WORKSHOP MANUAL

Section 7

Brakes
At the time of going to print, the illustrations and text appearing in this workshop manual are representative of manufacture. Whilst retaining the basic features shown herein, the manufacturer reserves the right to make, at any time, and without necessarily updating this manual, any alterations considered convenient for improvement or for any other reason.

Whilst every effort is made to ensure the accuracy of the particulars contained herein, LTI will not under any circumstances be held liable for any inaccuracies or the consequences thereof.
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GENERAL DESCRIPTION

Fig. 1  Braking system – hydraulic layout

The dual line hydraulic braking system is operated by a vacuum servo assisted tandem master cylinder located on the engine bulkhead. The 278 mm (10.9 in.) ventilated disc front brakes with 4-pot brake calipers are complemented by 254 X 70 mm (10 X 2.75 in.) self adjusting drum rear brakes.

Rear brake adjustment is achieved by means of a linkage within each rear brake assembly which operates a ratchet to progressively take up excessive brake shoe travel as the brake linings wear in service.
GENERAL DESCRIPTION

The primary brake hydraulic circuit is connected to one set of opposing cylinders in each front brake caliper and to both rear brakes, the rear brake pipe incorporating a PRV (pressure reducing valve) to reduce the possibility of rear wheel lock up. The secondary brake hydraulic circuit is connected to a second set of cylinders in each front caliper. This 'H + I' hydraulic layout provides braking effort to both front brakes from both the primary and secondary circuits in the system.

One of the pads fitted to the right hand caliper incorporates wiring which illuminates a warning lamp on the facia when the brake pads require replacement. The handbrake is cable operated.

The engine mounted vacuum pump is connected through an in-line non return valve to the brake servo unit, and incorporates a sensor to operate a warning light in the event of failure. The servo unit will provide servo assistance for a number of brake applications should the vacuum pump fail, after which braking effort is still available without assistance.
KEY DATA

BRAKE FLUID
FMVSS 116 DOT 4

FRONT BRAKE DISCS:
- RUN OUT: 0.1 mm (0.004 in.)
- MAXIMUM WEAR PER SIDE: 1.0 mm (0.04 in.)
- MINIMUM THICKNESS: 22.0 mm (0.875 in.)

REAR DRUM BRAKES:
- RUN OUT: 0.1 mm (0.004 in.)
- MAXIMUM WEAR: 2.0 mm (0.08 in.)
- MAX DRUM OVALITY: 0.05 mm (0.002 in.)

TORQUE SETTINGS:

<table>
<thead>
<tr>
<th>Component</th>
<th>Nm</th>
<th>lbf. ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caliper to steering knuckles</td>
<td>92-125</td>
<td>70-92</td>
</tr>
<tr>
<td>Disc to hub</td>
<td>45-55</td>
<td>33-41</td>
</tr>
<tr>
<td>Axle bearing retainer to rear axle</td>
<td>68-81</td>
<td>52-60</td>
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<tr>
<td>Master cylinder to servo</td>
<td>34-51</td>
<td>26-37</td>
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<tr>
<td>Reservoir to master cylinder</td>
<td>5.6-6.8</td>
<td>4-5</td>
</tr>
<tr>
<td>Caliper Bleed screws</td>
<td>7.9-10.1</td>
<td>6-7.5</td>
</tr>
<tr>
<td>Rear cylinder bleed screws</td>
<td>5.1-6.2</td>
<td>4-4.5</td>
</tr>
<tr>
<td>Hoses</td>
<td>13.5-16.0</td>
<td>10-12</td>
</tr>
<tr>
<td>Hydraulic pipe nuts (female)</td>
<td>17.0-20.0</td>
<td>12.5-14.5</td>
</tr>
<tr>
<td>Hydraulic pipe nuts (male) except rear pipe to PRV</td>
<td>14.0-17.0</td>
<td>10-12</td>
</tr>
<tr>
<td>Rear hydraulic pipe to PRV</td>
<td>12.0-14.0</td>
<td>9.0-10.5</td>
</tr>
</tbody>
</table>

Service Requirements

1000 miles/1500 Km
- Check/top-up brake & clutch fluid levels.
- Check/adjust handbrake cable. Lubricate exposed parts of linkage.
- Inspect brake hoses, pipes & connectors for chafes/leakage.
- Check operation of brake fluid level warning light.

9000 miles/15000 Km
- Check/top-up brake & clutch fluid levels.
- Check/adjust handbrake cable. Lubricate exposed parts of linkage.
- Inspect brake hoses, pipes & connectors for chafes/leakage.
- Check front brake pads for wear.
- Clean out rear brake drums check brake linings for wear & replace as necessary. Examine brake mechanism condition & cylinders for leakage.
- Check operation of brake fluid level warning light.
Service Requirements (Cont’d)

18000 miles/30000 Km

Check/top-up brake & clutch fluid levels.
Check/adjust handbrake cable. Lubricate exposed parts of linkage.
Inspect brake hoses, pipes & connectors for chafes/leakage.
Remove front brake pads, examine condition & wear, replace as necessary. Check calipers for signs of leakage.
Clean out rear brake drums check brake linings for wear & replace as necessary. Examine brake mechanism condition & cylinders for leakage.
Check operation of brake fluid level warning light.

54,000 miles (90,000 Km)
& each 54,000 miles (90,000 Km)
thereafter

Replace brake & clutch system fluid & bleed systems.

72,000 miles (120,000 Km) or 3 years
(whichever occurs first)

Examine the master cylinder, calipers and wheel all fluid seals and flexible brake hoses.
Refill the braking system with new fluid of the specific type and bled the braking system.
Replace the brake servo air filter.

Special tools

'E' clip fitting tool
Automation Products STL 107

Caliper piston clamp
SPX Churchill MS 331

Rear Brake Steady Post Retainer compressor
Snap on S 6118 (adapter), TM9CSA (handle)
GENERAL PRECAUTIONS

**NOTE:** Vehicles fitted with the type of braking system fitted to the TX1 have longer brake pedal travel than vehicles with less sophisticated braking systems. Pedal travel will increase as the linings wear and prior to each automatic shoe adjustment. Never try to reduce brake pedal travel by adjusting the handbrake mechanism - with the hand brake 'off', there should be no load on the handbrake operating mechanism.

1. Disc brake pads, drum brake linings, hoses and pipes should be examined regularly at intervals no greater than that specified in the maintenance schedule for the vehicle.

2. Over a period, brake fluid absorbs moisture and becomes contaminated with minute particles from the seals in the hydraulic system. The fluid should be changed completely every 54,000 miles (90,000Km) and each 54,000 miles thereafter.

3. Vehicles operating under severe conditions, in areas where a large proportion of driving takes place on steep hills, brake fluid changes should be made at more frequent intervals.

4. All fluid seals in the hydraulic system and all hoses should be replaced every 72,000 miles (120,000 Km) or 3 years (whichever occurs first). At the same time, the working surfaces of the pistons and bores in the master cylinder, calipers and wheel cylinders should be examined and new parts fitted where necessary.

5. Always use the specified FMVSS 116 DOT 4 brake fluid. Never use petrol or paraffin to clean braking system components - if solvent is required use methylated spirit, or purpose made brake cleaner.

6. Never leave unused brake fluid in unsealed containers where it will absorb moisture and can be dangerous if used in a braking system in this condition.

