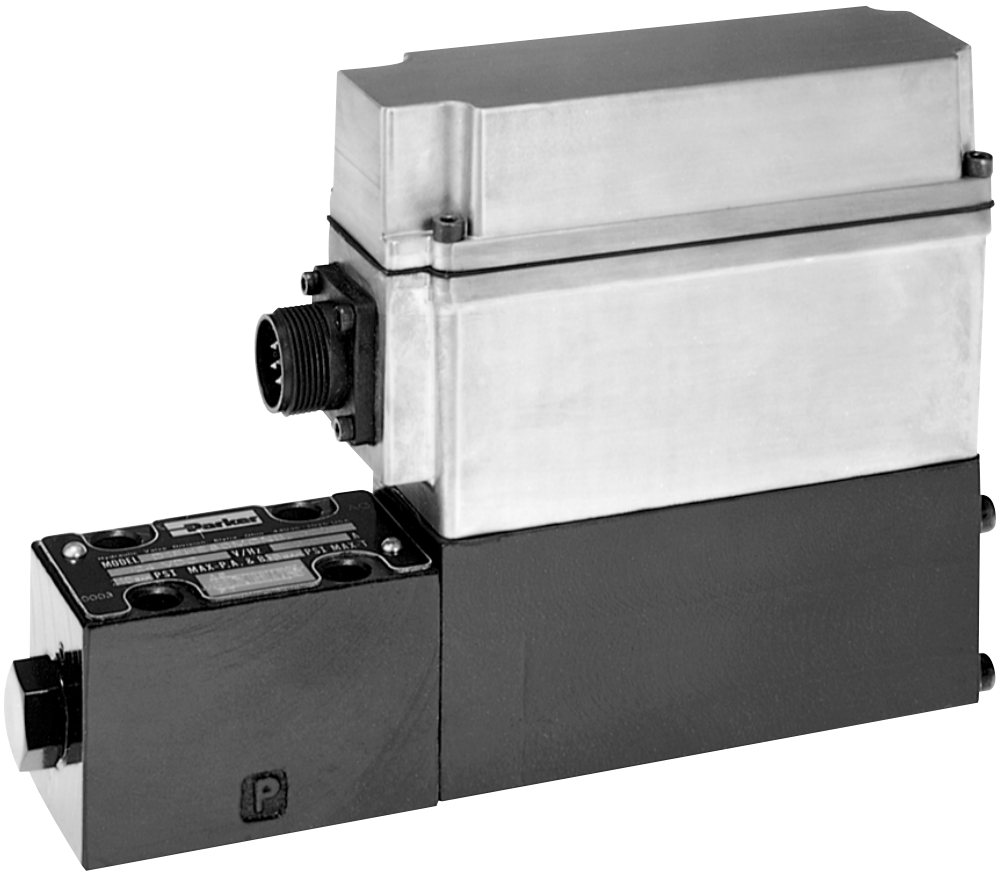
Parker Hydraulics

Bulletin HY14-2579-M1/US
Installation Guide

Series D1FH Proportional Directional Control Valves

Effective: February 1, 2001
Supersedes: April 1, 2000



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Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio 44035 USA

General Description

The Parker D1FH is a high response proportional servo valve with an on-board drive amplifier. The D1FH incorporates the use of state-of-the-art drive electronics with an LVDT for continuous monitoring of the spool position. Zero lap spools are available for closed loop applications with two different 'power down' configurations. The valve features frequency response levels greater than 100 Hz, along with low hysteresis and excellent repeatability.

