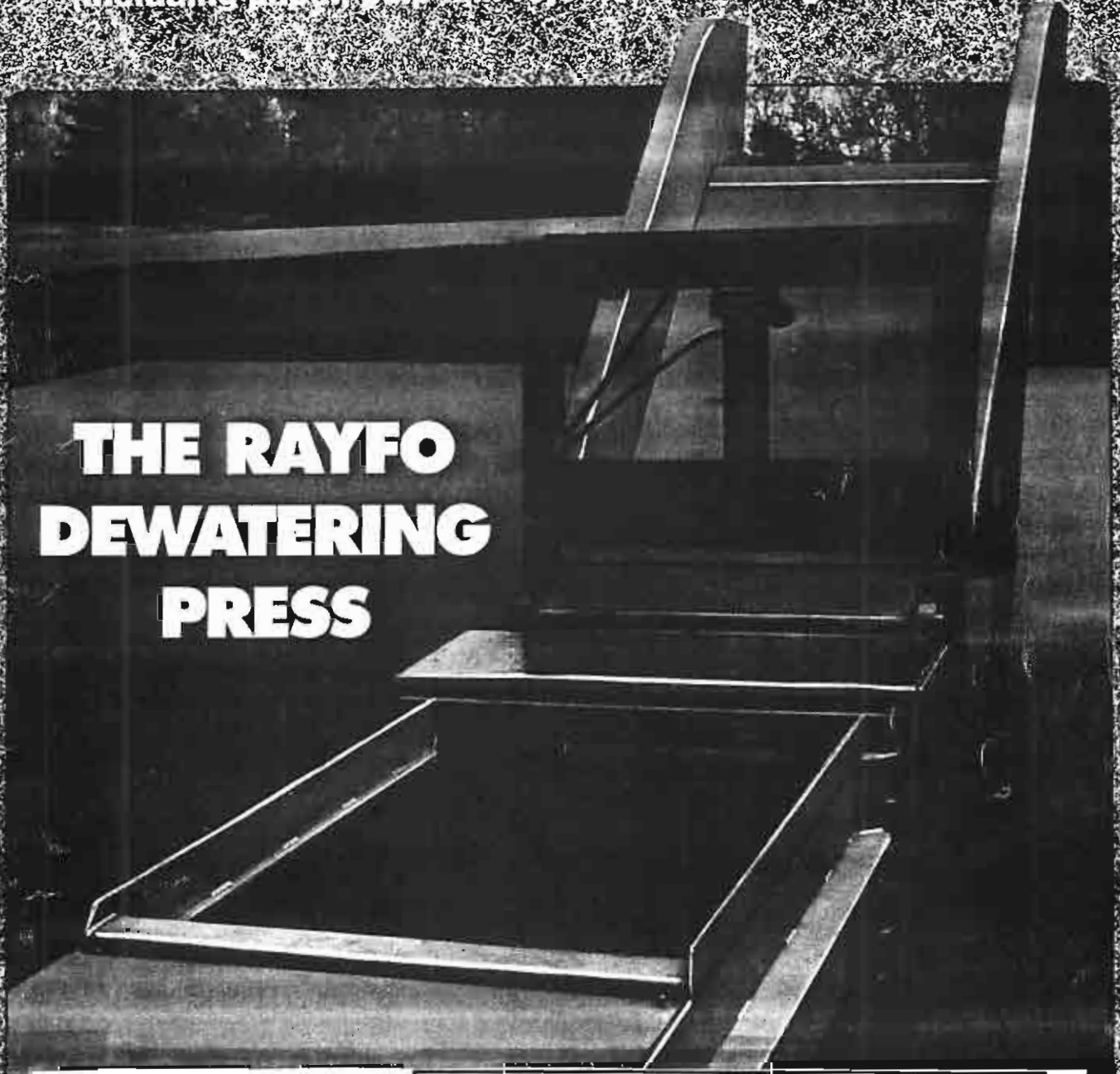
This is the efficient, economical way to dewater fibrous waste materials

(including paper, pulp mill rejects, old corrugated cartons)



THE RAYFO DEWATERING PRESS

RAYFO

RAYFO, INC.
4180 160th Street East
Rosemount, MN 55068
Telephone: 612/437-4441

INSTALLATION AND OPERATION MANUAL

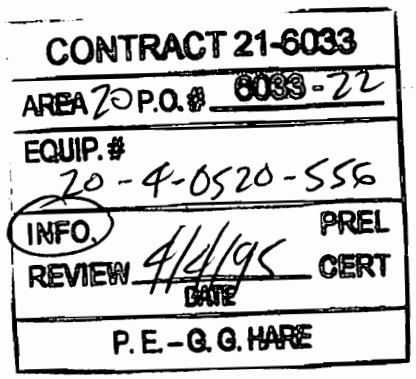
Blue Water Fiber

COMPACTOR SER # OW10178-52

POWER UNIT SER # 1611

LOCKOUT OR TAGOUT PROCEDURE FOR RAYFO DEWATERING PRESS

1. Turn key switch to off position and remove key.
2. Shut power disconnect off. (Supplied by end user)
3. Install lock-out tag or lock on power disconnect.
4. Press start button to ensure that the compactor will not cycle.
5. Manually reverse ram, by depressing override pin on solenoid valve, relieving pressure buildup.
6. Remove guards as required.
7. Service of dewatering press can now be performed.
8. Replace guards.
9. After service is complete, remove tag or lock, turn power disconnect on, turn key switch to **ON** position.
10. Cycle machine to ensure proper operation.



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Installation Instructions

- Locate electrical control panel on wall or vibration free metal structure.
- Locate dewatering machine.
- Locate hydraulic power unit.
- Anchor power unit and dewatering machine.
- Hook-up hydraulic hoses per the Hydraulic Power Unit drawing & De-Watering Press DW10078 drawing.

    A. 1 1/4" & 1" hose go to the back of the machine, port A & B.
    B. The 3/8" hose connects to ports D & F at the back of the machine.
    C. The 1/4" hose connects to ports C & E at the back of the machine.

    Note: Hose length should not exceed 4 ft. if not secured.

    Note: The use of Hydrasorb Clamping is suggested on lines.

- Hook-up cooling water supply lines (on water cooled units only). Cooling water should potable water with a maximum temperature of 60 degree F.
- Fill oil reservoir with hydraulic oil. Recommend premium quality hydraulic oil with a viscosity range between 150-250 SSU (30-50 cst.) at 100 degree F (38 degree C). Normal operating viscosity range between 80-1000 SSU (17-180 cst.). Maximum start-up viscosity is 4000 SSU (1000 cst.).
- Wire control panel to junction box and motor on hydraulic power unit.
- Supply 30 AMP fused 480 volt, 3 phase power to control box with a ground.
- Check for proper rotation of the motor.

    Note: An arrow on the pump flange will indicate the proper direction.

- Start machine and check for proper operation.

    Note: If any access doors are added, they must be electrically interlocking.

SEQUENCE OF OPERATIONS

The Dewatering Press has been designed to remove water from wet paper type materials. This is accomplished by compressing the material and allowing the water to escape through perforated sheets. The resistance to the flow of material is adjustable and controlled by an exit damper. After starting the unit the machine will cycle back and forth. This is accomplished by a pilot/slave hydraulic circuit.

The pilot valve is a 4-way, 3 position solenoid valve. The pilot valve is controlled by the PLC. The PLC starts the ram going in the forward direction by energizing the forward solenoid on the pilot valve (11). When the system pressure reaches 1200 psi the pump is held at this pressure for a predetermined amount of time (hold cycle). The hydraulic pump is allowed to go to high pressure. When the pressure on the blank end of the cylinder is reaching 2350 psi (measured by a pressure switch PS-2 (57)), then we start the reverse sequence. Then we time the ram retract stroke and start it forward again. See PLC Logic for reverse sequence.

The speed at which the unit cycles is controlled by 2 different hydraulic functions and a timed low pressure hold cycle. The first is accomplished by the use of a 30 gpm piston pump with horsepower-limiting control. The pump generates high volume at lower pressures and high pressures at low volumes.

The second function is a regenerative valve. The regenerative valve allows a cylinder to be advanced more rapidly by adding the oil from the rod end of the cylinder, to the pump flow, to the blind end, increasing the rate of advance.

The hold cycle can be set from 0-30 seconds. It's purpose is to squeeze the material at low pressure to remove more water than a quick rise to full pressure would. A pressure switch signals when the hold pressure is reached. Then the Remote Compensator holds the low, 1200 psi, pressure until preset hold time elapses and the Remote Compensator shifts closed to allow full system pressure.

The resistance to the flow of outlet material is obtained by the use of an exit damper, controlled by a hydraulic cylinder. The cylinder is controlled by a reducing/relieving valve which maintains an adjustable down pressure on the discharge material.

The retractable breaker bar is used to increase the efficiency of the press with low inlet consistency. A pair of hydraulic cylinders are used with a solid steel tapered bar to close the gap between the ram top and the stationary breaker bar, while still allowing large objects to pass through. The hydraulic cylinders act as a spring to keep constant down-pressure on the retractable breaker bar.

START-UP PROCEDURE FOR RAYFO DEWATERING PRESS

After installation of the press, start the unit and let it cycle empty. Attach one pressure gauge to the pressure port, port "P", and the other to the damper cylinder, port "G2". After running for 10-15 minutes, check for any leaks or loose connections. The next step is to form a PLUG in the press. This can be done by throwing several sheets of cardboard in the Hopper. Let the machine continue to cycle. Now add the reject material to the Hopper. The press will push the material forward into the DEWATERING SECTION and start to remove water. With the Damper down and the Retractable Breaker Bar up, the material will tend to stay in the DEWATERING SECTION until a PLUG is formed. As the PLUG starts to work its way out of the DEWATERING SECTION the damper will start to raise, while still keeping constant down pressure. Now observe the pressure gauge on the pressure port. It is desirable to have the PLUG start moving at 1700psi. To obtain this value, adjustment of the damper cylinder is required. More damper pressure will cause the PLUG to move at a higher pressure. Less damper pressure will cause the PLUG to move at a lower pressure. The Factory Set for the damper is 900psi. If the press is unable to keep up with the incoming material lower the Retractable Breaker Bar.

INITIAL PRESSURE SETTING FOR THE DW10078 DEWATERING PRESS WITH PLC CONTROL

Before starting the hydraulic power unit, make the following preliminary adjustments:

A) Adjust pressure switches (28 and 57) by turning the black knurled cylinder all the way clockwise (while looking at the electrical end). This will give a setting of approximately 4400 psi.

B) Loosen jam nut on pressure compensator (located on the hydraulic pump (3), then turn clockwise all the way in then back out one turn. This will give the pump compensator a setting of approximately 2500 psi.

C) Loosen the jam nut on the torque control (located on the hydraulic pump (3). Then turn the adjustment all the way in clockwise, then back out 3 turns.

D) Loosen the jam nut, then turn the relief valve (45) clockwise all the way in. this will give the relief valve a setting of about 3000 psi.

E) Loosen jam nut on the remote compensator (16) and screw the adjustment counter clockwise all the way out. This will give the remote compensator a setting of about 300 psi. This setting is pressure at which we hold to squeeze the load before we switch to high pressure and complete the cycle.

F) Remove plastic caps on gauge check points located on the axillary manifold (2). Screw on the supplied gauges on the G1 and P Ports. These need only be put on hand tight. The main system pressure will be read on the P port.

Now start the dewatering press power unit, the ram will start to go in forward direction.

G) Press the cycle start button in for 5 seconds, this will maintain the ram going in the forward direction.

H) When the ram reaches the end of stroke. Adjust the remote compensator (16) by turning the screw in clock wise until the system pressure reaches 1150 psi.

I) Now adjust the hold cycle pressure switch (25) until the contacts close. See DCS or PLC for input light.

J) Adjust the remote compensator (16) by turning in clockwise until the system pressure reaches 1200 psi.

K) Energize the remote compensator (16) by pushing the start button in for 2 seconds, this will allow the pump to go to high pressure.

L) Adjust the main system relief valve (45) by turning counter clockwise until the system pressure reaches 1400 psi. Adjust the torque control on the hydraulic pump (3) until the motor is drawing 5% less than full load amps. Lock jam nut on the torque control.

M) Now adjust the main system relief valve (45) until the pressure reaches 2500 psi, lock jam nut.

N) Turn the pressure compensator on the hydraulic pump (3) until the pressure drops to 2350 psi. Adjust the end of stroke pressure switch (57) until the contacts close (see DCS or PLC for input light) Turn pressure compensator on the hydraulic pump (3) until the pressure reaches 2400 psi. Lock jam nut.

PART SPECIFICATION AND FUNCTION

READING PRESSURE: Items 7 & 8 are quick disconnect fittings and pressure gauges, respectively.

A) To read system pressure attach a pressure gauge to port "P" on Item 2.

B) To read Damper pressure attach a pressure gauge to port "G2" on Item 2.

C) To read Retractable Breaker Bar pressure attach a pressure gauge to port "G1" on Item 2.

* Note: Refer to the Hydraulic Power Unit drawing for port location.

- HYDRAULIC PARTS-

1) LOGIC CARTRIDGE MANIFOLD: Contains hydraulic logic elements for direction control of the ram cylinders.

2) AUXILIARY MANIFOLD: Contains cartridge valves that control the Damper and Retractable Breaker Bar cylinders.

3) HYDRAULIC PUMP: Pressure compensated piston pump with HP limiting control.

A) Maximum pressure setting for Pressure Compensator is 2400 psi. Adjustment:

1) Energize the forward solenoid on the pilot valve (11), by pressing the forward button in and holding it for 5 seconds.
2) Turn main system relief, Item 45, all the way in, then out 1/2 turn.
3) Refer to Hydraulic Power Unit drawing. Loosen jam nut on Pressure Compensator adjustment screw and adjust Pressure Compensator until system pressure reaches 2400 psi. Tighten jam nut.
4) Re-adjust item 45 according to its instructions.

B) Torque control (HP limiter) reduces volume output as pressure rises to match HP of motor. Example: At 1000 psi output is 30 gpm, at 2000 psi output is 15 gpm.

Adjustment: Steps 1 - 4 are only for installing a new pump or new Torque Control adjustment screw. Steps 5 - 9 are for final adjustment or re-adjustment of the Torque Control screw.

1) Turn torque control screw all the way out and then turn maximum volume stop screw, item 3C, all the way in.
2) Carefully and slowly turn Torque Control screw all the way in, then back it four turns out.
3) Turn the jam nut and the adjustment nut on the Torque Control screw all the way down.
4) Drive locking spade into adjustment nut and back adjustment nut out three more turns.
5) Energize forward solenoid on item 11 and the remote compensator (16).

6) Turn main system relief, Item 45, out two turns.
7) Start motor, wait until ram dead ends in extended position, then adjust main system relief to 1300 psi.
8) Adjust Torque Control nut for 5% less than full load Amp draw of electric motor.
9) Lock Torque Control jam nut and re-adjust Item 45.

C) Max Volume Stop adjusts maximum pump flow from 0 - 30 gpm.

Adjustment: By using the Max Volume Stop to slow the cycle time of the press down as slow as possible and still process material fast enough to keep up with the in-coming material. Be sure to lock the jam nut when adjustments are completed.

4) HEAT EXCHANGER: Cools hydraulic fluid by transferring heat to cooling water. Water supply: maximum 60 degree F, potable water. Water flow controlled by Item 24.

5) OIL FILL CAP: Incorporates breather filter for air exchange between tank and surroundings and filter basket for straining coarse particles from oil added to tank.

6) RETURN LINE FILTER: Filters small particulate from oil as it returns to tank. Has internal oil bypass at 50 psi. Change element when indicator changes color.

7 & 8) MINICHECK COUPLING and 0-3000 PSI PRESSURE GAUGE: Refer to Pressure Reading instructions at the beginning of this section.

9) ELECTRIC MOTOR: 3 phase, 20 hp, 1750 rpm, TEFC, 256-T, 460 or 575 volts.

10) OIL LEVEL FLOAT SWITCH: Disables power unit if oil level gets too low, an indicator will light on the control panel if this is the case.

11) 4-WAY 3 POSITION HYDRAULIC PILOT VALVE: Changes ram direction at energization of forward and reverse solenoids. it does it by supplying pilot signals to hydraulic logic elements in Item 1.

12, 13 & 14) JAW TYPE COUPLING: For easy removal of pump or motor.

15) PUMP MOTOR ADAPTOR: Gives a high strength precision mount, which offers quiet operation, concealed couplers and shafts and accurate alignment of shafts.

16) REMOTE COMPENSATOR: Provides a low pressure hold cycle for maximum water removal from supplies material. The Remote Compensator consists of a pressure relief valve and a 2-position normally passing solenoid valve.

A) Adjustment:
   1) Energize the forward solenoid on pilot valve, item 11 - by holding the forward button in for 5 seconds.
   2) Loosen Remote Compensator jam nut, screw all the way out.
   3) Release system pressure by pulling manual handle on Damper or Breaker Bar, item 52, screw Remote Compensator adjustment screw until system pressure reads 1200 psi.
   4) Tighten jam nut and re-adjust item 45.

17) SUCTION STRAINER: Prevents large particulate from passing from the tank to the pump inlet.

18) HYDRAULIC CHECK VALVE: Installed on pump high press outlet. Prevents oil from flowing in reverse direction through pump.

19) DAMPER CYLINDER: 4" Bore x 12" stroke. Provides Damper resistance as dewatered material enters discharge chute.

20) RETRACTABLE BREAKER BAR CYLINDERS: 3" Bore x 2 1/2" stroke. Positions Retractable Breaker Bar, up or down.

21) RAM CYLINDERS: 6" bore x 78" stroke. Provides force to move ram, cushioned for longer cylinder life. 10,000 psi rated.

22) SIGHT GAUGE W/TEMPERATURE: Provides visual check for fluid level and temperature. Fluid level should be checked with ram cylinders retracted.

23) HYDRAULIC WATER STRAINER: Strains particulate from water on heat exchanger water inlet.

24) WATER TEMPERATURE CONTROL: Controls water flow to cooler based on oil temperature. Let press cycle until oil temperature reaches 110 degrees, then turn screw all the way out and then in until water flows.

25) PRESSURE SWITCH FOR HOLD CYCLE: Normally open, contacts close at specified pressure to signal start of hold cycle.

   A) Adjustment:
      1) Start press and hold start button in for 5 seconds.
      2) Turn pressure switch all the way in, clockwise.
      3) Adjust remote compensator, item 16, until the system pressure reads 1150 psi.
      4) Turn pressure switch out counter clockwise until the contacts close on the pressure switch. This can be done by observing the input light on PLC.
      5) Turn remote compensator, item 16, until the system pressure reads 1200 psi. Shut press off and restart.

42) PILOT TO CLOSE CHECK: Allows fluid flow from the rod end to the

blind end of the ram cylinders for more rapid travel in the forward direction.

43) COUNTER BALANCE VALVE: For regenerative functions, allows flow from rod end to tank when system pressure is greater than 1000 psi and ram moving in forward direction.

44) LOGIC ELEMENT: Normally closed, hydraulic modulating element used for direction control of fluid between pump and ram cylinders.

45) CARTRIDGE RELIEF: Main system relief.

A) Adjustment:
1) Energize the forward solenoid on the pilot valve 11 - by pressing the start button in for 5 seconds.
2) Turn in until system pressure reaches 2400 psi.
3) Turn 1/4 turn in and lock jam nut, to set at approximately 2500 psi.

49) CARTRIDGE CHECK VALVE: For exit on Damper and Retractable Breaker Bar cylinders. Holds constant pressure as system pressure fluctuates during cycle.

50) CARTRIDGE PRESSURE VALVE, REDUCING/RELIEVING 300-1200 psi: Supplies constant specified pressure to Damper and relieves excess pressure from Damper.

A) Adjustment:
1) Attach pressure gauge to port "G1".
2) Loosen jam nut on adjustment screw and turn adjustment screw all the way out.
3) With press running, release pressure by pulling and releasing manual handle on Damper Manual Valve.
4) Slowly turn Damper pressure adjustment screw in until desired pressure is reached and lock jam nut. Refer to Initial Pressure Setting instructions for recommended setting.

51) CARTRIDGE PRESSURE VALVE, REDUCING/RELIEVING 100-600 psi: Supplies constant specified pressure to retractable Breaker Bar and relieves excess pressure from Retractable Breaker Bar.

A) Adjustment:
1) Attach pressure gauge to port "G2".
2) Loosen jam nut on adjustment screw and turn adjustment screw all the way out.
3) With press running, release pressure by pulling and releasing manual handle on Damper Manual Valve.
4) Slowly turn Damper pressure adjustment screw in until desired pressure is reached and lock jam nut. Refer to Initial Pressure Setting instructions for recommended setting.

52) MANUAL CARTRIDGE VALVES: Manual control for Damper and Breaker Bar.
   A) Adjustment:
      1) Pull out, rotate 90 degrees and release to change from up to down or down to up.

53) HYDRAULIC POPPET LOGIC ELEMENT: Used for direction control between blind end of ram cylinders and tank.

54) HYDRAULIC FLOW REGULATOR: Sandwich pilot choke used to reduce pressure spikes to the reversal valve, item 11.
   A) Adjustment:
      1) With press cycling, loosen jam nut and slowly turn in the adjustment screw until press does not reverse.
      2) Slowly turn adjustment screw out until press reverses, lock jam nut.

55) QUICK DISCONNECT GAUGE FITTING: Used for connection of gauge to monitor system pressure.

56) PRESSURE SWITCH FOR END OF STOKE: Normally open, contacts close at specified pressure to signal end of stroke.
   A) Adjustment:
      1) Start press and hold start button in for 5 seconds, wait until ram reaches end of stroke.
      2) Press start button again.
      3) Turn pressure switch all the way in, clockwise.
      4) Adjust pressure pump compensator, item (37), until the system pressure reads 2350 psi.
      5) Turn pressure switch out counter clockwise until the contacts close on the pressure switch. This can be done by observing the input light on PLC.
      6) Turn pump compensator, item 3, until the system pressure reads 2400 psi. Shut press off and restart.

-MECHANICAL PARTS-

1) RAM: Cycles forward and backward to force material through press.

2) WEAR STRIPS: Provides low friction bearing surface and seal between ram and press body, made of SS304.

3) DEWATERING SECTION: Stainless steel sieve section between press body and discharge chute.

4) DAMPER PLATE: Provides resistance to materials entering the discharge chute from the dewatering section.

5) RETRACTABLE BREAKER BAR: Closes gap between fixed Breaker Bar and the top of the ram. Holds more materials in dewatering section. Enables press to process material at a greater rate.

   A) Adjustment:
      1) Loosens jam nut on cylinder rod.

2) Supports Retractable Breaker Bar and removes cylinder pin on rod end.
3) Turn rod end to adjust to desired length.
4) Reverse steps 1 & 2 above.

** NOTE: Be very careful not to lower the Retractable Breaker Bar in its down position. Major damage would occur if the ram hit the Breaker Bar on its forward stroke.

TROUBLE SHOOTING

The following is a list of possible problems that may occur, their causes and solutions. These possible problems will be divided into two categories, hydraulic problems and operational problems. Hydraulic problems are problems with the Power Unit caused, most often, by failed or mis-adjusted hydraulic components. Operational problems are problems with the De-watering Press processing material correctly.

-Hydraulic Problems-

PROBLEM	CAUSE	SOLUTION
Motor over-loads	Torque Control too high	Re-adjust Torque Control, item 3.
Press won't start	Low oil level	Add oil & reset control.
	High temp shutdown (optional High Temp Switch)	Check Main System Relief, Item 45, & reset control.
Ram won't reverse, F-R	Remote Compensator not shifting	See problem Remote Compensator not shifting
	Defective solenoid on pilot valve	Replace solenoid valve
	Pressure Compensator too low	Reset Pressure Compensator on pump, Item 3.
	Contaminant blockage in pilot valve	Use manual override to clear blockage, Item 11.
Ram won't go forward	Error in PLC logic	Correct
	Contamination in pilot valve	Clean or replace
	Solenoid on pilot valve defective	Replace
Slow in going forward	Regenerative circuit not working	Replace Counter Balance valve, Item 43.
Slow forward & reverse	Torque Control set too low	Reset Torque Control, Item 3.
	Max Volume Stop in too far	Reset Max Volume Stop, Item 3.
Remote Compensator not energizing	Pressure Switch setting too high	Reset or replace Pressure Switch, Item 25.
	Remote Compensator solenoid	Replace Remote Compensator, Item 16.

-Operational Problems-

PROBLEM	CAUSE	SOLUTION
Plug will not form	Damper up Material too wet	Lower Damper. Add large sheet of cardboard or similar material.
	Retractable Breaker Bar down	Raise until tight plug is formed.
Material coming out wet	Damper pressure set too low	Raise Damper pressure 50 psi, allow time to see reaction. Do not change Damper pressure more than 100 psi per day.
	Hold time not long enough	Increase hold time 1 second. Allow time to see reaction. Do not change hold time more than 2 seconds per day.
Plug moving at hold pressure	Damper pressure set too low	Raise Damper pressure 50 psi, allow time to see reaction. Do not change Damper pressure more than 100 psi per day.
	Remote Compensator set high	Lower Remote Compensator 50 psi, allow time to see reaction. Do not change Remote Compensator setting more than 100 psi per day.
Excess material coming out back of press	Retractable Breaker Bar down	Raise Breaker Bar if able to keep up with incoming material
	Clearance between Breaker Bar & top of Ram too small	Adjust Breaker Bar cylinder & increase clearance between Breaker Bar & Ram top. Allow time to see reaction. Do not change Breaker Bar height more than 1/8" per day.
	Wear Strips worn	Replace Wear Strip or shim to 1/8" clearance.

TABLE 1

Pressure Switch, Item 25	1150 psi
Pressure Switch, Item 51	2350 psi
Remote compensator, Item 16	1200 psi
Pressure Compensator, Item 3	2400 psi
Main System Relief, Item 45	2500 psi
Damper Reducing Valve, Item 50	900 psi - 1200 psi
Retractable Breaker Bar Reducing Valve, Item 51	400 psi

MAINTENANCE

1. Check for oil leaks weekly.
2. Check fluid level monthly.
3. Change Return Line filter after first 100 hours of operation and every 500 hours thereafter or when indicator changes its' color.
4. Clean suction strainer every 500 hours of operation.
5. Change breather filter every 1250 hours of operation.
6. Check wear-strip on ram yearly.
7. Check safeties (if added by customer) weekly.

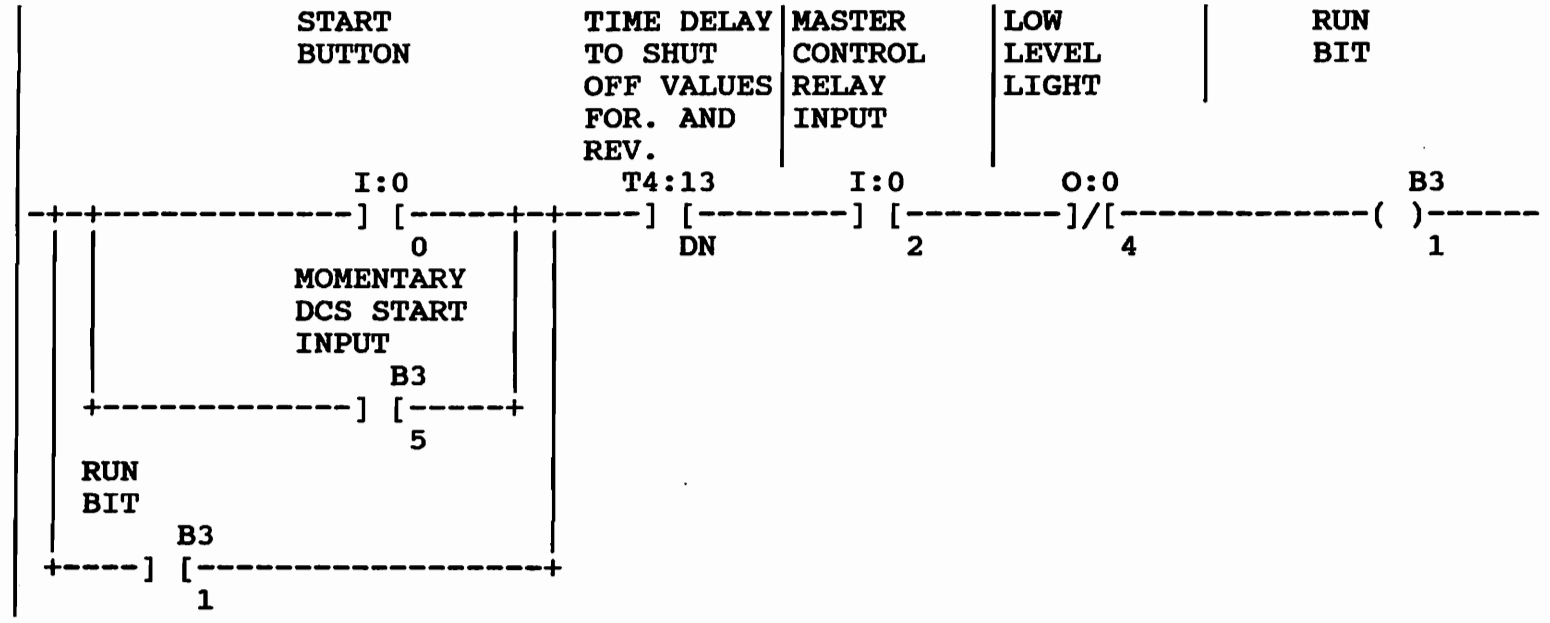
TYPICAL

SEE DCS FOR ACTUAL LOGIC CONTROL

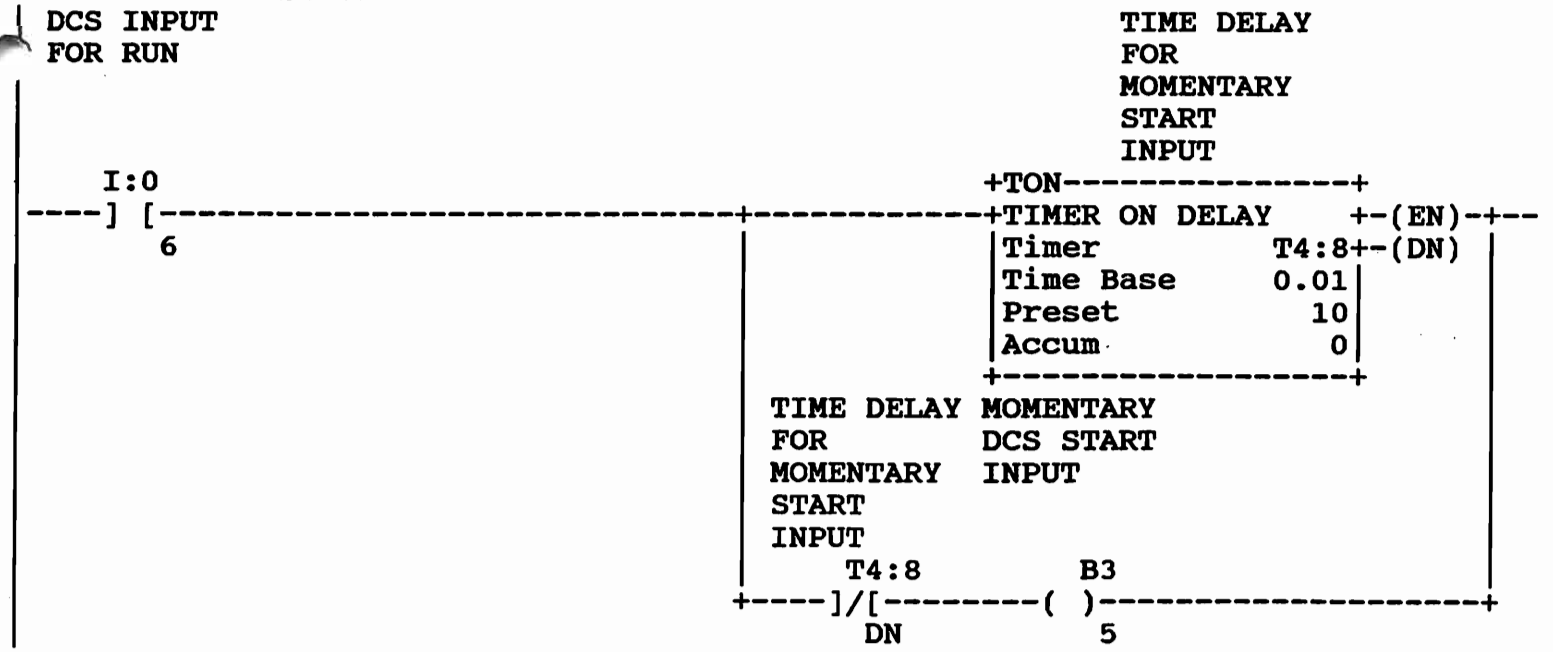
Allen-Bradley Co.
1747 Series Software
APS Release 4.02
Documentation Utility
Program Listing

