BRAKES

CONTENTS

	page		page
ANTILOCK BRAKE SYSTEM–BENDIX ABX-4	**68**	**GENERAL INFORMATION**	**1**
BASE BRAKE SYSTEM	**2**		

GENERAL INFORMATION

INDEX

page

GENERAL INFORMATION
BASE BRAKE SYSTEM DESCRIPTION 1

GENERAL INFORMATION

BASE BRAKE SYSTEM DESCRIPTION

Typical brake equipment consists of:

- Double pin floating caliper disc front brakes.
- Rear automatic adjusting drum brakes.
- Brake Fluid Level Switch.
- Master cylinder.
- Vacuum power booster.
- Double pin floating caliper rear disc brakes are available on some models.
- Hand operated auto adjust park brake lever.
- Front disc brake pads are semi-metallic.

Vehicles equipped with an Antilock Brake System (ABS) use a system designated ABX-4 and is supplied by Bendix. This system shares the base brake hardware with vehicles not equipped with ABS. A vehicle equipped with ABS does however use a different vacuum booster, master cylinder and brake tubes. Also included in the ABS system is a hydraulic control unit (HCU), four wheel speed sensors, and an electronic controller (CAB). These components will be described in detail in the Bendix ABX 4 brake section in this group of the service manual.

The hydraulic brake system is diagonally split on both the Non-ABS and ABS braking system. With the left front and right rear brakes on one hydraulic system and the right front and left rear on the other.

The master cylinder is anodized, lightweight aluminum. On vehicles equipped with front disc brakes and rear drum brakes, the master cylinder bore is 21.0 mm. On vehicles equipped with four wheel disc brakes, the master cylinder bore is 7/8”.

BASE BRAKE SYSTEM

INDEX

page

DESCRIPTION AND OPERATION
- CHASSIS TUBES AND HOSES 6
- FRONT DISC BRAKES 2
- MASTER CYLINDER 6
- PARKING BRAKES 4
- PROPORTIONING VALVES 5
- REAR DISC BRAKES 4
- REAR DRUM BRAKES 4
- REAR WHEEL HUB AND BEARING ASSEMBLY . 8
- RED BRAKE WARNING LAMP 7
- STOP LAMP SWITCH 8
- VACUUM BOOSTER 7

DIAGNOSIS AND TESTING
- BRAKE FLUID CONTAMINATION 19
- BRAKE SYSTEM BASIC DIAGNOSIS GUIDE . . . 9
- BRAKE SYSTEM DIAGNOSIS CHARTS 10
- DRUM BRAKE AUTOMATIC ADJUSTER 14
- PROPORTIONING VALVES 15
- RED BRAKE WARNING LAMP TEST 19
- ROTOR THICKNESS AND RUNOUT 14
- STOP LAMP SWITCH TEST PROCEDURE 19

SERVICE PROCEDURES
- BRAKE BLEEDING 19
- BRAKE DRUM MACHINING 23
- BRAKE FLUID LEVEL CHECK 19
- BRAKE ROTOR MACHINING 21
- BRAKE TUBE REPAIR 24
- MASTER CYLINDER BLEEDING 21
- PARK BRAKE LEVER AUTO ADJUSTER MECHANISM 23

REMOVAL AND INSTALLATION
- CHASSIS TUBES AND HOSES 46
- FRONT DISC BRAKE CALIPER 26
- FRONT DISC BRAKE SHOES 27
- MASTER CYLINDER 40
- PARK BRAKE CABLES 49
- PARK BRAKE LEVER ASSEMBLY 47
- PARK BRAKE LEVER OUTPUT CABLE 49

page

- PARK BRAKE SHOES WITH REAR DISC BRAKES 54
- PROPORTIONING VALVE (BASE BRAKES) . . . 46
- REAR BRAKE DRUM 33
- REAR BRAKE SHOE SUPPORT PLATE 36
- REAR BRAKE SHOES 34
- REAR BRAKE WHEEL CYLINDER 37
- REAR DISC BRAKE CALIPER 29
- REAR DISC BRAKE SHOES 31
- REAR HUB/BEARING 38
- STOP LAMP SWITCH 56
- VACUUM BOOSTER 42
- WHEEL AND TIRE ASSEMBLY 25

DISASSEMBLY AND ASSEMBLY
- BRAKE FLUID LEVEL SWITCH 57
- BRAKE FLUID RESERVOIR 56
- FRONT AND REAR DISC BRAKE CALIPER . . . 58
- WHEEL CYLINDER (REAR DRUM BRAKE) . . . 62

CLEANING AND INSPECTION
- CHASSIS TUBES AND HOSES 64
- FRONT DISC BRAKES 63
- REAR DISC BRAKES 63
- REAR DRUM BRAKE WHEEL CYLINDER 64
- REAR DRUM BRAKES 64
- REAR WHEEL HUB AND BEARING ASSEMBLY 64

ADJUSTMENTS
- PARKING BRAKE ADJUSTMENT 65
- REAR DRUM BRAKE SHOE ADJUSTMENT . . . 65
- STOP LAMP SWITCH 64

SPECIFICATIONS
- BRAKE ACTUATION SYSTEM 66
- BRAKE FASTENER TORQUE SPECIFICATIONS 66
- BRAKE FLUID 65

SPECIAL TOOLS
- BASE BRAKE SYSTEM 67

DESCRIPTION AND OPERATION

FRONT DISC BRAKES

The front disc brakes (Fig. 1) and (Fig. 2) consists of the following components:

- The driving hub
- Braking disc (rotor)
- Caliper assembly - single piston, floating type
- Brake shoes and linings

The double pin Kelsey-Hayes Calipers are mounted directly to the steering knuckles and use no adapter. The caliper is mounted to the steering knuckle using bushings, sleeves and 2 guide pin bolts which thread directly into bosses on the steering knuckle (Fig. 2) and (Fig. 3).

Two machined abutments on the steering knuckle position the caliper. The guide pin bolts, sleeves and bushings control the side to side movement of the caliper. The piston seal is designed to pull the piston back into the bore of the caliper when the brake

DESCRIPTION AND OPERATION (Continued)

pedal is released. This maintains the proper brake shoe to rotor clearance (Fig. 4).

All the front brake forces generated during braking of the vehicle is taken up directly by the steering knuckles of the vehicle.

The caliper is a one piece casting with the inboard side containing a single piston cylinder bore.

The front disc brake caliper piston (Fig. 2), is manufactured from a phenolic compound. The outside diameter of the caliper piston is 54 mm.

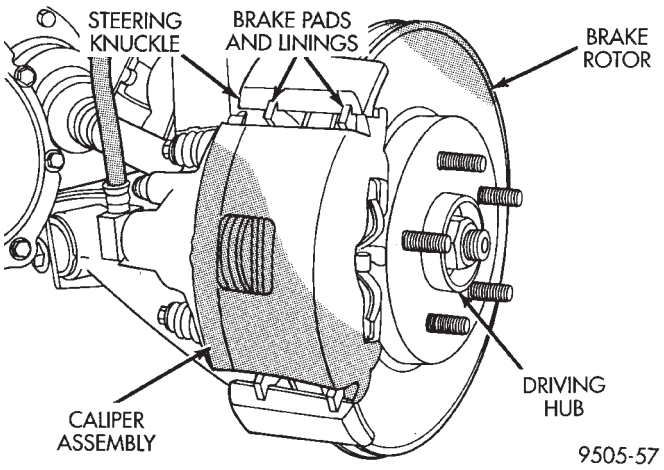


Fig. 1 Front Disc Brake Caliper Assembly

A square cut rubber piston seal is located in a machined groove in the caliper cylinder bore. This provides a hydraulic seal between the piston and the cylinder wall (Fig. 4).

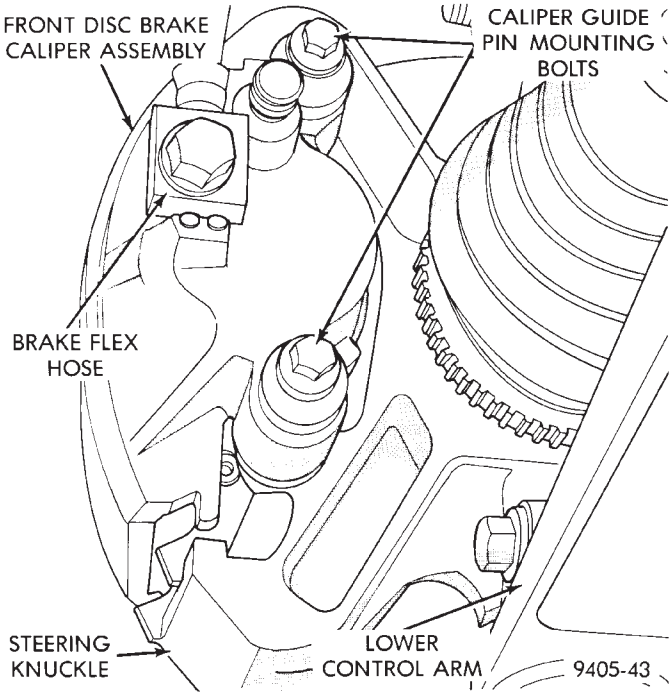


Fig. 3 Front Disc Brake Caliper Mounting

A rubber dust boot is installed in the cylinder bore opening and in a groove in the piston (Fig. 4). This prevents contamination in the bore area.

As front disc brake linings wear, master cylinder reservoir brake fluid level will drop. Fluid level should be checked after replacing linings.

Front disc brakes are equipped with an audible wear indicator (Fig. 2) on the outboard brake pad.

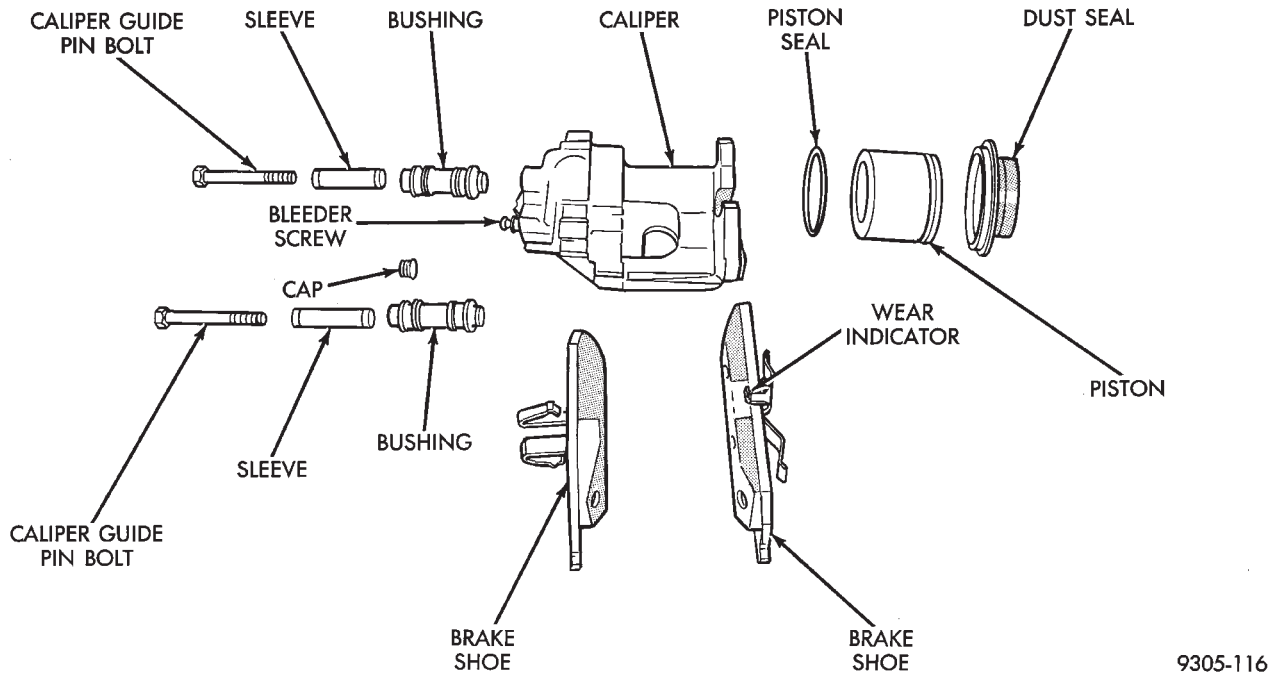


Fig. 2 Front Disc Brake Caliper (Exploded View)

DESCRIPTION AND OPERATION (Continued)

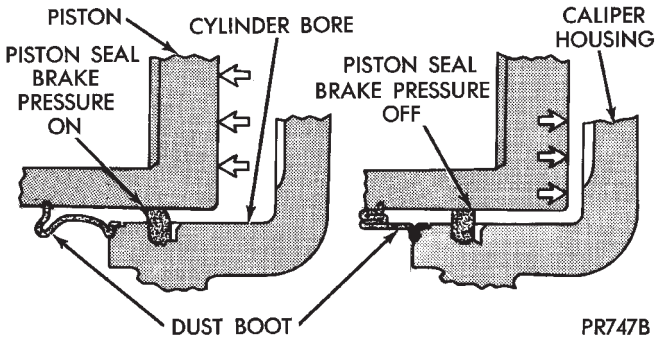


Fig. 4 Piston Seal Function for Automatic Adjustment

This sensor emits a sound when the brake lining may need inspection and/or replacement.

REAR DISC BRAKES

The rear disc brakes are similar to the front disc brakes, however, there are several distinctive features that require different service procedures. The single piston, floating caliper rear disc brake assembly includes a hub and bearing assembly, adapter, brake rotor, caliper, brake pads/linings. The parking brake system on all vehicles equipped with rear disc brakes consists of a small duo-servo drum brake mounted to the caliper adapter. The drum brake shoes expand out against a braking surface (hat section) on the inside area of the rotor.

Vehicles are equipped with a caliper assembly that has a 34 mm (1.43 in.) piston and uses a solid non-vented rotor.

The caliper assembly on all applications float on rubber bushings using internal metal sleeves which are attached to the adapter using threaded guide pin bolts.

The adapter and rotor shield are mounted to the rear suspension knuckles of vehicle. The adapter is used to mount the brake shoes and actuating cables for the parking brake system. The adapter also mounts the rear caliper assembly to the vehicle. The adapter has two machined abutments which are used to position and align the caliper and brake pads for movement inboard and outboard (Fig. 5).

REAR DRUM BRAKES

The rear wheel drum brakes are a two shoe, internal expanding type with an automatic adjuster screw (Fig. 6). The automatic adjuster screw is actuated each time the brakes are applied. The automatic adjuster screw is located directly below the rear brake wheel cylinder.

PARKING BRAKES

All vehicles are equipped with a center mounted, hand operated park brake lever. This lever is an

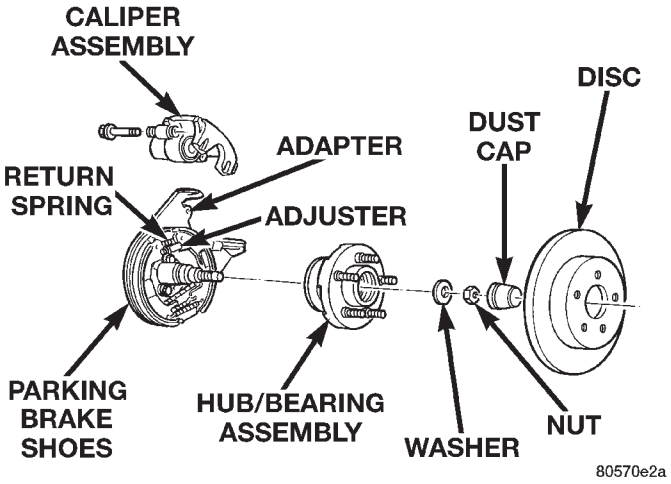


Fig. 5 Rear Disc Brake Assembly Exploded View

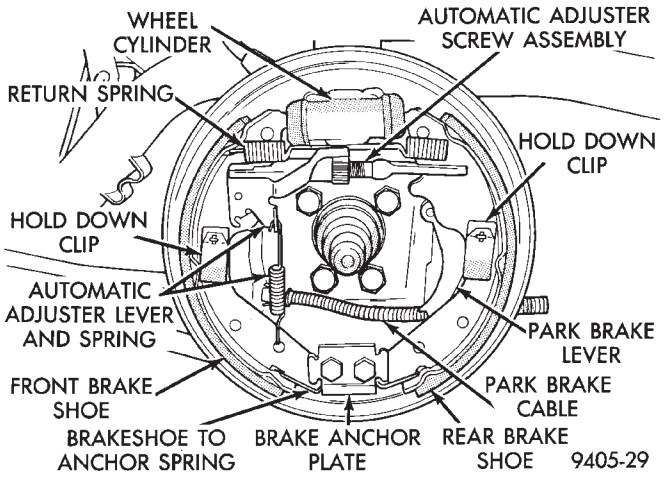


Fig. 6 Kelsey Hayes Rear Wheel Brake Assembly (Left Side Shown)

auto-adjust type which continuously applies minimal tension to the parking brake cables to keep them in adjustment at all times. Due to this feature, the park brake cable system does not require adjustment. Proper parking brake system adjustment is obtained by proper drum brake or drum-in-hat brake shoe adjustment.

On vehicles equipped with rear drum brakes, the rear wheel service brakes also act as the vehicle's parking brakes. The rear drum brake shoes, when acting as parking brakes, are mechanically operated using an internal actuating lever and strut which is connected to a flexible steel cable. There is an individual park brake cable for each rear wheel, which are joined using a park cable equalizer before terminating at the floor mounted, hand operated park brake lever.

The parking brakes on vehicles equipped with rear disc brakes consist of a small duo-servo brake assembly mounted to the disc brake caliper adapter (Fig. 7). The hat (center) section (Fig. 8) of the rear rotor

DESCRIPTION AND OPERATION (Continued)

serves as the braking surface (drum) for the parking brakes. This park brake application uses the same operating cable configuration as the drum brake equipped vehicles, but different cables.

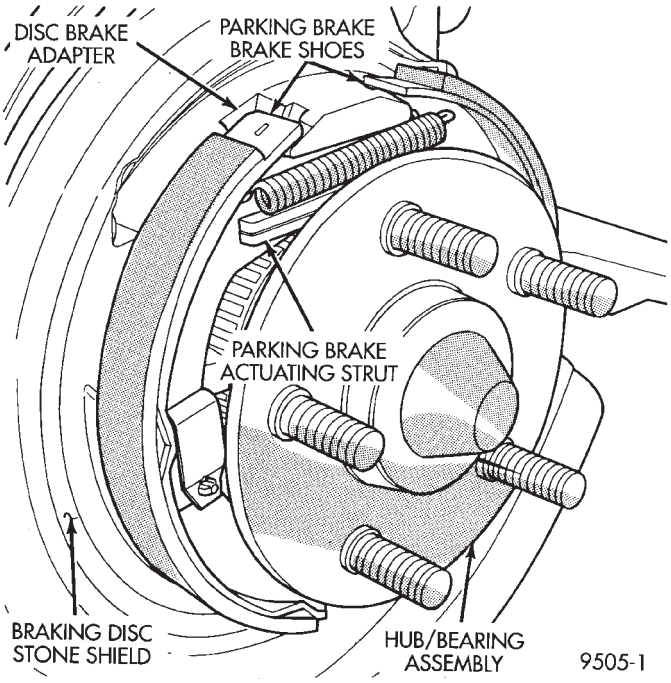


Fig. 7 Park Brake Assembly With Rear Disc Brakes

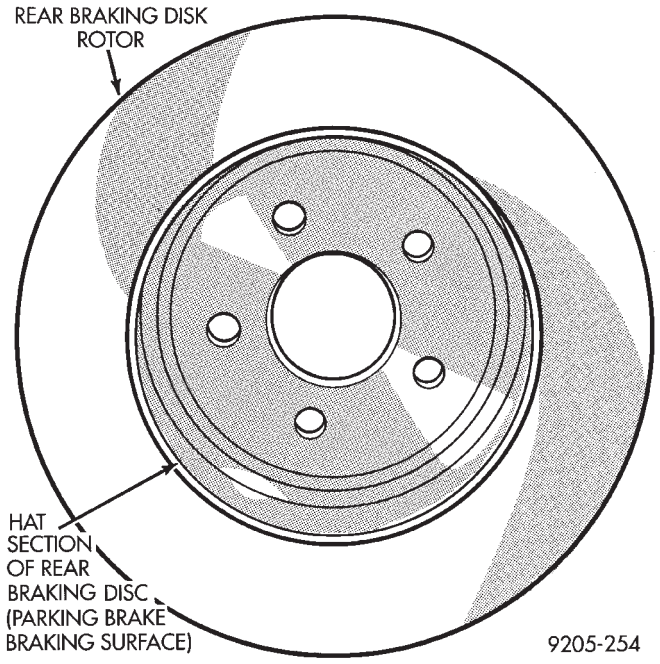


Fig. 8 Drum In Hat Rotor

PROPORTIONING VALVES

This vehicle uses screw-in proportioning valves at the master cylinder or Hydraulic Control Unit instead of the combination valve used in prior designs. With this new design, the chassis brake tubes connect directly from the master cylinder (or HCU) to the brake flex hose.

The non-ABS master cylinders are a four outlet design with two screw-in proportioning valves attached directly to the inboard side of the master cylinder housing (Fig. 9).

The ABS master cylinders are a two outlet design with the screw-in proportioning valves attached directly to the Hydraulic Control Unit (HCU) (Fig. 10).

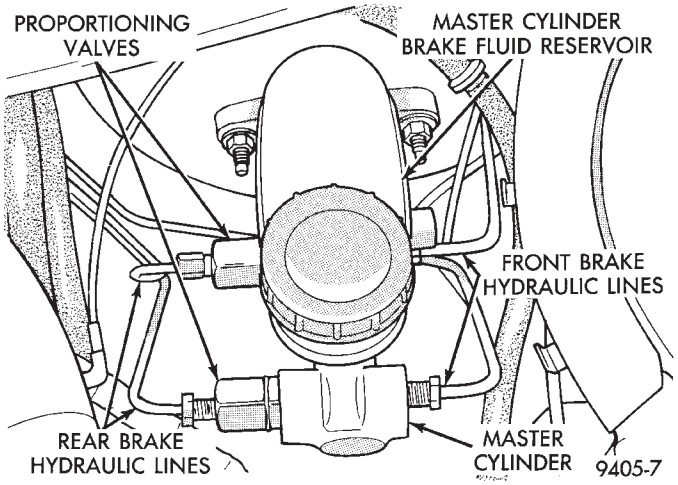


Fig. 9 Master Cylinder And Proportioning Valves For Non ABS Equipped Vehicles

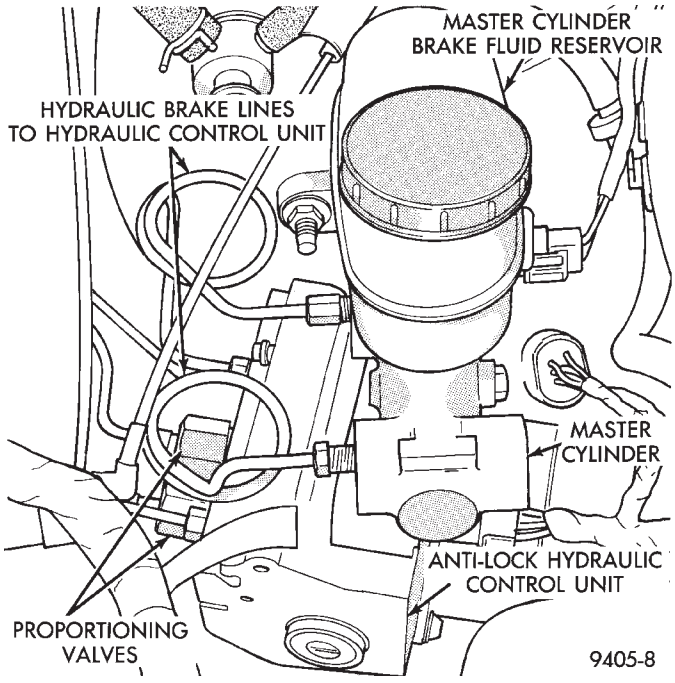


Fig. 10 Master Cylinder And Proportioning Valves For Antilock Brake Equipped Vehicles

Proportioning valves balance front to rear braking by controlling at a given ratio, the increase in rear brake system hydraulic pressure above a preset level

DESCRIPTION AND OPERATION (Continued)

(split point). Under light pedal application, the proportioning valve allows full hydraulic pressure to be applied to the rear brakes.

There are two proportioning valve assemblies used in each vehicle. Due to differences in thread sizes, each prop valve has a different part number. During any service procedures identify valve assemblies by supplier part number and or the color identification band (Fig. 11).

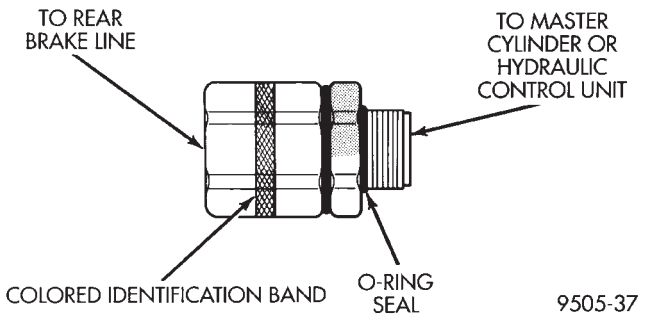


Fig. 11 Proportioning Valve Identification

CHASSIS TUBES AND HOSES

The purpose of the chassis brake tubes and flex hoses is to transfer the pressurized brake fluid developed by the master cylinder to the wheel brakes of the vehicle. The chassis tubes are steel with a corrosion resistant coating applied to the external surfaces and the flex hoses are made of reinforced rubber. The rubber flex hoses allow for the movement of the vehicles suspension.

MASTER CYLINDER

This vehicle is available with three different master cylinders. The vehicle uses screw-in proportioning valves at the master cylinder or Hydraulic Control Unit instead of the combination valve used in prior designs. With this new design, the chassis brake tubes connect directly from the master cylinder (or HCU) to the brake flex hose.

Vehicles not equipped with ABS use a standard compensating port design, while vehicles equipped with ABS use a center valve design master cylinder. In addition, the non-ABS master cylinders are a four outlet design with two screw-in proportioning valves attached directly to the inboard side of the master cylinder housing (Fig. 12). The ABS master cylinders are a two outlet design with the screw-in proportioning valves attached directly to the Hydraulic Control Unit (HCU) (Fig. 13). Vehicles equipped with rear drum brakes use a master cylinder with a 21 mm bore diameter, while vehicles equipped with rear disc brake use a 7/8” bore master cylinder.

The brake system master cylinder assembly (Fig. 12) consists of the following components. The body of the master cylinder is an anodized aluminum casting. It has a machined bore to accept the master cylinder piston and threaded ports with seats for hydraulic brake line connections. The brake fluid reservoir of the master cylinder assembly is made of a see through polypropelene type plastic.

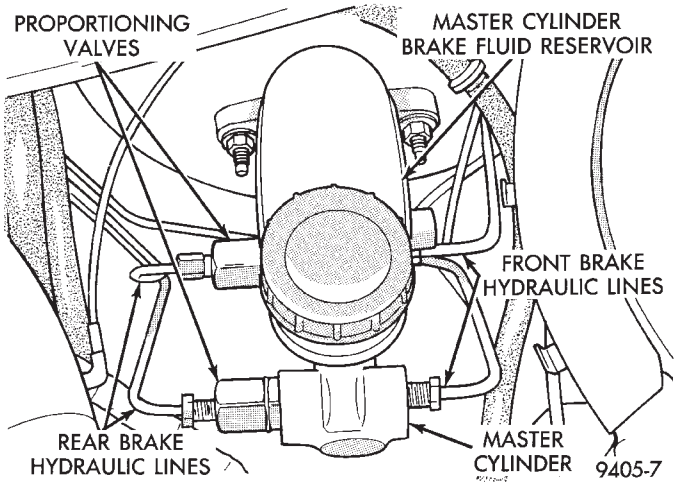


Fig. 12 Master Cylinder For Non Anti-Lock Brake Equipped Vehicles

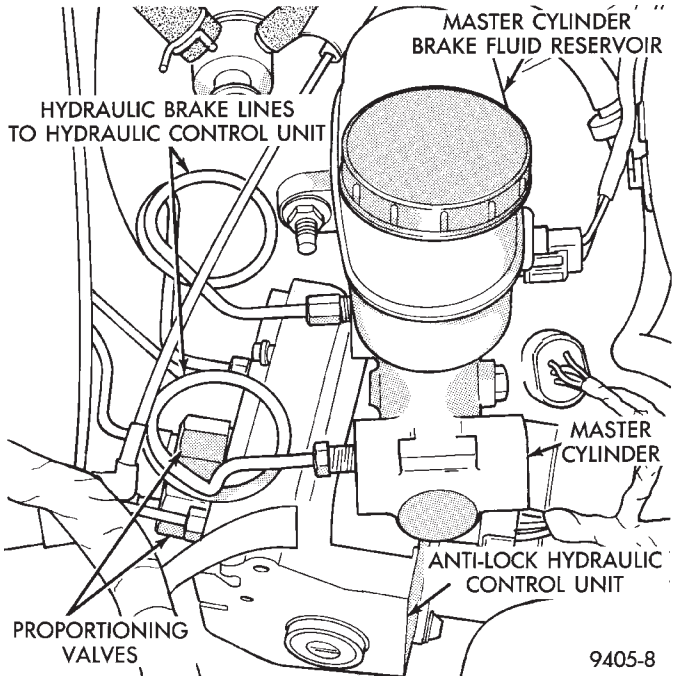


Fig. 13 Master Cylinder For Anti-Lock Brake Equipped Vehicles

On Non-ABS master cylinders, the primary outlet ports (Fig. 14) supply hydraulic pressure to the left front and right rear brakes. The secondary outlet ports (Fig. 14) supply hydraulic pressure to the right front and left rear brakes.

On ABS master cylinders, the primary outlet port (Fig. 15) supplies hydraulic pressure to the right front and left rear brakes. The secondary outlet port

DESCRIPTION AND OPERATION (Continued)

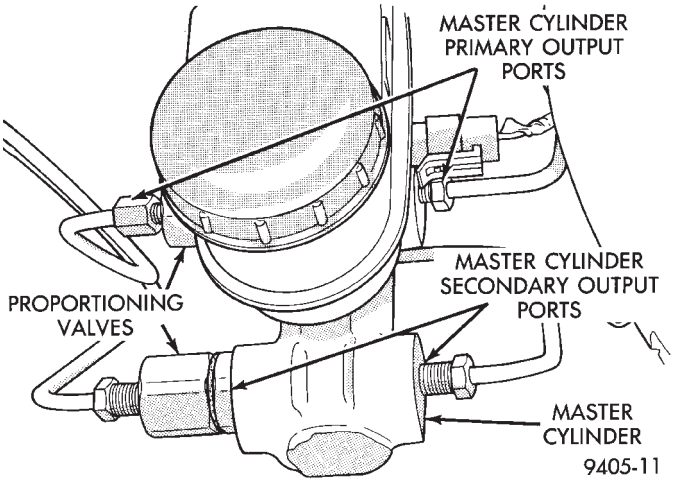


Fig. 14 Non-ABS Master Cylinder Primary And Secondary Ports

(Fig. 15) supplies hydraulic pressure to the left front and right rear brakes.

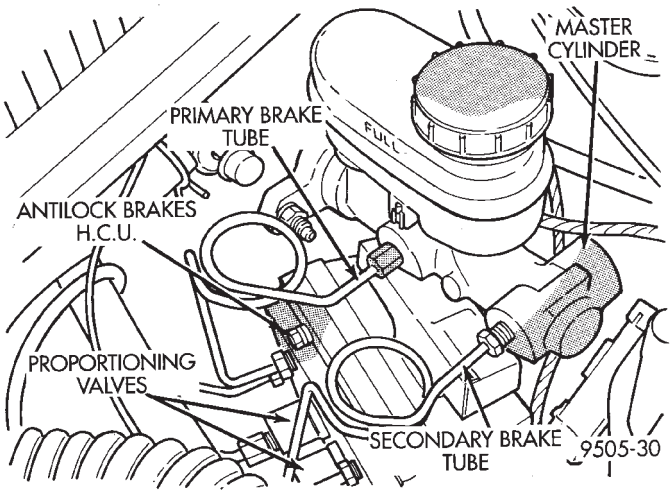


Fig. 15 ABS Master Cylinder Primary And Secondary Ports

VACUUM BOOSTER

All vehicles use a 230 mm single diaphragm power brake vacuum booster. There are however two different booster designs; one for vehicles equipped with ABS and one for vehicles without ABS. These two boosters differ at the interface to the master cylinder. If the power brake booster requires replacement be sure it is replaced with the correct part.

The power brake booster can be identified by the tag attached to the body of the booster assembly (Fig. 16). This tag contains the following information: The production part number of the power booster assembly, the date it was built, who manufactured it, and brake sales code.

NOTE: The power brake booster assembly is not a repairable part and must be replaced as a complete unit if it is found to be faulty in any way. The power booster vacuum check valve is not repairable but can be replaced as an assembly.

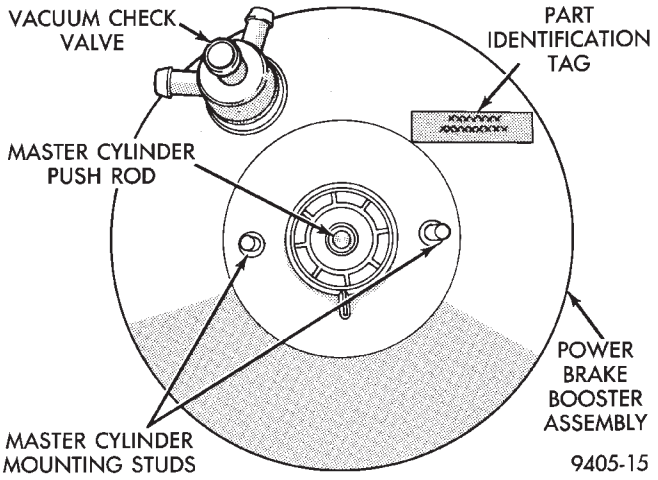


Fig. 16 Power Brake Booster Identification

The power brake booster reduces the amount of force required by the driver to obtain the necessary hydraulic pressure to stop vehicle.

The power brake booster is vacuum operated. The vacuum is supplied from the intake manifold on the engine through the power brake booster check valve (Fig. 16).

As the brake pedal is depressed, the power booster input rod moves forward (Fig. 17). This opens and closes valves in the power booster, allowing atmospheric pressure to enter on one side of a diaphragm. Engine vacuum is always present on the other side. This difference in pressure forces the output rod of the power booster (Fig. 17) out against the primary piston of the master cylinder. As the pistons in the master cylinder move forward this creates the hydraulic pressure in the brake system.

Different engine options available for this vehicle require that different vacuum hose routings be used.

The power brake vacuum booster assembly mounts on the engine side of the dash panel. It is connected to the brake pedal by the input push rod (Fig. 17). A vacuum line connects the power booster to the intake manifold. The master cylinder is bolted to the front of the power brake vacuum booster assembly.

RED BRAKE WARNING LAMP

The red Brake warning lamp is located in the instrument panel cluster and is used to indicate a low brake fluid condition or that the parking brake is applied. In addition, the brake warning lamp is turned on as a bulb check by the ignition switch when the ignition switch is placed in the crank position. Problems with this system will generally be of the type where the warning lamp fails to turn on when it should, or remains on when it should not.

DESCRIPTION AND OPERATION (Continued)

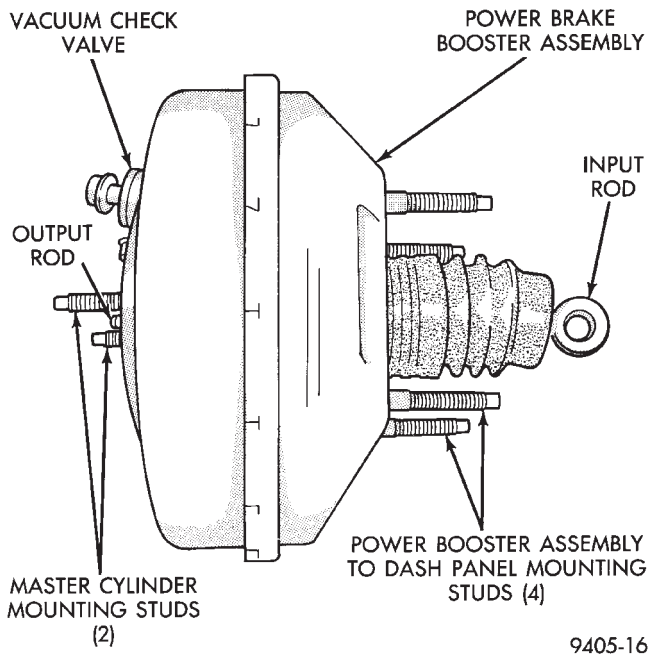


Fig. 17 Power Brake Booster Assembly

The warning lamp bulb is supplied a 12 volt ignition feed anytime the ignition switch is on. The bulb is then illuminated by completing the ground circuit either through the park brake switch, the fluid level sensor in the master cylinder reservoir, or the ignition switch in the crank position.

The Brake Fluid Level sensor is located in the brake fluid reservoir of the master cylinder assembly (Fig. 18). The purpose of the sensor is to provide the driver with an early warning that the brake fluid level in the master cylinder reservoir has dropped to below normal. This may indicate an abnormal loss of brake fluid in the master cylinder fluid reservoir resulting from a leak in the hydraulic system.

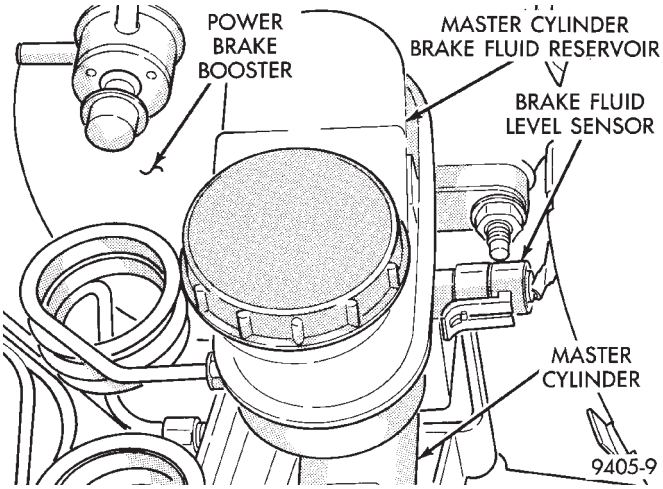


Fig. 18 Master Cylinder Fluid Level Sensor

As the fluid drops below the minimum level, the fluid level sensor closes the brake warning light circuit. This will turn on the red brake warning light. At this time, master cylinder fluid reservoir should be checked and filled to the full mark with DOT 3 brake fluid. **If brake fluid level has dropped in master cylinder fluid reservoir, the entire brake hydraulic system should be checked for evidence of a leak.**

STOP LAMP SWITCH

The stop lamp switch controls operation of the vehicles stop lamps. Also, if the vehicle is equipped with speed control, the stop lamp switch will deactivate speed control when the brake pedal is depressed.

The stop lamp switch controls operation of the right and left tail, stop and turn signal lamp and CHMSL lamp, by supplying battery current to these lamps.

The stop lamp switch controls the lamp operation by opening and closing the electrical circuit to the stop lamps.

REAR WHEEL HUB AND BEARING ASSEMBLY

All vehicles are equipped with permanently lubricated and sealed for life rear wheel bearings. There is no periodic lubrication or maintenance recommended for these units. However, if servicing of a rear wheel bearing is required, refer to procedures in the diagnosis and testing section and the removal and installation section in this group of the service manual for the inspection and replacement of the rear wheel bearing.

DIAGNOSIS AND TESTING

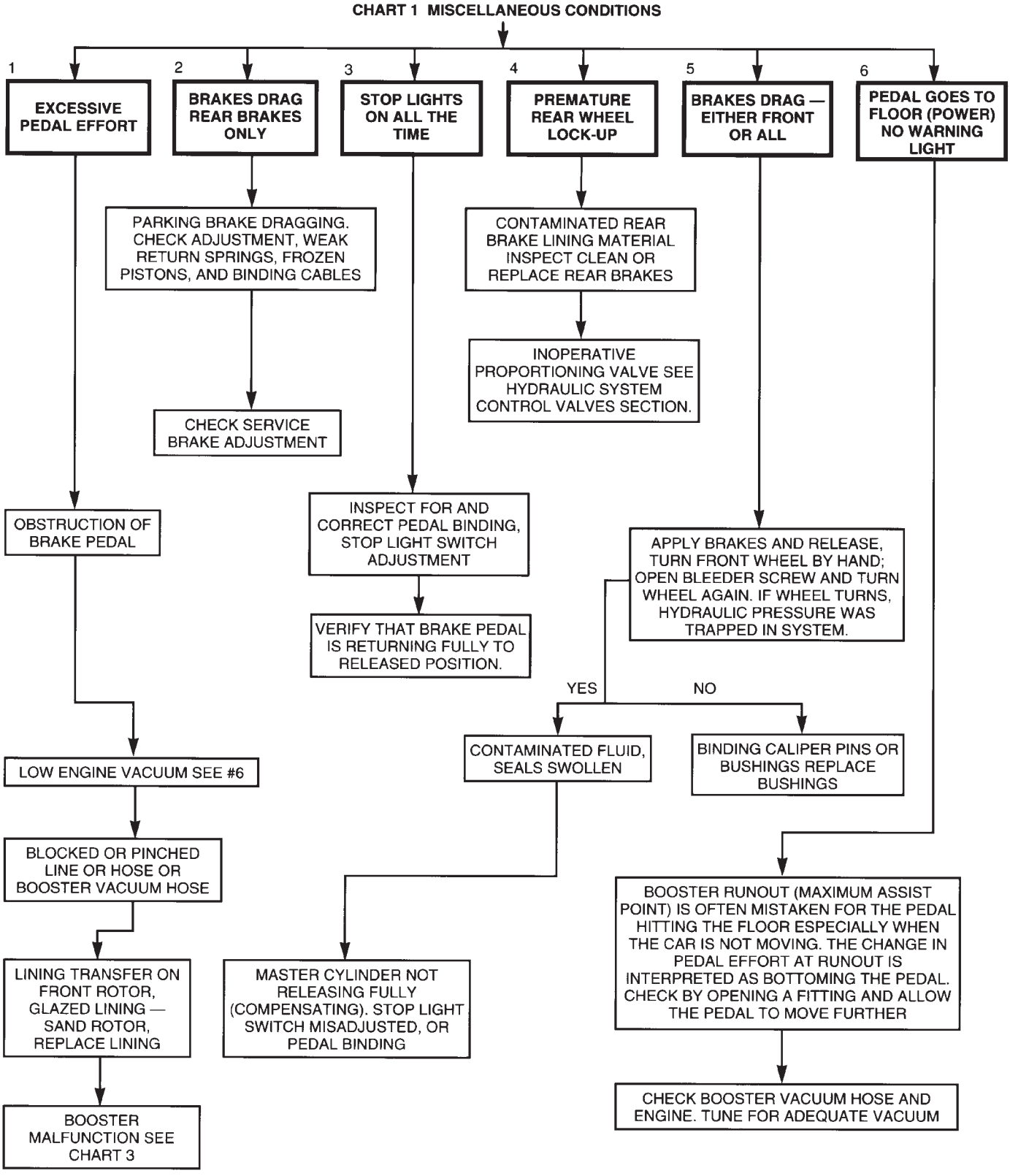
BRAKE SYSTEM BASIC DIAGNOSIS GUIDE

SYMPTOM	CHART 1 MISC. COND.	CHART 2 WARNING LIGHT	CHART 3 POWER BRAKES	CHART 4 BRAKE NOISE	CHART 5 WHEEL BRAKES
Brake Warning Light On		X	NO	NO	
Excessive Pedal Travel	6	X	NO		O
Pedal Goes To The Floor	6	X			
Stop Light On Without Brakes	3				
All Brakes Drag	5				
Rear Brakes Drag	2	NO	NO		
Grabby Brakes			O		X
Spongy Brake Pedal		X	NO		
Premature Rear Brake Lockup	4	NO	NO		O
Excessive Pedal Effort	1		O		
Rough Engine Idle		NO	O		
Brake Chatter (Rough)		NO	NO		X
Surge During Braking		NO	NO		X
Noise During Braking		NO	NO	X	
Rattle Or Clunking Noise		NO	NO	X	
Pedal Pulsates During Braking		NO	NO		X
Pull To Right Or Left		NO	NO		X
No: Not A Possible Cause		X: Most Likely Cause		O: Possible Cause	

DIAGNOSIS AND TESTING (Continued)

BRAKE SYSTEM DIAGNOSIS CHARTS

MISCELLANEOUS BRAKE SYSTEM CONDITIONS

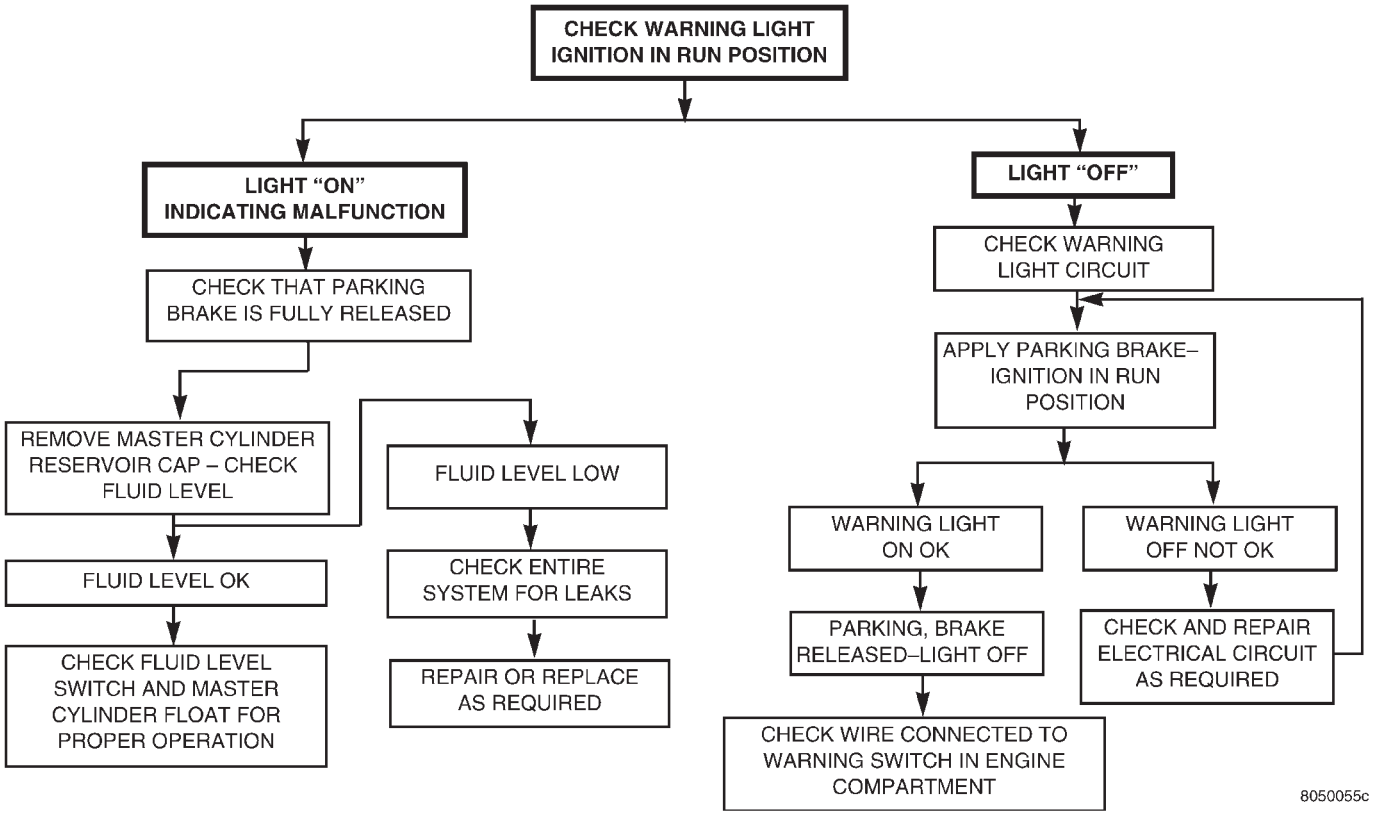


9505-81

DIAGNOSIS AND TESTING (Continued)

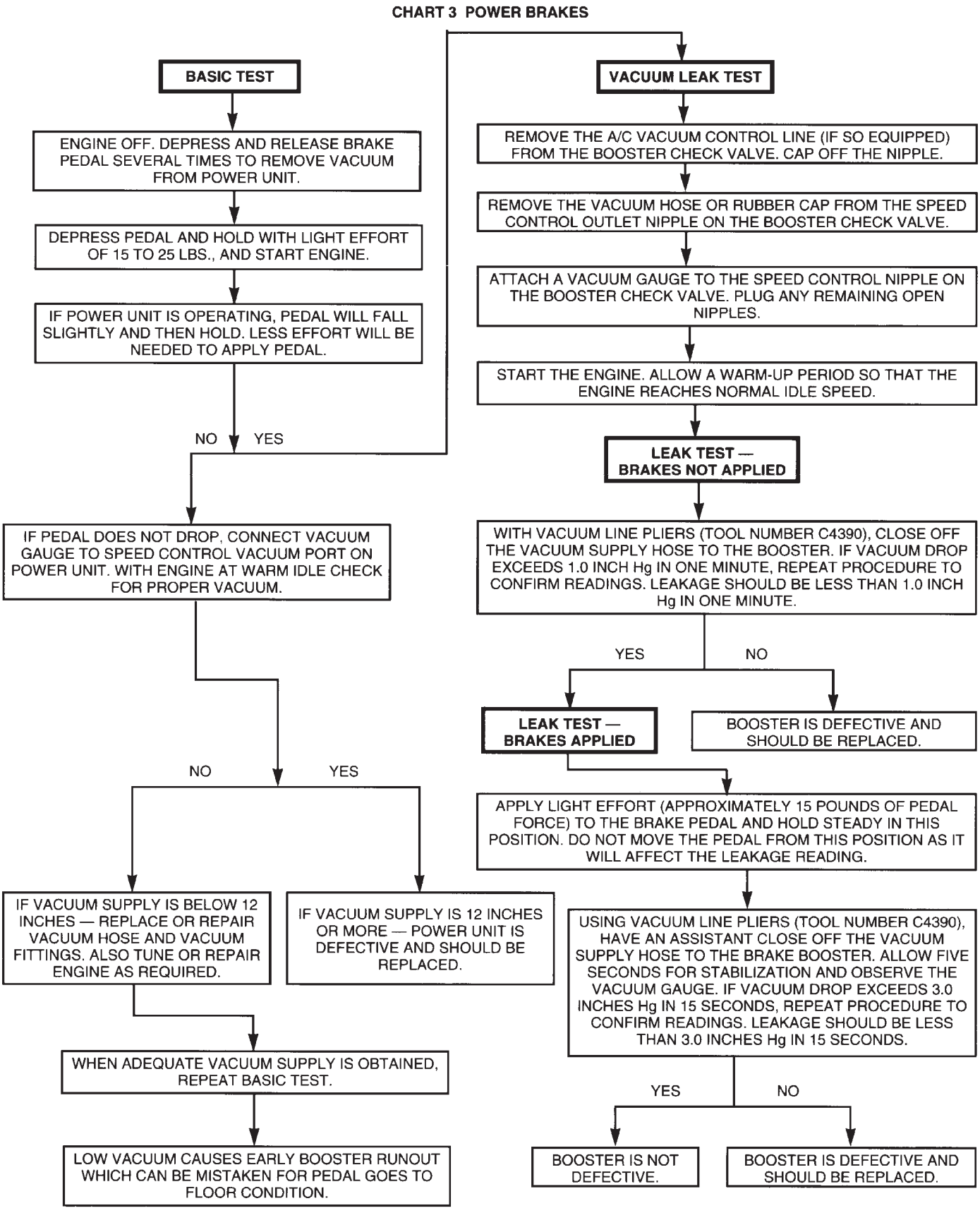
RED BRAKE WARNING LAMP FUNCTION

CHART 2 WARNING LAMP FUNCTION



DIAGNOSIS AND TESTING (Continued)

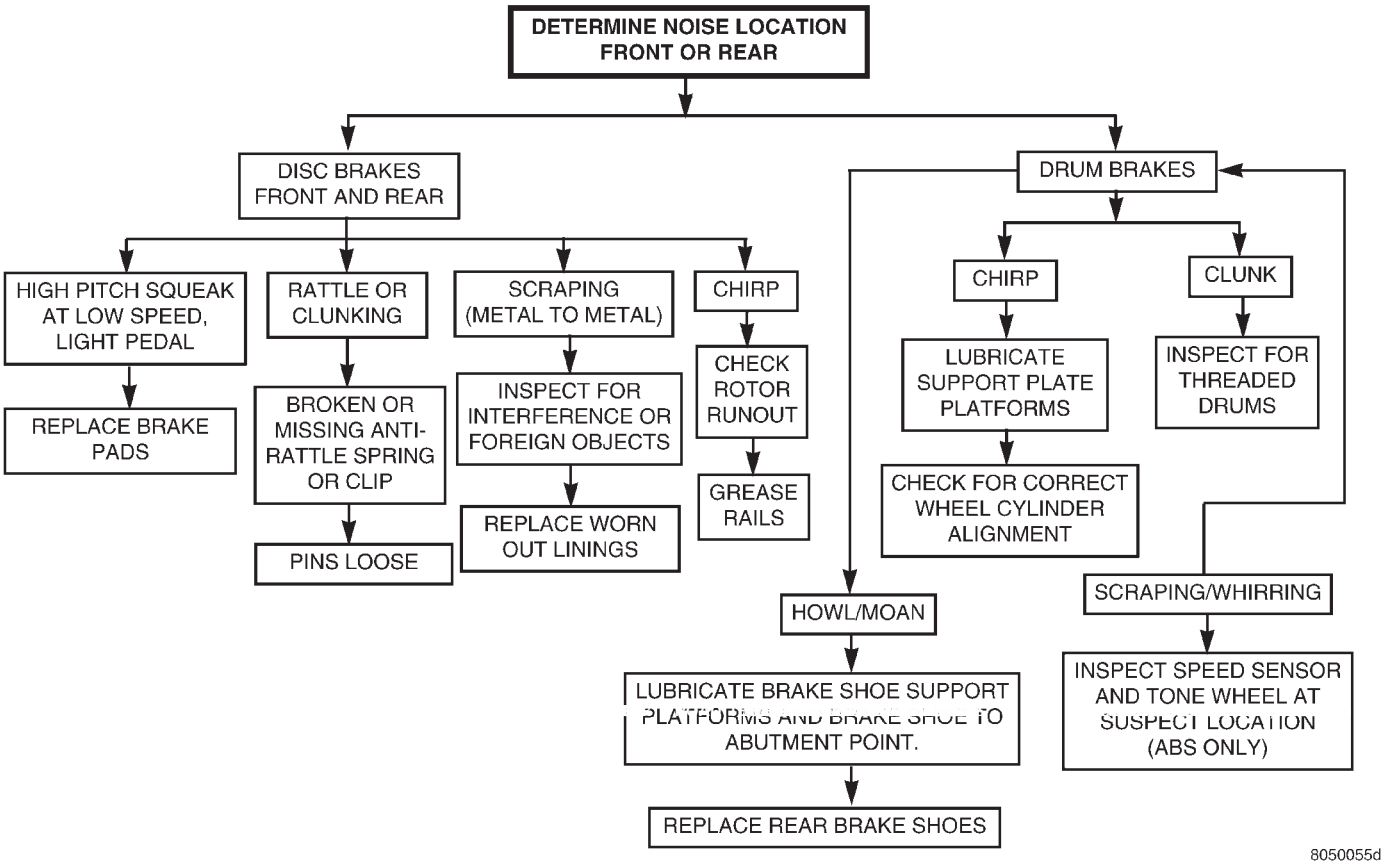
POWER BRAKE SYSTEM DIAGNOSTICS



9505-83

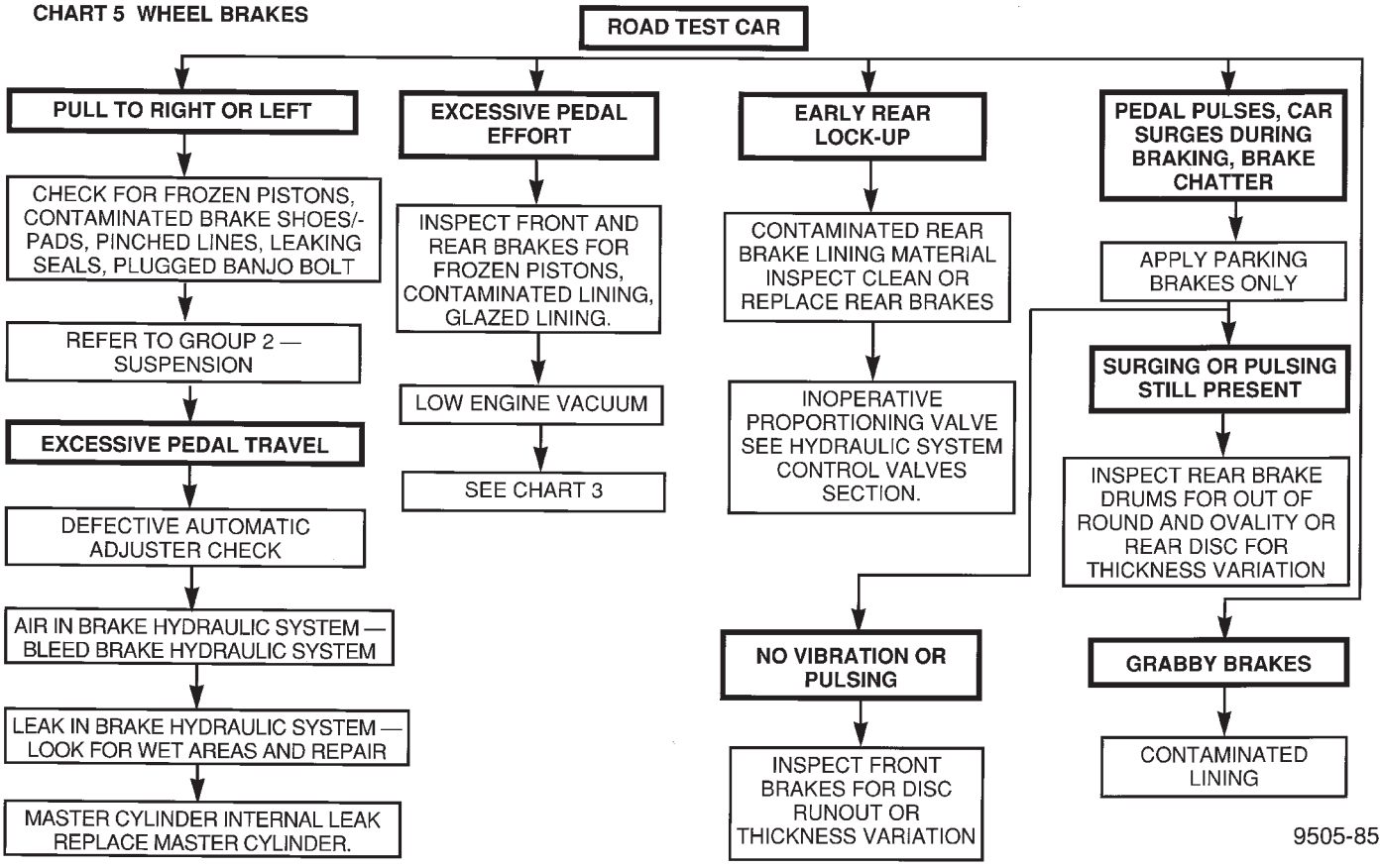
DIAGNOSIS AND TESTING (Continued)

BRAKE NOISE



VEHICLE ROAD TEST

CHART 5 WHEEL BRAKES



DIAGNOSIS AND TESTING (Continued)

DRUM BRAKE AUTOMATIC ADJUSTER

Place the vehicle on a hoist with a helper in the driver's seat to apply the brakes. Remove the access plug from the rear adjustment slot in each brake support plate to provide access to the adjuster star wheel. Then, to eliminate the possibility of maximum adjustment, back the star wheel off approximately 10 notches. It will be necessary to hold the adjuster lever away from the star wheel to permit this adjustment.