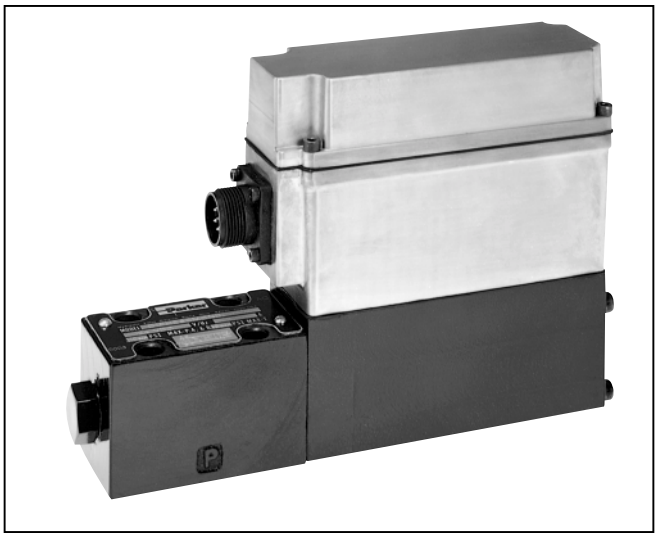
Operation

The D1FH valve uses a precision lapped spool and sleeve configured with four control positions. During normal operation the valve will shift from the center position to either side providing flow out the 'A' or 'B' port. When input power is removed from the drive amplifier, the valve will shift to a fourth position. The fourth position will block all four ports in one version. A second version that is available will block the 'P' port and allow the 'A' and 'B' ports to bleed to the 'T' (tank line). (Refer to the 'enable' note on page 4.)

Note: The tank line to the valve must have a minimum pressure of 1.4 Bar (20 PSI). Maximum pressure is 35 Bar (500 PSI).

Features

- **On-Board Electronic Drive Amplifier** — Integral electronics eliminates the need for costly wiring between the valve and driver card. The unit is shipped as a factory preset and tested unit.
- **High Frequency Response** — The valve has a very high frequency response which is necessary for many closed loop applications.
- **Four Position Spool Capability** — The four position spool provides predictable flow in the event of a power failure to the drive electronics, within the limits of the power curve.
- **315 Bar Pressure Capability** — The maximum operating pressure rating for the D1FH is 315 Bar or 4500 PSI
  (40 LPM version limited to 210 Bar).
- **Spool Position Feedback** — The LVDT continuous feedback monitoring circuit provides low hysteresis and excellent repeatability.
- **Contaminant Sensitivity** — The D1FH operates with standard mineral oil based fluids with a cleanliness level of ISO Class 16/13, SAE Class #4.
- **Drive Enable Feature** — Output to the coil is shut down when the enable signal, (5 to 30 VDC), is not present. The valve will then shift to the fourth position flow path selected by the user. (E50 or E80 spool)
  (See note on page 4.)



Specifications

Interface	NFPA D03, CETOP 3
Max. Operating Press.	315 Bar (4500 PSI)
Max. Tank Line Press.	35 Bar (500 PSI)
Min. Tank Line Press.	1.4 Bar (20 PSI)
Flow Rating at Δp 35 Bar (500 PSI) per metering edge	B spool 5 LPM (1.3 GPM) D spool 10 LPM (2.6 GPM) H spool 20 LPM (5.3 GPM) M spool 40 LPM (10.6 GPM)
Typical Spool Overlap	Zero Lap
Pressure Gain % of Change/1% Change in Command	Typical 40% Minimum 25%
Frequency Response	> 100 Hz at 5% spool stroke (-3 dB)
Step Response	< 16 ms at 100% signal
Hysteresis	< 0.5%
Repeatability	< 0.5%
Viscosity Range	15 to 65 cSt (75 to 300 SSU)
Fluids	Mineral base hydraulic fluid
Operating Temp. Range (Ambient)	0 to 60° C (32 to 140° F)
Fluid Cleanliness Level	ISO Class 16/13, SAE Class #4 or better
Power Requirements	24 VDC, +20%, -10% 2 amps average 4.0 amps peak (<10 ms)
Command Signals	± 10 VDC at 100 k ohm input impedance
	± 20 mA at 499 ohm input impedance
Protection Class	IP65, NEMA 12

Valve Type

D1FH

This valve operates using a 24 VDC supply, accepts a ± voltage or current command and interfaces to the system through a 7 pin I/O connector located on the conduit box.

Installation

Refer to the back of the manual for fluid recommendations, mounting restrictions and other general installation instructions.

Refer to Bulletin No. 2579-000-2/USA for the performance curves and valve dimensions for the D1FH.