Processor File: DEWELEC1.ACH
December 13, 1994 - 18:45

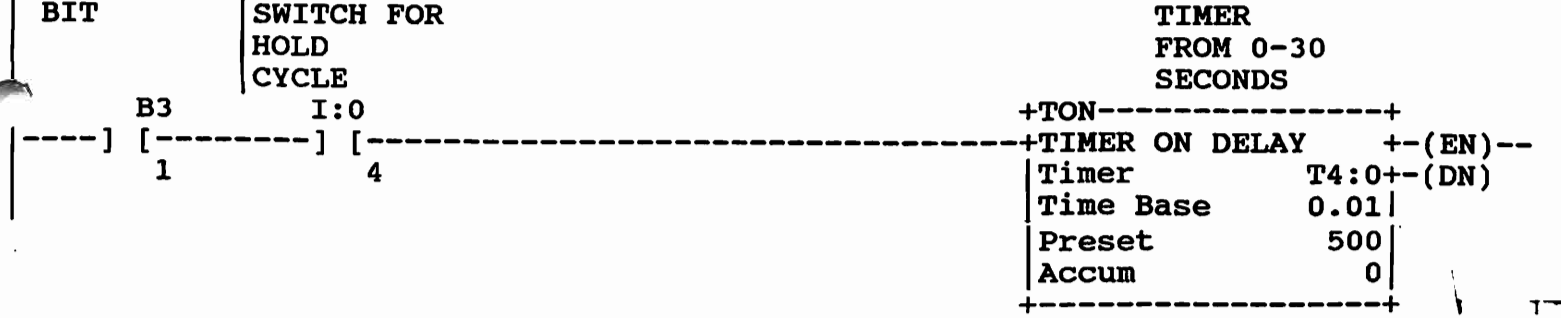
Rung 2:0
START CONTROL RUNG



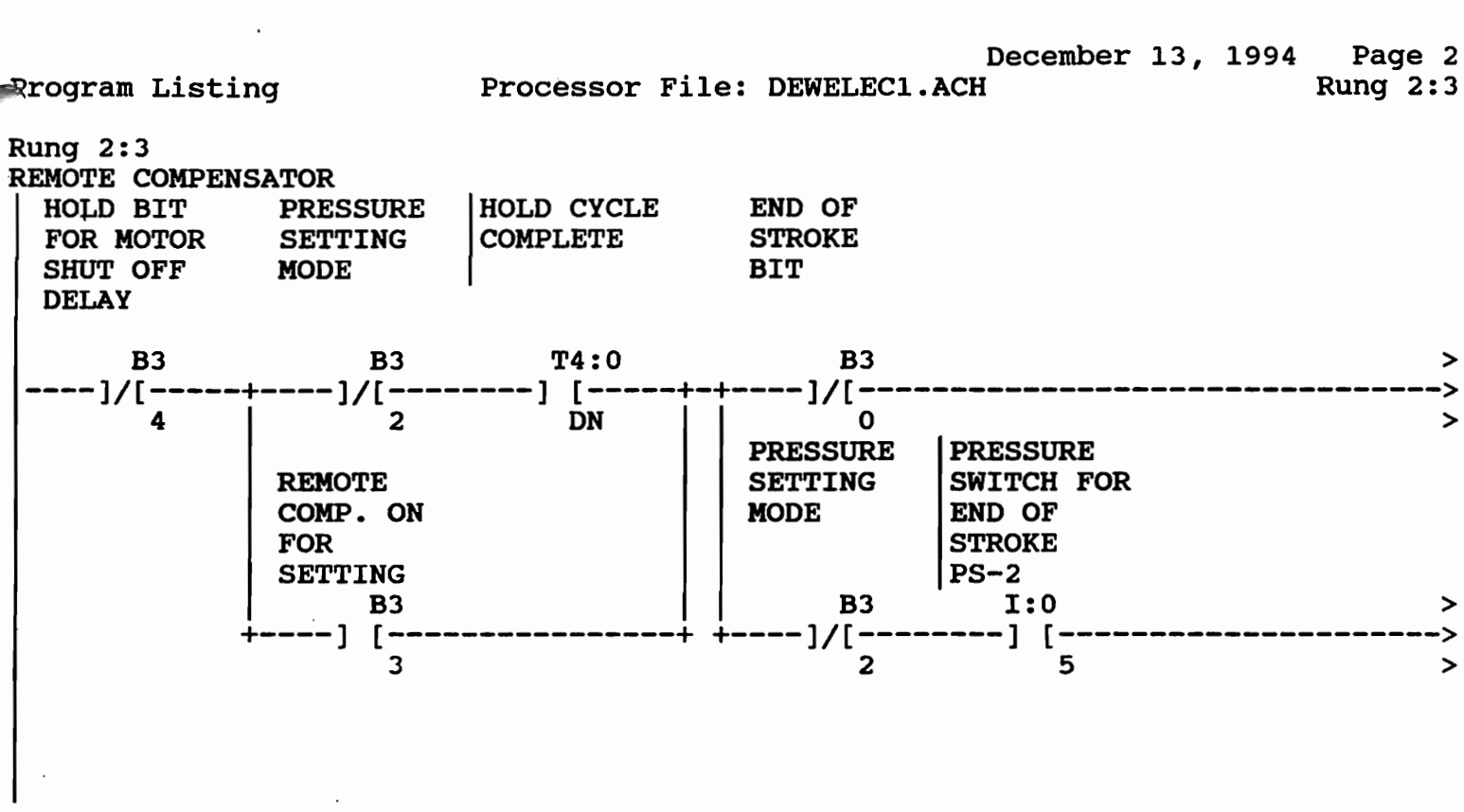
Rung 2:1
DELAY FOR DCS INPUT



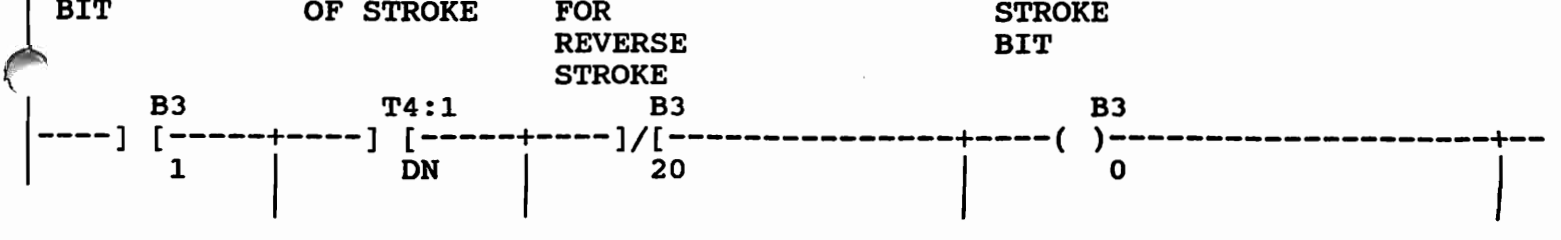
Rung 2:2
HOLD CYCLE

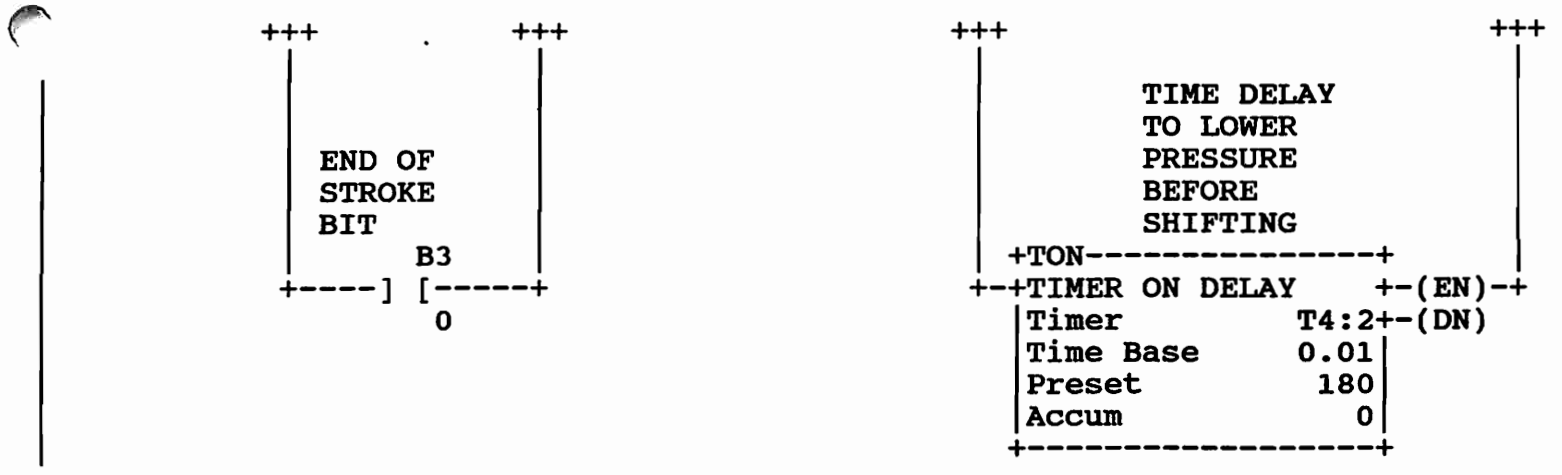


Rung 2:3
REMOTE COMPENSATOR

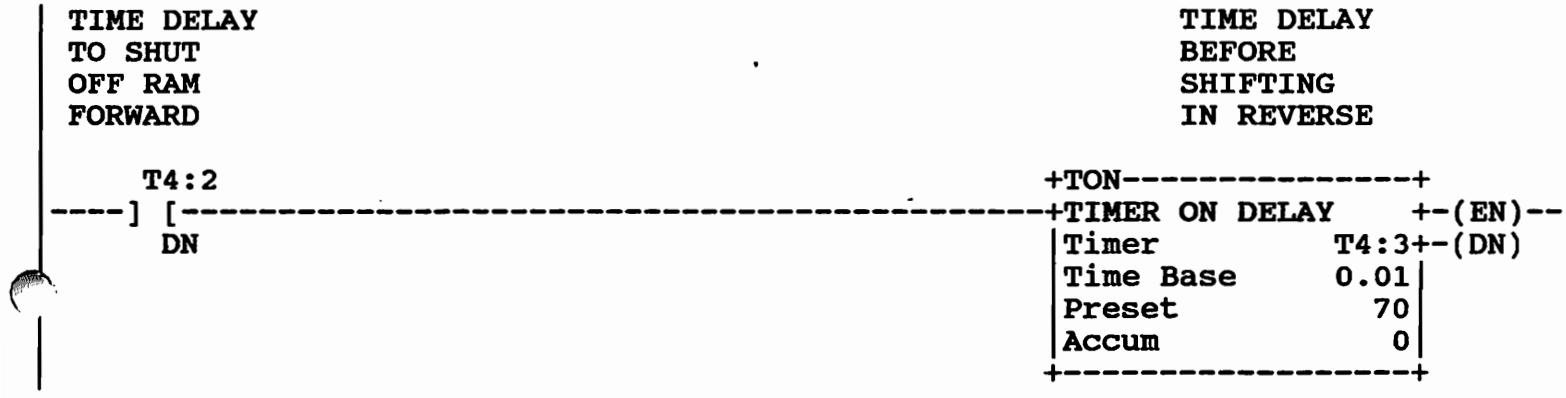


Rung 2:4
MAIN RAMS AT END OF STROKE AND REDUCE PRESSURE BEFORE SHIFTING

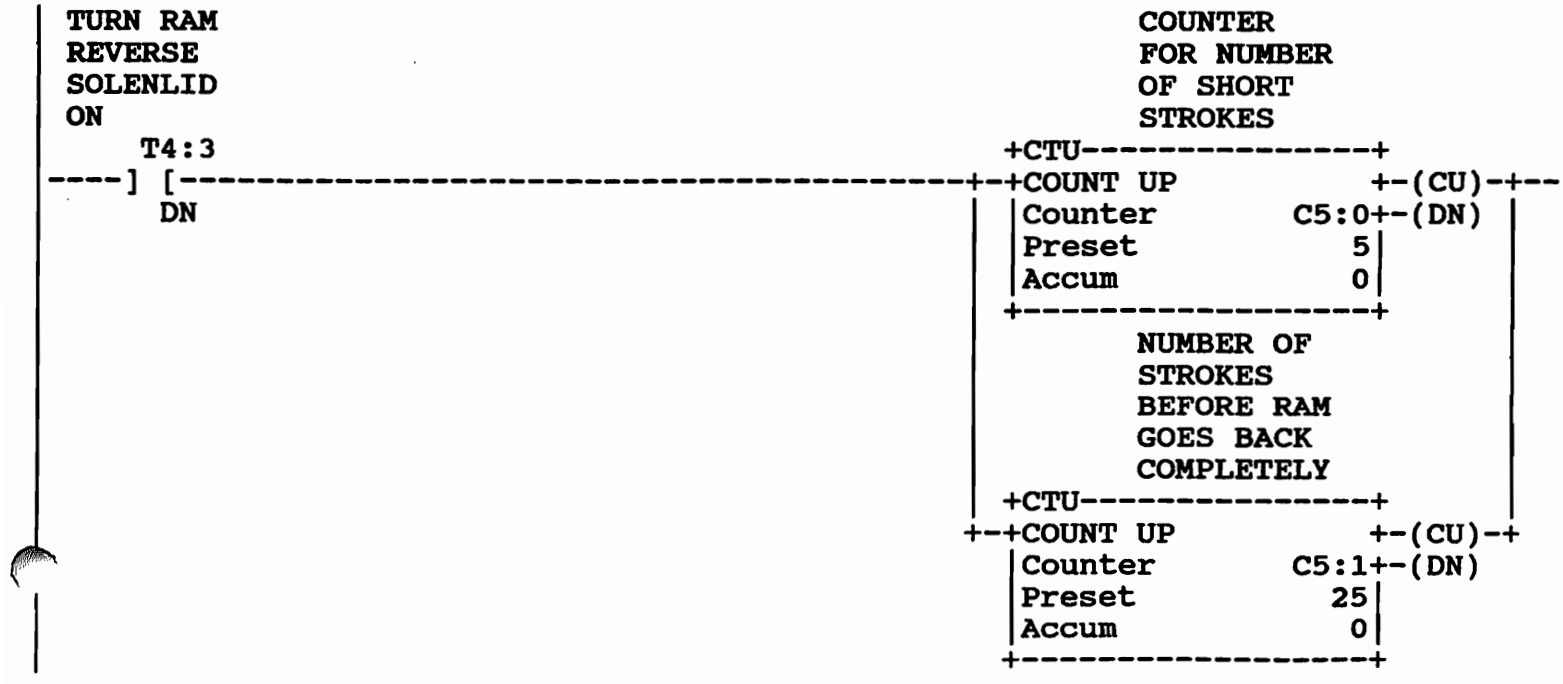




Rung 2:5
TIME DELAY BEFORE SHIFTING INTO REVERSE



Rung 2:6
COUNTERS FOR SHORT SHORTING AND FULL STROKE
SET C5:0 TO ZERO FOR CONTINOUS FULL LENGHT
STROKING



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ung 2:7
NORMAL FULL STROKE TIMER MUST ADJUST FOR
PUMP FLOW
 END OF     |SHORT      |FULL                                          TIME DELAY
 STROKE     |STROKE     |RETURN                                        FOR REV
 BIT        |COUNTER    |STROKE                                        MUST ADJ.
                        |COUNTER                                       FOR PUMP
                                                                       FLOW
      B3         C5:0        C5:1                          +TON---------------+
----] [--------] [--------]/[----------------------------+TIMER ON DELAY    +-(EN)--
       0          DN          DN                         |Timer         T4:10+-(DN)
                                                         |Time Base      0.01|
                                                         |Preset         2000|
                                                         |Accum             0|
                                                         +------------------+

Rung 2:8
TIMER TO INSURE CYLINDER BOTTOMS OUT ONCE
EVERY TWENTY FIVE STROKES MUST ADJUST FOR
PUMP FLOW
 END OF     |FULL                                                    TIME DELAY
 STROKE     |RETURN                                                  FOR
 BIT        |STROKE                                                  COMPLETE
            |COUNTER                                                 STROKE
      B3         C5:1                                  +TON---------------+
----] [--------] [----------------------------------+TIMER ON DELAY    +-(EN)--
       0          DN                                 |Timer         T4:11+-(DN)
                                                     |Time Base      0.01|
                                                     |Preset         2400|
                                                     |Accum             0|
                                                     +------------------+

Rung 2:9
SHORT STROKE TIMER
 END OF     |SHORT      |FULL                                          TIME DELAY
 STROKE     |STROKE     |RETURN                                        FOR SHORT
 BIT        |COUNTER    |STROKE                                        STROKE
                        |COUNTER
      B3         C5:0        C5:1                          +TON---------------+
----] [--------]/[--------]/[----------------------------+TIMER ON DELAY    +-(EN)--
       0          DN          DN                         |Timer         T4:12+-(DN)
                                                         |Time Base      0.01|
                                                         |Preset         1000|
                                                         |Accum             0|
                                                         +------------------+

Rung 2:10
RESET FOR SHORT STROKE TIMER
 TIME DELAY|                                                                 COUNTER
 FOR       |                                                                 FOR NUMBER
 NORMAL    |                                                                 OF SHORT
 STROKE    |                                                                 STROKES
   T4:10                                                                        C5:0
----] [-------------------------------------------------------------------(RES)-----
      DN
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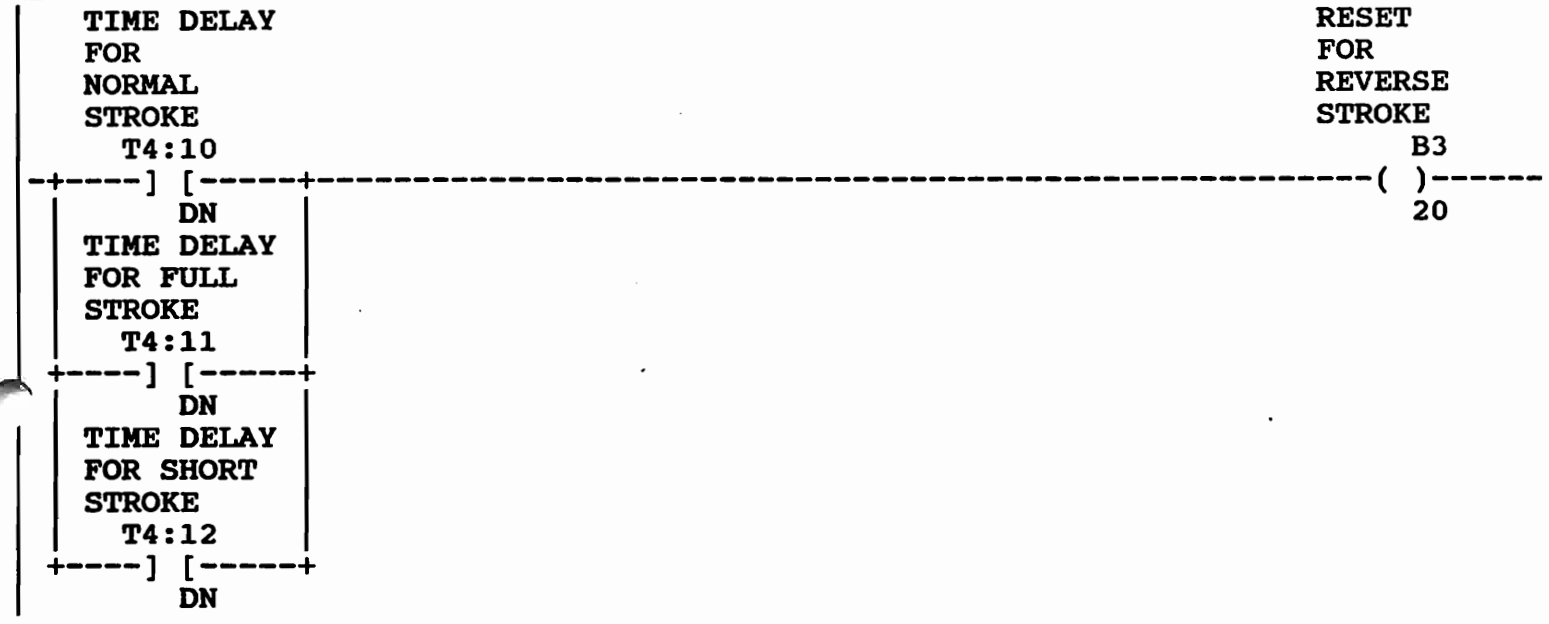
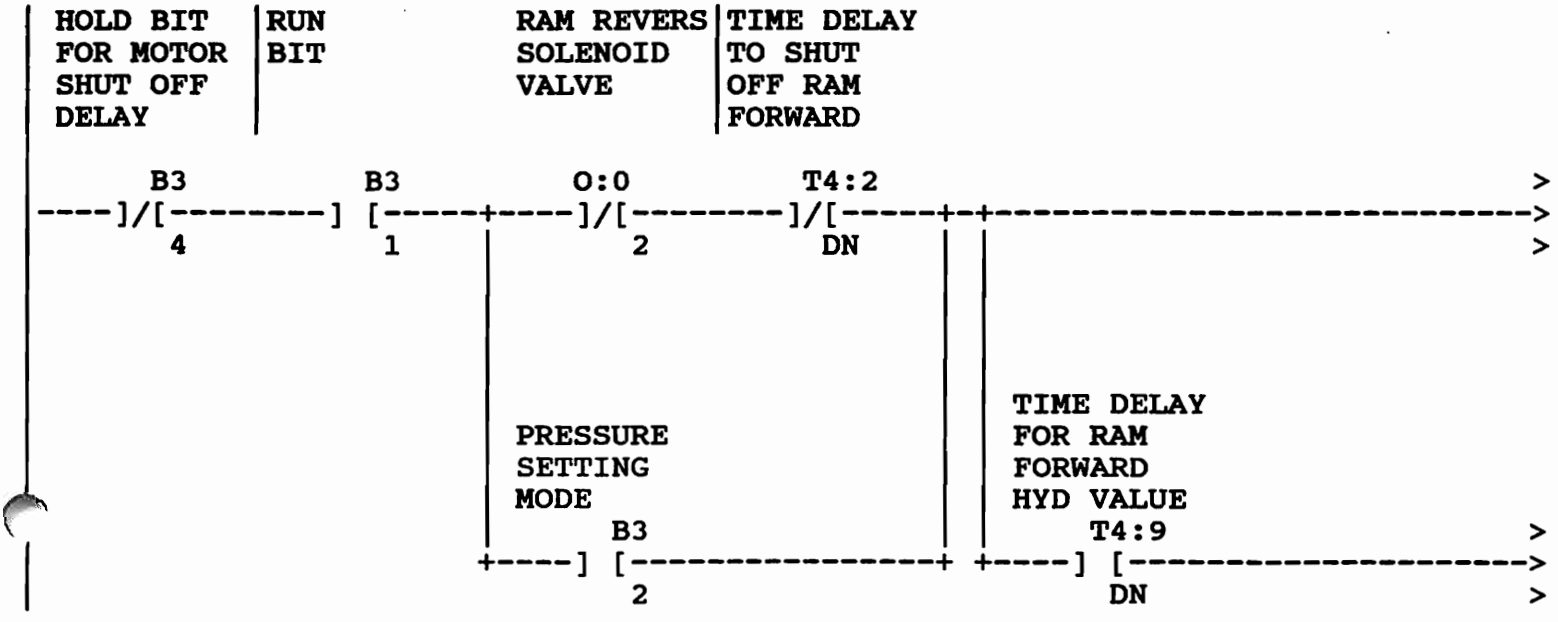
Rung 2:11
RESET FOR COMPLETE STROKE TIMER

Rung 2:12
RESET TO SEND RAM IN FORWARD STROKE



Rung 2:13
FORWARD HYDRAULIC VALVE



```
                                                    TIME DELAY
                                                    FOR RAM
                                                    FORWARD
                                                    HYD VALVE

                                                 +TON---------------+
                                                 +TIMER ON DELAY    +-(EN)-+--
                                                  |Timer          T4:9+-(DN) |
                                                  |Time Base      0.01|      |
                                                  |Preset           50|      |
                                                  |Accum             0|      |
                                                  +-------------------+      |
                                                  RAM FORWAD                 |
                                                  SOLENOID                   |
                                                  VALVE                      |
                                                                             |
                                                     O:0                     |
                                                 ----( )---------------------+
                                                        1
```

Rung 2:14
REVERSE HYRAULIC VALVE

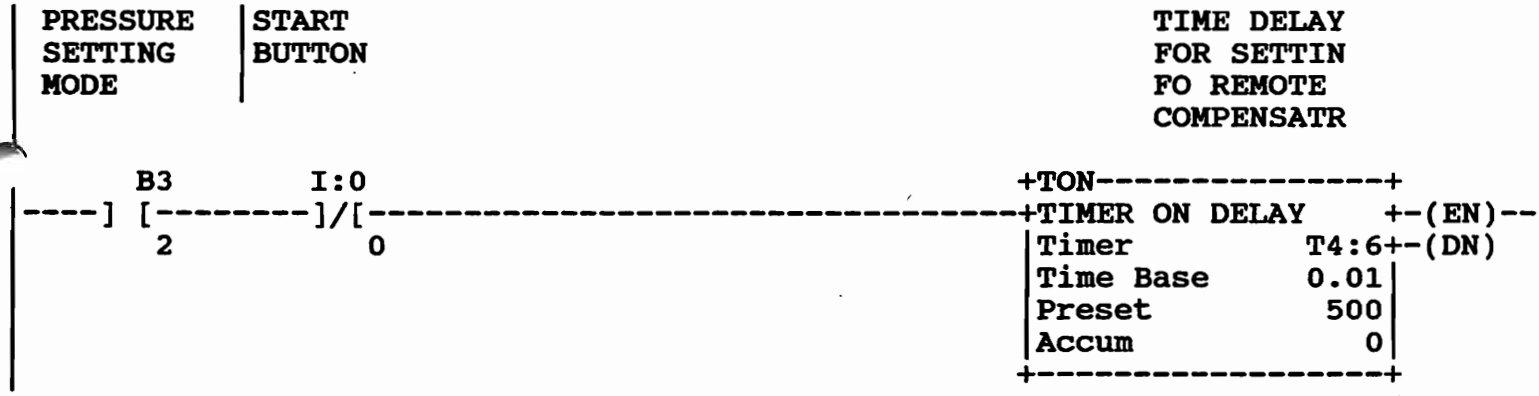
```
| HOLD BIT  | RUN       | RAM FORWAD | TURN RAM  | PRESSURE  |            RAM REVERS
| FOR MOTOR | BIT       | SOLENOID   | REVERSE   | SETTING   |            SOLENOID
| SHUT OFF  |           | VALVE      | SOLENLID  | MODE      |            VALVE
| DELAY     |           |            | ON        |           |
     B3          B3         O:0          T4:3         B3                    O:0
----]/[--------] [--------]/[--------] [--------]/[-------------------( )------
      4           1          1           DN          2                     2
```

Rung 2:15
TIME DELAY FOR PRESSURE SETTING MODE.
HOLD START BUTTON IN FOR FIVE SECONDS
THIS WILL TURN ON THE FORWARD HYDRAULIC
VALVE

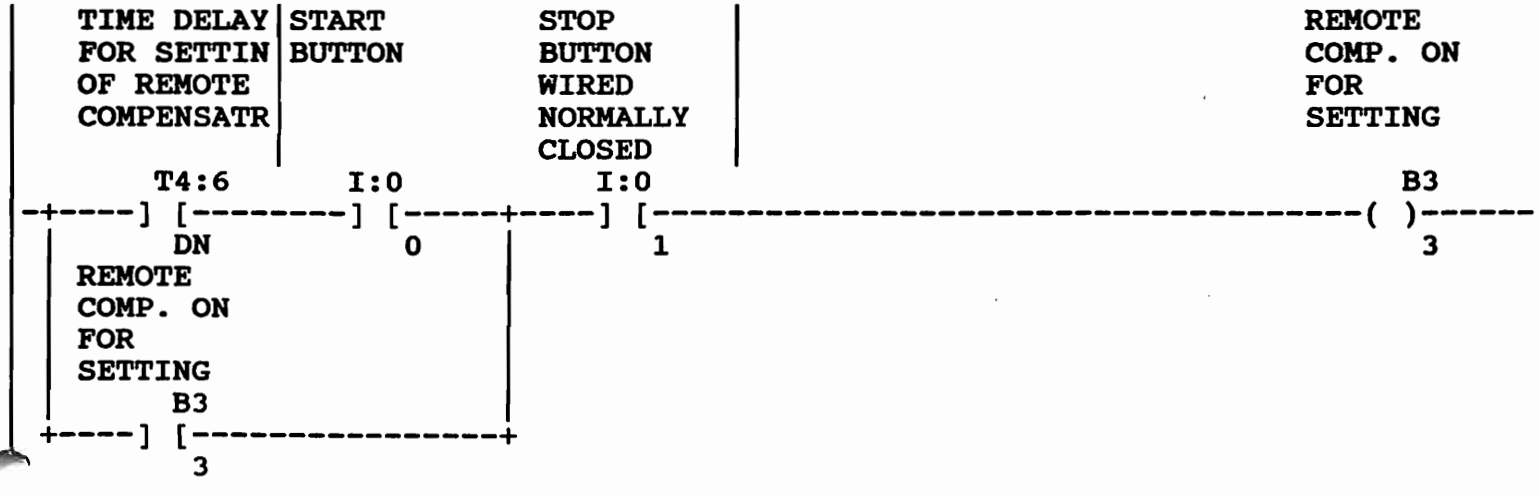
```
| RUN       | START                                                TIME DELAY
| BIT       | BUTTON                                               FOR
|           |                                                      SETTING
|           |                                                      MODE
     B3         I:0                                          +TON---------------+
----] [--------] [-------------------------------------------+TIMER ON DELAY    +-(EN)--
      1          0                                           |Timer          T4:5+-(DN)
                                                             |Time Base      0.01|
                                                             |Preset          500|
                                                             |Accum             0|
                                                             +-------------------+
```

Rung 2:16
PRESSURE SETTING MODE

Rung 2:17
TIME DELAY BEFORE GOING TO HIGH PRESSURE
IN THE PRESSURE SETTING MODE

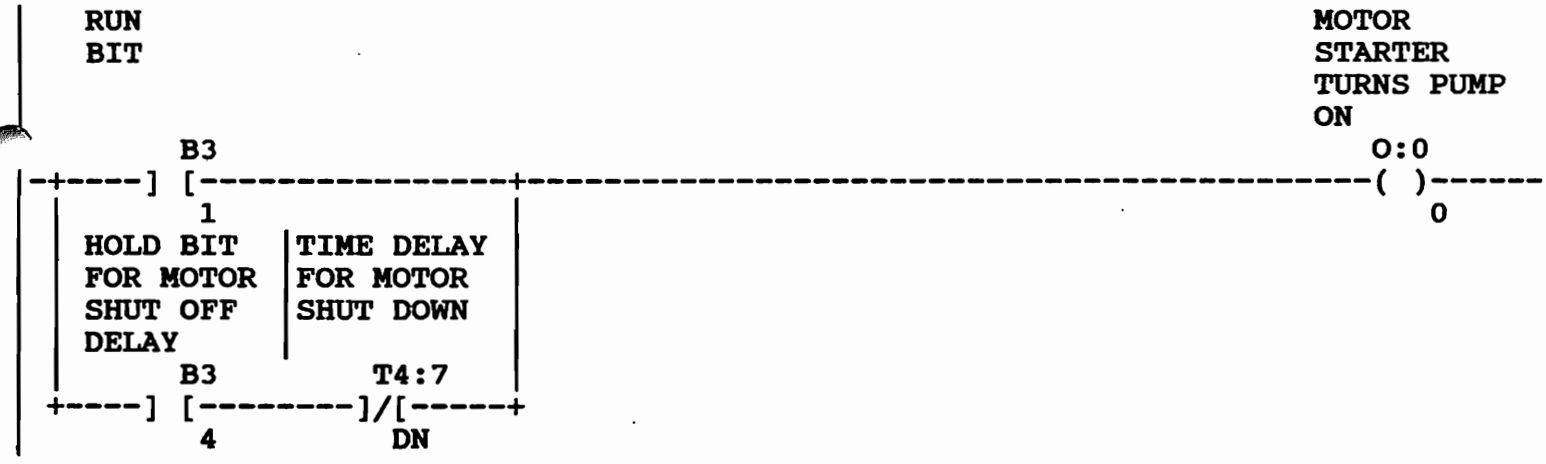


Rung 2:18
PRESSURE SETTING MODE AT HIGH PRESSURE BY TURNING
ON REMOTE COMPENSATOR

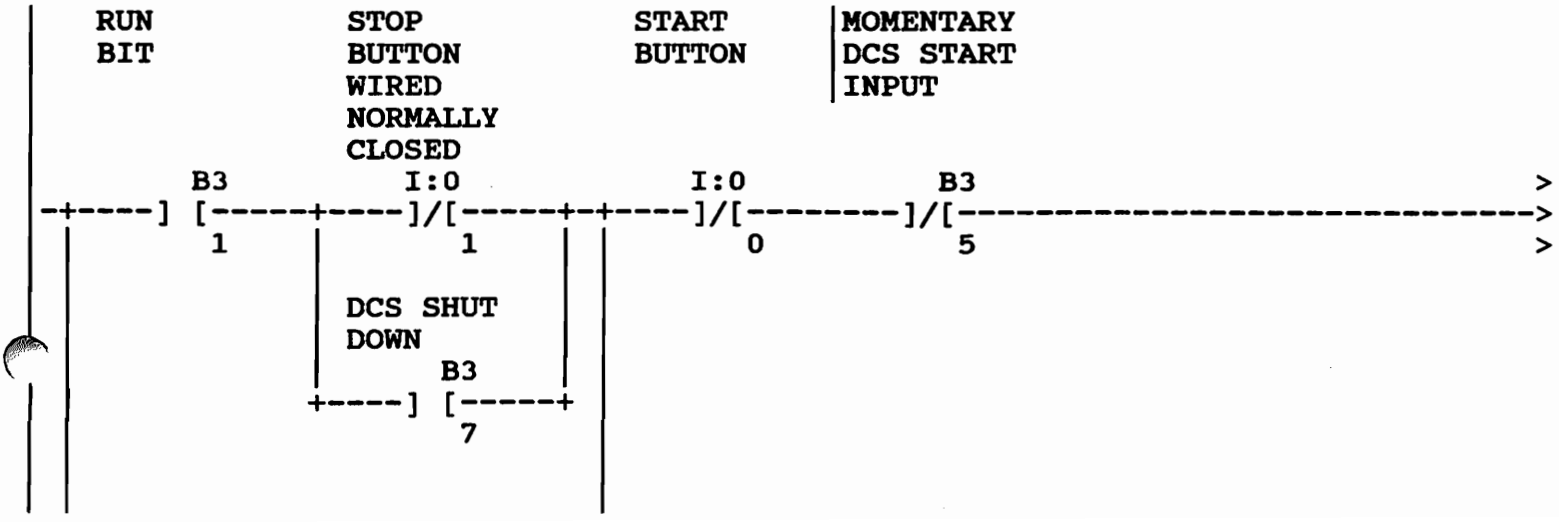


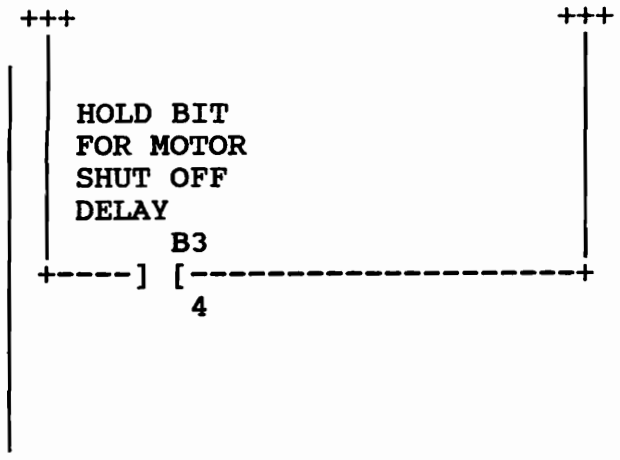
Rung 2:19
LOW OIL LEVEL SHUT DOWN RESET BY PUSHING CYCLE STOP BUTTON

Rung 2:20
MOTOR STARTER FOR HYDRAULIC PUMP

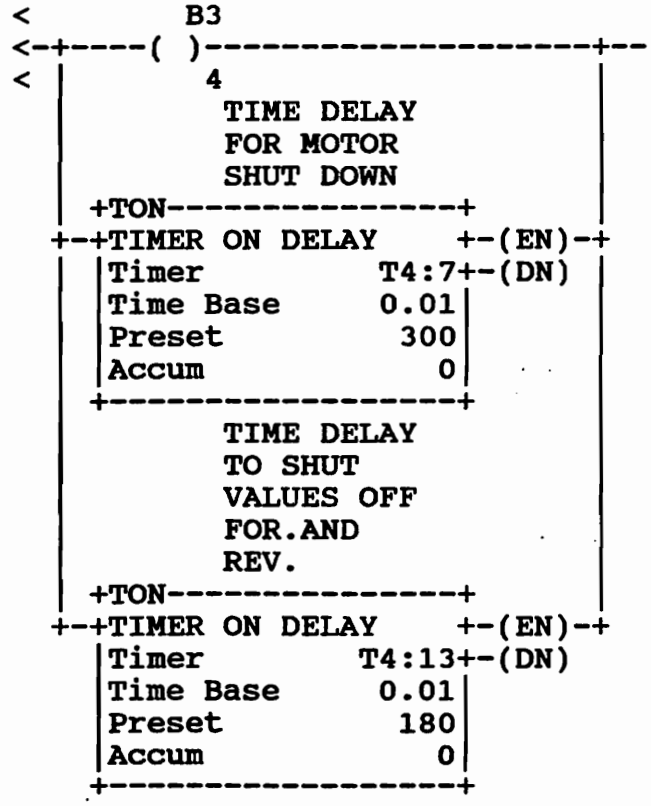


Rung 2:21
THIS RUNG ALLOWS THE HYDRAULIC VALUES TO CENTER POSTION TO RELIEVE SYSTEM PRESSURE BEFORE SHUTING OFF PUMP





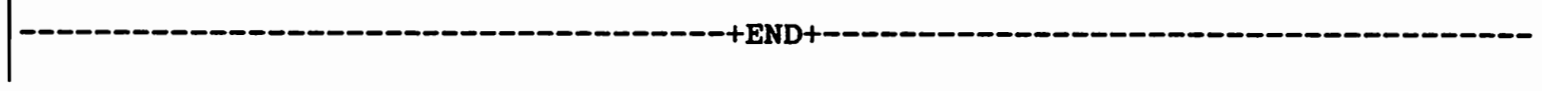
HOLD BIT
FOR MOTOR
SHUT OFF
DELAY



Rung 2:22
MAKES DCS SHUT DOWN SAME AS CYCLE STOP SHUT DOWN

Rung 2:23
SAME AS ABOVE

Rung 2:24



REPORT OPTIONS SUMMARY

Insure Valid X-Ref Info:	YES
Graphics Mode:	NO
Page Width:	80
Page Length:	66
Starting File:	2
Ending File:	2
Power Rail:	NO
Address Comments:	YES
Address Display:	YES
Rung Comments:	YES
Ladder Cross Reference:	NONE

Performance Information

Series PAVC 65 Pressure Compensated, Variable Volume, Piston Pumps

Features

- High Strength Cast-Iron Housing
- Built-In Supercharger
- High Speed Capability — 3000 RPM
- Sealed Shaft Bearing
- Two Piece Housing for Ease of Service
- Cartridge Type Controls — Field Changeable
- Replaceable Bronze Clad Port Plate
- Airbleed Standard for Quick Priming
- Hydrodynamic Cylinder Barrel Bearing
- Side Load Capability

Controls

- Pressure Compensation
- Load Sensing
- Horsepower Limiting
- Horsepower and Load Sensing
- Remote Pressure Compensation
- Adjustable Maximum Volume Stop
- Electrohydraulic Pressure
- Electrohydraulic Flow and Pressure (Servo Control)
- Dual and Tri Pressure
- Low Pressure Standby
- Multi-Pressure Load Sense

Specifications

Pressure Ratings: 3000 PSI (207 Bar) Continuous
3300 PSI (228 Bar) Intermittent
(20% duty cycle)

Speed Ratings: 600 to 3000 RPM

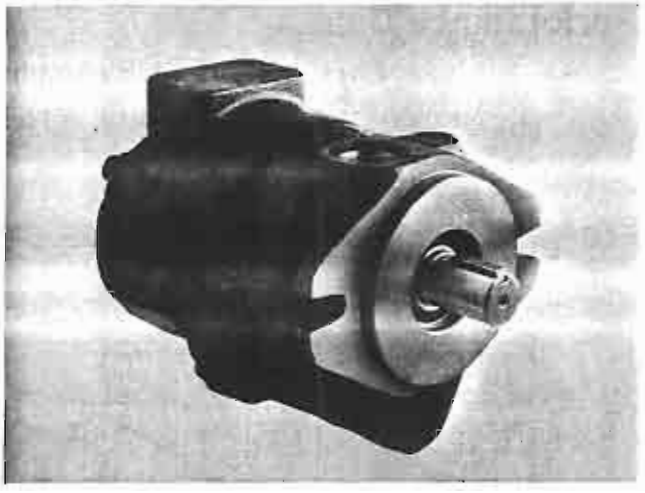
Inlet Conditions: 25 PSI (1.7 Bar) Max. Inlet Charge
5 In. Hg. Max. Vacuum Condition
(At 1800 RPM) See Chart for Other Shaft Speeds.

Operating Temperature Range: −40°F to 160°F
(−40°C to 71°C)

Housing Material: Cast-Iron

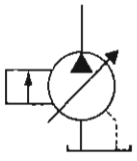
Filtration: Maintain SAE Class 4, ISO 16/13

Mounting: SAE C 2 Bolt Flange Mount or
Diagonally on SAE C 4 Bolt Flange Mount

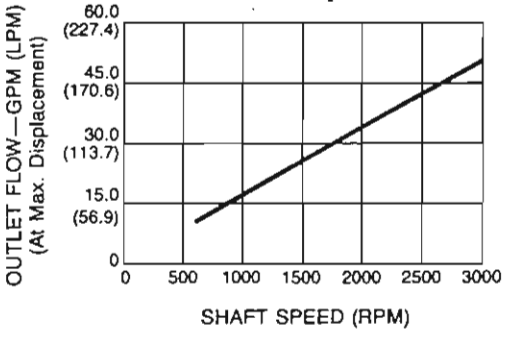


Schematic Symbol

(Basic Pump)



Flow vs. Speed



Installation Data: See page 58 of this catalog for specific recommendations pertaining to system cleanliness, fluids, start-up, inlet conditions, shaft alignment, drain line restrictions and other important factors relative to the proper installation and use of these pumps.

Quick Reference Data Chart

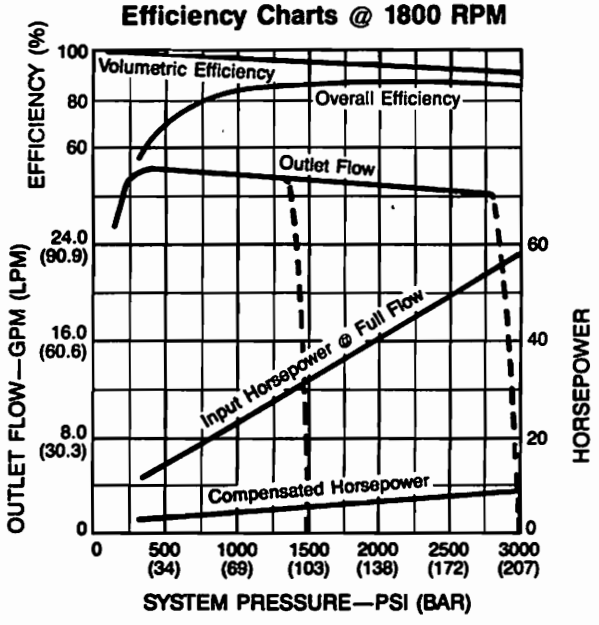
Pump Model	Displacement IN³ (CM³/REV)	Pump Delivery @ 300 PSI/21 Bar In GPM (LPM)		*Approximate Noise Levels dB(A) @ Full Flow 1800 RPM (1200 RPM)				Horsepower At 1800 RPM And At Maximum Pressure & Displacement
		1200 RPM	1800 RPM	500 PSI (34 Bar)	1000 PSI (69 Bar)	2000 PSI (138 Bar)	3000 PSI (207 Bar)	
PAVC 65	4.0 (65)	20.8 (78.7)	31.2 (118.1)	77 (75)	78 (76)	80 (78)	81 (79)	56.5

*Since many variables such as mounting, tank style, plant layout, etc., effect noise levels, it cannot be assumed that the above readings will be equal to those in the field. The above values are for guidance in selecting the proper pump. Noise levels are A-weighted, mean sound pressure levels at 1 meter from the pump, measured and recorded in accordance with applicable ISO and NFPA standards.

