

Technical Bulletin

Bulletin No.: PRO-11-01

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Page: 1 of 3

Subject: **AH-4 Air-Over-Hydraulic Intensifier**

Ref: Figures 1, 2, 3, 4, 5, and 6

The AH-4 Air-Over-Hydraulic Intensifiers have been in use for approximately three years and service requirements are starting to materialize.

The AH-4 uses one basic master cylinder design in combination with either a type 50, type 36 or a type 30 Rotochamber giving a pressure ratio of 23.5:1, 17:1 or 13.5:1 respectively. Master cylinder volume for type 50 and 36 is 6 inch³; for type 30 Master Cylinder Volume is 4.8 inch³.

Hydraulic fluid is supplied to the master cylinder from either a direct or a remote mounted reservoir. Most AH-4's use hydraulic brake fluid; however, certain models, equipped with different seals, use mineral type hydraulic oil.

Most assemblies are equipped with a stroke warning switch which will close upon excessive stroke, lighting a light at the operator's station.

The Rotochambers normally breathe from the non-pressure area through four openings between the head and shell; however, certain models designed for dusty operating conditions are designed with a close fit between head and shell and breathe through an air filter in the head.

Mounting brackets are normally supplied at each end of the rotochamber for either right of left-hand mounting and the high pressure hydraulic connection may be on either the right or left side of the master cylinder.

Figure 1 is a cross section of an assembly with integral reservoir.

Figure 2 shows a section of a 3/8" NPT adapter for connecting a remote reservoir.

Figure 3 shows an adapter with 1/4" flared tube seat.

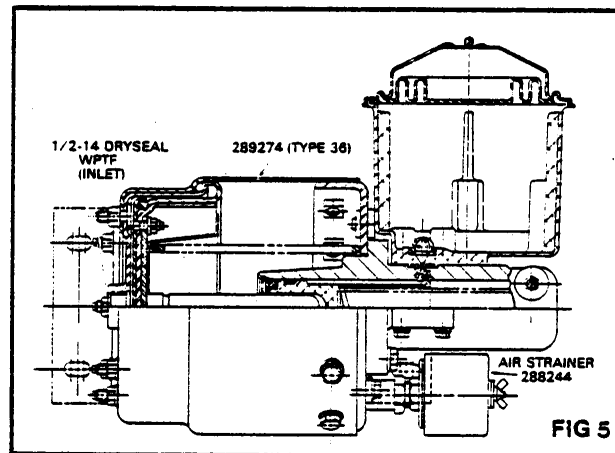
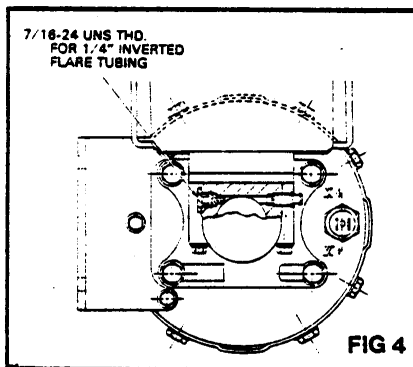
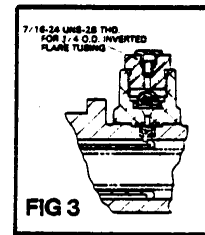
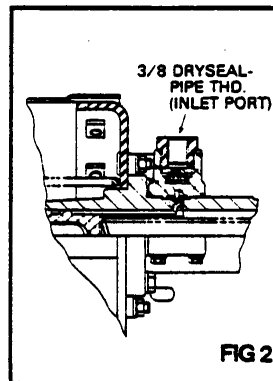
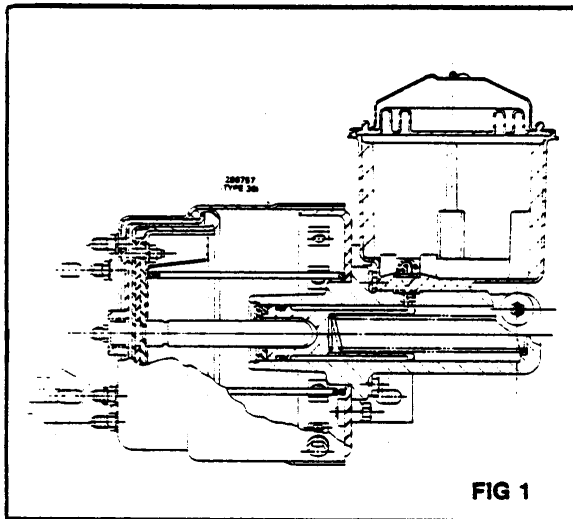
Figure 4 shows an end view of a master cylinder with left-hand mounting bracket and right-hand hydraulic delivery.

Figure 5 shows a cross section of the dust-resistant version with an air filter for breathing non-pressure air.

Figure 6 is a chart of the most popular Pc. Nos. indicating their configuration reference the foregoing figures and also vehicles on which most of the OEM installations have been made.

Service Data for AH-4's is available in SD-11-1 publication.

Maintenance kits for the master cylinder are available under Pc. No. 289286 for brake fluid and No. 289287 for mineral oil.



AH-4	ROTOCHAMBER	MASTER CYLINDER	RESERVOIR		DELIVERY PORT		BRACKET LOCATION		ORIGINAL EQUIPMENT INSTALLATION	
			Integral	Remote	Left	Right	Left	Right	Ford	Mack Harnischfeger
286756 (288857)	Note: 286757 (36)	288382 ^c		X		X		X	X	
287044 (286754)	286745 (50)	286746	X			X		X	X	
288393 (288856)	286757 (36)	286746	X			X		X	X	
286761	286757 (36)	286755		X	X			X		
287070	286745 (50)	287069		X		X	X			X
287071	286757 (36)	287069		X		X	X			X
289382*	286745 (50)	287069		X		X	X			X
289384*	286757 (36)	287069		X		X	X			X
289273 ^b	289274 (36)	286746	X			X		X		X
288568	288591 (30)	286746	X			X		X		
288569	288591 (30)	287069		X		X		X		

* WARNING SWITCH NOT INCLUDED

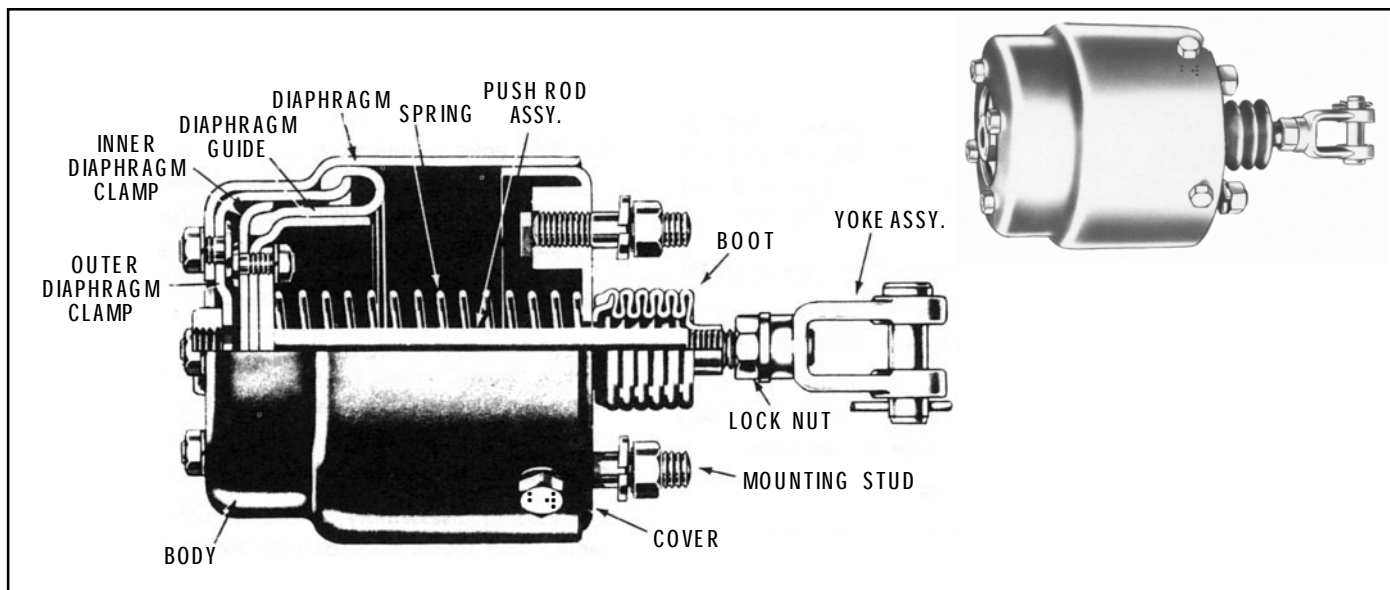
b NON-PRESSURE AIR BREATHS THRU AIR STRAINER 288244, PER FIGURE #5

c HYDRAULIC INLET, PER FIGURE #3

NOTE: UPPER NUMBER IN BRACKET NOW OBSOLETE, SUPERCEDED BY NUMBER IN PARENTHESIS.

PRO-11

Rotochambers



DESCRIPTION

The rotochamber is an actuator which converts the energy of air pressure into mechanical force. The type number of the rotochamber indicates the actuator's diaphragm effective area (Type 30 - 30 sq. in. of diaphragm) and the various sizes available give a wide range of output force and length of stroke. The rolling type diaphragm provides long life and gives a constant output force throughout the entire stroke.

