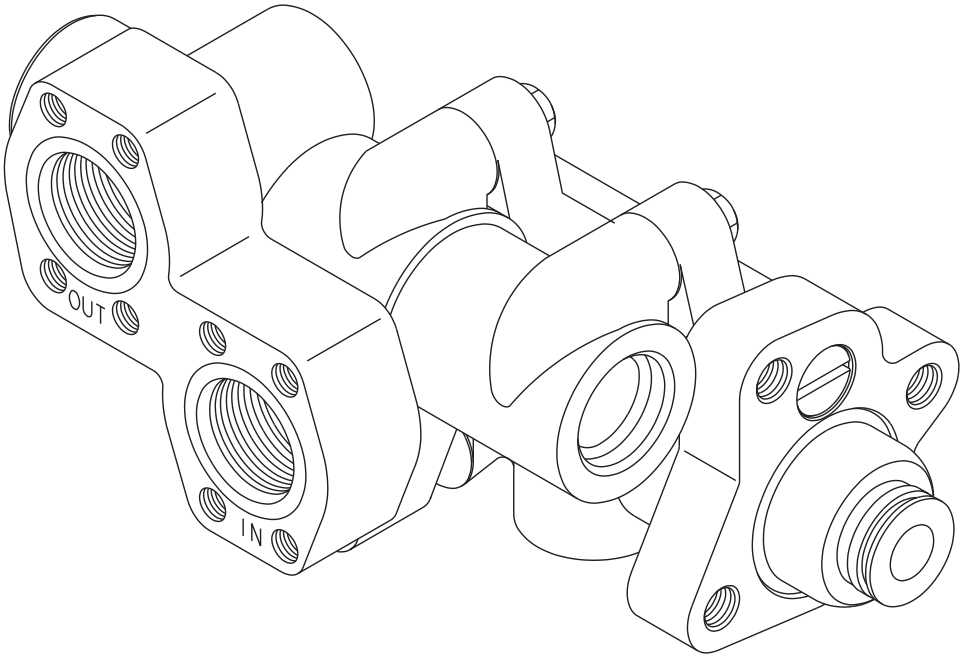
Integrated Accumulator Charging and Pressure Modulating Valve

Description and Operation



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DISASSEMBLY

(Refer to Figures 1, 2 and 3)

The Full Power Hydraulic Brake Valve is designed for installation in an open center hydraulic system. This valve is normally installed after the main pump/relief valve and before downstream secondary hydraulic devices, such as, a power steering valve, etc. (see Figure 1).

The Full Power Hydraulic Brake Valve is designed for use with mineral base hydraulic oil. Mineral base hydraulic oil and compatible wheel cylinder seals must be used.

Essentially, this device consists of two internally separate valves within one unit:

1. Charging Section - creates pressure used to charge the accumulator from an open center circuit, designed to operate within a preset range. When the accumulator is fully charged, it becomes a separate closed center circuit. The stored pressure in the accumulator provides available pressure for the control section.
2. Control Section - controls and regulates pressure to the brake system wheel cylinders by using the energy stored in the accumulator.

Flow through to the power steering valve or secondary devices is reduced fractionally for a very short time during accumulator charging. This does not noticeably affect the operation of the power steering valve or secondary devices. Full system pressure is available to these devices at all times.

The energy stored in the accumulator permits full hydraulic power braking even when the open center hydraulic system is not functioning "power-off". The number of "power-off" brake applications is limited only by the amount of pressurized fluid stored in the accumulator versus the volume required per application.

The accumulator charging rate, high pressure limit, and low pressure limit are preset at the factory to conform to specific customer requirements. Maximum available brake pressure is limited to prevent over-pressurizing the brake system.

