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# **Dart**

## **BUS CHASSIS SERVICE MANUAL**

### **COVERING MODELS**

**85 SDL 3020**

**9 SDL 3021**

**98 SDL 3022**

**85 SDL 3030**

**9 SDL 3031**

**98 SDL 3032**

**85 SDL 3023**

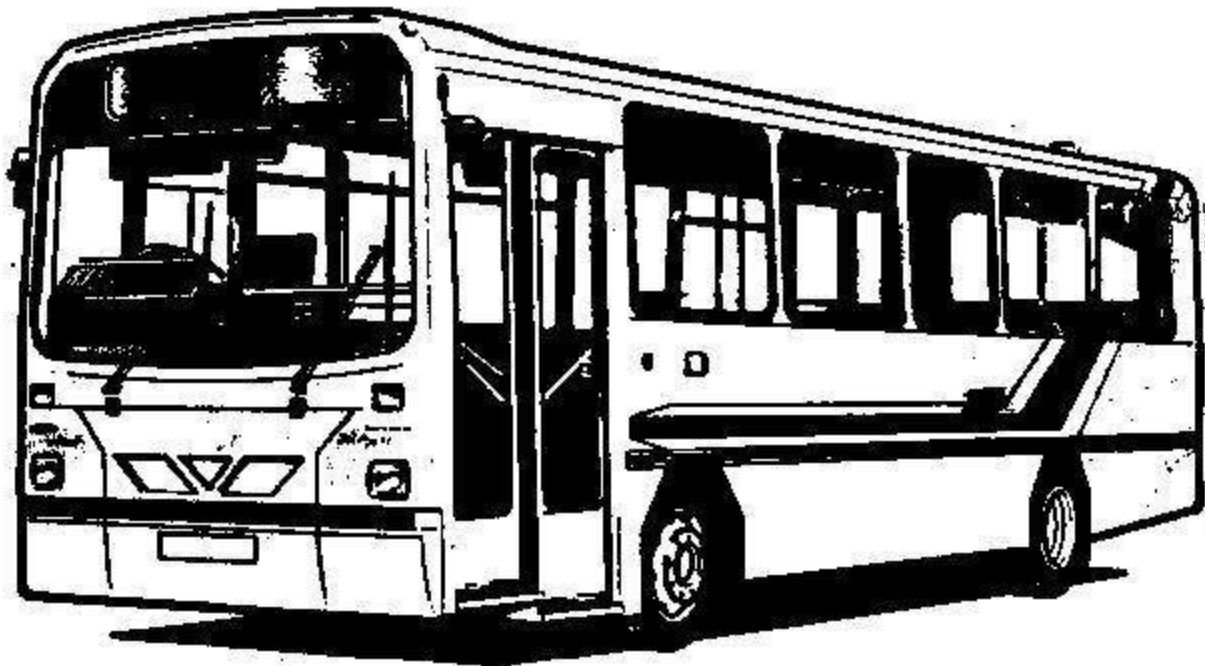
**9 SDL 3024**

**98 SDL 3025**

**85 SDL 3033**

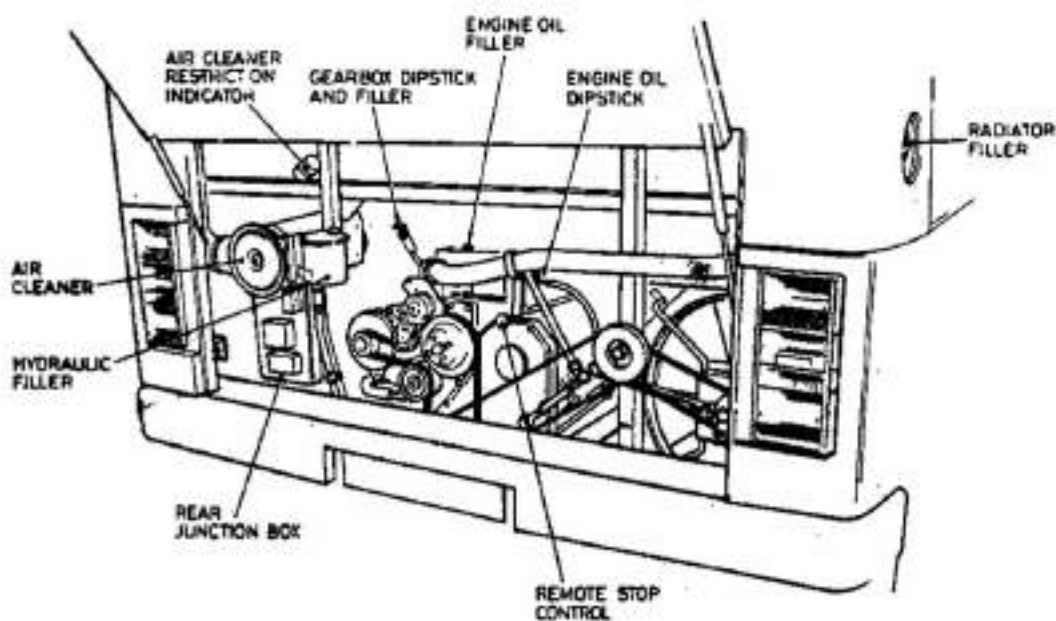
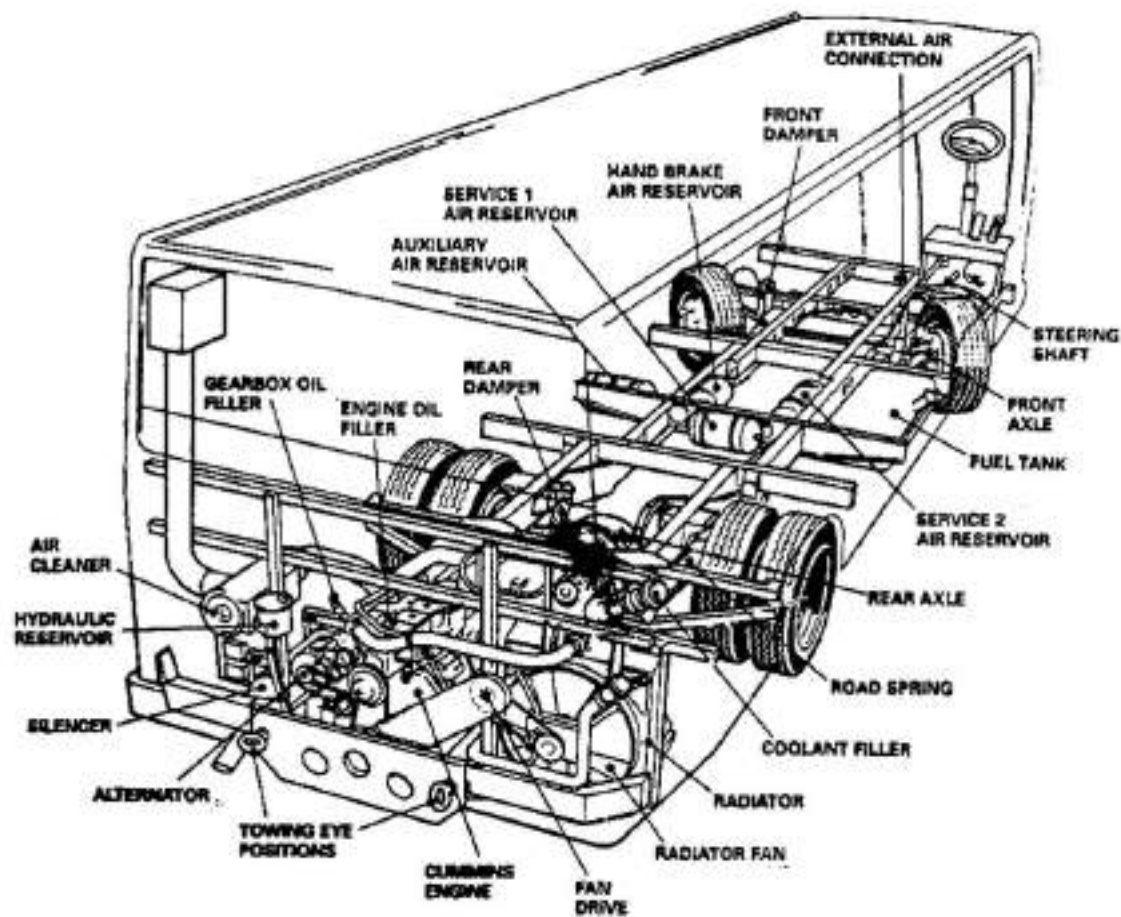
**9 SDL 3034**

**98 SDL 3035**



# **DENNIS**

**THE STRENGTH TO DRIVE ON**



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# DART SERVICE SCHEDULE

|               |       |                                   |
|---------------|-------|-----------------------------------|
| First Service | ..... | No later than 1000 miles from new |
| 'A' Service   | ..... | 6000 miles/3 months               |
| 'B' Service   | ..... | 12,000 miles/6 months             |
| 'C' Service   | ..... | 24,000 miles/12 months            |

Recommended Servicing sequence ..... A-B-A-C

The first service for a new vehicle must be carried out no later than 1000 miles, or after fitment of a new or reconditioned unit. As this is the most important service for the vehicle, it is essential that the service and inspection instructions in the following Schedules are followed to the letter.

**NOTE** On stop-start short distance operation the hours run are more important than the distance.

## OPERATION

|  | 1000<br>Mile | Daily | Weekly | A | B      | C                         |
|--|--------------|-------|--------|---|--------|---------------------------|
|  | •            | •     | •      | • | •      | •                         |
| <b>Steering Gear</b> (see also Hydraulics)   |              |       |        |   |        |                           |
| Check overall play at steering wheel   | •            |       | •      | • | •      | •                         |
| Check for play in steering column  |              |       |        |   |        | •                         |
| Check for security - drop arm securing nut, steering box mounting bolts, track rod clamp bolts and steering lock stops             |              |       |        |   |        | •                         |
| Check the steering box for leakage   | •            |       |        |   | •      | •                         |
| Check wheels do not foul other parts when on full lock   |              |       |        |   |        | •                         |
| Check front axle and steering alignment adjust if necessary  |              |       |        |   |        | •                         |
| Check all ball joints and linkages for play  |              |       |        | • | •      | •                         |
| Check mitre box for leakage  | •            |       |        | • | •      | •                         |
| Check mitre box oil level  |              |       |        |   |        | •                         |
| Lubricate steering relay shaft   |              |       |        |   |        | •                         |
| Check for play in relay shaft u.j.'s   |              |       |        |   |        | •                         |
| Check hydraulic steering limiter   |              |       |        |   |        | •                         |
| <b>Braking System</b> (see section Test & Check List)  |              |       |        |   |        |                           |
| <b>Note:</b> switch out retarder before checking brake performance   |              |       |        |   |        |                           |
| Check and adjust brakes if necessary   | •            |       | •      | • | •      | •                         |
| Check all systems function correctly and correct operating pressures are being attained  | •            | •     | •      | • | •      | •                         |
| Check all air line connections and mountings for leakage and security and all rubber components for signs of cracking or hardening | •            |       |        | • | •      | •                         |
| Check air pressure build-up and buzzer functioning correctly   | •            | •     | •      | • | •      | •                         |
| Check satisfactory operation of parking brake  | •            | •     | •      | • | •      | •                         |
| Check brake lining condition, adjust brakes if necessary   |              |       |        | • | •      | •                         |
| <b>It is advisable to remove all valves from the vehicle, dismantle and renew any worn or damaged parts</b>                        |              |       |        |   | Yearly |                           |
| Check fuction and cleanliness of air dryer   |              |       |        | • | •      | •                         |
| Replace air dryer cartridge  |              |       |        |   | Yearly |                           |
| Drain air reservoirs   |              |       |        | • | •      | •                         |
| Renew all brake actuator diaphragms  |              |       |        |   |        | 2 Yearly or 100,000 Miles |

**OPERATION**

|  | 1000<br>mile | Daily | Weekly | A | B | C |
|--|--------------|-------|--------|---|---|---|
|--|--------------|-------|--------|---|---|---|

|  |   |   |   |   |   |   |
|--|---|---|---|---|---|---|
|  | • | • | • | • | • | • |
|--|---|---|---|---|---|---|

**Front Axle**

|  |   |  |  |   |   |   |
|--|---|--|--|---|---|---|
| Check hub bearing adjustment                                 | • |  |  |   |   | • |
| Check oil seals for leakage                                  | • |  |  | • | • | • |
| Check for wear in stub axles                                 |   |  |  |   | • | • |
| Check security of axle                                       | • |  |  |   | • | • |
| Repack hub bearings with grease and check bearing adjustment |   |  |  |   |   | • |
| Check king pin wear  |   |  |  |   |   | • |
| Grease swivel pin and track rod ends                         |   |  |  |   | • | • |

**Rear Axle**

|   |   |  |  |   |   |                         |
|---|---|--|--|---|---|-------------------------|
| Check security of axle  | • |  |  |   | • | •                       |
| Check adjustment of hub bearings and satisfactory lubrication | • |  |  |   | • | •                       |
| Check oil seals for leakage                                   | • |  |  | • | • | •                       |
| Examine half shaft bolts, nuts and studs for security         | • |  |  | • | • | •                       |
| Drain oil when warm and refill with fresh oil                 | • |  |  |   |   | Yearly or 100,000 Miles |
| Repack hub bearings with fresh grease                         |   |  |  |   |   | •                       |
| Check axle oil level  | • |  |  | • | • | •                       |

**Propeller Shafts**

|  |   |  |  |   |   |   |
|--|---|--|--|---|---|---|
| Check tightness of all fixings                     | • |  |  | • | • | • |
| Check for wear on the universal and sliding joints | • |  |  |   | • | • |
| Grease universal and sliding joints                |   |  |  | • | • | • |

**Suspension**

|   |   |  |  |   |   |   |
|---|---|--|--|---|---|---|
| Check spring mountings, tighten if necessary      | • |  |  | • | • | • |
| Check the front and rear shock absorber mountings | • |  |  | • | • | • |
| Check shock absorbers for leaks                   |   |  |  | • | • | • |
| Check operation of shock absorbers                |   |  |  | • | • | • |

**Electrical**

|   |   |   |   |   |                        |   |
|---|---|---|---|---|------------------------|---|
| Check all connections throughout the system for cleanliness, security and insulation              | • |   |   |   | Yearly                 |   |
| Check operation of all lights, switches, warning lights, direction indicators, stop lights, horns | • | • | • | • | •                      | • |
| Check that alternator is charging correctly   | • | • | • | • | •                      | • |
| Check that instruments are working correctly  | • | • | • | • | •                      | • |
| Top up battery with pure distilled water, clean and protect terminals with petroleum jelly        | • |   |   | • | •                      | • |
| Check headlight beams are correctly set   | • |   |   |   |                        | • |
| Remove battery(s), clean and test, clean and repaint the carrier                                  |   |   |   |   | Yearly                 |   |
| Overhaul starter motor  |   |   |   |   | 2 Yearly               |   |
| Lubricate alternator  |   |   |   |   | 50,000 Miles or Yearly |   |

## OPERATION

|   | 1000<br>mile | Daily | Weekly | A | B | C |
|---|--------------|-------|--------|---|---|---|
|   | •            | •     | •      | • | • | • |
| <b>Gearbox</b>  |              |       |        |   |   |   |
| Check idling speed of engine  |              |       |        |   | • | • |
| Change the oil and sump filter  |              |       |        |   |   | • |
| Change auxilliary filter  | •            |       |        |   |   | • |
| Check adjustment of shift linkage   |              |       |        |   |   | • |
| Check modulator adjsutment  |              |       |        |   |   | • |
| Check gearbox breather  |              |       |        |   |   | • |
| Check the tightness of all fixings  | •            |       |        | • | • | • |
| Check for oil leaks and rectify   | •            |       |        | • | • | • |
| Check oil level   | •            |       | •      | • | • | • |
| <b>Cooling System</b>   |              |       |        |   |   |   |
| Check security of radiator mountings  | •            |       |        |   | • | • |
| Check cooling system level  | •            | •     | •      | • | • | • |
| Check hoses for leaks and signs of deterioration  |              |       |        | • | • | • |
| Check pressure cap spring and seal  |              |       |        |   |   |   |
| Drain and flush out. Refill with the correct engine coolant (Autumn)  |              |       |        |   |   |   |
|   |              |       |        |   |   |   |
| Check strength of anti-freeze   |              |       |        |   |   |   |
| Check radiator matrix and clear all debris  |              |       |        | • | • | • |
| Check operation of low coolant alarm  |              |       |        | • | • | • |
| Check fan and drive components for security and damage  |              |       |        |   | • | • |
| Check fan belt tension  |              |       |        |   | • | • |
| <b>Engine and Ancillaries</b>   |              |       |        |   |   |   |
| Carry out all service requirements indicated in the engine manufacturer's literature                                      | •            | •     | •      | • | • | • |
| For all engine information consult the relevant routine maintenance section in the engine manufacturer's operators manual | •            | •     | •      | • | • | • |
| Check security of throttle control linkage and lubricate  |              |       |        | • | • | • |
| Check the security of engine and gearbox in chassis   | •            |       |        |   |   |   |
| Check the security and efficiency of silencer and pipes   | •            |       |        | • | • | • |
| <b>Retarder System</b>  |              |       |        |   |   |   |
| Wash retarder   |              |       |        |   | • |   |
| Check tightness and condition of earth terminal and cable   |              |       |        | • | • | • |
| Check condition of main terminal block and cable  |              |       |        | • | • | • |
| Check tightness of all fixings <b>see torque chart</b>  |              |       |        |   | • | • |
| Check that air gaps are correct and constant, check lift on outboard rotor  |              |       |        |   | • | • |
| Check current draw  |              |       |        |   | • | • |
| Check condition of foot control pressure switches   |              |       |        | • | • | • |
| Check that control system is functioning correctly  |              |       |        | • | • | • |
| <b>For additional data refer to section 9</b>   |              |       |        |   |   |   |

**OPERATION**

1000  
mile    Daily    Weekly    A    B    C

•    •    •    •    •    •

**Engine and Ancillaries (Continued)**

Check for leaks in oil, water and fuel systems

•          •    •    •

Check the fuel filters for cleanliness

•                •

Check the fuel sedimenter for cleanliness

•          •    •    •

Check alternator drive belt tension

•          •    •    •

Drain water trap on fuel filter

•    •    •

Change fuel filter (engine)

•    •

**Air Cleaner**

Check security of mountings, pipework and hose connections to ensure a good and leak-free condition. Renew any damaged parts.

•    •    •

Check that the restriction indicator is not showing red. If it is, fit a new filter element.

•    •    •    •

**Hydraulics**

Check the oil level

•    •    •    •

Check security of all components as shown on the hydraulic system diagram

•    •

Check all pipework and connections for leaks

•    •    •

Change hydraulic oil

100,000 miles

Change reservoir filter

•          •

**General**

Check driver's seat for security and adjustment

•          •    •

Check the windscreen wipers and washers for correct operation

•    •    •    •    •

Check the windscreen washer fluid level

•    •    •    •    •

Security of fuel tank and operation of gauge

•    •    •    •    •

Fuel pipes for leaks and security

•    •    •    •    •

Lubricate all linkages with oil or grease as required

•    •    •    •    •

**Wheels and Tyres**

Check all wheel nuts and tighten if necessary

•    •    •    •    •

Tyres free from damage, cuts and foreign matter

•    •    •    •    •

Tyre pressures correct including spare if fitted

•    •    •    •    •

Tread depth is within legal limit

•    •    •    •

Check valves are positioned at 180 degrees to each other on twin wheel

•    •    •    •

NOTE: Equipment fitted to the coach body is additional to the above service schedule, and therefore information should be obtained from the bodybuilder.

## MAINTENANCE

Preventive maintenance begins with a day to day awareness of the condition of the vehicle

### ENGINE OIL LEVEL: CHECKING

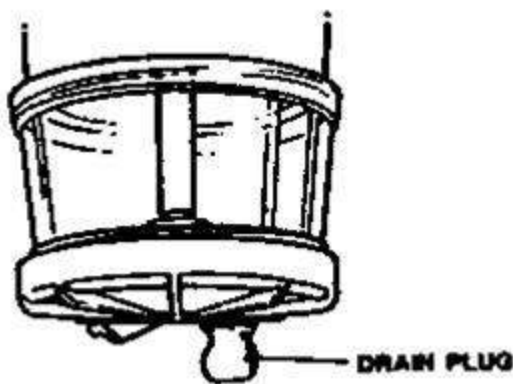
The engine dipstick is mounted at the rear of the vehicle. The filler cap is on the engine rear valve cover.

**Caution:** Never operate the engine with the oil level below the 'Low' mark or above the 'High' mark. Wait at least five minutes after shutting off the engine to check the oil. This allows time for the oil to drain to the oil pan.

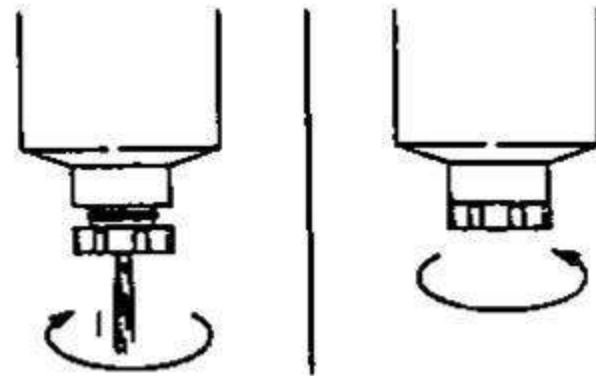
### FUEL/WATER SEPARATOR - DRAINING WATER AND SEDIMENT

Unscrew the plug on the bottom of the sedimenter at the offside of the vehicle beside the gearbox to allow water to drain. Refit the plug when clean fuel is visible.

