VPL PROPORTIONAL VALVE

Installation Instructions

This enclosure is provided to assist in installation, start-up and initial operation of the PULSAR™ VPL Series proportional valve. The valve has been stacked, tested, capped, and carefully packed to ensure a clean, operation-ready condition.

INSTALLATION COMMENTS

- Allow port caps to remain in place until hoses and other hook-ups have been prepared.
- The valve can be mounted in any position, however, additional attention should be given to start-ups where the orientation is other than with the mounting feet in a horizontal plane. In these cases refer to Fluid Power Systems Product Advisory 033.
- The mounting surface must be sufficiently flat to avoid excessive distortion upon tightening. Four (4) mounting holes are provided.
- **Handling Care**–Do not handle the valve stack by the solenoids or wires. The valves should be handled by the inlet/outlet valve bodies. Handling improperly will destroy solenoids.

CAUTION: The VP Series Pulsar™ valve is available in 12 volt or 24 volt solenoids. The Pulsar™ Solenoid is compatible with only the appropriate 12 volt or 24 volt peak-to-peak, 33 Hertz, pulse-width modulated controller signal output. If there is any question regarding a particular controller, contact Fluid Power Systems or your Fluid Power Systems representative.

RECOMMENDED PRACTICE

Successful start-up and function of a hydraulic system are often dependent on the quality of its installation. Following are some basic installation recommendations.

Cleanliness

- Installation operations such as cutting, threading, flaring result in debris. Care should be taken to prevent such debris from contaminating the system.
- All hoses should be flushed with appropriate degreasing solution prior to installation. Tubing may be blown out with compressed air or flushed.
- Take care that sealing components are not able to enter the hydraulic system. Do not apply teflon tape to the first few connector threads.
- Be sure hydraulic oil is clean before adding it to the system.
- If there is no high-pressure filter installed preceding the valve, it is recommended upon start-up that the valve supply line be connected directly to the return line, thereby avoiding the valve, for several minutes to allow the newly added oil to pass through the return line filter.

Hoses and Lines

- For maximum efficiency, hydraulic lines should be sufficiently large in diameter, yet short in length as possible. Avoid bends, keep the number of fittings to a minimum, and otherwise limit restrictions.
- For load sensing circuits, restrict the length of the sense line returned to the pump. Use as short a load sense line as possible.
- Provide sufficient slack in flexible hoses to relieve potential strain, while allowing kink-free movement throughout the machine range.
- Safeguard hoses from rubbing and avoid potential hot spots; install protective sheathing or insulation where necessary.
- Provide support for hydraulic lines which become necessarily long. Vibrating lines are capable of loosening sufficiently to produce leaks.
- Leakage at the inlet side of the pump cannot be allowed. Air which enters the system here can be responsible for an assortment of system difficulties.

HYDRAULIC

Hydraulic Oil Specifications

Fluid Power Systems recommends petroleum based hydraulic oil with 150 SUS (32 cSt) at 100 degrees F (38°C). However, specific operating conditions may influence the final petroleum base selection.

Viscosity range: 1500 to 30 SUS (323 to 1.1 cSt)
Temperature range: –40 to 250°F (–40 to 121°C)

- Oil filtration of SAE Class 5 (ISO 17/14) is recommended for hydraulic systems using the VPL valve. The high response option requires 10 micron, nominal. Additional filtration for the pilot stage is contained within the inlet section.
- For valve stacks equipped with the high response option, install a **separate** external drain line from the valve to tank to provide sufficient drainage.
- If load sensing will not be used, plug the allotted port on the inlet section.
- If shuttle port on outlet has a shipping plug, then this port must be connected to another valve or vented back to tank.

CAUTION: For hydraulic circuits employing load sensing **and** incorporating fluid logic from other component valves, verify their compatibility. The VPL Series valve sections use a **free-floating ball** shuttle and will ONLY be compatible with valves using this shuttle style.

NOTE: The VPL Series valve spool is designed to meter flow in and out of the section. To take advantage of this meter out capability, route the return line from the actuator back through the valve then to tank. This is beneficial in cases of those of a 4-way motorfunction where the motor shaft freewheels. Higher differential cylinder return flow must be connected to the C_2 port for lowest pressure drop.

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Hydraulic Valve Division

ELECTRICAL

- It is reemphasized that appropriate pulse-width modulated excitation MUST be provided for proportional flow control. If there is any question as to whether a particular controller satisfies this requirement, please contact Fluid Power Systems or a Fluid Power Systems representative.
- Solenoid coil current draw is less than 500 mA, however a minimum of 18 GA wire is recommended for strength and durability.
- There is no polarity requirement and special shielding is usually not required.

CAUTION: No more than two (2) coils should be wired to a common ground.

Controller Adjustment Procedure

The purpose in adjusting the controller is to obtain effective metering throughout the range of the control stick. This is achieved by adjusting the two potentiometers (trim pots) on the controller.

- The "Deadband" is the minimum flow adjustment. It sets the first flow point, thereby compensating for mechanical deadband. Turned slightly clockwise (CW), it sets a minimum voltage just below the valve's first flow point. This ensures the valve will start flow soon after the controller is displaced, and will shut off when returned to neutral.
- The other pot sets the "Max. Output." It determines the control stick position where maximum valve flow rate is achieved. This adjustment varies the rate of change in flow compared to controller displacement. When properly adjusted, maximum flow through the valve coincides with full control stick displacement.