7. Fluid drained from the system or used in bleeding should be discarded.
GENERAL PRECAUTIONS

8. The necessity for absolute cleanliness when any work is undertaken on the hydraulic system cannot be over emphasized.

9. Brake pads and shoes should always be replaced with those specified by the manufacturer. Always replace pads and shoes in axle sets.

10. Never blow out brake drums. Remove brake dust with a vacuum cleaner or wipe clean with a damp rag.

11. Before carrying out any work on the braking system always relieve the vacuum in the servo unit by operating the brake pedal several times with the engine stopped.

12. Never work under a vehicle when supported only by a jack; always use safety stands however small the service operation involved.

13. While it may not be mentioned in the individual repair operations, it is essential that work is inspected and tested following a repair. Where safety related items are involved, the vehicle should be road tested before being handed over to the customer.
## FAULT DIAGNOSIS

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>POSSIBLE CAUSE</th>
<th>ACTION NECESSARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall of fluid level in master cylinder reservoir.</td>
<td>1. Normal friction pad or brake wear.</td>
<td>Top up the fluid reservoir to the correct level, then check daily for the next few days. If the level again fails significantly carry out the procedure for 'hydraulic fluid leak'.</td>
</tr>
<tr>
<td></td>
<td>2. Hydraulic fluid leak.</td>
<td>Visually check the hydraulic connections for leaks, including the master cylinder, PRV, calipers and wheel cylinders, peeling back rubber boots where necessary. Tighten any loose connections found, but if the leak persists the suspect component must be repaired or replaced.</td>
</tr>
<tr>
<td>Excessive travel of footbrake pedal or the handbrake lever.</td>
<td>1. Failure of one hydraulic circuit in the braking system.</td>
<td>Carry out procedure for 'hydraulic fluid leak' to isolate fault. If no leak is apparent, dismantle the master cylinder, and if the bore and pistons are in perfect condition, service the assembly with the appropriate repair kit otherwise replace the complete master cylinder.</td>
</tr>
<tr>
<td></td>
<td>2. Excessive run-out of brake disc caused by worn or out of adjustment wheel bearings.</td>
<td>Renew or adjust the wheel bearings as specified in the workshop manual. Disc run out can sometimes be improved by fitting the brake disc to the hub in an alternative position. Disc run out should not exceed a dimension of 0.1 mm (0.004 in.).</td>
</tr>
<tr>
<td></td>
<td>3. Handbrake cable out of adjustment or inoperative rear brake adjuster mechanism</td>
<td>Adjust the handbrake rear cable as detailed in the workshop manual. If the fault persists, remove the rear brake drums and check that the automatic rear adjusters are functioning correctly. Rectify as necessary.</td>
</tr>
<tr>
<td>Spongy brake pedal.</td>
<td>1. Fluid level drop in master cylinder reservoir allowing air into the hydraulic system.</td>
<td>Thoroughly bleed the system, refill reservoir to the correct level and carry out the procedure for 'hydraulic fluid leak'.</td>
</tr>
<tr>
<td></td>
<td>2. Faulty brake hose.</td>
<td>Check all hoses for leakage or ballooning under pressure. Replace any defective hoses as necessary.</td>
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## FAULT DIAGNOSIS

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<tr>
<th>SYMPTOM</th>
<th>POSSIBLE CAUSE</th>
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<tbody>
<tr>
<td>Brake drag - all brakes</td>
<td>1. Mechanical binding or obstruction of foot pedal.</td>
<td>Check that the footbrake pedal returns to the 'off' position and is not obstructed for any reason.</td>
</tr>
<tr>
<td></td>
<td>2. Hydraulic pressure build up in the master cylinder.</td>
<td>Slacken the tube nuts at the master cylinder, if this releases the brakes there may be contaminated brake fluid in the system causing rubber components to swell blocking the by-pass ports and trapping hydraulic pressure. Refer to the 'action necessary' below.</td>
</tr>
<tr>
<td></td>
<td>3. Rubber cups or seals swollen due to brake fluid contamination by petrol, paraffin or mineral oil, etc.</td>
<td>Contamination may sometimes be confirmed by the characteristic smell in the fluid reservoir. Although the degree of swelling is relative to the severity of contamination, when withdrawn from the cylinder usually the swollen rubber seals may be easily recognized as oversize. All rubber parts such as cups, seals, and flexible hoses must be changed. Thoroughly flush the system with new brake fluid before fitting the new parts.</td>
</tr>
<tr>
<td>Brake Drag - one brake.</td>
<td>1. Disc pads seized or sticking in a caliper recess.</td>
<td>Remove the split pins, retaining pins and springs, withdraw the pads and clean the caliper recess with a damp rag. Do not blow out with an air line as it could be harmful to inhale the dust. Clean all dirt from the pads and inspect the condition of the anti-seal material on the back of the pads. Ensure the specified pads have been fitted. Refit the pads, retaining pins, springs and split pins and check that the disc spins freely.</td>
</tr>
<tr>
<td></td>
<td>2. Seized piston in disc brake caliper or wheel cylinder.</td>
<td>Remove the disc pads or brake drum as applicable, then carefully depress the foot pedal to check the movement of the pistons in the suspect assembly. If a piston is seized the complete caliper or wheel cylinder must be replaced.</td>
</tr>
<tr>
<td></td>
<td>3. Obstruction in a flexible hose.</td>
<td>Isolate the fault, disconnect the brake hose to confirm the complaint then renew the defective brake hose.</td>
</tr>
<tr>
<td>SYMPTOM</td>
<td>POSSIBLE CAUSE</td>
<td>ACTION NECESSARY</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Brake Drag - one brake.</td>
<td>4. Incorrect adjustment or seizure of the handbrake assembly.</td>
<td>Examine the handbrake cable, clevis pins and yokes etc., also the handbrake mechanism at the brake backplate, if necessary removing the brake drum to confirm correct operation of the seg-adjusting mechanism. Adjust the rear handbrake as necessary.</td>
</tr>
<tr>
<td></td>
<td>5. Weak or broken brake shoe pull off springs.</td>
<td>Remove the brake drum and carefully examine the assembly. If a weak spring is suspected replace all the pull off springs.</td>
</tr>
<tr>
<td>Unbalanced braking with pull or judder</td>
<td>1. Loose caliper mounting bolts, loose backplate, steering and suspension components, tyre pressures or condition.</td>
<td>Check the security of the brake assemblies and for wear on the steering and suspension parts. Ensure the tyres are at the recommended pressures and are in good condition and of the correct type.</td>
</tr>
<tr>
<td></td>
<td>2. Disc brake pads or shoe linings contaminated with oil, grease, or hydraulic fluid.</td>
<td>Examine the brake pads and shoes to confirm complaint then establish the cause of contamination and rectify by replacing any defective parts. A minor degree of friction material contamination may be removed with fine emery cloth, but at the same time moisten with a damp rag as it could be harmful to inhale the dust. Otherwise if contamination is severe the disc pads and brake shoes must be replaced in sets irrespective of their state of wear.</td>
</tr>
<tr>
<td></td>
<td>3. Different grades of pad lining material used in an axle set.</td>
<td>Remove the disc pads or brake shoes and check that the friction material is not of different grades. Otherwise replace the pads or shoes in complete axle sets.</td>
</tr>
<tr>
<td></td>
<td>4. Seized pistons in disc brake caliper or wheel cylinder.</td>
<td>Remove the disc pads or brake drum as applicable, then carefully depress the footbrake pedal to check movement of the pistons in the suspect assembly. If a piston is seized the complete caliper or wheel cylinder must be replaced.</td>
</tr>
</tbody>
</table>
# FAULT DIAGNOSIS

