BRAKES

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BRAKE COMPONENTS

Power assist front disc and rear drum brakes are standard on Cherokee/Wrangler models. Disc brake components consist of single piston calipers and ventilated rotors. Rear drum brakes are dual shoe units with cast brake drums.

The parking brake mechanism is lever and cable operated. The cables are attached to levers on the rear drum brake secondary shoes. The parking brakes are operated by a foot pedal on YJ models and a hand lever on XJ models.

A 205 mm dual diaphragm vacuum power brake booster is used for all applications. Two master cylinders are used; 4-cylinder YJ models have a one-piece master cylinder. All other models have a two-piece master cylinder with plastic reservoir.

All models are equipped with a combination valve. The valve contains a pressure differential valve and switch and a fixed rate rear proportioning valve.

BRAKELINING MATERIAL

Factory brakelining on all models consists of an organic base material combined with metallic particles. The lining does not contain asbestos.

BRAKE WARNING LIGHTS

Cherokee/Wrangler models are equipped with one or two brake warning lights. A red warning light is standard on all models. An amber light is added on models with ABS brakes. Both lights are located in the instrument panel.

The red light is in circuit with the pressure differential switch (in the combination valve), and with the parking brake switch. The light alerts the driver when the parking brakes are applied, or when a pressure differential exists between the front and rear hydraulic systems. The light also illuminates for a few seconds at start up as part of a bulb check.

The ABS warning light is amber in color and is located in the same side of the instrument cluster as the red warning light. The amber light only illuminates when an ABS circuit fault occurs.

ANTILOCK BRAKES (ABS)

An antilock brake system (ABS) is available on Cherokee/Wrangler models as an option. The system is an electronically operated, all-wheel brake control system. The ABS system is designed to prevent wheel lockup during periods of high wheel slip braking. Refer to the antilock brake section for operation and service information.

ABS SYSTEM CHANGES

A different master cylinder, power brake booster, and HCU are used in the 1995 Jeep ABS system.

The master cylinder reservoir has a single filler cap and is no longer interconnected with the HCU. The new HCU has built-in accumulators. The pedal travel sensor has been eliminated and a new dual diaphragm power brake booster is used.

BRAKE FLUID/LUBRICANTS/CLEANING SOLVENTS

Recommended fluid for all Jeep vehicles is Mopar DOT 3 brake fluid, or an equivalent meeting SAE J1703 and DOT 3 standards.

Use Mopar Multi Mileage grease to lubricate drum brake pivot pins and rear brakeshoe contact points on the support plates. Use GE 661, or Dow 111 silicone grease on caliper bushings and mounting bolts.

Use fresh brake fluid or Mopar brake cleaner to clean or flush brake system components. These are the only cleaning materials recommended.

CAUTION: Never use gasoline, kerosene, methyl or isopropyl alcohol, paint thinner, or any fluid containing mineral oil to clean brake parts. These fluids damage rubber cups and seals. If system contamination is suspected, check the fluid for dirt, discoloration, or separation into distinct layers. Drain and flush the system with new brake fluid if contamination is suspected.

JEEP BODY CODE LETTERS

The body/model identification code letters for Jeep vehicles are as follows:

- Code letters XJ: Cherokee
- Code letters YJ: Wrangler/YJ

The code letters are used throughout this group to simplify model identification and component application.

BRAKE SAFETY PRECAUTIONS

WARNING: ALTHOUGH FACTORY INSTALLED BRAKELINING ON JEEP VEHICLES IS MADE FROM ASBESTOS FREE MATERIALS, SOME AFTER MARKET BRAKELINING MAY CONTAIN ASBESTOS. THIS SHOULD BE TAKEN INTO ACCOUNT WHEN REPAIRING A VEHICLE WITH PRIOR BRAKE SERVICE. WEAR A RESPIRATOR WHEN CLEANING BRAKE COMPONENTS AS ASBESTOS FIBERS CAN BE A HEALTH HAZARD. NEVER CLEAN WHEEL BRAKE COMPONENTS WITH COMPRESSED AIR. USE A VACUUM CLEANER SPECIFICALLY DESIGNED FOR REMOVING BRAKE DUST. IF A VACUUM CLEANER IS NOT AVAILABLE, CLEAN THE PARTS WITH WATER DAMPENED SHOP RAGS. DO NOT CREATE DUST BY SANDING BRAKELINING. DISPOSE OF ALL DUST AND DIRT SUSPECTED OF CONTAINING ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS. FOLLOW ALL SAFETY PRACTICES RECOMMENDED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA), FOR HANDLING AND DISPOSAL OF ASBESTOS.

ABS BRAKE DIAGNOSIS

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GENERAL INFORMATION

The DRB scan tool is required for ABS diagnosis. The scan tool is used to identify ABS circuit faults.

Once a faulty circuit has been identified, refer to the appropriate chassis/body diagnostic manual for individual component testing.

ABS WARNING LIGHT DISPLAY

The amber antilock light illuminates at startup as part of the system self check feature. The light illuminates for 2-3 seconds then goes off as part of the normal check routine.

An ABS circuit fault is indicated when the amber light remains on after startup, or illuminates during vehicle operation.

Verify that a fault is actually related to the ABS system before making repairs. For example, if the red warning illuminates but the ABS light does not, the problem is related to a service brake component and not the ABS system. Or, if neither light illuminates but a brake problem is noted, again, the problem is with a service brake component and not with the ABS system.

ABS DIAGNOSTIC CONNECTOR

The ABS diagnostic connector is inside the vehicle. The connector is the access point for the DRB scan tool.

On XJ models, the connector is located under the instrument panel to the right of the steering column. On some models, the connecter may be tucked under the carpeting on the transmission tunnel. The connecter is a black, 6-way type.

On YJ models, the connector is under the instrument panel by the the driver side kick panel. The connecter is a black, 6 or 8-way type.

The DRB scan tool kit contains adapter cords for both types of connecter. Use the appropriate cord for test hookup.

DRB SCAN TOOL

ABS diagnosis is performed with the DRB scan tool. Refer to the DRB scan tool manual for test hookup and procedures. Diagnosis information is provided in the appropriate chassis/body diagnostic manual.

WHEEL/TIRE SIZE AND INPUT SIGNALS

Antilock system operation is dependant on accurate signals from the wheel speed sensors. Ideally, the vehicle wheels and tires should all be the same size and type. However, the Jeep ABS system is designed to operate with a compact spare tire installed.

NORMAL OPERATING CONDITIONS

Sound Levels

The hydraulic control unit pump and solenoid valves may produce some sound as they cycle on and off. This is a normal condition and should not be mistaken for faulty operation. Under most conditions, pump and solenoid valve operating sounds will not be audible.

Vehicle Response In Antilock Mode

During antilock braking, the hydraulic control unit solenoid valves cycle rapidly in response to antilock electronic control unit signals.

The driver will experience a pulsing sensation within the vehicle as the solenoids decrease, hold, or increase pressure as needed. Brake pedal pulsing will also be noted and is a **normal condition.**

Steering Response

A modest amount of steering input is required during extremely high deceleration braking, or when braking on differing traction surfaces. An example of differing traction surfaces would be when the left side wheels are on ice and the right side wheels are on dry pavement.

Owner Induced Faults

Driving away with the parking brakes still applied will cause warning light illumination. Pumping the brake pedal will also generate a system fault and interfere with ABS system operation.

ANTILOCK ECU AND HCU DIAGNOSIS

An ECU or HCU fault can only be determined through testing with the DRB scan tool. Do not replace either component unless a fault is actually indicated.

SERVICE BRAKE DIAGNOSIS

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GENERAL INFORMATION

The diagnosis information in this section covers service brake components which include:

- disc brake calipers
- disc brakeshoes
- drum brake wheel cylinders
- drum brakeshoes and brake drums
- drum brake support plates
- parking brake mechanism
- master cylinder/combination valve
- vacuum power brake booster
- brake pedal and brakelight switch
- brake warning light

DIAGNOSIS PROCEDURES

Service brake diagnosis involves determining if a problem is related to a mechanical, hydraulic or vacuum operated component. A preliminary brake check, followed by road testing and component inspection are needed to determine a problem cause.

Road testing will either verify proper brake operation or confirm the existence of a problem. Component inspection will, in most cases, identify the actual part responsible for a problem.

The first diagnosis step is the preliminary brake check. This involves inspecting fluid level, parking brake action, wheel and tire condition, checking for obvious leaks or component damage and testing brake pedal response. A road test will confirm or deny the existence of a problem. The final diagnosis procedure involves road test analysis and a visual inspection of brake components.

PRELIMINARY BRAKE CHECK

(1) If amber ABS light is illuminated, refer to ABS Brake System Diagnosis. If red warning light is illuminated, or if neither warning light is illuminated, continue with brake check.

(2) Inspect condition of tires and wheels. Damaged wheels and worn, damaged, or underinflated tires can cause pull, shudder, tramp and a condition similar to grab.

(3) If complaint was based on noise when braking, check suspension components. Jounce front and rear of vehicle and listen for noise that might be caused by loose, worn, or damaged suspension or steering components.

(4) Inspect brake fluid level:

(a) If vehicle has one-piece master cylinder, fluid level should be within 6 mm (1/4 in.) of reservoir rim.

(b) If vehicle has nylon reservoir with single filler cap, correct level is to FULL mark on side of reservoir. Acceptable level is between FULL and ADD marks.

(c) Remember that fluid level in the reservoir compartments will decrease in proportion to normal lining wear. However, if fluid level is abnormally low, look for leaks at calipers, wheel cylinders, brakelines and master cylinder.

(5) Inspect brake fluid condition:

(a) Fluid should be free of foreign material. **Note that brake fluid tends to darken over time. This is normal and should not be mistaken for contamination. If fluid is clear of foreign material, it is OK.**

(b) If fluid is highly discolored, or appears to contain foreign material, drain out a sample with a clean suction gun. Pour sample in a glass container and note condition described in step (c).

(c) If fluid separates into layers, obviously contains oil, or a substance other than brake fluid, system seals and cups will have to be replaced and hydraulic system flushed.

(6) Check parking brake operation. Verify free movement and full release of cables and foot pedal or

hand lever. Also note if vehicle was being operated with parking brake partially applied (this will cause red light to remain on).

(7) Check brake pedal operation. Verify that pedal does not bind and has adequate free play. If pedal lacks free play, check pedal and power booster for being loose or for bind condition. Do not road test until condition is corrected.

(8) If components inspected look OK, road test vehicle.

ROAD TESTING

(1) If amber warning light is on, problem is with antilock system component. Refer to antilock diagnosis section.

(2) If red warning light is not on, proceed to step (4).

(3) If red warning light is on, proceed as follows:

(a) See if parking brakes are applied. If brakes are applied, release them and proceed to step (4).

(b) Note if brake pedal is abnormally low. If pedal is definitely low and red light is still on, check front/rear hydraulic circuits for leak. **Do not road test. Inspect and repair as needed.**

(4) Check brake pedal response with transmission in Neutral and engine running. Pedal should remain firm under steady foot pressure. If pedal falls away, do not road test as problem is in master cylinder, or HCU on ABS models. If pedal holds firm, proceed to next step.

(5) During road test, make normal and firm brake stops in 25-35 mph range. Note faulty brake operation such as hard pedal, pull, grab, drag, noise, fade, etc.

(6) Return to shop and inspect brake components. Refer to inspection and diagnosis information.

COMPONENT INSPECTION

Fluid leak points and dragging brake units can usually be located without removing any components. The area around a leak point will be wet with fluid. The components at a dragging brake unit (wheel, tire, rotor) will be quite warm or hot to the touch.

Other brake problem conditions will require component removal for proper inspection. Raise the vehicle and remove the necessary wheels for better visual access.

During component inspection, pay particular attention to heavily rusted/corroded brake components (e.g. rotors, caliper pistons, brake return/holddown springs, support plates, etc.).

Heavy accumulations of rust may be covering severe damage to a brake component. It is wise to remove surface rust in order to accurately determine the depth of rust penetration and damage. Light surface rust is fairly normal and not a major concern (as long as it is removed). However, heavy rust buildup, especially on high mileage vehicles may cover structural damage to such important components as brakelines, rotors, support plates, and brake boosters. Refer to the wheel brake service procedures in this group for more information.

BRAKE WARNING LIGHT OPERATION

The red brake warning light will illuminate under the following conditions:

- for 2-3 seconds at startup as part of normal bulb check
- when parking brakes are applied
- low pedal caused by leak in front/rear brake hydraulic circuit

If the red light remains on after startup, first verify that the parking brakes are fully released. Then check pedal action and fluid level. A red light plus low pedal indicates the pressure differential switch and valve have been actuated due to a system leak.

On models with ABS brakes, the amber warning light only illuminates when an ABS malfunction has occurred. The ABS light operates independently of the red warning light.

PEDAL FALLS AWAY

A brake pedal that falls away under steady foot pressure is generally the result of a system leak. The leak point could be at a brakeline, fitting, hose, wheel cylinder, or caliper. Internal leakage in the master cylinder caused by worn or damaged piston cups, may also be the problem cause.

If leakage is severe, fluid will be evident at or around the leaking component. However internal leakage in the master cylinder will not be physically evident. Refer to the cylinder test procedure at the end of this section.

LOW PEDAL

If a low pedal is experienced, pump the pedal several times. If the pedal comes back up, worn lining and worn rotors or drums are the most likely causes. However, if the pedal remains low and the red warning light is on, the likely cause is a leak in the hydraulic system.

A decrease in master cylinder fluid level may only be the result of normal lining wear. Fluid level will drop somewhat as lining wear occurs. It is a result of the outward movement of caliper and wheel cylinder pistons to compensate for normal wear.

SPONGY PEDAL

Air in the system is the usual cause of a spongy pedal. Brake drums machined way beyond allowable limits (too thin), or substandard brake lines and hoses can also cause a condition similar to a spongy

pedal. The proper course of action is to bleed the system, or replace thin drums and suspect quality brake lines and hoses.

HARD PEDAL OR HIGH PEDAL EFFORT

A hard pedal or high pedal effort may be due to lining that is water soaked, contaminated, glazed, or badly worn. The power booster or check valve could also be faulty. Test the booster and valve as described in this section.

BRAKE DRAG

Brake drag occurs when the lining is in constant contact with the rotor or drum. Drag can occur at one wheel, all wheels, fronts only, or rears only. It is a product of incomplete brakeshoe release. Drag can be minor or severe enough to overheat the linings, rotors and drums. A drag condition also worsens as temperature of the brake parts increases.

Brake drag also has a direct effect on fuel economy. If undetected, minor brake drag can be misdiagnosed as an engine or transmission/torque converter problem.

Minor drag will usually cause slight surface charring of the lining. It can also generate hard spots in rotors and drums from the overheat/cool down process. In most cases, the rotors, drums, wheels and tires are quite warm to the touch after the vehicle is stopped.

Severe drag can char the brake lining all the way through. It can also distort and score rotors and drums to the point of replacement. The wheels, tires and brake components will be extremely hot. In severe cases, the lining may generate smoke as it chars from overheating.

An additional cause of drag involves the use of incorrect length caliper mounting bolts. Bolts that are too long can cause a partial apply condition. The correct caliper bolts have a shank length of 67 mm (2.637 in.), plus or minus 0.6 mm (0.0236 in.). Refer to the Disc Brake service section for more detail on caliper bolt dimensions and identification.

Some common causes of brake drag are:

- loose or damaged wheel bearing
- seized or sticking caliper or wheel cylinder piston
- caliper binding on bolts or slide surfaces
- wrong length caliper mounting bolts (too long)
- loose caliper mounting bracket
- distorted rotor, brake drum, or shoes
- brakeshoes binding on worn/damaged support plates
- severely rusted/corroded components
- misassembled components.

If brake drag occurs at all wheels, the problem may be related to a blocked master cylinder compensator port or faulty power booster (binds-does not release). The condition will worsen as brake temperature increases.

The brakelight switch can also be a cause of drag. An improperly mounted or adjusted brakelight switch can prevent full brake pedal return. The result will be the same as if the master cylinder compensator ports are blocked. The brakes would be partially applied causing drag.

BRAKE FADE

Brake fade is a product of overheating caused by brake drag. However, overheating and subsequent fade can also be caused by riding the brake pedal, making repeated high deceleration stops in a short time span, or constant braking on steep roads. Refer to the Brake Drag information in this section for causes.

PEDAL PULSATION (NON-ABS BRAKES ONLY)

Pedal pulsation is caused by parts that are loose, or beyond tolerance limits. This type of pulsation is constant and will occur every time the brakes are applied.

Disc brake rotors with excessive lateral runout or thickness variation, or out of round brake drums are the primary causes of pulsation.

On vehicles with ABS brakes, remember that pedal pulsation is normal during antilock mode brake stops. If pulsation occurs during light to moderate brake stops, a standard brake part is either loose, or worn beyond tolerance.

BRAKE PULL

A front pull condition could be the result of:

- contaminated lining in one caliper
- seized caliper piston
- binding caliper
- wrong caliper mounting bolts (too long)
- loose caliper
- loose or corroded mounting bolts
- improper brakeshoes
- damaged rotor
- incorrect wheel bearing adjustment (at one wheel)

A worn, damaged wheel bearing or suspension component are further causes of pull. A damaged front tire (bruised, ply separation) can also cause pull. Wrong caliper bolts (too long) will cause a partial apply condition and pull if only one caliper is involved.

A common and frequently misdiagnosed pull condition is where direction of pull changes after a few stops. The cause is a combination of brake drag followed by fade at the dragging brake unit.

As the dragging brake overheats, efficiency is so reduced that fade occurs. If the opposite brake unit is still functioning normally, its braking effect is magni-

fied. This causes pull to switch direction in favor of the brake unit that is functioning normally.

When diagnosing a change in pull condition, remember that pull will return to the original direction if the dragging brake unit is allowed to cool down (and is not seriously damaged).

REAR BRAKE GRAB

Rear grab (or pull) is usually caused by contaminated lining, bent or binding shoes and support plates, or improperly assembled components. This is particularly true when only one rear wheel is involved. However, when both rear wheels are affected, the master cylinder could be at fault.

BRAKES DO NOT HOLD AFTER DRIVING THROUGH DEEP WATER PUDDLES

This condition is caused by water soaked lining. If the lining is only wet, it can be dried by driving with the brakes lightly applied for a mile or two. However, if the lining is both wet and dirty, disassembly and cleaning will be necessary.

CONTAMINATED BRAKELINING

Brakelining contaminated by water is salvageable. The lining can either be air dried or dried using heat.

In cases where brakelining is contaminated by oil, grease, or brake fluid, the lining should be replaced. Replacement is especially necessary when fluids/lubricants have actually soaked into the lining material. However, grease or dirt that gets onto the lining surface (from handling) during brake repairs, can be cleaned off. Spray the lining surface clean with Mopar brake cleaner.

BRAKE FLUID CONTAMINATION

There are two basic causes of brake fluid contamination. The first involves allowing dirt, debris, or other materials to enter the cylinder reservoirs when the cover is off. The second involves adding non-recommended fluids to the cylinder reservoirs.

Brake fluid contaminated with only dirt, or debris usually retains a normal appearance. In some cases, the foreign material will remain suspended in the fluid and be visible. The fluid and foreign material can be removed from the reservoir with a suction gun but only if the brakes have not been applied. If the brakes are applied after contamination, system flushing will be required. The master cylinder may also have to be disassembled, cleaned and the piston seals replaced. Foreign material lodged in the reservoir compensator/return ports can cause brake drag by restricting fluid return after brake application.

Brake fluid contaminated by a non-recommended fluid may appear discolored, milky, oily looking, or foamy. However, remember that brake fluid will darken in time and occasionally be cloudy in appearance. These are normal conditions and should not be mistaken for contamination.

If some type of oil has been added to the system, the fluid will separate into distinct layers. To verify this, drain off a sample with a clean suction gun. Then pour the sample into a glass container and observe fluid action. If the fluid separates into distinct layers, it is definitely contaminated.

The only real correction for contamination by non-recommended fluid is to flush the entire hydraulic system and replace all the seals.

BRAKE NOISE

Squeak/Squeal

Factory installed brakelining is made from asbestos free materials. These materials have different operating characteristics than previous lining material. Under certain conditions, asbestos free lining may generate some squeak, groan or chirp noise. This noise is considered normal and does not indicate a problem. The only time inspection is necessary, is when noise becomes constant or when grinding, scraping noises occur.

Constant brake squeak or squeal may be due to linings that are wet or contaminated with brake fluid, grease, or oil. Glazed linings, rotors/drums with hard spots, and dirt/foreign material embedded in the brake lining also cause squeak. Loud squeak, squeal, scraping, or grinding sounds are a sign of severely worn brake lining. If the lining has worn completely through in spots, metal-to-metal contact occurs.

Thump/Clunk

Thumping or clunk noises during braking are frequently **not** caused by brake components. In many cases, such noises are caused by loose or damaged steering, suspension, or engine components. However, calipers that bind on the slide surfaces can generate a thump or clunk noise. In addition, worn out, improperly adjusted, or improperly assembled rear brakeshoes can also produce a thump noise.

Chatter/Shudder

Brake chatter, or shudder is usually caused by loose or worn components, or glazed/burnt lining. Rotors with hard spots can also contribute to chatter. Additional causes of chatter are out of tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.

WHEEL AND TIRE PROBLEMS

Some conditions attributed to brake components may actually be caused by a wheel or tire problem.

A damaged wheel can cause shudder, vibration and pull. A worn or damaged tire can also cause pull.

Severely worn tires with very little tread left can

produce a condition similar to grab as the tire loses and recovers traction.

Flat-spotted tires can cause vibration and wheel tramp and generate shudder during brake operation.

A tire with internal damage such as a severe bruise or ply separation can cause vibration and pull. The pull will be magnified when braking.

DIAGNOSING PARKING BRAKE MALFUNCTIONS

Adjustment Mechanism

Parking brake adjustment is controlled by a cable tensioner mechanism. The cable tensioner, once adjusted at the factory, will not need further attention under normal circumstances. There are only two instances when adjustment is required. The first is when a new tensioner, or cables have been installed. And the second, is when the tensioner and cables are disconnected for access to other brake components.

Parking Brake Switch And Warning Light Illumination

The parking brake switch on the lever, or foot pedal, is in circuit with the red warning light. The switch will illuminate the red light only when the parking brakes are applied. If the light remains on after parking brake release, the switch or wires are faulty, or cable tensioner adjustment is incorrect.

If the red light comes on while the vehicle is in motion and brake pedal height decreases, a fault has occurred in the front or rear brake hydraulic system.

Parking Brake problem Causes

In most cases, the actual cause of an improperly functioning parking brake (too loose/too tight/wont hold), can be traced to a drum brake component.

The leading cause of improper parking brake operation, is excessive clearance between the brakeshoes and the drum surface. Excessive clearance is a result of: lining and/or drum wear; oversize drums; or inoperative shoe adjuster components.

Excessive parking brake lever travel (sometimes described as a loose lever or too loose condition), is the result of worn brakeshoes/drums, improper brakeshoe adjustment, or incorrectly assembled brake parts.

A “too loose” condition can also be caused by inoperative brakeshoe adjusters. If the adjusters are misassembled, they will not function. In addition, since the adjuster mechanism only works during reverse stops, it is important that complete stops be made. The adjuster mechanism does not operate when rolling stops are made in reverse. The vehicle must be brought to a complete halt before the adjuster lever will turn the adjuster screw.

A condition where the parking brakes do not hold, will most probably be due to a wheel brake component.

Items to look for when diagnosing a parking brake problem, are:

- rear brakeshoe wear or adjuster problem
- rear brake drum wear
- brake drums machined beyond allowable diameter (oversize)
- parking brake front cable not secured to lever
- parking brake rear cable seized
- parking brake strut reversed
- parking brake strut not seated in both shoes
- parking brake lever not seated in secondary shoe
- parking brake lever or brakeshoe bind on support plate
- brakeshoes reversed
- adjuster screws seized
- adjuster screws reversed
- holddown or return springs misassembled or lack tension
- wheel cylinder pistons seized

Brake drums that are machined oversize are difficult to identify without inspection. If oversize drums are suspected, diameter of the braking surface will have to be checked with an accurate drum gauge. Oversize drums will cause low brake pedal and lack of parking brake holding ability.

Improper parking brake strut and lever installation will result in unsatisfactory parking brake operation. Intermixing the adjuster screws will cause drag, bind and pull along with poor parking brake operation.

Parking brake adjustment and parts replacement procedures are described in the Parking Brake section.

MASTER CYLINDER/POWER BOOSTER TEST

(1) Start engine and check booster vacuum hose connections. Hissing noise indicates vacuum leak. Correct any vacuum leak before proceeding.

(2) Stop engine and shift transmission into Neutral.

(3) Pump brake pedal until all vacuum reserve in booster is depleted.

(4) Press and hold brake pedal under light foot pressure.

(a) If pedal holds firm, proceed to step (5).

(b) If pedal does not hold firm and falls away, master cylinder is faulty due to internal leakage. Overhaul or replace cylinder.

(5) Start engine and note pedal action.

(a) If pedal falls away slightly under light foot pressure then holds firm, proceed to step (6).

(b) If no pedal action is discernible, or hard pedal is noted, power booster or vacuum check valve is faulty. Install known good check valve and repeat steps (2) through (5).

(6) Rebuild booster vacuum reserve as follows: Release brake pedal. Increase engine speed to 1500 rpm, close throttle and immediately turn off ignition.

(7) Wait a minimum of 90 seconds and try brake action again. Booster should provide two or more vacuum assisted pedal applications. If vacuum assist is not provided, perform booster and check valve vacuum tests.

POWER BOOSTER CHECK VALVE TEST

(1) Disconnect vacuum hose from check valve.

(2) Remove check valve and seal from booster (Fig. 1).

(3) Hand operated vacuum pump can be used for test (Fig. 2).

(4) Apply 15-20 inches vacuum at large end of check valve (Fig. 1).

(5) Vacuum should hold steady. If gauge on pump indicates any vacuum loss, valve is faulty and must be replaced.

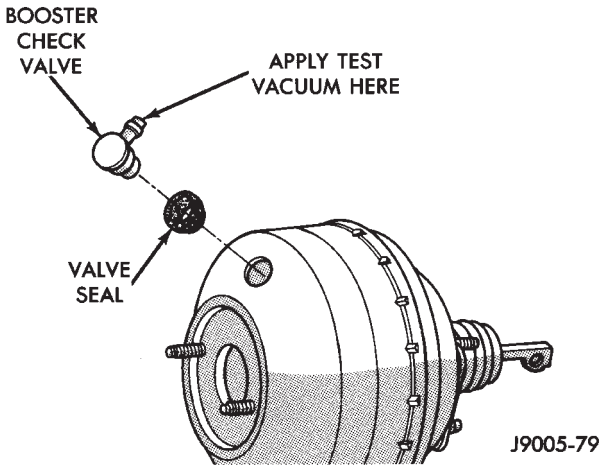

Fig. 1 Typical Vacuum Check Valve And Seal

POWER BOOSTER VACUUM TEST

(1) Connect a vacuum gauge to the booster check valve with a short length of hose and tee fitting (Fig. 3).

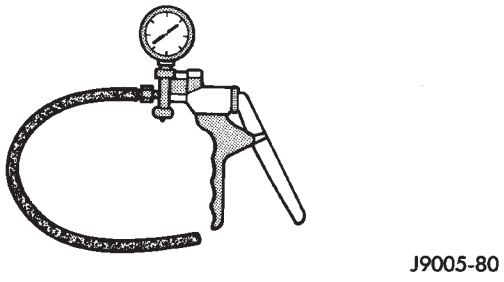

Fig. 2 Typical Hand Operated Vacuum Pump

(2) Start and run engine at idle speed for one minute.

(3) Pinch hose shut between vacuum source and check valve (Fig. 3).

(4) Stop engine and observe vacuum gauge.

(5) If vacuum drops more than one inch HG (33 millibars) within 15 seconds, booster diaphragm or check valve is faulty.

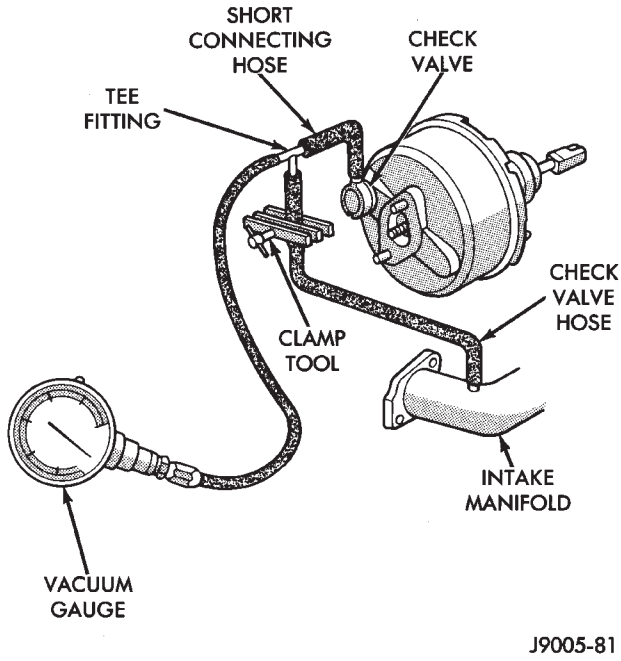

Fig. 3 Booster Vacuum Test Connections

BRAKE FLUID—BRAKE BLEEDING—BRAKELINES AND HOSES

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RECOMMENDED BRAKE FLUID

Recommended brake fluid for Jeep vehicles is Mopar brake fluid, or an equivalent fluid meeting SAE J1703 and DOT 3 standards. The recommendation applies to models with standard or ABS brakes.

Use new brake fluid to top off the master cylinder or refill the system. Never use reclaimed fluid, fluid not meeting the SAE/DOT standards or fluid from an unsealed container. Do not use fluid from any container that has been left open for any length of time. Fluid in open containers can absorb moisture.

BRAKE FLUID LEVEL

Always clean the master cylinder reservoir and cover or cap before adding fluid. This avoids having dirt from the cap or reservoir exterior fall into the fluid.

If the vehicle has a one piece master cylinder, correct fluid level is to within 6 mm (1/4 in.) of the reservoir rim (Fig. 1).

If the vehicle has a plastic reservoir with a single cap, preferred fluid level is to the FULL mark (Fig. 2).

CAUTION: Do not allow brake fluid to contact painted surfaces. Fluid spills must be cleaned up immediately as brake fluid can loosen and lift paint.

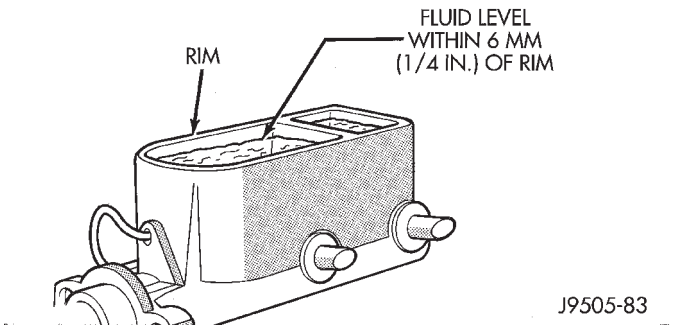


Fig. 1 Correct Fluid Level (4-Cylinder Models)

BRAKE FLUID CONTAMINATION

Oil in the fluid will cause brake system rubber seals to soften and swell. The seals may also become porous and begin to deteriorate.

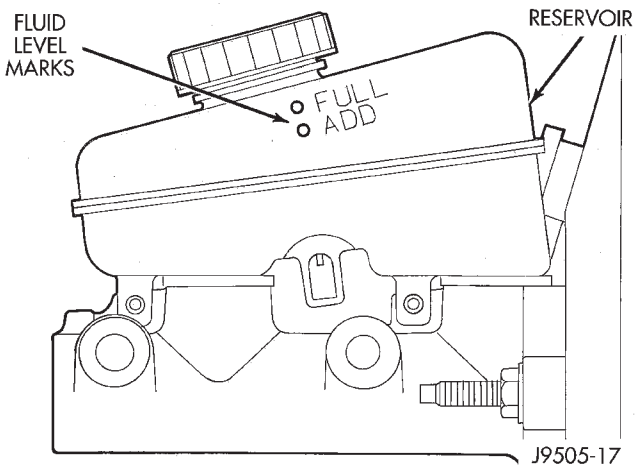


Fig. 2 Correct Fluid Level (All Except 4-Cylinder Models)

If fluid contamination is suspected, drain off a sample from the master cylinder. A suction gun or similar device can be used for this purpose.

Empty the drained fluid into a glass container. Contaminants in the fluid will cause the fluid to separate into distinct layers. If contamination has occurred, the system rubber seals, hoses and cups must be replaced and the system thoroughly flushed with clean brake fluid.

BRAKE BLEEDING RECOMMENDATIONS

- Use Mopar DOT 3 brake fluid, or an equivalent meeting SAE/DOT standards J1703-F and DOT 3, to fill and bleed the system.
- Bleeding can be performed manually, or with vacuum or pressure equipment. Vacuum and pressure bleeding equipment are both available. Both types are effective but should be used only as described in the manufacturers instructions.
- Do not allow the master cylinder to run out of fluid when bleeding the brakes. An empty cylinder will allow additional air to be drawn into the system. Check fluid level frequently during bleed operations.
- Do not pump the brake pedal at any time while bleeding. Air in system will be compressed into small

bubbles that are distributed throughout the hydraulic system. This will make extra bleeding operations necessary.

- Bleed only one wheel brake unit at a time and use a bleed hose to bleed each wheel brake unit (Fig. 3).
- Attach one end of bleed hose to the bleed screw and insert the opposite hose end in a glass container partially filled with brake fluid (Fig. 3). A glass container makes it easier to see air bubbles as they exit the bleed hose. Be sure the end of the bleed hose is immersed in fluid; this prevents air from being drawn back into cylinder and brakeline.

BRAKE BLEEDING (WITH STANDARD BRAKES)

(1) If master cylinder has been overhauled or a new cylinder will be installed, bleed cylinder on bench before installation. This shortens time needed to bleed system and ensures proper cylinder operation.

(2) Wipe master cylinder reservoir and cap clean with shop towels. Then fill cylinder reservoir with Mopar brake fluid.

(3) Open all caliper and wheel cylinder bleed screws. Close bleed screws after fluid begins flowing from each bleed screw.

(4) Top off master cylinder reservoir again.

(5) Bleed master cylinder and combination valve at brakeline fittings. Have helper operate brake pedal while bleeding cylinder and valve.

(6) Bleed wheel brakes in recommended sequence which is: right rear; left rear; right front; left front. Bleed procedure is as follows:

(a) Open caliper or wheel cylinder bleed fitting 1/2 to 3/4 turn.

(b) Have helper depress and hold brake pedal to floorpan.

(c) Tighten bleed fitting and have helper release brake pedal. Continue bleeding operation until fluid entering bleed container is clear and free of bubbles.

(d) Repeat bleeding operation at remaining wheel brake units.

(7) Top off master cylinder fluid level and verify proper brake operation before moving vehicle.

BRAKE BLEEDING (WITH ABS BRAKES)

ABS system bleeding requires conventional bleeding methods plus use of the DRB scan tool. The procedure involves performing a conventional bleed, followed by use of the scan tool to cycle and bleed the HCU pump and solenoids. A second conventional bleed procedure is then required remove any air remaining in the system.

(1) If a new master cylinder is to be installed, bleed cylinder on bench before installing it in vehicle. Refer to procedure in section covering master cylinder service.

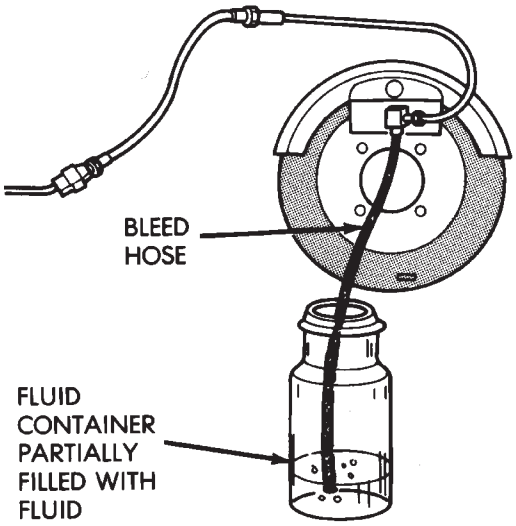


Fig. 3 Typical Bleed Hose And Fluid Container

(2) Wipe master cylinder reservoir and cap clean before removing cap. This avoids having dirt fall into fluid. Then fill reservoir with Mopar brake fluid.

(3) Perform conventional brake bleed as described in steps (4) and (5).

(4) Bleed master cylinder and combination valve at brakeline fittings. Have helper depress and release brake pedal while bleeding cylinder and valve.

(5) Bleed wheel brakes in recommended sequence which is: right rear; left rear; right front; left front. Bleed procedure is as follows:

(a) Attach bleed hose to caliper bleed screw. Immerse end of hose in glass container partially filled with brake fluid. Be sure hose end is submerged in fluid (Fig. 3).

(b) Have helper depress and hold brake pedal to floorpan.

(c) Open bleed screw 1/2 turn. Close bleed screw when brake pedal contacts floorpan. **Do not pump brake pedal at any time while bleeding. This compresses air into small bubbles which are distributed throughout system. Additional bleeding operations will then be necessary to remove all trapped air from the system.**

(d) Repeat bleeding operation at each wheel brake unit fluid entering glass container is free of air bubbles. Check reservoir fluid level frequently and add fluid if necessary.

(6) Perform HCU bleed procedure with DRB scan tool as follows:

(a) Connect scan tool to ABS diagnostic connector. Connector is under carpet at front of console, just under instrument panel center bezel.

(b) Select CHASSIS SYSTEM, followed by TEVES ABS BRAKES, then BLEED BRAKES. When scan tool displays TEST COMPLETE, dis-

connect scan tool and proceed to next step.

(7) **Repeat** conventional bleed procedure described in steps (4) and (5).

(8) Top off master cylinder fluid level and verify proper brake operation before moving vehicle.

BRAKELINES AND HOSES

Metal brakelines and rubber brake hoses should be inspected periodically and replaced if damaged.

Rubber brake hoses should be replaced if cut, cracked, swollen, or leaking. Rubber hoses must be replaced as they are not repairable.

Steel brakelines should be inspected any time the vehicle is in for normal maintenance. This is important on high mileage vehicles. It is especially important when the vehicle is operated on roads that are salted during winter months.

Heavily rusted/corroded brake rotors, drums, support plates, and brakelines should be cleaned and carefully inspected. Heavy rust buildup can hide severe damage to a component. Severely rusted parts should be replaced if condition is suspect.

BRAKELINE CHARTS

Brakeline routing and connections are displayed in Figures 4 through 10. Routing for both right hand drive (RHD) and left hand drive (LHD) models is provided.

