BRAKES

CONTENTS

GENERAL INFORMATION

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WHEEL BRAKE COMPONENTS

Front disc and rear drum brakes are used on all models. The disc brake components consist of single piston calipers and ventilated rotors. The 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 actuating levers mounted on the rear drum brake secondary shoes. The parking brake mechanism is operated by a foot pedal on YJ models and a hand lever on XJ models.

POWER BRAKES

Power brakes are standard on all models. A vacuum operated power booster is used for standard and ABS brake applications.

HYDRAULIC COMPONENTS

A dual reservoir master cylinder is used for all standard brake applications. A combination proportioning valve/pressure differential switch is used. A center feed style master cylinder is used for ABS brake applications.

BRAKELINING MATERIAL

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

BRAKE WARNING LIGHTS

A red, brake warning light is used to alert the driver if a pressure differential exists between the front and rear hydraulic systems. The light also alerts the driver when the parking brakes are applied. The light illuminates for a few seconds at start up as part of a bulb check procedure.

An additional warning light is used on models with antilock brakes. This light is amber in color and is located in the same side of the instrument cluster as the red warning light. The amber light illuminates only when an ABS system fault occurs.

ANTILOCK BRAKE SYSTEM (ABS)

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

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 the system components. 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 RECOMMENDED SAFETY PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA), FOR HANDLING AND DISPOSAL OF PRODUCTS CONTAINING ASBESTOS.

ABS BRAKE DIAGNOSIS

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DIAGNOSIS PROCEDURES

ABS diagnosis involves three basic steps. First is observation of the warning light display. Second is a visual examination for low fluid level, leaks, parking brakes applied, or obvious damage to system components or wires. The third step involves using the DRB II scan tool to identify a faulty component.

The visual examination requires a check of reservoir fluid level and all system components. Things to look for are leaks, loose connections, or obvious component damage.

The final diagnosis step involves using the DRB II scan tool to determine the specific circuit or component at fault. The tester is connected to the ABS diagnostic connector in the passenger compartment. The connector is at the driver side of the center console under the instrument panel. Refer to the DRB II scan tool Manual for tester procedures. Also refer to the ABS Fault Diagnosis charts at the end of this section for additional diagnosis information.

Initial faults should be cleared and the vehicle road tested to reset any faults that remain in the system. Faults can be cleared with the DRB II scan tool.

REAR SPEED SENSOR AIR GAP

The front wheel sensors are fixed and cannot be adjusted. Only the rear sensor air gap is adjustable. Air gap must be set with a brass feeler gauge.

Correct air gap is important to proper signal generation. An air gap that is too large may cause complete loss of sensor input. Or, a gap that is too small could produce a false input signal, or damaging contact between the sensor and tone ring.

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 function with a compact spare tire installed.

OPERATING SOUND LEVELS

The ABS 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.

VEHICLE RESPONSE IN ANTILOCK MODE

During antilock braking, the HCU solenoid valves cycle rapidly in response to ECU inputs.

The driver will experience a pulsing sensation within the vehicle as the solenoids decrease, hold, or increase pressure as needed. A pulsing brake pedal will also be noted.

The pulsing sensation occurs as the solenoids cycle during antilock mode braking. A slight pulse in the brake pedal may also be noted during the dynamic self check part of system initialization.

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.

LOSS OF SENSOR INPUT

Sensor malfunctions will most likely be due to loose connections, damaged sensor wires, incorrect rear sensor air gap, or a malfunctioning sensor. Additional causes of sensor faults would be sensor and tone ring misalignment or damage.

ABS WARNING LIGHT DISPLAY

ABS Light Illuminates At Startup

The amber ABS 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 self check routine.

ABS Light Remains On After Startup

An ABS system fault is indicated when the light remains on after startup. Diagnosis with the DRB II

scan tool will be necessary to determine which ABS component has malfunctioned.

ABS Light Illuminates During Brake Stop

A system fault such as loss of speed sensor signal or solenoid failure, will cause the amber warning light to illuminate. The most effective procedure here is to check for obvious damage first. Then check the electronic components with the DRB II scan tool.

BRAKE WARNING LIGHT DISPLAY

The red brake warning light and the ABS light operate independently. If the red light remains on after startup or illuminates during a brake stop, refer to the standard brake system diagnosis section. Either the parking brakes are applied, or a wheel brake malfunction has occurred.

ECU DIAGNOSIS

The ECU controls all phases of antilock system operation. It also differentiates between normal and antilock mode braking.

The ECU monitors and processes the signals generated from all of the system sensors at all times.

The ECU program includes a self check routine that tests each of the system components. The self check occurs during both phases of the initialization program. A failure of the self check program will cause the immediate illumination of the amber warning light. The light will also illuminate if a solenoid or other system component fails during the dynamic phase of initialization.

If a system malfunction should occur, do not immediately replace the ECU. A blown system fuse, bad chassis ground, or loss of feed voltage will each cause a system malfunction similar to an ECU failure. Never replace the ECU unless diagnosis with the DRB II scan tool indicates this is necessary.

HCU DIAGNOSIS

The HCU pump and motor and solenoid valve body are serviced only as an assembly. The HCU assembly should not be replaced unless a fault has actually been confirmed. Verify fault conditions with the DRB II scan tool before proceeding with repair.

ABS SYSTEM WIRING AND ELECTRICAL CIRCUITS

Location of the ABS fuse (in the fuse panel) is shown in Figure 1. The engine compartment harness routing for the ABS components is shown in Figure 2.

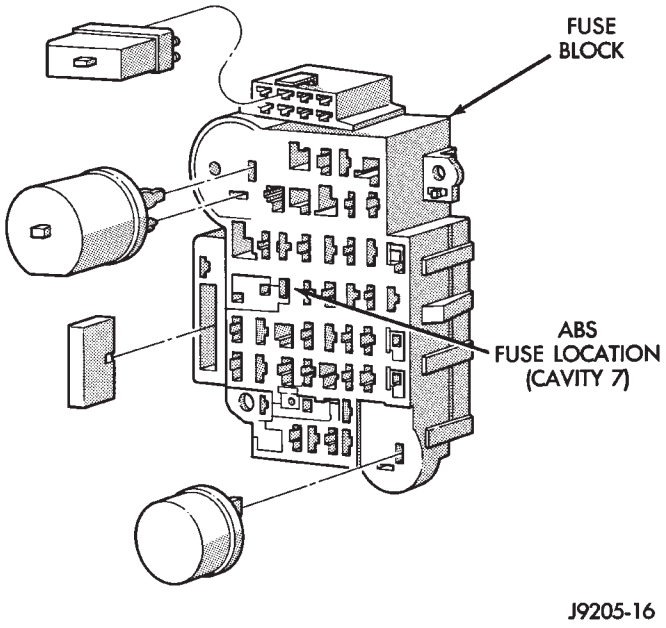

Fig. 1 ABS Fuse Location

ABS FAULT DIAGNOSIS

The fault diagnosis chart provides additional information on potential ABS system faults. Use the chart as a guide when diagnosing a system problem.

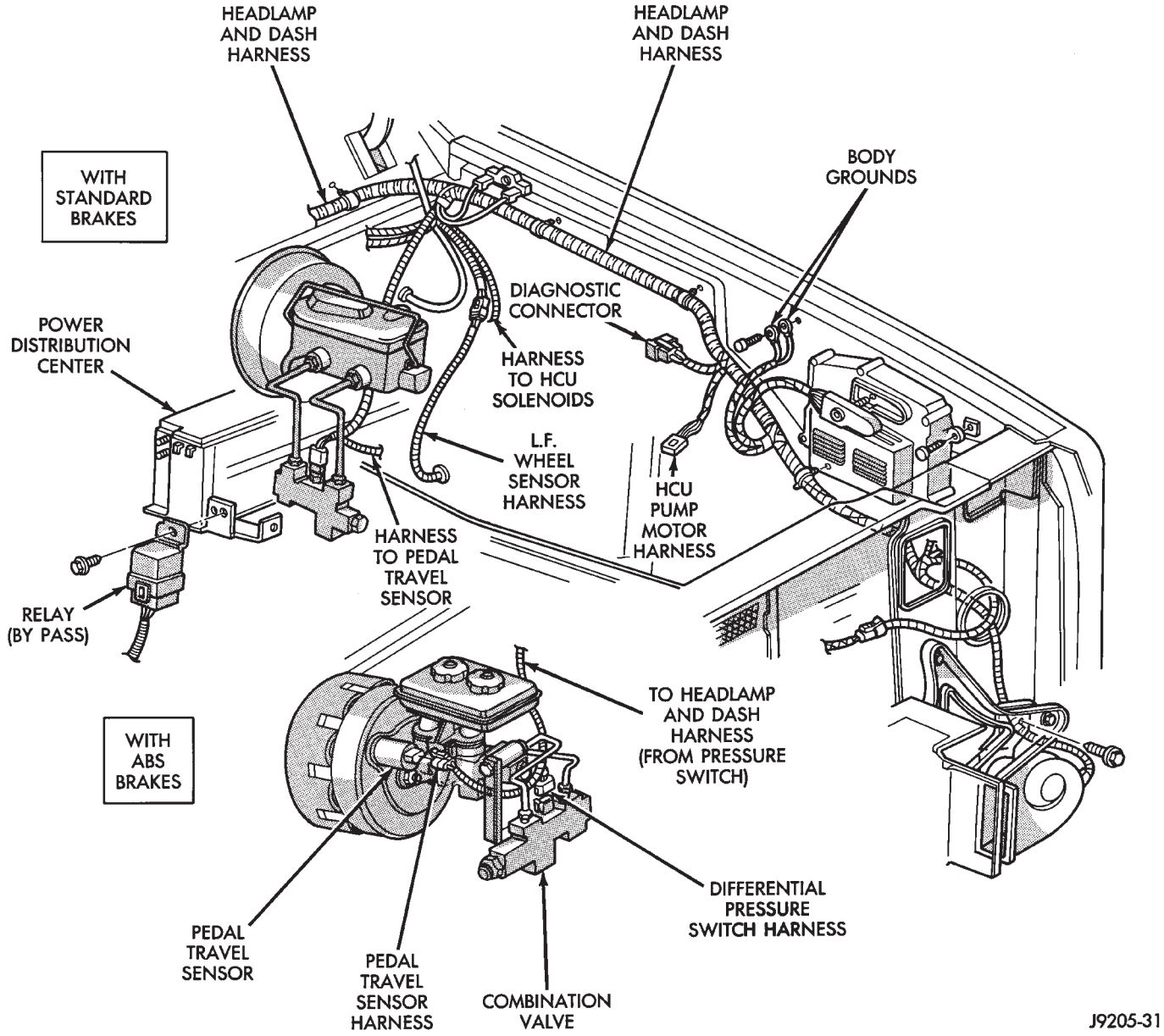

Fig. 2 ABS Engine Compartment Harness Routing (XJ)

ABS FAULT DIAGNOSIS

ABS CONDITION	PROBABLE CAUSE
WHEEL SENSOR FAULT	1. Sensor disconnected. 2. Incorrect sensor air gap (usually too large). 3. Damaged sensor wire. 4. Damaged sensor or tone ring. 5. Sensor and/or tone ring loose or misaligned.
HCU SOLENOID VALVE FAULT	1. Bad ECU. 2. HCU wire harness short, open loose connection, or wire damage. 3. System circuit breakers (in PDC) faulty. 4. Relay fault.
PUMP MOTOR FAULT	1. Fuse or wire harness problem. 2. Relay malfunction. 3. Pump motor sensor malfunction. 4. Pedal travel sensor fault (short, open, mismatched). 5. Pump motor malfunction.
MAIN RELAY FAULT	1. Short or open in relay. 2. Short or open in relay wiring. 3. Inadequate feed voltage (less than 9 volts).
ABS LIGHT ON BUT NO FAULT CODE SET	1. ABS fuse blown. 2. Inadequate feed voltage to ECU (less than 9 volts). 3. ECU ground wire damage or loose connection. 4. Main relay inoperative.
INADEQUATE FEED VOLTAGE (NOT ENOUGH VOLTAGE TO OPERATE SYSTEM)	1. Battery discharged or low on charge. 2. Battery cables loose or corroded (at terminals). 3. Loose, corroded system ground. 4. Loose harness connections or corroded connections.
DECREASING BRAKE PEDAL HEIGHT (MOVES CLOSER TO FLOOR)	Noticeable decrease during ABS stops is due to: (a) Fluid leak. (b) Air in system. (c) Pedal travel sensor cap and booster are mismatched. (d) Pedal travel sensor or pump malfunction.
INCREASING BRAKE PEDAL HEIGHT, PUMP RUNS CONTINUOUSLY DURING ABS STOP (PEDAL FARTHER FROM FLOOR)	1. Pump motor wire harness problem (short, open, ground, loose, damaged). 2. Pedal travel sensor fault.
ACCELERATION SWITCH FAULT	1. Switch wires loose, damaged. 2. Switch malfunction. 3. Switch mounted upside down.

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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 antilock light is illuminated, refer to Antilock Brake System Diagnosis. However, if red warning light is illuminated, or if neither warning light is illuminated, continue with diagnosis.

(2) Check 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 to 6 mm (1/4 in.) of reservoir rim. If vehicle two-piece, removable reservoir, correct level is to top of indicator rings in reservoir.

(b) On models with ABS brakes, preferred level is to MAX mark on reservoir. Acceptable level is between MAX and MIN marks.

(c) Remember that fluid level in the front and rear 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 reasonably clear and 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.

(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.

(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 the vehicle.

ROAD TESTING

(1) If amber warning light is illuminated, problem is with antilock system component. Refer to Antilock Brake System Diagnosis.

(2) If red warning light is illuminated, or if neither warning light is illuminated, make several stops and note pedal action and brake response.

(3) Check brake pedal response with transmission in Neutral and engine running. Pedal should remain firm under steady foot pressure. If pedal falls away, problem is either in vacuum booster or master cylinder.

(4) During road test, make normal and firm brake stops in 25-40 mph range. Note faulty brake operation such as pull, grab, drag, noise, fade, pedal pulsation, etc.

(5) Inspect suspect brake components and refer to problem diagnosis information for causes of various brake conditions.

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.

DIAGNOSING SERVICE BRAKE PROBLEMS

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
- parking brakes applied
- low pedal caused by malfunction in front/rear brake hydraulic circuit (differential switch valve actuated)

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 indicates that the valve in the differential pressure switch has been actuated. If a problem is confirmed, inspect the hydraulic system and wheel brake components.

On models with ABS brakes, the amber warning light only illuminates when an ABS component has malfunctioned. The ABS light operates independently of the red warning light. Refer to the antilock brake section for more detailed diagnosis information.

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 in 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/or the warning light illuminates, the problem is in the master cylinder, wheel cylinders, or calipers.

A decrease in master cylinder fluid level may only be the result of normal lining wear. Fluid level will decrease 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

A spongy pedal is most often caused by air in the system. However, thin drums or substandard brake lines and hoses will 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.

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 bushings or slide surfaces
- wrong length caliper mounting bolts (too long)
- loose caliper mounting bracket
- distorted brake drum or shoes
- rear 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 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

Pedal pulsation is caused by components that are loose, or beyond tolerance limits.

Disc brake rotors with excessive lateral runout or thickness variation, or out of round brake drums are the primary causes of pulsation. Other causes are loose wheel bearings or calipers and worn, damaged tires.

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 magnified. 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 or proportioning valve could be at fault.

BRAKES DO NOT HOLD AFTER DRIVING THROUGH DEEP WATER PUDDLES

This condition is generally 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.

BRAKE FLUID CONTAMINATION

There are two basic causes of brake fluid contamination. The first involves allowing dirt, debris, or other liquid materials to enter the cylinder reservoirs

when the cover is off. The second involves adding to, or filling the cylinder reservoirs with a non-recommended fluid.

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 will usually be discolored, milky, oily looking, or foamy. In some cases, it may even appear as if the fluid contains sludge. **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

Brake squeak or squeal may be due to linings that are wet or contaminated with brake fluid, grease, or oil. Glazed linings and rotors with hard spots can also contribute to squeak. Dirt and foreign material embedded in the brake lining will also cause squeak/squeal.

A very loud squeak or squeal is frequently a sign of severely worn brake lining. If the lining has worn through to the brakeshoes in spots, metal-to-metal contact occurs. If the condition is allowed to continue, rotors can become so scored that replacement is necessary.

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.

BRAKELINING CONTAMINATION

Brakelining contamination is usually a product of leaking calipers or wheel cylinders, driving through deep water puddles, or lining that has become covered with grease and grit during repair.

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 pull and vibration.

DIAGNOSING PARKING BRAKE PROBLEMS

Adjustment Mechanism

Parking brake adjustment is controlled by a cable tensioner mechanism. This applies to 1991 through 1994 YJ models and 1992 and later XJ models. The cable tensioner, once adjusted at the factory, will 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 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 mis-assembled brake parts.

A "too loose" condition can also be caused by inoperative brakeshoe adjusters. If the adjusters are mis-

assembled, 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
- rear brakedrum wear
- brakedrums 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. If oversize drums are suspected, the 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 (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, 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 valve 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.

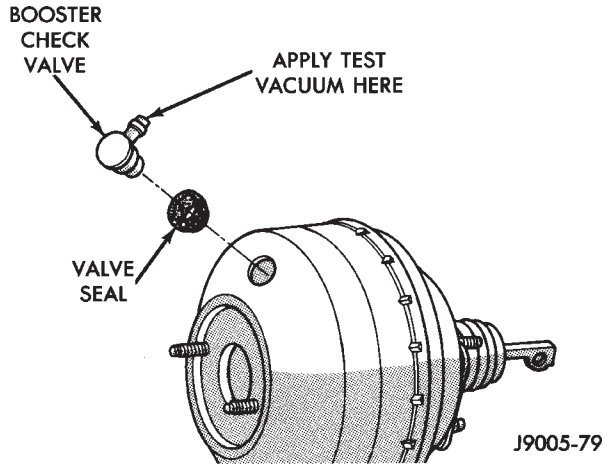

Fig. 1 Vacuum Check Valve And Seal (Typical)

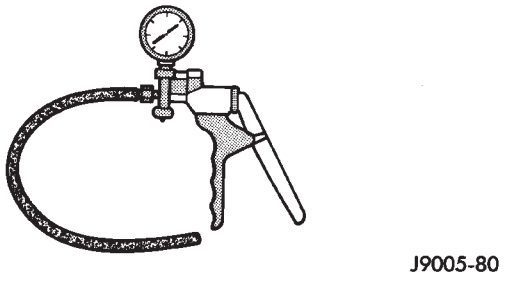

Fig. 2 Hand Operated Vacuum Pump (Typical)

POWER BOOSTER VACUUM TEST

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

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

(3) Clamp 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.

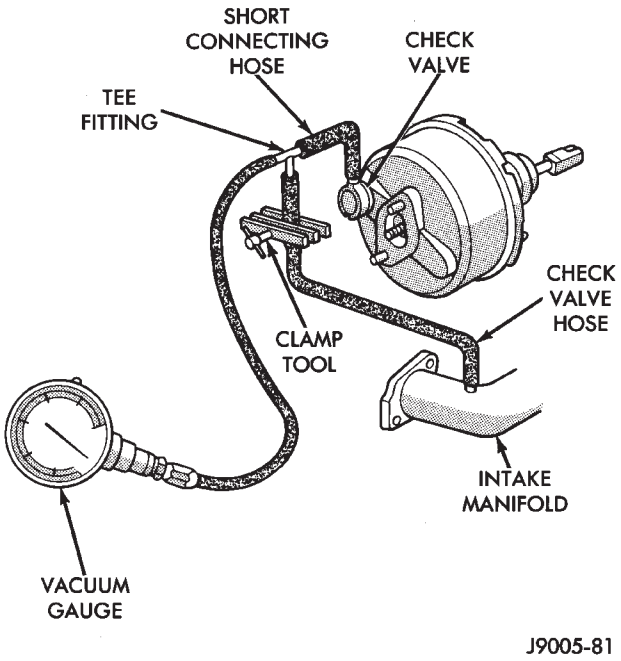

Fig. 3 Booster Vacuum Test Connections

BRAKE BLEEDING—BRAKE FLUID AND LEVEL—BRAKELINES AND HOSES

INDEX

RECOMMENDED BRAKE FLUID

The only brake fluid recommended for Jeep vehicles with standard or antilock brakes, is Mopar brake fluid, or an equivalent fluid meeting SAE J1703 and DOT 3 standards.

Use new brake fluid only 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 and cover before checking fluid level. If not cleaned, dirt from the cover could enter the fluid. Also check the cover seal and replace it if torn or distorted.

Correct fluid level is to within 6 mm (1/4 in.) of the reservoir rim, or to the fill mark on models with a plastic reservoir. Refer to the Antilock Brake section for fluid levels on models equipped with ABS brakes.

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.

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—XJ/YJ WITH STANDARD BRAKES

Use Mopar DOT 3 brake fluid, or an equivalent meeting SAE/DOT standards J1703-F and DOT 3, to fill and bleed the system.

On standard brake models, bleeding can be performed either manually or with pressure equipment. However, if pressure equipment is used, it will be necessary to hold the front brake metering valve open in order to bleed the front brakes. The valve can be held open with a tension clip tool or by hand. It will also be necessary that a suitable size pressure tank hose adapter be available for use on the master cylinder.

MANUAL BLEEDING PROCEDURE

(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.

(3) Remove cover and fill master cylinder reservoir with Mopar, or equivalent DOT 3 brake fluid.

(4) Open all caliper and wheel cylinder bleed screws.

(5) Close bleed screws after fluid begins flowing from each bleed screw.

(6) Top off master cylinder reservoir again.

(7) Use following bleed sequence:

- master cylinder
- right rear
- left rear
- right front
- left front

(8) Observe following brake bleeding precautions:

- Do not pump brake pedal at any time while bleeding. Air in system will be compressed into small bubbles that are distributed throughout hydraulic system. This will make a second and third bleeding operation necessary.
- Bleed only one wheel brake unit at a time and use a bleed hose to bleed each wheel brake unit (Fig. 7).
- Attach one end of bleed hose to bleed screw and insert opposite end in glass container partially filled with brake fluid (Fig. 7). Glass container makes it easier to see air bubbles as they exit the bleed hose.
- Be sure end of bleed hose is immersed in fluid. Immersing hose end in fluid prevents air from being drawn back into cylinder and brakeline.

(9) Bleed master cylinder first. Have helper operate brake pedal while bleeding each master cylinder fluid outlet line.

CAUTION: 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 the cylinder fluid level frequently and add fluid as needed.

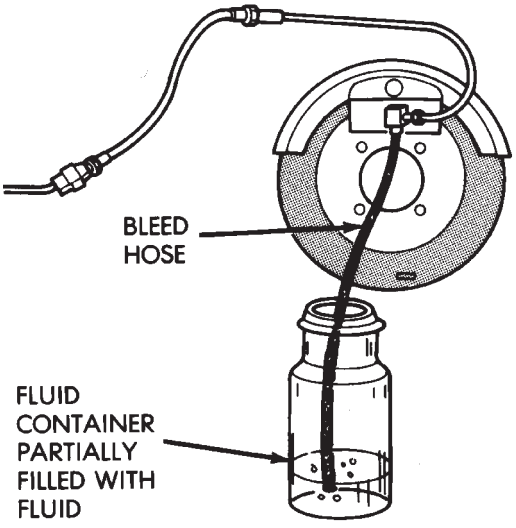

Fig. 7 Typical Bleed Hose And Fluid Container

(10) Bleed each wheel brake unit as follows:

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

(b) Have helper press and hold brake pedal to floor. **Do not pump brake pedal while bleeding. Air in system will be compressed into small bubbles that are distributed throughout hydraulic system. This will make a second and third bleeding operation necessary.**

(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.

(e) Discard fluid bled into glass container. It should not be reused.

(11) Check and adjust master cylinder fluid level.

(12) Verify proper brake operation before moving vehicle.

PRESSURE BLEEDING

The front brake metering valve is located in the forward end of the combination valve. The valve stem is accessible from the same end of the valve. The stem must be either pressed inward, or held outward slightly in order to bleed the front brakes.

(1) Fill bleeder tank if necessary.

(2) Purge air from bleeder tank and lines before proceeding.

(3) Wipe master cylinder cover clean.

(4) Remove master cylinder cover and install pressure hose adapter in place of cover. A suitable adapter will usually be available from tank manufacturer.

(5) Connect bleeder tank pressure hose to adapter.

(6) Bleed master cylinder first. Then bleed rear brakes as described in manual bleeding procedure.

(7) Bleed front brakes as described in manual bleeding procedure. Have helper hold metering valve open by pressing valve stem inward slightly. Amount of valve stem movement needed to hold valve open is quite modest. Do not use excessive force.

(8) Remove pressure bleeding equipment and top off master cylinder reservoir.

BRAKE BLEEDING—XJ/YJ WITH ABS BRAKES

A different bleeding method is required for the ABS system. It is basically a three step process consisting of: A conventional manual brake bleed. A second bleed using the DRB II, followed by a repeat of the conventional manual bleed procedure. Recommended ABS bleeding procedure is as follows:

(1) Clean master cylinder reservoir caps and reservoir exterior. Dirt, foreign material on the caps and reservoir must not be allowed to enter reservoir.

(2) Fill reservoir with Mopar brake fluid, or equivalent quality fluid meeting SAE 1703 and DOT 3 standards.

(3) Recommended bleeding sequence is:

- master cylinder
- HCU valve body (at fluid lines)
- right rear wheel
- left rear wheel
- right front wheel
- left front wheel.

(4) Attach bleed hose to caliper or wheel cylinder bleed fitting. Immerse end of bleed hose in glass container partially filled with brake fluid. Be sure hose end is submerged in fluid (Fig. 7).

(5) Bleed each wheel brake unit as follows:

(a) Have helper apply and hold brake pedal.

(b) 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.**

(c) Repeat bleeding operation 5-7 more times at each rear wheel brake unit.

(d) Continue bleeding until fluid entering glass container is free of air bubbles. Check reservoir fluid level frequently and add fluid if necessary.

(e) Repeat bleeding procedures at front wheels.

CAUTION: Do not allow the master cylinder reservoir to run dry while bleeding the brakes. Running dry will allow air to re-enter the system making a second bleeding operation necessary.

(6) Perform "Bleed Brake" procedure with DRB II scan tool. Procedure is described in DRB II software information and diagnostic manual.

(a) Connect DRB II scan tool to diagnostic connector.

(b) Run Bleed Brake procedure as described in tester manual.

(7) Repeat conventional bleeding procedure outlined in steps (1) through (8).

(8) Top off master cylinder fluid level if necessary.

(9) Verify proper brake operation.

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. They are not repairable parts.

When installing new, or original brakelines and hoses, lubricate the fitting threads with brake fluid before connection.

The steel brakelines should be checked every time the vehicle is in for normal maintainence. This is important on high mileage vehicles. It is even more important when a vehicle is operated in areas where salt is used regularly on the road surface during winter.

Heavily rusted/corroded brake rotors, drums, support plates, and brakelines should be cleaned and carefully inspected. Heavy rust buildup can hide severe damge to a component. Severely rusted parts should be replaced if you are unsure about their condition.

COMBINATION VALVE

The combination valve is not a serviceable part. The valve must be replaced if a malfunction occurs.

BRAKELINE CHARTS

Brakeline charts are provided in illustration Figures 1 through 8. The illustrations show typical brakeline routing, hose connections and component position.