One end of the diaphragm is clamped to the inside wall of the body by the outer clamp. The other end of the diaphragm is clamped between the diaphragm guide and inner diaphragm clamp. The cover is fastened to the outer body by cap screws. Mounting studs are used to mount the chambers. A boot retained by a boot retainer is used to prevent entrance of moisture through the hole in the cover. A lock nut and yoke with pin are screwed on the threaded push rod. Most rotochambers now have 3/8 in. NPTF inlet ports. The long stroke Type 50 employ a 1/2 in. NPTF inlet port.

OPERATION

Controlled air pressure enters the rotochamber through the inlet port and acts upon the diaphragm, moving the diaphragm guide and diaphragm forward. The diaphragm moves along the inside wall of the cylinder body with a smooth rolling

motion. The forward motion of the diaphragm guide and diaphragm forces the push plate and push rod forward.

When the rotochamber is used to actuate cam type foundation brake assemblies, the yoke is connected to a slack adjuster which in turn is connected to the brake cam shaft. This forward motion of the push rod rotates the slack adjuster, cam shaft and cam applying the vehicle brakes.

The rotochamber is also used in industrial applications and in such cases may be used in clamping or holding operations.

The greater air pressure admitted to the rotochamber, the greater the force applied by the push rod and, conversely, the less air pressure applied to the rotochamber, the less force applied by the push rod. Push rod force is determined by multiplying the air pressure delivered by the effective diaphragm area. For example, if 60 psi is admitted to the Type 30 rotochamber the lineal force on the end of the push rod is approximately 1800 lbs.

When air pressure is released from the rotochamber the rotochamber spring returns the slack adjuster (if applicable), push rod, diaphragm guide and diaphragm to the released position.

PREVENTIVE MAINTENANCE

- A. Every month, 8,000 miles, or after 300 operating hours, depending on type of operation:
1. Check push rod travel and adjust travel at the slack adjuster if needed. Push rod travel should be as short as possible without brakes dragging. Excessive push rod travel reduces braking efficiency, shortens diaphragm life, gives slow braking response and wastes air.
 2. Check push rod to slack adjuster alignment from release to full stroke position to be sure push rod moves out and returns properly without binding at the cover hole or with other structures. Also check the angle formed by the slack adjuster arm and push rod. It should be 90° or greater when the chamber is in the applied or released positions.
 3. Check tightness of mounting nuts. Check cotter pins to make sure they are in place.
 4. Check all hoses and lines. They should be secure and in good condition.
- B. Every year or after each 100,000 miles or 3,600 operating hours, depending on type of operation.
1. Disassemble and clean all parts.
 2. Install new diaphragm or any other parts if they are worn or deteriorated.

When the diaphragm, spring, or both are replaced they should be replaced in the corresponding chamber on the same axle.

OPERATING AND LEAKAGE TESTS

- A. Operating Test
1. Apply brakes and observe that the push rods move out promptly and without binding.
 2. Release brakes and observe that the push rods return to the released position promptly and without binding.
 3. Check push rod travel. Push rod travel should be as short as possible without brakes dragging. Adjust travel of push rod at slack adjuster if necessary.
- B. Leakage Test
1. Loosen rubber boot from around push rod hole in cover. Make and hold a full brake application.

Coat area with soap suds and check for leakage. No leakage is permissible. If leakage is detected, the diaphragm must be replaced.

REMOVING

1. Block vehicle wheels.
2. Disconnect line to rotochamber.
3. Remove the yoke pin.
4. Remove the rotochamber.

INSTALLING

1. Before installing chamber, check bracket for distortion, cracks or any condition which might cause chamber misalignment or malfunction.
2. Re-install the chamber on the bracket. Tighten the mounting nuts securely and evenly.
3. Connect the air lines to the rotochamber and check for leakage.
4. Insert the push rod yoke pin through the hole in the yoke and slack adjuster. Make sure the same hole location in the slack adjuster on each side of the axle is used.
5. The yoke should be adjusted on the push rod so that with brakes released the angle formed by the push rod and slack adjuster will be greater than 90° and all slack adjusters should be at the same angle. With properly adjusted brakes applied, the angle should still be greater than 90°.

DISASSEMBLY

For ease in disassembly, if the rotochamber has been in service and shows signs of rust accumulation, it is recommended that the chamber be immersed and soaked in the cleaning or rust dissolving solvent for 24 hours.

1. Remove yoke and lock nut from push rod.
2. Remove rubber boot.
3. Remove cap screws from cover.
4. Remove cover, springs and spring guides (if so equipped).
5. Remove nuts from body. These nuts secure the outer clamp to the body and are located at the air inlet end of the rotochamber.
6. Grasp the push rod and by pulling and wiggling the entire assembly consisting of push rod and plate, diaphragm guide, diaphragm, inner and outer clamps should ease out of the body.
7. Straighten the rolled diaphragm.
8. Remove outer diaphragm clamp.
9. Remove nuts from inside of diaphragm guide.
10. Disassemble inner diaphragm clamp, diaphragm and push plate rod assembly from the diaphragm guide.

CLEANING AND INSPECTION

1. Clean all metal parts in a good cleaning solvent.
2. Carefully inspect all metal parts for cracks, distortion or damage. Replace any parts not considered serviceable.
3. Replace diaphragm and rubber boot.

ASSEMBLY

1. Position the diaphragm on end in the inner diaphragm clamp. The smaller diameter end of the diaphragm should be against the diaphragm clamp.
2. Place and install the diaphragm guide within the diaphragm and over the inner diaphragm clamp studs.
3. Install the push plate push rod assembly within the diaphragm guide and over the inner diaphragm clamp studs.
4. Install nuts on the inner diaphragm clamp studs and tighten securely.
5. Place the assembly consisting of the push rod, push plate, diaphragm guide, diaphragm and inner clamp inside of the outer clamp.
6. Roll the free end of the diaphragm back and over the end of the outer diaphragm clamp.
7. Lubricate the inside wall of the body and the rolled surface of the diaphragm with Murphy's oil soap.
8. Slide the above assembly into the body. The end of the diaphragm should fit snugly against the shoulder in the body. Position the outer diaphragm clamp studs through the holes at the end of the body, install nuts and tighten securely.
9. Install spring guide (if so equipped) and install spring over push rod, and install spring guide on spring (if so equipped).
10. Install cover over push rod and into body. Attach cover to body with cap screws, tightening securely.
11. Install boot over push rod attaching to cover.
12. Install lock nut and yoke on push rod.

TESTING OF REBUILT ROTOCHAMBER

Perform "Operating and Leakage" checks.

WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS TO AVOID PERSONAL INJURY OR DEATH:

When working on or around a vehicle, the following general precautions should be observed at all times.

1. Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses.

2. Stop the engine and remove ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be removed. Where circumstances require that the engine be in operation, **EXTREME CAUTION** should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated or electrically charged components.
3. Do not attempt to install, remove, disassemble or assemble a component until you have read and thoroughly understand the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.
4. If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning **ANY** work on the vehicle. If the vehicle is equipped with an AD-IS™ air dryer system or a dryer reservoir module, be sure to drain the purge reservoir.
5. Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.
6. Never exceed manufacturer's recommended pressures.
7. Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.
8. Use only genuine Bendix® replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.
9. Components with stripped threads or damaged parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle and component manufacturer.
10. Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.





Service Data

SD-11-1357

Bendix® AH-4™ Air Hydraulic Intensifier

DESCRIPTION

The AH-4™ is an air-over-hydraulic intensifier available with pressure ratios of 13.5 to 1, 17 to 1 and 23.5 to 1. The air chamber is a rotochamber, either type 30, 36 or 50. The master cylinder design is identical in all units; however, the master cylinder is available with seals for hydraulic brake fluid, or for mineral oil. The master cylinder displaces 6 cubic inches with the type 36 or type 50 actuator and 4.6 cubic inches with the type 30.

The type 30 unit is designed for dusty operation, as in off-highway, with the non-pressure cavity protected by a tight fitting head and a filter for breathing non-pressure air.

The master cylinder may have a remote or direct mounted reservoir. Fig. 1 shows a 23.5 to 1 unit with integral reservoir.

OPERATION

The AH-4™ intensifier is normally used to provide hydraulic pressure to hydraulic disc brakes on an air braked vehicle. It may be used in any application where it is desired to "intensify" available air pressure to a higher hydraulic pressure. 100 psi air pressure introduced to the center port at the rear of the rotochamber will produce approximately 1,350 psi hydraulic pressure at the master cylinder delivery port with a type 30 rotochamber, 1,700 psi with a type 36 rotochamber, and approximately 2,350 psi with a type 50 rotochamber.

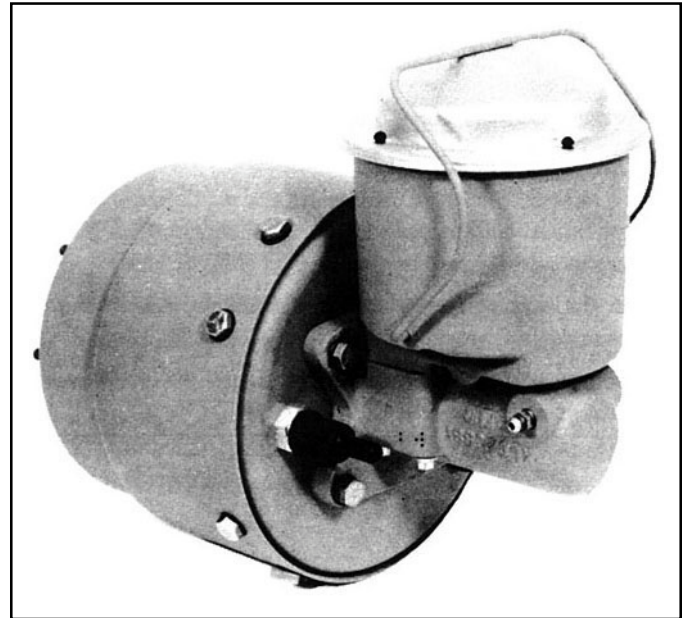
PREVENTIVE MAINTENANCE

Important: Review the warranty policy before performing any intrusive maintenance procedures. An extended warranty may be voided if intrusive maintenance is performed during this period.

