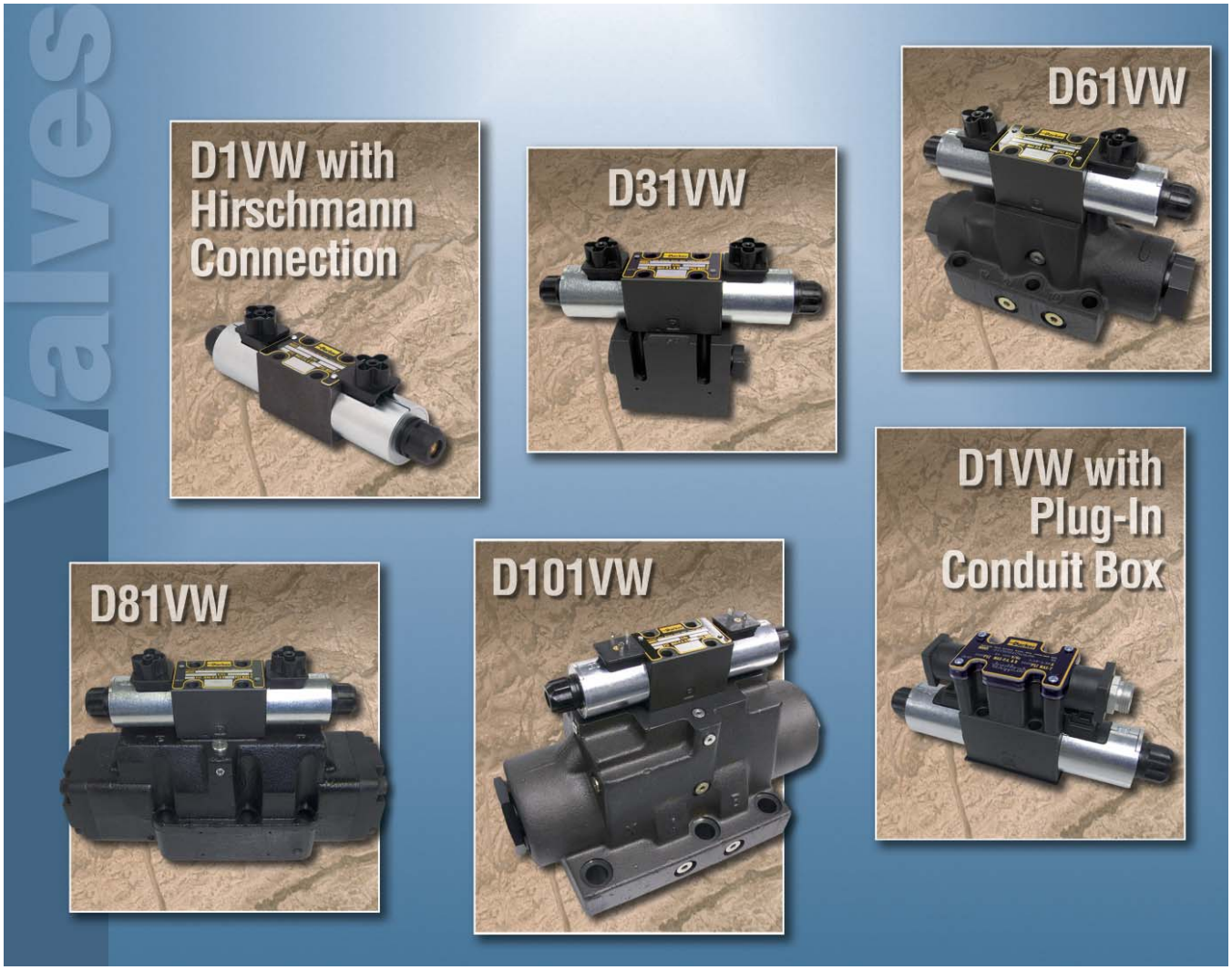
Bulletin HY14-2502-B1/US
Supplement to Catalog HY14-2502/US

Series D*VW
91 Design
Directional Control Valves

Product Ordering Quick Reference

Effective: September 1, 2007



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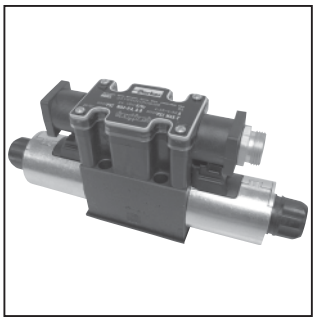
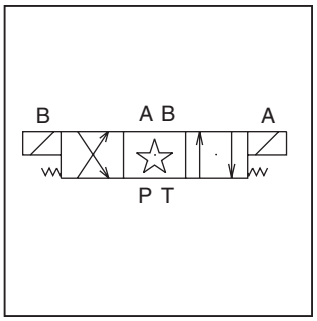
Bul HY14-2502-B1cvr.p65, dd

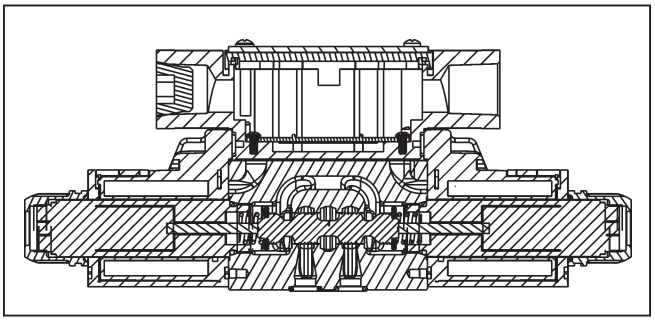
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series D1VW directional control valves are high performance, 4-chamber, direct operated, wet armature solenoid controlled, 3 or 4-way valves. They are available in 2 or 3-position and conform to NFPA's D03, CETOP 3 mounting patterns.







Features

- Softshift available.
- 19 standard spool styles available (for other spools – Consult Factory).
- Proportional spools.
- DC surge suppression.
- Nine electrical connection options.
- AC & DC lights available (CSA approval for solenoids and lights).
- Internally ground.
- Easy access mounting bolts.
- Waterproof (meets NEMA 4, up to IP67 on some models).
- Explosion proof.
- CSA approvals.
- U.L. recognized available - Contact Division.
- No tools required for coil removal.
- AC rectified coils.

Specifications

Mounting Pattern	NFPA D03, CETOP 3; NG 6
Mounting Interface	DIN 24340-A6 ISO 4401-AB-03-4-A CETOP R35H 4.2-4-03, NFPA D03
Maximum Pressure	P, A, B 345 Bar (5000 PSI) Standard CSA 276 Bar (3750 PSI) Tank: 103 Bar (1500 PSI) AC only 207 Bar (3000 PSI) DC or AC Rectified Standard 207 Bar (3000 PSI) AC Optional CSA 103 Bar (1500 PSI)

Leakage Rates* 100 SSU @ 49°C (120°F)	Maximum Allowable: 19.7 cc (1.2 Cu. in.) per Minute/Land @ 69 Bar (1000 PSI)* 73.8 cc (4.5 Cu. in.) per Minute/Land @ 207 Bar (3000 PSI)*
*#008 and #009 Spools may exceed these rates Consult Factory	Typical: 4.9 cc (0.3 Cu. in.) per Minute/Land @ 69 Bar (1000 PSI)* 26.2 cc (1.6 Cu. in.) per Minute/Land @ 345 Bar (5000 PSI)

Response Time

Response time (milliseconds) at 345 Bar (5000 PSI) is 32 LPM (8.5 GPM).

Solenoid Type	Pull-In	Drop-Out
AC	13	20
DC 8 Watt or 10 Watt	61	22
DC 30 Watt	51	21

		Spool Center Condition *					
		Closed		Open		2-Position	
Soft Shift	Orifice Size	Energize	De-Energize	Energize	De-Energize	Energize	De-Energize
S2	0.020	125 ms	920 ms	200 ms	275 ms	51 ms	100 ms
S5	0.050	51 ms	675 ms	50 ms	27 ms	51ms	21 ms

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Standard Valves

D Directional Control Valve

1V Basic Valve

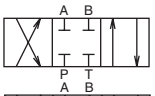
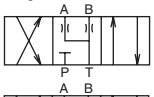
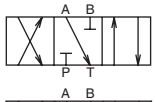
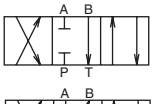
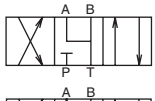
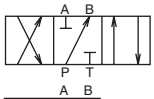
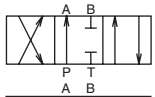
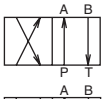
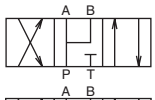
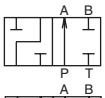
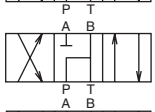
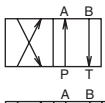
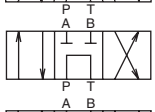
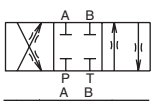
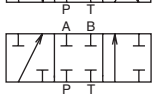
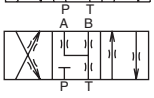
NFPA D03
CETOP 3
DIN NG6

Actuator

Code	Description
W*	**Solenoid, Wet Pin, Screw-in**
HW*	**Reversed Wiring**

* Valve schematic symbols are per NFPA/ANSI standards, providing flow P to A when energizing solenoid A. Note operators reverse sides for #008 and #009 spools. See installation information for details. To configure per DIN standards (A coil over A port, B coil over B port) code valves as D1VHW***.

Spool

Code	Symbol	Code	Symbol
001		011	
002		014	
003		015	
004		016	
005		**020***	
006		026*	
007		**030****	
008* **009****		**081**	
010		**082**	

* 008, 020 & 026 spools have closed crossover.
** 009 & 030 spool have open crossover.

Style

Seal

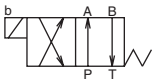
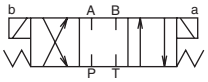
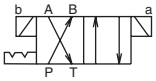
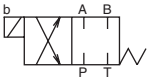
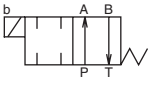
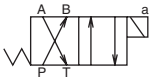
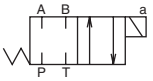
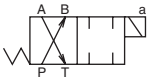
Code	Description
N	**Nitrile**
V	**Fluorocarbon**
E*	EPR

* Contact HVD for availability.