Since numerous adjustment combinations of the trim pots are possible, it is important to obtain the adjustment that corresponds to the flow range of the valve. This optimum adjustment is achieved by the following procedure:

1) Set the controller to a position approximately 5 degrees from the neutral position.
2) Turn the Deadband pot sufficiently to permit first flow. Clockwise (CW) increases flow, counterclockwise (CCW) reduces flow.
3) Actuate the controller to full displacement, approximately 30 degrees.
4) Turn the Max. Output pot to just permit maximum needed flow. CW increases, CCW reduces flow. Care should be taken to ensure that the trim pot is not rotated past full flow. If turned too high, full flow will be reached at a lesser control position and some controllability will be lost.
5) Return the controller to neutral. The valve should turn off, no flow.
6) If some flow occurs, the Deadband pot should be turned down CCW a very small amount until flow ceases.

With installation complete, it is possible to proceed with a system check.

SYSTEM START-UP CHECK

The following check is suggested to identify and eliminate inferior operating conditions capable of preventing successful start-up.

Electrical Circuit — Wire Check

Visually inspect all wires and connectors. Correct signs of loose or impeded connections as well as any exposed or severely crimped wires. Include the following:

1) Power supply connection and ground.
2) Power cable and connectors from power source to joystick controller.
3) Power cable and connectors between joystick controller and valve cartridges/coils.

NOTE: Electrically-related problems are often traced to contaminated connectors. To avoid this, clean both leads with an appropriate contact cleaner containing a de-greasing agent if possible. This precaution can avoid wrongly identifying an electrical component(s) as faulty.

Hydraulic Circuit — Line Check

Inspect hydraulic lines and connections for signs of looseness or obstruction. Tighten loose fittings and correct any crimped hoses or tubes, including as follows:

1) From pump, to valve stack.
2) For load sensing circuits, check sense line to pump.
3) Lines between valve stack and reservoir.
4) All hoses to actuators, i.e., cylinders, motors.
5) Tie-downs of hoses and tubing.

For valve stacks containing sections equipped with the manual override option, it is possible to test hydraulic operation manually. As the manual override lever is rotated away from the valve stack, oil leaves the section through the C_2 cylinder port (farside). The farther the lever is displaced, the greater the flow rate. Resulting operation should be free from irregular or abrupt motions. When operation of each eligible section in the stack has been checked in this manner, the system is ready for electrohydraulic actuation.

NOTE: Entrapped air in hydraulic lines is common upon start-up and may result in temporary irregular motion. Cycling the valve both manually and electrically will aid in speeding up the purging of entrapped air. However, if this condition persists after a reasonable operating period, hydraulic lines should be carefully inspected for leaks, starting with the pump suction line.

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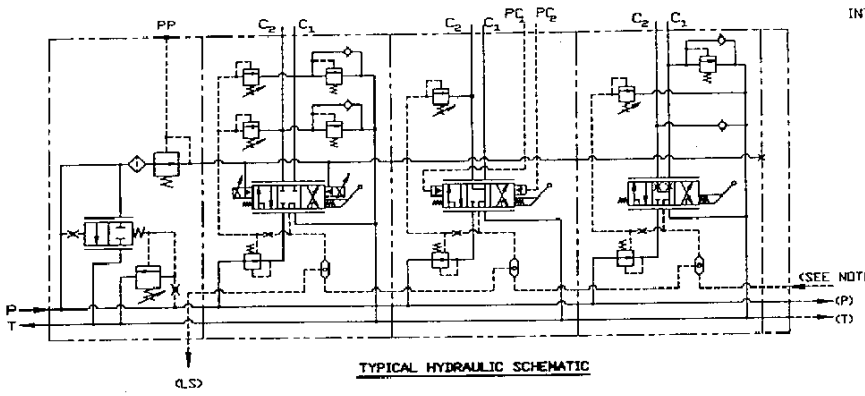
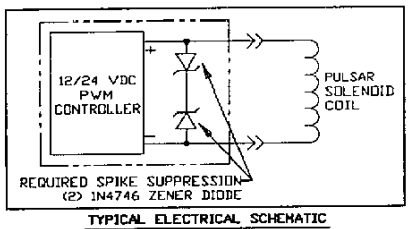


