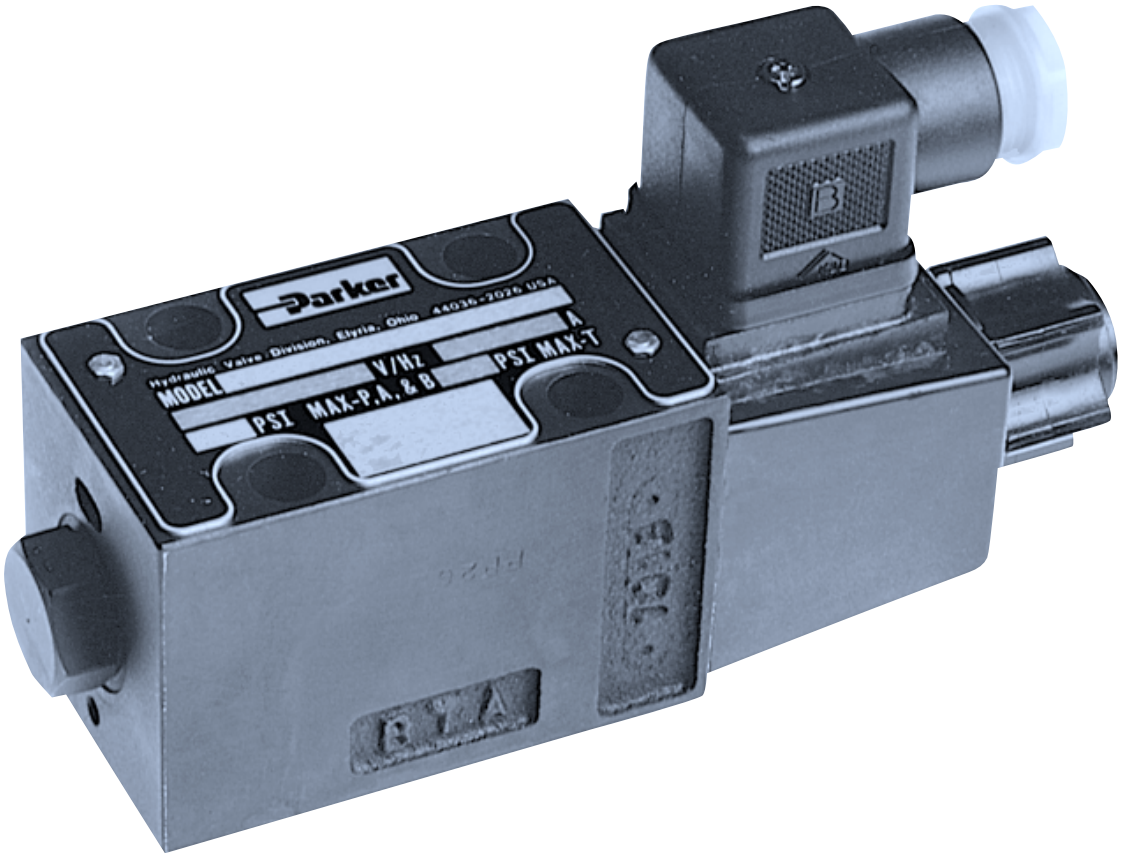
Parker Hydraulics

Bulletin 2531-M1/USA
Service Bulletin

Series D1VW, B Style

Effective: March 23, 1998



Model Code

Parts Data

2531-M1.pm6, sm, jj

Standard Valves

D	1V	W		B								
Directional Control Valve	Basic Valve	Actuator	Spool	Style	Seal	Solenoid Voltage	Solenoid Connection	Solenoid /Tube Combination	Tube Variation	Coil Variation	Valve Variations	Design Series

Basic Valve

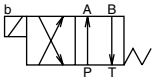
NFPA D03
CETOP 3

Actuator

Wet armature solenoid

Style

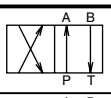
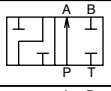
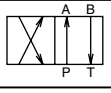
Single solenoid, 2 position, spring offset P to A and B to T in offset position



Seal

Code	Description
N	Nitrile
V	Fluorocarbon
E	EPR

Spool

Code	Symbol
20	
26	
30	

* 20 & 26 spool have closed crossover
** 30 spool has open crossover

Solenoid Voltage

Code	Description
A #	24/50 VAC
R #	24/60 VAC
Q #	100/50 VAC
Y	120/60 - 110/50 VAC
T	240/60 - 220/50 VAC
L	6 VDC
K	12 VDC
J	24 VDC
D	120 VDC
Z	250 VDC

High Watt Coil only.

Solenoid Connection

Code	Description
C	Conduit Box
E	Explosion Proof
P	Hirschmann w/ Plug
S # †	Dual Spade Lug
W †	Hirschmann w/o Plug
H* # †	Single Spade Lug

† Not available with lights
# Not CSA approved
* DC only

Solenoid /Tube Combination

Code	Coil	Tube
Omit	High Watt	Low Pressure
H*	High Watt	High Pressure
F	Low Watt	Low Pressure
FH*	Low Watt	High Pressure
D †	Explosion proof CENELEC	
M †	Explosion Proof M.S.H.A.	
U †	Explosion Proof UL/CSA	

* High pressure tube rating 210 Bar (3000 PSI)
† Explosion proof coils are 60Hz @ standard voltage and are high wattage only. Dual frequency rating not available.

Tube Variation

Code	Description
Omit	Standard Tube
P*	Extended Manual Override
R*	Repairable Manual Override
T*	Without Manual Override

* Tube variations not available on explosion proof.

Coil Variation

Code	Description
Omit	Standard Coil
B	Without Coil
C†	Hazardous Location
V*	Surge Suppression

† Conduit solenoid connection only.
* DC only, not available with solenoid connection H.

Valve Variations

Code	Description
Omit	Standard Valve
4*	C.S.A. Approved
5	Signal Lights
6	Manaplug 3-Pin Without Lights
P10†	Monitor Switch
56	Manaplug with Lights
630	Manaplug 5-Pin Without Lights

* Valve is derated with this option. See Technical Data.
† Not CSA or CE approved.

Valve Weight:
Single Solenoid 1.36 kg (3.0 lbs)
Double Solenoid 1.6 kg (3.5 lbs)
Standard Bolt Kit:
BK209

2531-M1.pm6, sm, jj

Soft Shift Valves

D	1V	W		B		
Directional Control Valve	**Basic Valve**	**Actuator**	**Spool**	**Style**	**Seal**	**Solenoid Voltage**

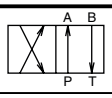
Basic Valve

NFPA D03
CETOP 3

Actuator

Wet armature solenoid

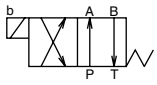
Spool

Code	Symbol
20*	

* 20 spool has closed crossover

Style

Single solenoid,
2 position, spring offset,
P to A and B to T in
offset position.



