Boosted Master Cylinder

Description and Operation

DESCRIPTION

(Refer to Figure 1)

The Boosted Master Cylinder will provide hydraulic power braking when installed in an open center hydraulic circuit. It can be used in conjunction with other hydraulic devices such as power steering, also installed in the same circuit. Using a single pump to provide flow and pressure, the boosted master cylinder should be installed in the system circuitry, in series, between the pump relief valve and the other hydraulic devices. The entire pump flow is directed through the boosted master cylinder and is available to actuate the downstream devices. The boosted master cylinder requires a very small volume of oil for its operation; therefore, it does not interfere with the rest of the circuit, nor does usual actuation of the downstream hydraulic devices affect operation of the brake valve. Full system pressure is always available for operating the rest of the system.

The Boosted Master Cylinder provides a single-fluid system using the systems hydraulic oil to operate the brakes. Synthetic rubber wheel cylinder cups must be used to prevent swelling.

This master cylinder reduces the braking effort to any required degree depending on pedal ratio. Brake pedal force is directly proportional to brake line pressure, thus giving a sense of feel in the operation of the brakes. Manual braking is always available whenever the hydraulic power system is not functioning. This is accomplished by a mechanical follow through within the master cylinder. A longer pedal stroke, usually with increased pedal effort, will be expected when braking in this condition.

BLEEDING SCHEMATIC

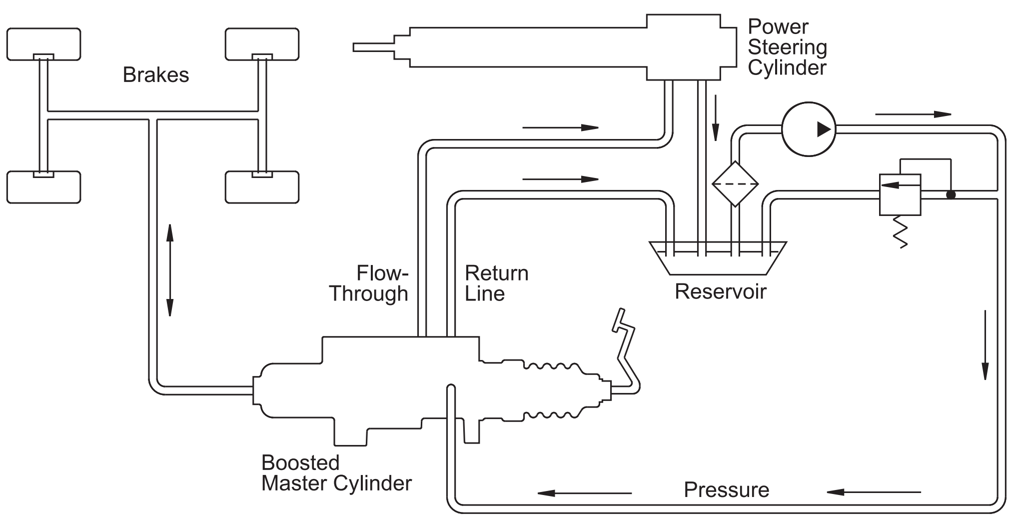


FIGURE 1

Flow capacity.................................See Specification Chart - Page 2
System pressure.................................0-137.9 bar (0-2000 PSI)
Brake line pressure.................................See Specification Chart - Page 2
Master cylinder, capacity.................................50.8 cm3 (3.1 in3)
Push rod travel with power.................................5.1 cm (0.20 in) approximately
Push rod force with power.................................154.2 kgf at 103.4 bar (340 lb at 1500 PSI) brake line pressure
102.1 kgf at 17.2 bar (225 lb at 250 PSI) brake line pressure - 06-460-652 only
Push rod travel without power.................................46.8 cm (1.844 in) approximately
Push rod force without power.................................6804 kgf at 50.0 bar (1500 lb at 725 PSI)
235.0 kgf at 17.2 bar (518 lb at 250 PSI) 06-460-652 only