Solenoid Voltage

Code	Description
A*	24/50 VAC
D	120 VDC
G	198 VDC
J	**24 VDC**
K	**12 VDC**
L	6 VDC
N**	220/50 VAC
P**	110/50 VAC
Q*	100/60 VAC
QD	100/60 - 100/50 VAC
R	24/60 VAC
T	**240/60 - 220/50 VAC**
U	98 VDC
Y	**120/60 - 110/50 VAC**
Z	250 VDC

* High Watt Coil only.
** Explosion Proof only.

Code	Description	Symbol
B*	**Single solenoid, 2 position, spring offset. P to A and B to T in offset position.**	
C	**Double Solenoid, 3 position, spring centered.**	
D**	**Double solenoid, 2 position, detent.**	
E	Single solenoid, 2 position, spring centered. P to B and A to T when energized.	
F‡	Single solenoid, 2 position, spring offset, energized to center. Position spool spacer on A side. P to A and B to T in spring offset position.	
H*	**Single solenoid, 2 position, spring offset. P to B and A to T in offset position.**	
K	Single solenoid, 2 position, spring centered. P to A and B to T when energized.	
M‡	Single solenoid, 2 position, spring offset, energized to center position. Spool spacer on B side. P to B and A to T in spring offset position.	

* Spools 020, 026 and 030 only.
** Spools 020, 030 only.
‡ High Watt only.

Bold: Designates Tier I products and options.

Non-bold: Designates Tier II products and options. These products will have longer lead times.

Standard Valves

Solenoid Connection

Code	Description
C††	**Leadwire Conduit Box**
D†‡¤	Metric Plug (M12X1), DESINA
E*	Explosion Proof
G‡	**Plug-In Conduit Box**
J†*	Deutsch (DT06-2S)
M†*	Metri-Pack (150)
P	**DIN with Plug**
S†*	Double Spade
W*	**DIN w/o Plug**

* Not available with lights.
† DC Only.
††No variations – See Plug-in.
‡ Must have lights.
¤ Must have Diode Surge Suppressor.

Coil Options

Code	Description
Omit†	**High Watt**
D#¤	Explosion Proof, EEXD ATEX
E#¤	Explosion Proof, EEXME ATEX
F**	Low Watt
L***	8 Watt
O#	Explosion Proof, MSHA
U#¤	Explosion Proof, UL/CSA
X*	No Coils

* See solenoid voltage code to specify proper tube.
** AC only.
*** DC or AC Rectified only.
† AC ambient temperature must not exceed 60°C (140°F).
# Explosion Proof – coils are 60 Hz at Std. voltage. Dual rating not available.
¤ Lights, softshift, and other options are not available on Explosion Proof coils.

Tube Options

Code	Description
Omit	**Standard Pressure 103.5 Bar (1500 PSI) AC 207 Bar (3000 PSI) DC**
H*	**High Pressure, AC only 207 Bar (3000 PSI)**

* Not available with CSA.

Manual Override Options

Code	Description
Omit	**Standard**
P*	Extended Manual Override w/Body
T*†	No Override

* Manual Override options not available with Explosion Proof or softshift.
† DC or AC Rectified only.

Electrical Options

Code	Description
Omit	**No Options**
J*	Diode Surge Suppressor
Z†	Rectified Coil

* DIN coil must have plug with lights.
† DC tube standard.

Shift Response and Indication

Code	Description
Omit	**Standard Response**
S2*	Softshift, 0.020" Orifice
S5*	Softshift, 0.050" Orifice
I7**	Monitor Switch Direct Op. End Stroke
I8**	Monitor Switch Direct Op. Start Stroke

* Not available with 8 watt.
** B, E, H & K styles only.
Spools 8,9,21,26,81,82 not available.
Not CE or CSA approved.

Approvals

Code	Description
Omit	**Standard Valve**
3*†	CSA USA (UL 429)
4*	**CSA Approved**

* Not available with AC high pressure tube.
† B, C, H styles only, J, K, Y, U voltages only, C, G, W solenoid connections only.

Valve Variations

Code	Description
5**	**Signal Lights**
56*	**Manaplug (Mini) with Lights**
7B*	Manaplug (Micro) with Lights
1C*	**Manaplug (Mini) Single Sol. 5-pin, with Lights**
1D*	Manaplug (Micro) Single Sol. 5-pin, with Lights
1M*	Manaplug Opposite of Normal
1P	Painted Body
4D†	Twist & Lock Override (Old 5426)
4E†	Push Manual Override (Old x5450)
4F	Heavy Duty Detent
7Y*	4-pin M12X1 Manaplug, special wiring with Lights (Old B755)

* Plug-in Conduit Box.
** Plug-in, DIN, or DESINA only.
† DC or AC Rectified only. Not available with softshift.

Design Series
NOTE: Not required when ordering.

Valve Weight:
Single Solenoid 1.36 kg (3.0 lbs.)
Double Solenoid 1.6 kg (3.5 lbs.)

Standard Bolt Kit: BK209

Metric Bolt Kit: BKM209

Bold: Designates Tier I products and options.

Non-bold: Designates Tier II products and options. These products will have longer lead times.

Notes

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

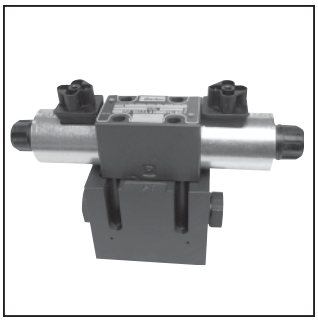
Series D31*W directional control valves are 5-chamber, pilot operated, solenoid controlled valves. The valves are suitable for manifold or subplate mounting.

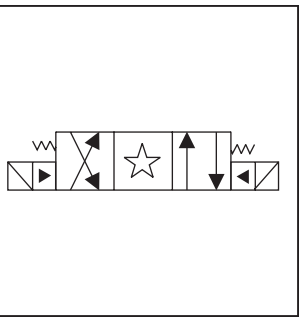
Features

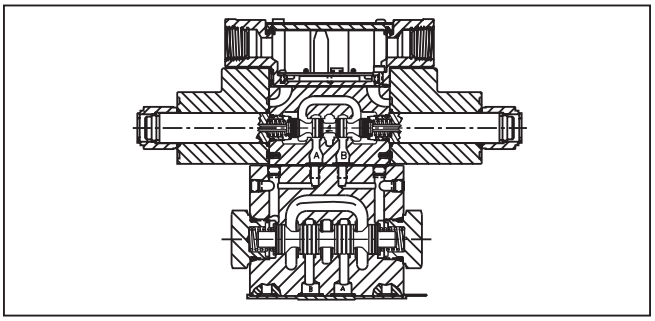
- **World design –** Available worldwide.
- **Mounting bolts below center line of spool –** Minimizes spool binding.
- **Five chamber style –** Eliminates pressure spikes in tubes, increasing valve life.
- **High pressure and flow ratings –** Increased performance options in a compact valve.

Specifications

Mounting Pattern	NFPA D05H, CETOP 5 NFPA D05HE, CETOP 5H
Max. Operating Pressure	345 Bar (5000 PSI) Standard CSA 207 Bar (3000 PSI)
Max. Tank Line Pressure	Internal Drain Model: 103 Bar (1500 PSI) AC Std. 207 Bar (3000 PSI) DC Std./AC Opt. External Drain Model: 207 Bar (3000 PSI) CSA 103 Bar (1500 PSI)
Max. Drain Pressure	103 Bar (1500 PSI) AC only 207 Bar (3000 PSI) DC Std./AC Opt. CSA 103 Bar (1500 PSI)
Min. Pilot Pressure	6.9 Bar (100 PSI)
Max. Pilot Pressure	345 Bar (5000 PSI) Standard CSA 207 Bar (3000 PSI)
Nominal Flow	76 Liters/Min (20 GPM)







Response Time

Response time (milliseconds)
at 345 Bar (5000 PSI) is 76 LPM (20 GPM)

Solenoid Type	Pilot Pressure	Pull-In	Drop-Out
DC	500	40	50
	1000	36	50
	2000	34	50
AC	500	20	33
	1000	18	33
	2000	13	33

D							
Directional Control Valve	Basic Valve	Actuator	Spool	Style	Pilot Supply and Drain	Seal	Solenoid Voltage

Basic Valve

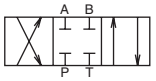
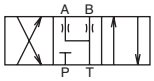
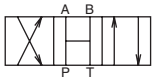
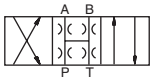
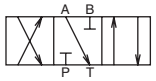
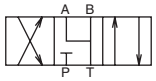
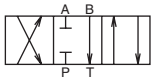
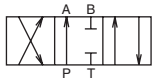
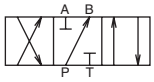
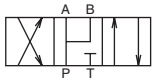
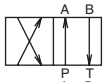
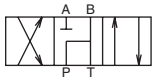
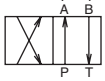
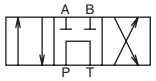
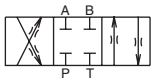
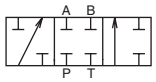
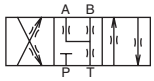
Code	Description
31D	NFPA D05, CETOP 5, DIN NG10, D03 Pilot, ISO Port
31V	**NFPA D05, CETOP 5, DIN NG10 D03 Pilot, NFPA Port**

Actuator

Code	Description
W*	**Solenoid, Wet Pin, Screw-in**
HW*	**Reversed Wiring**

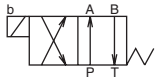
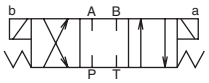
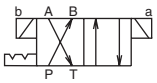
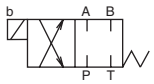
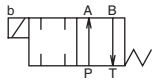
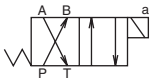
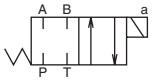
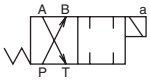
* Valve schematic symbols are per NFPA/ANSI standards, providing flow P to A when energizing solenoid A. Note operators reverse sides for #008 and #009 spools. See installation information for details. To configure per DIN standards (A coil over A port, B coil over B port) code valves as D1VHW***.

