

PLAINTIFF'S EXHIBIT

MAC-50

SD-38

DD3 SAFETY ACTUATOR

DESCRIPTION The DD3 Safety Actuator; DD describes the double diaphragm and the suffix 3 denotes the triple action for service, parking and emergency braking. The actuator functions normally as a service brake chamber but in addition has a means of mechanically locking a brake application so it can safely be used for parking. With various system arrangements the actuator may be installed to be automatically or manually applied under emergency braking conditions.

The DD3 Safety Actuator is stud mounted and a selection of actuators are available to fit either vertical or horizontal standard mounting stud centers. Three (3) connecting lines are used for the actuator installations; to the parking, service and locking ports.

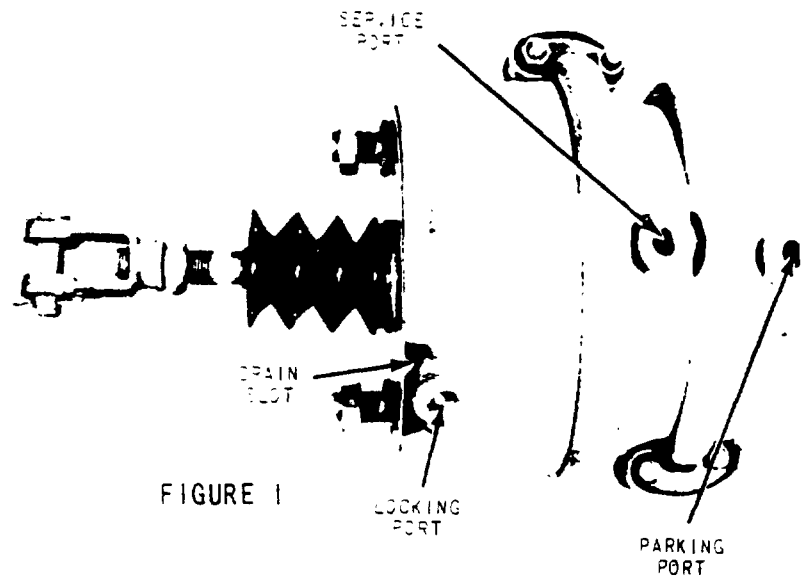


FIGURE 1

In late 1968, design improvements were incorporated into all DD3 Actuators. Changes incorporated are as follows:

1. The non-pressure plate was redesigned to provide better protection against entrance of water into the roller cavity and non-pressure area. Details of this redesign are:
 - a. A new design cap incorporating an "O" ring and shaft seal.
 - b. A heavier splash plate and gasket.
 - c. Studs installed in "blind holes" replace the T-bolts used on the old design non-pressure plate.
 - d. An exhaust check valve in the non-pressure plate to purge the non-pressure cavity area each time the actuator is applied.

