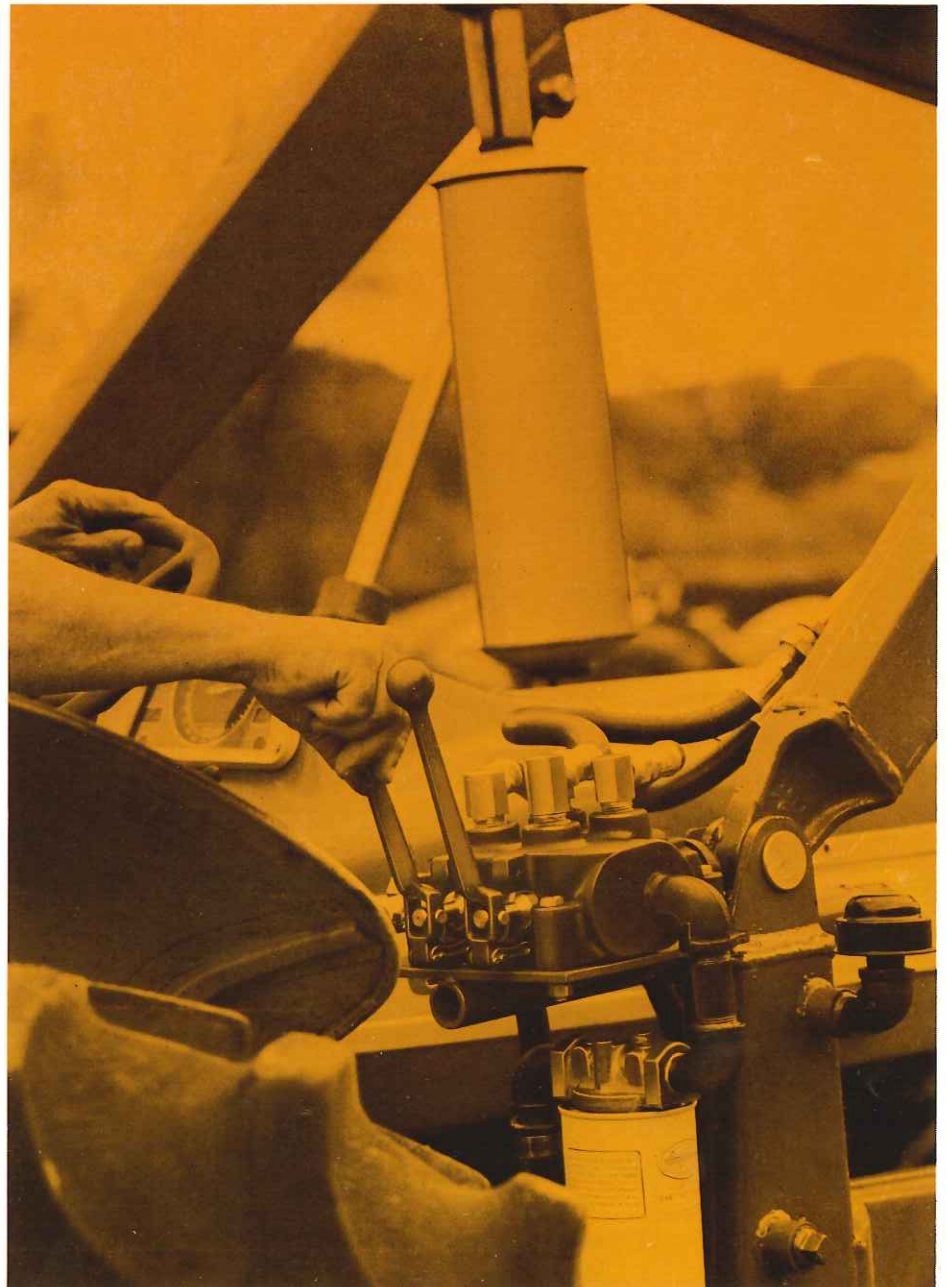
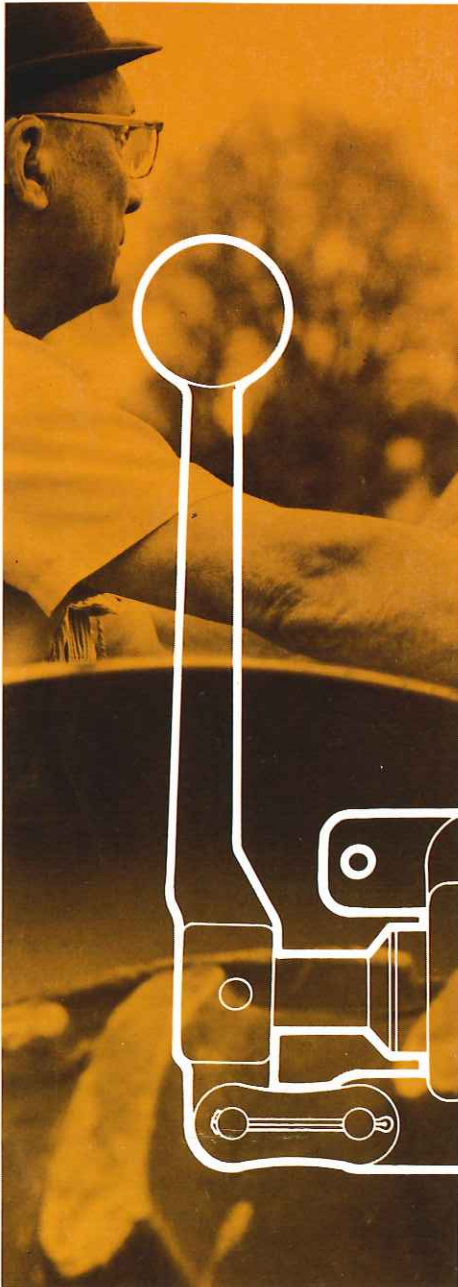


GRESEN[®]



MONOBLOCK DIRECTIONAL CONTROL VALVES



GRESEN®



GRESEN MANUFACTURING COMPANY

... a leader in the hydraulic components industry, provides the combined benefits of their years of experience and present-day technological research and development.

Gresen provides a full range of products for all equipment applications ... industrial ... mobile ... agricultural ... plus a fully-trained staff of factory and field personnel ready to provide assistance with any hydraulic problem.

This catalog provides specifications and ordering instructions, complete with drawings and technical data, allowing you to easily select items that will meet your specific requirements.

For further information, contact:
Your Gresen Representative or Distributor



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DEFINITIONS

Monoblock Directional Control Valves . . . contain all spools and valve parts in one solid cast iron housing. This type of construction is also called Cast-in-Block or Uni-Body.

Catalogs describing sectional or stack-type valve assemblies are available. Please contact your Gresen Representative or Distributor.

Directional Control Valves . . . start, stop and direct fluid flow. They control extension and retraction of cylinders, rotation of fluid motors and actuators, and sequence other circuit operations.

Directional Control Valves are classified according to the number of ports or connecting lines, the number of positions to which they can be actuated, the type of actuator and the way in which fluid flows in the valve.

The following are definitions of terms which are used in describing and ordering Gresen Monoblock Directional Control Valves and their available modifications. Code Symbols are referenced in the Ordering Instructions shown with each valve model. These code Symbols are necessary to properly define the valve desired and to assure proper accessory modifications which are to be factory installed.

OIL FLOW THRU VALVE ASSEMBLY

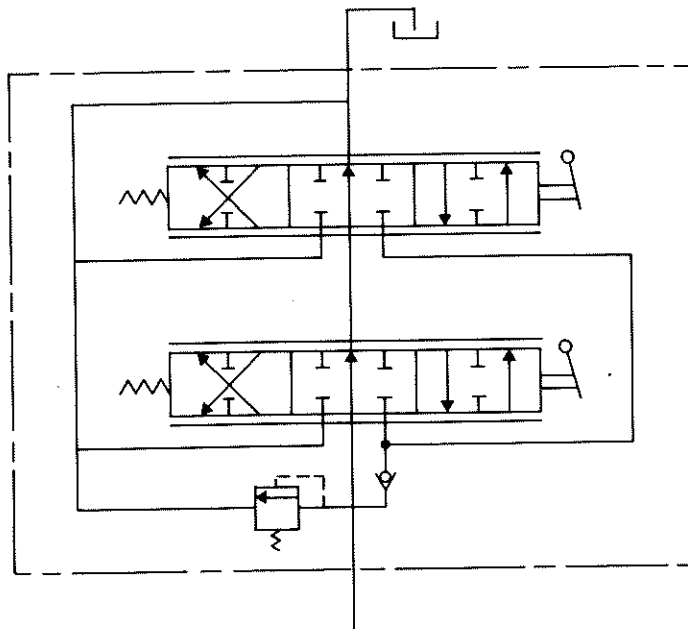
1. Parallel Circuit Valves

The open center passage is closed off when spool is fully shifted and hydraulic oil will flow directly to the power core passage, making oil available to all work ports. If two or more spools are fully shifted at the same time, the oil will follow the path of least resistance, and the hydraulic cylinder or the hydraulic motor with the lightest load will begin to function first.

The hydraulic oil can be divided so that it will flow to two or more functions by metering the spools.

The parallel circuit is the most commonly used circuit in mobile equipment because more than one function can be operated at the same time at random in the valve bank assembly.

Gresen Models SP and SPK Directional Control Valves are parallel circuit valves.

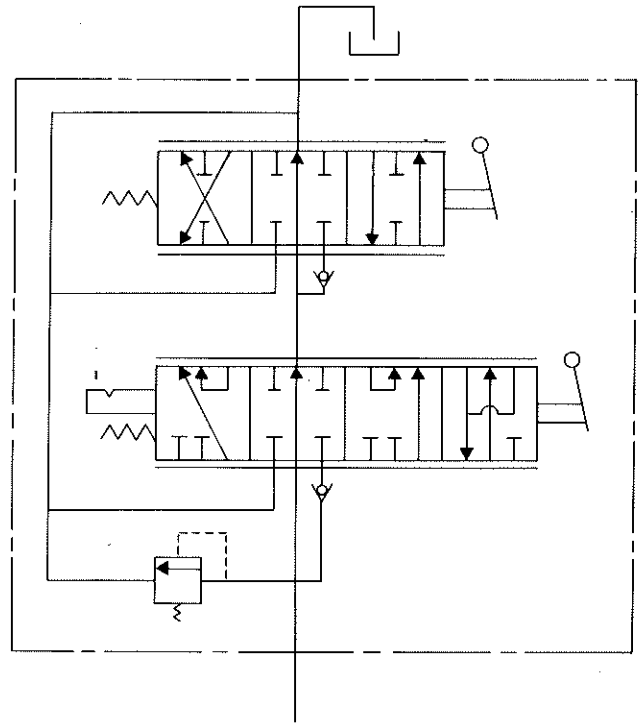


2. Series Circuit Valves

The entire flow of hydraulic oil is available to each work section in sequence from inlet to outlet port through the open center passage. As oil is directed from the inlet port to the work port of the first spool which is shifted, the returning oil to that section is directed back to the open center passage and not to the tank port as in a parallel valve circuit. The returning oil is then available for any downstream section.

In a series circuit, pressure is additive. That is, the sum of all pressures required by all sections cannot exceed the main relief valve setting or pump pressure capability.

The Gresen Model SSK Directional Control Valve is a Series Circuit Valve.

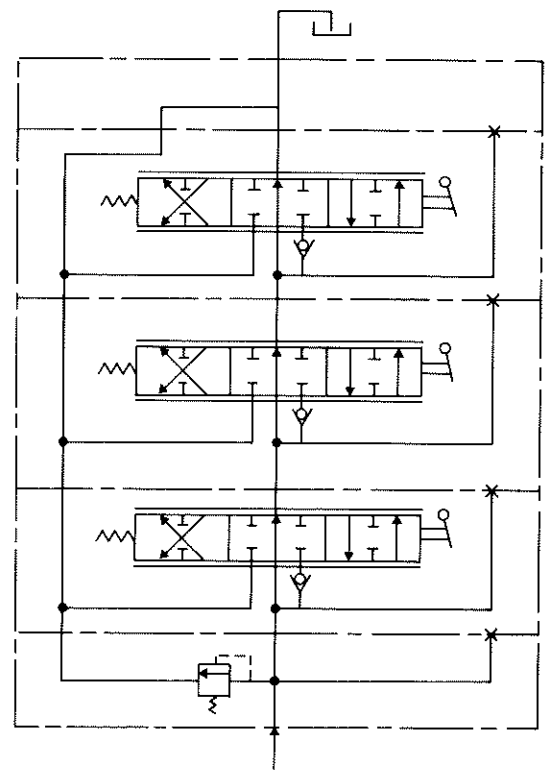


3. Tandem Circuit Valves

These Valves are also referred to as Priority, or Series-Parallel Circuit Valves.

Hydraulic oil is available to the work ports through the open center passage. When an upstream spool is fully shifted, no oil is available to a downstream section in a tandem circuit. The upstream section has priority.

Although Gresen manufactures Tandem Circuit Valves, they are not available in Monoblock Models.



DEFINITIONS (Cont.)

APPLICATION VARIATIONS

4. Open Center Application

Hydraulic oil is directed through the open center core of the Directional Control Valve to the exhaust core when all spools are in the Neutral position. Shifting the valve spool directs oil flow to the desired work port.

Maximum circuit pressure is limited by the main relief valve, which relieves into the exhaust core.

The pump generally used in an open center circuit is a fixed-displacement type delivering a constant flow. To control actuator speed, oil flow is metered either through the control valve or with separate flow-control valving.

The standard Gresen valve is an Open Center Control Valve. The inlet port is open to the tank port, and both work ports are blocked when the control valve spool is in Neutral position, thereby holding the cylinder or hydraulic motor in position.

With an optional free-flow motor spool installed in the control valve, the inlet port is still open to the tank port and both work ports are also open to tank port when the control valve spool is in Neutral position, allowing a cylinder to drift or a hydraulic motor to coast.

5. Closed Center Application Code Symbol C

Hydraulic oil flow from the pump is blocked when the Directional Control Valve spool(s) are in Neutral position.

Pressure is normally maintained at the control valve inlet by use of a variable-displacement pump or an accumulator-type circuit with an unloading valve.

In a Gresen Closed Center Control Valve, the center passage is blocked and both work ports are also blocked when the control valve spool is in Neutral position.

With an optional free-flow motor spool installed in the Control Valve, the center passage is still blocked, but the work ports are open to the tank port when the control valve spool is in Neutral position.

All control valves described in this catalog can be furnished for closed center application, except the Model SSK Valve.

6. Power Beyond (High Pressure Carryover) Code Symbol Y

This option allows the installation of another valve downstream from the first valve.

A Power Beyond sleeve is installed in the upstream valve which separates the open center core from the exhaust core at the outlet port. This allows hydraulic oil under pressure to be carried thru the upstream valve, thus making it available for a downstream function. A separate tank line is required from each Control Valve in the circuit.

Hydraulic oil is available to the downstream valve only when all spools in the upstream valve are in Neutral position.

If pressure requirements for both valves are the same, only one relief valve is required. It must be installed in the upstream valve.

Each valve in the circuit may have a different relief setting, but the highest setting must be upstream.

Gresen Model SP, SPK and SSK Control Valves are available with this feature as an option.

7. Conversion Plug Assembly Code Symbol X

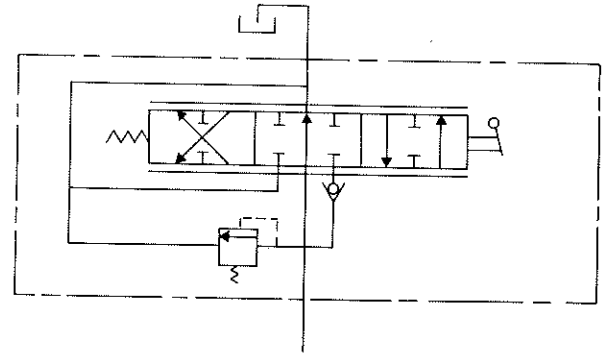
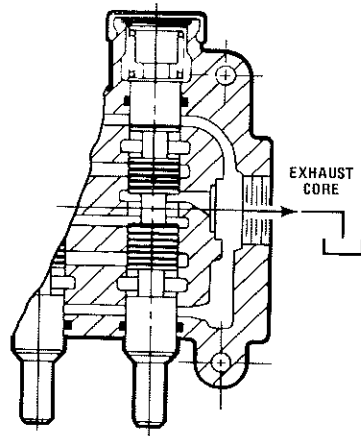
If additional hydraulic circuit options are to be added at a later date, or if the control valve is being ordered for stock, a Conversion Plug assembly should be considered. A Conversion Plug assembly gives a control valve great versatility and easily converts for different applications, reducing inventory requirements.

A control valve with a Conversion Plug remains an open center valve. The proper plug or sleeve changes the assembly into either a Closed Center or Power Beyond valve. Service Kits are available for these optional parts and must be ordered separately.

