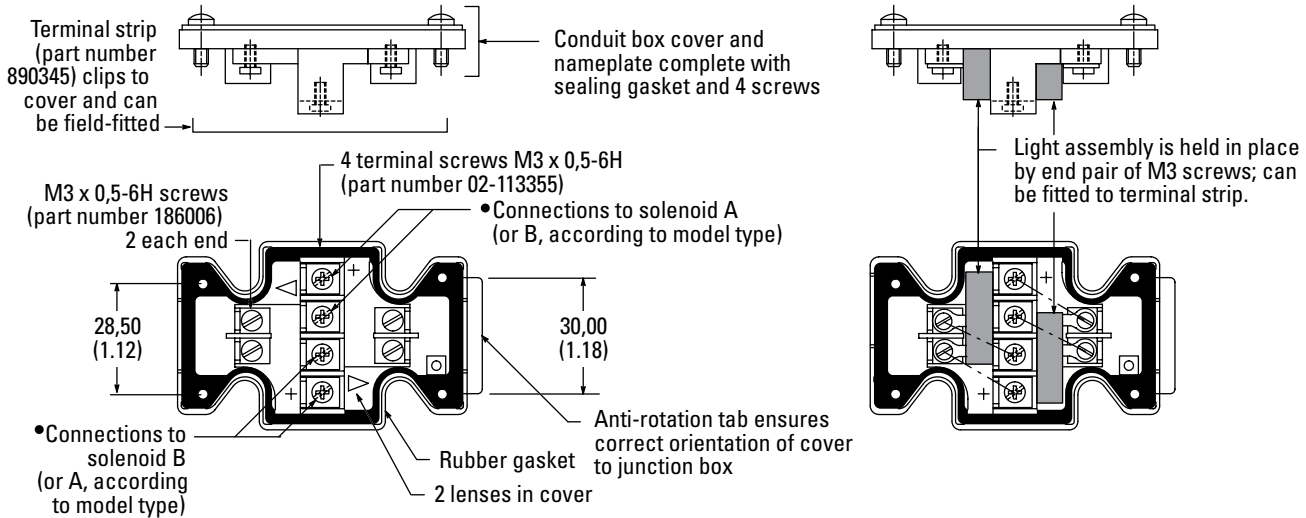
Special packard connector pins with seals - Female



Electrical Plugs and Connectors

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 incom-

ing 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

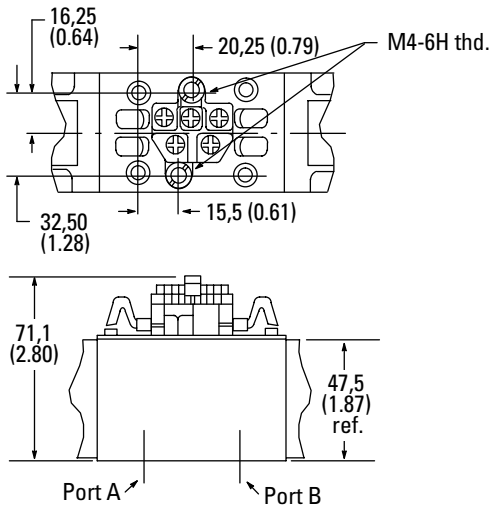
DG4V-3(S)—FPA—60
DG4V-3(S)—FPBW—60

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).

Electrical Plugs and Connectors

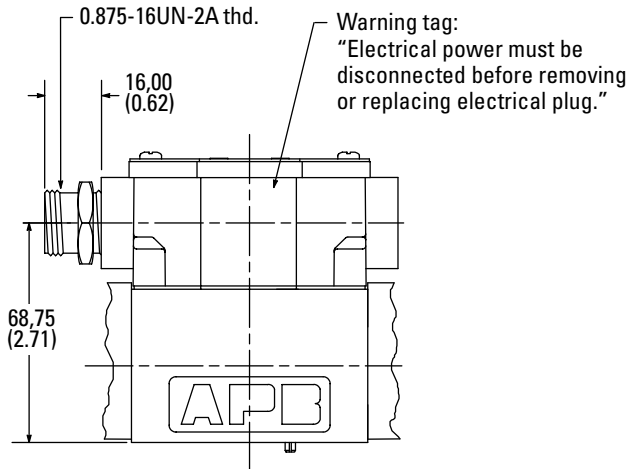
NFPA Connector T3.5.29-1980

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

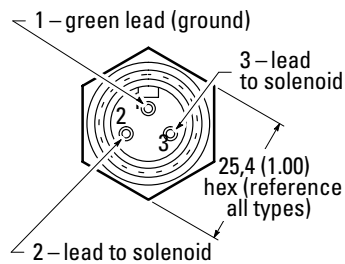


3 pin connector

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)

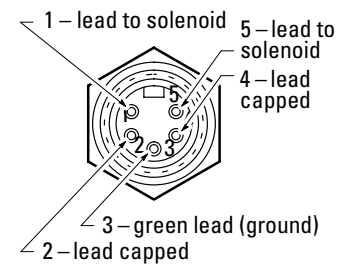


5 pin connector

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)

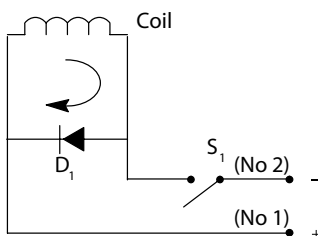


Surge Suppression Devices (For DC Valves)

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

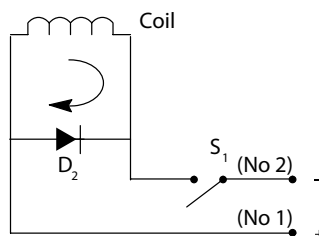


Surge Suppression Devices (For DC Valves)

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).

