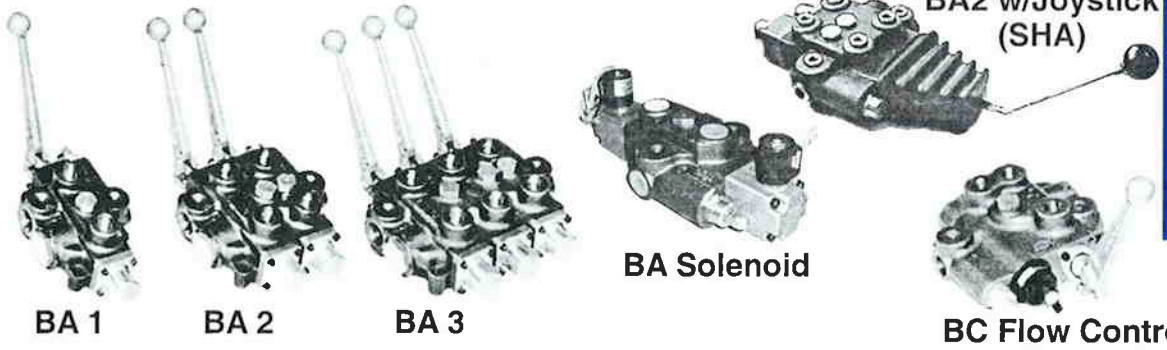
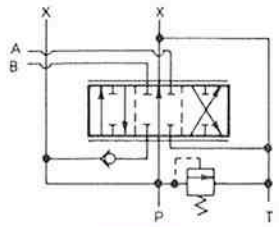
HYDRAULIC VALVES

DIRECTIONAL CONTROL
B SERIES
Specification Sheet



BA 1 BA 2 BA 3

BC Flow Control



The CROSS series B directional control valves provide good metering characteristics and long dependable service life. Optimum versatility is provided due to the many standard and optional features. Balanced spools are select-fit for minimum leakage and load holding checks prevent load drop when shifting. Parallel flow path permits spools to be operated independently or simultaneously.

GENERAL SPECIFICATIONS

Number of spools	one, two or three
Rated working pressure	3000 psi (206 bar)*
Maximum shock and surge pressure	4000 psi (276 bar)
Rated flow capacity	30 gpm (114 l/m)
Maximum spool leakage (at 1000 psi w/100 SUS oil at 120° F)	16 cc/min.
Mounting, any position	Three mounting holes for 3/8" dia. bolts
Weight	1 spool: 13 lbs. (6 Kg); 2 spool: 21 lbs. (9.5 Kg); 3 spool: 33 lbs. (15 Kg)

* SAE threads only, 2500 psi for NPTF

MATERIAL SPECIFICATIONS

Body	High tensile strength cast iron
Spools	Ground, plated and polished steel alloy
Seals	Buna N

STANDARD FEATURES

- Integral load holding check valves (prevent reverse flow through valve when shifting)
- Integral differential poppet type relief valve, adjustable (set at 2000 psi, 10 gpm)
- Balanced, select-fit spools (provide minimum leakage, smooth operation)
- External spool seals (permit easy replacement, reduced maintenance cost)
- 3/4" NPTF inlet and outlet ports; 1/2" NPTF work ports
- Complete handle assembly • 1, 2, or 3 spools

OPTIONAL FEATURES AVAILABLE

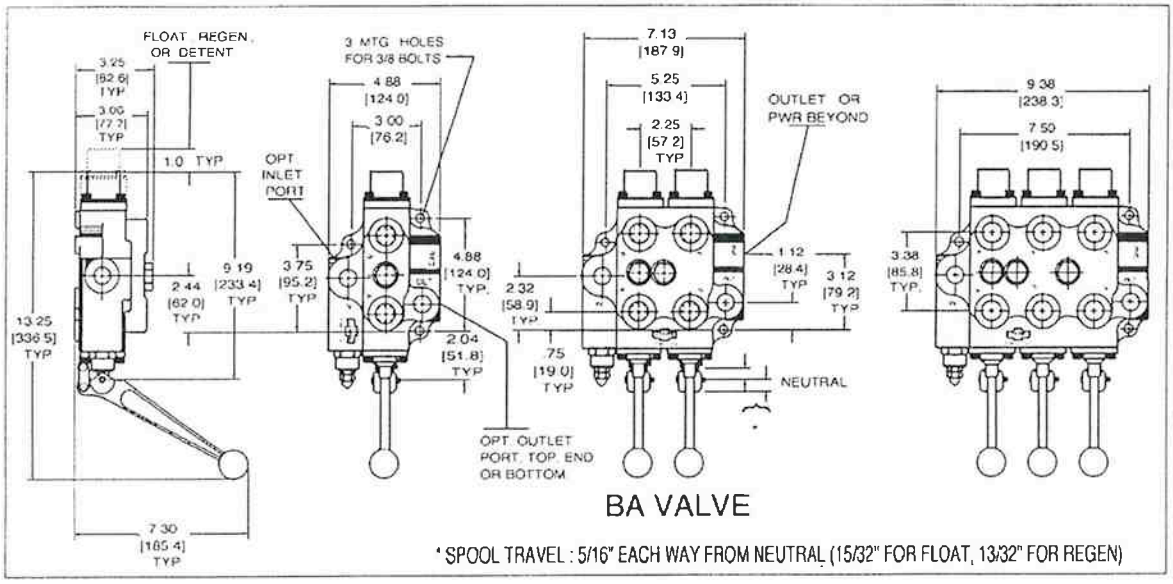
- Open or closed center positions, 3-way or 4-way operation, 3-position or 4-position (float position), full open center (motoring spool) and other spool options
- Power beyond (permits use of neutral flow at system pressure); also permits field conversion from closed center to open center (tandem) operation
- Top, bottom or end location of outlet port
- Top or end location of inlet port
- Pressure release detent, in either or both work positions
- Integral pressure compensated flow control (Model BC), adjustable from 0 to 25 gpm, ± 5% flow regulation. Available in 1-spool version only. 21 lbs. (9.5 Kg)

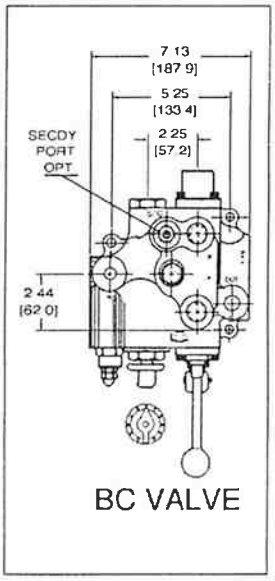
NOTE: Refer to CROSS Valve Technical/Service Sheet for recommendations and limitations.

DIRECTIONAL CONTROL
B SERIES
Specification Sheet

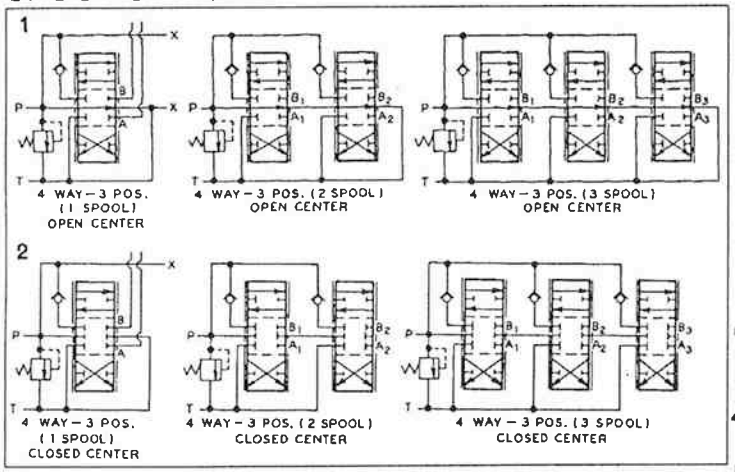
HYDRAULIC VALVES

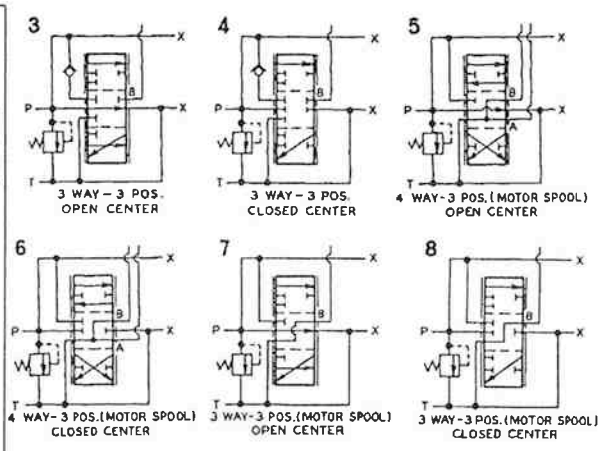
DIMENSIONAL DATA in inches and (millimeters)

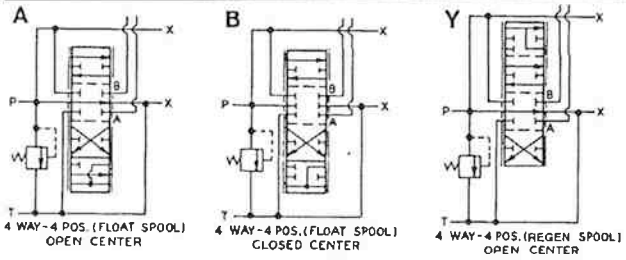


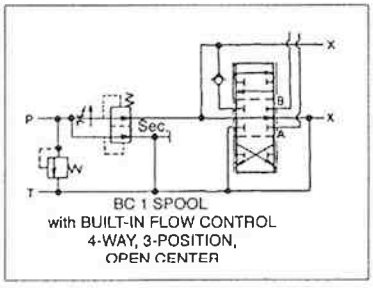


SPOOL OPTIONS

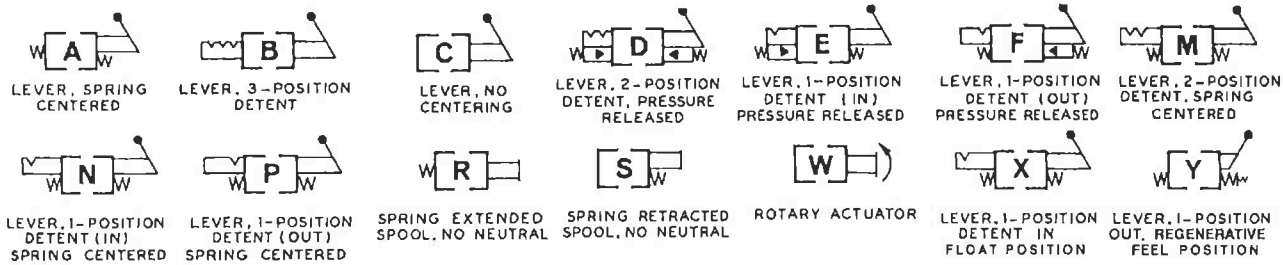








ACTUATOR OPTIONS

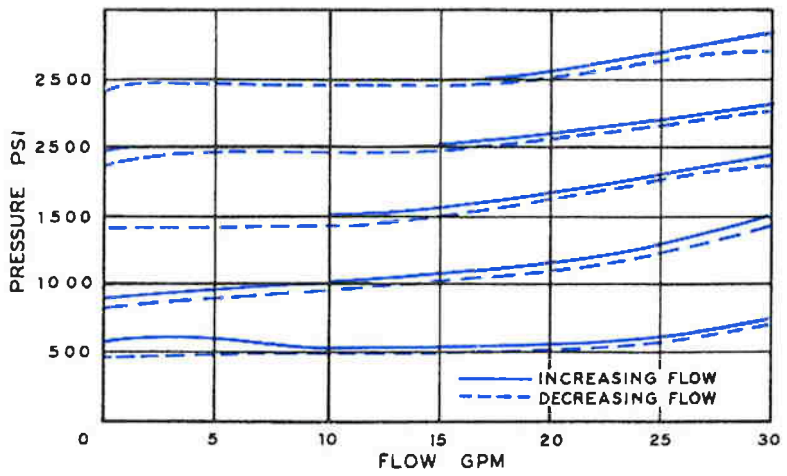


TYPICAL PERFORMANCE DATA

PRESSURE DROP (with 100 SUS oil at 120° F, ¾" NPTF in & out, ½" work ports)

FLOW RATE		P to T		P to A or B		A_1 or B_1 to T		A_2 or B_2 to T		A_3 or B_3 to T		
GPM	l/m	PSI	bar	PSI	bar	PSI	bar	PSI	bar	PSI	bar	
5	19	—	—	8	.6	2	.1	—	—	—	—	ONE SPOOL
10	38	3	.2	20	1.4	6	.4	—	—	—	—	
15	57	6	.4	36	2.5	13	.9	—	—	—	—	
20	76	11	.8	55	3.8	23	1.6	—	—	—	—	
25	95	17	1.2	83	5.7	35	2.4	—	—	—	—	
30	114	25	1.7	120	8.3	48	3.3	—	—	—	—	
35	132	33	2.3	159	11.0	64	4.4	—	—	—	—	
5	19	—	—	10	.7	6	.4	2	.1	—	—	TWO SPOOL
10	38	5	.3	20	1.4	15	1.0	6	.4	—	—	
15	57	10	.7	38	2.6	33	2.3	14	1.0	—	—	
20	76	18	1.2	60	4.1	58	4.0	22	1.5	—	—	
25	95	29	2.0	90	6.2	92	6.3	33	2.3	—	—	
30	114	41	2.8	127	8.8	133	9.2	36	2.5	—	—	
35	132	54	3.7	174	12.0	184	12.7	64	4.4	—	—	
5	19	—	—	8	.6	8	.6	6	.4	2	1.1	THREE SPOOL
10	38	12	.8	16	1.1	24	1.7	16	1.1	6	.4	
15	57	24	1.7	28	1.9	48	3.3	33	2.3	10	.7	
20	76	41	2.8	44	3.0	84	5.8	58	4.0	18	1.2	
25	95	64	4.4	64	4.4	134	9.2	93	6.4	28	1.9	
30	114	92	6.3	88	6.1	202	13.9	140	9.7	42	2.9	
35	132	124	8.6	120	8.3	276	19.0	196	13.5	58	4.0	

RELIEF VALVE CHARACTERISTICS (100 SUS oil at 120° F.)



DIRECTIONAL CONTROL
B SERIES
Specification Sheet

HYDRAULIC VALVES

ORDERING INFORMATION

MODEL NO.	# OF SPOOLS	SPOOL TYPE	ACTUATOR OPTIONS	RELIEF VALVE(4)	POWER BEYOND	OUTLET PORT LOCATION	SECONDARY FLOW OUTLET BC ONLY (OPTIONAL)	PORT SIZE & TYPE	HANDLE
BA	1	1	A	A	0	O	0	A	O
Manual	Single	4-way, 3-position, open center	3 position Spring centered	1000 psi	None	End Outlet when P/B not specified	No Port (plugged)	In & Out 3/4" NPTF, Work 1/2" NPTF(8)	Complete handle assy.-
	2	2 (1)	B	B	1 (6)	T	1	B	1
	Double	4-way, 3-position, closed center	3 position detent - no spring centering	1500 psi	3/4" NPTF P/B sleeve port	Top Outlet	7/8-14 (SAE #10)	In & Out 3/4" NPTF, Work 3/4" NPTF	Less Complete handle assy.-
	3	3	C	C	2 (6)	B	2	C	2
	Triple	3-way, 3-position, open center	Manual - no detent - no centering spring	2000 psi	1/16-12 SAE #12, P/B sleeve port	Bottom Outlet	1/2" NPTF	In & Out 1 1/16-12 SAE #12, Work 3/4-16 SAE #8(8)	Less handle only (Links, pins & bracket included)
		4 (1)	D (3)	D	3 (6)	E	3	D	3 (9)
		3-way, 3-position, closed center	Pressure detent "in & out"	None	Conversion plug	End Outlet	3/4-16 (SAE #8)	In & Out SAE #12, Work SAE #12	Single Handle Actuator
		5	E (3)	E	4 (6)	G	4	E	4
		4-way, 3-position, open center w/motoring spool	Pressure detent, "in" only, spring centering(4)	Other	7/8-14 SAE #10, P/B sleeve port	Bottom Outlet with Grommet	3/4" NPTF	In & Out 3/4" NPTF, Work 3/8" NPTF	No handle - solenoid operated
		6 (1)	F (3)	F(5)	5	P	5	F	5
		4-way, 3-position, closed center w/motoring spool	Pressure detent, "out" only, spring centering(4)	Adj. 500-1500 (set at 1000)	Closed center plug	Top Inlet & outlet	1 1/16-12 (SAE #12)	Other	Proportional
		7	H	G(5)	6	H	(OMIT ON BA)		6
		3-way, 3-position, open center w/motoring spool	Solenoid, 12 volt DC	Adj. 1500-3000 (set at 2000)	Check valve for solenoid oper.	Top Inlet			Heavy Duty Steel Handle
		8 (1)	J						
		3-way, 3-position, closed center w/motoring spool	Solenoid , 24 volt DC			(7)			
		A (2)	K						
		4-way, 4-position, open center detent float position	Solenoid, 120 volt, AC						
		B (1) (2)	L						
		4-way, 4-position, closed center detent float position	Solenoid, 240 volt, AC						
		C	M						
		4-way, 4-position, open center w/regen feel position	2 position detent, "in & out" spring centering						
			N						
			1 position detent, "in only" spring centering						
			P						
			1 pos. detent, "out only" spring centering						
			R						
			Spring ext., no neutral						
			S						
			Spring retr., no neutral						
			X						
			4-way, spr. center to neutral. detent in float.						
			Y						
			4-way, spring center with regen						
			W						
			Rotary actuator						
BC		1(1)	A(1)	A(1)	3(1)	E(1)	2(1)	A(1)	0(1)

Open Center BA Solenoid Valve must be externally drained.

