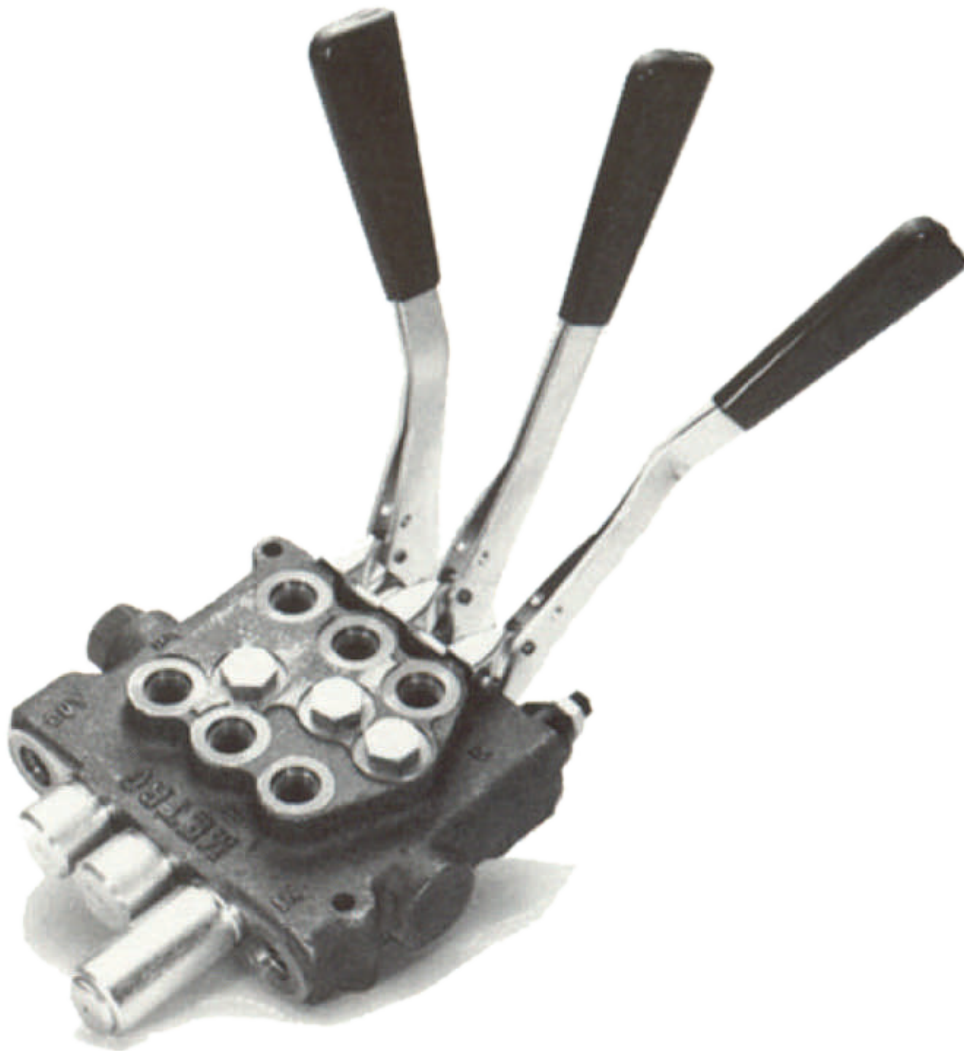

METRO

“When The Pressure’s On...”



***Our High Quality Components
Make the Difference!***

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Kits for Directional Control Valves

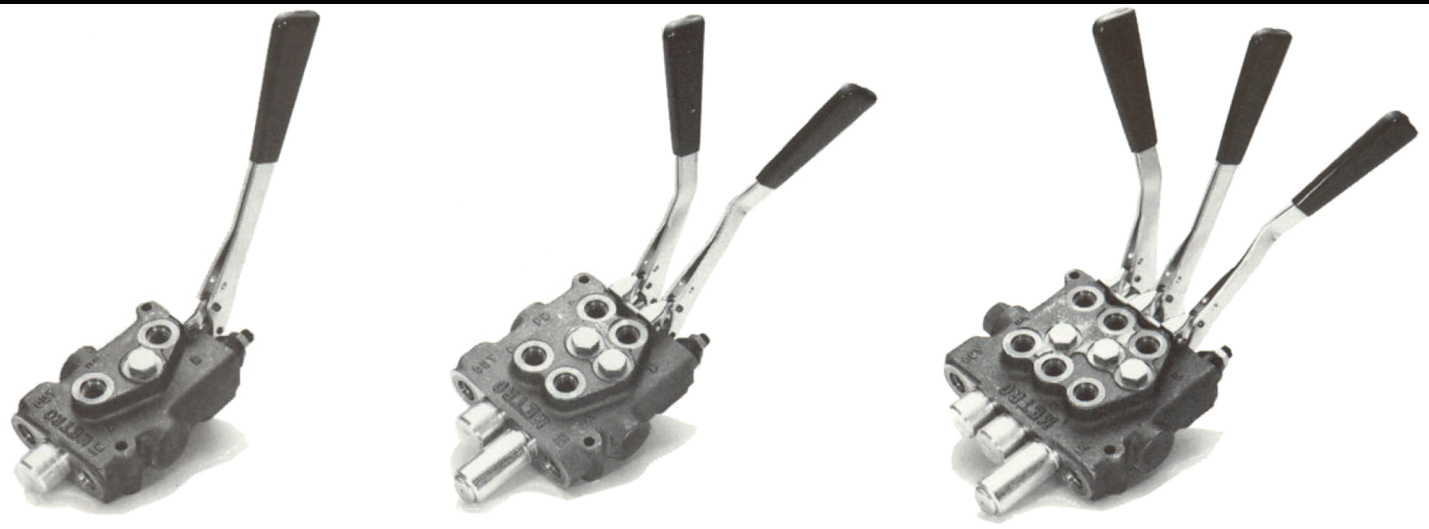
METRO MACHINE & ENGINEERING 952-259-3623

(CODE)	DESCRIPTION
830-00-001	Seal Kit (1 Spool Valve)
830-00-002	Seal Kit (2 Spool Valve)
830-00-003	Seal Kit (3 Spool Valve)
830-00-004	Handle Linkage Kit
830-00-005	Handle Kit, 1 Straight Handle
830-00-006	Float Spool Kit
830-00-007	Spring Center Kit
830-00-008	3 Position Detent Kit
830-00-009	Load Check Kit
830-00-010	Closed Center Kit
830-00-019	Relief Kit, 500 PSI
830-00-013	Relief Kit, 1000 - 1499 PSI
830-00-014	Relief Kit, 1500 - 1999 PSI
830-00-015	Relief Kit 2000 - 2499 PSI
830-00-016	Relief Kit 2500 - 3000 PSI
830-00-017	NO Relief Kit
830-00-023	2-Position Detent - Spool In
830-00-024	2-Position Detent - Spool Out
830-00-121-S	Power Beyond Plug, w/seals
H Handle Kit	1-Spool Valve
J Handle Kit	2-Spool Valve
K Handle Kit	3-Spool Valve

Other parts available upon request.