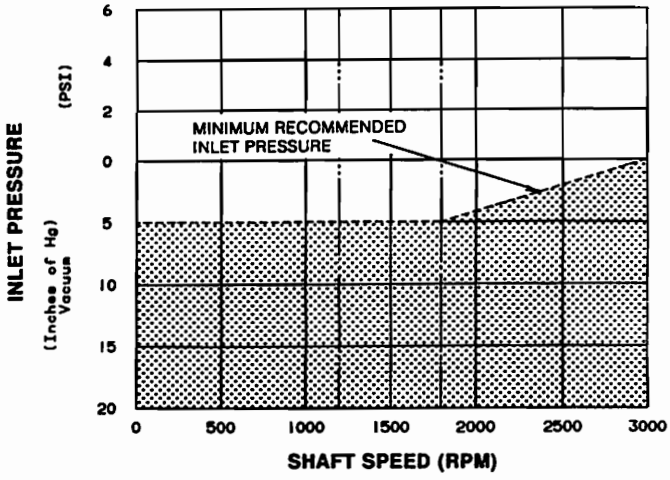
Performance Data

Fluid: Standard Hydraulic Oil 100 SSU @ 120°F (49°C)

Flow, Horsepower and Efficiency Charts @ 1800 RPM



INLET CHARACTERISTICS



NOTE: The efficiencies and data in the graph are good only for pumps running at 1800 RPM and stroked to maximum. To calculate approximate horsepower for the other conditions, use the following formula:

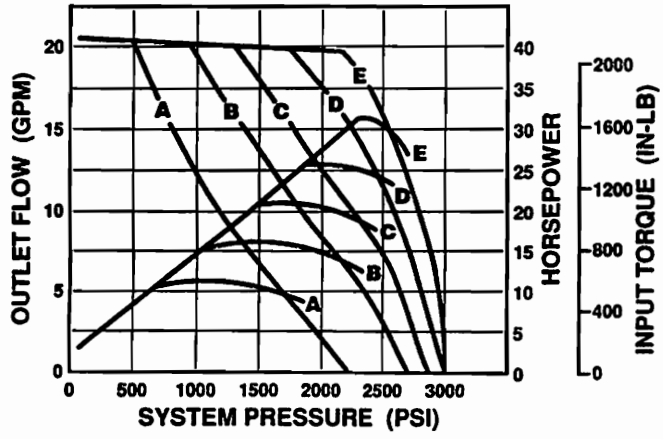
$$HP = \left[\frac{Q \times (PSI)}{1714}\right] + (CHp)$$

Actual GPM is directly proportional to drive speed and maximum volume setting. Flow loss, however, is a function of pressure only.

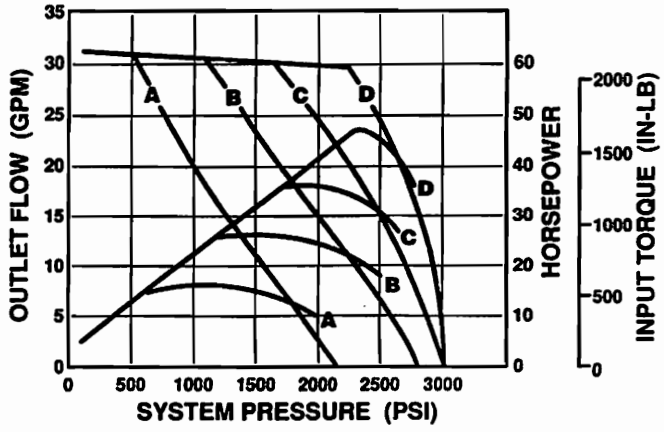
WHERE:
Q = Actual Output Flow in GPM
PSI = Pressure At Pump Outlet
CHp = Input Horsepower @ Full Compensation @ 1800 RPM (from graph read at operating pressure)

Minimum Horsepower Settings Attainable With Control Options C, H, CM & HM

PAVC 65 – 1200 RPM



PAVC 65 – 1800 RPM

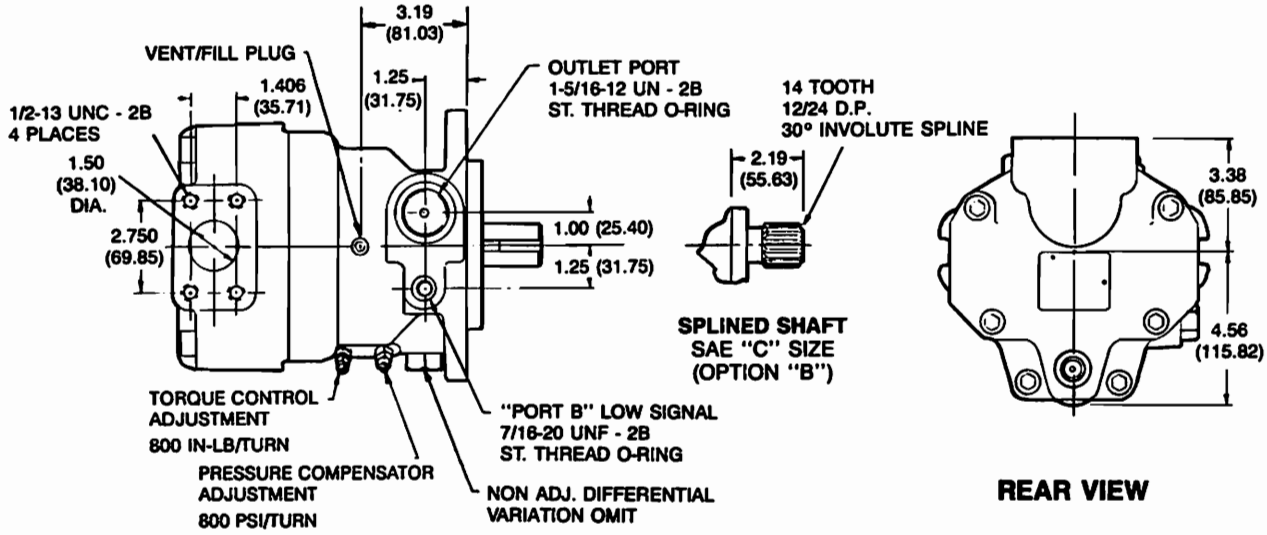


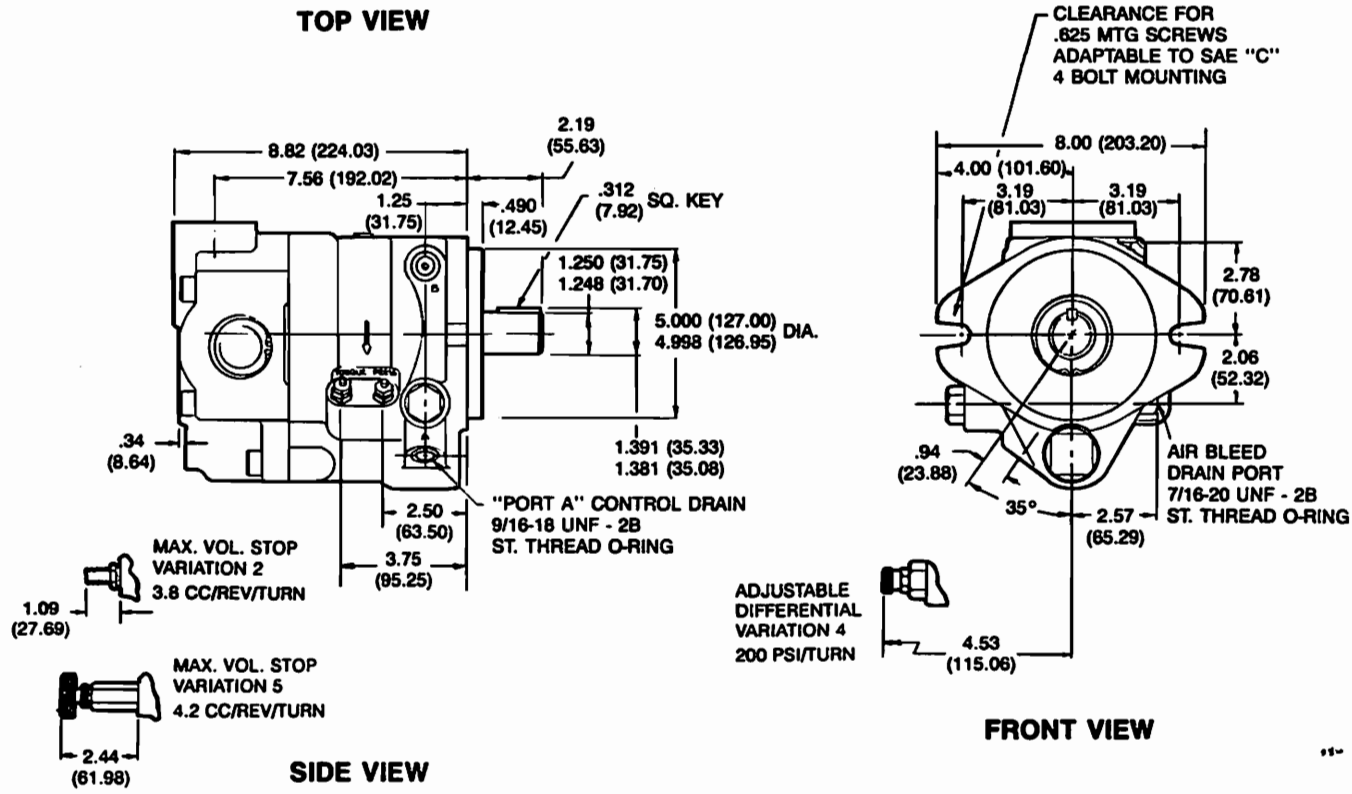
See page 16 for "How to Read Curves" information.

Dimensions — Top Port

Millimeter equivalents for inch dimensions are shown in (**)

Note:
1. Shown and dimensioned is a counterclockwise pump. Ports A and B, delivery port and pump controls will be on the opposite side for a clockwise pump.
2. Pump shaft and mounting comply with SAE "C" dimensions.

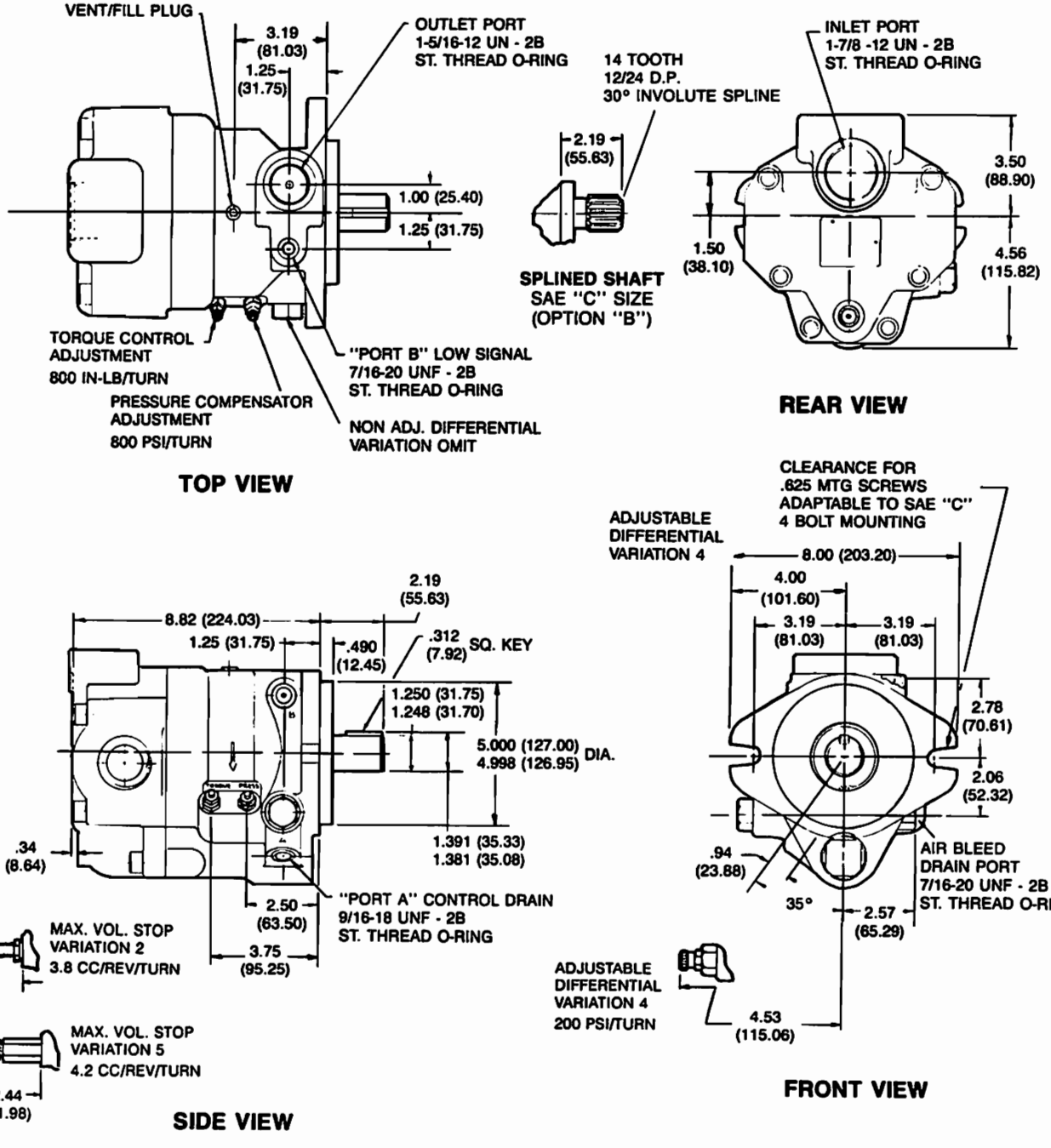




Dimensions — Rear Port

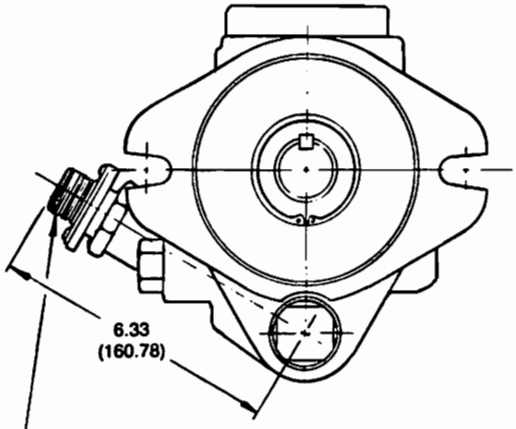
Millimeter equivalents for inch dimensions are shown in (**)

Note:
1. Shown and dimensioned is a counterclockwise pump. Ports A and B, delivery port and pump controls will be on the opposite side for a clockwise pump.
2. Pump shaft and mounting comply with SAE "C" dimensions.



Dimensions — Electrohydraulic Pump

Millimeter equivalents for inch dimensions are shown in (**)

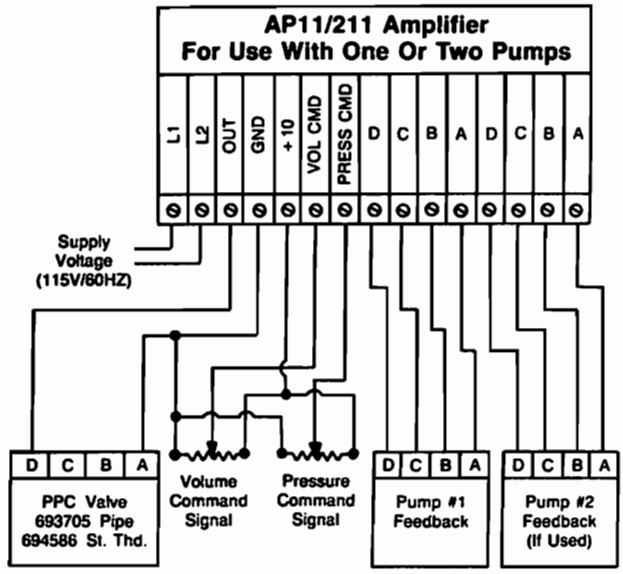


FEEDBACK CONNECTOR MS3102R14S-2PY.
MATES WITH MS3106A14S-2SY (PART NO. 800722)
ELECTROHYDRAULIC CABLE CAN BE ORDERED AS
EHC*4Y*

SHOWN WITH "S" OR "SE" OPTION

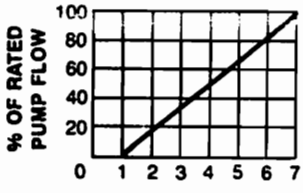
NOTES:

1. Consult factory for information relative to pump option selection and additional components required for desired pump function.
2. For electrohydraulic flow and pressure control of one or two pumps make electrical connections per Fig. IV. When one pump is used, omit connections to pump #2 feedback.
3. For electrohydraulic flow only, eliminate pressure command signal and place jumper between "Press CMD" and "+10V" terminals (compensating pressure will be controlled by maximum setting on pump or remote compensator if used).
4. For electrohydraulic pressure only, eliminate volume command signal, and place jumper between "VOL CMD" and "+10V" terminals or use 801179 pressure driver card.
5. Figures I thru III show nominal input vs. output relationships. The actual values will vary with component tolerances. Full volume range will be realized with 0 to 7 volts. Full pressure range will be realized with 0 to 7 volts, or 0-500MA.
6. Pump shown is a clockwise rotation. For a counterclockwise rotation LVDT feedback is on opposite side.
7. For further detail on installation of AP11/AP211, refer to drawing MC801036.



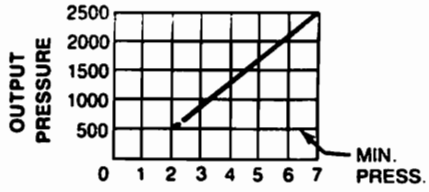
Typical Hookup for Infinitely Variable Electrohydraulic Pressure and Volume Control

FIG. IV



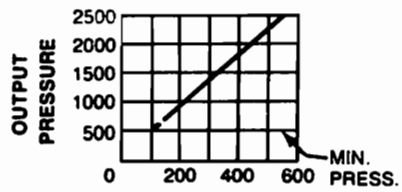
Volume Command Voltage
Nominal output flow vs. input command voltage when used in conjunction with AP11/211 amplifier and 694586 proportional pressure controller.

FIG. I



Pressure Command Voltage
Nominal output pressure vs. input command voltage when used in conjunction with AP11/211 amplifier and 694586 proportional pressure controller.

FIG. II



Input Current (MA)
Nominal input current vs. pressure when used in conjunction with a current source and proportional pressure controller 694586.

FIG. III

Variable Volume Piston Pumps
Series PAVC 65

Ordering Information

PAVC	65											
Pump Axial Piston Variable Controllable	Displacement	Fluids	Bearing Option	Shaft	Outlet	Inlet	Rotation*	Differential Control Option	Volume Stop	Control Options	Seals	Design Series

65 CM³/REV (4.0 In³/Rev.)

Fluid Option	
Code	Description
Omit	Mineral Based
W	Water Based

Rotation*	
Code	Rotation*
R	Right (CW)
L	Left (CCW)

* Viewed from shaft end

Seals	
Code	Description
Omit	Buna-N (Standard)

Bearing Option	
Code	Description
Omit	Single Piece Shaft
*9	Dual Bearing

* For applications where side loading may be experienced. Max. side load = 425#.

Typical Applications:
Belt/chain drive
Universal joint drive
Massive couplings
Foot mount installations

Differential Options	
Code	Description
Omit	Non-Adjustable Differential
4	Adjustable Differential

Volume Stop Options	
Code	Description
Omit	Volume Stop Plugged
2	Maximum Volume Stop
5	Max. Vol. Stop With O-Ring

Control Options	
Code	Description
Omit	Standard Pressure Compensated Setting Pressure 300-3000 PSI (21-207 Bar)
*A	Pressure & Flow (Load Sensing)
*C	Press, Flow & HP Limiting
*H	Pressure Compensated & HP Limiting
†M	Remote Pressure/Servo PSI
†ME	Remote Pressure/Servo PSI (Requires Pressure Signal) Ext.
†S	Servo Press. & Volume w/Int. Sensing (Requires PPC, Amplifier & Seq. Valve)
†SE	Servo Press. & Volume w/Ext. Sensing (Requires PPC, Amplifier & Seq. Valve)
AM	Remote Press. & Flow Compensated
CM	Remote Press, Flow & Power Comp.
HM	Remote Press. & Power Compensated

Horsepower controlled pumps (H, C, HM or CM) must have maximum input horsepower limit specification at a particular drive speed (RPM) included with order.

†Pumps with M, ME, S or SE controls will be set to compensate at 3000 PSI (207 Bar) unless Chart #1 otherwise specified.

Shaft Option	
Code	Description
Omit	Straight Key (SAE C)
B	Spline (SAE C)

Inlet Port		
Code	Type	Location
Omit	SAE Str. Thd.	Rear
2	SAE Flange	Top

Outlet Port		
Code	Type	Location
Omit	SAE Str. Thd.	Top

Flange Kit

Kit Includes Bolts And O-Ring. These Are 4-Bolt SAE Style Flanges.
See installation section page 58.

54F	24	1	A	A
	Size: 24 = 1-1/2"	Ports: 1 = NPTF	Seals: A = Buna N	Design Series

Accessories for S & SE Options	
PPC Valve	694586
Amp Single Pump	AP11
Amp Double Pump	AP211
Seq. Valve (40 GPM Max.)	SX6P/SX6V(-)
Seq. Valve (90 GPM Max.)	SX10P/SX10M(-)

Weight and Package Size

Model	Weight In Pounds	Length From Mounting Face In Inches (CM)	Height In Inches (CM)	Width In Inches (CM)
PAVC 65	50	8.82 (22.4)	7.42 (18.8)	8.00 (20.3)

Ordering Notes:

*Unless otherwise specified, pump is shipped at maximum GPM (1800 RPM) and set to 1000 PSI (69 Bar). When factory settings are required, the items shown in Chart #1 must be included with order.

Chart #1	
Item	
RPM	
PSI	
H.P.	
GPM	

Parker Hannifin Corporation
Fluidpower Pump Division
Otsego, MI 49078

Parker Fluidpower

DIRECTIONAL CONTROL VALVES

SOLENOID ACTUATED, DIRECT OPERATED

NFPA SIZE
D03
(FORMER D01)

CSA CERTIFIED

TYPICAL PERFORMANCE SPECIFICATIONS

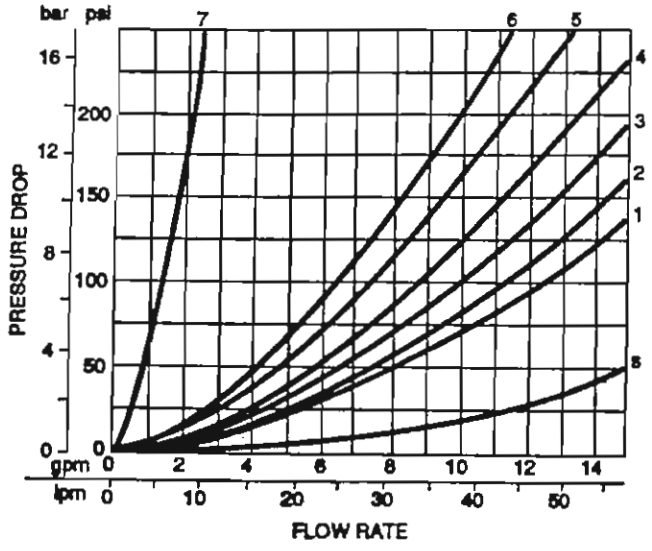
NOMINAL FLOW RATES	@ 4600 psi	7 gpm	27 lpm
	@ 1000 psi	12 gpm	46 lpm
MAXIMUM OPERATING PRESSURE①	P, A, B Ports	4600 psi	315 bar
	T port② Std.	1500 psi	105 bar
	T port② Code P	3000 psi	207 bar
INTERNAL LEAKAGE	(2-ports) 4600 psi 100 SUS	3.4 cipm	57 ml/m
MAX. CYCLE RATE	AC Solenoids	400 cpm	
	DC Solenoids	300 cpm	
MOUNTING SURFACE		NFPA T3.5.1 M R1 - 1984 - D03 ISO/D I S 4401 - SIZE 03	
WEIGHT	Single Actuator	2.75 lbs.	1.25 kg
	Double Actuator	3.5 lbs.	1.59 kg
SPOOL CODES AVAILABLE		A, B, E, F, F1, G, H, J, K, L, N, Q	

NOTES:

① Pressure rates apply to all valves except with code 68L coils. Limitations with Code 68L coils are: P, A, B ports Max. 1500 psi, 5gpm max. Code 68L Recommended Start-up Viscosity 40 to 1000 SUS. Code P with DC volt coils only.

② Includes surges.

TYPICAL PRESSURE DROP



FLOW PATH ΔP CURVES

SPOOL TYPE	FLOW CURVE NUMBER				
	SPOOL SHIFTED		SPOOL CENTERED		
	P to A or B	A or B to T	P to A or B	A or B to T	P to T
A	2	1	—	—	—
B	5	1	5	4	4
E	2	1	—	4	—
F	3	1	—	4	—
F1	3	1	—	7	—
G	2	2	2	—	—
H	2	1	—	—	6
J	2	1	4	—	—
K	2	1	—	4	—
L	6	5	—	—	4
N	2	1	4	—	—
Q	2	1	—	—	6
SUBPLATE	S (FULL CIRCUIT)				

All pressure drops shown on this data page are based on 100 SUS fluid viscosity and 0.87 specific gravity. For other viscosities see below.

Fluid Viscosities	CS / SUS	14.5 / 75	20.5 / 100	32 / 150	43 / 200	54 / 250	65 / 300	76 / 350	86 / 400
Multiplier		0.93	1.00	1.11	1.19	1.26	1.32	1.37	1.41

For any other specific gravity (G_1) the pressure drop (ΔP) will be approximately $\Delta P_1 = \Delta P\ (G_1/G)$.

VS5M

DIRECTIONAL CONTROL VALVES

SOLENOID ACTUATED, DIRECT OPERATED

CONTINENTAL HYDRAULICS

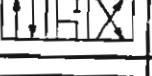
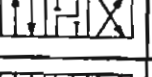
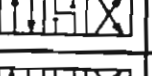
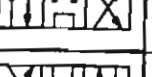
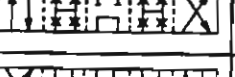
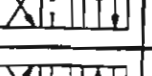
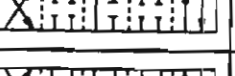
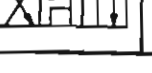
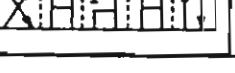
MAXIMUM FLOW

		SPOOL CODE													
		A		B		F		F1		G		L	E&K	J&N	H&Q
	FUNCTION CODE	AC	DC	AC	DC	AC	DC	AC	DC	AC	DC	AC/DC	AC/DC	AC/DC	AC/DC
(lpm) @ 1000psi gpm @ (70 bar)	1	(38) 10	(30) 8	(38) 10	N/A	(30) 8	(30) 8	(27) 7	(27) 7	N/A	N/A	N/A	N/A	N/A	N/A
	2	(46) 12	(23) 6**	(46) 12	(23) 6	(50) 13	(30) 8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	3,5	(57) 15	(57) 15	(46) 12	(30) 8	(50) 13	(23) 6	(38) 10	(30) 8	(50) 13	(50) 13	(38) 10	(50) 13	(50) 13	(23) 6
(lpm) @ 4600psi gpm @ (315 bar)	1	(38) 10	(30) 8	(38) 10	N/A	(30) 8	(23) 6	(19) 5	(19) 5	N/A	N/A	N/A	N/A	N/A	N/A
	2	(38) 10	(19) 5**	(46) 12	(23) 6	(50) 13	(30) 8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	3,5	(46) 12	(46) 12	(46) 12	(23) 6	•	•	(12) 3**	(12) 3	(46) 12	(23) 6	(16) 4	(38) 10 / (23) 6	(38) 10	(12) 3

Notes: N/A = Not Available
Max. flow with Code 68L solenoids = 5 gpm, 1500 psi MAX.
* Max. flow 12 gpm, Max. pressure 2500 psi (4600 psi as a D08 size pilot valve)
** 100% voltage min.

Performance measured on a four-way circuit (full circuit) Performance may be reduced from that shown if a three-way circuit (half circuit) is used, i.e. A or B port plugged.

SPOOL DESCRIPTION

CODE	SYMBOL	SPOOL FUNCTION	CENTER POSITION	CROSSOVER
A			All ports blocked	All ports blocked
B			All ports open	All ports open
E			P & A blocked B to T	All ports blocked
F			P blocked A & E to T	P blocked A or B to T
F1			P blocked A & E restricted to T	P blocked A or B restricted to T
G			P to A & B T blocked	P to A or B T & A or B blocked
H			P to A & T B blocked	All ports open
J			P to B A & T blocked	All ports blocked
K			P & B blocked A to T	All ports blocked
L			P to T A & B blocked	All ports open
N			P to A B & T blocked	All ports blocked
Q			P to B & T A blocked	All ports open

NOTE: Code G or L available on Code 3 & 5 valves only.
Code F1 available on Code 1, 3 & 5 valves only.
Code B not available on Code 1 with DC solenoids.

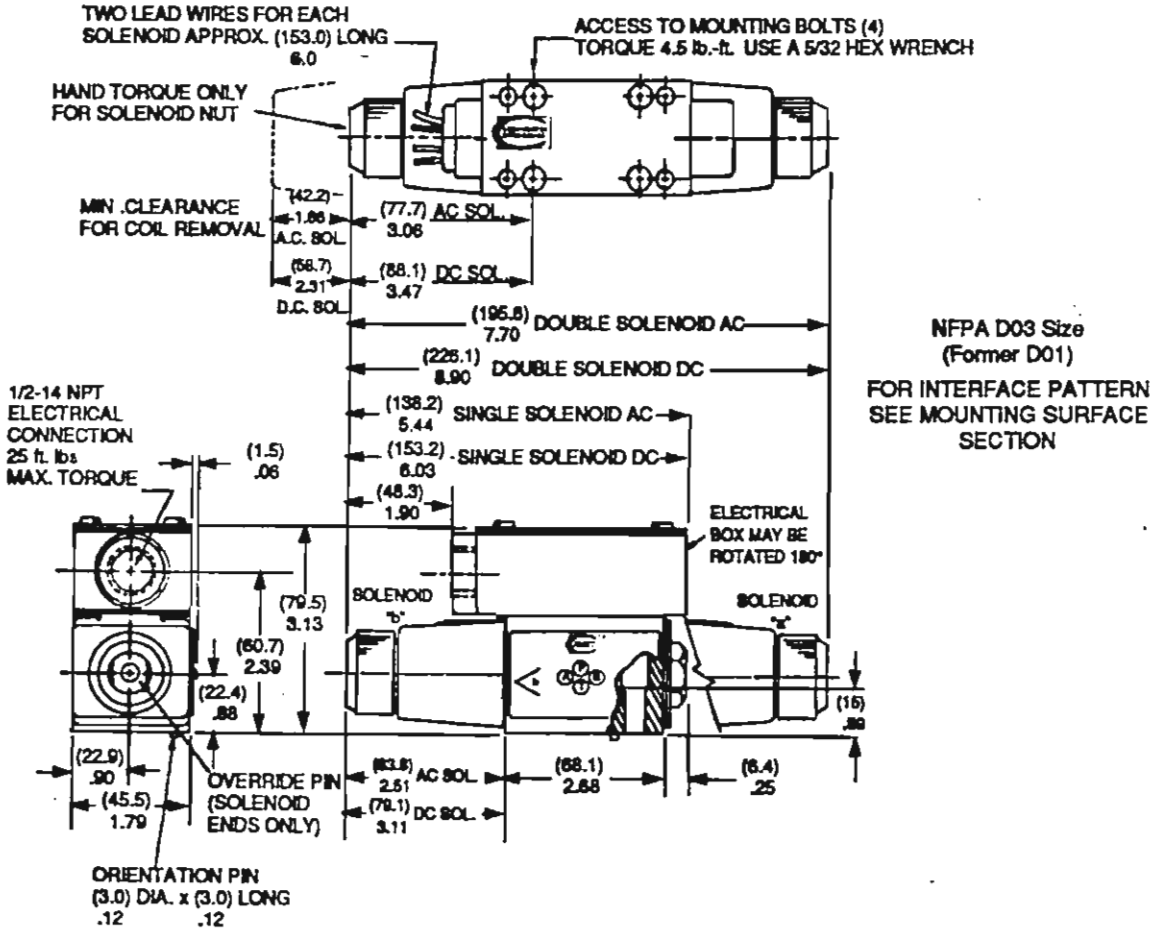
DIRECTIONAL CONTROL VALVES

SOLENOID ACTUATED, DIRECT OPERATED

TYPICAL ELECTRICAL AND RESPONSE TIME

SOLENOID CODE		VOLTAGE & FREQUENCY	VOLTAGE LIMITS	INRUSH CURRENT (AMP)	HOLDING CURRENT	HOLDING POWER	RESPONSE TIME (MILLISECONDS)	
LEAD WIRE	DIN CONN.	VOLTS - HZ	MIN - MAX	MAX	(AMP)	(WATTS)	SOLENOID	SPRING
60L	33L	120 - 60	108 - 126	2.10	.40	21	12	15
		110 - 50	99 - 116		.43	21	14	15
68L		120 - 60	108 - 132	1.10	.18	10	20	28
		110 - 50	99 - 121		.20	9.5	23	28
61L	34L	240 - 60	216 - 252	1.10	.21	22	12	15
		220 - 50	198 - 231		.25	22	14	15
	35L	280 - 60	252 - 297	1.00	.17	22	12	15
		240 - 50	216 - 255		.20	22	14	15
70L	42L	24 DC	21 - 26	1.00	1.00	24	35	30
75L	44L	12 DC	10 - 13	2.00	2.00	24	35	30

DIMENSIONS
(MILLIMETERS)
INCHES



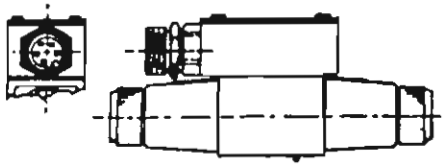
NFPA D03 Size
(Former D01)
FOR INTERFACE PATTERN SEE MOUNTING SURFACE SECTION

VS5M

DIRECTIONAL CONTROL VALVES

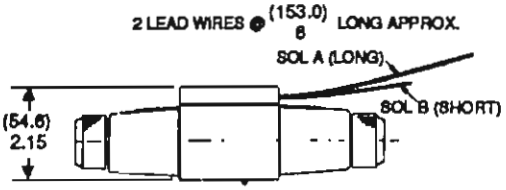
SOLENOID ACTUATED, DIRECT OPERATED

CODE B5H Quick disconnect for single or double solenoids
Top elec. box with sealed 5-pin male receptacle



NOTE: 1. Connector meets NFPA recommended standard T3.5.29M-1980

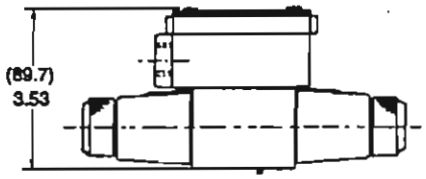
CODE C Low profile electrical box with body grounded coils



NOTE: 1. Common solenoid grounds (1 wire ea. coil) inside elec. box to valve body.
2. D.C. voltage coils only

CODES L1 OR L2

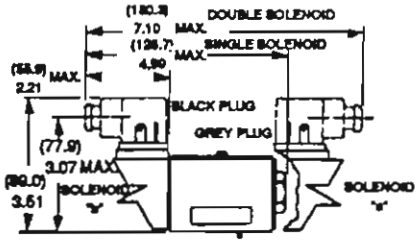
Solenoid Indicator Lights



NOTE: 1. Top elec. box required

CODES 33L THROUGH 44L

Solenoid(s) with DIN 43650/ISO 4400 (form A) connector(s)



NOTE: 1. No electrical box required
2. Connectors ordered separately

ORDERING INFORMATION

VS5M — [SELECT ONE: FUNCTION] [SELECT ONE: SPOOLS] — G [SELECT ONE: SEAL] [SELECT ONE: MECHANICAL OPTIONS] - [SELECT ONE: TOP ELECTRICAL BOX] [SELECT ONE: SOL. INDICATOR LIGHTS] — [SELECT ONE: SOLENOID]

BASIC VALVE

4-WAY DIRECTIONAL CONTROL VALVE
SOLENOID ACTIVATED
D03 SUBPLATE MOUNTING
7 GPM NOMINAL FLOW
4600 PSI MAX. OPER. PRESS.

FUNCTION

CODE	OPTION
1	Single actuator • 2 position spring offset
2	Double actuator • 2 position no spring, detented
3	Double actuator • 3 position spring centered
5	Single operator • 2 position spring centered
6	Single actuator • 2 position spring offset

SPOOLS

CODE
SEE PREVIOUS PAGE

SEAL

CODE
VITON SEALS STD.

MECHANICAL OPTIONS

CODE	OPTION
OMIT	NONE
R	SINGLE SOLENOID REVERSE ASSY SOL. "a" SUPPLIED
P①	3000 PSI SOLENOID CORE TUBE
Z②③	MANUAL OVERRIDE ON NON-SOLENOID END

TOP ELECTRICAL BOX

CODE	DESCRIPTION
LEAD WIRE CONNECTIONS	
B	TOP ELEC. BOX WITHOUT TERMINAL POSTS
BT	TOP ELEC. BOX WITH TERMINALS & GROUND
B5H	TOP ELEC. BOX WITH 5 PIN MALE RECEPTACLE FOR 1 OR 2 SOL'S.
C④	LOW PROFILE BOX
DIN 43650/ISO 4400 (FORM A) CONNECTIONS	
OMIT	NOT AVAILABLE

SOL. INDICATOR LIGHTS

CODE	DESCRIPTION
OMIT	NOT REQ.
L1	SINGLE SOL. INDICATOR 110/120 V 50/60 HZ
L2	DOUBLE SOLENOID INDICATOR 110/120 V 50/60 HZ
OMIT	NOT AVAILABLE

SOLENOID

CODE	VOLTAGE
60L	110/120 V 50/60 HZ
61L	220/240 V 50/60 HZ
66L	110/120V 50/60 HZ (LOW AMPS)
70L	24V DC
75L	12V DC
33L	110/120 V 50/60 HZ
34L	220/240 V 50/60 HZ
35L	240/280 V 50/60 HZ
42L	24V DC
44L	12V DC

Notes: ① Available with DC voltage solenoid codes only.
② Available on single solenoid valves only.
③ Available with DC voltage, lead wire solenoids only.

TYPICAL ORDERING CODE: **VS5M-1A-GB-60L**

TERMINOLOGY AND GENERAL SPECIFICATIONS

CONTINENTAL HYDRAULICS

FEATURES

SOLENOID ACTUATED
- CSA Certified (D03, D05, & D08 sizes).
- Wet armature solenoids
  - — Lead wires or DIN connectors
  - — Solenoid failures greatly reduced
  - — Standard and low amp coils available
  - — High temperature elements are isolated from direct human contact
  - — No oil leakage into electrical cavity
  - — Fast and easy solenoid replacement
  - — Continuous duty-rated coils
- No dynamic seals eliminate external oil leakages
- Electrical quick disconnects as factory installed or field installed options
  5-pin sealed connectors per NFPA recommended standard T3.5.29M-1980
- Large wiring cavity options for wire to wire connections
- Access to mounting bolts without entering electrical box
- Mounting bolt heads are below spool centerline to prevent body distortion and spool stick.

CAM ACTUATED
- VC5M cam follower may approach cam from any angle
- VC12M cam follower may be positioned perpendicular or parallel to mounting surface
- Bearing bronze push-rod for increased life
- Urethane wiper eliminates contamination from actuator
- Actuator internal parts are electro-filmed to resist corrosion

LEVER ACTUATED
- Lever boot keeps contaminants from linkage
- Lever directly connects to spool for positive spool action
- Detent option for positive hold
- Actuator internal parts are electro-filmed to resist corrosion

AIR ACTUATED
- Wide operating range of air pilot pressures
- Urethane sealing gland on air piston permits very low air flow rates
- Excellent control of spool shift rate
- Internal parts of air operator are electro-filmed to resist corrosion

OIL ACTUATED
- Controlled pilot flow will control spool shift rate
- Internal parts of oil operator are electro-filmed to resist corrosion
- Internal pilot drain
- Wide range for pilot operating pressures
- No dynamic seals eliminate oil leakages

GENERAL SPECIFICATIONS

RECOMMENDED FLUID
Petroleum, water-based fluids (not more than 40% water) and most phosphate esters (other fluids are acceptable, but special seals may be required). Viton seals standard.

FLUID TEMPERATURE RANGE
Fluid temperature up to 200°F. will not appreciably affect valve performance, however, from a safety standpoint, temperatures above 130°F. are not recommended.

RECOMMENDED OPERATING VISCOSITY
80 to 350 SUS.

