



VEHICLE SERVICING AND REPAIRING LEVEL- II

**BASED ON
ETHIOPIAN OCCUPATIONAL STANDARD
(EOS)**

Learning Guide -25

**Unit of Competence: -Remove, Disassemble and Install
Vehicle System Assemblies**

**Module Title: -Removing, Disassembling and Installing Vehicle
System Assemblies**

LG Code: EIS VSR2 M07 0919 LON-LG-25

TTLM Code: EIS VSR2 TTLM 0919v1

**LO4: Replace/reassemble system
Assemblies**



Instruction Sheet

Learning Guide 4

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Prepare for work
- Remove system assemblies and maintain equipment
- Disassemble system assemblies
- Replace/reassemble
- Clean-up work area

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, **you will be able to –**

- Remove vehicle system assembly according to workplace procedures and manufacturer and component supplier specifications and without causing damage to components or systems

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 20.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask your teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1” **in page -**.
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.



Information sheet- 1 Carry out measurement and adjustment

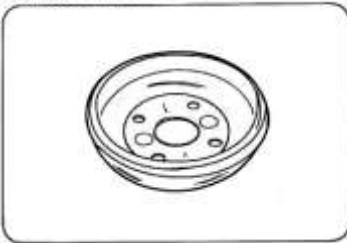
4.1.1. Inspection, Measurement and adjustment of vehicle brake system

► Drum brake

Brake drums must be inspected for excessive wear and damage. As with disc brake rotors, brake drums have certain specifications that must be met or the drum must be machined or replaced.

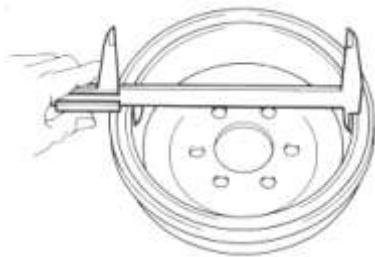
There are many conditions that affect the operating performance of brake drums. Follow the following procedures:

1. Inspect the brake drum.



Visual Inspection

Check the brake drum for cracks and scoring. Excessive scoring will require drum machining or replacement. Also inspect the drum for hard spots. Hard spots are caused by extreme heat and pressure. These hard spots, as well as any excessive scoring must be removed, or drum replacement is required. Any cracks in a brake drum can lead to a drum failure. Cracked drums must be replaced.



Measure brake drum inside diameter

Procedure: - 1. Clean inside part of drum.

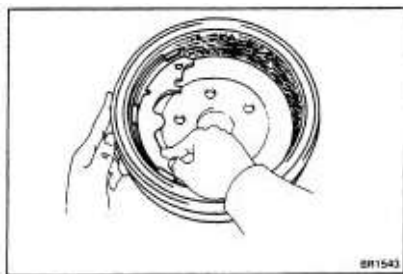
2. Used drum measuring calliper.

Standard inside diameter: 228.6 mm (9.000 in.)

Maximum inside diameter: 230.6 mm (9.079 in.)

If the drum is scored or worn, the brake drum may be lathed to the maximum inside diameter.

Inspect brake lining and drum for proper contact



If the contact between the brake lining and drum is improper, repair the lining with a brake shoe grinder, or replace the brake shoe assembly.

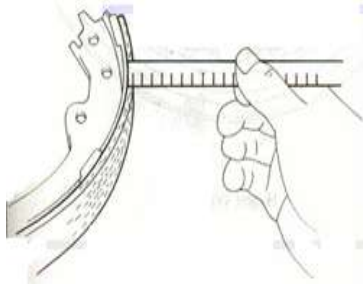
2. Inspect the brake shoe.



Inspect the shoe for damage and the lining for excessive or spot wear.



► Measure brake shoe lining thickness



Procedure: -1. Use steel rule measuring.

Standard thickness: 5.0 mm (0.197 in.)

Minimum thickness: 1.0 mm (0.039 in.)

If the shoe lining is less than minimum or shows signs of uneven wear, replace the brake shoes.

HINT: If any of the brake shoes have to be replaced, replace all of the rear shoes in order to maintain even braking

► Brake shoe clearance Adjustment

Early drum brakes required periodic adjustment to compensate for drum and shoe wear. If not done sufficiently often long brake pedal travel ("low pedal") resulted. Low pedal can be a severe hazard when combined with brake fade as the brakes can become ineffective when the pedal *bottoms out*.

Self-adjusting brakes may use a mechanism that engages only when the vehicle is being stopped from reverse motion. This is a traditional method suitable for use where all wheels use drum brakes (most vehicles now use disc brakes on the front wheels). By operating only in reverse it is less likely that the brakes will be adjusted while hot (when the drums are expanded), which could cause drag brakes that would accelerate wear and increase fuel consumption.

Self-adjusting brakes may also operate by a ratchet mechanism engaged as the hand brake is applied, a means suitable for use where only rear drum brakes are used. If the travel of the parking brake actuator lever exceeds a certain amount, the ratchet turns an adjuster screw that moves the brake shoes toward the drum.

The manual adjustment knob is usually at the bottom of the drum and is adjusted via a hole on the opposite side of the wheel. This requires getting underneath the car and moving the click wheel with a flathead screwdriver. It is important and tedious to adjust each wheel evenly so as to not have the car pull to one side during heavy braking, especially if on the front wheels. Either give each one the same amount of clicks and then perform a road test, or raise each wheel off the

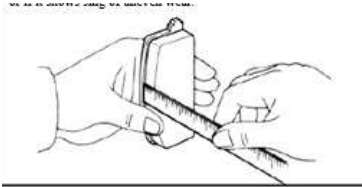


ground and spin it by hand measuring how much force it takes and feeling whether or not the shoes are dragging.

Measure and replace disc brake components

► Measure pad lining thickness

Replace the pad if the thickness is less than the minimum or if it shows signs of uneven wear.

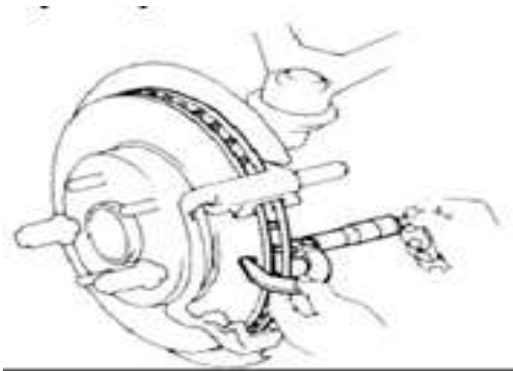


Standard thickness: 10.0 mm (0.394 in.)
Minimum thickness: 1.0 mm (0.039 in.)

► Measure rotor disc Thickness

To measure disc thickness, use an outside micrometer. Disc thickness is measured across the two friction surfaces in several locations. Variation in disc thickness indicates wear. Compare your measurements to the manufacturer's specifications.

Minimum disc thickness will sometimes be printed on the side of the disc. If not, refer to the manufacturer's service manual or a brake specification chart. If disc thickness is under specifications, replace the disc because a thin disc cannot dissipate heat properly and may warp or fail during service.



Standard thickness: 22.0 mm (0.866 in.)

Minimum thickness: 21.0 mm (0.827 in.)

► Brake Disc Run out

The amount of side-to-side movement, measured near the outer friction surface of the disc, is known as brake disc run out. Run out is measured using a dial indicator. Using a magnetic base, attach the dial indicator to the hub. Position the dial indicator so it touches the face of the disc. Rotate the disc by hand and read the indicator.



Compare the indicator reading to factory specifications. Typically, disc run out should not exceed .004 inch. If run out is beyond specifications, resurface the disc to its true friction surface. If the disc is scored or worn or if thickness is less than minimum, repair or replace the disc.

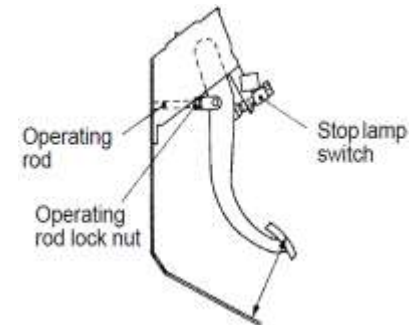
► Checking and adjustment of brake pedal

— Check and adjust brake pedal height

- a. Turn back the floor carpet, etc. under the brake pedal.
- b. Measure the brake pedal height from the asphalt sheet with a steel rule.

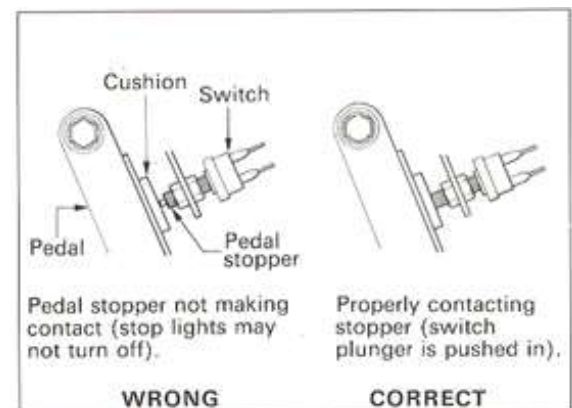
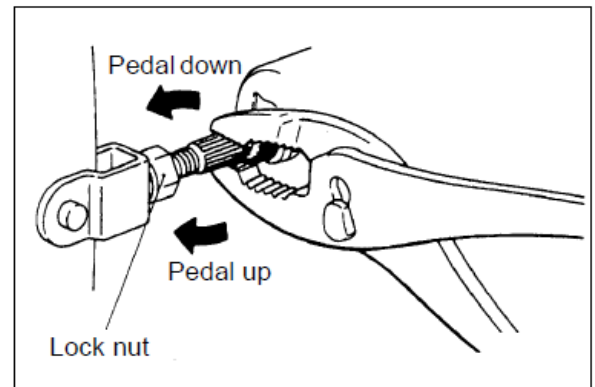
Standard pedal height from asphalt sheet: 151.5 — 161.5 mm
(5.96 — 6.36 in.)