D SERIES 6 GPM DIRECTIONAL CONTROL VALVES 1, 2 & 3 SPOOL

METRO MACHINE & ENGINEERING 952-259-3623



FEATURES

- One piece mono-block body construction using high tensile cast iron.
- Hard chrome plated and precision fitted spools.
- Easy installation with inlet and outlet ports on same end.
- Load check for each spool prevents accidental load drop (omitted with motor spool).
- Standard open center valving.

OPTIONS

- Variety of spool configurations.
- Spring centered or detented.
- Power beyond or closed center adapter plugs.
- Handle assemblies.
- **“MULTI” VALVE**, special 1 spool 4 way to 3 way conversion valve.

SPECIFICATIONS

Pressure Rating	Temperature Range
3000 PSI (207 Bar)	-22° to + 194° F -30° to + 90° C

ORDER EXAMPLE FOR D2DF1T2J					
D2	D	SPOOL 1	F 1		J
Basic Valve Function (With Load Checks)	Relief Setting (Cracking Pressure)	Spool	Spring Return	Power Beyond Option	Handle Option
		Repeat For Each Spool			
D1 1 Spool Valve	0 = No Relief	M = MOTOR (Load Check Omitted)	1 = Spring Centered with One Position Detent 2 = Standard Spring Centered Type	Omit if Not Required	Omit if No Handle Assembly Required
D2 2 Spool Valve	RELIEF SETTING A = 1000 PSI B = 1500 PSI C = 2000 PSI	T = TANDEM	3 = 3 Position Detent (no spring) 4 = Micro Switch (incorporates spring centering)	P = Power Beyond	H = (1) Complete Handle Assy. (not attached)
D3 3 Spool Valve	D = 2500 PSI E = 3000 PSI	Y = 3 WAY	5 = 2 Position Detent (neutral/spool in) 6 = 2 Position Detent (neutral/spool out) 7 = 2 Position Detent (spring offset)	S = Closed Center Plug	J = (2) Complete Handle Assy. (not attached)
CDI “Multi” Valve special 1 spool 4 way to 3 way conversion valve		F = FLOAT (specify spring return option “1” with this spool)	8 = Special, Detent Spool In, Spring Return Out 9 = Special, Detent Spool Out, Spring Return In		K = (3) Complete Handle Assy. (not attached)

ORDER PROCEDURES

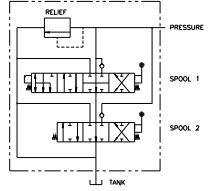
When developing the complete part number, copy all codes required.

Note: Other relief pressure settings, spool configuration, or port sizes available upon special order. Please consult factory.

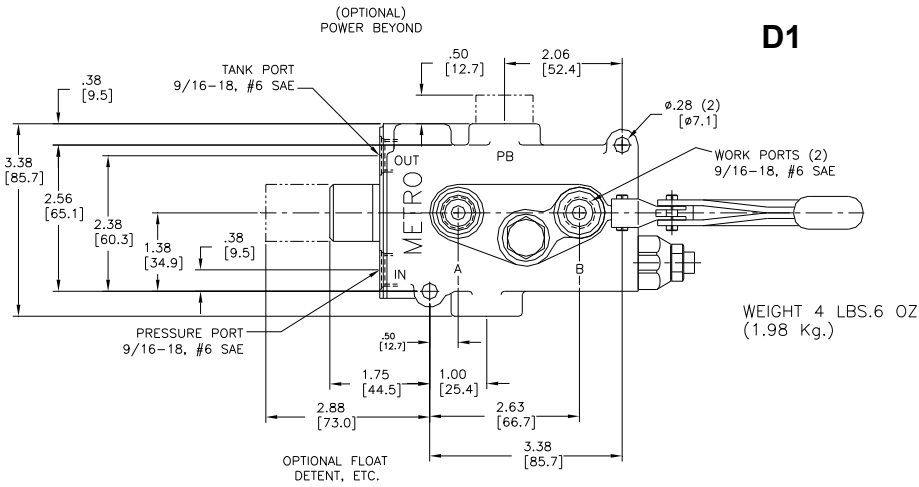
ORDER EXAMPLE

Complete part number of example **D2DF1T2J**

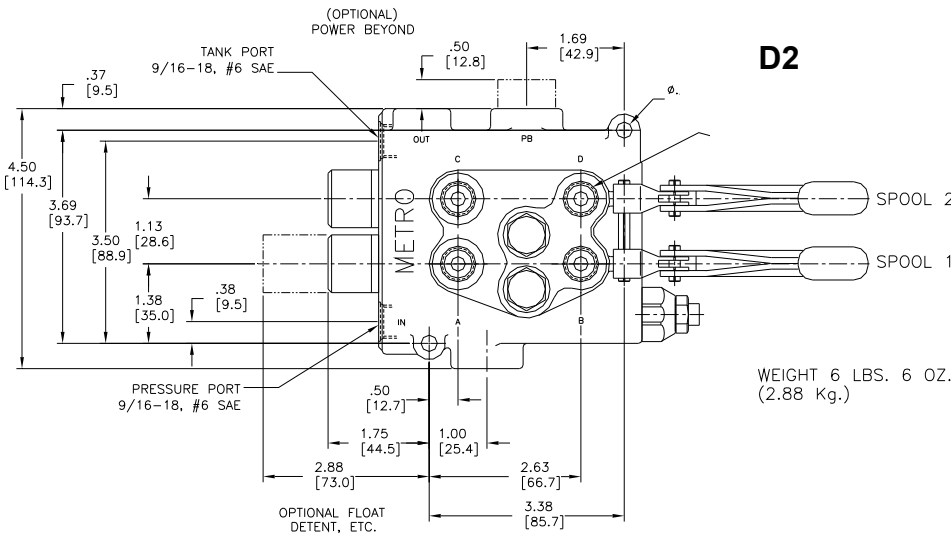
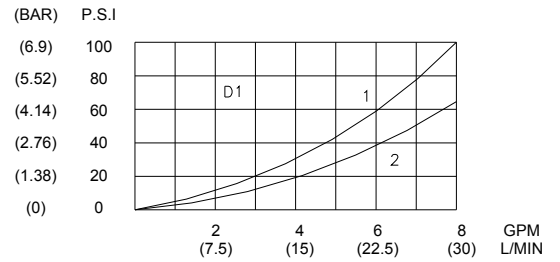
Float spool must always be in first or third position.