**NOTE:** Also drain the water separator fitted on the offside of the engine.



Sedimenter



Engine water separator

### COOLANT LEVEL CHECKING

The coolant filler cap is above the radiator beside the tank pressure cap at the rear of the vehicle. Remove the filler cap slowly to relieve coolant system pressure.

**Warning:** Check the coolant level only when the engine is stopped. Wait until the temperature is below 70 degree Centigrade (160 degrees Fahrenheit) before removing the pressure cap. Failure to do so can cause personal injury from heated coolant spray. When topping up the system, a 50/50 mixture of water and anti-freeze must be used.

**NOTE:** Never use a sealing additive to stop leaks in the coolant system. This can result in coolant system clogging and inadequate coolant flow.

### STEERING — OIL LEVEL CHECKING

The steering oil filler is situated on the reservoir at the LH side of the engine flap opening. The level should be checked with the oil cold.

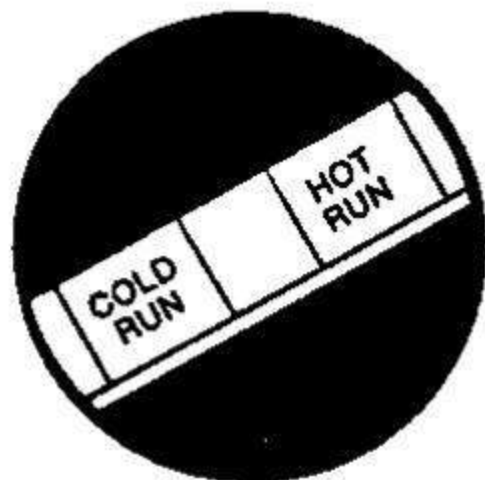
1. With the engine switched off, check whether the fluid is approximately on the uppermost line of the dipstick.
2. Top up as required.
3. Start the engine.
4. With the engine running at idle, the fluid level should go down to approximately the mid-point of the dipstick.



## GEARBOX — Oil Level

The gearbox remote filler and dipstick are to the left of the engine in the rear access door. The following points should be noted:

1. Gearbox should be in neutral
2. The decisive method of checking the oil level is with the gearbox at operating temperature and engine idling. The oil level must lie within the HOT RUN zone.
3. This check should be carried out immediately after use of vehicle.



To check if the gearbox has enough oil to be operated until a hot check can be made, run the engine for one minute to clear the oil system of air and check that the level is within the COLD RUN band.

## REAR AXLE

### Topping Up

With the vehicle on level ground, allow 15 minutes before removing the level plug from the rear of the axle case.

When the axle is correctly filled, the oil should be level with the bottom threads of the filler plug hole. Never add lubricant unless it is the same make and grade as used at initial fill.

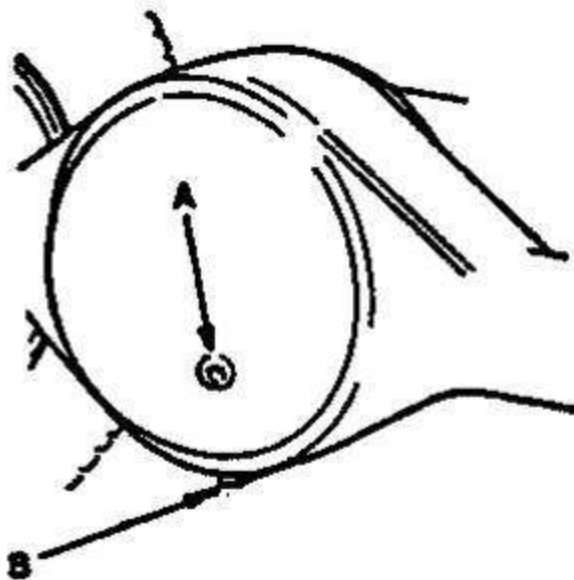
### Draining

This is best done at the end of a journey when the oil is warm. Unscrew the plug at bottom of casing and allow the oil to drain into a container. Clean drain plug, replace and tighten.

### Filling

Fill the axle through rear filler hole with the specified amount of lubricant (the lubricant should be at the level of the bottom of the filler hole), then refit filler plug.

**NOTE:** Always use the upper filler plug e.g. the larger plug mounted on the axle centre line.

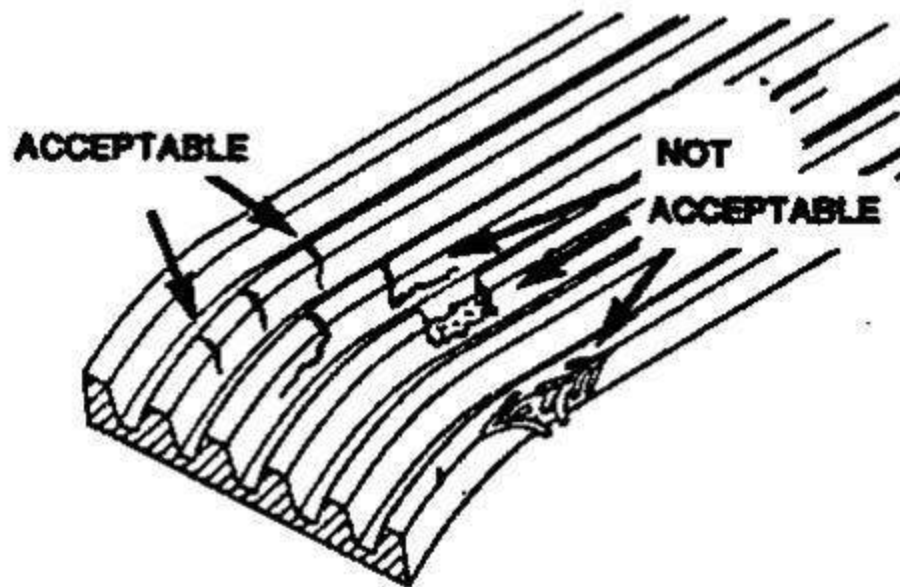


- A. Filler Plug
- B. Drain Plug

## DRIVE BELT INSPECTION

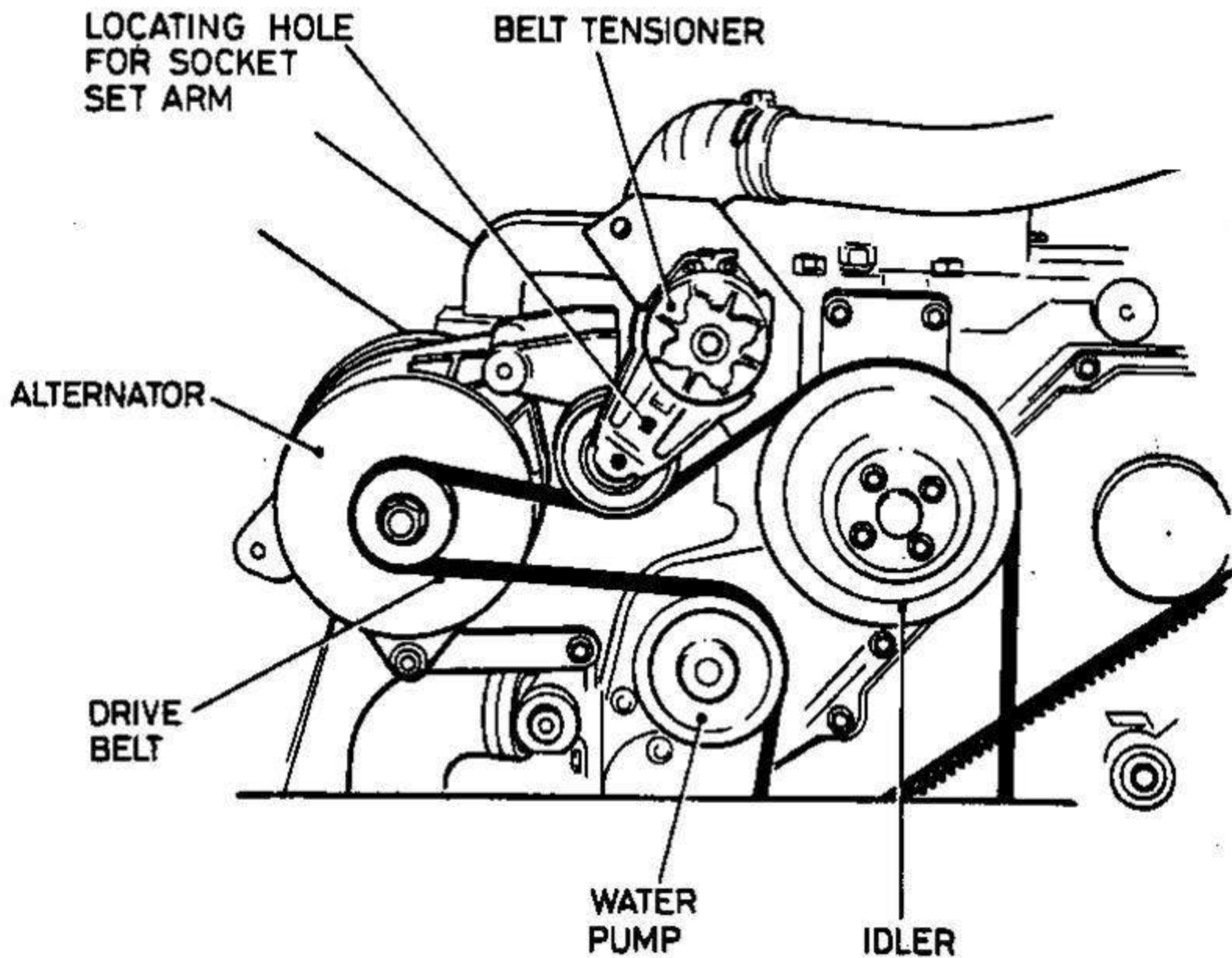
Visually inspect the belt. Check the belt for intersecting cracks. Transverse cracks (across the belt width) are acceptable. Longitudinal cracks (direction of belt length) intersecting with transverse cracks are NOT acceptable.

Renew the belt if it is frayed or has pieces of material missing.



## RENEWING THE DRIVE BELT

- (1) Check that the master switch is at OFF with the engine stopped
- (2) Using a bar from a socket set in the square hole in the arm, turn the automatic belt adjuster clockwise to remove belt tension.
- (3) Holding the adjuster in the raised position, remove the old belt and fit the new one, ensuring that the belt seats correctly in the grooves in the pulleys.
- (4) Lower the adjuster on to the belt and see that the belt is adequately tensioned.



## **AIR CLEANER RESTRICTION INDICATOR**

The restriction indicator is situated at the rear of the vehicle, above the air cleaner. The indicator is operated by the depression between the air cleaner and the engine, and at a pre-set figure, the red warning indicator will remain locked up in a visible position after the engine has stopped running.

When the red indicator band appears, the air cleaner element must be removed and renewed. After the element has been renewed, reset the indicator by pushing on the diaphragm at the top of the instrument.

## **TOWING**

The vehicle should be towed only from the towing eye. This should be screwed into either of the two tapped sockets in the front or rear cross member. A rigid tow bar should be used.

The parking brake should be released as follows:

### **(a) With compressed air**

- (1) Place chocks behind and in front of the wheels
- (2) Move the parking brake lever to the 'off' position
- (3) Connect a suitable air hose to the external air connector located on the front chassis crossmember
- (4) Increase the pressure until the brakes release. Under no circumstances must the pressure in the reservoir exceed 8 bar.

### **(b) Mechanically**

- (1) Place chocks behind and in front of the wheels.
- (2) Use a spanner to turn the release bolt under the cap in the centre of the inboard face of each rear brake actuator anti-clockwise until stops are encountered.

Restore the brake units to their normal state as soon as possible by turning the bolts clockwise and tightening to a torque of 20 - 30 Nm.

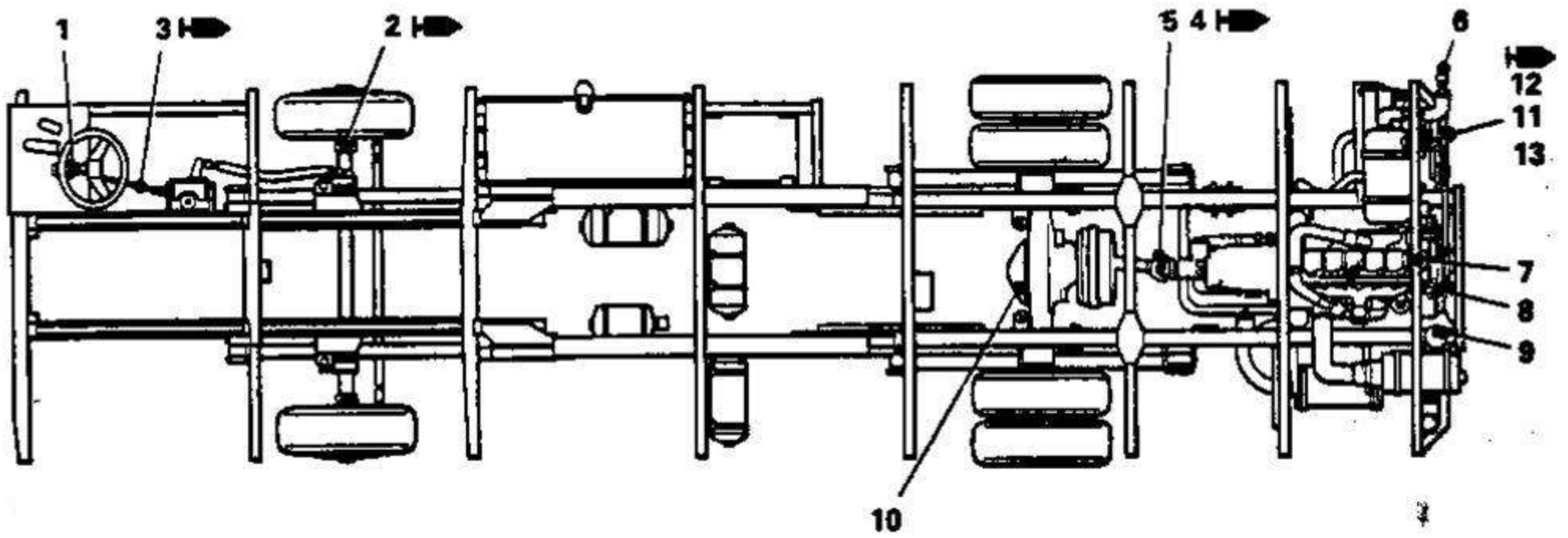


**Warning!** It is essential to remove and support the prop shaft before attempting to tow the vehicle.

**NOTE:** It is not possible to tow start the vehicle.

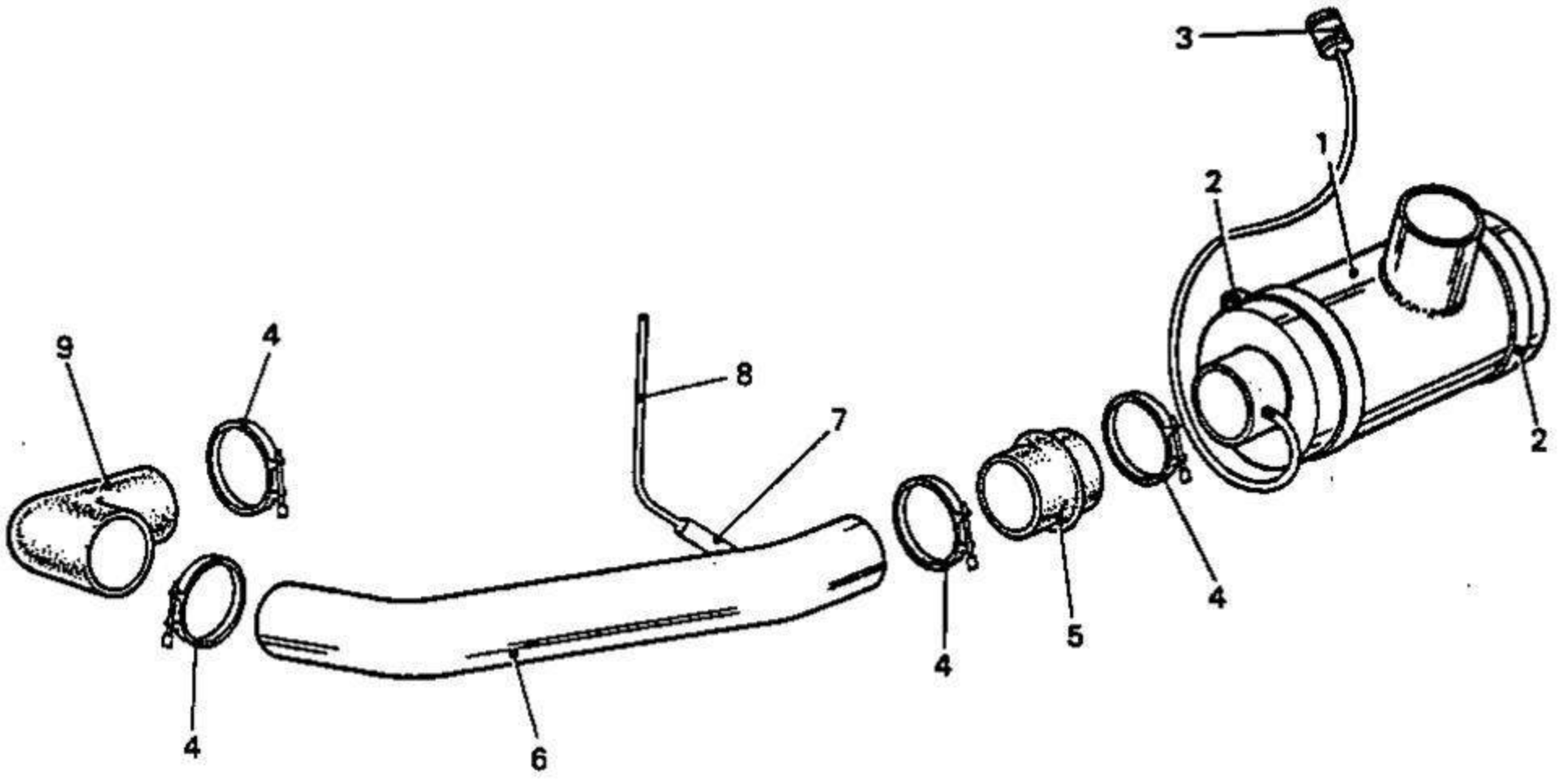
## LIQUID FILL CHART

| Vehicle Component          | Approx Capacity in Litres | Grade   | Brand Name   |
|----------------------------|---------------------------|---------|--|
| Engine                     | 14.3                      | 15W/40  | Total Rubia XT                                       |
| Gearbox                    | 20.26                     |         | Dexron II  |
| Rear axle                  | 12                        | 85W/140 | Total EPB  |
| Steering column            | 0.75                      |         | Dexron II  |
| Hydraulic system           | 5                         |         | Dexron II  |
| Grease points              | A/R                       |         | Total Multis EP2                                     |
| Propshaft grease points    | A/R                       |         | Total Multis Complex EP2                             |
| Idler pulley grease points | A/R                       |         | Total Multis Complex EP2                             |
| Cooling system             | 22.0                      |         | Total Universal antifreeze<br>(50/50 mix with water) |



- |                                   |                                   |
|-----------------------------------|-----------------------------------|
| 1 Steering Column                 | 8 Gearbox oil filler              |
| 2 King pin top and bottom swivels | 9 Hydraulic filler                |
| 3 Steering connecting shaft       | 10 Rear axle                      |
| 4 Propshaft spider                | 11 Fan drive idler pulley         |
| 5 Propshaft slide                 | 12 Idler arm spigot - fan carrier |
| 6 Coolant filler                  | 13 Idler arm spigot - adjuster    |
| 7 Engine oil filler               |                                   |

|                             |      |   |
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1. Air filter
2. Mounting band
3. Restriction indicator
4. Clip
5. Hump hose
6. Intake pipe
7. Hose
8. Compressor intake pipe
9. Reducing elbow

## AIR CLEANER

## **AIR CLEANER**

### **Description**

The air cleaner is fitted on the nearside of the vehicle. The cleaner encloses a pleated filter element which is treated to combat premature blockage by exhaust carbon. A remote restriction indicator is connected to the outlet to indicate clogging.

### **Servicing**

Access is obtained through the rear engine door.

The element should be changed if the restriction indicator (fitted above the rear of the filter) shows red. It is not recommended that treated elements should be washed as this removes the active chemical. In a case of necessity the element can be cleaned by blowing through with air at a max 100 p.s.i. (7 bar) in the reverse direction.

To remove the element, undo the centre hand nut on the cleaner casing lid. Pull out the element and wipe out the inside of the casing with a damp cloth. Check that the gaskets are in good condition and that the casing and lid are undamaged. Fit the new element, position the lid and tighten the hand nut. If necessary reset the restriction indicator by pressing down on the top.

### **Vehicle Checks**

After re-assembly but before restarting engine, the following system checks must be carried out.