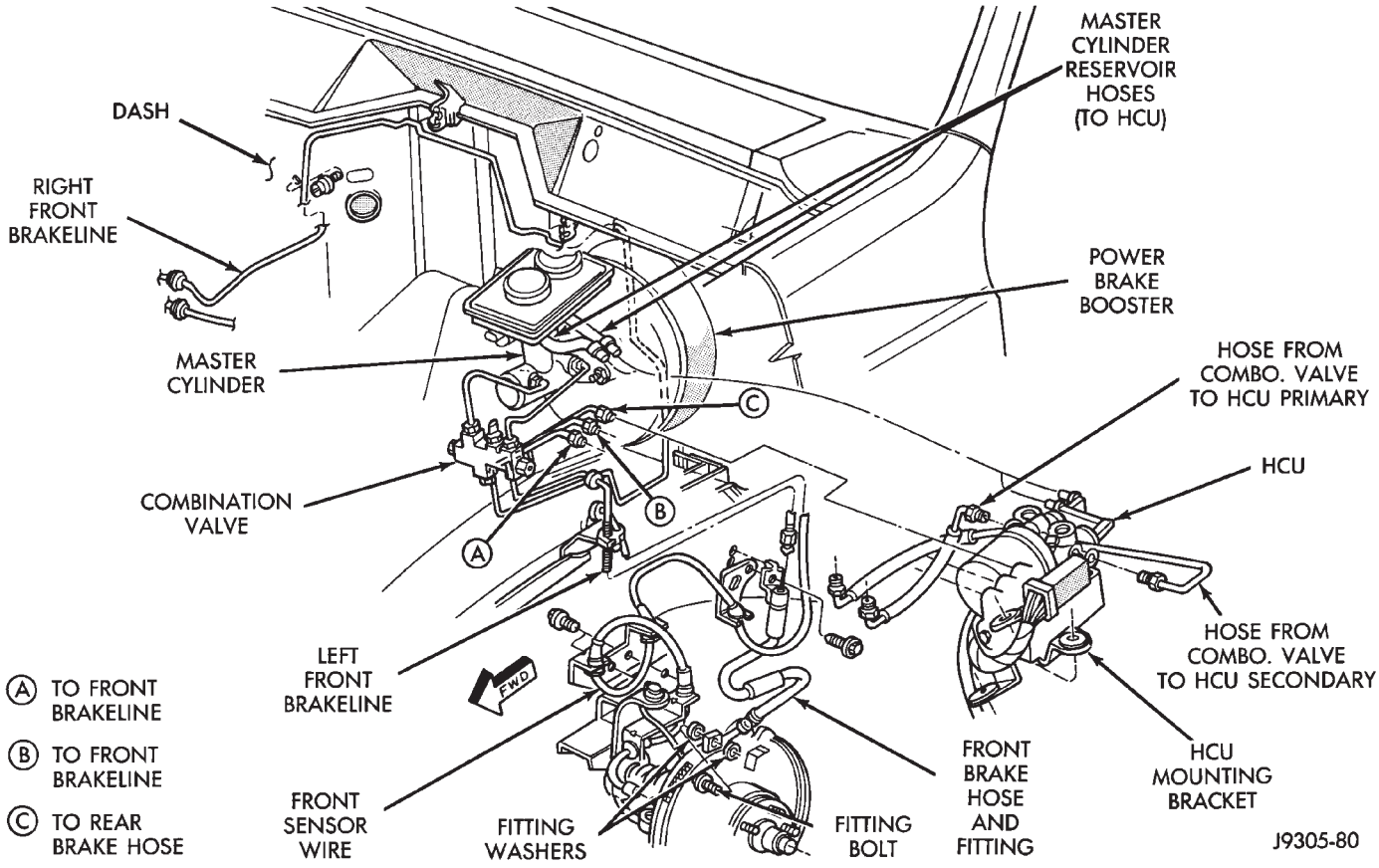

Fig. 1 Front Brakeline Routing (XJ With ABS Brakes)

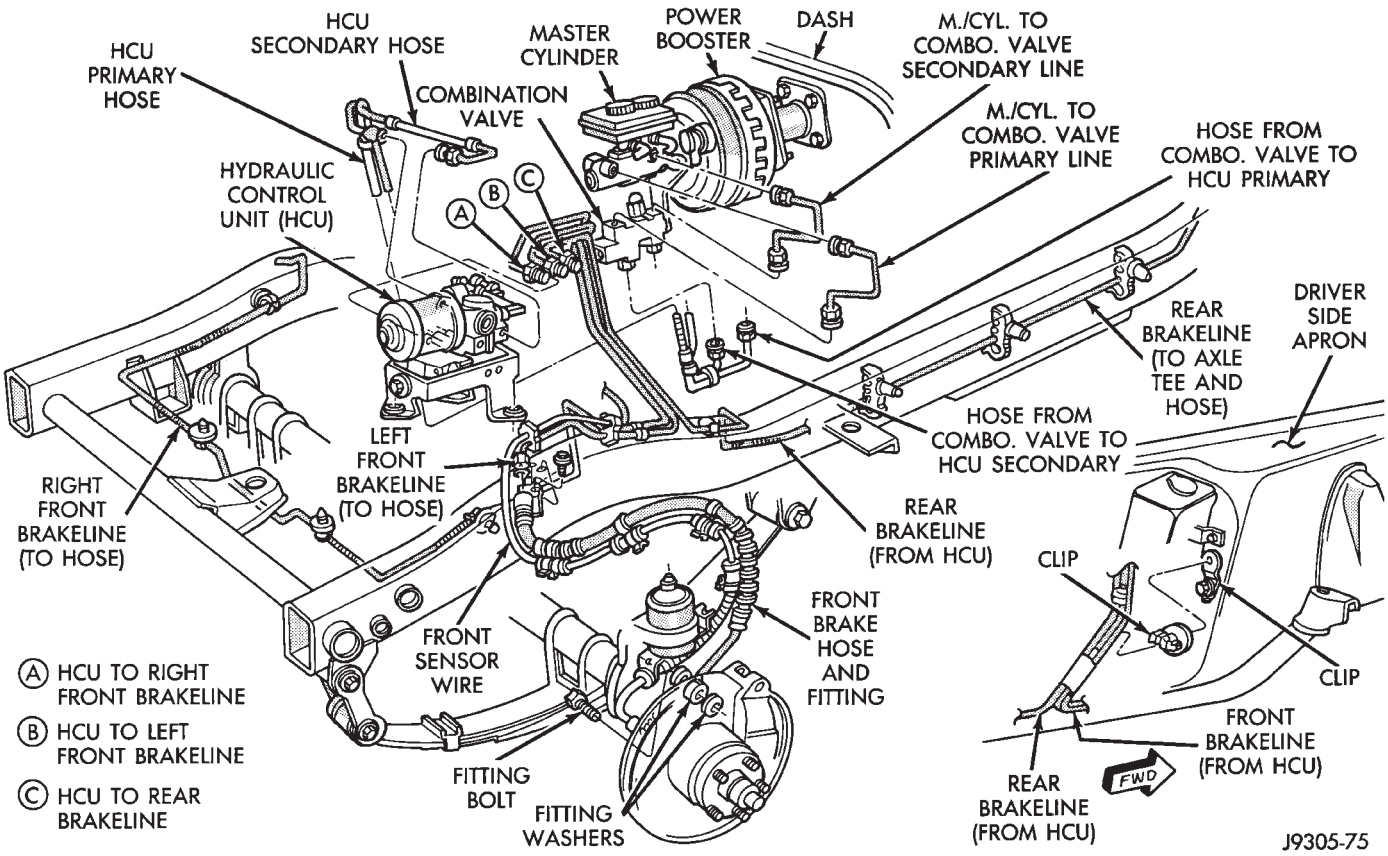

Fig. 2 Front Brakeline Routing (YJ With ABS Brakes)

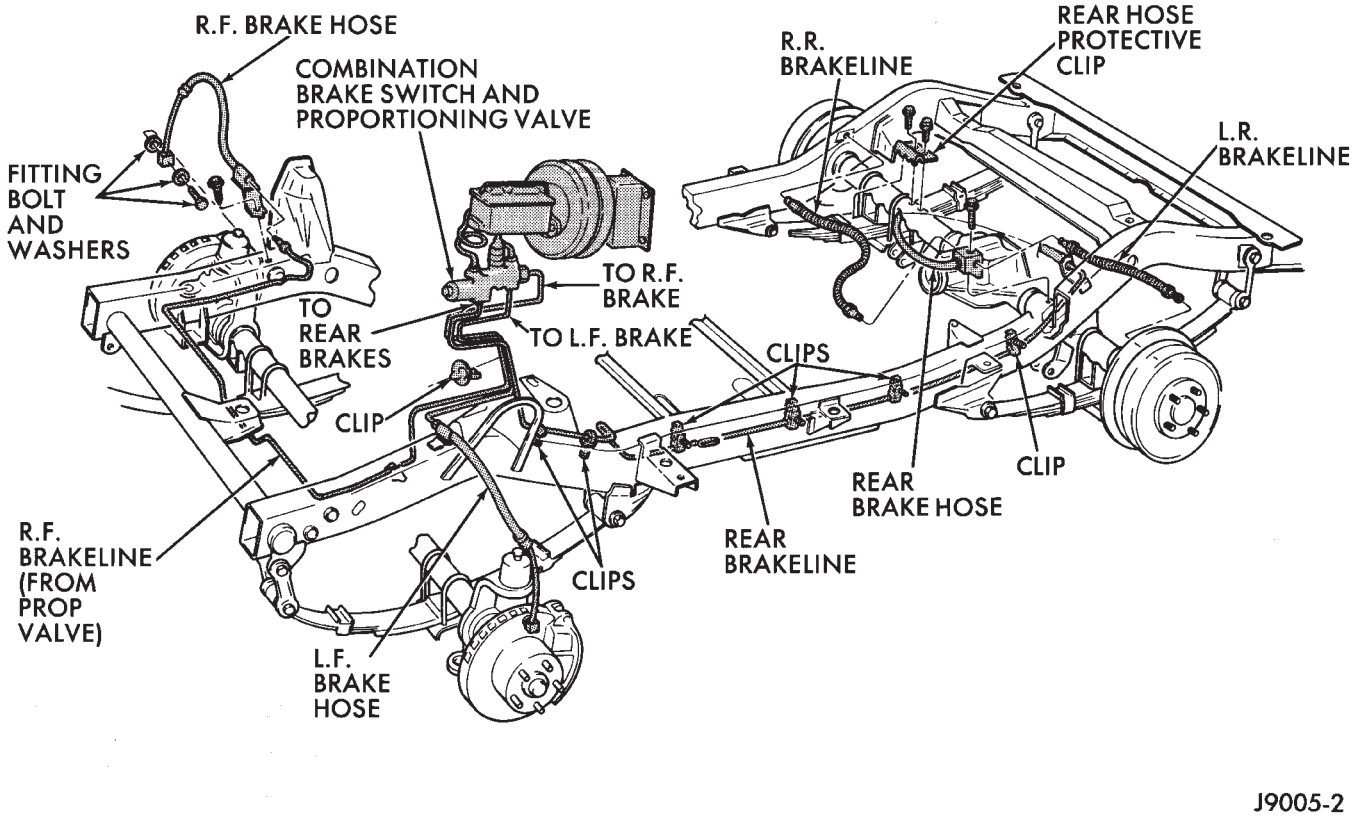

Fig. 3 Brakeline Routing (YJ With Standard Brakes)

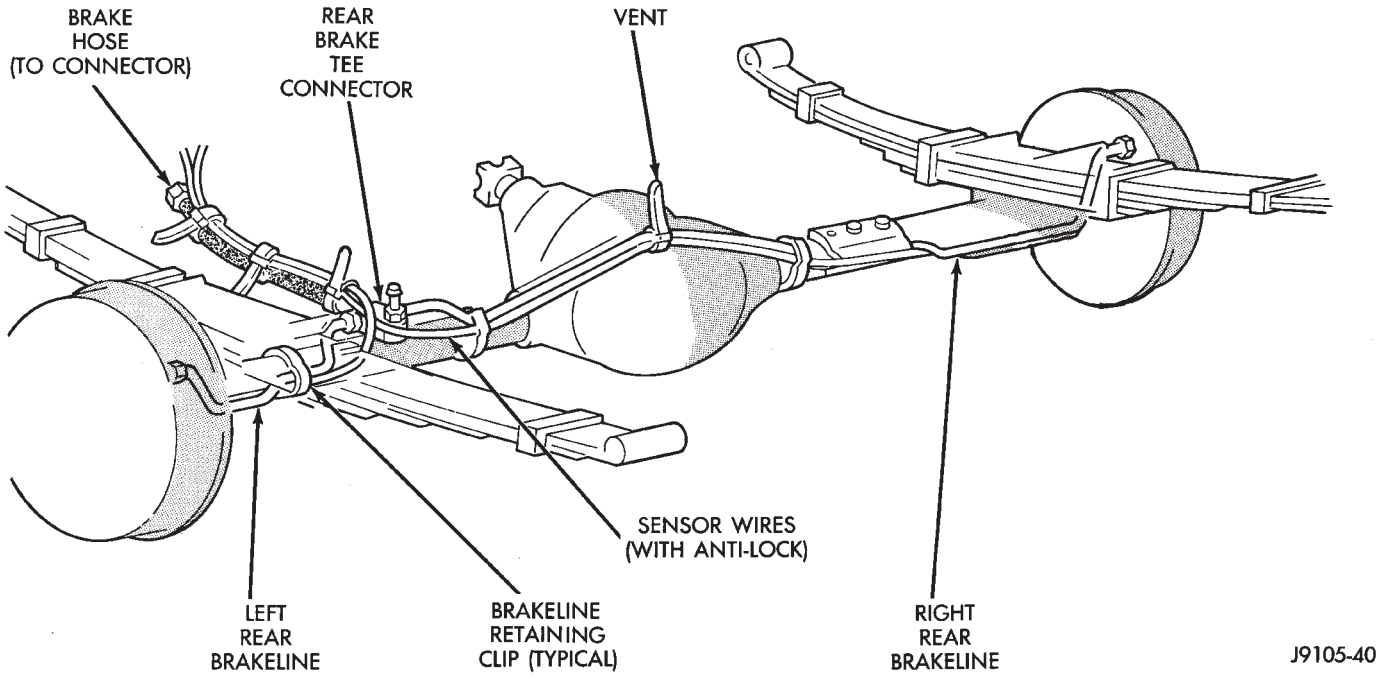

Fig. 4 Rear Brakeline Routing (XJ With Standard Brakes)

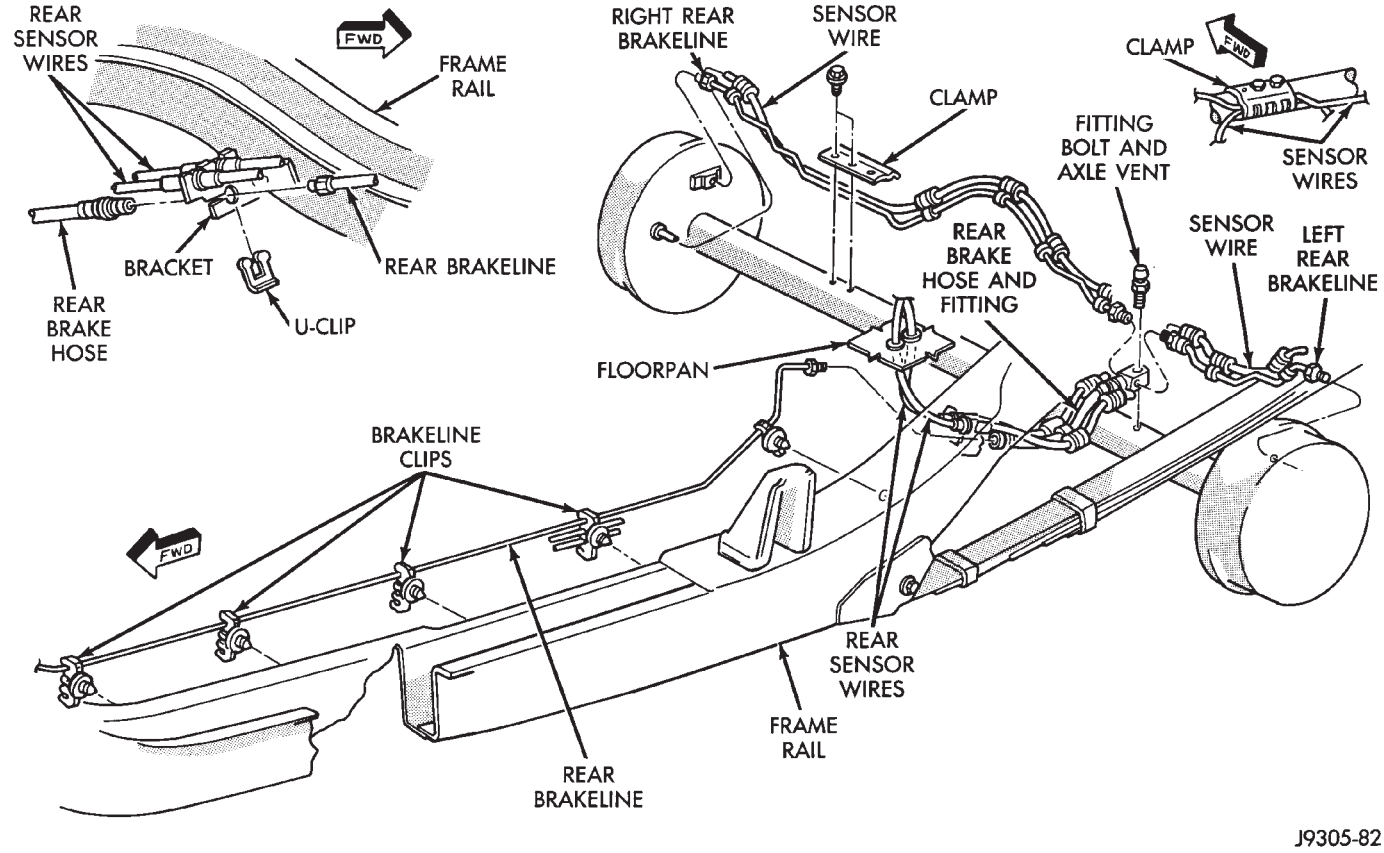

Fig. 5 Rear Brakeline Routing (XJ With ABS Brakes)

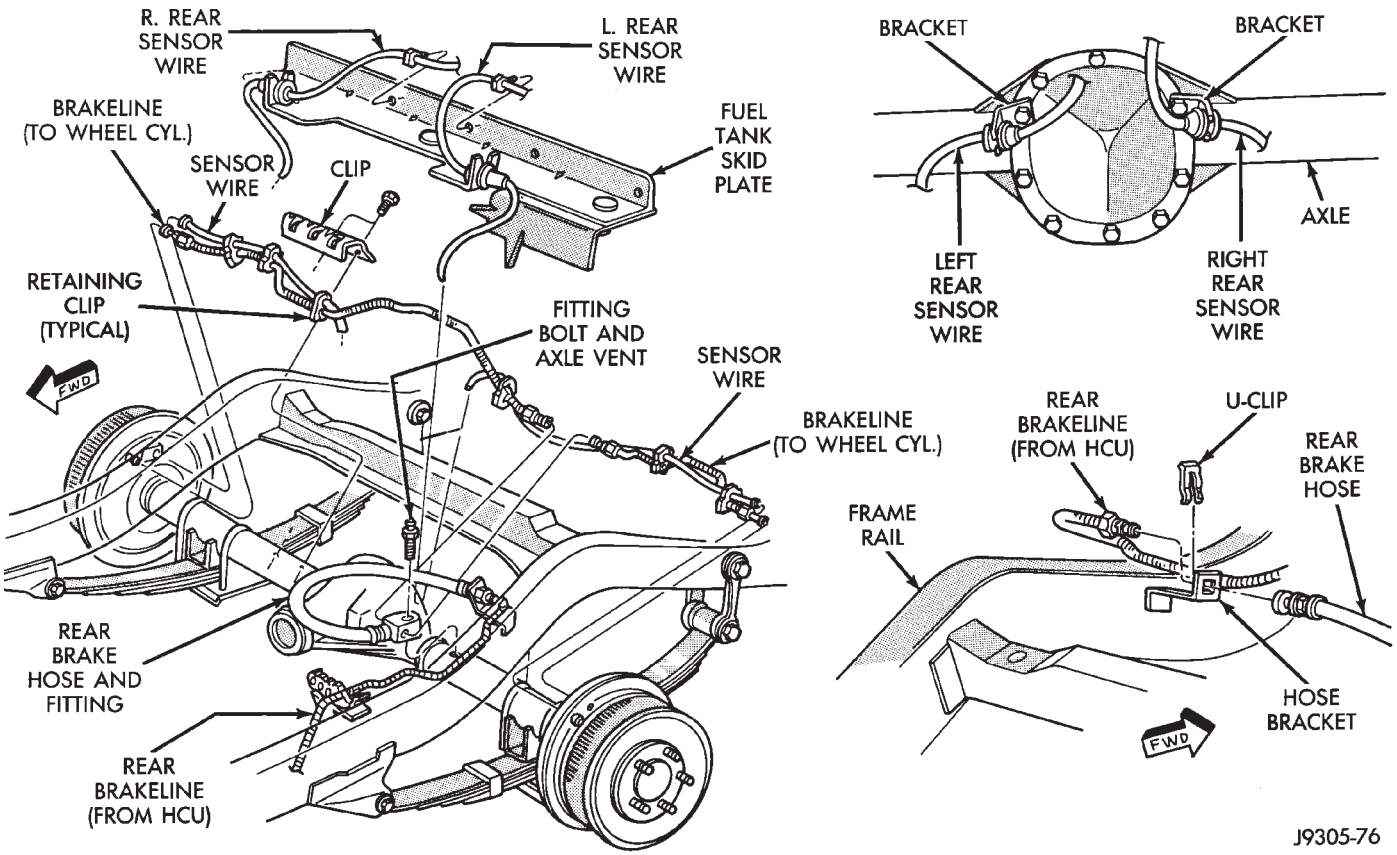

Fig. 6 Rear Brakeline Routing (YJ With ABS Brakes)

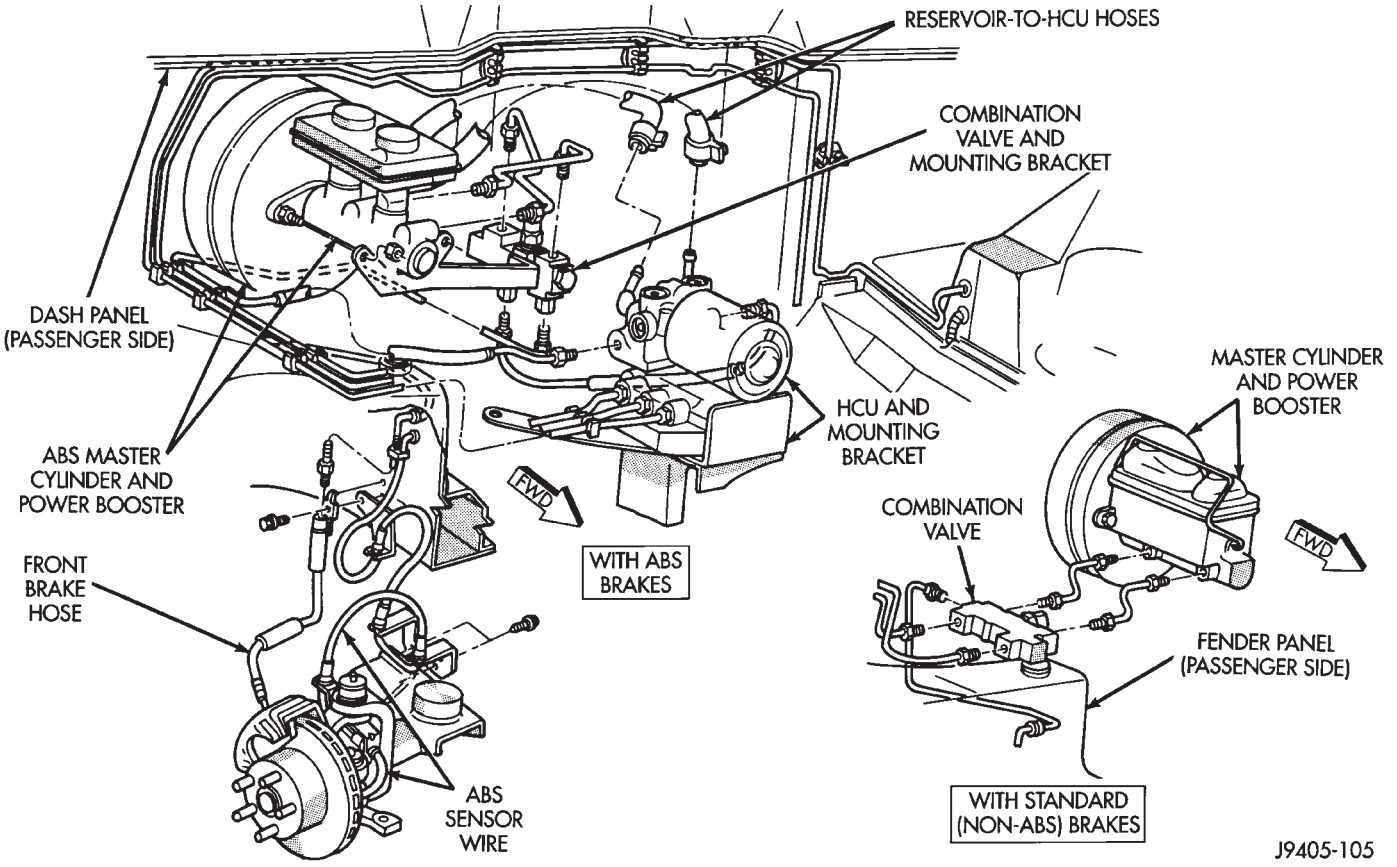

Fig. 7 Front Brakeline Routing (Right Hand Drive XJ With ABS Brakes)

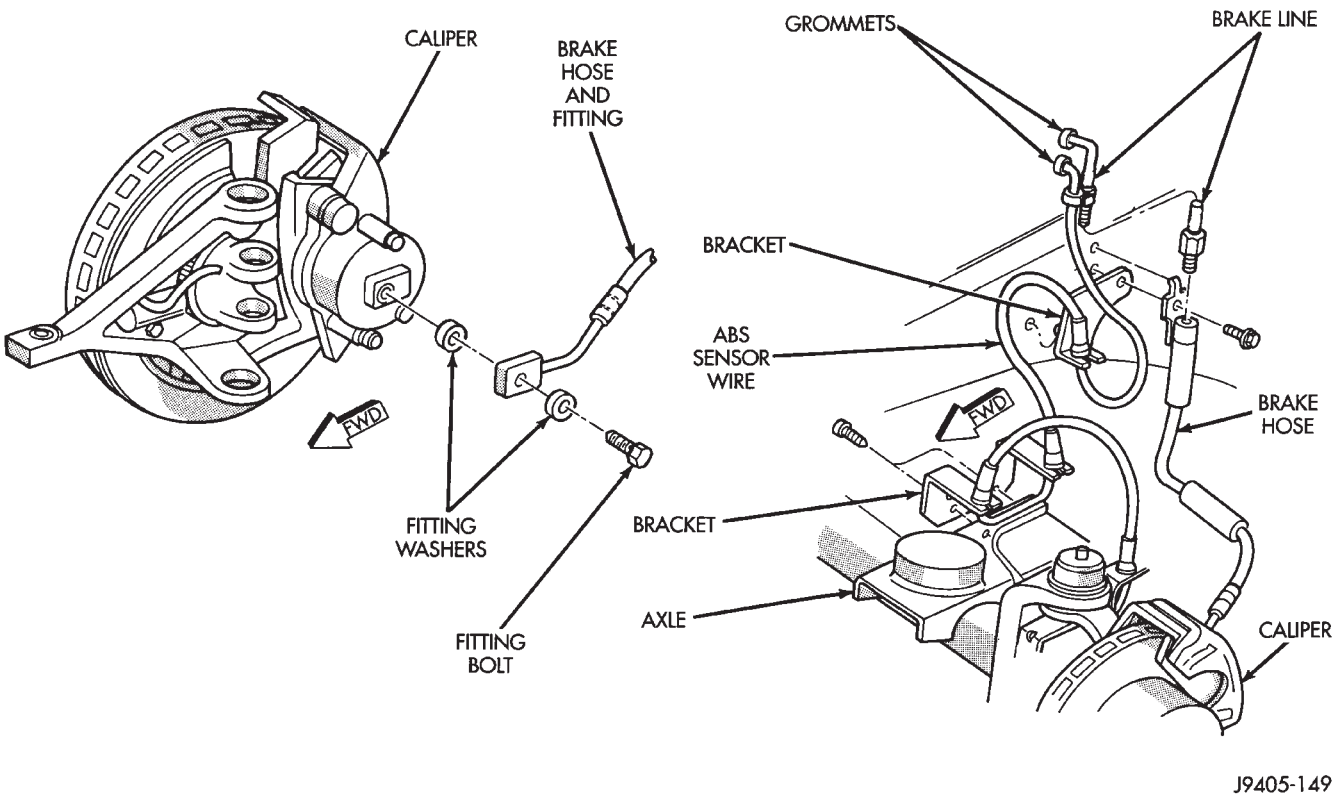

Fig. 8 Front Brake Hose Attachment (Right Hand Drive XJ With ABS Brakes)

STANDARD MASTER CYLINDER

INDEX

GENERAL SERVICE INFORMATION

The service information in this section covers the standard (non-ABS) master cylinder only. The center feed master cylinder used with the ABS system is covered in the antilock brake component service section.

MASTER CYLINDER REMOVAL

(1) Disconnect brake lines at master cylinder.

(2) Remove cylinder mounting nuts and remove master cylinder.

(3) Remove cylinder cover and drain fluid.

MASTER CYLINDER INSTALLATION

(1) Bleed master cylinder on bench before installation. Refer to overhaul assembly procedure in this section for bleeding method.

(2) Install cylinder on brake booster studs and install cylinder attaching nuts. Tighten nuts to 21 N•m (15 ft. lbs.).

(3) Connect brakelines to cylinder.

(4) Fill and bleed brake system.

MASTER CYLINDER OVERHAUL

CYLINDER DISASSEMBLY

(1) Remove cylinder cover and drain fluid.

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

(3) Clamp cylinder in vise (Fig. 1).

(4) Press primary piston inward with wood dowel or phillips screwdriver and remove snap ring (Fig. 2).

(5) Remove and discard primary piston (Fig. 3). Piston is serviced only as an assembly.

(6) Remove secondary piston (Fig. 4). 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.

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

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

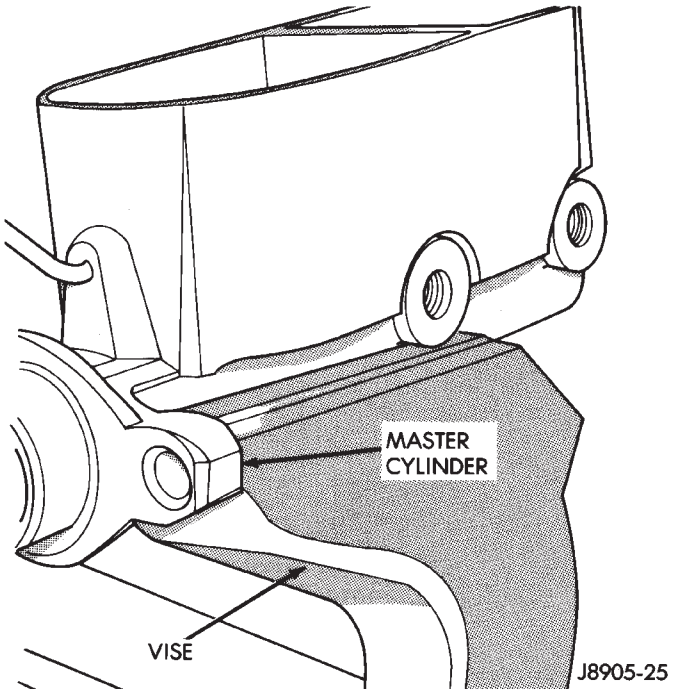

Fig. 1 Cylinder Mounted In Vise

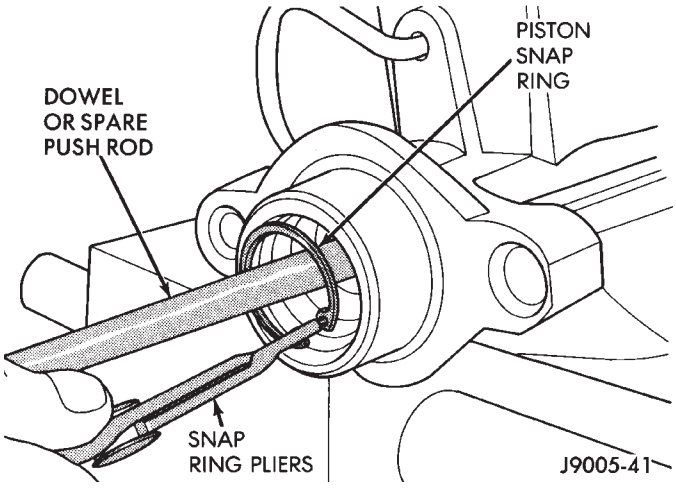

Fig. 2 Removing/Installing Piston Snap Ring

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.**

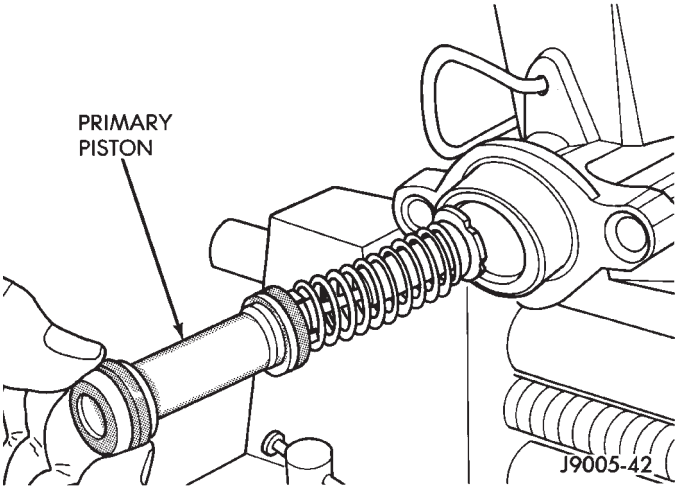

Fig. 3 Removing/Installing Primary Piston

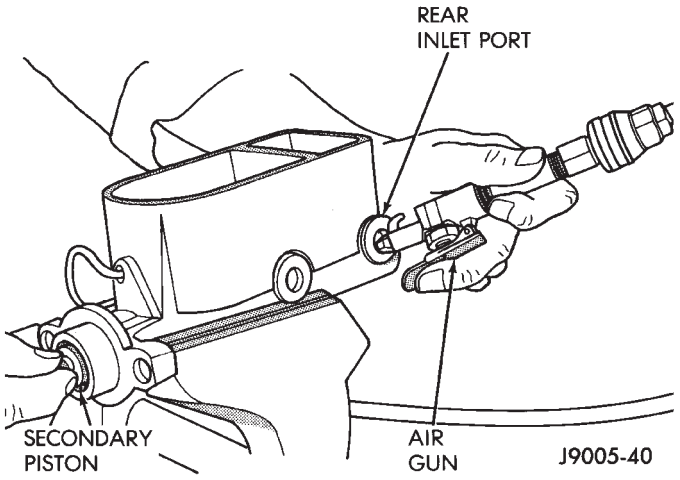

Fig. 4 Removing Secondary Piston Assembly

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. 5). **Do not use any tools to start seals into bore. Tools can cut seal and scratch bore.**

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

(4) Push primary piston inward and install snap ring (Fig. 2).