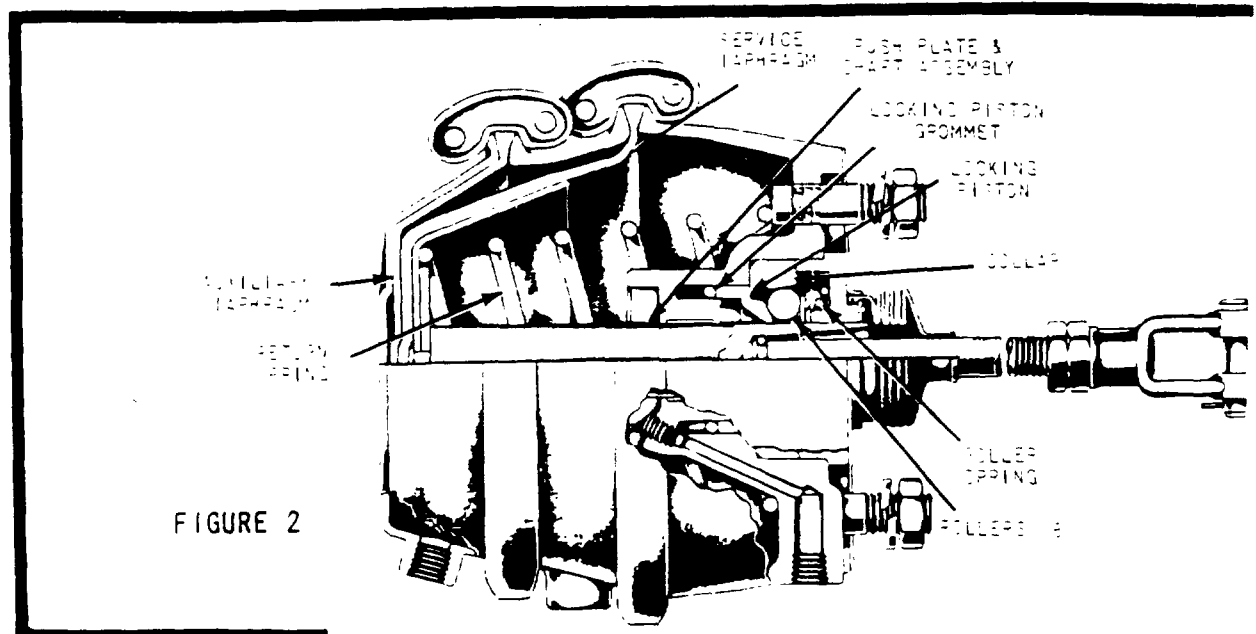


FIGURE 2

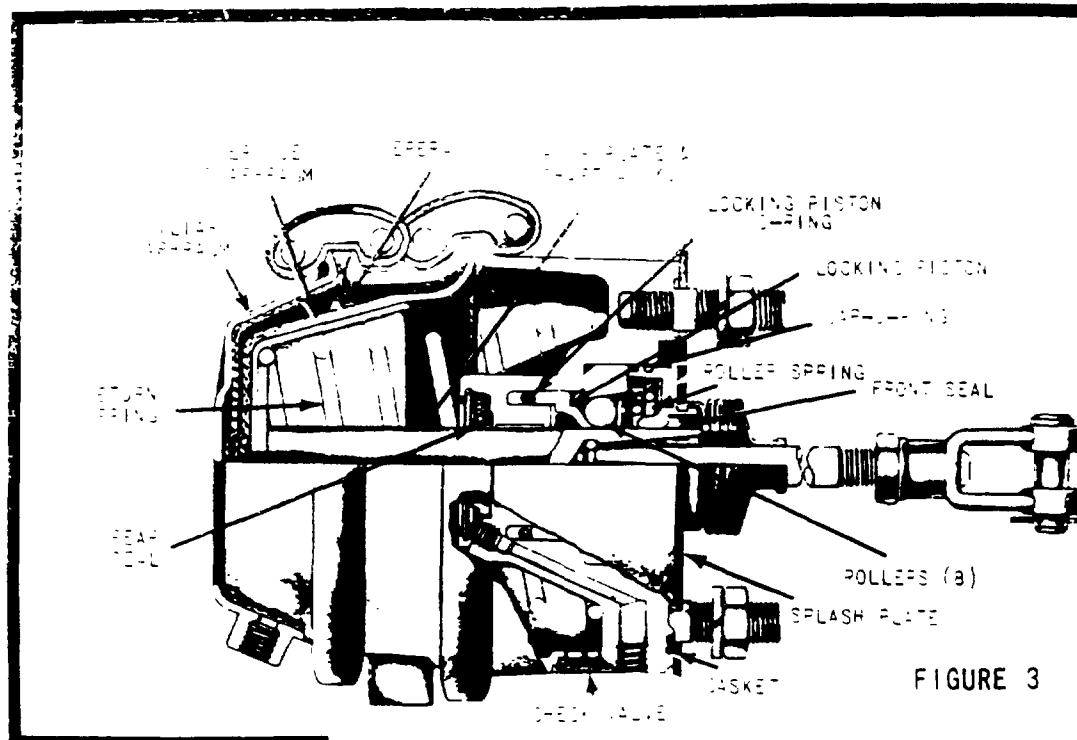


FIGURE 3

2. The service diaphragm was redesigned to provide longer life by incorporating a separator, which is retained by a bead on the service diaphragm preventing contact between the auxiliary and service diaphragms.

