BRAKES

CONTENTS

GENERAL INFORMATION

Throughout this group, references may be made to a particular vehicle by letter or number designation. A chart showing the break down of these designations is included in the Introduction Section at the front of this service manual.

Standard brake equipment consists of:

- Double pin floating caliper disc front brakes.
- Rear automatic adjusting drum brakes.
- Differential valve with a brake warning switch.
- Master cylinder.
- Vacuum power booster.
- Double pin floating caliper rear disc brakes are available on some models.

The Anti-Lock braking system. Uses the standard power brake system caliper assemblies, braking discs, pedal assembly, brake lines and hoses. The unique parts of the Anti-Lock braking system consists of the following components. Unique proportioning valves, wheel speed sensors, tone wheels, electronic control units, modulator assembly and hydraulic assembly which replaces the conventional master cylinder and power booster. These components will be described in detail in the Anti-Lock brake section in this group of the service manual.

The front disc brake shoes have semi-metallic linings.

The hydraulic brake system (Figs. 1, 2 and 3) 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 Non-ABS and ABS brake system uses different types of brake line fittings and tubing flares. The Non-ABS brake system uses double wall tubing flares and fittings at all tubing joint locations. The ABS brake system uses both ISO style tubing flares and double wall tubing flares and corresponding fittings at different joint locations. See (Figs. 2 and 3) for specific joint locations and type of tubing flare.

The front disc brakes consist of two different types of caliper assemblies. The double pin Kelsey-Hayes caliper (family caliper) with a bolt-on adapter attached to the steering knuckle, or a double pin Kelsey-Hayes caliper which mounts directly to rails on the steering knuckle. The non-family caliper.

CAUTION: Caliper pistons, boots and seals for the different caliper assemblies used on the front and rear disc brake assemblies are not interchangeable. Misusage could result in a complete brake system failure. Be sure that the parts are replaced with the correct replacement parts, refer to the parts book for the type and model year of the vehicle being worked on.

The master cylinder is anodized, lightweight aluminum, with a bore size of 24.0mm, 21.0mm or 7/8 inch.

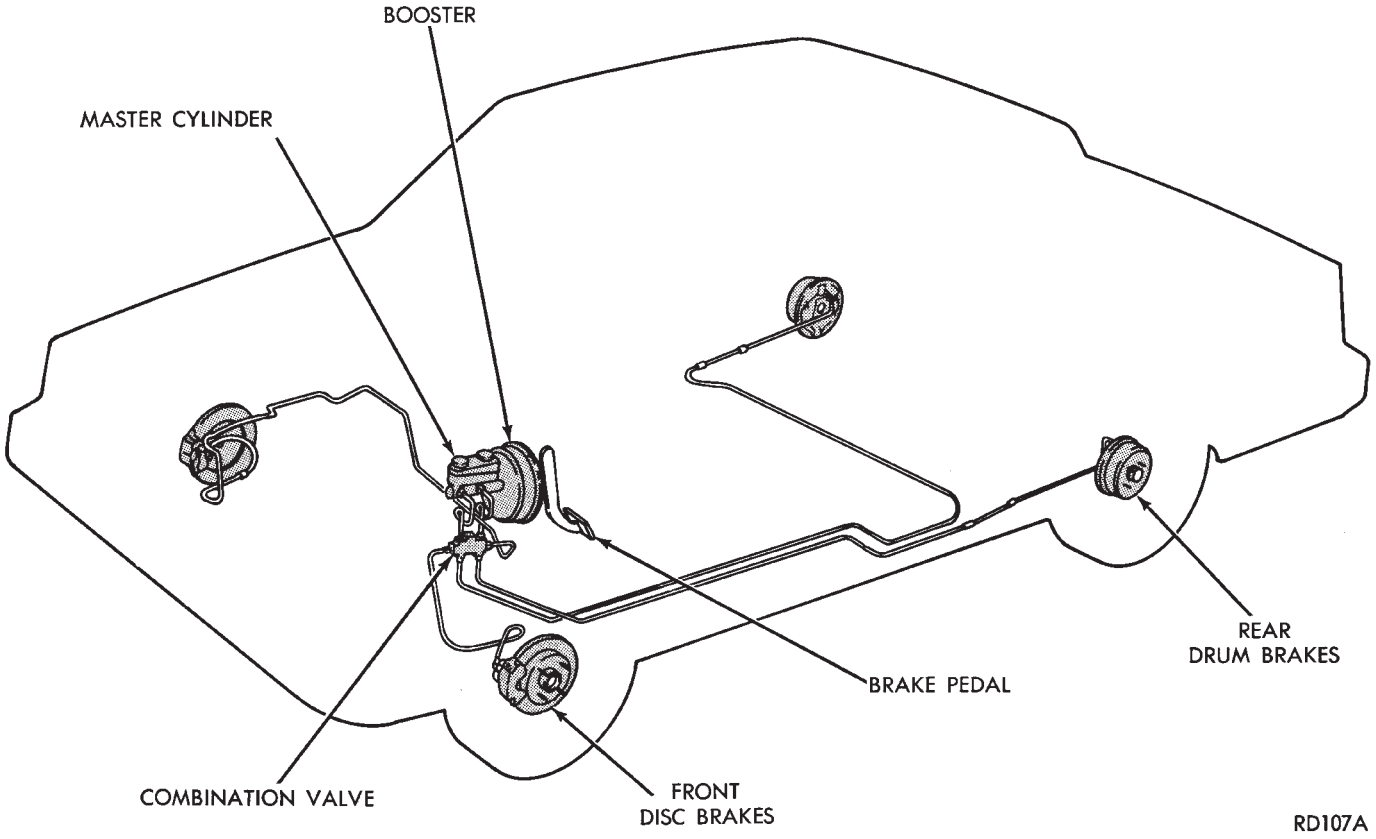

Fig. 1 Diagonally Split Braking System (Typical Non-ABS System)

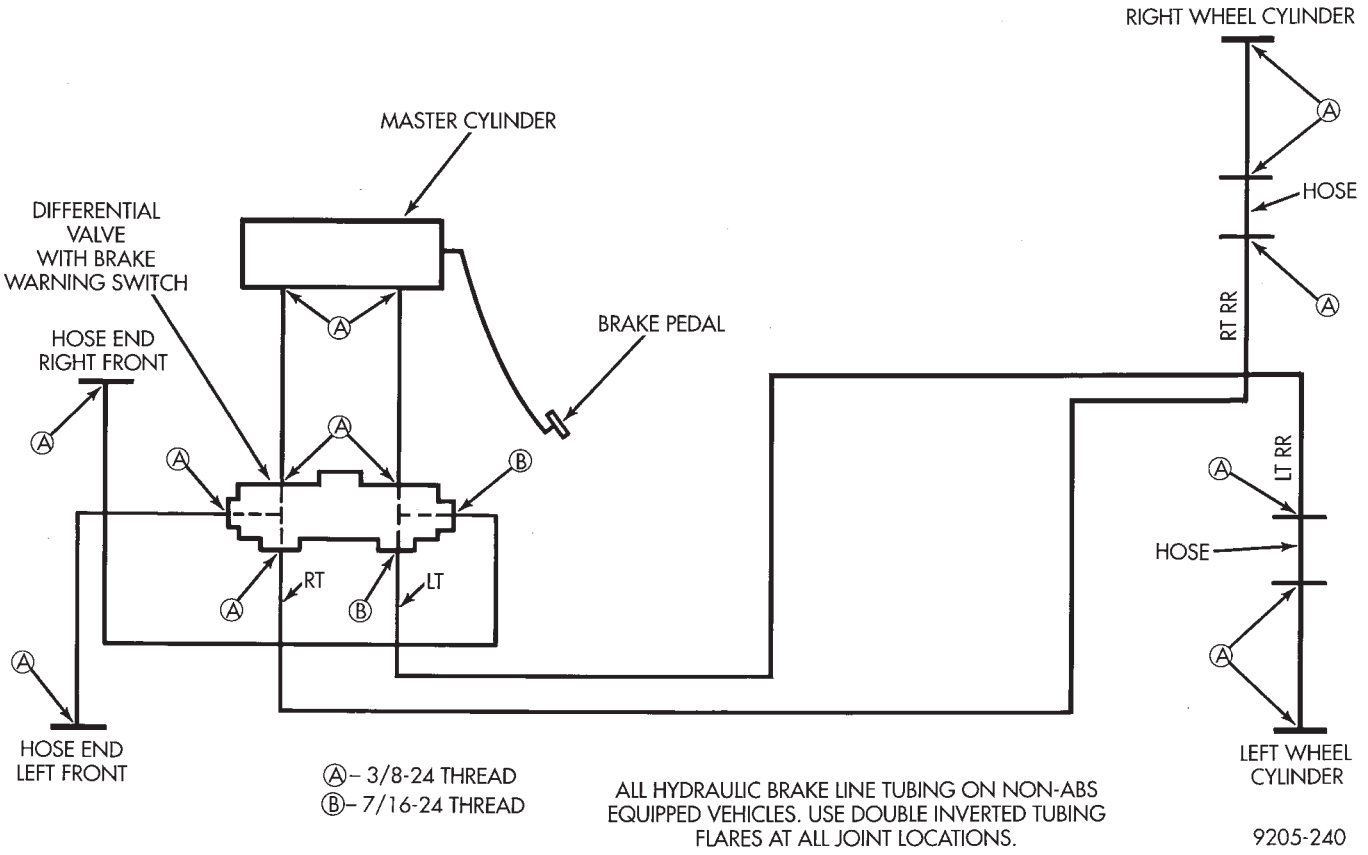

Fig. 2 Proper Nut Thread Size And Tube Routing (Non-ABS Equipped)

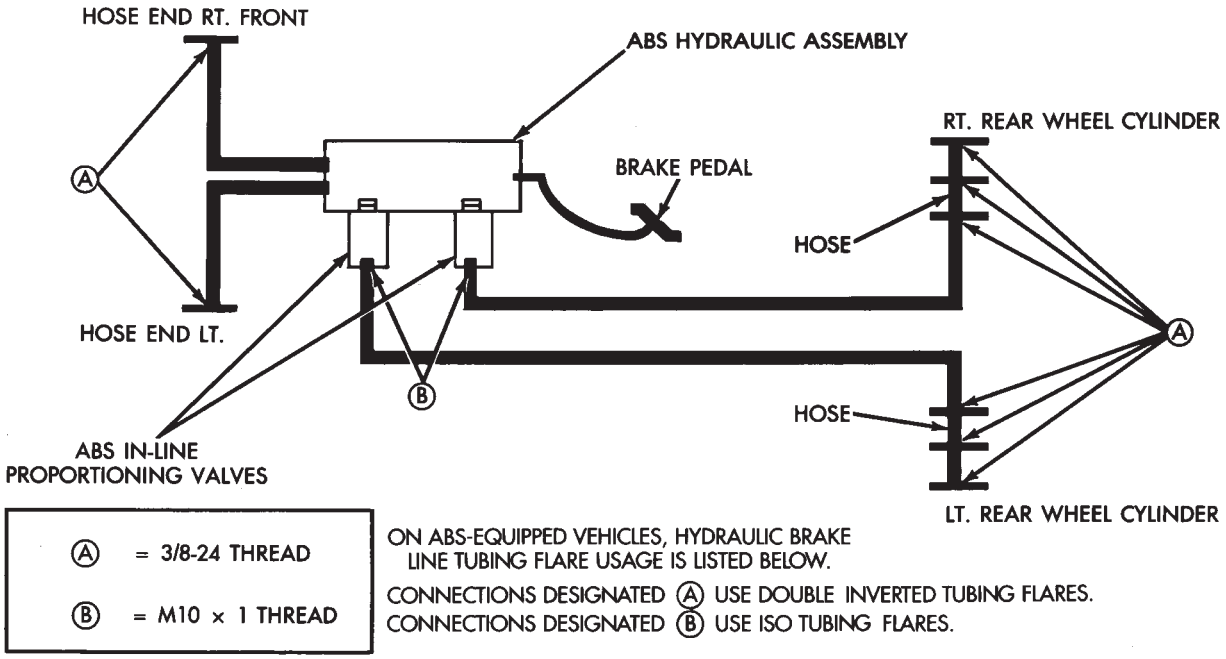

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Fig. 3 Proper Nut Thread Size And Tube Routing (ABS Equipped)

SERVICE ADJUSTMENTS

INDEX

MASTER CYLINDER FLUID LEVEL

NON-ABS BRAKES

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

Master cylinder reservoirs are marked with the words fill to bottom of rings indicating proper fluid level (Fig. 1).

If necessary, add fluid to bring the level to the bottom of the primary reservoir split ring.

Use only Mopar® brake fluid or an equivalent from a sealed container. Brake fluid must conform to DOT 3, specifications.

DO NOT use brake fluid with a lower boiling point, as brake failure could result during prolonged hard braking.

Use only brake fluid that was stored in a tightly-sealed container.

DO NOT use petroleum-based fluid because seal damage in the brake system will result.

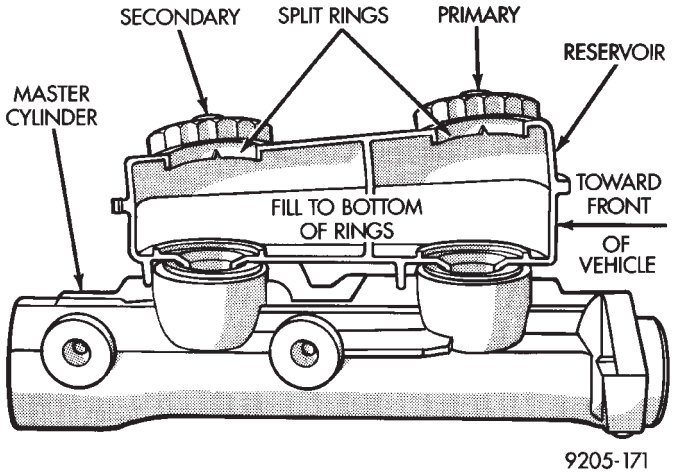

Fig. 1 Master Cylinder Fluid Level (Non-ABS)

ABS BRAKES

The hydraulic assembly is equipped with a plastic fluid reservoir with a filter/strainer in the filler neck of the reservoir.

The Anti-Lock brake system requires that the hydraulic accumulator be de-pressurized whenever checking the brake fluid level. To check the brake fluid level, the following procedure should be used:

(1) With the ignition off, de-pressurize the hydraulic accumulator by applying the brake pedal approximately 40 times, using a pedal force of approximately 220 N (50 lbs.). A noticeable change in pedal feel will occur when the accumulator is de-pressurized. Continue to apply the pedal several times after this change in pedal feel occurs to insure that the brake system is fully de-pressurized.

(2) Thoroughly clean both reservoir caps and surrounding area of reservoir, (Fig. 2) before removing caps. This is to avoid getting dirt into the reservoir and contaminating the brake fluid.

(3) Inspect the brake fluid to see if it is at the proper level, see instructions on top of reservoir. (FILL TO TOP OF WHITE SCREEN ON FRONT FILTER/STRAINER.)

(4) Fill reservoir with brake fluid to top of screen (Fig. 3) on the filter/strainer located in brake fluid reservoir. Only use brake fluid conforming to DOT 3 specifications such as Mopar® or equivalent.

(5) Replace brake fluid reservoir caps.

ADJUSTING REAR SERVICE BRAKES

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. 4), from the rear brake shoe support plate.

(3) **Be sure parking brake lever is fully released. Then back off parking brake cable adjustment so there is slack in the cable.**

(4) Insert Brake Adjuster, Special Tool C-3784, (Fig. 5) or equivalent through the adjusting hole in support plate and against star wheel of adjusting screw. Move handle of tool upward until a slight drag is felt when the road wheel is rotated.

(5) Insert a thin screwdriver or piece of welding rod into brake adjusting hole (Fig. 5). Push adjusting lever out of engagement with star wheel. **Care should be taken so as not to bend adjusting le-**

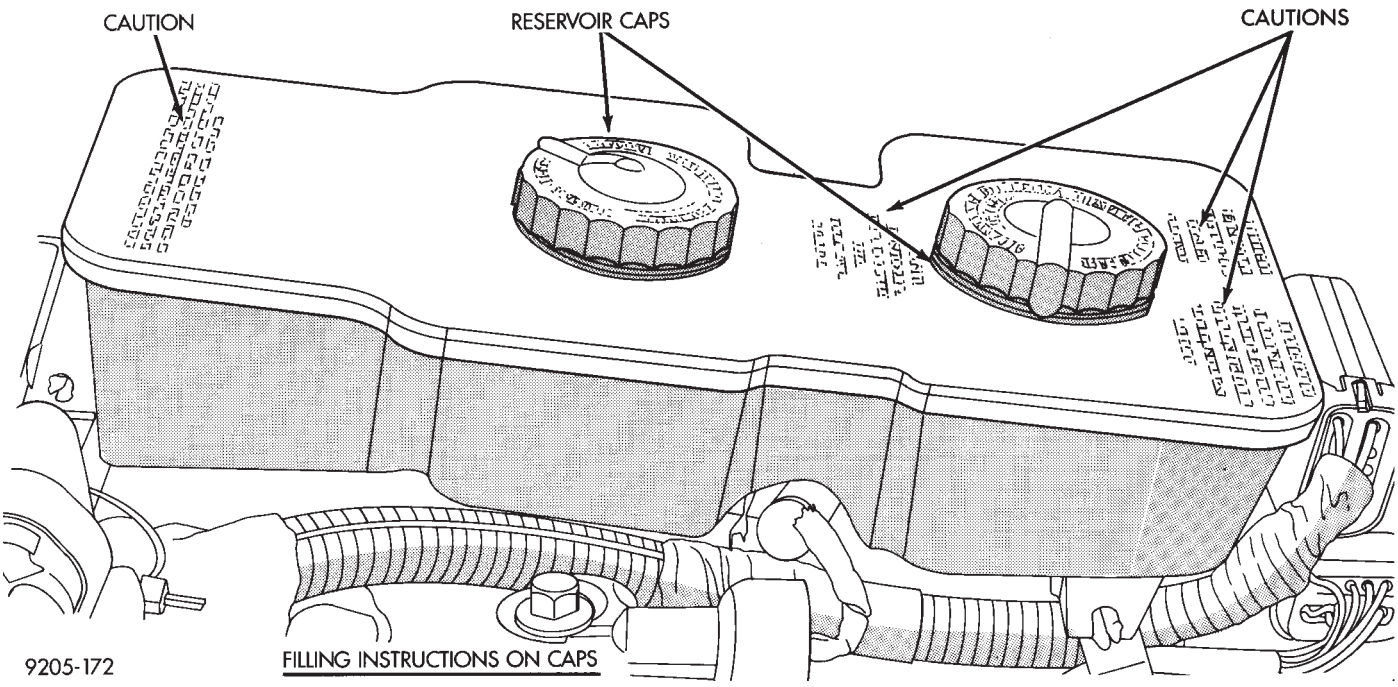

Fig. 2 Master Cylinder Fluid Level (W/ABS)

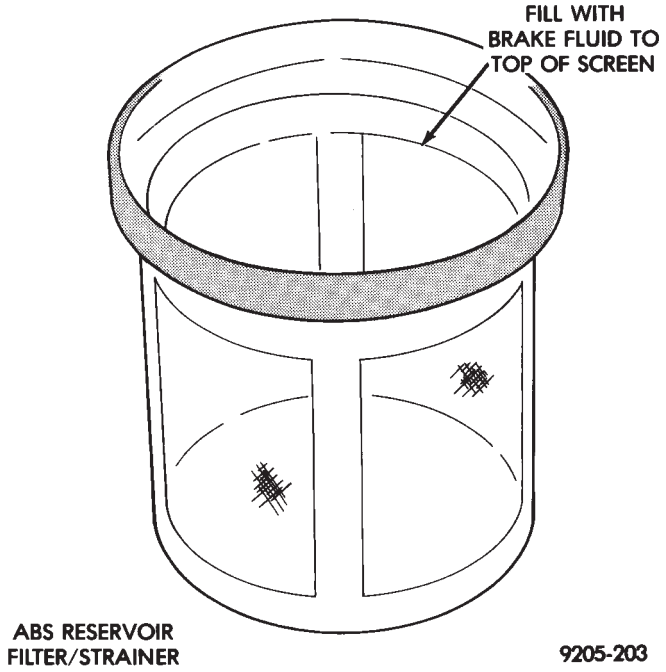

Fig. 3 ABS Reservoir Fill Level On Filter/Strainer

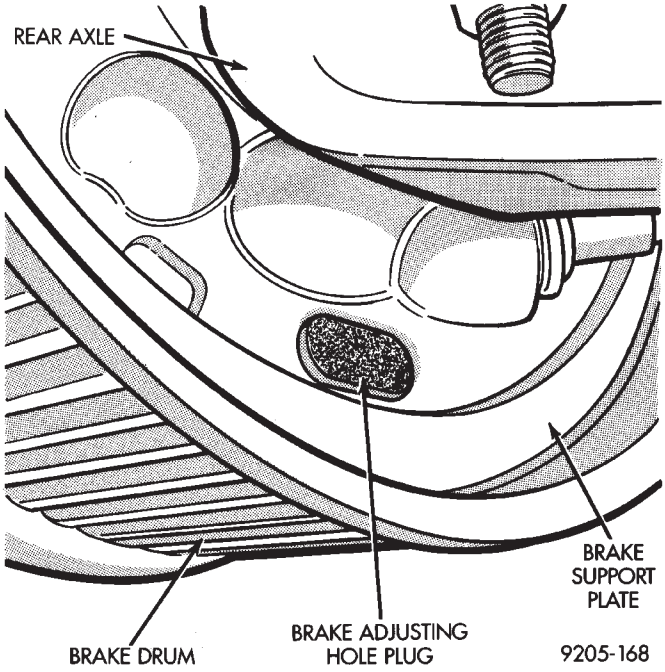

Fig. 4 Brake Adjusting Hole Plug

ver 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. 4) in rear brake supports.

(7) Adjust parking brake **after** wheel brake adjustment. See parking brake adjustment, under Parking Brakes in this group of the service manual.

It is important to follow the above sequence to avoid the possibility of the parking brake system causing brake drag. This could occur if the parking brakes are adjusted before the service brakes.

TESTING APPLICATION ADJUSTER OPERATION

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

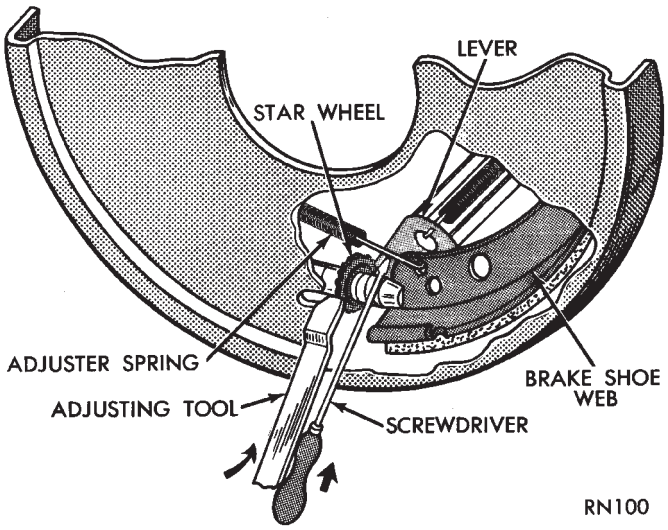

Fig. 5 Brake Drum Adjustment With Tool C-3784

support plate (Fig. 4) to provide access to the adjuster star wheel. Then, to eliminate the possibility of maximum adjustment, where the adjuster does not operate because the closest possible adjustment has been reached. Back the star wheel off approximately 30 notches. It will be necessary to hold the adjuster lever away from the star wheel to permit this adjustment.

Spin the wheel and brake drum in the reverse direction, and with a greater than normal force apply the brakes suddenly. This sudden application of force will cause the secondary brake shoe to leave the anchor. The wrap up effect will move the secondary shoe, and the cable will pull the adjuster lever up. Upon application of the brake pedal, the lever should move upward, 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.

BLEEDING BRAKE SYSTEM

CAUTION: For bleeding of the Anti-Lock brake hydraulic system. See the Anti-Lock Brake system service procedures in this group which refers to the particular Anti-Lock brake system being serviced.

PRESSURE BLEEDING

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

CAUTION: Use bleeder tank Special Tool C-3496-B with adapter Special Tool C-4578 to pressurize the system for bleeding.

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. 6). 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.

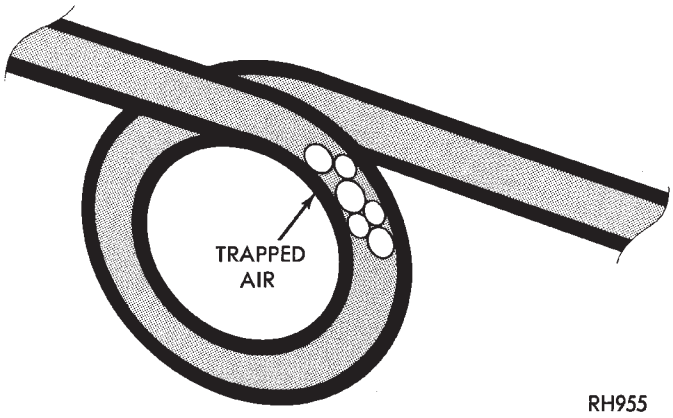

Fig. 6 Trapped Air in Brake Line

To bleed the brake system. Attach a clear plastic hose to the bleeder screw at one wheel and feed the hose into a clear jar containing fresh brake fluid (Fig. 7).

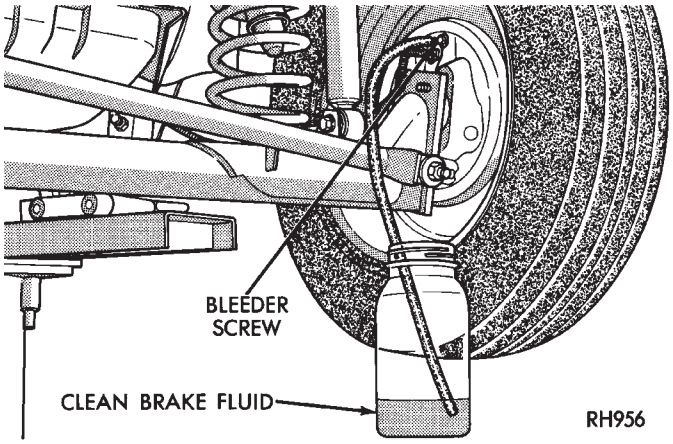

Fig. 7 Proper Method for Purging Air From Brake System (Typical)

Next, open the bleeder screw at least **one full turn** or more to obtain an adequate flow of brake fluid (Fig. 8).

CAUTION: Just cracking the bleeder screw often restricts fluid flow, and a slow, weak fluid discharge will NOT get all the air out.

After 4 to 8 ounces of fluid has been bled through the brake system. And an air-free flow is maintained in the clear plastic hose and jar, this will indicate a good bleed.

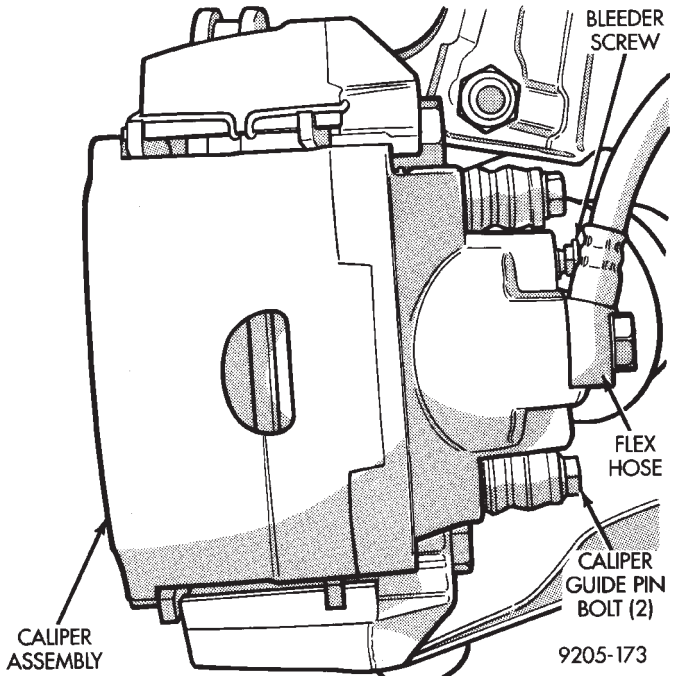

Fig. 8 Open Bleeder Screw at Least One Full Turn (Typical)

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.

BLEEDING WITHOUT A PRESSURE BLEEDER

If a pressure bleeder is not available. A good brake fluid flow can be obtained by manual bleeding of the brake hydraulic system, following these steps.

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

(2) Then open the bleeder screw at least 1 full turn. When the bleeder screw opens the brake pedal will drop all the way to the floor.

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

(4) Repeat steps 1 through 3, four or five times, at each bleeder screw. This should pass a sufficient amount of fluid to expel all the trapped air from the brake system. Be sure to monitor the fluid level in the master cylinder, so it stays at a proper level so air will not reenter the brake system through the master cylinder.

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

TEST FOR 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 small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil contamination.

If contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals and all hoses.

WHEEL STUD NUT TIGHTENING

When tightening wheel stud nuts, a criss-cross tightening sequence should be followed (Fig. 9).

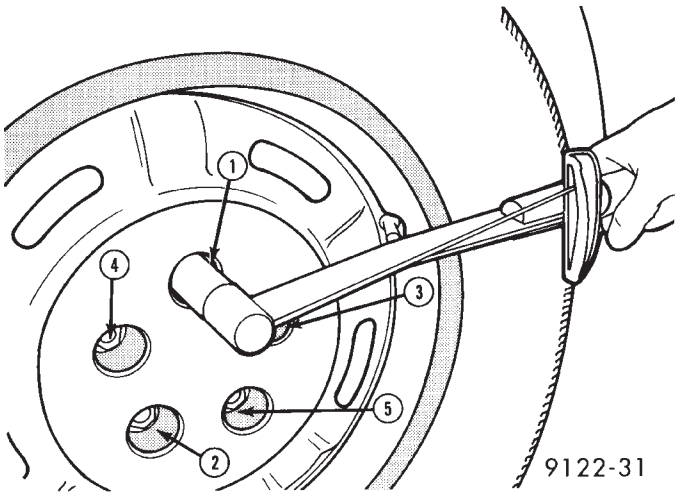

Fig. 9 Wheel Stud Nut Tightening Sequence

Tighten all stud nuts to one-half specified torque. Repeat, fully tightening to 129 N●m (95 ft. lbs.).

BRAKE HOSE AND TUBING

INSPECTION OF BRAKE HOSE AND TUBING

Flexible rubber hose is used at both front brakes and at the rear axle. 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, or worn spots. Should the fabric casing of the rubber hose be 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 and wheel, tire or chassis interference (Figs. 10, 11 and 12).

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

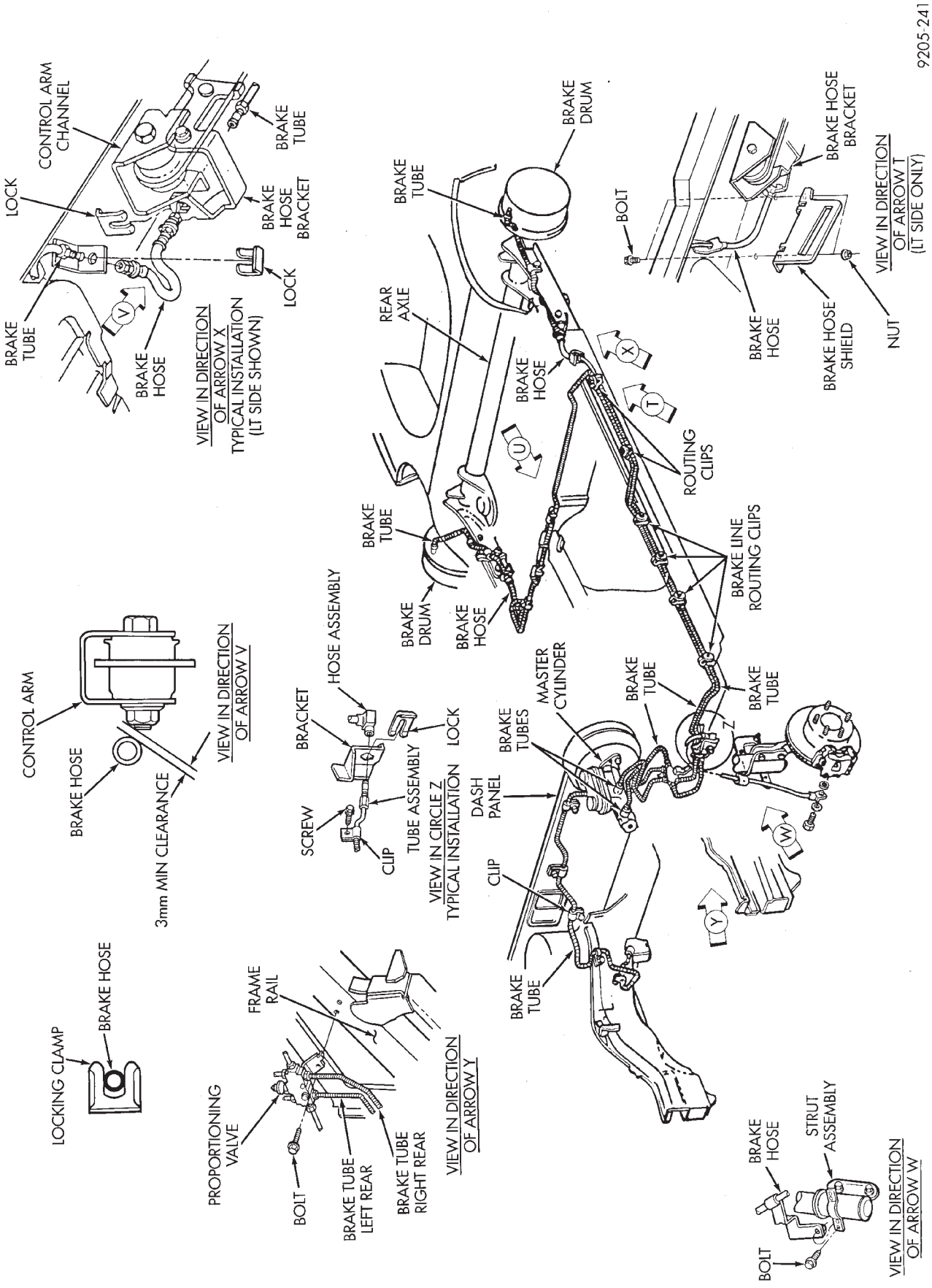

FIG. 10 BRAKE LINE ROUTING NON ABS BRAKES

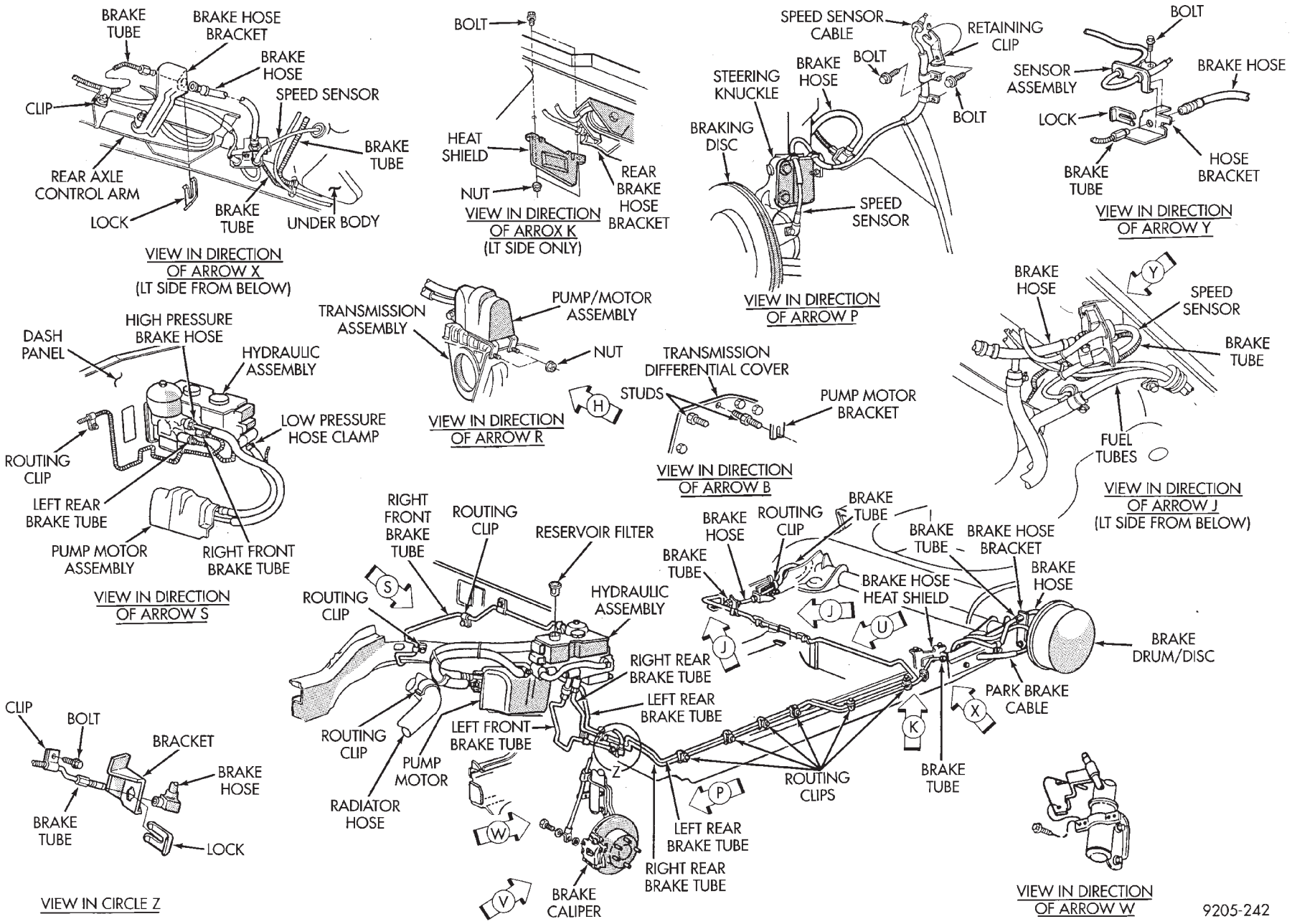

FIG. 11 BRAKE LINE ROUTING WITH ANTI-LOCK 10 BRAKES

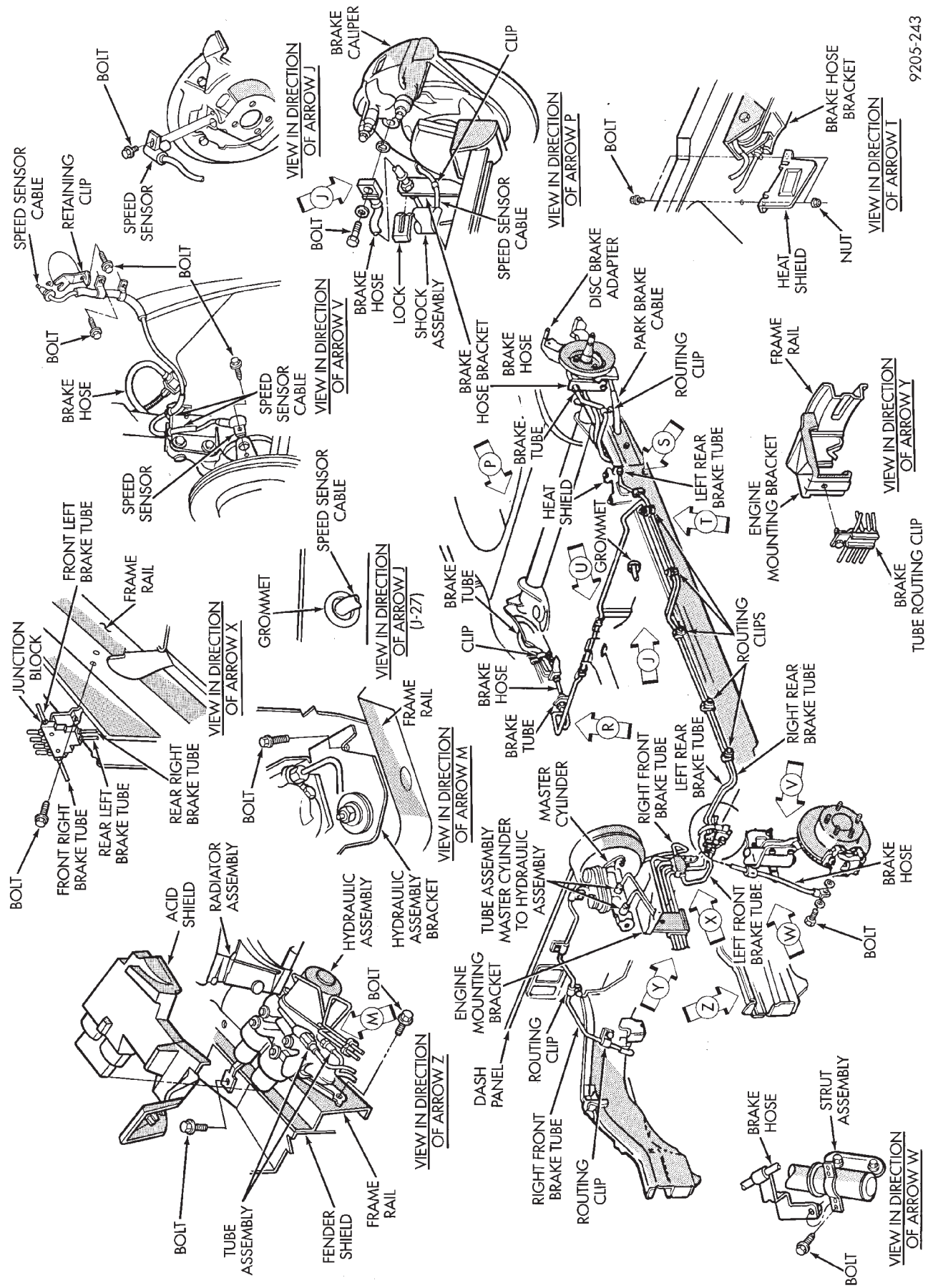

FIG. 12 BRAKE LINE ROUTING WITH ANTI-LOCK 6 BRAKES

INSTALLATION OF BRAKE HOSE

Always use factory recommended brake hose 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. **Front right and left side hoses are not interchangeable.**

Connections should be correct and properly made. 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 the body bracket and steel brake tubing. Tighten all fittings to specified torque. The body bracket and hose end are keyed so that they will only fit one way.

Install rear brake hoses first to the trailing arm tubes and then to the floor pan tubes. Minimize hose twisting. Vehicles equipped with rear disc brakes have brake hoses attached to the caliper on each side. The brake hose should be first attached by the Banjo bolt to the caliper and then secured to the hose bracket with the retaining clip. Then attach the steel brake tubing to the hose fitting.

REPAIR AND INSTALLATION OF BRAKE TUBING

Only double wall 4.75mm (3/16 in.) steel tubing should be used for replacement. Care should 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.

TYPES OF TUBING FLARES

Two different tubing flares (Fig. 13) are used on 92 M.Y. vehicles. On all ABS brake systems the tubing connections made to the hydraulic assembly use an ISO flare. All other ABS brake system component, tubing connections are made using a double inverted flare. On non-ABS brake systems all component tubing connections use only the double inverted flare. No ISO flares are used.

CAUTION: ALWAYS USE THE PROPER FLARING TOOL AND PROCEDURE, FOR THE TYPE OF BRAKE SYSTEM THAT IS BEING SERVICED TO INSURE THE INTEGRITY OF THE HYDRAULIC SYSTEM.

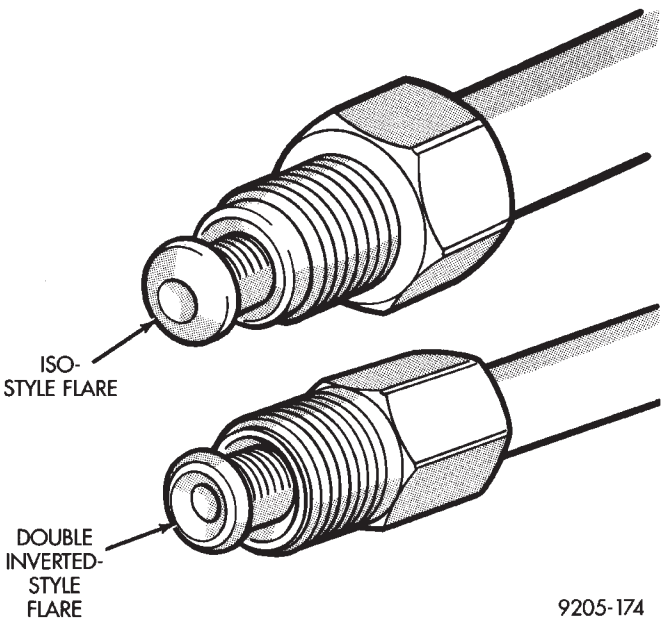

Fig. 13 Identifying Hydraulic Brake Tubing Flares

TO REPAIR OR FLARE TUBING

Using Tubing Cutter, Special Tool C-3478-A or equivalent, cut off damaged seat or tubing (Fig. 14). Ream out any burrs or rough edges showing on inside of tubing (Fig. 15). This will make the ends of tubing square (Fig. 15) and ensure better seating of flared end tubing. **PLACE TUBE NUT ON TUBING BEFORE FLARING THE TUBING.**

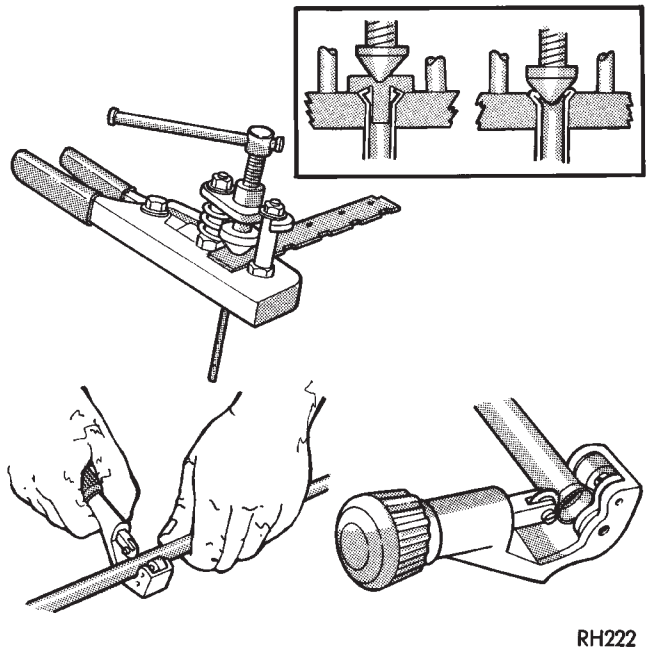

Fig. 14 Cutting and Flaring of Brake Line Tubing

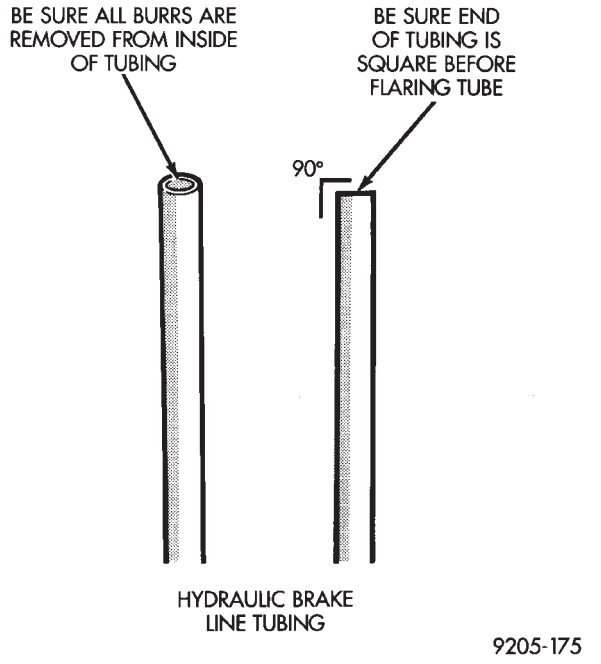

Fig. 15 Brake Tube Preparation For Flaring

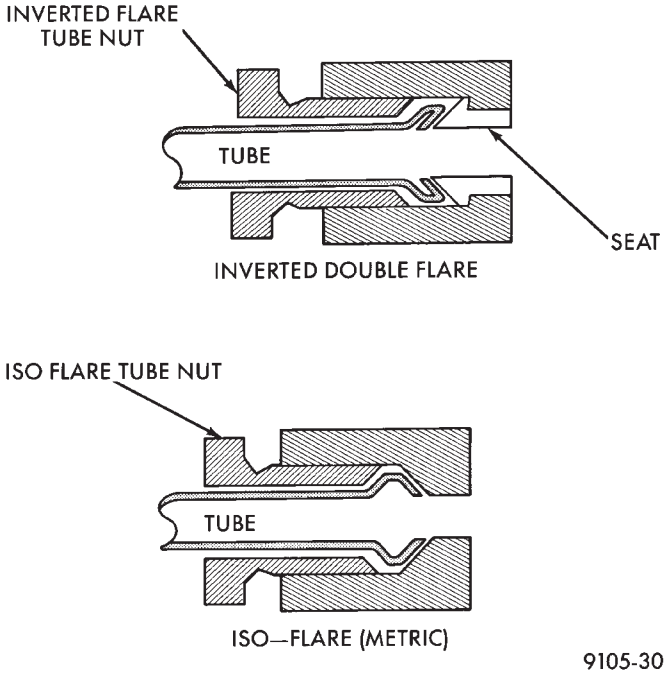

Fig. 16 Double Flare And ISO-Flare Tubing Connections

DOUBLE INVERTED TUBING FLARES.

To make a double inverted tubing flare (Figs. 13 and 16). 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.

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 routing diagrams (Figs. 10 to 12) for proper routing and clip location. Replace any damaged tube routing clips.

ISO TUBING FLARES

CAUTION: All ISO style tubing flares (Figs. 13 and 16) are of metric dimensions. When performing any service procedures on vehicles using ISO style tubing flares, metric size tubing of 4.75 mm MUST be used with metric ISO tube flaring equipment.

To create a (metric) ISO style tubing flare, Use Snap-On Flaring Tool TFM-428, or equivalent. See (Fig. 17) and proceed with the steps listed below. **Be sure to place the tubing nut on the tube before flaring the tubing.**

(1) Carefully prepare the end of the tubing to be flared. Be sure the end of the tubing to be flared is square and all burrs on the inside of the tubing are removed (Fig. 15). **This preparation is essential to obtain the correct form of a (metric) ISO tubing flare.**

(2) Open the jaws of the Flaring Tool. Align the mating size jaws of the flaring tool around the size of the tubing to be flared. Close the jaws of the Flaring Tool around the tubing to keep it from sliding out of the flaring tool, but do not lock the tubing in place. (See Fig. 17.)

(3) Position the tubing in the jaws of the Flaring Tool so that it is flush with the top surface of the flaring tool bar assembly. (See Fig. 17.)

(4) Install the correct size adaptor for the brake tubing being flared, on the feed screw of the yoke assembly. Center the yoke and adapter over the end of the tubing. Apply lubricant to the adapter area that contacts brake tubing. Making sure the adapter pilot is fully inserted in the end of the brake tubing. Screw in the feed screw of the yoke assembly until the adaptor has seated squarely on the surface of the bar assembly (Fig. 17). This process has created the (metric) ISO tubing flare.

STOP LAMP SWITCH ADJUSTMENT (ALL VEHICLES)

The stop lamp switch incorporates a self adjusting feature. If adjustment or replacement is required, proceed as follows: Install the switch in the retaining

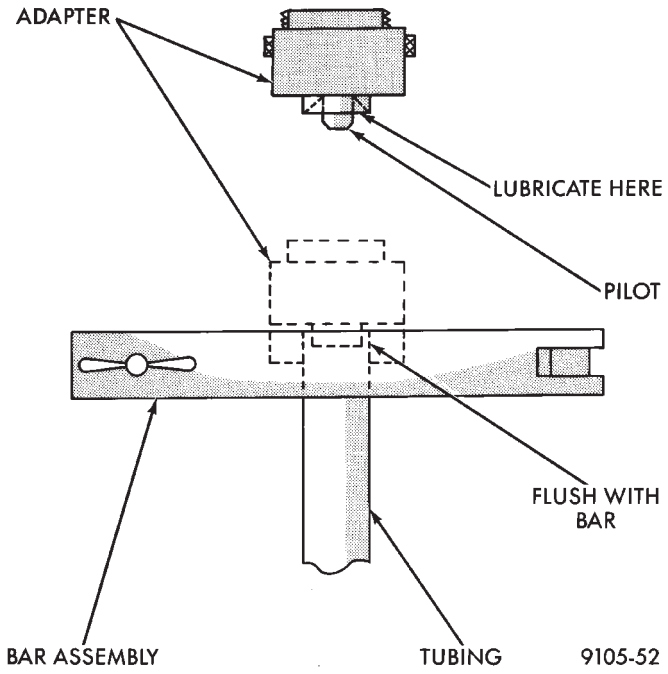

Fig. 17 ISO Tubing Flare Process

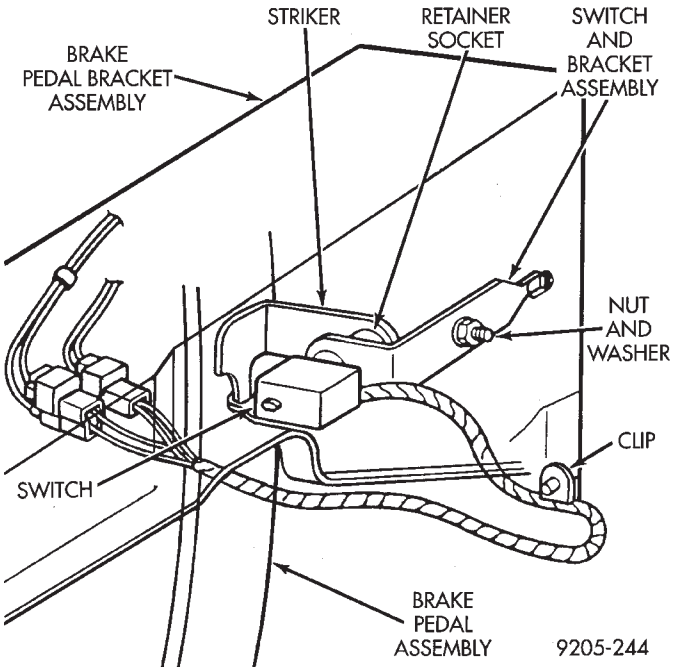

Fig. 18 Stop Lamp Switch

bracket and push the switch forward as far as it will go. The brake pedal will move forward slightly (Fig. 18). Gently pull back on the brake pedal bringing the striker back toward the switch until the brake pedal will go back no further. This will cause the switch to ratchet backward to the correct position. Very little movement is required, and no further adjustment is necessary.

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		
EXCESSIVE PEDAL TRAVEL	6	X	NO		O
PEDAL GOES TO 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 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 POSSIBLE CAUSE X: MOST LIKELY CAUSE O: POSSIBLE CAUSE

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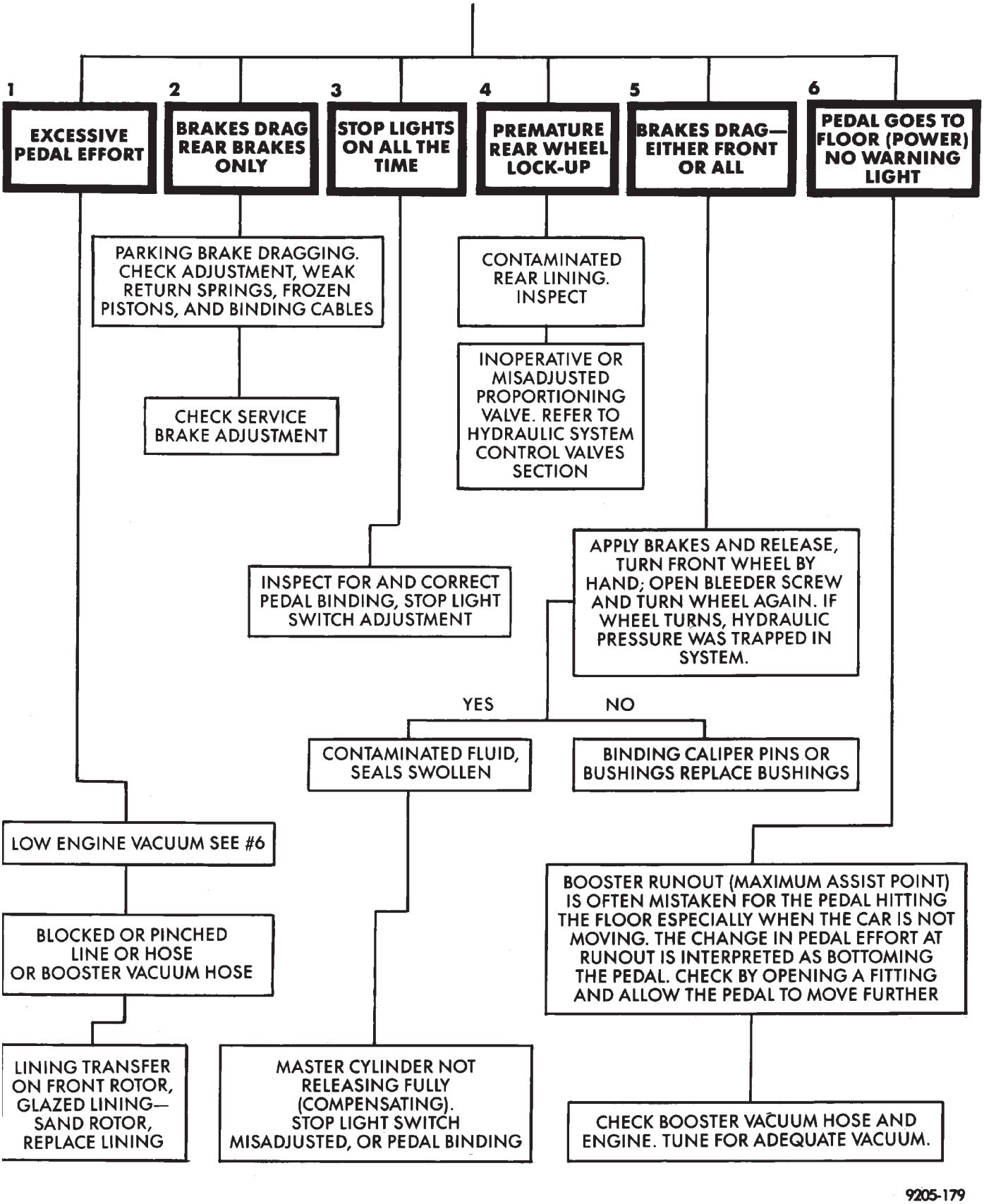
BRAKE SYSTEM DIAGNOSTICS

CHART 1 MISCELLANEOUS CONDITIONS



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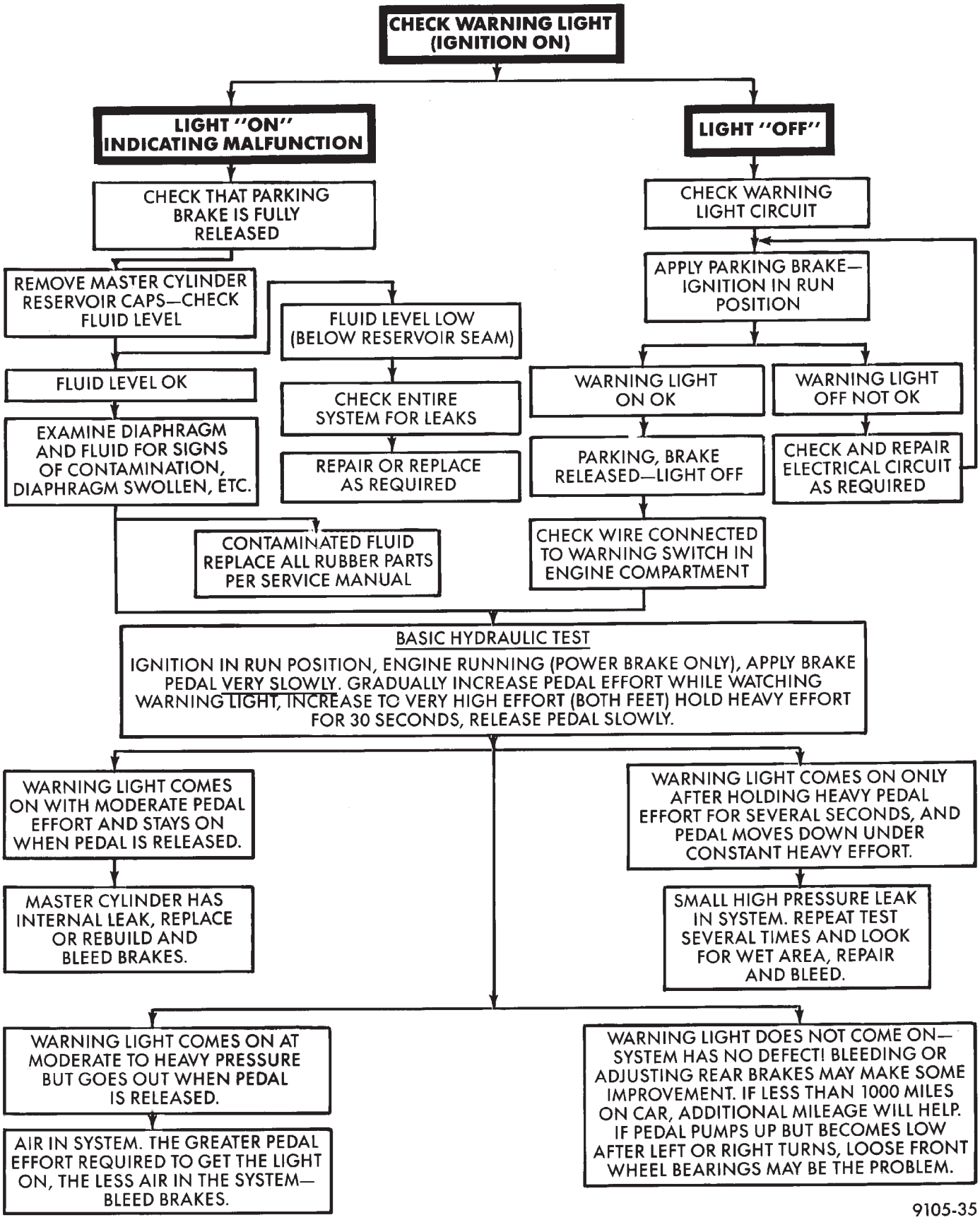
BRAKE SYSTEM DIAGNOSTICS

CHART 2 ACTUATION



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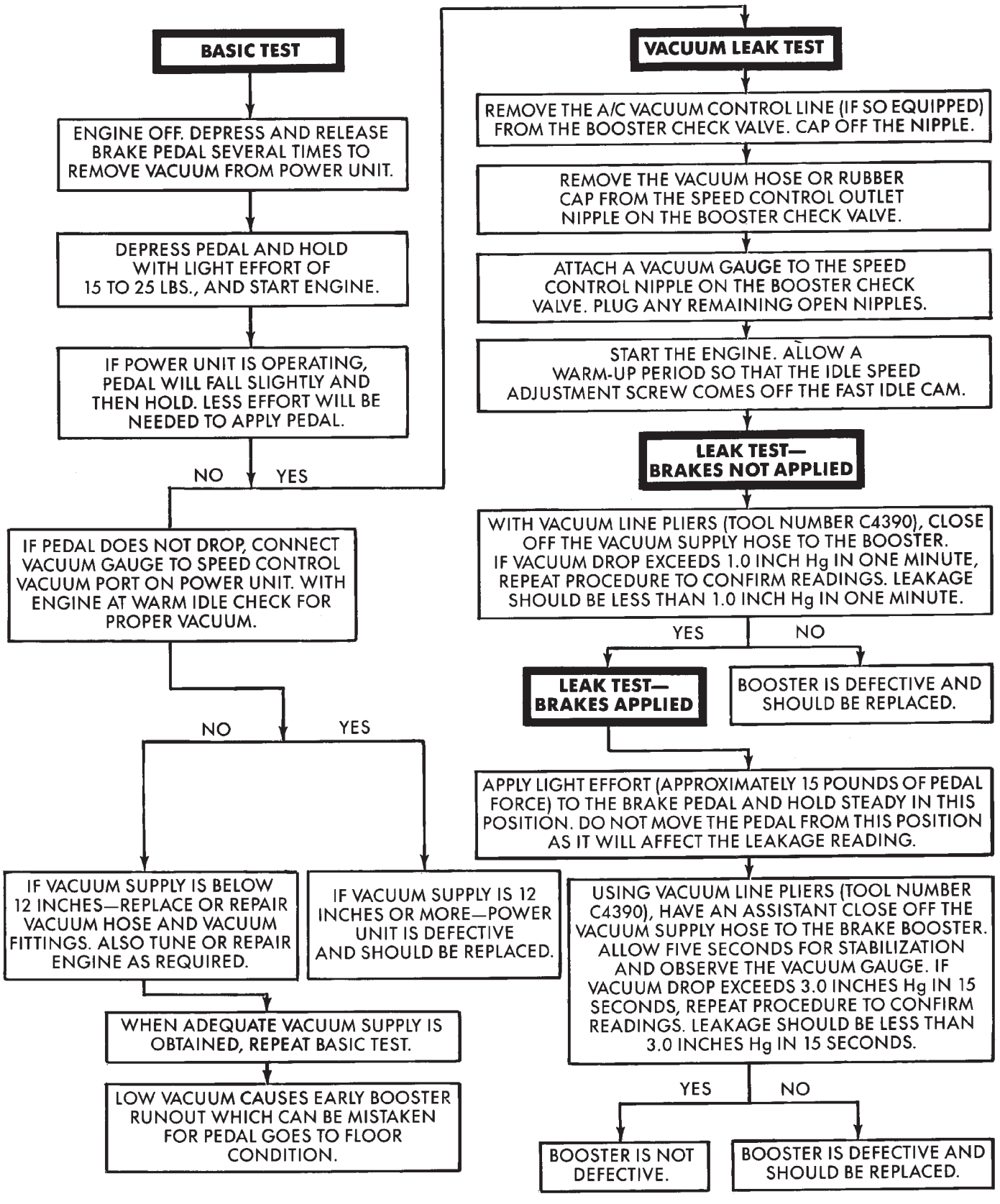
BRAKE SYSTEM DIAGNOSTICS

CHART 3 POWER BRAKES



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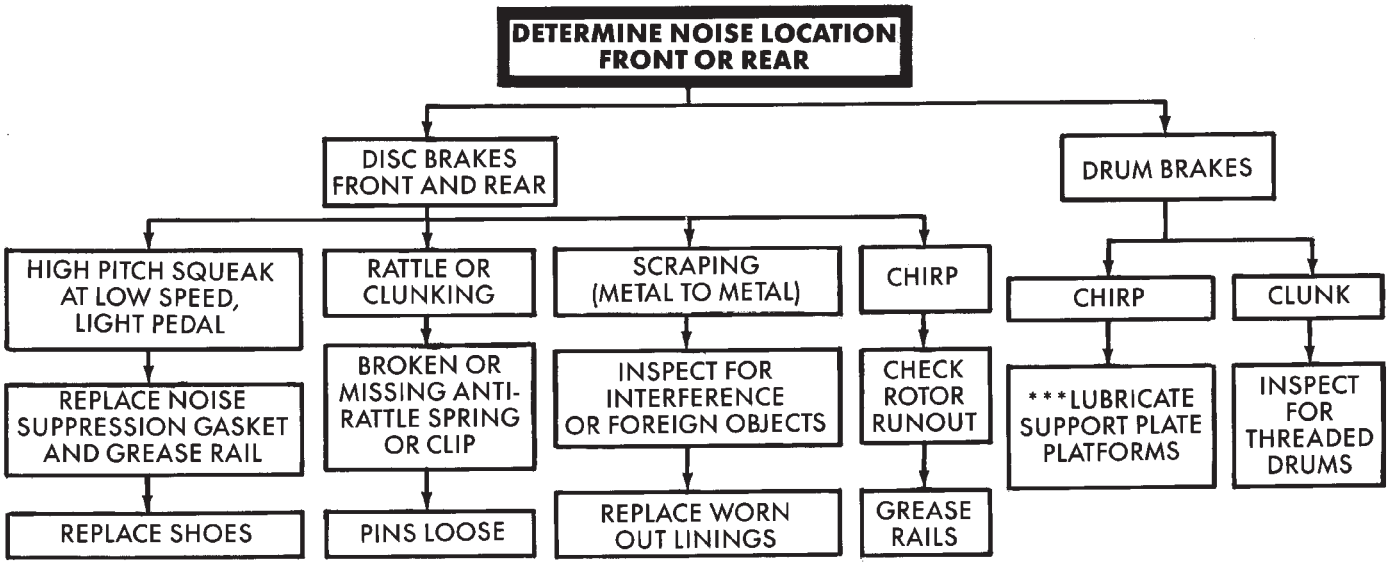
BRAKE SYSTEM DIAGNOSTICS

CHART 4 BRAKE NOISE

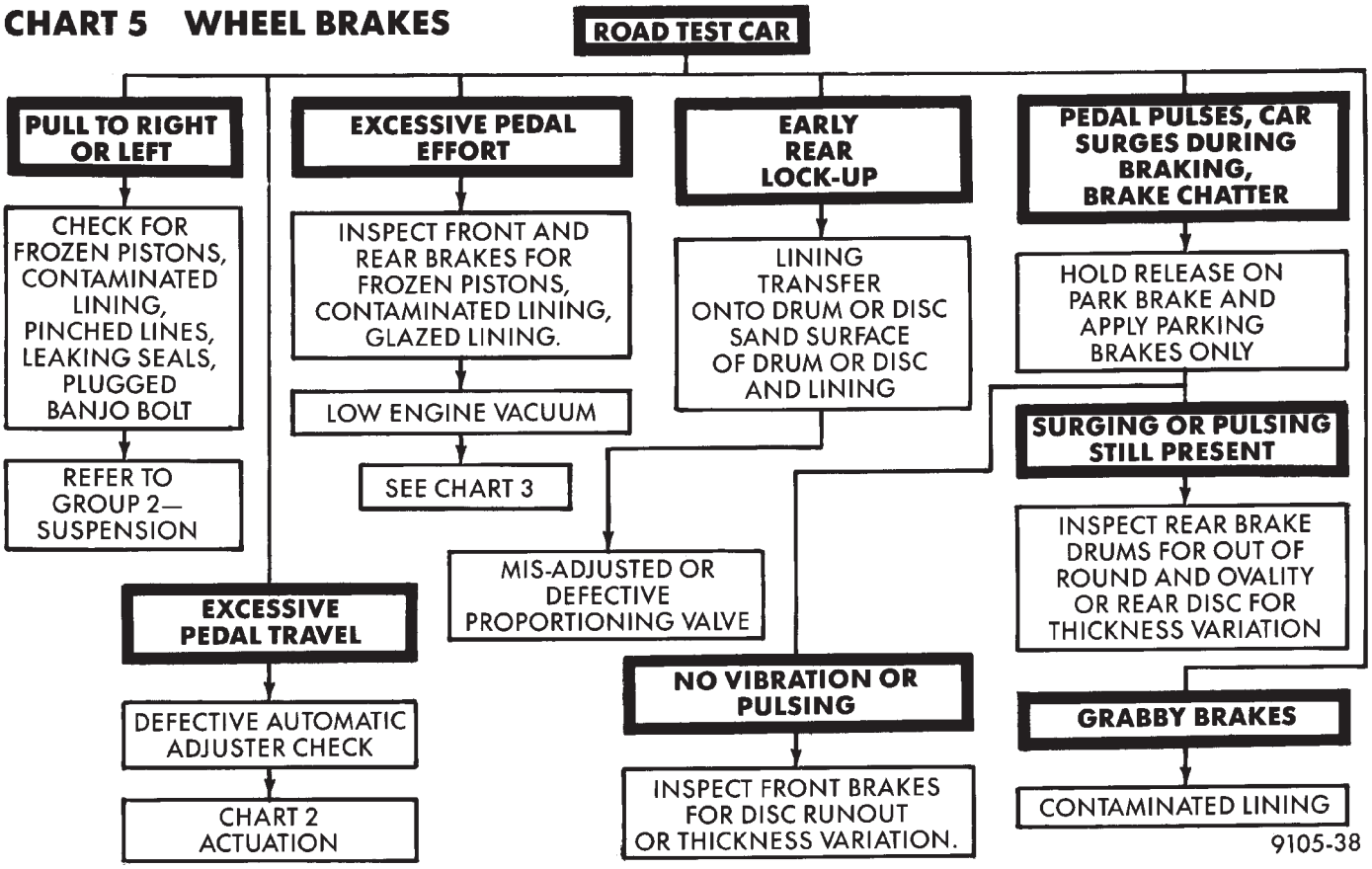


***MOPAR MULTIPURPOSE LUBRICANT, OR EQUIVALENT.

9105-37

BRAKE SYSTEM DIAGNOSTICS

CHART 5 WHEEL BRAKES



9105-38

REAR WHEEL DRUM BRAKES

INDEX

DESCRIPTION

Rear wheel drum brakes (Figs. 2 and 3) are two shoe, internal expanding type with an automatic adjuster screw assembly that is activated each time the brakes are applied. The automatic adjuster screw is located directly below the wheel cylinder as shown in figure (Figs. 2 and 3).

WARNING: DUST AND DIRT ON BRAKE PARTS GENERATED DURING THE NORMAL USE AND WEAR OF MOTOR VEHICLE BRAKE SYSTEMS CAN CONTAIN ASBESTOS FIBERS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM, SUCH AS ASBESTOSIS AND CANCER. EXTREME CARE SHOULD BE EXERCISED WHILE SERVICING BRAKE ASSEMBLIES OR COMPONENTS.

DO NOT CLEAN BRAKE ASSEMBLIES OR COMPONENTS WITH COMPRESSED AIR OR BY DRY BRUSHING; USE A VACUUM CLEANER SPECIFICALLY RECOMMENDED FOR USE WITH ASBESTOS FIBERS. IF A SUITABLE VACUUM CLEANER IS NOT AVAILABLE, CLEANING SHOULD BE DONE WET USING A WATER DAMPENED CLOTH.

DO NOT CREATE DUST BY SANDING, GRINDING, AND/OR SHAVING BRAKE LININGS OR PADS UNLESS SUCH OPERATION IS DONE WHILE USING PROPERLY EXHAUST VENTILATED EQUIPMENT.

DISPOSE OF ALL DUST AND DIRT SUSPECTED TO CONTAIN ANY ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE DUST EXPOSURE TO YOURSELF AND OTHERS.

FOLLOW ALL RECOMMENDED PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY. FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DIRT WHICH MAY CONTAIN ASBESTOS FIBERS.

SERVICE PROCEDURES

REAR BRAKE DRUM REMOVAL

Further clearance can be obtained by backing off the brake automatic adjuster screw. Remove rubber plug from the top of the support plate and rotate the automatic adjuster screw assembly with an upward motion, using the Brake Adjuster, Special Tool C-3784.

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

Remove wheel bearing grease cap (Fig. 1).

Remove cotter pin, lock nut, retaining nut and washer (Fig. 1).

Remove brake drum and hub and bearing assembly from the rear spindle (Fig. 1).

Inspect brake linings for wear, shoe alignment and contamination.

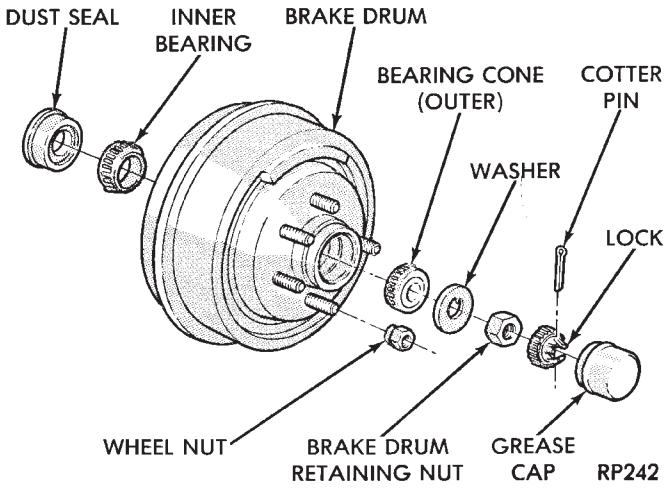


Fig. 1 Brake Drum and Hub Assembly

BRAKE DRUM INSTALLATION

Install brake drum and hub and bearing assembly on rear spindle.