Part number building example:
BA2A1XAB1EA0 is a manually operated double spool valve: the **first** spool being 4-way, 4-position. open center, spring centered with detent in float position; the **second** spool being 4-way, 3-position, open center spring centered. The non-adjustable relief is set at 1500 psi. 3/4" NPTF power beyond sleeve port, outlet port in end position. Inlet and outlet ports are 3/4" NPTF and the work ports are 1/2" NPTF. Complete handle assembly included.

NOTES: (1) Model BC is a one spool combination adjustable priority flow divider and directional control valve, open centered, with conversion plug installed; available power behond capability by adding kit. Not available as closed center.
(2) Float position A or B is available on 1st spool only on 2 or 3 spool valves.
(3) Specify detent kick-out pressure if other than 1,000 psi.
(4) Pressure settings at 10 gpm.
(5) If other setting desired, specify on order.
(6) Top, end or bottom outlet (specify).
(7) Specify T, B or E when ordering closed center spool, power beyond, or conversion plug.
(8) Machined for unidirectional orifice plates.
(9) Available for BA2 and BA3 models.

CROSS MANUFACTURING
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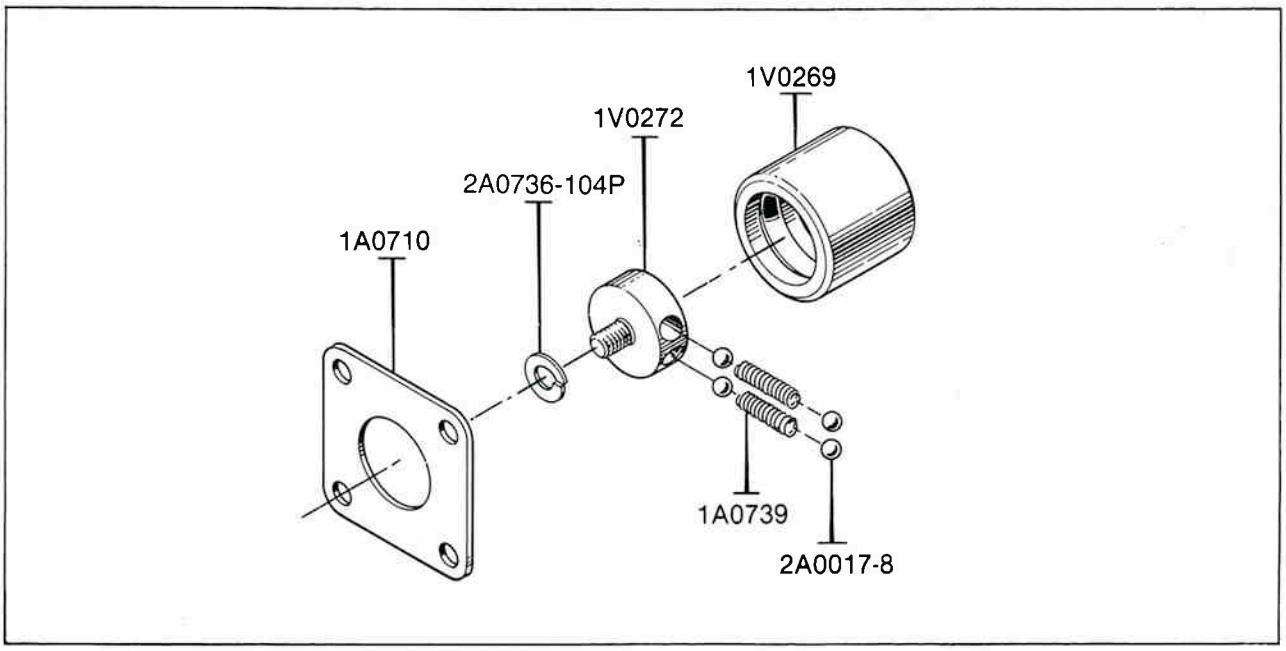
Lewis, Kansas 67552
Phone 620/324-5525; FAX 620/324-5737
e-mail: info@crossmfg.com

SERIES B and C DIRECTIONAL CONTROL VALVE DETENT KIT
PART NO. 1V0294

With this option, the valve spool will remain in any of three positions in which it is placed manually. There is no spring return to neutral when this detent option is installed.



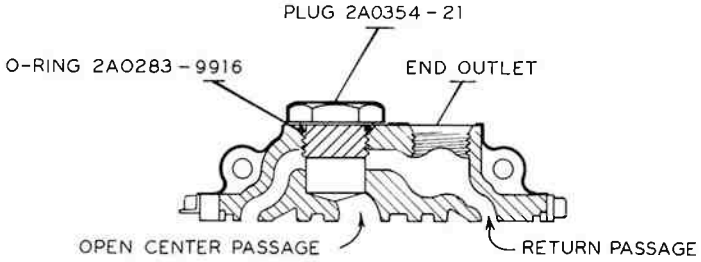
To convert from the standard 3-position spring-centered version to a 3-position detent, proceed as follows:

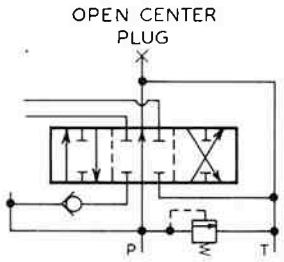
1. Remove the four socket head cap screws and end cap.
2. Remove the socket head cap screw from the spool end and take out the spring centering mechanism.
3. Position the retainer plate (1A0710) on end of valve body.
4. Install lockwasher (2A0736-104P) on threaded end of retainer (1V0272).
5. Screw the factory assembled detent mechanism into the end of the spool. Loctite #271, 9-11 ft. lbs. torque recommended.
6. Replace end cap and the four socket head cap screws.

Conversion is now complete. Save the spring centering mechanism in the event that reconversion should ever be desired.

SERIES B DIRECTIONAL CONTROL VALVE CONVERSION PLUG OPTIONS
(Refer to B series Directional Control Valve Specification Sheet, Form VBA1)

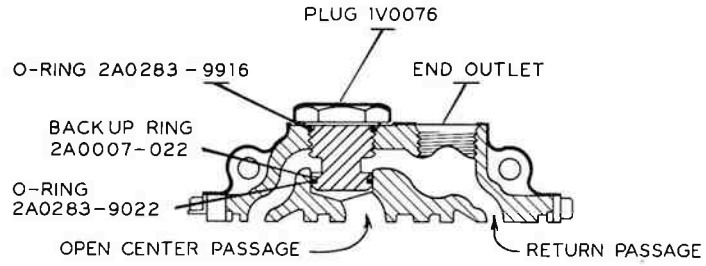
STANDARD OPEN CENTER VALVE WITH CONVERSION PLUG (option #3)
Plug Assembly 2A0354 - 121

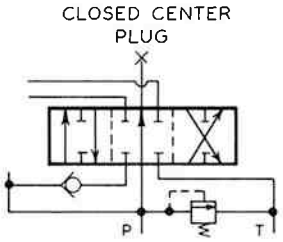




This option allows conversion from standard open center function to either powe beyond or to a closed center function.

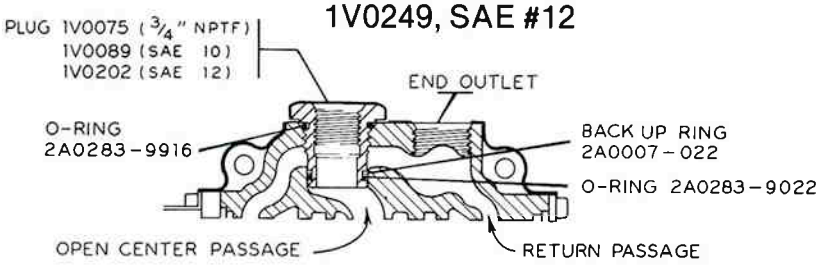
CLOSED CENTER PLUG
Plug Assembly 1V0206

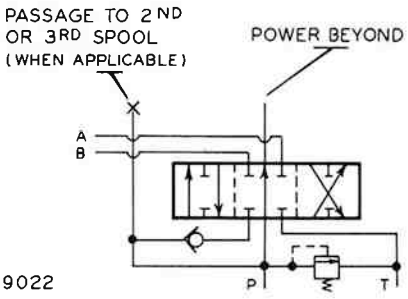




By replacing the conversion plug assembly (2A0354-121) with the closed center plug assembly (1V0206) the directional control valve is converted from open center to closed center function.

POWER BEYOND PLUG
Plug Assembly 1V0208, 3/4" NPTF port
1V0209, SAE #10
1V0249, SAE #12



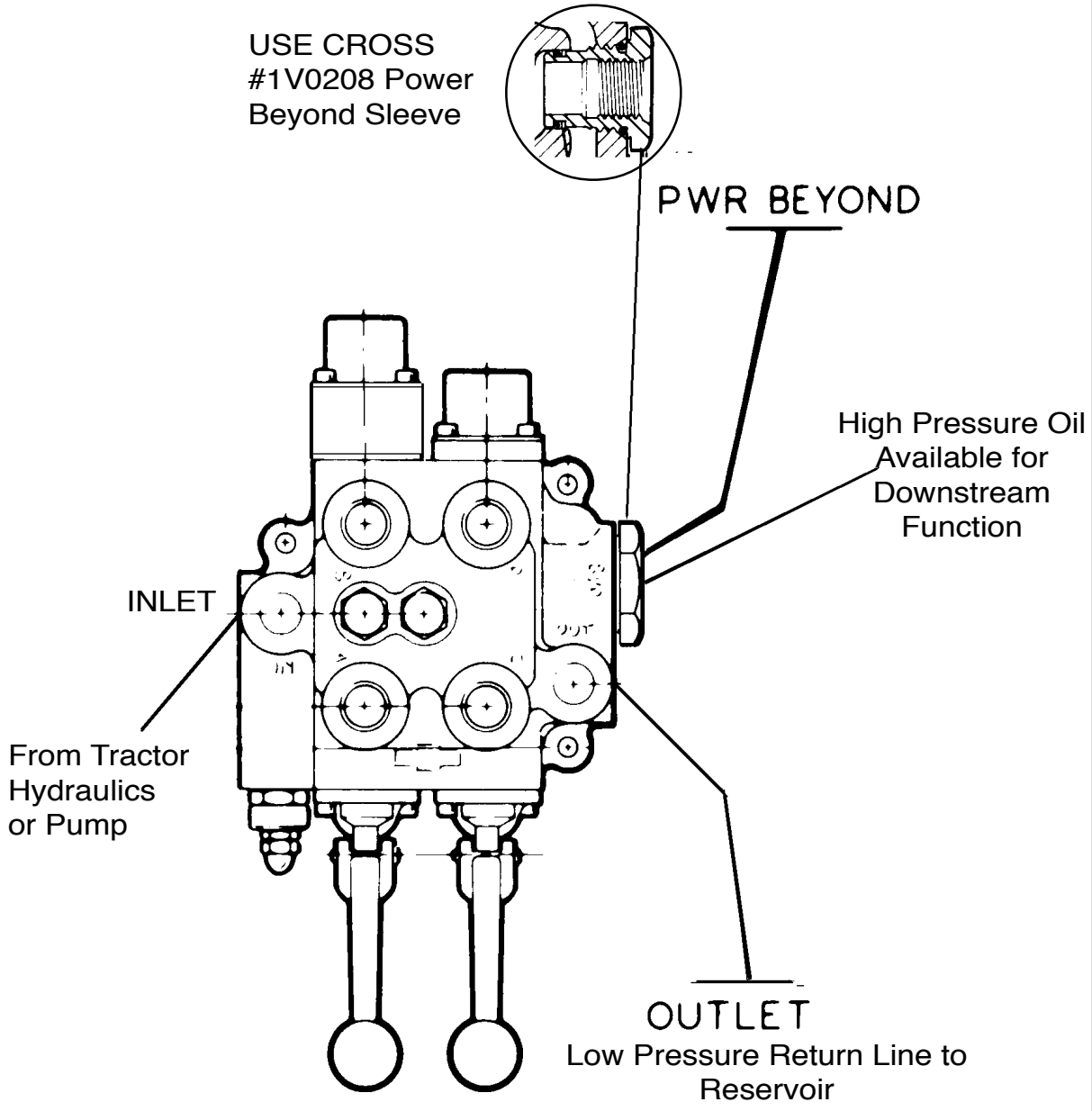


By replacing plug assembly 2A0354-121 with the power beyond plug assembly, an additional valve may be connected downstream of the B series valve.

NOTE: Closed center or power beyond plugs CANNOT be installed in B series valves without the conversion plug option. Closed center version valves or valves with power beyond option may be converted using any of the above plug assemblies.

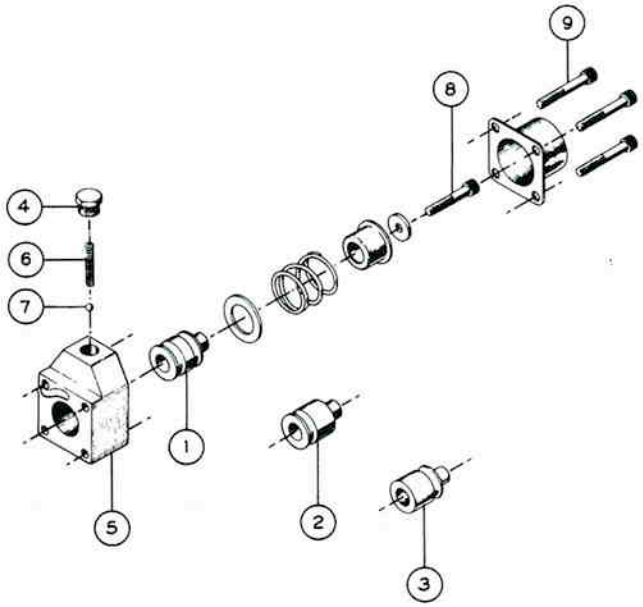
B Series

POWER BEYOND INSTALLATION



SERIES B DIRECTIONAL CONTROL VALVE OPTIONS

DETENT WITH SPRING CENTERING

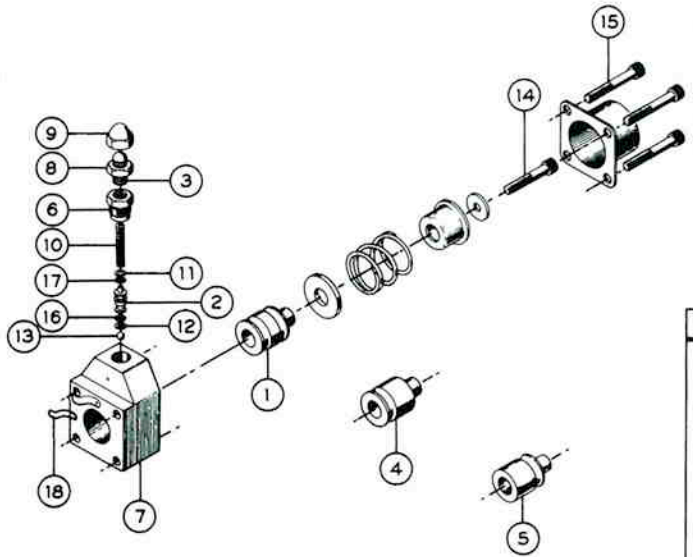


THIS FEATURE ALLOWS SPRING CENTERING TO NEUTRAL WITH A DETENT FOR THE "IN", "OUT" POSITION, OR BOTH THE "IN" AND "OUT" POSITIONS. THE ONE OR TWO POSITION DETENT WITH SPRING CENTERING IS DESIRABLE FOR THE OPERATION OF HYDRAULIC CYLINDERS OR MOTORS. THE ONE POSITION DETENT PROVIDES A FLOAT POSITION FOR A THREE-WAY SPOOL IN THE "IN" OR DUMP POSITION. THIS DETENT FEATURE IS APPLICABLE WHERE QUICK RELEASE AND CENTERING IS NEEDED OR FOR GOOD METERING OF FLOW BEFORE PLACING INTO DETENT.