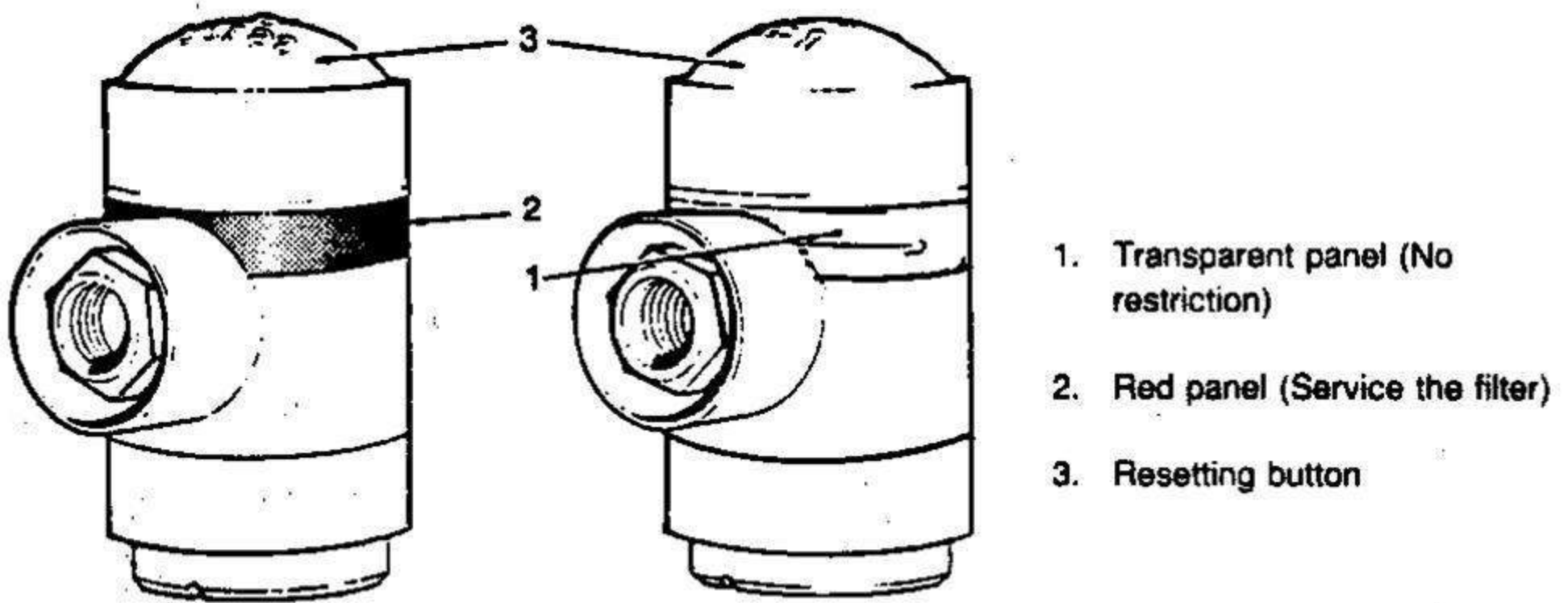
- (a) Check all cleaner to engine pipework for defects to ensure good leak free condition.
- (b) Check that all rubber hose connections are tight and leak free. Renew any worn or damaged parts.
- (c) Check that the cleaner mounting fixtures are secure.

## RESTRICTION INDICATOR

The restriction indicator gives a warning that the air cleaner filter is too clogged for further service. The indicator is operated by the depression between the air cleaner and the engine, and at a preset figure, the red warning indicator will remain locked up in a visible position after the engine has stopped running.

When the red indicator band appears, the air cleaner element must be removed and renewed. After the element has been renewed, reset the indicator by pushing on the diaphragm at the top of the instrument.

Blank off the connection if the indicator is not fitted.



RESTRICTION INDICATOR



|                                      |      |   |
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# S43L FRONT AXLE

## 1. DESCRIPTION

The Axle is of the 'Reverse Elliot' type, comprising a girder section axle bed or beam with stub axles. Each stub axle is carried on a parallel king pin with fully greased phosphor bronze bushes at both top and bottom jaws. The load is carried by a parallel roller thrust bearing fitted between the bottom stub axle jaw and axle beam. The hub is fully floating, running on taper roller bearings which are secured and adjusted by means of double locknut arrangement.

The brakes are single leading shoe type with wedge expanders.

Steering ball joints with case hardened ball pins and rubbing pads incorporate compression springs which automatically take up any wear.

## 2. HUB BEARING ADJUSTMENT

An adjustment should be made after the first 3,000 miles (4,800 Km) and then at intervals of 25,000 miles (40,000 Km). With the wheels raised up they should revolve quite freely without roughness. The hub bearing should have slight end float movement within the limits 0.0005" to 0.002" when rocked backwards and forwards on the stub. See 'TO ADJUST END FLOAT SECTION' if any adjustment is required.

## 3. CHECKING FRONT WHEEL ALIGNMENT

To preserve correct steering and avoid excessive tyre wear, the tracking (or alignment) of the front wheels should be checked periodically, as follows:—

Set the front wheels in straight ahead position and at point level with the wheel centre, measure the distance between the edges of the wheel rims, both in front and behind the axle centre. The two measurements should be the same i.e. no toe in or toe out.

To allow for inaccuracies in the wheels, the same check should be made with the vehicle moved an equivalent to half of wheel revolution. Any adjustment required can be effected by slackening the clamp bolts in the ball sockets and rotating the tie (track) rod tube. After adjustment tighten clamp bolts to 35/45 lb ft torque, using an  $1\frac{1}{16}$ " A/F socket. See also steering.

## 4. REMOVING THE BRAKE AND HUB (fig 1)

- (a) Chock the appropriate wheels.
- (b) Whilst the wheels are still on the ground, loosen the eight wheel nuts (1) slightly on each wheel.
- (c) Jack up the axle and support with suitably placed axle stands.
- (d) Remove the wheel nuts (1) and road wheels.
- (e) Disconnect the brake air hose.
- (f) Remove the screw (55) and withdraw the brake drum (4). If necessary, back off the brake adjustment as described under Wheel Brakes.
- (g) Using a  $\frac{1}{2}$ " A/F socket, unscrew and remove the four hub cap setscrews (60) and washers (59).
- (h) Remove the hub cap (58) and joint (57).
- (i) Using suitable pliers, remove split pin (54).
- (j) Using Tool No. E456, unscrew and remove the hub bearing nuts (2 and 56) along with hub bearing washer (3).
- (k) Remove the hub (6).

- (l) Remove the oil seal (9) from the hub (6).
- (m) Drive out the hub bearings (5 and 8) from the hub (6).
- (n) If the hub distance piece (12) shows any signs of wear or corrosion, it must be removed and replaced with new part.
- (o) Remove the nuts (53) and washers (52) to free the brake assembly (11).

## 5. INSPECTION

Thoroughly clean all parts. Inspect all parts for wear and/or damage and renew if necessary. Parts such as oil seals, paper or cork joints and split pins should be renewed whenever they have been removed.

## 6. REMOVING STUB AXLE ASSEMBLY (fig 1)

- (a) Disconnect the steering lever (23) and bottom lever (39) from the steering gear and tie rod socket assembly (37).
- (b) Using a  $\frac{1}{2}$ " A/F socket, unscrew and remove the top cap screws (18) and bottom cap screws (49) with their washers.
- (c) Remove the top and bottom caps (20 and 47) and joints (21 and 46). Discard the joints.
- (d) Using an  $\frac{11}{16}$ " A/F socket, unscrew and remove the swivel pin cotter nut (28) and washer (27).
- (e) Using a soft metal drift, drive out the swivel pin cotter (26) from the axle beam (25). Care must be taken not to damage the cotter pin threads.
- (f) Drive out the swivel pin (45) downwards, thus releasing the swivel pin from the axle beam (25).
- (g) Remove the thrust bearing (34), the thrust bearing shims (35) and thrust bearing seal (36).
- (h) Using a  $\frac{1}{4}$ " blade screwdriver, flick out the seal (30) from the swivel (14). Discard the seal.
- (i) Press out the top and bottom swivel bushes (29 and 44) from the swivel (14).
- (j) Using a  $1\frac{1}{8}$ " A/F socket, unscrew and remove the two top steering lever nuts (24), then pull off the top steering lever (23). Care must be taken not to damage the studs (22).
- (k) Using a  $1\frac{1}{8}$ " A/F socket, unscrew and remove the two bottom lever nuts (40), then pull off the bottom lever (39). Care must be taken not to damage the studs (41 and 42).
- (l) Check the condition of the swivel stop screw (33) and remove for renewal if required using a  $\frac{15}{16}$ " spanner.

## 7. INSPECTION

Clean and inspect all dismantled parts for wear and/or damage. Any parts found defective in any way should be renewed.

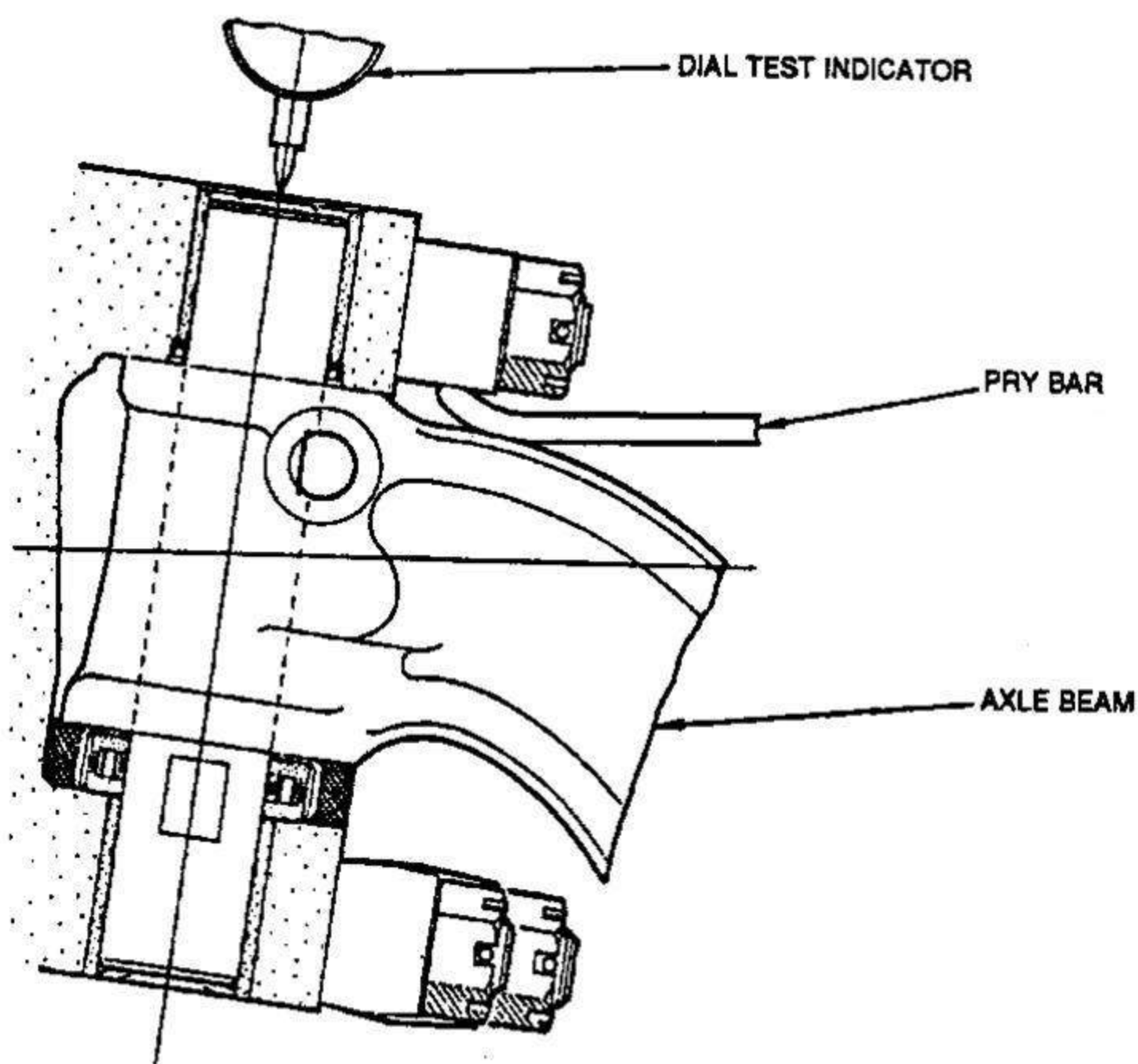
## 8. ASSEMBLING SWIVEL (fig 1)

- (a) Prior to assembly, soak the thrust bearing seal (36) in clean gear oil until fully impregnated.
- (b) Coat all internal surfaces/parts except paper joints (21 and 46) with clean gear oil.
- (c) Press the swivel pin top bush (29) into position in the swivel (14). Also fit oil seal (30) into the swivel (14).

- (d) Press the swivel pin bottom bush (44) into the swivel (14).
- (e) Make sure the swivel pin bore in the axle beam (25) is free of burrs and corrosion, and grease the bore with multi purpose chassis grease.
- (f) Position the swivel assembly (14) onto the axle beam (25).
- (g) Select swivel thrust bearing adjusting shim (35) with a total thickness of 0.020" and place in position along with the thrust bearing (34) and seal (36) between the axle beam and bottom jaw of swivel .
- (h) Push the swivel pin (45) through the swivel (14) and axle beam (25) ensuring that the machined groove in the pin is correctly aligned with swivel pin cotter hole.
- (i) Fit the swivel pin cotter (26), washer (27) and nut (28), but DO NOT tighten nut.
- (j) Check the tightening torque of steering lever studs (22) and bottom lever studs (42 and 41) 190/210 lb ft, using a  $\frac{3}{4}$ " UNF stud box.
- (k) Locate the top lever (23) onto studs (22). Fit two nuts (24) using a  $1\frac{1}{8}$ " A/F socket, tighten to 190/210 lb ft. torque.
- (l) Locate bottom lever (39) onto studs (41 and 42). Fit two nuts (40). Using a  $1\frac{1}{8}$ " A/F socket, tighten to 190/210 lb ft. torque.

## 9. SWIVEL SETTING AND ADJUSTMENT (fig 1)

- (a) With the normal shim (35) thickness of 0.020" placed between the bearing (34) and swivel (14), mount a Dial Test Indicator on the axle beam (25) and position the pointer on the top jaw of the swivel (14). See Fig. 2.



**FIG. 2 CHECKING SWIVEL END FLOAT**

- (b) Position a suitable pry bar between the axle beam (25) and swivel (14) to check for lift. The correct reading should be 0.000" – 0.005" slack fit. If reading is not between these limits it will be necessary to alter the shim (35).

Add or subtract shims as required until a reading of 0.000" – 0.005" is obtained.

- (c) When swivel is set correctly, tighten the swivel pin cotter nut (28), using an  $1\frac{1}{16}$ " A/F socket.

#### 10. SWIVEL FINAL ASSEMBLY (fig 1)

- (a) Place a new paper joint (21) and top cap (20) in position on swivel (14).
- (b) Secure top cap and joint with two setscrews (18) and washers (17). Using a  $\frac{1}{2}$ " A/F socket, tighten to 17/19 lb ft. torque.
- (c) Using a  $\frac{7}{16}$ " A/F spanner, refit lubricator (19) onto top cap (20).
- (d) Repeat Operations a) to c) to assemble bottom cap (47) to swivel (14).
- (e) Charge the swivel assembly with grease. Swivel is full when grease seeps between the upper face of the axle beam (25) and swivel bush seal (30), and from between the thrust bearing seal (36) and lower face of axle beam (25). See Fig 3 below.

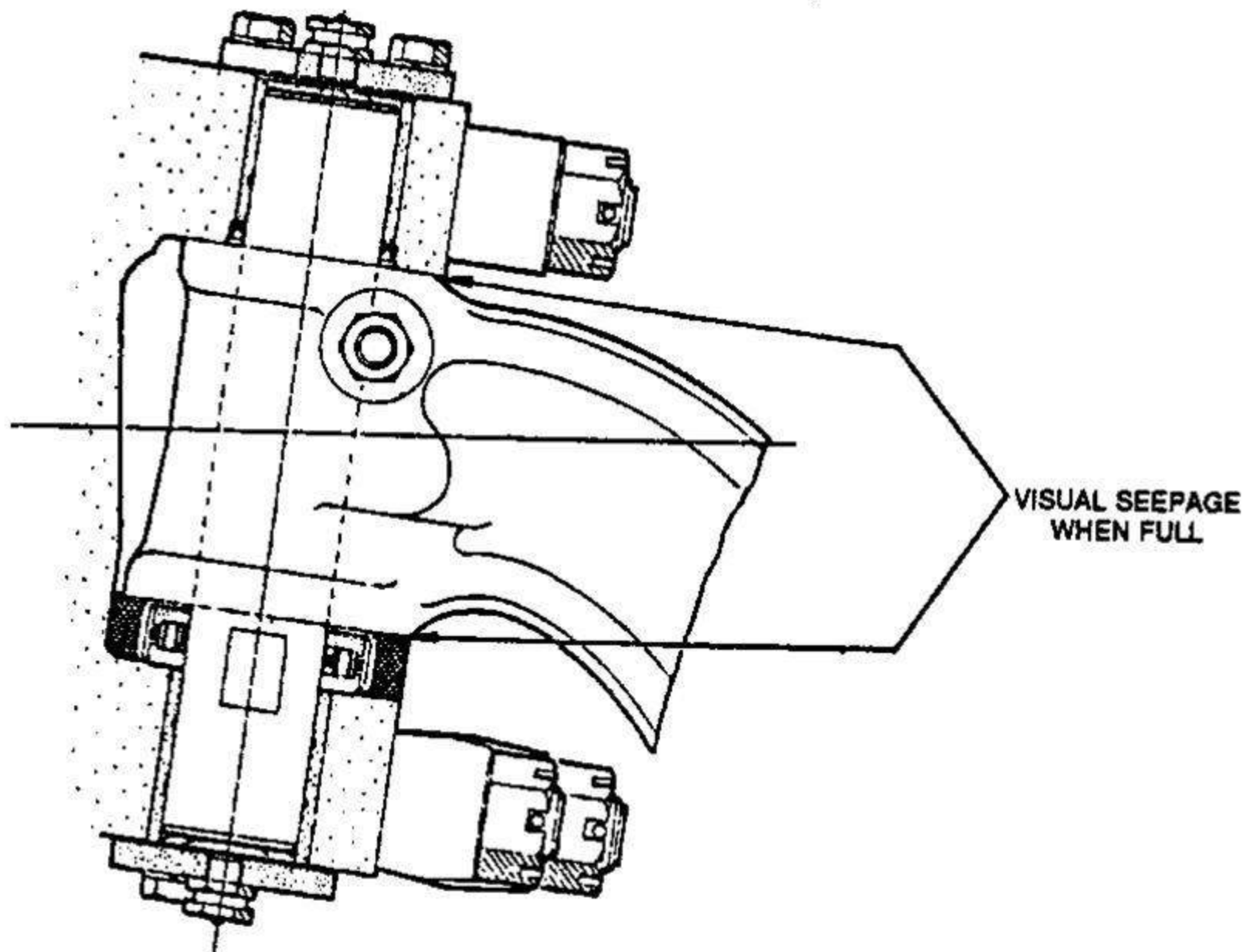


FIG. 3 CORRECT GREASING INDICATION

NOTE: Rotate the swivel periodically when greasing.

- (f) Re-connect the steering gear and tie rod (38) assembly to top and bottom levers.

## 11. ASSEMBLING THE HUB AND BRAKE (fig 1)

- (a) Position the brake unit (11) on the studs (51). Secure with the nuts (53) and washers (52).
- (b) Fit the hub distance piece (12) onto the stub axle.
- (c) Fit the inner and outer hub bearing cups. (5 and 8) into their respective bores in the hub (6).
- (d) Pack the hub and bearings with grease. See Fig.4.