(5) Fill master cylinder reservoirs with brake fluid.

(6) Fabricate and install bleed tubes in master cylinder (Fig. 6). Be sure tube ends are submerged in brake fluid. Tubes can be fabricated from copper tubing and spare brakeline fittings.

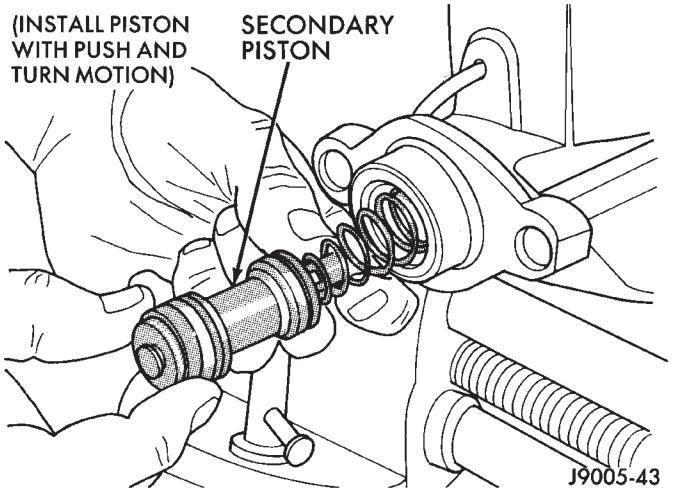

Fig. 5 Installing Secondary Piston

(7) Using push rod or wooden dowel (Fig. 6), press pistons fully into bore and allow pistons to return under spring pressure. Repeat this operation until air bubbles cease to appear in fluid.

(8) Remove bleed tubes. Cap outlet ports and install reservoir cover and seal.

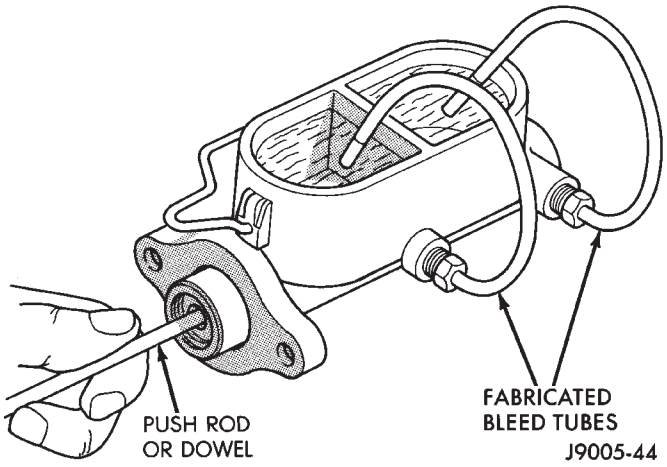

Fig. 6 Master Cylinder Bleeding

POWER BRAKE BOOSTER

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SERVICE INFORMATION

The power brake booster is not a serviceable component. If a booster malfunction occurs, the booster must be replaced as an assembly. The booster (Figs. 1 and 2), is attached to the dash panel and pedal support.

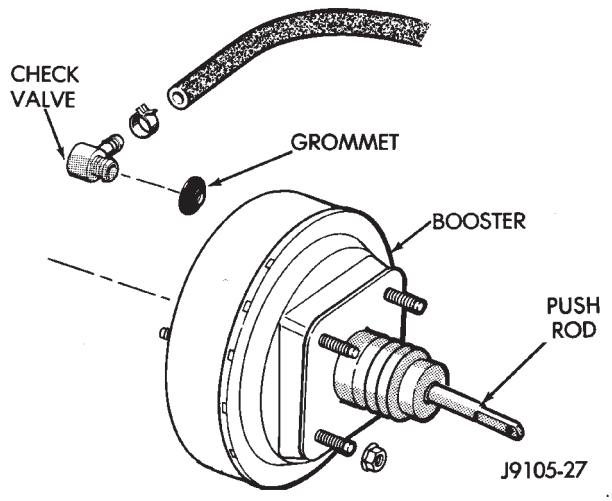

Fig. 1 Power Brake Booster (XJ)

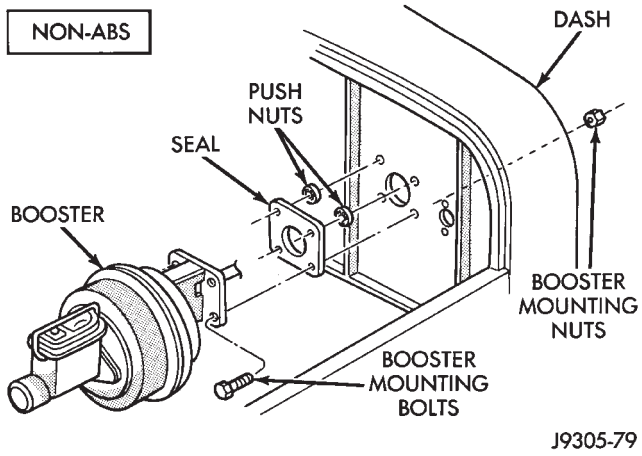

Fig. 2 Power Brake Booster (YJ)

POWER BRAKE BOOSTER OPERATION

Booster Components

The booster assembly consists of a housing divided into separate chambers by an internal diaphragm. The outer edge of the diaphragm is attached to the booster housing. The diaphragm is in turn, connected to the booster push rod.

Two push rods are used to operate the booster. One push rod connects the booster to the brake pedal. The second push rod (at the forward end of the housing), strokes the master cylinder pistons. The rear push rod is connected to the two diaphragms in the booster housing.

The atmospheric inlet valve is opened and closed by the push rod connected to the brake pedal. The booster vacuum supply is through a hose attached to a fitting on the intake manifold. The hose is connected to a vacuum check valve in the booster housing. The check valve 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 an inlet valve at the rear of the housing.

The forward portion of the booster housing (area in front of the two diaphragms), is exposed to manifold vacuum. The rear portion (area behind the diaphragms), is exposed to normal atmospheric pressure of 101.3 kilopascals (14.7 pounds/square in.).

Pressing the brake pedal causes the rear push rod to open the inlet valve. This exposes the area behind the diaphragm to atmospheric pressure. The resulting force applied to the diaphragm is what provides the extra apply pressure for power assist.

POWER BRAKE BOOSTER REMOVAL

(1) Loosen but do not remove nuts attaching master cylinder to booster (Fig. 3).

(2) Remove instrument panel lower trim cover.

(3) Remove retaining clip attaching booster push rod to brake pedal (Fig. 4).

(4) Remove bolts/nuts attaching booster to dash panel.

(5) In engine compartment, loosen vacuum hose clamp and disconnect vacuum hose from booster check valve (Fig. 5).

(6) Remove master cylinder attaching nuts and remove cylinder from mounting studs on booster.

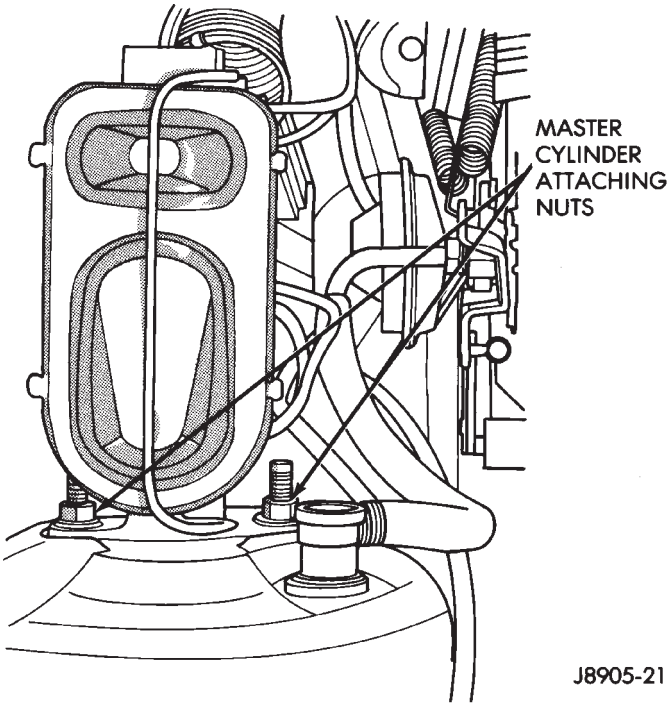

Fig. 3 Master Cylinder Attachment (Typical)

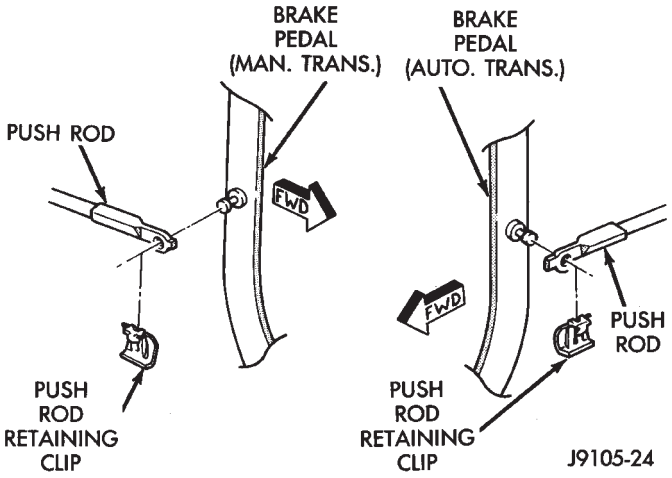

Fig. 4 Booster Push Rod Attachment

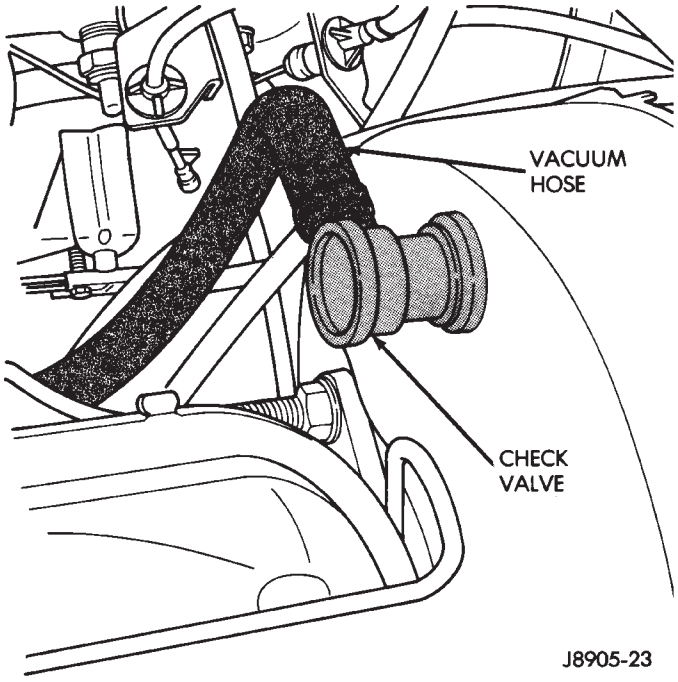

Fig. 5 Booster Check Valve And Hose

(7) Carefully move master cylinder aside and remove booster.

POWER BRAKE BOOSTER INSTALLATION

(1) Install check valve and grommet in booster. Also install spacer on booster, if equipped.

(2) Position booster on dash panel and install booster mounting bolts/nuts.

(3) Working inside vehicle, install nuts on booster mounting studs.

(4) Attach booster push rod to brake pedal. Secure push rod with new bolt and nuts.

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

(6) Tighten pedal push rod bolt inner nut to 34 N·m (25 ft. lbs.) torque. Then tighten outer locknut to 8 N·m (75 in. lbs.) torque.

(7) Install master cylinder on booster studs. Tighten attaching nuts to 21 N·m (15 ft. lbs.).

(8) Connect vacuum hose to booster, top off master cylinder fluid level and check brake operation.

DISC BRAKES

INDEX

GENERAL INFORMATION

1994 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 continous 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 this 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 will be 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.

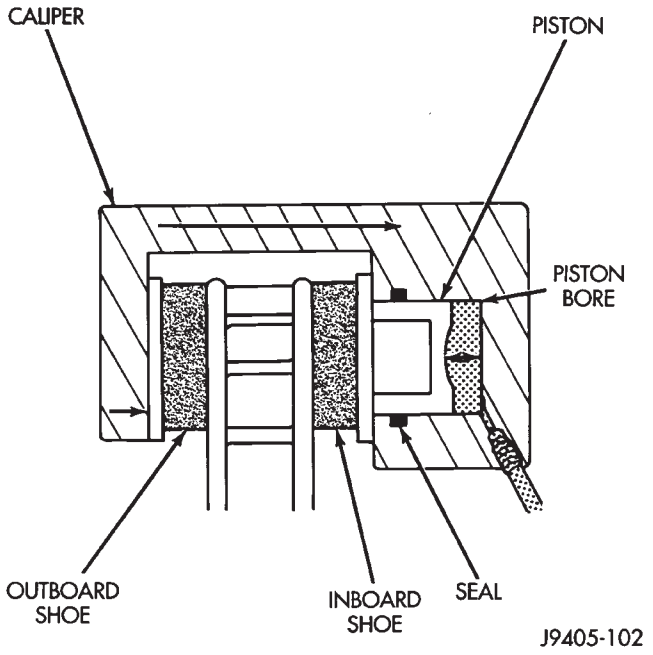

Fig. 1 Disc Brake Caliper Operation

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.).

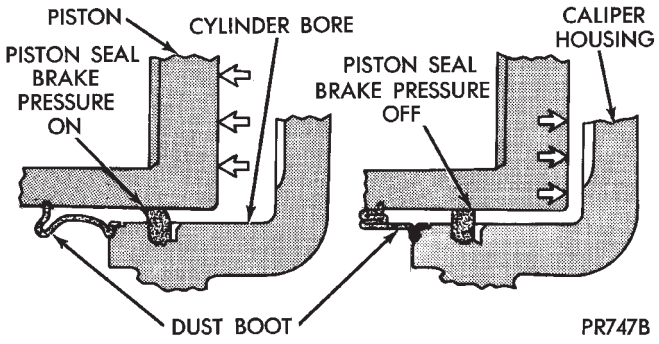

Fig. 2 Lining Wear Compensation By Piston Seal

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.**

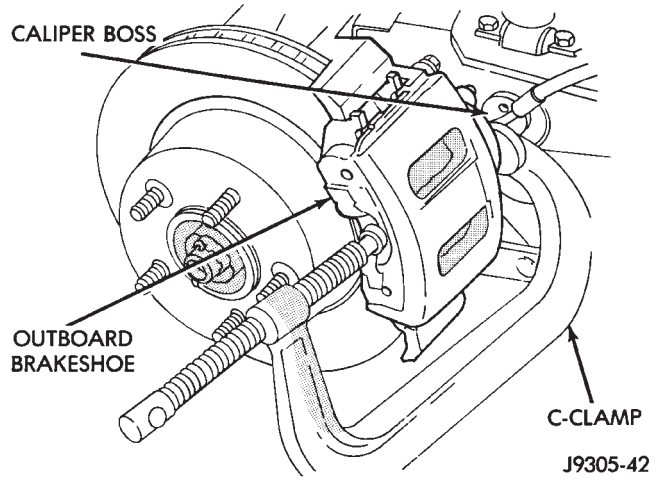

Fig. 3 Bottoming Caliper Piston With C-Clamp

(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).

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

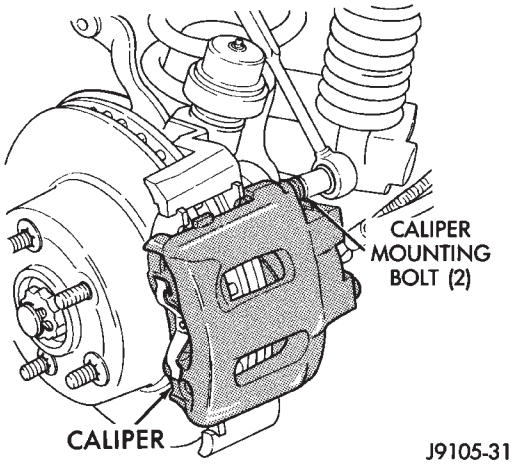

Fig. 4 Removing/Installing Caliper Mounting Bolts

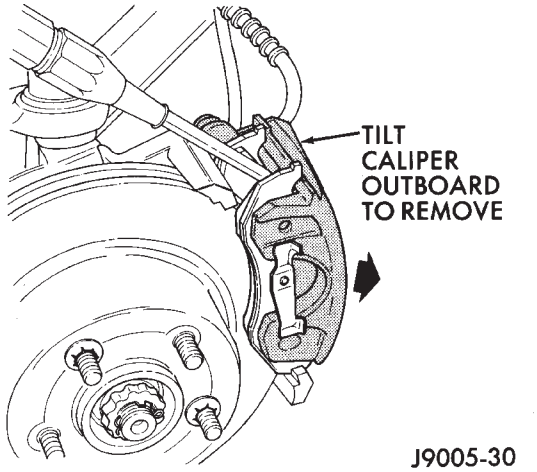

Fig. 5 Tilting Caliper Outward

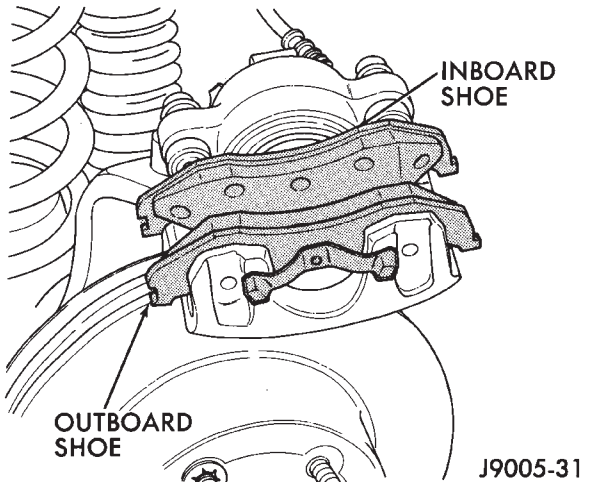

Fig. 6 Caliper Removal

(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).

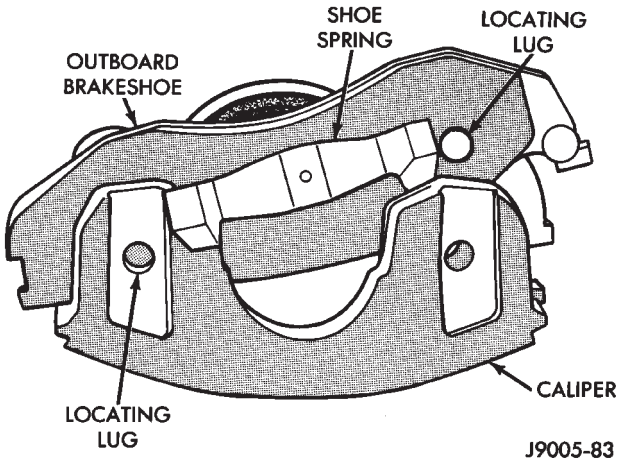

Fig. 7 Removing Outboard Brakeshoe

(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.

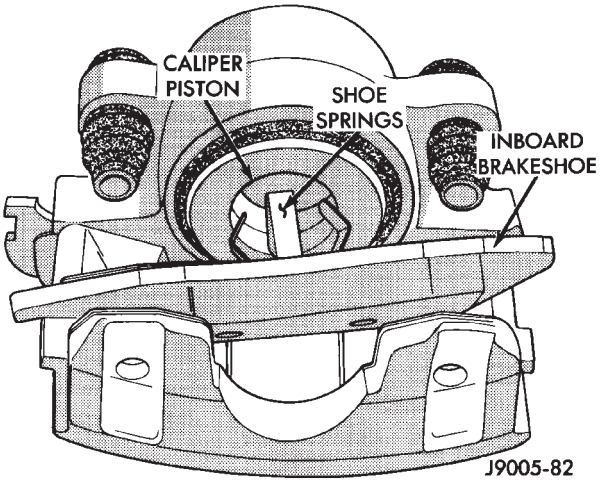

Fig. 8 Removing Inboard Brakeshoe

(10) Support caliper on box, mechanics stool, or secure it 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.

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.

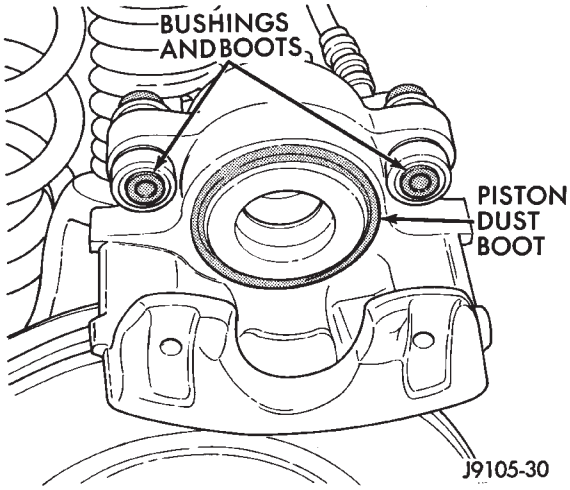

Fig. 9 Caliper Dust Boots And Bushing Locations

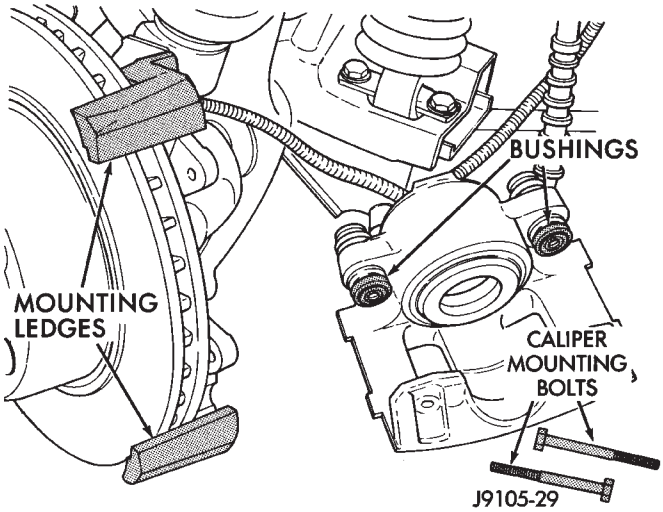

Fig. 10 Caliper Lubrication Points

(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 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.

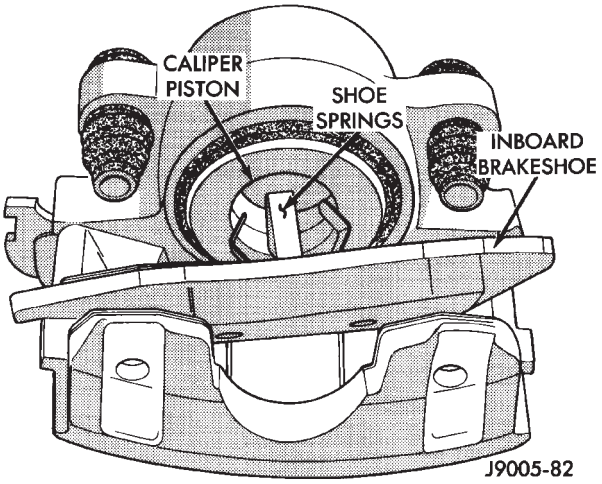

Fig. 11 Installing Inboard Brakeshoe

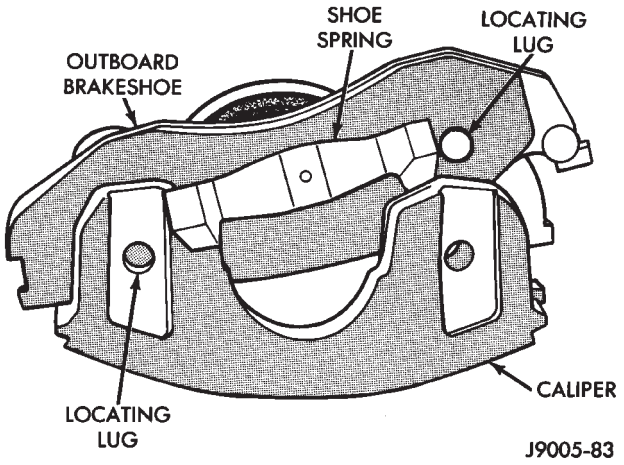

Fig. 12 Installing Outboard Brakeshoe

(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.

(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 caliper mounting bolts (Fig. 4).

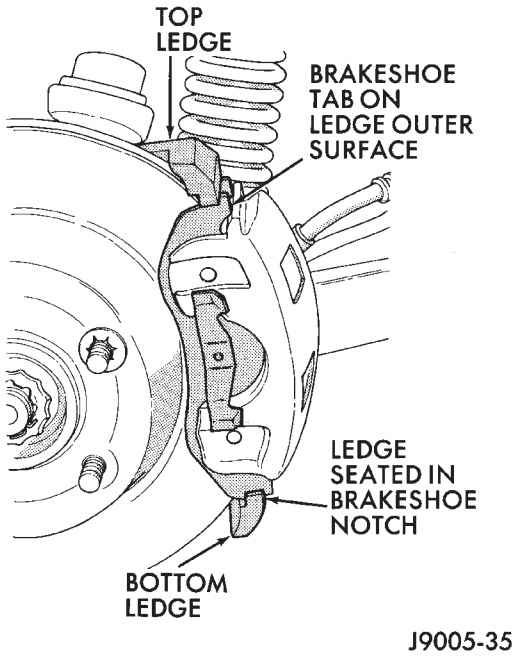

Fig. 13 Caliper Installation

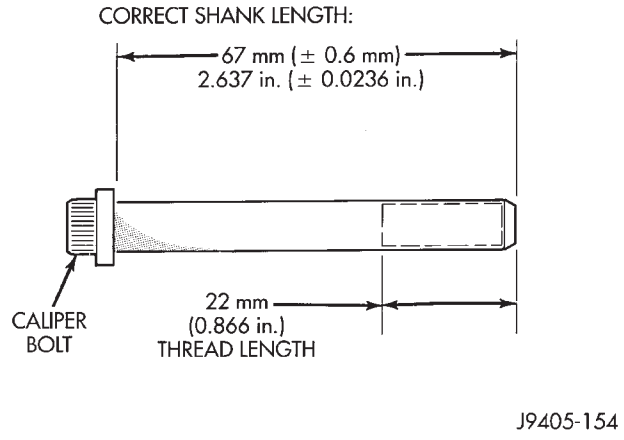

Fig. 14 Caliper Mounting Bolt Dimensions

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

(4) Remove caliper hose fitting bolt and disconnect front brake hose at caliper. Discard fitting bolt washers. They are not reusable and should be replaced.

(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.

(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).

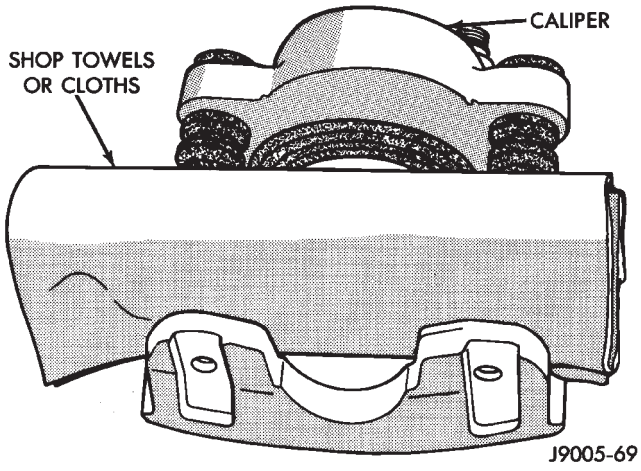

Fig. 15 Padding Caliper Interior To Protect Piston During Removal

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.

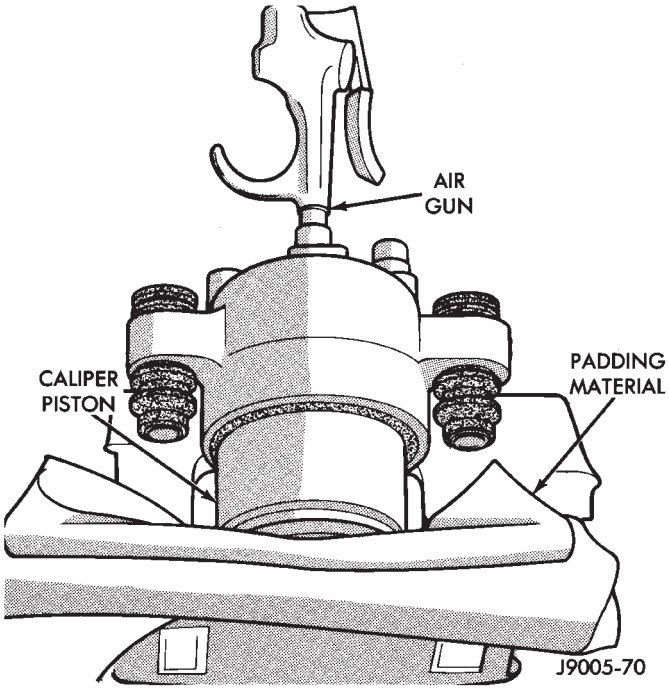

Fig. 16 Removing Caliper Piston

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

(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.

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

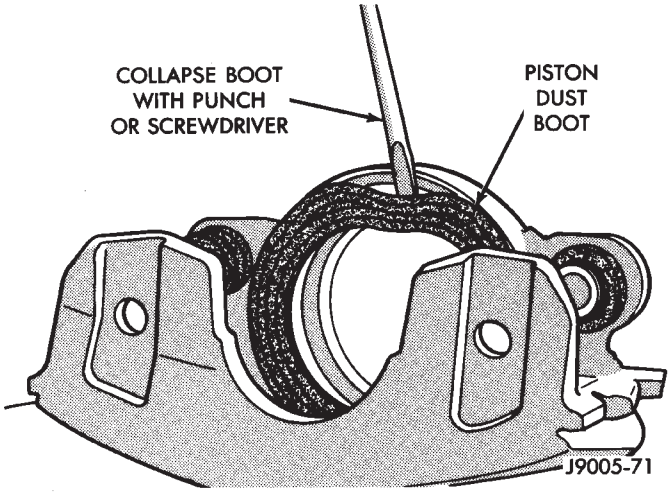

Fig. 17 Removing Caliper Piston Dust Boot

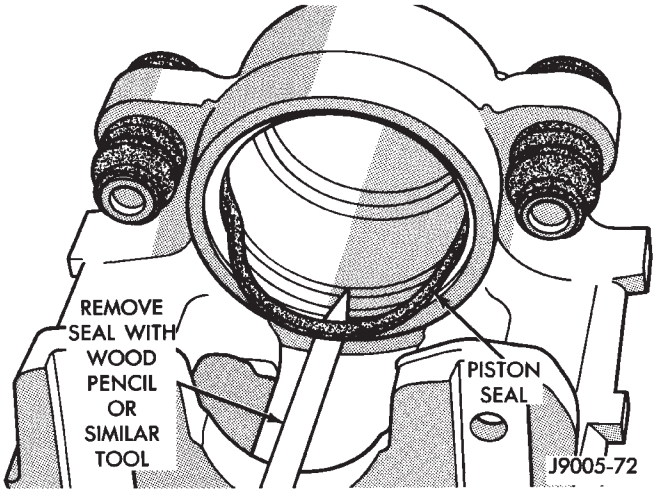

Fig. 18 Removing Caliper Piston Seal

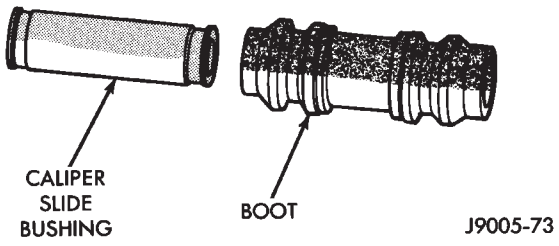

Fig. 19 Caliper Slide Bushing And Boot

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 (plastic material) 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).