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

SPECIFICATION CHART

Part Number	Brake Flow Port	Pressure Port	Flow Through Port	Tank Port	Brake Line Pressure (with power)		Flow Capacity	
					bar	(PSI)	L/min	(GPM)
* 06-460-520 Complete unit replaced by 06-460-658	1/2-20UNF	SAE No. 10	SAE No. 10	1/2-14NPTF	127.6 ± 3.5	(1850 ± 50)	11.4-90.8	(3-24)
06-460-522	9/16-18UNF	SAE No. 10	SAE No. 10	SAE No. 10	127.6 ± 3.5	(1850 ± 50)	11.4-90.8	(3-24)
* 06-460-550 Complete unit replaced by 06-460-656	1/2-20UNF	SAE No. 10	SAE No. 10	1/2-14NPTF	103.4 ± 3.5	(1500 ± 50)	11.4-90.8	(3-24)
* 06-460-560 Complete unit replaced by 06-460-656	1/2-20UNF	SAE No. 8	SAE No. 8	SAE No. 10	106.9 ± 3.5	(1550 ± 50)	11.4-90.8	(3-24)
* 06-460-570 Complete unit replaced by 06-460-662	9/16-18UNF	SAE No. 8	SAE No. 8	SAE No. 10	106.9 ± 3.5	(1550 ± 50)	11.4-90.8	(3-24)
* 06-460-580 Complete unit replaced by 06-460-656	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	103.4 ± 3.5	(1500 ± 50)	11.4-90.8	(3-24)
* 06-460-588 Complete unit replaced by 06-460-664	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	106.9 ± 3.5	(1550 ± 50)	11.4-90.8	(3-24)
* 06-460-610 Complete unit replaced by 06-460-666	9/16-18UNF	SAE No. 10	SAE No. 10	1/2-14NPTF	65.5 ± 3.5	(950 ± 50)	11.4-90.8	(3-24)
* 06-460-620 Complete unit replaced by 06-460-656	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	103.4 ± 3.5	(1500 ± 50)	11.4-90.8	(3-24)
06-460-642	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	106.9 ± 3.5	(1550 ± 50)	11.4-90.8	(3-24)
* 06-460-650 Complete unit replaced by 06-460-656	1/2-20UNF	SAE No. 10	SAE No. 10	1/2-14NPTF	103.4 ± 3.5	(1500 ± 50)	11.4-90.8	(3-24)
06-460-654 Complete unit replaced by 06-460-676	9/16-18UNF	SAE No. 8	SAE No. 8	SAE No. 10	103.4 ± 3.5	(1500 ± 50)	11.4-45.4	(3-12)
* 06-460-656	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	103.4 ± 3.5	(1500 ± 50)	11.4-90.8	(3-24)
* 06-460-658	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	127.6 ± 3.5	(1850 ± 50)	11.4-90.8	(3-24)
* 06-460-660	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	79.3 ± 3.5	(1150 ± 50)	11.4-90.8	(3-24)
* 06-460-662	9/16-18UNF	SAE No. 10	SAE No. 10	SAE No. 10	106.9 ± 3.5	(1550 ± 50)	11.4-90.8	(3-24)
* 06-460-666	9/16-18UNF	SAE No. 10	SAE No. 10	SAE No. 10	65.5 ± 3.5	(950 ± 50)	11.4-90.8	(3-24)
06-460-668	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	69.0 ± 3.5	(1000 ± 50)	11.4-45.4	(3-12)
06-460-672	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	51.7 ± 3.5	(750 ± 50)	11.4-90.8	(3-24)
06-460-676	9/16-18UNF	SAE No. 10	SAE No. 10	SAE No. 10	103.4 ± 3.5	(1500 ± 50)	11.4-45.4	(3-12)
06-460-678	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	117.2 ± 3.5	(1700 ± 50)	11.4-90.8	(3-24)
06-460-682 Complete unit replaced by 06-460-672	1/2-20UNF	SAE No. 8	SAE No. 8	SAE No. 10	51.7 ± 3.5	(750 ± 50)	11.4-90.8	(3-24)
06-460-684	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	75.8 ± 3.5	(1100 ± 50)	11.4-45.4	(3-12)
* 06-460-686 Complete unit replaced by 06-460-674	1/2-20UNF	SAE No. 10	SAE No. 10	1/2-14NPTF	103.4 ± 3.5	(1500 ± 50)	11.4-45.4	(3-12)
06-460-688	9/16-18UNF	SAE No. 10	SAE No. 10	SAE No. 10	40.0 ± 3.5	(580 ± 50)	11.4-90.8	(3-24)
06-460-690	9/16-18UNF	SAE No. 10	SAE No. 10	SAE No. 10	117.2 ± 3.5	(1700 ± 50)	11.4-90.8	(3-24)
06-461-520 Complete unit replaced by 06-461-658	1/2-20UNF	SAE No. 10	SAE No. 10	1/2-14NPTF	127.6 ± 3.5	(1850 ± 50)	11.4-90.8	(3-24)
06-461-550 Complete unit replaced by 06-461-656	1/2-20UNF	SAE No. 10	SAE No. 10	1/2-14NPTF	103.4 ± 3.5	(1500 ± 50)	11.4-90.8	(3-24)
06-461-610 Complete unit replaced by 06-461-666	9/16-18UNF	SAE No. 10	SAE No. 10	1/2-14NPTF	65.5 ± 3.5	(950 ± 50)	11.4-90.8	(3-24)
06-461-642	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	106.9 ± 3.5	(1550 ± 50)	11.4-90.8	(3-24)
06-461-656	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	103.4 ± 3.5	(1500 ± 50)	11.4-90.8	(3-24)
06-461-658	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	127.6 ± 3.5	(1850 ± 50)	11.4-90.8	(3-24)
06-461-660	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	79.3 ± 3.5	(1150 ± 50)	11.4-90.8	(3-24)
06-461-666	9/16-18UNF	SAE No. 10	SAE No. 10	SAE No. 10	65.5 ± 3.5	(950 ± 50)	11.4-90.8	(3-24)
06-461-674	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	103.4 ± 3.5	(1500 ± 50)	11.4-45.4	(3-12)
06-461-684	1/2-20UNF	SAE No. 10	SAE No. 10	SAE No. 10	75.8 ± 1.7	(1100 ± 25)	11.4-45.4	(3-12)