► Measured value: _____ mm



If the brake pedal height is not within the standard value, follow the procedure below:

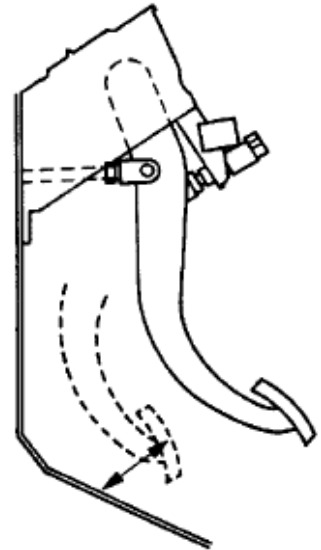
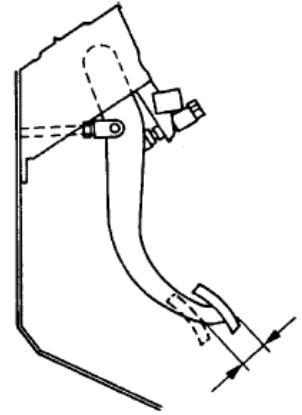
- a. Disconnect the stop lamp switch connector, and sufficiently loosen the stop lamp switch.
- b. Loosen the rod lock nut.
- c. Adjust the brake pedal height by turning the operating rod (pedal push rod) with pliers, until the correct brake pedal height is obtained.
- d. Return the stop light switch until its body lightly contacts the pedal stopper.
- e. Secure by tightening the lock nut of the operating rod.
- f. Connect the connector of the stop lamp switch.
- g. Check that the stop lamp is not illuminated with the brake pedal released.





— **Check pedal free play**

- a. With the engine stopped, depress the brake pedal two or three times to eliminate the vacuum from the power-brake booster.
- b. Push in the brake pedal until the beginning of resistance is felt.
- c. Measure the distance as shown
 - Standard value: 3 to 6 mm
 - Measured value: _____mm
- If necessary, adjust pedal free play
 - If the free play exceeds the standard value, adjust the pedal free play by turning the pedal push rod.
 - Start the engine and confirm that pedal free play exists.
 - After adjusting the pedal free play, check the pedal height.



— **Reserve distance**

- a. Release the parking brake.
- b. Start the engine, depress the brake pedal with approximately 490 N of force (refer the manual), and measure the clearance between the brake pedal and the floorboard.
 - Standard value: _____mm
 - Measured value: _____mm
- c. If the clearance is outside the standard value, trouble shoots the brake system. That is, check for:
 - Air trapped in the brake line,
 - Clearance between the lining and
 - The drum and dragging in the parking brake
- d. Adjust and replace defective parts as required. Turn back the carpet, etc



Operation sheet- 1	Measurement and Adjustment
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1. Measurement and Adjustment of brake system

❖ Measure and Adjust the following component and system

Procedures: - Use the information under 4.1.1, (or information sheet- 1)

1. Drum brake systems
 - I. Measure brake drum inside diameter
 - II. Measure brake shoe lining thickness
2. Measure and replace disc brake components
 - I. pad lining thickness
 - II. rotor disc thickness
 - III. measure rotor disc run out
3. Check and adjust brake pedal
 - I. Check and adjust brake pedal height
 - II. Check and adjust pedal free play



Self-Check -1	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next

Page:-

1. Brake drums must be inspected for _____?
2. _____ is used for measuring inside diameter of brake drum?
3. List down disc brake components that can be measured and write measuring equipment with techniques?
4. How to check and adjust brake pedal?

Note: Satisfactory rating - 5 points

Unsatisfactory - below 5 points

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____



2. Brake Hose Replacement

❖ Replace brake hose

To replace according to the following procedures:

1. Reattach the brake caliper with the original mounting bolts. Be sure to clean the bolt threads and apply thread lock. Tighten the caliper mounting bolts to 129 ft. lbs.
2. Disconnect brake line from brake hose at the frame bracket. Plug brake line to prevent fluid loss. Remove the retaining clip.
3. Remove bolt and gaskets from brake caliper. Remove brake hose. Do not reuse gaskets.
4. Attach new brake hose 170107 to the caliper with the supplied washers and original bolt. *See illustration 18.* Tighten bolt to 32 ft. lbs.
5. Insert brake hose through frame bracket. Install 9/16” USS washer from kit 860554 over fitting on top of bracket.
6. Remove plug and attach brake line to brake hose. While keeping the hose from turning, tighten the brake line fitting to 14 ft. lbs. secure hose to bracket with the new E-type retaining clip.
7. Reconnect ABS electrical connector. Attach wire to upper control arm.
8. Reinstall wheelhouse liner.
9. Repeat steps 1 through 7 for the other side.
10. Bleed front brakes per manufacturer’s recommendations.



Illustration – 18



Operation sheet- 3

Disc brake assembly

3. Front disc brake assembly

❖ Assemble front disc brake

Assembly/installing procedures:

1. Install front disc.

— Aligning the match marks, install the front disc.

Hint: select the installation position where the front disc has the minimum run out.

2. Inspect disc run out.

— Temporarily fasten the disc with hub nuts.

Torque: 103 N/m (1,050 kgf/cm, 76 ft/lbf)

— Using a dial indicator, measure the disc run out 10 mm (0.39 in.) away from the outer edge of the disc. **Maximum disc run out: 0.05 mm (0.0020 in.)**

— If the disc run out is the maximum value or greater, check the bearing play in the axial direction and check the axle hub run out (see page 30–2). if the bearing play and axle hub run out are normal, adjust the disc run out or grind it on a "on-car" brake lathe.

3. Temporary tighten front disc brake bleeder plug.

— Temporarily tighten the bleeder plug, and install bleeder plug cap to the disc brake cylinder.

4. Install piston seal.

— Apply the lithium soap base glycol grease on a new piston seal.

— Install the piston seal to the disc brake cylinder.

5. Install front disc brake piston.

— Apply the lithium soap base glycol grease on the piston.

— Install the piston to the disc brake cylinder.

Notice: do not screw the piston forcedly in the disc brake cylinder.

6. Install cylinder boot.

— Apply the lithium soap base glycol grease to a new cylinder boot. install the cylinder boot to the disc brake cylinder.

Hint: install the boot securely to the grooves of the cylinder and piston.



- Using a screwdriver, install the set ring.

Notice: do not damage the cylinder boot.

7. Install front disc brake bush dust boot.

- Place front disc brake cylinder mounting in vise.
- Apply the lithium soap base glycol grease to seal surface of 2 new bush dust boots.
- Using a socket wrench (19 mm) and hammer drive the 2 bush dust boots to the disc brake cylinder mounting.

8. Install front disc brake cylinder mounting LH.

- Install the disc brake cylinder mounting LH with the 2 bolts.

Torque: 106.8 N/m (1,089 kgf/cm, 79 ft/lbf)

9. Install front disc brake cylinder slide pin.

- Apply the lithium soap base glycol grease to the sliding part and the seal surface of the 2 cylinder slide pins.
- Install the 2 cylinder slide pins to the disc brake cylinder mounting.

10. Install front disc brake pad support plate.

- Install the 2 front disc brake pad support plates to the cylinder mounting.

11. install disc brake pad kit front (pad only)

Notice: if necessary, replace the anti-squeal shim kit when replacing the brake pad.

- Apply disc brake grease to each anti-squeal shim No.1.
- Install anti-squeal shims on each pad.
- Install the pad wear indicator plate facing upward, and install each pad.

12. Install front disc brake cylinder sub-assy.

- Install the disc brake cylinder with the 2 bolts.
Torque: 34.3 N/m (350 kgf/cm, 25 ft/lbf)
- Install a new gasket and flexible hose with the union bolt.
- Torque: 29 N/m (296 kgf/cm, 21 ft/lbf)
- Hint: gasket has 2 types: 2-piece type and 1-piece type.
- Install the flexible hose lock securely in the lock hole in the disc brake cylinder.

13. Fill reservoir with brake fluid.



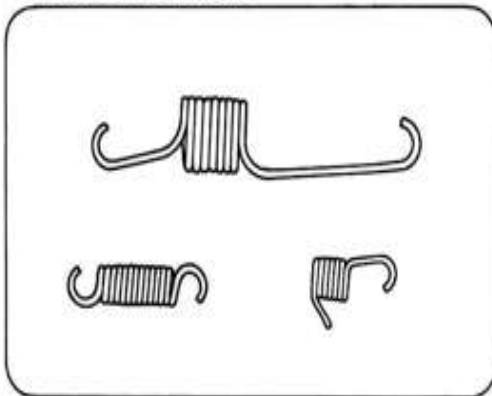
14. Bleed master cylinder.
— SST 09023–00100
15. Bleed brake line.
16. Check fluid level in reservoir.
17. Check brake fluid leakage.
18. Install front wheel.
— Torque: 103 N/m (1,050 kgf/cm, 76 ft/lbf)

Operation sheet- 4	Drum brake components assembly
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4. Drum brake system assembly
 - ❖ Inspect and assemble drum brake components

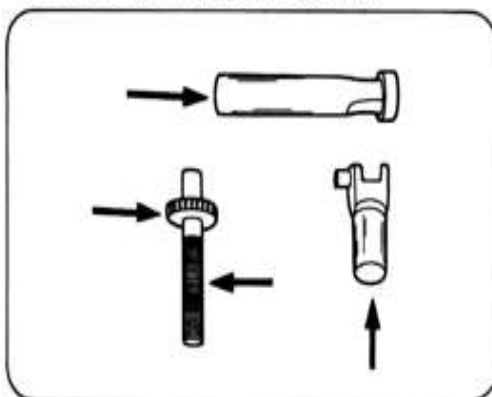
Procedures:

3. Inspect the springs.



- (1) Inspect for damage or deformation.

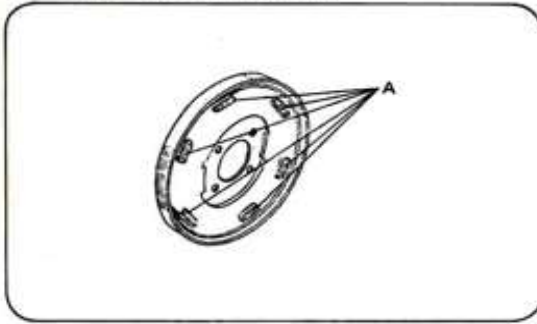
4. Inspect the brake auto adjuster.



- (1) Inspect the tooth face of the parking brake shoe strut set and the bolt for wear, damage or improper movement.