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<tr>
<th>SYMPTOM</th>
<th>POSSIBLE CAUSE</th>
<th>ACTION REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unbalanced braking with pull or judder (continued).</td>
<td>5. If associated with judder, surface condition and run out of discs, or excessive run out of brake drums.</td>
<td>Ensure that the wheel bearings are not worn or out of adjustment, replace or adjust as necessary. Minor disc friction surface imperfections may be removed with a fine emery cloth, if in doubt replace the disc. Check the disc run out which must not exceed a dimension of 0.1 mm (0.004 in.). Check and compare the thickness of the disc at various points around the friction surface. If a thick/thin condition is confirmed replace the disc. Brake discs should not be reground in service. Disc wear must not exceed 0.1 mm (0.004 in.). each side and disc thickness must not be less than 22.0mm (0.875 in.). Rear brake drum judder may be detected by gently applying the handbrake at low speed. Drum run out may be checked with a dial gauge by fitting the brake drum to the hub the wrong way round. Run out must not exceed a dimension of 0.1 mm (0.004 in.). Drum ovality must not exceed a dimension of 0.025mm (0.001 in.).</td>
</tr>
<tr>
<td>Brakes inefficient giving increased brake pedal effort.</td>
<td>1. Servo unit inoperative.</td>
<td>With the engine off depress the brake pedal several times to relieve all vacuum from the servo unit, during this operation the air control valve should hiss every time the pedal is pressed. With all vacuum released, apply light pressure to the brake pedal and start the engine, if the servo is working the pedal will appreciably sink down as the servo operates. With the brakes held on there should be no hiss from the air inlet. These tests are not exhaustive, therefore, if the servo unit gives cause for doubt as to its performance it is advisable to replace the unit.</td>
</tr>
</tbody>
</table>
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<th>POSSIBLE CAUSE</th>
<th>ACTION NECESSARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brakes inefficient giving increased brake pedal effort (continued).</td>
<td>1. Servo unit inoperative. (continued)</td>
<td>A continuous hiss from the servo servo unit vacuum seal may indicate a worn or faulty</td>
</tr>
<tr>
<td>2. Glazed or worn out pads or linings.</td>
<td>Glazed surfaces on pads or shoes can be removed by rubbing down with rough sandpaper, but at the same time moisten with a damp rag as it could be harmful to inhale the dust. Otherwise worn down to the stated limits replace the pads or shoes.</td>
<td></td>
</tr>
<tr>
<td>3. Damaged or rusty friction surface of brake discs.</td>
<td>Examine the brake discs for cracks, scoring, or a rust deposit which after being subject to heat by the pads gives the friction surfaces a black appearance. Minor surface imperfections may be removed with fine emery cloth but such faults may render the disc inefficient, therefore, if any doubt exists renew the disc.</td>
<td></td>
</tr>
<tr>
<td>4. Disc pads or shoes contaminated with oil, grease or hydraulic fluid.</td>
<td>Examine the pads or shoes to confirm complaint then establish the cause of contamination and rectify by replacing any defective parts. A minor degree of friction contamination may be removed with a fine emery cloth, but at the same time moisten with a damp rag as it could be harmful to inhale the dust. Otherwise if contamination is severe the disc brake pads or brake shoes must be replaced in axle sets irrespective of their state of wear.</td>
<td></td>
</tr>
<tr>
<td>5. Seized piston(s) in disc brake caliper or wheel cylinder</td>
<td>Remove the disc pads or brake drum as applicable, then carefully depress the footbrake pedal to check movement of the pistons in the suspect assembly. If a piston is seized the complete caliper or wheel cylinder assembly must be replaced.</td>
<td></td>
</tr>
<tr>
<td>Disc brake squeal.</td>
<td>1. High frequency pad vibration.</td>
<td>Withdraw the disc brake pads. Clean all dirt from the pads and inspect the condition of the anti-squeal coating on the back of the pads. Ensure the specified pads have been fitted. Refit the pads and secure with the retaining pins, springs and split pins.</td>
</tr>
</tbody>
</table>
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<tr>
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<th>POSSIBLE CAUSE</th>
<th>ACTION REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disc brake squeal (continued)</td>
<td>2. Loose caliper mounting bolts.</td>
<td>Confirm this possible cause and rectify by tightening the mounting bolts to 95 - 125 Nm (70-92 lbf. ft.)</td>
</tr>
<tr>
<td>Brake drum squeal</td>
<td>1. Lack of lubrication and/or excessive dust in brake assembly.</td>
<td>Remove the brake drum, then the shoes and other parts and clean the assembly. Do not blow out with an air line as it could be harmful to inhale the dust, but remove the dust with a vacuum cleaner or wipe clean with a damp rag. Lightly smear with Lockheed Expander lubricant the tips of the brake shoes, the cylinder and abutments slots, also the area of the backplate where the brake shoe platforms make contact. Ensure that the friction surface of the drum is clean, do not allow the grease to contact the shoe linings, rubber parts or the friction surface of the drum.</td>
</tr>
</tbody>
</table>
FRONT BRAKE PADS

Fig 2. Front disc brake components

The clamp illustrated will assist with caliper piston retraction, also with fitting of the new metal wiper seal retainers.

This service tool is available under part no. MS331 from the manufacturers SPX UK Ltd, Churchill Way, High March Ind Est. Daventry, NN11 4SF, UK. Tel 01327 704461

BRAKES Section 7

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FRONT BRAKE PADS

Remove/ Replace/ Examine

NOTE: BRAKE PADS MUST ALWAYS BE REPLACED IN AXLE SETS USING THE NON ASBESTOS REPLACEMENT BRAKE PADS SPECIFIED BY THE MANUFACTURER. NEVER REPLACE BRAKE PADS INDIVIDUALLY OR AS A SINGLE WHEEL SET. SERIOUS CONSEQUENCES COULD RESULT FROM OUT OF BALANCE BRAKING DUE TO A MIX OF BRAKE FRICTION MATERIALS

1. Apply the handbrake and chock the rear wheels. Remove the front hub caps and partly release the front wheel nuts. Raise the front of the vehicle and support it on stands placed under the chassis members. Remove the road wheels.

2. Disconnect the plug of the lead to the brake wear sensor fitted to the inner brake pad of the right hand side brake by pressing the square sides of its socket to release the latches on the side of the plug.

3. Working on one caliper at a time, clean the outside of the caliper assembly (use methylated spirit and a wire brush d necessary to move excessive road dirt).

4. Remove the two split pins which secure the pad retaining pins. Withdraw the retaining pins and springs. Lift the pads out of the caliper assembly.

5. Examine the brake pads. Regardless of the state of wear, the pads must be replaced if there is any sign of cracking between the friction material and the metal backplate. If the friction material has worn down to 3mm (0.125 in.) the pads must be replaced.

6. Fit the brake pads into the caliper assembly - the pad with the sensor leads should be fitted to the inside of the right hand brake assembly and the sensor plug reconnected.
FRONT BRAKE PADS

Remove/ Replace/ Examine (Cont'd)

NOTE: When new pads are replacing well worn pads it will be necessary to carefully press the brake pistons into the caliper housings. During this operation brake fluid will be displaced. To prevent the reservoir overflowing, fit a bleed tube to the relevant brake bleed screw and release the brake fluid into a container. Retighten the bleed screw when the pistons are fully retracted. Discard the removed brake fluid.