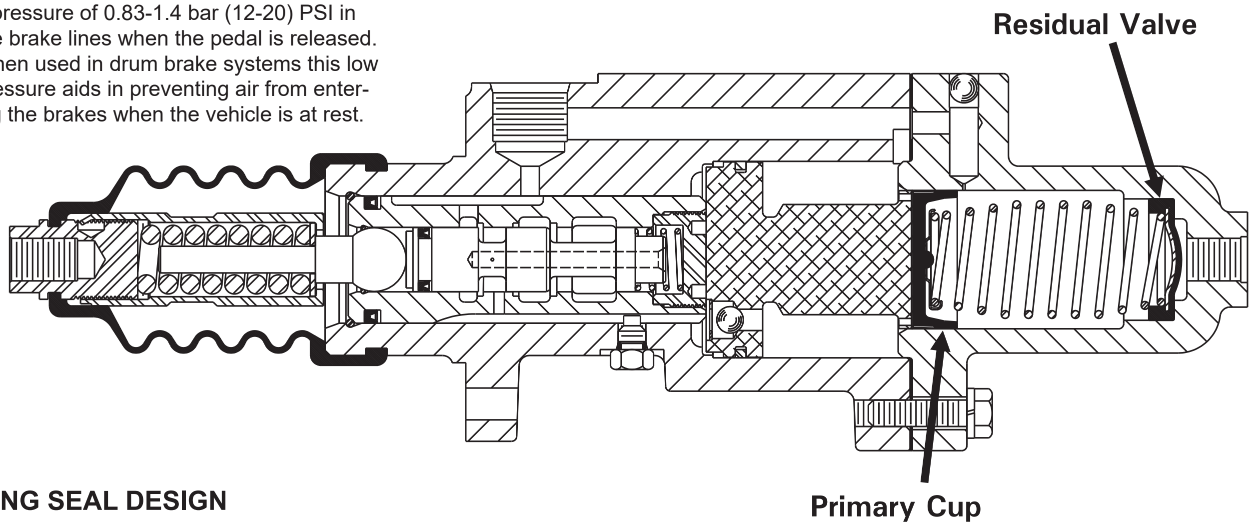
* For use with drum brakes (has residual check valve)

NOTE: The master cylinders should be used within the flow capacities indicated above for optimum performance. Master cylinders are functional at lower flows but response is reduced. At the higher flow operation higher pressure drops are seen.

BOOSTED MASTER CYLINDER DESIGNS

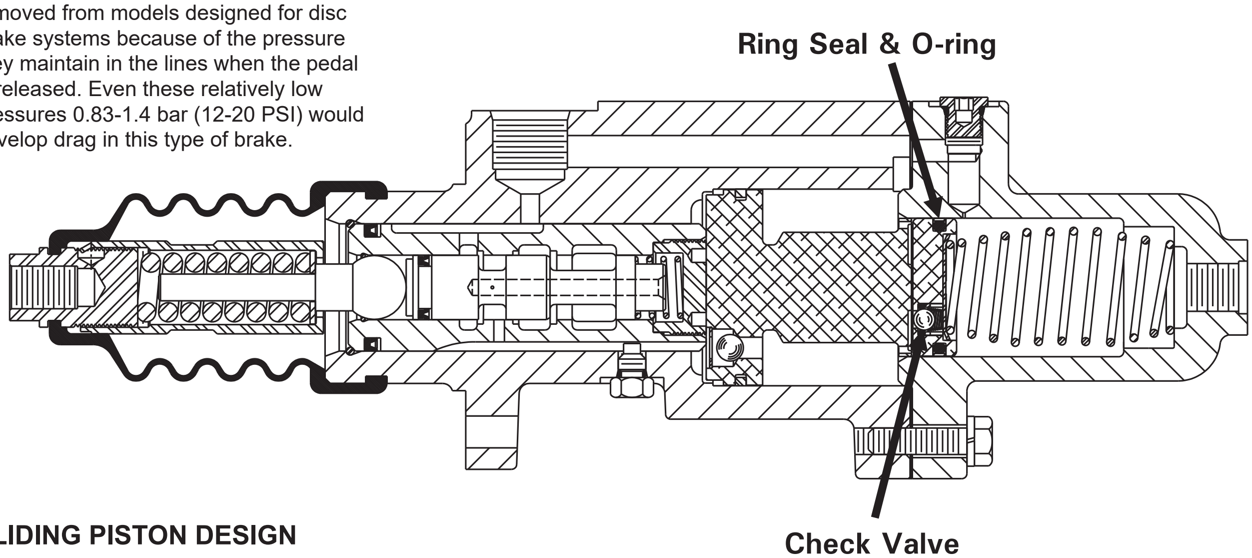
PRIMARY CUP DESIGN

The primary cup design uses a residual valve. This master cylinder will maintain a pressure of 0.83-1.4 bar (12-20) PSI in the brake lines when the pedal is released. When used in drum brake systems this low pressure aids in preventing air from entering the brakes when the vehicle is at rest.