Install outer wheel bearing, thrust washer and nut.

Tighten wheel bearing adjusting nut to 27 to 34 N•m (240 to 300 in. lbs.) torque while rotating hub. This seats the bearings.

Back off adjusting nut 1/4 turn (90°) then tighten adjusting nut finger tight.

Position lock on nut with one pair of slots in-line with cotter pin hole. Install cotter pin.

Install grease cap and wheel and tire assemblies. Tighten wheel stud nuts to 129 N•m (95 ft. lbs.) torque on all models. Install wheel covers.

BRAKE SHOE ASSEMBLIES

Two brake shoe assemblies are used. Vehicles will have axle sets of either Kelsey Hayes (Fig. 2), or Varga (Fig. 3). Varga brake shoes are HANDED for right or left side.

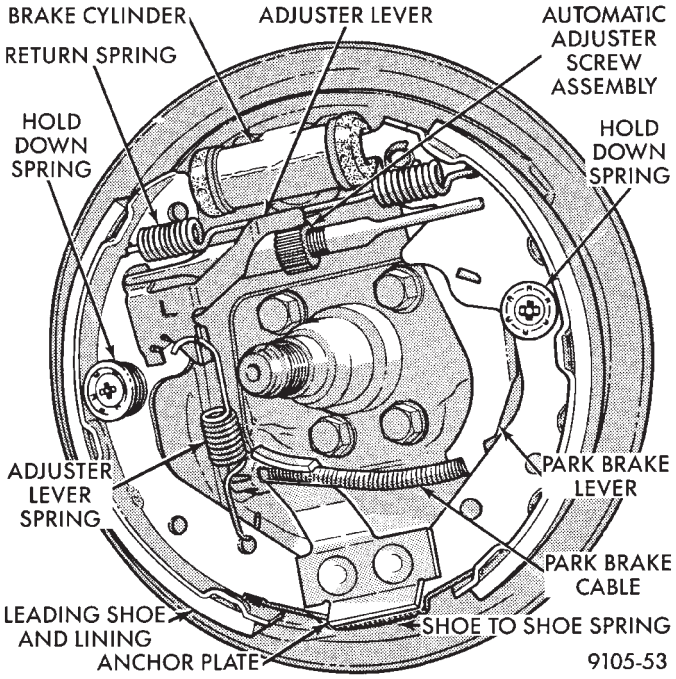


Fig. 2 Kelsey Hayes (Left) Rear Wheel Brake

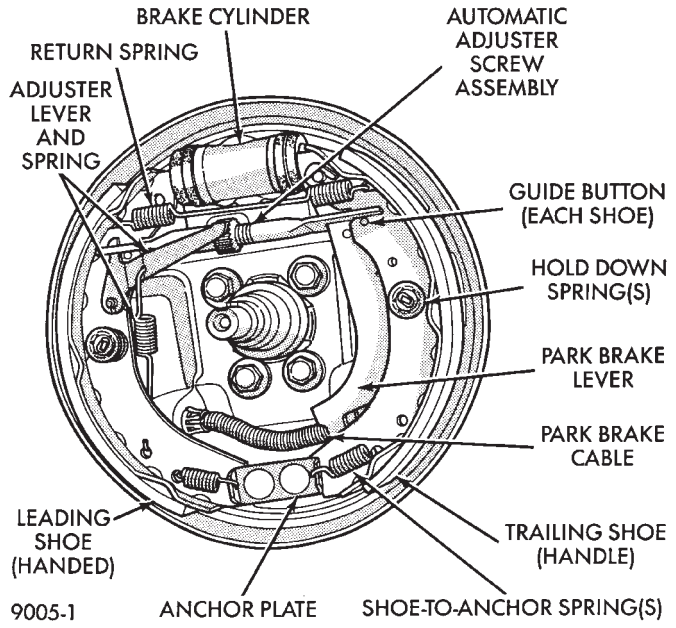


Fig. 3 Varga (Left) Rear Wheel Brake

Except for shoe to anchor plate, park brake lever retention and automatic adjuster positioning guide buttons the service procedures for either assembly (except as noted) are essentially the same.

REMOVAL

Remove automatic adjuster spring and lever (Fig. 4).

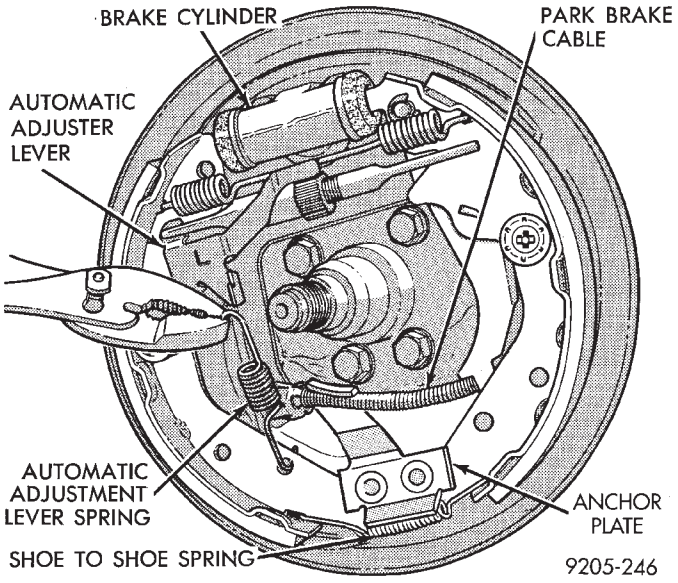


Fig. 4 Remove or Install Adjuster Lever Spring

Rotate the automatic adjuster screw assembly so that each shoe assembly moves out far enough to be free from the wheel cylinder boots (Fig. 5).

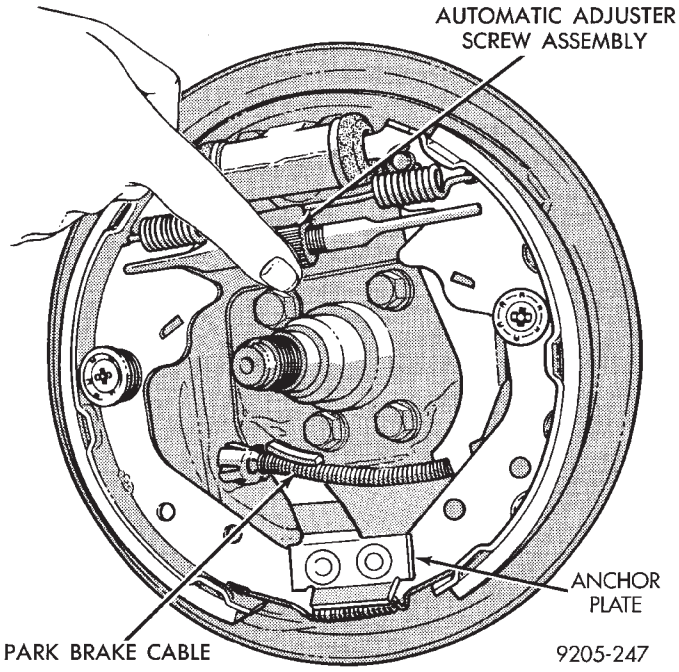


Fig. 5 Expand or Retract Adjuster Screw

Disconnect the parking brake cable from the parking brake lever (Fig. 6).

Kelsey Hayes—Leading/trailing shoes; Remove holddown springs (Fig. 7). Pull assembly down and

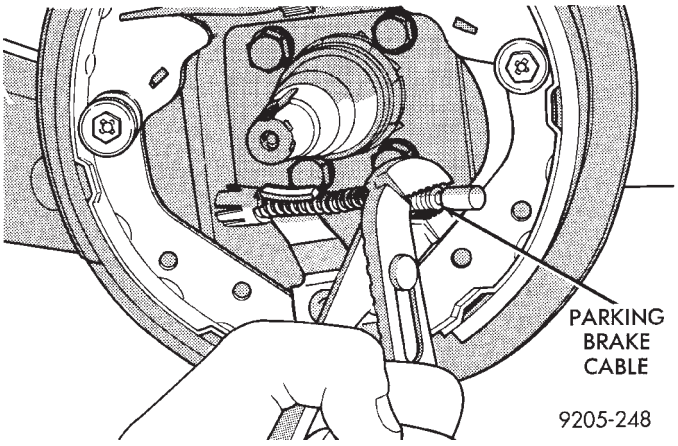


Fig. 6 Disconnect Parking Brake Cable

away to remove shoes from support plate (Fig. 8). Remove brake shoe springs and adjusting screw assembly.

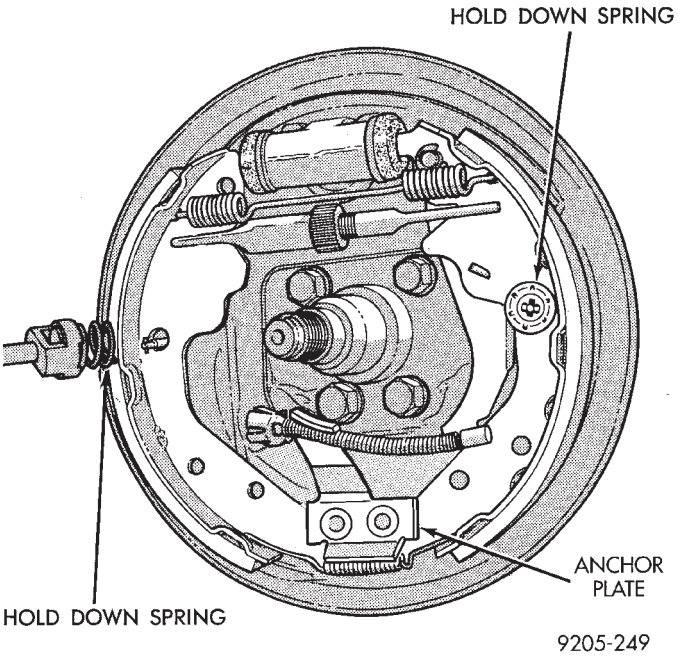


Fig. 7 Remove or Install Holddown Springs

Varga—Leading shoe; Remove the upper shoe to shoe return spring (Fig. 3). The leading shoe hold down spring (Fig. 7). And the shoe to shoe spring at the anchor plate (Fig. 3). Remove shoe and adjuster assembly.

Varga—Trailing shoe; Remove holddown spring and lower shoe-to-anchor plate spring.

Kelsey Hayes: Remove park brake lever from trailing brake shoe by disengaging the retainer clip (Fig. 9). Be sure not to lose park brake lever wave washer.

Varga: Remove park brake lever from trailing brake shoe by prying retainer tangs apart. Discard retainer (Fig. 9). New retainers are provided with service kit. Be sure not to lose park brake lever wave washer.

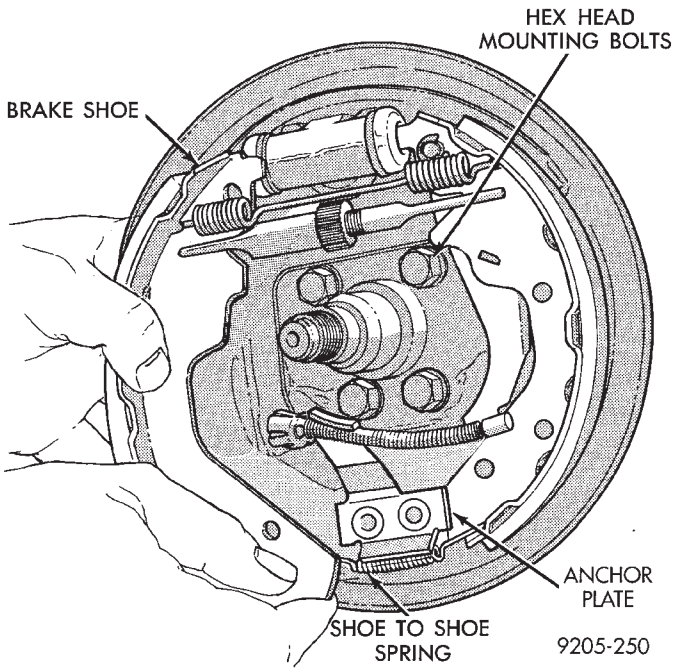


Fig. 8 Remove or Install Brake Shoes

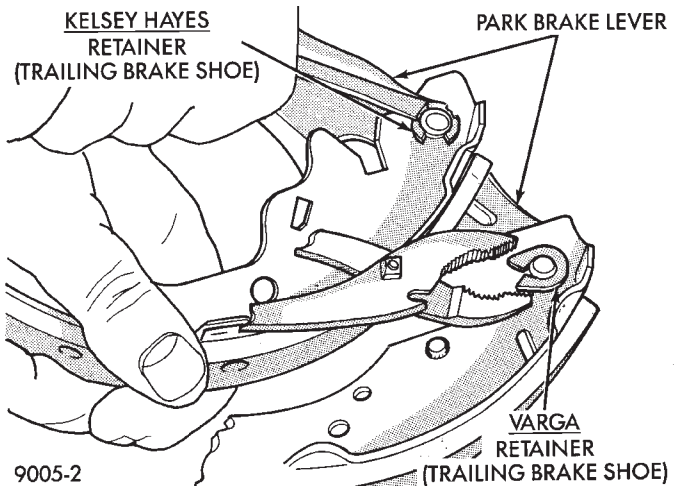


Fig. 9 Remove or Install Park Brake Lever Retainer

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 maybe 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. 10). Replace adjusting screw if corroded.

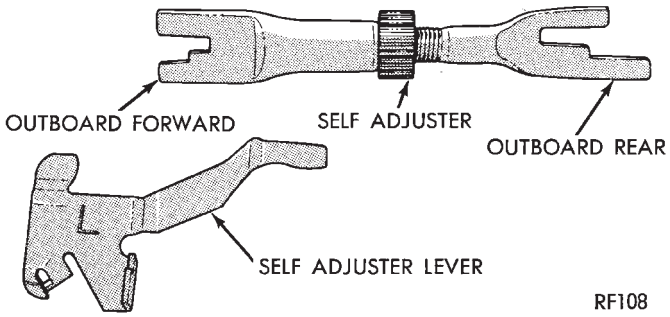


Fig. 10 Adjuster Screw and Lever (Typical)

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

BRAKE SHOE INSTALLATION

Lubricate the eight shoe contact areas on the support plate and anchor using Mopar Multi-Purpose Lubricant or equivalent (Fig. 11).

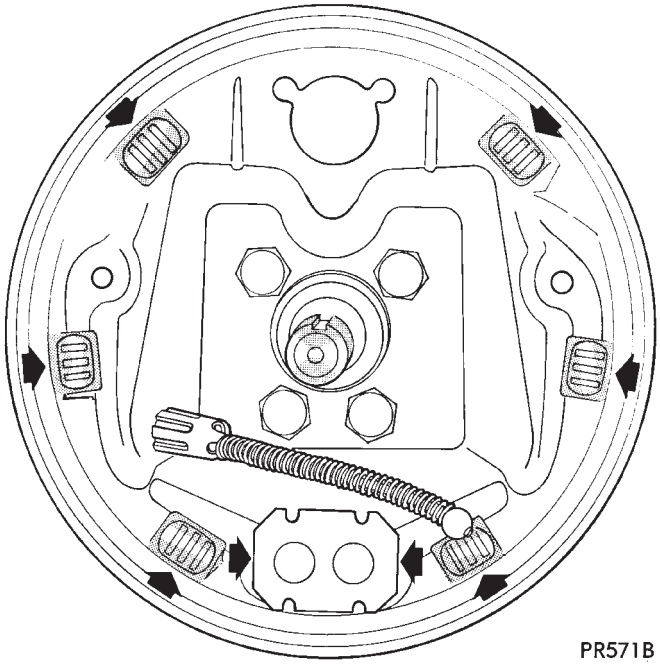


Fig. 11 Shoe Contact Areas on Support Plate

KELSEY HAYES REASSEMBLE

Assemble the park brake lever and wave washer to the new replacement shoe (Fig. 9).

Attach upper return spring between the two new shoe assemblies.

Apply a small amount of Mopar Multi-Purpose Lubricant or equivalent to the automatic adjuster screw assembly. Install adjuster with the two stepped forks facing toward the outboard side of the shoes (Fig. 10). The longer fork will be pointing to the rear.

Connect the lower shoe to shoe spring.

Expand the automatic adjuster so that the end of the shoes will clear the wheel cylinder boots. Position the brake shoe assemblies on support plate and install holddown springs (Fig. 7).

Install self adjuster lever and spring.

Connect park brake cable.

Adjust brake shoes so that they will not interfere with the drum installation.

CAUTION: Make sure the adjuster screw nut contacts the adjuster tubular strut.

Install the drums and pump the brake pedal several times to partially complete the shoe adjustment.

After adjusting the Parking brake cable (see Adjusting Parking Brake), road test vehicle. The automatic adjuster will continue the brake adjustment during the test.

VARGA REASSEMBLE

Assemble the park brake lever and wave washer to the new trailing shoe. Install retainer and close retainer ends (Fig. 9).

Install park brake cable in park brake lever of trailing shoe.

Attach trailing shoe, then leading shoe lower springs to shoes and anchor plate.

Position shoes on support plate and install holddown springs.

Install automatic adjusters. **Left side adjuster has left hand threads and right side adjuster has right-hand threads. Do not interchange sides.** Make sure adjuster is installed correctly. (Adjuster ends must be above extruded pins in web of shoe as shown in Fig. 3).

Install upper shoe to shoe spring. Ensure that the spring terminal ends are fully engaged in the shoe webs.

Rotate serrated adjuster nut to remove free play from the adjuster assembly.

Install the adjuster lever on the leading shoe pivot pin. Then attach the short end of the adjuster spring into the hole on the lever. Then install the long end of the spring in the leading shoe hole.

Connect park brake cable and adjust brake shoes so as not to interfere with drum installation.

BRAKE DRUM REFACING

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 drums will show markings of maximum allowable diameter (Fig. 12).

Using suitable tool, remove grease seal from drum hub. Clean, inspect and pack wheel bearings. Install new seal (Fig. 13). See Wheel Bearings section in

this group of the service manual for detailed information on the wheel bearings, and service procedures.

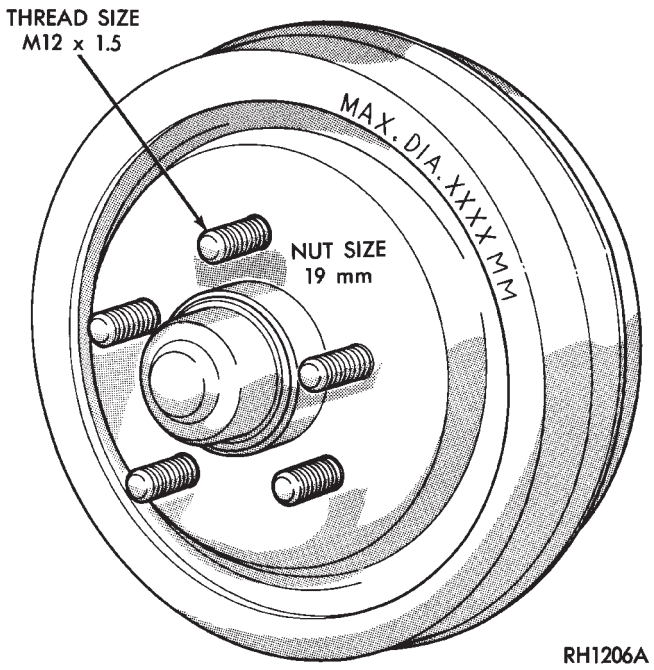


Fig. 12 Maximum Drum Diameter Identification

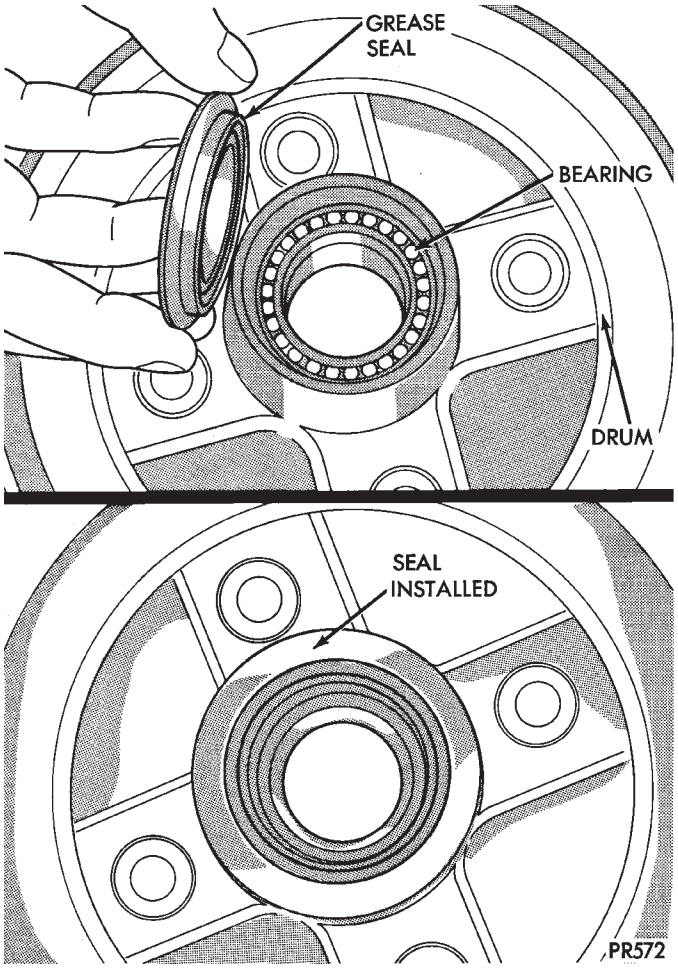


Fig. 13 Installing Grease Seal

WHEEL CYLINDERS

INDEX

GENERAL INFORMATION

The piston boots are of the push-on type and prevent moisture from entering the wheel cylinder.

To perform service operations or inspections of the rear wheel brake cylinders. It will be necessary to remove the cylinders from the support plate and disassemble on the bench.

CAUTION: Wheel cylinders with cup expanders must have cup expanders after any service procedures (reconditioning or replacement).

SERVICE PROCEDURES

REMOVING WHEEL CYLINDERS FROM BRAKE SUPPORT PLATES

With brake drums removed, inspect the wheel cylinder boots for evidence of a brake fluid leak. Then block the brake pedal in the stroke position, and 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. (A slight amount of fluid on the boot may not be a leak, but maybe preservative fluid used at assembly.)

(1) In case of a leak, remove brake shoes, (replace if soaked with grease or brake fluid.)

(2) Disconnect brake tube from wheel cylinder (Fig. 1).

(3) Remove the rear wheel cylinder attaching bolts (Fig. 1). Then pull wheel cylinder assembly off the brake support plate (Fig. 2).

DISASSEMBLING WHEEL CYLINDERS

To disassemble the wheel cylinders, (Fig. 3) proceed as follows:

(1) Pry boots away from cylinders and remove.

(2) Press **IN** on one piston to force out opposite piston, cup and spring (with cup expanders). 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 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.)

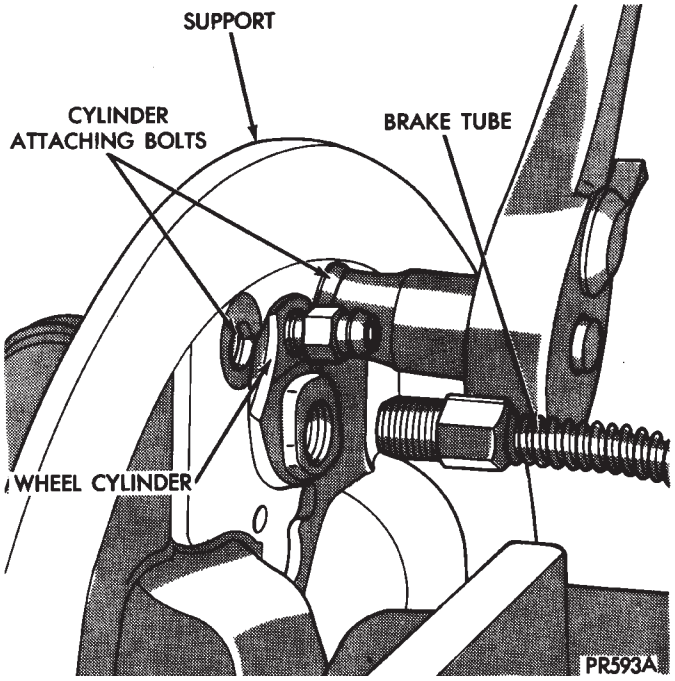


Fig. 1 Brake Tube Disconnected

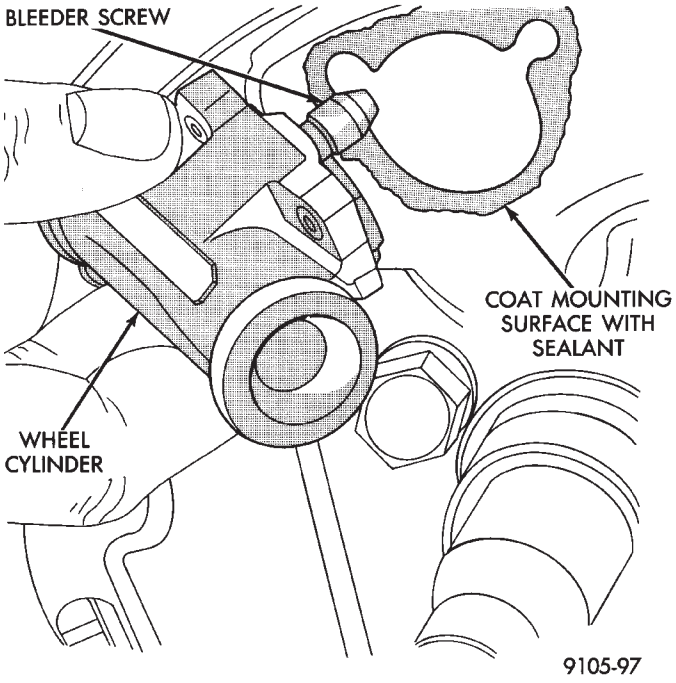


Fig. 2 Remove or Install Wheel Cylinder

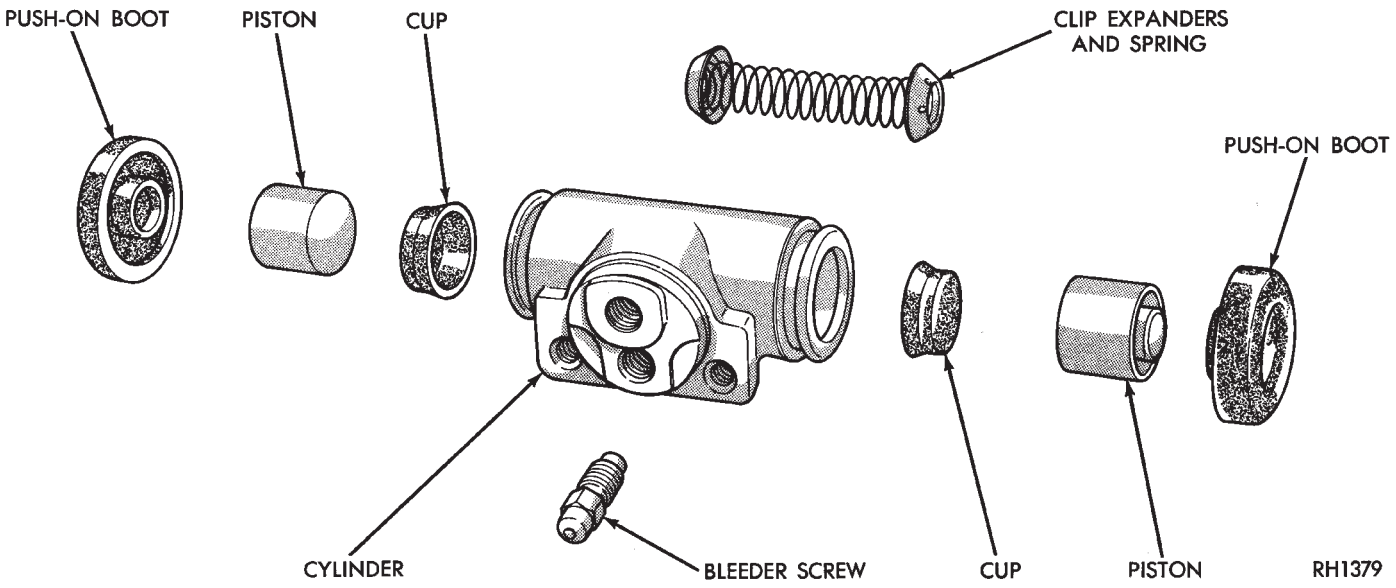


Fig. 3 Rear Wheel Cylinder

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.

ASSEMBLING WHEEL CYLINDERS

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

(3) Install piston in each end of cylinder having the flat face of each piston contacting the flat face of each cup, already installed (Fig. 3).

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

INSTALLING WHEEL CYLINDERS

(1) Apply Mopar® Gasket In-A-Tube or equivalent sealant around wheel cylinder mounting surface (Fig. 4).

(2) Install wheel cylinder onto brake support, and tighten the wheel cylinder to brake support plate attaching bolts to 8 N●m (75 in. lbs.).

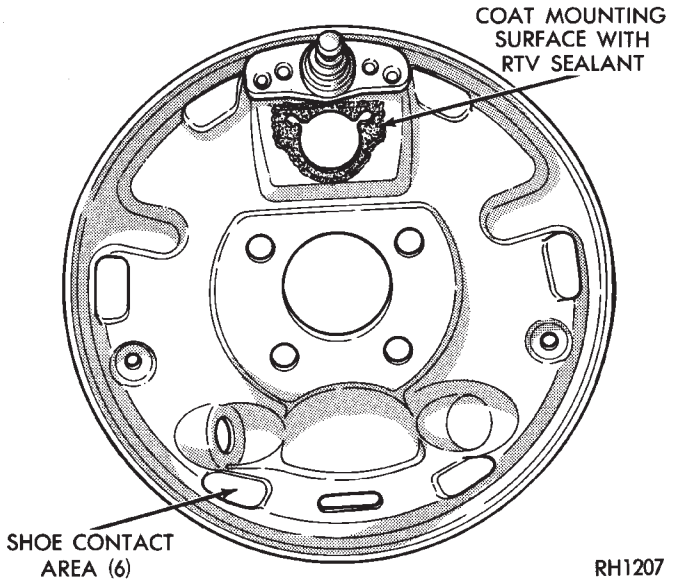


Fig. 4 Apply Sealant on Support Plate

(3) Attach hydraulic brake tube to wheel cylinder, and tighten tube to wheel cylinder fitting to 17 N●m (145 in. lbs.).

(4) Install brake shoes on support plate.

(5) Install rear brake drum onto rear hub. Install rear wheel and tire assembly, tighten wheel stud nuts to 129 N●m (95 ft. lbs.).

(6) Adjust the rear brakes, (See Adjusting Service Brakes) in Service Adjustments section in this group of the service manual.

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

BRAKE SUPPORT ASSEMBLY

REMOVAL

Back off parking brake adjusting nut to provide slack in cable.

With wheel and brake drum removed, disconnect hydraulic tube from wheel cylinder. Disconnect parking brake cable and adjuster lever spring (Fig. 1).

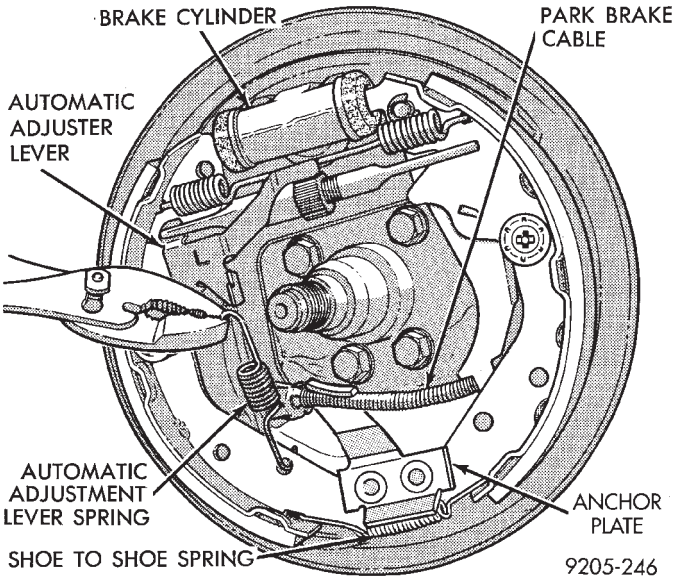


Fig. 1 Removing Adjuster Lever Spring

Using a suitable tool such as an aircraft type hose clamp, install the clamp over the retainer on the end of the parking brake cable (Fig. 2). Compress cable housing retainer and start housing out of support plate (Fig. 2). Remove clamp when retainer is free from the park brake cable mounting hole in the rear brake support plate. Alternate method is to slide a 14 mm box wrench over housing end fitting compressing the three fingers.

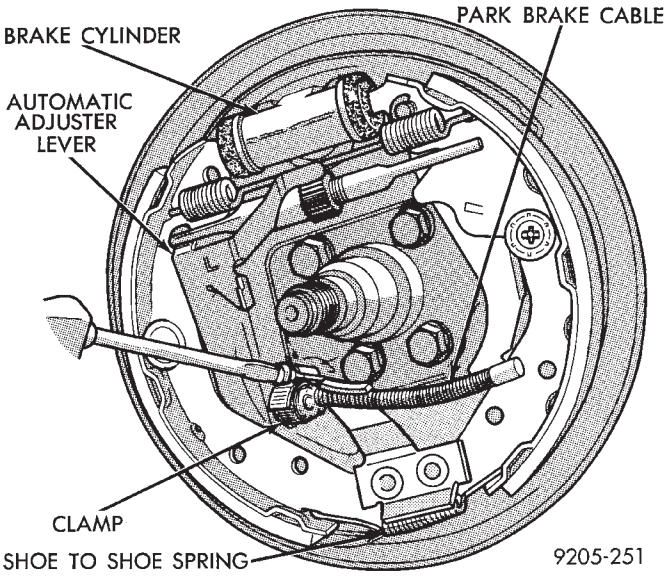


Fig. 2 Removing Park Brake Cable From Support Plate

Remove attaching bolts and washers and separate brake support and spindle from rear support trailing arm.

INSTALLATION

Insert parking brake cable and housing into support plate.

Install support plate, spindle and gasket between support plate and spindle on to rear suspension member. Tighten support plate attaching bolts to 71 N●m (53 ft. lbs.) torque.

Attach cable to parking brake lever.

Connect brake tube to wheel cylinder. Tighten brake tube to wheel cylinder fitting to 17 N●m (145 in. lbs.).

Install brake drum and wheel. Adjust and bleed service brakes. Adjust parking brake.

HYDRAULIC SYSTEM CONTROL VALVES

INDEX

GENERAL INFORMATION

Most models not equipped with an Anti-Lock braking system have a combination hydraulic system control valve in the brake hydraulic system (Fig. 1). The valve is attached to the frame rail below the master cylinder.

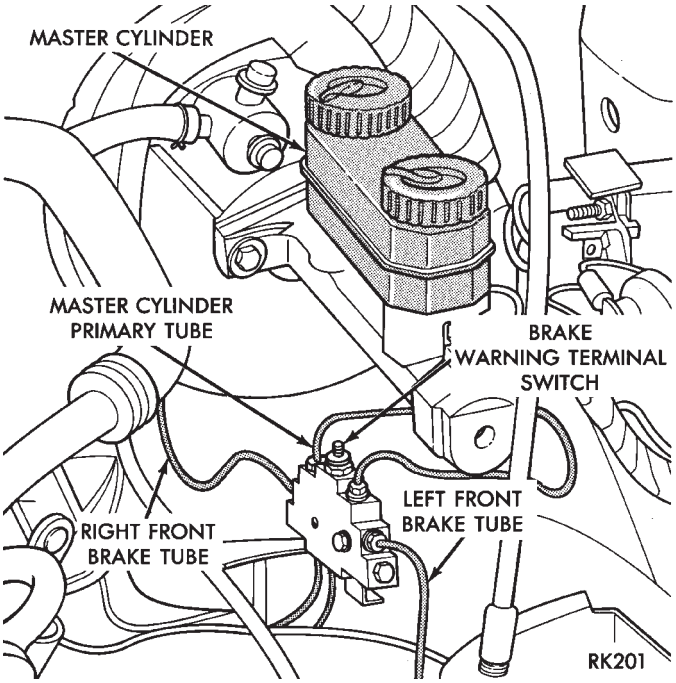


Fig. 1 Brake Combination Valve And Warning Switch Location

The control valve assembly combines a warning switch with a dual proportioning valve (Fig. 2).

Proportioning valves balance front to rear braking by controlling at a given ratio, the increase in rear system hydraulic pressure above a preset level. Under light pedal application, the valve allows full hydraulic pressure to the rear brakes.

There is only one valve assembly in each vehicle, see Valve Application Chart. During any service procedures identify valve assemblies by part number as well as split point (PSI) and slope.

PRESSURE DIFFERENTIAL WARNING LIGHT SWITCH

The hydraulic brake system, on non-ABS vehicles, is split diagonally. The left front and right rear brakes are part of one system. And the right front and left rear are part of another. Both systems are routed through, but hydraulically separated by a Pressure Differential Switch. The function of the Pressure Differential Switch is to alert the driver of a malfunction in the brake system.

If hydraulic pressure is lost in one system, the warning light switch will activate a red light on the instrument panel, when the brake pedal is depressed. At this point the brakes require service. However, since the brake systems are split diagonally the vehicle will retain 50% of its stopping capability in the event of a failure in either half.

The warning light switch is the latching type. It will automatically center itself after the repair is made and the brake pedal is depressed.

The instrument panel bulb can be checked each time the ignition switch is turned to the start position or the parking brake is set.

NON-ABS PROPORTIONING UNIT OPERATION

The proportioning valve section operates by transmitting full input pressure to the rear brakes up to a certain point. This is called the split point. Beyond this point it reduces the amount of pressure increase to the rear brakes according to a certain ratio.

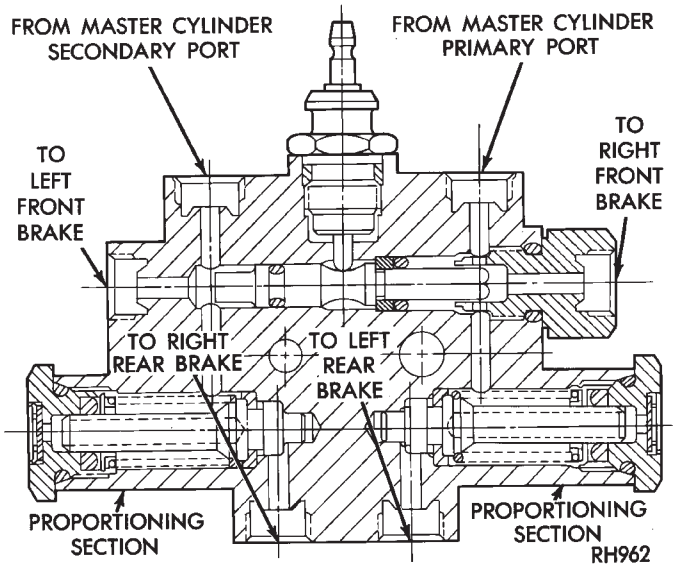


Fig. 2 Switch and Valve Assembly

On light pedal applications equal brake pressure will be transmitted to the front and rear brakes. On

heavier pedal applications the pressure transmitted to the rear will be lower than the front brakes. This will prevent premature rear wheel lock-up and skid. If hydraulic pressure is lost in one half of the diagonally split system, the operation of the proportioning valve in the remaining half is not effected.

ABS BRAKE PROPORTIONING VALVE OPERATION

On vehicles using the ABS braking system, screw in proportioning valves are used in place of the conventional differential pressure/proportioning valve (Fig. 3).

Each rear brake circuit has its own screw-in proportioning valve which is attached to the rear brake outlet ports of the hydraulic assembly. These valves limit brake pressure to the rear brakes after a certain pressure is reached. This improves front to rear brake balance during normal braking.

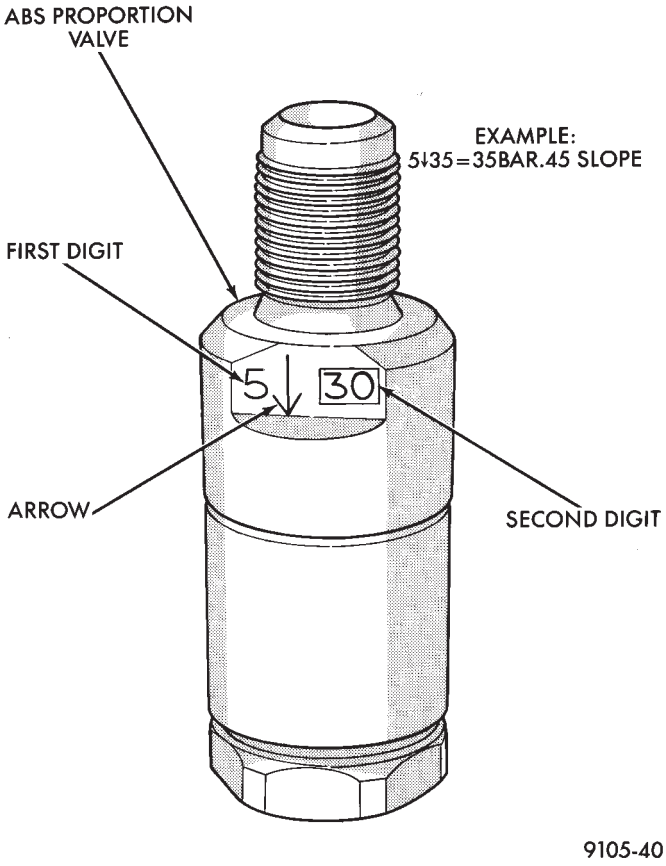


Fig. 3 ABS PROPORTIONING VALVE IDENTIFICATION

Screw in proportioning valves can be identified by the numbers stamped on the body of the valve. The first digit represents the slope, the second digit represents the split (cut-in) point, and the arrow represents the flow direction of the valve. **Be sure that the numbers listed on the replacement valve are the same as on the valve that is being removed.** See (Fig. 3) for detail of the valve identification.

HYDRAULIC SYSTEM SERVICE PROCEDURES

BRAKE WARNING SYSTEM

CHECKING BRAKE WARNING SWITCH UNIT

The Red Brake Warning light will come on when the parking brake is applied with the ignition key turned ON. The same light will also illuminate should one of the two service brake hydraulic systems fail.

To test the service brake warning system lamp. Raise the vehicle on a hoist and open a wheel cylinder bleeder while a helper depresses the brake pedal and observes the warning light.

CAUTION: Make sure air does not enter the hydraulic system during this test procedure. See bleeding without a pressure bleeder at the beginning of this section for master cylinder fluid level checking procedures.

If the light fails to light, inspect for a burned out bulb, disconnected socket, or a broken or disconnected wire at the switch. If the bulb is not burned out and the wire continuity is uninterrupted. Check the service brake warning switch operation with a test lamp between the switch terminal and a known good ground. Be sure to fill master cylinder and bleed brake system after correction has been made, if necessary.

PROPORTIONING VALVES

TESTING PROPORTIONING VALVE UNIT

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

The proportioning valve is designed with two **separate** systems. One half controls the right rear brake, and the other half controls the left rear brake. Therefore, a road test to determine which rear brake slides first is essential.

RIGHT REAR WHEEL SLIDES FIRST

To test the proportioning valve when the right rear wheel slides first, leave the front brakes connected to the valve, proceed as follows:

(1) Install one gauge and (TEE) of set C-4007-A between the brake line from the master cylinder secondary port and the brake valve assembly.

(2) Install the second gauge of set C-4007-A to the right rear brake outlet port (Fig. 4). Using an adapter tube, made from a short piece of brake tube and (2) 3/8 x 24 tube nuts. Connect the hose to the valve. Bleed the hose and gauge.

(3) Have a helper exert pressure on the brake pedal (holding pressure) to get a reading on the valve inlet gauge and check the reading on the outlet

PROPORTIONING VALVE APPLICATIONS

NON-ABS BRAKES

VEH FAM	VALVE FUNCTION	MATERIAL	PROPORTIONING SPLIT	PROPORTIONING SLOPE	IDENT.
AA	14" DISC-DRUM DIFFERENTIAL PROPORTIONING	BRASS	400 PSI	.43	YELLOW
AA	14" DISC-DISC DIFFERENTIAL PROPORTIONING	BRASS	400 PSI	.27	WHITE
AP	14" DISC-DRUM DIFFERENTIAL PROPORTIONING	BRASS	400 PSI	.43	YELLOW
AP	14" DISC-DISC DIFFERENTIAL PROPORTIONING	BRASS	400 PSI	.43	YELLOW
AY	14" DISC-DRUM DIFFERENTIAL PROPORTIONING	BRASS	500 PSI	.59	BLACK
AG	14" DISC-DRUM DIFFERENTIAL PROPORTIONING	BRASS	400 PSI	.43	YELLOW
AG	15" DISC-DISC DIFFERENTIAL PROPORTIONING	BRASS	400 PSI	.27	WHITE
AJ	14" DISC-DRUM DIFFERENTIAL PROPORTIONING	BRASS	400 PSI	.43	YELLOW
AJ	15" DISC-DISC DIFFERENTIAL PROPORTIONING	BRASS	400 PSI	.43	YELLOW
AJ	14" DISC-DISC DIFFERENTIAL PROPORTIONING	BRASS	500 PSI	.27	GREY

ABS BRAKES

VEH FAM	VALVE FUNCTION	MATERIAL	PROPORTIONING SPLIT	PROPORTIONING SLOPE	IDENT.
AA	14" DISC-DISC SCREW IN PROPORTIONING	PLATED BLACK	20 BAR 290 PSI	.45	20↓.5
AA	15" DISC-DISC SCREW IN PROPORTIONING	PLATED BLACK	30 BAR 430 PSI	.45	30↓.5
AC	14" DISC-DRUM SCREW IN PROPORTIONING	PLATED BLACK	20 BAR 290 PSI	.3	20↓.3
AY	14" DISC-DISC SCREW IN PROPORTIONING	PLATED BLACK	20 BAR 290 PSI	.3	20↓.3
AG	15" DISC-DISC SCREW IN PROPORTIONING	PLATED BLACK	30 BAR 435 PSI	.45	30↓.5
AJ	15" DISC-DISC SCREW IN PROPORTIONING	PLATED BLACK	30 BAR 435 PSI	.45	30↓.5

9205-252

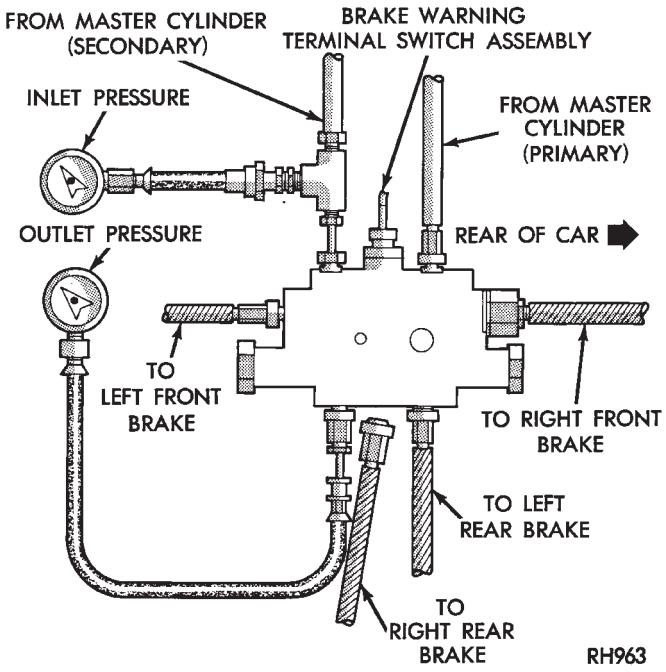


Fig. 4 Tube Connection for Right Rear Skidding

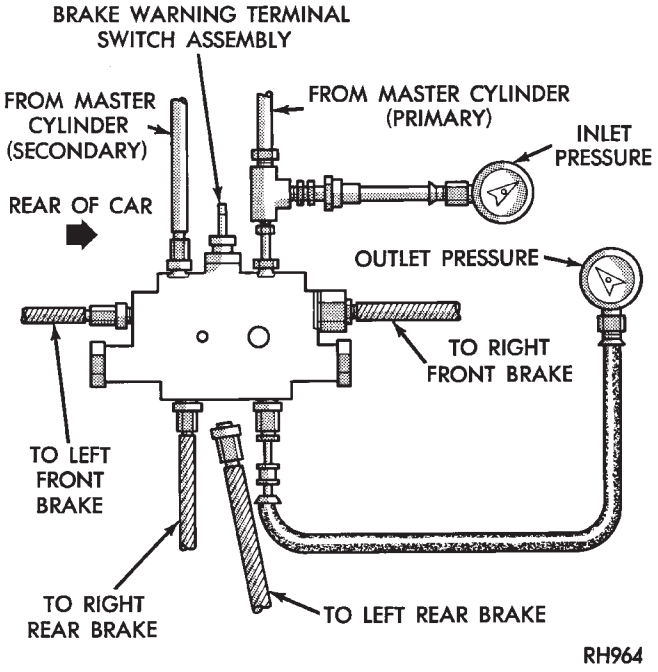


Fig. 5 Tube Connection for Left Rear Skidding

gauge. If the inlet and outlet pressures do not agree with the values on the following chart, replace the valve.

LEFT REAR WHEEL SLIDES FIRST

To test the proportioning valve when the left rear wheel slides first, leave the front brakes connected to the valve, proceed as follows:

(1) Install one gauge and (TEE) of set C-4007-A between brake line from the master cylinder primary port and the brake valve assembly.

(2) Install the second gauge of set C-4007-A to the left rear brake outlet port (Fig. 5). An adapter tube, made up from a 7/16 x 24 tube nut, a short piece of brake tube and 3/8 x 24 tube nut. Will be required to connect the hose to the valve. Bleed the gauge and hose.

(3) Have a helper exert pressure on the brake pedal. Hold pressure steady to get a reading on the valve inlet gauge and check the reading on the outlet gauge. If the inlet and outlet pressures do not agree with the values on the following chart, replace the valve.

TESTING ABS PROPORTIONING VALVES

All ABS components use an ISO type tubing flare. Use the correct adapters with ISO type tubing flares when installing gauges to test ABS proportioning valves.

(1) Install one gauge and (TEE) between the hydraulic assembly and the male end (Inlet) of the valve.

(2) Install the second gauge at the female end (Outlet) of the valve (Fig. 6).

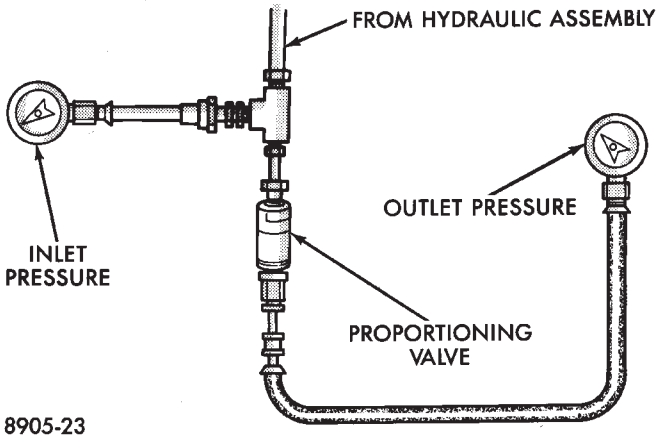


Fig. 6 Tube Connections for ABS

(3) Have a helper exert pressure on the brake pedal (holding pressure) to get a reading on the valve inlet gauge.

(4) Check the reading on the outlet gauge. If the inlet and outlet pressures do not agree with the following chart, replace the valve. See (Fig. 3) for proportioning valve identification.

PROPORTIONING VALVE PRESSURES ABS-BRAKES

PROPORTIONING VALVE ABS BRAKE SYSTEM	SLOPE	INLET PRESSURE PSI	OUTPUT PRESSURE PSI
30 BAR	.45	1000 PSI	640–720 PSI
35 BAR	.45	1000 PSI	685–765 PSI
40 BAR	.45	1000 PSI	725–805 PSI
45 BAR	.45	1000 PSI	765–845 PSI
20 BAR	.3	1000 PSI	460–540 PSI
25 BAR	.3	1000 PSI	510–590 PSI
30 BAR	.3	1000 PSI	560–640 PSI
WHERE 1 BAR IS EQUAL TO 14.7 PSI			

9105-49

PROPORTIONING VALVE PRESSURES NON-ABS BRAKES

PROPORTIONING VALVE NON-ABS BRAKE SYSTEM	SLOPE	INLET PRESSURE PSI	OUTLET PRESSURE PSI
400 PSI	.27	1000 PSI	525–600PSI
500 PSI	.59	1000 PSI	725–850 PSI
400 PSI	.43	1000 PSI	600–700 PSI

9105-50

FRONT DISC BRAKES

INDEX

GENERAL INFORMATION

The single piston, floating caliper disc brake assembly (Figs. 1 and 2) consists of:

- The driving hub
- Braking disc (rotor)
- Caliper assembly
- Shoes and linings
- Adapter for mounting the caliper assembly to the steering knuckle

WARNING: THE PISTONS THAT ARE USED IN THE 2 DIFFERENT CALIPER ASSEMBLIES ARE UNIQUE TO THE CALIPER THEY ARE USED IN. THE DIMENSIONS OF THESE PISTONS ARE DIFFERENT, DO NOT INTERCHANGE THE CALIPER PISTONS. IMPROPER USE COULD CAUSE A COMPLETE FAILURE OF THE BRAKE SYSTEM.

The double pin Kelsey-Hayes Family Caliper, is mounted to the adapter using bushings, sleeves and 2 through bolts threaded into the adapter (Figs. 3 and 5). The adapter is then mounted to the steering knuckle using 2 attaching bolts.

The double pin Kelsey-Hayes Non-Family Caliper, is mounted directly to the steering knuckle of the vehicle using bushings, sleeves and 2 through bolts (Figs. 4 and 5). The adapter is not used on the vehicles equipped with the Non-Family caliper assembly.

Two machined abutments on the caliper mounting adapter or steering knuckle, (Figs. 3 and 4) position and align the caliper fore and aft. The guide pin bolts, sleeves and bushings control the float, 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 pedal is released. This will help in maintaining proper brake shoe to rotor clearance (Fig. 6).

Vehicles equipped with the Kelsey-Hayes double pin family caliper. Have 1 anti-rattle clip attached to the top of the adapter (Fig. 1).

All of the braking force is taken up directly by the adapter or the steering knuckle depending on the type of caliper assembly the vehicle is equipped with.

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

The front disc brake caliper phenolic piston is 60 mm (2.36 inch) in diameter.

A square cut rubber piston seal is located in a machined groove in the cylinder bore. This provides a hydraulic seal between the piston and the cylinder wall (Fig. 6).

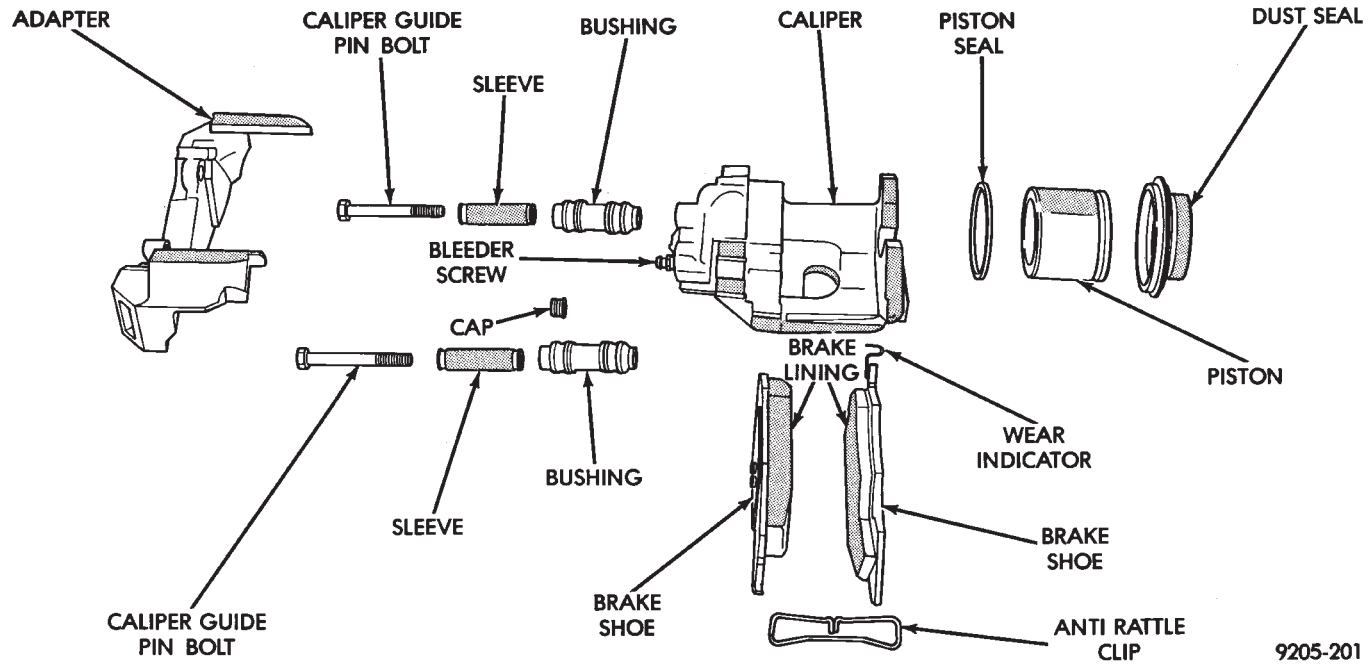


Fig. 1 Front Disc Brake Assembly (Family Caliper Typical)

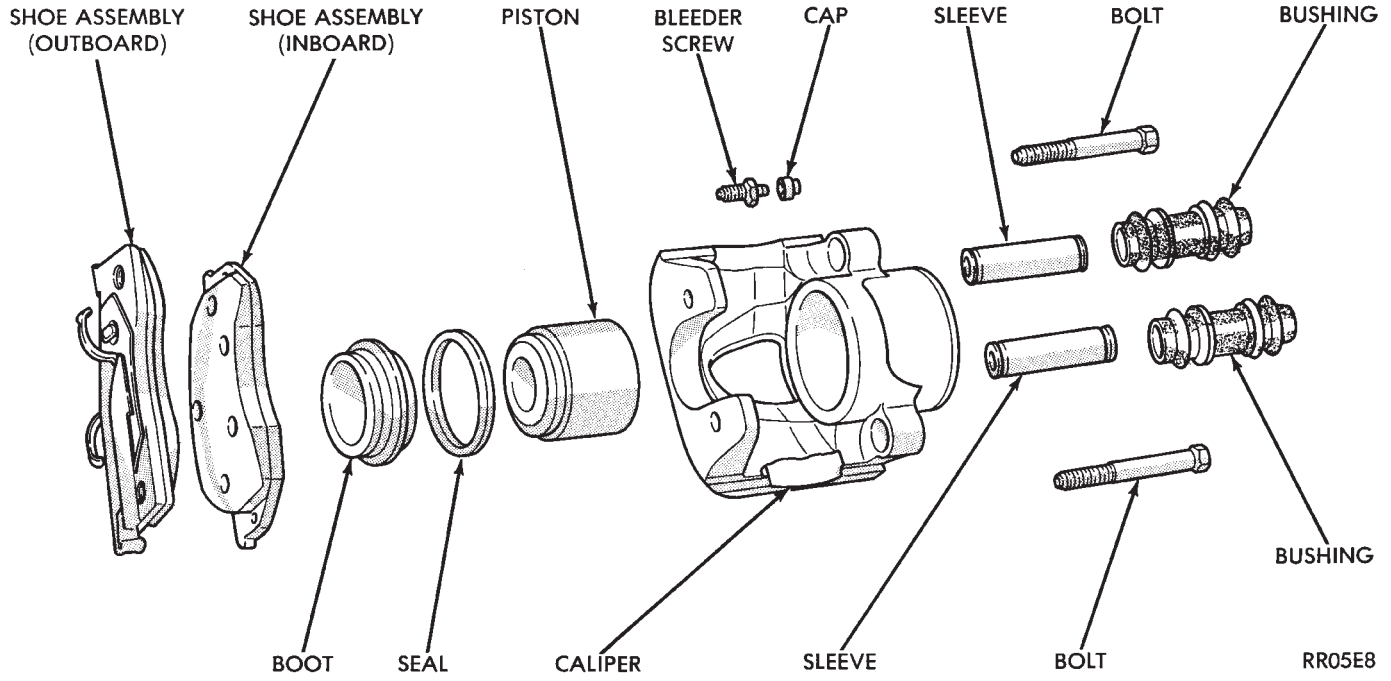


Fig. 2 Front Disc Brake Assembly (Non-Family Caliper Typical)

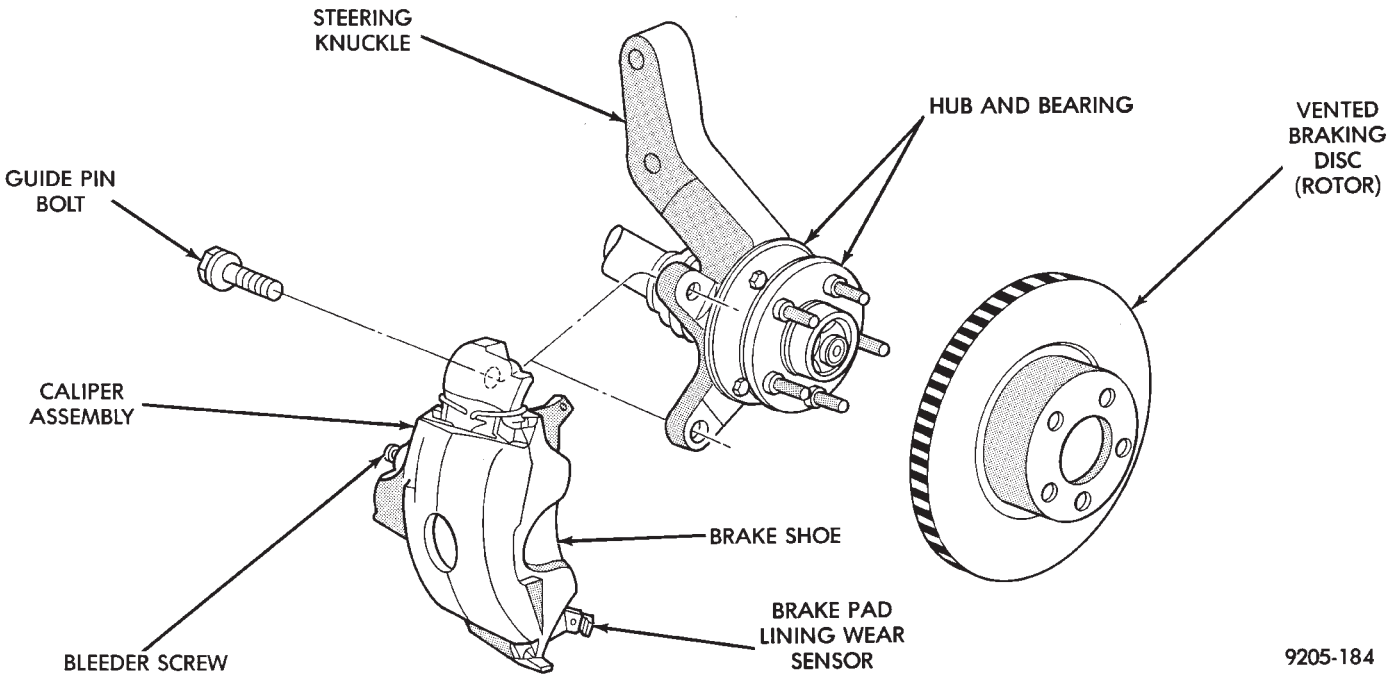


Fig. 3 Disc Brake Caliper Mounting (Family Caliper)

A molded rubber dust boot installed in a groove in the cylinder bore and piston, keeps contamination from the cylinder wall and piston.

The boot mounts in the cylinder bore opening and in a groove in the piston (Fig. 6). This prevents contamination in the bore area.

As lining wears, master cylinder reservoir brake fluid level will go down. If brake fluid has been added to the reservoir, reservoir overflow may occur when the piston is pushed back into the new lining position. Overflowing can be avoided in this case by removing a small amount of fluid from the master cylinder reservoir.

All vehicles, are equipped with an audible wear sensor on the outboard pad of the front disc brake assemblies. This sensor when emitting a sound signals that brake lining may need inspection and/or replacement.

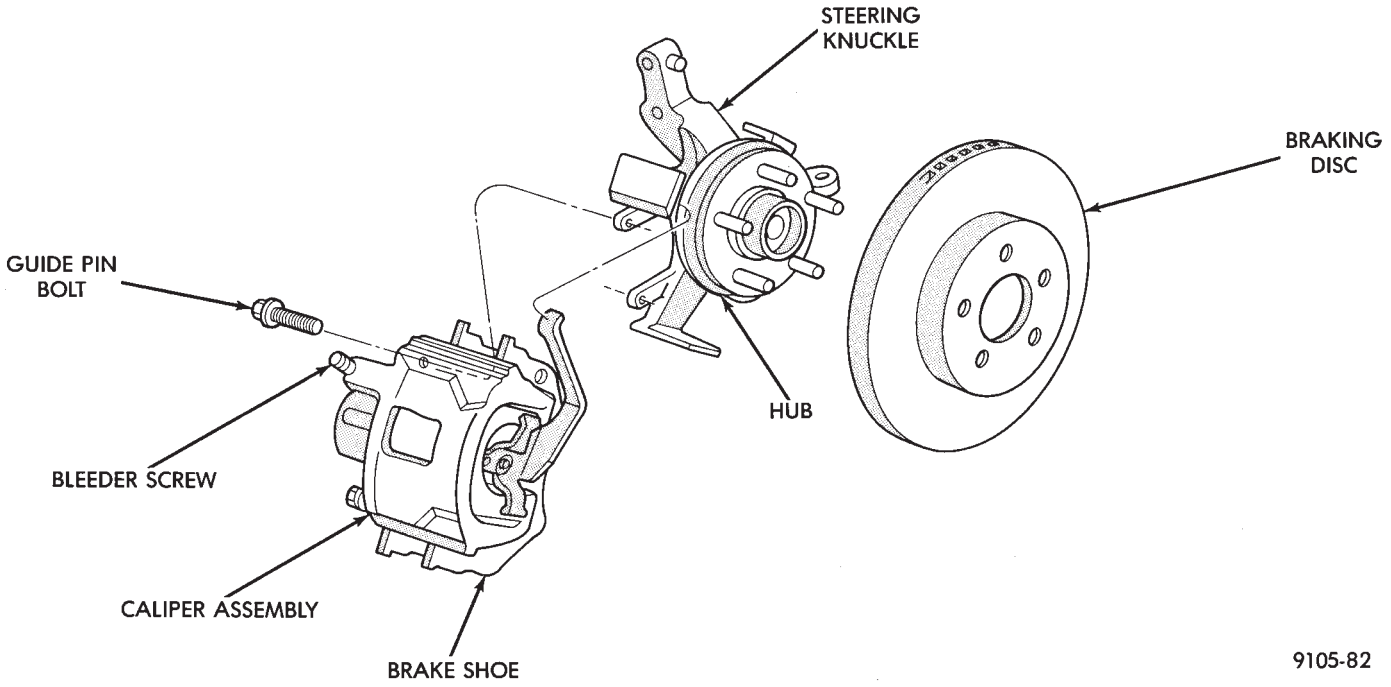


Fig. 4 Disc Brake Caliper Mounting (Non-Family Caliper)

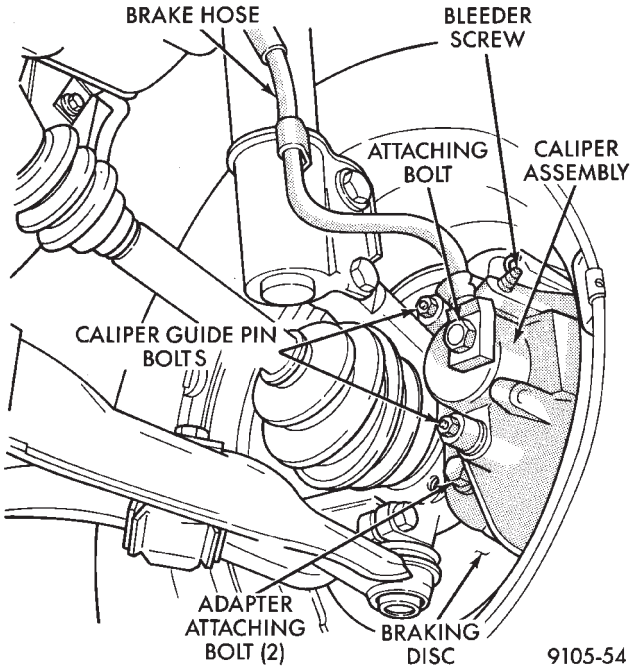


Fig. 5 Disc Brake Caliper Mounting (Typical)

SHOE AND 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.

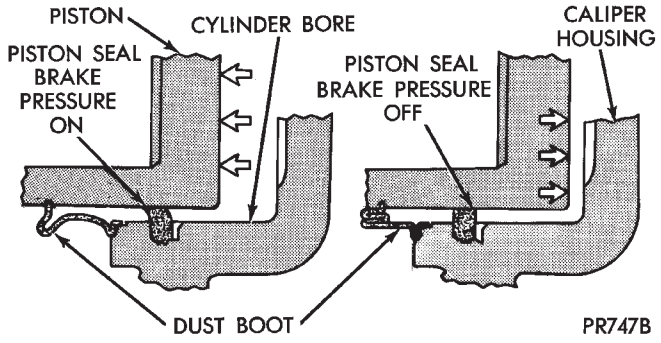


Fig. 6 Piston Seal Function for Automatic Adjustment

Remove the shoe and lining assemblies. (See Brake Shoe Removal paragraph).

Combined shoe and lining thickness should be measured at the thinnest part of the assembly.

When a shoe and lining assembly is worn to a thickness of approximately 7.95 mm (5/16 inch) it should be replaced.

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

If a shoe assembly does not require replacement. Reinstall, the shoe assemblies making sure each shoe assembly is returned to the original position. (See Brake Shoe Installation).

SERVICE PRECAUTIONS

WARNING: DUST AND DIRT ON BRAKE PARTS GENERATED DURING THE NORMAL USE AND WEAR OF MOTOR VEHICLE BRAKE SYSTEMS CAN CONTAIN ASBESTOS FIBERS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM, SUCH AS ASBESTOSIS AND CANCER. EXTREME CARE SHOULD BE EXERCISED WHILE SERVICING BRAKE ASSEMBLIES OR COMPONENTS.

DO NOT CLEAN BRAKE ASSEMBLIES OR COMPONENTS WITH COMPRESSED AIR OR BY DRY BRUSHING; USE A VACUUM CLEANER SPECIFICALLY RECOMMENDED FOR USE WITH ASBESTOS FIBERS. IF A SUITABLE VACUUM CLEANER IS NOT AVAILABLE, CLEANING SHOULD BE DONE WET USING A WATER DAMPENED CLOTH.

DO NOT CREATE DUST BY SANDING, GRINDING, AND/OR SHAVING BRAKE LININGS OR PADS UNLESS SUCH OPERATION IS DONE WHILE USING PROPERLY EXHAUST VENTILATED EQUIPMENT.

DISPOSE OF ALL DUST AND DIRT SUSPECTED TO CONTAIN ANY ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE DUST EXPOSURE TO YOURSELF AND OTHERS.

FOLLOW ALL RECOMMENDED PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY. FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DIRT WHICH MAY CONTAIN ASBESTOS FIBERS.

Grease or any other foreign material must be kept off the caliper assembly, surfaces of the braking disc and external surfaces of the hub, during service procedures.

Handling of the braking disc and caliper. Should be done in such a way as to avoid deformation of the disc 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.

Before vehicle is moved after any brake service work, be sure to obtain a firm brake pedal.

KELSEY HAYES DOUBLE PIN FAMILY CALIPER

BRAKE SHOE SERVICE PROCEDURES

REMOVAL

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

(2) Remove front wheel and tire assemblies.

(3) Remove caliper guide pin bolts (Fig. 1).

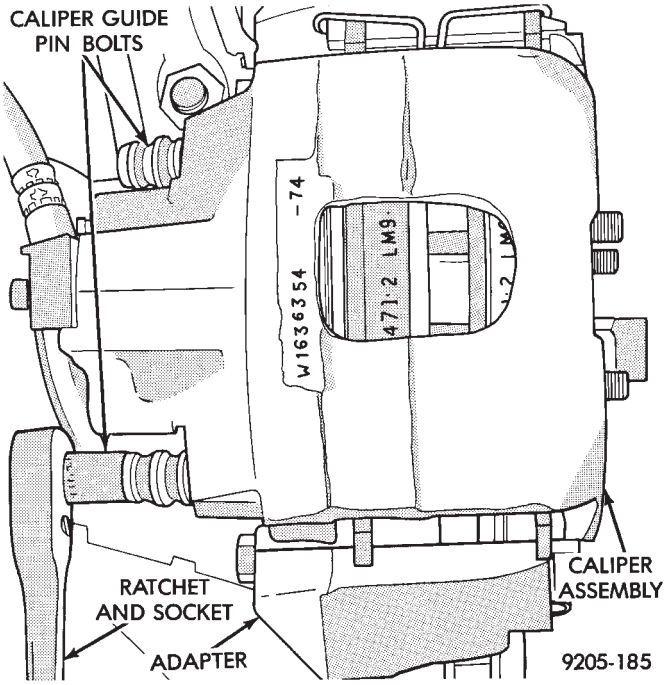


Fig. 1 Removing or Installing Caliper Guide Pin Bolts

(4) After removing the caliper guide pin bolts. Pry the caliper away from the braking disc with a pry bar or screwdriver (Fig. 2).

(5) Remove caliper assembly from braking disc and adapter by sliding the assembly out and away from the braking disc and adapter (Fig. 3).

(6) Support caliper firmly to prevent weight of caliper from damaging the flexible brake hose (Fig. 4).

(7) Remove the outboard brake shoe assembly from the caliper adapter (Fig. 5).

(8) Remove the braking disk (rotor) from the hub by pulling it straight off the wheel mounting studs (Fig. 6).

(9) Remove the inboard brake shoe assembly by sliding it out along the bottom adapter abutment until brake shoe assembly loosens from anti-rattle clip (Fig. 7).

(10) Remove the anti-rattle clip from the top adapter abutment (Fig. 8).