FLUID OPERATING VISCOSITY
Acceptable start-up viscosity to 1500 SUS. Minimum viscosity to 30 SUS.

FILTRATION
ISO 18/15 (25 micron).

MOUNTING POSITION
Optional: horizontal preferred.

NFPA FLOW PATH/ACTUATING PATTERN

SOLENOID, AIR AND OIL ACTUATED:
Actuating operator a – connects flow to cylinder port A.
Actuating operator b – connects flow to cylinder port B.

CAM ACTUATED:
Activated – connects flow to cylinder port B.
Released – connects flow to cylinder port A.

LEVER ACTUATED:
Push – connects flow to cylinder port A.
Pull – connects flow to cylinder port B.

NOTE:
The NFPA flow path/actuating pattern is reversed for Spools Code L.

GENERAL INFORMATION

VALVE OPERATION
Spring centered and spring offset valve types will be spring positioned unless actuated continuously. Detented, no-spring valves may be actuated momentarily. When operator is deactuated, the spool will remain shifted provided there is no severe shock, vibration, or pressure transients.

PRESSURE SURGES
Pressure surges in a common tank line serving these and other valves can be large enough to cause inadvertent shifting of these valves. This is particularly critical in the no-spring detented type valves. Separate tank lines may be necessary. Maximum pressure rating on solenoid operated valve tank ports include surges.

SILTING
Any sliding spool valve, if held shifted under pressure for long periods of time, may stick and not spring return due to fluid residue formation and, therefore, should be cycled periodically to prevent this from happening.

RESPONSE TIME
Response times of air actuated valves are dependent on air flow rate and pressure supplied to the operator.

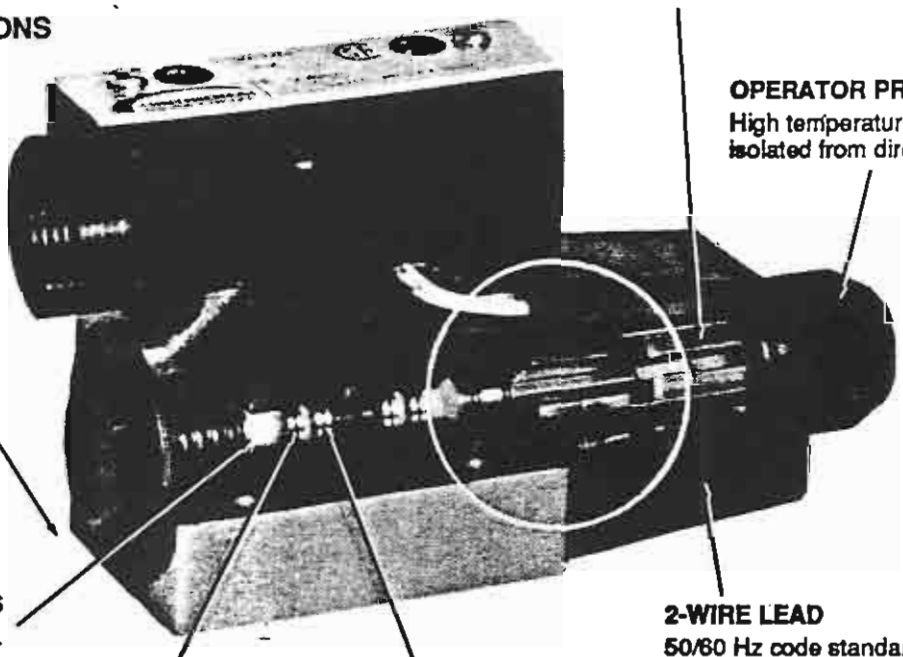
Response times of hydraulic actuated valves will vary with pilot line diameter and length, pilot pressure, pilot control valve shift time, pilot oil flow rate, and fluid viscosity.

CONTINENTAL HYDRAULICS®

DIRECTIONAL CONTROL VALVES

INTRODUCTION

- **FLOWS UP TO 175 GPM**
- **PRESSURES UP TO 4600 PSI**
- **UP TO 5 ACTUATORS:**
  Solenoid, Air, Cam, Lever and Oil
- **UP TO 12 SPOOL OPTIONS**



SEALED WET ARMATURE SOLENOIDS
Maximum protection against moisture, corrosion and dirt.

OPERATOR PROTECTION
High temperature elements are isolated from direct contact.

STANDARD MOUNTINGS
Conforms to NFPA and ANSI/ISO standards. O-rings included.

INTERCHANGEABLE SPOOLS
Provide easy field maintenance. No matching of parts.

2-WIRE LEAD
50/60 Hz code standard for increased application flexibility.

LOW CROSS-PORT LEAKAGE
Premium bore honing and spool grinding results in less leakage, less energy wasted.

SPOOL "U" GROOVES
Improves contamination tolerance of spools over conventional "V" grooves. Significantly reduces spool hang-up resulting in loss of production.

STATIC O-RING DESIGN
Eliminates external leakage, guards against contamination. No seals to wear out causing premature valve failure.

NO DYNAMIC PUSH-PIN SEAL
Up to 50% greater shifting forces result at the spool. Higher malfunction points.

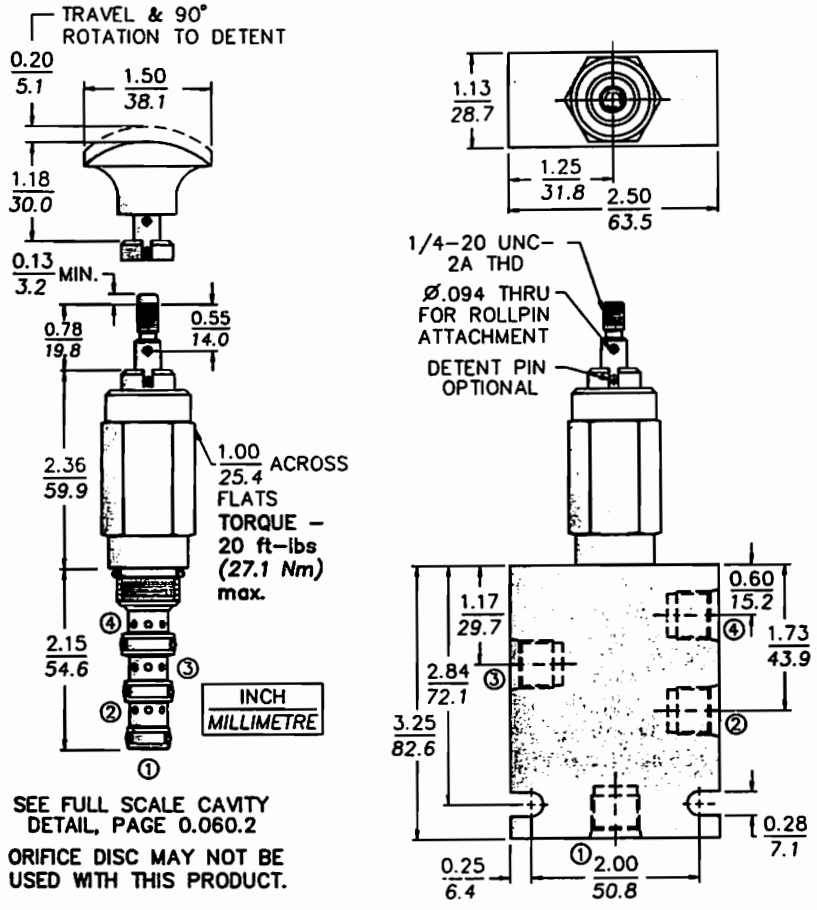
MOUNTING BOLT
Heads are below spool center line to reduce body distortion and spool stick.

FEATURING:

- Low pressure drops to reduce heat loss and increase efficiency.
- VITON seals standard
- Compact design

MP08-40

DIMENSIONS



SEE FULL SCALE CAVITY DETAIL, PAGE 0.060.2

ORIFICE DISC MAY NOT BE USED WITH THIS PRODUCT.

MATERIALS

Cartridge: Weight: 0.25 kg. (0.55 lbs.); Steel with hardened work surfaces. Zinc-plated exposed surfaces. Buna N O-rings and back-ups standard. Plastic knob optional.

Standard Ported Body: Weight: 0.18 kg. (0.40 lbs.); Anodized high-strength 6061 T6 aluminum alloy, rated to 240 bar (3500 psi). See page 6.040.1. Steel bodies available; consult factory.

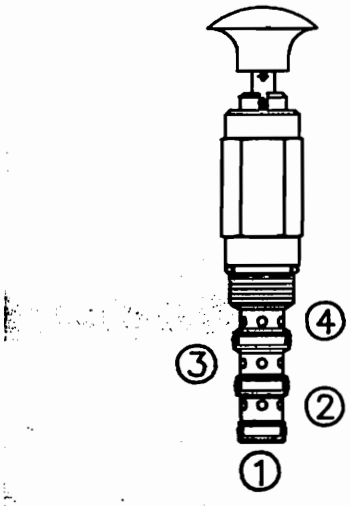
TO ORDER

MP08-40 ___ - ___ - ___

Option		Porting		Seals	
Threaded Shaft/ Spring Return	T	Cartridge Only	0	N	Buna N (Std.)
Threaded Shaft/ Lock Position Pin	R	1/4 in. NPTF	2P	V	Viton A
Black Plastic Knob/ Spring Return	K	3/8 in. NPTF	3P		
Black Plastic Knob/ Lock Position Pin	D	SAE 6	6T		
Red Plastic Knob/ Spring Return	J	1/4 in. BSP*	2B		
Red Plastic Knob/ Lock Position Pin	L	3/8 in. BSP*	3B		

*BSP Body; U.K. Mfr. Only

Manual, Spring Return, Pull-to-Shift



DESCRIPTION

A 4-way, manual, pull-to-shift, spring-return, directional hydraulic cartridge valve.

Series operation is prohibited due to the tank port (①) pressure rating.

OPERATION

In its steady-state spring-offset position, the MP10-40 directs flow from ③ to ②, and from ④ to ① (tank).

In the actuated (pulled) position, the cartridge directs flow from ③ to ④, and from ② to ①. Note that all ports are open in transition.

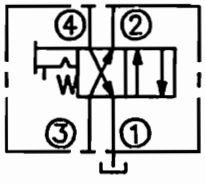
A unique pull-and-rotate feature for holding the positive actuated position is optional. A 90° rotation is required to position at the hold slot. The valve resets to spring-return de-actuated with a slight pull and a 90° turn from the locked actuated position.

FEATURES

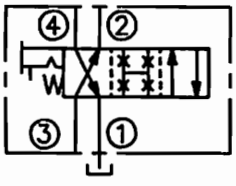
- Hardened spool and cage for long life.
- Remains closed to 14 bar (200 psi) back-pressure.
- Optional rotational lock position.
- Industry common cavity.

SYMBOLS

USASI/ISO:



TRANSITION:



RATINGS

Operating Pressure:
On ③, ② and ④: 207 bar (3000 psi)
On ① (Max.): 14 bar (200 psi)

Proof Pressure: 350 bar (5075 psi)

Flow: See Performance Chart

Internal Leakage: 82 cc/minute (5 in.³/minute) max.

Mechanical Pull Effort Required: 7.3 kg. (16 lbs.) installed; 8.2 kg. (18 lbs.) to travel 3.2 mm (0.125 inch); 8.6 kg. (19 lbs.) to detent

Temperature: -40 to 120°C

Filtration: Recommend 25µ nominal or better

Fluids: Mineral-based or synthetics with lubricating properties at viscosities of 6 to 420 cSt (45 to 2000 ssu)

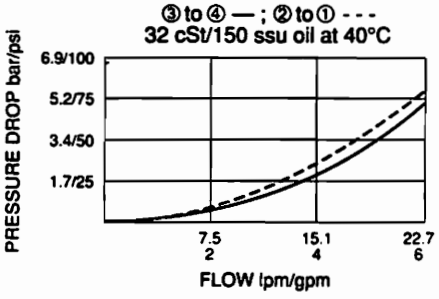
Installation: No restrictions; See page 0.020.1

Cavity: VC10-4; See page 0.070.2

Cavity Tool: CT10-4XX; See page 6.300.1

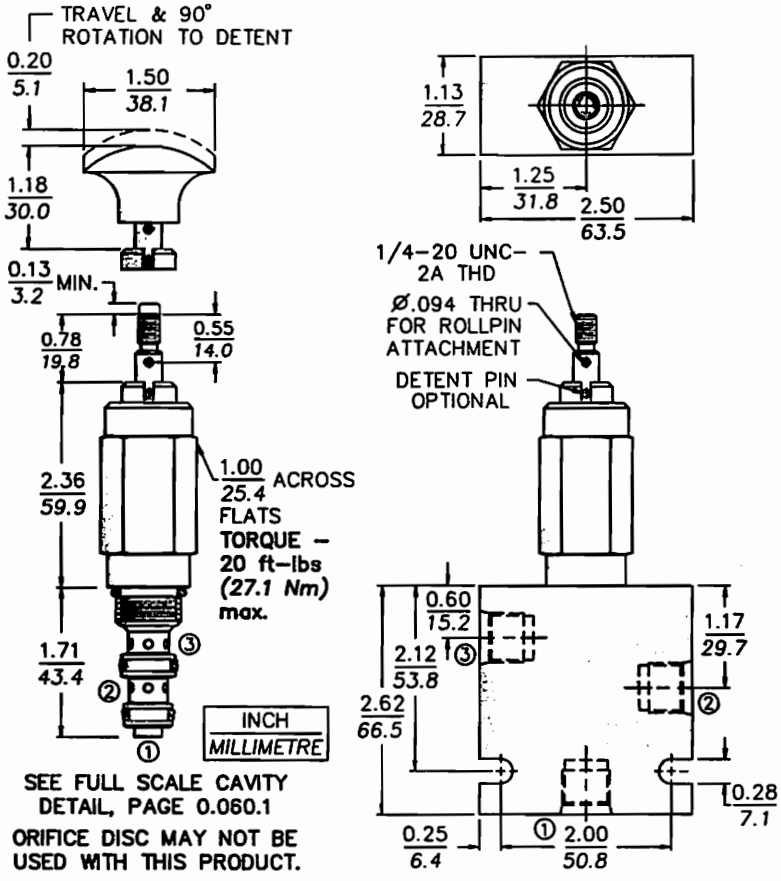
Seal Kit: SK10-4X-MMT; See page 6.025.1

PERFORMANCE (Cartridge Only)



MP08-30

DIMENSIONS



SEE FULL SCALE CAVITY DETAIL, PAGE 0.060.1

ORIFICE DISC MAY NOT BE USED WITH THIS PRODUCT.

MATERIALS

Cartridge: Weight: 0.23 kg. (0.50 lbs.); Steel with hardened work surfaces. Zinc-plated exposed surfaces. Buna N O-rings and polyester elastomer back-ups standard. Plastic knob optional.

Standard Ported Body: Weight: 0.27 kg. (0.60 lbs.); Anodized high-strength 6061 T6 aluminum alloy, rated to 240 bar (3500 psi). See page 6.040.1. Steel bodies available; consult factory.

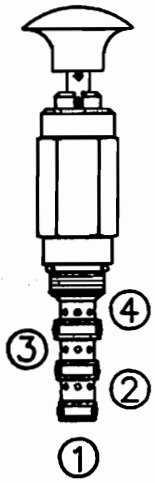
TO ORDER

MP08-30 ___ - ___ ___ - ___

Option		Porting		Seals	
Threaded Shaft/ Spring Return	T	Cartridge Only	0	N	Buna N (Std.)
Threaded Shaft/ Lock Position Pin	R	1/4 in. NPTF	2P	V	Viton A
Black Plastic Knob/ Spring Return	K	3/8 in. NPTF	3P		
Black Plastic Knob/ Lock Position Pin	D	SAE 6	6T		
Red Plastic Knob/ Spring Return	J	1/4 in. BSP*	2B		
Red Plastic Knob/ Lock Position Pin	L	3/8 in. BSP*	3B		

*BSP Body; U.K. Mfr. Only

Manual, Spring Return, Pull-to-Shift



DESCRIPTION

A 4-way, manual, pull-to-shift, spring-return, directional hydraulic cartridge valve.

Series operation is prohibited due to the tank port (①) pressure rating.

OPERATION

In its steady-state, spring-offset position, the MP08-40 directs flow from ③ to ②, and from ④ to ①.

In the actuated (pulled) position, the cartridge directs flow from ③ to ④, and from ② to ①. The spring chamber is vented at ①.

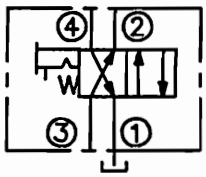
A unique pull-and-rotate feature for holding the positive actuated position is optional. A 90° rotation is required to position at the hold slot. The valve resets to spring-return de-actuated with a slight pull and a 90° turn from the locked actuated position.

FEATURES

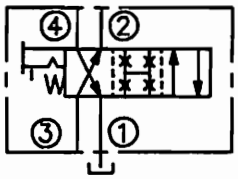
- Hardened spool and cage for long life.
- Pressure to 14 bar (200 psi) on ①.
- Optional rotational lock position.
- Compact size.

SYMBOLS

USASI/ISO:



TRANSITION:



RATINGS

Operating Pressure:
On ②, ③ and ④: 240 bar (3500 psi)
On ① (Max.): 14 bar (200 psi)

Proof Pressure: 350 bar (5075 psi)

Flow: See Performance Chart

Internal Leakage: 82 cc/minute (5 in.³/minute) max.

Mechanical Pull Effort Required: 37.5 kg. (17 lbs.) installed; 41.9 kg. (19 lbs.) to travel 3.2 mm (0.125 in.); 44.1 kg. (20 lbs.) to detent

Temperature: -40 to 120°C

Filtration: Recommend 25µ nominal or better

Fluids: Mineral-based or synthetics with lubricating properties at viscosities of 6 to 420 cSt (45 to 2000 ssu)

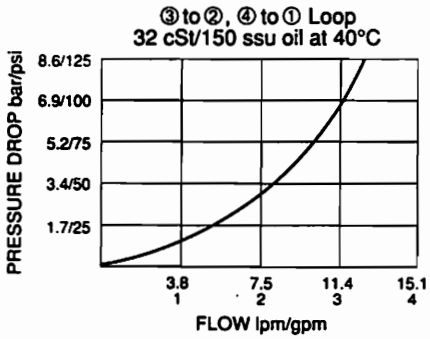
Installation: No restrictions; See page 0.020.1

Cavity: VC08-4; See page 0.060.2

Cavity Tool: CT08-4XX; See page 6.300.1

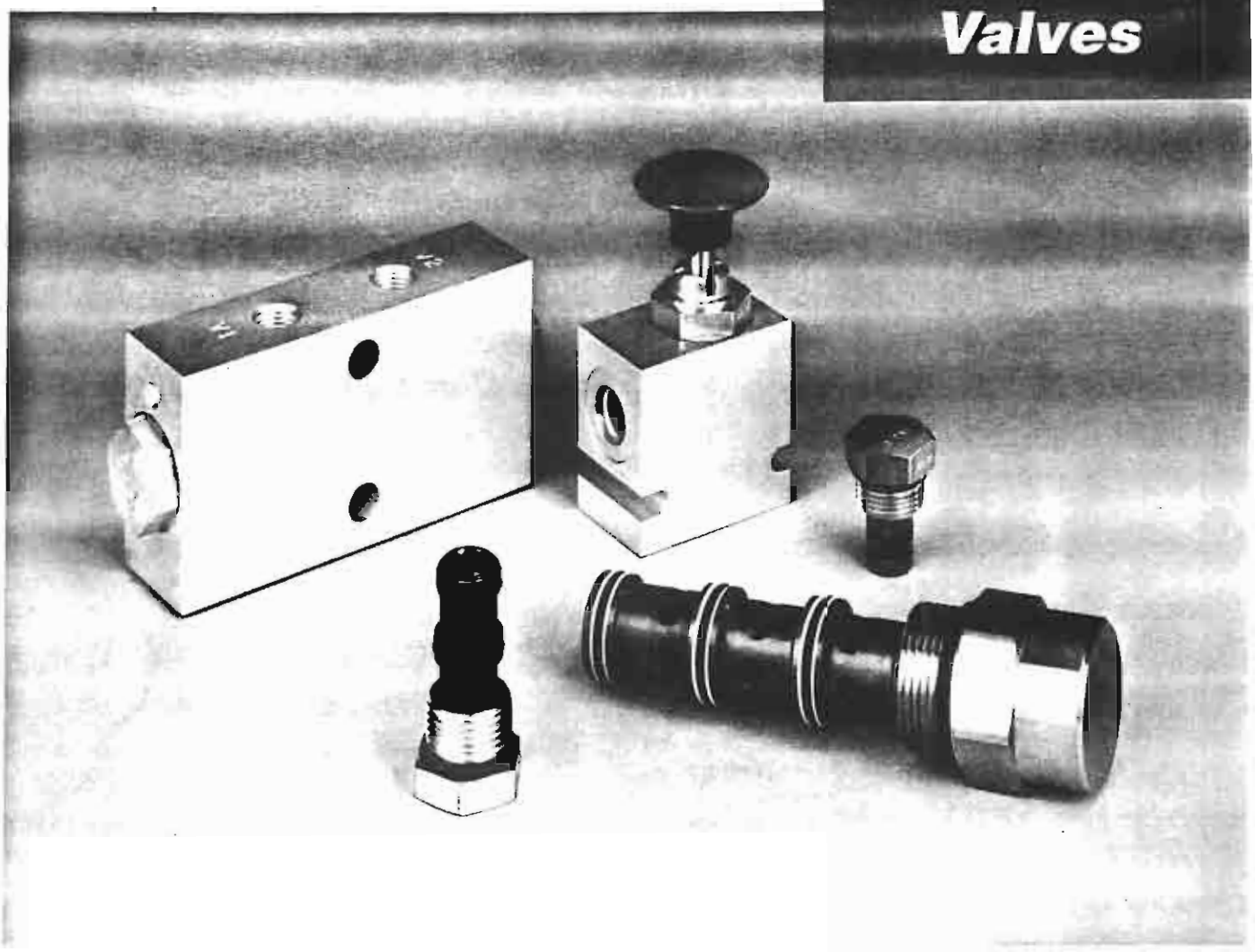
Seal Kit: SK08-X-MMT; See page 6.025.1

PERFORMANCE (Cartridge Only)



HYDRAFORCE

Directional Valves



Check valves have optional bias springs and operate at flows up to 150 lpm (40 gpm). Pilot operated check valve models are available for flows up to 60 lpm (16 gpm).

Load shuttle check valves are available for flows up to 30 lpm (8 gpm).

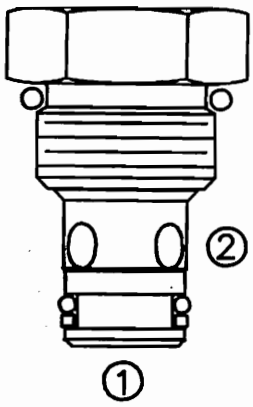
Lock valves feature optional thermal reliefs and sealed pistons. Models are available for flows up to 76 lpm (20 gpm).

Spool type logic elements offer multiple function or multiple application potential, smooth shift transitions and low pressure drop. Models are available for flows up to 190 lpm (50 gpm).

Manual spring return directional valves feature poppet or spool construction with optional rotational lock position. Models are available for flows up to 57 lpm (15 gpm).

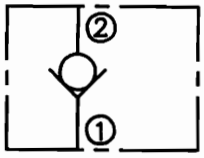
- Check valves for blocking or load holding
- Pilot operated valves for remote actuation
- Logic elements for multi-function applications
- Manual spring-return or pressure actuated models
- Operating pressures to 240 bar (3500 psi)
- Hardened precision poppets, spools and cages for long life and low leakage
- Industry common cavities—compact sizes
- Can be used to create innovative circuitry options

Check Valve



SYMBOLS

USASI:



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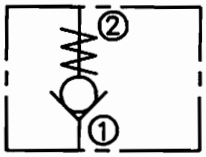
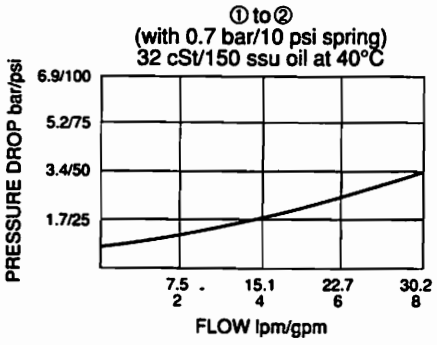


PERFORMANCE (Cartridge Only)



DESCRIPTION

A screw-in, cartridge-style, hydraulic check valve for use as a blocking or load-holding device.

OPERATION

The CV08-20 allows flow passage from ① to ②, while normally blocking oil flow in the opposite direction.

The cartridge has a fully guided check which is spring-biased closed until sufficient pressure is applied at ① to open to ②.

FEATURES

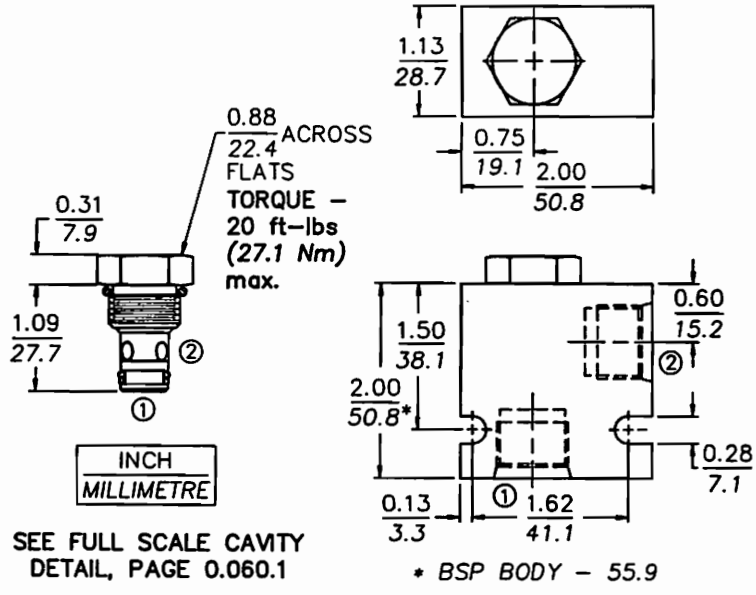
- Hardened seat for long life and low leakage.
- Optional bias springs for back-pressure application flexibility.
- Fully guided check assembly.
- Compact size.

RATINGS

Operating Pressure: 240 bar (3500 psi)
Proof Pressure: 350 bar (5075 psi)
Flow: See Performance Chart
Internal Leakage: 0.25 cc/minute (5 drops/minute) max. at 240 bar (3500 psi)
Crack Pressure Defined: Gauge psi evident at ① at 16.4 cc/minute (1 $in.^3$/minute) attained
Standard Bias Springs at Crack: 0.3 bar (4 psi); 0.7 bar (10 psi); 1.7 bar (25 psi); 4.1 bar (60 psi)
Temperature: -40 to 120°C
Filtration: Recommend 25µ nominal or better
Fluids: Mineral-based or synthetics with lubricating properties at viscosities of 6 to 420 cSt (45 to 2000 ssu)
Installation: No restrictions; See page 0.020.1
Cavity: VC08-2; See page 0.060.1
Cavity Tool: CT08-2XX; See page 6.300.1
Seal Kit: SK08-2X-T; See page 6.025.1

CV08-20

DIMENSIONS



SEE FULL SCALE CAVITY DETAIL, PAGE 0.060.1

* BSP BODY – 55.9

MATERIALS

Cartridge: Weight: 0.05 kg. (0.12 lbs.); Steel with hardened work surfaces; Zinc-plated exposed surfaces; Buna N O-rings and back-up standard.

Standard Ported Body: Weight: 0.16 kg. (0.35 lbs.); Anodized high-strength 6061 T6 aluminum alloy, rated to 240 bar (3500 psi); See page 6.040.1. Steel bodies available; consult factory.

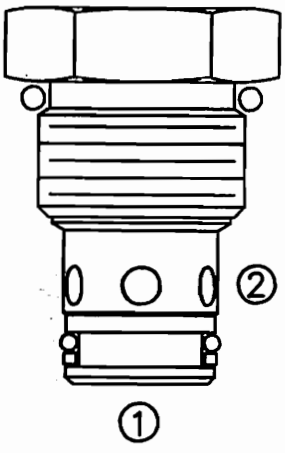
TO ORDER

CV08-20 - ___ - ___ - ___

Porting		Seals		Bias Spring	
Cartridge Only	**0**	**N**	Buna N (Std.)	**4**	0.3 bar (4 psi)
1/4 in. NPTF	**2P**	**V**	Viton A	**10**	0.7 bar (10 psi)
3/8 in. NPTF	**3P**			**25**	1.7 bar (25 psi)
SAE 4	**4T**			**60**	4.1 bar (60 psi)
SAE 6	**6T**				
SAE 8	**8T**				
1/4 in. BSP*	**2B**				
3/8 in. BSP*	**3B**				
1/2 in. BSP*	**4B**				

*BSP Body; U.K. Mfr. Only

Check Valve



DESCRIPTION

A screw-in, cartridge-style, hydraulic check valve for use as a blocking or load-holding device.

OPERATION

The CV10-20 allows flow passage from ① to ②, while normally blocking oil flow in the opposite direction.

The cartridge has a fully guided check which is spring-biased closed until sufficient pressure is applied at ① to open to ②.

FEATURES

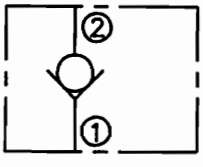
- Hardened seat for long life and low leakage.
- Optional bias springs for back-pressure application flexibility.
- Fully guided check assembly.
- Industry common cavity.

RATINGS

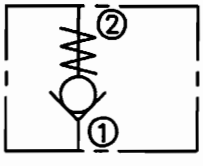
Operating Pressure: 240 bar (3500 psi)
Proof Pressure: 350 bar (5075 psi)
Flow: See Performance Chart
Internal Leakage: 0.25 cc/minute (5 drops/minute) max. at 240 bar (3500 psi)
Crack Pressure Defined: Gauge psi evident at ① at 16.4 cc/minute (1 in.³/minute) attained
Standard Bias Springs at Crack: 0.34 bar (5 psi); 1 bar (15 psi); 2.1 bar (30 psi); 4.8 bar (70 psi)
Temperature: -40 to 120°C
Filtration: Recommend 25μ nominal or better
Fluids: Mineral-based or synthetics with lubricating properties at viscosities of 6 to 420 cSt (45 to 2000 ssu)
Installation: No restrictions; See page 0.020.1
Cavity: VC10-2; See page 0.070.1
Cavity Tool: CT10-2XX; See page 6.300.1
Seal Kit: SK10-2X-T; See page 6.025.1

SYMBOLS

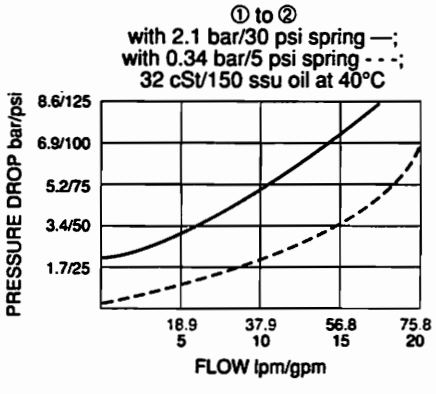
USASI:



ISO:

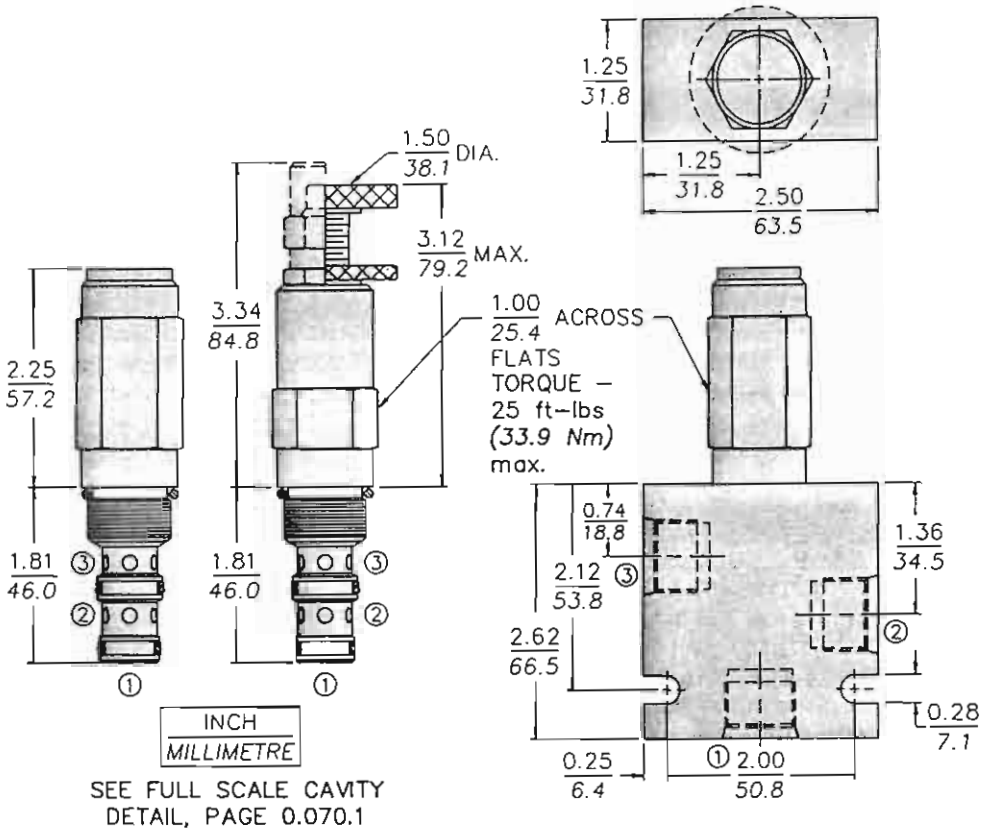


PERFORMANCE (Cartridge Only)



PR10-30

DIMENSIONS



SEE FULL SCALE CAVITY DETAIL, PAGE 0.070.1

MATERIALS

Cartridge: Weight: 0.27 kg. (0.60 lbs.); Steel with hardened work surfaces. Zinc-plated exposed surfaces. Buna N O-rings and polyester elastomer back-ups standard. Anodized aluminum knobs and caps.

Standard Ported Body: Weight: 0.36 kg. (0.80 lbs.); Anodized high-strength 6061 T6 aluminum alloy, rated to 240 bar (3500 psi); See page 6.042.1. Steel bodies available; consult factory.

TO ORDER

PR10-30 __ - __ - __ - __ / __

Ajustment Option

1/4 in. Hex Allen Head	A
1-1/2 in. Dia. Alum. Knobs	B
Option A with Cover Cap	C
Factory Preset Non-Adj.	F
Factory Preset; Hidden Adj.	H
Option C w/ Lockwire Holes	L

Porting

Cartridge Only	0
1/4 in. NPTF	2P
3/8 in. NPTF	3P
SAE 6	6T
SAE 8	8T
1/4 in. BSP*	2B
3/8 in. BSP*	3B

*BSP Body; U.K. Mfr Only

Seals

Buna N (Std.)	N
Viton A	V

Setting in bar[1]

(Blank)	for Adjustable, or Specify, for example:
M25	25 bar
M100	100 bar

Setting in psi[1]

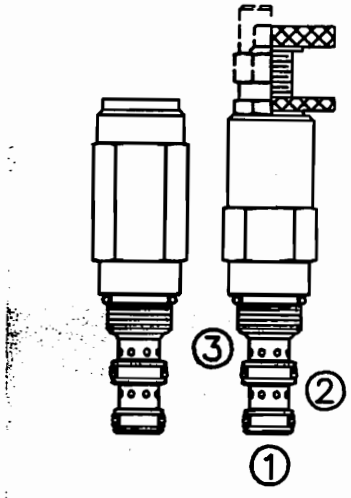
(Blank)	for Adjustable, or Specify, for example:
9.0	900 psi
21.0	2100 psi

Spring Range

4	5.5 to 27.6 bar (80 to 400 psi)
8	13.8 to 55.2 bar (200 to 800 psi)
15	20.7 to 103.4 bar (300 to 1500 psi)
21	27.6 to 144.9 bar (400 to 2100 psi)

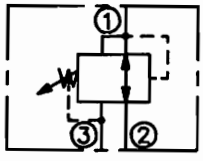
[1]Adjustable valves will be preset to approx. 50% of spring max. potential.

Pressure Reducing/Relieving

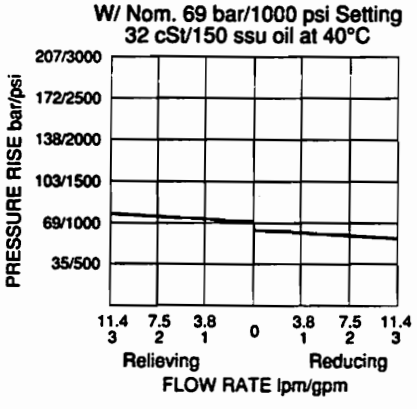


SYMBOLS

USASI/ISO:



PERFORMANCE (Cartridge Only)



DESCRIPTION

A screw-in, cartridge-style, direct-acting, spool-type, hydraulic pressure reducing/relieving valve with internal pilot and internal spring chamber drain, designed to act as a pressure-regulating device for secondary circuits. It is intended for use in stable input flow circuits.

OPERATION

In its steady state, the PR08-32 allows flow to pass bidirectionally from ② to ①, with the spring chamber constantly drained at ③.

On attainment of a pre-determined pressure at ①, the cartridge shifts to block flow at ②, thereby regulating pressure at ①. In this mode, the valve also will relieve ① to ③ at a variable value over the set reducing pressure.

FEATURES

- Adjustments cannot be backed out of the valve.
- Adjustments prohibit springs from going solid.
- Optional spring ranges to 152 bar (2200 psi).
- Hardened spool and cage for long life.
- Industry common cavity.
- Compact size.

RATINGS

Operating Pressure: 240 bar (3500 psi)

Proof Pressure: 390 bar (5700 psi)

Flow: 11.4 lpm (3 gpm) max.