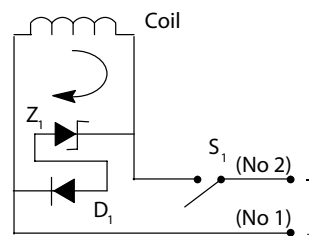
- Works only with DC voltage
- Polarity dependent
- Increase drop out time



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).

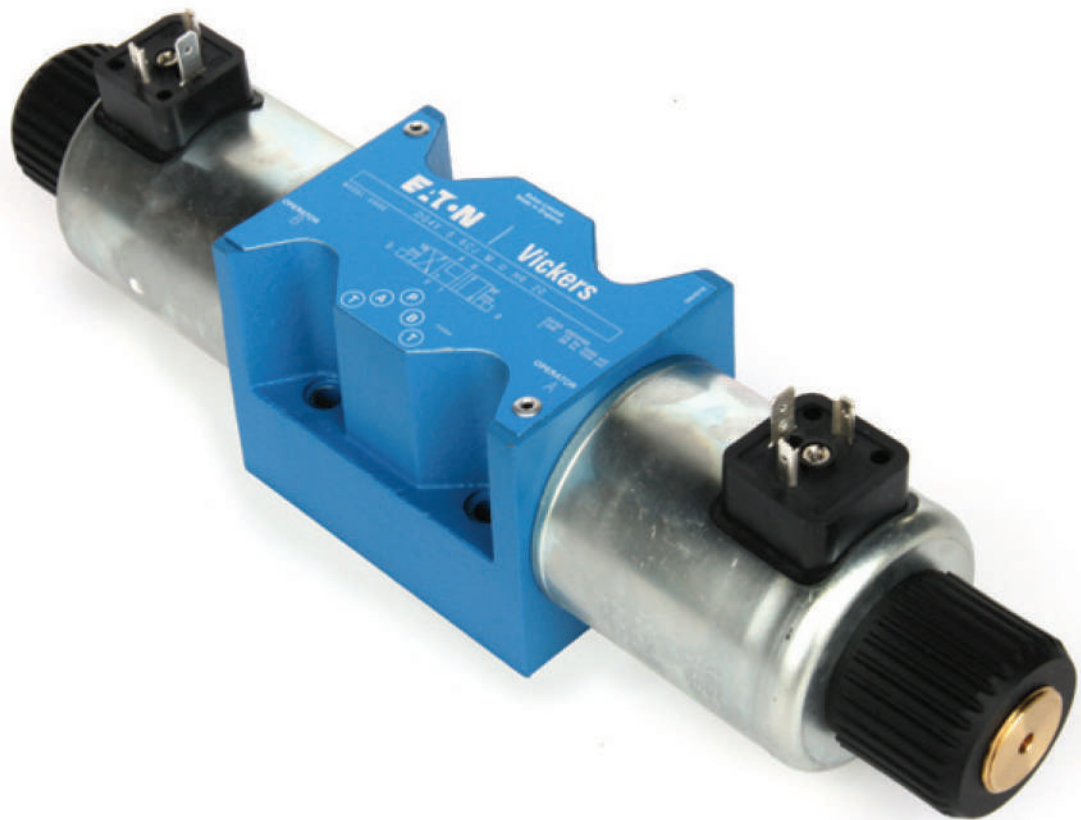
Valve Shift and Dropout Times with and without Surge Suppression

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

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Fax: (+86 21) 5200 0400



Solenoid Operated Directional Valve

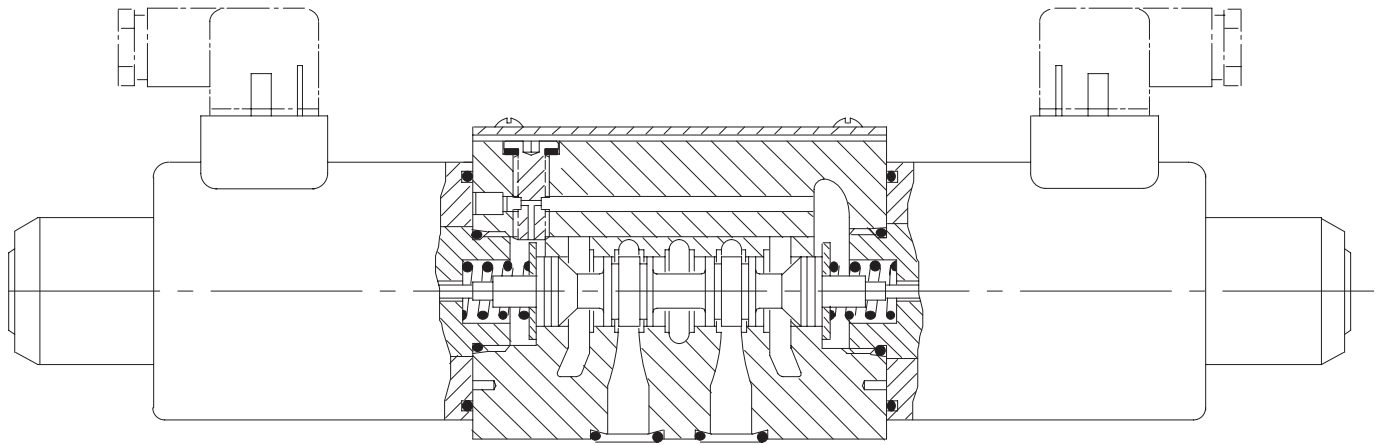
DG4V-5-20 Design

General description

A range of four-port solenoid operated directional control valves with four-land spool design to facilitate provision of smooth, variable valve response speeds.