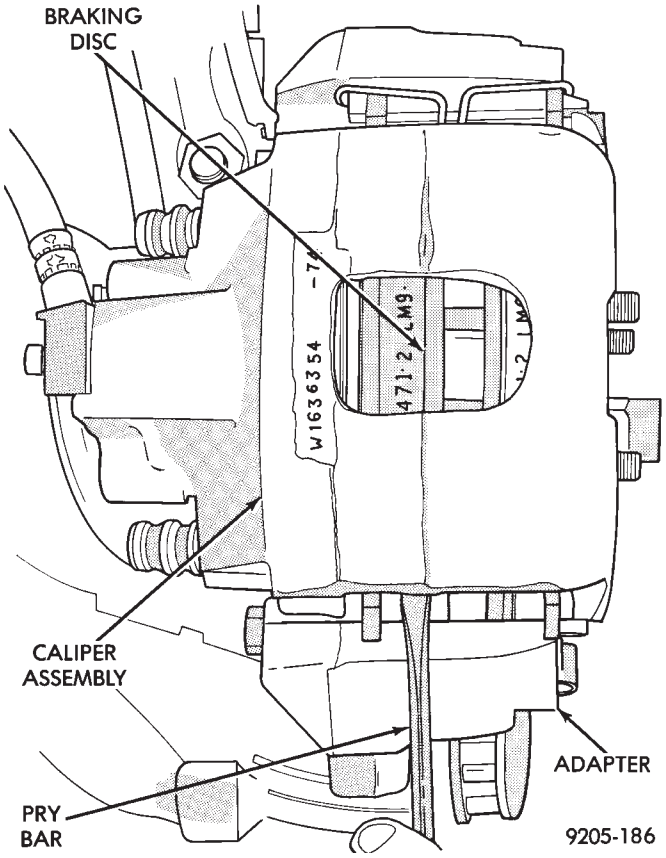


Fig. 2 Loosening Family Caliper Assembly From Adapter And Rotor

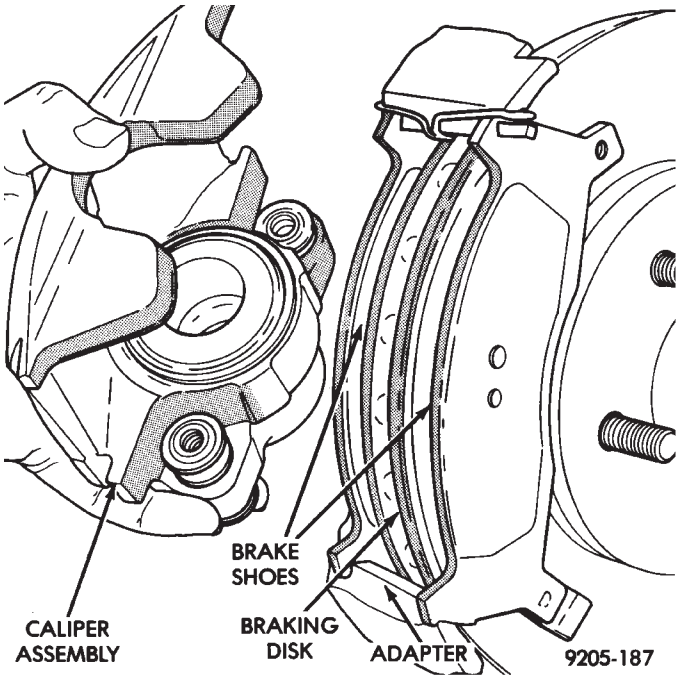


Fig. 3 Removing or Installing Caliper Assembly

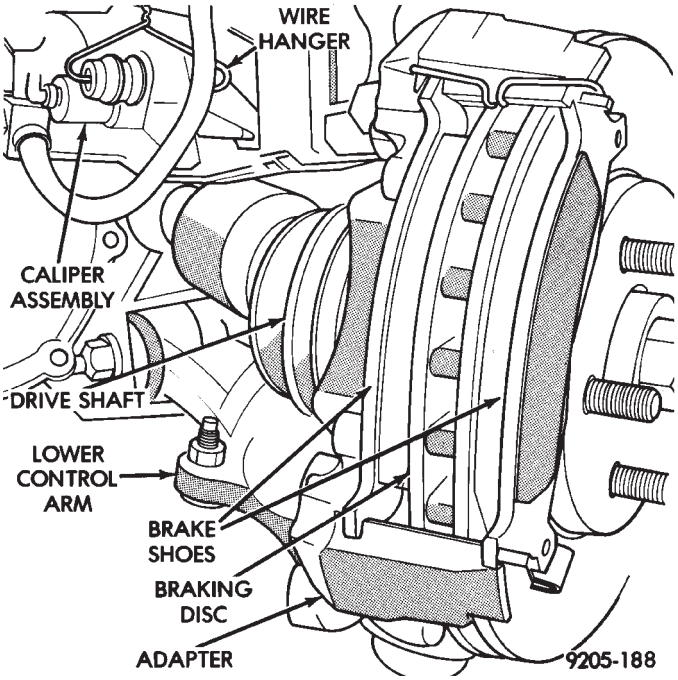


Fig. 4 Storing Caliper

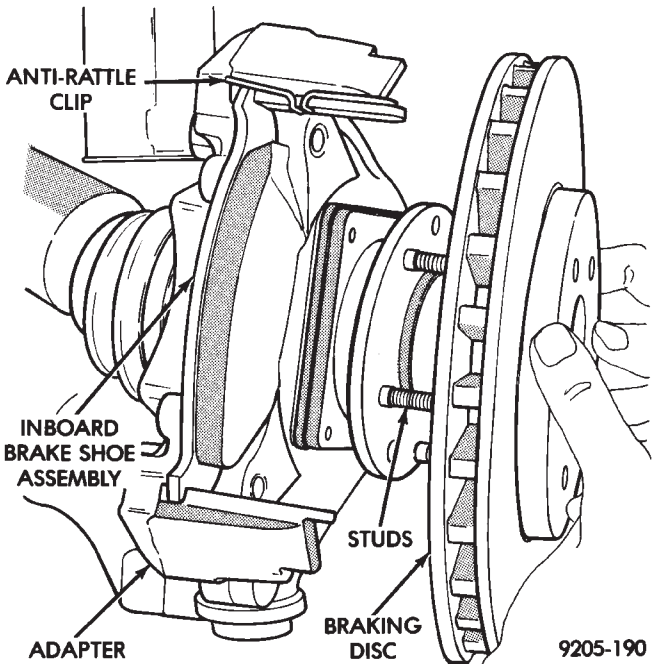


Fig. 6 Removing or Installing Braking Disc

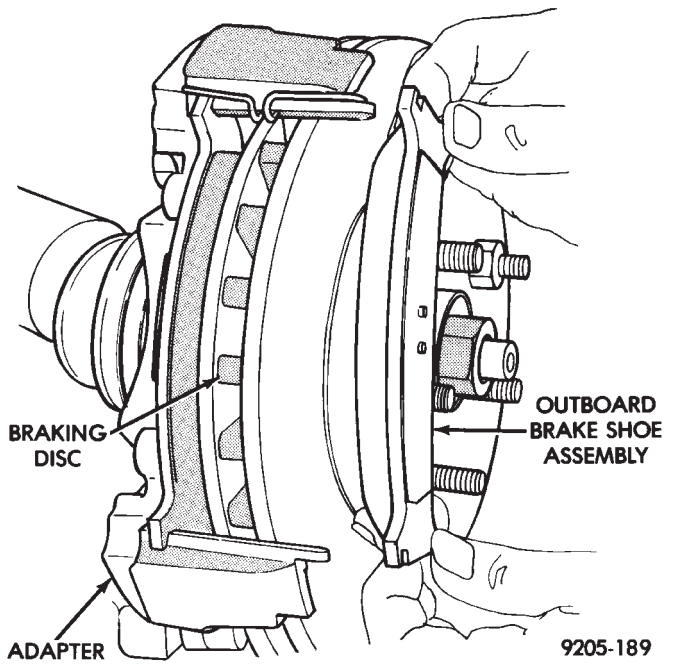


Fig. 5 Removing and Installing Outboard Shoe Assembly

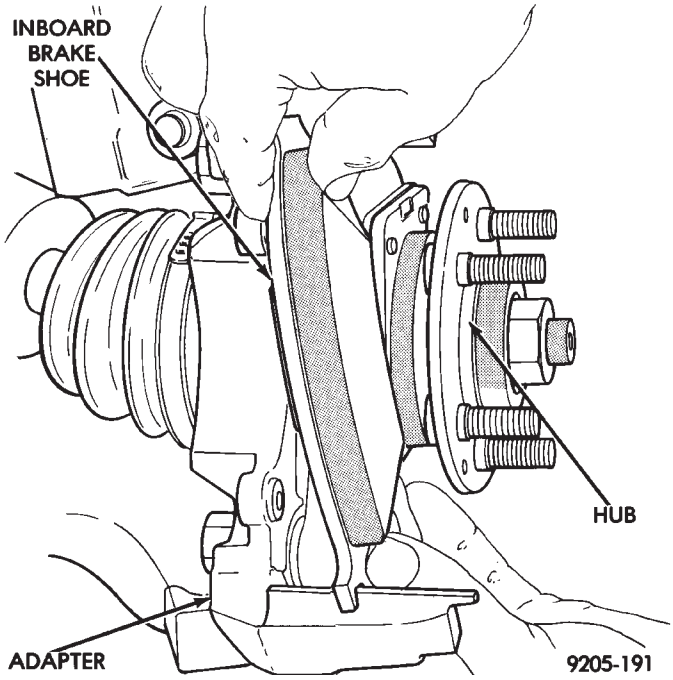


Fig. 7 Removing or Installing Inboard Shoe Assembly

INSTALLATION

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

(2) Install the anti-rattle clip on the upper abutment of the caliper mounting adapter (Fig. 8).

(3) Remove the protective paper from the noise suppression gasket on both the inner and outer brake shoe assemblies (if equipped).

(4) Install the new inboard brake shoe assembly on the adapter by sliding it along the adapter abutments. Be careful not to get any grease from the adapter abutment on the surface of the brake lining material, (Fig. 7). Be sure inboard brake shoe assembly is correctly positioned against anti-rattle clip (Fig. 6).

(5) Reinstall the Braking Disk on the hub, by installing it over the wheel studs until it is seated against the face of the hub (Fig. 6).

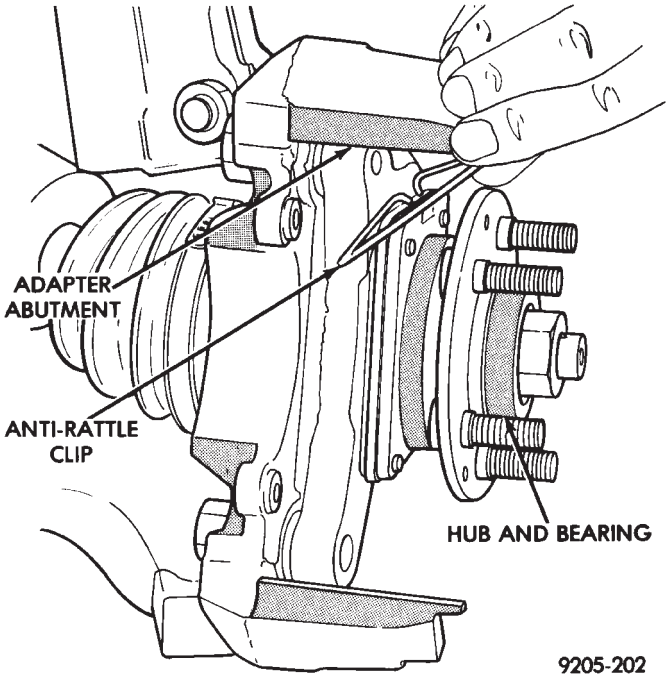


Fig. 8 Remove Or Replace Anti-Rattle Clip

(6) Slide the new outboard brake shoe assembly on the adapter abutment, (Fig. 5).

(7) Carefully lower caliper over the braking disk and brake shoe assemblies (Fig. 3). Make sure that the caliper guide pin bolt, bushings and sleeves are clear of the adapter.

(8) Install the caliper guide pin bolts and tighten to 34 to 37 N●m (25 to 35 ft. lbs.). **Extreme caution should be taken not to cross the threads of the caliper guide pin bolts.**

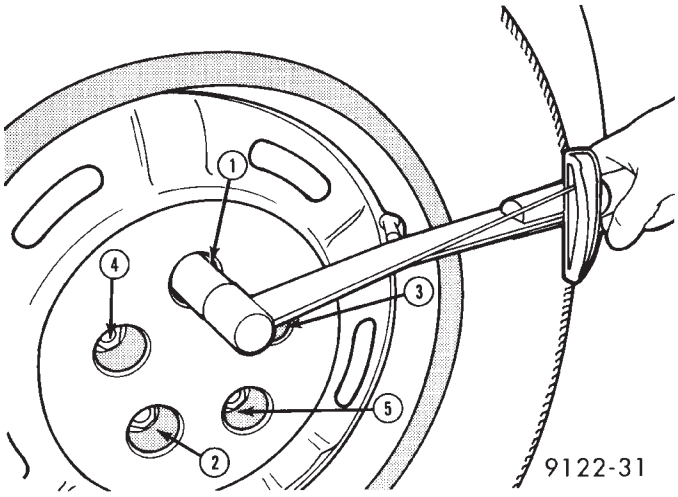


Fig. 9 Tightening Wheel Nuts

(9) Install the wheel and tire assembly. Tighten the wheel mounting stud nuts in proper sequence (Fig. 9) until all nuts are torqued to half specification. This is important. Then repeat the tightening sequence to the full specified torque of 129 N●m (95 ft. lbs.).

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

Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake shoe linings.

KELSEY HAYES DOUBLE PIN NON-FAMILY CALIPER

INDEX

SERVICE PROCEDURES

BRAKE SHOES REMOVE

Raise the vehicle on jackstands or centered on a hoist.

Remove the front wheel and tire assemblies from the vehicle.

Remove the brake caliper assembly to steering knuckle attaching guide pin bolts (Fig. 1).

Pull lower end of brake caliper out from the machined abutment on the steering knuckle (Fig. 2). Then roll caliper out and away from braking disc (Fig. 2). The brake shoe assemblies will remain with the brake caliper.

When the caliper is removed from the vehicle to service the brake shoes. **SUPPORT CALIPER FIRMLY TO PREVENT WEIGHT OF CALIPER FROM DAMAGING THE FLEXIBLE HOSE.** (See Fig. 3.)

Remove the outboard brake shoe by prying between the top of the outboard shoe and the top of the caliper assembly as shown in (Fig. 4).

Remove the inboard brake shoe from the caliper, by pulling the inboard shoe assembly away from the piston (Fig. 5).

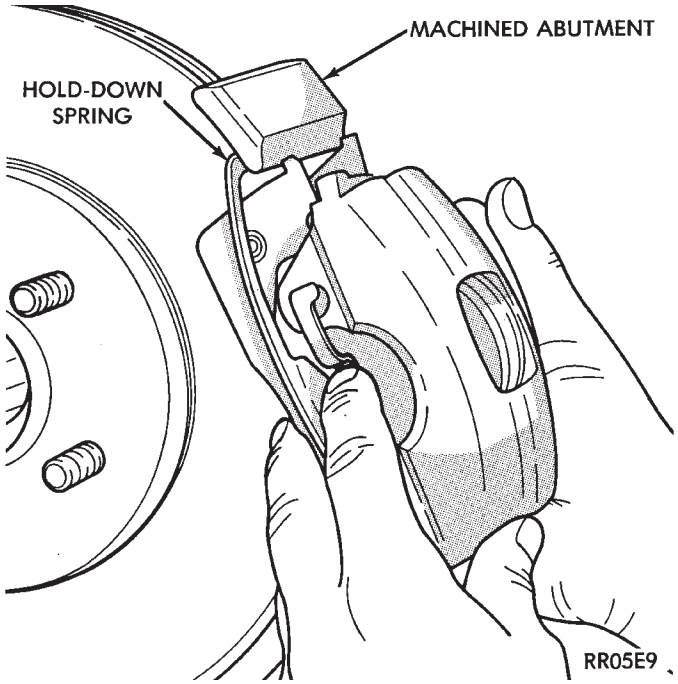


Fig. 2 Removing Caliper and Brake Shoes as an Assembly

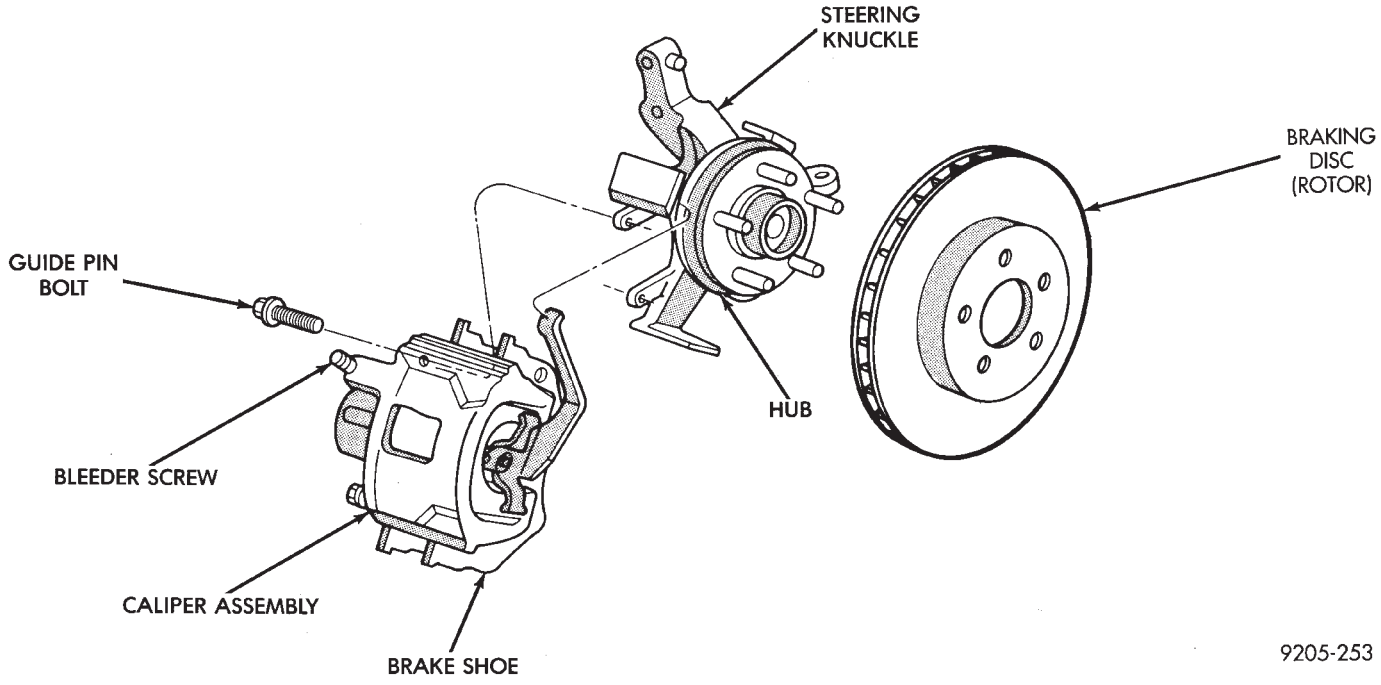


Fig. 1 Non-Family Disc Brake Assembly

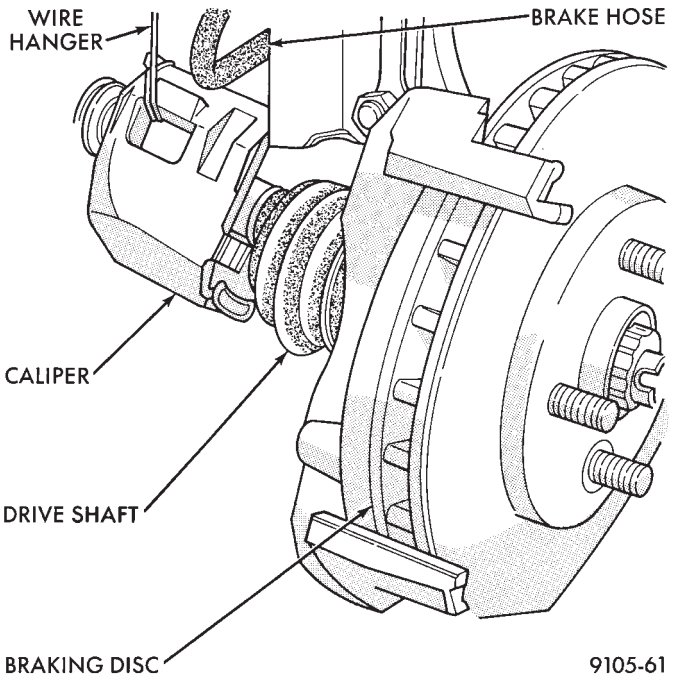


Fig. 3 Storing Caliper

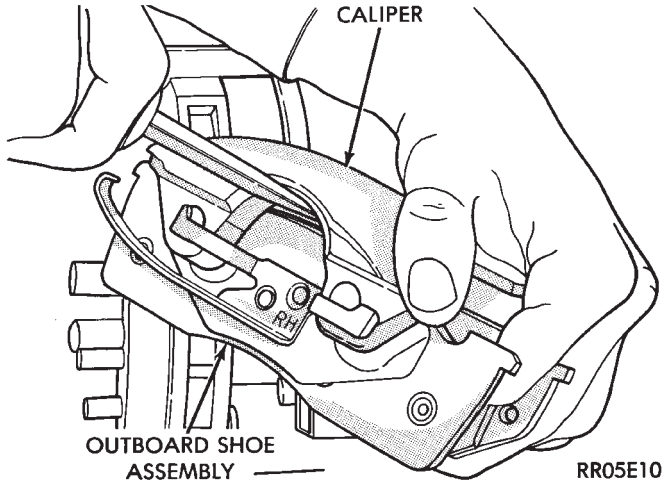


Fig. 4 Prying Outboard Shoe Assembly Away from Caliper

CLEANING AND INSPECTION

Check 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 assembly and install a new seal and boot,(and piston if scored). Refer to procedures titled DISC BRAKE CALIPER DISASSEMBLY.

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 Caliper Service.

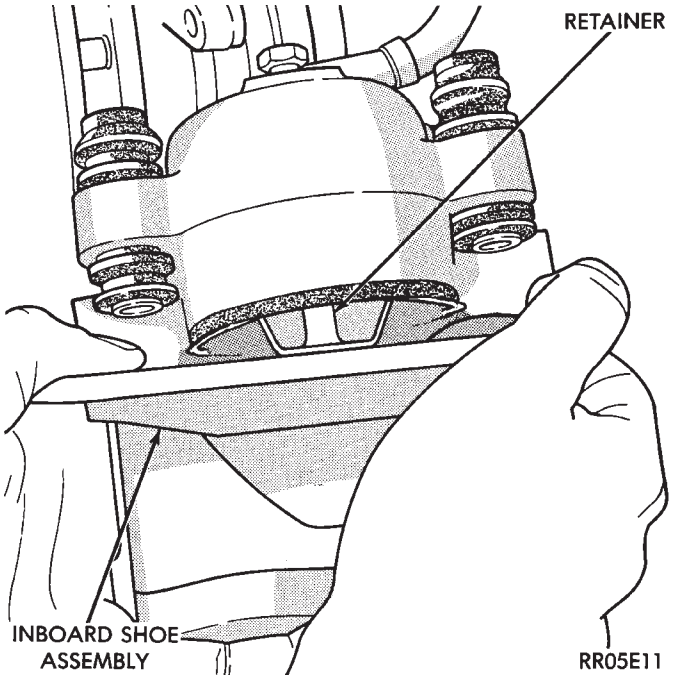


Fig. 5 Removing or Installing Inboard Shoe Assembly

BRAKE SHOES INSTALL

Lubricate both adapter ways on the steering knuckle, with a liberal amount of Mopar Multipurpose Lubricant, or equivalent.

The inboard brake shoes are common. The outboard brake shoes are marked with an (LH) or (RH) to denote which side of the vehicle to be installed on (Fig. 6).

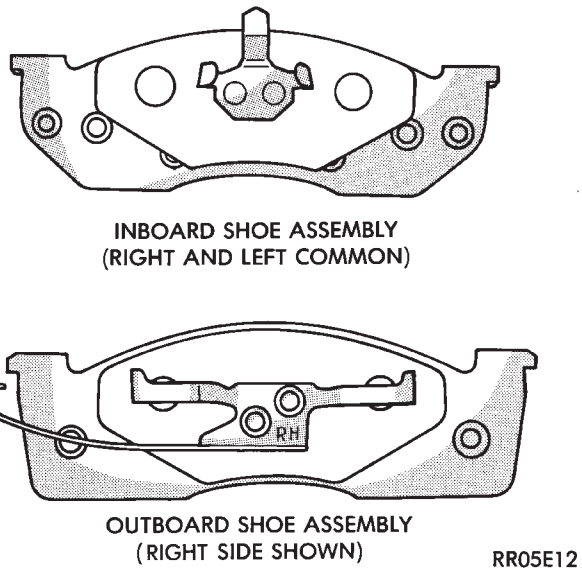


Fig. 6 Brake Shoe Identification

Install new inboard brake shoe assembly in caliper, by installing retaining clip into the bore of the piston (Fig. 5).

Remove protective paper from the noise suppression gasket and position the properly marked outboard brake shoe assembly onto the caliper (Fig. 7).

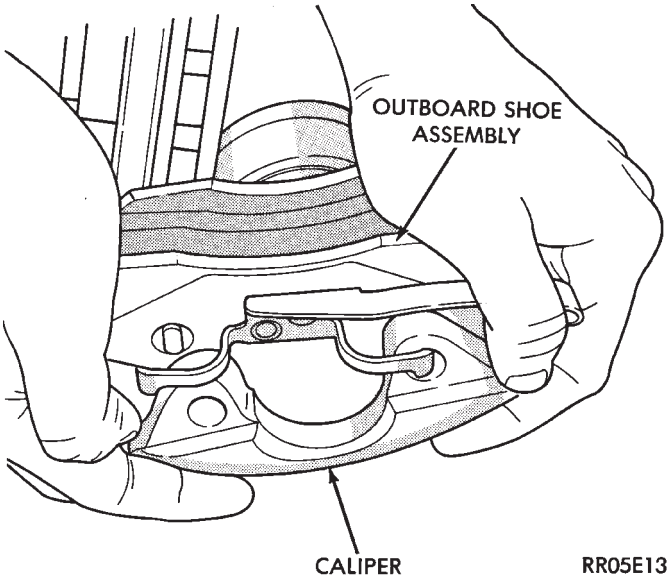


Fig. 7 Installing Outboard Shoe Assembly onto Caliper

CAUTION: Use care when installing the caliper assembly onto the steering knuckle, so the seal on the sealed for life bushings does not get damaged.

Carefully lower caliper over braking disc and guide holddown spring under machined abutment on knuckle assembly (Fig. 8).

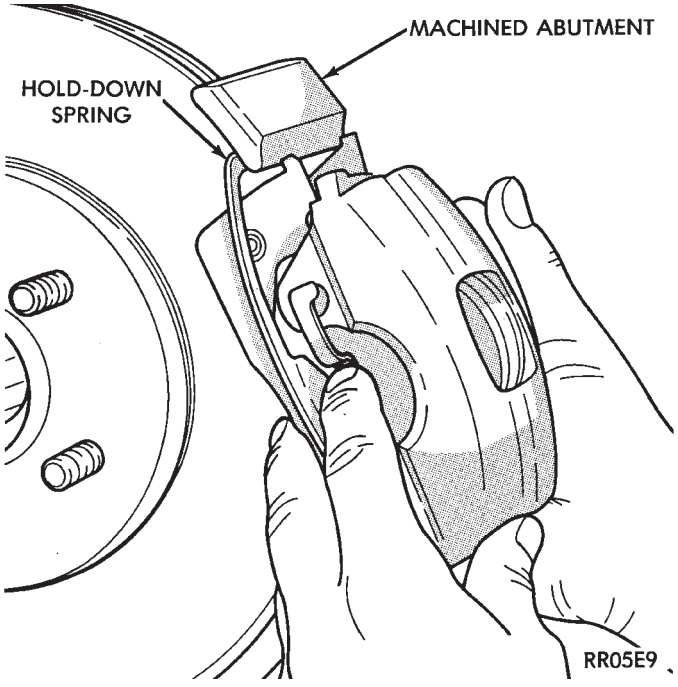


Fig. 8 Guiding Holddown Spring Under Machined Abutment

Install caliper guide pin bolts and tighten to 24-34 N●m (18-25 ft. lbs.) torque. **When installing guide pin bolts, use extreme caution not to cross thread the guide pin bolts.**

Install wheel and tire assembly. Tighten stud nuts in proper sequence until all nuts are torqued to half specification. **This is important.** Then repeat sequence to full specification.

Remove jackstands or lower hoist. **Before moving vehicle be sure it has a firm pedal, pump pedal several times.**

Road test vehicle and make several stops to wear off any foreign material on the brakes and to seat the linings.

DISC BRAKE CALIPER DISASSEMBLY

CLEANING AND INSPECTION

Check for piston fluid seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of piston dust boot. If boot is damaged, or fluid leak is visible, disassemble caliper assembly and install a new seal and boot,(and piston if scored). Refer to procedures titled Disassembling Caliper.

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 Caliper Service.

(1) Remove caliper from braking disc (See Brake Shoe Removal). Hang assembly on a wire hook away from braking disc, so hydraulic fluid cannot get on braking disc (See Fig. 3 in Brake Shoe Removal). Place a small piece of wood between the piston and caliper fingers.

(2) **Carefully** depress brake pedal to hydraulically push piston out of bore. (Brake pedal will fall away when piston has passed bore opening.) Then prop up the brake pedal to any position below 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 flexible brake line at frame bracket after removing piston. Plug brake tube and remove piston from opposite caliper. Using the same process as above for the first piston removal.

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

(4) Disconnect brake flexible hose from the caliper. To disassemble, mount caliper assembly in a vise equipped with protective jaws.

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

Clamp caliper in vise (with protective caps on vise jaws).

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

Remove dust boot from the brake caliper and discard (Fig. 1).

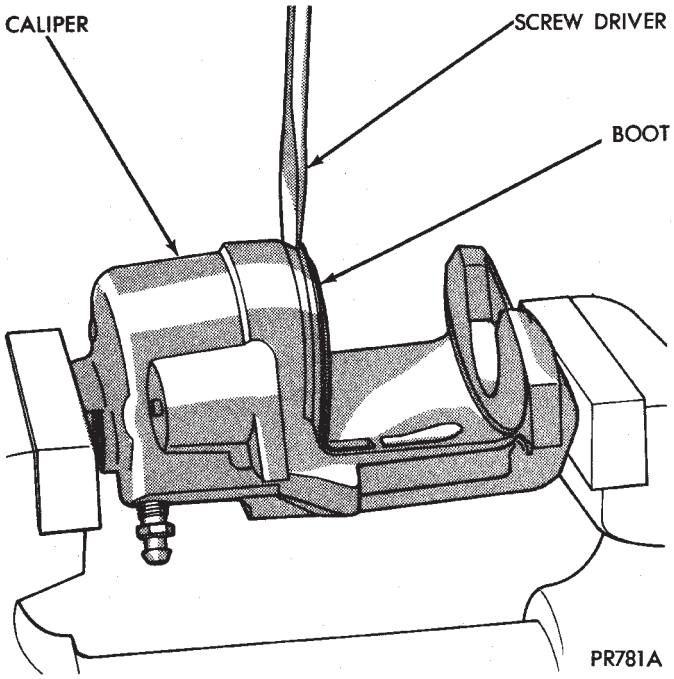


Fig. 1 Removing Piston Dust Boot

Using a plastic trim stick, work piston seal out of its groove in caliper piston bore (Fig. 2). Discard old seal. **Do not use a screwdriver or other metal tool for this operation, because of the possibility of scratching piston bore or burring edges of seal groove.**

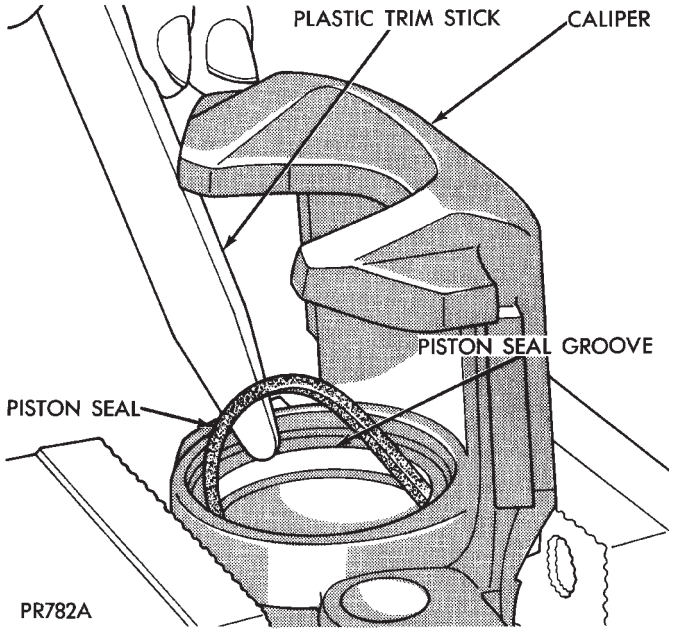


Fig. 2 Removing Piston Seal

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

(1) Push out and then pull the inner sleeve from inside of the bushing using your fingers as shown in (Fig. 3).

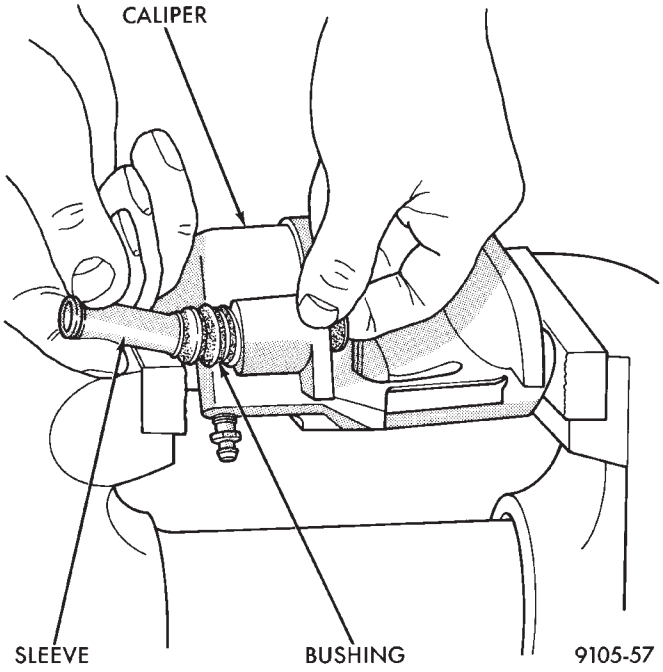


Fig. 3 Removing Inner Sleeve

(2) Using your fingers collapse one side of the bushing. Then pull on the opposite side to remove the bushing from the brake caliper assembly (Fig. 4).

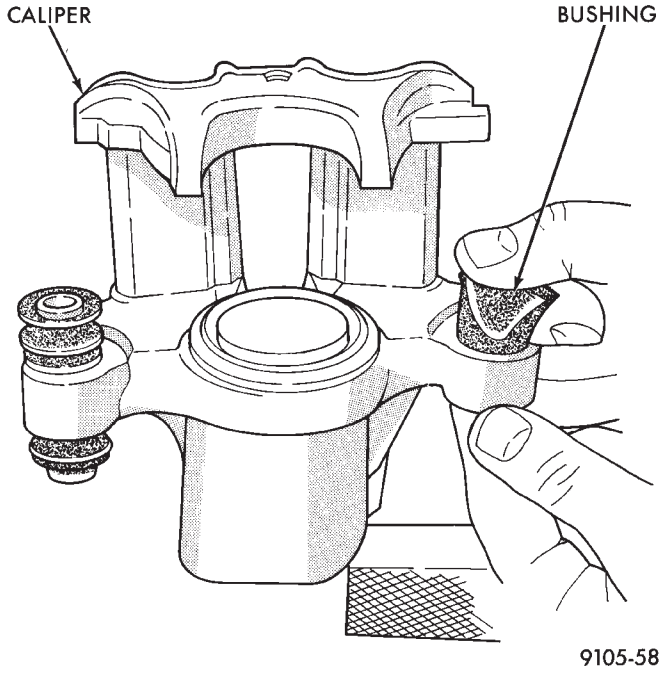


Fig. 4 Removing Bushings From Caliper

CLEANING AND INSPECTION OF BRAKE CALIPER

Clean all parts using alcohol or a suitable solvent and wipe dry. Clean out all drilled passages and bores. **(Whenever a caliper has been disassembled, a new boot and seal must be installed at assembly.)**

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. 5).

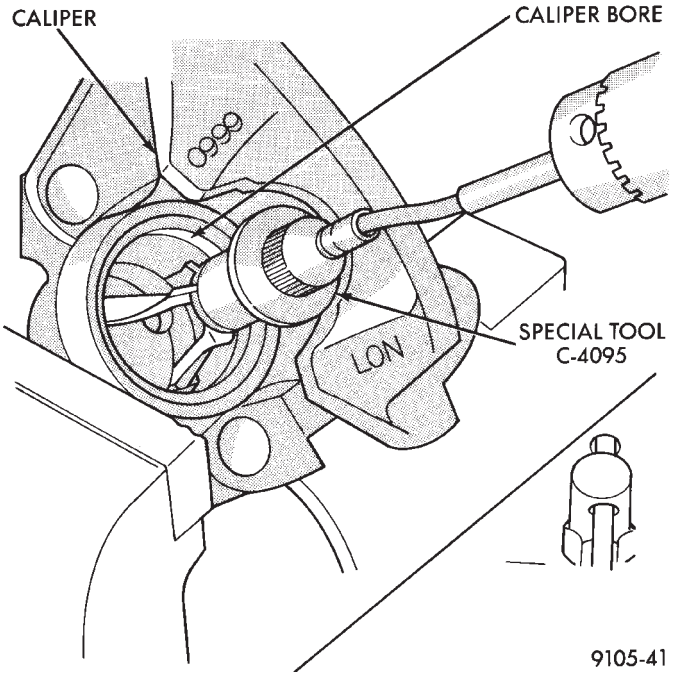


Fig. 5 Honing Piston Bore

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.

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.

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.

ASSEMBLING DISC BRAKE CALIPER

Clamp caliper in vise (with protective caps on vise jaws).

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

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. 1), 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. 1).

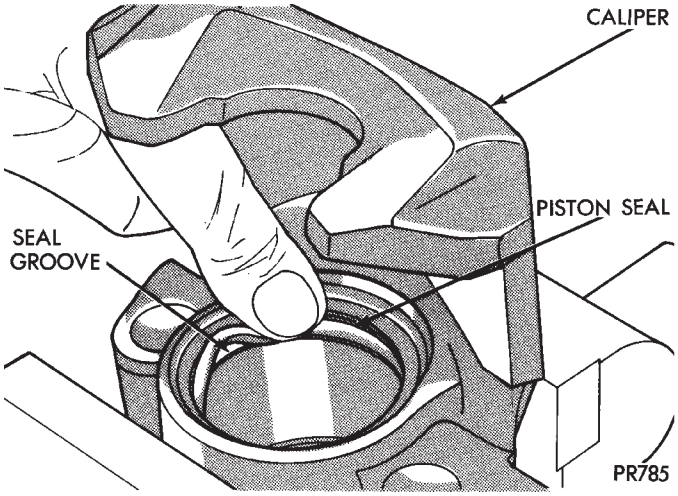


Fig. 1 Installing New Piston Seal

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

Position dust boot over piston after coating with brake fluid.

Install piston into caliper bore pushing it past the piston seal until it bottoms in the caliper bore (Fig. 2).

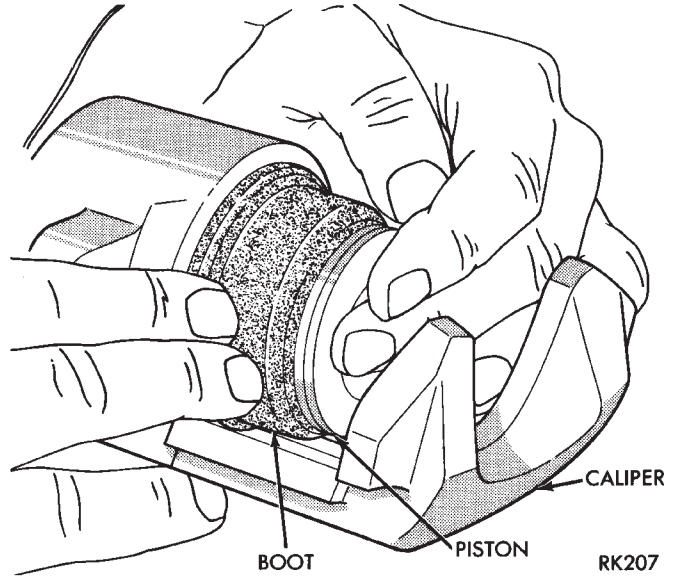


Fig. 2 Pushing Piston into Bore

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

Position dust boot in counterbore of the caliper piston bore.

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. 3).

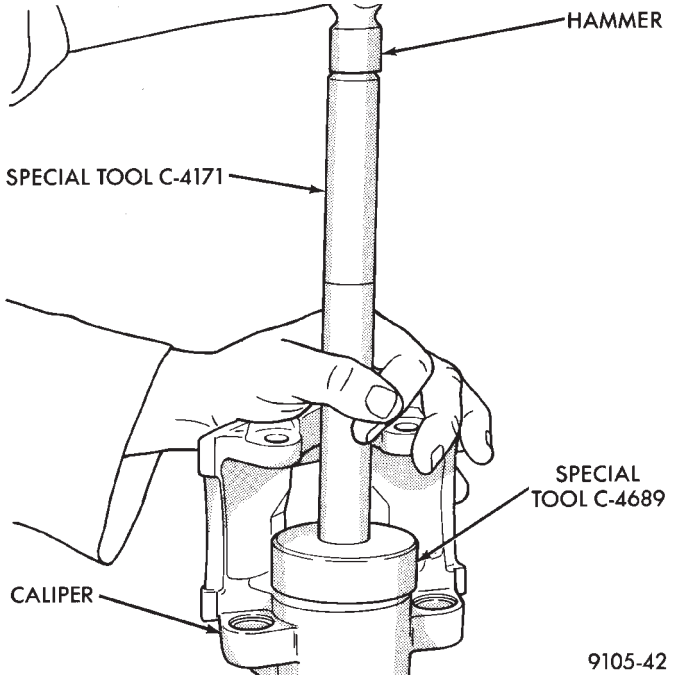


Fig. 3 Installing Dust Boot in Caliper Counterbore

Use the following steps, to install the Guide Pin Sleeve Bushings into the caliper assembly.

(1) Fold the bushing in half lengthwise at the solid middle section of the bushing (Fig. 4).

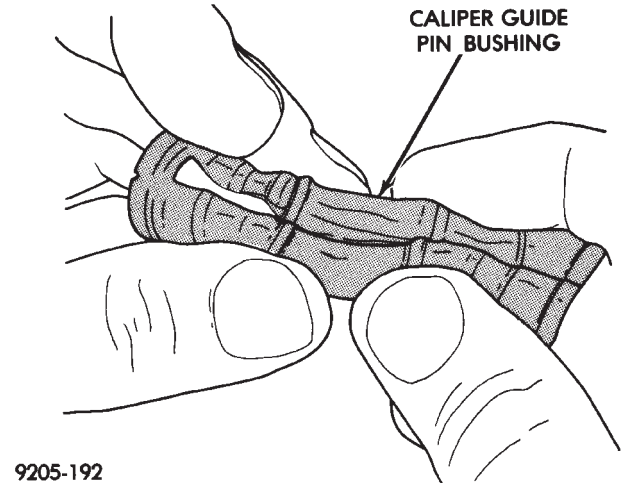


Fig. 4 Folded Caliper Guide Pin Bushing

(2) Using your fingers insert the folded bushing into the caliper assembly (Fig. 5). **Do not use a sharp object to perform this step do to possible damage to the bushing.**

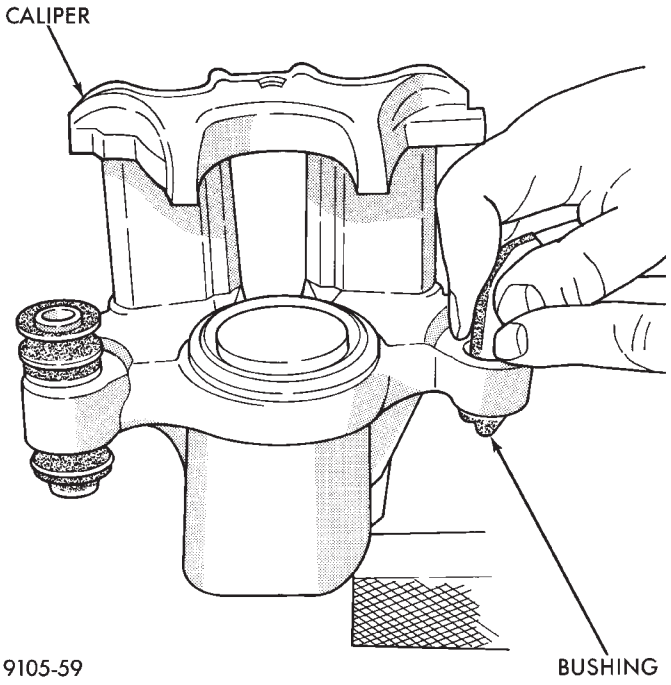


Fig. 5 Installing Caliper Guide Pin Sleeve Bushings

(3) Unfold the bushing using your fingers or a wooden dowel until the bushing is fully seated into the caliper assembly. Flanges should be seated evenly on both sides of the bushing hole in the caliper assembly (Fig. 6).

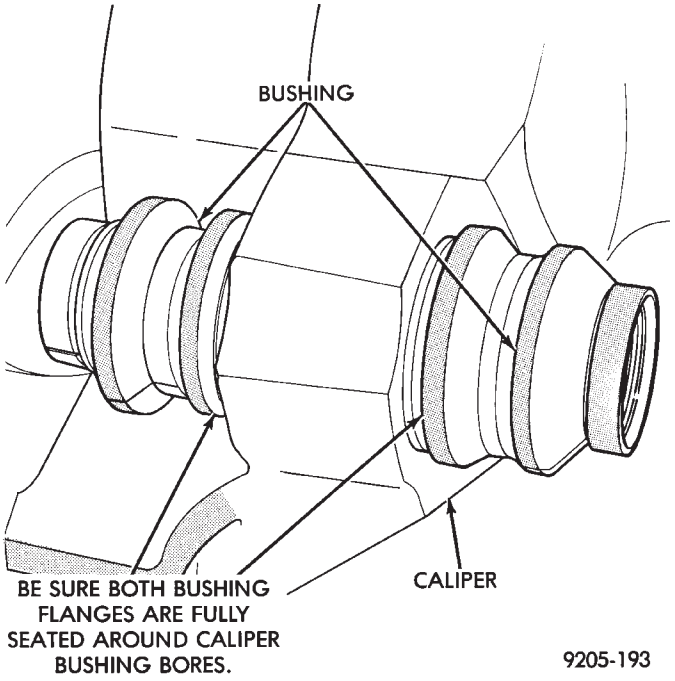


Fig. 6 Bushing Correctly Installed In Caliper

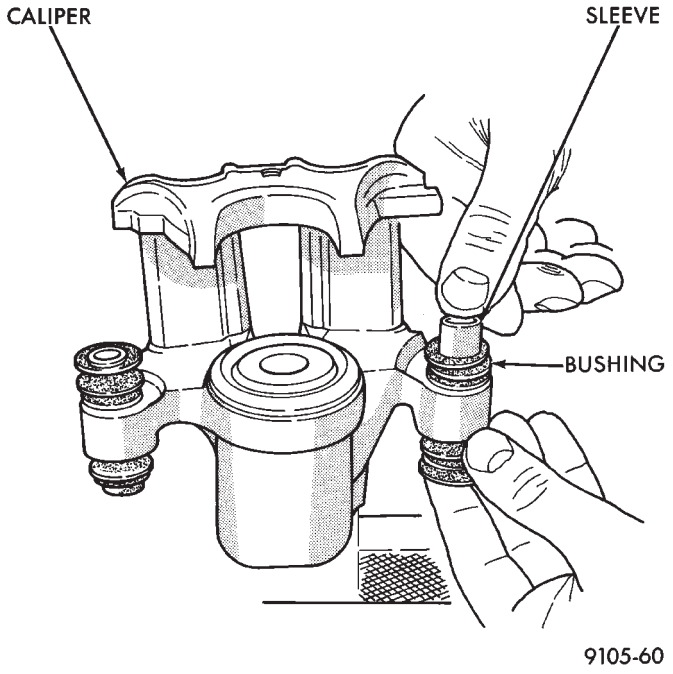


Fig. 7 Installing Caliper Sleeves

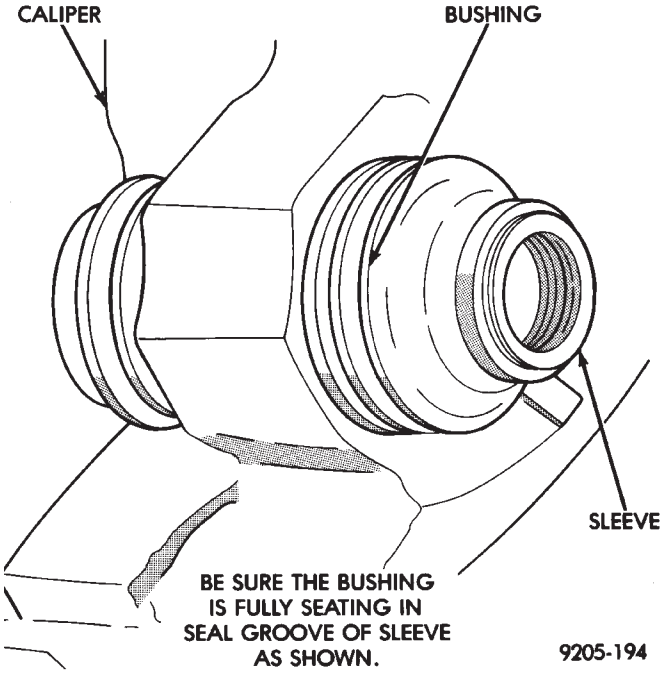


Fig. 8 Installed Caliper Bushing Sleeve

Install the Guide Pin Sleeve into the guide bushing using the following procedure.

(1) Install the sleeve into one end of the bushing until the seal area of the bushing is past the seal groove in the sleeve (Fig. 7).

(2) Holding the convoluted end of the bushing with one hand. Push the sleeve through the bushing (Fig. 7) until the one end of the bushing is fully seated into the seal groove on the one end of the sleeve.

(3) Holding the sleeve in place work the other end of the bushing over the end of the sleeve and into the seal grove (Fig. 8). Be sure the other end of the bushing did not come out of the seal grove in the sleeve.

(4) When the sleeve is seated properly into the bushing. The sealed for life bushing can be held between your fingers and easily slid back and forth without the bushing seal unseating from the sleeve.

Before installing caliper assembly on vehicle, inspect braking disc. If any conditions as described in Checking Braking Disc for Runout and Thickness are present the braking disc, must be replaced or refaced. If the braking disc does not require any servicing, install caliper assembly.

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.**

Bleed the brake system (see Bleeding Brake System).

REAR DISC BRAKES

INDEX

GENERAL INFORMATION

The rear disc brakes are similar to front disc brakes, however, there are several distinctive features that require different service procedures. This single piston, floating caliper rear disc brake assembly includes a hub assembly, adapter, braking disc (rotor), caliper, shoes and 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 braking disk (rotor).

The AC and AY body vehicles are equipped with a caliper assembly that has a 36 mm (1.42 inch) piston, and utilizes a 14 inch solid braking disc (rotor).

The AA body vehicle are equipped with a caliper assembly that uses a 34 mm (1.34 inch) piston. The AA body uses the same 14 inch solid braking disc (rotor) as on the AC and AY applications. Also available on the AA body is a caliper assembly with a 36 mm (1.42 inch) piston, with a 15 inch vented braking disc (rotor).

The AG and AJ body vehicles are also equipped with different size caliper pistons depending on the size and type of braking disk used on the vehicle. The 14″ solid braking disk (rotor) applications use a 34 mm (1.34 inch) piston, and the 15″ vented braking disk (rotor) applications use a 36 mm (1.42 inch) piston.

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 is mounted to the rear axle of the vehicle and 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 shoes for movement for and aft (Fig. 1)

LINING WEAR

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

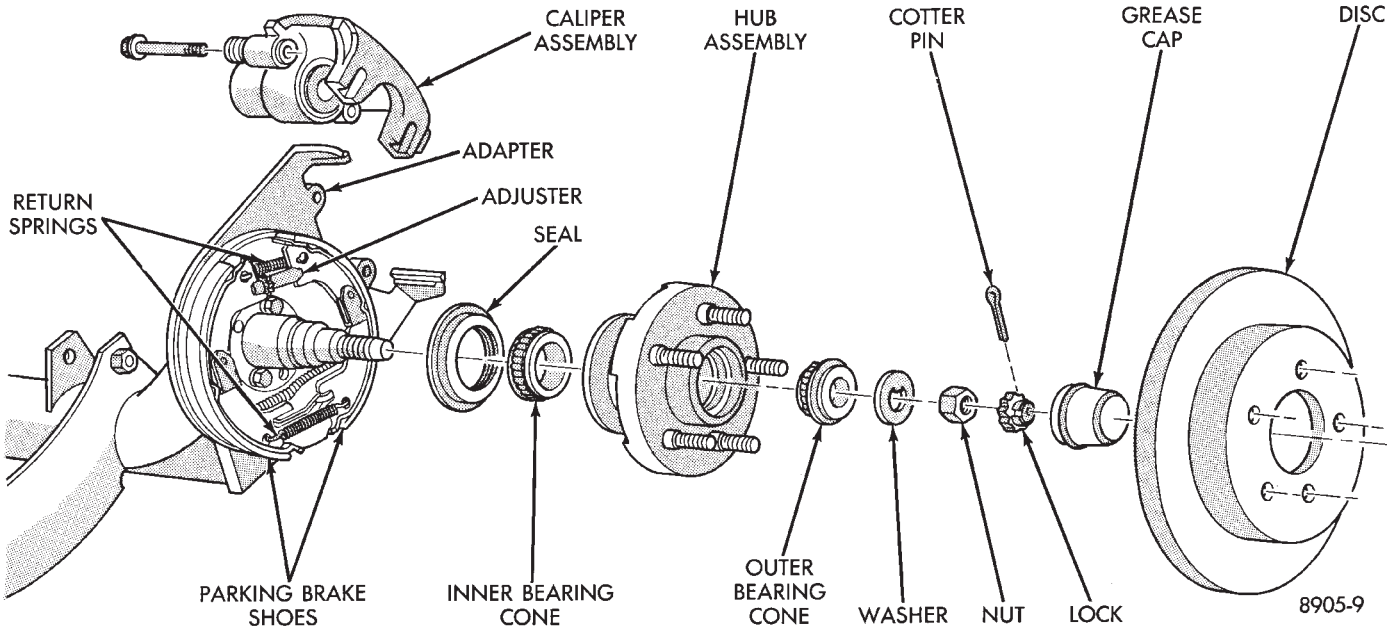


Fig. 1 Rear Disc Brake Assembly

removal will be necessary. Remove the shoe and lining assemblies (see Brake Shoe Removal).

Combined shoe and lining thickness should be measured at the thinnest part of the assembly.

When a shoe and lining assembly is worn to a thickness of approximately 7.0 mm (9/32 inch) it should be replaced.

Replace both shoe assemblies (inboard and outboard) on both wheels whenever shoe assemblies on either side are replaced.

If a shoe assembly does not require replacement. Reinstall it, making sure each shoe assembly is returned to its original position on the wheel of the vehicle from which it was removed. (See Brake Shoe Installation).

SERVICE PRECAUTIONS

WARNING: DUST AND DIRT ON BRAKE PARTS GENERATED DURING THE NORMAL USE AND WEAR OF MOTOR VEHICLE BRAKE SYSTEMS CAN CONTAIN ASBESTOS FIBERS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM, SUCH AS ASBESTOSIS AND CANCER. EXTREME CARE SHOULD BE EXERCISED WHILE SERVICING BRAKE ASSEMBLIES OR COMPONENTS.

DO NOT CLEAN BRAKE ASSEMBLIES OR COMPONENTS WITH COMPRESSED AIR OR BY DRY BRUSHING; USE A VACUUM CLEANER SPECIFICALLY RECOMMENDED FOR USE WITH ASBESTOS FIBERS. IF A SUITABLE VACUUM CLEANER IS NOT AVAILABLE, CLEANING SHOULD BE DONE WET USING A WATER DAMPENED CLOTH.

DO NOT CREATE DUST BY SANDING, GRINDING,AND/OR SHAVING BRAKE LININGS OR PADS UNLESS SUCH OPERATION IS DONE WHILE USING PROPERLY EXHAUST VENTILATED EQUIPMENT.

DISPOSE OF ALL DUST AND DIRT SUSPECTED TO CONTAIN ANY ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE DUST EXPOSURE TO YOURSELF AND OTHERS.

FOLLOW ALL RECOMMENDED PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY. FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DIRT WHICH MAY CONTAIN ASBESTOS FIBERS.

Grease or any other foreign material must be kept off the caliper assembly, surfaces of the braking disc and external surfaces of the hub, during service procedures.

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

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

Before vehicle is moved after any brake service work, be sure to obtain a firm brake pedal.

BRAKE SHOE REMOVAL

(1) Raise vehicle on jackstands or centered on a hoist.

(2) Remove rear wheel and tire assemblies.

(3) Remove caliper attaching bolts (Fig. 2).

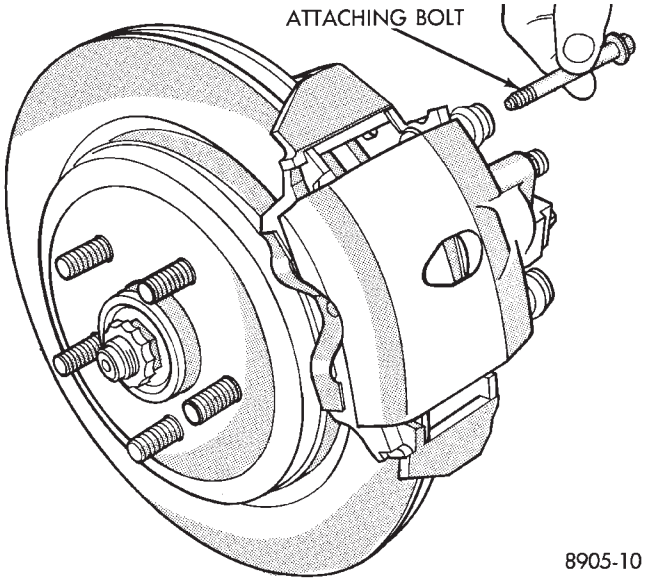


Fig. 2 Removing Caliper Attaching Bolts

(4) Lift caliper away from adapter rails (Fig. 3).

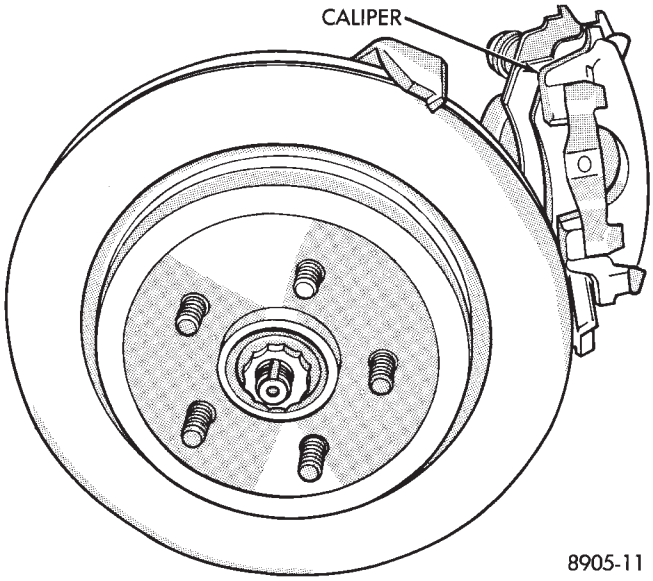


Fig. 3 Removing Caliper

(5) Remove outboard shoe. By prying the shoe retaining clip over the raised area on the caliper. Then slide the shoe down and off the caliper (Fig. 4).

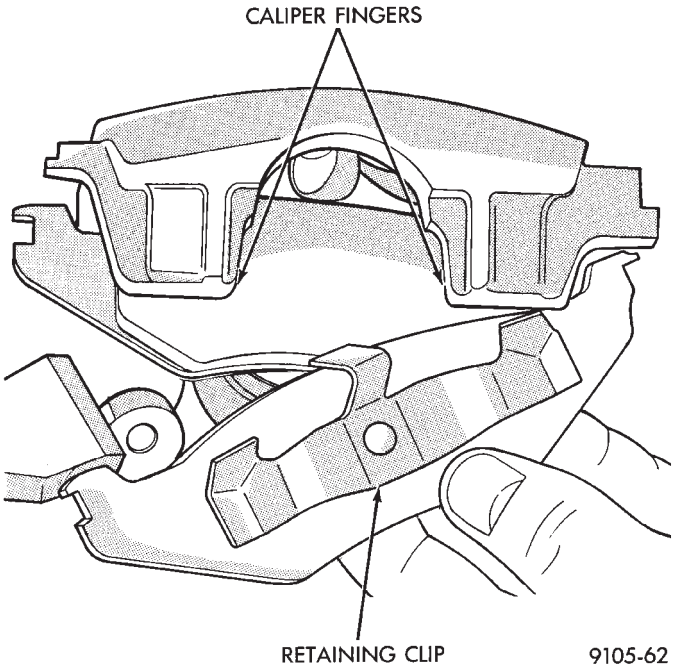


Fig. 4 Removing Outboard Shoe

(6) Pull inboard shoe away from piston, until the retaining clip is free from the cavity in the piston. (Fig. 5).

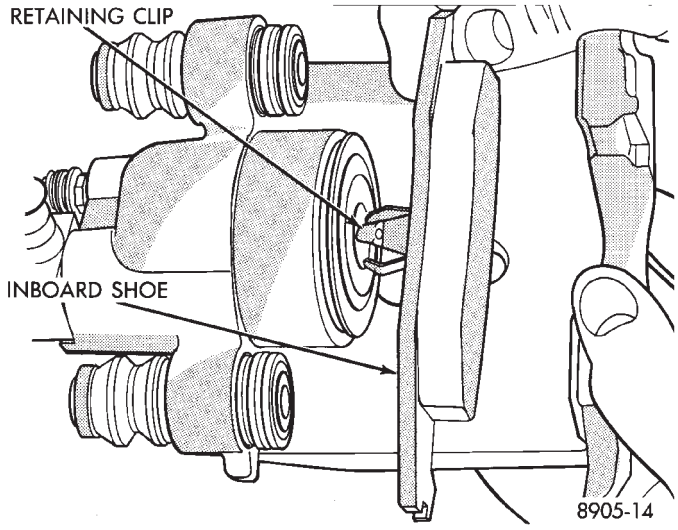


Fig. 5 Removing Inboard Shoe

CLEANING AND INSPECTION

Check for piston seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of piston dust boot. If the boot is damaged, or fluid leak is visible, disassemble caliper assembly and install a new seal and boot (and piston if scored). Refer to procedure titled Disassembling Caliper.

BRAKE SHOE INSTALLATION

(1) Retract piston.

(2) Install inboard brake shoe by inserting shoe retaining clip into piston cavity. Be sure brake shoe is seated squarely on the face of the piston. (Fig. 6).

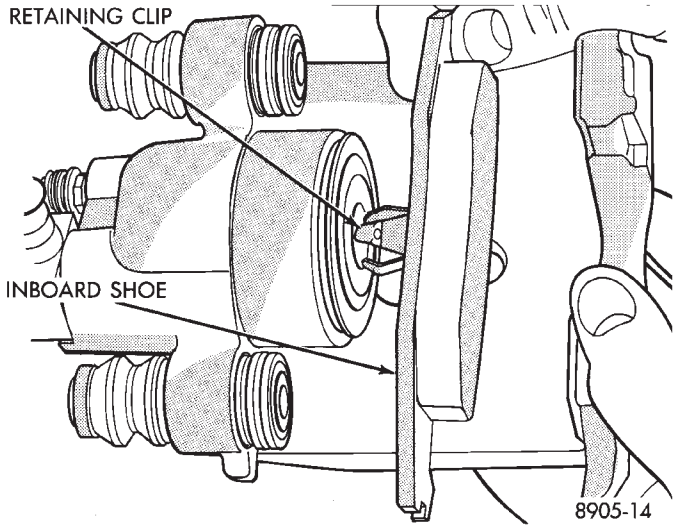


Fig. 6 Installing Inboard Shoe

(3) Install outboard shoe by sliding retaining clip over caliper fingers. Be sure the brake shoe is installed on the caliper, so the retaining clip is past the raised area on the caliper fingers (Fig. 7).

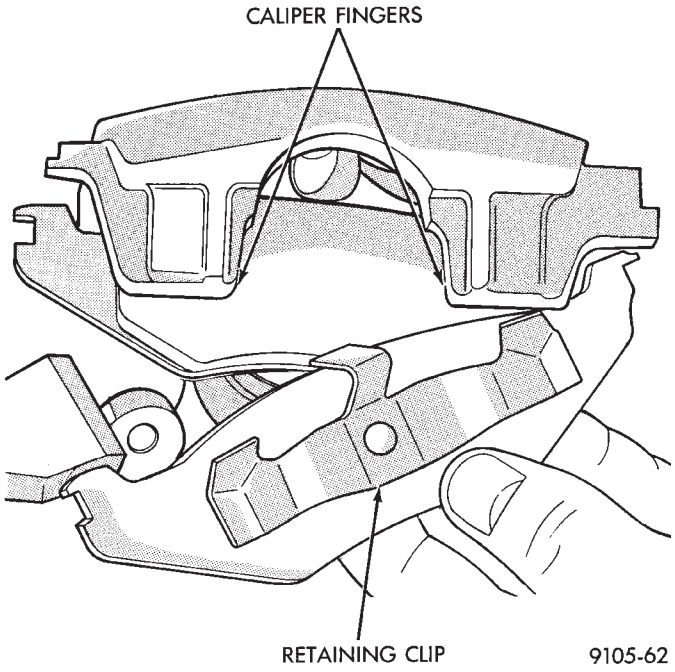


Fig. 7 Installing Outboard Shoe

(4) Install lower end of caliper on to adapter. Make sure the lower tabs on the brake shoes and the casting projections on the caliper are under the adapter rail (Fig. 8).

(5) Rotate caliper down over rotor.

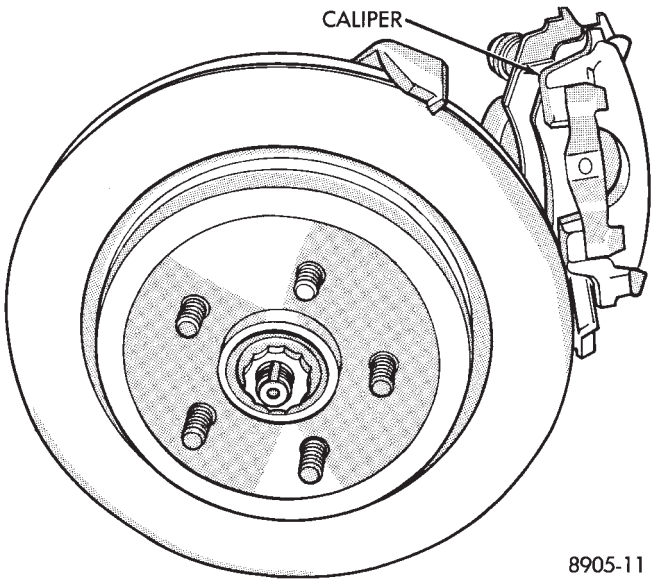


Fig. 8 Installing Caliper

(6) Install caliper attaching bolts and tighten to 22 N●m (193 in. lbs.) torque (Fig. 9).

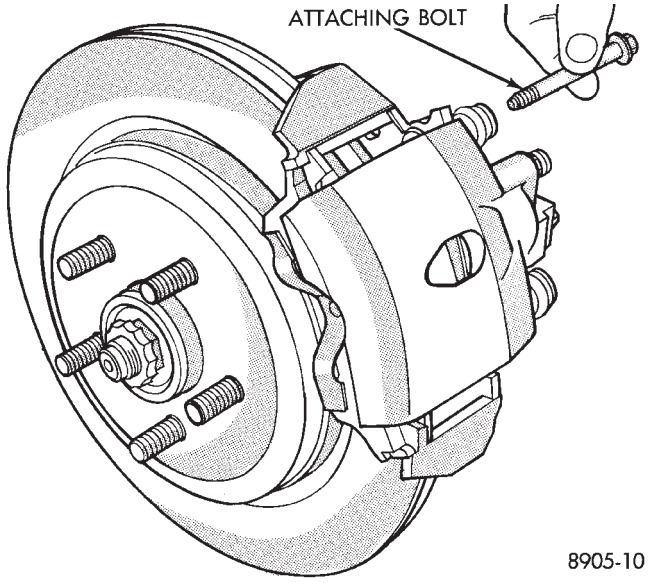


Fig. 9 Installing Attaching Bolts

(7) Install wheel and tire assembly. Tighten stud nuts in proper sequence until all nuts are torqued to half specification. **This is important.** Then repeat sequence to full specification.

(8) Remove jackstands or lower hoist. **Before moving vehicle be sure it has a firm pedal.**

DISASSEMBLING REAR CALIPER ASSEMBLY

CLEANING AND INSPECTION

Check for piston fluid seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of piston dust boot. If boot is damaged, or fluid leak is visible, disassemble caliper assembly and install a new seal and boot, (and piston if scored). Refer to procedures titled Disassembling Caliper.

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 Caliper Service.

(1) Remove caliper from braking disc (See Brake Shoe Removal). Hang assembly on a wire hook away from braking disc, so hydraulic fluid cannot get on braking disc (See Fig. 4 in Brake Shoe Removal). Place a small piece of wood between the piston and caliper fingers.

(2) **Carefully** depress brake pedal to hydraulically push piston out of bore. (Brake pedal will fall away when piston has passed bore opening.) Then prop up the brake pedal to any position below 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 flexible brake line at frame bracket after removing piston. Plug brake tube and remove piston from opposite caliper. Using the same process as above for the first piston removal.

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

(4) Disconnect brake flexible hose from the caliper. To disassemble, mount caliper assembly in a vise equipped with protective jaws.

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

Support rear caliper assembly in a vise. Then remove caliper to piston dust boot and discard (Fig. 1).

Using a plastic trim stick, work piston seal out of its groove in caliper piston bore (Fig. 2). Discard old seal. **Do not use a screwdriver or other metal tool for this operation, because of the possibility of scratching piston bore or burring edges of seal groove.**

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

(1) Using your fingers push on one end the inner sleeve until it pops out of the bushing. Then grasp the inner sleeve with your fingers and pull the inner sleeve out from the inside of the bushing (Fig. 3).

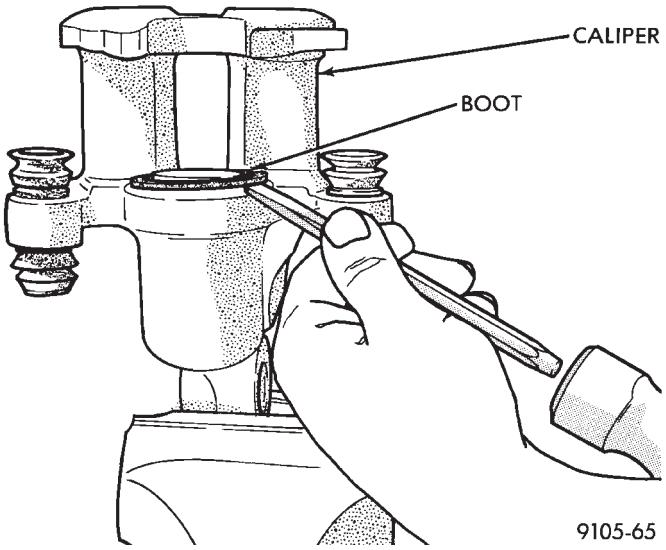


Fig. 1 Removing Piston Dust Boot

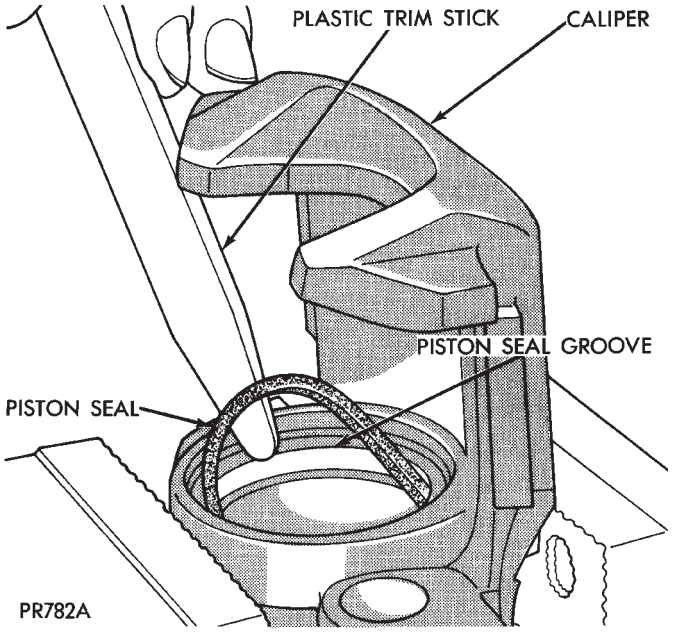


Fig. 2 Removing Piston Seal

(2) Using your fingers collapse one side of the bushing. Then pull on the opposite side to remove the bushing from the caliper assembly (Fig. 4).

CLEANING AND INSPECTION

Clean all parts using alcohol or a suitable solvent and wipe dry. Clean out all drilled passages and bores on the caliper assembly body. **(Whenever a caliper has been disassembled, a new boot and seal must be installed at assembly).**

Inspect the caliper assembly piston bore for scoring or pitting. Bores that show light scratches or corrosion, can usually have the scratches or corrosion removed using crocus cloth.

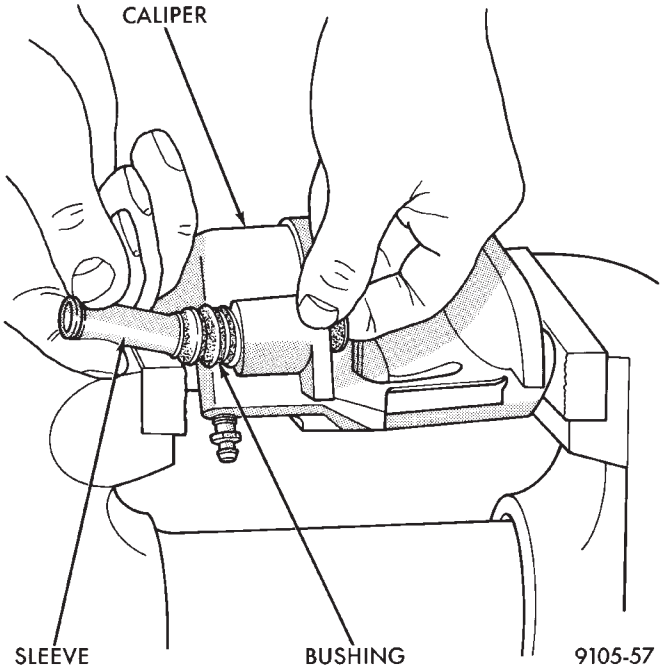


Fig. 3 Removing Inner Sleeve From Bushing

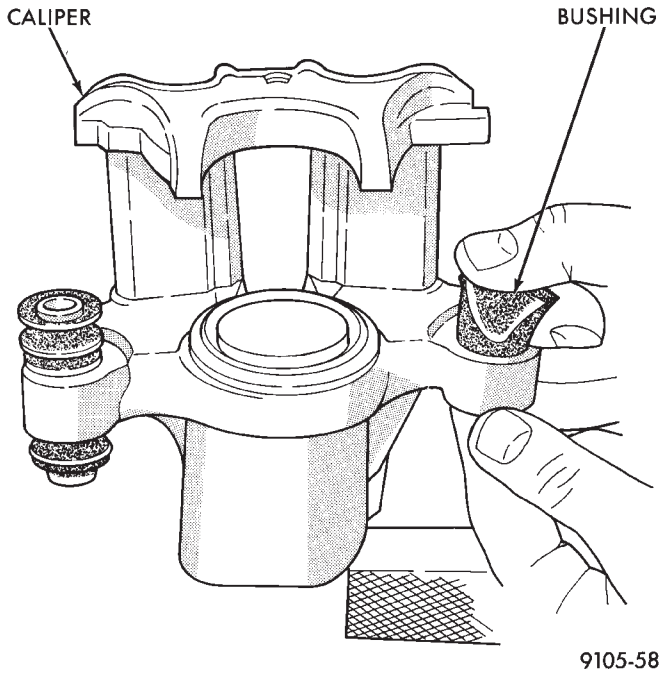


Fig. 4 Removing Bushings From Caliper

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. 5).

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.

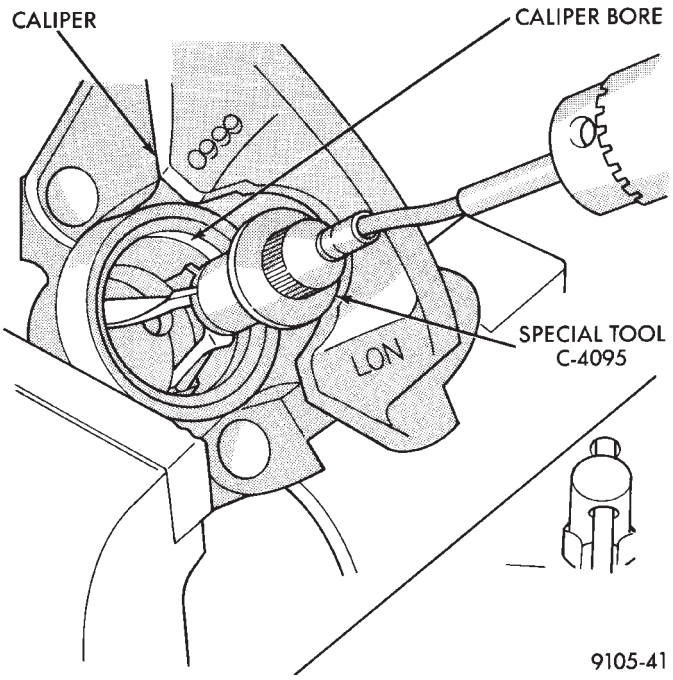


Fig. 5 Honing Piston Bore

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.