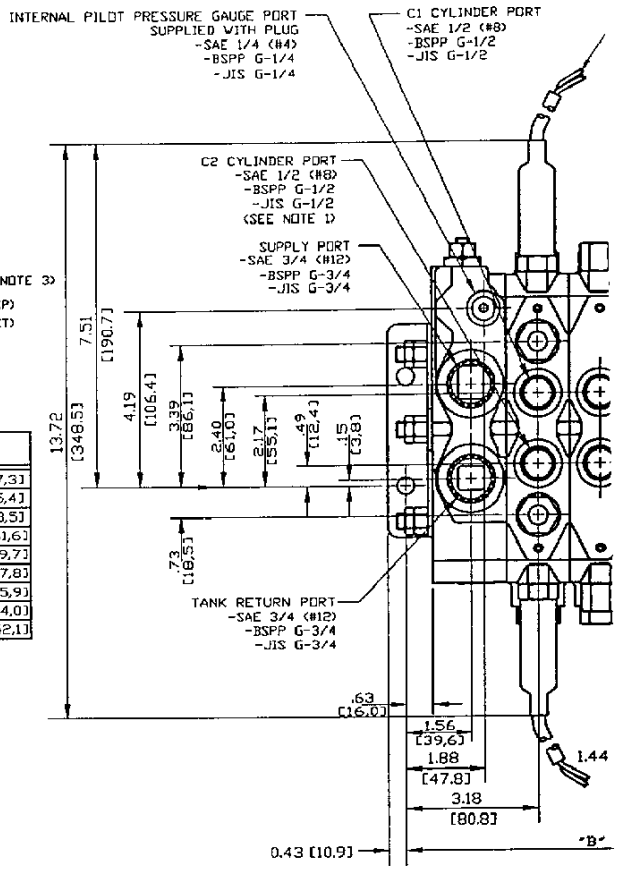
TYPICAL HYDRAULIC SCHEMATIC

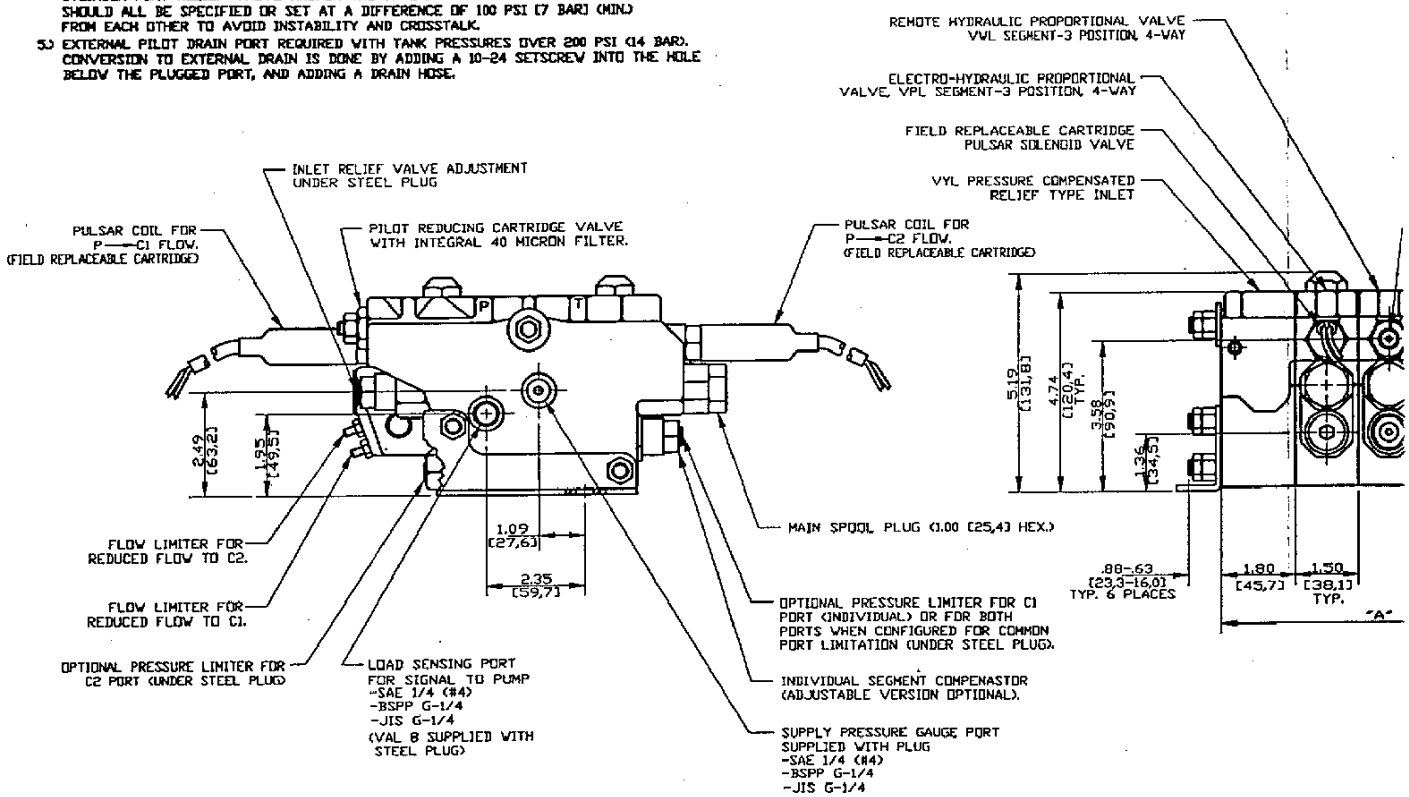


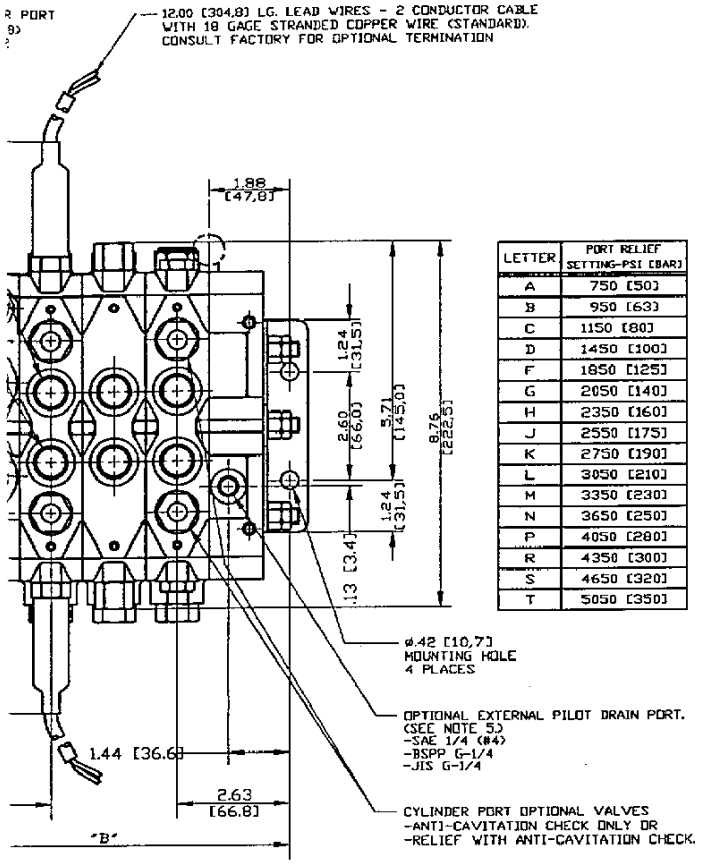
TYPICAL ELECTRICAL SCHEMATIC

NUMBER OF SEGMENTS	"A"	"B"
1	4.55 [115,5]	5.80 [147,3]
2	6.05 [153,6]	7.30 [185,4]
3	7.55 [191,7]	8.80 [223,5]
4	9.05 [229,8]	10.30 [261,6]
5	10.55 [267,9]	11.80 [299,7]
6	12.05 [306,0]	13.30 [337,8]
7	13.55 [344,1]	14.80 [375,9]
8	15.05 [382,2]	16.30 [414,0]
9	16.55 [420,3]	17.80 [452,1]