Although the operation of the DD3 Actuator remains the same, these design changes incorporate additional new parts, which in some cases obsolete and superseded parts used in the old design actuator. If past service history indicates that a particular DD3 installation has had a problem of moisture accumulation in the lock area and non-pressure cavity area, it is recommended that the complete non-pressure plate be replaced when service becomes necessary on any one major part. If moisture accumulation has not been a problem, then replacement of individual, superseding parts can be made as time or wear indicates.

OPERATION Through the operation of a control valve, air enters the actuator locking port and exerts pressure on the locking piston grommet. The resultant force moves the locking piston forward against the rollers and roller spring. The beveled or ramp end of the piston will pick up and hold the rollers away from the shaft.

NORMAL RUNNING As long as air pressure remains against the locking piston and the rollers are not in contact with the shaft, normal service brake applications will permit the shaft to move freely, back and forth, past the locking mechanism. When a normal service brake application is made, air enters the actuator service port and pushes against the service diaphragm. The diaphragm moves the push plate and shaft out, applying the brakes. Upon release of the service application, the brakes are released.

PARKING To park, air is exhausted from the locking port and air is applied against the auxiliary diaphragm through the auxiliary diaphragm port. When air is exhausted from the lock piston, the roller-spring forces the rollers against the collar and shaft. Air entering the parking port exerts force on the auxiliary diaphragm. The diaphragm moves the push plate and shaft out, applying the brakes. With no air on the lock piston, if the shaft partially retracts it becomes mechanically locked in the applied position when the rollers wedge between the shaft and collar.

NOTE: While in a parked position, when there is a loss of air pressure on the auxiliary diaphragm, the output force on the shaft is reduced. However, the shaft will not retract since its output force is transferred to the mechanical lock mechanism.

RELEASE OF PARKING APPLICATION To release a parking application of the DD3 Actuator, it is necessary to re-apply air pressure to equal a shaft force approximately the same as was used in making the parking application. This is necessary to release the locking rollers so they can be moved away from the shaft when air is re-applied to the locking piston. This can be accomplished by making a heavy service application after the control valve is operated to release the parking application.

To release a parking application, air enters the locking piston and the air on the auxiliary diaphragm is exhausted. A heavy service brake application will be necessary to force the shaft forward sufficiently to allow the locking rollers to dis-engage and unlock the shaft. Upon release of the service application, the return spring will return the shaft to the release position, releasing the parking application.

EMERGENCY OPERATION Through different system arrangements, the DD3 Safety Actuator in conjunction with other automatic or manual air applied valves will operate for emergency situations in the same sequence as described under "Parking".

PREVENTIVE MAINTENANCE General - Depending on experience and type of operation, the drain slot in the actuator non-pressure plate should be checked and cleared of any restricting road grime, mud, ice, snow, etc.

Brakes should be adjusted as is customary with any brake chambers. Push rod travel should be as short as possible without brakes dragging. Excessive travel not only shortens the normal service life of diaphragms but gives slow braking response, wastes air, and could possibly result in decreasing brake torque output.

Push rod to slack adjuster alignment should be checked in both the applied and released positions, the rod should move out and return properly without binding. Also, check the angle formed by the slack adjuster arm and push rod. It should be 90° or greater when the actuator is in the applied or released positions when brakes are adjusted.

EVERY YEAR OR 3600 OPERATING HOURS OR AFTER 100,000 MILES DEPENDING ON TYPE OF OPERATION

Disassemble DD3 Actuator, clean all parts and lubricate locking mechanism.

Install new diaphragms and other rubber parts/or parts if they are worn or deteriorated.

When diaphragms or return spring or both are replaced, like parts in the corresponding actuator on the same axle should also be replaced.

OPERATING AND LEAKAGE CHECKS

OPERATING With the actuator in the released position, make several service brake applications and note that actuators apply and release properly.

Operate parking control valve and observe that actuators apply. While actuators are in a parking position, drain air supply to auxiliary diaphragm and note that actuators remain applied.

Replenish air supply to auxiliary diaphragm. Operate control valve to release parking application, then make a full service application to complete release of actuators. The magnitude of the service brake application to release the brakes may vary on different vehicles due to compressor governor settings. Normally a service application of approximately 70 psi should release the brakes.

LEAKAGE With system pressure up and DD3 actuators in the released position, check drain slot and around the push rod boot with a soapy solution to detect possible leakage by the locking piston grommet.