Seal

Code	Description
N	Nitrile
V	Fluorocarbon
E	EPR

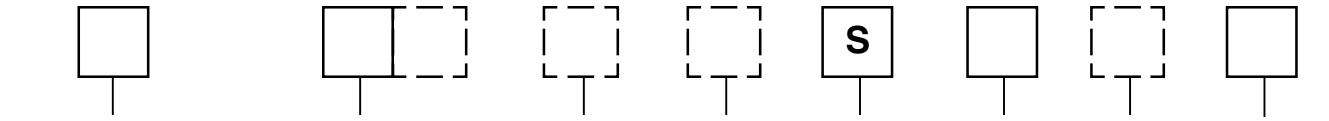
Solenoid Voltage

Code	Description
Q *	100/50 VAC
Y *	120/60 - 110/50 VAC
T *	240/60 - 220/50 VAC
L	6 VDC
K	12 VDC
J	24 VDC
D	120 VDC
Z	250 VDC

* AC input voltage, not necessarily coil voltage.

Valve Weight:
Single Solenoid 1.36 kg (3.0 lbs)
Double Solenoid 1.6 kg (3.5 lbs)
Standard Bolt Kit:
BK209

Soft Shift Valves



Code	Description
C	Conduit Box
P	Hirschmann w/ Plug
S*† #	Dual Spade Lug
W*†	Hirschmann w/o Plug

* DC voltage only
† Not available with lights
# Not CSA approved

Code	Description
Omit	Standard Coil
B*	Without Coil
C†	Hazardous Location

* Not available with solenoid connection "P".
† Conduit solenoid connection only.

NOTE:
Not Required When Ordering

Code	Coil	Tube
Omit	High Watt	Low Pressure
H*	High Watt	High Pressure
F †	Low Watt	Low Pressure
FH*†	Low Watt	High Pressure

* High pressure tube rating 210 Bar (3000 PSI)
† Not available with AC input.

Code	Description
Omit	Standard Valve
4	C.S.A. Approved
5	Signal Lights
56	Manaplug with Lights Single Solenoid 3-Pin
5630	Manaplug with Lights Single Solenoid 5-Pin

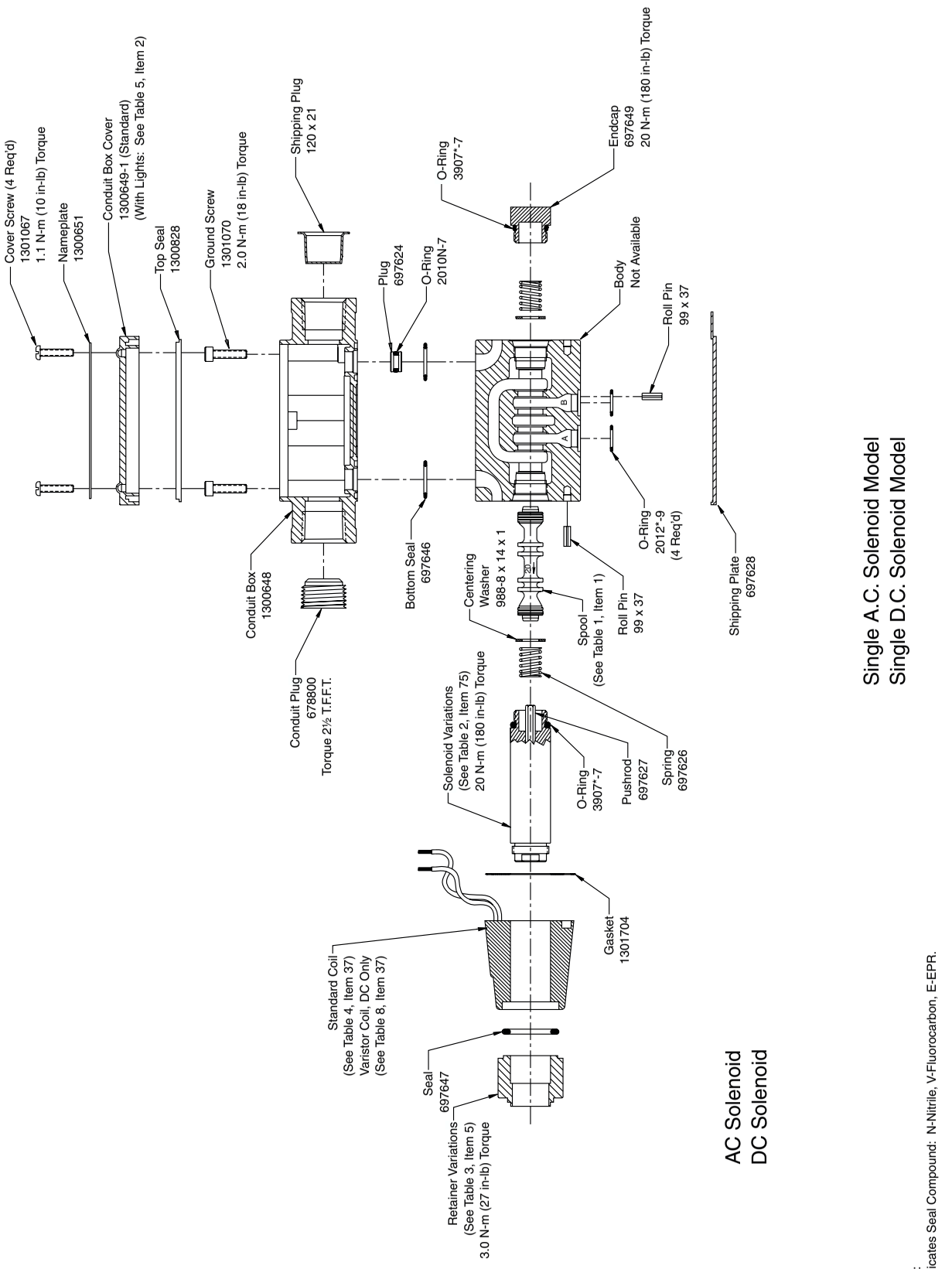
Code	Description
Omit	Standard Tube
R	Repairable Manual Override

X-Number	Orifice Size	Voltage	Spool Center Condition *					
			Closed		Open		2-Position	
			Energize	De-Energize	Energize	De-Energize	Energize	De-Energize
XB072	0.020	AC	175 ms	700 ms	600 ms	800 ms	150 ms	200 ms
		DC	200 ms	650 ms	700ms	650 ms	175 ms	225 ms
XB073	0.030	AC	150 ms	400 ms	500 ms	600 ms	100 ms	150 ms
		DC	125 ms	325 ms	550 ms	550 ms	100 ms	100 ms
XB074	0.040	AC	125 ms	300 ms	450 ms	500 ms	100 ms	100 ms
		DC	100 ms	250 ms	500 ms	450 ms	75 ms	60 ms
XB075	0.050	AC	100 ms	250 ms	400 ms	450 ms	50 ms	100 ms
		DC	50 ms	225n ms	400 ms	400 ms	50 ms	40 ms
XB070	No Orifice	AC	75 ms	250 ms	300 ms	350 ms	40 ms	100 ms
		DC	50 ms	200 ms	300 ms	300 ms	40 ms	40 ms