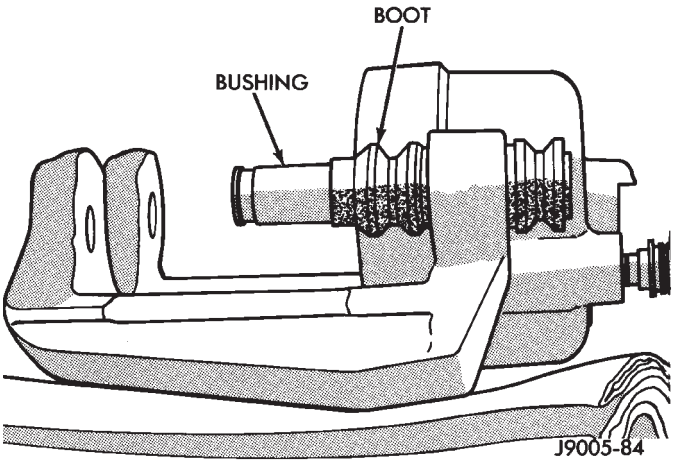

Fig. 20 Installing Bushings And Boots

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

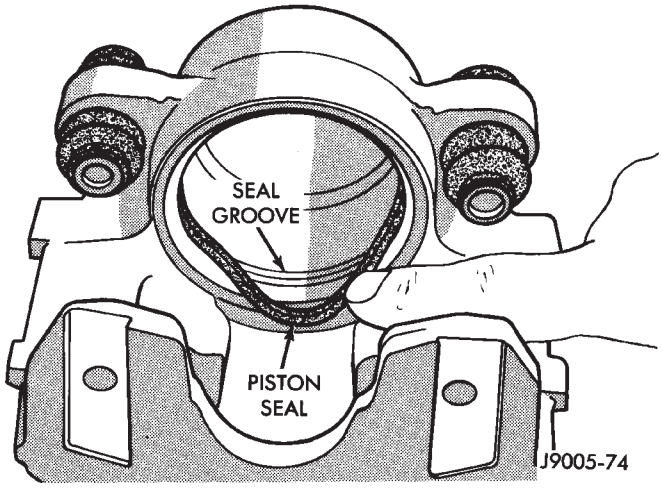

Fig. 21 Installing Piston Seal

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

(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.

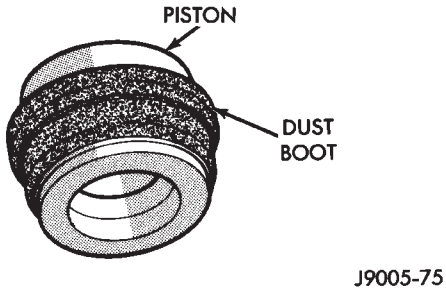

Fig. 22 Installing Dust Boot On Piston

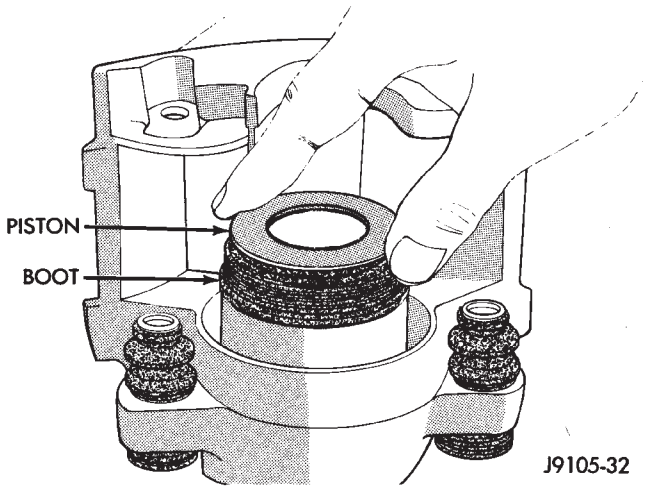

Fig. 23 Installing Caliper Piston

(7) Apply light coat of GE 661, Dow 111, or Permatex silicone grease to indicated areas (circumfer-

ence) of piston and caliper boot groove (Fig. 24). Grease serves as corrosion protection for these areas.

(8) Press caliper piston to bottom of bore.

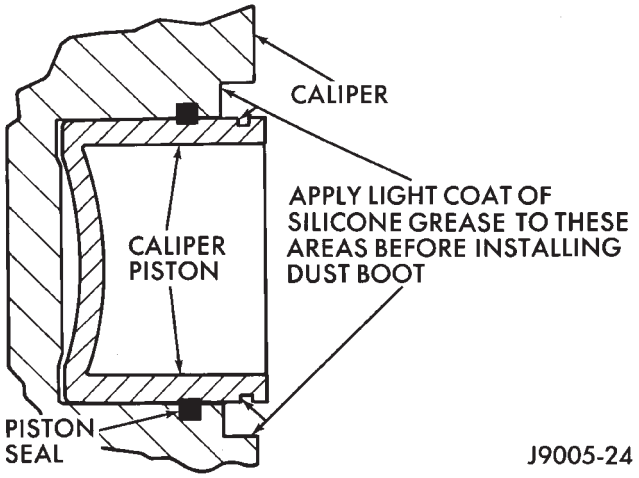

Fig. 24 Typical Caliper/Piston Areas To Be Lightly Coated With Silicone Grease

(9) Seat dust boot in caliper with Installer Tool C-4842 and Tool Handle C-4171 (Fig. 25).

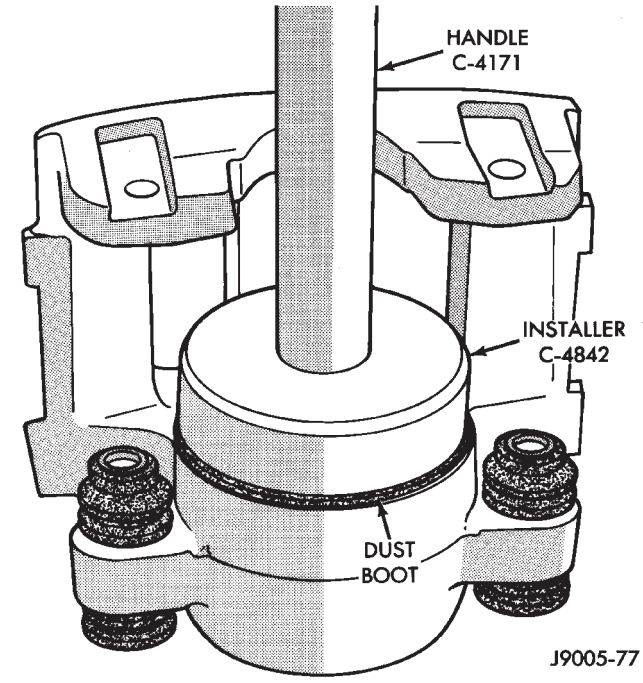

Fig. 25 Seating Caliper Piston Piston Dust Boot

(10) Install caliper bleed screw if removed.

CALIPER INSTALLATION

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

(2) Connect brake hose fitting to caliper but do not tighten fitting bolt completely at this time. **Be sure to use new washers on fitting bolt to avoid leaks (Fig. 26).**

(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).

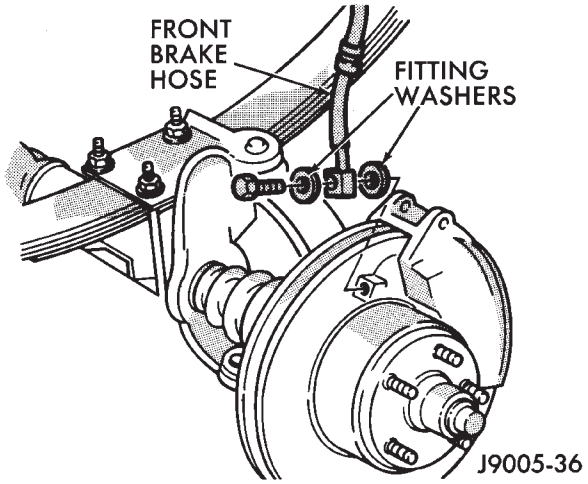

Fig. 26 Front Brake Hose And Fitting Components

(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.

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. 27).

(4) Remove rotor from hub (Fig. 27).

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

ROTOR INSTALLATION

(1) Install rotor on hub.

(2) Install caliper.

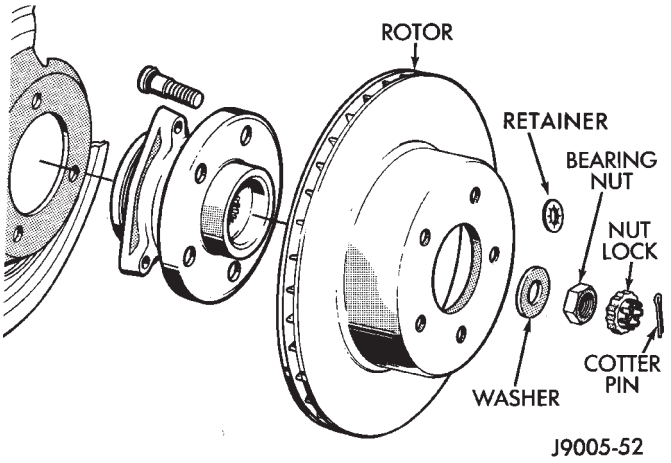

Fig. 27 Rotor And Hub

(3) Install new spring nuts on wheel studs.
(4) 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. 28).

Use a dial indicator to check lateral runout (Fig. 28).

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

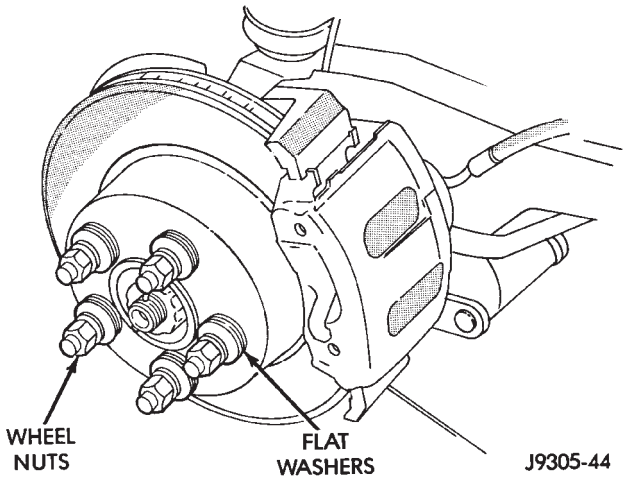

Fig. 28 Securing 4 x 4 Rotor For Lateral Runout Check

Check lateral runout with a dial indicator (Fig. 29). 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.).

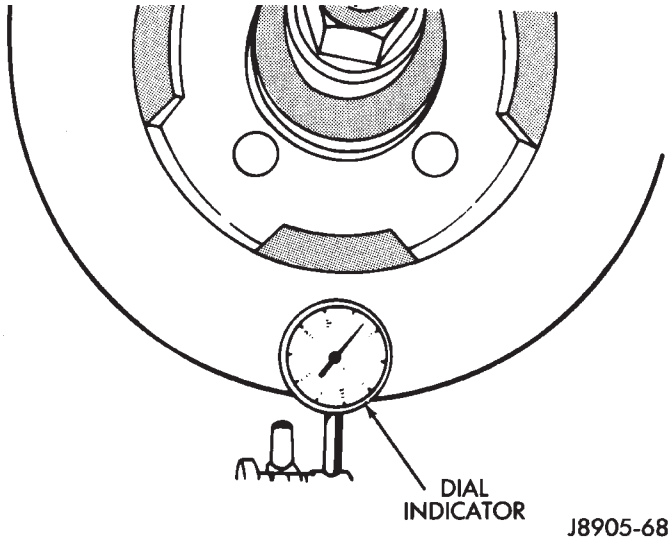

Fig. 29 Typical Method Of Checking Rotor Lateral Runout

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. 30).

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.

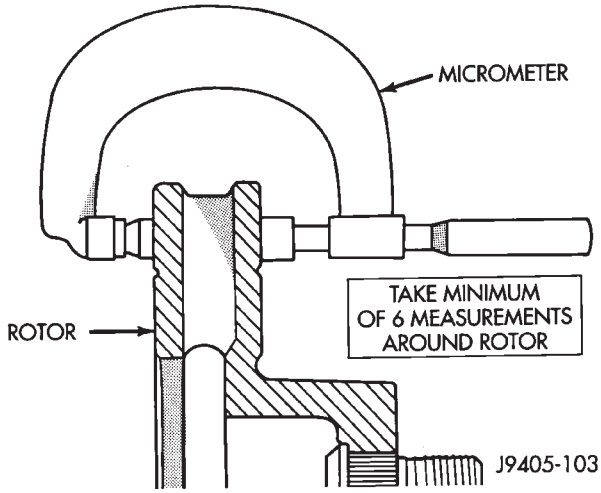

Fig. 30 Measuring Rotor Thickness Variation

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.

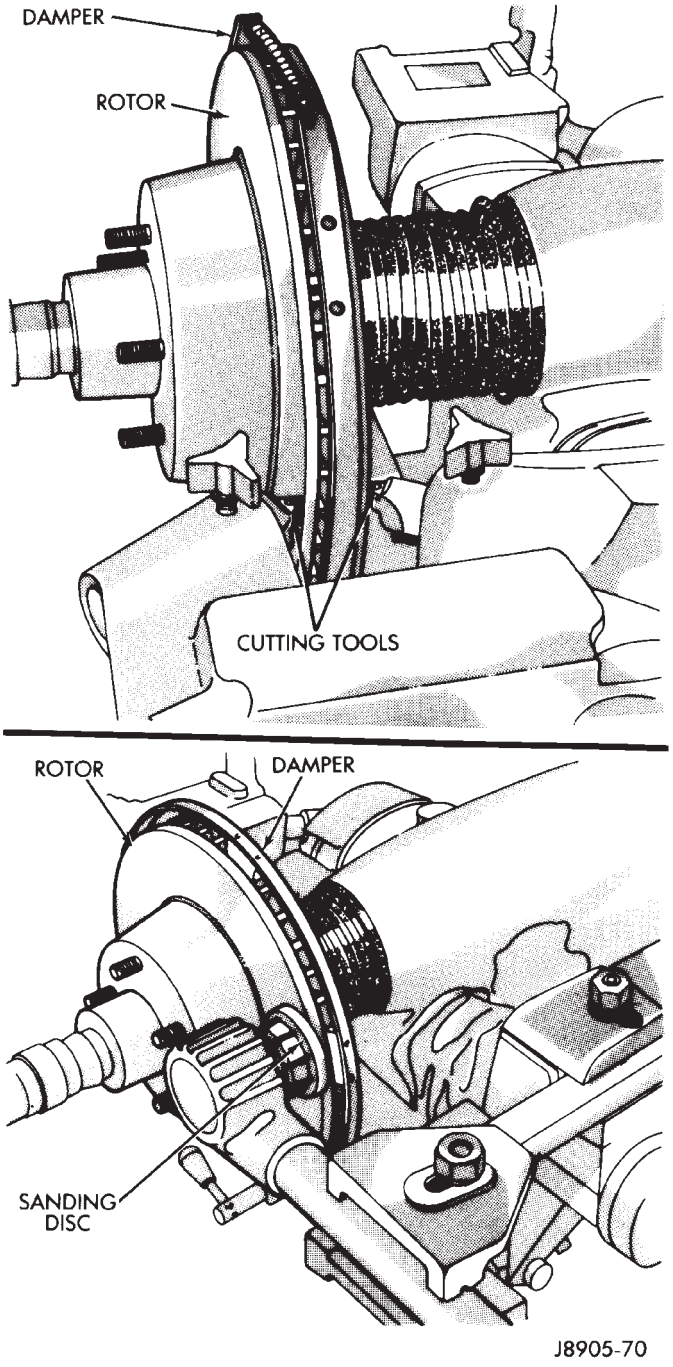

Fig. 31 Rotor Refinishing Equipment

Recommended Refinishing Equipment

The brake lathe must be capable of machining both rotor surfaces simultaneously with dual cutter heads (Fig. 31). **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. 32). Use sanding discs to produce this finish.

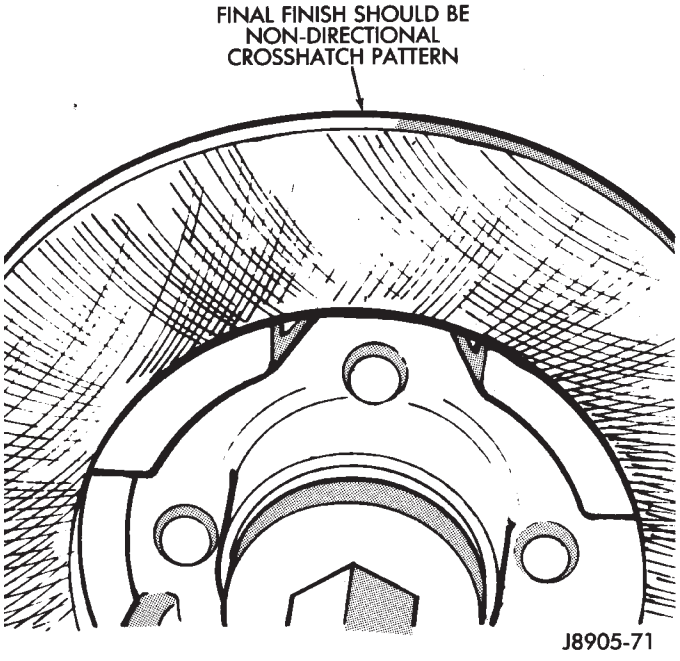

Fig. 32 Preferred Rotor Surface Finish

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 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. 33).

Recommended torque range for XJ/YJ wheel lug 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.

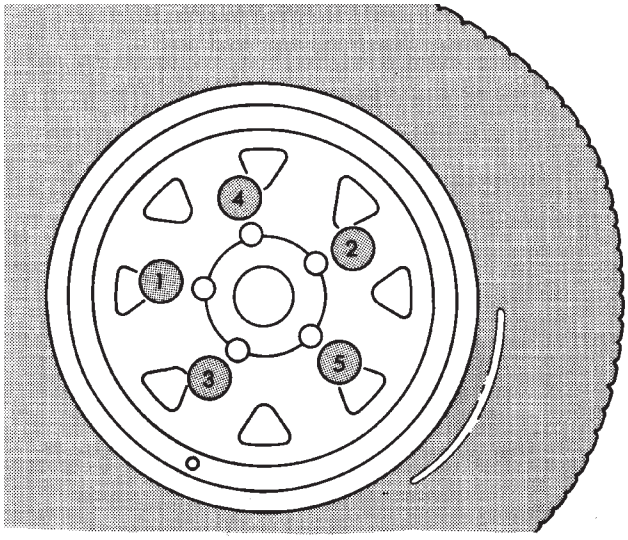

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Fig. 33 Wheel Nut Tightening Sequence

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 Retaining Spring Tool C-4070.

(7) Install Spring Clamps C-416 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) Clean and lubricate anchor pin with light coat of Mopar multi-mileage grease.

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

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

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

(6) Remove wheel cylinder clamps.

(7) Attach parking brake cable to lever.

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

(9) Install parking brake strut and spring.

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

(11) Install primary and secondary return springs.

(12) Install adjuster cable guide on secondary shoe.

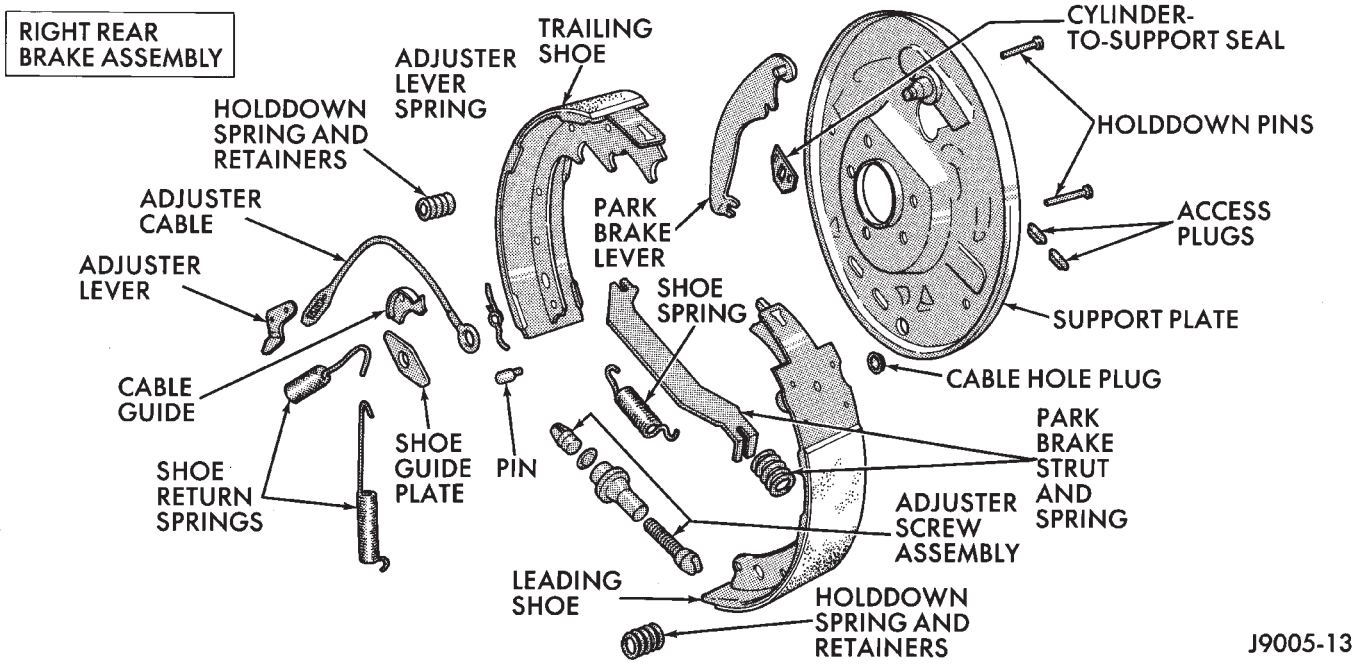

Fig. 1 Nine Inch Drum Brake Components

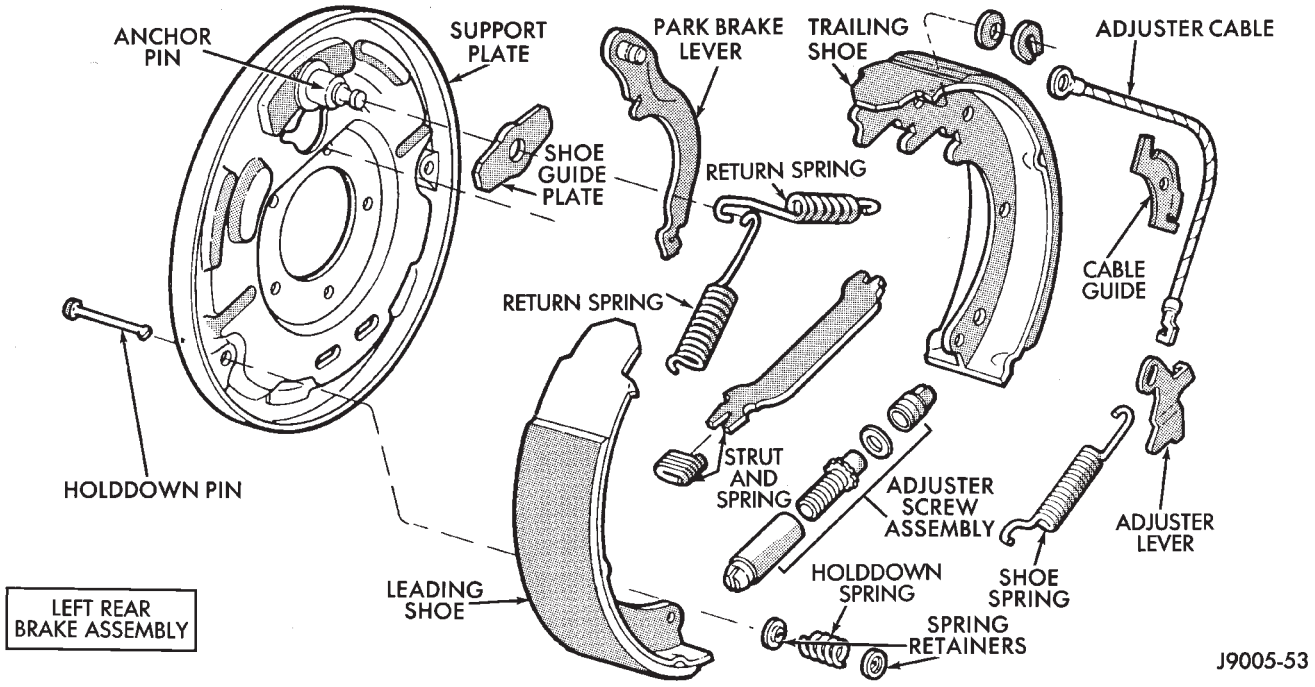

Fig. 2 Ten Inch Drum Brake Components

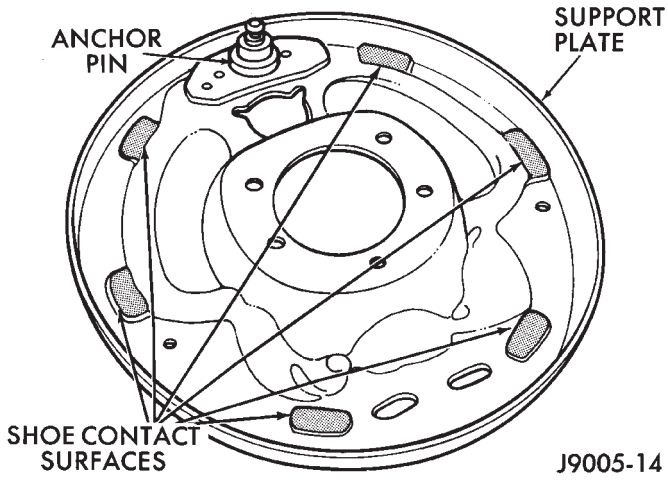

Fig. 3 Shoe Contact Surfaces (9-Inch Support Plate)

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

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

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

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

(17) Verify firm brake pedal before moving vehicle.

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.

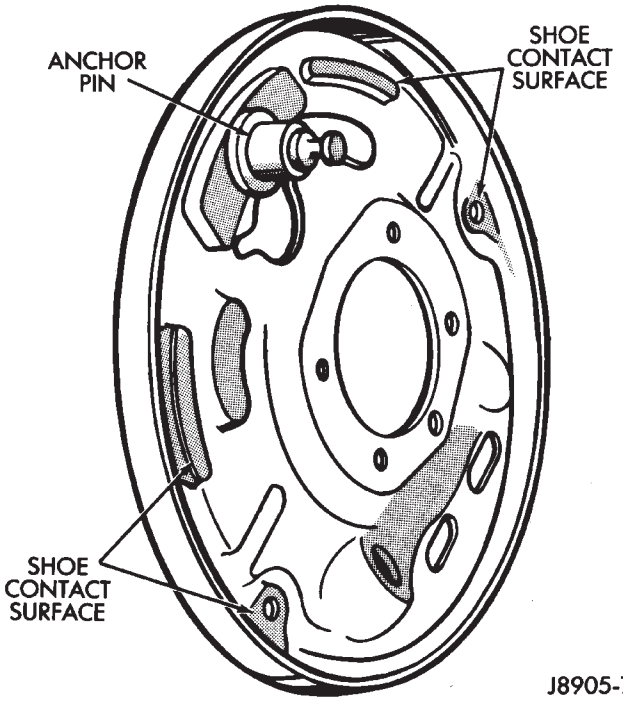

Fig. 4 Shoe Contact Surfaces (10-Inch Support Plate)

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.

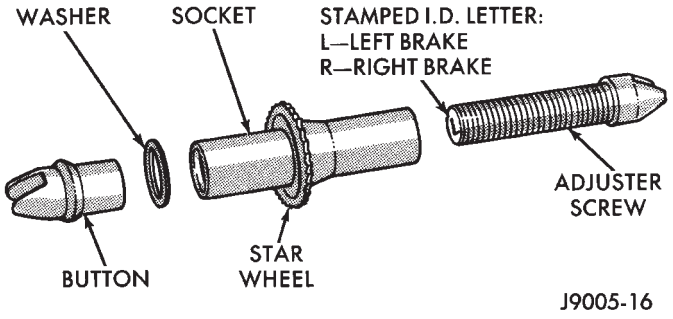

Fig. 5 Adjuster Screw Components (9-Inch Brake)

(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).

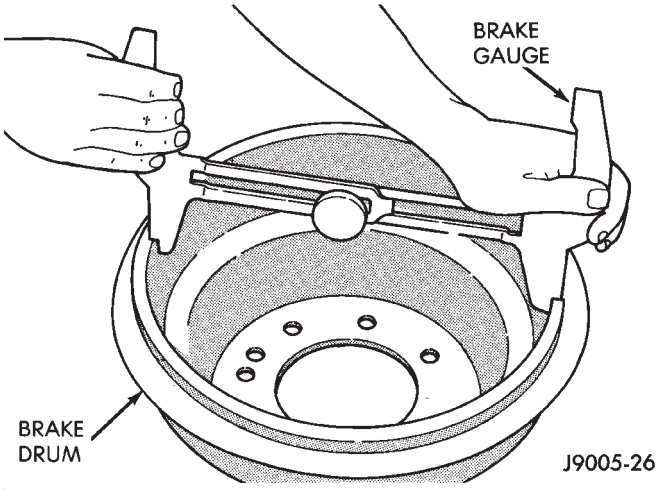

Fig. 6 Adjusting Gauge To Brake Drum

(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.

(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.**

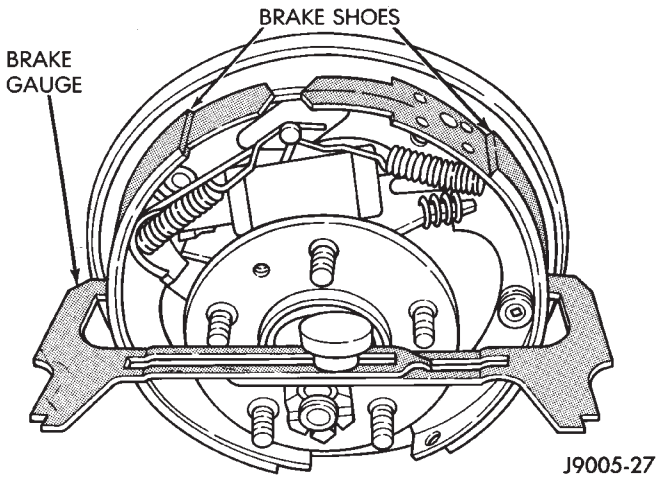

Fig. 7 Adjusting Brakeshoes To Gauge

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.