Make and hold a service brake application and again check the actuator drain slot or exhaust check valve if so equipped for service diaphragm leakage. Continue to hold the service application and coat around the service and auxiliary diaphragm clamping rings with the soapy solution to detect seal leakage.

Operate the actuator control valve to a parking position and check the exhaust port of a service brake application to detect auxiliary diaphragm leakage. This auxiliary diaphragm leakage detection point could be the exhaust port of the foot brake valve, quick release valve or relay valve depending on system. While still in a parking position, the auxiliary diaphragm clamping ring should be coated with the soap solution to detect seal leakage.

Should leakage be detected at the clamping rings in either of the above tests, the clamping ring nuts should be tightened evenly but only enough to stop leakage.

If the DD3 Safety Actuator does not function as described or leakage is excessive, it is recommended that it be returned to the nearest Bendix-Westinghouse authorized distributor for a factory reconditioned actuator under the repair exchange plan. If this is not possible, the actuator can be repaired with genuine Bendix-Westinghouse parts in which case the following should prove helpful.

REMOVING AND INSTALLING

Block and hold vehicle by some means other than air brakes. With the actuators in the released position, disconnect or completely remove air lines from parking and service ports of the actuator. (Note of caution: Air will be exhausted out the line that is connected to the parking port when the control valve is operated. If this line is not removed, it should be disconnected in such a way that it will not whip and cause damage as the air exhausts.) After disconnecting only the parking and service port lines, operate the parking control valve. This action will exhaust the isolated air supply and air from the locking port.

As a safety precaution, the service system should also be drained, if it is separate.

Disconnect air line at actuator lock port.

Remove yoke pin cotter pin and knock out yoke pin.

Remove mounting nuts, then actuator.

INSTALLING

Important - DD3 Safety Actuators must be installed with the exhaust check valve down (if so equipped) and the drain slot pointing down.

Mount Actuator to mounting bracket and tighten securely.

Fasten actuator push rod yoke to slack adjuster with yoke pin. Lock yoke pin with cotter pin. The angle formed by the push rod and slack adjuster arm should be greater than 90°.

Connect air lines to actuator. Take care that the correct line is installed in the correct port.

Adjust brakes.

DISASSEMBLY

NOTE: This procedure covers both the old and new design actuators; for further information, refer to "Description" section.

1. Clean actuator exterior of all road grime and mark in such a way so it can be assembled in the same manner.
2. Remove yoke and yoke lock nuts.
3. Remove splash guard, boot, felt breather, and (gasket - new design only).
4. Remove auxiliary and service clamping ring nuts and bolts.
5. Spread clamping rings slightly, just enough to slip rings off plates. It may be necessary to use a soft mallet to break the clamping rings loose. If clamping rings are to be reused, caution should be taken so they are not distorted.
6. Remove auxiliary pressure plate, auxiliary diaphragm, service pressure plate, service diaphragm (with separator, if present).
7. Place non-pressure plate assembly on a smooth surface with the push plate down.
8. Connect an air supply (shop air) line to the locking port. Apply pressure down on the actuator non-pressure plate; and at the same time, apply air to the locking port. As the shaft is unlocked (released), ease the non-pressure plate back and remove the push plate and shaft assembly with push rod and return spring.
9. While holding cap assembly down against roller spring tension, completely remove four (4) machine screws, release cap assembly, and remove.
10. (New Design Only) Remove retainer from cap by turning in clockwise direction until tabs of retainer line up with slots in cap. Remove retainer spring and seal. Remove inner and outer cap "O" Rings.
11. Remove roller spring, spring seat washer, and eight (8) rollers.
12. Remove collar, piston, and piston "O" ring. NOTE: If necessary, apply air cautiously at the lock port to assist in removal of the above parts.
13. (New Design Only) Remove rear retaining spring by dislodging from groove of plate and remove rear seal.
14. Inspect bearing in shaft bore of non-pressure plate, and remove only if it shows signs of wear and is to be replaced. The push rod should not be removed from the shaft unless it is damaged and requires replacement. To remove rod, place a heavy washer over the rod against the shaft; position a spacer (short length of pipe) and a second washer over the rod (and on top of the spacer). Install yoke lock nut(s) and turn down with a long-handled wrench, pulling the push rod from the shaft.
15. (New Design Only) Remove exhaust check valve from non-pressure plate.