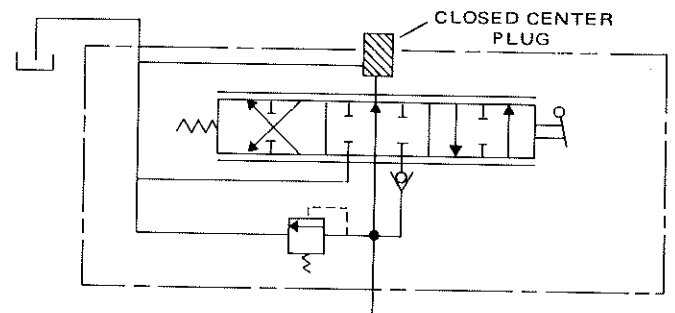
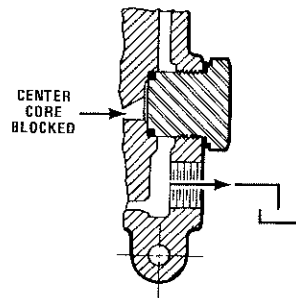
Service Kits are available to quickly change spool actions. Typical changes are from a Spring Centered to Neutral assembly to a 3-Position Detent assembly.

DEFINITIONS (Cont.)

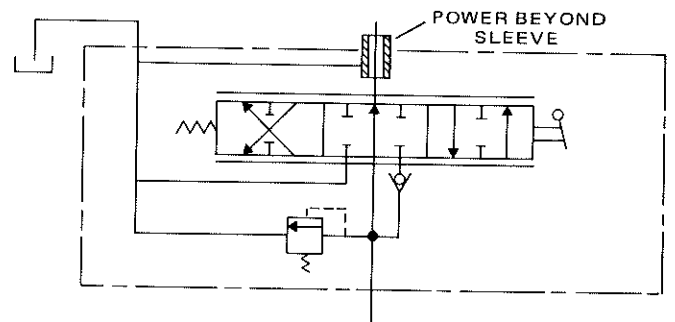
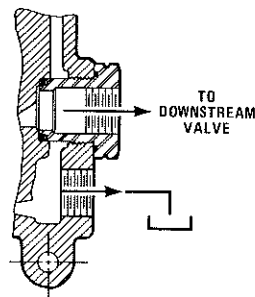
4. OPEN CENTER



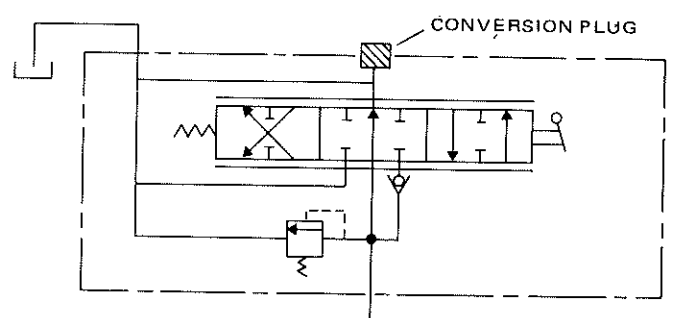
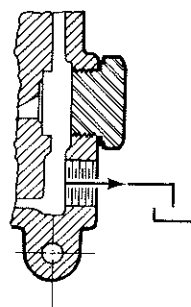
5. CLOSED CENTER



6. POWER BEYOND



7. CONVERSION PLUG



DEFINITIONS (Cont.)

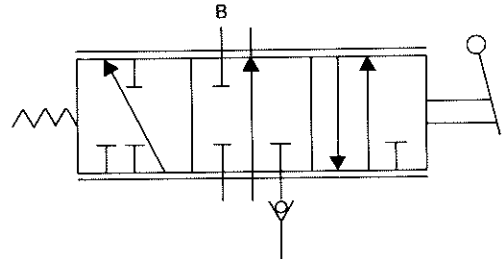
SPOOL VARIATIONS

NOTE: All Gresen Valve Spools are select hone fitted at the factory for minimum internal leakage, and are not field replaceable.

8. 3-Way, 3-Position Spool Code Symbol 3

For control of single-acting cylinders or unidirectional motors. Work port is blocked when spool is in neutral.

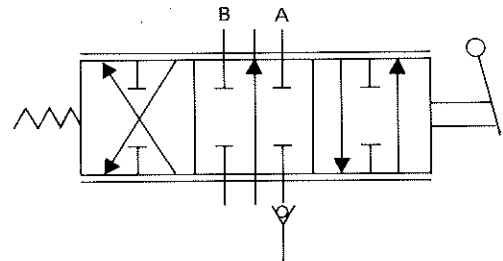
When the valve spool is moved into its Work position, hydraulic oil flow is directed from the inlet port to the single work port and into the motor or cylinder. When the spool is moved in the opposite direction, both the work port and the inlet port are open to the tank port.



9. 4-Way, 3-Position Spool Code Symbol 4

For control of double-acting cylinders or bi-directional motors. Both Work ports are blocked when the spool is in neutral.

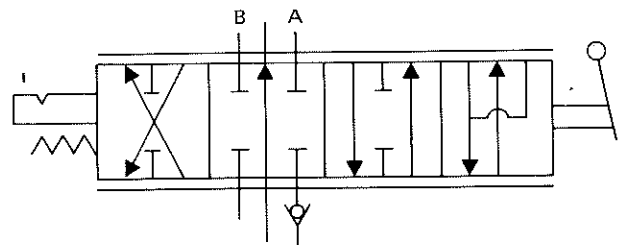
When the valve spool is moved, hydraulic oil flow is directed from the inlet port to one of the work ports. The alternate work port is open to the tank port in a parallel circuit. When the spool is moved in the opposite direction, work port functions are reversed.



10. 4-Way, 4-Position Float Spool Code Symbol K

This spool is the same as the 4-way, 3-position spool, with the addition of a fourth "Float" position. When in Float position, the pump flow is directed to the tank through the open center core. Both cylinder ports are open to tank.

This spool is spring-centered to neutral in three positions. The fourth position is the detented "Float" position, which allows a cylinder to "Float" or a motor to "Free Wheel".

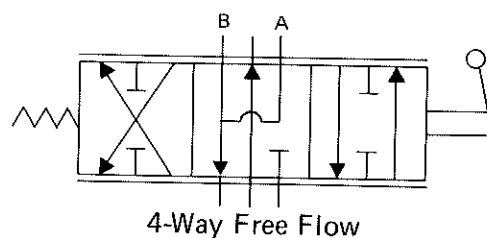
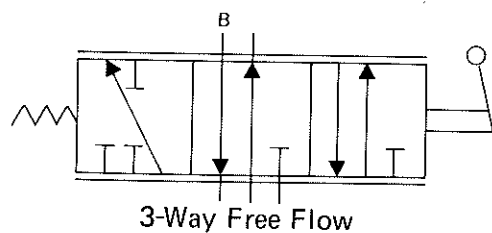


Available for No. 1 spool of Models SPK and SSK Directional Control Valves only.

11. Free Flow Motor Spool Code Symbol F

Allows a cylinder to drift or a motor to coast when the valve spool is in Neutral position.

Work ports are open to tank port when the spool is in neutral. This optional spool is available as a 3-Way or 4-Way free flow spool.



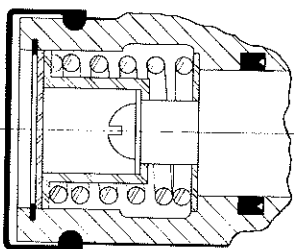
12. Metering Spool Code Symbol Z

An optional Metering Spool is available for Models SP and SPK 3 and 4 way spools to provide more accurate control of the work port.

SPOOL ACTION OPTIONS

13. Spring Return to Neutral (Furnished as standard, unless otherwise specified)

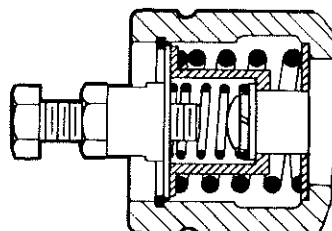
Spool action has three positions with spring return to neutral from both work ports.



14. Spool Travel Limiter Code Symbol L

With this assembly, the operator may adjust the forward spool travel only (spool "IN") to a very fine degree, allowing a restricted amount of pressurized oil to pass through "A" Port of the control valve to the cylinder or motor. This makes possible a regulated speed of operation. Used with standard Spring Return to Neutral assembly or Spring Extended spool option.

For 3-way (single-acting cylinder) operation, "A" Port is plugged and "B" Port only is used. Therefore, the Spool Travel Assembly would restrict exhausting oil from Work Port "B" to tank port.

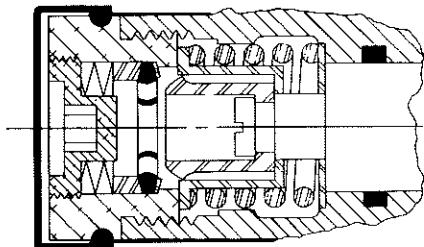


DEFINITIONS (Cont.)

15. 4-Position Float Assembly

This option is spring-centered to neutral in three positions. The fourth position is the detented "Float" position, which allows a cylinder to "Float" or a motor to "Free Wheel".

Available for No. 1 spool of Models SPK and SSK Directional Control Valves only.

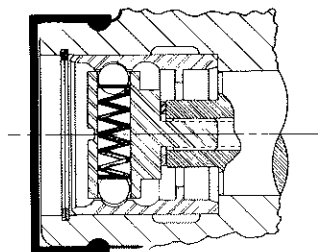


16. 3-Position Detent

Code Symbol D

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

Detent stop available to limit spool travel.



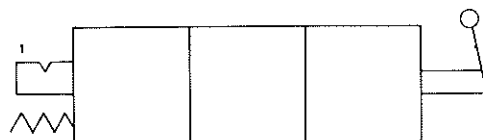
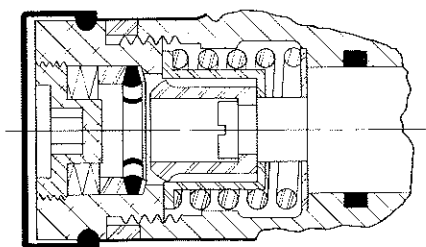
NOTE: The Detent Option is designed to provide operator "FEEL". It is NOT intended for use as a Positive Spool Locking Device against excessive external forces or machine vibration.



17. 1-Position Detent with Spring Return to Neutral

Code Symbol R

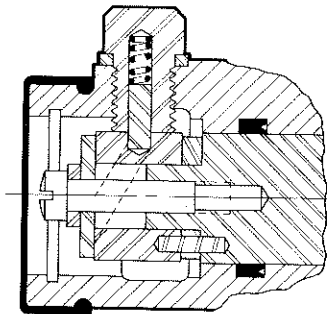
This feature allows spring-centering to neutral with a Detent for the spool "IN" Position Only. Work Port "B" will remain open to tank in detent, thereby allowing a single-acting cylinder to "float".



18. Rotary Spool

Code Symbol W

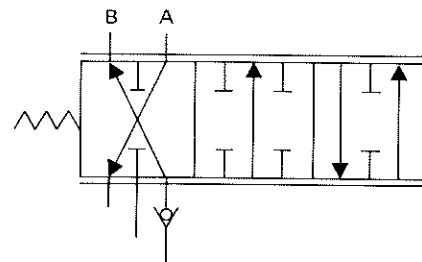
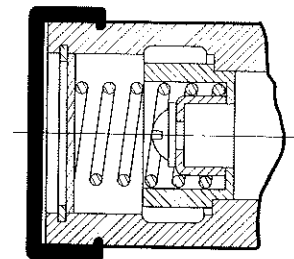
With this option the spool is pulled or pushed by rotary movement of the spool. Allows for 90° rotation of the spool each direction from center, making a 180° total handle rotation with Detent position in neutral. There is no spring-centering, therefore the spool will stay in any position placed. (No handle is supplied—customer must furnish his own handle mechanism.)



19. Spring Extended Spool

Code Symbol A

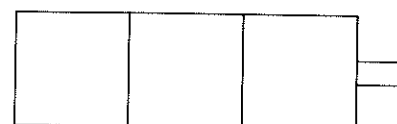
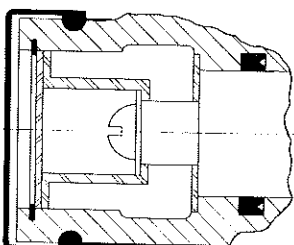
This feature eliminates Spring-Return to Neutral, and spring loads the spool to the "OUT" Position only. Usually used for "Cam-Operation" of spool. Customer must supply cam-follower mechanism. When this option is ordered, a handle assembly is not furnished.



20. Manual Actuator

Code Symbol M

The manual spool permits full spool travel without spring centering or detent assemblies.



DEFINITIONS (Cont.)

MAIN RELIEF VALVES

21. Relief Valves

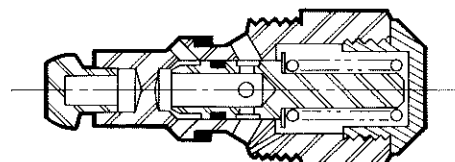
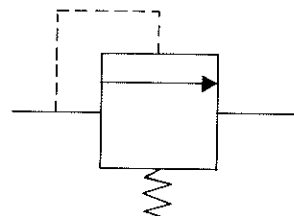
Relief Valves are used to control system pressures or the pressure within an individual circuit of a hydraulic system. The relief valve installed in a control valve will normally be used to control the maximum pressure of a complete hydraulic circuit. A relief valve in a separate housing can often be used as a circuit relief for a specific function. Relief valve performance refers to the difference or differential between the cracking pressure and its "full flow" setting. Various types of relief valves are used. Three of the most common types are "ball spring," "pilot-operated," and "differential type."

Ball/Spring Type Relief Valve

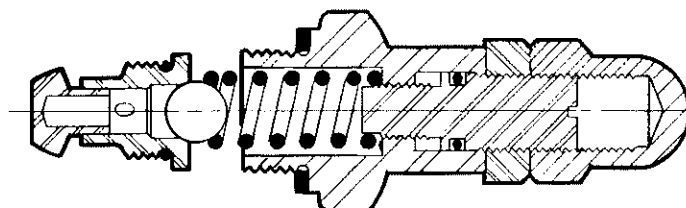
Ball/Spring Type Relief Valve (Model J) is an inexpensive Relief Valve highly tolerant of foreign material in the hydraulic system. It is virtually trouble-free and suitable for many applications.

Differential Poppet-Type Relief Valve

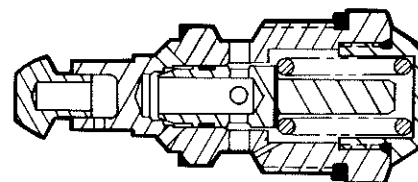
Gresen Differential Poppet-Type Relief Valves (Models WS, and WK) are a quality Relief Valve with excellent crack to full-flow characteristics—quiet Reliefs that are also tolerant of foreign material. These Reliefs are cartridge-type, permitting easier servicing and interchangeability.



MODEL WS NON-ADJUSTABLE
DIFFERENTIAL POPPET TYPE RELIEF



MODEL J STANDARD RELIEF



MODEL WK NON-ADJUSTABLE
DIFFERENTIAL POPPET TYPE RELIEF

RELIEF VALVE MODEL

SPECIFICATIONS:

	WS	WSA	WK	WKA	J	J(NJ)
RATED G.P.M.	30	30	30	30	20	20
BALL/SPRING					X	X
DIFFERENTIAL POPPET	X	X	X	X		

OPTIONS:

ADJUSTABLE		X		X	X	
NON-ADJUSTABLE (ADJUSTABLE WITH SHIMS ONLY)	X		X			X

WHERE USED:

DIRECTIONAL CONTROL VALVES

SP MAIN RELIEF	X	X			X	X
SPK/SSK MAIN RELIEF			X	X	X	X

MISCELLANEOUS FEATURES and OPTIONS

22. Load Check

The Load Check blocks against pressurized return flow from a work port back to the inlet port until overcome by pressure build-up from the pump.

This feature will keep a load from dropping as the control valve spool is being shifted, until the inlet pressure is greater than the pressure developed by the load. At this time the Load Check will open and movement of the load can then be controlled by the control valve spool.

Note that the Load Check has nothing to do with the load-holding ability of the valve when the spool is in the Neutral position. It functions only when the spool is being shifted.

All Gresen Directional Control Valves have Load Checks, except the Model 400.

Model SP and SPK Valves have a Load Check for the "A" Port valve circuit and another Load Check for the "B" Port valve circuit.

The Model SSK Valve has individual Load Checks for each spool.

23. Handle Assemblies

A variety of control handles are available. Handles are standard for all models and are included in the standard price of a valve assembly (except with spool action options A and W). See pages 38 and 39 for specifications.

Control valves can be supplied Less Handle Only (LHO), which includes link and pins, less handle
OR

Less Complete Handle Assembly (LCHA), which does not include handle, link or pins.

All handles are cast iron with a black plastic coating. Plain cast iron can be ordered as an option.

24. Construction

All valve housings are made of high tensile cast iron for durability and resistance to shock loads.

Spools are hard, chrome-plated for long life and resistance to corrosion. All spools are select hone-fitted for minimum internal leakage and maximum load-holding ability.

25. Fluid Compatibility

Gresen products are compatible for use with any petroleum-based fluid and various fire-resistant fluids. All Gresen products utilize BUNA-N seals. They are generally compatible with water-in-oil emulsions and water-glycol solutions.