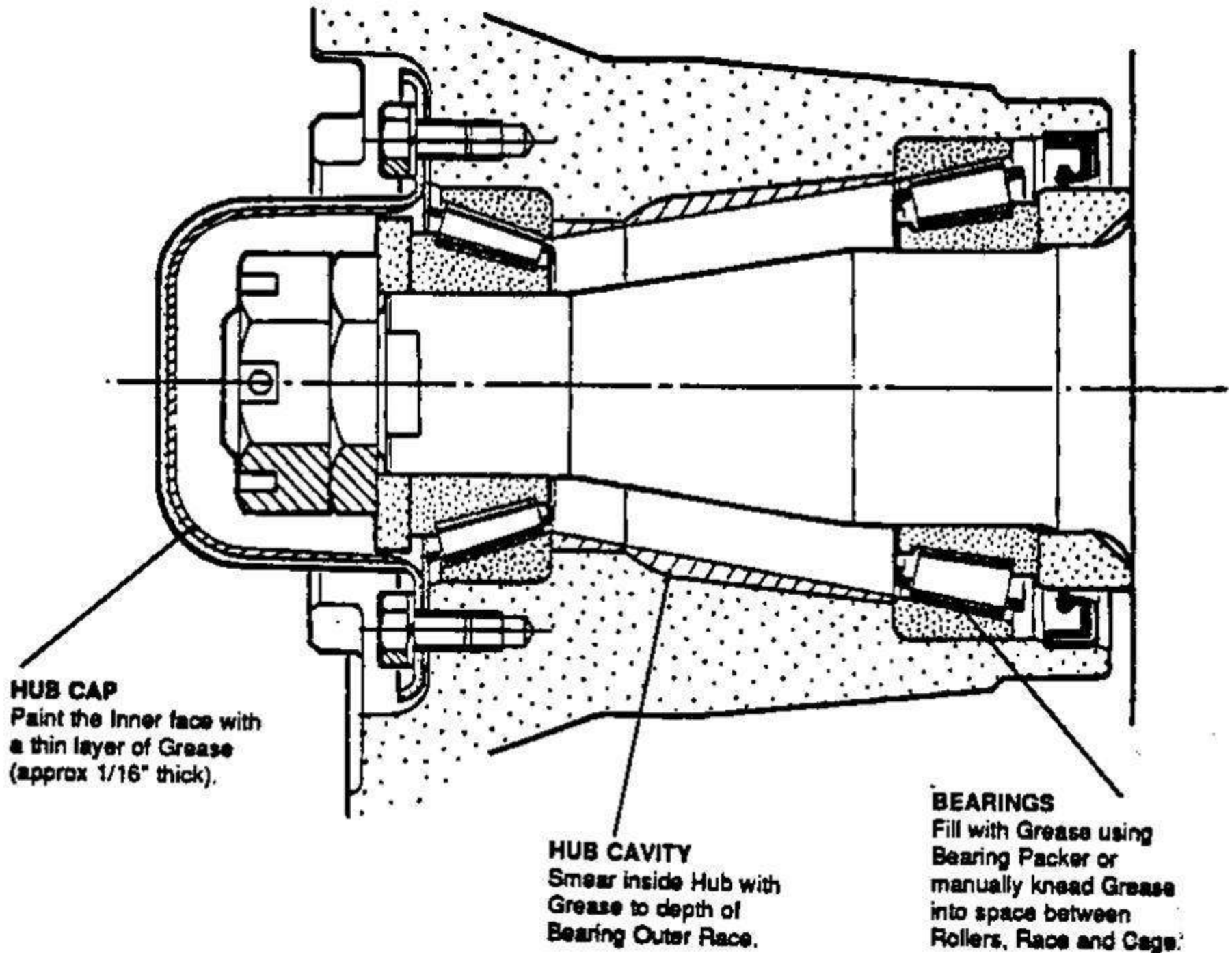
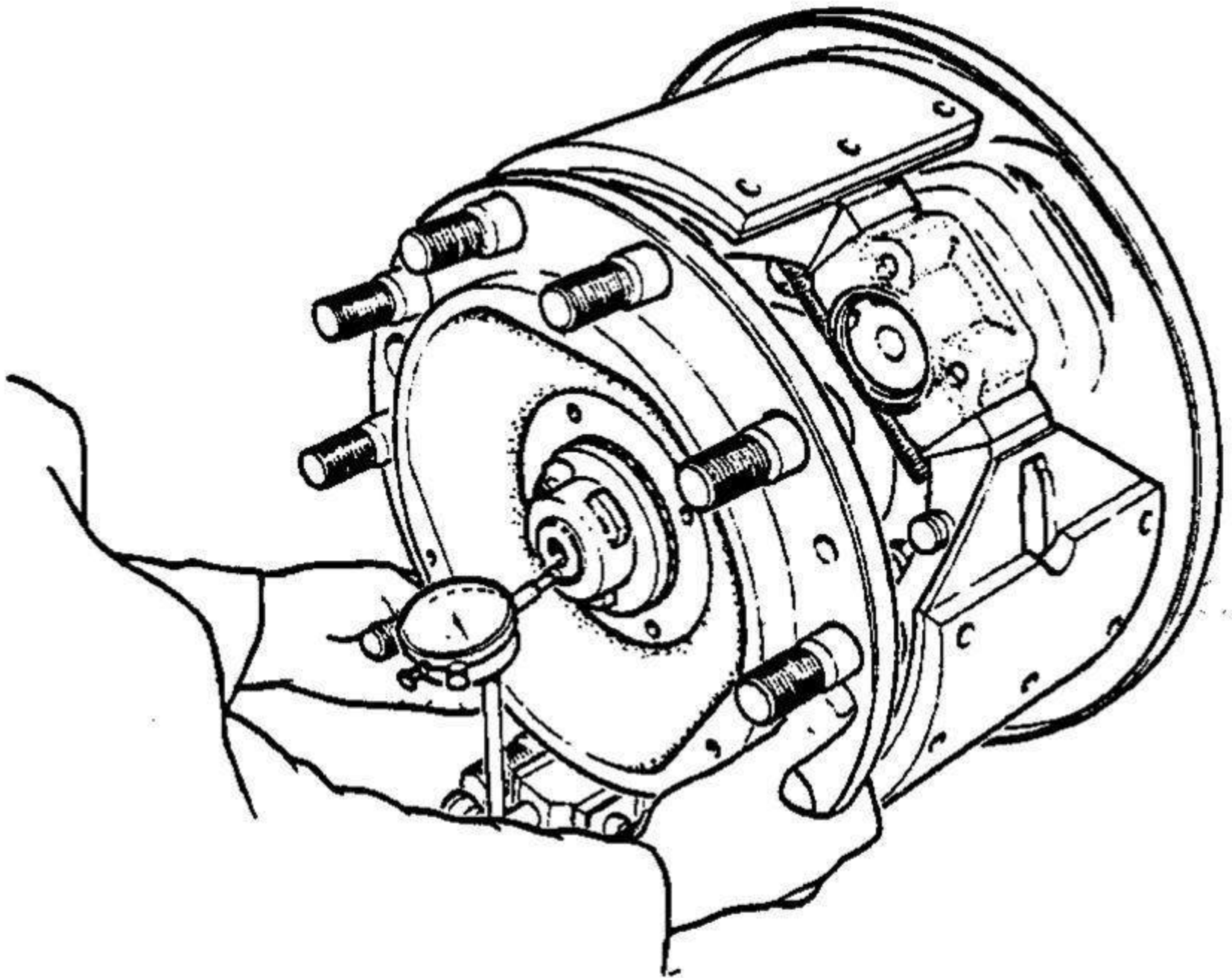


FIG 4 GREASING HUB

- (e) Fit the inner hub bearing cone (8) into its cup in the hub (6).
- (f) Using Tool No.E455 press the hub oil seal (9) into position in the hub (6).
- (g) Fit the hub (6) onto the stub axle.
- (h) Fit the outer hub bearing cone (5) into its cup.
- (i) Fit the bearing washer (3), hub bearing locknut (2) and hub bearing nut (56). Using Tool No.E456 tighten nuts.
- (j) Adjust hub 'end float' as follows:—
  - i) Rotate the hub and, using a hide faced mallet, knock the hub backwards and forwards along stub axle to 'shock load' and thus settle bearings in position.

**PLEASE NOTE:** It is important to 'shock load' the hub because:—  
The rotation serves to ensure that the bearings rollers settle in their correct tracks. The 'shock load' is to ensure that the bearings are seated correctly up to their abutment shoulders.

- ii) Check the tightness of the hub bearing locknut (2), if loose re-tighten hard.
- iii) Rotate and 'shock load' the hub again.
- iv) Continue this procedure until the hub bearing locknut (2) cannot be tightened further after hub has been rotated and 'shock loaded'.
- v) Back off the hub bearing locknut (2) by approximately 30° then rotate again and knock the hub outwards along the axle arm to release the bearings. Tighten the hub bearing nut (56) tight, ensuring the hub bearing nut slot aligns correctly with the split pin hole in the swivel stub.
- vi) Mount a Dial Test Indicator on the hub flange, and position the pointer on the end of the stub axle. See Fig 5.



**FIG. 5 ADJUSTING HUB END FLOAT**

- vii) Rock the hub backwards and forwards along the arm, taking a reading on the Dial Test Indicator.
- viii) The correct end float is between 0.004" – 0.006" (0.102 – 0.152mm).
- ix) Adjust if outside the specified limits.
- (k) Smear the inside of the hub cap (58) with a thin coating of grease, as described in Fig.4.
- (l) Fit the hub cap (58) along with a new hub cap joint (57), secure with four hub cap setscrews (60) and washers (59). Using a 1/2" A/F socket, tighten to 17/19 lb ft. torque.



- n. Connect the air hose brake assemblies.
- o. Refit the road wheels and fit wheel nuts 1, tighten to 285/315 lb ft. torque.
- p. Remove the axle stands and lower the vehicle onto the ground.

**Section 1: General**

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**Section 2: Periodic Service**

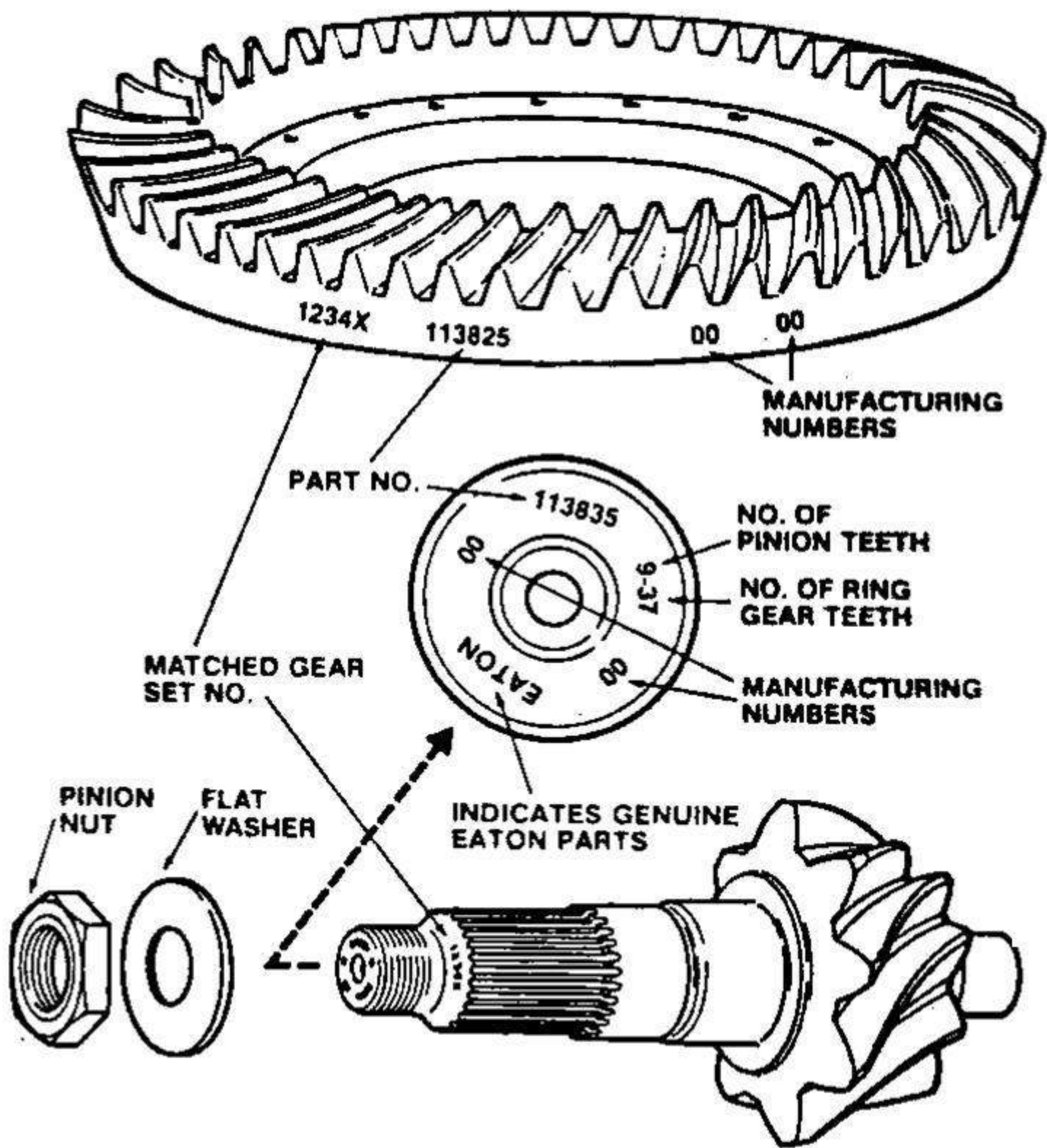
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**Ring Gear and Pinion Identification**



## **2 MAINTENANCE/ADJUSTMENT**

### **2A LUBRICATION**

Proper lubrication is vital for optimal drive axle service life. The importance of the following procedures cannot be overstated.

The recommended multi grade gear lubricant is 85W-140.

Synthetic lubricants are approved provided they meet MIL-L-2105C.

Oil additives are **not approved** for use in Eaton Axles.

The proper oil fill level is level with the bottom of the filler hole. A level close enough to be seen or touched is not enough. Oil must be level with the bottom of the filler hole.

**Note:** Check and clean housing breather vent at each oil level check.

**Note:** Do not mix lubricants of different grades.

### **2B OIL CHANGE INTERVAL**

Change the oil according to the schedule shown, following steps below.

|                     |               |
|---------------------|---------------|
| New or rebuilt axle | 5,000 miles   |
| On-highway use      | 100,000 miles |
| More severe use     | 40,000 miles  |
| Low mileage         | annually      |

**Caution:** Initial oil change within 5,000 miles is critical. This will remove fine particles of wear material generated during running - in and prevent accelerated wear.

### **2C CHANGING OIL**

**Draining:** Drain into suitable container with the oil at normal operating temperature. Inspect drain plug for excessive metal particle accumulation symptomatic of extreme wear. Clean and refit plug after draining.

**Note:** After initial oil change the entire unit should be inspected if excessive particle accumulation is observed.

**Filling:** Remove filler hole plug and fill housing with approved lubricant until level with bottom of filler hole. Approx 12 litres (25 pints) of oil are required for gearing and bearings

**Note:** Always use the upper plug i.e. the larger plug mounted on the axle centre line.

**Do not remove the lower plug.**

### **2D WHEEL BEARING LUBRICATION**

When wheel equipment is being installed either new or after servicing, wheel bearings must be manually lubricated or they will be severely damaged with use. Raise each side of the axle for a moment after filling with oil to allow flow to the wheel bearings at each end.

If this is not possible, pack bearing with good quality grease before assembly.

### **2E WHEEL BEARING ADJUSTMENT (SPINDLE WASHER TYPE)**

1. Remove outer nut and spindle washer.
2. Tighten the inner wheel nut 100lb-ft. (136 Nm) torque while rotating the wheel in both forward and reverse directions. The wheel should turn easily. Back off inner wheel

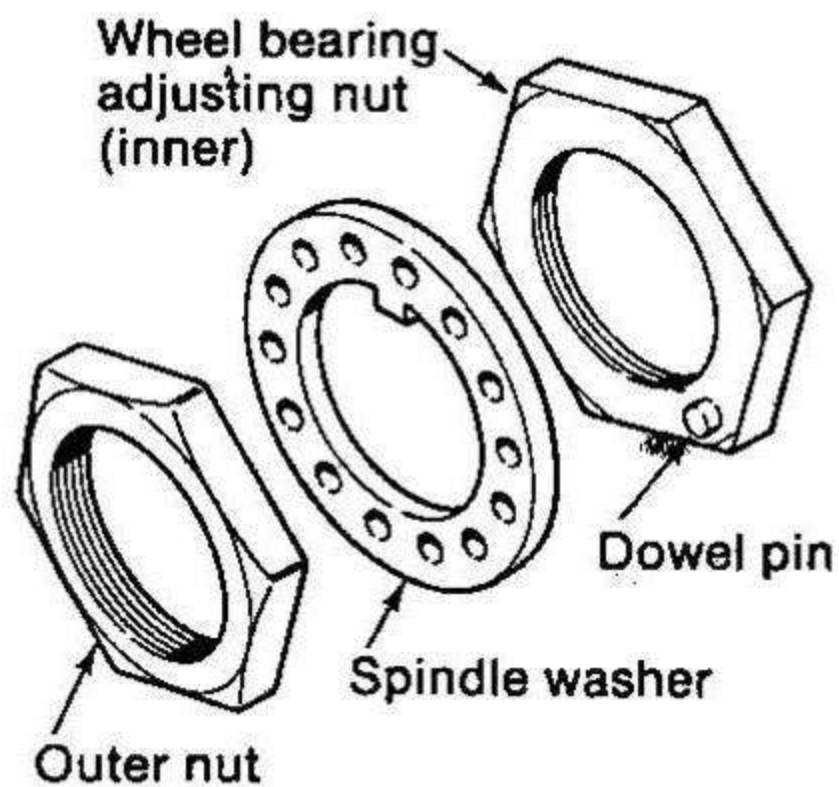
## 2 MAINTENANCE/ADJUSTMENT

nut  $\frac{1}{4}$  to  $\frac{1}{3}$  turn to relieve bearing preload, then install spindle washer (engaging nut dowel pin with hole in washer).

**NOTE:** If dowel pin and washer hole are not aligned, remove washer, turn over and reinstall. For further alignment, the nut can be moved slightly. However, do not exceed the  $\frac{1}{3}$  turn back-off noted in Step 2.

- 3 Repeat rotation of the wheel in both directions. The wheel should rotate freely and be within limits of 0.001" to 0.010" end play.
- 4 With adjustment complete, install outer nut and torque to 330 - 370 lb. ft. (448 - 502 Nm). Reinstall axle shaft. Refill axle to proper oil level.

### SPINDLE WASHER TYPE ADJUSTING NUT



## 2F CLEANING

Proper cleaning requires complete disassembly.

The differential carrier assembly may be steam cleaned only while mounted in the housing provided all openings are plugged.

Wash castings or other rough parts in solvent or clean in hot solution tanks using mild alkali solutions, heating parts thoroughly before rinsing.

Rinse all parts thoroughly. Dry immediately with clean rag. Lightly oil parts and wrap in corrosion - resistant paper if not reused immediately. Store parts in a clean, dry place.

**WARNING:** Petrol is not an acceptable cleaning solvent because of its extreme combustibility. It is unsafe in the workshop environment.

## 2G INSPECTION

All axle components should be closely inspected after cleaning to determine which require renewal.

Inspect steel parts for notches, visible steps or grooves. Look for scuffing, deformation or discolouration related to improper lubrication.

Inspect gear teeth for signs of excessive wear, pitting or cracking along contact lines before reusing. Check tooth contact pattern.

Inspect machined surfaces of cast or malleable parts for cracks, scoring, and wear. Look for elongation of drilled holes, wear on machined surfaces and nicks or burrs in mating surfaces.

Inspect fasteners for rounded heads, bends, cracks or damaged threads.

The axle housing should be inspected for cracks or leaks, loose studs or cross threaded holes.

**CAUTION:** Any damage which affects the alignment or structural integrity of the housing requires housing renewal. Repair by welding or straightening must not be attempted. Such processes can affect the housing metallurgy and cause it to fail completely under load.

## 2H REPAIR AND RENEWAL

Renew lower-cost parts, such as thrust washers, seals, etc., that protect the axle from premature wear and do not add greatly to the cost of your rebuild.

Renew heavily worn but unbroken parts, since the damage done, should they fail, would greatly exceed their renewal cost.

Steel parts such as shafts or gears are not repairable. If worn or damaged, they should be renewed along with mating parts as necessary.

Seals and washers should be routinely renewed. Fasteners with self-locking patches may be reused if secured with several drops of Loctite 277.

Axle housing repairs are limited to removal of nicks or burrs on machined surfaces or renewal of damaged studs.

### 3 OVERHAUL

**WARNING:** Do not strike the axle shaft flange with a hammer. Do not use chisels or wedges to loosen shaft or dowels.

**WARNING:** Do not lie under carrier while removing fasteners or after fasteners are removed. Use transmission jack to support and remove differential carrier assembly

#### Differential Carrier Assembly Removal (Follow procedure in numerical sequence.)

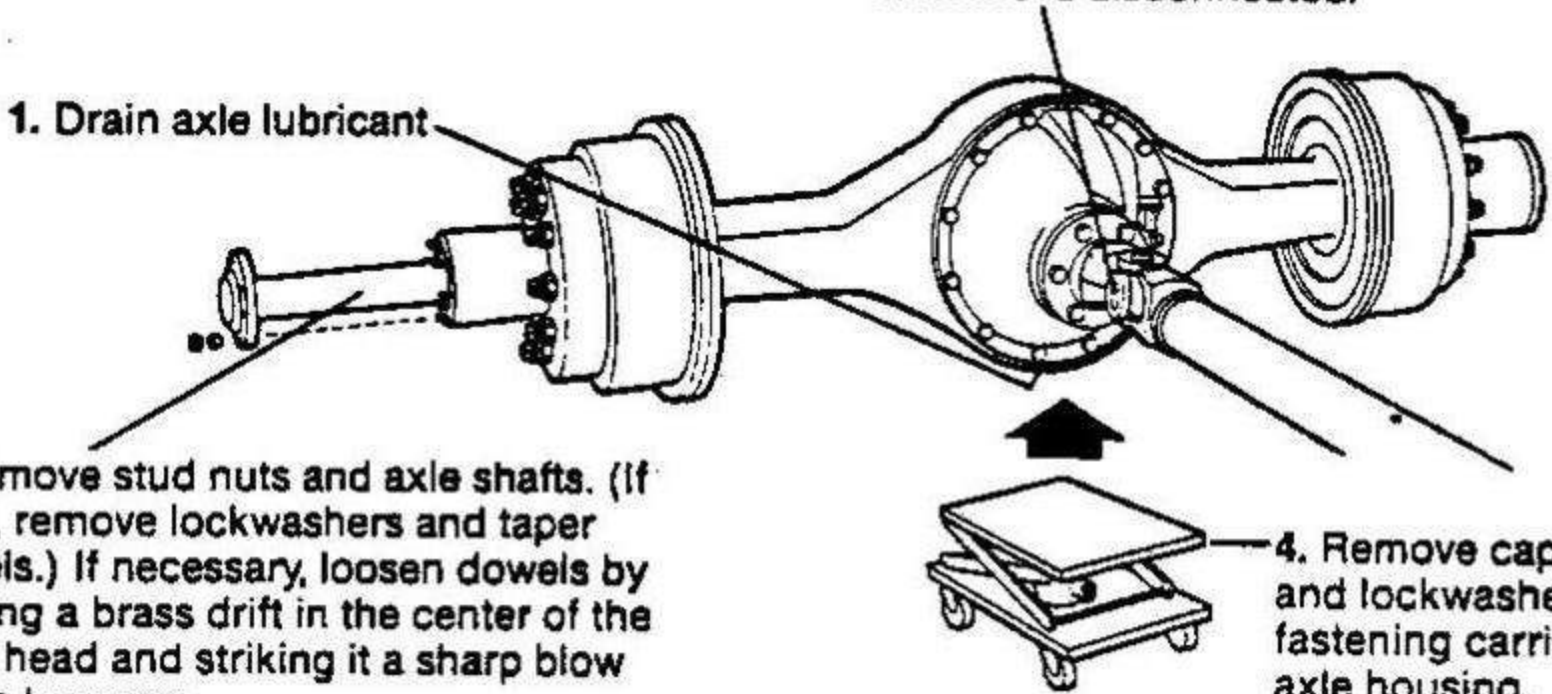
2. Disconnect driveline.

