

BR120

Brake Systems



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TECHNICAL TRAINING

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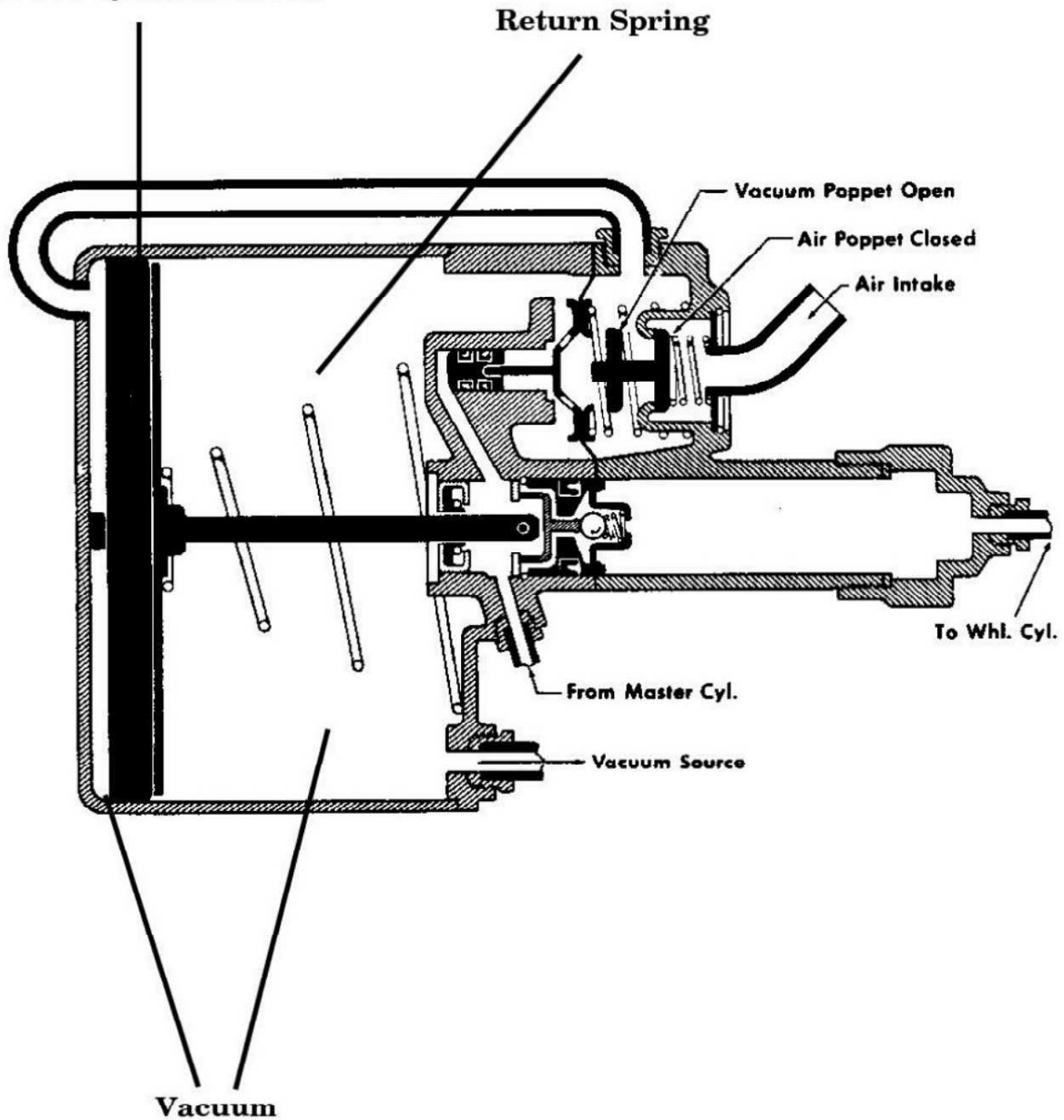
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Brakes Off

With the brake pedal in the released position, the vacuum poppet is open and the air poppet is closed. This causes vacuum to be present on both sides of the vacuum powered cylinder piston. The power cylinder piston will be held in the off position by the power cylinder piston return spring.