SYSTEM SCHEMATIC

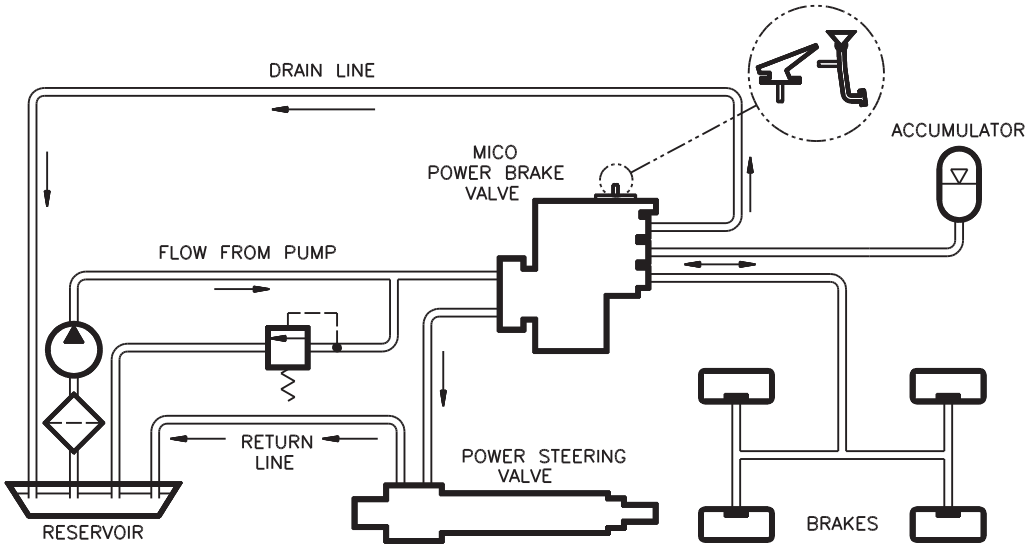


FIGURE 1

REPRESENTATIVE PERFORMANCE DATA

* Flow thru capacity.....to 246.0 L/min (65 GPM)
Accumulator charging rate..... 1.9 to 12.1 L/min @ 69.0 bar (0.5 to 3.2 GPM @ 1000 PSI) in three ranges
Accumulator capacity ..... Determined from brake line pressure, displacement and number of off power emergency brake applications
Force required to operate valve at actuating link..... Determined by valve requirement
Actuating push rod stroke.....5.6-10.7 mm (0.219-0.420 in) depending on model

Technical Data for any specific model furnished upon request.

NOTE: Brake system rubber parts (Buna N) must be compatible with mineral based hydraulic oil.

* Minimum flow determined by system parameters.

This brake valve contains an internal filter through which all oil in the control section, accumulator and brake system must flow. Hydraulic system cleanliness and adequate circuit filtration is imperative in any hydraulic system, minimum 10 micron filtration is recommended.

OPERATION

Spring (5) is forcing piston (6) to cause restriction to the flow through port. The function of spring (5) is to maintain a higher pressure on the pressure port side of valve spool (6) causing the pressure drop necessary for accumulator charge to be priority. This pressure drop is communicated through the center of valve spool (6) into cavity (15). The function of valve spool (6) is to divert a small portion of the hydraulic system flow to the accumulator. Pilot valve spring (7) opens low limit check ball (10) and, at the same time, closes high limit check ball (8). Pilot valve spool (9) permits only one of these balls to be open at any one time.

When low limit check ball (10) is open, pressure from the accumulator enters chamber (16). This allows charging valve spring (5) and the accumulator hydraulic pressure to balance the hydraulic force in cavity (15). Thus, pump pressure which charges the accumulator is always higher than the accumulator pressure. The rate at which the accumulator is charged depends on the size of orifice (11) in the check valve seat.

When the accumulator is charged to the high limit, pressure will open high limit check ball (8) and closes low limit check ball (10). When the high limit check ball (8) is open, the pressure in chamber (16) is allowed to flow to return port and back to tank. Pressure in chamber (15) forces valve spool (6) toward stop (4) increasing flow to the flow through port.

The charging of the accumulator is a separate function and does not interfere with the operation of the brakes or power steering.