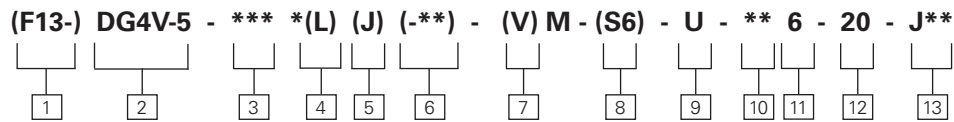
The range includes:

- AC and DC wet-armature solenoid options with ISO 4400 (DIN 43650) electrical connections and manual overrides.
- Variable speed changeover potential in all DC models; see "Response Times" section.
- Many spool types; in spring-offset, spring-centered and detented arrangements.
- Compact, cost effective system design when used with Eaton® SystemStak™ valves and subplates.



G

Model Code



1 Prefix, fluid compatibility

Blank – AC or DC-voltage models for petroleum oils, water-in-oil (invert) emulsions or phosphate esters.
AC - voltage models for water glycols.

F13 – DC-voltage models for water glycols.

2 Model Series

4 – Solenoid operated
V – Pressure rating 315 bar (4568 psi) on P, A & B parts
5 – ISO4401 Size 05

3 Spool type

See “Functional Symbols” section

4 Spool spring arrangement

A – Spring offset to A. Single end.
AL – As ‘A’, but left hand build
B – Spring centered. Single end.
BL – As ‘B’, but left hand build
C – Spring centered. Double End.
N – No spring detented. Double end.

5 Spool design

Blank – “0A” DC-valves and all AC valves except “8B(L)” and “8C” spool/ spring arrangements.
J – All DC valves except “0A” spool/ spring arrangements. AC valves with “8B(L)” and “8C” spool/spring arrangements.

6 Manual override option

Blank – Standard plain override(s) in solenoid end(s) only ▼
H – Water-resistant override(s) in solenoid end(s) ▼
W – Twist and lock override in solenoid end only
Z – No overrides at either end
Omit for standard plain override(s) in solenoid end(s) only ▼
▼ No override in non-solenoid end of single-solenoid valves.

7 Solenoid energization identity

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 page 4.

8 Spool position indicator switch

Blank – No spool position monitoring switch.
S7 – Spool position monitoring switch. Single solenoid valves only

9 Coil Type

U – ISO 4400 (DIN 43650) mounting(s) without plug(s)
U1 – ISO 4400 with fitted DIN plug
U6 – ISO 4400 with fitted DIN plug with lights
KU – Flying leads from top of the solenoid
KUM5LD3 – M12 connector with diode lights
KUP10 – Flying leads metri-pack connector (male)
KUP4 – Junior timer (AMP) connector
KUP5D2 – Moulded Deutsch connector with diode
KUP6D2 – Flying lead with Deutsch connector with diode

10 Coil rating

A – 110V AC 50
C – 220V AC 50
ED – 240V AC 50
EK – 115V AC 60
EH – 230V AC 60
G – 12V DC
H – 24V DC
HL – 24V DC (32W)
OJ – 48V DC
P – 110V DC
DJ – 98V DC (42W)
EJ – 196V DC (43W)
EO – 205V DC (43W)
KK – 48V AC 50HZ
NN – 24V AC 50HZ

11 Tank Pressure Rating

6 – 160 Bar Tank Pressure Rating

12 Design number

Subject to change. Installation dimensions unaltered for design numbers 20 to 29 inclusive.

13 Spool speed control

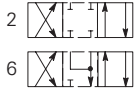
J06 – 0,6 mm orifice
J08 – 0,8 mm orifice
J10 – 1,0 mm orifice
J12 – 1,2 mm orifice
J99 – no orifice. Must be specified where future fitting of orifice is required, see page A.11, “Spool Speed Control Orifice”

Functional Symbols

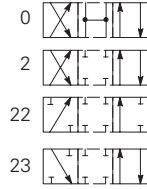
Spool Options

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

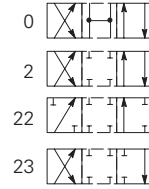
DG4V-5-*N valves



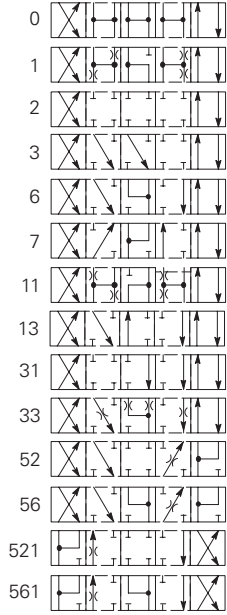
DG4V-5-*A valves



DG4V-5-*AL valves



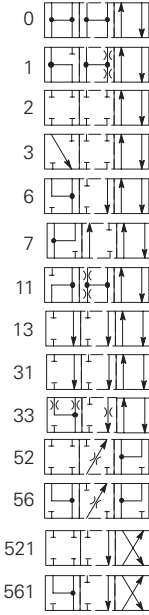
DG4V-5-*C valves



DG4V-5-*B valves



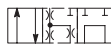
DG4V-5-*BL valves



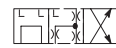
DG4V-5-8CV valves



DG4V-5-8BLV valves



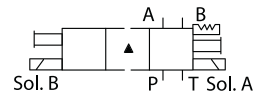
DG4V-5-8BV valves



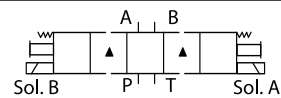
Solenoid Identified Standards

U.S. Solenoid Standard

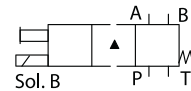
Double solenoid valves, two position, detented