Internal Leakage ② to ③: 82 cc/minute (5 in.³/minute) max. at 207 bar (3000 psi) to 90% of nominal setting

Standard Spring Ranges (Reducing Function):
3.4 to 20.7 bar (50 to 300 psi);
6.9 to 41.4 bar (100 to 600 psi);
20.7 to 82.8 bar (300 to 1200 psi);
34.5 to 151.7 bar (500 to 2200 psi)

Temperature: -40 to 120°C with standard Buna seals

Filtration: Recommend 25μ nominal or better

Fluids: Mineral-based or synthetics with lubricating properties at viscosities of 6 to 420 cSt (45 to 2000 ssu)

Installation: No restrictions; See page 0.020.1

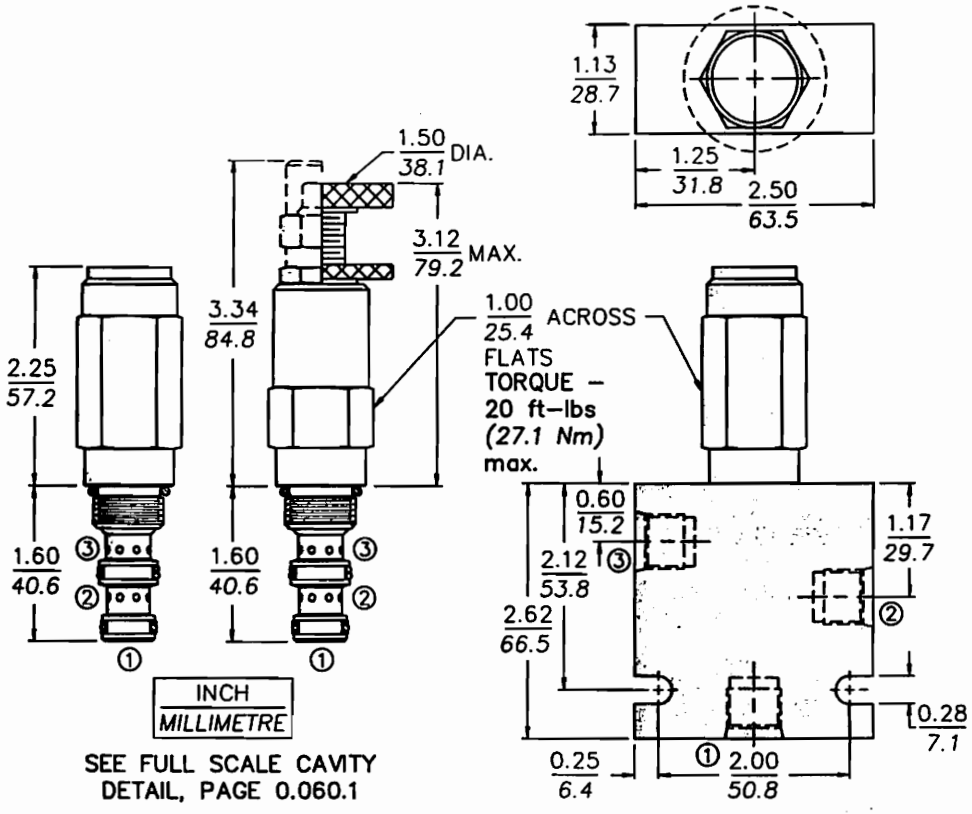
Cavity: VC08-3; See page 0.060.1

Cavity Tool: CT08-3XX; See page 6.300.1

Seal Kit: SK08-3X-BM; See page 6.025.1

PR08-32

DIMENSIONS



SEE FULL SCALE CAVITY DETAIL, PAGE 0.060.1

MATERIALS

Cartridge: Weight: 0.25 kg. (0.55 lbs.); Steel with hardened work surfaces. Zinc-plated exposed surfaces. Buna N O-rings and back-ups standard. Anodized aluminum knob.

Standard Ported Body: Weight: 0.27 kg. (0.60 lbs.); Anodized high-strength 6061 T6 aluminum alloy, rated to 240 bar (3500 psi); See page 6.040.1. Steel bodies available; consult factory.

TO ORDER

PR08-32 __ - ___ - __ - ___ / ____

Ajustment Option

1/4 in. Hex Allen Head	**A**
1-1/2 in. Dia. Alum. Knobs	**B**
Option A with Cover Cap	**C**
Factory Preset Non-Adj.	**F**
Factory Preset; Hidden Adj.	**H**
Option C w/ Lockwire Holes	**L**

Porting

Cartridge Only	**0**
1/4 in. NPTF	**2P**
3/8 in. NPTF	**3P**
SAE 4	**4T**
SAE 6	**6T**
1/4 in. BSP*	**2B**
3/8 in. BSP*	**3B**

*BSP Body; U.K. Mfr Only

Seals

Buna N (Std.)	**N**
Viton A	**V**

Setting in bar†

(Blank)	for Adjustable, or Specify, for example:
M25	25 bar
M100	100 bar

Setting in psi†

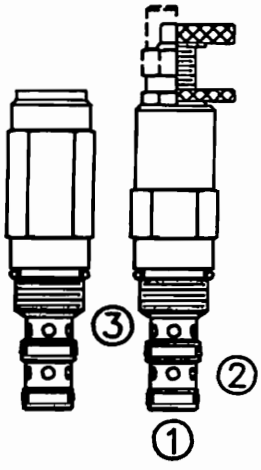
(Blank)	for Adjustable, or Specify, for example:
9.0	900 psi
21.0	2100 psi

Spring Range

3	3.4 to 20.7 bar (50 to 300 psi)
6	6.9 to 41.4 bar (100 to 600 psi)
12	20.7 to 82.8 bar (300 to 1200 psi)
22	34.5 to 151.7 bar (500 to 2200 psi)

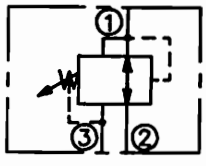
†Adjustable valves will be preset to approx. 50% of spring max. potential.

Pressure Reducing/Relieving

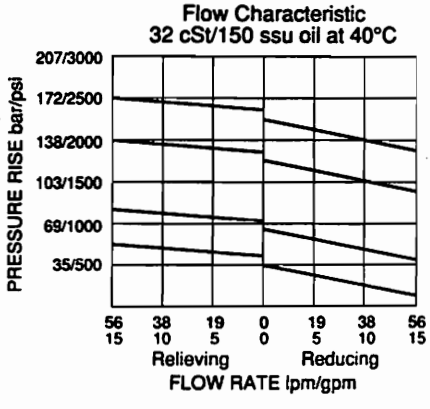


SYMBOLS

USASI/ISO:



PERFORMANCE (Cartridge Only)



DESCRIPTION

A screw-in, cartridge-style, direct-acting, spool-type, hydraulic pressure reducing/relieving valve with internal pilot and internal spring chamber drain, designed to act as a pressure-regulating device for secondary circuits. It is intended for use in stable input flow circuits.

OPERATION

In its steady state, the PR10-32 allows flow to pass bidirectionally from ② to ①, with the spring chamber constantly drained at ③.

On attainment of a pre-determined pressure at ①, the cartridge shifts to restrict input flow at ②, thereby regulating pressure at ①. In this mode, the valve will also relieve ① to ③ at approximately 10 bar (150 psi) over the reducing setting.

FEATURES

- Adjustments cannot be backed out of the valve.
- Adjustments prohibit springs from going solid.
- Optional spring ranges to 145 bar (2100 psi).
- Hardened spool and cage for long life.
- Industry common cavity.

RATINGS

Operating Pressure: 207 bar (3000 psi)

Flow: See Performance Chart

Internal Leakage ② to ③: 82 cc/minute (5 in.³/minute) max. at ΔP 207 bar (3000 psi)

Standard Spring Ranges (Reducing Function):
5.5 to 27.6 bar (80 to 400 psi);
13.8 to 55.2 bar (200 to 800 psi);
20.6 to 103 bar (300 to 1500 psi);
27.6 to 145 bar (400 to 2100 psi)

Temperature: -40 to 120°C with standard Buna seals

Filtration: Recommend 25µ nominal or better

Fluids: Mineral-based or synthetics with lubricating properties at viscosities of 6 to 420 cSt (45 to 2000 ssu)

Installation: No restrictions; See page 0.020.1

Cavity: VC10-3; See page 0.070.1

Cavity Tool: CT10-3XX; See page 6.300.1

Seal Kit: SK10-3X-BM; See page 6.025.1

Barksdale

Maxtrol™ Field Adjustable Pressure Switch

Operating Characteristics							
Range	Pressure Setting Range				Approx. Actuation Value (Differential)	Proof Pressure	Catalog Number
	Decreasing		Increasing				
	Min.	Max.	Min.	Max.			
30" Hg (Vac)	1" Hg	28" Hg	4" Hg	30" Hg	1-4" Hg	30 psi	96221-BB1
15	2.5	12.8	3	15	.5-2.2	1000	96211-BB1*
35	5	31	6	35	1-4.2	1000	96211-BB2*
50	10	44	10	50	1.5-5.5	1000	96211-BB3
125	22.5	112	25	125	2.5-13	1000	96211-BB4
250	70.0	220	50	250	10-30	1000	96211-BB5
500	110	440	130	500	20-60	1000	96211-BB6
600	190	450	250	600	60-150	7000	96201-BB1
1700	360	1450	430	1700	70-250	7000	96201-BB2
4400	1450	3900	1650	4400	200-500	7000	96201-BB3
7500	3650	6700	4000	7500	350-800	12000	96201-BB4
Approximate Shipping Weight: 0.95 lbs.							

General Description

The 96201 series switch utilizes a sealed piston sensor. The 96211 and 96221 series switches use a diaphragm piston sensor. These switches offer field adjustable set points. The differential is fixed and varies with pressure setting.

Electrical Connections include free leads as standard with optional spade terminals, DIN type connector or screw type connections. They are environmentally sealed and are resistant to shock and vibration. Designed to deliver millions of maintenance free cycles, the sealed piston and diaphragm piston designs are ideally suited for harsh environments.

Detail Data

Electrical Connection — Free leads approximately 12" long.

Pressure Connection — 1/4" NPT male.

Temperature Range — 96201 series = −40° to 165°F.
96211 series = −20° to 165°F.
(*0°F Min. as noted)
96221 series = 0° to 165°F.

Wetted Materials

96201 series
Body — Brass
Seals — Buna N o'ring
Piston — Stainless steel

96211 & 96221 series
Body — Brass
Diaphragm — Buna N

Housing — Open type plastic housing.

Approvals/Listings — UL & CSA applied for

Optional Modifications

Electrical — 1/4" male quick connection terminals. To specify, add suffix -T1 to catalog number.
DIN 43650 type connector for PG9 (5-8mm OD) cable size. To specify, add suffix -T2 to catalog number.
#6 Screw type connections. To specify, add suffix -T3 to catalog number.

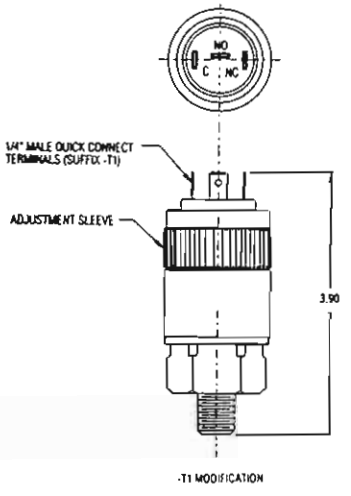
Wetted Material — Body: Stainless steel. To specify, add suffix -SS to catalog number.

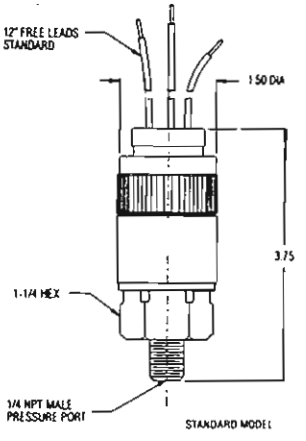
Diaphragm Seal — Other compounds available. Consult factory.

Process Connection — 7/16-20 SAE type male straight threads with o'ring seal. Consult factory.

Adjustment Instructions — Secure hex body with open end wrench. Hand turn adjustment sleeve clockwise to increase, counterclockwise to decrease set point.

Ordering Instructions — To ensure correct switch is furnished, always specify full catalog number (including required modifications) and service. Example: 96211-BB2-SS-T2.





WIRE CODE	PRESSURE	VACUUM
Lead	Color	Color
Normally Closed	Blue	Red
Common	Purple	Purple
Normally Open	Red	Blue

ELECTRICAL RATING			
Limit Switch Class	Voltage (Volts)	Maximum Continuous Current (Amps)	
		Resistive	Inductive
BB	125/250 VAC	5	5

All models incorporate Underwriters' Laboratories, Inc. listed and CSA approved single pole double throw snap-action switches

DOMESTIC SALES AND DISTRIBUTION:

State/City	Name	Phone (Area) Number
ALABAMA	IMO INDUSTRIES INC. (Atlanta, GA)	404-261-7063
Birmingham	Activation, Inc.	205-942-1753
Theodore	Activation, Inc.	205-653-5240
ALASKA		
Anchorage	ARCTIC CONTROLS, INC.	907-561-7555
ARIZONA		
Scottsdale	SOUTHWEST CONTROLS, INC.	602-945-1717
Tucson	SOUTHWEST CONTROLS, INC.	602-886-2098
ARKANSAS	IMO INDUSTRIES INC. (Atlanta, GA)	404-261-7063
N. Little Rock	Centro, Inc.	501-835-2193
CALIFORNIA		
Northern	IMO INDUSTRIES INC. (San Francisco)	415-342-3350
Southern	IMO INDUSTRIES INC. (Los Angeles)	213-858-2268
Bakersfield	Controlco	805-323-8111
Fresno	Controlco	209-485-9873
Los Angeles	W. R. Ladewig Co.	213-723-6371
Garden Grove	Fluid Tech Sales/South	714-554-9090
San Diego	Barbee Valve & Supply	619-585-8484
COLORADO		
Denver	WARREN FLUID POWER CO.	303-936-8400
CONNECTICUT	IMO INDUSTRIES INC. (Hartford)	203-563-3737
Bridgeport	M. A. Selmon Co.	203-377-3525
DELAWARE	IMO INDUSTRIES INC. (Philadelphia, PA)	215-674-1698
FLORIDA	IMO INDUSTRIES INC. (Atlanta, GA)	404-261-7063
Tampa	State Instruments	813-933-7676
GEORGIA	IMO INDUSTRIES INC. (Atlanta)	404-261-7063
Decatur	Activation, Inc.	404-981-6900
HAWAII		
Honolulu	BERKLEY ENGINEERING	808-845-9377
IDAHO		
Northern	Spencer Fluid Power (VALVE)	206-763-0210
	Tower Equipment Co. (SWITCH)	206-644-2244
Southern	PROCESS INSTRUMENTS & CONTROL SYSTEMS	801-262-5568
ILLINOIS		
Northern	IMO INDUSTRIES INC. (Chicago)	312-681-4806
Rockford	R. R. Floody Co. Inc.	815-399-1931
Rock Island	R. R. Floody Co. Inc.	800-535-6639
Southern	IMO INDUSTRIES INC. (St. Louis, MO)	314-567-4005
E. St. Louis	IMO INDUSTRIES INC. (St. Louis, MO)	314-567-4005
INDIANA		
Northern	IMO INDUSTRIES INC. (Chicago, IL)	312-681-4806
Southern	IMO INDUSTRIES INC. (Cincinnati, OH)	513-489-5300
IOWA	IMO INDUSTRIES INC. (Chicago, IL)	312-681-4805
Cedar Rapids	R. R. Floody Co. Inc.	319-378-1512
KANSAS		
Northeast	IMO INDUSTRIES INC. (St. Louis, MO)	314-567-4005
Shawnee Mission	A. W. Schultz Co.	913-362-0265
	IMO INDUSTRIES INC. (Tulsa, OK)	918-663-7231
Wichita	Baker Fluid Power	316-943-0213
KENTUCKY	IMO INDUSTRIES INC. (Cincinnati, OH)	513-489-5300
Louisville	Paquin Co.	502-897-5510
LOUISIANA		
Shreveport	IMO INDUSTRIES INC. (Dallas/Ft. Worth, TX)	817-860-4242
	IMO INDUSTRIES INC. (Kenner, LA)	504-466-8504
Baton Rouge	Desselle-Maggard	504-293-3290
	Standard Supply & Hard.	504-356-5211
Lake Charles	Standard Supply & Hard.	318-433-8586
New Orleans	Standard Supply & Hard.	504-586-8400
MAINE	IMO INDUSTRIES INC. (Hartford, CT)	203-563-3737
MARYLAND	IMO INDUSTRIES INC. (Philadelphia, PA)	215-674-1698
Baltimore	Lanier Engineering Sales	301-789-6800
MASSACHUSETTS	IMO INDUSTRIES INC. (Hartford, CT)	203-563-3737
MICHIGAN		
Detroit	IMO INDUSTRIES INC.	313-585-8200
Troy	R. H. Jackson Co.	313-689-9950
MINNESOTA		
Minneapolis	THE HARTFIEL CO.	612-941-7300
MISSISSIPPI	IMO INDUSTRIES INC. (Atlanta, GA)	404-261-7063
	Activation Inc.	205-942-1753
MISSOURI	IMO INDUSTRIES INC. (St. Louis)	314-567-4005
Kansas City	A. W. Schultz Co.	913-362-0265
St. Louis	Neff Power, Inc.	314-727-6200
MONTANA		
Billings	NORTHWEST PIPE FITTINGS, INC.	406-252-0142
NEBRASKA	A. W. SCHULTZ CO. (Shawnee Mission, KS)	913-362-0265
NEVADA		
Reno	IMO INDUSTRIES INC. (San Francisco, CA)	415-342-3350
Las Vegas	IMO INDUSTRIES INC. (Los Angeles, CA)	213-858-2268
Eastern	PROCESS INSTRUMENT & CONTROL SYSTEMS (Salt Lake City, UT)	801-262-5568
NEW HAMPSHIRE	IMO INDUSTRIES INC. (Hartford, CT)	203-563-3737
NEW JERSEY		
Northern	IMO INDUSTRIES INC. (Elmwood Park)	201-794-8315
Skillman	The Truesdell Co. Inc.	201-526-2900
Southern	IMO INDUSTRIES INC. (Philadelphia, PA)	215-674-1698
NEW MEXICO		
Albuquerque	UTILITY PRODUCTS, INC.	505-899-8420
NEW YORK		
Northeastern	IMO INDUSTRIES INC. (Hartford, CT)	203-563-3737
Northern	IMO INDUSTRIES INC. (Pittsburgh, PA)	412-343-5666
New York City, Long Island	IMO INDUSTRIES INC. (Elmwood Park, NJ)	201-794-8315
NORTH CAROLINA	IMO INDUSTRIES INC. (Atlanta, GA)	404-261-7063
Charlotte	Brown & Morrison	704-554-8570
NORTH DAKOTA		
Eastern	THE HARTFIEL CO. (Minneapolis, MN)	612-941-7300
Western	NORTHWEST PIPE FITTINGS, INC. (Billings, MT)	406-252-0142
OHIO		
Eastern	IMO INDUSTRIES INC. (Cleveland)	216-333-1805
Cleveland	Paquin Co.	216-261-5700
Cincinnati	Paquin Co.	513-489-1117
Northwest	IMO INDUSTRIES INC. (Detroit, MI)	313-585-8200
Southwest	IMO INDUSTRIES INC. (Cincinnati)	513-489-5300
OKLAHOMA		
Tulsa	IMO INDUSTRIES INC.	918-663-7231
	Tulsa Gauge & Instrument	918-622-5061
OREGON	IMO INDUSTRIES INC. (Seattle, WA)	206-241-8812
Eugene	Spencer Fluid Power	503-485-7165
Portland	Spencer Fluid Power	503-249-2835
PENNSYLVANIA		
Eastern	IMO INDUSTRIES INC. (Philadelphia)	215-674-1698
W. Conshohocken	Dees Corporation (VALVES)	215-828-5500
Western	IMO INDUSTRIES INC. (Pittsburgh)	412-343-5666
Pittsburgh	Stanley Berg, Inc.	412-923-1911
Erie	IMO INDUSTRIES INC. (Cleveland, OH)	216-333-1805
PUERTO RICO		
San Juan	INDUSTRIAL AUTOMATION	809-759-8300
RHODE ISLAND	IMO INDUSTRIES INC. (Hartford, CT)	203-563-3737
SOUTH CAROLINA	IMO INDUSTRIES INC. (Atlanta, GA)	404-261-7063
	Brown & Morrison (Charlotte, NC)	704-554-8570
SOUTH DAKOTA		
Eastern	THE HARTFIEL CO. (Minneapolis, MN)	612-941-7300
Western	NORTHWEST PIPE FITTINGS, INC. (Billings, MT)	406-252-0142
TENNESSEE	IMO INDUSTRIES INC. (Atlanta, GA)	404-261-7063
Chattanooga	Activation, Inc.	615-267-8220
Knoxville	Activation, Inc.	615-522-3406
Nashville	Activation, Inc.	615-889-8472
Memphis	Centro, Inc.	901-357-1261
TEXAS		
Northern	IMO INDUSTRIES INC. (Dallas/Ft. Worth)	817-860-4242
Dallas	Wilsher Co.	214-239-9463
Odessa	Lee Equipment	915-381-6738
Southern	IMO INDUSTRIES INC. (Houston)	713-448-1337
Beaumont	Wilsher Co.	409-832-6937
Corpus Christi	Wilsher Co.	512-851-0493
Houston	Wilsher Co.	713-683-6826
San Antonio	Wilsher Co.	512-533-4719
Freeport	Lisco	409-233-0251
UTAH		
Salt Lake City	PROCESS INSTRUMENTS & CONTROL SYSTEMS	801-262-5568
VERMONT	IMO INDUSTRIES INC. (Hartford, CT)	203-563-3737
VIRGINIA	IMO INDUSTRIES INC. (Philadelphia, PA)	215-674-1698
Roanoke	Lanier Engineering Sales	703-563-9600
Virginia Beach	Lanier Engineering Sales	804-497-4846
WASHINGTON	IMO INDUSTRIES INC. (Seattle)	206-241-8812
Bellevue	Tower Equipment Co.	206-644-2244
Tri-Cities	Tower Equipment Co.	509-545-9309
Seattle	Spencer Fluid Power (VALVES)	206-763-0210
WASHINGTON, DC	IMO INDUSTRIES INC. (Landover, MD)	301-459-7521
WEST VIRGINIA		
Eastern	IMO INDUSTRIES INC. (Philadelphia, PA)	215-674-1698
Western	IMO INDUSTRIES INC. (Pittsburgh, PA)	412-343-5666
WISCONSIN		
Eastern	IMO INDUSTRIES INC. (Milwaukee)	414-321-1183
Cedarburg	Automation Engineering Inc.	414-377-8000
Western	THE HARTFIEL CO. (Minneapolis, MN)	612-941-7300
WYOMING	WARREN FLUID POWER CO. (Denver, CO)	303-936-8400

WHERE TO BUY:

Imo Industries Inc.

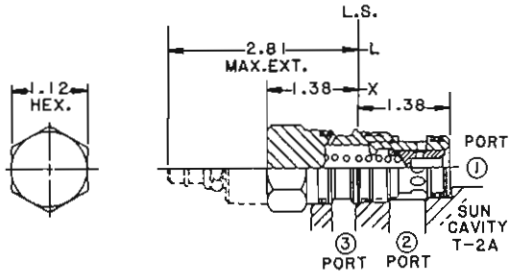
Barksdale Controls Division
3211 Fruitland Avenue
P.O. Box 58843
Los Angeles, CA 90058-0843
Telephone: (213) 589-6181
FAX: (213) 589-3463

NORMALLY OPEN MODULATING ELEMENTS

SUN's normally open modulating (pressure) elements function as restrictive type pressure compensators or, when modified with an internal orifice, as the main stage of remotely controlled or remotely vented pressure reducing valves. Since the compensator version requires a separate external orifice, these elements are generally incorporated into multi-function manifolds.

MAXIMUM SYSTEM PRESSURE 3000 PSI

SERIES 2 - SUN CAVITY T-2A
MAXIMUM INPUT FLOW - 15 GPM



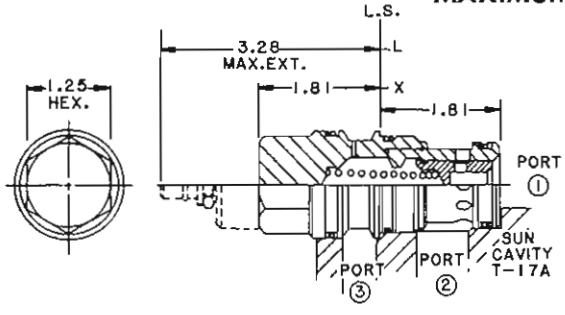
PILOT FLOW (INTERNAL ORIFICE)—10 TO 15 CU. IN./MIN.

BASIC CARTRIDGE PRICE

MODEL **LPF* *D*** 39.00

① PILOTING SOURCE
② CONTROLS
③ SEALS

SERIES 3 - SUN CAVITY T-17A
MAXIMUM INPUT FLOW - 30 GPM



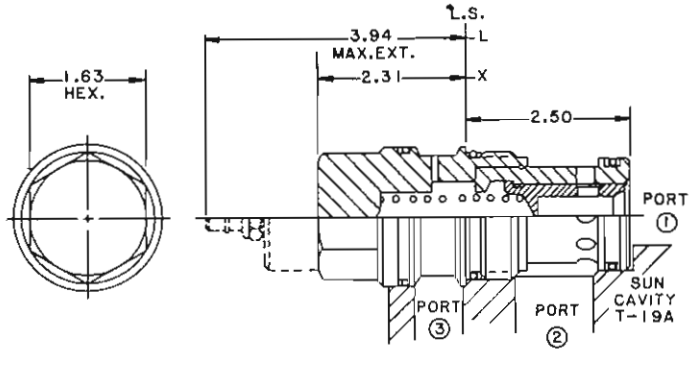
PILOT FLOW (INTERNAL ORIFICE)—15 TO 30 CU. IN./ MIN.

BASIC CARTRIDGE PRICE

MODEL **LPH* *D*** 68.10

① PILOTING SOURCE
② CONTROLS
③ SEALS

SERIES 4 - SUN CAVITY T-19A
MAXIMUM INPUT FLOW - 60 GPM



PILOT FLOW (INTERNAL ORIFICE)—15 TO 30 CU. IN./MIN.

BASIC CARTRIDGE PRICE

MODEL **LPJ* *DV** 140.70

① PILOTING SOURCE
② CONTROLS
③ VITON SEALS STANDARD

SPECIAL CARE SHOULD BE TAKEN TO ASSURE THAT THE PILOT CHAMBER (PORT 3) OF NON-ORIFICED CARTRIDGES (COMPENSATORS) IS BLED OF ALL AIR AND IS FULL OF OIL BEFORE STARTING UP NEW SYSTEMS.

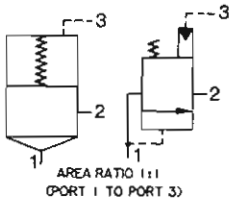
NORMALLY CLOSED MODULATING ELEMENTS

SUN normally closed modulating (pressure) elements function as by-pass type pressure compensators or, when modified with an internal orifice, as the main stage of remotely controlled or remotely vented pressure relief or sequence valves. Since the compensator version requires a separate external orifice, these elements are generally incorporated into multi-function manifolds.

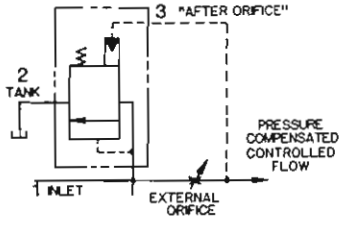
MAXIMUM SYSTEM PRESSURE 3000 PSI

BYPASS TYPE PRESSURE COMPENSATOR

NO INTERNAL ORIFICE



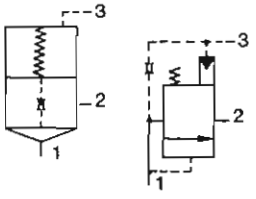
SUN's normally closed by-pass type compensator cartridge will modulate to maintain a constant pressure drop across an external control orifice, regardless of upstream or downstrem pressure variations. Excess oil flow is by-passed to tank at the work pressure rather than at system relief pressure, resulting in a cooler running circuit. Normally supplied as a non-adjustable cartridge (X), an adjustable "tuning" version (L) is also offered if it is necessary to vary the pressure drop across the compensator to increase maximum flow, or otherwise tune the valve to a particular system. The external orifice may be fixed or variable, including the variable orifice created by proportional type directional valves.



TYPICAL APPLICATION

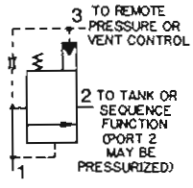
MAIN STAGE PRESSURE RELIEF VALVE

INTERNAL ORIFICE - PORT 1 TO PORT 3



SUN's normally closed modulating (pressure) element with an internal orifice serves as the main stage for a pilot operated relief or sequence valve with remote pressure control and/or externally controlled venting.

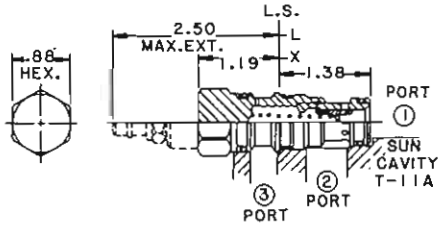
SUN's RBAC *** direct acting relief cartridges (p. 1.47) make excellent remote pressure control operators for these valves.



TYPICAL APPLICATION

CARTRIDGES

SERIES 1 - SUN CAVITY T-11A
MAXIMUM INPUT FLOW -15 GPM



BASIC CARTRIDGE PRICE

MODEL **LRD* *D*** — **28.60**

① PILOTING SOURCE
② CONTROLS
③ SEALS

PILOT FLOW (INTERNAL ORIFICE)— 10 TO 15 CU. IN./MIN.

NORMALLY CLOSED MODULATING ELEMENTS - CARTRIDGE OPTIONS

① PILOTING SOURCE		② CONTROLS		③ SEALS		
CODING	ALL MODELS	CODING	ALL MODELS	CODING	LRD* LRF*	LRH*
A Internal Orifice Port 1 to Port 3	+3.00	**X** Non-Adjustable	+ .00	**N** Buna N	+ .00	+ .00
C External Pilot	+ .00	**L** "Tuning" Adjustment Leakproof - "O" ring on screw	+4.00	**V** Viton	+1.50	+2.00

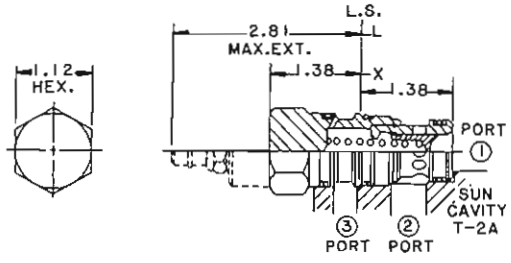
NOTE: SPECIAL CARE SHOULD BE TAKEN TO ASSURE THAT THE PILOT CHAMBER (PORT 3) OF NON-ORIFICED CARTRIDGES (COMPENSATORS) IS BLED OF ALL AIR AND IS FULL OF OIL BEFORE STARTING UP NEW SYSTEMS.

NORMALLY CLOSED MODULATING ELEMENTS

SUN normally closed modulating (pressure) elements function as by-pass type pressure compensators or when modified with an internal orifice, as the main stage for remotely controlled or remotely vented pressure relief or sequence valves. Since the compensator version requires a separate external orifice, these elements are generally incorporated into multi-function manifolds.

MAXIMUM SYSTEM PRESSURE 3000 PSI

SERIES 2 – SUN CAVITY T-2A
MAXIMUM INPUT FLOW – 30 GPM



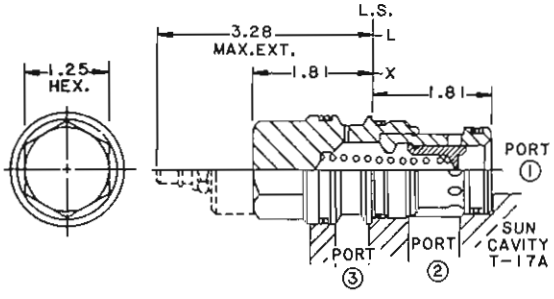
PILOT FLOW (INTERNAL ORIFICE)—10 TO 15 CU. IN./MIN.

BASIC CARTRIDGE PRICE

MODEL **LRF* *D*** 39.40

① PILOTING SOURCE
② CONTROLS
③ SEALS

SERIES 3 – SUN CAVITY T-17A
MAXIMUM INPUT FLOW – 60 GPM



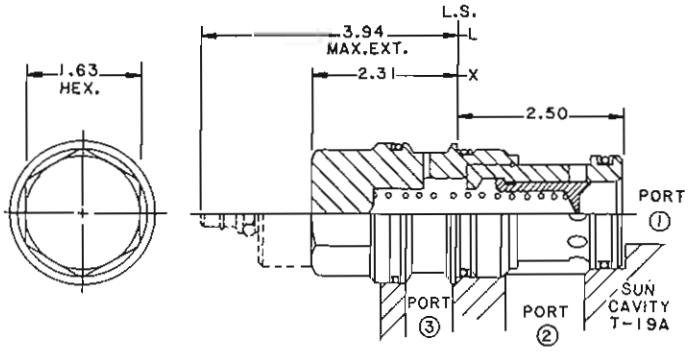
PILOT FLOW (INTERNAL ORIFICE)—15 TO 30 CU. IN./MIN.

BASIC CARTRIDGE PRICE

MODEL **LRH* *D*** 69.90

① PILOTING SOURCE
② CONTROLS
③ SEALS

SERIES 4 – SUN CAVITY T-19A
MAXIMUM INPUT FLOW – 120 GPM



PILOT FLOW (INTERNAL ORIFICE)—15 TO 30 CU. IN./MIN.

BASIC CARTRIDGE PRICE

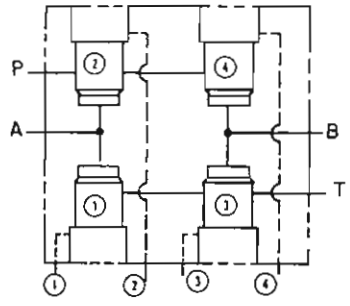
MODEL **LRJ* *DV** 132.90

① PILOTING SOURCE
② CONTROLS
③ VITON SEALS STANDARD

NOTE: SPECIAL CARE SHOULD BE TAKEN TO ASSURE THAT THE PILOT CHAMBER (PORT 3) OF NON-ORIFICED CARTRIDGES (COMPENSATORS) IS BLED OF ALL AIR AND IS FULL OF OIL BEFORE STARTING UP NEW SYSTEMS.

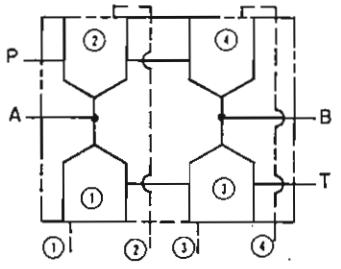
VALVE BODIES FOR CARTRIDGE LOGIC ELEMENTS

FOR PROTOTYPES - LIMITED PRODUCTION

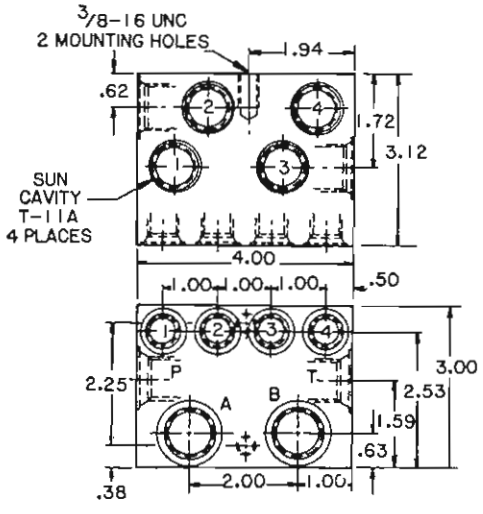


SUN offers two valve body styles, in four cartridge cavity sizes, which can simplify the construction of prototype or limited production logic element circuits. Each valve body incorporates four cavities so the designer can duplicate any of the four-way valve functions described on page 8.06 or create new circuit combinations using Normally Open and Normally Closed logic element cartridges together in the same block. Porting is provided for the normal P, A, B and T connections, as well as individual pilot connections for each cartridge. This allows the control circuit to be bread boarded, and tested or modified as required, before committing the final design to manifold form.

The four cavity bodies shown here can duplicate nearly every four-way valve function and can be used in either open-center or closed-center systems. The five cavity bodies (pp. 8.17 & 8.18) have an extra cavity connecting P and T. This allows the installation of a SUN normally closed modulating element or vented relief cartridge to serve as a remotely controlled and/or vented relief valve, primarily for open center systems with fixed displacement pumps.



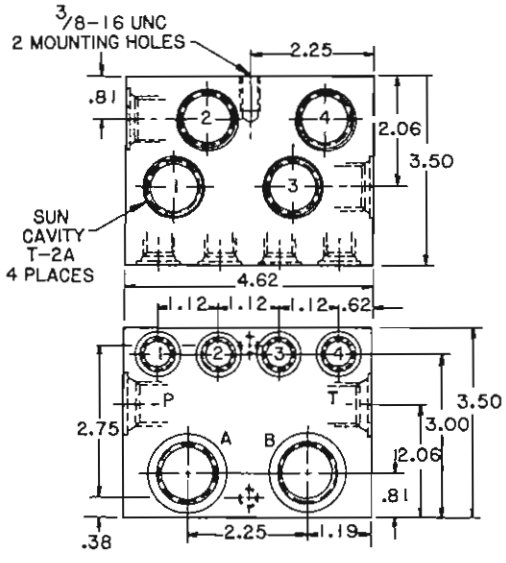
SERIES 1 T-11A CAVITIES



MAIN PORTS PORTS P, A, B & T	PILOT PORTS	BODY MODEL	BODY PRICE
1/4" NPTF	1/4" NPTF	YRZ	75.80
3/8" NPTF	1/4" NPTF	YRY	75.80
1/2" NPTF	1/4" NPTF	YRX	75.80
SAE-6	SAE-6	YRW	75.80
SAE-8	SAE-6	YRV	75.80
SAE-10	SAE-6	YRT	75.80
1/4" BSPP	1/4" BSPP	YRP †	75.80
3/8" BSPP	1/4" BSPP	YRM †	75.80
1/2" BSPP	1/4" BSPP	YRQ †	75.80

† MOUNTING HOLES - M10 x 1.5 - 6H

SERIES 2 T-2A CAVITIES

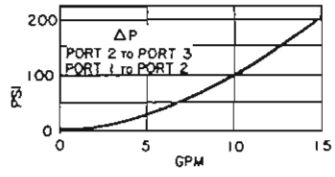


MAIN PORTS PORTS P, A, B & T	PILOT PORTS	BODY MODEL	BODY PRICE
3/8" NPTF	1/4" NPTF	YPZ	84.40
1/2" NPTF	1/4" NPTF	YPY	84.40
3/4" NPTF	1/4" NPTF	YPX	84.40
SAE-8	SAE-6	YPW	84.40
SAE-10	SAE-6	YPV	84.40
SAE-12	SAE-6	YPT	84.40
3/8" BSPP	1/4" BSPP	YPP†	84.40
1/2" BSPP	1/4" BSPP	YPM†	84.40
3/4" BSPP	1/4" BSPP	YPQ†	84.40

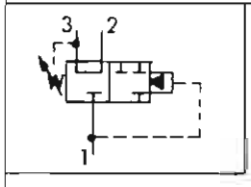
† MOUNTING HOLES - M10 x 1.5 - 6H

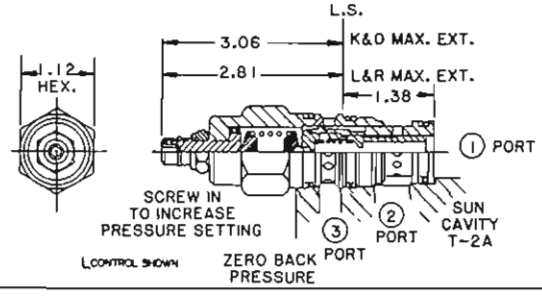
PILOT-OPERATED DIRECTIONAL VALVES - CARTRIDGES

3000 psi maximum system pressure
PILOT FLOW - 10 to 15 cu. in./min.