NOTES:
1) RECOMMEND HIGHER DIFFERENTIAL CYLINDER RETURN FLOW TO BE CONNECTED TO THE C2 PORT FOR LOWEST PRESSURE DROP.
2) IDENTIFICATION MARKED AS: FLOW (IN GPM)/CYLINDER PORT CONFIGURATION (VOC=VENTED OPEN, CC=CLOSED, OCO=OPEN (MOTOR)).
3) THE OPTIONAL SHUTTLE PORT IS USED TO BRING IN ANY EXTERNAL LOAD SENSING SIGNAL FROM OTHER CIRCUITS. THIS PORT ALLOWS ANOTHER VALVE STACK TO BE CONNECTED FOR SINGLE LOAD SENSING OUTPUT TO THE PUMP AND ELIMINATES THE NEED FOR AN EXTERNAL SHUTTLE VALVE.
4) THE PRESSURE SETTINGS BETWEEN THE SYSTEM'S MAIN RELIEF VALVE, A FUNCTION'S CYLINDER PORT RELIEF VALVE AND/OR THE SAME FUNCTION'S PRESSURE LIMITER SHOULD ALL BE SPECIFIED OR SET AT A DIFFERENCE OF 100 PSI [7 BAR] (MIN.) FROM EACH OTHER TO AVOID INSTABILITY AND CROSSTALK.
5) EXTERNAL PILOT DRAIN PORT REQUIRED WITH TANK PRESSURES OVER 200 PSI (14 BAR). CONVERSION TO EXTERNAL DRAIN IS DONE BY ADDING A 10-24 SETSCREW INTO THE HOLE BELOW THE PLUGGED PORT, AND ADDING A DRAIN HOSE.







LETTER	PORT RELIEF SETTING-PSI [BAR]
A	750 [50]
B	950 [63]
C	1150 [80]
D	1450 [100]
F	1850 [125]
G	2050 [140]
H	2350 [160]
J	2550 [175]
K	2750 [190]
L	3050 [210]
M	3350 [230]
N	3650 [250]
P	4050 [280]
R	4350 [300]
S	4650 [320]
T	5050 [350]