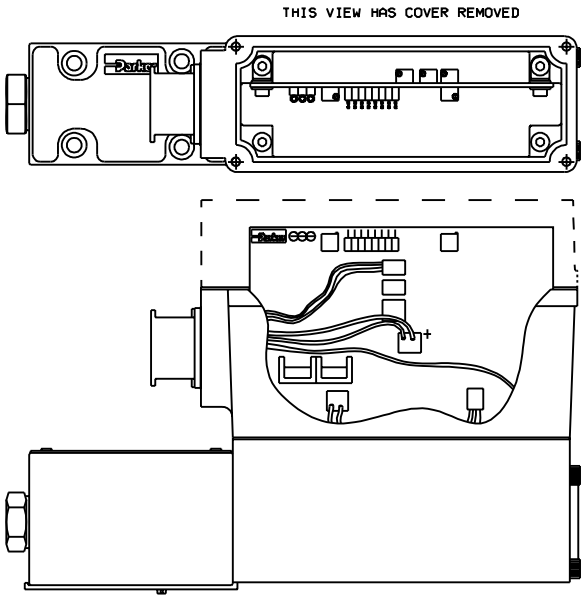


Figure 1 – Configurations

Interface Wiring - 7 Pin I/O Connector

Power Supply	24 VDC Nominal 2.0 Amps 4.0 Amps Peak (<10 ms) + to Pin A - to Pin B
Enable	5 to 30 VDC at Pin C No signal disables the valve.
Command Input	±10 VDC between Pin D and Pin E If D is more positive than E, flow is from P→A. Note: If command source is not differential tie the unused input to the command source common.
Spool Position Output (optional)	Pin F ±10 VDC Positive voltage is P→A. Negative voltage is P→B.
Chassis Ground	Pin G, internally wired to the valve body.

EHC 8G Cable Wiring

PIN	FUNCTION	COLOR
A	+Pwr Sup	Red
B	Pwr Sup Com	Blk
C	Enable	Yel
D	+Cmd	Blue
E	-Cmd	Orn
F	Spool	Wht
G	Chassis Gnd	Grn

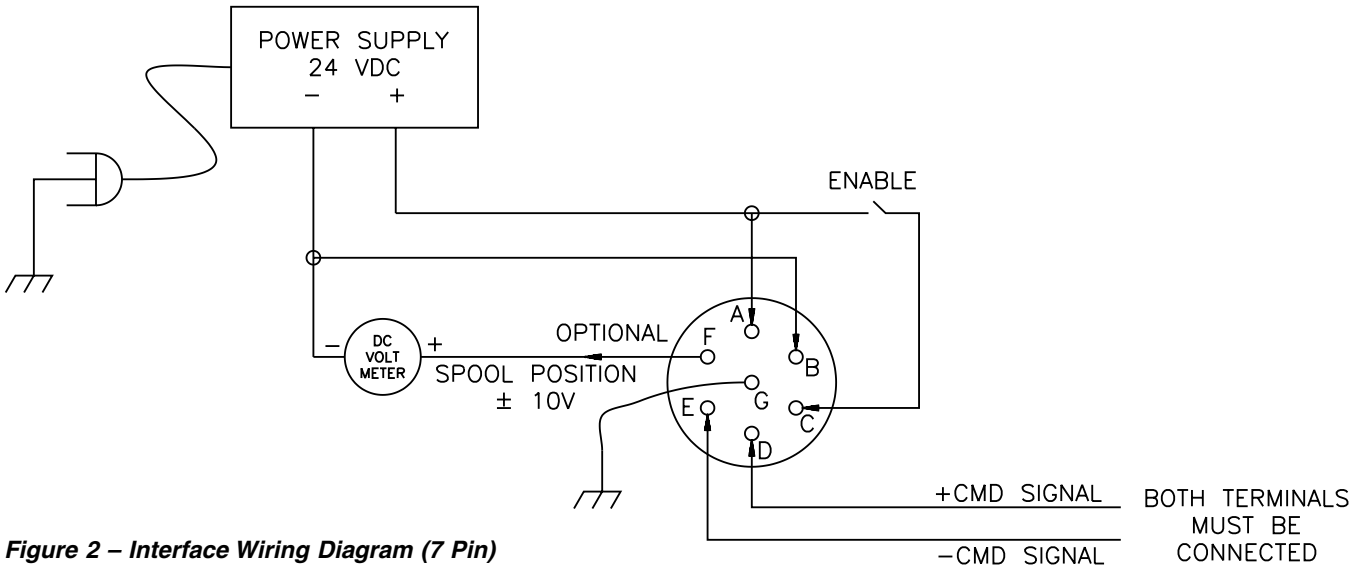


Figure 2 – Interface Wiring Diagram (7 Pin)