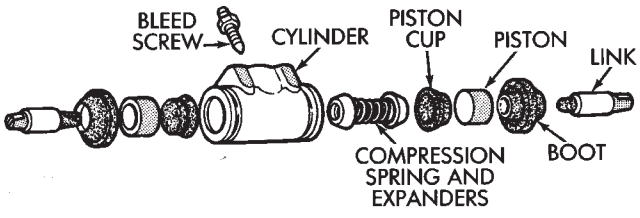

Fig. 8 Wheel Cylinder (9-Inch Brake)

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

(8) Install bleed screw.

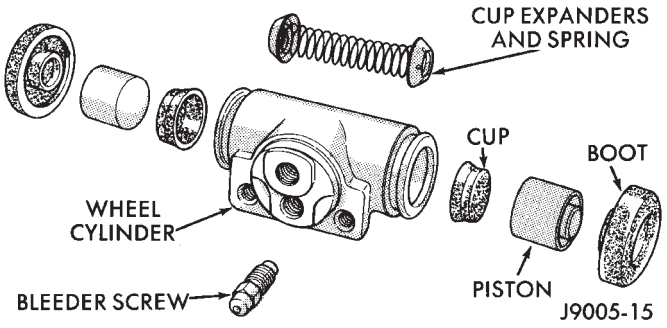

Fig. 9 Wheel Cylinder (10-Inch Brake)

(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.

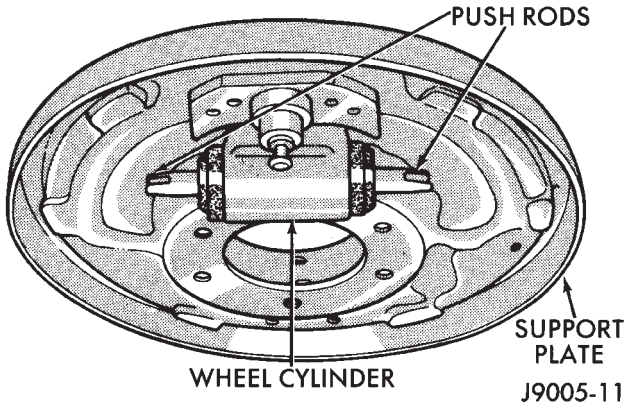

Fig. 10 Wheel Cylinder Mounting

(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.

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

WHEEL NUT TIGHTENING

The wheel attaching lug 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 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.

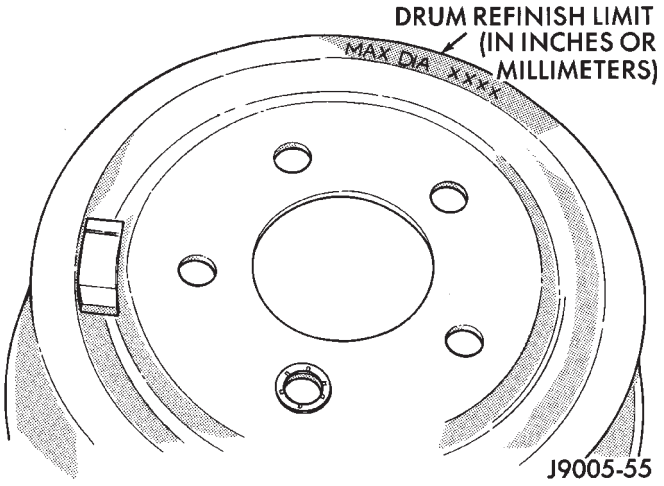

Fig. 11 Typical Location Of Brake Drum Refinish Limit

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 lug 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.

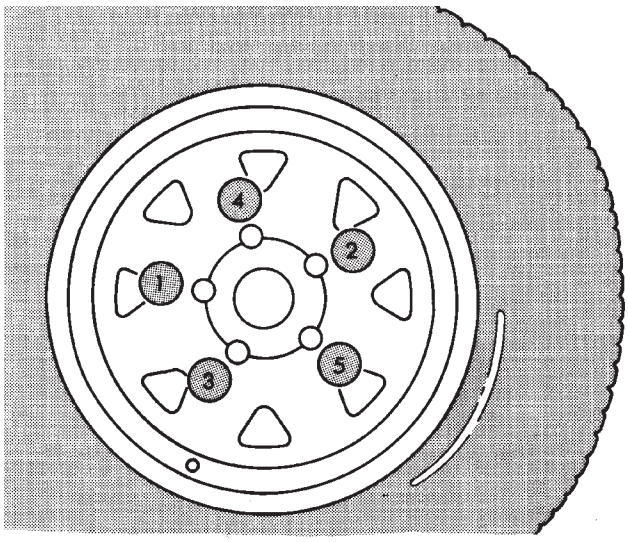

Fig. 12 Wheel Nut Tightening Sequence

ABS SYSTEM OPERATION

INDEX

GENERAL INFORMATION

The Jeep antilock brake system (ABS) is an electronically operated, all-wheel brake control system. Major components include the master cylinder, vacuum power brake booster, ECU, hydraulic control unit (HCU) and various control sensors (Fig. 1). The ABS brake system is available on XJ and YJ models.

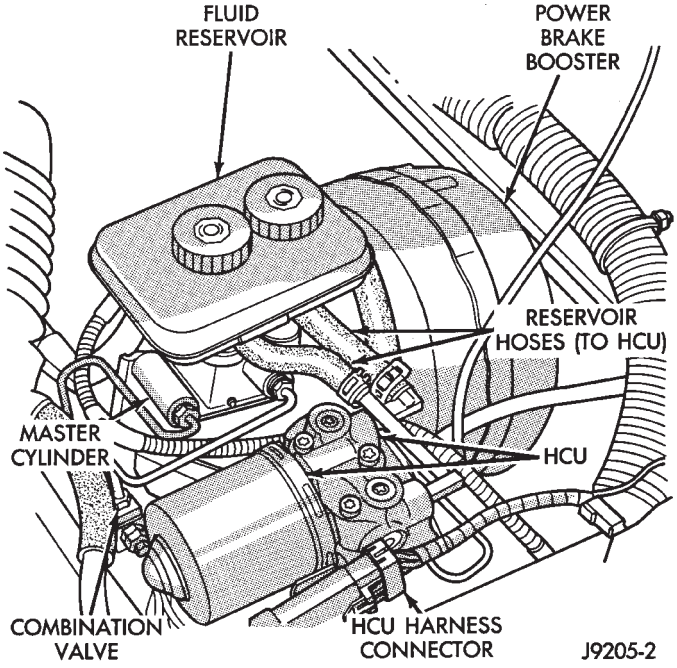

Fig. 1 Antilock Components (XJ Shown)

The antilock hydraulic system is a three channel design. The front wheel brakes are controlled individually and the rear wheel brakes in tandem (Fig. 2).

The antilock system is designed to retard wheel lockup during periods of high wheel slip when braking. Retarding wheel lockup is accomplished by modulating fluid pressure to the wheel brake units.

The ABS electronic control system is separate from other electrical circuits in the vehicle. A specially programmed electronic control unit (ECU) is used to operate the system components.

System components include:

- electronic control unit (ECU)
- wheel speed sensors and axle shaft tone rings
- hydraulic control unit (HCU)
- tandem master cylinder with central valves
- vacuum power brake booster
- pedal travel sensor
- acceleration switch
- main relay and pump motor relay
- ABS warning light
- pump motor sensor

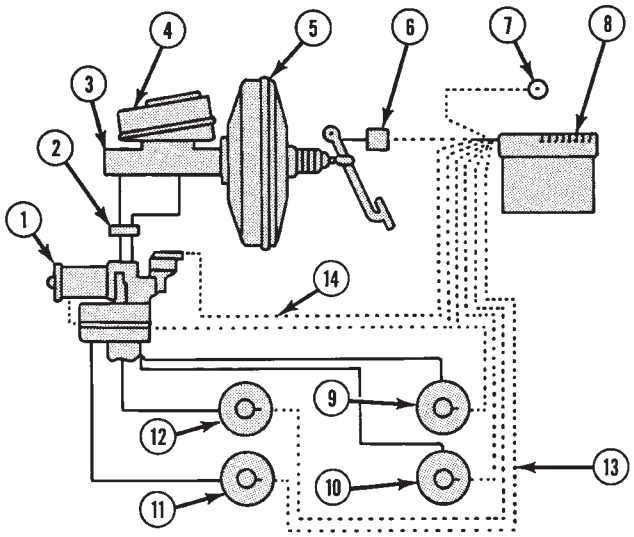

Fig. 2 AntiLock System Basic Layout

HYDRAULIC CONTROL UNIT (HCU)

The hydraulic control unit (HCU) consists of a valve body and pump/motor assembly (Fig. 3).

The valve body contains the electrically operated solenoid valves. It is the solenoid valves that modulate brake fluid apply pressure during antilock braking. The valves are operated by the antilock electronic control unit (ECU).

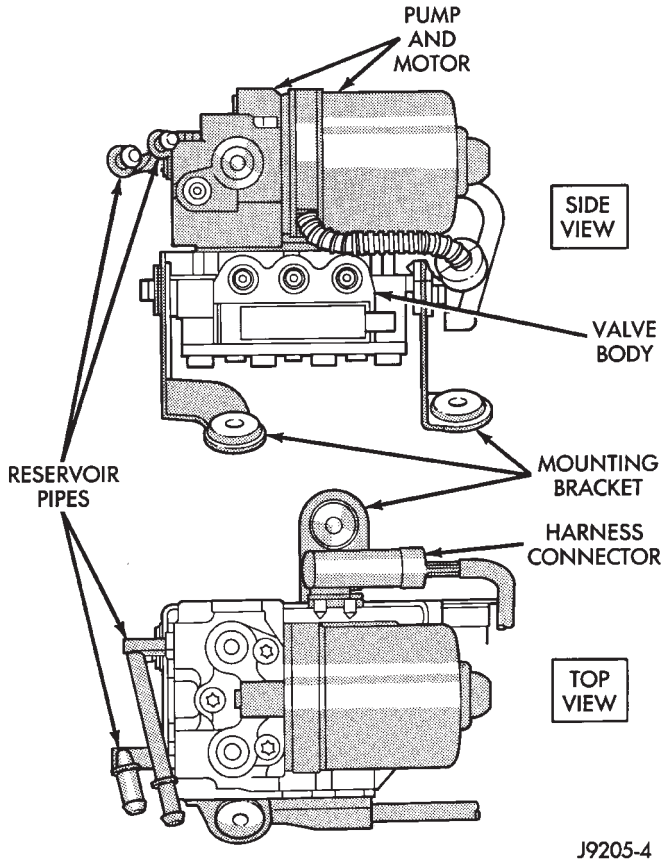

Fig. 3 AntiLock Hydraulic Control Unit (HCU)

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.

The pump/motor assembly provides the extra volume of fluid needed during antilock braking. The pump is connected to the master cylinder reservoir by supply and return hoses.

The pump is operated by an integral electric motor. The DC type motor is controlled by the ECU.

The pump mechanism consists of two opposing pistons operated by an eccentric cam. One piston supplies the primary hydraulic circuit. The opposite piston supplies the secondary hydraulic circuit. In operation, one piston draws fluid from the master cylinder reservoir. The opposing piston then pumps fluid to the valve body solenoids. The pump cam is operated by the electric motor.

MASTER CYLINDER

A new style tandem master cylinder is used with the ABS system (Fig. 4). It is a center feed design. The primary and secondary pistons each contain a central valve which is a unique feature. The valves are used in place of the conventional piston and seal assemblies. The valves close and open the cylinder pressure chambers during brake application and release.

The only repairable components on the ABS master cylinder are the reservoir, reservoir grommets and the connecting hoses. The cylinder itself cannot be disassembled and is serviced only as an assembly.

POWER BRAKE BOOSTER

A dual diaphragm, vacuum operated power brake booster is used with the ABS master cylinder (Fig.

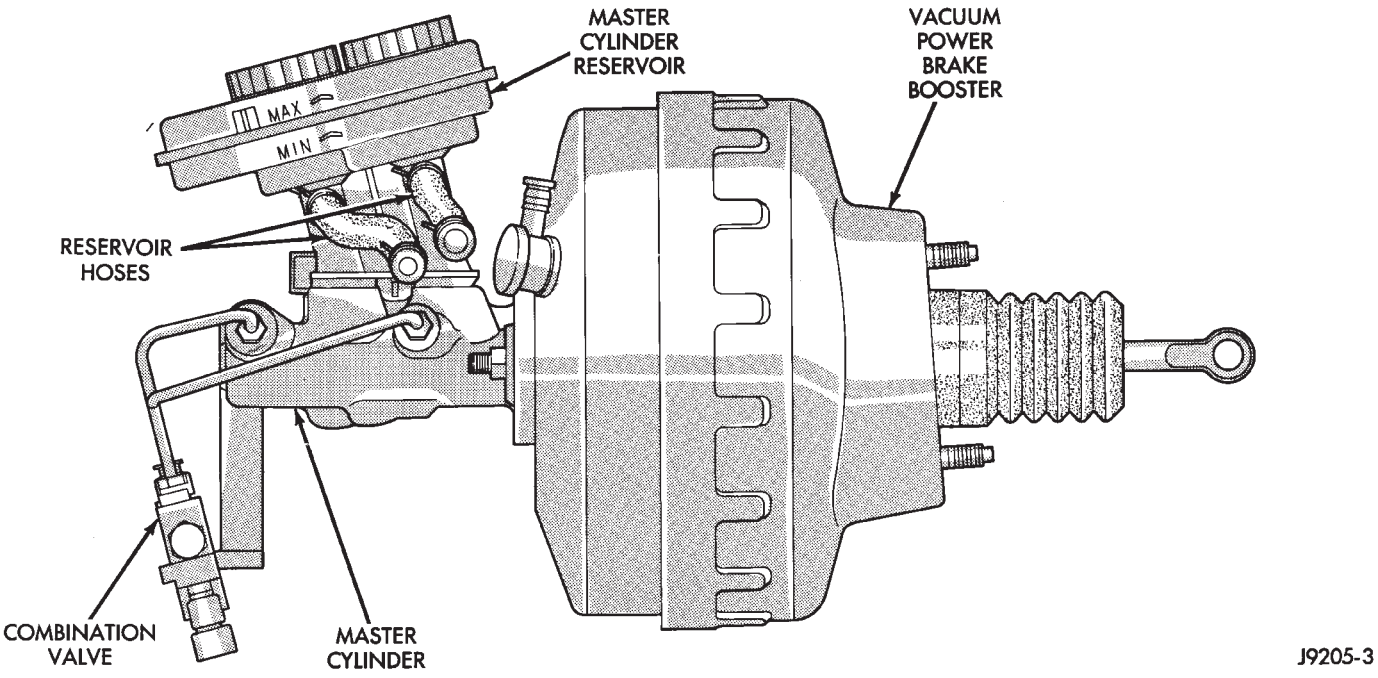

Fig. 4 ABS Power Brake Booster/Master Cylinder Assembly

4). The engine intake manifold serves as the vacuum source for booster operation.

The booster is mounted on the engine compartment side of the dash panel. The master cylinder is mounted on attaching studs at the front of the booster. The master cylinder central valves are directly actuated by the booster push rod.

The pedal travel sensor is mounted in the forward face of the booster shell. The sensor plunger is actuated by the booster diaphragm plate.

PEDAL TRAVEL SENSOR

The pedal travel sensor signals brake pedal position to the antilock ECU. The sensor signal is based on changes in electrical resistance. The resistance changes occur in steps that are generated by changes in brake pedal position. A resistance signal generated by changing brake pedal position, will cause the ECU to run the antilock pump when necessary.

The sensor is a plunger-type, electrical switch mounted in the forward housing of the power brake booster (Fig. 5). The sensor plunger is actuated by movement of the booster diaphragm plate.

The tip on the sensor plunger is color coded. The tip must be matched to the color dot on the face of the brake booster front shell (Fig. 5).

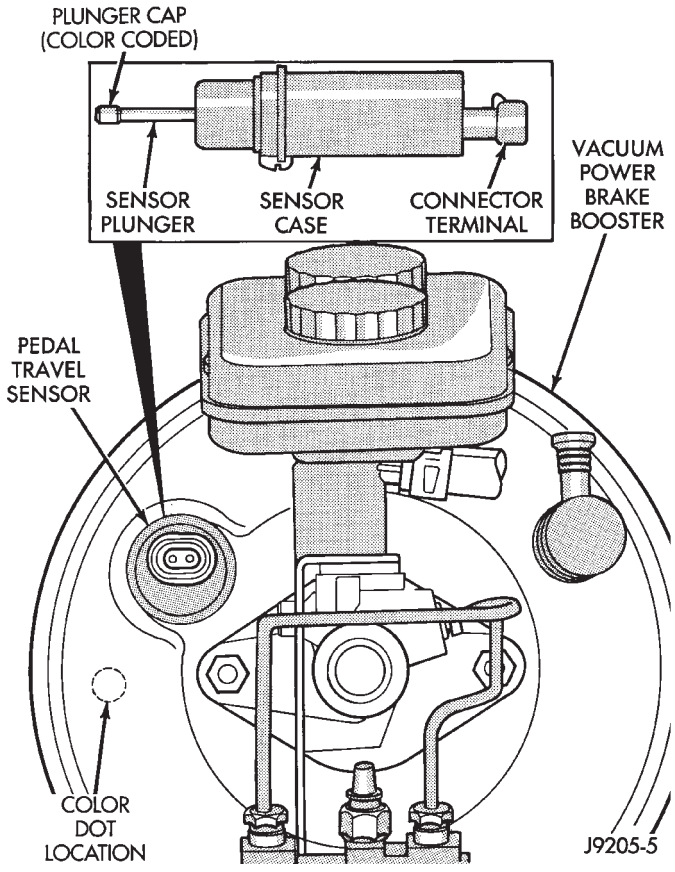

Fig. 5 Pedal Travel Sensor Location

WHEEL SPEED SENSORS

A sensor is used at each wheel. The sensors convert wheel speed into an electrical signal. This signal is transmitted to the antilock electronic control unit (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. 6). The front/rear sensors have the same electrical values but are not interchangeable.

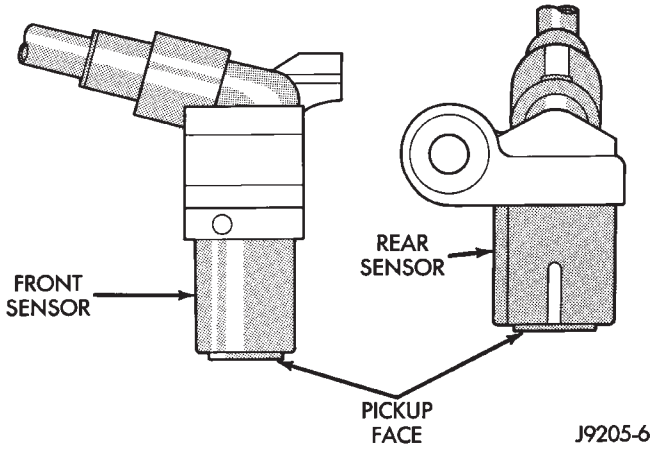

Fig. 6 Wheel Speed Sensors

ELECTRONIC CONTROL UNIT (ECU)

A separate electronic control unit (ECU) monitors, operates and controls the antilock system (Fig. 7). The ECU contains dual microprocessors. The logic block in each microprocessor receives identical sensor signals. These signals are processed and compared simultaneously (Fig. 8).

The ECU is located under the instrument panel. It is located at the right side of the steering column.

The power up voltage source for the ECU is through the ignition switch in the On and Run positions.

The antilock ECU is separate from the other vehicle electronic control units. It contains a self check program that illuminates the amber warning light when a system fault is detected. Faults are stored in a diagnostic program memory and are accessible with the DRB II 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.

ACCELERATION SWITCH

An acceleration switch (Fig. 9), 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. Equal wheel speeds occur during braking in undifferentiated 4-wheel ranges.

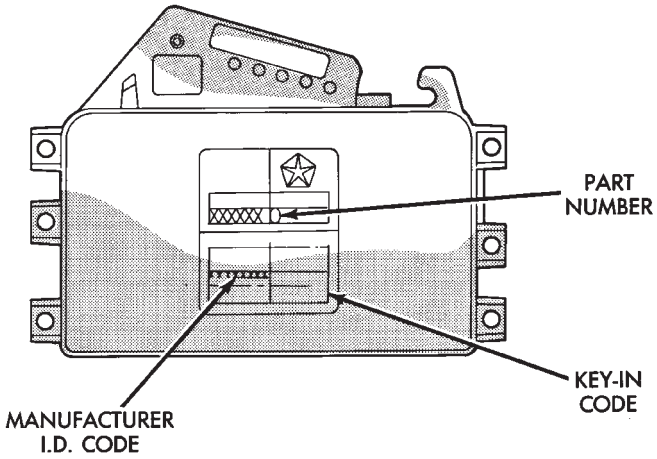

Fig. 7 Anti-Lock ECU

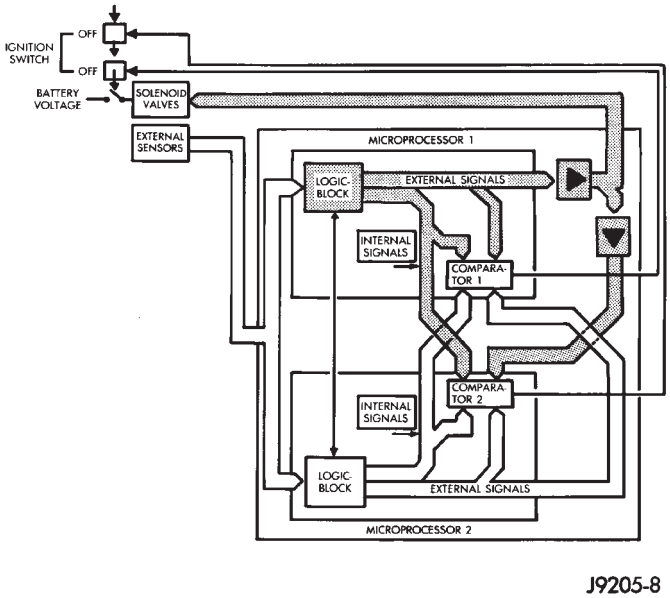

Fig. 8 ECU Dual Microprocessor Schematic

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 remaining system components. 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. The start/stop signal to the ECU is generated by the pedal travel sensor. Refer to the ABS schematic at the end of this section for circuit details.

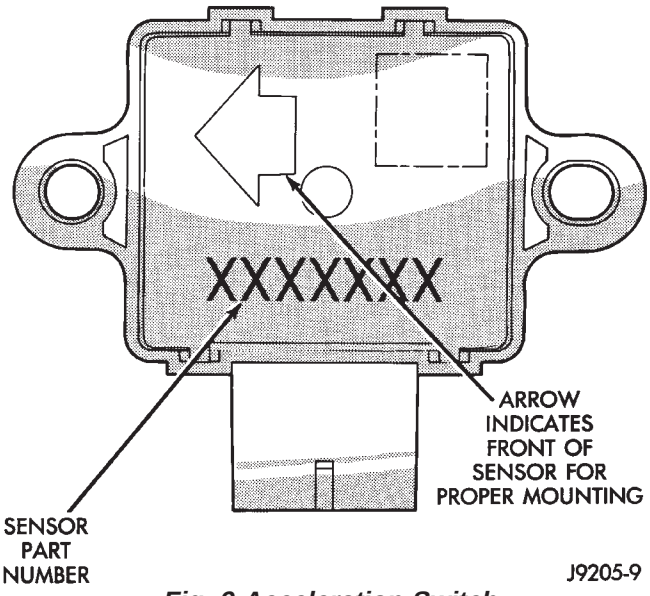

Fig. 9 Acceleration Switch

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, relays, solenoid valves, and warning light when the ignition switch is in the ON, Start and Run positions. Refer to the ABS system schematic at the end of this section for details.

SYSTEM WARNING LIGHTS

Two warning lights are used. The standard brake system light is red. The antilock system light is amber. Both lights are in the instrument cluster. The amber ABS light is in circuit with the ECU and operates independently of the red brake light.

The amber light indicates antilock system condition. It is in circuit with the valve body solenoids and main relay. The light illuminates (flashes) at start-up for the self check. The light then goes out when the self check program determines system operation is normal.

If an ABS fault occurs either during the start-up self check, or during normal operation, the amber light remains on until the fault is corrected.

COMBINATION VALVE

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

ANTILOCK BRAKE SYSTEM OPERATION

INDEX

SYSTEM POWER-UP AND INITIALIZATION

The antilock system is in standby mode with the ignition switch in Off or Accessory position. The antilock electrical components are not operational.

Turning the ignition switch to On or Run position allows battery voltage to flow through the switch to the ECU ignition terminal.

The ABS system is activated when battery voltage is supplied to the ECU. 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 immediately after the ignition switch is turned to the On 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 to verify operation. The HCU solenoids are checked continuously.

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 occur when brake stops involve high pedal pressure and rate of vehicle deceleration.

The antilock system retards 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 Jeep ABS system has three fluid pressure control channels. The front brakes are controlled separately and the rear brakes in tandem (Fig. 10). A speed sensor input signal indicating high slip conditions activates the ECU antilock program.

Two solenoid valves are used in each antilock control channel (Fig. 11). 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 SOLENOID VALVE 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. 11).

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. Opening the outlet valve also opens the hydraulic return circuit to the master cylinder reser-

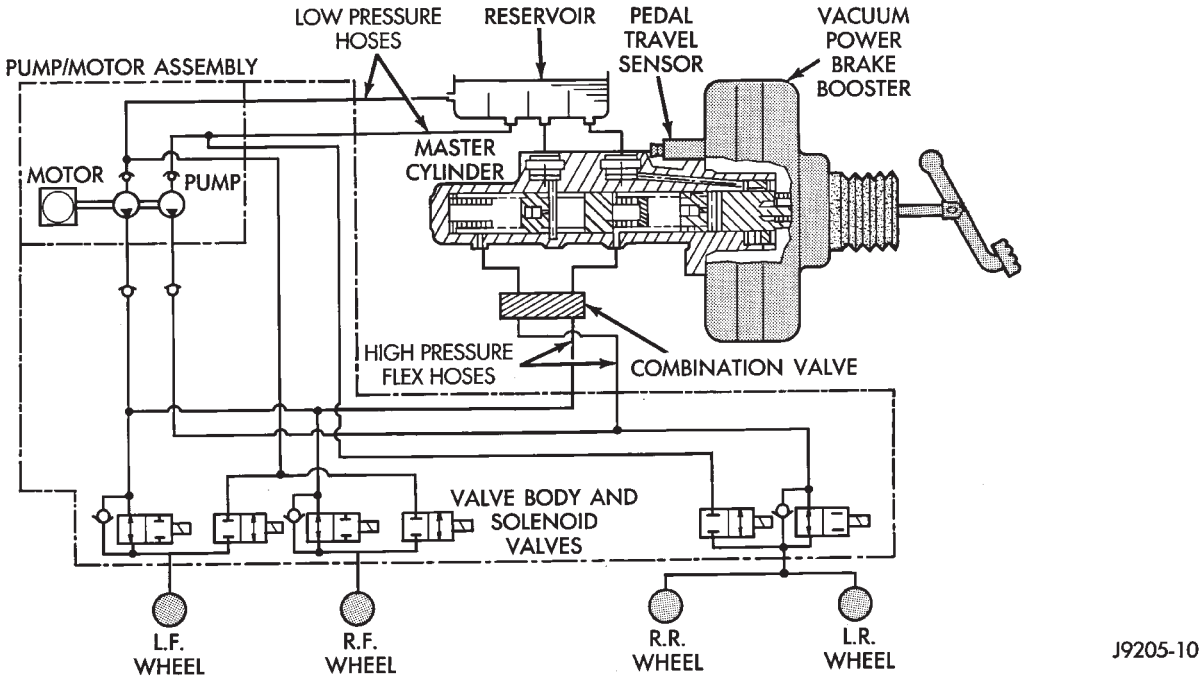

Fig. 10 Three-Channel ABS Hydraulic Control Circuit

voir. 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.

Pressure Hold

Both solenoid valves are closed in the pressure hold cycle (Fig. 12). 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. 13). The pressure increase cycle is used to counteract unequal wheel speeds. This cycle controls reapplication of fluid apply pressure after a pressure decrease cycle.

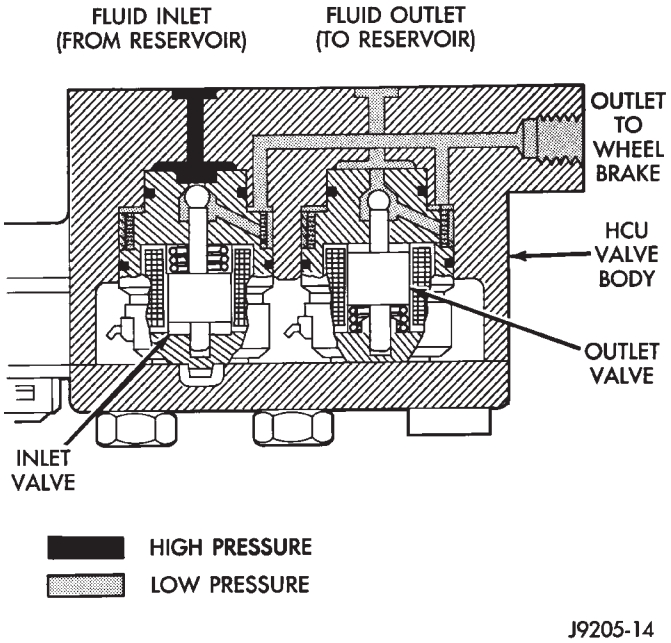

Fig. 11 Solenoid Valves In Pressure Decrease Cycle

HCU PUMP AND PEDAL TRAVEL SENSOR OPERATION

The HCU pump has two functions during antilock braking. First, the pump supplies the extra volume of fluid needed. And second, the pump maintains brake pedal height. The fluid source for the pump is the master cylinder reservoir. The reservoir and HCU are interconnected by hoses.

The pump motor is activated by the ECU. However, the signal to run the pump actually comes from the pedal travel sensor.

The pedal travel sensor is mounted in the forward face of the brake booster (Fig. 14). The sensor plunger is actuated by movement of the booster diaphragm plate. The sensor has a total of seven pedal positions, six of which are monitored. The six pedal positions monitored range from full release to full apply. Each pedal position (toward full apply), generates an increasing degree of electrical resistance in the sensor.

The ECU continuously monitors electrical resistance at the pedal travel sensor. The ECU activates the pump whenever sensor electrical resistance increases during ABS mode braking.