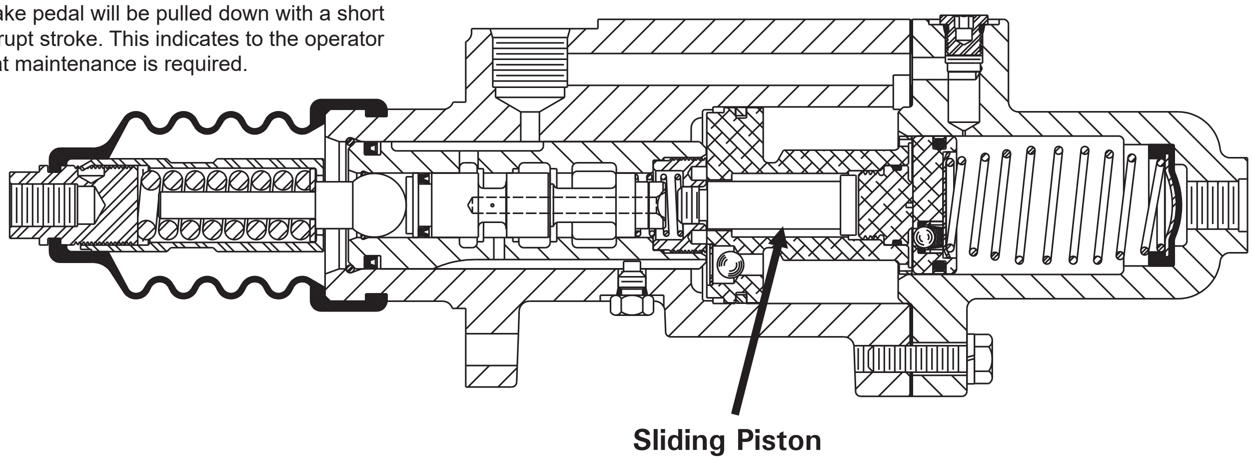
RING SEAL DESIGN

The ring seal design is used mainly in disc brake systems. The residual valve is removed from models designed for disc brake systems because of the pressure they maintain in the lines when the pedal is released. Even these relatively low pressures 0.83-1.4 bar (12-20 PSI) would develop drag in this type of brake.



SLIDING PISTON DESIGN

The sliding piston design was created with a specific function in mind. A specially designed piston slides inside the primary piston when the brake pedal is actuated. If the primary piston strokes too far, the brake pedal will be pulled down with a short abrupt stroke. This indicates to the operator that maintenance is required.



OPERATION

FIGURE 2 - Brake Pedal Completely Released

- In the neutral position, fluid enters at the pressure port and flows relatively unrestricted through the master cylinder and exits the flow through port.
- Residual pressure is maintained in the brake system by the residual check valve.