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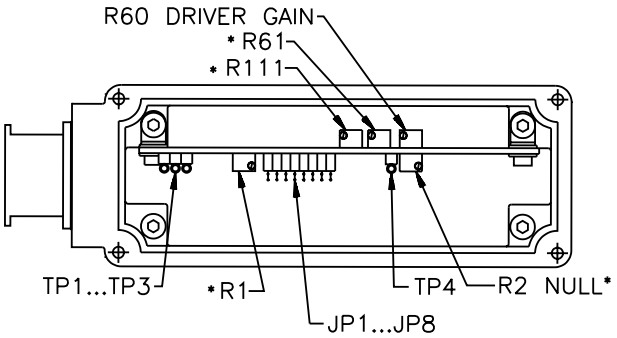
Initial Startup

The following procedure is for start up only. Once the valve is in the system and operating this will not be required.

1) Mount valve keeping contamination to a minimum. We suggest you install a 1.4 Bar (20 PSI) check valve in the T port line. (Solenoid Up not recommended.)
2) Run oil to the valve with the electronics off, allowing the valve body to heat up and acclimatize to hot oil temperatures. (Turn on the power to valve with Enable Signal removed.)
3) Always start with the system gain at minimum — this is the external closed loop gain of your computer or PLC. If the system gain is too high the valve will oscillate and could pull in air. With the gain low, apply the Enable signal. The Enable signal has a 10 mS time delay to allow the electronics to stabilize. During the transition with a OV or OmA command signal, the valve will go through the
P-B, A-T position while traveling to the functional center position of the valve.
4) If the valve oscillates check your command inputs for noise or air in the system.
5) Once the valve is stabilized, adjust R60 CW for maximum performance.
6) Run valve through a series of repeat cycles, in and out for 5 minutes. Adjust the gain as required for system performance. If the speed is different for extend and retract it probably means you need to set different gains in your controller for extend and retract.