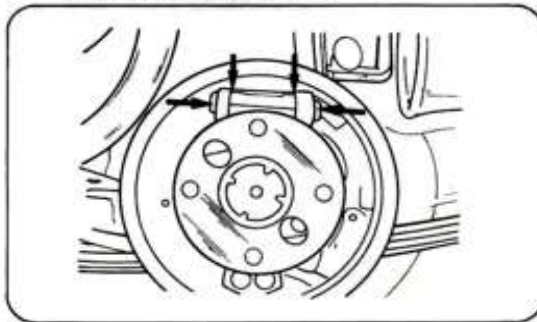


5. Inspect the backing plate.



- (1) Inspect for damage.
- (2) Inspect the shoe contacting surface (A) for wear or damage.

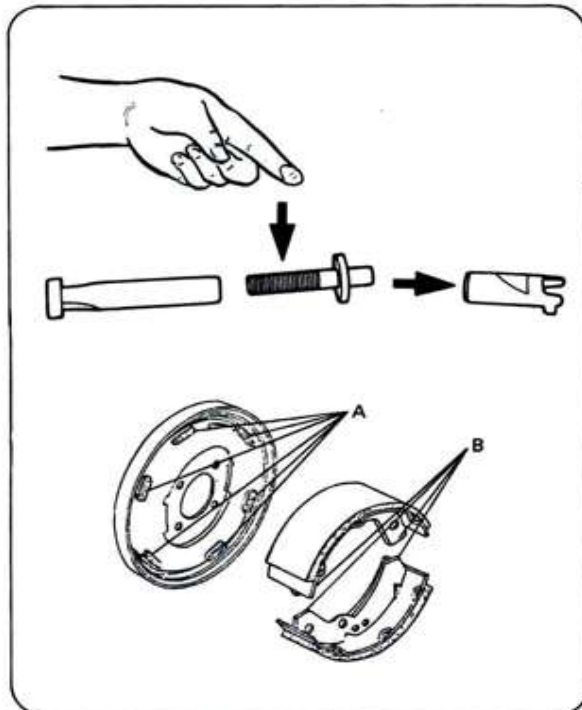
6. Inspect the wheel cylinder.



- (1) Inspect for oil leaks.

Reassembly

Reassemble the brake.



- (1) Pay attention to the following points:
 - a. Ensure the proper position, direction and installing sequence of parts.
 - b. Do not get oil or grease on the brake shoe or on the inner surface of the brake drum.
 - c. Apply a thin coat of the specified grease to the threads of the parking brake shoe strut and to the hole in the support piece.
 - d. Apply a thin coat of the specified grease to the backing plate-to-shoe contacting surface (A).
 - e. Apply a thin coat of the specified grease to the wheel cylinder and to the anchor-to-shoe contacting surface (B).
 - f. Replace the C-washer with a new one.


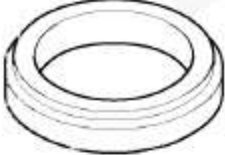
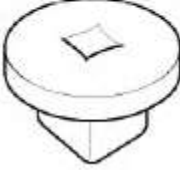


Troubleshooting Chart for Hydraulic Brake







MALFUNCTION	PROBABLE CAUSE	POSSIBLE REMEDY
Low pedal, pedal goes to floor board.	1. Excessive clearance between linings and drum.	1. Adjust brakes.
	2. Automatic adjusters not working.	2. Make forward and reverse stops. If pedal stay low, repair faulty adjusters.
	3. Weak brake hose.	3. Replace hose.
	4. Leaking brake pipe.	4. Repair or replace faulty parts
	5. Leaking wheel cylinder.	5. Clean and rebuild.
	6. Leaking master cylinder.	6. Clean and rebuild.
	7. Leaking master cylinder check valve.	7. Replace valve.
	8. Leaking stop light switch.	8. Replace switch.
	9. Air in system.	9. Bleed system.
	10. Plugged master cylinder filler cap.	10. Clean filler cap vent holes; bleed system.
	11. Improper brake fluid.	11. Flush system and replace with correct fluid.
	12. Low fluid level.	12. Fill reservoir; bleed system.
Springy, spongy pedal.	1. Air trapped in hydraulic system.	1. Remove air by bleeding.
	2. Improper brake fluid.	2. Flush and bleed system.
	3. Anchor pin adjustment incorrect.	3. Adjust anchor pin.
	4. Improper lining thickness or location.	4. Install specified lining or replace shoe lining.
	5. Drums worn too thin.	5. Replace drums.
	6. Master cylinder filler vent clogged.	6. Clean vent or replace cap; bleed brakes.
	7. Weak hose.	7. Replace hose.
Excessive pedal pressure required to stop car.	1. Brake adjustment not correct.	1. Adjust brakes or repair self adjuster.
	2. Incorrect lining.	2. Install specified lining.
	3. Grease or fluid soaked lining.	3. Repair grease seal, or wheel cylinder. Install new linings.
	4. Improper fluid.	4. Flush out system; fill with correct type fluid.
	5. Frozen master or wheel cylinder pistons.	5. Rebuild or replace.
	6. Brake pedal binding on shaft.	6. Lubricate or replace.
	7. Linings installed on wrong shoes.	7. Install primary and secondary linings correctly.
	8. Glazed linings.	8. Sand surface of linings.





SPECIAL TOOLS

Tool (Number and Name)	Use	Illustration
09216-21100 Mount bushing remover and installer	 B'182'100	Removal & installation of lower arm bushing (G) (Use with 09216-21200, 09545-02000)
09216-21200 Mount bushing remover and installer base	 B'182'200	Removal & installation of the lower arm bushing (G) (Use with 09216-21100, 09545-02000)
09532-11600 Preload socket	 E'321'600	Measurement of the lower arm ball joint & stabilizer link starting torque



Tool (Number and Name)	Use	Illustration
09545-02000 Lower arm bushing remover and installer	 E4820000	Removal & installation of the lower arm bushing (G) (Use with 09216-21100, 09216-21200)
09545-11000 Ball joint remover and installer	 E4511000	Installation of the lower arm ball joint
09545-21100 Ball joint dust cover installer	 E4521100	Installation of the lower arm ball joint dust cover
09551-25000 Trailing arm bushing remover and installer	 E5125000	Removal & installation of the trailing arm bushing
09552-25000 Rear suspension arm bushing remover and installer	 E5252140H	Removal & installation of the rear suspension arm bushing (Use with 09545-28100)
09568-34000 Ball joint puller	 E6834000	Separation of the lower arm ball joint



Tool (Number and Name)	Use	Illustration
09546-26000 Strut spring compressor or J38402 Strut spring compressor	 E4626000 EHDA140K	Compression of front coil spring Compression of the front and rear coil spring (Use with A-42 or A-20)
09624-34000 Trailing arm bushing remover and installer	 F2434000	Removal and installation of the lower arm bush (G)



operation sheet- 5

Front suspension system assembly

5. Assemble Front suspension system

I. Suspension inspection

❖ Visual Inspection

A technician who performs a good visual inspection can often discover many items that need attention. Use a logical and systematic approach to visual inspections rather than randomly looking at components that may or may not have anything to do with the situation at hand. Begin your inspection by looking over the entire vehicle, and consider the following:

1. Does the vehicle appear to lean?
2. How do the tires look? Look at the tread for signs of abnormal wear. Take a close look at the tire. Do you see any wear pattern that may be caused by the suspension system?
3. Based on your knowledge of tires and the suspension system, what type of problem or component may relate to the concern?

Once you have completed this initial overall inspection, take a look at.

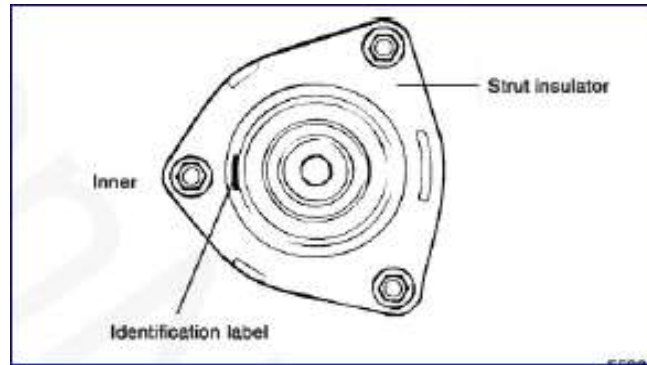


Leaking shocks can no longer effectively dampen the spring and must be replaced

II. Assemble Front strut assembly

Procedures:

1. When installing the front strut, be sure to clear the connecting surface.
2. Install the strut assembly so the identification label on the strut insulator faces toward the inside of vehicle.



3. Tighten the components below to the specified torque as follows.

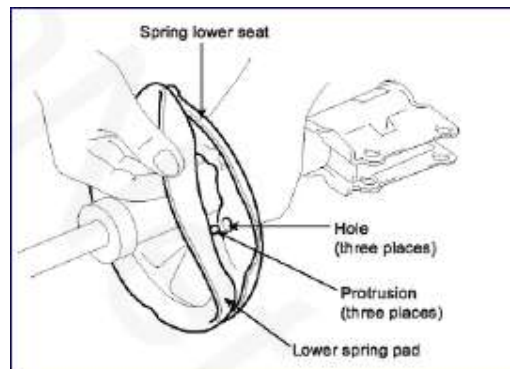
Items	Torque Nm (kgf-cm, lbf-ft)
Front strut upper mounting nut	45-60 (450-600, 33-44)
Front strut to knuckle	140-160 (1400-1600, 104-118)
Stabilizer link nut	35-45 (350-450, 26-33)

4. Install the brake hose and front wheel speed sensor wire on the front strut assembly.

III. Assemble lower spring pad

Procedures:

1. Install lower spring pad so that the protrusions fit in the holes of the spring lower seat.

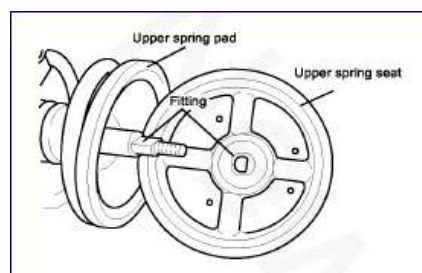


2. Install the dust cover on the shock absorber.

3. Using the special tools (09546-26000 or J38402), compress the coil spring. After the spring is fully compressed, install it on the shock absorber.

Note: - Install the coil spring with the identification mark directed toward the knuckle.