Non-actuated position

FIGURE 2

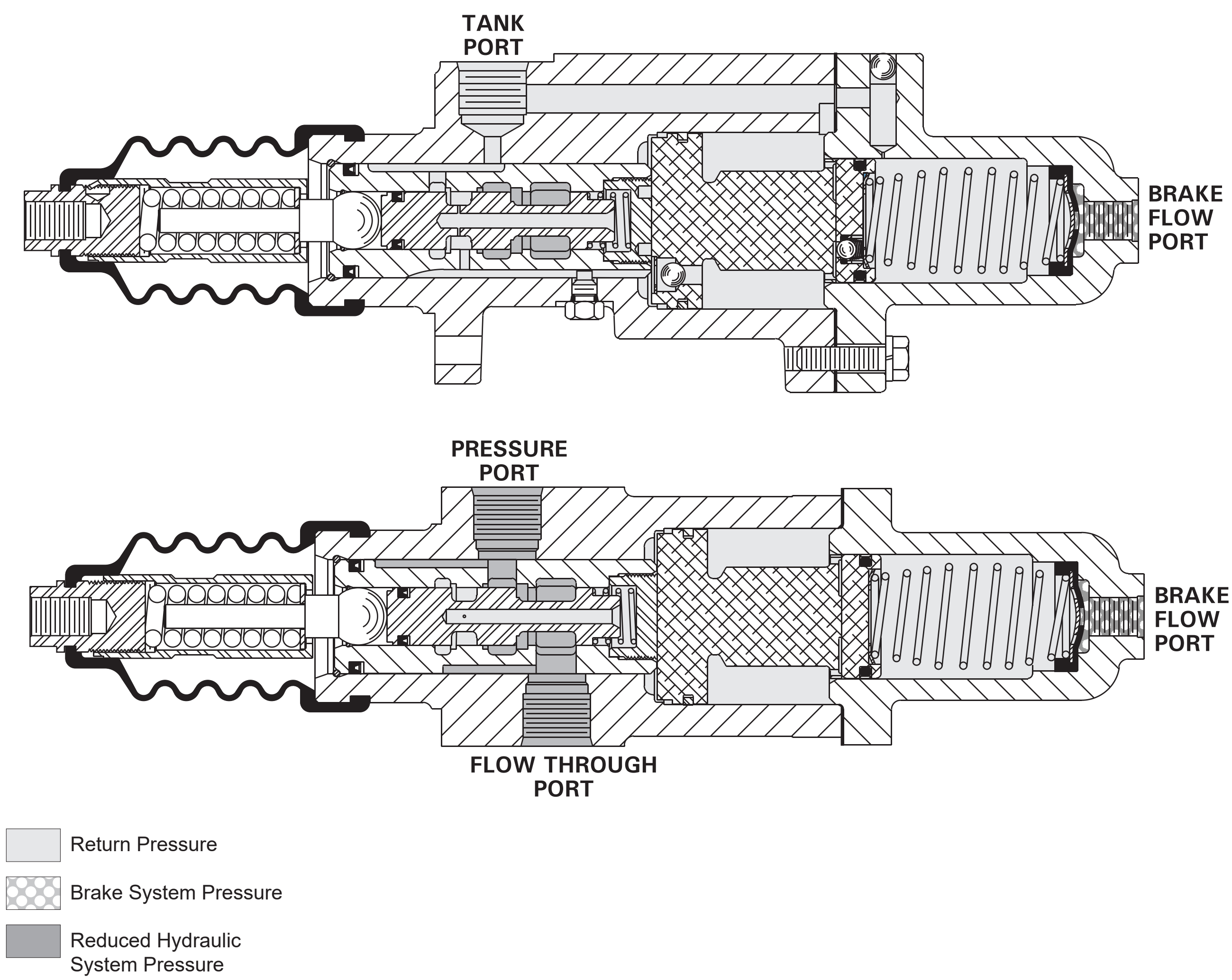


FIGURE 3 - Forward Movement of Brake Pedal

- As the operator applies the brake pedal, spring (1) begins to compress and force regulating spool (2) forward, restricting flow at land (3) and closing land (4). Pressure builds in cavity (5). Land (6) begins to open allowing this pressurized fluid to enter cavity (7) and boost chamber (8). This pressure moves pistons (9 & 10) forward forcing fluid to the brakes.
    1. The area of piston (9) is larger than the area of piston (10), therefore, the fluid pressure being forced to the brakes is higher than the pressure in boost chamber (8). The ratio of the area for piston (9) to piston (10) is approximately 2:1.
- As pressure in cavity (7) and boost chamber (8) increase, brake system pressure also increases. The pressure increase in cavity (7) forces regulating spool (2) back, compressing spring (1). (This provides the operator with a modulated "feel" of brake system pressure). At some point the hydraulic force acting upon regulating spool (2) will equal the input pedal force. When this occurs, regulating spool (2) controls and regulates pressure in cavity (7) by either opening or closing at lands (4 & 6). Orifices (14) control the rate of pressure increase in cavity (7) by metering flow, contributing to smooth operation of the valve.
- Another function of pressure regulating spool (2) is to prevent a sudden build-up of pressure downstream from adversely affecting brake line pressure.
- Maximum brake system pressure is achieved when spring (1) compresses to the point where push rod link (12) contacts sleeve (11).
    1. Maximum valve pressure is set by adjusting push rod connector (13). Turning connector (13) in, increases maximum brake line pressure. Turning connector (13) out, reduces maximum brake line pressure. The push rod connector is preset at the factory and crimped at stake hole (15).
- When the pedal is released, the spring in the cavity (7) returns pressure regulating spool (2) to neutral. This closes land (6) to the hydraulic system and opens land (4) which allows the fluid in cavity (7) and boost chamber (8) to flow to the flow through port. The spring in the master cylinder returns master cylinder piston (10) to the neutral position.