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.

ASSEMBLING REAR DISC BRAKE CALIPER

Clamp caliper in vise (with protective caps on vise jaws).

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

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. 6), 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. 6).

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

Position dust boot over piston after coating with brake fluid.

Install piston into caliper bore pushing it past the piston seal until it bottoms in the caliper bore (Fig. 7).

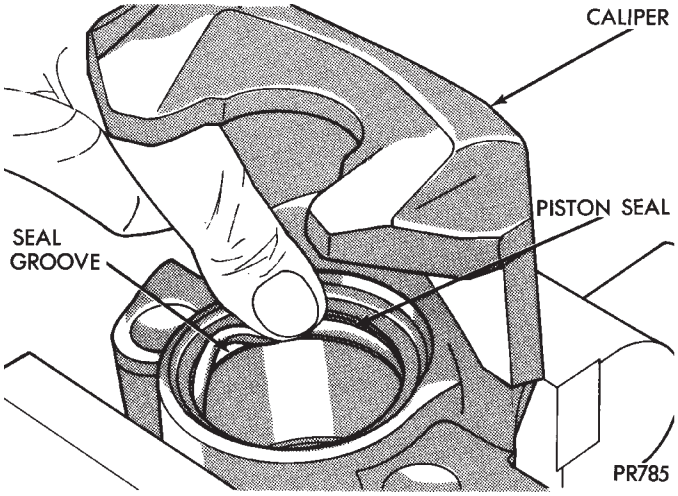


Fig. 6 Installing New Piston Seal

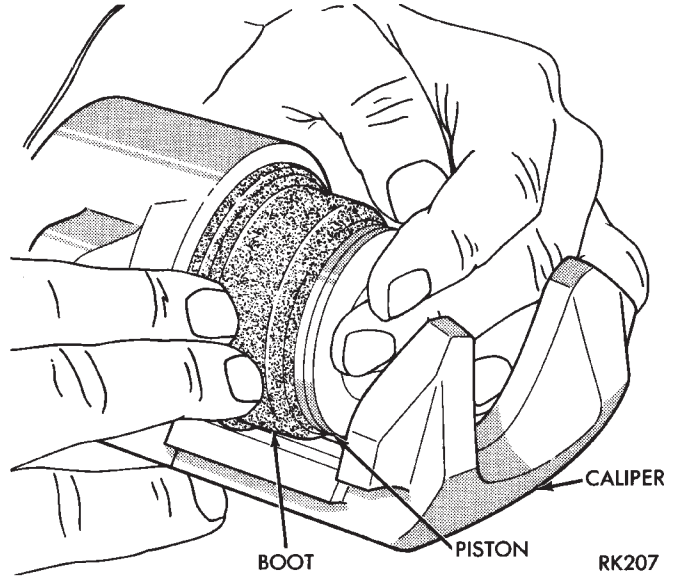


Fig. 7 Pushing Piston into Bore

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

Position dust boot in counterbore of the caliper piston bore.

Using a hammer and Installer Piston Caliper Boot, Special Tool C-4383-7 and Handle, Special Tool C-4171, drive boot into counterbore of the caliper (Fig. 8).

Use the following steps, to install the Guide Pin Sleeve Bushings into the caliper assembly.

(1) Fold the bushing in half lengthwise at the solid middle section of the bushing (Fig. 9).

(2) Using your fingers insert the folded bushing into the caliper assembly (Fig. 10). **Do not use a sharp object to perform this step do to possible damage to the bushing.**

(3) Unfold the bushing using your fingers or a wooden dowel until the bushing is fully seated into

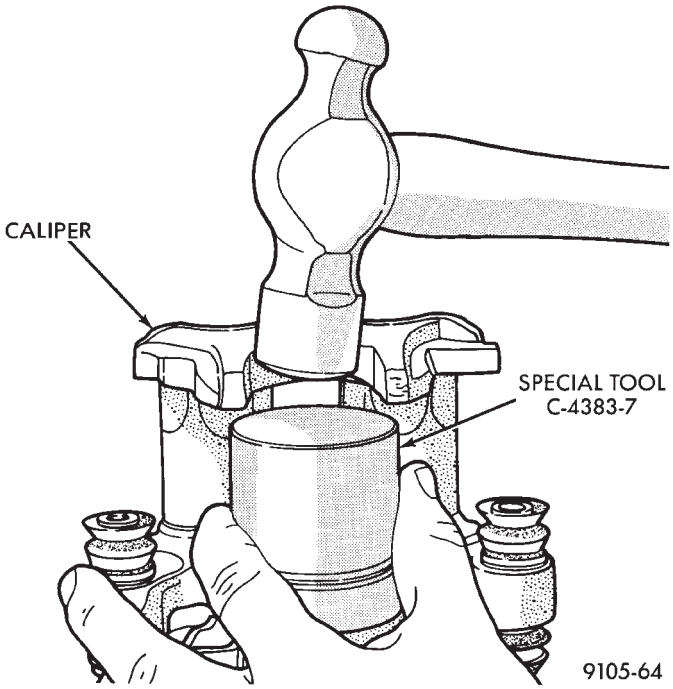


Fig. 8 Installing Boot in Caliper

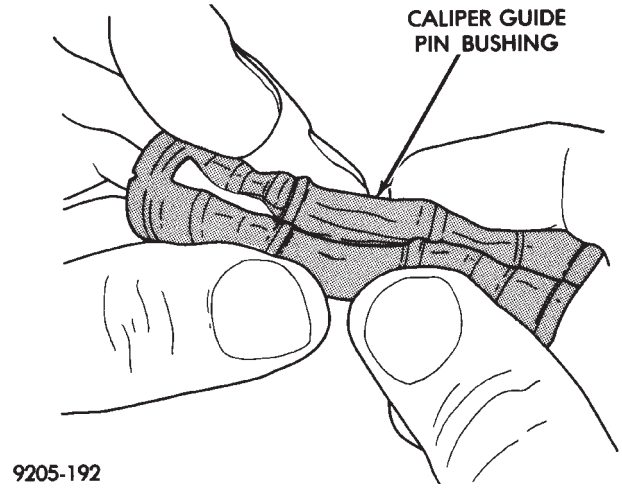


Fig. 9 Folded Caliper Guide Pin Bushing

the caliper assembly. Flanges should be seated evenly on both sides of the bushing hole in the caliper assembly (Fig. 11).

Install the Guide Pin Sleeve into the guide bushing using the following procedure.

(1) Install the sleeve into one end of the bushing until the seal area of the bushing is past the seal groove in the sleeve (Fig. 12).

(2) Holding the convoluted end of the bushing with one hand. Push the sleeve through the bushing (Fig. 13) until the one end of the bushing is fully seated into the seal groove on the one end of the sleeve.

(3) Holding the sleeve in place work the other end of the bushing over the end of the sleeve and into the seal grove (Fig. 13). Be sure the other end of the bushing did not come out of the seal grove in the sleeve.

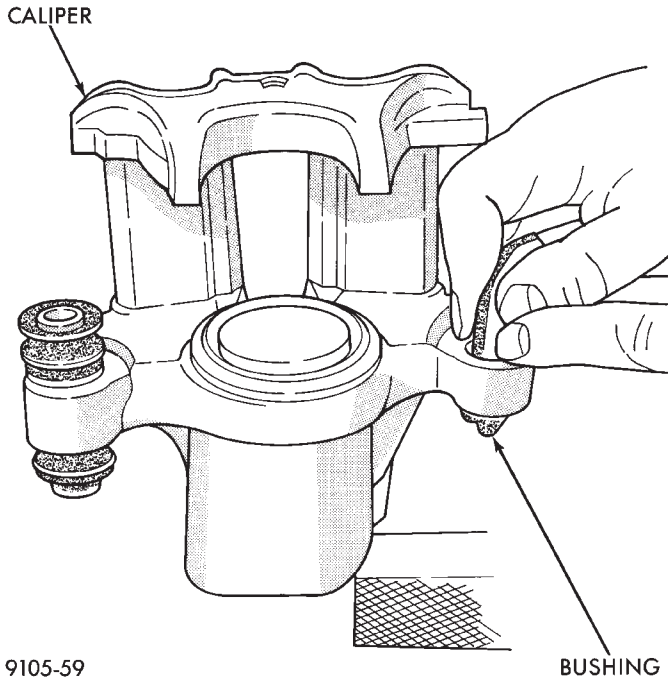


Fig. 10 Installing Caliper Guide Pin Sleeve Bushings

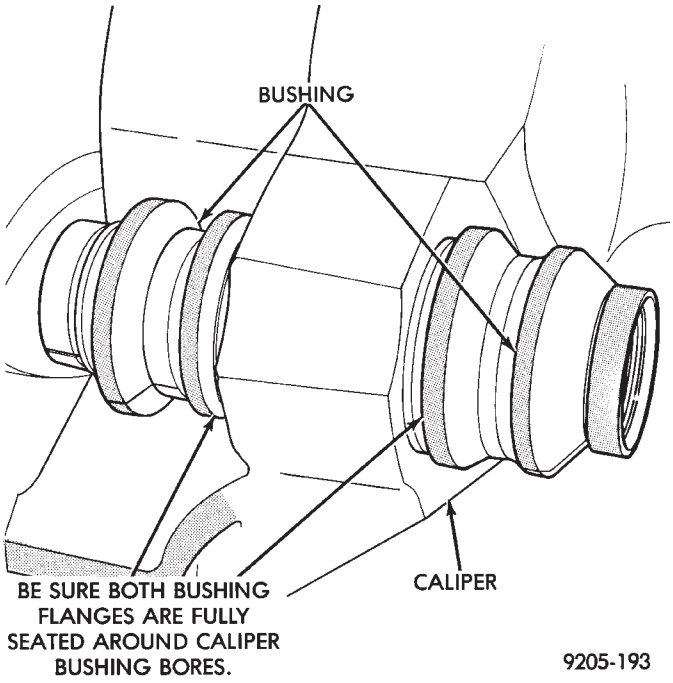


Fig. 11 Bushing Correctly Installed In Caliper

(4) When the sleeve is seated properly into the bushing. The sealed for life bushing can be held between your fingers and easily slid back and forth without the bushing seal unseating from the sleeve.

Before installing caliper assembly on vehicle, inspect braking disc. If any conditions as described in Checking Braking Disc for Runout and Thickness are present the braking disc, must be replaced or refaced. If the braking disc does not require any servicing, install caliper assembly.

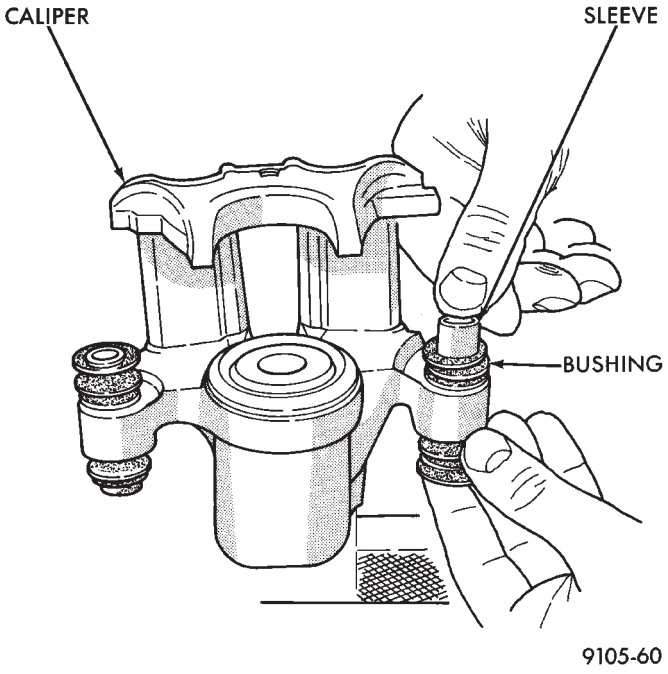


Fig. 12 Installing Caliper Sleeves

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.**

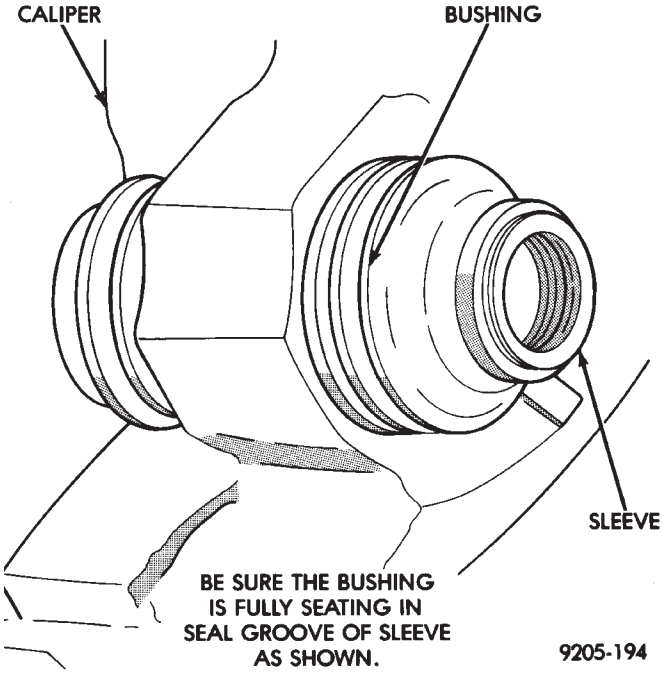


Fig. 13 Installed Caliper Bushing Sleeve

Bleed the brake system (see Bleeding Brake System). Pump the brake pedal several times to be sure that the vehicle has a firm pedal, before the vehicle is moved or driven.

BRAKE DISC (ROTOR)

INDEX

GENERAL INFORMATION

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

CAUTION: If the braking disk (rotor) needs to be replaced with a new part. The protective coating on the braking surfaces of the rotor MUST BE REMOVED with an appropriate solvent, to avoid contamination of the brake shoe linings.

When replacing a rotor with a new part do NOT reface the new rotor. Rotor already has the required micro finish when manufactured, only remove the protective coating.

INSPECTION DIAGNOSIS

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

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

Excessive lateral rotor runout or wobble.

Thickness variation (Parallelism).

Dishing or distortion (Flatness).

If a vehicle has not been driven for a period of time. The discs 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 disc can cause temporary improper lining contact if ridges are not removed before installation of new brake shoe assemblies.

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

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

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

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

SERVICE PROCEDURES

CHECKING BRAKING DISC FOR RUNOUT AND THICKNESS

On vehicle, braking disc (rotor) runout is the combination of the individual runout of the hub face and the runout of the disc. (The hub and disc are separable). To measure runout on the vehicle, remove the wheel and reinstall the lug nuts tightening the disc 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 disc (braking surface) approximately one inch from edge of disc (See Fig. 1). Check lateral runout (both sides of disc) runout should not exceed 0.13 mm (0.005 inch).

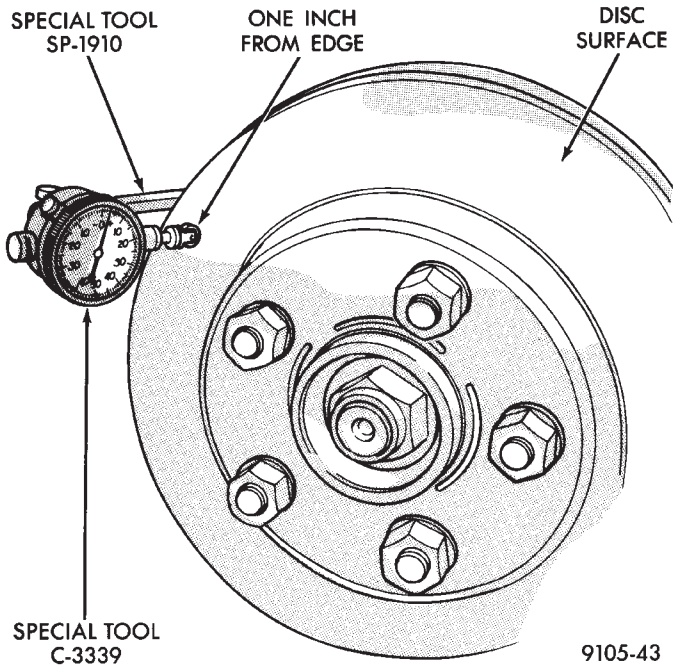


Fig. 1 Checking Braking Disc for Runout

If runout is in excess of the specification, check the lateral runout of the hub face. Before removing disc from hub, make a chalk mark across both the disc and one wheel stud on the high side of runout. So you'll know exactly how the disc and hub was originally mounted (Fig. 2). Remove disc from hub.

Install Dial Indicator, Special Tool C-3339 and Mounting Adaptor, Special Tool SP-1910 on steering

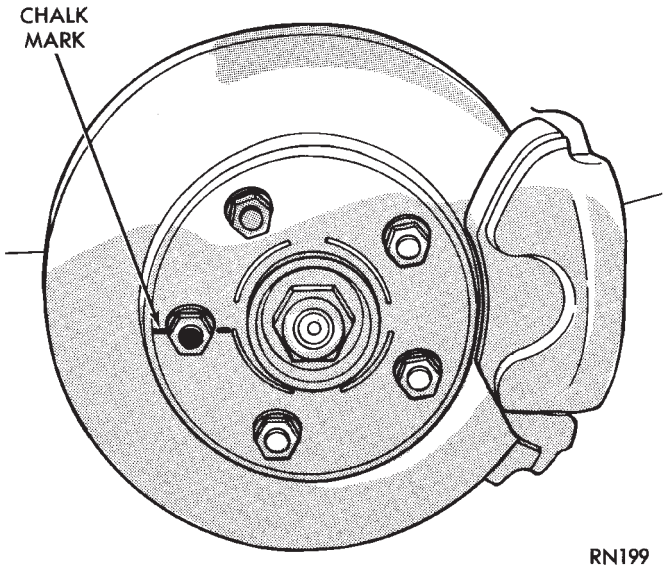


Fig. 2 Marking Braking Disc and Wheel Stud

knuckle. Position stem so it contacts hub face near outer diameter. Care must be taken to position stem outside the stud circle but inside the chamfer on the hub rim. **Clean hub surface before checking.** (See Fig. 3)

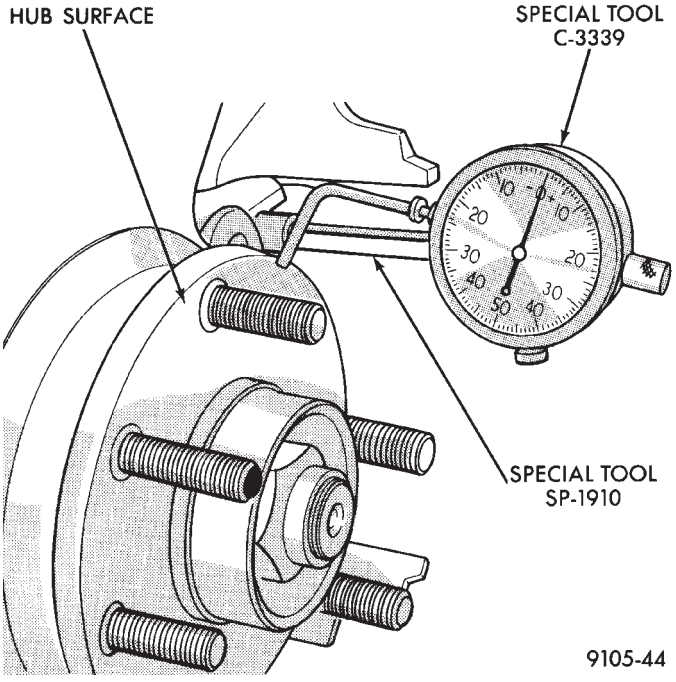


Fig. 3 Checking Hub for Runout

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 disc on hub with chalk marks two wheel studs apart (Fig. 4). Tighten nuts in the proper sequence and torque to specifications. Finally, check runout of disc to see if runout is now within specifications.

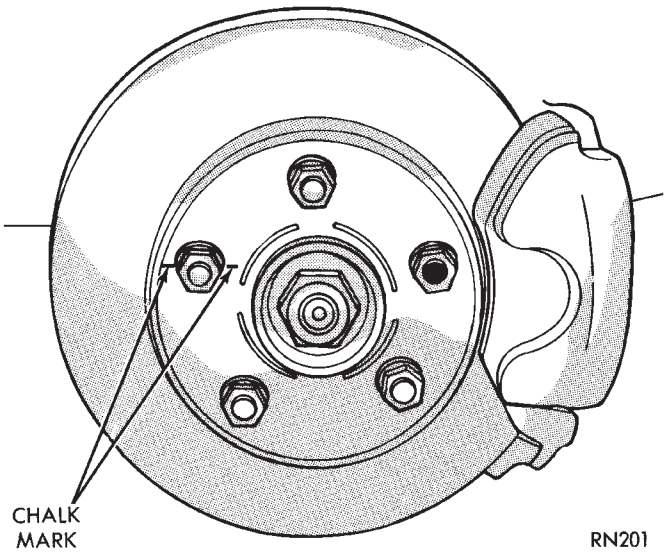


Fig. 4 Index Braking Disc and Wheel Stud

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

Thickness variation measurements of disc should be made in conjunction with runout. Measure thickness of disc at 12 equal points with a micrometer at a radius approximately 25.4 mm (1 inch) from edge of disc (Fig. 5). If thickness measurements vary by more than 0.013 mm (0.0005 inch) disc should be removed and resurfaced (Figs. 6 and 7), or a new disc installed. If cracks or burned spots are evident in the disc, disc must be replaced.

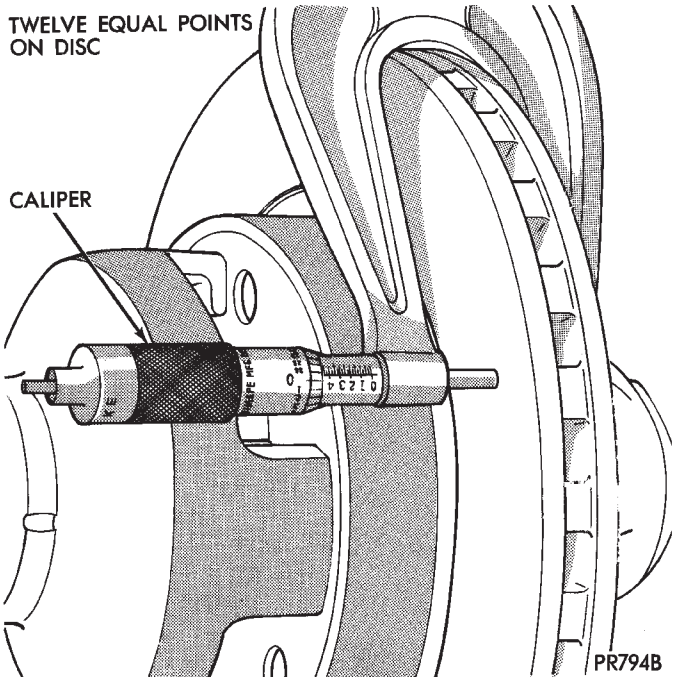


Fig. 5 Checking Disc for Thickness

Light scoring and/or wear is acceptable. If heavy scoring or warping is evident, the disc must be refinished or replaced (See Refinishing/Refacing Braking Disc). If cracks are evident in the disc, replace the disc.

BRAKING DISC REMOVAL

(1) Raise vehicle on hoist or jackstands. Remove wheel and tire assembly.

(2) Remove caliper assembly, as described under Brake Shoe Removal in this Group, (but do not disconnect brake line). Suspend caliper from wire hook or loop to avoid strain on flexible hose.

(3) Remove braking disc from the hub.

INSTALLING BRAKING DISC

(1) Slide braking disc on hub. Clean both sides of braking disc with alcohol or suitable solvent.

(2) Install caliper assembly, as described in Brake Shoe Installation paragraph.

REFINISHING BRAKING DISC

REFACING BRAKING DISC

Refacing of the braking disc is not required each time the shoe assemblies are replaced.

If the braking disc surface is deeply scored or warped or there is a complaint of brake roughness or pulsation the rotor should be resurfaced or refaced (Figs. 6 and 7).

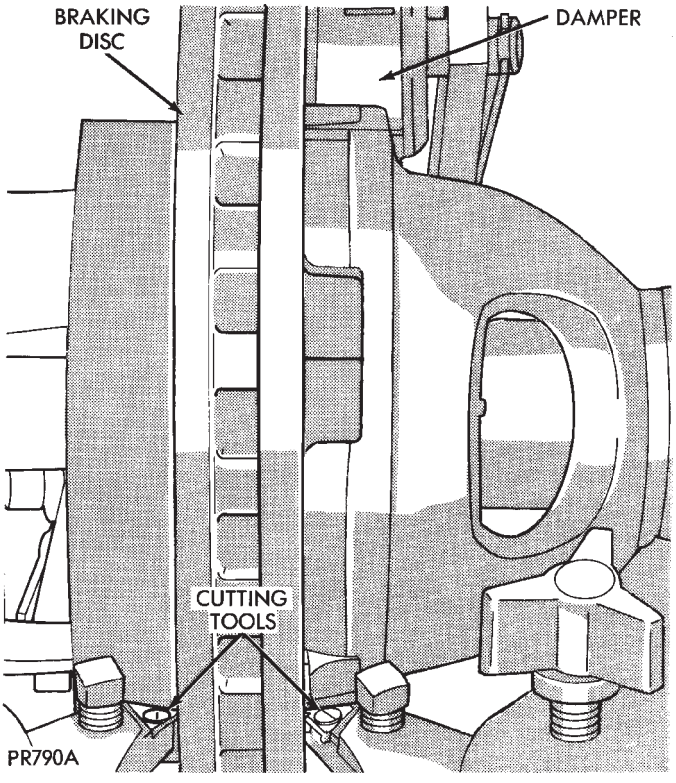


Fig. 6 Refacing Braking Disc

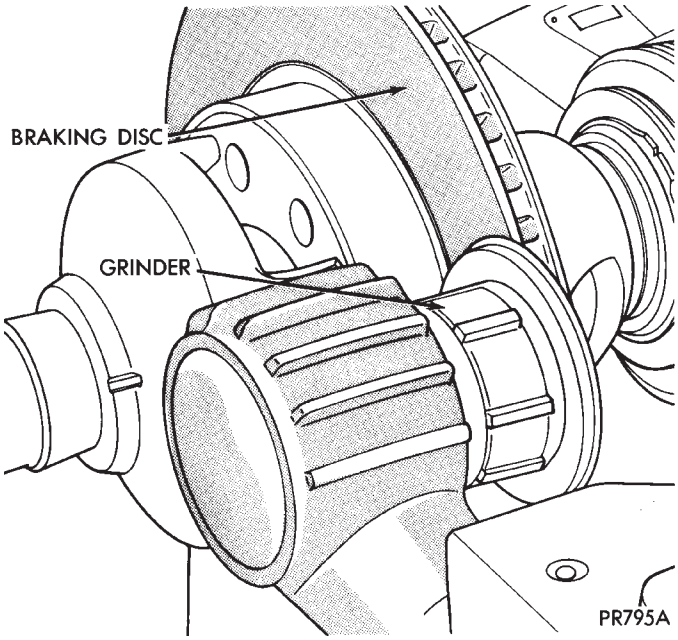


Fig. 7 Resurfacing Braking Disc (Final Finish)

When refacing a braking disc the required 0.10 mm (0.004 inch) TIR (Total Indicator Reading) and 0.013 mm (0.0005 inch) thickness variation limits MUST BE MAINTAINED. **Extreme care** in the operation of braking disc turning equipment is required.

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

If the disc is not mounted properly the run-out will be worse after refacing than before refacing.

The use of a double straddle cutter (Fig. 6) that machines both sides of the disc at the same time is highly recommended.

RESURFACING BRAKING DISC

This operation can be used when the disc surface is rusty or has lining deposits.

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

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

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

All braking discs have markings for minimum allowable thickness cast on an un-machined surface of the braking disc (Fig. 8). The thickness markings may be located on the disc as shown in (Fig. 8) or on an alternate surface.

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

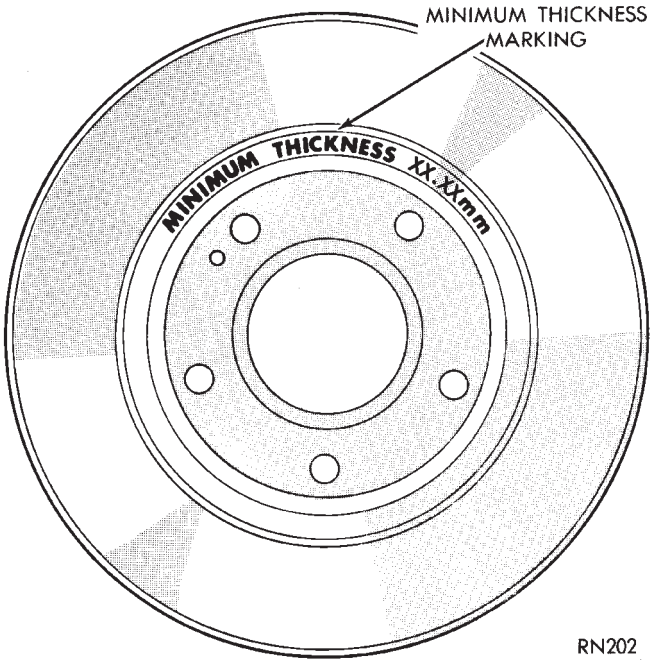


Fig. 8 Minimum Thickness Markings

BRAKING DISC (ROTOR) REFINISHING LIMITS

	Thickness	Minimum Thickness	Thickness Variation	Disc Runout*	Micro Finish
Braking Disc	22.13-21.87 mm (.870-.861 in.)	20.4 mm (.803 in.)	.013 mm (.0005 in.)	.13 mm (.005 in.)	15-80 RMS

*TIR – Total Indicator Reading (measured on vehicle)

9105-100

PARKING BRAKES

INDEX

GENERAL INFORMATION

The parking brake mechanism on vehicles with rear disc brake applications. Consists of a small duo-servo brake which is mounted to the adapter. The hat (center) section (Fig. 1) of the rear rotor serves as the braking surface (drum) for the parking brakes. On the vehicles with rear disc brake applications, the parking brake cables are single unit assemblies.

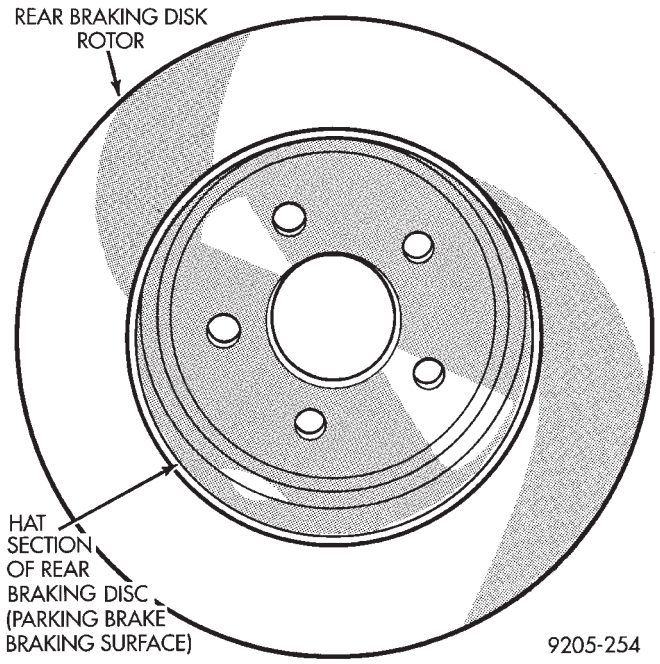


Fig. 1 Drum In Hat Braking Disc

On non-rear wheel disc brake applications, the rear wheel service brakes also act as parking brakes. The rear drum brake shoes are mechanically operated by an internal lever and strut connected to a flexible steel cable. The wheel brake cables are joined to an intermediate cable which attach to the front cable leading to the foot lever (Figs. 2, 3 and 4).

SERVICE PROCEDURES

ADJUSTING PARKING BRAKE

AP, AA, AC & AY (STANDARD BRAKES)

The service brakes must be properly adjusted before adjusting the parking brake.

Release the parking brake lever then back-off parking brake cable adjustment so there is slack in the cable (Figs. 2 and 3).

Before loosening cable adjusting nut, clean threads with a wire brush, and lubricate with Mopar Multi-Purpose grease on equivalent.

The rear brakes adjust every time you depress the brake pedal.

Adjust the parking brake after service brake adjustment by tightening the adjusting nut until a slight drag is felt while rotating the wheels.

Loosen the cable adjusting nut until both rear wheels can be rotated freely, then back-off the cable adjusting nut two full turns.

Apply and release the parking brake several times to see that the rear wheels rotate freely without dragging.

AG AND AJ BODY

The parking brake hand lever assembly contains a self adjuster for the cable system. Routine parking brake adjustment is no longer required (Figs. 3 and 4).

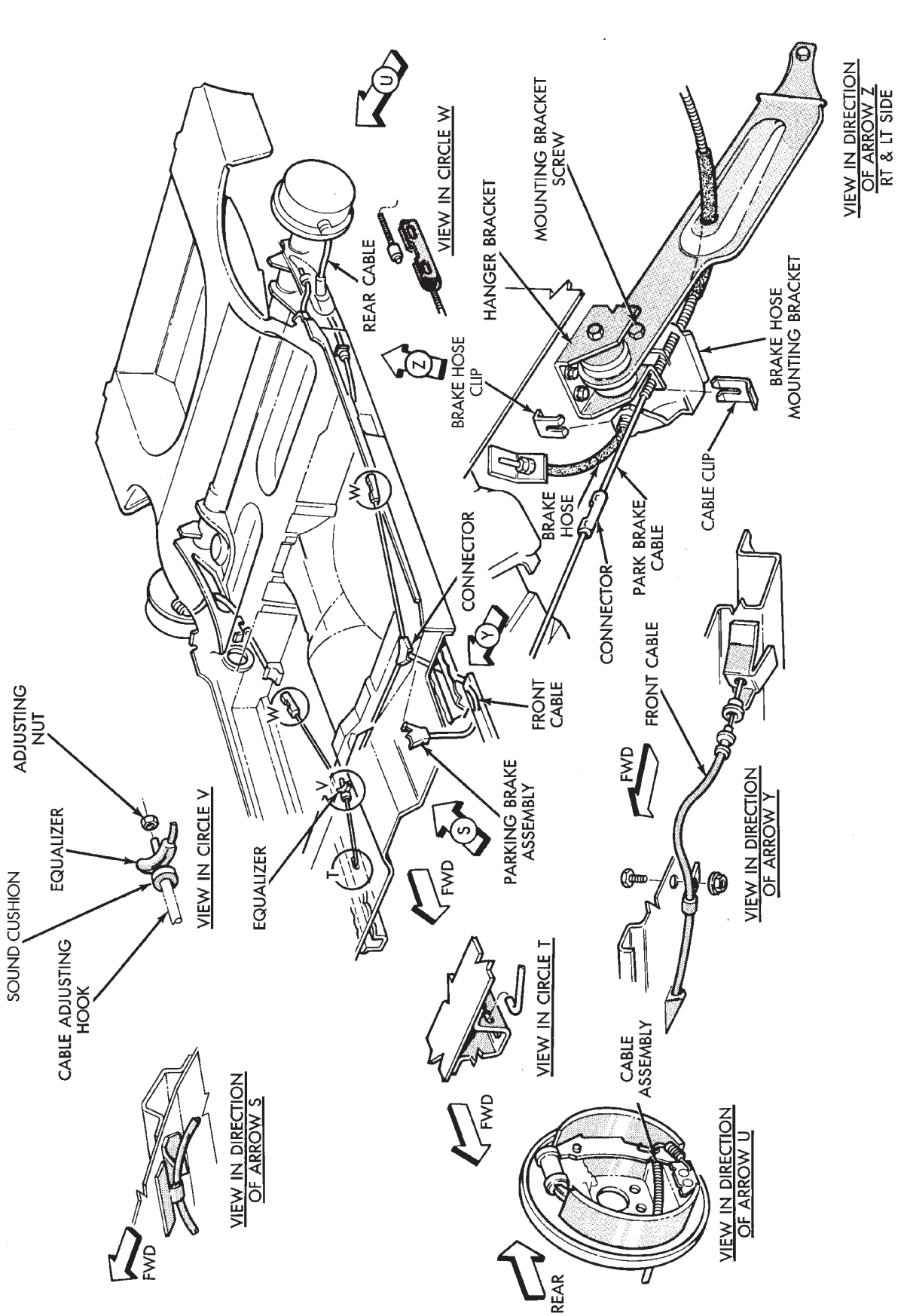


FIG. 2 PARKING BRAKE CABLE ROUTING AA AND AP BODY

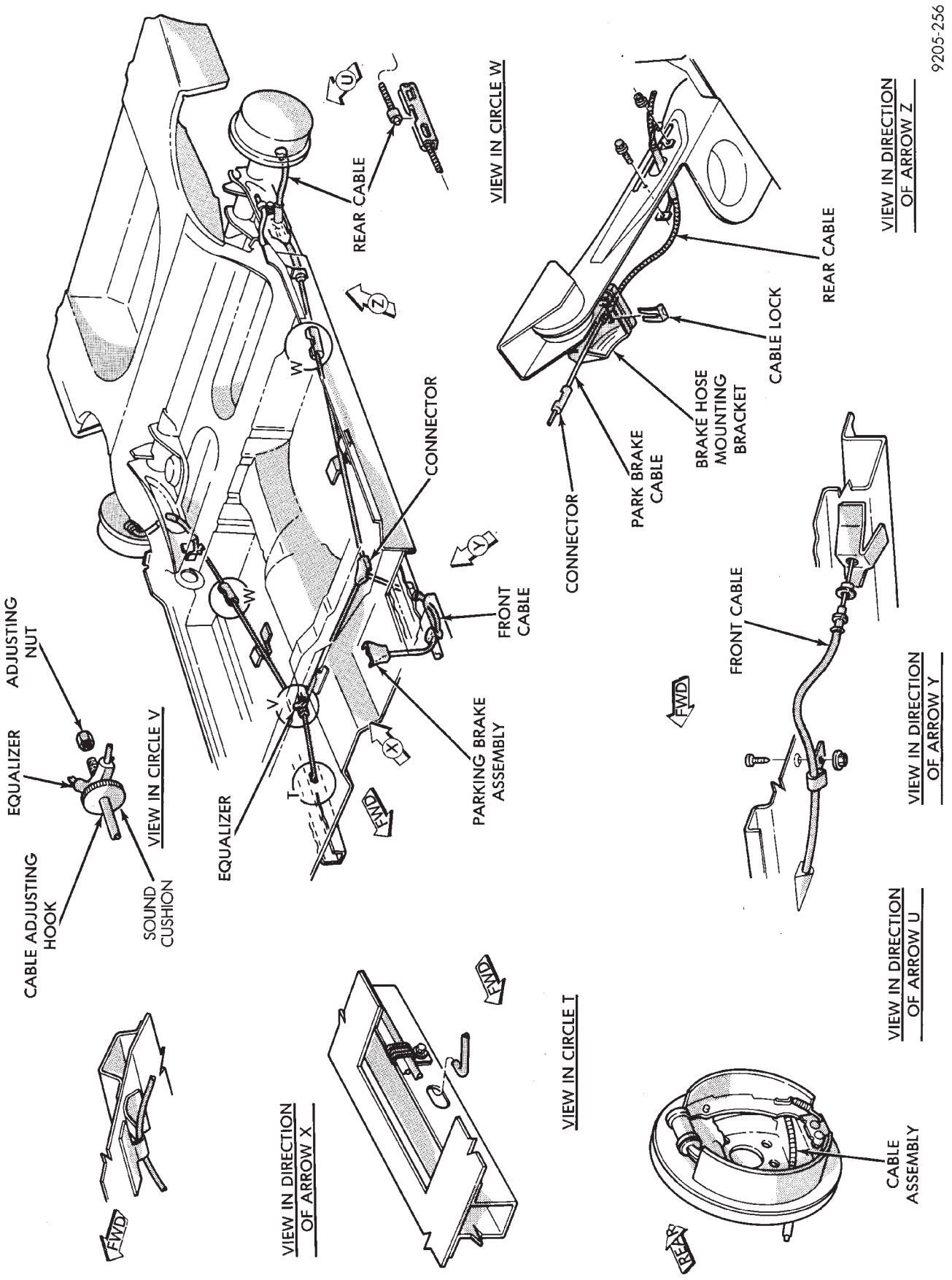
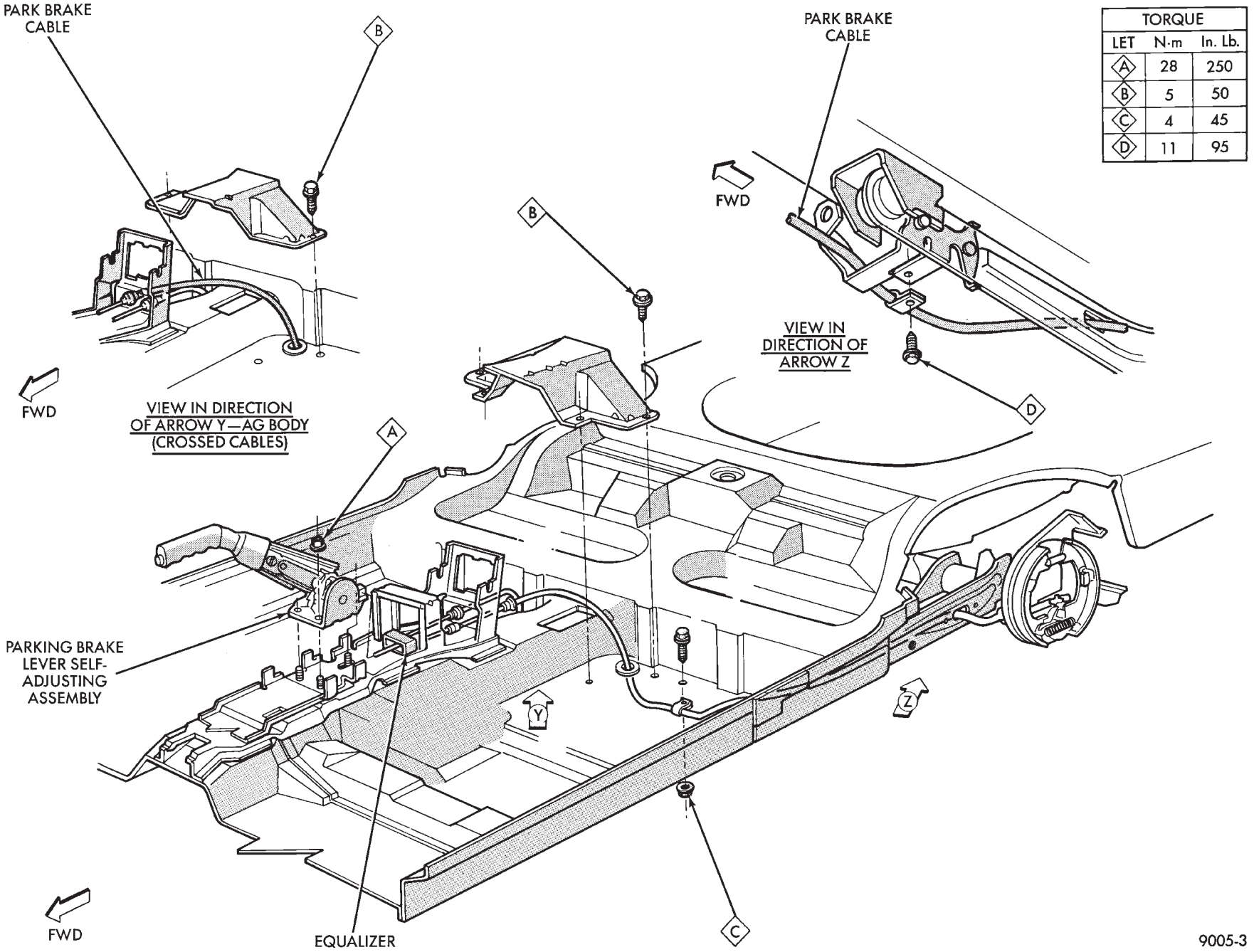


FIG. 3 PARKING BRAKE CABLE ROUTING AC AND AY-BODY



TORQUE		
LET	N·m	In. Lb.
A	28	250
B	5	50
C	4	45
D	11	95

FIG. 4 PARKING BRAKE CABLE ROUTING AG AND AJ BODY

WARNING: THE SELF ADJUSTING FEATURE OF THIS PARKING BRAKE LEVER ASSEMBLY CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 30 POUNDS. CARE MUST BE TAKEN TO PREVENT EXCESSIVE JARRING OF THE ASSEMBLY. DO NOT RELEASE THE SELF ADJUSTER LOCKOUT DEVICE BEFORE INSTALLING CABLES INTO THE EQUALIZER. KEEP HANDS OUT OF SELF ADJUSTER SECTOR AND PAWL AREA. FAILURE TO OBSERVE CAUTION IN HANDLING THIS MECHANISM COULD LEAD TO SERIOUS INJURY.

When repairs to the hand lever assembly or cable system are required the self adjuster must be reloaded and locked out.

SELF ADJUSTING PROCEDURES

TO RELOAD SELF ADJUSTER

Remove ash receiver or courtesy light from rear of center console to gain access to self adjuster. Also, remove carpet from sides of console.

Pull on equalizer/output cable to wind up spring(requires greater than 30 pounds effort). Continue until self adjuster lockout pawl is positioned about midway on the self adjuster sector (Fig. 4). Rotate lockout pawl into self adjuster sector by turning allen screw clockwise. **Rotating lockout device requires very little effort. Do not force or failure of lockout device will occur.**

When repairs are complete, adjust rear brakes before adjusting parking brake. On drum-in-hat type of rear disc brake adjust shoe diameter to 171.5 mm (6.75 inch).

ADJUST PARKING BRAKE

Be sure that the cables are properly assembled to the equalizer bracket prior to cable adjustment.

Insert a 7/32 inch allen wrench into hex socket and turn counter-clockwise through approximately 15° of rotation (Fig. 5). In turning lockout device, self adjuster release is a loud snapping noise followed by reaching a more felt than heard detente. Very light effort is required to seat lockout arm into detente. Follow through to the detente is important in preventing the lockout rod from rattling.

Note: The parking brake handle can be in any position when releasing self adjuster.

Cycle lever to position cables. Rear wheels should rotate freely without dragging.

REAR PARKING BRAKE CABLE REMOVAL

The rear brake cables are attached to rear connectors.

Should it become necessary to remove either parking brake cable for installation of a new cable, proceed as follows:

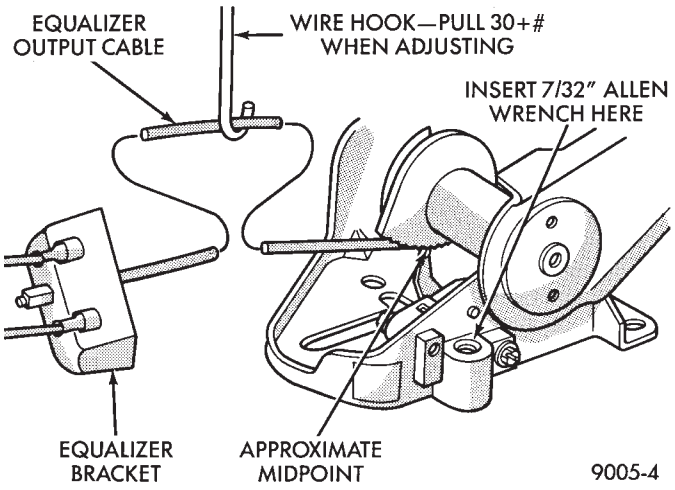


Fig. 5 Self Adjusting Parking Brake Lever Assembly

With vehicle jacked up on a suitable hoist, remove wheel and tire assembly.

Back off cable adjusting nut to provide slack and disconnect rear brake cable from connector.

DRUM BRAKES

Disconnect cable from park brake lever.

Using an aircraft type hose clamp compress retainers on end of cable housing and start cable out of retaining hole in the adapter. Remove clamp when retainers are free of the mounting hole in the support plate, (Fig. 6).

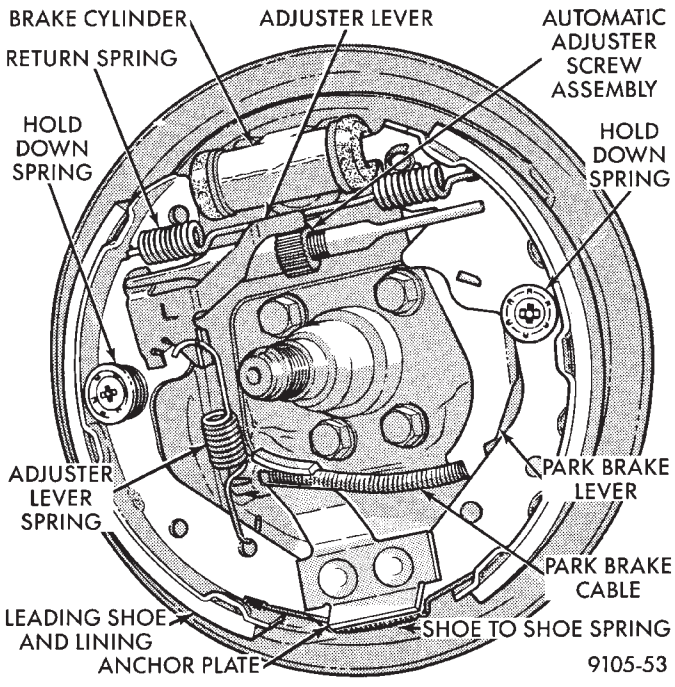


Fig. 6 Removing Brake Cable from Support Plate

Remove clip from brake cable at support bracket and pull cable away from trailing arm assembly (Figs. 2, 3 and 4).

DISC BRAKES

Remove disc brake caliper from adapter and braking disc (rotor) from rear hub.

Disconnect parking brake cable from brake shoe lever.

Using an aircraft type hose clamp compress retainers on end of cable housing and start cable out of retaining hole in the adapter. Remove clamp when retainers are free of the mounting hole in the support plate, (Fig. 6).

Remove clip from parking brake cable at cable support bracket and pull cable away from trailing arm.

INSTALLING PARKING BRAKE REAR CABLE

DRUM BRAKES

Route parking brake cable assembly through trailing arm and mounting bracket.

Install parking brake cable retaining clip. (Except AG and AJ Body.)

On AC body applications attach parking brake cable to trailing arm with nut and screw.

Install parking brake cable into rear brake support plate. Be sure the retainers are expanded around mounting hole in the brake support plate and connect parking brake cable end to brake shoe lever.

Insert forward end of parking brake cable into connector.

Install brake drum, and wheel and tire assembly.

DISC BRAKES ALL

Route parking brake cable assembly through trailing arm and parking brake cable mounting bracket.

Install parking brake cable to mounting bracket retaining clip.

Install parking brake cable into rear brake support adapter. Be sure the retainers on the parking brake cable are expanded around mounting hole in adapter and connect cable end to brake shoe lever.

Insert forward end of cable into connector.

Adjust parking brake shoe diameter to 171 mm (6.75 inch).

Install rear braking disc, caliper assembly and wheel and tire assembly.

REMOVING PARKING BRAKE FRONT CABLE

Loosen parking brake cable adjusting nut under car (except AG and AJ). Disengage front cable from equalizer bracket (Fig. 2).

Lift floor mat for access to floor pan.

Remove floor pan seal panel.

Pull parking brake cable end forward and disconnect from clevis. (AG and AJ vehicles use one piece cable. Separate parking brake cable from brake shoe lever.)

Pull parking brake cable assembly through hole.

INSTALLING PARKING BRAKE FRONT CABLE

Insert parking brake cable housing retainers into hole in rail bracket and parking brake pedal assembly (Fig. 1).

Feed parking brake cable end through holes in pan and rail bracket.

Install floor pan seal.

Engage parking brake cable end in lever clevis. (On AG vehicles criss-cross cables in console bracket) (Fig. 4). Seat cable ends in parking brake assembly and parking brake cable rail bracket.

Replace floor mat.

Engage rear parking brake cable end to equalizer bracket.

Adjust service and parking brakes.

PARKING BRAKE HAND LEVER ASSEMBLY REMOVAL AND INSTALLATION

REMOVAL AG AND AJ BODY

Remove ash receiver or courtesy light from rear of console. Remove carpet from sides of console. Remove parking brake trim cover from passenger side of console (pulls off).

Load and lockout parking brake self adjuster (Fig. 5). Disconnect rear cables from equalizer bracket.

Remove the 3 hold down nuts and remove hand lever assembly through opening created by removing console trim cover. Passenger seat might have to be removed. Also, if metal tab at bottom of console prevents removal of hand brake assembly, bend tab out of the way. (Bend the tab back to original position after R & R of hand brake.)

INSTALLATION AG AND AJ BODY

Install hand lever assembly through side opening in console and bolt into place.

Connect rear parking brake cables to equalizer.

Adjust parking brakes.

Install console trim cover, carpet, passenger seat and rear ash receiver or courtesy light.

REMOVAL AND INSTALLATION PARKING BRAKE SHOES

ALL WITH REAR DISC BRAKES

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

(2) Remove rear braking disc from rear hub (See Removing Braking Disk).

(3) Remove grease cap.

(4) Remove cotter pin, lock nut, hub bearing retaining nut, and washer.

(5) Remove hub and bearings. (See Wheel Bearing Section)

(6) Remove forward brake shoe assembly hold down clip (Fig. 1).

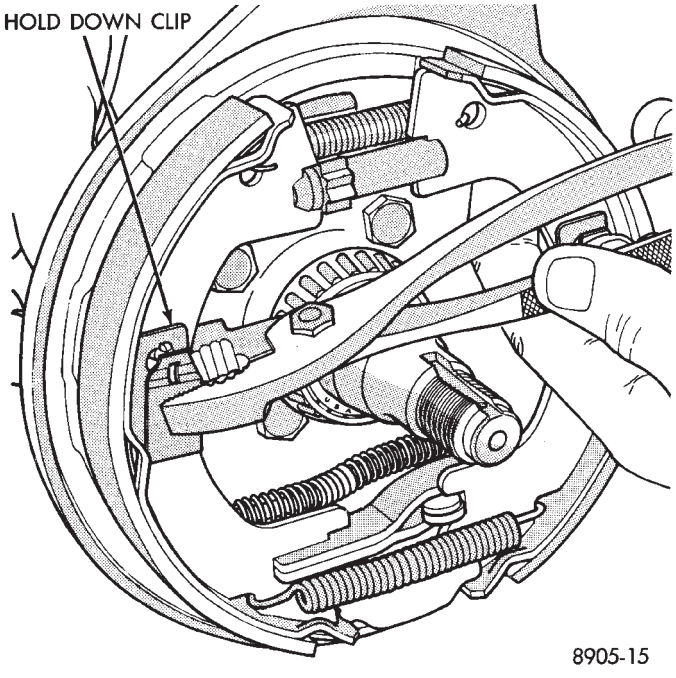


Fig. 1 Removing Brake Shoe Hold-Down Clip

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

(8) Remove the parking brake, shoe adjuster assembly (Fig. 2).

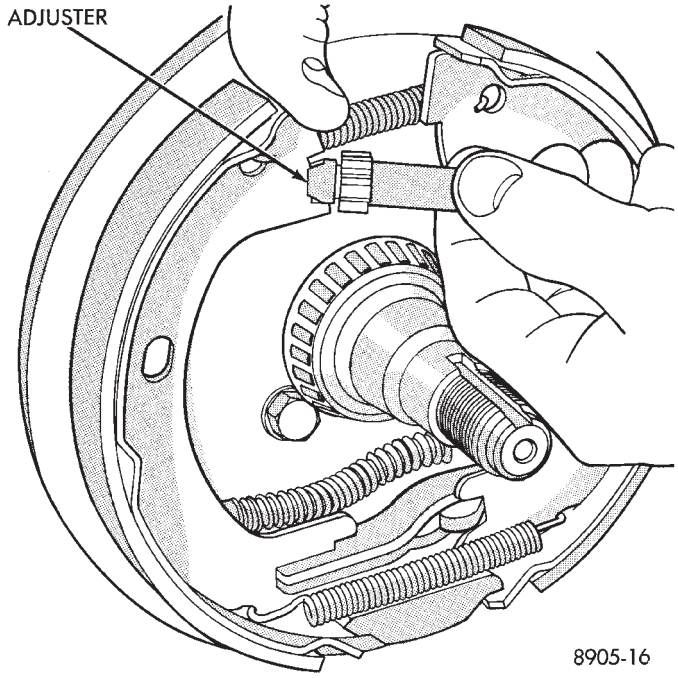


Fig. 2 Removing Adjuster Assembly

(9) Remove upper parking brake, shoe to shoe spring (Fig. 3).

(10) Pull front parking brake shoe, away from anchor. Then remove front parking brake shoe and lower spring (Fig. 4).

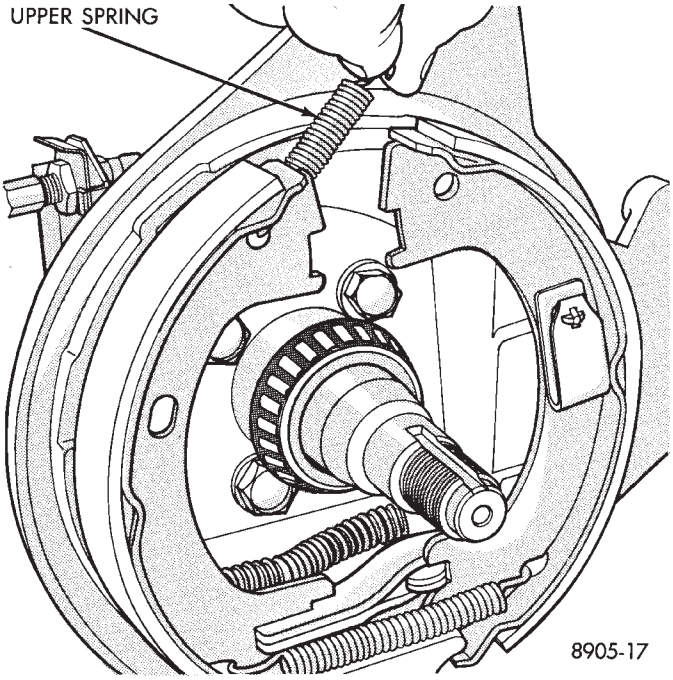


Fig. 3 Removing Upper Spring

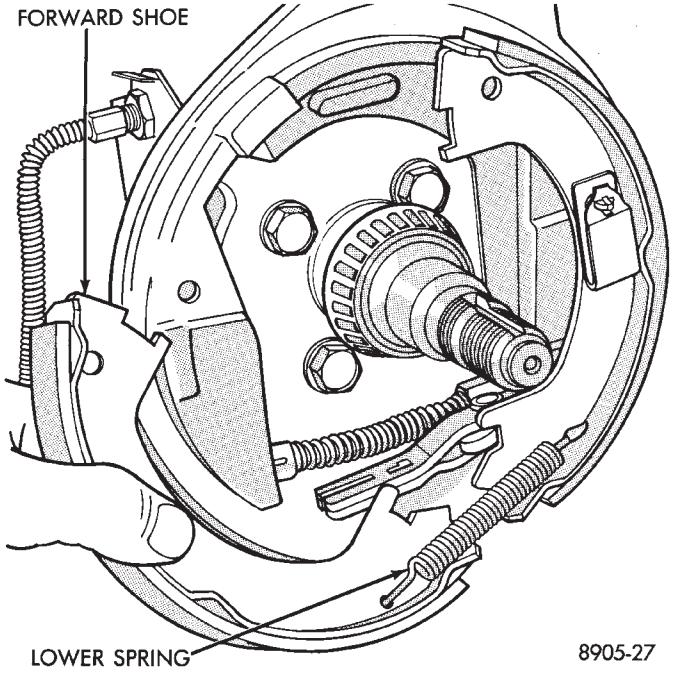


Fig. 4 Removing Shoe and Lower Spring

(11) Remove rear parking brake shoe hold-down clip. Then remove rear parking brake shoe assembly (Fig. 5).

INSTALLING PARKING BRAKE SHOES

(1) Install rear parking brake shoe and holddown clip (Fig. 6).

(2) Install lower parking brake, shoe to shoe return spring (Fig. 7).

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

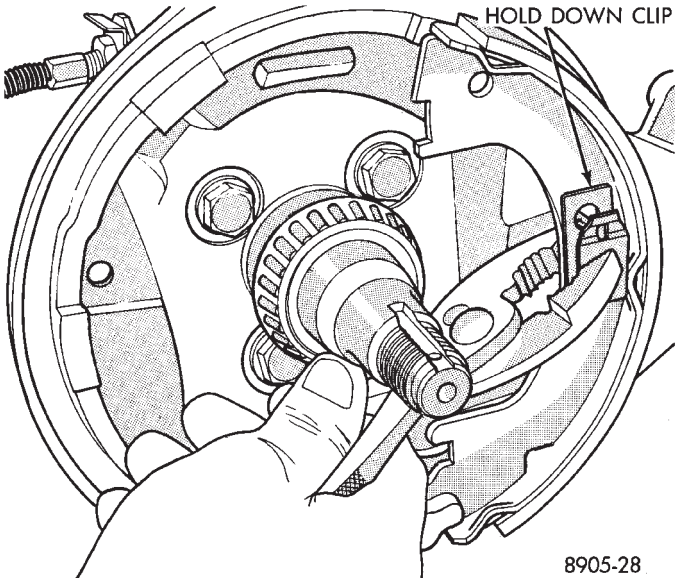


Fig. 5 Removing Rear Holddown Clip and Shoe

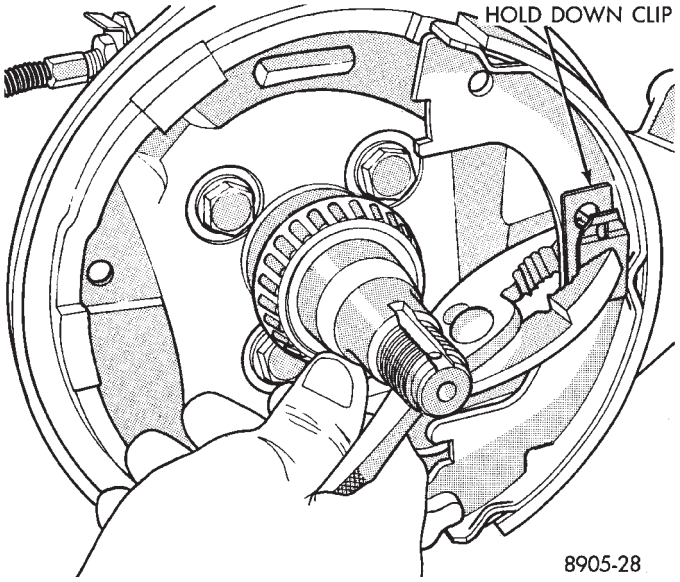


Fig. 6 Installing Rear Shoe and Hold-Down Clip

(4) Install upper parking brake, shoe to shoe return spring (Fig. 8).

(5) Install parking brake shoe adjuster assembly with star wheel forward (Fig. 9).

(6) Install front, parking brake shoe holddown clip (Fig. 10).

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

(8) Install hub assembly on spindle.

(9) Install outer bearing, thrust washer and nut.

(10) Tighten wheel bearing adjusting nut to 27 to 34 N●m (240 to 300 in. lbs.) torque while rotating hub. This seats the bearings.

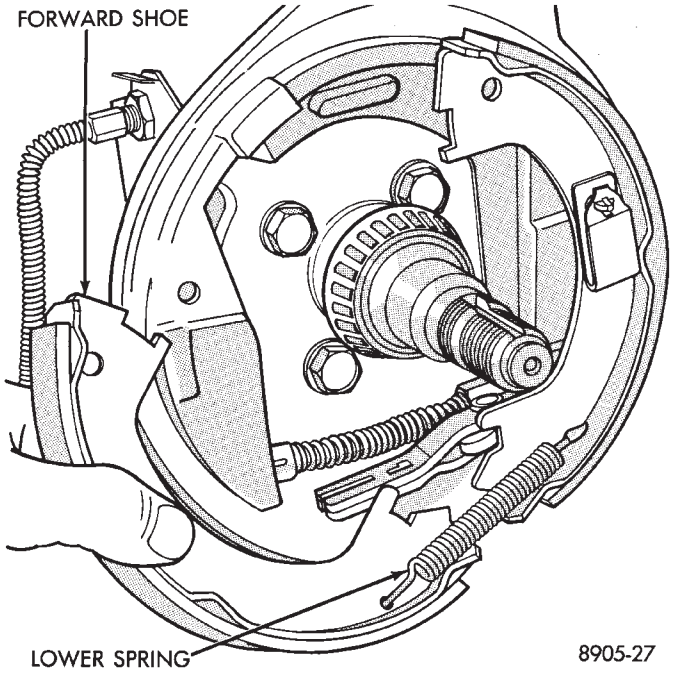


Fig. 7 Installing Lower Spring

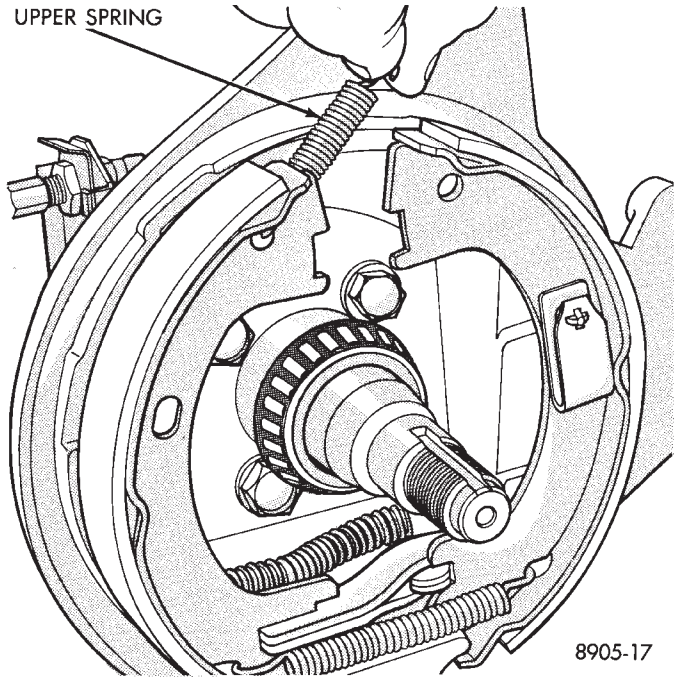


Fig. 8 Installing Upper Spring

(11) Back off adjusting nut 1/4 turn (90°) then tighten adjusting nut finger tight.

(12) Position lock on nut with one pair of slots in line with cotter pin hole. Install cotter pin.

(13) Install grease cap.

(14) Install rear braking disc.

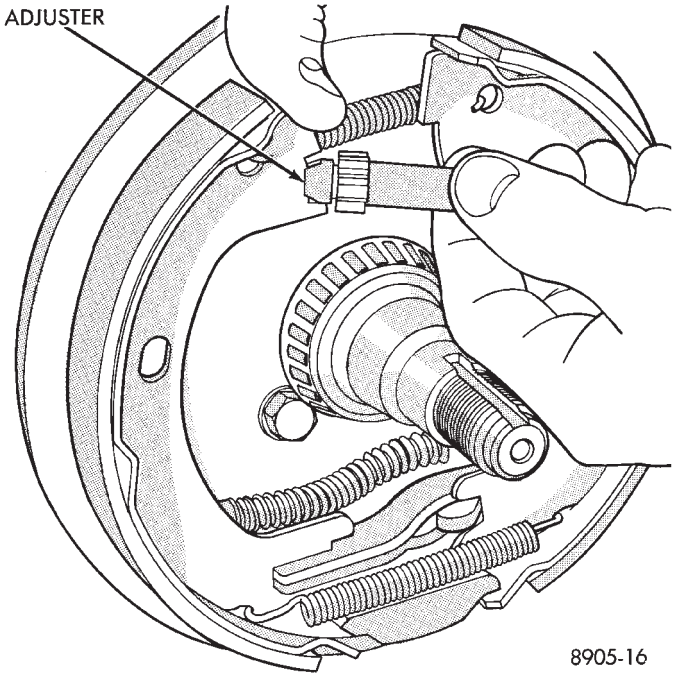


Fig. 9 Installing Adjuster Assembly

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

(16) Install wheel and tire assemblies.

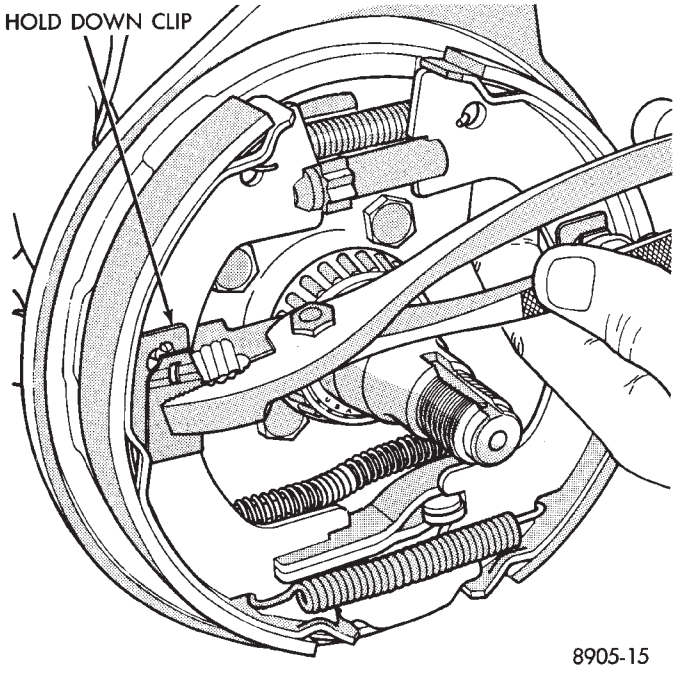


Fig. 10 Installing Front Parking Brake Shoe Hold-Down Clip

(17) Tighten wheel stud nuts to 129 N●m (95 ft. lbs.).

MASTER CYLINDER

INDEX

GENERAL INFORMATION

The tandem master cylinder (Fig. 1) has a glass reinforced nylon reservoir and an anodized aluminum body.

Do not hone the bore of the cylinder, as this will remove the anodized surface.

The reservoir is indexed to prevent installation in the wrong direction (Fig. 2). The cap diaphragms are slit to allow atmospheric pressure to equalize on both sides of the diaphragm.

The primary and secondary outlet tubes from the master cylinder are connected to the valve mounted under the master cylinder. The front part of this block connects to the secondary outlet tube and supplies the right rear and left front brakes. The rear portion of the block connects to the primary outlet tube and supplies the right front and left rear brakes.

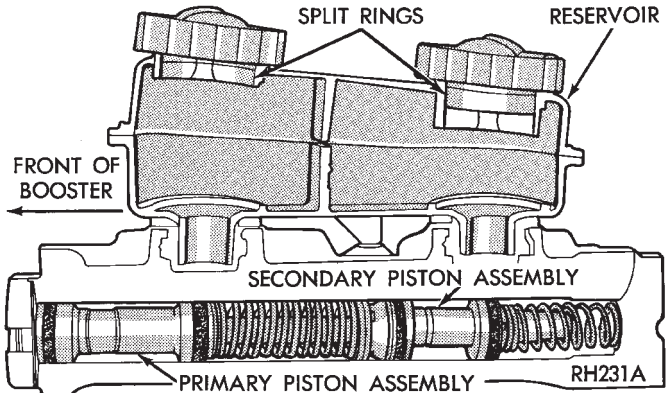


Fig. 1 Aluminum Master Cylinder (Cutaway View)

BRAKE FLUID LEVEL SENSOR

The Brake Fluid Level sensor is found only in the AG body vehicles with the visual electronic message center. The purpose of the sensor is to provide the driver with an early warning message that the brake fluid in the master cylinder reservoir has dropped to a below normal level.

As the fluid drops below the design level the sensor closes the warning message circuit. Approximately 15 seconds later the message BRAKE FLUID LOW appears on the instrument panel. At this time the master cylinder reservoir should be checked and filled to the bottom of the rings with DOT 3 brake fluid.

To check the operation of the Brake Fluid Level sensor, with ignition on and wiring still attached,remove sensor from master cylinder and hold in upright position. Within 30 seconds the instrument panel message BRAKE FLUID LOW should appear. Next invert the sensor. The instrument panel message should turn off immediately. If the above sequence occurs the sensor is operating properly. If the message does not appear remove the wiring from the sensor and using a jumper wire connect both sides of the plug. The instrumental panel message BRAKE FLUID LOW should appear within 30 seconds. If the message does not appear a problem exists in the wiring or instrumentation. If the message does appear the sensor is faulty and must be replaced. **The Brake Fluid Level sensor is not a repairable item (Fig. 2).**

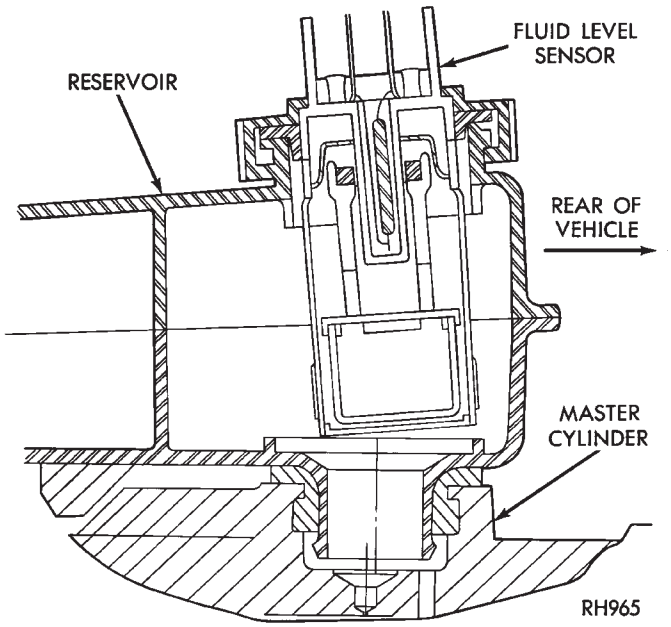


Fig. 2 Brake Fluid Level Sensor

TESTING THE MASTER CYLINDER

Be sure master cylinder vents at both ports.

Apply pedal lightly with engine running and look for fluid squirting or swirling into reservoirs.

In this master cylinder, a special baffle reduces the amount of fluid entering the secondary reservoir only a small disturbance may be seen.

MASTER CYLINDER SERVICE PROCEDURES

MASTER CYLINDER REMOVAL

Disconnect primary and secondary brake tubes from master cylinder housing. Install plugs at brake tube outlets.

Remove 2 nuts (Fig. 3) attaching master cylinder housing to power brake booster unit.

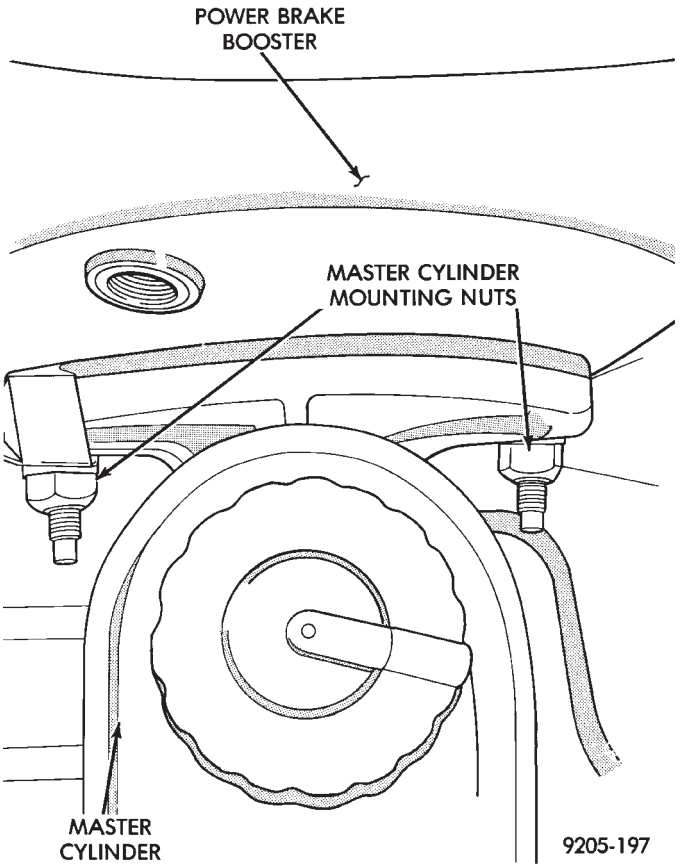


Fig. 3 Master Cylinder Mounting

Slide master cylinder straight out, and away from power brake booster unit.