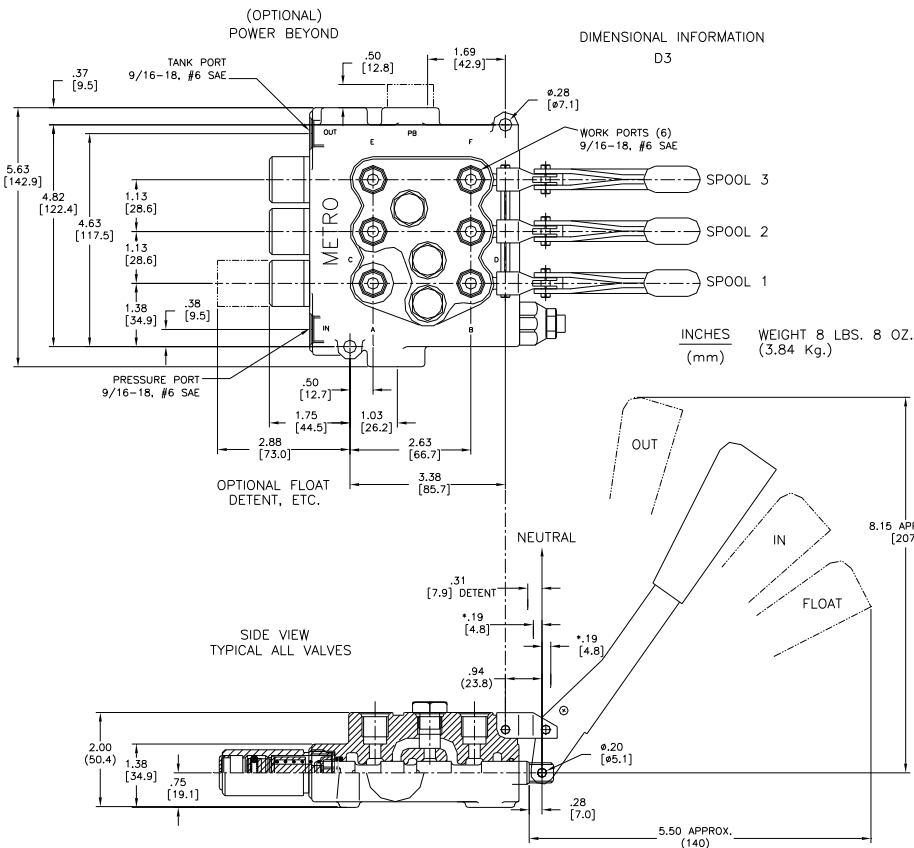
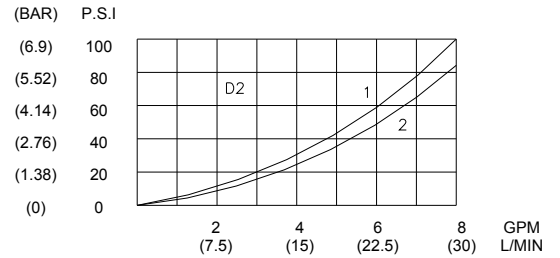
DIMENSIONAL INFORMATION



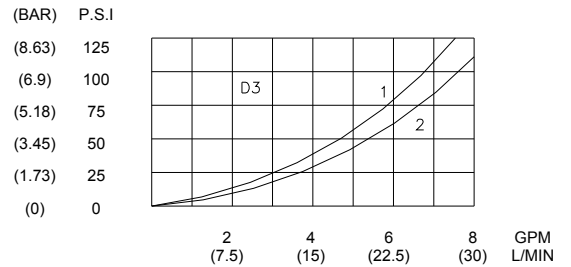
PRESSURE DROP CHARACTERISTICS



PRESSURE DROP CHARACTERISTICS



D3 PRESSURE DROP CHARACTERISTICS



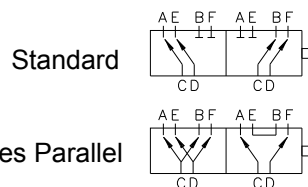
1—PRESSURE TO WORK PORT
2—PRESSURE TO TANK

MAXIMUM INTERNAL LEAKAGE
1 cubic inch/minute at 1000 psi
16.4 milliliters/minute at 69 bar

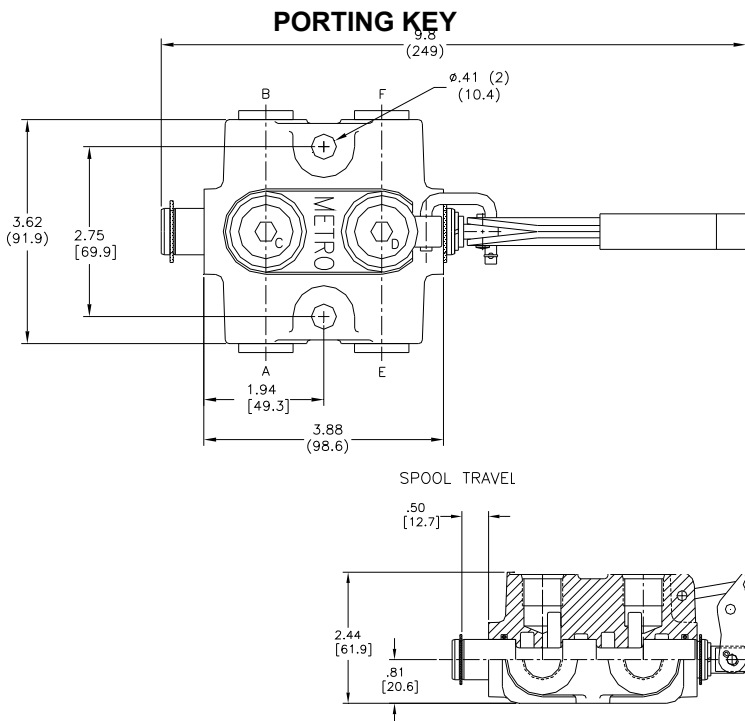
*THIS DIMENSION CHANGES TO .12/(3.2) WHEN OPTIONAL FLOAT POSITION SPOOL IS USED.