4. After fully extending the piston

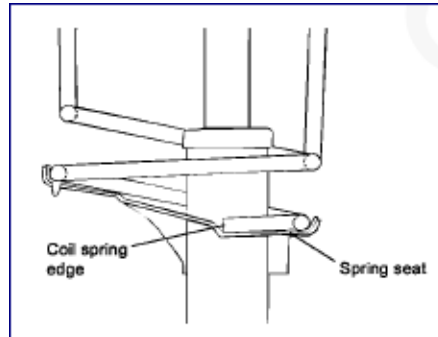


rod, install the



spring upper seat and Insulator assembly. NOTE: - Align the D-shaped hole in the spring seat upper assembly with the protrusion on the piston rod.

5. After seating the upper and lower ends of the coil spring in the upper and lower spring seat grooves correctly, tighten the new self-locking nut temporarily.



6. Remove the special tool- (09546-26000 or J38402).
7. Tighten the self-locking nut to the specified torque.

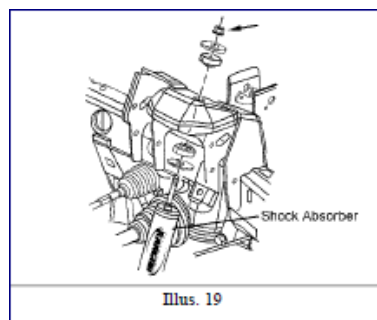
Tightening torque - 50-70 Nm (500-700 kgf-cm, 37-51 lbf-ft)

IV. Assemble shock absorber & end link

Procedures:

Caution: Do not use original shock absorbers.

1. Support the driver side lower control arm.
2. Install washer and bushing on shock absorber stud. Insert shock stud through upper mounting hole. Install bushing, washer and nut. See illustration 19. Tighten the upper nut to 22 ft. lbs.



Illus. 19

See illustration 19

3. Attach lower mount to the lower control arm bracket with the original hardware. Tighten the lower nut and bolt to 59 ft. lbs.



4. Reattach left sway bar end link to flipped sway bar. See illustration 20. Tighten nuts to 32 ft. lbs. **NOTE:** DO NOT flip end links, ONLY sway bar is flipped left to right



Illustration -20

5. Repeat steps 1 through 4 to install the Rancho shock absorber and right end link on the passenger side

v. Assemble torsion bar

Procedures:

1. Fully insert left torsion bar re-locator 176353 into the driver side lower control arm. Align the hex opening as close to the original bushing as possible. See illustration 24. Transfer index mark to re-locator.



Illustration -24



2. Align mark on left torsion bar with mark on torsion bar re-locator. Insert torsion bar into left re-locator.
3. Align marks and install torsion bar arm.
4. Install the adjuster bolt, spacer and adjuster nut. Tighten the adjuster bolt to its original height.
5. Repeat steps 1 through 4 to install right torsion bar re-locator 176352 on the passenger side.
6. Install front wheels and lower vehicle to ground. Tighten the lug nuts to 103 ft. lbs.

vi. Assemble bump stop bracket

Procedures:

1. Remove the bolts attaching the rear bump stop to the frame rail. Remove the bump stop.
2. Place bump stop bracket 176409 on bump stop. Attach the bump stop assembly to the frame rail with the 10mm hardware from kit 860555. See illustration 29. Apply thread lock and tighten bolts to 27 ft. lbs. Do not over tighten.
3. Repeat steps 1 and 2 for the other side.



Illustration – 29

vii. Inspect stabilizer bar

Procedures

1. Check the stabilizer bar for deterioration and damage.
2. Check all bolts for damage and deformation.



3. Check the stabilizer link dust cover for cracks or damage.
4. Check the stabilizer link ball joint for rotating torque.

viii. Assemble stabilizer bar

Assembly is in the reverse order of removal.

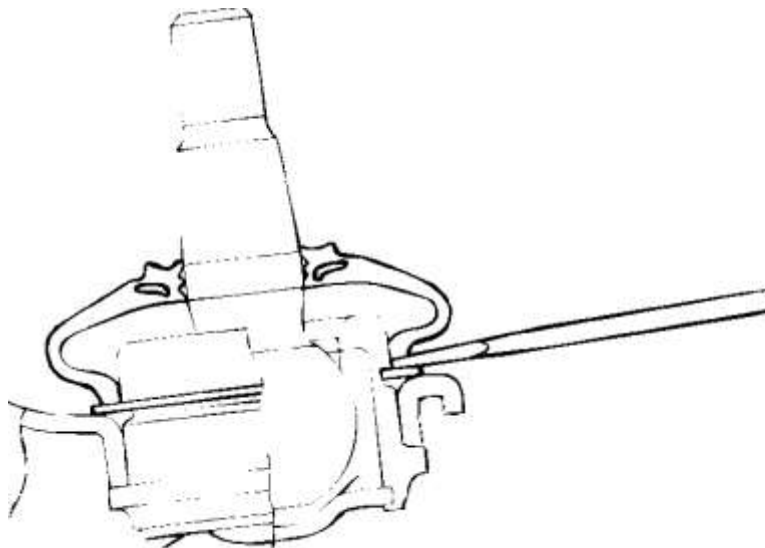
NOTE: - Tighten the components below to the specified torque as follows.

Items	Torque Nm (kgf-cm, lbf-ft)
Wheel nut	90-110 (900-1100, 67-82)
Driveshaft nut	2.0 L : 200-260 (2000-2600, 148-192) 2.7 L : 200-280 (2000-2600, 148-192)
Strut lower mounting	140-160 (1400-1600, 104-118)
Lower arm ball joint nut	60-72 (600-720, 43-52)
Lower arm bushing(A)	130-150 (1300-1500, 96-111)
Lower arm bushing(G)	130-150 (1300-1500, 96-111)
Stabilizer link nut	35-45 (350-450, 26-33)

ix. Replace ball joint and dust cover

Replacing procedures:

1. Using a flat-tipped screwdriver, remove the dust cover from the lower arm ball joint.

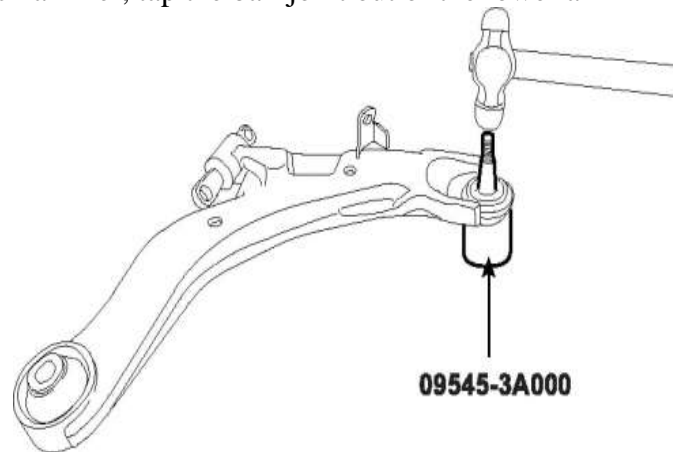


EHDA253D

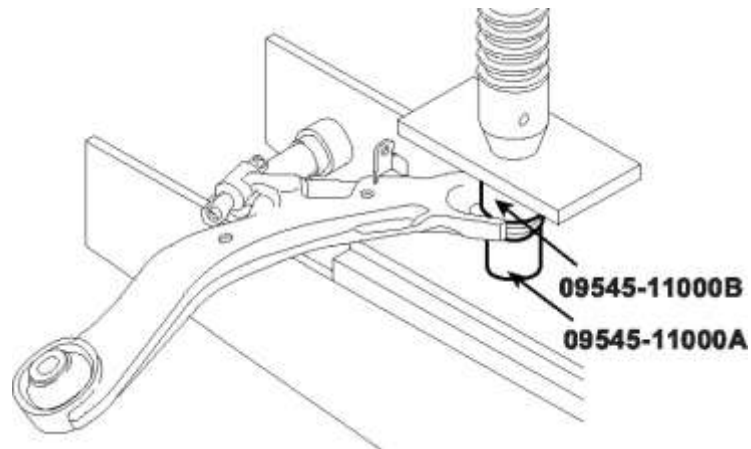
2. Remove the snap ring.



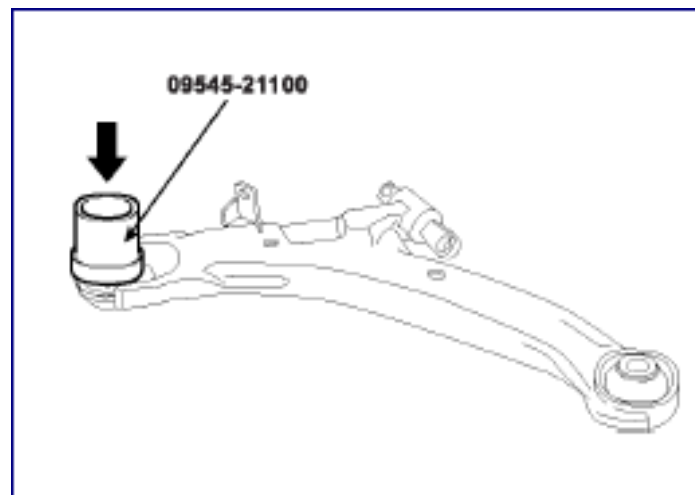
- Using a plastic hammer, tap the ball joint out of the lower arm.



- Using special tool (09545 - 11000), press-fit the ball joint into the lower arm assembly.



- Install the snap ring.
- Using the special tool (09545 - 21100), install the dust cover.