SPECIAL PARTS

	PART NO	DESCRIPTION	QTY REQD
1	1V0067	2-POSITION DETENT SLEEVE	1
2	1V0070	1-POSITION DETENT SLEEVE, "IN" (OPT.)	1
3	1V0071	1-POSITION DETENT SLEEVE, "OUT" (OPT.)	1
4	1V0217	DETENT PLUG	1
5	1V0264	DETENT HOUSING ASSEMBLY	1
6	1A0610	DETENT SPRING	1
7	2A0017-8	BALL (1/4 STEEL)	1
8	2A0079-414N	CAPSCREW	1
9	2A0079-416	CAPSCREW	4
		NOTE: ORDER BY KIT NUMBER	
	1V0557	DETENT KIT (2 POSITION)	1
	1V0558	DETENT KIT (1 POSITION "IN")	1
	1V0559	DETENT KIT (1 POSITION "OUT")	1

PRESSURE DETENT KIT NO. 1V0642



"8A" VALVES WITH THREE-POSITION SPOOLS CAN BE PROVIDED WITH THIS OPTION ON ANY OR ALL SPOOLS. A PRESSURE DETENT HOLDS THE SPOOL IN THE "IN" POSITION, "OUT" POSITION OR BOTH "IN" AND "OUT" POSITIONS. THE DETENT IS HELD UNTIL THE CYLINDER OR MOTOR REACHES A PRE-SET PRESSURE, RELEASING THE DETENT, ALLOWING THE SPOOL TO SPRING RETURN TO NEUTRAL. *FIELD INSTALLATION CAN BE MADE ONLY IF VALVE ALREADY HAS THIS OPTION.*

SPECIAL PARTS

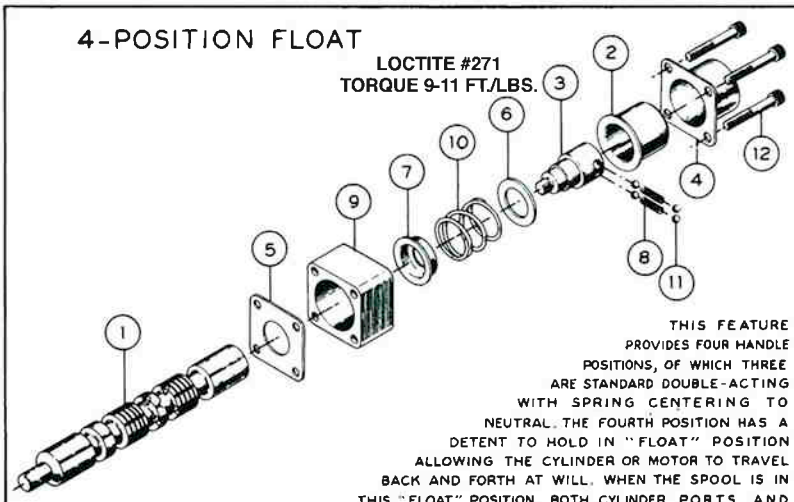
		PART NO.	DESCRIPTION	QTY REQD
	1	1V0067	2-POSITION DETENT SLEEVE	1
*	2	1V0068	PRESSURE DETENT PISTON	1
*	3	1V0069	ADJUSTMENT SCREW	1
	4	1V0070	1-POSITION DETENT SLEEVE "IN" (OPT.)	1
	5	1V0071	1-POSITION DETENT SLEEVE "OUT" (OPT.)	1
*	6	1V0072	PISTON STOP	1
*	7	1V0264	DETENT HOUSING ASSEMBLY	1
*	8	1A0569	NUT	1
*	9	1A0570	ACORN NUT	1
*	10	1A0610	DETENT SPRING	1
*	11	2A0012-008	UPPER O-RING BACK-UP	1
*	12	2A0012-007	LOWER O-RING BACK-UP	1
*	13	2A0017-8	BALL (1/4 STEEL)	1
	14	2A0079-414N	CAPSCREW	1
	15	2A0079-416	CAPSCREW	4
*	16	2A0283-7007	LOWER PISTON O-RING	1
*	17	2A0283-7008	UPPER PISTON O-RING	1
*	18	2A0283-9017	HOUSING O-RING	1

* CONTAINED IN KIT NO. 1V0642. DETENT SLEEVE (1) (4) OR (5), & CAPSCREWS (14) & (15) MUST BE ORDERED SEPARATELY.

SERIES B DIRECTIONAL CONTROL VALVE OPTIONS

4-POSITION FLOAT

LOCTITE #271
TORQUE 9-11 FT./LBS.



THIS FEATURE PROVIDES FOUR HANDLE POSITIONS, OF WHICH THREE ARE STANDARD DOUBLE-ACTING WITH SPRING CENTERING TO NEUTRAL. THE FOURTH POSITION HAS A DETENT TO HOLD IN "FLOAT" POSITION ALLOWING THE CYLINDER OR MOTOR TO TRAVEL BACK AND FORTH AT WILL. WHEN THE SPOOL IS IN THIS "FLOAT" POSITION, BOTH CYLINDER PORTS AND PUMP PORTS ARE OPEN TO TANK.

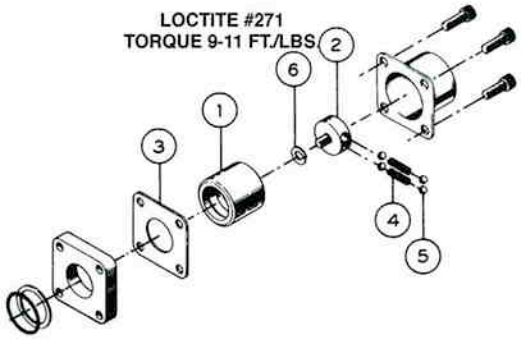
KIT NO. 1V1600
(SPOOL NOT INCLUDED)

SPECIAL PARTS

	PART NO.	DESCRIPTION	QTY REQD
1	1V0094	FLOAT SPOOL	1
2	1V0205	FLOAT DETENT SLEEVE	1
3	1V0260	FLOAT DETENT RETAINER	1
4	1A0294P	END CAP	1
5	1A0710	RETAINER PLATE	1
6	1A0737	FLOAT STOP WASHER	1
7	1A0738P	FLOAT STOP COLLAR	1
8	1A0739	DETENT SPRING	2
9	1A0764	FLOAT SPACER	1
10	1A9231	FLOAT CENTERING SPRING	1
11	2A0017-8	BALL (1/4 STEEL)	4
12	2A0079-416	CAPSCREW	4

3-POSITION DETENT

LOCTITE #271
TORQUE 9-11 FT./LBS.

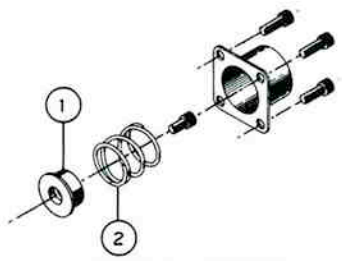


THIS FEATURE PROVIDES THREE HANDLE POSITIONS, ALL OF WHICH ARE HELD WITH A DETENT, AND HAS NO SPRING CENTERING TO NEUTRAL. THIS OPTION ALLOWS CONTROL AND DIRECTING OF FLOW TO STOP, START OR REVERSE HYDRAULIC MOTORS. IT CAN BE USED TO DIVERT FLOW TO ONE OR MORE SEPARATE CIRCUITS.

SPECIAL PARTS

	PART NO.	DESCRIPTION	QTY REQD
TO CONVERT FROM SPRING CENTERING TO 3-POSITION DETENT:			
	1V0294	DETENT CONVERSION KIT	1
KIT CONTAINS THESE PARTS:			
1	1V0269	DETENT SLEEVE	1
2	1V0272	DETENT RETAINER	1
3	1A0710	RETAINER PLATE	1
4	1A0739	DETENT SPRING	2
5	2A0017-8	BALL (1/4 STEEL)	4
6	2A0736-104P	LOCKWASHER	1

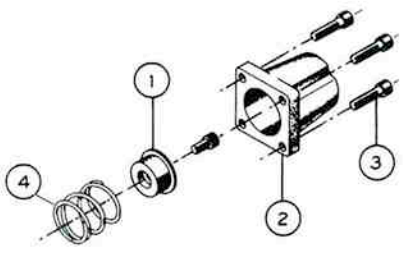
SPRING EXTENDED SPOOL



SPECIAL PARTS

	PART NO.	DESCRIPTION	QTY REQD
1	1V0082	STOP COLLAR	1
2	1A9008	SPRING	1

SPRING RETRACTED SPOOL

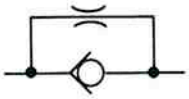


SPECIAL PARTS

	PART NO.	DESCRIPTION	QTY REQD
1	1V2020	SPOOL SPACER	1
2	1V2021	SPECIAL END CAP	1
3	2A0079-410	CAPSCREW	4
4	1A9008	SPRING	1

HYDRAULIC VALVES

DIRECTIONAL CONTROL
ACCESSORIES
ORIFICE PLATES



FUNCTION

To restrict the fluid flow in or out of valve ports.

APPLICATION

"IN-FLOW" POSITION

Orifice plates installed in this position restrict flow entering the valve port from a cylinder or motor, offering these advantages:

1. Prevents cavitation of cylinder or motor having an inertia load.
2. Improves control of operation for double or single acting cylinders when lowering.
3. Improves control of rotary cylinders which have inertia loads in both directions. (use an orifice plate in both cylinder ports)

"OUT-FLOW" POSITION

Orifice plates installed in this position restrict flow of pressurized oil flowing out of the valve port to a cylinder or motor, offering the advantage of:

Improved control for extending single or double acting cylinders or speed of a hydraulic motor.

ORIFICE SIZING:

CROSS Engineering will calculate the proper orifice size for each application if flow rate, system pressure, and pressure drop requirements are supplied.

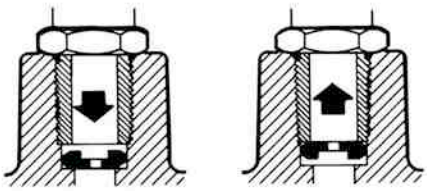
ORIFICE SIZES AVAILABLE

.031	.081
.040	.094
.047	.109
.052	.125
.055	.140
.060	.156
.063	.204
.078	.250

INSTALLATION INSTRUCTIONS

Insert orifice plate into port in proper position to obtain desired direction of flow restriction. Lips of plate always point toward the pressure source to assure proper seating. (For "IN-FLOW" restriction, plate lips point "OUT". For "OUT-FLOW" restriction, plate lips point "IN".

3/4 - 16 (SAE #8) Ports

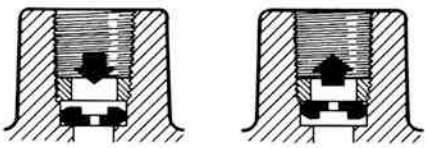


IN-FLOW OUT-FLOW

RESTRICTION

The lower face of the fitting inserted into the port will limit the upward travel of the orifice plate.

1/2" NPTF Ports



IN-FLOW OUT-FLOW

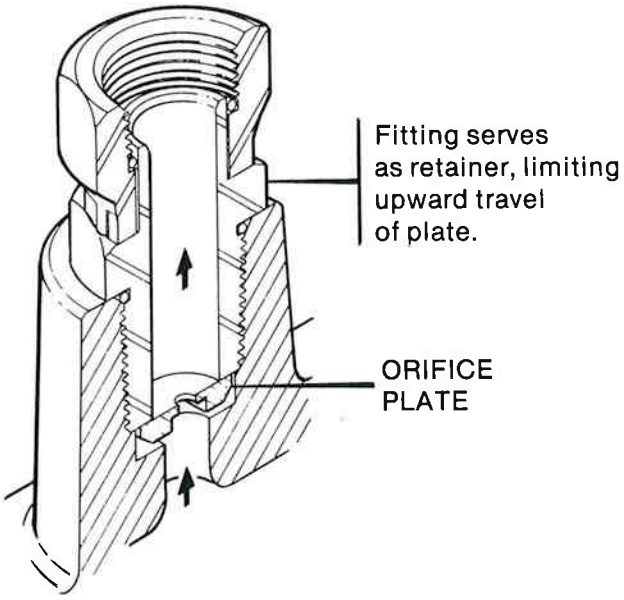
RESTRICTION

It is necessary to use the retainer (#1A0741) screwed into the port until it bottoms on the port thread, to limit the upward travel of the orifice plate. CAUTION: After installation of retainer, check to see that orifice plate is free to move at least 1/32 inch.

HYDRAULIC VALVES

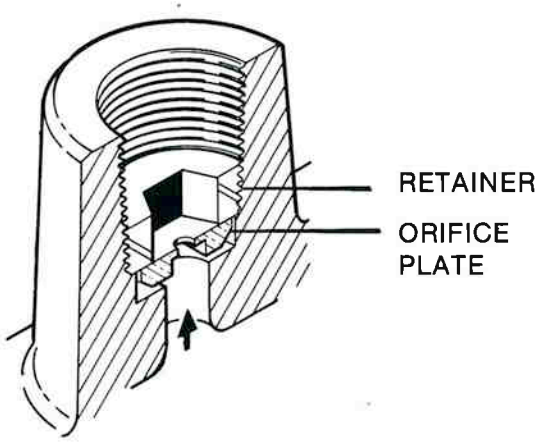
ORDERING INFORMATION

SAE PORT



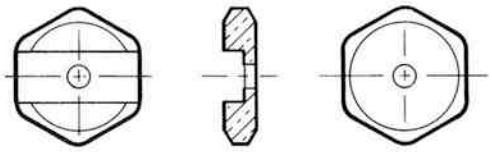
ORIFICE PLATE ONLY
Available for 3/4 - 16 (SAE #8) ports only.

NPTF PORT

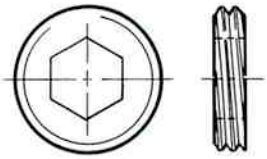


ORIFICE PLATE and RETAINER
Available for 1/2" ports only.

ORIFICE PLATE Part No. 1A0742



RETAINER Part No. 1A0741



SAE #8 (3/4 - 16)	ORIFICE PLATE - 1A0742	HOLE DIA. use 3 digit decimal to identify diameter of hole in orifice plate.
NPTF (1/2")	RETAINER - 1A0741 ORIFICE PLATE - 1A0742	

EXAMPLE: 1A0742-125 describes an orifice plate with 1/8" hole. If the hole diameter is not specified, plates without hole will be shipped and customer must drill.

CROSS MANUFACTURING, INC.
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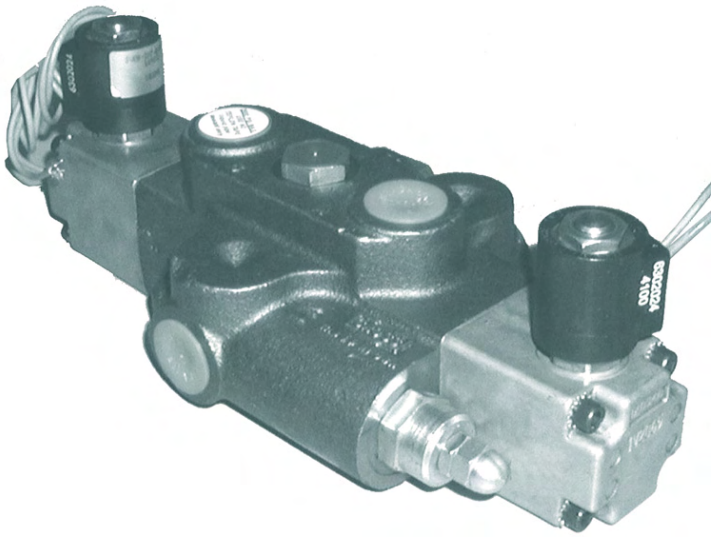
Solenoid Option for BA Series Valve



CROSS is pleased to announce the addition of a solenoid option for the 30 Gallon 3000 psi Series BA valve. Available in 12 or 24 volts DC, or 120 or 240 volts AC, this feature offers the convenience and remote control capabilities of electrical operation with the load check advantages of the BA Valve for lifting applications. External drains are required on all open center models. The versatile BA valve is available in a single, double, or triple spool model with power beyond option as well as a variety of spool and actuator choices.

Standard Valves — 4 way, 3 position open center (tandem), 12 volt solenoid, 2000 psi adjustable relief, with end outlet and 1V3636 check plug in power beyond, SAE ports — 1 1/16-12 in and out & 3/4-16 work

Single spool	**SBS2**	**132040**	**BA11HG6EC4**
Double spool	**SBS22**	**137020**	**BA211HHG6EC4**
Triple spool	**SBS222**	**146505**	**BA3111HHHG6EC4**

These standard valves are included in our Full Line catalog.

Ordering Notes: Nomenclature will be similar to the BA valve.

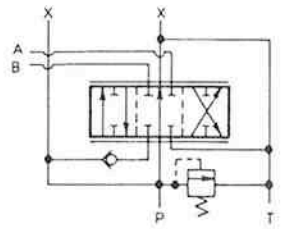
- For actuator options use "H" for 12 volt, "J" for 24 volt, "K" for 120 volt , and "L" for 240 volt.
- Specify #6 for the 1V3636 check valve in the power beyond machining (unless you are specifying a power beyond sleeve or closed center plug).
- A #4 designation for the handle option will indicate "no handle" for those spools where a solenoid option has been specified.

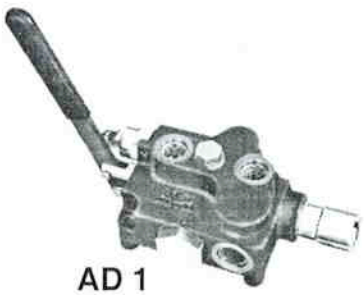
External Drain Kits:

BA1 - #12 SAE - #1V2171	BA2 - #12 SAE - #1V2173	BA3 - #12 SAE - #1V2175
BA1 - 3/4" NPTF - #1V2172	BA2 - 3/4" NPTF - #1V2174	BA3 - 3/4" NPTF - #1V2176

HYDRAULIC VALVES

DIRECTIONAL CONTROL
AD SERIES
Specification Sheet





AD 1

AD 2

The Cross series AD directional control valves provide good metering characteristics and long dependable service life. Optimum versatility is provided due to the many standard and optional features. Balanced spools are select-fit for minimum leakage and load holding checks prevent load drop when shifting. Parallel flow path permits spools to be operated independently or simultaneously.