BRAKE FLUID RESERVOIR REPLACEMENT

Clean master cylinder housing and brake fluid reservoir.

Remove the brake fluid reservoir caps. Using a syringe or equivalent empty brake fluid from reservoir.

Position master cylinder in vise.

Rock reservoir from side to side and remove from master cylinder housing (Fig. 4).

Do not pry off with tool, damage to reservoir may result.

Remove housing-to-reservoir grommets (Fig. 5).

Install new housing-to-reservoir grommets in master cylinder housing.

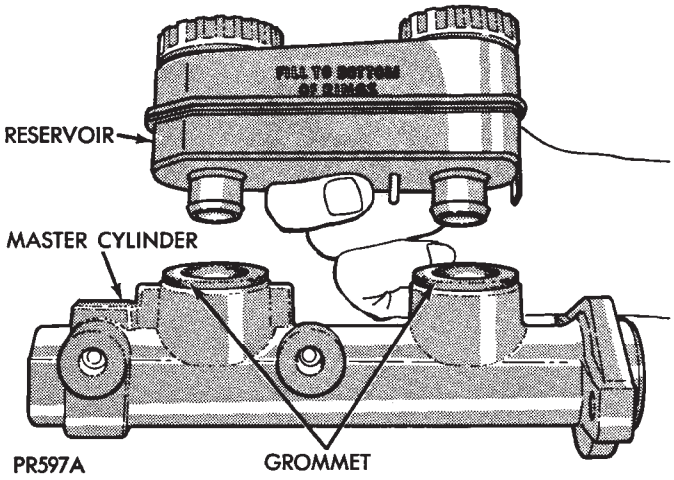


Fig. 4 Removing Reservoir

Lubricate reservoir mounting area with clean brake fluid. Place reservoir in position over grommets. Seat reservoir with a rocking motion onto master cylinder housing.

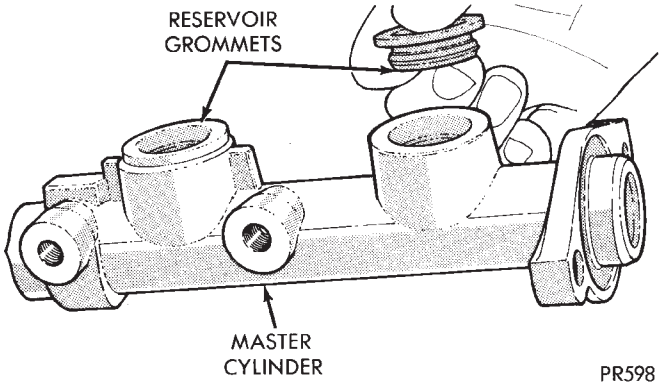


Fig. 5 Removing Grommets

Be sure reservoir is positioned properly. All lettering should be properly read from the left side of the master cylinder (Fig. 4).

Make sure bottom of reservoir touches top of grommet.

BLEEDING MASTER CYLINDER

Clamp the master cylinder in a vise. Attach Bleeding Tubes, Special Tool C-4546 to the master cylinder. Position tubes so the outlet of the Bleeding Tubes will be below the surface of the brake fluid when the reservoir is filled to the proper level.

Fill both reservoirs with brake fluid conforming to DOT 3 specifications such as Mopar or Equivalent.

Using a wooden dowel per (Fig. 6). Depress push rod slowly, and then allow pistons to return to released position. Repeat several times until all air bubbles are expelled (Fig. 6).

Remove bleeding tubes from cylinder, plug outlets and install caps.

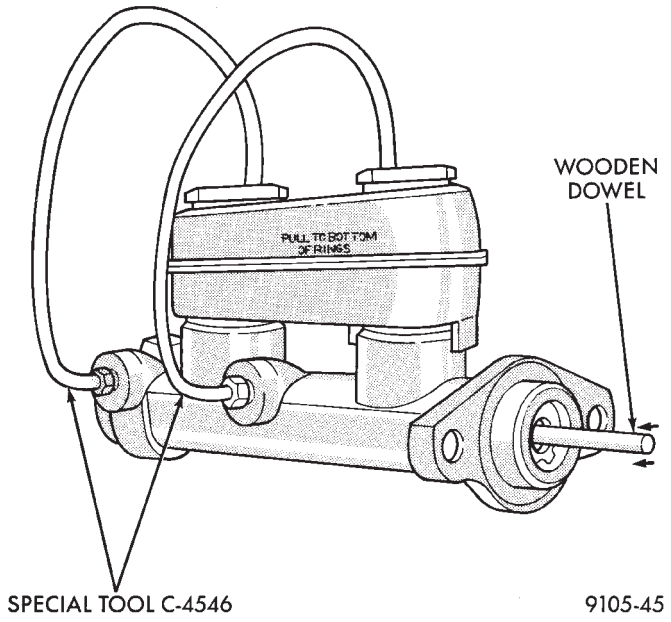


Fig. 6 Bleeding Master Cylinder

Remove master cylinder from vise and install on power brake vacuum booster.

It is not necessary to bleed the entire hydraulic system after replacing the master cylinder, providing that the master cylinder has been bled and filled upon installation.

INSTALLING MASTER CYLINDER

Position master cylinder over studs of power brake unit, align push rod with master cylinder piston.

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

Connect brake tubes to master cylinder primary and secondary ports. Tighten fittings to 17 N●m (145 in. lbs.) torque.

POWER BRAKES

GENERAL INFORMATION

All vehicles, except non turbo charged AP bodies, equipped with manual transmissions use a 205 mm tandem booster. The non turbo charged manual transmission equipped AP body application use a 230 mm non-tandem booster.

The purpose of the vacuum operated power brake booster. Is to reduce the amount of force applied to the brake pedal by the drivers foot. To obtain the required hydraulic pressure in the brake system to stop the vehicle.

The power brake booster can be identified if required, by the tag attached to the body of the booster assembly (Fig. 1). This tag contains the following information. The production part number of the power booster assembly, the date it was built and who manufactured it.

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 replaceable as an assembly.

The power brake booster in vacuum operated. The vacuum is supplied from the intake manifold on the engine through the power brake booster check valve (Fig. 2).

As the brake pedal is depressed, the power boosters input rod moves forward. This opens and closes valves in the power booster, creating a vacuum on one side of a diaphragm and allowing atmospheric pressure to enter on the other. This difference in pressure forces the output rod of the power booster 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.

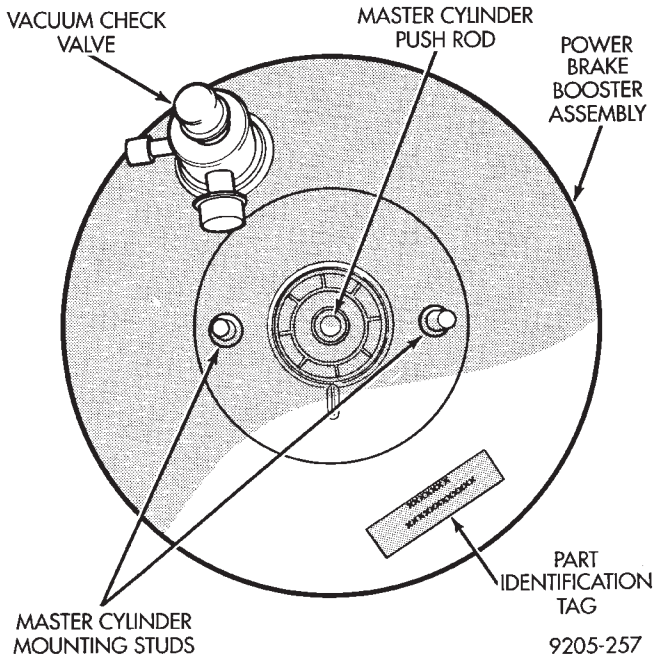


Fig. 1 Power Brake Booster Identification

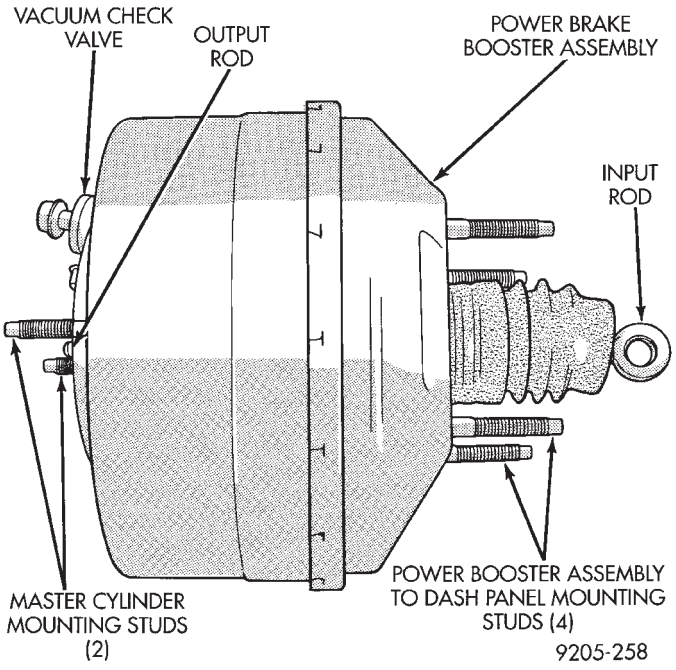


Fig. 2 Power Brake Booster Assembly

Different systems and engine combinations require different vacuum hose routings.

The power brake booster assembly mounts on the engine side of the dash panel. It is externally connected to the brake system by an input push rod to the brake pedal. A vacuum line connects the power booster to the intake manifold. The master cylinder is bolted to the front of the power brake booster assembly (Fig. 3).

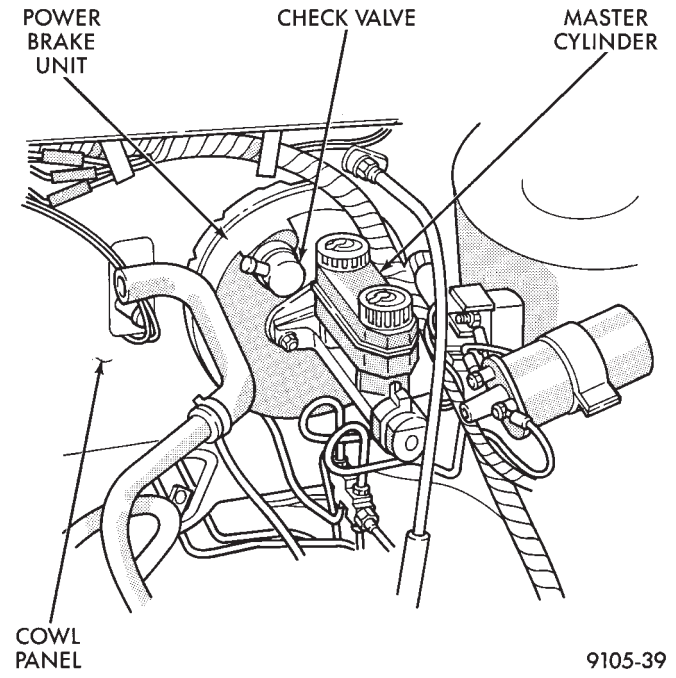


Fig. 3 Power Brake Mounting

SERVICE PROCEDURES

POWER BRAKE BOOSTER ASSEMBLY

REMOVE

(1) Remove the 2 nuts (Fig. 4) attaching master cylinder assembly to power brake unit.

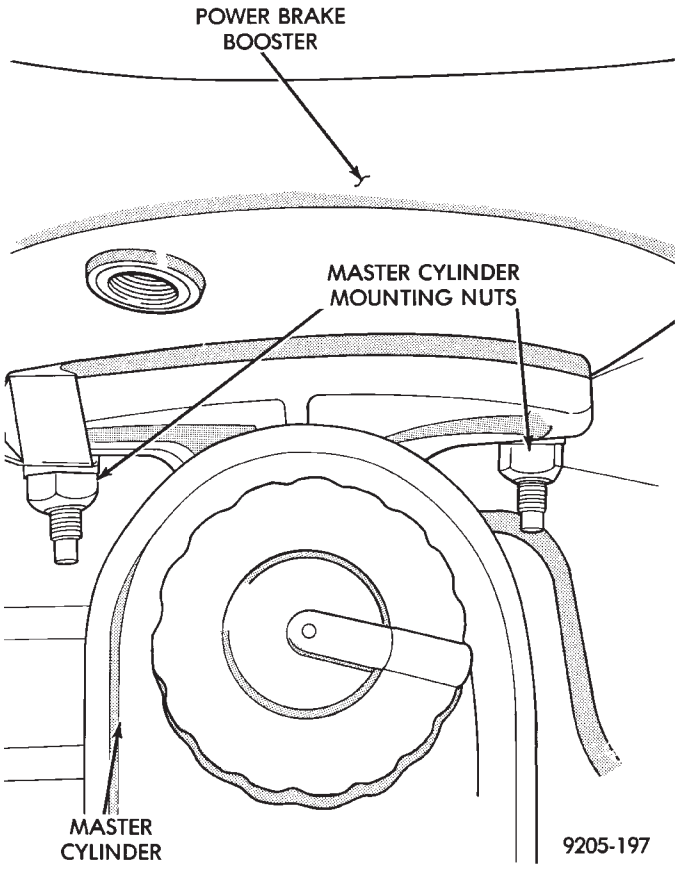


Fig. 4 Master Cylinder Mounting

(2) Carefully slide master cylinder off mounting studs with brake lines attached, and allow the assembly to rest against fender shield.

(3) Disconnect vacuum hose from power brake booster check valve (Fig. 1). **DO NOT REMOVE CHECK VALVE FROM POWER BRAKE BOOSTER.**

(4) From under instrument panel, position a small screwdriver between the center tang on the power brake booster input rod to brake pedal pin retaining clip.

(5) Rotate screwdriver enough to allow retainer clip center tang to pass over end of brake pedal pin and pull retainer clip off pin. **Discard retainer clip it is not to be reused, replace only with a new retainer clip.**

(6) Remove the four nuts that attach the power brake booster to the vehicle dash panel. Nuts are accessible from under the dash panel in the area of the steering column and pedal bracket (Fig. 5).

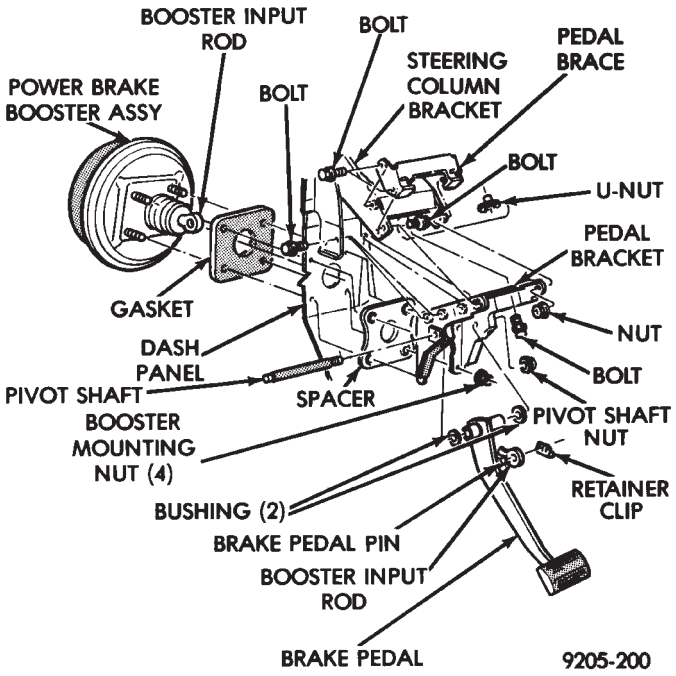


Fig. 5 Power Brake Booster Mounting

(7) Unfasten brackets on steel heater water line at dash panel and left frame rail. **On Manual Transmission vehicles,** unfasten clutch cable bracket at shock tower and move aside.

(8) Slide the power brake unit up and to the left (mounting holes are slotted) on the dash panel, then tilt inboard and up to remove.

CAUTION: Do not attempt to disassemble power brake unit as this booster is serviced ONLY as a complete assembly.

INSTALL

(1) Position power brake booster onto dash panel.

(2) Install and tighten the 4 power brake booster to dash panel mounting nuts (Fig. 5) to 29 N●m (250 in. lbs.) torque.

(3) Install steel heater water line and clutch cable bracket, if so equipped.

(4) Carefully position master cylinder on power brake unit.

(5) Install and tighten the 2 master cylinder to power booster mounting nuts (Fig. 4) to 29 N●m (250 in. lbs.) torque.

(6) Connect vacuum hose onto the check valve, located on the power brake unit.

(7) Using lubriplate, or equivalent, coat the bearing surface of pedal pin (Fig. 5).

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

(9) Check stop light operation.

WHEEL BEARINGS

FRONT WHEEL BEARINGS

Front wheel drive vehicles are equipped with permanently sealed front wheel bearings. There is no periodic lubrication or maintenance recommended for these units. However if during servicing of the brake system, service to the front wheel bearing is required refer to Group 2, Suspension in this service manual.

REAR WHEEL BEARINGS

NORMAL SERVICE

The lubricant in the rear wheel bearings should be inspected whenever the hubs are removed to inspect or service the brake system. Or at least every 30,000 miles (48,000 km). The bearings should be cleaned and repacked with a High Temperature Multipurpose E.P. Grease whenever the disc brake rotors are resurfaced.

INSPECTION

Check lubricant to see that it is adequate in quantity and quality. If the grease is low in quantity, contains dirt, appears dry or has been contaminated with water, it will appear milky. The bearings then must be cleaned and repacked. **Do not add grease to a wheel bearing that already has grease packed in it. Relubricate completely. Mixing of different types of greases in wheel bearings should be avoided since it may result in excessive thinning and leakage of the grease.**

REMOVAL AND INSTALLATION

For the servicing, removal and installation of the rear wheel bearings follow the procedure listed below.

(1) Remove the rear tire and wheel assembly.

(2) On rear disc brake equipped vehicles remove the caliper and rotor. Support the caliper out of the way. **Do not allow the caliper to hang by the hydraulic hose.** See disc brake section in this group for caliper removal procedure.

(3) Remove grease cap, cotter pin, nut lock, nut, thrust washer and outer wheel bearing.

(4) Carefully slide hub or drum from spindle. Do not drag inner bearing or grease seal over stub axle (thread, bearing, and oil seal may be damaged.) Using an appropriate tool remove the grease seal and inner bearing from the drum or hub. Discard grease seal, a new seal should be used when reinstalling the inner bearing. (See Fig. 1)

(5) Thoroughly clean all old grease from the outer and inner bearings, bearing cups and hub cavity (See Fig. 1). **To clean bearings, soak them in an appropriate cleaning solvent. Strike the flat sur-**

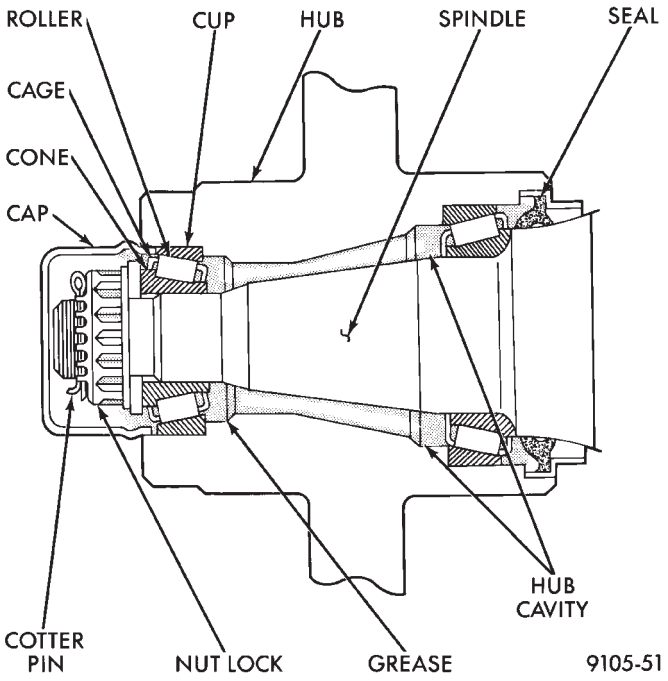


Fig. 1 Rear Wheel Bearings

face of the bearing inner race against a hardwood block several times. Immerse the bearings in solvent between the blows to jar grease loose and wash old particles of hardened grease from bearings. Repeat this operation until bearings are clean. Bearings can be dried using compressed air but do not spin the bearings. After cleaning, oil the bearings with engine oil. Insert the bearing into its appropriate cup, apply pressure to the bearing while rotating it to test them for pitting and roughness. Replace all worn or defective bearings. If bearing shows signs of pitting or roughness they should be replaced. Bearings must be replaced as a set, both the cup and the bearing need to be replaced at the same time. If bearings are suitable for further use, remove engine oil from bearings using appropriate solvent and dry bearings. Repack the bearings using a Multi-Purpose NLGI. Grade 2 EP Grease such as Mopar or equivalent, and place them in a clean covered container until ready for installation. If a bearing packer is not available, hand pack grease into all cavities between bearing cage and rollers.

(6) If bearings and cups are to be replaced, remove cups from the drum or hub using a brass drift or suitable remover.

(7) Replace bearing cups with appropriate installing tool.

(8) Install inner bearing in grease coated hub and bearing cup, and install new grease seals using the appropriate seal installer.

(9) Coat hub cavity and cup with grease.

(10) Before installing hub or drum assembly, inspect stub axle and seal surface for burrs or roughness, and smooth out all rough surfaces.

(11) Coat the stub axle with Multi-Purpose NLGI, Grade 2 EP grease such as Mopar or equivalent.

(12) Carefully slide the hub of drum assembly onto the stub axle. **Do not drag seal or inner bearing over the threaded area of the stub axle.**

(13) Install outer bearing, thrust washer and nut.

(14) Tighten the wheel bearing adjusting nut to 27 to 34 N●m (240 to 300 in. lbs.) while rotating hub or drum assembly. This seats the bearings.

(15) Back off adjusting nut 1/4 turn (90°) then tighten adjusting nut only finger tight.

(16) Position the nut lock over the bearing adjusting nut with one pair of slots in line with the cotter pin hole in the stub axle and install cotter pin.

(17) Install the grease caps and the wheel and tire assemblies. Tighten wheel stud nuts to 115 N●m (85 ft. lbs.) on all models. reinstall wheel covers if so equipped.

ANTI-LOCK BRAKE SYSTEM—BENDIX ANTI-LOCK 10 AC/Y BODY

INDEX

GENERAL INFORMATION

The purpose of the Anti-Lock Brake System (ABS) is to prevent wheel lock-up under heavy braking conditions on virtually any type of road surface. Anti-Lock 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.

ANTI-LOCK BRAKE SYSTEM DEFINITIONS

In this section of the manual several abbreviations are used for the components that are in the Anti-Lock Braking System They are listed below for your reference.

- CAB—Controller Anti-Lock Brake
- ABS—Anti-Lock Brake System
- PSI—Pounds per Square Inch (pressure)
- WSS—Wheel Speed Sensor

NORMAL BRAKING SYSTEM FUNCTION

Under normal braking conditions, the ABS System functions much the same as a standard brake system with a diagonally split master cylinder. The primary difference is that power assist is provided by hydraulic power assist instead of the conventional vacuum assist.

If a wheel locking tendency is noticed during a brake application, the system will enter Anti-Lock mode. During Anti-Lock braking, hydraulic pressure in the four wheel circuits is modulated to prevent any wheel from locking. Each wheel has a set of electrical solenoid valves and hydraulic line to provide modulation, although for vehicle stability, both rear wheel valves receive the same electrical signal. The

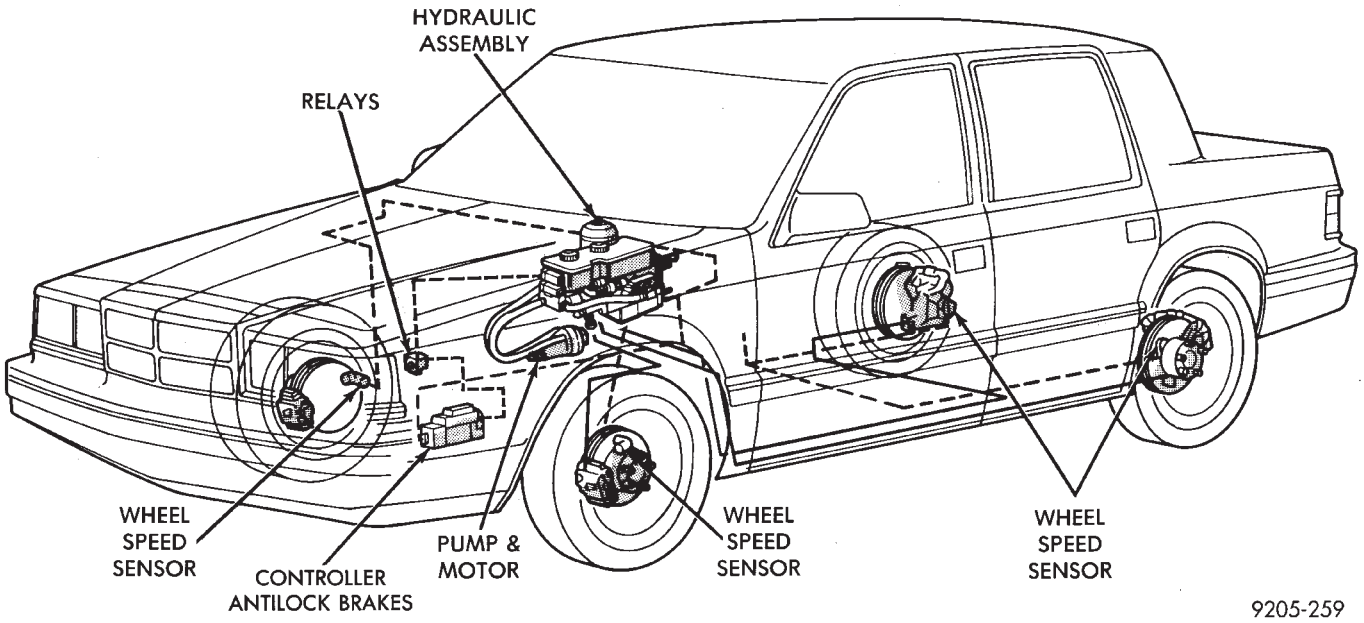


Fig. 1 Four-Wheel Anti-Lock Brake System

system can build, hold or reduce pressure at each wheel of the vehicle. This is determined by the signals generated by the wheel speed sensors (WSS) at each wheel and received at the Controller-Anti-Lock Brake (CAB).

MAJOR ABS COMPONENTS

The following is a list of major system components. Details of all components can be found later in this section.

HYDRAULIC ASSEMBLY

The Hydraulic Assembly (Fig. 1) provides the function of an integral master cylinder and hydraulic booster assembly, and contains the wheel circuit valves used for brake pressure modulation.

WHEEL SPEED SENSORS

A Wheel Speed Sensor (Fig. 2) is located at each wheel to transmit wheel speed information to the Controller Anti-Lock Brake (CAB).

CONTROLLER-ANTI-LOCK BRAKE (CAB)

The (CAB) (Fig. 3) is a small control computer that receives wheel speed information, controls Anti-Lock operation and monitors system operation.

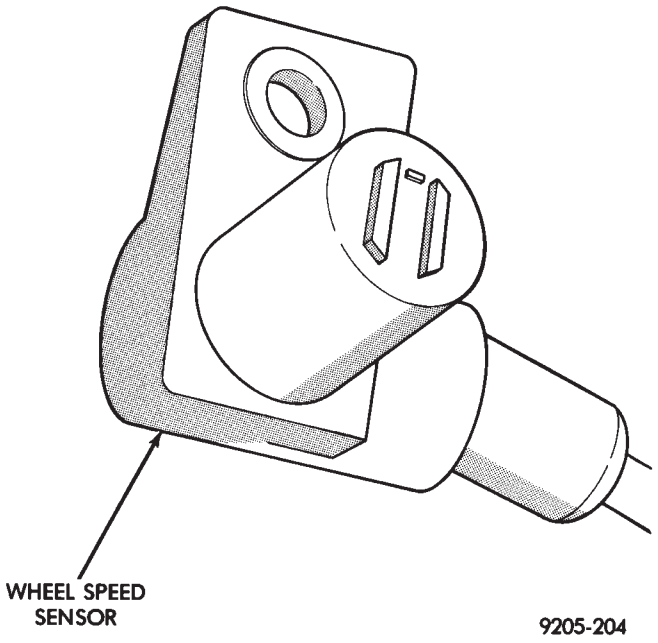


Fig. 2 Wheel Speed Sensor

PUMP/MOTOR ASSEMBLY

The Pump/Motor Assembly (Fig. 4) is an electrically driven pump. It takes low pressure brake fluid from the hydraulic assembly reservoir and pressur-

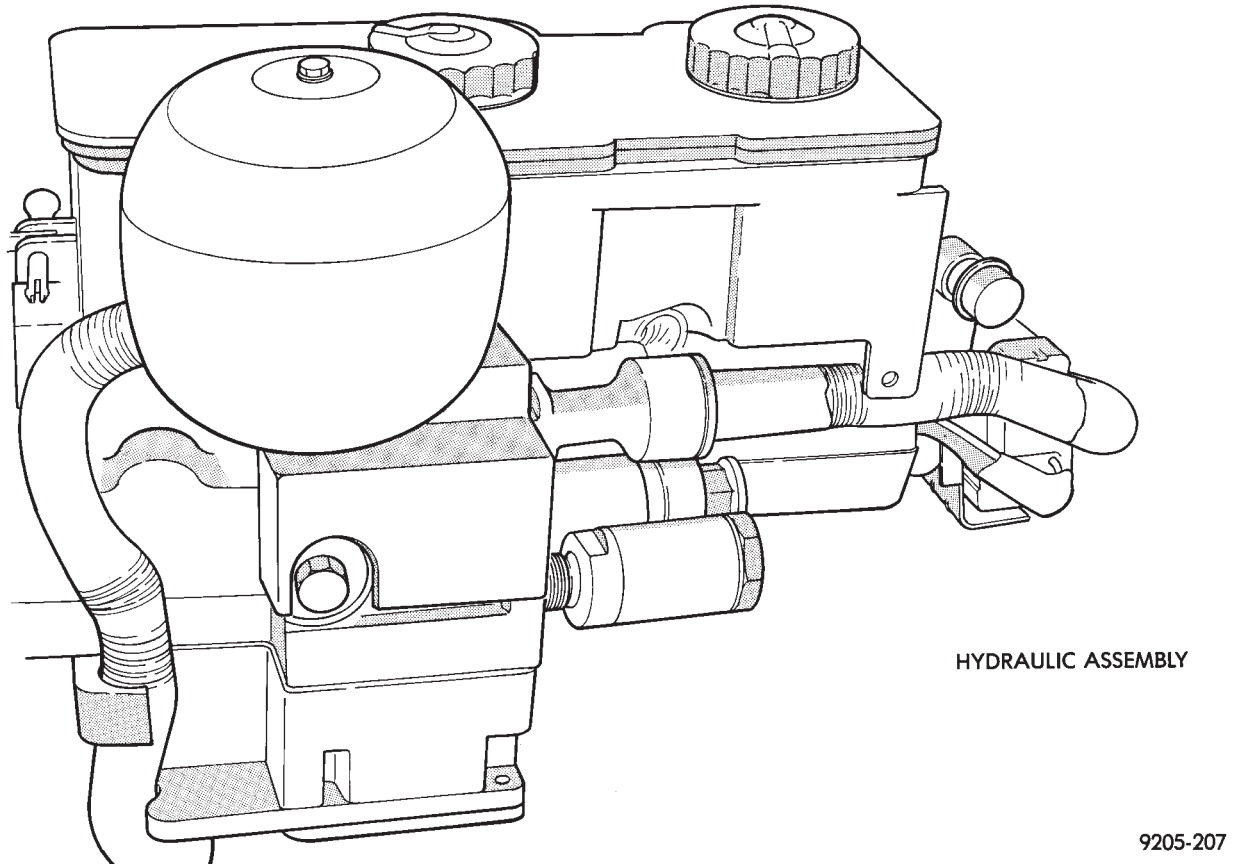


Fig. 1 ABS Hydraulic Assembly

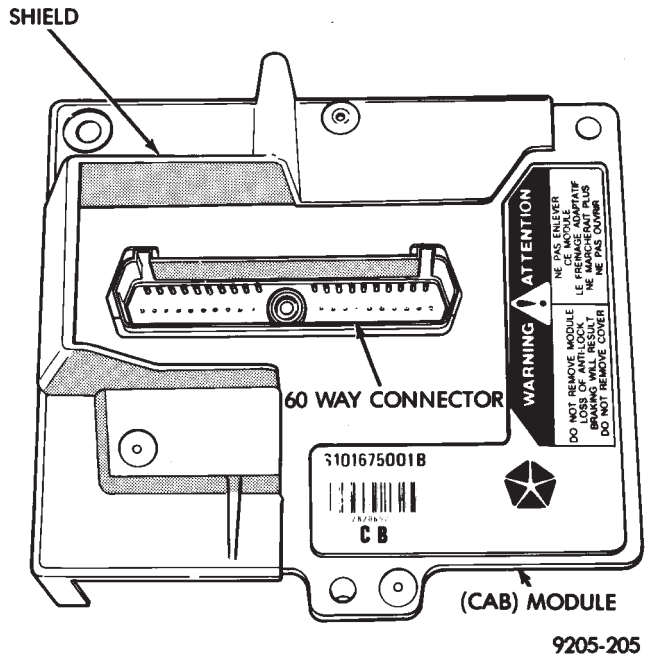


Fig. 3 (CAB) Controller Anti-Lock Brake Module

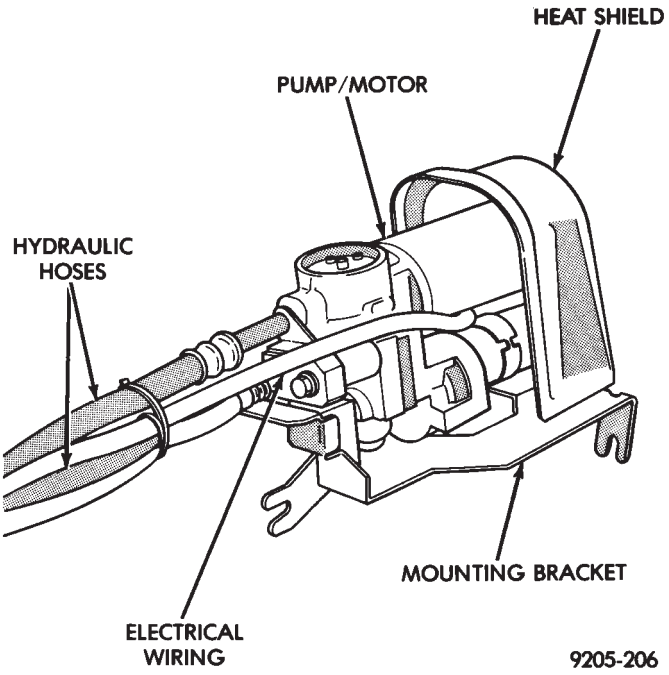


Fig. 4 ABS Pump/Motor Assembly

izes it for storage in the accumulators for power assist and Anti-Lock braking.

ANTI-LOCK OPERATION AND PERFORMANCE

NORMAL BRAKING SYSTEM FUNCTION

Under normal braking conditions, the ABS System functions much the same as a standard brake system with a diagonally split master cylinder. The primary difference is that power assist is provided by hydraulic power assist instead of the conventional vacuum assist.

If a wheel locking tendency is noticed during a brake application, the system will enter Anti-Lock mode. During Anti-Lock braking, hydraulic pressure in the four wheel circuits is modulated to prevent any wheel from locking. Each wheel has a set of electrical solenoid valves and a hydraulic line to provide modulation, although for vehicle stability, both rear wheel valves receive the same electrical signal. The system can build, hold or reduce pressure at each wheel. Depending on the signals generated by the wheel speed sensors (WSS) at each wheel and received at the Controller-Anti-Lock Brake (CAB).

The 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. That differ from conventional vacuum boosted hydraulic actuation systems. Because, there are several performance characteristics that may at first seem different but should be considered normal. These characteristics are discussed below. More technical details are discussed further in this section.

PEDAL FEEL

The ABS System uses hydraulic power assist for both normal power assisted braking and to provide a source of high pressure hydraulic fluid during Anti-Lock Braking. In general, pedal feel will be similar to that of a conventional vacuum boosted brake system. If during an Anti-Lock stop additional force is applied to the brake pedal, or the brake pedal is released and reapplied rapidly. The driver may notice a very hard pedal feel. This is due to normal isolation of the master cylinder during A.B.S. operation as wheel brake pressure is fed from the hydraulic booster.

ANTI-LOCK OPERATION

During Anti-Lock Braking, brake pressures are modulated by cycling electric valves. The cycling of these valves can be heard as a series of popping or ticking noises. In addition, the cycling may be felt as a pulsation in the brake pedal, although no pedal movement will be noticed. If Anti-Lock operation occurs during hard braking. Some pulsation may be felt in the vehicle body due to fore and aft movement of the vehicles suspension as brake pressures are modulated.

Although ABS operation is available at virtually all vehicle speeds. It will automatically turn off at speeds below 3 to 5 mph. Therefore wheel lock-up may be perceived at the very end of an Anti-Lock stop and should be considered normal.

TIRE NOISE & MARKS

Although the ABS system prevents complete wheel lock-up, some wheel slip is desired to achieve opti-

mum braking performance. During brake pressure modulation, as brake pressure is increased, wheel slip is allowed to reach up to 30%. This means that the wheel rolling velocity is 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 payment. However, Anti-Lock Braking will not leave dark black tire marks since the wheel never reaches a locked condition. Tire marks may however be noticeable as light patched marks.

ABS EQUIPPED VEHICLE PERFORMANCE

Anti-Lock Brakes provide the driver with some steering control during hard braking. However there are conditions where the system does not provide any benefit. In particular, hydroplaning is still possible when the tires ride on a film of water, resulting in the tire leaving the road surface rendering the vehicle almost 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. So, the ABS system is termed Anti-Lock instead of Anti-Skid.

One of the significant benefits of the ABS system is that of maintaining steering control during hard braking or during braking on slippery surfaces. It is therefore possible to steer the vehicle while braking on almost any road surface.

ABS SYSTEM SELF-DIAGNOSTICS

The ABS system has been designed with Self Diagnostic Capability. There are two self checks the systems performs every time the vehicle is started. First, when the key is turned on the system performs an electrical check called Start-Up Cycle. During this check, the Red Brake Warning Lamp and the Amber Anti-Lock Warning Lamp are illuminated. Then turned off at the end of the test, after about 1 to 2 seconds. When the vehicle reaches a speed of about 3 to 4 miles per hour. The system performs a functional check called Drive-Off. During Drive-Off. hydraulic valves are activated briefly to test their function. Drive-Off can be detected as a series of rapid clicks upon driving off the first time the car is started. If the brake pedal is applied during Drive-Off, the test is by-passed. Both of these conditions are a normal part of the system self test. Most fault conditions will set a ABS Fault Code in the (CAB), which can be retrieved to aid in fault diagnosis. Details can be found in Diagnosis Section.

ABS WARNING SYSTEMS OPERATION

The ABS system uses two methods for notifying the driver of a system malfunction. These include the standard Red Brake Warning Lamp and an Amber Anti-Lock Warning Lamp, both located in the instrument cluster. The purpose of these two lamps are discussed in detail below.

RED BRAKE WARNING LAMP

The Red Brake Warning Lamp, located in the instrument cluster, will Turn On to warn the driver of brake system conditions that may result in reduced braking ability. The lamp is also turned on when the parking brake is not fully released. Conditions which may cause the Red Brake Warning Lamp to Turn On include:

- Parking brake not fully released. If the parking brake is applied or not fully released. The switch on the parking brake pedal assembly will ground the Red Brake Warning Lamp circuit and cause the lamp to turn on. On vehicles equipped with mechanical instrument clusters, the Amber Anti-Lock Lamp will turn on if the vehicle is driven above 3 miles per hour with the Parking Brake applied.
- Low brake fluid. The fluid level sensor in the hydraulic assembly reservoir will ground the Red Brake Warning Lamp circuit if low brake fluid level is detected. In addition, ABS will be deactivated above 3 miles per hour and the Amber Anti-Lock Warning Lamp will be illuminated. If the vehicle is equipped with EVIC, a low fluid condition will also cause the Low Brake Fluid message to appear.
- Low accumulator pressure. In the event of low accumulator pressure, the dual function pressure switch in the hydraulic assembly will signal the (CAB) to ground the Red Brake Warning Lamp circuit. This will cause the Red Brake Warning Lamp to turn on. Low accumulator pressure may result in loss of power assist.
- Hydraulic assembly or (CAB) faults. The hydraulic assembly or (CAB) may turn on the Red Brake Warning Lamp. If certain faults are detected in either the hydraulic assembly or the (CAB), or the normal brake system.
- Bulb check. As a bulb check, the Red Brake Warning Lamp will illuminate whenever the ignition switch is placed in the crank position.

Illumination of the red Brake Warning Lamp may indicate reduced braking ability. A vehicle that has the Red Brake Warning Lamp ON should not be driven except to do diagnostic procedures described in Section 2 of this manual. Most conditions that turn on the Red Brake Warning Lamp will also turn on the Amber Anti-Lock Warning Lamp, consequently disabling the Anti-Lock function.

ANTI-LOCK WARNING LAMP

The Anti-Lock Warning Lamp is located in the instrument cluster and is Amber in color. The Amber Anti-Lock Warning Lamp is illuminated when the

(CAB) detects a condition that results in a shutdown of Anti-Lock function. The Amber Anti-Lock Warning Lamp is normally on until the (CAB) completes its self tests and turns the lamp off. For example, if the (CAB) is disconnected, the lamp is on.

Display of the Amber Anti-Lock Warning Lamp without the Red Brake Warning Lamp indicates only that Anti-Lock function has been disabled. Power assisted normal braking is unaffected.

NORMAL OPERATION OF WARNING LAMPS

With the ignition in the Crank position, the Red Brake Warning Lamp will turn on as a bulb check. The Amber Anti-Lock Warning Lamp will turn on for as little as 1 second to as long as 30 seconds.

If the car has not been started for several hours, for example after sitting overnight. The Red Brake Warning Lamp and the Amber Anti-Lock Warning Lamp may both be turned on for as long as 60 seconds after turning the ignition on. This condition is caused by the loss of accumulator charge when the vehicle is parked for extended periods, particularly in cold weather. When the key is then turned on. The Pump/Motor assembly must recharge the hydraulic accumulator to its normal operating pressure. As recharging is completed, both warning lamps will turn off when accumulator pressure reaches about (1,000 psi). Both lamps should remain off at all other times, indicating normal operation.

ANTI-LOCK BRAKE SYSTEM COMPONENTS

The following is a detailed description of the Anti-Lock Brake System components. For information on servicing the other Non-ABS related components that may be referred to in this section. See the Standard Brakes Section that refers to the specific component.

HYDRAULIC ASSEMBLY

The ABS system uses an integral Hydraulic Assembly (Fig. 1) which includes a Booster/Master Cylinder, Modulator, Hydraulic Bladder Accumulator and Fluid Reservoir. The Hydraulic Assembly is located on the dash panel cowl on the drivers side of the vehicle. The following is a description of the components that make up the Hydraulic Assembly.

HYDRAULIC ASSEMBLY BRAKE FLUID RESERVOIR

A one piece Fluid Reservoir is attached to the hydraulic assembly with rubber seals. The Fluid Reservoir (Fig. 1) is internally separated into three fluid sections. Most of the brake fluid is contained in the Fluid Reservoir and hydraulic bladder accumulator (Fig. 1) Additional fluid is contained in the pump/motor assembly accumulator.

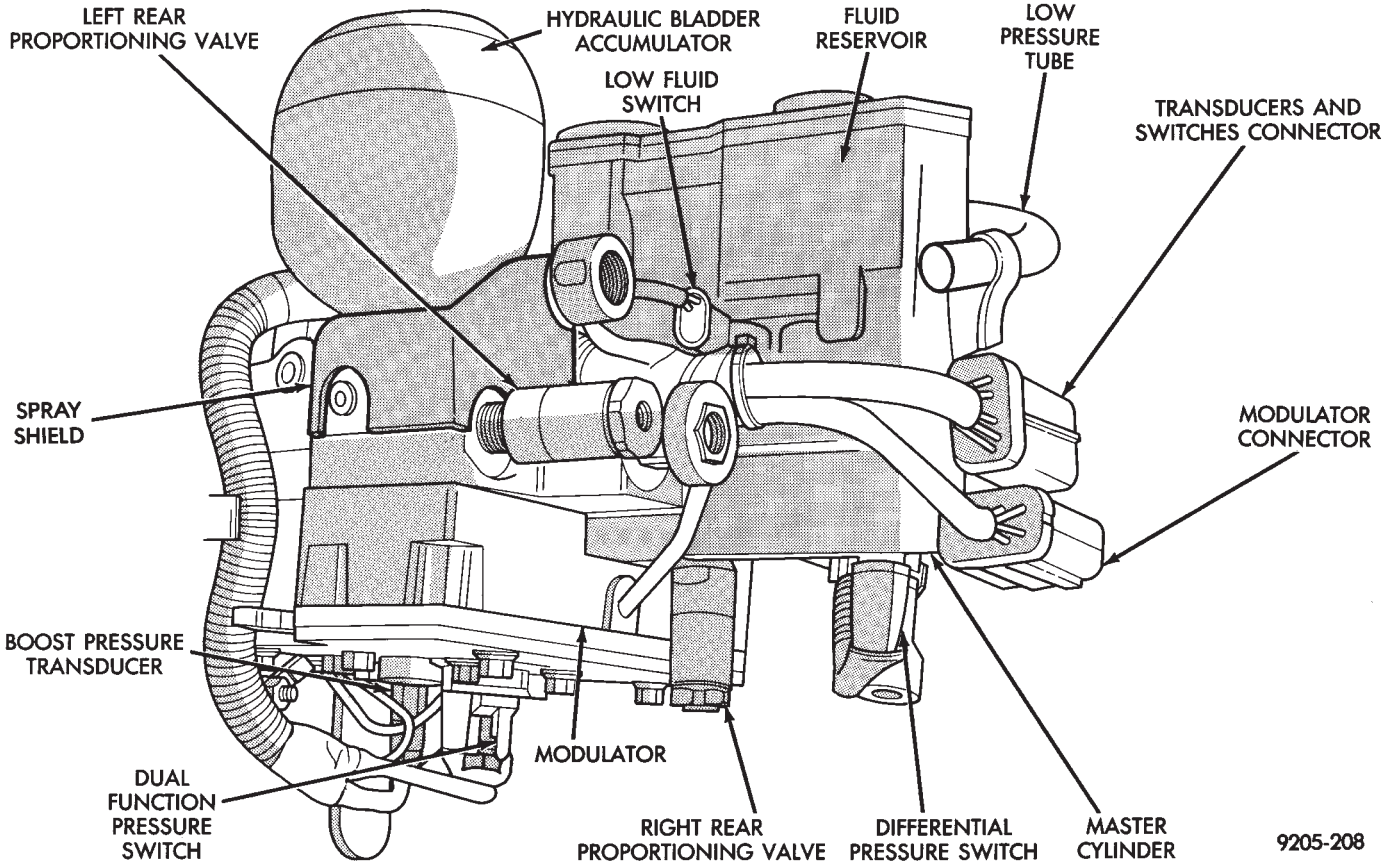


Fig. 1 Hydraulic Assembly

BOOSTER/MASTER CYLINDER

The Booster/Master Cylinder portion of the hydraulic assembly is an integral component and should never be disassembled.

The Booster/Master Cylinder uses a diagonally split configuration during normal braking. The two circuits are hydraulically isolated so a leak or malfunction in one circuit will allow continued braking ability in the other.

When force is applied to the brake pedal, the input pushrod applies force to the boost control valve. As the boost control valve is moved, it allows the pressurized fluid from the accumulator to flow into the master cylinder booster chamber. The pressure generated in the booster chamber is directly proportioned to the brake pedal force exerted by the driver. This pressure in the booster servo in turn applies pressure to the primary master cylinder piston that in turn applies pressure to the secondary master cylinder piston. The pressure generated in the primary and secondary circuits are used to apply the brakes during normal braking.

WARNING: THE HYDRAULIC ACCUMULATORS CONTAIN BRAKE FLUID AND NITROGEN GAS AT HIGH PRESSURE. CERTAIN PORTIONS OF THE BRAKE SYSTEM ALSO CONTAIN BRAKE FLUID AT HIGH PRESSURE. REMOVAL OR DISASSEMBLY MAY RESULT IN PERSONAL INJURY AND IMPROPER SYSTEM OPERATION. REFER TO THE APPROPRIATE SERVICE MANUAL FOR PROPER SERVICE PROCEDURES.

HYDRAULIC BLADDER ACCUMULATOR

A Hydraulic Bladder Accumulator (Fig. 2) is used to store brake fluid at high pressure. The pressurized fluid is used for Anti-Lock operation and for power assisted normal braking. The accumulator uses an elastomeric bladder configuration with a nitrogen precharge of about 6,895 kPa (1,000 psi). With no brake fluid in the system, the nitrogen gas pre-charge applies approximately 6,895 kPa (1,000 psi) to one side of the diaphragm (Fig. 2).

Under normal operation, the Pump/Motor assembly charges the accumulator to an operating pressure of between 11,032 and 13,790 kPa (1600 psi to 2,000 psi). As pressurized brake fluid enters the accumulator, pushing against the opposite side of the diaphragm, (Fig. 2) the nitrogen gas is compressed and increases in pressure.

DUAL FUNCTION PRESSURE SWITCH

The Dual Function Pressure Switch is located on the bottom of the hydraulic assembly (Fig. 1) and monitors Accumulator Pressure. The Dual Function Pressure Switch, if found to be functioning improperly using the ABS diagnostics, can be replaced. See service procedure in Electronic Components area of On Car ABS Service in this section of the service manual. The primary function is to control operation of the Pump/Motor assembly and thus maintain proper accumulator operating pressure. When accumulator pressure falls to or below 11,032 kPa (1600 psi) the pump motor switch (internal to the dual function pressure switch) will close. This provides a ground, through Pin 1 of the Transducer and Switch, 10 way electrical connector to the Pump/Motor relay coil. The energized coil pulls the relay contacts closed, providing battery voltage to run the Pump/Motor. When Accumulator Pressure reaches 13,790 kPa (2,000 psi) the switch opens, de-energizing the Pump/Motor Relay that turns off the Pump/Motor.

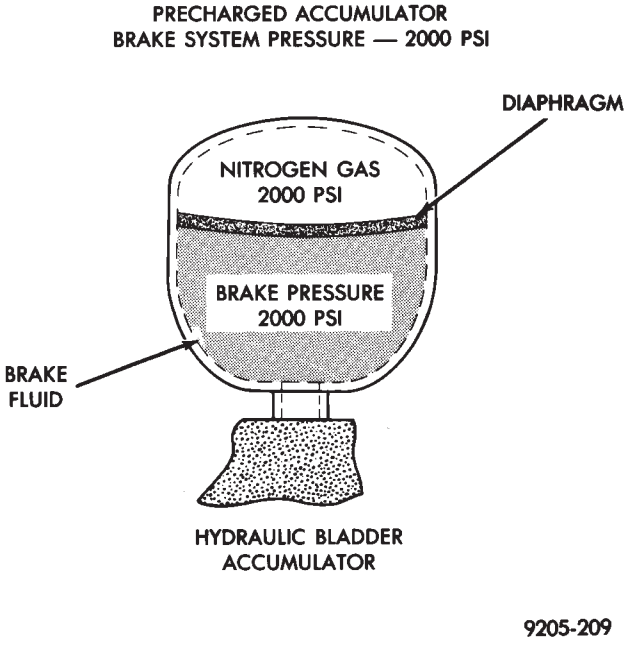


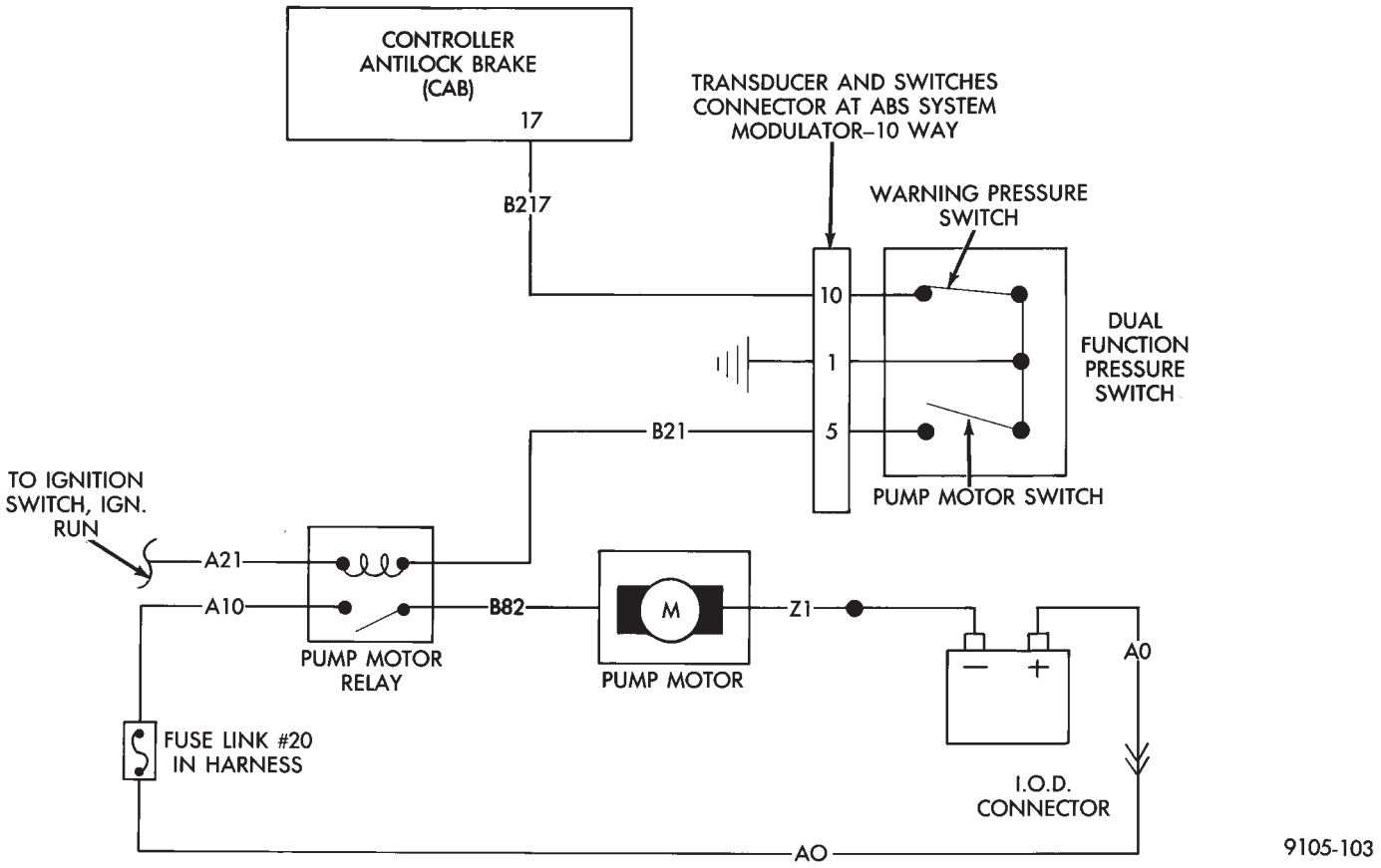
Fig. 2 Hydraulic Fluid Accumulator

NOTE: THE (CAB) DOES NOT REGULATE OR CONTROL ACCUMULATOR PRESSURE.

The second purpose of the Dual Function Pressure Switch is to provide a signal to the (CAB) when the Accumulator Pressure falls below 6,895 kPa (1,000 psi). A Warning Pressure Switch, internal to the Dual Function Pressure Switch, is normally closed above 6,895 kPa (1,000 psi). This sends a ground signal to pin 17 at the (CAB). At or below 6,895 kPa (1,000 psi) the Warning Pressure Switch opens. Internally, the (CAB) (pin 17) detects 12 volts and thus low pressure. At this warning pressure, the (CAB) will disable the Anti-Lock Braking functions, light the Red Brake Warning Lamp and the Amber Anti-Lock Warning Lamp. After two minutes of continuous detection, a low accumulator fault is stored.

Grounding for the Dual Function Pressure Switch. Is provided through Pin 1 of the Transducer and Switch, 10 way electrical connector and the Modulator Assembly.

DUAL FUNCTION PRESSURE SWITCH WIRING DIAGRAM



PRESSURE TRANSDUCERS

Two Pressure Transducers are used for brake system fault detection. Both transducers generate a voltage signal (between 0.25 volts and 5.0 volts) that is proportional to pressure. These signals are compared by the (CAB) and used to detect brake system faults that would require Anti -Lock Braking to be disabled.

The Boost Pressure Transducer is mounted on the bottom of the hydraulic assembly, (Fig. 1) and monitors booster servo pressure. The Primary Pressure Transducer is mounted on the left side of the hydraulic assembly and monitors primary master cylinder pressure.

DIFFERENTIAL PRESSURE SWITCH

A non-latching Differential Pressure Switch is used to detect a pressure difference greater than 2,068 kPa (300 psi.) between the primary and secondary master cylinder hydraulic circuits. If detected, the Differential Pressure Switch grounds the output of the primary pressure transducer (circuit B-218). This results in a 0.0 volt signal from the Primary Pressure Transducer that is sensed by the (CAB) as a differential pressure fault. The (CAB) will then light the Red Brake Warning Lamp and the Amber Anti-Lock Warning Lamp and disable the Anti-Lock braking function. See Fig. 1 for location of the differential pressure switch.

PROPORTIONING VALVES

The ABS system uses screw-in Proportioning Valves in place of the conventional Height Sensing Proportioning Valve. Each rear brake circuit has its own screw-in Proportioning Valve that is attached to the rear brake outlet ports of the hydraulic assembly (Fig. 1). These valves limit brake pressure to the rear brakes after a certain brake pressure is reached. This improves front to rear wheel brake balance during normal braking.

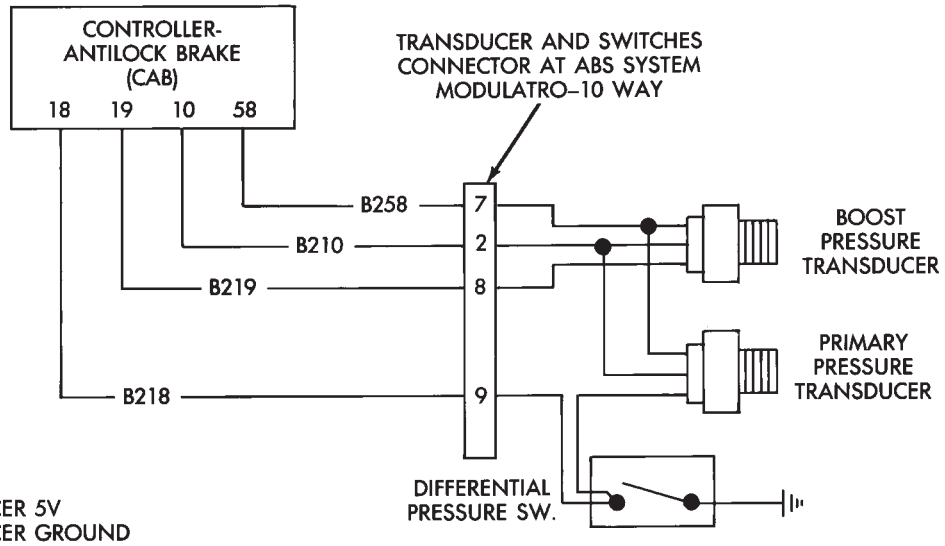
FILTERS-SERVICEABILITY

There is a screen filter in each of the two master cylinder fill ports. There is also a low pressure filter for the pump/motor. The filter is integral to the Pump/Motor low pressure hose.

FLUID LEVEL SWITCH

A Low Fluid Switch is located in the hydraulic assembly fluid reservoir, (Fig. 1). The switch consists of a float and magnetic reed switch that closes when low fluid is detected. The Low Fluid Switch is used as an input, to the Red Brake Warning Lamp, the (CAB), and the EVIC (if so equipped). When a low

PRESSURE SWITCH AND PRESSURE TRANSDUCER WIRING



fluid condition exists the switch will close, grounding the low fluid circuit and illuminating the Red Brake Warning Lamp. The (CAB) will disable the Anti-Lock Function and light the Amber Anti-Lock Warning Lamp if the vehicle is in motion above 3 mph. If the vehicle is not in motion, the Amber Anti-Lock Warning Lamp will NOT be lit.

PUMP/MOTOR ASSEMBLY

NOTE: The (CAB) does not control the operation of the pump/motor assembly.

The Pump/Motor Assembly is mounted to the transaxle below the hydraulic assembly,(Fig. 3). Integral to the Pump/Motor Assembly is an accumulator using a sliding piston configuration with a nitrogen precharge of 3,172 kPa (460 psi.) The Pump/Motor is an electrically driven pump that takes low pressure brake fluid from the hydraulic assembly fluid reservoir and pressurizes it. The pressurized fluid is then stored in the piston accumulator and hydraulic bladder accumulator for power assist and Anti-Lock Braking. Operation of the Pump/Motor is controlled by the Dual Function Pressure Switch through the Pump/Motor Relay. **The (CAB) does NOT control the Pump/Motor activation.** Rubber isolators are used to mount the pump to its bracket for noise isolation. The Pump/Motor Assembly is connected to the Hydraulic Assembly with a low pressure return hose and a high pressure hose. A filter is located in the low pressure return line.

WHEEL SPEED SENSORS

One Wheel Speed Sensor (WSS), is located at each wheel (Figs. 4, 5 and 6) and sends a small (AC) electrical signal to the control module (CAB). This signal is generated by magnetic induction. The mag-

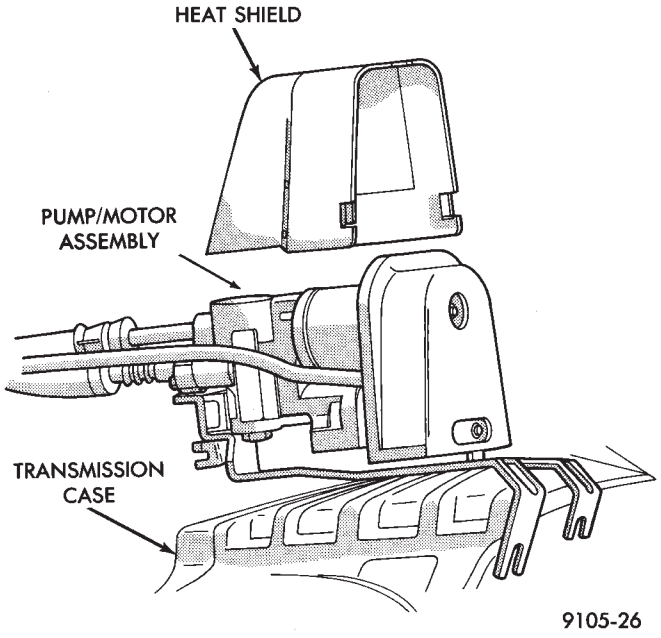


Fig. 3 Pump/Motor Assembly And Heat Shield

netic induction is created when a toothed sensor ring (Tone Wheel) passes by the stationary magnetic (Wheel Speed Sensor). The (CAB) converts the (AC) electrical signal generated at each wheel into a digital signal. If a wheel locking tendency is detected, the (CAB) will then modulate hydraulic pressure to prevent the wheel(s) from locking.

The front Wheel Speed Sensor (Fig. 4) is mounted to a boss on the steering knuckle, for both the Front Wheel Drive and All Wheel Drive applications. The Tone Wheel is part of the outboard constant velocity joint housing.

The Rear Wheel Speed Sensor, is mounted to the caliper mounting adapter (Fig. 5). The rear Tone

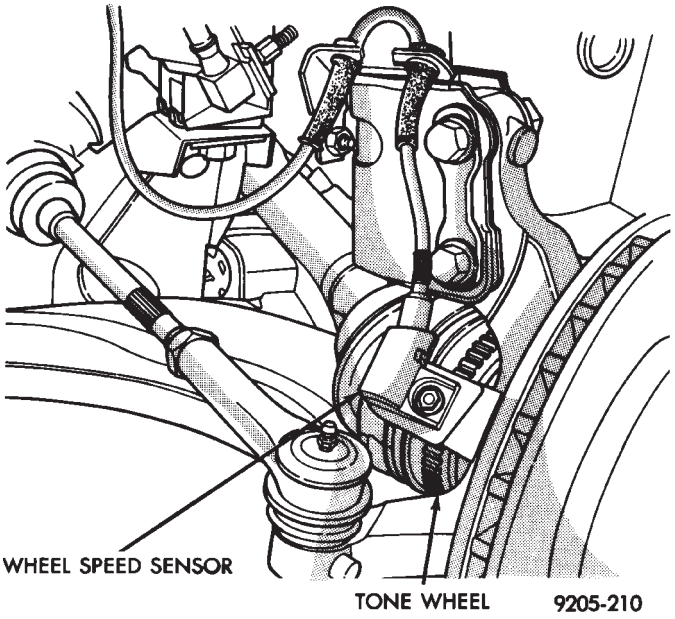


Fig. 4 Front Wheel Speed Sensor

Wheel is an integral part of the rear disc brake rotor hub (Fig. 6).

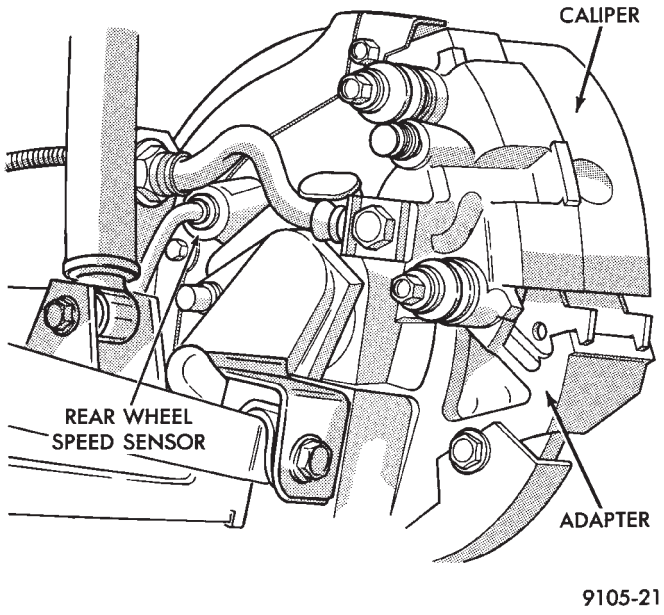


Fig. 5 Rear Wheel Speed Sensor

The speed sensor, to tone wheel air gap on all applications is NOT adjustable.

All 4 of the vehicles, Wheel Speed Sensors are serviced individually as replaceable components.

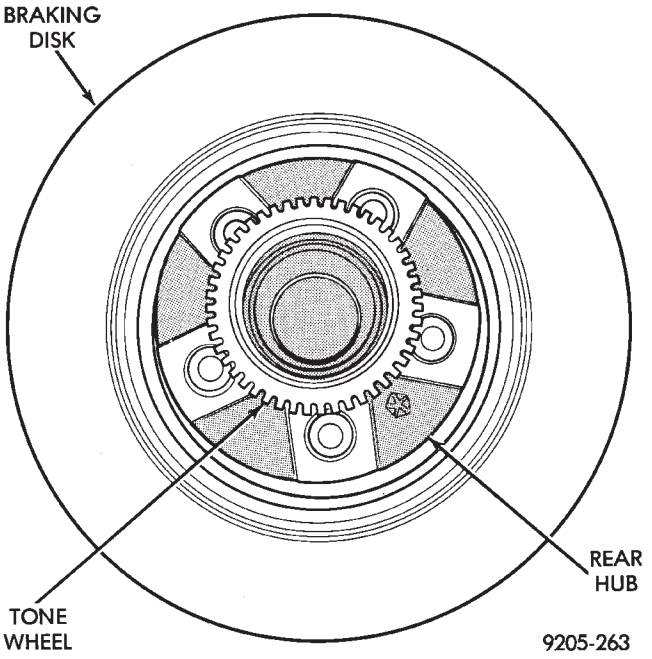


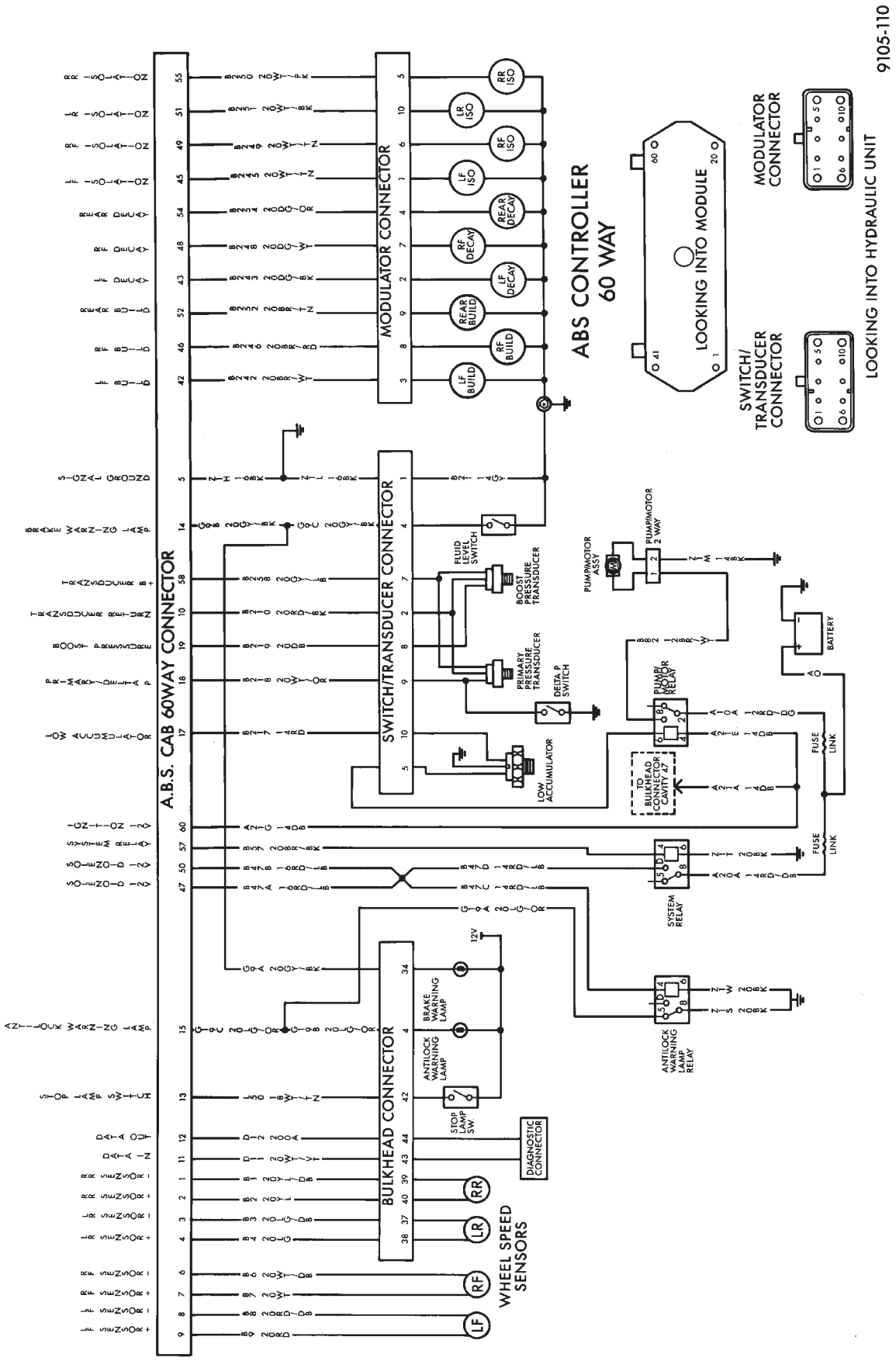
Fig. 6 Rear Tone Wheel

The Front Wheel Drive front Tone Wheels are serviced as an assembly with the front outboard constant velocity joint housings. The rear Tone Wheels are serviced as an assembly with the rear disc brake rotor hub.

Correct Anti-Lock System operation is dependent on wheel speed signals from the wheel speed sensors. The vehicles' wheels and tires must all be the same size and type to generate accurate signals. In addition, the tires must be inflated to the recommended pressures for optimum system operation. Variations in wheel and tire size or significant variations in inflation pressure can produce inaccurate wheel speed signals.

CONTROLLER ANTI-LOCK BRAKE (CAB)

The Anti-Lock Brake Controller is a small microprocessor based device that monitors the brake system and controls the system while it functions in Anti-Lock Mode. The CAB is located under the battery tray and is mounted to the left frame rail (Fig. 7) and uses a 60-way system connector. The power source for the CAB is through the ignition switch to pin 60 of the controller. With the ignition in the RUN or ON position. **IF THE (ABS) CONTROLLER NEEDS TO BE REPLACED BE SURE THE CORRECT CONTROLLER IS USED. THE CONTROLLER ANTI-LOCK BRAKE (CAB) IS NOT ON THE CCD BUS.**



ABS SYSTEM WIRING SCHEMATIC

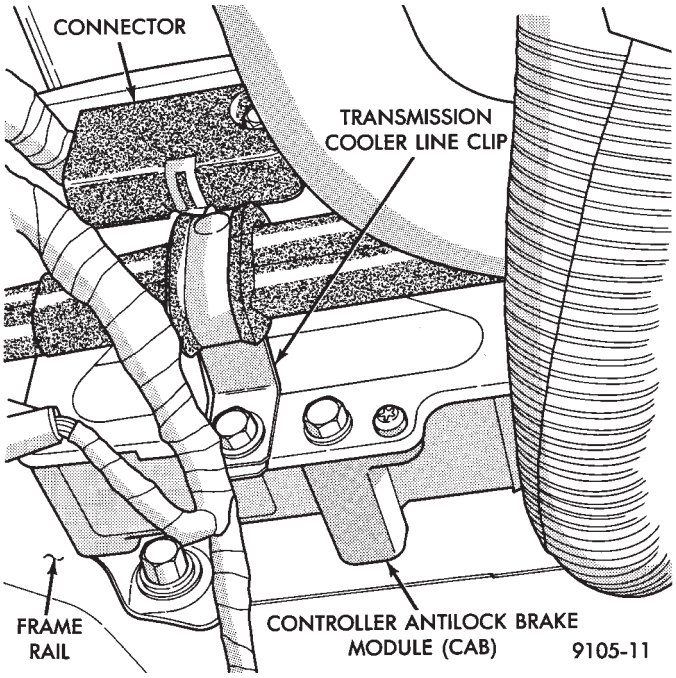


Fig. 7 Location Controller Anti-Lock Brake (CAB)

The primary functions of the (CAB) are:

- (1) Detect wheel locking tendencies.
- (2) Control fluid modulation to the brakes while in Anti-Lock mode.
- (3) Monitor the system for proper operation.
- (4) Provide communication to the DRB II 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) will isolate the master cylinder from the wheel brakes. This is done by activating the Isolation Valves. The (CAB) then commands the appropriate Build or Decay valves to modulate brake fluid pressure in some or all of the hydraulic circuits. The fluid used for modulation comes from the booster servo circuit. The (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 can disable the Anti-Lock braking function. Depending on the fault, the (CAB) will light one or both of the brake warning lamps.

The (CAB) contains a System Diagnostic Program which triggers the brake system warning lamps when a system fault is detected. Faults are stored in a diagnostic program memory. There are 19 fault codes that may be stored in the (CAB) and displayed through the DRB II. These fault codes will remain in the (CAB) memory even after the ignition has been turned off. These fault codes will remain in memory until they are cleared with the DRB II, or automatically erased from the memory after (50) ignition switch on/off cycles.