Apply the brake pedal. This application of force will cause the brake shoes to leave the anchor. Upon application of the brake pedal, the lever should move downward, turning the star wheel. Thus, a definite rotation of the adjuster star wheel can be observed if the automatic adjuster is working properly. If one or more adjusters do not function properly, the respective drum must be removed for adjuster servicing.

ROTOR THICKNESS AND RUNOUT

Any servicing of the rotor requires extreme care to maintain the rotor within service tolerances to ensure proper brake action.

Before refinishing or refacing a rotor, the disc should be checked and inspected for the following conditions:

Braking surface scoring, rust, impregnation of lining material and worn ridges.

Excessive lateral runout or wobble.

Thickness variation (Parallelism).

Dishing or distortion (Flatness).

If a vehicle has not been driven for a period of time, the rotor surface will rust in the area not covered by the brake lining and cause noise and chatter when the brakes are applied.

Excessive wear and scoring of the rotor can cause temporary improper lining contact if ridges are not removed before installation of new brake pad assemblies.

Some discoloration or wear of the rotor surface is normal and does not require resurfacing when linings are replaced.

Excessive runout or wobble in a rotor can increase pedal travel due to piston knock back. This will increase guide pin sleeve wear due to tendency of caliper to follow rotor wobble.

Thickness variation in a rotor can also result in pedal pulsation, chatter and surge due to variation in brake output. This can also be caused by excessive runout in rotor or hub.

Dishing or distortion can be caused by extreme heat and abuse of the brakes.

ROTOR RUNOUT AND THICKNESS VARIATION

On vehicle rotor runout is the combination of the individual runout of the hub face and the runout of the rotor. (The hub and rotor runouts are separable). To measure runout on the vehicle, remove the wheel and reinstall the lug nuts tightening the rotor to the hub. Mount Dial Indicator, Special Tool C-3339 with Mounting Adaptor, Special Tool SP- 1910 on steering arm. Dial indicator plunger should contact braking surface of rotor approximately one inch from edge of rotor (Fig. 19). Check lateral runout (both sides of rotor) runout should not exceed 0.13 mm (0.005 inch).

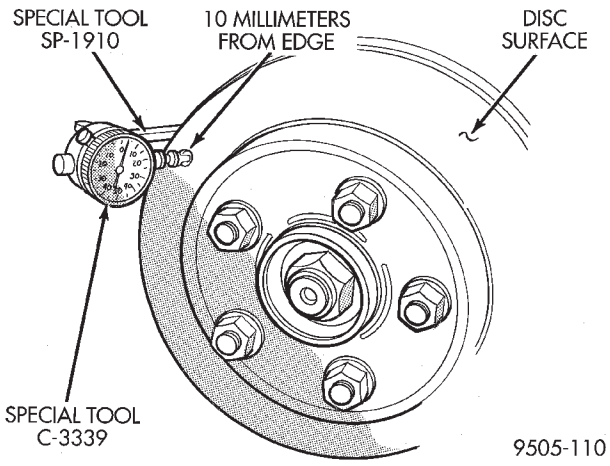


Fig. 19 Checking Rotor For Runout

If runout is in excess of the specification, check the lateral runout of the hub face. Before removing rotor from hub, make a chalk mark across both the rotor and one wheel stud on the high side of runout so you'll know exactly how the rotor and hub was originally mounted (Fig. 20). Remove rotor from hub.

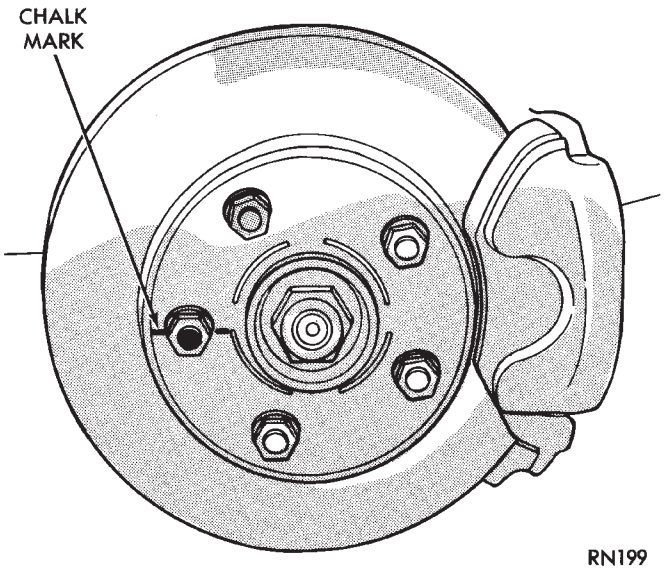


Fig. 20 Marking Rotor and Wheel Stud

Install Dial Indicator, Special Tool C-3339 and Mounting Adaptor, Special Tool SP-1910 on steering knuckle. Position stem so it contacts hub face near

DIAGNOSIS AND TESTING (Continued)

outer diameter. Care must be taken to position stem outside the stud circle but inside the chamfer on the hub rim (Fig. 21). **Clean hub surface before checking.**

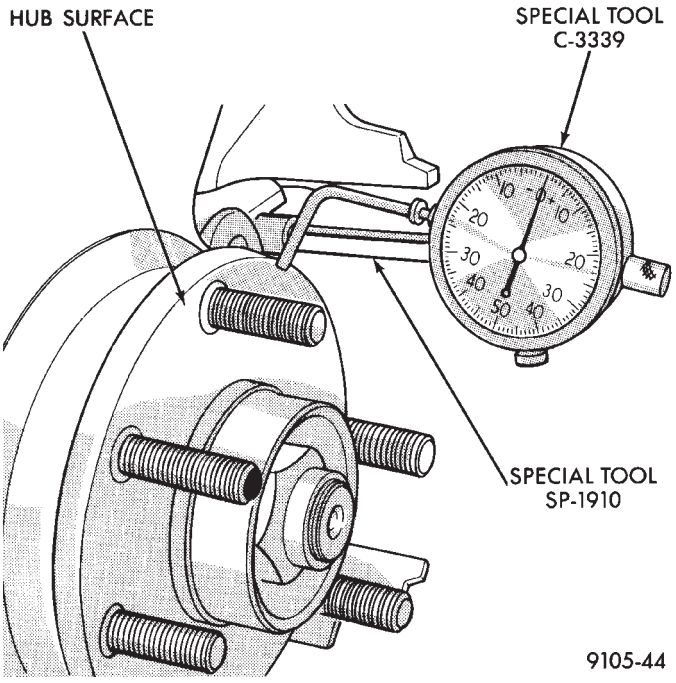


Fig. 21 Checking Hub for Runout

Runout should not exceed 0.08 mm (0.003 inch). If runout exceeds this specification, hub must be replaced. See Suspension Group 2. If hub runout does not exceed this specification, install rotor on hub with chalk marks two wheel studs apart (Fig. 22). Tighten nuts in the proper sequence and torque to specifications. Finally, check runout of rotor to see if runout is now within specifications.

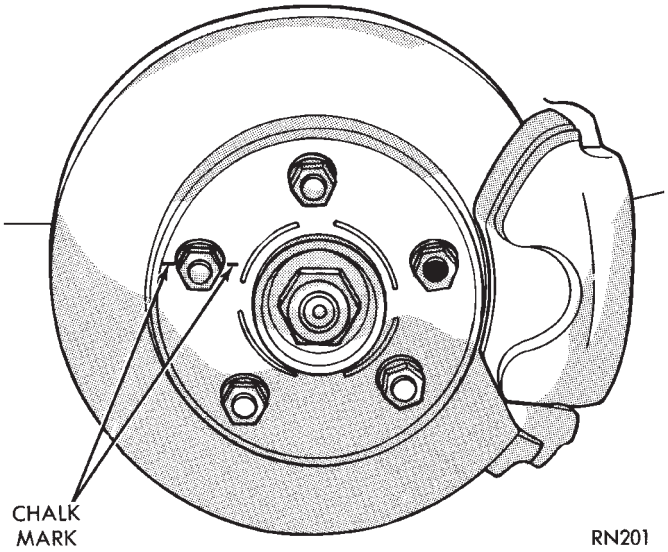


Fig. 22 Index Rotor And Wheel Stud

If runout is not within specifications. Install a new rotor or reface rotor, being careful to remove as little as possible from each side of rotor. Remove equal amounts from each side of rotor. Do not reduce thickness below minimum thickness cast into the un-machined surface of the rotor.

Thickness variation measurements of rotor should be made in conjunction with runout. Measure thickness of rotor at 12 equal points with a micrometer at a radius approximately 25 mm (1 inch) from edge of rotor (Fig. 23). If thickness measurements vary by more than 0.013 mm (0.0005 inch) rotor should be removed and resurfaced, or a new rotor installed. If cracks or burned spots are evident, rotor must be replaced.

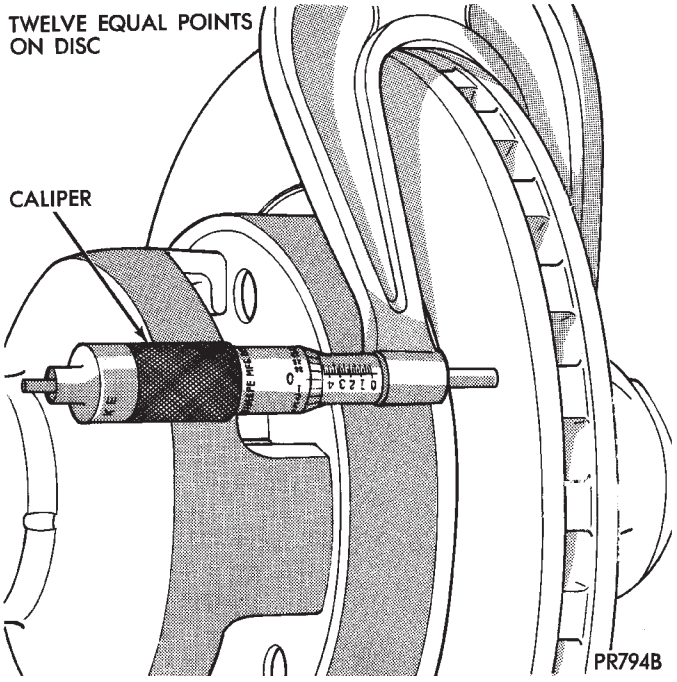


Fig. 23 Checking Rotor For Thickness

Light scoring and/or wear is acceptable. If heavy scoring or warping is evident, the rotor must be machined or replaced. See Brake Rotor Machining in the Service Procedures Section in this group of the service manual. Refer to front or rear brake rotor in the Removal And Installation section in this group of the service manual for the required brake rotor replacement procedure.

PROPORTIONING VALVES

PROPORTIONING VALVE TESTING SPECIAL TOOLS

The in-line proportioning valves used on this vehicle require special pressure fittings to test the proportioning valves for proper proportioning valve function. The pressure fittings are installed before and after the proportioning valve being tested to ver-

DIAGNOSIS AND TESTING (Continued)

ify proportioning valve is maintaining the required hydraulic pressure to the rear wheel brake which it controls.

If a condition of premature rear wheel skid occurs on a vehicle, the proportioning valve should always be tested prior to it being replaced. This is due to the fact that there are conditions other then a faulty proportioning valve which can cause a premature rear wheel skid.

Testing proportioning valve pressures on a vehicle with or without ABS requires using the same special tools.

There are 4 Pressure Fittings, Special Tool 6805 (Fig. 24) which are to be used for testing both rear proportioning valves if mounted at the master cylinder or the HCU.

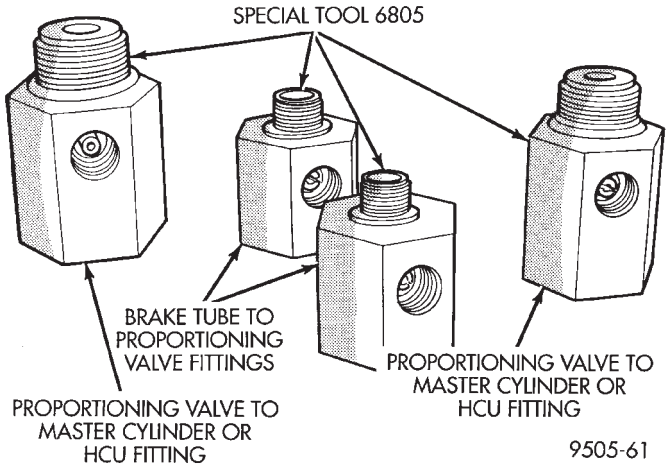


Fig. 24 Proportioning Valve Pressure Test Fittings

The pressure gauges used for testing the new in-line proportioning valves on both non-ABS and ABS brakes, is Pressure Gauge Set, Special Tool C-4007-A currently used for testing the combination valve (Fig. 25).

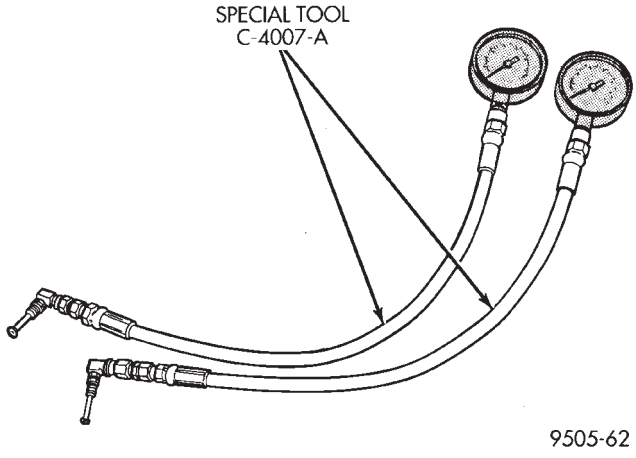


Fig. 25 Proportioning Valve Pressure Test Gauge Set

PROPORTIONING VALVE TESTING NON ABS BRAKE

If premature rear wheel skid occurs on hard brake application, it could be an indication that a malfunction has occurred with one of the proportioning valves.

One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake (Fig. 26). Therefore, a road test to determine which rear brake slides first is essential. Once the wheel which slides first is determined, use the following procedure to diagnose the proportioning valve.

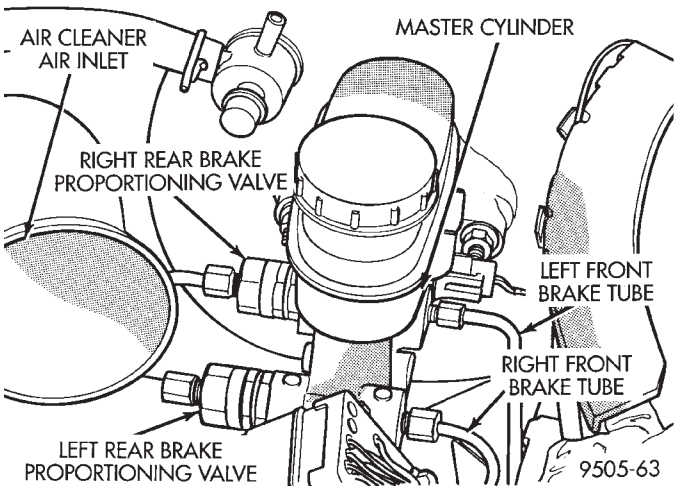


Fig. 26 Non-ABS Brakes Proportioning Valve Location On Master Cylinder

The test procedure for a premature rear wheel skid is the same for both rear wheel proportioning valves. The pressure test fittings used for each proportioning valve though are different due to proportioning valve and brake tube nut thread sizes being unique for each rear wheel. After road testing vehicle to determine which wheel skids first, the proper test fittings required will have to be determined. Then follow the procedure below for testing the required proportioning valve.

(1) After road testing vehicle to determine which rear wheel exhibits premature rear wheel skid, refer to (Fig. 26) to determine which proportioning valve needs to be tested.

(2) Remove hydraulic brake tube (Fig. 26) from proportioning valve controlling the rear wheel of the vehicle which has premature wheel skid.

(3) Remove proportioning valve from that outlet port of the master cylinder.

CAUTION: Be sure the pressure test fitting being installed into master cylinder, has the correct thread sizes for installation into the master cylinder and the installation of the proportioning valve.

DIAGNOSIS AND TESTING (Continued)

(4) Install Pressure Test Fitting, Special Tool 6805-1 or 6805-2 (Fig. 27) into the outlet port of the master cylinder, which the proportioning valve was removed from.

(5) Install proportioning valve into pressure test fitting installed in master cylinder outlet port (Fig. 27).

CAUTION: Be sure the pressure test fitting being installed into proportioning valve, has the correct thread sizes for installation into the proportioning valve and installation of brake tube fitting.

(6) Install Pressure Test Fitting, Special Tool 6805-3 or 6805-4 (Fig. 27) into the outlet port of the proportioning valve.

(7) Connect brake hydraulic tube onto the pressure test fitting that was installed in proportioning valve (Fig. 27).

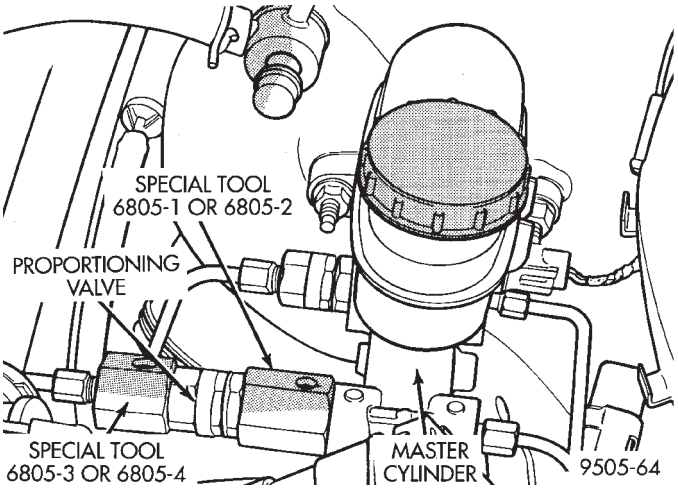


Fig. 27 Proportioning Valve Installation For Pressure Testing

(8) Install a Pressure Gauge, Special Tool C-4007-A into each pressure test fitting (Fig. 28). Bleed air out of hose from pressure test fitting to pressure gauge, at pressure gauge to remove all trapped air. hose.

(9) With the aid of a helper, apply pressure to the brake pedal until reading on proportioning valve inlet gauge, is at the pressure shown on the following chart. Then check the pressure reading on the proportioning valve outlet gauge. If proportioning valve outlet pressure does not agree with value shown on the following chart, when inlet pressure shown on chart is obtained, replace the proportioning valve. If proportioning valve is within pressure specifications do not replace proportioning valve.

(10) Check rear wheel brake shoe linings for contamination or for replacement brake shoes not meeting OEM brake lining material specifications. These conditions can also be a possible cause for a premature rear wheel skid.

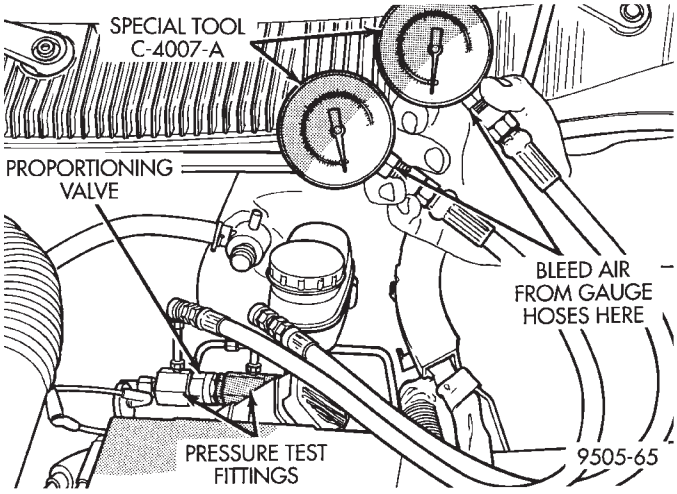


Fig. 28 Pressure Gauges Installed On Pressure Test Fittings

(11) Install proportioning valve in master cylinder and hand tighten until proportioning is fully installed and O-ring seal is seated into master cylinder. Then torque proportioning valve to 40 N·m (30 ft. lbs.).

(12) Install brake tube on proportioning valve. Torque tube nut to 17 N·m (145 in. lbs.) torque.

(13) Bleed the affected brake line. See Bleeding Brake System in the Service Adjustments section of the manual for proper bleeding procedure

PROPORTIONING VALVE TEST WITH ABS BRAKES

If premature rear wheel ABS cycling occurs on a hard brake application, it could be an indication that a malfunction has occurred with one of the proportioning valves.

One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake (Fig. 29). Since ABS cycles both rear brakes together, both valves must be tested to isolate the suspect proportioning valve.

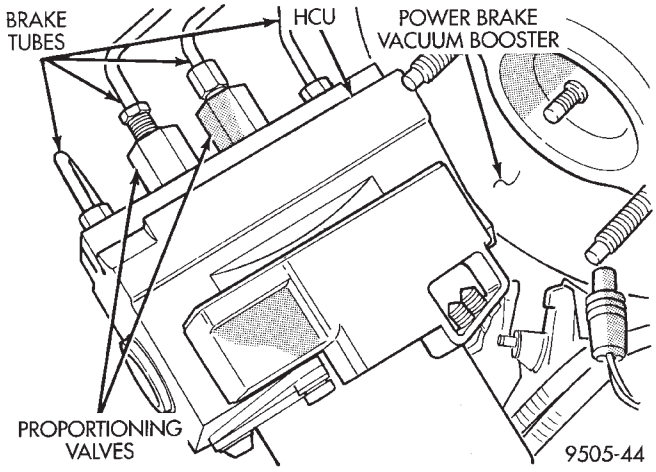


Fig. 29 Proportioning Valve Locations On HCU

DIAGNOSIS AND TESTING (Continued)

The test procedure is the same for both rear wheel proportioning valves. The pressure test fittings used for each proportioning valve though are different due to proportioning valve and brake tube nut thread sizes being unique for each rear wheel. Follow the procedure below for testing the required proportioning valve.

(1) Road test vehicle to verify premature rear wheel ABS cycling, refer to (Fig. 29) to determine which proportioning valve needs to be tested.

(2) Remove hydraulic brake tube (Fig. 29) from one of the proportioning valves.

(3) Then remove proportioning valve from that outlet port of the HCU.

CAUTION: Be sure the pressure test fitting being installed into the HCU, has the correct thread sizes for installation into the HCU and installation of the proportioning valve.

(4) Install Pressure Test Fitting, Special Tool 6805-1 or 6805-2 (Fig. 30) into the outlet port of the HCU.

(5) Install proportioning valve (Fig. 30) into pressure test fitting installed in the HCU outlet port.

CAUTION: Be sure the pressure test fitting being installed into proportioning valve, has the correct thread sizes for installation into the proportioning valve and installation of brake tube fitting into proportioning valve.

(6) Install Pressure Test Fitting, Special Tool 6805-3 or 6805-4 (Fig. 30) into the outlet of the proportioning valve.

(7) Connect brake tube onto pressure test fitting installed in proportioning valve (Fig. 30).

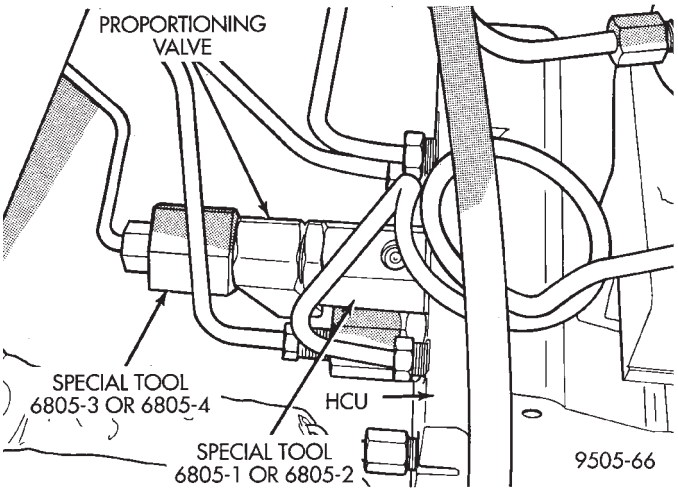


Fig. 30 Proportioning Valve Installation For Pressure Testing

(8) Install a Pressure Gauge, Special Tool C-4007-A into each pressure test fitting (Fig. 31). Bleed air out of hose from pressure test fitting to pressure gauge, at pressure gauge to remove all trapped air.

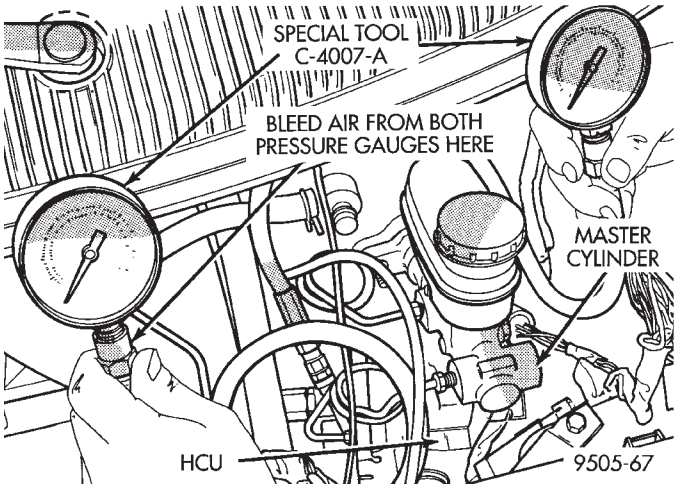


Fig. 31 Pressure Gauges Installed On Pressure Test Fittings At HCU

(9) With the aid of a helper, apply pressure to the brake pedal until reading on proportioning valve inlet gauge, is at the pressure shown on the following chart. Then check the pressure reading on the proportioning valve outlet gauge. If proportioning valve outlet pressure does not agree with value shown on the following chart, when inlet pressure shown on chart is obtained, replace the proportioning valve. If proportioning valve is within pressure specifications do not replace proportioning valve.

(10) Install proportioning valve in HCU and hand tighten until proportioning is fully installed and O-ring seal is seated into HCU. Then torque proportioning valve to 40 N·m (30 ft. lbs.).

(11) Install brake tube on proportioning valve. Torque tube nut to 17 N·m (145 in. lbs.) torque.

(12) Bleed the affected brake line. See Bleeding Brake System in the Service Adjustments section of the manual for proper bleeding procedure.

(13) Repeat steps 2 thru 12 for the second proportioning valve.

(14) Check rear wheel brake shoe linings for contamination or for replacement brake shoes not meeting OEM brake lining material specifications. These conditions can also be a possible cause for a premature rear wheel skid.

DIAGNOSIS AND TESTING (Continued)

BRAKE PROPORTIONING VALVE APPLICATIONS AND PRESSURE SPECIFICATIONS

SALES CODE	BRAKE SYSTEM TYPE	SPLIT POINT	SLOPE	IDENTIFICATION	INLET PRESSURE	OUTLET PRESSURE
BRA	14” Disc/Drum	400 psi	0.43	Black Band	1000 psi	600-700 psi
BRD	14” Disc/Disc	400 psi	0.34	Bar Code Band	1000 psi	550-650 psi
BRF	14” Disc/Disc W/ABS	400 psi	0.34	Bar Code Band	1000 psi	550-650 psi

BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals, Antilock Brakes hydraulic unit and all hydraulic fluid hoses.

RED BRAKE WARNING LAMP TEST

For diagnosis of specific problems with the red brake warning lamp system, refer to Brake System Diagnostics Chart 2, located in the Diagnosis And Testing section in this group of the service manual.

STOP LAMP SWITCH TEST PROCEDURE

The required procedure for testing the stop lamp switch is covered in Group 8H, Vehicle Speed Control System in this service manual. The electrical circuit tests for stop lamps is covered in Group 8W Rear Lighting in this service manual.

SERVICE PROCEDURES

BRAKE FLUID LEVEL CHECK

Check master cylinder reservoir brake fluid level a minimum of twice a year.

Master cylinder reservoirs are marked with the words **FULL AND MIN** indicating proper range of the master cylinder fluid level (Fig. 32).

CAUTION: Use only Mopar® brake fluid or an equivalent from a tightly sealed container. Brake fluid must conform to DOT 3 specifications. Do not use petroleum-based fluid because seal damage in the brake system will result.

If necessary, add specified brake fluid bringing level to the **FULL** mark on the side of the master cylinder brake fluid reservoir (Fig. 32).

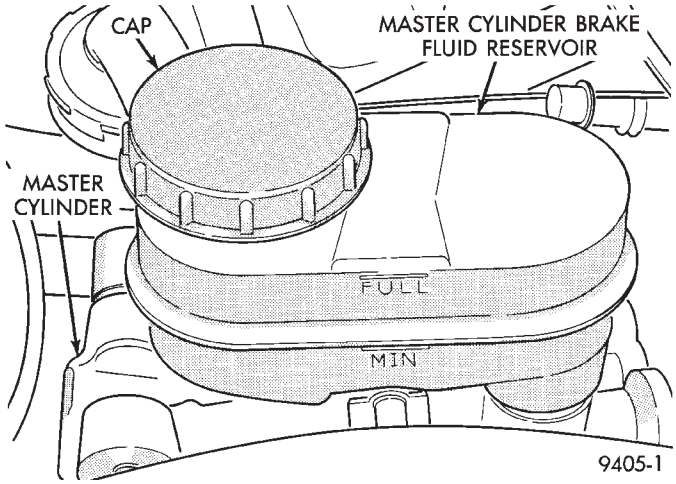


Fig. 32 Master Cylinder Fluid Level

BRAKE BLEEDING

NOTE: For bleeding the ABS hydraulic system, see Bleeding ABX-4 Brake System in the Service Procedures Section of the ABS Brake Section in this group of the service manual.

CAUTION: Before removing the master cylinder cover, wipe it clean to prevent dirt and other foreign matter from dropping into the master cylinder.

PRESSURE BLEEDING

CAUTION: Use bleeder tank Special Tool C-3496-B with required adapter for the master cylinder reservoir to pressurize the hydraulic system for bleeding.

NOTE: Follow pressure bleeder manufacturer’s instructions for use of pressure bleeding equipment.

When bleeding the brake system, some air may be trapped in the brake lines or valves far upstream, as much as ten feet from the bleeder screw (Fig. 33). Therefore, it is essential to have a fast flow of a large volume of brake fluid when bleeding the brakes to ensure all the air gets out.

The following wheel sequence for bleeding the brake hydraulic system should be used to ensure

SERVICE PROCEDURES (Continued)

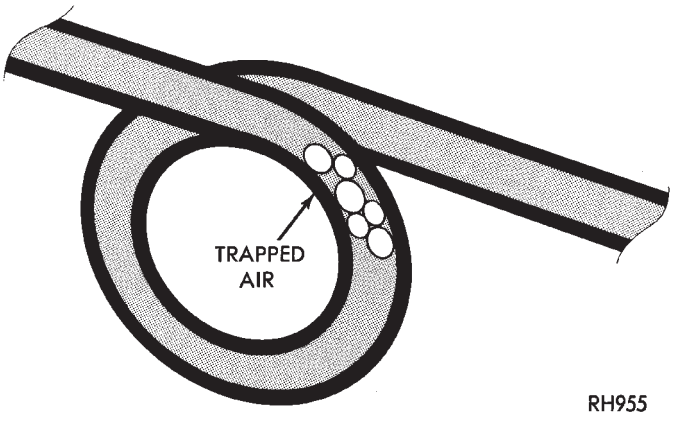


Fig. 33 Trapped Air in Brake Line

adequate removal of all trapped air from the hydraulic system.

- Left rear wheel
- Right front wheel
- Right rear wheel
- Left front wheel

(1) Attach a clear plastic hose to the bleeder screw starting at the right rear wheel and feed the hose into a clear jar containing enough fresh brake fluid to submerge the end of the hose (Fig. 34).

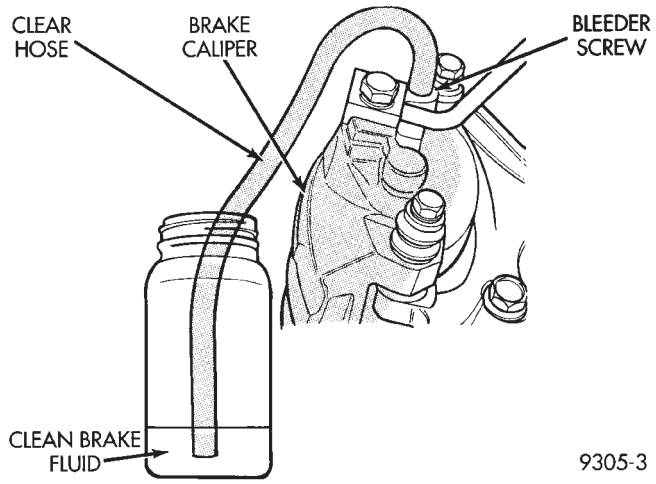


Fig. 34 Proper Method for Purging Air From Brake System (Typical)

(2) Open the bleeder screw at least **one full turn** or more to obtain an steady stream of brake fluid (Fig. 35).

(3) After 4 to 8 ounces of fluid has been bled through the brake and an air-free flow is maintained in the clear plastic hose and jar, close the bleeder screw.

(4) Repeat the procedure at all the other remaining bleeder screws. Then check the pedal for travel. If pedal travel is excessive or has not been improved, enough fluid has not passed through the system to expel all the trapped air. Be sure to monitor the fluid level in the pressure bleeder. It must stay at the proper level so air will not be allowed to reenter the brake system through the master cylinder reservoir.

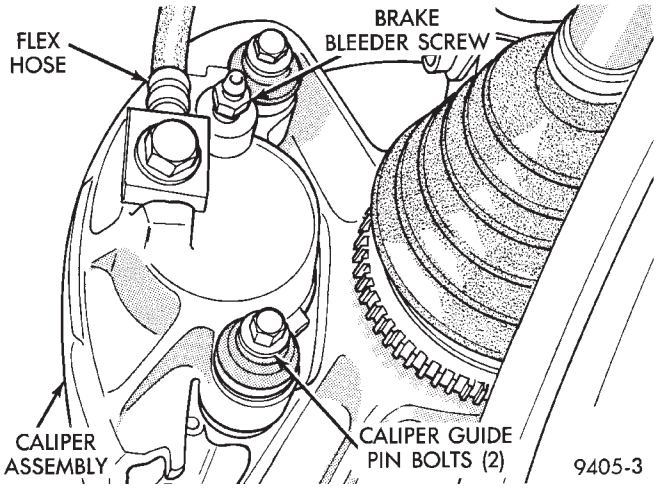


Fig. 35 Open Bleeder Screw at Least One Full Turn

BLEEDING WITHOUT A PRESSURE BLEEDER

NOTE: Correct bleeding of the brakes hydraulic system without the use of pressure bleeding equipment will require the aid of a helper.

The following wheel sequence for bleeding the brake hydraulic system should be used to ensure adequate removal of all trapped air from the hydraulic system.

- Left rear wheel
- Right front wheel
- Right rear wheel
- Left front wheel

(1) Attach a clear plastic hose to the bleeder screw starting at the right rear wheel and feed the hose into a clear jar containing enough fresh brake fluid to submerge the end of the hose (Fig. 34).

(2) Pump the brake pedal three or four times and hold it down before the bleeder screw is opened.

(3) Open the bleeder screw at least 1 full turn. When the bleeder screw opens the brake pedal will drop.

(4) Close the bleeder screw. Release the brake pedal only **after** the bleeder screw is closed.

(5) Repeat steps 1 through 3, four or five times at each bleeder screw. Then check the pedal for travel. If pedal travel is excessive or has not been improved, enough fluid has not passed through the system to expel all the trapped air. Be sure to monitor the fluid level in the master cylinder reservoir. It must stay at the proper level so air will not be allowed to re-enter the brake system.

(6) Test drive vehicle to be sure brakes are operating correctly and that pedal is solid.

SERVICE PROCEDURES (Continued)

MASTER CYLINDER BLEEDING

(1) Clamp the master cylinder in a vise. Attach Bleeding Tubes, Special Tool 6802 to the master cylinder (Fig. 36) and (Fig. 37). Position so outlets of Bleeding Tubes will be below surface of brake fluid when reservoir is filled to its proper level.

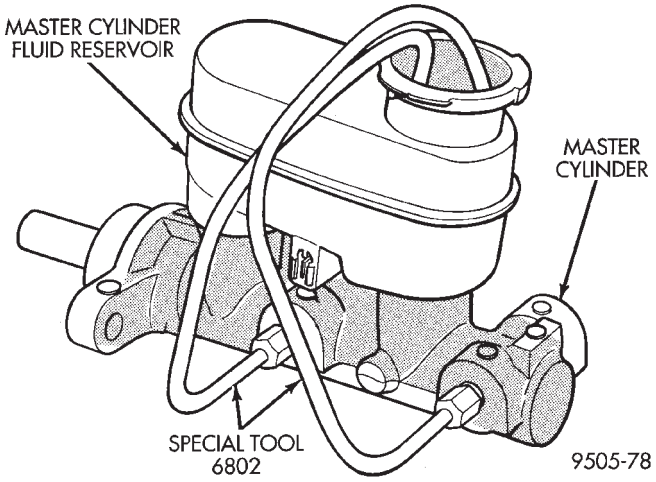


Fig. 36 Bleeding Tubes Attached to ABS Master Cylinder

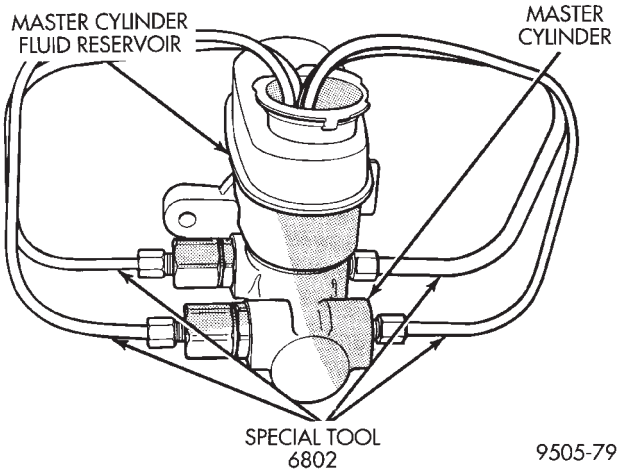


Fig. 37 Bleeding Tubes Attached To Non-ABS Master Cylinder

(2) Fill brake fluid reservoir with brake fluid conforming to DOT 3 specifications such as Mopar or an Equivalent.

(3) Using a wooden dowel per (Fig. 38). Depress push rod slowly, and then allow pistons to return to released position. Repeat several times until all air bubbles are expelled.

(4) Remove bleeding tubes from master cylinder outlet ports, plug outlet ports and install fill cap on reservoir.

(5) Remove master cylinder from vise.

NOTE: Note: It is not necessary to bleed the entire hydraulic system after replacing the master cylinder. But the master cylinder must have been bled and filled upon installation.

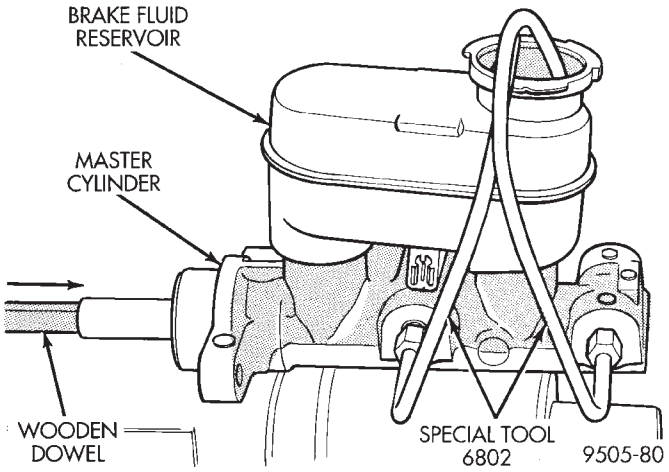


Fig. 38 Bleeding Master Cylinder

BRAKE ROTOR MACHINING

BRAKE ROTOR MACHINING PROCEDURES

Any servicing of the rotor requires extreme care to maintain the rotor to within service tolerances to ensure proper brake action.

If the rotor surface is deeply scored or warped, or there is a complaint of brake roughness or pulsation, the rotor should be resurfaced, refaced (Fig. 39) or (Fig. 40) or replaced.

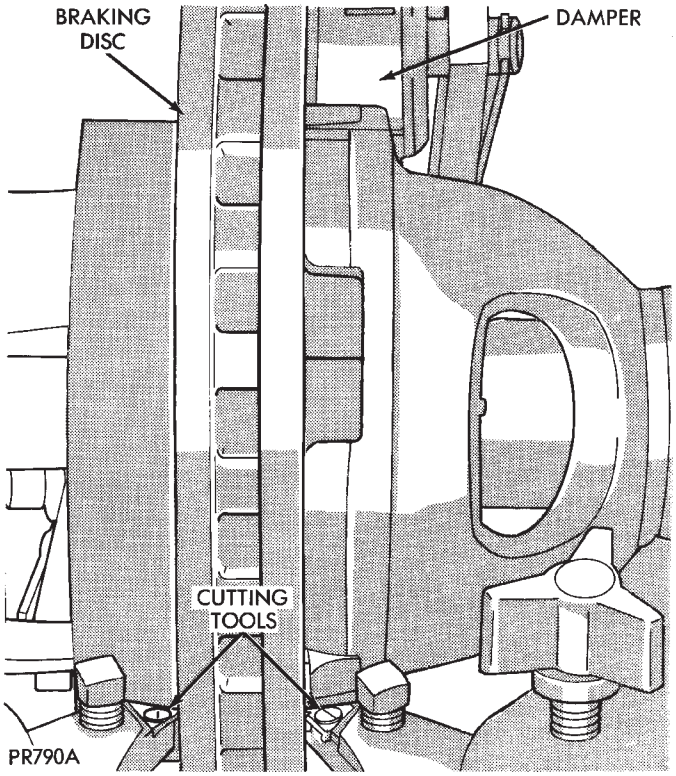


Fig. 39 Refacing Brake Rotor

SERVICE PROCEDURES (Continued)

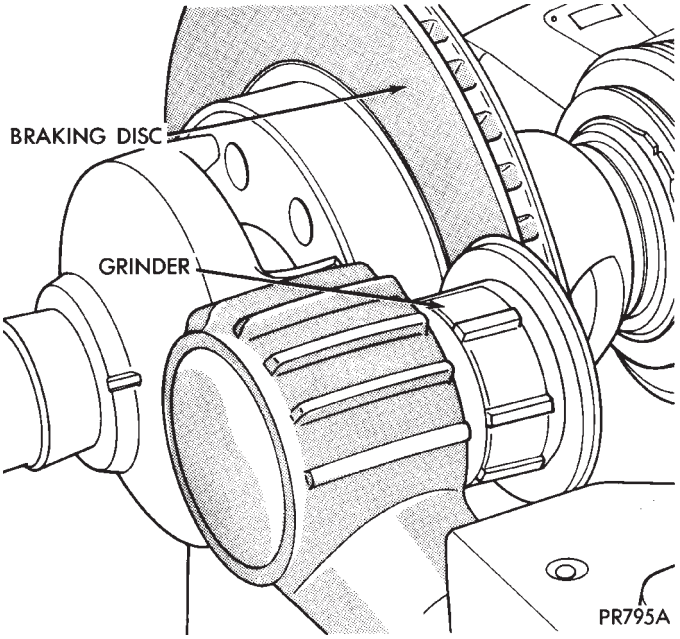


Fig. 40 Resurfacing Brake Rotor (Final Finish)

The following chart shows the location of measurements and specifications when servicing the rotor.

NOTE: All rotors have markings for minimum allowable thickness cast on an un-machined surface of the rotor (Fig. 41).

This marking includes 0.76 mm (0.030 inch) allowable rotor wear beyond the recommended 0.76 mm (0.030 inch) of rotor refacing.

The collets, shafts and adapters used on the brake lathe and the bearing cups in the rotor MUST be clean and free from any chips or contamination.

When mounting the rotor on the brake lathe, strict attention to the brake lathe manufacturer's operating instructions is required.

If the rotor is not mounted properly, the lateral runout will be worse after refacing or resurfacing than before.

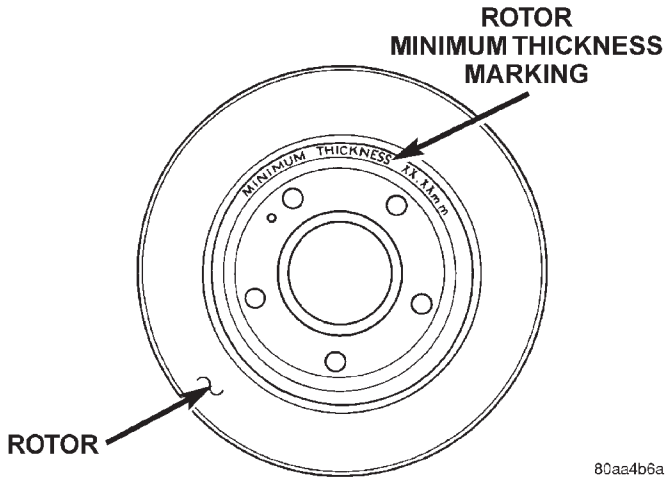


Fig. 41 Minimum Brake Rotor Thickness Markings (Typical)

REFACING BRAKE ROTOR

Refacing of the rotor is not required each time the brake pads are replaced.

When refacing a rotor the required 0.8 mm (0.003 inch) TIR (Total Indicator Reading) and 0.013 mm (0.0005 inch) thickness variation limits MUST BE MAINTAINED. **Extreme care** in the operation of rotor turning equipment is required.

The use of a double straddle cutter (Fig. 39) that machines both sides of the rotor at the same time is highly recommended.

RESURFACNG BRAKE ROTOR

This operation can be used when rotor surface is rusty, has lining deposits or excessive lateral runout or thickness variation is evident.

A sanding rotor attachment will remove surface contamination without removing much rotor material.

It will generally follow variations in thickness that are in the rotor.

BRAKE ROTOR REFINISHING LIMITS

BRAKING ROTOR	ROTOR THICKNESS	MINIMUM ROTOR THICKNESS	ROTOR THICKNESS VARIATION	ROTOR RUN OUT*	ROTOR MICRO FINISH
All Front Disc Brakes	20.13-19.87 mm .792 -.782 in.	18.4 mm .724 in.	0.013 mm 0.0005 in.	0.13 mm 0.005 in.	15-80 RMS
* TIR Total Indicator Reading (Measured On Vehicle)					

SERVICE PROCEDURES (Continued)

BRAKE DRUM MACHINING

Measure drum runout and diameter. If not to specification, reface drum. (Runout should not exceed 0.1524 mm or 0.006 inch). The diameter variation (oval shape) of the drum braking surface must not exceed either 0.0635 mm (0.0025 inch) in 30° or 0.0889 mm (0.0035 inch) in 360°.

All brake drums are marked with the maximum allowable brake drum diameter (Fig. 42).

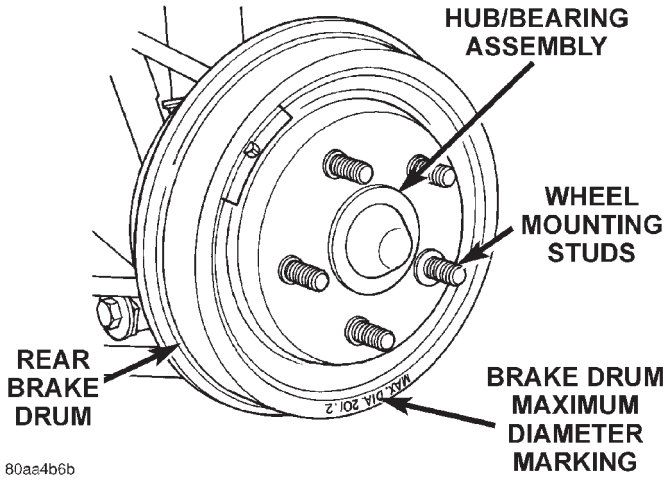


Fig. 42 Brake Drum Maximum Diameter Identification

PARK BRAKE LEVER AUTO ADJUSTER MECHANISM

WARNING: THE AUTO ADJUSTING FEATURE OF THIS PARKING BRAKE LEVER CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 20 POUNDS. DO NOT RELEASE THE AUTO ADJUSTER LOCK-OUT DEVICE BEFORE INSTALLING CABLES INTO THE EQUALIZER. KEEP HANDS OUT OF AUTO ADJUSTER SECTOR AND PAWL AREA. FAILURE TO OBSERVE CAUTION IN HANDLING THIS MECHANISM COULD LEAD TO SERIOUS INJURY.

WARNING: WHEN REPAIRS TO THE PARK BRAKE LEVER OR CABLES IS REQUIRED, THE AUTO ADJUSTER MUST BE RELOADED AND LOCKED OUT.

(1) Remove screws attaching rear of center console assembly to console bracket (Fig. 43) or (Fig. 44).

(2) Remove the 2 screws located in cup holders (Fig. 45), attaching front of center console assembly to console bracket.

(3) Raise park brake hand lever assembly as high as it will go for required clearance to remove center console.

(4) Remove center console assembly from vehicle.

(5) Lower park brake lever handle.