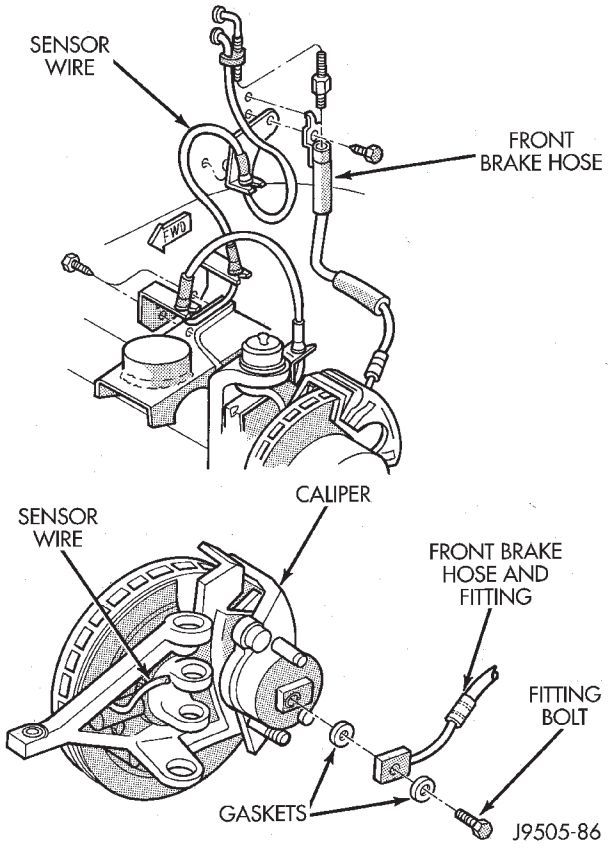


Fig. 5 Front Brake Hose And Sensor Wire Routing (RHD XJ With ABS)

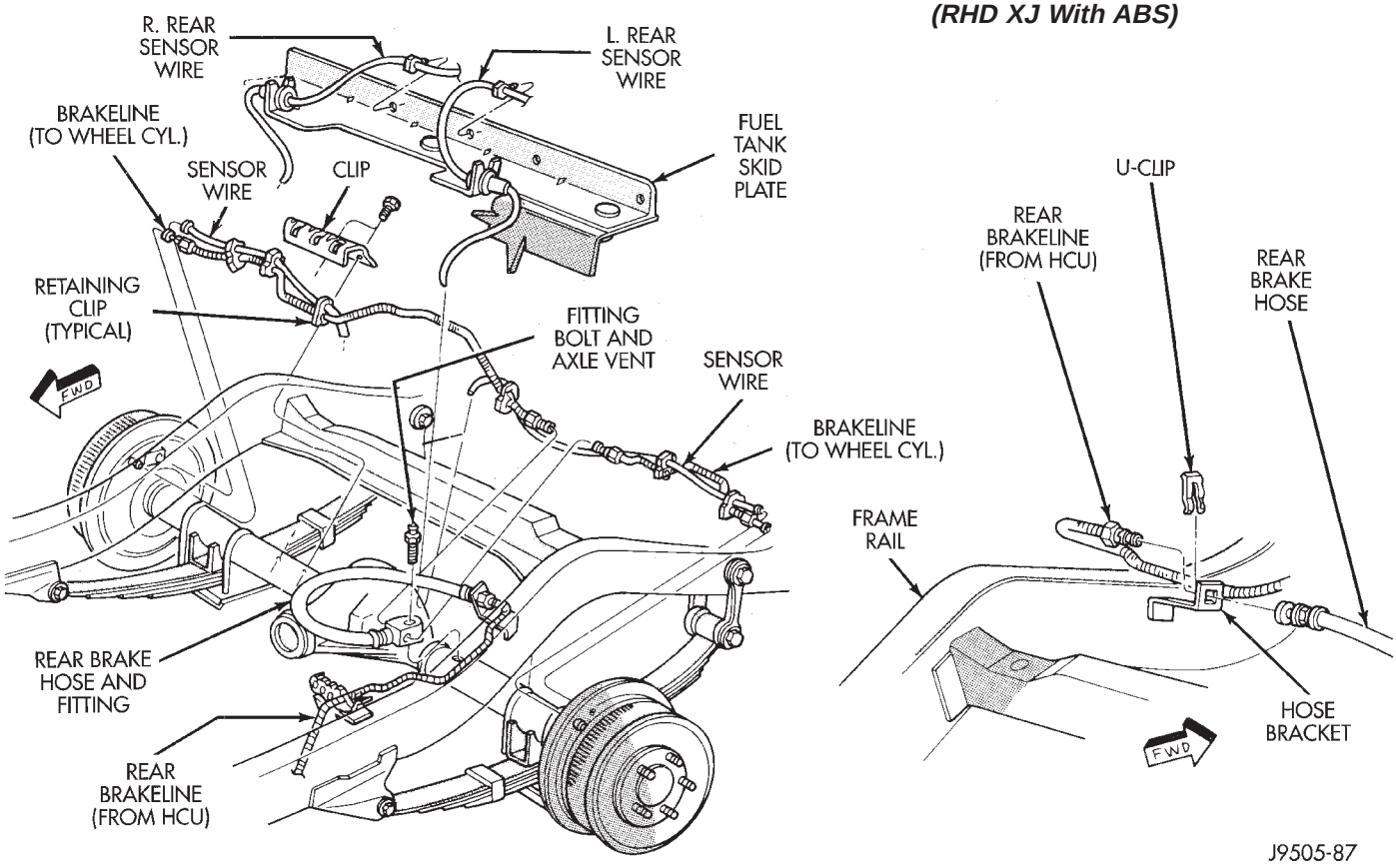


Fig. 4 Brakeline Routing (YJ With ABS)

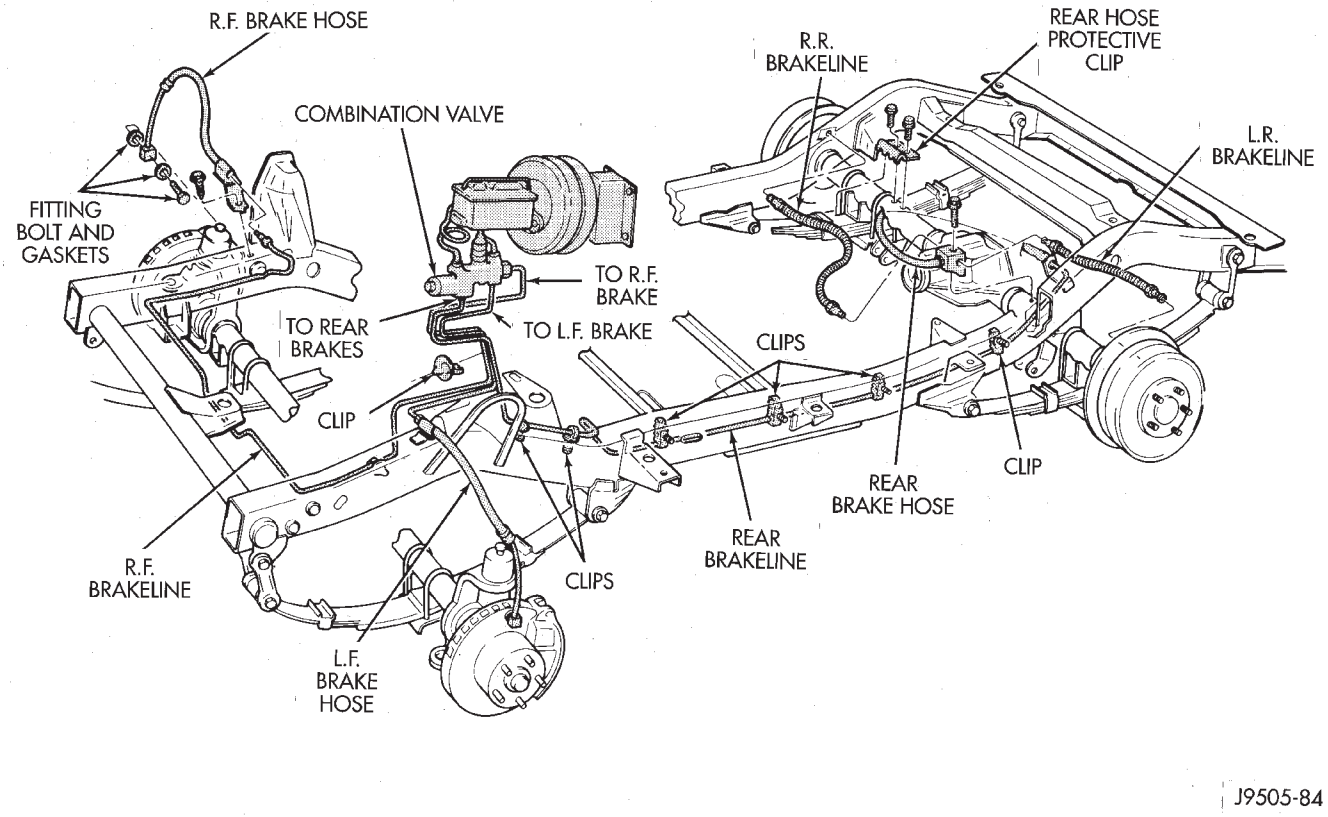


Fig. 6 Brakeline Routing (YJ With 4-Cylinder Engine)

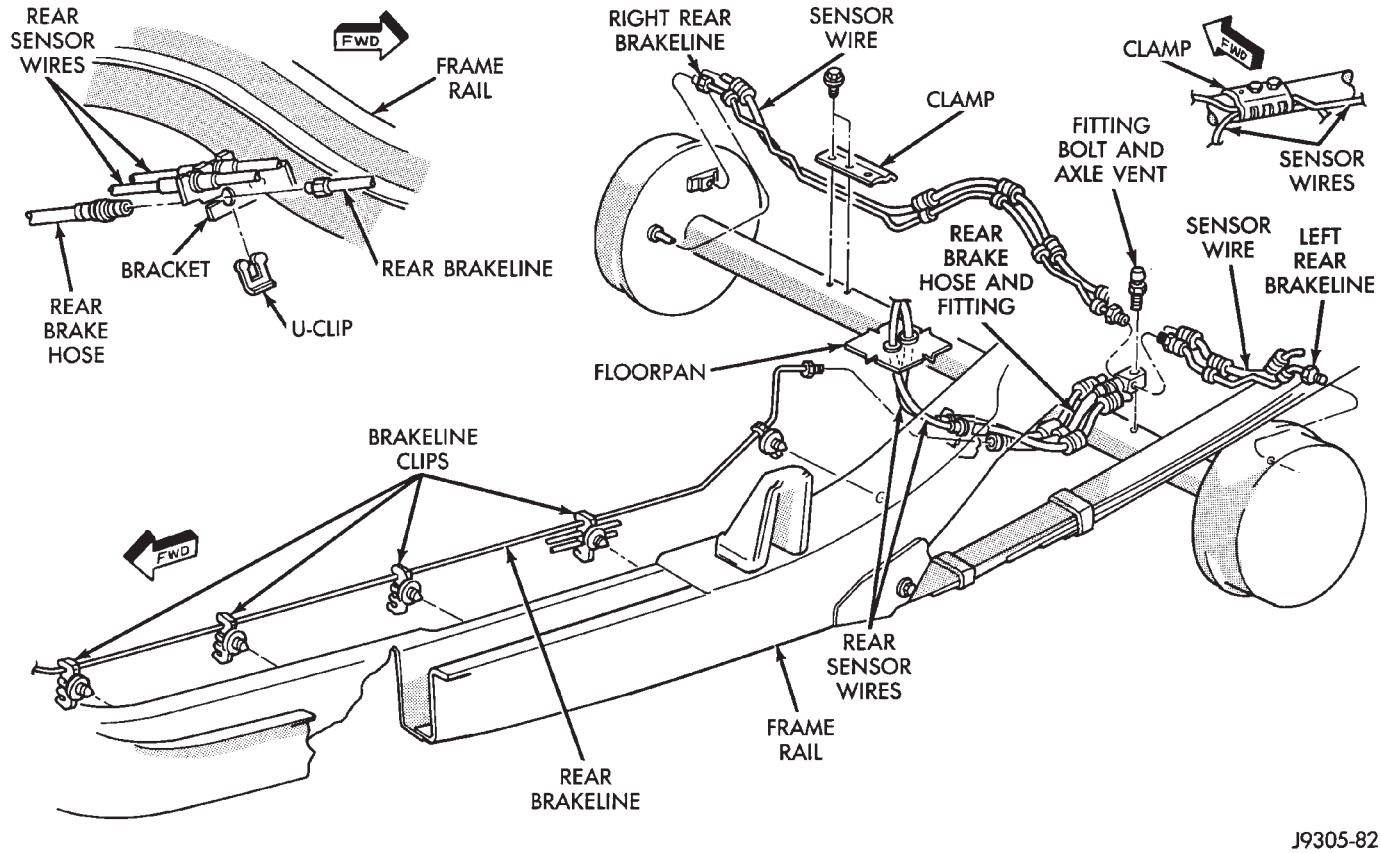


Fig. 7 Rear Brakeline Routing (XJ With ABS)

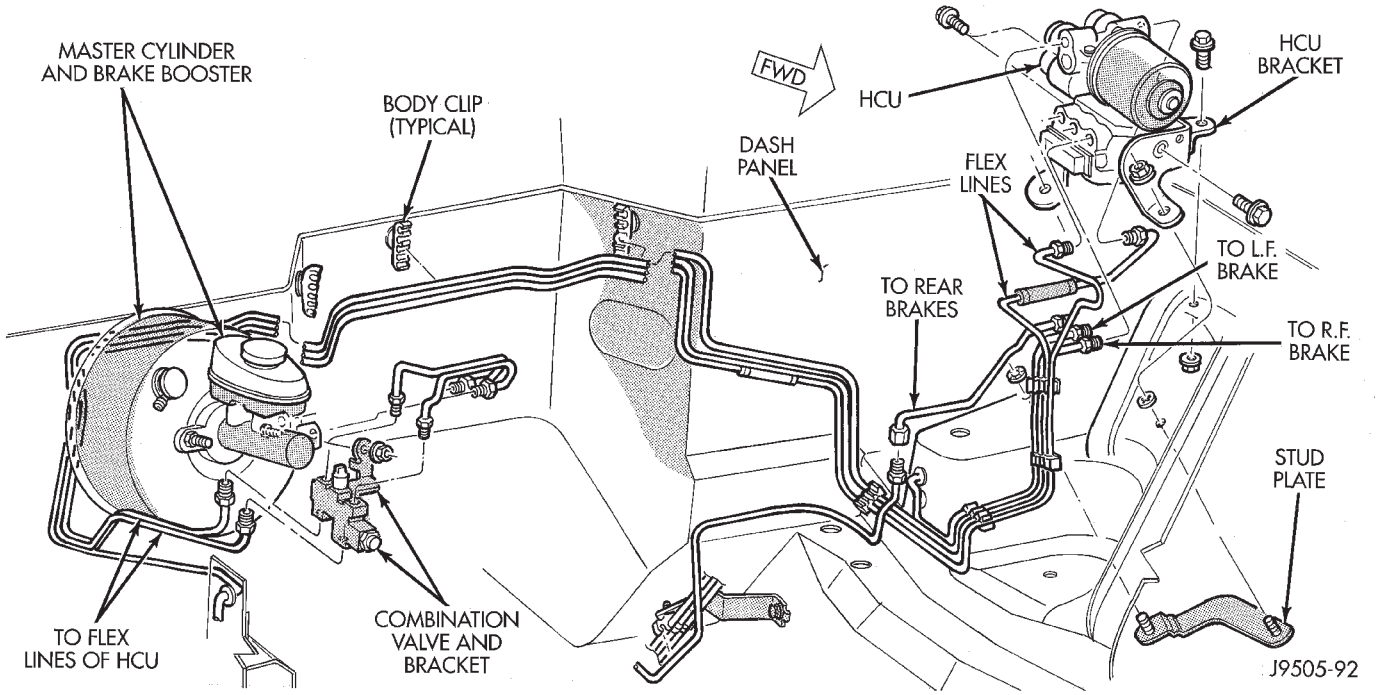


Fig. 8 Front Brakeline Routing (RHD XJ With ABS)

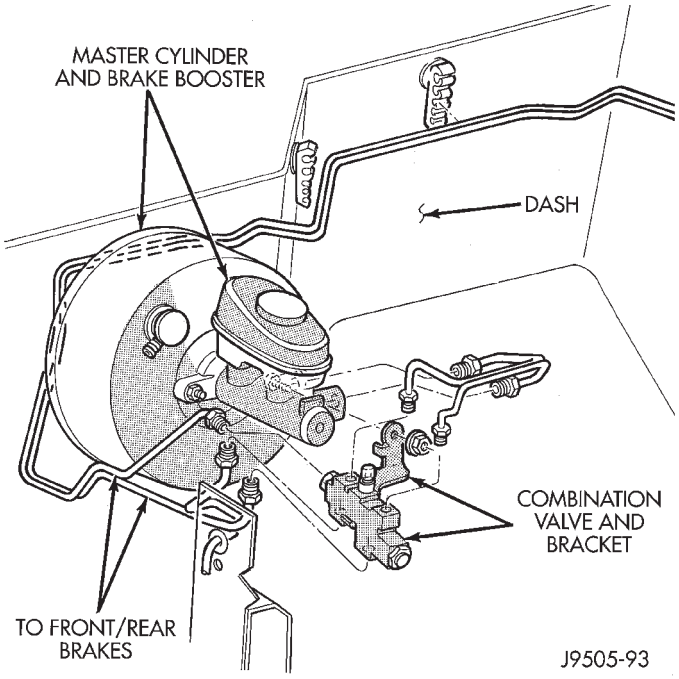


Fig. 9 Front Brakeline Routing (RHD XJ Without ABS)

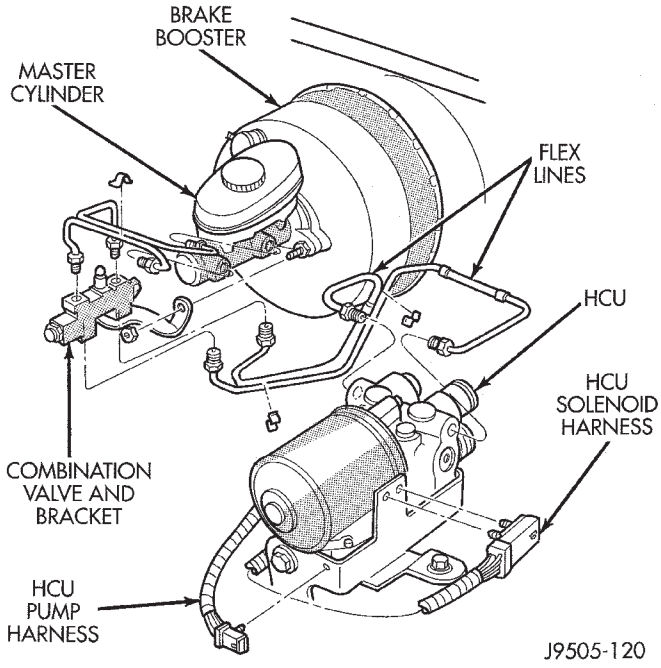


Fig. 10 Master Cylinder/Combination Valve Connection (RHD XJ With ABS)

MASTER CYLINDER—COMBINATION VALVE

INDEX

GENERAL SERVICE INFORMATION

Master Cylinder

Two different master cylinders are used. A one-piece cast aluminum cylinder is used on 4-cylinder YJ models (Fig. 1). All other models have a two-piece master cylinder with removable nylon reservoir (Fig. 2).

The two master cylinders are serviced differently. The reservoir and grommets are the only replaceable parts on the two-piece master cylinder. The one-piece master cylinder can be overhauled when necessary.

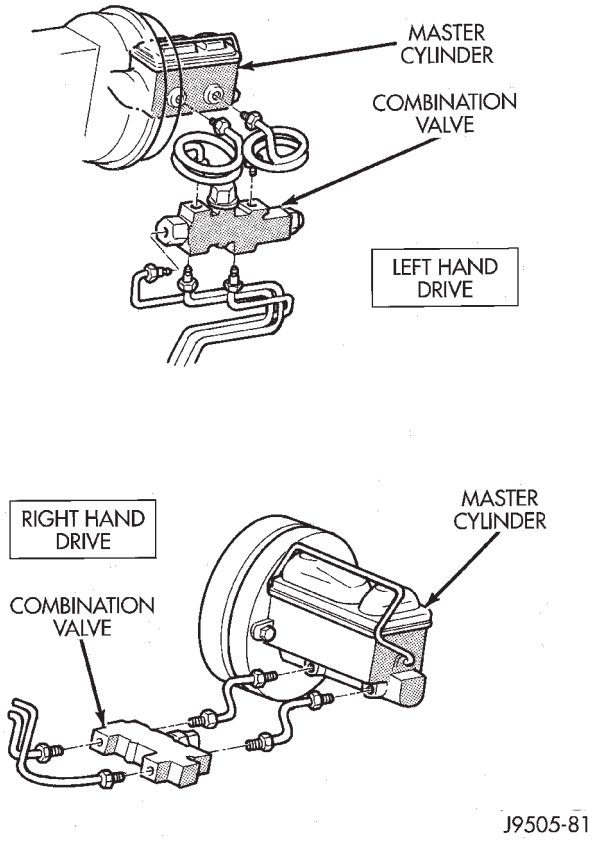


Fig. 1 Master Cylinder And Combination Valve (4-Cyl. YJ Models)

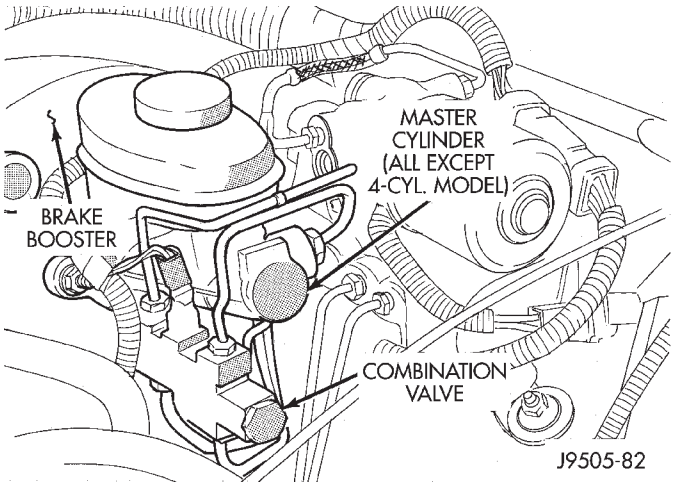


Fig. 2 Master Cylinder And Combination Valve (All Except 4-Cyl. YJ Models)

Combination Valve

A combination valve is used in all models. The valve contains a pressure differential valve and switch and a rear brake proportioning valve. The valve is not repairable. It must be replaced if diagnosis indicates this is necessary.

The pressure differential switch is connected to the brake warning light. The switch is actuated by movement of the switch valve. The switch monitors fluid pressure in the separate front/rear brake hydraulic circuits.

A decrease or loss of fluid pressure in either hydraulic circuit will cause the switch valve to shuttle to the low pressure side. Movement of the valve pushes the switch plunger upward. This action closes the switch internal contacts completing the electrical circuit to the red warning light. The switch valve will remain in an actuated position until repairs are made.

The rear proportioning valve is used to balance front-rear brake action. The valve allows normal fluid flow during moderate effort brake stops. The valve only controls (meters) fluid flow during high effort brake stops.

MASTER CYLINDER REMOVAL (NON-ABS)

(1) Remove air cleaner hose, cover and housing.

(2) Disconnect brake lines at master cylinder and combination valve.

(3) Remove nuts attaching master cylinder to booster studs.

(4) Remove master cylinder.

(5) Remove cylinder cover and drain fluid.

(6) If two-piece master cylinder reservoir requires service, refer to reservoir replacement procedure in this section.

MASTER CYLINDER INSTALLATION (NON-ABS)

(1) Bleed master cylinder on bench before installation. Refer to procedure in this section.

(2) If new two-piece master cylinder is being installed, remove plastic protective sleeve from primary piston shank. Also check condition of seal at rear of cylinder body. Reposition seal if dislodged. Replace seal if cut, or torn.

(3) Clean cylinder mounting surface of brake booster. Use shop towel wetted with brake cleaner for this purpose. Dirt, grease, or similar materials will prevent proper cylinder seating and could result in vacuum leak.

(4) Slide master cylinder onto brake booster studs.

(5) Install nuts attaching master cylinder to booster studs. Tighten nuts to 25 N·m (220 in. lbs.) torque.

(6) Connect brakelines to master cylinder and combination valve (Figs. 1 and 2).

(7) Fill and bleed brake system.

COMBINATION VALVE REPLACEMENT (NON-ABS)

The combination valve is not a repairable component. The valve is serviced as an assembly whenever diagnosis indicates replacement is necessary.

(1) Remove air cleaner cover and hose for access to valve, if necessary.

(2) Disconnect differential pressure switch wire at combination valve. Do not pull switch wire to disconnect. Unsnap connecter lock tabs to remove.

(3) Disconnect brakelines at combination valve and remove valve.

(4) Connect brakelines to replacement valve. Start line fittings by hand to avoid cross threading. Tighten fittings snug but not to required torque at this time.

(5) Connect wire to pressure differential switch.

(6) Bleed brakes.

(7) Tighten brakeline fittings to 18-24 N·m (160-210 in. lbs.) torque after bleeding.

MASTER CYLINDER OVERHAUL (4-CYLINDER MODELS)

CYLINDER DISASSEMBLY

(1) Examine cylinder cover seal. Discard seal if torn or distorted.

(2) Clamp cylinder in vise (Fig. 3).

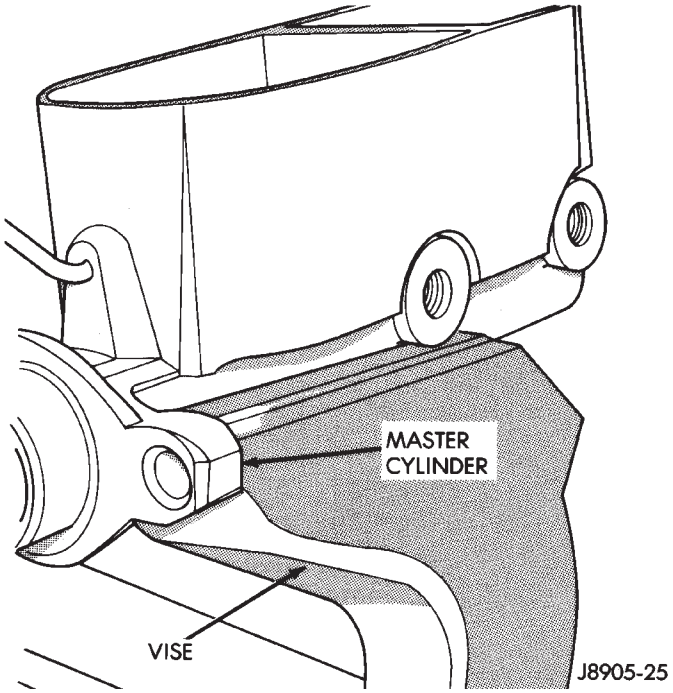


Fig. 3 Mounting Cylinder In Vise

(3) Remove piston retaining snap ring. Press and hold primary piston inward with wood dowel or similar tool. Then remove snap ring (Fig. 4).

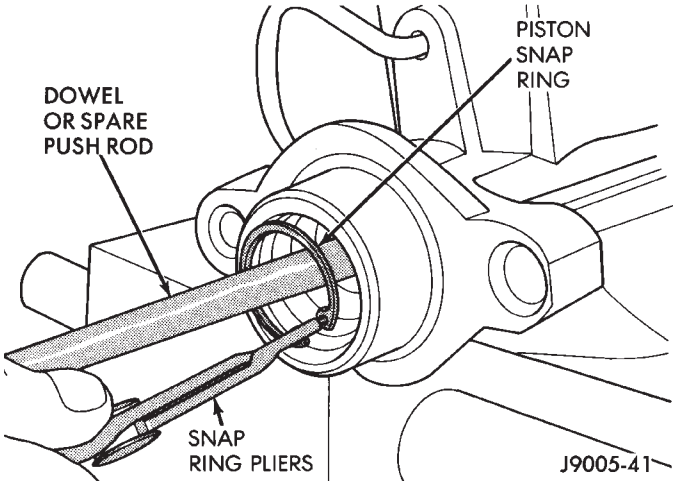


Fig. 4 Removing/Installing Piston Snap Ring

(4) Remove and discard primary piston (Fig. 5). Piston is serviced only as assembly.

(5) Remove secondary piston (Fig. 6). Apply air pressure through rear outlet port to ease piston out of bore. Cover small ports at bottom of rear reservoir with towel to prevent air leakage.

(6) Discard secondary piston. Do not disassemble piston as components are only serviced as assembly.

MASTER CYLINDER CLEANING AND INSPECTION

Clean the cylinder with Mopar brake cleaning solvent or clean brake fluid. Remove cleaning residue with compressed air.

Inspect the cylinder bore. A light discoloration of

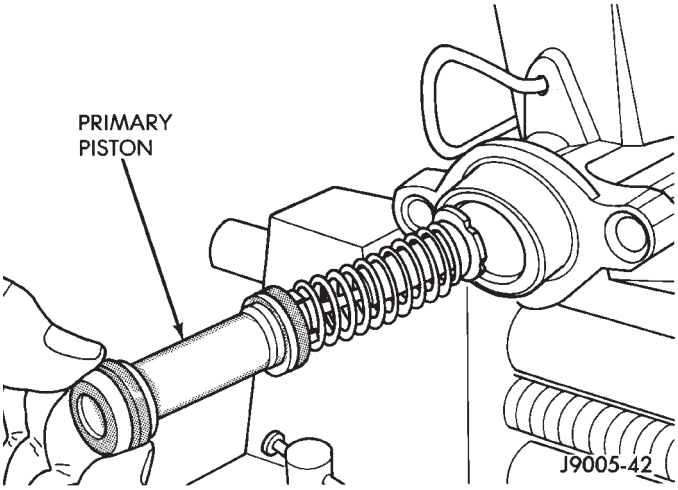


Fig. 5 Removing/Installing Primary Piston

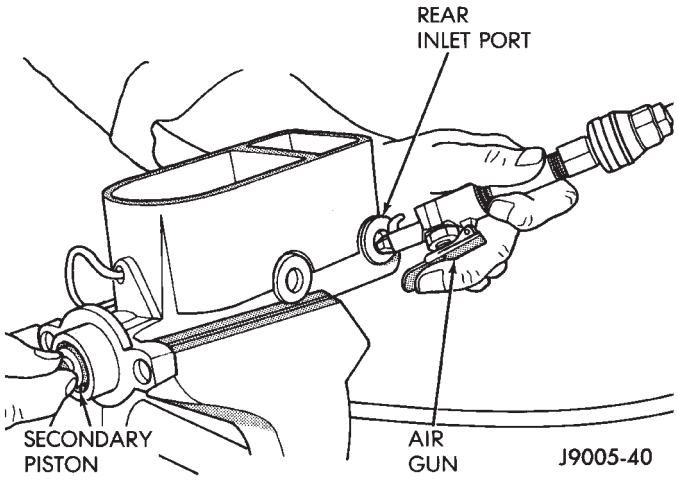


Fig. 6 Removing Secondary Piston Assembly

the bore surface is normal and acceptable but only if the surface is in good condition.

Replace the cylinder if the bore is scored, corroded, or pitted. **Do not hone the cylinder bore in an attempt to restore the surface. Replace the cylinder if the bore is corroded or if doubt exists about cylinder bore condition.**

Check the outer and inner surfaces of the cylinder for cracks or porosity, especially if wet spots were noted on the cylinder outer surface during removal and disassembly.

Inspect the cylinder cover, seal and retainer spring. Replace the seal if torn or distorted and replace the cover and spring if either part is bent or damaged in any way.

MASTER CYLINDER ASSEMBLY

(1) Coat cylinder bore and new piston assemblies with brake fluid.

(2) Install secondary piston in bore with push and turn motion (Fig. 7). **Do not use any tools to start seals into bore. Tools can cut seal and scratch bore.**

(3) Insert primary piston in bore (Fig. 5).

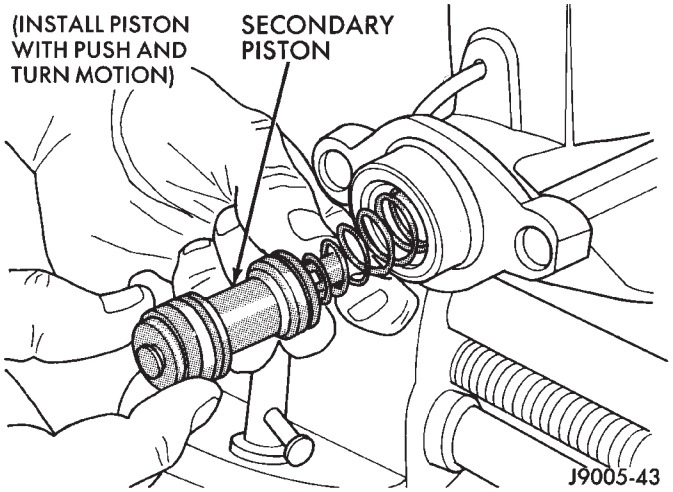


Fig. 7 Installing Secondary Piston

(4) Push primary piston inward and install snap ring (Fig. 4).

MASTER CYLINDER AND COMBINATION VALVE REMOVAL (WITH ABS)

(1) Disconnect vent hoses at air cleaner cover.

(2) Loosen clamp securing air cleaner hose to intake manifold. Use screwdriver to tap clamp loose.

(3) Remove air cleaner cover and hose. Then remove air filter from air cleaner housing (Fig. 8).

(4) Remove two bolts and one nut that secure air cleaner housing to body (Fig. 8).

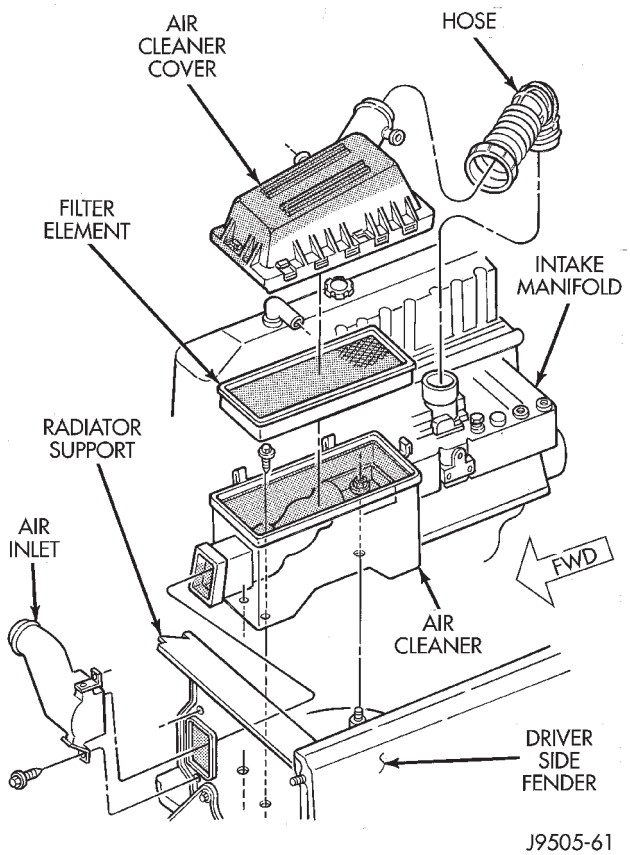


Fig. 8 Air Cleaner Components

(5) Remove air cleaner housing from engine compartment.

(6) Disconnect wire from combination valve pressure differential switch (Fig. 9). Do not pull wire to disconnect. Unsnap lock tabs on wire connecter.

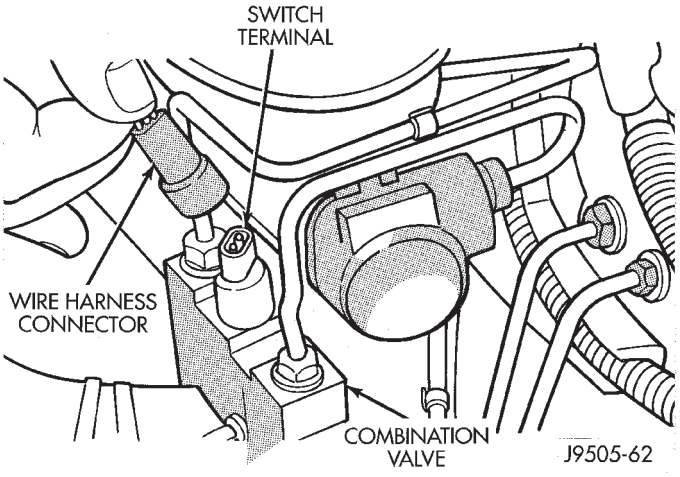


Fig. 9 Pressure Differential Switch Wire Connection

(7) Disconnect canister vacuum line at manifold fitting (Fig. 10).

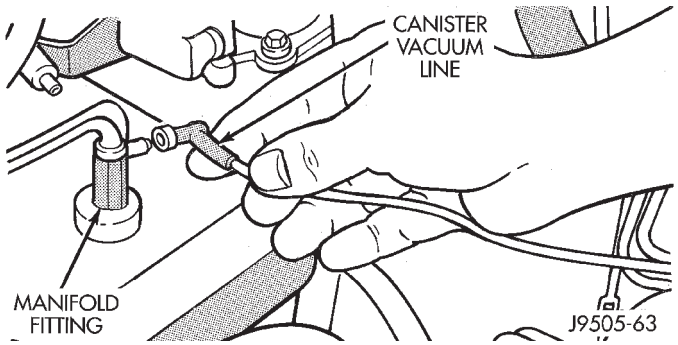


Fig. 10 Canister Vacuum Line Location (At Manifold Fitting)

(8) Disconnect brake booster vacuum hose at intake manifold fitting (Fig. 11). Move hose aside for working clearance.

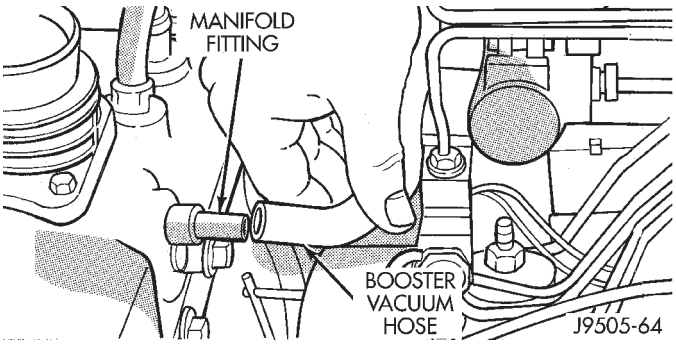


Fig. 11 Booster Vacuum Hose Removal/Installation (From Manifold Fitting)

(9) Unseat small S-clip that secures brakelines (Fig. 12).

(10) Remove brakeline that connects master cylinder front port to combination valve front port (Fig. 12).

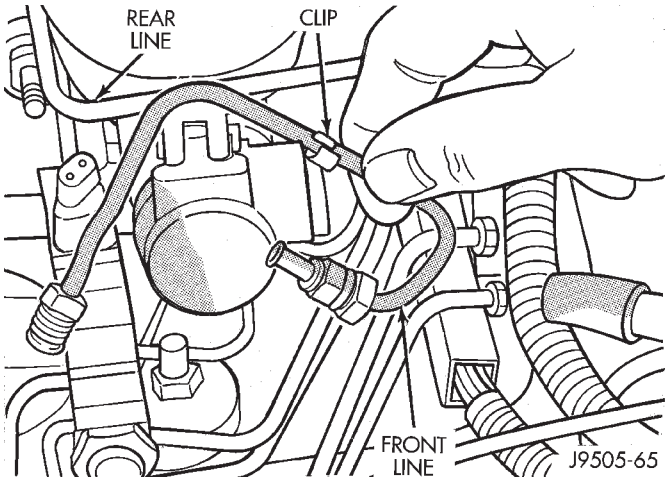


Fig. 12 Master Cylinder Front Brakeline Removal/ Installation

(11) Disconnect master cylinder rear brakeline at cylinder. Then loosen line at combination valve and swing line around to opposite side of cylinder (Fig. 13).

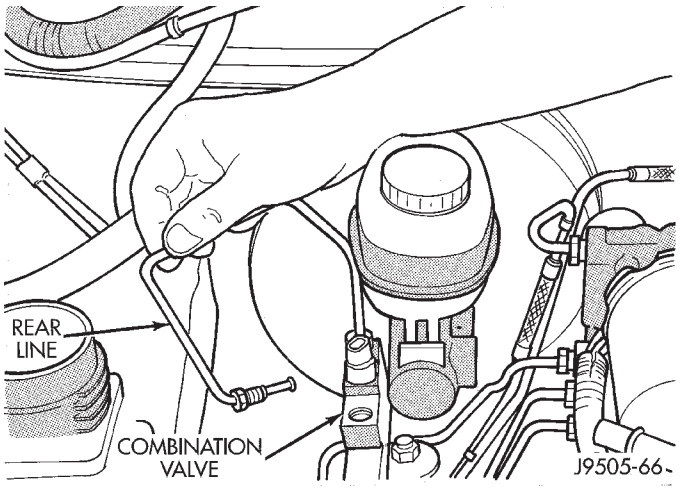


Fig. 13 Disconnecting Master Cylinder Rear Brakeline

(12) Disconnect rear brakeline at HCU (Fig. 14).

(13) Disconnect both flex brakelines at HCU (Fig. 14).

(14) Disconnect HCU line to rear brakes at HCU port (Fig. 14).

(15) Remove nut attaching combination valve bracket to brake booster stud.

(16) Remove combination valve and brakelines as assembly (Fig. 15). Work valve bracket off booster stud. Then work brakelines around cylinder and HCU and remove assembly.

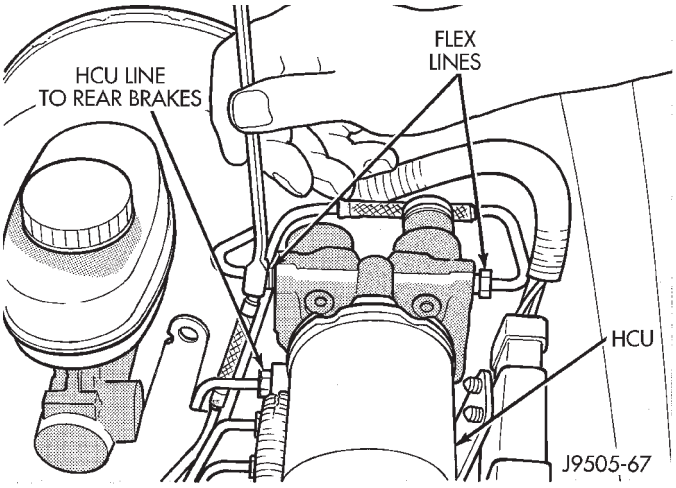


Fig. 14 Location Of HCU Flexlines And HCU Line To Rear Brakes

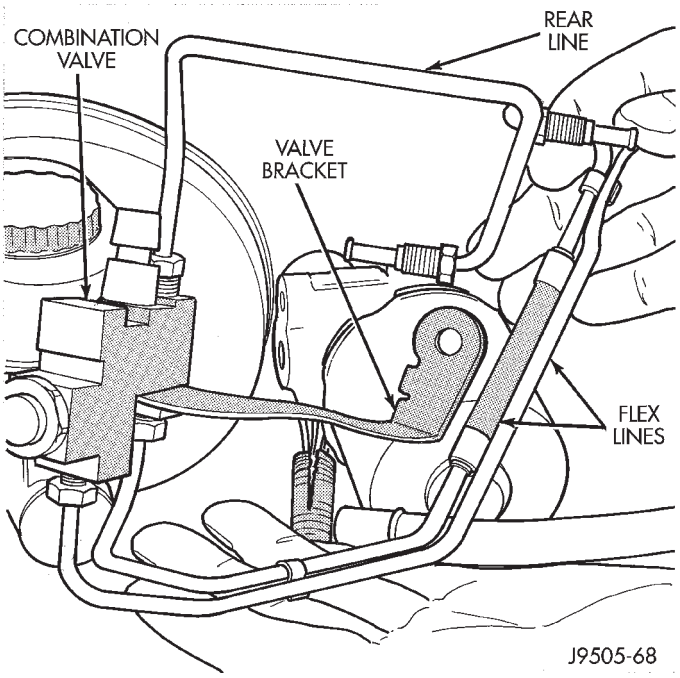


Fig. 15 Combination Valve And Brakeline Removal

(17) Remove nuts attaching master cylinder to booster studs and remove cylinder (Fig. 16).

(18) Remove master cylinder reservoir cap and drain fluid.

RESERVOIR REPLACEMENT (2-PIECE MASTER CYLINDER)

(1) Remove reservoir cap and empty fluid into drain container.

(2) Remove pins that retain reservoir to master cylinder. Use hammer and pin punch to remove pins (Fig. 17).

(3) Clamp cylinder body in vise with brass protective jaws.

(4) Loosen reservoir from grommets with pry tool (Fig. 18).

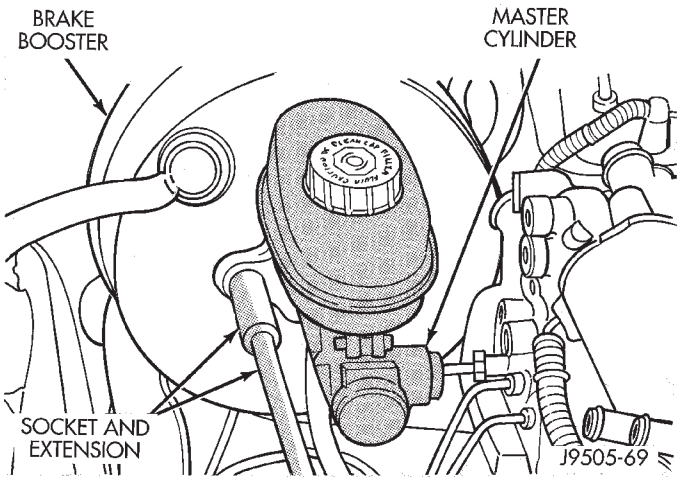


Fig. 16 Master Cylinder Attaching Nut Removal

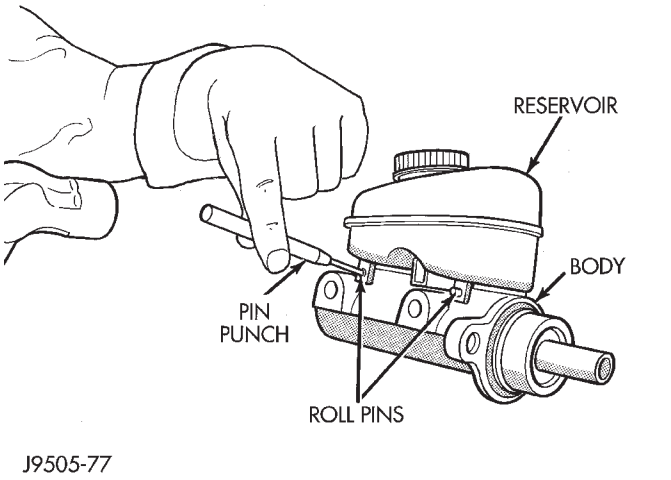


Fig. 17 Removing/Installing Reservoir Retaining Pins

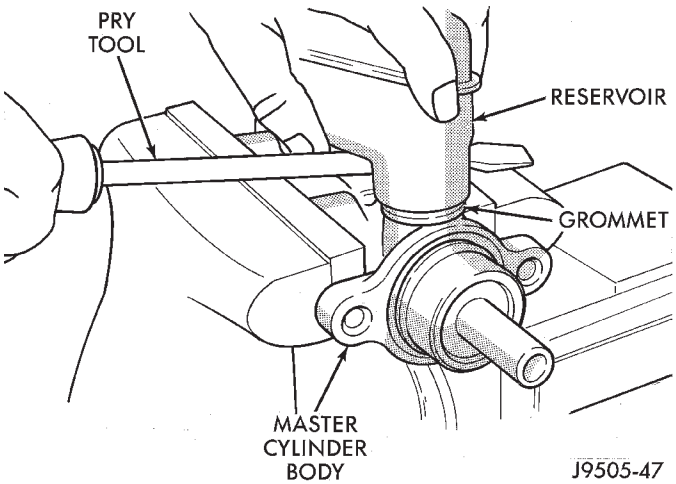


Fig. 18 Loosening Reservoir From Grommets

(5) Remove reservoir by rocking it to one side and pulling free of grommets (Fig. 19).