**NOTE:** For easier disassembly, the drive pinion nut can be loosened after driveline is disconnected.

1. Drain axle lubricant

3. Remove stud nuts and axle shafts. (If used, remove lockwashers and taper dowels.) If necessary, loosen dowels by holding a brass drift in the center of the shaft head and striking it a sharp blow with a hammer.

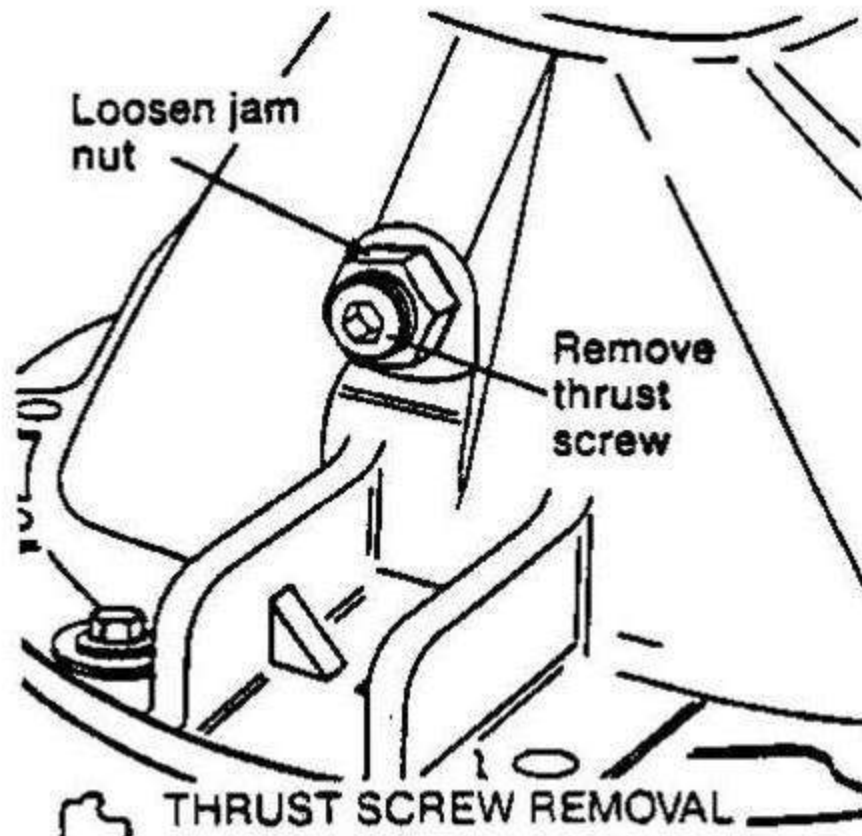
4. Remove cap screws and lockwashers fastening carrier to axle housing.



#### 3B DISASSEMBLE DIFFERENTIAL CARRIER

**NOTE:** If gear set is to be reused, check tooth contact pattern and ring gear backlash before disassembling differential carrier. Best results are obtained when established wear patterns are maintained in used gearing. Omit this step if the gear set is to be renewed

1. Mount differential carrier assembly in repair stand. Loosen but do not remove pinion nut
2. Loosen locking nut on ring gear thrust screw. Remove thrust screw

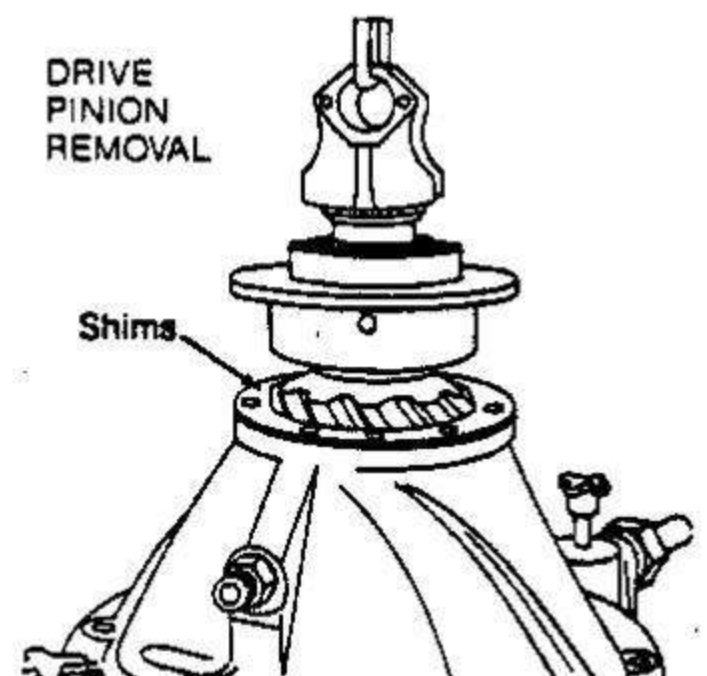
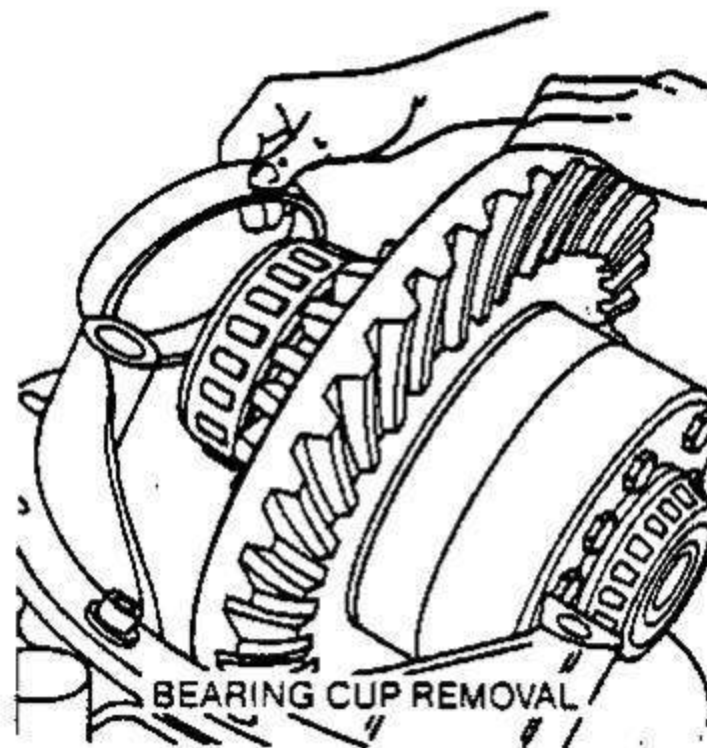
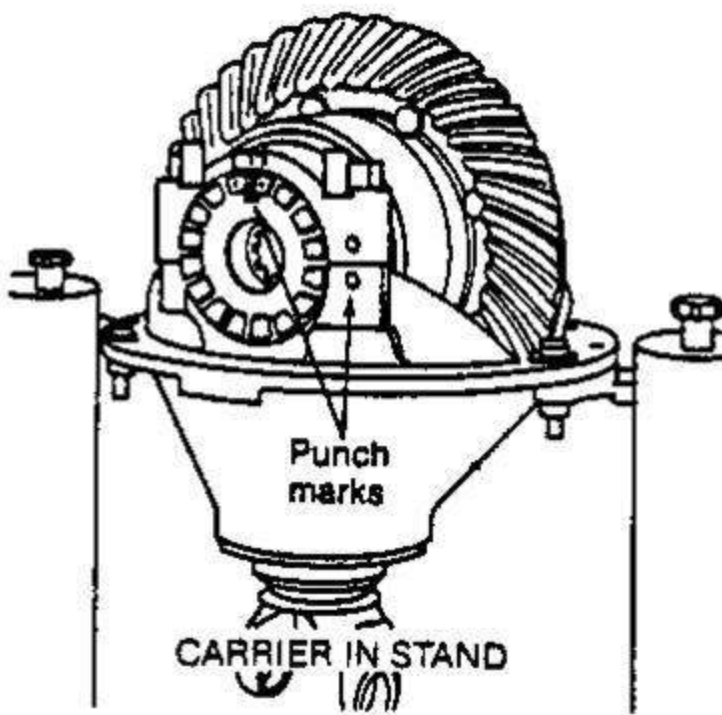




### 3B DISASSEMBLE DIFFERENTIAL CARRIER ( cont'd)

3. Punch mark differential bearing caps. If reusing gear set, also punch mark bearing adjusters for reference during reassembly.
4. Remove cap screws, flat washers and bearing caps.
5. Remove bearing adjuster and bearing cups. Using a chain hoist, lift ring gear and differential assembly out of carrier.
6. Invert carrier in stand for drive pinion assembly removal.
7. Remove pinion bearing cage cap screws. Using a chain hoist, lift drive pinion, cage and yoke assembly out of carrier.

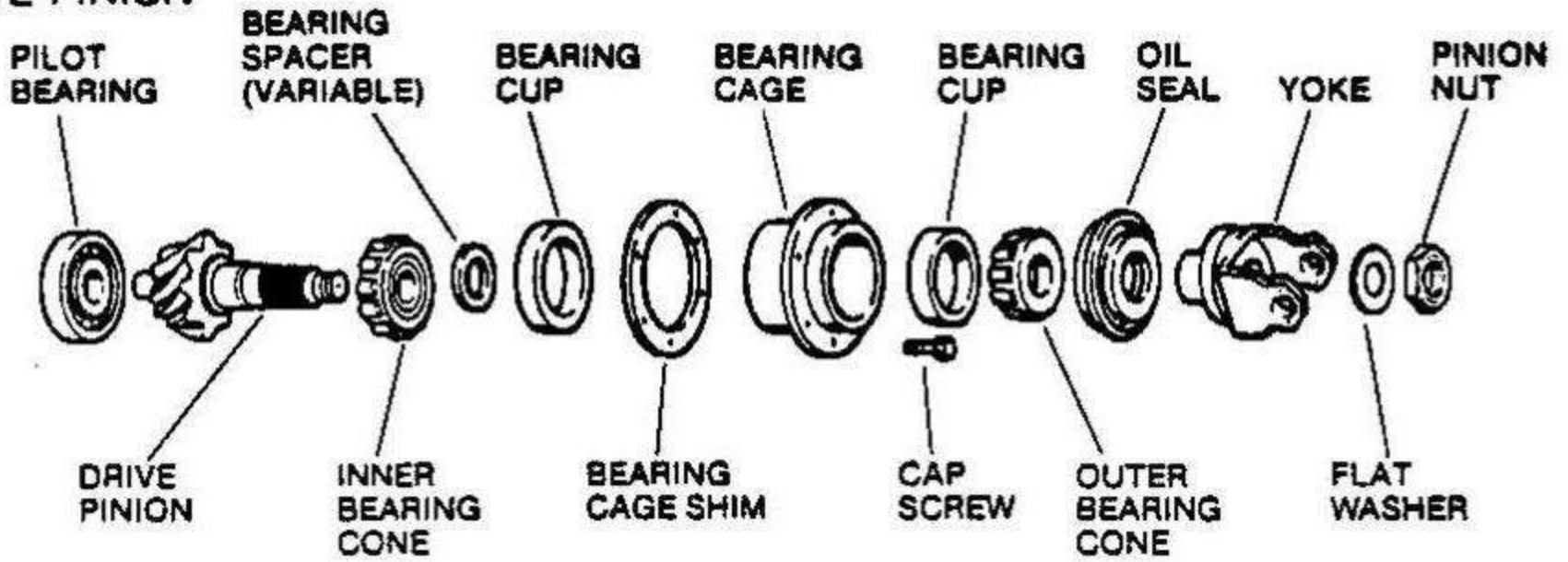
**NOTE:** If gear set is to be reused, keep pinion bearing cage shim pack intact for use in reassembly. If the original shims cannot be reused, record the number and size in the pack.



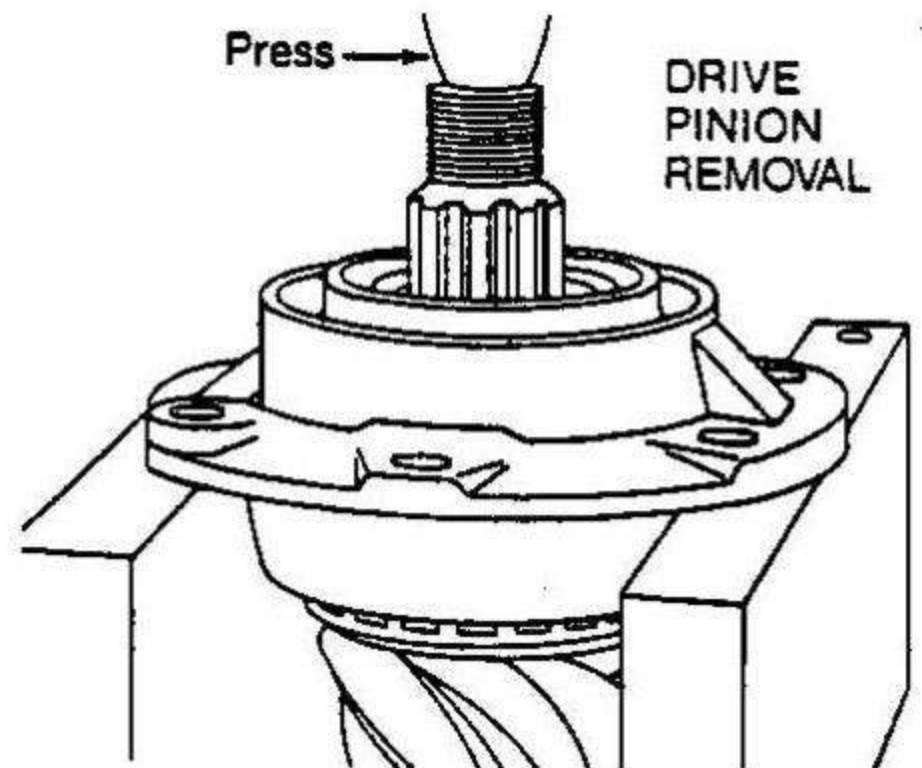
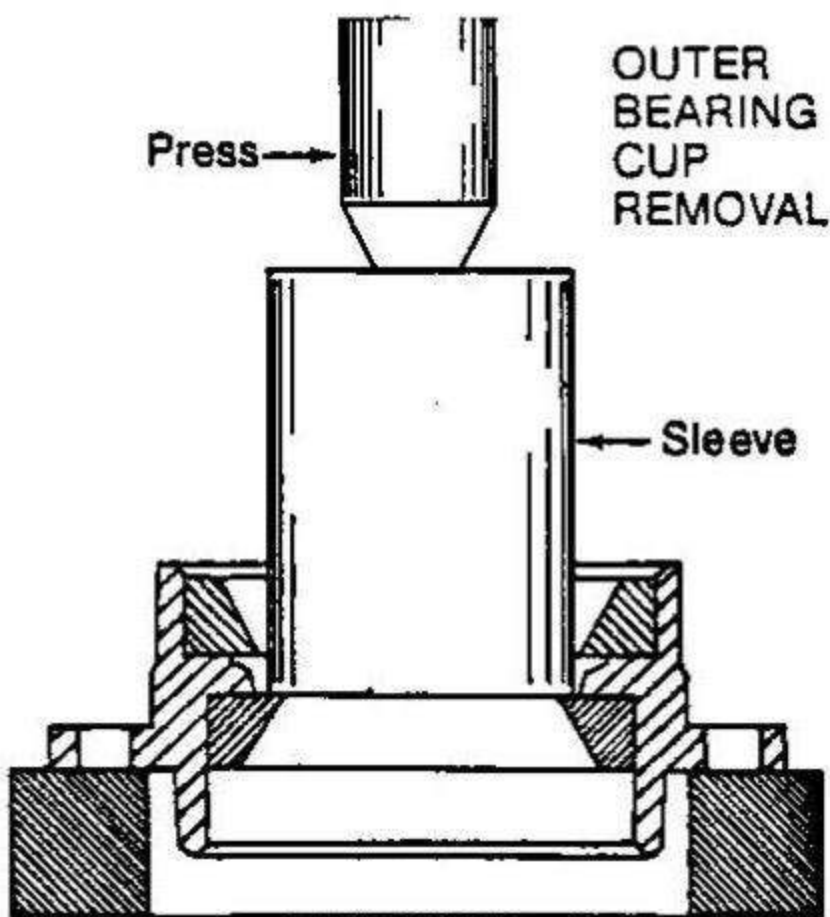
### 3C DISASSEMBLE DRIVE PINION

**CAUTION:** During the following yoke removal procedure, do not allow the pinion to drop on a hard surface.

#### DRIVE PINION



1. If pinion nut was loosened during earlier disassembly, clamp yoke in vice jaws. Use brass pads to prevent damage. Loosen and remove pinion nut. To remove yoke, use suitable puller or press pinion out of yoke.
2. Support cage and press pinion out of bearing cage.
3. Press oil seal and outer bearing cup out of cage. Discard oil seal.



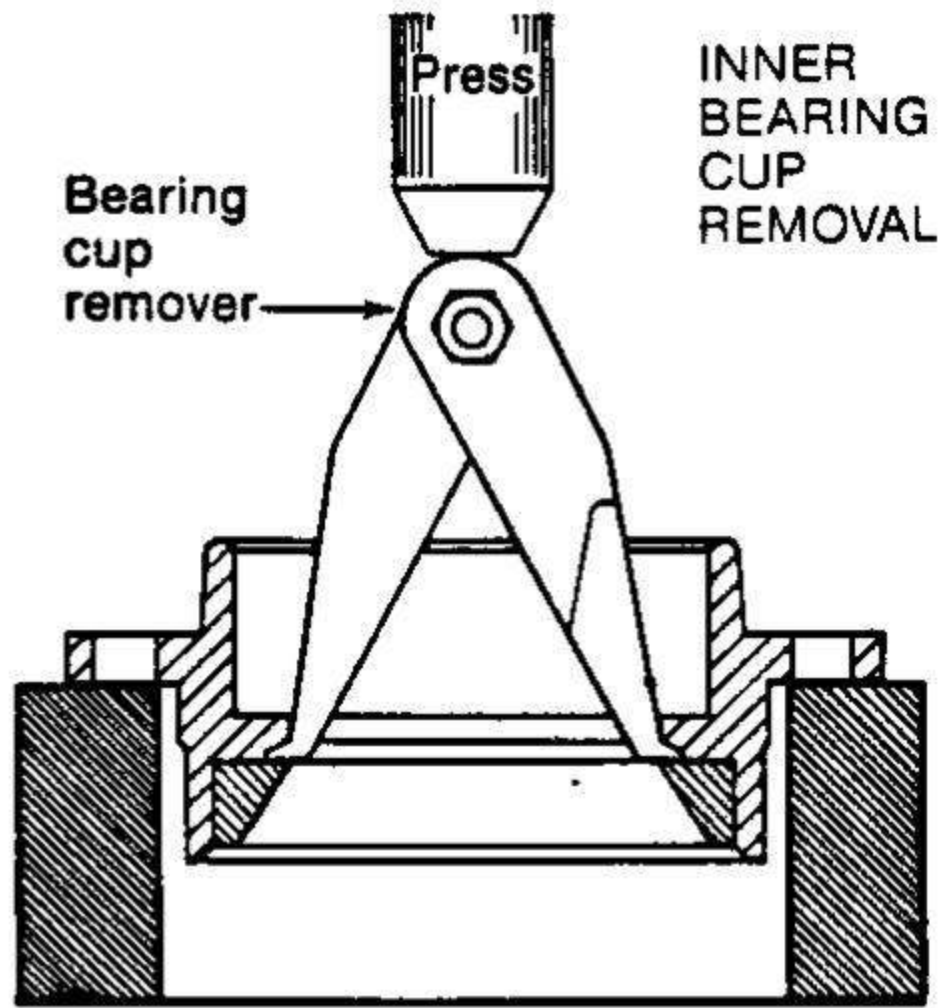
### 3C DISASSEMBLE DRIVE PINION (CONT'D)

4. Remove and retain bearing spacer from pinion.

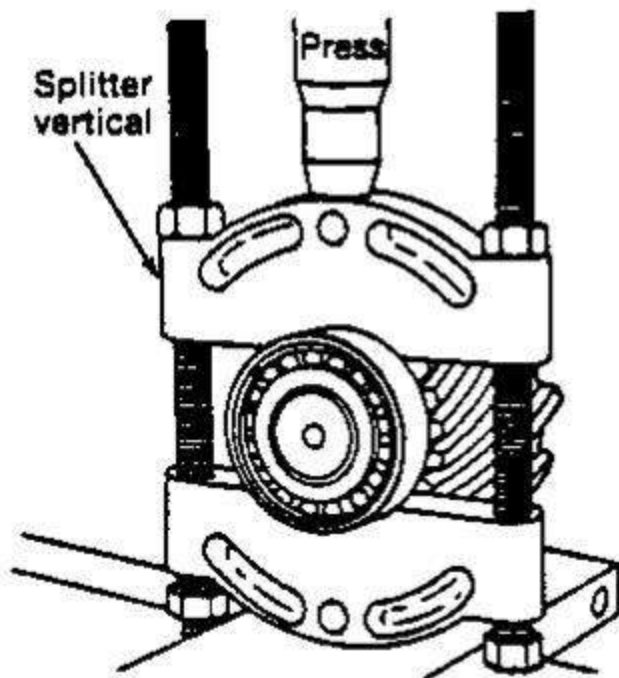
5. Using a bearing cup remover, remove inner bearing cup.