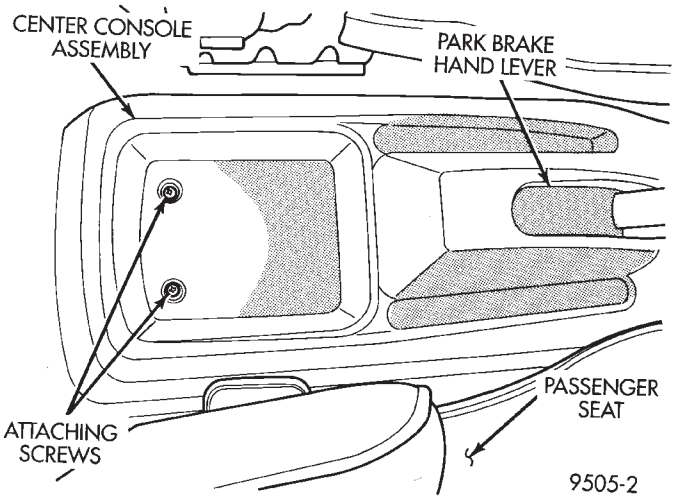


Fig. 43 Attaching Screws At Rear Of Center Console W/O Arm Rest

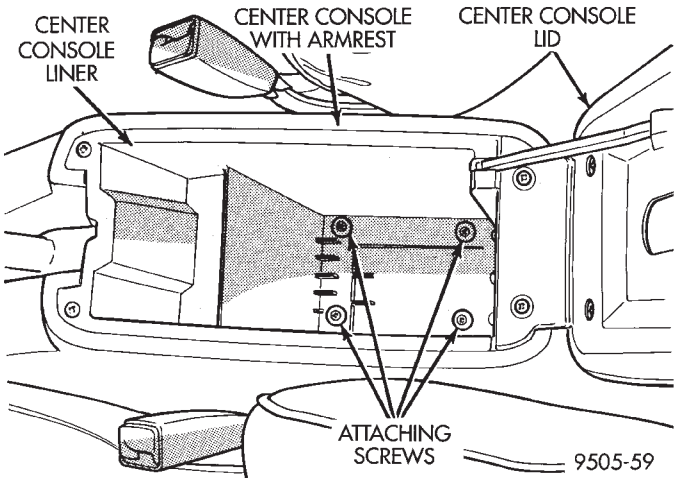


Fig. 44 Attaching Screws At Rear Of Center Console With Arm Rest

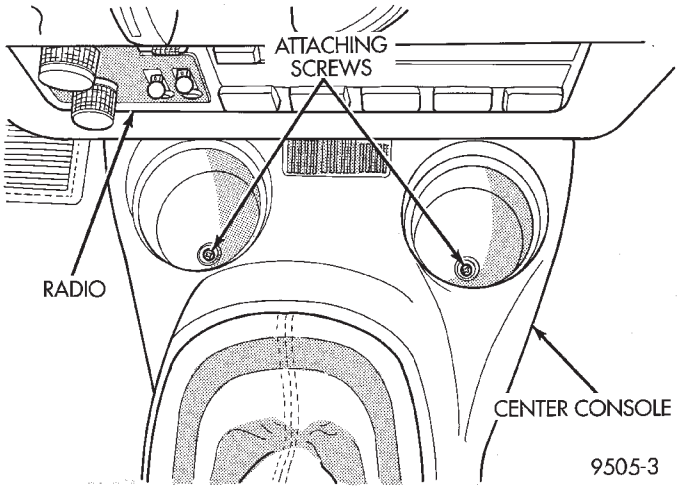


Fig. 45 Attaching Screws At Front Of Center Console

SERVICE PROCEDURES (Continued)

(6) Grasp park brake lever output cable by hand and pull upward (Fig. 46). Continue pulling on cable until a 3/16 in. drill bit can be inserted into handle and sector gear of park brake mechanism (Fig. 46). This will lock the park brake mechanism and take tension off park brake cables.

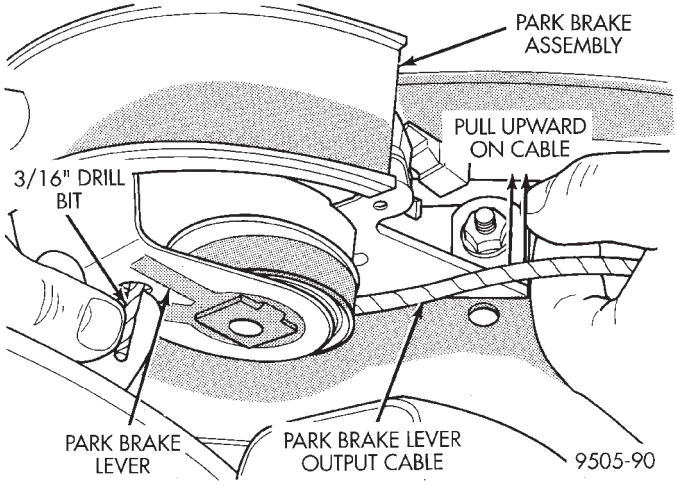


Fig. 46 Locking Pin Installed In Park Brake Mechanism

RELEASING PARK BRAKE AUTO ADJUSTER

NOTE: The park brake lever can be in any position when releasing the auto adjuster. To ease installation of center console, it is advisable to pull park brake lever handle all the way up before removing lockout pin

(1) Be sure rear park brake cables are properly installed in the equalizer (Fig. 47).

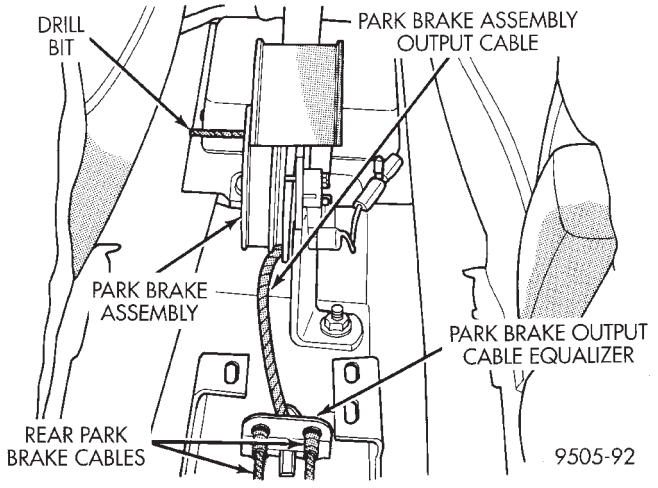


Fig. 47 Park Brake Cables Properly Installed In Equalizer

(2) Pull park brake lever handle all the way up.

(3) Firmly grasp park brake lever locking pin (Fig. 48), and quickly remove it from the park brake lever mechanism. This will allow the park brake lever mechanism to correctly adjust the park brake cables.

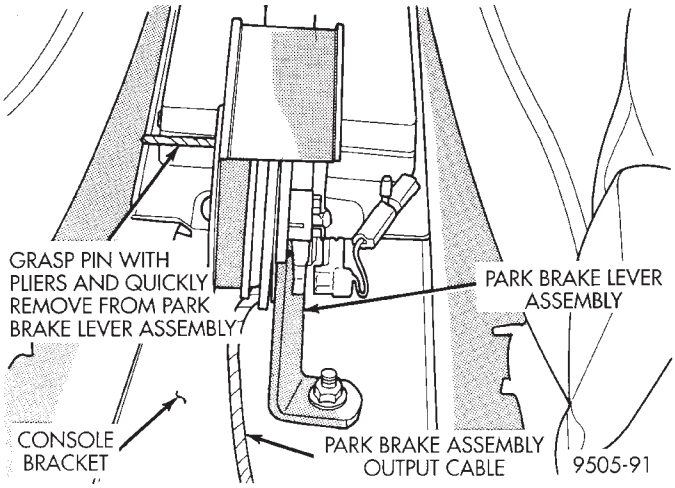


Fig. 48 Removing Lockout Pin From Park Brake Lever

(4) Install center console.

(5) Install the 4 console assembly attaching screws (Fig. 43) or (Fig. 44).

(6) Cycle park brake lever once to position park brake cables. Then return the park brake lever its released position. Check the rear wheels of the vehicle, they should rotate freely without dragging.

BRAKE TUBE REPAIR

Only double wall 4.75mm (3/16 in.) steel tubing with Al-rich/ZN-AL alloy coating and the correct tube nuts are to be used for replacement of a hydraulic brake tube.

Care should be taken when repairing brake tubing, to be sure the proper bending and flaring tools and procedures are used, to avoid kinking. Do not route the tubes against sharp edges, moving components or into hot areas. All tubes should be properly attached with recommended retaining clips.

Using Tubing Cutter, Special Tool C-3478-A or equivalent, cut off damaged seat or tubing (Fig. 49). Ream out any burrs or rough edges showing on inside of tubing (Fig. 50). This will make the ends of tubing square (Fig. 50) and ensure better seating of flared end tubing. **PLACE TUBE NUT ON TUBING BEFORE FLARING THE TUBING.**

DOUBLE INVERTED TUBING FLARES

To make a double inverted tubing flare (Fig. 51) and (Fig. 52). Open handles of Flaring Tool, Special Tool C-4047 or equivalent. Then rotate jaws of tool until the mating jaws of tubing size are centered between vertical posts on tool. Slowly close handles with tubing inserted in jaws but do not apply heavy pressure to handle as this will lock tubing in place.

SERVICE PROCEDURES (Continued)

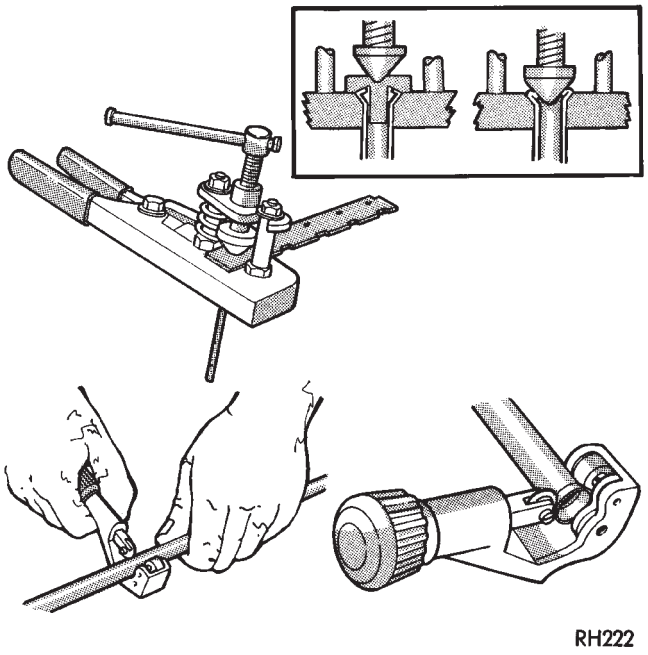


Fig. 49 Cutting And Flaring Of Brake Fluid Tubing

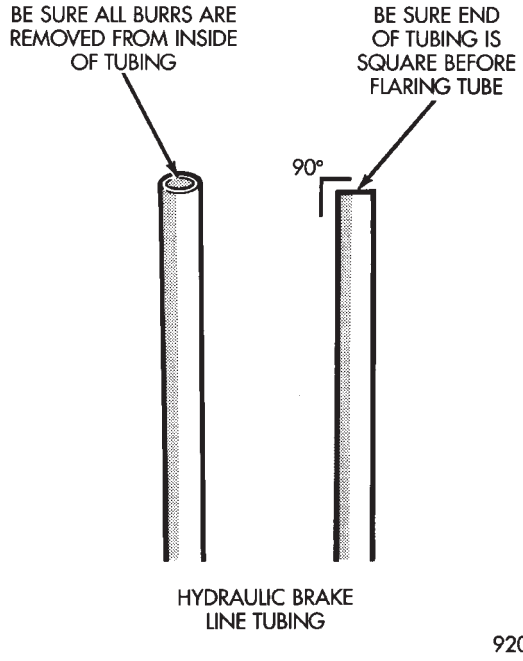


Fig. 50 Brake Fluid Tube Preparation For Flaring

Place gauge (Form A) on edge over end of brake tubing. Push tubing through jaws until end of tubing contacts the recessed notch in gauge matching the tubing size. Squeeze handles of flaring tool and lock tubing in place. Place 3/16 inch plug of gauge (A) down in end of tubing. Swing compression disc over gauge and center tapered flaring screw in recess of disc. Screw in until plug gauge has seated on jaws of flaring tool. This action has started to invert the extended end of the tubing. Remove gauge and continue to screw down until tool is firmly seated in tubing. Remove tubing from flaring tool and inspect seat. Refer to tube routing diagrams for proper brake tube routing and clip locations. Replace any damaged tube routing clips.

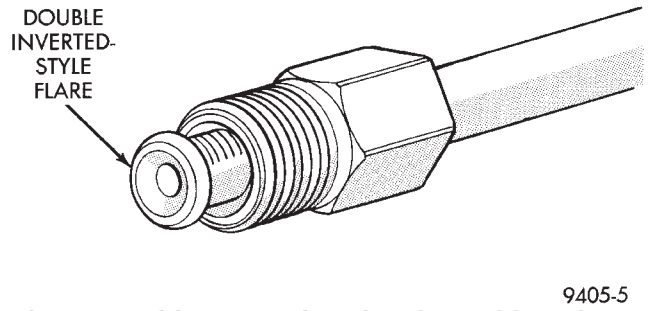


Fig. 51 Double Inverted Brake Line Tubing Flare

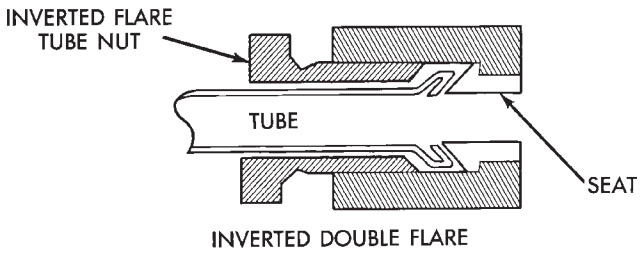


Fig. 52 Double Wall Inverted Flare Connection

REMOVAL AND INSTALLATION

WHEEL AND TIRE ASSEMBLY

To install the wheel and tire assembly, first position it properly on the mounting surface using the hub pilot as a guide. Then progressively tighten the lug nuts in the proper sequence (Fig. 53) to half of the required torque. Finally tighten the lug nuts in the proper sequence (Fig. 53) to 129 N·m (95 ft. lbs.). Never use oil or grease on studs or nuts.

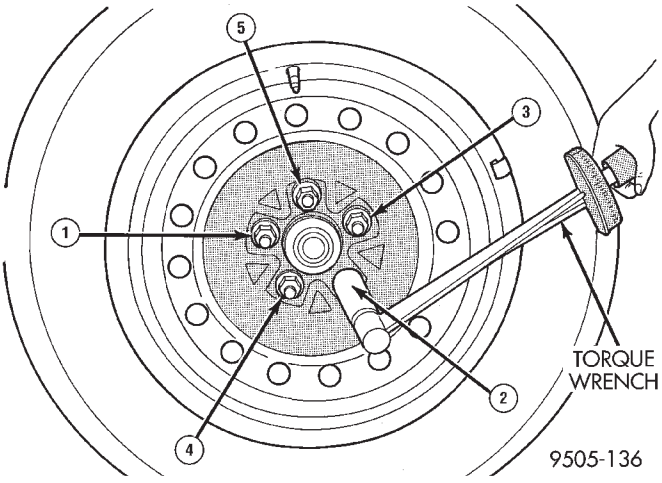


Fig. 53 Wheel Nut Tightening Sequence

REMOVAL AND INSTALLATION (Continued)

FRONT DISC BRAKE CALIPER

REMOVE

During service procedures, grease or any other foreign material must be kept off caliper assembly, surfaces of braking rotor and external surfaces of hub.

Handling of the braking rotor and caliper should be done in such a way as to avoid deformation of the rotor and scratching or nicking of the brake linings.

During removal and installation of a wheel and tire assembly, use care not to strike the caliper.

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this service manual for the required lifting procedure for this vehicle.

(2) Remove the front wheel and tire assemblies from this vehicle.

(3) Remove the 2 brake caliper to steering knuckle guide pin bolts (Fig. 54).

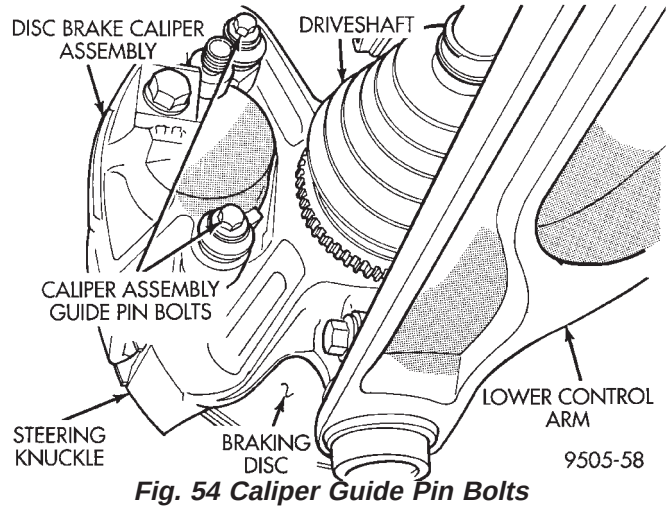


Fig. 54 Caliper Guide Pin Bolts

(4) Remove caliper from steering knuckle, by first rotating free end of caliper away from steering knuckle. Then slide opposite end of caliper out from under machined abutment on steering knuckle (Fig. 55).

(5) Support the disc brake caliper firmly using a wire hanger (Fig. 56). This is required to prevent the weight of the caliper from damaging the flexible brake hose .

INSTALL

NOTE: Step 1 below is only required when installing a caliper after new brake shoes have been installed.

(1) Completely retract the caliper piston back into the bore of the caliper.

(2) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) If removed, install the front rotor on the hub, making sure it is squarely seated on face of hub.

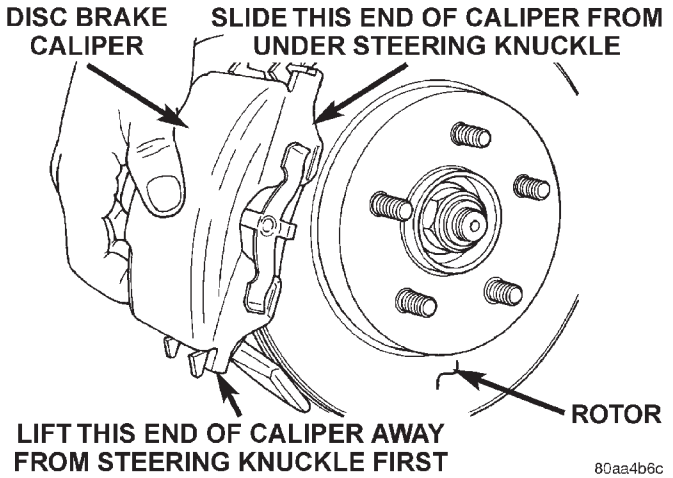


Fig. 55 Removing Caliper Assembly From Steering Knuckle

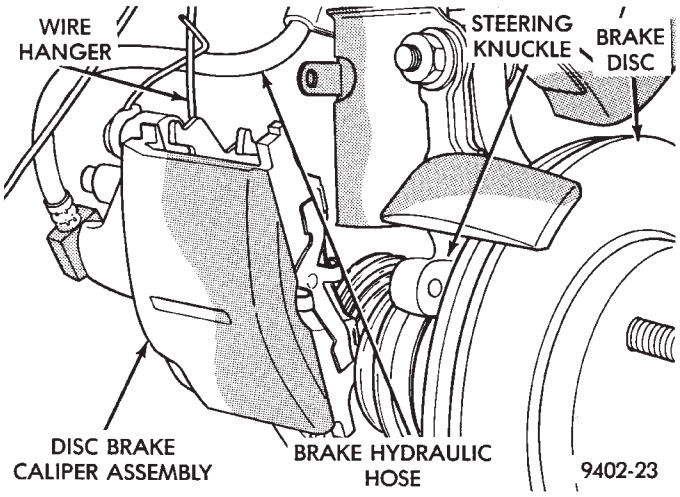


Fig. 56 Storing Disc Brake Caliper

CAUTION: Use care when installing the caliper assembly onto the steering knuckle so the seals on the caliper guide pin bushings do not get damaged by the steering knuckle bosses.

(4) Carefully position the brake caliper and brake shoes on the steering knuckle by first hooking the end of the caliper under the edge of the steering knuckle as shown in (Fig. 57). Then rotate caliper into position on the steering knuckle.

(5) Install the caliper guide pin bolts and tighten to 18 to 20 N·m (192 in. lbs.) (Fig. 54). **Extreme caution should be taken not to cross thread the caliper guide pin bolts.**

(6) Install the wheel and tire assembly.

(7) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(8) Remove jackstands or lower hoist. **Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal.**

REMOVAL AND INSTALLATION (Continued)

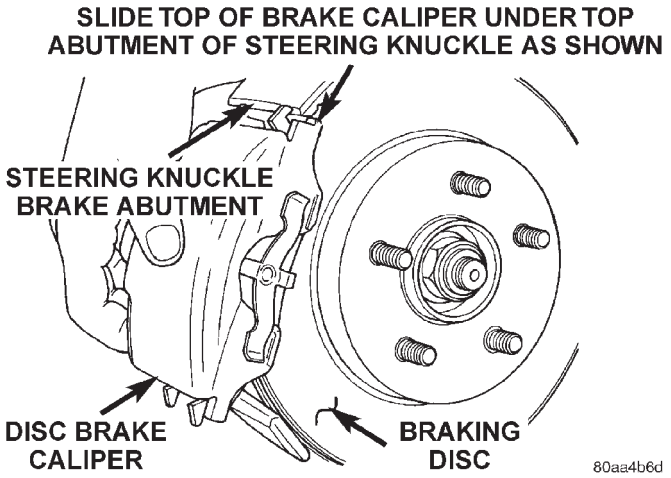


Fig. 57 Installing Caliper Assembly On Steering Knuckle

(9) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake pads.

FRONT DISC BRAKE SHOES

WARNING: ALTHOUGH FACTORY INSTALLED BRAKELININGS ARE MADE FROM ASBESTOS FREE MATERIALS, SOME AFTER MARKET BRAKELINING MAY CONTAIN ASBESTOS. THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SERVICING A VEHICLE'S BRAKE SYSTEM, WHEN AFTERMARKET BRAKELININGS MAY HAVE BEEN INSTALLED ON THE VEHICLE. ALWAYS WEAR A RESPIRATOR WHEN CLEANING BRAKE COMPONENTS AS ASBESTOS CAN CAUSE SERIOUS BODILY HARM SUCH AS ASBESTOSIS AND OR CANCER. NEVER CLEAN BRAKE COMPONENTS BY USING COMPRESSED AIR, USE ONLY A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF BRAKE DUST. IF A VACUUM CLEANER IS NOT AVAILABLE, CLEAN BRAKE PARTS USING ONLY WATER DAMPENED SHOP TOWELS. DO NOT CREATE BRAKELINING DUST BY SANDING BRAKE LININGS WHEN SERVICING A VEHICLE. DISPOSE OF ALL DUST AND DIRT SUSPECTED OF CONTAINING ASBESTOS FIBERS USING ONLY SEALED AIRTIGHT BAGS OR CONTAINERS. FOLLOW ALL RECOMMENDED SAFETY PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA), FOR HANDLING AND DISPOSAL OF PRODUCTS CONTAINING ASBESTOS.

During service procedures, grease or any other foreign material must be kept off caliper assembly, surfaces of braking rotor and external surfaces of hub.

Handling of the braking rotor and caliper should be done in such a way as to avoid deformation of the rotor and scratching or nicking of the brake linings.

If inspection reveals that the square sectioned caliper piston seal is worn or damaged, it should be replaced immediately.

During removal and installation of a wheel and tire assembly, use care not to strike the caliper.

NOTE: Before vehicle is moved after any brake service work, pump the brake pedal several times to insure the vehicle has a firm brake pedal.

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove the front wheel and tire assemblies from vehicle.

(3) Remove the 2 guide pin bolts (Fig. 58) mounting the caliper to the steering knuckle .

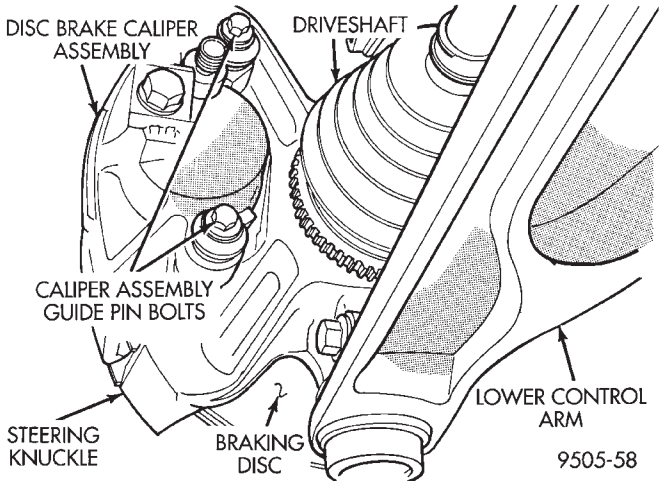


Fig. 58 Caliper Guide Pin Bolts

(4) Remove brake caliper from steering knuckle, by first rotating free end of caliper away from steering knuckle. Then slide opposite end of caliper out from under machined abutment on steering knuckle (Fig. 59).

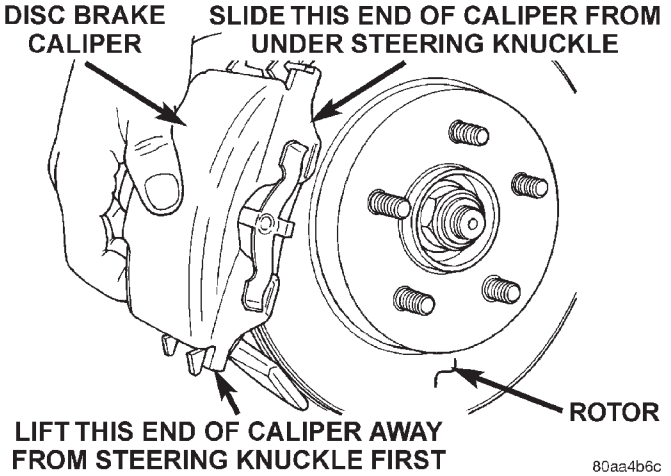


Fig. 59 Removing Caliper From Steering Knuckle

REMOVAL AND INSTALLATION (Continued)

(5) Support caliper firmly to prevent weight of caliper from damaging the flexible brake hose (Fig. 60).

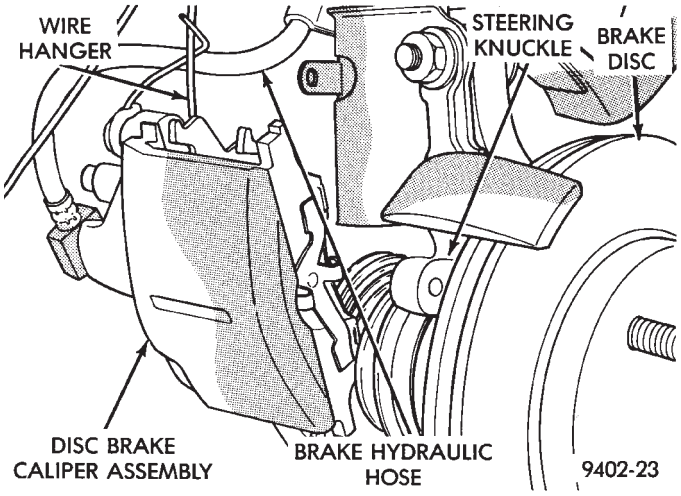


Fig. 60 Storing Caliper

(6) Remove brake rotor from hub by pulling it straight off the wheel mounting studs (Fig. 61).

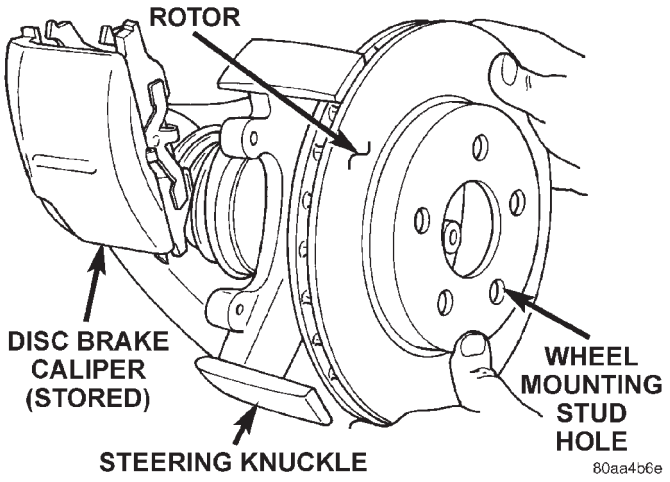


Fig. 61 Removing/Installing Brake Rotor

(7) Remove outboard brake shoe by prying the shoe retaining clip over raised area on caliper. Then slide the brake shoe down and off the caliper (Fig. 62).

(8) Pull the inboard brake shoe away from the caliper piston until the retaining clip is out of the cavity in the piston. (Fig. 63).

CALIPER INSPECTION

Check caliper for piston seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of the piston dust boot. If boot is damaged, or fluid leak is visible, disassemble caliper and install a new seal and boot, (and piston if scored). Refer to Caliper Disassembly And Re-Assembly Procedures in Disc Brake Caliper Service in this section of the service manual.

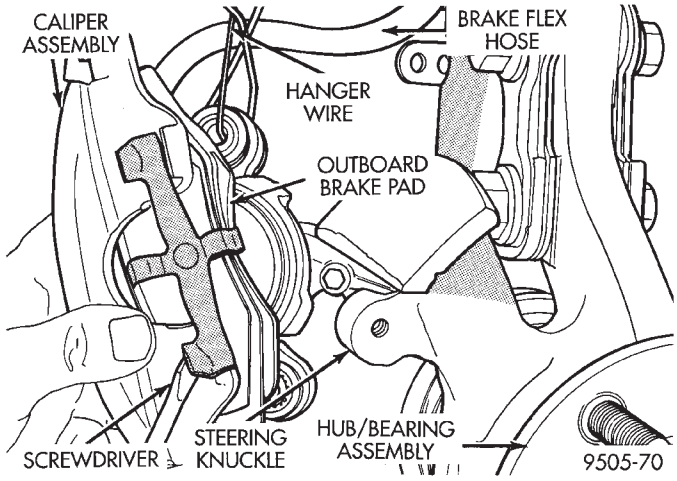


Fig. 62 Removing Outboard Brake Shoe

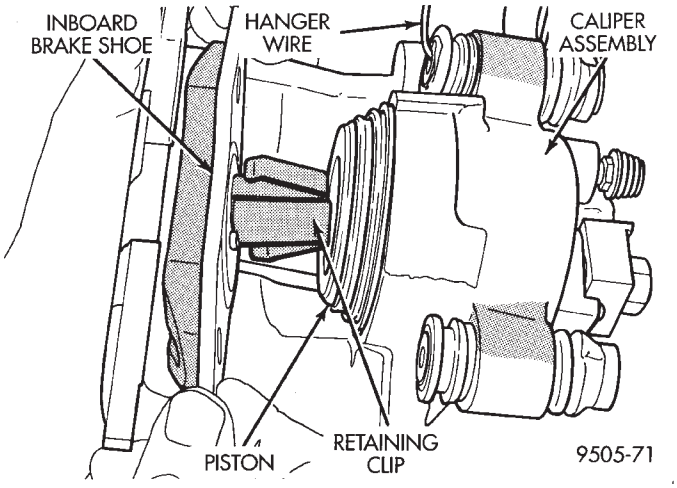


Fig. 63 Removing Inboard Brake Shoe

Check the caliper dust boot and caliper pin bushings to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Guide Pin Bushing Service in Disc Brake Caliper Service in this section of the service manual.

INSTALL

(1) Completely retract caliper piston back into piston bore of caliper. This is required for caliper installation with new brake shoe assemblies.

(2) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) Install the front rotor on the hub, making sure it is squarely seated on face of hub (Fig. 61).

(4) Remove the protective paper from the noise suppression gasket on both the inner and outer brake shoes (if equipped).

NOTE: Note: The inboard and outboard brake shoes are not common (Fig. 64).

REMOVAL AND INSTALLATION (Continued)

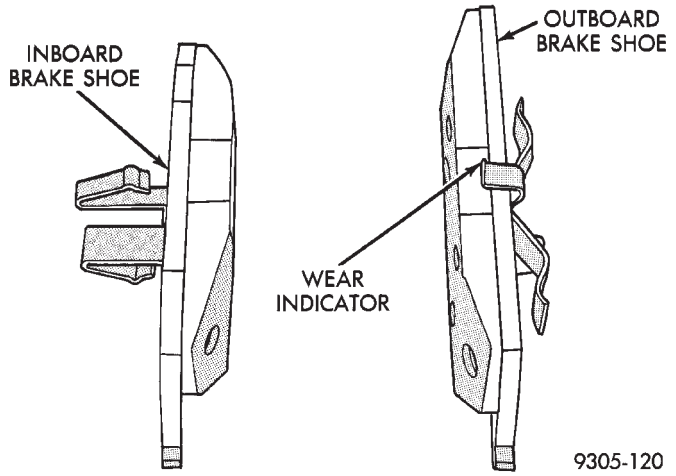


Fig. 64 Front Brake Shoe Identification

(5) Install the new inboard brake shoe into the caliper piston by firmly pressing into piston bore with thumbs (Fig. 65). Be sure inboard brake shoe is positioned squarely against the face of the caliper piston.

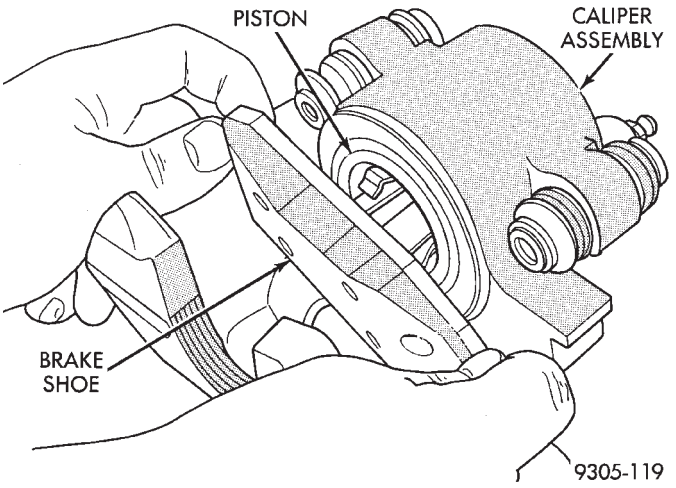


Fig. 65 Installing Inboard Brake Shoe

(6) Slide the new outboard brake shoe onto the caliper (Fig. 66).

CAUTION: Use care when installing the caliper onto the steering knuckle so the seals on the caliper guide pin bushings do not get damaged by the steering knuckle bosses.

(7) Carefully position the brake caliper and brake shoes over the rotor by hooking the end of the caliper under the steering knuckle (Fig. 67). Then rotate caliper into position on steering knuckle.

(8) Install the caliper guide pin bolts (Fig. 58) and tighten to 18 to 20 N·m (192 in. lbs.). **Extreme caution should be taken not to cross thread the caliper guide pin bolts.**

(9) Install the wheel and tire assembly.

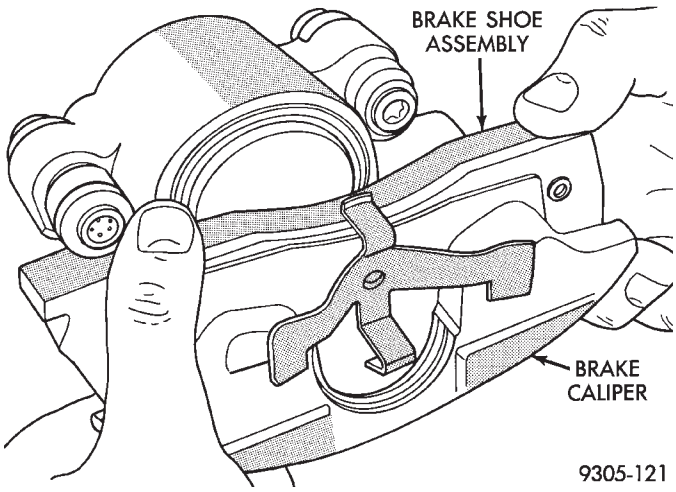


Fig. 66 Installing Outboard Brake Shoe

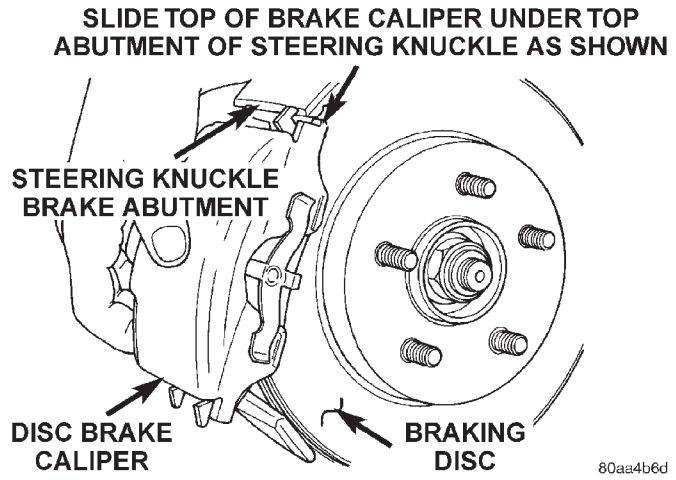


Fig. 67 Installing Caliper On Steering Knuckle

(10) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(11) Remove jackstands or lower hoist. **Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal.**

(12) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake pads.

REAR DISC BRAKE CALIPER

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove rear wheel and tire assemblies from vehicle.

REMOVAL AND INSTALLATION (Continued)

(3) Remove the 2 caliper assembly to adapter guide pin bolts (Fig. 68).

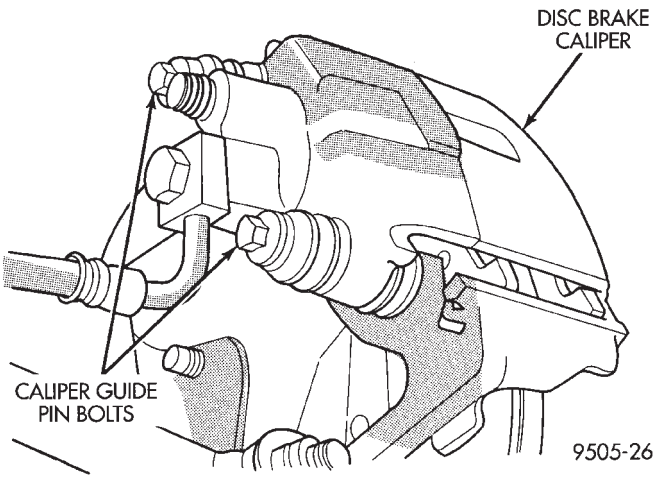


Fig. 68 Caliper Assembly Guide Pin Bolts

(4) Remove caliper assembly from adapter and rotor by first rotating top of caliper assembly away from adapter, and then lifting caliper assembly off lower machined abutment on adapter (Fig. 69).

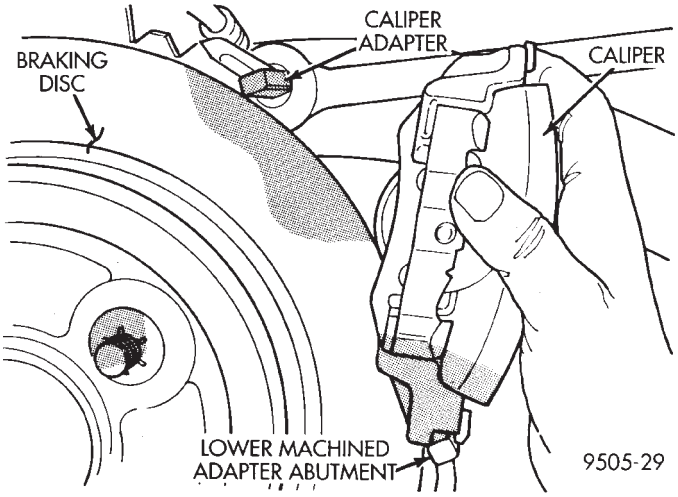


Fig. 69 Removing Caliper Assembly From Adapter

(5) Support caliper assembly firmly from rear strut to prevent weight of caliper from damaging the flexible brake hose (Fig. 70).

INSTALL

NOTE: Step 1 below is only required when installing the disc brake caliper, after new brake shoes have been installed.

(1) Completely retract caliper piston back into piston bore of caliper assembly.

(2) Lubricate both adapter abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

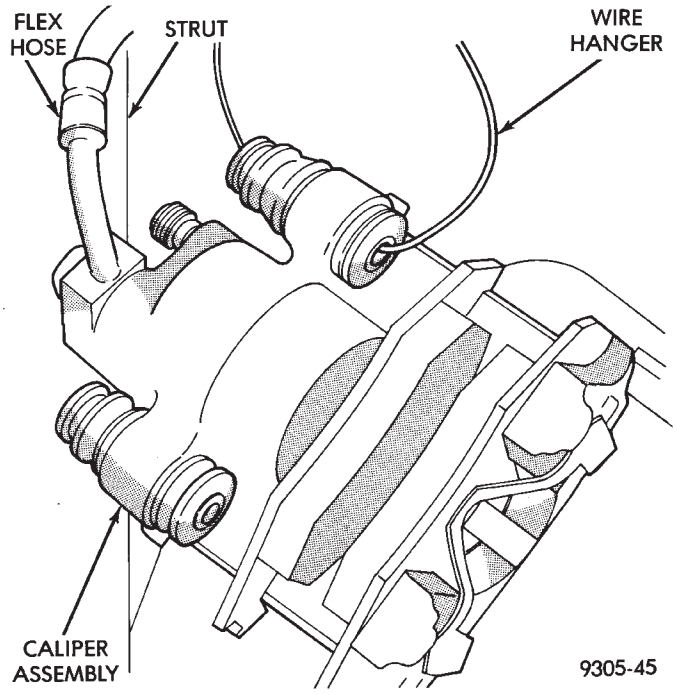


Fig. 70 Storing Caliper

(3) If removed, install the rear rotor on the hub making sure it is squarely seated on the face of the hub (Fig. 71).

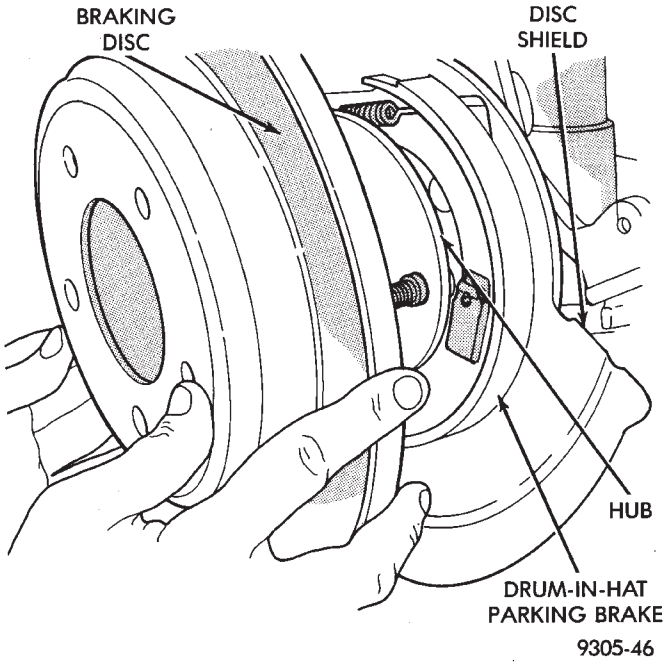


Fig. 71 Installing Rear Rotor

CAUTION: Use care when installing caliper assembly onto adapter so the guide pin bushings and sleeves do not get damaged by the mounting bosses on adapter.

(4) Carefully lower caliper and brake shoe assemblies over braking disc (rotor) reversing the required

REMOVAL AND INSTALLATION (Continued)

removal procedure (Fig. 69). Make sure that the caliper guide pin bolts, bushings and sleeves are clear of the adapter bosses.

CAUTION: Extreme caution should be taken not to cross thread the caliper guide pin bolts when they are installed.

(5) Install caliper assembly guide pin bolts into adapter and tighten (Fig. 68). Then torque both guide pin bolts to 22 N·m (192 in. lbs.).

(6) Install the wheel and tire assembly.

(7) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(8) Remove jackstands or lower hoist. **Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal.** .

(9) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake pads.

REAR DISC BRAKE SHOES

WARNING: ALTHOUGH FACTORY INSTALLED BRAKELININGS ARE MADE FROM ASBESTOS FREE MATERIALS, SOME AFTER MARKET BRAKELINING MAY CONTAIN ASBESTOS. THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SERVICING A VEHICLE'S BRAKE SYSTEM, WHEN AFTERMARKET BRAKELININGS MAY HAVE BEEN INSTALLED ON THE VEHICLE. ALWAYS WEAR A RESPIRATOR WHEN CLEANING BRAKE COMPONENTS AS ASBESTOS CAN CAUSE SERIOUS BODILY HARM SUCH AS ASBESTOSIS AND OR CANCER. NEVER CLEAN BRAKE COMPONENTS BY USING COMPRESSED AIR, USE ONLY A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF BRAKE DUST. IF A VACUUM CLEANER IS NOT AVAILABLE, CLEAN BRAKE PARTS USING ONLY WATER DAMPENED SHOP TOWELS. DO NOT CREATE BRAKELINING DUST BY SANDING BRAKE LININGS WHEN SERVICING A VEHICLE. DISPOSE OF ALL DUST AND DIRT SUSPECTED OF CONTAINING ASBESTOS FIBERS USING ONLY SEALED AIRTIGHT BAGS OR CONTAINERS. FOLLOW ALL RECOMMENDED SAFETY PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA), FOR HANDLING AND DISPOSAL OF PRODUCTS CONTAINING ASBESTOS.

During service procedures, grease or any other foreign material must be kept off caliper assembly, surfaces of braking rotor and external surfaces of hub.

Handling of the braking rotor and caliper should be done in such a way as to avoid deformation of the rotor and scratching or nicking of the brake linings.

If inspection reveals that the square sectioned caliper piston seal is worn or damaged, it should be replaced immediately.

During removal and installation of a wheel and tire assembly, use care not to strike the caliper.

NOTE: Before vehicle is moved after any brake service work, pump the brake pedal several times to insure the vehicle has a firm brake pedal.

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove rear wheel and tire assemblies from vehicle.

(3) Remove the 2 caliper assembly to adapter guide pin bolts (Fig. 72).

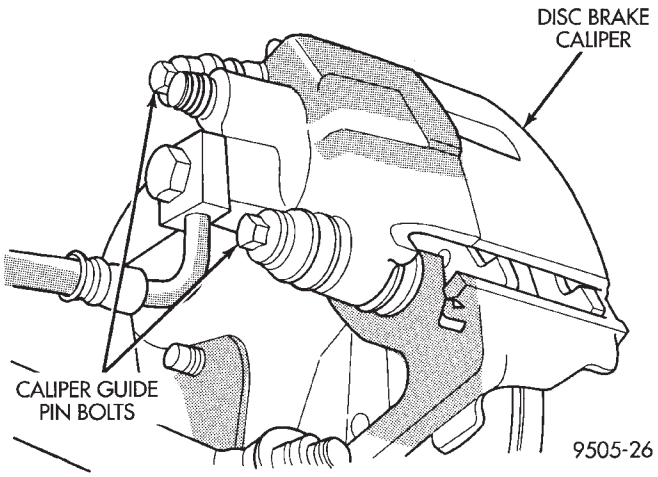


Fig. 72 Caliper Assembly Guide Pin Bolts

(4) Remove caliper assembly from adapter and rotor by first rotating top of caliper assembly away from adapter, and then lifting caliper assembly off lower machined abutment on adapter (Fig. 73).

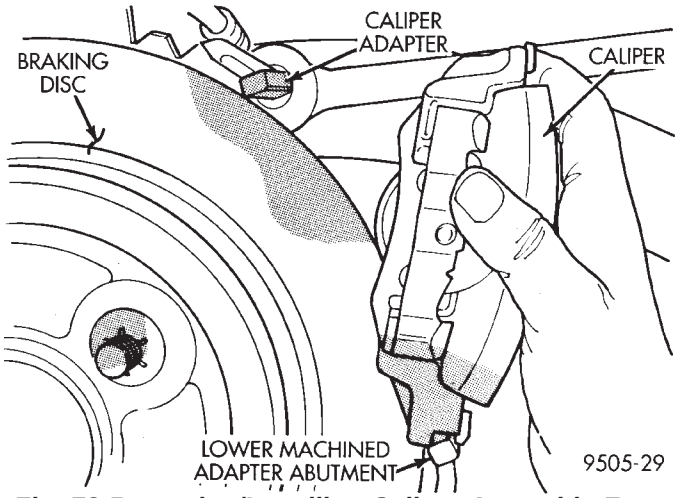


Fig. 73 Removing/Installing Caliper Assembly From Adapter

REMOVAL AND INSTALLATION (Continued)

(5) Support caliper assembly firmly from rear strut to prevent weight of caliper from damaging the flexible brake hose (Fig. 74).

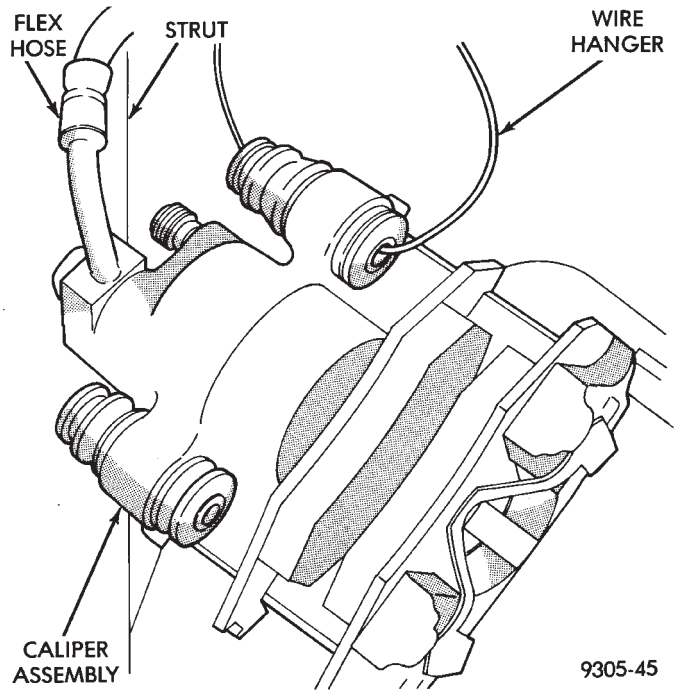


Fig. 74 Storing Caliper

(6) Remove rear rotor from hub/bearing assembly (Fig. 75). Then inspect drum-in-hat parking brake shoes and parking brake braking surface on rotor for any signs of excessive wear or damage. Replace parking brake shoes if required.

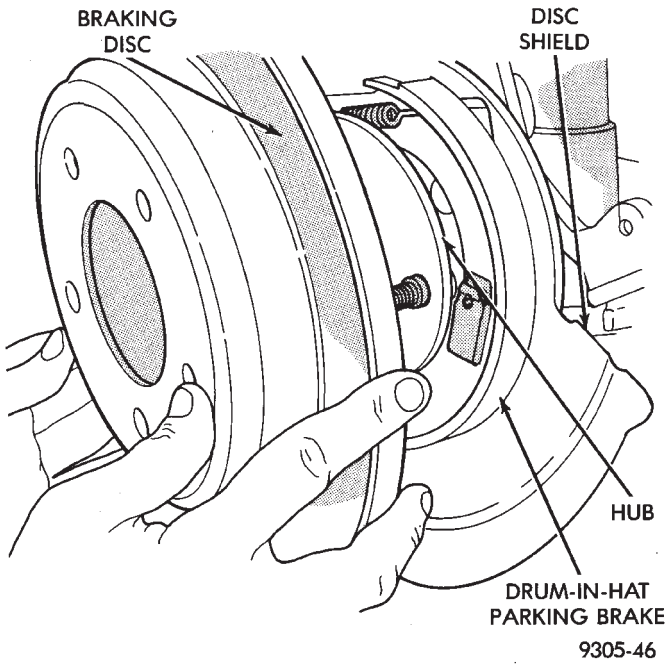


Fig. 75 Rear Brake Rotor

(7) Remove outboard brake pad from caliper by prying brake pad retaining clip over raised area on caliper. Then slide brake pad down and off the caliper (Fig. 76).

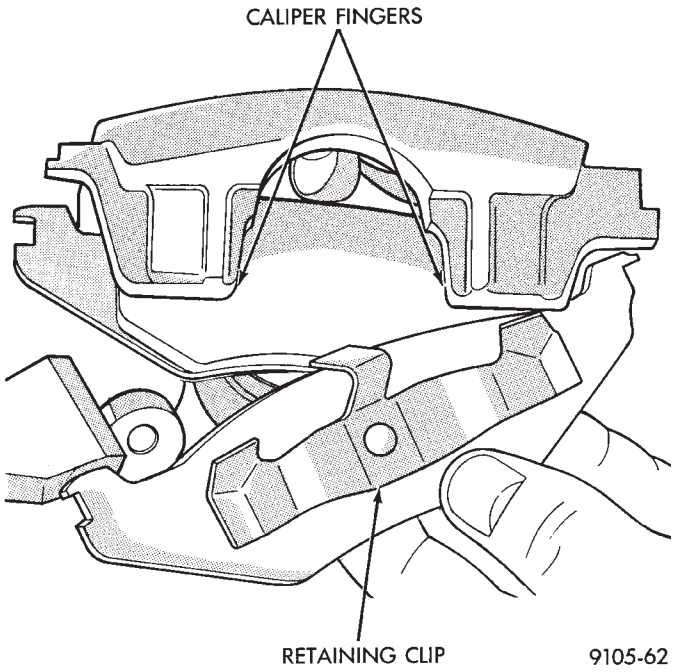


Fig. 76 Outboard Brake Shoe

(8) Pull inboard brake pad away from caliper piston, until retaining clip is free from cavity in piston. (Fig. 77).

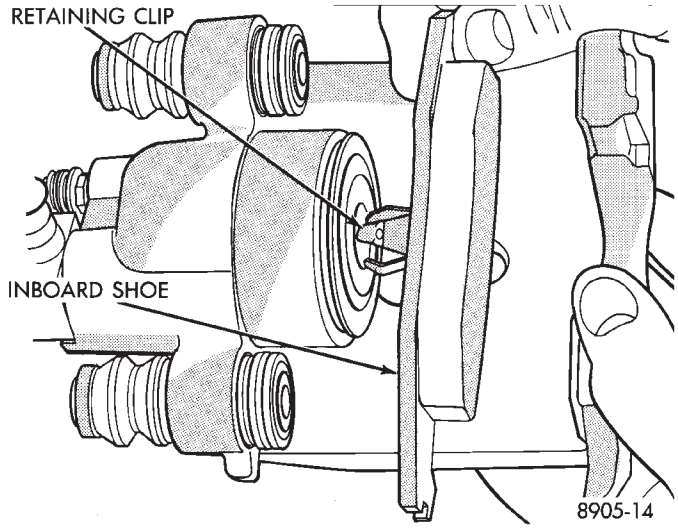


Fig. 77 Removing Inboard Brake Shoe

CALIPER INSPECTION

Check caliper for piston seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of the piston dust boot. If boot is damaged, or fluid leak is visible, disassemble caliper and install a new seal and boot, (and piston if scored). Refer to Caliper Disassembly And Re-Assembly Pro-

REMOVAL AND INSTALLATION (Continued)

cedures in Disc Brake Caliper Service in this section of the service manual.

Check the caliper dust boot and caliper pin bushings to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Guide Pin Bushing Service in Disc Brake Caliper Service in this section of the service manual.

INSTALL

(1) Completely retract the caliper piston back into the piston bore of the caliper assembly. This is required for caliper installation when new brake pad assemblies are installed on caliper.

(2) Lubricate both adapter abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) Install rear rotor on the hub making sure it is squarely seated on face of hub (Fig. 75).

(4) Remove protective paper from noise suppression gasket on both inner and outer brake pad assemblies (if equipped).

(5) Install new inboard brake shoe assembly into caliper piston by firmly pressing into piston bore with thumbs (Fig. 77). **Be sure inboard brake shoe assembly is positioned squarely against face of caliper piston.**

(6) Slide new outboard brake pad assembly onto the caliper assembly (Fig. 76). Be sure retaining clip is squarely seated in the depressed areas on the caliper.

CAUTION: Use care when installing caliper assembly onto adapter, so the guide pin bushings and sleeves do not get damaged by the mounting bosses on adapter.

(7) Carefully lower caliper and brake shoe assemblies over braking disc (rotor) reversing the required removal procedure (Fig. 73). Make sure that caliper guide pin bolts, bushings and sleeves are clear of the adapter bosses.