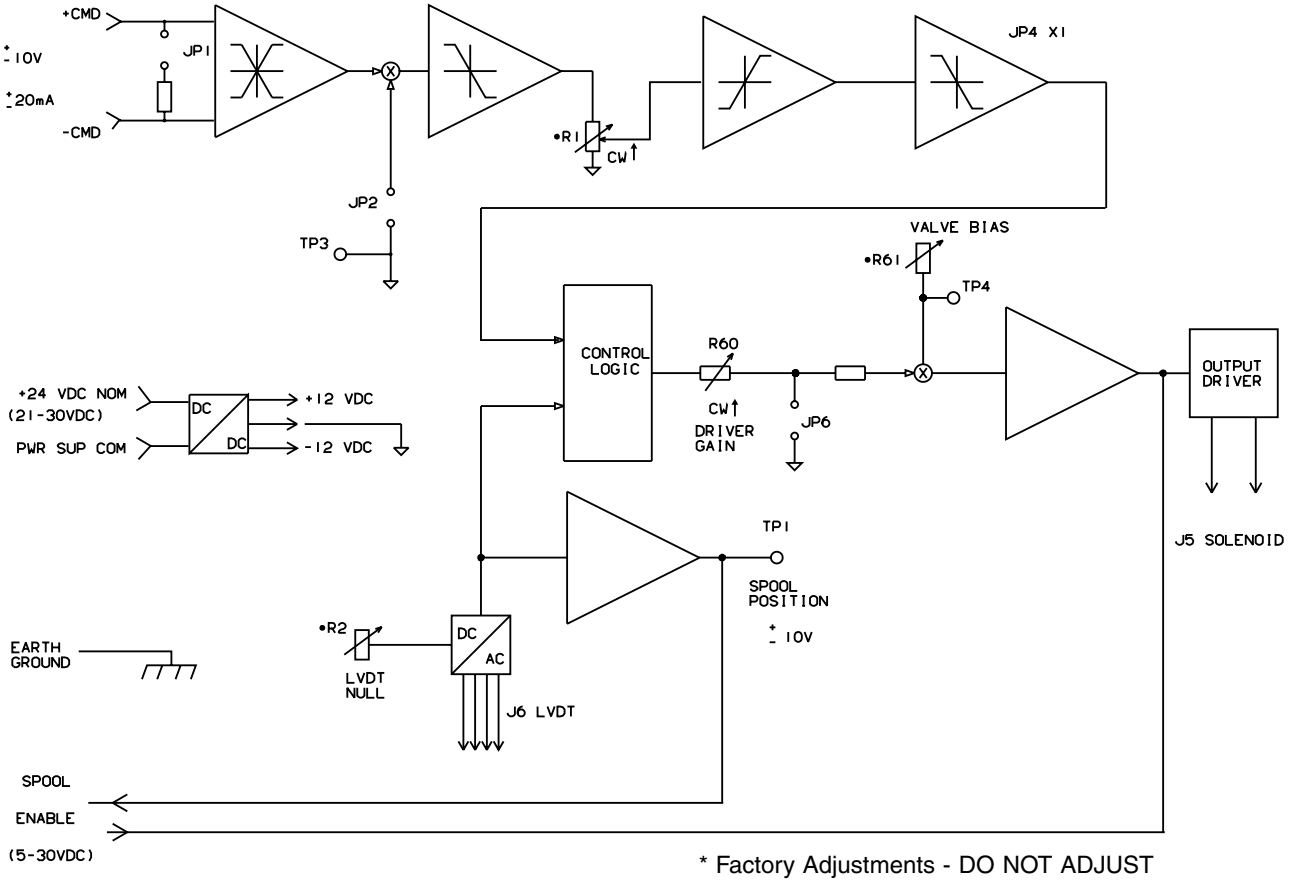
Jumpers

Command Input	Jumper Selection
±10 VDC	JP2 IN JP4 IN JP7 SPARE
±20 mA	JP1 IN JP2 IN JP4 IN



* Factory Adjustments - DO NOT ADJUST

Figure 3 – Board Setup



* Factory Adjustments - DO NOT ADJUST

Figure 4 – Functional Block Diagram

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Symptom	Cause	Solution
Instability	*Power Supply?*	Select a power supply not current limited below 4.0 Amps. Use a separate power supply for each valve. The power supply must be chassis grounded.
	Noise on inputs?	To verify, remove input signals and short +CMD to -CMD. For best noise immunity, connect input signals (2 wires for each input) directly to the command source. This is a high bandwidth valve so 60 hertz noise at the inputs could be amplified.
	System Gain?	Initial startup should be with the external feedback loop gain at a minimum value and lower pressure. Oscillation may be a result of high loop gain. (Note: with motion controllers minimum gain may less than one).
	Oil Temperature?	The oil temperature should be within the 38°C to 60°C (100°F to 140°F) range. (Viscosity range = 15 to 65 cSt or 75 to 300 SSU).
	Air in valve?	High frequency operation with low tank line pressure could result in air in the valve. The suggested tank line pressure is a minimum of 20 PSI. To eliminate air, apply a low pressure and cycle the valve at a low frequency with a command of approximately ±10 VDC (or ±20 mA).
Null	*System Variations?*	The valve was nulled for a double rod cylinder. The external closed loop system gain should compensate for load variations and provide the error signal required for null. With closed loop control removed, actuator may drift. Circuit may require an idle mode manifold.
Low Flow	*Flow Limited?*	Verify potentiometer R1 is fully CW. Verify that the Command input is +10 VDC or -10 VDC for maximum flow.
	Floating Input?	Both inputs terminals must be connected. If only one terminal is used, tie the other terminal to command source common.
		System pressure? Verify that the system pressure is set as required and there are no other flow paths.
No Flow	*Power?*	Verify there is power to the board and it is wired with the correct polarity.
		Verify that the ENABLE signal is present.
		Verify that the connections to the valve subplate are correct.
Full Flow	*Phasing?*	If connected to an external feedback system, verify open loop operation of valve with a potentiometer. Improper system phasing would result in maximum Command input.
Cylinder Extended/ Retracted and Won't Return	*Phasing?*	System phasing is incorrect. Try reversing the system Cmd or Fdbk inputs.
Flow With No Enable	*System Dynamics?*	The spool will return to the fourth position only if the system dynamic flows and pressures are within the power capacity envelope. The fourth position is subject to all Bernoulli flow forces, radial hydraulic lock forces and other forces that affect all directional control valves. The system designer must determine if the dynamic flows and pressures in the system will prevent the spool from returning to the fourth position. This would have to be verified with full load testing.
		As with any spool valve, the user should not rely on the valve to hold loads in place. The leakage rate through the fourth position blocked center spool (80 spool) will allow an unloaded single rod cylinder to extend. This occurs with any blocked center four-way valve.