GENERAL SPECIFICATIONS

Number of spools	One, two
Maximum working pressure	3000 psi (206 bar)
Maximum shock and surge pressure	4000 psi (276 bar)
Maximum flow capacity	15 gpm (57 l/m)
Maximum spool leakage (at 1000 psi w/100 SUS oil at 120° F)	16 cc/min.
Mounting, any position	Two mounting holes for 1/4" dia. bolts
Weight	1 spool: 8 lbs. (3.6 Kg.) 2 spool: 10 lbs. (4.5 Kg)

MATERIAL SPECIFICATIONS

Body	High tensile strength cast iron
Spools	Ground, plated and polished steel alloy
Seals	Buna N

STANDARD FEATURES

- Integral load holding check valves (prevent reverse flow through valve when shifting)
- Integral differential poppet type relief valve, adjustable (set at 2000 psi, 10 gpm)
- Balanced, select-fit spools (provide minimum leakage, smooth operation)
- External spool seals (permit easy replacement, reduced maintenance cost)
- SAE#10 (5/8") 7/8 - 14 inlet and outlet ports: SAE#8 (1/2") 3/4 - 16 work ports
- Complete handle assembly

OPTIONAL FEATURES AVAILABLE

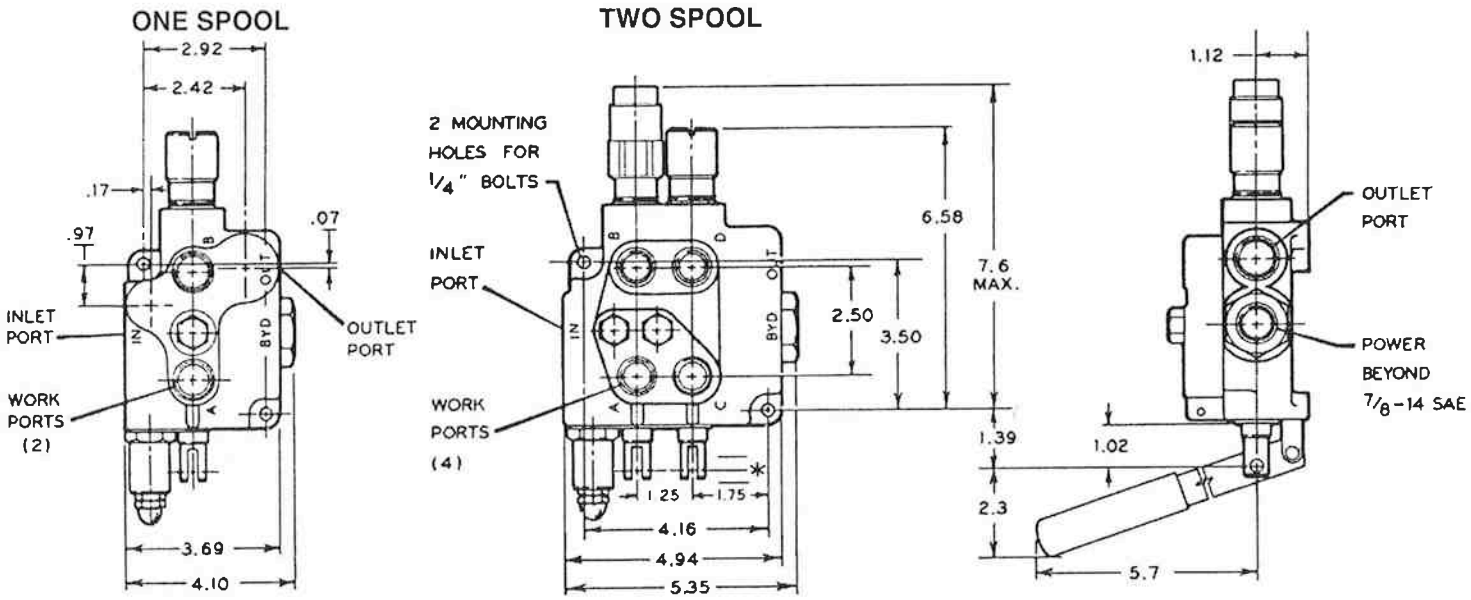
- Open or closed center positions, 3-way or 4-way operation, 3-position or 4-position (float position), full open center (motoring spool) and other spool options
- Power beyond (permits use of neutral flow at system pressure); also permits field conversion from closed center to open center (tandem) operation

NOTE: Refer to CROSS Valve Technical/Service Sheet for recommendations and limitations.

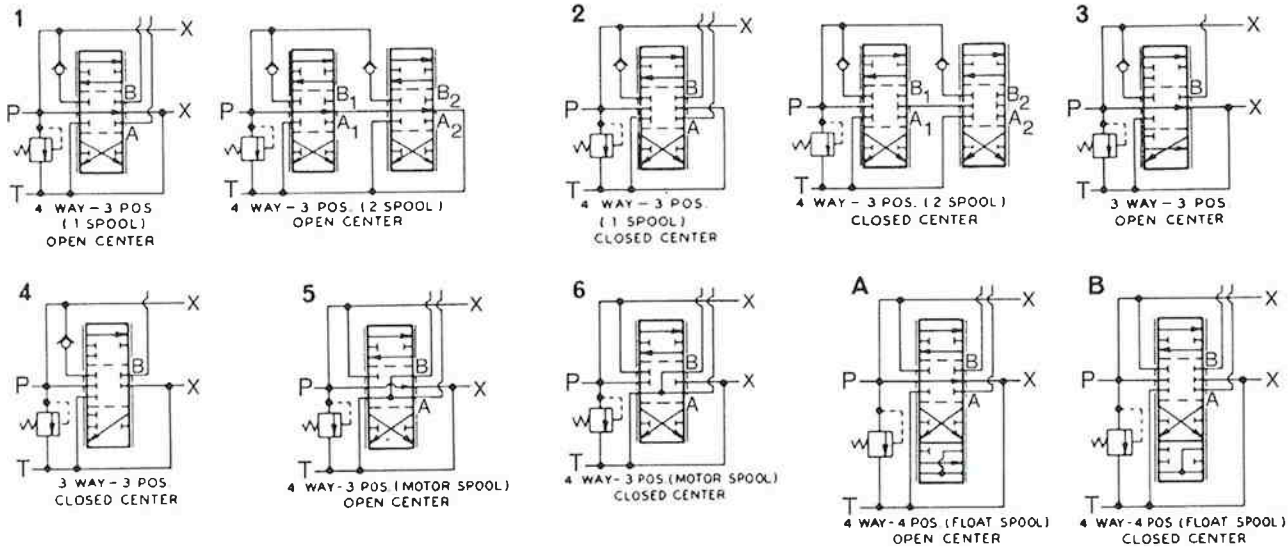
DIRECTIONAL CONTROL
AD SERIES
Specification Sheet

HYDRAULIC VALVES

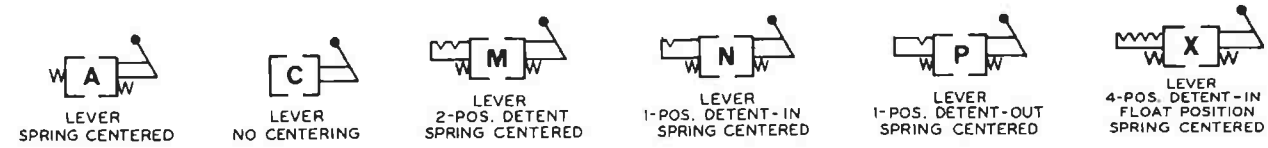
DIMENSIONAL DATA in inches



SPOOL OPTIONS



ACTUATOR OPTIONS



TYPICAL PERFORMANCE DATA

PRESSURE DROP (with 100 SUS oil at 120° F, SAE #10 in and out, #8 work ports)

AD 1

FLOW GPM	PSI P-A	P-B	A-T	B-T	P-T
3	9	5	1	1	2
6	21	20	3	3	5
9	42	40	10	11	11
12	65	63	21	20	20
15	90	87	34	32	32

FLOW GPM	PSI FLOAT	P-A-B-T	P-A-B-T
3	12	10	11
6	23	27	29
9	43	53	60
12	65	88	100
15	90	125	140

TO CONVERT	INTO	MULTIPLY BY
GALLONS	LITERS	3.7853
PSI	BAR	0.0690

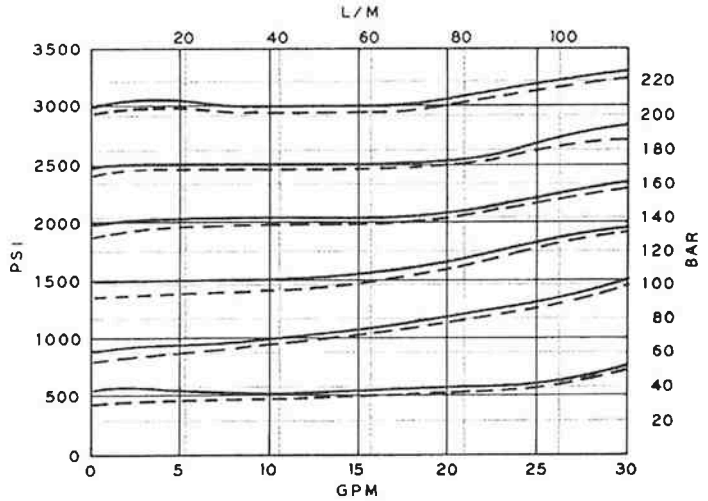
AD 2

FLOW GPM	PSI P-T	P-A	P-B	P-C	P-D
3	4	20	18	20	20
6	12	38	34	40	36
9	28	62	54	72	58
12	46	96	82	110	88
15	71	138	114	156	122

FLOW GPM	PSI A-T	B-T	C-T	D-T	FLOAT A-B	B-A
3	4	4	4	4	10	10
6	12	12	10	10	32	30
9	24	26	22	20	70	64
12	40	44	36	34	118	108
15	60	66	54	50	180	164

FLOW GPM	PSI PABT →	PBAT →	PCDT →	PDCT →
3	24	24	24	24
6	52	52	54	48
9	94	88	98	84
12	146	134	158	130
15	212	192	228	286

RELIEF VALVE CHARACTERISTICS



100 SSU oil at 120° F

Opening
Closing

HYDRAULIC VALVES

ORDERING INFORMATION

MODEL NO.	NUMBER-OF SPOOLS	SPOOL TYPE	ACTUATOR OPTIONS	RELIEF VALVE	POWER BEYOND	OUTLET PORT LOCATION	PORT SIZE & TYPE	HANDLE
	1	1	A	A		0	0	0
AD	Single	4-way, 3-position, open center	3 position Spring centered	1000 psi		End Outlet	SAE #10, 7/8-14 In & Out	Complete handle assembly
	2	2	B	B		P*	SAE #8 ,3/4-16 Work Ports	1
	Double	4-way, 3-position, closed center	3 position manual detent - no spr. ctrg.	1500 psi		Top Inlet & Outlet		Less Complete handle assembly
		3	C	C	3	H*	1	2
		3-way, 3-position, open center	manual - no detent - no centering spring	2000 psi	Conversion plug	Top Inlet	1/2" NPTF In & Out, 3/8" NPTF Work Ports	Less Handle only (Link,pins & bracket included)
		4	M	D	4	R	2	
		3-way, 3-position, closed center	2 -position detent, "in& out" spring centering	None	7/8 -14 SAE #10	Rear 3/8" NPTF	SAE #6, 9-16 In & Out & Work Ports	
		5	N	E	5	T	3	
		4-way, 3-position, open center w/motoring spool	1 -position detent," in" only,spring centering	Other	Closed center plug	Top Outlet	Other	
		6	P	F				
		4-way, 3-position, closed center w/motoring spool	1 -position detent, "out" only,spring centering	Adjustable 500-1500 psi (set at 1000)				
		A	X	G				
		4-way, 4-position, open center, detent ffloat position	4-pos. spring centered to neutral. Detent in float.	Adjustable 1500-3500 (set at 2000)				
		B	Y					
		4-way, 4-position, closed center, detent float position	4-pos. spring centered with regen					
		C						
		4-way, 4-position, open center w/ regen feel position						

EXAMPLE: AD2A1XAG4000 is a manually operated double spool valve, the first spool being 4-way, 4 position, open center, spring centered with detent in float position; the second spool being 4-way, 3-position, open centered spring centered. The adjustable relief valve is set at 2000 psi. Power beyond sleeve with 7/8-14 SAE thread. Inlet and outlet ports SAE #10, 7/8-14. Work ports SAE#8, 3/4-16. Complete handle assembly.

Standard Full Line Valves : (See page 6 in Full Line Catalog for additional information.)

- **SA2** - AD11AG3000 - Single spool 3-position, 4-way
- **SA22** - AD211AAG3000 - Double spool 3-position, 4-way
- **SAF2** - AD2A1XAG3000 - Double spool 1st spool 4-position float, 2nd spool 3-position, 4-way

CROSS MANUFACTURING
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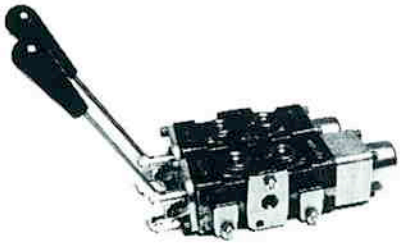
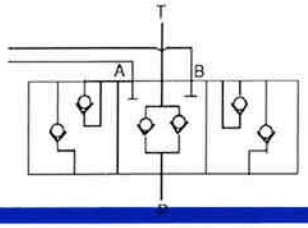
HYDRAULIC VALVES

DIRECTIONAL CONTROL
SS SERIES
Specification Sheet





The CROSS series SS directional control valve offers extremely low leakage with exceptional load holding ability in a small, yet rugged, sectional valve. A single section may be utilized by itself or stacked in series to perform multiple functions giving this valve a unique versatility. Solenoid as well as manual actuators are available. It is compact, yet large enough to accommodate quick disconnect fittings.

GENERAL SPECIFICATIONS

Number of spools	one or mutliple
Rated working pressure	3500 psi (241 bar)
Maximum shock and surge pressure	4500 psi (309 bar)
Rated flow capacity	7 gpm (26.5 l/m)
Maximum spool leakage (at 1000 psi w/120 SUS oil at 120°F)	5 cc/min
Spool forces:	Full Travel: 30 lb.; Into float position: 80-90 lb.; Out of float: 75-85 lb.
Mounting, any position	1/4"-20 mtg. holes - 2 per section
Weight, 1 spool	7 lbs.

MATERIAL SPECIFICATIONS

Body	Ductile iron
Inlet relief plate	Aluminum
Spools	Ground, plated and polished steel alloy
Seals	Buna N

STANDARD FEATURES

- Series operation
- Excellent spool metering characteristics
- Open center, 4 way 3 position or 4 way, 4 position (float)
- Integral load holding check valves to prevent reverse flow through valve when shifting
- Balanced, select-fit spools to provide minimum leakage, smooth operation
- 9/16-18 (SAE #6) inlet and outlet ports, 9/16-18 (SAE #6) work ports
- May stand alone or be stacked in series
- Built-in power beyond capability
- Complete handle assembly

OPTIONAL FEATURES

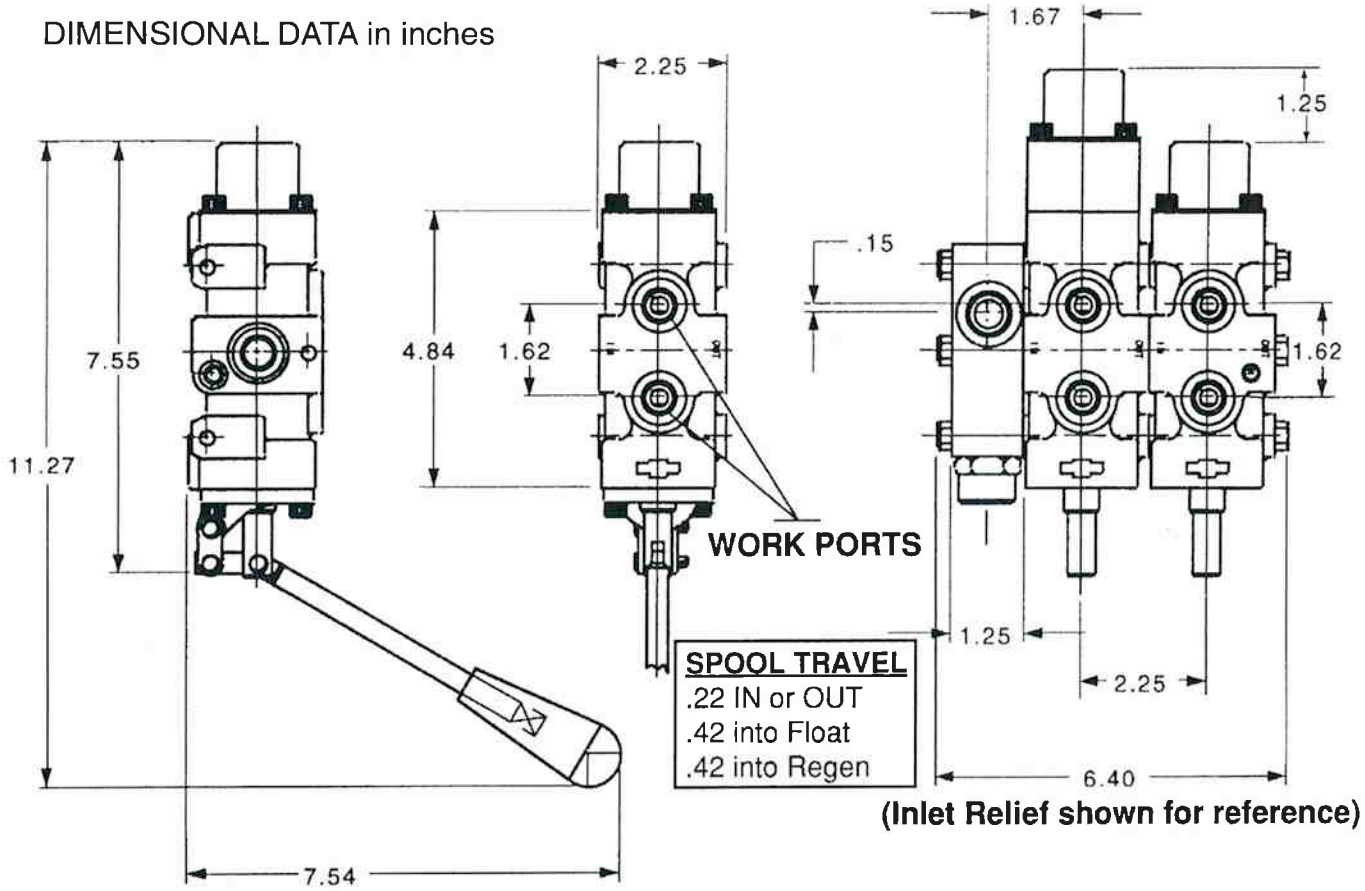
- Optional add-on inlet section with differential poppet type relief valve
- High flow spool available for up to 10 gpm
- Single handle actuator with rubber boot
- 3/4-16 (SAE #8) inlet and outlet ports, 3/4-16 (SAE #8) work ports
- Solenoid actuators (12 and 24 volt DC, 120 and 240 volt AC) - complete internal plumbing - no external drains required

