Series DY Servovalves

Flapper - Nozzle Style

Catalog HY14-1483/US

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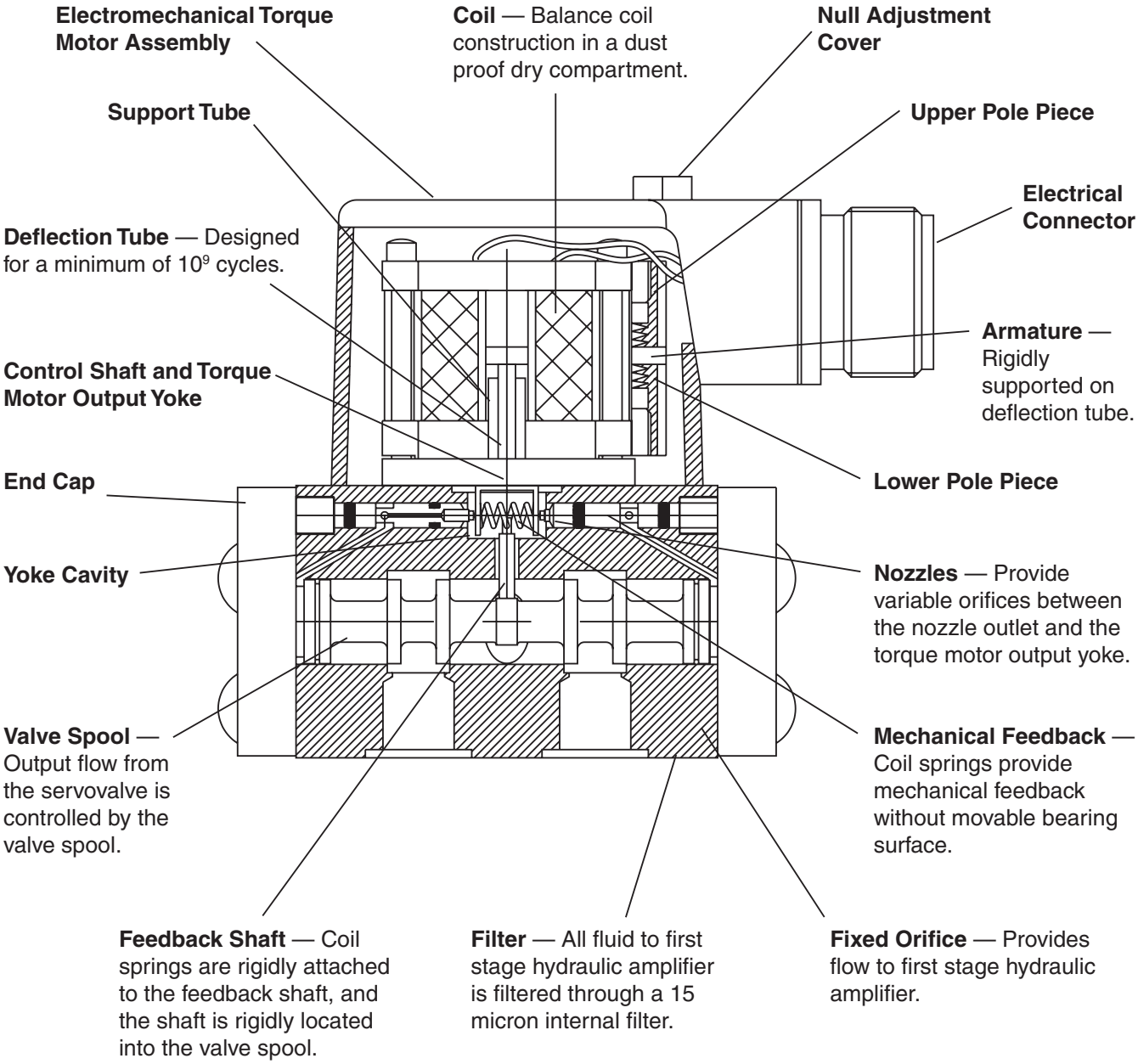
SAFETY GUIDE

For safety information, see Safety Guide SG HY14-1000 at www.parker.com/safety or call 1-800-CParker.

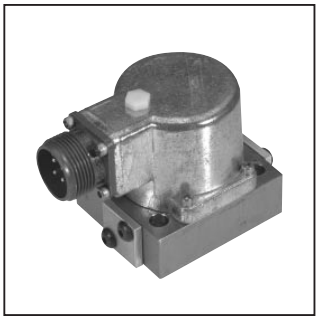
Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

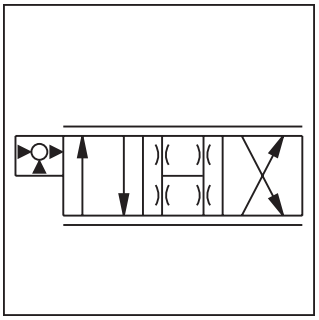
Typical Electrohydraulic Servovalve Design Features



General Description

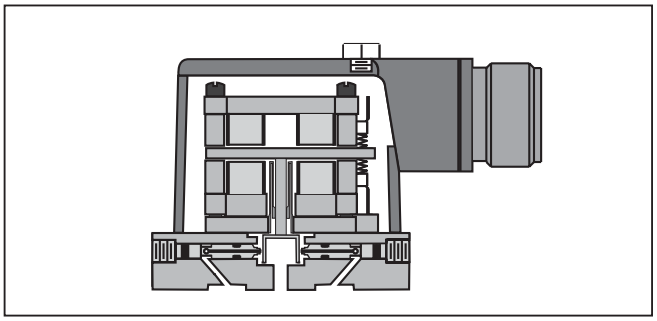
Series DY1S are open center, single stage differential pressure control valves. They are operated by a current driven torque motor. These valves controls the pressure difference between the two actuator ports, C1 and C2, by varying the resistance to flow through their nozzles.





Features

- No mechanical wear points.
- High frequency response.
- Nozzle and flapper design.
- Versatile 21.59 mm (0.850 in.) port circle, can mount to standard 19.81 mm (0.780 in.) and 23.62 mm (0.930 in.) port circle patterns.



Specifications

Flow Rating @ 90 Bar (1300 PSI)	0.4 LPM (0.1 GPM)
Quiescent Flow @ 90 Bar (1300 PSI)	1.3 – 1.9 LPM (0.3 – 0.5 GPM)
Supply Pressure	7 – 90 Bar (100 – 1300 PSI)
Tank Port Pressure	90 Bar (1300 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 100 Hz
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	 ≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	1% minimum
Step Response	10 – 90%, < 5 ms
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY1S

Series

Description
0.4 LPM (0.1 GPM)
90 Bar (1300 PSI)

Material Options

Code	Description
A	Standard
Z	Special (specify)

Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
F	80 ohm	80 mA	40 mA
L	360 ohm	30 mA	15 mA
M	475 ohm	40 mA	20 mA
R	650 ohm	30 mA	15 mA
T	1000 ohm	10 mA	5 mA
V	1200 ohm	40 mA	20 mA
Z	Special (specify)		

Wiring

Code	Description
C	Standard
Z	Special

Seals

Code	Description
N	Nitrile
V	Fluorocarbon (standard)
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

Factory Code for Special Options

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0500

Subplate: 55-0100-2 SAE-6 Side ports

Null Adjust Tool: 27-0210

Electronic Drivers: 23-5030, 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.
* For output currents >15 mA

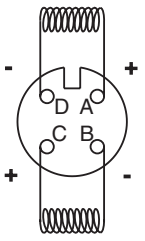
Special Options:

Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals

Weight: 0.5 kg (1.2 lbs.)

Wiring Option C
(Standard)

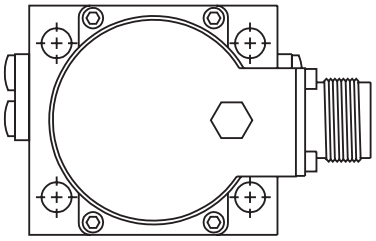


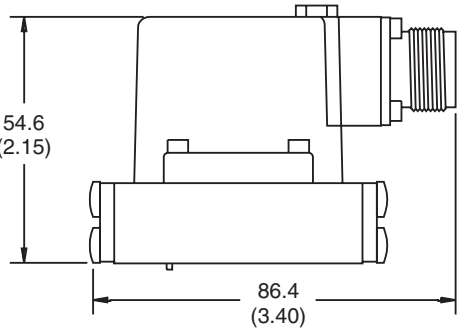
Polarity shown connects
P to C2 port.

Flushing valve is rated for 3000 psi operation.

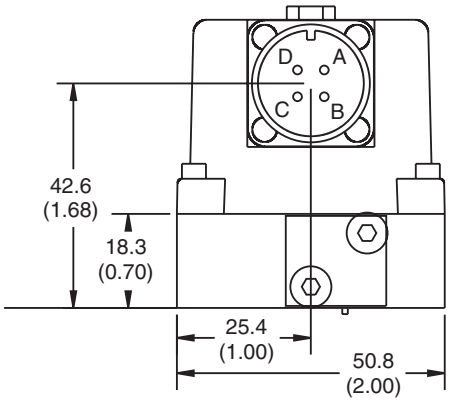
Dimensions

Inch equivalents for millimeter dimensions are shown in (**)

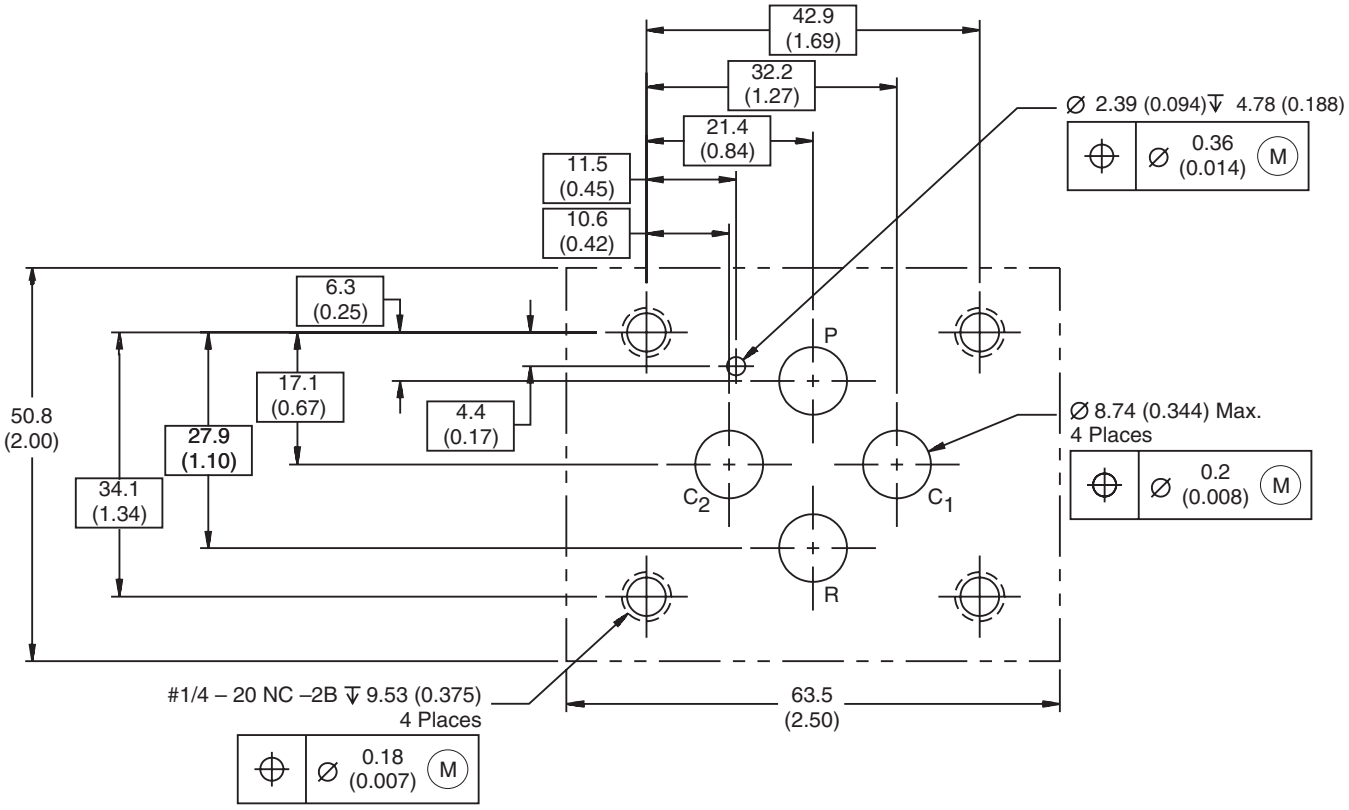




Connector over C1 port



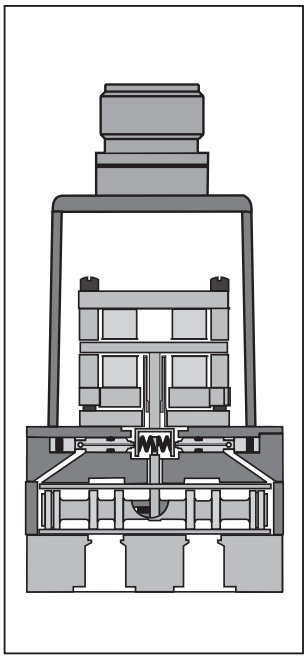
Mounting Interface

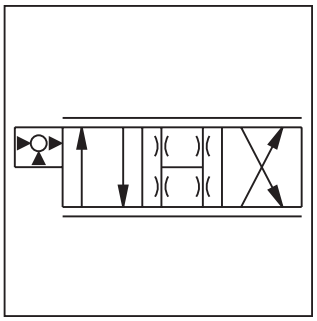


General Description

Series DY3H and DY6H are two stage, 4-way, high frequency, closed center servovalves, with mechanical spool position feedback. These valves use a flapper and nozzle type, torque motor driven pilot stage to drive the sliding spool second stage. The unique rigid pin feedback design avoids ball glitch problems, which can occur in other types of servovalves.

The DY3H and DY6H offer a compact, lower cost alternative without sacrificing performance in systems operating at 105 Bar (1500 PSI) or less.





Features

- Precision lapped spool and sleeve.
- No ball glitch.
- High frequency response.
- Nozzle and flapper design.
- Adapters available for mounting to D03 or ISO port patterns.

Specifications

Flow Rating @ 70 Bar (1000 PSID)	11 and 22 LPM (3 and 6 GPM)
Supply Pressure	10 – 105 Bar (145 – 1500 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	1.3 – 1.9 LPM (0.3 – 0.5 GPM)
Tank Port Pressure	105 Bar (1500 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 190 Hz (See Performance Curves)
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	 ≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% minimum, 70% maximum
Step Response	10 – 90%, < 6 ms for DY3H < 8 ms for DY6H
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

Series

Code
DY3H
DY6H

Material Options

Code	Description
A	Standard
Z	Special (specify)

Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
L	360 ohm	30 mA	15 mA
M	475 ohm	40 mA	20 mA
R	650 ohm	30 mA	15 mA
T	1000 ohm	10 mA	5 mA
V	1200 ohm	40 mA	20 mA
Z	Special (specify)		

Wiring

Code	Description
C	Standard
Z	Special

Seals

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

Operating Pressure: **E**

Code	Description
E	105 Bar (1500 PSI)

Flows

Code	Description
3	11 LPM (3 GPM)
6 *	22 LPM (6 GPM)

* 6 GPM for DY6H only

Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

Factory Code for Special Options

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0300

Subplate: 55-0100-2 SAE-6 Side ports

Null Adjust Tool: 27-0210

Electronic Drivers: 23-5030, 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.
* For output currents >15 mA

Special Options:

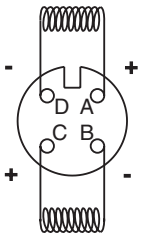
Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals

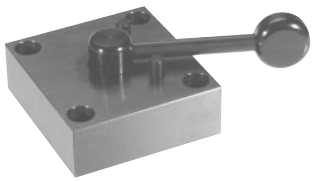
Weight:

DY3H	0.34 kg (0.56 lbs.)
DY6H	0.34 kg (0.56 lbs.)

