

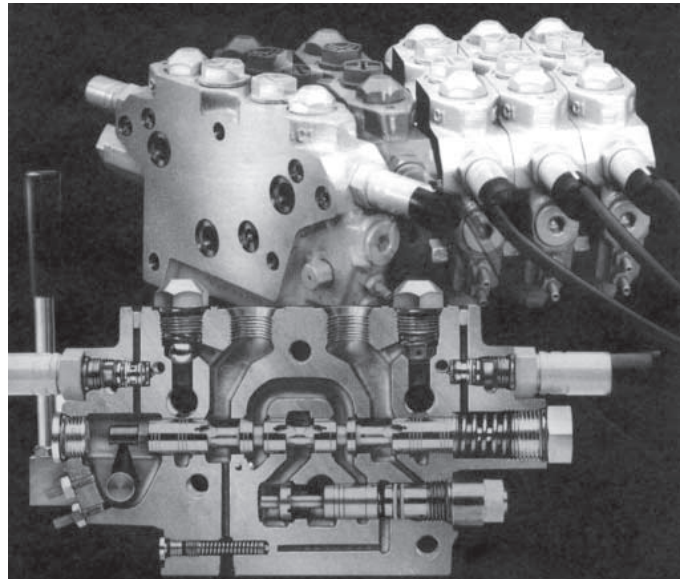


Bulletin HY14-2101-B2/US

Series VPL Proportional Valves

Effective: February 1, 2004

Supersedes: Cat. No. PMF-1030 dated 3/98



 **WARNING**

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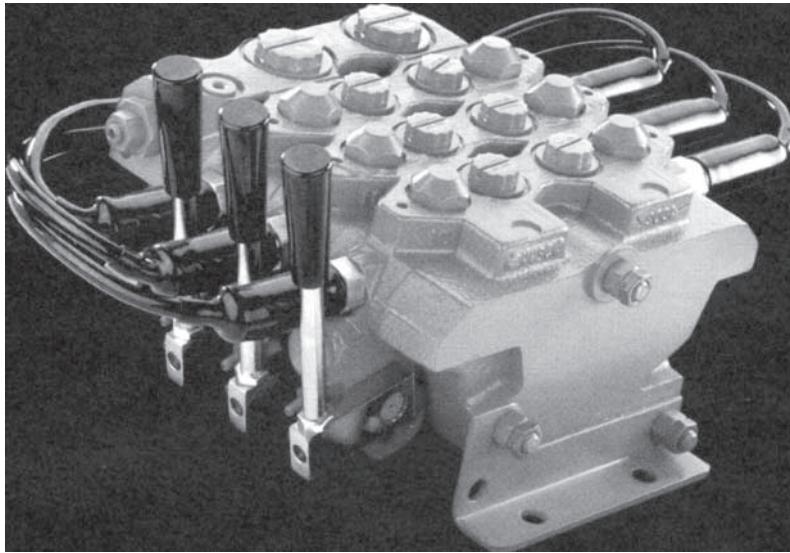
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A combination of practicality and valve design expertise has been combined to give you and your customers a control valve package equaled by none.

The **VPL** series valve can:

- Fit into any type of pumping system
- Control the direction of flow
- Regulate flow precisely and repeatedly
- Flow compensates as the function's parameters vary
- Control pressures on inlet and cylinder ports
- Offer dual operating stations with a positive manual lever and remote control, hydraulic or electrical
- Be controlled manually, remote hydraulically or electrohydraulically
- Be stacked to provide the required number of control segments
- Combine all of your functions requirement into one valve segment
- Be stacked with a VP series valve segment for higher flows

The **VPL** series valve provides efficiency to you by:

- Having available the proper style inlet; bypassing, load sensing etc., for your circuit
- Letting you tailor the C₁ or C₂ port flows to meet the function's flow requirements
- Limiting the function pressure to exactly that which is required for either cylinder port
- Using pressure compensation to give predictable and repeatable flow output

The **VPL** inlet can be:

- Bypassing with relief for fixed pumps
- Bypassing with relief for multiple stacks
- Bypassing with power beyond to other valves for fixed pumps
- Closed center for variable pumps

- Closed center with relief for variable pumps
- Has an integral pilot supply which can be used for both hydraulic and electrical control

The **VPL** directional section will:

- Control direction in 3 ways or 4 ways
- Allow various proportional maximum output flows to the cylinder ports
- Allow different maximum output flows to C₁ port and C₂ port
- Allow shock and suction valves in the cylinder ports
- Limit output pressures to both ports, one port or two ports selectively to less than pump or main relief
- Has interchangeable directional spools
- Provide positive flow stops as a standard feature
- Incorporates an internal sense network for use in load sensing systems
- Can be controlled by direct lever input or by a remote hydraulic or electrical signal

The **VPL** stacking plate provides:

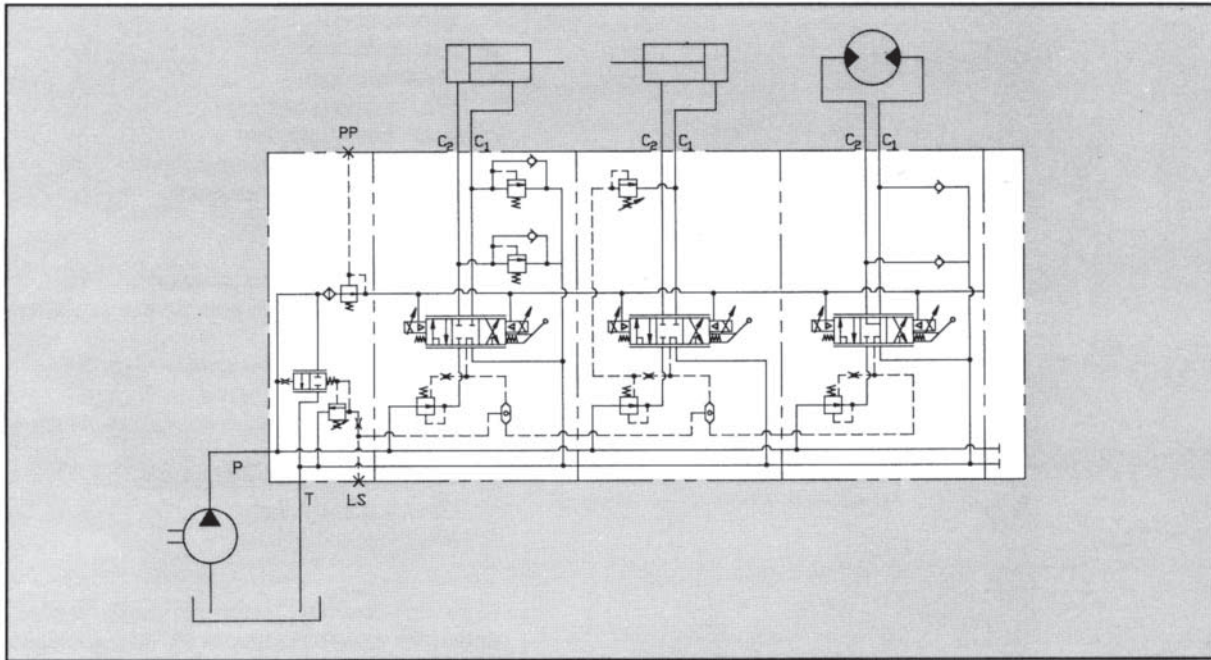
- Additional P & T ports for circuit simplification
- Simplifies the load sense circuit by eliminating external shuttles
- Closes off the stack in a positive yet efficient fashion
- Optional external pilot drain