Accumulator Being Charged, Brakes Applied

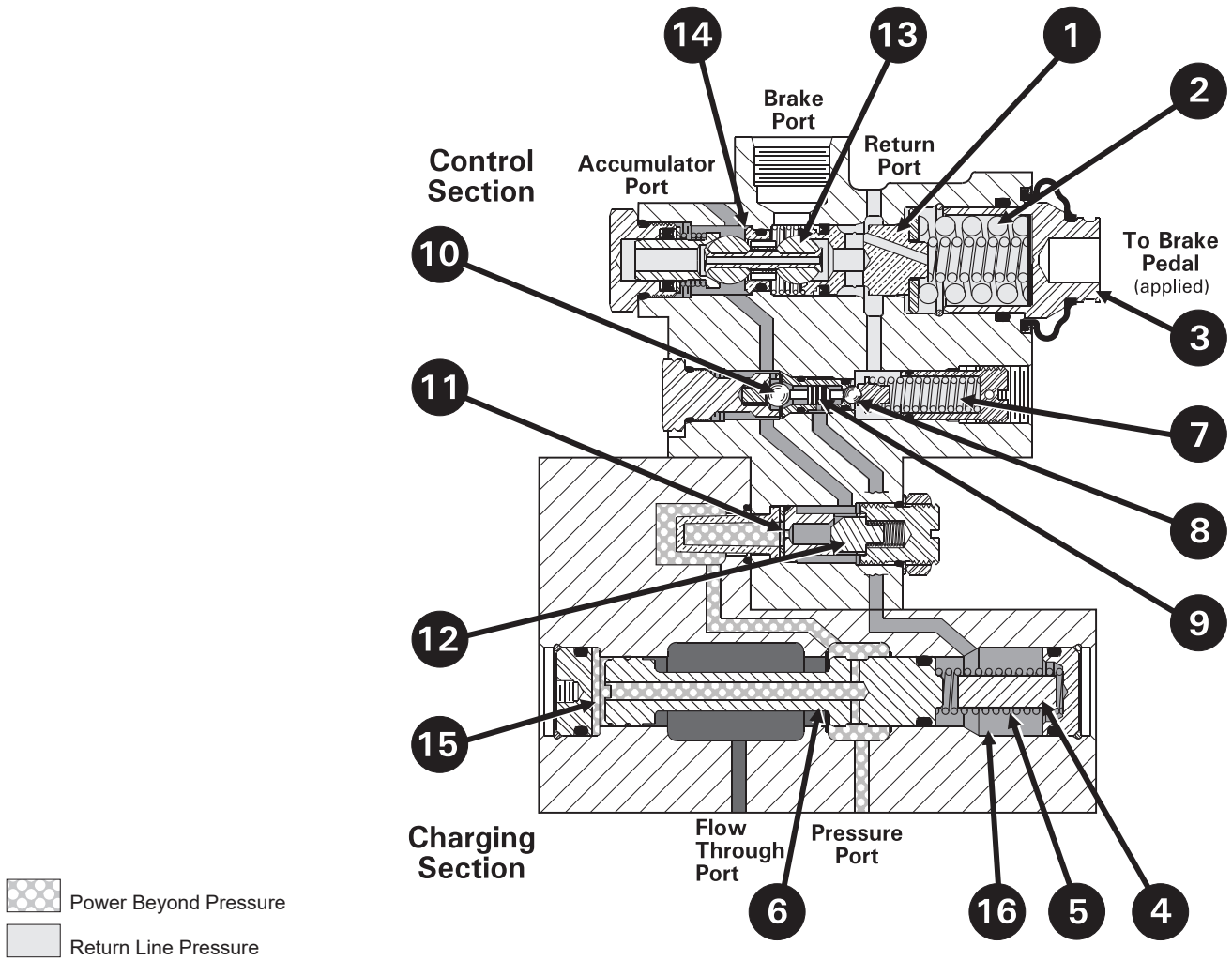


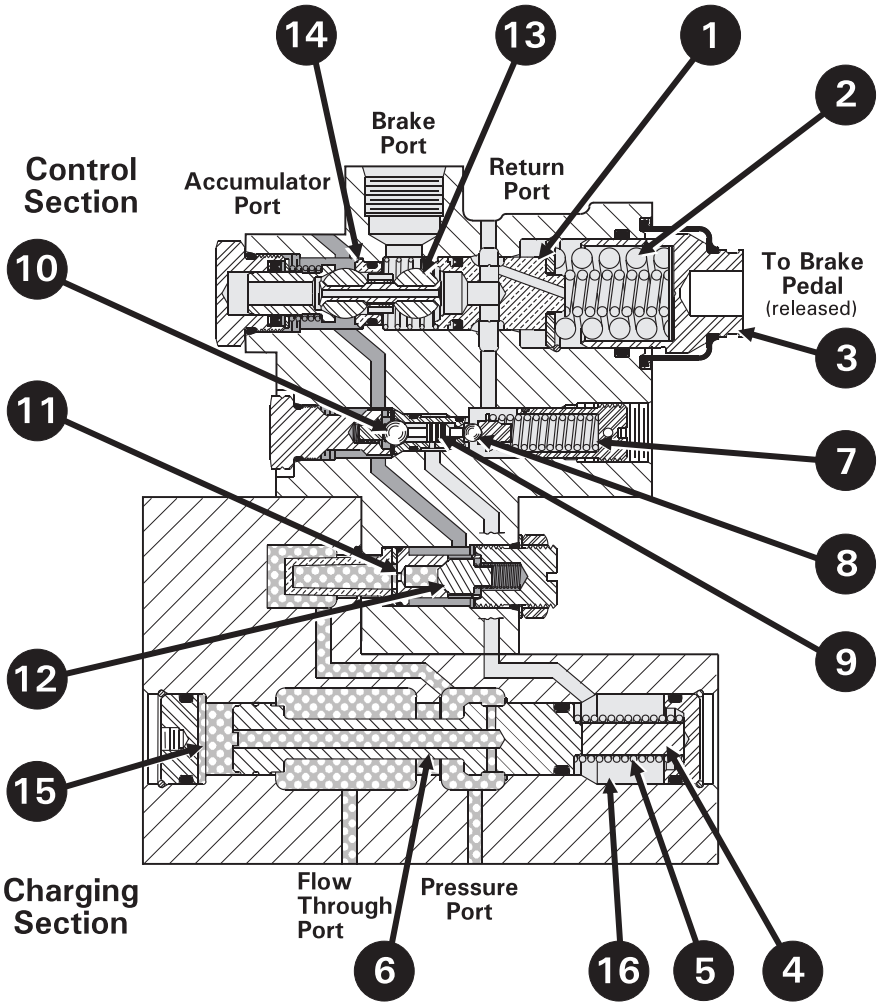
FIGURE 2

When a secondary device in the system causes operating pressure to become greater than accumulator pressure, check valve (12) opens and charges the accumulator without the aid of the charging valve. In this condition the maximum accumulator pressure is only limited to the setting of the main hydraulic system relief valve.

When the brake pedal is applied, piston (3) pushes on pressure regulating spring (2) which seats plunger (1) against ball valve (13) closing off the brake port from the return port. At the same time, ball valve (13) is pushed off ball valve seat (14) allowing fluid to flow from the accumulator into the brakes. As the pressure to the brakes increases, it also reacts against plunger (1), pushing plunger (1) back against pressure regulating spring (2) until ball valve (13) once again closes at ball valve seat (14) closing off flow from the accumulator.

Pressure is then held in the brake system until the force on the brake pedal is either increased or reduced [opening or closing ball valve (13)]. If pedal force is reduced, oil flows from the brakes to the return port until pressure regulating spring (2) balances the hydraulic reaction against plunger (1). Flow to the return port stops, and the new brake system pressure is maintained. Pedal effort is directly proportional to the brake system pressure which provides the pedal "feel" when braking the vehicle.