Wiring Option C
(Standard)



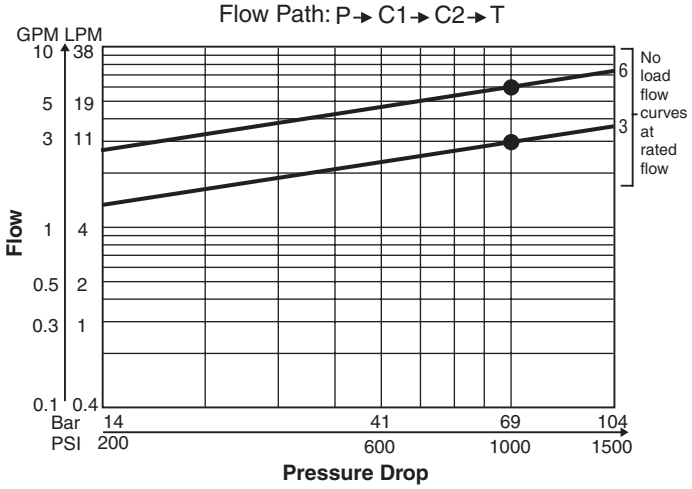
Polarity shown connects
P to C2 port.



Flushing valve is rated for 3000 psi operation.

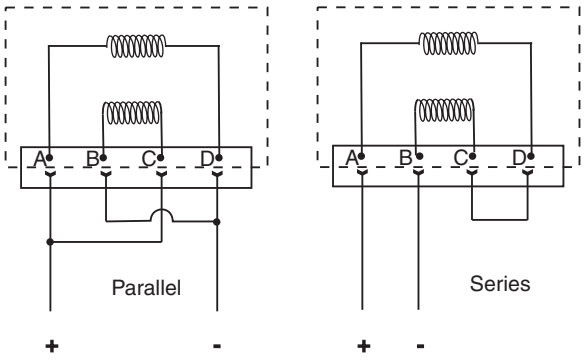
Performance Curves

Flow vs. Pressure Drop
at 100% command
Flow Path: P→ C1→ C2→ T



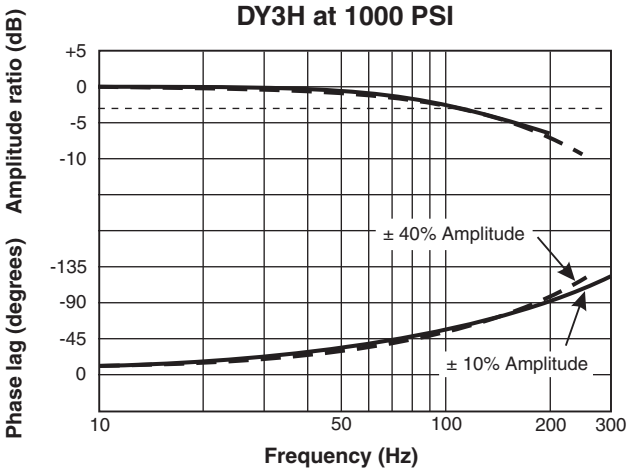
Installation Wiring Options

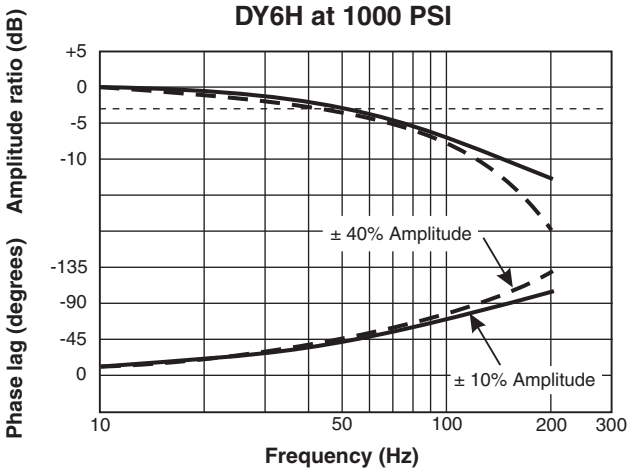
This servovalve has two coils. This illustration shows the internal wiring configurations for these valves. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustration below and to the mounting pattern for this valve to insure proper control phasing.



Polarity shown connects flow from P to C2 port.

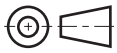
Frequency Response

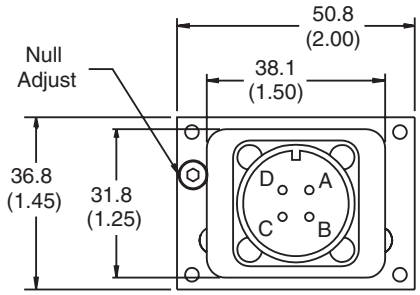


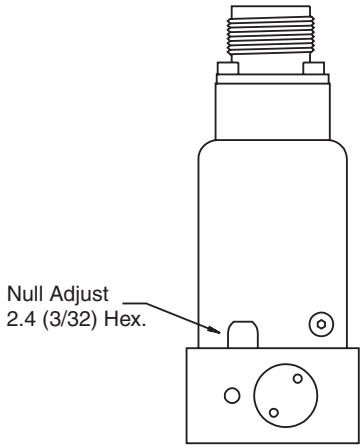


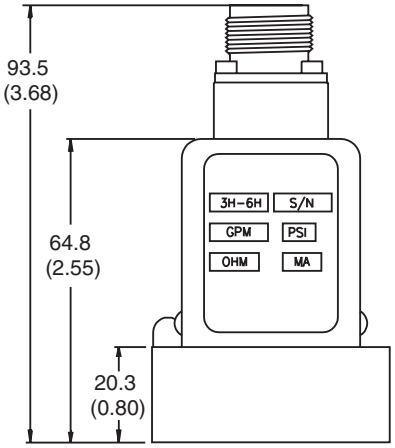
Dimensions

Inch equivalents for millimeter dimensions are shown in (**)

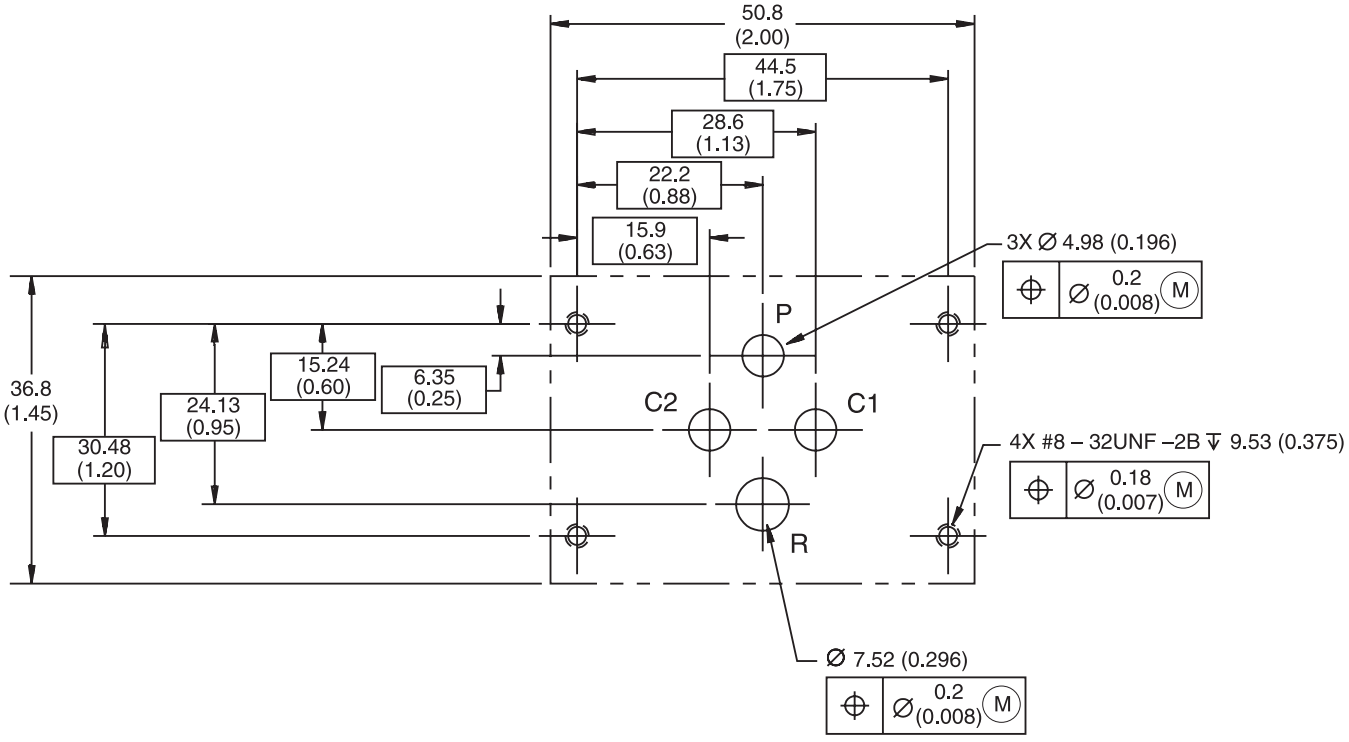








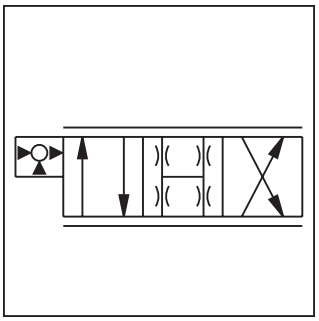
Mounting Interface

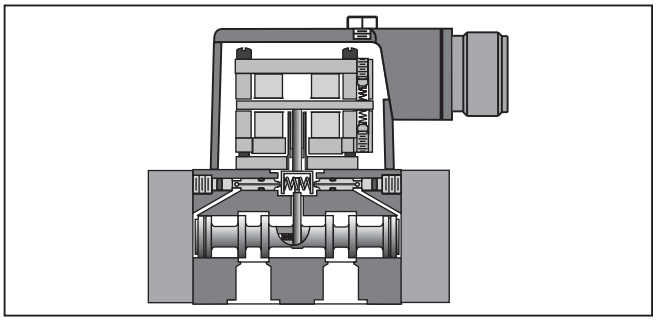


General Description

Series DY01 are two stage, 4-way, flapper and nozzle style servovalves. The DY01 servovalve combines a spool and sleeve construction, and a high frequency torque motor, for optimal performance. The unique rigid pin feedback design avoids ball glitch problems, which can occur in other types of servovalves. This valve is rated for 210 Bar (3000 PSI) standard, or can be built for 350 Bar (5000 PSI) service. The pressure ratings are the same for both the tool steel construction or the optional stainless steel spool and body.

The DY01 servovalve was specially designed for high precision flight simulator applications.





Features

- Precision lapped spool and sleeve.
- No ball glitch.
- Tool steel, or stainless steel, spool and body.
- Versatile 21.59 mm (0.850 in.) port circle, can mount to standard 19.81 mm (0.780 in.) and 23.62 mm (0.930 in.) port circle patterns.

Specifications

Flow Rating @ 70 Bar (1000 PSID)	3 and 11 LPM (1 and 3 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI) opt. 350 Bar (5000 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	0.42 – 0.95 LPM (0.11 – 0.25 GPM)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 180 Hz (See Performance Curves)
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% Minimum, 70% Maximum
Step Response	10 – 90%, < 8 ms
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY01 — Series

□ — Material Options

Code	Description
A	Steel (standard)
B	Stainless Steel
Z*	Special (specify)

* Material selection does not not affect operating pressure.

□ — Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
L	360 ohm	30 mA	15 mA
M	475 ohm	40 mA	20 mA
R	750 ohm	30 mA	15 mA
T	1000 ohm	10 mA	5 mA
V	1200 ohm	40 mA	20 mA
Z	Special (specify)		

□ — Wiring

Code	Connector over:	Flow P to C2 with:
C	Port C1	(+) Signal to A, C
D	Port C1	(+) Signal to B, D
Z	Special (specify)	

□ — Seals

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

□ — Operating Pressure

Code	Description
A	210 Bar (3000 PSI)
B	350 Bar (5000 PSI)
Z	Special (specify)

Operating pressure is independent of material selection.

□ — Flows

Code	Description
1	3.8 LPM (1 GPM)
1.5	5.7 LPM (1.5 GPM)
3	11 LPM (3 GPM)

□ — Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

□□□□ — Factory Code for Special Options

Weight: 1.0 kg (2.1 lbs.)

Special Options:

Consult factory for price, delivery and availability of special options.

- Special coil
- Special wiring
- Special seals
- Special flow rate
- Dual flow rate
- Dual gain
- Zener barriers

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

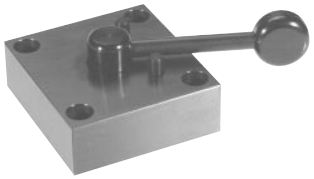
Flushing Valve: 11-0500

Subplate: 55-0100-8 SAE-8 Side ports

Null Adjust Tool: 27-0210

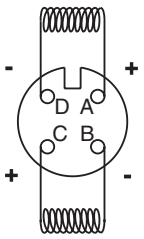
Electronic Drivers: 23-5030, 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.
* For output currents >15 mA



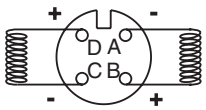
Flushing valve is rated for 3000 psi operation.

Wiring Option C
(Standard)



Polarity shown connects P to C2 port.

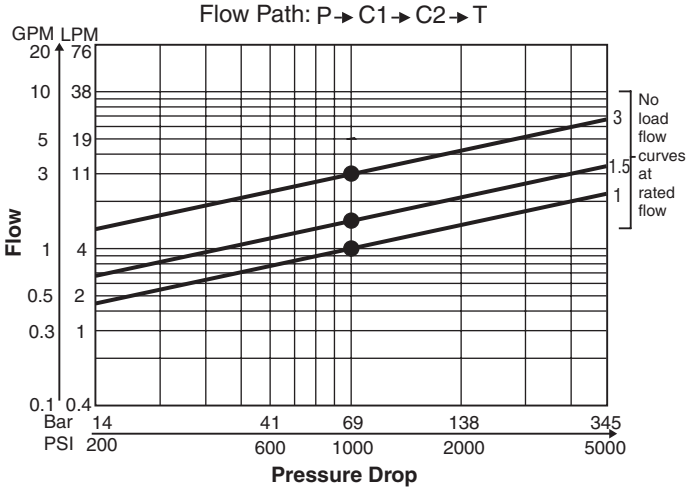
Wiring Option D



Moog, Atchley and Vickers standard.