The **VPL** utilizes the Pulsar[®] for electrohydraulic control. The Pulsar[®] is:

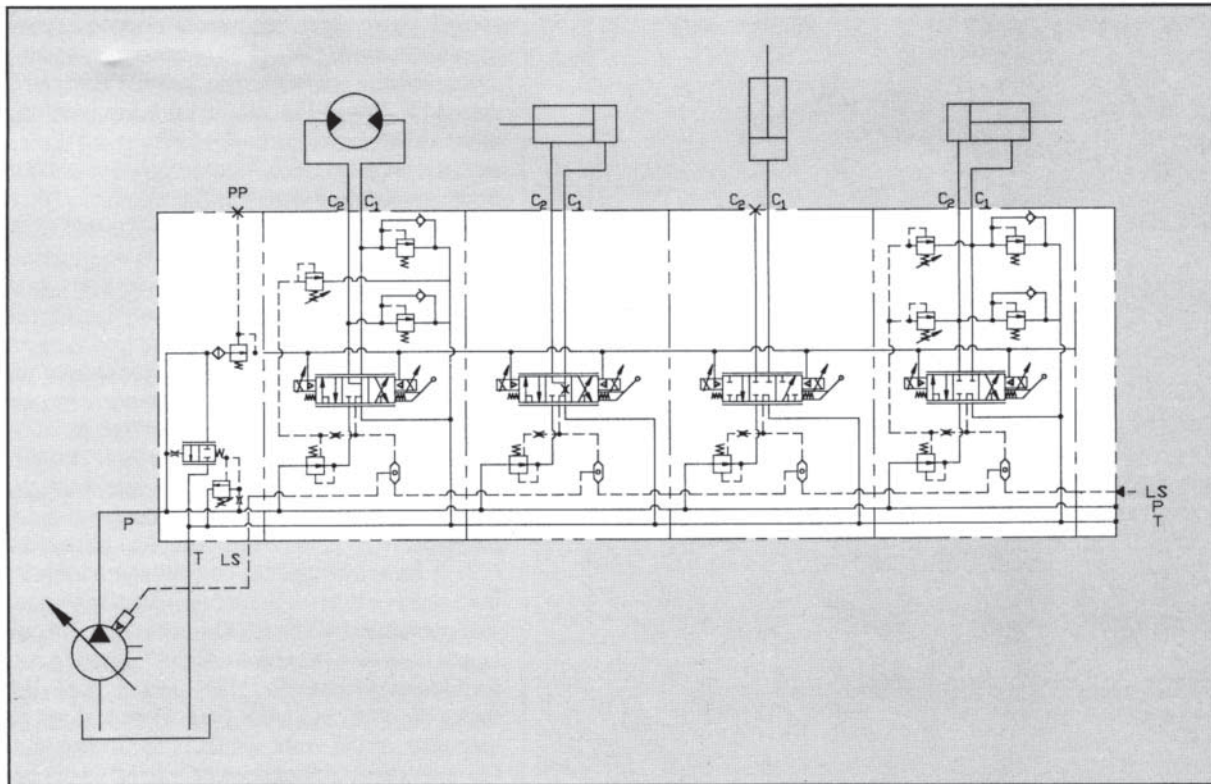
- Available in 12 or 24 VDC configuration
- Intrinsically safe as an option
- Available for marine applications as an option
- Can be microprocessor driven because of its low power requirements (less than 500 mA)
- Is available in an ON/OFF as an option