**NOTE:** Bearing cup remover, part number J-3940 (Kent Moore Co.) or equivalent can be used to remove inner bearing cup.

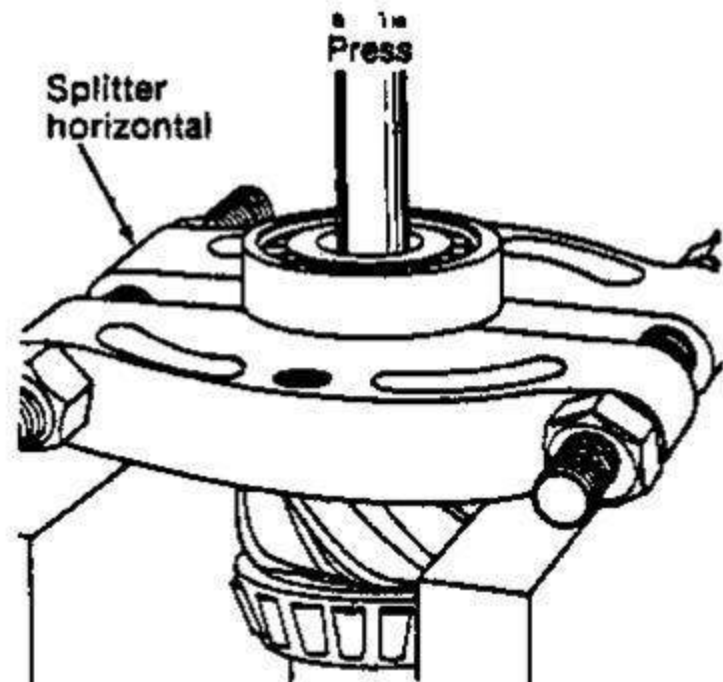
6. Remove pilot bearing and inner bearing cone from pinion, using a split-type puller. Use two procedure steps to remove each bearing (see illustration below).



#### PILOT BEARING REMOVAL



**FIRST,** mount splitter vertically to split bearing.



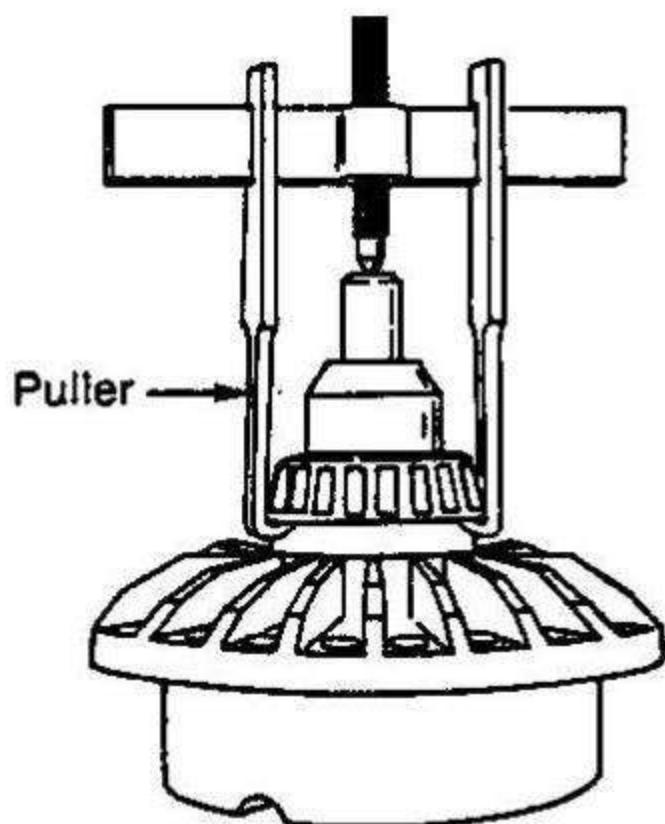
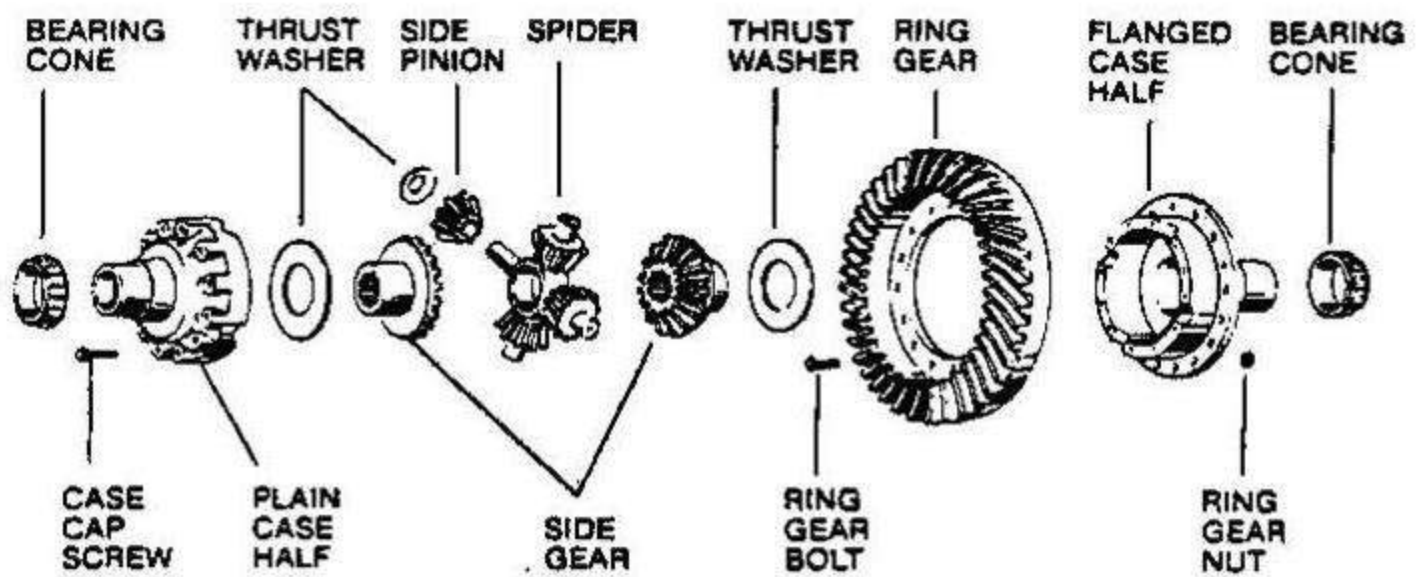
**SECOND,** mount splitter horizontally to remove bearing.

### 3D DISASSEMBLE WHEEL DIFFERENTIAL

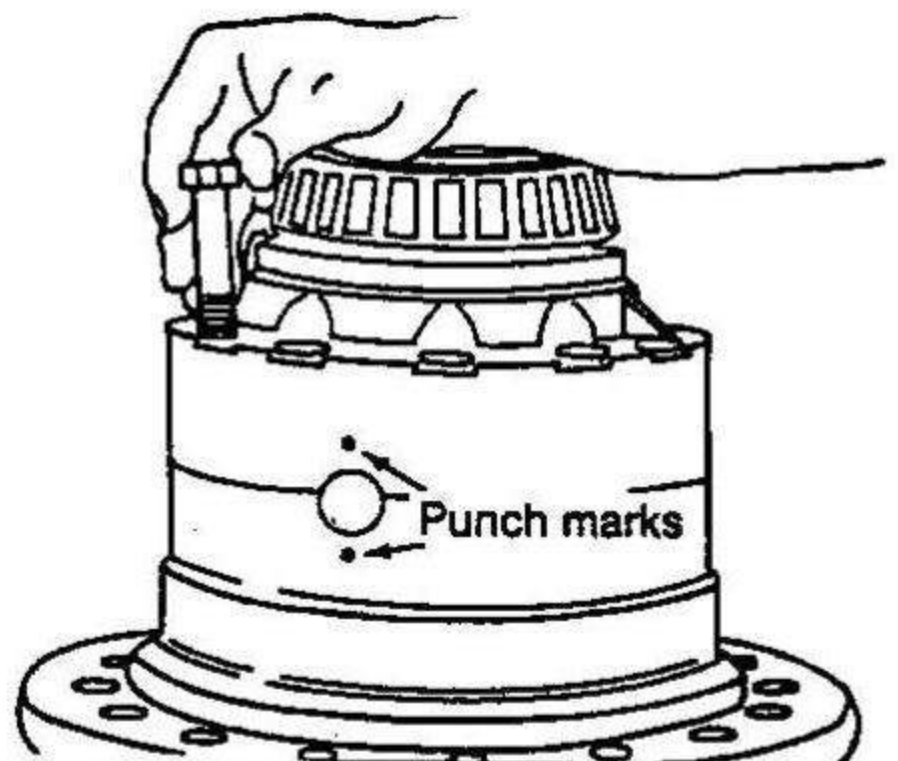
**CAUTION:** During following procedure, place differential assembly on malleable surface to prevent damage when ring gear falls off it's mounting position.

1. Remove nuts and bolts fastening ring gear to differential cases, allowing gear to fall free. If gear does not fall, tap outer diameter with soft mallet to loosen.
2. Punch mark differential cases for correct location during assembly. Remove cap screws and lift off plain differential case half.
3. Lift off side gear and thrust washer.
4. Lift out spider, side pinions and thrust washers.
5. Remove side gear and thrust washer.
6. Remove bearing cone from flanged and plain halves using suitable puller.
7. Clean and inspect parts for damage or wear to determine which parts require renewal as detailed under INSPECTION

### WHEEL DIFFERENTIAL ASSEMBLY



BEARING CONE REMOVAL



### 3E ASSEMBLE WHEEL DIFFERENTIAL

**NOTE:** Lubricate differential parts with gear oil during assembly.

1. Press bearing cone on flanged differential case.
2. Press bearing cone on plain differential case.

**CAUTION:** To prevent bearing damage, use suitable sleeve that only contacts bearing inner race.

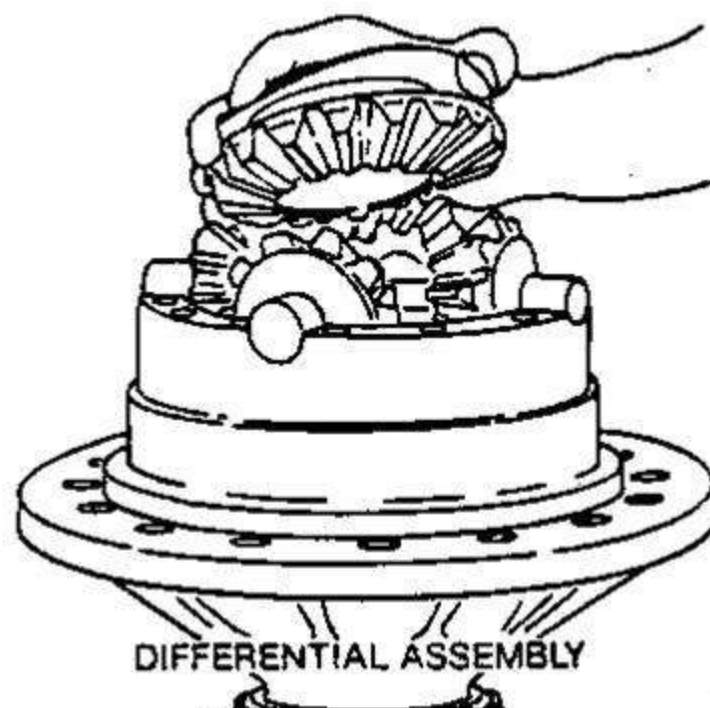
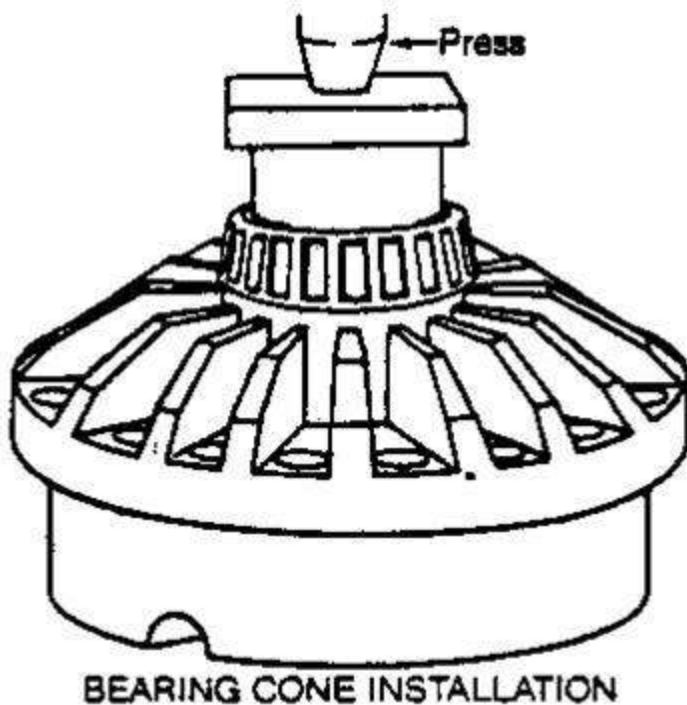
3. Place thrust washer and side gear in flanged differential case.
4. Assemble side pinions and thrust washers on spider. Place this assembly in flanged differential case. Rotate gears and check for proper mesh.
5. Place side gear and thrust washer on side pinions.

**NOTE:** Fasteners using self-locking thread "patches" may be reused if not damaged, but should be secured by a few drops of Loctite 277 on threaded surface of differential case. Reused fasteners should be wiped clean of excess oil, but do not require special cleaning.

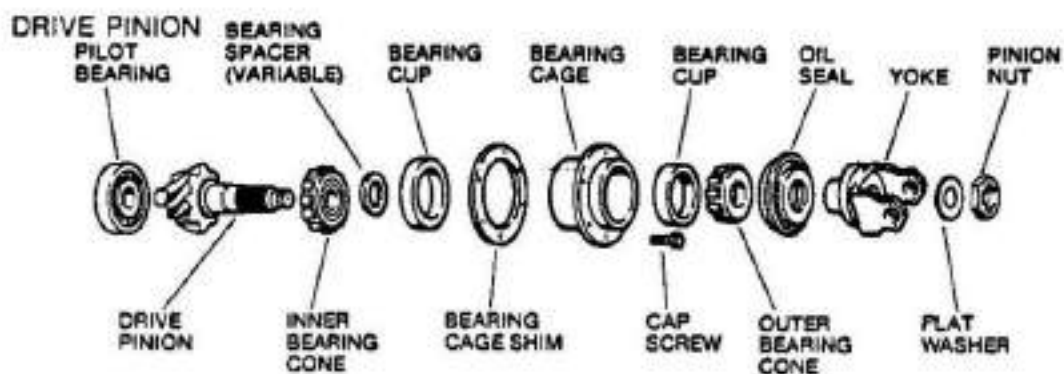
6. Align punch marks and install plain case half. Install cap screw and tighten to correct torque listed in the torque chart.

Check differential for free rotation by turning side gear hub. Differential may require up to 50lb-ft. (68 N.m) torque to rotate.

7. Install ring gear. Secure with bolts and nuts and tighten to correct torque (listed in torque chart).

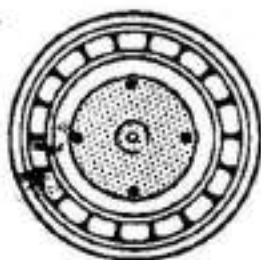
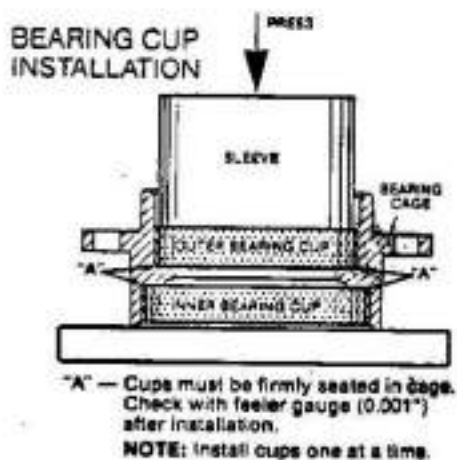
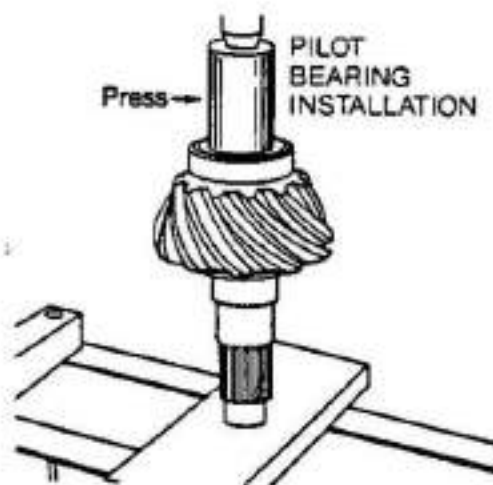


### 3F ASSEMBLE DRIVE PINION



**NOTE:** Lubricate parts with gear oil during reassembly. When installing bearing cones and pilot bearing, use properly-sized sleeves that only contact the inner bearing race.

1. Before installing cups, check for burrs on bearing surfaces and remove. Press bearing cups in cage.
2. Press bearing on pinion. Stake bearing using staking tool. See illustration for stake pattern.
3. Perform Trial Build-Up Pinion Preload Test following procedures on next page.



PINION PILOT BEARING  
STAKE PATTERN

### 3G PINION BEARING PRELOAD ADJUSTMENT (Trial Build - up)

Pinion bearing spacer thickness should be predetermined using a trial build-up. This procedure will result in proper bearing preload in three out of four cases, saving time in subsequent procedures.

1. Assemble pinion bearing cage, cups, bearings, and nominal size spacer (0.703in, 17.85 mm) in the order shown to the right and position as shown in drawing below.

**NOTE:** During assembly procedure, centre bearing spacer between the two bearing cones.

2. Lubricate bearings and place the assembly in the press. Position sleeve or spacer so that load is applied directly to the back face of the outer bearing cone.

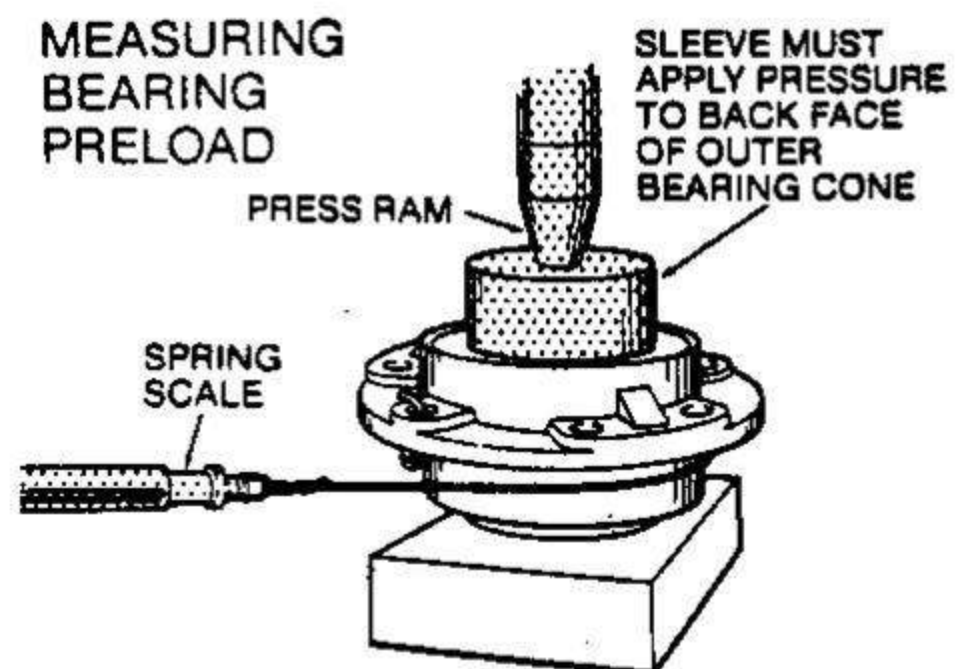
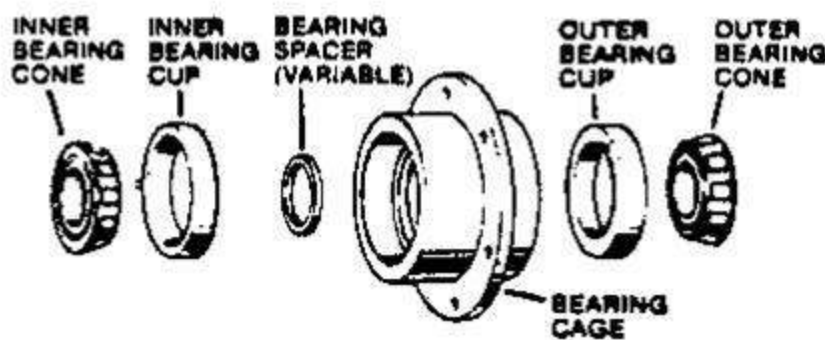
3. Apply a press load of 11-12 tonnes to the assembly. Wrap soft wire or strong string around the bearing cage, attach spring balance and pull steadily. Preload is correct when torque required to rotate the pinion bearing cage is from 10-20 lb-in. (1.1-2.3N.m). This is equivalent to a spring balance reading of 4 to 7 lb.

4. If necessary, adjust pinion bearing preload by changing the pinion bearing spacer. A thicker spacer will decrease preload. A thinner spacer will increase preload.

**CAUTION:** Use the correctly sized spacer. Do not shim stock or grind spacers. These practices can lead to loss of bearing preload and gear or bearing failure.