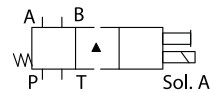
Double solenoid valves, spring centered



Single solenoid valves, solenoid at port A end



Single solenoid valves, solenoid at port B end



▲ Transient condition only

Operating Data

| Feature | DG4V-5 | |
|---|--------------------------------|-------------------------|
| Pressure Limits | | |
| P, A and B ports | 315 bar (4500 psi) | |
| T port: T _A | 120 bar (1750 psi) for AC Sol. | |
| T _B | 160 bar (2325 psi) for DC Sol. | |
| Flow rating | See performance data | |
| Relative duty factor | Continuous; ED = 100% | |
| Type of protection: ISO 4400 coils with plug fitted correctly | IEC 144 class IP65 | |
| Coil winding | Class H | |
| Lead wires (coils type F***) | Class H | |
| Coil encapsulation | Class F | |
| Permissible voltage fluctuation: | | |
| Maximum | Refer to temperature limits. | |
| Minimum | 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) | |
| Pressure | 175 bar (2537 psi) | |
| AC (~) energizing | 30 ms | |
| AC (~) de-energizing | 40 ms | |
| DC (=) energizing | 120 ms ■ | |
| DC (=) de-energizing | 45 ms ■* | |
| Power consumption, AC solenoids (for coils listed in model code). | Initial VA (RMS)▲ | Holding VA (RMS) |
| Full power coils: | | |
| Dual frequency coils at 50 Hz | 700 | 105 |
| Dual frequency coils at 60 HZ | 105 | 130 |
| Power consumption, DC solenoids at rated voltage and 20 C (68 F). | | |
| Full power coils: | | |
| Others | 38W | |
| Model type "HL" | 32W | |
| Mass, Approx. kg (lb) | | |
| Single solenoid models, AC coils | 4,0 (8.8) | |
| Single solenoid models, DC coils | 4,8 (10.6) | |
| Double solenoid models, AC coils | 4,5 (9.9) | |
| Double solenoid models, DC coils | 6,3 (13.9) | |
| Temperature Limits | | |
| Minimum ambient | -20 °C (-4 °F) | |
| Maximum ambient: | | |
| AC 50 Hz valves | 50 °C (122 °F) | |
| AC 60 Hz valves | 40 °C (104 °F) | |
| DC valves | 70 °C (158 °F) | |

Spool Speed Control Orifice

For fine tuning of valve spool speed. Only applicable to valves already fitted with an orifice or blank plug, see model code, page 3.

Orifice Kit

Orifice kits must be ordered separately, part number 02-350116. Kit comprises 1 off each as per code 13 on page 3:

* In pure switched conditions, devoid of the effects of any suppression diodes and full-wave rectifiers.

■ DG4V-5-2CJ valves. Longer response times can be obtained by fitting an orifice plug in a special pilot port, standard in all bodies. An orifice kit 459065, containing a selection of plugs of differing orifice size, can be ordered separately. Ask your Eaton representative for details.

▲ 1st half cycle; armature fully retracted.

Operating Data

Spool Position Indicator Models

Spool/spring arrangement types 0A, 2A, 2AJ, 22A, 22AJ, 35A, 35AJ, 0BJ, 2BJ, 6BJ

DC model type "S7"



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 |

Pin Connections;

| | |
|-------|---------------|
| Pin 1 | + Supply |
| Pin 2 | Normal Closed |
| Pin 3 | 0V |
| Pin 4 | Normal Open |

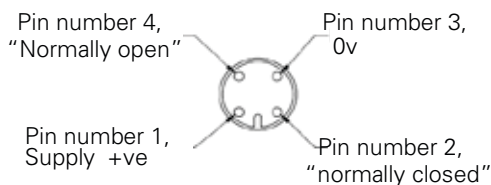
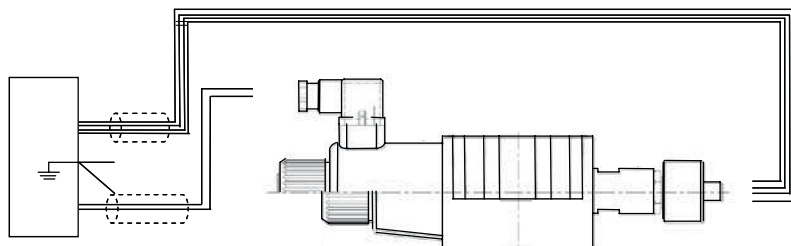
| | |
|-------------------|----------------------------------|
| EMC Protection | DIN EN 61000-6-1/2/3/4, Aug 2002 |
| Humidity | 0-95% rel. (nach DIN 40040) |
| Protection Class | IP65 DIN 40050 |
| Vibration 0-500Hz | Max. 20g |
| Shock | Max. 50g |

Wiring Connections



Warning

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



Customer 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

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

Max. Flow Rates

Based on warm solenoid(s) operating at 10% below rated voltage.

Flow limits applicable to following usages:

1. All valves except those with types 22, 52, 56, 521 and 561 spools having simultaneous equal flow rates from P to A or B and from B or A to T.