2-WAY PILOT-OPERATED DIRECTIONAL VALVE-NORMALLY OPEN





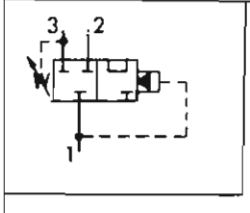
SUN CAVITY T-2A

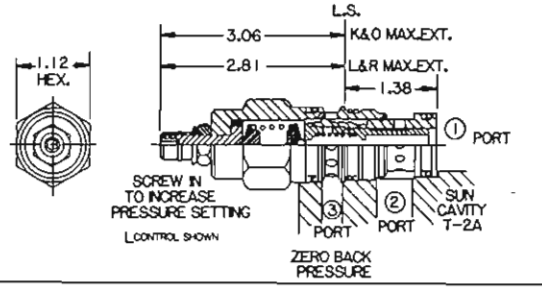
BASIC CARTRIDGE PRICE

MODEL **DPCA** ✱✱✱ **57.20**

① **CONTROLS**
② **ADJUSTMENT RANGES**
③ **SEALS**

2-WAY PILOT-OPERATED DIRECTIONAL VALVE-NORMALLY CLOSED





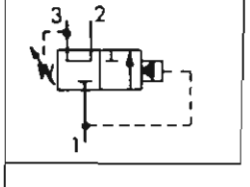
SUN CAVITY T-2A

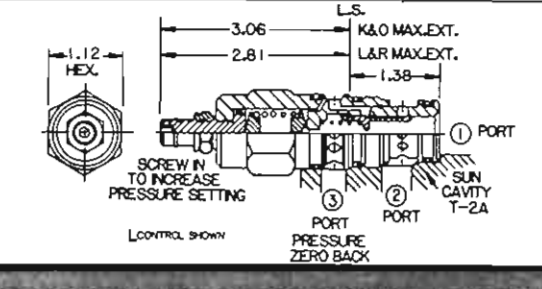
BASIC CARTRIDGE PRICE

MODEL **DPCB** ✱✱✱ **57.20**

① **CONTROLS**
② **ADJUSTMENT RANGES**
③ **SEALS**

3-WAY PILOT-OPERATED DIRECTIONAL VALVE





SUN CAVITY T-2A

BASIC CARTRIDGE PRICE

MODEL **DPCC** ✱✱✱ **62.80**

① **CONTROLS**
② **ADJUSTMENT RANGES**
③ **SEALS**

PILOT-OPERATED DIRECTIONAL VALVE CARTRIDGE OPTIONS

① CONTROLS (See p.xii)			② ADJUSTMENT RANGES			③ SEALS		
	CODING	ALL MODELS		CODING	MODELS		CODING	ALL MODELS
L	Leakproof screw adjustment	+ .00	**A**	100 to 3000 psi 1000 psi standard setting	+ .00	**N**	Buna N	+ .00
K	Handknob with lock knob	+2.00	**B**	50 to 1500 psi 1000 psi standard setting	+ .00	**V**	Viton	+1.50
O	Panel mount with handknob	+4.00		NOTE: OTHER ADJUSTMENT RANGES ARE AVAILABLE ON SPECIAL ORDER				

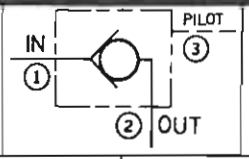
NOTE: Cartridge models DPC* may be installed in any body or manifold machined with a SUN T-2A cavity. For line mounting, typical SUN bodies are BC* or BA* (pp. 1.38 or 3.12). For other mounting or operating information, contact factory.

PILOT-TO-CLOSE CHECK VALVES

SUN pilot-to-close check valves are useful tools. Like all check valves, they allow flow in one direction only, but will stop free flow with the application of sufficient pilot pressure. These valves are especially adaptable to multi-function systems such as regenerative circuits.

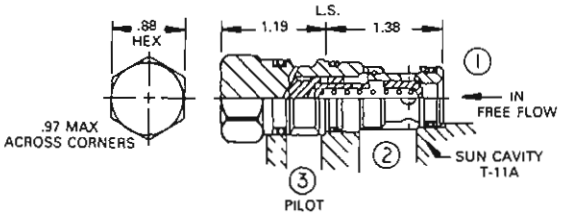
CARTRIDGES

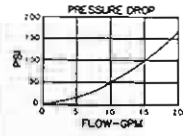
PILOT RATIO 1.8:1
(1000 psi pilot pressure will hold check valve closed against 1800 psi blocked pressure, provided outlet pressure drops to zero.)



3000 psi maximum system pressure
Steel seat for long wear, maximum dirt tolerance.

SUN CAVITY T–11A

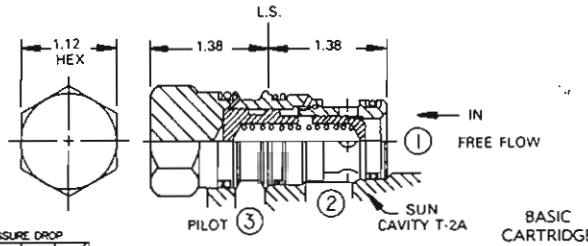


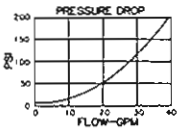


MODEL **CODA X****
① CRACKING PRESSURE
② SEALS

BASIC CARTRIDGE PRICE **22.90**

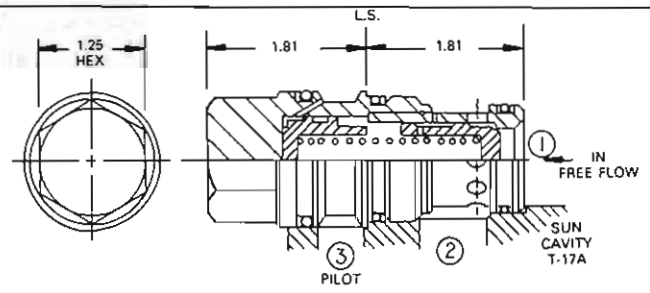
SUN CAVITY T–2A



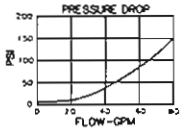


MODEL **COFA X****
① CRACKING PRESSURE
② SEALS

BASIC CARTRIDGE PRICE **32.40**

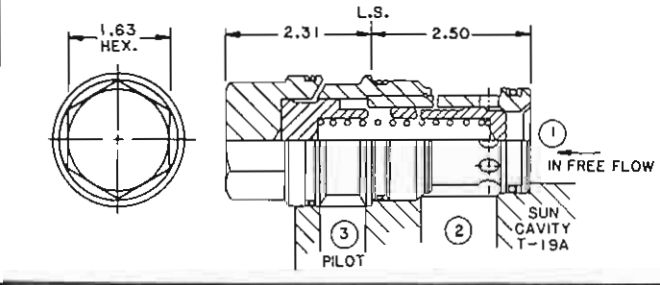


SUN CAVITY T–17A

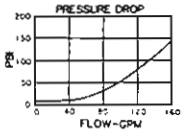


MODEL **COHA X****
① CRACKING PRESSURE
② SEALS

BASIC CARTRIDGE PRICE **54.80**



SUN CAVITY T–19A

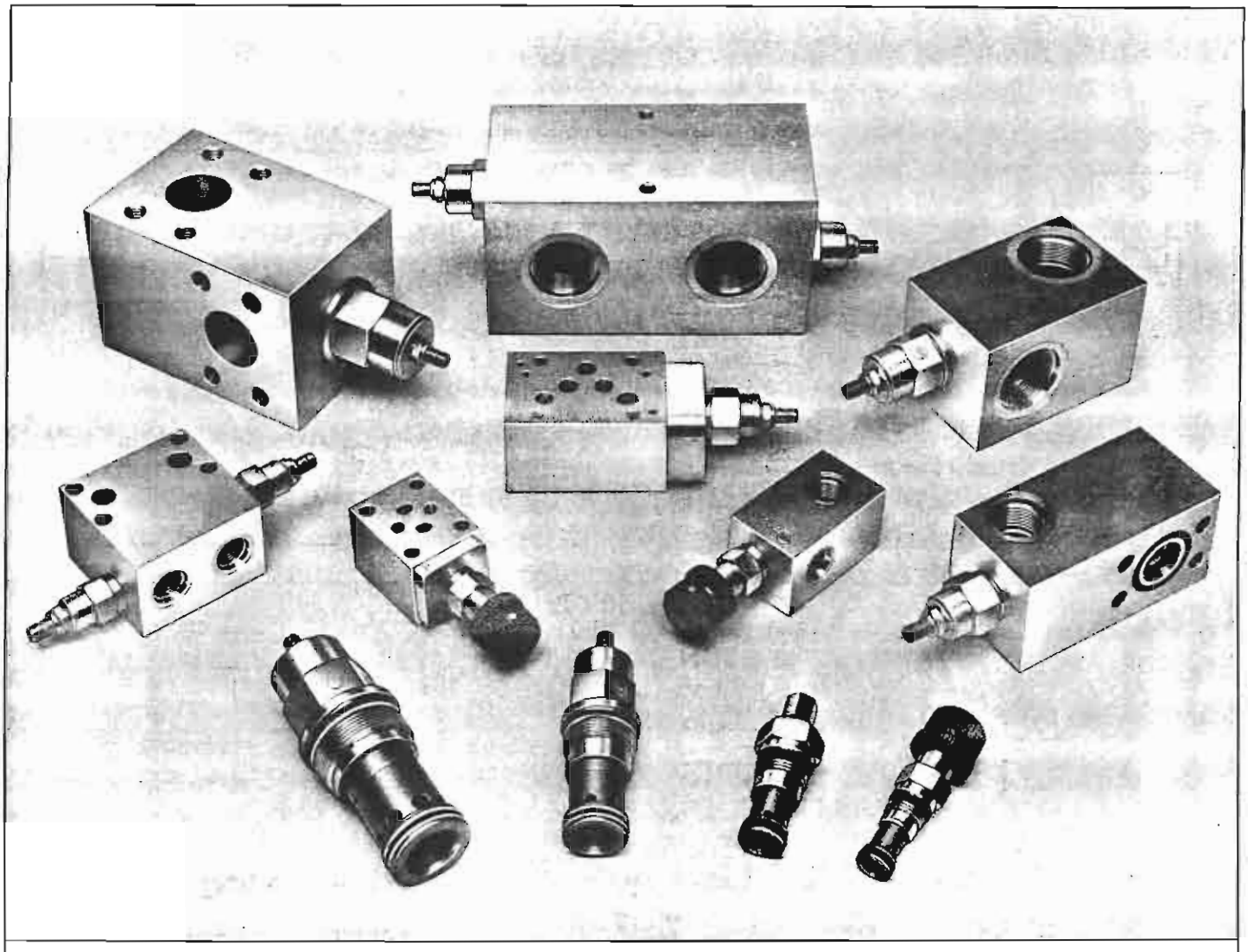


MODEL **COJA X*V**
① CRACKING PRESSURE
② VITON SEALS STANDARD

BASIC CARTRIDGE PRICE **101.30**

PILOT-TO-CLOSE CHECK VALVE CARTRIDGE OPTIONS

① CRACKING PRESSURE						② SEALS		
CODING	ALL MODELS	CODING	ALL MODELS	CODING	ALL MODELS	CODING	CODA COFA	COHA
A 4 ± 1 psi	+ 1.00	**D** 50 ± 5 psi	+1.00	**Z** 1 ± 1/2 psi	+1.00	**N** Buna N	+ .00	+ .00
B 15 ± 2 psi	+1.00	**E** 75 ± 7 psi	+ .00			**V** Viton	+1.50	+2.00
C 30 ± 3 psi	+ .00	**F** 100 ± 10 psi	+1.00					

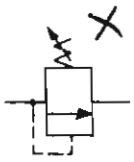


SUN relief valve cartridge configurations, suitable for every type of industrial and mobile pressure control application, will be found in this section. These products include:

- Pilot Operated Relief Valves
  Smoothly and consistently regulate maximum system pressure in any hydraulic system or subsystem, over widely varying flow conditions. Hysteresis is virtually unmeasurable.
- Direct Acting (differential area) Relief Valves
  Designed for intermittent duty for surge or overload protection. Fast acting, dirt tolerant. SUN's unique design (pat. pend.) results in extremely low hysteresis for valves of this type—Reseat pressure equals 90% of set pressure—and the same flow path as SUN's pilot operated relief valve cartridges, for maximum circuit flexibility.
- Rapid Response Pilot Operated Relief Valves
  Pilot operated relief valve cartidges modified to respond quickly for protection against high pressure surges or overloads.
- Kick-Down Relief Valves
  Hydraulic circuit breakers which open fully at their setting and unload a circuit at low pressure.
- Vented Pilot Operated Relief Valves
  Pilot operated relief valves with a third (control) port for remote pressure control, multiple pressure systems, remote unloading circuits.

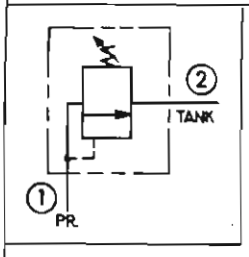
SUN relief valve cartridges are available in a broad selection of useful body configurations for easy installation in a variety of hydraulic circuits, including:

- Line mounted valves in several body styles to simplify circuit layout and construction.
- SAE 4-Bolt flange bodies for direct mounting on pumps, motors or cylinders.
- Line mounted dual cross-port reliefs with or without anti-cavitation check.
- Gasket mounting bodies for direct mounting on many popular hydraulic motors. Optional shuttle valve for brake release.
- Solenoid operated vented relief valve assemblies.
- Sandwich mounting—a variety of relief valve circuits for sandwich mounting under NFPA DO1, DO2, "02H," DO4, DO6 and "06H" industrial solenoid controlled directional valves.

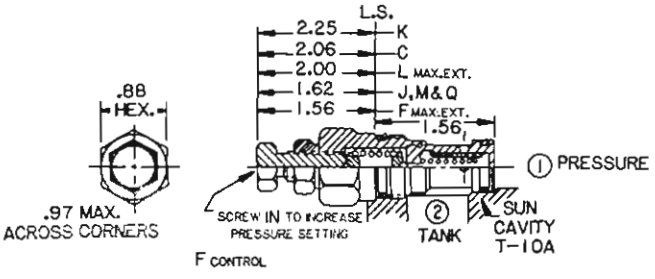


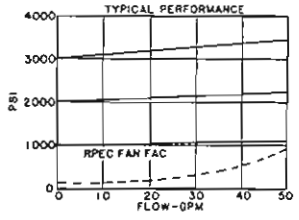
CARTRIDGES

SUN pilot-operated, balanced spool valves for accurate pressure regulation
5000 psi maximum system working pressure
(6000 psi maximum overload pressure relief setting.)



0 to 25 GPM
(0 to 50 GPM @ 2000 psi and above)
SUN CAVITY T–10A



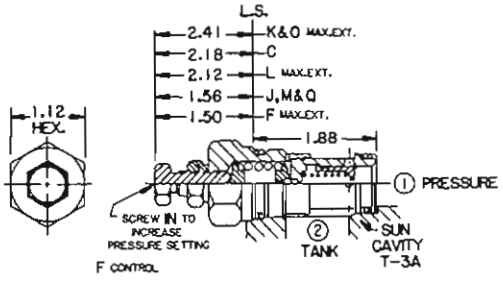


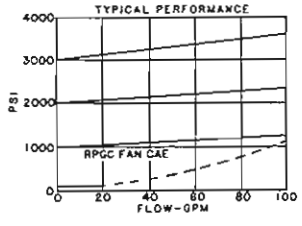
BASIC CARTRIDGE PRICE **25.10**

MODEL **RPEC** ✱✱✱
① CONTROLS
② ADJUSTMENT RANGES
③ SEALS

MAXIMUM ALLOWABLE LEAKAGE
1 CU. IN./MIN./1000 PSI

0 to 50 GPM
(0 to 100 GPM @ 2000 psi and above)
SUN CAVITY T–3A



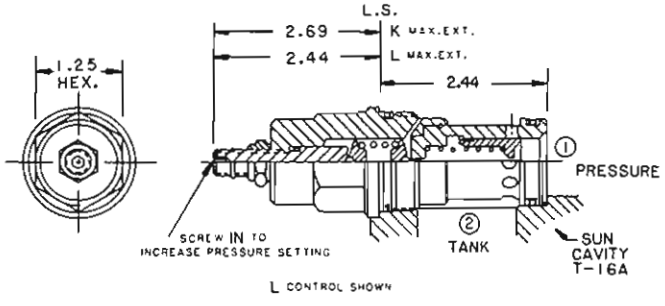


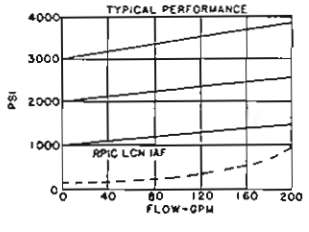
BASIC CARTRIDGE PRICE **36.80**

MODEL **RPGC** ✱✱✱
① CONTROLS
② ADJUSTMENT RANGES
③ SEALS

MAXIMUM ALLOWABLE LEAKAGE
1 CU. IN./MIN./1000 PSI

0 to 100 GPM
(0 to 200 GPM @ 2000 psi and above)
SUN CAVITY T–16A





BASIC CARTRIDGE PRICE **72.10**

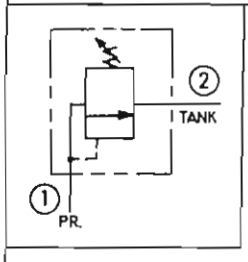
MODEL **RPIC** ✱✱✱
① CONTROLS
② ADJUSTMENT RANGES
③ SEALS

MAXIMUM ALLOWABLE LEAKAGE
2 CU. IN./MIN./1000 PSI

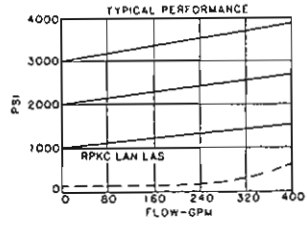
NOTE: For emergency relief protection, to limit dead head surges, see cartridge models RPEE, RPGE and RPIE (pp. 1.16)

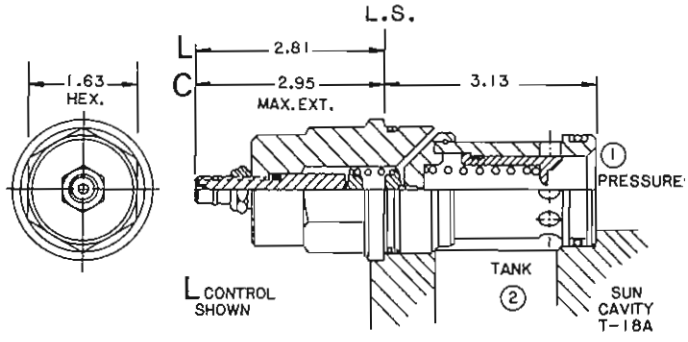
CARTRIDGES

SUN pilot-operated, balanced spool valves for accurate pressure regulation
5000 psi maximum system working pressure
(6000 psi maximum overload pressure relief setting.)



0 to 200 GPM
(0 to 400 GPM @ 2000 psi and above)
SUN CAVITY T–18A





BASIC CARTRIDGE PRICE

MODEL RPKC ✱✱V 135.40

① CONTROLS
② ADJUSTMENT RANGES
③ VITON SEALS STANDARD

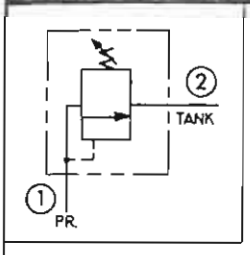
MAXIMUM ALLOWABLE LEAKAGE
2 CU. IN./MIN./1000 PSI

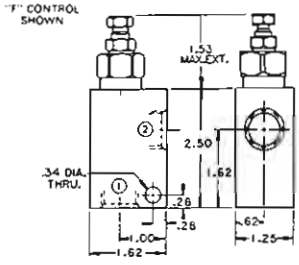
RELIEF VALVE CARTRIDGE OPTIONS

① CONTROLS (See p. xii)			② ADJUSTMENT RANGES			③ SEALS		
CODING	RPEC RPGC	RPIC RPKC	CODING		ALL MODELS	CODING	RPEC RPGC	RPIC
L Leakproof Screw adjustment	+4.00	+ .00	**A** 100 to 3000 psi 1000 psi standard setting		+ .00	**N** Buna N	+ .00	+ .00
K Handknob with lock knob	+6.00	+2.00	**B** 50 to 1500 psi 1000 psi standard setting		+ .00	**V** Viton	+1.00	+1.50
O Panel mount with handknob	+8.00	N/A	**C** 150 to 6000 psi 1000 psi standard setting		+2.00			
C Tamperproof (1–29) Factory set (30 & over)	+8.00 +7.00	+4.00 +3.00	**D** 25 to 800 psi 400 psi standard setting	(1–29) (30 & over)	+ .50 + .00			
F Standard adjustment with locknut	+ .00	N.A	**E** 25 to 400 psi 200 psi standard setting	(1–29) (30 & over)	+ .50 + .00			
J Capped (Concealed adjustment)	+ .50	N.A						
M Capped ("J") with lockwire holes	+1.00	N/A	Customer specified setting (Setting stamped on Cartridge hex.)	(1-29) (30 & over)	+1.00 + .50			
Q Factory set & lockwired	+6.00	N/A						

NOTE: For emergency relief protection, to limit dead head surges, see cartridge model RPKE (p. 1.17)

LINE MOUNTED





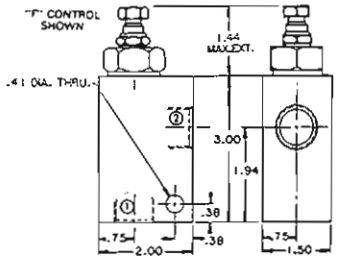
PORTS ① ②	BASIC VALVE MODEL (a)	BASIC PRICE (a)
1/4" NPTF	RPEC *** FAA	36.50
3/8" NPTF	RPEC *** FAB	36.50
1/2" NPTF*	RPEC *** FAC	36.50
SAE-6	RPEC *** FAI	36.50
SAE-8	RPEC *** FAJ	36.50
SAE-10*	RPEC *** FAK	36.50
1/4" BSPP	RPEC *** FAT	36.50
3/8" BSPP	RPEC *** FAU	36.50
1/2" BSPP*	RPEC *** FAV	36.50

MODEL RPEC * FA***

See RPEC Cartridge Model Coding (p. 1.02)

PORTS SEE CHART

*If differential pressure Port 2 to Port 1 exceeds 1000 psi, consult factory.

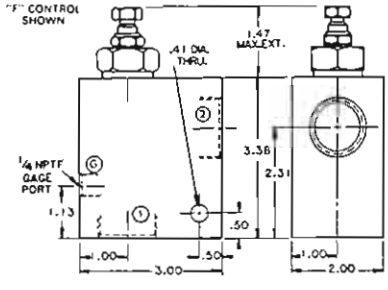


PORTS ① ②	BASIC VALVE MODEL (a)	BASIC PRICE (a)
3/8" NPTF	RPGC *** CAB	50.50
1/2" NPTF	RPGC *** CAC	50.50
3/4" NPTF	RPGC *** CAD	50.50
SAE- 8	RPGC *** CAJ	50.50
SAE-10	RPGC *** CAK	50.50
SAE-12	RPGC *** CAL	50.50
3/8" BSPP	RPGC *** CAU	50.50
1/2" BSPP	RPGC *** CAV	50.50
3/4" BSPP	RPGC *** CAW	50.50

MODEL RPGC * CA***

See RPGC Cartridge Model Coding (p. 1.02)

PORTS SEE CHART



PORTS ① ②	BASIC VALVE MODEL (a)	BASIC PRICE (a)
1" NPTF	RPGC *** CAE	64.20
SAE-16	RPGC *** CAM	64.20
1" BSPP	RPGC *** CAX †	64.20

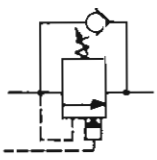
† 1/4" BSPP gage port

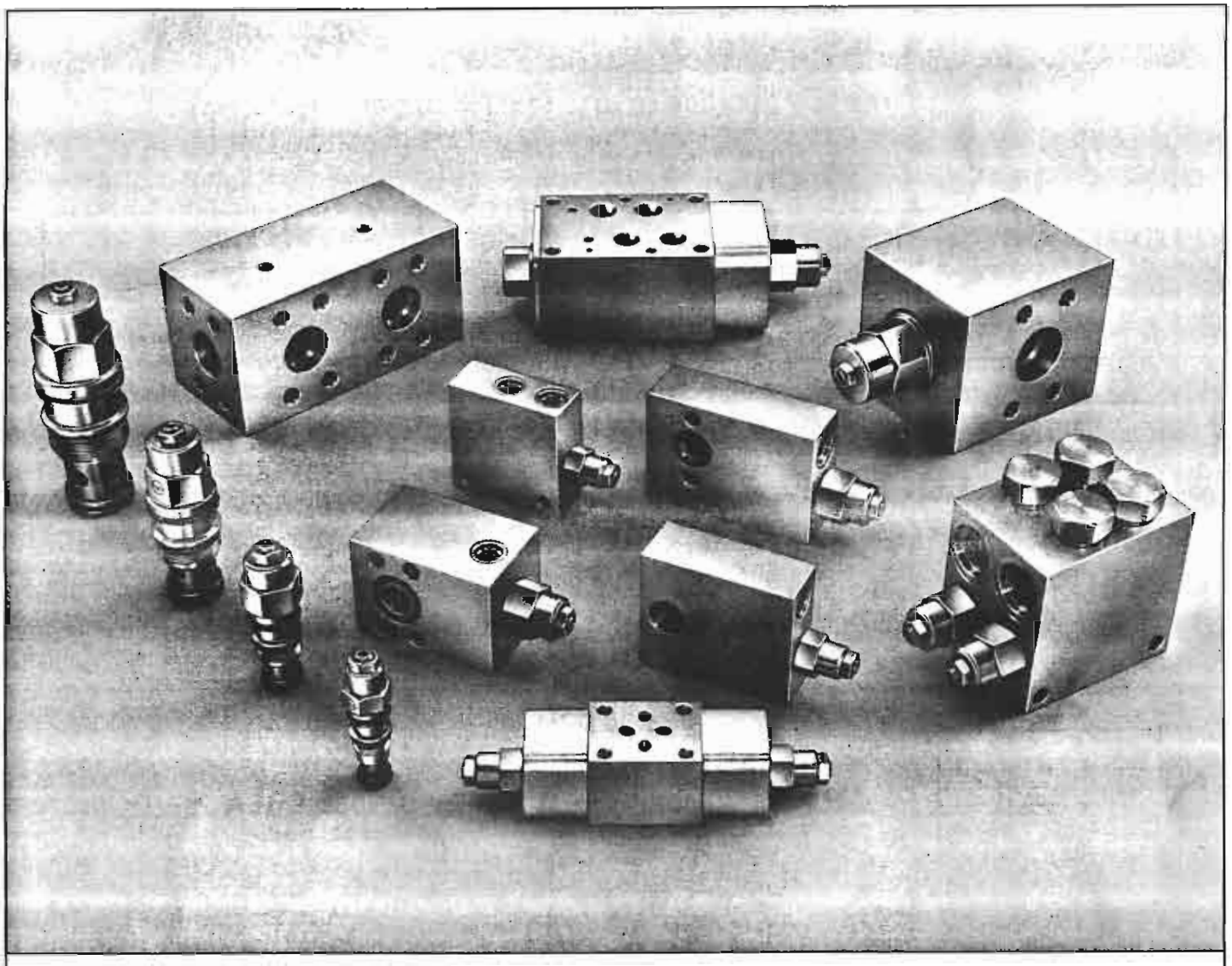
MODEL RPGC * CA***

See RPGC Cartridge Model Coding (p. 1.02)

PORTS SEE CHART

(a) See cartridge models RPEC *** and RPGC *** (p. 1.02) for performance data, options and option prices.





SUN counterbalance valves with pilot assist are specifically designed for overrunning load control and hydraulic load locking. In use, they restrain flow from a hydraulic actuator, to prevent cavitation which would occur if the load ran ahead of the pump. These valves function as deceleration controls and serve as safety devices, locking the load in case of hydraulic line breakage or in the event of accidental or unauthorized operation of the directional control valve when the pump is not operating. They also provide thermal relief protection in blocked systems and full flow relief protection in applications where the actuator may be pushed back mechanically.

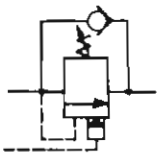
SUN's cartridge construction, with all the functioning hydraulic components combined in a single element, makes it easy to install this type of valving in cavities machined directly into the end cap of lift cylinders. This provides maximum protection against loss of load if a hydraulic line fails.

With the pilot assist feature, external piloting effectively reduces the pressure setting of the valve and permits smooth control of overrunning loads and cushioned deceleration. Because SUN counterbalance cartridges are internally damped, no external orificing is required.

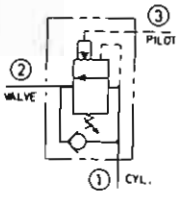
Several pilot ratios are available to meet the operating requirements of a broad range of mobile and industrial hydraulic applications and systems.

SUN counterbalance valves are offered in a number of mounting configurations to simplify the piping of many types of hydraulic circuits. Standard mountings include:

- Line mounted—single and dual functions
- Line mounted—single and dual functions with brake release shuttle valve
- SAE 4-bolt pad mounting for direct installation on cylinders or motors.
- Direct bolt-down gasket mounting for cylinder applications.
- Close coupled mounting, for hard mounting to cylinders using a close pipe nipple.
- SUN sandwich bodies, which allow the counterbalance function to be bolted between a solenoid controlled valve and a subplate or bar manifold. This type of mounting is available for all standard solenoid valve interfaces including NFPA D01, D02, D04 and D06 as well as the "02H" and "06H" configurations.



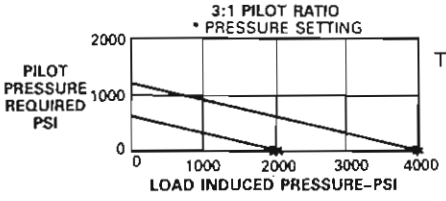
CARTRIDGES



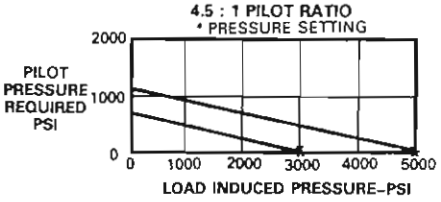
FOR LOW LEAKAGE LOAD HOLDING (0 TO 5 DROPS/MIN., MAX.)

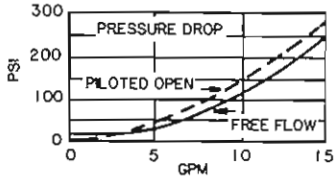
- Built-in free flow check valve
- Manual emergency load release

NOTE: Valve should be set at 1.3 times load induced pressure.

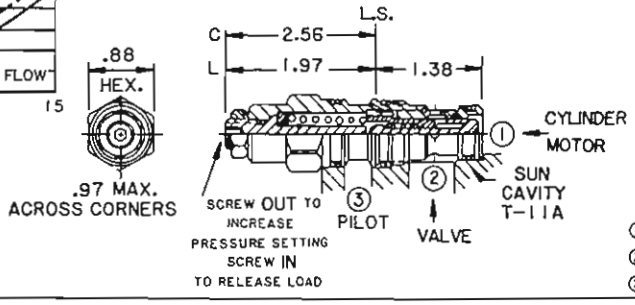


TYPICAL PERFORMANCE CHARACTERISTICS



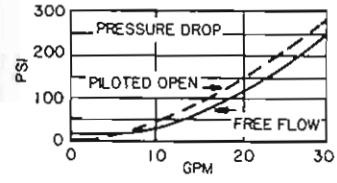


0 to 15 GPM
SUN CAVITY T-11A

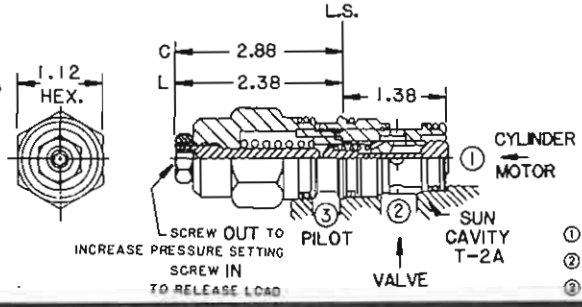


	BASIC CARTRIDGE PRICE
MODEL **CBCA** *** PILOT RATIO 3:1	34.40
MODEL **CBCG** *** PILOT RATIO 4.5:1	35.60

① CONTROLS
② ADJUSTMENT RANGES
③ SEALS



0 to 30 GPM
SUN CAVITY T-2A



	BASIC CARTRIDGE PRICE
MODEL **CBEA** *** PILOT RATIO 3:1	47.20
MODEL **CBEG** *** PILOT RATIO 4.5:1	48.30

① CONTROLS
② ADJUSTMENT RANGES
③ SEALS

COUNTERBALANCE VALVE CARTRIDGE OPTIONS

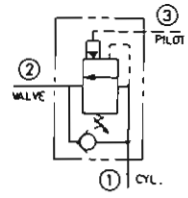
①CONTROLS (See page xii)		②ADJUSTMENT RANGE & CHECK POPPET OPENING PRESSURE						③SEALS		
CODING	ALL MODELS	GENERAL PURPOSE 25 PSI OPENING PRESSURE	CB*A	CB*G	ANTI-CAVITATION CHECK 4 PSI OPENING PRESSURE	CB*A	CB*G	CODING	CBC* CBE*	CBG*
L Leakproof screw adjustment	+ .00	**H** 1000 to 4000 psi 3000 psi standard setting	+ .00	N/A	**A** 1000 to 4000 psi 3000 psi standard setting	+1.00	N/A	**N** Buna N	+ .00	+ .00
C Tamperproof (1–29) Factory set (30 & over)	+4.00 +3.00	**I** 400 to 1500 psi 1000 psi standard setting	+ .00	N/A	**B** 400 to 1500 psi 1000 psi standard setting	+1.00	N/A	**V** Viton	+1.50	+2.00
		J 2000 to 5000 psi 3000 psi standard setting	N/A	+1.00	**C** 2000 to 5000 psi 3000 psi standard setting	N/A	+2.00			
		K 1000 to 2500 psi 2000 psi standard setting	N/A	+ .00	**D** 1000 to 2500 psi 2000 psi standard setting	N/A	+1.00			
		Customer specified setting - all models (Setting stomped on cartridge hex)			(1-29) (30 & over)	+1.00 + .50	+1.00 + .50			

CARTRIDGES

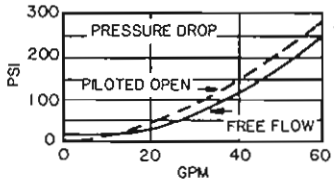
SUN offers counterbalance cartridges with two different free flow poppet return spring options:

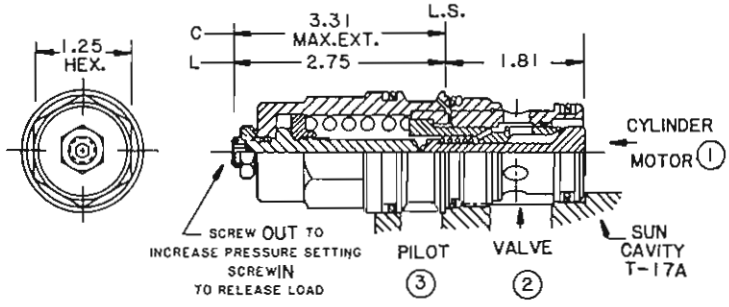
- 25 psi opening pressure—Recommended for most applications, except those requiring low cracking pressure for anti-cavitation protection. Specifically recommended for high shock circuits (such as heavy platen presses with jogging controls), high cycle, high frequency reversing or reciprocating circuits and circuits using gas-over-oil accumulators.
- 4 psi opening pressure—Recommended for circuits requiring protection against actuator cavitation; for example, hydrostatic transmission and winch drives.

NOTE: Since HYDRAULIC MOTORS LEAK, a hydraulically released, spring applied brake should always be used to positively lock any stopped, live load.



0 to 60 GPM
SUN CAVITY T–17A

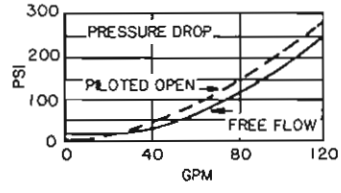


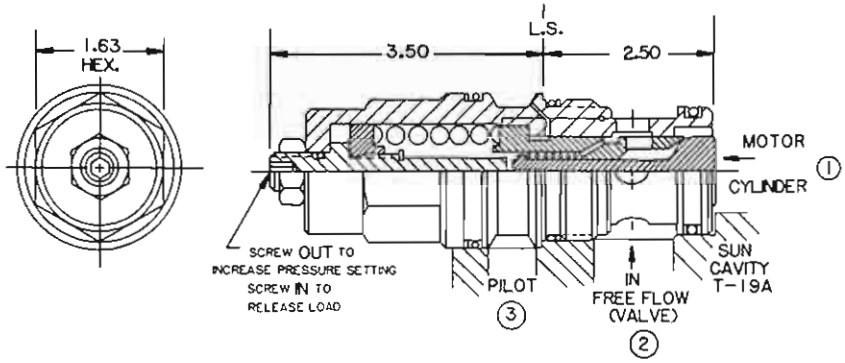


	BASIC CARTRIDGE PRICE
MODEL **CBGA** ✱✱✱ PILOT RATIO 3:1	83.30
MODEL **CBGG** ✱✱✱ PILOT RATIO 4.5:1	84.40

① CONTROLS
② ADJUSTMENT RANGES
③ SEALS

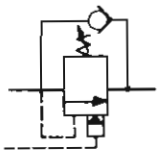
0 to 120 GPM
SUN CAVITY T–19A



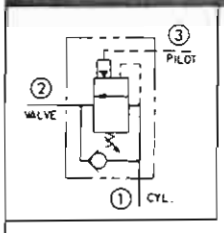


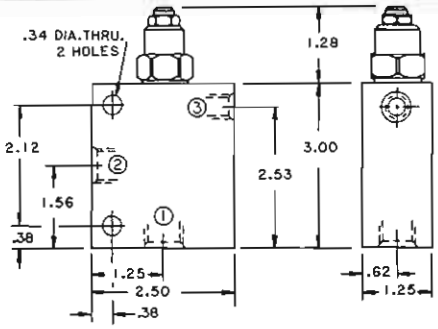
	BASIC CARTRIDGE PRICE
MODEL **CBIA** ✱✱V PILOT RATIO 3:1	158.50
MODEL **CBIG** ✱✱V PILOT RATIO 4.5:1	159.60

① CONTROLS
② ADJUSTMENT RANGES
③ VITON SEALS STANDARD



INTERNAL OR EXTERNAL OPERATION (WITH PILOT ASSIST)





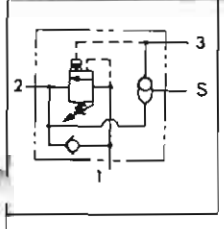
MAIN PORTS ① ②	PILOT PORT ③	BASIC VALVE MODEL (a)	BASIC PRICE (a)
1/4" NPTF	1/4" NPTF	CBC* *** ECA	47.60
3/8" NPTF	1/4" NPTF	CBC* *** ECB	47.60
1/2" NPTF	1/4" NPTF	CBC* *** ECC	47.60
SAE-6	SAE- 6	CBC* *** ECI	47.60
SAE- 8	SAE- 6	CBC* *** ECJ	47.60
SAE-10	SAE- 6	CBC* *** ECK	47.60
1/4" BSPP	1/4" BSPP	CBC* *** ECT	47.60
3/8" BSPP	1/4" BSPP	CBC* *** ECU	47.60
1/2" BSPP	1/4" BSPP	CBC* *** ECV	47.60

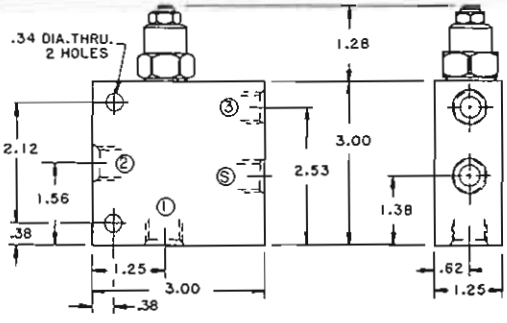
MODEL **CBC* *** EC***

See CBC* Cartridge Modeling Coding (p. 4.02)

PORTS SEE CHART

INTERNAL OR EXTERNAL OPERATION (WITH PILOT ASSIST) WITH BUILT-IN SHUTTLE VALVE





MAIN PORTS ① ②	PILOT & SHUTTLE PORTS ③ ⑤	BASIC VALVE MODEL (a)	BASIC PRICE (a)
1/4" NPTF	1/4" NPTF	CBC* *** EGA	71.80
3/8" NPTF	1/4" NPTF	CBC* *** EGB	71.80
1/2" NPTF	1/4" NPTF	CBC* *** EGC	71.80
SAE- 6	SAE- 6	CBC* *** EGI	71.80
SAE- 8	SAE- 6	CBC* *** EGJ	71.80
SAE-10	SAE- 6	CBC* *** EGK	71.80
1/4" BSPP	1/4" BSPP	CBC* *** EGT	71.80
3/8" BSPP	1/4" BSPP	CBC* *** EGU	71.80
1/2" BSPP	1/4" BSPP	CBC* *** EGV	71.80

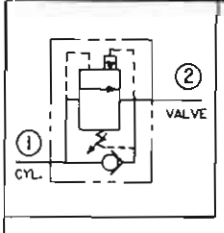
MODEL **CBC* *** EG***

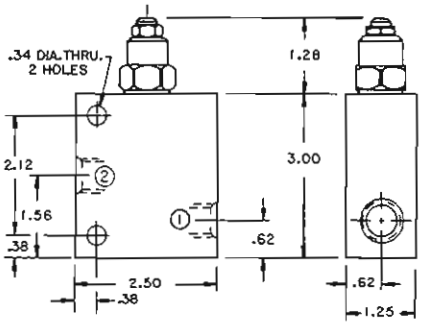
See CBC* Cartridge Model Coding (p. 4.02)

PORTS SEE CHART

SHUTTLE VALVE PROVIDES A PRESSURE SOURCE FOR HYDRAULICALLY RELEASING A SPRING APPLIED MECHANICAL BRAKE OR A LOAD PRESSURE SIGNAL FOR LOAD SENSING CIRCUITS.