Because no two vehicles operate under identical conditions, maintenance intervals will vary. Experience is a valuable guide in determining the best maintenance interval for a vehicle.

Every Month, After 8,000 Miles, or 300 Operating Hours

1. Remove the cover and gasket from the brake fluid reservoir, taking extreme care to first remove all dirt and foreign material so that no foreign material is permitted to get into the hydraulic fluid. If the fluid level is low, proper fluid should be added. **CAUTION** - The cover and gasket will each indicate whether hydraulic brake fluid or mineral oil should be added. The gasket for brake fluid is black and the gasket for mineral oil is green.



2. Check the stroke warning switch by grasping the switch extension rod underneath the rubber boot and pulling firmly. With the ignition turned on, the warning light in the cab should light. **NOTE:** If the warning light comes on during a service application, the vehicle should be brought in for service immediately.
3. Check tightness of mounting nuts, air and hydraulic fittings.

Every 12 Months, 100,000 Miles, or 3,600 Operating Hours

1. Disassemble and clean all parts.
2. Install new rotochamber diaphragm, reservoir gasket, seals or any parts worn or damaged.

OPERATING AND LEAKAGE TESTS

Operating Test

1. With the air system built up to governor cut-out pressure, make and hold a full brake application. Hold for at least 5 minutes. Check the rear of the rotochamber and the rotochamber head vents for air leakage by coating with a soap solution.
2. While still holding the brake application, check for hydraulic fluid leaks at all fitting connections and at the disc brake calipers.

3. Observe the stroke warning light. If the master cylinder piston seal leaks, the master cylinder, under sustained pressure, will slowly stroke until the stroke warning switch is activated.

REMOVAL FROM VEHICLE

1. Disconnect the hydraulic line from the delivery port of the master cylinder and allow the hydraulic fluid to drain into a suitable receptacle. The drainage may be expedited by removing the reservoir cover and gasket.
2. Disconnect the air line from the rotochamber, the fluid supply line from the master cylinder (in the case of remote mounted reservoirs), and the electrical connections from the stroke warning switch mounted in the head of the rotochamber.
3. Remove the nuts from the studs which hold the mounting brackets and remove the AH-4™ intensifier from the vehicle.

INSTALLING ON VEHICLE

1. Remount the AH-4™ intensifier, reconnect the air delivery line to the rotochamber and the electrical connections to the stroke warning switch.

2. In the case of remote mounted reservoir, reconnect the reservoir to the master cylinder.
3. Before adding hydraulic fluid, cycle the AH-4™ intensifier very carefully by making a very light brake application. The rotochamber should extend to full stroke and operate the stroke warning switch, causing the warning light to come on in the cab. This will test the stroke warning system. Release the application and reset the stroke warning switch.
4. Remove plugs, reconnect the fluid lines and bleed the master cylinder. The master cylinder itself may be bled by gravity by filling the reservoir and opening the bleeder fitting opposite the discharge port. When clear fluid flows from the bleeder fitting, it may be closed. If the rest of the system needs bleeding, it may be done by opening the appropriate bleed fitting and cycling the AH-4™ intensifier. Hydraulic brake fluid equivalent to DOT 3 specifications should always be used. Some AH-4™ intensifier units are designed to be used with mineral oil, in which case, the reservoir cover will clearly so designate. Rubber parts for use with mineral oil are color coded. Reservoir gasket diaphragm is green, seals and o-rings are brown.

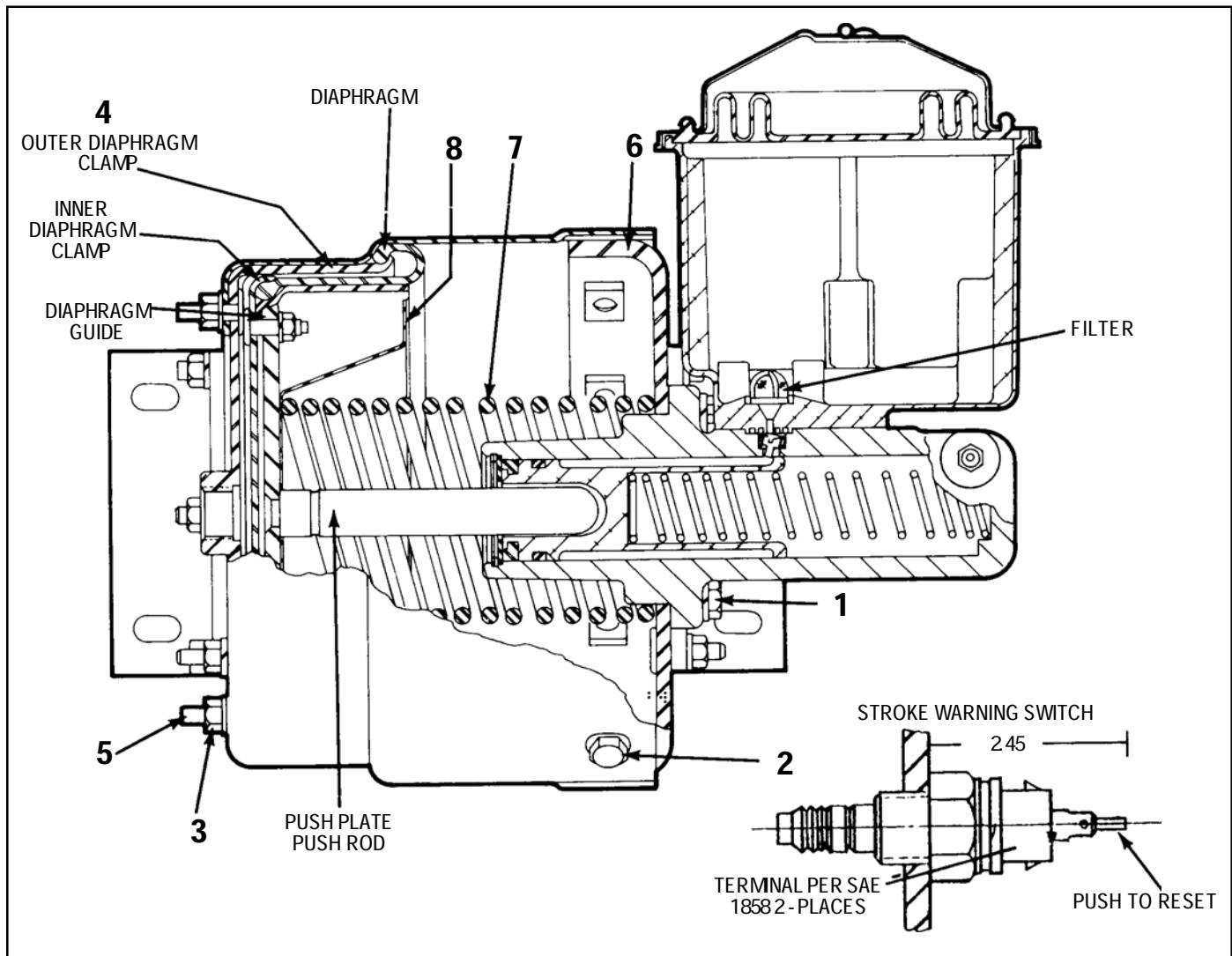


FIGURE 1

DISASSEMBLY

Rotochamber from Master Cylinder FIGURE 1

1. Remove four cap screws (1), and remove the master cylinder from the rotochamber.

Rotochamber

1. Remove the Gap screws (2) which hold the rotochamber head in the shell and remove the head (6), return spring (7), and spring guide (8).
2. Remove the nuts (3) from the body which secure the outer clamp (4) to the body. On some units, one of the mounting brackets is also retained by three of these nuts.
3. Place body, open end down on bench and tap the ends of the studs (5) with a brass drift, lead or plastic hammer. The studs should be tapped on one side of the air inlet and then the other alternately, to free the outer clamp.
4. Grasp the push rod and, by pulling and wiggling the entire assembly consisting of push rod and plate, diaphragm guide, diaphragm, inner and outer clamps should ease out of the body.
5. Remove the outer clamp.
6. Remove nuts from inside of diaphragm guide.
7. Disassemble the inner diaphragm clamp, diaphragm, push plate rod assembly, and diaphragm guide.
8. Remove the stroke warning switch from the rotochamber head and bench test for electrical integrity. If OK, replace in head.

DISASSEMBLY

Master Cylinder FIGURE 2

1. Clean exterior of master cylinder and drain any remaining fluid. In the case of remote mounted reservoir, drain and clean the reservoir.
2. Secure master cylinder in a vise. Depress piston (1) Fig. 2, at least 1/2 in. and hold. This may be done with a simple tool as shown in Figs. 3 and 4. Remove the four self-threading bolts (9) securing the adapter block or the reservoir to the master cylinder. Remove the adapter block or reservoir and the compensating valve (3) and spring (11).

CAUTION The compensating valve must be removed before any attempt is made to remove the hydraulic piston assembly (see Fig. 5).

3. Remove retaining ring (8) and stop washer (7).
4. Remove piston holding tool and remove piston (1) and spring (4).
5. Remove cap nut (10) from adapter block. Remove o-ring (2) from cap nut and compensating valve seal (5) from adapter block or reservoir.