5. Once correct bearing preload has been established, note the spacer size used. Select a spacer 0.001in. larger for use in the final pinion bearing cage assembly.

#### ASSEMBLE THESE PARTS FOR TRIAL BUILD-UP



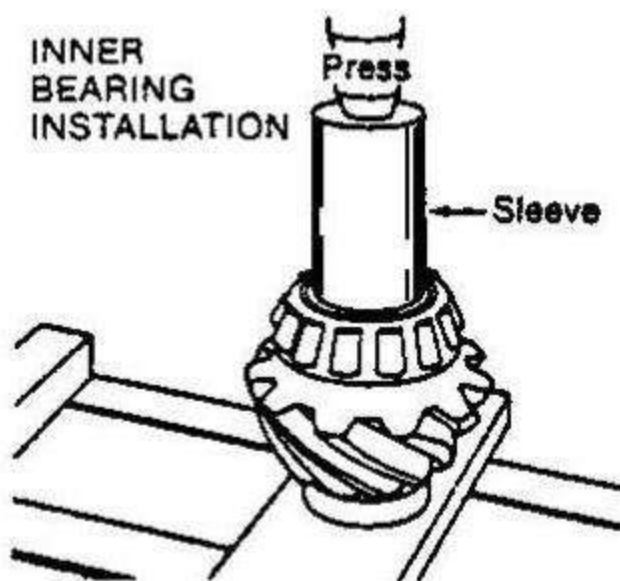
## TRIAL BUILD - UP (Cont'd)

The larger spacer compensates for slight "growth" in the bearings which occurs when they are pressed on the pinion shank.

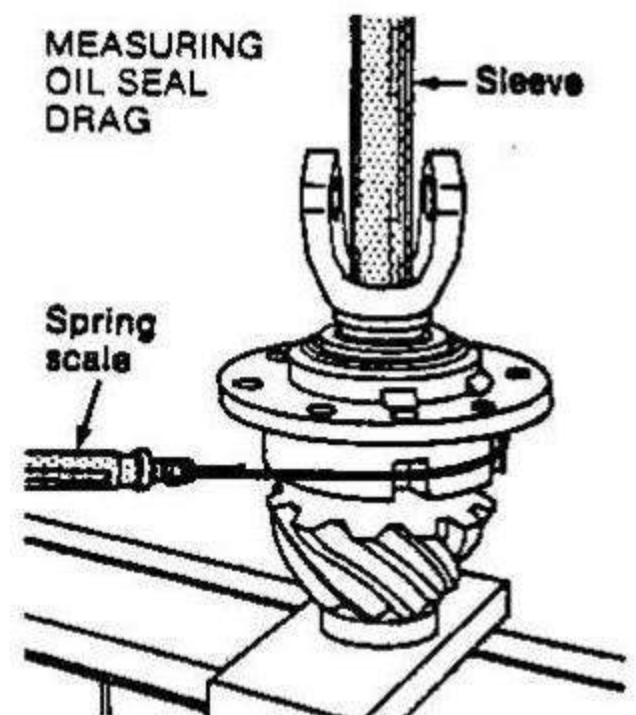
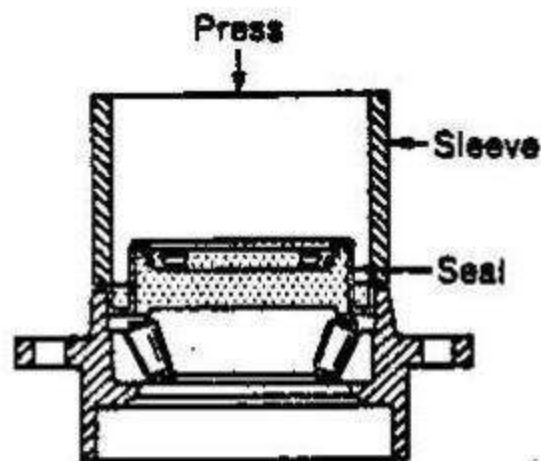
### Oil Seal Drag Test

The pinion seal used in the axle creates a small amount of drag which can affect pinion bearing preload measured at pinion final assembly. The drag attributable to these seals must be determined through the following procedure.

1. Press inner bearing cone on to pinion using a properly sized sleeve.
2. Install bearing spacer on pinion.
3. Place outer pinion bearing cone in outer bearing cup of bearing cage.
4. Using a properly-sized sleeve to prevent distortion, carefully press the seal into the pinion bearing cage.
5. Lubricate the oil seal lip and yoke sealing surface. The yoke must be free from nicks and grooves.
6. Set the cage, bearing, and seal assembly on the pinion shank.
7. Position the yoke on the pinion splines. Be careful not to damage the seal or roll the outer dust lip under while installing the yoke.
8. Using a properly-sized sleeve contacting the washer face of the yoke, press the yoke and cage assembly on the pinion being careful to leave a slight amount of freeplay in the bearings - enough to allow approximately 1/16in. vertical movement of the bearing cage.
9. Measure oil seal drag using a spring balance as described in the trial build-up instructions. Record the reading.



OIL SEAL INSTALLATION





### 3G PINION BEARING PRELOAD TEST(Cont'd)

When oil seal drag has been determined, the pinion bearing preload should be measured using either of the two following methods. The press method should be used only if a press is available having a calibrated load cell to accurately indicate press load in tons. If such a press is not available, the vice method should be used.

**PRESS METHOD:** Position a properly sized sleeve to clear the thread portion of the pinion and bear against the washer face of the yoke. Apply a press load of 11-12 tonnes to preload the assembly. While loaded, check the rolling resistance of the bearing cage and seal assembly with a spring balance in the manner previously described. Note the scale reading and subtract the known value for oil seal drag to determine the corrected spring balance reading. The corrected spring balance reading should be 6-13lb.

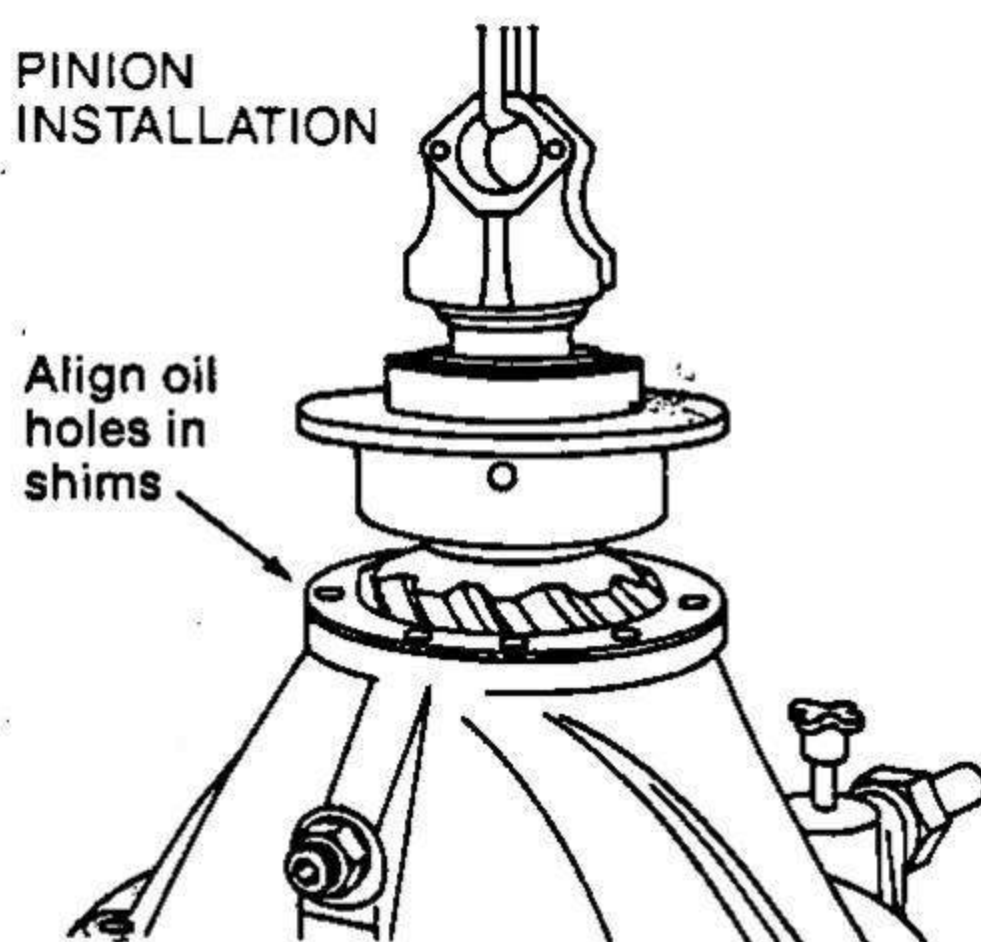
**VICE METHOD:** Install pinion nut and tighten to 376-461 lb-ft, 510-625 Nm torque. Clamp the yoke in a vice allowing the bearing cage to rotate. Check the rolling resistance of the bearing cage and seal assembly using a spring balance as previously described. Subtract oil seal drag measured earlier from the spring balance reading noted. The corrected scale reading should be 6-13lb.

**NOTE:** If the value obtained from either of these methods does not fall within the acceptable range, disassemble the pinion and bearing cage assembly as recommended in this manual and change the spacer. A thicker spacer will result in less preload. A thinner spacer will provide more preload. Repeat the preload checks above until proper preload is obtained.

#### Final Pinion Bearing Preload Test

If the press method was used, install the pinion nut, torque to the value given in the torque chart and recheck the rolling torque using the vice method outlined above. When the proper preload is obtained, proceed to the drive pinion installation instructions.

If the vice method was used and the correct preload obtained, proceed to the drive pinion installation portion of the manual.



### 3H INSTALL DRIVE PINION

1. Place shim pack on carrier.

**NOTE:** If gear is to be reused, install same quantity and size of shims removed during disassembly. When installing a new gear set, use nominal shim pack of 0.024in. (0.61mm) thickness.

2. Install pinion assembly. Install bearing cage cap screws. Torque cap screws to the figure given in the Torque Chart.

**NOTE:** Fasteners using self-locking thread "patches" may be reused if not damaged, but should be secured by a few drops of Loctite 277 on threaded surface of differential carrier. Reused fasteners should be wiped clean of excess oil but do not require special cleaning.

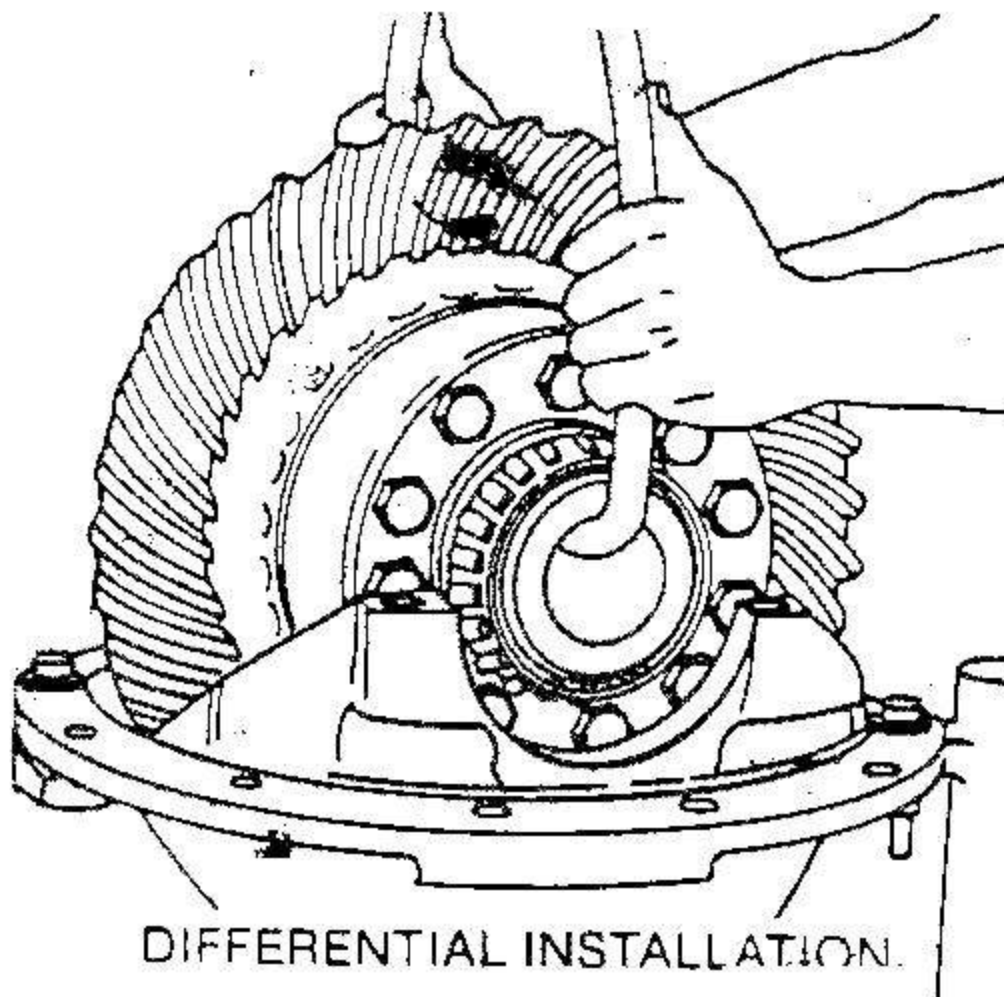
### 3J INSTALL DIFFERENTIAL AND RING GEAR ASSEMBLY

**NOTE:** Lubricate bearings during the following assembly procedures.

1. Place ring gear and differential assembly in carrier. Carefully lower the assembly until bearing cones rest on carrier.
2. Install bearing cups at both sides of differential case. Install bearing adjusters and caps. Install cap screws and flat washers.
3. Tighten bearing cap screws finger-tight. If this is difficult, use hand wrench.

**CAUTION:** When installing bearing caps and adjusters, exercise care not to cross threads.

**NOTE:** The assembly is now ready for adjustment of differential bearing preload, ring gear backlash and gear tooth contact (see next page).



### 3K ADJUST DIFFERENTIAL BEARING PRELOAD

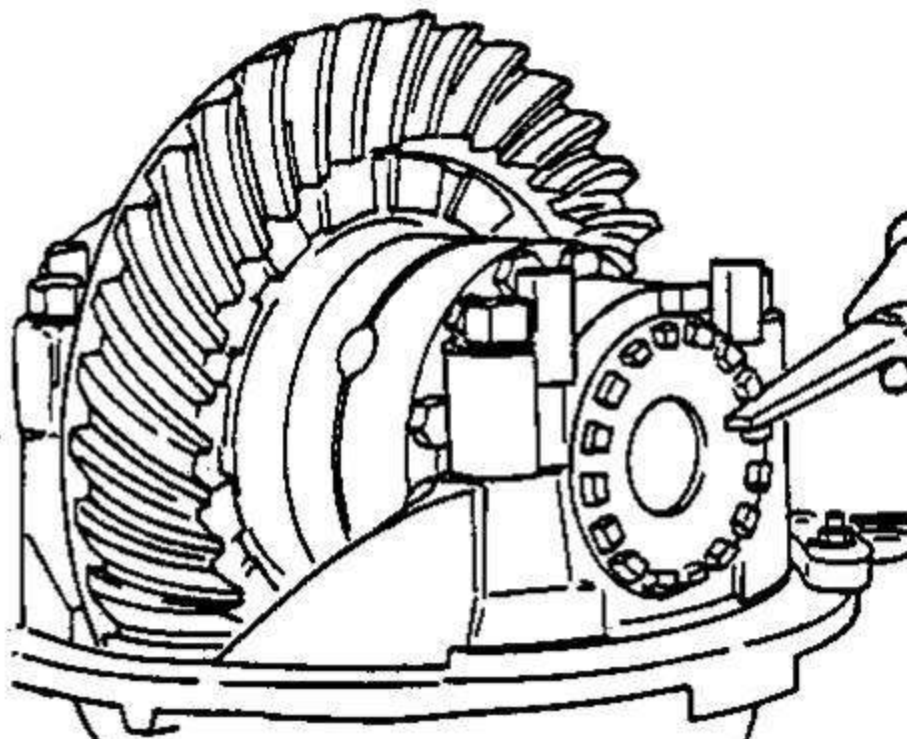
Correct differential bearing preload ensures proper location of these bearings under load and helps position the ring gear for proper gear tooth contact.

**NOTE:** Before performing the following adjustments, make sure there is adequate clearance between the ring gear and thrust screw if still installed. Adjust thrust screw only after all carrier adjustments are completed.

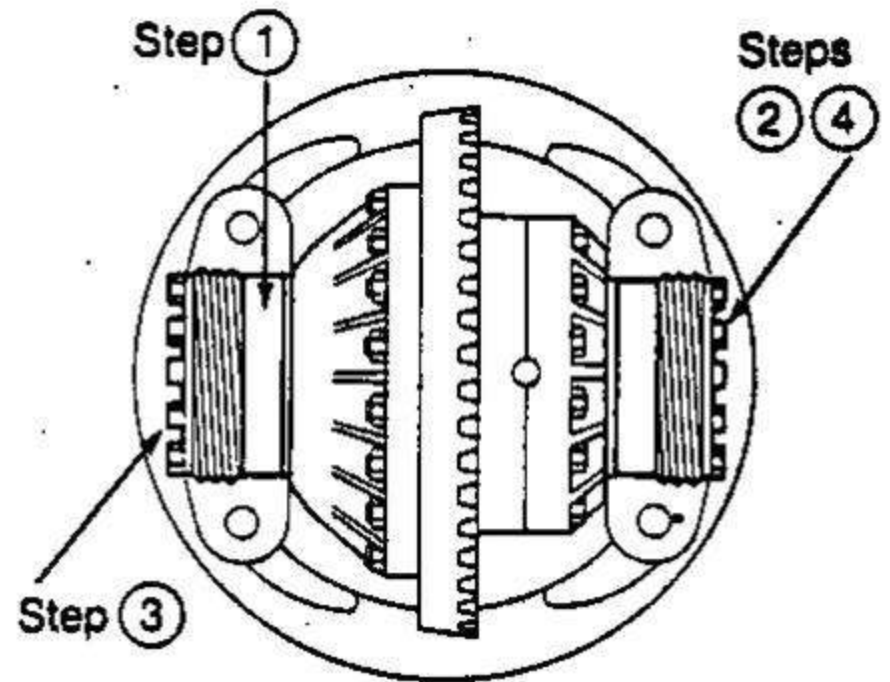
1. Lubricate differential bearings.
2. Loosen the bearing adjuster on the same side as the ring gear teeth until its first thread is visible.
3. Tighten the bearing adjuster on the backface side of the ring gear until there is no backlash. This can be tested by facing the ring gear teeth and pushing the gear away from the body while gently rocking the gear from side to side. There should be no free movement.

Rotate the ring gear and check for any point where the gear may bind. If such a point exists, loosen and retighten the back side adjuster. Make all further adjustments from the point of tightest mesh.

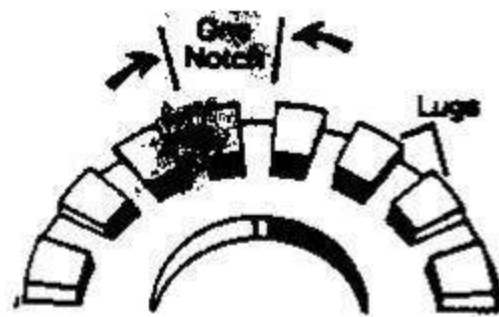
4. At teeth side of ring gear, tighten adjuster until it contacts the bearing cup. Continue tightening adjuster two three notches and this will preload bearings and provide approximate backlash. Measure backlash and adjust if necessary (see following page).



STEP 2  
LOOSENING BEARING ADJUSTER



PROCEDURE STEPS TO  
ADJUST BEARING PRELOAD



ADJUSTER NOTCH

### 3L ADJUST RING GEAR BACKLASH

**NOTE:** Check backlash as described below and adjust if necessary.

1. Measure backlash with a dial indicator. For new gearing this should be 0.008-0.017 in. (0.20-0.43mm). The indicator should be positioned on a ring gear tooth, at the extreme heel end, perpendicular to the tooth surface.