DIRECT OPERATED (WITHOUT PILOT ASSIST)





PORTS ① ②	BASIC VALVE MODEL (a)	BASIC PRICE (a)
1/4" NPTF	CBC* *** EDA	51.50
3/8" NPTF	CBC* *** EDB	51.50
1/2" NPTF	CBC* *** EDC	51.50
SAE- 6	CBC* *** EDI	51.50
SAE- 8	CBC* *** EDJ	51.50
SAE-10	CBC* *** EDK	51.50
1/4" BSPP	CBC* *** EDT	51.50
3/8" BSPP	CBC* *** EDU	51.50
1/2" BSPP	CBC* *** EDV	51.50

MODEL **CBC* *** ED***

See CBC* Cartridge Model Coding (p. 4.02)

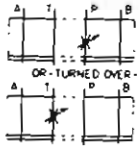
PORTS SEE CHART

(a) See cartridge model CBC* *** (p. 4.02) for performance data, options and option prices.

SANDWICH VALVES–NFPA D01

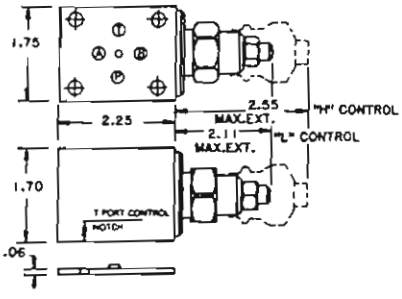
FOR USE WITH **NFPA D01** AND **CETOP 3** STANDARD SOLENOID VALVES

NEEDLE VALVE SANDWICHES



METER IN P OR METER OUT T

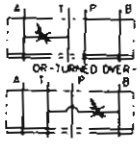
METER OUT ON T ALLOWS EQUAL METER OUT CONTROL OF A & B

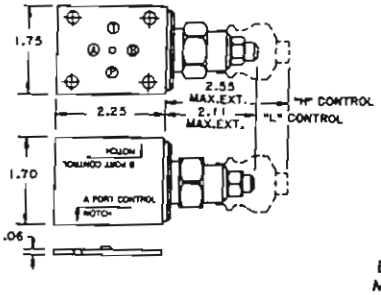


BASIC MODEL PRICE (a)

MODEL **NFCC *** GBP** 45.90

BLEED OFF A → T OR B → T

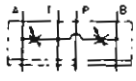


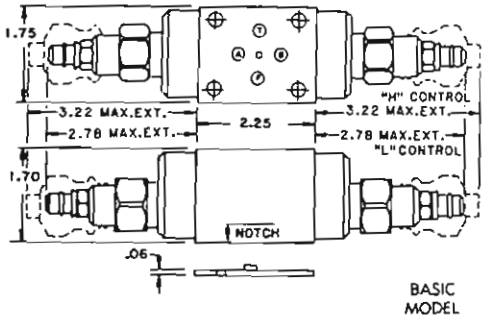


BASIC MODEL PRICE (a)

MODEL **NFCC *** GBW** 48.70

DUAL–BLEED OFF A & B → T





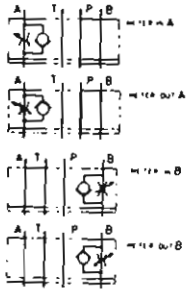
BASIC MODEL PRICE (a)

MODEL **NFCC *** GBX** 84.40

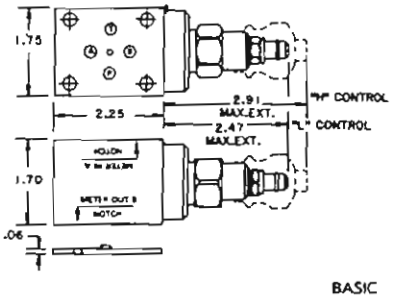
(a) See cartridge model NFCC*** (p. 7.05) for performance data, options and option prices.

RESTRICTOR VALVE SANDWICHES

NEEDLE VALVE WITH REVERSE FREE FLOW



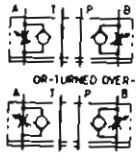
SINGLE CYLINDER PORT CONTROL

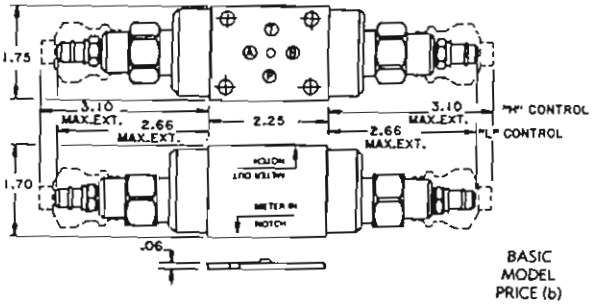


BASIC MODEL PRICE (b)

MODEL **NCCB *** GBA** 51.00

DUAL CYLINDER PORT CONTROL



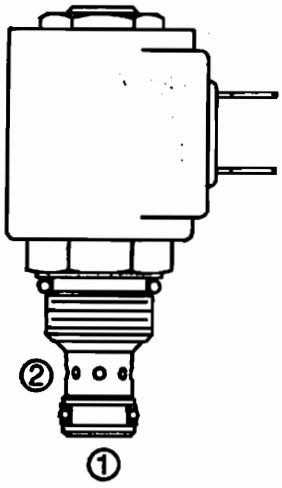


BASIC MODEL PRICE (b)

MODEL **NCCB *** GBY** 79.10

(b) See cartridge model NCCB *** (p. 7.06) for performance data, options and option prices.

SV08-25 Spool, 2-Way, Normally Open



DESCRIPTION

A solenoid-operated, 2-way, normally open, direct-acting, spool-type, screw-in hydraulic cartridge valve designed to function as a bidirectional blocking valve in low flow circuits.

OPERATION

When de-energized, the **SV08-25** allows flow in both directions.

When energized, the valve's spool shifts to close bidirectionally.

Operation of Manual Override Option: To override, push button in and twist counterclockwise 180°. The internal spring will push the button out. In this position, the valve may be only partially shifted. To assure full override shift, pull the button out to its fullest extension and hold it in this position.

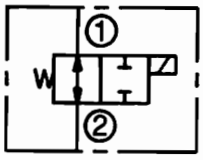
To return to normal valve function, push button in, twist clockwise 180°, and release. Override will be detented in this position.

FEATURES

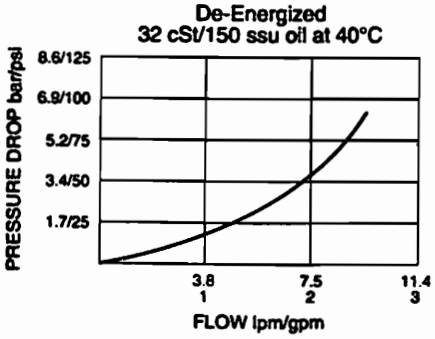
- Hardened precision spool and cage for long life.
- Optional coil voltages and terminations.
- Efficient wet-armature construction.
- Both ports may be fully pressurized.
- Cartridges are voltage-interchangeable.
- Manual override option.
- Unitized molded coil design.
- Compact size.

SYMBOLS

USASI/ISO:



PERFORMANCE (Cartridge Only)



RATINGS

Operating Pressure: 207 bar (3000 psi)

Flow: 9.5 lpm (2.5 gpm) max.

Internal Leakage: 82 cc/minute (5 in.³/minute) max. at 207 bar (3000 psi)

Temperature: -40 to 120°C with standard Buna seals

Coil Duty Rating: Continuous from 85% to 115% of nominal voltage

Initial Coil Current Draw at 20°C: 1.2 amps at 12 VDC; 0.13 amps at 115 VAC (full wave rectified)

Minimum Pull-In Voltage: 85% of nominal at 207 bar (3000 psi)

Filtration: Recommend 10µ nominal; See page 8.010.1

Fluids: Mineral-based or synthetics with lubricating properties at viscosities of 7.4 to 420 cSt (50 to 2000 ssu)

Installation: No restrictions; See page 8.020.1

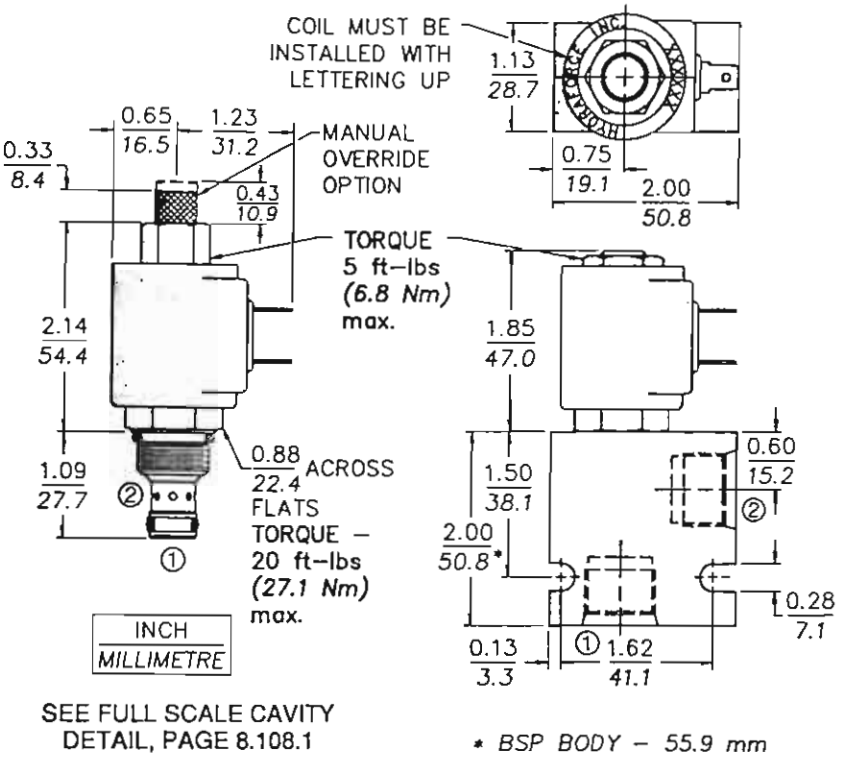
Cavity: VC08-2; See page 8.108.1

Cavity Tool: CT08-2XX; See page 7.200.1

Seal Kit: SK08-2X-M; See page 8.500.1

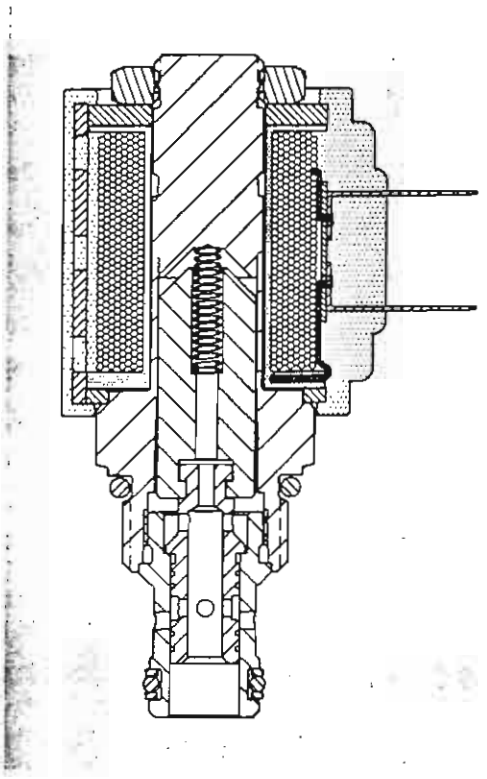
SV08-25

DIMENSIONS



SEE FULL SCALE CAVITY DETAIL, PAGE 8.108.1

* BSP BODY – 55.9 mm



MATERIALS

Cartridge: Weight: 0.09 kg. (0.20 lbs.); Steel with hardened work surfaces. Zinc-plated exposed surfaces. Buna N O-rings and back-ups standard.

Standard Ported Body: Weight: 0.16 kg. (0.35 lbs.); Anodized high-strength 6061 T6 aluminum alloy, rated to 240 bar (3500 psi); See page 6.040.1. Steel bodies available; consult factory.

Coil: Weight: 0.11 kg. (0.25 lbs.); Unitized thermoplastic encapsulated, Class H high temperature magnet-wire; See page 8.200.1.

TO ORDER

SV08-25 _ - _ _ _ - _ - _ _ _ _

Option

None	(Blank)
Manual Override	M
Screen	S
Waterproofing	W

Porting

Cartridge Only	0
1/4 in. NPTF	2P
3/8 in. NPTF	3P
SAE 4	4T
SAE 6	6T
SAE 8	8T
1/4 in. BSP*	2B
3/8 in. BSP*	3B
1/2 in. BSP*	4B

*BSP Body: U.K. Mfr. Only

Seals

N	Buna N (Std.)
V	Viton A

Voltage

0	Less Coil
10	10 VDC'
12	12 VDC
24	24 VDC
36	36 VDC
48	48 VDC
110	110 VDC
24	24 VAC
115	115 VAC
230	230 VAC

'Available only with DS, DW or DL terminations.

Terminations (VDC)

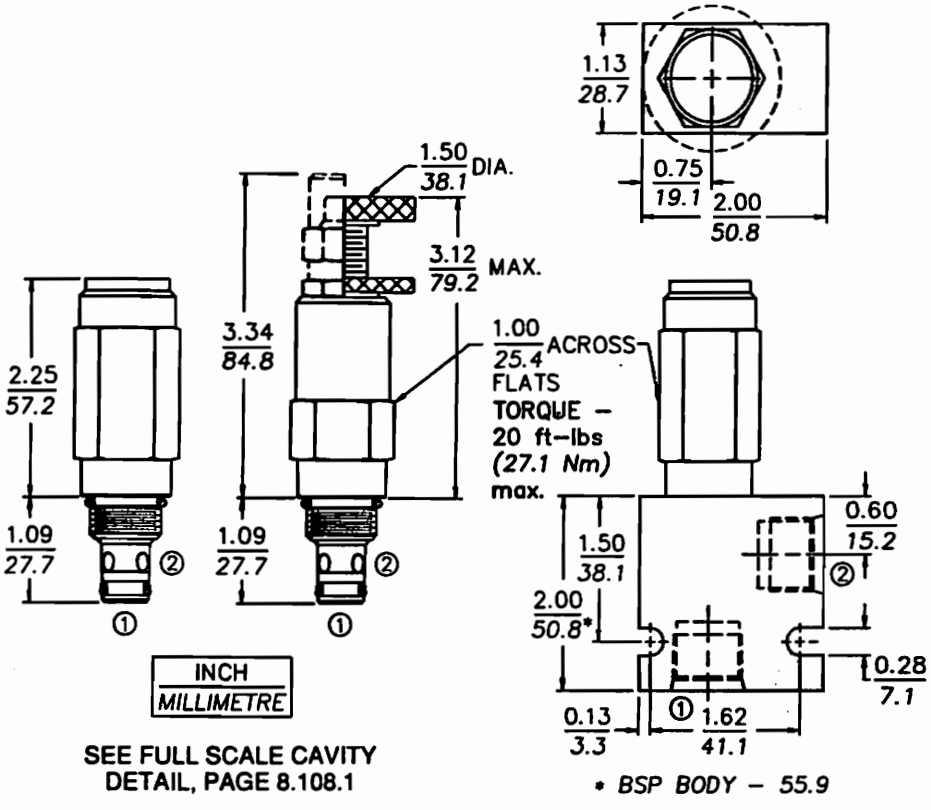
DS	Dual Spades
DG	DIN 43650
DL	Leadwires (2)
DW	Leads w/Weatherpak® Connectors
DD	Single 8-32 Stud, Internal Ground w/Diode
DE	Dual 8-32 Stud
DB	Single 8-32 Stud, Internal Ground

Terminations (VAC)

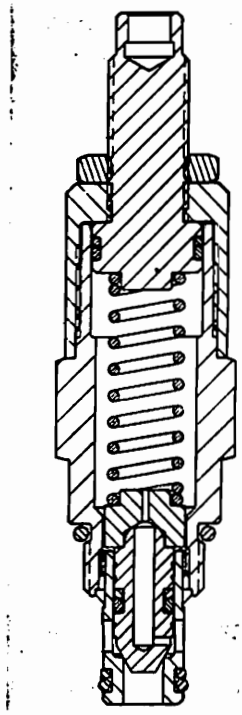
AG	DIN 43650
AP	1/2 in. Conduit

RV08-20

DIMENSIONS



SEE FULL SCALE CAVITY DETAIL, PAGE 8.108.1



MATERIALS

Cartridge: Weight: 0.23 kg. (0.50 lbs.); Steel with hardened work surfaces. Zinc-plated exposed surfaces. Buna N O-rings and back-up standard. Anodized aluminum knobs and caps.

Standard Ported Body: Weight: 0.16 kg. (0.35 lbs.); Anodized high-strength 6061 T6 aluminum alloy, rated to 240 bar (3500 psi); See page 6.040.1. Steel bodies available; consult factory.

TO ORDER

RV08-20 ___ - ___ - ___ - ___ / ___

Adjustment Option

1/4 in. Hex Allen Head	A
1-1/2 in. Dia. Alum. Knob	B
Option A w/ Cover Cap	C
Factory Preset Non-Adj.	F
Factory Preset Hidden Adj.	H
Option C w/ Lockwire Holes	L

Porting

Cartridge Only	0
1/4 in. NPTF	2P
3/8 in. NPTF	3P
SAE 4	4T
SAE 6	6T
SAE 8	8T
1/4 in. BSP*	2B
3/8 in. BSP*	3B
1/2 in. BSP*	4B

*BSP Body; U.K. Mfr. Only

Seals

Pressure on P Only:

N	Buna N (Std.)
V	Viton A

Bidirectional Pressure:

NC	Buna N
VC	Viton A

Spring Range

5	3.4 to 34.5 bar (50 to 500 psi)
9	3.4 to 62.0 bar (50 to 900 psi)
18	6.9 to 124 bar (100 to 1800 psi)
33	6.9 to 227.5 bar (100 to 3300 psi)

Setting in bar[1]

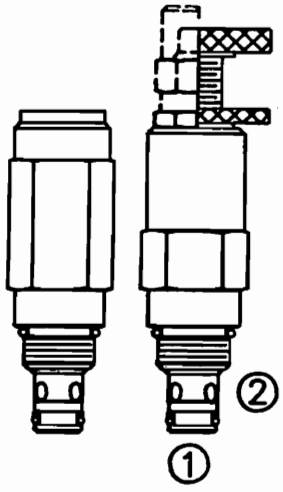
(Blank)	for Adjustable, or Specify, for example:
M25	25 bar
M100	100 bar

Setting in psi[1]

(Blank)	for Adjustable, or Specify, for example:
9.0	900 psi
23.5	2350 psi

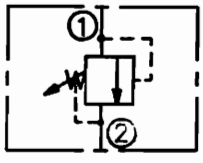
[1]Adjustable valves will be preset to approx. 50% of spring max.

RV08-20 Relief, Direct-Acting Poppet

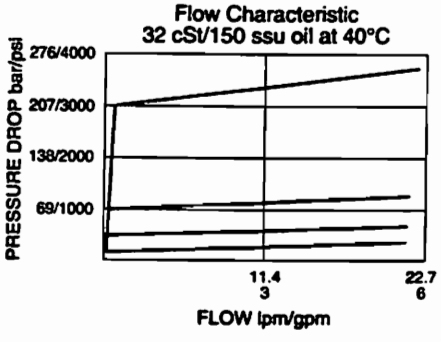


SYMBOLS

USASI/ISO:



PERFORMANCE (Cartridge Only)



DESCRIPTION

A screw-in, cartridge-style, direct-acting, poppet-type, hydraulic relief valve intended for lower flow circuits requiring low internal leakage.

OPERATION

The **RV08-20** blocks flow from ① to ② until sufficient pressure is present at ① to force the spring-opposed poppet from its seat.

For settings over 228 bar (3300 psi), see model RV58-20.

Note: The RV08-20 may be used in cross-over relief applications (back pressure on ②) with the use of the "C" double back-up ring seal option. See Ordering Table.

FEATURES

- Adjustments cannot be backed out of the valve.
- Adjustments prohibit springs from going solid.
- Optional spring ranges to 228 bar (3300 psi).
- Rapid response to pressure changes.
- Compact size.

RATINGS

Operating Pressure: 228 bar (3300 psi)

Flow: The Performance Chart illustrates flow handling capacity at max. setting for each spring range option. Pressure rise will vary with spring (range) and with setting within range due to flow forces. Consult factory for specific flow characteristic values.

Internal Leakage: 0.25 cc/minute (5 drops/minute) max. to 75% of nominal setting

Crack Pressure Defined: bar (psi) evident at 0.95 lpm (0.25 gpm) attained

Reseat Pressure: Nominal 80% of crack pressure

Standard Spring Ranges:
3.4 to 34.5 bar (50 to 500 psi);
3.4 to 62.0 bar (50 to 900 psi);
6.9 to 124 bar (100 to 1800 psi);
6.9 to 227.5 bar (100 to 3300 psi)

Temperature: -40 to 120°C with standard Buna seals

Filtration: Recommend 25µ nominal or better; See page 8.010.1

Fluids: Mineral-based or synthetics with lubricating properties at viscosities of 7.4 to 420 cSt (50 to 2000 ssu)

Installation: No restrictions; See page 8.020.1

Cavity: VC08-2; See page 8.108.1

Cavity Tool: CT08-2XX; See page 7.200.1

Seal Kit: SK08-2X-B; See page 8.500.1
SK08-2X-M (for cross-over relief application)

Installation and Specification Data Model 40CN

Specifications:
Maximum Allowable Operating Pressure (MAOP): 800 psi (55 bar)

Design Safety Factor: 2.5:1

Rated Fatigue Pressure: 350 psi (24 bar)

Warning: Maximum absolute system pressure must not exceed filter's rated fatigue pressure (RFP) of 350 psi if the system frequently cycles between 0 and RFP. Also, limitations on fittings may restrict operating pressure to less than rated static pressure (RSP) of 800 psi. Refer to SAE J1065, Table 2 for fitting recommendations. Please consult Parker Filter Division if you have questions about your application.

Operating Temperatures:
Buna N (Nitrile)— –40°F to 225°F (–40°C to 107°C)
Viton— –20°F to 400°F (–29°C to 204°C)

Element Collapse Rating:
10C—150 psi (10 bar)
03B, 10B, 20B—35 psi (24 bar)

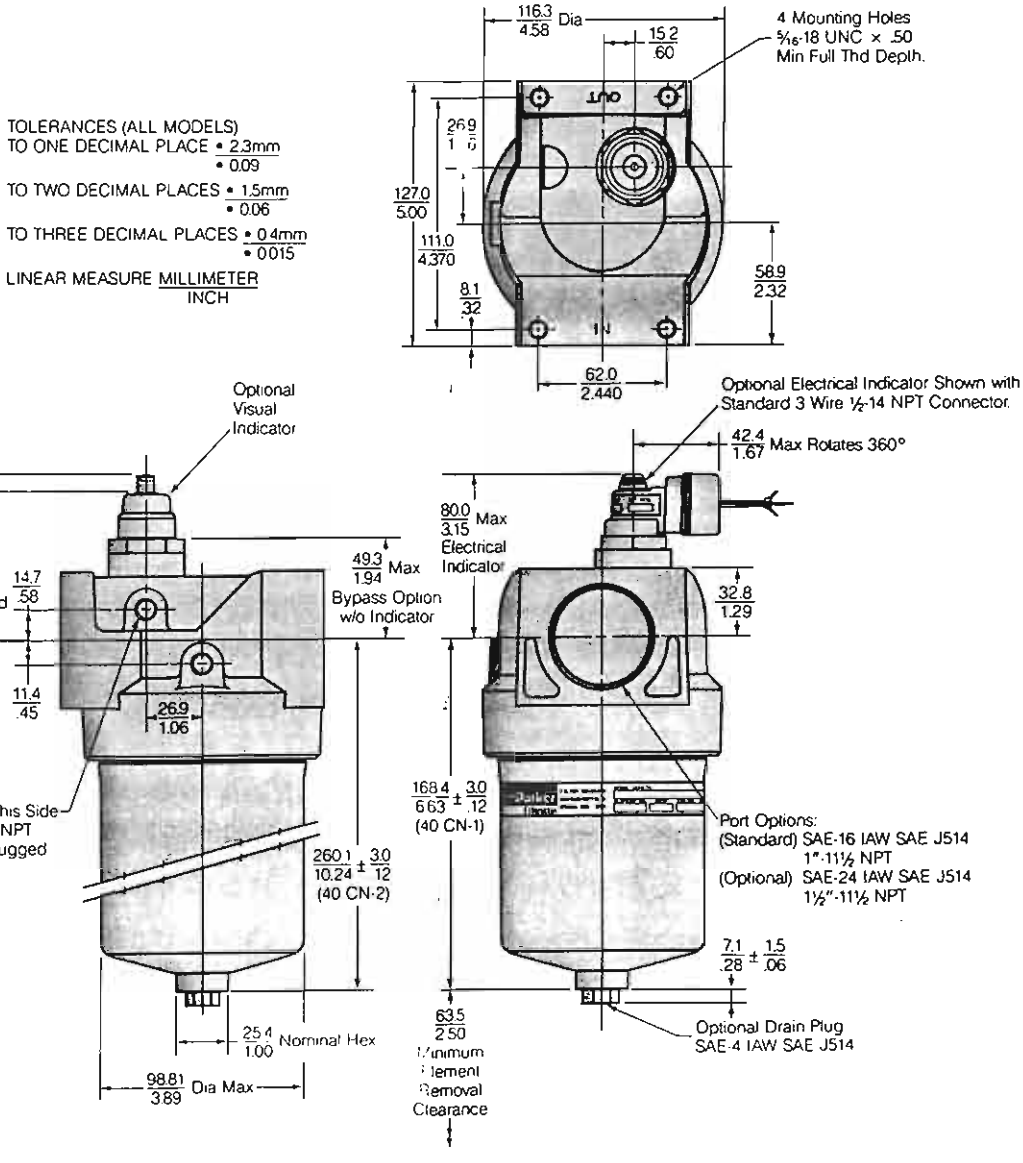
Visual Indicator (optional):
Differential pressure type.

Electrical Indicator (optional):
Electrical Switch rated 7A at 125/250 VAC, 7A resistive and 4A inductive at 28VDC. Color coding: White (N.C.), Red (N.O.), Black (common).

Filter Housing: Aluminum.

Weights (approximate):

40CN-1	4.5 lb. (2.00 kg)
40CN-2	5.5 lb. (2.49 kg)

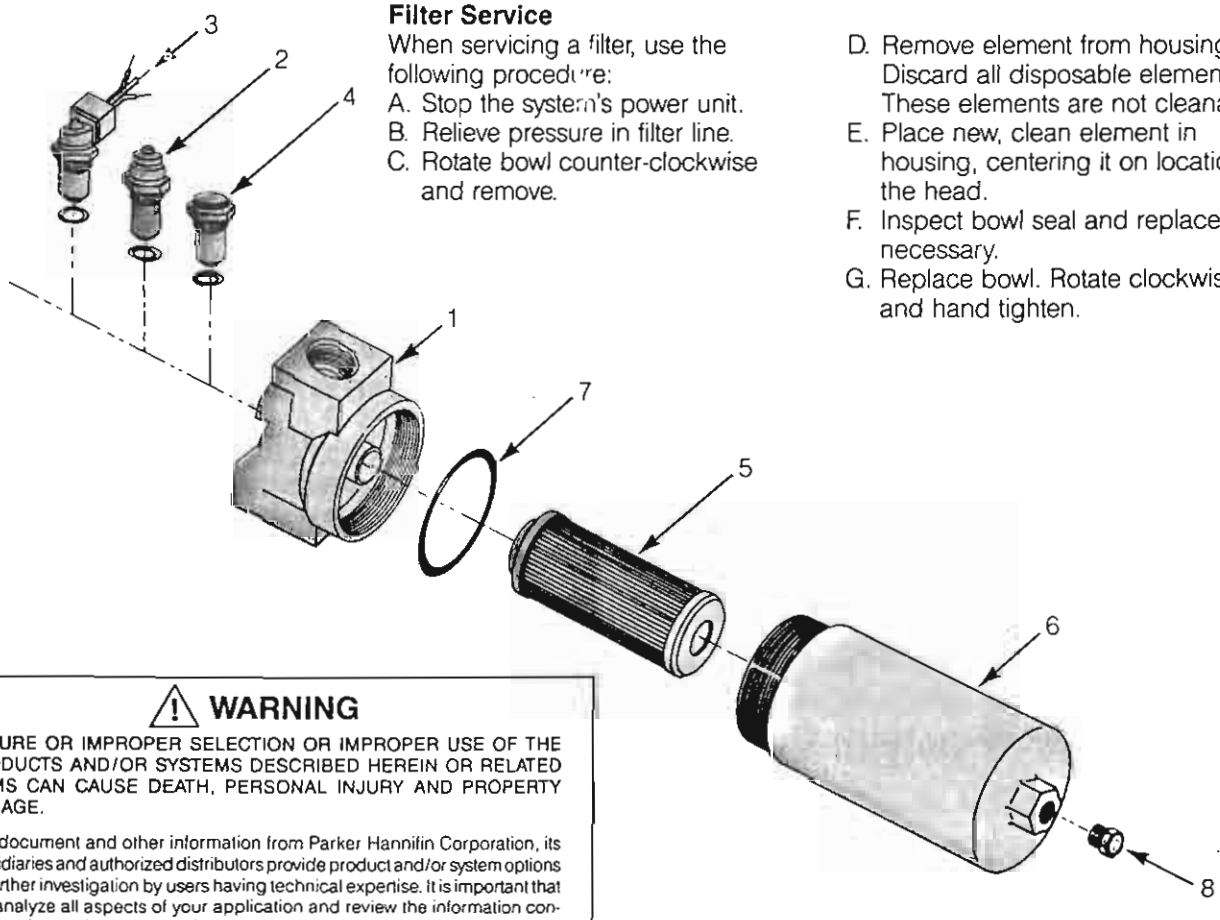


Parts List

INDEX	DESCRIPTION	40CN
1	**HEAD**	
	1½" NPT w/bypass	929546
	1½" NPT w/no bypass	929554
	SAE-24 w/bypass	929544
	SAE-24 w/no bypass	929552
	1" NPT w/bypass	929547
	1" NPT w/no bypass	929555
	SAE-16 w/bypass	929545
	SAE-16 w/no bypass	929553
	INDICATOR/BYPASS ASSEMBLIES	
2	Visual/25 psi—Buna N (Nitrile)	929849
	Visual/25 psi—Viton	929850
	Visual/25 psi w/thermal lockout—Buna N (Nitrile)	929851
	Visual/25 psi w/thermal lockout—Viton	929852
	Visual/50 psi—Buna N (Nitrile)	929853
	Visual/50 psi—Viton	929854
	Visual/50 psi w/thermal lockout—Buna N (Nitrile)	929855
	Visual/50 psi w/thermal lockout—Viton	929856
3	Electrical/25 psi w/conduit connection, 12" leads—Buna N (Nitrile)	930035
	Electrical/25 psi w/conduit connection, 12" leads—Viton	930036
	Electrical/25 psi w/12" leads only—Buna N (Nitrile)	930039
	Electrical/25 psi w/12" leads only—Viton	930040
	Electrical/50 psi w/conduit connection, 12" leads—Buna N (Nitrile)	930037
	Electrical/50 psi w/conduit connection, 12" leads—Viton	930038
	Electrical/50 psi w/12" leads only—Buna N (Nitrile)	930041
	Electrical/50 psi w/12" leads only—Viton	930042
4	No indicator/25 psi—Buna N (Nitrile)	929845
	No indicator/25 psi—Viton	929846
	No indicator/50 psi—Buna N (Nitrile)	929847
	No indicator/50 psi—Viton	929848
5	**ELEMENT** (See below)	
6	**BOWL**	
	Single Length	929420
	Double Length	929424
7	**BOWL SEAL**	
	Buna N (Nitrile)	929575
	Viton	V72240
8	**SAE-4 DRAIN PLUG**	
	Buna N (Nitrile)	921088
	Viton	928882

Replacement Element Part Numbers

Media	40CN-1	40CN-2
03B	926716	926717
10B	926836	926838
20B	930100	930119
10C	930096	930115



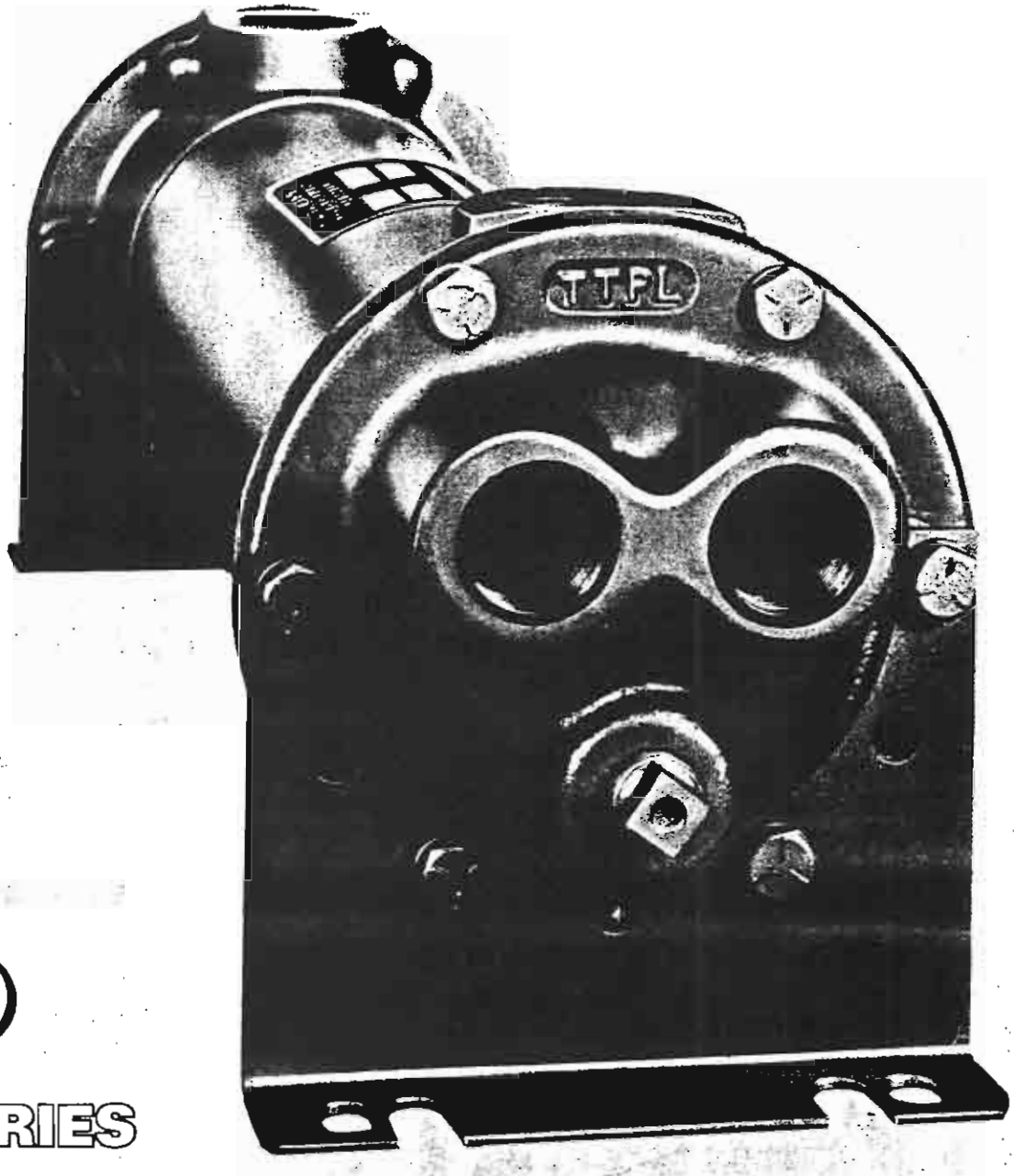
Filter Service

When servicing a filter, use the following procedure:

A. Stop the system's power unit.
B. Relieve pressure in filter line.
C. Rotate bowl counter-clockwise and remove.
D. Remove element from housing. Discard all disposable elements. These elements are not cleanable.
E. Place new, clean element in housing, centering it on location in the head.
F. Inspect bowl seal and replace if necessary.
G. Replace bowl. Rotate clockwise and hand tighten.