Spool

Code	Symbol	Code	Symbol
001		011	
002		012	
003		014	
004		015	
005		016	
006		**020***	
007		**030****	
008* **009****		**081**	
010		**082**	

* 008, 020 spools have closed crossover.
** 009 & 030 spool have open crossover.

Style

Code	Description	Symbol
B*	**Single solenoid, 2 position, spring offset. P to A and B to T in offset position.**	
C	**Double Solenoid, 3 position, spring centered.**	
D**	**Double solenoid, 2 position, detent.**	
E	Single solenoid, 2 position, spring centered. P to B and A to T when energized.	
F‡	Single solenoid, 2 position, spring offset, energized to center. Position spool spacer on A side. P to A and B to T in spring offset position.	
H*	**Single solenoid, 2 position, spring offset. P to B and A to T in offset position.**	
K	Single solenoid, 2 position, spring centered. P to A and B to T when energized.	
M‡	Single solenoid, 2 position, spring offset, energized to center position. Spool spacer on B side. P to B and A to T in spring offset position.	

* Only spools 020, 026 and 030.
** Only spools 020, 030 and 100.
‡ High Watt only.

Pilot Supply and Drain

Code	Description
1	**Internal Pilot, External Drain**
2	**External Pilot, External Drain**
4*	**Internal Pilot, Internal Drain**
5	**External Pilot, External Drain**

* Not available with 002, 007, 008, 009 and 014 spools.

Seal

Code	Description
N	**Nitrile**
V	**Fluorocarbon**

Solenoid Voltage

Code	Description
A*	24/50 VAC
D	120 VDC
G	198 VDC
J	**24 VDC**
K	**12 VDC**
N**	220/50 VAC
Q*	100/60 VAC
R	24/60 VAC
T	**240/60 - 220/50 VAC**
U	98 VDC
Y	**120/60 - 110/50 VAC**
Z	250 VDC

* High Watt Coil only.
** Explosion Proof only.

Bold: Designates Tier I products and options.

Non-bold: Designates Tier II products and options. These products will have longer lead times.

Solenoid Connection

Code	Description
C**	**Conduit Box**
D*^¤	Metric Plug (M12X1), DESINA
E†	Explosion Proof
G‡^	**Plug-In Conduit Box**
J*†	Deutsch (DT06-2S)
M*†	Metri-Pack (150)
P	**DIN with Plug**
S*#†	Double Spade
W†	**DIN w/o Plug**

\# Not CSA approved.
† Not available with lights.
* DC Only.
** No variations – See Plug-in.
‡ Required for variations on Conduit Box style.
^ Must have lights.
¤ Must have Diode Surge Suppressor.

Coil Options

Code	Description
Omit	**High Watt**
D#¤	Explosion Proof, EEXD ATEX
E#¤	Explosion Proof, EEXME ATEX
F**	Low Watt
L***	8 Watt
O#¤	Explosion Proof, MSHA
U#¤	Explosion Proof, UL/CSA
X*	No Coils

* See solenoid voltage code to specify proper tube.
** AC only.
*** DC or AC Rectified only.
\# Explosion Proof – coils are 60 Hz at Std. voltage. Dual rating not available.
¤ Lights, softshift, and other options are not available on Explosion Proof coils.

Tube Options

Code	Description
Omit	**Standard Pressure 103.5 Bar (1500 PSI) AC 207 Bar (3000 PSI) DC**
H*	**High Pressure, AC only 207 Bar (3000 PSI)**

* Not available with CSA.

Manual Override Options

Code	Description
Omit	**Standard**
P	Extended with Boot
T†	None

† DC or AC Rectified only.
Manual Override options not available with Explosion Proof.

Electrical Options

Code	Description
Omit	**No Options**
J*	Diode Surge Suppressor
Z	Rectified Coil

* DC or AC Rectified only.
DIN coil must include plug with lights.

Shift Response and Indication

Code	Description
Omit	**Standard Response, No Switch**
I3	Monitor Switch, 'A' & 'B' Port End
I6	Monitor Switch, 'A' & 'B' Port Start

Note: Not CE or CSA approved.
Spools 8, 9, 81 and 82 not available.

Approvals

Code	Description
Omit	**Standard Valve**
3*†	CSA USA (UL 429)
4*	**CSA Approved****

* Not available with AC high pressure tube.
** Valve is derated with this option.
† B, C, H styles only. J, K, Y, U voltages only with C, G, W solenoid connections only.

Valve Variations

See next page

Design Series

NOTE: Not required when ordering.

Valve Weight: Double Solenoid 5.4 kg (12.0 lbs.)
Standard Bolt Kit: BK98

Bold: Designates Tier I products and options.

Non-bold: Designates Tier II products and options. These products will have longer lead times.

Valve Variations

Code	Description
5*	**Signal Lights – Standard**
	Signal Lights – Hirsch. (DIN with Plug)
7B**	Manaplug – Brad Harrison (12x1) Micro with Lights
56**	**Manaplug (Mini) with Lights**
20	**Fast Response**
1C**	**Manaplug (Mini) Single Sol. 5-pin, with Lights**
1D**	Manaplug (Micro) Single Sol. 5-pin, with Lights
1G**	Manaplug (Mini) Single Sol. 5-pin, with Stroke Adjust 'A' & 'B' End and Lights
1H**	Manaplug (Micro) Single Sol. 5-pin, with Stroke Adjust 'A' & 'B' End and Lights
1M	Manaplug Opposite Normal
1P	Painted Body
1R	Stroke Adjust 'A' & 'B' End with Pilot Choke Meter In
3A	**Pilot Choke Meter Out**
3B	**Pilot Choke Meter In**
3C	**Pilot Pressure Reducer**
3D	Stroke Adjust 'B' End
3E	Stroke Adjust 'A' End
3F	Stroke Adjust 'A' & 'B' End
3G*	**Pilot Choke Meter Out with Lights**
3H*	**Pilot Choke Meter In with Lights**
3J*	Pilot Pressure Reducer with Lights
3K	Pilot Choke Meter Out with Stroke Adjust 'A' & 'B' End
3L**	Pilot Choke Meter Out, Stroke Adjust 'A' & 'B' End with Lights and Manaplug — Brad Harrison Mini
3M	Pilot Choke Meter Out, Pilot Pressure Reducer, Stroke Adjust 'A' & 'B' End
3R	Pilot Choke Meter Out & Pilot Pressure Reducer
3S**	Lights, Mini Manaplug, Pilot Choke Meter Out
7Y**	M12x1 Manaplug (4-pin), Special Wiring, and Lights

* DESINA, plug-in conduit box, and DIN with plug styles only.
** Must have plug-in style conduit box.

Bold: Designates Tier I products and options.

Non-bold: Designates Tier II products and options. These products will have longer lead times.

General Description

Series D61VW directional control valves are 5-chamber, pilot operated, solenoid controlled valves, They are available in 2 or 3-position styles. These valves are manifold or subplate mounted, and conform to NFPA's D08, CETOP 8 mounting patterns.

Operation

Series D61VW pilot operated valves are standard with low shock spools and pilot orifice. The orifice can be removed if a faster shift is required. It is recommended, however, that all systems operating above 138 Bar (2000 PSI) use the standard valve to avoid severe shock.

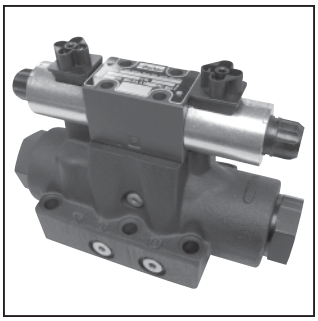
Features

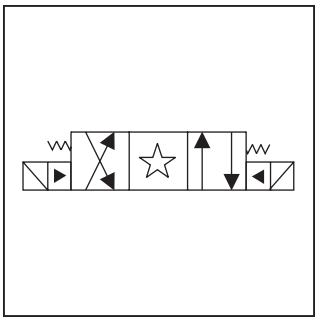
- Low pressure drop design.
- Hardened spools provide long life.
- Fast response option available.
- Explosion proof availability.
- Wide variety of voltages and electrical connection options.
- No tools required for coil removal.

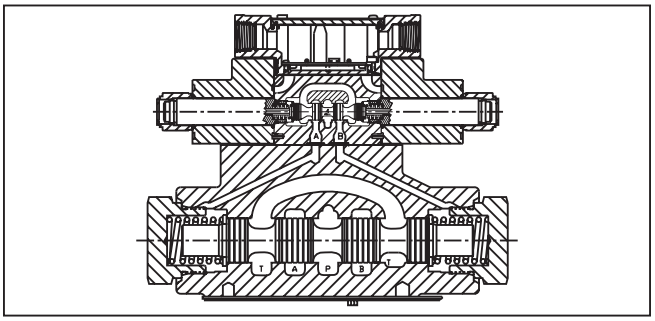
Specifications

Mounting Pattern	NFPA D08 CETOP 8, NG25
Maximum Operating Pressure	205 Bar (3000 PSI) Standard CSA 205 Bar (3000 PSI)
Maximum Tank Line Pressure	Internal Drain Model: 102 Bar (1500 PSI) AC Only 205 Bar (3000 PSI) DC Std./ AC Optional External Drain Model: 205 Bar (3000 PSI) CSA 102 Bar (1500 PSI)
Maximum Drain Pressure	102 Bar (1500 PSI) AC Standard 205 Bar (3000 PSI) DC Standard/ AC Optional CSA 102 Bar (1500 PSI)
Minimum Pilot Pressure	5.1 Bar* (75 PSI)
Maximum Pilot Pressure	205 Bar (3000 PSI) Standard CSA 205 Bar (3000 PSI)
Nominal Flow	189 LPM (50 GPM)

* 6.9 Bar (100 PSI) for spool configurations 002, 007, 008, 009 & 014.







Response Time

Response times (milliseconds) are measured at 205 Bar (3000 PSI) and 195 LPM (50 GPM) with various pilot pressures as indicated.