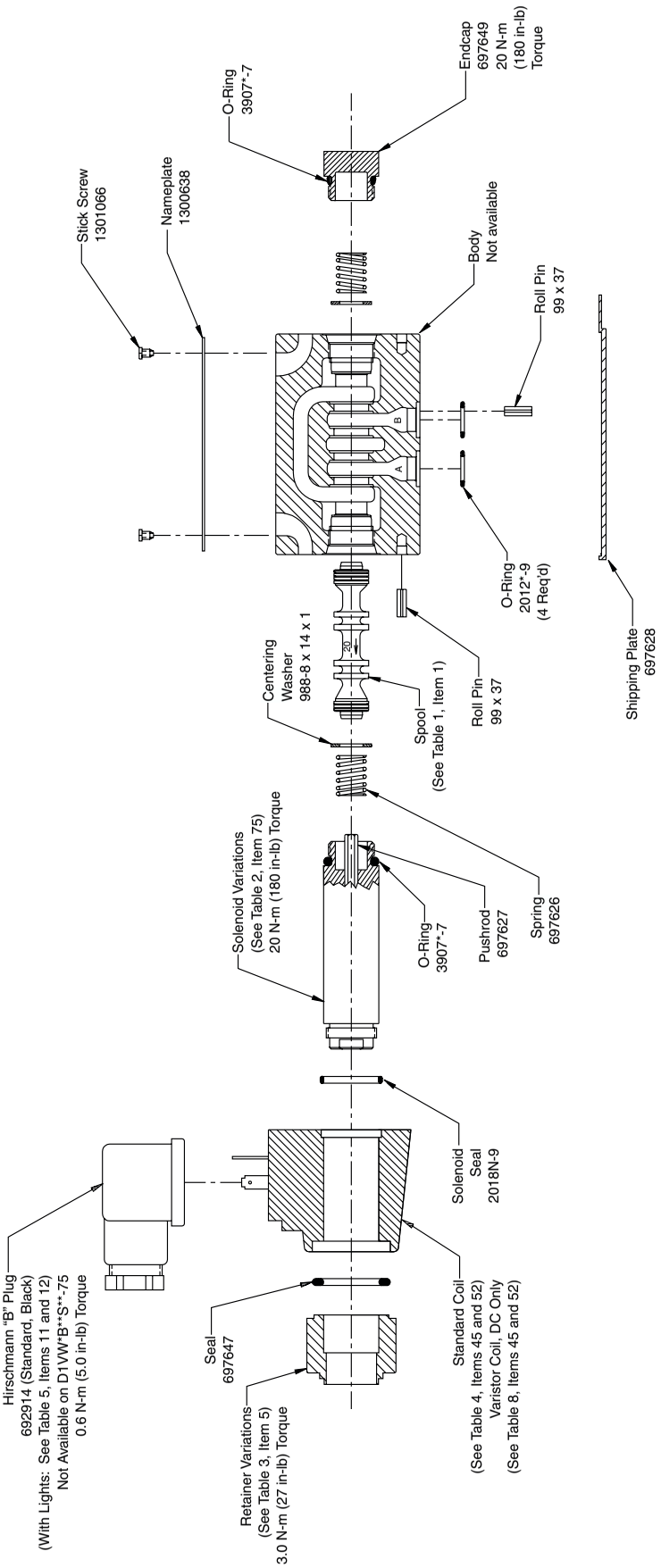
* Step response times were obtained under the folowing conditions: 100 SSU fluid @ 120°F with the valve operating at nominal pressure and flow. Published response times are nominal and may vary with spool, flow, pressure and temperature.

Orifice Kit:	Part Number 1301661
Orifice Removal Tool:	Part Number 1301651

2531-M1.pm6, sm, jj

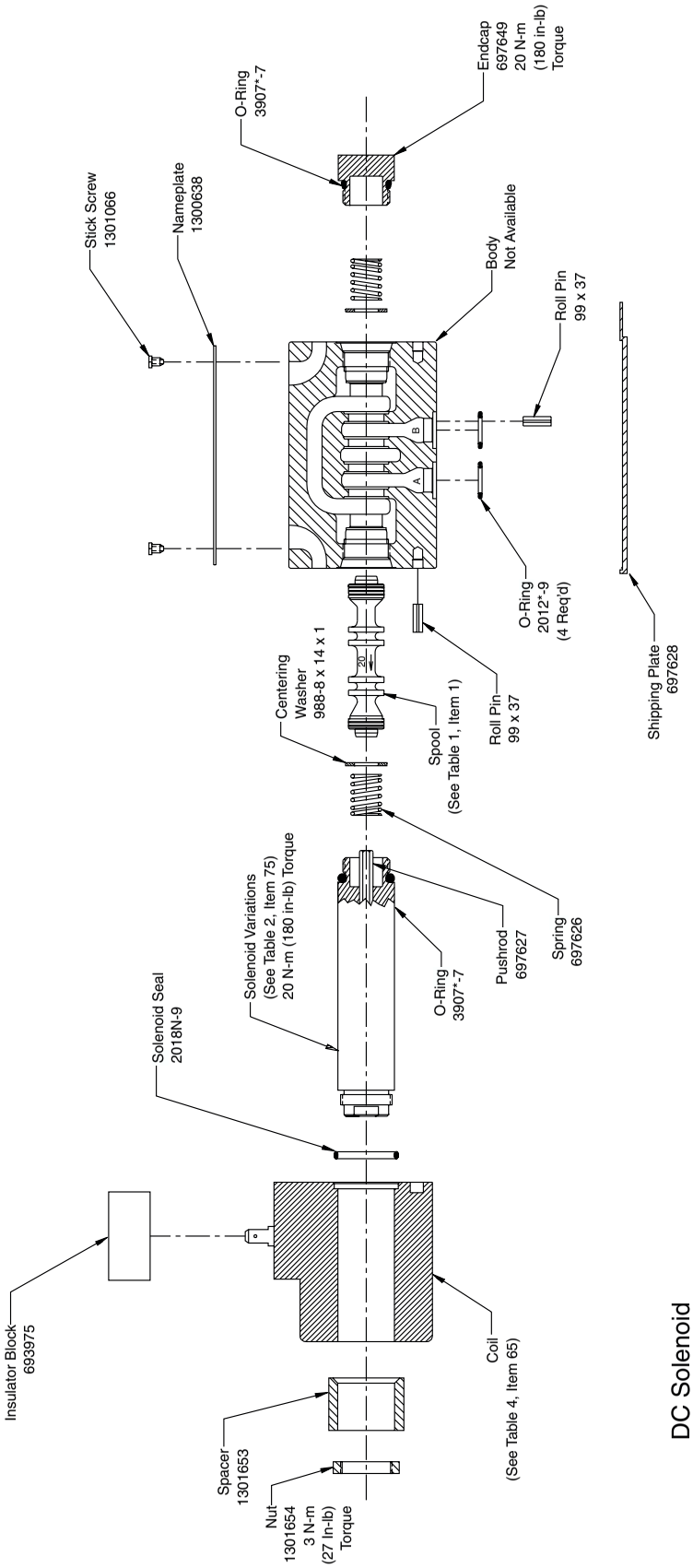


NOTES:
1) * Indicates Seal Compound: N-Nitrile, V-Fluorocarbon, E-EPR.



NOTES:
1) * Indicates Seal Compound: N-Nitrile, V- Fluorocarbon, E-EPR.