DIRECTIONAL CONTROL
SS SERIES
Specification Sheet

HYDRAULIC VALVES

CROSS

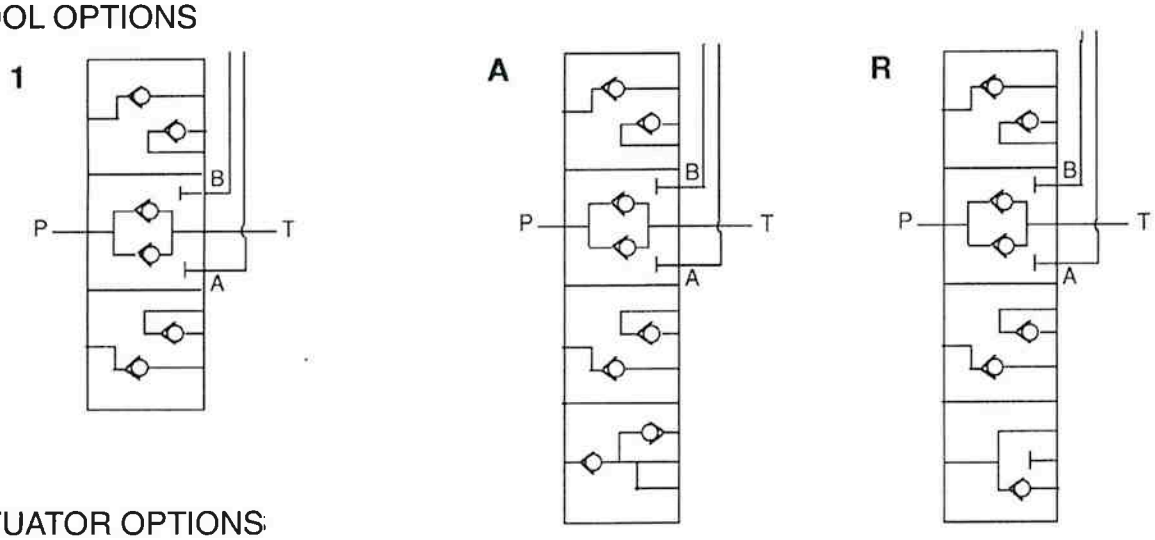
DIMENSIONAL DATA in inches



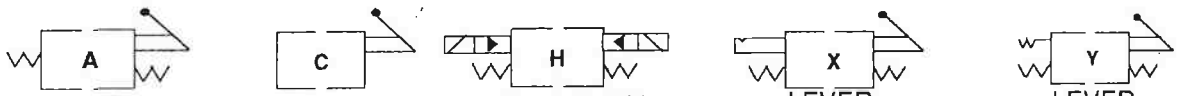
SPOOL TRAVEL
.22 IN or OUT
.42 into Float
.42 into Regen

(Inlet Relief shown for reference)

SPOOL OPTIONS



ACTUATOR OPTIONS



LEVER, SPRING CENTERED

LEVER, NO SPR. CNTR

(also J, K or L) SOLENOID, DC OR AC SPR. CNTR

LEVER, 1-POS. DETENT IN , FLOAT POSITION

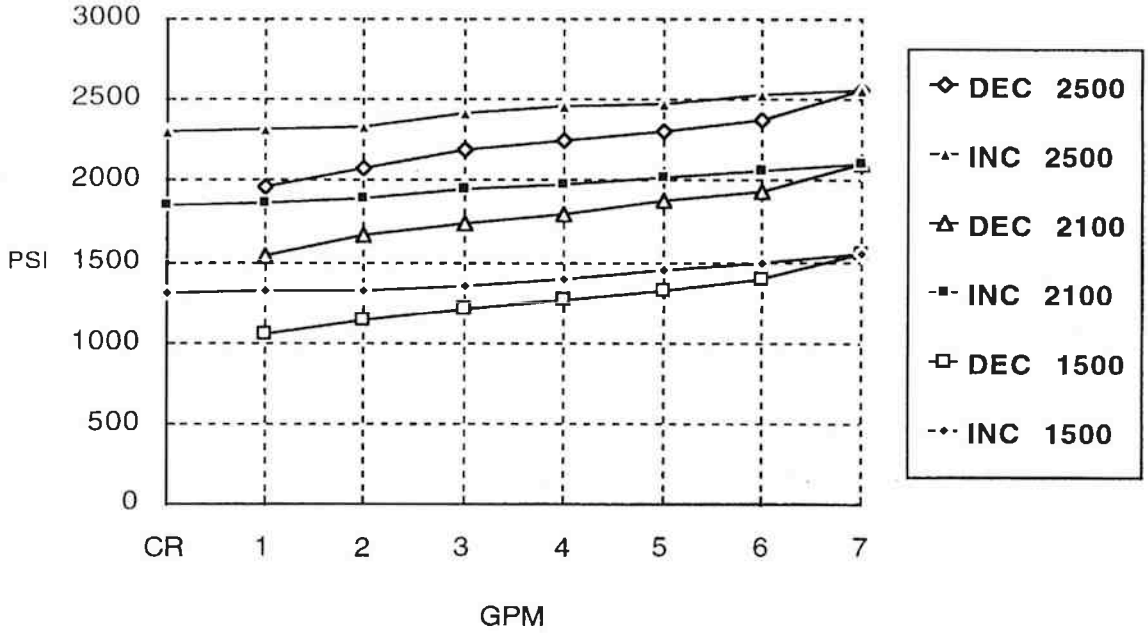
LEVER, SPR. CTR. W/ REGEN FEEL POS.

TYPICAL PERFORMANCE DATA

PRESSURE DROP (with 120 SUS oil at 120°F, 9/16-18 ports)

FLOW RATE in GPM	1	2	3	4	5	6	7	8
SINGLE SPOOL VALVE								
P to A or B	9	14	24	36	50	66	90	113
A or B to T	10	18	28	45	66	87	116	146
P to T	8	10	14	24	31	40	51	64
TWO SPOOL VALVE								
P to T	14	17	24	40	55	72	93	116
A1 or B1 to T	16	24	37	61	90	119	158	199
P to A2 or B2	14	20	32	52	74	98	132	166
P to A1 or B1 same as single spool data; A2 or B2 to tank same as A1 or B1 to tank data of single spool.								
THREE SPOOL VALVE								
P to T	19	24	32	56	79	104	135	170
A1 or B1 to T	22	30	46	77	114	151	200	252
P to A3 or B3	20	27	42	68	98	130	174	219
P to A1 or B1 same as single spool data; P to A2 or B2 same as 2 spool data; A2 or B2 to tank same as A1 or B1 to tank data of two spool; A3 or B3 to tank same as A1 or B1 to tank data of single spool.								
Adder per spool	6	6	9	16	24	32	42	53
(Use adder figure for all ports except last ports to tank or first ports from pump)								

RELIEF VALVE CHARACTERISTICS (120 SUS OIL AT 120°F.)



ORDERING INFORMATION

MODEL NO.	SPOOL TYPE	SPOOL ACTION	PORT SIZE & TYPE	HANDLE	HIGH FLOW SPOOL
SS	1 4 way, 3 pos. open center	A 3-position, spring centered	A 9/16-18, SAE #6, all ports	0 Complete handle ass'y. "A" port end.	High flow spool (above 7 gpm)
SSC * (use with optional inlet relief plate)	3 3 way, 3 pos. open center	H Solenoid, 12 volt DC	B 3/4-16, SAE #8, all ports	1 Complete handle ass'y. "B" port end.	
	5 4 way, 3 pos. open center w. motoring spool	J Solenoid, 24 volt DC	C 3/4-16 SAE #8, In & Out. 9/16-18 SAE #6 work ports.	2 Less handle ass'y. "A" port.	
	A 4 way, 4 pos. open center, detented float position	K Solenoid, 120 volt DC		3 Less handle ass'y. "B" port.	
	R 4 way, 4 pos. open center, with regen feel position	L Solenoid, 240 volt DC		4 Less handle w/brackets. "A" port. end.	
		Y 4-position, spring centered with regen feel position			
		X 4 pos. spring ctr. to neutral. Detent in float position			

EXAMPLE: SS1AA0 is a manually operated single section with 4 way, 3 position, spring centered open center spool, with 9/16-18 SAE ports and handle assembly "A" port end.

* Must be last section in stack.

Optional inlet plate may be ordered by specifiying port size and pressure relief setting.

Single handle actuator with rubber boot is available on multi-stack units.

Contact CROSS ENGINEERING for specifications.

CROSS

CROSS MANUFACTURING, INC.
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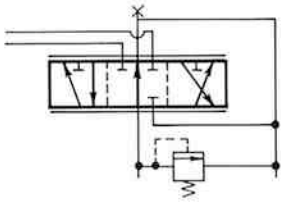
HYDRAULIC VALVES

DIRECTIONAL CONTROL
C SERIES
Specification Sheet



The CROSS series C monoblock type directional control valves provide good metering characteristics and long dependable service life. Select-fit spools give minimum leakage for maximum load holding ability. Many options are available including pressure release detents and solenoid actuators. Basically a series type valve, the first spool has priority in the 2-spool version. These valves are recommended for all general purpose applications except for metering-up with heavy vertical loads. See Hydraulic Safety Sheet.

GENERAL SPECIFICATIONS

Number of spools	1 or 2
Rated working pressure	2500 psi (172 bar)*
Maximum shock and surge pressure	4000 psi (276 bar)
Rated flow capacity	30 gpm (114 l/m)
Maximum spool leakage (@ 1000 psi w/100 SUS oil @ 120°F)	32 cc/min.
Mounting, any position	Three mounting holes for 3/8" dia. bolts
Weight 1 spool: Standard, 9 lbs. (4Kg); w/detents, 10 lbs. (4.5 Kg), w/sol., 12 lbs. (5 Kg)	
2 spool: Standard, 17 lbs. (7.7 Kg), w/detents, 18 lbs. (8 Kg), w/sol., 23 lbs. (10 Kg)	

MATERIAL SPECIFICATIONS

Body	High tensile strength cast iron
Spool	Ground, plated and polished steel alloy
Seals	Buna N

STANDARD FEATURES

- Built-in system relief valve (non-adjustable), set at 1500 psi
- Balanced select-fit spools for minimum leakage, smooth operation and long life
- 3-position, 4-way spool with spring centering and complete handle assembly
- 3/4" NPTF inlet and outlet ports, 1/2" NPTF work ports
- open center • 1 or 2 spools

OPTIONAL FEATURES AVAILABLE

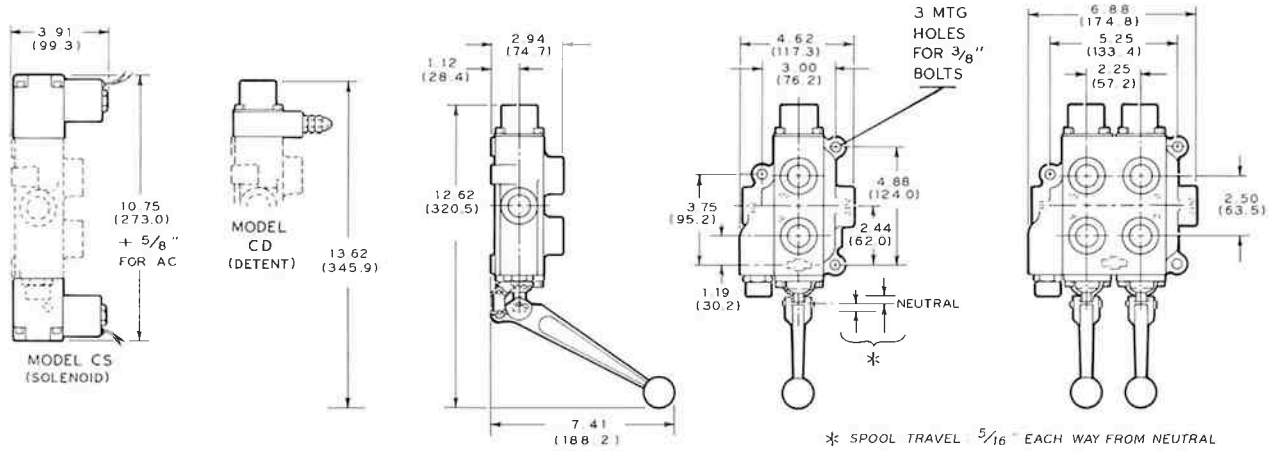
- Built-in system relief valve, fixed or adjustable, with optional pressure settings to 2000 psi
- Various spool types, 3 or 4-way, with various actuators and actuator positions
- Various sizes of SAE straight thread or NPTF dryseal pipe thread ports
- Pressure released detents (Model CD) in the "in", "out" or both positions
- AC or DC solenoid operation (Model CS), from 6 to 24 volt DC, 120 to 480 volts AC

* Limited to 2000 psi when integral relief valve is used.
NOTE: Refer to CROSS Valve Technical/Service Sheet for recommendations and limitations.

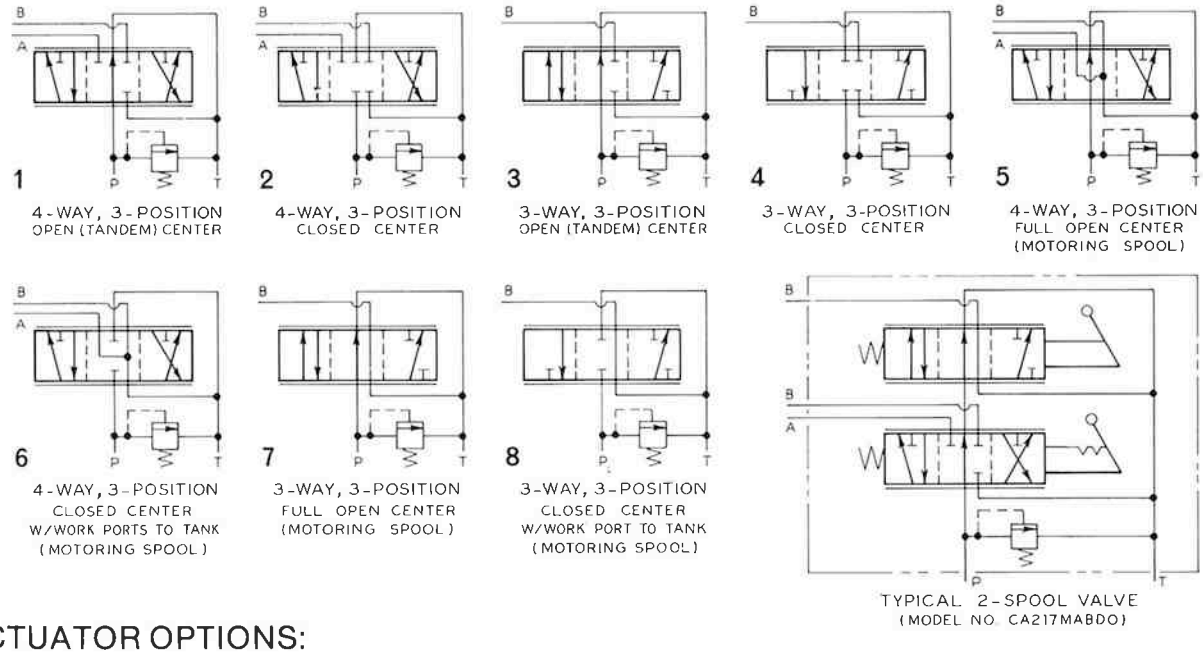
DIRECTIONAL CONTROL
C SERIES
Specification Sheet

HYDRAULIC VALVES

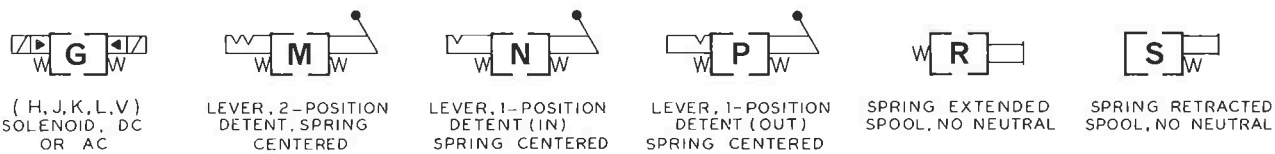
DIMENSIONAL DATA: in inches and (millimeters)



SPOOL OPTIONS:



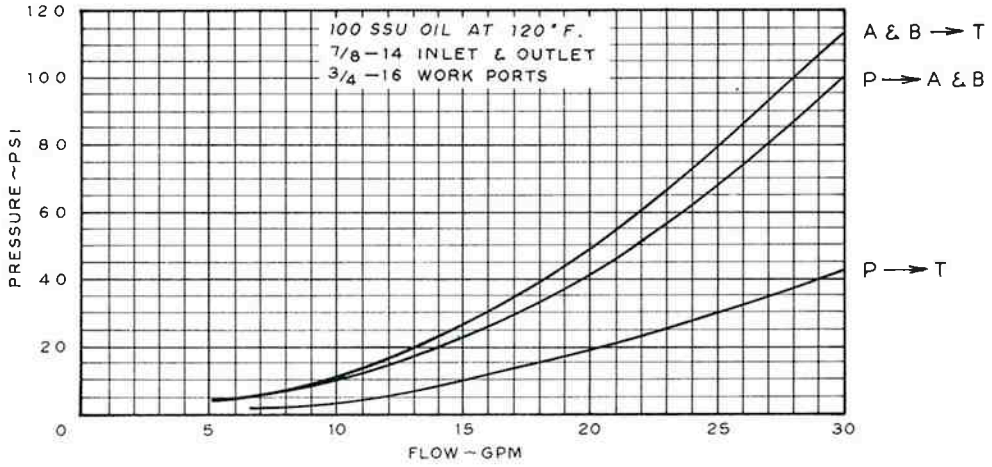
ACTUATOR OPTIONS:



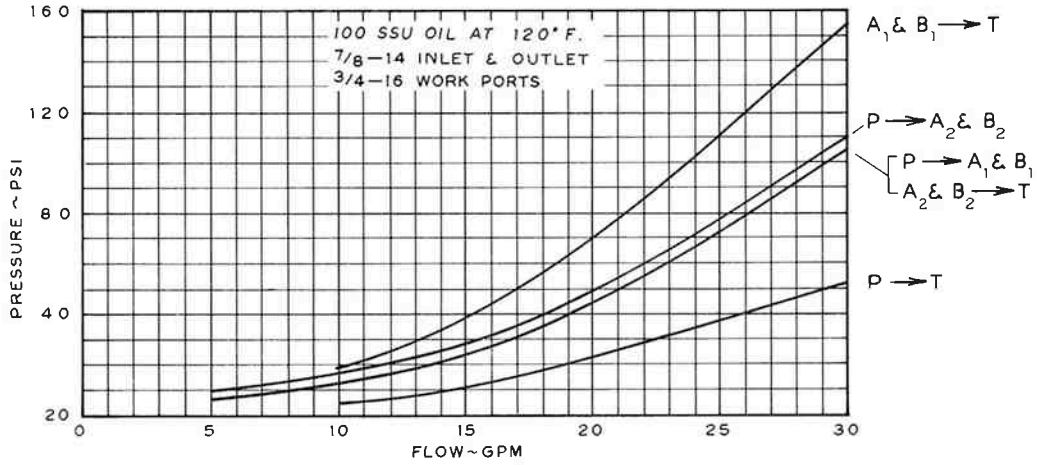
NOTE: ALL ACTUATORS MAY BE LOCATED AT EITHER END OF VALVE, EXCEPT ON MODEL CD.