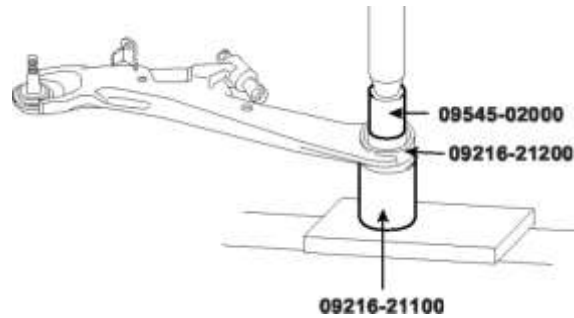




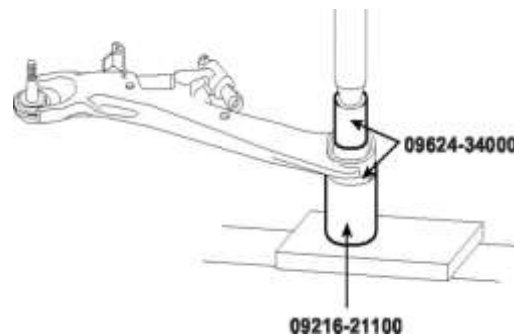
X. Assemble lower arm bushing (g)

Procedures:

1. Install the special tools (09545-02000, 09216-21100 and 09216-21200) on the lower arm.
2. Press out the bushing.

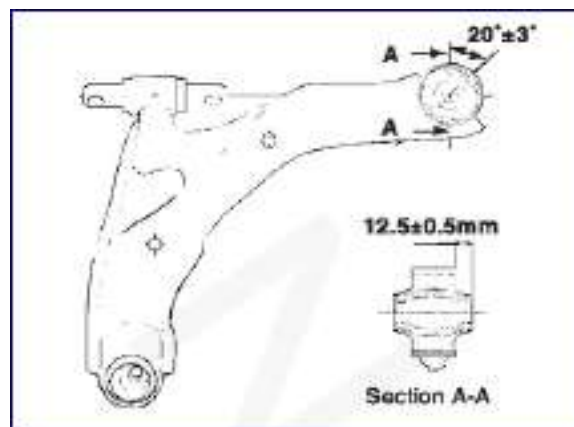


3. Apply soap solution to the following parts.
 - Outer surface of the bushing
 - Inner surface of the lower arm bushing mounting part.
4. Install the new bushing on the lower arm by using special tools (09216-21100, 09624-34000).



Wore - Press-in the lower arm bushing (G) in the same direction as shown in illustration.

Pull out force for the bushing - 80 N [800 kg (f), 11.9 lb (f)] or more





XI. Assemble stabilizer bar bushing

Procedures:

1. Install the bushing on the stabilizer bar.

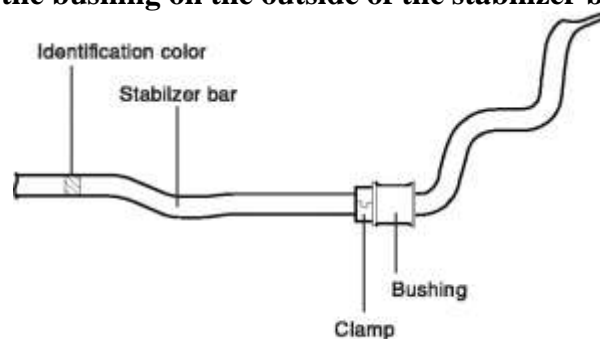
NOTE: -

- a. When installing the stabilizer bar, follow the identification color (ID color) as below.

Model	ID color	Outer diameter
2.0L Sports (HARD)	-	21.8mm (0.86 in.)
2.0L Normal (SOFT)	White	18.8mm (0.74 in.)
2.7L Sports (HARD)	Yellow	21.8mm (0.86 in.)
2.7 Normal (SOFT)	Red	18.8mm (0.74 in.)

ID: Identification

- b. Position the bushing on the outside of the stabilizer bar clamp so as to install it.



EGKSS13A

- c. Let the selection of the bushings be able to be decided by customers.
2. Install the bracket on the bushing.
 3. After tightening the bolts of the bushing bracket temporarily, install the bushing bracket on the opposite side.

Operation sheet- 6 Rear suspension system assembly

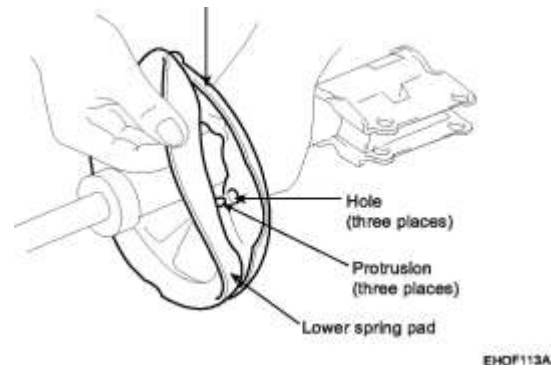
6. Assemble rear suspension arm assembly

I. Assemble lower spring pad

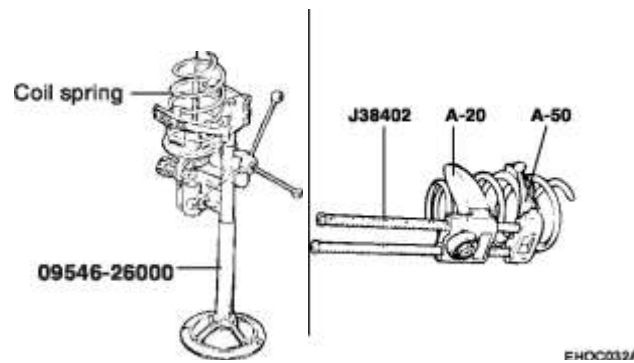
Procedures:

1. Install the lower spring pad so that the protrusions fit in the holes in the spring lower seat.

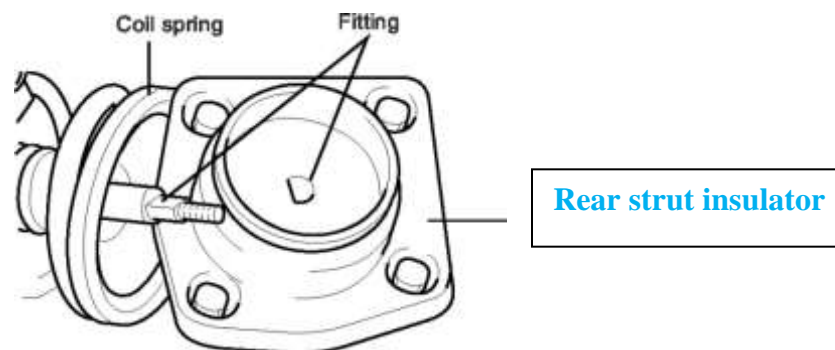
Spring lower seat



2. Install the dust cover on the shock absorber.
3. Using the special tools (09546-26000 or J38402), compress the coil spring.

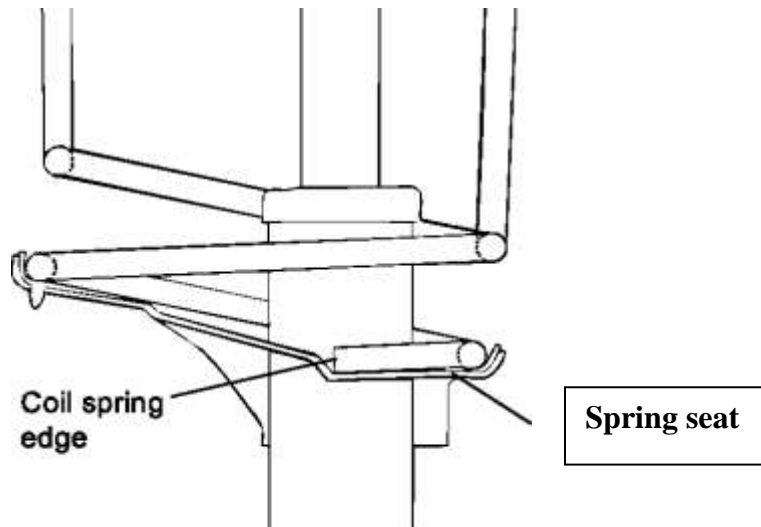


4. After extending the piston rod fully, install the insulator assembly and pipe.
NOTE:- Align the D-shaped hole in the spring seat upper assembly with the protrusion of the piston rod.



5. After seating the lower ends of the coil spring in the lower spring seat grooves correctly, tighten the new self-locking nut temporarily.

CAUTION: - Replace the self-locking nut with new ones after removal.



6. Remove the special tools (09546-26000 or J38402).

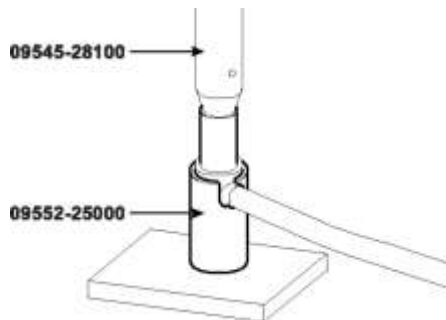
7. Tighten the self-locking nut to the specified torque.

Tightening torque: - 40-60 Nm (400-600 kgf-cm, 29-37 lbf ft)

II. Assemble rear suspension arm bushing

Procedures:

1. Install the special tools (09545-28100, 09552-25000) on the rear suspension arm.



2. Remove the rear suspension bushing.

3. Apply soap solution to the new bushing and the rear suspension arm.

4. Using the special tool (09552-25000), press-fit the bushing.

III. Assemble rear stabilizer bar bushing

Procedures:

1. Install the bushing on the stabilizer bar.

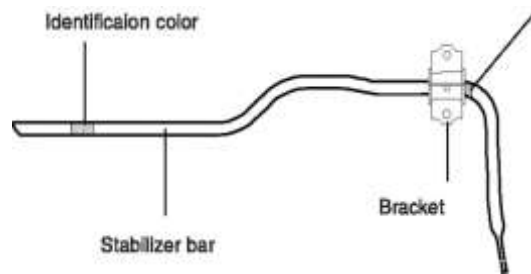


NOTE:-

— When installing the stabilizer bar, follow the Identification color (ID color) as below.

Model	ID color	Outer diameter
GL/GLS	Yellow	16.8mm (0.66 in.)
Sports/Top	Green	17.8mm (0.70 in.)

— After matching the bushing in the inside of the white painted part on the stabilizer bar, install the them.



2. Install the bracket on the bushing.

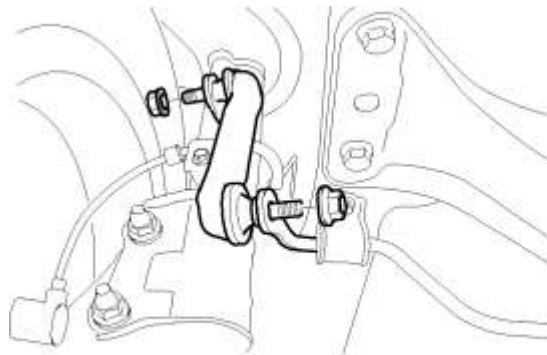
3. Tighten the components below to the specified torque as follows.