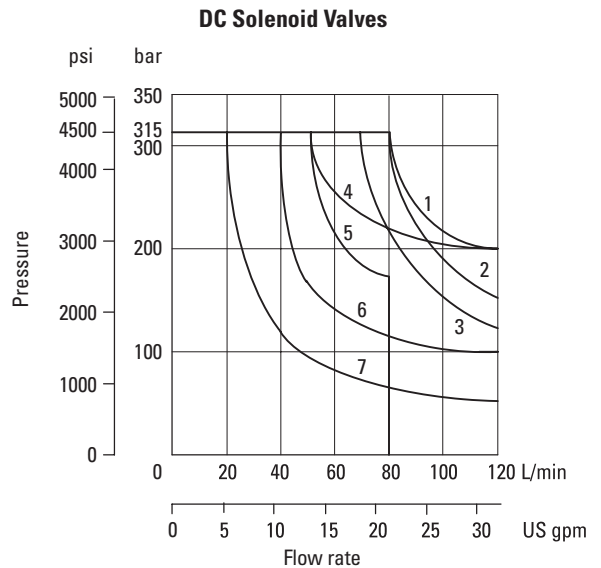
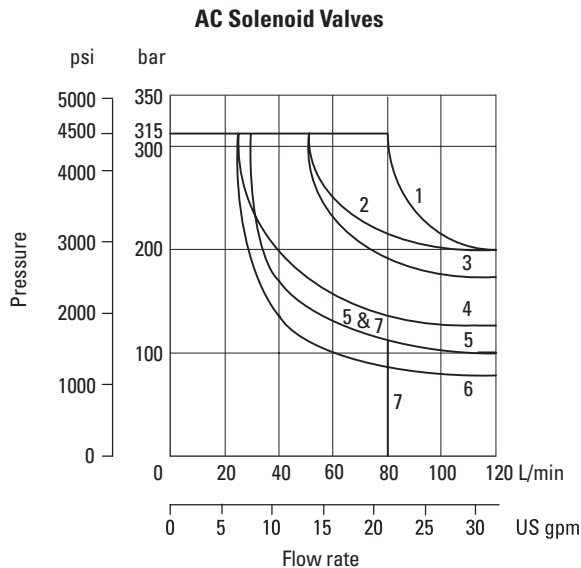
2. Valves with type 22 spools having flow from P to A or B, the other being blocked. T is drained at all times.
3. Valves with types 52, 56, 521 and 561 spools having one service port connected to the full bore end of a 2:1 area ratio double-acting cylinder and the other service port to the annulus end.

4. Valves with type 23 spools having single flow from A or B to T, P and the other service port being blocked.

Consult Eaton with application details if any of the following are required:

- a) Single flow path, i.e. P to A, P to B, A to T or B to T.

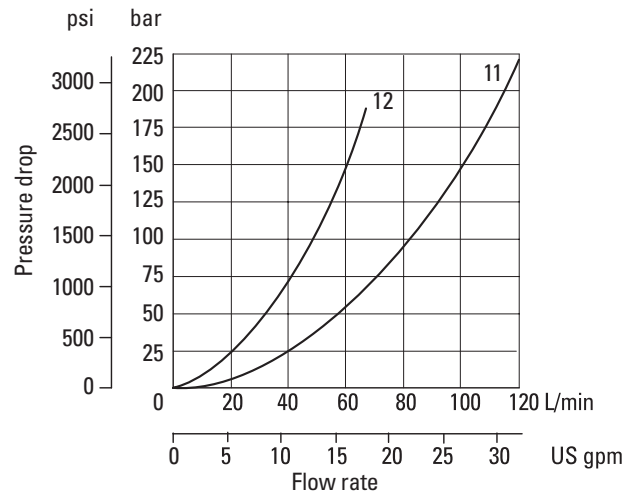
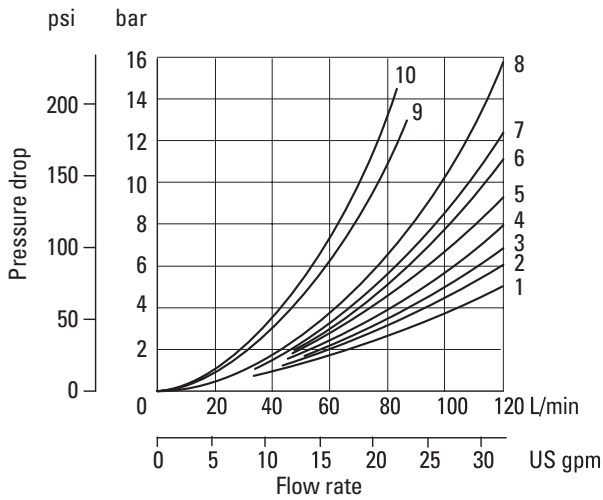
- b) Substantially different simultaneous flow rates between P to A or B and B or A to T.
- c) Spools as in 3 above are to be used with cylinder ratios greater than about 3:1 at low flow rates or 2:1 at high flow rates.



| Spool/spring code | AC valve graph curve | DC valve graph curve |
|--|----------------------|----------------------|
| 0A(L) | 3 | 2 |
| 0B(L) & 0C | 2 | 4 |
| 1B(L) & 1C | 6 | 7 |
| 2A(L) | 3 | 2 |
| 2B(L), 2C & 2N | 1 | 1 |
| 3B(L), 3C, 6B(L) & 6C | 4 | 6 |
| 6N | 3 | 3 |
| 7B(L) & 7C | 1 | 1 |
| 8B(L) & 8C | 7 | 5 |
| 11B(L), 11C & 22A(L) | 6 | 7 |
| 23A(L) | 5 | 6 |
| 31B(L) & 31C | 4 | 6 |
| 33B(L), 33C | 3 | 6 |
| 52B(L), 52C, 56BL, 56C, 521B, 521C, 561B & 561C | 4 | 6 |

Performance Data

Pressure Drops Typical with petroleum oil at 36 cSt (170 SUS) and a specific gravity of 0,87