Examples

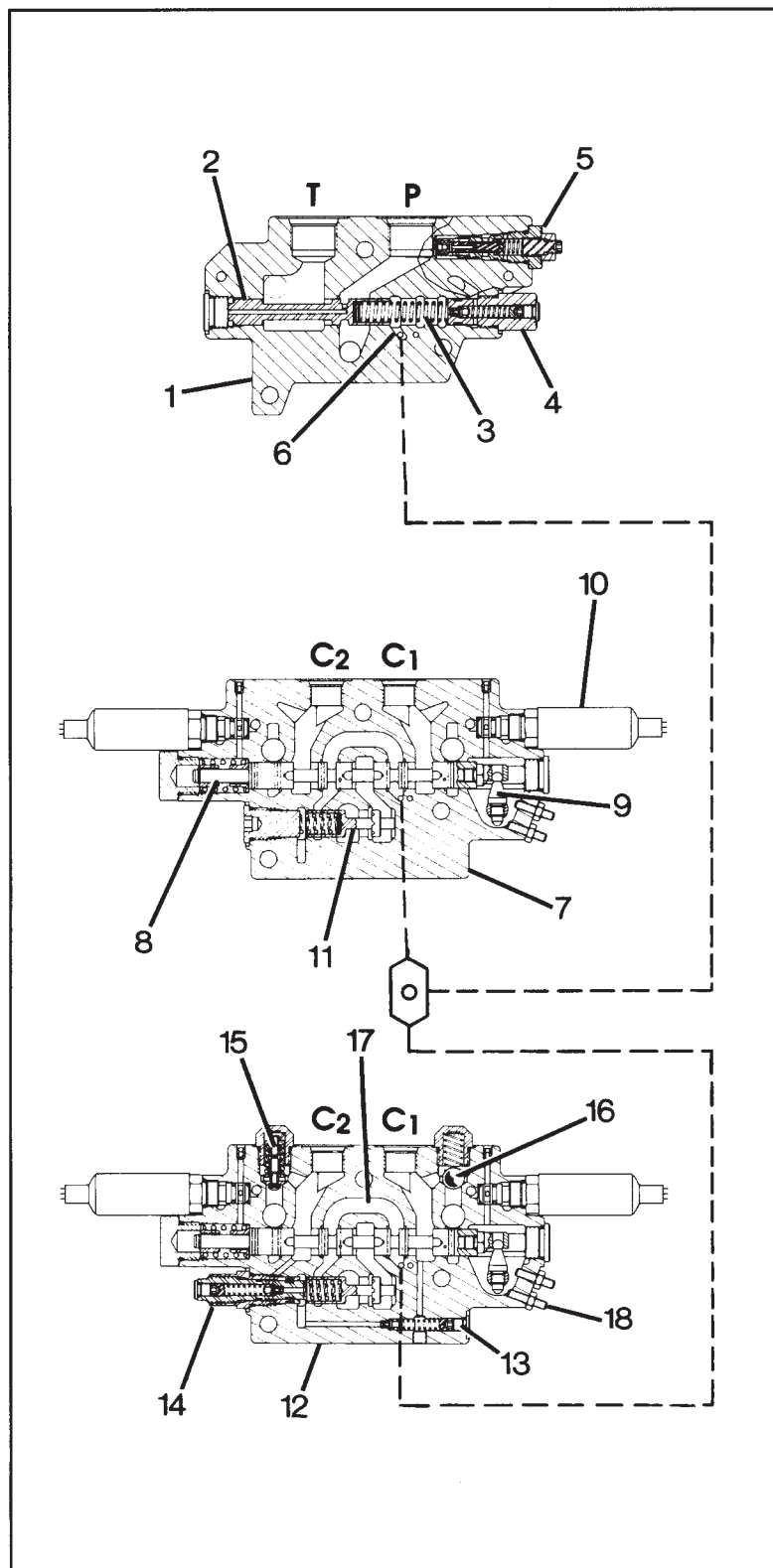
1. Sample fixed displacement circuit



2. Sample load sensing circuit



VPL - sectional drawing



1. Bypass inlet body
2. Bypass spool
3. Bypass spring
4. Relief cartridge
5. Pilot reducing cartridge
6. Load sense passage
7. VPL body standard, no options
8. Flow control spool assembly
9. Mechanical override
10. Pulsar solenoid
11. Segment compensation spool
12. VPL body with work port options and pressure limiters
13. Pressure limiter adjustment, C₂ port
14. Pressure limiter adjustment, C₁ port
15. Work port relief with anticavitation check cartridge
16. Work port anticavitation check
17. Load sense passage
18. Mechanical flow limiters

When the fixed displacement pump is started, oil enters the valve assembly at "P" on the inlet body (1). The load sense passage (6) is vented to tank whenever the flow control spools are centered in the work sections. The pump's flow is bypassed at the bypass spring (3) pressure of 200 psi to the "T" port. A load sense signal causes the bypass spool (2) to close until the supply of oil reaches a pressure equal to load sense pressure plus 200 psi from the bypass spring (3). When the load sense pressure rises to the main relief cartridge's (4) setting, the load sense signal is relieved, allowing the bypass spool (2) to shift open, unloading the pump. The standard VPL section (7) is actuated by energizing the Pulsar (10). The flow control spool (8) shifts, allowing proportional control. The individual compensation spool (11) maintains a constant pressure drop across the meter-in land, independent of supply or load pressure variations. The direct acting mechanical override linkage (9) can provide pressure compensated directional proportional flow control for a manual control station or emergency override. The VPL body with work port options and dual individual pressure limiters (12) provides these features in a compact package. The pressure of the load sense passage (17) is limited by the C₂ port pressure limiter (13) or the C₁ port pressure limiter (14), depending on which work port is pressurized. The relief with anticavitation check cartridge (15) protects the C₂ work port and an anticavitation check (16), which also provides make-up oil to the work port. Flow limiters (18) are standard on all work sections, providing maximum flow limitation, independently for each work port.

VPL Valve General Specifications

Operating Pressure:

Pressure supply port	5000 psi (350.0 bar)
Cylinder ports	5000 psi (350.0)
Tank ports	200 psi (14.0 bar)
Inlet relief valve settings	500-4000 psi (35.0 - 280.0 bar)
Maximum inlet flow	50 gpm (189 L/min)
Spool flow ratings*	1.3, 2.5, 4, 7, 11, 17, 24, 30 gpm (5, 10, 15, 25, 40, 65, 90, 114 L/min)
Spool/cylinder port configuration	Closed, restricted open, open (motor)
Spool deadband	25% of stroke
C ₁ C ₂ leakage (per section)	0.006 gpm (20 ml/min) at 1000 psi (69.0 bar) 150 SUS (30 cSt)
Recommended filtration	SAE Class 5 (17/14-ISO 4406)
Fluid temperature range	-40°F to 195°F (-40°C to 90°C)
Maximum fluid temperature	250°F (121°C)
Ambient temperature range	-40°F to 190°F (-40°C to 88°C)
Fluid viscosity range	1500 to 30 SUS (323 to 1.1 cSt)
Seal material	Buna-N
Mounting attitude	Unrestricted
Weight (approx.)	70 lbs. (32 kg) stacking plate 10.0 lbs. (4.5 kg) work segment 10.0 lbs. (4.5 kg) inlet valve

* Additional flow ratings available, consult factory

VPL Manual Control

Handle torque	5-31 lb/in (0.6 - 3.5 Nm)
Angle for full spool shift	+/- 20°
Four handle adapter positions from horizontal +30° to -90° in 15° increments. Horizontal adapter position standard.	

VPL Hydraulic Control

Pressure required for standard spools:

Deadband	80 psi (5.5 bar)
Fullstroke	220 psi (15.2 bar)
Reduced 350 psi (24 bar) pilot supply available from inlet	

VPL Electrohydraulic Control

Step response:	
0% to 100%	300 milliseconds
100 to 0%	150 milliseconds

Standard and Marine Solenoids

Coil resistance (12 VDC)	28.0 OHMS at 70°F (21°C)
(24 VDC)	65.0 OHMS at 70°F (21°C)
Operating voltage range	12 +/- 3 VDC 24 +/- 3 VDC
Current draw	430 mA at 12VDC and 70°F (21°C) 370 mA at 24 VDC and 70°F (21°C)
PWM frequency	33 Hz
Connectors	Weather Pac, Hirschmann, Flying Leads (standard solenoid); Flying leads (marine solenoid)

Intrinsically Safe Solenoids

Coil resistance	28.0 OHMS at 70°F (21°C)
Rated Operating Voltage	12.0 VDC Max.
Current Draw	430 mA at 12 VDC and 70°F (21°C)
PWM frequency	33 Hz
Connectors	Weather Pac, Electro Brand Immersible Waterproof Connector

Pulsar products comply with the following standards for use in hazardous environments:

US Code of Federal Regulations Title 30 - Mineral Resources	MSHA Evaluations IA-627-0, IA-14328-0
CENELEC European Norms EN50014 - 1977	NEMKO Evaluation 90.114
and EN 50020-1977	EEx ib IIA T4, I _{max} = 300mA, 12VDC, L _{eq} = 2.25mH, C _{eq} =0
	EEx ib IIB T4, I _{max} = 250mA, 9VDC, L _{eq} = 2.25mH, C _{eq} =0
EN 50014 - 1977 and EN 50028 - 1987	NEMKO Evaluation 90.277X, EEx m II T4

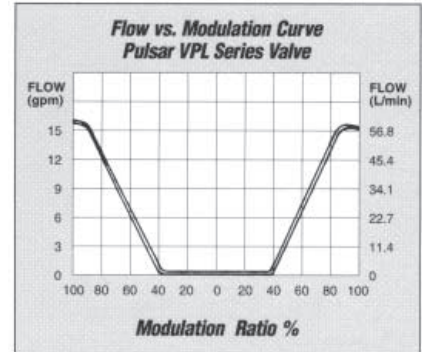
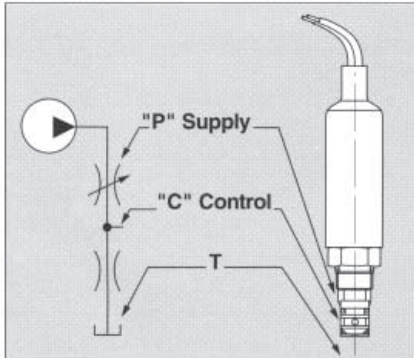
All values typical

THE VPL VALVE

THE UNIQUE PULSAR PROPORTIONAL SOLENOID FOR PILOT PRESSURE CONTROL

Electrical control of the VPL Series valve is achieved with the patented Pulsar electrohydraulic pilot valve. This pilot pressure control uses digital electronics to provide a pressure control which is linear and repeatable. Being a truly digital device means that the valve is either open or closed. This results in a device in which the current draw (less than 500 mA) is controllable in the simpler electronic circuits. These electronics use PWM type drive to vary the modulation ratio, on time versus off time to provide smooth valve operation. Valve resolution is optimized and gives a valve output of low hysteresis which results in predictable machine performance.