TYPICAL PERFORMANCE DATA:

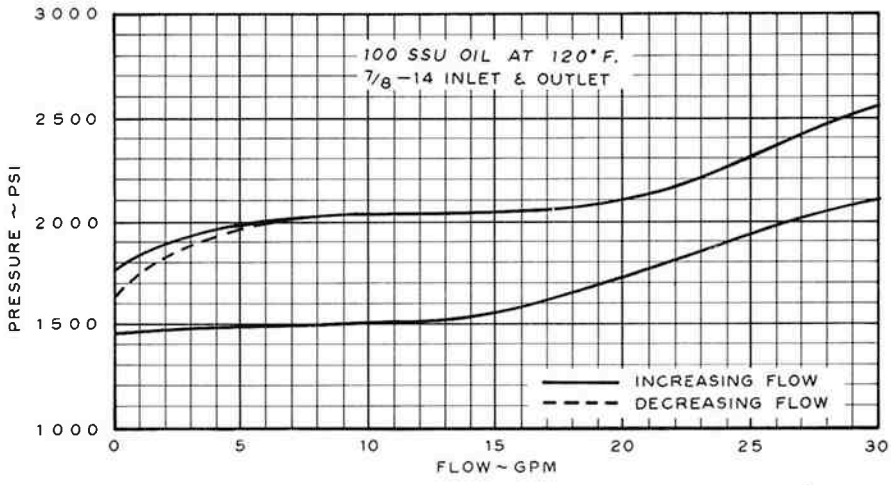
CA 1-SPOOL VALVE



CA 2-SPOOL VALVE



CA RELIEF VALVE REGULATION



ORDERING INFORMATION

MODEL NO.	# OF SPOOLS	SPOOL TYPE	ACTUATOR OPTIONS	RELIEF VALVE(6)	PORT SIZE & TYPE	HANDLE	DET. RELEASE
CA	1	1	A	A	A	0	(4)
Manual	Single	4-way, 3-position, open center	3 position Spring centered	1000 psi	In & Out 3/4" NPTF,Work 1/2" NPTF	Complete handle assy.- "A" port end	
	2	2	B	B	B	1	
CD	Double	4-way, 3-position, closed center	3 position detent - no spring centering	1500 psi	In & Out 3/4" NPTF,Work 3/8" NPTF	Complete handle assy.- "B" port end (3)	
pressure detent		3	C	C	C	2	
		3-way, 3-position, open center	manual - no detent - no centering spring	2000 psi	In & Out 3/4" NPTF,Work 3/4" NPTF	Less complete handle assy. "A" port	
		4	D	D	D	3	
CS		3-way, 3-position, closed center	Pressure detent "in & out" (4)	None	In & Out SAE #10,Work SAE #8	Less complete handle assy. "B" port (3)	
solenoid		5	E	E	E	4	
		4-way, 3-position, open center w/motoring spool	Pressure detent," in" only,spring centering(4)	Other	In & Out SAE #12,Work SAE #12	Less handle w/brackets "A" port end	
		6	F	F	F	5	
		4-way, 3-position, closed center w/motoring spool	Pressure detent, "out" only,spring centering(4)	Adj. 750-1250 (set at 1000)	Other	Less handle w/brackets "B" port end (3)	
		7	H	G	G	6	
		3-way, 3-position, open center w/motoring spool	Solenoid, 12 volt DC (5)	Adj. 1750-2250 (set at 2000)	In & Out SAE #12,Work SAE #8	Other	
		8	J				
		3-way, 3-position, closed center w/motoring spool	Solenoid , 24 volt DC (5)				
		9	K				
		Other	Solenoid, 120 volt, AC (5)				
			L				
		(2)	Solenoid, 240 volt, AC (5)				
			M				
			2 -position detent, "in & out" spring centering				
			N				
			1 -position detent, "in only" spring centering				
			P				
			1 -position detent, "out only" spring centering				
			R				
			Spring ext. no neutral				
			S				
			Spring retrr., no neutral				
			V				
			Solenoid, 480 Volt AC (5)				
			W				
			Rotary actuator				
CV	1 (1)	1(1)	A (1)	B (1)	A(1)	0(1)	

Standard Stock Valves:
(see Full Line catalog)
SCA2 (CA11ABA0)
SCD2E (CD11FCA0) for Logsplitter
Converta (SCV-1)

Part number building example:
CA217MABDO is a manually operated double spool valve: the **first** spool being 4-way, 3-position. open center, spring centered with detent in the "in" and "out" position; the **second** spool being 3-way, 3-position, open center motoring and spring centered. The non-adjustable relief is set at 1500 psi, inlet and outlet ports are SAE #10 and the work ports SAE #8. The complete handle assembly is located on the "A" port end.

NOTES: (1) **Model CV** (converta) is a standard model without options. A conversion plug for 3-way operation is included & a field installable manual detent kit (1V0294) is available. Refer to Form #VCV9 for details.

(2) If closed center is required on a 2-spool valve, the first spool must be open center.

(3) Not applicable for **Model CD**.

(4) **Model CD** - specify detent kick-out pressure if other than 1000 psi (must be at least 200 psi below relief setting).

(5) **Model CS**

(6) Settings at 10 gpm. Other flow or pressure settings must be specified up to a maximum of 2000 psi.

(7) Omit for CS version valves. Add second number if 2nd spool handle assembly is different from first.

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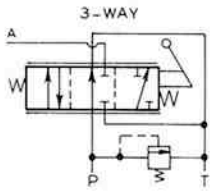
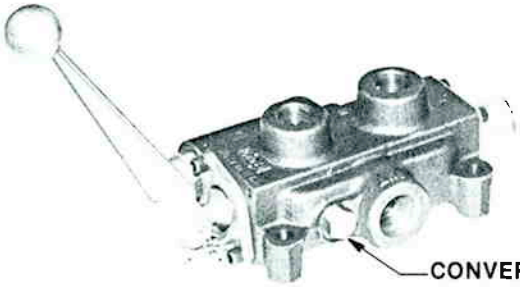
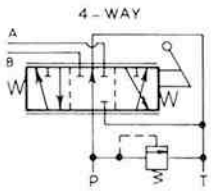
HYDRAULIC VALVES

DIRECTIONAL CONTROL
CV SERIES
Technical/Service Sheet







The CROSS series CV (CONVERTA) valve is a highly versatile 3-way or 4-way, 3 position directional control valve for use with either double-acting or single-acting cylinders.

SPECIFICATIONS

Rated working pressure	2000 psi (138 bar)
Maximum shock and surge pressure	4000 psi (276 bar)
Rated flow capacity	25 gpm (94.6 l/m)
Relief valve setting	2000 psi (138 bar) at 10 gpm (37.8 l/m)
Ports	3/4" NPTF inlet and outlet, 1/2" NPTF work (cylinder)
Basic spool type	4-way, 3-position, spring centered, open (tandem) center
Shipping weight (boxed)	9 lbs. (4 Kg)

CONVERSION

Included in the CV package is a 3-way cylinder port plug and a 3-way conversion plug. To convert from the basic 4-way (double-acting) to a 3-way (single-acting):

1. Insert the cylinder port plug (P/N 2AO349-8) into cylinder port "A" (port nearest handle).
2. Remove the conversion plug (P/N 1VO277), ie, the hex nut located adjacent to the outlet port, (as shown above).
3. Insert the 3-way conversion plug (P/N 2A0354-108).

The valve is now converted for use with a single-acting cylinder or uni-directional motor. (Save the 4-way conversion plug for later reconverting back to 4-way operation).

DETENT KIT

To change from the standard spring centered version to a 3-position detent, order Detent Kit P/N 1VO294. Convert as follows:

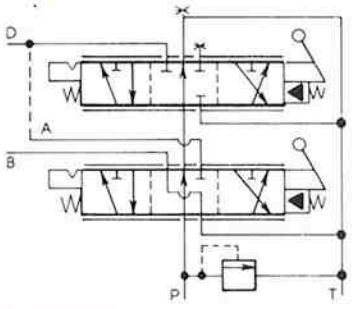
1. Remove end cap
2. Remove spring centering mechanism
3. Install detent kit
4. Replace end cap

The valve is now converted from spring centered to 3-position detent.

NOTE: This valve is not intended for use in lifting circuits.
See reverse side for complete parts list, exploded view, and dimensions.
See Directional Control Valve Specification sheet "C Series" for additional information.

HYDRAULIC VALVES

DIRECTIONAL CONTROL
AUTO-CYCLE
Technical/Service Sheet

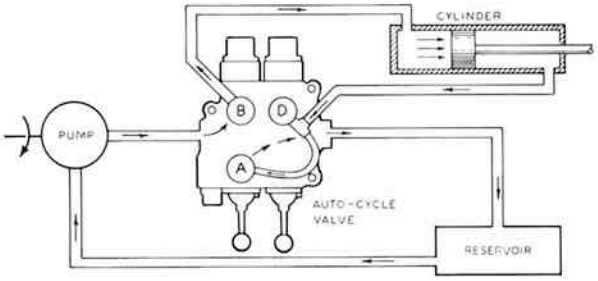


The CROSS AUTO-CYCLE valve is a modified series C directional control valve (Model Number CD213FFGAO) applied in a unique manner to provide automatic cycling.

For proper auto-cycle operation, the "A" and "D" ports must be inter-connected. If system flow rate exceeds 10 gpm (38 l/m), 1/2" minimum I.D. hose should be used.

The standard version valve (CD213FFGAO) is supplied with an adjustable relief valve (set at 2000 psi at 10 gpm), 3/4" inlet and outlet ports, 1/2" inlet ports, and complete handle assemblies located on the "A" port end of the valve. However, all C series relief, port and handle options are available. (Refer to C Series Directional Control Valve Specification Sheet).

OPERATION (Typical)



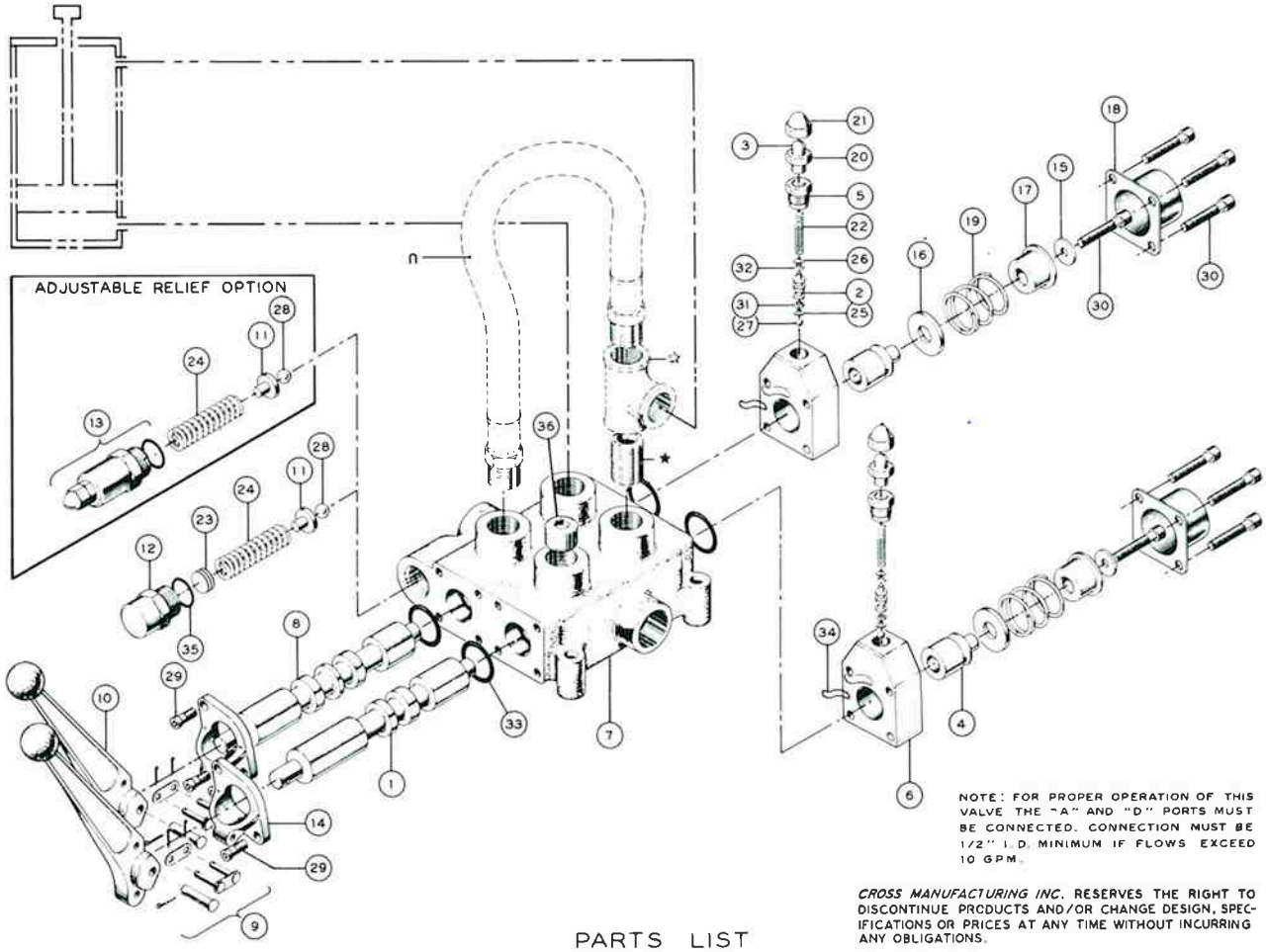
When both levers are pulled out, oil flow is directed from the inlet port, out the "B" port, to the piston side of the cylinder, causing the cylinder to extend. Return oil passes from the rod side of the cylinder through the valve "A" port to the outlet port back to the reservoir. Upon reaching the end of the cylinder stroke, pressure increases to the pre-set detent kick-out pressure, causing the first valve spool to return to neutral. Oil flow is then directed from the inlet port through the open center first spool and out the "D" port, thereby causing the cylinder to retract. Return oil from the piston side of the cylinder passes through the "B" port and out the outlet port back to the reservoir. When the cylinder is fully retracted, pressure increases to "kick-out" the second spool detent, returning it to neutral.
The system has now completed its full cycle and is ready to again be re-activated.

APPLICATIONS (Typical): Compactors, Presses

NOTE: NOT RECOMMENDED FOR LOGSPLITTERS.

DIRECTIONAL CONTROL
AUTO-CYCLE
Technical/Service Sheet

HYDRAULIC VALVES



NOTE: FOR PROPER OPERATION OF THIS VALVE THE "A" AND "D" PORTS MUST BE CONNECTED. CONNECTION MUST BE 1/2" I.D. MINIMUM IF FLOWS EXCEED 10 GPM.

CROSS MANUFACTURING INC. RESERVES THE RIGHT TO DISCONTINUE PRODUCTS AND/OR CHANGE DESIGN, SPECIFICATIONS OR PRICES AT ANY TIME WITHOUT INCURRING ANY OBLIGATIONS.