Power Cylinder Piston



Brakes Applied

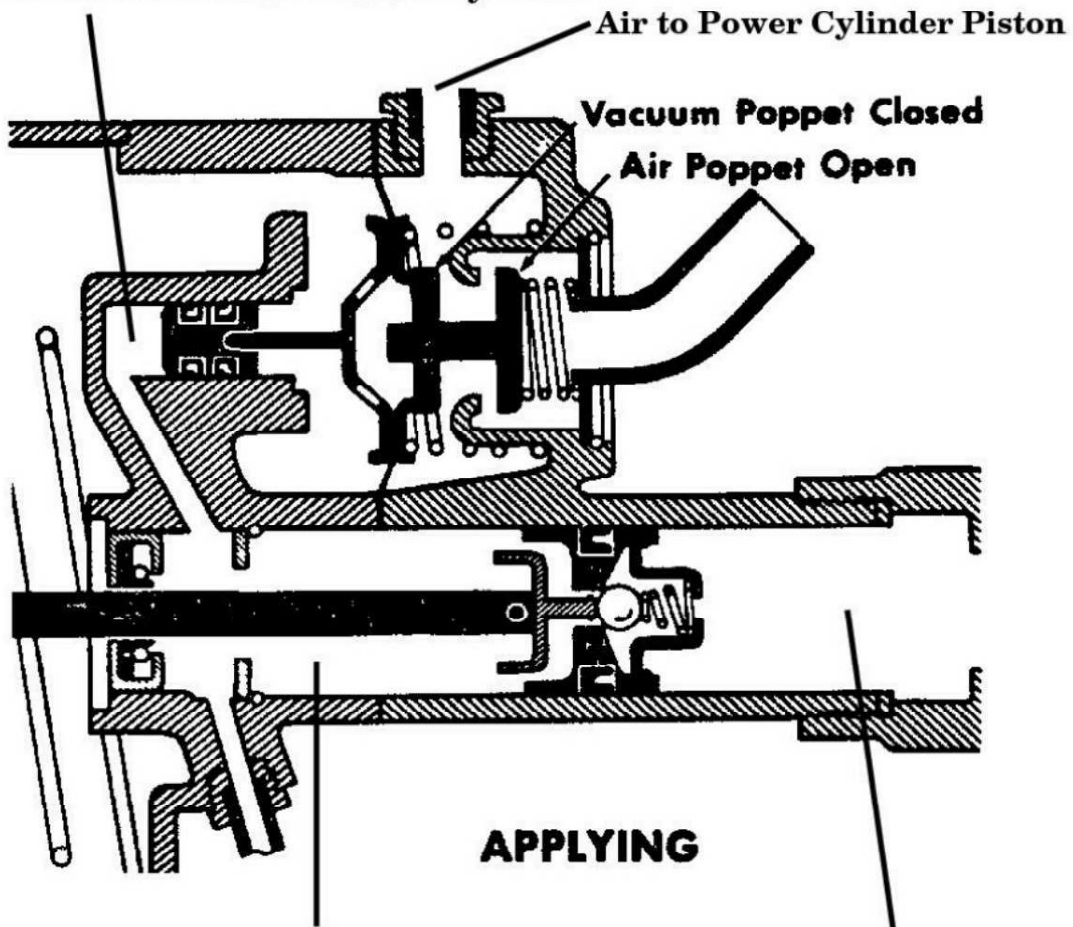
As the brake pedal is depressed, the hydraulic pressure developed within the master cylinder is transmitted to the hydraulic piston of the booster slave cylinder. With pressure applied to the slave piston, the vacuum valve closes and the atmospheric valve opens to admit air to the control side of the vacuum power cylinder.