Solenoid Type	Pilot Pressure	Pull-In		Drop-Out	
		Std	Fast	Std	Fast
DC	500	130	100	80	80
	1000	90	90	80	80
	2000	80	80	80	80
AC	500	80	40	72	72
	1000	40	40	72	72
	2000	30	30	72	72

Because of the high drain line pressure transients generated during shifting, use of the fast response option is not recommended for pilot pressures exceeding 138 Bar (2000 PSI)

D	61V						
Directional Control Valve	Basic Valve	Actuator	Spool	Style	Pilot Supply and Drain	Seal	Solenoid Voltage

NFPA D08, CETOP 8, DIN NG25 Low Flow, D03 Pilot

Code	Description
W*	**Solenoid, Wet Pin, Screw-in**
HW*	**Reversed Wiring**

* Valve schematic symbols are per NFPA/ANSI standards, providing flow P to A when energizing solenoid A. Note operators reverse sides for #008 and #009 spools. See installation information for details. To configure per DIN standards (A coil over A port, B coil over B port) code valves as D1VHW***.

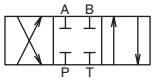
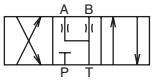
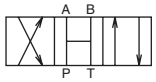
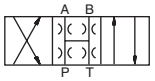
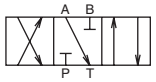
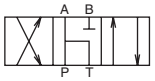
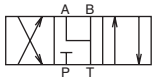
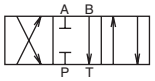
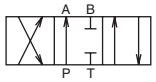
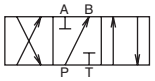
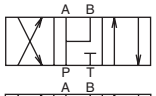
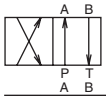
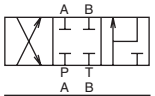
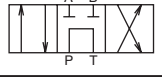
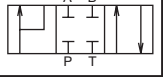
Code	Description
1	**Internal Pilot, External Drain**
2	**External Pilot, External Drain**
3**	Internal Pilot w/Check, External Drain
4*	**Internal Pilot, Internal Drain**
5	**External Pilot, Internal Drain**
6**	Internal Pilot w/Check Internal Drain

* Not availble with 002, 007, 008, 009 & 014 spools.
** #3 and #6 bodies cannot be converted to other styles. Other pilot versions cannot be converted to styles 3 and 6.

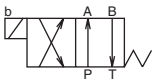
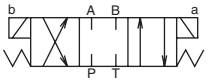
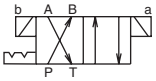
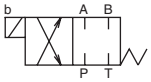
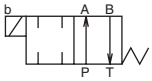
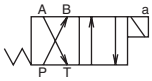
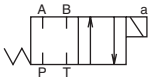
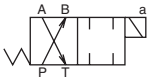
Code	Description
N	**Nitrile**
V	**Fluorocarbon**

Code	Description
A*	24/50 VAC
D	120 VDC
G	198 VDC
J	**24 VDC**
K	**12 VDC**
N**	220/50 VAC
Q*	100/60 VAC
R	24/60 VAC
T	**240/60 - 220/50 VAC**
U	98 VDC
Y	**120/60 - 110/50 VAC**
Z	250 VDC

* High Watt only.
** Explosion Proof only.

Code	Symbol	Code	Symbol
001		011	
002		012	
003		014	
004		015	
005		016	
006		020*	
007		021	
008* **009****		022	

* 008 spool has closed crossover.
** 009 spool has open crossover.

Code	Description	Symbol
B*	**Single solenoid, 2 position, spring offset. P to A and B to T in offset position.**	
C	**Double Solenoid, 3 position, spring centered.**	
D*	**Double solenoid, 2 position, detent.**	
E	Single solenoid, 2 position, spring centered. P to B and A to T when energized.	
F**	Single solenoid, 2 position, spring offset, energized to center. Position spool spacer on A side. P to A and B to T in spring offset position.	
H*	**Single solenoid, 2 position, spring offset. P to B and A to T in offset position.**	
K	Single solenoid, 2 position, spring centered. P to A and B to T when energized.	
M**	Single solenoid, 2 position, spring offset, energized to center position. Spool spacer on B side. P to B and A to T in spring offset position.	

* Available with 001, 002, 004, 011 and 014 spools only.
** High watt coil only.

Bold: Designates Tier I products and options.

Non-bold: Designates Tier II products and options. These products will have longer lead times.

Solenoid Connection

Code	Description
C**	**Conduit Box**
D*^¤	Metric Plug (M12X1), DESINA
E†	Explosion Proof
G‡^	**Plug-In Conduit Box**
J*†	Deutsch (DT06-2S)
M*†	Metri-Pack (150)
P	**DIN with Plug**
S*#†	Double Spade
W†	**DIN w/o Plug**

\# Not CSA approved.
† Not available with lights.
* DC Only.
** No variations – See Plug-in.
‡ Required for variations on Conduit Box style.
^ Must have lights.
¤ Must have Diode Surge Suppressor.

Coil Options

Code	Description
Omit	**High Watt**
D#¤	Explosion Proof, EEXD ATEX
E#¤	Explosion Proof, EEXME ATEX
F**	**Low Watt**
L***	8 Watt
O#¤	Explosion Proof, MSHA
U#¤	Explosion Proof, UL/CSA
X*	No Coils

* See solenoid voltage code to specify proper tube.
** AC only.
*** DC or AC Rectified only.
\# Explosion Proof – coils are 60 Hz at Std. voltage. Dual rating not available.
¤ Lights, softshift, and other options are not available on Explosion Proof coils.

Tube Options

Code	Description
Omit	**Standard Pressure 103.5 Bar (1500 PSI) AC 207 Bar (3000 PSI) DC**
H*	**High Pressure, AC only 207 Bar (3000 PSI)**

* Not available with CSA.

Manual Override Options

Code	Description
Omit	**Standard**
P	Extended with Boot
T†	None

† DC or AC Rectified only.
Manual Override options not available with Explosion Proof.

Electrical Options

Code	Description
Omit	**No Options**
J*	Diode Surge Suppressor
Z	Rectified Coil

* DC or AC Rectified only.
DIN coil must include plug with lights.

Shift Response and Indication

Code	Description
Omit	**Standard Response, No Switch**
I3	Monitor Switch, 'A' & 'B' Port End
I6	Monitor Switch, 'A' & 'B' Port Start

Note: Not CE or CSA approved.

Approvals

Code	Description
Omit	**Standard Valve**
3*†	CSA USA (UL 429)
4*	**CSA Approved****

* Not available with AC high pressure tube.
** Valve is derated with this option.
† B, C, H styles only. J, K, Y, U voltages only with C, G, W solenoid connections only.

Valve Variations

See next page

Design Series

NOTE: Not required when ordering.

Valve Weight: Double Solenoid 12.1 kg (26.6 lbs.)
Standard Bolt Kit: BK227

Bold: Designates Tier I products and options.

Non-bold: Designates Tier II products and options. These products will have longer lead times.

Valve Variations

Code	Description
5*	**Signal Lights – Standard**
	Signal Lights – Hirsch. (DIN with plug)
7B**	Manaplug – Brad Harrison (12x1) Micro with lights
56**	**Manaplug (Mini) with Lights**
20	Fast Response
1C**	**Manaplug (Mini) Single Sol. 5-pin, with Lights**
1D**	Manaplug (Micro) Single Sol. 5-pin, with Lights
1G**	Manaplug (Mini) Single Sol. 5-pin, with Stroke Adjust 'A' & 'B' End and Lights
1H**	Manaplug (Micro) Single Sol. 5-pin, with Stroke Adjust 'A' & 'B' End and Lights
1M	Manaplug Opposite Normal
1P	Painted Body
1R	Stroke Adjust 'A' & 'B' End with Pilot Choke Meter In
3A	**Pilot Choke Meter Out**
3B	**Pilot Choke Meter In**
3C	**Pilot Pressure Reducer**
3D	Stroke Adjust 'B' End
3E	Stroke Adjust 'A' End
3F	Stroke Adjust 'A' & 'B' End
3G*	**Pilot Choke Meter Out with Lights**
3H*	**Pilot Choke Meter In with Lights**
3J*	Pilot Pressure Reducer with Lights
3K	Pilot Choke Meter Out with Stroke Adjust 'A' & 'B' End
3L**	Pilot Choke Meter Out, Stroke Adjust 'A' & 'B' End with Lights and Manaplug — Brad Harrison Mini
3M	Pilot Choke Meter Out, Pilot Pressure Reducer, Stroke Adjust 'A' & 'B' End
3R	Pilot Choke Meter Out & Pilot Pressure Reducer
3S**	Lights, Mini Manaplug, Pilot Choke Meter Out
7Y**	M12x1 Manaplug (4-pin), Special Wiring, and Lights

* DESINA, plug-in conduit box, and DIN with plug styles only.
** Must have plug-in style conduit box.

General Description

Series D81VW directional control valves are 5-chamber, pilot operated, solenoid controlled valves. They are available in 2 or 3-position styles. These valves are manifold or subplate mounted, and conform to NFPA's D08, CETOP 8 mounting pattern.

Operation

Series D81VW pilot operated valves are standard with low shock spools and pilot orifice. The orifice can be removed if a faster shift is required. It is recommended, however, that all systems operating above 138 Bar (2000 PSI) use the standard valve to avoid severe shock.

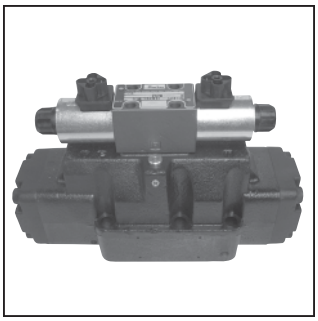
Features

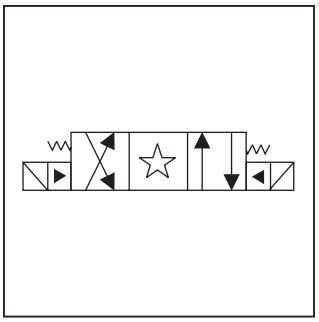
- Low pressure drop design.
- Hardened spools provide long life.
- Fast response option available.
- Wide variety of voltages and electrical connection options.
- Explosion proof availability.
- No tools required for coil removal.