NOTE: HANDLE ASSEMBLY NOT ATTACHED TO VALVE FOR SHIPPING. DESIGNED FOR STANDARD 90° AS SHOWN, MAY ALSO BE USED REVERSED FROM STANDARD.

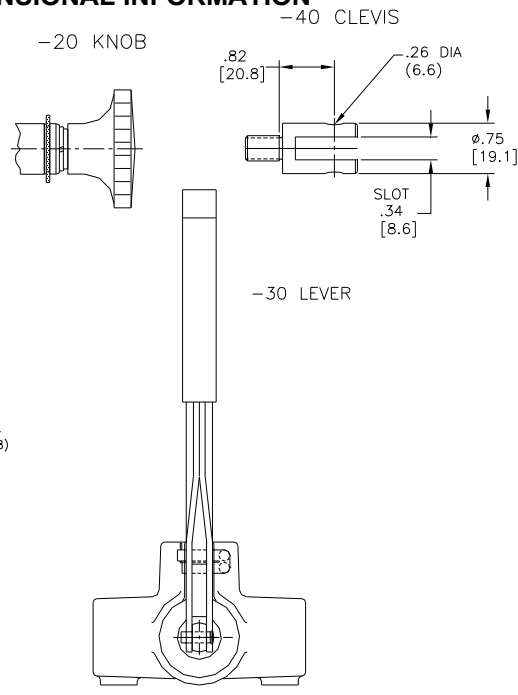
DS SIX PORT—TWO POSITION DOUBLE SELECTOR VALVES



METRO MACHINE & ENGINEERING 952-259-3623



DIMENSIONAL INFORMATION

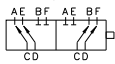
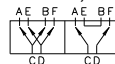


DESCRIPTION

The DS is a two position, double selector valve which directs the flow of hydraulic fluid to two separate hydraulic circuits. This allows operation of two double acting cylinders with one four-way control valve or four single-acting cylinders with two three-way control valves.

The Metro DS two position double selector valve is of the open-crossover type. When the spool is moved and one pair of outlet ports start to close, the other pair of outlet ports start to open.

ORDERING INSTRUCTIONS

DS	04	-	20	DR
Valve Model Number	Port Size	Spool Type Options	Spool Actuator Options	Spool Return Options
DS Double Selector Valve	02= 1/4 -18 NPT	= Standard Crossover Type	10= No Actuator	Omit if Not Required
	03= 3/8 -18 NPT		20= Knob	DR= Spring Return
	04= 1/2 -14 NPT	P = Optional Parallel Type (available on special order)	30= Lever*	
	06= 9/16 -18 #6 SAE		40= Clevis	
	08= 3/4 -16 #8 SAE	Other Special Spool Types Available on Special Order		

*LEVER ASSEMBLY NOT ATTACHED TO VALVE FOR SHIPPING

PORTING KEY (Viewed from Handle End)

Standard Open Crossover: (See drawing upper right)

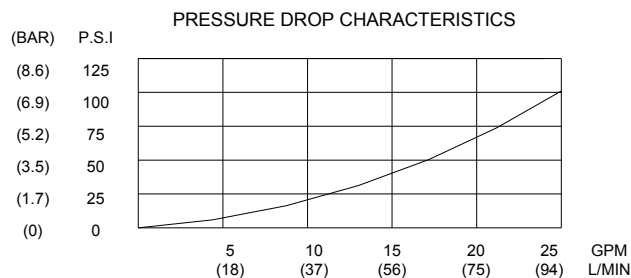
- With spool pushed into housing, port D and E are connected to each other, port C and A are connected to each other.
- With spool pulled out of housing, port D and F are connected to each other, port C and B are connected to each other.

SERIES PARALLEL (Available on Special Order)

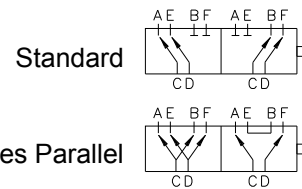
- With spool pushed into housing, port C is connected to port A and B, port D is connected to E and F.
- With spool pulled out of housing, port C is connected to port A and port D is connected to port F, port B is connected to port E.

SPECIFICATIONS

Flow Capacity	Pressure Rating	Temperature Range	Weight
20 GPM 75 (L/MIN)	3000 PSI (207 Bar)	-22° to + 194° F -30° to + 90° C	4 lbs 4 oz (1.92 kg)