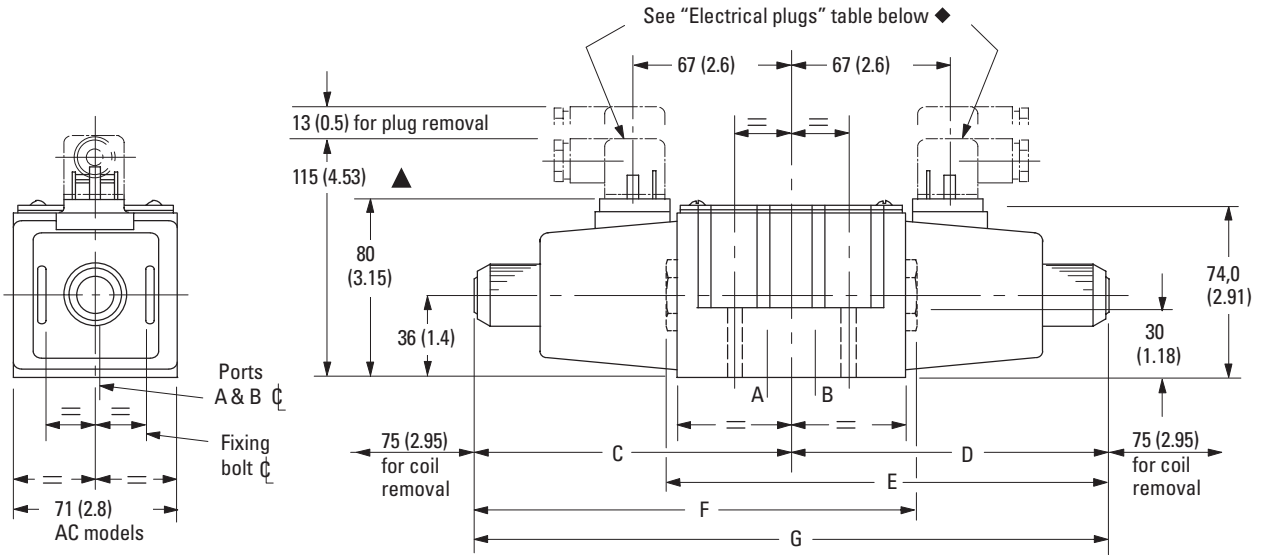


| Spool/spring code | Spool positions covered | P to A | P to B | A to T | B to T | P to T | A to B or B to A |
|-------------------|-------------------------|--------|--------|--------|--------|--------|------------------|
| 0A(L) | Both | 2 | 2 | 4 | 5 | – | – |
| 0B(L) & 0C | De-energized | – | – | – | – | 3t | – |
| | Energized | 1 | 1 | 6 | 7 | – | – |
| 1B(L) & 1C | De-energized | – | – | – | – | 6u | – |
| | Energized | 1 | 2 | 6 | 4 | – | – |
| 2A(L) | Both | 3 | 3 | 5 | 6 | – | – |
| 2B(L) & 2C | All | 2 | 2 | 4 | 5 | – | – |
| 2N | Both | 3 | 3 | 5 | 6 | – | – |
| 3B(L) & 3C | De-energized | – | – | 5 | – | – | – |
| | Energized | 2 | 3 | 6 | 5 | – | – |
| 6B(L) & 6C | De-energized | – | – | 5m | 6u | – | – |
| | Energized | 3 | 3 | 6 | 7 | – | – |
| 6N | Both | 4 | 4 | 4 | 5 | – | – |
| 7B(L) & 7C | De-energized | 3m | 3u | – | – | – | 5■ |
| | Energized | 2 | 2 | 5 | 6 | – | – |
| 8B(L) & 8C | All | 2 | 2 | 7 | 8 | 8 | – |
| 11B(L) & 11C | De-energized | – | – | – | – | 6m | – |
| | Energized | 2 | 1 | 4 | 7 | – | – |
| 22A(L) | Both | 3 | 3 | – | – | – | – |
| 23A(L) | Both | 3 | 3 | 5 | 6 | – | – |
| 31B(L) & 31C | De-energized | – | – | – | 6 | – | – |
| | Energized | 3 | 2 | 4 | 7 | – | – |
| 33B(L) & 33C | De-energized | – | – | 12m | 12u | – | – |
| | Energized | 2 | 2 | 5 | 6 | – | – |
| 52BL & 52C | All | 7m | 8 | 4 | – | – | 9■ |
| 56BL & 56C | De-energized | – | – | 8m | 10u | – | – |
| | Energized | 7m | 8 | 6 | – | – | 9■ |
| 521B & 521C | All | 8 | 7u | – | 5 | – | 9■ |
| 561B & 561C | De-energized | – | – | 10m | 8u | – | – |
| | Energized | 8 | 7u | – | 7 | – | 9■ |

t A and B blocked u A blocked m B blocked ■ P blocked

Installation Dimensions in mm (inches)