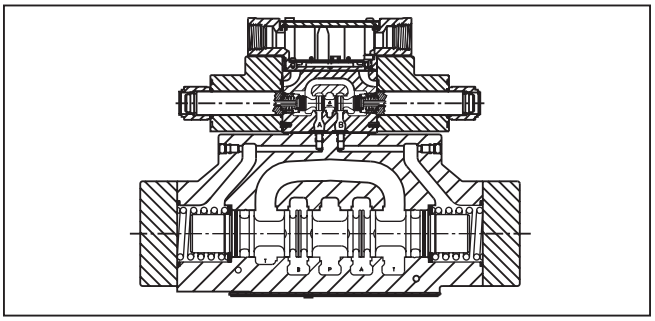
Specifications

Mounting Pattern	NFPA D08, CETOP 8, NG25
Maximum Operating Pressure	350 Bar (5000 PSI) Standard CSA 207 Bar (3000 PSI)
Maximum Tank Line Pressure	Internal Drain Model: 102 Bar (1500 PSI) AC Only 205 Bar (3000 PSI) DC Std., AC Optional External Drain Model: 350 Bar (5000 PSI) CSA 102 Bar (1500 PSI)
Maximum Drain Pressure	102 Bar (1500 PSI) AC Only 205 Bar (3000 PSI) DC Std., AC Optional CSA 102 Bar (1500 PSI)
Minimum Pilot Pressure	5.1 Bar* (75 PSI)
Maximum Pilot Pressure	350 Bar (5000 PSI) Standard CSA 207 Bar (3000 PSI)
Nominal Flow	302 LPM (80 GPM)

* 6.9 Bar (100 PSI) for spool configurations 002, 007,008, 009 & 014.







Response Time

Response times (milliseconds) are measured at 345 Bar (5000 PSI) and 300 LPM (80 GPM) with various pilot pressures as indicated.

Solenoid Type	Pilot Pressure	Pull-In		Drop-Out	
		Std	Fast	Std	Fast
DC	500	140	100	70	70
	1000	125	90	76	76
	2000	100	70	70	70
AC	500	100	60	60	60
	1000	85	50	60	60
	2000	60	30	60	60

Because of the high drain line pressure transients generated during shifting, use of the fast response option is not recommended for pilot pressures exceeding 205 Bar (2000 PSI)

Bolt Kits

For use with 3/4" Manapaks and D8 Series Directional Control Valves. All bolts are SAE grade 8, 1/2 -13 UNC-13A.

2.75 Thick Manapaks (New Style)	Bolt Kit
0	BK228
1	BK131
2	BK132

Pilot Valve with 1 Manapak:
BK400 **(M5 x 70 Metric Bolt)**

D	81V	☐	☐	☐	☐	☐	☐
Directional Control Valve	Basic Valve	Actuator	Spool	Style	Pilot Supply and Drain	Seal	Solenoid Voltage

NFPA D08, CETOP 8, DIN NG25 High Flow, D03 Pilot

Code	Description
W*	**Solenoid, Wet Pin, Screw-in**
HW*	**Reversed Wiring**

* Valve schematic symbols are per NFPA/ ANSI standards, providing flow P to A when energizing solenoid A. Note operators reverse sides for #008 and #009 spools. See installation information for details. To configure per DIN standards (A coil over A port, B coil over B port) code valves as D1VHW***.

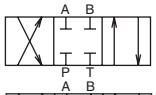
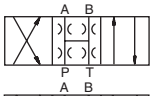
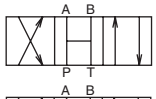
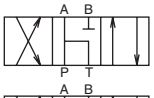
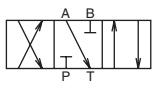
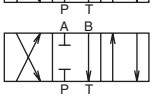
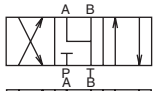
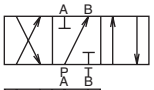
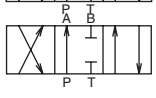
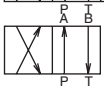
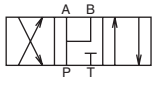
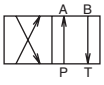
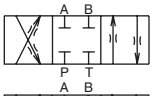
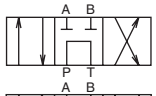
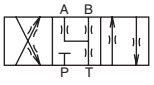
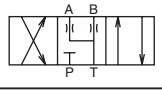
Code	Description
1	**Internal Pilot, External Drain**
2	**External Pilot, External Drain**
3	Internal Pilot w/Check, External Drain
4*	**Internal Pilot, Internal Drain**
5	**External Pilot, Internal Drain**
6	Internal Pilot w/Check, Internal Drain

* Not availble with 002, 007, 008, 009, 014 & 030 spools.

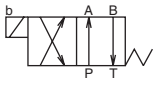
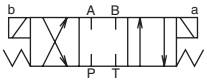
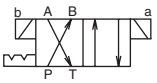
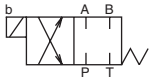
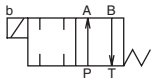
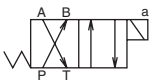
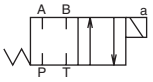
Code	Description
N	**Nitrile**
V	**Fluorocarbon**

Code	Description
A*	24/50 VAC
D	120 VDC
G	198 VDC
J	**24 VDC**
K	**12 VDC**
N**	220/50 VAC
Q*	100/60 VAC
R	24/60 VAC
T	**240/60 - 220/50 VAC**
U	98 VDC
Y	**120/60 - 110/50 VAC**
Z	250 VDC

* High Watt Coil only.
** Explosion Proof only.

Code	Symbol	Code	Symbol
001		012	
002		014	
003		015	
004		016	
005		**020***	
006		**030****	
007		**081**	
008* **009****		**082**	
011			

* 008 & 020 spool have closed crossover.
** 009 & 030 spool have open crossover.

Code	Description	Symbol
B*	**Single solenoid, 2 position, spring offset. P to A and B to T in offset position.**	
C	**Double Solenoid, 3 position, spring centered.**	
D*	**Double solenoid, 2 position, detent.**	
E	Single solenoid, 2 position, spring centered. P to B and A to T when energized.	
F**	Single solenoid, 2 position, spring offset, energized to center. Position spool spacer on A side. P to A and B to T in spring offset position.	
H*	**Single solenoid, 2 position, spring offset. P to B and A to T in offset position.**	
K	Single solenoid, 2 position, spring centered. P to A and B to T when energized.	
M**	Single solenoid, 2 position, spring offset, energized to center position. Spool spacer on B side. P to B and A to T in spring offset position.	

* Is available with 020 and 030 spools only.
** High watt coil only.

Bold: Designates Tier I products and options.

Non-bold: Designates Tier II products and options. These products will have longer lead times.

Solenoid Connection

Code	Description
C**	**Conduit Box**
D*^¤	Metric Plug (M12X1), DESINA
E†	Explosion Proof
G‡^	**Plug-In Conduit Box**
J*†	Deutsch (DT06-25)
M*†	Metri-Pack (150)
P	**DIN with Plug**
S*#†	Double Spade
W†	**DIN w/o Plug**

\# Not CSA approved.
† Not available with lights.
* DC Only.
** No variations – See Plug-in.
‡ Required for variations on Conduit Box style.
^ Must have lights.
¤ Must have Diode Surge Suppressor.

Coil Options

Code	Description
Omit	**High Watt**
D#¤	Explosion Proof, EEXD ATEX
E#¤	Explosion Proof, EEXME ATEX
F**	Low Watt
L***	8 Watt
O#¤	Explosion Proof, MSHA
U#¤	Explosion Proof, UL/CSA
X*	No Coils

* See solenoid voltage code to specify proper tube.
** AC only.
*** DC or AC Rectified only.
\# Explosion Proof – coils are 60 Hz at Std. voltage. Dual rating not available.
¤ Lights, softshift, and other options are not available on Explosion Proof coils.

Tube Options

Code	Description
Omit	**Standard Pressure 103.5 Bar (1500 PSI) AC 207 Bar (3000 PSI) DC**
H*	**High Pressure, AC only 207 Bar (3000 PSI)**

* Not available with CSA.

Manual Override Options

Code	Description
Omit	**Standard**
P	Extended with Boot
T†	None

† DC or AC Rectified only.
Manual Override options not available with Explosion Proof.

Electrical Options

Code	Description
Omit	**No Options**
J*	Diode Surge Suppressor
Z	Rectified Coil

* DC or AC Rectified only.
DIN coil must include plug with lights.

Shift Response and Indication

Code	Description
Omit	**Standard Response, No Switch**
I3	Monitor Switch, 'A' & 'B' Port End
I6	Monitor Switch, 'A' & 'B' Port Start

Note: Not CE or CSA approved.
Not available with 'F' or 'M' styles.

Approvals

Code	Description
Omit	**Standard Valve**
3*†	CSA USA (UL 429)
4*	**CSA Approved****

* Not available with AC high pressure tube.
** Valve is derated with this option.
† B, C, H styles only. J, K, Y, U voltages only with C, G, W solenoid connections only.

Valve Variations

See next page

Design Series

NOTE: Not required when ordering.

Valve Weight: Double Solenoid 19.6 kg (43.2 lbs.)
Standard Bolt Kit: BK228

Bold: Designates Tier I products and options.

Non-bold: Designates Tier II products and options. These products will have longer lead times.

Valve Variations

Code	Description
5*	**Signal Lights – Standard**
	Signal Lights – Hirsch. (DIN with plug)
7B**	Manaplug – Brad Harrison (12x1) Micro with Lights
56**	**Manaplug (Mini) with Lights**
20	**Fast Response**
1C**	**Manaplug (Mini) Single Sol. 5-pin, with Lights**
1D**	Manaplug (Micro) Single Sol. 5-pin, with Lights
1G**	Manaplug (Mini) Single Sol. 5-pin, with Stroke Adjust 'A' & 'B' End and Lights
1H**	Manaplug (Micro) Single Sol. 5-pin, with Stroke Adjust 'A' & 'B' End and Lights
1M	Manaplug Opposite Normal
1P	Painted Body
1R	Stroke Adjust 'A' & 'B' End with Pilot Choke Meter In
3A	**Pilot Choke Meter Out**
3B	**Pilot Choke Meter In**
3C	**Pilot Pressure Reducer**
3D	Stroke Adjust 'B' End
3E	Stroke Adjust 'A' End
3F	Stroke Adjust 'A' & 'B' End
3G*	**Pilot Choke Meter Out with Lights**
3H*	**Pilot Choke Meter In with Lights**
3J*	Pilot Pressure Reducer with Lights
3K	Pilot Choke Meter Out with Stroke Adjust 'A' & 'B' End
3L**	Pilot Choke Meter Out, Stroke Adjust 'A' & 'B' End with Lights and Manaplug — Brad Harrison Mini
3M	Pilot Choke Meter Out, Pilot Pressure Reducer, Stroke Adjust 'A' & 'B' End
3R	Pilot Choke Meter Out and Pilot Pressure Reducer
3S**	Lights, Mini Manaplug, Pilot Choke Meter Out
7Y**	M12x1 Manaplug (4-pin), Special Wiring, and Lights

* DESINA, plug-in conduit box, and DIN with plug styles only.
** Must have plug-in style conduit box.