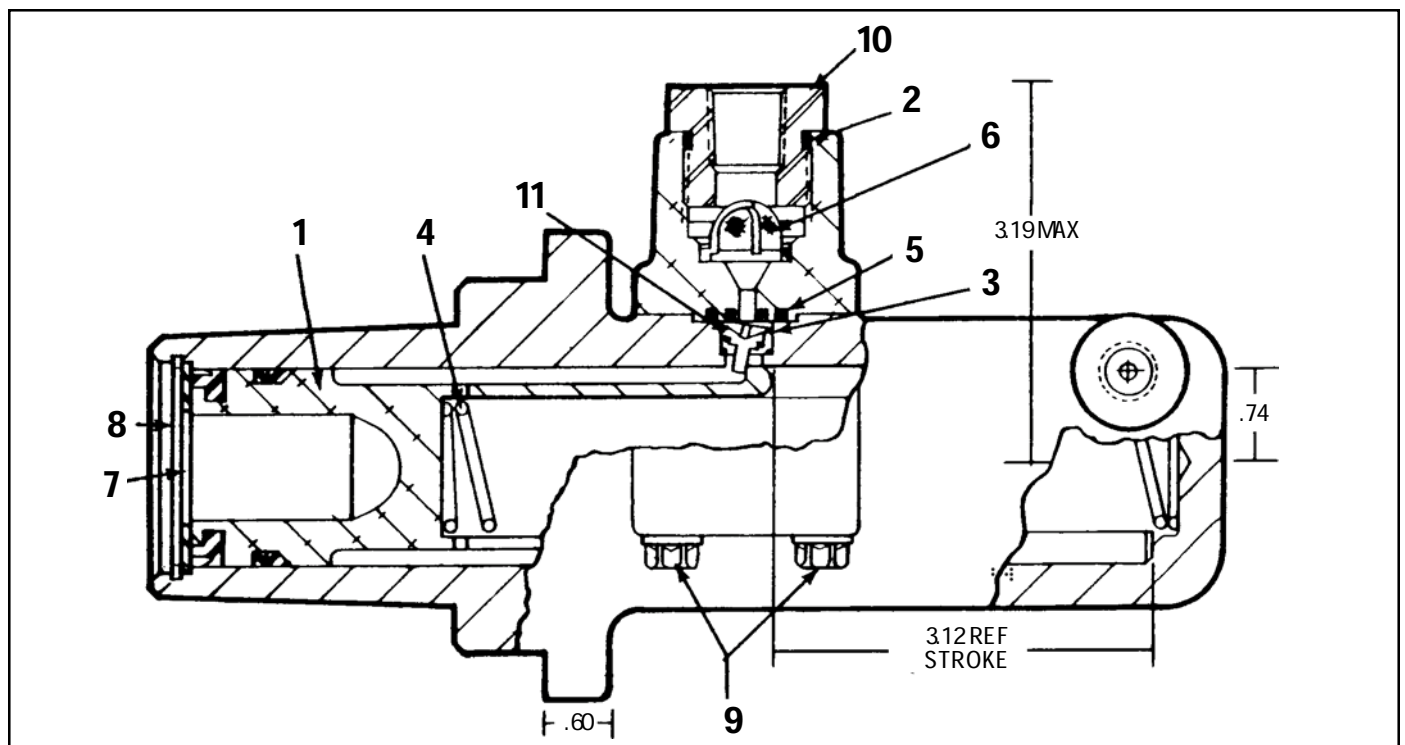


FIGURE 2

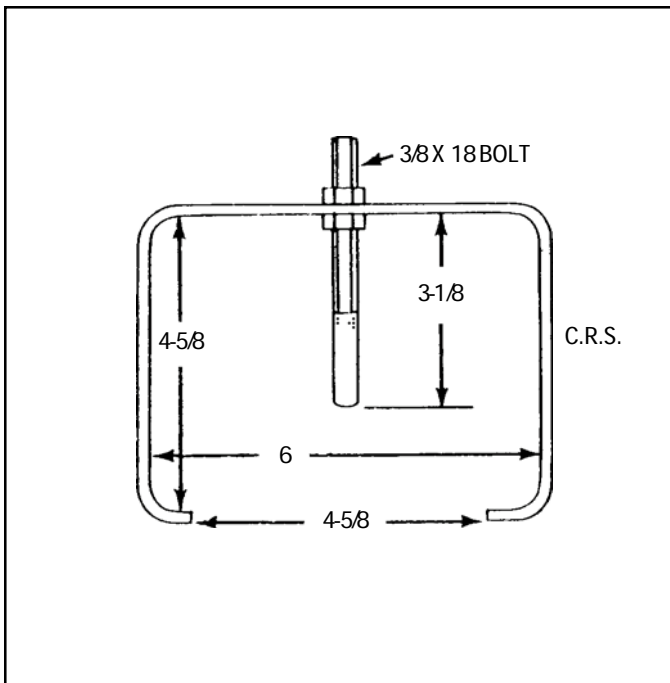


FIGURE 3

ASSEMBLY

Rotochamber

1. Position the diaphragm on end in the inner diaphragm clamp (Fig. 1). The smaller diameter end of the diaphragm should be against the diaphragm clamp.
2. Place and install the diaphragm guide within the diaphragm and over the inner diaphragm clamp studs.
3. Install the push plate push rod assembly within the diaphragm guide and over the inner diaphragm clamp studs.
4. Install nuts on the inner diaphragm clamp studs and tighten securely (55-70 inch pounds)
5. Place the assembly consisting of the push rod, push plate, diaphragm guide, diaphragm, and inner clamp inside of the outer clamp.
6. Roll the free end of the diaphragm back and over the end of the outer diaphragm clamp.
7. Lubricate the inside wall of the body and the rolled surface of the diaphragm with BW652M Type 2.
8. Slide the above assembly into the body. The end of the diaphragm should fit snugly against the shoulder in the body. Position the outer diaphragm clamp studs through the holes at the end of the body, install nuts and tighten securely. Torque to 100-125 inch pounds.
9. Install spring guide, and install spring over push rod.
10. Install cover over push rod and into body. Attach cover to body with cap screws, tightening securely. Torque to 110-150 inch pounds.

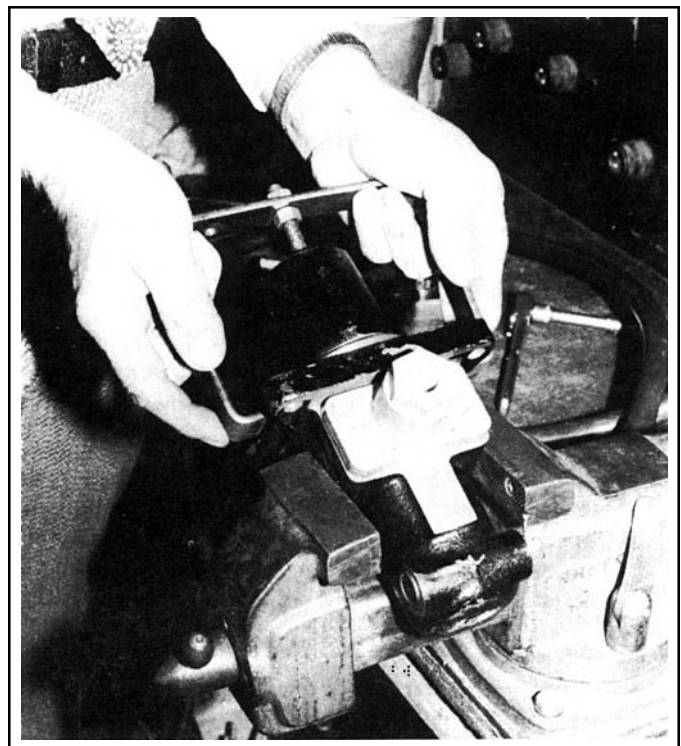


FIGURE 4

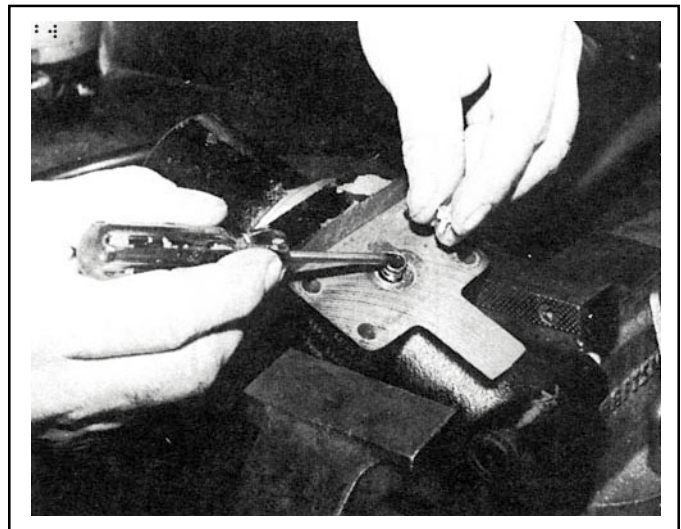


FIGURE 5

ASSEMBLY

Master Cylinder

1. Wash the cap nut, adapter block, and cylinder castings with alcohol or mineral spirits and dry thoroughly.
2. Carefully clean the filter screen. (6)

Continued on Page 5.

3. Install the new o-ring (2) on the cap nut after lubricating with the fluid to be used in the master cylinder or Dow Corning 55-M pneumatic grease. Thread the cap nut in the adapter block and torque to 300 inch pounds.
4. Coat the new compensating seal (5) with fluid or Dow Corning 55-M pneumatic grease and install in mating grooves in bottom of adapter block or reservoir.
5. Coat bore in master cylinder with fluid to be used, place spring (4) in piston assembly (1) and slide both into bore of master cylinder (fig. 6).