This Pulsar digital technology does not have the same sensitivity to viscosity and contamination as servo valves or other pilot sources. Since it is manufactured in cartridge form, serviceability is easy and there are no null or center adjustments.

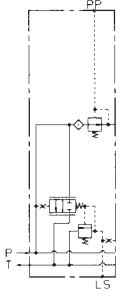
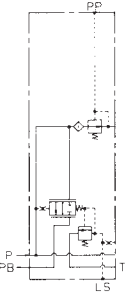
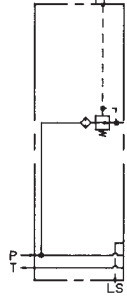
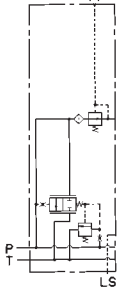


Work Segment Operators:

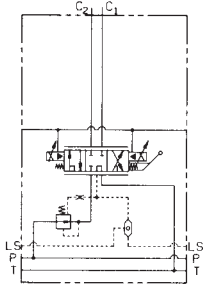
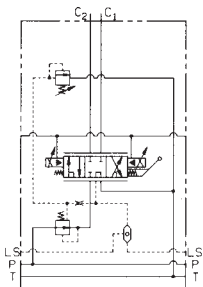
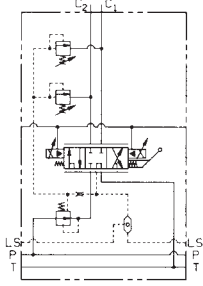
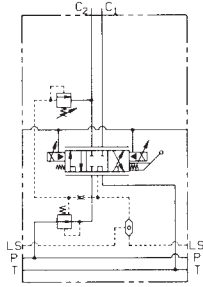
SYMBOL	DESCRIPTION	
<p>VNL *****</p>	<p>MANUAL CONTROL</p> <ul style="list-style-type: none"> • Spring centered • Handle mounting in line or 90° to adapter • Adapter mounting +30° to -90° in 15° increments • Conversion capability to electrohydraulic proportional 	
<p>VWL *****</p>	<p>HYDRAULIC REMOTE CONTROL</p> <ul style="list-style-type: none"> • Spring centered • Pilot supply available from valve stack inlet • Conversion capability to electrohydraulic proportional 	
<p>VQL *****</p>	<p>ELECTROHYDRAULIC ON/OFF CONTROL</p> <ul style="list-style-type: none"> • Spring centered • Available in 12 or 24-volt coils • PWM Signal not required • Internal pilot supply available from valve stack inlet 	
<p>VPL *****</p>	<p>ELECTROHYDRAULIC PROPORTIONAL CONTROL</p> <ul style="list-style-type: none"> • Spring centered • Available in 12 or 24-volt coils • Pulse width modulation control • Internal pilot supply available from valve stack inlet 	

VPL Product Code Number

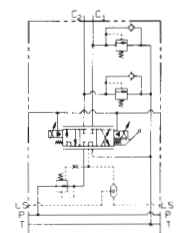
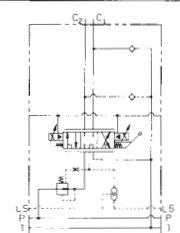
A Inlet Types:

SYMBOL	DESCRIPTION
 <p>VBL 2211-****</p>	<p>Bypass type inlet with adjustable relief valve feature</p> <ul style="list-style-type: none"> • For use with fixed displacement pumps • Integral pilot reducing valve cartridge with 40 micron screen
 <p>VBL 2411-****</p>	<p>Bypass type inlet with Power-Beyond Feature and adjustable relief valve</p> <ul style="list-style-type: none"> • For use with fixed displacement pumps • Power-Beyond feature provides priority to working segments in this valve assembly and allows for excess oil to be used by downstream valve assemblies to full system pressure • External relief valve required to protect valve stacks • Integral pilot reducing valve cartridge with 40 micron screen
 <p>VLL 2210-****</p>	<p>Load sensing type inlet</p> <ul style="list-style-type: none"> • For use with variable displacement pumps • Load sensing port is plugged for use with pressure compensated pump • Integral pilot reducing valve with 40 micron screen
 <p>VYL 2211-****</p>	<p>Load sensing type inlet with adjustable relief valve feature</p> <ul style="list-style-type: none"> • For use with variable displacement pumps • Load sensing port is plugged for use with pressure compensated pump • Integral pilot reducing valve with 40 micron screen




B Work Segments

SYMBOL	DESCRIPTION
 <p>VPL•247-•23*-0000</p>	<p>Work segment with individual compensator</p> <ul style="list-style-type: none"> • Pressure compensated for constant flow at any load/supply pressure condition • Manual operator linkage standard • Load sense shuttle logic standard • Mechanical flowstop standard
 <p>VPL•247-•33*-0000</p>	<p>Work segment with individual compensator and common C₁ and C₂ pressure limiter</p> <ul style="list-style-type: none"> • Pressure compensated for constant flow at any load/supply pressure condition • Manual operator linkage standard • Load sense shuttle logic standard • Mechanical flowstop standard • Common cylinder port pressure limitation for same reduced maximum pressure at C₁ and C₂ ports
 <p>VPL•247-•43*-0000</p>	<p>Work segment with individual compensator and individual C₁ and C₂ pressure limiter</p> <ul style="list-style-type: none"> • Pressure compensated for constant flow at any load/supply pressure condition • Manual operator linkage standard • Load sense shuttle logic standard • Mechanical flowstop standard • Dual individual cylinder port pressure limitation for separate reduced maximum pressures at C₁ and C₂ ports
 <p>VPL•247-•53*-0000</p>	<p>Work segment with individual compensator and C₁ pressure limiter</p> <ul style="list-style-type: none"> • Pressure compensated for constant flow at any load/supply pressure condition • Manual operator linkage standard • Load sense shuttle logic standard • Mechanical flowstop standard • Single cylinder port pressure limitation for reduced maximum pressure on only the C₁ port