► Rear stabilizer bar mounting bracket:

17-26 Nm (170-260 kgfcm, 13-19 lbf ft)

► Rear stabilizer bar link mounting:

35-45 Nm (350-450 kgf cm, 26-33 lbf ft)



EHO240B

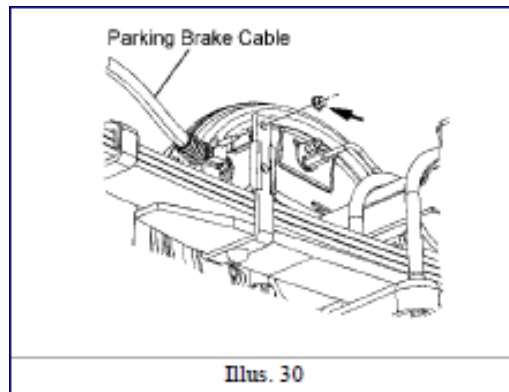
IV. Assemble leaf spring bracket & shackle

Procedures:

1. Loosen the leaf spring front and rear mounting bolts on both sides.



2. Disconnect the parking brake cable from the leaf spring. See illustration 30



3. Remove the leaf spring front mounting bolt. See illustration- 31.

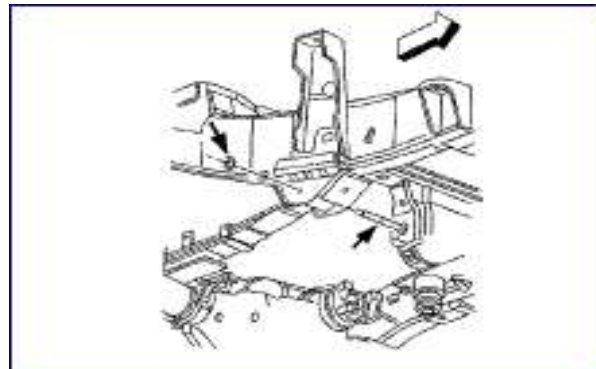


Illustration-31

4. Lower the axle and place leaf spring bracket 176399 over the original frame bracket.
— Using sleeve 420062, attach the bracket to the frame with the original hardware.
See illustration- 32.



Illustration- 32

- **CAUTION:** Do not allow the axle to hang by any hoses or cables. Do not rest the driveshaft on the cross member.



5. Attach the front of bracket 176399 to the frame with the 12mm hardware and larger USS washers from kit 860555. Tighten the 12mm bolt to 55 ft. lbs then the 14mm bolt to 85 ft. lbs.
6. Loosely attach the leaf spring to bracket 176399 with the 14mm hardware from kit 860555.
7. If necessary, lower the spare tire. Remove the rear shackle mounting bolts. See illustration 33. Remove the shackle.

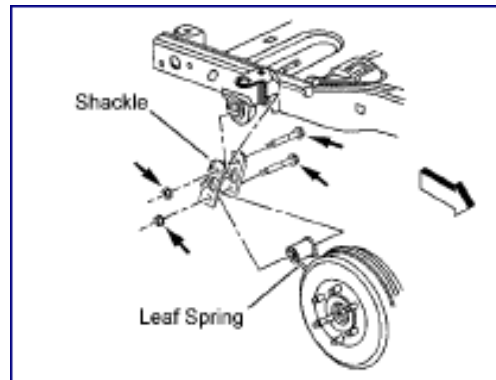


Illustration -33

8. Using the original hardware, loosely attach rear shackle 176413 to the leaf spring and frame bracket. See illustration -34.



Illustration - 34

9. To reattach the parking brake cable, bend the leaf spring bracket slightly inward. Attach cable to bracket with the original bolt.
10. Repeat steps 2 through 9 for the other side.



V. Assemble shock absorber

Procedures:

NOTE: Do not install the original shock absorbers.

1. Attach new Rancho shock absorber to upper mount with the original bolts. See illustration 35. Tighten bolts to 26 ft. lbs.
2. Attach new Rancho shock absorber to lower mount with the original hardware. Tighten nut and bolt to 70 ft. lbs.

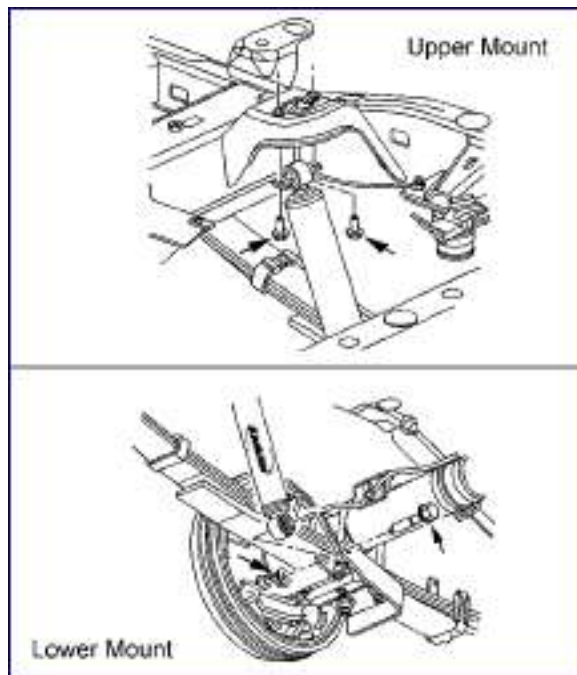


Illustration -35

3. Repeat for other side.
4. Install rear wheels and lower vehicle to ground. Tighten lug nuts to 103 ft. lbs.
5. Tighten the nut and bolt on the leaf spring front mount to 59 ft. lbs. on the first pass. Tighten the leaf spring shackle bolts to 63 ft. lbs.
6. Tighten the nut and bolt on the leaf spring front mount an additional 80 degrees using torque angle meter J 36660-A.



7. Brake fluids

Standards: Brake fluids can be based on the following standards.

- SAEJ 1703
- FMVSS 116 – Federal motor vehicle safety standards
- ISO 4925

Requirements of brake fluid:

- Must remain liquid over a wide range of temperature
- Should maintain the lowest possible viscosity at very low temperatures
- Must resist corrosion
- Must lubricate the hydraulic system moving parts
- Must provide resistance to thermal stress. I.e., must not evaporate easily
- Must be compatible with rubber seals and other components.
- Must be able to absorb water (hygroscopic). Otherwise, the water could freeze and cause brake failure.

Note:-

- Some liquids such as gasoline, kerosene, and oil attack rubber seals and cause them to swell.
- Brake fluids except DOT-5 are aggressive for skins and painted surfaces.
- Poisons if it is swallowed symptoms – headache, dizziness, stomach pains, vomiting, diarrhoea, & loss of consciousness.

Important tests

test as per	FMSS116			SAEJ 1703
Requirements/ Date	DOT 3	DOT 4	DOT 5,5.1	11.83
Dry boiling point min. ⁰ C	205	230	260	205
Wet boiling point min ⁰ C	140	155	180	140
Cold viscosity at -40 ⁰ c mm ² /s	1500	1800	900	1800

The wet boiling point is after 3.5% additional water has been absorbed

Brake fluid level

- Over filling



- Under Filling

Brake fluid level switch

- It comes on when the brake fluid level is below the lower limit. It uses a magnetic float.

Note: -

The lamp goes on when the parking brake is applied and on diesel engines (IC), when the vacuum switch goes on.

Checking the brake fluid level

An important part of a brake system inspection involves checking the level and condition of the brake fluid.

Procedures

- To check the brake fluid on older cars, remove the master cylinder cover. Pry off the spring clip or unbolt the cover. Typically, the brake fluid level should be $\frac{1}{4}$ inch (6mm) from the top of the reservoir.
- On most new cars, the reservoir is translucent and you can see the fluid level without removing the cap. There will be a "full" or "upper" or "**MAX**" mark; the brake fluid should be at this line.



Brake fluid level found: correct: incorrect:

In case the fluid level has to be corrected check service manual for recommended brake fluid!

Brake fluid recommended:

Brake fluid level

- Over filling
- Under Filling

Tips & Warnings

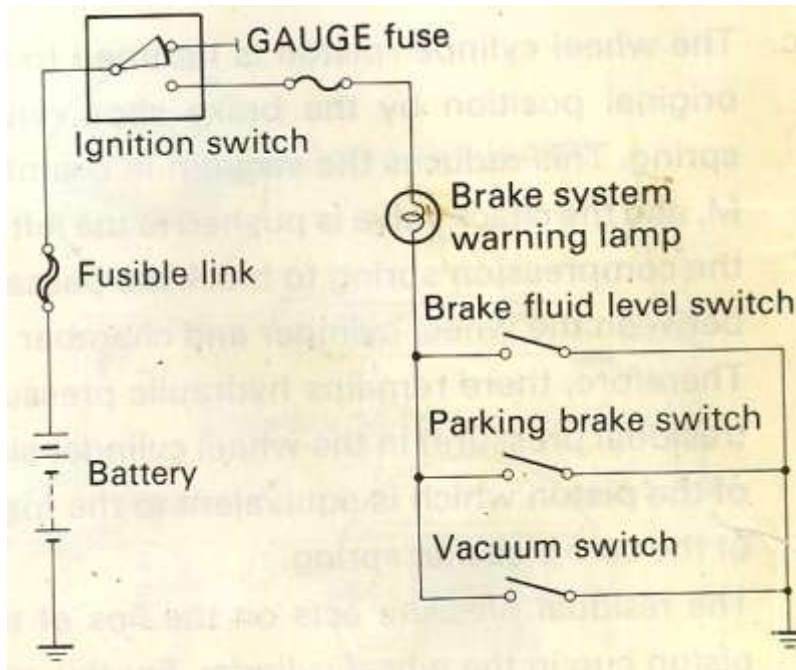
- Brake fluid is very toxic. Keep it away from hands and eyes, and avoid spilling it on the ground. Dispose of empty containers carefully. Be especially careful not to spill brake fluid on your car's paint. (All brake fluids, apart from DOT 5 (silicon based), are aggressive when they come into contact with skin and painted surfaces.
- Wash your hands well after handling brake fluid.



- Don't drive a car that has run out of brake fluid
- Brake fluid will also lift paints and other coatings on contact (DOT 3 and DOT 4).