As air is admitted, the control side of the piston is now at atmospheric pressure. The slave cylinder side of the piston remains under a vacuum. This differential forces the power cylinder piston to move against the return spring.

The forces acting upon the vacuum power cylinder pistons are transmitted directly to the hydraulic slave piston through the push rod. As the hydraulic slave piston starts to move, the piston check valve closes, trapping fluid under pressure ahead of the slave piston.

The total hydraulic pressure created and transmitted to the wheel cylinders is the sum of the pressure developed as a result of the vacuum power cylinder push rod thrust and the pressure received by the hydrovac slave cylinder from the master cylinder.

Hydraulic Pressure from the Master Cylinder



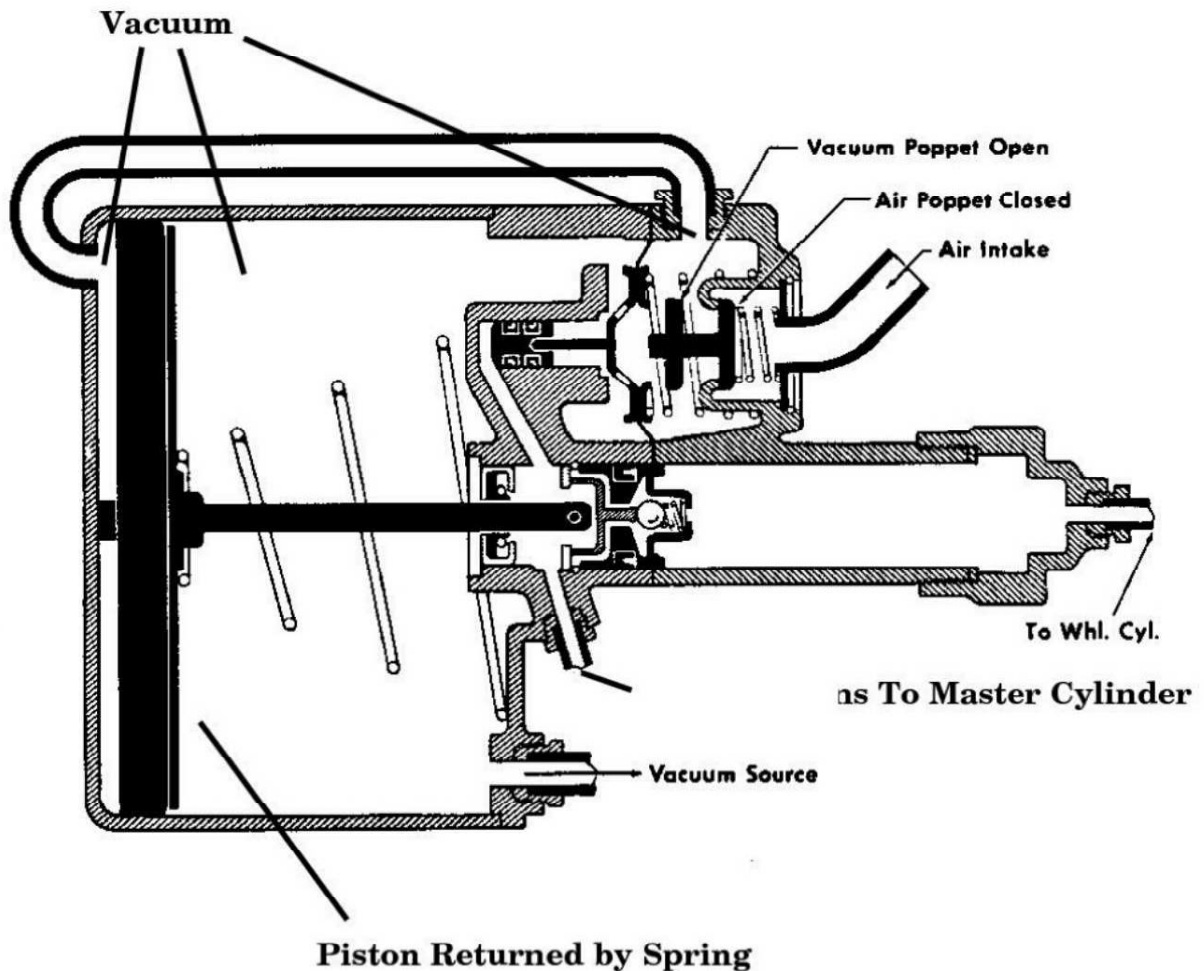
Hydraulic Pressure from the Master Cylinder