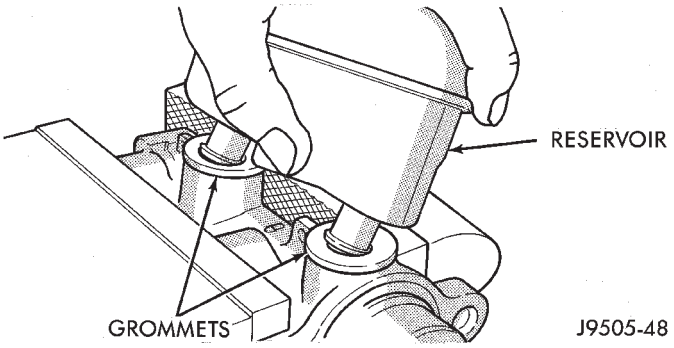


Fig. 19 Reservoir Removal

(6) Remove old grommets from cylinder body (Fig. 20).

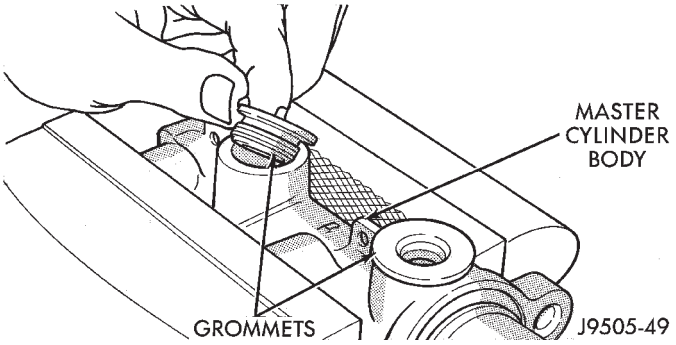


Fig. 20 Grommet Removal

(7) Lubricate new grommets with clean brake fluid.

(8) Install new grommets in cylinder body (Fig. 21). Use finger pressure only to install and seat grommets.

CAUTION: Do not use any type of tool to install the grommets. Tools may cut, or tear the grommets creating a leak problem after installation. Install the grommets using finger pressure only.

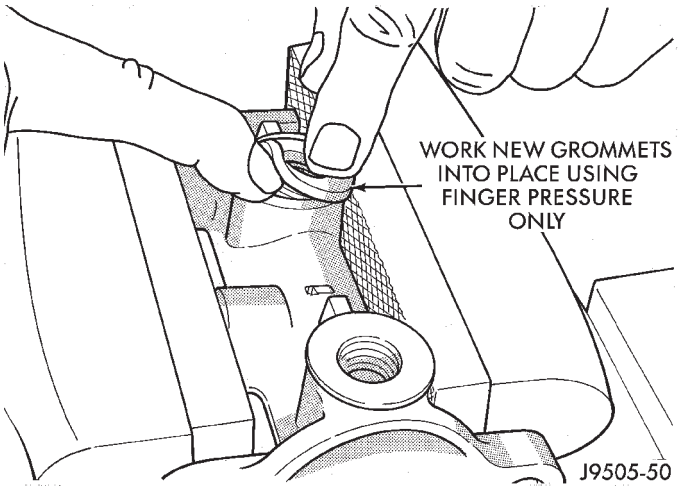


Fig. 21 Grommet Installation

(9) Start reservoir in grommets. Then rock reservoir back and forth while pressing downward to seat it in grommets.

(10) Install pins that retain reservoir to cylinder body (Fig. 17).

(11) Fill and bleed master cylinder on bench before installation in vehicle.

MASTER CYLINDER AND COMBINATION VALVE INSTALLATION (WITH ABS)

(1) Bleed master cylinder on bench before installation. Refer to procedure in this section.

(2) If new master cylinder is being installed, remove plastic protective sleeve from primary piston shank.

(3) If original master cylinder is being installed, check condition of seal at rear of master cylinder (Fig. 22). Clean and reposition seal if dislodged. Replace seal if cut, or torn.

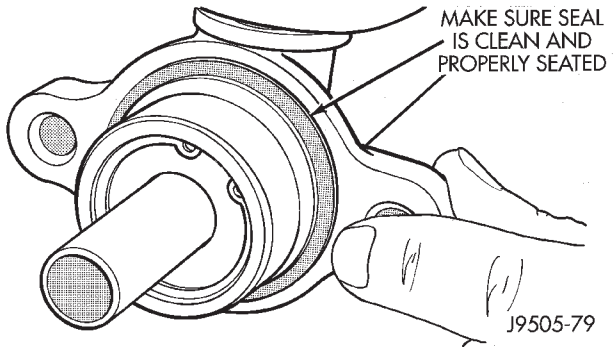


Fig. 22 Checking Master Cylinder Seal

(4) Clean cylinder mounting surface of brake booster (Fig. 23). Use shop towel wetted with brake cleaner for this purpose. Dirt, grease, or similar materials will prevent proper cylinder seating and could result in vacuum leak.

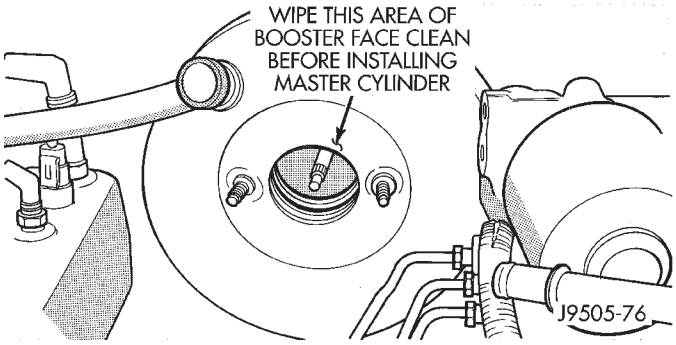


Fig. 23 Cylinder Mounting Surface Of Brake Booster

(5) If new master cylinder is being installed, **remove plastic protective sleeve from piston shank before installation.**

(6) Position master cylinder on booster studs (Fig. 24). Then install and tighten cylinder attaching nuts to 25 N·m (220 in. lbs.) torque.

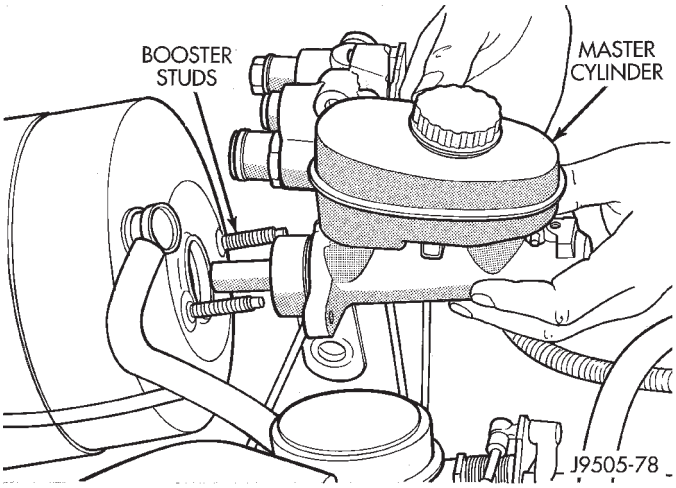


Fig. 24 Master Cylinder Installation

(7) Install combination valve as follows:

(a) Work combination valve and brakelines into position.

(b) Slide combination valve bracket onto booster stud closest to driver side fender (Fig. 25). Then install bracket attaching nut but do not fully tighten nut at this time.

(c) Connect flex lines to HCU. Start lines by hand to avoid cross threading.

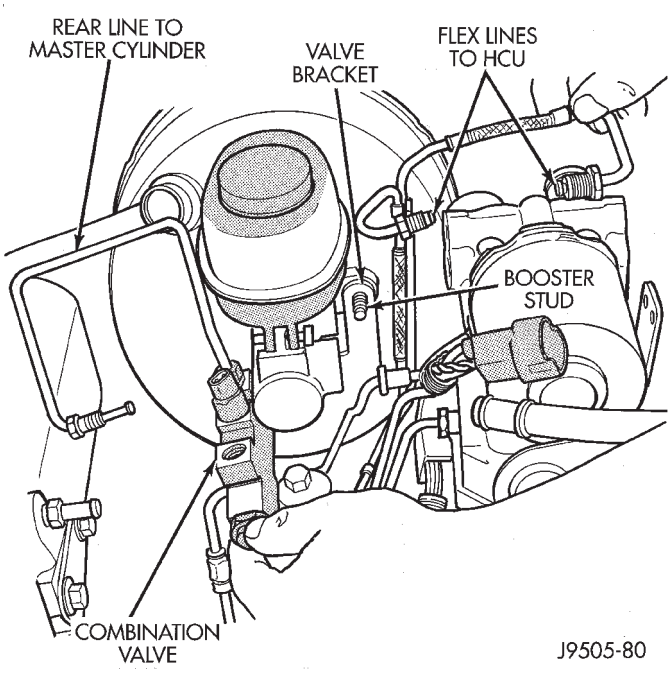


Fig. 25 Combination Valve Installation

(8) Swing rear brakeline around and connect it to master cylinder. Then install and connect front brakeline to combination valve and master cylinder. Start brakelines by hand to avoid cross threading.

(9) Tighten combination valve bracket attaching nut to 25 N·m (220 in. lbs.) torque.

(10) Install S-clip on lines from master cylinder to combination valve.

(11) Connect wire to pressure differential switch in combination valve.

(12) Fill and bleed brake system.

(13) Tighten brakeline fittings to 15-18 N·m (130-160 in. lbs.) at HCU and master cylinder and to 18-24 N·m (160-210 in. lbs.) at combination valve.

(14) Connect brake booster and canister vacuum hoses to manifold fittings.

(15) Install air cleaner housing, filter, cover, and hose.

(16) Connect PCV hose.

MASTER CYLINDER BENCH BLEEDING

The bench bleeding procedure for both master cylinder types is basically the same. The only difference, is that both bleed tubes go in the same filler neck opening on cylinders with the nylon reservoir.

(1) On models with integral master cylinder, fill each reservoir to within 6 mm (1/4 in.) of rim. On two-piece cylinder, fill reservoir to FULL mark.

(2) Fabricate and install master cylinder bleed tubes. Be sure tube ends are submerged in brake fluid. Tubes can be fabricated from rubber hose, or copper tubing and spare brakeline fittings.

(3) Using push rod or wooden dowel (Fig. 26), stroke cylinder pistons fully into bore;then allow pistons to return under spring pressure. Repeat this operation until air bubbles cease to appear in fluid.

(4) Remove bleed tubes, cap outlet ports, and install reservoir cap, or cover and seal.

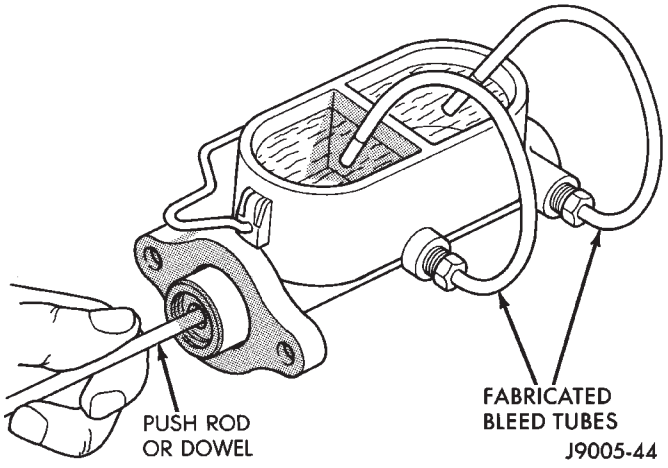


Fig. 26 Typical Method Of Bleeding Master Cylinder (One-Piece Cylinder Shown)

POWER BRAKE BOOSTER—BRAKE PEDAL—BRAKELIGHT SWITCH

INDEX

GENERAL INFORMATION

A 205 mm (8.07 in.) dual diaphragm power brake booster is used for all applications (Figs. 1 and 2).

The only serviceable parts on the power brake booster (Figs. 1 and 2) are the check valve, and vacuum hose. The booster itself is not serviceable. Replace the booster as an assembly whenever diagnosis indicates a malfunction has occurred.

Brake Pedal And Brakelight Switch

A suspended-type brake pedal is used on all models. The pedal pivots on a shaft mounted in the pedal support bracket. The bracket is attached to the dash and instrument panels on all models.

A plunger-type, adjustable brakelight switch is used on all models. The switch is attached to a flange on the pedal support bracket.

The brake pedal is a serviceable component. The pedal, pivot pin, sleeve, pedal bushings and spacers/washers are all replaceable parts. The pedal bracket can also be replaced when necessary.

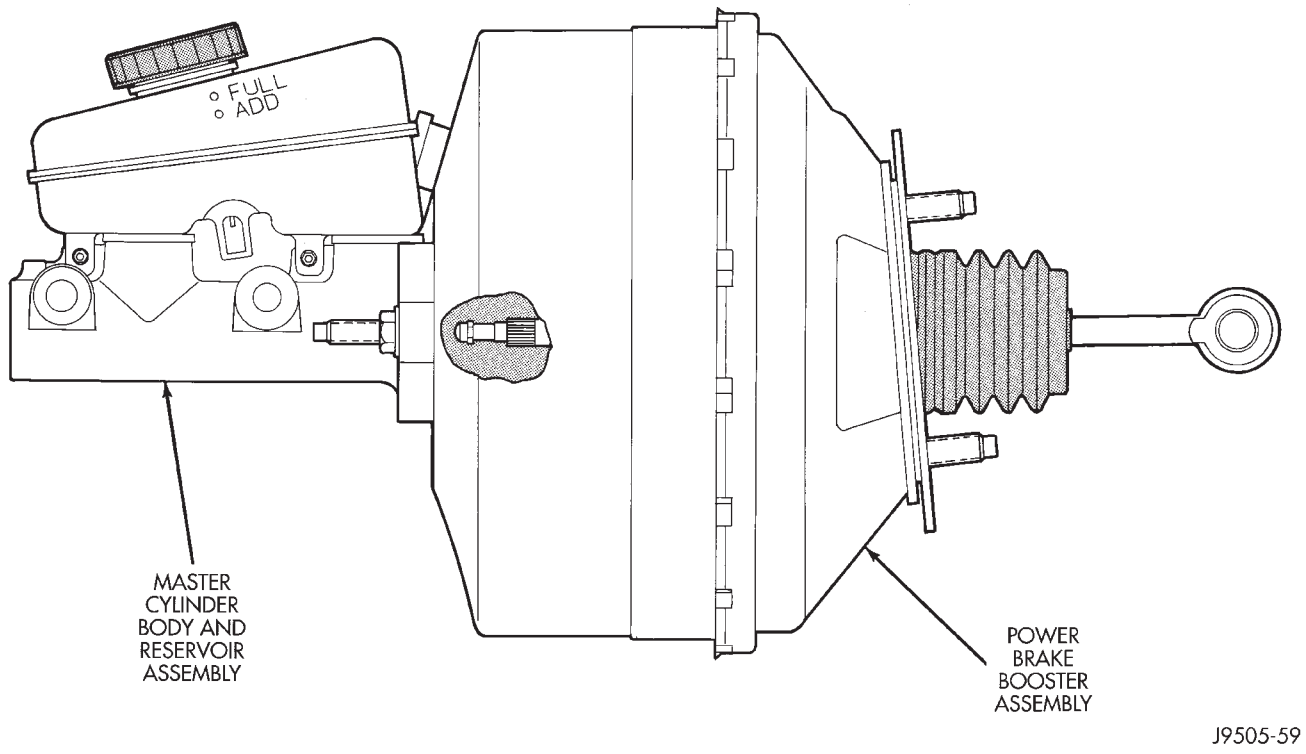


Fig. 1 Brake Booster/Master Cylinder Assembly (XJ)

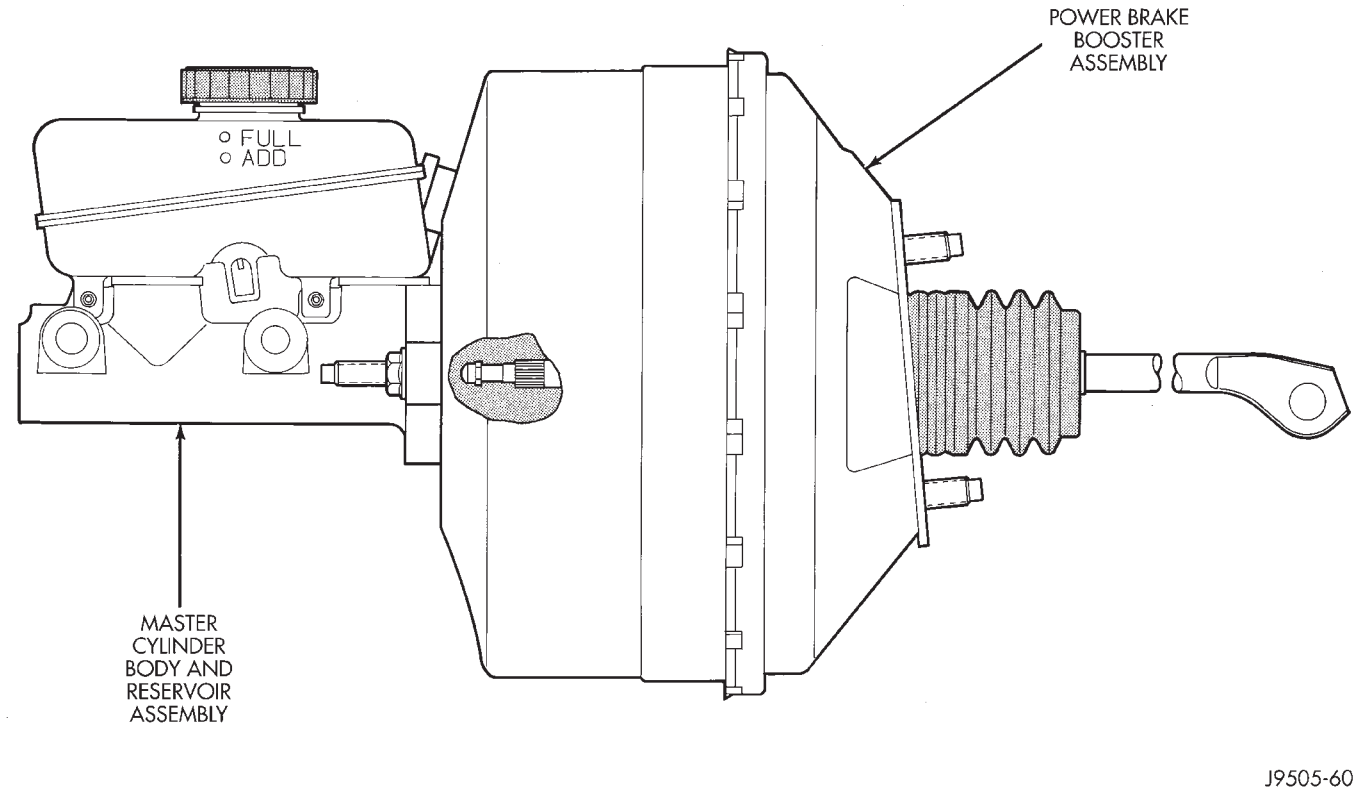


Fig. 2 Brake Booster/Master Cylinder Assembly (YJ)

POWER BRAKE BOOSTER OPERATION

Booster Components

The booster assembly consists of a housing divided into separate chambers by two internal diaphragms (Fig. 2). The outer edge of each diaphragm is attached to the booster housing. The diaphragms are connected to the booster primary push rod.

Two push rods are used in the booster. The primary push rod connects the booster to the brake pedal. The secondary push rod connects the booster to the master cylinder to stroke the cylinder pistons.

The atmospheric inlet valve is opened and closed by the primary push rod. Booster vacuum supply is through a hose attached to an intake manifold fitting at one end and to the booster check valve at the other. The vacuum check valve in the booster housing is a one-way device that prevents vacuum leak back.

How Brake Boost Is Generated

Power assist is generated by utilizing the pressure differential between normal atmospheric pressure and a vacuum. The vacuum needed for booster operation is taken directly from the engine intake manifold. The entry point for atmospheric pressure is through a filter and inlet valve at the rear of the housing (Fig. 3).

The chamber areas forward of the booster diaphragms are exposed to vacuum from the intake manifold. The chamber areas to the rear of the diaphragms, are exposed to normal atmospheric pressure of 101.3 kilopascals (14.7 pounds/square in.).

Brake pedal application causes the primary push rod to open the atmospheric inlet valve. This exposes the area behind the diaphragms to atmospheric pressure. The resulting pressure differential provides the extra apply pressure for power assist.

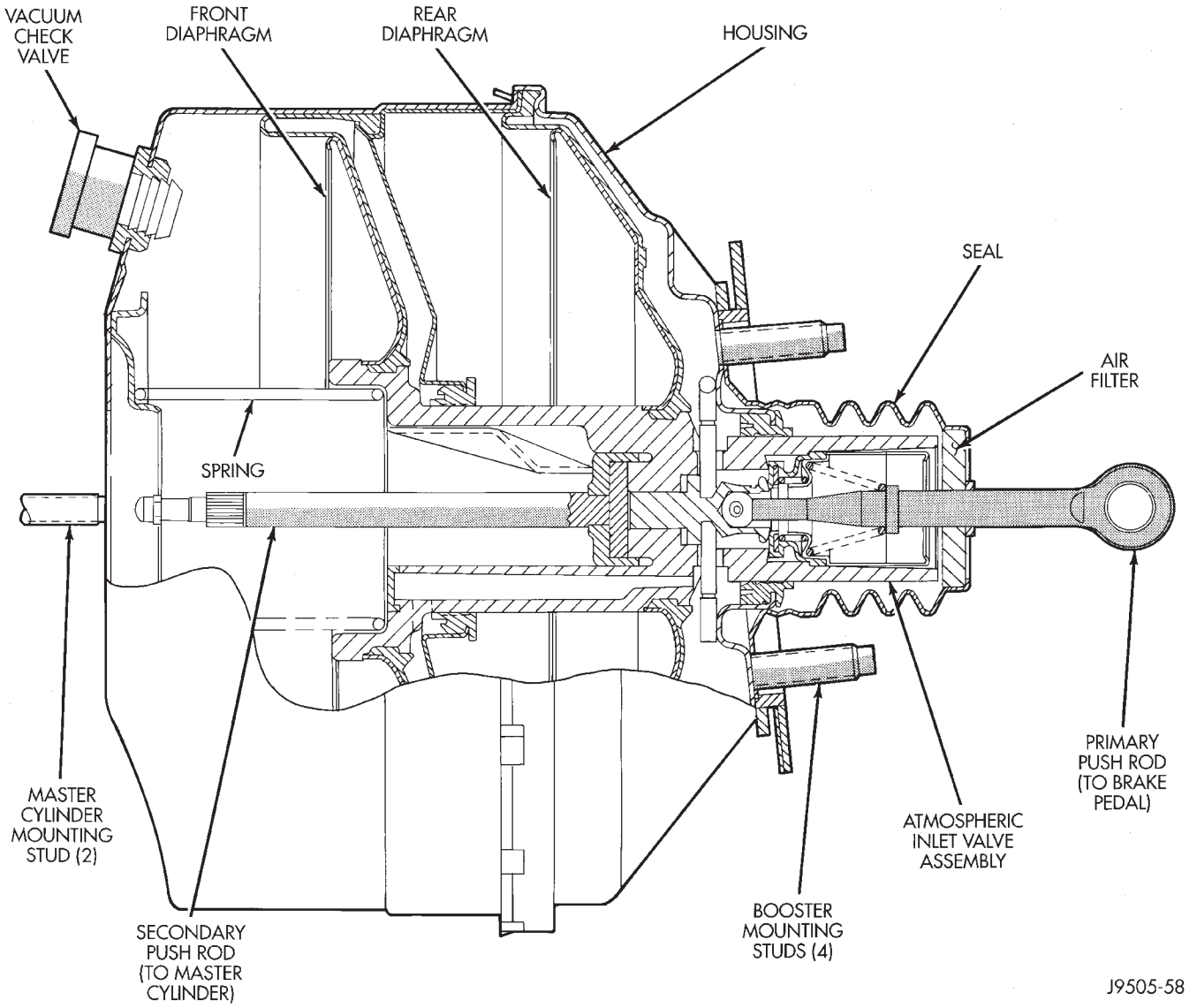


Fig. 3 Power Brake Booster Internal Components

POWER BRAKE BOOSTER REMOVAL (XJ WITH ABS)

(1) Disconnect vacuum and vent hoses at air cleaner cover.

(2) Loosen clamp securing air cleaner hose to intake manifold. Use screwdriver to tap clamp loose.

(3) Remove air cleaner cover and hose. Then remove air filter from air cleaner housing (Fig. 4).

(4) Remove two bolts and one nut that secure air cleaner housing to body (Fig. 4).

(5) Remove air cleaner housing from engine compartment (Fig. 4).

(6) Disconnect wire at combination valve pressure differential switch (Fig. 5). Do not pull on wires to disconnect. Unsnap lock tabs on connecter to remove wires.

(7) Disconnect canister vacuum line at manifold fitting (Fig. 6).

(8) Disconnect brake booster vacuum hose at intake manifold fitting (Fig. 7). Move hose aside for working clearance.

(9) Unseat small S-clip that secures brakelines (Fig. 8).

(10) Remove front brakeline that connects master cylinder front port to combination valve front port (Fig. 8).

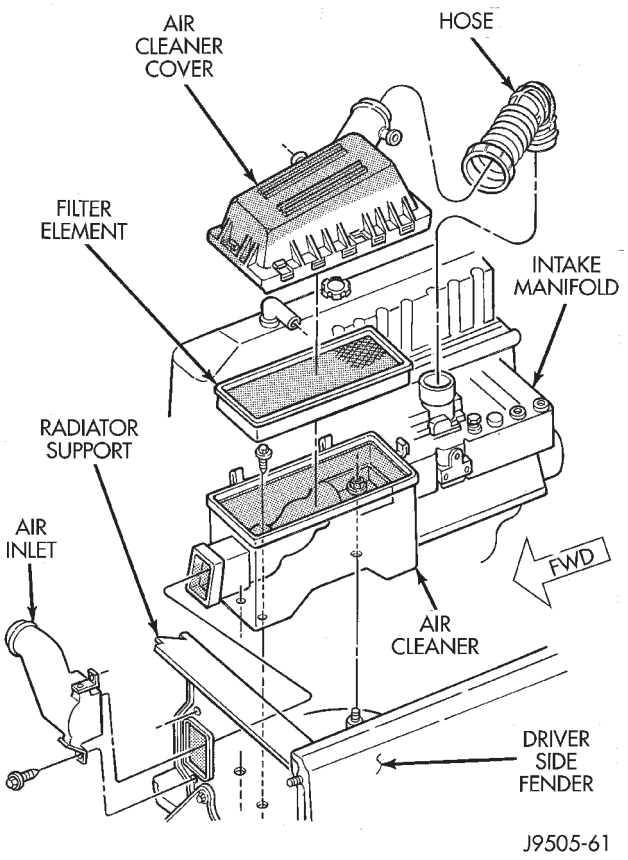


Fig. 4 Air Cleaner Components

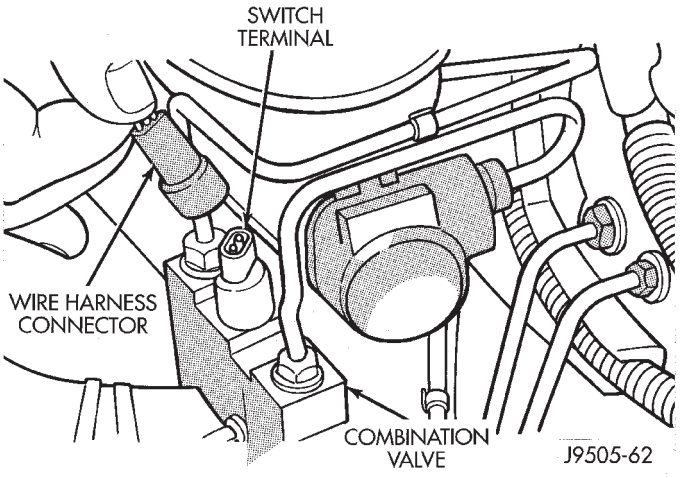


Fig. 5 Pressure Differential Switch Wire Connection

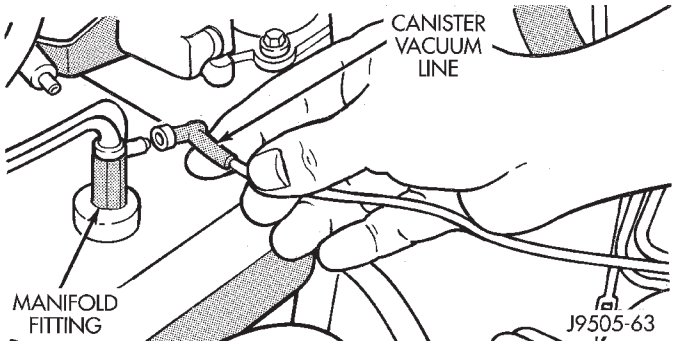


Fig. 6 Canister Vacuum Line Location (At Manifold Fitting)

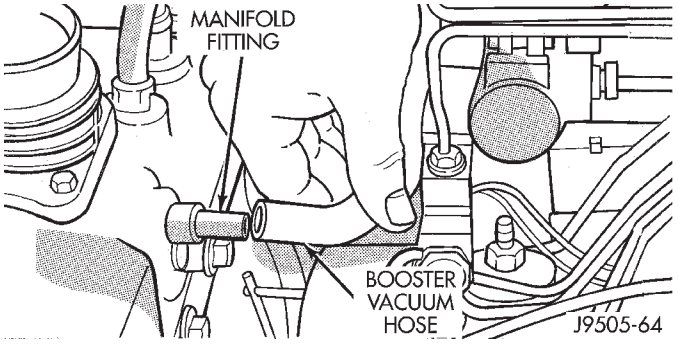


Fig. 7 Booster Vacuum Hose Removal/Installation (From Manifold Fitting)

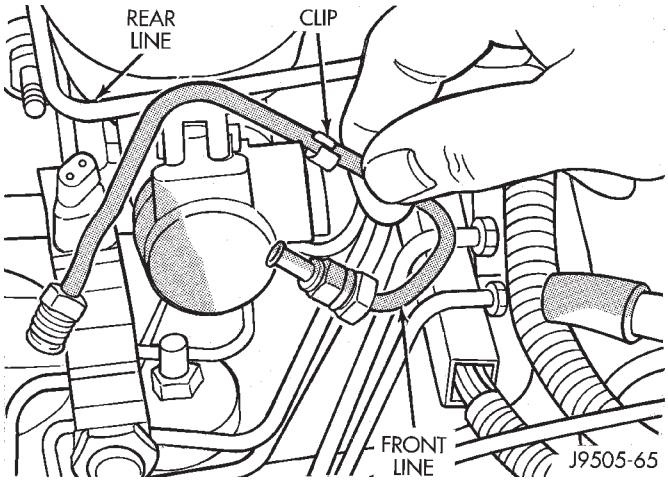


Fig. 8 Master Cylinder Front Brakeline Removal/ Installation

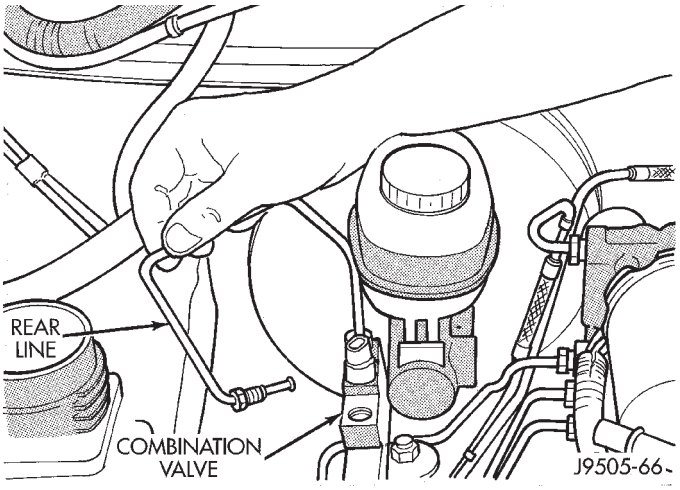


Fig. 9 Disconnecting Master Cylinder Rear Brakeline

(11) Disconnect master cylinder rear brakeline at cylinder. Then loosen line at combination valve and swing line around to opposite side of cylinder (Fig. 9).

(12) Disconnect rear brakeline at HCU (Fig. 10).

(13) Disconnect both flex brakelines at HCU (Fig. 10).

(14) Disconnect HCU line to rear brakes at HCU port (Fig. 10).

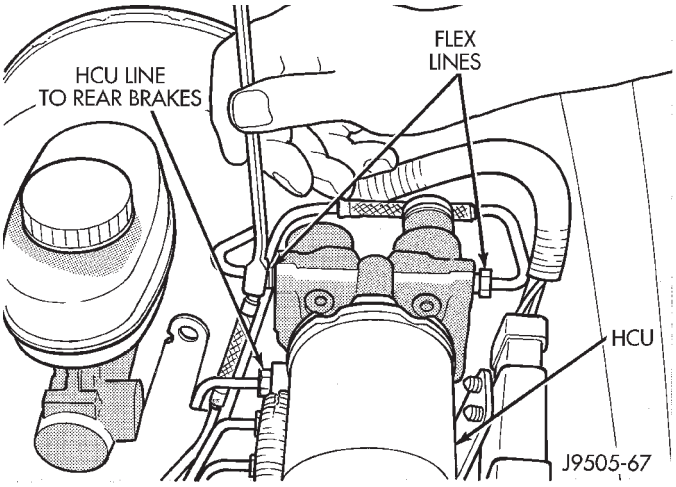


Fig. 10 Location Of HCU Flexlines And HCU Line To Rear Brakes

(15) Remove nut attaching combination valve bracket to brake booster stud.

(16) Remove combination valve and brakelines as assembly (Fig. 11). Work valve bracket off booster stud. Then work brakelines around cylinder and HCU and remove assembly.

(17) Remove nuts attaching master cylinder to booster studs and remove cylinder (Fig. 12).

(18) Remove master cylinder reservoir cap and drain fluid.

(19) Disconnect HCU solenoid harness from main harness (Fig. 13).

(20) Disconnect HCU pump motor harness (Fig. 14).

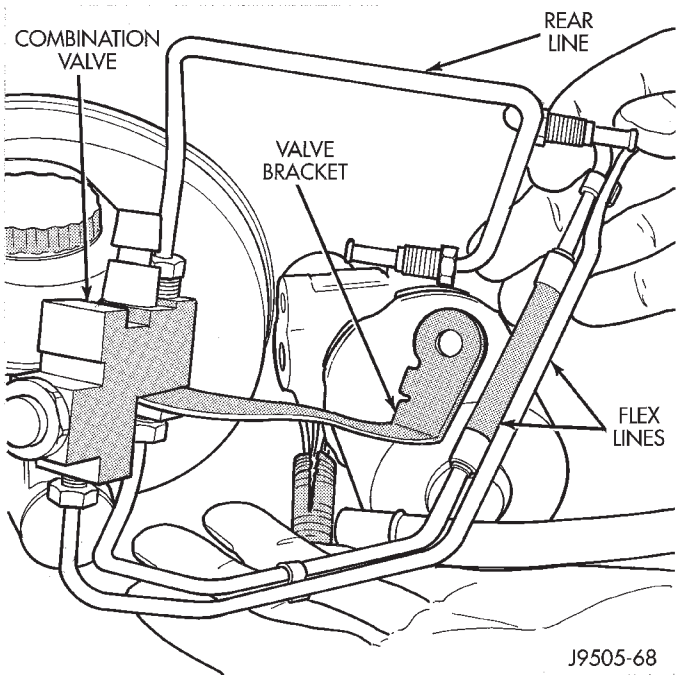


Fig. 11 Combination Valve And Brakeline Removal

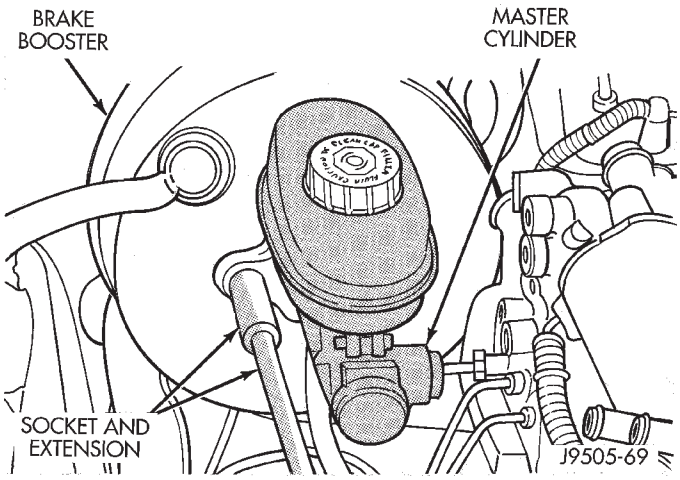


Fig. 12 Master Cylinder Attaching Nut Removal

(21) Disconnect lines at lower left side of HCU (Fig. 15).

(22) Remove nuts attaching HCU mounting bracket to stud plate and body. Then remove HCU and bracket as assembly.

(23) In passenger compartment, remove instrument panel lower trim cover.

(24) Remove retaining clip that secures booster push rod to brake pedal (Fig. 16).

(25) Remove nuts attaching booster to passenger compartment side of dash panel.

(26) In engine compartment, slide booster studs out of dash panel, tilt booster upward, and remove booster from engine compartment.

(27) Remove booster spacer, if equipped.

(28) Remove dash seal from booster, or dash panel.

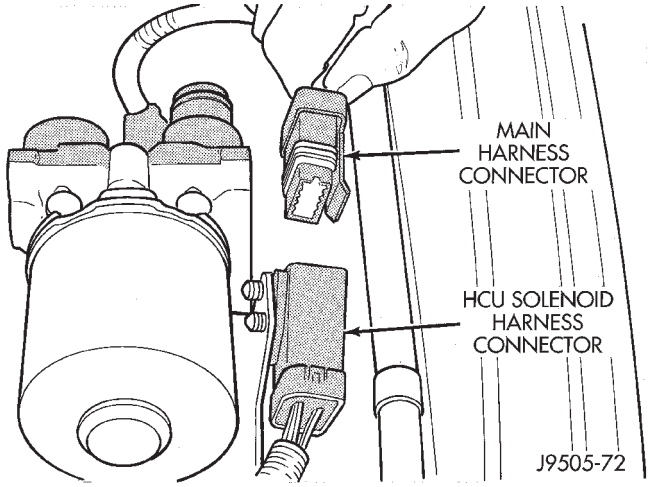


Fig. 13 Disconnecting HCU Solenoid Harness

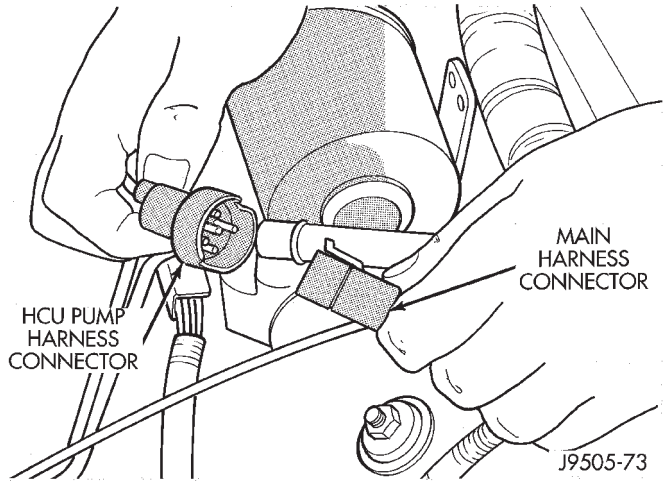


Fig. 14 Disconnecting HCU Pump Harness

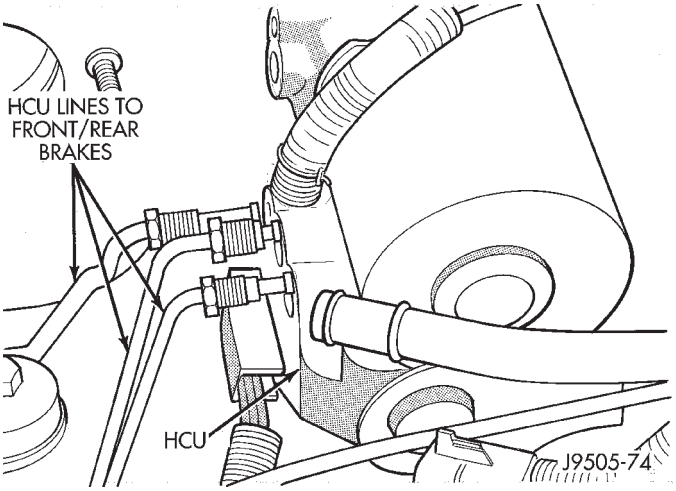


Fig. 15 HCU Front/Rear Brakeline Connections

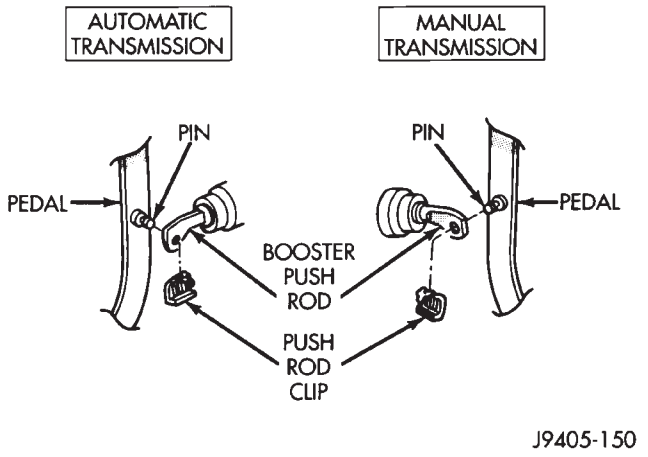


Fig. 16 Push Rod Attachment At Brake Pedal

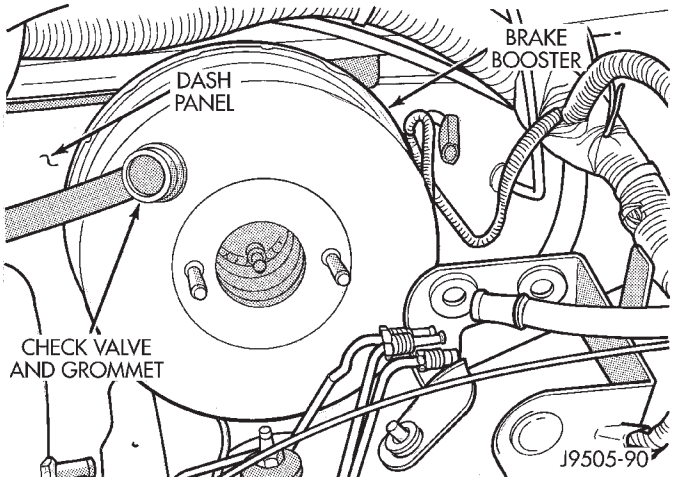


Fig. 17 Brake Booster Positioned On Dash Panel

POWER BRAKE BOOSTER INSTALLATION (XJ WITH ABS)

(1) If new booster is being installed, install new check valve and vacuum hose (Fig. 17). Also install dash seal and spacer on new booster, if equipped.

(2) Position booster on dash panel (Fig. 17) seat booster studs in dash panel holes.

(3) Working inside vehicle, install nuts on booster mounting studs. Tighten nuts just enough to hold booster in place.

(4) Attach booster push rod to brake pedal. Secure push rod with retainer clip.

(5) Tighten booster attaching nuts to 41 N·m (30 ft. lbs.) on XJ and 34 N·m (25 ft. lbs.) on YJ.

(6) If necessary, bleed master cylinder on bench before installation. Refer to procedure in master cylinder section.

(7) If new master cylinder is being installed, **remove plastic protective sleeve from primary piston shank.**

(8) Check condition of seal at rear of master cylinder (Fig. 22). Clean and reposition seal if dislodged. Replace seal if cut, or torn.