AC Solenoid Models

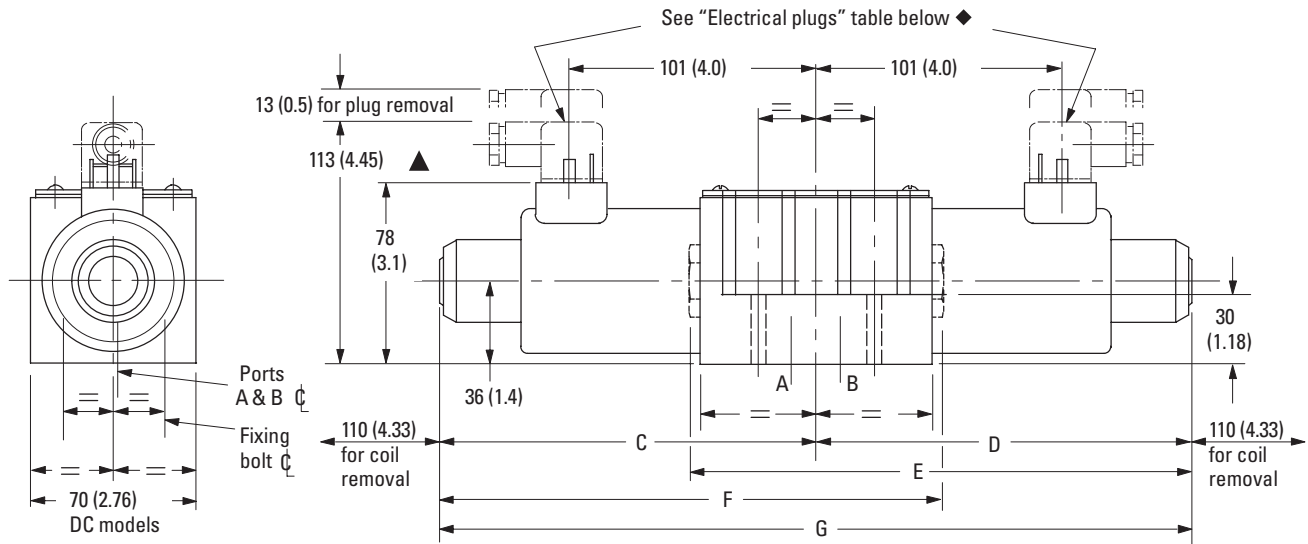


- ▲ May vary according to plug source.
- ◆ The cable entry can be repositioned at 90° intervals from the position shown. This is done by reassembling the contact holder into the appropriate position inside the plug housing.

| Model | Solenoid at: | C | D | E | F | G |
|----------------------------|--------------|------------|------------|------------|------------|-------------|
| DG4V-5-*A(L)/B(L)-(Z)-(V)M | Port A end | 123 (4.84) | – | – | 182 (7.17) | – |
| | Port B end | – | 123 (4.84) | 182 (7.17) | – | – |
| DG4V-5-*C/N-(Z)-(V)M | Both ends | 123 (4.84) | 123 (4.84) | – | – | 246 (9.68) |
| DG4V-5-*C/N-H-(V)M | Both ends | 138 (5.43) | 138 (5.43) | – | – | 276 (10.87) |

Installation Dimensions in mm (inches)

DC Solenoid Models

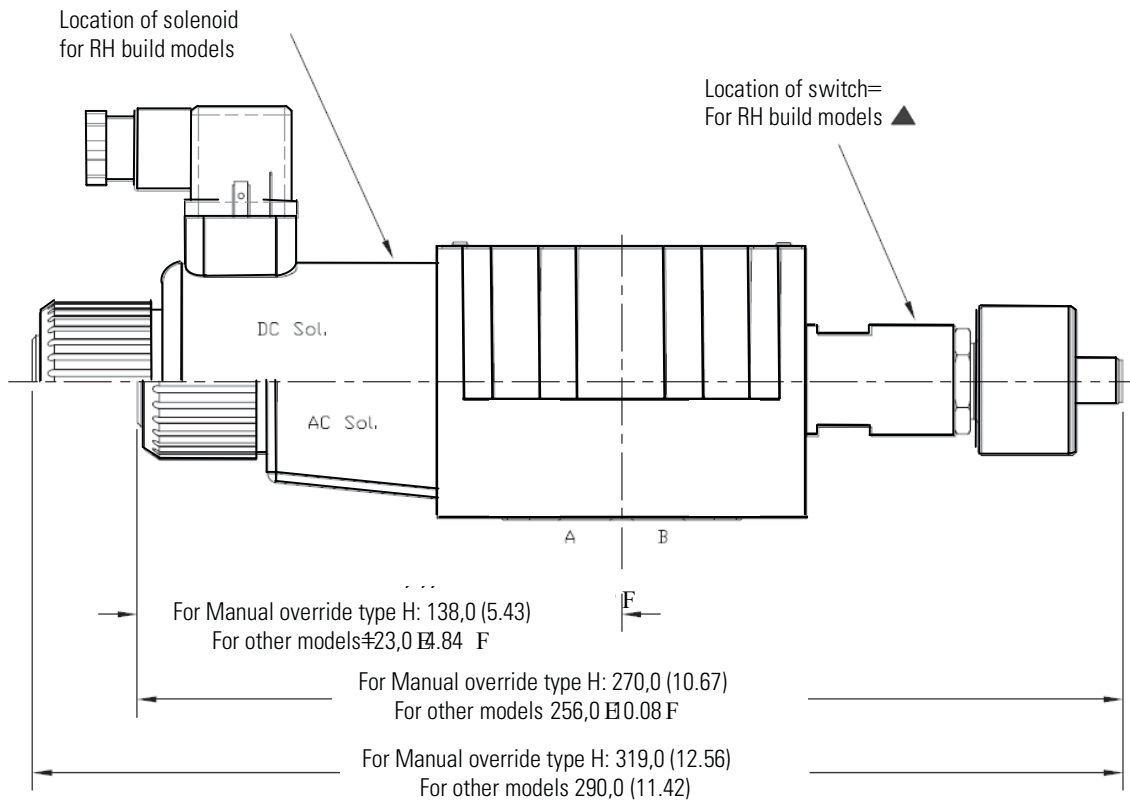


- ▲ May vary according to plug source.
- ◆ The cable entry can be repositioned at 90° intervals from the position shown. This is done by reassembling the contact holder into the appropriate position inside the plug housing.

| Model | Solenoid at: | C | D | E | F | G |
|----------------------------|--------------|------------|------------|------------|------------|-------------|
| DG4V-5-*A(L)/B(L)(-Z)-(V)M | Port A end | 156 (6.14) | – | – | 215 (8.46) | – |
| | Port B end | – | 156 (6.14) | 215 (8.46) | – | – |
| DG4V-5-*C/N(-Z)-(V)M | Both ends | 156 (6.14) | 156 (6.14) | – | – | 312 (12.28) |
| DG4V-5-*C/N-H-(V)M | Both ends | 185 (7.28) | 185 (7.28) | – | – | 370 (14.57) |