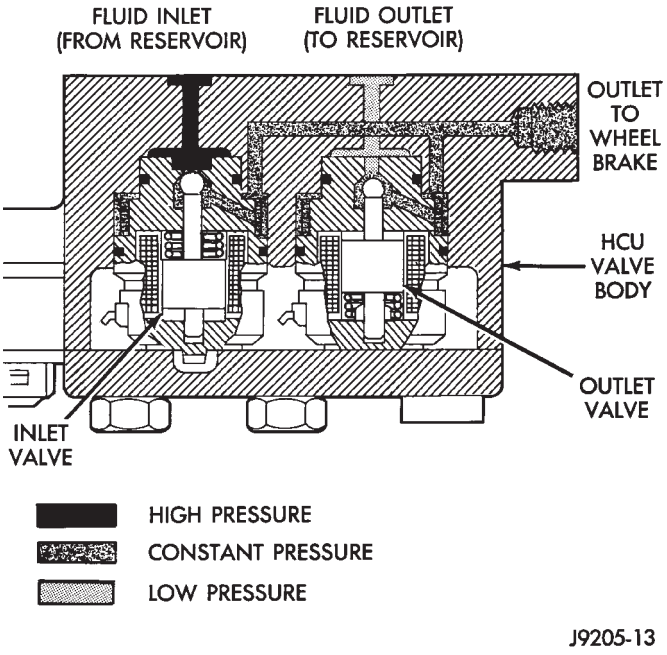

Fig. 12 Solenoid Valves In Pressure Hold Cycle

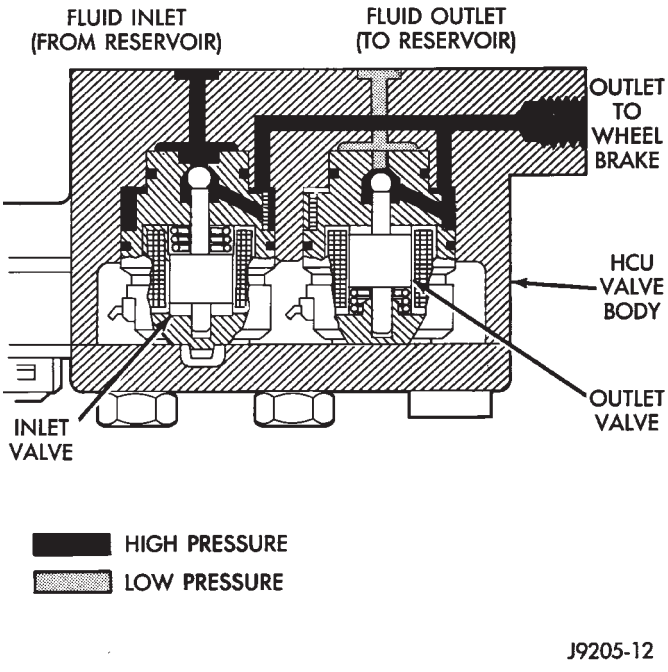

Fig. 13 Solenoid Valves In Pressure Increase Cycle

At the start of antilock braking, pedal height will decrease as the volume of fluid in the master cylinder is used up. When pedal height drops a predetermined amount, the pedal travel sensor will signal the ECU to run the pump. At this point, the pump is activated to supply the extra fluid volume and restore pedal height at the same time.

The pump does not run continuously. It cycles on/off according to signals from the travel sensor and ECU. The pump is connected directly to the master cylinder reservoir by hoses. During antilock braking, the additional volume of fluid needed is drawn by the pump from the reservoir.

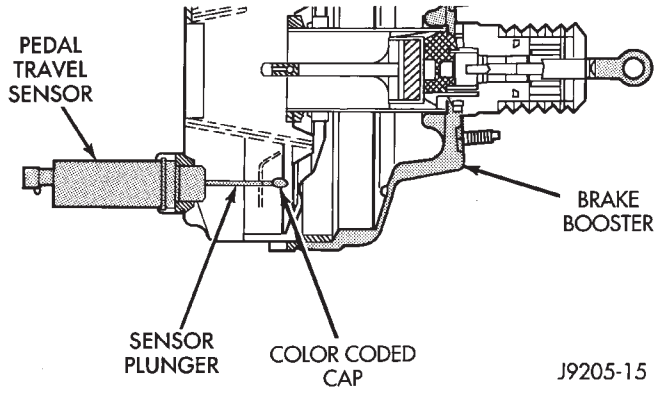

Fig. 14 Pedal Travel Sensor Actuation

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 slip or 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 all of 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 to retard and prevent wheel lock during periods of high wheel slip.

Solenoid valve operation is selective. The solenoid valves may not be cycled simultaneously, nor are they all cycled in the same pressure modulation phase at the same time. The ECU cycles the valves in each control channel as needed. For example, sensor inputs may indicate that only the left front wheel requires modulation during a period of high slip.

ABS COMPONENT SERVICE

INDEX

COMPONENT SERVICEABILITY

The ABS components are serviced as assemblies (Figs. 1 and 2); they are not repairable. The following ABS components can be replaced separately:

- center feed master cylinder
- master cylinder-to-booster seal
- power brake booster (includes matched pedal travel sensor)
- booster check valve and grommet
- pedal travel sensor and select fit caps
- combination valve
- HCU and pump motor assembly
- ECU
- acceleration sensor
- wheel sensors
- system wire harnesses

The axle shaft tone wheels are not serviceable. If a tone wheel becomes damaged, it will be necessary to replace the axle shaft, or disc brake rotor and hub assembly on 2-wheel drive models.

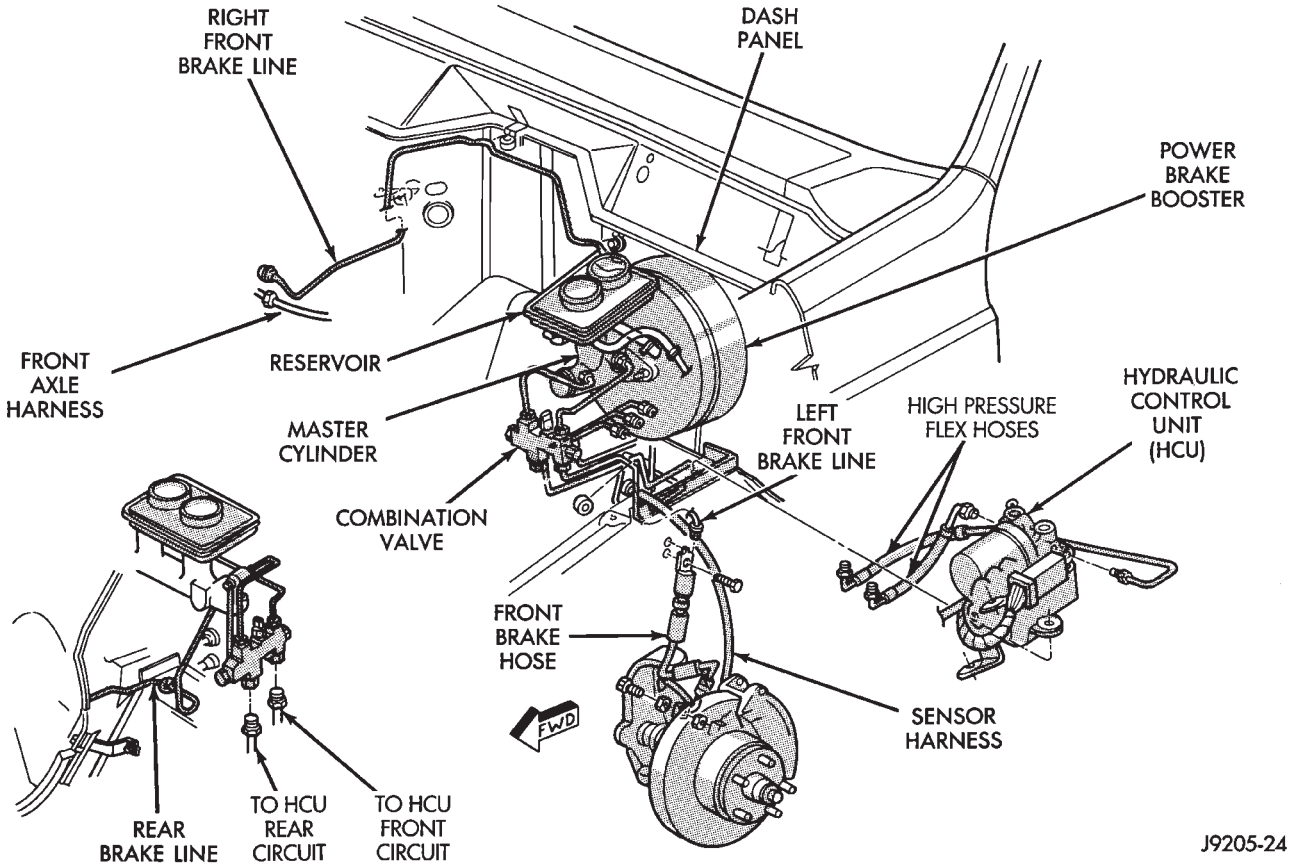

Fig. 1 ABS Hydraulic Component Locations (XJ)

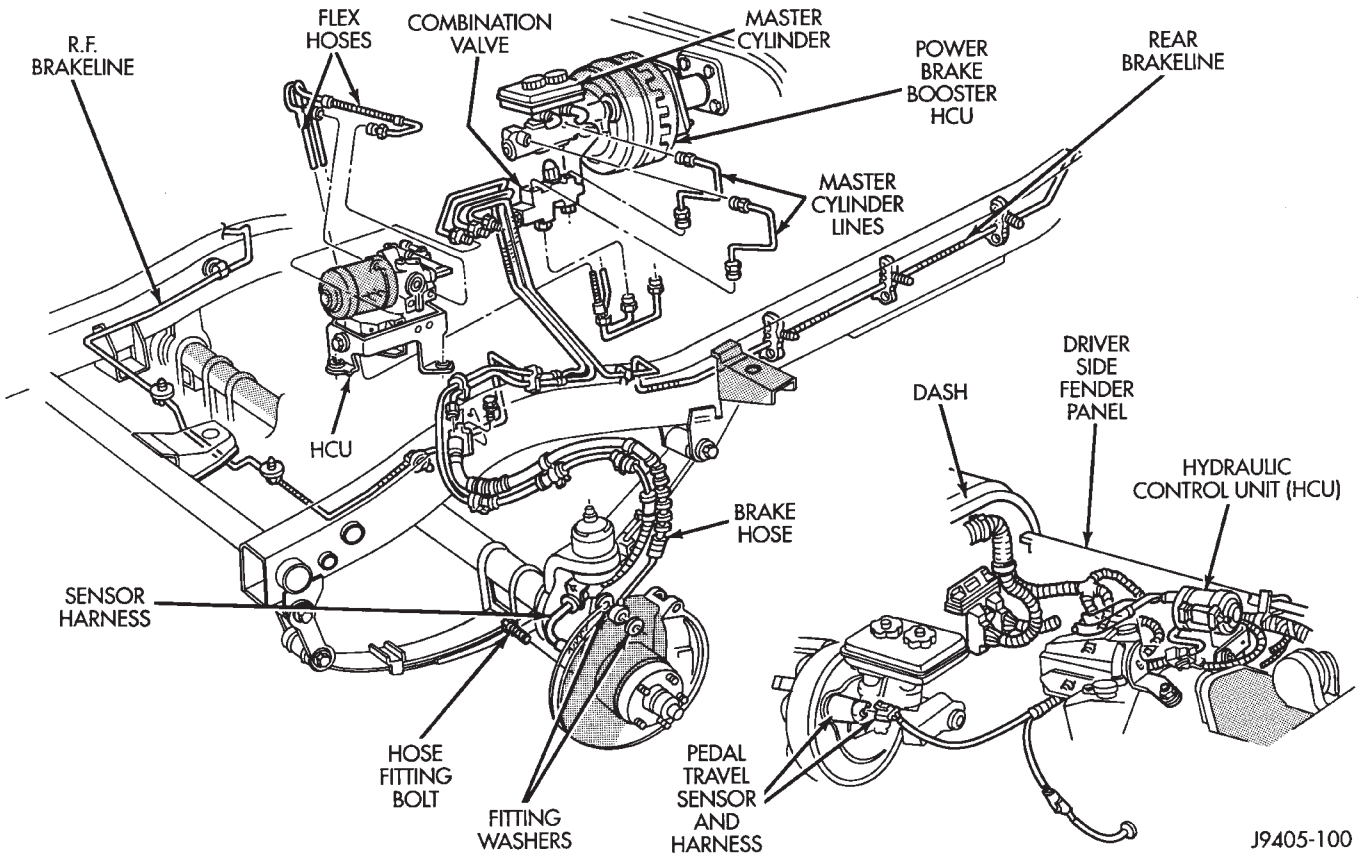

Fig. 2 ABS Hydraulic Component Locations (YJ)

The wheel brake components such as the calipers, brakeshoes, wheel cylinders, rotors and drums are all serviced the same as standard brake system components.

RECOMMENDED BRAKE FLUID

Recommended brake fluid for the Jeep ABS system is Mopar DOT 3 brake fluid. If Mopar fluid is not readily available, a top quality fluid meeting SAE J1703 and DOT 3 standards can be used.

Brake fluid used in the ABS system must meet the SAE and DOT quality standards and be exceptionally clean. **Never use substandard fluid, fluid not meeting the SAE and DOT standards, reclaimed fluid, or fluid from open containers.**

CORRECT FLUID LEVEL

Correct brake fluid level is marked on the driver side of the master cylinder reservoir (Fig. 3).

Preferred fluid level is to the MAX indicator mark. Acceptable fluid level is between the MAX and MIN marks.

If fluid level is at or below the MIN mark, the brake hydraulic system should be checked for leaks.

CAUTION: Clean the reservoir caps and exterior thoroughly before checking fluid level. Do not allow any dirt or foreign material to enter the reservoir while checking fluid level. Such materials can interfere with solenoid valve operation causing an ABS malfunction.

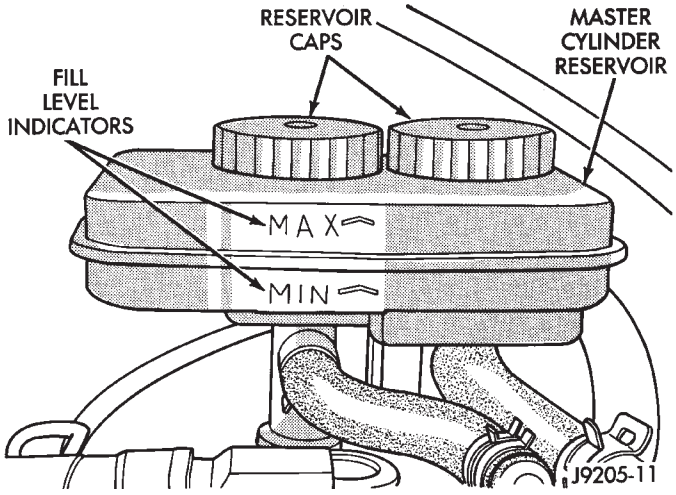

Fig. 3 Reservoir Fluid Level Indicators

IMPORTANCE OF CLEAN BRAKE FLUID

The antilock system brake fluid must be kept clean and uncontaminated. Foreign material in the fluid, or non-recommended fluids will cause system malfunctions.

Clean the reservoir and caps thoroughly before checking level or adding fluid. Cap open lines and hoses during service to prevent dirt entry.

Dirt or foreign material entering the ABS hydraulic system through the reservoir opening will circulate within the system. The result will be poor brake performance and possible component failure. Use clean, fresh fluid only to top off, or refill the system.

WHEEL SENSOR AIR GAP ADJUSTMENT

Only rear sensor air gap is adjustable. The front sensors are fixed and cannot be adjusted.

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.

Preferred rear sensor air gap is 1.1 mm (0.043 in.). Acceptable air gap range is 0.92 to 1.275 mm (0.036 to 0.050 in.).

Front sensor air gap is not adjustable. The front sensors are fixed in position and cannot be adjusted. Front sensor air gap can only be checked. Air gap should be 0.040 to 1.3 mm (0.0157 to 0.051 in.). If front sensor air gap is incorrect, the sensor is either loose, or damaged.

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 before removal.

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

(5) Unseat grommet retaining sensor wire in wheel house panel.

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

FRONT WHEEL SENSOR INSTALLATION

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

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

(3) Tighten sensor bolt to 14 N•m (11 ft. lbs.) torque.

(4) Attach sensor wire to steering knuckle bracket with grommets on sensor wire.

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

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

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

(8) 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.

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

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

REAR WHEEL SENSOR REMOVAL

(1) On XJ models, if separate connectors are not used to attach sensor harness to each sensor wire, proceed as follows:

(a) Raise and fold rear seat forward for access to rear sensor connectors (Figs. 4 and 5).

(b) Disconnect sensors at rear harness connectors.

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

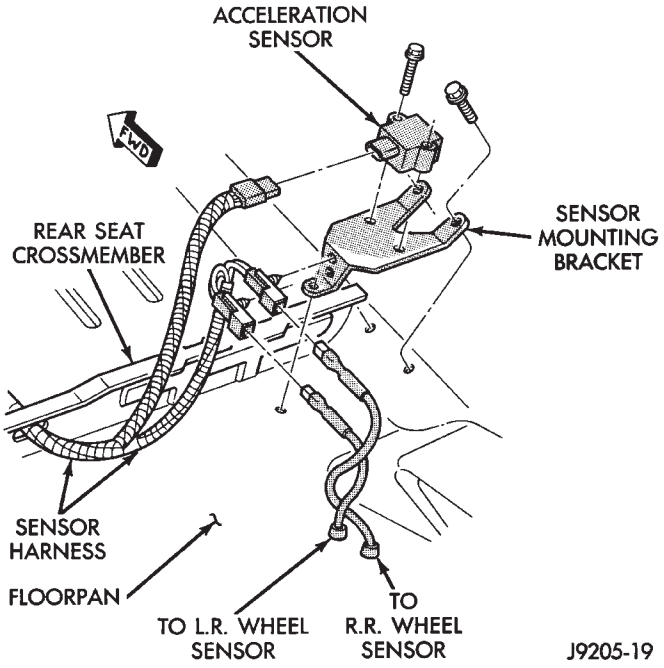

Fig. 4 Acceleration Switch And Rear Sensor Connections (XJ)

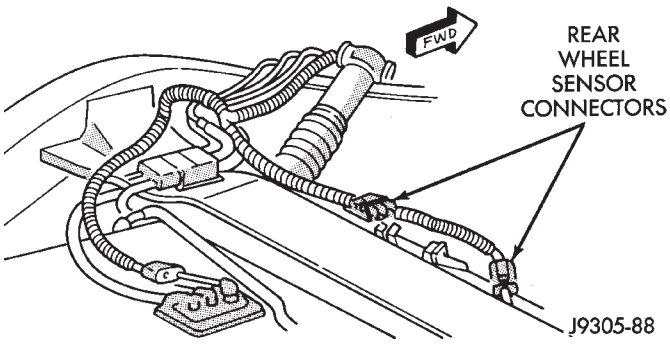

Fig. 5 Rear Sensor Connections (XJ)

(2) Raise vehicle.
(3) Disconnect sensor wires at rear axle connectors.
(4) Remove wheel and tire assembly.
(5) Remove brake drum.
(6) Remove clips securing sensor wires to brake lines or rear axle and rear brake hose.
(7) Unseat sensor support plate grommet.
(8) Remove bolt attaching sensor to bracket and remove sensor.

REAR WHEEL SENSOR INSTALLATION

(1) Insert sensor wire through support plate hole and seat sensor grommet in support plate.
(2) Apply Mopar Lock N' Seal or Loctite 242 to original sensor bolt. Use new bolt if original is worn or damaged.
(3) Install sensor bolt finger tight only at this time.
(4) Set sensor air gap as follows:
(a) If **original sensor** is being installed, remove any remaining pieces of cardboard spacer from sensor pickup face. Then adjust air gap to preferred setting of 1.1 mm (0.043 in.) with brass feeler gauge (Fig. 6). Tighten sensor bolt to 11 N·m (11 ft. lbs.) torque.
(b) If **new sensor** is being installed, push cardboard spacer on sensor face (Fig. 7) against tone ring. 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.
(c) Verify sensor air gap adjustment. If adjustment changed after tightening bolt, readjust sensor air gap as needed.

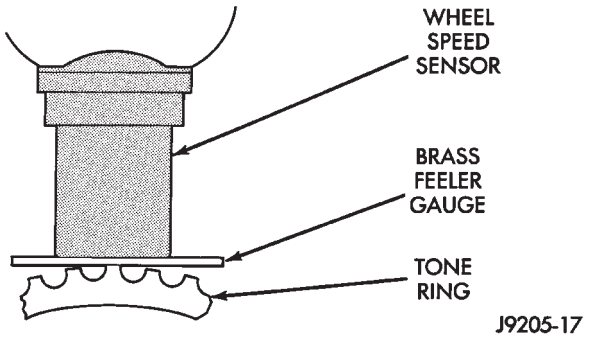

Fig. 6 Setting Air Gap On Original Rear Sensor

(5) On YJ, connect rear sensor wires to connectors at axle. On XJ, route sensor wires to rear seat area.
(6) Feed sensor wires through floorpan access hole and seat sensor grommets in floorpan.
(7) Verify that rear sensor wire are secured to rear brake hose and axle with clips. Verify that wire is clear of rotating components.
(8) Install brake drum and wheel.
(9) Lower vehicle.
(10) On XJ, connect sensor wire to harness connector. Then reposition carpet and fold rear seat down.

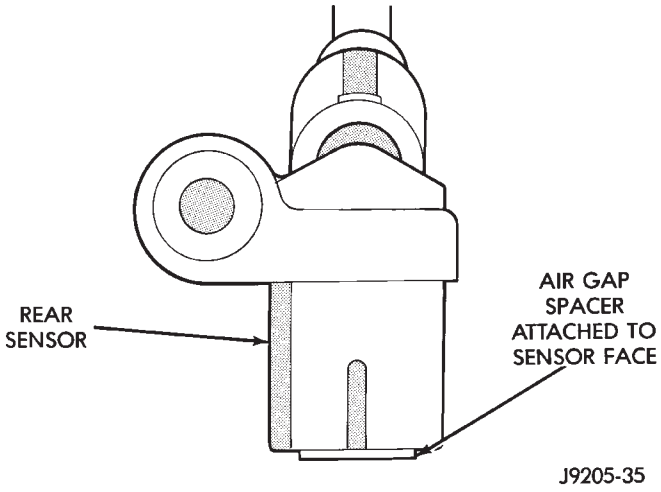

Fig. 7 New Rear Sensor With Air Gap Spacer

MASTER CYLINDER REMOVAL

(1) Disconnect pedal travel sensor wires.
(2) Remove air cleaner and hoses on XJ models.
(3) Remove clamps that secure reservoir hoses to HCU pipes.
(4) Position small drain container under master cylinder reservoir. Remove reservoir hoses from HCU pipes and allow fluid to drain into container before removing reservoir. Discard fluid drained from reservoir.
(5) Pump brake pedal to exhaust all vacuum from power brake booster.
(6) Disconnect necessary brakelines at master cylinder and combination valve. Also remove combination valve bracket bolt.
(7) Remove nuts attaching master cylinder to booster mounting studs.
(8) Remove master cylinder. Pull cylinder forward and off studs. Then work cylinder past combination valve, brakelines, pedal travel sensor and out of engine compartment.

MASTER CYLINDER INSTALLATION

(1) If new master cylinder is being installed, bleed cylinder on bench before installing it in vehicle.
(2) Work master cylinder into position and install it in booster. Be sure cylinder is properly seated on booster studs. Also be sure booster-to-cylinder seal is not displaced during installation.
(3) Connect reservoir hoses to HCU pipes.
(4) Verify that master cylinder and booster are properly connected.
(5) Install and tighten master cylinder attaching nuts to 34 N·m (25 ft. lbs.) torque.
(6) Connect brakelines to master cylinder.
(7) Install combination valve, if removed and install bolt that secures valve bracket to master cylinder.
(8) Connect sensor wires.

(9) Fill reservoir and bleed brakes. Refer to procedure in this section.

(10) Install air cleaner and hoses.

PEDAL TRAVEL SENSOR SERVICE

CAUTION: The pedal travel sensor and booster must form a matched set. The cap on the sensor plunger and booster shell are color coded for identification, and to ensure they are used as matched sets. Be sure the color of the sensor cap and the color dot on the booster shell are the same before installation. Refer to the Sensor Replacement information before installing a new or original sensor.

PEDAL TRAVEL SENSOR REMOVAL

(1) Disconnect wires at sensor.

(2) Pump brake pedal to exhaust all vacuum from booster.

(3) Unseat sensor retaining ring.

(4) Remove sensor from booster (Fig. 8).

PEDAL TRAVEL SENSOR REPLACEMENT

A new pedal travel sensor is supplied with four different color caps. The caps are color coded to ease matching them with the color code dot on the booster shell.

Compare the color of the new sensor cap and the color dot on the booster shell. If the colors match, proceed with sensor installation. However, if the colors **do not match**, select and install the correct color cap on the sensor plunger before proceeding.

PEDAL TRAVEL SENSOR INSTALLATION

(1) Check color dot on face of brake booster. Then check color of cap on sensor plunger. If colors match, proceed with installation. If colors do not match, install correct color cap on end of plunger.

(2) Install O-ring on sensor.

(3) Install sensor retaining ring on booster flange.

(4) Insert sensor in retaining ring and booster.

(5) Verify that retaining ring is properly engaged in sensor and that sensor is seated in booster.

(6) Connect wires to sensor.

(7) Check sensor operation with DRB II scan tool.

POWER BRAKE BOOSTER REMOVAL

(1) Pump brake pedal until all vacuum is exhausted from power brake booster.

(2) Disconnect pedal travel sensor.

(3) Remove air cleaner and hoses.

(4) Remove clamps that secure reservoir hoses to HCU pipes. Then remove hoses from pipes.

(5) Disconnect brakelines at master cylinder.

(6) Remove combination valve bracket bolt if necessary.

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

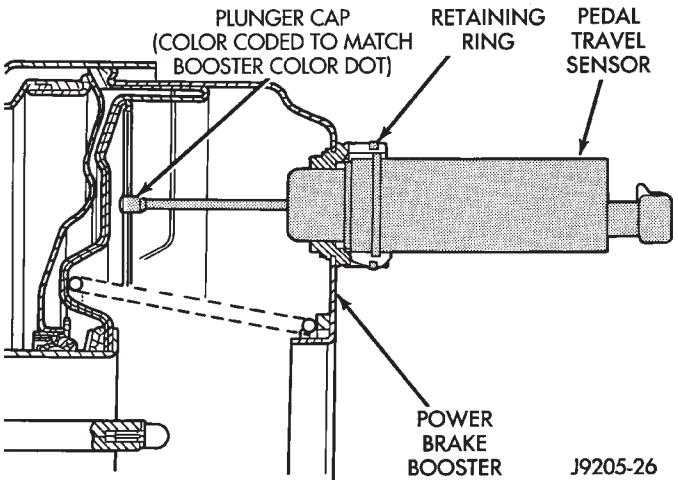

Fig. 8 Pedal Travel Sensor Mounting

(8) Remove master cylinder. Pull cylinder forward and off studs. Then work cylinder past combination valve, brakelines, pedal travel sensor and out of engine compartment.

(9) Disconnect vacuum hose at booster check valve.

(10) Disconnect booster push rod from brake pedal.

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

(12) Slide booster forward and work it out of engine compartment.

POWER BRAKE BOOSTER INSTALLATION

(1) Position booster on dash panel. Align booster mounting studs with holes in panel and seat booster (Fig. 9).

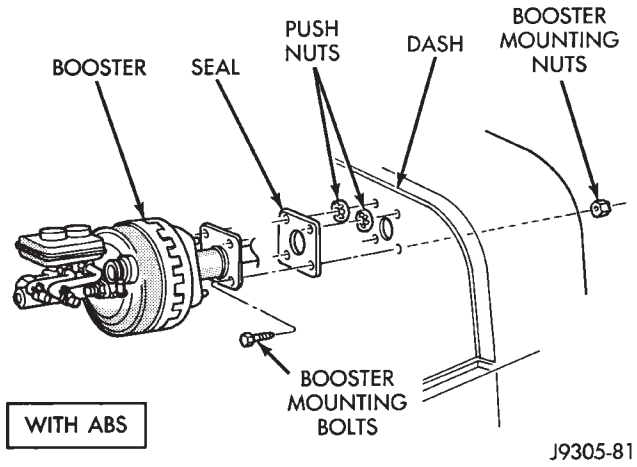

Fig. 9 Booster Attachment At Dash Panel—YJ Shown

(2) In passenger compartment, install booster attaching nuts on mounting studs. Tighten attaching nuts to 41 N·m (30 ft. lbs.) torque.

(3) Install seal on master cylinder. Seal is slight interference fit to help hold it in place.

CAUTION: The pedal travel sensor and booster must form a matched set. The cap on the sensor plunger and the color dot on the booster shell are color coded for identification, and to ensure they are used as matched sets. Be sure the color on the sensor cap and booster shell are the same before installation. Refer to the Sensor Replacement information before installing a new or original sensor.

(4) If new pedal travel sensor is being installed in original booster, compare color dot on booster shell with color of cap on sensor (Fig. 10). If both are same color, proceed with installation. However, if colors **do not match**, select correct color cap from kit supplied with new sensor and install it on end of sensor plunger.

(5) Install O-ring on pedal travel sensor.

(6) Install sensor retaining ring on booster flange. Be sure retaining ring is firmly seated.

(7) Insert sensor into booster. Be sure sensor is fully seated and engaged in retaining ring.

(8) Connect booster push rod to brake pedal.

(9) Attach vacuum hose to booster check valve.

(10) Install master cylinder on booster. Tighten cylinder attaching nuts to 25-30 N·m (220-267 in. lbs.) torque.

(11) Connect brakelines to master cylinder.

(12) Install combination valve bracket bolt if removed.

(13) Connect reservoir hoses to HCU pipes.

(14) Connect sensor wires.

(15) Bleed brakes. Refer to procedure in this section.

(16) Install air cleaner and hoses.

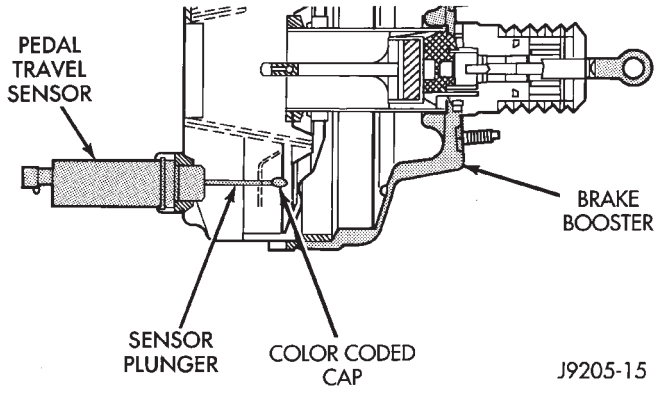

Fig. 10 Booster Push Rod And Pedal Travel Sensor

ACCELERATION SENSOR REMOVAL

(1) On XJ models, tilt rear seat assembly forward for access to sensor (Fig. 11).

(2) On YJ models, move driver seat forward or rearward for access to sensor and mounting bracket (Fig. 11).

(3) Disconnect sensor harness (Fig. 10).