PARTS LIST

	PART NO.	DESCRIPTION	QTY REQD
1	1V0006	✳ SPOOL (3-WAY)	1
2	1V0068	PRESSURE DETENT PISTON	2
3	1V0069	ADJUSTMENT SCREW	2
4	1V0071	PRESSURE DETENT SLEEVE	2
5	1V0072	PISTON STOP	2
6	1V0263	DETENT HOUSING	2
7	1V0326	✳ VALVE HOUSING	1
8	1V0648	✳ SPOOL (4-WAY)	1
9	1V1702	PIN KIT	2
10	1V1703	HANDLE	2
11	1R0014	SPRING GUIDE	1
12	1R0028	RELIEF O-RING GUIDE	1
13	1R0045	ADJUSTABLE RELIEF CARTRIDGE	OPT.
14	424306	HANDLE BRACKET	2
15	1A0290	WASHER	2
16	1A0291	STOP WASHER	2
17	1A0292	SPOOL COLLAR	2
18	1A0294	END CAP	2

✳ THE SELECT-FIT HONING PROCESS AT FACTORY, WHICH FITS A SPOOL TO AN INDIVIDUAL VALVE BODY, ELIMINATES THE POSSIBILITY OF ORDERING THE VALVE BODY AND SPOOL AS SEPARATE ITEMS.

	PART NO.	DESCRIPTION	QTY REQD
19	1A0332	CENTERING SPRING	2
20	1A0569	LOCKNUT	2
21	1A0570	ACORN NUT	2
22	1A0610	DETENT SPRING	2
23	1A0682	SHIM	AS REQD
24	1A0685	RELIEF SPRING	1
25	2A0012-007	LOWER O-RING BACK-UP	2
26	2A0012-008	UPPER O-RING BACK-UP	2
27	2A0017-8	STEEL BALL (1/4")	2
28	2A0017-14	STEEL BALL (7/16")	1
29	2A0079-404	MACHINE SCREW	4
30	2A0079-414	MACHINE SCREW	10
31	2A0283-7007	LOWER PISTON O-RING	2
32	2A0283-7008	UPPER PISTON O-RING	2
33	2A0283-7214	SPOOL SEAL	4
34	2A0283-9017	O-RING	2
35	2A0283-9910	O-RING	1
36	2A0349-8	PIPE PLUG	1
☆		1/2" NPTF TEE	1
★		1/2" NPTF NIPPLE	1
n	446035	HOSE ASSEMBLY	1

CROSS MANUFACTURING, INC.
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HYDRAULIC VALVES

DIRECTIONAL CONTROL
CS SERIES
Technical/Service Sheet

The CROSS series CS solenoid operated directional control valves use standard solenoid cartridges to control the pilot flow for actuating the main valve spool. The pilot supply is obtained through drilled internal passages which connect pump pressure to the solenoid/pilot sections.

REQUIREMENTS

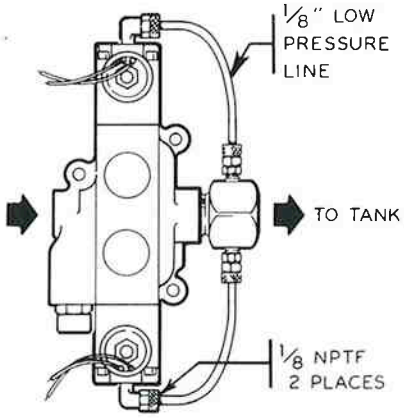
In order to move the valve spool hydraulically, a minimum of 30 psi (2.1 bar) is required. 50 to 60 psi (3.4 to 4.1 bar) is optimum, and 100 psi (6.9 bar) is maximum. 10 micron filtration is required for the CS valve.

CLOSED CENTER APPLICATIONS

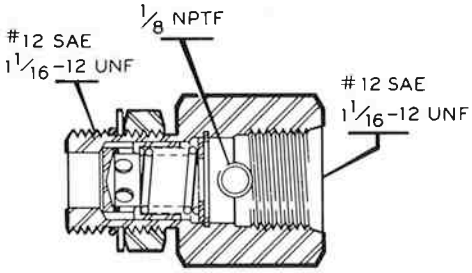
All necessary porting for operation of the CS valve is accomplished internally. No adjustments or modifications are necessary.

OPEN CENTER APPLICATIONS

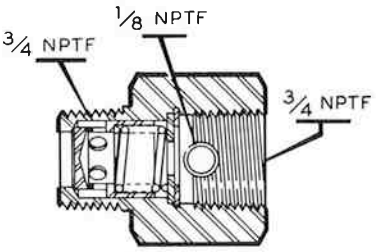
In order to have ample pilot pressure available (30 psi minimum), it is necessary to install a back pressure check valve (formerly known as R-75) in the tank port and to vent the ends of both solenoid blocks back to tank. (If not vented, the valve spool would not shift as pressure is supplied to both ends of the spool).



INTERNAL VIEW OF BACK PRESSURE CHECK VALVE



1V1990
SAE VERSION



1V2075
NPTF VERSION

PILOT PRESSURE KITS

Each kit includes the back pressure check valve plus the necessary fittings and tubing to complete the assembly. If the CS valve is supplied with other than ¾" NPTF outlet port, two additional adaptor fittings are necessary.

Kit Number SAE	Kit Number NPTF	DESCRIPTION OF KIT
1V1991	1V0266	For 1-spool valve (except 3-way motoring spool) or 2-spool valve w/1st manual
1V1992	1V0266A	For 2-spool valve w/1st spool solenoid, 2nd spool manual
1V1993	1V0267	For 2-spool valve, both solenoid (except 3-way motoring spools)
1V1994	1V0268	For 1-spool valve with 3-way motoring spool
1V1995	1V0543	For 2-spool valve with 1-spool as a 3-way motoring spool
1V1996	1V0544	For 2-spool valve with both spools 3-way motoring spools

HYDRAULIC PRODUCT SAFETY

WARNING : Valve lever (spool) may "stick" (not center) under certain conditions allowing the hydraulic equipment to continue to operate and could cause <u>serious injury, death or equipment failure.</u>

VALVE SAFETY: Read and follow instructions carefully. Failure to observe instructions and guidelines may cause serious injury, death or equipment failure. A sticking valve (spool bind) may be caused by one or more of the following factors:

<u>DIRTY OIL:</u> Oil must be filtered to a minimum of 25 microns. Filters should be changed regularly - spin-on types after 50 hours of initial use and then after every two hundred fifty hours of use. Use of a condition indicator is recommended. Consult your tractor or implement owner's manual for filtration and changing recommendations for internal systems.

<u>OIL REQUIREMENTS:</u> Premium quality anti-wear type oil with a viscosity between 100 and 200 SSU at operating temperatures. Certain synthetic oils may cause spool seals to swell and the valve to stick. If in doubt, call CROSS Engineering.

<u>IMPROPER HOOK UP OR MOUNTING:</u> Always use the proper size fittings. Hook up "in" & "out" as noted on the valve body. Do not overtorque pipe fittings. Mounting surfaces should be flat and care should be used when tightening mounting bolts. Over-tightened bolts can cause spool bind and casting breakage. When hooking a valve in series, always use a power beyond sleeve. Consult your tractor or implement manual to make sure you have the proper quick disconnect line connected to the inlet of the remote valve.

<u>MISAPPLICATION:</u> Always use the proper valve for the job. CONVERTA, CD, CS or CA valves should <u>never</u> be used for metered heavy load lifting - loaders or similar applications. Use an open center valve for open center applications and a closed center valve for closed applications. If in doubt, check with your tractor dealer. Contact CROSS if the valve allows the hydraulic equipment to creep excessively.

<u>MAINTENANCE:</u> Make sure all bolts are tightened and torqued to the recommended specification. Bent or broken parts should not be used. Replace immediately. Always use exact replacements.Always protect valve spool from paint overspray.

Faulty quick disconnects can cause high back pressures and sticking spools. Check quick disconnects periodically to make sure they are functioning properly. If valve spool does not center or appears to stick, do not use!

PUMPS & MOTORS SAFETY:

A relief or bypass in your hydraulic system is necessary to prevent pump from breakage due to overpressurization. Use correct fittings and proper oil as noted in the technical service manual packed with each unit. Change oil as recommended by your implement or tractor manufacturer.

CYLINDER SAFETY:

Check clevis clearances before, during and after extending the cylinder and before using the cylinder under pressure to avoid possible injury, or bent or broken rods caused by binding. Never operate a cylinder above recommended pressures. Never use a cylinder as a safety device when transporting equipment.

PINHOLE LEAKS:

If you observe a pinhole leak, discontinue use of the component. If oil has penetrated your skin or contacted your eye, seek medical attention immediately!

HYDRAULIC VALVE

DIRECTIONAL CONTROL
DV LOADER SERIES
Specification Sheet

The CROSS DV series

directional control loader valve offers extremely low leakage with outstanding load-holding capability in a compact, space saving model. All ports come out the same surface of the valve and it will fit in a space less than 6 inches wide. Float and regen capabilities, load checks, built-in power beyond and single handle actuator make this valve ideally suited for the mobile loader market.

GENERAL SPECIFICATIONS

Number of spools	two
Rated working pressure	3000 psi
Maximum shock and surge pressure	4000 psi
Rated flow capacity (2 spool options available)	8-10 gpm, 15 gpm
Mounting - bottom surface	Two mounting holes for 5/16" dia. bolts
Maximum spool leakage (at 1000 psi w/120 SUS oil at 120F)	5 cc/min

MATERIAL SPECIFICATIONS

Body	Class 50 grey iron
Spools	Ground, plated and polished steel alloy
Seals	Buna N

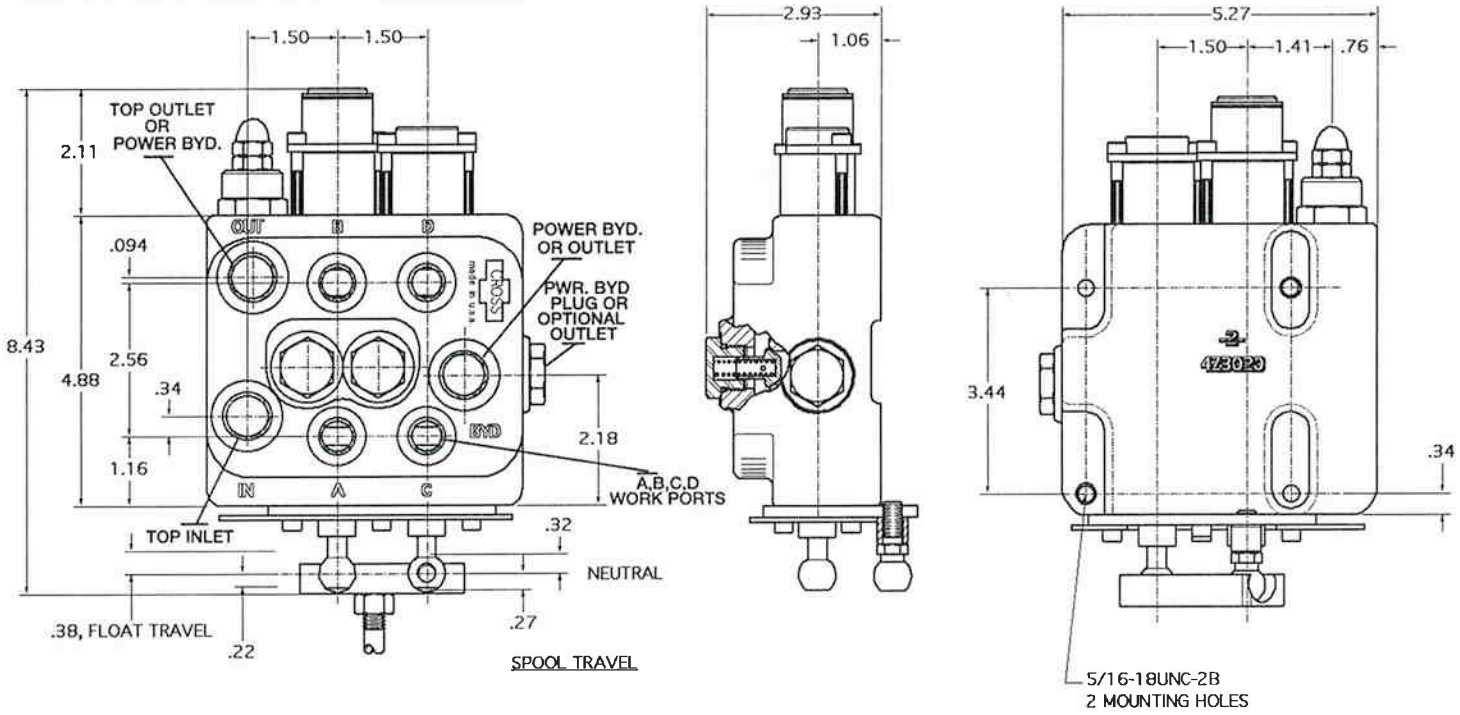
STANDARD FEATURES

- Parallel operation
- Excellent spool metering characteristics
- Open center: 4 way, 4 position (float) on first spool;
  4 way, 3 position or regen on second spool
- Integral load holding check valves prevent reverse when shifting from neutral
- Integral differential poppet type relief valve, adjustable
- Balanced, select-fit spools to provide minimum leakage, smooth operation
- 3/4 - 16 (SAE #8) inlet, outlet and power beyond with 3/4-16 (SAE #8) work ports
- Built-in power beyond capability
- Handles or single handle actuator assembly with rubber boot

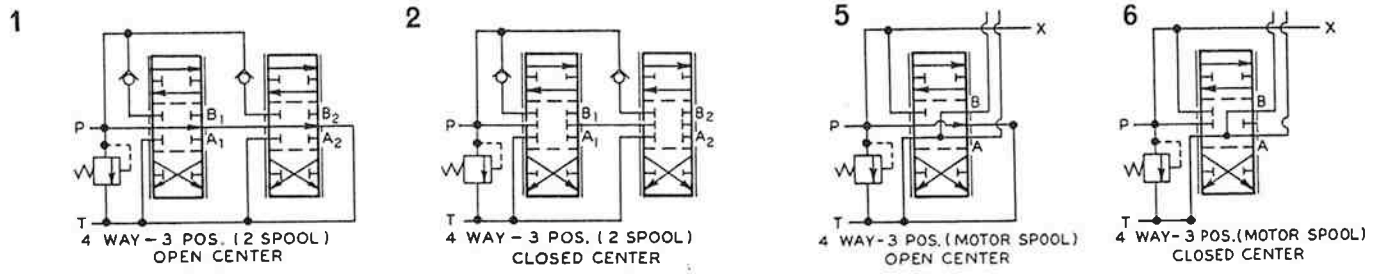
DIRECTIONAL CONTROL
DV LOADER SERIES
Specification Sheet