Check the bearing edges of new pads for blemishes (high spots on the steel pressure plates may be carefully removed with a smooth file).

7. Refit the pad retaining springs and springs. Secure the retaining pins with split pins using new parts as required.

8. Repeat operations 3 - 7 for the other side of the vehicle.

9. Refit the front road wheels tightening the securing nuts as much as possible.

10. Lower the vehicle and torque the wheel nuts to specification (torque 200 Nm, 150 lbf. ft). Replace the hub cap.

11. Operate the foot brake to 'bed' the brake pads. Check the brake fluid level in the fluid reservoir and correct as necessary. Always use new brake fluid to specification FMVSS 116 DOT 4.

NOTE: Remember new brake pads may take several hundred miles to fully 'bed in'. The 'bedding in' process will be extended if the brake discs are not in good condition.
FRONT BRAKE DISC

Remove/ Replace

1. Remove the hub cap and partly release the wheel nuts. Chock the rear wheels. Raise the front of the vehicle and support it on stands placed under the chassis members. Remove the road wheel.

2. Make a suitable wire support for the brake caliper assembly and hang the support on the chassis side member behind the front suspension. Remove the two bolts securing the brake hose securing bracket to the steering knuckle. (When working on the right hand side, remove the brake pad wear sensor lead plug by pressing the square sides of its socket to release the latches on the side of the plug. The earth lead for the sensor is under the head of the hose securing bracket inner bolt). Remove the two bolts securing the caliper assembly and carefully hang the assembly on the wire support so that the brake hoses are not stressed and the caliper is not damaged.

3. Remove the hub dust cap with a suitable lever. Remove the split pin, nut retainer, hub bearing nut and tab washer.

NOTE: The hub bearing nut should normally be at most just finger tight.

4. Carefully pull the hub and disc assembly from the steering knuckle spindle to release the outer hub cone, and remove the hub and disc assembly.

5. Support the hub assembly in a road wheel to allow the brake disc cap screws to be removed and discarded. Check the disc mounting surface is clean and free from burrs and imperfections before fitting a new disc with new cap screws (torque 45-55 Nm, 33-41 lbf. ft.).
FRONT BRAKE DISC

Remove/ Replace (Cont’d)

Fig 3. Front hub – adjustment sequence

NOTE: Brake disc wear must not exceed 1 mm on either side of the disc, and disc thickness must not be less than 22mm (0.0875 in.). Brake discs may not be reground in service.

6. Fit the hub, outer bearing, tab washer, and hub nut.

7. Use a suitable torque wrench to tighten the hub nut to 7 Nm (5 lbf. ft.) while spinning the hub.

NOTE: Do not over tighten the hub nut as this could cause permanent damage to the hub bearings.

8. Slacken the hub, nut without disturbing the hub. Tighten the hub nut again, FINGER TIGHT ONLY.

9. Fit the hub retainer without disturbing the hub nut so that one of the tabs on the retainer partly covers the left hand side of the split pin hole in the stub axle (see Fig 3. - illustration A).

10. Slacken the nut and nut retainer until the split pin hole is fully exposed (see Fig 3. illustration B), to give the correct bearing end float of 0.025 - 0.152 mm (0.001-0.006 in.)
FRONT BRAKE DISC

Remove/ Replace (Cont’d)

NOTE: Never set the front wheel bearings too tight; the bearing nut should be loose after following this setting procedure. Correctly set the bearings should have just perceptible end float - if in doubt check the end float with a dial gauge.

11. Fit a new split pin, and replace the hub dust cap.

NOTE: If a new brake disc has been fitted, the brake disc run out must be checked with a dial gauge. Brake disc run out must not exceed 0.1 mm.

12. Check the brake pad wear and replace the pads as necessary. Refit the brake calipers and torque the two caliper securing bolts to specification 95 -125 Nm, 70-92 lbf. ft. Remove the wire caliper support.

13. Replace the brake hose securing bracket and earth lead (RHS only), ensuring the brake hoses follow their natural curve clear of the suspension. Refit the brake pad wear sensor lead plug (RHS only).

14. Refit the road wheel tightening the securing nuts as much as possible.

15. Lower the vehicle and torque the wheel nuts to specification (torque 200 Nm, 150 lbf. ft.). Replace the hub cap.

16. Start the engine and pump the brake pedal to position the brake pads to their correct position. Stop the engine.
Front Brake Calipers

Remove/ Replace/ Overhaul

**NOTE:** THE CALIPER UNIT IS SERVICED AS A COMPLETE ASSEMBLY, LESS BRAKE PADS. DO NOT ATTEMPT TO SEPARATE THE TWO HALVES OF THE CALIPER ASSEMBLY TO REPLACE THE PISTON SEALS.

1. Remove the brake pads as previously described. Place a receptacle under the caliper to receive any displaced brake fluid. Remove the bolts securing the caliper assembly to the steering knuckle, disconnect and plug the hydraulic pipes to prevent dirt ingress and fluid loss, and remove the caliper assembly. If the caliper assembly is to be overhauled, thoroughly clean the outside of the caliper assembly and the pad recesses using methylated spirit or brake fluid. If the caliper assembly is to be replaced, proceed to operation 9.

2. Use the special tool MS 331 to hold two adjacent pistons into the caliper body. Place a suitable block of wood into the caliper recess to hold one of the remaining pistons.

**NOTE:** CARE SHOULD BE TAKEN WHEN CARRYING OUT THE NEXT OPERATION TO ENSURE THE FINGERS ARE NOT TRAPPED AS THE PISTONS ARE EJECTED FROM THE PISTON BORES.

Place a rag into the brake caliper recess to protect the unsupported piston. Apply gentle air pressure from an air line to the brake pipe orifice leading to the unsupported piston to eject the piston from its bore until it is sufficiently exposed to allow it to be removed by hand.

**NOTE:** If any of the pistons is seized, the complete caliper assembly must be replaced.
FRONT BRAKE CALIPERS

Remove/ Replace/ Overhaul (Cont’d)

Fig 4. Caliper – piston seals
FRONT BRAKE CALIPERS

Remove/ Replace/ Overhaul
(Cont’d)

3. The wiper seal can be removed by inserting a blunt screwdriver between the retainer and the seal to prise the retainer carefully from the mouth of the piston bore. Taking great care not to damage the seal grooves in the cylinder bore, extract the wiper seal and the fluid seal.

4. Thoroughly clean the bore, piston and the seal grooves with new brake fluid or methylated spirit. If the caliper or piston is corroded, or their condition is not perfect, the parts must be replaced.

5. Coat the new fluid seal with Lockheed Disc Brake Lubricant. Ease the seal into the groove in the bore using only the fingers, ensuring that it is correctly seated into the groove. The fluid seal groove and the seal are not the same in section, thus when bedded the seal feels proud to the touch at the edge furthest from the mouth of the bore.

6. Slacken the relevant bleed screw on the caliper one complete turn and after lightly coating the piston with Lockheed Disc Brake Lubricant insert it squarely into the bore using only the fingers. Do not tilt the piston during insertion and leave approximately 8 mm (5/16 in.) protruding from the mouth of the bore.

7. Coat a new wiper seal with Lockheed Disc Brake Lubricant and fit it into the new seal retainer. Slide the assembly squarely, seal first, over the protruding piston and up to the bore mouth. Carefully push home the seal retainer and the piston using the special tool MS 331. Tighten the bleed screw.