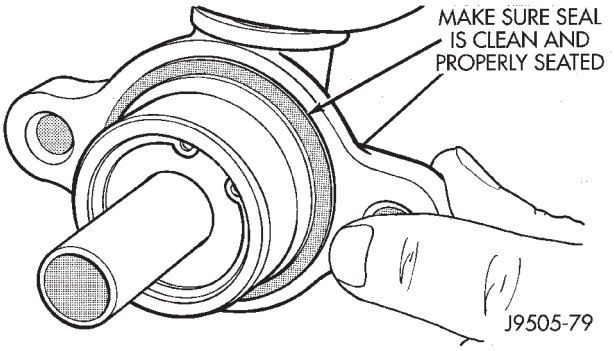


Fig. 18 Checking Master Cylinder Seal

(9) Clean cylinder mounting surface of brake booster (Fig. 19). Use shop towel wetted with brake cleaner for this purpose. Dirt, grease, or similar materials will prevent proper cylinder seating and could result in vacuum leak.

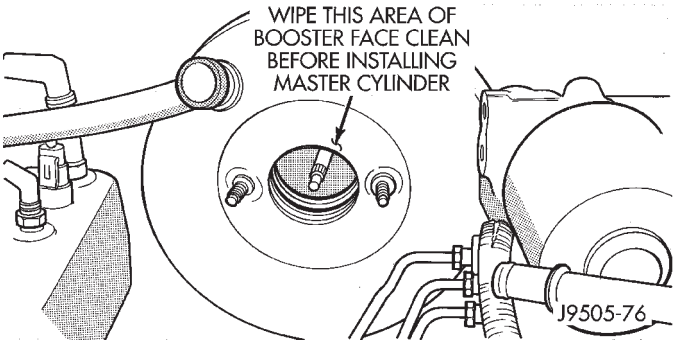


Fig. 19 Cylinder Mounting Surface Of Brake Booster

(10) Position master cylinder on booster studs (Fig. 20). **Be sure booster push rod is centered and seated in master cylinder piston shank.**

(11) Install and tighten master cylinder attaching nuts to 25 N·m (220 in. lbs.) torque.

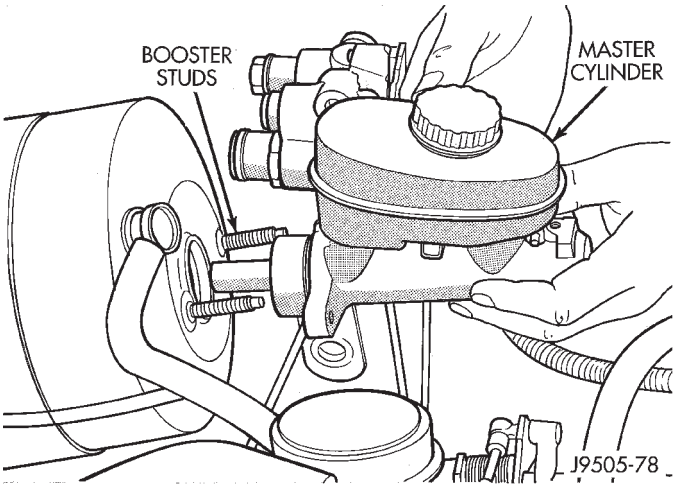


Fig. 20 Master Cylinder Installation

(12) Install HCU as follows:

(a) If only the HCU was removed, position HCU in mounting bracket. Then install and tighten three shoulder bolts that attach HCU to bracket (Figs. 21 and 22). One bolt is used at forward end of bracket and two at rear as shown.

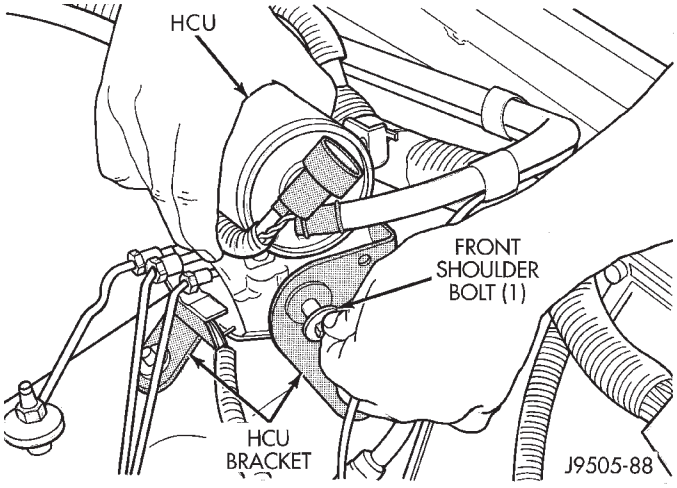


Fig. 21 Installing HCU Front Shoulder Bolt

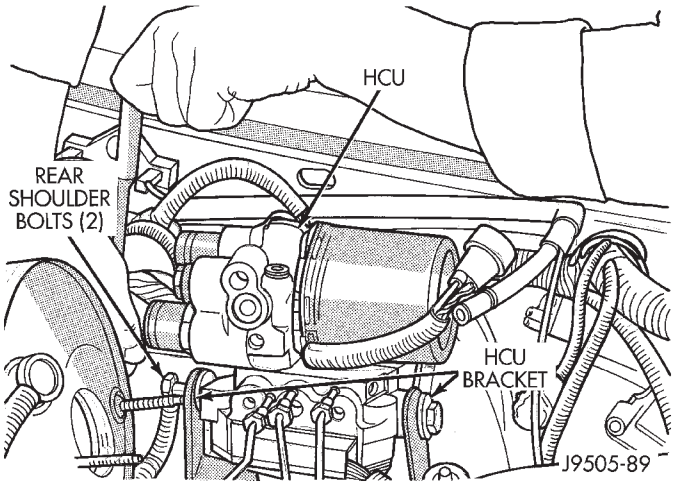


Fig. 22 Installing HCU Rear Shoulder Bolts

(b) If HCU and bracket were removed as assembly, position bracket on studs and install attaching nuts. Tighten nuts to 10-13 N·m (92-112 in. lbs.) torque.

(c) On right hand drive models, If brackets were removed, assemble brackets. Then position lower bracket on body studs and install attaching nuts and the one attaching bolt (Fig. 23).

(13) If HCU mounting bracket was not removed, press solenoid harness connecter fasteners into mounting bracket holes.

(14) Connect HCU pump motor and solenoid harnesses (Figs. 13 and 14).

(15) Connect brakelines to HCU. Start brakeline fittings in HCU ports by hand to avoid cross threading (Fig. 24). Then tighten line fittings snug but not to required torque at this time.

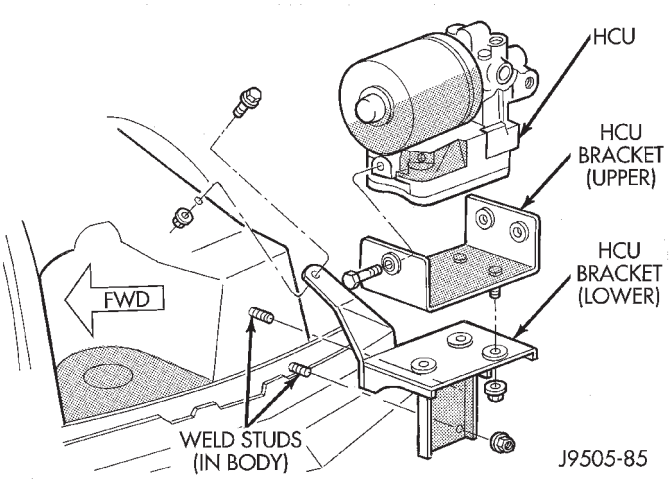


Fig. 23 HCU And Bracket Mounting (RHD Models)

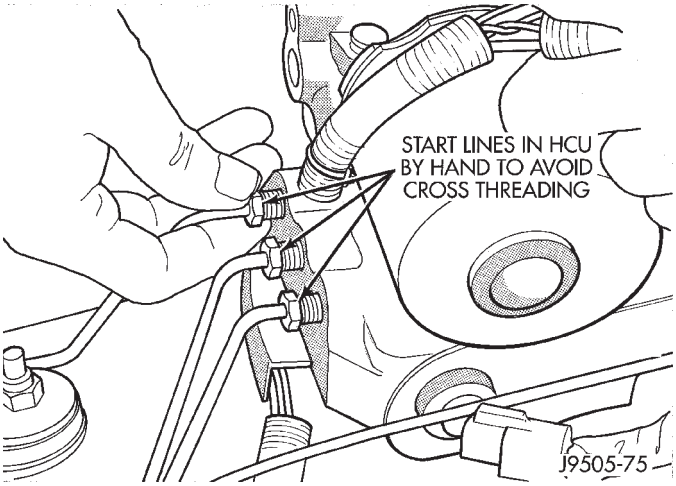


Fig. 24 Starting Brakelines In HCU

(16) Install combination valve as follows:

(a) Work combination valve and brakelines into position.

(b) Slide combination valve bracket onto booster stud closest to driver side fender (Fig. 25). Then install bracket attaching nut but do not fully tighten nut at this time.

(c) Connect flex lines to HCU. Start lines by hand to avoid cross threading.

(17) Swing rear brakeline around and connect it to master cylinder. Then install and connect front brakeline to combination valve and master cylinder. Start brakelines by hand to avoid cross threading.

(18) Tighten combination valve bracket attaching nut to 25 N·m (220 in. lbs.) torque.

(19) Install clip on lines from master cylinder to combination valve.

(20) Connect wire to pressure differential switch on combination valve.

(21) Connect flex lines to HCU (Fig. 10). Start line fittings by hand to avoid cross threading. Then tighten fittings snug but not to required torque at this time.

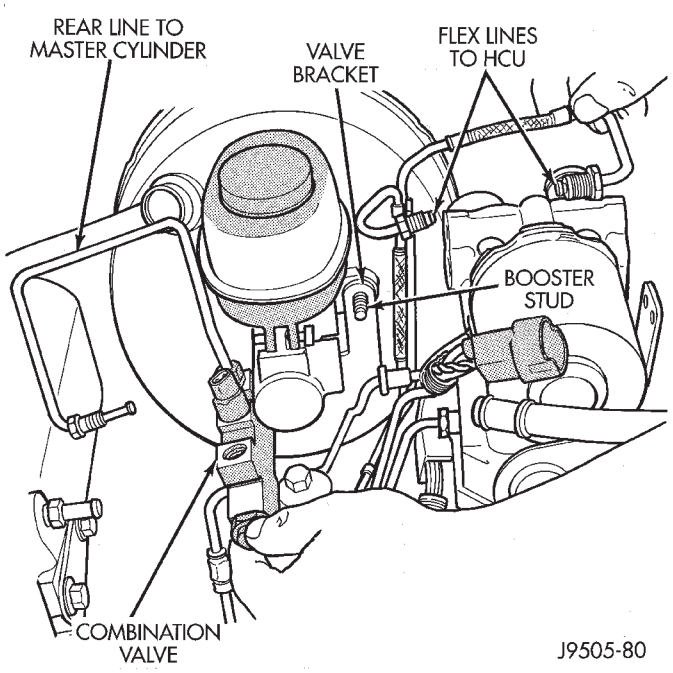


Fig. 25 Combination Valve Installation

(22) Bleed brakes. Refer to procedure in Brake Fluid-Brake Bleeding-Brakelines And Hoses section.

(23) Tighten brakeline fittings to 15-18 N·m (130-160 in. lbs.) at HCU and master cylinder, and 18-24 N·m (160-210 in. lbs.) at combination valve.

(24) Install air cleaner assembly.

(25) Connect vacuum lines to manifold fittings.

(26) Check brake pedal action before moving vehicle. Bleed brakes again if pedal is not firm (feels soft/spongy).

POWER BRAKE BOOSTER REMOVAL (XJ WITHOUT ABS)

(1) Disconnect vent and vacuum hose from engine air cleaner cover.

(2) Remove engine air cleaner cover, filter, housing and hoses (Fig. 4).

(3) Disconnect brakelines at master cylinder.

(4) Disconnect wire at combination valve differential pressure switch.

(5) If combination valve does not have an integral bracket, disconnect brakelines at combination valve and remove valve.

(6) If combination valve has integral bracket, remove nut attaching valve bracket to booster studs and remove valve.

(7) Remove nuts attaching master cylinder to booster studs and remove cylinder.

(8) Disconnect vacuum hose from booster check valve.

(9) In passenger compartment, remove instrument panel lower trim cover.

(10) Remove retaining clip that secures booster push rod to brake pedal (Fig. 5).

(11) Remove nuts attaching booster to passenger compartment side of dash panel.

(12) In engine compartment, slide booster studs out of dash panel, tilt booster upward, and remove booster from engine compartment.

(13) Remove dash seal from booster.

(14) If booster is only being removed for access to other components, cover booster front opening with clean shop towel.

POWER BRAKE BOOSTER INSTALLATION (XJ WITHOUT ABS)

(1) If original booster is being installed, test check valve with vacuum tool before booster installation. Replace check valve if it will not hold vacuum.

(2) Install dash seal on booster.

(3) Align and position booster on dash panel (Fig. 17).

(4) In passenger compartment, install nuts that attach booster to dash panel. Tighten nuts just enough to hold booster in place.

(5) Slide booster push rod onto brake pedal. Then secure push rod to pedal pin with retaining clip.

(6) Tighten booster attaching nuts to 41 N·m (30 ft. lbs.) on XJ and 34 N·m (25 ft. lbs.) on YJ.

(7) Install instrument panel lower trim cover.

(8) If original master cylinder is being installed, check condition of seal at rear of master cylinder (Fig. 18). Clean and reposition seal if dislodged. Replace seal if cut, or torn.

(9) Clean cylinder mounting surface of brake booster. Use shop towel wetted with brake cleaner for this purpose. Dirt, grease, or similar materials will prevent proper cylinder seating and could result in vacuum leak.

(10) Align and install master cylinder on booster studs. Tighten cylinder attaching nuts to 13-25 N·m (115-220 in. lbs.) torque.

(11) Connect vacuum hose to booster check valve.

(12) Connect and secure brakelines to combination valve and master cylinder. Start all brakeline fittings by hand to avoid cross threading.

(13) If combination valve has integral bracket, position bracket on booster studs. Then install and tighten bracket attaching nuts to 13-25 N·m (115-220 in. lbs.) torque.

(14) Connect wire to combination valve switch.

(15) Top off master cylinder fluid level.

(16) Bleed brakes. Refer to procedures in section on brake bleeding.

(17) Install engine air cleaner and hoses.

(18) Verify proper brake operation before moving vehicle.

POWER BRAKE BOOSTER REMOVAL (YJ)

(1) Disconnect brakelines at master cylinder. Then loosen lines at combination valve and move lines away from cylinder.

(2) Remove nuts master cylinder to booster studs.

(3) If combination valve has integral bracket, slide bracket off studs and move valve aside.

(4) Remove master cylinder. Slide cylinder off studs and remove it from engine compartment.

(5) Working under instrument panel, remove retainer clip that secures booster push rod to brake pedal.

(6) Disconnect vacuum hose at booster check valve.

(7) On non-ABS models, remove nuts attaching brake booster spacer to dash panel and remove booster (Fig. 26).

(8) On ABS models, remove nuts attaching booster to spacer and remove booster (Fig. 27).

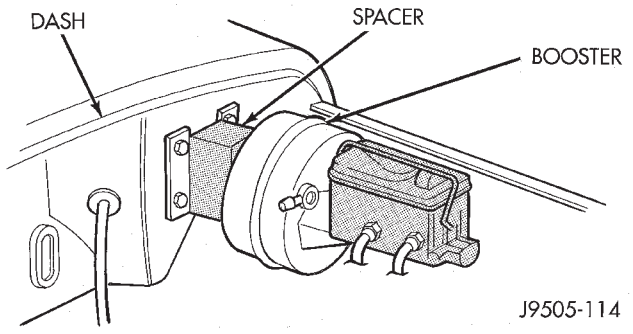


Fig. 26 Booster Mounting (4-Cyl. Models)

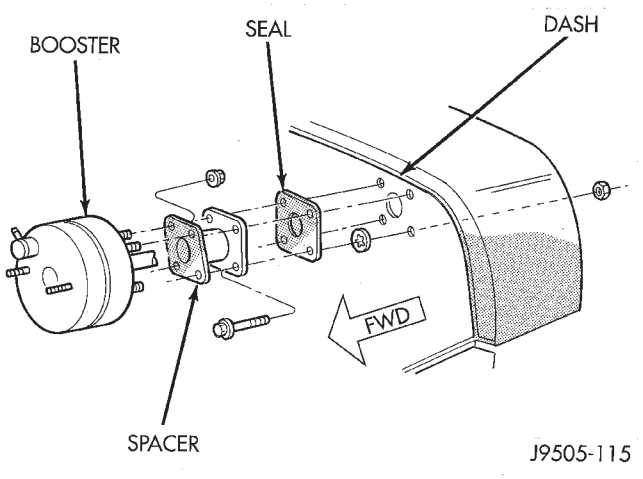


Fig. 27 Booster Mounting (With ABS)

POWER BRAKE BOOSTER INSTALLATION (YJ)

(1) Install seal on booster spacer, if equipped.

(2) Position booster on dash panel, or on spacer.

(3) Secure booster push rod to brake pedal with retaining clip.

(4) Install and tighten booster attaching nuts to 27-47 N·m (20-35 ft. lbs.) torque. Nut torque applies to both styles of booster.

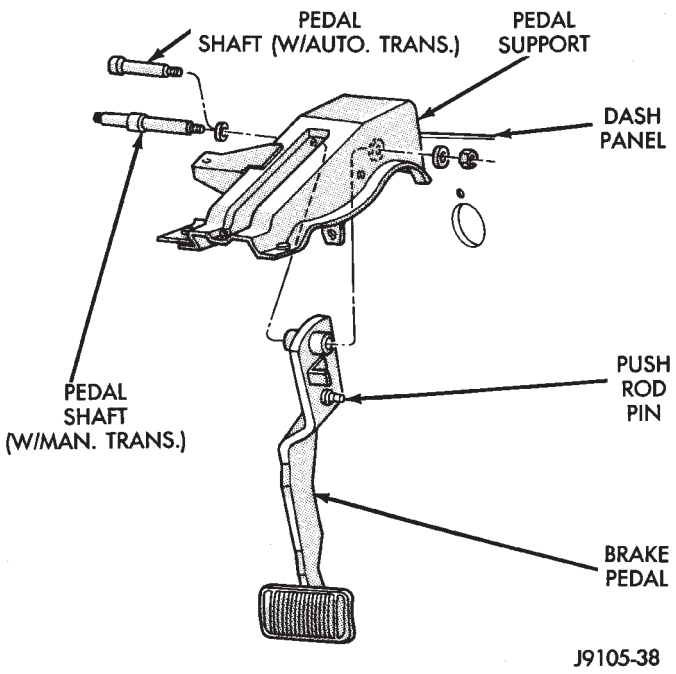


Fig. 28 Brake Pedal And Support Bracket (YJ)

(5) Connect vacuum hose to brake booster check valve.

(6) Install master cylinder and combination valve.

(7) Bleed brakes. Then tighten brakeline fittings to 15-18 N·m (130-160 in. lbs.) at master cylinder and 18-24 N·m (160-210 in. lbs.) at combination valve.

BRAKE PEDAL REMOVAL

(1) Remove lower trim panel and A/C duct if necessary.

(2) Remove steering column lower trim panel and bezel.

(3) Remove necessary dash panel-to-instrument panel brace rods.

(4) Disconnect and remove brakelight switch.

(5) Remove retainer clip securing booster push rod to pedal (Fig. 16).

(6) Remove nut securing pedal shaft in support bracket.

(7) Slide pedal shaft outward for clearance and remove brake pedal (Figs. 28 and 29).

(8) Remove pedal bushings if they are to be replaced.

BRAKE PEDAL INSTALLATION

(1) Install new bushings in pedal. Lubricate bushings and pivot pin with Mopar multi mileage grease.

(2) Position pedal, sleeve and spacer(s) in bracket and install pivot pin.

(3) Install new nut on pivot pin. **Pivot pin nut is specially formed and should not be reused. Be sure to install new nut to secure pin.**

(4)) Tighten new pivot pin nut to 27 N·m (20 ft. lbs.) on models with manual transmission. Tighten nut to 35 N·m (26 ft. lbs.) on models with automatic transmission.

(5) Install booster push rod on pedal pin (Fig. 16). Secure push rod with original, or new retainer clip if necessary.

(6) Install and connect brakelight switch.

(7) Install dash brace rod, if equipped.

(8) Install instrument panel and steering column trim covers.

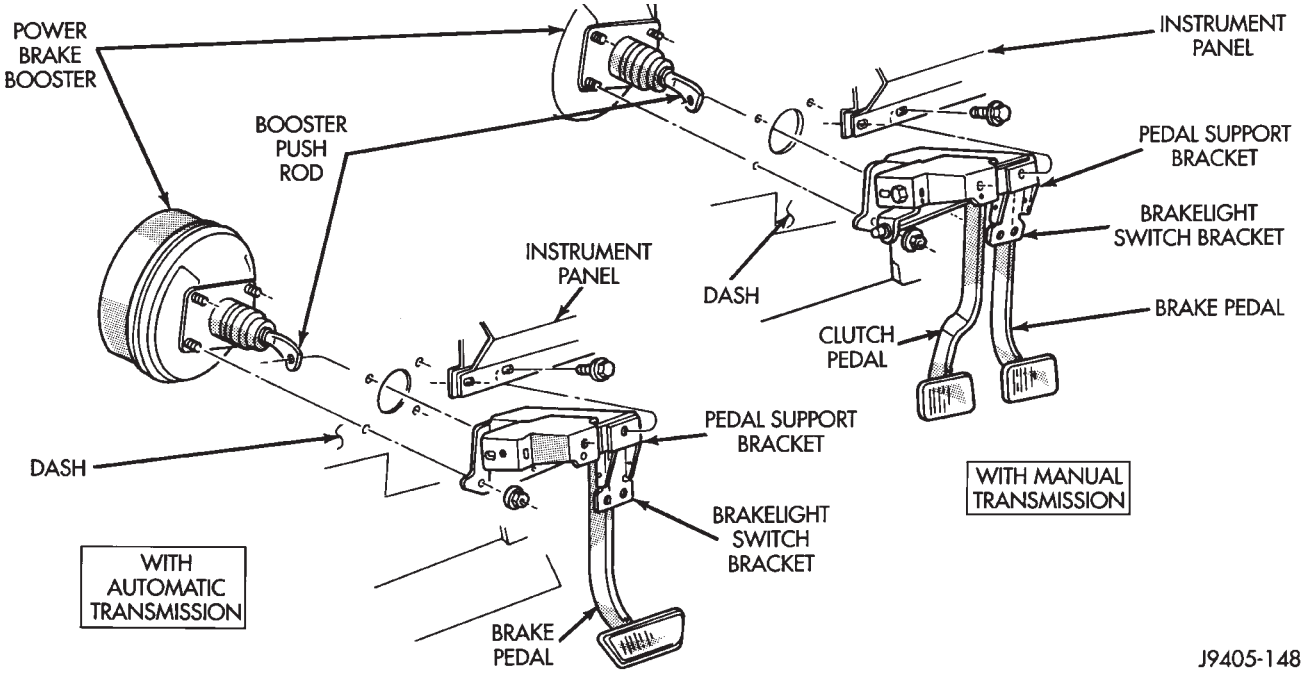


Fig. 29 Brake Pedal And Support Bracket (XJ)

BRAKELIGHT SWITCH REMOVAL

The brakelight switch is mounted in the pedal support bracket and is operated by the pedal. The switch is secured in the bracket with a retainer (Fig. 30).

(1) Remove steering column cover and lower trim panel for switch access, if necessary.

(2) Disconnect switch wire harness.

(3) Thread switch out of retainer, or rock switch up/down and pull it rearward out of retainer.

(4) Inspect switch retainer, if equipped. Replace retainer if worn, distorted, loose, or damaged.

BRAKELIGHT SWITCH INSTALLATION

(1) Insert replacement switch in retainer. Thread switch into place or rock it up/down until switch plunger touches brake pedal. Insert switch in bracket and thread clip onto plunger to secure switch.

(2) Connect switch wires.

(3) Check switch operation. Adjust switch position if necessary. Refer to procedures in this section.

(4) Install trim panels (if removed).

BRAKELIGHT SWITCH ADJUSTMENT

A plunger-type brakelight switch is used on XJ and YJ models (Fig. 30). The switch plunger is actuated directly by the brake pedal.

The switch internal contacts are open when the brake pedal is in the released position. Brake application moves the pedal away from the switch allowing the plunger to extend. As the plunger extends, the switch internal contacts close completing the circuit to the brakelights.

The switch is retained in the bracket by a clip. The clip has tangs that seat in the threads of the switch plunger barrel.

SWITCH ADJUSTMENT PROCEDURE

(1) Check switch adjustment. Move the brake pedal forward by hand and note operation of the switch plunger. Plunger should extend when pedal free play is taken up and brake application begins. A clearance of approximately 3 mm (1/8 in.) should exist between plunger and pedal at this point.

(a) If switch-to-pedal clearance is OK and brakelights operate correctly, adjustment is not required.

(b) If switch plunger does not extend and clearance between pedal and plunger is insufficient, adjust switch position as described in step (2).

(2) Grasp brake pedal and pull it rearward as far as possible. Switch plunger barrel will "ratchet" rearward in retaining clip to correct position.

(3) Verify brakelight switch operation and proper clearance between switch plunger and brake pedal.

CAUTION: Be very sure the brake pedal returns to a fully released position after adjustment. The switch can interfere with full pedal return if too far forward. The result will be brake drag caused by partial brake application.

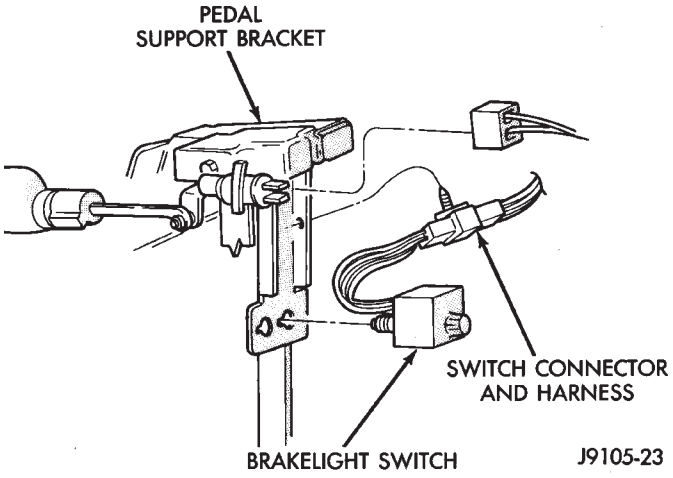


Fig. 30 Brakelight Switch Mounting And Location (XJ/YJ)

ABS OPERATION AND SERVICE

INDEX

SYSTEM DESCRIPTION

The Jeep antilock brake system (ABS) is an electronically operated, all wheel brake control system.

The system is designed to prevent wheel lockup and maintain steering control during periods of high wheel slip when braking. Preventing lockup is accomplished by modulating fluid pressure to the wheel brake units.

The hydraulic system is a three channel design. The front wheel brakes are controlled individually and the rear wheel brakes in tandem (Fig. 1). The ABS electrical system is separate from other electrical circuits in the vehicle. A specially programmed electronic control unit (ECU) operates the system components.

ABS system major components include:

- hydraulic control unit (HCU)
- electronic control unit (ECU)
- wheel speed sensors and axle shaft tone rings
- acceleration switch
- main relay and pump motor relay
- ABS warning light
- pump motor sensor

HYDRAULIC CONTROL UNIT (HCU)

The hydraulic control unit (HCU) consists of a valve body, pump body, accumulators, pump motor, and wire harnesses (Fig. 2).

The pump, motor, and accumulators are combined into an assembly attached to the valve body. The accumulators store the extra fluid released to the system for ABS mode operation. The pump provides the fluid volume needed and is operated by a DC type motor. The motor is controlled by the ECU.

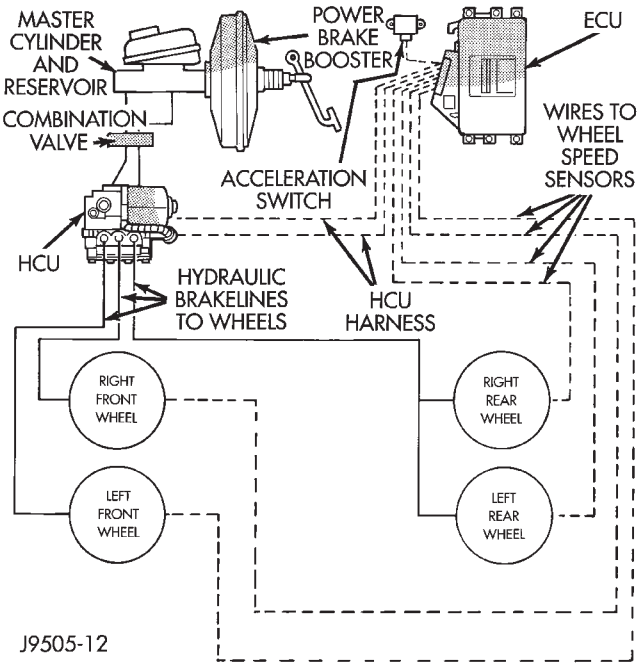


Fig. 1 Jeep ABS System

The valve body contains the solenoid valves. The valves modulate brake pressure during antilock braking and are controlled by the ECU.

The HCU provides three channel pressure control to the front and rear brakes. One channel controls the rear wheel brakes in tandem. The two remaining channels control the front wheel brakes individually.

During antilock braking, the solenoid valves are opened and closed as needed. The valves are not static. They are cycled rapidly and continuously to modulate pressure and control wheel slip and deceleration.

MASTER CYLINDER/POWER BRAKE BOOSTER

A 25 mm bore master cylinder and 205 mm (8.07 in.) dual diaphragm power brake booster are used for all ABS applications (Fig. 2).

The master cylinder has a removable plastic reservoir which is the only serviceable component. The cylinder body and pistons are not repairable and are serviced as an assembly. The check valve and grommet are the only serviceable parts on the booster. The booster itself is only serviced as an assembly.

COMBINATION VALVE

A combination valve is used with the ABS system (Fig. 2). The valve contains a front/rear brake pressure differential switch and rear brake proportioning valve. The combination valve is connected between the master cylinder and HCU.

The pressure differential switch is connected to the red brake warning light. The switch is actuated by movement of the switch valve. The switch monitors fluid pressure in the separate front/rear brake hydraulic circuits.

A decrease or loss of fluid pressure in either hydraulic circuit will cause the switch valve to shuttle forward or rearward in response to the pressure differential. Movement of the switch valve will push the switch plunger upward. This closes the switch internal contacts completing the electrical circuit to the red warning light. The switch valve remains in an actuated position until the fault is repaired.

The rear proportioning valve is used to balance front-rear brake action.

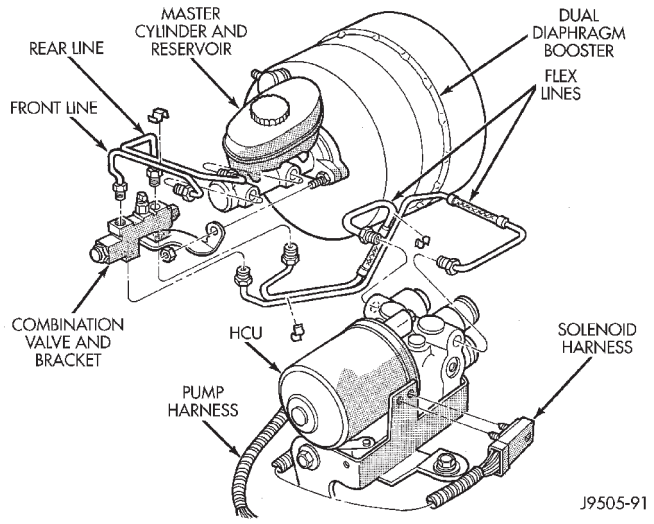


Fig. 2 ABS Master Cylinder-Booster-Combination Valve-HCU

ELECTRONIC CONTROL UNIT (ECU)

A separate electronic control unit (ECU) operates the ABS system (Fig. 3). The ECU is separate from other vehicle electrical circuits. ECU voltage source is through the ignition switch in the Run position.

The ECU is located under the instrument panel in the passenger compartment. On YJ models, it is just above the heater plenum in line with the glove box. In left hand drive XJ models, it at the right side of the steering column. In right hand drive models, it is near the cowl panel

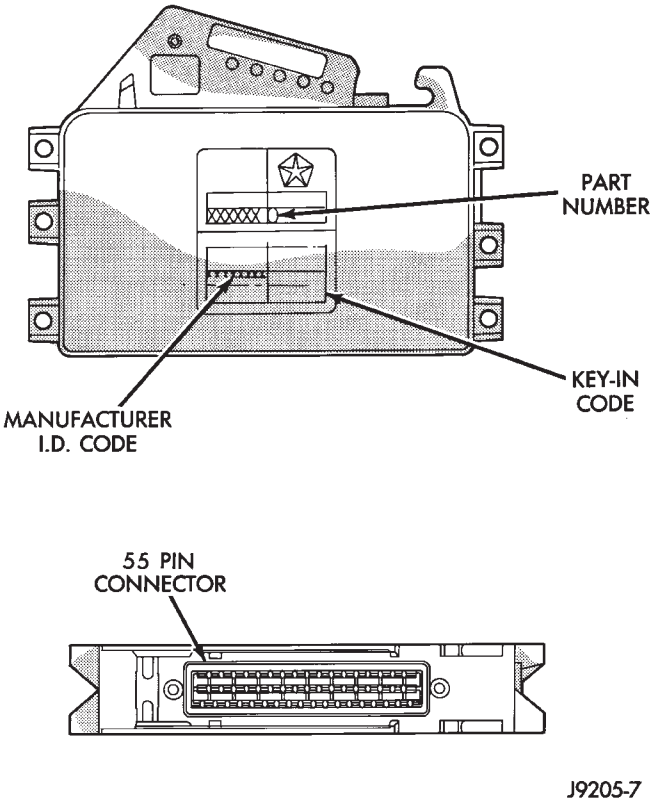


Fig. 3 Antilock ECU

The ECU contains dual microprocessors. A logic block in each microprocessor receives identical sensor signals. These signals are processed and compared simultaneously.

The ECU contains a self check program that illuminates the ABS warning light when a system fault is detected. Faults are stored in a diagnostic program memory and are accessible with the DRB scan tool.

ABS faults remain in memory until cleared, or until after the vehicle is started approximately 50 times. Stored faults are **not** erased if the battery is disconnected.

WHEEL SPEED SENSORS

A speed sensor is used at each wheel. The sensors convert wheel speed into an electrical signal. This signal is transmitted to the antilock ECU.

A gear type tone ring serves as the trigger mechanism for each sensor. The tone rings are mounted at the outboard ends of the front and rear axle shafts.

Different sensors are used at the front and rear wheels (Fig. 4). The front/rear sensors have the same electrical values but are not interchangeable.

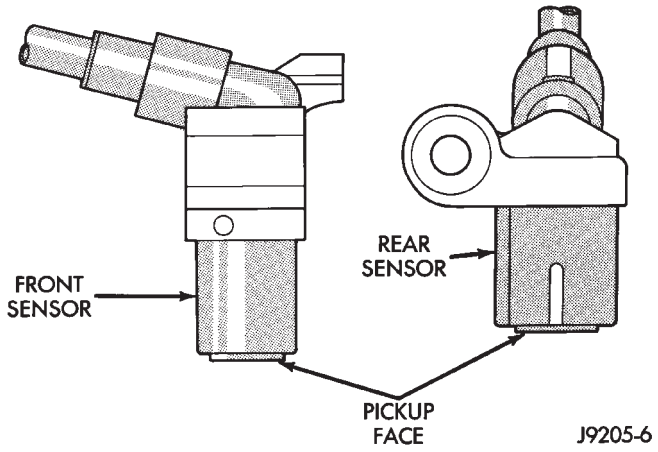


Fig. 4 Wheel Speed Sensors

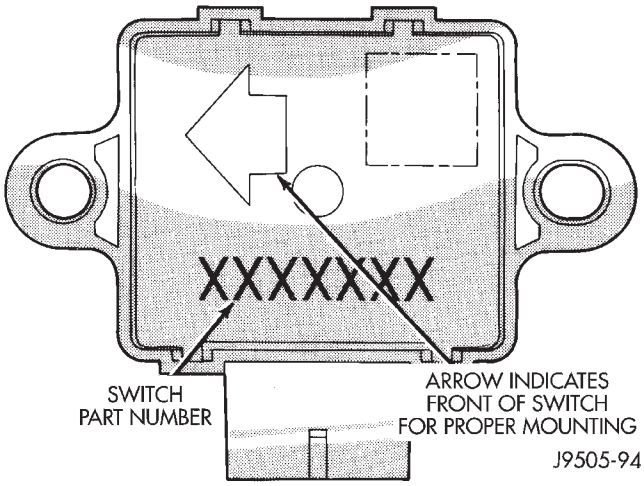


Fig. 5 Acceleration Switch

ABS DIAGNOSTIC CONNECTOR

The ABS diagnostic connector is inside the vehicle. The connector is the access point for the DRB scan tool.

On XJ models, the connector is located under the instrument panel to the right of the steering column. On some models, the connecter may be tucked under the carpeting on the transmission tunnel. The connecter is a black, 6-way type.

On YJ models, the connector is under the instrument panel by the the driver side kick panel. The connecter is a black, 6 or 8-way type.

The DRB scan tool kit contains adapter cords for both types of connecter. Use the appropriate cord for test hookup.

ACCELERATION SWITCH

An acceleration switch (Fig. 5), provides an additional vehicle deceleration reference during 4-wheel drive operation. The switch is monitored by the antilock ECU at all times. The switch reference signal is utilized by the ECU when all wheels are decelerating at the same speed.

SYSTEM RELAYS

The ABS system has two relays, which are the main and motor pump relays. The motor pump relay is used for the motor pump only. The main relay is used for the solenoid valves and ECU. The main relay is connected to the ECU at the power control relay terminal. The pump motor relay starts/stops the pump motor when signaled by the ECU.

IGNITION SWITCH

The antilock ECU and warning light are in standby mode with the ignition switch in Off or Accessory position. No operating voltage is supplied to the system components.

A 12 volt power feed is supplied to the ECU and warning light when the ignition switch is in the Run position.

SYSTEM WARNING LIGHT

The amber ABS warning light is in circuit with the ECU and operates independently of the red brake warning light.

The ABS light indicates antilock system condition. The light illuminates (flashes) at start-up for the self check. The light goes out when the self check program determines system operation is normal.

ABS SYSTEM POWER-UP AND INITIALIZATION

battery voltage is supplied to the ECU ignition terminal when the ignition switch is turned to Run position. The ECU performs a system initialization procedure at this point. Initialization consists of a static and dynamic self check of system electrical components.

The static check occurs after the ignition switch is turned to Run position. The dynamic check occurs when vehicle road speed reaches approximately 10 kph (6 mph). During the dynamic check, the ECU briefly cycles the pump and solenoids to verify operation.

If an ABS component exhibits a fault during initialization, the ECU illuminates the amber warning light and registers a fault code in the microprocessor memory.

ABS OPERATION IN NORMAL BRAKING MODE

The ECU monitors wheel speed sensor inputs continuously while the vehicle is in motion. However, the ECU will not activate any ABS components as long as sensor inputs and the acceleration switch indicate normal braking.

During normal braking, the master cylinder, power booster and wheel brake units all function as they would in a vehicle without ABS. The HCU components are not activated.

ABS OPERATION IN ANTILOCK BRAKING MODE

The purpose of the antilock system is to prevent wheel lockup during periods of high wheel slip. Preventing lockup helps maintain vehicle braking action and steering control.

The antilock ECU activates the system whenever sensor signals indicate periods of high wheel slip. High wheel slip can be described as the point where wheel rotation begins approaching zero (or lockup) during braking. Periods of high wheel slip may occur when brake stops involve high pedal pressure and rate of deceleration.

The antilock system prevents lockup during high slip conditions by modulating fluid apply pressure to the wheel brake units.

Brake fluid apply pressure is modulated according to wheel speed, degree of slip and rate of deceleration. A sensor at each wheel converts wheel speed into electrical signals. These signals are transmitted to the ECU for processing and determination of wheel slip and deceleration rate.

The ABS system has three fluid pressure control channels. The front brakes are controlled separately and the rear brakes in tandem (Fig. 1). A speed sensor input signal indicating a high slip condition activates the ECU antilock program.

Two solenoid valves are used in each antilock control channel. The valves are all located within the HCU valve body and work in pairs to either increase, hold, or decrease apply pressure as needed in the individual control channels.

The solenoid valves are not static during antilock braking. They are cycled continuously to modulate pressure. Solenoid cycle time in antilock mode can be measured in milliseconds.

HCU OPERATION

Normal Braking

During normal braking, the HCU solenoid valves and pump are not activated. The master cylinder and power booster operate the same as a vehicle without an ABS brake system.

Antilock Pressure Modulation

Solenoid valve pressure modulation occurs in three stages which are: pressure increase, pressure hold, and pressure decrease. The valves are all contained in the valve body portion of the HCU.

Pressure Decrease

The outlet valve is opened and the inlet valve is closed during the pressure decrease cycle (Fig. 6).

A pressure decrease cycle is initiated when speed sensor signals indicate high wheel slip at one or more wheels. At this point, the ECU opens the outlet valve, which also opens the return circuit to the accumulators. Fluid pressure is allowed to bleed off (decrease) as needed to prevent wheel lock.

Once the period of high wheel slip has ended, the ECU closes the outlet valve and begins a pressure increase or hold cycle as needed.

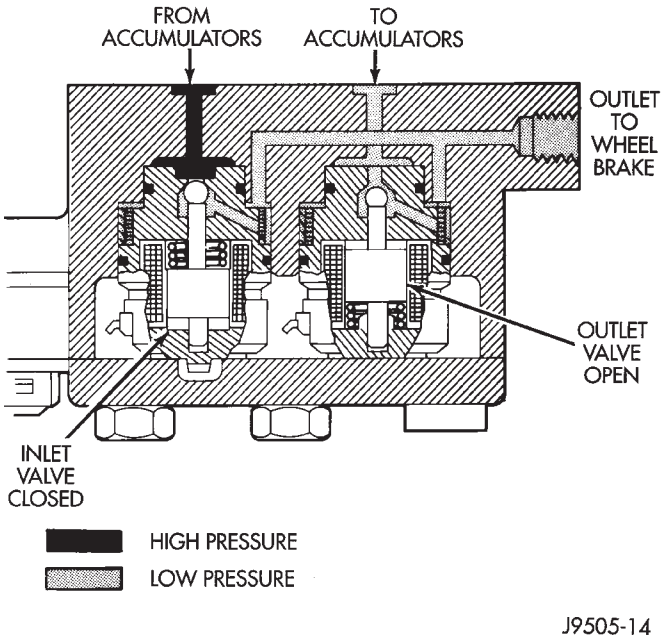


Fig. 6 Pressure Decrease Cycle

Pressure Hold

Both solenoid valves are closed in the pressure hold cycle (Fig. 7). Fluid apply pressure in the control channel is maintained at a constant rate. The ECU maintains the hold cycle until sensor inputs indicate a pressure change is necessary.

Pressure Increase

The inlet valve is open and the outlet valve is closed during the pressure increase cycle (Fig. 8). The pressure increase cycle is used to counteract unequal wheel speeds. This cycle controls re-application of fluid apply pressure due to changing road surfaces or wheel speed.