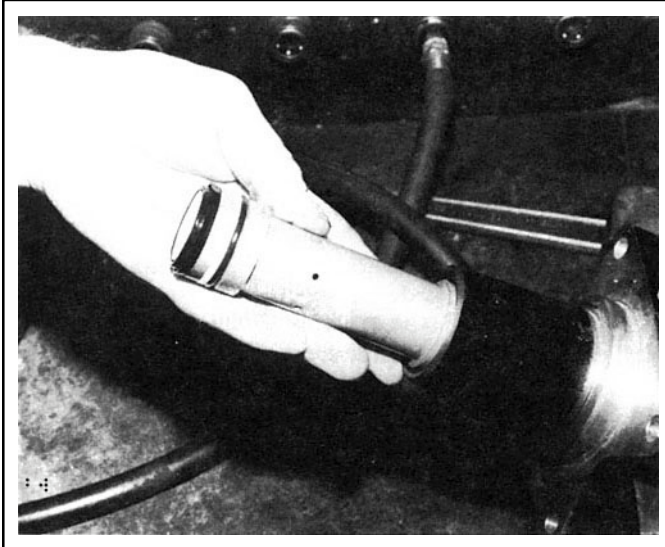


FIGURE 6

6. Place the stop washer (7) and retaining ring (8) over the center post of the retaining tool, depress the piston (1) (see Fig. 7). Make certain the retaining ring is properly seated in its corresponding groove in the master cylinder casting (see Fig. 8). **CAUTION - Keep retaining tool in place until step 8 is completed!!**

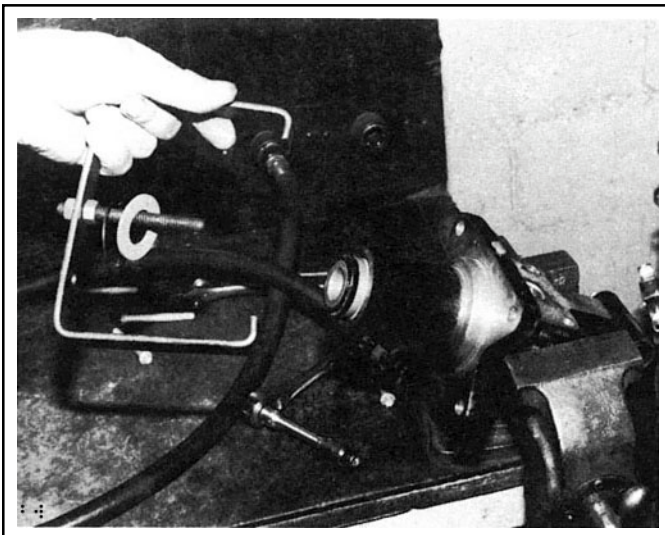


FIGURE 7

7. With piston still depressed, install compensating spring (11) and compensating valve (3). Set adapter block (or reservoir) in place. The master cylinder casting should preferably be held in a horizontal position for this operation. Start the four self-threading bolts (9) by hand to prevent cross threading and torque to 150- 200 inch pounds. **Care should be taken that the compensating valve is properly located before the adapter block or reservoir is located and snugged down (Fig. 9).** The piston may now be released by removing the retaining tool.

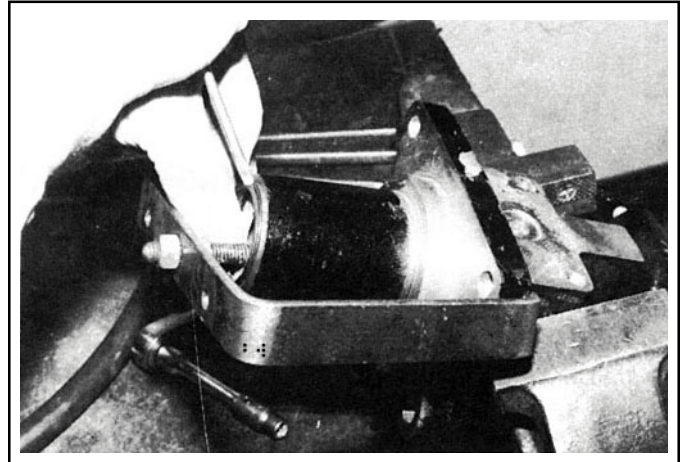


FIGURE 8

8. A simple check may be made to determine that the compensating valve is properly installed. Apply air pressure on the discharge port of the master cylinder. With the piston released, air should back flow through the compensating valve and out the adapter fitting or reservoir. Depress the piston at least 1/4 in. Air pressure should now be trapped in the master cylinder and there should be no evidence of back flow out the adapter block or reservoir.

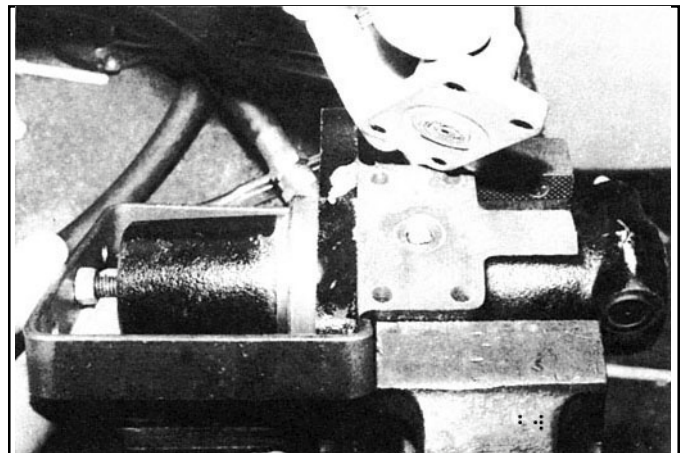


FIGURE 9

CAUTION - 50 psi air pressure will create approximately 100 pounds of additional reactive force on the piston. The piston retaining tool should, therefore, be used for this test.

9. Install the master cylinder on the rotochamber with four 3/8 in. cap screws torqued to 300 inch pounds.

WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS TO AVOID PERSONAL INJURY OR DEATH:

When working on or around a vehicle, the following general precautions should be observed at all times.

1. Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses.
2. Stop the engine and remove ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be removed. Where circumstances require that the engine be in operation, **EXTREME CAUTION** should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated or electrically charged components.
3. Do not attempt to install, remove, disassemble or assemble a component until you have read and thoroughly understand the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.
4. If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning **ANY** work on the vehicle. If the vehicle is equipped with an AD-IS™ air dryer system or a dryer reservoir module, be sure to drain the purge reservoir.
5. Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.
6. Never exceed manufacturer's recommended pressures.
7. Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.
8. Use only genuine Bendix® replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.
9. Components with stripped threads or damaged parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle and component manufacturer.
10. Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.



TYPE 36 ROTOCHAMBER

All units on this page use brake fluid.

The AH-4 Air Hydraulic Intensifier is a device used to convert air pressure to hydraulic pressure. It is a combination of two components; a specially designed Rotochamber and Hydraulic Master Cylinder.

The AH-4 is used to provide pressure to hydraulic disc brakes on air braked vehicles. The units are used on both on-highway and off-highway vehicles.

For complete service/maintenance information, see Service Data Sheet SD-11-1.

Maintenance Kits for Master Cylinders:
For Brake Fluid — Pc. No. 289286
For Mineral Oil — Pc. No. 289287

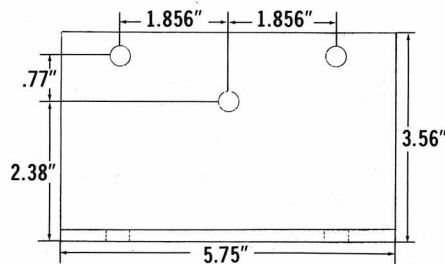
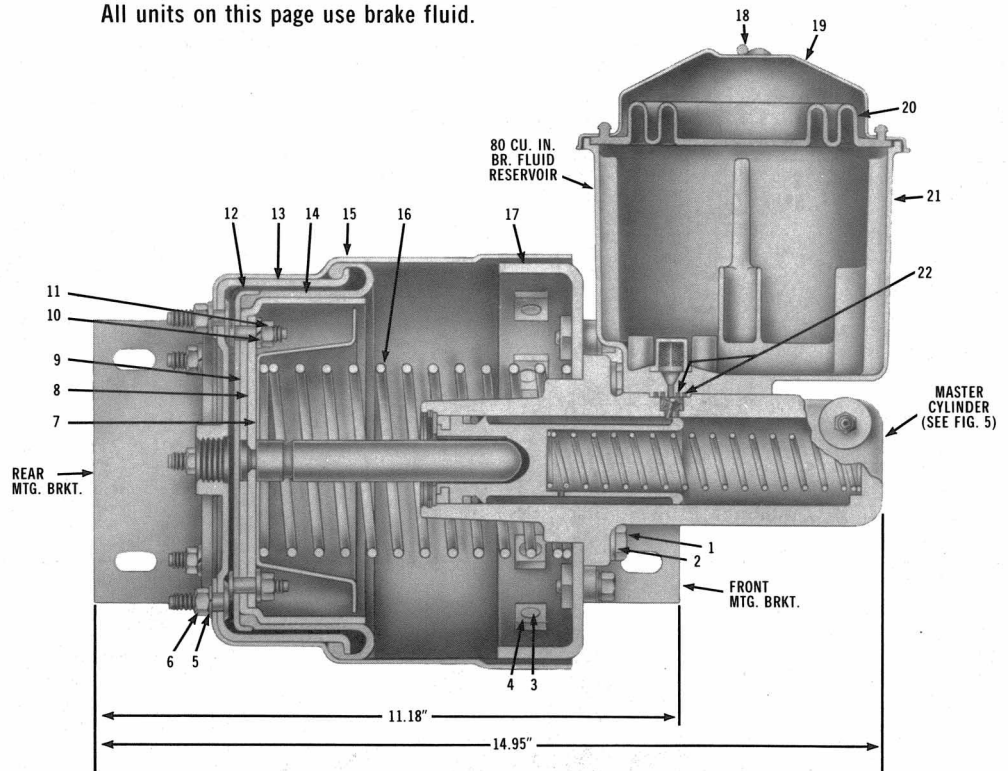
Power Ratio — 17:1
Max. Displacement — 6 cu. in.