8. Repeat operations 2 - 7 for each of the other pistons.
FRONT BRAKE CALIPPERS

Remove/ Replace/ Overhaul (Cont’d)

9. Refit the brake calipers and torque the caliper securing bolts to specification 95 -125Nm, 70-92 lbf. ft. Reconnect the brake pipes. Fit new brake pads into the caliper assembly as previously described - the pad with the sensor leads should be fitted to the inside of the right hand brake assembly and the sensor plug reconnected.

NOTE: BRAKE PADS MUST ALWAYS BE REPLACED IN AXLE SETS USING THE NON ASBESTOS REPLACEMENT BRAKE PADS SPECIFIED BY THE MANUFACTURER. NEVER REPLACE BRAKE PADS INDIVIDUALLY OR AS A SINGLE WHEEL SET. SERIOUS CONSEQUENCES COULD RESULT FROM OUT OF BALANCE BRAKING DUE TO A MIX OF BRAKE FRICTION MATERIALS

10. Bleed the braking system (see Brake Bleeding procedure).

11. Refit the front road wheels tightening the securing nuts as much as possible.

12. Lower the vehicle and torque the wheel nuts to specification (torque 200 Nm, 150 lbf. ft). Replace the hub cap.

13. Operate the foot brake to 'bed' the brake pads. Check the brake fluid level in the fluid reservoir and correct as necessary. Always use new brake fluid to specification FMVSS 116 DOT 4.

NOTE: Remember new brake pads may take several hundred miles to fully 'bed in'. The 'bedding in' process will be extended if the brake discs are not in good condition.
FRONT BRAKE HOSES

1. Apply the handbrake and chock the rear wheels. Relieve the vacuum from the servo unit by operating the brake pedal several times. Remove the front hub caps and partly release the front wheel nuts. Raise the front of the vehicle and support it on stands placed under the chassis members. Remove the road wheels.

2. Place a suitable drain tray below the front brake hose connections. Disconnect the brake hydraulic pipes from each end of the hoses and plug the brake pipes to prevent dirt ingress.

**NOTE:** The front brake hoses are similar to each other and are fitted so that ends with the rubber reinforcement sleeves are fitted towards, the calipers. The two brake hoses each side of the vehicle are routed forward from the support bracket on the steering knuckle to form a natural curve before entering the support bracket on the top of the front crossmember from front to rear. The end fittings of the hoses are 'D' shaped and fit into 'D' shaped holes in the support brackets so that the natural curve is retained once the securing clips have been positioned. The primary circuit hose leading from the front mounting point on the steering knuckle hose support bracket is routed to the lower of the two hose mounting holes in the support bracket on the crossmember. Conversely, the secondary circuit hose leading from the rear mounting point on the steering knuckle support bracket is routed to the upper hole in the support bracket on the crossmember. This routing of the hoses is critical to the correct operation of the brakes.

3. Remove the spring clips which secure the ends of the hoses in the support brackets. Discard the hoses and replace any clips which may be damaged.

**NOTE:** The tie securing the lead to the brake pad wear sensor to the secondary hose on the right hand side of the vehicle should be cut so that the hose can be removed.
FRONT BRAKE HOSES

4. On one side of the vehicle, fit the ends of the new brake hoses (without the rubber reinforcing sleeves) to the upper hose support bracket mounted on the crossmember and secure with the spring clips.

NOTE: In service the clips may be fitted in towards the centre of the vehicle provided the outer edge of each clip is positioned parallel to the edge of the support bracket.

Ensure each clip is pushed fully home into its recess in the hose pipe end fitting. Route the end of the hose leading from the upper position in the crossmember hose support bracket in a natural curve round and down into the rear hole on the support bracket attached to the steering knuckle, and secure it with a clip. Similarly route the other hose to the front hole in the lower support bracket. Ensure each clip is pushed fully home into its recess in the hose pipe end fitting. Reconnect the hydraulic pipes at each end of each hose. Repeat the procedure on the other side of the vehicle. Use a new tie to secure the lead to the brake wear sensor to the secondary hose on the right hand side of the vehicle.

5. When all other work on the braking system has been completed, bleed the hydraulic system thoroughly using new brake fluid which complies with the specification FMVSS 116 DOT 4 (see - Brake Bleeding). Apply the brake pedal several times to automatically adjust the brake shoes and obtain the correct running clearance. Top up the master cylinder reservoir to its correct level before road testing the vehicle.
REAR BRAKE DRUMS/ SHOES/ BRAKE ADJUSTERS

Remove/ Replace

NOTE: BRAKE SHOES MUST ALWAYS BE REPLACED IN AXLE SETS USING THE NON ASBESTOS REPLACEMENT BRAKE SHOES SPECIFIED BY THE MANUFACTURER. NEVER REPLACE BRAKE SHOES INDIVIDUALLY OR AS A SINGLE WHEEL SET. SERIOUS CONSEQUENCES COULD RESULT FROM OUT OF BALANCE BRAKING DUE TO A MIX OF BRAKE FRICTION MATERIALS.

Remove the hub cap and partly release the wheel nuts. Chock the front wheels and fully release the handbrake. Relieve all brake servo vacuum by operating the brake pedal several times. Raise the rear of the vehicle and support the axle on stands.

Remove the rear wheel, remove the brake drum retaining screw and withdraw the brake drum. If the drum is tight on its centre spigot, lightly tap the drum off the hub using a soft faced mallet.

NOTE: If the brake drum is very worn it may be necessary to release the brake self adjuster mechanism before the drum can be removed. Remove the access plug in the backplate and use a suitable screwdriver to push the tail of the small adjuster towards the shoe platform.

3. From below the vehicle, remove the split pin and clevis pin securing the front handbrake cable to the handbrake lever.

Take careful note of the position of the brake shoes and springs. Depress and turn the brake shoe steady pin retainers to release the pins and springs (a special service tool is available to simplify this operation). Extract the steady pins from the inboard side of the backplate.

4. Pull the heel of the leading shoe and the toe of the trailing shoe out of the fixed abutment slots against the load of the tension spring taking care not to over stretch the spring. Unhook and remove the spring hooks from the brake shoe webs.
REAR BRAKE DRUMS/ SHOES/ BRAKE ADJUSTERS

Remove/ Replace (Cont'd)

Fig 5. Rear brake assembly
REAR BRAKE DRUMS/ SHOES/ BRAKE ADJUSTERS

Remove/ Replace (Cont’d)

5. Ease the toe of the leading shoe followed by the heel of the trailing shoe out off the piston slots. Unhook the pull-off spring and the cross lever tension spring and disconnect the cross lever (the cross lever spring is not interchangeable with the spring on the opposite brake). Disengage the handbrake cable from the handbrake lever on the trailing shoe and remove the brake shoes. Prevent ejection of the wheel cylinder pistons by restraining them with an elastic band or soft wire around the brake cylinder body.

NOTE: Take care not to damage the wheel cylinder boots.

6. Remove all dust and deposits from the original parts and the friction surface of the brake drum. **DO NOT BLOW OUT WITH AN AIR LINE - IT COULD BE HARMFUL TO INHALE THE DUST.** Remove with a vacuum cleaner or wipe clean with a damp rag.

NOTE: Do not use petrol or paraffin - if solvent is required use methylated spirit, or purpose made brake cleaner.

7. New brake shoes must be fitted if the friction material has worn down to 1.5 mm (0.062in.) or irrespective of the state of wear if the linings are contaminated with lubricants or hydraulic fluid.