Phosphate Ester fluids will usually cause BUNA-N seals to swell. This swelling is not normally detrimental to any static seals, but can be a problem for dynamic seals such as valve spool seals. Swelling of these seals can result in binding spools. Butyl seals are compatible with phosphate ester fluids and are available for Models SP, SPK and SSK Directional Control Valves.

Due to the large number of hydraulic oil manufacturers and the increasing availability of oil under various brand names, we recommend that the customer test each application to his own satisfaction. Consult your hydraulic oil supplier.

26. Orifice Restrictors

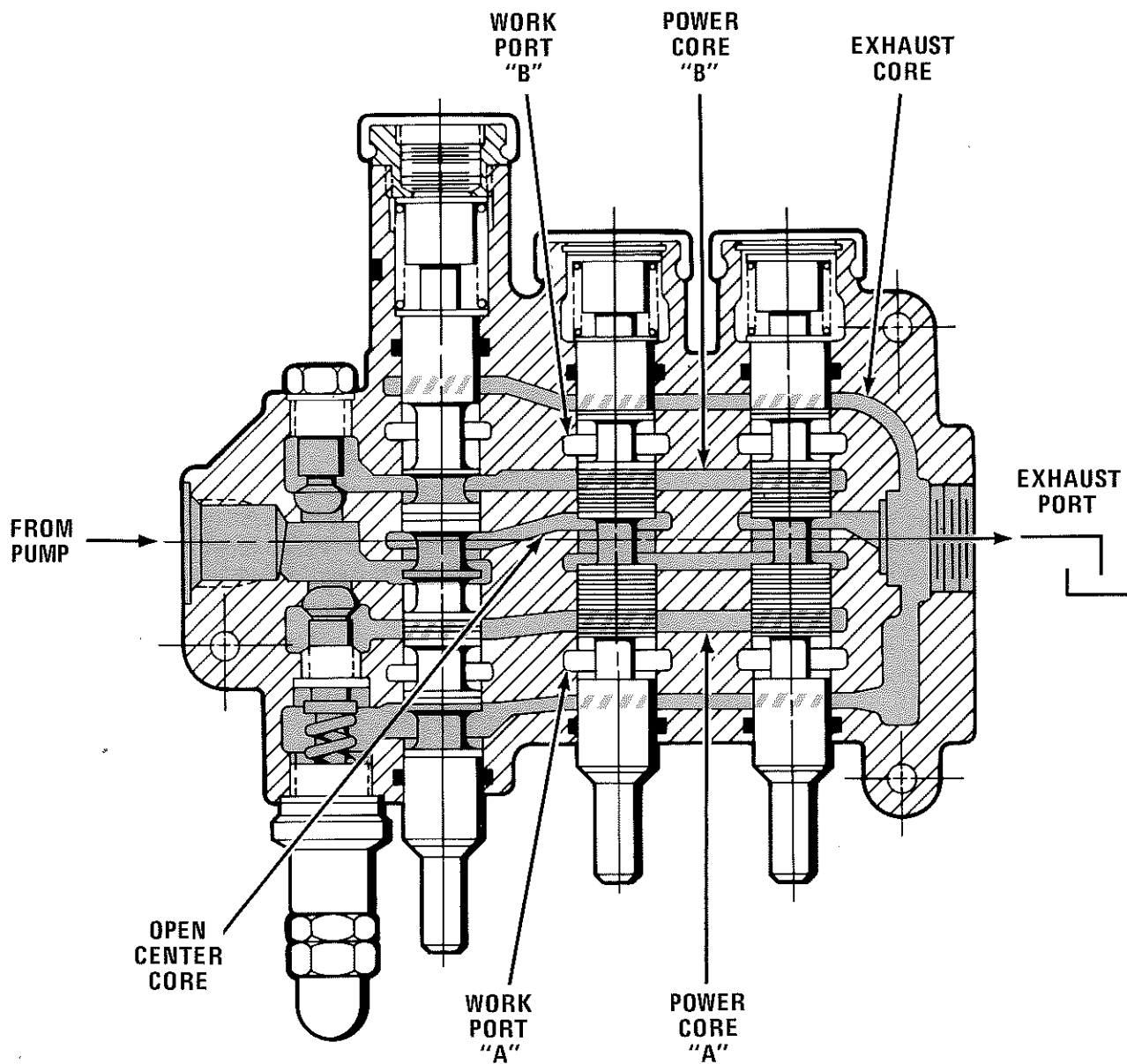
Orifice restrictors limit hydraulic oil flow, causing limited cylinder or motor speed in one direction, but will allow free flow of oil in the opposite direction.

Built-in, work port restrictors are not available for any of the Monoblock valves. When required, order a Model LT Line Throttle Valve. (Refer to the Gresen Accessory Valve Catalog, No. PC-4000.) An LT throttle valve may be ordered with proper threads to install directly into a valve work port.

VALVE DESIGN

Internal coring and construction of all valve models is not the same and this schematic view is only shown as

a typical 3-spool open center valve. The model pictured is SPK-4-4-4.



CONDENSED SPECIFICATIONS and OPTIONS

	Code Symbol	Page 18 Model SP	Page 22 Model SPK	Page 26 Model SSK	Page 30 Model 300	Page 34 Model 400
CAPACITY						
Nominal Rating, GPM		20	20	20	16	16
MAXIMUM PRESSURE, PSI		2000	2000	2000	2500	2500
SPOOLS						
Maximum Number		3	3	2	1	1
TYPE OF CIRCUIT		PARALLEL		SERIES		
Tandem Circuits Not Available in Monoblock Valves						
APPLICATION VARIATIONS						
Open Center	—	X	X	X	X	X
Closed Center	C	X	X		X	X
Power Beyond	Y	X	X	X		
Conversion Plug	X	X	X	X		
SPOOL VARIATIONS						
3-Way, 3-Position	3	X	X ^a	X ^a	X	
4-Way, 3-Position	4	X	X ^a	X ^a		X
4-Way, 4-Position Float	K		X ^b	X ^b		
Free Flow Motor Type	F	X	X ^a	X ^a	X	X
Metering	Z	X	X ^a			
SPOOL ACTION OPTIONS						
Spring Return to Neutral	—	X	X ^a	X ^a	X	X
3-Position Detent	D	X	X ^a	X ^a	X	X
1-Position Detent With Spring Return	R	X	X ^a			
Rotary	W	X	X ^a			
Spring Extended	A	X	X ^a	X ^a	X	X
Manual	M	X	X ^a	X ^a	X	X
Spool Travel Limiter	L	X	X ^a	X ^a		
MISCELLANEOUS FEATURES AND OPTIONS						
Load Checks		X	X	X	X	
Butyl Spool Seals —Optional		X	X	X		
Orifice Restrictors		NOT AVAILABLE				

a SPOOLS No. 2 and No. 3 only

b SPOOL No. 1 only



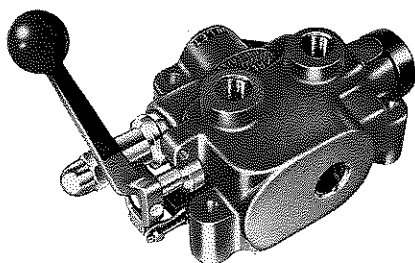
MODEL
SP

20 GPM
(Nominal)

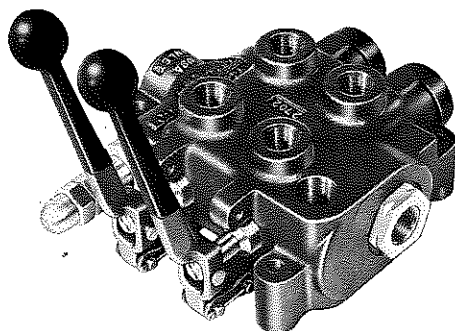
2000 PSI

DIRECTIONAL CONTROL VALVE

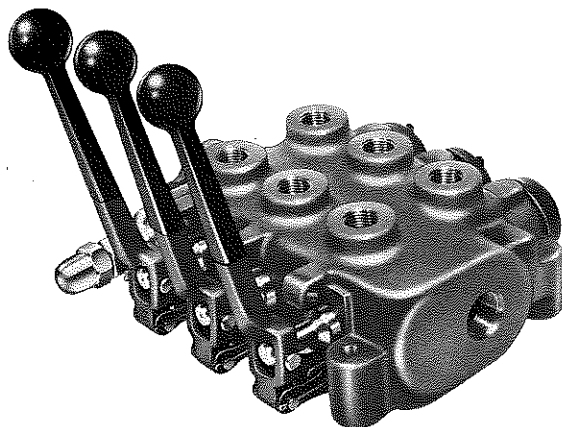
PARALLEL CIRCUIT



1-SPOOL MODEL
(Standard)



2-SPOOL MODEL
(With Power Beyond
and Top Outlet)



3-SPOOL MODEL

The Gresen Model SP Directional Control Valve is manufactured to give outstanding, long-lasting performance. Spools are hone-fitted for above average "load-hold" characteristics.

Model SP Valves are available either 3-way (single-acting), 4-way (double-acting) or with combinations of both.

Monoblock valve housings are available in 1-, 2-, and 3-spool configurations. Optional spools, bonnet assemblies and ports are available on special order.

FEATURES

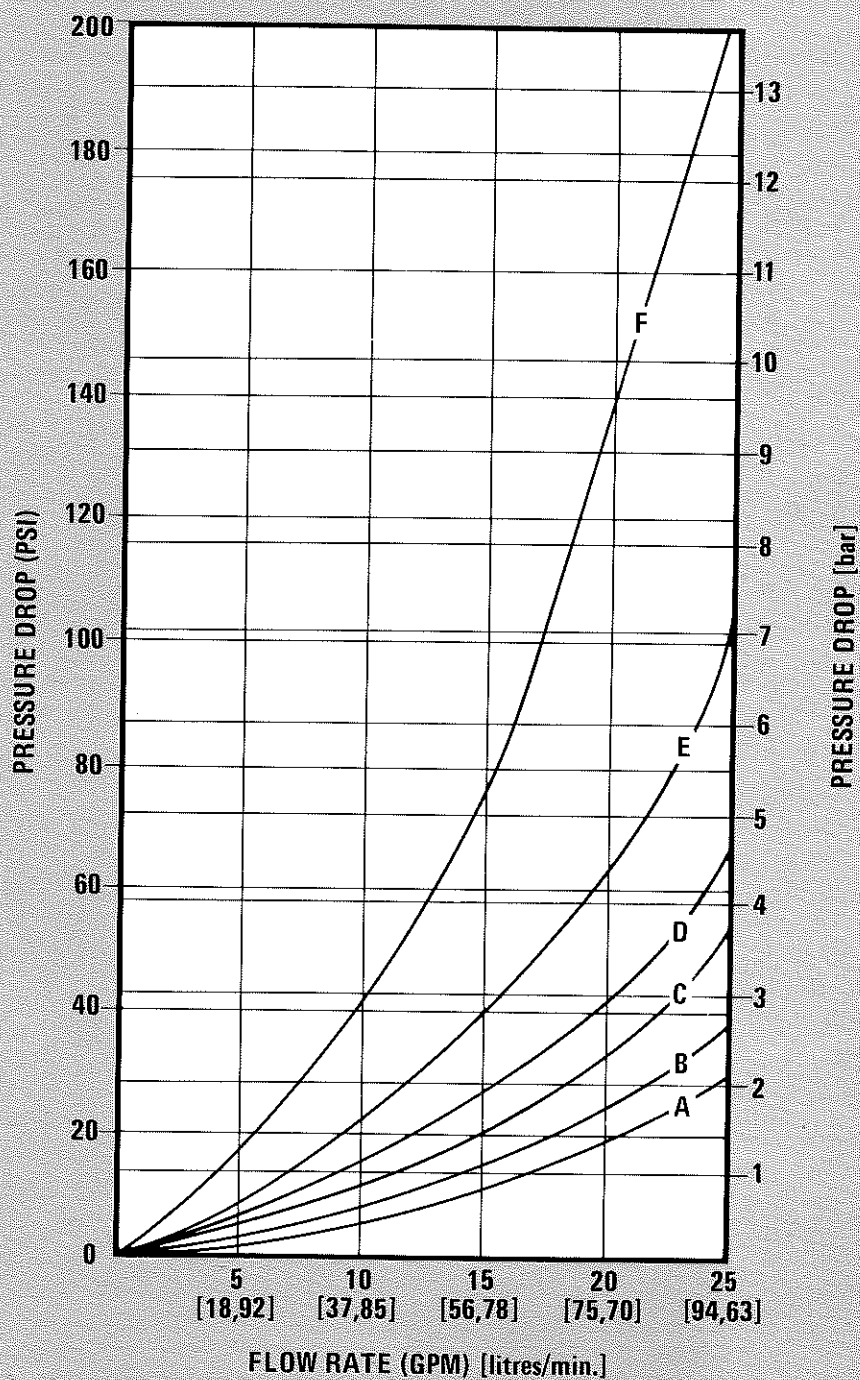
- Adjustable or Non-Adjustable Ball/Spring Type Relief Valve.
- Optional Model WS Differential Poppet Main Relief Valve available.
- Built-In Load Checks — One Check for "A" Port Circuit and one for "B" Port Circuit.
- Control Handles may be mounted in "UP" or "DOWN" Position. (Handles included as standard equipment, except with "A" or "W" options).
- Power Beyond Outlet Available.

SPECIFICATIONS

Capacity	Up to 20 GPM [75,70 liters/min]
Maximum Pressure	2000 PSI [138,0 bar]
Maximum Exhaust Core Pressure	500 PSI [34,5 bar]
Shipping Weight	
1-Spool	15-1/2 pounds [7,03 kg]
2-Spool	24 pounds [10,89 kg]
3-Spool	32-1/2 pounds [14,74 kg]

TYPICAL PRESSURE DROP WITH STANDARD PORTS

150 SUS [3,65 ENGLER] oil at 100°F



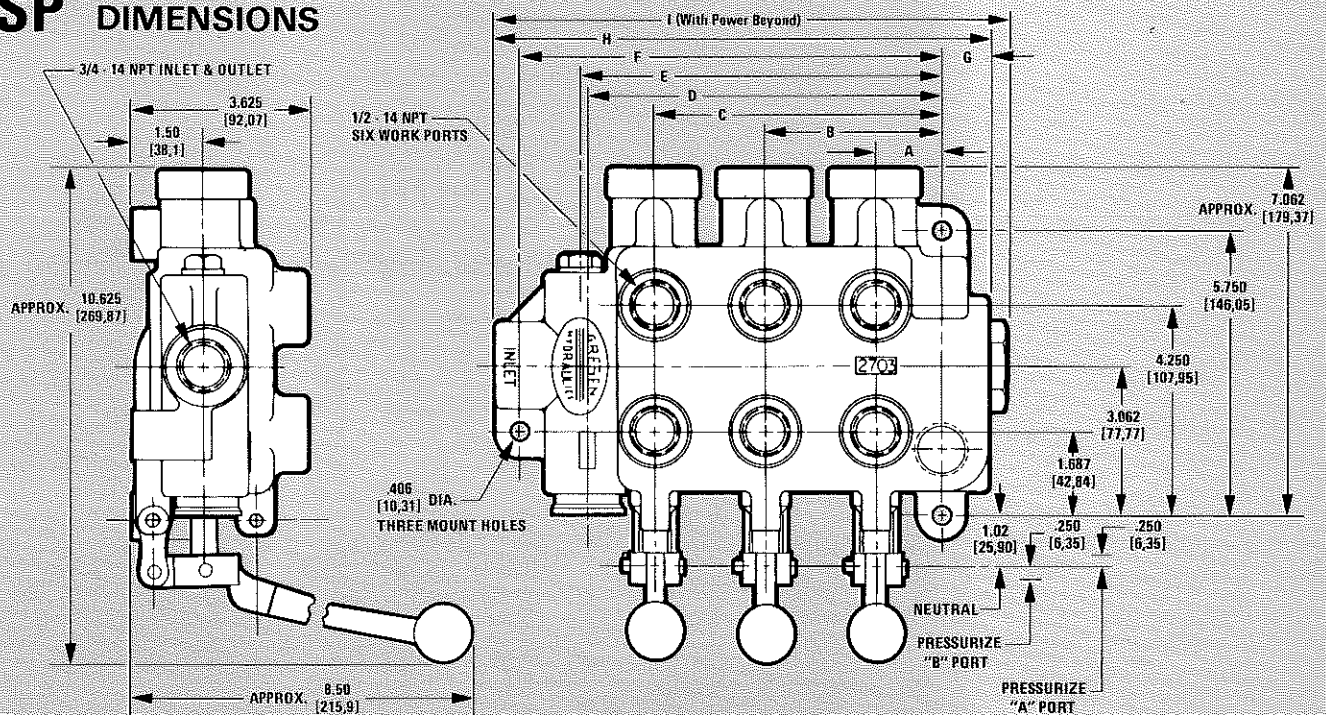
PRESSURE DROP THRU OPEN CENTER

A	1-Spool Valve
B	2-Spool Valve
C	3-Spool Valve

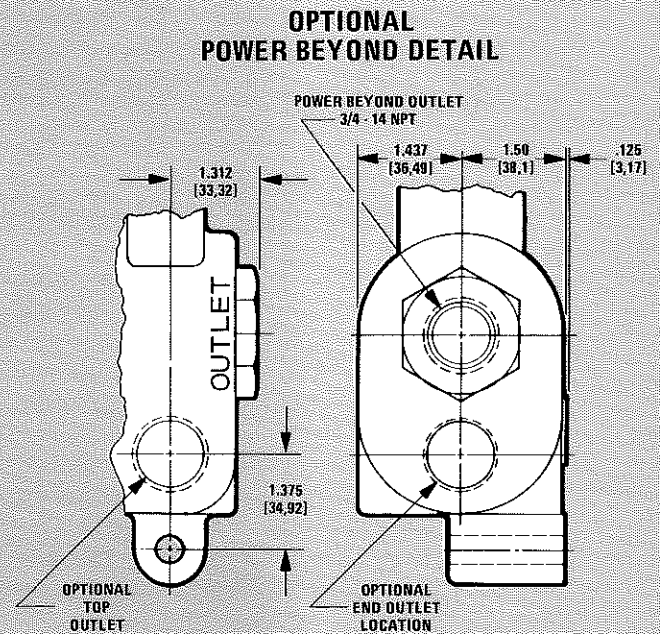
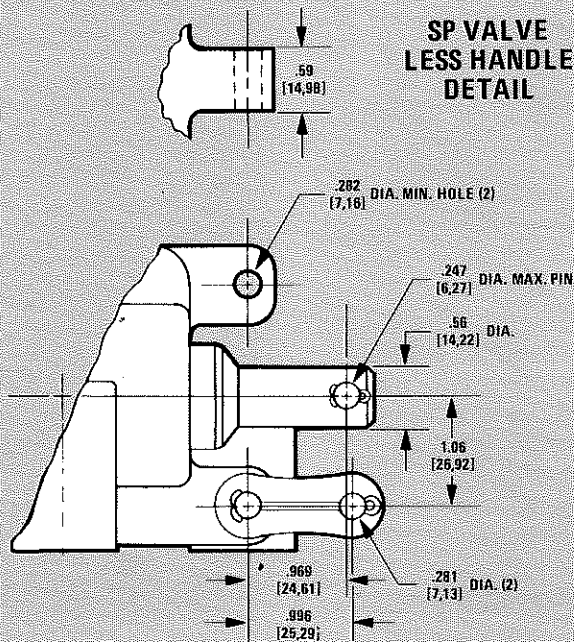
MAXIMUM PRESSURE DROP THRU VALVE (One spool in "Power Position")