CONTROLLER ANTI-LOCK BRAKE (INPUTS)

- Four wheel speed sensors.
- Boost pressure transducer.
- Primary pressure transducer.
- Low fluid level switch.
- Differential pressure switch.
- Parking brake switch.
- Dual function pressure switch (warning pressure only)
- Stop lamp switch.
- Ignition switch.
- System relay voltage.
- Ground.
- Low Accumulator

CONTROLLER ANTI-LOCK BRAKE (OUTPUTS)

- Ten modulator valves-3 decay, 3 build and 4 isolation.
- Red Brake warning lamp.
- Amber Anti-Lock Warning Lamp.
- System relay actuation.
- Diagnostic communication.

ABS SYSTEM DIAGNOSTIC CONNECTOR

The Bendix Anti-Lock system diagnostic connector is located under the lower dash panel or in the area of the fuse box (Fig. 8). The fuse box is located behind the access panel that is on the bottom portion of the dash panel, left of the steering column. The diagnostics connector is a blue 6 way connector.

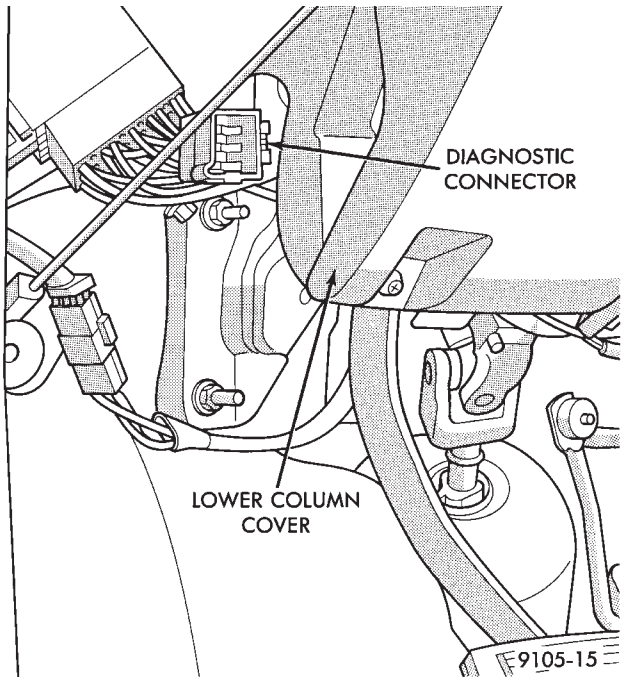


Fig. 8 A.B.S. Diagnostic Connector Location

ANTI-LOCK SYSTEM RELAYS AND WARNING LAMPS

PUMP/MOTOR RELAY

Pump/Motor power is supplied by the Pump/Motor Relay. The Pump/Motor relay is located inside the Power Distribution Center (PDC). Thee relay coil is energized by a ground from the Dual Function Pressure Switch. See (Fig. 9) for the location of the pump/motor relay in the (PDC).

SYSTEM RELAY

The (ABS) Modulator Valves and Anti-Lock Warning Lamp Relay are controlled through a System Relay. The System relay is located on the top left inner fender behind the headlight (Fig. 10). The system relay provides power to the (CAB) for modulator valve operation (pins 47 and 50) after the start-up cycle when the ignition is turned on.

ANTI-LOCK WARNING LAMP RELAY

The Anti-Lock Warning Lamp is controlled by the Yellow Light Relay. See (Fig. 10) for location behind the left headlight. With the relay de-energized, the lamp is lit. When the system relay is energized by the (CAB), the Anti-Lock Warning Lamp relay is energized, and the lamp is turned off. Thus, the lamp will be lit if the (CAB) is disconnected or if a system fault causes (ABS) function to be turned off, or if the system relay fails open.

ANTI-LOCK WARNING LAMP OFF

System Relay (normally open) and Yellow Light Relay (normally closed) Energized.

When the (CAB) energizes the system relay by providing 12 volts to pin 57. The voltage flow in the coil closes the system relay. Electrical current is then provided to pins 47 and 50 of the (CAB) to provide power to the modulator valves. This voltage also energizes the Anti-Lock Warning Lamp Relay Switch. This breaks the ground path to the Anti-Lock Warning Lamp and the lamp is turned off.

The (CAB) by itself, also can turn on the Anti-Lock Warning Lamp. The (CAB) can turn on the Anti-Lock Warning Lamp by providing a ground at pin 15.

ANTI-LOCK WARNING LAMP ON

System Relay and Anti-Lock Warning Lamp Relay De-Energized.

When the Amber Anti-Lock Warning Lamp is on, there is no current flow from the (CAB) at pin 57. The system relay coil is NOT energized. No electrical current flows to pins 47 and 50 (modulator valve power), or to the Anti-Lock Warning Lamp relay coil. Thus, the Anti-Lock Warning Lamp Relay is not energized. The Anti-Lock Warning Lamp is grounded through the Anti-Lock Warning Lamp relay contacts. The Anti-Lock Warning Lamp is illuminated.

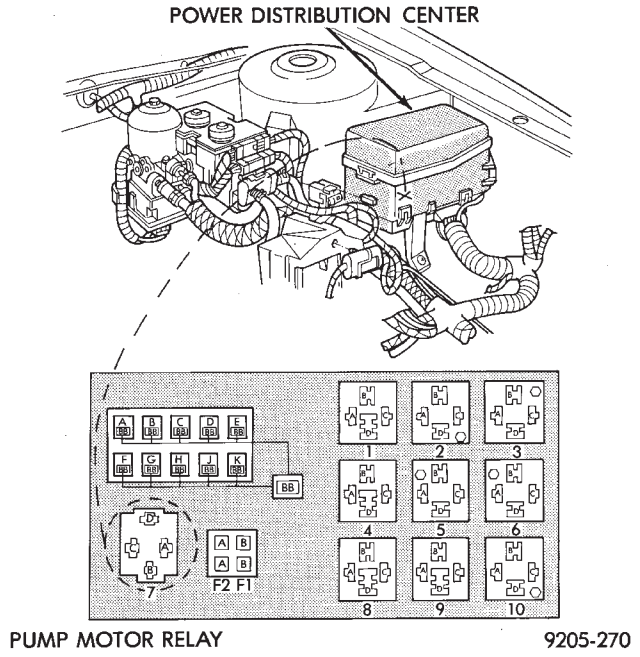


Fig. 9 Pump/Motor

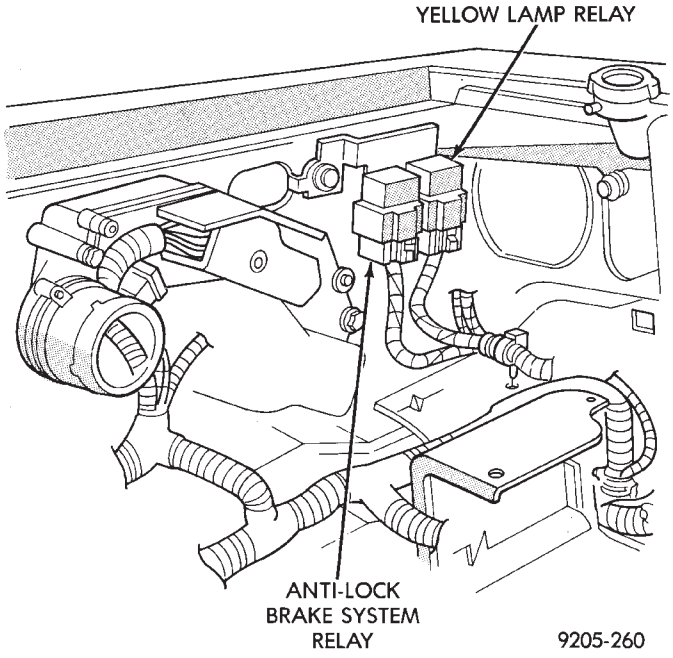
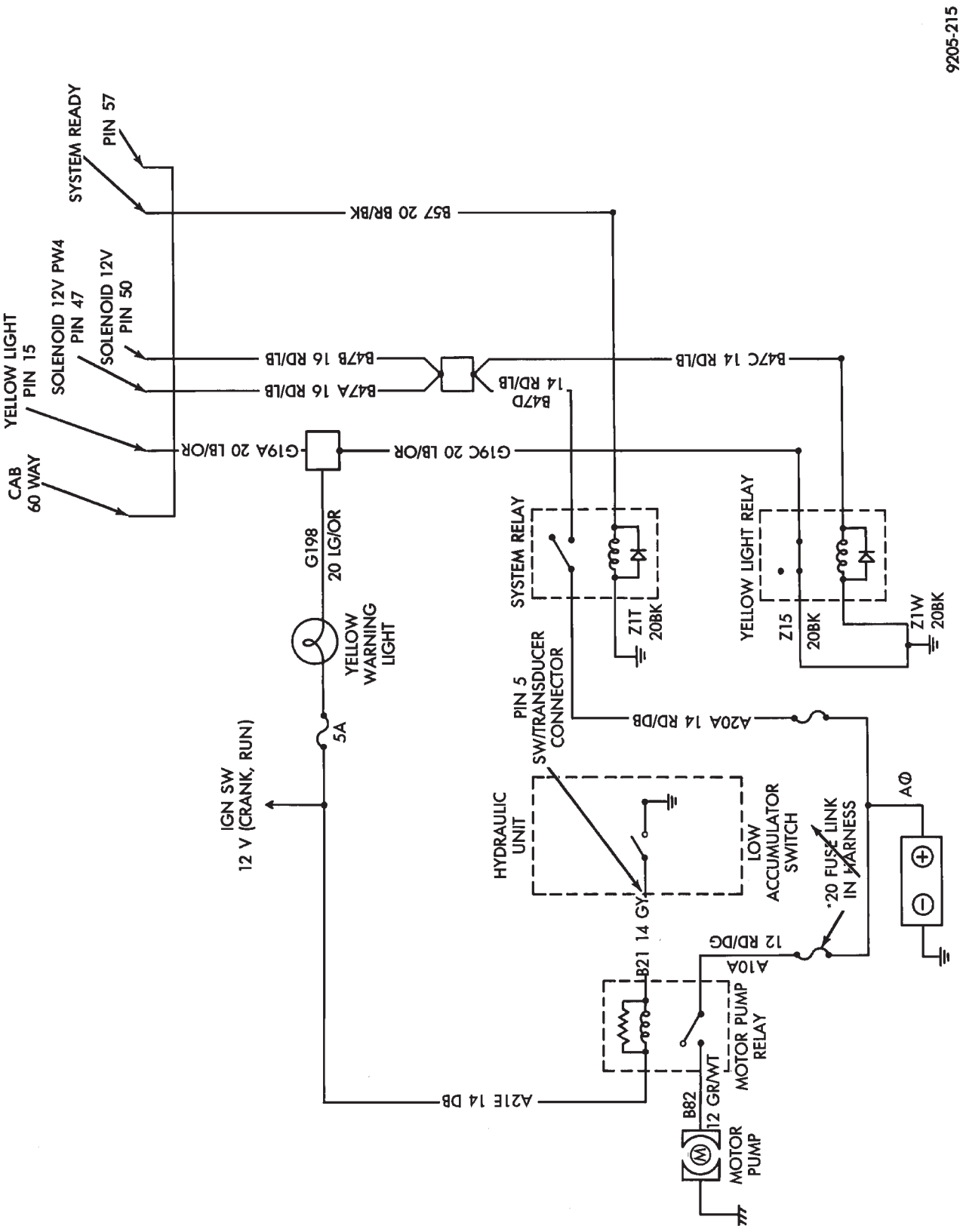


Fig. 10 ABS System Relay And Yellow Lamp Relay Location



ANTI-LOCK SYSTEM RELAY WIRING SCHEMATIC

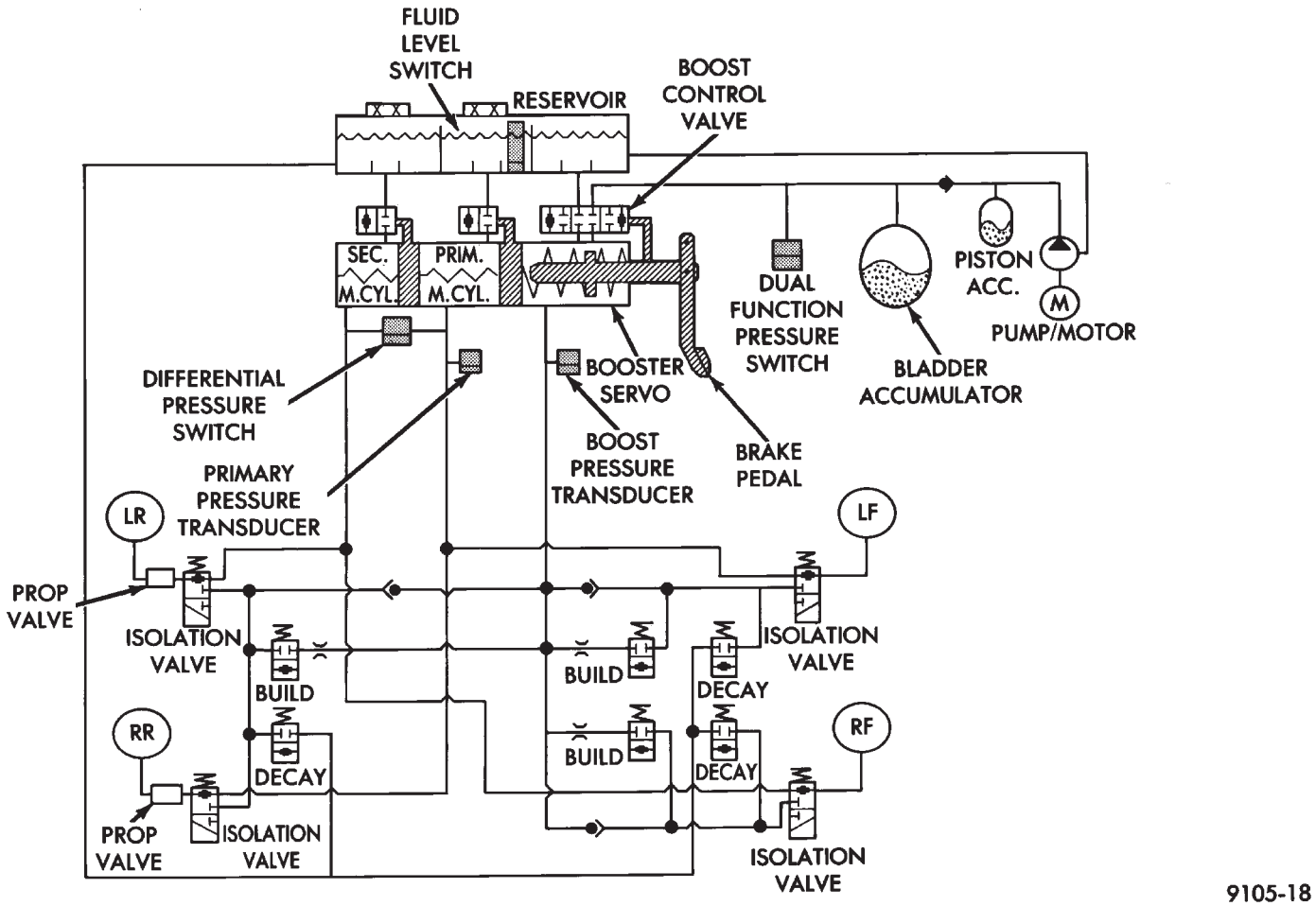


Fig. 11 Normal Braking - Hydraulic Control

ABS HYDRAULIC CIRCUITS AND VALVE OPERATION

Through the following operation descriptions and diagrams. 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 Anti-Lock Braking.

NORMAL BRAKING

ISOLATION VALVES

Open to primary and secondary master cylinder brake fluid supply (Fig. 11).

DECAY AND BUILD VALVES

Closed, not allowing for the build-up or release of brake fluid supply (Fig. 11).

The brake pedal is applied. The travel of the brake pedal closes primary, secondary and booster servo circuits from fluid supply at the fluid reservoir. Brake fluid from the primary and secondary circuits flows through the open isolation valves and applies the wheel brakes. Fluid from the booster servo circuit does not flow to the wheel brakes. The fluid flow is blocked by the closed build valves and check valves.

POWER ASSIST

The boost control valve shuttles between its three positions to provide power assisted braking (Fig. 11).

ABS BRAKING-BUILD PRESSURE

ISOLATION VALVES

Closed, isolating wheel brakes from master cylinder primary and secondary fluid supplies and open to booster servo circuit pressure through open build valves (Fig. 12).

DECAY VALVES

Closed, not allowing the escape of pressurized fluid supply from the hydraulic system (Fig. 12).

BUILD VALVES

Open, allowing booster servo circuit pressure to flow to the wheel brakes through the isolation valves (Fig. 12).

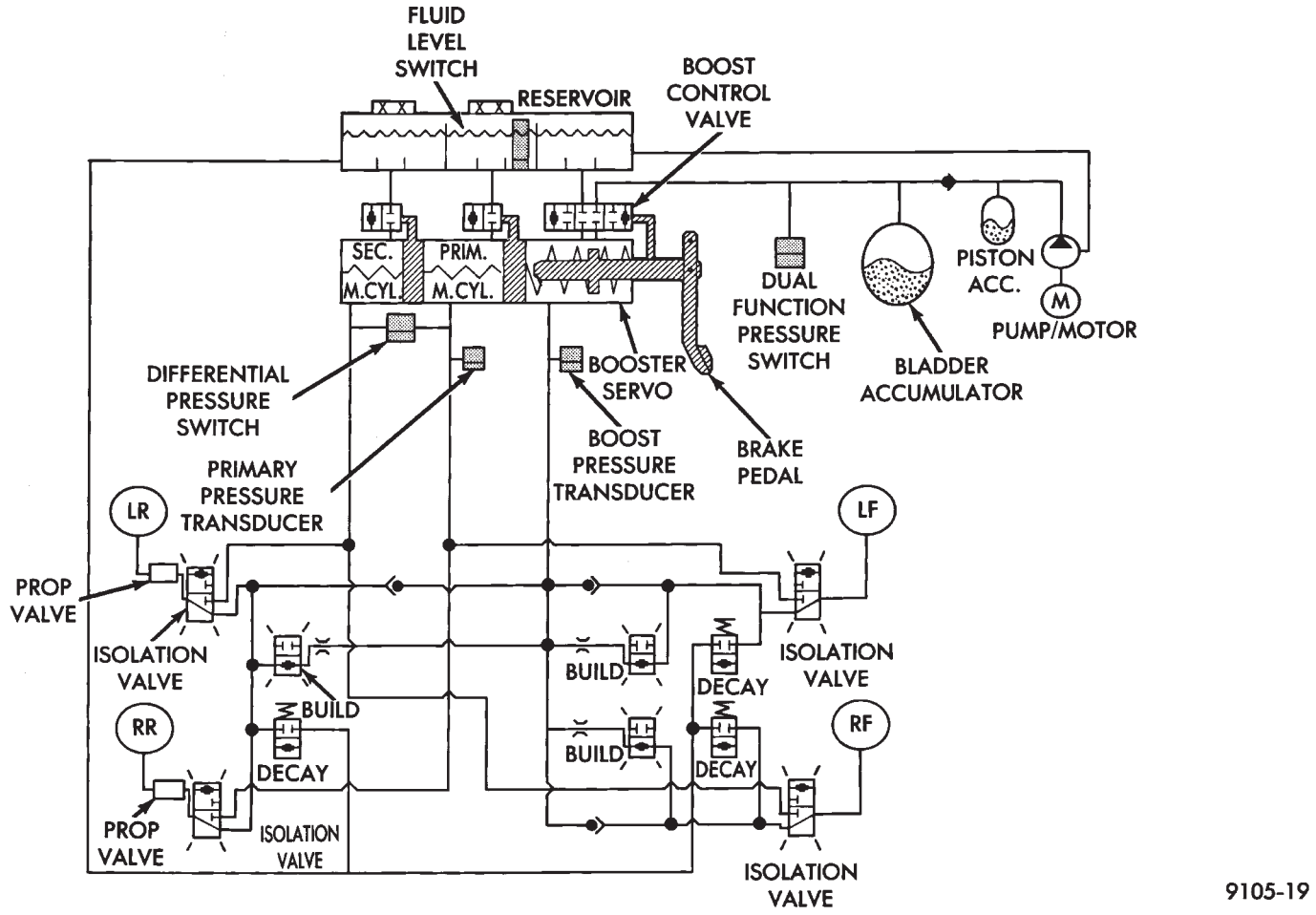


Fig. 12 Build Pressure - Hydraulic Control

POWER ASSIST

The boost control valve shuttles between its three positions to provide power assisted braking (Fig. 12).

ABS BRAKING-HOLD PRESSURE

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

ISOLATION VALVES

Closed, isolating the wheel brakes from the master cylinder primary and secondary fluid supplies. Build and decay valves are closed preventing any fluid from reaching the open isolation valves (Fig. 13).

DECAY AND BUILD VALVES

Closed, not allowing fluid supply to reach the open isolation valves (Fig. 13).

ABS BRAKING-DECAY PRESSURE

ISOLATION VALVES

Closed, isolating the wheel brakes from the master cylinder primary and secondary fluid supplies (Fig. 14).

DECAY VALVES

Open, allowing release of fluid pressure through decay valve to the fluid reservoir (Fig. 14).

BUILD VALVE

Closed, blocking booster servo circuit fluid to wheel brakes (Fig. 14).

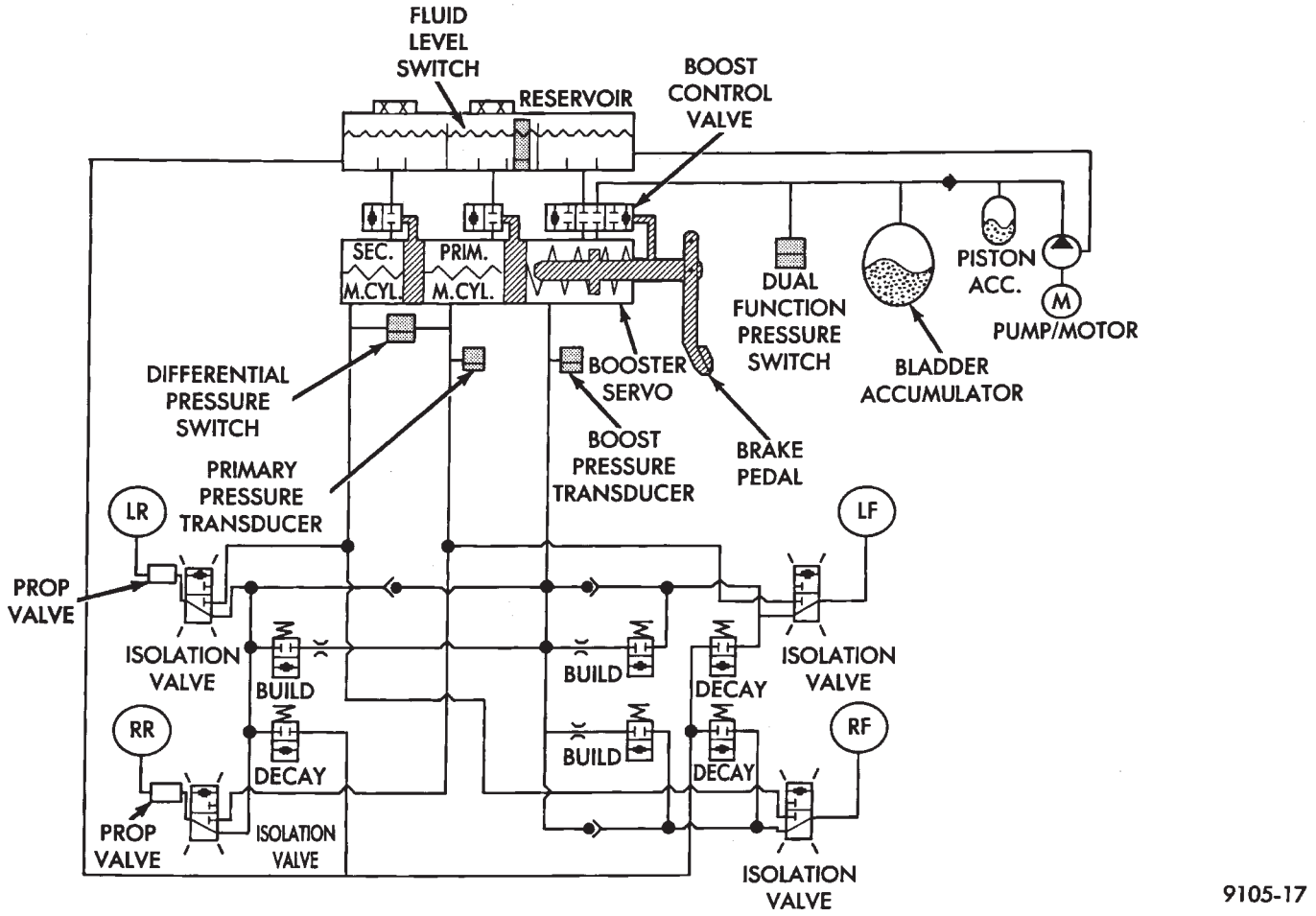


Fig. 13 Hold Pressure - Hydraulic Control

ABS BRAKING SYSTEM DIAGNOSIS

WARNING: SOME OPERATIONS IN THIS SECTION REQUIRE THAT HYDRAULIC TUBES, HOSES AND FITTINGS BE DISCONNECTED FOR INSPECTION OR TESTING PURPOSES. THIS BRAKE SYSTEM USES A HYDRAULIC ACCUMULATOR THAT, WHEN FULLY CHARGED, CONTAINS BRAKE FLUID AT HIGH PRESSURE. BEFORE DISCONNECTING ANY HYDRAULIC TUBE, HOSE OR FITTING. BE SURE THAT THE ACCUMULATOR IS FULLY DE-PRESSURIZED AS DESCRIBED IN THIS SECTION. FAILURE TO DEPRESSURIZE THE ACCUMULATOR MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

CAUTION: Certain components of the Anti-Lock Brake System (ABS) are not intended to be serviced individually. Attempting to remove or disconnect certain system components, may result in personal injury and/or improper system operation. Only those components with approved removal, service and installation procedures described in this manual should be serviced.

GENERAL INFORMATION

This section contains information necessary for diagnosis of mechanical conditions that can affect the operation of the Bendix Anti- Lock 10 Brake System. Specifically, this section should be used to help diagnose mechanical conditions that result in any of the following:

CAUTION: Review this entire section before performing any mechanical work on a vehicle equipped with the Bendix Anti-Lock 10 brake system. For information on precautions pertaining to potential component damage, vehicle damage and personal injury.

(1) Anti-Lock warning lamp illuminated
(2) BRAKE warning lamp on
(3) Lack of Power Assist or Excessive Pedal Travel
(4) Brakes Lock on Hard Application

Diagnosis of conditions that are obviously mechanical in nature. Such as brake noise, brake pulsation, or vehicle vibration during normal braking. Should be directed to Group 5 Brakes in the service manual. This also pertains to problems involving the parking brake system.

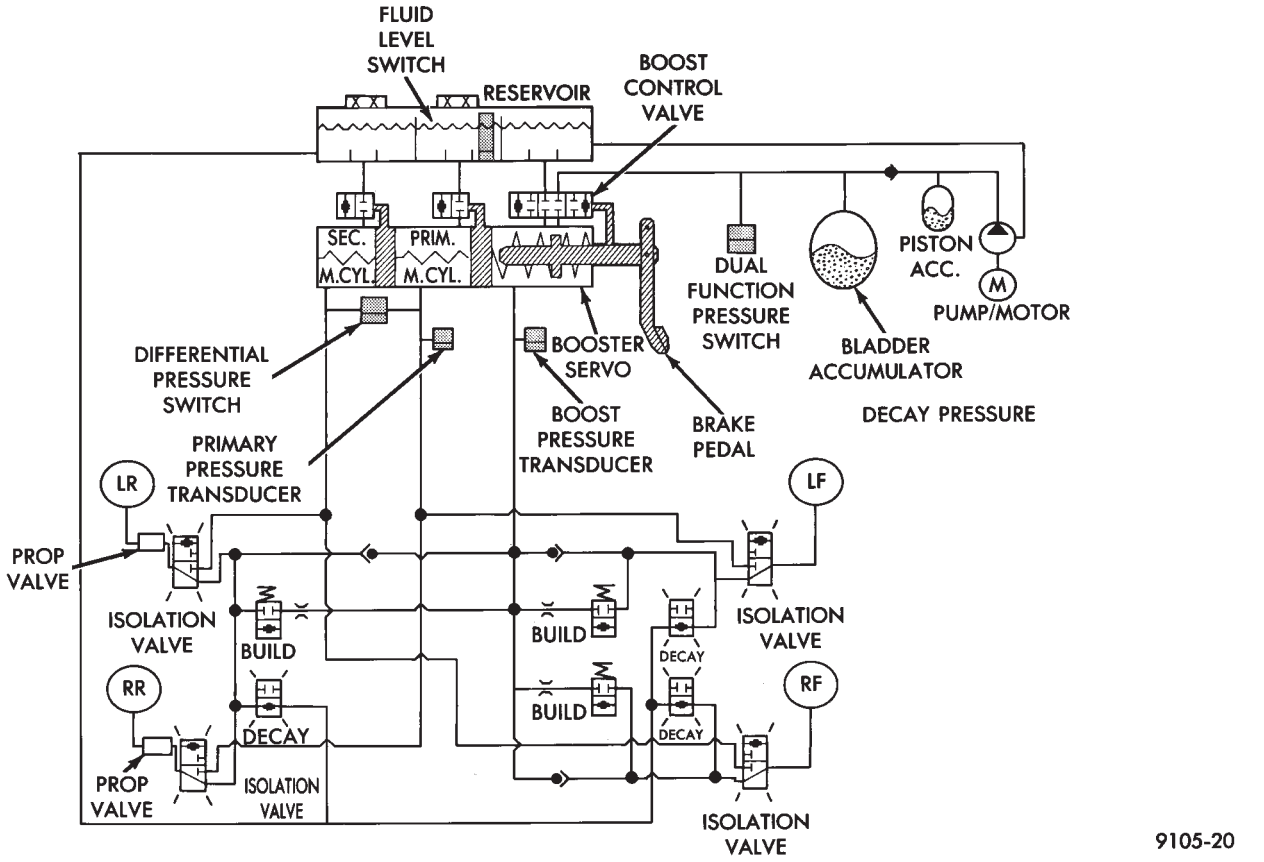


Fig. 14 Decay Pressure - Hydraulic Control

In order to effectively diagnose an Anti-Lock Brake System (ABS) condition. It is important to read Section 1 of this manual, Anti-Lock Brake System Description. This section will give you information on the function of the ABS components. Then follow the diagnostic procedures outlined in this section.

Many conditions that generate customer complaints may be normal operating conditions, but are judged to be a problem due to unfamiliarity 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 Section 1 of this manual to familiarize yourself with the operating principles of the ABS system.

DEFINITIONS

Several abbreviations are used in this manual. They are presented here for reference.

- CAB—Controller Anti-Lock Brake
- ABS—Anti-Lock Brake System
- PSI—Pounds per Square Inch (pressure)
- WSS—Wheel Speed Sensor

ABS CONTROLLER ANTI-LOCK BRAKE (CAB) SERVICE PRECAUTIONS

The ABS system uses an electronic control module, the (CAB). This module is designed to withstand normal current draws associated with vehicle operation. However 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 by the appropriate diagnostic procedure. These circuits should only be tested using a high impedance multi-meter, special tools or the DRB II 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.

ABS SYSTEM GENERAL SERVICE PRECAUTIONS

TEST DRIVING ABS COMPLAINT VEHICLES

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.

Before test driving a brake complaint vehicle, especially if the Red Brake Warning Lamp is on. Test the brake function at low speed to be sure that the car will stop normally. Remember that conditions that result in illumination of the Red Brake Warning Lamp may indicate reduced braking ability. The following procedure should be used to test drive an ABS complaint:

(1) Ignition on. Turn the ignition to the ON position without starting the car and wait until the Red Brake Warning Lamp and Amber Anti-Lock Warning Lamp turn off. This will allow the pump to charge the accumulator to operating pressure. If the warning lamp(s) do not turn off, go to step 3.

(2) Ignition off for 15 seconds.

(3) Start car. Wait for displays to return to normal operating mode before proceeding.

(4) With Shift lever in PARK, slowly depress brake pedal and release.

(5) Drive vehicle a short distance. During this test drive, be sure that the vehicle achieves at least 20 mph. Then brake to at least one complete stop and accelerate slowly back up to at least 20 mph.

(6) If a functional problem with the A.B.S. system is determined while test driving a vehicle. Refer to the Bendix Anti-Lock 10 Diagnostics Manual for required test procedures and proper use of the DRB II tester.

CAUTION: The following are general precautions that should be observed when servicing and diagnosing the ABS system and/or other vehicle systems. Failure to observe these precautions may result in ABS system damage.

(1) If welding work is to be performed on the vehicle using an arc welder, the (CAB) should be disconnected before the welding operation begins.

(2) The (CAB) and hydraulic assembly 10 way connectors should never be connected or disconnected with the ignition on.

(3) Some components of the ABS system are not serviced separately and must be serviced as complete assemblies. Do not disassemble any component which is designated as non-serviceable.

(4) **Always de-pressurize the Hydraulic Accumulator when performing any work that requires disconnecting any hydraulic tube, flex hose or fitting. The ABS system uses brake fluid at high pressure. Failure to de-pressurize the accumulator may result in personal injury and/or damage to painted surfaces.**

Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash off with water immediately.

DE-PRESSURIZING HYDRAULIC ACCUMULATOR

The ABS pump/motor assembly keeps the hydraulic accumulator charged between approximately 11,032 and 13,790 kPa (1600 and 2000 psi) anytime the ignition is in the ON position. The pump/motor assembly cannot run if the ignition is off or if either battery cable is disconnected.

Unless otherwise specified, the hydraulic accumulator should be de-pressurized before disassembling any portion of the hydraulic system. The following procedure should be used to de-pressurize the hydraulic accumulator:

(1) With ignition off, or either battery cable disconnected, pump the brake pedal a minimum of 40 times using approximately 50 pounds of pedal force. A noticeable change in pedal feel will occur when the accumulator becomes discharged.

(2) When a definite increase in pedal effort is felt, pump the pedal a few additional times. This will insure removal of all hydraulic pressure from the brake system.

WHEEL SPEED SENSOR CABLES

Proper installation of wheel speed sensor cables is critical to continued ABS system operation. Be sure that cables are installed and routed properly. Failure to install cables in their retainers, as shown in Section 3 of this manual. May result in contact with moving parts or over extension of cables, resulting in an open circuit.

MECHANICAL DIAGNOSTICS AND SERVICE PROCEDURES

SPECIAL SERVICE TOOLS

Some diagnostic procedures in this section require the use of special service tools. Each of these tools is described below.

DRB II DIAGNOSTIC TESTER

Some of the diagnostic procedures that are explained in this section require the use of the DRB II DIAGNOSTICS TESTER to insure that proper diagnostics are performed. Refer to those sections for proper testing procedures and the DRB II manual for its proper operational information.

MST-6163 PRESSURE TESTER

Some diagnostic procedures in this manual require the use of the MST-6163 pressure gauge and adaptor (See Fig. 2) to measure accumulator pressure during certain phases of operation. The pressure gauge and adaptor should be installed as follows:

(1) De-pressurize the accumulator by pumping the brake pedal a minimum of 40 times with the ignition off. The procedure is fully explained under De-Pressurizing Hydraulic Accumulator which is described earlier in this System Diagnosis Section.

WARNING: FAILURE TO DE-PRESSURIZE THE ACCUMULATOR PRIOR TO PERFORMING THIS OPERATION MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

(2) Remove hydraulic assembly accumulator port plug,located on right hand side of hydraulic assembly (Fig. 1).

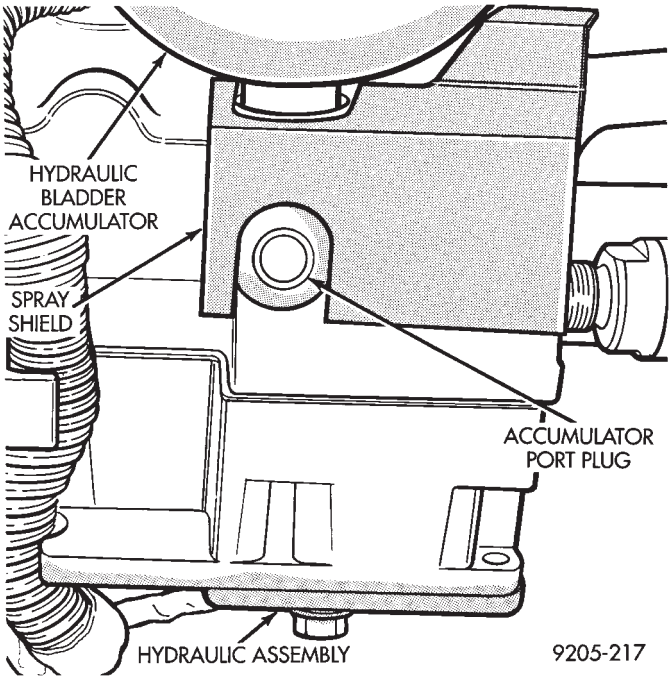


Fig. 1 Hydraulic Assembly Accumulator Port Plug Location

(3) Install pressure gauge to hydraulic assembly adaptor (Fig. 2) into accumulator port of hydraulic assembly, and tighten to 10 N•m (7.5 ft. lbs.) torque.

(4) Install adaptor onto the pressure gauge hose (Fig. 2) and tighten the fitting to 15 N•m (11 ft. lbs.) torque.

(5) Install pressure gauge and hose adaptor assembly onto the adaptor installed in the hydraulic assembly accumulator port. Then install the retaining clip into the grove on the accumulator port adaptor (Fig. 2). **MAKE SURE THAT THE RETAINING CLIP IS INSTALLED ON THE ACCUMULATOR PORT ADAPTOR BEFORE RE-PRESSURIZING THE HYDRAULIC SYSTEM.**

WARNING: BEFORE REMOVING PRESSURE GAUGE AND ADAPTOR, BE SURE TO DE-PRESSURIZE THE HYDRAULIC ASSEMBLY. THEN INSTALL AND TIGHTEN ACCUMULATOR PORT PLUG TO 12 N•M (9 FT. LBS.).

It is not necessary to bleed the hydraulic assembly or brake system after installation and removal of the pressure gauge. Unless additional tubes, hoses, or fittings were removed or loosened.

INTERMITTENT FAULTS

As with almost 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 electrical connector halves, or

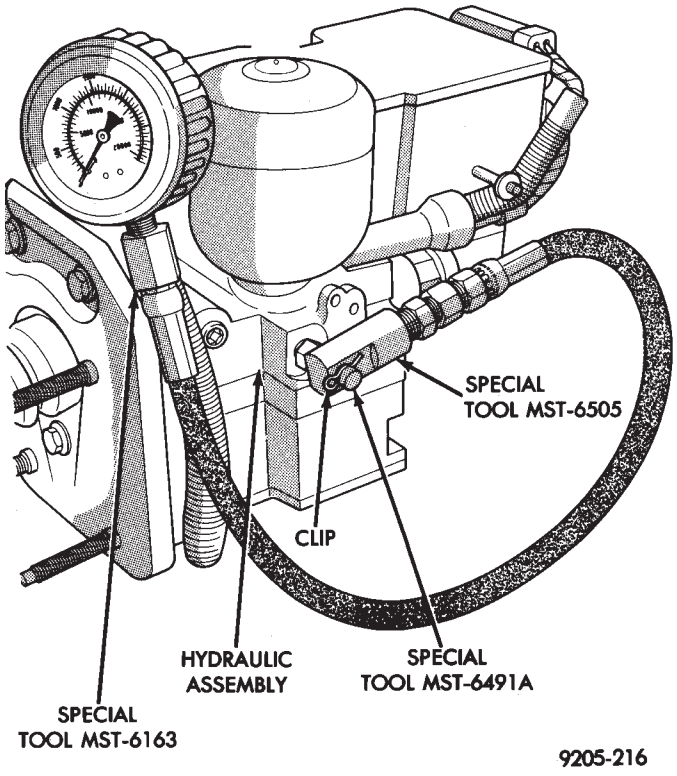


Fig. 2 Pressure Gauge and Adapter Installed on Hydraulic Assembly

electrical terminals not fully seated in the connector body.

(2) Improperly formed or damaged electrical 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 and inspecting for proper terminal to wire connection.

If a visual check does not find the cause of the problem, operate the vehicle in an attempt to duplicate the condition and record the Fault Code.

Most failures of the ABS system will disable the Anti-Lock function for the entire ignition cycle even if the fault clears before ignition 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 Red Brake Warning Lamp and/or Amber Anti-Lock Warning Lamp. All other failures will cause the lamp(s) to remain on until the ignition switch is turned off. Circuits and or components involving these inputs to the (CAB) should be investigated if a complaint of intermittent warning system operation is encountered.

• Low system voltage. If low system voltage is detected by the (CAB), the (CAB) will turn on the Amber Anti-Lock Warning Lamp until normal system voltage is achieved. Once normal voltage is seen at the (CAB), normal operation resumes.
• Low Brake Fluid. A low brake fluid condition will cause the Red Brake Warning Lamp to illuminate. When the fluid sensor again indicates an acceptable fluid level, the Red Brake Warning Lamp will go out. This condition may exist during hard cornering or while the vehicle is on a grade. If the vehicle is in motion above 3 M.P.H. the Amber Anti-Lock Warning Lamp will also be turned on.
• Low Accumulator Pressure. Low Accumulator Pressure will cause both the Red Brake Warning and Amber Anti-Lock Warning Lamps to illuminate. Once normal operating pressure is achieved, the lamps will extinguish and the system will return to normal operation.

Additionally, any condition that results in interruption of power to the (CAB) or hydraulic assembly may cause the Red Brake Warning and Amber Anti-Lock Warning Lamps to illuminate intermittently.

All the conditions (or faults) mentioned above, can store a fault code in the (CAB) module.

ABS BRAKE SYSTEM DIAGNOSTIC FEATURES

SYSTEM SELF DIAGNOSIS

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

CONTROLLER ANTI-LOCK BRAKE (CAB)

Fault codes are kept in a Non-Volatile memory until either erased by the technician using the DRB II or erased automatically after 50 ignition cycles (key ON-OFF cycles). The only fault that will not be erased after 50 (KEY CYCLES) is the (CAB) fault. The (CAB) fault can only be erased by using the DRB II diagnostic tester. More than one fault can be stored at a time. The number of key cycles 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 II Diagnostic Tester.

START-UP CYCLE

The START-UP CYCLE takes place immediately after the ignition switch is turned on. It is an electrical check of basic electrical functions such as the System Relay and Anti-Lock Warning Lamp Relay. During this check, the Amber Anti-Lock Warning Lamp is turned on, then turned off at the end of the test. The test takes approximately 1 - 2 seconds to complete.

DRIVE-OFF CYCLE

The DRIVE-OFF CYCLE takes place when the vehicle reaches about 3 miles per hour the first time after an ignition reset. During this test, the modulator solenoid valves are activated briefly to test their function. The DRIVE-OFF CYCLE will be bypassed if you drive-off with the service brake pedal depressed.

LATCHING VERSUS NON-LATCHING FAULTS

Some faults detected by the (CAB) are latching. The fault is latched and (ABS) function is disabled until the ignition switch is reset (turned OFF/ON). Thus (ABS) function is disabled even if the original fault has disappeared during the ignition cycle in which it occurred. Other faults are non-latching; any warning lights that are turned on are only on as long as the fault condition exists. As soon as the condition goes away. The Amber Anti-Lock Warning Light is turned off. Although a fault code will be set in most cases. (Example:low accumulator fault will not be stored for a time of 2 minutes after the fault is detected).

BENDIX ABS SYSTEMS DIAGNOSTICS

The Bendix Anti-Lock 10 Brake System diagnostics. Beyond the basic mechanical diagnostics, systems and components covered earlier in this section, is accomplished by using the DRB II diagnostic tester. See testing procedures outlined in the Bendix Anti-Lock 10 Diagnostics Manual for the 1992 M.Y.

Please reference the above mentioned manual. For any further diagnostic service procedures that are required on the Bendix Anti-Lock 10 Brake System, requiring the use of the DRB II diagnostic tester.

ON CAR HYDRAULIC ABS COMPONENT SERVICE

WARNING: FAILURE TO FULLY DE-PRESSURIZE THE HYDRAULIC ACCUMULATOR BEFORE PERFORMING HYDRAULIC SYSTEM SERVICE OPERATIONS. COULD RESULT IN INJURY TO SERVICE PERSONNEL AND OR DAMAGE TO PAINTED SURFACES. SEE SECTION 2 FOR ADDITIONAL WARNINGS AND CAUTIONS.

GENERAL SERVICE PRECAUTIONS

The following are general precautions that should be observed when servicing the Anti-Lock Brake System and/or other vehicle systems. Failure to observe these precautions may result in Anti-Lock brake system 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) or hydraulic assembly connector should never be connected or disconnected with the ignition switch in the **ON** position.

Many components of the Anti-Lock brake system are not serviceable and must be replaced as an assembly. **Do not attempt to disassemble any component that is not designed to be a serviced component.**

DE-PRESSURIZING HYDRAULIC ACCUMULATOR

The pump/motor assembly will keep the hydraulic accumulator charged to approximately 11,032 and 13,790 kPa (1600 and 2000 psi) any time that the ignition is in the ON position. The pump/motor assembly cannot run if the ignition is off or if either battery cable is disconnected.

Unless otherwise specified, the hydraulic accumulator should be de-pressurized before disassembling any portion of the hydraulic system. The following procedure should be used to relieve the pressure in the hydraulic accumulator:

(1) With ignition off, or either battery cable disconnected, pump the brake pedal a minimum of 40 times, using approximately 222 N (50 lbs.) pedal force. A noticeable change in pedal feel will occur, when the accumulator is discharged.

(2) When a definite increase in pedal effort is felt, pump pedal a few additional times. This will insure removal of all hydraulic pressure from the brake system.

CHECKING BRAKE FLUID LEVEL

CAUTION: Use only brake fluid conforming to DOT 3 specifications such as Mopar® or Equivalent. Do not use any fluid in the brake hydraulic system, which contains a petroleum base. Do not use a container which has been used for petroleum based fluids or a container that is wet with water. Petroleum based fluids will cause swelling and distortion of rubber parts in the hydraulic brake system and water will mix with brake fluid, lowering the fluid boiling point. Keep all brake fluid containers tightly capped to prevent contamination.

The hydraulic assembly is equipped with a plastic fluid reservoir, with a filter/strainer located in the filler neck of each reservoir section.

The Anti-Lock brake system requires that the hydraulic accumulator be de-pressurized when checking the fluid level. To check the brake fluid level, the following procedure should be used:

(1) With the ignition off, de-pressurize the hydraulic accumulator by applying the brake pedal approximately 40 times, using a pedal force of approximately 220 N (50 lbs.). A noticeable change in pedal feel will occur when the accumulator is de-pressurized. When a definite increase in pedal effort is felt, pump pedal a few additional times. This will insure removal of all hydraulic pressure from the brake system.

(2) Thoroughly clean both reservoir caps and surrounding area of reservoir before cap removal. This will avoid getting dirt into the reservoir and brake fluid.

(3) Inspect the fluid level, see instructions on top of reservoir (Fill To Top Of The White Screen In Front Filter/Strainer).

(4) Fill reservoir to top of white screen on filter/strainer (Fig. 1) as required. Use only brake fluid conforming to DOT 3 specifications such as Mopar® or an Equivalent.

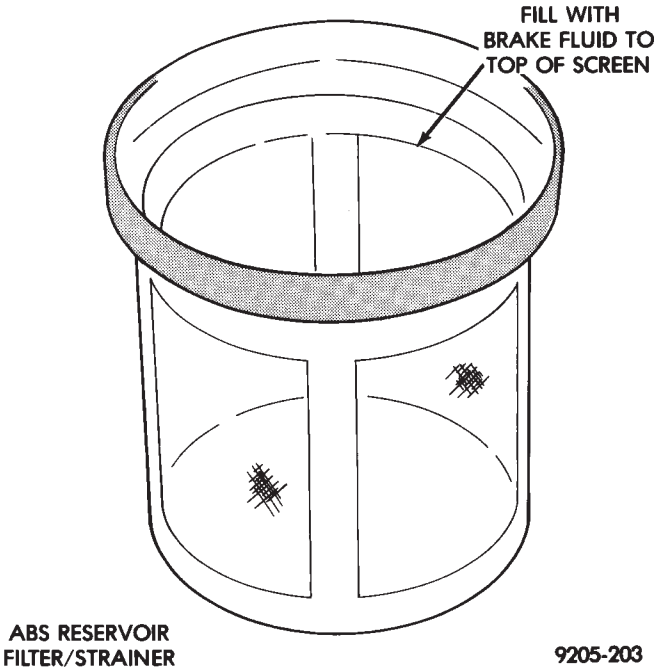


Fig. 1 ABS Fill Level On Filter/Strainer

(5) Replace reservoir cap.

BLEEDING ABS BRAKE SYSTEM

The Anti-Lock brake system must be bled anytime air is permitted to enter the brake hydraulic system, due to disconnection of brake lines or hoses for service. It is important to note that excessive air in the brake system may set a primary pressure/delta P fault in the (CAB). Refer to Diagnosis, for further information.

Pressure bleeding or manual bleeding procedures can be used when bleeding the (ABS) hydraulic system, after brake lines or hoses have been disconnected. Bleeding the (ABS) hydraulic system is also necessary after the replacement of the hydraulic assembly or wheel brakes.

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 only DOT 3 brake fluid to the reservoir as required.

PRESSURE BLEEDING (FIG. 2)

The brake lines may be pressure bled, using a standard diaphragm type pressure bleeder. Only diaphragm type pressure bleeding equipment should be used to prevent air, moisture, and other contaminants from entering the system. The following procedure should be used for pressure bleeding of the master cylinder and wheel circuits (Fig. 2).

(1) Ignition should be turned off and remain off throughout this procedure.

(2) De-pressurize the hydraulic accumulator by pumping the brake pedal a minimum of 40 times, as fully described in this section under De-Pressurizing Hydraulic Accumulator.

WARNING: FAILURE TO DE-PRESSURIZE HYDRAULIC ACCUMULATOR, BEFORE PERFORMING THIS OPERATION, MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

(3) Remove both reservoir caps (Fig. 2).

(4) Install pressure bleeder adapter, on front reservoir port and a cap on the rear port of the reservoir (Fig. 2).

(5) Attach bleeding equipment to bleeder adapter (Fig. 2). Charge pressure bleeder to approximately 138 kPa (20 psi).

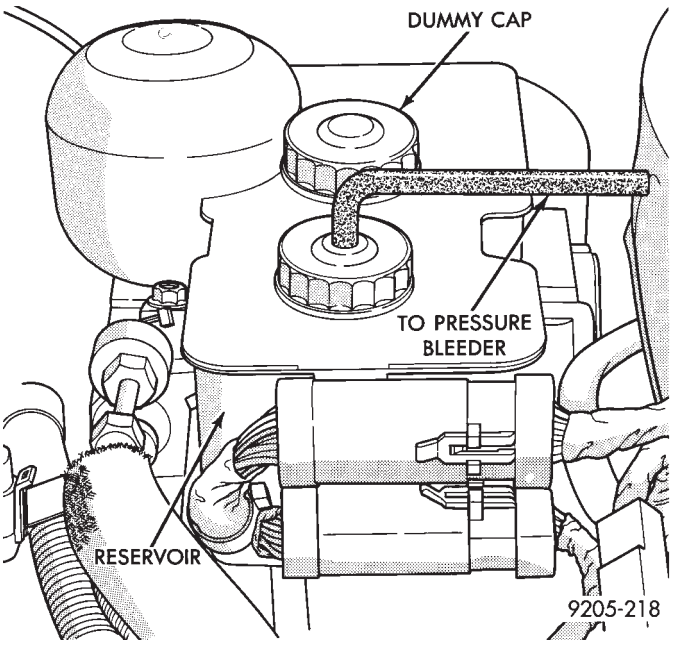


Fig. 2 Pressure Bleeding Brake System

(6) Connect a transparent hose to the caliper bleed screw (Fig. 3). Submerge the free end of the hose in a clear glass container, which is partially filled with clean, fresh brake fluid.

(7) With the pressure bleeder turned on, open the caliper bleed screw 3/4 to one full turn allowing brake fluid to flow into the container. Leave bleed screw open until a clear, bubble-free flow of brake fluid is coming from the hose in the container. If the reservoir has been drained or the hydraulic assembly removed from the car before the bleeding operation. Slowly pump the brake pedal one or two times while the bleed screw is open and fluid is flowing. This will help purge any trapped air from the hydraulic assembly. Tighten bleeder screw to 10 N●m (7.5 ft. lbs.) torque.

(8) Step 7 above should be done at all wheel brakes, following the order wheel by wheel as listed below.

a) Left rear.
b) Right rear.
c) Left front.
d) Right front.

(9) After bleeding is completed at all four wheel brakes. Remove the pressure bleeding equipment and bleeder adapter by closing the pressure bleeder valve and slowly unscrewing the bleeder adapter from the hydraulic assembly reservoir. **Failure to release pressure in the reservoir will cause spillage of brake fluid, and could result in personal injury or damage to painted surfaces.**

(10) Using a syringe or equivalent method, remove excess fluid from the reservoir to bring the brake fluid to the required fill level (Fig. 1). If brake fluid is below the proper level add Mopar® brake fluid or equivalent conforming to DOT 3, requirements.

(11) Install the reservoir caps and turn on the ignition to allow the (ABS) pump to charge the accumulator.

MANUAL BLEEDING

Brake lines can be bled, using the manual bleeding method. Manual bleeding is a two person operation, one to pump the brake pedal and the other to bleed each wheel brake. The following procedure should be used:

De-pressurizing the hydraulic accumulator is done by following the steps described below.

(1) Verify that the ignition switch is in the off position.

(2) De-pressurize the hydraulic accumulator by pumping the brake pedal a minimum of 40 times. Use the procedure as described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

WARNING: FAILURE TO DE-PRESSURIZE HYDRAULIC ACCUMULATOR, PRIOR TO PERFORMING THIS OPERATION, MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

(3) Connect a transparent hose to the bleed screw on the wheel cylinder or brake caliper that is to be

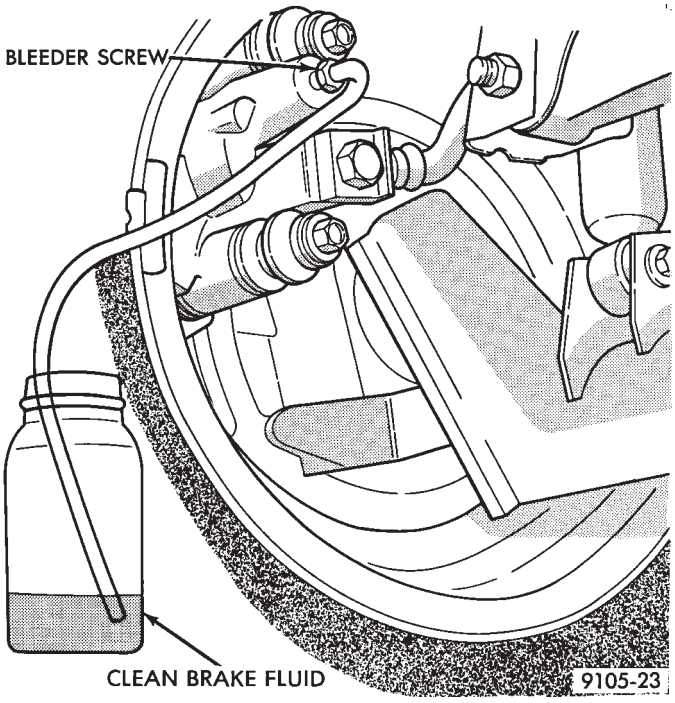


Fig. 3 Bleeding Brake System

bled (Fig. 3). Submerge the free end of the hose in a clear glass container, which is partially filled with clean, fresh brake fluid.

(4) Slowly pump the brake pedal several times, using full strokes of the pedal and allowing approximately five seconds between pedal strokes. After two or three strokes, continue to hold pressure on the pedal, keeping it at the bottom of its travel.

(5) With pressure on the pedal, open the bleed screw 3/4 to 1 full turn. Leave bleed screw open until fluid no longer flows from the hose. Tighten the bleed screw and release the pedal. **Be sure that the bleed screw it tightened before brake pedal is released, or air may be drawn back into hydraulic system.**

(6) Repeat Steps 3, 4 and 5 on each wheel brake, until clear, bubble-free fluid flows from the hose.

(7) Repeat the above sequence at each wheel brake, in the following order:

a) Left rear.

b) Right rear.

c) Left front.

d) Right front.

(8) Fill the hydraulic assembly to the proper fill level (Fig. 1) using Mopar® or equivalent brake fluid meeting DOT 3, requirements.

(9) Install both reservoir caps on reservoir.

(10) Turn the ignition switch to the RUN position to allow the Pump/Motor to turn on and recharge the accumulator.

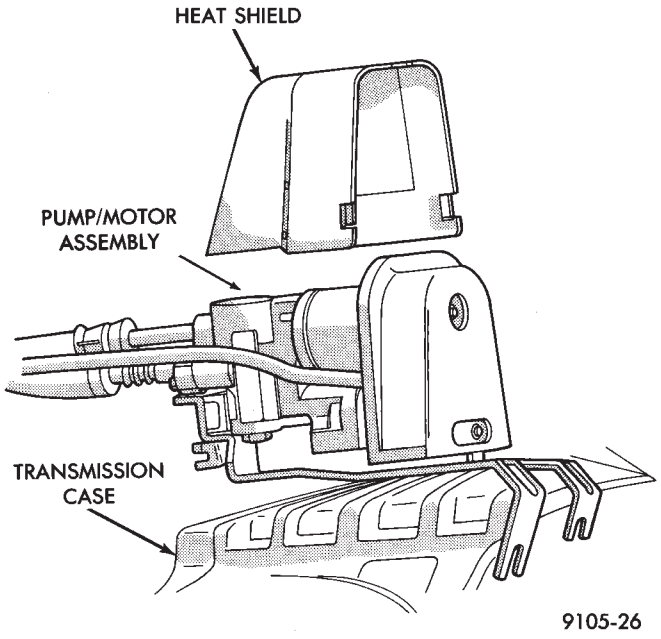


Fig. 4 Pump/Motor Assembly Mounting

PUMP/MOTOR SERVICE (FIG. 4)

REMOVE

(1) De-pressurize the hydraulic accumulator by pumping the brake pedal a minimum of 40 times. Using the procedure as described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

WARNING: FAILURE TO DE-PRESSURIZE HYDRAULIC ACCUMULATOR, BEFORE PERFORMING THIS OPERATION, MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

(2) Remove the fresh air intake ducts from the engine induction system.

(3) Loosen the low pressure hose clamp (Fig. 5) at the hydraulic assembly.

(4) Disconnect any routing clips which attach the high and low pressure fluid lines to the body or components of the vehicle (Fig. 5).

(5) Unclip the pump/motor assembly wiring harness electrical connector from the left side engine mount (Fig. 5). Disconnect the pump/motor assembly wiring harness from the underhood wiring harness.

(6) Loosen the high pressure hose tube nut at the hydraulic assembly fitting (Fig. 5).

(7) Remove the high and low pressure hose assembly (Fig. 5) from the hydraulic assembly. Cap all open ports on reservoir and hydraulic assembly to prevent brake fluid from leaking out.

(8) Remove the pump/motor assembly front heat shield to mounting bracket attaching bolt, from front of pump/motor bracket (Fig. 5).

(9) Remove front heat shield from the pump/motor assembly.

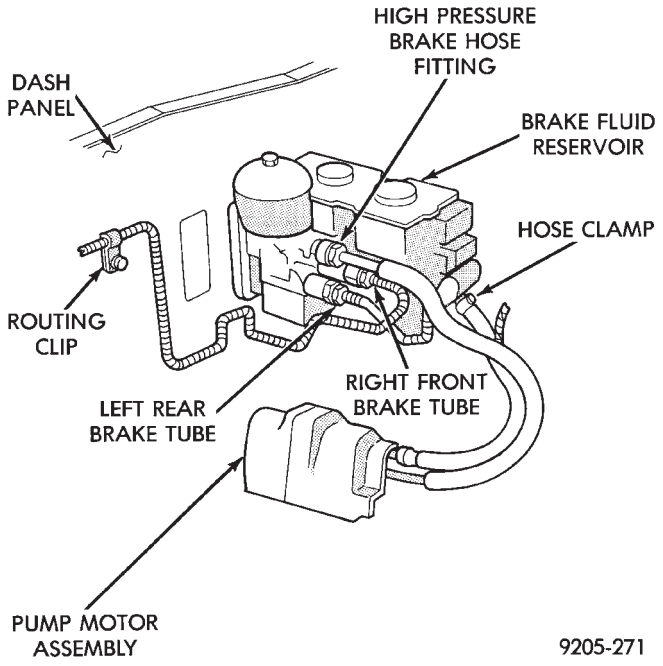


Fig. 5 Brake Tube and Hose Routing

(10) Lift pump/motor assembly from mounting bracket and remove assembly from the vehicle.

INSTALL

CAUTION:Be sure all high and low pressure hose routing clips. Are securely fastened to the vehicle body or component they were removed from when hose assembly is reinstalled (Fig. 5).

(1) Install pump/motor assembly in reverse order of removal.

(2) Tighten the pump/motor assembly fluid lines to the torque values shown below.

- Low pressure hose clamp. 1 N●m (10 in. lbs.)
- High pressure hose fitting to pump/motor assembly. 16 N●m (145 in. lbs.) Fig. 5.

Note: It is not necessary to bleed the foundation brakes of the vehicle when the pump/motor assembly and high and low pressure fluid hoses are serviced. Any other service to the brake system unless stated otherwise will require bleeding of the complete brake system.

BRAKE FLUID PRESSURE AND RETURN HOSES (FIG. 6)

REMOVE

(1) Remove the pump/motor assembly from its mounting bracket, see Pump/Motor Service.

(2) Cut the 4 tie straps that secure the high and low pressure hoses and pump/motor assembly wiring harness together Fig. 6.

(3) Remove the banjo bolt and spray shield from the pump/motor assembly Fig. 6.

(4) Remove the high and low pressure hose assembly from the pump/motor assembly Fig. 6.

INSTALL

(1) The rubber O-Ring seals used on the high and low pressure hose connections to the pump/motor assembly. Should be lubricated with clean brake fluid before connecting hoses to the pump/motor assembly.

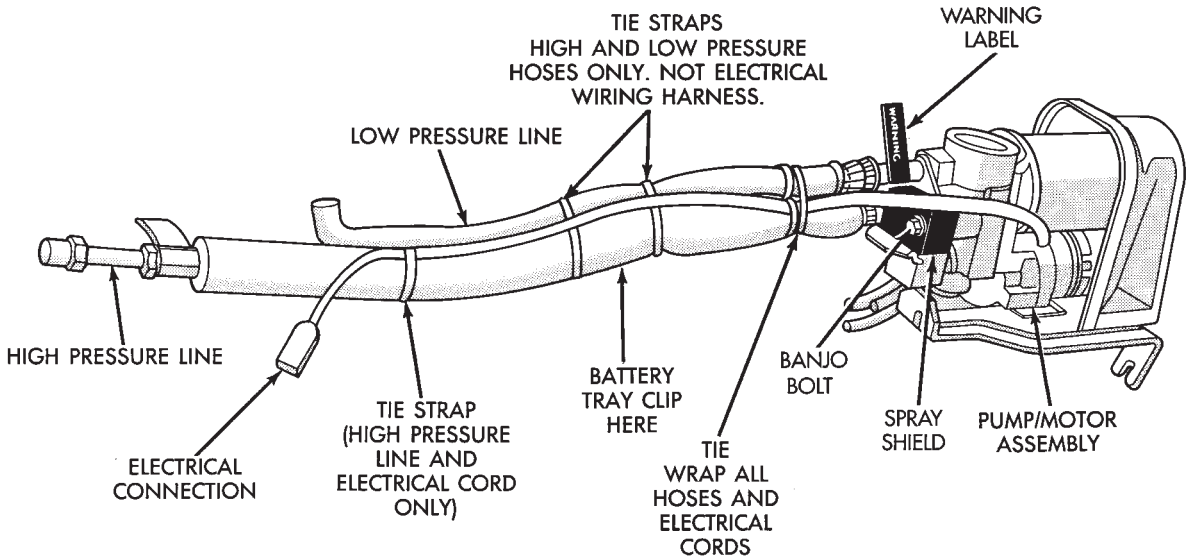


Fig. 6 Positioning Tie Straps On High And Low Pressure Hose Assembly

(2) Position the high and low pressure hose assembly and spray shield on the pump/motor assembly (Fig. 6). Then install the banjo bolt and torque to 14 N●m (120 in. lbs.)

(3) Carefully route pump/motor assembly wiring harness along the side of the high and low pressure hose assembly (Fig. 6).

(4) Install the 4 tie straps around the hose assembly and wiring harness per the sequence and locations shown in (Fig. 6).

(5) Install the pump/motor assembly back on mounting bracket, See Pump/Motor Service.

(6) Turn the ignition switch to the RUN position. This will turn on the pump/motor assembly to charge the high pressure system.

(7) Pump the brake system down as detailed in De-pressurizing Hydraulic Accumulator in this section of the service manual.

(8) Fill the hydraulic assembly to the proper level with Mopar® brake fluid or an equivalent meeting DOT 3 specifications. See Master Cylinder Fluid Level in the Service Adjustments section of this group.

HYDRAULIC ASSEMBLY

REMOVE

(1) De-pressurize the hydraulic accumulator by pumping the brake pedal a minimum of 40 times. Using the procedure as described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

WARNING: FAILURE TO DE-PRESSURIZE HYDRAULIC ACCUMULATOR, BEFORE PERFORMING THIS OPERATION, MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

(2) Remove fresh air intake duct and air cleaner from vehicle.

(3) Remove the windshield washer fluid bottle from the vehicle.

(4) Disconnect all electrical connectors from the hydraulic assembly.

(5) Remove as much fluid as possible from the reservoir on the hydraulic assembly.

(6) Remove pump high pressure hose fitting (Fig. 7) from hydraulic assembly.

(7) Disconnect pump return hose from steel tube. Cap the end of the steel tube.

(8) Disconnect the 4 brake tubes from the hydraulic assembly (Fig. 7).

(9) From under the instrument panel, position a small screwdriver between the center tang on the retainer clip and the pin in the brake pedal. Rotate the screwdriver enough to allow the retainer clip center tang to pass over the end of the brake pedal pin. **Discard the old retainer clip, a new clip must be used when hydraulic assembly is reinstalled (Fig. 8).**

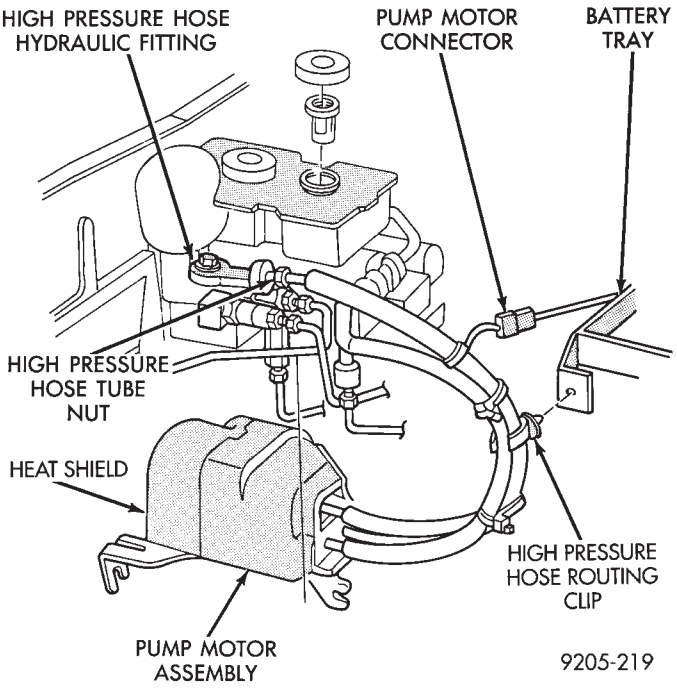


Fig. 7 Brake Tube and Hose Routing at Hydraulic Unit

(10) Remove the 4 hydraulic assembly to dash panel mounting nuts from the hydraulic assembly mounting studs, located under instrument panel (Fig. 8).

(11) Remove hydraulic assembly from vehicle.

INSTALL

(1) Position the hydraulic assembly into its mounting holes on the dash panel of the vehicle.

(2) Install and tighten the 4 hydraulic assembly to dash panel mounting stud nuts (Fig. 8) to 28 N●m (250 in. lbs.) torque.

(3) Using lubriplate or equivalent, coat the bearing surface of the brake pedal pin.

(4) Connect push rod to pedal pin and install a **NEW** retainer clip. **HYDRAULIC ASSEMBLY PUSH ROD MUST BE ASSEMBLED TO BRAKE PEDAL PIN IN THE POSITION AS SHOWN IN (FIG. 8).**

(5) If proportioning valves were removed from the hydraulic assembly, install and torque to 40 N●m (30 ft. lbs.) torque.

Then install all 4 brake tubes on the hydraulic assembly (Fig. 7). Torque the brake tubes to hydraulic assembly fittings to 16 N●m (145 in. lbs.).

(6) Install return hose on steel tube. Tighten the return hose clamp to 1 N●m (10 in. lbs.).

(7) Install high pressure hose to hydraulic assembly (Fig. 7). Tighten the hose, to hydraulic assembly fitting to 16 N●m (145 in. lbs.).

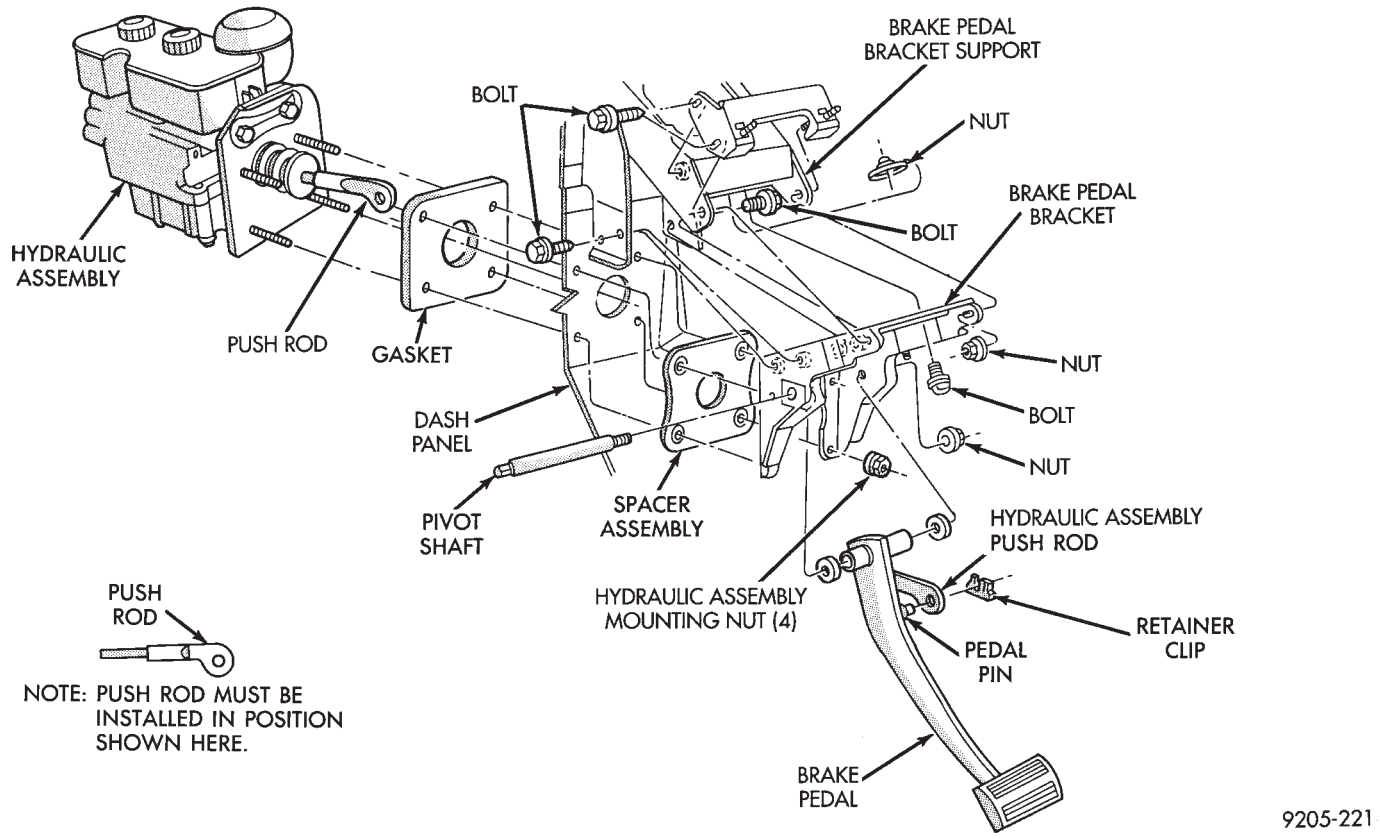


Fig. 8 Removing or Installing Hydraulic Assembly

(8) Fill hydraulic assembly brake fluid reservoir to top of screen on the reservoir filter/strainer (Fig. 9).

(9) Connect all electrical connectors to the hydraulic assembly.

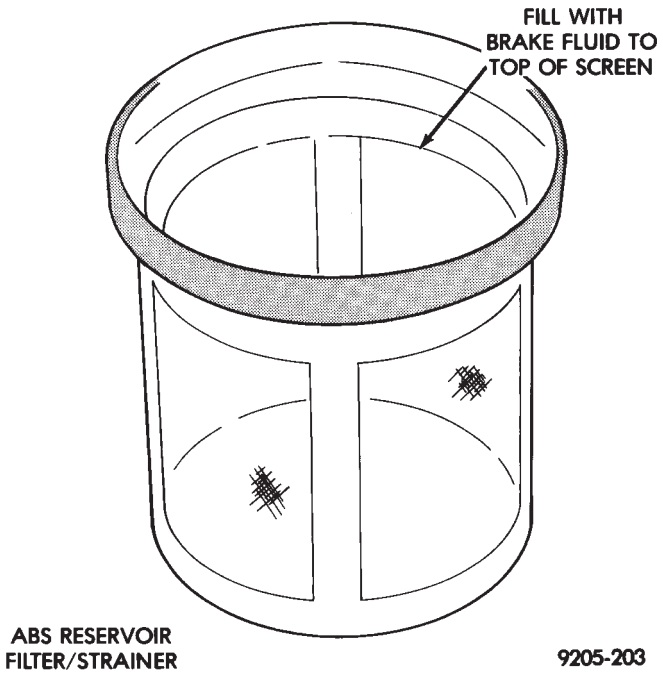


Fig. 9 ABS Fill Level On Filter/Strainer

(10) Bleed the entire brake system, see Bleeding Brake System in this section of the Service Manual.

(11) Replace all fresh air intake ducts, air cleaner and washer bottle.

(12) Check that the brake fluid in the hydraulic assembly is at the correct level before moving vehicle (Fig. 9). (See Checking Brake Fluid Level in this section of the service manual.)

BRAKE FLUID RESERVOIR

REMOVE

(1) De-pressurize the hydraulic accumulator by pumping the brake pedal a minimum of 40 times. Using the procedure as described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

WARNING: FAILURE TO DE-PRESSURIZE HYDRAULIC ACCUMULATOR, BEFORE PERFORMING THIS OPERATION, MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES.

(2) Remove as much brake fluid as possible from the fluid reservoir, using a syringe or equivalent method.

(3) Using Oil Filter Band Wrench, Special Tool C-4065 or equivalent loosen bladder accumulator. Then remove the bladder accumulator and brake

fluid spray shield from the hydraulic assembly (Fig. 10). Remove high pressure banjo fitting from hydraulic assembly.