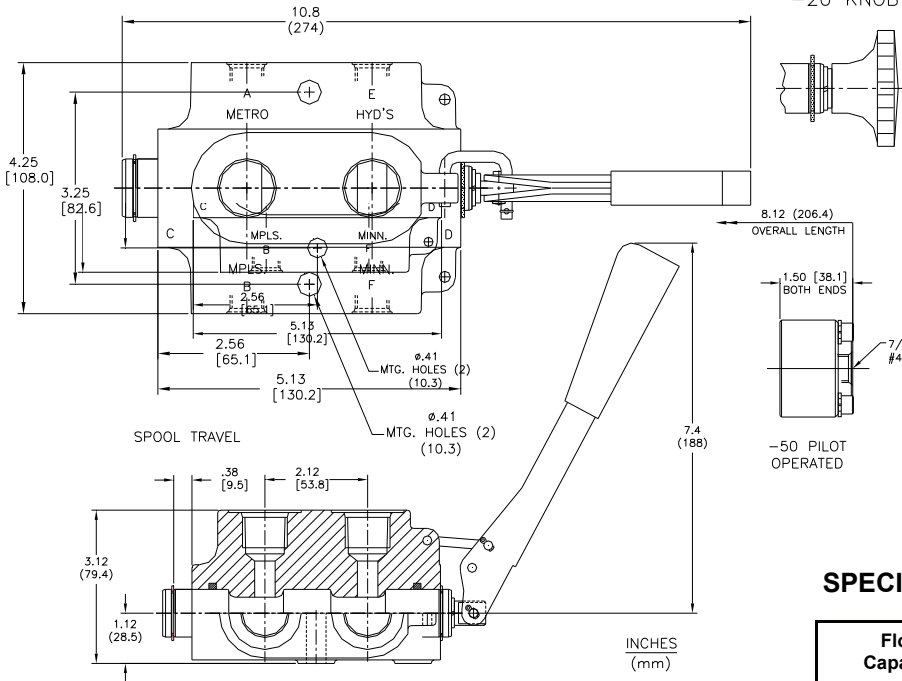


MDS SIX PORT—TWO POSITION DOUBLE SELECTOR VALVES

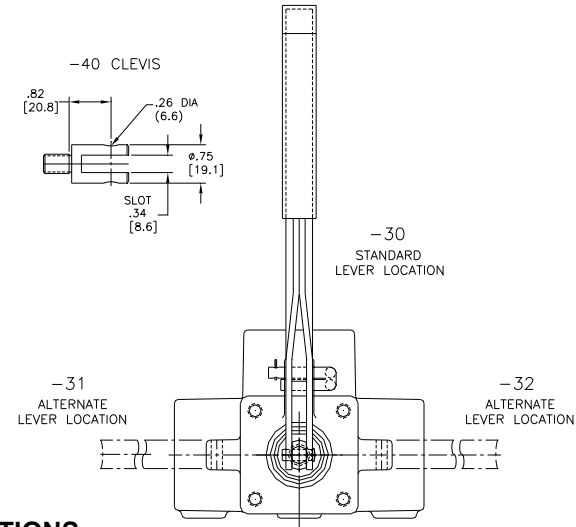


METRO MACHINE & ENGINEERING 952-259-3623

PORTING KEY



DIMENSIONAL INFORMATION



SPECIFICATIONS

Flow Capacity	Pressure Rating	Temperature Range	Weight
30 GPM 114 (L/MIN)	3000 PSI (207 Bar)	-22° to + 194° F -30° to + 90° C	10 lbs (4.5 kg)

DESCRIPTION

The MDS is a two position, double selector valve which directs the flow of hydraulic fluid to two separate hydraulic circuits. This allows operation of two double acting cylinders with one four-way control valve or four-single acting cylinders with two-three-way control valves.

The Metro MDS two position double selector valve is of the open-crossover type. When the spool is moved and one pair of outlet ports start to close, the other pair of outlet ports start to open.

ORDERING INSTRUCTIONS

MDS	08	-	50	SR
Valve Model Number	Port Size	Spool Type Options	Spool Actuator Options	Spool Return Options
MDS Double Selector Valve	04= 1/2 -14 NPT 05= 3/4 -14 NPT 06= 1 -14 NPT 08= 3/4 -16 #8 SAE 10= 7/8 -14 #10 SAE 12= 1-1/16 -12 #12 SA 14= 1-3/16 -12 #14 SAE 16= 1-5/16 -12 #16 SAE	(-) Standard Crossover Type P = Optional Parallel Type 	10= No Actuator 20= Knob 30= Lever* 40= Clevis 50= Pilot Operated (hydraulically)	Omit if Spring Return Not Required SR= Spring Return (casted) RD= Spring Return (stamped)

PORTING KEY (Viewed from Handle End)

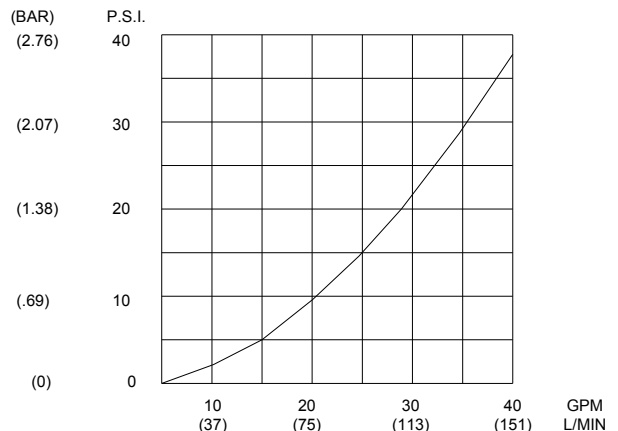
Standard Open Crossover: (See drawing upper right)

- With spool pushed into housing, port C and D are connected to each other, port E and A are connected to each other.
- With spool pulled out of housing, port D and F are connected to each other, port C and B are connected to each other.

SERIES PARALLEL (Available on Special Order)

- With spool pushed into housing, port C is connected to port A and B, port D is connected to E and F.
- With spool pulled out of housing, port C is connected to port A and port D is connected to port F, port B is connected to port E

PRESSURE DROP CHARACTERISTICS



*LEVER ASSEMBLY NOT ATTACHED TO VALVE FOR SHIPPING

MV, SV AND MSL SELECTOR VALVES



METRO MACHINE & ENGINEERING 952-259-3623

DESCRIPTION

The Metro MV, SV and MSL Selector Valves with the standard spool may be used as an open or closed three way valve where flow is directed to an actuator i.e., single-acting cylinder in one position or flow from the actuator is allowed to return to tank, in the other position.

This valve may also be used as a three way diverter valve where inlet flow is directed to either of the two ports.

The standard spool has an open crossover so, as the spool is being shifted, one outlet port begins to close and the other outlet port begins to open.

OPTIONS

A closed crossover spool is available upon special order for the MV and SV selector valves. Here, as the spool is being shifted, flow is not allowed to crossover between outlet ports because flow is closed to the outlet ports for a moment while shifting.

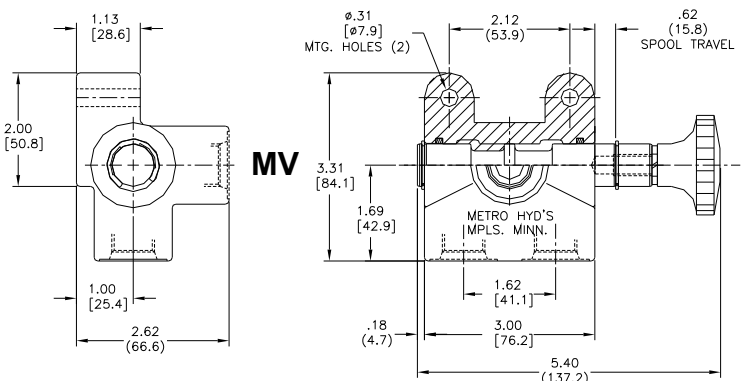
An optional float spool is available for the selector valves where all ports are either open to each other or closed to each other. This option is designed to allow cylinders to float or motors to free-wheel in such equipment as snowblows, combine headers, mower attachments, etc.