CAUTION: Extreme caution should be taken not to cross thread the caliper guide pin bolts when they are installed.

(8) Install caliper assembly guide pin bolts into adapter and tighten (Fig. 72). Then torque both guide pin bolts to 22 N·m (192 in. lbs.).

(9) Install the wheel and tire assembly.

(10) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(11) Remove jackstands or lower hoist. **Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal.** .

(12) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake pads.

REAR BRAKE DRUM

REMOVE

Further clearance can be obtained by backing off the brake automatic adjuster screw. Remove rubber plug from top of brake support plate. Rotate automatic adjuster screw assembly with an upward motion, using a medium size screwdriver.

See adjusting rear service brakes in the Service Adjustments section in this group of the service manual for the specific adjustment procedure.

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove the rear wheel and tire assemblies from the vehicle.

(3) Remove rear brake drum to hub retaining clips (if equipped).

(4) Remove rear brake drum from rear hub/bearing assembly (Fig. 78).

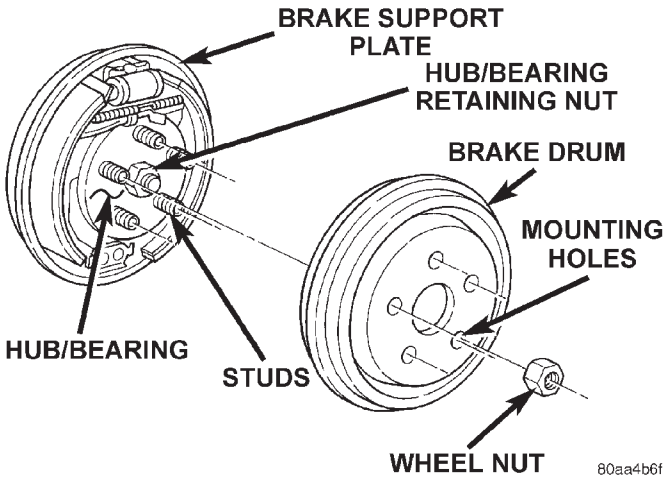


Fig. 78 Brake Drum And Hub/Bearing

(5) Inspect brake linings for wear, shoe alignment and contamination.

INSTALL

(1) Install rear brake drum assembly on rear hub and bearing assembly.

(2) Install the wheel and tire assembly.

(3) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

REAR BRAKE SHOES

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove the rear wheel and tire assemblies from the vehicle.

(3) Remove the brake drum to hub/bearing retaining clips (if equipped) (Fig. 79).

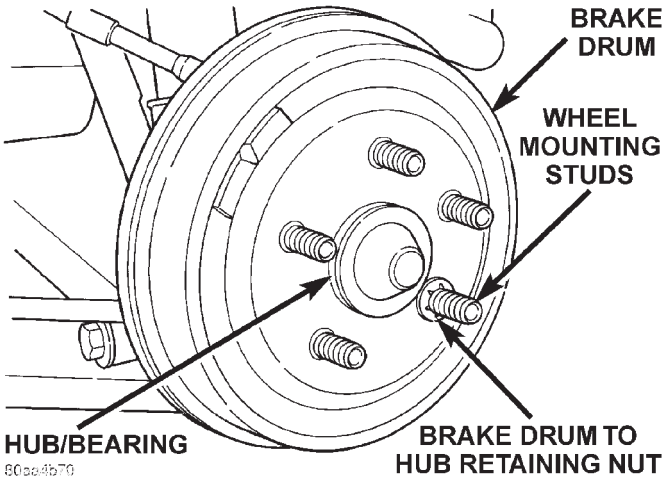


Fig. 79 Rear Brake Drum

(4) Remove the brake drum from the hub/bearing (Fig. 80).

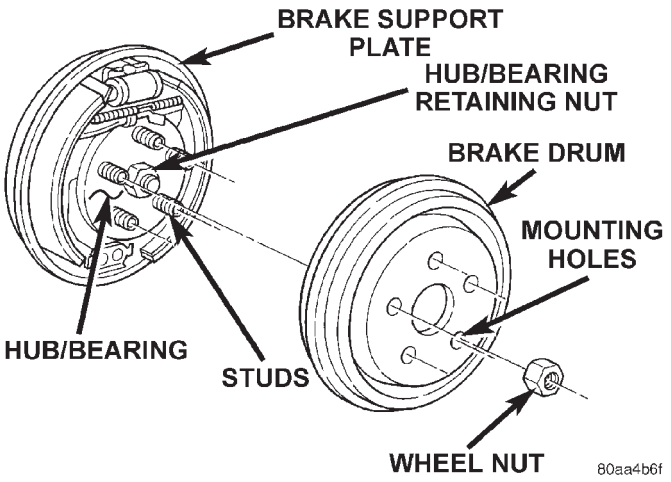


Fig. 80 Brake Drum Remove/Install

(5) Remove the adjustment lever to leading brake shoe spring (Fig. 81).

(6) Remove the automatic adjustment lever (Fig. 82) from the brake shoe.

(7) Remove hold down clips and pins attaching the leading and trailing brake shoes to the brake support plate (Fig. 83).

(8) Remove lower brake shoe to anchor plate return spring (Fig. 84).

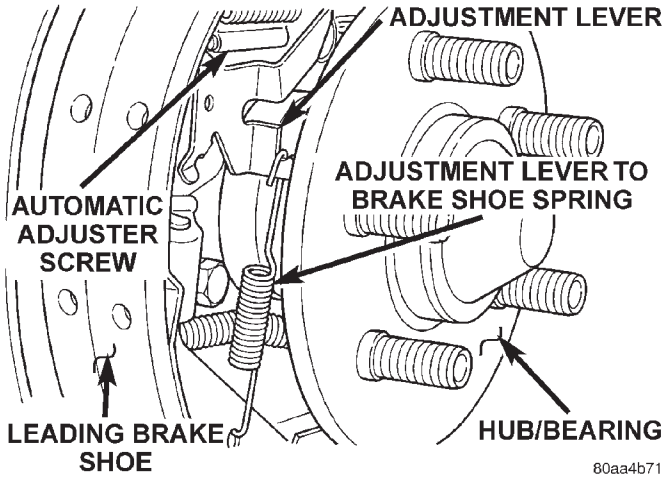


Fig. 81 Automatic Adjustment Lever Spring

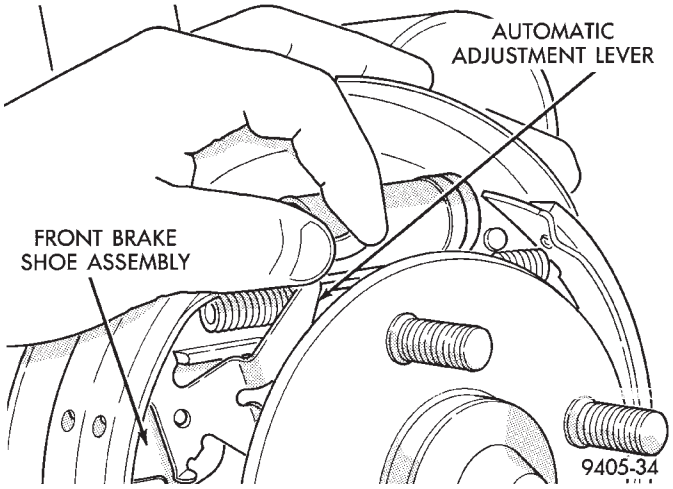


Fig. 82 Automatic Adjustment Lever

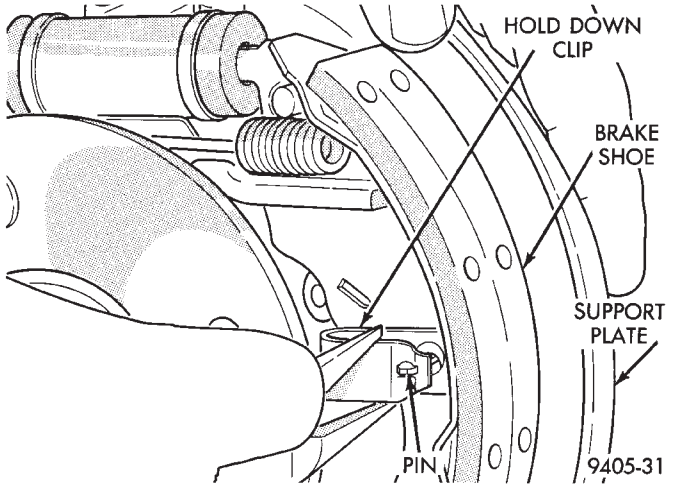


Fig. 83 Brake Shoe Hold Down Clips And Pins

(9) Remove the park brake lever pin to rear brake shoe retaining clip (Fig. 85).

(10) Remove the leading and trailing brake shoe, upper return spring and automatic adjuster screw

REMOVAL AND INSTALLATION (Continued)

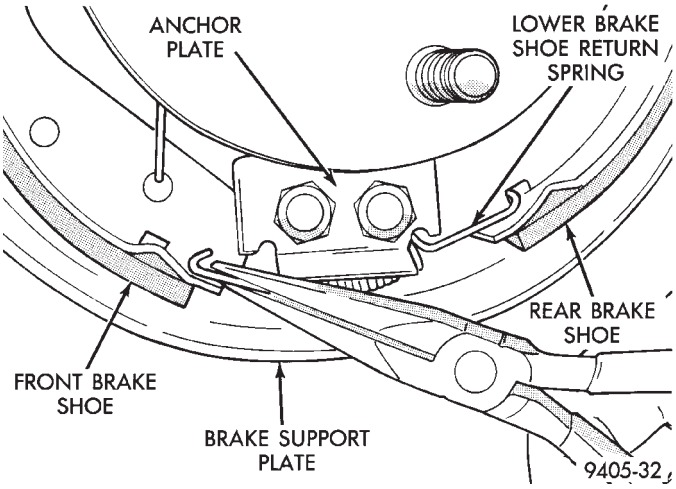


Fig. 84 Brake Shoe To Anchor Plate Return Spring

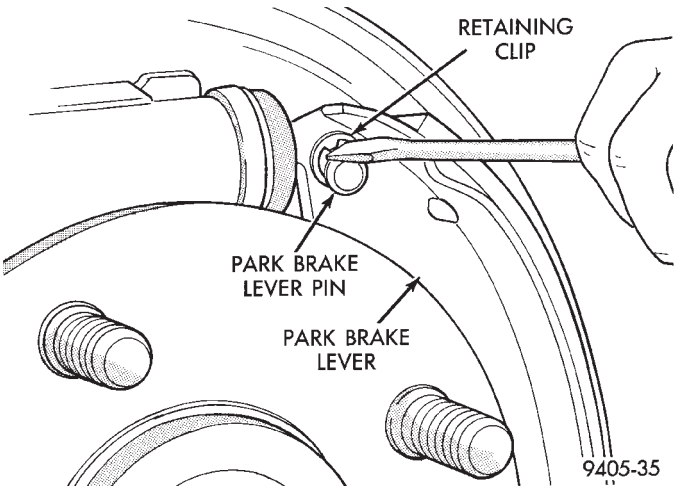


Fig. 85 Park Brake Lever Pin To Brake Shoe Retaining Clip

from the brake support plate as an assembly (Fig. 86).

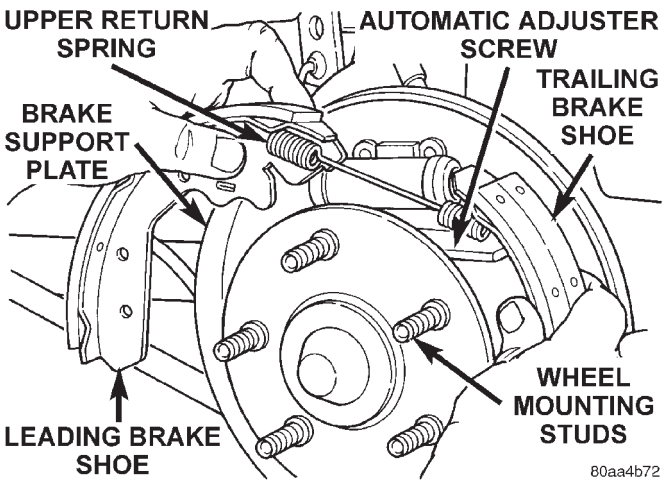


Fig. 86 Remove /Install Brake Shoes

CLEANING AND INSPECTION

Clean metal portion of brake shoes. Check to see if shoes are bent.

Lining should show contact across entire width and from heel to toe, otherwise replace.

Shoes with lack of contact at toe or heel may be improperly ground.

Clean and inspect support and adjusting screws. Apply a thin coat of Mopar Multi-Purpose Lubricant or equivalent to the threads of the self adjuster (Fig. 87). Replace adjusting screw if corroded.

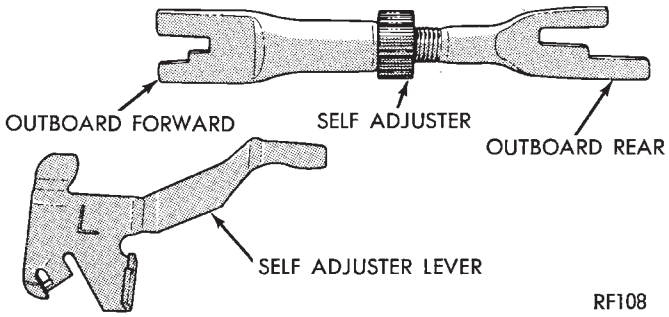


Fig. 87 Adjuster Screw and Lever (Typical)

If old springs have overheated or are damaged, replace. Overheating indications are paint discoloration or distorted end coils.

INSTALL

(1) Lubricate the eight shoe contact areas on the support plate and anchor using Mopar Multi-Purpose Lubricant or equivalent (Fig. 88).

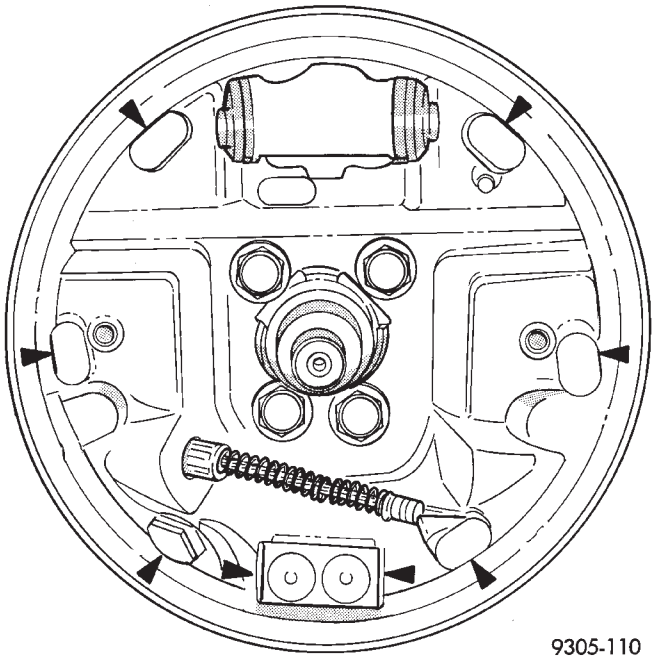


Fig. 88 Shoe Contact Areas on Support Plate

REMOVAL AND INSTALLATION (Continued)

(2) Assemble front and rear brake shoe assembly, automatic adjuster screw and upper return spring before installation on brake support plate.

(3) Install the pre-assembled brake shoes, automatic adjuster screw and upper return spring on the brake support plate (Fig. 86).

(4) Install the wave washer on the pin of park brake lever.

(5) Install pin on park brake lever into hole in rear brake shoe assembly (Fig. 89).

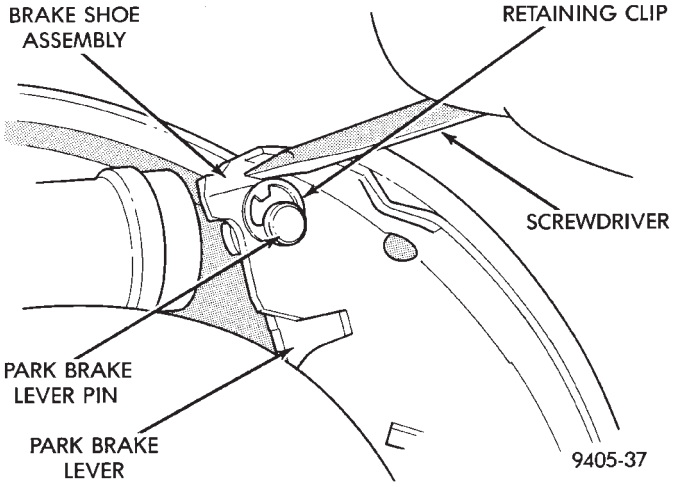


Fig. 89 Park Brake Lever Pin Retaining Clip Installation

(6) Install both brake shoe, to brake support plate, hold down pins and clips (Fig. 83).

(7) Install the lower brake shoe to anchor plate return spring (Fig. 84).

(8) Install the automatic adjustment lever, on the front brake shoe of the rear wheel brake assembly (Fig. 82).

(9) Install the automatic adjustment lever to front brake shoe assembly spring (Fig. 81).

(10) Adjust brake shoes assemblies so as not to interfere with brake drum installation.

(11) Install the rear brake drums on the hubs.

(12) Adjust rear brake shoes per Adjusting Rear Brakes procedure in the service adjustments section of the service manual.

(13) Install the wheel and tire assembly.

(14) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(15) Road test vehicle. The automatic adjuster will continue the brake adjustment during the road test of the vehicle.

REAR BRAKE SHOE SUPPORT PLATE

REMOVE

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove rear tire and wheel assembly from vehicle.

(3) Remove the dust cap (Fig. 90) from the rear hub/ bearing.

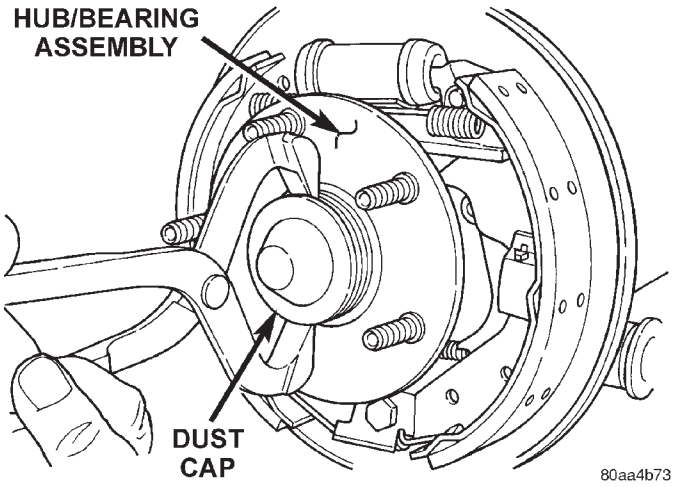


Fig. 90 Hub/ Bearing Dust Cap

(4) Remove the retaining nut (Fig. 91) holding the rear hub/bearing to the spindle. Remove the hub/ bearing from the spindle.

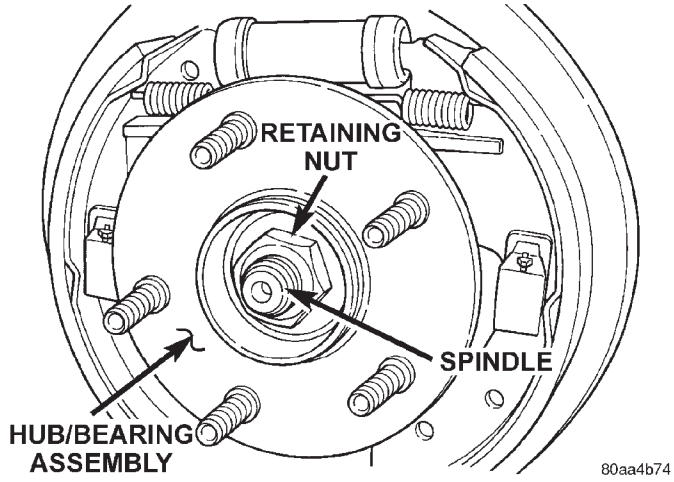


Fig. 91 Rear Hub/ Bearing Retaining Nut

REMOVAL AND INSTALLATION (Continued)

(5) Remove the rear brake shoes from the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section in this group of the service manual for the proper brake shoe assembly removal procedure.

(6) Disconnect the rear brake flex hose tube from the wheel cylinder (Fig. 92).

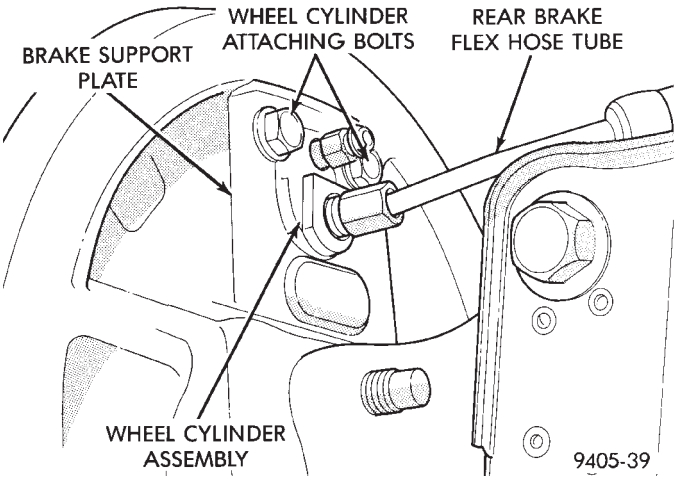


Fig. 92 Brake Flex Hose Tube At Wheel Cylinder

(7) Remove park brake actuator lever from the park brake cable.

(8) Position a 1/2 wrench over the retainer fingers on the end of the parking brake cable (Fig. 93). Compress cable housing retaining fingers and start cable housing out of support plate (Fig. 93). Remove wrench when retainer is free from the park brake cable mounting hole in the rear brake support plate. Alternate method is to use a aircraft type hose clamp over cable housing end fitting compressing the three fingers.

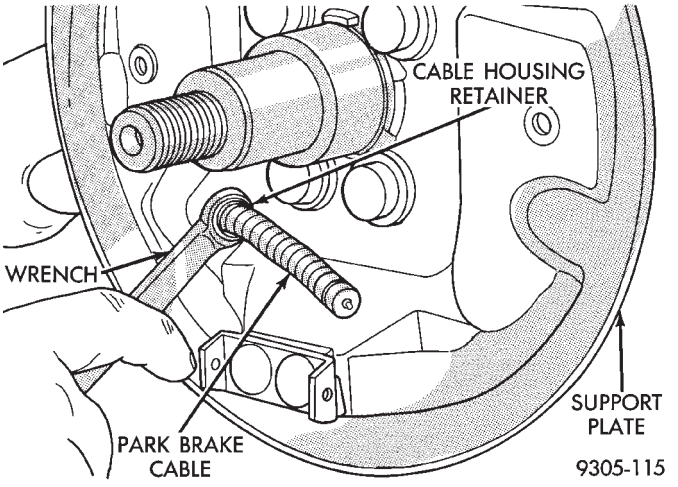


Fig. 93 Removing Park Brake Cable From Support Plate

(9) Remove the 4 brake support plate to knuckle attaching bolt and washer assemblies. Separate brake support plate from rear suspension knuckle.

INSTALL

(1) Install brake support plate and gasket on rear suspension knuckle casting. Torque support plate to knuckle casting attaching bolts to 75 N·m (55 ft. lbs.).

(2) Insert parking brake cable end fitting into brake support plate.

(3) Hand start hydraulic brake hose tube fitting to wheel cylinder. Torque tube nut to wheel cylinder fitting to 17 N·m (145 in. lbs.).

(4) Attach parking brake cable to the parking brake actuator.

(5) Install rear brake shoe assemblies on the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section in this group of the service manual for the proper brake shoe assembly installation procedure.

(6) Install rear hub and bearing assembly on rear spindle. Install a **NEW** hub and bearing assembly retaining nut (Fig. 91). Torque hub and bearing assembly retaining nut to 217 N·m (160 ft. lbs.). Install dust cap.

(7) Adjust brake shoes assemblies so as not to interfere with brake drum installation.

(8) Install brake drum. Adjust and bleed service brakes.

(9) After brake drums are installed, pump brake pedal several times to do final adjustment of the brake shoe assemblies.

(10) Install the wheel and tire assembly. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

REAR BRAKE WHEEL CYLINDER

REMOVE

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the tire and wheel assembly from the vehicle.

(3) Remove rear brake drum.

(4) Remove rear brake shoe assemblies from the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section in this group of the service manual for the proper brake shoe assembly removal procedure.

(5) If brake shoes are wet with grease or brake fluid, remove and replace.

REMOVAL AND INSTALLATION (Continued)

(6) Disconnect the rear brake flex hose from the wheel cylinder (Fig. 94).

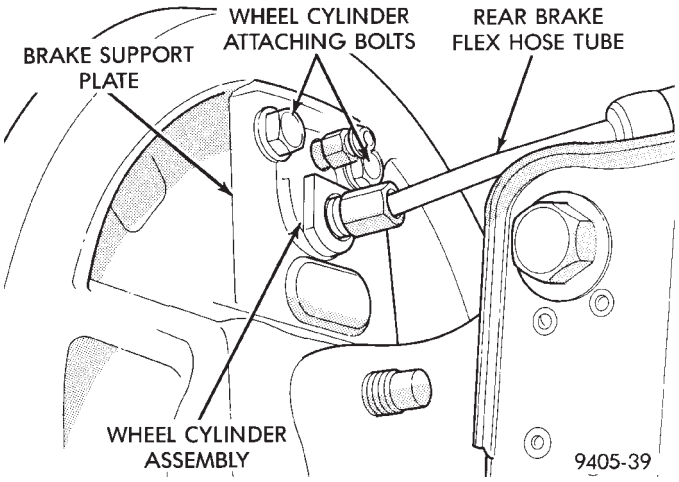


Fig. 94 Brake Flex Hose At Wheel Cylinder

(7) Remove rear wheel cylinder attaching bolts (Fig. 94).

(8) Remove rear wheel cylinder assembly from brake support plate (Fig. 95).

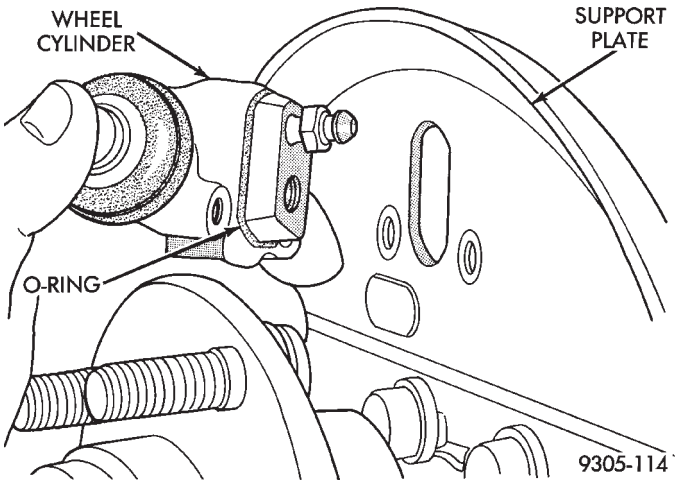


Fig. 95 Remove/Install Wheel Cylinder

INSTALL

(1) Apply a small bead of silicone sealer around the mating surface of the wheel cylinder to brake support plate.

NOTE: When installing wheel cylinder on brake support plate, be sure it is positioned squarely (horizontal) to the brake shoe assemblies.

(2) Install wheel cylinder onto brake support plate. Tighten the attaching bolts to 13 N·m (115 in. lbs.).

(3) Hand start hydraulic brake hose tube fitting to wheel cylinder. Torque tube nut to 17 N·m (145 in. lbs.).

(4) Install rear brake shoe assemblies on the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section in this group of the service manual for the proper brake shoe assembly installation procedure.

(5) Install rear brake drum onto rear hub.

(6) Install the wheel and tire assembly. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(7) Adjust the rear brakes. See Rear Drum Brake Shoe Adjustment in the Adjustments section in this group of the service manual.

(8) Bleed the entire brake system. See Bleeding Brake System in Service Adjustments section in this group of the service manual.

REAR HUB/BEARING

REMOVE

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual for the required lifting procedure to be used for this vehicle.

(2) Remove rear wheel and tire assembly.

(3) On vehicles equipped with rear drum brakes, remove brake drum (Fig. 96) from rear hub/bearing assembly. On vehicles equipped with rear disc brakes, remove disc brake caliper from disc brake adapter, and then remove rotor (Fig. 97) from hub/bearing assembly.

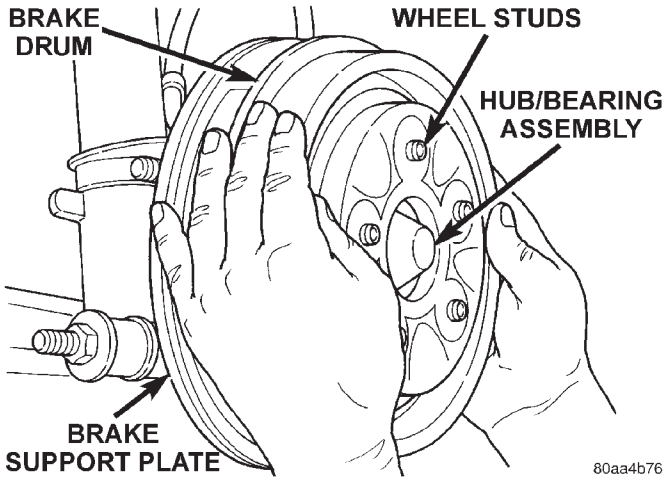


Fig. 96 Brake Drum Removal

REMOVAL AND INSTALLATION (Continued)

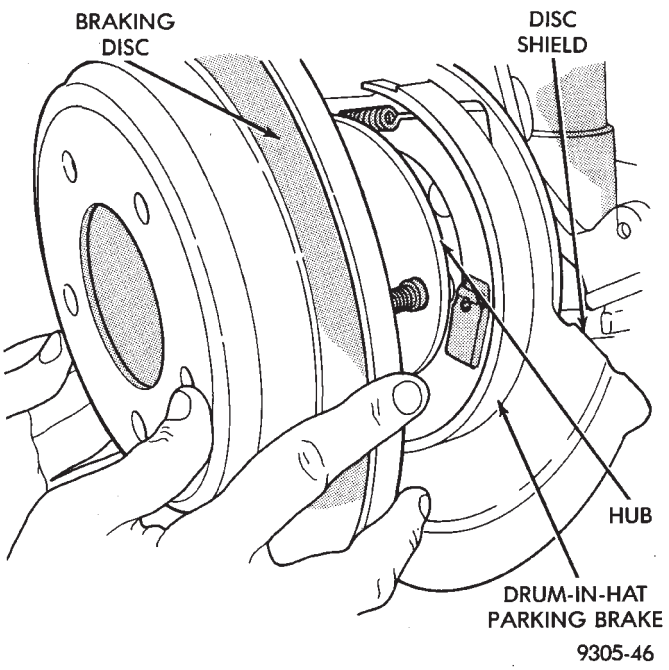


Fig. 97 Rear Rotor Removal

(4) Remove the dust cap (Fig. 98) from the rear hub/bearing.

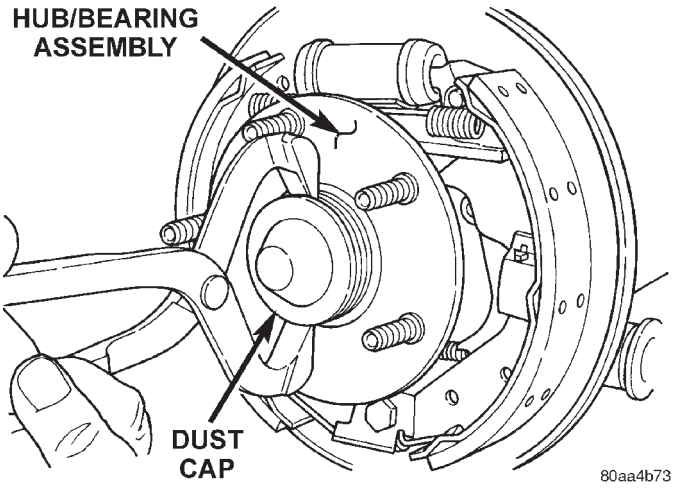


Fig. 98 Rear Hub/Bearing Dust Cap

(5) Remove the retaining nut (Fig. 99) mounting the hub/bearing to the rear spindle.

(6) Remove the hub/bearing from the rear spindle by pulling it off the end of spindle by hand.

INSTALL

CAUTION: The hub/bearing retaining nut must be tightened to but must not exceed its required torque specification. The proper torque specification of the retaining nut is critical to the life of the hub bearing.

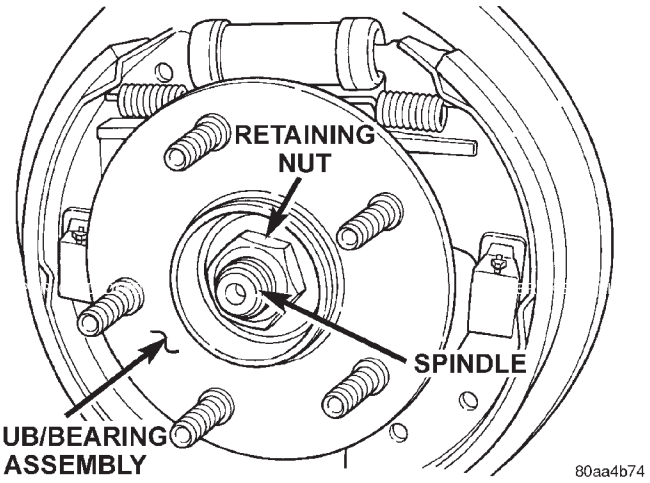


Fig. 99 Hub/Bearing Assembly Retaining Nut

(1) Position hub/bearing assembly on rear spindle.

(2) Install **a new hub nut** (Fig. 99) and tighten to a torque of 217 N·m (160 ft. lbs.).

(3) Install the dust cap, on the hub/bearing using a soft faced hammer.

(4) On drum brake equipped vehicles, install the brake drum on the hub/bearing. On vehicles equipped with rear disc brakes, install the rotor on the hub/bearing.

(5) On disc brake equipped vehicles install the disc brake caliper on the adapter. Install the 2 guide pin bolts (Fig. 100) mounting the disc brake caliper to the adapter. Tighten the guide pin bolts to a torque of 22 N·m (192 in. lbs.). Refer To Rear Disc Brake Service in this group of the service manual for the required caliper installation procedure.

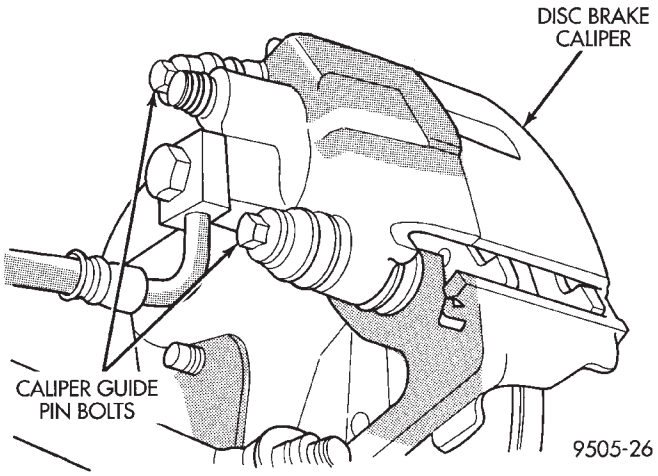


Fig. 100 Caliper Guide Pin Bolts

(6) Install rear wheel and tire assembly on vehicle. Tighten all wheel stud nuts in criss cross pattern to one-half specified torque. Then repeat pattern, fully tightening stud nuts to 135 N·m (100 ft. lbs.).

(7) Lower vehicle.

REMOVAL AND INSTALLATION (Continued)

MASTER CYLINDER

REMOVE

CAUTION: On ABS equipped vehicles, vacuum in power booster must be pumped down before removing master cylinder to prevent booster from sucking in any contamination. This can be done simply by pumping the brake pedal until a firm pedal is achieved, with the ignition off.

(1) On ABS equipped vehicles, be sure engine is not running, and pump the brake pedal until a firm pedal is achieved (4-5 strokes).

(2) Remove vehicle wiring harness connector, from brake fluid level sensor, in master cylinder brake fluid reservoir (Fig. 101).

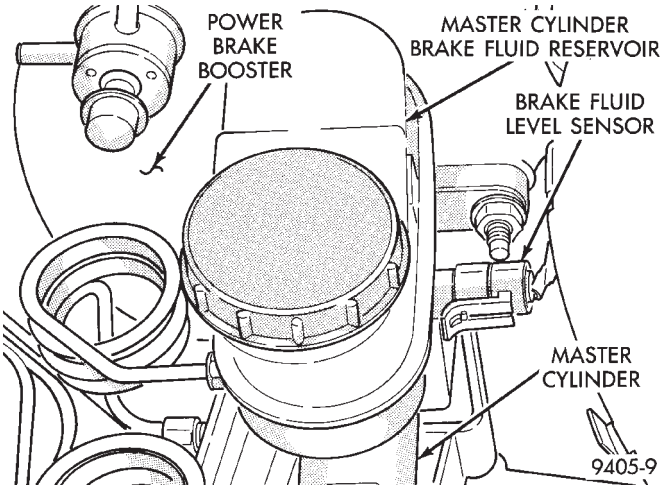


Fig. 101 Master Cylinder Fluid Level Sensor

(3) Disconnect the primary and secondary brake tubes from the master cylinder (Fig. 102) and (Fig. 103). Install plugs at all open brake tube outlets on master cylinder assembly.

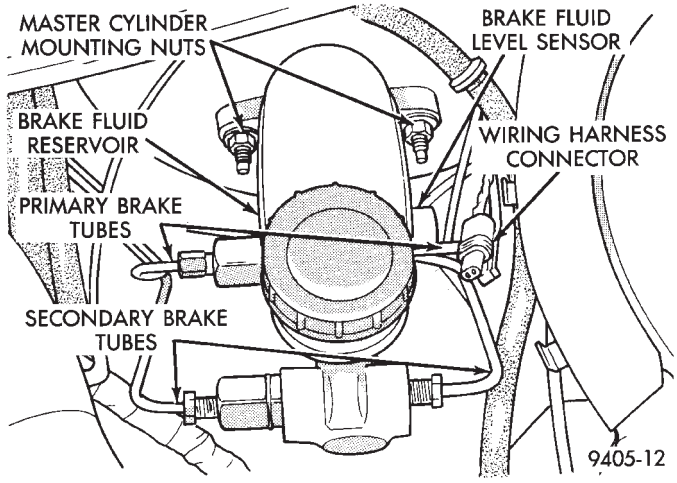


Fig. 102 Primary And Secondary Brake Tubes W/O ABS Brakes

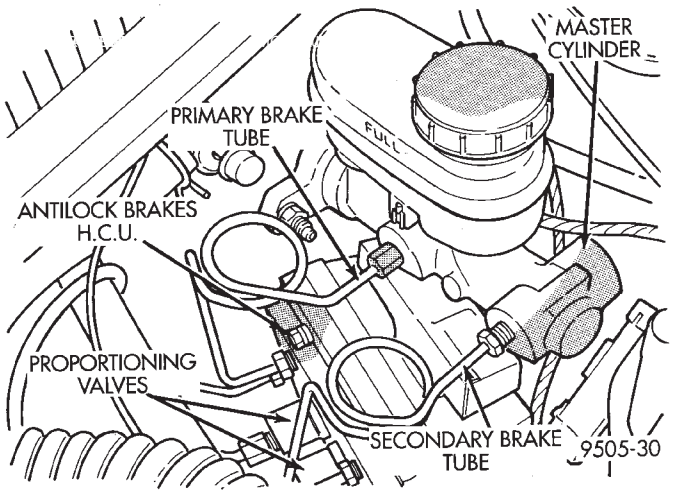


Fig. 103 Primary And Secondary Brake Tubes With ABS Brakes

(4) On vehicles equipped with ABS, clean area where master cylinder attaches to booster using a suitable brake cleaner product such as Mopar Brake Parts Cleaner or an equivalent.

(5) Remove the 2 nuts (Fig. 104) attaching master cylinder housing to power brake vacuum booster.

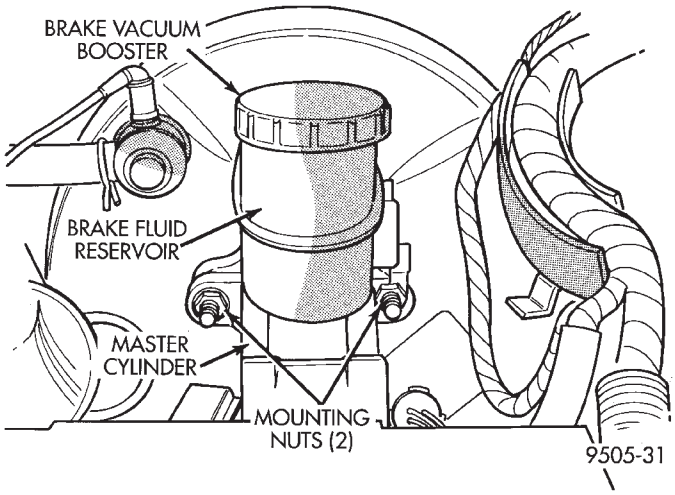


Fig. 104 Master Cylinder Mounting To Vacuum Booster

(6) Slide master cylinder assembly straight out of the power brake vacuum booster.

CAUTION: On vehicles equipped with ABS, the master cylinder is used to create the seal for holding vacuum in the power brake vacuum booster. The vacuum seal in the front of the power brake vacuum booster (Fig. 105) MUST be replaced whenever the master cylinder is removed from the power brake vacuum booster.

(7) If vehicle is equipped with ABS, remove vacuum seal (Fig. 105) located in the front of the power

REMOVAL AND INSTALLATION (Continued)

brake vacuum booster. Vacuum seal is removed by **carefully** inserting a small screw driver between the push rod of the power brake vacuum booster and vacuum seal (Fig. 105) and pry seal out of power brake vacuum booster. **Do not attempt to pry seal out of master cylinder by inserting a tool between seal and power brake vacuum booster.**

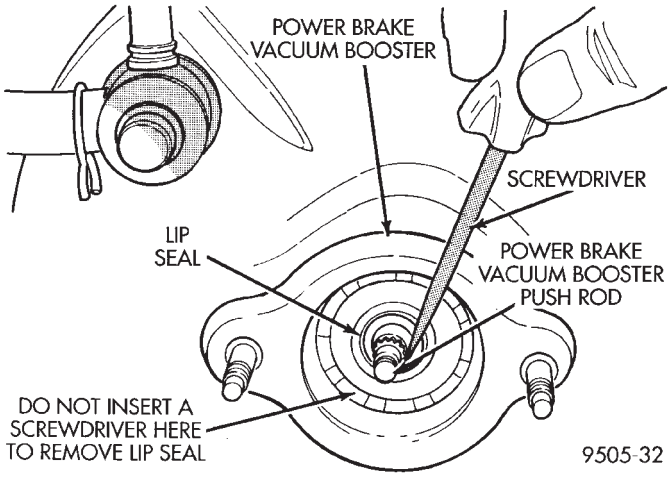


Fig. 105 Removing Seal From Vacuum Booster

BLEEDING MASTER CYLINDER

(1) Clamp the master cylinder in a vise. Attach Bleeding Tubes, Special Tool 6802 to the master cylinder (Fig. 106) and (Fig. 107). Position tubes so outlets of Bleeding Tubes will be below surface of brake fluid when reservoir is filled to proper level.

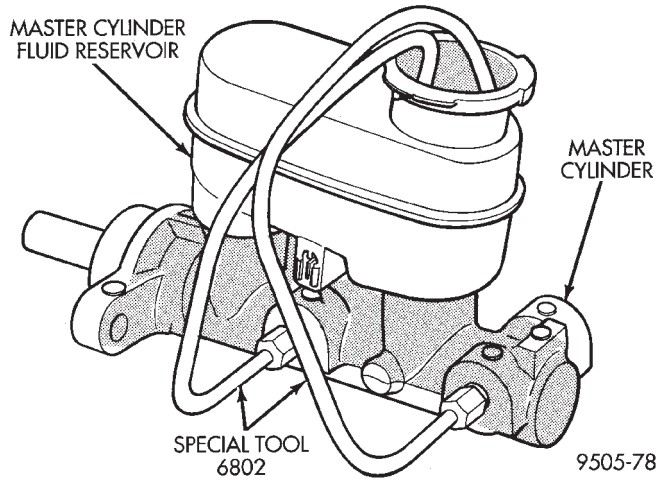


Fig. 106 Bleeding Tubes Attached to ABS Master Cylinder

(2) Fill brake fluid reservoir with brake fluid conforming to DOT 3 specifications such as Mopar or an Equivalent.

(3) Using a wooden dowel per (Fig. 108), depress push rod slowly and then allow pistons to return to released position. Repeat several times until all air bubbles are expelled.

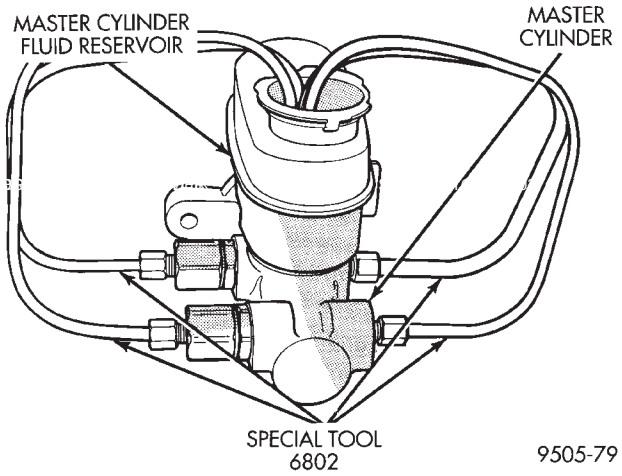


Fig. 107 Bleeding Tubes Attached To Non-ABS Master Cylinder

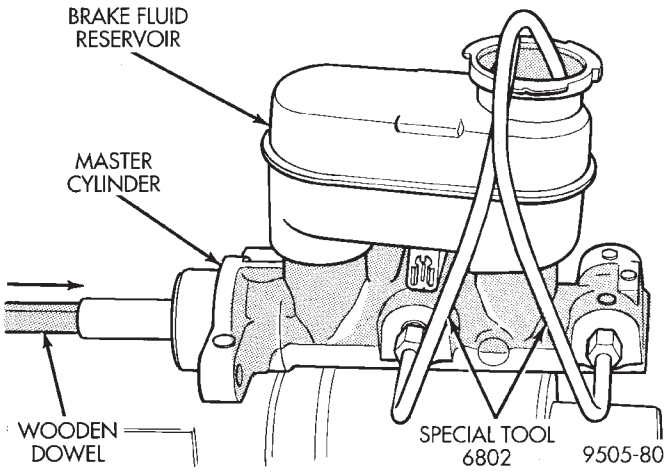


Fig. 108 Bleeding Master Cylinder

(4) Remove bleeding tubes from master cylinder outlet ports, plug outlet ports and install fill cap on reservoir.

(5) Remove master cylinder from vise.

NOTE: Note: It is not necessary to bleed the entire hydraulic system after replacing the master cylinder. But the master cylinder must have been bled and filled upon installation.

INSTALL

CAUTION: When replacing the master cylinder on a vehicle equipped with ABS, a NEW vacuum seal MUST be installed in the power brake vacuum booster. Use only the procedure detailed below for installing vacuum seal into power brake vacuum booster. Be sure old vacuum seal is removed from power brake vacuum booster before attempting to install new seal.

REMOVAL AND INSTALLATION (Continued)

CAUTION: When lubricating master cylinder push rod, use only Mopar Silicone Dielectric Compound. Using any other type of grease or lubricant on the push rod, will not provide adequate long term lubrication of the push rod.

(1) Lubricate master cylinder push rod as indicated in (Fig. 109) only using **Mopar Dielectric Grease—And No Substitutes.** Refer to the Mopar Chemicals Catalog to obtain the required lubricant.

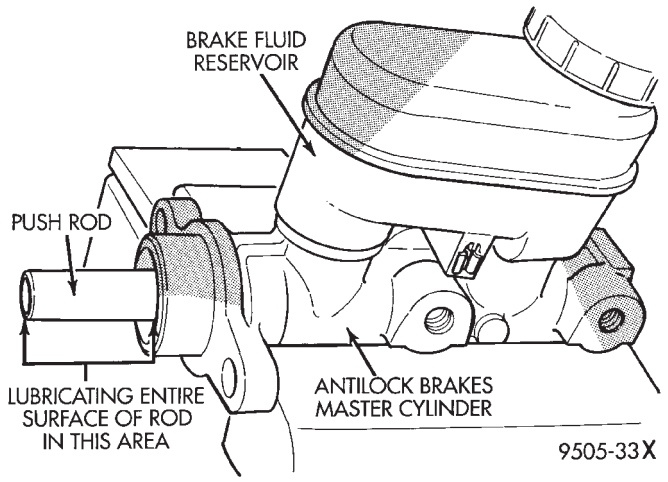


Fig. 109 Lubricating Master Cylinder Push Rod

(2) Install vacuum seal on master cylinder push rod as shown in (Fig. 110) with notches on vacuum seal pointing toward master cylinder housing. Then slide vacuum seal onto master push rod until seal is seated against master cylinder housing (Fig. 111) before installing master cylinder on power brake vacuum booster.

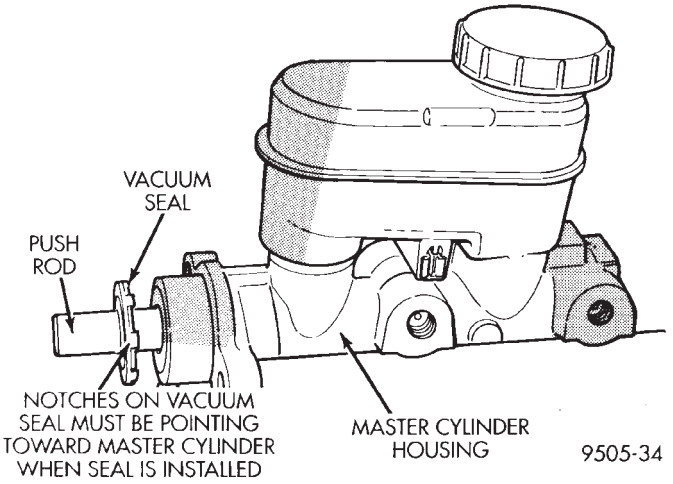


Fig. 110 Installing Vacuum Seal On Master Cylinder Push Rod

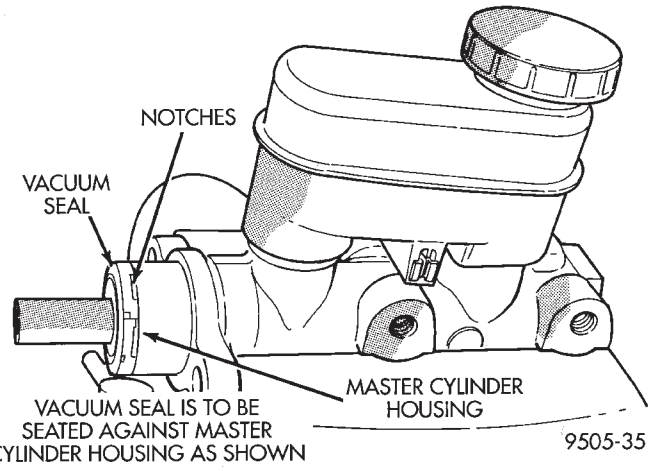


Fig. 111 Vacuum Seal Positioned For Installing Master Cinder

CAUTION: If vehicle is equipped with ABS, be sure old vacuum seal is removed from power brake vacuum booster before attempting to install master cylinder and NEW vacuum seal. If vacuum seal is not removed, refer to Master Cylinder Removal in this section of the service manual for required vacuum seal removal procedure.

(3) Position master cylinder on studs of power brake unit, aligning push rod on power brake vacuum booster with master cylinder push rod.

(4) Install the 2 master cylinder to power brake unit mounting nuts (Fig. 104) and torque to 28 N·m (250 in. lbs.) torque.

(5) Connect brake tubes to master cylinder primary and secondary ports (Fig. 102) and (Fig. 103). Torque all tube nuts to 17 N·m (145 in. lbs.) torque.

VACUUM BOOSTER

REMOVE

CAUTION: On ABS equipped vehicles, vacuum in power booster must be pumped down before removing master cylinder to prevent booster from sucking in any contamination. This can be done simply by pumping the brake pedal until a firm pedal is achieved, with the ignition off.

(1) On ABS equipped vehicles, with engine not running, pump the brake pedal until a firm pedal is achieved (4-5 strokes).

REMOVAL AND INSTALLATION (Continued)

(2) Remove vehicle wiring harness connector from brake fluid level sensor located in master cylinder brake fluid reservoir (Fig. 112).

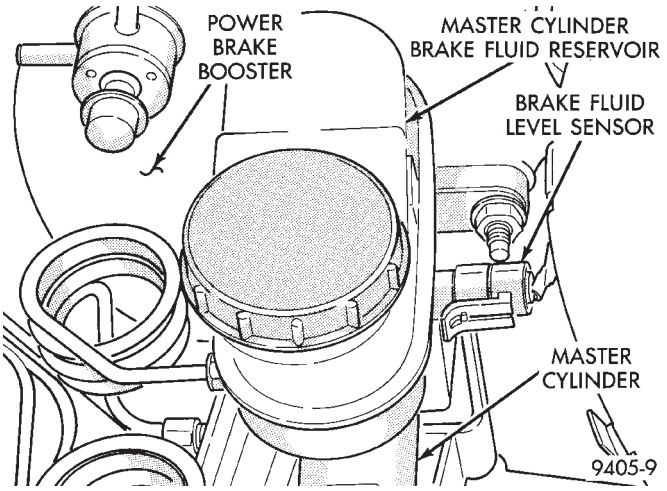


Fig. 112 Master Cylinder Fluid Level Sensor

(3) Disconnect the primary and secondary brake tubes from the master cylinder (Fig. 113) and (Fig. 114). Install plugs at all open brake tube outlets on master cylinder assembly.

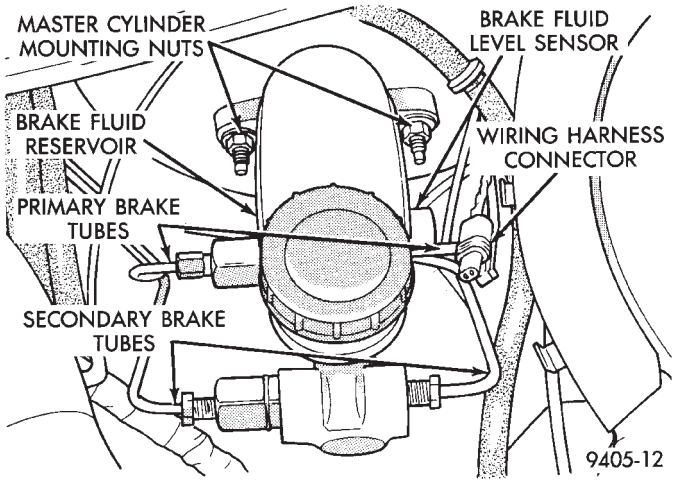


Fig. 113 Primary And Secondary Brake Tubes W/O ABS Brakes

(4) On vehicles equipped with ABS, clean area where master cylinder attaches to booster using a suitable brake cleaner such as Mopar Brake Parts Cleaner or an equivalent.