Weight — Remote Res. — Approx. 32 Lbs.
Integral Res. — Approx. 37 Lbs.

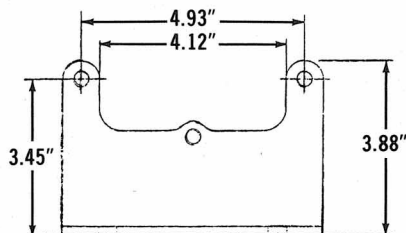
VMRS No. 13-006

Note: Detail part numbers may differ depending on type of fluid (mineral oil or brake fluid) used, and should not be interchanged.

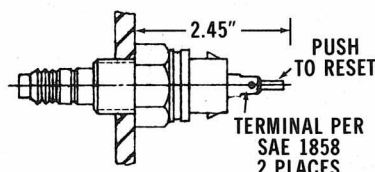
For Intensifier with Type 50 Rotochamber, see Catalog 11-B-1.



MOUNTING BRACKET PC. NO. 290690
(REAR)



MOUNTING BRACKET PC. NO. 290691
(FRONT)



STROKE WARNING SWITCH

COMMON SERVICE PARTS

NO.	PC. NO.	QTY.	DESCRIPTION	NO.	PC. NO.	QTY.	DESCRIPTION
1	291833	3	CAP SCREW 3/16"	13	286759	1	OUTER DIAPHRAGM CLAMP
2	201318	3	LOCK WASHER 3/16"	14	231534	1	DIAPHRAGM
3	231826	8	CAP SCREW 3/8"	15	290958	1	BODY
4	201504	8	LOCK WASHER 3/8"	16	231540	1	SPRING
5	202982	8	LOCK WASHER 1/2"	17	286760	1	COVER COMPLETE
6	204214	8	HEX NUT 3/16"	18	290931	1	BAIL
7	290688	1	SPRING GUIDE	19	290930	1	RESERVOIR
8	286758	1	PUSH ROD COMPLETE	20	290935	1	DIAPHRAGM
9	231536	1	DIAPHRAGM GUIDE	21	287157	1	RESERVOIR BODY COMPLETE
10	202981	8	LOCK WASHER 1/4"	22	292214	1	SEAL (BRAKE FLUID)
11	203105	8	HEX NUT 1/4"		292939	1	SEAL (MINERAL OIL)
12	277830	1	INNER DIAPHRAGM CLAMP				

SUB ASSY. AND DETAIL REFERENCE

AH-4 HYD. INTENSIFIER ASSY. PC. NO.	TYPE 36 ROTO- CHAMBER ASSY.	MASTER CYL. ASSY. (SEE FIG. 5)	WARNING SWITCH	BOOT (ON WARNING SW.)	DELIVERY PORT (SEE FIG. 4)		BRACKET LOCATION		J.E.M. INSTALLATION IDENTIFICATION		
					LEFT	RIGHT	LEFT	RIGHT	FORD PC. NO.	MAK	HARNISCH- FEGER
INTEGRAL RESERVOIR											
288856	286757	286746	286747	NONE		X		X	D6HT-2B571-CA		
A289273	289274	286746	287131	290959		X		X		X	
REMOTE RESERVOIR											
B286761	286757	286755	287131	290959	X			X		X	
B287071	286757	287069	287131	290959		X	X			X	
C288857	286757	287069	NONE	NONE		X	X		D6HT-2B571-DA		
B289384	286757	286746	286747	NONE		X	X			X	

A — SEE FIG. 3 BACK OF PAGE
B — SEE FIG. 1 BACK OF PAGE
C — SEE FIG. 2 BACK OF PAGE

TYPE 36 ROTOCHAMBER

REMOTE RESERVOIR VERSIONS

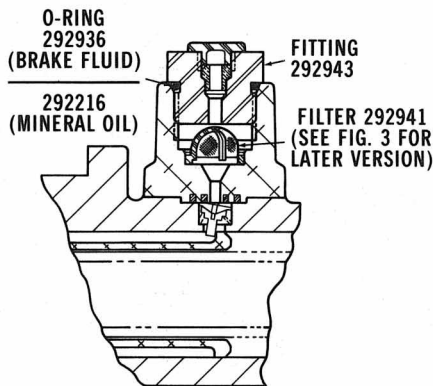


FIG. 2
ADAPTER WITH 1/4" FLARED
TUBE SEAT

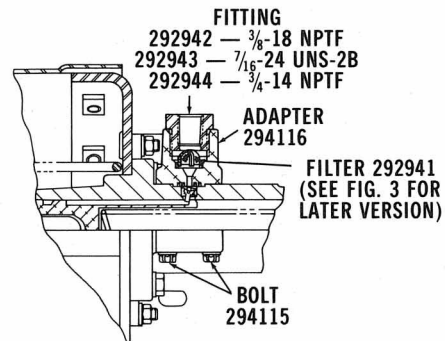


FIG. 1
3/8" NPT ADAPTER FOR CONNECTING
REMOTE RESERVOIR

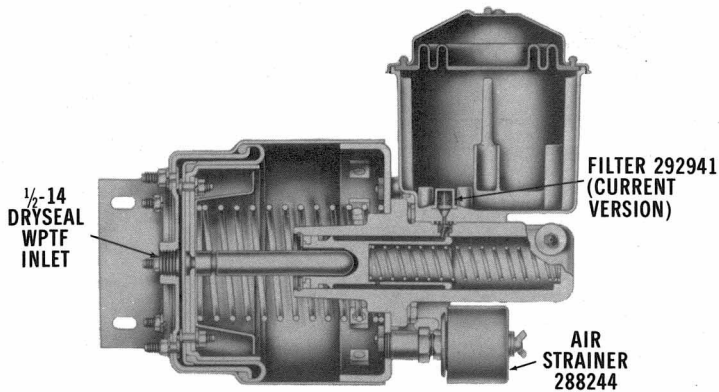


FIG. 3
DUST RESISTANT VERSION
WITH AIR STRAINER

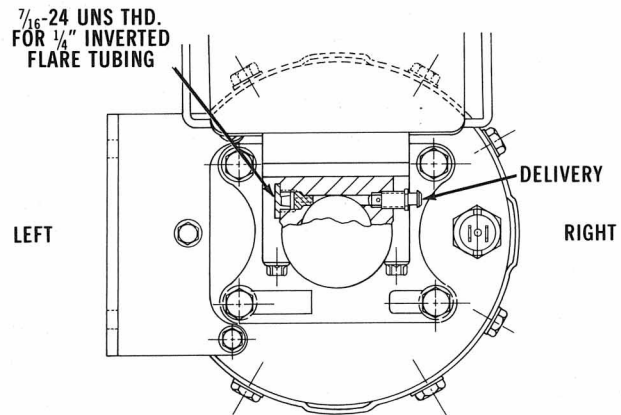


FIG. 4
LEFT HAND MOUNTING BRACKET
& RIGHT HAND HYDRAULIC DELIVERY

MAINTENANCE KITS FOR MASTER CYLINDERS

MASTER CYLINDERS USING BRAKE FLUID

PC. NO. 289286

NO.	PC. NO.	QTY.	DESCRIPTION
1	289283	1	PISTON ASSY.
2	292214	1	SEAL
3	292933	1	POPPET
4	292934	1	SPRING
5	292936	1	O-RING
6	292937	1	WASHER
7	292938	1	RETAINING RING

MASTER CYLINDERS USING MINERAL OIL

PC. NO. 289287

NO.	PC. NO.	QTY.	DESCRIPTION
1	289280	1	PISTON ASSY.
2	292939	1	SEAL
3	292933	1	POPPET
4	292934	1	SPRING
5	292216	1	O-RING
6	292937	1	WASHER
7	292938	1	RETAINING RING