Accumulator Charged, Brakes Released



Hydraulic System and Power Beyond Pressure

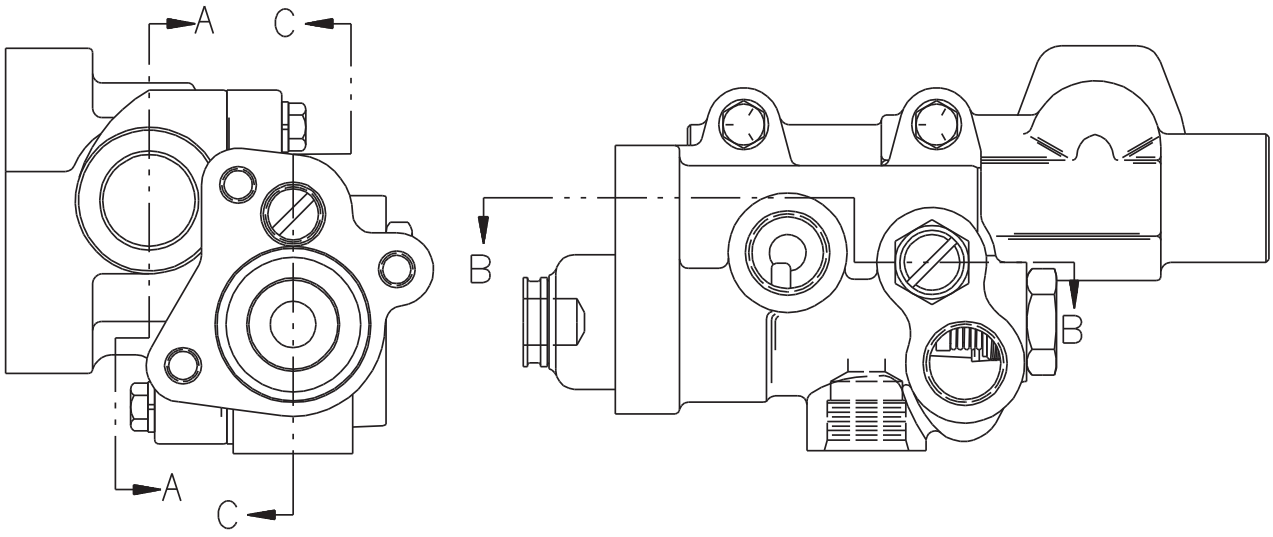
Return Line Pressure

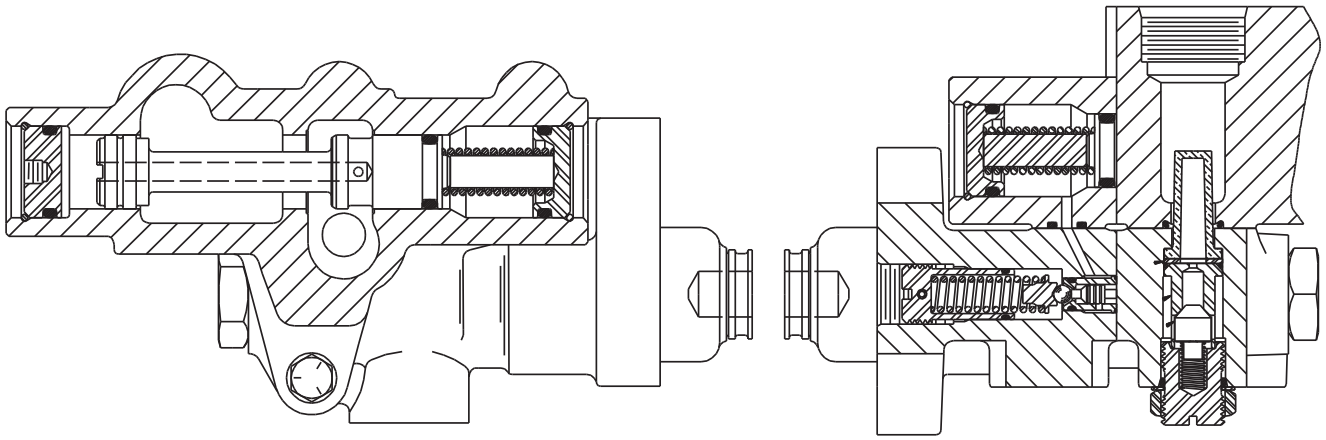
Accumulator Pressure

FIGURE 3

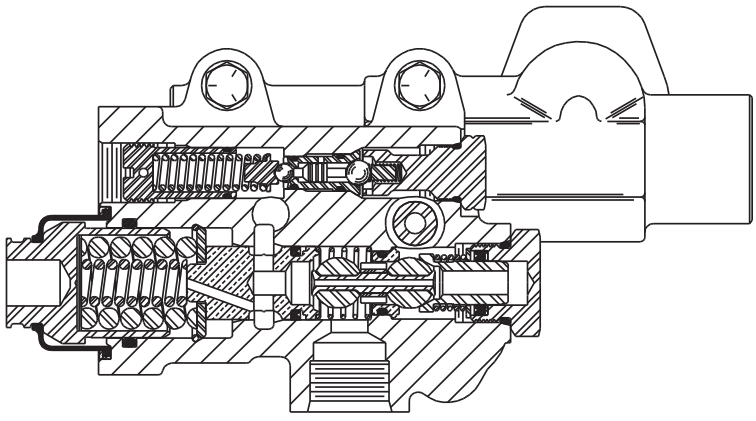
CROSS SECTION VIEWS - TYPICAL BRAKE VALVE