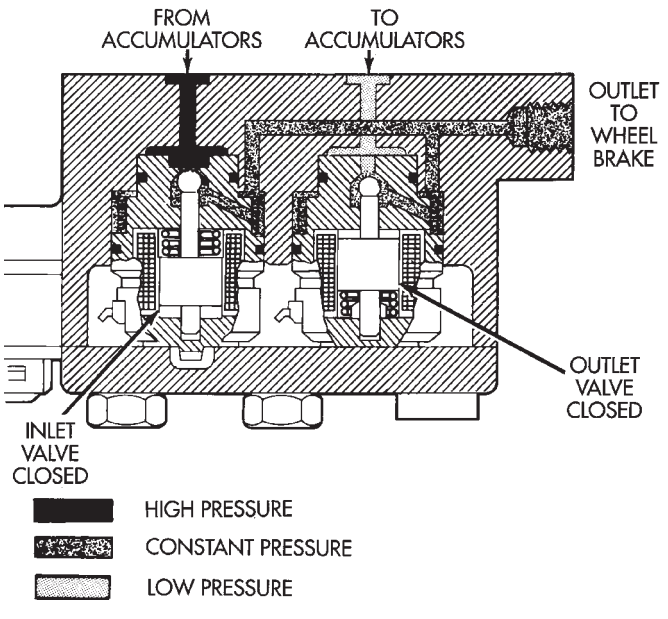


Fig. 7 Pressure Hold Cycle

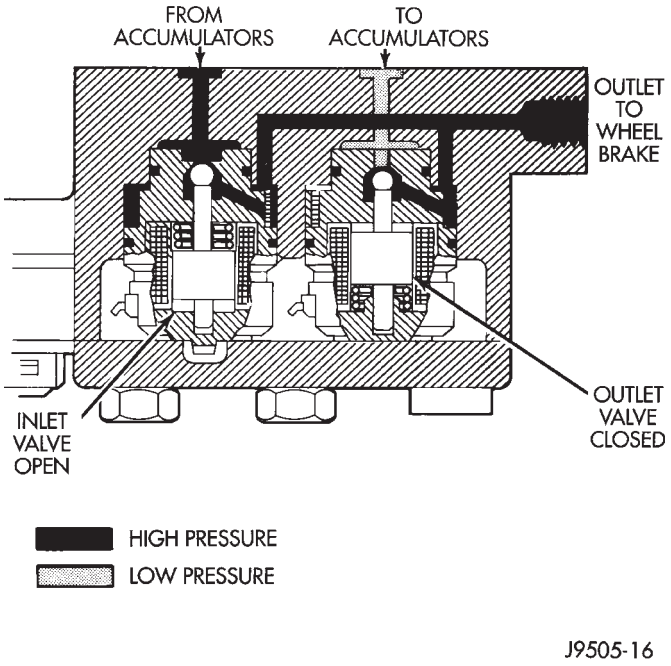


Fig. 8 Pressure Increase Cycle

WHEEL SPEED SENSOR OPERATION

Wheel speed input signals are generated by a sensor and tone ring at each wheel. The sensors, which are connected directly to the ECU, are mounted on brackets attached to the front steering knuckles and rear brake support plates.

The sensor triggering devices are the tone rings which are similar in appearance to gears. The tone rings are located on the outboard end of each front/rear axle shaft. The speed sensors generate a signal whenever a tone ring tooth rotates past the sensor pickup face.

The wheel speed sensors provide the input signal to the ECU. If input signals indicate ABS mode braking, the ECU causes the HCU solenoids to decrease, hold, or increase fluid apply pressure as needed.

The HCU solenoid valves are activated only when wheel speed input signals indicate that a wheel is approaching a high slip, or lockup condition. At this point, the ECU will cycle the appropriate wheel control channel solenoid valves to prevent lockup.

The wheel sensors provide speed signals whenever the vehicle wheels are rotating. The ECU examines these signals for degree of deceleration and wheel slip. If signals indicate normal braking, the solenoid valves are not activated. However, when incoming signals indicate the approach of wheel slip, or lockup, the ECU cycles the solenoid valves as needed.

ACCELERATION SWITCH OPERATION

The ECU monitors the acceleration switch at all times. The switch assembly contains three mercury switches that monitor vehicle ride height and deceleration rates (G-force). Sudden, rapid changes in vehicle and wheel deceleration rate, triggers the switch sending a signal to the ECU. The switch assembly provides three deceleration rates; two for forward braking and one for rearward braking.

ECU OPERATION

The antilock ECU controls all phases of antilock operation. It monitors and processes input signals from the system sensors.

It is the ECU that activates the solenoid valves to modulate apply pressure during antilock braking. The ECU program is able to determine which wheel control channel requires modulation and which fluid pressure modulation cycle to use. The ECU cycles the solenoid valves through the pressure decrease, hold and increase phases.

ABS COMPONENT SERVICEABILITY

The ECU, acceleration sensor, wheel sensors, and wire harnesses are serviced as assemblies only. The axle shaft tone wheels are also not serviceable. If a tone wheel becomes damaged, it will be necessary to replace the axle shaft, or disc brake rotor and hub assembly.

SPEED SENSOR AIR GAP

Front sensor air gap is fixed and not adjustable. Only rear sensor air gap is adjustable.

Although front air gap is not adjustable, it can be checked if diagnosis indicates this is necessary. Front

air gap should be 0.40 to 1.3 mm (0.0157 to 0.051 in.). If gap is incorrect, the sensor is either loose, or damaged.

A rear sensor air gap adjustment is only needed when reinstalling an original sensor. Replacement sensors have an air gap spacer attached to the sensor pickup face. The spacer establishes correct air gap when pressed against the tone ring during installation. As the tone ring rotates, it peels the spacer off the sensor to create the required air gap. Rear sensor air gap is 0.92-1.45 mm (0.036-0.057 in.).

Sensor air gap measurement, or adjustment procedures are provided in this section. Refer to the front, or rear sensor removal and installation procedures as required.

FRONT WHEEL SENSOR REMOVAL

(1) Raise vehicle and turn wheel outward for easier access to sensor.

(2) Remove sensor wire from mounting brackets.

(3) Clean sensor and surrounding area with shop towel before removal.

(4) Remove bolt attaching sensor to steering knuckle and remove sensor.

(5) remove sensor wire from brackets on body and steering knuckle.

(6) Unseat sensor wire grommet in wheel house panel.

(7) In engine compartment, disconnect sensor wire connector at harness plug. Then remove sensor and wire.

FRONT WHEEL SENSOR INSTALLATION

(1) If **original** sensor will be installed, wipe all traces of old spacer material off sensor pickup face. Use a dry shop towel for this purpose.

(2) Apply Mopar Lock N' Seal or Loctite 242 to bolt that secures sensor in steering knuckle. Use new sensor bolt if original bolt is worn or damaged.

(3) Position sensor on steering knuckle. Seat sensor locating tab in hole in knuckle and install sensor attaching bolt finger tight.

(4) Tighten sensor attaching bolt to 14 N·m (11 ft. lbs.) torque.

(5) If original sensor has been installed, check sensor air gap. Air gap should be 0.40 to 1.3 mm (0.0157 to 0.051 in.). If gap is incorrect, sensor is either loose, or damaged.

(6) Secure sensor wire to steering knuckle and body brackets.

(7) Route sensor wire forward and behind shock absorber. Then attach sensor wire to spring seat bracket with grommets on sensor wire.

(8) Route sensor wire to outer sill bracket. Remove all twists or kinks from wire.

(9) Attach sensor wire to sill bracket with grommet. Be sure wire is free of twists and kinks.

(10) Verify sensor wire routing. Wire should loop forward and above sill bracket. Loose end of wire should be below sill bracket and towards brake hose.

(11) Seat sensor wire grommet in body panel and clip wire to brake line at grommet location.

(12) Connect sensor wire to harness in engine compartment.

REAR WHEEL SENSOR REMOVAL

(1) On XJ models, raise and fold rear seat forward for access to rear sensor connectors (Fig. 9).

(2) Disconnect sensors at rear harness connectors.

(3) Push sensor grommets and sensor wires through floorpan.

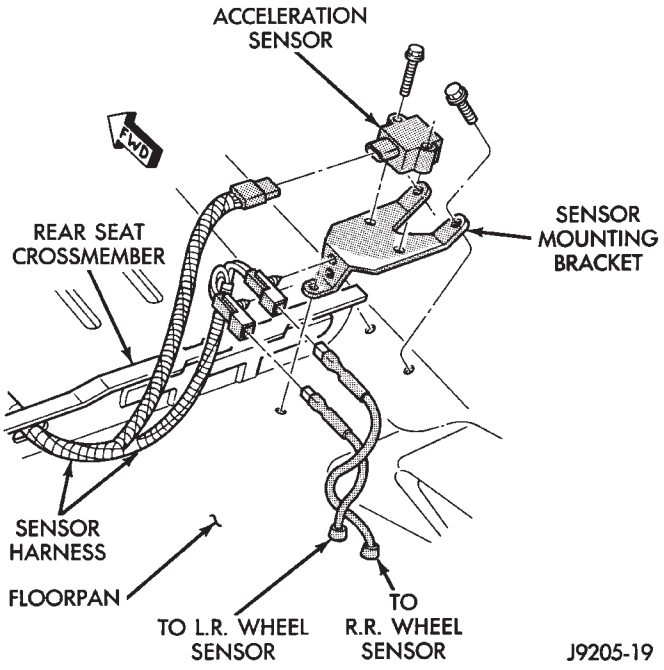


Fig. 9 Acceleration Switch And Rear Sensor Connections (XJ)

(4) Raise vehicle.

(5) Disconnect sensor wires at rear axle connectors.

(6) Remove wheel and tire assembly.

(7) Remove brake drum.

(8) Remove clips securing sensor wires to brakelines, rear axle and, brake hose.

(9) Unseat sensor wire support plate grommet.

(10) Remove bolt attaching sensor to bracket and remove sensor.

REAR WHEEL SENSOR INSTALLATION AND ADJUSTMENT

(1) If **original sensor** is being installed, remove any remaining pieces of cardboard spacer from sensor pickup face. Use dry shop towel only to remove old spacer material.

(2) Insert sensor wire through support plate hole. Then seat sensor grommet in support plate.

(3) Apply Mopar Lock N' Seal or Loctite 242 to

original sensor bolt. Use new bolt if original is worn or damaged.

(4) Install sensor bolt finger tight only at this time.

(5) If **original** rear sensor was installed, adjust sensor air gap to 0.92-1.45 mm (0.036-0.057 in.). Use feeler gauge to measure air gap (Fig. 10). Tighten sensor bolt to 11 N·m (11 ft. lbs.) torque.

(6) If **new** sensor was installed, push cardboard spacer on sensor face against tone ring (Fig. 11). Then tighten sensor bolt to 8 N·m (6 ft. lbs.) torque. Correct air gap will be established as tone ring rotates and peels spacer off sensor face.

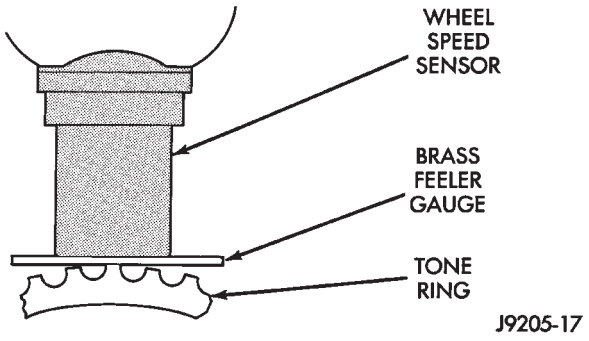


Fig. 10 Setting Air Gap On Original Rear Sensor

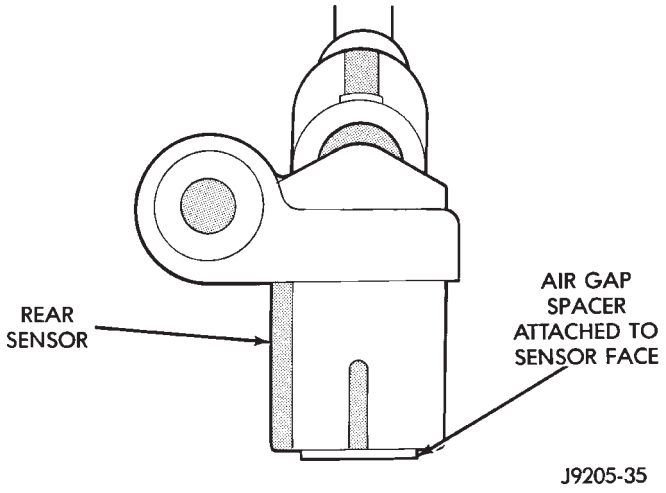


Fig. 11 Location Of Spacer On New Rear Sensor

(7) On YJ, connect rear sensor wires to connectors at axle. On XJ, route sensor wires to rear seat area.

(8) Feed sensor wires through floorpan access hole and seat sensor grommets in floorpan.

(9) Verify that rear sensor wires are secured to rear brake hose and axle with clips. Verify that wire is clear of rotating components.

(10) Install brake drum and wheel.

(11) Lower vehicle.

(12) On XJ, connect sensor wire to harness connector. Then reposition carpet and fold rear seat down.

ACCELERATION SWITCH REMOVAL

(1) On XJ models, tilt rear seat assembly forward for access to sensor (Fig. 12).

(2) On YJ models, move driver seat forward or rearward for access to sensor and mounting bracket (Fig. 12).

(3) Disconnect switch harness.

(4) On XJ models, remove screws attaching switch to bracket. Then remove switch.

(5) On YJ models, remove screws attaching switch bracket to floorpan. Then remove switch from bracket.

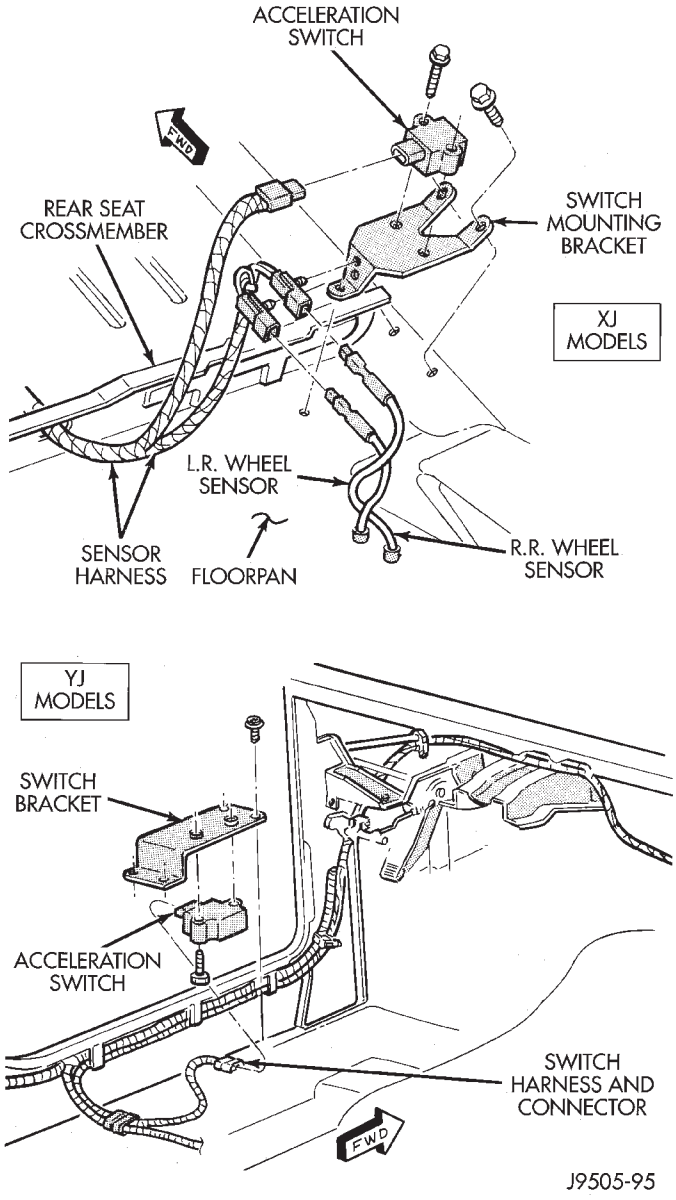


Fig. 12 Acceleration Switch Mounting (XJ/YJ)

ACCELERATION SWITCH INSTALLATION

(1) Note position of locating arrow on switch. Switch must be positioned so arrow faces forward.

CAUTION: The mercury switch (inside the acceleration switch), will not function properly if the switch is mispositioned. Verify that the switch locating arrow is pointing to the front of the vehicle.

(2) Position switch in mounting bracket.

(3) Install and tighten switch attaching screws to 2-4 N·m (17-32 in. lbs.) torque.

(4) Connect harness to switch. Be sure harness connecter is firmly seated.

(5) Move seat back to normal position.

ECU REMOVAL (XJ MODELS)

On left hand drive models, the ECU is located to the right of the steering column near the heater duct (Fig. 13). On right hand drive models, the ECU is located near the right side cowl panel adjacent to the dash (Fig. 14).

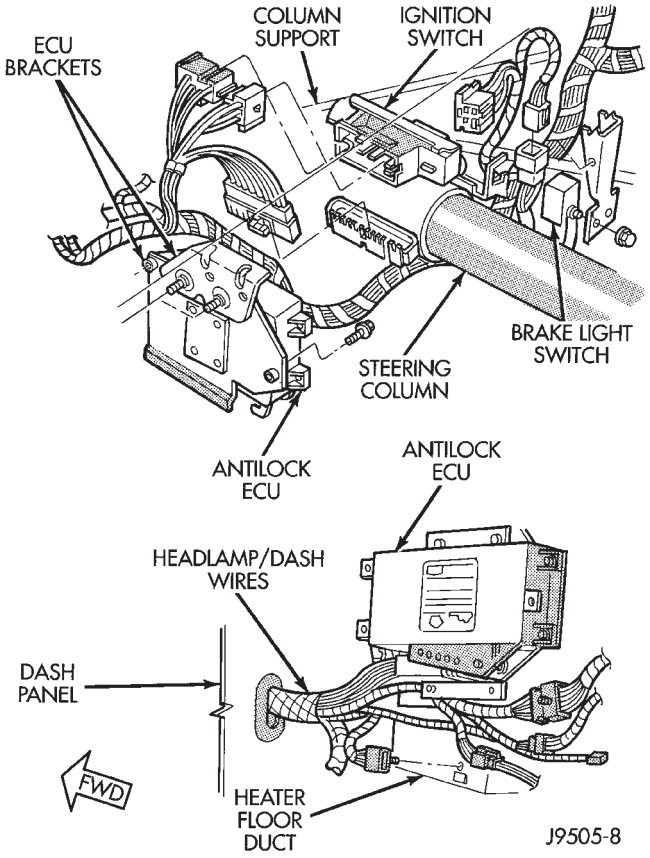


Fig. 13 Antilock ECU Mounting (Left Hand Drive XJ)

(1) Turn ignition key to Off position.

(2) Remove lower finish panel from instrument panel for added working clearance if necessary.

(3) Remove ECU mounting bracket attaching bolts/nuts.

(4) Release strap that secures ECU harness connector to pin terminals (Fig. 15). Use tool such as small flat blade screwdriver to lift and release strap.

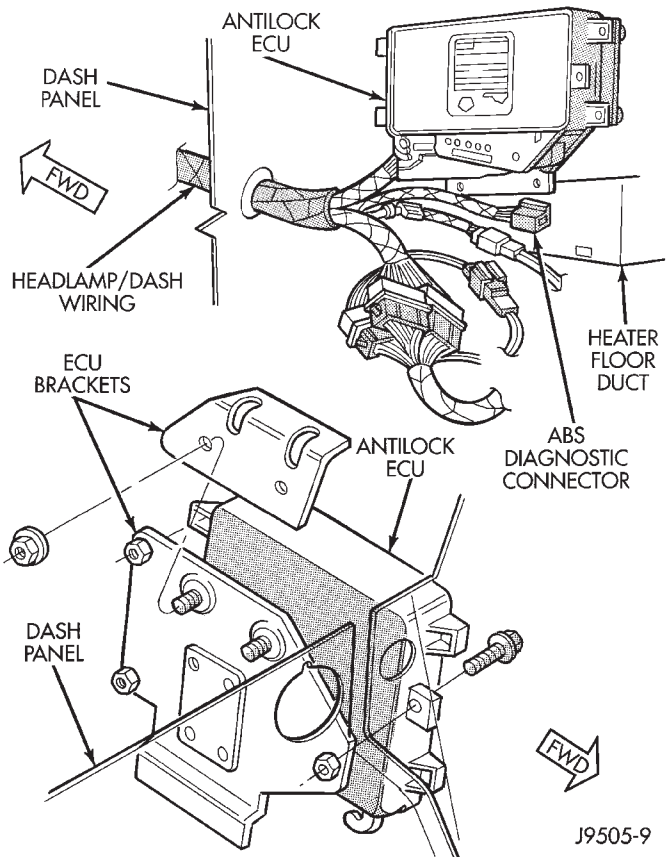


Fig. 14 Antilock ECU Mounting (Right Hand Drive XJ)

(5) Disconnect harness connector from ECU. Tilt connector upward to disengage it from ECU pin terminals. Then slide it out of retaining tangs in ECU.

(6) Remove ECU and mounting bracket as assembly.

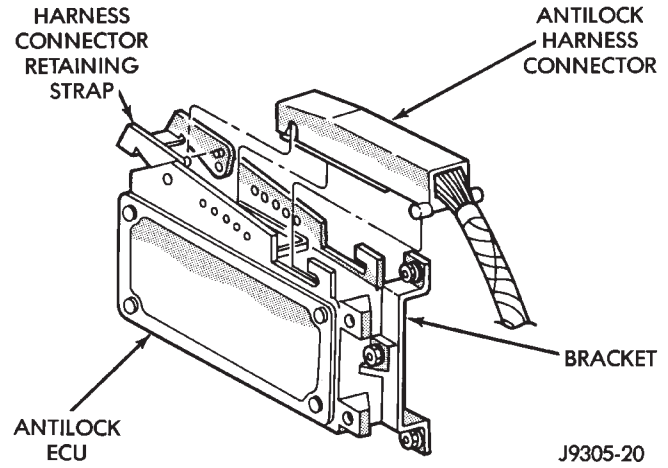


Fig. 15 ECU Harness Connector Attachment (XJ)

ECU INSTALLATION (XJ MODELS)

(1) If ECU is being replaced, install it on mounting bracket and tighten fasteners to 10-14 N·m (85-125 in. lbs.) torque

(2) Align and attach harness connector to ECU. Slide connector into engagement with tangs on ECU. Then tilt connector downward and into engagement with ECU pin terminals. Exercise care as pin terminals can be damaged if connector is forced into place.

(3) Connect harness to security alarm module, if equipped.

(4) Position ECU bracket under instrument panel.

(5) Install and tighten ECU mounting bracket bolts/nuts to 8-14 N·m (75- 125 in. lbs.) torque.

(6) Install trim panel on instrument panel, if removed.

ECU REMOVAL/INSTALLATION (YJ MODELS)

The antilock ECU is attached to the dash panel inside the passenger compartment. It is positioned just above the heater/air conditioning plenum housing, in line with the glove box (Fig. 16).

The ECU is attached to the dash panel by bolts and nuts that are accessible from the engine compartment. The fasteners are located just to the right of the battery.

On models with air conditioning, it will be necessary to remove the air conditioning fascia panel and ducts for access to the ECU and harness connecter.

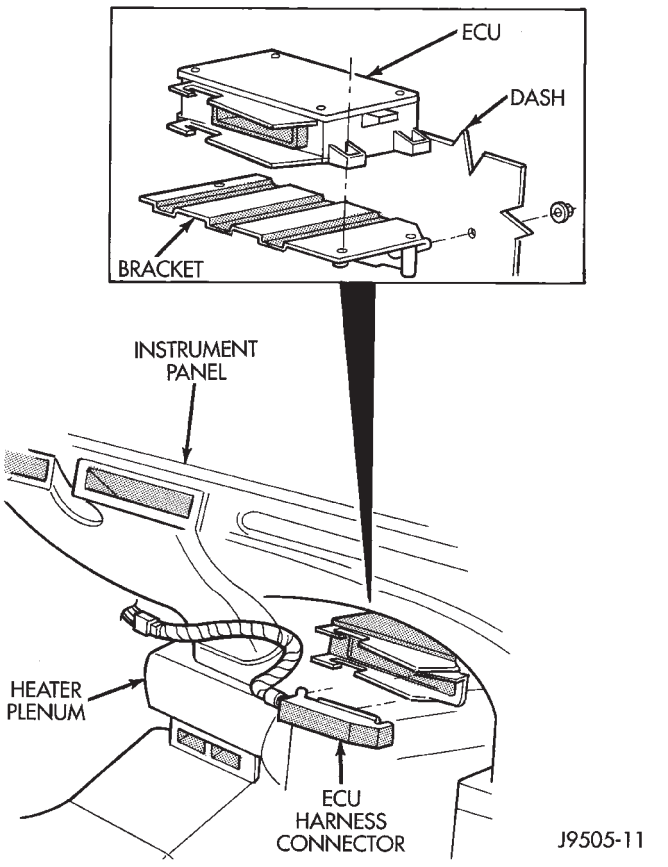


Fig. 16 ECU Location (YJ)

HCU REMOVAL (XJ)

A new design HCU is used in 1995 models. The new HCU has built-in accumulators that store the extra fluid released for antilock mode operation. As a result, the master cylinder and HCU are no longer interconnected by hoses. **The 1995 and prior hydraulic control units are NOT interchangeable.**

(1) Disconnect vent hoses at air cleaner cover.

(2) Loosen clamp securing air cleaner hose to intake manifold. Use screwdriver to tap clamp loose.

(3) Remove air cleaner cover and hose. Then remove air filter from air cleaner shell (Fig. 17).

(4) Remove two bolts and one nut that secure air cleaner housing to body panel (Fig. 17).

(5) Remove air cleaner housing from engine compartment.

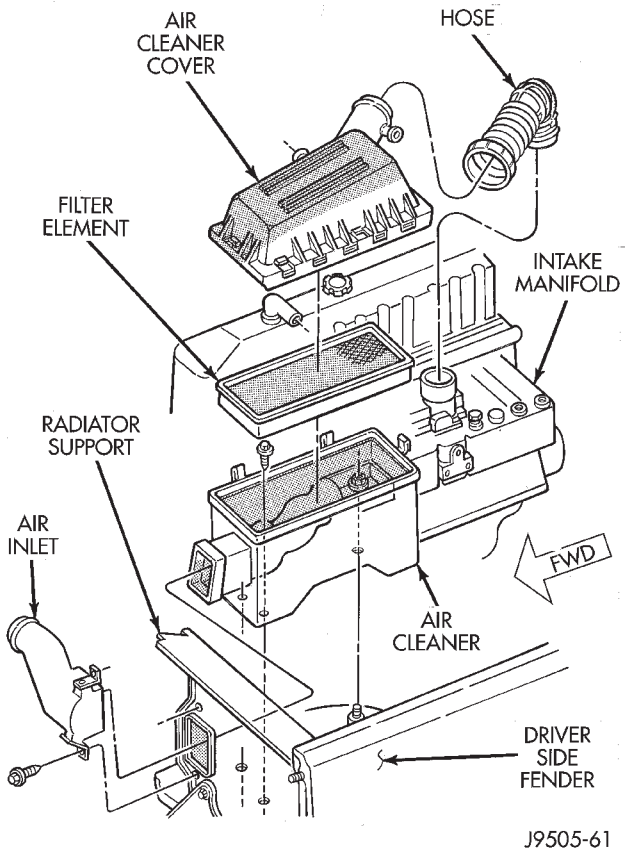


Fig. 17 Air Cleaner Components

(6) Disconnect both flex brakelines at HCU (Fig. 18).

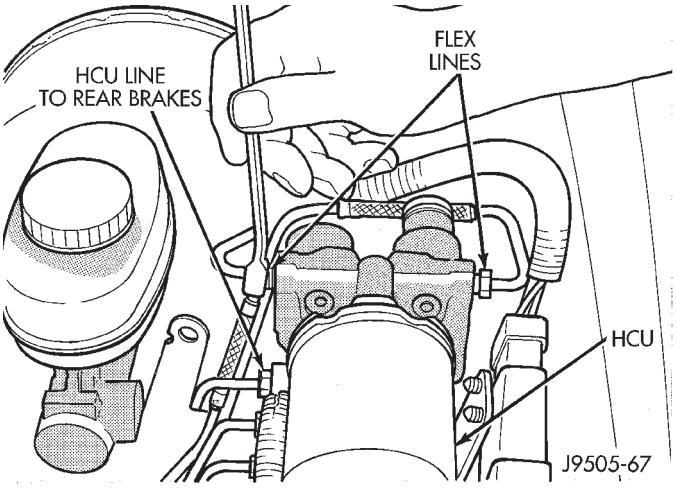


Fig. 18 Disconnecting Flex Lines From HCU

(7) Disconnect HCU solenoid harness from main harness (Fig. 19).

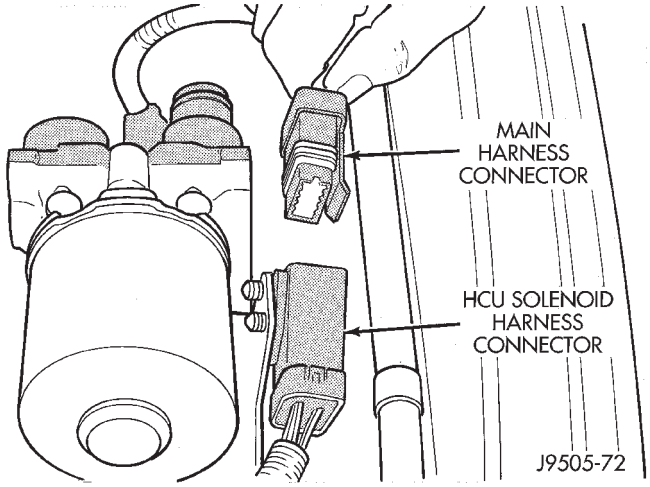


Fig. 19 Disconnecting HCU Solenoid Harness

(8) Disconnect HCU pump motor harness (Fig. 20).

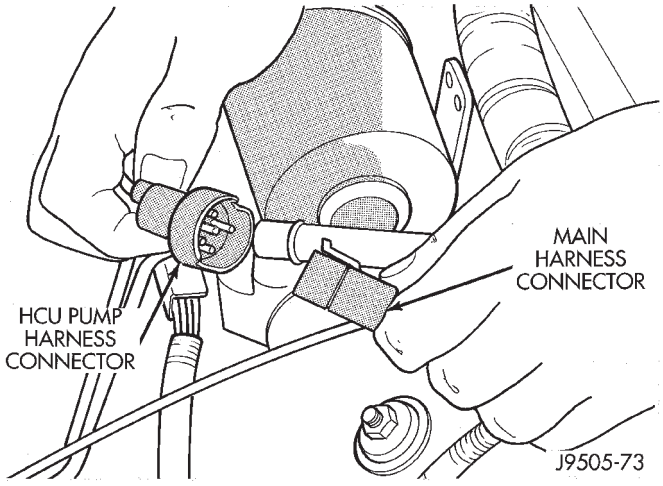


Fig. 20 Disconnecting HCU Pump Harness

(9) If HCU mounting bracket will be left in place, it will be necessary to remove HCU solenoid harness connecter from mounting bracket. Remove connecter fasteners, by squeezing them closed with needle nose pliers; then pulling them out of bracket.

(10) Disconnect lines to front/rear brakes at lower left side of HCU (Fig. 21).

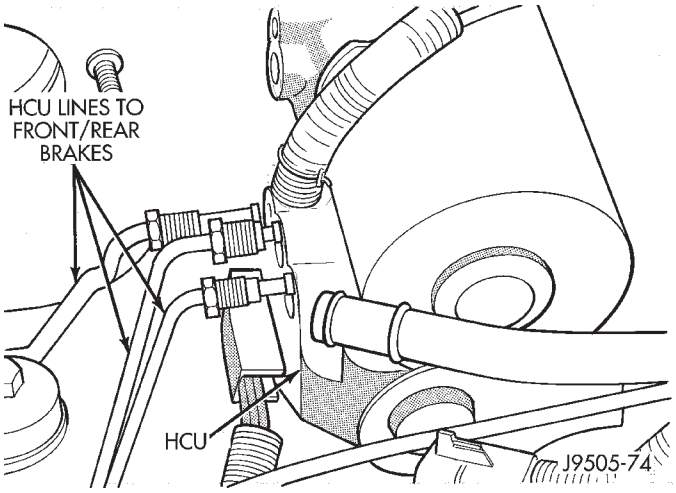


Fig. 21 HCU Front/Rear Brakeline Connections

(11) Remove HCU as follows:

(a) If only the HCU will be removed, remove three shoulder bolts attaching HCU to mounting bracket and remove HCU (Fig. 22).

(b) If HCU and bracket will be removed as assembly, remove three nuts attaching HCU to stud plate and remove HCU and bracket as assembly.

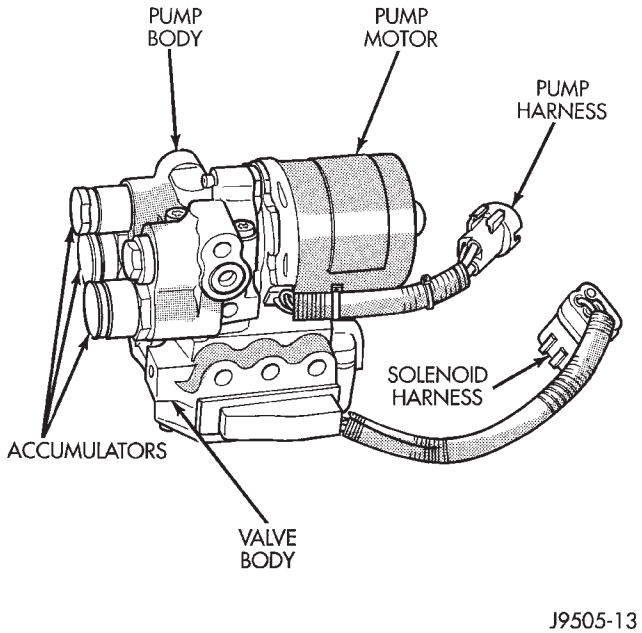


Fig. 22 HCU Assembly

HCU INSTALLATION (XJ)

(1) Install HCU as follows:

(a) If only the HCU was removed, position HCU in mounting bracket. Then install and tighten three shoulder bolts that attach HCU to bracket (Figs. 23 and 24). One bolt is used at forward end of bracket and two at rear as shown.

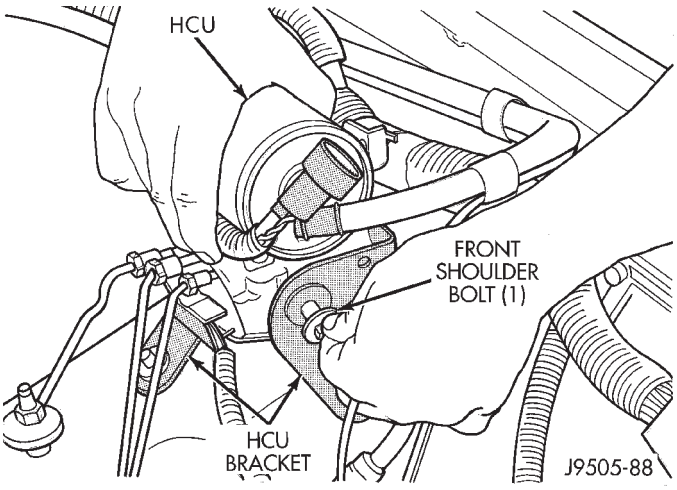


Fig. 23 Installing HCU Front Shoulder Bolt

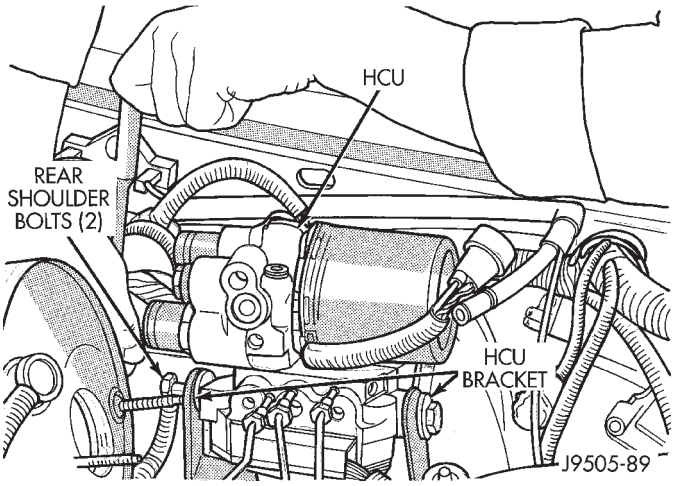


Fig. 24 Installing HCU Rear Shoulder Bolts

(b) If HCU and bracket were removed as assembly, position bracket on studs and install attaching nuts. Tighten nuts to 10-13 N·m (92-112 in. lbs.) torque.

(c) On right hand drive models, If brackets were removed, assemble brackets. Then position lower bracket on body studs and install attaching nuts and the one attaching bolt (Fig. 25).

(2) If HCU mounting bracket was not removed, press solenoid harness connecter fasteners into mounting bracket.

(3) Connect HCU pump motor and solenoid harnesses (Figs. 19 and 20).

(4) Connect brakelines from front/rear brakes to HCU. Start brakeline fittings in HCU ports by hand

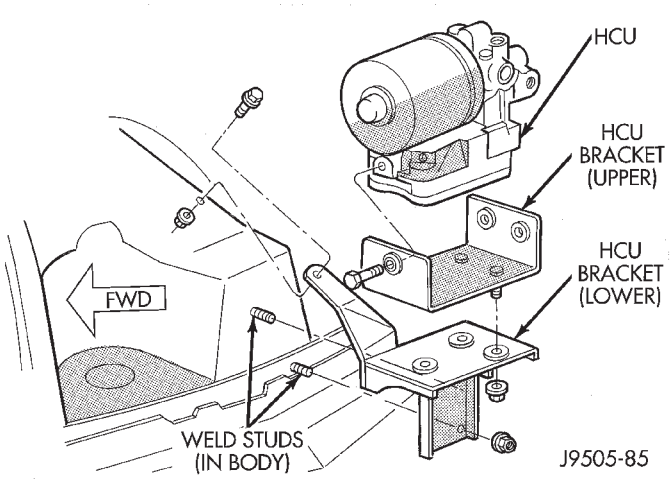


Fig. 25 HCU And Bracket Mounting (RHD Models)

to avoid cross threading (Fig. 26). Then tighten line fittings snug but not to required torque at this time.

(5) Connect flex lines to HCU (Fig. 18). Start

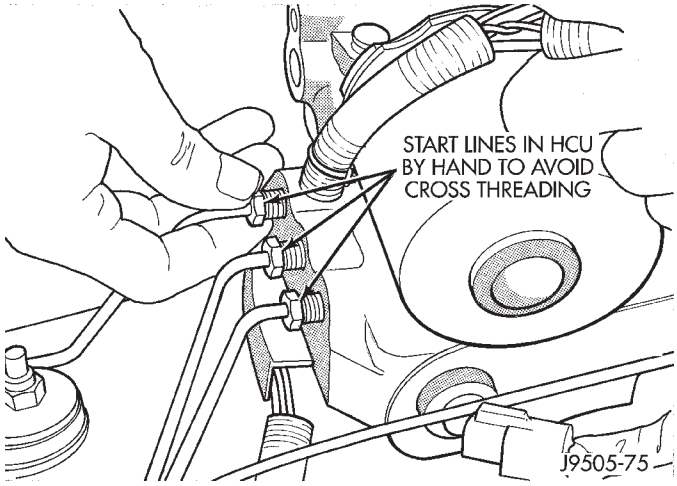


Fig. 26 Starting Brakelines In HCU (By Hand)

brakeline fittings in flex line ports by hand to avoid cross threading. Then tighten line fittings snug but not to required torque at this time.

(6) Bleed brakes. Refer to procedure in Brake Fluid-Brake Bleeding-Brakelines And Hoses section.

(7) Tighten brakeline fittings to following torques after brake bleeding: 15- 18 N·m (130-160 in. lbs.) at HCU and master cylinder and 18-24 N·m (160-210 in. lbs.) at combination valve.

(8) Install engine air cleaner assembly and hoses.

(9) Connect vacuum lines to manifold fittings.

(10) Check brake pedal action before moving vehicle. Bleed brakes again if pedal is not firm (feels soft/spongy).

HCU REMOVAL (YJ)

(1) Place shop towels under master cylinder and HCU brakelines.

(2) Disconnect flex lines at upper part of HCU.

(3) Disconnect solenoid and pump harness wires at HCU harness connecters.

(4) Disconnect lines to front/rear brakes at lower part of HCU.

(5) Remove shoulder bolts attaching HCU to mounting bracket and remove HCU.

HCU INSTALLATION (YJ)

(1) Position HCU in mounting bracket (Fig. 27).

(2) Install shoulder bolts that attach HCU to bracket.

(3) Connect brakelines to HCU. Start brakeline fittings by hand to avoid cross threading. Tighten fittings snug but not to torque at this time.

(4) Connect HCU pump and solenoid harness wires to engine compartment harness.

(5) Fill and bleed brake system.

(6) Tighten brakeline fittings to 15-18 N·m (130-160 in. lbs.) at HCU and master cylinder, and to 18-24 N·m (160-210 in. lbs.) at combination valve.

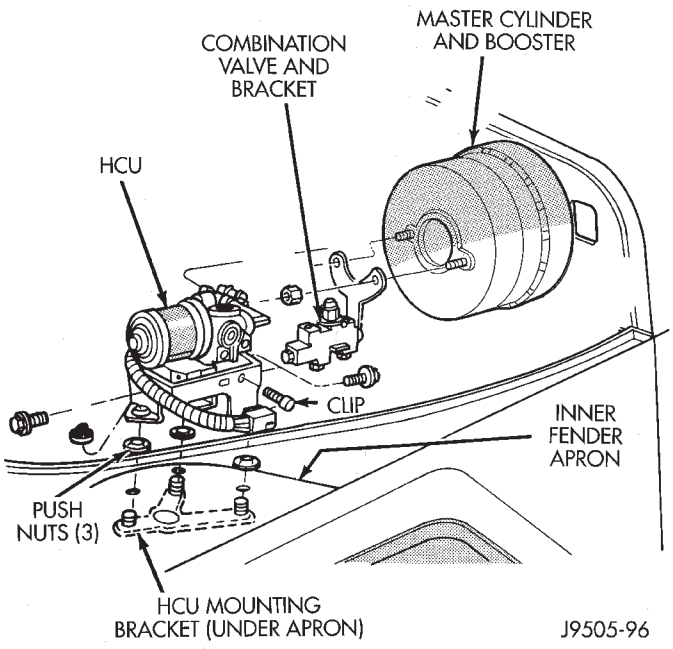


Fig. 27 HCU Mounting (YJ)

DISC BRAKES

INDEX

GENERAL INFORMATION

Jeep XJ/YJ models are equipped with single piston, floating-type disc brake calipers. Ventilated, cast rotors are used for all applications.

The disc brake calipers are supported in mounting arms that are an integral part of the steering knuckle. The calipers slide on mounting bolts that also attach the calipers to the steering knuckle.

CALIPER OPERATION AND WEAR COMPENSATION

Caliper Operation

The significant feature of single piston caliper operation is that the calipers are free to slide laterally on the mounting bolts. It is the freedom of lateral movement that allows continuous compensation for lining wear.

A simplified cross section of a single piston caliper is shown in Figure 1. The illustration graphically portrays the forces at work when the brakes are applied.

Upon brake application, fluid pressure exerted against the caliper piston increases greatly. Of equal importance, is the fact that fluid pressure is exerted equally and in all directions. What this means, is that pressure in the caliper bore, will be exactly the same as pressure on the piston. In other words, pressure against piston and caliper bore is equal.

Fluid pressure applied to the piston is transmitted directly to the inboard brakeshoe. This forces the shoe lining against the inner surface of the disc brake rotor (Fig. 1).

At the same time, fluid pressure within the piston bore, forces the caliper to slide inward on the mounting bolts. This action brings the outboard brakeshoe lining into contact with the outer surface of the disc brake rotor (Fig. 1).