Forward pedal movement until fully applied, pedal released

FIGURE 3

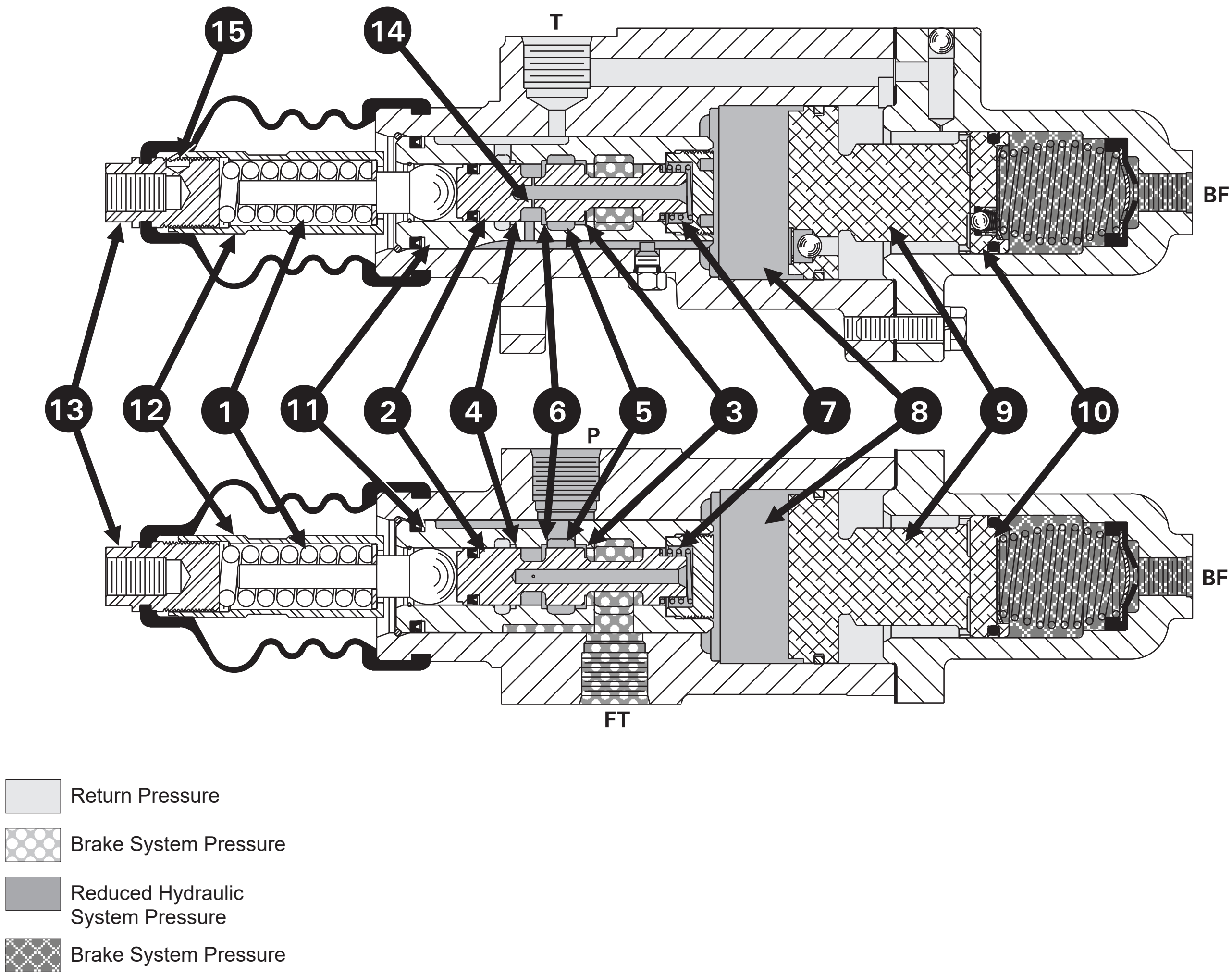


FIGURE 4 - Brake Pedal Applied During Power-off Hydraulic System

- This boosted master cylinder will act as a manual brake master cylinder during power-off application. The push rod link (12) contacts sleeve (11) which pushes directly on piston (9), forcing fluid to the brake system.
- This master cylinder requires a long pedal stroke during power-off application.