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

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

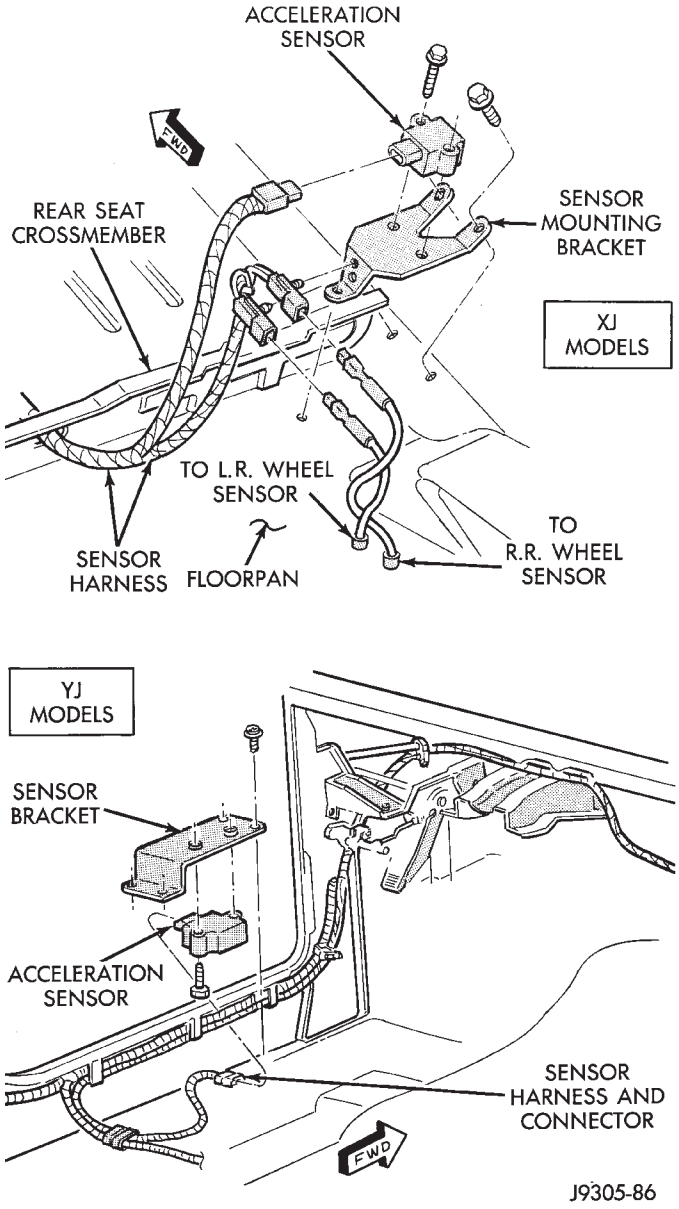

Fig. 11 Acceleration Sensor Mounting

ACCELERATION SENSOR INSTALLATION

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

CAUTION: The sensor mercury switch will not function properly if the sensor is mispositioned. Verify that the sensor locating arrow is pointing to the front of the vehicle.

(2) Position sensor in mounting bracket (Fig. 10).

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

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

(5) Move seat back to normal position.

ECU REPLACEMENT—XJ

ECU Removal

(1) Turn ignition key to Off position.

(2) Remove screws attaching ECU to mounting bracket (Fig. 12).

(3) Disconnect ECU wiring harness.

(4) Remove ECU.

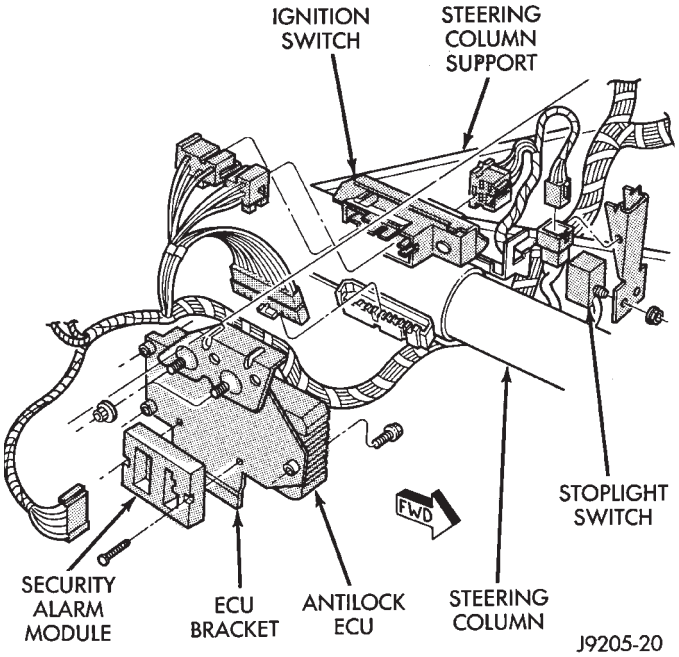

Fig. 12 Antilock ECU Mounting (XJ)

ECU Installation

(1) If new ECU is being installed, transfer mounting bracket to new ECU.

(2) Tighten ECU-to-mounting bracket screws to 8-13 N·m (75-115 in. lbs.) torque.

(3) Connect wire harness to ECU.

(4) Position and install ECU.

(5) Tighten ECU attaching nuts to 10-14 N·m (85-125 in. lbs.) torque.

ECU REPLACEMENT—YJ

The antilock electronic control unit (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. 13).

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.

HCU REMOVAL—XJ

(1) Remove air cleaner.

(2) Remove clamp that secures air cleaner hose and pipe to fender apron (Fig. 14).

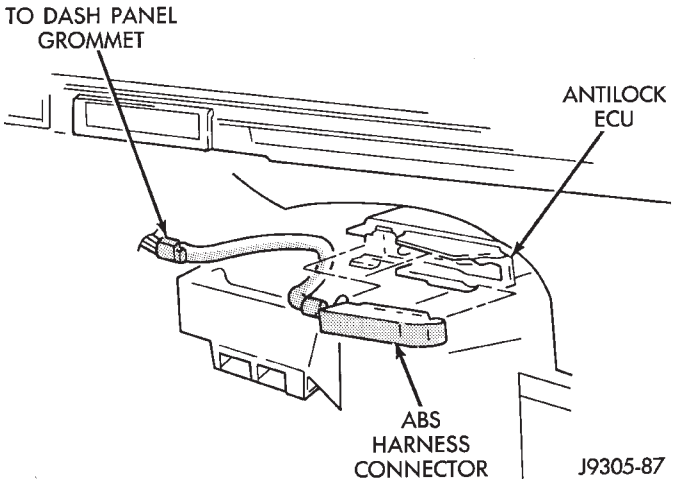

Fig. 13 ECU Location (YJ)

(3) Position suitable size fluid drain container under master cylinder reservoir hoses. Disconnect reservoir hoses from HCU and drain fluid into container. Discard old fluid and remove reservoir.

(4) Disconnect pump motor and solenoid harness wires at HCU (Fig. 15).

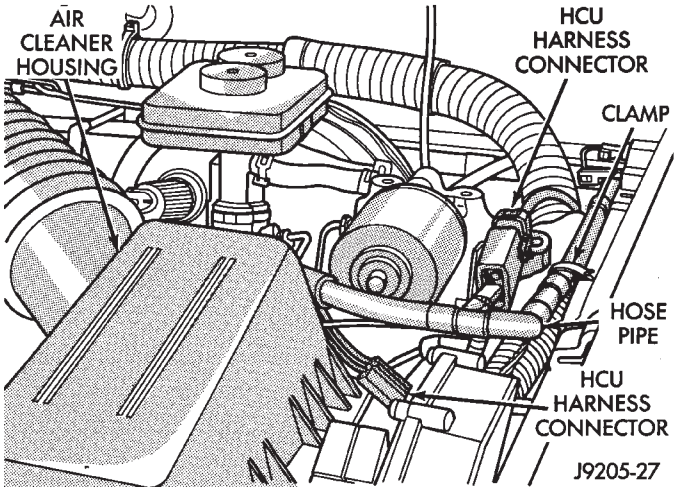

Fig. 14 Air Cleaner And Harness Connector Location (XJ)

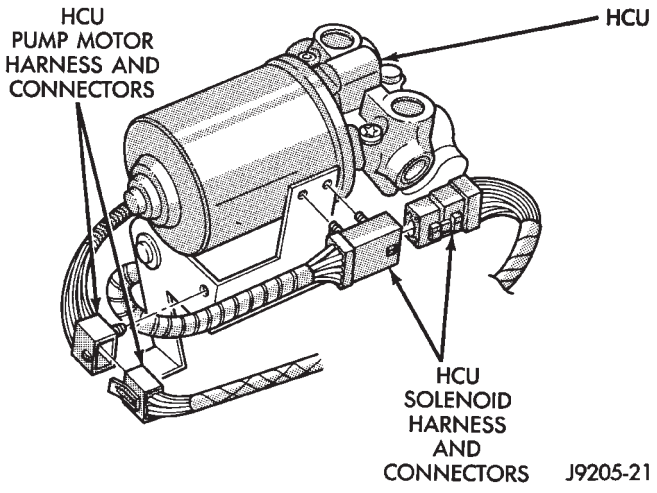

Fig. 15 HCU Wire Harness Connections

(5) Mark or tag HCU hydraulic lines for assembly reference.

(6) Disconnect hydraulic lines at HCU.

(7) Move HCU harness and air cleaner hose pipe aside for access to HCU bracket nuts.

(8) Remove single bolt and two nuts attaching HCU to mounting bracket on inner fender panel (Figs. 16 and 17).

(9) Remove HCU. Lift HCU up and off mounting bracket studs. Then work HCU past brakelines and master cylinder to remove it.

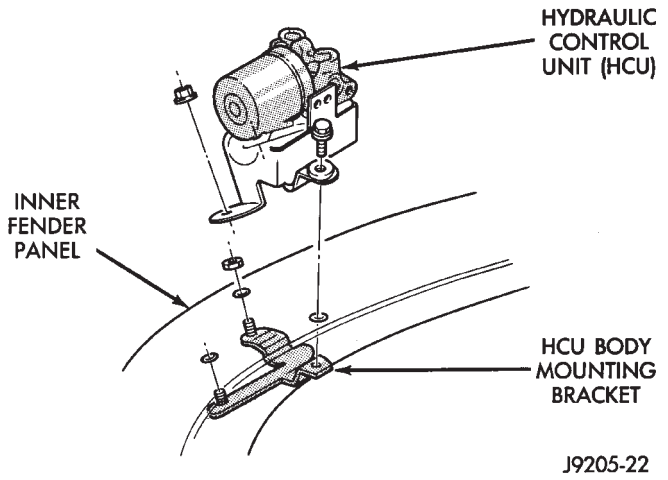

Fig. 16 HCU Mounting (Left Hand Drive XJ)

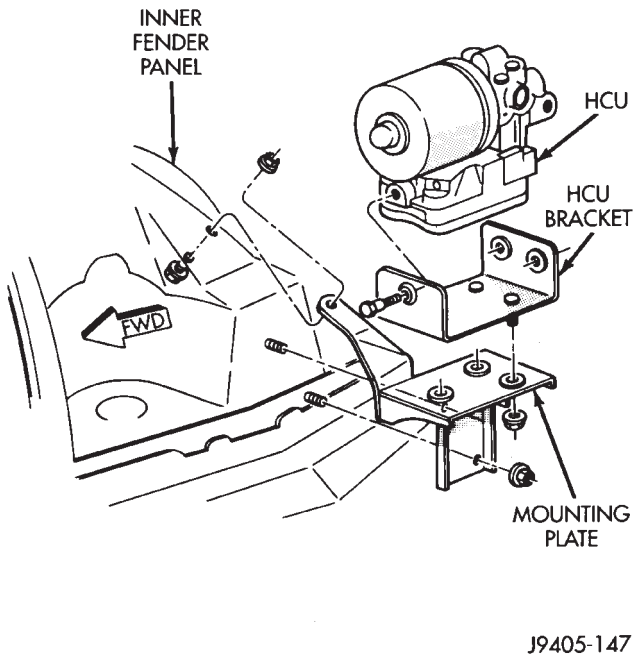

Fig. 17 HCU Mounting (Right Hand Drive XJ)

HCU INSTALLATION—XJ

(1) Connect master cylinder reservoir hoses to HCU pipes.

(2) Position HCU assembly on mounting bracket and install attaching nuts.

(3) Connect hydraulic lines to HCU (Fig. 18). Line fitting nuts and bosses on valve body ports are color coded. Be sure lines are properly connected.

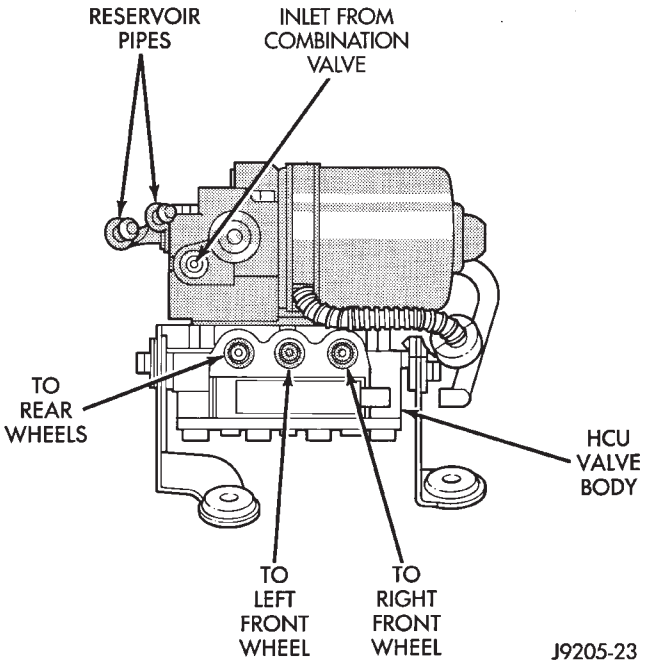

Fig. 18 HCU Hydraulic Line Connections

(4) Connect HCU harness wires to HCU.

(5) Check routing of HCU lines/hoses. Be sure lines are not kinked and are clear of engine components.

(6) Fill master cylinder reservoir with Mopar DOT 3 brake fluid or equivalent.

(7) Bleed brake system.

(8) Install air cleaner and hoses. Secure air cleaner hose pipe to fender apron with clamp.

(9) Check brake pedal action. Bleed brakes again if pedal is not firm (feels soft/spongy).

HCU REMOVAL—YJ

(1) Place shop towels or small container under master cylinder reservoir hoses.

(2) Disconnect master cylinder reservoir hoses at HCU.

(3) Disconnect all sensor and harness wires at HCU.

(4) Disconnect brakelines at HCU (Fig. 19). Mark or tag lines for installation reference.

(5) Remove bolt and nuts attaching HCU mounting bracket to fender apron and remove HCU.

HCU INSTALLATION—YJ

(1) Position HCU on fender apron (Figs. 2 and 19) and install attaching bolts/nuts.

(2) Connect brakelines to HCU.

(3) Connect harness and sensor wires to HCU.

(4) Connect master cylinder reservoir hoses to HCU.

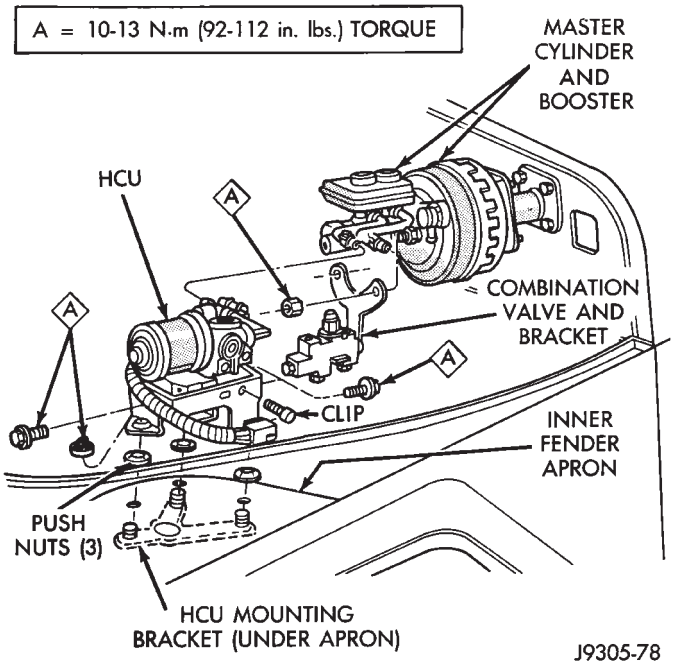

Fig. 19 HCU Mounting (YJ)

(5) Fill and bleed brake system.

COMBINATION VALVE REPLACEMENT—XJ

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 housing for access to valve, if necessary.

(2) Remove bolt attached valve to master cylinder (Fig. 20).

(3) Disconnect pedal travel sensor harness connector and move harness wires aside for working access if necessary.

(4) Disconnect pressure differential switch wires at valve.

(5) Disconnect hydraulic lines at valve and remove valve from vehicle.

(6) Connect hydraulic lines to valve.

(7) Position valve bracket on master cylinder and install bracket attaching bolt.

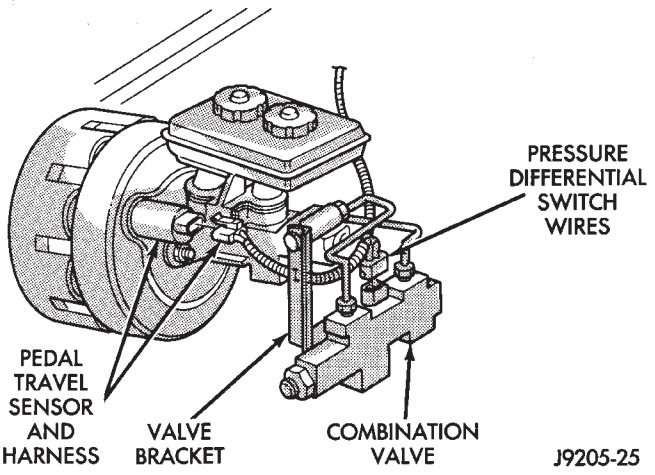

Fig. 20 Combination Valve Mounting (XJ)

(8) Reconnect pressure differential switch and pedal travel sensor wires.

(9) Bleed brake system. Refer to procedure in this section.

COMBINATION VALVE REPLACEMENT—YJ

The combination valve mounting bracket is permanently attached to the valve. The bracket and valve are serviced as an assembly.

(1) Disconnect harness wires from combination valve switch.

(2) Disconnect brakelines attached to combination valve.

(3) Remove nuts attaching combination valve bracket to master cylinder mounting studs (Fig. 19).

(4) Remove valve and bracket as assembly.

(5) Start all brakelines in combination valve by hand. Tighten line fittings just enough to prevent leaks.

(6) Position valve mounting bracket on studs.

(7) Install and tighten nuts that attach combination valve bracket to studs on power brake booster.

(8) Connect wires to combination valve switch.

(9) Fill and bleed brake system.

(10) Final-tighten brakeline fittings to 18-23 N·m (160-210 in. lbs.) torque after bleeding brakes.

PARKING BRAKES

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GENERAL SERVICE INFORMATION

Parking brake adjustment is controlled by a cable tensioner mechanism. The tensioner mechanism is used on 1991 through 1994 YJ models and XJ models starting with 1992 models. The cable tensioner, once adjusted at the factory, will 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 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.

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 at one end and the cable tensioner at the other. The tensioner is connected to the equalizer which is the connecting device for the rear cables (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.

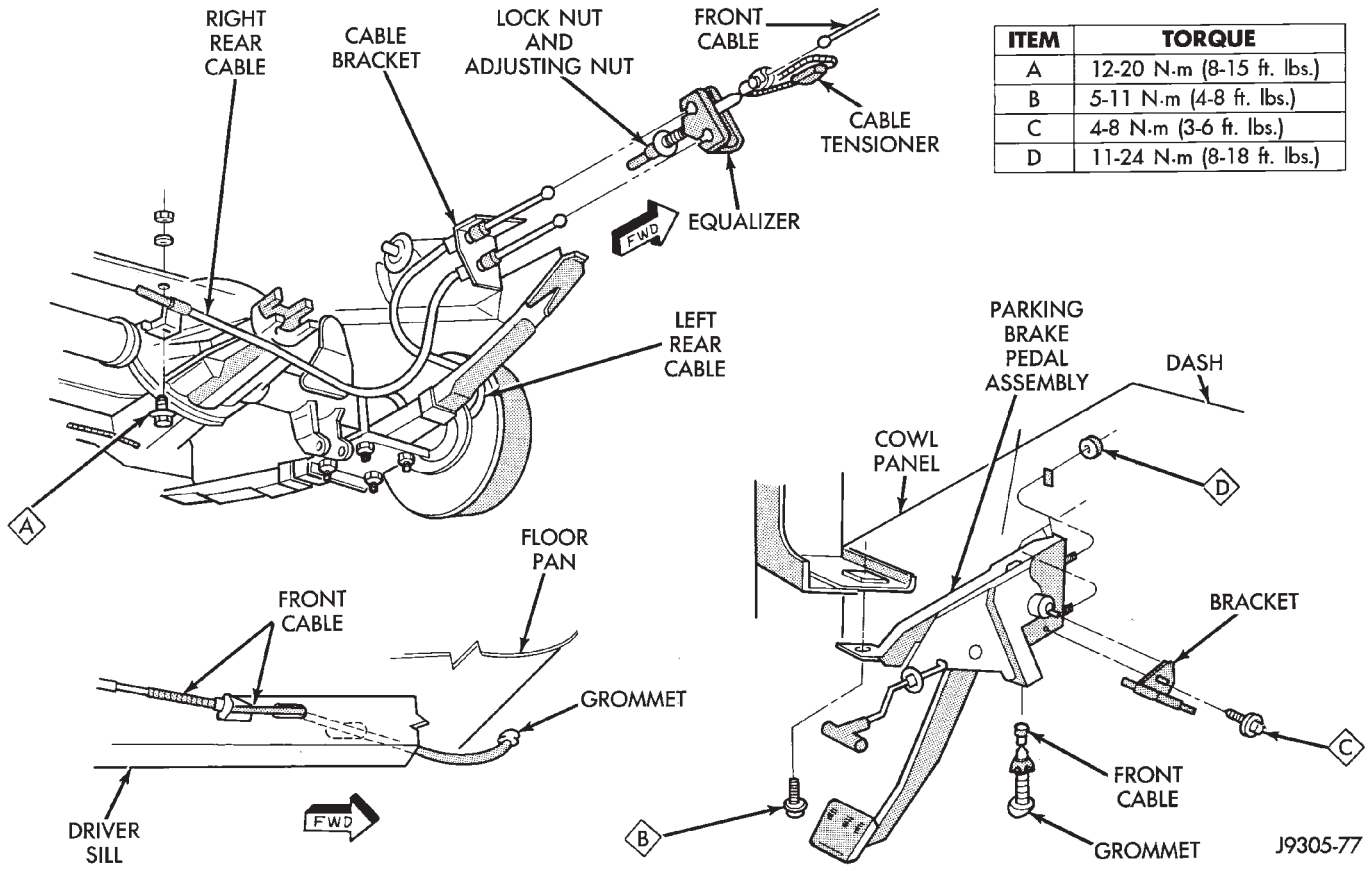
Parking Brake Application

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 brake drum, force exerted through the strut does not end. Instead, further lever movement continues to exert force against the strut; only this time, in a reverse direction. The strut force then causes the secondary shoe to pivot into contact with the drum as well.

The brakeshoes will 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.



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)

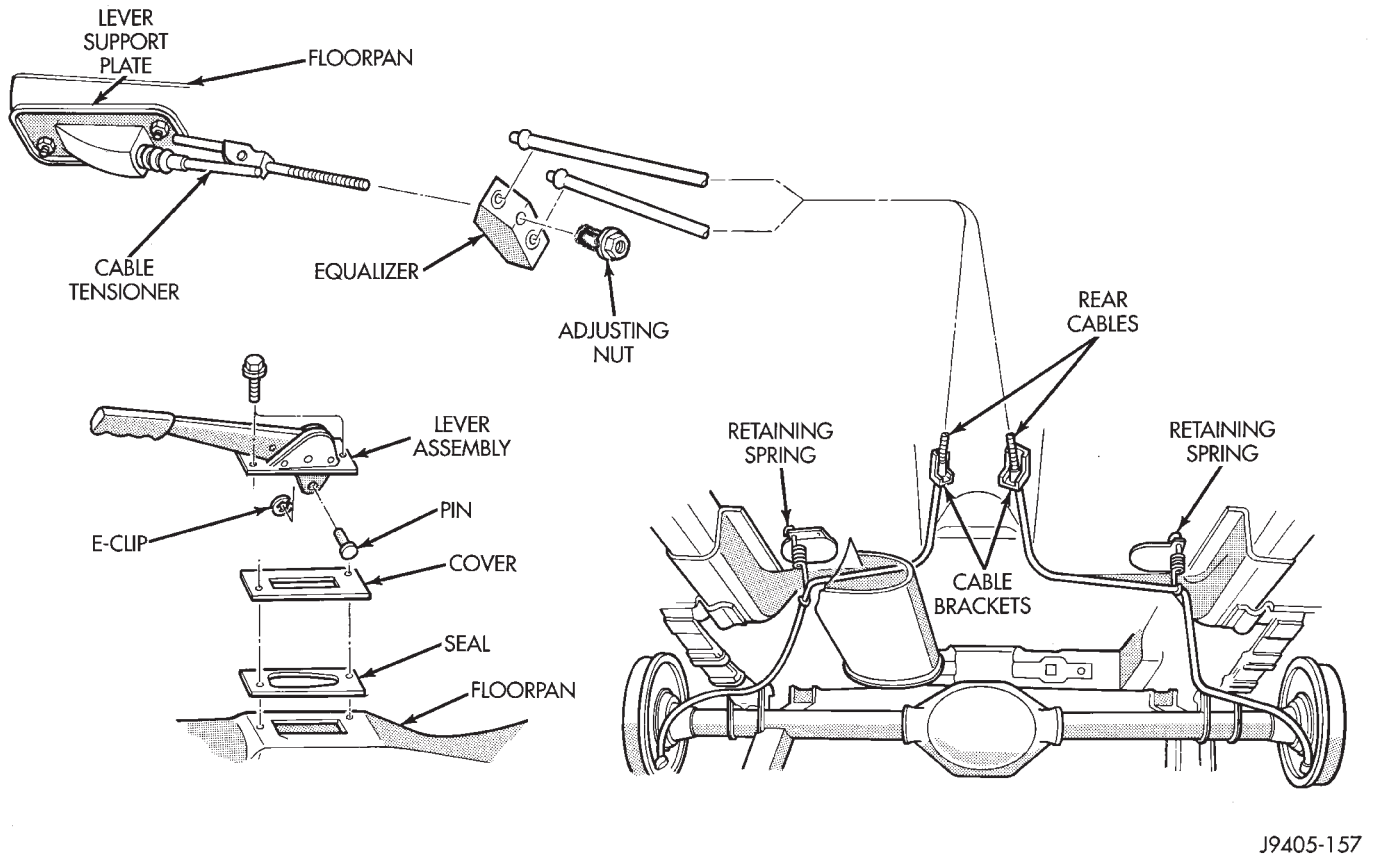


Fig. 2 Parking Brake Components (XJ)

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) Remove lever assembly from floorpan.
(7) Remove tensioner cover and boot for access to lever arm (Fig. 3).
(8) Remove E-clip and pin that connect tensioner to lever arm (Fig. 3).
(9) Remove lever attaching screws from floorpan (Fig. 4).
(10) Remove lever assembly.

PARKING BRAKE LEVER INSTALLATION (XJ WITH MINI CONSOLE)

(1) Assemble lever and tensioner components (Figs. 3 and 4). Be sure E-clip is fully seated in pin (Fig. 3).
(2) Verify that tensioner boot is properly seated in cover (Fig. 5).
(3) Position lever assembly on floorpan and install lever attaching screws, if equipped.

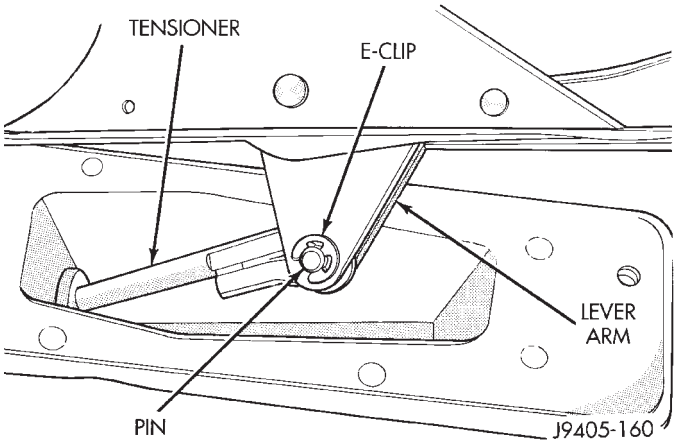


Fig. 3 Tensioner E-Clip And Retaining Pin Location

(4) Raise vehicle.
(5) Insert cable tensioner rod in equalizer and install adjusting nut on tensioner rod.
(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 and verify correct parking brake operation.

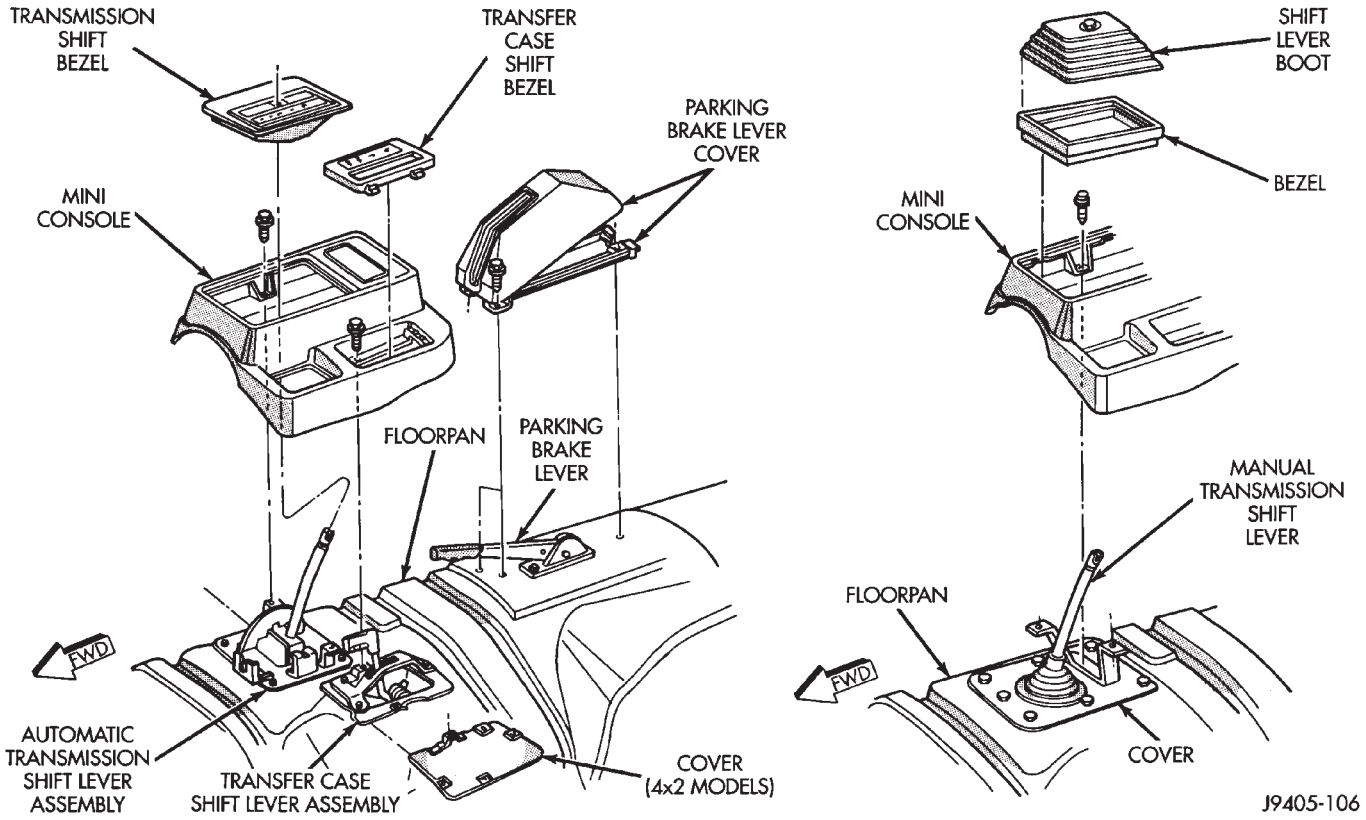


Fig. 4 Mini Console And Parking Brake Lever Cover (XJ)

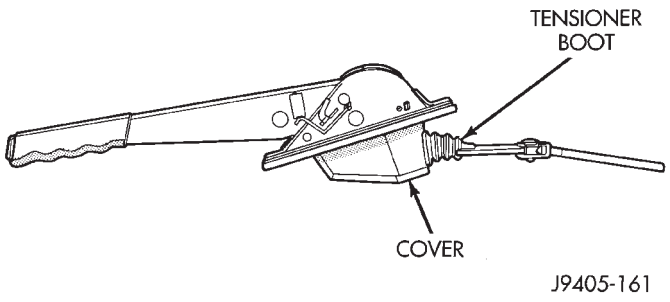


Fig. 5 Tensioner Boot Seated In Cover

PARKING BRAKE LEVER REMOVAL (XJ WITH FULL CONSOLE)

(1) Release parking brakes, if necessary.