NOTE: The lining material fitted to the leading shoe, with the auto adjust mechanism, is considerably thicker than the lining material on the trailing shoe, with the integral handbrake lever. It is most important that the shoes are fitted in their correct positions.
8. Carefully inspect all the components for faults or wear. Check the pull-off springs and cross lever tension spring for signs of weakness or stretching. If in doubt fit new springs. Check for any signs of hydraulic fluid leakage and examine the condition of the wheel cylinder rubber boots. Examine the brake drum friction surface for scoring, cracks or distortion and renew where there is any doubt about its condition.

**NOTE:** Maximum permitted brake drum wear may not exceed 1.0 mm (0.040 in.). Brake drums may not be reground.
REAR BRAKE DRUMS/SHOES/BRAKE ADJUSTERS

Remove/Replace (Cont'd)

9. Before transferring the adjuster plates to the new leading brake shoe, take careful note of their positions. Remove pivot pin circlips and extract the pins, together with the plain washers, spring and toothed adjuster plates. Thoroughly clean the components, lightly lubricate pivot pins with PolyButyl Cuprisil (PBC) Shell Corrosion Resistance Grease SB2628, Lockheed high-temperature grease or equivalent and assemble as noted using any new parts as necessary.

NOTE: Do not lubricate the teeth on the mating edges of the adjuster plates.

10. Set the adjuster to minimum adjustment by disengaging the smaller plate to allow the larger plate to be moved as far as possible towards the lining platform. In a similar manner lubricate the pivot pin and transfer the handbrake lever onto the replacement trailing shoe in the position noted. Replace any necessary parts. Other than hydraulic parts, metal to metal contact points should be lightly lubricated with a high melting point grease, i.e., shoe tips, the areas where the shoe platform seats against the backplate, the wheel cylinder and abutment slots, etc.

NOTE: Keep grease away from the shoe linings, rubber parts and the friction surface of the drum.

11. Hook the longer end of the crosslever tension spring into the hole towards the end of the trailing shoe web. Engage the other end of the spring in the notch in the crosslever to hold the crosslever in position. The crosslever spring is not interchangeable with the spring on the opposite brake.
REAR BRAKE
DRUMS/ SHOES/ BRAKE
ADJUSTERS

Remove/ Replace (Cont’d)

12. Fit the end of the handbrake cable to the trailing brake shoe assembly and then fit the brake shoe to the backplate positioning the crosslever under the wheel cylinder. Fit the brake shoe webs into the slot in the abutment and wheel cylinder piston. Refit the steady pin, spring and retainer.

13. Install the leading brake shoe assembly into its slot in the wheel cylinder piston while taking care to position the crosslever into the slot in the adjuster plate. Position the web in the backplate abutment and refit the steady pin, spring and retainer.

14. Fit the pull-off springs in the positions previously noted (the stronger spring fits in the upper position). Reconnect the handbrake front cable to the handbrake lever securing the clevis pin with a new split pin.

NOTE: The operation of the adjuster may be checked by operating the brake pedal very gently while the drum is off. After a short outward movement of the brake shoes, the cross lever pulls the large adjuster plate of the ratchet mechanism until it will be heard to ‘click’ to its next position against the small adjuster plate. This adjustment must be backed off before fitting the brake drum. Remove the access plug in the backplate and push the small adjuster plate towards the abutment to allow the pull-off springs to restore the original position. Replace the access plug in the backplate.

15. Lightly grease the brake drum spigot and replace the brake drum and its securing screw.
REAR BRAKE DRUMS/ SHOES/ BRAKE ADJUSTERS

Remove/ Replace (Cont’d)

16. Operate the brake pedal to align the brake shoes. Check the handbrake operation. Refit the road wheel tightening the securing nuts as much as possible.

17. Lower the vehicle and torque the wheel nuts to specification (torque 200 Nm, 150 lb ft.). Replace the hub cap.
REAR WHEEL CYLINDER

Remove/ Replace/ Overhaul

1. Remove brake shoes and springs as previously described.

2. Disconnect the hydraulic pipe from the wheel cylinder, plug the pipe to prevent fluid loss and dirt entry, use a screwdriver to take off the 'E' clip securing the cylinder to the backplate and remove the wheel cylinder.

**NOTE:** Factory assembled and tested wheel cylinder assemblies are available and should be fitted wherever possible. If an overhaul is carried out the procedure detailed below must be followed.

3. Wipe the outside of the wheel cylinder to remove dirt and dust - do not use petrol or paraffin. If solvent is required, use methylated spirit, purpose made brake cleaner or clean brake fluid. Disengage the rubber boots from the grooves in the cylinder body using the fingers only. Extract the pistons and retrieve the spring between them. Remove the boot and seal from each piston taking care not to damage the piston seal groove.
REAR WHEEL CYLINDER

Remove/ Replace/ Overhaul (Cont'd)

4. Carefully inspect the pistons and cylinder bore for damage, wear or corrosion. If the condition of these parts is at all suspect, fit a complete new assembly; otherwise clean all the parts with new brake fluid which complies with the specification FMVSS 116 DOT 4. Fit new rubber parts which are available as a kit.

5. Coat a new piston seal with clean brake fluid and, using only the fingers, fit the seal into the piston groove, the larger diameter facing away from the slotted end of the piston. Repeat the process for the other piston. Smear the cylinder bore with brake fluid then push the pistons into the bore taking care that the lip of each seal is not bent back, and that the spring is seated correctly in the piston counterbores.

6. Smear the beaded edges and inside of the boots with Lockheed Rubberlube Part No: LBK 102194 and push into position. Ensure each boot locates correctly in the piston and cylinder body grooves.

7. Clean the backplate and fit the wheel cylinder. Fit a new 'E' clip to secure the cylinder, using Automotive Products 'E' clip fitting tool Part No: STL.107.

8. Reconnect the hydraulic pipe and refit the brake shoes as previously described.

9. When all other work on the braking system has been completed, bleed the hydraulic system thoroughly using new brake fluid which complies with the specification FMVSS 116 DOT 4 (see - Brake Bleeding). Apply the brake pedal several times to automatically adjust the brake shoes and obtain the correct running clearance. Top up the master cylinder reservoir to its correct level before road testing the vehicle.
REAR WHEEL CYLINDER

Remove/ Replace/ Overhaul (Cont'd)

NOTE: Remember new brake linings may take several hundred miles to fully 'bed in'. The "bedding in' process will be extended if the brake drums are not in good condition. Vehicles fitted with this type of brake assembly will have longer brake pedal travel than vehicles with a less sophisticated braking system. Pedal travel will increase as the linings wear and prior to each automatic shoe adjustment. Never try to reduce brake pedal travel by adjusting the handbrake mechanism - with the hand brake 'off, there should be no load on the handbrake operating mechanism.
REAR BRAKE BACKPLATE

Remove/ Replace

To perform this operation it is necessary to remove the rear wheel bearing from the axle shaft (see - REAR AXLE)
REAR BRAKE HOSE

Remove/ Replace

1. Chock the front wheels. Raise the rear of the vehicle and support the axle on stands.

2. Disconnect the brake hydraulic pipe from the front of the rear brake hose and plug the pipe to prevent dirt ingress and fluid loss. Remove the thin locknut securing the hose to the chassis bracket. Disconnect the hose from the three way connector on the rear axle.