SPECIFICATIONS

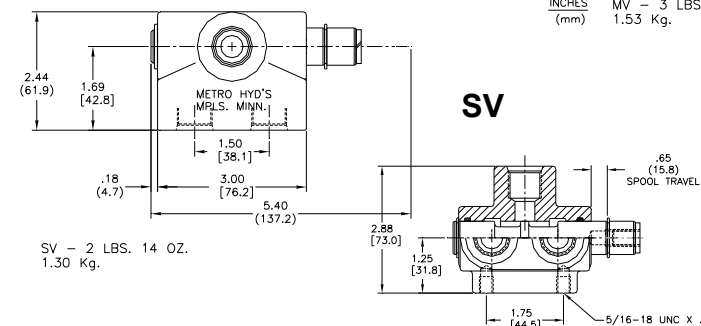
Pressure Rating	Temperature Range
3000 PSI (207 Bar)	-22° to + 194° F -30° to + 90° C

ORDERING INSTRUCTIONS

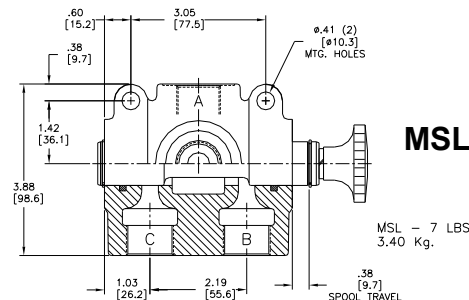
MV	04			
Model Number	Port Size	Options Other Than Standard Spool With Knob	Spool Actuator Location Options	Return Options
MV or SV Up to 20 GPM (75.8 L/MIN)	03= 3/8 -18 NPT 04= 1/2 -14 NPT 06= 9/16 -18 #6 SAE 08= 3/4 -16 #8 SAE	10= No Knob 80= Float Spool w/Knob 81= Standard Spool w/Clevis 82= Standard Spool w/Spring Return 83= Float Spool w/Clevis 85= Float Spool w/Spring Return 89= Closed Center w/Knob & Spring Return	R= Reverse Spool *Lever assembly for MV model available upon request	See spool options
MSL Up to 40 GPM (151.6 L/MIN)	04= 1/2 -14 NPT 05= 3/4 -14 NPT 06= 1 -NPT 08= 3/4 -16 #8 SAE 10= 7/8 -14 #10 SAE 12= 1-1/16 -12 #12 SAE 16= 1-5/16 -12 #16 SAE	F= Float w/Knob 30= Handle 40= Standard w/Clevis 50= Pilot Operated	R= Reverse Spool	SR= Spring Return



INCHES (mm) MV - 3 LBS. 6 OZ. 1.53 Kg.

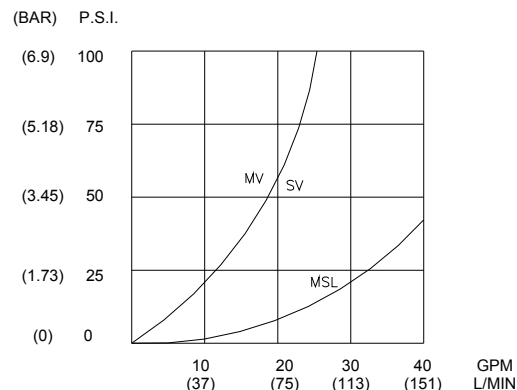


SV - 2 LBS. 14 OZ. 1.30 Kg.

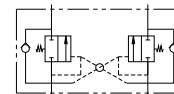


MSL - 7 LBS. 8 OZ. 3.40 Kg.

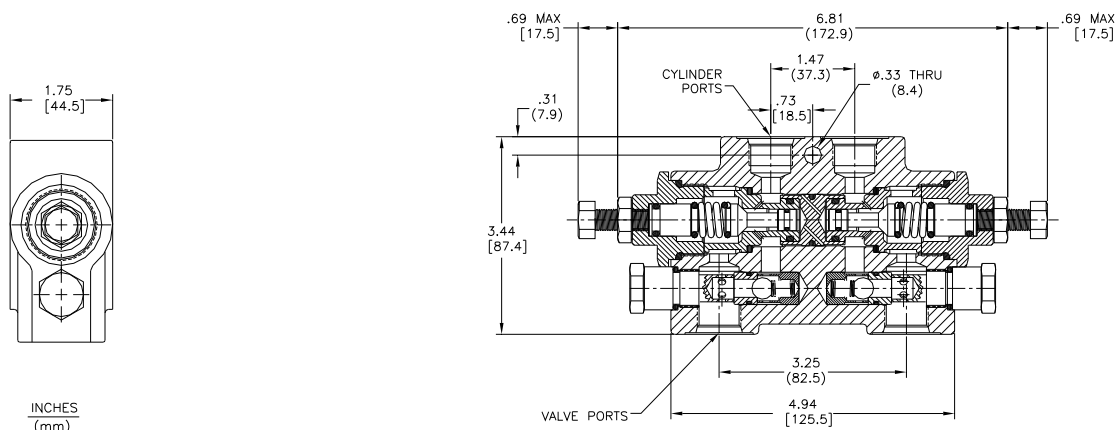
PRESSURE DROP CHARACTERISTICS



D-601 DOUBLE PILOT OPERATED LOCK VALVES



METRO MACHINE & ENGINEERING 952-259-3623



The D-601 Lock Valve is designed to lock a cylinder or part of a circuit while a directional control valve is in the neutral position, specifically for applications where directional control valve leakage could adversely affect the performance of the system. In addition, this lock valve also has built in integral reliefs for thermal or excess pressure shocks on the locked part of a circuit.

With the directional control valve in the neutral position, flow from both ends of a cylinder is locked by the D-601 Lock Valve. When the directional control valve is activated, flow is directed to one side of the valve unseating the ball check on that side. This allows pilot pressure to open the poppet on the opposite side of the valve and allow flow to return to tank. The pilot pressure required to unlock the load is approximately 20% of the difference between the internal relief setting and the load induced pressure.

1. Prevents load from dropping faster than fluid is supplied to the actuator by the pump.
2. Locks actuator in selected position when no motion is desired.
3. Relieves excess pressure on system caused by load or thermal expansion.
4. Provides an emergency manual release for lowering load in case of power failure.
5. Requires less power when load is being raised or lowered.
6. Permits smooth movement and eliminates actuator chatter or cavitations.
7. Prevents load drifting due to directional valve leakage.