(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, boot and bezel.

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

(8) Remove shift handle and shift bezel (Fig. 7).

(9) Remove console cover screws (Fig. 8).

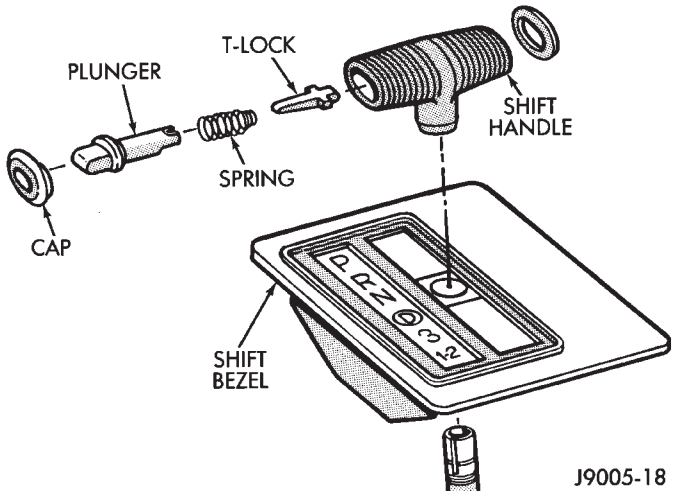


Fig. 7 Automatic Transmission Shift Handle

(10) On models with power mirror switch, pry switch out of console cover and disconnect switch connector (Fig. 8).

(11) Remove console cover from base (Fig. 9).

(12) Remove console base.

(13) Disconnect brake warning light wire connector at lever.

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

(15) Move cover and boot aside for access to lever arm (Fig. 3).

(16) Remove E-clip and pin that connect tensioner to lever arm (Fig. 3).

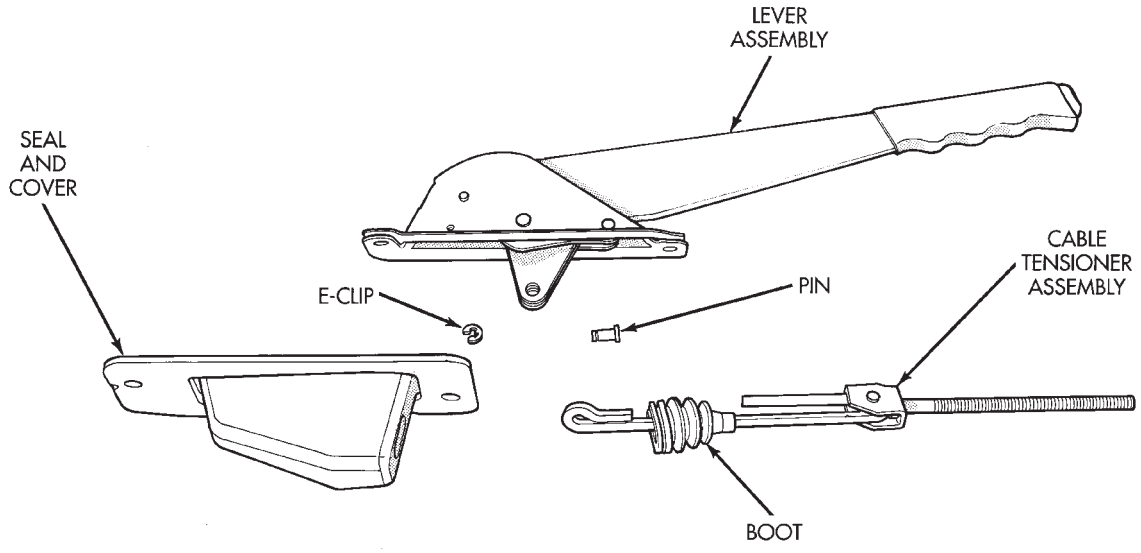


Fig. 6 Hand Lever And Cable Tensioner Components (XJ)

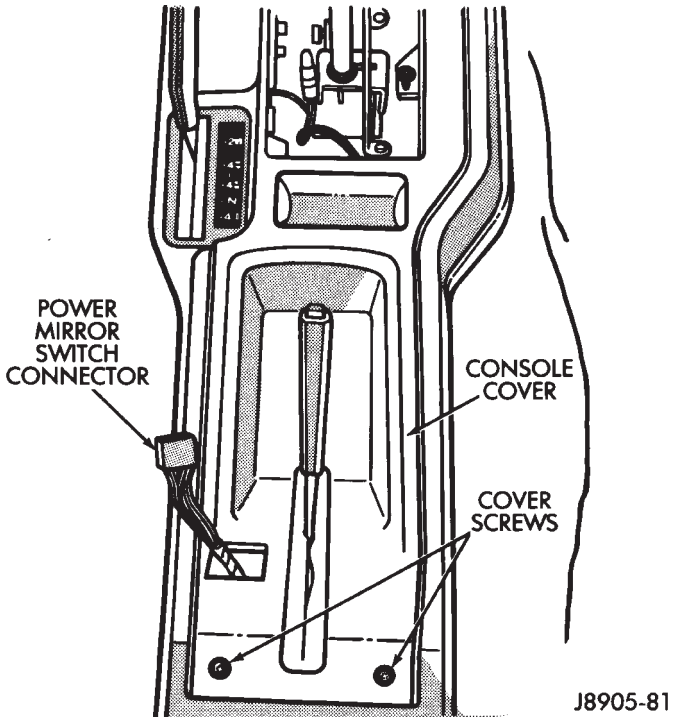


Fig. 8 Console Cover Screws And Power Mirror Switch Connector

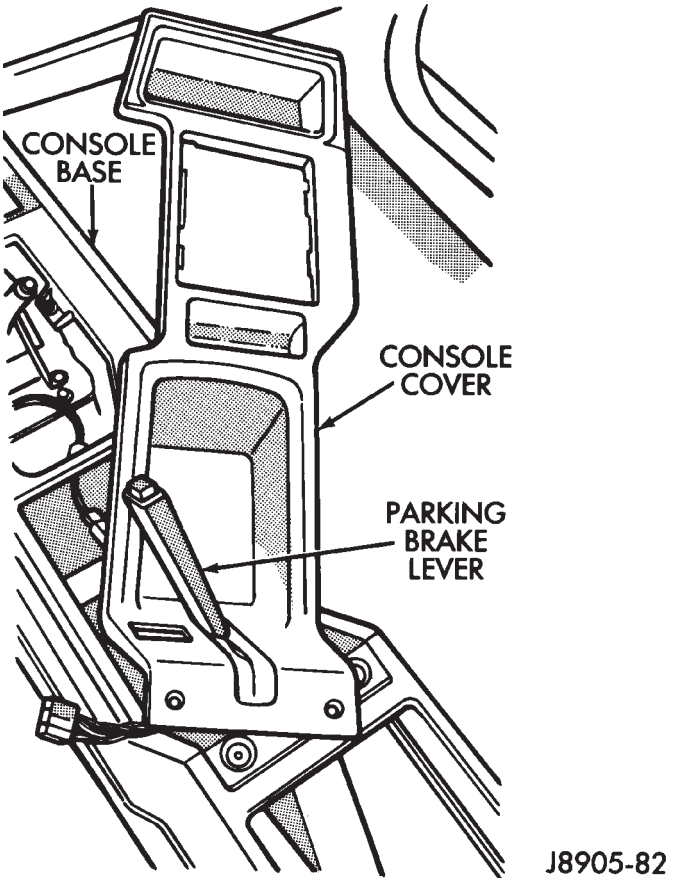


Fig. 9 Console Cover And Base

PARKING BRAKE LEVER INSTALLATION (XJ WITH FULL CONSOLE)

(1) Assemble lever and tensioner (Figs. 3 and 4). Be sure E-clip is fully engaged in retaining pin (Fig. 3).

(2) Verify that tensioner boot is fully seated in cover (Fig. 5).

(3) Position assembled lever and tensioner in floorpan.

(4) Connect brake warning light wires to switch on lever.

(5) Install console base and cover.

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

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

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

(9) Raise vehicle.

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

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

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

PARKING BRAKE LEVER REMOVAL (XJ WITHOUT CONSOLE)

(1) Raise vehicle.

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

(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. 10).

(6) Remove cover attaching screws. Or, if cover is attached with rivets, drill out and remove cover.

(7) Disconnect brake warning light wire at lever.

(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. 3 and 4).

(2) Verify that tensioner boot is properly seated in cover (Fig. 5).

(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) Connect brake warning light wires to switch on lever.

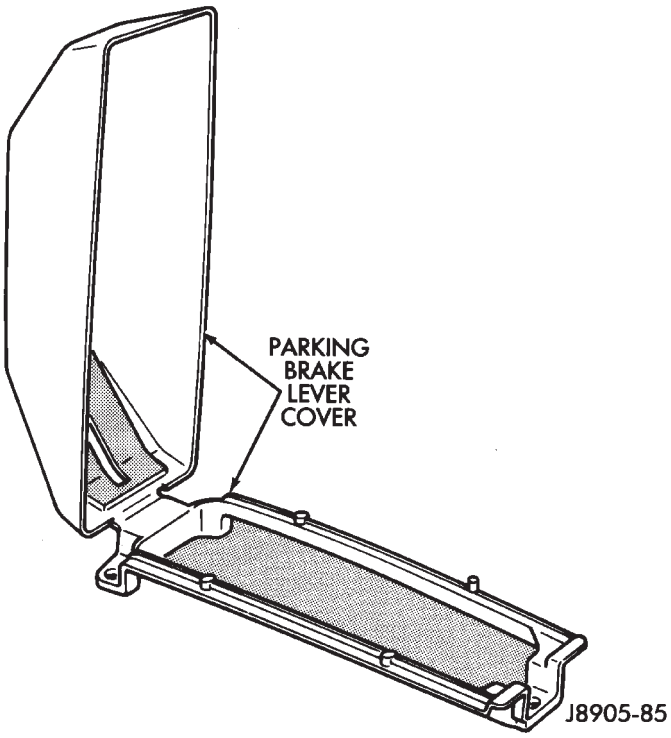


Fig. 10 Lever Cover (XJ)

(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.

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. 3).
(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. 3).
(13) Align cover and seal on lever flange.
(14) Verify that tensioner boot is seated in cover (Fig. 5).
(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. 11).

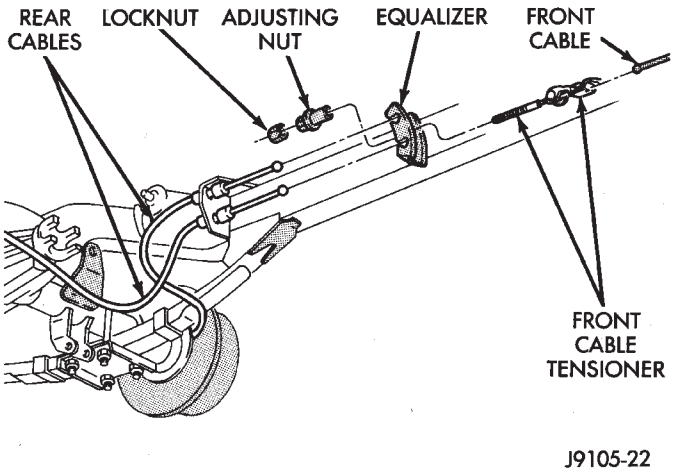


Fig. 11 Front Cable And Equalizer (YJ)

(3) Lower vehicle.
(4) Remove dash-to-instrument panel brace rod, if equipped.
(5) Disconnect warning light switch wire from pedal assembly.
(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. 12).
(8) In engine compartment, remove pedal mounting stud nuts.
(9) Remove pedal assembly from panel.
(10) Disengage front cable from retainer (Fig. 12).
(11) Squeeze cable clip (Fig. 12) and pull cable out of pedal frame.
(12) Remove pedal assembly.

PARKING BRAKE PEDAL INSTALLATION (YJ)

(1) Connect front cable to pedal retainer.

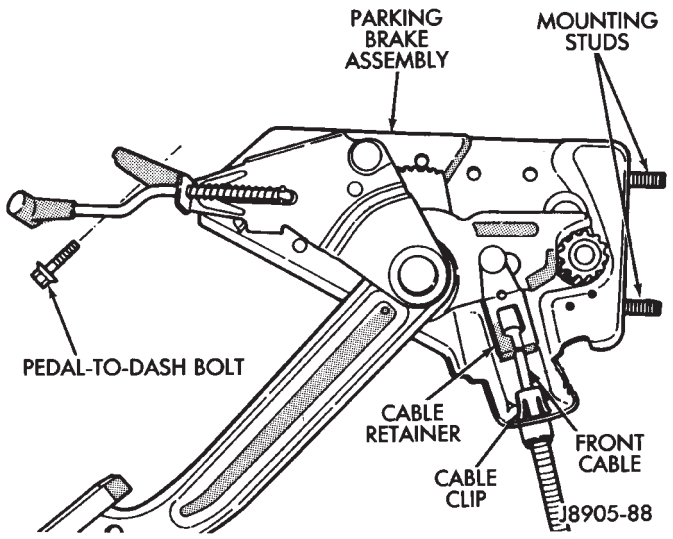


Fig. 12 Parking Brake Pedal Assembly (YJ)

(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.

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. 13).

(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. 14) 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.

(9) Install brake drum and wheel.

(10) Engage cable in equalizer and install equalizer nuts (Fig. 13).

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

PARKING BRAKE FRONT CABLE REPLACEMENT (YJ)

(1) Raise vehicle.

(2) Remove equalizer nuts (Fig. 15).

(3) Remove front cable from equalizer (Fig. 15).

(4) Remove cable-to-frame bracket clip.

(5) Lower vehicle.

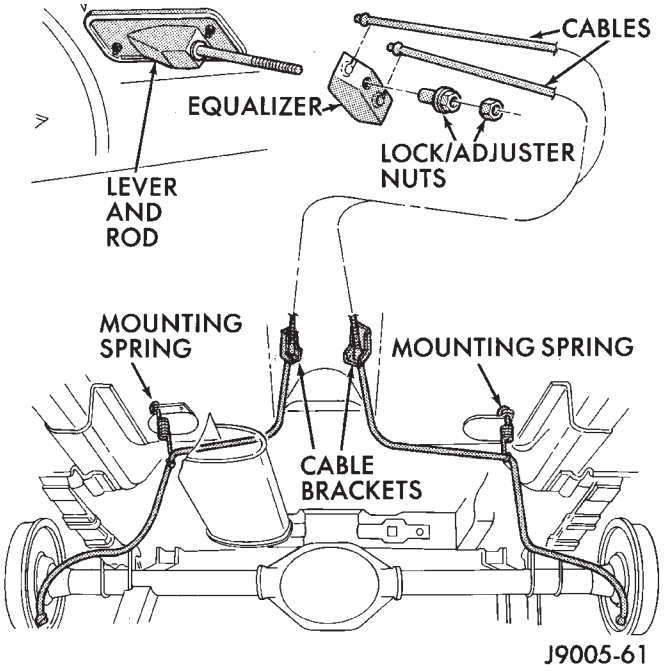


Fig. 13 Parking Brake Cables (XJ)

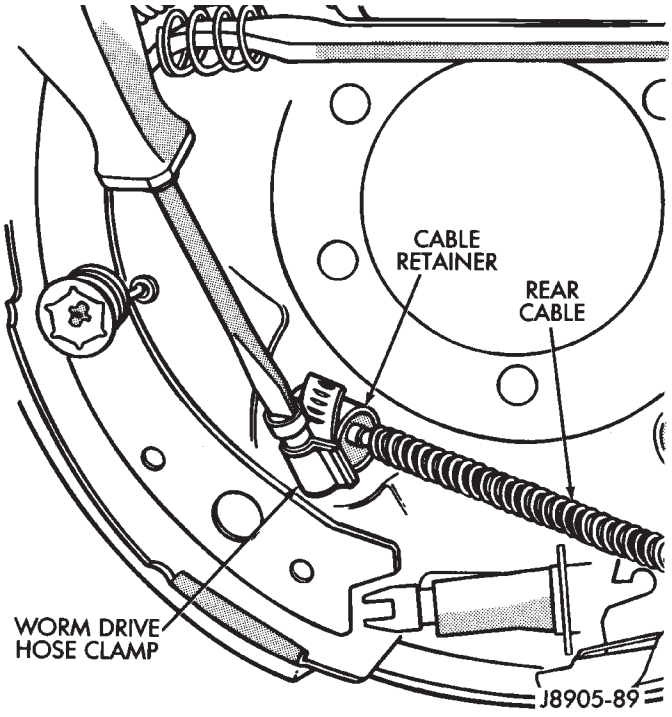


Fig. 14 Compressing Rear Cable Retainer

(6) Move front carpeting away from pedal.

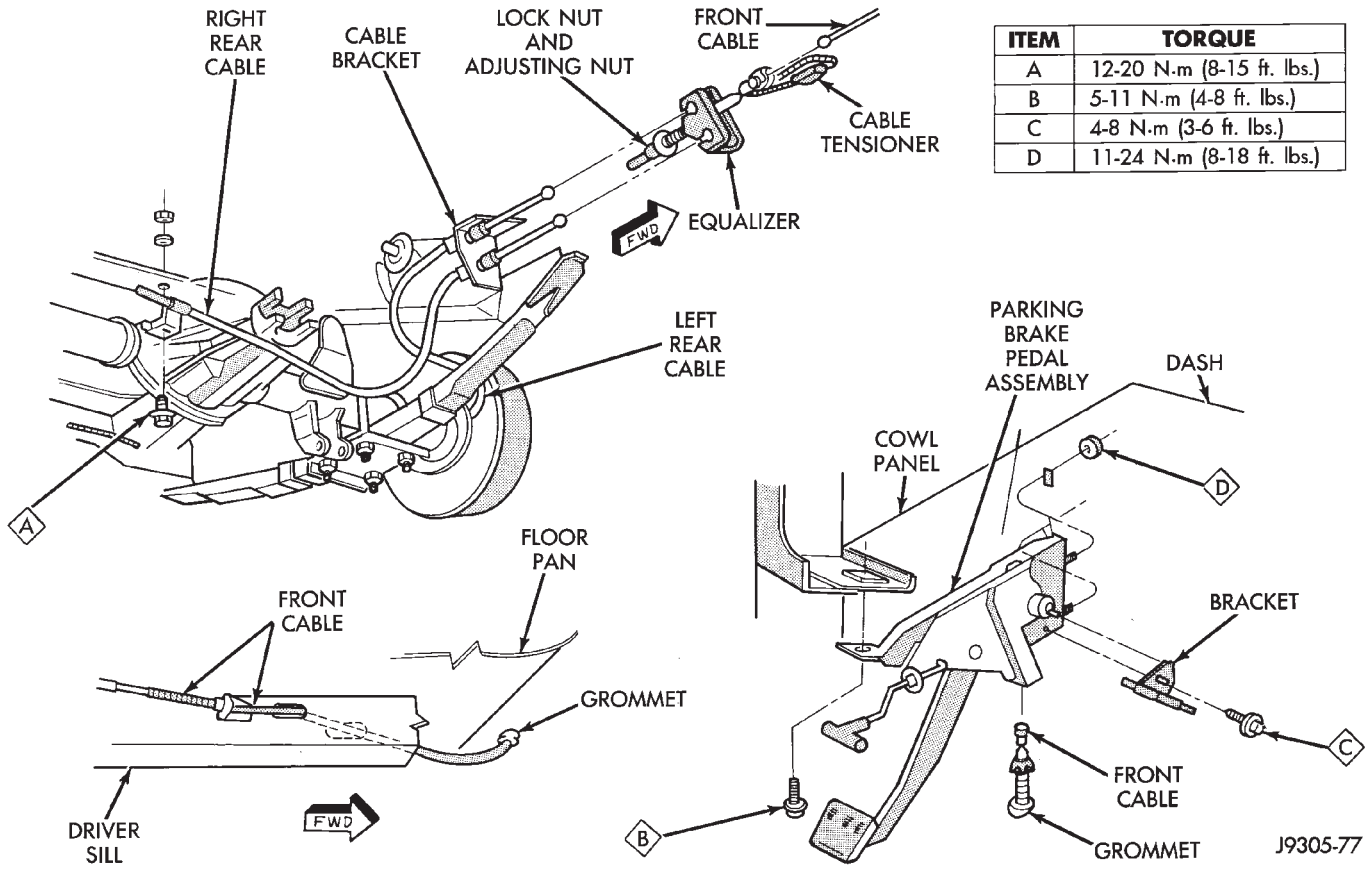
(7) Compress clip securing cable to pedal frame (Fig. 15). Use hose clamp to compress clip.

(8) Disconnect cable from pedal retainer and remove cable.

(9) Remove grommet (Fig. 15) 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.



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. 15 Parking Brake Cables (YJ)

(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.

PARKING BRAKE REAR CABLE REPLACEMENT (YJ)

(1) Raise vehicle and loosen equalizer nuts (Fig. 15).

(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. 14) 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 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. 16).

(9) Tighten adjusting nut at equalizer until mark on tensioner rod moves into alignment with tensioner bracket (Fig. 16). **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.

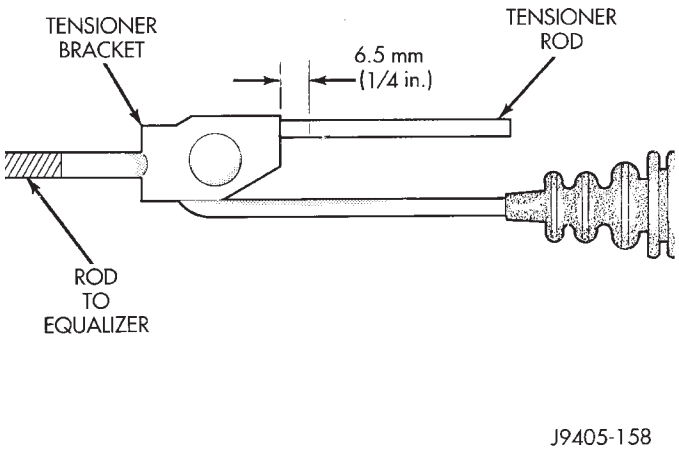


Fig. 16 Placing Adjustment Mark On Tensioner Rod

BRAKE PEDAL AND BRAKELIGHT SWITCH

INDEX

GENERAL INFORMATION

A suspended-type brake pedal is used on all models (Figs. 1 and 2). 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.

BRAKE PEDAL SERVICE

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.

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.

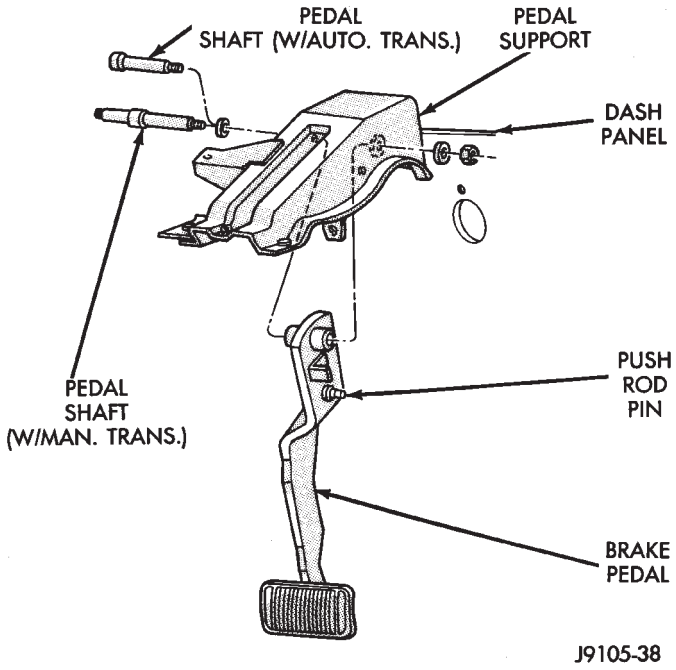


Fig. 1 Brake Pedal And Support Bracket (YJ)

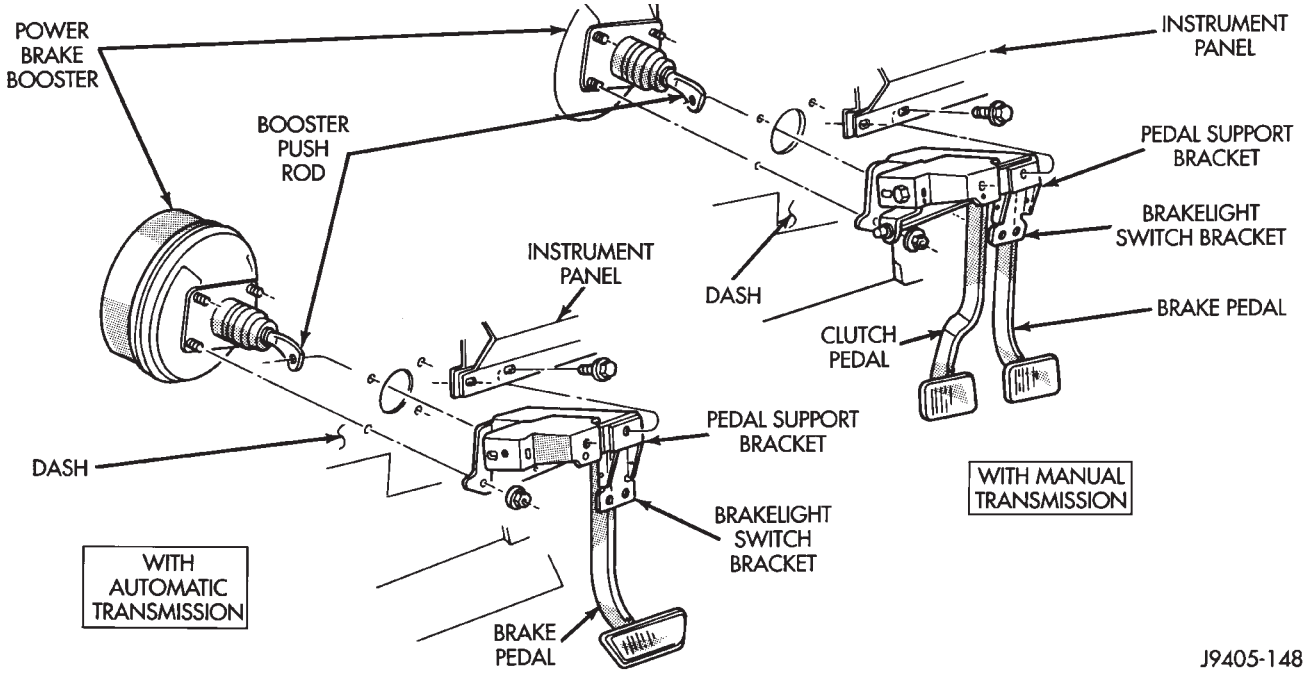


Fig. 2 Brake Pedal And Support Bracket (XJ)

(4) Remove retainer clip securing booster push rod to pedal (Fig. 3).

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

(6) Slide pedal shaft outward for clearance and remove brake pedal.

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

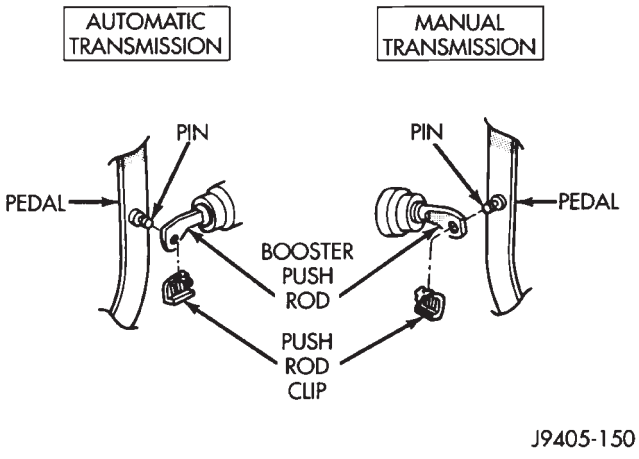


Fig. 3 Push Rod Attachment At Brake Pedal (XJ)

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. 3). Secure push rod with original, or new retainer clip if necessary.

(6) Install dash brace rod, if equipped.

(7) Check and adjust brakelight switch if necessary. Refer to procedure in this section.

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. 4).

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

(2) Disconnect switch wires.

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

(4) Inspect switch retainer. 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.

(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. 4). 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.

A circular, metal clip is used to secure the switch to the bracket on the pedal support. The clip has tangs that seat in the threads of the switch plunger barrel.

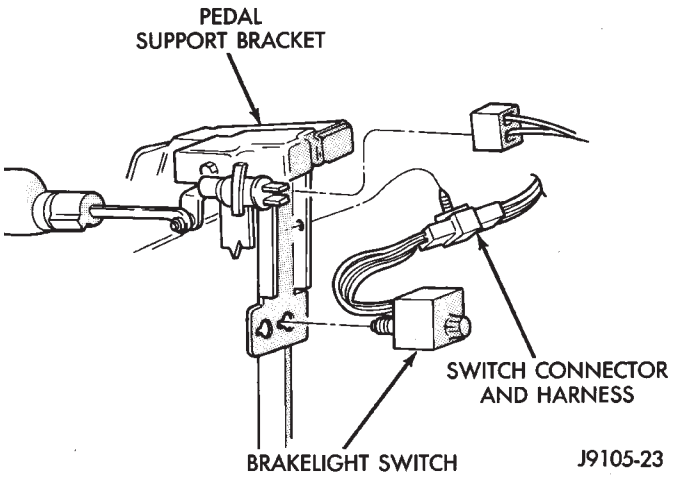


Fig. 4 Brakelight Switch Mounting And Location (XJ/YJ)

SWITCH ADJUSTMENT PROCEDURE

(1) Check switch adjustment. Move the brake pedal forward by hand and note operation of the switch plunger. Plunger should be fully extended 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 fully extend and clearance between pedal and switch barrel 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.

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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