Brake fluid level warning switch

When the brake fluid level falls below the minimum level, a magnetic float goes down and turns



the switch ON. This activates the brake warning lamp to warn the driver. The warning lamp also goes ON when the parking brake is applied and, on vehicles mounting 1C (Diesel) engine when the vacuum switch goes ON. The circuit diagram is shown below:

Self-Check -2	Written Test
---------------	--------------

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next

Page:-

1. Brake drums must be inspected for _____?
2. _____ is used for measuring inside diameter brake drum.
3. List down disc brake components that can be measured and write measuring equipment with techniques?
4. How to check and adjust brake pedal?



Note: Satisfactory rating - 5 points

Unsatisfactory - below 5 points

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____



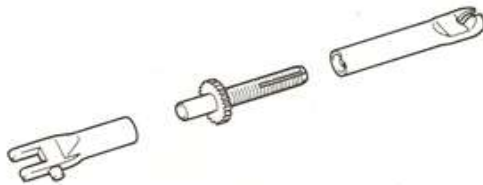
Information sheet- 3 Adjustment of system component

8. Adjustment of drum brake system component

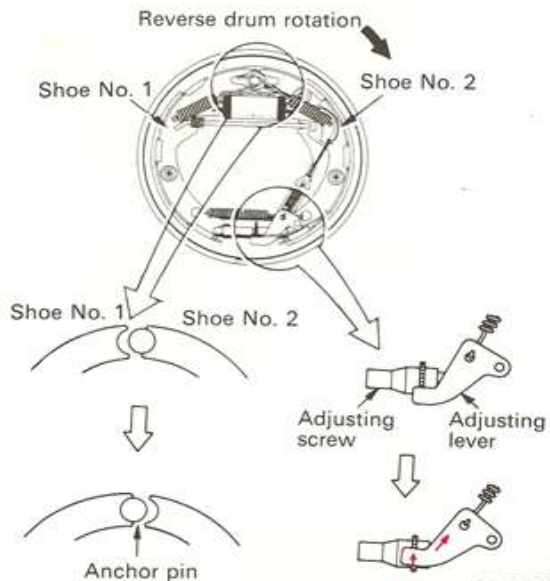
• Operation

When the brake pedal is depressed while the vehicle is moving backward, the brake shoes expand and contact the drum. The shoes are forced by the drum to begin rotating, until the upper end of shoe No. 1 contacts the anchor pin. Since shoe No. 2 is moving away from the anchor pin at the same time, it pulls the adjusting wire. This causes the adjusting lever to turn the shoe adjusting screw and adjust the clearance.

The shoe adjusting screw consists of a bolt and nut as shown.



Since each end of the screw is in contact with a brake shoe, the brake shoe clearance increases and decreases as the screw turns.

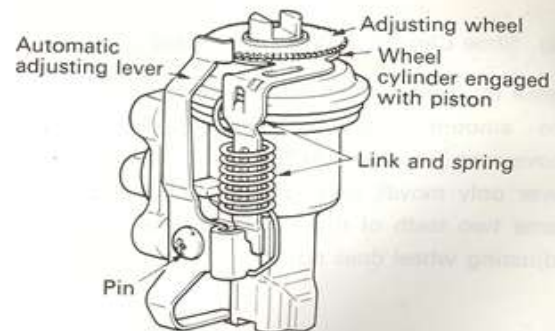


OHP 98

(2) Adjustment Effected by Braking During Forward Travel

One end of the link on the wheel cylinder is engaged with the wheel cylinder piston and moves with the piston as a unit. The other end of the link is connected to the automatic adjusting lever via a spring and transmits the movement of the piston to the automatic adjusting lever.

The automatic adjusting lever is fitted to the wheel cylinder body by a pin. One end of the automatic adjusting lever is connected to a spring, while the other end engages with the teeth of the adjusting wheel. The adjusting lever pivots around the pin in accordance with the movements of the link and thus turns the adjusting wheel. This adjusts the shoe clearance.

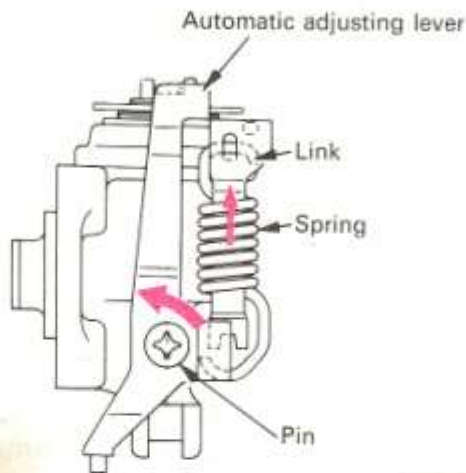


**AUTOMATIC ADJUSTING MECHANISM
(For Front Wheels)**



• Operation

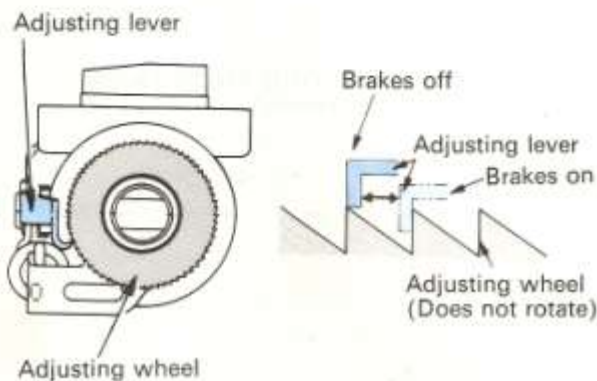
When the brake pedal is depressed, the piston and link move upwards as a unit. This causes the automatic adjusting lever to pivot around the pin in a counterclockwise direction.



OHP 98

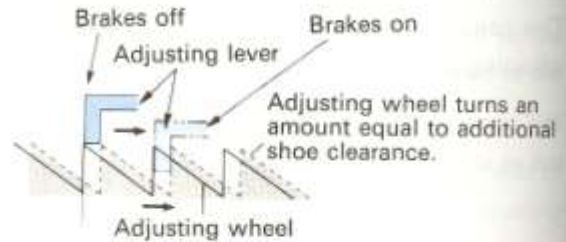
(a) Shoe Clearance Within Standard

Since the amount of piston movement is small, the amount of automatic adjusting lever movement is also small. Therefore, the adjusting lever only moves back and forth between the same two teeth of the adjusting wheel, so the adjusting wheel does not rotate.



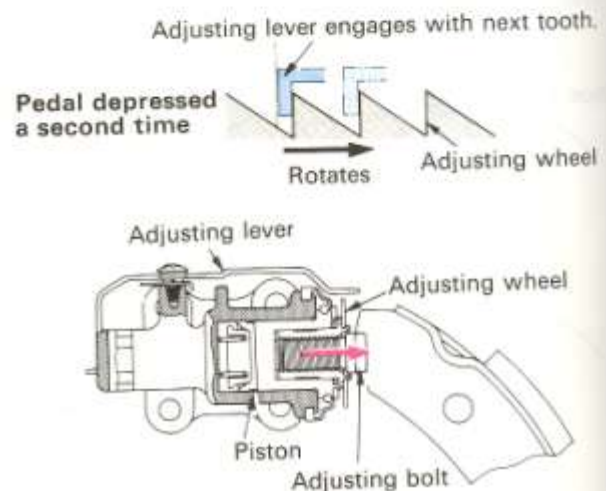
(b) Shoe Clearance Greater than Standard

When the brake pedal is depressed, the amount of piston movement is greater than that of the standard shoe clearance. Therefore, the amount of adjusting lever rotation is also greater, causing the adjusting wheel to turn a little.



When the brake pedal is released, the piston, link and adjusting lever return to their original positions, but since the adjusting wheel has turned from its original position, the adjusting lever engages with the next tooth of the adjusting wheel.

When the brake pedal is depressed the second time, the adjusting wheel rotates, the adjusting bolt moves in such a direction that the brake shoes expand, and shoe clearance is adjusted accordingly.



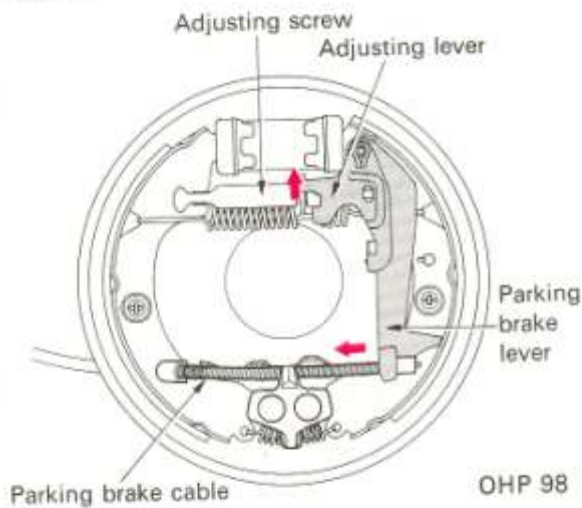


3) Adjustment Effected by Parking Brake

The adjusting lever is fitted, together with the parking brake lever, to the shoes. One end of the adjusting lever is fitted to a brake shoe via a spring, and the other end of the lever engages with the adjusting screw, which is built into the parking brake shoe strut.

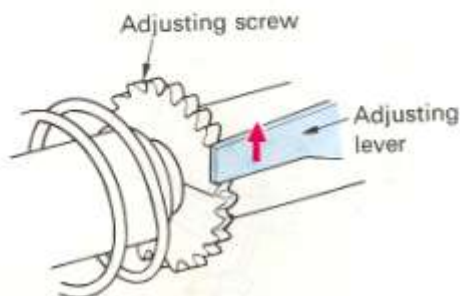
• Operation

When the parking brake is applied, the parking brake lever is pulled to the left. At the same time, the adjusting lever rotates clockwise around the pin to which the shoe is fitted, turning the adjusting screw.

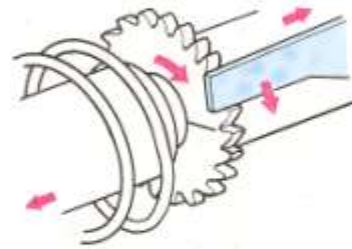


(a) Brake Shoe Clearance Greater than Standard

When the parking brake lever is pulled, the adjusting lever moves an extra distance over to the next tooth of the adjusting screw.

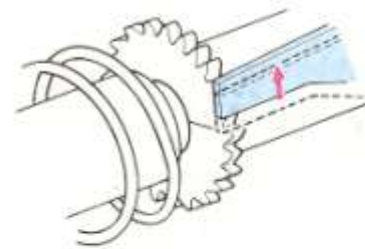


When the parking brake lever is released, the adjusting lever also goes down. This causes the adjusting screw to rotate, adjusting the brake shoe clearance.