D	1-Spool Valve
E	2-Spool Valve
F	3-Spool Valve

SP DIMENSIONS



ALL DIMENSIONS ARE IN INCHES (MILLIMETRES)
AND ARE FOR REFERENCE ONLY



DIMENSIONS

MODEL	A	B	C	D	E	F	G	H	I
1 SPOOL	1.375 in. [34,925mm]			2.750 in. [69,850mm]	2.875 in. [73,025mm]	4.125 in. [104,775mm]	1.000 in. [25,400mm]	5.625 in. [142,875mm]	5.937 in. [150,800mm]
2 SPOOL	1.375 in. [34,925mm]	3.625 in. [92,075mm]		5.000 in. [127,000mm]	5.125 in. [130,175mm]	6.375 in. [161,925mm]	1.000 in. [25,400mm]	7.875 in. [200,025mm]	8.187 in. [207,950mm]
3 SPOOL	1.375 in. [34,925mm]	3.625 in. [92,075mm]	5.875 in. [149,225mm]	7.250 in. [184,150mm]	7.375 in. [187,375mm]	8.625 in. [219,075mm]	1.000 in. [25,400mm]	10.125 in. [257,175mm]	10.437 in. [265,100mm]

ORDERING INSTRUCTIONS (Refer to pages 4 thru 12 for explanation of Code Symbols.)

MODEL NO.

SP Y T - DF4 - 3 - Z4 - J - HP - LHO

BASIC MODEL

HOUSING MACHINING OPTIONS

—, Y, C or X

TANK OUTLET PORT OPTIONS

— Standard End Outlet
T Optional Top Outlet
E Optional End Outlet Location

SPOOL ACTION OPTIONS

—, A, D, L, M, R or W

Additional Spool Action Options

- Heavier Return to Neutral centering spring. Order Spring No. 986-001
- Detent stop (Used with D option)

SPECIFY

Neutral and Spool "OUT" positions only OR
Neutral and Spool "IN" positions only

SPOOL VARIATIONS

—, F or Z and 3 or 4

HANDLE INFORMATION

—, LHO or LCHA

Standard, No. 2580-001 Black Plastic Coated Handle and Link Assembly.

For additional Handle Options, see page 39.

RELIEF VALVE OPTIONS

RELIEF MODELS

— Standard (J), Adjustable Ball/Spring (100-1500 PSI)
J-HP High-Pressure, Adjustable Ball/Spring (1501-2000 PSI)
J-NJ Non-Adjustable, Ball/Spring (150-1500 PSI)
J-NJ-HP High-Pressure, Non-Adjustable, Ball/Spring (1501-2000 PSI)
WS* Differential Poppet-Type, Non-Adjustable (500-2000 PSI)
WSA* Differential Poppet-Type, adjustable within the spring range installed:
No. 1864-001 Spring; (1351-1750 PSI)
No. 1451-001 Spring; (1751-2000 PSI)
NR No relief. Relief port plugged.

Specify Relief setting. If not specified, the adjustable Ball/Spring Relief Valve will be set at 1000 PSI at 7.6 GPM full flow. Pressure settings must be specified on all non-adjustable models.

Refer to Gresen Accessory Valve Catalog No. PC-4000 for relief performance curves.

*All Model SP housings are machined for the Model J Ball/Spring - Type Relief Valve unless the Model WS Differential Poppet - Type Relief is specified. If relief valve is not required, the relief port will be plugged "NR".

*Machining for the Model J is not the same as that required for the Model WS, therefore these relief valves are not interchangeable.

If a valve with 2 or 3 spools is required, order spools in same manner as for Spool No. 1. If not required, omit.

PORT SIZES AND LOCATIONS

STANDARD

NPT pipe ports are furnished unless otherwise specified.

	STANDARD PORTS		OPTIONAL PORTS	
	NPT PIPE PORTS	SAE STRAIGHT THREAD PORTS	NPT PIPE PORTS	SAE STRAIGHT THREAD PORTS
End Inlet	3/4	12	none	none
Work Ports (All)	1/2	10	none	none
End Outlet—when Power Beyond, Closed Center or Conversion Plug is not specified	3/4	12	none	none
Optional Location End Outlet—when Power Beyond, Closed Center or Conversion Plug is specified	—	—	3/4	10
Top Outlet	—	—	3/4	10
Power Beyond Sleeve Outlet	—	—	3/4	10
				12

Note: NPT and SAE ports cannot be intermixed in the same valve housing. All work ports in the same valve housing must be the same.

MISCELLANEOUS OPTIONS

See page 15

SEALS

BUNA-N O-Ring Spool Seals are standard.
Optional Seals:

BUNA-N Quad Ring, No. 2902-001;
Butyl Quad Ring, No. 2816-001



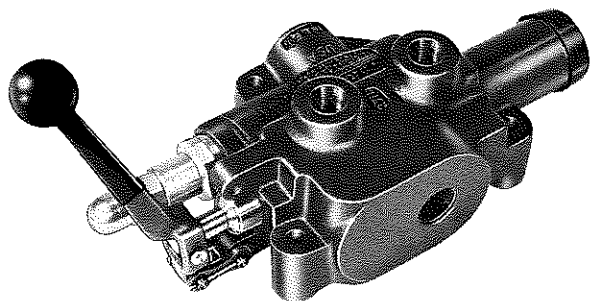
**MODEL
SPK**

20 GPM
(Nominal)

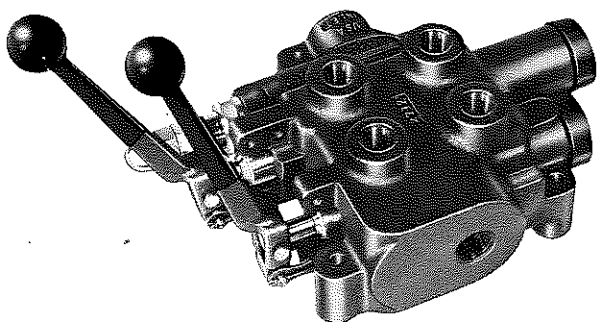
2000 PSI

DIRECTIONAL CONTROL VALVE WITH FLOAT POSITION

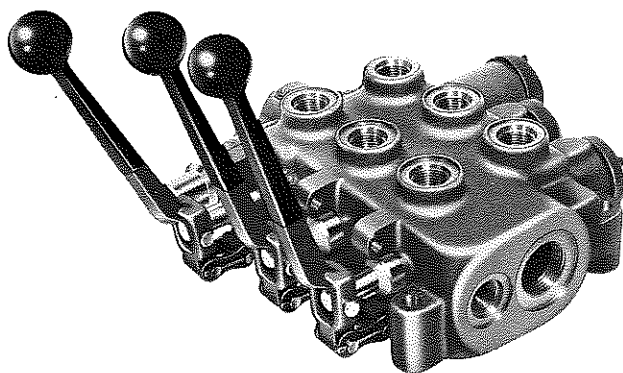
PARALLEL CIRCUIT



1-SPOOL MODEL



2-SPOOL MODEL



3-SPOOL MODEL

The Model SPK Directional Control Valve is available in 1-spool, 2-spool or 3-spool body configurations. The No. 1 spool is always a 4-way float spool. Spools No. 2 and No. 3 are either 3-way or 4-way, the same as in the SP Valve.

The float spool is the same as the 4-way, 3-position spool, with the addition of a fourth "Float" position. When in "Float" position, the pump flow is directed to the tank through the open center core. Both work ports are open to the tank.

This spool is spring-centered to Neutral in three positions. The fourth position is a detented Float position which allows a cylinder to "Float" or a motor to "Free Wheel".

Applications for Valves with "Float" positions are bulldozers, snow plows and other types of equipment that require a combination of both "Float" and "Hold" when in neutral.

FEATURES

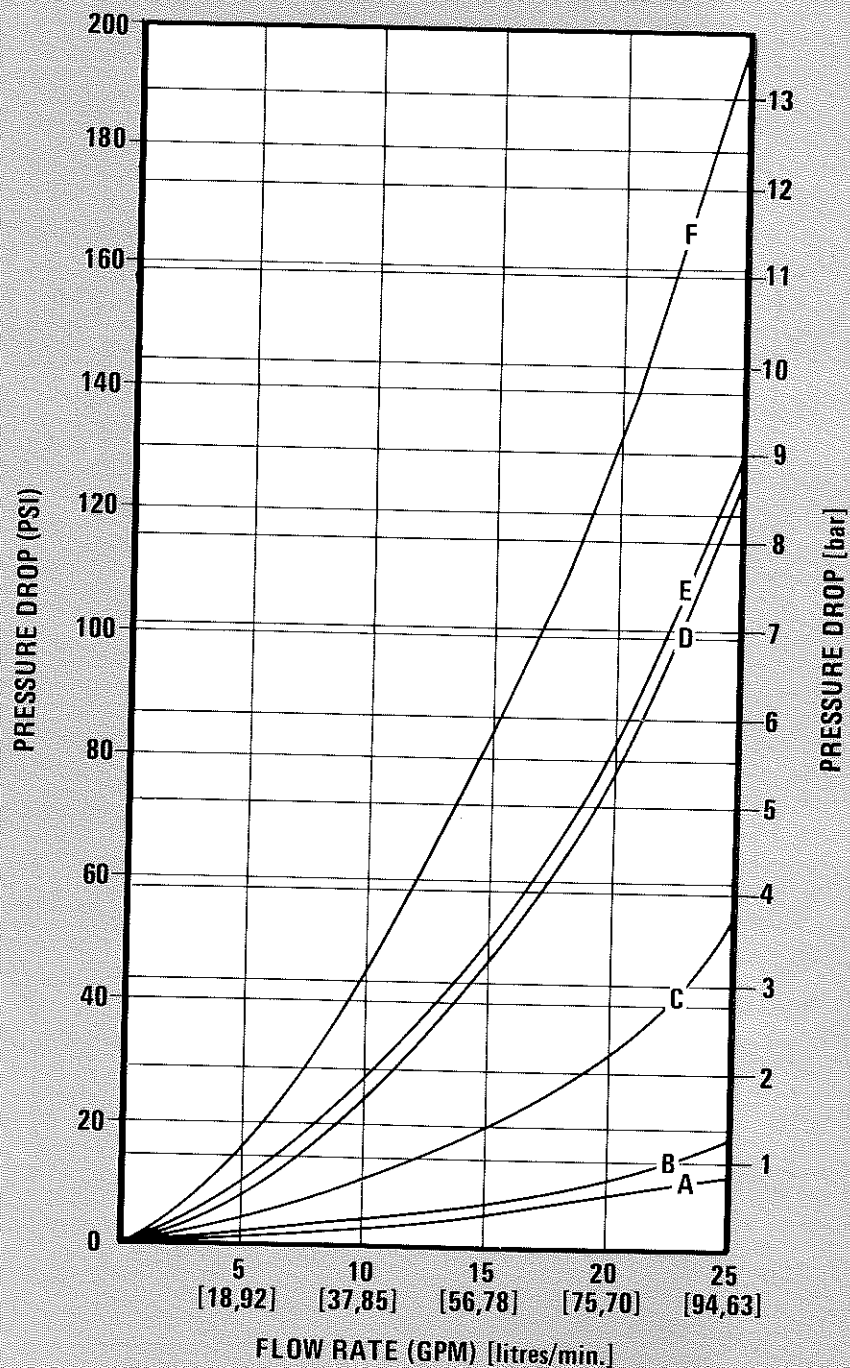
- Detent in Float Position. (Spool No. 1 only)
- Adjustable or Non-Adjustable Ball/Spring-Type Relief Valve.
- Model WK Differential Poppet Relief available.
- Built-In Load Checks —One Check for "A" Port and one for "B" Port Circuit.
- Control Handles may be mounted in "Up" or "Down" Position.
- Power Beyond Outlet Available.

SPECIFICATIONS

Capacity (nominal) Up to 20 GPM [75,70 liters/min]
Maximum Pressure 2000 PSI [138,0 bar]
Maximum Exhaust Core Pressure 500 PSI [34,5 bar]
Shipping Weight
1-Spool 17-1/2 pounds [7,94 kg]
2-Spool 23-1/2 pounds [10,66 kg]
3-Spool 29-1/2 pounds [13,38 kg]