Fluid To Wheel Cylinders

Brakes Released

As the brake pedal is released, the pressure within the booster hydraulic piston chamber is reduced, allowing the atmospheric poppet to close and allowing the vacuum poppet to open, by action of return springs. The vacuum power cylinder piston is again balanced in vacuum and returns to release position by action of a large return spring.

When the hydraulic piston nears the release end of its stroke, its check valve reopens, thus permitting the full release of the brakes. Should this check valve not open, or should the vacuum pistons or slave piston stick, the brakes might drag



Important There have been a number of different power brake systems used on Clark lift trucks over the years. Refer to the appropriate service manual for information for the model truck you are working on.

Section 3. Components of the Braking System

This section discusses the main components of the braking system, including the master cylinder, the residual check valve (which is present on some models of Clark lift trucks), the hydraulic inching valve, the wheel cylinder, brake adjusters, and brake tubes and hoses.

Using Authorized Parts

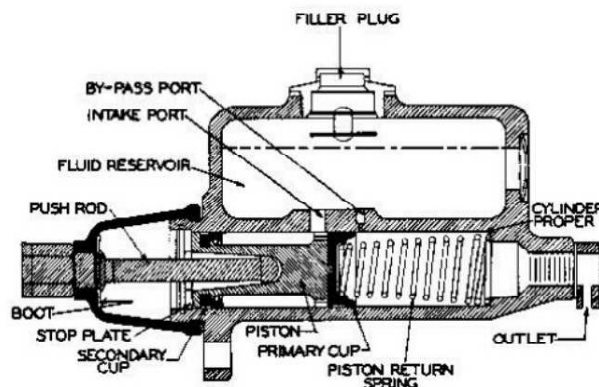
Always use authorized parts. This is the only way to be guaranteed the proper coefficient of friction, as described under “**Principles of Braking**” and listed in “**Basic Objectives in Brake Design.**” “Will-fit”, or non-authorized parts may accomplish the first objective of brake design, stopping the truck, but they may not have acceptable life, be free of squeal or chatter, be smooth, or meet the ITA Draw Bar Drag Test. If you make sure to use the serial number of the lift truck and to order Clark authorized replacement components only, you will be sure to receive the correct parts.

Master Cylinders

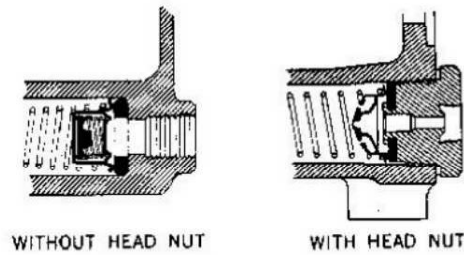
The master cylinder provides hydraulic flow to the wheel cylinders, to apply the shoe against the drum, or disc brake pistons to cause the pads to contact the caliper. There are a number of different master cylinders used. We will discuss the most common types used.

Combination Type Master Cylinders

The combination type master cylinder has the cylinder and fluid supply reservoir combined in one casting and is joined by an “intake” and “compensating” (by-pass) ports located in the cylinder wall between the two cavities. The piston, check valve, and other internal parts are usually removed or installed at the push rod end. When a head nut is used at the outlet end of the cylinder bore, it is sometimes necessary to remove this nut in order to remove the master cylinder components.