In summary, fluid pressure acting simultaneously on both piston and caliper, produces a strong clamping action. When sufficient force is applied, friction will stop the rotors from turning and bring the vehicle to a stop.

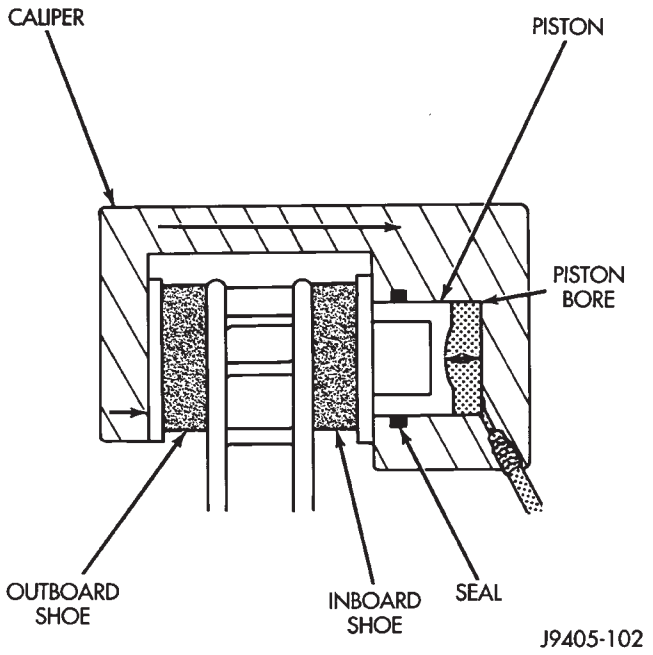


Fig. 1 Disc Brake Caliper Operation

Brakeshoe Wear Compensation

Application and release of the brake pedal generates only a very slight movement of the caliper and piston. Upon release of the pedal, the caliper and piston return to a rest position. The brakeshoes do not retract an appreciable distance from the rotor. In fact, clearance is usually at, or close to zero. The reasons for this are to keep road debris from getting between the rotor and lining and in wiping the rotor surface clear each revolution.

The caliper piston seal controls the amount of piston extension needed to compensate for normal lining wear.

During brake application, the seal is deflected outward by fluid pressure and piston movement (Fig. 2). When the brakes (and fluid pressure) are released, the seal relaxes and retracts the piston.

The amount of piston retraction is determined by brakelining wear. Generally, the amount is just enough to maintain contact between the piston and inboard brakeshoe. Brakelining running clearance at the rotor, will be held between zero and a maximum of 0.12 mm (0.005 in.).

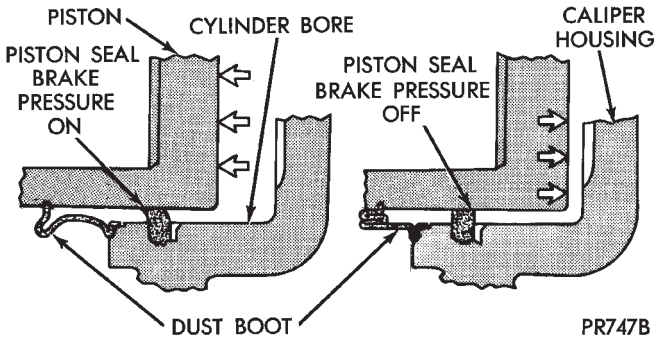


Fig. 2 Lining Wear Compensation By Piston Seal

DISC BRAKESHOE REMOVAL

(1) Raise vehicle and remove front wheels.

(2) Drain small amount of fluid from master cylinder front brake reservoir with suction gun.

(3) Bottom caliper piston in bore with C-clamp. Position clamp screw on outboard brakeshoe and clamp frame on rear of caliper. Typical C-clamp attachment is shown in Figure 3. **Do not allow clamp screw to bear directly on outboard shoe retainer spring. Use wood or metal spacer between shoe and clamp screw if necessary.**

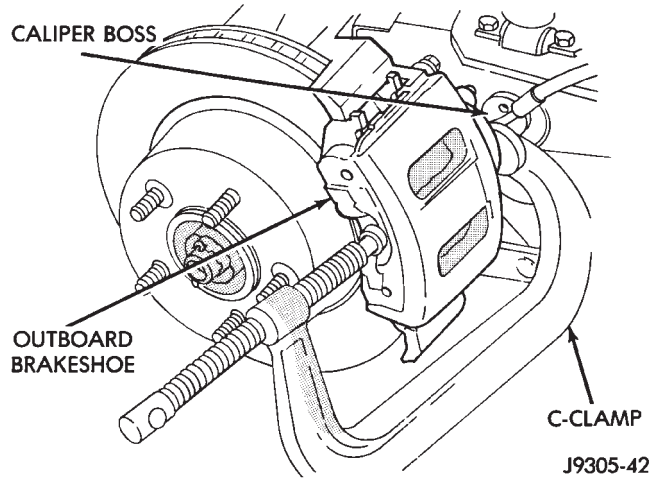


Fig. 3 Bottoming Caliper Piston With C-Clamp

(4) Remove caliper mounting bolts (Fig. 4). **If brakeshoes are being removed to correct a pull or drag condition, verify length of caliper bolts as they may be incorrect length. Refer to bolt information in brakeshoe installation procedure.**

(5) Tilt top of caliper outward. Use pry tool if necessary (Fig. 5).

(6) Lift caliper off steering knuckle (Fig. 6).

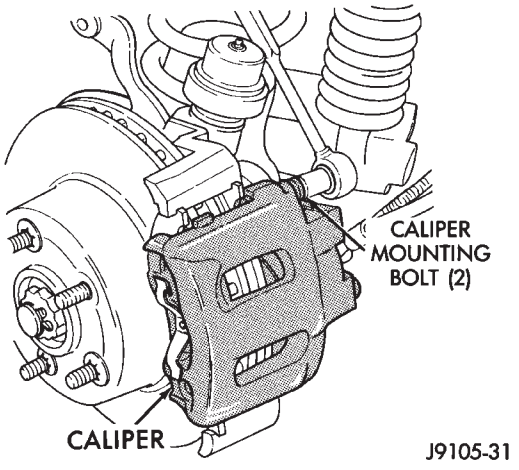


Fig. 4 Removing/Installing Caliper Mounting Bolts

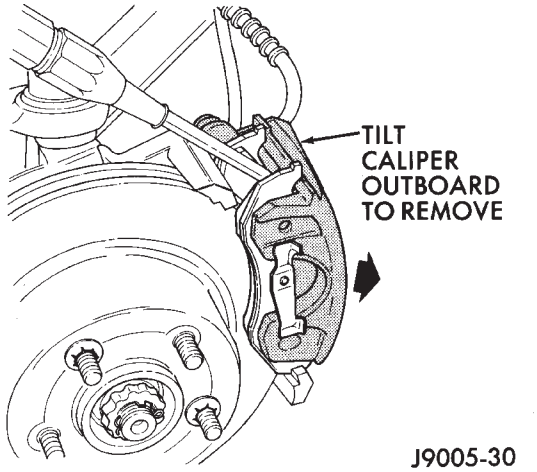


Fig. 5 Tilting Caliper Outward

(7) **If original brakeshoes will be used, keep them in sets (left and right); they are not interchangeable.**

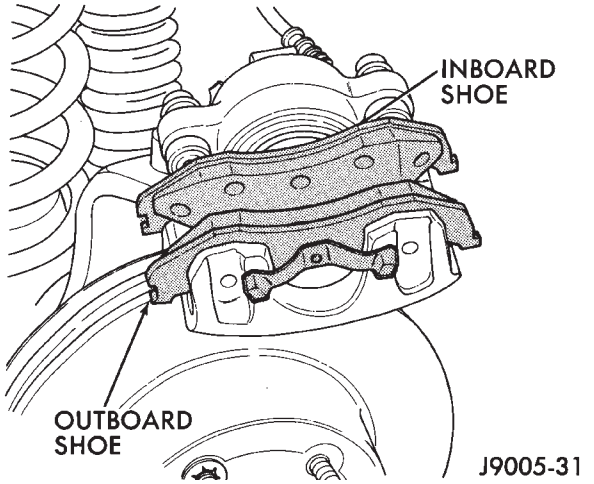


Fig. 6 Caliper Removal

(8) Remove outboard shoe. Press one end of shoe inward to disengage shoe lug. Then rotate shoe upward until retainer spring clears caliper. Press opposite end of shoe inward to disengage shoe lug and rotate shoe up and out of caliper (Fig. 7).

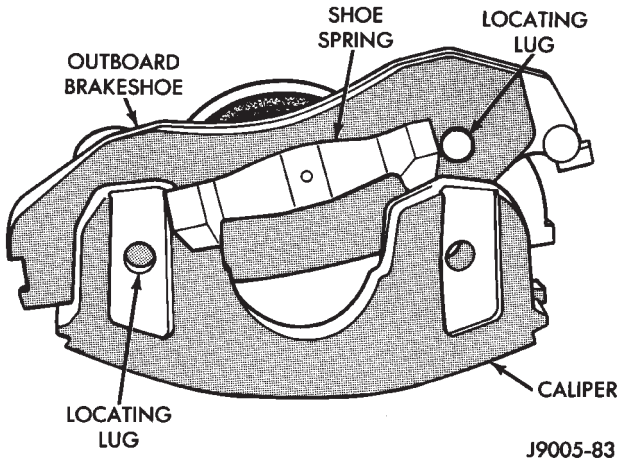


Fig. 7 Removing Outboard Brakeshoe

(9) Remove inboard shoe. Grasp ends of shoe and tilt shoe outward to release springs from caliper piston (Fig. 8). Then remove shoe from caliper.

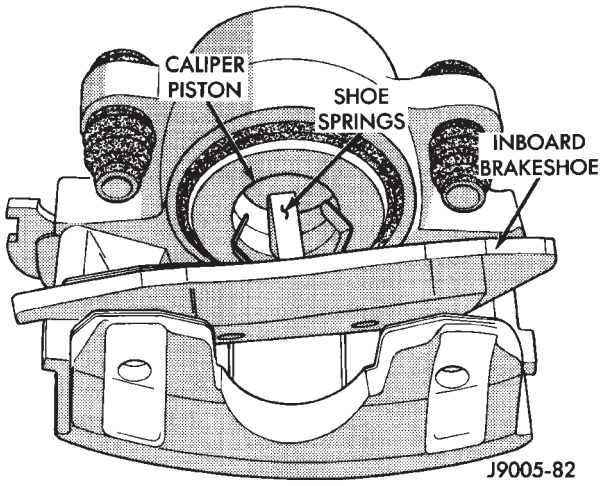


Fig. 8 Removing Inboard Brakeshoe

(10) Secure caliper to nearby suspension part with wire. **Do not allow brake hose to support caliper weight.**

(11) Wipe caliper off with shop rags or towels. **Do not use compressed air. Compressed air can unseat dust boot and force dirt into piston bore.**

(12) Inspect condition of caliper piston dust boot (Fig. 9). Overhaul caliper if there is evidence of leakage past piston and dust boot. Then inspect caliper bushings and boots (Fig. 9). Replace boots if torn or cut. If bushings or boots are damaged, replace them.

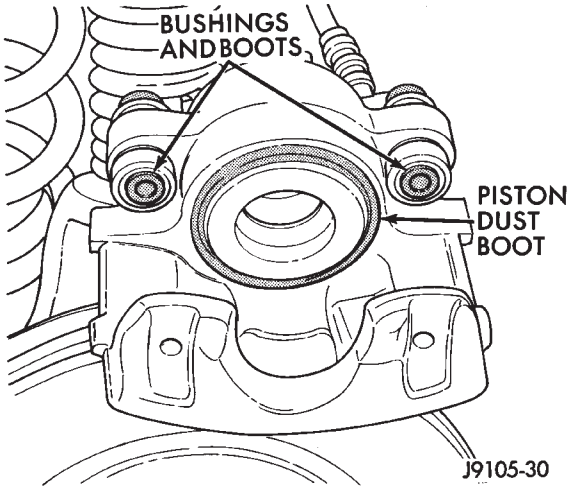


Fig. 9 Caliper Dust Boots And Bushing Locations

DISC BRAKESHOE INSTALLATION

(1) Clean brakeshoe mounting ledge slide surfaces of steering knuckle with wire brush. Then apply light coat of Mopar multi-mileage grease to slide surfaces (Fig. 10).

(2) Lubricate caliper mounting bolts and bushings (Fig. 10). Use GE 661 or Dow 111 silicone grease.

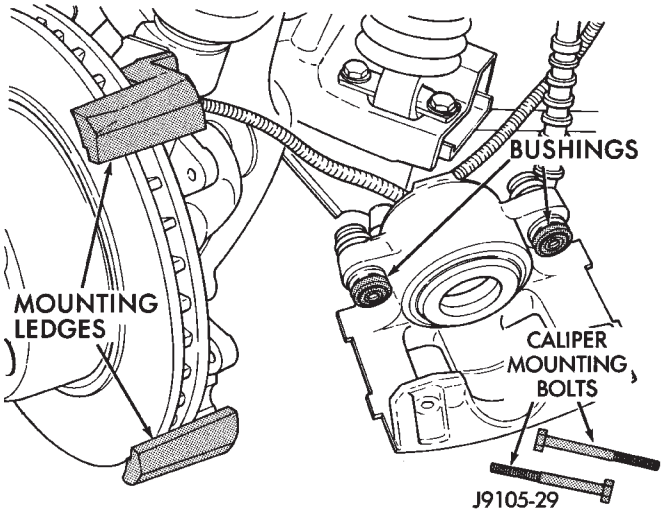


Fig. 10 Caliper Lubrication Points

(3) Keep new or original brakeshoes in sets. Do not interchange them.

(4) Install inboard shoe in caliper (Fig. 11). Be sure shoe retaining springs are fully seated in caliper piston.

(5) Install outboard shoe in caliper (Fig. 12). Start one end of shoe in caliper. Rotate shoe downward and into place until shoe locating lugs and shoe spring are seated.

(6) Verify that locating lugs on outboard shoe are seated in caliper (Fig. 6).

(7) Install caliper. Position notches at lower end of brakeshoes on bottom mounting ledge (Fig. 13). Then

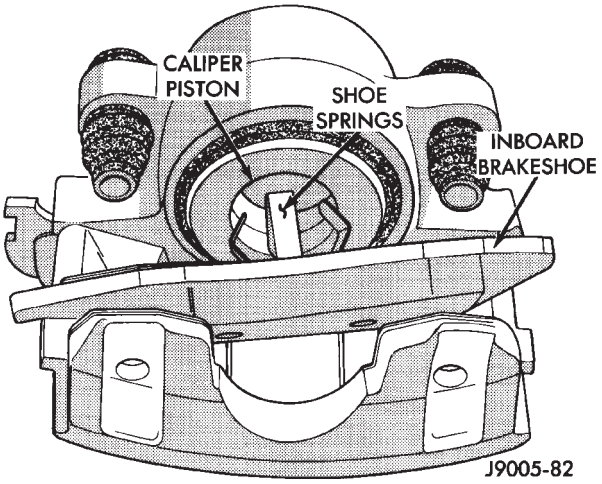


Fig. 11 Installing Inboard Brakeshoe

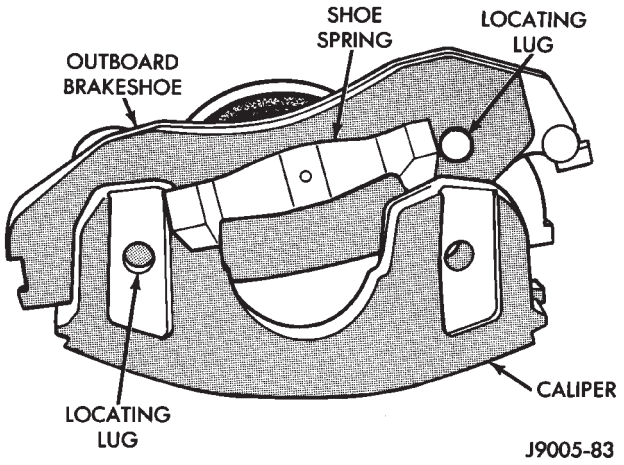


Fig. 12 Installing Outboard Brakeshoe

install caliper over rotor and seat upper ends of brakeshoes on top mounting ledge (Fig. 11).

CAUTION: Before securing the caliper, be sure the caliper brake hose is not twisted, kinked or touching any chassis components. Also be sure the hose is clear of all suspension and steering components. Loosen and reposition the hose if necessary.

(8) Install and tighten caliper mounting bolts to 10-20 N·m (7-15 ft. lbs.) torque.

CAUTION: If new caliper bolts are being installed, or if the original reason for repair was a drag/pull condition, check caliper bolt length before proceeding. If the bolts have a shank length greater than 67.6 mm (2.66 in.), they will contact the inboard brakeshoe causing a partial apply condition. Refer to Figure 14 for required caliper bolt length.

(9) Install wheels. Tighten lug nuts to 102 N·m (75 ft. lbs.) torque.

(10) Pump brake pedal until caliper pistons and brakeshoes are seated.

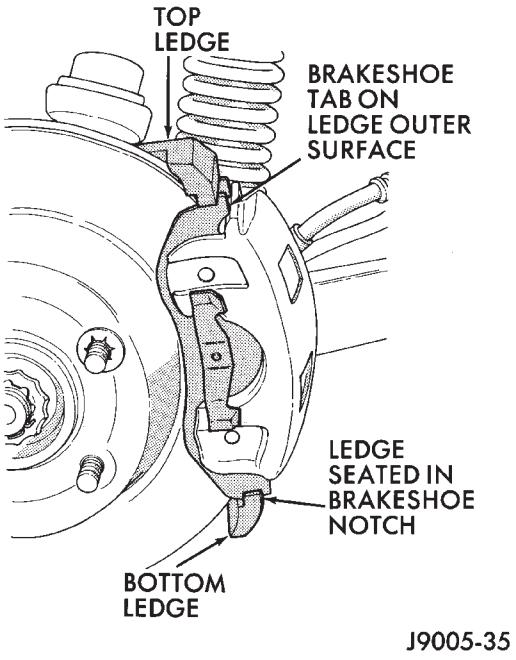


Fig. 13 Caliper Installation

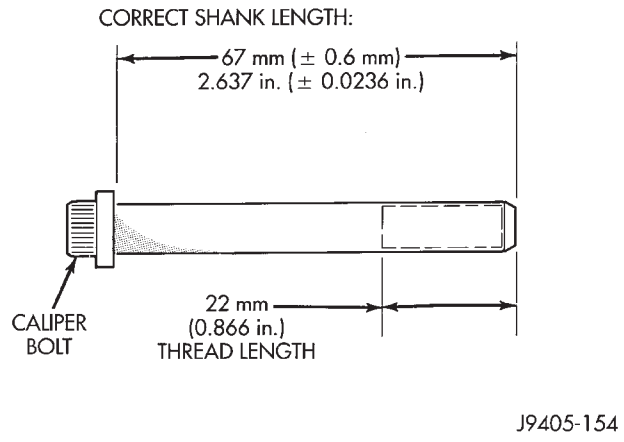


Fig. 14 Caliper Mounting Bolt Dimensions

(11) Top off brake fluid level if necessary. Use Mopar brake fluid or equivalent meeting SAE J1703 and DOT 3 standards only.

CALIPER REMOVAL

(1) Raise vehicle and remove front wheels.

(2) Remove fitting bolt and disconnect front brake hose at caliper. Discard fitting bolt gaskets. They should not be reused.

(3) Remove caliper mounting bolts (Fig. 4).

(4) Rotate caliper rearward by hand or with pry tool (Fig. 5). Then rotate caliper and brakeshoes off mounting ledges.

(5) Remove caliper from vehicle.

CALIPER DISASSEMBLY

(1) Remove brakeshoes from caliper.

(2) Pad interior of caliper with minimum, 2.54 cm (1 in.) thickness of shop towels or rags (Fig. 15). Towels are needed to protect caliper piston during removal.

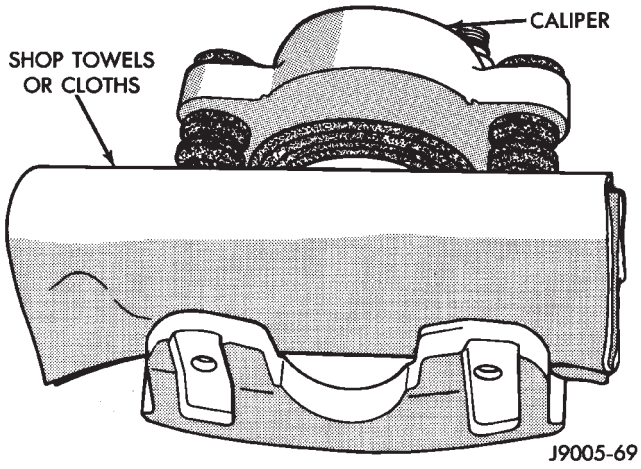


Fig. 15 Padding Caliper Interior To Protect Piston During Removal

(3) Remove caliper piston with **short bursts** of low pressure compressed air. Direct air through fluid inlet port and ease piston out of bore (Fig. 16).

CAUTION: Do not blow the piston out of the bore with sustained air pressure. This could result in a cracked piston. Use only enough air pressure to ease the piston out. In addition, NEVER attempt to catch the piston as it leaves the bore. This will result in personal injury.

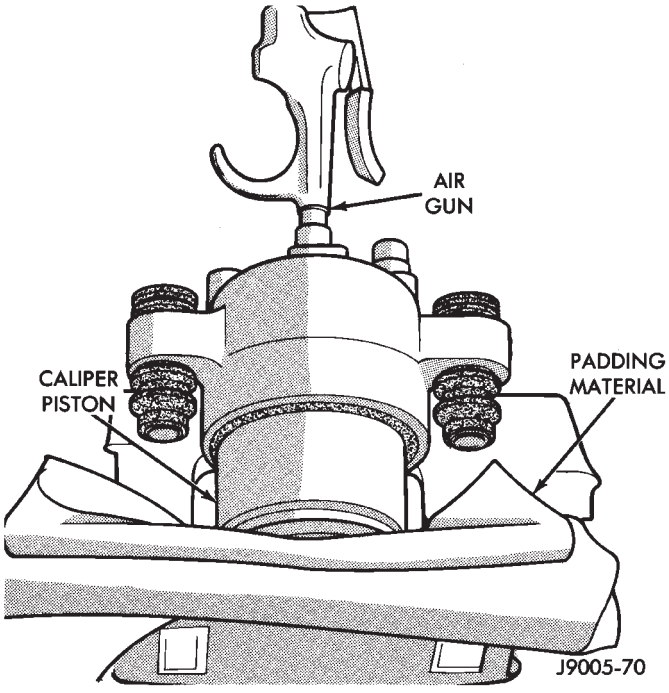


Fig. 16 Removing Caliper Piston

(4) Remove caliper piston dust boot (Fig. 17). Collapse boot with suitable tool and remove and discard boot.

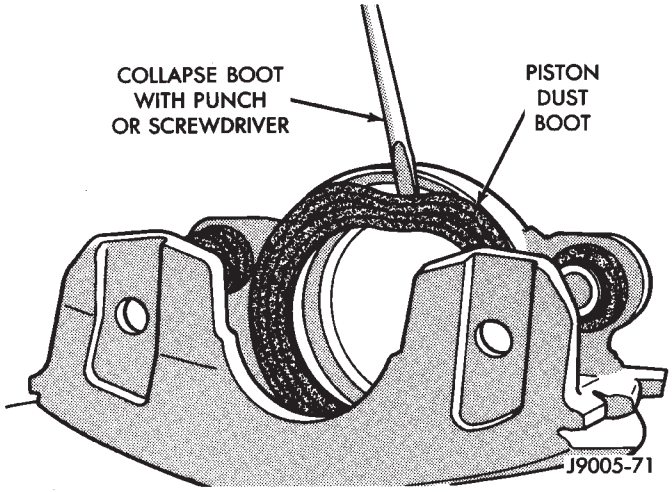


Fig. 17 Removing Caliper Piston Dust Boot

(5) Remove and discard caliper piston seal with wood or plastic tool (Fig. 18). Do not use metal tools as they will scratch piston bore.

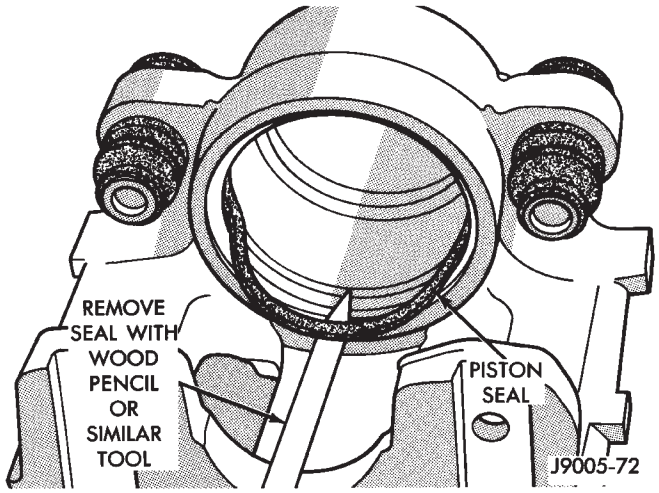


Fig. 18 Removing Caliper Piston Seal

(6) Remove caliper mounting bolt bushings and boots (Fig. 19).

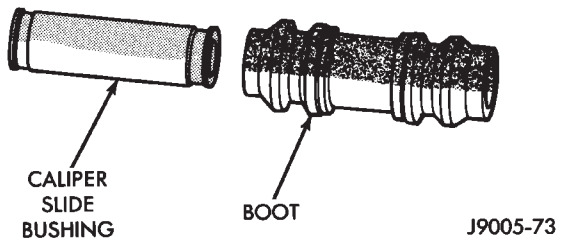


Fig. 19 Caliper Bushing And Boot

CALIPER CLEANING AND INSPECTION

Clean the caliper and piston with Mopar brake cleaner, clean brake fluid, or denatured alcohol only. Do not use gasoline, kerosene, thinner, or similar solvents. These products leave a residue that will damage pistons and seals.

Wipe the caliper and piston dry with lint free towels or use low pressure compressed air.

Inspect the piston and piston bore. Replace the caliper if the bore is corroded, rusted, pitted, or scored. Do not hone the caliper piston bore. Replace the caliper if the bore exhibits any of the aforementioned conditions.

Inspect the caliper piston. The piston is made from a phenolic resin and should be smooth and clean. Replace the piston if cracked, chipped, or scored. Do not attempt to restore a scored, or corroded piston surface by sanding or polishing. The piston must be replaced if damaged.

CAUTION: Never interchange phenolic resin and steel caliper pistons. The seals, seal grooves, caliper bores and piston tolerances are different for resin and steel pistons. Do not intermix these components.

Inspect the caliper mounting bolt bushings and boots. Replace the boots if cut or torn. Clean and lubricate the bushings with GE 661 or Dow 111 silicone grease if necessary.

Inspect condition of the caliper mounting bolts. Replace the bolts if corroded, rusted, or worn. Do not reuse the bolts if unsure of their condition.

Length of the caliper mounting bolts is also extremely important.

Use the replacement bolts specified in the parts catalog at all times. Do not use substitute bolts. Bolts that are too long will partially apply the inboard brakeshoe causing drag and pull. Refer to the caliper and brakeshoe installation procedures for service details and bolt dimensions.

CALIPER ASSEMBLY

(1) Coat caliper piston bore, new piston seal and piston with clean, fresh brake fluid.

(2) Lubricate caliper bushings and interior of bushing boots with GE 661, Dow 111, or Permatex Dielectric silicone grease.

(3) Install bushing boots in caliper first. Then insert bushing into boot and push bushing into place (Fig. 20).

(4) Install new piston seal in caliper bore. Press seal into seal groove with finger (Fig. 21).

(5) Install dust boot on caliper piston (Fig. 22). Slide boot over piston and seat boot in piston groove.

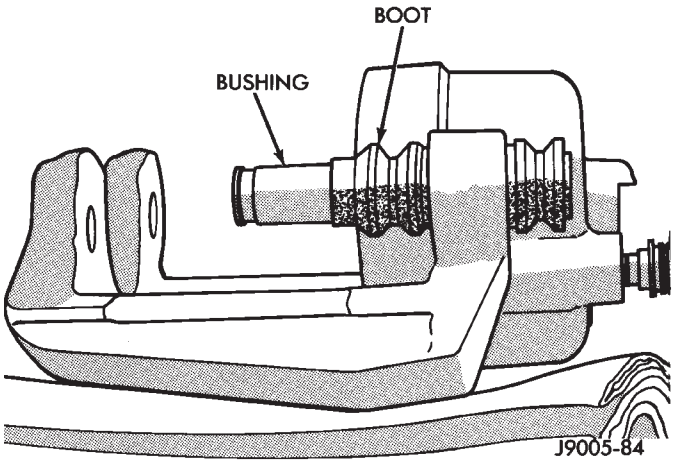


Fig. 20 Installing Bushings And Boots

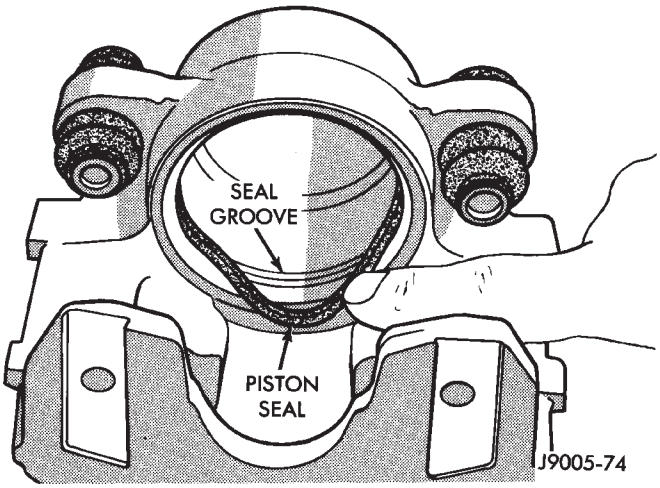


Fig. 21 Installing Piston Seal

(6) Start caliper piston in bore by hand (Fig. 23). Use a turn and push motion to work piston into seal. Once piston is started in seal, press piston **only part way** into bore.

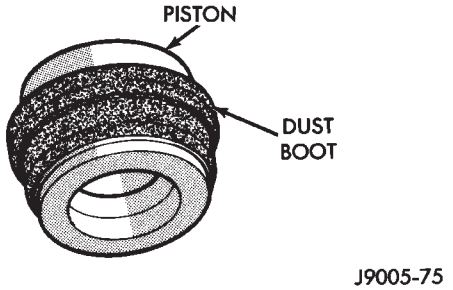


Fig. 22 Installing Dust Boot On Piston

(7) Press caliper piston to bottom of bore.

(8) Seat dust boot in caliper with Installer Tool C-4842 and Tool Handle C- 4171 (Fig. 24).

(9) Install caliper bleed screw if removed.

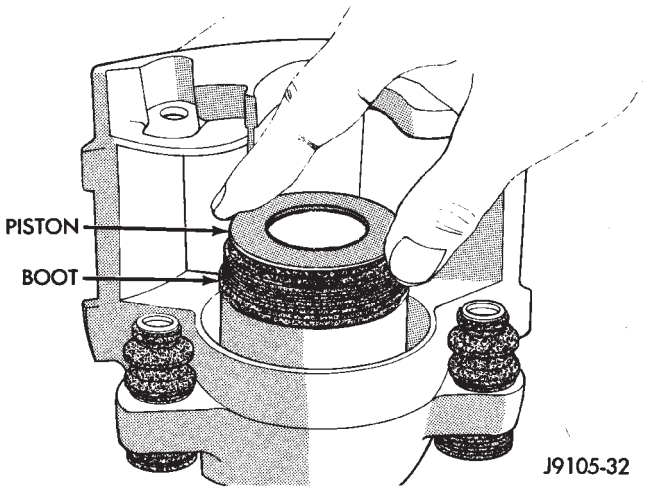


Fig. 23 Installing Caliper Piston

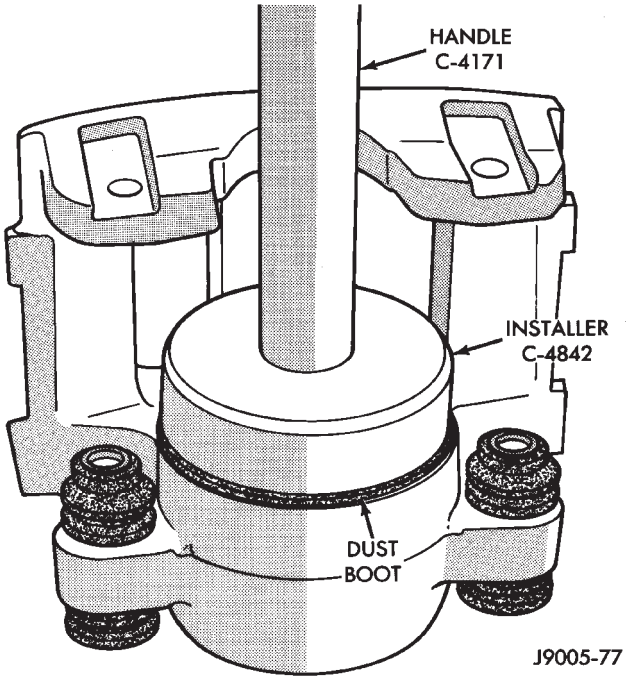


Fig. 24 Seating Caliper Piston Dust Boot

CALIPER INSTALLATION

(1) Install brakeshoes in caliper (Figs. 11, 12).

(2) Connect brake hose to caliper but do not tighten fitting bolt completely at this time. **Be sure to use new gaskets on fitting bolt to avoid leaks (Fig. 25).**

(3) Install caliper. Position mounting notches at lower end of brakeshoes on bottom mounting ledge (Fig. 13). Then rotate caliper over rotor and seat notches at upper end of shoes on mounting ledge (Fig. 13).

(4) Coat caliper mounting bolts with GE 661 or Dow 111 silicone grease. Then install and tighten bolts to 10-20 N·m (7-15 ft. lbs.) torque.

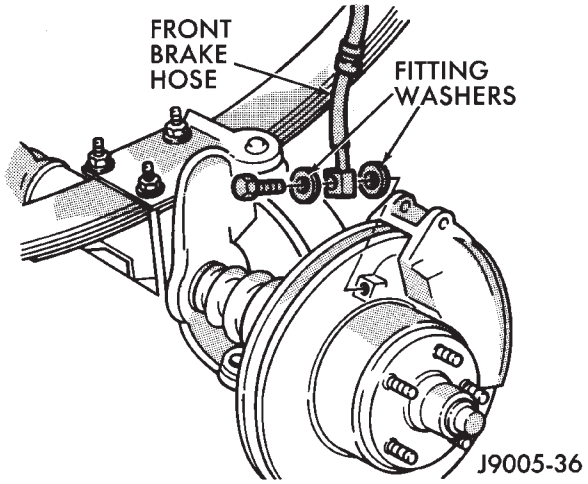


Fig. 25 Front Brake Hose And Fitting Components

CAUTION: If new caliper bolts are being installed, or if the original reason for repair was a drag/pull condition, check caliper bolt length before proceeding. If the bolts have a shank length greater than 67.6 mm (2.66 in.), they may contact the inboard brakeshoe causing a partial apply condition. Refer to Figure 14 for the required caliper bolt length.

(5) Position front brake hose clear of all chassis components and tighten caliper fitting bolt to 31 N·m (23 ft. lbs.) torque.

CAUTION: Be sure the brake hose is not twisted or kinked at any point. Also be sure the hose is clear of all steering and suspension components. Loosen and reposition the hose if necessary.

(6) Install wheels. Tighten wheel lug nuts to 109-150 N·m (80-110 ft. lbs.) torque.

(7) Fill and bleed brake system. Refer to procedures in Service Adjustments section.

ROTOR REMOVAL

(1) Raise vehicle and remove wheel.

(2) Remove caliper.

(3) Remove retainers securing rotor to hub studs (Fig. 26).

(4) Remove rotor from hub (Fig. 26).

(5) If rotor shield requires service, remove front hub and bearing assembly.

ROTOR INSTALLATION

(1) If new rotor is being installed, remove protective coating from rotor surfaces with Mopar carb cleaner. **It is not necessary to machine a rotor to remove the coating. Mopar carb cleaner followed by a rinse with brake cleaner will remove the coating.**

(2) Install rotor on hub.

(3) Install caliper.

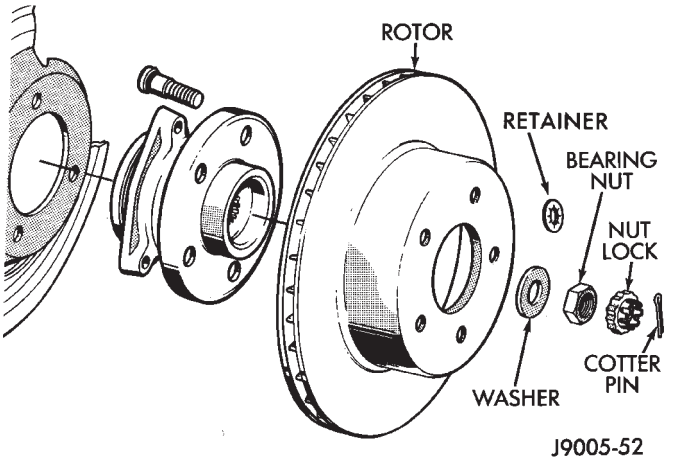


Fig. 26 Rotor And Hub

(4) Install new spring nuts on wheel studs.
(5) Install wheel and lower vehicle.

DISC BRAKE ROTOR THICKNESS

Rotor minimum usable thickness is 22.7 mm (0.89 in.). This dimension is either cast, or stamped on the rotor hub, or outer edge.

Measure rotor thickness at the center of the brakeshoe contact surface.

Replace the rotor if worn below minimum thickness. Also replace the rotor if refinishing would reduce thickness below the allowable minimum.

DISC BRAKE ROTOR RUNOUT

Check rotor lateral runout whenever pedal pulsation, or rapid, uneven brakelining wear has occurred.

On 4-wheel drive models, the rotor must be securely clamped to the hub to ensure an accurate runout measurement. Secure the rotor with the wheel nuts and 4 or 5 large diameter flat washers on each stud as shown (Fig. 27).

Use a dial indicator to check lateral runout (Fig. 27).

Maximum allowable rotor lateral runout is 0.13 mm (0.005 in.).

Check lateral runout with a dial indicator (Fig. 28). Excessive lateral runout will cause brake pedal pulsation and rapid, uneven wear of the brakeshoes.

Maximum allowable rotor runout for all models is 0.12 mm (0.005 in.).

DISC BRAKE ROTOR THICKNESS VARIATION

Variations in rotor thickness will cause pedal pulsation, noise and shudder.

Measure rotor thickness at four to six points around the rotor face. Position the micrometer approximately 2 cm (3/4 in.) from the rotor outer circumference for each measurement (Fig. 29).

Thickness should not **vary** by more than 0.013 mm (0.0005 in.) from point-to-point on the rotor. Refinish or replace the rotor if necessary.

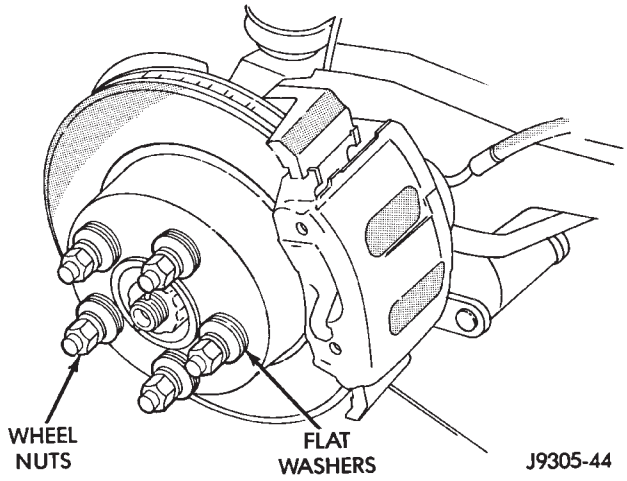


Fig. 27 Securing 4 x 4 Rotor For Lateral Runout Check

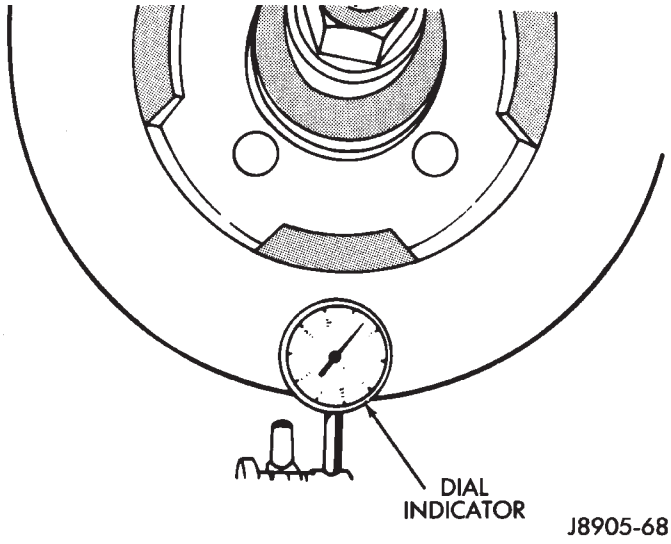


Fig. 28 Typical Method Of Checking Rotor Lateral Runout

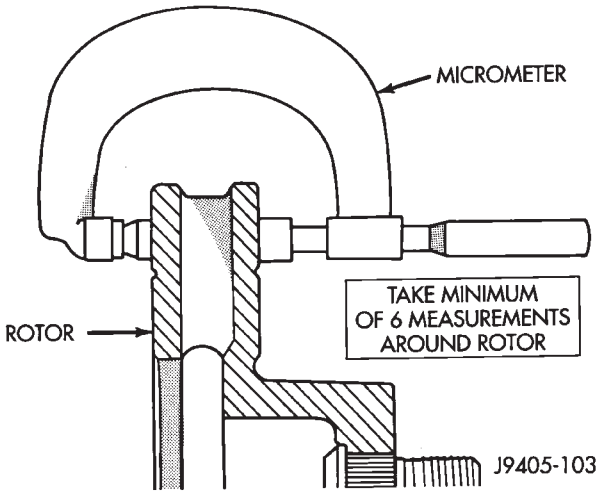


Fig. 29 Measuring Rotor Thickness Variation

DISC BRAKE ROTOR REFINISHING

When To Refinish

Rotor braking surfaces can be refinished by sanding and/or machining in a disc brake lathe. However, the rotor should be cleaned and inspected beforehand. Careful inspection will avoid refinishing rotors with very little service life left in them.

Pay particular attention to rotors that are heavily rusted, or corroded. Accumulated rust/corrosion on braking surfaces and ventilating ribs may extend to a depth beyond acceptable limits. This can be especially true on: (a) high mileage vehicles; (b) vehicles regularly exposed to road salt during winter months; (c) vehicles operated in coastal regions where salt air/road splash is a factor; (d) and vehicles used for extensive off-road operation.

New rotors have a protective coating that should be removed before installation. **It is not necessary to machine a rotor to remove this coating. The coating is easily removed with Mopar carb cleaner followed by a rinse with Mopar brake cleaner. A scotch brite pad, or steel wool can also be used to help loosen and remove the coating if desired.**

Recommended Refinishing Equipment

The brake lathe must be capable of machining both rotor surfaces simultaneously with dual cutter heads (Fig. 30). **Equipment capable of machining only one side at a time will produce a tapered rotor.** The lathe should also be equipped with a grinder attachment, or dual sanding discs for final cleanup or light refinishing.

Refinishing Techniques

If the rotor surfaces only need minor cleanup of rust, scale, or scoring, use abrasive sanding discs to clean up the rotor surfaces. However, when a rotor is scored or worn, machining with cutting tools will be required.