TYPICAL PRESSURE DROP WITH STANDARD PORTS

150 SUS [3,65 ENGLER] oil at 100°F



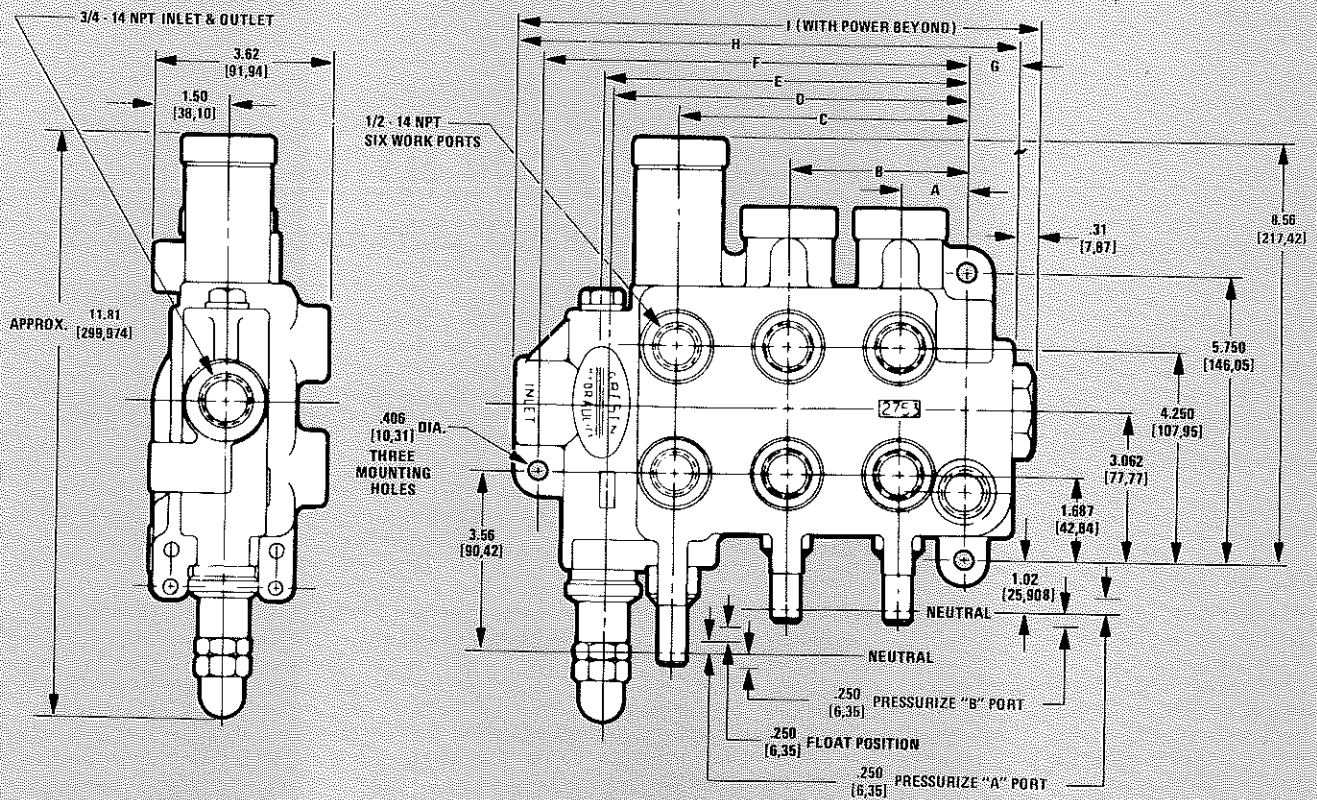
PRESSURE DROP THRU OPEN CENTER

A	1-Spool Valve
B	2-Spool Valve
C	3-Spool Valve

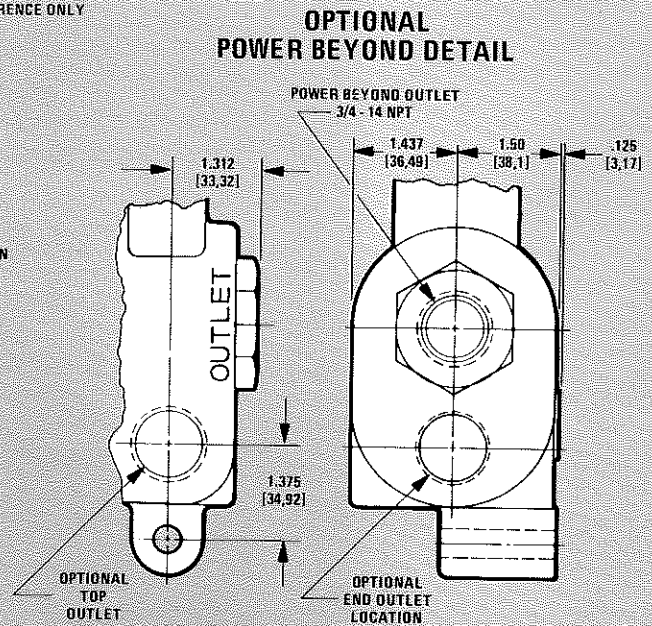
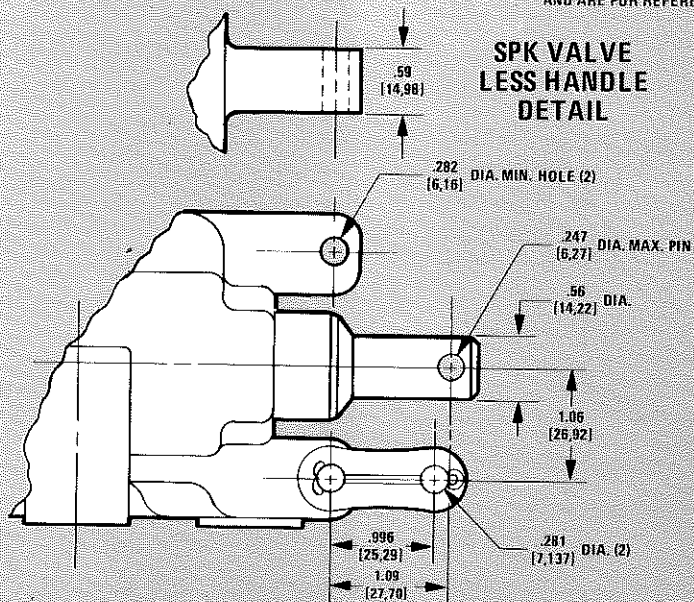
MAXIMUM PRESSURE DROP THRU VALVE (One spool in "Power Position")

D	1-Spool Valve
E	2-Spool Valve
F	3-Spool Valve

SPK DIMENSIONS



ALL DIMENSIONS ARE IN INCHES (MILLIMETRES)
AND ARE FOR REFERENCE ONLY



DIMENSIONS

MODEL	A	B	C	D	E	F	G	H	I
1 SPOOL	1.375 in. [34,925mm]			2.750 in. [69,850mm]	2.875 in. [73,025mm]	4.125 in. [104,775mm]	.94 [23,876]	5.625 in. [142,875mm]	5.937 in. [150,800mm]
2 SPOOL	1.375 in. [34,925mm]	3.625 in. [92,075mm]		5.000 in. [127,000mm]	5.125 in. [130,175mm]	6.375 in. [161,925mm]	.94 [23,876]	7.875 in. [200,025mm]	8.187 in. [207,950mm]
3 SPOOL	1.375 in. [34,925mm]	3.625 in. [92,075mm]	5.875 in. [149,225mm]	7.250 in. [184,150mm]	7.375 in. [187,375mm]	8.625 in. [219,075mm]	.94 [23,876]	10.125 in. [257,175mm]	10.437 in. [265,100mm]

ORDERING INSTRUCTIONS (Refer to pages 4 thru 12 for explanation of Code Symbols.)

MODEL NO. **SPK Y T - 4 - DF4 - Z4 - WK - LHO**

Spool No. 1
Spool No. 2
Spool No. 3

BASIC MODEL

HOUSING MACHINING OPTIONS

—, Y, C or X

TANK OUTLET PORT OPTIONS

— Standard End Outlet
 T Optional Top Outlet
 E Optional End Outlet Location

SPOOL ACTION OPTIONS

NO. 1 SPOOL ONLY

4-way, 4-position, float no options

NO. 2 AND NO. 3 SPOOLS ONLY

—, A, D, L, M, R or W

Additional Spool Action Options

- Heavier Return to Neutral centering spring. Order Spring No. 986-001
- Detent stop (Used with D option)

SPECIFY

Neutral and Spool "OUT" positions only

OR

Neutral and Spool "IN" positions only

SPOOL VARIATIONS

—, F, or Z and 3 or 4.

HANDLE INFORMATION

—, LHO or LCHA

Standard, No. 2580-001 Black Plastic Coated Handle and Link Assembly.

For additional Handle Options, see page 39.

RELIEF OPTIONS

RELIEF MODELS

— Standard (J), Adjustable Ball/Spring (300-1500 PSI)
 J-HP High-Pressure, Adjustable Ball/Spring (1501-2000 PSI)
 J-NJ Non-Adjustable, Ball/Spring (400-1500 PSI)
 J-NJ-HP High-Pressure, Non-Adjustable, Ball/Spring (1501-2000 PSI)
 WK* Differential Poppet-Type, Non-Adjustable (500-2000 PSI)
 WKA* Differential Poppet-Type, adjustable within the spring range installed:
 No. 1864-001 Spring; 1351-1750 PSI
 No. 1451-001 Spring; 1751-2000 PSI
 NR No relief. Relief port plugged.

Specify Relief setting. If not specified, the Adjustable Ball/Spring Relief Valve will be set at 1000 PSI at 7.6 GPM full flow. Pressure settings must be specified on all non-adjustable models.

Refer to Gresen Accessory Valve Catalog No. PC-4000 for relief performance curves.

All Model SPK housings are machined for the Model J Ball/Spring - Type Relief Valve unless the Model WK Differential Poppet - Type Relief is specified. If relief valve is not required, the relief port will be plugged "NR".

*Machining for the Model J is not the same as that required for the Model WK, therefore these relief valves are not interchangeable.

If a Valve with 3 spools is required, order spool in same manner as for Spool No. 2. If a 2- or 3-spool valve is not required, omit.

PORT SIZES AND LOCATIONS

STANDARD

NPT pipe ports are furnished unless otherwise specified.

	STANDARD PORTS		OPTIONAL PORTS	
	NPT PIPE PORTS	SAE STRAIGHT THREAD PORTS	NPT PIPE PORTS	SAE STRAIGHT THREAD PORTS
End Inlet	3/4	12	none	none
Work Ports (All)	1/2	10	none	none
End Outlet—when Power Beyond, Closed Center or Conversion Plug is not specified	3/4	12	none	none
Optional Location End Outlet—when Power Beyond, Closed Center or Conversion Plug is specified	—	—	3/4	10
Top Outlet	—	—	3/4	10
Power Beyond Sleeve Outlet	—	—	3/4	10
				12

Note: NPT and SAE ports cannot be intermixed in the same valve housing. All work ports in the same valve housing must be the same.

MISCELLANEOUS OPTIONS

See page 15

SEALS

BUNA-N O-Ring Spool Seals are standard.

Optional Seals:

BUNA-N Quad Ring, No. 2902-001;
 Butyl Quad Ring, No. 2816-001



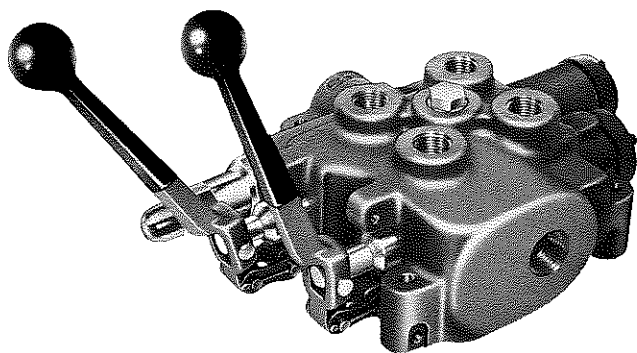
MODEL
SSK

20 GPM
(Nominal)

2000 PSI

DIRECTIONAL CONTROL VALVE WITH FLOAT POSITION

SERIES CIRCUIT



The Gresen Model SSK 2-Spool Directional Control Valve is designed for Series Circuit Operation, which allows the simultaneous operation of two cylinders or motors by directing the discharge oil from the cylinder or motor controlled by the No. 1 spool to the cylinder or motor controlled by the No. 2 spool.

If the No. 1 spool is used to control a double-acting cylinder . . . and that cylinder is fully extended or fully retracted . . . and the spool is not returned to neutral . . . oil will not be available to the No. 2 spool.

The No. 1 spool of the Model SSK Valve is a 4-way, 4-position float spool as described in paragraph 10, page 8. This spool is spring-centered to neutral in 3 positions with a detent provided for the "Float" position. The No. 2 spool is a 4-way, 3-position spool with spring return to neutral from both work ports.

In the SSK Valve, pressure is additive. The sum of the pressures required by both sections cannot exceed the main relief valve setting or pump pressure capability.

For use in any Open Center circuit where it is necessary to actuate two different functions simultaneously.

FEATURES

- Available in 2-Spool Model only
- Detent in Float Position, Spool No. 1
- Adjustable or Non-Adjustable Ball/Spring-Type Relief Valve
- Optional Model WK, Differential Poppet Relief Available. Quiet operation—excellent operating characteristics.
- Built-in Load Checks—One Check for Each Spool.
- Control Handles may be Mounted in "Up" or "Down" Position.
- Power Beyond Outlet Available.

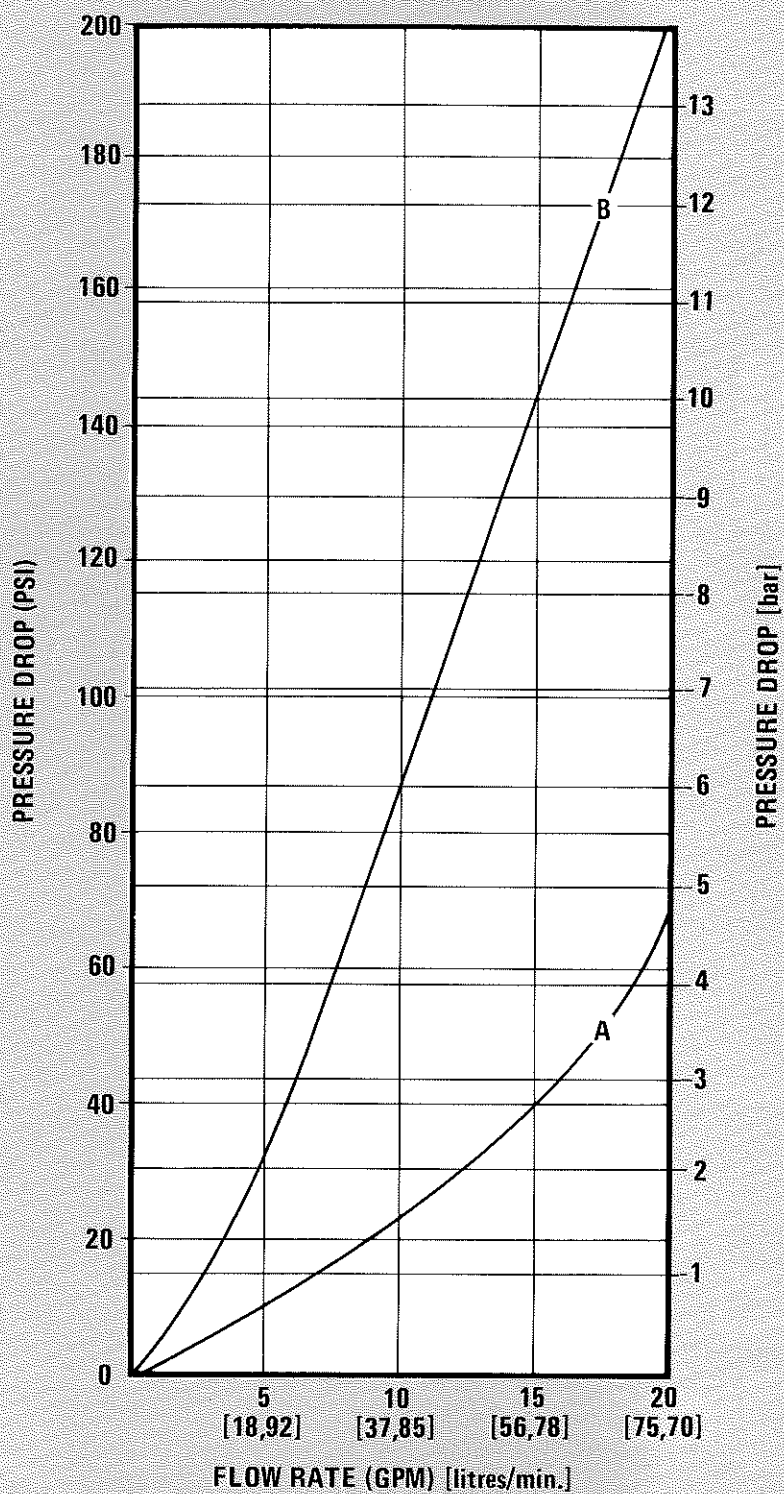
SPECIFICATIONS

Capacity (nominal)	20 GPM [75,70 liters/min]
Maximum Pressure	2000 PSI [138,0 bar]
Maximum Exhaust Core Pressure	500 PSI [34,5 bar]
Shipping Weight	24 pounds [10,89 kg]

Not suitable for use in a "Closed Center" hydraulic circuit.