Typical Combination Type Master Cylinder

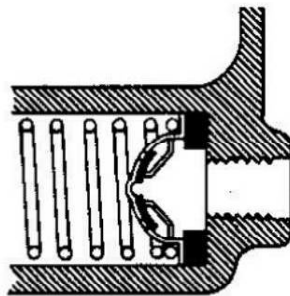


Another commonly used master cylinder uses a remote reservoir. The master cylinder and reservoir are connected by a hose. This type operates the same as the combination type master cylinders.

Residual Check Valves

This check valve, which is used in some trucks, is usually located at the outlet end of the master cylinder and performs these functions:

- It maintains between 6 to 18 psi of hydraulic pressure in the system while brakes are in the released position, thus lessening the possibility of air leaking into the system at the wheel cylinders.
- It assists “bleeding” the system by preventing air from entering the system during the bleeding operation.
- It raises the boiling point of brake fluid in the remainder of the system approximately four degrees for each psi of residual pressure. This is similar to the action of a pressure radiator cap.



This check valve is generally used on older Clark lift truck models, and may be located in a power brake unit or in a brake line fitting rather than in the master cylinder.

Wheel Cylinders

In hydraulic actuation, each wheel cylinder responds to hydraulic pressure in the system and converts this pressure into mechanical force to expand the brake shoes into contact with the drum. The wheel cylinder normally consists of the cylinder casting, two pistons, two sealing cups, a spring (between the cups), two boots, and a bleeder screw.



SINGLE END ("F" TRUCK BRAKE)



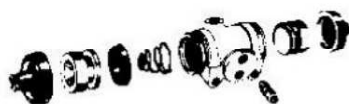
TRUCK (FR-2, FR-3, FR-5 BRAKES)



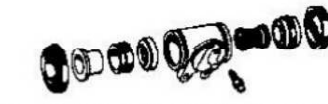
HUCK TYPE



TRUCK CYLINDERS WITH CUP FILLERS



TRUCK CYLINDERS WITH RING CUPS



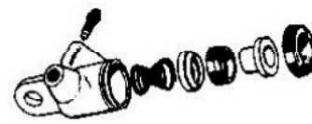
DOUBLE-END WITH RING CUPS, 2-PIECE PISTON



SINGLE END (SERVO BRAKE)



TYPICAL DOUBLE-END, STRAIGHT-BORE OR STEP BORE



SINGLE-END WITH RING CUP, 2-PIECE PISTON

Examples of Wheel Cylinders

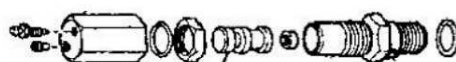
Hydraulic Inching

Inching is controlled slippage of the clutch pack that enables the truck to creep forward while moving a load with the transmission in gear. Inching can be actuated by a hydraulic cylinder or by a cable. Most Clark trucks will have hydraulic inching. Inching is controlled through a one or two pedal type system:

1.2-pedal system: 1 pedal controls inching and the other is the service brake.

2.1-pedal system: both pedals have both inching and braking functions.

Hydraulic inching is accomplished by forcing brake fluid from the inching master cylinder piston to the inching slave valve piston, located in the transmission control cover, as the inching pedal is depressed. The movement of inching slave cylinder piston causes a rod in the control cover to move compressing the inching spool springs allowing the inching spool to move which, reduces the flow of transmission fluid to the dirrectional clutch pack piston. This enables the transmission to slip.