(b) Brake Shoe Clearance Normal

When the parking brake lever is pulled, the adjusting lever moves only a small distance and the adjusting lever does not move to the next tooth of the adjusting screw. Brake shoe clearance remains unchanged as a result.



REFERENCE

The adjusting lever is arranged in such a way as to engage with one adjusting screw tooth. Therefore, one operation of the parking brake lever only advances the adjusting screw by one tooth, reducing brake shoe clearance by approximately 0.03 mm, even if brake shoe clearance is large.



Operation sheet- 7

Adjustment of system component

7. Adjust drum brake system assembly

- I. Adjust drum brake shoe clearance.

Procedures: - use the instruction on information sheet – 3



Self-Check -3	Written Test
----------------------	---------------------

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next

Page:-

1. What is your action when brake shoe clearance greater than standard?
2. List down brake system adjusting component with function.

Note: Satisfactory rating - 5 points

Unsatisfactory - below 5 points

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____



Operation sheet- 8

Check that parking brake lever travel and correct

8. Check and correct parking brake lever travel

Use the following procedures:

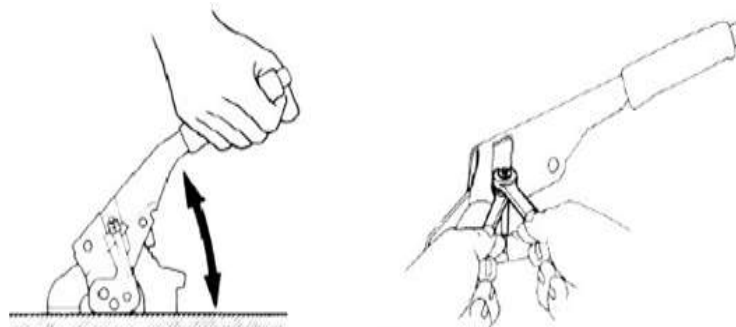
Pull the parking brake lever all the way up, and count the number of clicks.

Parking brake lever travel at 20 kg (44.1 lb., 196 NI): 5 — 8 clicks if incorrect, adjust the parking brake.

If necessary, adjust parking brake lever travel

Hint: before adjusting the parking brake, make sure that the rear brake shoe clearance has been adjusted.

- Remove the console box.
- Loosen the lock nut and turn the adjusting nut until the lever travel is correct.
- Tighten the lock nut.
- Install the console box.



PROCEDURE: Test of Brake Booster

HINT: If there is leakage or lack of vacuum, repair before testing. If Available, use a brake booster tester to check the booster operating Condition.

OPERATING CHECK

- Depress the brake pedal several times with the engine stopped, and check that is no change in the pedal reserve distance.
- Depress the brake pedal and start the engine. If the pedal goes down slightly, operation





is normal.

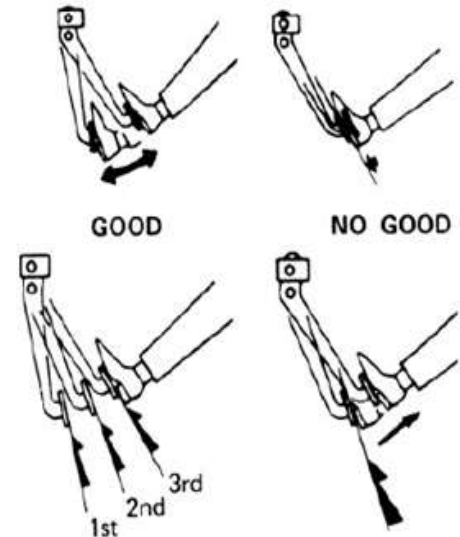
Air tightness check

- a. Start the engine and stop it after one or two minutes.

Depress the brake pedal several times slowly. If the Pedal goes down further the first time, but gradually rises after the second or third time,

The booster is air tight.

Depress the brake pedal while the engine is Running, and stop it with the pedal depressed. If There is no change in pedal reserve travel after Holding the pedal of or this tier seconds, the boost Is air tight?



Operation sheet- 9	Final check and adjustment
---------------------------	----------------------------

9. Final check and adjustment

Procedures:

1. Jounce suspension and move the vehicle to normalize ride height. Verify that the front spindle to fender height is 24.5" to 24.7" and that both sides are equal. If necessary, adjust the tension on the torsion bars to correct the height.
2. Turn the front wheels completely left then right. Verify adequate tire, wheel, and brake hose clearance. Inspect steering and suspension for tightness and proper operation.
3. Readjust headlamps. Have vehicle aligned at a certified alignment facility.

Recommended Alignment Specifications

Caster (degrees): $4.6^{\circ} \pm 1.0^{\circ}$

Camber (degrees): $0^{\circ} - .3^{\circ}$

Sum Toe in (degrees): $0^{\circ} \pm .2^{\circ}$

NOTE: Tie Rod may need to be trimmed to allow proper Sum Toe In adjustment. If Required:

1. Mark the location of the tie rod end on the tie rod. Remove tie rod end. Back the jam nut 1/4" inboard.



2. Trim 3/16" – 1/4" from the end of the tie rod. See illustration 36 for details.
3. Reinstall tie rod end. Secure jam nut against tie rod end.

Information sheet- 4

Fit system assemblies

Fittings

Assorted fittings are used to connect steel tubing to junction blocks or other tubing sections. The most common fitting is the double or inverted flare style.

Double flaring is important to maintain the strength and safety of the system. Single flare or sleeve compression fittings may not hold up in the rigorous operating environment of a standard vehicle brake system. Fittings are constructed of steel or brass. The 37-degree inverted flare or standard flare fitting is the most commonly used coupling. Newer vehicles may use the ISO or metric bubble flare fitting.

Never change the style of fitting being used on the vehicle. Replace ISO fittings only with ISO fittings. Replace standard fittings with standard fittings. The metal composition of the fittings must also match exactly. Using an aluminum-alloy fitting with steel tubing may provide a good initial seal, but the dissimilar metals create a corrosion cell that eats away the metal and reduces the connection's service life.

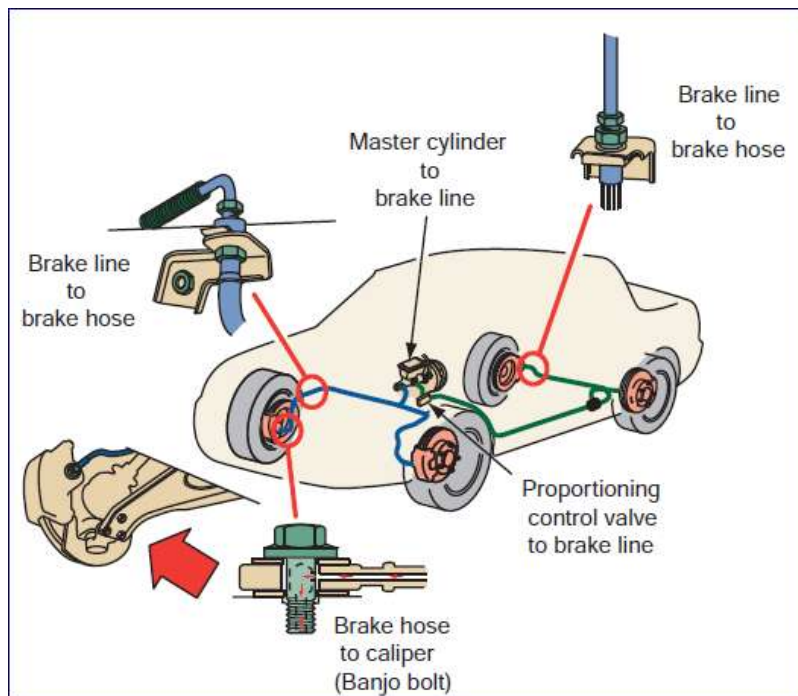


Figure - 1. Typical layout of the hoses and tubes of the brake system and fitting



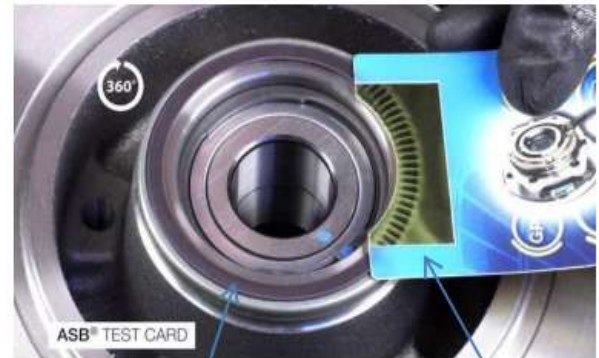
Operation sheet- 10

Fit disc brake system assemblies

Fit system assemblies

Follow the following procedures:

1. Before fitting the new brake disc hub remove the plastic ASB® protective cover.
2. Take care to protect the magnetic encoder from impacts. Avoid all contact with dirty or magnetic surfaces. Check that the magnetic poles are not damaged using the ASB® testing card



ASB® magnetic encoder

ASB® testing card

3. Install the new components in the reverse order to that in which they were removed:
 - Install the new brake disc hub on the stub axle
 - Take care not to damage the ABS sensor
 - Install the new nut
 - Use a torque wrench to tighten the nut to the correct tightening torque specified by the manufacturer, the torque setting can be found on the product label.
 - Install the new grease cap



4. To help insure the correct fitment of the disc hub, NTN SNR list the correct torque setting for the product on the product box label



5. Final steps:

- Re-install the caliper carrier
- Install the new brake pads
- Re-install the brake caliper
- Re-mount the wheel

Recommendations

Follow the vehicle manufacturer's installation procedures and apply the specified tightening torques.

Refer to the vehicle applications in our online catalogue: eshop.ntn-snr.com

Watch the installation video about brake disc hubs on the NTN-SNR YouTube® channel: <https://www.youtube.com/watch?v=MWfSaZorWAw>

**LAP Test 3****Practical Demonstration 4**

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within --- hour.

Task 1. Inspect and measure

- i. Measure brake drum inside diameter and Measure brake shoe lining thickness?
- ii. Measure pad lining thickness and Measure rotor disc thickness?

Task 2. Checking the brake fluid level?

Task 3. Check leaking of

- a. Shocks absorber
- b. Brake fluid
- c. Exhaust system