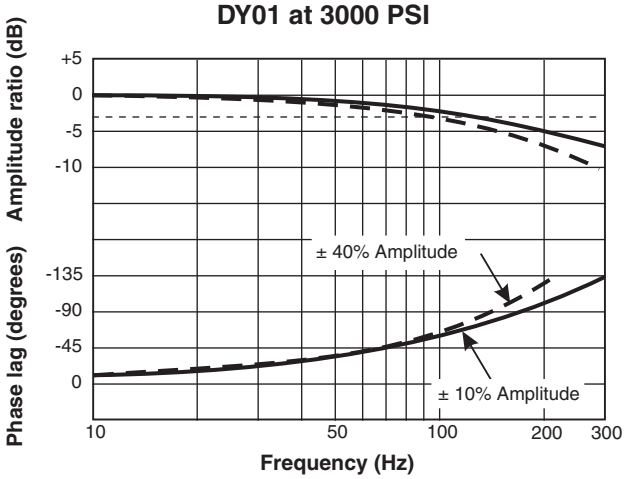
Performance Curves

DY01 Flow vs. Pressure Drop
at 100% command
Flow Path: P → C1 → C2 → T



Frequency Response

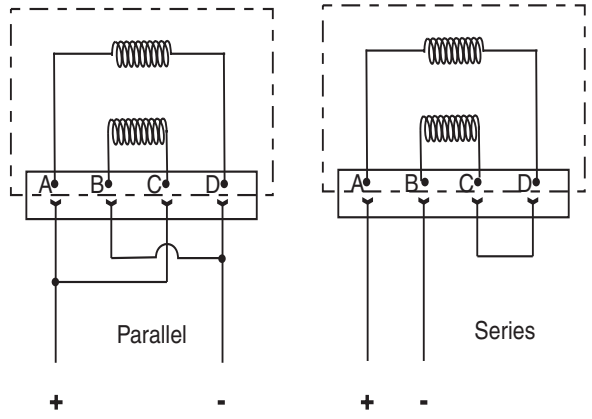
DY01 at 3000 PSI



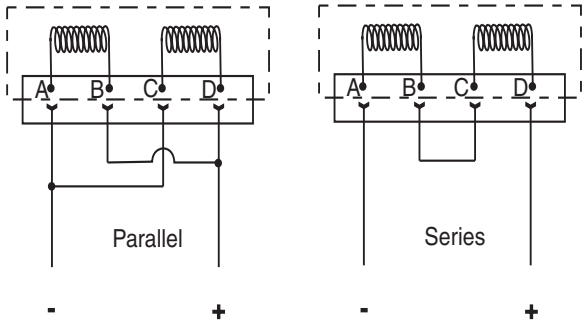
Installation Wiring Options

This servovalve has two coils. This illustration shows the internal wiring configurations for options C and D. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustrations below and to the mounting pattern for this valve to insure proper control phasing.

Option C



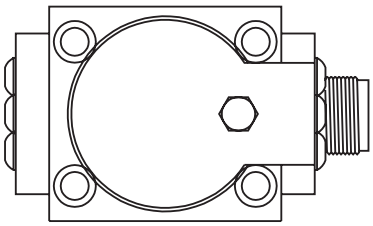
Option D

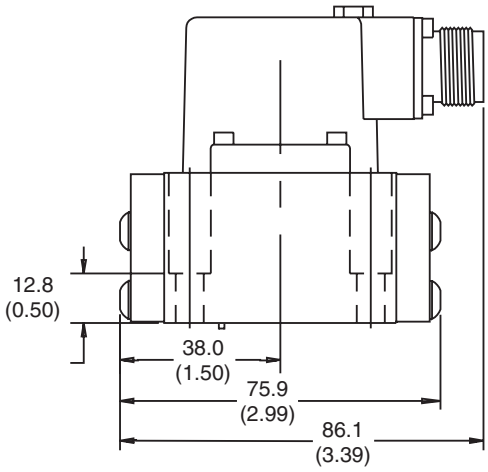


Polarity shown connects flow from P to C2 port.

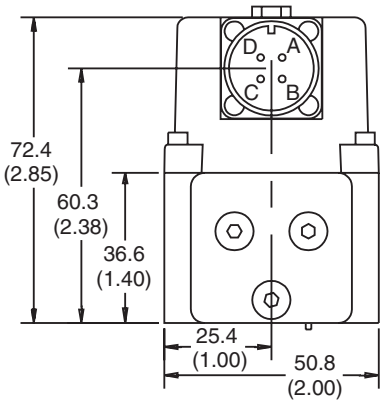
Dimensions

Inch equivalents for millimeter dimensions are shown in (**)

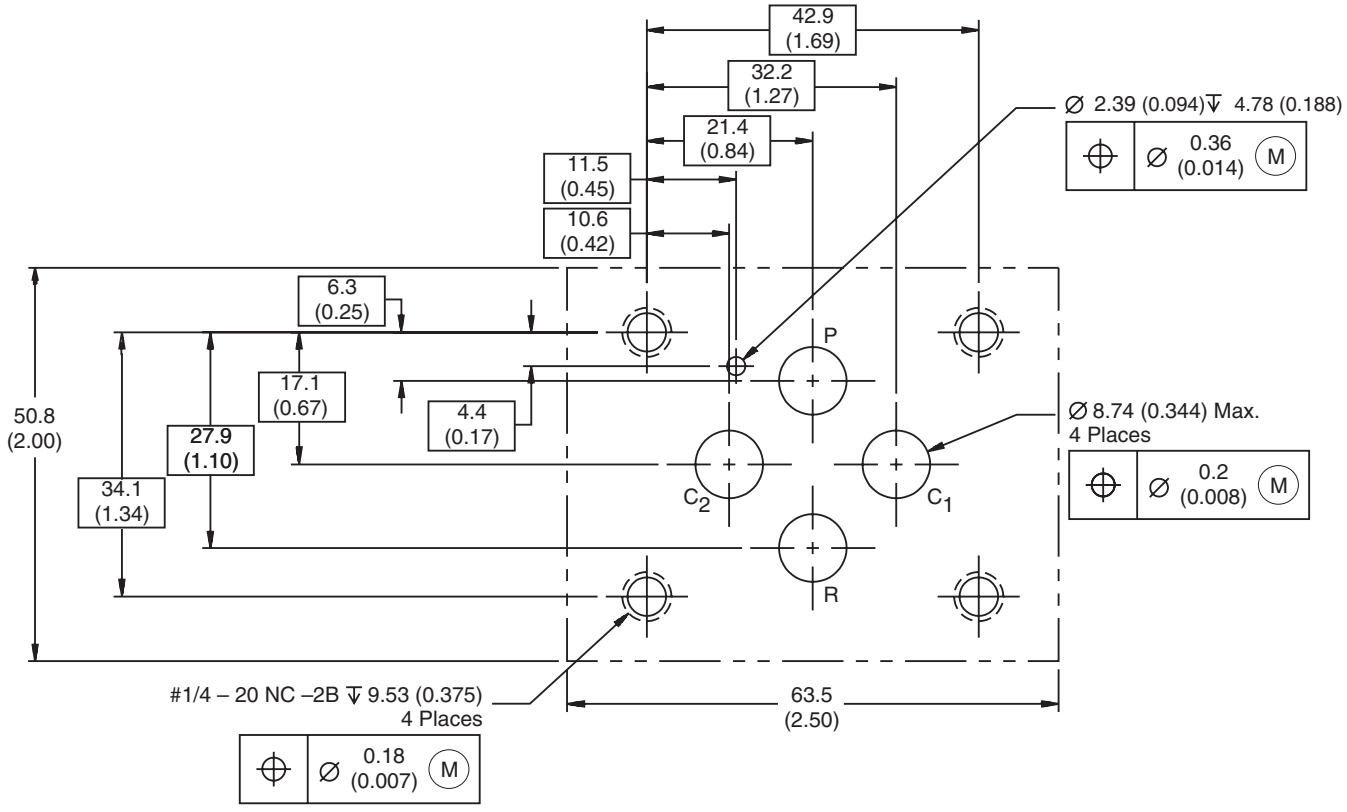




Connector over port C1



Mounting Interface

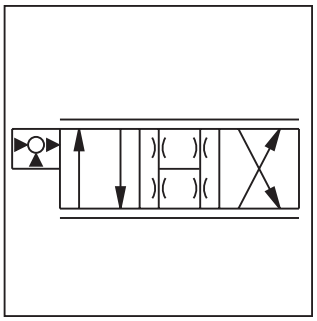


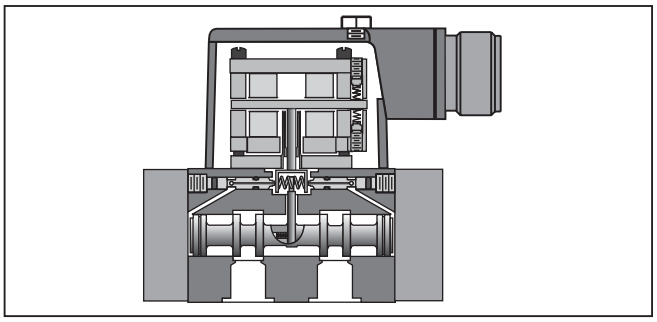
HY14-1483.indd, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series DY05 are two stage, 4-way, flapper and nozzle style servovalves. The DY05 has a wide range of flow ratings within a lower cost spool and body design. The unique rigid pin feedback design avoids ball glitch problems, which can occur in other types of servo-valves. These valves are rated for 210 Bar (3000 PSI) standard, or can be built for 350 Bar (5000 PSI) service. The pressure ratings are the same for both the tool steel construction or the optional stain-less steel spool and body.





Features

- Lapped spool and body.
- No ball glitch.
- Tool steel, or stainless steel, spool and body.
- Versatile 21.59 mm (0.850 in.) port circle, can mount to standard 19.81 mm (0.780 in.) and 23.62 mm (0.930 in.) port circle patterns.
- Survives high tank port pressures.

Specifications

Flow Rating @ 70 Bar (1000 PSID)	0.95, 1.9, 3.8. 9.5 and 19 LPM (0.25, 0.5, 1.0, 2.5 & 5 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI) opt. 350 Bar (5000 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	0.42 – 0.95 LPM (0.11 – 0.25 GPM)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 100 Hz (See Performance Curves)
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% minimum, 70% maximum
Step Response	10 – 90%, < 11 ms
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY05 — Series

□ — Material Options

Code	Description
A	Steel (standard)
B	Stainless Steel
Z*	Special (specify)

* Material selection does not not affect operating pressure.

□ — Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
L	360 ohm	30 mA	15 mA
M	475 ohm	40 mA	20 mA
R	750 ohm	30 mA	15 mA
T	1000 ohm	10 mA	5 mA
V	1200 ohm	40 mA	20 mA
Z	Special (specify)		

□ — Wiring

Code	Connector over:	Flow P to C2 with:
C	Port C1	(+) Signal to A, C
D	Port C1	(+) Signal to B, D
Z	Special (specify)	

□ — Seals

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

□ — Operating Pressure

Code	Description
A	210 Bar (3000 PSI)
B	350 Bar (5000 PSI)
Z	Special (specify)

Operating pressure is independent of material selection.

□ — Flows

Code	Description
0.25	0.95 LPM (0.25 GPM)
0.5	1.9 LPM (0.5 GPM)
1	3.8 LPM (1 GPM)
2.5	9.5 LPM (2.5 GPM)
5	19 LPM (5 GPM)

□ — Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

□□□□ — Factory Code for Special Options

Weight: 1.0 kg (2.1 lbs.)

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with Valve

Flushing Valve: 11-0500

Subplate: 55-0100-8 SAE-8 Side ports

Null Adjust Tool: 27-0210

Electronic Drivers: 23-5030, 23-7030, BD90*, BD95*, and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.
* For output currents >15 mA

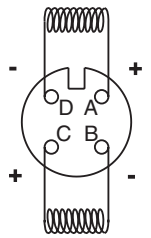
Flushing valve is rated for 3000 psi operation.

Special Options:

Consult factory for price, delivery and availability of special options.

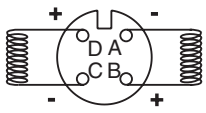
Special coil
Special wiring
Special seals
Special flow rate
Dual flow rate
Dual gain
Zener barriers
High frequency torque motor (Models 5, 10, 12 & 15 only)

Wiring Option C
(Standard)



Dyval and Pegasus standard.

Wiring Option D

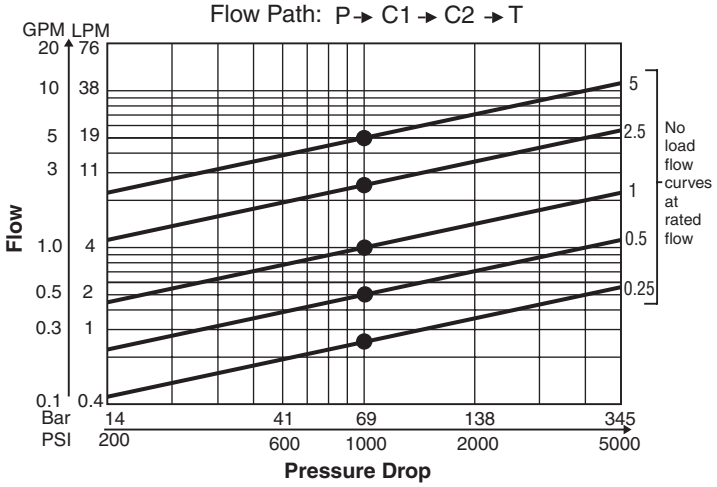


Moog, Atchley and Vickers standard.

In both cases, polarity shown connects P to C2 port.

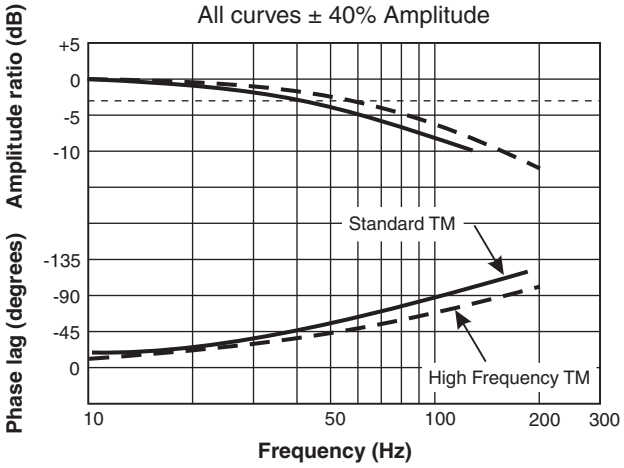
Performance Curves

DY05 Flow vs. Pressure Drop
at 100% command
Flow Path: P → C1 → C2 → T



Frequency Response

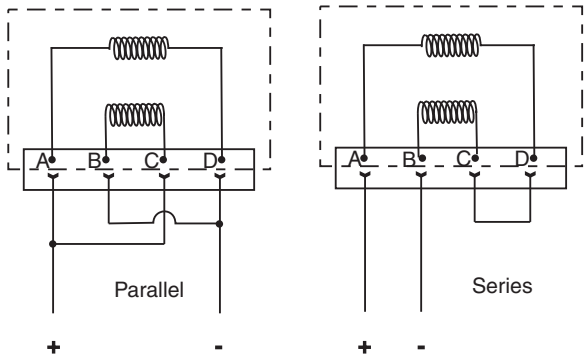
DY05 at 3000 PSI
All curves ± 40% Amplitude



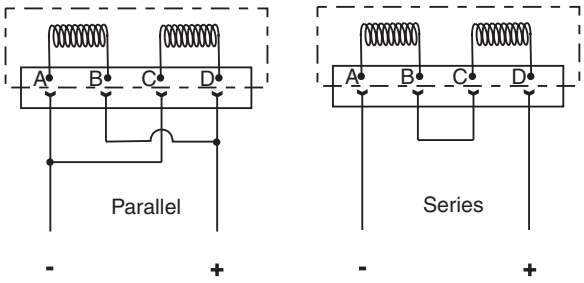
Installation Wiring Options

This servovalve has two coils. This illustration shows the internal wiring configurations for options C and D. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustrations below and to the mounting pattern for this valve to insure proper control phasing.