NOTE: The T-Bolts used in the older design and the studs used in the newer design can be removed if necessary.

CLEANING AND INSPECTION

1. Wash all metal parts in a good cleaning solvent and dry thoroughly. It is generally recommended that all rubber parts be replaced; however, any rubber parts that are to be reused should be wiped dry.
2. Discard felt breather.
3. Inspect all parts for excessive wear or deterioration. Particular attention should be given to the piston and collar bores in the non-pressure plate. The air passage from the lock port to piston bore should be checked for restriction and cleaned; if necessary, remove the inspection plug to thoroughly clean this passage.
4. Rollers should be carefully checked, and all rollers replaced if one or more need replacing.
5. Check springs for cracks, distortion, or corrosion.
6. Replace all parts not considered serviceable during these inspections.

If servicing older design actuators, it may be necessary to replace existing parts with parts of the newer design which obsolete and supersede parts of the older design actuator. For further information, refer to section titled "Description".

ASSEMBLY NOTE: This procedure covers both the old and new design actuators; for further information, refer to "Description" section.

1. Line up parts as they were marked prior to assembly.
2. If the bearing in the non-pressure plate was removed, it should be reinstalled or replaced if necessary.
3. Lubricate piston and collar bores, shaft, piston "O" ring, piston and roller cavity liberally with "Never Seez" lubricant (BW 404-M).
4. Position piston "O" ring in piston bore, then piston with smooth end down against "O" ring.
5. Place collar in its bore (chamfer side down).
6. Coat rollers thoroughly and liberally with "Never Seez" lubricant (BW 404-M) and place eight (8) rollers in groove formed by top of piston and collar ramp.
7. Pack roller cavity liberally with "Never Seez" lubricant (BW 404-M).
8. Place roller spring seat washer on top of rollers.
9. Position cone-shaped roller spring on washer with smaller end to washer.
10. (New Design Only) Install "O" rings in cap, small "O" ring in inner bore, large "O" ring on outside of cap, making certain "O" rings are properly seated in grooves.
11. (New Design Only) Place seal in bore of cap. Lip of seal should face front of cap. Place retainer spring on seal, position retainer on spring, compress spring, line up tabs on retainer to slots on cap, and lock retainer in cap by turning 1/4 turn counter-clockwise.
12. Position cap on roller spring. (NOTE: On new design cap, drain hole in cap should be positioned so that it lines up with drain area of non-pressure plate.) Press cap down and hold while installing four (4) machine screws evenly and securely. Install new felt breather.
13. (New Design Only) Turn over non-pressure plate assembly, and install rear seal. Lip of seal faces non-pressure cavity. Install spring retainer, making certain it is retained in groove of non-pressure plate.
14. Install push plate return spring (larger end down).
15. Position push plate and shaft over return spring and press down so shaft moves through lock. The lock should hold shaft position against return spring. If not, check previous assembly procedure.
16. Install separator on service diaphragm, making certain bead on diaphragm engages and retains separator. (NOTE: It is recommended that a new service diaphragm with separator and a new auxiliary diaphragm be used as a set and not mixed with the old style diaphragm (without separator) in any combination. The new style diaphragm with separator can and should be used with both the old and new style actuators.

CAUTION: DO NOT ATTEMPT TO INSTALL SEPARATOR IN COMBINATION WITH THE OLD STYLE SERVICE DIAPHRAGM (WITHOUT RETAINING BEAD).

17. Install service diaphragm and separator, service pressure plate, and clamping ring.
18. Install auxiliary diaphragm, auxiliary pressure plate, and clamping ring.
19. Tighten bolts on both clamping rings evenly and securely.
20. (New Design Only) Install exhaust check valve.
21. If push rod was removed, replace with new rod and new locking ring. Pack shaft cavity with BW 204-M barium lubricant (Piece No. 240176 or Piece No. 246671). Install lock ring in groove on rod and press rod in shaft cavity, making certain rod is locked in place in cavity of shaft.
22. (New Design Only) Install new gasket on non-pressure plate.
23. Install boot over cap assembly. Install splash plate over boot.