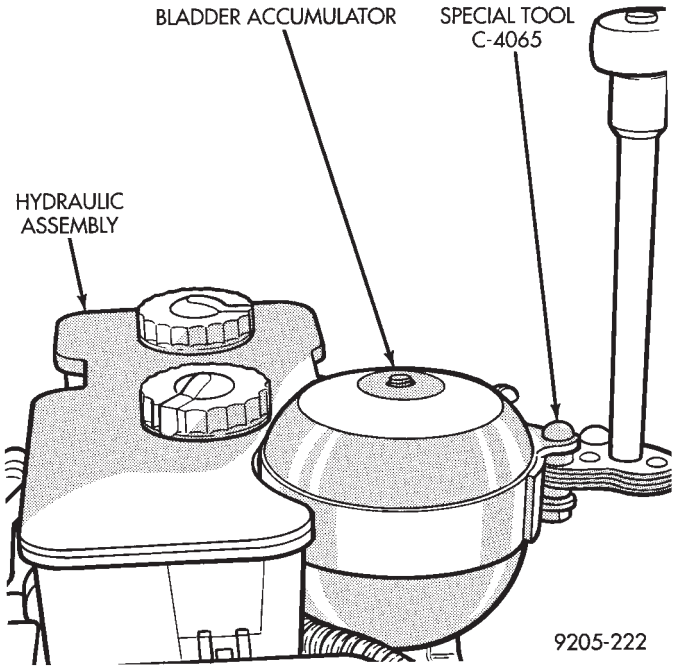


Fig. 10 Removing Bladder Accumulator

(4) Using needle nose pliers, remove the three fluid reservoir retaining pins from the hydraulic assembly (Fig. 11). Compress the barb on the opposite side of retaining pin to prevent pin from breaking.

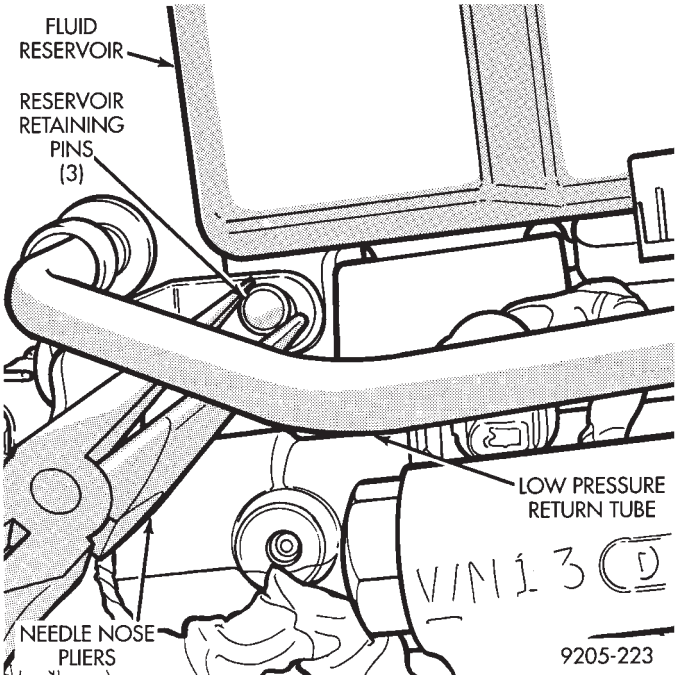


Fig. 11 Remove Reservoir Retaining Pins

(5) Remove reservoir from hydraulic assembly by CAREFULLY prying between reservoir and hydraulic assembly with a blunt prying tool (Fig. 12). Use a rocking motion to help disengage reservoir from grommets while prying. **BE EXTREMELY CAREFUL TO AVOID DAMAGING OR PUNCTURING RESERVOIR DURING THIS PROCEDURE.**

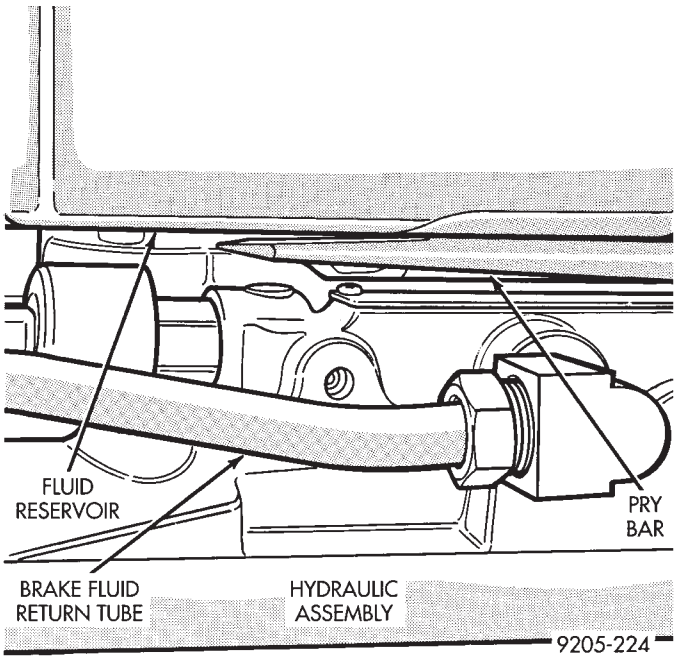


Fig. 12 Remove Reservoir From Hydraulic Assembly

(6) Remove the brake fluid level sensor switch from the reservoir.

Remove switch by compressing the retaining barbs (Fig. 13) on the end of the switch and then slide switch out of the brake fluid reservoir (Fig. 14).

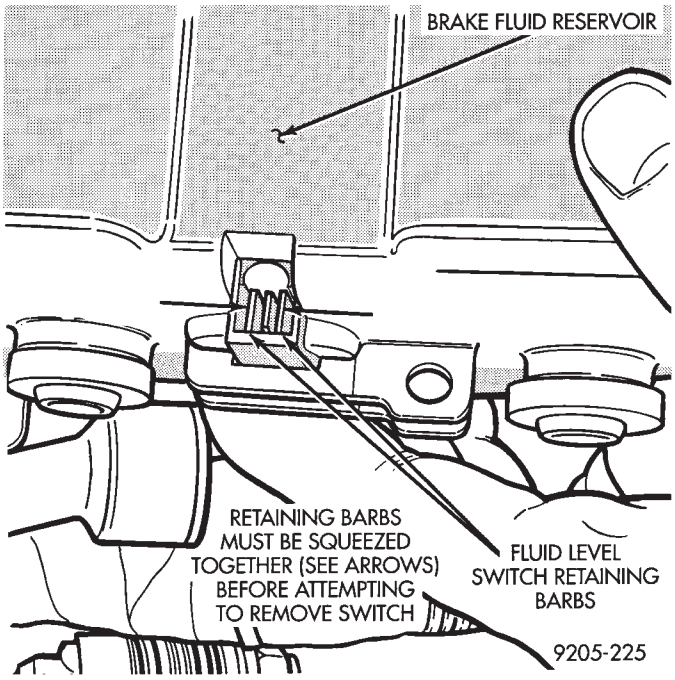


Fig. 13 Fluid Switch Retaining Barbs

(7) Using fingers, remove the 3 reservoir grommets (Fig. 14) from the hydraulic assembly or reservoir, and discard. **Grommets must not to be reused when reservoir is installed on hydraulic assembly.**

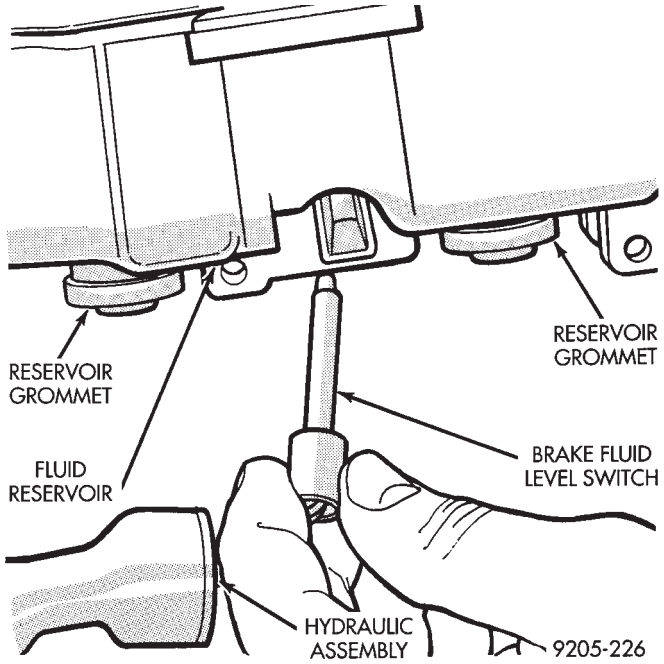


Fig. 14 Remove Brake Fluid Level Switch

INSTALL

(1) Thoroughly lubricate the new reservoir grommets with clean brake fluid and install on reservoir outlet ports (Fig. 14). **The new reservoir grommets supplied with reservoir, must ALWAYS be used.**

(2) Install brake fluid level switch into brake fluid reservoir (Fig. 14).

(3) Press reservoir into hydraulic assembly **BY HAND**, using a rocking motion to help seat reservoir into hydraulic assembly. Be sure that grommets are fully seated in the hydraulic assembly. **DO NOT ATTEMPT TO POUND RESERVOIR INTO HYDRAULIC ASSEMBLY, USING A HAMMER.**

(4) Using needle nose pliers, install the 3 brake fluid reservoir to hydraulic assembly retaining pins (Fig. 11). Make sure that pins are fully installed with barbs extending past reservoir on opposite side.

(5) Reinstall the high pressure hose, banjo fitting onto the hydraulic assembly and torque the fitting to 13 N●m (10.0 ft. lbs.).

(6) Install the brake fluid spray shield and bladder accumulator onto the hydraulic assembly. Install the bladder accumulator by hand to be sure it does not bet cross threaded. **Be sure that the O-Ring on the bladder accumulator is fully seated into the hydraulic assembly.**

(7) Using Oil Filter Band Wrench, Special Tool C-4065 or equivalent, (Fig. 10) torque the bladder accumulator to 48 N●m (35 ft. lbs.).

(8) Fill the hydraulic assembly reservoir to the top of the screen on the filter/strainer (Fig. 15). Using fresh clean brake fluid such as Mopar® or equivalent, conforming to DOT 3 requirements.

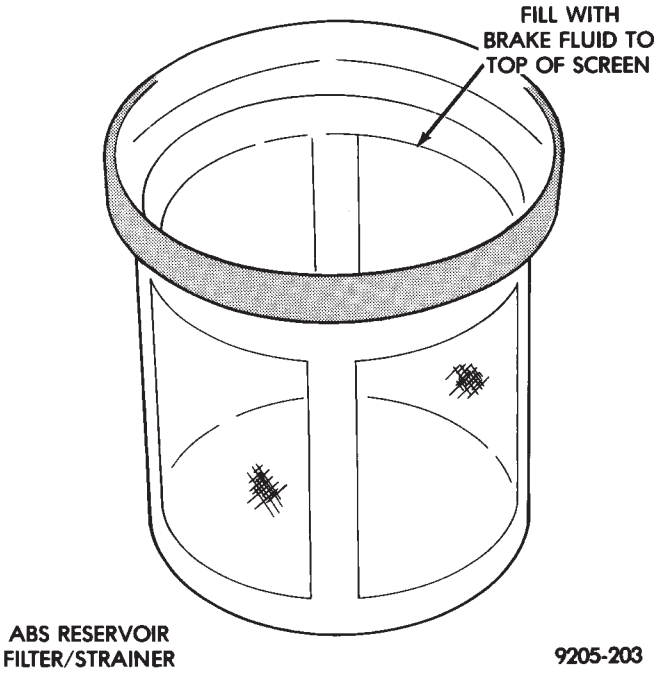


Fig. 15 ABS Reservoir Fill Level On Filter/Strainer

HYDRAULIC BLADDER ACCUMULATOR

REMOVE

(1) De-pressurize the hydraulic accumulator by pumping the brake pedal a minimum of 40 times. Using the procedure as described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

WARNING: FAILURE TO DE-PRESSURIZE THE HYDRAULIC ASSEMBLY/ACCUMULATOR BEFORE PERFORMING THIS OPERATION, MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES OF THE VEHICLE.

(2) Using Oil Filter Band Wrench, Special Tool C-4065 or equivalent loosen bladder accumulator. Then remove the bladder accumulator and brake fluid shield from the hydraulic assembly (Fig. 16).

INSTALL

(1) Install the brake fluid spray shield onto the hydraulic accumulator (Fig. 1).

(2) Install the bladder accumulator onto the hydraulic assembly by hand. Be sure that the O-Ring on the bladder accumulator is fully seated into the hydraulic assembly.

(3) Using Oil Filter Band Wrench, Special Tool C-4065 or equivalent, (Fig. 16) torque the bladder accumulator to 48 N●m (35 ft. lbs.).

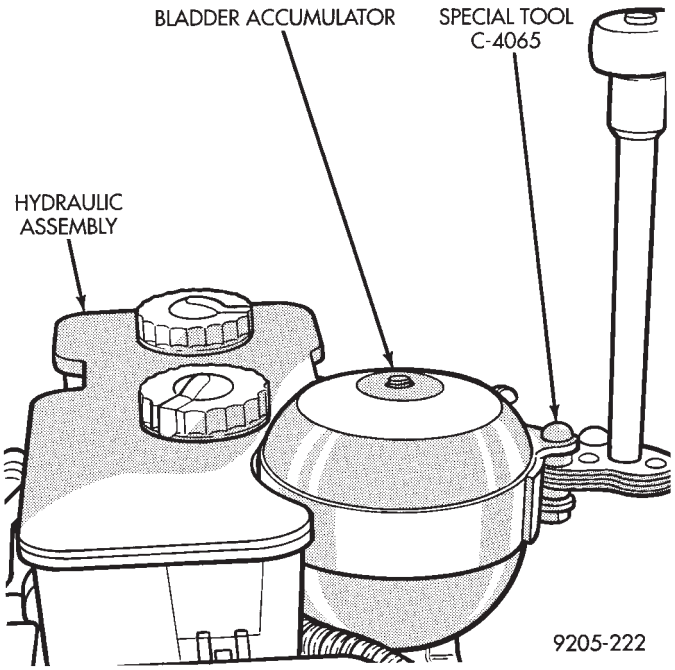


Fig. 16 Remove And Install Bladder Accumulator

(4) Turn ignition switch to the run position to energize the pump/motor assembly and pressurize hydraulic system. Check for leakage at the hydraulic assembly to hydraulic bladder accumulator fitting.

(5) Again de-pressurize the accumulator by pumping the brake pedal a minimum of 40 times as described in De-Pressurizing Hydraulic Accumulator in this section of the manual.

(6) Then check the brake fluid level in the hydraulic assembly reservoir. If brake fluid level is low, fill reservoir to proper level (Fig. 15) with Mopar® brake fluid or equivalent conforming to DOT 3 requirements.

PROPORTIONING VALVES (FIG. 17)

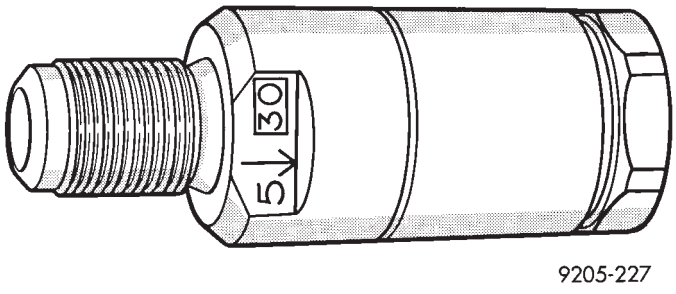


Fig. 17 ABS Proportioning Valve

CAUTION: Proportioning valves should never be disassembled or repaired in any way, repair is by replacement only.

REMOVE

(1) De-pressurize the hydraulic accumulator by pumping the brake pedal a minimum of 40 times. Using the procedure as described in De-Pressurizing Hydraulic Accumulator listed earlier in this section.

WARNING: FAILURE TO DE-PRESSURIZE THE HYDRAULIC ASSEMBLY/ACCUMULATOR PRIOR TO PERFORMING THIS OPERATION, MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO PAINTED SURFACES OF THE VEHICLE.

(2) Remove fresh air intake ducts and air cleaner.

(3) Remove pressure and return hose (Fig. 5) from hydraulic unit. (See Pressure and Return Hose Section For Proper Removal Procedure.)

(4) Remove brake tube from the proportioning valve that requires servicing.

(5) Remove proportioning valve requiring service from the hydraulic assembly (Fig. 18).

INSTALL

(1) Install proportioning valve on hydraulic assembly and tighten to 40 N●m (30 ft. lbs.) torque.

(2) Install brake tube on proportioning valve. Tighten tube nut to 16 N●m (145 in. lbs.) torque.

(3) Install hydraulic pressure and return hoses. Torque pressure hose to hydraulic assembly fitting to 16 N●m (145 in. lbs). Torque return hose to metal tube hose clamp to 1 N●m (10 in. lbs.).

(4) Install fresh air intake duct and air cleaner.

(5) Bleed the affected brake line, see Bleeding Brake System in this section.

ELECTRONIC COMPONENTS

CONTROLLER ANTI-LOCK BRAKE (CAB)

REMOVAL

(1) Turn vehicle ignition off.

(2) Raise vehicle on hoist, (CAB) access for removal is from the underside of the vehicle (Fig. 19).

(3) Remove transmission oil cooler line routing clip.

(4) Disconnect the wiring harness 60 way connector from the Controller Anti-Lock Brake Module (CAB). **VERIFY THAT THE VEHICLE IGNITION IS OFF BEFORE REMOVING THE 60 WAY CONNECTOR.**

(5) Remove the 3 (CAB) module to frame rail mounting bolts.

(6) Remove the (CAB) module from the vehicle.

INSTALLATION

(1) Install the (CAB) module back in the vehicle.

(2) Install the 3 (CAB) module to frame rail attaching bolts. Torque the 3 (CAB) module to frame rail attaching bolts to 5 N●m (40 in. lbs.).

(3) **VERIFY THAT THE VEHICLE IGNITION IS OFF BEFORE CONNECTING THE 60 WAY CONNECTOR.** Connect the wiring harness 60 way

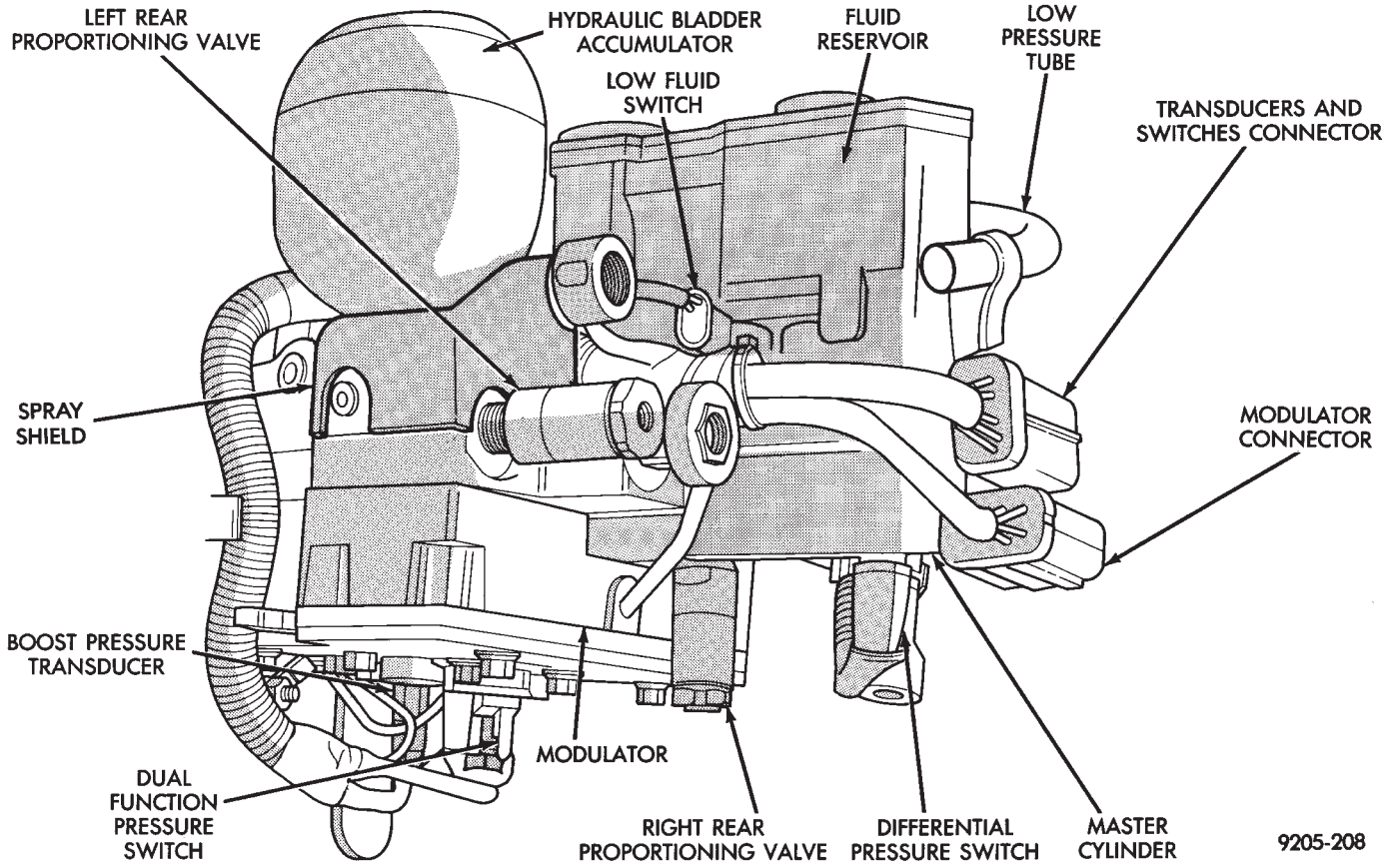


Fig. 18 Hydraulic Assembly

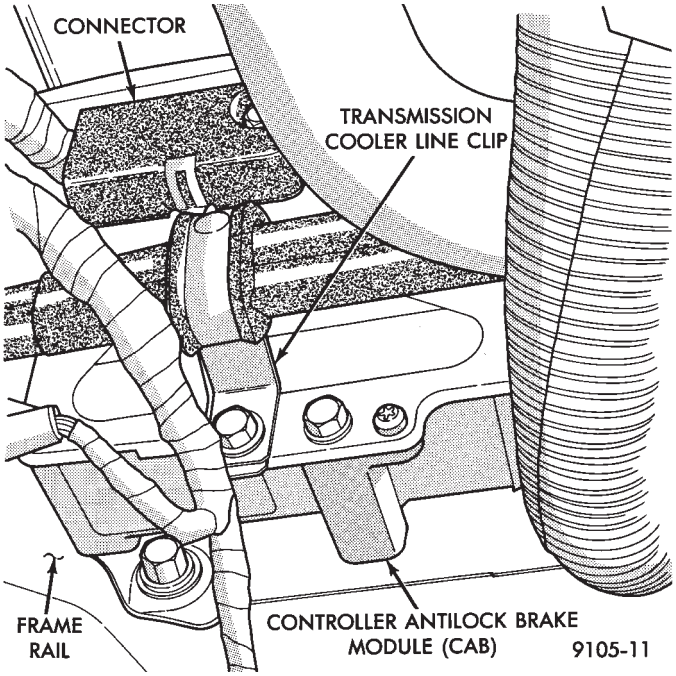


Fig. 19 Location Controller Anti-Lock Brake (CAB)

connector into the (CAB) module until it is fully seated. Torque the 60 way connector to (CAB) module retaining bolt to 12 N•m (105 in. lbs.).

PUMP/MOTOR RELAY (FIG. 9)

REMOVE/INSTALL

See (Fig. 9) Power Distribution Center. Find the location of the pump/motor relay in the (PDC). Remove pump/motor relay by pulling upward and install by pushing firmly into position. Do not twist the relay when removing or installing it.

See (Fig. 10) Relay and Warning Lamp Section of this group for the location of the Anti-Lock system relay and the Yellow Lamp relay. Remove the relay from the vehicle using the following procedure.

(1) Disconnect the wiring harness connectors from the relays. Connectors are removed from the relays by disengaging the connector locking tab from relay and pulling strait off relay, do not twist.

(2) Then remove the relay pack to inner fender attaching bolt.

The Anti-Lock system and Yellow Lamp relay are installed using the following procedure.

(1) Mount the relay pack to the inner fender with the anti-rotation tab on the bracket around lip of inner fender hole (Fig. 10) Relay and Warning Lamp Section of this group.

(2) Install the relay pack to inner fender mounting bolt and torque to 4 N•m (35 in. lbs.).

(3) Connect the wiring harness connectors onto the relays until the locking tabs on the connectors and

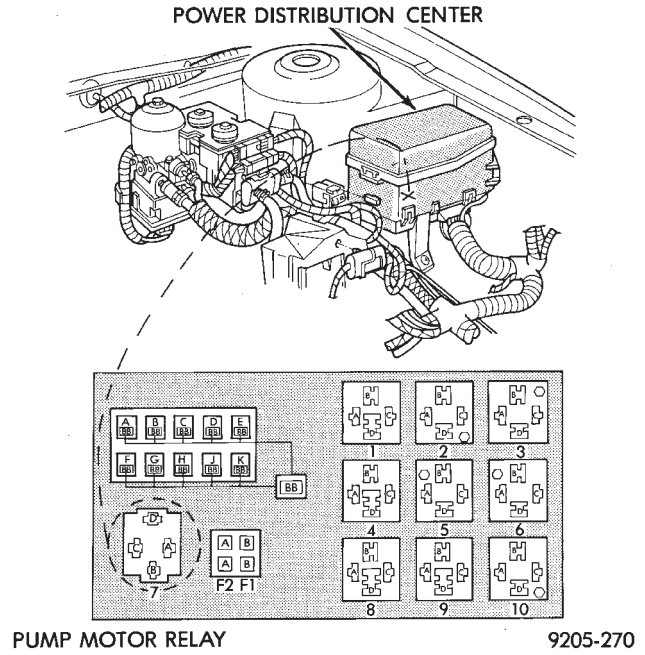


Fig. 9 Pump/Motor Relay

relays are fully engaged. Do not twist connectors when installing them on the relays.

WHEEL SPEED SENSORS

INSPECTION

Inspect tone wheels (Fig. 10) for any missing or broken teeth, this can cause erratic speed sensor signals.

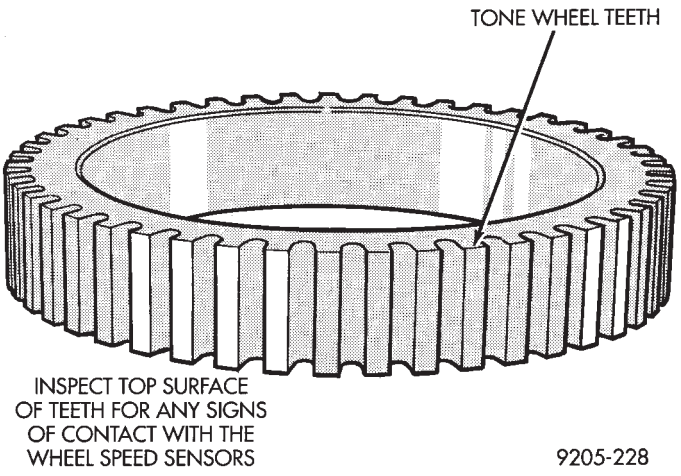


Fig. 10 Tone Wheel (Typical)

Tone wheels should show no evidence of contact with the wheel speed sensor. If contact was made, determine cause and correct.

Excessive runout of the tone wheels can cause erratic wheel speed sensor signals. Replace assembly if runout exceeds approximately 0.25 mm (0.010 inch).

FRONT WHEEL SPEED SENSOR

REMOVAL

(1) Raise vehicle and remove front wheel and tire assembly.

(2) Remove screw from clip (Fig. 11) that holds sensor assembly grommet into fender shield.

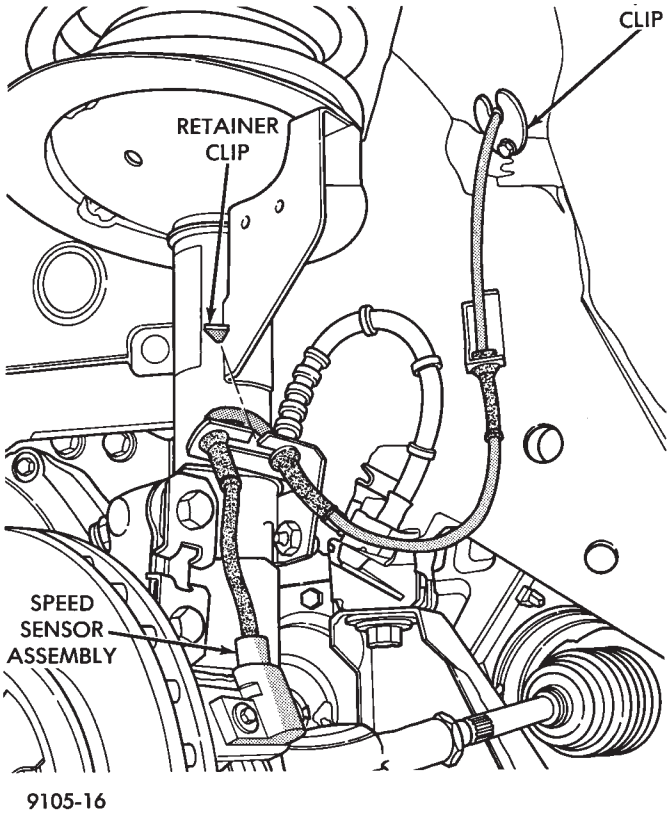


Fig. 11 Front Wheel Speed Sensor Routing

(3) Carefully, pull sensor assembly grommet from fender shield. **When removing grommet from fender shield, do not pull on speed sensor cable.**

(4) Unplug speed sensor cable connector, from vehicle wiring harness.

(5) Remove the 2 screws (Fig. 11) that secure the speed sensor cable, routing tube to the fender well.

(6) Remove the 2 sensor assembly grommets from the retainer bracket, on the strut damper (Fig. 11).

(7) Remove speed sensor assembly to steering knuckle attaching bolt (Fig. 11).

(8) Carefully, remove sensor head from steering knuckle. If the sensor has seized, due to corrosion, use a hammer and punch to tap edge of sensor ear

(Fig. 12), rocking the sensor side to side until free. **DO NOT USE PLIERS ON SENSOR HEAD.**

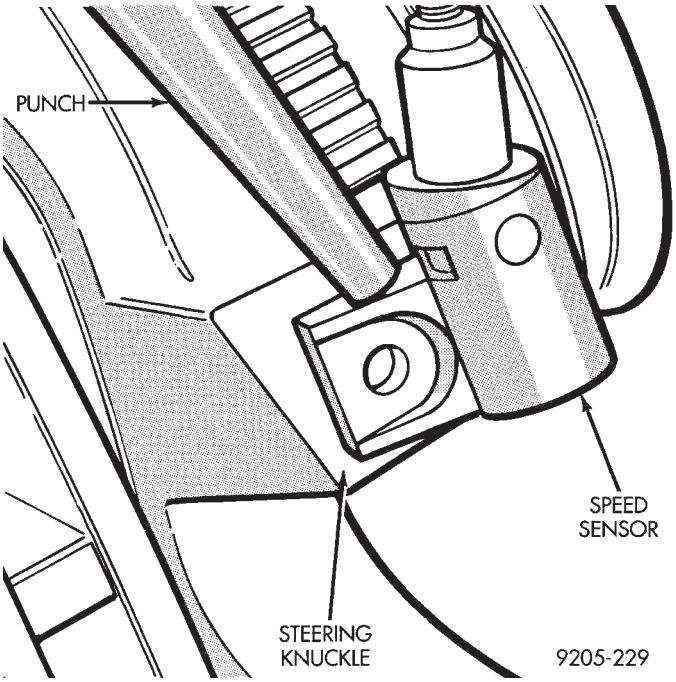


Fig. 12 Removing Speed Sensor (Typical)

INSTALLATION

(1) Connect the wheel speed sensor cable connector, to the vehicle wiring harness.

(2) Push sensor assembly grommet into hole in fender shield. Install clip and screw (Fig. 11). Torque screw to 4 N●m (35 in. lbs.).

(3) Install speed sensor cable grommets in bracket on strut damper (Fig. 11).

(4) Install speed sensor cable routing tube to fender well (Fig. 11). Torque both screws to 4 N●m (35 in. lbs.).

(5) Coat the speed sensor with High Temperature Multi-purpose E.P. Grease before installing into the steering knuckle. Install speed sensor attaching screw and tighten to 7 N●m (60 in. lbs.).

CAUTION: Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are routed correctly and installed in all retainers. Failure to properly route and install cables in retainers, as shown in this section. May result in contact with moving parts and/or over extension of cables, resulting in an open circuit.

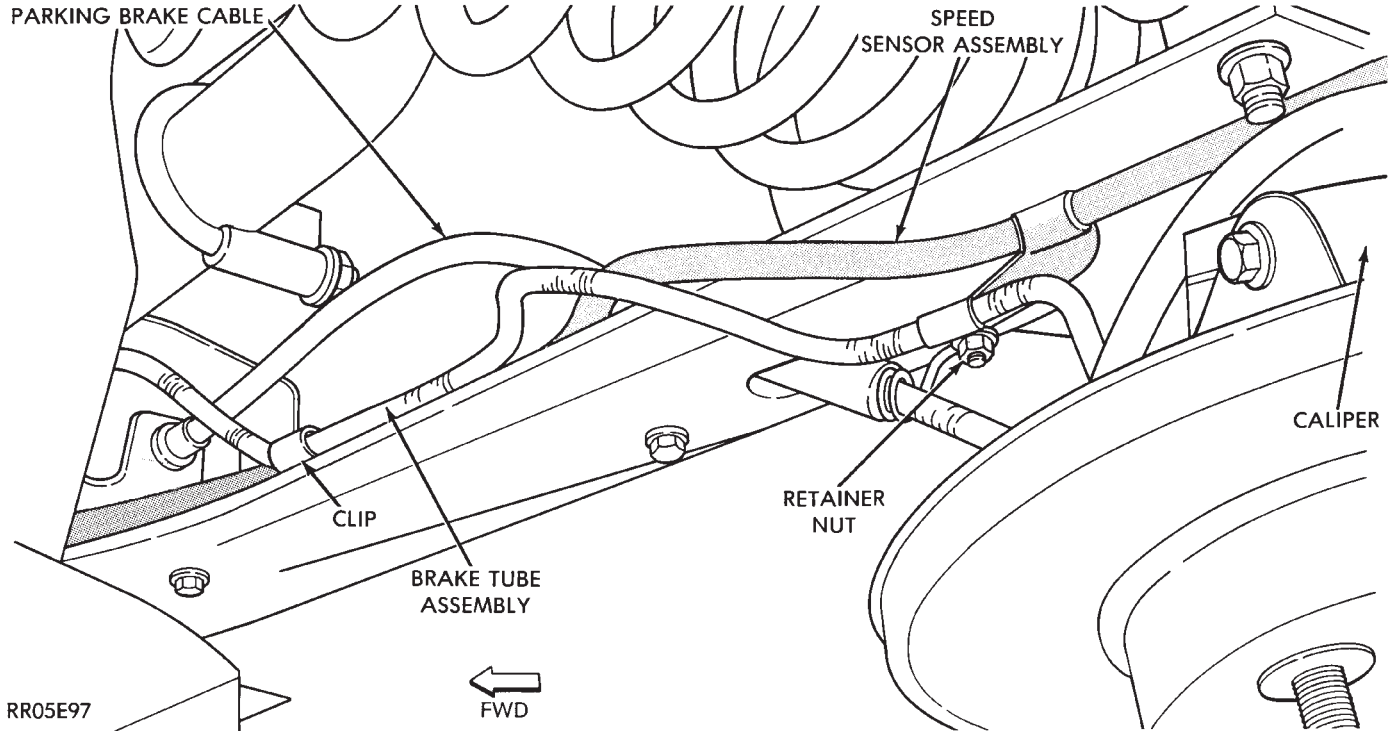


Fig. 13 Rear Wheel Speed Sensor Routing at Trailing Arm

REAR WHEEL SPEED SENSOR (FIGS. 13 AND 15)

REMOVAL

(1) Raise vehicle and remove wheel and tire assembly.
(2) Remove sensor assembly grommet from underbody and pull harness through hole in underbody.
(3) Unplug connector from harness.
(4) Remove sensor grommet bracket screw from body hose bracket, just forward of trailing arm bushing.
(5) Remove sensor assembly clip, located on the inboard side of trailing arm.
(6) Remove sensor wire fastener from rear brake hose bracket.
(7) Remove outboard sensor assembly retainer nut.
(8) Remove sensor head screw.
(9) Carefully, remove sensor head from adapter assembly. If the sensor has seized, due to corrosion, DO NOT USE PLIERS ON SENSOR HEAD. Use a hammer and a punch (Fig. 14) and tap edge of sensor ear, rocking the sensor side to side until free.

INSTALLATION

Installation is reverse order of removal. Be sure to coat sensor with High Temperature Multi-purpose E.P. Grease before installing into adapter assembly. Tighten screw to 7 N•m (60 in. lbs.) torque. Avoid getting grease on the pickup area of the speed sensor assembly.

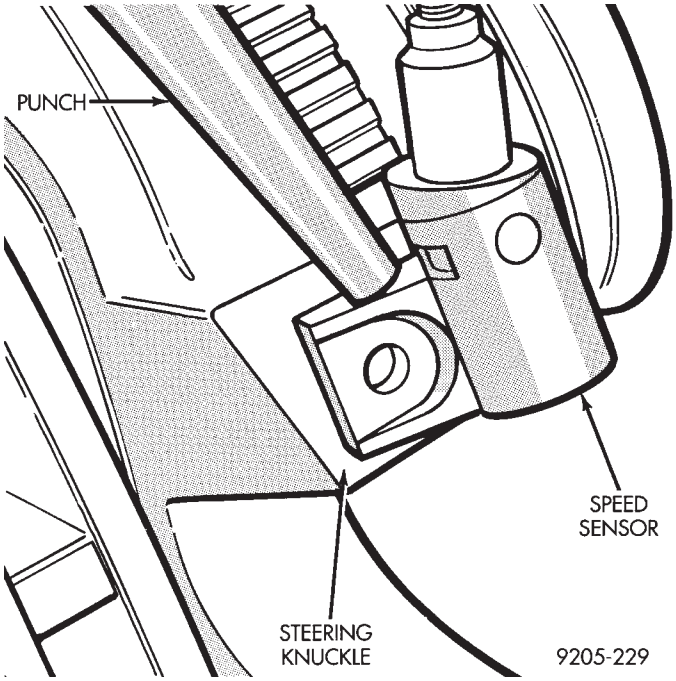


Fig. 14 Removing Speed Sensor (Typical)

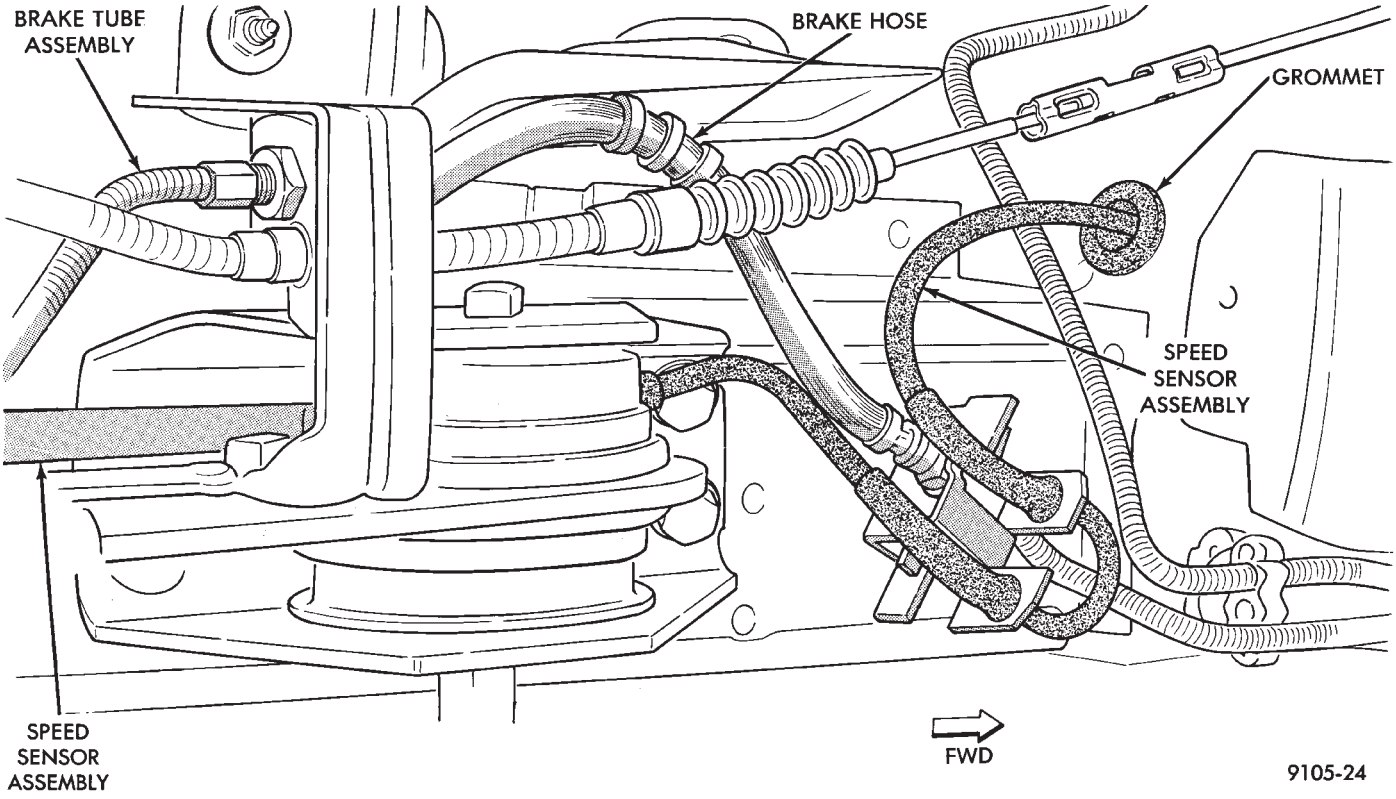


Fig. 15 Body Routing of Rear Speed Sensor Wiring

ANTI-LOCK BRAKE SYSTEM—BENDIX ANTI-LOCK 6 AA,AG,AJ BODY

INDEX

GENERAL INFORMATION

The purpose of the Anti-Lock Brake System (ABS) is to prevent wheel lock-up under heavy braking conditions on virtually any type of road surface. Anti-Lock 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, diagnostics, and on car service for the Bendix Anti-Lock 6 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.

ANTI-LOCK BRAKE SYSTEM DEFINITIONS

In this section of the manual several abbreviations are used for the components that are in the Anti-Lock Braking System They are listed below for your reference.

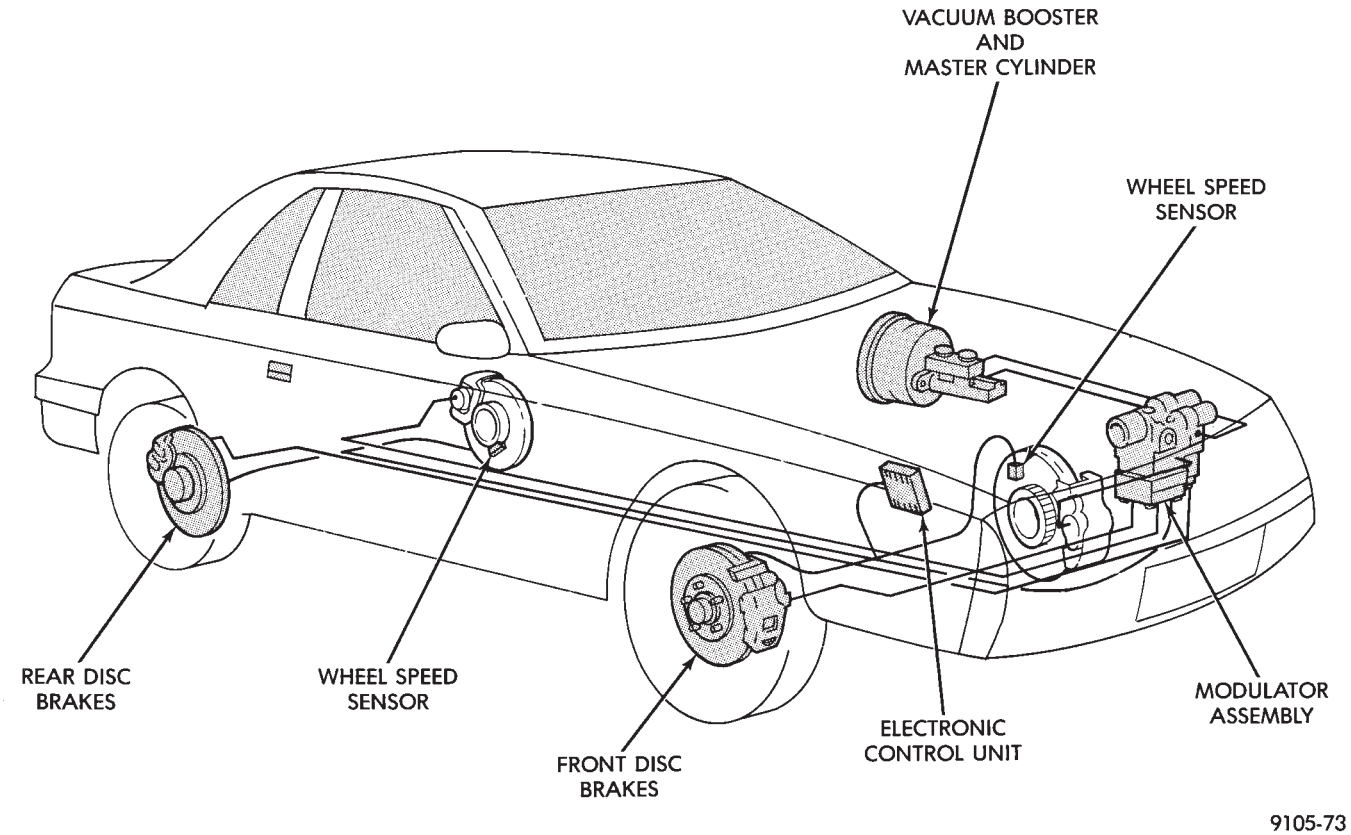


Fig. 1 Four-Wheel Anti-Lock Brake System Components AA/AG/AJ Body

- CAB—Controller Anti-Lock Brake
- ABS—Anti-Lock Brake System
- PSI—Pounds per Square Inch (pressure)
- WSS—Wheel Speed Sensor

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.

If a wheel locking tendency is detected during a brake application, the system will enter Anti-Lock mode. During Anti-Lock 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 electrical valves and hydraulic line to provide modulation, although for vehicle stability, both rear wheel valves receive the same electrical signal. The system can build or reduce pressure at each wheel, depending on the signals generated by the wheel speed sensors (WSS) at each wheel and received at the Controller Anti-Lock Brake (CAB).

MAJOR COMPONENTS

The following is a list of major system components. Details of all components can be found later in this section. See (Fig. 1) for the general location of the components in the vehicle.

MASTER CYLINDER AND VACUUM BOOSTER

The Bendix Anti-Lock 6 Brake System uses the vehicles standard Master Cylinder/Reservoir and Vacuum Booster (Fig. 2). The master cylinder primary and secondary outputs go directly to the Modulator Assembly.

MODULATOR AND PUMP MOTOR/ASSEMBLY

The Modulator Assembly (Fig. 3) contains the wheel circuit valves used for brake pressure modulation and the Pump/Motor.

The Pump/Motor function, as part of the Modulator Assembly. Is to pump low pressure brake fluid from the brake fluid sump into the ABS Accumulator. During a stop which requires the ABS system to become operational.

WHEEL SPEED SENSORS

A Wheel Speed Sensor (Fig. 4) is located at each wheel to transmit wheel speed information to the Controller Anti-Lock Brake (CAB).

CONTROLLER ANTI-LOCK BRAKE (CAB)

The (CAB) (Fig. 5) is a small control computer which receives wheel speed information, controls Anti-Lock operation and monitors system operation.

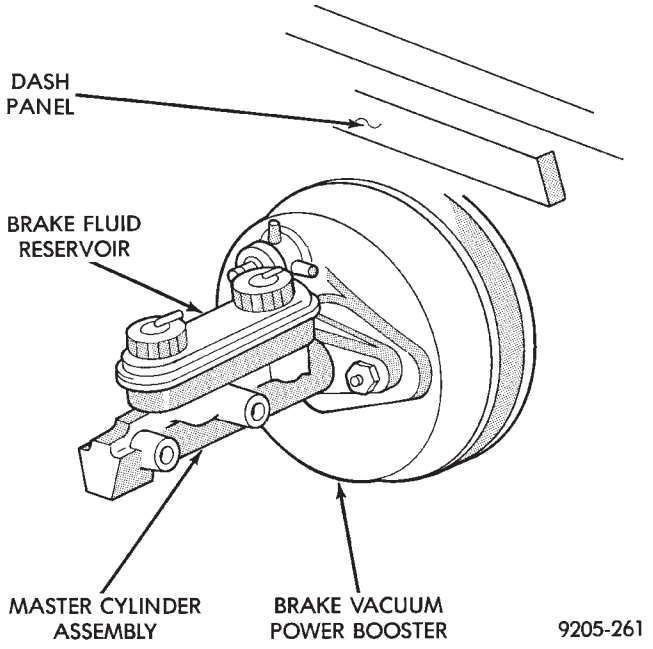


Fig. 2 Master Cylinder Brake Booster Assemble

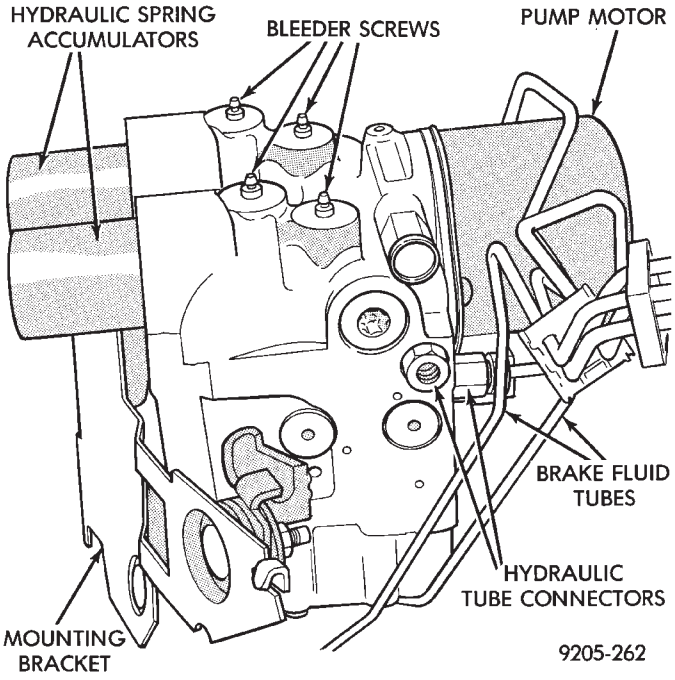


Fig. 3 Modulator And Pump/Motor Assembly

ANTI-LOCK BRAKES OPERATION AND PERFORMANCE

This Anti-Lock Braking 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

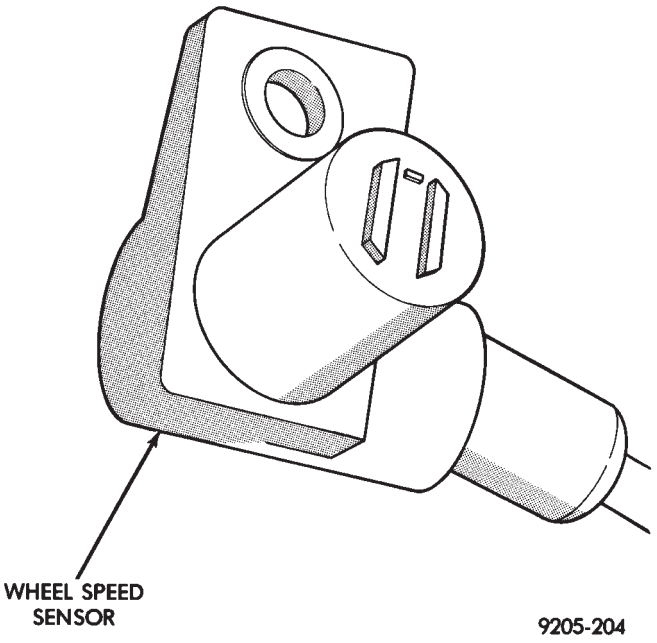


Fig. 4 Wheel Speed Sensor

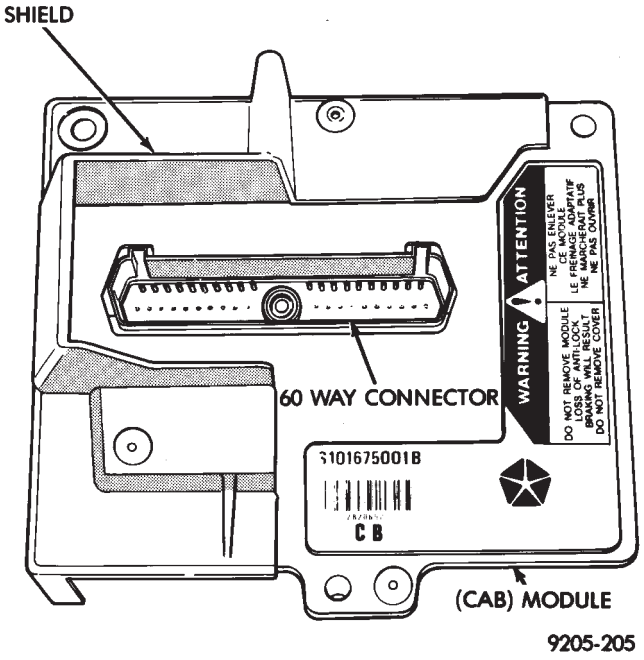


Fig. 5 Controller Anti-Lock Brake (CAB)

normal. These characteristics are discussed below. More technical details are discussed further in this section.

PEDAL FEEL

Since the Bendix Anti-Lock 6 Braking System uses the conventional Booster/Master Cylinder. The brake pedal feel during normal braking is the same as conventional Non ABS equipped cars.

When Anti-Lock is activated during hard braking due to a wheel lockup tendency. Brake pedal effort will increase do to the master cylinder pressure being isolated from the brake system. Some brake pedal movement and associated noises may be felt and heard by the driver. This is normal of a Anti-Lock Braking System due to pressurized fluid being transferred to and from the wheel brakes.

ANTI-LOCK BRAKE SYSTEM OPERATION

During Anti-Lock Braking, brake pressures are modulated by cycling electric solenoid valves. The cycling of these valves can be faintly heard as a series of popping or ticking noises. In addition, the cycling may be felt as a pulsation in the brake pedal, although no pedal movement will be noticed. If Anti-Lock 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.

Although ABS operation is available at virtually all vehicle speeds. It will automatically turn off at speeds below 3 to 5 mph. Wheel lockup may be perceived at the very end of an anti lock stop and is considered normal.

TIRE NOISE & MARKS

Although the ABS system prevents complete wheel lock-up, some wheel slip is desired in order to achieve optimum braking performance. During brake pressure modulation, as brake pressure is increased, wheel slip is allowed to reach up to 30%. This means that the wheel rolling velocity is 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 Anti-Lock Braking System will not leave dark black tire marks since the wheel never reaches a locked condition. Tire marks may however be noticeable as light patched marks.

VEHICLE PERFORMANCE

Anti-Lock Brakes provide the driver with some steering control during hard braking, however there are conditions where the system does not provide any benefit. In particular, hydroplaning is still possible when the tires ride on a film of water, resulting in the tire 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 Anti-Lock instead of Anti-Skid.

SYSTEM SELF-DIAGNOSTICS

The Bendix Anti-Lock 6 Brake System has been designed with the following self diagnostics capability.

The self diagnostic ABS startup cycle begins when the ignition switch is in the on position. An electrical check is completed on the ABS components such as Wheel Speed Sensor Continuity and System and other Relay continuity. During this check the Amber Anti-Lock Light is on for approximately 1-2 seconds.

Further Functional testing is accomplished once the vehicle is set in motion.

(1) The solenoid valves and the pump/motor are activated briefly to verify function.

(2) The voltage output from the wheel speed sensors is verified to be within the correct operating range.

If the vehicle is not set in motion within 3 minutes from the time the ignition switch is set in the on position. The solenoid test is bypassed but the pump/motor is activated briefly to verify that it is operating correctly.

WARNING SYSTEMS OPERATION

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

The Amber Anti-Lock Warning Light will turn on when the (CAB) detects a condition which results in a shutdown of the Anti-Lock function. The Amber Anti-Lock Warning Lamp is normally on until the (CAB) completes its self tests and turns the lamp off (approximately 1-2 seconds). When the Amber Anti-Lock Warning Light is on only the Anti-Lock 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 Amber Anti-Lock Warning Light is on.

NORMAL OPERATION OF WARNING LAMP

With the ignition in the Crank position, the Red Brake Warning Lamp will turn on as a bulb check. The Amber Anti-Lock Warning Lamp will stay on for 1-2 seconds then turn off. Once verification of the self diagnosis is completed.

ANTI-LOCK BRAKE SYSTEM COMPONENTS

The following is a detailed description of the Anti-Lock Brake System components. For information on servicing the Four Wheel Disk Brake System, see the standard Brake section of this Service Manual.

MODULATOR ASSEMBLY

WARNING: THE ONLY PART OF THE MODULATOR ASSEMBLY THAT IS A SERVICEABLE COMPONENT IS THE DELTA P SWITCH. THE REMAINING COMPONENTS OF THE MODULATOR ASSEMBLY ARE NOT SERVICEABLE ITEMS AND NO ATTEMPT IN ANY WAY SHOULD BE MADE TO REMOVE OR SERVICE ANY OTHER PARTS OF THE MODULATOR ASSEMBLY.

The Modulator Assembly (Fig. 1) is located under the battery tray and is covered with an acid shield. The Modulator Assembly contains the following components for controlling the Anti-Lock braking system. 2 Isolation Valves, 4 Build/Decay Valves, 4 Shuttle Orifices, 2 Fluid Sumps, 2 Accumulators, a Pump/Motor and a Pressure Differential Valve/ Switch. Also attached to the Modulator Assembly are 4 brake tubes which are connected to an 8 way connector block. The connector block is mounted to the left frame rail below the master cylinder in the same location as the non ABS equipped combination valve. The wheel brake lines are attached to the system via the connector block.

ISOLATION VALVES

The Isolation Valves are used to isolate the master cylinder from the rest of the brake hydraulic circuit during an Anti-Lock stop. Two Isolation Valves are used, one for the primary circuit and one for the secondary circuit. The Isolation Valves are spring loaded in the released position. In the released position the Isolation Valves provide a fluid path from the master cylinder outputs to the wheel brakes via the Build/Decay valves. When actuated it provides a fluid path from the accumulator (which was charged by the Pump/Motor during ABS operation) to the Build/Decay valves through the Shuttle Orifices.

BUILD/DECAY VALVES

There are 4 Build/Decay valves, one for each wheel. In the released position they provide a fluid path from the wheel brakes to the Isolation Valve through the shuttle orifices. In the actuated (decay) position, they provide a fluid path from the wheel brakes to the sump. The Build/Decay valves are spring loaded in the released (build) position.

SHUTTLE ORIFICE

There are 4 Shuttle Orifice Valves, one for each wheel. The Shuttle Orifice Valve is a hydraulically actuated valve which shuttles when the Build/Decay valve is actuated. Actuating of the Build/Decay valve causes a pressure differential to be created across the Shuttle Orifice Valve. This acts like placing an orifice (restriction) in the line between the Isolation Valve and the Build/Decay Valve. This restriction provides a controlled build rate to each wheel brake during an Anti-Lock stop. The Shuttle Orifice Valve will remain in the orificed position until the ABS cycle is complete. When the ABS cycle has been completed the Isolation and Build/Decay valves will return to their released position which will equalize the pressure across the Shuttle Orifice Valves. When

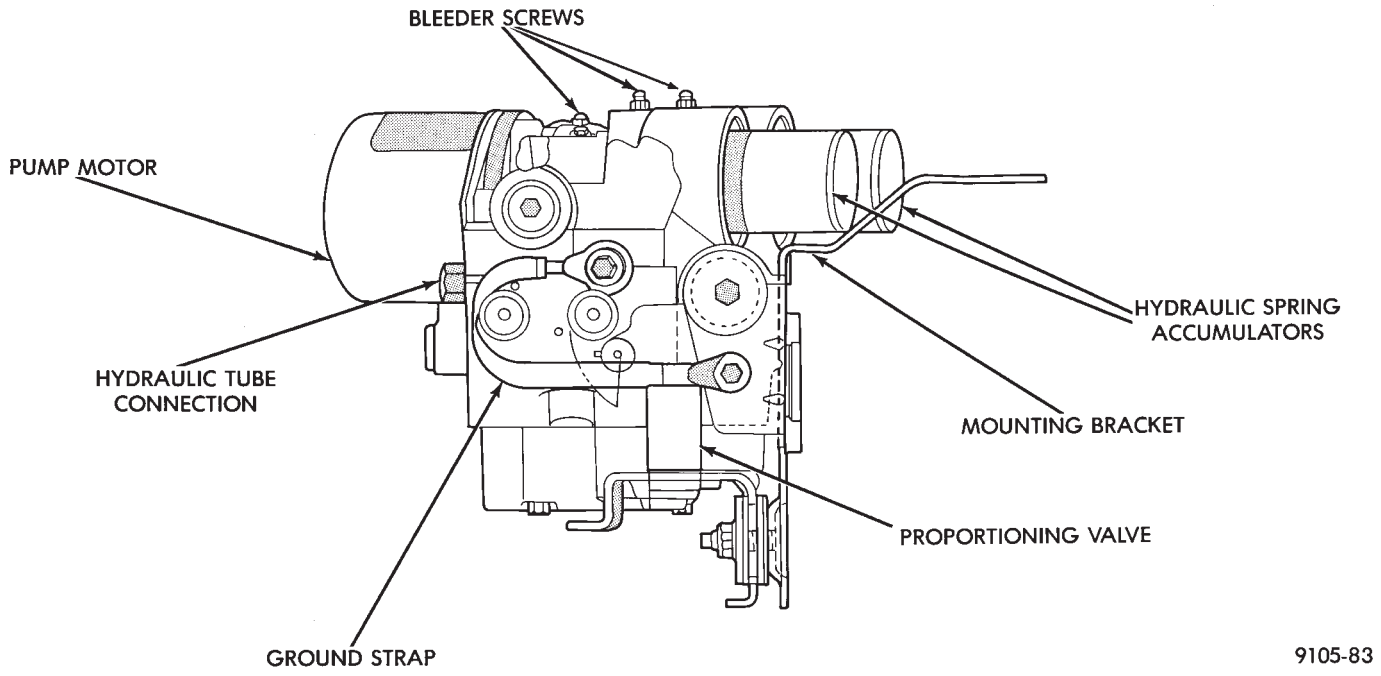


Fig. 1 Modulator Assembly

the pressure equalizes, the spring loaded Shuttle Orifice valves will return to the unrestricted position.

FLUID SUMPS

There are two Fluid Sumps in the Hydraulic Assembly, one each for the primary and secondary hydraulic circuits. The Fluid Sumps store the brake fluid that is decayed from the wheel brakes during ABS cycle. This fluid is then pumped to an accumulator and/or the hydraulic system in order to provide build pressure. The typical pressure in the sumps is 50 psi, During ABS operation only.

HYDRAULIC SPRING ACCUMULATOR

The Hydraulic Spring Accumulators (Fig. 2) (one on each circuit) are used to store pressurized hydraulic brake fluid during ABS operation only. This fluid is used during hard braking when the ABS system is activated, to supplement brake pressure when required. During normal Non ABS braking operation there is NO pressurized brake fluid stored in the accumulators. The Hydraulic Spring Accumulators are not a serviceable part of the Modulator Assembly and should never be removed from the assembly.

PRESSURE DIFFERENTIAL VALVE/SWITCH (DELTA P SWITCH)

The Pressure Differential Valve/Switch is located inside the hydraulic assembly. This valve/switch functions the same as the Pressure Differential Valve/Switch located in the combination valve on standard brake systems. The delta P switch monitors the primary and secondary hydraulic circuits for a difference in pressure. A pressure difference greater than 225 psi. Will move and latch the shuttle to

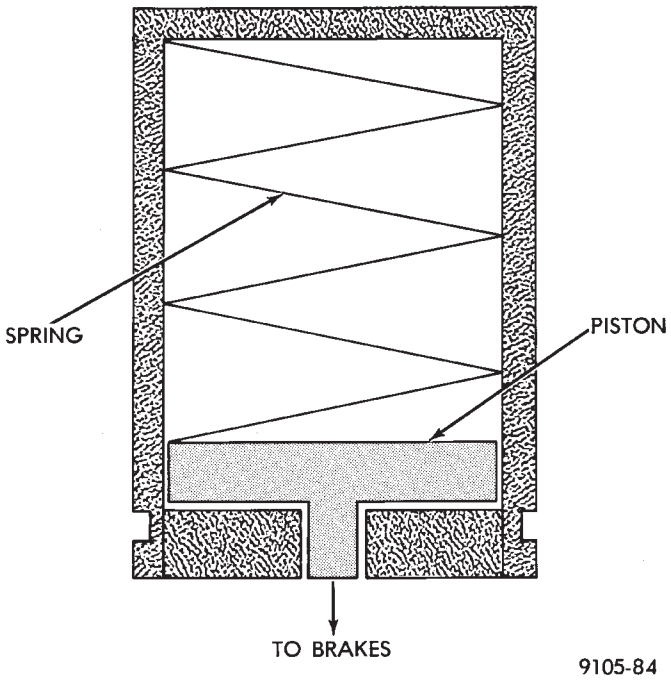


Fig. 2 Hydraulic Spring Accumulator

ground the Red Brake Warning Light circuit. This will in turn, turn on the Red Brake Warning Light in the instrument panel to warn the driver of a hydraulic system problem. This Pressure Differential Valve Switch is a replaceable item of the Modulator Assembly. **The Red Brake Warning Light indicates a problem with the foundation brake system and not the Anti-Lock system.**

PUMP/MOTOR ASSEMBLY

The Modulator Assembly 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 Modulator Assembly. The pumps pick up fluid from the sumps to supply pressure to the accumulators or hydraulic system via the isolation valves during an Anti-Lock 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 Modulator Assembly must be replaced.

PROPORTIONING VALVES

Two Proportioning Valves (Fig. 3) 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 bottom of the hydraulic assembly (Fig. 1). They are the same screw in type as the ones used on the Bendix Anti-Lock 10 and Bosh Anti-Lock Brake systems.

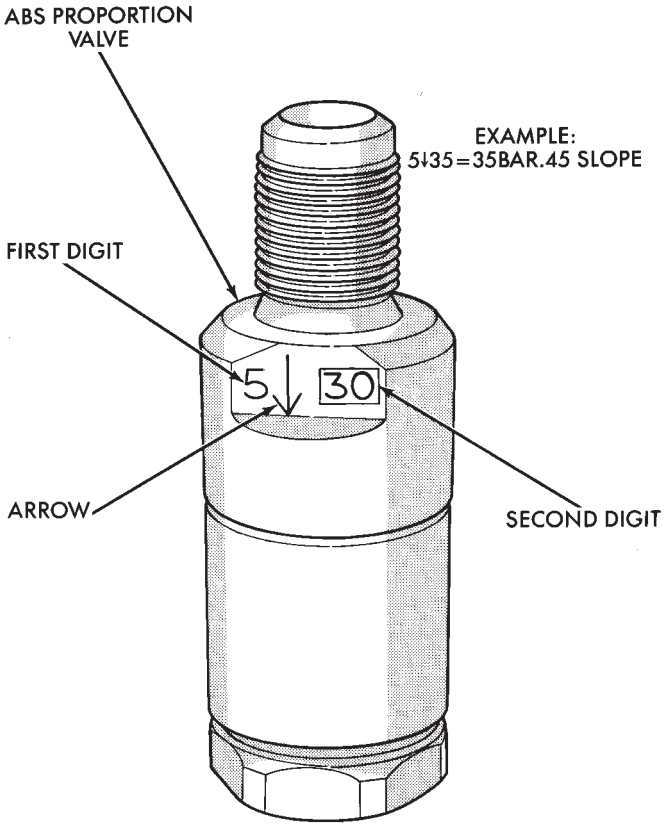


Fig. 3 Proportioning Valve Identification

WHEEL SPEED SENSORS

One Wheel Speed Sensor (WSS), is located at each wheel (Figs. 4 and 5), and sends a small (AC) signal to the control module (CAB). This signal is generated by magnetic induction. The magnetic induction is created, when a toothed sensor ring Tone Wheel (Fig. 6) passes a 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, the (CAB) will then modulate hydraulic pressure to prevent the wheel(s) from locking.

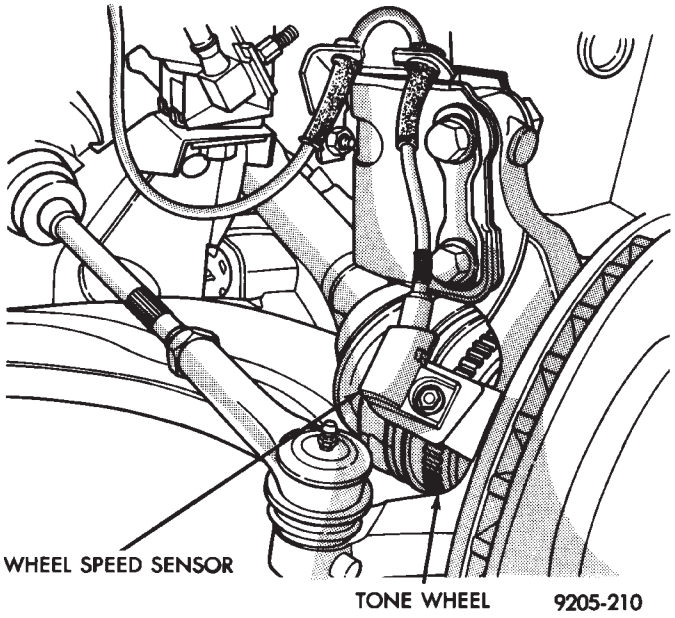


Fig. 4 Front Wheel Speed Sensor

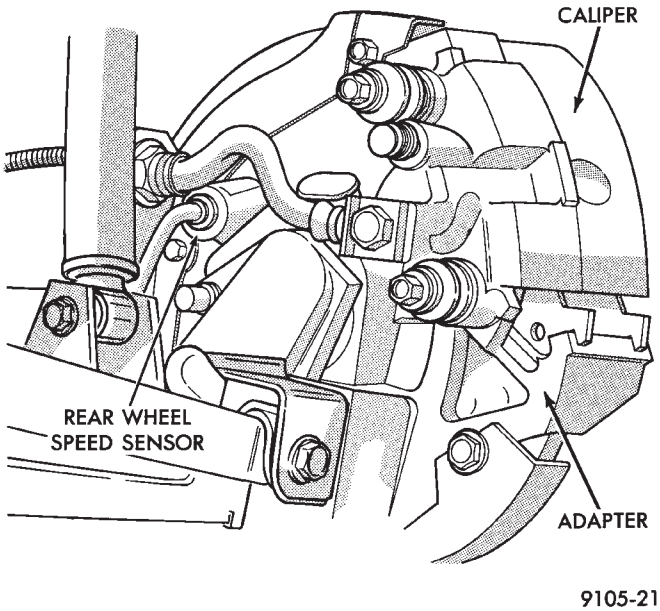


Fig. 5 Rear Wheel Speed Sensor

The front Wheel Speed Sensor is attached to a boss in the steering knuckle (Fig. 4). The tone wheel is part of the outboard constant velocity joint. The rear Wheel Speed Sensor is mounted to the caliper adaptor (Fig. 5) and the rear tone wheel is an integral part of the rear wheel hub (Fig. 6). The speed sensor air gap is NOT adjustable.

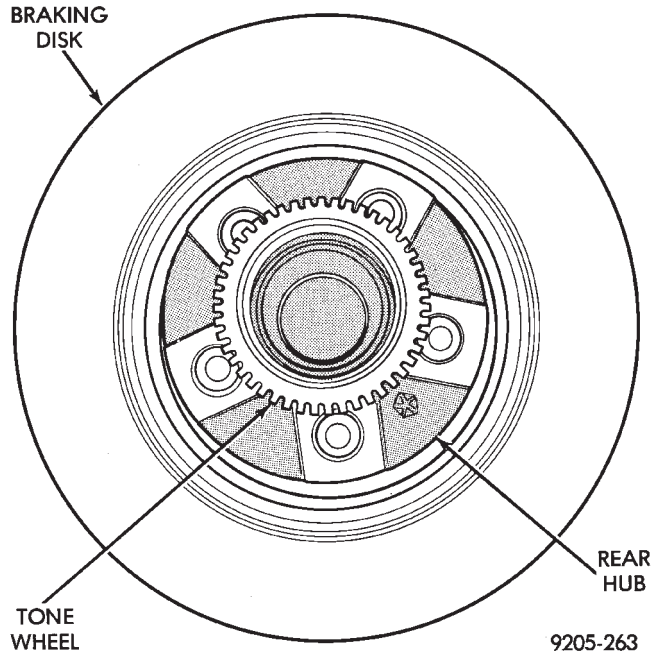


Fig. 6 Tone Wheel (Typical)

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 brake hub.

Correct Anti-Lock system operation is dependent on the vehicle's wheel speed signals, that are generated by the Wheel Speed Sensors. The vehicle's wheels and tires must all be the same size and type to generate accurate signals. In addition, the tires must be inflated to the recommended pressures for optimum system operation. Variations in wheel and tire size or significant variations in inflation pressure can produce inaccurate wheel speed signals.

CONTROLLER ANTI-LOCK BRAKE (CAB)

The Anti-Lock Brake Controller is a small microprocessor based device which monitors the brake system and controls the system while it functions in Anti-Lock mode. The CAB is mounted on the top of the right front frame rail and uses a 60-way system connector (Fig. 7). The power source for the CAB is through the ignition switch in the Run or On position.

THE CONTROLLER ANTI-LOCK 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 Anti-Lock mode.

(3) Monitor the system for proper operation.

(4) Provide communication to the DRB II 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 front wheel locking tendency is detected, the (CAB) will isolate the master cylinder from the wheel brakes. This is done by activating the Isolation Valves. The (CAB) then commands the appropriate Build/Decay valves to modulate brake fluid pressure in some or all of the hydraulic circuits. The (CAB) continues to control pressure in individual hydraulic circuits until a locking tendency is no longer present.

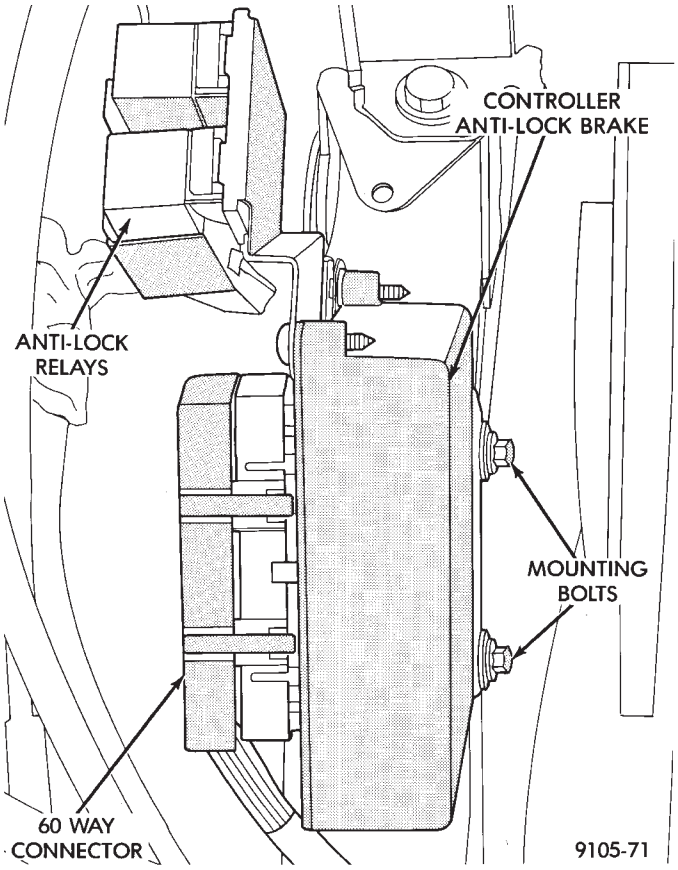


Fig. 7 Location Controller Anti-Lock Brake (CAB)

The (ABS) system is constantly monitored by the (CAB) for proper operation. If the (CAB) detects a fault, it will turn on the Amber Anti-Lock 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 Anti-Lock Warning Lamp when a system fault is detected. Faults are stored in a diagnostic program memory. There are 16 fault codes which may be stored in the (CAB) and displayed through the DRB II. These fault codes will remain in the (CAB) memory even after the ignition has been turned off. The fault codes can be cleared by using the DRB II diagnostics tester, or they will be automatically cleared from the memory after (50) ignition switch on/off cycles.