SPECIFICATIONS

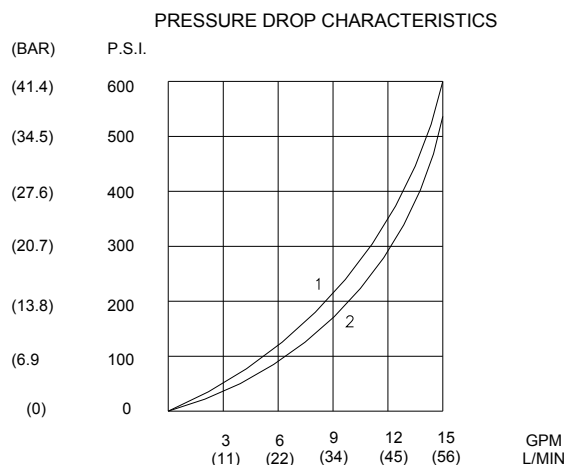
Flow Capacity	Pressure Rating	Temperature Range	Weight
See Performance Graph	2500 PSI	-22° to + 194° F -30° to + 90° C	3 lbs 4 oz (1.47 kg)

APPLICATION

A pilot operated check valve (lock valve) should be incorporated in every loader, outrigger, back-hoe, work platforms.

ORDERING INSTRUCTIONS

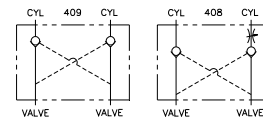
D-601	08
Model Number	Port Size
D-601	08 - 3/4 16 #8 SAE



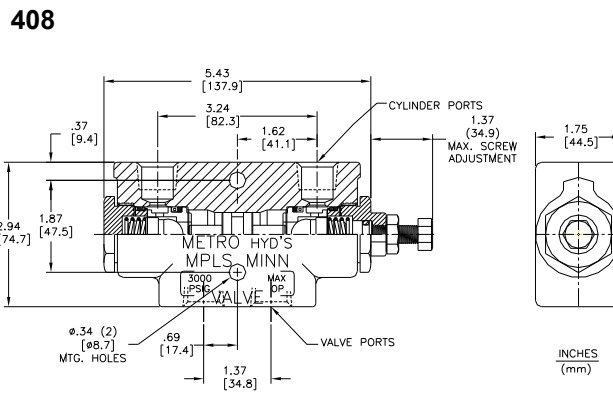
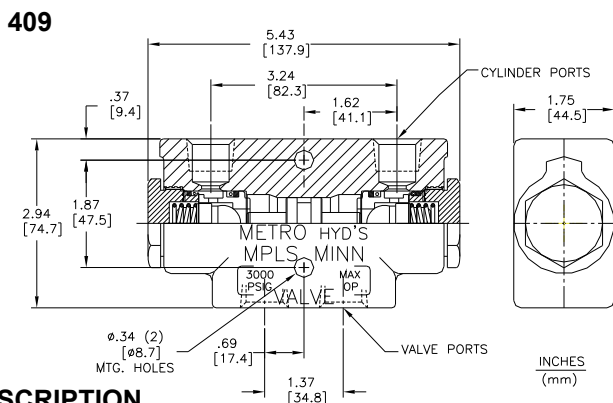
1. Valve Port to Cylinder Port
2. Cylinder Port to Valve Port

407, 408, 409— DOUBLE LOCK VALVE

411, 412— SINGLE LOCK VALVE



METRO MACHINE & ENGINEERING 952-259-3623



DESCRIPTION

The Double Lock valves are designed to lock a cylinder or part of a circuit while a directional control valve is in the neutral position. Designed for applications where directional control valve leakage could adversely affect the performance of the system.

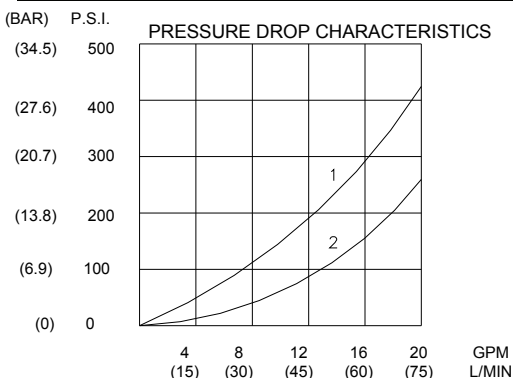
OPERATION

With the directional control valve in the neutral position, flow from both ends of a cylinder is blocked, locking the cylinder piston in position by the Double Lock Valve. When the directional control valve is shifted to direct flow to one side of the cylinder, pressure opens the check ball and simultaneously moves the piston over to the opposite side of the valve opening this check ball allowing free flow return to the directional control valve. The 407 lock valve has two adjustable flow controls, and the 408 has one adjustable flow control which, by adjusting in or out, changes the pressure drop in the valves. This in most cases, smoothes our pulsations and eliminates valve chatter.

Single Lock Valves are also available. The 411 single lock is non-adjustable and the 412 single lock is adjustable.

SPECIFICATIONS

Flow Capacity	Pressure Rating	Temperature Range	Weight
See Performance Graph	3000 PSI (207 Bar)	-22° to + 194° F -30° to + 90° C	407 2 lbs. 8 oz. (1.09 kg.)
			408 2 lbs. 6 oz. (1.07 kg.)
			409 2 lbs. 4 oz. (1.02 kg.)
			411 2 lbs. 1 oz. (1.00 kg.)
			412 2 lbs. 3 oz. (1.01 kg.)



1. Valve Port to Cylinder Port
2. Cylinder Port to Valve Port

APPLICATION

Typical applications are loaders, outriggers, back hoes, cranes, fork lifts, work platforms, hydraulic winches, land planes, wing lifts, gauge wheels or any application where loads must be held in neutral position.

A 4-way control valve is required for all lock valve circuits, including single-acting cylinders, in order to apply unlocking pressure to the pilot circuit. The position pilot ratio is 3:1.

The amount of pressure required in the pilot circuit of the valve to unlock a single-acting cylinder is 30% of the locked pressure.

The amount of pressure required in the pilot circuit of the valve to unlock a single-acting cylinder is a function of cylinder areas and trapped pressure.

When the base end of the cylinder is locked use this formula for calculating the unlocking pressure.

$$\text{Unlocking pressure} = 3 - \frac{\text{Pressure on the rod end} \times \text{Cylinder area} - \text{Rod area}}{\text{Cylinder area}}$$

When the rod end of the cylinder is locked use this formula.

$$\text{Unlocking pressure} = 3 - \frac{\text{Pressure on the base end}}{\text{Cylinder area}}$$

CAUTION: Note that when the rod end of a double-acting cylinder is locked, if the rod diameter exceeds approximately .75 times the cylinder diameter, unlocking pressure becomes excessive.