FOR MAXIMUM VALVE RELIABILITY, ADHERE TO THE FOLLOWING INSTALLATION INFORMATION

Fluid Recommendations

Premium quality hydraulic oil with a viscosity range between 32-54 cSt (150-250 SSU) at 38°C (100°F) is recommended. The absolute operation viscosity range is from 15-65 cSt (75-300 SSU). Oil should have maximum anti-wear properties and rust and oxidation treatment.

Filtration

For maximum valve and system component life, the system should be protected from contamination at a level not to exceed 125 particles greater than 10 microns per milliliter of fluid. (SAE Class 4 or better/ ISO Code 16/13). **Flushing the system prior to valve installation is recommended on new installations.**

Silting

Silting can cause any sliding spool valve to stick, and not spring return, if held shifted under pressure for long periods of time. The valve should be cycled periodically to prevent sticking.

Special Installations

Consult your Parker representative for any application requiring the following:

- Pressure above rated.
- Fluid other than those specified.
- Synthetic or fire-resistant fluids.
- Oil temperature above 71.1°C (160°F).
- Flow path other than normal.
- Non-standard power supply grounding.

Torque Specifications

The recommended torque values are for the bolts which mount the valve to the manifold or subplate are as follows:

NFPA Size	Bolt Thread Size		Torque
	Metric	English	
D03	M5 x 0.8	10-24 UNC	5.6 N.m. (50 in.-lbs.)

Mounting Restriction

In order to ensure proper operation, the D1FH must be mounted horizontally. If the valve is mounted vertically, a check valve with a minimum rating of 1.4 Bar (20 PSI), should be placed in the tank line to maintain back pressure to the valve.

Tank Line Surges

If several valves are piped with a common tank line, flow surges in the line may cause an unexpected spool shift. Separate tank lines should be used when line surges are expected.

Subplate Specifications

Subplate	Port Size	Location	Max. Pressure
SPD23	3/8" NPTF	Bottom	207 Bar (3,000 PSI)
SPD2330	3/8" NPTF	Bottom	345 Bar (5,000 PSI)
SPD23S	9/16-18 NPTF	Bottom	207 Bar (3,000 PSI)
SPD23SA	9/16-18 NPTF	Side	207 bar (3,000 PSI)

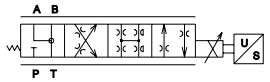
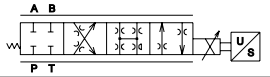
D	1	F	H	E			C		B	J	0	0	
Directional Control Valve	Size and Interface	Proportional Flow Regulation	High Response w/ LVDT & On-Board Electronics	Flow Ratio	Spool	Stroke Code of Spool	Style	Seals	Electronic Variations	Supply Voltage	Electronic Accessories	Valve Accessory	Design Series Not required for ordering

Code	Description
1	NG06/CETOP 3

Code	Ratio
E	QA = QB

Code	Type
N	Nitrile
V	Fluorocarbon

Code	Description
C	Bi-Directional

Spool w/0% overlap (servo) Flow ratio A : B = 1	
Code	**Symbol**
50	
80	

Code	Flow at Δp 35 Bar (500 PSI) per metering edge	
B	5 LPM	(1.3 GPM)
D	10 LPM	(2.6 GPM)
H	20 LPM	(5.3 GPM)
M	40 LPM	(10.6 GPM)

Code	Voltage
J	24 VDC

Code	Description
B	Voltage Input 0 ... ±10 V (user configurable to 0 ... ± 20 mA)

Flow Ratio: E = throttling area (P→A=A→T)=(P→B=B→T)

Use one Power Supply for each valve. #PS24

Connector — Part #697323 (7 pin CE)
Part # (7 pin CE)

Mounting Bolt Kit — #BK209
Metric #M5X30 (qty 4)

Weight: NG06 3.7 kg (8.2 lbs.)

Cables

EHC		8	G	E
Electrohydraulic Cable for D3FH Valve	Length	Cable Type	Pin Orientation	Options

Code	Length
3	Length in feet
6	
9	
12	
15	

Code	Description
8	8-wire, 20 awg. shielded (Alpha 5388)

Code	Description
G	D1FH

Code	Description
Omit	Standard
E	Metal CE Compliant

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

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

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

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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.

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