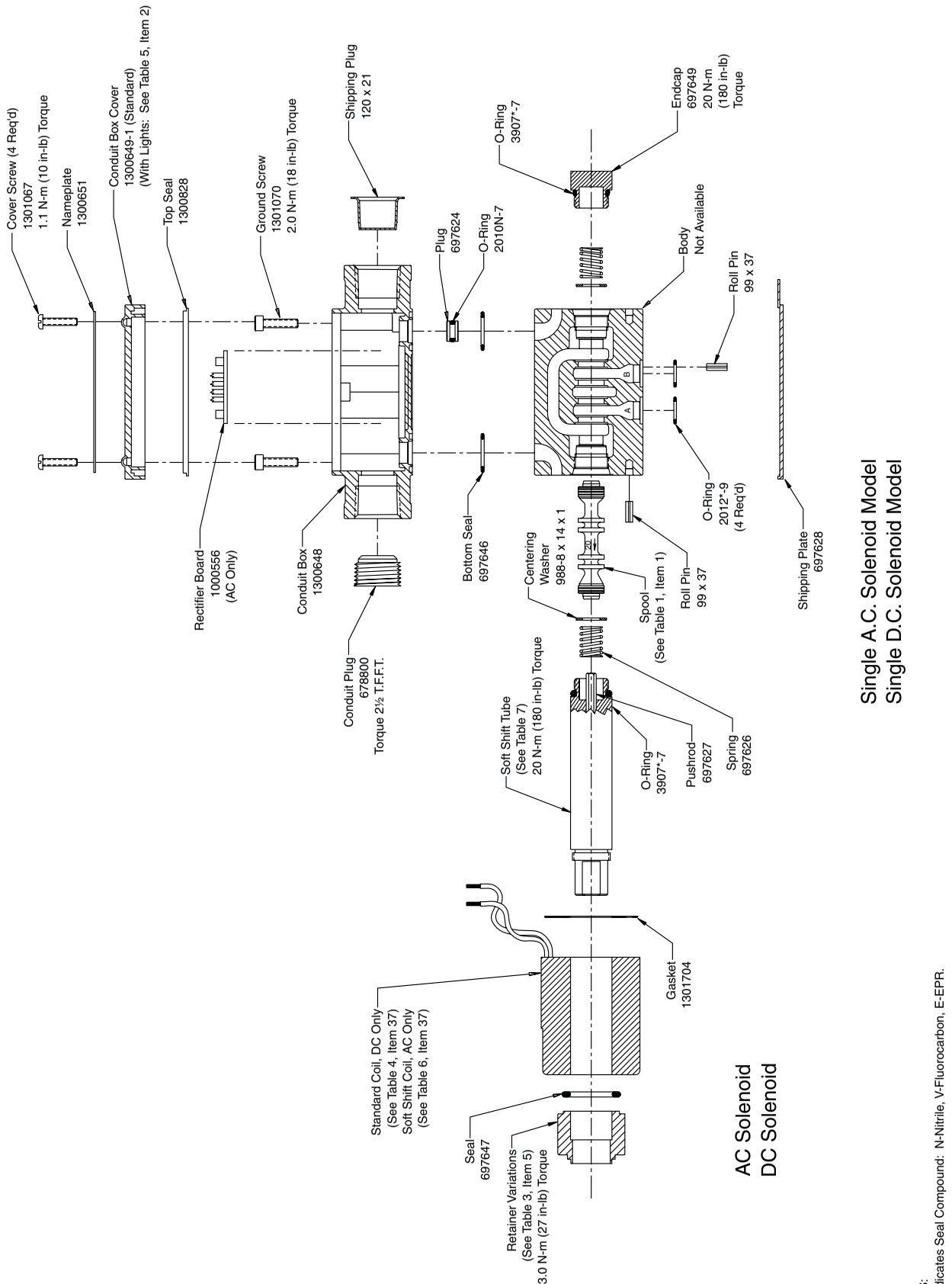
2531-M1.pm6, sm, jj



DC Solenoid

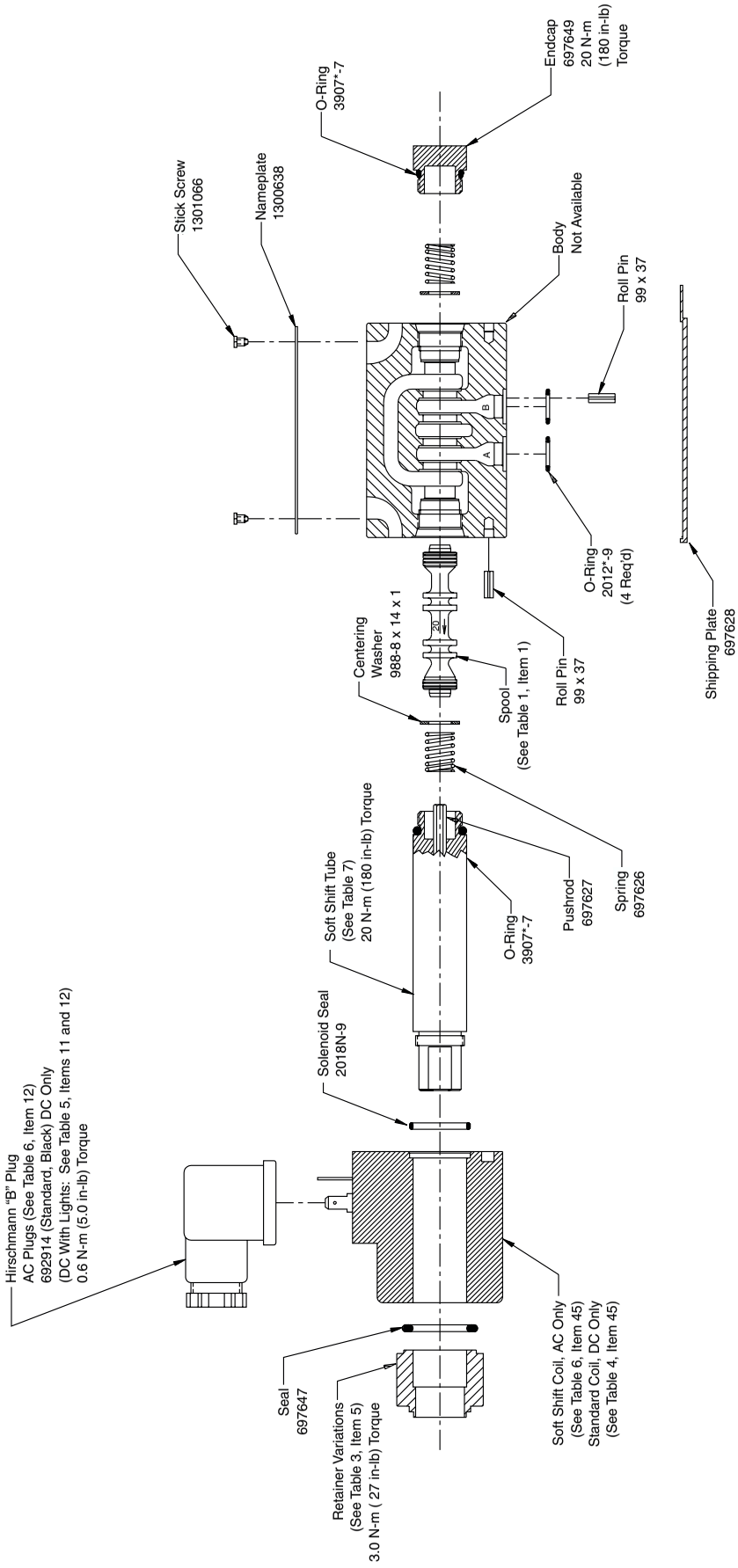
Single D.C. Solenoid Model

NOTES:
1) * Indicates Seal Compound: N-Nitrile, V-Fluorocarbon, E-EPR.