Option C



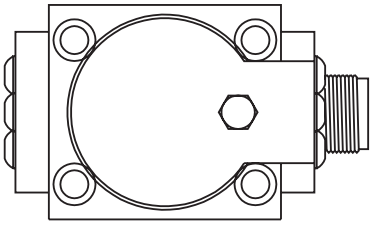
Option D

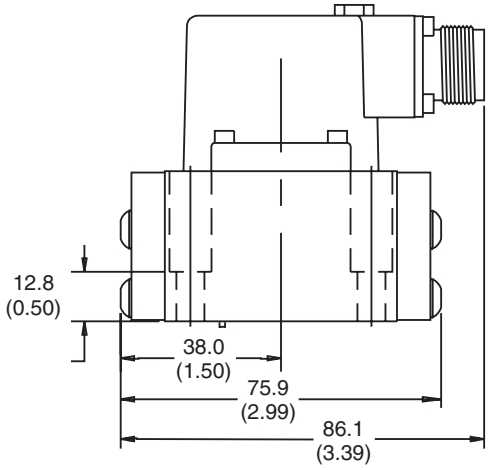


Polarity shown connects flow from P to C2 port.

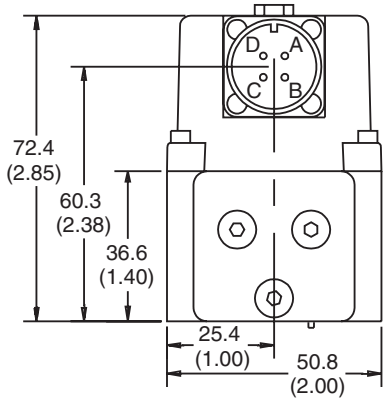
Dimensions

Inch eqivalents for millimeter dimensions are shown in (**)

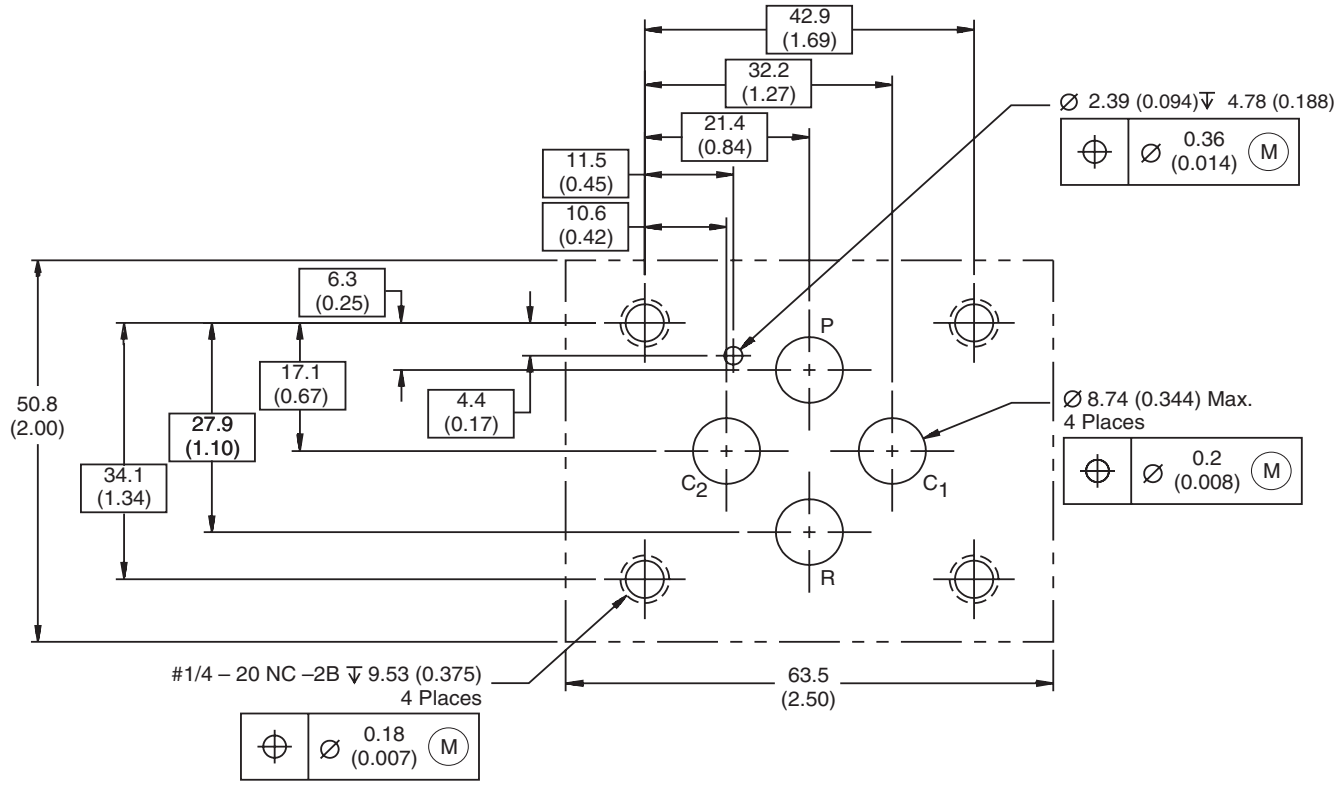




Connector over port C1



Mounting Interface

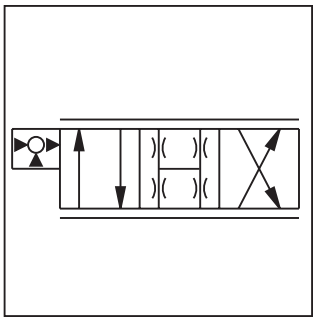


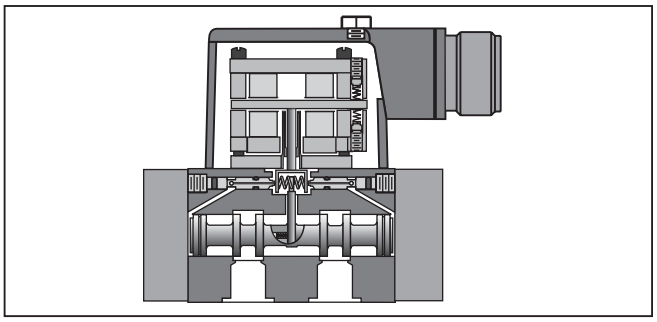
HY14-1483.indd, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series DY10 are two stage, 4-way, flapper and nozzle style servovalves. The DY10 is a higher flow version of the DY05. The unique rigid pin feedback design avoids ball glitch problems, which can occur in other types of servovalves. These valves are rated for 210 Bar (3000 PSI) standard, or can be built for 350 Bar (5000 PSI) service. The pressure ratings are the same for both the tool steel construction or the optional stainless steel spool and body.





Features

- Lapped spool and body.
- No ball glitch.
- Tool steel, or stainless steel, spool and body.
- Versatile 21.59 mm (0.850 in.) port circle, can mount to standard 19.81 mm (0.780 in.) and 23.62 mm (0.930 in.) port circle patterns.
- Survives high tank port pressures.

Specifications

Flow Rating @ 70 Bar (1000 PSID)	28 and 38 LPM (7.5 and 10 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI) opt. 350 Bar (5000 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	0.57 – 1.1 LPM (0.15 – 0.3 GPM)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 100 Hz (See Performance Curves)
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% minimum, 70% maximum
Step Response	10 – 90%, < 13 ms
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY10 — Series

□ Material Options

Code	Description
A	Steel (standard)
B	Stainless Steel
Z*	Special (specify)

* Material selection does not affect operating pressure.

□ Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
L	360 ohm	30 mA	15 mA
M	475 ohm	40 mA	20 mA
R	750 ohm	30 mA	15 mA
T	1000 ohm	10 mA	5 mA
V	1200 ohm	40 mA	20 mA
Z	Special (specify)		

□ Wiring

Code	Connector over:	Flow P to C2 with:
C	Port C1	(+) Signal to A, C
D	Port C1	(+) Signal to B, D
Z	Special (specify)	

□ Seals

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

□ Operating Pressure

Code	Description
A	210 Bar (3000 PSI)
B	350 Bar (5000 PSI)
Z	Special (specify)

Operating pressure is independent of material selection.

□ Flows

Code	Description
7.5	28 LPM (7.5 GPM)
10	38 LPM (10 GPM)

□ Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

□□□□ Factory Code for Special Options

Weight: 1.0 kg (2.1 lbs.)

Special Options:

Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals
Special flow rate
Dual flow rate
Dual gain
Zener barriers
High frequency torque motor (Models 5, 10, 12 & 15 only

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0500

Subplate: 55-0100-8 SAE-8 Side ports

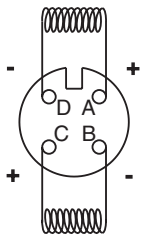
Null Adjust Tool: 27-0210

Electronic Drivers: 23-5030, 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.
* For output currents >15 mA

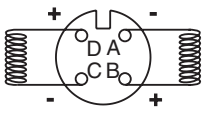
Flushing valve is rated for 3000 psi operation.

Wiring Option C
(Standard)



Dyval and Pegasus standard.

Wiring Option D

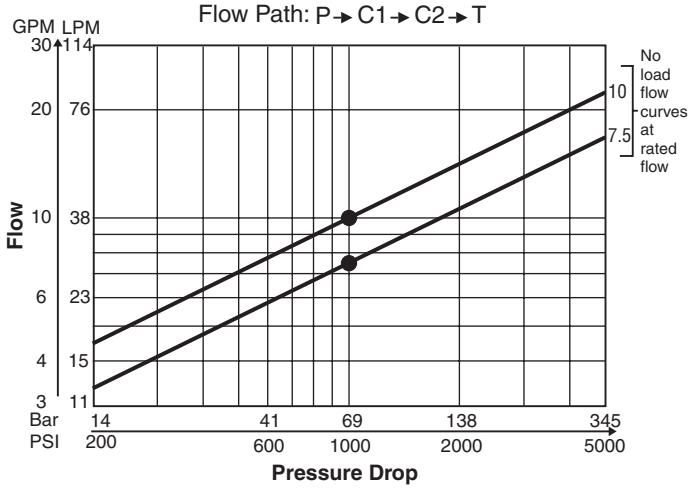


Moog, Atchley and Vickers standard.

In both cases, polarity shown connects P to C2 port.

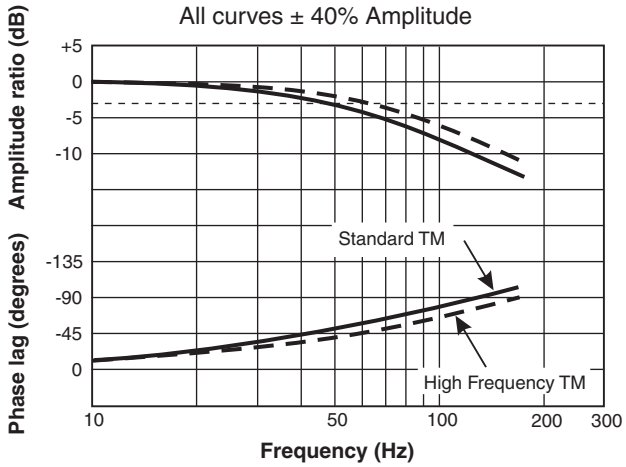
Performance Curves

DY10 Flow vs. Pressure Drop
at 100% command
Flow Path: P→C1→C2→T



Frequency Response

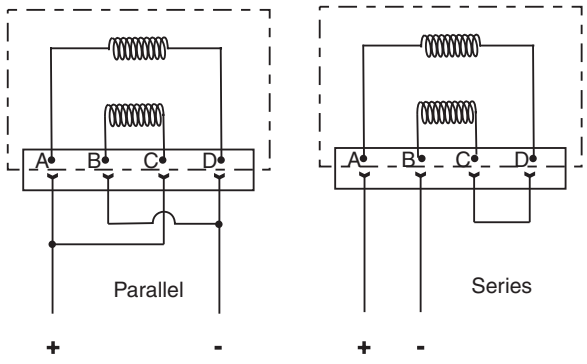
DY10 at 3000 PSI
All curves ± 40% Amplitude



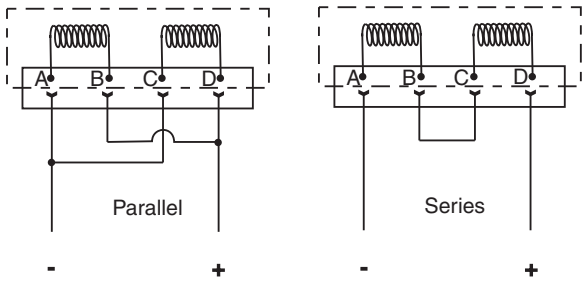
Installation Wiring Options

This servovalve has two coils. This illustration shows the internal wiring configurations for options C and D. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustrations below and to the mounting pattern for this valve to insure proper control phasing.

Option C



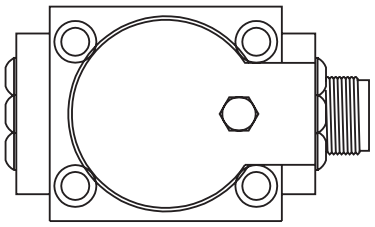
Option D

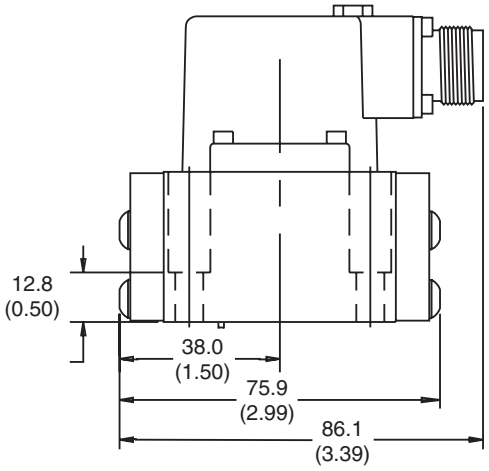


Polarity shown connects flow from P to C2 port.