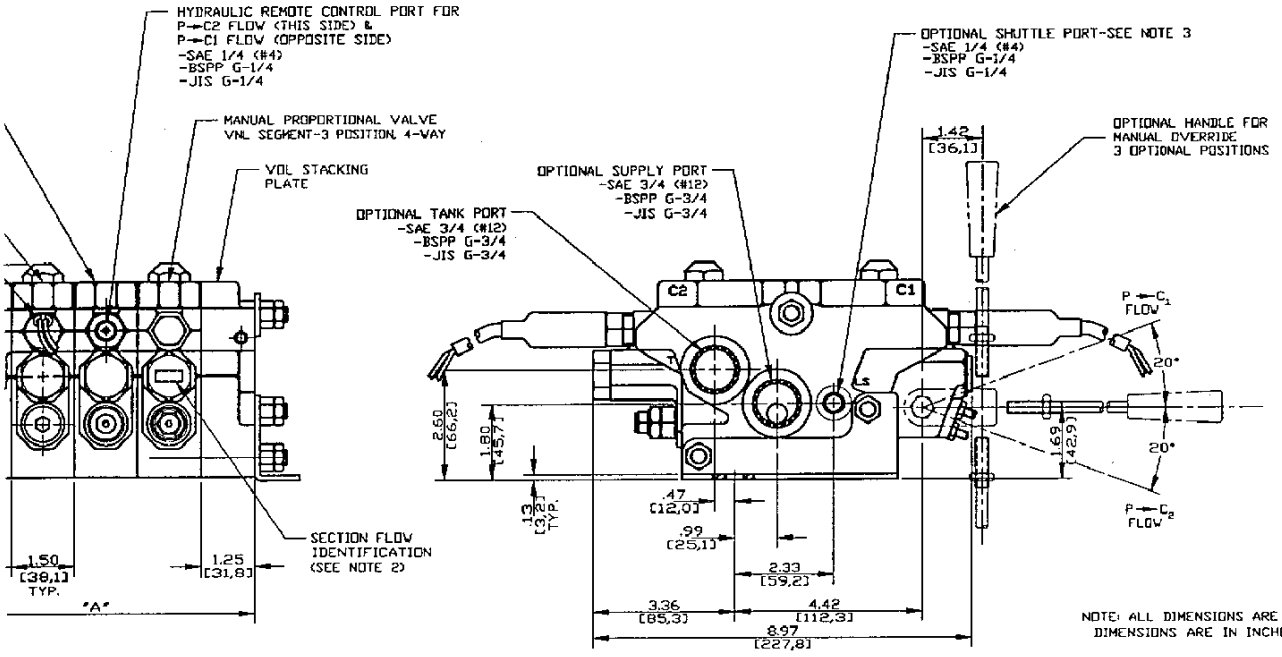
SPECIFICATIONS

HYDRAULIC

OPERATING PRESSURE:	
PRESSURE SUPPLY PORTS	5000 PSI [350 BAR]
CYLINDER PORTS	5800 PSI [400 BAR]
TANK PORTS	200 PSI [14 BAR]
PILOT SUPPLY PRESSURE	210 PSID [14,5 BAR] FROM PP→T (VPL/VQL)
	350 PSID [24,1 BAR] FROM PP→T (VWL)
INLET RELIEF VALVE SETTING	500-5000 PSI [35-343 BAR] (SEE NOTE 4)
CYLINDER PORT RELIEF SETTING	SEE TABLE (SEE NOTE 4)
A.C. CHECK CRACKING PRESSURE	LESS THAN 7 PSI [0,5 BAR]
PRESSURE LIMITER LOAD SETTING	500-4800 PSI [35-329 BAR] (SEE NOTE 4)
PRESSURE SETTING TOLERANCE	(-30/+100 PSI [-0/+7 BAR]
MAXIMUM INLET FLOW	30 GPM [190 L/MIN.]
SPOOL FLOW RATINGS	1.3 TO 30 GPM [5 TO 114 L/M.]
SPOOL CONFIGURATIONS	2 POS, 2 WAY (P→C1)
	2 POS, 4 WAY (P→C1, C2→T)
	3 POS, 3 WAY (P→C1 & C1→T)
	3 POS, 4 WAY
CYLINDER PORT CONFIGURATIONS	VENTED OPEN, CLOSED, OPEN (MOTOR), OR
	CLOSED (C1) & VENTED OPEN (C2)
SPOOL DEADBAND	25% OF STROKE
REMOTE HYDRAULIC DEADBAND	80 PSI [5,5 BAR]
REMOTE HYDRAULIC FULLSTROKE	220 PSI [15,2 BAR]
ELECTRICAL DEADBAND (FROM NULL)	33% ±11% MODULATION RATIO
DEADBAND SYMMETRY	±5% OF MODULATION RATIO
CYLINDER LEAKAGE (PER PORT)	0.006 GPM [20 mL/MIN] AT 1000 PSI [69 BAR]
NEUTRAL LEAKAGE (PER SECTION)	0.003 GPM [10 mL/MIN] AT 200 PSI [14 BAR]
RECOMMENDED FILTRATION	SAE CLASS 5 (17/14 - ISO 4406)
FLUID VISCOSITY RANGE	1500-30 SUS [323-1.1 cSt]
MAXIMUM FLUID TEMPERATURE	250°F [121°C]
AMBIENT TEMPERATURE RANGE	-40°F TO 190°F [-40°C TO 88°C]
STEP RESPONSE (0% TO 100%)	300 MILLISECONDS
(100% TO 0%)	150 MILLISECONDS
SEAL MATERIAL	BUNA-N (STANDARD)
MOUNTING ATTITUDE	UNRESTRICTED
WEIGHT (APPROX.)	7.0 LBS. [3,2 KG] (STACKING PLATE)
	10.0 LBS. [4,5 KG] (WORK SEGMENT)
	10.0 LBS. [4,5 KG] (INLET VALVE)

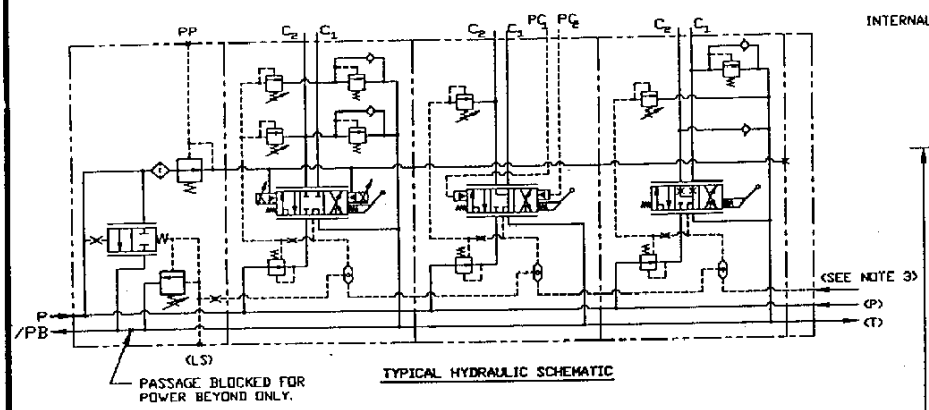
ELECTRICAL

RATED OPERATING VOLTAGES PULSAR	12±3 VDC
	24±3 VDC
COIL RESISTANCE (12VDC) PULSAR	2.8.0 OHMS @ 70°F [21°C]
(24VDC) PULSAR	65.0 OHMS @ 70°F [21°C]
CURRENT DRAW PULSAR	430 mA AT 12 VDC & 70°F [21°C]
	370 mA AT 24 VDC & 70°F [21°C]
PWM FREQUENCY PULSAR	33 HZ (SQUARE WAVE)

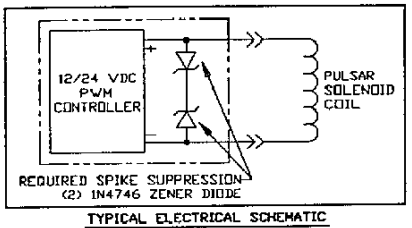


NOTE: ALL DIMENSIONS ARE NOMINAL. DIMENSIONS ARE IN INCHES [MM]