Light cuts are recommended when machining the rotor surfaces. Heavy feed rates are not recommended and may result in chatter marks, or taper.

CAUTION: Never refinish a rotor if machining would cause the rotor to fall below minimum allowable thickness.

The final finish on the rotor should be a non-directional, cross hatch pattern (Fig. 31). Use sanding discs to produce this finish.

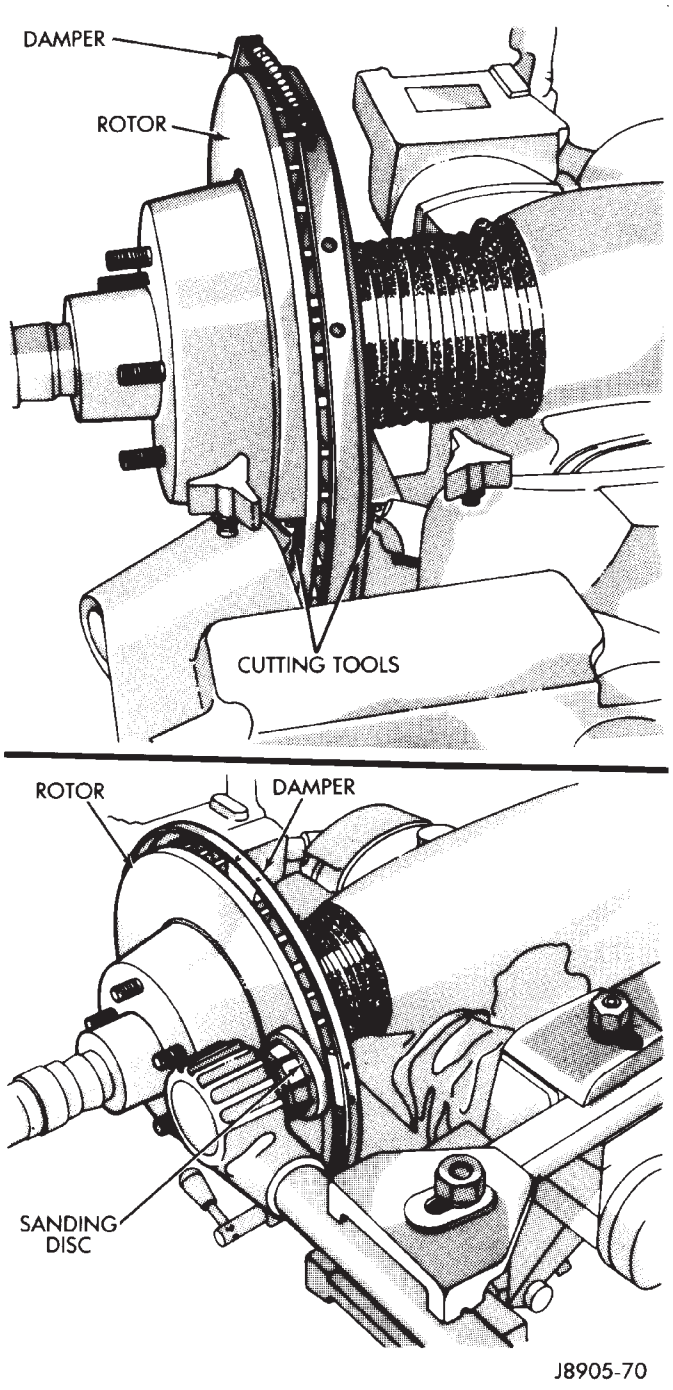


Fig. 30 Rotor Refinishing Equipment

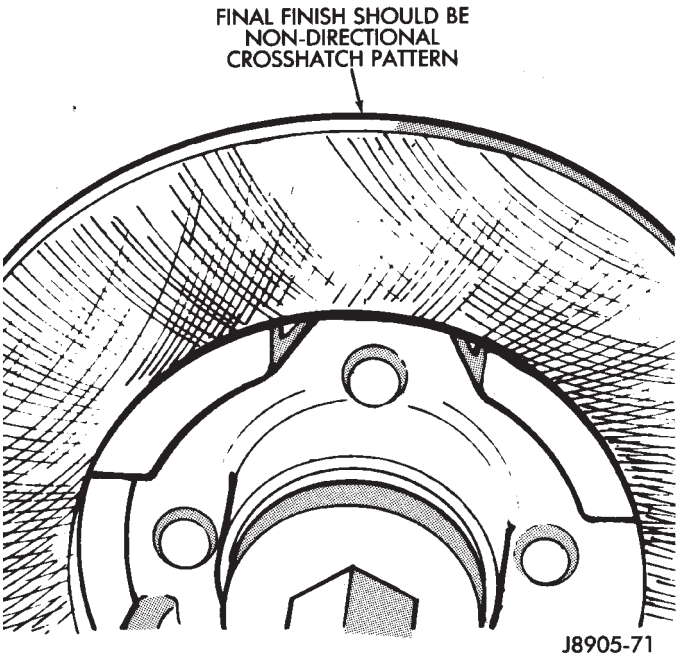


Fig. 31 Preferred Rotor Surface Finish

WHEEL NUT TIGHTENING

The wheel attaching nuts must be tightened properly to ensure efficient brake operation. Overtightening the nuts or tightening them in the wrong sequence can cause distortion of the brake rotors and drums. Impact wrenches are not really recommended for tightening wheel nuts. A torque wrench should be used for this purpose.

A light coat of LPS Anti-Corrosion spray lube around the hub face and on the studs will cut down on rust/corrosion formation.

The correct tightening sequence is important in avoiding rotor and drum distortion. The correct sequence is in a diagonal crossing pattern (Fig. 32).

Recommended torque range for XJ/YJ wheel nuts is 108-149 N·m (80-110 ft. lbs.). Preferred set-to torque is 129 N·m (95 ft. lbs.) torque.

Seat the wheel and install the wheel nuts finger tight. Tighten the nuts in the sequence to 1/2 the required torque. Then repeat the tightening sequence to final specified torque.

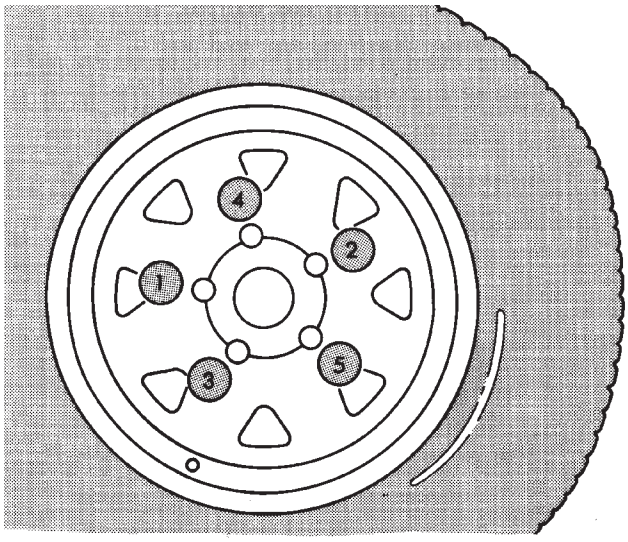


Fig. 32 Wheel Nut Tightening Sequence

DRUM BRAKES

INDEX

DRUM BRAKESHOE REMOVAL (Figs. 1 and 2)

(1) Raise vehicle and remove rear wheels.

(2) Remove and discard spring nuts securing drums to wheel studs.

(3) Remove brake drums. If drums prove difficult to remove, retract brakeshoes. Remove access plug at the rear of backing plate and back off adjuster screw with brake tool and screwdriver.

(4) Remove U-clip and washer securing adjuster cable to parking brake lever.

(5) Remove primary and secondary return springs from anchor pin with Brake Spring Plier Tool 8078.

(6) Remove holddown springs, retainers and pins with standard retaining spring tool.

(7) Install spring clamps on wheel cylinders to hold pistons in place.

(8) Remove adjuster lever, adjuster screw and spring.

(9) Remove adjuster cable and cable guide.

(10) Remove brakeshoes and parking brake strut.

(11) Disconnect cable from parking brake lever and remove lever.

DRUM BRAKESHOE INSTALLATION

(1) Clean support plate with Mopar brake cleaner. Replace support plate if worn, or rusted through at any point. Do not attempt to salvage, or reuse a damaged support plate.

(2) If new drums are being installed, remove protective coating with Mopar Carb cleaner followed by final rinse with Mopar brake cleaner. A scotch brite pad, or steel wool can also be used to help loosen and remove coating if desired. **It is not necessary to machine drums to remove the coating.**

(3) Clean and lubricate anchor pin with light coat of Mopar multi-mileage grease.

(4) Apply Mopar multi-mileage grease to brakeshoe contact surfaces of support plate (Figs. 3 and 4).

(5) Lubricate adjuster screw threads and pivot with Mopar spray lube.

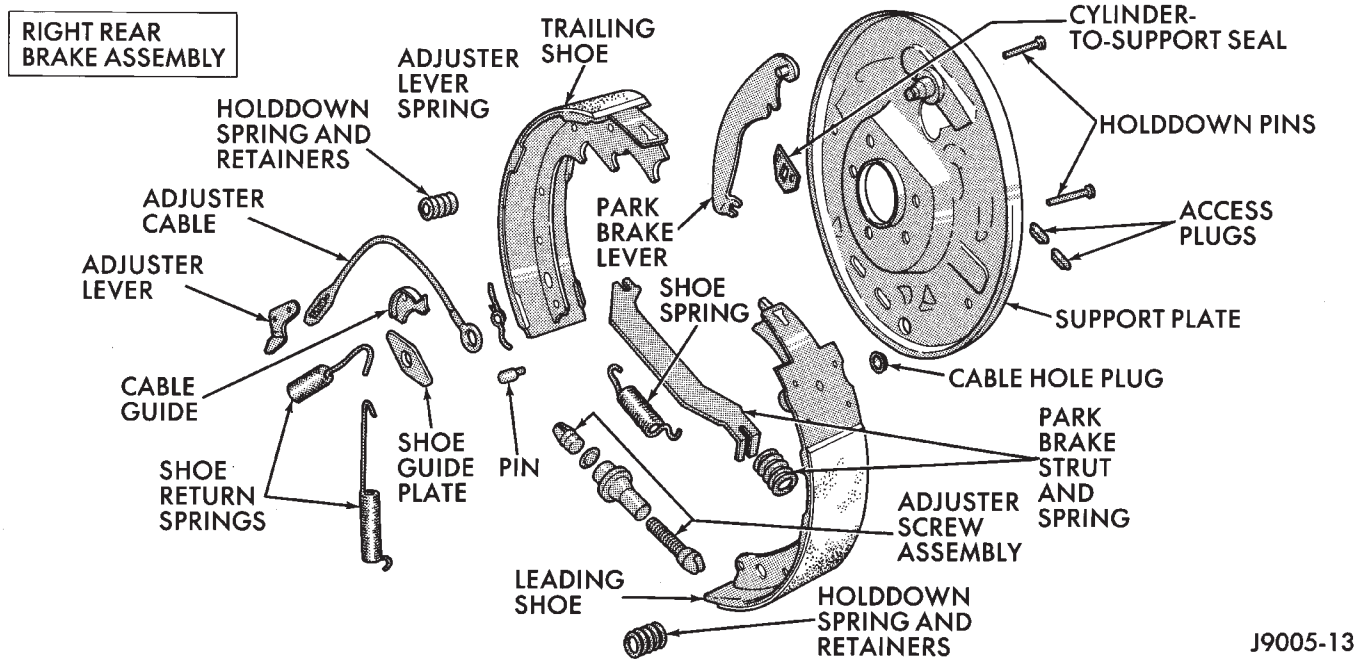


Fig. 1 Nine Inch Drum Brake Components

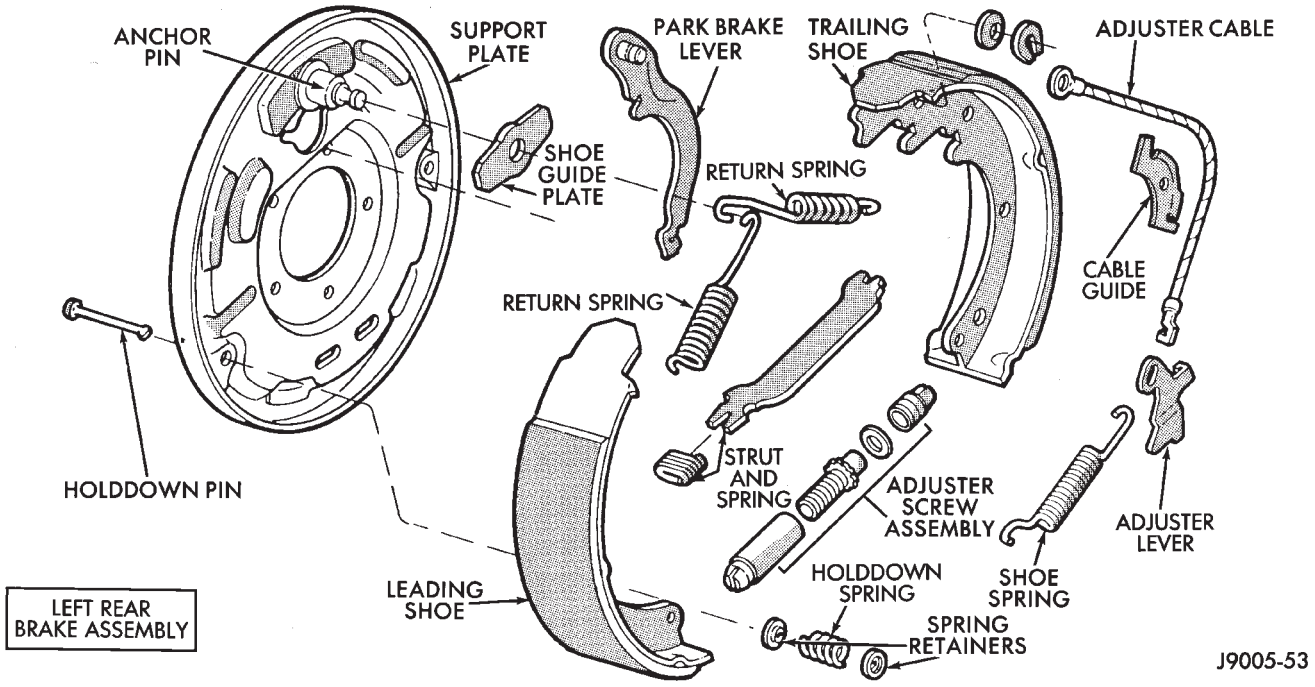


Fig. 2 Ten Inch Drum Brake Components

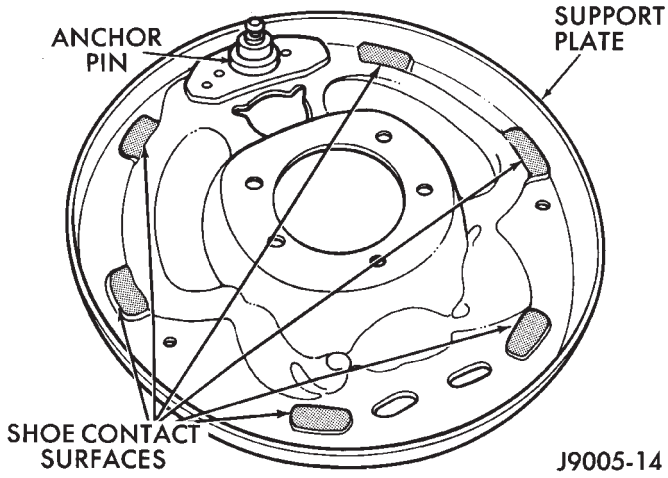


Fig. 3 Shoe Contact Surfaces (9-Inch Support Plate)

(6) Attach parking brake lever to secondary brakeshoe. Use new washer and U-clip to secure lever.

(7) Remove wheel cylinder clamps.

(8) Attach parking brake cable to lever.

(9) Install brakeshoes on support plate. Secure shoes with new holddown springs, pins and retainers.

(10) Install parking brake strut and spring.

(11) Install guide plate and adjuster cable on anchor pin.

(12) Install primary and secondary return springs.

(13) Install adjuster cable guide on secondary shoe.

(14) Lubricate and assemble adjuster screw (Fig. 5).

(15) Install adjuster screw, spring and lever and connect to adjuster cable.

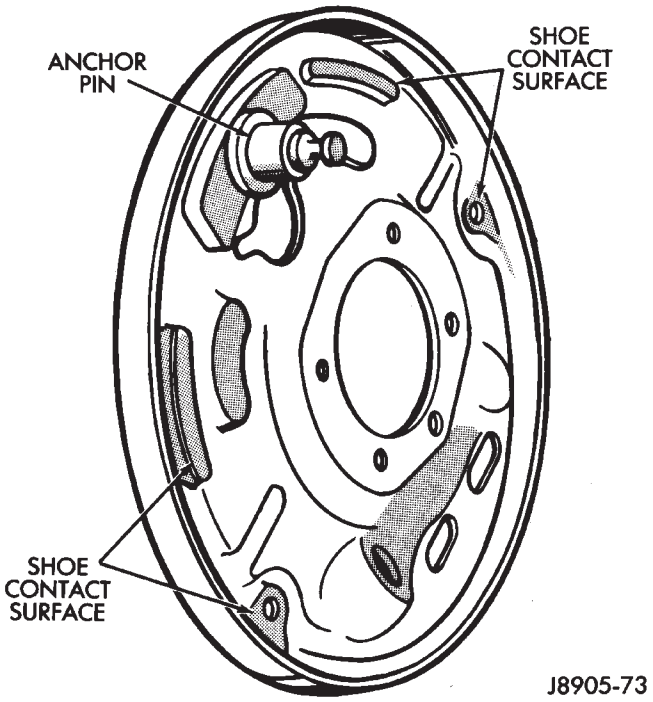


Fig. 4 Shoe Contact Surfaces (10-Inch Support Plate)

(16) Adjust shoes to drum as described in following procedure.

(17) Install wheel/tire assemblies and lower vehicle.

(18) Verify firm brake pedal before moving vehicle.

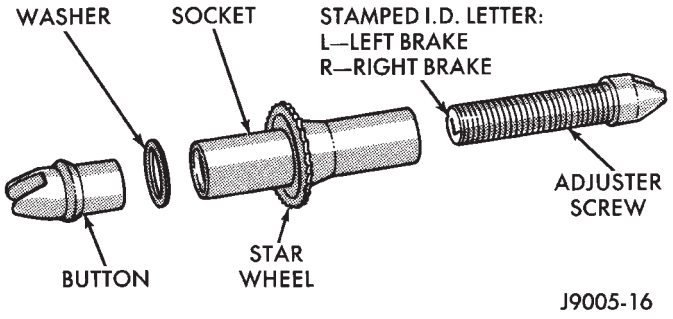


Fig. 5 Adjuster Screw Components (9-Inch Brake)

DRUM BRAKE ADJUSTMENT

Rear drum brakes are equipped with a self adjusting mechanism. Under normal circumstances, the only time adjustment is required is when the shoes are replaced, removed for access to other parts, or when one or both drums are replaced.

The only tool needed for adjustment is a standard brake gauge.

Adjustment is performed with the brakeshoes installed on the support plate. Procedure is as follows:

ADJUSTMENT PROCEDURE

(1) Raise and support vehicle rear end and remove wheels and brake drums.

(2) Verify that left/right automatic adjuster lever and cable are properly connected.

(3) Insert brake gauge in drum. Expand gauge until gauge inner legs contact drum braking surface. Then lock gauge in position (Fig. 6).

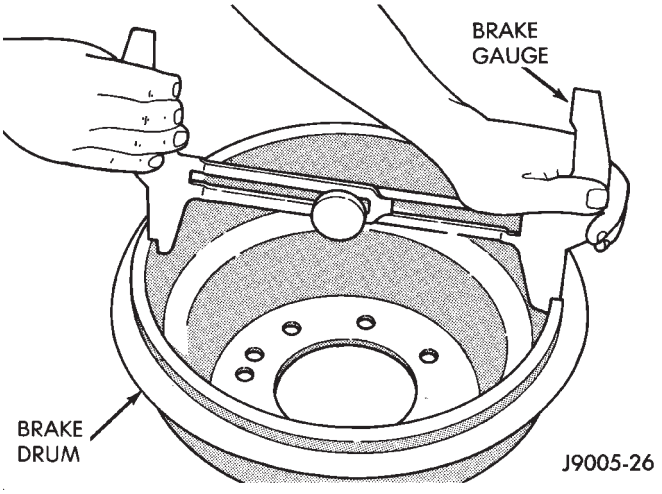


Fig. 6 Adjusting Gauge To Brake Drum

(4) Reverse gauge and install it on brakeshoes (Fig. 6). Position gauge legs at shoe centers as shown. If gauge does not fit (too loose or tight), adjust shoes.

(5) Pull shoe adjuster star wheel away from adjuster lever.

(6) Turn adjuster star wheel (by hand) to expand or retract brakeshoes. Continue adjustment until gauge outside legs are light drag-fit on shoes (Fig. 7).

(7) Repeat adjustment at opposite brakeshoe assembly.

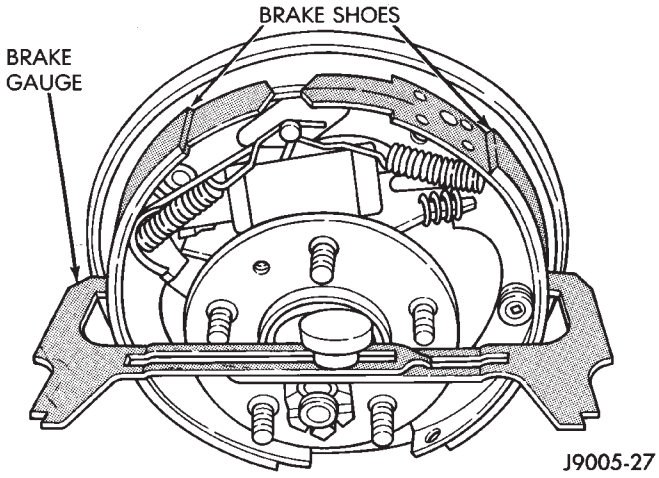


Fig. 7 Adjusting Brakeshoes To Gauge

(8) Install brake drums and wheels and lower vehicle.

(9) Make final adjustment as follows:

(a) Drive vehicle and make one forward stop followed by one reverse stop.

(b) Repeat procedure 8-10 times to actuate self adjuster components and equalize adjustment.

(c) **Bring vehicle to complete standstill at each stop. Incomplete, rolling stops will NOT activate adjuster mechanism.**

WHEEL CYLINDER REMOVAL

(1) Raise vehicle and remove wheel.

(2) Disconnect brakeline at wheel cylinder. **If cylinder brakeline fitting is hard to break loose, spray generous amount of Mopar Rust Penetrant between fitting and line and around fitting threads in wheel cylinder. Note that it may require a few minutes for penetrant to work.**

(3) Remove brakeshoes.

(4) Remove bolts attaching wheel cylinder to support plate and remove cylinder.

WHEEL CYLINDER OVERHAUL (Figs. 8 and 9)

(1) Remove links.

(2) Remove dust boots.

(3) Remove cups and pistons. Discard cups.

(4) Remove and discard spring and expander.

(5) Remove bleed screw.

(6) Clean cylinder, pistons and links with Mopar brake cleaner.

(7) Inspect cylinder bore and pistons. Light discoloration of bore is acceptable. However, replace cylinder if bore and pistons are scored, pitted, or corroded.

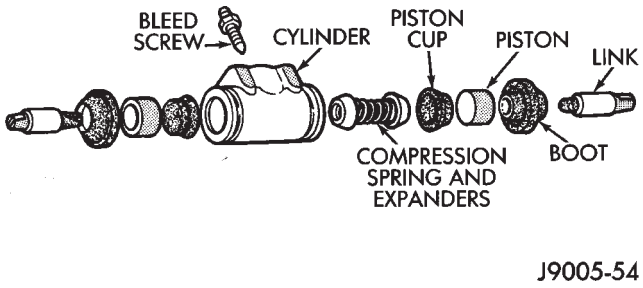


Fig. 8 Wheel Cylinder (9-Inch Brake)

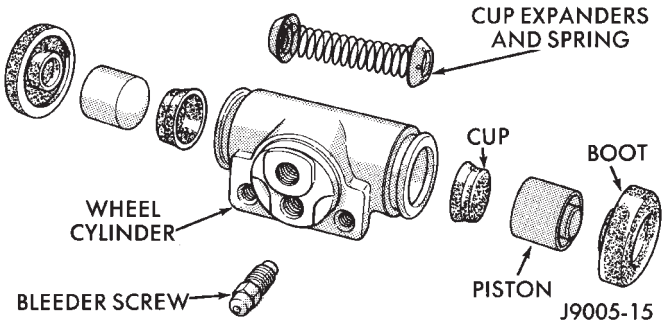


Fig. 9 Wheel Cylinder (10-Inch Brake)

Do not hone cylinder bores or polish pistons. Replace cylinder as an assembly if bore is damaged.

(8) Install bleed screw.

(9) Coat cylinder bore, pistons, cups and expander with brake fluid and reassemble cylinder components. Be sure piston cup lips face expander.

WHEEL CYLINDER INSTALLATION

(1) Apply small bead of silicone sealer around cylinder mounting surface of support plate.

(2) Start brakeline in wheel cylinder fitting by hand.

(3) Align and seat wheel cylinder on support plate (Fig. 10).

(4) Install cylinder mounting bolts (Fig. 10). Tighten bolts to 10 N·m (90 in. lbs.) torque.

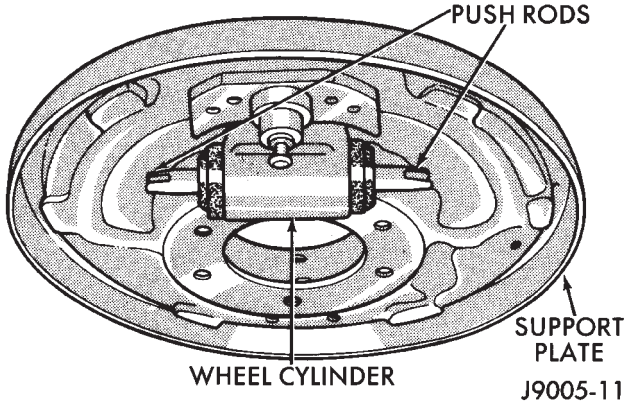


Fig. 10 Wheel Cylinder Mounting

(5) Tighten brakeline fitting to 15 N·m (132 in. lbs.) torque.

(6) Install brakeshoes. Adjust shoes to drum with brake gauge.

(7) Install brake drums and lower vehicle.

(8) Fill master cylinder and bleed brakes.

SUPPORT PLATE REPLACEMENT

The support plate should cleaned and inspected whenever the drum brake components are being serviced.

Check the support plate for wear, or rust through at the contact pads and replace the plate if necessary. Be sure to lubricate the contact pads with Mopar multi-mileage grease before shoe installation. Lubrication will avoid noisy operation and shoe bind.

(1) Raise vehicle and remove wheel/tire assembly.

(2) Remove brake drum, brakeshoes, and wheel cylinder.

(3) Remove axle shaft as described in Group 3.

(4) Remove support plate attaching nuts and remove support plate.

(5) Clean axle tube flange. If gasket is not used on flange, apply thin bead of silicone adhesive/sealer to flange.

(6) Position new support plate on axle tube flange.

(7) Apply Mopar Lock N″ Seal, or Loctite 242 to support plate attaching nuts. Then install and tighten nuts.

(8) Apply light coat of Mopar multi-mileage grease to contact pads of new support plate.

(9) Install wheel cylinder and brakeshoes.

(10) Adjust brakeshoes to drums. Refer to procedure in this section.

(11) Bleed brakes.

(12) Install wheel and tire assembly.

(13) Adjust parking brake cable tensioner. Refer to procedure in Parking Brake section.

(14) Lower vehicle and verify proper service brake and parking brake operation.

BRAKE DRUM REFINISHING

Brake drums can be machined to restore the braking surface. Use a brake lathe to clean up light scoring and wear.

CAUTION: Never refinish a brake drum if machining will cause the drum to exceed maximum allowable brake surface diameter.

Brake drums that are warped, distorted, or severely tapered should be replaced. Do not refinish drums exhibiting these conditions. Brake drums that are heat checked or have hard spots should also be replaced.

If the brake drums are heavily coated with rust, clean and inspect them carefully. Rust damage on high mileage drums can be severe enough to require replacement.

New drums have a protective coating that should be removed before installation. **It is not necessary to machine a drum to remove this coating. The coating is easily removed with Mopar carb cleaner followed by a rinse with Mopar brake cleaner. A scotch brite pad, or steel wool can also be used to help loosen and remove the coating if desired.**

The maximum allowable diameter for the drum braking surface is usually indicated on the drum outer face (Fig. 11).

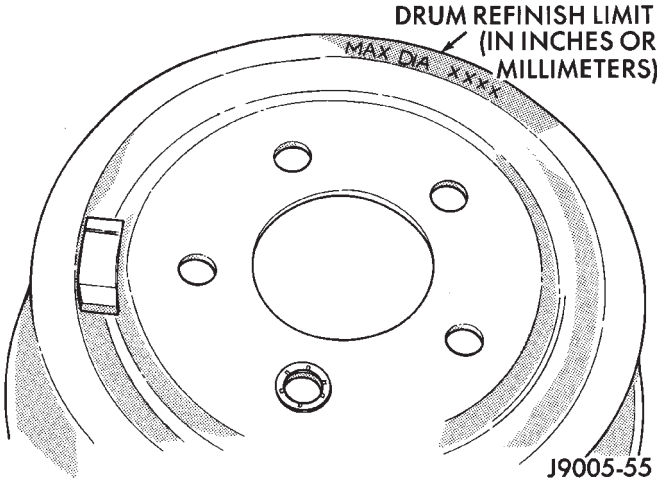


Fig. 11 Typical Location Of Brake Drum Refinish Limit

WHEEL NUT TIGHTENING

The wheel attaching lug nuts must be tightened properly to ensure efficient brake operation. Over-tightening the nuts or tightening them in the wrong sequence can cause distortion of the brake rotors and drums.

Impact wrenches are not recommended for tightening wheel nuts. A torque wrench should be used for this purpose.

A light coat of LPS Anti-Corrosion spray lube around the hub face and on the studs will cut down on rust/corrosion formation.

The correct tightening sequence is important in avoiding rotor and drum distortion. The correct sequence is in a diagonal crossing pattern (Fig. 12).

Recommended torque range for XJ/YJ wheel nuts is 109-150 N·m (80-110 ft. lbs.).

Seat the wheel and install the wheel nuts finger tight. Tighten the nuts in the sequence to half the required torque. Then repeat the tightening sequence to final specified torque.

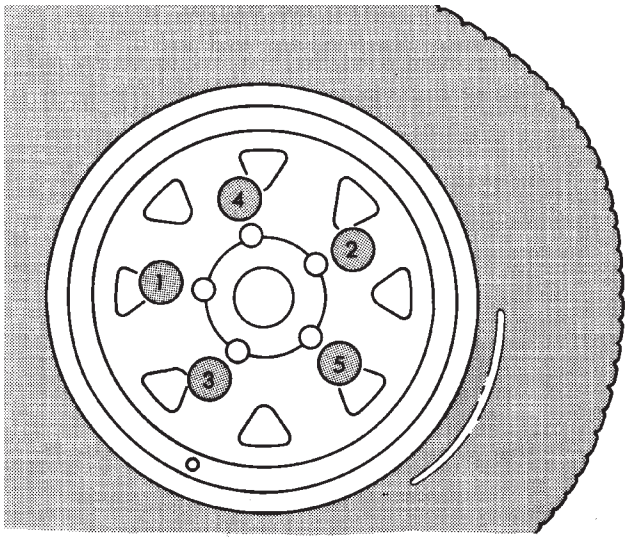


Fig. 12 Wheel Nut Tightening Sequence

PARKING BRAKES

INDEX

GENERAL SERVICE INFORMATION

Parking brake adjustment is controlled by a cable tensioner mechanism.

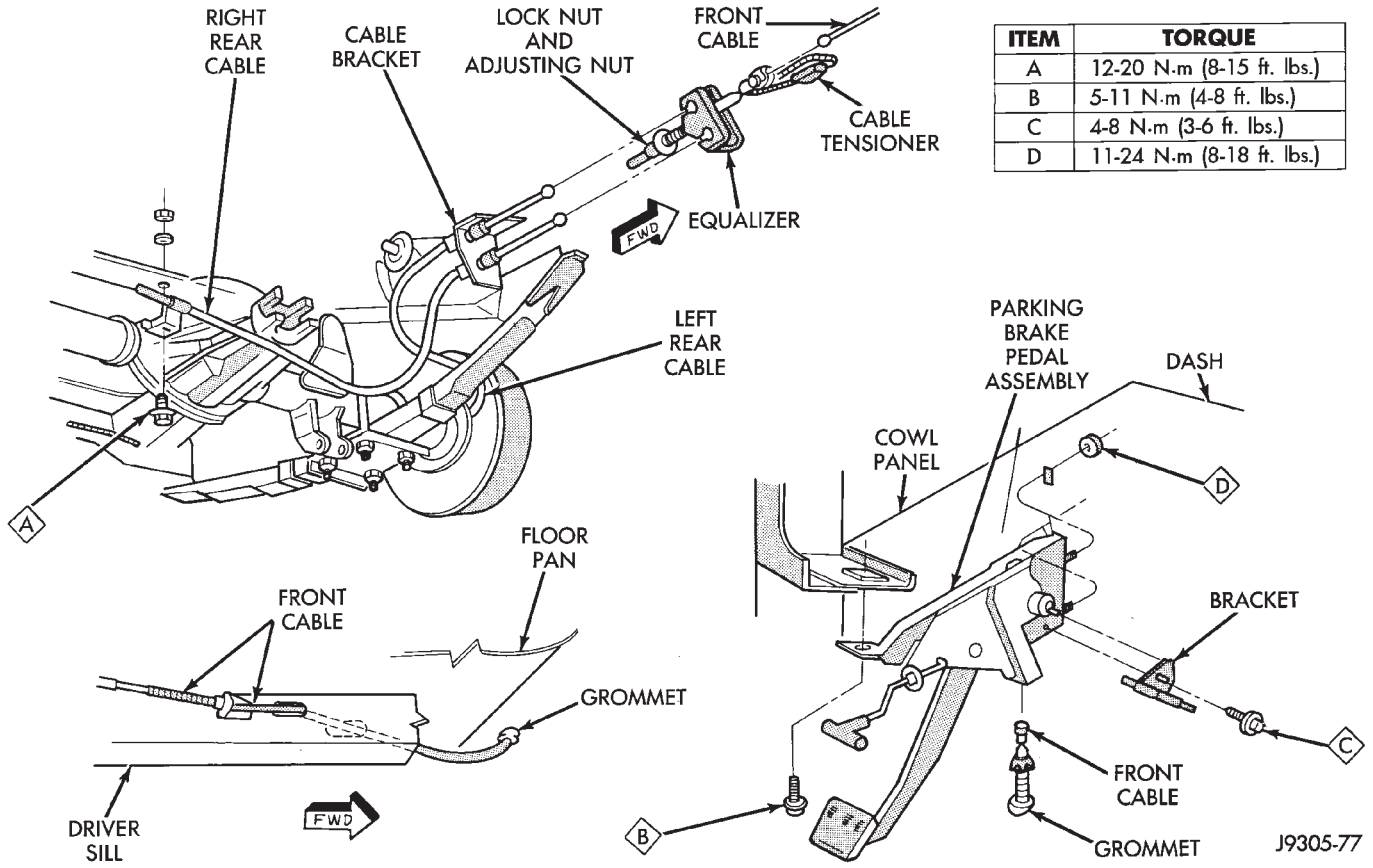
The cable tensioner, once adjusted at the factory, should not need further adjustment under normal circumstances. There are only two instances when adjustment is required. The first is when a new tensioner, or cables have been installed. And the second, is when the tensioner and cables are disconnected for access to other brake components.

PARKING BRAKE OPERATION

The rear brakes are utilized for the parking brake function. They are actuated hydraulically during normal brake operation but are mechanically actuated for parking brake operation.

Parking Brake Components

The rear brakeshoes are applied by a system of levers and cables for parking brake operation. A foot or hand operated lever in the passenger compartment is the main application device. Actuating levers on the



ITEM	TORQUE
A	12-20 N·m (8-15 ft. lbs.)
B	5-11 N·m (4-8 ft. lbs.)
C	4-8 N·m (3-6 ft. lbs.)
D	11-24 N·m (8-18 ft. lbs.)

Fig. 1 Parking Brake Components (YJ)

secondary brakeshoes move the shoes directly into contact with the drum braking surface. The actuating levers are interconnected by a system of cables and a tensioner mechanism. The tensioner mechanism controls parking brake adjustment.

A parking brake switch is used on all models. It is mounted on the parking brake lever or foot pedal and is actuated by movement of the lever/pedal. The switch, which is in circuit with the red warning light in the dash, will illuminate the warning light whenever the parking brakes are applied.

On XJ models, the cable tensioner is part of the lever assembly. On YJ models, the tensioner and equalizer are mounted in a bracket attached to the underbody.

On YJ models, the parking brake front cable is attached to the foot pedal and cable tensioner. The tensioner and rear cables are connected to the equalizer (Fig. 1).

On XJ models, the cable tensioner is connected directly to the hand lever (a front cable is not used). The tensioner rod is attached to the equalizer which is the connecting point for the rear cables (Fig. 2).

The rear cables are connected to the actuating lever on each secondary brakeshoe. The levers are attached to the brakeshoes by a pin either pressed into, or welded to the lever. A clip is used to secure the pin in the brakeshoe. The pin allows each lever to pivot independently of the brakeshoe.

Struts installed between each brakeshoe, are used to maintain shoe alignment and equal motion when the parking brakes are applied. Each strut is equipped with a combination tension and anti-rattle spring.

Parking Brake Application

To apply the parking brakes, the foot pedal is pressed downward, or the hand lever is pulled upward, to an engaged position. This pulls the rear brakeshoe actuating levers forward, by means of the interconnected tensioner and cables.

As the actuating lever is pulled forward, the parking brake strut (which is connected to both shoes), exerts a linear force against the primary brakeshoe. This action presses the primary shoe into contact with the drum.

Once the primary shoe contacts the drum, force exerted through the strut does not stop. Instead, further lever movement exerts continuing force against the strut. This force is transferred through the strut to the secondary brakeshoe causing it to pivot into the drum as well.

The brakeshoes remain engaged with the drum until the levers and cables are released. A gear type ratcheting mechanism is used to hold the pedal or lever in an applied position. Parking brake release is accomplished by means of the release handle on YJ models. Or by the hand lever release button on XJ models.

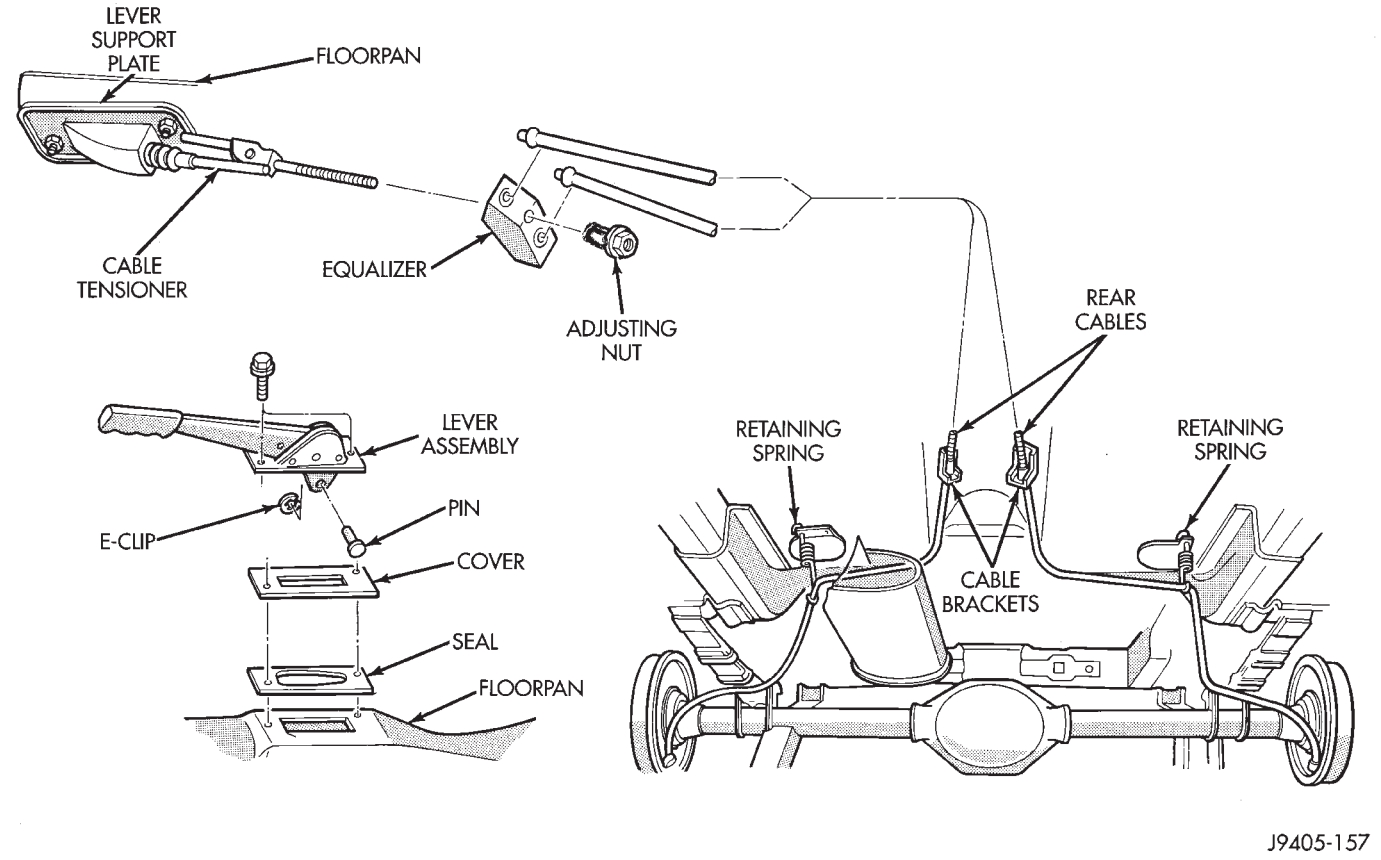


Fig. 2 Parking Brake Components (XJ)

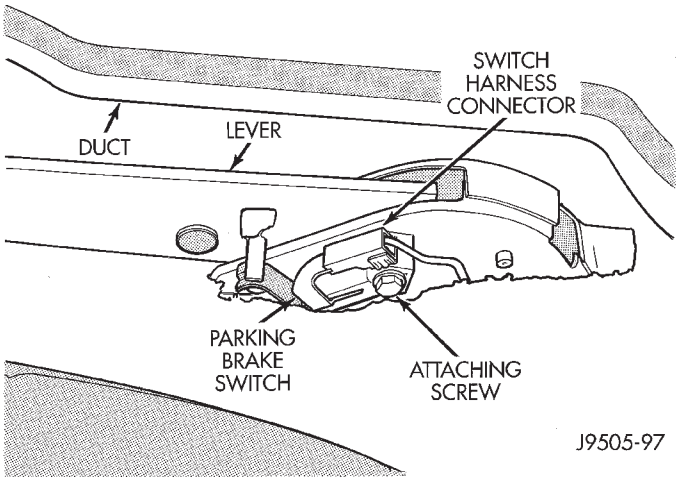


Fig. 3 Parking Brake Switch Mounting

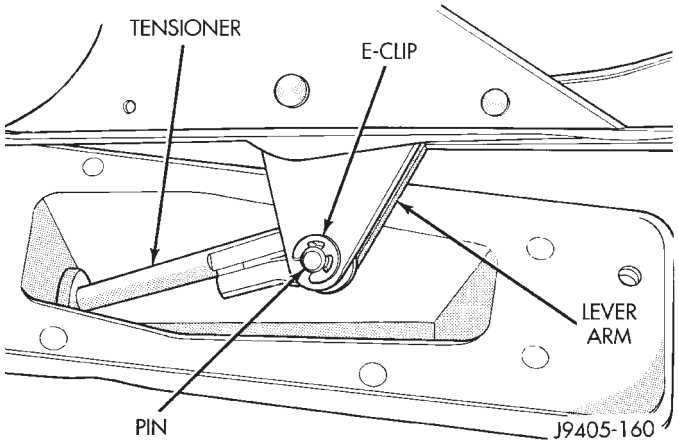


Fig. 4 Tensioner E-Clip And Retaining Pin Location

PARKING BRAKE LEVER REMOVAL (XJ WITH MINI CONSOLE)

(1) Release parking brakes, if necessary.