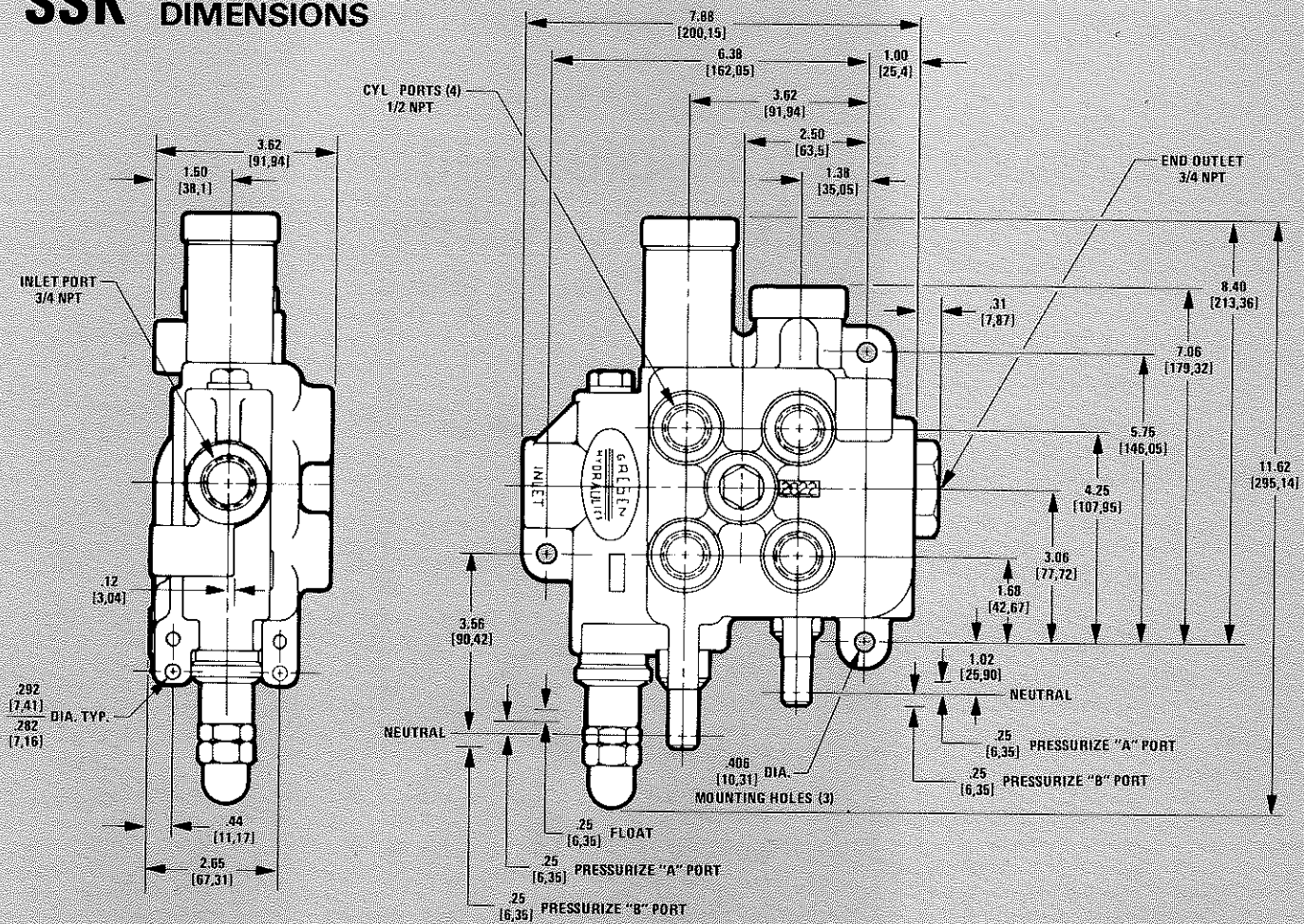
TYPICAL PRESSURE DROP WITH STANDARD PORTS

150 SUS [3,65 ENGLER] oil at 100°F

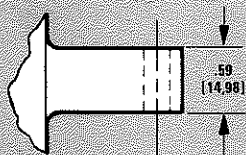


A	PRESSURE DROP THRU OPEN CENTER
B	MAXIMUM PRESSURE DROP THRU VALVE (One Spool in "Power Position")

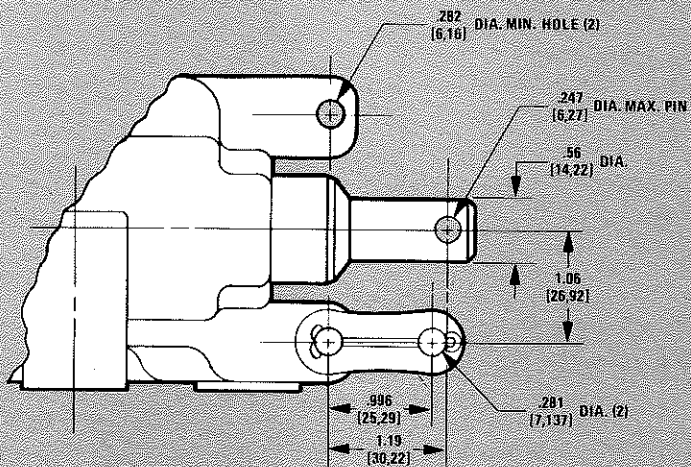
SSK DIMENSIONS



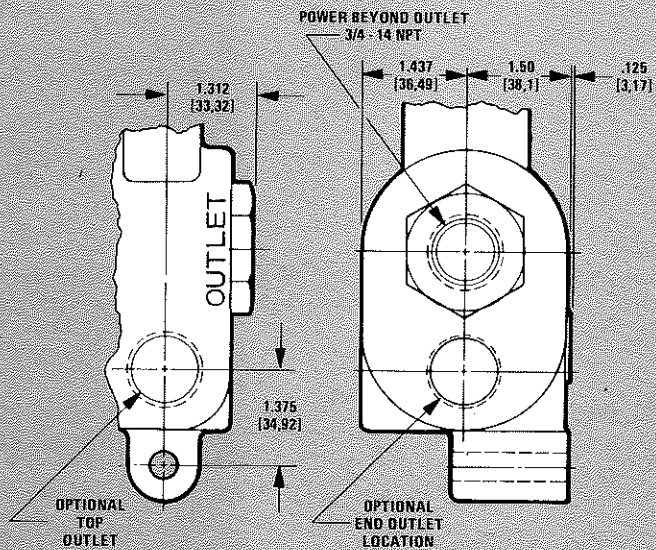
ALL DIMENSIONS ARE IN INCHES (MILLIMETRES)
AND ARE FOR REFERENCE ONLY



SSK VALVE LESS HANDLE DETAIL



**OPTIONAL
POWER BEYOND DETAIL**



ORDERING INSTRUCTIONS (Refer to pages 4 thru 12 for explanation of Code Symbols.)

SSK

MODEL NO.

SSK - Y T - 4 - D F4 - WK - LHO

Spool
No. 1

Spool
No. 2

BASIC MODEL

HOUSING MACHINING OPTIONS

—, Y, or X

TANK OUTLET PORT OPTIONS

— Standard End Outlet
T Optional Top Outlet
E Optional End Outlet Location

SPOOL ACTION OPTIONS

No. 1 SPOOL ONLY

4-way, 4-position, float
No option

NO. 2 SPOOL ONLY

—, A, D, L, M, R or W

Additional Spool Action Options

- Heavier Return to Neutral centering spring.
Order Spring No. 986-001
- Detent stop (Used with D option)

SPECIFY

Neutral and Spool "OUT" posi-
tions only OR
Neutral and Spool "IN" positions
only

SPOOL VARIATIONS

— or F and 3 or 4

HANDLE INFORMATION

—, LHO or LCHA

Standard, No. 2580-001 Black Plastic Coated Handle
and Link Assembly.

For additional Handle Options, see page 39.

RELIEF OPTIONS

RELIEF MODELS

—	Standard (J), Adjustable Ball/Spring (300-1500 PSI)
J-HP	High-Pressure, Adjustable Ball/Spring (1501-2000 PSI)
J-NJ	Non-Adjustable, Ball/Spring (400-1500 PSI)
J-NJ-HP	High-Pressure, Non-Adjustable, Ball/Spring (1501-2000 PSI)
WK*	Differential Poppet-Type, Non-Adjustable (500-2000 PSI)
WKA*	Differential Poppet-Type, adjustable within the spring range in- stalled: No. 1864-001 Spring; 1351-1750 PSI No. 1451-001 Spring; 1751-2000 PSI
NR	No relief. Relief port plugged.

Specify Relief Setting. If not specified, the Adjustable Ball/Spring Relief Valve will be set at 1000 PSI at 7.6 GPM full flow. Pressure settings must be specified on all non-adjustable models.

Refer to Gresen Accessory Valve Catalog No. PC-4000 for relief performance curves.

* All Model SSK housings are machined for the Model J Ball/Spring - Type Relief Valve unless the Model WK Differential Poppet - Type Relief Valve is specified. If relief valve is not required, the relief port will be plugged "NR".

Machining for the Model J is not the same as that required for the Model WK, therefore these relief valves are not interchangeable.

MISCELLANEOUS OPTIONS

See page 15

SEALS

BUNA-N O-Ring Seals are standard.
Optional Seals:

BUNA-N Quad Ring, No. 2902-001;
Butyl Quad Ring, No. 2816-001

PORT SIZES AND LOCATIONS

STANDARD

NPT pipe ports are furnished unless otherwise specified.

	STANDARD NPT PORTS	OPTIONAL PORT SIZES and LOCATIONS	
		NPT PIPE PORTS	SAE STRAIGHT THREAD PORTS
End Inlet	3/4	none	12
Work Ports (All)	1/2	none	10
End Outlet—when Power Be- yond or Conversion Plug is not specified	3/4	none	12
Optional Location End Out- let—when Power Beyond or Conversion Plug is specified		3/4	10
Top Outlet		3/4	10
Power Beyond Sleeve Outlet		3/4	10
			12

NPT and SAE ports cannot be intermixed in the same valve housing.
All work ports in the same valve housing must be the same.

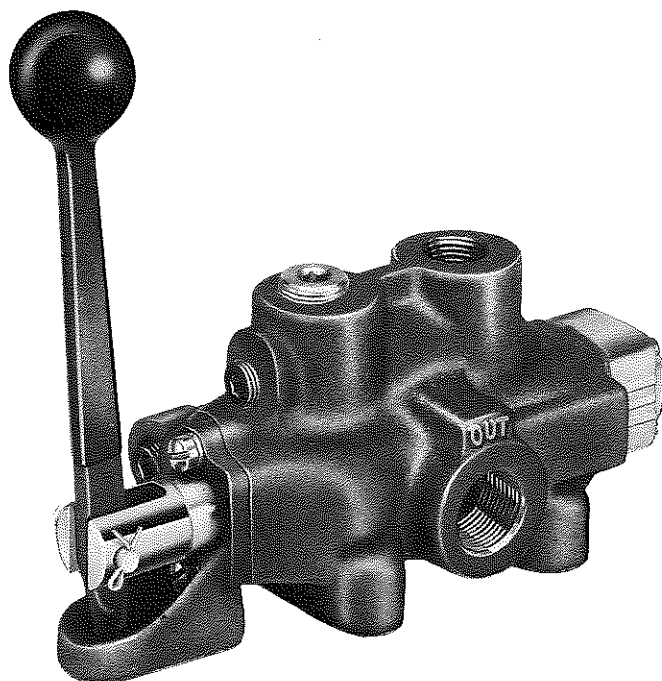


MODEL
300

16 GPM
(Nominal)
2500 PSI

DIRECTIONAL CONTROL VALVE

3-WAY OPERATION



The Model 300 Valve was designed to control a single acting cylinder or a uni-directional hydraulic motor. The spool in this valve is a 3-way, 3-position spool - the 3 positions are Power, Neutral, and Exhaust. "B" Port is always the power port and "A" Port is always plugged.

The Standard Model 300 Valve is spring-centered to neutral position with work port blocked in neutral. Optional spool and spool positioner assemblies are available.

This valve, available in single-spool housing only, is ideal for general mobile and industrial hydraulic applications.

FEATURES

- Built-In Relief Valve, Shim adjustable (optional)
- Replaceable, Hardened Relief Valve Seats
- Built-In Load Check

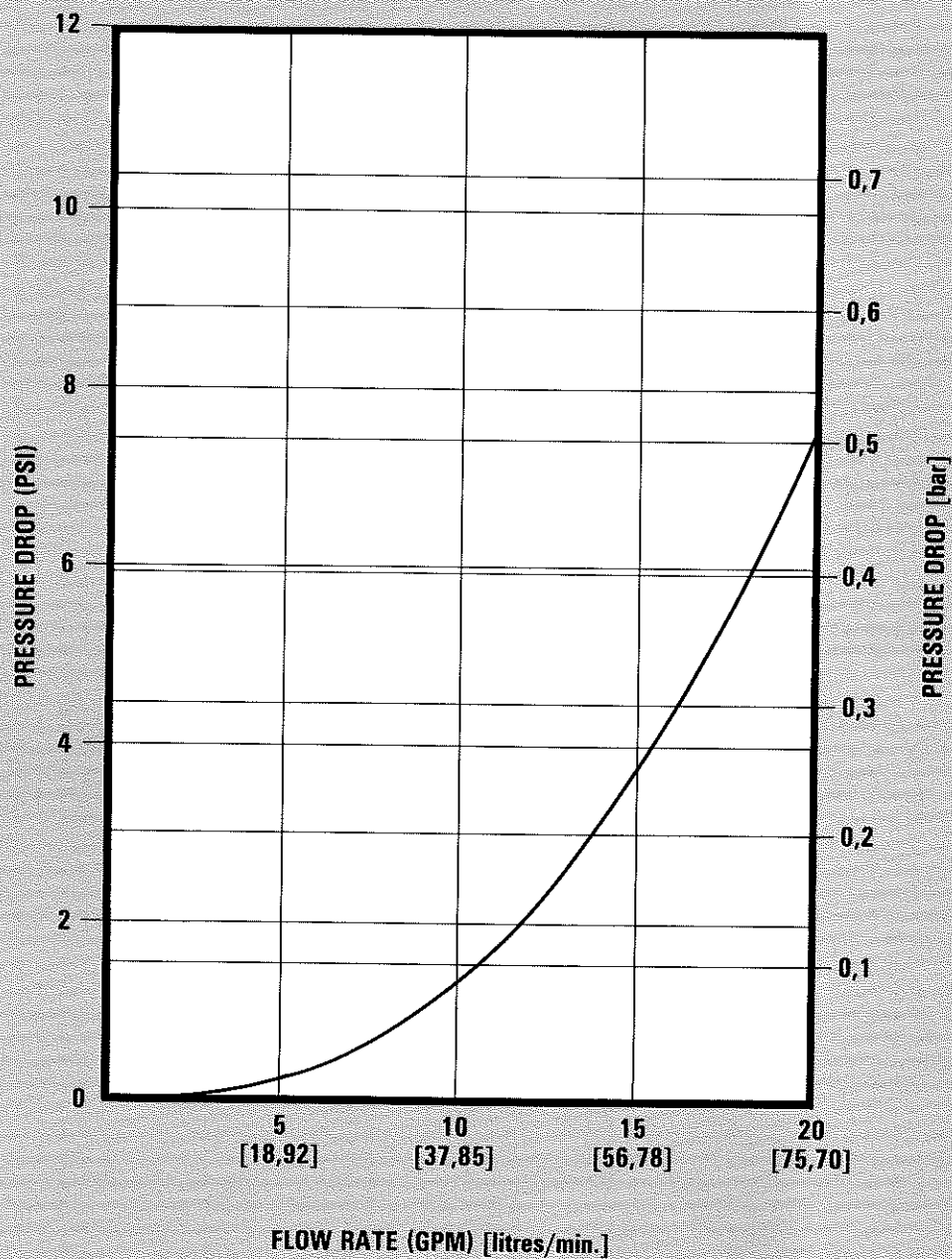
SPECIFICATIONS

SPECIFICATIONS	CAPACITY	MAXIMUM PRESSURE RANGE	SHIPPING WEIGHT
With Standard Non-Adjustable Relief Valve	16 GPM - nominal [60,56 liters/min]	400 to 2500 PSI [27,6 bar to 172,5 bar]	8 1/4 pounds [3.74 kg]
With No Relief Valve (Relief Cavity not Machined)	16 GPM - nominal [60,56 liters/min]	2500 PSI maximum [172,5 bar]	
Maximum Exhaust Core Pressure		1000 PSI maximum* [34,5 bar]	
PORT SIZES	Inlet and Outlet Ports 3/4 NPT Work Ports 1/2 NPT		

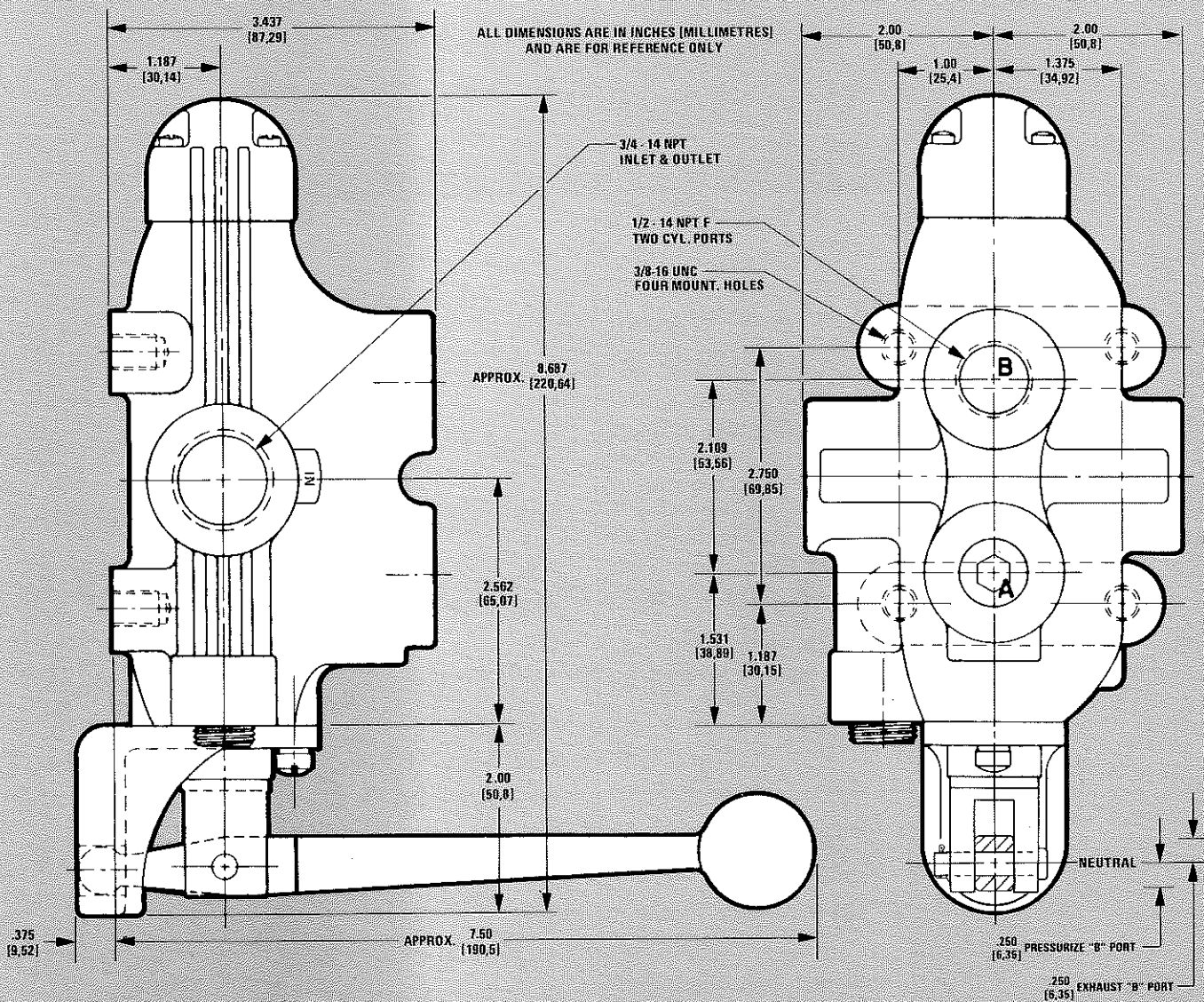
*Valves with exhaust core pressures above 500 PSI may require a heavy spool centering spring.