Parker Filter Division
16810 Fulton County Road #2
Metamora, OH 43540
(419) 644-4311 FACSIMILE: 419 644-6205

Parker Filtration



THERMAL TRANSFER PRODUCTS LTD

NBS SERIES

HEAT EXCHANGERS

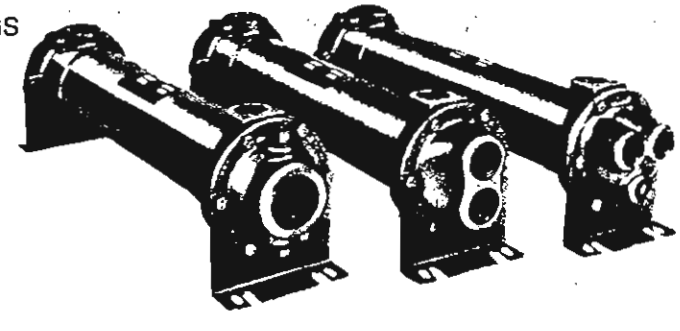
FIXED BUNDLE / WATER COOLED

SPECIFICATIONS

MATERIALS
Tubes—Copper
Headers—Brass, Steel B-2000 Series
Shell—Brass, Steel B-2000 Series
End Hubs—Brass
End Bonnets—Cast Iron
Baffles—Brass, Steel B-2000 Series
Mounting Brackets—Steel
Gaskets—Non-asbestos nitrile rubber/cellulose fiber
Nameplate—Aluminum Foil

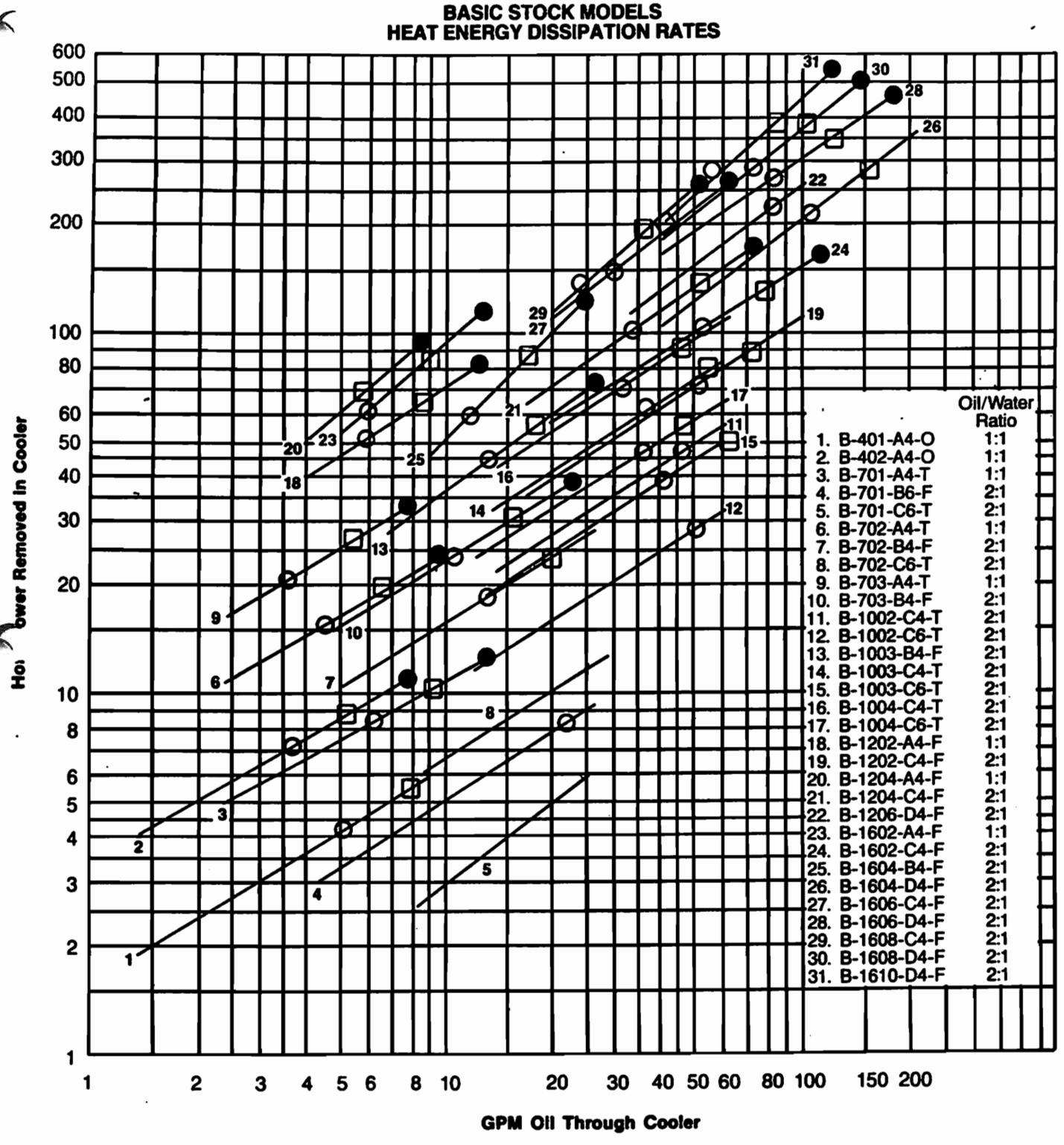
PRESSURE & TEMPERATURE RATINGS
Operating Pressure
Tubes—150 psi
Shell—250 psi

Test Pressure
Tubes—225 psi
Shell—300 psi
Operating Temp. 350° F



 Younge

PERFORMANCE DATA B-400 THROUGH B-1600 SERIES

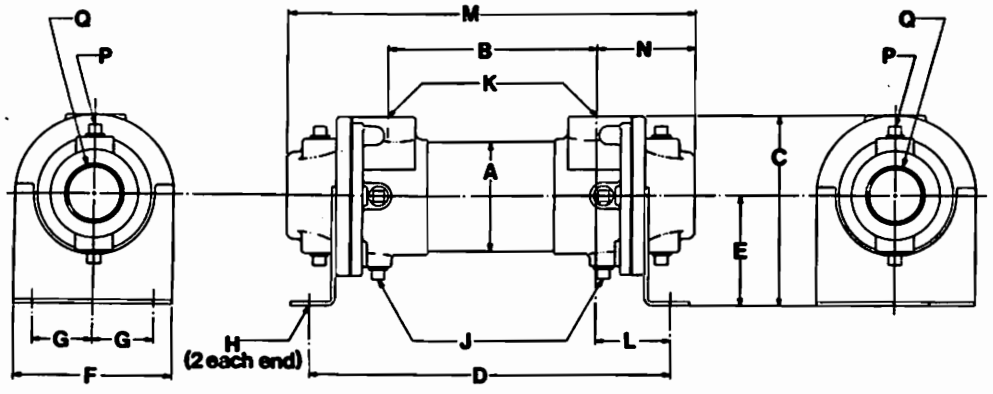


Sizing Notes:

1) Above curves based on 40°F approach temperature. Example: oil leaving cooler at 125°F using 85°F cooling water (125 - 85 = 40).
2) The oil to water ratio of 1:1 or 2:1 means that for every gallon of oil circulated, a minimum of 1 or 1/2 gallon (respectively) of 85F water must be circulated to obtain the curve results.
3) Curve performance based on oil with an average viscosity of 100 SSU.
4) Oil pressure drop coding: ○ = 5 psi; □ = 10 psi; ● = 20 psi. Curves having no pressure drop code symbol means that the oil pressure drop is less than 5 psi to the maximum recommended flow rate for that model cooler.
5) Corrections for approach temperatures: $H.P. = H.P._{curve} \times \left(\frac{\text{Actual Approach}}{40}\right)$

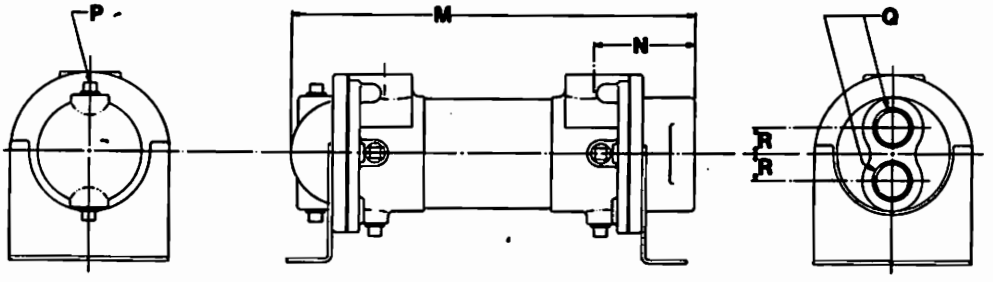
DIMENSIONAL DATA B-400 THROUGH B-1600 SERIES

SINGLE PASS (Code "O")



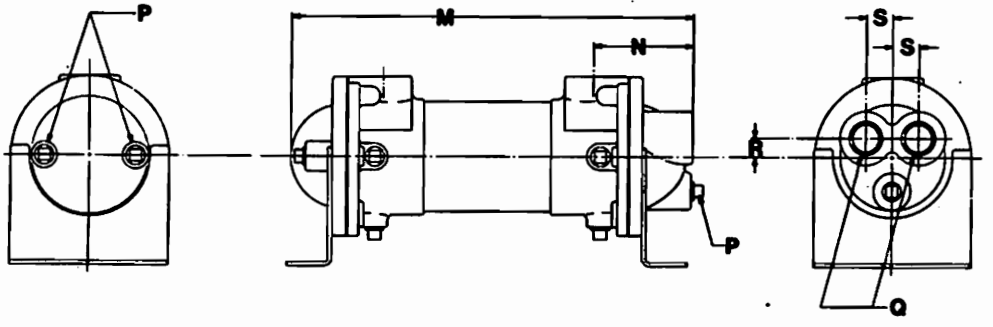
MODEL	M	N	P NPT	Q NPT
B-401	11.24			
B-402	20.24	1.81	—	1.00
B-701	13.47		(4)	
B-702	22.47	3.24	.38	1.50
B-703	31.47			
B-1002	23.60		(4)	
B-1003	32.60	4.05	.38	2.00
B-1004	41.60			
B-1202	24.38			
B-1203	33.25			
B-1204	42.12		(4)	
B-1205	51.12	4.88	.50	3.00
B-1206	60.25			
B-1207	69.25			
B-1208	78.12			
B-1602	26.62			
B-1603	35.62			
B-1604	44.62			
B-1605	53.62		(4)	
B-1606	62.62	6.52	.50	4.00
B-1607	71.62			
B-1608	80.62			
B-1609	89.62			
B-1610	98.62			

TWO PASS (Code "T")



MODEL	M	N	P NPT	Q NPT	R
B-401	—	—	—	—	—
B-402	—	—	—	—	—
B-701	13.28		(2)		
B-702	22.28	3.30	.38	1.00	.88
B-703	31.28				
B-1002	23.29		(2)		
B-1003	32.29	3.80	.38	1.50	1.19
B-1004	41.29				
B-1202	23.94				
B-1203	32.81				
B-1204	41.69		(2)		
B-1205	50.69	4.56	.50	2.00	1.44
B-1206	59.81				
B-1207	68.81				
B-1208	77.69				
B-1602	25.10				
B-1603	34.10				
B-1604	43.10				
B-1605	52.10		(2)		
B-1606	61.10	6.08	.50	2.50	1.38
B-1607	70.10				
B-1608	79.10				
B-1609	88.10				
B-1610	97.10				

FOUR PASS (Code "F")



MODEL	M	N	P NPT	Q NPT	R	S
B-401	—	—	—	—	—	—
B-402	—	—	—	—	—	—
B-701	13.42		(3)			
B-702	22.42	3.24	.38	.75	.62	.88
B-703	31.42					
B-1002	23.55		(3)			
B-1003	32.55	4.06	.38	1.00	.75	1.34
B-1004	41.55					
B-1202	24.44					
B-1203	33.31		(2)			
B-1204	42.19		.38			
B-1205	51.19	4.90		1.50	1.06	1.40
B-1206	60.31		(1)			
B-1207	69.31		.50			
B-1208	78.19					
B-1602	26.72					
B-1603	35.72					
B-1604	44.72					
B-1605	53.72		(3)			
B-1606	62.72	6.48	.50	2.00	1.38	1.88
B-1607	71.72					
B-1608	80.72					
B-1609	89.72					
B-1610	98.72					

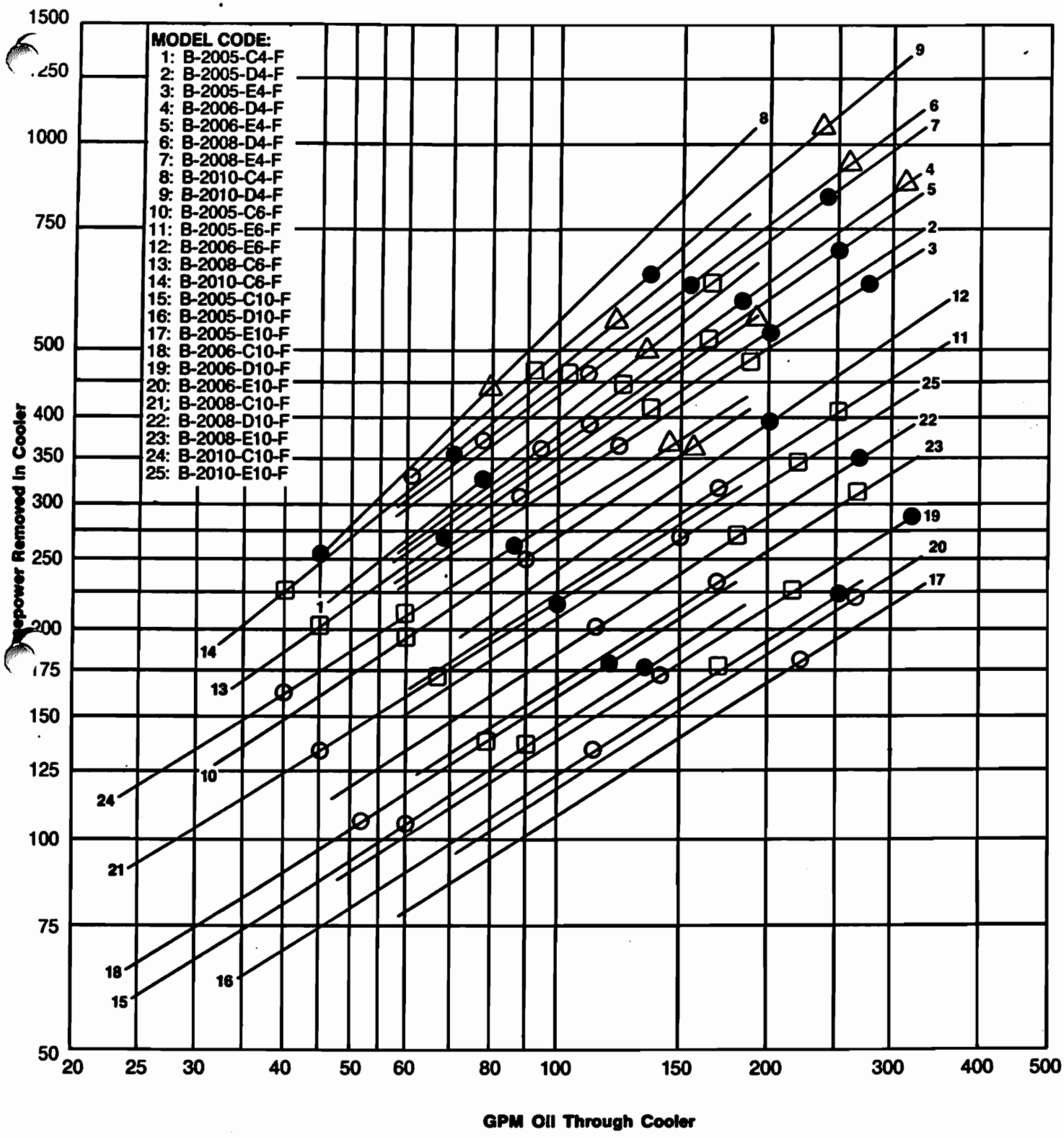
COMMON DIMENSIONS

MODEL	A	B	C	D	E	F	G	H	J NPT	K NPT	L	NET WEIGHT (LBS)	MODEL
B-401		7.62		11.06								7	B-401
B-402	2.125	16.62	3.50	20.06	1.94	2.62	.88	.41 Dia.	—	.50	1.72	10	B-402
B-701		7.00		12.38					(2)			23	B-701
B-702	3.656	16.00	6.25	21.38	3.62	5.25	1.50	.44x1.00	.38	1.00	2.69	28	B-702
B-703		25.00		30.38								35	B-703
B-1002		15.50		21.62								49	B-1002
B-1003	5.125	24.50	7.38	30.62	4.00	6.75	2.00	.44x1.00	(6) .38	1.50	3.06	65	B-1003
B-1004		33.50		39.62								72	B-1004
B-1202		14.62		21.50								72	B-1202
B-1203		23.50		30.38								90	B-1203
B-1204		32.38		39.25					(6)			110	B-1204
B-1205	6.125	41.38	8.81	48.25	4.75	7.50	2.50	.44x.88	.38	2.00	3.44	135	B-1205
B-1206		50.50		57.38								160	B-1206
B-1207		59.50		66.38								185	B-1207
B-1208		68.38		75.25								200	B-1208
B-1602		13.60		22.38								145	B-1602
B-1603		22.60		31.38								170	B-1603
B-1604		31.60		40.38								195	B-1604
B-1605		40.60		49.38					(6)			245	B-1605
B-1606	8.00	49.60	12.13	58.38	6.50	8.62	3.50	.44x1.00	.38	3.00	4.39	259	B-1606
B-1607		58.60		67.38								270	B-1607
B-1608		67.60		76.38								310	B-1608
B-1609		76.60		85.38								350	B-1609
B-1610		85.60		94.38								400	B-1610

All dimensions in inches. Zinc anodes optional.

NOTE: We reserve the right to make reasonable design changes without notice.

PERFORMANCE DATA B-2000 SERIES

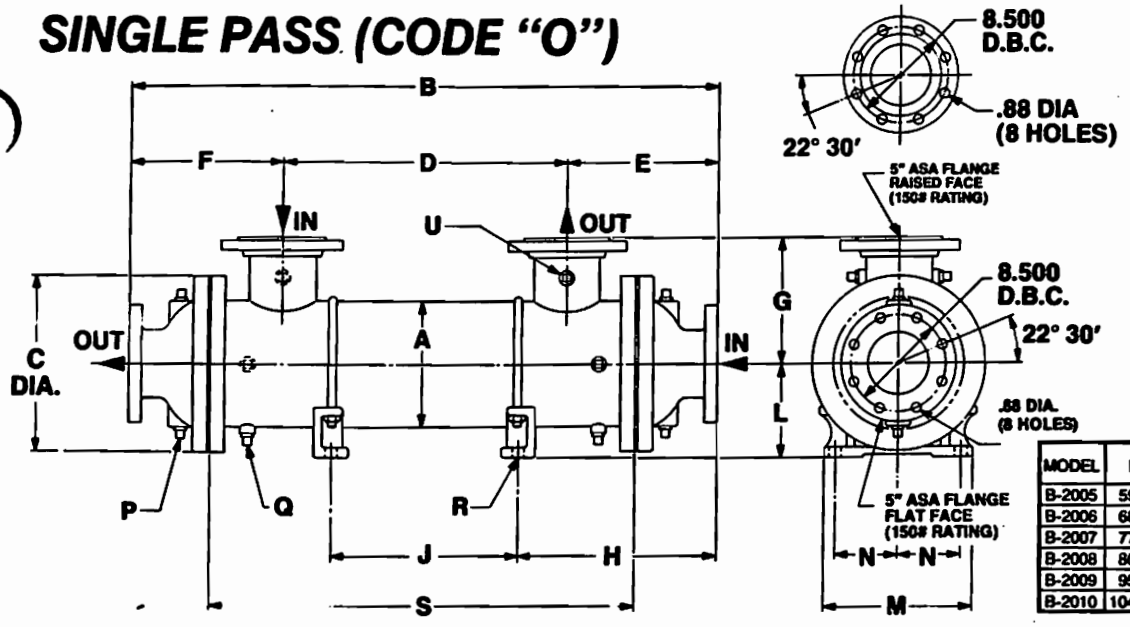


Sizing Notes:

1) Above curves based on 40°F approach temperature. Example: oil leaving cooler at 125°F using 85°F cooling water (125 - 85 = 40).
2) The oil to water ratio 2:1 means that for every gallon of oil circulated, a minimum of 1/2 gallon of 85°F water must be circulated to obtain the curve results.
3) Curve performance based on oil with an average viscosity of 100 SSU.
4) Oil pressure drop coding: ○ = 5 psi; □ = 10 psi; ● = 20 psi; △ = 50 psi. Curve length represents range of recommended flow rates for that model cooler.
5) Corrections for approach temperatures: $H.P. = H.P._{curve} \times \left(\frac{\text{Actual Approach}}{40}\right)$

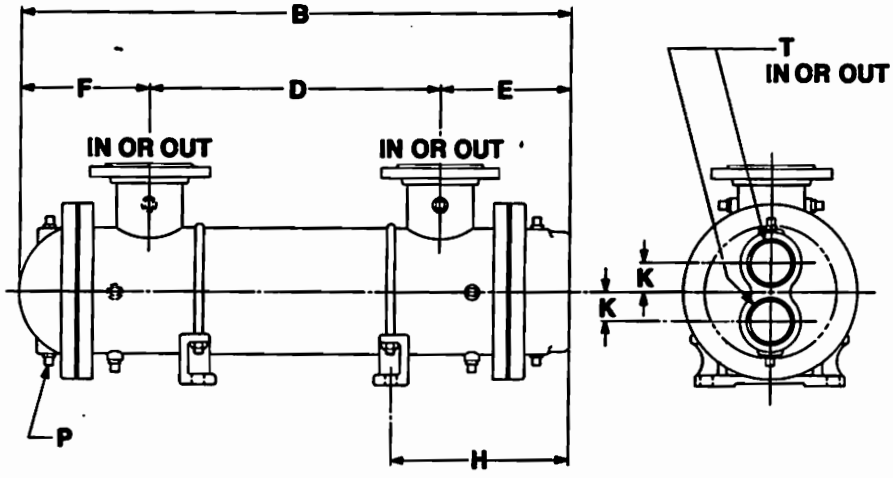
DIMENSIONAL DATA B-2000 SERIES

SINGLE PASS (CODE "O")



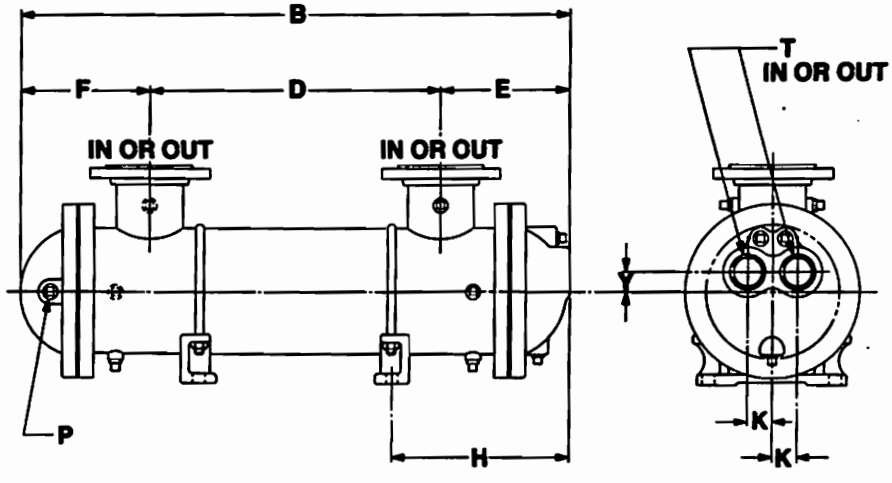
MODEL	B	E	F	H	P N.P.T.
B-2005	59.88	12.88	12.88	17.44	(4) .50
B-2006	68.88				
B-2007	77.88				
B-2008	86.88				
B-2009	95.88				
B-2010	104.88				

TWO PASS (CODE "T")



MODEL	B	E	F	H	K	P N.P.T.	T N.P.T.
B-2005	55.63	10.88	10.63	15.38	2.50	(4) .50	3.00
B-2006	64.63						
B-2007	73.63						
B-2008	82.63						
B-2009	91.63						
B-2010	100.63						

FOUR PASS (CODE "F")



MODEL	B	E	F	H	K	P N.P.T.	Y	T N.P.T.
B-2005	55.63	10.88	10.63	15.38	2.00	(5) .50	1.75	2.50
B-2006	64.63							
B-2007	73.63							
B-2008	82.63							
B-2009	91.63							
B-2010	100.63							

COMMON DIMENSIONS

MODEL	A	C	D	G	J	L	M	N	Q N.P.T.	R	S	U N.P.T.	NET WEIGHT LBS	MODEL
B-2005	10.75	14.88	34.12	10.75	25.00	8.00	12.25	5.00	(4) .50	(4) .750 DIA.	46.12	(2) .38	670	B-2005
B-2006			43.12		34.00						55.12		720	B-2006
B-2007			52.12		43.00						64.12		770	B-2007
B-2008			61.12		52.00						73.12		820	B-2008
B-2009			70.12		61.00						82.12		870	B-2009
B-2010			79.12		70.00						91.12		920	B-2010

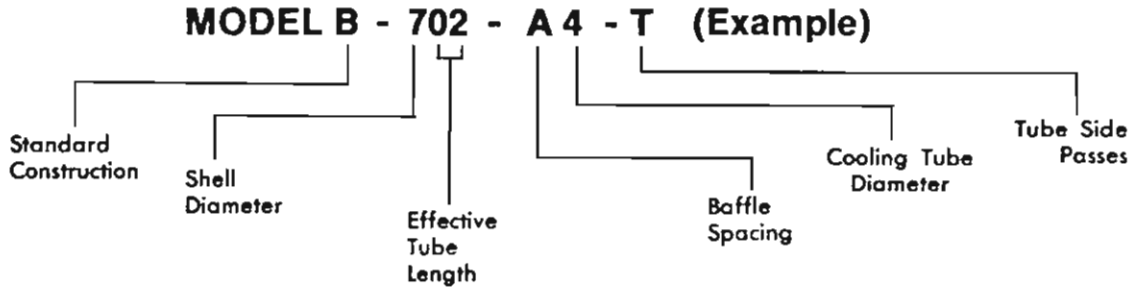
All dimensions in inches. Zinc anodes optional. NOTE: We reserve the right to make reasonable design changes without notice.

INSTALLATION

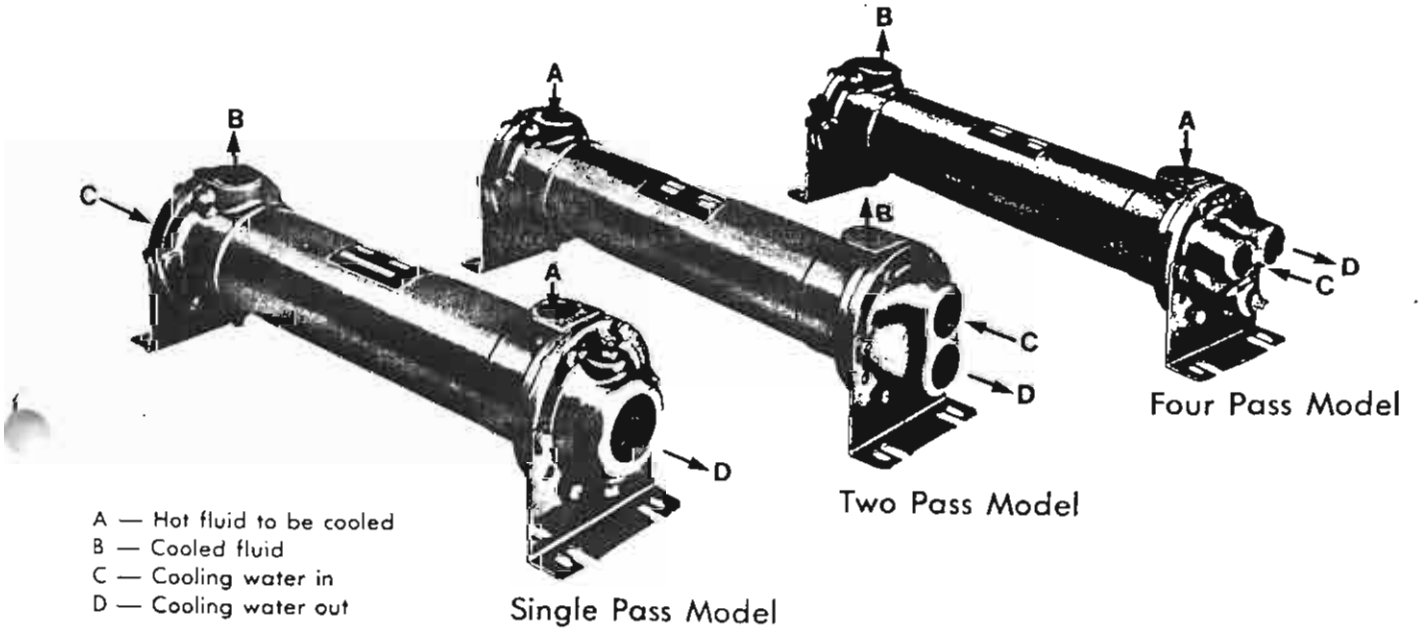
The satisfactory use of this heat exchange equipment is dependent upon certain precautions which must be taken at the time of installation.

1. Connect the hot fluid (and most viscous fluid) lines and the cooling water lines in accordance with the piping instructions below.
2. If an automatic water regulating valve is used, place it on the **Inlet** end of the cooler. Arrange the water outlet piping so that the exchanger remains flooded with water, but at little or no pressure. If this is not done, and a leak develops internally, water can be forced into the oil chamber because of the difference in fluid pressures. The temperature probe is placed in the hydraulic reservoir to sense a system temperature rise. Consult the factory for water regulating valve recommendations.
3. There are normally no restrictions as to how a cooler may be mounted. The only limitation regarding the mounting of this equipment is the possibility of having to drain either the water or the oil chambers after the cooler has been installed. The bottom drain plugs should then be located to accomplish the draining of these fluids. Drains on all models except 400 series.
4. It is possible to protect your cooler from high flow and pressure surges of hot fluid by installing a fast acting relief valve or a bypass check valve in the **Inlet** line to the cooler.
5. It is recommended that water strainers be installed ahead of this cooler when the source of cooling water is from other than a municipal water supply. Dirt and debris can plug the water passages very quickly rendering the cooler ineffective. Consult the factory for water strainer recommendations.
6. Caution: Incorrect installation can cause this product to fail prematurely, causing the shell-side and tube-side fluids to intermix. Maximum allowable flow rates are printed and included with each heat exchanger. If this information is not available, contact the factory before installation. For liquid to liquid applications, maximum shell velocity 8 feet per second; maximum tube velocity 7.5 feet per second. Maximum nozzle velocity 11 feet per second.
7. The differential temperature between the entering shell side fluid and the entering tube side fluid should not exceed 150°F. For applications that exceed these limits, heat exchangers with floating tube bundles must be used. Consult factory for assistance.

UNIT CODING



PIPING HOOK UP

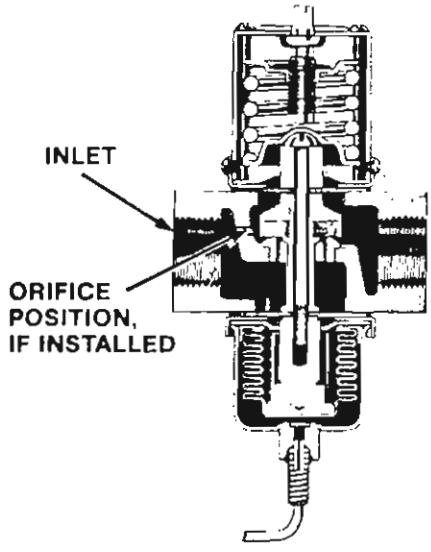


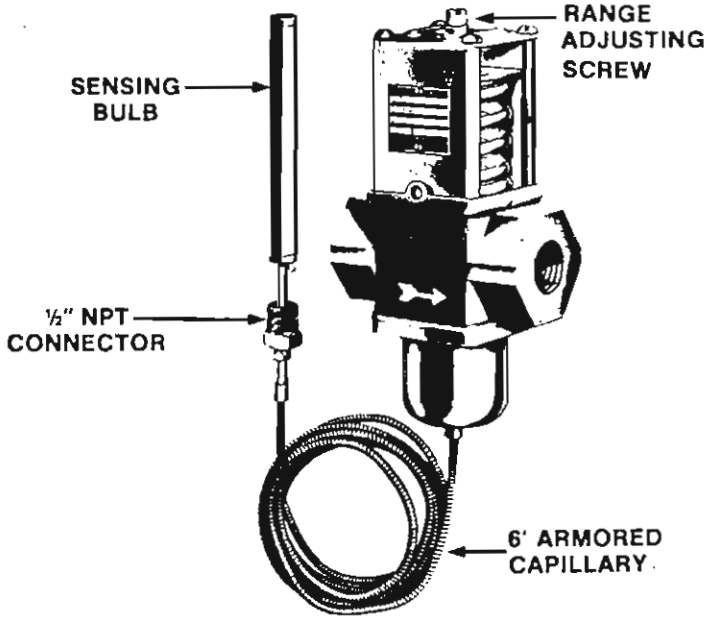
A — Hot fluid to be cooled
B — Cooled fluid
C — Cooling water in
D — Cooling water out

THERMAL TRANSFER PRODUCTS, LTD.

5215 21ST STREET • RACINE, WISCONSIN 53406 • TELEPHONE (414) 554-8330 • TELEX 26-0068 • FAX (414) 554-8536

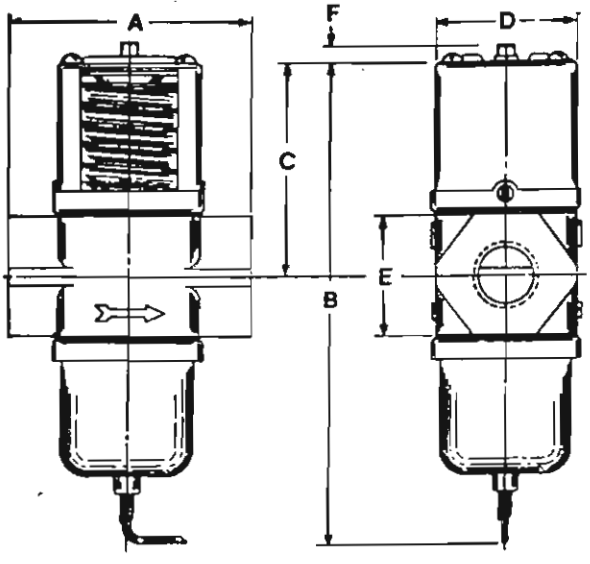
TEMPERATURE ACTUATED MODULATING WATER VALVES





Working pressure to 150 PSI Max.

PART NUMBER	PIPE SIZE NPT	RANGE (OPENING POINT)	BULB SIZE	SHIPPING WEIGHT	WATER FLOW AT 55 PSI
65293	1/2"	115° to 180°F.	11/16" x 3-1/4"	4.3 lbs.	25 GPM
65127	3/4"	115° to 180°F.	11/16" x 3-1/4"	5.8 lbs.	40 GPM
65128	1"	115° to 180°F.	11/16" x 5"	10.0 lbs.	55 GPM
65146	1-1/4"	115° to 180°F.	11/16" x 5"	11.8 lbs.	75 GPM
65511	1/2"	75° to 135°F.	11/16" x 10"	4.3 lbs.	25 GPM
65253	3/4"	75° to 135°F.	11/16" x 10"	5.8 lbs.	40 GPM
65254	1"	75° to 135°F.	11/16" x 16-1/4"	10.0 lbs.	55 GPM
65255	1-1/4"	75° to 135°F.	11/16" x 16-1/4"	12.1 lbs.	75 GPM



APPLICATION: These modulating valves regulate the flow of water to the heat exchanger to maintain a desired exiting oil temperature. They open automatically as the result of a temperature increase at the sensing bulb. No external power source is required to actuate the valve. Not to be used with salt water.

ADJUSTMENT: Valves can be adjusted with a screwdriver. Turn the adjusting screw clockwise to *decrease* opening temperature; and counter-clockwise to *increase* opening temperature. Valves are not calibrated, so final desired temperature setting must be established experimentally.

VALVE SIZE	DIMENSIONS IN INCHES					
	A	B	C	D	E	F
1/2"	3- 1/4	7	3- 3/8	1-27/32	1-1/2	13/32
3/4"	3- 9/16	7-29/64	3-51/64	2- 1/32	1-3/4	13/32
1"	4-27/32	10-13/64	5-31/64	2- 5/8	2	1/2
1-1/4"	4-55/64	10-37/64	5-43/64	2- 5/8	2-3/8	1/2

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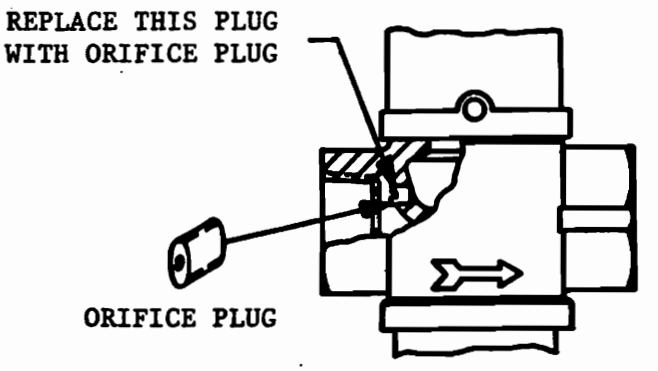

All stock valves are supplied with a drilled and tapped internal by-pass in the regulator body. A solid plug is installed in this hole for 100% shut-off. A drilled plug is packed in an envelope with each valve for field installation, if continuous minimum flow is required.

WATER VALVE PART NO.	BY-PASS ORIFICE DIAMETER	MAX. BULB TEMPERATURE °F	OPENING TEMPERATURE (FACTORY SETTING) °F
65293	.062"	200	135
65127	.062"	200	135
65128	.093"	200	135
65146	.093"	200	135
65253	.062"	155	103
65254	.093"	155	103
65255	.093"	155	103
65511	.062"	155	103

MISCELLANEOUS SPECIFICATIONS

Valve Disc: Buna N in brass disc retainer.

Standard temperature elements are furnished with 6' capillary.

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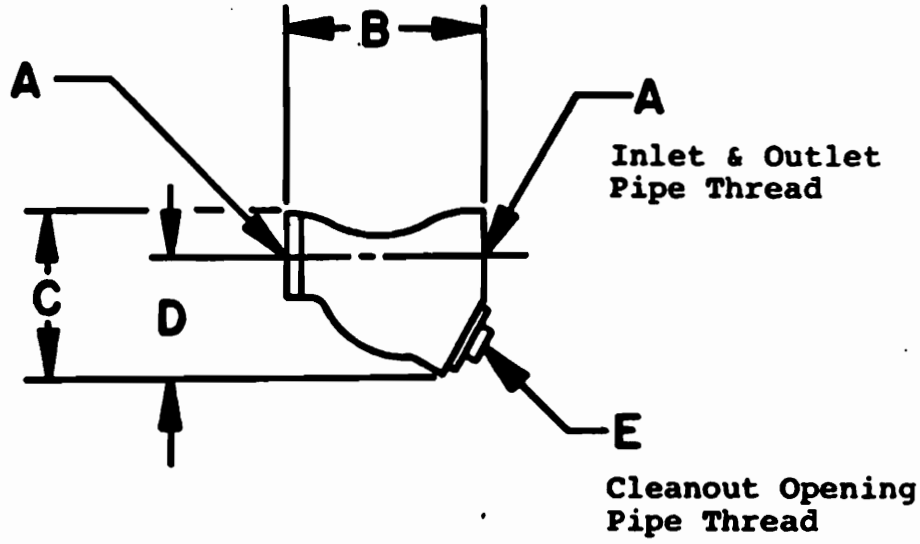
WATER STRAINERS



Type	Part Number	Size A	Size B	Dimensions (inches) C	D	E	Weight Lbs.
BRASS	65294	3/8	2-1/2	2-5/8	2	1/4	3/4
	65295	1/2	2-1/2	2-5/8	2	1/4	3/4
	65296	3/4	3-1/2	3-3/4	2-3/4	1/2	1-3/4
	65297	1	3-1/2	3-3/4	2-3/4	1/2	1-3/4
CAST IRON	65298	1/2	4	3-1/4	2-1/2	3/8	2
	65299	3/4	4	3-1/4	2-1/2	3/8	2
	65300	1	4-3/4	4-3/8	3-3/8	3/4	4
	65301	1-1/4	6	5-1/8	3-7/8	3/4	4-3/4
	65302	1-1/2	6	5-1/8	3-7/8	3/4	4-3/4
	65303	2	8-1/8	6-3/8	4-5/8	3/4	13-1/4

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RAYFO 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.

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