VAL6 * — ***4 — ***
VAL8 *** — ***4 — ***
LOW FLOW VALVE STACK WITH L.S. RELIEF INLET FOR VARIABLE VOLUME PUMP**



TYPICAL HYDRAULIC SCHEMATIC



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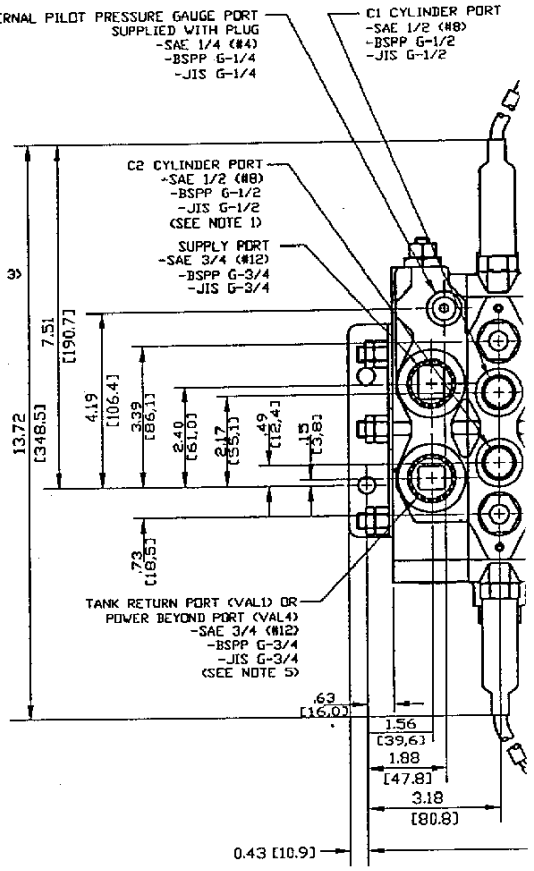

NOTES:
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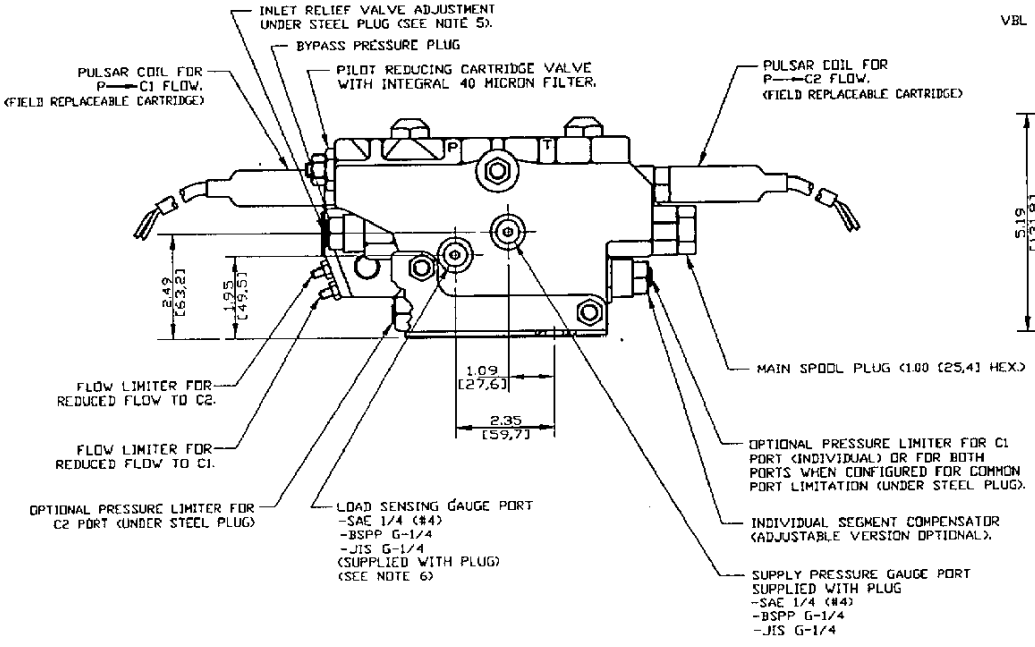
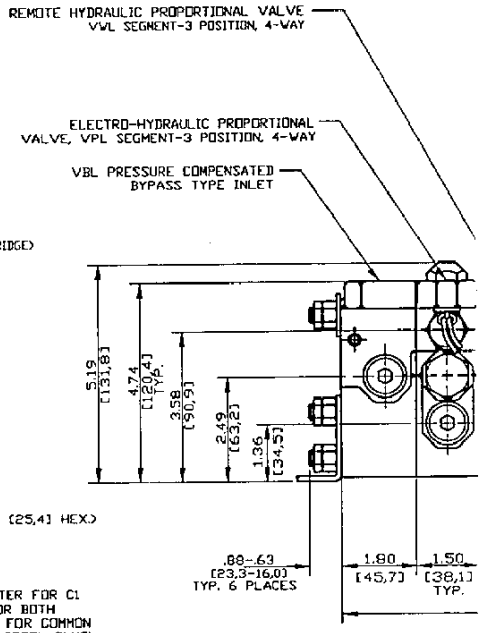
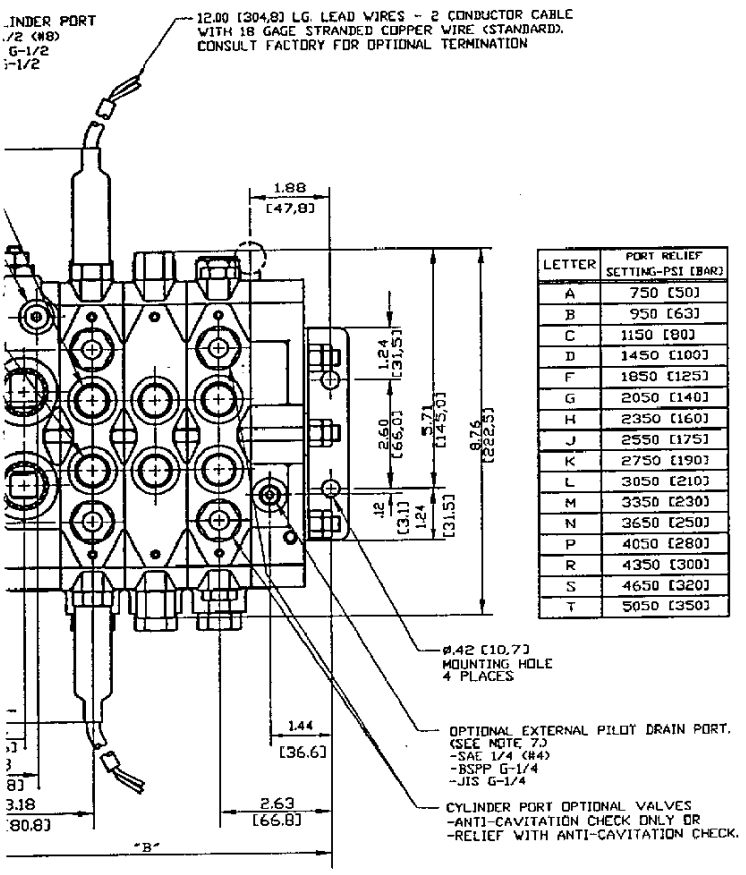
2.) IDENTIFICATION MARKED AS: FLOW (IN GPM)/CYLINDER PORT CONFIGURATION (VOC=VENTED OPEN, CC=CLOSED, OCOM=OPEN CMOTOR).
3.) THE OPTIONAL SHUTTLE PORT IS USED TO BRING IN ANY EXTERNAL LOAD SENSING SIGNAL FROM OTHER CIRCUITS. THIS PORT ALLOWS ANOTHER VALVE STACK TO SHARE ONE COMMON INLET AND ELIMINATES THE NEED FOR AN EXTERNAL SHUTTLE VALVE.