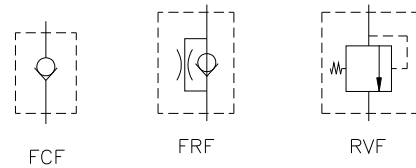
ORDERING INSTRUCTIONS

Model Number	Port Size
407 Double	02= 1/4 -18 NPT
408 Double	03= 3/8 -18 NPT
409 Double	04= 1/2 -14 NPT
411 Single	05= 3/4 -14 NPT
412 Single	06= 9/16 -18 #6 SAE
	08= 3/4 -16 #8 SAE
	10= 7/8 -14 #10 SAE

FC, FCF— CHECK VALVE

FR, FRF— RESTRICTOR

RV, RVF— RELIEF VALVE



METRO MACHINE & ENGINEERING 952-259-3623

DESCRIPTION

The model FC-FCF Check Valve, FR-FRF Restrictor (Throttle) Valve, RV-RVF Relief Valve series of inline valves are available in a variety of sizes. These valves will operate satisfactorily when mounted inline in any position.

The FC,FR and RV are male/female design whereas the FCF, FRF and RVF are female/female design.

APPLICATION DATA

The FC-FCF Check Valves allow free flow in one direction and checked flow in the opposite direction. Cracking pressure is 1 psi (.07 bar).

The FR-FRF Restrictor (throttle) Valve allows free flow in one direction and restricted flow in the opposite direction. Applications include accurate control of a double acting cylinder by pressurizing both sides of the piston, reducing cavitations of cylinders and motors or speed control of cylinders and motors.

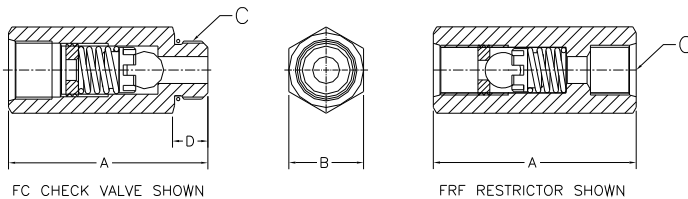
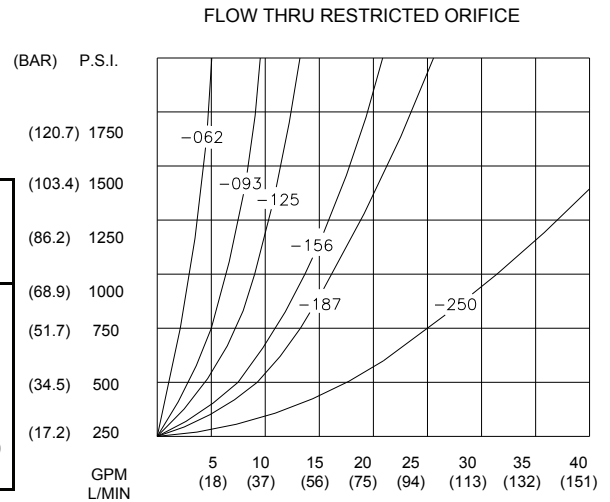
The RV-RVF Relief Valves provide an inexpensive, but reliable fast acting relief protection in a hydraulic circuit.

ORDERING INSTRUCTIONS

FR	50	-062
Model Number	Port Size	Orifice Size or Relief Setting
FC	08	Orifice size for restrictor valves only
FR	38	
RV	40	Relief setting for relief valve only
FCF	50	
FRF	60	
RVF		

SPECIFICATIONS

Pressure Rating	Temperature Range	Restrictor Valve Orifice Sizes				Relief Valve Pressure Settings
		Number	Size	Number	Size	
3000 PSI (207 Bar)	-22° to + 194° F	-046	3/64	-125	1/8	1 -500 PSI (standard) 501 -1200 PSI 1201 -2500 PSI
	-30° to + 90° C	-062	1/16	-140	9/64	
		-078	5/64	-156	5/32	
		-093	3/32	-187	3/16	
		-109	7/64	-250	1/4	



Port Sizes	A Length Inches (mm)	B Hex Size Inches (mm)	C Thread (Both Ends)	D Thread Length Inches (mm)	E Weight
All dimensions common for: FCF, FRF & RV					
08	3.0 (76.2)	1.12 (28.6)	3/4 -16 SAE #8	.44 (11.2)	8 oz. (.23 kg.)
38	3.0 (76.2)	1.00 (25.4)	3/8 -18 NPT	.75 (19.1)	8 oz. (.23 kg.)
40	3.0 (76.2)	1.06 (26.9)	3/8 -18 NPT male To 1/2 -14 NPT female	.75 (19.1)	9 oz. (.26 kg.)
50	3.0 (76.2)	1.06 (26.9)	1/2 -14 NPT	.81 (20.6)	9 oz. (.26 kg.)
60	3.38 (85.7)	1.38 (34.9)	3/4 -14 NPT	.81 (20.6)	1 lb. (.45 kg.)
All dimensions common for: FC, FR & RVF					
08	3.0 (76.2)	1.12 (28.6)	3/4 -16 SAE #8		9 oz. (.26 kg.)
38	3.0 (76.2)	1.00 (25.4)	3/8 -18 NPT		9 oz. (.26 kg.)
40	3.0 (76.2)	1.06 (26.9)	3/8 -18 NPT one end 1/2 -14 NPT other		10 oz. (.28 kg.)
50	3.0 (76.2)	1.06 (26.9)	1/2 -14 NPT		10 oz. (.28 kg.)
60	3.63 (92.2)	1.38 (34.9)	3/4 -14 NPT		1 lb. 3 oz. (.54 kg.)



Metro has over five decades of engineering excellence in the design, manufacture and marketing of hydraulic components for industrial, mobile and agricultural markets.

Special requirements in valve design, manifolds or modification to Metro's standard product to meet your specific needs will gladly be quoted upon request.

METRO

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LIMITED WARRANTY

The Company, warrants the products it manufactures against defective workmanship and/or materials for a period of one year from the date of sale to the original customer, provided written notice of the defect is received by the Company during said period. The warranty is limited to repair or exchange of the product at the sellers option. No obligation is assumed for the repair or exchange of any product rendered defective or damaged through normal wear or improper application, handling or use. No other liability, expressed or implied, is assumed by the Company. This warranty is in lieu of all other warranties, expressed or implied.