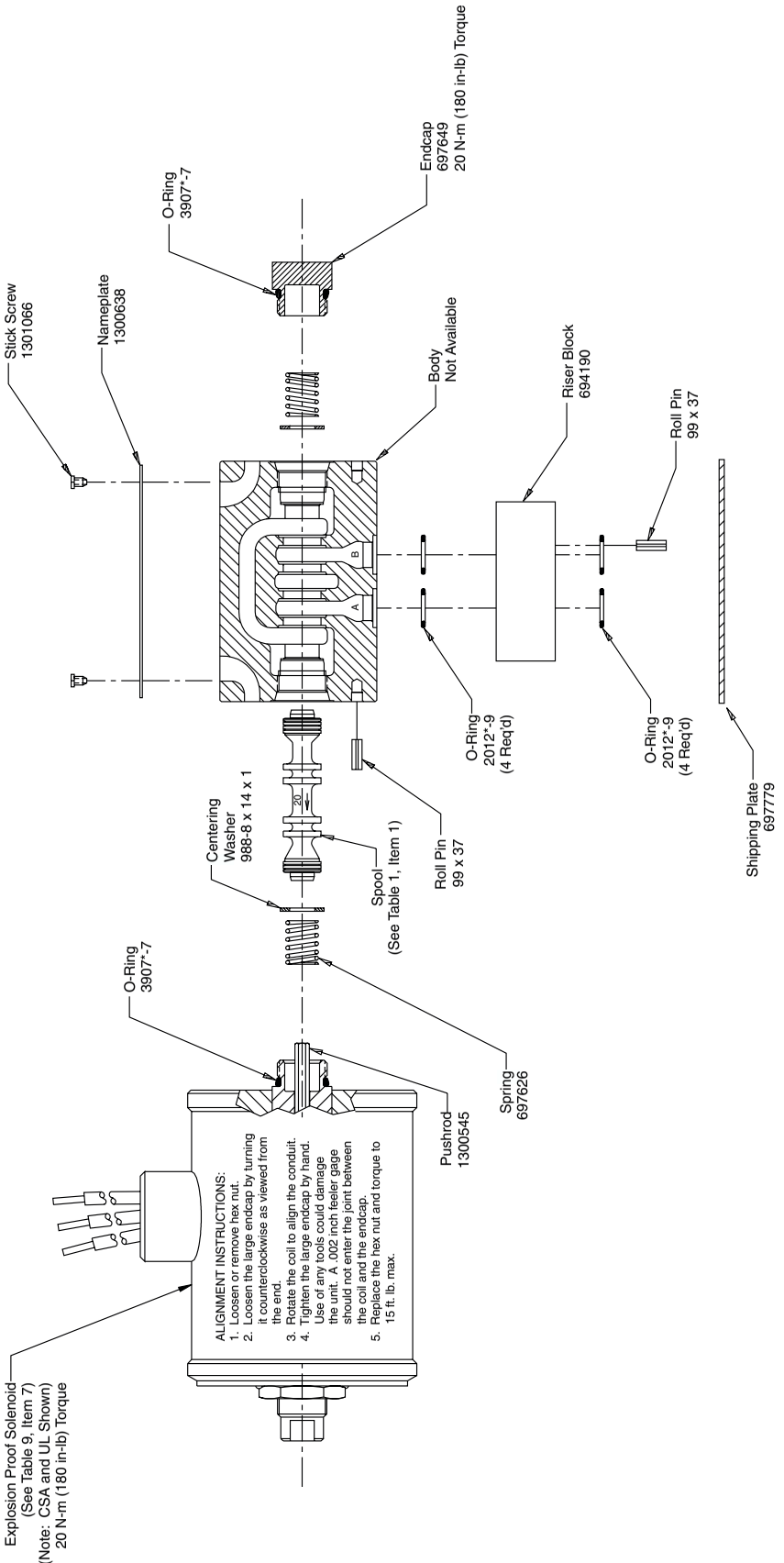
NOTES:
1) * Indicates Seal Compound: N-Nitrile, V-Fluorocarbon, E-EPR.

2531-M1.pm6, sm, jj



NOTES:
1) * Indicates Seal Compound: N-Nitrile, V-Fluorocarbon, E-EPR.

2531-M1.pm6, sm, jj



Single A.C. Solenoid Explosion Proof Model
Single D.C. Solenoid Explosion Proof Model

AC Solenoid
DC Solenoid

NOTES:
1) * Indicates Seal Compound. N-Nitrile, V-Fluorocarbon, E-EPR.

2531-M1.pm6, sm, jj

Table 1 - Spools					
Code	*Item*	*Part Number*	*Qty*	*Description*	1
20	1	697620	1	#20 Spool	
26	1	1300209	1	#26 Spool	
30	1	697630	1	#30 Spool	

1 Arrow points toward 'A' Port for all Spools.

2 Repairable cartridge P/N 1300300, for O-ring only, PN 5-190-*884-75. * Indicates Seal Compound. N-Nitrile, V-Viton, E-EPR.

Table 2 - Solenoid Variations				
Code	*Item*	*Part Number*	*Qty*	*Description*
Omit or F	75	697632	1	A.C. Tube 1500 PSI
		697633		D.C. Tube 1500 PSI
H or FH	75	697714	1	A.C. Tube 3000 PSI
		697717		D.C. Tube 3000 PSI
P or FP	75	697715	1	Extended A.C. Tube 1500 PSI
		697718		Extended D.C. Tube 1500 PSI
HP or FHP	75	697716	1	Extended A.C. Tube 3000 PSI
		697719		Extended D.C. Tube 3000 PSI
R or FR	75	1300296	1	Repairable A.C. Tube 1500 PSI
		1300297		Repairable D.C. Tube 1500 PSI
HR or FHR	75	1860017	1	Repairable A.C. Tube 3000 PSI 2
		N/A		Repairable D.C. Tube 3000 PSI

Table 3 - Retainer Variations				
Code	*Item*	*Part Number*	*Qty*	*Description*
All Except R,S,P & T	5	697981	1	Standard Retainer
P or FP HP or FHP	5	697833	1	Extended Override Retainer
		697161		Extended Override Boot
All R All S	5	1300289	1	Repairable Override Retainer
All T	5	697981	1	Standard Retainer
		1300812		Tamperproof Disc
		1300532		Tamperproof Disc

Table 5 - Signal Lights				
Code	*Item*	*Part Number*	*Qty*	*Description*
All	11	697048	1	Label - "B" Solenoid
YP*5	12	694936	1	Plug w/ light, 100-120V
QP*5	12	694936	1	Plug w/ light, 100-120V
QD*5	12	694936	1	Plug w/ light, 100-120V
TP*5	12	694936	1	Plug w/ light, 240V
KP*5	12	694935	1	Plug w/ light, 12V
JP*5	12	694935	1	Plug w/ light, 24V
DP*5	12	694936	1	Plug w/ light, 100-120V
YC*5	2	1300650-Y	1	Conduit Box Cover, 120V
QC*5	2	1300650-Q	1	Conduit Box Cover, 100VAC
TC*5	2	1300650-T	1	Conduit Box Cover, 240VAC
RC*5	2	1300650-R	1	Conduit Box Cover, 24VAC
AC*5	2	1300650-R	1	Conduit Box Cover, 24VAC
LC*5	2	1300650-L	1	Conduit Box Cover, 6VDC
KC*5	2	1300650-K	1	Conduit Box Cover, 12VDC
JC*5	2	1300650-J	1	Conduit Box Cover, 24VDC
DC*5	2	1300650-D	1	Conduit Box Cover, 120VDC
ZC*5	2	1300650-Z	1	Conduit Box Cover, 250VDC