4.) THE PRESSURE SETTINGS BETWEEN THE SYSTEM'S MAIN RELIEF VALVE, A FUNCTION'S CYLINDER PORT RELIEF VALVE AND/OR THE SAME FUNCTION'S PRESSURE LIMITER SHOULD ALL BE SPECIFIED OR SET AT A DIFFERENCE OF 100 PSI (7 BAR) MIN.) FROM EACH OTHER TO AVOID INSTABILITY AND CROSSTALK.
5.) A SEPERATE EXTERNAL RELIEF VALVE IS REQUIRED FOR A POWER-BEYOND CIRCUIT, TO ALLOW FOR RELIEF PROTECTION WHEN A VALVE DOWNSTREAM OF THE POWER-BEYOND PORT IS BEING USED.
6.) IF A DEADMAN OPERATION IS REQUIRED, REMOVE THE LOAD SENSING PLUG AND VENT THE PORT TO TANK DURING THE DEADMAN CONTROL. A VALVE TO BLOCK THE LINE FROM VENTING IS REQUIRED TO BUILD UP LOAD PRESSURE AND MUST BE MOUNTED CLOSE TO THE PORT.
7.) EXTERNAL PILOT DRAIN PORT REQUIRED WITH TANK PRESSURES OVER 200 PSI (14 BAR). CONVERSION TO EXTERNAL DRAIN IS DONE BY ADDING A 10-24 SETSCREW INTO THE HOLE BELOW THE PLUGGED PORT, AND ADDING A DRAIN HOSE.