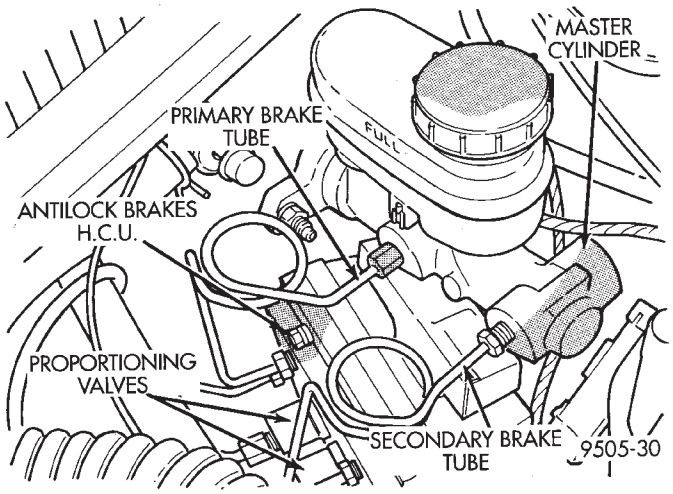


Fig. 114 Primary And Secondary Brake Tubes With ABS Brakes

(5) Remove the 2 nuts (Fig. 115) attaching master cylinder housing to power brake vacuum booster.

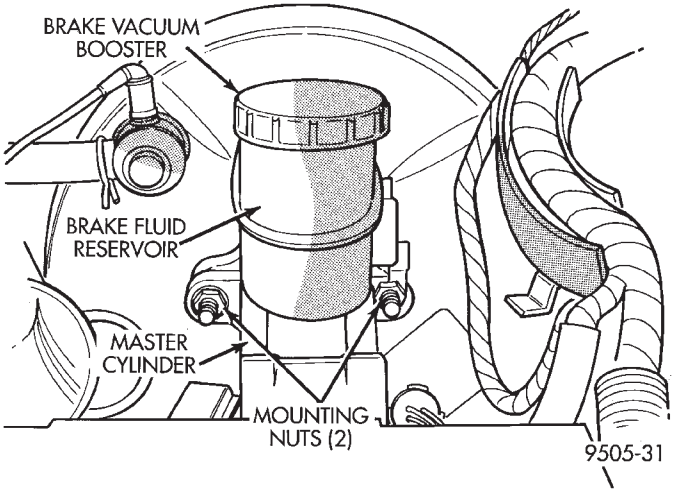


Fig. 115 Master Cylinder Mounting To Vacuum Booster

(6) Slide master cylinder assembly straight out of the power brake vacuum booster.

CAUTION: On vehicles equipped with ABS, the master cylinder is used to create the seal for holding vacuum in the power brake vacuum booster. The vacuum seal in the front of the power brake vacuum booster (Fig. 116) MUST be replaced whenever the master cylinder is removed from the power brake vacuum booster.

(7) If vehicle is equipped with ABS, remove vacuum seal (Fig. 116) located in the front of the power brake vacuum booster. Vacuum seal is removed by **carefully** inserting a small screw driver between the push rod of the power brake vacuum booster and vacuum seal (Fig. 116) and prying seal out of power

REMOVAL AND INSTALLATION (Continued)

brake vacuum booster. **Do not attempt to pry seal out of master cylinder by inserting a tool between seal and power brake vacuum booster .**

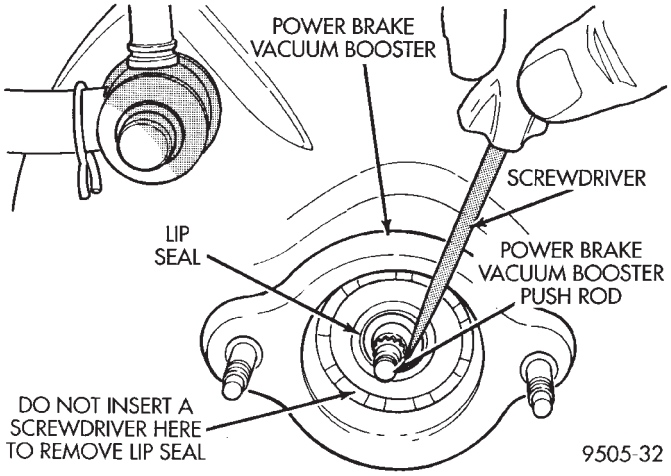


Fig. 116 Vacuum Seal Removal From Power Brake Booster

(8) Disconnect vacuum hoses from check valve on power brake vacuum booster (Fig. 117). **Do not remove check valve from power brake vacuum booster.**

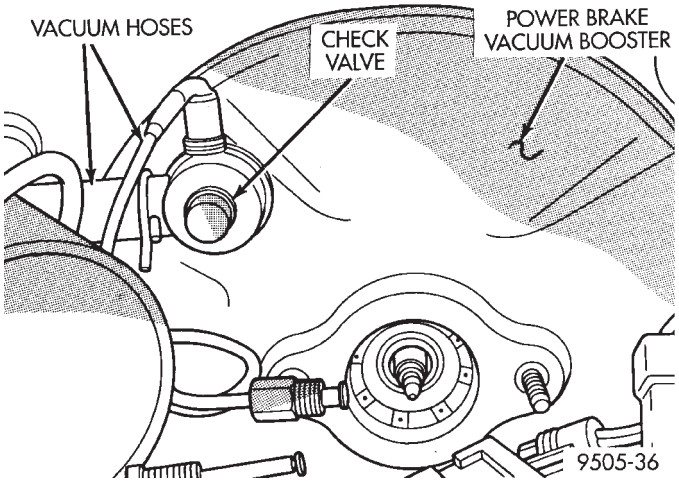


Fig. 117 Power Brake Vacuum Booster Check Valve

NOTE: If vehicle is equipped with antilock brakes, the hydraulic control unit (HCU) needs to be removed from the vehicle to allow removal of the power brake vacuum booster. Refer to Antilock Brake System Hydraulic Control Unit in the Removal And Installation Section of the Antilock Brake System Section of this service manual for the required procedure.

(9) Locate the power brake vacuum booster input rod to brake pedal attachment under instrument panel. Position a small screwdriver (Fig. 118) under the center tang of the retaining clip.

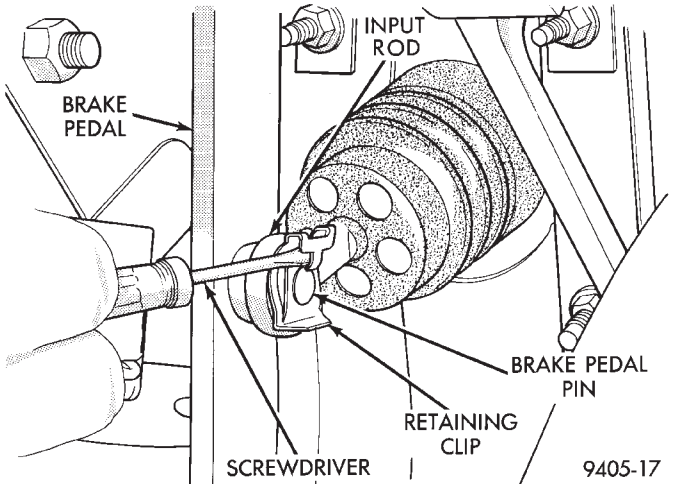


Fig. 118 Input Rod Retaining Pin

CAUTION: Discard retaining clip when removed, it is not to be reused. Replace only with a new retaining clip when assembled.

(10) Rotate screwdriver (Fig. 118) enough to allow retaining clip tang to pass over the end of the brake pedal pin.

(11) Remove the 4 nuts attaching the power brake vacuum booster to the dash panel (Fig. 119). The nuts are accessible from under the instrument panel in the area of the steering column and brake pedal bracket.

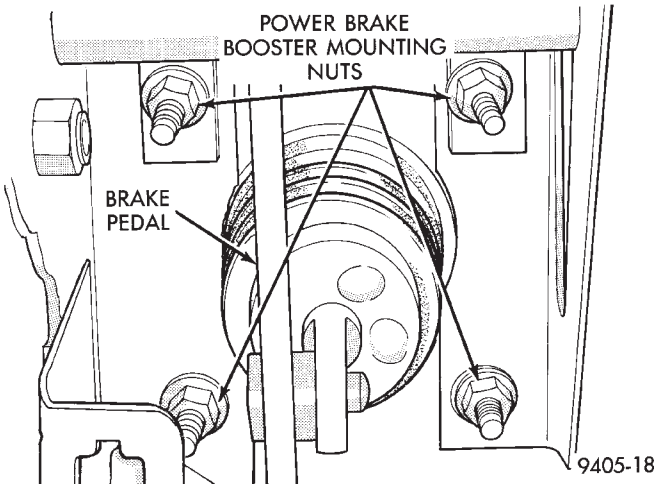


Fig. 119 Power Brake Booster Mounting

(12) Slide power brake vacuum booster forward until mounting studs clear dash panel, then tilt the booster up and to the center of the vehicle to remove.

INSTALL

(1) Position power brake booster onto dash panel.

(2) Install and torque the 4 power brake vacuum booster mounting nuts (Fig. 119) to 29 N·m (250 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

(3) Using lubriplate, or equivalent, coat the surface of the brake pedal pin where it contacts the brake vacuum booster input rod.

(4) Connect power brake vacuum booster input rod to brake pedal pin and install a NEW retaining clip. **Use only a new retainer clip DO NOT USE the old clip.**

(5) Connect all previously removed vacuum hoses onto power brake vacuum booster check valve (Fig. 117).

(6) If vehicle is equipped with ABS, install HCU. Refer to Antilock Brake System Hydraulic Control Unit in the Removal And Installation Section of the Antilock Brake System Section of this service manual for the required procedure.

CAUTION: When replacing the power brake vacuum booster on a vehicle equipped with ABS, a NEW vacuum seal MUST be installed in the power brake vacuum booster. Use only the procedure detailed below for installing vacuum seal into power brake vacuum booster. If old vacuum seal came out with master cylinder when it was removed from power brake vacuum booster, be sure it is removed from master cylinder before attempting to install master cylinder into power brake vacuum booster.

CAUTION: When lubricating master cylinder push rod, use only Mopar Silicone Dielectric Compound. Using any other type of grease or lubricant on the push rod, will not provide adequate long term lubrication of the push rod.

(7) Lubricate master cylinder push rod as indicated in (Fig. 120) only using **Mopar Dielectric Grease—And No Substitutes.** Refer to the Mopar Chemicals Catalog to obtain the required lubricant.

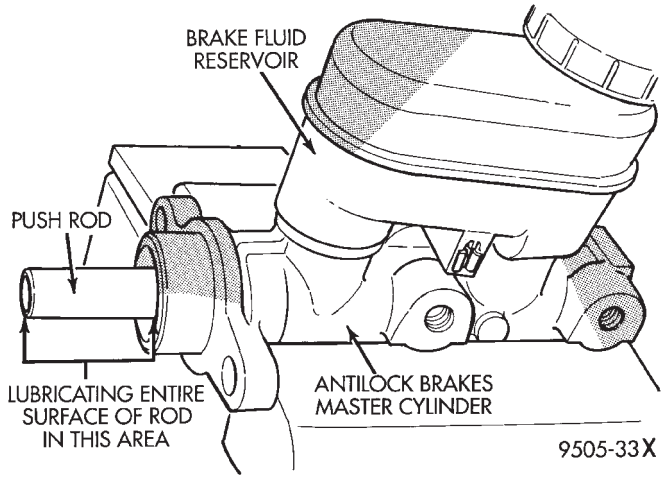


Fig. 120 Lubricating Master Cylinder Push Rod

(8) Install vacuum seal on master cylinder push rod as shown with notches on vacuum seal pointing toward master cylinder housing (Fig. 121). Then slide vacuum seal onto master push rod until seal is seated against master cylinder housing (Fig. 122) before installing master cylinder on power brake vacuum booster.

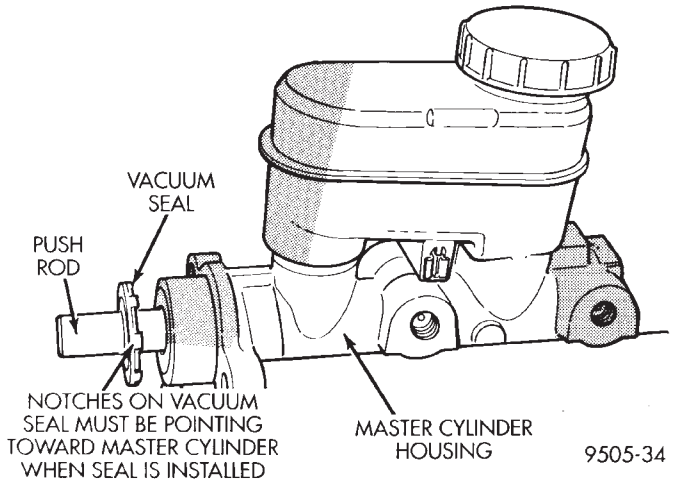


Fig. 121 Installing Vacuum Seal On Master Cylinder Push Rod

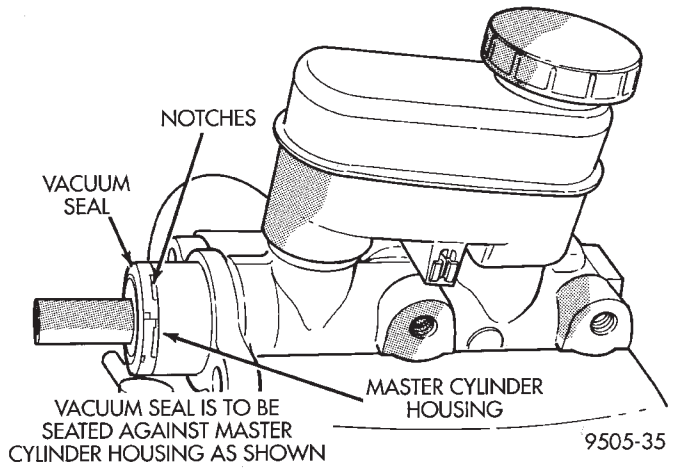


Fig. 122 Vacuum Seal Positioned For Installing Master Cylinder

CAUTION: If vehicle is equipped with ABS, be sure the old vacuum seal is removed from power brake vacuum booster before attempting to install master cylinder and NEW vacuum seal. If vacuum seal is not removed, refer to Master Cylinder Removal in this section of the service manual for required vacuum seal removal procedure.

(9) Position master cylinder on studs of power brake unit, aligning push rod on power brake vacuum booster with master cylinder push rod.

REMOVAL AND INSTALLATION (Continued)

(10) Install the 2 master cylinder mounting nuts (Fig. 115) and torque to 28 N·m (250 in. lbs.) torque.

(11) Connect brake tubes to master cylinder primary and secondary ports (Fig. 113) and (Fig. 114). Torque all tube nuts to 17 N·m (145 in. lbs.) torque.

(12) Reconnect wiring connector to fluid level sensor.

(13) Adjust stop lamp switch as necessary.

(14) Bleed brake system.

CHASSIS TUBES AND HOSES

Always use Mopar replacement brake hose assemblies to ensure quality, correct length and superior fatigue life. Care should be taken to make sure that the tube and hose mating surfaces are clean and free from nicks and burrs. **Hose assemblies for each brake are unique and not interchangeable.**

Use new copper seal washers on all connections using Banjo Bolts and tighten all fittings to their specified torques.

The flexible front hydraulic brake hose should always be installed on the vehicle by first attaching the Banjo connector to the caliper assembly. Then bolt the intermediate hose bracket to the strut assembly allowing the bracket to position the hose to prevent twisting. Attach the hose to brake tubing, before attaching to front frame rail. Then tighten all brake line fittings to specified torque.

On vehicles equipped with rear drum brakes, install rear brake hoses first to wheel cylinders and rear struts and then attach hose bracket to body. On vehicles equipped with rear disc brakes, attach brake hoses to calipers and struts first and then attach brake hose bracket to body. Following this procedure will reduce potential for twisting brake during installation procedure.

Only double wall 4.75mm (3/16 in.) steel brake line tubing, with Al- Rich/ZN-AL alloy coating should be used for replacement. Care must be taken when replacing brake tubing, to be sure the proper bending and flaring tools and procedures are used to avoid kinking. Do not route the tubes against sharp edges, moving components or into hot areas. All tubes should be properly attached with recommended retaining clips.

PROPORTIONING VALVE (BASE BRAKES)

CAUTION: Proportioning valves (Fig. 123) should never be disassembled.

There are two proportioning valve assemblies used in each vehicle. Due to different thread sizes, each proportioning valve has a different part number. During any service procedures identify the proportioning valve assemblies by supplier part number and or the color identification band (Fig. 123).

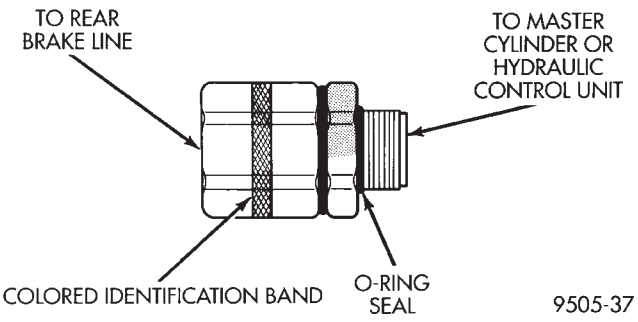


Fig. 123 Proportioning Valve

If premature rear wheel skid occurs on hard brake application, it could be an indication that a malfunction has occurred with one of the proportioning valves.

One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake (Fig. 124). Therefore, a road test to determine which rear brake slides first is essential.

If a malfunctioning proportioning valve is suspected on a vehicle. Refer to Brake Hydraulic System Control Valves in the Diagnosis And Testing Section in this group of the service manual for the required test procedure.

REMOVE

Use the proportioning valve test procedure stated above to determine which proportioning valve requires replacement, then replace it using procedure below.

(1) Disconnect brake tube from proportioning valve requiring removal from the master cylinder (Fig. 124).

(2) Remove proportioning valve (Fig. 124) from the master cylinder requiring replacement.

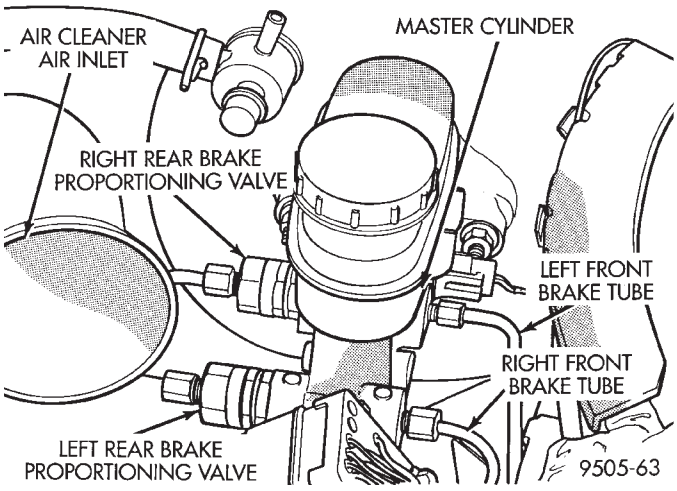


Fig. 124 Non-ABS Proportioning Valve Locations On Master Cylinder

REMOVAL AND INSTALLATION (Continued)

INSTALL

(1) Wet O-ring seal on new proportioning valve using clean fresh brake fluid.

(2) Install proportioning valve in master cylinder and hand tighten until proportioning valve and O-ring seal is fully seated in master cylinder. Torque proportioning valve to 40 N·m (30 ft. lbs.).

(3) Install brake tube on proportioning valve. Tighten tube nut to 17 N·m (145 in lbs.) torque.

(4) Bleed the affected brake line. See Bleeding Base Brake Hydraulic System in the Service Procedures Section in this group of the service manual for the proper bleeding procedure.

PARK BRAKE LEVER ASSEMBLY

WARNING: THE AUTO ADJUSTING FEATURE OF THIS PARKING BRAKE LEVER ASSEMBLY CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 20 POUNDS. DO NOT RELEASE THE AUTO ADJUSTER LOCKOUT DEVICE BEFORE INSTALLING CABLES INTO THE EQUALIZER. KEEP HANDS OUT OF AUTO ADJUSTER SECTOR AND PAWL AREA. FAILURE TO OBSERVE CAUTION IN HANDLING THIS MECHANISM COULD LEAD TO SERIOUS INJURY.

REMOVE

(1) Remove the screws attaching the rear of the center console assembly to console bracket (Fig. 125) or (Fig. 126).

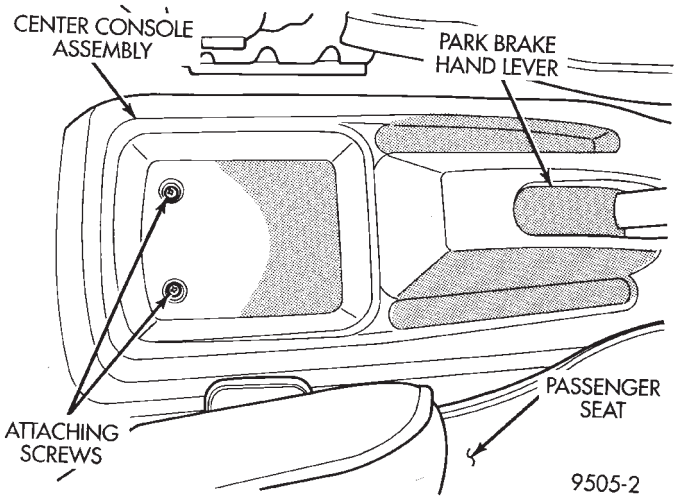


Fig. 125 Center Console Rear Attaching Screws W/O Arm Rest

(2) Remove the 2 screws located in cup holders (Fig. 127), attaching front of center console assembly to console bracket.

(3) Raise park brake hand lever as high as it will go to get the required clearance to remove the center console.

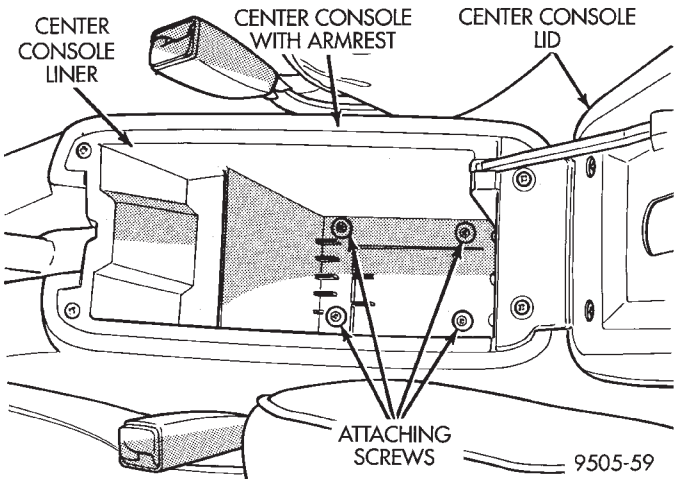


Fig. 126 Center Console Rear Attaching Screws With Arm Rest

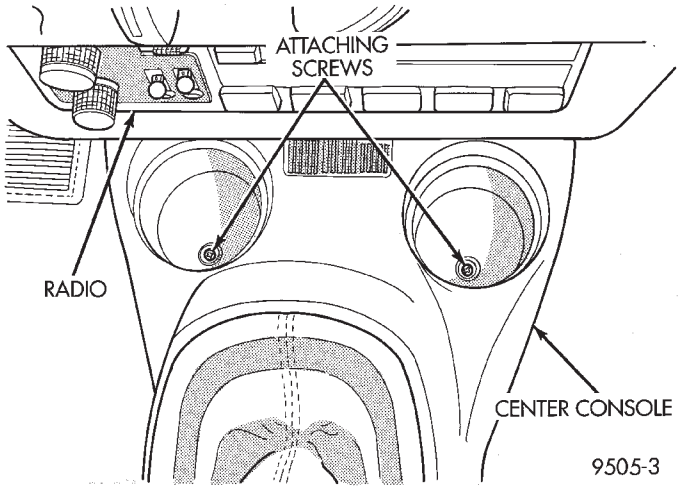


Fig. 127 Attaching Screws At Front Of Center Console

(4) Remove center console assembly.

WARNING: WHEN REPAIRS TO THE PARK BRAKE HAND LEVER ASSEMBLY OR CABLES IS REQUIRED, THE AUTO ADJUSTER MUST BE RELOADED AND LOCKED OUT.

(5) Lower park brake lever handle.

(6) Grasp park brake lever output cable by hand and pull rearward (Fig. 128). Continue pulling on cable until a 3/16 in. drill bit can be inserted into handle and sector gear of park brake mechanism (Fig. 128). This will lock the park brake mechanism and take tension off park brake cables.

(7) Remove both rear park brake cables from the park brake cable equalizer (Fig. 129).

(8) Remove wiring harness electrical connector for brake warning light ground from the park brake lever (Fig. 130).

REMOVAL AND INSTALLATION (Continued)

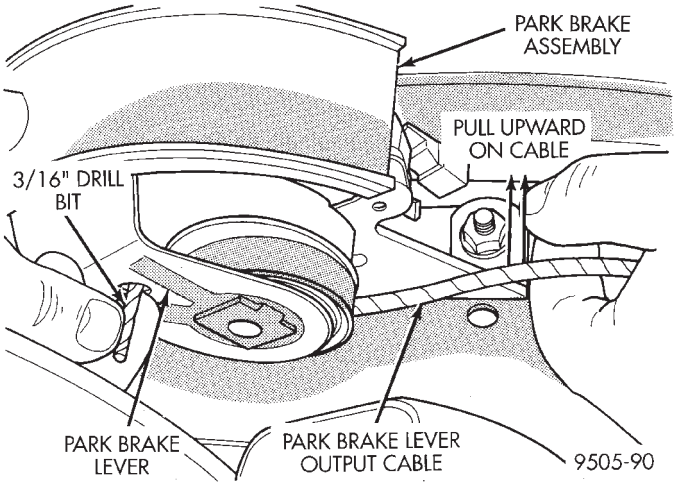


Fig. 128 Locking Pin Installed In Park Brake Mechanism

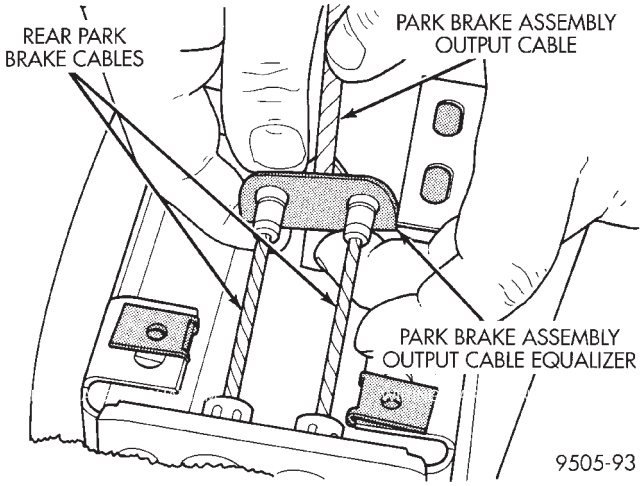


Fig. 129 Park Brake Cables At Equalizer

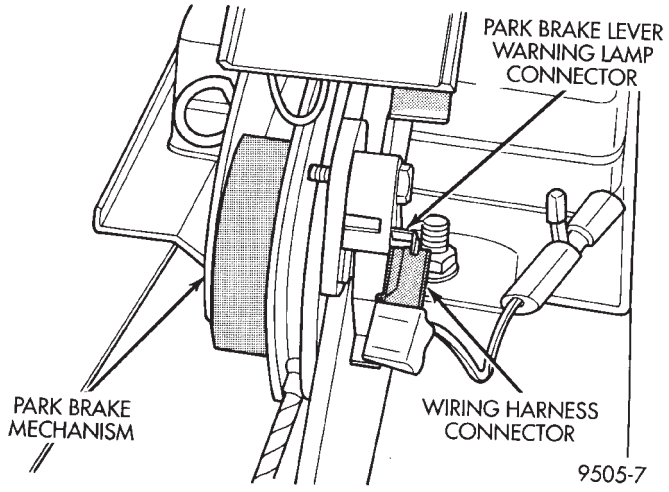


Fig. 130 Brake Warning Lamp Connection To Park Brake Lever

(9) Remove the 2 nuts (Fig. 131) attaching the park brake lever to the console bracket. Remove park brake lever mechanism from vehicle.

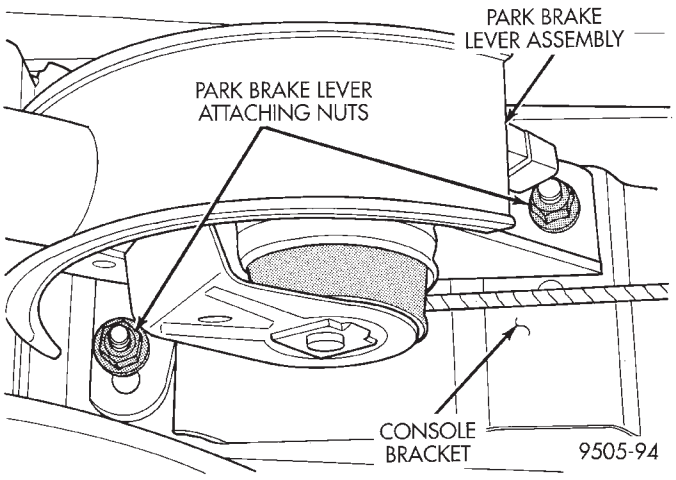


Fig. 131 Park Brake Lever Attachment To Console Bracket

INSTALL

(1) Place park brake lever on console bracket. Install and securely tighten the 2 attaching nuts (Fig. 131).

(2) Install both rear park brake cables into equalizer on park brake lever output cable (Fig. 129).

(3) Ensure that park brake cable is correctly installed and aligned with cable track on park brake lever.

(4) Firmly grasp park brake lever locking pin (Fig. 132) and quickly remove it from the park brake lever mechanism. This will allow the park brake lever mechanism to correctly adjust the park brake cables.

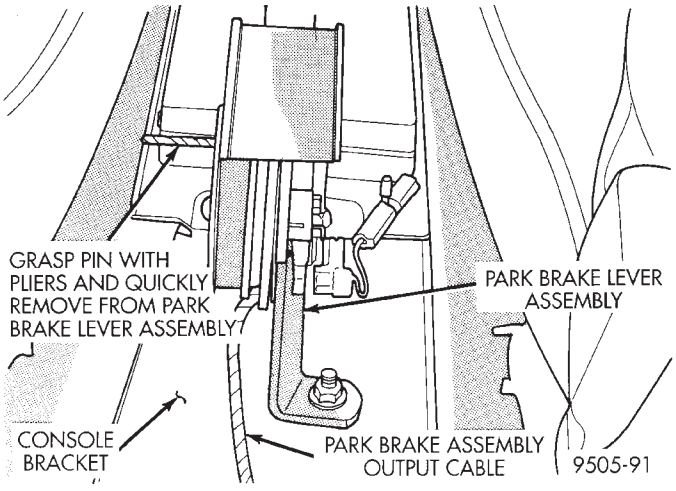


Fig. 132 Removing Lockout Pin From Park Brake Lever Assembly

(5) Connect electrical connector for brake warning lamp onto terminal on park brake lever assembly (Fig. 130).

REMOVAL AND INSTALLATION (Continued)

(6) Cycle park brake lever once to position park brake cables. Then return the park brake lever its released position. Check the rear wheels of the vehicle. They should rotate freely without dragging.

(7) Raise park brake lever to its fully engaged position. This is necessary to allow installation of the center console.

(8) Install center console assembly.

(9) Install the 4 center console assembly attaching screws (Fig. 125), (Fig. 126) and (Fig. 127).

PARK BRAKE LEVER OUTPUT CABLE

On this vehicle, the park brake lever output cable (Fig. 133), is not replaceable as a separate component of the park brake lever. The park brake lever output cable (Fig. 133) should never be attempted to be repaired in any manner. Follow the require procedures under park brake lever removal and replacement when servicing a park brake lever output cable.

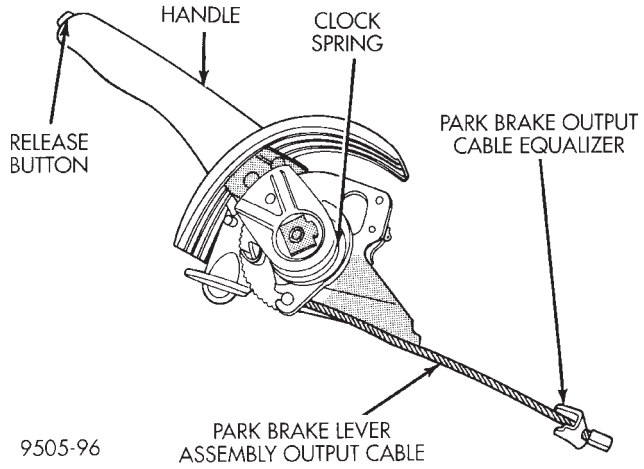


Fig. 133 Brake Lever Assembly And Output Cable

PARK BRAKE CABLES

NOTE: Note: Remove only one rear park brake cable from rear brakes at a time. Failure to do so will result in high efforts required to connect park brake cables to equalizer or park brake lever at rear wheel brakes.

For installation of the rear park brake cables follow the procedure as listed below.

REMOVE

(1) Remove screws attaching rear of center console assembly to floor pan of vehicle (Fig. 134) or (Fig. 135).

(2) Remove the 2 screws located in cup holders (Fig. 136) attaching front of center console to console bracket.

(3) Raise park brake lever as high as it will go for the clearance required to remove the center console.

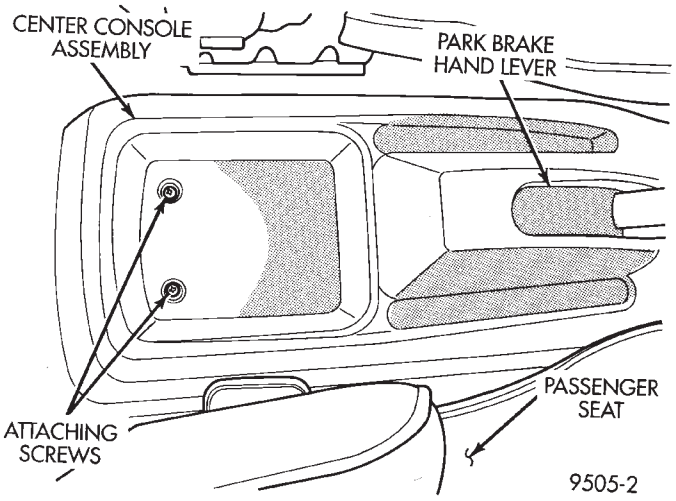


Fig. 134 Center Console W/O Arm Rest Rear Attaching Screws

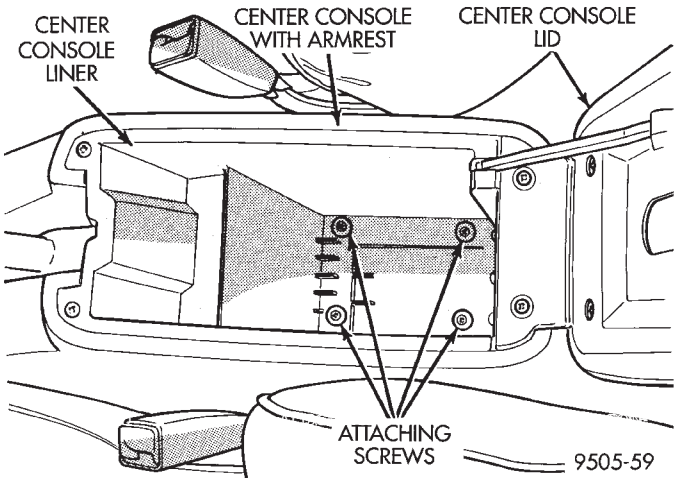


Fig. 135 Center Console With Arm Rest Rear Attaching Screws

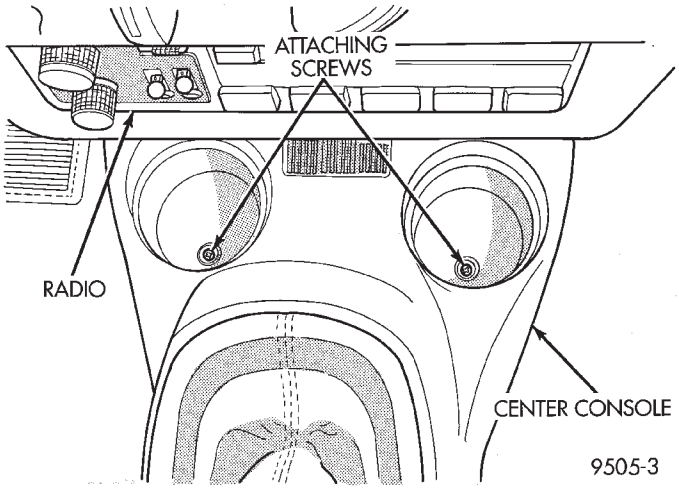


Fig. 136 Center Console Front Attaching Screws

(4) Remove center console assembly from vehicle.

REMOVAL AND INSTALLATION (Continued)

WARNING: WHEN REPAIRS TO THE PARK BRAKE HAND LEVER ASSEMBLY OR CABLES IS REQUIRED, THE AUTO ADJUSTER MUST BE RELOADED AND LOCKED OUT.

(5) Lower park brake lever handle.

(6) Grasp park lever output cable by hand and pull rearward (Fig. 137). Continue pulling on cable until a 3/16 in. drill bit can be inserted into handle and sector gear of park brake mechanism (Fig. 137). This will lock the park brake mechanism and take tension off park brake cables.

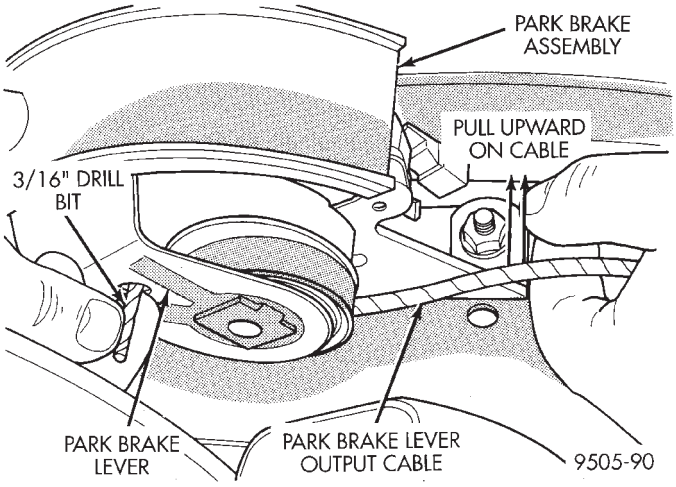


Fig. 137 Locking Pin Installed In Park Brake Mechanism

(7) Remove rear park brake cables from the park brake cable equalizer (Fig. 138).

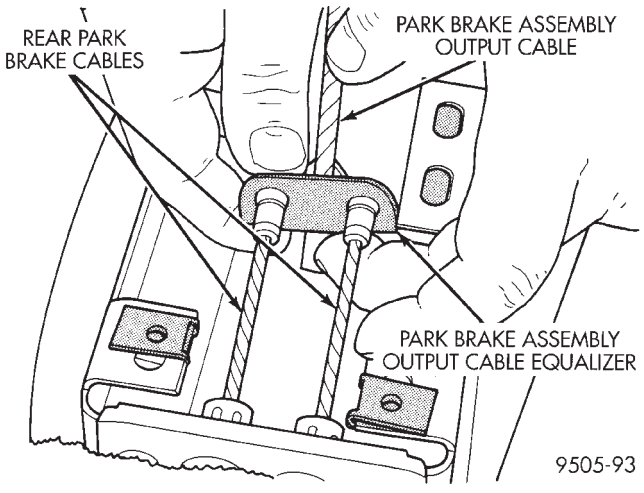


Fig. 138 Park Brake Cables Attachment To Equalizer

(8) Remove rear seat cushion from vehicle.

(9) Remove scuff plates (Fig. 139) from right and left rear door sills. Scuff plates are attached to door sills using clips on bottom of scuff plates. Remove by **carefully** prying scuff plate retaining clips out of door sills.

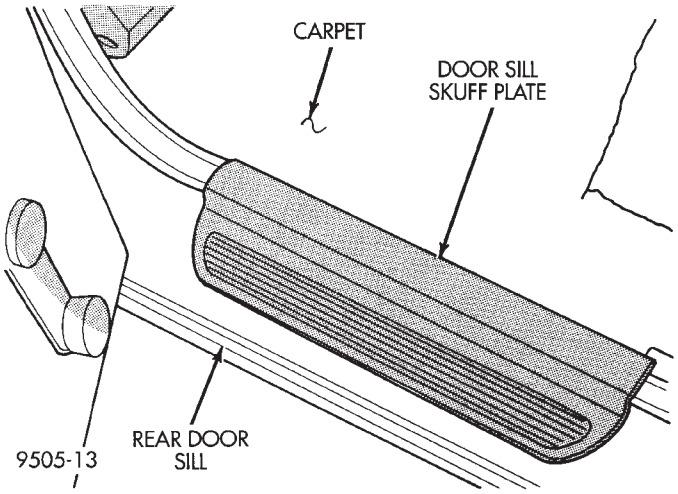


Fig. 139 Rear Door Sill Scuff Plates

(10) Fold rear carpeting forward to expose park brake cables.

(11) Install the box end of a 1/2 in. wrench over the park brake cable retainer as indicated in (Fig. 140). This will compress tabs on park brake cable retainer, allowing cable to be removed from console bracket. From under carpet, grasp park brake cable housing and pull cable straight out of console bracket.

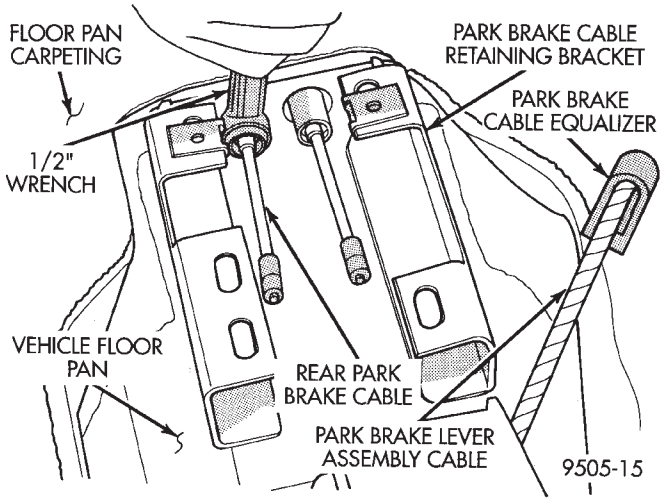


Fig. 140 Compressing Park Brake Cable Retaining Tabs

(12) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual for the required lifting procedure to be used for this vehicle.

(13) Remove rear wheel and tire assembly.

(14) On vehicles equipped with rear drum brakes, remove brake drum (Fig. 141) from rear hub/bearing assembly. On vehicles equipped with rear disc brakes, remove disc brake caliper from disc brake

REMOVAL AND INSTALLATION (Continued)

adapter, and then remove rotor (Fig. 142) from hub/bearing assembly.

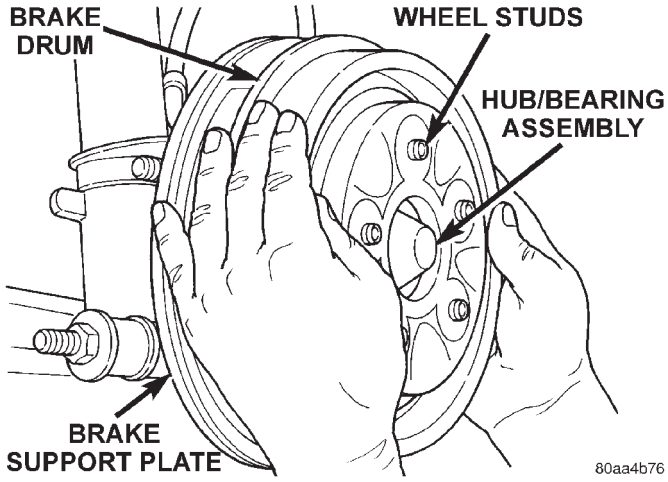


Fig. 141 Brake Drum Removal

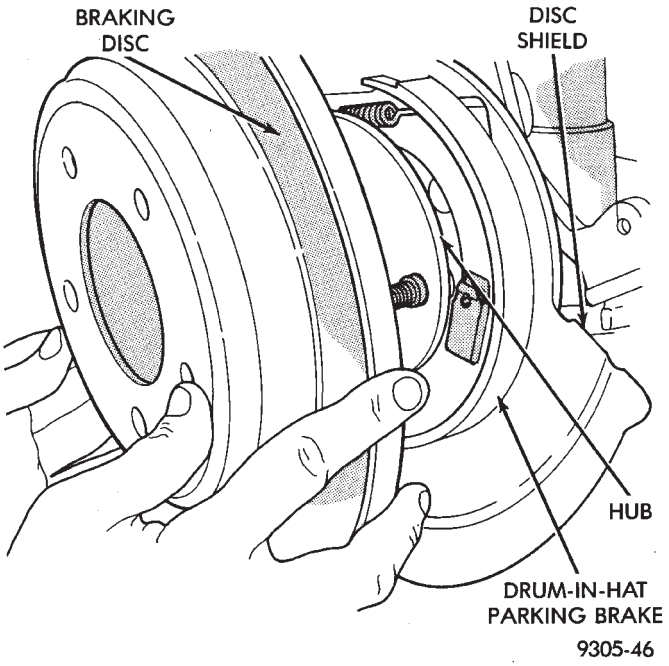


Fig. 142 Rear Brake Rotor

(15) Remove the dust dust cap (Fig. 143) from the rear hub/bearing.

(16) Remove the retaining nut (Fig. 144) for the hub/bearing from the spindle.

(17) Remove thehub/bearing (Fig. 145) from the rear spindle.

(18) **On vehicles equipped with rear drum brakes,** remove park brake cable from park brake actuating lever (Fig. 146). Then remove the actuating spring (Fig. 147) between brake shoe adjustment lever and brake shoe assembly.

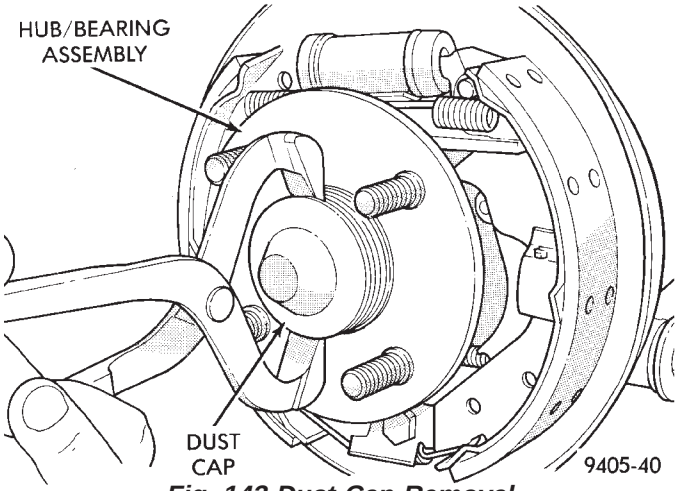


Fig. 143 Dust Cap Removal

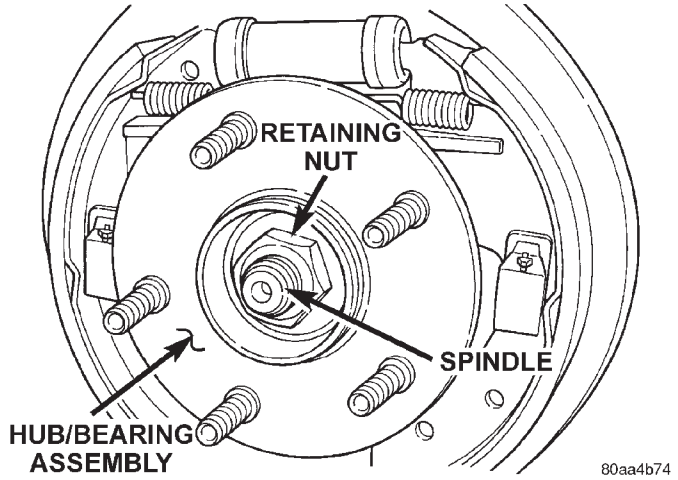


Fig. 144 Hub/Bearing Retaining Nut

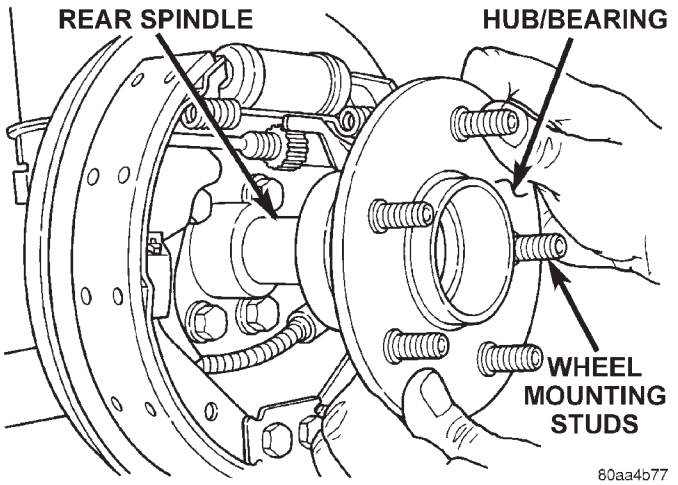


Fig. 145 Hub/Bearing Removal From Spindle (Drum Brakes Shown)

(19) **On vehicles equipped with rear disc brakes,** remove brake shoe assemblies (Fig. 148) from rear disc brake adapter. Then remove parking brake actuating lever (Fig. 149) from the park brake cable.

REMOVAL AND INSTALLATION (Continued)

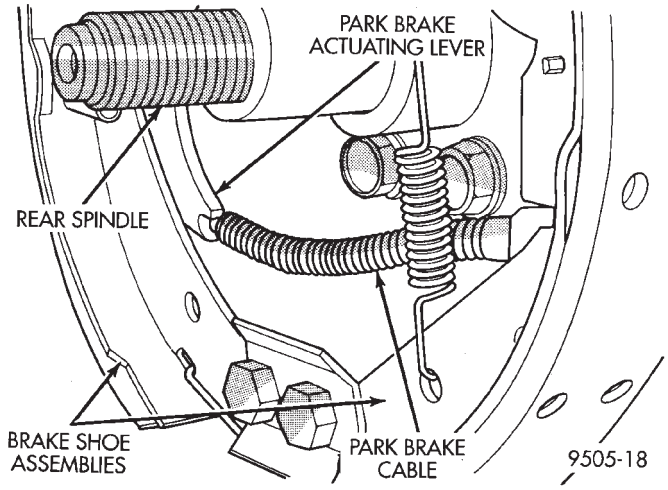


Fig. 146 Park Brake Cable Attachment To Actuating Lever

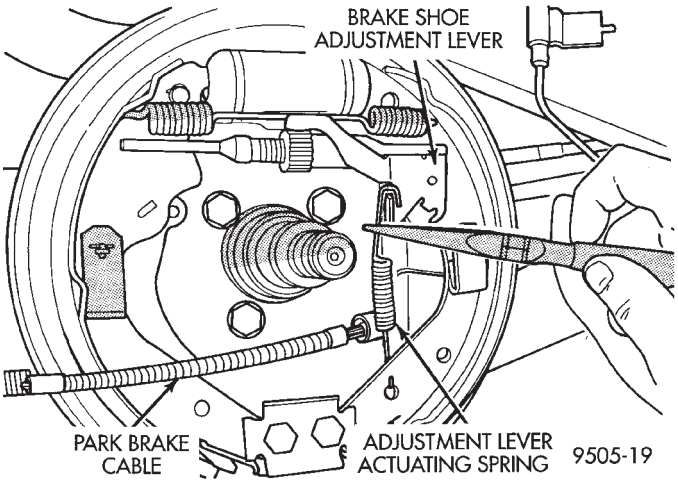


Fig. 147 Brake Adjustment Lever Actuating Spring

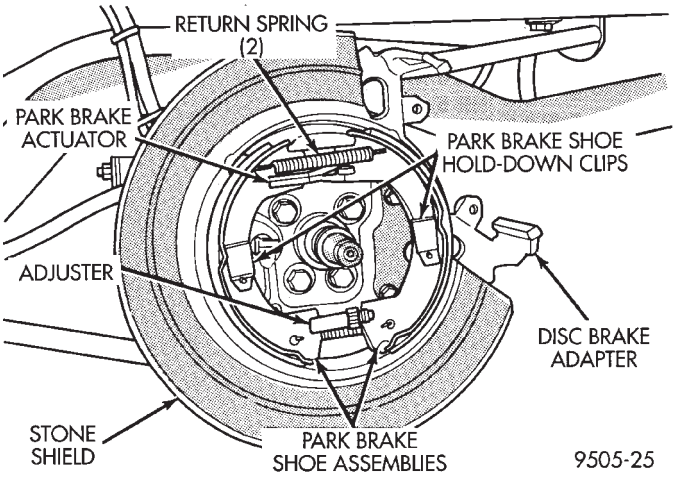


Fig. 148 Parking Brake Shoe Assemblies

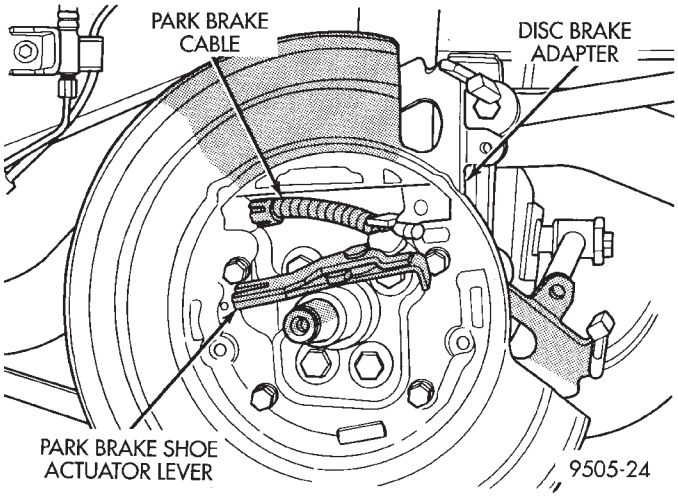


Fig. 149 Parking Brake Actuator Lever

(20) On vehicles equipped with rear drum brakes, remove park brake cable (Fig. 150) from rear brake support plate. Park brake cable is removed from brake support plate using a 1/2 in. wrench as shown in (Fig. 150) to compress locking tabs on park brake cable retainer.

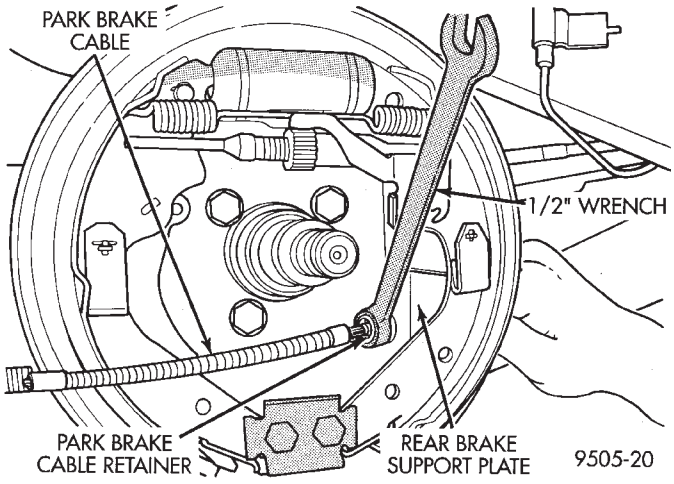


Fig. 150 Park Brake Cable Removal From Brake Support Plate

REMOVAL AND INSTALLATION (Continued)

(21) On vehicles equipped with rear disc brakes, remove park brake cable (Fig. 151) from rear disc brake adapter. Park brake cable is removed from disc brake adapter using a screwdriver as shown in (Fig. 151) to compress locking tabs on park brake cable retainer.