**TYPICAL PRESSURE DROP THRU OPEN CENTER
WITH STANDARD PORTS**

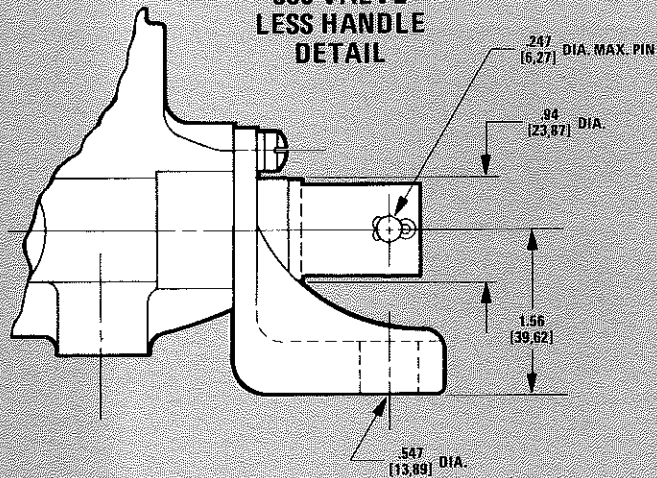
150 SUS [3,65 CENTISTOKES] oil at 100°F



300 DIMENSIONS



**300 VALVE
LESS HANDLE
DETAIL**



ORDERING INSTRUCTIONS (Refer to pages 4 thru 12 for explanation of Code Symbols.)

MODEL NO. 300 - NR - LHO

HANDLE INFORMATION

—	Standard No. 0552-001 Black Plastic Coated Handle and Pin Assembly (Except with Model 320).
LHO	Less Handle Only. Includes Handle Bracket and Pin Assembly.
LCHA	Less Complete Handle, Bracket and Pin Assemblies.

For additional Handle Options, see page 38.

RELIEF VALVE OPTIONS

—	Standard Relief. Specify Relief Valve pressure setting at either crack pressure or at full-flow GPM of system. If not specified, Relief Valves will be set at 1500 PSI at 7.6 GPM.
NR	No Relief Option. (Relief area stamped "NR".)

NOTE: Valves shipped from factory with "NR" option cannot be modified to include relief valve.

MODEL NUMBER	
300	Basic Model. Open Center 3-way control. Work port blocked in neutral. Spring-centered to neutral. See paragraph 8, page 10.
POSITIONER OPTIONS	
310	Same as Model 300 except 3-position detent replaces spring centering. See paragraph 16, page 12.
320	Same as Model 300 except spool is spring-loaded to Spool "OUT" position for cam control. Furnished with spool clevis only, no handle or cam assembly. See paragraph 19, page 13.
SPOOL OPTIONS	
330	Same as Model 300 except for closed center spool. See paragraph 5, page 8.
340	Same as Model 300 except for free-flow motor spool. See paragraph 11, page 11.

Note: A Positioner Option and a Spool Option may be combined in one Valve Assembly.

Example—a free-flow motor spool (Model 340) may be combined with a 3-position detent (Model 310) and should be specified as Model 310-40.

GRESEN®



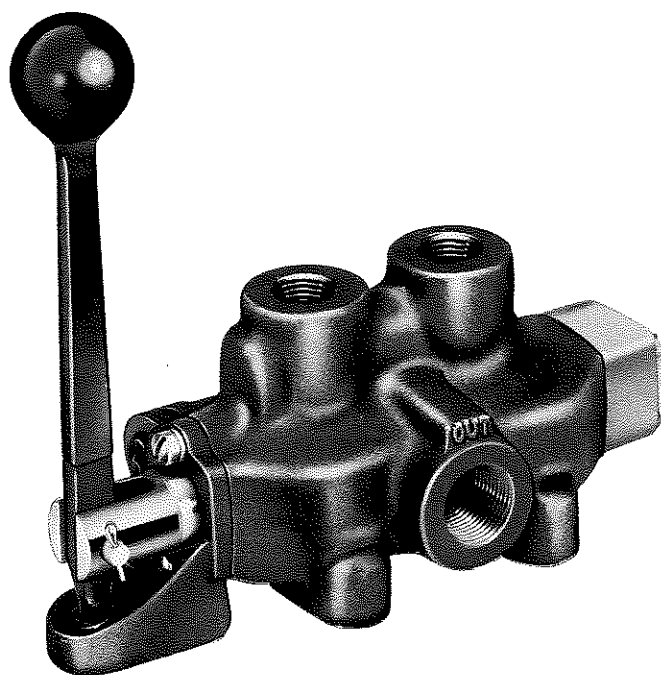
MODEL
400

16 GPM
(Nominal)

2500 PSI

DIRECTIONAL CONTROL VALVE

4-WAY OPERATION



The Model 400 Valve was designed to control a double-acting cylinder or a reversible hydraulic motor. The standard spool for this valve is a 4-way, 3-position spool. The Model 400 Valve cannot be converted to a 3-way valve.

The Model 400 Valve does not have a load check assembly to prevent reverse flow.

The spool is spring-centered to Neutral position with cylinder ports blocked in neutral. Optional spool and spool positioner assemblies are available.

This valve, available in single-spool housing only, is ideal for general mobile and industrial hydraulic applications.

FEATURES

- Built-In Relief Valve, Shim adjustable (optional)
- Replaceable, Hardened Relief Valve Seats

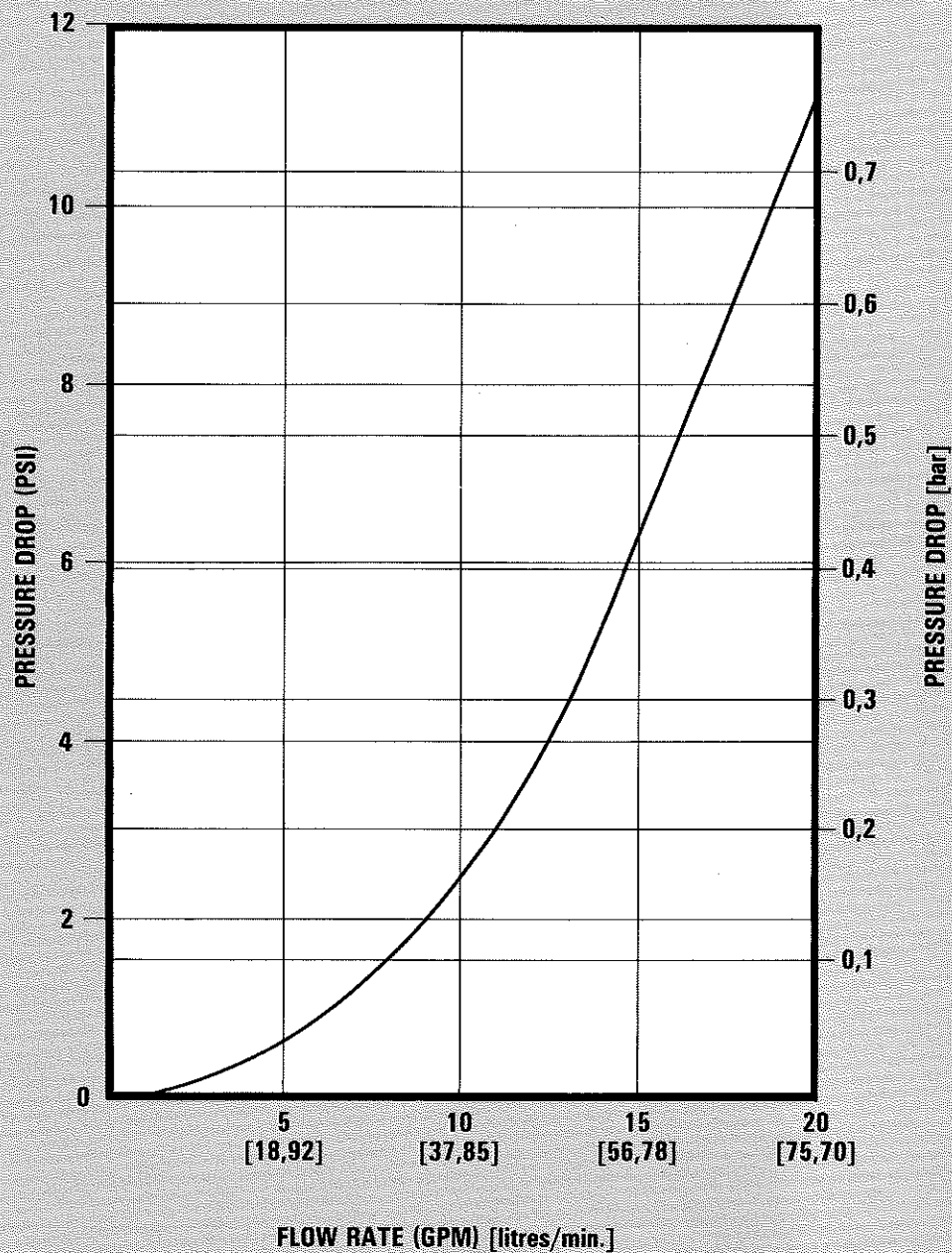
SPECIFICATIONS

SPECIFICATIONS	CAPACITY	MAXIMUM PRESSURE RANGE	SHIPPING WEIGHT
With Standard Non-Adjustable Relief Valve	16 GPM - nominal [60,56 liters/min]	400 to 2500 PSI [27,6 bar to 172,5 bar]	8½ pounds [3,74 kg]
With No Relief Valve (Relief Cavity not Machined)	16 GPM - nominal [60,56 liters/min]	2500 PSI maximum [172,5 bar]	
Maximum Exhaust Core Pressure		1000 PSI maximum* [34,5 bar]	
PORT SIZES	Inlet and Outlet Ports 3/4 NPT Work Ports 1/2 NPT		

*Valves with exhaust core pressures above 500 PSI may require a heavy spool centering spring.

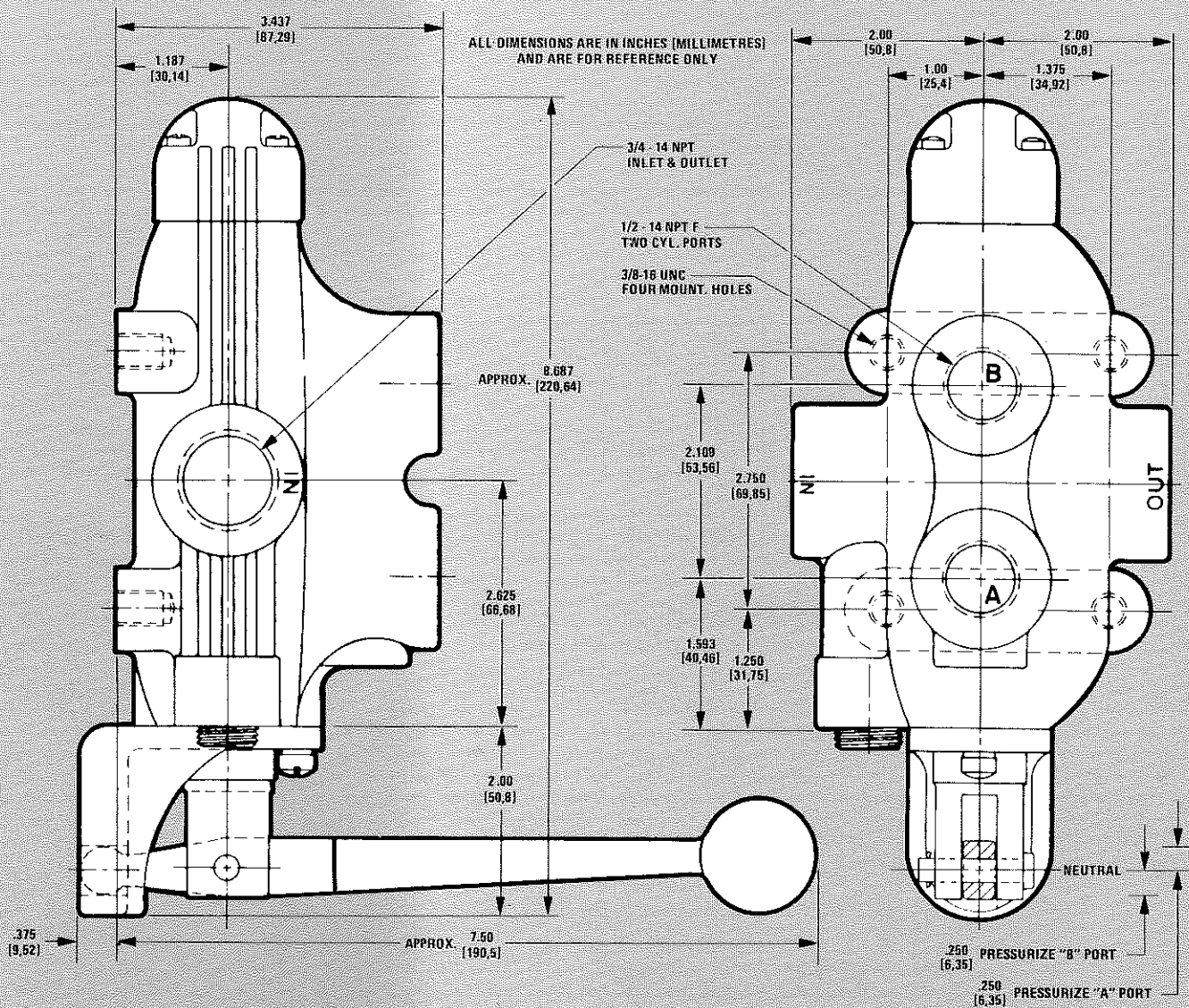
**TYPICAL PRESSURE DROP THRU OPEN CENTER
WITH STANDARD PORTS**

150 SUS [3,65 CENTISTOKES] oil at 100°F

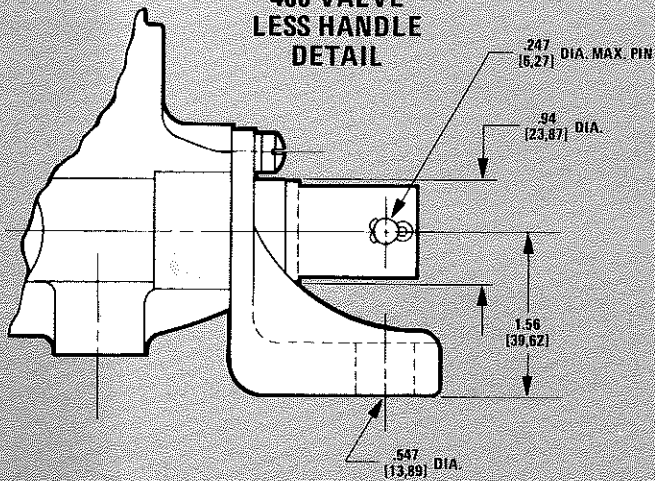


400

DIMENSIONS



**400 VALVE
LESS HANDLE
DETAIL**



ORDERING INSTRUCTIONS (Refer to pages 4 thru 12 for explanation of Code Symbols.)

MODEL NO. 400 - NR - LHO

HANDLE INFORMATION

—	Standard No. 0552-001 Black Plastic Coated Handle and Pin Assembly (Except with Model 420).
LHO	Less Handle Only. Includes Handle Bracket and Pin Assembly.
LCHA	Less Complete Handle, Bracket and Pin Assemblies.

For additional Handle Options, see page 38.

RELIEF VALVE OPTIONS

—	Standard Relief. Specify Relief Valve pressure setting at either crack pressure or at full-flow GPM of system. If not specified, Relief Valves will be set at 1500 PSI at 7.6 GPM.
NR	No Relief Option. (Relief area stamped "NR".)

NOTE: Valves shipped from factory with "NR" option cannot be modified to include relief valve.