(2) Raise vehicle.

(3) Remove adjusting nut from tensioner rod (Fig. 2). Then secure equalizer and rear cables to chassis with wire.

(4) Remove nuts attaching lever support plate to underside of floorpan. Then move plate aside.

(5) Lower vehicle.

(6) Disconnect parking brake switch wire at switch (Fig. 3).

(7) Remove parking brake lever assembly from floorpan.

(8) Remove tensioner cover and boot for access to lever arm (Fig. 4).

(9) Remove E-clip and pin that connect tensioner to lever arm (Fig. 4).

(10) Remove lever attaching screws from floorpan (Fig. 5).

(11) Remove lever assembly.

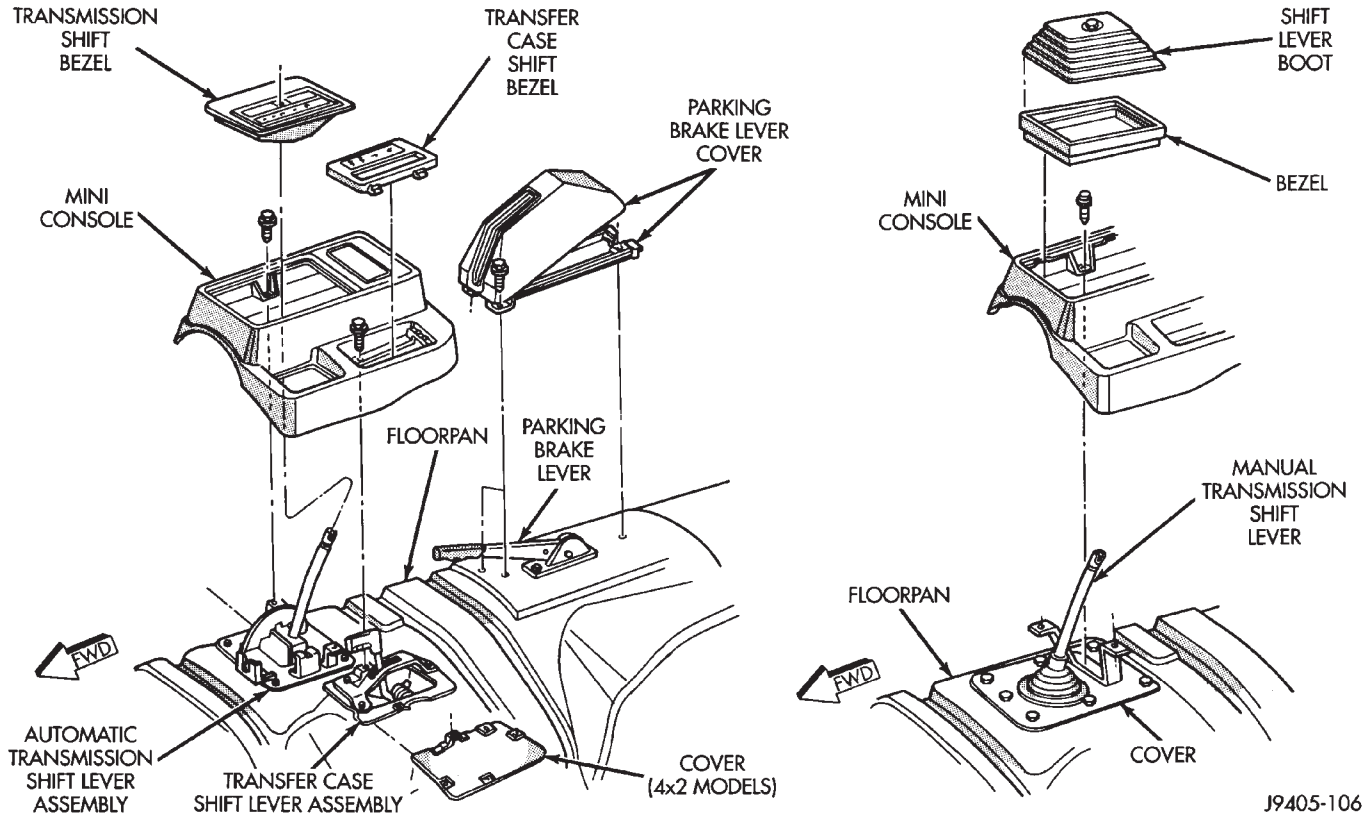


Fig. 5 Mini Console And Parking Brake Lever Cover (XJ)

(12) Parking brake switch can be serviced at this time, if necessary.

PARKING BRAKE LEVER INSTALLATION (XJ WITH MINI CONSOLE)

(1) Assemble lever and tensioner components (Figs. 4 and 5). Be sure E-clip is fully seated in pin (Fig. 4).

(2) Verify that tensioner boot is properly seated in cover (Fig. 6).

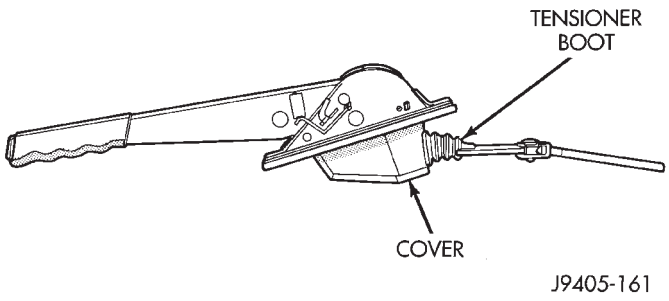


Fig. 6 Tensioner Boot Seated In Cover

(3) Position lever assembly on floorpan and install lever attaching screws/nuts. Also install parking brake switch if removed, or replaced.

(4) Raise vehicle.

(5) Insert cable tensioner rod in equalizer and install adjusting nut on tensioner rod (Fig. 7).

(6) Install and tighten nuts that attach lever support plate to floorpan and lever screws.

(7) Adjust parking brakes. Refer to procedure in this section.

(8) Lower vehicle.

(9) Connect parking brake switch wire.

(10) Install lever trim cover, if equipped.

(11) Verify correct parking brake operation.

PARKING BRAKE LEVER REMOVAL (XJ WITH FULL CONSOLE)

(1) Release parking brakes.

(2) Raise vehicle.

(3) Remove adjusting nut from tensioner rod. Then temporarily secure equalizer to nearby chassis component with wire.

(4) Remove nuts attaching lever support plate to underside of floorpan.

(5) Lower vehicle.

(6) On models with manual transmission, remove shift knob, outer boot, and bezel.

(7) On models with automatic transmission, remove shift handle cap and remove plunger, spring and T-lock (Fig. 8).

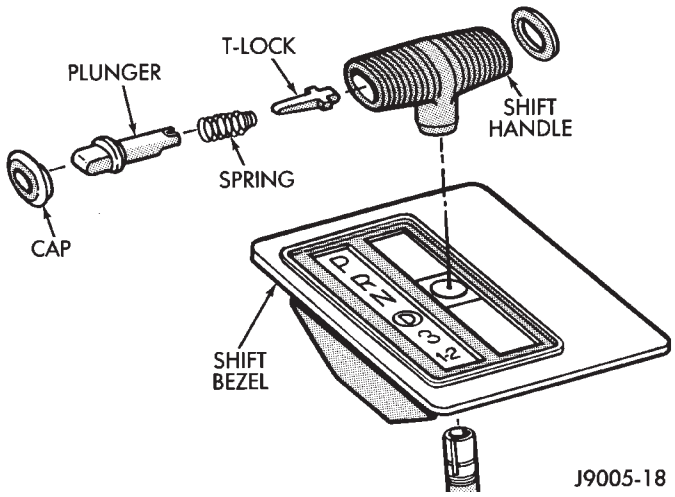


Fig. 8 Automatic Transmission Shift Handle And Bezel

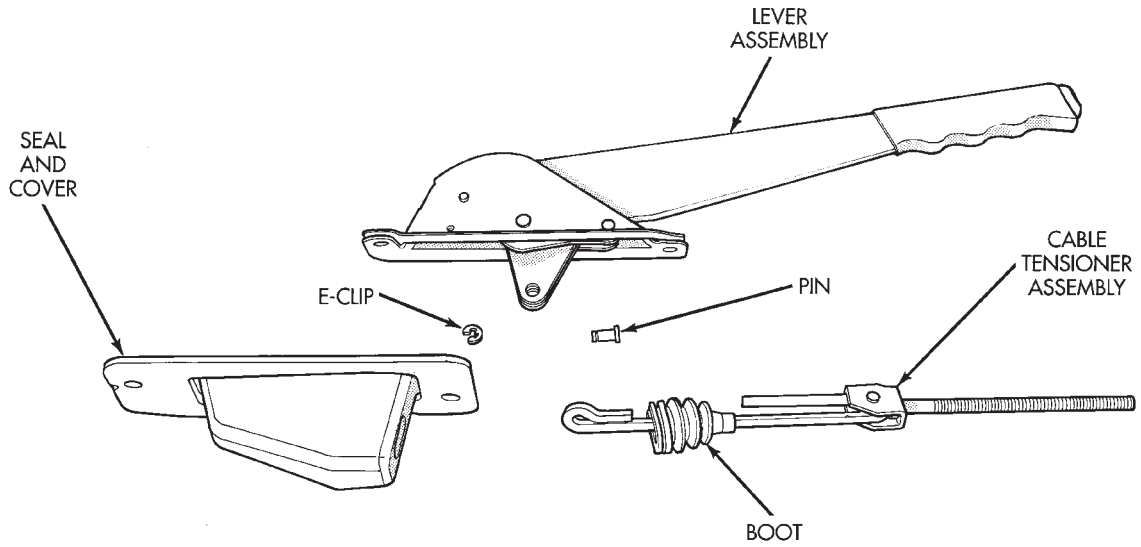


Fig. 7 Hand Lever And Cable Tensioner Components (XJ)

(8) Remove shift handle by pulling upward sharply on handle. Then remove shift bezel (Fig. 7).

(9) Remove console cover screws (Figs. 9 and 10).

(10) On models with power mirror switch, pry switch out of console cover and disconnect switch connector (Fig. 9).

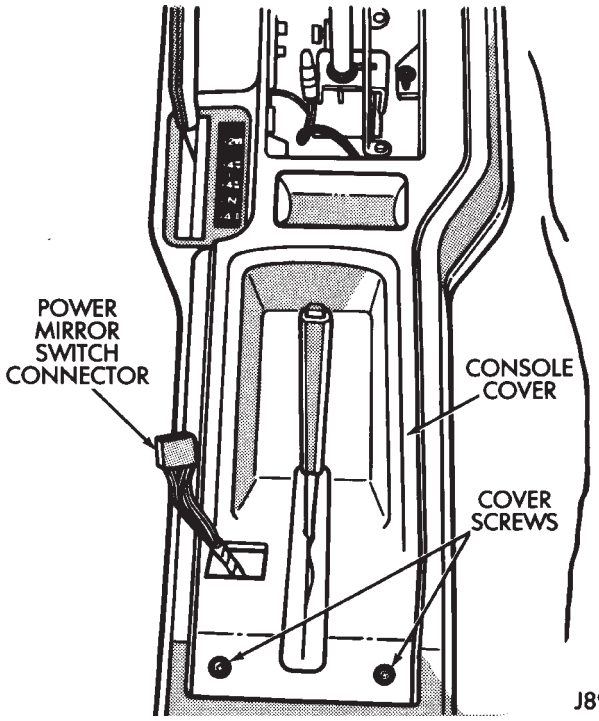


Fig. 9 Console Cover Screws And Power Mirror Switch Connector

(11) Remove cover from console (Fig. 10).

(12) Remove screws attaching console to brackets and shifter covers (Fig. 11).

(13) Remove console (Fig. 11).

(14) Remove duct (Fig. 11).

(15) Disconnect wire at parking brake switch on lever (Fig. 4).

(16) Remove lever and cable tensioner assembly from floorpan.

(17) Move cover and boot aside for access to lever arm (Fig. 4).

(18) Remove E-clip and pin that connect tensioner to lever arm (Fig. 4).

(19) Parking brake switch can be replaced at this time if necessary.

PARKING BRAKE LEVER INSTALLATION (XJ WITH FULL CONSOLE)

(1) Assemble lever and tensioner (Figs. 4 and 5). Be sure E-clip is fully engaged in retaining pin (Fig. 4).

(2) Verify that tensioner boot is fully seated in cover (Fig. 6).

(3) Position assembled lever and tensioner in floorpan.

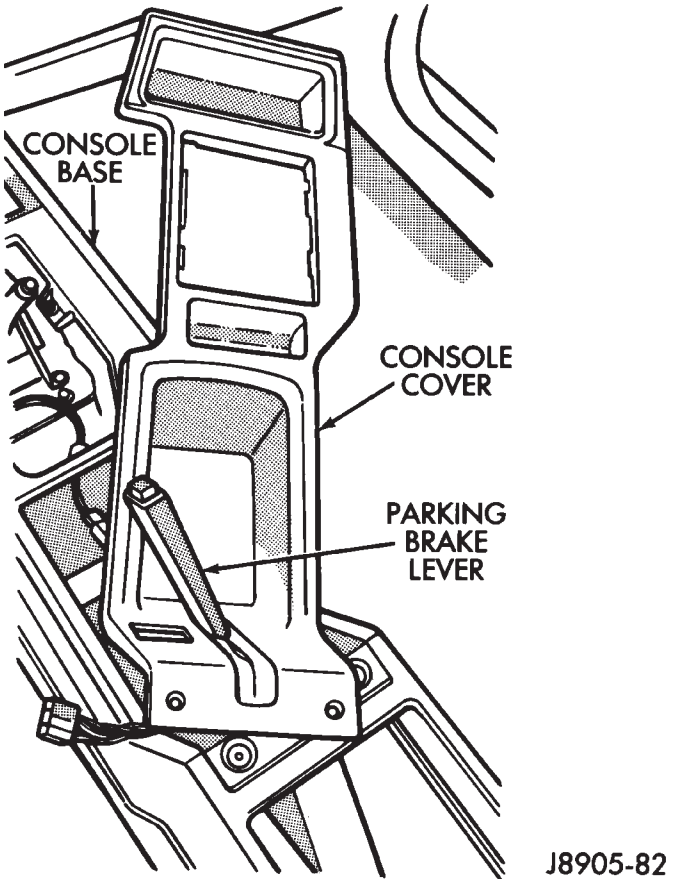


Fig. 10 Console Cover And Base

(4) Install parking brake switch on lever if removed, and connect brake warning light wires to switch.

(5) Install duct and console (Fig. 11).

(6) Connect power mirror switch wire to switch and install switch in console cover.

(7) Install console cover.

(8) On automatic transmission models, install shift bezel and shift handle.

(9) On manual transmission models, install bezel, outer boot, and shift knob.

(10) Raise vehicle.

(11) Insert tensioner rod in equalizer and install adjusting nut on tensioner rod.

(12) Install nuts attaching lever support plate to floorpan and lever.

(13) Adjust parking brakes. Refer to procedure in this section.

(14) Lower vehicle and verify proper parking brake operation.

PARKING BRAKE LEVER REMOVAL (XJ WITHOUT CONSOLE)

(1) Raise vehicle.

(2) Remove nuts attaching lever support plate to underside of floorpan.

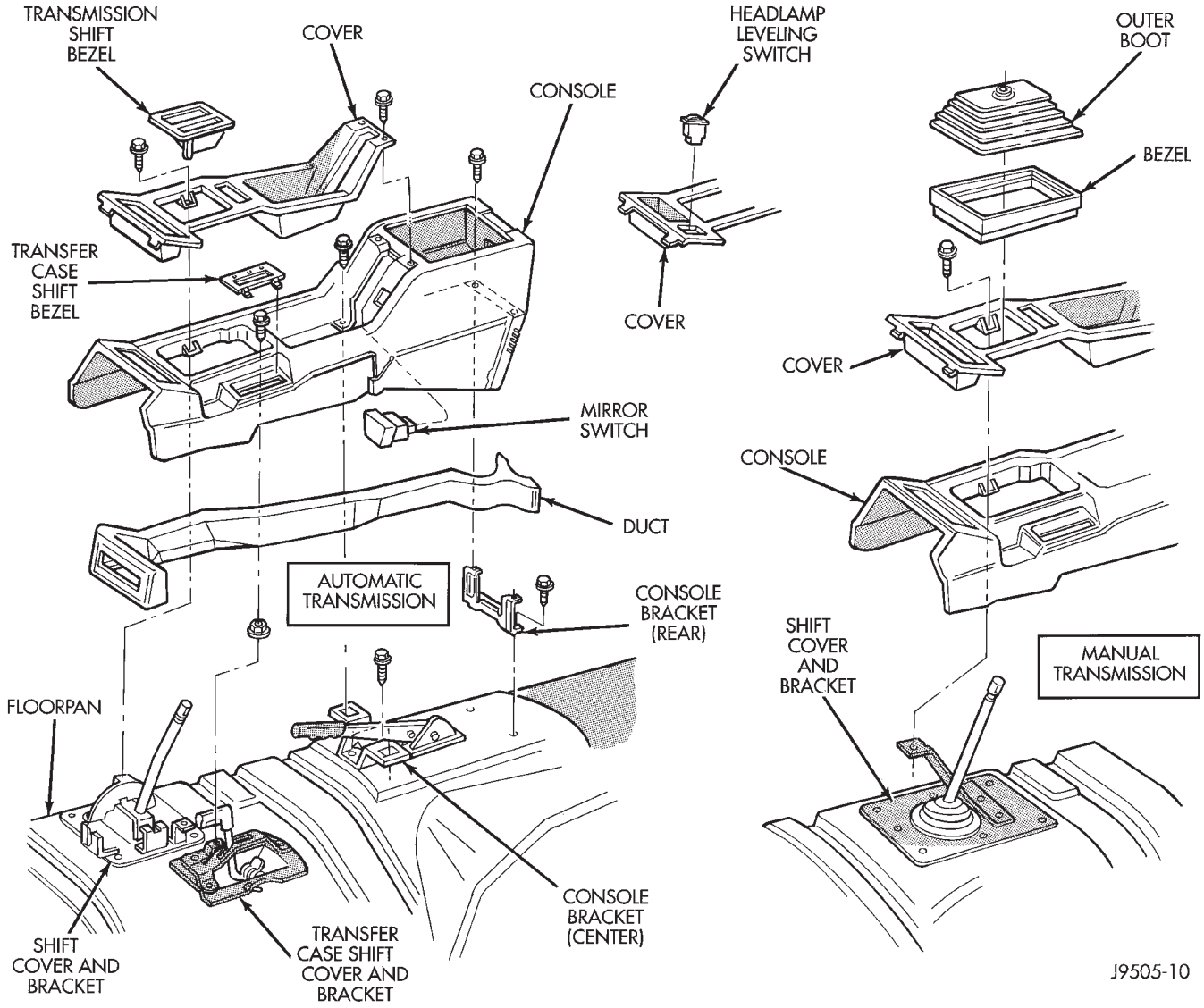


Fig. 11 Full Console Components (XJ)

(3) Remove adjusting nut from tensioner rod. Then temporarily secure equalizer and cables to nearby chassis component with wire.

(4) Lower vehicle.

(5) Raise lever cover at rear and tilt it forward (Fig. 12).

(6) Remove cover attaching screws. Or, if cover is attached with rivets, drill out and remove cover.

(7) Disconnect parking brake warning light wire at switch on lever. Remove switch if replacement is necessary.

(8) Remove lever and tensioner assembly from floorpan.

(9) Move cover and boot aside for access to tensioner retaining pin and clip.

(10) Remove pin and E-clip that secure tensioner to lever arm and separate lever and tensioner.

PARKING BRAKE LEVER INSTALLATION (XJ WITHOUT CONSOLE)

(1) Assemble lever and tensioner (Figs. 4 and 5).

(2) Verify that tensioner boot is properly seated in cover (Fig. 6).

(3) Position lever on floorpan and insert lever screws through floorpan. Be sure lever cover and seal are in place between lever and floorpan.

(4) Install parking brake switch on lever, if removed, and connect warning light wires to switch.

(5) Install lever cover. Secure cover with new rivets, or original attaching screws.

(6) Raise vehicle.

(7) Connect tensioner to lever with retaining pin and E-clip.

(8) Install nuts attaching lever support plate to lever screws.

(9) Adjust parking brakes. Refer to procedure in this section.

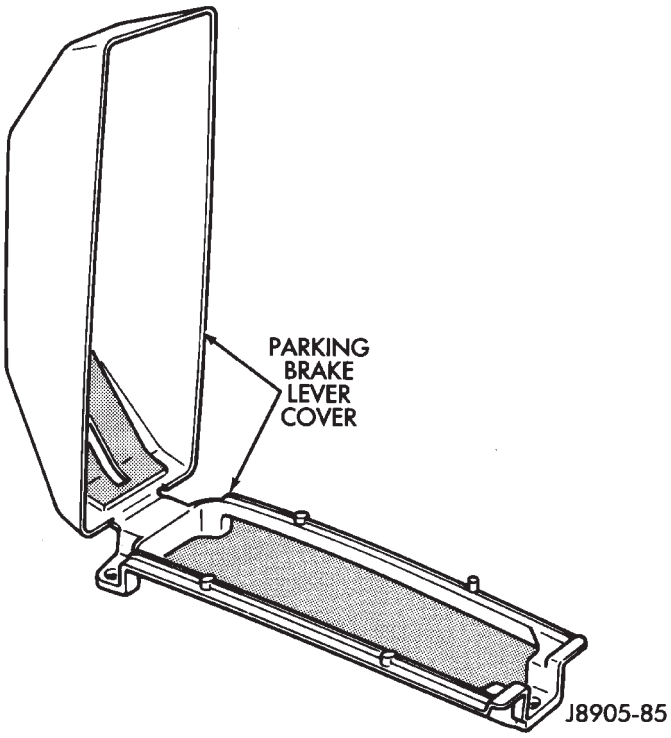


Fig. 12 Lever Cover (XJ)

PARKING BRAKE CABLE TENSIONER REPLACEMENT (XJ)

(1) Raise vehicle.
(2) Remove adjuster nut from tensioner rod. Secure equalizer and cables to nearby chassis component with wire.
(3) Remove nuts attaching lever assembly to support plate and floorpan.
(4) Lower vehicle.
(5) Remove console components and lever assembly cover.
(6) Remove lever and tensioner assembly.
(7) Move cover and boot for access to tensioner retaining pin.
(8) Remove E-clip and pin that attach tensioner to lever arm (Fig. 4).
(9) Remove tensioner from cover.
(10) Transfer boot to new tensioner if necessary.
(11) Attach tensioner to lever arm with pin and E-clip.
(12) Verify that E-clip is fully engaged in pin (Fig. 4).
(13) Align cover and seal on lever flange.
(14) Verify that tensioner boot is seated in cover (Fig. 6).
(15) Install assembled lever and tensioner in floorpan.
(16) Install necessary console components.
(17) Adjust parking brakes as described in this section.

PARKING BRAKE PEDAL REMOVAL (YJ)

(1) Raise vehicle.
(2) Loosen equalizer nuts until front cable is slack (Fig. 13).

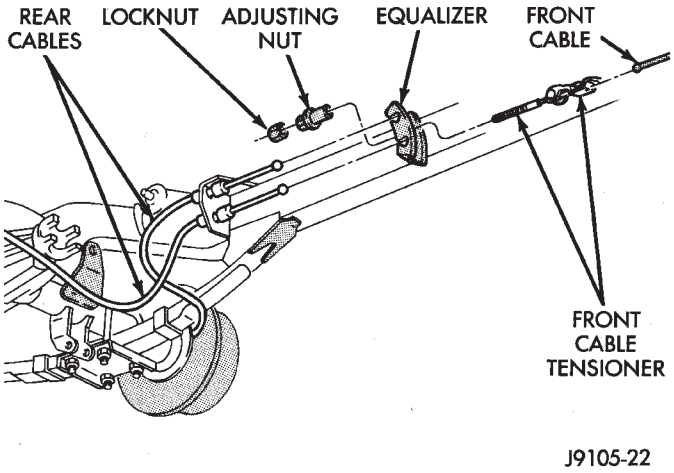


Fig. 13 Front Cable And Equalizer (YJ)

(3) Lower vehicle.
(4) Remove dash-to-instrument panel brace rod, if equipped.
(5) Disconnect warning light wire from parking brake switch on pedal assembly. Remove switch if replacement is necessary.
(6) On some YJ models, a ground wire may be attached to upper end of bolt that secures parking brake pedal to instrument panel. Wire is secured with a nut. Be sure to remove nut and detach ground wire before proceeding. If this wire is not removed beforehand, wire and harness could be damaged when pedal assembly bolt is removed. Ground wire and attaching nut are accessible from under instrument panel.
(7) Remove bolt securing pedal assembly to instrument panel (Fig. 14).
(8) In engine compartment, remove pedal mounting stud nuts.
(9) Remove pedal assembly from panel.
(10) Disengage front cable from retainer (Fig. 14).
(11) Squeeze cable clip (Fig. 14) and pull cable out of pedal frame.
(12) Remove pedal assembly.

PARKING BRAKE PEDAL INSTALLATION (YJ)

(1) Connect front cable to pedal retainer.
(2) Position pedal assembly on panel and install mounting stud nuts and pedal-to-dash bolt.
(3) Install ground wire on upper end of pedal-to-dash bolt and secure wire with attaching nut.
(4) Connect warning light switch wire to pedal connector.
(5) Install dash-to-instrument panel brace rod, if equipped.
(6) Raise vehicle and adjust brake cables. Refer to procedure in Service Adjustment section.

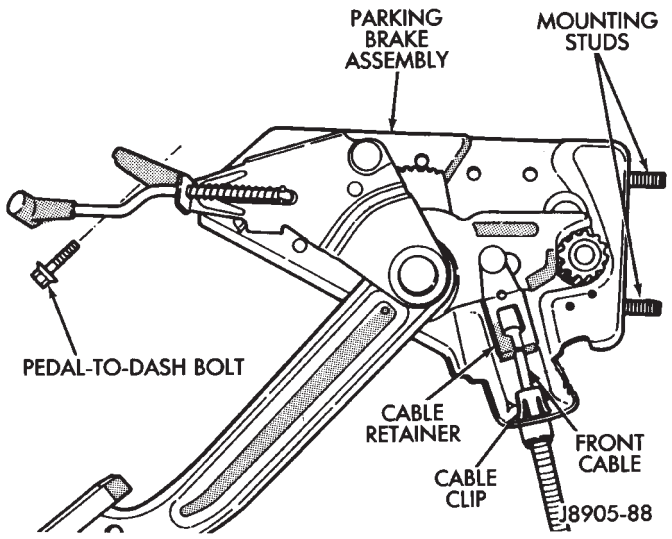


Fig. 14 Parking Brake Pedal Assembly (YJ)

PARKING BRAKE REAR CABLE REPLACEMENT (XJ)

(1) Raise vehicle and loosen equalizer nuts until rear cables are slack.

(2) Disengage cable from equalizer and remove cable clip and spring (Fig. 15).

(3) Remove rear wheel and brake drum.

(4) Remove secondary brakeshoe and disconnect cable from lever on brakeshoe.

(5) Compress cable retainer with worm drive hose clamp (Fig. 16) and remove cable from backing plate.

(6) Install new cable in backing plate. Be sure cable retainer is seated.

(7) Attach cable to lever on brakeshoe and install brakeshoe on backing plate.

(8) Adjust brakeshoes to drum with brake gauge.

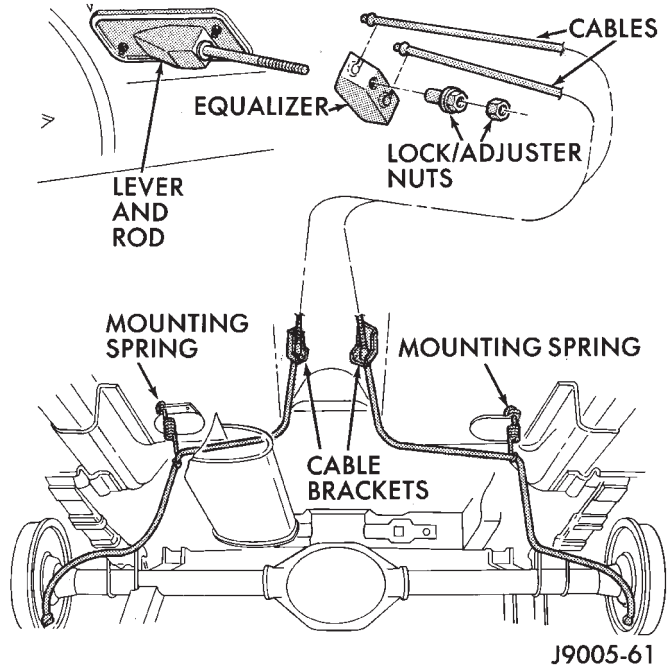


Fig. 15 Parking Brake Cables (XJ)

(9) Install brake drum and wheel.

(10) Engage cable in equalizer and install equalizer nuts (Fig. 15).

(11) Adjust parking brakes. Refer to procedure in this section.

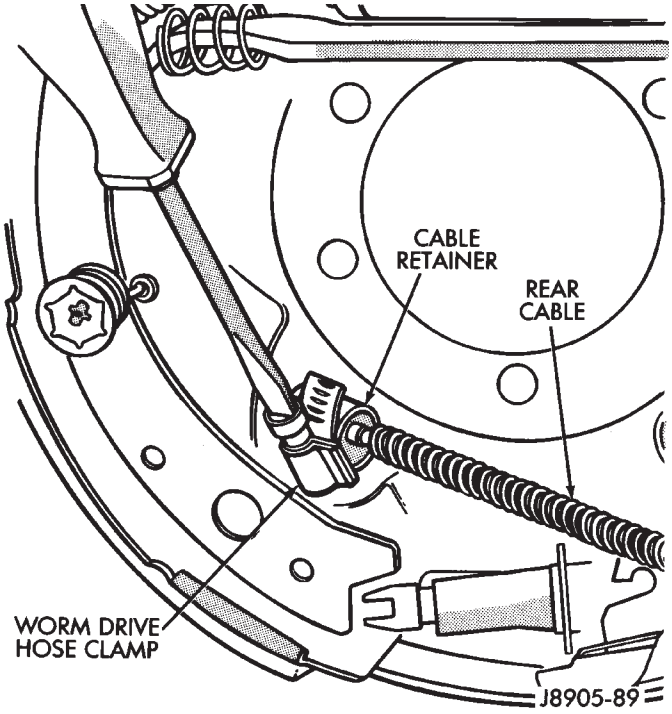


Fig. 16 Compressing Rear Cable Retainer

PARKING BRAKE FRONT CABLE REPLACEMENT (YJ)

(1) Raise vehicle.

(2) Remove equalizer nuts (Fig. 17).

(3) Remove front cable from equalizer (Fig. 17).

(4) Remove cable-to-frame bracket clip.

(5) Lower vehicle.

(6) Move front carpeting away from pedal.

(7) Compress clip securing cable to pedal frame (Fig. 17). Use hose clamp to compress clip.

(8) Disconnect cable from pedal retainer and remove cable.

(9) Remove grommet (Fig. 17) from old cable and transfer it to new cable, if necessary.

(10) Install new cable in floorpan and connect it to pedal assembly.

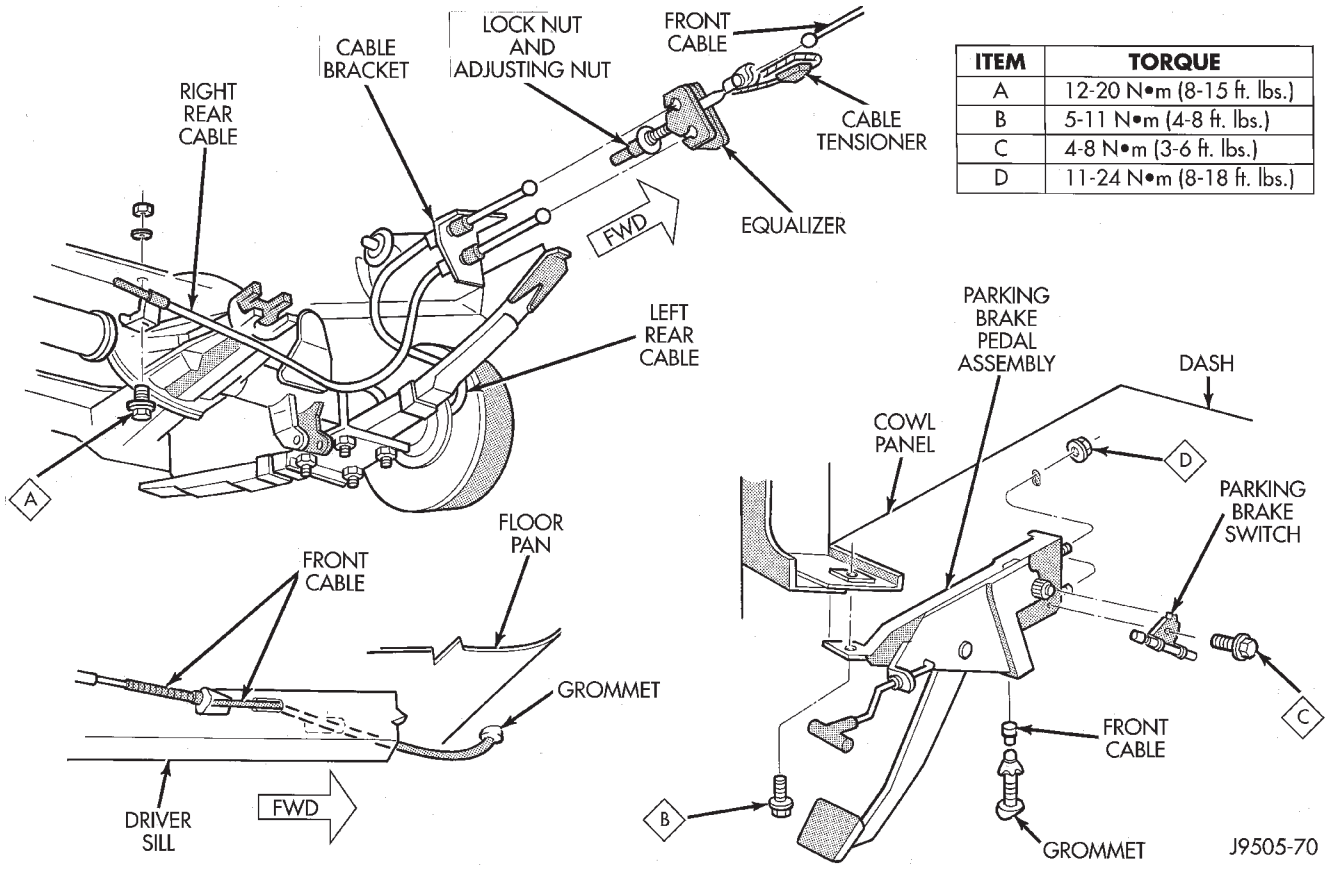
(11) Seat cable grommet in floorpan.

(12) Raise the vehicle.

(13) Install cable-to-frame retaining clip.

(14) Insert cable in equalizer and install equalizer washer and nuts.

(15) Adjust parking brakes as described in Service Adjustment section.



ITEM	TORQUE
A	12-20 N•m (8-15 ft. lbs.)
B	5-11 N•m (4-8 ft. lbs.)
C	4-8 N•m (3-6 ft. lbs.)
D	11-24 N•m (8-18 ft. lbs.)

Fig. 17 Parking Brake Components (YJ)

PARKING BRAKE REAR CABLE REPLACEMENT (YJ)

(1) Raise vehicle and loosen equalizer nuts (Fig. 17).

(2) Remove clamp and cotter pin attaching rear cable to equalizer and remove cable.

(3) Remove cable clips.

(4) Remove rear wheel and brake drum.

(5) Remove secondary brakeshoe and disconnect cable from lever on brakeshoe.

(6) Compress cable retainer with hose clamp (Fig. 16) and remove cable from backing plate.

(7) Install new cable in backing plate. Be sure cable retainer lock tabs are engaged in plate.

(8) Install secondary brakeshoe.

(9) Adjust brakeshoes to brake drum and install drum and wheel.

(10) Install cable in equalizer. Secure cable with retainer and cotter pin.

(11) Install cable clips.

(12) Adjust parking brakes. Refer to procedure in this section.

PARKING BRAKE SWITCH

The parking brake switch is located on the lever assembly on XJ models, or on the foot pedal assembly on YJ models (Fig. 18). Switch replacement is described in the parking brake lever or foot pedal removal/installation procedures in this section.

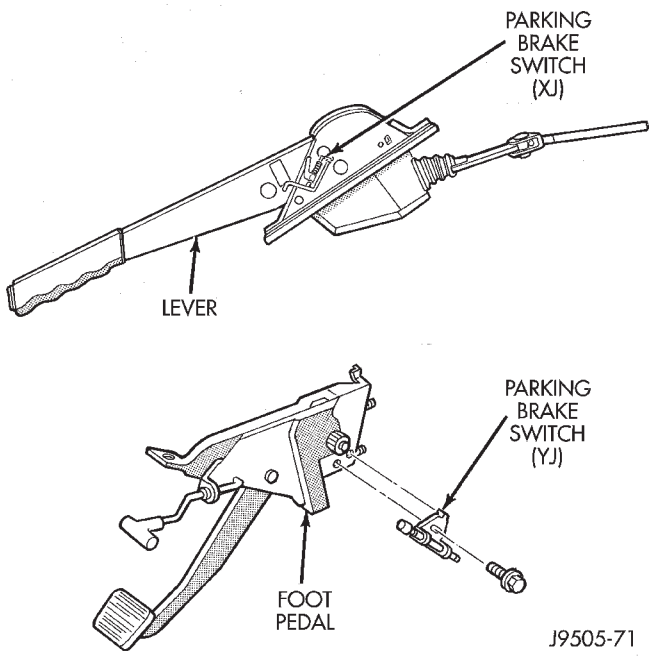


Fig. 18 Parking Brake Switch Location

PARKING BRAKE CABLE TENSIONER ADJUSTMENT (XJ/YJ)

Parking brake adjustment is only necessary when the tensioner, or a cable has been replaced or disconnected for service. When adjustment is necessary, perform adjustment only as described in the following procedure. This is necessary to avoid faulty parking brake operation.

(1) Raise vehicle.

(2) Back off tensioner adjusting nut to create slack in cables.

(3) Remove rear wheel/tire assemblies and remove brake drums.

(4) Check rear brakeshoe adjustment with standard brake gauge. Also check condition of brake parts as follows:

(a) Replace worn parts if necessary. **Excessive shoe-to-drum clearance, or worn brake components will result in faulty parking brake adjustment and operation.**

(b) Verify that parking brake cables operate freely and are not binding, or seized. Replace faulty cables, before proceeding.

(c) Adjust rear brakeshoes shoes to drum.

(5) Reinstall brake drums and wheel/tire assemblies after brakeshoe adjustment is complete.

(6) Lower vehicle enough for access to parking brake lever or foot pedal. **Then fully apply parking brakes. Leave brakes applied until adjustment is complete.**

(7) Raise vehicle again.

(8) Mark tensioner rod 6.5 mm (1/4 in.) from tensioner bracket (Fig. 19).

(9) Tighten adjusting nut at equalizer until mark on tensioner rod moves into alignment with tensioner bracket (Fig. 19). **Do not loosen/tighten equalizer adjusting nut for any reason after completing adjustment.**

(10) Lower vehicle until rear wheels are 15-20 cm (6-8 in.) off shop floor.

(11) Release parking brake lever and verify that rear wheels rotate freely without drag.

(12) Lower vehicle.

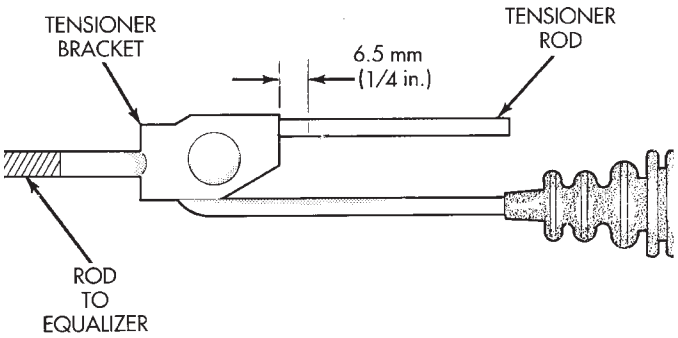


Fig. 19 Placing Adjustment Mark On Tensioner Rod

SPECIFICATIONS

BRAKE TORQUE SPECIFICATIONS

Description	Torque
Acceleration Sensor Screws:	
at sensor	8-9 N•m (71-83 in. lbs.)
at bracket	1-2 N•m (13-18 in. lbs.)
Brake Booster Mounting Nuts	41 N•m (30 ft. lbs.)
Brakeline Fittings At:	
combination valve	18-24 N•m (160-210 in. lbs.)
front brake hose	15-18 N•m (130-160 in. lbs.)
HCU	14-16 N•m (125-140 in. lbs.)
master cylinder primary outlet	14-16 N•m (125-140 in. lbs.)
master cylinder secondary outlet	15-18 N•m (135-160 in. lbs.)
rear brakeline (to hose)	15-18 N•m (130-160 in. lbs.)
wheel cylinder	15-18 N•m (130-160 in. lbs.)
Brake Pedal Support Bolt	23-34 N•m (200-300 in. lbs.)
Brake Pedal Pivot Bolt/Nut	27-35 N•m (20-26 ft. lbs.)
Caliper Mounting Bolts	10-20 N•m (7-15 ft. lbs.)
Combination Valve Adaptor Fittings	23-27 N•m (200-240 in. lbs.)
ECU Mounting Screws	8-13 N•m (75-115 in. lbs.)

Description	Torque
Front Brake Hose Bracket Screw	4-6 N•m (34-50 in. lbs.)
Front Brake Hose Fitting Bolt	24-38 N•m (216-336 in. lbs.)
Front Wheel Sensor Bracket Bolt	4-6 N•m (34-50 in. lbs.)
HCU Bracket Attaching Nuts	10-13 N•m (92-112 in. lbs.)
Master Cylinder Attaching Nuts	13-25 N•m (115-220 in. lbs.)
Parking Brake Cable Retainer Nut	1-2 N•m (12-16 in. lbs.)
Parking Brake Lever Screws	10-14 N•m (85-125 in. lbs.)
Parking Lever Bracket Screws	10-14 N•m (85-125 in. lbs.)
Rear Axle Vent Fitting	11-18 N•m (100-160 in. lbs.)
Rear Brake Hose Bracket Screw	8-9 N•m (74-82 in. lbs.)
Rear Sensor Axle Bracket Bolt	8-9 N•m (74-82 in. lbs.)
Rear Sensor Bolt	12-14 N•m (10-11 ft. lbs.)
Support Plate Bolts/Nuts	43-61 N•m (32-45 ft. lbs.)
Wheel Cylinder Bolts	10 N•m (90 in. lbs.)
Wheel Lug Nuts	120 N•m (88 ft. lbs.)

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