Table 7 – Soft Shift Tubes, AC or DC				
Code	*Item*	*Part Number*	*Qty*	*Description*
S	75	1860024-*	1	1500 PSI Soft Shift Tube
SH	75	1860025-*	1	3000 PSI Soft Shift Tube
SR	75	1301658-*	1	1500 PSI Repairable Soft Shift Tube
SHR	75	1301656-*	1	3000 PSI Repairable Soft Shift Tube

* Indicates size of orifice. The dash number specifies the following:
-0 = no orifice, x-number xB070
-2 = 0.020 inch, x-number xB072
-3 = 0.030 inch, x-number xB073
-4 = 0.040 inch, x-number xB074
-5 = 0.050 inch, x-number xB075

Table 4 - Standard Coils

Sol Connection ITEM			C (Conduit) 37	P (Hirsch w/ plug) 45	S (Dual Spade) 52	W (Hirsch w/o plug) 45	H (Spade w/o varistor) 65
Code	*Description*	*Qty*	*Part Number*	*Part Number*	*Part Number*	*Part Number*	*Part Number*
Y*	120/60-110/50 VAC	1	697212	697228	1301819	697228	N/A
Y*F	120/60-110/50 VAC Low Watt	1	692619	693715	1301817	693715	N/A
T*	240/60-220/50 VAC	1	697213	697229	1301820	697229	N/A
T*F	240/60-220/50 VAC Low Watt	1	1301930	1301932	1301818	1301932	N/A
Q*	100/60 VAC	1	697348	697350	N/A	697350	N/A
Q*F	100/60VAC Low Watt	1	N/A	N/A	N/A	N/A	N/A
QD	100/60-100/50 VAC	1	N/A	697863	N/A	697863	N/A
R*	24/60 VAC	1	1300344	1300348	N/A	1300348	N/A
R*F	24/60 Low Watt	1	1300715	N/A	N/A	N/A	N/A
A*	24/50 VAC	1	1300345	1300349	N/A	1300349	N/A
A*F	24/50 VAC Low Watt	1	N/A	N/A	N/A	N/A	N/A
E*	24/50-24/60 VDC	1	697214	697693	1301821	697693	N/A
L*	6 VDC	1	1301520	1301515	1301610	1301515	1301620
L*F	6 VDC Low Watt	1	1301530	1301525	1301615	1301525	1301625
K*	12 VDC	1	1301521	1301516	1301611	1301516	1301621
K*F	12 VDC Low Watt	1	1301531	1301526	1301616	1301526	1301626
J*	24 VDC	1	1301522	1301517	1301612	1301517	1301622
J*F	24 VDC Low Watt	1	1301532	1301527	1301617	1301527	1301627
D*	120 VDC	1	1301523	1301518	1301613	1301518	1301623
D*F	120 VDC Low Watt	1	1301533	1301528	1301618	1301528	1301628
Z*	250 VDC	1	1301524	1301519	1301614	1301519	1301624
Z*F	250 VDC Low Watt	1	1301534	1300529	1301619	1300529	1301629

Table 6 – Soft Shift Coils, AC

Sol Connection Item			C (Conduit) 37	P (Hirsch w/ Plug) 45	(Hirschmann Plugs, AC only)			
Code	*Description*	*Qty*	*Part Number*	*Part Number*	*Item*	*Description*	*Qty*	*Part Number*
Y*H	120/60-110/50 VAC	1	1301682	1301692				
Y*F	120/60-110/50VAC Low Watt	1	1301682	1301692	12	Rectified Standard, Plug “B”		1301053
T*H	240/60-220/50Vac	1	1301683	1301693				
T*F	240/60-220/50 VAC Low Watt	1	1301683	1301693	12	Rectified with lights, Plug “B”	1	1300712
QD*H	100/60-100/50 VAC	1	1301684	1301694				

Table 8 – Varistor Coils, DC only

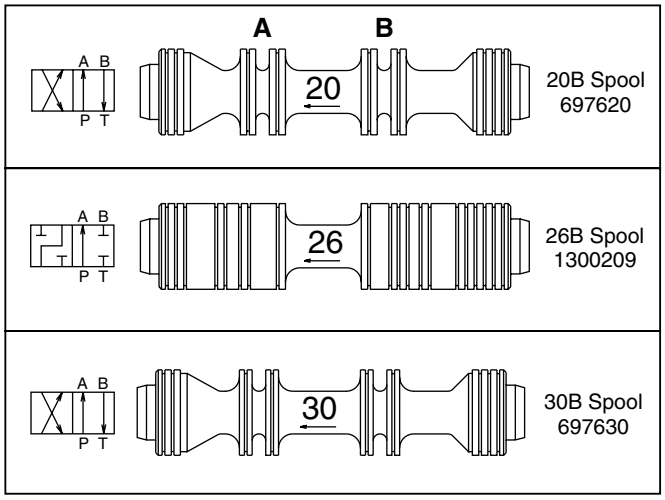
Sol Connection Item			C (Conduit) 37	P (Hirsch w/ Plug) 45	S (Dual Spade) 52	W (Hirsch w/o Plug) 45
Code	*Description*	*Qty*	*Part Number*	*Part Number*	*Part Number*	*Part Number*
L*	6VDC	1	1860001-L	1860003-L	1860005-L	1860003-L
L*F	6VDC – Low Watt	1	1860002-L	1860004-L	1860006-L	1860004-L
K*	12VDC	1	1860001-K	1860003-K	1860005-K	1860004-K
K*F	12 VDC – Low Watt	1	1860002-K	1860004-K	1860006-K	1860004-K
J*	24 VDC	1	1860001-J	1860003-J	1860005-J	1860003-J
J*F	24 VDC – Low Watt	1	1860002-J	1860004-J	1860006-J	1860004-J
D*	120 VDC	1	1860001-D	1860003-D	1860005-D	1860003-D
D*F	120 VDC – Low Watt	1	1860002-D	1860004-D	1860006-D	1860004-D
Z*	250 VDC	1	1860001-Z	1860003-Z	1860005-Z	1860003-Z
Z*F	250 VDC –Low Watt	1	1860002-Z	1860004-Z	1860006-Z	1860004-Z

Table 9 – Explosion Proof Coils

Sol Connection Item			D (Cenelec) 7	M (MSHA) 7	U (UL & CSA) 7
Code	*Description*	*Qty*	*Part Number*	*Part Number*	*Part Number*
YE	120/60-110/50 VAC	1	1300830	697761	697770
TE	240/60-220/50 VAC	1	1300853	697762	697771
QE	100/60 VAC	1	1300856	697763	697772
RE	24/60 VAC	1	1300857	697764	697773
AE	24/50 VAC	1	1300888	N/A	N/A
LE	6 VDC	1	1300858	697765	697774
KE	12 VDC	1	1300859	697766	697775
JE	24 VDC	1	1300860	697767	697776
DE	120 VDC	1	1300861	697768	697777
ZE	250 VDC	1	1300862	697769	697778
NE	220/50	1	1300854	N/A	1300714

B-SOLENOID
* (A-SOLENOID)

A-SOLENOID
* (B-SOLENOID)



Note: Spools 20 and 26 are closed crossover.
Spool 30 is open crossover.