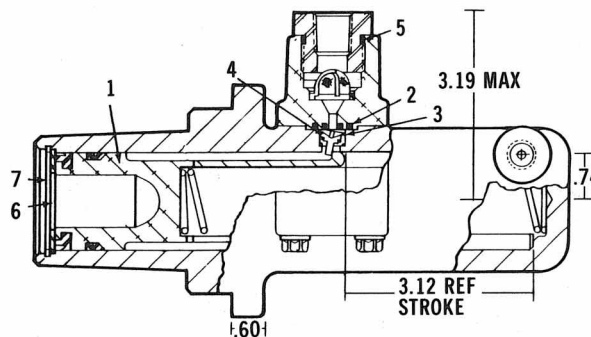
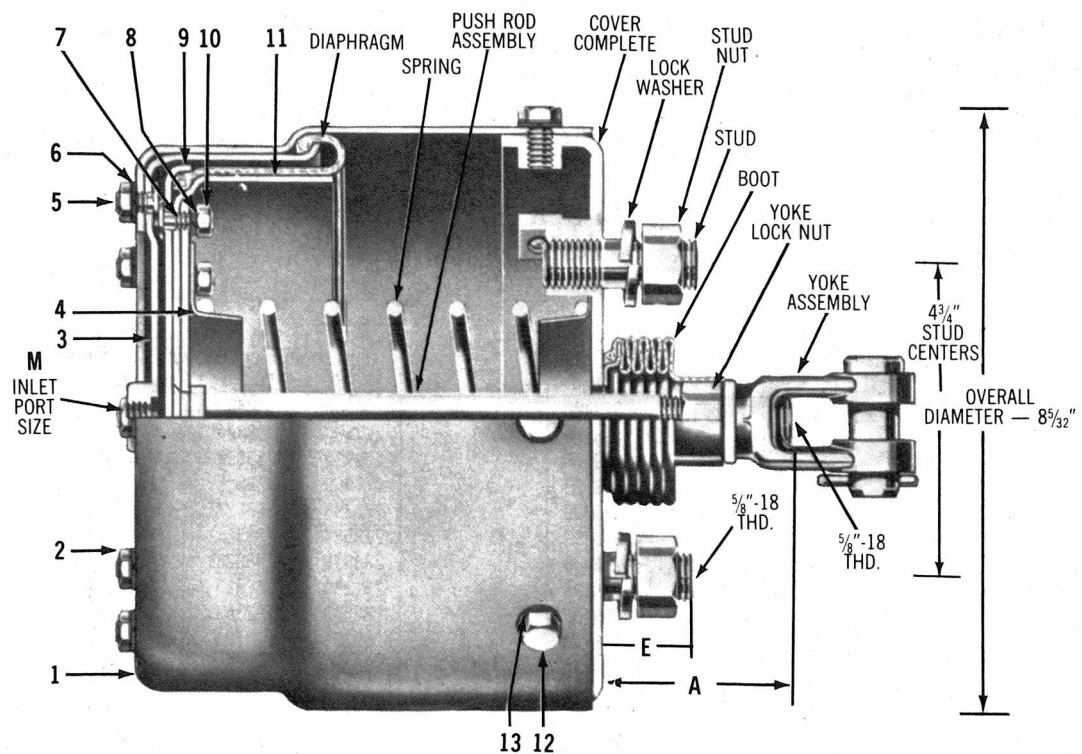


FIG. 5
MASTER CYLINDER

TYPE 36 SERVICE 3 1/2 INCH STROKE

A Rotochamber is an actuator which converts the energy of air pressure into a mechanical force. The various sizes available provide a wide range of output forces. The rolling type diaphragm provides long life and gives a constant output force throughout the entire stroke.

For further information regarding installation and maintenance, consult Instruction & Service Data Sheet SD-9.



EFFECTIVE DIAPHRAGM AREA — 36 SQUARE INCHES

No.	Pc. No.	Quan.	Description
1	231533	1	Body
2	203145	8	Nut
3	222259	1	Outer Diaphragm Clamp
4	245413	2	Spring Guide
5	290923	8	Bolt
6	202982	8	Lock Washer
7	290927	8	Bolt

No.	Pc. No.	Quan.	Description
8	202981	8	Lock Washer
9	222257	1	Inner Diaphragm Clamp
10	203147	8	Nut
11	231536	1	Diaphragm Guide
12	201504	8	Lock Washer
13	231826	8	Cap Screw

SEE SCHEDULE OF SERVICE PC. NO'S. AND
CONVERSION LIST ON BACK OF PAGE.

TYPE 36 SERVICE
3 1/2 INCH STROKE

TYPE 36 SERVICE ROTOCHAMBER PC. NO.	PUSH ROD ASSEMBLY PC. NO.	YOKE LOCK NUT PC. NO.	STUD (2 REQ'D.) PC. NO.	STUD NUT (2 REQ'D.) PC. NO.	LOCK WASHER (2 REQ'D.) PC. NO.	SPRING PC. NO.	COVER COMPLETE PC. NO.	DIAPHRAGM PC. NO.	A PUSH ROD TO COVER (INCHES)	E STUD END TO COVER (INCHES)	M INLET PORT SIZE	FEATURES
F 223719	222258	204781	212360	204781	202986	231540	281890	231534	3 5/16	2 5/16	1/4"	LONG MTG. STUDS
C 282549	282550	204781	NONE	NONE	NONE	246784	282568	231534	4 1/4	—	1/2"	HVG. SPRING, LARGE INLET
BDG 282794	223450	204781	230675	204781	202986	231540	282795	236530	2 9/16	1 9/16	1/4"	SHORT STROKE
E 283730	285195	NONE	212694	204781	202986	247993	283731	231534	2 3/16	1 1/8	1/4"	LONG STROKE
AB 288825	288826	204781	230675	204781	202986	231540	281890	231534	11 1/16	1 9/16	3/8"	HVY. SPRING
B 288827	288826	204781	230675	204781	202986	231540	281890	231534	11 1/16	1 9/16	3/8"	STD. UNIT
B 288828	288826	204781	230675	204781	202986	231540	281890	236530	11 1/16	1 9/16	3/8"	NEOPRENE DIAPH.

A-ADD INNER SPRING, 237843.

B-SUBSTITUTE OUTER DIAPHRAGM CLAMP, 226889 FOR ITEM 3 (3/4" P.T. INLET)

C-ADD INNER SPRING, 246785. OMIT ONE (1) OF ITEM 4. SUBSTITUTE OUTER DIAPHRAGM CLAMP 281426 FOR ITEM 3 (1/2 P.T. INLET)

D-STROKE FOR THIS ASSY. IS 1 1/8".

F-INCLUDES YOKE ASSY. 228798.

G-INCLUDES YOKE ASSY. 228790.

NOTE: ALL SERVICE ROTOCHAMBERS ARE FURNISHED WITH LONG THREADED PUSH ROD, LESS YOKE.

TYPE 36 SERVICE ROTOCHAMBER
CONVERSION LIST

ORIG. EQUIP. PC. NO.	SERVICE REPLACEMENT	
	ROTO-CHAMBER PC. NO.	YOKE ASSY. PC. NO.
222256	288827	228798
222789	288827	228798
223025	288827	229496
223390	288827	228799
223719	223719	228798
224186	288827	228799
224290	288827	229496
224526	288827	228798
224718	288827	229496
225019	288827	228790
225039	288827	228790
227109	288827	229496
227399	288827	228798
227969	288827	229496
228041	288827	229496
229010	288827	229496
229053	288828	229496
229224	288828	229496
229820	288827	NONE
276644	288825	228790

ORIG. EQUIP. PC. NO.	SERVICE REPLACEMENT	
	ROTO-CHAMBER PC. NO.	YOKE ASSY. PC. NO.
276948	288825	NONE
277500	288827	NONE
277932	288828	NONE
277968	288825	229496
278398	288827	NONE
278589	288827	NONE
280839	288828	228790
281280	288825	229496
282549	282549	NONE
282794	282794	228790
283730	283730	NONE
284158	288827	229496
284767	288825	229496
285237	288827	228790
286707	288827	228790
286784	288828	NONE
287172	288827	229496
287330	288827	228790
288272	288827	228798

The AH-4 Air Hydraulic Intensifier is a device used to convert air pressure to hydraulic pressure. It is a combination of two components, a specially designed Rotochamber and Hydraulic Master Cylinder.

The AH-4 is used to provide pressure to hydraulic disc brakes on air braked vehicles. The units are used on both on-highway and off-highway vehicles.

For complete service/maintenance information see service data sheet SD-11-1.

Maintenance kits for master cylinders:
For Brake Fluid — Pc. No. 289286
For Mineral Oil — Pc. No. 289287

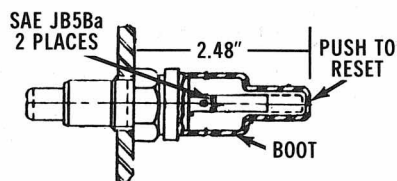
Power Ratio — 23.5:1
Max. Displacement — 6 cu. in.

Weight — Remote Res. — Approx. 39 Lbs.
Integral Res. — Approx. 42 Lbs.

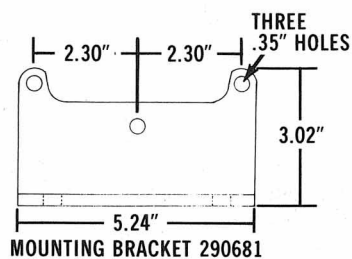
VMRS No. 13-006

Note: Detail part numbers may differ depending on type of fluid (mineral oil or brake fluid) used, and should not be interchanged.

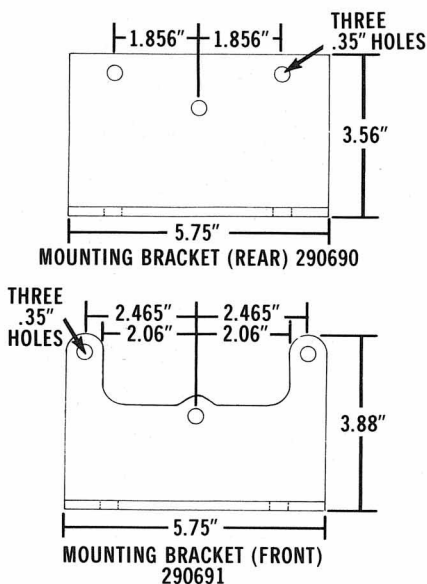
For Intensifier with Type 36 Rotochamber, see Catalog 11-A-1.