Installation Dimensions in mm (inches)

Spool Position Indicator Switch Models



▲ For LH models ("L" in model code location 4) solenoid and switch locations are reversed

⚠ **Wiring:** See warning note on page 6

Electrical Plugs and Connectors

DIN 43650 Connector

Cable diameter range:

Wire section range:

Terminals:

Type of protection:

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):

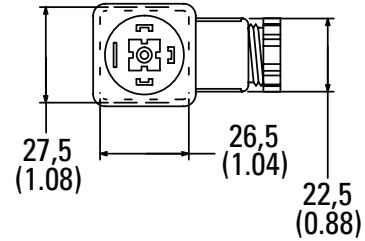
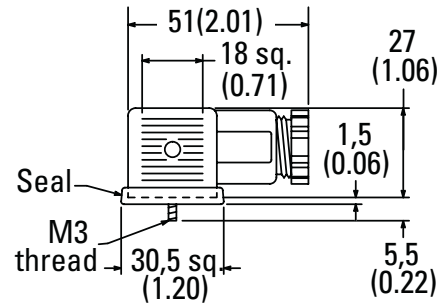
Ø6–10 mm (0.24–0.40)

Ø,5–1,5 mm²

(0.0008– 0.0023 in²)

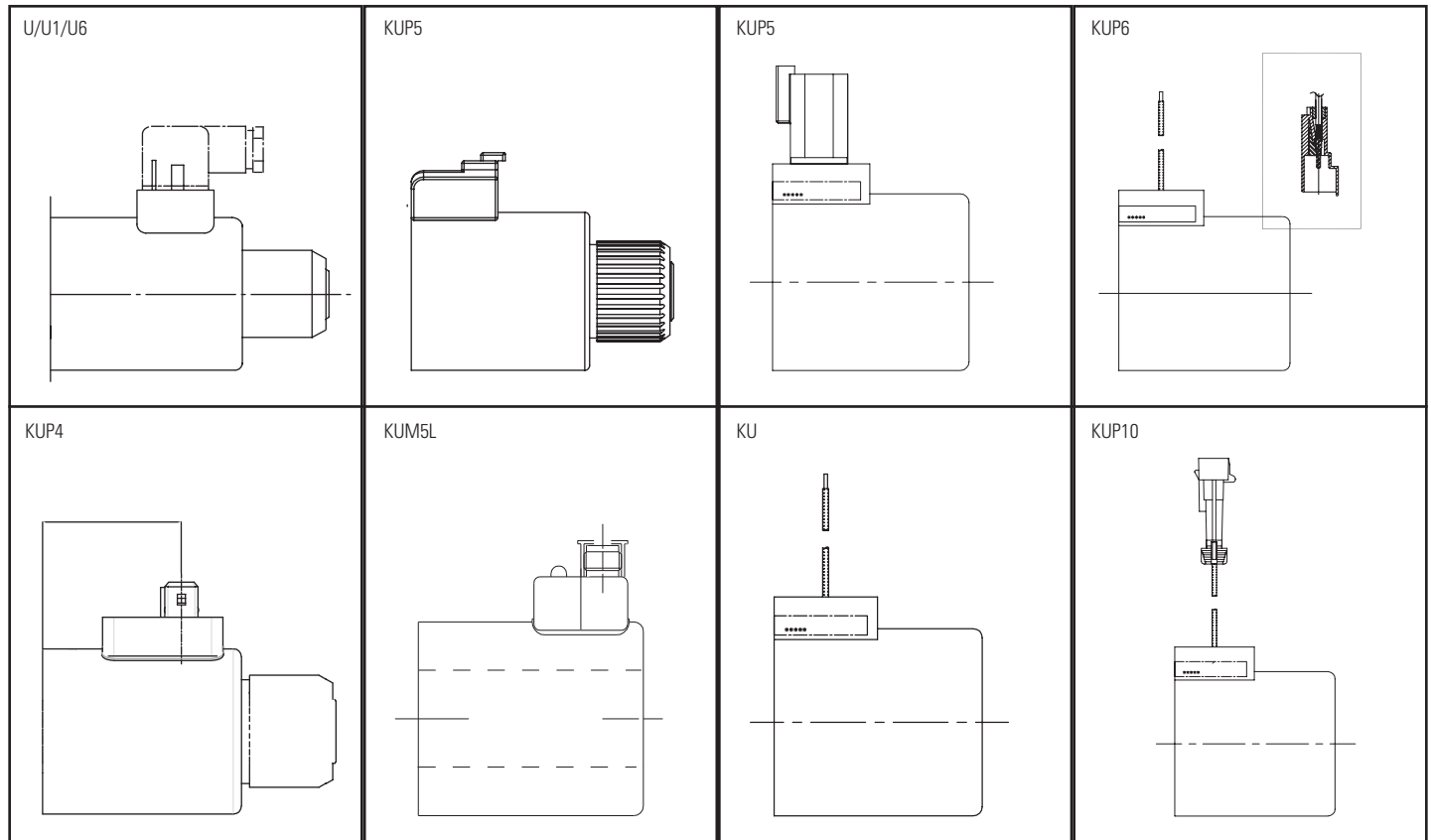
Screw type

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



| Receptacle | Voltage (AC or DC) | Part Numbers Gray – "A" sol. | Black – "B" sol. |
|-------------------------|-----------------------------|---------------------------------|----------------------------|
| U1 Coils without lights | – | 710776 | 710775 |
| U6 Coils with lights | 12-24 100-125 200-240 | 977467 977469 977471 | 977466 977468 977470 |

Connectors



Eaton
Hydraulics Business USA
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Eden Prairie, MN 55344
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