Figure 1: Variation 6, Single Solenoid Models with 3-Pin Manaplug without Lights.

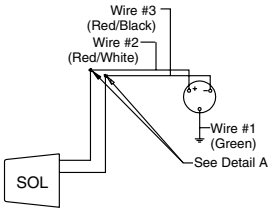
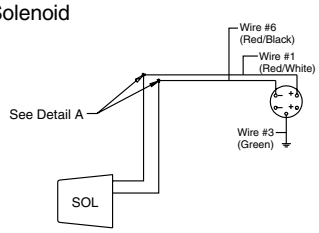
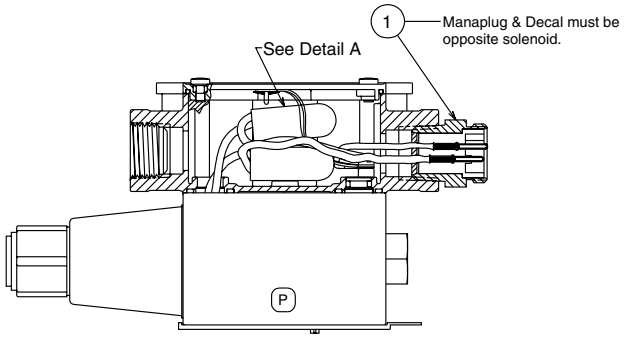
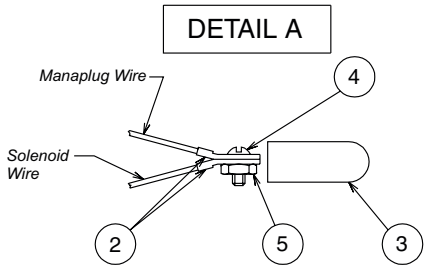
Valve	Spool	Pilot Nameplate Wiring	Wiring diagram	*Item*	*Part Number*	*Qty*	*Description*
D1VW	All	B AB	"B" Solenoid 	1	1302151	1	Manaplug, 3-Pin
				2	MA693015	8	Ring Terminal
				3	MA693452	4	Plastic Boot
				4	4 x 277SZ	4	Screw
				5	16 x 104SZ	4	Hex Nut
				6	MA697787	1	Warning Label

Figure 2: Variation 630, Single Solenoid Models with 5-Pin Manaplug without Lights (See Detail B).

Valve	Spool	Pilot Nameplate Wiring	Wiring diagram	*Item*	*Part Number*	*Qty*	*Description*
D1VW	All	B AB	"B" Solenoid 	1	1302154	1	Manaplug, 5-Pin
				2	MA693015	8	Ring Terminal
				3	MA693452	4	Plastic Boot
				4	4 x 277SZ	4	Screw
				5	16 x 104SZ	4	Hex Nut
				6	MA697629	1	Warning Label





Wiring Instructions:

1. Cut solenoid wires to 100mm (4.00 in.), strip 10mm (.40 in.), and assemble ring terminals (Item 3) to wire.
2. Assemble ring terminals (Item 2) to manaplug wires. On Variation 630, put ring terminals only on the 2 wires needed. Assemble wire caps, (Item 7) to other 2 wires.
3. Slip ground screw (A1301070, Ref.) through ring terminal on green ground wire (from manaplug) and secure to valve body.
4. Following the Wiring Diagram, stack one solenoid wire with one manaplug wire & install screw through ring terminals & secure assembly with nut. Cover with plastic boot. (See Detail A)
5. Place warning label (Item 6) on conduit box side.

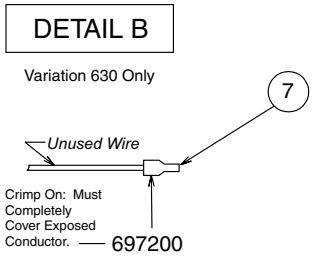


Figure 3: Variation 56, Single Solenoid Models with 3-Pin Manaplug with Lights.

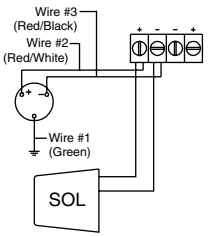
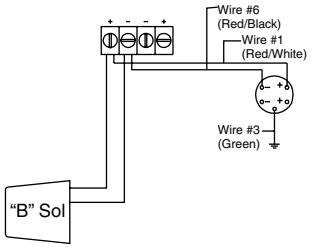
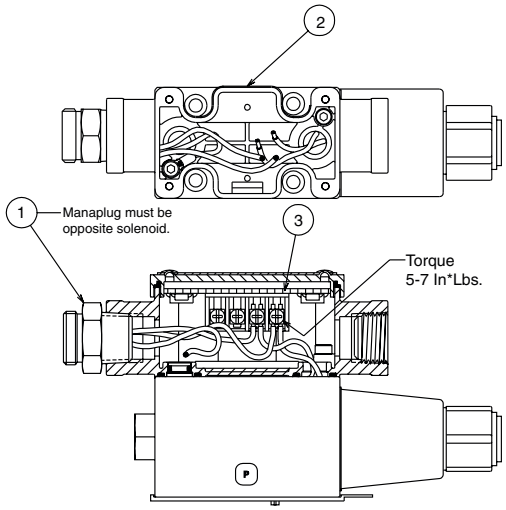
Valve	Spool	Pilot Nameplate Wiring	Wiring diagram	Sol *Code*	*Item*	*Part Number*	*Qty*	*Description*
D1VW	All	B AB	"B" Solenoid 	All	1	1302154	1	Manapug, 5-Pin
				All	2	MA697629	1	Warning Label
				Y	3	C)1300650-Y	1	Circuit Board - 120VAC
				Q		C)1300650-Q	1	Circuit Board - 100VAC
				T		C)1300650-T	1	Circuit Board - 240VAC
				R		C)1300650-R	1	Circuit Board - 24VAC
				A		C)1300650-R	1	Circuit Board - 24VAC
				L		C)1300650-L	1	Circuit Board - 6VDC
				K		C)1300650-K	1	Circuit Board - 12VDC
				J		C)1300650-J	1	Circuit Board - 24VDC
				D		C)1300650-D	1	Circuit Board - 120VDC
				Z		C)1300650-Z	1	Circuit Board - 250VDC

Figure 4: Variation 5630, Single Solenoid Models with 5-Pin Manaplug with Lights.