STROKE WARNING SWITCH 287131

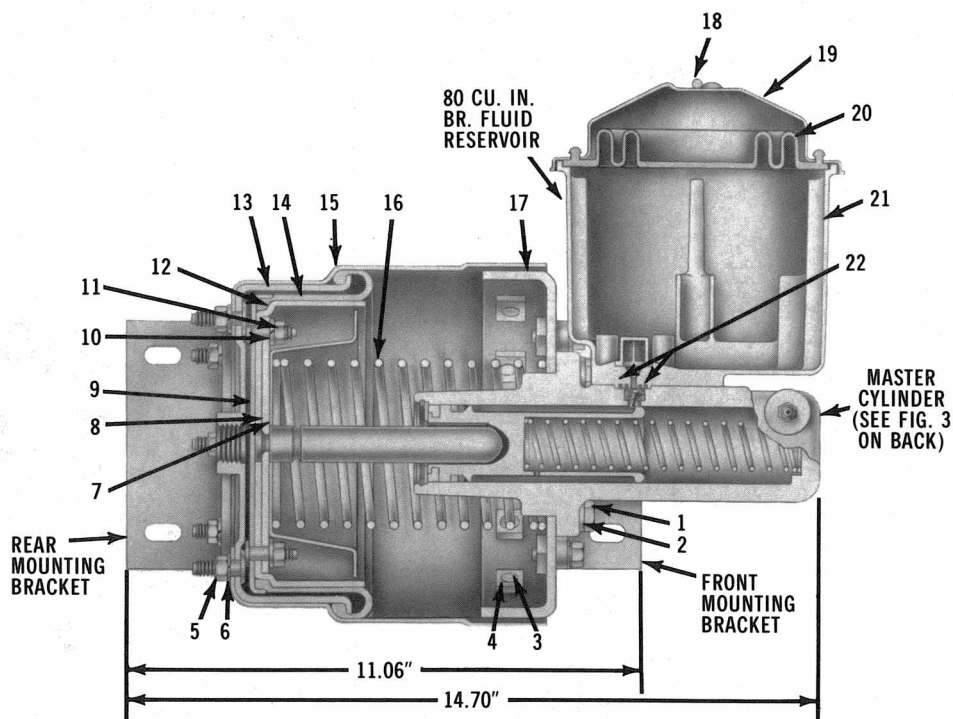


MOUNTING BRACKET 290681



MOUNTING BRACKET (FRONT)
290691

TYPE 50 ROTOCHAMBER



COMMON SERVICE PARTS

NO.	PC. NO.	QTY.	DESCRIPTION	NO.	PC. NO.	QTY.	DESCRIPTION
1	241957	4	CAP SCREW 3/8	12	280523	1	INNER DIAPHRAGM CLAMP
2	237686	4	LOCKWASHER 3/8	13	277834	1	OUTER DIAPHRAGM CLAMP
3	231826	8	CAP SCREW 3/8	14	231491	1	DIAPHRAGM
4	201504	8	LOCKWASHER 3/8	15	231490	1	BODY
5	202982	11	LOCKWASHER 5/16	16	231498	1	SPRING
6	204514	11	HEX NUT 5/16	17	289518	1	COVER COMPLETE
7	290682	1	SPRING GUIDE	18	290931	1	BAIL
8	286748	1	PUSH ROD COMPLETE	19	292174	1	RESERVOIR COVER
9	231494	1	DIAPHRAGM GUIDE	20	292175	1	DIAPHRAGM
10	202981	8	LOCKWASHER 1/4	21	287157	1	RESERVOIR BODY COMPL.
11	203105	8	HEX NUT 1/4	22	292214	1	SEAL (BRAKE FLUID)
					292939	1	SEAL (MINERAL OIL)

SUB ASSY AND DETAIL REFERENCE

AH-4 HYD. INTENSIFIER ASSY. PC. NO.	ROTO- CHAMBER ASSY.	MASTER CYLINDER ASSY.	WARNING SWITCH	BOOT	DELIVERY (SEE FIG. 4)		ROTOCHAMBER BRACKET		BRACKET LOCATION	
					LEFT	RIGHT	FRONT	REAR	LEFT	RIGHT
INTEGRAL RESERVOIR (SEE FIG. 2)										
289542	289517	288398*	287131	290959		X	290681	290681		X
REMOTE RESERVOIR (SEE FIG. 1)										
286754	286745	286755	287131	290959		X	290681	290681		X
287070	286745	287069	287131	290959		X	290691	290690	X	
289382	286745	287069	NONE	NONE		X	290691	290690	X	

NOTE: ABOVE AH-4 INTENSIFIERS ARE O.E.M. INSTALLED BY MACK

*MINERAL OIL SYSTEM

TYPE 50 ROTOCHAMBER

FIG. 1

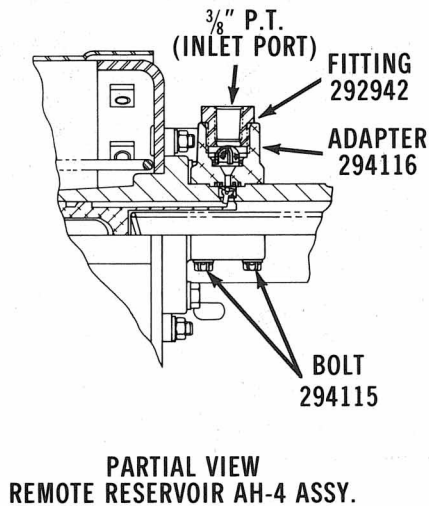


FIG. 2

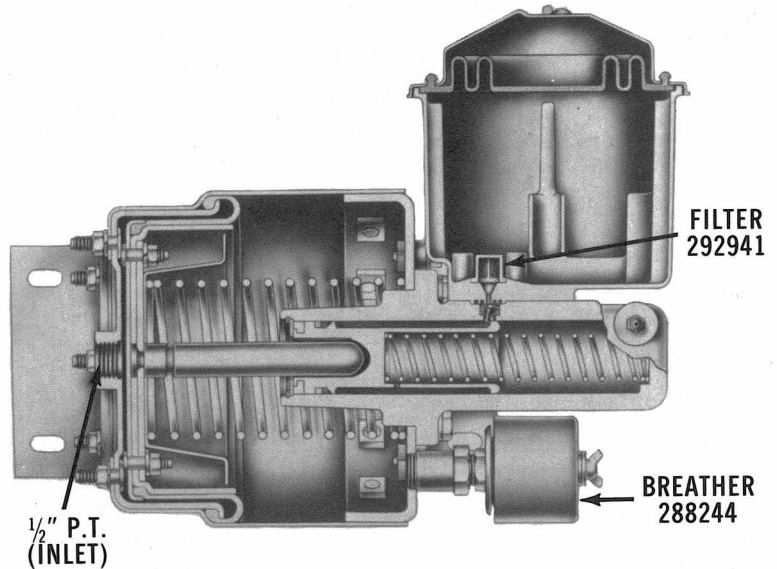


FIG. 3

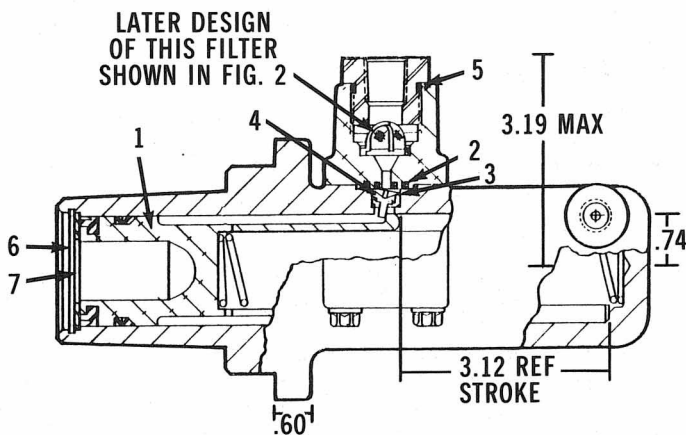
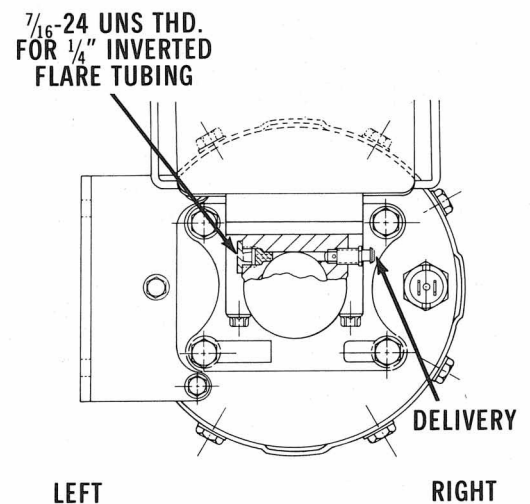


FIG. 4



LEFT HAND MOUNTING BRACKETS —
RIGHT HAND HYDRAULIC DELIVERY

MAINTENANCE KITS FOR MASTER CYLINDERS

FOR BRAKE FLUID — PC. NO. 289286

NO.	PC. NO.	QTY.	DESCRIPTION
1	289283	1	PISTON ASSEMBLY
2	292214	1	SEAL
3	292933	1	POPPET
4	292934	1	SPRING
5	292936	1	O-RING
6	292937	1	WASHER
7	292938	1	RETAINING RING

FOR MINERAL OIL — PC. NO. 289287

NO.	PC. NO.	QTY.	DESCRIPTION
1	289280	1	PISTON ASSEMBLY
2	292939	1	SEAL
3	292933	1	POPPET
4	292934	1	SPRING
5	292216	1	O-RING
6	292937	1	WASHER
7	292938	1	RETAINING RING