3. Install the new hose in the vehicle, connecting it to the three way connector and fitting it to the chassis bracket with the locknut provided before connecting the brake hydraulic pipe.

4. When all other work on the braking system has been completed, bleed the hydraulic system thoroughly using new brake fluid which complies with the specification FMVSS 116 DOT 4 (see - Brake Bleeding). Apply the brake pedal several times to automatically adjust the brake shoes and obtain the correct running clearance. Top up the master cylinder reservoir to its correct level before road testing the vehicle.
MASTER CYLINDER

Remove/ Replace/ Overhaul

THE NECESSITY FOR ABSOLUTE CLEANLINESS THROUGHOUT THE FOLLOWING PROCEDURE CANNOT BE OVER-EMPHASIZED. BRAKE FLUID WILL DAMAGE PAINT WORK SO PRECAUTIONS MUST BE TAKEN TO COVER PAINTED AREAS TO PREVENT DAMAGE.

1. Apply the handbrake and chock the rear wheels. Operate the brake pedal several times to relieve the vacuum from the brake servo unit. Remove the front hub caps and partly release the front wheel nuts. Raise the front of the vehicle and support it on stands placed under the chassis members. Remove the front road wheels. Open the bonnet and fit wing covers.

2. Connect bleed tubes to the bleed screws each side of the right hand front caliper (LHS on LHD vehicles) and immerse both tubes into clean brake fluid in a glass jar of sufficient size to contain all the brake fluid in the brake fluid reservoir. Unscrew the bleed screws haft a turn and have an assistant fully depress the brake pedal several times until the brake fluid reservoir is empty. Tighten the bleed screws, discard the removed fluid and clean the glass jar for the later brake bleeding operations.

3. Remove the hydraulic pipes from the brake master cylinder and plug the exposed ports to prevent any residual fluid loss and dirt ingress. Disconnect the wires to the fluid level sensor and unscrew the two nuts securing the master cylinder to the servo unit so that the master cylinder may be withdrawn. NOTE: The brake pedal must not be depressed while the master cylinder is disconnected from the servo unit.
NOTE: Factory assembled and tested master cylinder assemblies are available and should be fitted wherever possible. If an overhaul is carried out the procedure detailed below must be followed.

4. Drain any remaining fluid from the master cylinder reservoir, then thoroughly clean the outside of the master cylinder assembly using brake fluid or methylated spirit. Mount the cylinder in a soft jawed vice, and remove the two screws securing the fluid reservoir to the master cylinder. Lift off the reservoir and remove the two rubber seals from the recesses in the master cylinder body. Take note of the location of the secondary piston stop pin located in one of the secondary cylinder feed port holes.
MASTER CYLINDER

Remove/ Replace/ Overhaul (Cont'd)

5. Using a soft metal rod push the primary piston fully into the master cylinder to release the secondary piston stop pin which should then be removed from the secondary cylinder feed port.

6. Using suitable circlip pliers carefully extract the circlip from the end of the master cylinder bore and withdraw the primary piston assembly and spring, followed by the secondary piston and spring.

7. Note the position of the components and in particular the rubber seals before removing the seals from the secondary piston only.

NOTE: Use only the fingers to remove the rubber seals.

8. Thoroughly clean all the parts with new brake fluid; dry the components with a lint free cloth and carefully examine the metal components for signs of damage, wear or corrosion. A replacement master cylinder assembly will always be necessary where the cylinder bores exhibit the slightest signs of corrosion or scoring. If the metal parts are in perfect condition a repair kit containing a new primary piston sub assembly and secondary piston seals may be fitted.

9. Scrupulous cleanliness is essential, therefore ensure the hands are free of any grease or dirt. Check the fluid feed ports are clear. Lubricate the cylinder bores and new components with new brake fluid. Locate a new piston washer on the head of the secondary piston. Using the fingers only, ease the new main seal over the piston nose, lip last so that it is seated up to the piston head holding the washer in place. Fit the remaining seal, lip last, into the groove on the other end of the piston.
10. Place the spring retainer onto the secondary piston nose followed by the return spring. Insert the return spring, spring retainer and secondary piston into the master cylinder bore, taking care not to bend back the lip of the leading seal. Enter the new primary piston sub assembly into the bore again ensuring the seal lips are not bent back. Refit the circlip at the mouth of the master cylinder bore and check it is correctly seated in its groove. Push the primary piston fully into the master cylinder with a push rod, then insert the secondary cylinder stop pin into either of the two secondary cylinder feed port holes.

11. Fit two new reservoir seals into the recesses in the top of the master cylinder. Check the fluid reservoir, its cap and the fluid level sensor are clean and insert the reservoir feed tubes into the seals. Secure the reservoir with the two screws and tighten to a torque of 6.8 Nm (5 lbf.ft.). Do not over tighten.
MASTER CYLINDER

Remove/ Replace/ Overhaul (Cont'd)

12. Refit the master cylinder to the brake servo unit and tighten the nuts to a torque of 51 Nm (37 lbf. ft.). Reconnect the brake hydraulic pipes to the master cylinder and tighten the tube nuts just sufficient to prevent leakage.

13. When all other work on the braking system has been completed, bleed the hydraulic system thoroughly using new brake fluid which complies with the specification FMVSS 116 DOT 4 (see - Brake Bleeding). Apply the brake pedal several times to automatically adjust the brake shoes and obtain the correct running clearance. Top up the master cylinder reservoir to its correct level before road testing the vehicle.
BRAKE SERVO ASSEMBLY/ VACUUM SEAL/ AIR FILTER

Remove/ Replace Components

1. Remove the master cylinder assembly (see - Master Cylinder).

Vacuum seal replacement:

If servo performance is impaired by a vacuum leak between the servo and master cylinder proceed as follows: Extract the toothed retainer, withdraw the vacuum seal, washer and retainer. Smear the new seal with Lockheed Rubber lube before reassembling the parts in the reverse order. Ensure the toothed retainer does not compress the vacuum seal.

Servo assembly replacement:

Disconnect the vacuum pipe from the connector fitted to the front face of the servo unit and note its position. From inside the vehicle, remove the securing clip, plain washer and clevis pin connecting the brake pedal to the servo push rod. Release the servo assembly by removing the retaining nuts and spring washers.

NOTE: Apart from the foam rubber air filter adjacent to the servo push rod, and the servo vacuum seal between the servo and master cylinder, there are no other service parts for the servo which must be replaced as a complete unit.

2. Replace the servo unit in the reverse order of removal, ensuring the position of the vacuum connector is as noted previously. Refit the clevis pin securing the pedal to the servo push rod, fit the plain washer and the securing clip. Reconnect the vacuum hose to the connector.
BRAKE SERVO
ASSEMBLY/ VACUUM
SEAL/ AIR FILTER

Remove/ Replace
Components (Cont'd)

Air filter replacement:

Pull back the protective rubber boot on the servo push rod to expose the metal retaining cap. Release the cap and extract the air filter element. Cut the new element diagonally from the edge to the centre hole, fit it over the push rod and seat it squarely into the recess. Refit the retaining cap and seat the rubber boot into its retainer.

3. Replace the master cylinder assembly (see - Master Cylinder).
BRAKE BLEEDING

NOTE: AT ALL TIMES USE NEW BRAKE FLUID TO SPECIFICATION FMVSS 116 DOT 4. NEVER LEAVE BRAKE FLUID IN UNSEALED CONTAINERS. IT ABSORBS MOISTURE QUICKLY AND CAN BE DANGEROUS IF USED IN A BRAKING SYSTEM IN THIS CONDITION. FLUID DRAINED FROM THE BRAKING SYSTEM DURING THE BLEEDING PROCEDURE SHOULD BE DISCARDED. THE NECESSITY FOR ABSOLUTE CLEANLINESS THROUGHOUT THE PROCEDURE CANNOT BE OVER-EMPHASIZED.