Bold: Designates Tier I products and options.

Non-bold: Designates Tier II products and options. These products will have longer lead times.

General Description

Series D101VW directional control valves are 5-chamber, pilot operated, solenoid controlled valves. They are available in 2 or 3-position styles. These valves are manifold or subplate mounted, and conform to NFPA's D10, CETOP 10 mounting pattern.

Operation

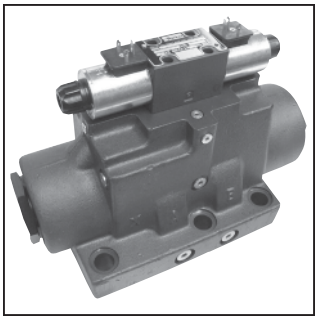
Series D101VW pilot operated valves are standard with low shock spools and pilot orifice. The orifice can be removed if a faster shift is required. However, it is recommended that all systems operating above 138 Bar (2000 PSI) use the standard valve to avoid severe shock.

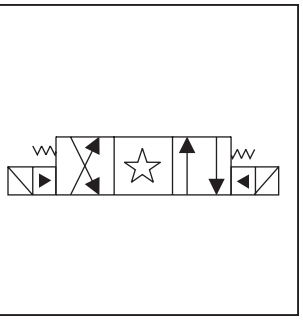
Features

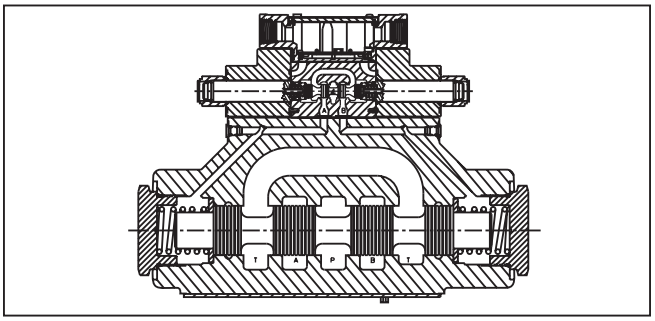
- Low pressure drop design
- Hardened spools provide long life
- Fast response option available
- Wide variety of voltags and electrical connection options
- Explosion proof availability
- No tools required for coil removal

Specifications

Mounting Pattern	NFPA D10 , CETOP 10, NG32
Maximum Operating Pressure	207 Bar (3000 PSI) Standard CSA 207 Bar (3000 PSI)
Maximum Tank Line Pressure	Internal Drain Model: 102 Bar (1500 PSI) AC Only 207 Bar (3000 PSI) DC Standard/AC Optional External Drain Model: 207 Bar (3000 PSI) CSA 102 Bar (1500 PSI)
Maximum Drain Pressure	102 Bar (1500 PSI) AC Only 207 Bar (3000 PSI) DC Standard/AC Optional CSA 102 Bar (1500 PSI)
Minimum Pilot Pressure	4.4 Bar (65 PSI)
Maximum Pilot Pressure	207 Bar (3000 PSI) Standard CSA 207 Bar (3000 PSI)
Nominal Flow	378 LPM (100 GPM)







Response Time

Response times (milliseconds) are measured at 205 Bar (3000 PSI) and 416 LPM (110 GPM) with various pilot pressures as indicated.

Solenoid Type	Pilot Pressure	Pull-In		Drop-Out	
		Std	Fast	Std	Fast
DC	500	180	170	195	195
	1000	130	125	195	195
	2000	100	95	195	195
AC	500	140	130	185	185
	1000	90	85	185	185
	2000	60	55	185	185

Because of the high drain line pressure transients generated during shifting, use of the fast response option is not recommended for pilot pressures exceeding 205 Bar (2000 PSI).

D	101V						
Directional Control Valve	Basic Valve	Actuator	Spool	Style	Pilot Supply and Drain	Seal	Solenoid Voltage

NFPA D10
CETOP 10
DIN NG32
D03 Pilot

Code	Description
W*	**Solenoid, Wet Pin, Screw-in**
HW*	**Reversed Wiring**

* Valve schematic symbols are per NFPA/ANSI standards, providing flow P to A when energizing solenoid A. Note operators reverse sides for #008 and #009 spools. See installation information for details. To configure per DIN standards (A coil over A port, B coil over B port) code valves as D1VHW***.

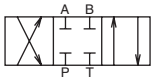
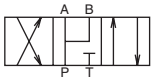
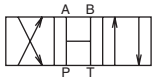
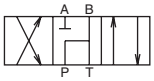
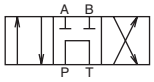
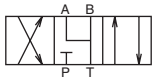
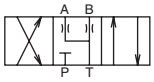
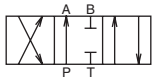
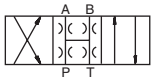
Code	Description
1	**Internal Pilot, External Drain**
2	**External Pilot, External Drain**
3	Internal Pilot w/Check, External Drain
4#	**Internal Pilot, Internal Drain**
5	**External Pilot, Internal Drain**
6	Internal Pilot w/Check, Internal Drain

\# Not available with 002, 007, 008 and 009 spools.

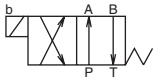
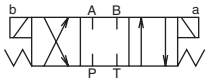
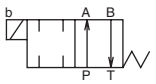
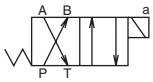
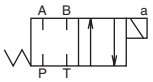
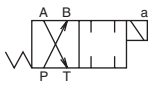
Code	Description
N	**Nitrile**
V	**Fluorocarbon**

Code	Description
A*	24/50 VAC
D	120 VDC
G	198 VDC
J	**24 VDC**
K	**12 VDC**
N**	220/50 VAC
Q*	100/60 VAC
R	24/60 VAC
T	**240/60 - 220/50 VAC**
U	98 VDC
Y	**120/60 - 110/50 VAC**
Z	250 VDC

* High Watt only.
** Explosion Proof only.

Code	Symbol	Code	Symbol
001		006	
002		007	
003		**008*** **009****	
004		011	
005		012	

* 008 spool has closed crossover.
** 009 spool has open crossover.

Code	Description	Symbol
B*	**Single solenoid, 2 position, spring offset. P to A and B to T in offset position.**	
C	**Double Solenoid, 3 position, spring centered.**	
D*	**Double solenoid, 2 position, detent.**	
E	Single solenoid, 2 position, spring centered. P to B and A to T when energized.	
F	Single solenoid, 2 position, spring offset, energized to center. Position spool spacer on A side. P to A and B to T in spring offset position.	
H*	**Single solenoid, 2 position, spring offset. P to B and A to T in offset position.**	
K	Single solenoid, 2 position, spring centered. P to A and B to T when energized.	
M	Single solenoid, 2 position, spring offset, energized to center position. Spool spacer on B side. P to B and A to T in spring offset position.	

* Is available with 001, 002, 004 and 011 spools only.

Bold: Designates Tier I products and options.

Non-bold: Designates Tier II products and options. These products will have longer lead times.

Solenoid Connection

Code	Description
C**	**Conduit Box**
D*^¤	Metric Plug (M12X1), DESINA
E†	Explosion Proof
G‡^	**Plug-In Conduit Box**
J*†	Deutsch (DT06-25)
M*†	Metri-Pack (150)
P	**DIN with Plug**
S*#†	Double Spade
W†	**DIN w/o Plug**

\# Not CSA approved.
† Not available with lights.
* DC Only.
** No variations – See Plug-in.
‡ Required for variations on Conduit Box style.
^ Must have lights.
¤ Must have Diode Surge Suppressor.

Coil Options

Code	Description
Omit	**High Watt**
D#¤	Explosion Proof, EEXD ATEX
E#¤	Explosion Proof, EEXME ATEX
F**	Low Watt
L***	8 Watt
O#¤	Explosion Proof, MSHA
U#¤	Explosion Proof, UL/CSA
X*	No Coils

* See solenoid voltage code to specify proper tube.
** AC only.
*** DC or AC Rectified only.
\# Explosion Proof – coils are 60 Hz at Std. voltage. Dual rating not available.
¤ Lights, softshift, and other options are not available on Explosion Proof coils.

Tube Options

Code	Description
Omit	**Standard Pressure 103.5 Bar (1500 PSI) AC 207 Bar (3000 PSI) DC**
H*	**High Pressure, AC only 207 Bar (3000 PSI)**

* Not available with CSA.

Manual Override Options

Code	Description
Omit	**Standard**
P	Extended with Boot
T*	None

* DC or AC Rectified only. Manual Override options not available with Explosion Proof.

Electrical Options

Code	Description
Omit	**No Options**
J*	Diode Surge Suppressor
Z	Rectified Coil

* DC or AC Rectified only.
DIN coil must include plug with lights.

Shift Response and Indication

Code	Description
Omit	**Standard Response, No Switch**
I3	Monitor Switch, 'A' & 'B' Port End
I6	Monitor Switch, 'A' & 'B' Port Start

Note: Not CE or CSA approved.
Not available with 'F' or 'M' styles.

Approvals

Code	Description
Omit	**Standard Valve**
3*†	CSA USA (UL 429)
4*	**CSA Approved**

* Not available with AC high pressure tube.
† B, C, H styles only. J, K, Y, U voltages only with C, G, W solenoid connections only.

Valve Variations

See next page

Design Series

NOTE: Not required when ordering.

Valve Weight: Double Solenoid 35.0 kg (77.1 lbs.)
Standard Bolt Kit: BK229

Bold: Designates Tier I products and options.

Non-bold: Designates Tier II products and options. These products will have longer lead times.