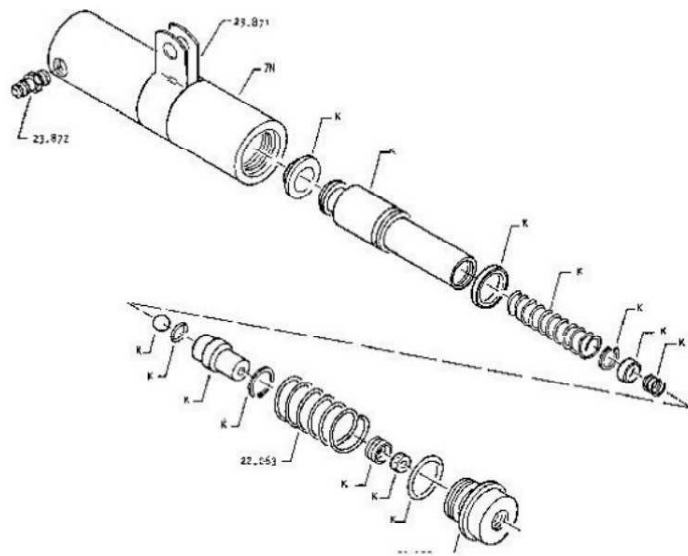
Piston

Typical Inching Slave Cylinder Assembly

On most trucks, when the slave piston reaches the end of it's travel, fluid is then allowed to enter the brake wheel cylinders by way of a fitting or brake selector valve as pedal pressure is increased. This allows the operator to use the inching pedal to stop the truck at low speed.

Brake Selector Valve

The brake selector valve contains a piston inside a cylinder, divided in the center by a seal. One side of the valve is connected to the inching system, the other side to the brake system. As the inching pedal is depressed, the inching slave cylinder piston at the transmission control cover starts to move. When the slave cylinder piston reaches the end of its travel, further pedal travel causes fluid to enter the inching side of the brake selector valve. This fluid will then move the selector valve piston. The piston will then force fluid out the brake system side of the selector valve. This fluid now travels to the wheel cylinders applying the brakes.



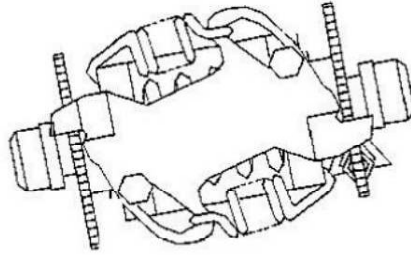
Brake Selector Valve

Brake Adjusters

Five types of brake adjusters are used in Clark lift trucks. The brake adjuster's function is to maintain the correct pedal height under all conditions, and they are always located in the brake shoe area.

The five types are

1. Slot Adjuster: These are located in the shoe assembly on the old style shoe brakes
2. Star Wheel Adjuster: These are located in the shoe assembly on the new style shoe brakes.
3. O-ring: These are located on the brake caliper pistons on disc brakes.
4. Brake Retractor: These are located in place of pistons on oil-cooled disc brakes.
5. Slack: These are located in the shoe assembly on air brakes.



Typical Brake Shoe Adjuster

Hydraulic Tubing and Hoses

1. Tubing. Hydraulic brake tubes are steel tubes of 3/16-inch, 1/4-inch, or 5/16-inch outside diameter. The tube ends are double-flared to reduce leaks.

Note Clean this tube carefully to be sure there are no cracks on the flare.

Important Do not use copper tubing in place of steel tubing.

2. Hoses. Connections between the frame and wheels or between locations having different movements are made with flexible hose having a burst pressure considerably higher than the maximum hydraulic pressure.



Typical Two-Ply Hose, Rubber and Cotton Fabric

Brake Fluid

Fluid naturally resists compression and exerts equal pressure upon each square inch of its container. Hydraulic controlling pressures are always inherently equalized unless an obstruction blocks the movement of fluid.

Note To ensure quality performance, use fluids that meet or exceed Clark's minimum specifications. Refer to the appropriate service manual for the model truck you are working on.

To function satisfactory, however, a good fluid also possesses other qualities which provide all-season chemical balance with these essential special characteristics:

Important Drain and flush the brake system and replace the brake fluid when replacing brake linings.