Valve	Spool	Pilot Nameplate Wiring	Wiring diagram	Sol *Code*	*Item*	*Part Number*	*Qty*	*Description*
D1VW	All	B AB	"B" Solenoid 	All	1	1302154	1	Manapug, 5-Pin
				All	2	MA697629	1	Warning Label
				Y	3	C)1300650-Y	1	Circuit Board - 120VAC
				Q		C)1300650-Q	1	Circuit Board - 100VAC
				T		C)1300650-T	1	Circuit Board - 240VAC
				R		C)1300650-R	1	Circuit Board - 24VAC
				A		C)1300650-R	1	Circuit Board - 24VAC
				L		C)1300650-L	1	Circuit Board - 6VDC
				K		C)1300650-K	1	Circuit Board - 12VDC
				J		C)1300650-J	1	Circuit Board - 24VDC
				D		C)1300650-D	1	Circuit Board - 120VDC
				Z		C)1300650-Z	1	Circuit Board - 250VDC



Wiring Instructions:

1) Cut solenoid wires to 95mm (3.75 in.), strip 5.5mm (.200 in.).
2) Install manaplug (Item 1) opposite solenoid.
3) Slip ground screw (A1301070, Ref.) through ring terminal on green ground wire (from manaplug) and secure to valve body.
4) Insert solenoid and manaplug wires into terminal strip on cover (Item 3) as shown in wiring diagram. Ensure all wire strands are contained by the connector and tighten clamping screws to 0.5 N*m (5 In*lbs.).
5) Install cover on the conduit box.
6) Place warning decal (Item 2) on conduit box side, as shown.

NOTES:
1) When using the D1 Valve as a pilot, wiring may vary, consult factoy.

2531-M1.pm6, sm, jj

Solenoid Ratings**

Insulation	Class F
Allowable Deviation from rated voltage	-10% to +15%
Armature	Wet pin type
CSA file LR60407	

** DC Solenoids available with optional molded metal oxide varistor (MOV) for surge suppression.
Leadwire length 6" from coil face.

D1VW Solenoid Electrical Characteristics†

Solenoid Code	Nominal Volts/Hz	In Rush Amps	Holding Amps	Watts
Y	120/60 110/50	2.00 2.10	0.49 0.58	25 27
T	240/60 220/50	1.00 1.05	0.26 0.31	25 27
Q	100/50	2.05	24	24
R	24/60	10. 50	2.70	27
A	24/50	8.7	2.65	28
L	6 VDC	—	5.00	30
K	12 VDC	—	2.50	30
J	24 VDC	—	1.25	30
D	120 VDC	—	0.25	30
Z	250 VDC	—	0.12	30

D1VW*****F Solenoid Electrical Characteristics†

Solenoid Code	Nominal Volts/Hz	In Rush Amps	Holding Amps	Watts
YF	120/60 110/50	1.90 2.00	0.42 0.50	21 23
TF	240/60 220/50	0.95 1.00	0.22 0.26	21 23
LF	6 VDC	—	4.00	24
KF	12 VDC	—	2.00	24
JF	24 VDC	—	1.00	24
DF	120 VDC	—	0.20	24
ZF	250 VDC	—	0.10	24

† Based on nominal voltage @ 22°C (72°F)

D1VW Soft Shift AC Electrical Characteristics

Solenoid Code	Input Volts/Hz	Coil Voltage	Holding Amps	Watts
Q	100/50	86 VDC	2.87	30
Y	120/60 110/50	98 VDC	3.27	30
T	240/60 220/50	214 VDC	7.13	30

Explosion Proof Solenoids

Explosion Proof Solenoid Ratings

U.L. (EU)	Class I, Div. 1 & 2, Groups C & D Class II, Div 1 & 2, Groups E, F & G As defined by the N.E.C
M.S.H.A. (EM)	Complies with 30 CFR, Part 18.
CENELEC (ED)	Complies with BASEEFA requirements for BS5501: Parts 1 and 5 Ex'd CENELEC EN50 – D18, Group II B
CSA Hazardous L	Class II, Groups E, F & G

Electrical Characteristics* ED, EM and EU

Solenoid Code	Nominal Volts/Hz	In Rush Amps	Holding Amps	Watts
Q	100/60	2.60	0.70	27
Y	120/60	2.20	0.58	27
T	240/60	1.10	0.29	27
R	24/60	11.10	2.90	27
L	6 VDC	—	5.50	33
K	12 VDC	—	2.75	33
J	24 VDC	—	1.38	33
D	120 VDC	—	0.28	33
Z	250 VDC	—	0.13	33

*Dual frequency not available on explosion proof coils.

Warning

Before any circuit connection is broken, be sure to turn off all power and relieve system pressure. Lower all vertical loads and cylinders, lock any load which could produce pressure and discharge any accumulators. Plug and cap all lines and openings to prevent contamination from entering the system.

Cleaning and Inspection

1. Proper cleaning is a critical part of preventive maintenance in the use of directional control valves. All parts should be cleaned with a solvent that is compatible with the system fluid. Compressed air may also work well when cleaning orifices and passage ways, but proper filtration must be employed to remove water and contamination.

   NOTE: Always make sure all parts have been cleaned before reassembling.

2. Inspection
   a. Inspect all passage ways for obstructions.
   b. Inspect all washers, push pins, plungers and pole faces for signs of wear and/or mushrooming. Inspect all springs for signs of distortion. Replace parts as necessary.
   c. Look for nicks and burrs on the spool and bore lands. Nicks in these areas indicate likely contamination of the system fluid.
3. If there are no signs of nicks or burrs on the spool and bore, check the spool clearance as follows:
   a. Lubricate the spool and bore with clean system fluid.
   b. Insert the spool back into the body and slowly move the spool back and forth. The spool should move freely. If there is any sticking between the spool and the bore, remove the spool and repeat 2b.
   c. The spool clearance can also be checked by placing the valve body on end and inserting the spool. Gravity will pull the spool to the other end if there is no sticking.
   d. After several attempts have been made without resolution, replace the valve.

Troubleshooting

Problem: Valve spool fails to move

	Cause	Recommendation
Mechanical	Recommended flow exceeded	Check maximum flow rate for appropriate spool by spool function.
	Recommended pressure exceeded	Check maximum pressure rating for valve
	Improper installation connections	Check installation drawings
	Contamination in system	Disasemble, inspect, clean and flush
	Improper assembly	Check proper assembly. Refer to drawing for appropriate model.
	Valve has silted	Disassemble and clean valve.
Electrical	Power off	Turn power on
	Improper voltage	Check voltage requirements for valve model
	Faulty connection	Check connections
	Faulty coil	Check coil resistance

Problem: Valve produces undesirable response

	Cause	Recommendation
Mechanical	Recommended flow exceeded	Check maximum flow rate for appropriate spool by spool function.
	Recommended pressure exceeded	Check maximum pressure rating for valve.
	Improper installation connections	Check installation drawings.
	Contamination in system	Disassemble, inspect, clean and flush.
	Improper assembly	Check proper assembly. Refer to drawing for appropriate model.
	Improper fluid	Check fluid recommendations.
	Recommended temperature exceeded (indicated by fluid discoloration or spool tarnishing)	Check maximum temperature recommendations.
	Incorrect orifice size (soft shift only)	Check orifice size for desired response time.
Electrical	Improper voltage	Check voltage requirements for valve model.
	Faulty connection	Check connections.
	Faulty coil	Check coil resistance.

Parker Hannifin Corporation
Hydraulic Valve Division
520 Ternes Avenue
Elyria, Ohio 44035 USA
Tel: (440) 366-5200
Fax: (440) 366-5253
Web Site: http://www.parker.com/hydraulicvalve

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