Valve Variations

Code	Description
5*	**Signal Lights – Standard**
	Signal Lights – Hirsch. (DIN with plug)
7B**	Manaplug – Brad Harrison (12x1) Micro with Lights
56**	**Manaplug (Mini) with Lights**
20	**Fast Response**
1C**	**Manaplug (Mini) Single Sol. 5-pin, with Lights**
1D**	Manaplug (Micro) Single Sol. 5-pin, with Lights
1G**	Manaplug (Mini) Single Sol. 5-pin, with Stroke Adjust 'A' & 'B' End and Lights
1H**	Manaplug (Micro) Single Sol. 5-pin, with Stroke Adjust 'A' & 'B' End and Lights
1M	Manaplug Opposite Normal
1P	Painted Body
1R	Stroke Adjust 'A' & 'B' End with Pilot Choke Meter In
3A	**Pilot Choke Meter Out**
3B	**Pilot Choke Meter In**
3C	**Pilot Pressure Reducer**
3D	Stroke Adjust 'B' End
3E	Stroke Adjust 'A' End
3F	Stroke Adjust 'A' & 'B' End
3G*	**Pilot Choke Meter Out with Lights**
3H*	**Pilot Choke Meter In with Lights**
3J*	Pilot Pressure Reducer with Lights
3K	Pilot Choke Meter Out with Stroke Adjust 'A' & 'B' End
3L**	Pilot Choke Meter Out, Stroke Adjust 'A' & 'B' End with Lights and Manaplug — Brad Harrison Mini
3M	Pilot Choke Meter Out, Pilot Pressure Reducer, Stroke Adjust 'A' & 'B' End
3R	Pilot Choke Meter Out and Pilot Pressure Reducer
3S**	Lights, Mini Manaplug, Pilot Choke Meter Out
7Y**	M12x1 Manaplug (4-pin), Special Wiring, and Lights

* DESINA, plug-in conduit box, and DIN with plug styles only.
** Must have plug-in style conduit box.

Bold: Designates Tier I products and options.

Non-bold: Designates Tier II products and options. These products will have longer lead times.

Offer of Sale

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2. Payment: Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that the Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

3. Delivery: Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

4. Warranty: Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 18 months from date of shipment from Parker Hannifin Corporation. **THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO ITEMS PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED. NOTWITHSTANDING THE FOREGOING, THERE ARE NO WARRANTIES WHATSOEVER ON ITEMS BUILT OR ACQUIRED WHOLLY OR PARTIALLY, TO BUYER'S DESIGNS OR SPECIFICATIONS.**

5. Limitation Of Remedy: SELLER'S LIABILITY ARISING FROM OR IN ANY WAY CONNECTED WITH THE ITEMS SOLD OR THIS CONTRACT SHALL BE LIMITED EXCLUSIVELY TO REPAIR OR REPLACEMENT OF THE ITEMS SOLD OR REFUND OF THE PURCHASE PRICE PAID BY BUYER, AT SELLER'S SOLE OPTION. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, INCLUDING BUT NOT LIMITED TO LOST PROFITS ARISING FROM OR IN ANY WAY CONNECTED WITH THIS AGREEMENT OR ITEMS SOLD HEREUNDER, WHETHER ALLEGED TO ARISE FROM BREACH OF CONTRACT, EXPRESS OR IMPLIED WARRANTY, OR IN TORT, INCLUDING WITHOUT LIMITATION, NEGLIGENCE, FAILURE TO WARN OR STRICT LIABILITY.

6. Changes, Reschedules and Cancellations: Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require.

7. Special Tooling: A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

8. Buyer's Property: Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property, Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Taxes: Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

10. Indemnity For Infringement of Intellectual Property Rights: Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. Patents, U.S. Trademarks, copyrights, trade dress and trade secrets (hereinafter 'Intellectual Property Rights'). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights. If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

11. Force Majeure: Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter 'Events of Force Majeure'). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.

12. Entire Agreement/Governing Law: The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of the sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues. 9/91-P

Parker Safety Guide for Selecting and Using Hydraulic Valves and Related Accessories

WARNING: Failure or improper selection or improper use of Parker Hydraulic Valve Division (HVD) Valves or related accessories ("Products") can cause death, personal injury and property damage. Possible consequences of failure or improper use of these Products include but are not limited to:

- Valves or parts thereof thrown off at high speed
- High velocity fluid discharge
- Explosion or burning of the conveyed fluid
- Contact with suddenly moving or falling objects controlled by the Valve
- Injections by high-pressure fluid discharge
- Contact with fluid that may be hot, cold, toxic or otherwise injurious
- Injuries resulting from injection, inhalation or exposure to fluids
- Injury from handling a heavy item (dropped, awkward lift)
- Electric shock from improper handling of solenoid connections
- Injury from slip or fall on spilled or leaked fluid

Before selecting or using any of these Products, it is important that you read and follow the instructions below. In general, the Products are not approved for in-flight aerospace applications. Consult the factory for the few that are FAA approved.

1.-1 GENERAL INSTRUCTIONS

1.1 **Scope**: This safety guide provides instructions for selecting and using (including assembling, installing and maintaining) these Products. For convenience all items in this guide are called "Valves". This safety guide is a supplement to and is to be used in conjunction with the specific Parker catalogs for the specific Valves and/or accessories being considered for use. See item 1.6 below for obtaining those catalogs.

1.2 **Fail-Safe:** Valves can and do fail without warning for many reasons. Design all systems and equipment in a fail-safe mode, so that failure of the Valve or Valve Assembly will not endanger persons or property.

1.3 **Safety Devices:** Never disconnect, override, circumvent or otherwise disable any safety lockout on any system whether powered by HVD Valves or any motion control system of any manufacturer. (e.g. Automatic shut-off on a riding lawn mower should the operator get out of the seat).

1.4 **Distribution:** Provide a copy of this safety guide to each person that is responsible for selecting or using HVD Valve Products. Do not select HVD Valves without thoroughly reading and understanding this safety guide as well as the specific Parker catalogs for the Products considered or selected.

1.5 **User Responsibility:** Due the wide variety of operating conditions and applications for Valves, HVD and its distributors do not represent or warrant that any particular Valve is suitable for any specific system. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The user, through its own analysis and testing is solely responsible for:

- Making the final selection of the Valve
- Assuring that the user's requirements are met and that the application presents no health or safety hazards.
- Providing all appropriate health and safety warnings on the equipment on which the Valves are used.
- Assuring compliance with all applicable government and industry standards.

1.6 **Additional Questions:** Call the appropriate Parker technical service department if you have any questions or require any additional information. See the Parker publication for the product being considered or used, or call 1-800-CPARKER, or go to www.parker.com , for the telephone numbers of the appropriate technical service department. For additional copies of this or any other Parker Safety Guide go to www.parker.com and click on the safety button on the opening page. Catalogs and/or catalog numbers for the various HVD Valve Products can be obtained by calling HVD at 440-366-5100. Phone numbers and catalog information is also available on the Parker website, www.parker.com .

2.0 VALVE SELECTION INSTRUCTIONS

2.1 **Pressure:** Valve selection must be made so that the maximum working pressure of the Valve is equal to or greater than the maximum system pressure. Surge, impulse or peak transient pressures in the system must be below the maximum working pressure of the Valve. Surge, impulse and peak pressures can usually be determined by sensitive electrical instrumentation that measures and indicates pressures at millisecond intervals. Mechanical pressure gauges indicate only average pressure and cannot be used to determine surge, impulse or peak transient pressures. Burst pressure ratings if given or known are for manufacturing purposes only and are not an indication that the Product can be used in applications at the burst pressure or otherwise above the maximum working pressure.

2.2 **Temperature:** The fluid temperature must be regulated or controlled so that the operating viscosity of the fluid is maintained at a level specified for the particular Valve product. Such ranges are given in the product catalogs or can be obtained from the appropriate customer service department for the particular Valve product.

2.3 **Fluid Compatibility:** The fluid conveyed in Valves has direct implications on the Valve selection. The fluid must be chemically compatible with the Valve component materials. Elastomer seals, brass, cast iron, aluminum for example all are potentially affected by certain fluids. Additionally, fluid selection affects the performance of various Valves. Considerations relative to fluid selection are outlined in the specific HVD Valve product catalog. Of particular importance is that the fluid be for hydraulic use, contain the proper additives and wear inhibitors. See 1.6 "Additional Questions" above for information to obtain such HVD catalogs.

2.4 **Changing Fluids:** If a system requires a different fluid, it should be done with the guidance in number 2.3 above. Additionally, it may be necessary to flush the system (including the Valves) to remove any of the previous fluid. Consult the Parker Valve Division for guidance.

2.5 **Size:** Transmission of power by means of pressurized fluid varies with pressure and rate of flow. The size of the components must be adequate to keep pressure losses to a minimum and avoid damage due to heat generation or excessive fluid velocity.

2.6 **Placement:** Installation of Valves must take into account the orientation of the Valve and the proximity of the Valve to other parts of the system. This includes but is not limited to closeness to hot and cold areas, access for servicing and operation as well as orientation for proper connectors.

2.7 **Ports:** Connection of Valves in systems can be by threaded ports, sub-base surfaces, flanges and manifolds. In all cases, the proper fitting, surface or mounting hardware must be selected to properly seal and contain the system fluid so as to avoid the adverse conditions listed in the initial warning box above. Specifically, if using threaded ports, the designer must make sure that the mating fitting is of the compatible thread. Also, the instructions provided by the connector hardware supplier must be read and understood so as to properly assemble the connector. The Parker Safety Guide for using Hose, Tubing and Fittings and Related Accessories is but one reference to this end.

2.8 **Environment:** Care must be taken to insure that the Valve and Valve Assemblies are either compatible with or protected from the environment (that is, surrounding conditions) to which they are exposed. Environmental conditions including but not limited to ultraviolet radiation, sunlight, heat, ozone, moisture, water, salt water, chemicals and air pollutants can cause degradation and premature failure.

2.9 **Electric Power:** For Valves requiring electric power for control, it is imperative that the electricity be delivered at the proper voltage, current and wattage requirements. To obtain the proper control requirements please refer to the respective Parker product catalog for the specific Valve that is intended for use. If further guidance is required, call the appropriate technical service department identified in the respective Parker product catalog.