CONTROLLER ANTI-LOCK BRAKE (INPUTS)

- Four wheel speed sensors.
- Stop lamp switch.
- Ignition switch.

- System relay voltage.
- Ground.
- Pump/Motor Relay Monitor
- Diagnostics Communications

CONTROLLER ANTI-LOCK BRAKE (OUTPUTS)

- 6 modulator valves, 4 Build/Decay and 2 isolation valves.
- Anti-Lock warning lamp.
- System relay actuation.
- Diagnostic communication.
- Pump motor relay actuation

DIAGNOSTIC CONNECTOR

On the AA, AG and AJ bodies, the Bendix Anti-Lock System diagnostic connector is located under the fuse panel access cover. The access cover is located on the lower section of the instrument panel on the left side of the steering column. The diagnostics connector is a blue 6 way connector see (Fig. 8).

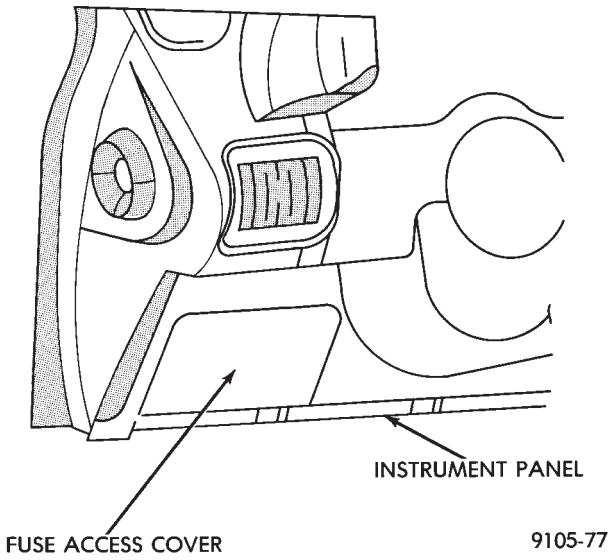


Fig. 8 A.B.S. Diagnostic Connector Location

ANTI-LOCK SYSTEM RELAYS AND WARNING LAMPS

SYSTEM RELAY

The (ABS) Modulator Valves and Anti-Lock Warning Lamp Relay. Are powered through a System Relay located on a bracket mounted to the (CAB) see (Fig. 9) for location of the relay. The System Relay provides power to the (CAB) for modulator valve operation (pins 47 and 41) after the startup cycle when the ignition is turned on.

ANTI-LOCK WARNING LAMP RELAY

The Amber Anti-Lock Warning Lamp is controlled by the Anti-Lock Warning Lamp relay The relay is mounted to the same bracket as the system relay at the (CAB) see (Fig. 9). With the relay de-energized, the lamp is lit. When the System Relay is energized by the (CAB), the Anti-Lock warning lamp relay is energized, and the lamp is turned off. Thus, the lamp will be lit if the (CAB) is disconnected or if a system fault causes the (ABS) function to be turned off.

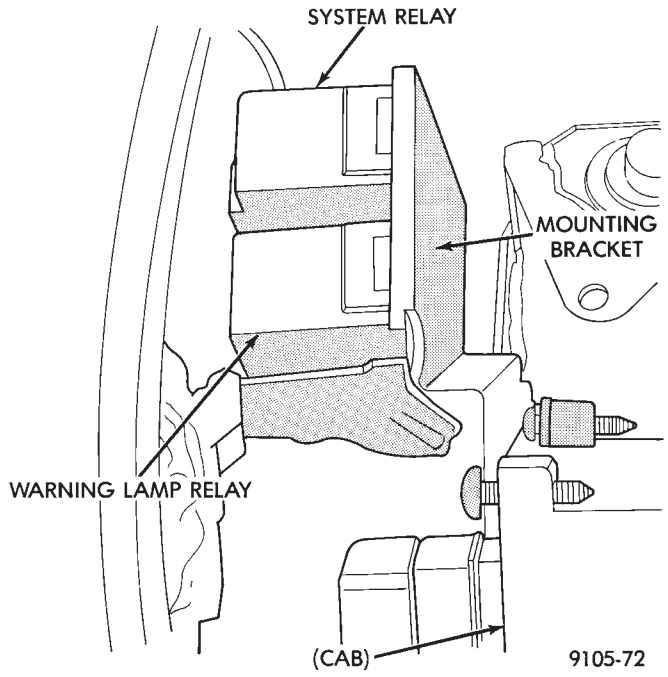


Fig. 9 System Relay/Warning Lamp Relay

PUMP/MOTOR RELAY

Pump/Motor power is supplied by the Pump/Motor Relay. The Pump/Motor Relay is either mounted on the left front inner fender shield, or the front of the left shock tower. The mounting location is dependent on whether the vehicle is or is not equipped with a power distribution center. See (Figs. 10 and 11) for specific mounting locations.

ANTI-LOCK WARNING LAMP OFF

System Relay and Anti-Lock Warning Lamp Relay Energized

From pin 57 the (CAB) energizes the system relay coil. The electrical current flow in the coil closes the system relay, electrical current is then provided to pins 47 and 41 of the (CAB) to provide power to the modulator valves. This electrical current also energizes the Amber Anti-Lock Warning Lamp Relay coil.The current flow in the Anti-Lock Warning Lamp Relay opens the Anti-Lock Warning Lamp Relay switch. This breaks the ground path to the Amber Anti-Lock Warning Lamp and the light is turned off.

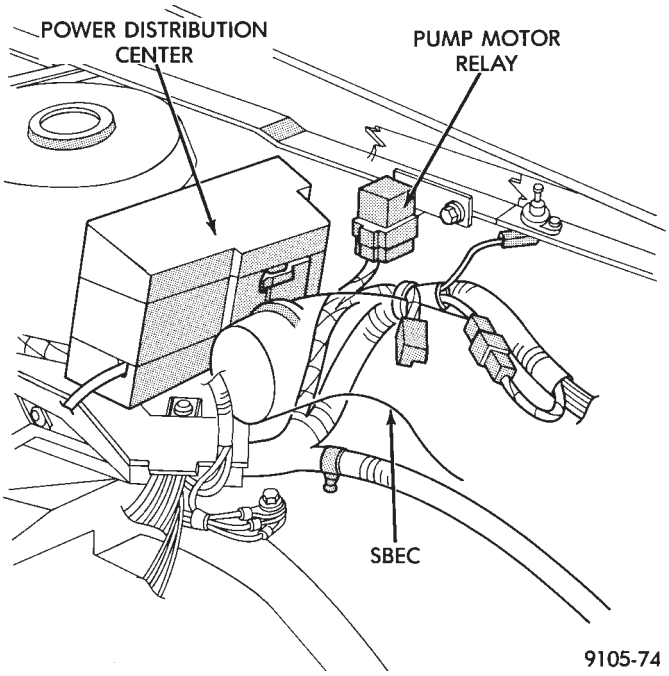


Fig. 10 Pump Motor Relay With Power Distribution Center

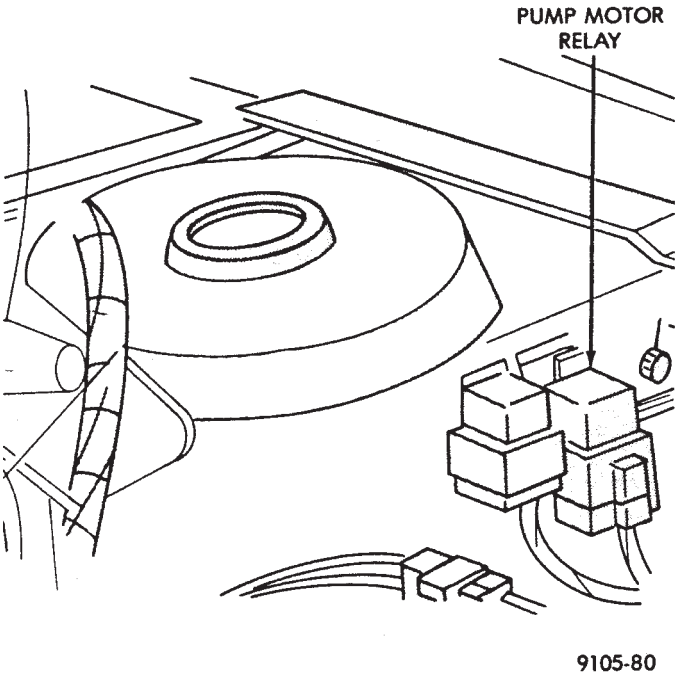


Fig. 11 Pump Motor Relay W/O Power Distribution Center

The (CAB) by itself, also has the ability to turn on the Amber Anti-Lock Warning Lamp. The (CAB) can turn on the Amber Anti-Lock Warning Lamp by providing a ground at pin 15.

ANTI-LOCK WARNING LAMP ON

System Relay and Anti-Lock Warning Lamp Relay De-Energized.

When the Amber Anti-Lock Warning Lamp is on, there is no electrical current flow from the (CAB) at pin 57. The System Relay coil is NOT energized. No electrical current flows to pin 47 and 41 (modulator valve power), or to the Anti-Lock Warning Lamp Relay coil. Thus, the Amber Anti-Lock Warning Lamp is not energized. The Amber Anti-Lock Warning Lamp is grounded through the Anti-Lock Warning Lamp Relay contacts. The Amber Anti-Lock Warning Lamp is turned on.

HYDRAULIC CIRCUITS AND VALVE OPERATION

Through the following operation descriptions and diagrams. 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 Anti-Lock 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

ISOLATION VALVES

Open to primary and secondary master cylinder fluid supply (Fig. 1).

BUILD/DECAY VALVES

Closed (Fig. 1).

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 open isolation valves, through the build/decay valves to the wheel brakes.

ABS BRAKING-BUILD PRESSURE

ISOLATION VALVES

Closed, isolating wheel brakes from master cylinder primary and secondary fluid supply. Through open build valves (Fig. 2).

BUILD/DECAY VALVES

Open (Fig. 2).

ABS BRAKING-DECAY PRESSURE

ISOLATION VALVES

Closed, isolating the wheel brakes from the master cylinder primary and secondary fluid supplies (Fig. 3).

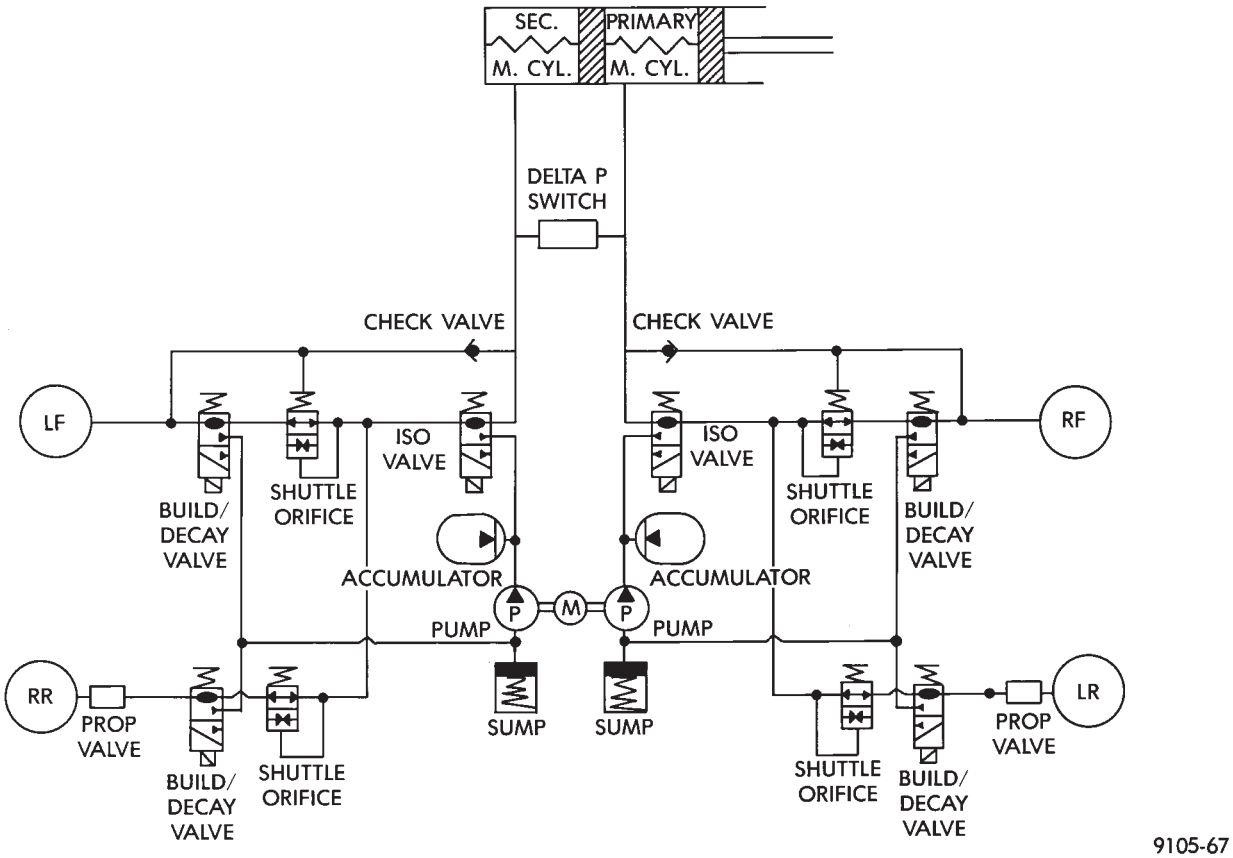


Fig. 1 Normal Braking - Hydraulic Control

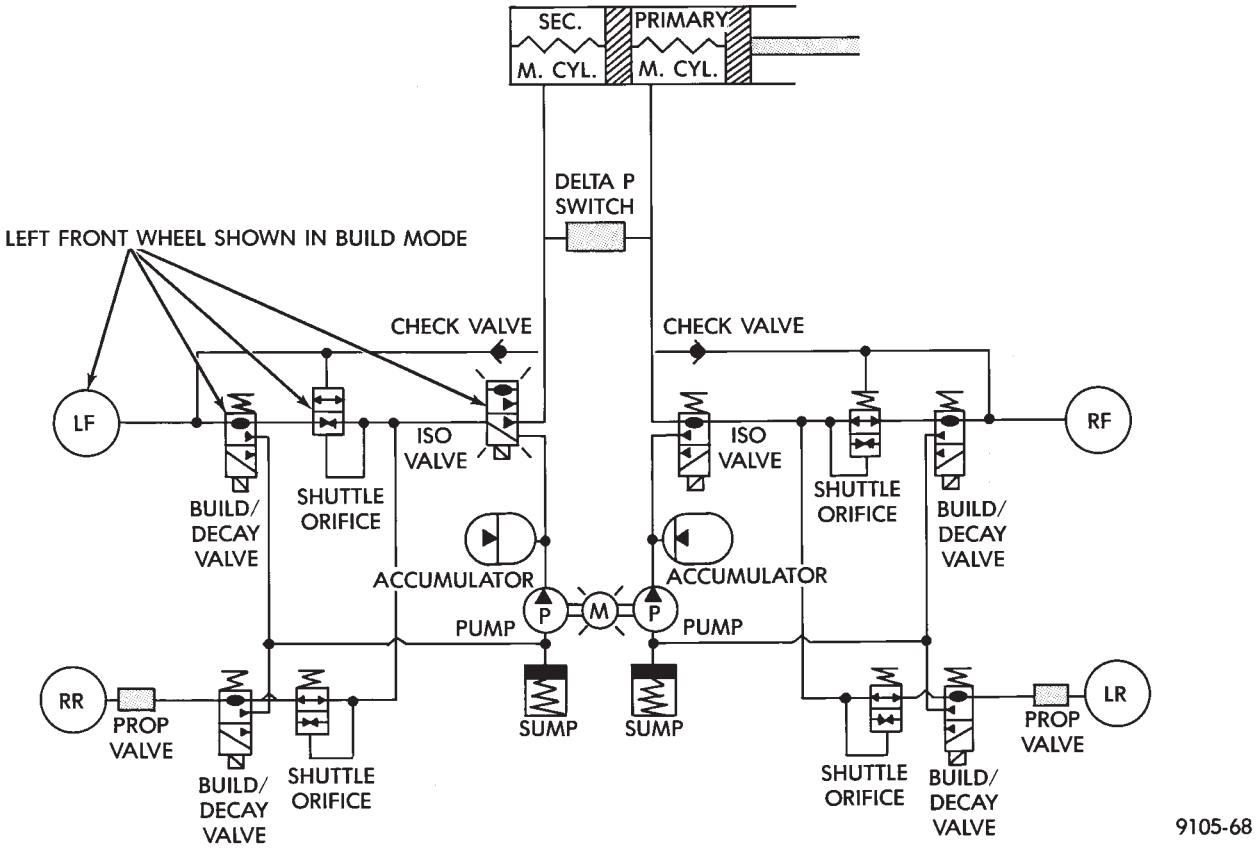


Fig. 2 Build Pressure - Hydraulic Control

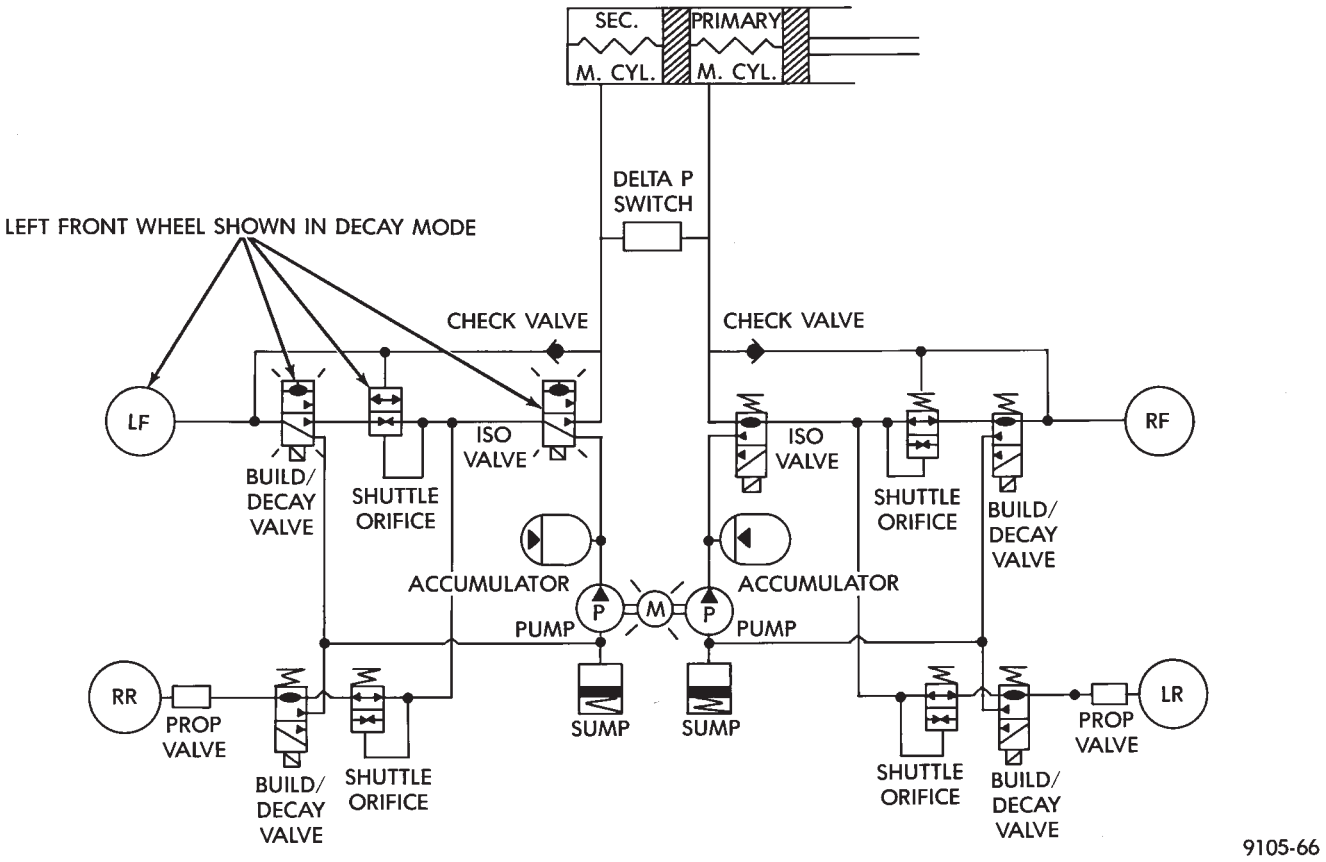


Fig. 3 Decay Pressure - Hydraulic Control

BUILD/DECAY VALVES

Open, allowing release of fluid pressure through decay valve to the fluid reservoir. Which gets pumped into the accumulator for the build pressure cycle (Fig. 3).

ABS BRAKE SYSTEM DIAGNOSIS

GENERAL INFORMATION

WARNING: SOME OPERATIONS IN THIS SECTION REQUIRE THAT HYDRAULIC TUBES, HOSES AND FITTINGS BE DISCONNECTED FOR INSPECTION OR TESTING PURPOSES.

CAUTION: REVIEW THIS ENTIRE SECTION PRIOR TO PERFORMING ANY MECHANICAL WORK ON A VEHICLE EQUIPPED WITH THE BENDIX ANTI-LOCK 6 BRAKE SYSTEM. THIS SECTION CONTAINS THE 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 Anti-Lock Brake System (ABS) are not intended to be serviced individually. Attempting to remove or disconnect certain system components, may result in personal injury and/or improper system operation. Only those components with approved removal and installation procedures in this manual should be serviced.

This section contains information necessary for diagnosis of mechanical conditions which can affect the operation of the Bendix Anti-Lock 6 Brake System. Specifically, this section should be used to help diagnose mechanical conditions which result in any of the following:

(1) Anti-Lock Warning Lamp turned on.
(2) Brakes Lock on Hard Application.

Diagnosis of conditions which are obviously mechanical in nature. Such as brake noise, brake pulsation, lack of power assist, turning on of the Red Brake Warning Lamp or vehicle vibration during normal braking. Should be directed to Group 5 Brakes in this service manual. This also pertains to problems involving the parking brake system.

In order to effectively diagnose an Anti-Lock Brake System (ABS) condition. It is important to read Anti-Lock Brake System Description. And to follow the diagnostic procedures outlined in this section.

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 Section 1 of this manual to familiarize yourself with the operating principles of the ABS system.

DEFINITIONS

Several abbreviations are used in this manual. They are presented here for reference.

- CAB—Controller Anti-Lock Brake
- ABS—Anti-Lock Brake System
- PSI—Pounds per Square Inch (pressure)
- WSS—Wheel Speed Sensor

ABS COMPUTER SYSTEM SERVICE PRECAUTIONS

The ABS system uses an electronic control module, the (CAB). This module is designed to withstand normal current draws associated with vehicle operation. However 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 by the appropriate diagnostic procedure.** These circuits should only be tested using a high impedance multimeter, special tools or the DRB II 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.

ABS GENERAL SERVICE PRECAUTIONS

TEST DRIVING ABS COMPLAINT VEHICLES

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.

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 or Amber Brake Warning Lamp is turned on. If it is the Red Brake Warning Lamp, refer to the standard brake, Control Valves Section in the brake group of this manual. If the Amber Anti-Lock Warning light was/is on, read record and erase the fault. While the Amber ABS Warning Lamp is on the ABS system is not functional. When the Amber Anti-Lock Warning Lamp is on only the Anti-Lock function of the brake system if affected. The standard brake system and the ability to stop the car is not be affected if only the Amber Anti-Lock Warning Lamp is on.

(1) Turn the key to the off position and then back to the on position. Note whether the Amber ABS Warning Lamp continues to stay on. If it does refer to the 1992 M.Y. Bendix Anti-Lock 6 Diagnostic Manual for the required test procedures.

(2) If the Amber 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 Amber ABS Warning Lamp goes on refer to the Bendix Anti-Lock 6 Diagnostic Manual.

(3) If the Amber 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 A.B.S. system is determined while test driving a vehicle. Refer to the Bendix Anti-Lock 6 Diagnostics Manual for required test procedures and proper use of the DRB II tester.

ABS BRAKE SYSTEM ON VEHICLE SERVICE

The following are general precautions which should be observed when servicing and diagnosing the ABS system and/or other vehicle systems. Failure to observe these precautions may result in ABS system damage.

(1) If welding work is to be performed on a vehicle using an arc welder, the (CAB) should be disconnected before the welding operation begins.

(2) The (CAB) and modulator assembly 10 way connector should never be connected or disconnected with the ignition in the on position.

(3) Some components of the ABS system are not serviced separately and must be serviced as complete assemblies. Do not disassemble any component which is designated as non-serviceable.

CAUTION: Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash off with water immediately.

WHEEL SPEED SENSOR CABLES

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 component failure and an open circuit.

MECHANICAL DIAGNOSTICS AND SERVICE PROCEDURES

SPECIAL SERVICE TOOL

Some diagnostic procedures in this section require the use of the DRB II diagnostics tester. The proper application and procedures for the use of this tool are described below.

DRB II DIAGNOSTIC TESTER

Some of the diagnostic procedures that are explained in this section require the use of the DRB II Diagnostics Tester to insure that proper diagnostics are performed. Refer to those sections for proper testing procedures and the DRB II operators manual for its proper operational information.

INTERMITTENT FAULTS

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.

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.

Most failures of the ABS system will disable Anti-Lock 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 Amber Anti-Lock 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.

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

(2) Anti-Lock relay. If the relay fails to make the ground circuit connection or is an intermittent ground. The (CAB) will turn on the Amber Anti-Lock Warning Light.

(3) Excess decay, an extended pressure decay period, will turn on the Amber Anti-Lock Warning Light until the vehicle comes to a complete stop.

Additionally, any condition which results in interruption of power to the (CAB) or modulator assembly may cause the Amber Anti-Lock Warning Lamp to turn on intermittently.

ABS BRAKE SYSTEM DIAGNOSTIC FEATURES

ABS SYSTEM SELF DIAGNOSIS

The ABS 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. An electrical check is completed on the ABS components. Such as Wheel Speed Sensor Continuity and System and other Relay continuity. During this check the Amber Anti-Lock Light is turned on for approximately 1- 2 seconds.

Further Functional testing is accomplished once the vehicle is set in motion.

- The solenoid valves and the pump/motor are activated briefly to verify function.
- The voltage output from the wheel speed sensors is verified to be within the correct operating range.

If the vehicle is not set in motion within 3 minutes from the time the ignition switch is set in the on position. The solenoid test is bypassed but the pump/motor is activated briefly to verify that it is operating correctly.

CONTROLLER ANTI-LOCK BRAKE (CAB)

Fault codes are kept in a Non-Volatile memory until either erased by the technician using the DRB II or erased automatically after 50 ignition cycles (key ON-OFF cycles). The only fault that will not be erased after 50 (KEY CYCLES) is the (CAB) fault. A (CAB) fault can only be erased by the technician using the DRB II diagnostic tester. More than one fault can be stored at a time. The number of key cycles 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 II.

LATCHING VERSUS NON-LATCHING ABS FAULTS

Some faults detected by the (CAB) are latching; the fault is latched and (ABS) is disabled until the ignition switch is reset. Thus ABS is disabled 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 Anti-Lock Warning Light is turned off. Although a fault code will be set in most cases.

BENDIX ABS SYSTEMS DIAGNOSTICS

The Bendix Anti-Lock 6 Brake System Diagnostics, beyond the basic mechanical diagnostics, systems and components covered earlier in this section. Are accomplished by the use of the DRB II diagnostic tester. See testing procedures outlined in the Bendix Anti-Lock 6 Diagnostics Manual for the 1992 M.Y. vehicles.

Please refer to the above mentioned manual for any further electronic diagnostics and service procedures that are required on the Bendix Anti-Lock 6 Brake System.

ON-CAR ABS BRAKE SYSTEM SERVICE

GENERAL SERVICE PRECAUTIONS

The following are general cautions which should be observed when servicing the Anti-Lock brake system and/or other vehicle systems. Failure to observe these precautions may result in Anti-Lock Brake 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) connector should never be connected or disconnected with the ignition switch in the ON position.

Many components of the Anti-Lock Brake System are not serviceable and must be replaced as an assembly. Do not disassemble any component which is not designed to be serviced.

CHECKING BRAKE FLUID LEVEL

CAUTION: Only use brake fluid conforming to DOT 3 specifications, such as Mopar or Equivalent. Do not use any fluid which contains a petroleum base. Do not use a container which has been used for petroleum based fluids or a container which is wet with water. Petroleum based fluids will cause swelling and distortion of rubber parts in the hydraulic brake system. Water will mix with brake fluid, lowering the fluid boiling point. Keep all brake fluid containers capped to prevent contamination. Remove the front cap of the master cylinder reservoir and fill to the bottom of the split ring.

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

BLEEDING BENDIX ANTI-LOCK 6 BRAKE SYSTEM

The Anti-Lock Brake System must be bled anytime air is permitted to enter the hydraulic system, due to disconnection of brake lines, hoses of components.

If the Modulator Assembly is removed from the vehicle, both the Base Brake System and the Anti-Lock Brake System must be bled using the appropriate procedures. 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 Anti-Lock 6 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 Anti-Lock portion of brake system MUST be bled separately. This bleeding procedure requires the use of the DRB II Diagnostic tester and the bleeding sequence procedure outlined below.

ABS BLEEDING PROCEDURE (FIG. 1)

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

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

To perform the bleeding procedure on the ABS unit. The battery and acid shield must be removed from the vehicle. Reconnect the vehicles battery, to the vehicles positive and negative battery cables using jumper cables. This is necessary to allow access to the 4 bleeder screws located on the top of the Modulator assembly.

(3) Connect the DRB II Diagnostics Tester to the diagnostics connector. Located behind the Fuse Panel access cover on the lower section of the dash panel to the left of the steering column. (It is a blue 6 way connector).

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

WARNING: WHEN BLEEDING THE MODULATOR ASSEMBLY 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.

When bleeding the Modulator Assembly. The following bleeding sequence **MUST** be followed to insure complete and adequate bleeding of the brakes hydraulic system. The Modulator Assembly 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 Adjustments section at the beginning of this group, for proper equipment usage and procedures.

MODULATOR ASSEMBLY BLEEDING SEQUENCE

1 SECONDARY SUMP

(1) Put a bleeder tube on the Secondary Sump bleeder screw (Fig. 1).

(2) Use a pressure bleeder, or have an assistant, apply light and constant pressure on the brake pedal. Loosen the Secondary Sump bleeder screw (Fig. 1).

(3) Using the DRB II select the Actuate Valves test mode. Then actuate the LF Build/Decay Valve.

(4) Bleed the Secondary Sump. Until a clear air free flow of brake fluid is evident in the clear hose and no air bubbles appear in the container, or the brake pedal bottoms.

(5) Tighten the bleeder screw and release the brake pedal.

(6) Repeat steps 2 through 5 until a clear air free flow of brake fluid is coming out of the Secondary Sump bleeder screw.

(7) Next select and actuate the RR Build/Decay Valve. Again repeat steps 2 through 5 until a clean air free flow of brake fluid is coming out of the Secondary Sump bleeder screw.

2 PRIMARY SUMP

(1) Put a bleeder tube on the Primary Sump bleeder screw (Fig. 1).

(2) Use a pressure bleeder, or have an assistant, apply light and constant pressure on the brake pedal. Loosen the Primary Sump bleeder screw (Fig. 1).

(3) Using the DRB II select the Actuate Valves test mode. Then actuate the RF Build/Decay Valve.

(4) Bleed the Primary Sump. Until a clear air free flow of brake fluid is evident in the clear hose and no air bubbles appear in the container, or the brake pedal bottoms.

(5) Tighten the bleeder screw and release the brake pedal.

(6) Repeat steps 2 through 5 until a clear air free flow of brake fluid is coming out of the Primary Sump bleeder screw.

(7) Next select and actuate the LR Build/Decay Valve. Again repeat steps 2 through 5 until a clean air free flow of brake fluid is coming out of the Primary Sump bleeder screw.

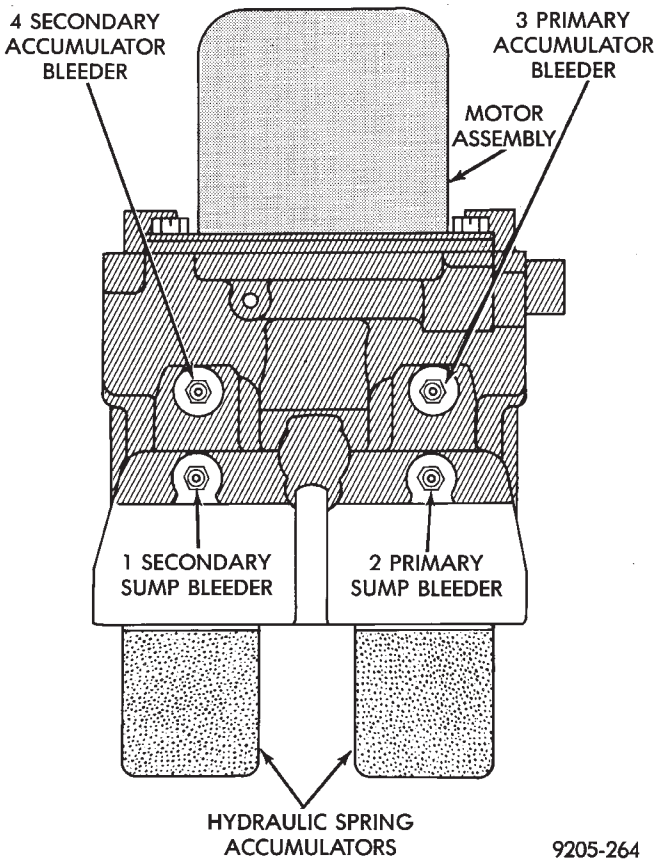


Fig. 1 Bleeding ABS Modulator Assembly

3 PRIMARY ACCUMULATOR

(1) Put a bleeder tube on the Primary Accumulator bleeder screw (Fig. 1).

(2) Use a pressure bleeder, or have an assistant, apply light and constant pressure on the brake pedal. Loosen the Primary Accumulator bleeder screw (Fig. 1).

(3) Using the DRB II select the Actuate Valves test mode. Then actuate the RF/LR Isolation Valve.

(4) Bleed the Primary Accumulator. Until a clear air free flow of brake fluid is evident in the clear hose and no air bubbles appear in the container, or the brake pedal bottoms.

(5) Tighten the bleeder screw and release the brake pedal.

(6) Repeat steps 2 through 5 until a clear air free flow of brake fluid is coming out of the Primary Accumulator bleeder screw.

(7) Next select and actuate the RF Build/Decay Valve. Again repeat steps 2 through 5 until a clean air free flow of brake fluid is coming out of the Primary Accumulator bleeder screw.

4 SECONDARY ACCUMULATOR

(1) Put a bleeder tube on the Secondary Accumulator bleeder screw (Fig. 1).

(2) Use a pressure bleeder, or have an assistant, apply light and constant pressure on the brake pedal. Loosen the Secondary Accumulator bleeder screw (Fig. 1).

(3) Using the DRB II select the Actuate Valves test mode. Then actuate the LF/RR Isolation Valve.

(4) Bleed the Secondary Accumulator. Until a clear air free flow of brake fluid is evident in the clear hose and no air bubbles appear in the container, or the brake pedal bottoms.

(5) Tighten the bleeder screw and release the brake pedal.

(6) Repeat steps 2 through 5 until a clear air free flow of brake fluid is coming out of the Secondary Accumulator bleeder screw.

(7) Next select and actuate the LF Build/Decay Valve. Again repeat steps 2 through 5 until a clean air free flow of brake fluid is coming out of the Primary Accumulator bleeder screw.

PUMP/MOTOR SERVICE

On the Bendix Anti-Lock 6 Brake System the Pump/Motor assembly can only be serviced as part of Modulator Assembly.

MODULATOR ASSEMBLY (FIG. 2)

REMOVAL

(1) Center vehicle on hoist, or raise front of vehicle on jack stands.

(2) Disconnect and remove the battery, battery tray and acid shield covering the modulator assembly (Fig. 2).

(3) Disconnect the delta (P) switch electrical connector from the Modulator Assembly (Fig. 3). Remove the top Modulator Assembly bracket to fender shield mounting bolt (Fig. 2).

(4) Disconnect the 2 master cylinder supply tubes at the Modulator Assembly. Loosen the 2 tubes at the Master Cylinder so the tubes can be swung out of the way without kinking them (Fig. 4).

(5) Raise the vehicle on the hoist.

(6) From under the vehicle disconnect the Modulator Assembly 10 way connector (Fig. 3). Remove the 4 remaining hydraulic brake tubes from the Modulator Assembly.

(7) (a) Remove the Modulator Assembly bracket mounting bolt closest to the junction block. (b) Loosen but do not fully remove the bracket mounting bolt nearest the radiator.

(8) Lower the vehicle, the Modulator Assembly and bracket can now be lifted out of the vehicle (Fig. 2).

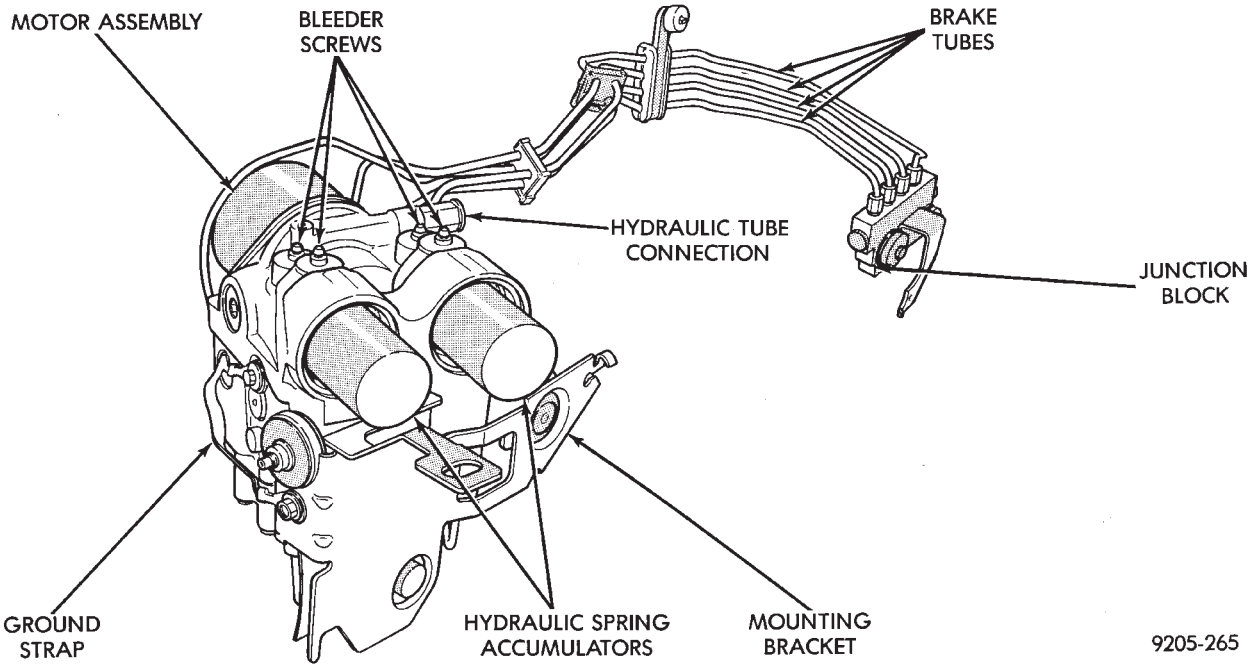


Fig. 2 Modulator Assembly

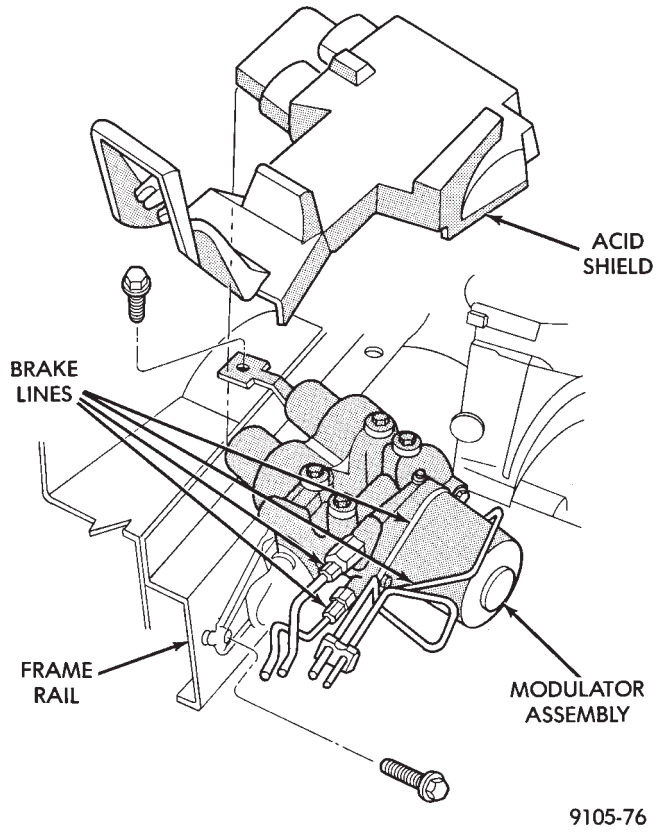


Fig. 2 Modulator Assembly Removal

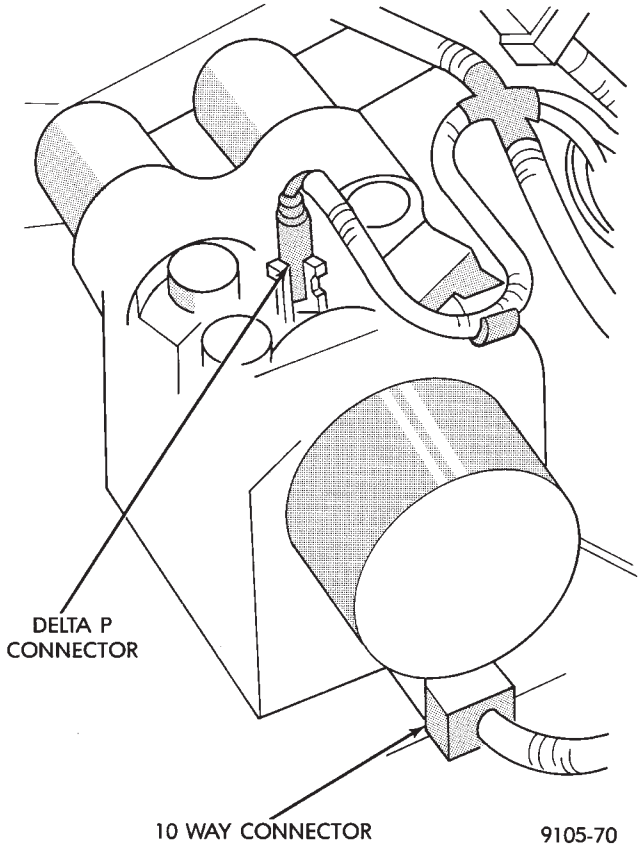


Fig. 3 Modulator Assembly Electrical Connections

INSTALLATION

(1) Install the Modulator Assembly in the vehicle. Use the protruding tab on the Modulator Assembly to locate and hold the assembly in place in the vehicle. Make sure the bracket is held by the front mounting bolt.

(2) Install but do not tighten the Modulator Assembly bracket to fender shield attaching bolt.

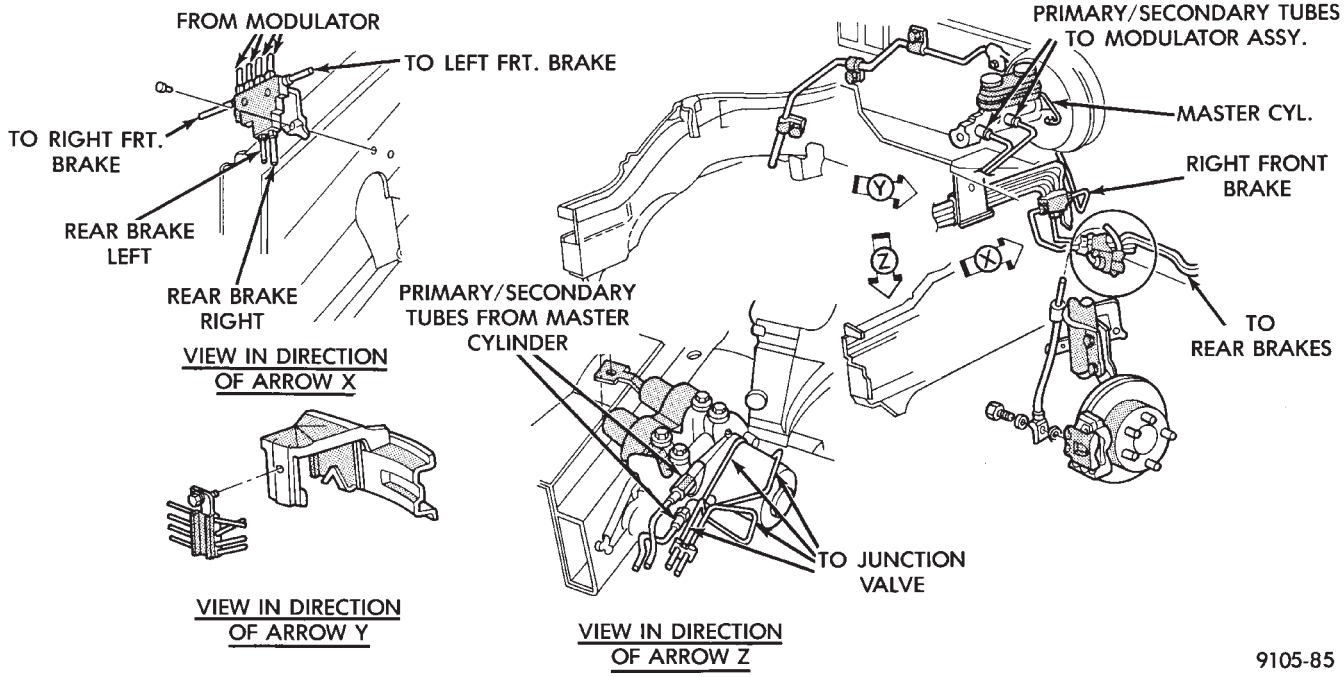


Fig. 4 Brake Tube and Hose Routing at Modulator Assembly

(3) Raise the vehicle on the hoist. Install the Modulator Assembly bracket mounting bolt near the junction block. Torque both lower mounting bracket bolts to 28 N●m (250 in. lbs.).

(4) Reinstall the 4 hydraulic brake tubes to the Modulator Assembly and torque the fittings to 16 N●m (145 in. lbs.).

(5) Reconnect the 10 way Modulator assembly connector, and the delta P switch connector.

(6) Lower the vehicle and install the 2 master cylinder supply tubes to the Modulator Assembly. Torque the Modulator Assembly fittings and the master cylinder fittings to 16 N●m (145 in. lbs.).

(7) Torque the Modulator to fender splash shield attaching bolt to 28 N●m (250 in. lbs.).

(8) Bleed the brake system. Refer to the Bleeding Bendix Anti 6 Brake System in this section of the manual for proper bleeding procedure.

(9) Reinstall the acid shield and battery tray. Reinstall battery and connect battery cables.

MASTER CYLINDER AND POWER BOOSTER

REMOVAL AND INSTALLATION

If the Master Cylinder or the Power Booster need to be serviced or replaced. Refer to Master Cylinder or Power Brake Service section in this group of the service manual.

After servicing the Master Cylinder. Refer back to this section of the service manual. For the appropriate procedure and sequence, used to bleed the base and ABS portion of the brake system.

PROPORTIONING VALVES (FIG. 5)

CAUTION: Proportioning valves should never be disassembled.

REMOVAL

(1) Remove brake tube and fitting from proportioning valve.

(2) Remove proportioning valve from Modulator Assembly.

INSTALLATION

(1) Install proportioning valve on Modulator Assembly and tighten to 40 N●m (30 ft. lbs.) torque.

(2) Install brake tube on proportioning valve. Tighten tube nut to 15 N●m (11 ft. lbs.) torque.

(3) Bleed the affected brake line, see Bleeding Bendix Anti Lock 6 Brake System in this section of the manual.

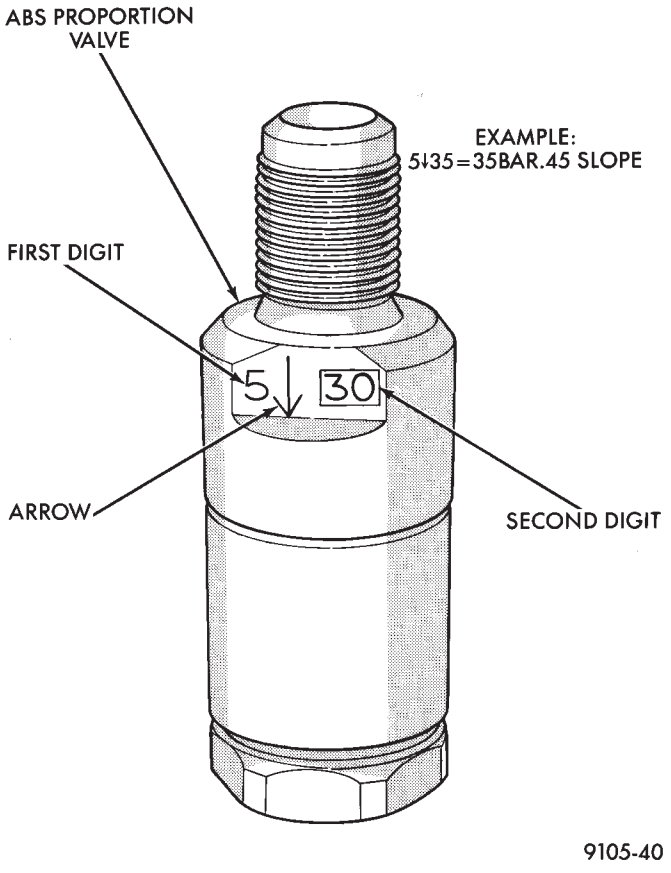


Fig. 5 ABS Proportioning Valve Identification

ELECTRONIC COMPONENTS

CONTROLLER ANTI-LOCK BRAKE (CAB)

REMOVAL

(1) Turn vehicle ignition off.

(2) Disconnect the wiring harness connectors from the Anti-Lock relays (Fig. 6). Relays will be removed as part of the (CAB) bracket.

(3) Disconnect the wiring harness 60 way connector (Fig. 6) from the Controller Anti-Lock Brake Module (CAB). **VERIFY THAT THE VEHICLE IGNITION IS OFF BEFORE REMOVING THE 60 WAY CONNECTOR.**

(4) Remove the 2 (CAB) module bracket, to frame rail mounting bolts (Fig. 6).

(5) Remove the (CAB) module from the vehicle.

(6) Remove the 3 (CAB) to bracket mounting screws and remove the (CAB) from the mounting bracket (Fig. 7).

INSTALLATION

The Controller Anti-Lock Brake (CAB) module installation is done in the reverse order of removal.

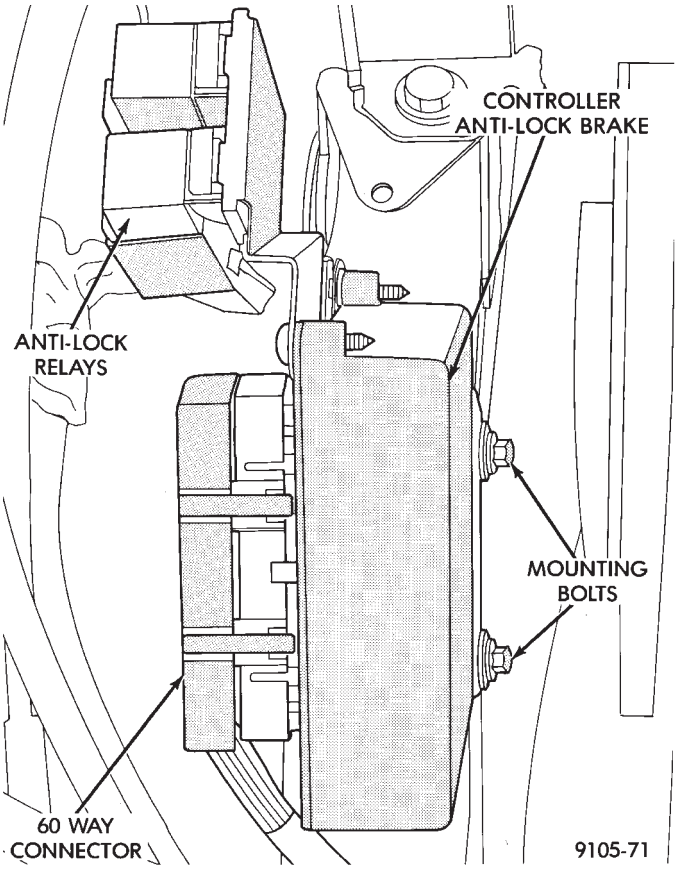


Fig. 6 Location Controller Anti-Lock Brake (CAB)

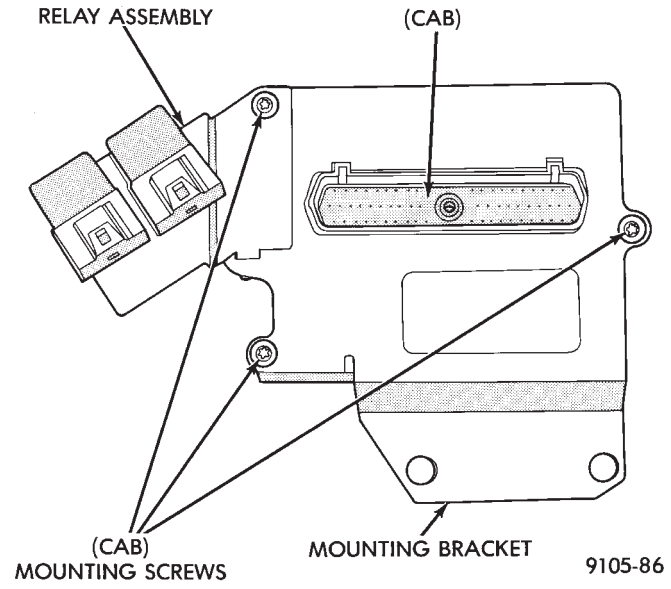


Fig. 7 (CAB) Removal From Mounting Bracket

REMOVAL/INSTALLATION OF SYSTEM AND WARNING LAMP RELAY

The System and Warning Lamp relay are both serviced together as an assembly, with the mounting bracket. They are mounted to a separate bracket that is attached to the (CAB) bracket assembly (Fig. 8).

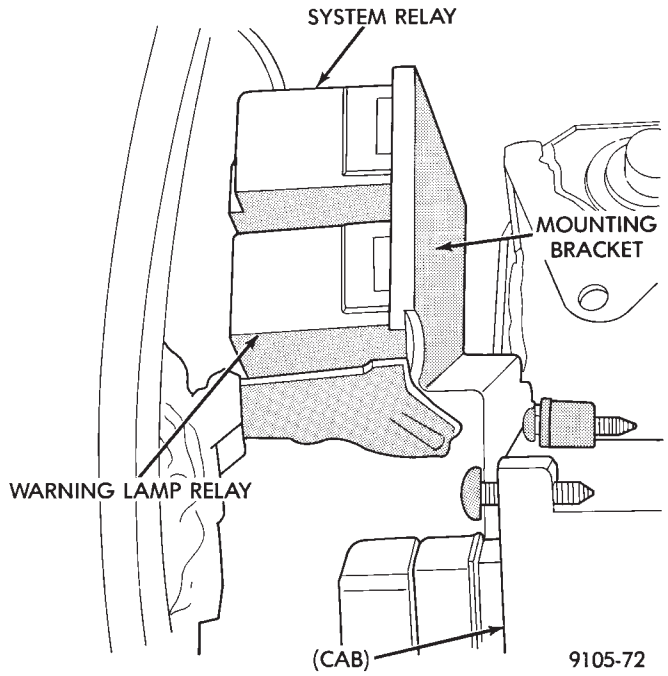


Fig. 8 System Relay/Warning Lamp Relay Location

REMOVE

(1) Hold the relays with one hand, while pulling strait down on the wiring harness connector. Until the connectors are free from the relays **(do not twist the connectors).**

(2) Remove the screw (Fig. 9) holding the relay bracket to the (CAB) bracket. Remove the relays and bracket assembly.

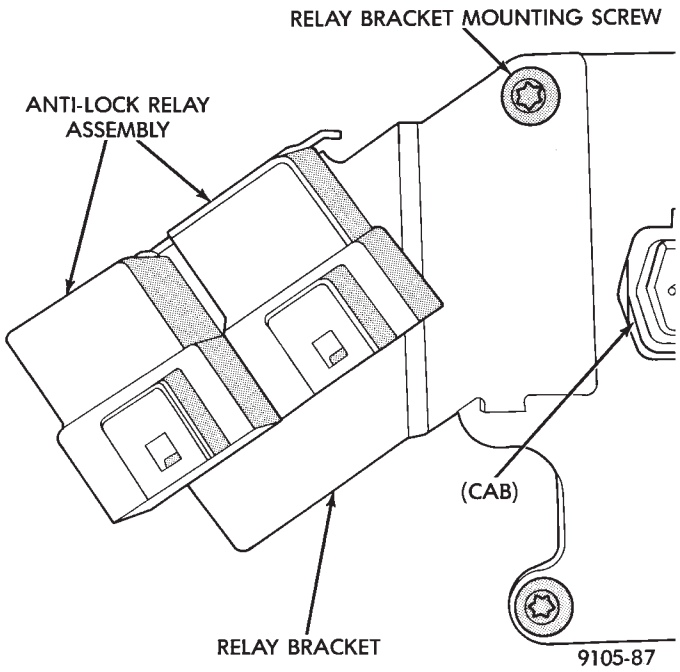


Fig. 9 Relay And Bracket Removal

INSTALL

(1) Mount the relay and bracket assembly to the (CAB) bracket, with the mounting screw (Fig. 9).

(2) Holding the relays with one hand, push the wiring harness connector strait onto the terminals of the relay. Make sure the connector is fully seated onto the terminals of the relay.

REMOVE/INSTALL PUMP MOTOR RELAY

Find the location of the Pump Motor Relay (Figs. 10 and 11), depending on whether the vehicle has or does not have a Power Distribution Center.

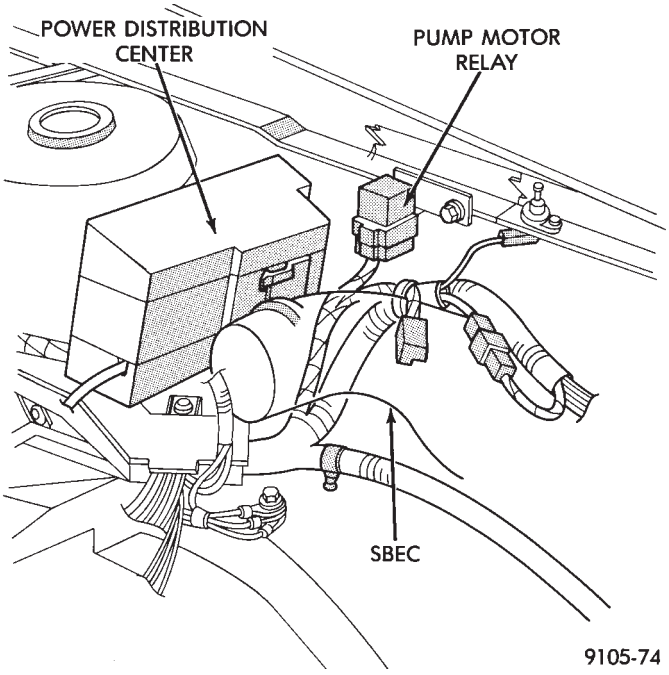


Fig. 10 Pump Motor Relay Location With Power Distribution Center

(1) Hold the relay with one hand. While pulling the relay connector strait off the relay terminals.

(2) Remove the relay from the vehicle.

(3) Installation is done in the reverse order off removal. Be sure that the wiring harness connector is fully seated onto the terminals of the Pump Motor Relay.

WHEEL SPEED SENSORS

INSPECTION

Inspect tonewheel for missing or broken teeth, this can cause erratic sensor signals.

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

Excessive runout of the tonewheel can cause erratic wheel speed sensor. Replace assembly if runout exceeds approximately 0.25 mm (0.010 inch).

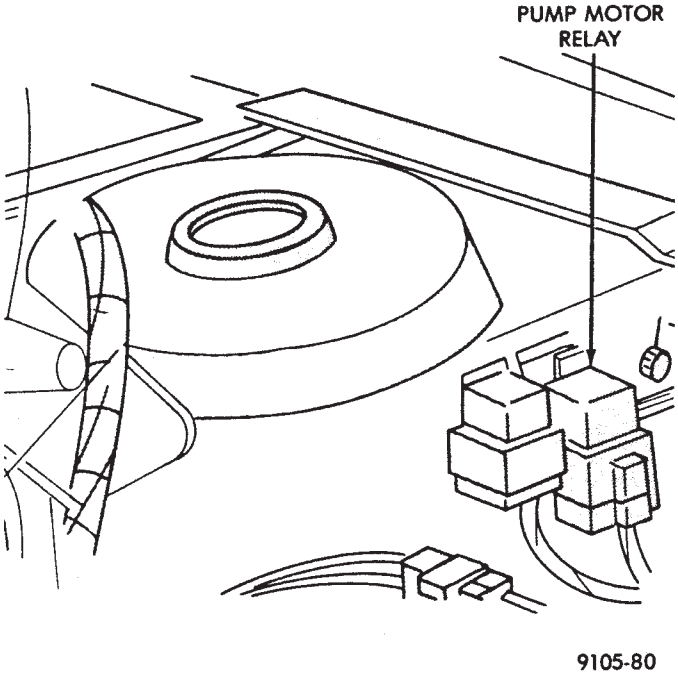


Fig. 11 Pump Motor Relay Location W/O Power Distribution Center

FRONT WHEEL SPEED SENSOR (FIG. 12)

REMOVAL

(1) Raise vehicle and remove wheel and tire assembly.

(2) Remove screw from grommet retainer clip that holds the grommet into fender shield (Fig. 12).

(3) Remove the 2 screws that fasten the sensor routing tube to the frame rail.

(4) Carefully, pull sensor assembly grommet from fender shield.

(5) Unplug speed sensor connector from vehicle wiring harness.

(6) Remove the sensor assembly grommets from the retainer brackets.

(7) Remove sensor head screw.

(8) 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.

INSTALLATION

(1) Connect the wheel speed sensor connector to the wiring harness.

(2) Push sensor assembly grommet into hole in fender shield. Install clip and screw.

(3) Install the 2 screws that fasten the speed sensor routing tube to the frame rail.

(4) Install sensor grommets in brackets on fender shield and strut damper.

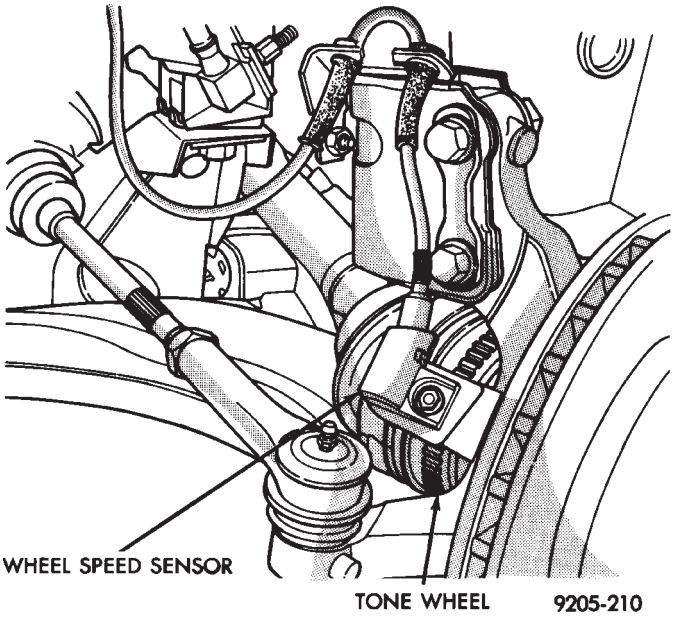


Fig. 12 Front Wheel Speed Sensor Routing

(5) Coat the speed sensor with High Temperature Multi-purpose E.P. Grease before installing into the steering knuckle. Install screw tighten to 7 N•m (60 in. lbs.).

CAUTION: Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are installed in retainers. Failure to install cables in retainers, as shown in this section, may result in contact with moving parts and/or over extension of cables, resulting in an open circuit.

REAR WHEEL SPEED SENSOR (FIGS. 13 AND 14)

REMOVAL

(1) Raise vehicle and remove wheel and tire assembly.

(2) Remove sensor assembly grommet from underbody and pull harness through hole in underbody.

(3) Unplug connector from harness.

(4) Remove sensor assembly grommets from bracket which is screwed into the body hose bracket, just forward of trailing arm bushing (batwing bracket).

(5) Remove sensor and brake tube assembly clip, located on the inboard side of trailing arm.

(6) Remove sensor wire fastener from rear brake hose bracket.

(7) Remove outboard sensor assembly retainer nut. This nut also is used to capture the brake tube clip.

(8) Remove sensor head screw.

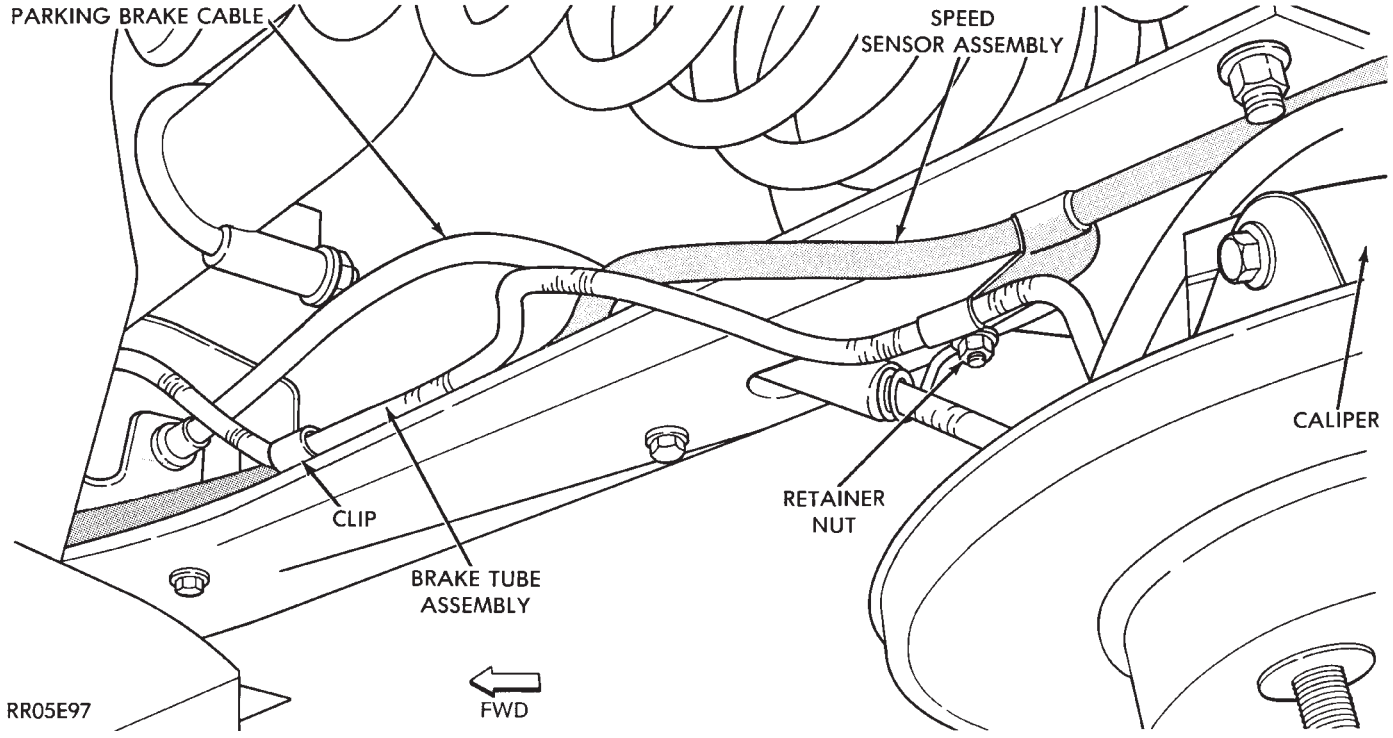


Fig. 13 Rear Wheel Speed Sensor Routing at Trailing Arm

(9) Carefully, remove sensor head from adapter assembly. 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.

INSTALLATION

Installation is reverse order of removal. Be sure to coat sensor with High Temperature Multi-purpose E.P. Grease before installing into adapter assembly. Tighten screw to 7 N●m (60 in. lbs.) torque.

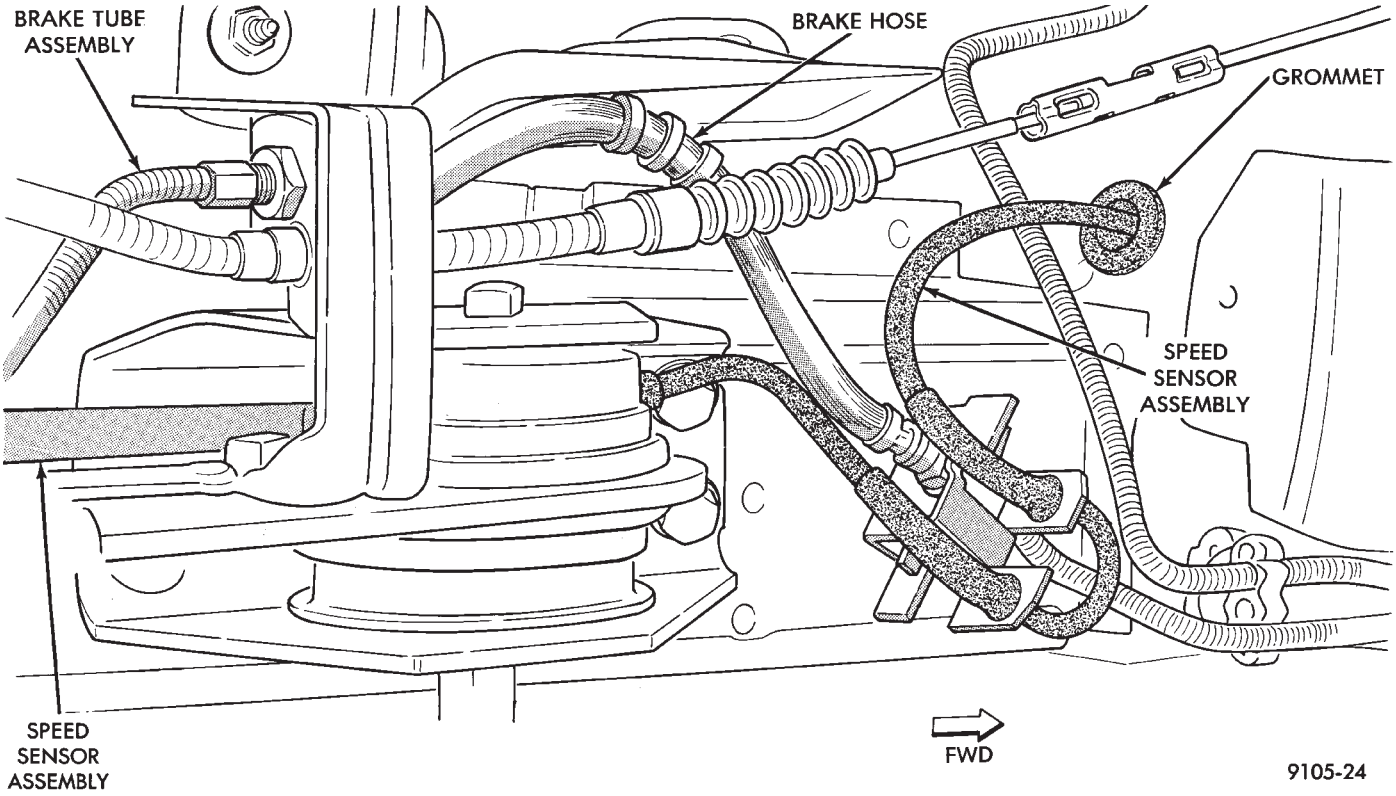


Fig. 14 Body Routing of Rear Speed Sensor Wiring

SPECIFICATIONS

SPECIFICATIONS METRIC

FRONT BRAKES	
Type	Single Piston—Pin Slider—Disc
Caliper Bore Diameter	54 mm AA, AG, AJ, AP
	60 mm AA, AC, AY
Adjustment	Automatic
Piston Material	Glass Filled Phenolic
Piston Boot Type	Press in EPDM Rubber
Disc Type All Bodies	Vented
Disc Diameter—Outside AP	240 mm Standard—260 mm Heavy Duty
AA, AC, AG & AJ	260 mm Standard
Runout—Maximum Allowable T.I.R.	.1016
Parallelism—Total Variation in Thickness in 360° of Rotation	.01270 mm

REAR BRAKES—DRUM	
Type	Leading Trailing
Adjustment	Automatic
Drum Diameter—AP, AG, AJ	200 mm Standard
AA	220 mm Standard
AC &	220 mm Heavy Duty and C-45 Ribbed and Flared
Wheel Cylinder Diameter AA, AP, AG, AC & AY	15.9 mm

REAR BRAKES—DISC WITH SEPARATE PARKING BRAKE	
Type	Single Piston With Internal Park Brake (Drum in Hat)
Caliper Bore Diameter AA, AG	
AJ, AP	34 mm 14 in. Wheel
AC, AY	36 mm 14 in. Wheel
AA	36 mm 15 in. Wheel
Adjustment	Disc Brake—Automatic Parking Brake—Manual
Piston Material	Glass Filled Phenolic
Piston Boot Type	Press in EPDM Rubber
Disc Type	Solid—14 in. Wheel Vented—15 in. Wheel
Disc Diameter—Outside	270 mm—14 in. Wheel 286 mm—15 in. Wheel
Diameter—Parking Brake Drum	171.9 mm to 172.15 mm

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BRAKE ACTUATION SYSTEM

ACTUATION:	Power Brakes Standard
Hydraulic System	Dual-Diagonally Split
MASTER CYLINDER:	
Type	Dual-Tandem—Two Piece
Body Material	Anodized Aluminum
Reservoir Material	Glass Reinforced Nylon
Bore and Stroke	24.0 mm x 33.4 mm .875 in. x 33.4 mm
Displacement Split	50/50
Outlet Port Threads	3/8 x 24
Outlet Fitting Type	45 Inverted Flare
Pedal Ratio	5.10 for AC/AY W/ABS 3.28:1 AA, AC, AG, AJ, AP w/o ABS
BOOSTER:	
Make	Bendix/Vacuum and Hydraulic
Mounting Studs	M8 x 1.25
Type	205 mm Tandem
Boost @ 20" HG	4048 N•m in all Vehicles
Type AC & AY Only	Hydraulic Power
Boost	Hydraulic/Electric
DIFFERENTIAL WARNING SWITCH:	
Material	Brass
Function	Warning Light Switch (Latching)
COMBINATION HYDRAULIC VALVE:	
Material	Brass/Aluminum
Function	Proportioning Valve and Warning Light Switch (Latching)

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TIGHTENING REFERENCE

DESCRIPTION	TORQUE
Hydraulic Brake Tubes To All Fittings (If Not Specified)	17 N•m (143 in. lbs.)
Brake Hoses To Calipers (Banjo Bolts)	48 N•m (35 ft. lbs.)
Brake Hose Intermediate Bracket	12 N•m (105 in. lbs.)
Master Cylinder To Brake Booster Mounting Nuts	28 N•m (250 in. lbs.)
Brake Booster Assembly To Dash Panel	28 N•m (250 in. lbs.)
Wheel Cylinder to Rear Brake Support Plate	8 N•m (75 in. lbs.)
Wheel Cylinder Bleed Screw	10 N•m (80 in. lbs.)
Brake Support Plate To Rear Axle Mounting Bolts	109 N•m (80 ft. lbs.)
Wheel Stud Lug Nuts	110 - 135 N•m (85 - 115 ft. lbs.)
Caliper Adapter To Steering Knuckle Mounting Bolts	217 N•m (160 ft. lbs.)
Caliper Guide Pin Bolts	41 N•m (30 ft. lbs.)
Bearing Retainer Mounting Bolt	28 N•m (250 in. lbs.)
Caliper Bleed Screw	15 N•m (125 in. lbs.)
Brake Light Switch Mounting Bracket Screw	8 N•m (75 in. lbs.)
Parking Brake Assembly Mounting	28 N•m (250 in. lbs.)

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