NOTE: Valve shown with accumulator at high limit setting and brake pressure at maximum setting.





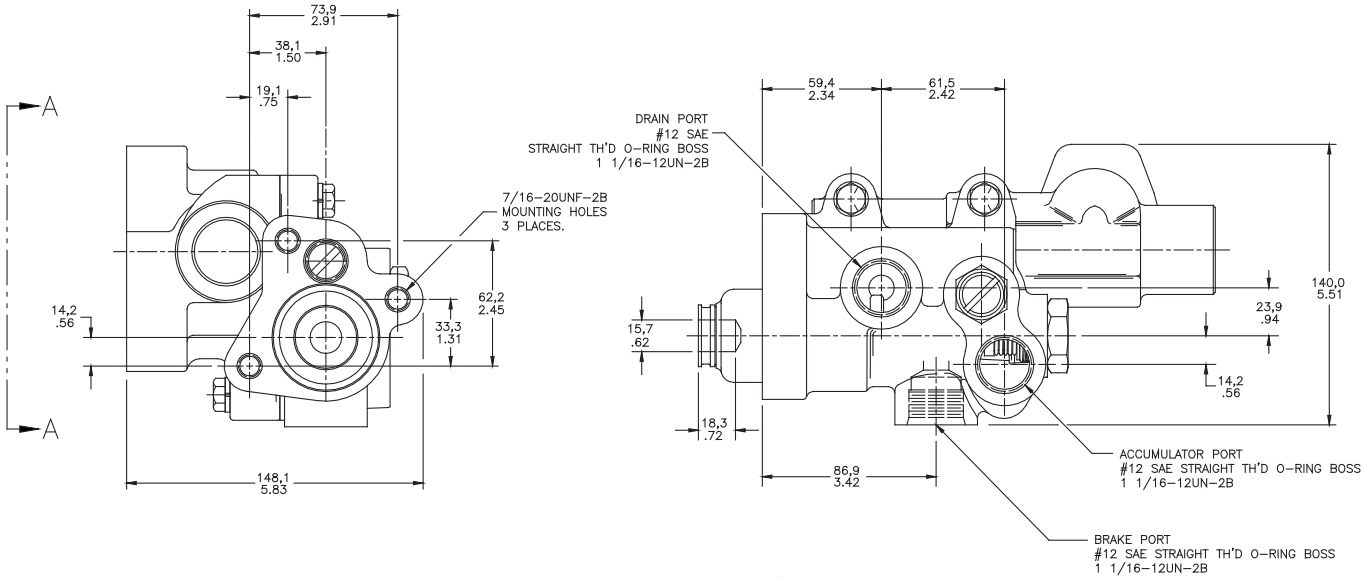
SECTION A-A **SECTION B-B**



SECTION C-C

TYPICAL BRAKE VALVE

(Dimensions will vary slightly between units and are to be used for reference purposes only.)



millimeters
inches