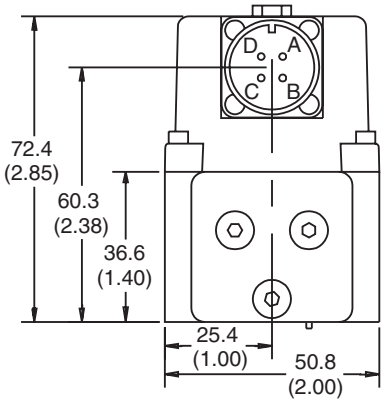
Dimensions

Inch equivalents for millimeter dimensions are shown in (**)

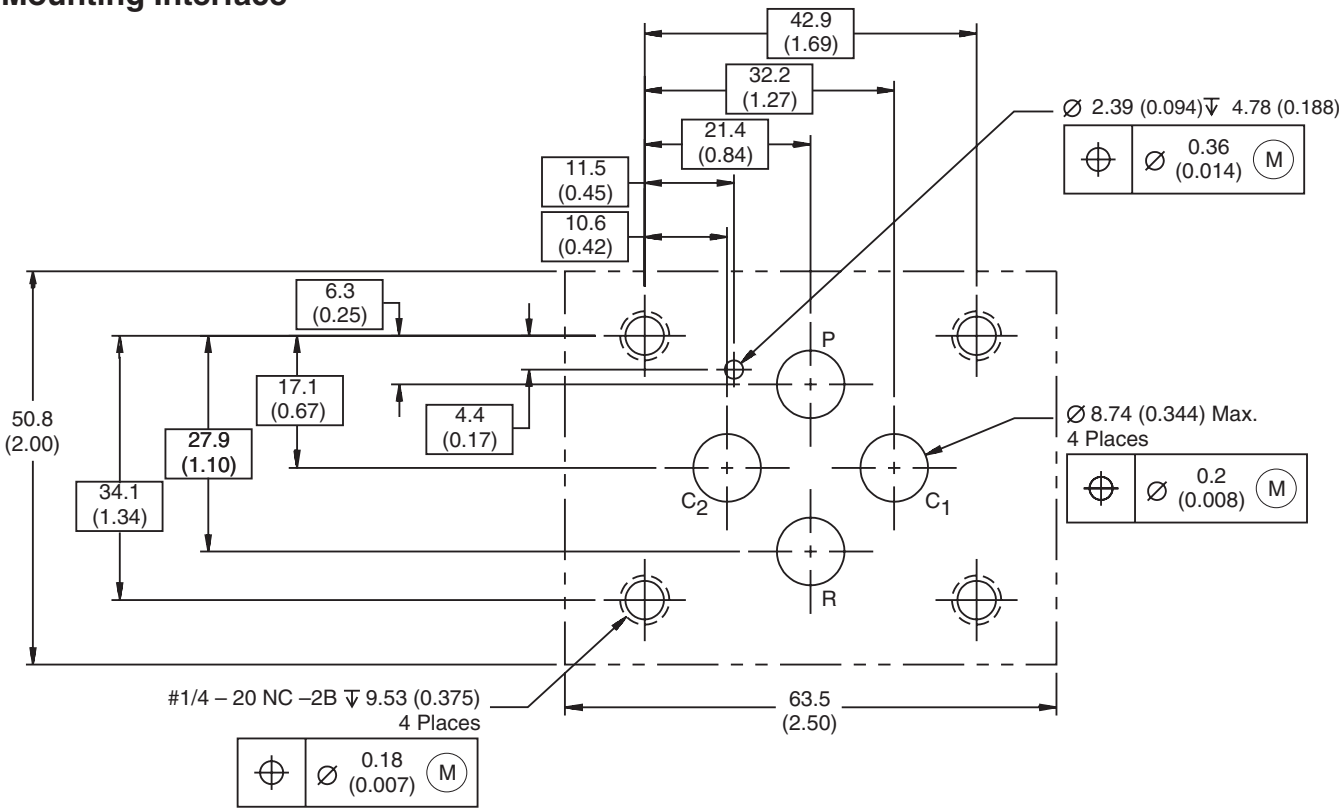




Connector over port C1



Mounting Interface

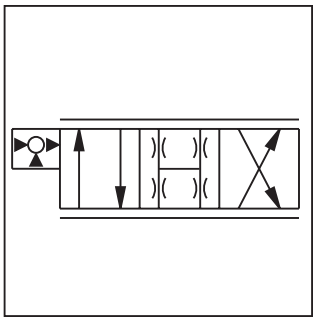


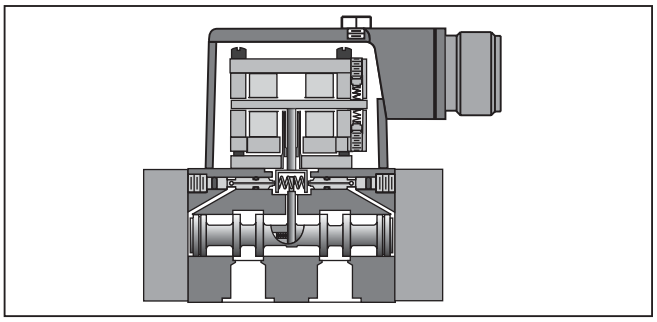
HY14-1483.indd, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series DY12 are two stage, 4-way, flapper and nozzle style servovalves. They have the same port pattern and body as the DY10 valve, but have a longer spool stroke for higher flow. The unique rigid pin feedback design avoids ball glitch problems, which can occur in other types of servovalves. These valves are rated for 210 Bar (3000 PSI) standard, or can be built for 350 Bar (5000 PSI) service. The pressure ratings are the same for both the tool steel construction or the optional stainless steel spool and body.





Features

- Lapped spool and body.
- No ball glitch.
- Tool steel, or stainless steel, spool and body.
- Nozzle and flapper design.
- Versatile 21.59 mm (0.850 in.) port circle, can mount to standard 19.81 mm (0.780 in.) and 23.62 mm (0.937 in.) port circle patterns.
- Survives high tank port pressures.

Specifications

Flow Rating @ 70 Bar (1000 PSID)	47 and 57 LPM (12.5 and 15 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI) opt. 350 Bar (5000 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	0.57 – 1.1 LPM (0.15 – 0.3 GPM)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 100 Hz (See Performance Curves)
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% minimum, 70% maximum
Step Response	10 – 90%, < 13 ms
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY12 — Series

□ Material Options

Code	Description
A	Steel (standard)
B	Stainless Steel
Z*	Special (specify)

* Material selection does not affect operating pressure.

□ Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
L	360 ohm	30 mA	15 mA
M	475 ohm	40 mA	20 mA
R	750 ohm	30 mA	15 mA
T	1000 ohm	10 mA	5 mA
V	1200 ohm	40 mA	20 mA
Z	Special (specify)		

□ Wiring

Code	Connector over:	Flow P to C2 with:
C	Port C1	(+) Signal to A, C
D	Port C1	(+) Signal to B, D
Z*	Special (specify)	

□ Seals

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

□ Operating Pressure

Code	Description
A	210 Bar (3000 PSI)
B	350 Bar (5000 PSI)
Z	Special (specify)

Operating pressure is independent of material selection.

□ Flows

Code	Description
12.5	47 LPM (12.5 GPM)
15	57 LPM (15 GPM)

□ Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

□□□□ Factory Code for Special Options

Weight: 1.0 kg (2.1 lbs.)

Special Options:

Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals
Special flow rate
Dual flow rate
Dual gain
Zener barriers
High frequency torque motor (Models 5, 10, 12 & 15 only)

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0500

Subplate: 55-0100-8 SAE-8 Side ports

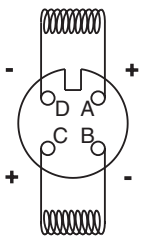
Null Adjust Tool: 27-0210

Electronic Drivers: 23-5030, 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.
* For output currents >15 mA

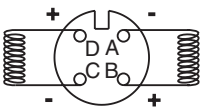
Flushing valve is rated for 3000 psi operation.

Wiring Option C
(Standard)



Dyval and Pegasus standard.

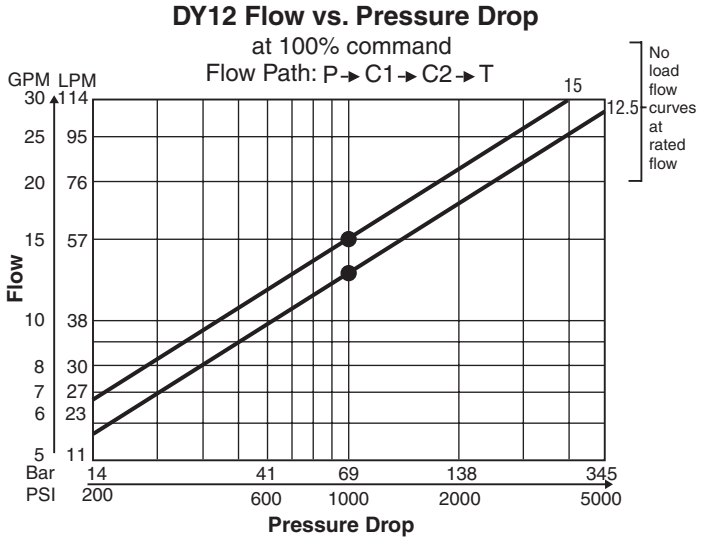
Wiring Option D



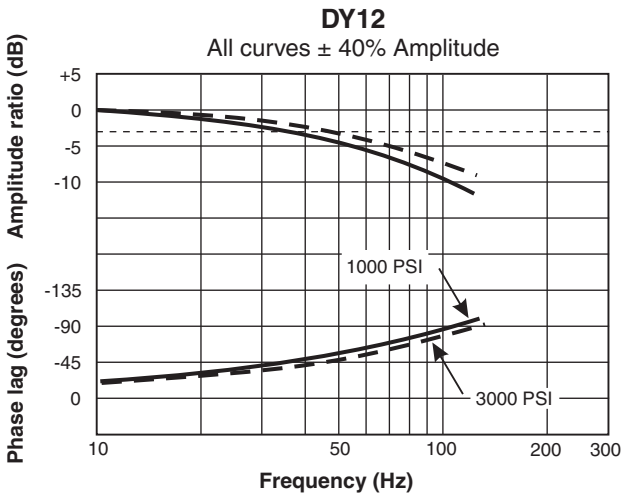
Moog, Atchley and Vickers standard.

In both cases, polarity shown connects P to C2 port.

Performance Curves

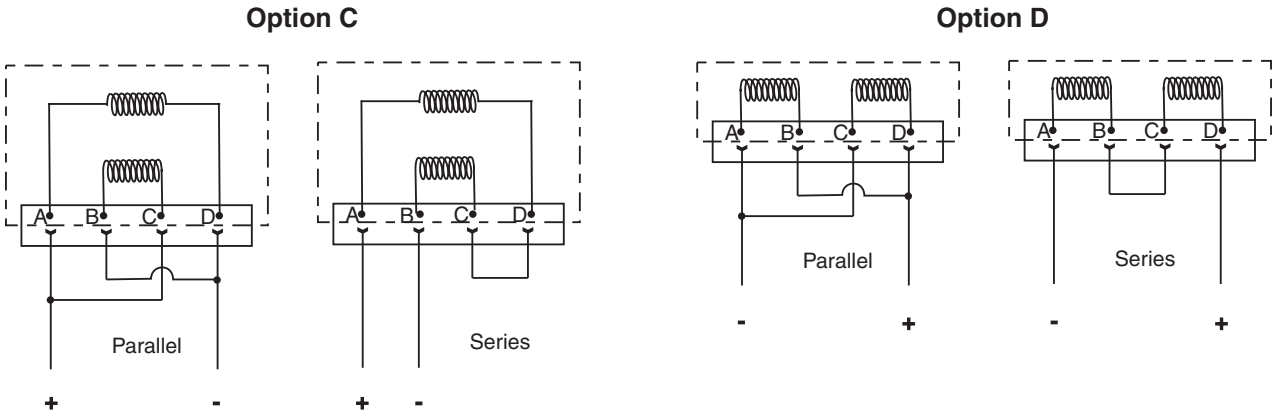


Frequency Response



Installation Wiring Options

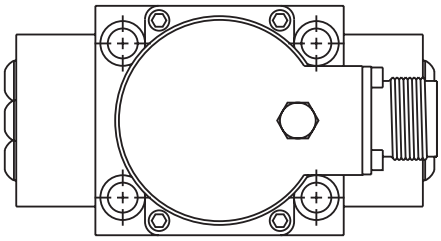
This servovalve has two coils. This illustration shows the internal wiring configurations for these valves. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustration below and to the mounting pattern for this valve to insure proper control phasing.



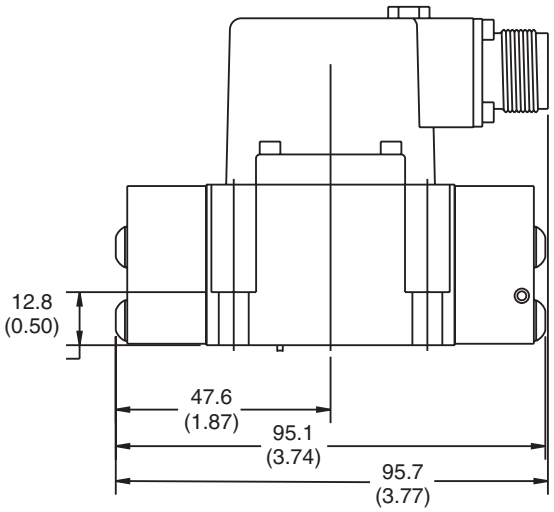
Polarity shown connects flow from P to C2 port.

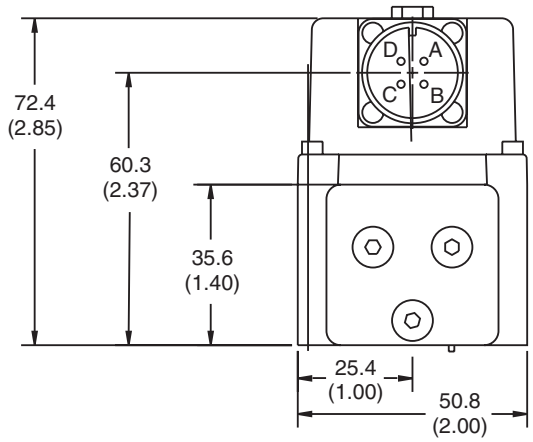
Dimensions

Inch equivalents for millimeter dimensions are shown in (**)

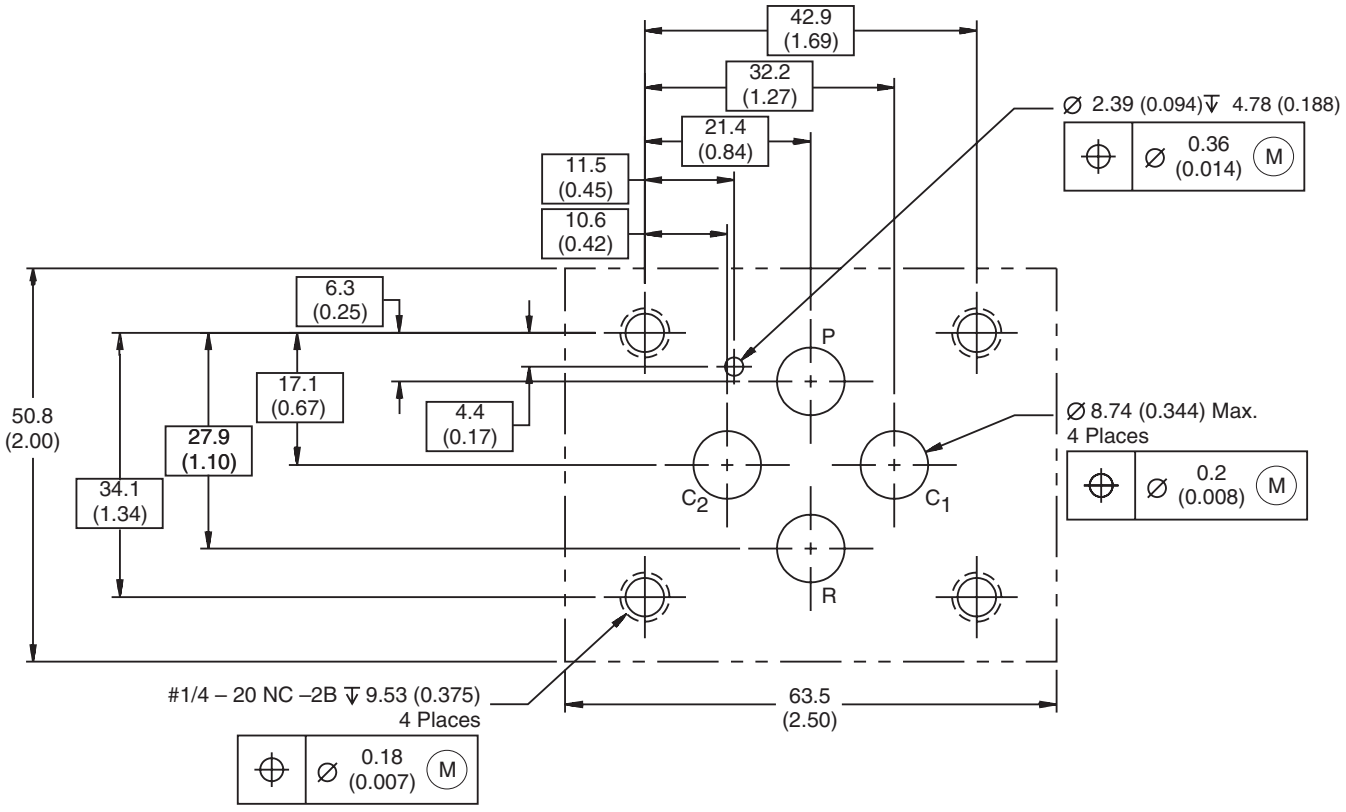


Connector over C1 port





Mounting Interface

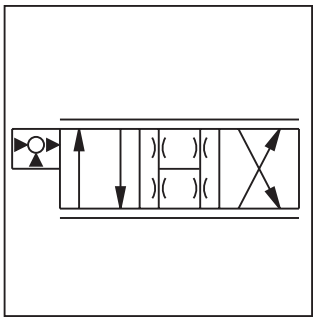


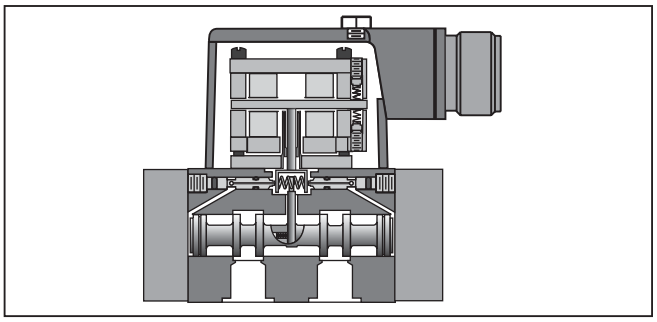
HY14-1483.indd, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

General Description

Series DY15 are two stage, 4-way, flapper and nozzle style servovalves. This valve is rated for 210 Bar (3000 PSI) standard, or can be built for 350 Bar (5000 PSI) service. The pressure ratings are the same for both the tool steel construction or the optional stainless steel spool and body.