MODEL NUMBER

400	Basic Model. Open Center 4-way control. Work ports blocked in neutral. Spring centered to neutral. No load checks. See paragraph 9, page 10.
POSITIONER OPTIONS	
401	Same as Model 400 except return spring omitted for complete manual operation. See paragraph 20, page 13.
410	Same as Model 400 except 3-position detent replaces spring centering. See paragraph 16, page 12.
420	Same as Model 400 except spool is spring loaded to Spool "OUT" position for cam control. Furnished with spool clevis only, no handle or cam assembly. See paragraph 19, page 13.
SPOOL OPTIONS	
430	Same as Model 400 except for closed center spool to stop all flow thru valve when spool is in Neutral position. Normally used with a variable displacement pump. See paragraph 5, page 8.
440	Same as Model 400 except for free-flow motor spool. Both work ports open to tank in Neutral position. See paragraph 11, page 11.

Note: A Positioner Option and a Spool Option may be combined in one Valve Assembly.

Example—a free-flow motor spool (Model 440) may be combined with a 3-position detent (Model 410) and should be specified as Model 410-40.



HANDLE OPTIONS

FOR GRESEN MONOBLOCK DIRECTIONAL CONTROL VALVES

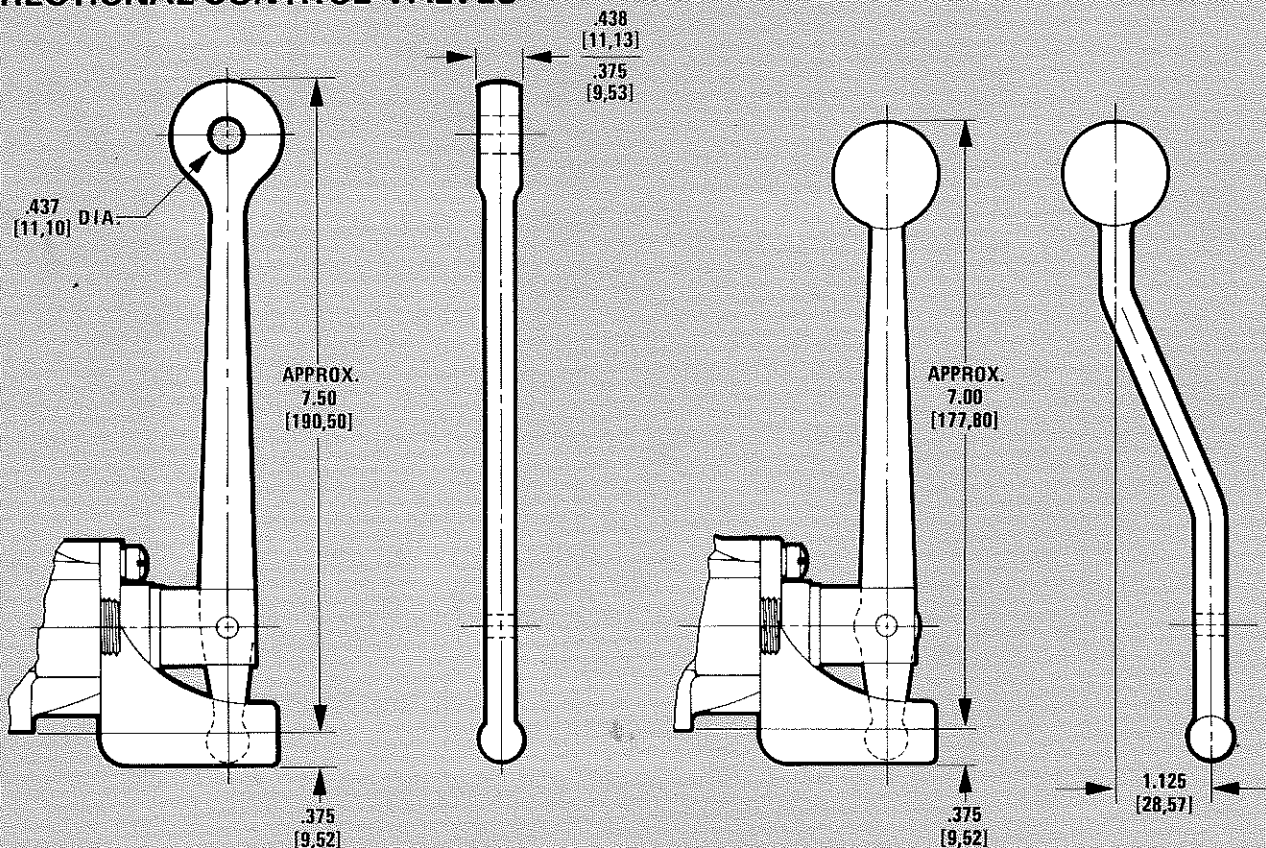
Handle Options are available for certain models of Gresen Directional Control Valves. Standard Handles will be furnished, unless otherwise specified when ordering.

If the bracket, links and pins are required, but not the handle, specify "LHO" — Less Handle Only.

If the complete bracket, handle, link and pins are not required, specify "LCHA" — Less Complete Handle Assembly.

All handles are cast iron with a black plastic coating. Handles can be ordered with plain cast iron as an option.

HANDLE OPTION FOR THE MODELS 300 AND 400 DIRECTIONAL CONTROL VALVES



Optional Handle

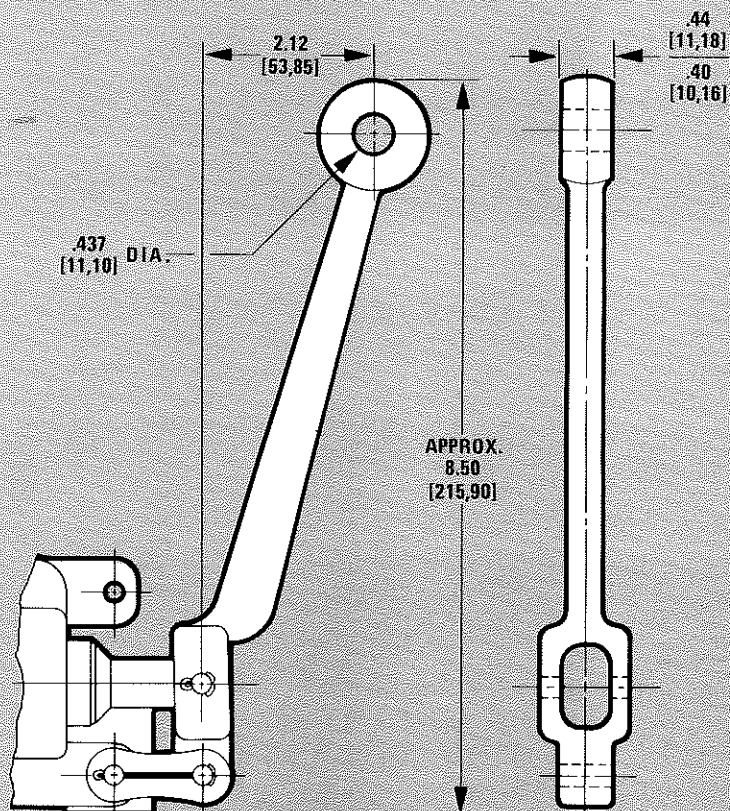
No. 0552-003 Plain handle, not coated
(Not available with black plastic coating)

Optional Handle with offset to left,

No. 0565-001 Black plastic coating
No. 0565-003 Plain handle, not coated (optional)

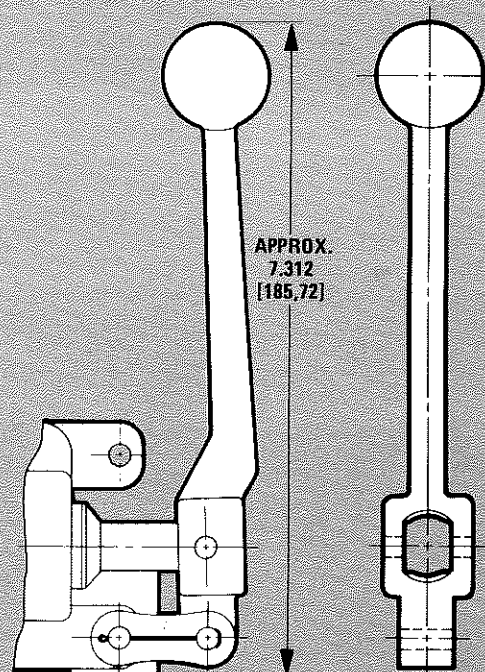
HANDLE OPTIONS FOR THE MODELS SP, SPK AND SSK DIRECTIONAL CONTROL VALVES

HANDLE OPTIONS



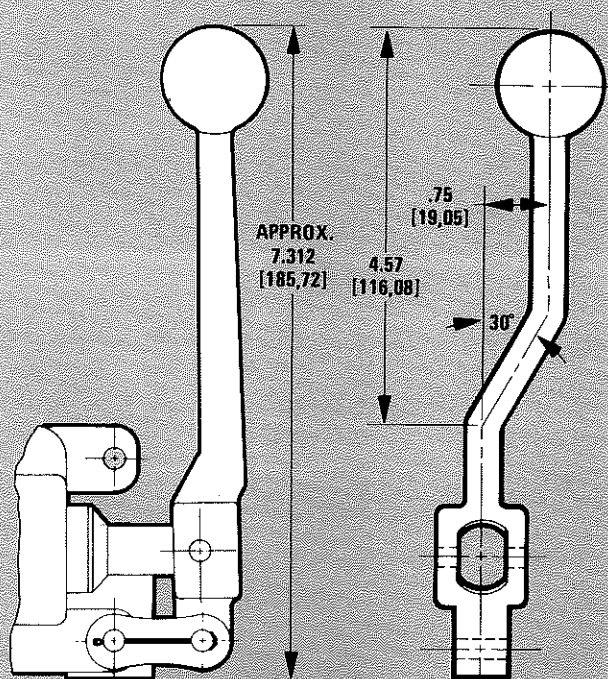
Optional Handle

No. 2580-003 Plain handle, not coated
(Not available with black plastic coating)



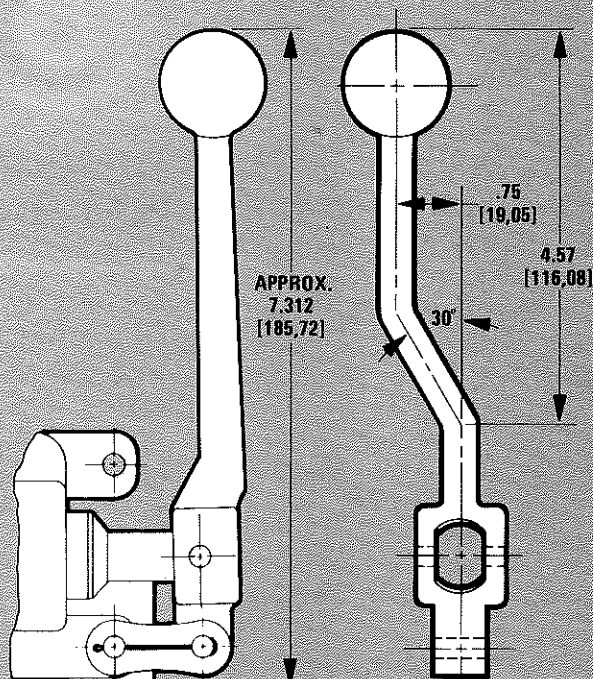
Optional Handle

No. 0902-001 Black plastic coating
No. 0902-003 Plain handle, not coated (optional)



Optional Handle with offset to right,

No. 3461-001 Black plastic coating
No. 3461-003 Plain handle, not coated (optional)



Optional Handle with offset to left,

No. 3462-001 Black plastic coating
No. 3462-003 Plain handle, not coated (optional)



THREAD SIZES

SAE DASH NO.	SAE O-RING PORTS		NPTF PIPE PORTS	
	NOMINAL TUBE SIZE OD	THREAD SIZE	SIZE	THREAD
2	1/8	5/16"-24	1/4	1/4"-18
3	3/16	3/8"-24	3/8	3/8"-18
4	1/4	7/16"-20	1/2	1/2"-14
5	5/16	1/2"-20	3/4	3/4"-14
6	3/8	9/16"-18	1	1"-11-1/2
8	1/2	3/4"-16	1-1/4	1-1/4"-11-1/2
10	5/8	7/8"-14	1-1/2	1-1/2"-11-1/2
12	3/4	1-1/16"-12	2	2"-11-1/2
14	7/8	1-3/16"-12		
16	1	1-5/16"-12		
20	1-1/4	1-5/8"-12		
24	1-1/2	1-7/8"-12		
32	2	2-1/2"-12		

METRIC CONVERSION TABLE

	ENGLISH TO METRIC	METRIC TO ENGLISH
LENGTH	1 inch = 25,4 millimetre (mm)	1 millimetre (mm) = 0.0394 inch
PRESSURE	1 pound per square inch (PSI) = 0,069 bar (gage)	1 bar (gage) = 14.493 pounds per square inch (PSI)
VACUUM	1 inch of mercury (in Hg) = 0,034 bar (a value less than 1.0) at 60° degrees Fahrenheit (°F)	0,1 bar (a value less than 1.0) = 2.94 inches of mercury (in Hg) at 15.6 degrees Celsius (°C)
FLOW	1 gallon per minute (GPM) = 3,785 litres per minute (l/min) 1 gallon per minute (GPM) = 3785 cubic centimetres per minute (cc/min)	1 litre per minute (l/min) = .264 gallons per minute (GPM) 1 cubic centimetre per minute (cc/min) = .000264 gallons per minute (GPM)
FORCE	1 pound _f (lb _f) = 4,44 Newton (N)	1 Newton (N) = .225 pound _f (lb _f)
MASS	1 pound _m (lb _m) = 0,455 kilogram (kg)	1 kilogram (kg) = 2.20 pound _m (lb _m)
TIME	second (s)	second (s)
VOLUME	1 US gallon (gal) = 3,785 litre (l) 1 US gallon (gal) = 3785 cubic centimetres (cc)	1 litre (l) = .264 US gallon (gal) 1 cubic centimetre (cc) = .000264 US gallons (gal)
TEMPERATURE	°C = .556 (°F-32°)	°F = (1.8 x °C)+ 32°
TORQUE	1 pound _f inch (lb _f - in.) = 0,1136 Newton metre (N•m) or joule	1 Newton metre (N•m) or joule = 8.8 pound _f inches (lb _f - in.)
POWER	1 horsepower (HP) = 0.746 kilowatt (kW)	1 kilowatt (kW) = 1.34 horsepower (HP)
SHAFT SPEED	revolutions per minute (RPM)	revolutions per minute (rev/min)
FREQUENCY	1 cycle per second (cps) = 1 Hertz (Hz)	1 Hertz (Hz) = 1 cycle per second (cps)
DISPLACEMENT	1 cubic inch per revolution (cu. in./rev.) = 16,4 cubic centimetres per revolution (cc/rev)	1 cubic centimetre per revolution (cc/rev) = .061 cubic inches per revolution (cu. in./rev.)
VELOCITY	1 foot per second (fps) = 0,305 metre per second (m/s)	1 metre per second (m/s) = 3.28 feet per second (fps)

NOTE: 1 cubic centimetre (cc) = 1 millilitre (ml) = 0.001 litre (l)

WARRANTY & LIMITATION OF LIABILITY

Gresen products are warranted for a period of twelve (12) months from date of shipment from Seller's plant to be free from defects in material and workmanship under correct use, normal operating conditions, and proper application. Seller's obligation under this warranty shall be limited to the repair or exchange, at Seller's option, F.O.B. Seller's factory, of any Gresen product or part which proves to be defective as provided herein. Seller reserves the right to either inspect the product at Buyer's location or require it to be returned to the factory for inspection. The above warranty does not extend to goods damaged, or subjected to accident, abuse, or misuse after shipment from Seller's factory, nor to goods altered or repaired by anyone other than authorized Gresen representatives.

SELLER MAKES NO EXPRESS WARRANTIES OTHER THAN THOSE WHICH ARE SPECIFICALLY DESCRIBED HEREIN. Any description of the goods sold hereunder, including any references to Buyer's specifications and any descriptions in catalogs, circulars and other written material published by Seller is for the sole purpose of identifying such goods and shall not create an express warranty that the goods shall conform to such description. Any sample or model is for illustrative purposes only and shall not create any express warranty that the goods shall conform to the sample or model. **BUYER IS SOLELY RESPONSIBLE FOR DETERMINING THE SUITABILITY OF GOODS SOLD HEREUNDER FOR USE BY BUYER.**

This Warranty is expressly in lieu of all other warranties expressed or implied. There are no implied warranties of merchantability or fitness for a particular purpose. This Warranty states Seller's entire and exclusive liability and Buyer's exclusive remedy for any claim for damages in connection with the sale or furnishings of Gresen products, their design, suitability for use, installation or operation, or for any claimed defects therein. Seller will in no event be liable for any incidental or consequential damages whatsoever, nor for any sum in excess of the price received for the goods for which liability is claimed.

Gresen Manufacturing Company reserves the right to discontinue, modify or revise the specifications for the products described herein. All specifications are approximate and may vary depending upon installation. All metric conversions herein have been rounded off to the nearest decimal or whole number for clarity and expediency.



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