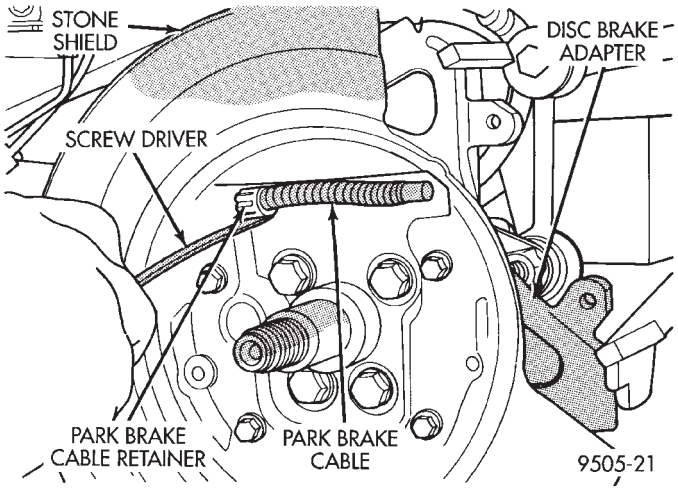


Fig. 151 Park Brake Cable Removal From Disc Brake Adapter

(22) Remove park brake cable routing bracket (Fig. 152) from vehicle frame rail.

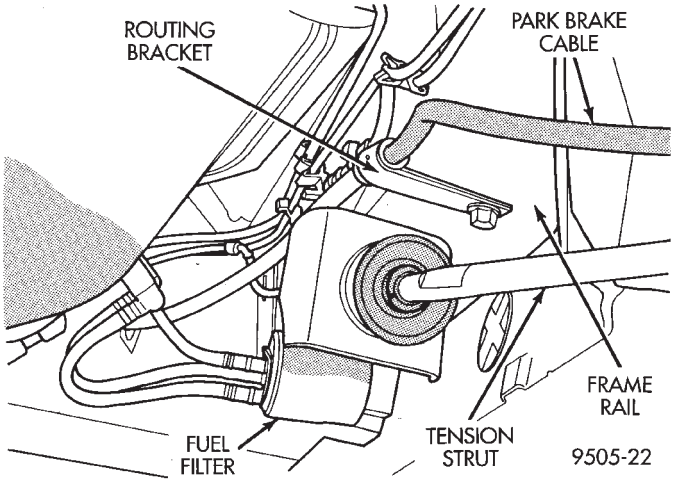


Fig. 152 Park Brake Cable Routing Bracket

(23) Remove park brake cable and sealing grommet (Fig. 153) from floor pan of vehicle.

INSTALL

(1) Install park brake cable into floor pan of vehicle making sure sealing grommet is installed in floor pan as far as possible to insure proper seal.

(2) Install park brake cable into brake support plate or rear disc brake adapter. Be sure locking tabs on cable retainer are expanded to ensure park brake cable is securely held in support plate or adapter.

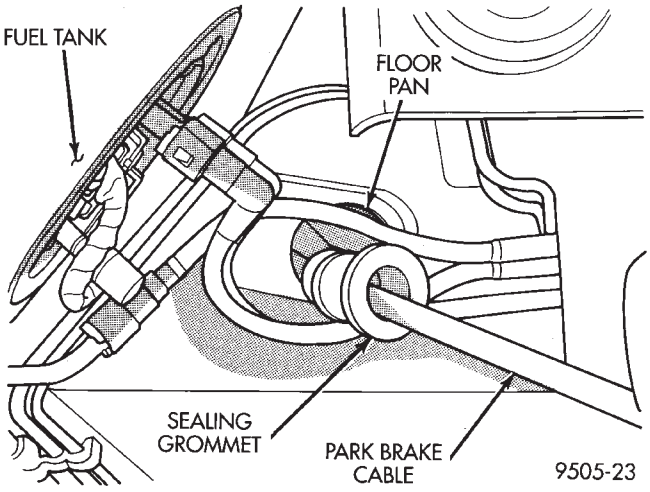


Fig. 153 Park Brake Cable Seal At Floor Pan

(3) Install park brake cable routing bracket (Fig. 152) on frame rail. Install and securely tighten routing bracket attaching bolt.

(4) **On vehicles equipped with rear drum brakes,** install park brake cable on park brake cable actuating lever (Fig. 146). Then install actuating spring between brake shoe assembly and brake adjustment lever (Fig. 147).

(5) **On vehicles equipped with rear disc brakes,** install park brake shoes actuator lever (Fig. 149) on park brake cable. Then install park brake shoe assemblies on disc brake adapter (Fig. 148).

(6) Install the hub/bearing assembly on the rear spindle. Then install **A NEW** rear hub/bearing assembly retaining nut. Torque hub/bearing assembly retaining nut to 217 N·m (160 ft. lbs.).

(7) Install hub/bearing assembly dust cap, using a soft faced hammer.

(8) On drum brake equipped vehicles, install rear brake drum on hub/bearing assembly. On vehicles equipped with rear disc brakes, install rotor on hub/bearing assembly.

(9) On disc brake equipped vehicles install disc brake caliper on disc brake adapter. Install the 2 caliper guide pin bolts (Fig. 154) and torque to 22 N·m (192 in. lbs.). Refer To Rear Disc Brake Service in this group of the service manual for the required caliper installation procedure.

(10) Install rear wheel and tire assembly on vehicle. Tighten all wheel stud nuts in criss cross pattern to one-half specified torque. Then repeat pattern, fully tightening stud nuts to 135 N·m (100 ft. lbs.).

(11) Lower vehicle.

(12) Grasp park brake cable to floor pan seal grommet (Fig. 155) by hand, and pull it into floor pan to ensure seal grommet is fully seated into floor pan.

(13) Route park brake cable under carpeting and up to park brake cable retaining bracket on floor

REMOVAL AND INSTALLATION (Continued)

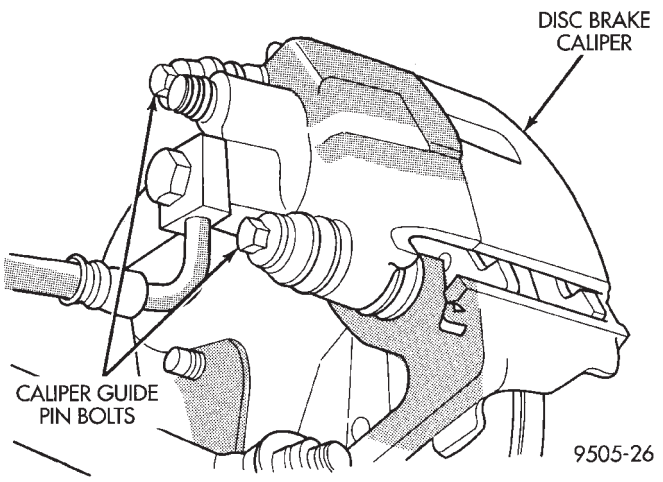


Fig. 154 Rear Caliper Guide Pin Bolts

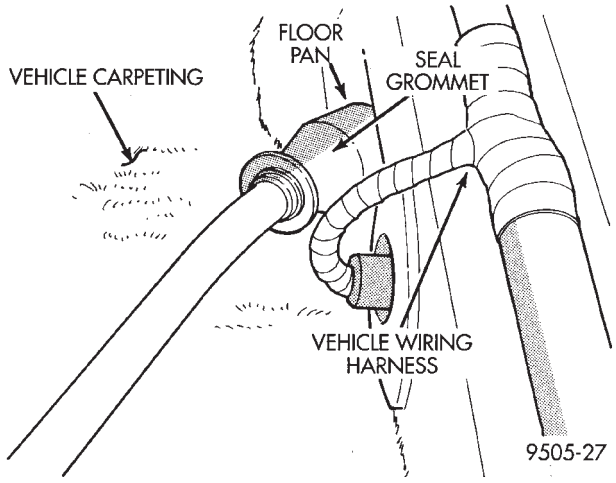


Fig. 155 Seal Grommet Installation In Floor Pan

pan. Then install park brake cable into retaining bracket (Fig. 156). Be sure tabs (Fig. 156) on park brake cable retainer, have expanded out to hold park brake cable in retaining bracket.

(14) Install rear park brake cables into equalizer (Fig. 138) on park brake lever cable.

(15) Reposition rear carpeting.

(16) Install both rear door sill plate scuff moldings, by snapping them onto rear door sills.

(17) Install lower rear seat cushion. Be sure lower seat cushion is fully installed in retainers on floor pan of vehicle.

(18) Firmly grasp park brake lever locking pin (3/16 in. drill bit) (Fig. 157) and quickly remove it from the park brake lever mechanism. This will allow the park brake lever mechanism to correctly adjust the park brake cables.

(19) Cycle park brake lever ounce to position park brake cables. Then return the park brake lever its released position. Check the rear wheels of the vehicle, they should rotate freely without dragging.

(20) Apply park brake to full engagement.

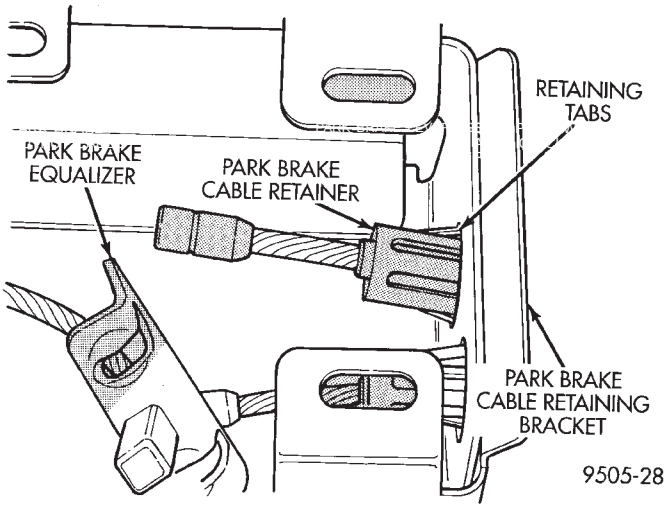


Fig. 156 Park Brake Cable Installed In Retaining Bracket

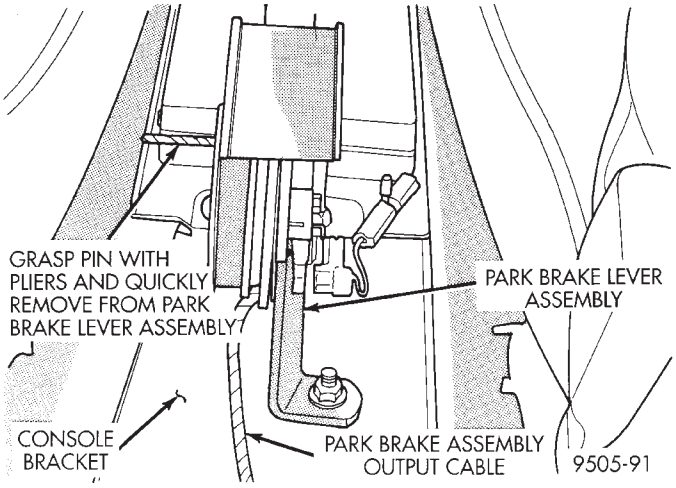


Fig. 157 Removing Lockout Pin From Park Brake Lever

(21) Install center console assembly.

(22) Install the center console assembly attaching screws.

PARK BRAKE SHOES WITH REAR DISC BRAKES

REMOVE

(1) Remove rear disc brake caliper assembly from adapter and rotor (See Disc Brake Shoe Removal).

(2) Remove rear rotor from rear hub.

(3) Remove dust cap from rear hub.

(4) Remove rear hub and bearing assembly retaining nut and washer.

(5) Remove rear hub and bearing assembly from rear spindle.

(6) Remove rear brake shoe assembly hold down clip (Fig. 158).

(7) Turn brake shoe adjuster wheel until adjuster is at shortest length.

REMOVAL AND INSTALLATION (Continued)

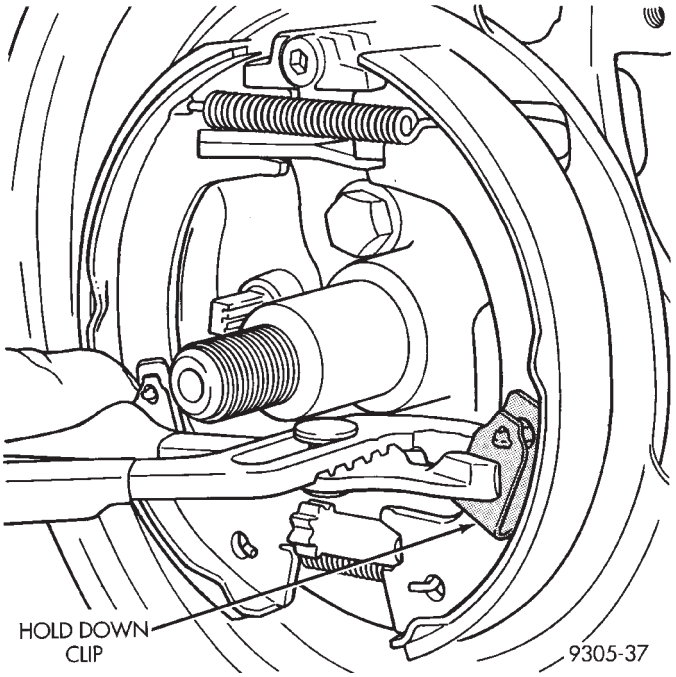


Fig. 158 Rear Brake Shoe Hold-Down Clip

(8) Remove adjuster assembly from the parking brake shoe assemblies (Fig. 159).

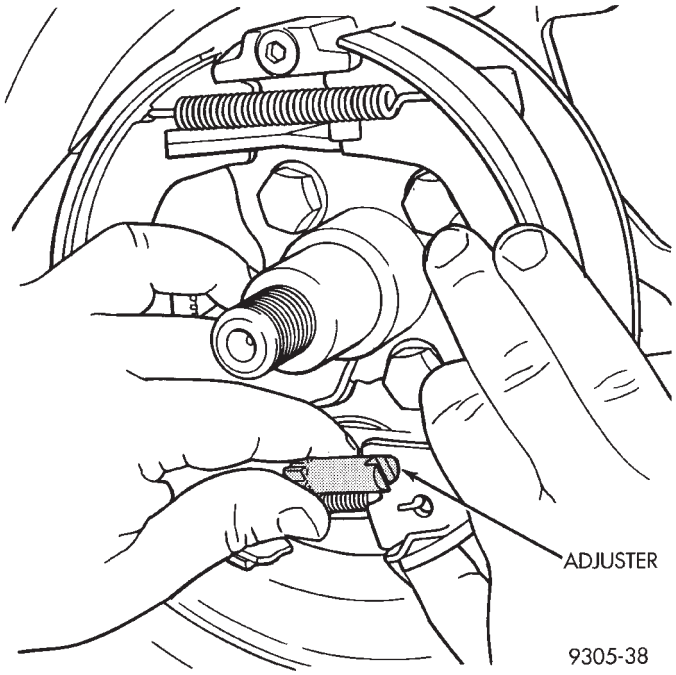


Fig. 159 Park Brake Shoe Adjuster Assembly

(9) Remove lower shoe to shoe spring (Fig. 160).

(10) Pull rear brake shoe assembly away from anchor. Then remove rear brake shoe and upper spring (Fig. 161).

(11) Remove front brake shoe hold-down clip (Fig. 162). Then remove front brake shoe assembly.

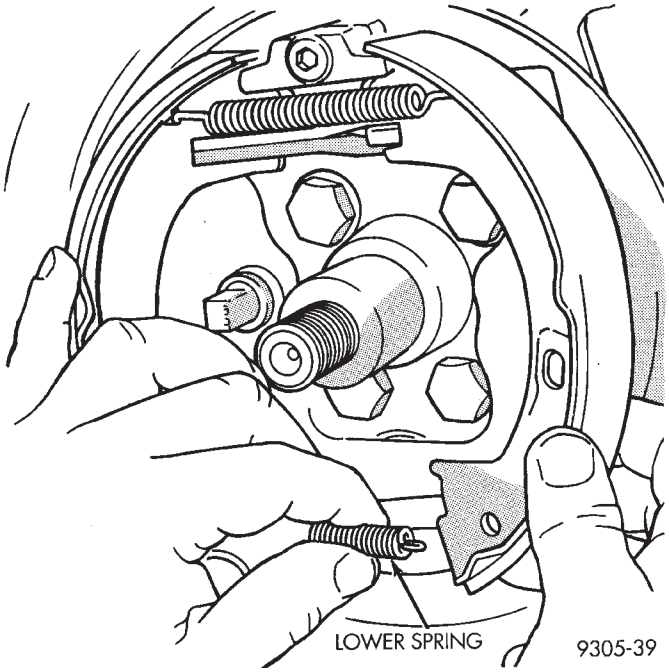


Fig. 160 Brake Shoe Lower Return Spring

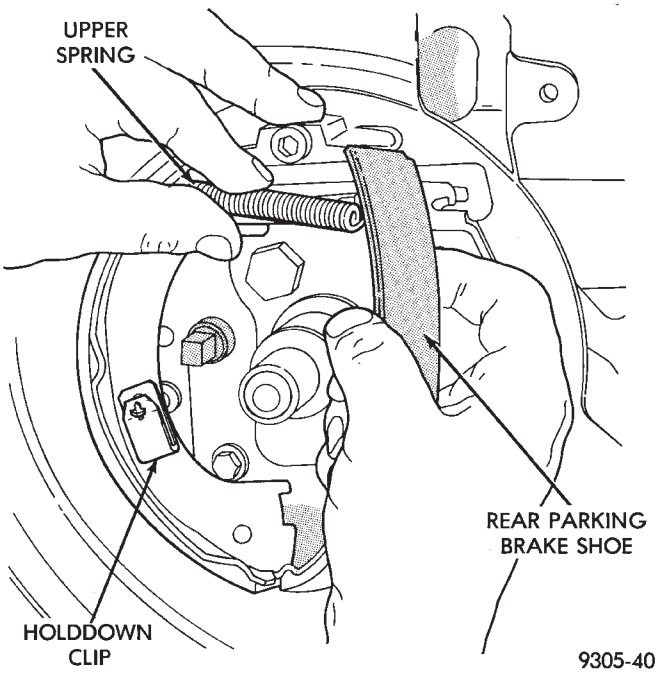


Fig. 161 Brake Shoe and Upper Spring

INSTALL

(1) Install front brake shoe and hold down clip (Fig. 162).

(2) Install rear brake shoe and the upper brake shoe to shoe return spring (Fig. 161).

(3) Pull rear brake shoe over anchor block until properly located on adapter.

(4) Install the lower shoe to shoe return spring (Fig. 160).

REMOVAL AND INSTALLATION (Continued)

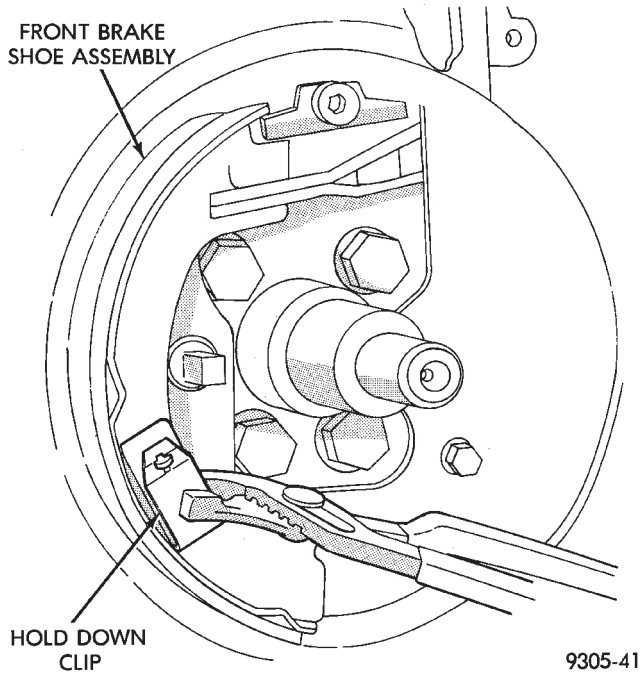


Fig. 162 Front Hold Down Clip And Brake Shoe

(5) Install brake shoe adjuster assembly with star wheel rearward (Fig. 159).

(6) Install rear brake shoe hold down clip (Fig. 158).

(7) Adjust brake shoes to a diameter to 171 mm (6.75 inch).

(8) Install rear hub and bearing assembly on spindle.

(9) Install **A NEW** hub and bearing assembly retaining nut. Torque the hub and bearing assembly retaining nut to 168 N·m (124 ft. lbs.).

(10) Install hub and bearing assembly dust cap.

(11) Install rear rotor.

(12) Install rear disc brake caliper on the adapter (See Brake Shoe Removal).

(13) Install wheel and tire assemblies.

(14) Tighten wheel stud nuts to 129 N·m (95 ft.lbs.).

STOP LAMP SWITCH

REMOVE

(1) Depress and hold the brake pedal while rotating stop lamp switch (Fig. 163) in a counter-clockwise direction approximately 30 degrees.

(2) Pull the switch rearward and remove from its mounting bracket.

(3) Disconnect wiring harness connector from stop lamp switch.

INSTALL

NOTE: Prior to installing stop lamp switch into bracket, the plunger must be moved to its fully extended position using procedure in Step 1.

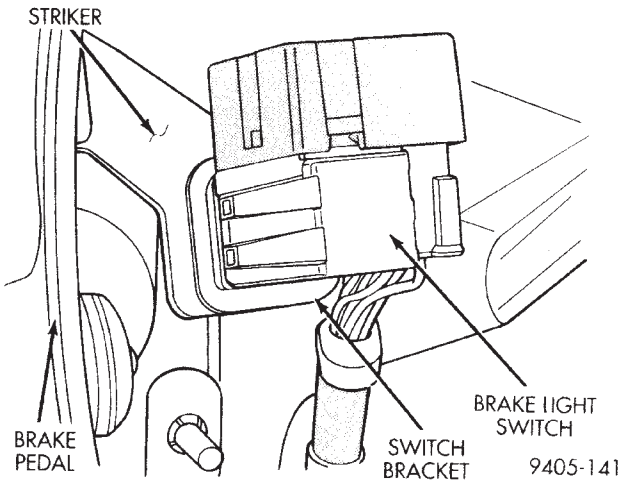


Fig. 163 Stop Lamp Switch

(1) Hold stop lamp switch firmly in one hand. Then using other hand, pull outward on the plunger of the stop lamp switch until it has ratcheted out to its fully extended position.

(2) Connect the wiring harness connector to the stop lamp switch.

(3) Mount the stop lamp switch into the bracket using the following procedure. Depress the brake pedal as far down as possible. Then install switch in bracket by aligning index key on switch with slot at top of square hole in mounting bracket. When switch is fully installed in bracket, rotate switch clockwise approximately 30° to lock switch into bracket.

CAUTION: Do not use excessive force when pulling back on brake pedal to adjust the stop lamp switch. If to much force is used, damage to the stop lamp switch or striker (Fig. 163) can result.

(4) Gently pull back on brake pedal until the pedal stops moving. This will cause the switch plunger to ratchet backward to the correct position.

DISASSEMBLY AND ASSEMBLY

BRAKE FLUID RESERVOIR

NOTE: The master cylinder does not need to be removed from the power brake vacuum booster for replacement of the brake fluid reservoir.

(1) Clean master cylinder housing and brake fluid reservoir.

(2) Remove the brake fluid reservoir cap. Using a **CLEAN** syringe or equivalent type tool, empty as much brake fluid as possible from the reservoir.

NOTE: Do not pry off using a tool, damage to reservoir may result.

DISASSEMBLY AND ASSEMBLY (Continued)

(3) Rock brake fluid reservoir from side to side while pulling up to remove the reservoir from the master cylinder housing (Fig. 164).

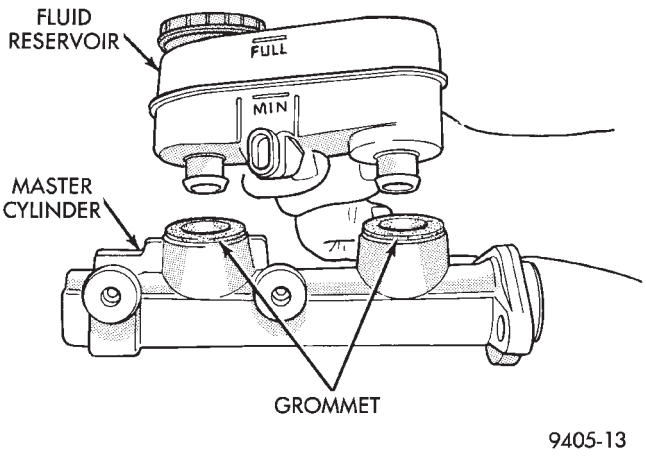


Fig. 164 Removing Fluid Reservoir From Master Cylinder

(4) Remove master cylinder housing to brake fluid reservoir grommets.

(5) Install new master cylinder housing to brake fluid reservoir sealing grommets (Fig. 164) in master cylinder housing.

(6) Lubricate reservoir mounting area with fresh clean brake fluid. Place reservoir in position over grommets. Seat reservoir into grommets using a rocking motion while firmly pressing down on fluid reservoir.

(7) Be sure reservoir is positioned properly.

(8) Make sure bottom of reservoir touches top of grommet.

BRAKE FLUID LEVEL SWITCH

The master cylinder or brake fluid reservoir does not have to be removed from vehicle for replacement of the brake fluid level sensor.

(1) Remove wiring harness connector from brake fluid reservoir level sensor (Fig. 165).

(2) Compress retaining tabs (Fig. 166) on end of brake fluid level switch.

(3) While compressing retaining tabs, grasp opposite end of brake fluid level switch and pull it out of master cylinder brake fluid reservoir (Fig. 167).

(4) Correctly align the replacement level switch with its mounting hole in the brake fluid reservoir. Push switch into fluid reservoir until retaining tabs are fully expanded on opposite side of fluid reservoir (Fig. 166).

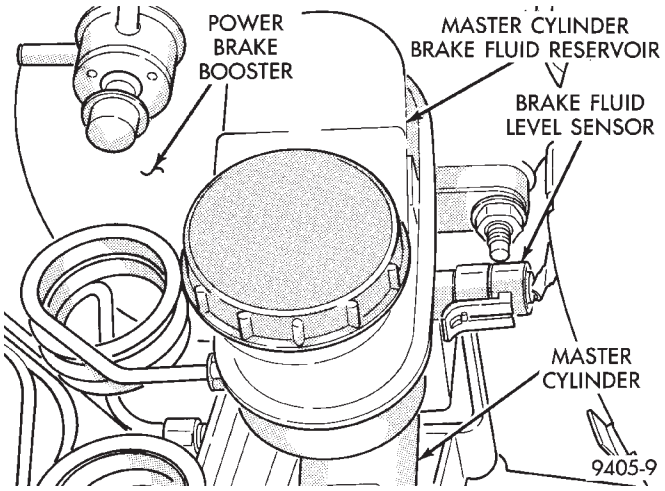


Fig. 165 Master Cylinder Fluid Level Sensor

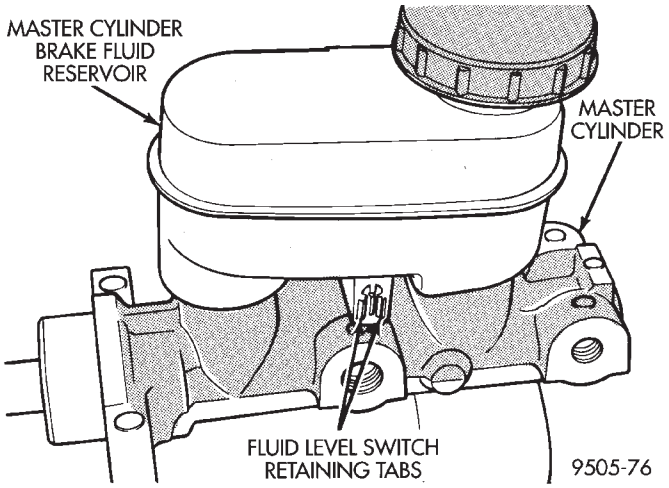


Fig. 166 Brake Fluid Level Switch Retaining Tabs

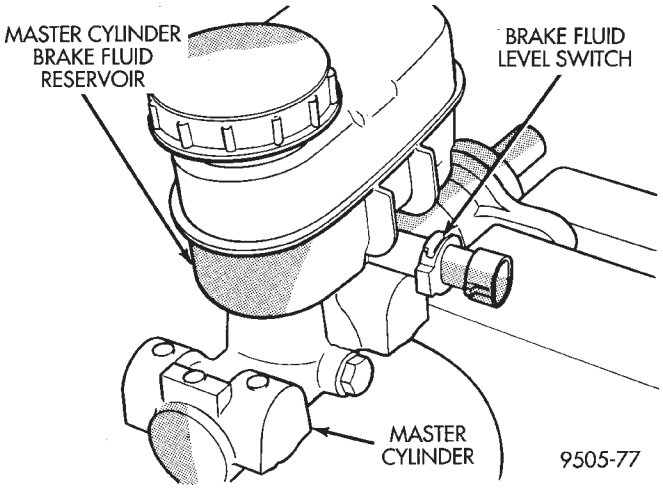


Fig. 167 Removing/Installing Fluid Reservoir Level Switch

DISASSEMBLY AND ASSEMBLY (Continued)

(5) Install the wiring harness connector onto the brake fluid level switch.

FRONT AND REAR DISC BRAKE CALIPER

CLEANING AND INSPECTION

Check for brake fluid leaks in and around dust boot area and inboard brake pad, and for any ruptures, brittleness or damage to the piston dust boot. If the dust boot is damaged, or a fluid leak is visible, disassemble caliper assembly and install a new piston seal and dust boot, and piston if scored. Refer to Caliper Disassembly And Re-Assembly Procedures in Disc Brake Caliper Service in this section of the service manual.

Check the guide pin dust boots to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Guide Pin Bushing Service in Disc Brake Caliper Service in this section of the service manual.

CALIPER GUIDE PIN BUSHING SERVICE

The double pin caliper uses a sealed for life bushing and sleeve assembly. If required this assembly can be serviced using the following procedure.

REMOVING CALIPER GUIDE PIN BUSHINGS

(1) Remove caliper from brake rotor (See Brake Shoe Removal). Hang caliper assembly on a wire hook away from the brake rotor.

(2) Push out and then pull the steel sleeve from the inside of the bushing using your fingers as shown in (Fig. 168).

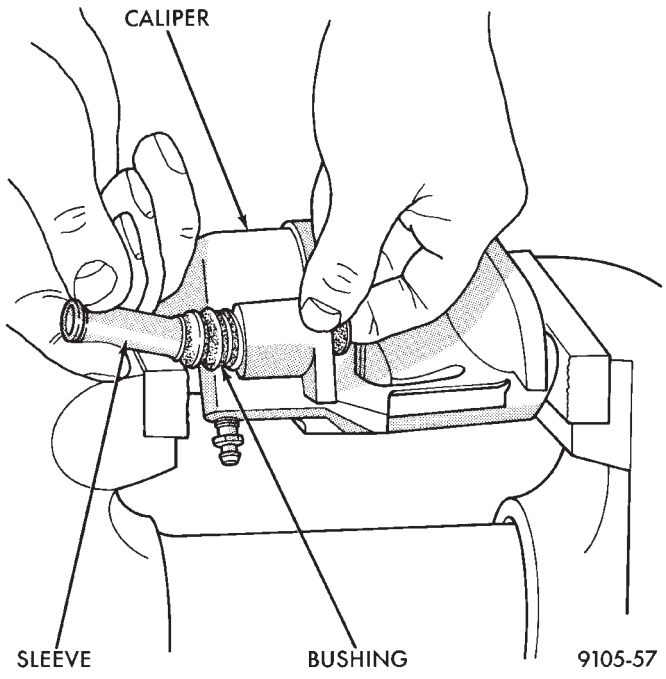


Fig. 168 Removing Inner Sleeve From Bushing

(3) Using your fingers, collapse one side of the bushing. Then pull on the opposite side to remove the bushing from the brake caliper housing (Fig. 169).

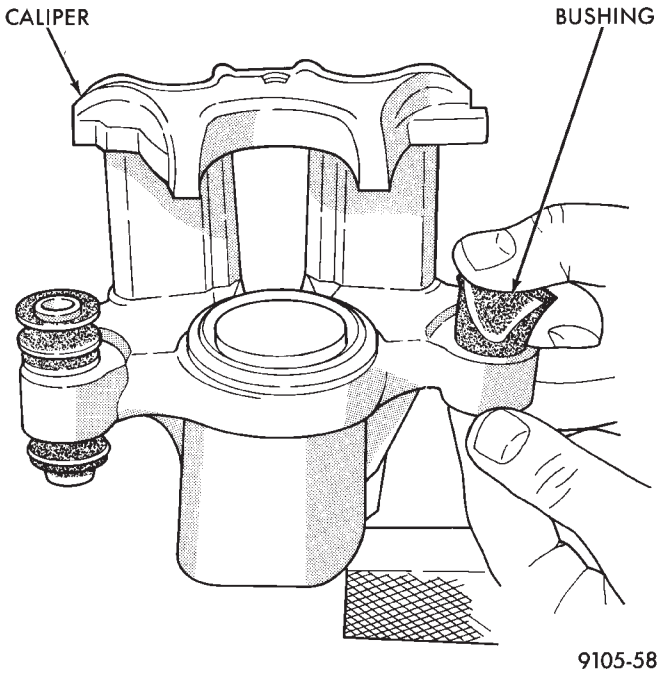


Fig. 169 Removing Bushing From Caliper

INSTALLING CALIPER GUIDE PIN BUSHINGS

(1) Fold the bushing in half lengthwise at the solid middle section of the bushing (Fig. 170).

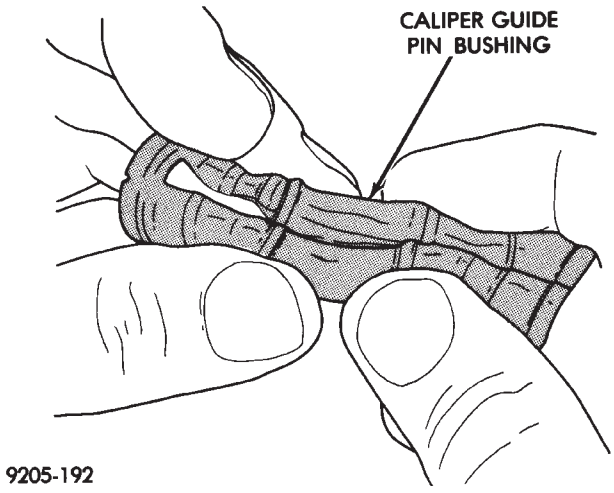


Fig. 170 Folded Caliper Guide Pin Bushing

(2) Insert the folded bushing into the caliper housing (Fig. 171). **Do not use a sharp object to perform this step due to possible damage to the bushing.**

(3) Unfold the bushing using your fingers or a wooden dowel until the bushing is fully seated into the caliper housing. Flanges should be seated evenly on both sides of the bushing hole (Fig. 172).

DISASSEMBLY AND ASSEMBLY (Continued)

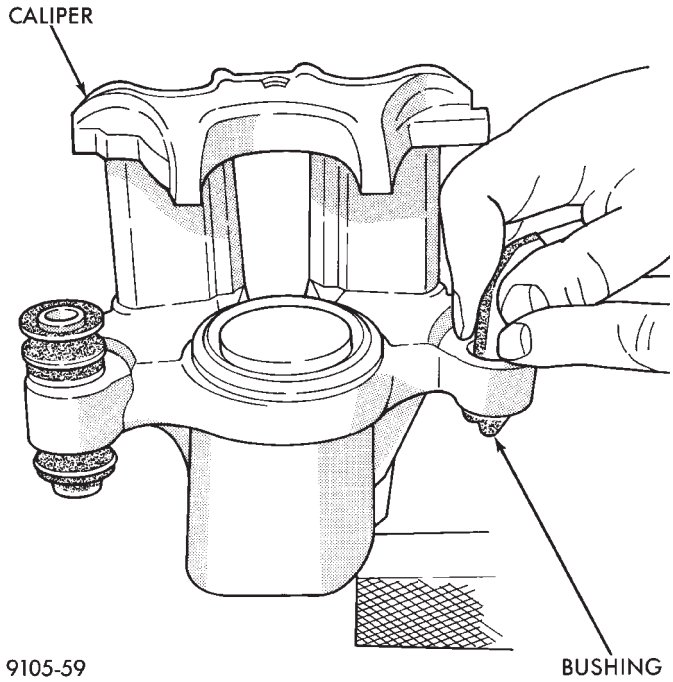


Fig. 171 Installing Caliper Guide Pin Bushing

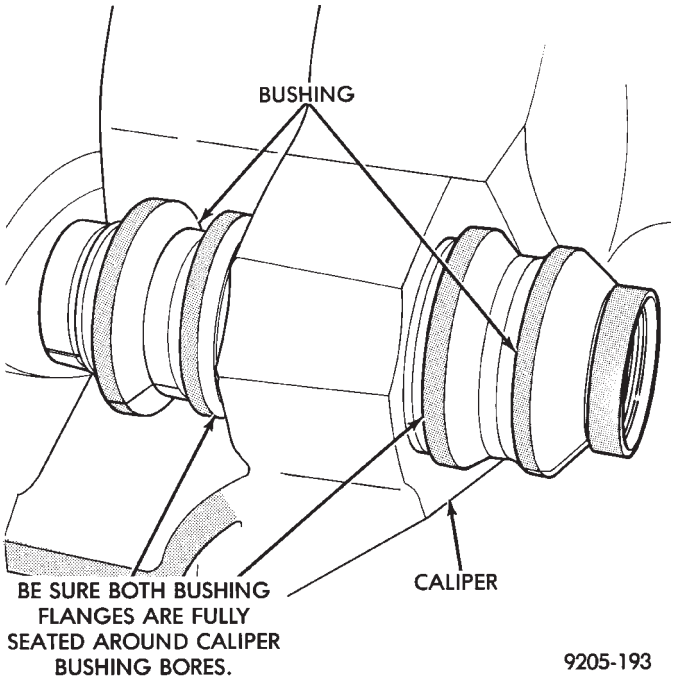


Fig. 172 Bushing Correctly Installed In Caliper

(4) Lubricate the inside surfaces of the bushing using Mopar, Silicone Dielectric Compound or an equivalent.

(5) Install guide pin sleeve into one end of bushing until seal area of bushing is past seal groove in sleeve (Fig. 173).

(6) Holding convoluted boot end of bushing with one hand, push steel sleeve bushing through boot

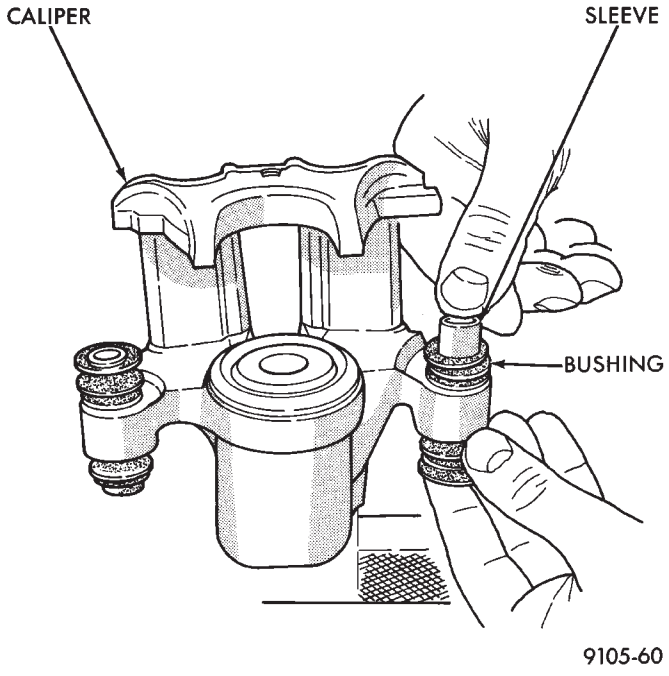


Fig. 173 Installing Sleeve In Bushing

until one end of bushing is fully seated into seal groove on one end of sleeve (Fig. 173).

(7) Holding sleeve in place, work other end of bushing over end of sleeve and into the seal grove on sleeve (Fig. 174). Be sure other end of bushing did not come out of seal grove in sleeve.

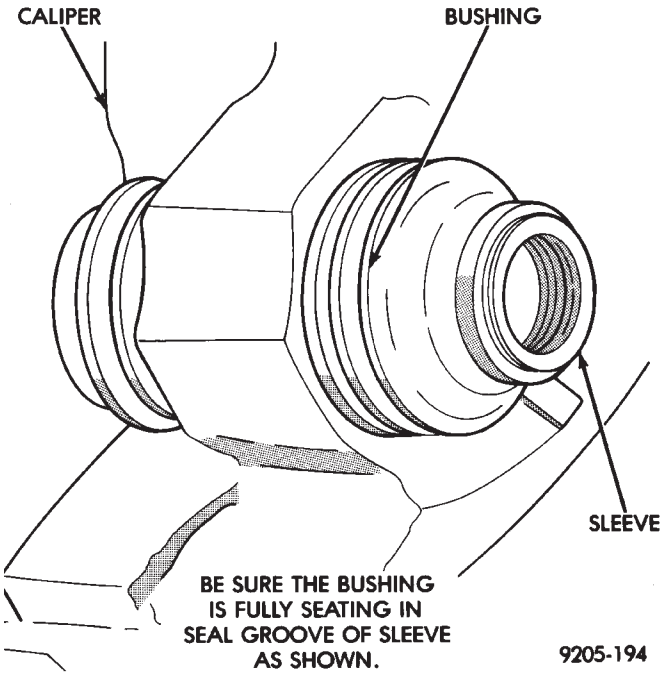


Fig. 174 Correctly Installed Caliper Sleeve And Bushing

(8) When the sleeve is seated properly into the bushing, the sealed for life sleeve/bushing can be

DISASSEMBLY AND ASSEMBLY (Continued)

held between your fingers and easily slid back and forth without the bushing unseating from the sleeve groove.

CALIPER DISASSEMBLY

WARNING: UNDER NO CONDITION SHOULD AIR PRESSURE EVER BE USED TO REMOVE A PISTON FROM A CALIPER BORE. PERSONAL INJURY COULD RESULT FROM SUCH A PRACTICE.

(1) Remove caliper from brake rotor (See Brake Shoe Removal). Hang assembly on a wire hook away from rotor, so hydraulic fluid cannot get on rotor. Place a small piece of wood between the piston and caliper fingers.

(2) **Carefully** depress brake pedal to hydraulically push piston out of bore. Then apply and hold down the brake pedal to any position beyond the first inch of pedal travel. This will prevent loss of brake fluid from the master cylinder.

(3) If both front caliper pistons are to be removed, disconnect brake tube at flexible brake hose at frame rail. Plug brake tube and remove piston from opposite caliper using the same process as above for the first piston removal.

(4) Disconnect the brake fluid flex hose from the caliper assembly.

CAUTION: Do not use excessive force when clamping caliper in vise. Excessive vise pressure will cause bore distortion and binding of piston.

(5) To disassemble caliper, mount in a vise equipped with protective jaws.

(6) Remove guide pin sleeves and guide pin bushings. See Removing Guide Pin Bushings in the caliper disassembly section of this manual.

(7) Remove the piston dust boot from the caliper and discard (Fig. 175).

(8) Using a soft tool, such as a plastic trim stick, work piston seal out of its groove in caliper piston bore (Fig. 176). Discard old seal. **Do not use a screw driver or other metal tool for this operation, because of the possibility of scratching piston bore or burring edges of seal groove.**

(9) Clean all parts using alcohol or a suitable solvent and wipe dry **using only a lint free cloth.** No lint residue can remain in caliper bore. Clean out all drilled passages and bores. **Whenever a caliper has been disassembled, a new boot and seal must be installed at assembly.**

(10) Inspect the piston bore for scoring or pitting. Bores that show light scratches or corrosion can usually be cleared of the light scratches or corrosion using crocus cloth. Bores that have deep scratches or scoring should be honed. Use Caliper Hone, Special Tool C-4095, or equivalent providing the diameter of the bore is not increased more than 0.0254 mm (0.001 inch) (Fig. 177).

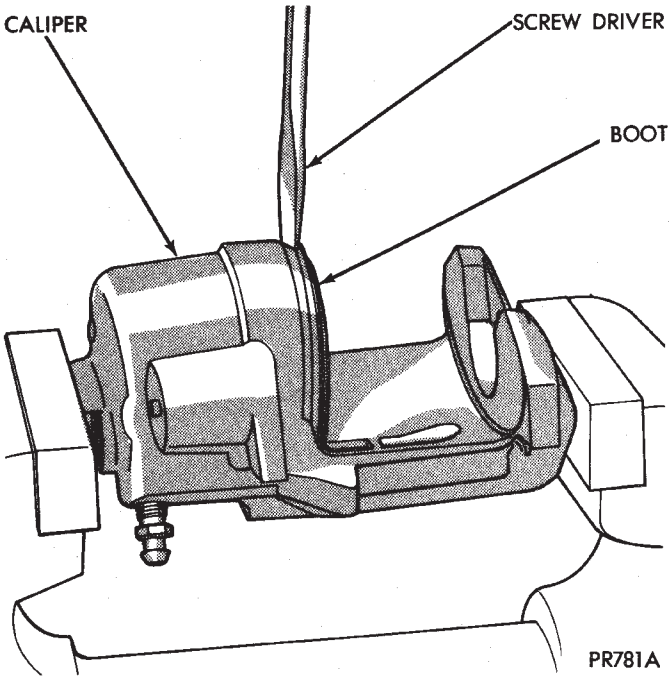


Fig. 175 Removing Caliper/Piston Dust Boot

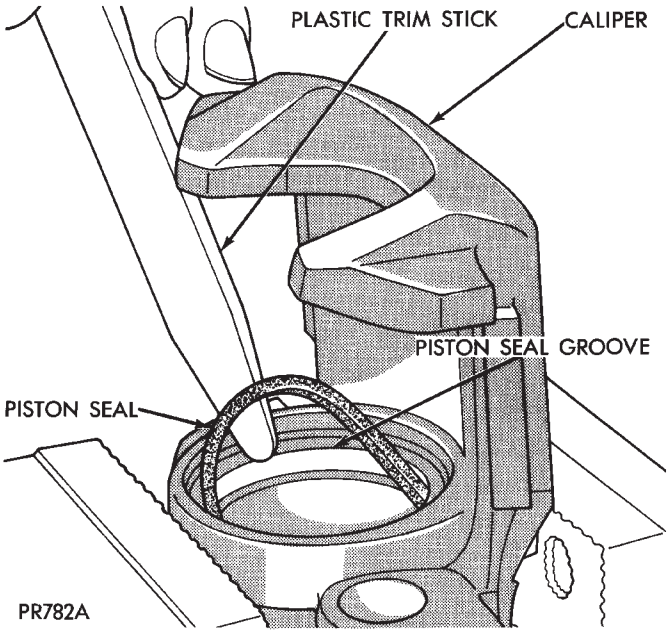


Fig. 176 Removing Piston Seal From Caliper

(11) If the bore does not clean up within this specification, a new caliper housing should be installed. Install a new piston if the old one is pitted or scored.

NOTE: When using Caliper Honing Tool, Special Tool C-4095, coat the stones and bore with brake fluid. After honing the bore, carefully clean the seal and boot grooves with a stiff non-metallic rotary brush.

DISASSEMBLY AND ASSEMBLY (Continued)

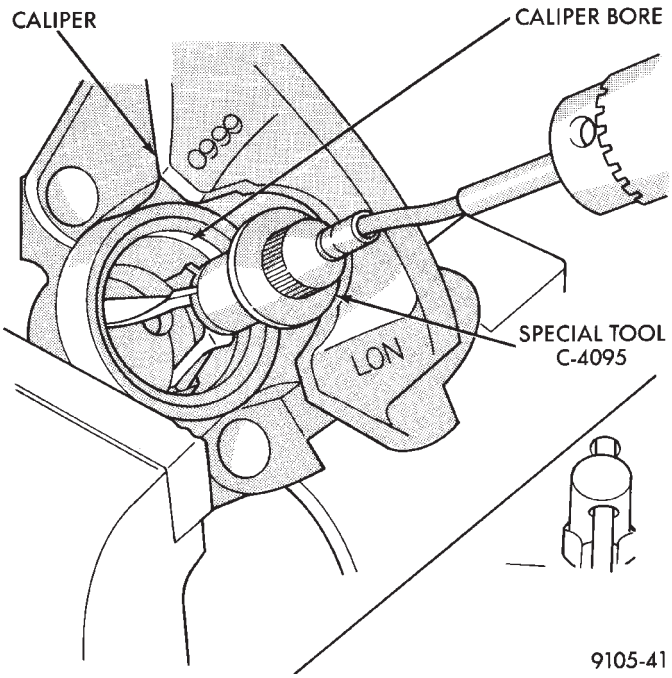


Fig. 177 Honing Brake Caliper Piston Bore

NOTE: Use extreme care in cleaning the caliper after honing. Remove all dirt and grit by flushing the caliper with brake fluid; wipe dry with a clean, lint free cloth and then clean a second time.

CAUTION: When inspecting caliper piston, do not use anything but solvents to clean piston surface. If surface of piston cannot be cleaned using only solvents, piston must be replaced.

(12) Inspect caliper piston for pitting, scratches, or any physical damage. Replace piston if there is evidence of scratches, pitting or physical damage.

CALIPER ASSEMBLY

CAUTION: Excessive vise pressure will cause bore distortion and binding of piston.

(1) Clamp caliper in a vise (with protective caps installed on jaws of vise).

(2) Dip new piston seal in clean brake fluid and install in the groove of the caliper bore. Seal should be positioned at one area in groove and gently worked around the groove (Fig. 178), using only your fingers until properly seated. **NEVER USE AN OLD PISTON SEAL.** Be sure that fingers are clean and seal is not twisted or rolled (Fig. 178).

(3) Coat new piston boot with clean brake fluid leaving a generous amount inside boot.

(4) Position dust boot over piston after coating with brake fluid.

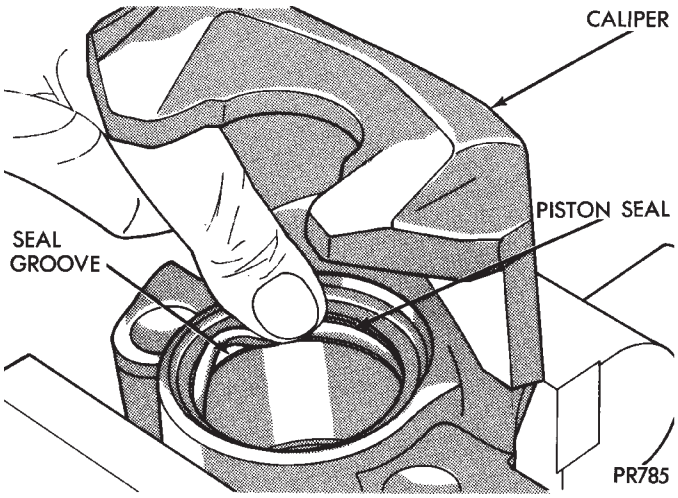


Fig. 178 Installing New Piston Seal In Caliper

CAUTION: Force must be applied to the piston uniformly to avoid cocking and binding of the piston in the bore of the caliper.

(5) Install piston into caliper bore pushing it past the piston seal until it bottoms in the caliper bore (Fig. 179).

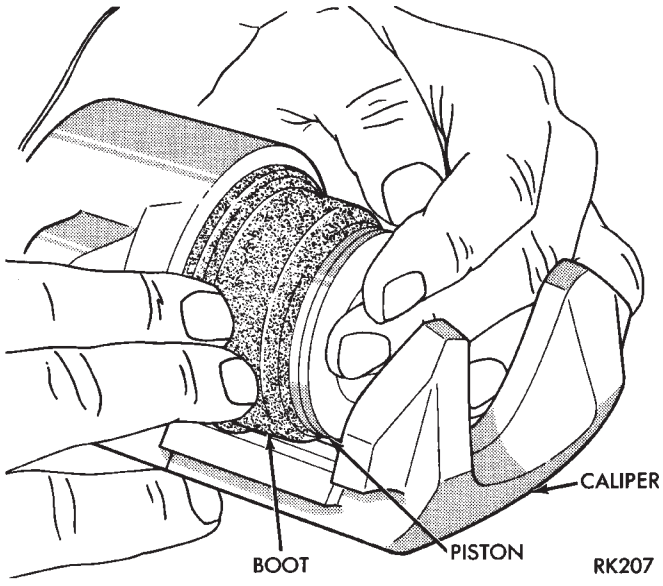


Fig. 179 Installing Piston Into Caliper Bore

(6) Position dust boot into the counterbore of the caliper assembly piston bore.

(7) Using a hammer and Installer Piston Caliper Boot, Special Tool C-4689 and Handle, Special Tool C-4171, drive boot into counterbore of the caliper (Fig. 180).

(8) Install guide pin sleeves and bushings. See Install Guide Pin Bushings section in the caliper disassembly section of this manual.

DISASSEMBLY AND ASSEMBLY (Continued)

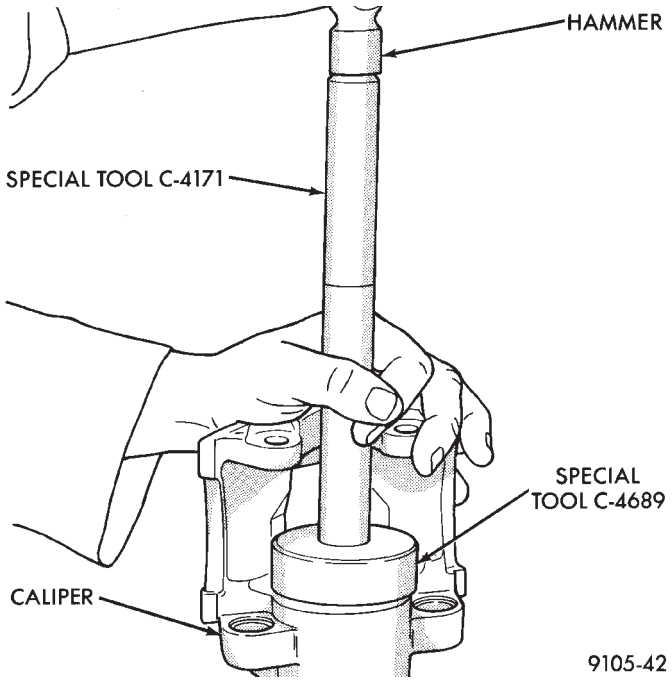


Fig. 180 Installing Dust Boot In Caliper Counterbore

(9) Install brake pads. See Installing Brake Pads in the Brake Pad Service Procedures section of this manual.

(10) Before installing caliper assembly on vehicle, inspect brake rotor. If any conditions as described in Checking Brake Rotor for Runout and Thickness are present the rotor, must be replaced or refaced. If the rotor does not require any servicing, install caliper assembly.