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B	950 [63]
C	1150 [80]
D	1450 [100]
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M	3350 [230]
N	3650 [250]
P	4050 [280]
R	4350 [300]
S	4650 [320]
T	5050 [350]

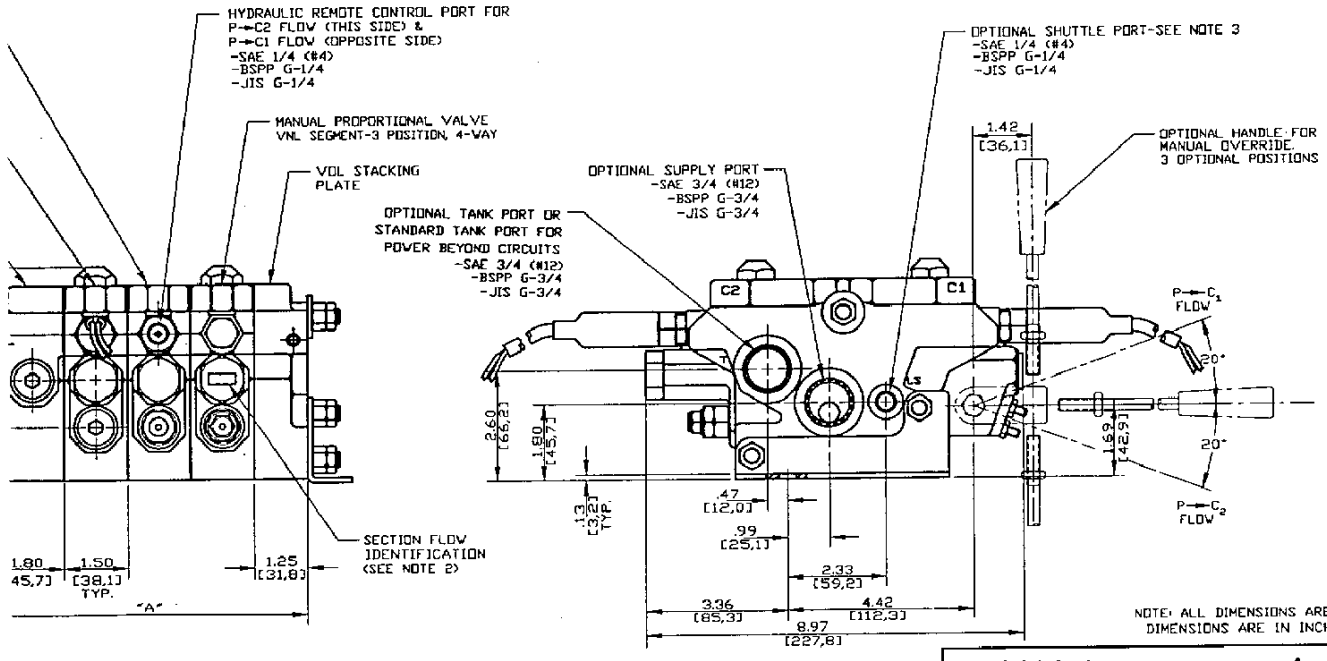
SPECIFICATIONS

OPERATING PRESSURE:
- PRESSURE SUPPLY PORTS - - - - - 5000 PSI [350 BAR]
- CYLINDER PORTS - - - - - - - - - - 5800 PSI [400 BAR]
- TANK PORTS - - - - - - - - - - - 200 PSI [14 BAR]
- POWER BEYOND PORT- - - - - - - - - 4000 PSI [280 BAR] (VAL4)

PILOT SUPPLY PRESSURE - - - - - - - 210 PSID [14,5 BAR] FROM PP—►T (VPL/VQL)
350 PSID [24,1 BAR] FROM PP—►T (VVL)
PRESET BYPASS PRESSURE - - - - - - 215 PSID [14,8 BAR] FROM P—►T (MIN.) @ 4GPM
INLET RELIEF VALVE SETTING - - - - 500-5000 PSI [35-343 BAR] (SEE NOTE 4)
CYLINDER PORT RELIEF SETTING - - - - SEE TABLE (SEE NOTE 4)
A.C. CHECK CRACKING PRESSURE - - - LESS THAN 7 PSI [0,5 BAR]
PRESSURE LIMITER LOAD SETTING - - - 500-4800 PSI [35-329 BAR] (SEE NOTE 4)
PRESSURE SETTING TOLERANCE - - - - (-)0/+100 PSI [-0/+7 BAR]
MAXIMUM INLET FLOW - - - - - - - - 50 GPM [190 L/MIN.]
SPOOL FLOW RATINGS - - - - - - - - 1.3 TO 30 GPM (5 TO 114 L/M.)
SPOOL CONFIGURATIONS - - - - - - - - 2 POS. 2 WAY (P—►C1)
2 POS. 4 WAY (P—►C1, C2—►T)
3 POS. 3 WAY (P—►C1 & C1—►T)
3 POS. 4 WAY
CYLINDER PORT CONFIGURATIONS - - - - VENTED OPEN, CLOSED, OPEN (MOTOR), OR CLOSED (C1) & VENTED OPEN (C2)
SPOOL DEADBAND - - - - - - - - - - - 25% OF STROKE
REMOTE HYDRAULIC DEADBAND - - - - 80 PSI [5,5 BAR]
REMOTE HYDRAULIC FULLSTROKE - - - 220 PSI [15,2 BAR]
ELECTRICAL DEADBAND (FROM NULL) - - 33% ±11% MODULATION RATIO
DEADBAND SYMMETRY - - - - - - - - ±5% OF MODULATION RATIO
CYLINDER LEAKAGE (PER PORT)- - - - 0.006 GPM [20 ml/MIN] AT 1000 PSI [69 BAR]
NEUTRAL LEAKAGE (PER SECTION)- - - 0.003 GPM [10 ml/MIN] AT 200 PSI [14 BAR]
RECOMMENDED FILTRATION - - - - - - - SAE CLASS 5 (17/14 - ISO 4406)
FLUID VISCOSITY RANGE - - - - - - 1500-30 SUS [323-1.1 cSt]
MAXIMUM FLUID TEMPERATURE - - - - 250°F [121°C]
AMBIENT TEMPERATURE RANGE - - - -40°F TO 190°F [-40°C TO 88°C]
STEP RESPONSE (0% TO 100%) - - - - 300 MILLISECONDS
(100% TO 0%) - - - - 150 MILLISECONDS
SEAL MATERIAL - - - - - - - - - - - BUNA-N (STANDARD)
MOUNTING ATTITUDE - - - - - - - - - - UNRESTRICTED
WEIGHT (APPROX.)- - - - - - - - - - - 7.0 LBS. [3,2 KG] (STACKING PLATE)
10.0 LBS. [4,5 KG] (WORK SEGMENT)
10.0 LBS. [4,5 KG] (INLET VALVE)

ELECTRICAL

RATED OPERATING VOLTAGES PULSAR - - - - 12±3 VDC
24±3 VDC
COIL RESISTANCE (12VDC) PULSAR - - 2.8.0 OHMS @ 70°F [21°C]
(24VDC) PULSAR - - 65.0 OHMS @ 70°F [21°C]
CURRENT DRAW PULSAR - - - - - - - - 430 mA AT 12 VDC & 70°F [21°C]
370 mA AT 24 VDC & 70°F [21°C]
PWM FREQUENCY PULSAR- - - - - - - - - 33 HZ, (SQUARE WAVE)



NOTE: ALL DIMENSIONS ARE NOMINAL. DIMENSIONS ARE IN INCHES [MM]

VAL1 * — ***4 — ***
VAL4 *** — ***4 — ***
LOW FLOW VALVE STACK WITH P.C. BYPASS INLET FOR FIXED PUMP**