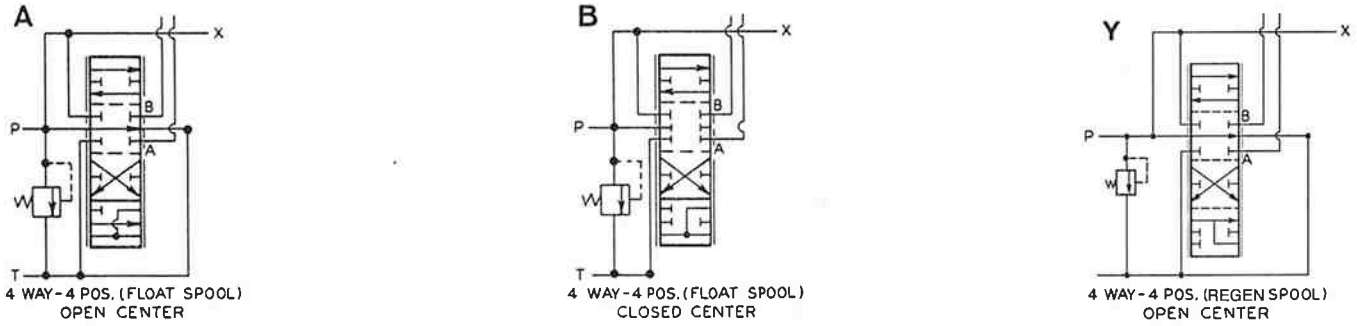
HYDRAULIC VALVE

DIMENSIONAL DATA in inches

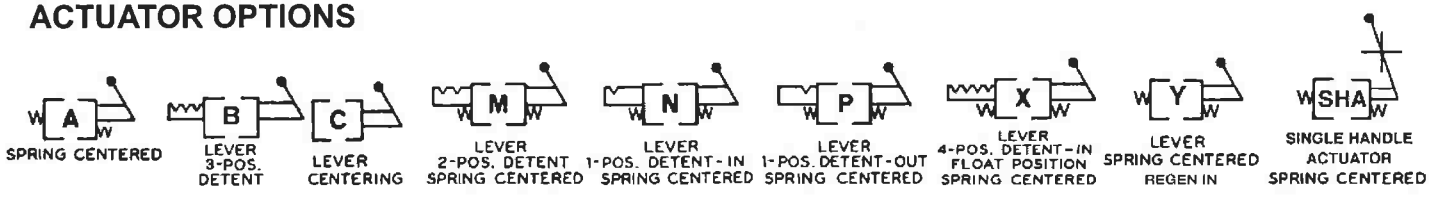


SPOOL OPTIONS





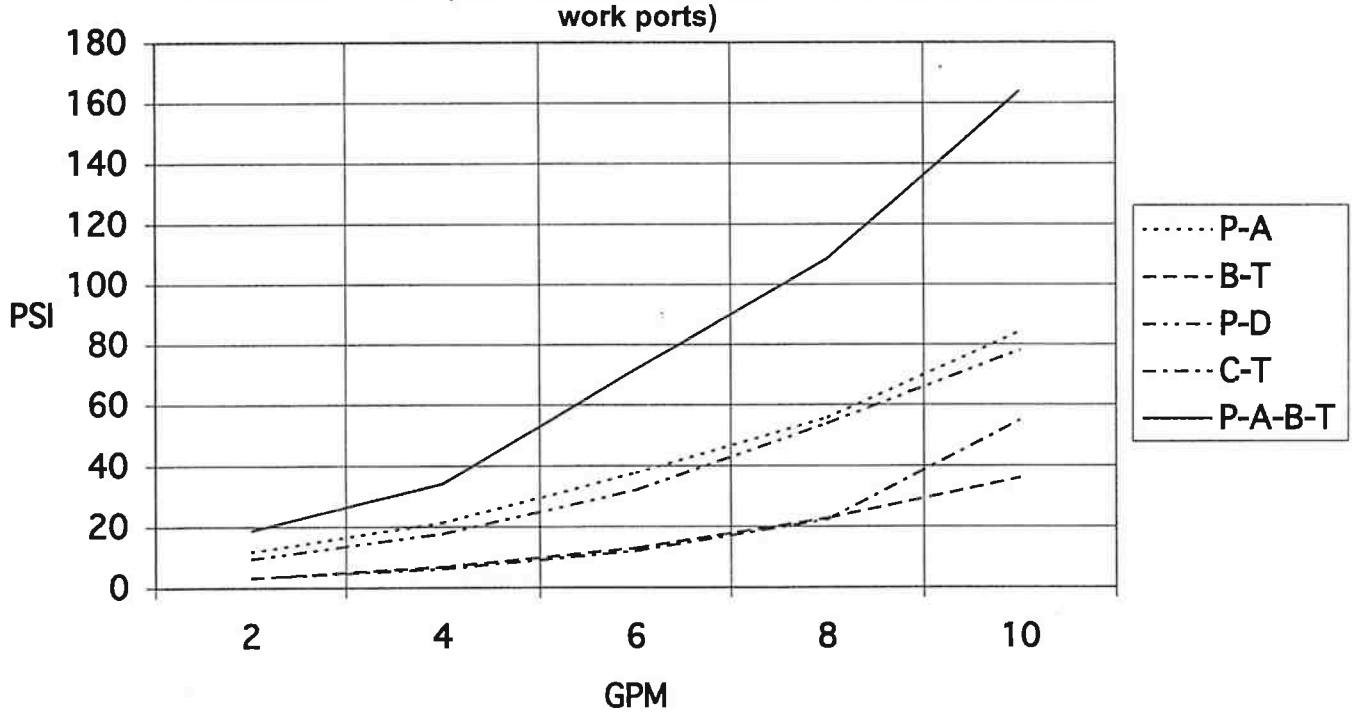
ACTUATOR OPTIONS



TYPICAL PERFORMANCE DATA

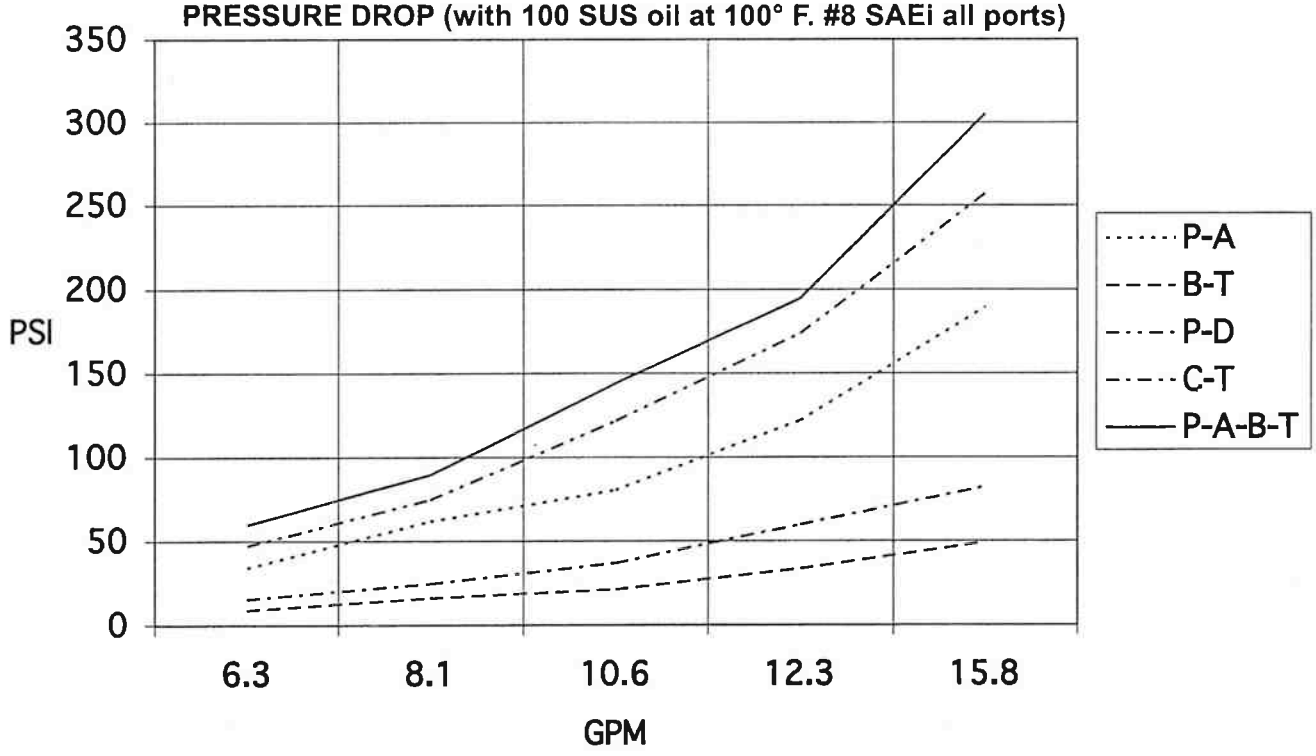
DV10

PRESSURE DROP (with 100 SUS oil at 100° F. SAE #8 in & out, #6 work ports)



DV15

PRESSURE DROP (with 100 SUS oil at 100° F. #8 SAEi all ports)



DIRECTIONAL CONTROL
DV LOADER SERIES
Specification Sheet

HYDRAULIC VALVE

ORDERING INFORMATION

Model No.	No. Spools	Spool Type	Actuator Options	Relief Valve	Power Beyond	Outlet Port Location	Port Size & Type	Handle
DV10	**2**	**1**	**A**	**A**	**0**	**P**	**0**	**0**
10 GPM		4-Way, 3-Pos. Open Ctr.	3-Pos. Spring Centered	1,000 PSI	No Pwr. Byd.	Std. Top Inlet & Outlet	9/16-18 SAE Work Ports, 3/4-16 In & Out	Handle
DV15		**2**	**B**	**B**	**3**	**1**	**1**	**1**
15 GPM		4-Way, 3-Pos. Closed Ctr.	3-Position Manual Detent	1,500 PSI	Conv. Plug	Top Outlet BYD. 3/4-16 SAE	3/4-16 SAE Work, In & Out Ports	Less Hdl. Ass'y. (drilled hole in ball)
		5	**C**	**C**	**4**	**2**	**2**	
		4-Way, 3-Pos. Open Ctr. Motoring	Manual, No Detent, No Spr. Ctr.	2,000 PSI	Pwr. Byd. 3/4-16 SAE	Right Side Outlet 3/4-16 SAE	9/16-18 SAE Work, In & Out Ports	
		6	**M**	**D**	**5**			**3**
		4-Way, 3-Pos. Closed Ctr. Motoring	2- Pos. Det. "In" & "Out", Spr. Ctr..	None	Closed Center			Single Handle Actuator Assy.
		A	**N**	**E**				**4**
		4-Way, 4-Pos. Open Ctr. Float Spool	1-Pos. Det. "In" only, Spr. Ctr.	Other				Single Hdl. Act. Ass'y. rotated 180 deg. (no regen on 2nd spool.)
		B	**P**	**F**				
		4-Way, 4-Pos. Closed Ctr. Float Spool	1-Pos. Det. "Out" only, Spr. Ctr.	Adj. 500-1500 PSI set @ 1000 PSI				
		C	**X**	**G**				
		4-Way, 4-Pos. Open Ctr. Regen IN Position	4-Pos. Spr. Ctr. to Neutral, Det. in Float	Adj. 1500-3000 PSI set @ 2000 PSI				
			Y					
			4-Pos. Spr. Ctr. w/ Regen					
DV10	**2**	**AC**	**XY**	**F**	**3**	**P**	**0**	**3**

Example: DV102ACXYF3P03 is a DV10 10 GPM manually operated double spool valve. First spool is 4-way, 4-position spring centered with detent in float. Second spool is 4 way, 4 position, open center, regen "In", spring centered with regen. Adjustable relief valve is set @ 1500 psi. Power beyond has conversion plug. Standard port location: inlet and outlet SAE #8, 3/4-16 thread, work ports SAE #6, 9/16-18 thread with single handle actuator location.

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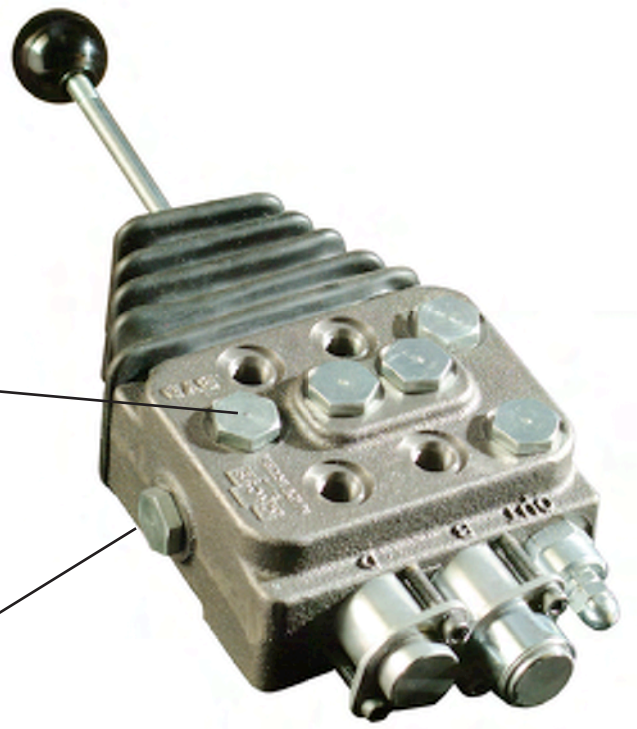
DV LOADER VALVE

Power Beyond Conversion



Remove plug from Top Power Beyond and plumb directly in to top power beyond location (3/4-16). (No Power Beyond Sleeve is required.)

Install #1V2853 Conversion Plug Assy. in End Outlet Location.

The **CROSS** **DV series loader valve** was designed for the mobile loader market but its compact size and versatility make it suitable for many applications. It is proving to be a durable, low leakage valve with excellent metering characteristics. The DV is available in a 10 and 15 gpm version and features a newly designed manual joystick control with protective boot or conventional handles.

Standard DV valve models (SDV) are listed in our Full Line catalog and will be discounted as the full line products or see DV specification sheet for a full list of options. (Current surcharges are applicable.)

We invite your inquiries and look forward to serving your needs!

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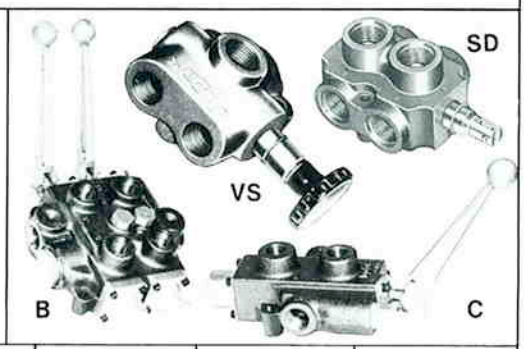
FOR CROSS SERIES A, B, C, SD and VS DIRECTIONAL CONTROL VALVES

The CROSS spool type, monoblock construction, directional control valves have been designed, manufactured and tested to insure the highest possible quality. This manual has been prepared to assist in the application and installation in order to obtain optimum performance. Refer to individual Specification Sheets for detailed data. All CROSS directional control valves, with proper maintenance, will provide long, dependable service.

See HYDRAULIC SAFETY SHEET.



VALVE SERIES ⟶	A	B	C	SD	VS
Number of spools	1, 2, or 3	1, 2, or 3	1 or 2	1	1
Number of positions	3 or 4	3 or 4	3	2	2
Rated working pressure	3000 psi	2500 psi	2500 psi	2500 psi	2500 psi
Max. shock & surge pressure	4000 psi	4000 psi	4000 psi	4000 psi	4000 psi
Rated flow capacity	15 gpm	30 gpm	30 gpm	40 gpm	20/40 gpm
Maximum spool leakage	16 cc/min.	16 cc/min.	32 cc/min.	16 cc/min.	16 cc/min.
Integral relief valve, fixed	Opt.	Opt.	Std.	N.A.	N.A.
Integral relief valve, adjustable	Std.	Std.	Opt.	N.A.	N.A.
Integral load holding check valves	Std.	Std.	N.A.	N.A.	N.A.
Pressure released detents	Opt.	Opt.	Opt.	N.A.	N.A.
Power beyond port	Opt.	Opt.	N.A.	N.A.	N.A.

VALVE SELECTION AND APPLICATION:

It is necessary to use the proper valve according to application requirements. Common application errors to be avoided are as follows: (Series B & C valves)

- Using an open center valve in a closed center system (should use closed center valve).
- Using a closed center valve in an open center system (should use open center valve).
- Using outlet port flow to second valve (should use power beyond option - Series B).
- Using Series C valve in load lifting application (should use Series B with load checks).
- Using valve without motoring spool in hyd. motor drives (can damage motor and valve).
- Using 3-way valve with double acting cylinder or 4-way valve with single acting cylinder.

Use No Teflon Tape! Liquid Pipe Sealant Only

VALVE CONVERSIONS:

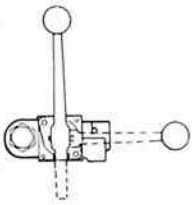
The Series B valve, if ordered with the power beyond option, can be converted from open center to closed center by installing a closed center plug in the power beyond port and setting the relief valve at least 500 psi higher than system pressure (or replacing the relief valve with "D" plug 1R0035). The CV version valve includes a conversion plug for changing from 4-way to 3-way operation. (Refer to CROSS literature "Directional Control Valve Accessories - Conversion Plug" for detailed information).

VALVE ADJUSTMENTS:

Series B and C valves are available with adjustable relief valves - the "F" designation from 500 to 1500 psi (factory preset at 1000 psi) "G" designation from 1500 to 2500 psi (factory preset at 2000 psi). Pressure settings are made at 10 gpm and hence, pressures will be slightly higher at higher flow rates and slightly lower at lower flow rates. To reset, remove acorn nut, loosen lock nut, turn screw clockwise to increase pressure or counter-clockwise to reduce pressure. Series B valves are available with pressure released detents which are factory preset at 1000 psi which can be adjusted in the same manner as the system relief valves. (Should be at least 200 psi less than relief valve setting).

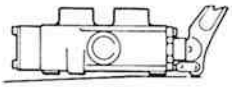
NEVER ATTEMPT TO ADJUST PRESSURE WITHOUT THE USE OF A RELIABLE GAGE IN THE SYSTEM.

HANDLE POSITION:

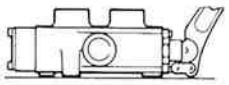


Symmetrical mounting holes permit the valve handles to be mounted in any of 4 positions, at 90° intervals. Series B and C valves are limited to 3 positions and multiple spool valves to the up or down position. If handle position is changed from the factory assembled position, the capscrews should be "LOCTITED" when reassembled. CAUTION: Handle extensions should not be used as the resulting increased force could damage valves. When mounting, be sure there is adequate space to permit full handle movement.

Valves may be mounted in any position. Series B and C valves have 3 mounting feet; SD and VS have 2. BC, C, SD and VS4 use 3/8" bolts (19-20 ft. lbs. torque). Bolts for the VS are 5/16" (11-12 ft.lbs. torque). Mounting surfaces must be flat and care should be used when tightening mounting bolts. Over-tightening bolts on uneven surfaces can distort the valve body and cause spool binding and casting breakage.



NO



YES

START-UP PROCEDURE:

Prior to installation, check valve for possible damage in shipping or handling.

1. Install valve and tighten fittings. OVER-TIGHTENED PIPE FITTINGS CAN DAMAGE VALVE.
2. Fill reservoir as necessary, using the correct, clean oil.
3. Start system and check for leaks. CAUTION: DO NOT USE HANDS.
4. Bleed air from system, as necessary.
5. Gradually increase load, checking for leaks, abnormal noises, binding, etc.

MAINTENANCE:

1. Clean and replace filters on a regular basis, as needed.
2. Check for presence of water in oil (cloudy appearance), air in oil (foaming oil), or burnt oil (rancid odor). Correct problem as necessary.
3. Check reservoir level regularly. Fill as needed.

TROUBLE SHOOTING:

There are only 3 potential spool valve problems: external leakage, excessive internal leakage, or spool bind. External leakage due to seal failure can be corrected by replacing seals. Leakage due to a cracked valve body requires complete valve replacement. Excessive internal leakage is usually caused by worn spools due to contaminates in the oil. Replace valve and system oil. Spool bind is caused by contamination, excessive heat, improper mounting or misalignment of valve linkage. Correct problem as needed. Refer to CROSS Trouble Shooting Guide for system overheating problems.

REPAIR:

CROSS spool type directional control valves are not field repairable except for seal replacement and relief valve cartridges. Spool seals are easily replaced by removing the handle bracket, end cap and o-rings. Replace o-rings using standard seal kits, (refer to appropriate parts list). Reassemble valve and "LOCTITE" capscrews. Standard seal kits include o-rings for relief valve cartridges and conversion plugs (if appropriate). CS (solenoid) version valves do not have spool seals; however, the solenoid cartridge seals can be easily replaced if needed. Worn detents can be repaired by installing a replacement detent kit. Temporary repair is possible by removing the handle and rotating the spool 180°.