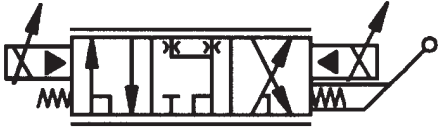

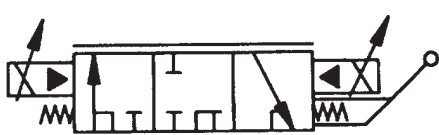


C Work Segment Work Port Options

SYMBOL	DESCRIPTION
 <p>VPL* 247-*23*-22**</p>	<p>Relief with anticavitation valve</p> <ul style="list-style-type: none"> • Pressure compensated for constant flow at any load/supply pressure condition • Manual operator linkage standard • Load sense shuttle logic standard • Mechanical flowstop standard • Direct-acting relief valve with anticavitation check valve • Available for either work port or both
 <p>VPL* 247-*23*-3300</p>	<p>Anticavitation valve</p> <ul style="list-style-type: none"> • Pressure compensated for constant flow at any load/supply pressure condition • Manual operator linkage standard • Load sense shuttle logic standard • Mechanical flowstop standard • Anticavitation check valve • Available for either work port or both

D Stacking Plate

SYMBOL	DESCRIPTION
 <p>VOL 0001-0*0*</p>	<p>Stacking plate</p> <ul style="list-style-type: none"> • No ports included • External pilot drain available (VOL 0002-0*0*)
 <p>VOL 1111-0*0*</p>	<p>Stacking plate with ports</p> <ul style="list-style-type: none"> • Pressure tank & shuttle (load sense) ports included • Shuttle port for consolidating plumbing of load sense circuits (includes shuttle ball) • Tank port required when stack has a power-beyond inlet • Shuttle port must be connected to auxiliary load sense • External pilot drain available (VOL 1112-0*0*)
 <p>VOL 5551-0*0*</p>	<p>Stacking plate with plugged ports</p> <ul style="list-style-type: none"> • Pressure and tank load ports included • Tank port required when stack has a power-beyond inlet • All ports fitted with steel plugs • Shuttle port not useable • External pilot drain available (VOL 5552-0*0*)

E Work Segment Spools

SYMBOL	DESCRIPTION
 <p>VPL*14</p>	<p>VENTED OPEN</p> <ul style="list-style-type: none"> • 4 way, 3 position • Cylinder ports open to tank in neutral for venting valves • Flow restricted 0.5 gpm at 100 psi (2 L/min at 7,0 bar)
 <p>VPL*24</p>	<p>CLOSED</p> <ul style="list-style-type: none"> • 4 way, 3 position • Cylinder ports closed to tank in neutral • Low leakage version available
 <p>VPL*33</p>	<p>CLOSED</p> <ul style="list-style-type: none"> • 3 way, 3 position • Cylinder port closed to tank in neutral • C₂ port plugged • Flow metering out is flow compensated with remote hydraulic and electrohydraulic actuated • Low leakage version available
 <p>VPL*34</p>	<p>CLOSED/VENTED OPEN</p> <ul style="list-style-type: none"> • 4 way, 3 position • C₁ port closed, C₂ port open to tank in neutral for venting valves • Flow restricted 0.5 gpm at 100 psi (2 L/min at 7,0 bar) • Low leakage version available
 <p>VPL*44</p>	<p>OPEN (MOTOR)</p> <ul style="list-style-type: none"> • 4 way, 3 position • Cylinder ports open to tank in neutral for motors • Open flow 15 gpm at 50 psi (57 L/min at 3,5 bar)

SPOOL FLOW TABLE

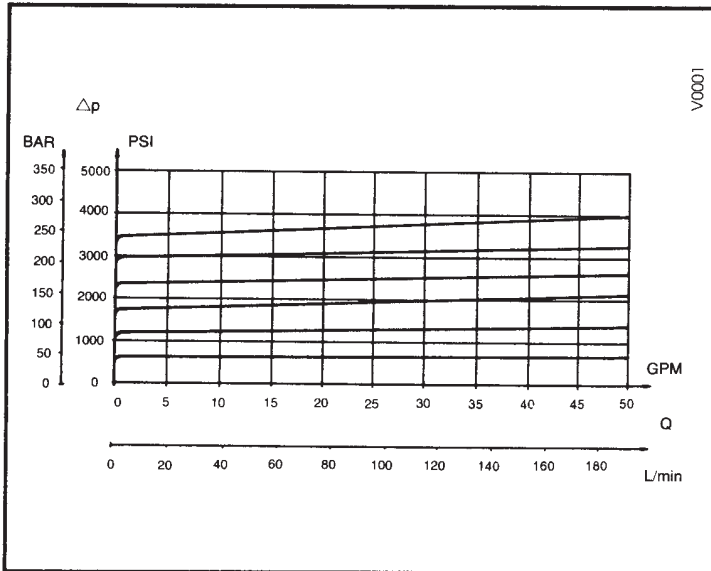
Spool I.D. Code	GPM	L/min
A	1.3	5
1	2.5	10
2	4	15
3	7	25
4	11	40
5	17	65
6	24	90
7	30	114

NOTES

- 1) Intermediate flow rates available.
- 2) Dual flows C₁/C₂ available, consult factory.
- 3) Additional flow ratings available, consult factory.

INLET

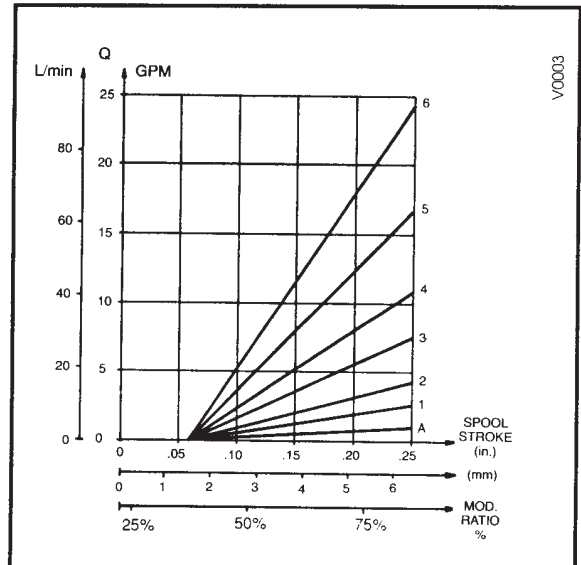
Inlet pressure relief valve characteristic



Pressure setting made at 1 gpm (4 L/min)