Features

- Lapped spool and body.
- No ball glitch.
- Tool steel, or stainless steel, spool and body.
- Nozzle and flapper design.
- Unique port pattern (see next page).
- Survives high tank port pressures.

Specifications

Flow Rating @ 70 Bar (1000 PSID)	57, 75 and 95 LPM (15, 20 and 25 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI) opt. 350 Bar (5000 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	0.95 – 1.7 LPM (0.25 – 0.45 GPM)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 45 Hz (See Performance Curves)
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% minimum, 70% maximum
Step Response	10 – 90%, < 18 ms < 18 ms up to 75 LPM (20 GPM) < 20 ms up to 95 LPM (25 GPM)
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY15 — Series

□ Material Options

Code	Description
A	Steel (standard)
B	Stainless Steel
Z*	Special (specify)

* Material selection does not affect operating pressure

□ Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
L	360 ohm	30 mA	15 mA
M	475 ohm	40 mA	20 mA
R	750 ohm	30 mA	15 mA
T	1000 ohm	10 mA	5 mA
V	1200 ohm	40 mA	20 mA
Z	Special (specify)		

□ Wiring

Code	Connector over:	Flow P to C2 with:
C	Port C1	(+) Signal to A, C
D	Port C1	(+) Signal to B, D
Z	Special (specify)	

□ Seals

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

□ Operating Pressure

Code	Description
A	210 Bar (3000 PSI)
B	350 Bar (5000 PSI)
Z	Special (specify)

Operating pressure is independent of material selection.

□ Flows

Code	Description
15	57 LPM (15 GPM)
20	76 LPM (20 GPM)
25	95 LPM (25 GPM)

□ Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

□□□□ Factory Code for Special Options

Weight: 1.8 kg (3.9 lbs.)

Special Options:

Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals
Special flow rate
Dual flow rate
Dual gain
Zener barriers
High frequency torque motor (Models 5, 10, 12 & 15 only)

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0600

Subplate: 55-0300-2 SAE-16 Side ports

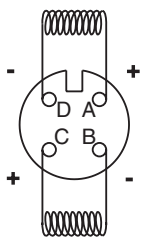
Null Adjust Tool: 27-0210

Electronic Drivers: 23-5030, 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.
* For output currents >15 mA

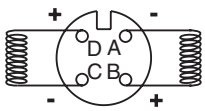
Flushing valve is rated for 3000 psi operation.

Wiring Option C
(Standard)



Dyval and Pegasus standard.

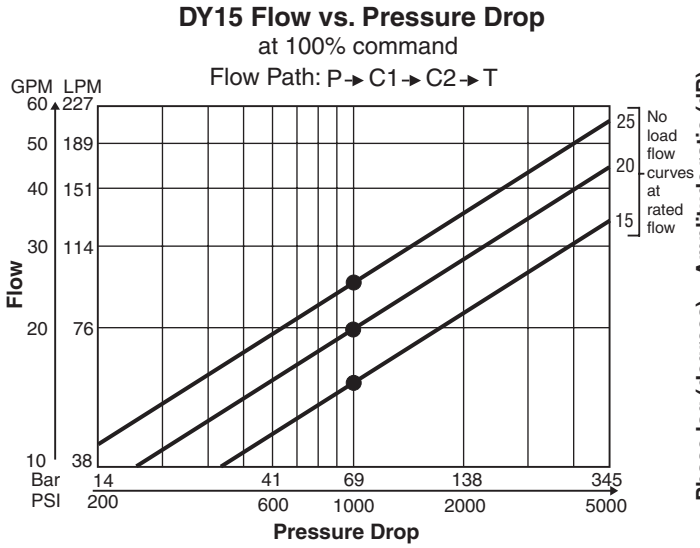
Wiring Option D



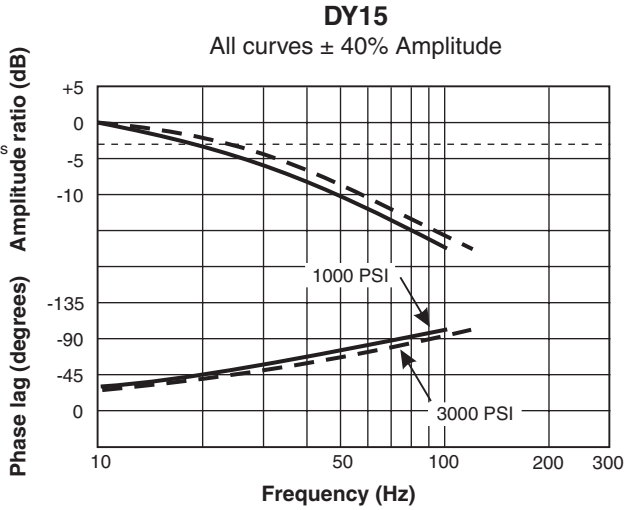
Moog, Atchley and Vickers standard.

In both cases, polarity shown connects P to C2 port.

Performance Curves

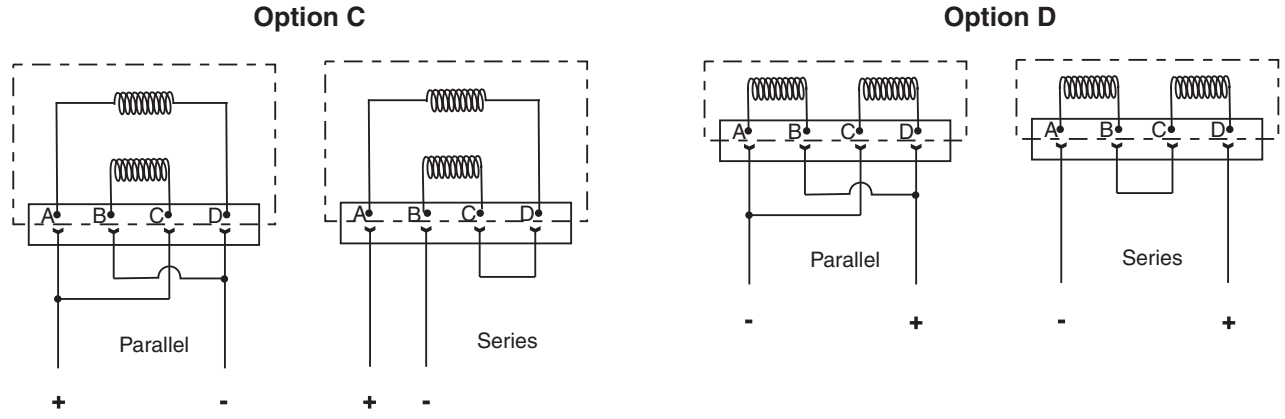


Frequency Response



Installation Wiring Options

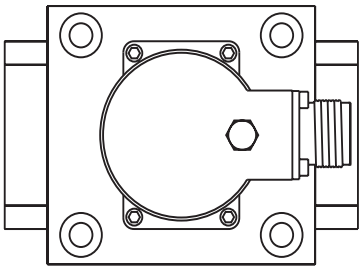
This servovalve has two coils. This illustration shows the internal wiring configurations for options C and D. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustrations below and to the mounting pattern for this valve to insure proper control phasing.

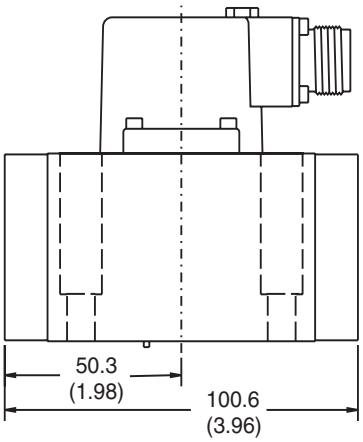


Polarity shown connects flow from P to C2 port.

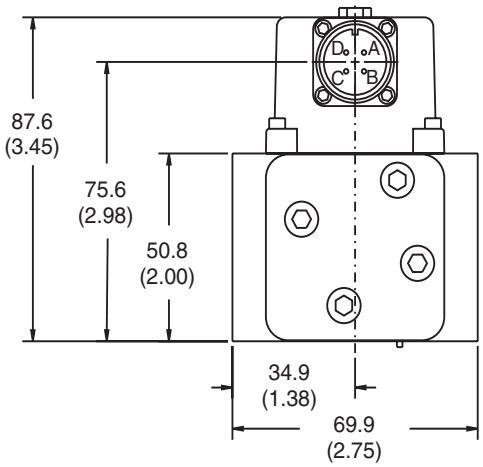
Dimensions

Inch equivalents for millimeter dimensions are shown in (**)

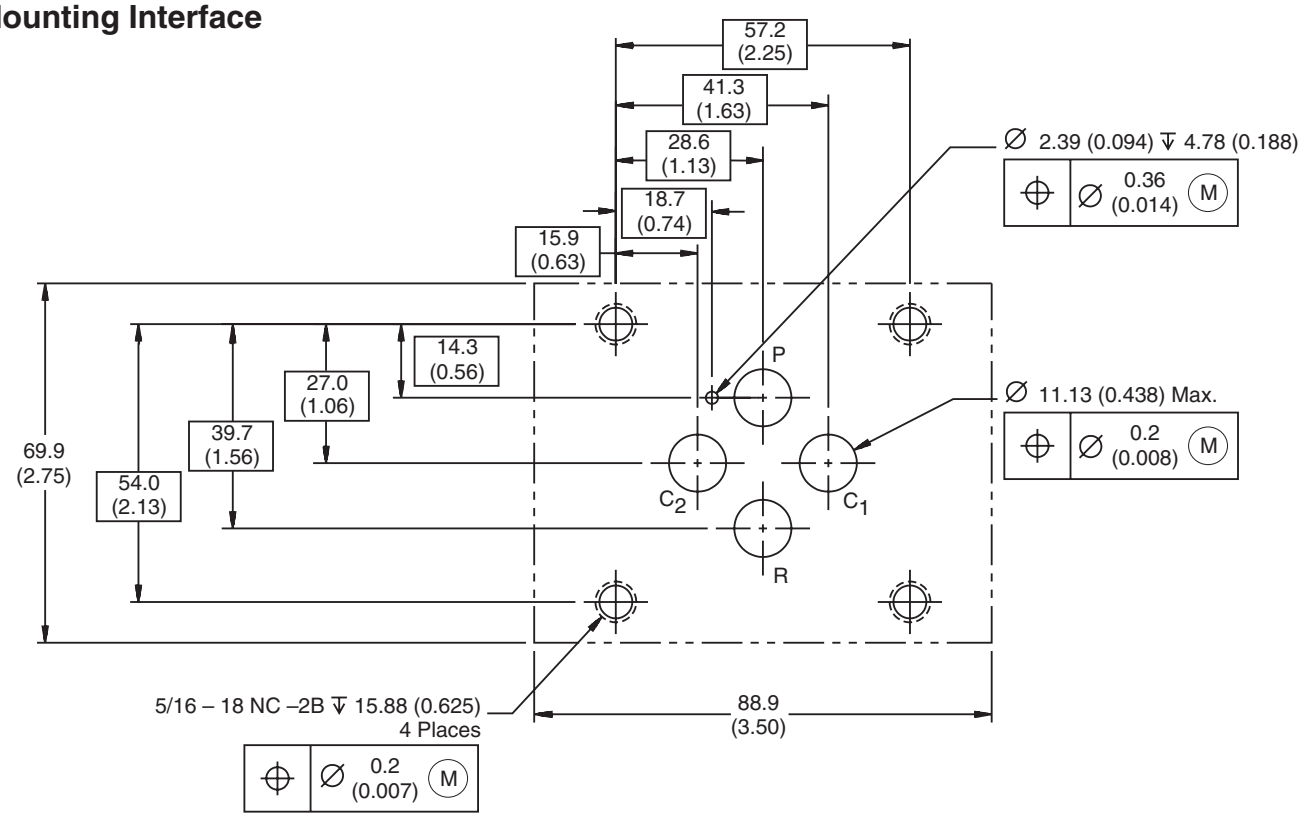




Connector over port C1



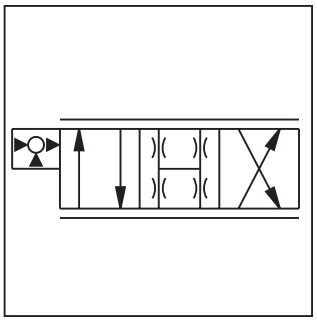
Mounting Interface

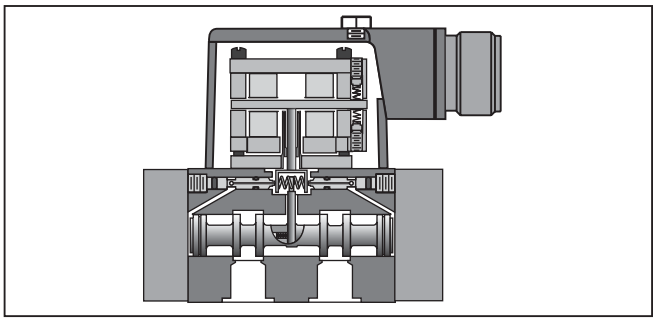


HY14-1483.indd, dd

General Description

Series DY25 are two stage, 4-way, flapper and nozzle style servovalves. They have the same port pattern and body dimensions as the DY15, but use a higher force torque motor pilot. These valves are rated for 210 Bar (3000 PSI) standard, or can be built for 350 Bar (5000 PSI) service. The pressure ratings are the same for both the tool steel construction, and the optional stainless steel spool and body.