1. Remove the front wheel hub caps and partly release the wheel nuts. Operate the brake pedal several times to relieve the vacuum from the brake servo unit. Chock the rear wheels and support the vehicle on a hoist or on stands at a suitable working height. Open the bonnet and top up the brake fluid reservoir with brake fluid.

2. Connect a brake bleed tube to the bleed screw on the left hand rear brake (RHS on LHD vehicles) and immerse the bleed tube into a clean glass jar containing a small quantity of brake fluid. Unscrew the bleed screw half a turn and have an assistant fully and slowly depress the brake pedal several times until brake fluid flows from the bleed tube into the fluid in the glass jar without any sign of air bubbles. Tighten the bleed screw as the brake pedal is depressed. Repeat this operation for the other rear brake, ensuring the master cylinder reservoir is continually topped up as required.

3. NOTE: Each front brake caliper is fitted with three brake bleed screws - one at the top and one on each side.

NOTE: WHEN BLEEDING THE FRONT BRAKES, ONLY ONE PART OF THE SYSTEM IS BLED AT A TIME SO BRAKE PEDAL TRAVEL AND EFFORT DURING THE BLEEDING OPERATION WILL BE DIFFERENT THIS IS NORMAL.
BRAKE BLEEDING

Two bleed tubes are required to bleed the front brakes. First, connect the two bleed tubes to the bleed screws each side of the left hand front caliper (RHS on LHD vehicles) and immerse both tubes into the clean fluid in the glass jar. Unscrew the outer bleed screw half a turn and have an assistant fully depress the brake pedal several times until brake fluid flows from the bleed tube into the fluid in the glass jar without any sign of air bubbles. Tighten the bleed screw at the brake pedal is depressed.

Repeat this operation for the inner bleed screw, ensuring the master cylinder reservoir is topped up as required. Then connect a bleed tube to the top bleeding screw and again repeat the bleeding procedure.

Repeat this operation for the other front brake.

4. Check brake pedal 'feel' with and without the engine running and repeat the procedure above if the brakes are in any way 'spongy' indicating the continued presence of air in the hydraulic system.

5. Refit the front road wheels tightening the securing nuts as much as possible.

6. Lower the vehicle and torque the wheel nuts to specification (torque 200 Nm, 150 lb ft). Replace the hub caps.
**HAND BRAKE REAR CABLE**

**Remove/ Replace**

1. From below the vehicle, disconnect the front handbrake cable from the handbrake lever to release spring tension in the rear cable. Remove both brake drums and the brake shoes (see - Brake shoes).

2. On each side of the vehicle, disconnect the brake cable from the trailing brake linkage. Ease off the cable retaining clip to release the handbrake cable from the brake backplate. Replacement cables are fitted with retaining clips. Retaining clips are also serviced separately and may be replaced if damaged during removal where the cable is to be reused.

Fig 10. Handbrake cables - layout
3. Release the handbrake cable guides from the 'P' clip fastenings on the rear axle and the cable support bracket on the chassis sidemember.

4. Remove the 'E' clip securing the handbrake to the abutment bracket on the chassis sidemember. Unscrew the adjuster nut securing the handbrake to the abutment bracket on the chassis sidemember.

5. Remove the split pin and clevis pin from the handbrake cable compensator to release the handbrake rear cable assembly. Check the condition of the clevis and split pin and discard if they show signs of wear.

6. Secure the new rear handbrake cable into position (do not attempt to adjust the cable at this stage). Fit the 'E' clip retainer to secure the cable to the lower position on the abutment bracket.
HANDBRAKE REAR CABLE

Remove/ Replace (Cont’d)

**NOTE:** The new hand brake cable is fitted so that the threaded adjuster is mounted into the top position on the abutment bracket on the chassis side member with an adjuster nut each side of the bracket. Remove the adjuster nuts from the threaded portion of the cable before attempting to fit it to the vehicle.

7. Route the handbrake cable from its upper position on the handbrake abutment bracket, behind the left hand rear damper through to the left hand rear brake backplate as shown in Fig. 10. Secure the cable into position at the top location on the cable support bracket (on the chassis sidemember) and the two locations on the rear axle using the ‘P’ clips and hardware fitted previously. Torque the ‘P’ clip bolts to 10 - 14 Nm (7.5-9.5 lbf. ft.).

**NOTE:** The ‘P’ clip fitted to the outer position on the axle may differ from that fitted at the other two locations.

Route the handbrake cable to the right hand brake backplate, attaching it to the lower mounting bolt of the cable support bracket (on the chassis sidemember) as shown in Fig 10. Torque the bolt to 10 - 14 Nm (7.5 - 9.5 lbf. ft.).

8. Push the cable ends through the brake back plates and reinstall the rear brake shoes, connecting the brake cable to the brake linkage, ensuring the new cable is correctly clipped into position on each backplate using new clips as required.

**NOTE:** Before performing the above operation check the condition of the rear brake linings and drums. A new handbrake cable will not compensate for worn out brake linings or drums which must be replaced if their wear limit has been reached.
HAND BRAKE REAR CABLE

Remove/ Replace (Cont'd)

9. Lightly grease the brake drum spigots and replace the brake drums and their securing screws.

10. Connect the rear handbrake cable compensator to the front handbrake cable and then the front handbrake cable to the handbrake lever using new clevis pins and split pins as required. Operate the brake pedal to align the brake shoes.

11. Adjust the rear handbrake cable using the cable adjusting nuts each side of the chassis abutment bracket to take up the slack in the rear cable until the handbrake is fully 'on' with 5 'notches' of the handbrake lever. Operate the handbrake several times to 'bed' the new cable. Again check the adjustment (no load on the clevis pin). Lock up the adjusting nuts on the handbrake rear cable.

NOTE: Correctly adjusted, there should be no pre-load in the handbrake cables and will be 4/5 “notches” on the handbrake lever ratchet before the handbrake is on.

12. Again check the handbrake operation, brake cable 'run' and the clevis and split pins are secure.

13. Refit the road wheels tightening the securing nuts as much as possible.

14. Lower the vehicle and torque the wheel nuts to specification (torque 200 Nm, 150 lb ft). Replace the hub caps.
HAND BRAKE FRONT CABLE

Remove/ Replace

1. Release the handbrake and raise the vehicle on a lift. Chock the wheels.

2. Remove the split pins and clevis pins securing the cable to the handbrake shaft lever and the rear cable compensator. Remove the 'E' clips securing the handbrake cable to the chassis abutment brackets and remove the cable.

3. Install the new cable noting that the yoke end is fitted towards the handbrake lever. Ensure the 'E' clips are in good condition and fit into the grooves machined into the handbrake end fittings.

4. Check the condition of the clevis pins and fit new as necessary. Connect the handbrake cable to the compensator first, followed by connection to the handbrake lever. Fit new split pins. Operate the handbrake several times and adjust the rear handbrake several times and adjust the rear handbrake as necessary.

NOTE: Correctly adjusted, there should be no pre-load in the handbrake cables and will be 4/5 'notches' on the handbrake lever ratchet before the handbrake is on.