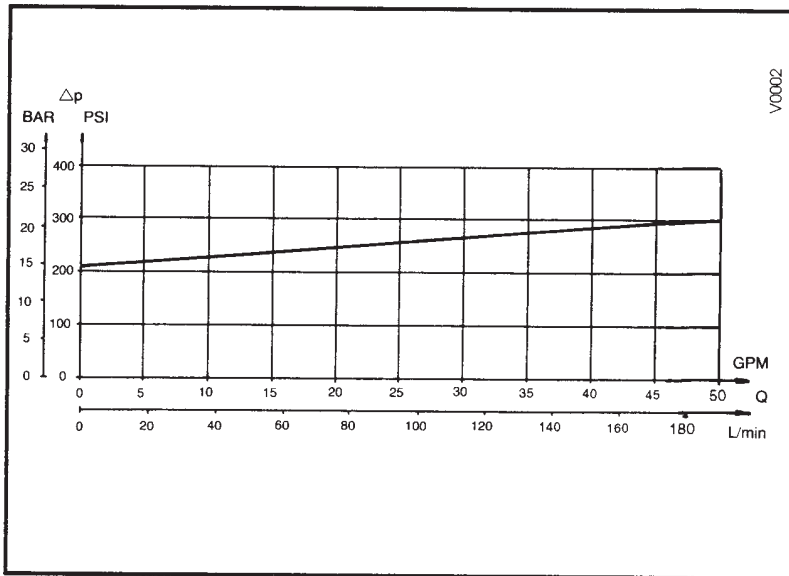
WORK SEGMENT

Pressure-compensated flow gain characteristic



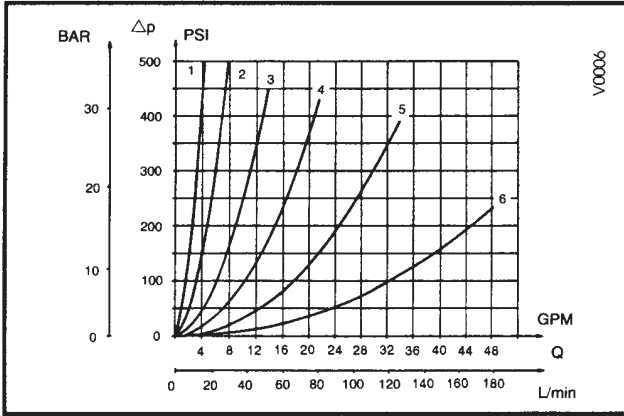
The curves are shown for spool I.D. numbers 1 through 6

Neutral flow pressure drop on VBL inlet, open center



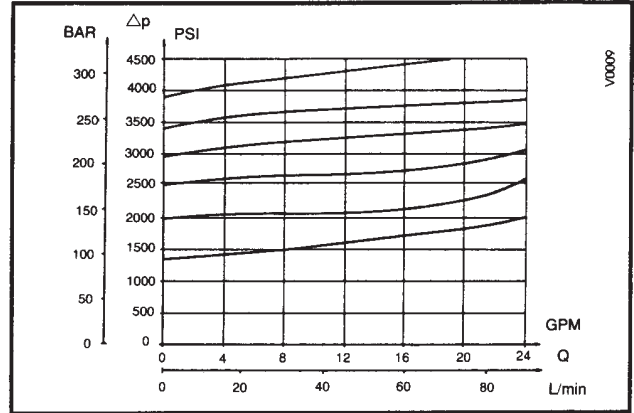
Work Segment (continued)

Pressure drop $C_1/C_2 \rightarrow T$

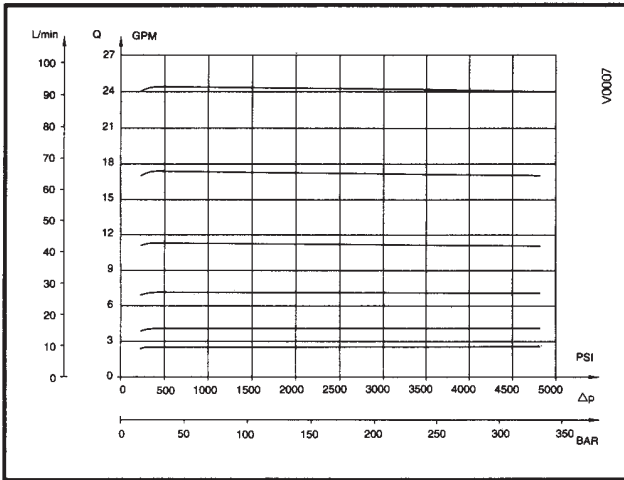


WORK PORT OPTIONS

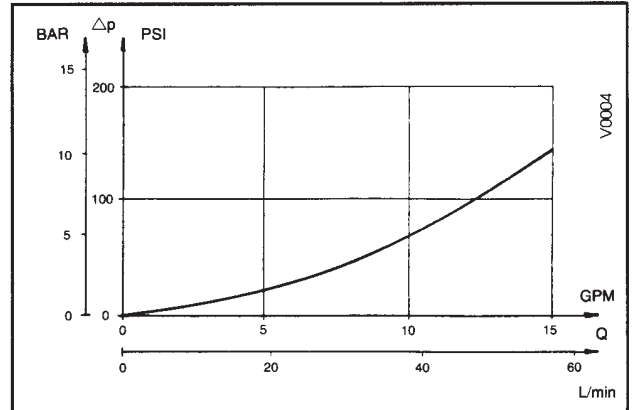
Relief with anticavitation valve
 Relief characteristics



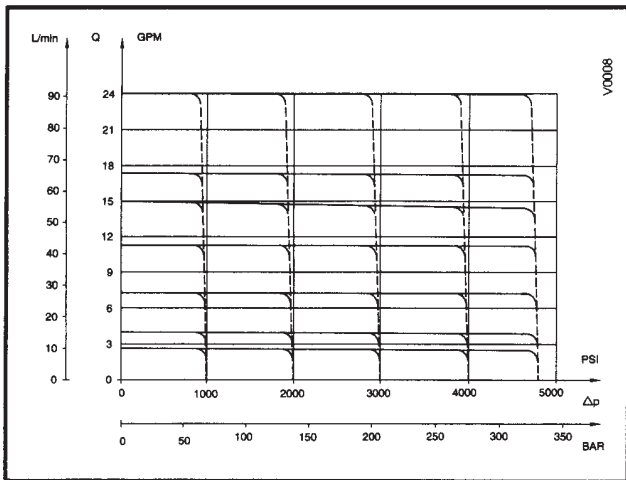
Individual segment compensator characteristic



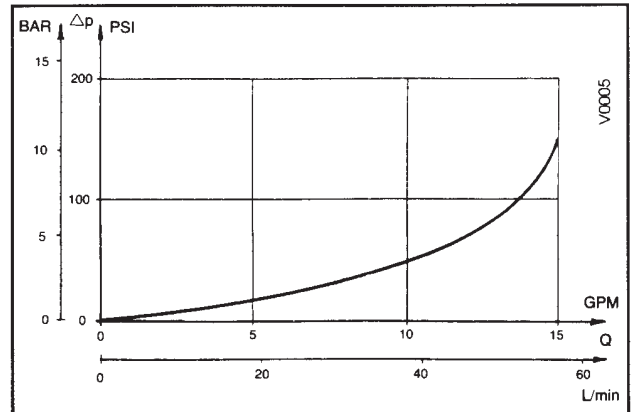
Relief with anticavitation valve
 Anticavitation characteristic