Features

- Lapped spool and body.
- No ball glitch.
- Tool steel, or stainless steel, spool and body.
- Nozzle and flapper design.
- Unique port pattern (see next page).
- Survives high tank port pressures.

Specifications

Flow Rating @ 70 Bar (1000 PSID)	57 and 75 LPM (25 and 30 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI) opt. 350 Bar (5000 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	0.95 – 1.7 LPM (0.25 – 0.45 GPM)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 35 Hz (See Performance Curves)
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% minimum, 70% maximum
Step Response	10 – 90%, < 18 ms @ 95 LPM (25 GPM) < 20 ms @ 114 LPM (30 GPM)
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY25 — Series

□ Material Options

Code	Description
A	Steel (standard)
B	Stainless Steel
Z*	Special (specify)

* Material selection does not affect operating pressure

□ Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
R	750 ohm	30 mA	15 mA
Z	Special (specify)		

□ Wiring

Code	Connector over:	Flow P to C2 with:
C	Port C1	(+) Signal to A, C
D	Port C1	(+) Signal to B, D
Z	Special (specify)	

□ Seals

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

□ Operating Pressure

Code	Description
A	210 Bar (3000 PSI)
B	350 Bar (5000 PSI)
Z	Special (specify)

Operating pressure is independent of material selection.

□ Flows

Code	Description
25	95 LPM (25 GPM)
30	114 LPM (30 GPM)

□ Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

□□□□ Factory Code for Special Options

Weight: 1.9 kg (4.2 lbs.)

Special Options:

Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals
Special flow rate
Dual flow rate
Dual gain
Zener barriers

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0600

Subplate: 55-0300-2 SAE-16 Side ports

Null Adjust Tool: 27-0210

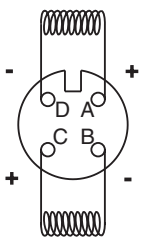
Electronic Drivers: 23-5030, 23-7030, BD90*, BD95*, and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.

* For output currents >15 mA

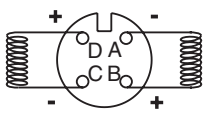
Flushing valve is rated for 3000 psi operation.

Wiring Option C
(Standard)



Dyval and Pegasus standard.

Wiring Option D

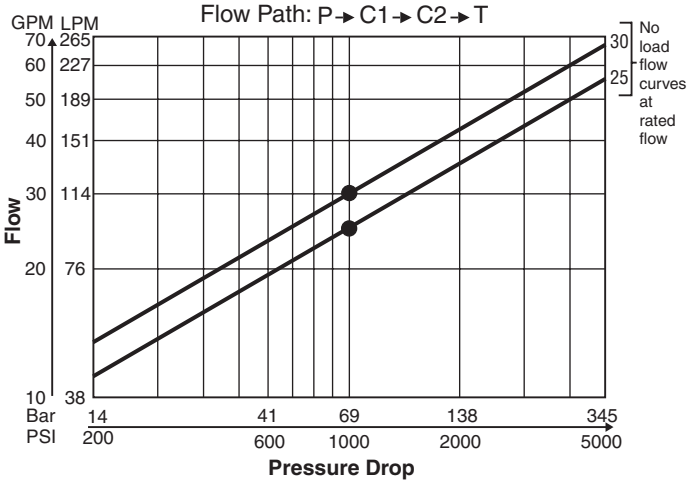


Moog, Atchley and Vickers standard.

In both cases, polarity shown connects P to C2 port.

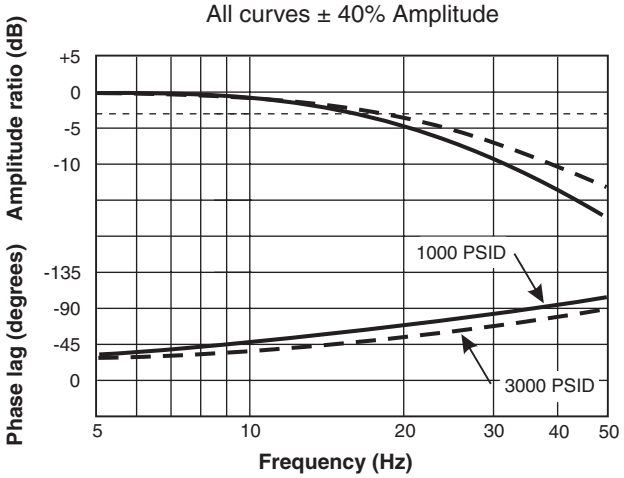
Performance Curves

DY25 Flow vs. Pressure Drop
at 100% command
Flow Path: P→C1→C2→T



Frequency Response

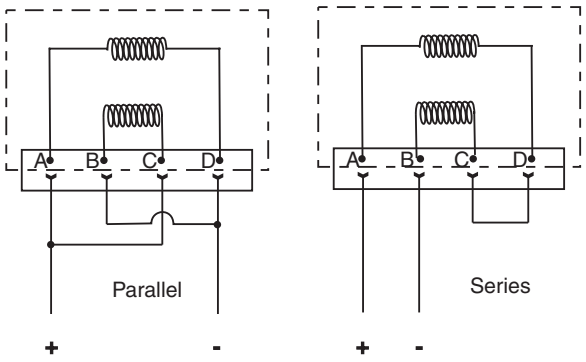
DY25
All curves ± 40% Amplitude



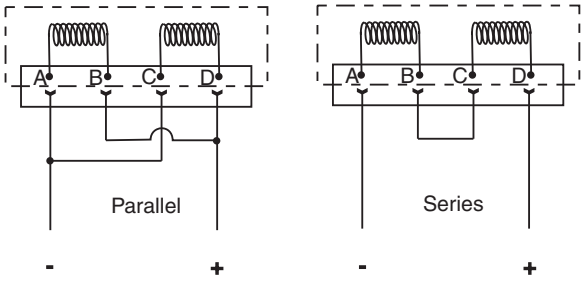
Installation Wiring Options

This servovalve has two coils. This illustration shows the internal wiring configurations for options C and D. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustrations below and to the mounting pattern for this valve to insure proper control phasing.

Option C



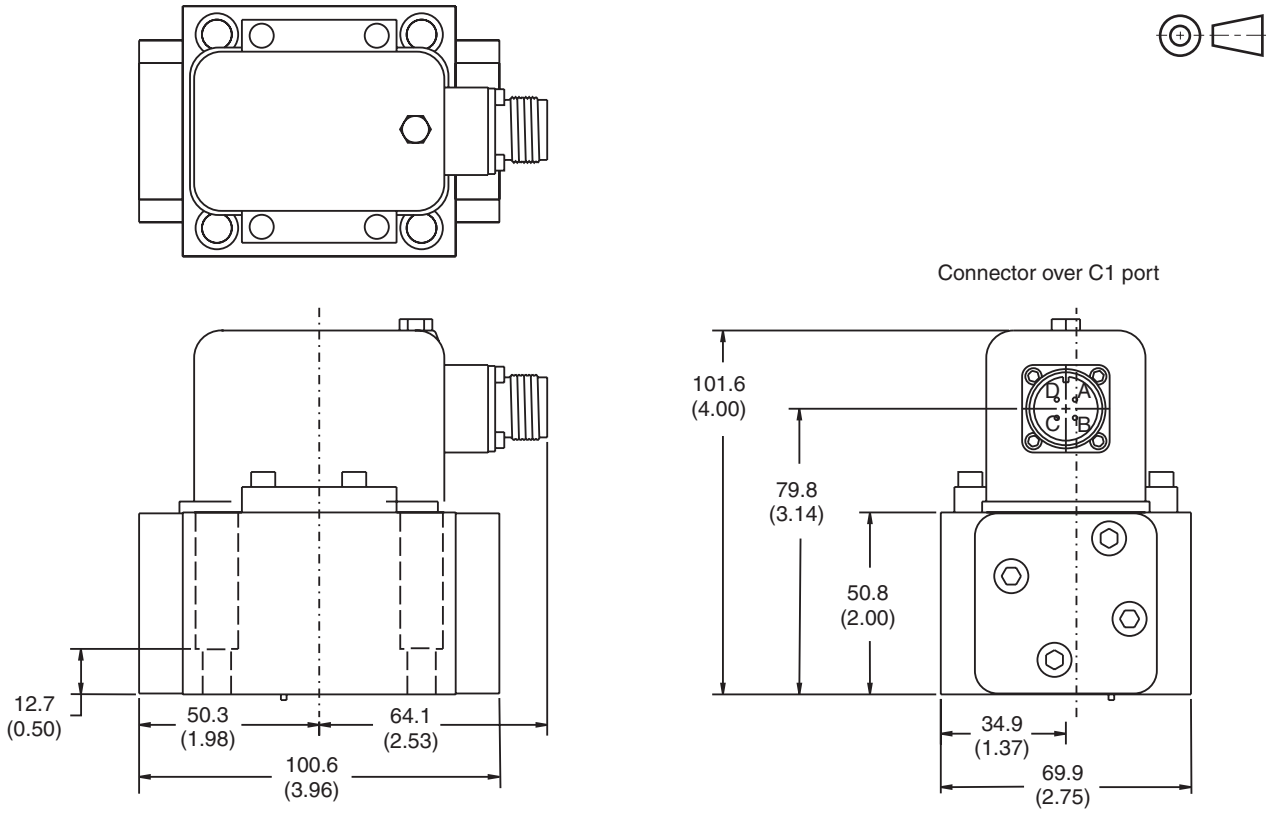
Option D



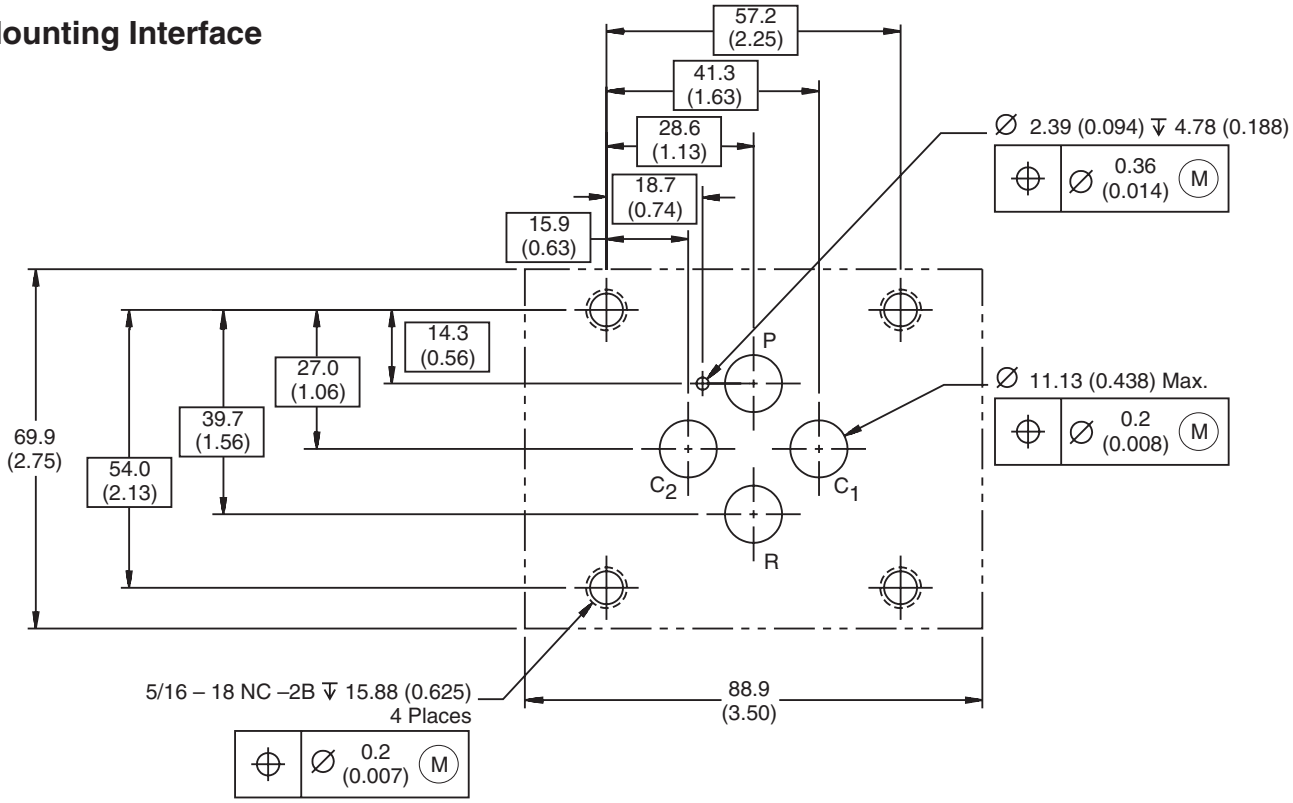
Polarity shown connects flow from P to C2 port.

Dimensions

Inch equivalents for millimeter dimensions are shown in (**)



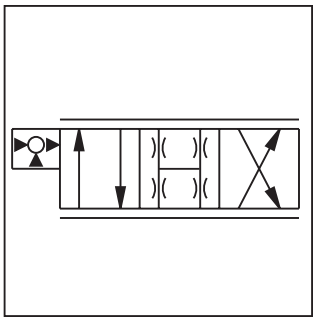
Mounting Interface

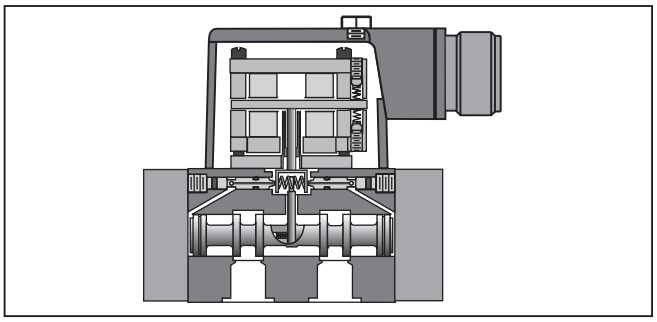


HY14-1483.indd, dd

General Description

Series DY45 are two stage, 4-way, flapper and nozzle style servovalves. These valves are rated for 210 Bar (3000 PSI) standard, or can be built for 350 Bar (5000 PSI) service. The pressure ratings are the same for both the tool steel construction, and the optional stainless steel spool and body.





Features

- Lapped spool and body.
- No ball glitch.
- Tool steel, or stainless steel, spool and body.
- Nozzle and flapper design.
- Unique port pattern (see mounting pattern).
- Survives high tank port pressures.

Specifications

Flow Rating @ 70 Bar (1000 PSID)	150, 190 and 225 LPM (40, 50 and 60 GPM)
Supply Pressure	10 – 210 Bar (145 – 3000 PSI) opt. 350 Bar (5000 PSI)
Leakage Flow @ 70 Bar (1000 PSID)	1.3 – 2.7 LPM (0.35 – 0.70 GPM)
Tank Port Pressure	210 Bar (3000 PSI) Max. < 10 Bar (145 PSI) for best performance
Input Command	±50 mA std.
Frequency Response @ 90° phase shift	> 30 Hz at ±10% amplitude
Non-Linearity	≤ 10%
Threshold	≤ 0.5%

Null Shift with temperature with pressure	≤ 2% per 55°C (100°F) ≤ 2% per 70 Bar (1000 PSI)
Presssure Gain % change in pressure per 1% change in input command	30% minimum, 70% maximum
Step Response	10 – 90%, < 25 ms
Fluid	Mineral Oil, 60 – 225 SSU 1000 SSU maximum
Operating Temperature	-1°C to + 106°C (+30°F to +225°F)
Protection Class	NEMA 4, IP65
Filtration	ISO 4406 15/12 or better

DY45 — Series

□ — Material Options

Code	Description
A	Steel (standard)
B	Stainless Steel
Z*	Special (specify)

* Material selection does not affect operating pressure

□ — Coils

Code	Description	Parallel	Series
D	200 ohm (Std.)	50 mA	25 mA
F	80 ohm	80 mA	40 mA
G	22 ohm	200 mA	100 mA
K	40 ohm	150 mA	75 mA
R	750 ohm	30 mA	15 mA
Z	Special (specify)		

□ — Wiring

Code	Connector over:	Flow P to C2 with:
C	Port C1	(+) Signal to A, C
D	Port C1	(+) Signal to B, D
Z	Special (specify)	

□ — Seals

Code	Description
N	Nitrile (standard)
V	Fluorocarbon
E *	EPR
Z *	Special (specify)

* Consult factory for delivery

□ — Operating Pressure

Code	Description
A	210 Bar (3000 PSI)
B	350 Bar (5000 PSI)
Z	Special (specify)

Operating pressure is independent of material selection.