(11) Install brake hose onto caliper using banjo bolt. Torque the brake hose to caliper assembly banjo bolt to 33 N·m (24 ft. lbs.). **New seal washers MUST always be used when installing brake hose to caliper.**

(12) Bleed the brake system (see Bleeding Brake System).

WHEEL CYLINDER (REAR DRUM BRAKE)

DISASSEMBLE

To disassemble the wheel cylinders, proceed as follows:

(1) Pry boots away from cylinders and remove (Fig. 181).

(2) Press **IN** on one piston to force out opposite piston, cup and spring (Fig. 181). Then using a soft tool such as a dowel rod, press out the cup and piston that remain in the wheel cylinder.

(3) Wash wheel cylinder, pistons, and spring (Fig. 181) in clean brake fluid or alcohol; **(DO NOT USE ANY PETROLEUM BASE SOLVENTS)** clean thoroughly and blow dry with compressed air. Inspect cylinder bore and piston for scoring and pitting. (Do not use a rag as lint from the rag will stick to bore surfaces.)

(4) Wheel cylinder bores and pistons that are badly scored or pitted should be replaced. Cylinder walls that have light scratches, or show signs of corrosion, can usually be cleaned with crocus cloth, using a circular motion. Black stains on the cylinder walls are caused by piston cups and will not impair operation of cylinder.

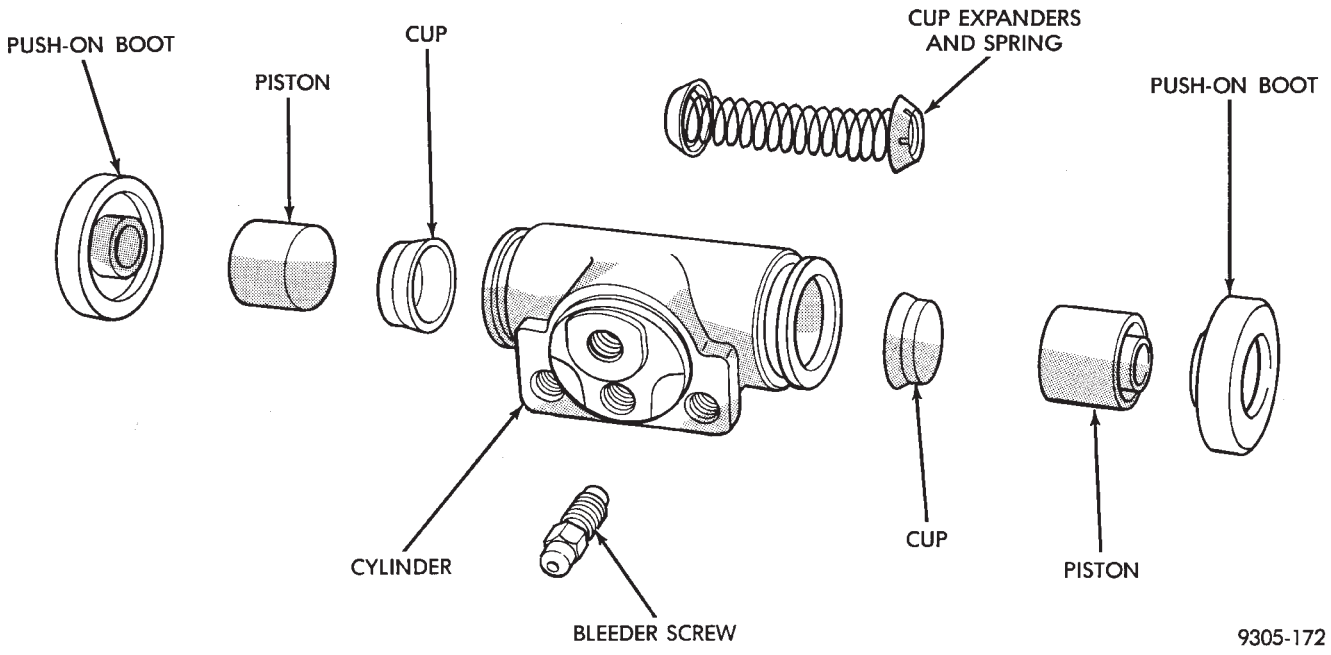


Fig. 181 Rear Wheel Cylinder (Exploded View)

DISASSEMBLY AND ASSEMBLY (Continued)

ASSEMBLE

Before assembling the pistons and new cups in the wheel cylinders, dip them in clean brake fluid. If the boots are deteriorated, cracked or do not fit tightly on the pistons or the cylinder casting, install new boots.

(1) Coat cylinder bore with clean brake fluid.

(2) Lightly coat the sealing lip and outer surfaces of the wheel cylinder cups with Mopar Protect-A-Cup Lubricant.

(3) Install expansion spring with cup expanders in cylinder. Install cups in each end of cylinder with open end of cups facing each other (Fig. 181).

(4) Install piston in each end of cylinder having the flat face of each piston contacting the flat face of each cup, already installed (Fig. 181).

(5) Coat the interior surfaces of the push on boots (Fig. 181) with the Mopar Protect-A-Cup Lubricant

(6) Install a boot over each end of cylinder (Fig. 181). **Be careful not to damage boot during installation.**

CLEANING AND INSPECTION

FRONT DISC BRAKES

BRAKE PAD LINING WEAR

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the wheel and tire assemblies, and the calipers.

Remove the front disc brake shoes. Refer to Front Disc Brake Shoe Removal in the Removal And Installation section in this group of the service manual for the required procedure.

The combined brake shoe and lining material thickness should be measured at the thinnest part of the assembly.

When a set of brake shoes are worn to a total thickness of approximately 7.95 mm (5/16 inch) they should be replaced.

Replace **both** brake shoe assemblies (inboard and outboard). It is necessary that **both** front wheel sets be replaced whenever brake shoe assemblies on either side are replaced.

If the brake shoe assemblies do not require replacement, reinstall, the assemblies making sure each brake shoe is returned to the original position. Refer to Front Disc Brake Shoe Installation in the Removal And Installation section in this group of the service manual for the required procedure.

CALIPER INSPECTION

Check for brake fluid leaks in and around boot area and inboard lining, and for any ruptures, brittleness or damage to the piston dust boot. If the boot is damaged, or a fluid leak is visible, disassemble caliper assembly and install a new seal and boot, and piston if scored. Refer to Front Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

Check the guide pin dust boots to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Front Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

REAR DISC BRAKES

BRAKE PAD LINING WEAR

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the wheel and tire assemblies, and the calipers.

Remove the rear disc brake shoes. Refer to Rear Disc Brake Shoe Removal in the Removal And Installation section in this group of the service manual for the required procedure.

The combined brake shoe and lining material thickness should be measured at the thinnest part of the assembly.

When a set of brake shoes are worn to a total thickness of approximately 7.0 mm (9/32 inch) they should be replaced.

Replace **both** brake shoe assemblies (inboard and outboard). It is necessary that **both** rear wheel sets be replaced whenever brake shoe assemblies on either side are replaced.

If the brake shoe assemblies do not require replacement, reinstall, the assemblies making sure each brake shoe is returned to the original position. Refer to Rear Disc Brake Shoe Installation in the Removal And Installation section in this group of the service manual for the required procedure.

CALIPER INSPECTION

Check for brake fluid leaks in and around boot area and inboard lining, and for any ruptures, brittleness or damage to the piston dust boot. If the boot is damaged, or a fluid leak is visible, disassemble caliper assembly and install a new seal and boot, and piston if scored. Refer to Rear Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

Check the guide pin dust boots to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Rear Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

CLEANING AND INSPECTION (Continued)

REAR DRUM BRAKES

Rear brake shoe lining should show contact across entire width of the lining and also from the heel to the toe of the lining, otherwise replace.

Brake shoes with lack of contact at the toe or heel of the brake shoe linng may be improperly ground.

Clean and inspect the brake support plate and adjusting screws. Apply a thin coat of Mopar Multi-Purpose Lubricant or equivalent to the threads of the self adjuster (Fig. 182). Replace adjusting screw if corroded.

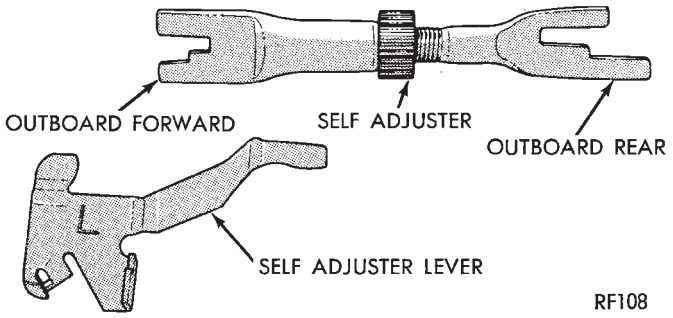


Fig. 182 Adjuster Screw And Lever (Typical)

If old brake shoe return or hold down springs have overheated or are damaged, replace. Overheating indications are paint discoloration or distorted end coils.

REAR DRUM BRAKE WHEEL CYLINDER

With brake drums removed, inspect the wheel cylinder boots for evidence of a brake fluid leak. Visually check the boots for cuts, tears, or heat cracks. If any of these conditions exist, the wheel cylinders should be completely cleaned, inspected and new parts installed.

If a wheel cylinder is leaking and the brake lining material is saturated with brake fluid, the brake shoes must be replaced.

CHASSIS TUBES AND HOSES

Flexible rubber hose is used at both front and rear brakes. Inspection of brake hoses should be performed whenever the brake system is serviced and every 7,500 miles or 12 months, whichever comes first (every engine oil change). Inspect hydraulic brake hoses for severe surface cracking, scuffing, worn spots or physical damage. If the fabric casing of the rubber hose becomes exposed due to cracks or abrasions in the rubber hose cover, the hose should be replaced immediately. Eventual deterioration of the hose can take place with possible burst failure. Faulty installation can cause twisting, resulting in wheel, tire, or chassis interference.

The steel brake tubing should be inspected periodically for evidence of corrosion, physical damage or contact with moving or hot components of the vehicle.

REAR WHEEL HUB AND BEARING ASSEMBLY

The rear hub and bearing assembly is designed for the life of the vehicle and should require no maintenance. The following procedure may be used for evaluation of bearing condition.

With wheel and brake drum removed, rotate flanged outer ring of hub. Excessive roughness, lateral play or resistance to rotation may indicate dirt intrusion or bearing failure. If the rear wheel bearings exhibit these conditions during inspection, the hub and bearing assembly should be replaced.

Damaged bearing seals and resulting excessive grease loss may also require bearing replacement. Moderate grease loss from bearing is considered normal and should not require replacement of the hub and bearing assembly.

ADJUSTMENTS

STOP LAMP SWITCH

(1) Remove stop lamp switch from its bracket by rotating it approximately 30° in a counter-clockwise direction.

(2) Disconnect wiring harness connector from stop lamp switch.

(3) Hold stop lamp switch firmly in one hand. Then using other hand, pull outward on the plunger of the stop lamp switch until it has ratcheted out to its fully extended position.

(4) Install the stop lamp switch into the bracket using the following procedure. Depress the brake pedal as far down as possible. Then while keeping the brake pedal depressed, install the stop lamp switch into the bracket by aligning index key on switch with slot at top of square hole in mounting bracket. When switch is fully installed in the square hole of the bracket, rotate switch clockwise approximately 30° to lock the switch into the bracket.

CAUTION: Do not use excessive force when pulling back on brake pedal to adjust the stop lamp switch. If too much force is used, damage to the vacuum booster, stop lamp switch or striker (Fig. 183) can result.

(5) Connect the wiring harness connector to the stop lamp switch.

(6) Gently pull back on brake pedal until the pedal stops moving. This will cause the switch plunger (Fig. 183) to ratchet backward to the correct position.

ADJUSTMENTS (Continued)

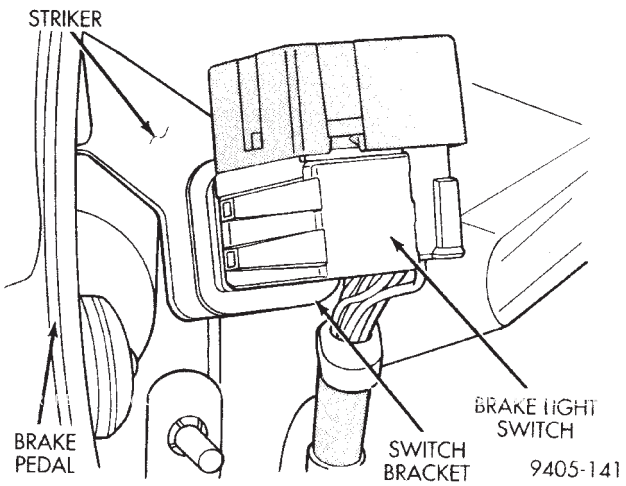


Fig. 183 Stop Light Switch Location In Vehicle

REAR DRUM BRAKE SHOE ADJUSTMENT

NOTE: Normally, self adjusting drum brakes will not require manual brake shoe adjustment. Although in the event of a brake reline it is advisable to make the initial adjustment manually to speed up the adjusting time.

(1) Raise the vehicle so all wheels are free to turn. See Hoisting Recommendations in the Lubrication And Maintenance Section at the front of this service manual.

(2) Remove rear brake adjusting hole rubber plug (Fig. 184) from the rear brake shoe support plate.

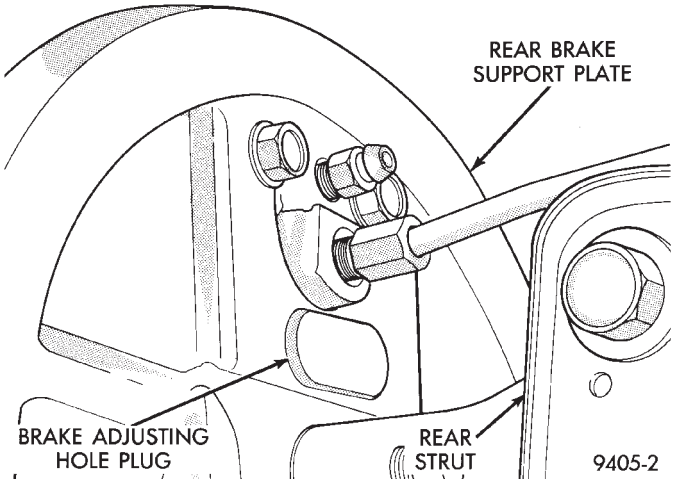


Fig. 184 Rear Brake Adjusting Hole Plug

(3) **Be sure parking brake lever is fully released.**

(4) Insert Brake Adjuster, Special Tool C-3784, (Fig. 185) or equivalent, through the adjusting hole in support plate and against star wheel of adjusting screw. Move handle of tool downward until a slight drag is felt when the road wheel is rotated.

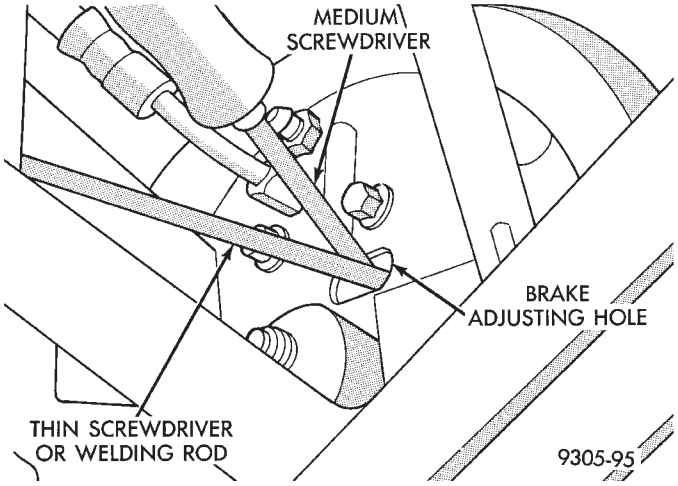


Fig. 185 Brake Drum Adjustment With Tool C-3784

(5) Insert a thin screwdriver or piece of welding rod into brake adjusting hole (Fig. 185). Push adjusting lever out of engagement with star wheel. **Care should be taken so as not to bend adjusting lever or distort lever spring.** While holding adjusting lever out of engagement with star wheel, back off star wheel to ensure a free wheel with no brake shoe drag.

(6) Repeat above adjustment at the other rear wheel. Install adjusting hole rubber plugs (Fig. 184) in rear brake supports.

(7) Apply and release the park brake lever one time **after** wheel brake adjustment.

PARKING BRAKE ADJUSTMENT

VEHICLE EQUIPPED REAR DRUM BRAKES

Due to the auto adjust feature of the parking brake lever, adjustment of the parking brake system on vehicles equipped with rear drum brakes relies on proper drum brake shoe adjustment. See Rear Brake Adjustment in the Service Adjustments Section in this group of the service manual.

VEHICLE EQUIPPED REAR DISC BRAKES

Due to the auto adjust feature of the parking brake lever, adjustment of the parking brake system on vehicles equipped with rear disc brakes relies on proper drum-in-hat brake shoe adjustment. See Rear Park Brake Adjustment in the Parking Brakes Section in this group of the service manual.

SPECIFICATIONS

BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use

SPECIFICATIONS (Continued)

only Mopar brake fluid or an equivalent from a tightly sealed container.

CAUTION: Never use reclaimed brake fluid or fluid from an container which has been left open. An open container will absorb moisture from the air and contaminate the fluid.

CAUTION: Never use any type of a petroleum-based fluid in the brake hydraulic system. Use of such type fluids will result in seal damage of the vehicle brake hydraulic system causing a failure of the vehicle brake system. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid ect.

BRAKE ACTUATION SYSTEM

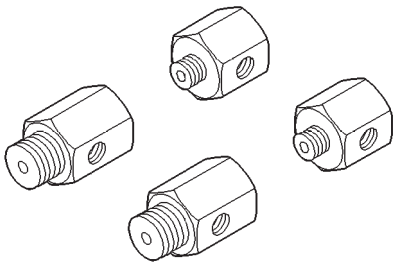
ACTUATION:
Vacuum Operated Power Brakes . . . . . Standard
Hydraulic System . . . . . Dual-Diagonally Split
MASTER CYLINDER ASSEMBLY:
Type . . . . . Dual Tandem
Body Material . . . . . Anodized Aluminum
Reservoir Material . . . . . Polypropelene
MASTER CYLINDER BORE / STROKE AND SPLIT:
Non ABS . . . . . 21 mm x 32.6 mm (.875 in. x 1.28 in.)
ABS . . . . . 21 mm x 32.7 mm (.874 in. x 1.29 in.)
Displacement Split . . . . . 50 / 50
MASTER CYLINDER FLUID OUTLET PORTS:
ABS . . . . . Primary 3/8–24 Secondary 7/16–24
Non ABS . . . . . Primary Inboard And Outboard 7/16–24
Non ABS . . . . . Secondary Inboard And Outboard 3/8–23
Outlet Fitting Type . . . . . SAE 45 ° Inverted Flare
ABS HYDRAULIC CONTROL UNIT:
Hydraulic Tube Fitting Type . . . . . SAE 45 ° Inverted Flare
BOOSTER:
Make/Type . . . . . Bendix Vacuum W/&W/O ABS
Mounting Studs . . . . . M8 x 1.25
Type . . . . . 230 mm Single
Boost At 20 inches Of Manifold Vacuum . . . . . 4690 All
SCREW IN PROPORTIONING VALVE:
Material . . . . . Aluminum
Function . . . . . Hydraulic Pressure Proportioning
BRAKE PEDAL
Pedal Ratio 3.28

BRAKE FASTENER TORQUE SPECIFICATIONS

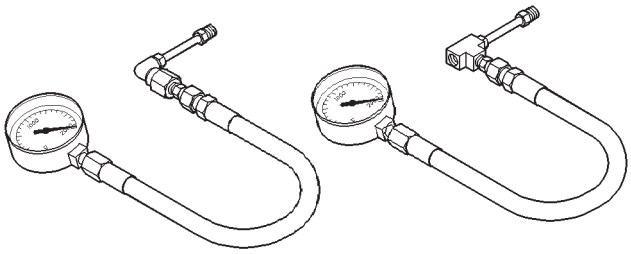
DESCRIPTION	TORQUE
BRAKE TUBES:	
Tube Nuts To Fittings And Components Except HCU.	17 N·m (145 in. lbs.)
From Master Cylinder To HCU At HCU Ports	21 N·m (185 in. lbs.)
BRAKE HOSE:	
To Caliper Banjo Bolt	48 N·m (35 ft. lbs.)
Intermediate Bracket	12 N·m (105 in. lbs.)
MASTER CYLINDER:	
To Vacuum Booster Mounting Nut	28 N·m (250 in. lbs.)
BRAKE BOOSTER:	
To Dash Panel Mounting Nuts	28 N·m (250 in. lbs.)
REAR WHEEL CYLINDER:	
To Support Plate Mounting Bolts	13 N·m (115 in. lbs.)
Bleeder Screw	10 N·m (80 in. lbs.)
BRAKE SUPPORT PLATE:	
To Axle Mounting Bolts	75 N·m (55 ft. lbs.)
REAR DISC BRAKE ADAPTER:	
To Axle Mounting Bolts	75 N·m (55 ft. lbs.)
DISC BRAKE CALIPER:	
Guide Pin Bolts	22 N·m (192 in. lbs.)
Bleeder Screw	15 N·m (125 in. lbs.)
ABS HYDRAULIC CONTROL UNIT:	
To Mounting Bracket Bolts	28 N·m (250 in. lbs.)
Bracket To Frame Rail Mounting Bolt (Top)	18 N·m (160 in. lbs.)
Bracket To Frame Rail Mounting Bolts (Side)	22 N·m (200 in. lbs.)
PARKING BRAKE:	
Lever Mounting Nuts	28 N·m (250 in. lbs.)
REAR HUB AND BEARING:	
To Knuckle Retaining Nut	217 N·m (160 ft. lbs.)
WHEEL:	
Stud Lug Nut	109–150 N·m (80–110 ft. lbs.)

SPECIAL TOOLS

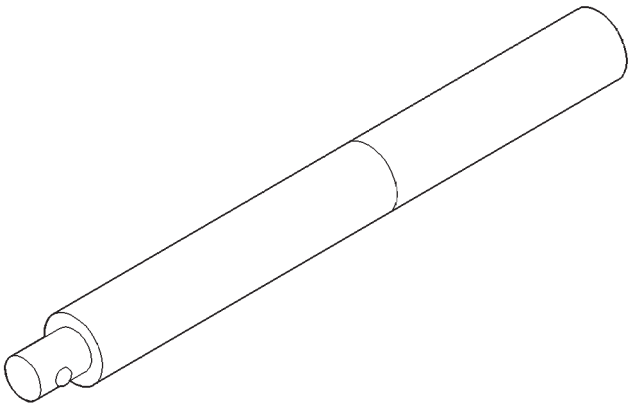
BASE BRAKE SYSTEM



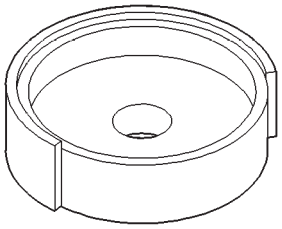
Adapters, Brake Pressure Test 6805



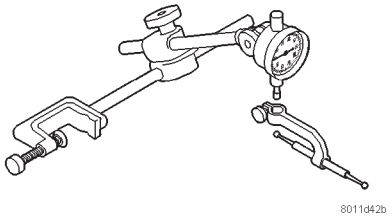
Gauge Set C-4007-A



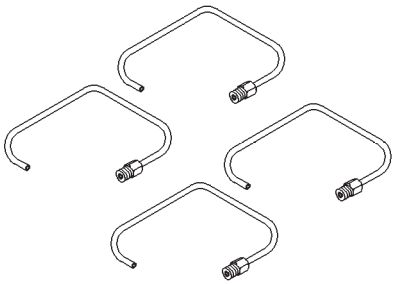
Handle, Universal C-4171



Installer, Dust Boot C-4689



Dial Indicator C-3339



Tubes, Master Cylinder Bleeding 6802

ANTILOCK BRAKE SYSTEM–BENDIX ABX-4

INDEX

page

DESCRIPTION AND OPERATION
- ABS BRAKING MODE HYDRAULIC CIRCUIT SOLENOID AND VALVE FUNCTION 73
- ABS COMPONENT ABBREVIATION LIST 68
- ABS COMPONENTS 69
- ABS HYDRAULIC CONTROL UNIT (HCU) 70
- ABS OPERATION AND VEHICLE PERFORMANCE 69
- ABS WARNING LAMP FUNCTION AND LOCATION 73
- ANTILOCK BRAKES OPERATION DESCRIPTION 68
- CONTROLLER ANTILOCK BRAKE (CAB) 72
- HYDRAULIC CONTROL UNIT DECAY SOLENOIDS 70
- HYDRAULIC CONTROL UNIT FLUID SUMPS . . 70
- HYDRAULIC CONTROL UNIT PUMP MOTOR ASSEMBLY 71
- HYDRAULIC CONTROL UNIT SHUTTLE VALVES 70
- MASTER CYLINDER AND POWER BRAKE BOOSTER 70
- PROPORTIONING VALVES 71
- PUMP/MOTOR RELAY OPERATION 71
- RELAY BOX 71
- SYSTEM RELAY OPERATION 71
- WHEEL SPEED SENSORS 72

DIAGNOSIS AND TESTING
- ABS GENERAL DIAGNOSTICS INFORMATION 74
- ABS SERVICE PRECAUTIONS 76
- BRAKE FLUID CONTAMINATION 76
- DIAGNOSTIC TESTER (DRB) 74
- DIAGNOSTIC TROUBLE CODE INFORMATION 74
- DIAGNOSTICS MANUAL INFORMATION 74
- DRB DIAGNOSTIC CONNECTOR 74
- INTERMITTENT DIAGNOSTIC TROUBLE CODES 75
- PROPORTIONING VALVES 75
- SELF DIAGNOSTICS INFORMATION 74
- TONEWHEEL INSPECTION 75
- VEHICLE TEST DRIVE INFORMATION AND PROCEDURE 76

SERVICE PROCEDURES
- BLEEDING PROCEDURE INFORMATION 76
- BRAKE FLUID LEVEL INSPECTION 76

REMOVAL AND INSTALLATION
- ABS HYDRAULIC CONTROL UNIT 78
- CONTROLLER ANTILOCK BRAKES (CAB) 83
- FRONT WHEEL SPEED SENSOR 83
- GENERAL SERVICE CAUTIONS 77
- MASTER CYLINDER AND POWER BRAKE BOOSTER 81
- PROPORTIONING VALVES 81
- REAR WHEEL SPEED SENSOR 84
- RELAY BOX 81

SPECIFICATIONS
- BRAKE FASTENER TORQUE SPECIFICATIONS 85
- SPEED SENSOR TONE WHEEL RUNOUT 85
- WHEEL SPEED SENSOR TO TONE WHEEL CLEARANCE 85

DESCRIPTION AND OPERATION

ANTILOCK BRAKES OPERATION DESCRIPTION

The purpose of the Antilock Brake System (ABS) is to prevent wheel lock-up under heavy braking conditions on virtually any type of road surface. Antilock Braking is desirable because a vehicle which is stopped without locking the wheels will retain directional stability and some steering capability. This allows the driver to retain greater control of the vehicle during heavy braking.

This section of the service manual covers the description and on car service for the Bendix ABX-4 Brake System. If other service is required on the non ABS related components of the brake system, refer to the appropriate section in this group of the manual for the specific service procedure required.

ABS COMPONENT ABBREVIATION LIST

In this section of the service manual several abbreviations are used for the components that are in the Bendix ABX-4 Brake System. These components are listed below for your reference.

- CAB—Controller Antilock Brake
- HCU—Hydraulic Control Unit
- ABS—Antilock Brake System
- PSI—Pounds per Square Inch (pressure)
- WSS—Wheel Speed Sensor
- FWD—Front Wheel Drive
- DTC—Diagnostic Trouble Code

DESCRIPTION AND OPERATION (Continued)

ABS OPERATION AND VEHICLE PERFORMANCE

This ABS System represents the current state-of-the-art in vehicle braking systems and offers the driver increased safety and control during braking. This is accomplished by a sophisticated system of electrical and hydraulic components. As a result, there are a few performance characteristics that may at first seem different but should be considered normal. These characteristics are discussed below.

NORMAL BRAKING SYSTEM FUNCTION

Under normal braking conditions, the ABS System functions the same as a standard brake system with a diagonally split master cylinder and conventional vacuum assist.

ABS SYSTEM OPERATION

If a wheel locking tendency is detected during a brake application, the brake system will enter the ABS mode. During ABS braking, hydraulic pressure in the four wheel circuits is modulated to prevent any wheel from locking. Each wheel circuit is designed with a set of electric solenoids to allow modulation, although for vehicle stability, both rear wheel solenoids receive the same electrical signal.

During an ABS stop, the brakes hydraulic system is still a diagonally split. However, the brake system pressure is further split into three control channels. During antilock operation of the vehicle brake system, the front wheels are controlled independently and are on two separate control channels. The rear wheels of the vehicle however, are controlled together through one control channel.

The system can build and release pressure at each wheel, depending on signals generated by the wheel speed sensors (WSS) at each wheel and received at the Controller Antilock Brake (CAB).

ABS operation is available at all vehicle speeds above 3 to 5 mph. Wheel lockup may be perceived at the very end of an ABS stop and is considered normal.

VEHICLE HANDLING PERFORMANCE DURING ABS BRAKING

It is important to remember that an antilock brake system does not shorten a vehicle's stopping distance under all driving conditions, but does provide improved control of the vehicle while stopping. Vehicle stopping distance is still dependent on vehicle speed, weight, tires, road surfaces and other factors.

Though ABS provides the driver with some steering control during hard braking, there are conditions however, where the system does not provide any benefit. In particular, hydroplaning is still possible when the tires ride on a film of water. This results in the vehicles tires leaving the road surface rendering the vehicle virtually uncontrollable. In addition, extreme steering maneuvers at high speed or high speed cornering beyond the limits of tire adhesion to the road surface may cause vehicle skidding, independent of vehicle braking. For this reason, the ABS system is termed Antilock instead of Anti-Skid.

NOISE AND BRAKE PEDAL FEEL

During ABS braking, some brake pedal movement may be felt. In addition, ABS braking will create ticking, popping and/or groaning noises heard by the driver. This is normal due to pressurized fluid being transferred between the master cylinder and the brakes. If ABS operation occurs during hard braking, some pulsation may be felt in the vehicle body due to fore and aft movement of the suspension as brake pressures are modulated.

At the end of an ABS stop, ABS will be turned off when the vehicle is slowed to a speed of 3–4 mph. There may be a slight brake pedal drop anytime that the ABS is deactivated, such as at the end of the stop when the vehicle speed is less then 3 mph or during an ABS stop where ABS is no longer required. These conditions will exist when a vehicle is being stopped on a road surface with patches of ice, loose gravel or sand on it. Also stopping a vehicle on a bumpy road surface may activate the ABS because of the wheel hop caused by the bumps.

TIRE NOISE AND MARKS

Although the ABS system prevents complete wheel lock-up, some wheel slip is desired in order to achieve optimum braking performance. Wheel slip is defined as follows, 0 percent slip means the wheel is rolling freely and 100 percent slip means the wheel is fully locked. During brake pressure modulation, wheel slip is allowed to reach up to 25 to30%. This means that the wheel rolling velocity is 25 to 30% less than that of a free rolling wheel at a given vehicle speed. This slip may result in some tire chirping, depending on the road surface. This sound should not be interpreted as total wheel lock-up.

Complete wheel lock up normally leaves black tire marks on dry pavement. The ABS System will not leave dark black tire marks since the wheel never reaches a fully locked condition. Tire marks may however be noticeable as light patched marks.

ABS COMPONENTS

The following is a detailed description of the Allied Signal ABX-4 ABS brake system components. For information on servicing the base brake system components, see the Base Brake section of this Service Manual.

DESCRIPTION AND OPERATION (Continued)

MASTER CYLINDER AND POWER BRAKE BOOSTER

The Bendix ABX-4 ABS System uses a modified master cylinder and power brake booster assembly (Fig. 1). The master cylinder primary and secondary outputs go directly to the hydraulic control unit (HCU). Refer to the appropriate base brake section in this group of the service manual for further information on the individual components.

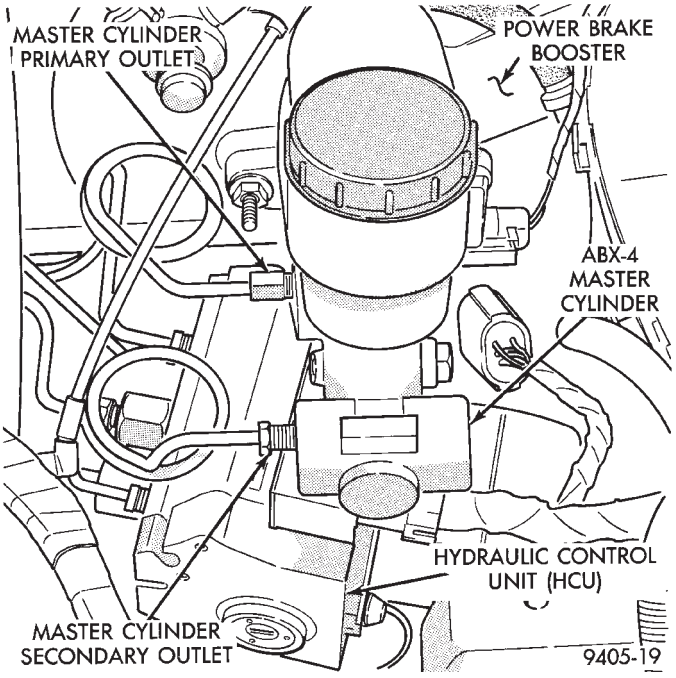


Fig. 1 ABX-4 Master Cylinder And Brake Booster Assembly

ABS HYDRAULIC CONTROL UNIT (HCU)

WARNING: THE ONLY PARTS OF THE HYDRAULIC CONTROL UNIT (HCU) THAT ARE SERVICEABLE, ARE THE RELAY BOX, THE PROPORTIONING VALVES, AND THE HCU MOUNTING BRACKET. THE REMAINING COMPONENTS OF THE HYDRAULIC CONTROL UNIT (HCU) ARE NOT SERVICEABLE ITEMS. NO ATTEMPT SHOULD EVER BE MADE TO REMOVE OR SERVICE ANY OTHER PARTS OF THE HYDRAULIC CONTROL UNIT (HCU).

The hydraulic control unit (HCU) is located under the master cylinder and power brake booster and is mounted to the left frame rail (Fig. 2). The HCU contains the following components for controlling the vehicle's braking system during ABS braking: 4 Decay Valves, 4 Shuttle Valves, 2 Fluid Sumps, a Pump/Motor and a relay box. Also attached to the hydraulic control unit are the rear brake proportioning valves and the vehicles 6 hydraulic brake tubes (Fig. 2).

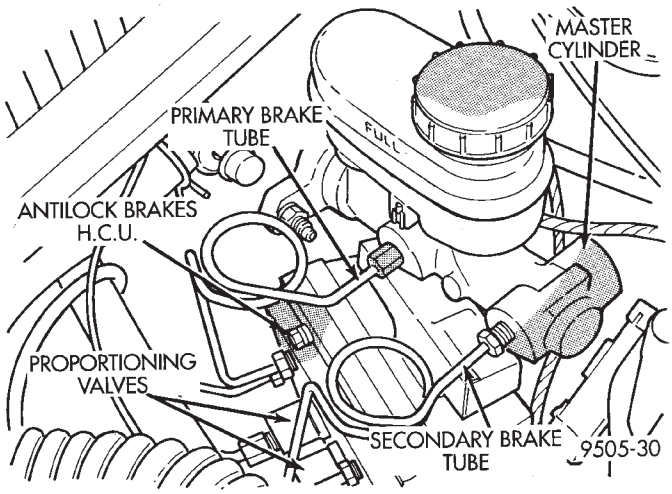


Fig. 2 Hydraulic Control Unit Location In Vehicle

HYDRAULIC CONTROL UNIT DECAY SOLENOIDS

There are 4 decay solenoids, one for each wheel. In the released position they provide a fluid path from the master cylinder to the wheel brakes of the vehicle. In the actuated (decay) position, they provide a fluid path from wheel brakes of the vehicle to the sumps. The Decay solenoids are spring loaded in the released (build) position during normal braking.

HYDRAULIC CONTROL UNIT SHUTTLE VALVES

There are 4 Shuttle Valves, one for each wheel. The Shuttle Valve is a hydraulically actuated valve which shuttles when the decay solenoid and pump are energized. This places an orifice (restriction) in the line between the pump and the decay solenoid. This restriction provides a controlled build rate to each wheel brake during an ABS stop. The Shuttle Valve will remain in the orificed position until the ABS cycle is complete. When the ABS cycle has been completed the decay solenoids will return to their released position which will equalize the pressure across the Shuttle Valves. When the pressure equalizes, the spring loaded Shuttle Orifice valves will return to the unrestricted position.

HYDRAULIC CONTROL UNIT FLUID SUMPS

There are two fluid sumps in the hydraulic control unit (HCU), one each for the primary and secondary hydraulic circuits. The fluid sumps temporarily store brake fluid that is decayed from the wheel brakes during an ABS cycle. This fluid is then delivered to the pump to provide build pressure. The typical pressure in the sumps is 50 psi, during ABS operation only.

DESCRIPTION AND OPERATION (Continued)

HYDRAULIC CONTROL UNIT PUMP MOTOR ASSEMBLY

The HCU contains 2 Pump Assemblies, one each for the primary and secondary hydraulic circuits. Both pumps are driven by a common electric motor which is part of the HCU. The pumps pick up fluid from the sumps to supply build pressure to the brakes during an ABS stop. The motor only runs during an ABS stop and is controlled by the CAB via the Pump/Motor Relay. The Pump/Motor Assembly is not a serviceable item. If it requires service the HCU must be replaced.

RELAY BOX

ABX-4 utilizes two relays contained in a relay box mounted to the HCU. The relay box contains a system relay and a pump/motor relay. A single 10-way connector provides the electrical interface. The relay box is serviceable as an assembly.

PUMP/MOTOR RELAY OPERATION

Pump/Motor power is supplied by the Pump/Motor Relay. The pump motor relay is also part of the relay box (Fig. 3) mounted to the HCU. If pump/motor relay replacement is required, it is also only serviced by the replacement of the relay box assembly (Fig. 3).

Voltage for the 12 volt side of the relay coil is provided by the system relay. The ground path through the relay coil is completed by the CAB during ABS braking. The relay contacts are closed when the relay is energized. This provides 12 volts to the pump/motor as needed during ABS braking.

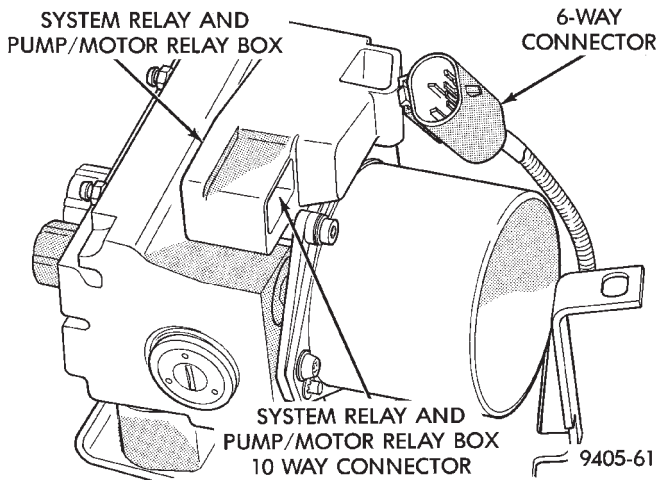


Fig. 3 System Relay And Pump/Motor Relay Box

SYSTEM RELAY OPERATION

The main purpose of the system relay is to put the ABS system into a stand-by mode for ABS operation. The system relay is energized by the CAB shortly after the ignition switch is turned on.

When energized by the CAB, the system relay turns off the ABS warning lamp and provides 12 volts to the CAB. This voltage can then be used by the CAB to energize the decay solenoids during ABS braking. When energized, the system relay also provides the pump/motor relay coil with 12 volts. The ground path to the pump/motor relay is completed by the CAB during ABS braking.

Conversely, when the system relay is de-energized, the ABS warning lamp is illuminated, voltage to the decay solenoids is cut off, and the pump/motor relay is prevented from energizing. Typically, the system relay is de-energized by the controller when a fault is detected that requires turning ABS off.

PROPORTIONING VALVES

Two Proportioning Valves are used in the system, one for each rear brake hydraulic circuit. The Proportioning Valves function the same as in a standard brake system. The Proportioning Valves are located on the side of the HCU. The proportioning valve application is identified by the colored band on the proportioning valve (Fig. 4).

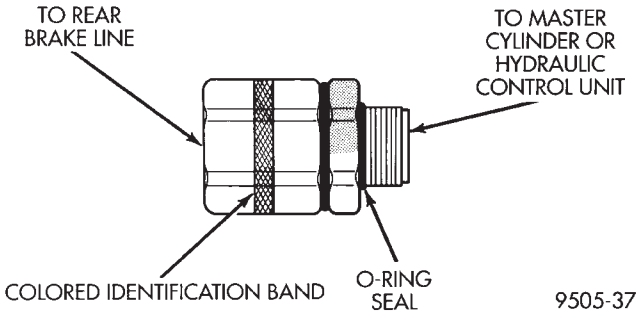


Fig. 4 Proportioning Valve Identification

DESCRIPTION AND OPERATION (Continued)

WHEEL SPEED SENSORS

One Wheel Speed Sensor (WSS) is located at each wheel (Fig. 5), (Fig. 6) and (Fig. 7), and sends a small AC signal to the control module (CAB). This signal is generated by magnetic induction created when a toothed sensor ring (tone wheel) (Fig. 5) passes the stationary magnetic Wheel Speed Sensor. The (CAB) converts the AC signal generated at each wheel into a digital signal. If a wheel locking tendency is detected by the CAB, it will then modulate hydraulic pressure via the HCU to prevent the wheel(s) from locking.

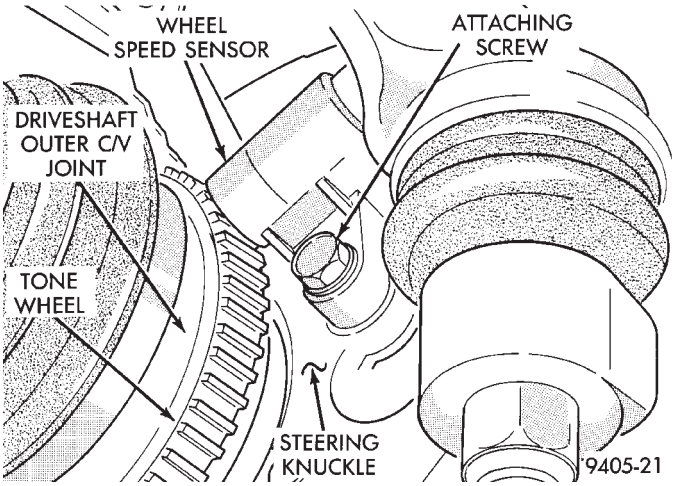


Fig. 5 Front Wheel Speed Sensor

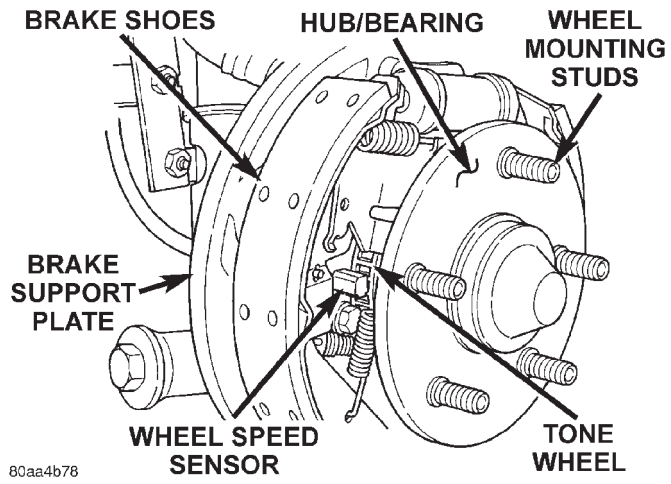


Fig. 6 Wheel Speed Sensor With Drum Brakes

The front Wheel Speed Sensor is attached to a boss in the steering knuckle (Fig. 5). The tone wheel is part of the outboard constant velocity joint (Fig. 5). The rear Wheel Speed Sensor on rear drum brake applications is mounted to the rear brake support plate (Fig. 6) and the rear tone wheel is an integral part of the rear wheel hub and bearing assembly. The rear Wheel Speed Sensor on rear disc brake applications is mounted to the rear disc brake adapter (Fig. 7) and the rear tone wheel is also an integral part of the rear wheel hub and bearing assembly. The speed sensor air gap on both applications is NOT adjustable.

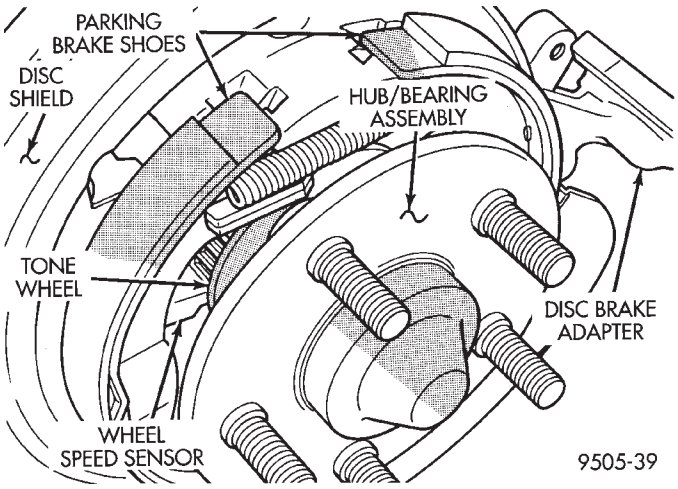


Fig. 7 Wheel Speed Sensor With Disc Brakes

The four Wheel Speed Sensors are serviced individually. The front Tone Wheels are serviced as an assembly with the outboard constant velocity joint. The rear Tone Wheels are serviced as an assembly with the rear hub and bearing assembly.

Correct ABS system operation is dependent on accurate wheel speed signals. The vehicle's wheels and tires must all be the same size and type to generate accurate signals. Variations in wheel and tire size can produce inaccurate wheel speed signals.

CONTROLLER ANTILOCK BRAKE (CAB)

The Antilock Brake Controller (CAB) is a microprocessor based device which monitors the ABS system during normal braking and controls it when in an ABS stop. The CAB is mounted under the instrument panel on the drivers side kick panel (Fig. 8). The CAB uses a 60 way electrical connector on the vehicle wiring harness. The power source for the CAB is through the ignition switch in the Run or On position. **THE CONTROLLER ANTILOCK BRAKE (CAB) IS NOT ON THE CCD BUS**

The primary functions of the (CAB) are:

(1) Detect wheel locking tendencies.

(2) Control fluid modulation to the brakes while in ABS mode.

(3) Monitor the system for proper operation.

(4) Provide communication to the DRB while in diagnostic mode.

The CAB continuously monitors the speed of each wheel through the signals generated at the Wheel Speed Sensors to determine if any wheel is beginning to lock. When a wheel locking tendency is detected, the CAB commands the HCU to modulate brake fluid pressure in some or all of the hydraulic circuits. The

DESCRIPTION AND OPERATION (Continued)

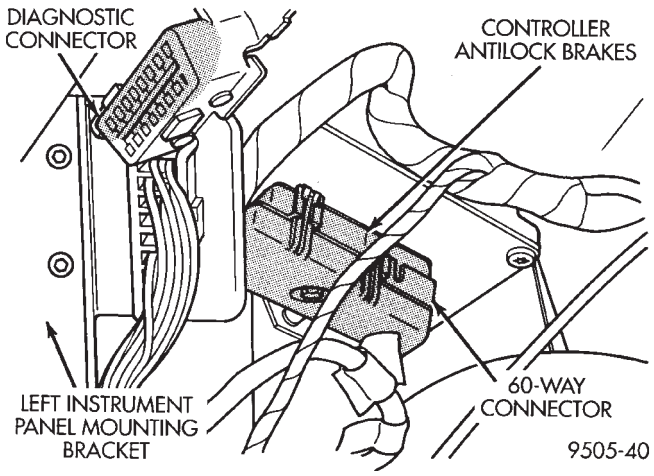


Fig. 8 Location Of Controller Antilock Brake (CAB)

CAB continues to control pressure in individual hydraulic circuits until a locking tendency is no longer present.

The ABS system is constantly monitored by the CAB for proper operation. If the CAB detects a fault, it will turn on the Amber ABS Warning Lamp and disable the ABS braking system. The normal Non ABS braking system will remain operational.

The CAB contains a self-diagnostic program which will turn on the Amber ABS Warning Lamp when a ABS system fault is detected. Faults are then stored in a diagnostic program memory. There are multiple fault messages which may be stored in the CAB and displayed through the DRB. These fault messages will remain in the CAB memory even after the ignition has been turned off. The fault messages can be cleared by using the DRB diagnostics tester, or they will be automatically cleared from the memory after the vehicle is driven approximately 3500 miles.

CONTROLLER ANTILOCK BRAKE INPUTS

- Four wheel speed sensors.
- Stop lamp switch.
- Ignition switch.
- System relay voltage.
- Ground.
- Pump/Motor Relay Monitor
- Diagnostics Communications

CONTROLLER ANTILOCK BRAKE OUTPUTS

- 4 Decay Solenoids
- ABS warning lamp.
- System relay actuation.
- Diagnostic communication.
- Pump motor relay actuation

ABS WARNING LAMP FUNCTION AND LOCATION

The ABS system uses an Amber ABS Warning Lamp, located in the instrument cluster. The purpose of the warning lamp is discussed in detail below.

The ABS warning lamp will turn on when the CAB detects a condition which results in a shutdown of ABS function. The ABS Warning Lamp is normally on until the CAB completes its self tests and turns the lamp off (approximately 5 seconds after the ignition switch is turned on). When the ABS warning lamp is on, only the ABS function of the brake system if affected. The standard brake system and the ability to stop the car will not be affected when only the ABS warning lamp is on.

ABS BRAKING MODE HYDRAULIC CIRCUIT SOLENOID AND VALVE FUNCTION

Through the following operation descriptions the function of the various hydraulic control valves in the ABS system will be described. The fluid control valves mentioned below, control the flow of pressurized brake fluid to the wheel brakes during the different modes of ABS braking.

For explanation purposes we will assume all speed sensors are sending the same wheel speed information, requiring the same hydraulic fluid modulation at the same rate.

NORMAL BRAKING BUILD/DECAY VALVE FUNCTION

BUILD/DECAY VALVES OPEN

The brake pedal is applied. The travel of the brake pedal closes primary and secondary circuits from the master cylinder fluid supply. Brake fluid from the primary and secondary circuits flows through the build/decay valves to the wheel brakes.

ABS BRAKING-DECAY MODE-DECAY SOLENOID FUNCTION

DECAY SOLENOID ENERGIZED

This will allow brake hydraulic pressure to be dumped to the HCU sump. At the HCU sump, the brake hydraulic fluid is picked up by the pump and restored to high pressure for the next build cycle.

ABS BRAKING-BUILD MODE-DECAY SOLENOID FUNCTION

DECAY SOLENOID DE-ENERGIZED

Decayed brake fluid, is picked up by the pump in the HCU and restored to high pressure. This high pressure brake fluid causes the shuttle valve in the HCU to actuate, routing high pressure brake fluid through the build orifice. Routing the high pressure brake fluid through the build orifice allows for a controlled build pressure in the brakes hydraulic system. High pressure brake fluid from the build orifice then

DESCRIPTION AND OPERATION (Continued)

passes through the de-energized decay solenoid and to the wheel brakes to restore braking pressure.

DIAGNOSIS AND TESTING

ABS GENERAL DIAGNOSTICS INFORMATION

This section contains information necessary to diagnose and test the Bendix ABX-4 Brake System. Specifically, this section should be used to help diagnose conditions which result in any of the following:

- ABS Warning Lamp turned on.
- Brakes Lock on Hard Application

Diagnosis of base brake conditions which are obviously mechanical in nature should be directed to Group 5 Brakes in this service manual. This includes brake noise, brake pulsation, lack of power assist, parking brake, Red BRAKE Warning Lamp lighting, or vehicle vibration during normal braking.

Many conditions that generate customer complaints may be normal operating conditions, but are judged to be a problem due to not being familiar with the ABS system. These conditions can be recognized without performing extensive diagnostic work, given adequate understanding of the operating principles and performance characteristics of the ABS system. See the ABS System Operation section in this group of the service manual to familiarize yourself with the operating principles of the ABS system.

DIAGNOSTICS MANUAL INFORMATION

Detailed procedures for diagnosing specific ABS conditions are covered in the Bendix ABX-4 diagnostics manual. The following information is presented to give the technician a general background on the diagnostic capabilities of the ABX-4 ABS system. Please refer to the above mentioned manual for any further electronic diagnostics and service procedures that are required on the Bendix ABX-4 Brake System.

DIAGNOSTIC TESTER (DRB)

The Allied Signal ABX-4 Antilock Brake System diagnostics are performed using the DRB scan tool. Refer to the Allied Signal ABX-4 diagnostic manual for the proper testing procedures and the DRB operators manual for its proper operational information when diagnosing this brake system.

DRB DIAGNOSTIC CONNECTOR

On this vehicle, the ABX-4 brake system (DRB) diagnostic connector is located under the steering column cover, directly below the steering column (Fig. 9). The ABX-4 system uses the ISO 9141-K connector which is shared by other vehicle diagnostic systems such as the powertrain control module and air bag.

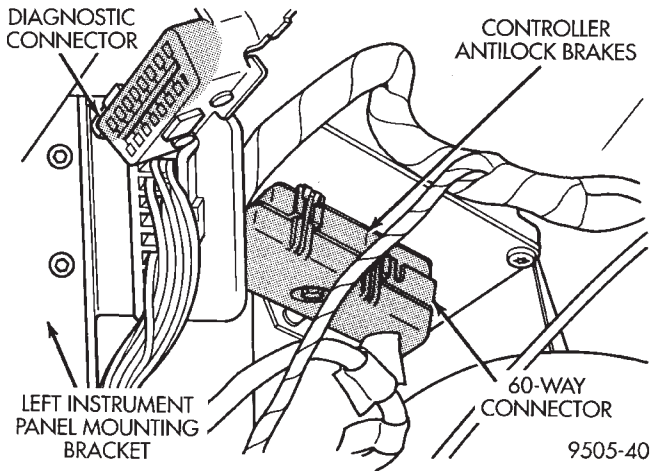


Fig. 9 ABS System Diagnostic Connector Location

SELF DIAGNOSTICS INFORMATION

The ABX-4 system is equipped with a self diagnostic capability which may be used to assist in isolation of ABS faults. The features of the self diagnostics system are described below.

START-UP CYCLE

The self diagnostic ABS start up cycle begins when the ignition switch is turned to the on position. Electrical checks are completed on ABS components, such as the Controller, decay solenoid continuity, and the system relay operation. During this check the Amber ABS Warning Light is turned on for approximately 5 seconds.

DRIVE-OFF CYCLE

Further Functional testing is accomplished once the vehicle is set in motion and reaches a speed of about 7 mph. This cycle is performed only once after each ignition on/off cycle.

- The solenoid valves and the pump/motor are activated briefly to verify function. If the brake pedal is applied at this time, the test is bypassed.
- The wheel speed sensor output is verified to be within the correct operating range.