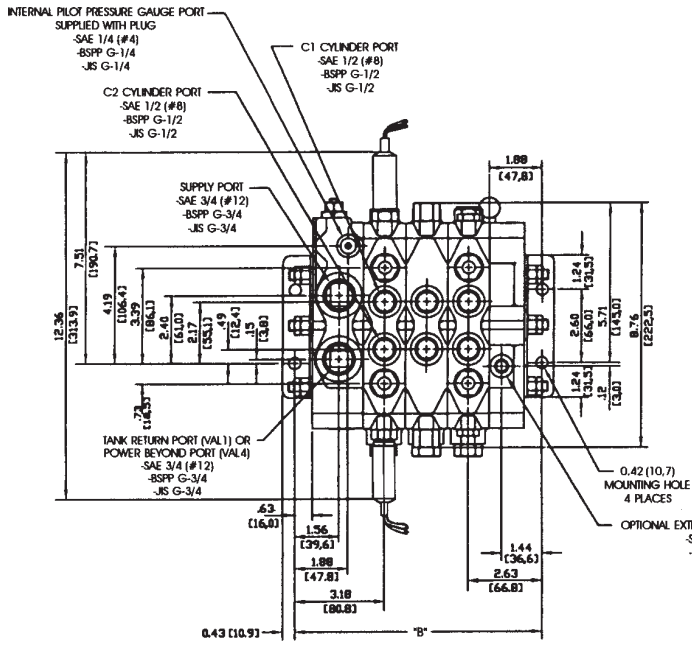


Pressure limiter characteristic

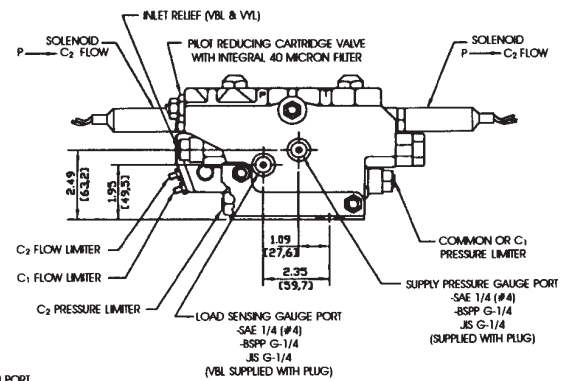


Anticavitation valve
 Anticavitation characteristic

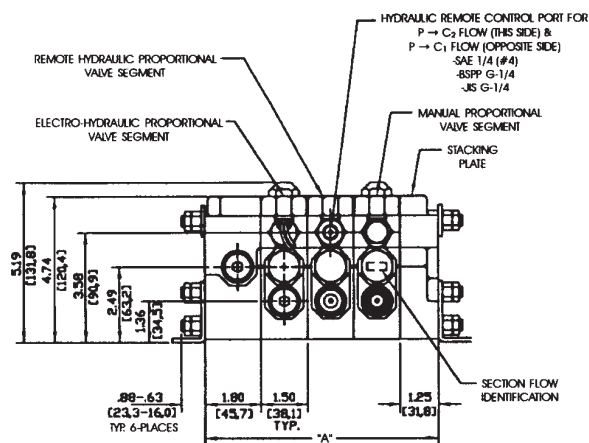




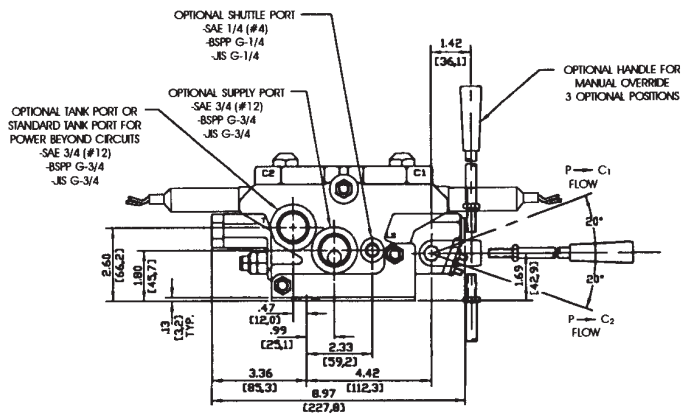
Top View



Inlet View



Side View

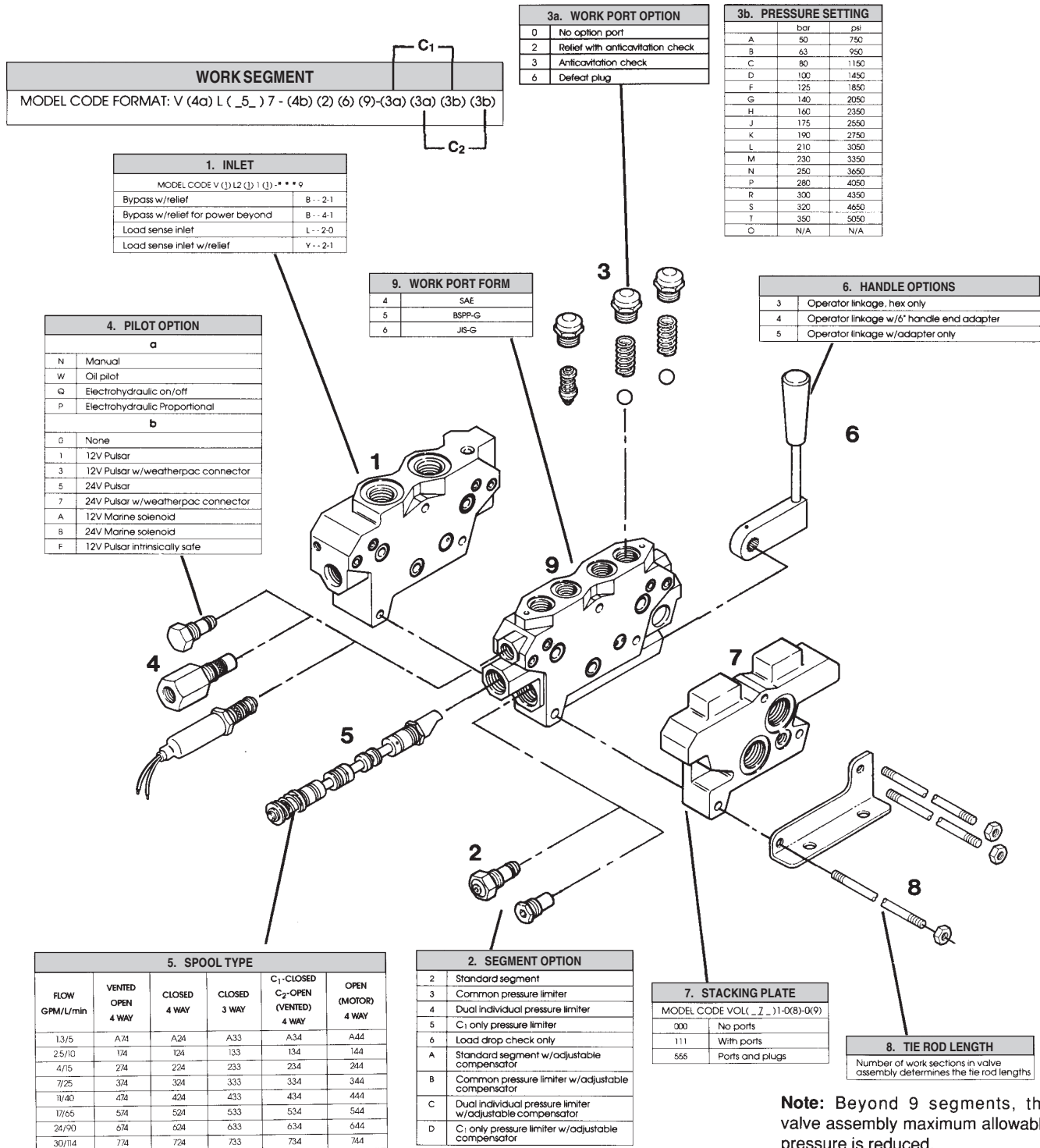


Stacking Plate View

WEIGHTS (APPROX)
 STACKING PLATE....7.0 LBS. (3.2 KG)
 WORK SEGMENT....10.0 LBS. (4.5 KG)
 INLET VALVE.....10.0 LBS. (4.5 KG)

DIMENSIONS ARE IN INCHES (mm)

NUMBERS OF SEGMENTS	A (in/mm)	B (in/mm)
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)



Note: Beyond 9 segments, the valve assembly maximum allowable pressure is reduced.