Brake pedal applied - power-off

FIGURE 4

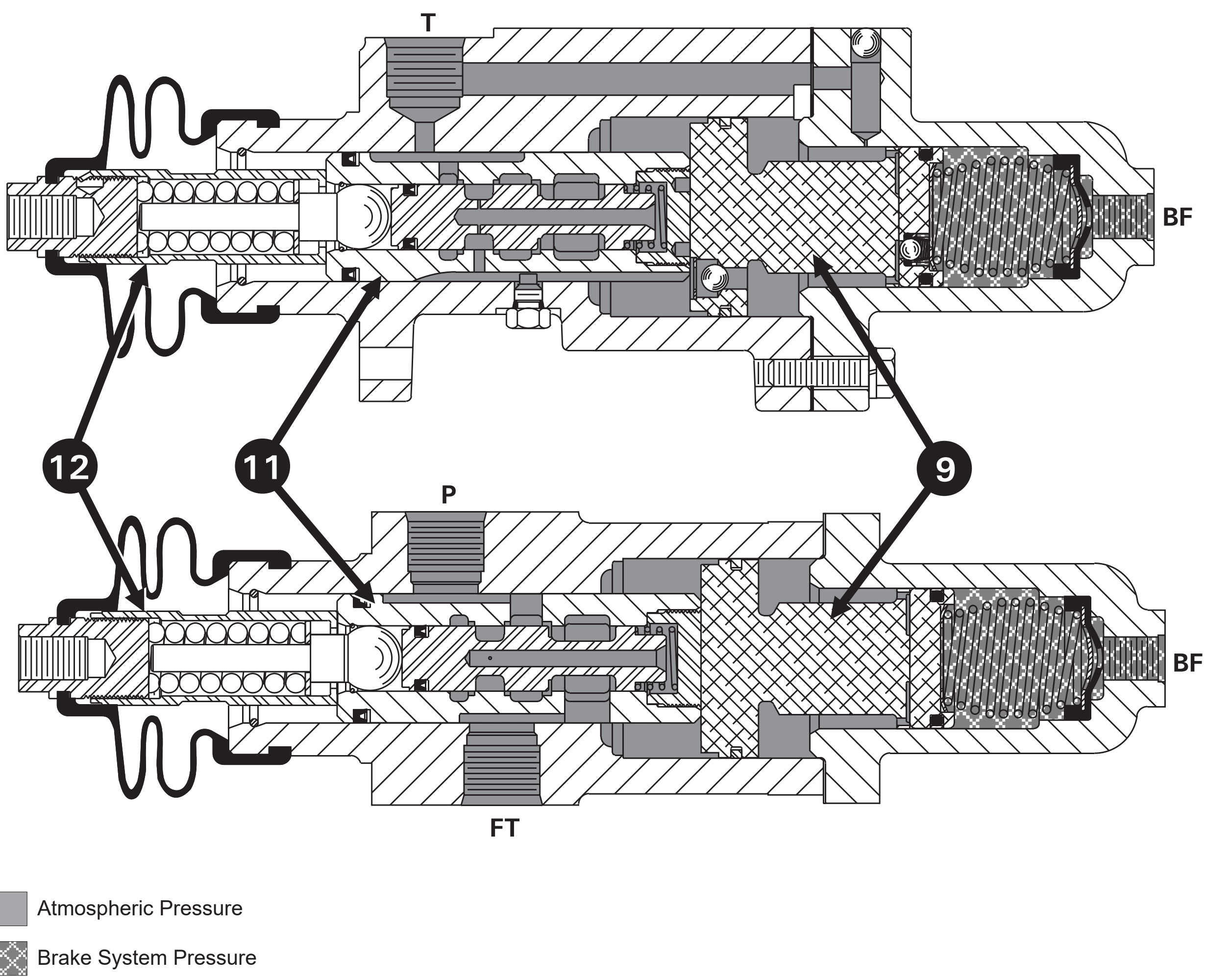
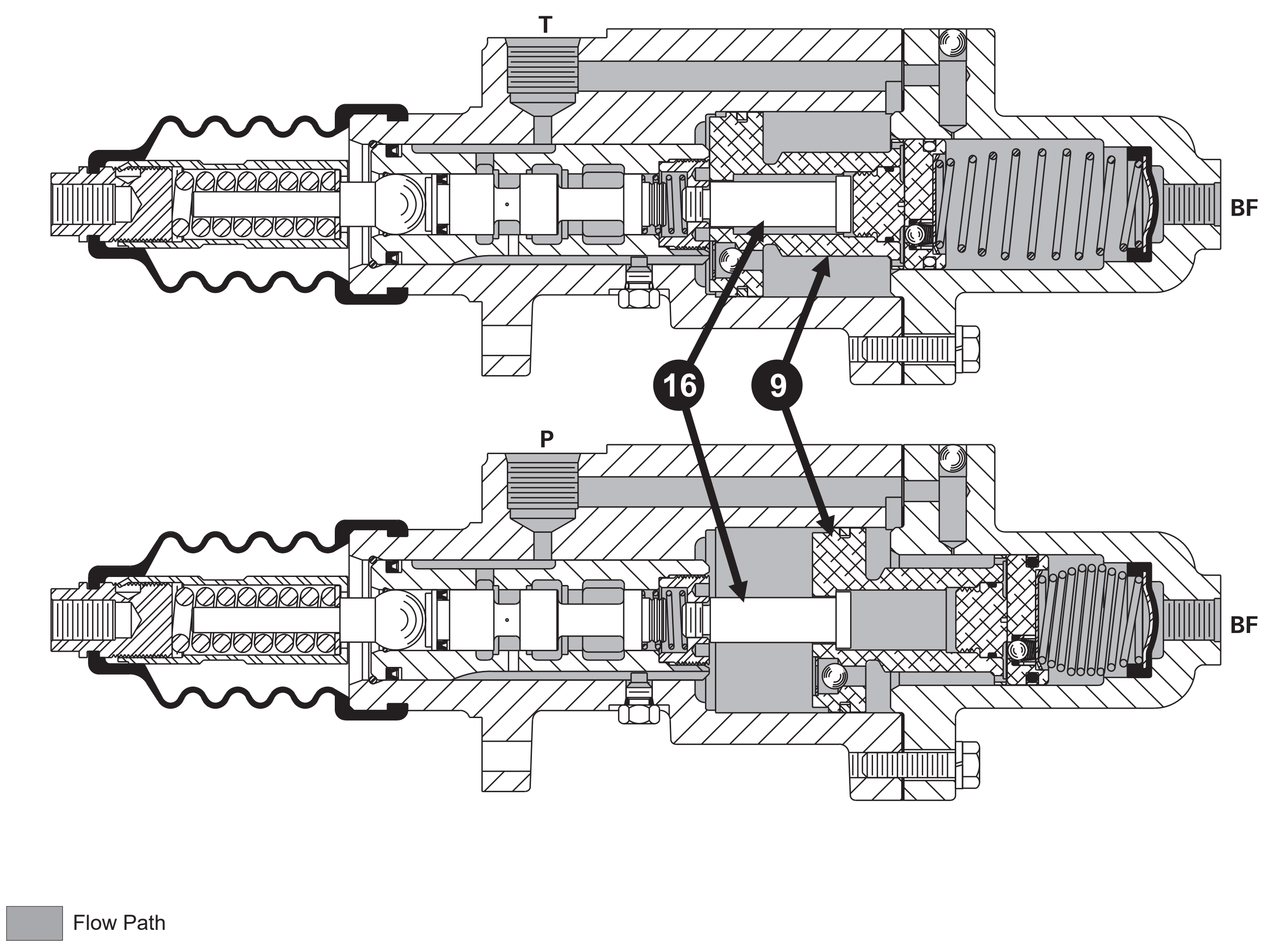