ONGOING TESTS

Other tests are performed on a continuous basis. These include checks for decay solenoid continuity, wheel speed sensor continuity and wheel speed sensor output.

DIAGNOSTIC TROUBLE CODE INFORMATION

Fault codes are kept in the controller's memory until either erased by the technician using the DRB or erased automatically after the vehicle has been driven 3500 miles. Fault codes are retained by the controller even if the ignition is turned off or the battery is disconnected. The only fault that will not be

DIAGNOSIS AND TESTING (Continued)

erased automatically is the (CAB) fault. A (CAB) fault can only be erased by the technician using the DRB diagnostic tester. More than one fault can be stored at a time. The number of miles the vehicle has been driven since the most recent fault was stored is also displayed. Most functions of the (CAB) and ABS system can be accessed by the technician for testing and diagnostic purposes by using the DRB.

LATCHING VERSUS NON-LATCHING ABS FAULTS

Some faults detected by the CAB are latching; the fault is latched and ABS braking is disabled until the ignition switch is reset. Thus ABS braking is non operational even if the original fault has disappeared. Other faults are non-latching; any warning lights that are turned on, are only turned on as long as the fault condition exists. As soon as the condition goes away, the ABS Warning Light is turned off, although a fault code will be set in most cases.

INTERMITTENT DIAGNOSTIC TROUBLE CODES

As with virtually any electronic system, intermittent faults in the ABS system may be difficult to accurately diagnose.

Most intermittent faults are caused by faulty electrical connections or wiring. When an intermittent fault is encountered, check suspect circuits for:

(1) Poor mating of connector halves or terminals not fully seated in the connector body.

(2) Improperly formed or damaged terminals. All connector terminals in a suspect circuit should be carefully reformed to increase contact tension.

(3) Poor terminal to wire connection. This requires removing the terminal from the connector body to inspect.

(4) Pin presence in the connector assembly

(5) Proper ground connections. Check all ground connections for signs of corrosion, tight fasteners, or other potential defects. Refer to wiring diagram manual for ground locations.

(6) If a visual check does not find the cause of the problem, operate the car in an attempt to duplicate the condition and record the Fault code.

(7) Most failures of the ABS system will disable ABS function for the entire ignition cycle even if the fault clears before key-off. There are some failure conditions, however, which will allow ABS operation to resume during the ignition cycle in which a failure occurred if the failure conditions are no longer present. The following conditions may result in intermittent illumination of the ABS Warning Lamp. All other failures will cause the lamp to remain on until the ignition switch is turned off. Circuits involving these inputs to the (CAB) should be investigated if a complaint of intermittent warning system operation is encountered.

(8) Low system voltage. If Low System Voltage is detected by the CAB, the CAB will turn on the ABS Warning Lamp until normal system voltage is achieved. Once normal voltage is seen at the CAB, normal operation resumes.

(9) Additionally, any condition which results in interruption of electrical current to the CAB or modulator assembly may cause the ABS Warning Lamp to turn on intermittently.

TONEWHEEL INSPECTION

Carefully inspect tonewheel at the suspected faulty wheel speed sensor for missing, chipped or broken teeth, this can cause erratic speed sensor signals.

Tonewheels should show no evidence of contact with the wheel speed sensors. If contact was made, determine cause and correct before replacing the wheel speed sensor.

Excessive runout of the tonewheel can cause erratic wheel speed sensor signals. Refer to Tonewheel Runout in the Specification Section in this section of the service manual for the tonewheel runout specification. Replace drive shaft assembly or rear hub/bearing assembly if tonewheel runout exceeds the specification.

Inspect tonewheels for looseness on their mounting surfaces. Tonewheels are pressed onto their mounting surfaces and should not rotate independently from the mounting surface.

Check the wheel speed sensor head alignment to the tone wheel. Also check the gap between the speed sensor head and the tone wheel to ensure it is at specification. Refer to Wheel Speed Sensor Clearance in the Specification Section in this section of the service manual.

PROPORTIONING VALVES

CAUTION: Proportioning valves (Fig. 10) should never be disassembled.

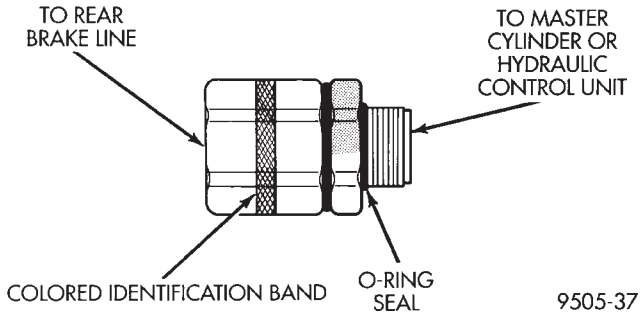


Fig. 10 Proportioning Valve

If premature rear wheel ABS cycling occurs on a hard brake application, it could be an indication that

DIAGNOSIS AND TESTING (Continued)

a malfunction has occurred with one of the proportioning valves.

One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake.

If a malfunctioning proportioning valve is suspected on a vehicle equipped with the Bendix ABX-4 ABS Brake System, refer to Proportioning Valve Test With ABS Brakes in the Base Brake Diagnosis And Testing Section in this group of the service manual.

BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals, Antilock Brakes hydraulic unit and all hydraulic fluid hoses.

VEHICLE TEST DRIVE INFORMATION AND PROCEDURE

Most ABS complaints will require a test drive as a part of the diagnostic procedure. The purpose of the test drive is to duplicate the condition.

NOTE: Remember conditions that result in the turning on of the Red BRAKE Warning Lamp may indicate reduced braking ability. The following procedure should be used to test drive an ABS complaint vehicle.

Before test driving a brake complaint vehicle, note whether the Red Brake Warning Lamp or Amber ABS Warning Lamp is turned on. If it is the Red Brake Warning Lamp, refer to the hydraulic system section in the brake group of this manual. If the ABS Warning lamp was/is on, test drive the vehicle as described below, to verify the complaint. While the ABS Warning Lamp is on, the ABS system is not functional. The standard brake system and the ability to stop the car is not be affected if only the ABS Warning Lamp is on.

(1) Turn the key to the off position and then back to the on position. Note whether the ABS Warning Lamp continues to stay on. If it does, refer to the ABX-4 Diagnostic Manual for the required test procedures.

(2) If the ABS Warning Lamp goes out, shift into gear and drive the car to a speed of 5 mph to complete the ABS start up cycle. If at this time the ABS Warning Lamp goes on refer to the ABX-4 Diagnostic Manual.

(3) If the ABS Warning Lamp remains OUT, drive the vehicle a short distance. During this test drive be sure that the vehicle achieves at least 25 mph. Brake to at least one complete stop and again accelerate to 25 mph.

(4) If a functional problem with the ABS system is determined while test driving a vehicle, refer to the ABX-4 Diagnostics Manual for required test procedures and proper use of the DRB tester.

ABS SERVICE PRECAUTIONS

The ABS uses an electronic control module, the CAB. This module is designed to withstand normal current draws associated with vehicle operation. Care must be taken to avoid overloading the CAB circuits. **In testing for open or short circuits, do not ground or apply voltage to any of the circuits unless instructed to do so for a diagnostic procedure.** These circuits should only be tested using a high impedance multi-meter or the DRB tester as described in this section. Power should never be removed or applied to any control module with the ignition in the ON position. Before removing or connecting battery cables, fuses, or connectors, always turn the ignition to the OFF position.

CAUTION: Use only factory wiring harnesses. Do not cut or splice wiring to the brake circuits. The addition of after-market electrical equipment (car phone, radar detector, citizen band radio, trailer lighting, trailer brakes, ect.) on a vehicle equipped with antilock brakes may affect the function of the antilock brake system.

SERVICE PROCEDURES

BRAKE FLUID LEVEL INSPECTION

CAUTION: Use only Mopar brake fluid or an equivalent from a tightly sealed container. Brake fluid must conform to DOT 3 specifications. Do not use petroleum-based fluid because seal damage in the brake system will result.

For the specific procedure covering the inspection of the brake fluid level and adding brake fluid to the reservoir, refer to the Service Adjustments Section in this group of the service manual.

BLEEDING PROCEDURE INFORMATION

The base brake system must be bled anytime air is permitted to enter the hydraulic system, due to disconnection of brake tubes, hoses or components. The

SERVICE PROCEDURES (Continued)

ABS system, particularly the HCU, should only be bled when the HCU is replaced or removed from the vehicle, or if there is reason to believe the HCU has ingested air. Under most circumstances that would require brake bleeding, only the base brake system needs to be bled.

It is important to note that excessive air in the brake system will cause a soft or spongy feeling brake pedal.

During bleeding operations, be sure that the brake fluid level remains close to the FULL level in the reservoir. Check the fluid level periodically during the bleeding procedure and add DOT 3 brake fluid as required.

The Bendix ABX-4 Brake System must be bled as two independent braking systems. The non ABS portion of the brake system is to be bled the same as any non ABS system. Refer to the Service Adjustments section in this manual for the proper bleeding procedure to be used. This brake system can be either pressure bled or manually bled.

The ABS portion of brake system MUST be bled separately. This bleeding procedure requires the use of the DRB Diagnostic tester and the bleeding sequence procedure outlined below.

ABS BLEEDING PROCEDURE

When bleeding the ABS system, the following bleeding sequence **MUST** be followed to insure complete and adequate bleeding. The ABS system can be bled using a manual bleeding procedure or standard pressure bleeding equipment.

If the brake system is to be bled using pressure bleeding equipment, refer to Bleeding Brake System in the Service Procedure section in the Base Brake Section in this group of the service manual for proper equipment usage and procedures.

(1) Assemble and install all brake system components on vehicle making sure all hydraulic fluid lines are installed and properly torqued.

(2) Connect the DRB Diagnostics Tester to the diagnostics connector. Located under the steering column cover, directly below the steering column (Fig. 11).

(3) Using the DRB, check to make sure the CAB does not have any fault codes stored. If it does, remove them using the DRB.

WARNING: WHEN BLEEDING THE BRAKE SYSTEM WEAR SAFETY GLASSES. A CLEAR BLEED TUBE MUST BE ATTACHED TO THE BLEEDER SCREWS AND SUBMERGED IN A CLEAR CONTAINER FILLED PART WAY WITH CLEAN BRAKE FLUID. DIRECT THE FLOW OF BRAKE FLUID AWAY FROM THE PAINTED SURFACES OF THE VEHICLE. BRAKE FLUID AT HIGH PRESSURE MAY COME OUT OF THE BLEEDER SCREWS WHEN OPENED.

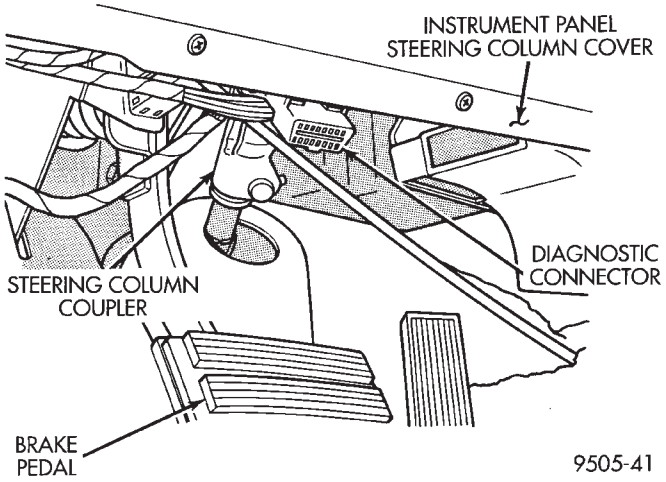


Fig. 11 ABS System Diagnostic Connector Location

(4) Bleed the base brake system using the standard pressure or manual bleeding procedure as outlined in the Service Adjustments section of this service manual.

(5) Using the DRB, go to the “Bleed ABS” routine. Apply the brake pedal firmly and initiate the “Bleed ABS” cycle one time. Release the brake pedal.

(6) Bleed the base brake system again, as in step Step 4 above.

(7) Repeat steps Step 5 and Step 6 above until brake fluid flows clear and free of bubbles. Check brake fluid level in reservoir periodically to prevent reservoir from running low on brake fluid.

(8) Test drive the vehicle to be sure brake are operating correctly and that pedal is solid.

REMOVAL AND INSTALLATION

GENERAL SERVICE CAUTIONS

CAUTION: Review this entire section prior to performing any mechanical work on a vehicle equipped with the Allied Signal ABX- 4 Antilock Brake System. This section contains information on precautions pertaining to potential component damage, vehicle damage and personal injury which could result when servicing an ABS equipped vehicle.

CAUTION: Certain components of the ABS System are not intended to be serviced individually. Attempting to remove or disconnect certain system components may result in improper system operation. Only those components with approved removal and installation procedures in this manual should be serviced.

REMOVAL AND INSTALLATION (Continued)

CAUTION: Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash off with water immediately.

The following are general cautions which should be observed when servicing the ABS system and/or other vehicle systems. Failure to observe these precautions may result in ABS System component damage.

If welding work is to be performed on the vehicle, using an electric arc welder, the CAB connector should be disconnected during the welding operation.

The CAB 60 way connector or the HCU 10 and 6 way connectors should never be connected or disconnected with the ignition switch in the ON position.

ABS HYDRAULIC CONTROL UNIT

REMOVE

(1) Disconnect negative (ground) cable from the battery and isolate cable.

(2) Disconnect vehicle wiring harness connector from brake fluid level sensor at base of master cylinder brake fluid reservoir (Fig. 12).

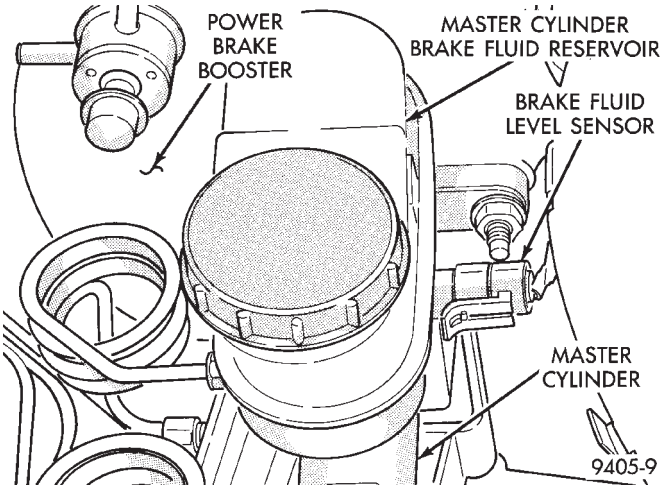


Fig. 12 Master Cylinder Brake Fluid Level Sensor

(3) Disconnect primary and secondary brake tubes from master cylinder housing (Fig. 13). Install plugs at brake tube outlets of master cylinder assembly.

(4) Clean area where master cylinder attaches to booster using a suitable brake cleaner.

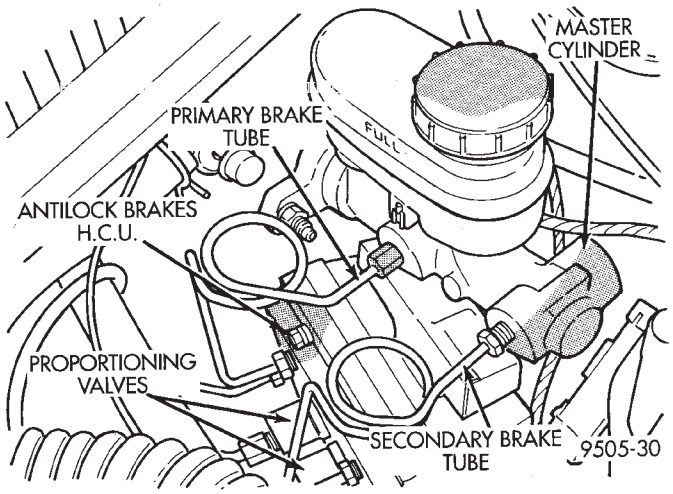


Fig. 13 Primary And Secondary Brake Tubes With ABS Brakes

CAUTION: On ABS equipped vehicles, vacuum in power booster must be pumped down before removing master cylinder to prevent the booster from sucking in any contamination. This can be done simply by pumping the brake pedal, with the engine not running, until a firm brake pedal is achieved.

(5) Remove the 2 nuts (Fig. 14) attaching master cylinder to power brake booster unit.

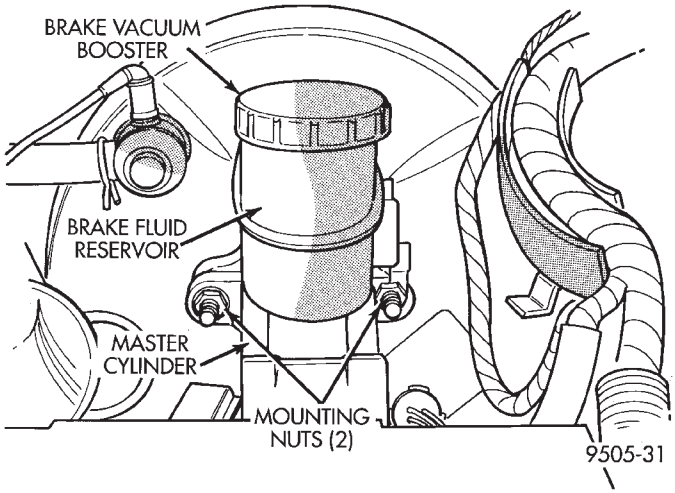


Fig. 14 Master Cylinder Mounting

(6) Slide master cylinder assembly straight out, and away from power brake booster unit.

REMOVAL AND INSTALLATION (Continued)

(7) Disconnect the 6 way connector from the HCU wiring harness and 10 way connector from the relay box located on the HCU (Fig. 15).

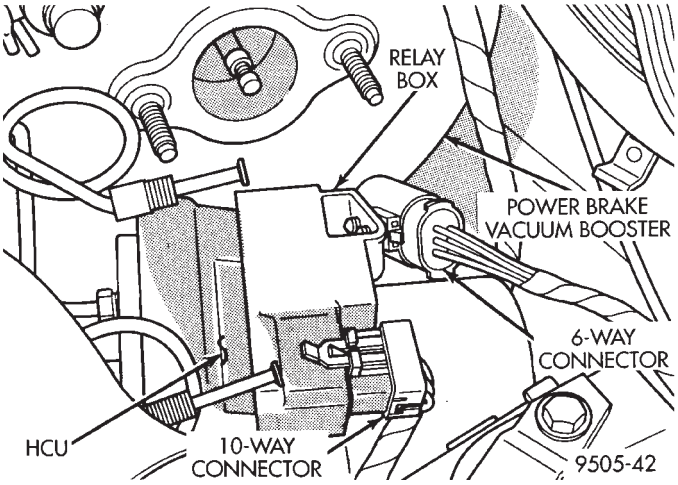


Fig. 15 Electrical Connections To HCU And Relay Box

(8) Remove the primary and secondary master cylinder brake tubes (Fig. 16) from the HCU.

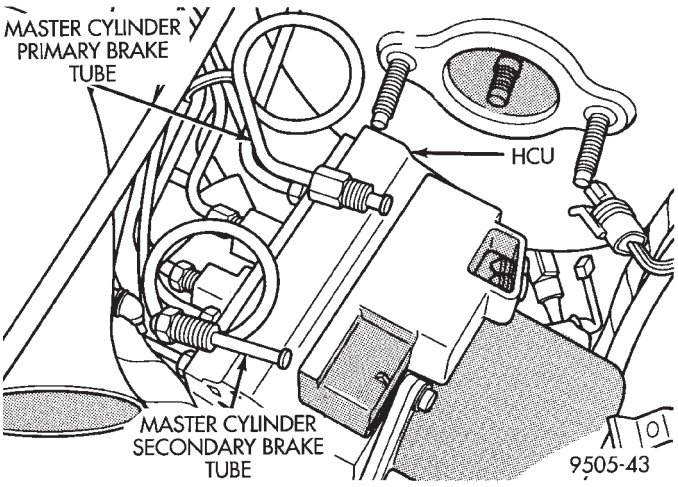


Fig. 16 Primary And Secondary Brake Tubes From Master Cylinder To HCU

(9) Remove the chassis brake tubes from the proportioning valves and outlet ports of the (HCU) (Fig. 17).

(10) Raise vehicle.

(11) Loosen and remove the 2 bolts attaching the HCU mounting bracket to the side of the front frame rail (Fig. 18).

(12) Lower vehicle.

(13) Loosen and remove the bolts attaching the HCU mounting bracket to the top of the frame rail (Fig. 18).

(14) Remove HCU and its mounting bracket as an assembly from the vehicle.

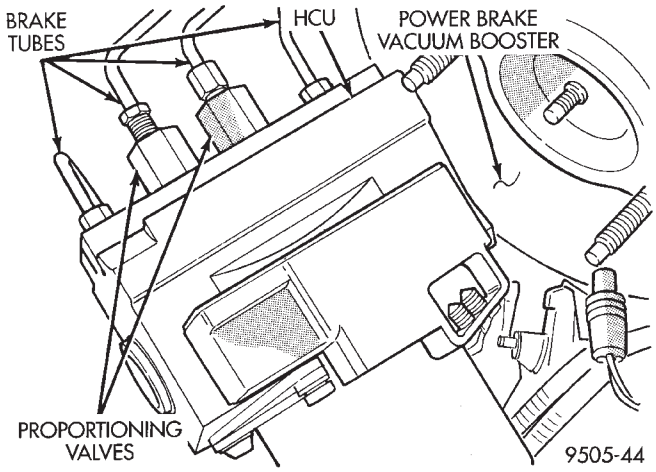


Fig. 17 Chassis Brake Tube Connections To HCU

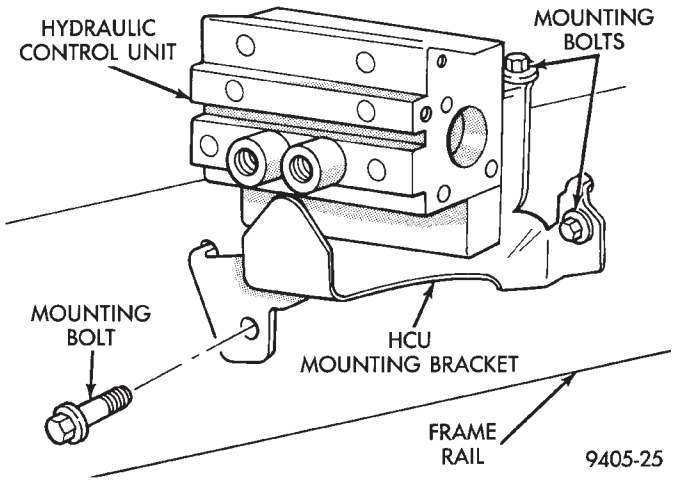


Fig. 18 Hydraulic Control Unit Mounting Bracket

INSTALL

(1) Install the HCU and mounting bracket as an assembly, on left front frame rail of the vehicle, aligning tabs on mounting bracket with holes in frame rail. (Fig. 18).

(2) Install and loosely tighten the bolt attaching the HCU mounting bracket to the top of the frame rail.

(3) Raise vehicle.

(4) Install the 2 bolts attaching the HCU mounting bracket to the side of the front frame rail (Fig. 18). Then torque both mounting bolts to 28 N·m (200 in. lbs.).

(5) Lower vehicle.

(6) Torque bolt attaching HCU mounting bracket to top of frame rail to 20 N·m (180 in. lbs.).

(7) Install the 4 chassis brake tubes (Fig. 17) onto the proportioning valves and outlet ports of the HCU. Torque the 4 chassis brake tube nuts to 17 N·m (145 in.lbs.).

REMOVAL AND INSTALLATION (Continued)

(8) Install primary and secondary brake tubes (Fig. 16) from the master cylinder onto the HCU, **with tube nuts only hand tightened.**

(9) Install vehicle wiring harness connectors onto the 10 way, and 6 way connectors, located on the relay box of the HCU (Fig. 15).

(10) Remove vacuum seal (Fig. 19) located in the front of the power brake vacuum booster. Vacuum seal is removed by **carefully** inserting a small screw driver between the push rod of the power brake vacuum booster and vacuum seal (Fig. 19) and pry seal out of power brake vacuum booster. **Do not attempt to pry seal out of master cylinder by inserting a tool between seal and power brake vacuum booster.**

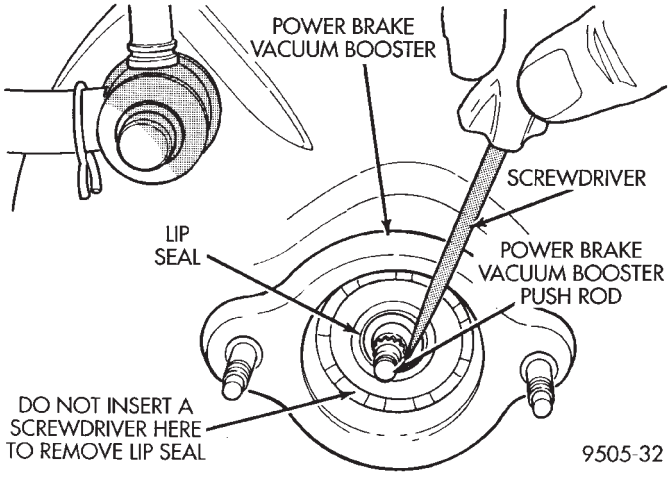


Fig. 19 Removing Vacuum Seal From Vacuum Booster

(11) Remove old vacuum seal from master cylinder, if the vacuum seal came out of power brake vacuum booster when master cylinder was removed.

CAUTION: When replacing the master cylinder on a vehicle equipped with ABS, a NEW vacuum seal MUST be installed in the power brake vacuum booster. Use only the procedure detailed below for installing vacuum seal into power brake vacuum booster. Be sure old vacuum seal is removed from power brake vacuum booster before attempting to install new seal.

CAUTION: When lubricating master cylinder push rod, use only Mopar Silicone Dielectric Compound. Using any other type of grease or lubricant on the push rod, will not provide adequate long term lubrication of the push rod.

(12) Lubricate master cylinder push rod as indicated in (Fig. 20) only using **Mopar Dielectric Grease—And No Substitutes.** Refer to the Mopar Chemicals Catalog to obtain the required lubricant.

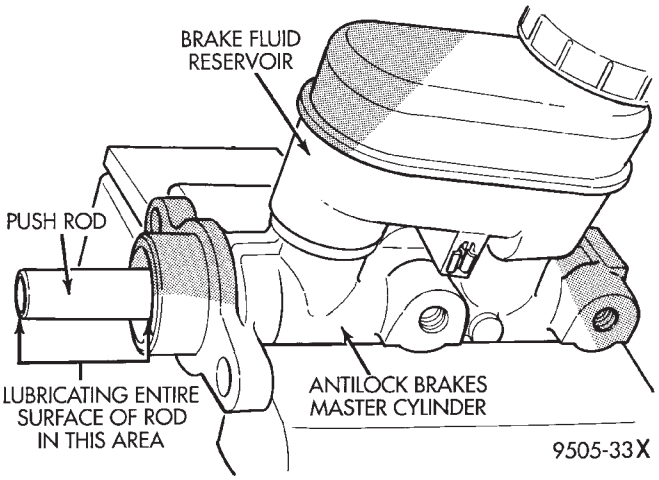


Fig. 20 Lubricating Master Cylinder Push Rod

(13) Install vacuum seal on master cylinder push rod as shown in (Fig. 21) with notches on vacuum seal pointing toward master cylinder housing. Then slide vacuum seal onto master push rod until seal is seated against master cylinder housing (Fig. 22) before installing master cylinder on power brake vacuum booster.

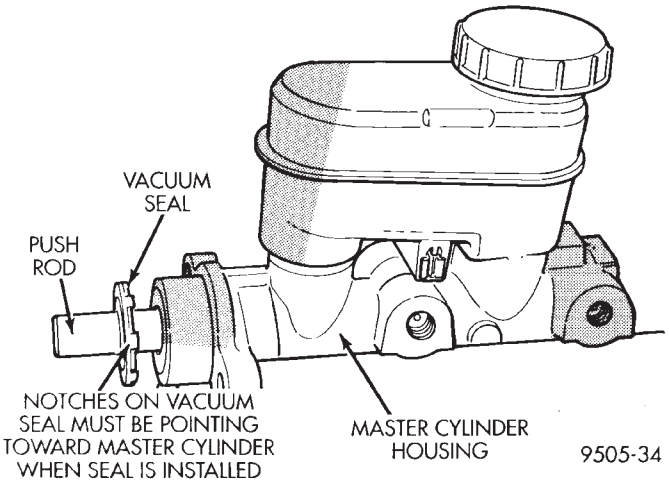


Fig. 21 Installing Vacuum Seal On Master Cylinder Push Rod

CAUTION: If vehicle is equipped with ABS, be sure old vacuum seal is removed from power brake vacuum booster before attempting to install master cylinder and NEW vacuum seal. If vacuum seal is not removed, refer to Master Cylinder Removal in this section of the service manual for required vacuum seal removal procedure.

(14) Position master cylinder on studs of power brake unit, aligning push rod on power brake vacuum booster with master cylinder push rod.

REMOVAL AND INSTALLATION (Continued)

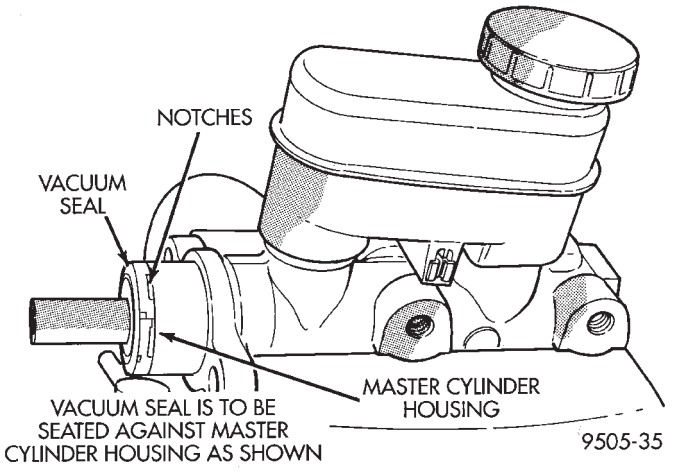


Fig. 22 Vacuum Seal Positioned For Installing Master Cylinder

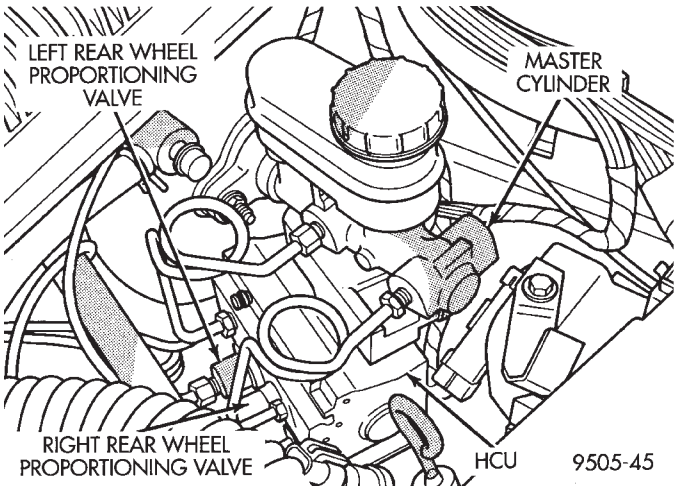


Fig. 23 Rear Wheel Proportioning Valve Location On HCU

(15) Install the 2 master cylinder to power brake unit mounting nuts (Fig. 14) and torque to 28 N·m (250 in. lbs.) torque.

(16) Connect brake tubes to master cylinder primary and secondary ports (Fig. 13). Torque all tube nuts to 17 N·m (145 in. lbs.) torque.

(17) Install the wiring harness connector on the master cylinder reservoir brake fluid level switch (Fig. 12).

(18) Bleed the base brakes and the ABS brakes hydraulic systems. Refer to Bleeding Base Brake Hydraulic System in Service Procedures of the Base Brake Section and Antilock Brakes Hydraulic System Bleeding Procedure in Service Procedures of the Antilock Brake Section for the required procedures.

(19) Road test vehicle to ensure proper operation of the base and ABS brake systems.

PROPORTIONING VALVES

The HCU does not require removal from the vehicle for the replacement of the proportioning valves. Use the proportioning valve test procedure in the Diagnosis And Testing Section in this group of the service manual to determine which proportioning valve requires replacement, then replace it using procedure below.

REMOVE

(1) Disconnect the brake tube fitting from the proportioning valve requiring removal from the HCU (Fig. 23).

(2) Remove proportioning valve (Fig. 23) requiring replacement, from the HCU.

INSTALL

(1) Wet O-ring seal on new proportioning valve using clean fresh brake fluid.

(2) Install proportioning valve in HCU and hand tighten until proportioning is fully installed and O-ring seal is seated into HCU. Then torque proportioning valve to 40 N·m (30 ft. lbs.).

(3) Install brake tube on proportioning valve. Tighten tube nut to 17 N·m (145 in. lbs.) torque.

(4) Bleed the base brakes hydraulic system. Refer to Bleeding Base Brake Hydraulic System in Service Procedures of the Base Brake Section.

MASTER CYLINDER AND POWER BRAKE BOOSTER

If the Master Cylinder or the Power Booster need to be serviced or replaced, refer to Master Cylinder or Power Brake Booster in the Removal And Installation Section in the Base Brake Section of this service manual.

RELAY BOX

The system relay and pump/motor relay are both serviced together as an assembly with the relay box. The relay box is mounted directly to the HCU.

To remove the relay box from the HCU, the HCU requires removal from the vehicle. This is to allow visual access of the relay box to HCU electrical connection. Visual access to this connection is necessary to be sure connection is correctly made when installing relay box on the HCU.

REMOVE

(1) Disconnect negative (ground) cable from the battery and isolate the cable.

(2) Remove the HCU from the vehicle. See Hydraulic Control Unit in the Removal And Installation Section of the Antilock Brake System Section, in this group of the service manual, for the required HCU removal procedure.

(3) Unclip the 6 way wiring harness connector (Fig. 24) from the relay box.

REMOVAL AND INSTALLATION (Continued)

(4) Remove the 2 screws (Fig. 24) attaching the relay box assembly to the HCU. **Remove only the 2 screws mounting the relay box to the HCU do not remove the pump motor mounting screws (Fig. 24).**

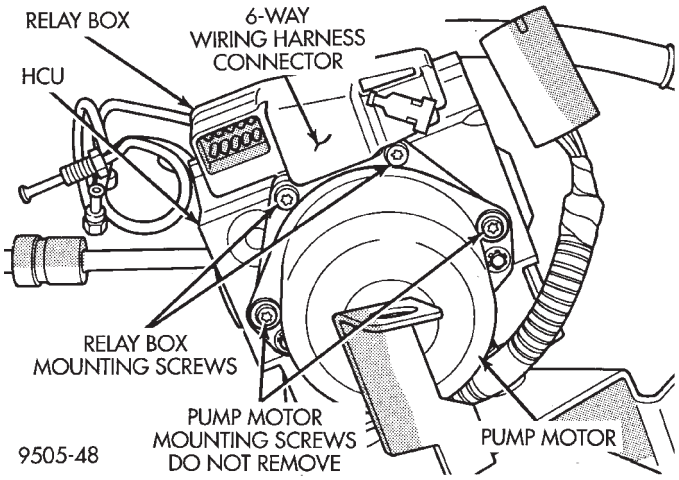


Fig. 24 Relay Box To HCU Mounting Screws

(5) Grasp relay box. Without twisting or rocking, pull relay box away from pump motor housing until connector on relay box unplugs from the pump motor terminal (Fig. 25). **This is a tight connection, relay box will require a good amount of force to unplug from pump motor.**

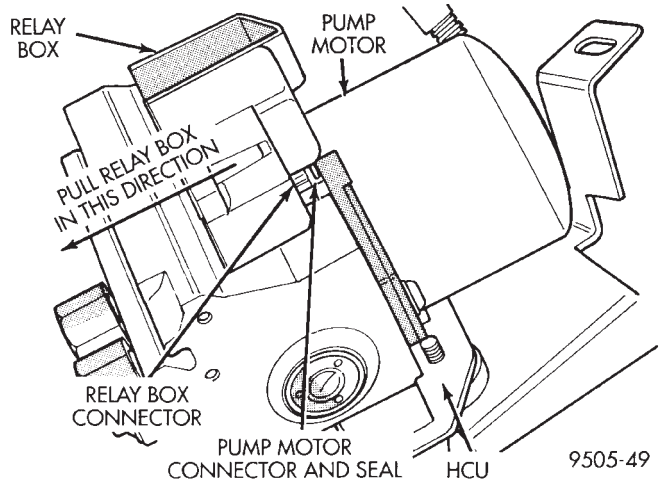


Fig. 25 Relay Box To HCU Electrical Connection

(6) Remove relay box from HCU.

INSTALL

(1) Be sure electrical connector seal (Fig. 26) is installed in pump motor housing before installing relay box. If electrical connector seal is cracked, brittle or in any way damaged it must be replaced before installing relay box.

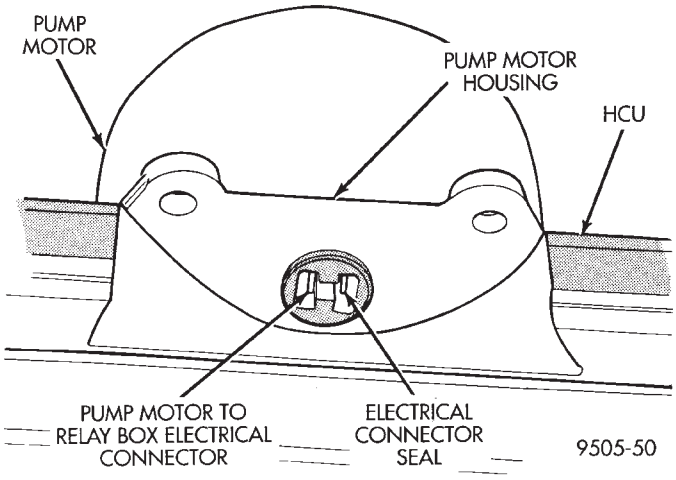


Fig. 26 Pump Motor To Relay Box Electrical Connection Seal

(2) Position relay box on HCU and carefully align the terminals on the relay box with the terminals on the pump motor.

(3) Grasp relay box with both hands. Then without twisting or rocking, push relay box onto the pump motor electrical connector as far as possible by hand.

(4) Install and securely tighten the 2 screws (Fig. 24) attaching the relay box assembly to the HCU.

(5) Reconnect the 6 way connector onto the relay box.

(6) Install the HCU back in the vehicle. See Hydraulic Control Unit in the Removal And Installation Section of the Antilock Brake System Section, in this group of the service manual, for the required HCU installation procedure.

(7) Connect the negative (-) ground cable back on the negative post of the battery.

(8) Bleed the base brakes and the ABS brakes hydraulic systems. Refer to Bleeding Base Brake Hydraulic System in Service Procedures of the Base Brake Section and Antilock Brakes Hydraulic System Bleeding Procedure in Service Procedures of the Antilock Brake Section for the required procedures.

(9) Road test vehicle to ensure proper operation of the base and ABS systems.

REMOVAL AND INSTALLATION (Continued)

CONTROLLER ANTILOCK BRAKES (CAB)

The CAB is mounted under the instrument panel on the drivers side kick panel of the vehicle (Fig. 27).

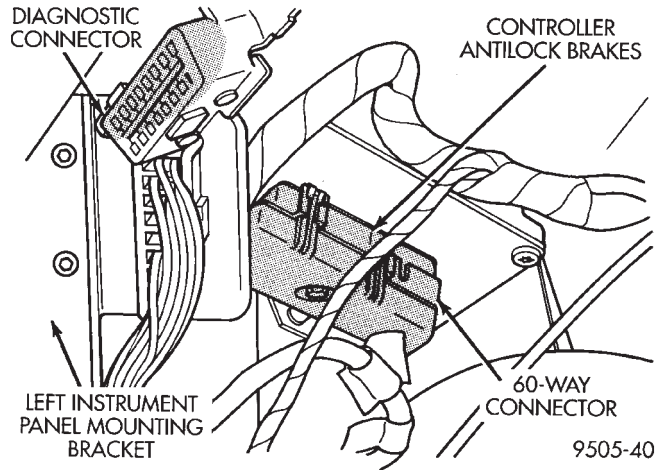


Fig. 27 Location Of Controller Antilock Brake (CAB)

REMOVE

(1) Turn vehicle ignition off.

(2) Disconnect the wiring harness 60 way connector (Fig. 28) from the Controller Antilock Brake Module (CAB). **VERIFY THAT THE VEHICLE IGNITION IS OFF BEFORE REMOVING THE 60 WAY CONNECTOR.**

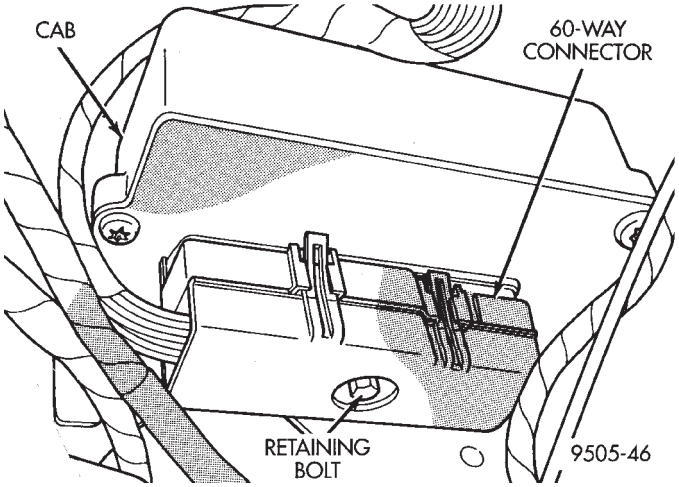


Fig. 28 CAB 60-Way Wiring Harness Connector

(3) Remove the 2 controller bracket to drivers side cowl mounting nuts (Fig. 29).

(4) Remove the CAB from the vehicle.

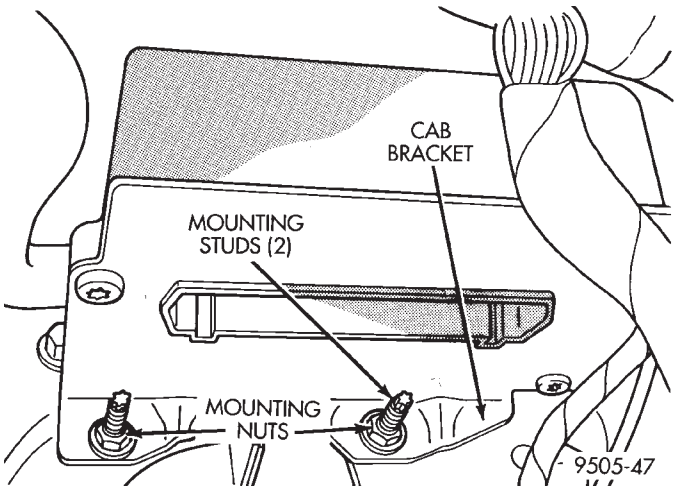


Fig. 29 CAB Bracket To Kick Panel Mounting

INSTALL

(1) Install CAB and mounting bracket on mounting studs located on passenger side kick panel (Fig. 29).

(2) Install the 2 CAB bracket mounting nuts (Fig. 29) and securely tighten.

(3) Install the 60-way wiring harness connector (Fig. 28) by hand into the 60-way CAB connector, as far as possible. Then use the CAB connector retaining bolt (Fig. 28) to fully seat wiring harness connector into the CAB.

(4) Torque the 60-way connector retaining bolt (Fig. 28) to 4 N·m (38 in. lbs.).

(5) **If a new CAB is being installed, it must be initiallized prior to the vehicle being driven. The CAB is initialized using the DRB Scan Tool and the initializing procedure described upon selecting Bendix ABX-4 Diagnostics. New controllers are programmed to flash the ABS warning lamp until initilized by the installing technician.**

FRONT WHEEL SPEED SENSOR

NOTE: Proper installation of the Wheel Speed Sensor Cables is critical to continued system operation. Be sure that cables are installed, routed and clipped properly. Failure to install speed sensor cables as shown in the on car service section of this manual, may result in contact with moving parts or over extension of cables, resulting in an open circuit.

REMOVAL AND INSTALLATION (Continued)

REMOVE

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the tire and wheel assembly from the vehicle.

(3) Unplug speed sensor cable connector (Fig. 30) from vehicle wiring harness. Remove clip (Fig. 30) attaching speed sensor cable connector to vehicle body.

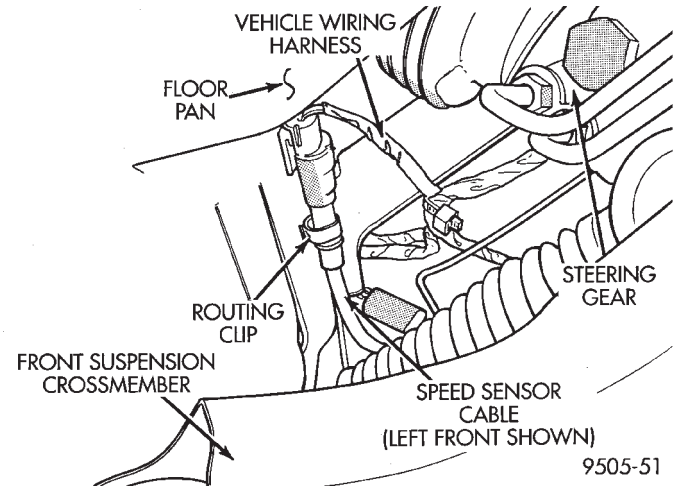


Fig. 30 Speed Sensor Cable To Wiring Harness Connection

(4) Remove wheel speed sensor head to steering knuckle attaching bolt (Fig. 31).

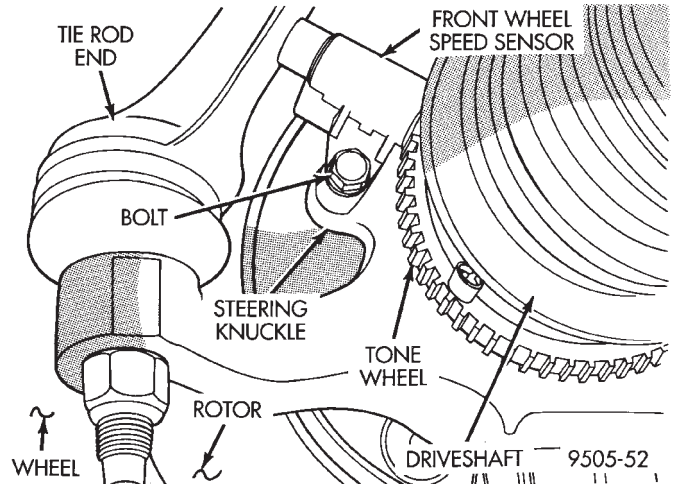


Fig. 31 Front Wheel Speed Sensor Attaching Bolt

(5) Carefully, remove sensor head from steering knuckle. If the sensor has seized, due to corrosion, **DO NOT USE PLIERS ON SENSOR HEAD.** Use a hammer and a punch and tap edge of sensor ear, rocking the sensor side to side until free.

(6) Remove the speed sensor cable assembly grommets from the retaining bracket (Fig. 32). Remove speed sensor cable routing clip from the frame of the vehicle (Fig. 32).

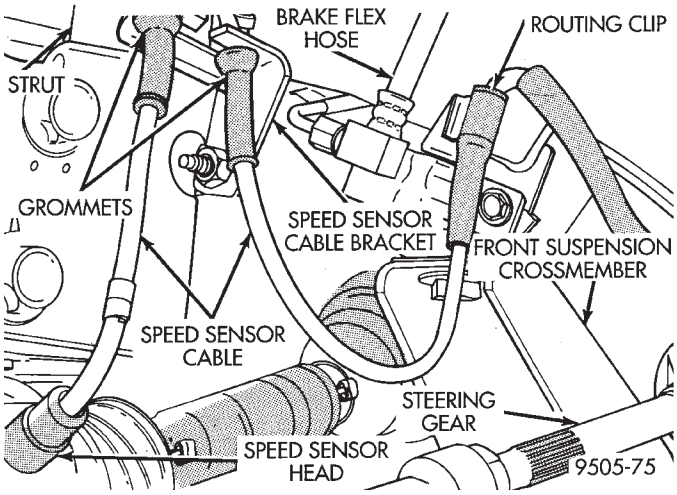


Fig. 32 Front Wheel Speed Sensor Cable Routing

INSTALL

(1) Connect the wheel speed sensor cable connector to the vehicle wiring harness (Fig. 30).

(2) Install the speed sensor cable assembly grommets into the retaining bracket (Fig. 32). Install speed sensor cable routing clip onto the frame of the vehicle (Fig. 32).

(3) Install wheel speed sensor to steering knuckle attaching screw (Fig. 31). Torque the attaching screw to 7 N·m (60 in. lbs.)

(4) Install the wheel and tire assembly on vehicle.

(5) Road test vehicle to ensure proper operation of the base and ABS systems.

REAR WHEEL SPEED SENSOR

NOTE: Proper installation of the Wheel Speed Sensor Cables is critical to continued system operation. Be sure that cables are installed, routed and clipped properly. Failure to install speed sensor cables as shown in the on car service section of this manual, may result in contact with moving parts or over extension of cables, resulting in an open circuit.

REMOVE

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the tire and wheel from the vehicle.

REMOVAL AND INSTALLATION (Continued)

(3) Unplug speed sensor cable connector from vehicle wiring harness (Fig. 33). Remove clip (Fig. 33) attaching speed sensor cable connector to vehicle body.

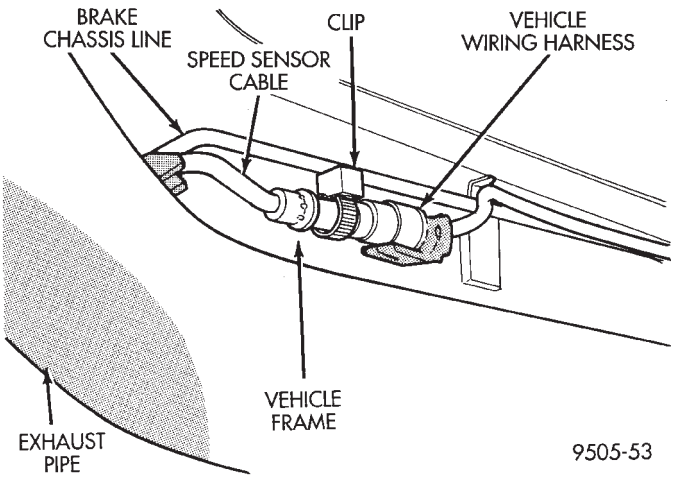


Fig. 33 Rear Speed Sensor Connection To Vehicle Wiring Harness

(4) Remove the speed sensor cable routing bracket from under rear brake flex hose mounting bracket. Then remove the speed sensor cable from the routing clips on the rear brake flex hose and chassis brake tube.

(5) Remove bolt (Fig. 34) attaching the rear wheel speed sensor to the disc brake adapter. Then remove bolt attaching speed sensor cable routing bracket to rear strut assembly (Fig. 34).

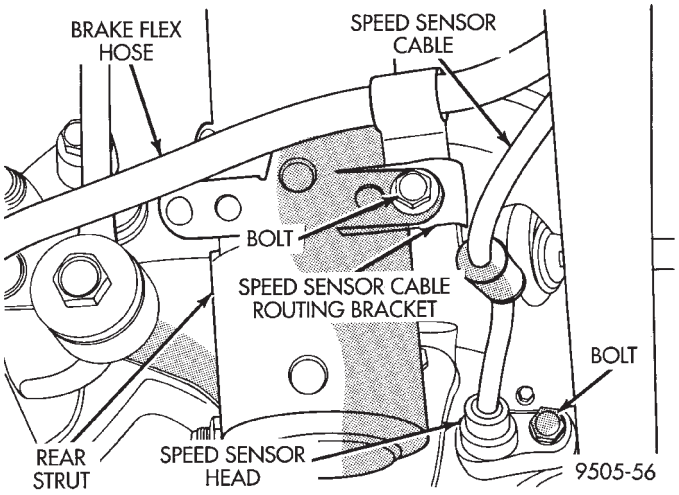


Fig. 34 Speed Sensor Head Mounting And Cable Routing

(6) Remove speed sensor head from the disc brake adapter. If the speed sensor head has seized in the adapter, DO NOT USE PLIERS ON SENSOR HEAD.

INSTALL

(1) Install wheel speed sensor head into disc brake adapter (Fig. 34).

(2) Install wheel speed sensor attaching bolt (Fig. 34). Tighten the attaching bolt to a torque of 7 N·m (60 in. lbs.)

(3) Install the brake flex hose and wheel speed sensor cable routing bracket on the rear strut bracket (Fig. 34).

(4) Install wheel speed sensor cable into the routing clips on the rear brake flex hose and chassis brake tube.

(5) Plug speed sensor cable connector into vehicle wiring harness (Fig. 33). Install clip (Fig. 33) attaching speed sensor cable connector to vehicle body.

(6) Install the tire and wheel assembly on vehicle.

(7) Road test vehicle to ensure proper operation of the base and ABS systems.

SPECIFICATIONS

SPEED SENSOR TONE WHEEL RUNOUT

The total indicator runout allowed for both the front and rear tone wheel measured using a dial indicator is 0.25 mm (.009 in.).

WHEEL SPEED SENSOR TO TONE WHEEL CLEARANCE

FRONT WHEEL

Minimum Clearance .35mm (.014 in.)
Maxamum Clearance 1.2 mm (.047 in.)

REAR WHEEL

Minimum Clearance .40mm (.016 in.)
Maxamum Clearance 1.2 mm (.047 in.)

BRAKE FASTENER TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
BRAKE TUBES:	
Tube Nuts To Fittings And Components Except HCU.	17 N·m (145 in. lbs.)
From Master Cylinder To HCU At HCU Ports	21 N·m (185 in. lbs.)
BRAKE HOSE:	
To Caliper Banjo Bolt	48 N·m (35 ft. lbs.)
Intermediate Bracket	12 N·m (105 in. lbs.)
MASTER CYLINDER:	
To Vacuum Booster Mounting Nut	28 N·m (250 in. lbs.)
BRAKE BOOSTER:	
To Dash Panel Mounting Nuts	28 N·m (250 in. lbs.)

SPECIFICATIONS (Continued)

DESCRIPTION	TORQUE
REAR WHEEL CYLINDER:	
To Support Plate Mounting Bolts	13 N·m (115 in. lbs.)
Bleeder Screw	10 N·m (80 in. lbs.)
BRAKE SUPPORT PLATE:	
To Axle Mounting Bolts	75 N·m (55 ft. lbs.)
REAR DISC BRAKE ADAPTER:	
To Axle Mounting Bolts	75 N·m (55 ft. lbs.)
DISC BRAKE CALIPER:	
Guide Pin Bolts	22 N·m (192 in. lbs.)
Bleeder Screw	15 N·m (125 in. lbs.)
ABS HYDRAULIC CONTROL UNIT:	
To Mounting Bracket Bolts	28 N·m (250 in. lbs.)
Bracket To Frame Rail Mounting Bolt (Top)	18 N·m (160 in. lbs.)
Bracket To Frame Rail Mounting Bolts (Side)	22 N·m (200 in. lbs.)
PARKING BRAKE:	
Lever Mounting Nuts	28 N·m (250 in. lbs.)
REAR HUB AND BEARING:	
To Knuckle Retaining Nut	217 N·m (160 ft. lbs.)
WHEEL:	
Stud Lug Nut	109–150 N·m (80–110 ft. lbs.)