EXAMPLE: A 10 GPM, closed cylinder port, 3 position, 4 way, proportional, 12V Pulsar w/weatherpac connector, individually compensated valve, dual individual pressure limiter (C₁ at 1300 psi and C₂ at 2500 psi), 6" nonremovable handle, SAE ports, C₁ port anticavitation and C₂ port relief with anticavitation at 2750 psi is: VPL5247-3444-320K

ASSEMBLY KITS: Assembly kits include tierods, nuts, jam nuts, shuttleballs and mounting feet.
VAL*K1---Number of work segments (1-9)

Distributor _____
 Phone _____
 Customer _____
 Application _____
 Customer P/N _____
 Author _____ Date _____

VPL Series

Valve Assembly Code: VAL _____

INLET

Pump type: fixed variable load sensing
 Relief/Comp setting _____ psi
 Pump flow _____ GPM (min.)
 _____ GPM (max.)
 Power Beyond: yes no
 Ports
 P open T open
 plugged plugged

STACKING PLATE

with ports without ports
 Ports
 P open T open
 plugged plugged
 LS
 Plugged (no shuttle ball)
 Shuttle ball (required for LS input)
 Number Of Work Segments _____

Electrical Control (Pulsar)

Voltage _____
 Connector type _____
 Marine Other _____
 Intrinsically Safe

WORK SEGMENT INFORMATION

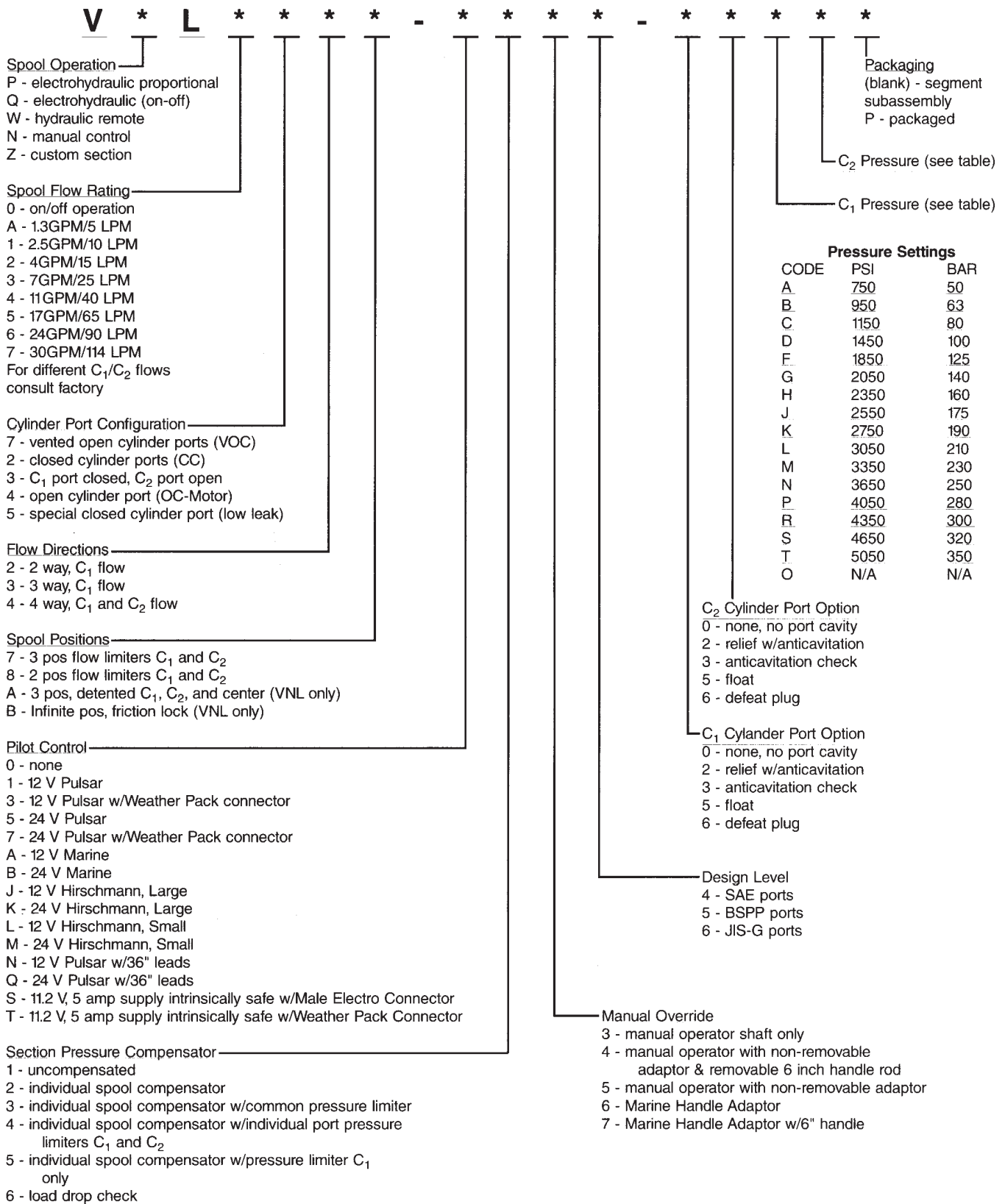
SEGMENT POSITION	SEGMENT FUNCTION	SPOOL TYPE (5)	FLOW (5)		PRES. LIMITER (2)		C1 PORT OPTION (3)			C2 PORT OPTION (3)		
			C1	C2	C1	C2	Relief	Anticav	Defeat	Relief	Anticav	Defeat
Example*	Boom Lift	524	10	10	1300	2500		3		K		
1st												
2nd												
3rd												
4th												
5th												
6th												
7th												
8th												
9th												

SEGMENT POSITION	VALVE ACTUATOR				NOTES AND / OR SPECIAL INSTRUCTIONS
	MANUAL	REMOTE	ELECTRIC		
			ON/OFF	PROP	
Example				X	
1st					
2nd					
3rd					
4th					
5th					
6th					
7th					
8th					
9th					

* Model Code VPL5247-3444-320K



Ordering Information



Offer of Sale**Proportional Valve
Series VPL**

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9/91-P

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