FIGURE 5 - Sliding Piston Design

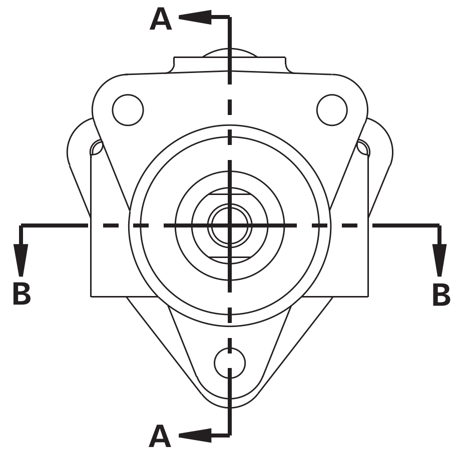
- The sliding piston design operates in the same manner as the standard design except for an additional sliding piston (16) feature. This specially designed piston slides inside piston (9) when the brake pedal is applied. If the piston (9) strokes to far, the brake pedal will be pulled down with a short abrupt stroke. This indicates to the operator that maintenance is required. Excessive stroke can be caused by:
    A. Brake components worn or out of adjustment.
    B. Leak in the brake system.
    C. Air in the brake system.

Sliding piston design

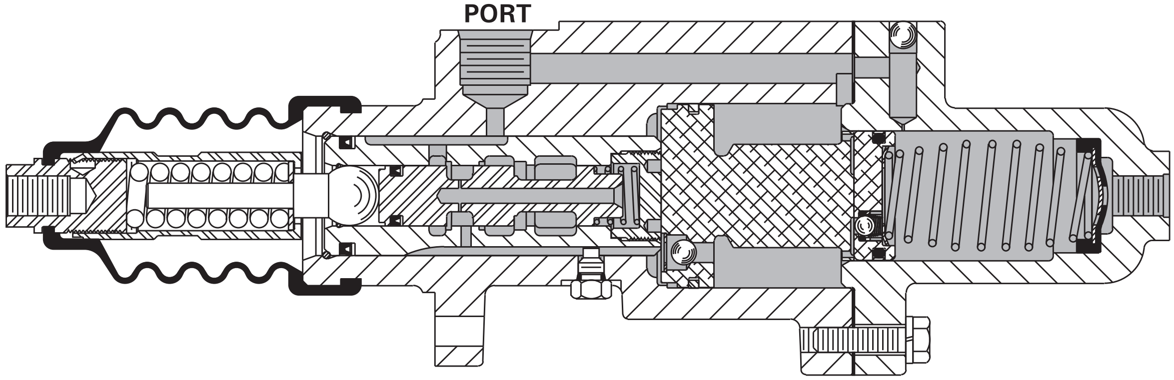
FIGURE 5



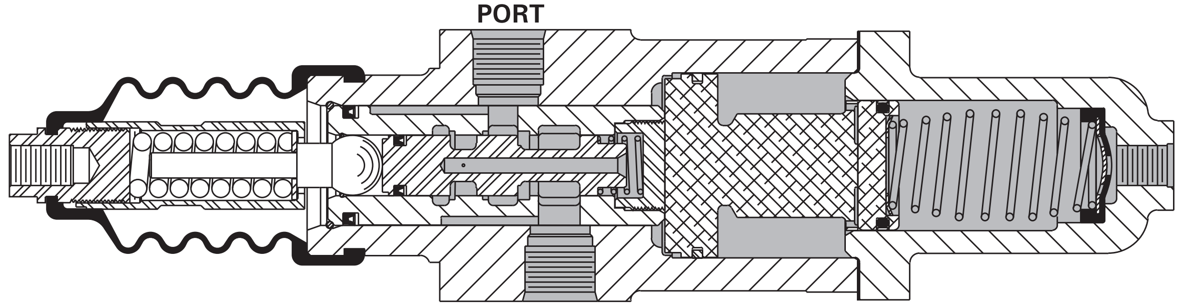
CROSS SECTION VIEWS - Typical Boosted Master Cylinder



Flow Path



SECTION A-A



SECTION B-B

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Form No. 81-460-231 Revised 2009-04-27