2.10 **Specifications and Standards:** When selecting Valves, government, industry and Parker specifications and recommendations must be reviewed and followed as applicable.

2.11 **Accessories:** All accessories used in conjunction with any Parker Valve product must be rated to the same requirements of the Valve including but not limited to pressure, flow, material compatibility, power requirements. All of these items must be examined as stated in the "VALVE INSTALLATION INSTRUCTIONS" paragraph 3.0.

(continued on next page)

3.0 VALVE INSTALLATION INSTRUCTIONS

3.1 **Component Inspection:** Prior to use, a careful examination of the Valve(s) must be performed. The Valve intended for use must be checked for correct style, size, catalog number and external condition. The Valve must be examined for cleanliness, absence of external defects or gouges, cracked or otherwise deformed parts or missing items. The mounting surface or port connections must be protected and free of burrs, scratches, corrosion or other imperfections. Do NOT use any item that displays any signs of nonconformance. In addition, any accessory including but not limited to fittings, bolt kits, hoses, sub bases, manifolds, and electrical connectors must be subjected to the same examination.

3.2 **Handling Valves:** Many Valves whether HVD Valves or of another manufacturer can be large, bulky or otherwise difficult to handle. Care must be taken to use proper lifting techniques, tools, braces, lifting belts or other aids so as not to cause injury to the user, any other person or to property.

3.3 **Filtration:** Fluid cleanliness is a necessity in any hydraulic system. Fluid filters must be installed and maintained in the system to provide the required level of fluid cleanliness. Filters can be placed in the inlets, pressure lines and return lines. The level of cleanliness required is specified in the HVD product catalog for the specific Valve(s) selected or intended for use. For additional information on Filter selection contact Parker Filter Division at 800-253-1258 or 419-644-4311.

3.4 **Servo Valves:** Application of Servo Valves in general requires knowledge and awareness of "closed loop control theory" and the use of electronic controls for successful and safe operation. Individuals who do not have such experience or knowledge must gain training before use of such Products. Parker offers both classroom training as well as manuals to assist in gaining this knowledge. These aids can be obtained by contacting Hydraulic Valve Division at 440-366-5100, calling the general Parker help line 800-CPARKER or going to the Parker web site at www.parker.com.

3.5 **Accessory Ratings:** All accessories used in combination with the selected or intended Valve product must be rated and compatible with the selected Valve. Specifically, the items must be of equal or greater rating including but not limited to pressure, flow, power, size, port style, thread connectors and material.

3.6 **Connection Styles:** It is the responsibility of the user of the Parker product to properly select connectors and accessories that match the connections on the sub plate, Valve, flange or threaded connection or manifold. It is also the responsibility of the installer to possess adequate skill and knowledge including but not limited to thread preparation, torque technique, hose assembly and inspection, tube preparation and assembly, and fitting installation. Parker Tube Fitting Division (www.parker.com/tfd) catalog 4300 and Parker Hose Products (www.parkerhose.com) catalog 4400 describe some basic technical information relative to proper fitting assembly.

3.7 **Electrical Connections:** All electrical connections must be made to the applicable codes and local safety requirements.

3.8 **Gauges and Sensors:** The user must install sufficient gauges and sensors in the system so as to be able to determine the condition of the system. This includes but is not limited to pressure gauges, flow meters, temperature sensors and site gauges. These are of utmost importance should removal or disassembly of a Valve, portion of a Valve or portion of the system become necessary. Refer to "VALVE MAINTENANCE AND REPLACEMENT INSTRUCTIONS" for details and especially item 4.8.

3.9 **System Checkout:** Once installed, the Valve installation must be tested to insure proper operation and that no external leakage exists. All safety equipment must be in place including but not limited to safety glasses, helmets, ear protection, splash guards, gloves, coveralls and any shields on the equipment. All air entrapment must be eliminated and the system pressurized to the maximum system pressure (at or below the Valve maximum working pressure) and checked for proper function and freedom from leaks. Personnel must stay out of potentially hazardous areas while testing and using.

4.0 VALVE MAINTENANCE AND REPLACEMENT INSTRUCTIONS

4.1 **Maintenance Program:** Even with proper installation, Valves and Valve System life may be significantly reduced without a continuing maintenance program. The severity of the application and risk potential must determine the frequency of the inspection and the replacement of the Products so that Products are replaced before any failure occurs. A maintenance program must be established and followed by the user and, at a minimum, must include instructions 4.2 through 4.10. An FMEA (Failure Mode and Effects Analysis) is recommended in determining maintenance requirements.

4.2 **Visual Inspection-Valves:** Any of the following conditions require immediate shut down and replacement of the Valve.

- Evidence that the Valve is in partial dis-assembly.
- Visible crack or suspicion of a crack in the Valve housing or bent, cracked or otherwise damaged solenoid.
- Missing or partially extending drive pin on a flow control knob.
- Missing, loose components, obstructions or other condition impeding the motion or function of the manual knob, lever, foot pedal or other mechanical operator of a hydraulic Valve.
- Any evidence of burning or heat induced discoloration.
- Blistered, soft, degraded or loose cover of any kind.
- Loose wire or electrical connector.

4.3 **Visual Inspection-Other:** The following conditions must be tightened, repaired, corrected or replaced as required.

1. Fluid on the ground must be cleaned immediately. Also, the source of the fluid must be determined prior to running the equipment again.
2. Leaking port or excessive external dirt build-up.
3. System fluid level is too low or air is entrapped or visible in the reservoir.
4. Equipment controlled by the Valve or Valve assembly has been losing power, speed, efficiency

4.4 **Filter Maintenance:** System filters must be maintained and kept in proper working order. The main service requirement is periodic replacement of the filter element or screen. Contact Parker Filter Division at 800-253-1258 or 419-644-4311 for further filter maintenance details.

4.5 **Functional Test:** See "System Checkout" number 3.9 above in "VALVE INSTALLATION INSTRUCTIONS".

4.6 **Replacement Intervals:** Valves and Valve Systems will eventually age and require replacement. Seals especially should be inspected and replaced at specific replacement intervals based on previous experience, government or industry recommendations, or when failures could result in unacceptable downtime, damage or injury risk. At a minimum seals must be replaced whenever service is rendered to a Valve product.

4.7 **Adjustments, Control Knobs, and Other Manual Controls:** System Pressure and Flow are typically adjusted by knobs and/or handles. A set-screw or lock-nut secures the adjustment device so as to maintain the desired setting. This set-screw or lock-nut must first be loosened prior to making any adjustments and re-tightened after adjustment on the HVD Valve. All adjustments must be made in conjunction with pressure gauges and/or flow meters (or by watching the speed of the actuator in the case of setting flow only). See paragraph "Gauges and Sensors" above in the section "VALVE INSTALLATION INSTRUCTIONS'. Under no circumstances should any control knob, adjustment stem, handle, foot pedal or other actuating device be forced beyond the mechanical stop(s) on the Valve. For example, the Parker Safety Notice Bulletin **HY14-3310-B1/US** for HVD Colorflow Valves specifically restricts the adjustment torque to "hand adjust" or "less than 10 ft/lbs" if it cannot be adjusted by hand. Failure to adhere to this may force the knob beyond the stop point allowing it to be ejected at high speed resulting in death, personal injury and property damage. For complete safety instructions on HVD Colorflow Valves, copies of Safety Notice **Bulletin HY14-3310-B1/US** can be obtained directly from the Hydraulic Valve Division at 440-366-5100 or from the Parker web site at www.parker.com by selecting the "Safety" button. Parker help line 800-CPARKER is on call 24/7 as well should there be any question about the use of a HVD Valve. Additionally, when making adjustments, always adjust the Valve with all parts of your body to the side of the Valve (that is, the knob is not pointing toward you or anyone else).

4.8 **High pressure Warning:** Hydraulic power is transmitted by high-pressure fluids through hoses, fittings and valves, pumps and actuators. This condition can be dangerous and potentially lethal and, therefore, extreme caution must be exercised when working with fluids under pressure. From time to time, hoses, Valves, tubes or fittings fail if they are not replaced at proper time intervals. Typically these failures are the result of some form of misapplication, abuse, wear, or failure to perform proper maintenance. When such failure occurs, generally the high pressure fluid inside escapes in a stream which may or may not be visible to the user. Under no circumstances should the user attempt to locate the leak by "feeling" with their hands or any other part of their body. High-pressure fluids can and will penetrate the skin and cause severe tissue damage and possible loss of limb or life. Even seemingly minor hydraulic fluid injection injuries must be treated immediately by a physician with knowledge of the tissue damaging properties of hydraulic fluid.

If a hose, tube, fitting or Valve failure occurs, immediately shut down the equipment and leave the area until pressure has been completely released from the system. Simply shutting down the pump may or may not eliminate the pressure in the system. It may take several minutes or even hours for the pressure to be relieved so that the leak area can be examined safely. Once the pressure has been reduced to zero, the suspected leaking item can be taken off the equipment and examined. It must always be replaced if a failure has occurred. Never attempt to patch or repair a connector (especially a hose) or Valve that has failed. Consult the nearest Parker distributor or the appropriate Parker division for component replacement information. Never touch or examine a failed hydraulic component unless it is obvious that the item no longer contains fluid under pressure.

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Parker Hannifin Corporation

About Parker Hannifin Corporation

Parker Hannifin is a leading global motion-control company dedicated to delivering premier customer service. A Fortune 500 corporation listed on the New York Stock Exchange (PH), our components and systems comprise over 1,400 product lines that control motion in some 1,000 industrial and aerospace markets. Parker is the only manufacturer to offer its customers a choice of hydraulic, pneumatic, and electromechanical motion-control solutions. Our Company has the largest distribution network in its field, with over 7,500 distributors serving nearly 400,000 customers worldwide.

Parker's Charter

To be a leading worldwide manufacturer of components and systems for the builders and users of durable goods. More specifically, we will design, market and manufacture products controlling motion, flow and pressure. We will achieve profitable growth through premier customer service.

Product Information

North American customers seeking product information, the location of a nearby distributor, or repair services will receive prompt attention by calling the Parker Product Information Center at our toll-free number: 1-800-C-PARKER (1-800-272-7537). In Europe, call 00800-C-PARKER-H (00800-2727-5374).

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Catalog HY14-2502-B1/US,
8/07, PHD