□ — Flows

Code	Description
40	150 LPM (40 GPM)
50	190 LPM (50 GPM)
60	225 LPM (60 GPM)

□ — Special Options

Code	Description
Omit	Standard
D	(Specify) See list below

□□□□ — Factory Code for Special Options

Weight: .3 kg (16.0 lbs.)

Special Options:

Consult factory for price, delivery and availability of special options.

Special coil
Special wiring
Special seals
Special flow rate
Dual flow rate
Dual gain
Zener barriers

Accessories

Cable with Mating Connector: EHC154S

Mating Connector: MS3106E-14S-2S

Bolt Kit: Included with valve

Flushing Valve: 11-0700

Subplate: 55-0200-2 SAE-24 Side ports

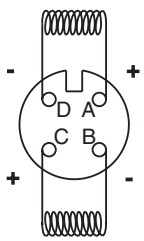
Null Adjust Tool: 27-0210

Electronic Drivers: 23-5030, 23-7030, BD90*, BD95* and BD101*

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.
* For output currents >15 mA

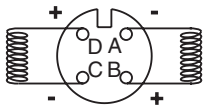
Flushing valve is rated for 3000 psi operation.

Wiring Option C
(Standard)



Dyval and Pegasus standard.

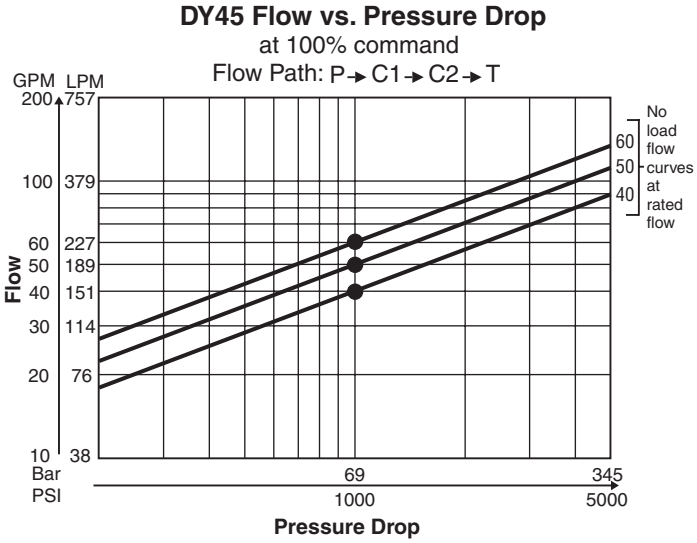
Wiring Option D



Moog, Atchley and Vickers standard.

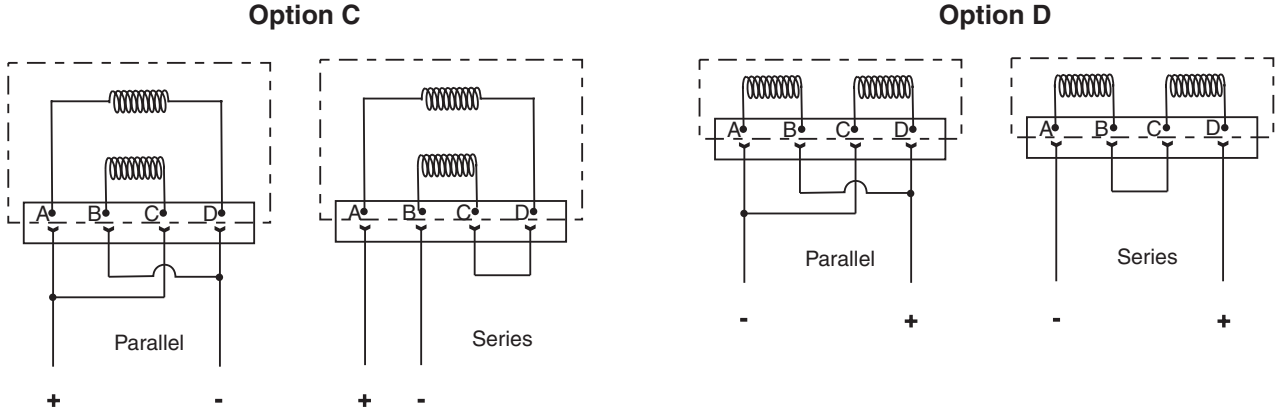
In both cases, polarity shown connects P to C2 port.

Performance Curves



Installation Wiring Options

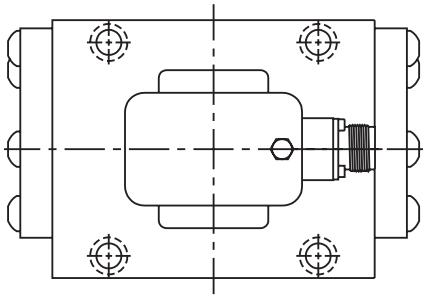
This servovalve has two coils. This illustration shows the internal wiring configurations for options C and D. When connecting the valve to a drive amplifier, the user's external wiring may put the coils either in parallel or in series as needed. Refer to the illustrations below and to the mounting pattern for this valve to insure proper control phasing.

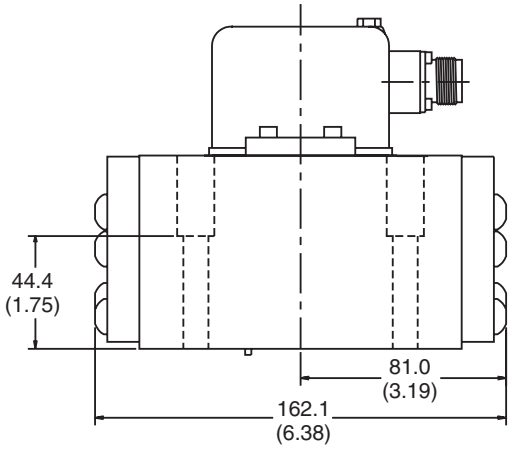


Polarity shown connects flow from P to C2 port.

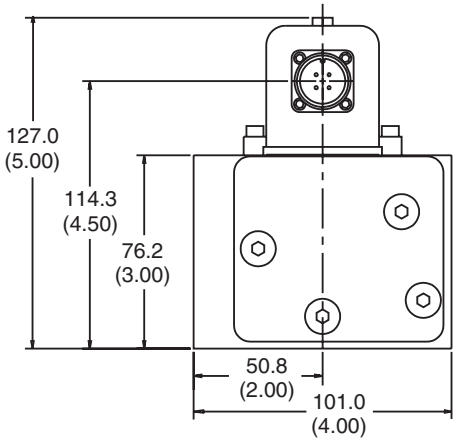
Dimensions

Inch equivalents for millimeter dimensions are shown in (**)

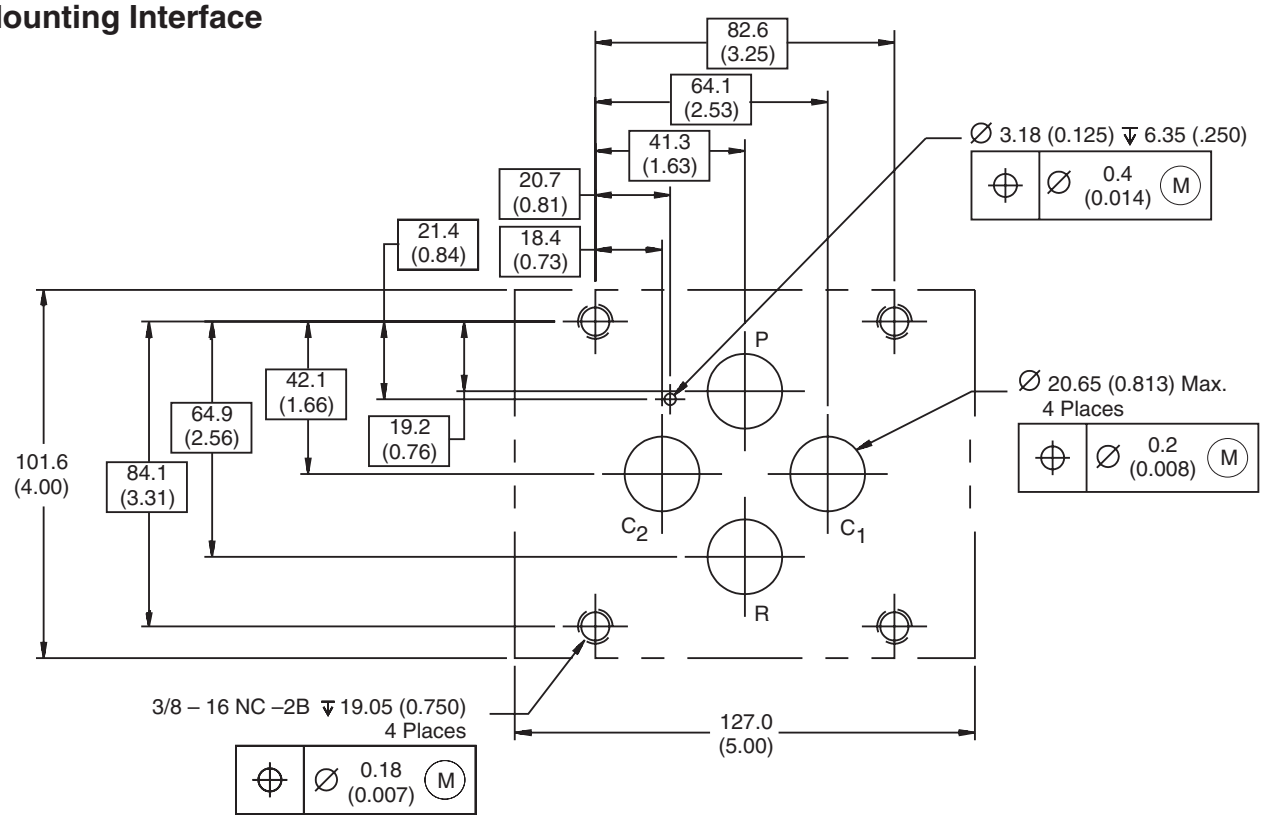




Connector over C1 port



Mounting Interface



HY14-1483.indd, dd

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Offer of Sale

The items described in this document and other documents or descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors are hereby offered for sale at prices to be established by Parker Hannifin Corporation, its subsidiaries and its authorized distributors. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any such items, when communicated to Parker Hannifin Corporation, its subsidiary or an authorized distributor ("Seller") verbally or in writing, shall constitute acceptance of this offer.

1. Terms and Conditions of Sale: All descriptions, quotations, proposals, offers, acknowledgments, acceptances and sales of Seller's products are subject to and shall be governed exclusively by the terms and conditions stated herein. Buyer's acceptance of any offer to sell is limited to these terms and conditions. Any terms or conditions in addition to, or inconsistent with those stated herein, proposed by Buyer in any acceptance of an offer by Seller, are hereby objected to. No such additional, different or inconsistent terms and conditions shall become part of the contract between Buyer and Seller unless expressly accepted in writing by Seller. Seller's acceptance of any offer to purchase by Buyer is expressly conditional upon Buyer's assent to all the terms and conditions stated herein, including any terms in addition to, or inconsistent with those contained in Buyer's offer, Acceptance of Seller's products shall in all events constitute such assent.

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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6035 Parkland Boulevard
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160 Chisholm Drive Milton
Ontario Canada L9T 3G9
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Fax: 905-876-1958

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Fax: 514-684-4191

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Toluca, Mex C.P. 50100
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Fax: 52 722 2799308

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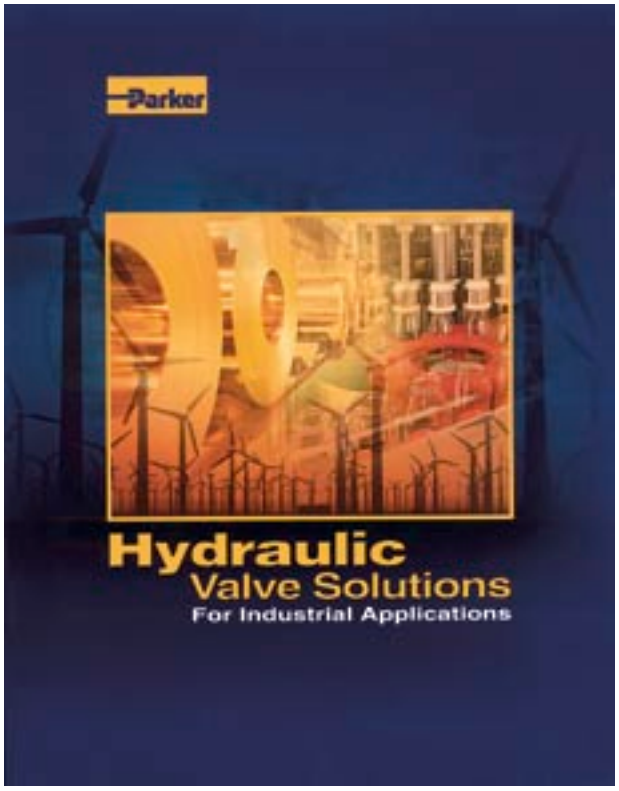

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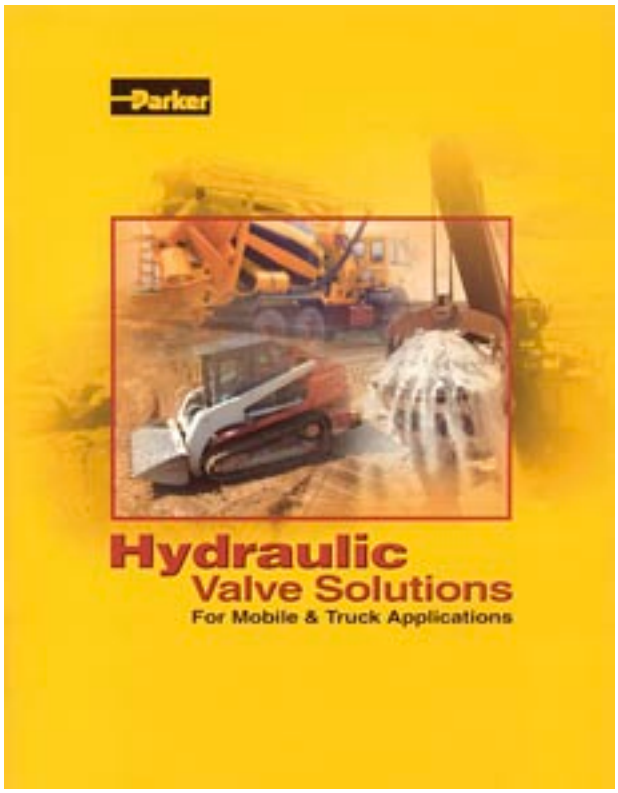

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