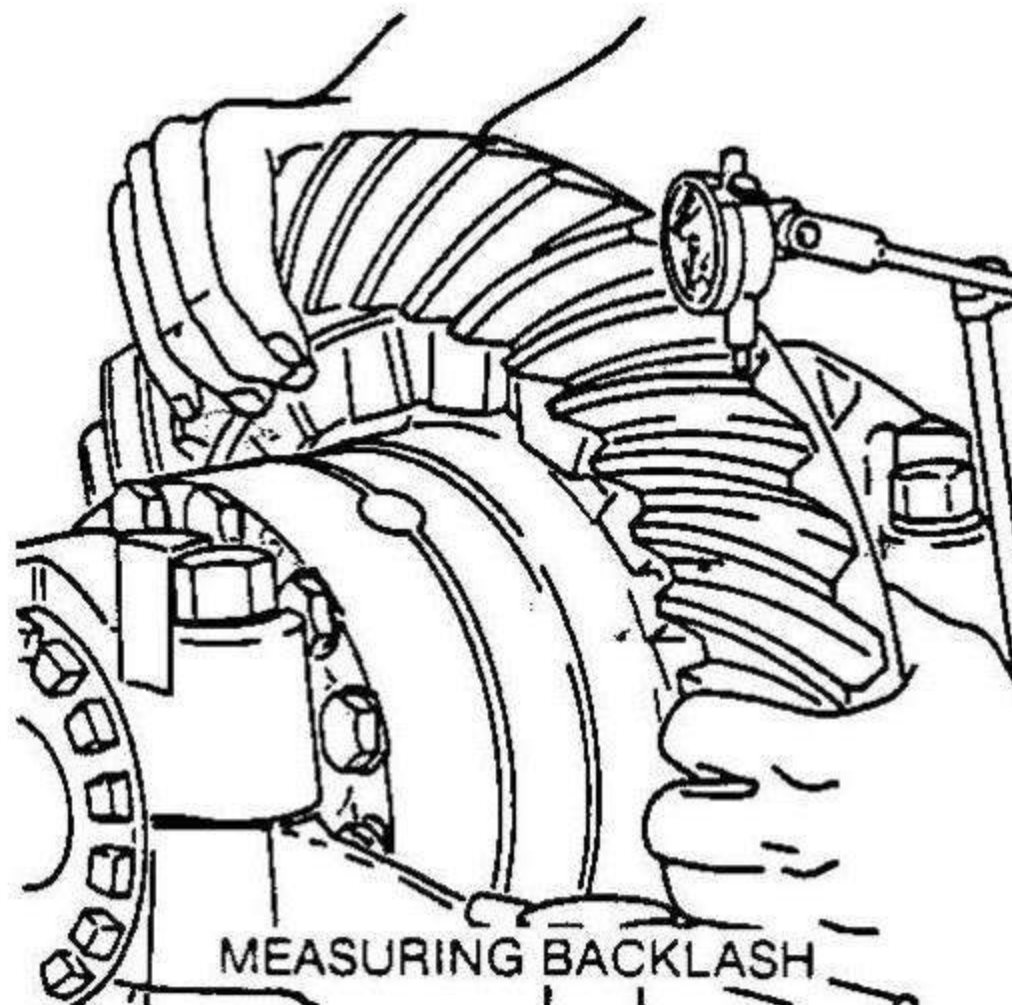
**NOTE:** For new gearing, check ring gear backlash after each shim change and adjust if necessary. For used gearing reset to normal backlash recorded before disassembly.

**TO REMOVE** backlash: Loosen the adjuster on the teeth side of the ring gear several notches. Tighten the opposite adjuster one notch.

Return to adjuster on teeth side of ring gear and tighten adjuster until it contacts the bearing cup. Continue tightening the same adjuster 2 or 3 notches. Recheck backlash.

**TO ADD** backlash: Loosen the adjuster on the teeth side of the ring gear several notches. Loosen the opposite adjuster one notch.

Return to adjuster on teeth side of ring gear and tighten adjuster until it contacts the bearing cup. Continue tightening the same adjuster 2 or 3 notches. Recheck backlash.



### 3M ADJUST RING GEAR TOOTH CONTACT

After differential bearing preload and gear backlash adjustment is complete, check gear tooth contact pattern and adjust if necessary

#### Correct Tooth Contact Pattern (New Gearing)

Paint ring gear teeth with marking compound and roll the gear to obtain a contact pattern as shown in the drawings. The length of the pattern in an unloaded condition is approximately one-half to two-thirds of the ring gear tooth.

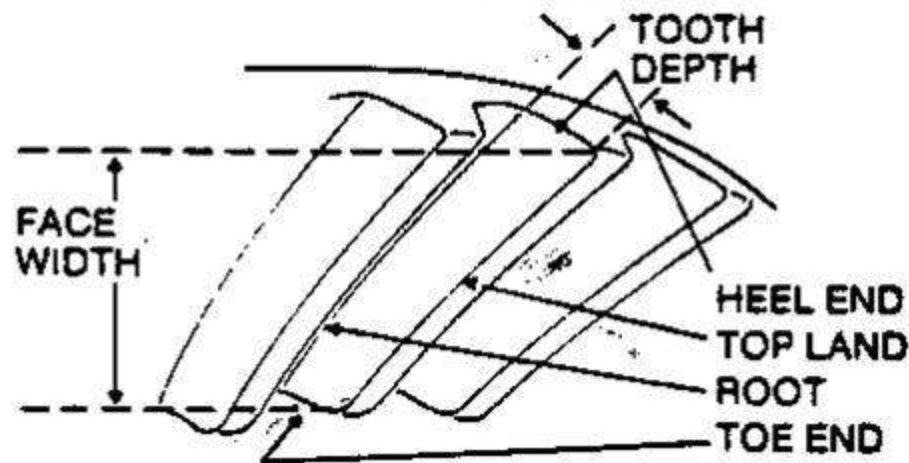
#### Correct Tooth Contact Pattern (Used Gearing)

Used gearing may not display the square, even contact pattern found in new gear sets. The gear may have a "Pocket" at heel end of contact pattern. The more use a gear has had, the more the pocket becomes the dominant characteristic of the pattern.

Adjust used gear sets to display the same contact pattern observed before disassembly. A correct pattern is up slightly off the toe and centres evenly along the face width between the top land and root. Otherwise, the length and shape of the pattern are highly variable and are considered acceptable as long as there is some pattern on toe end of the tooth.

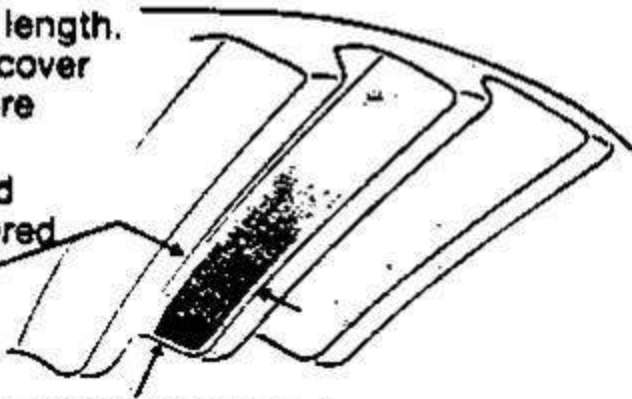
**NOTE :** Tooth contact patterns are a function of the relative position of the gear ring and pinion. An improper pattern will require relocation of either or both. Always adjust pinion position first, if necessary, then ring gear position. Recheck backlash when done.

#### RING GEAR TOOTH NOMENCLATURE



#### CORRECT PATTERN (NEW GEARING)

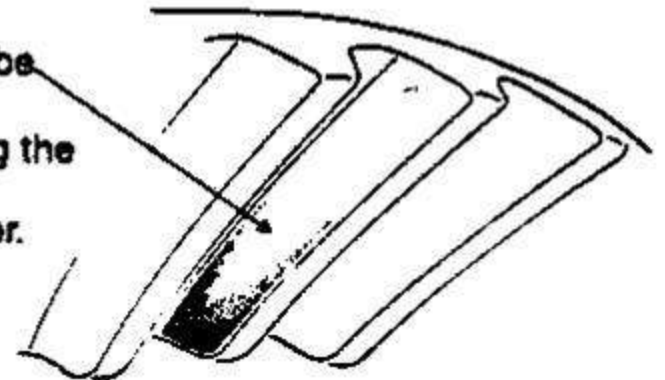
- Could vary in length. Pattern should cover 1/2 tooth or more (face width).
- Pattern should be evenly centered between tooth top land and root.



- Pattern should range from just clear of toe end to about 3/8" from toe end.

#### TYPICAL PATTERN (USED GEARING)

- Pocket may be extended.
- Pattern along the face width could be longer.



### 3M ADJUST RING GEAR TOOTH CONTACT (CONT'D)

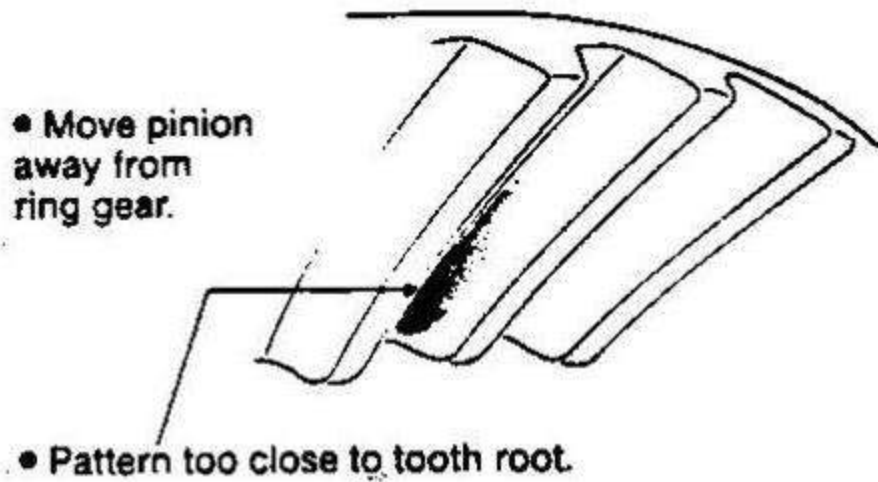
#### Adjust Pinion Position

If the contact pattern shows incorrect tooth depth contact, change drive pinion position by altering the shim pack under the cage and cup assembly. Used gears should achieve proper contact with the same shims removed from the axle at disassembly.

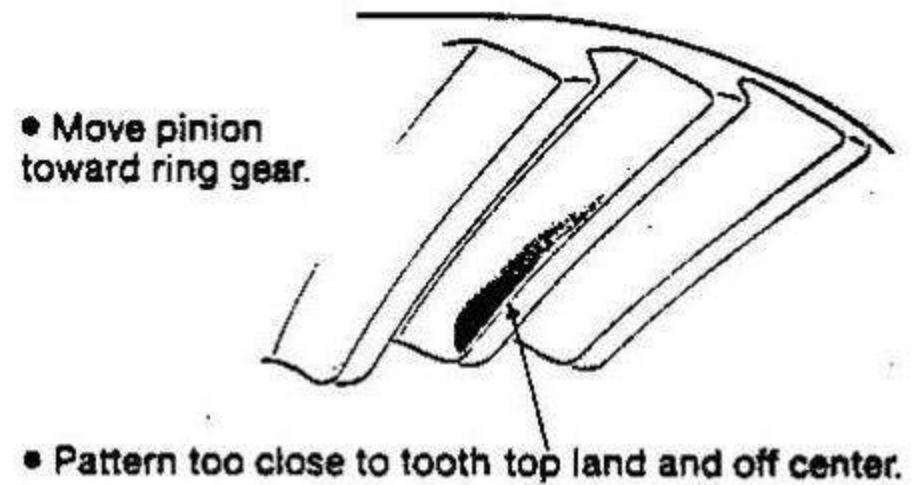
If the pattern is too close to the root of the gear tooth, add pinion shims.  
If the pattern is too close to the top of the gear tooth, remove pinion shims.

**NOTE:** Check ring gear backlash after each shim change and adjust if necessary to maintain correct backlash. Always re-check tooth contact pattern after making shim pack changes.

#### INCORRECT PATTERN



#### INCORRECT PATTERN



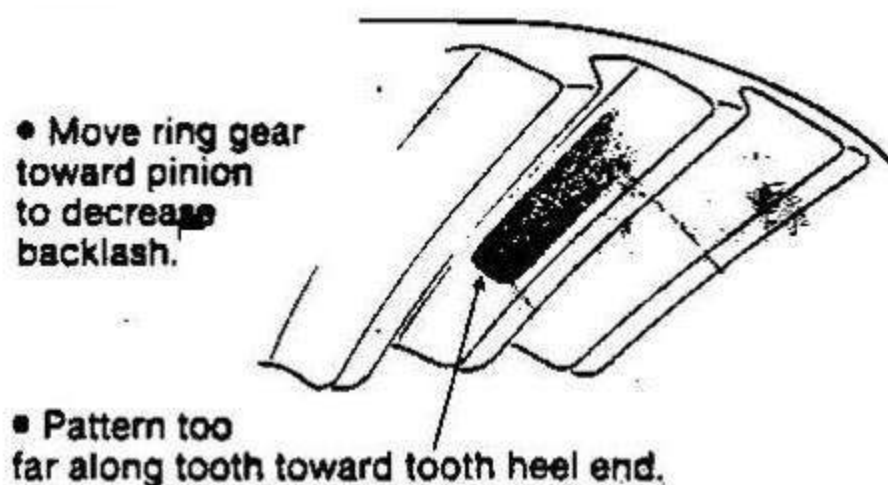
#### Adjust Backlash

If the contact pattern shows incorrect face width contact, change backlash and recheck the contact pattern.

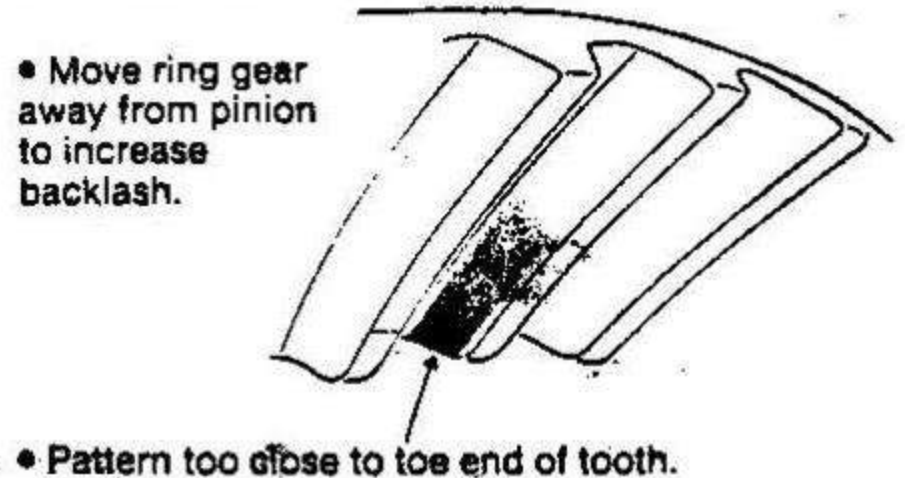
With the pattern concentrated at the toe (too far down the tooth), **ADD BACKLASH** by loosening the bearing adjuster on the teeth side of ring gear several notches. Loosen the opposite adjuster one notch. Return to adjuster on teeth side of ring gear and tighten adjuster until it contacts the bearing cup. Continue tightening the same adjuster 2 or 3 notches. Recheck backlash.

If the pattern is concentrated at the heel (too far up the tooth), **REMOVE BACKLASH** by loosening the bearing adjuster on the teeth side of ring gear several notches. Tighten the opposite adjuster one notch. Return to adjuster on teeth side of ring gear and tighten adjuster until it contacts the bearing cup. Continue tightening the same adjuster 2 or 3 notches. Recheck backlash.

#### INCORRECT PATTERN



#### INCORRECT PATTERN



### 3M ADJUST RING GEAR TOOTH CONTACT (Cont'd)

When preloaded, backlash and tooth contact are correct, align differential bearing adjusters with cotter pin holes, then tighten differential bearing cap screws to correct torque (given in the Torque Chart). Install split pins.

### 3N INSTALL / ADJUST RING GEAR THRUST SCREW

1. Thread thrust screw into the carrier until firm contact with the backface of the ring gear is made.

2. Loosen the thrust screw  $\frac{1}{2}$  turn to obtain the correct adjustment of 0.020" (0.50mm) clearance between gear face and screw. Torque lock nut to the figure given in the Torque Chart.

Hold thrust screw stationary with a wrench while tightening nut.

3. Recheck to assure minimum clearance during full rotation of ring gear.

### 3P INSTALL DIFFERENTIAL CARRIER ASSEMBLY

**NOTE:** Before installing carrier assembly, inspect and thoroughly clean interior of axle housing.

**NOTE:** Use silicone rubber gasket compound on axle housing mating surface as shown in the illustration. Gasket compound will set in 20 minutes. Install carrier before compound sets or reapply.

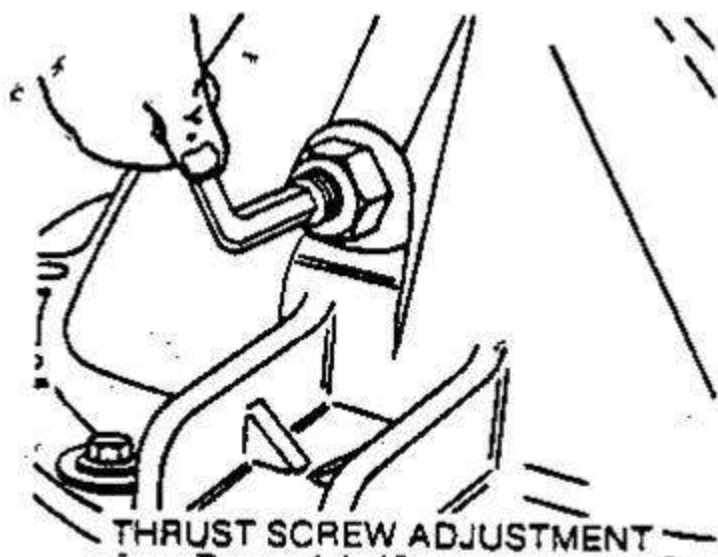
1. Install differential carrier assembly in axle housing. Install cap screws and lockwashers. Tighten to correct torque as given in the Torque Chart.

**NOTE:** Fasteners using self-locking thread "patches" may be reused if not damaged, but should be secured by a few drops of Loctite 277 on threaded surface of differential carrier. Reused fasteners should be wiped clean of excess oil, but do not require special clearing.

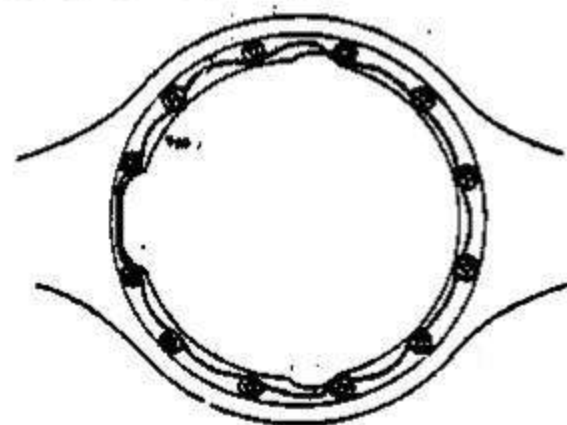
2. Install axle shaft, silicone gasket compound, and stud nuts. Connect driveline.

3. Fill axle with correct oil (see Lubrication Section)

**NOTE:** When axle has been disassembled or housing, gears, axle shafts or wheel equipment renewed, check axle assembly for proper differential action before operating vehicle. Wheels must rotate freely and independently.



AXLE HOUSING SILICONE GASKET COMPOUND PATTERN



Apply  $\frac{1}{8}$ " diameter bead completely around housing surface and around each threaded hole.

### 3Q TORQUE CHART

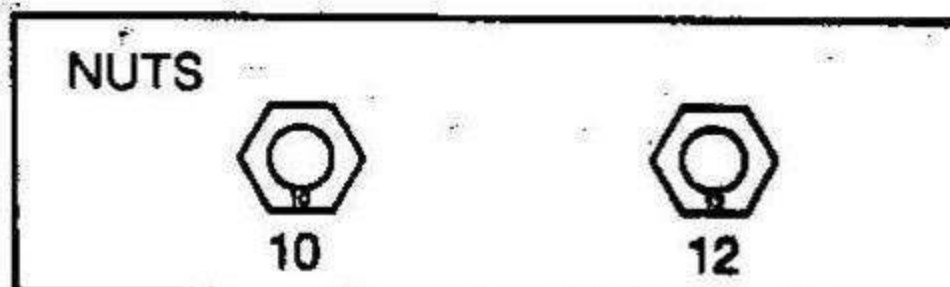
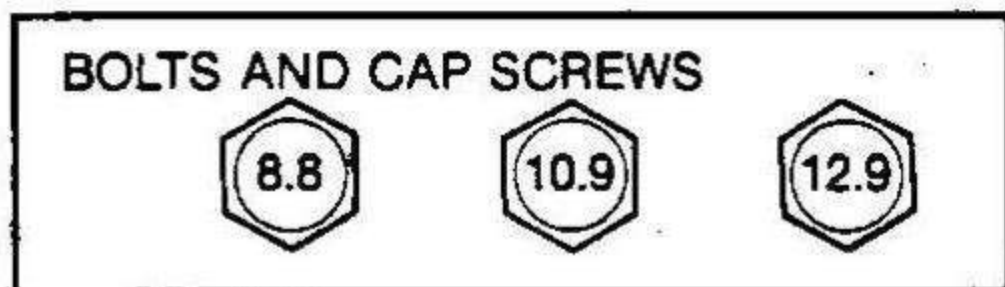
| Fastener                      | Metric Threaded Size | Class | N.m       | lb - ft   |
|-------------------------------|----------------------|-------|-----------|-----------|
| Differential case cap screw   | M12 x 1.75           | 10.9  | 136 - 149 | 100 - 110 |
| Ring gear nut                 | M14 x 1.5            | 12    | 230 - 258 | 170 - 190 |
| Pinion bearing cage cap screw | M14 x 2.0            | 10.9  | 210 - 237 | 155 - 175 |
| Bearing cap screw             | M16 x 2.0            | 12.9  | 305 - 345 | 255 - 255 |
| Carrier to housing cap screw  | M12 x 1.75           | 12.9  | 156 - 170 | 115 - 125 |
| Thrust screw lock nut         | M24 x 2.0            | -     | 200 - 245 | 148 - 181 |
| Pinion nut                    | M30 x 1.5            | -     | 510 - 625 | 376 - 461 |
| Shift actuator capscrew       | M10 x 1.5            | 8.8   | 34 - 41   | 25 - 30   |

#### Fastener Identification - Metric System

These axles are equipped with Metric Fasteners. The data in the torque chart includes these metric thread size, Metric class, and Metric / torque values.

Thread Size Identification ..... M12 X 1.75  
 Diameter (mm) Pitch (mm)

Class Identification ..... Fastener Strength  
 Strength (class) is identified by numbers on the bolt head or nut face. Increasing numbers represent increasing strength.





#### **4. HUB DISMANTLING**

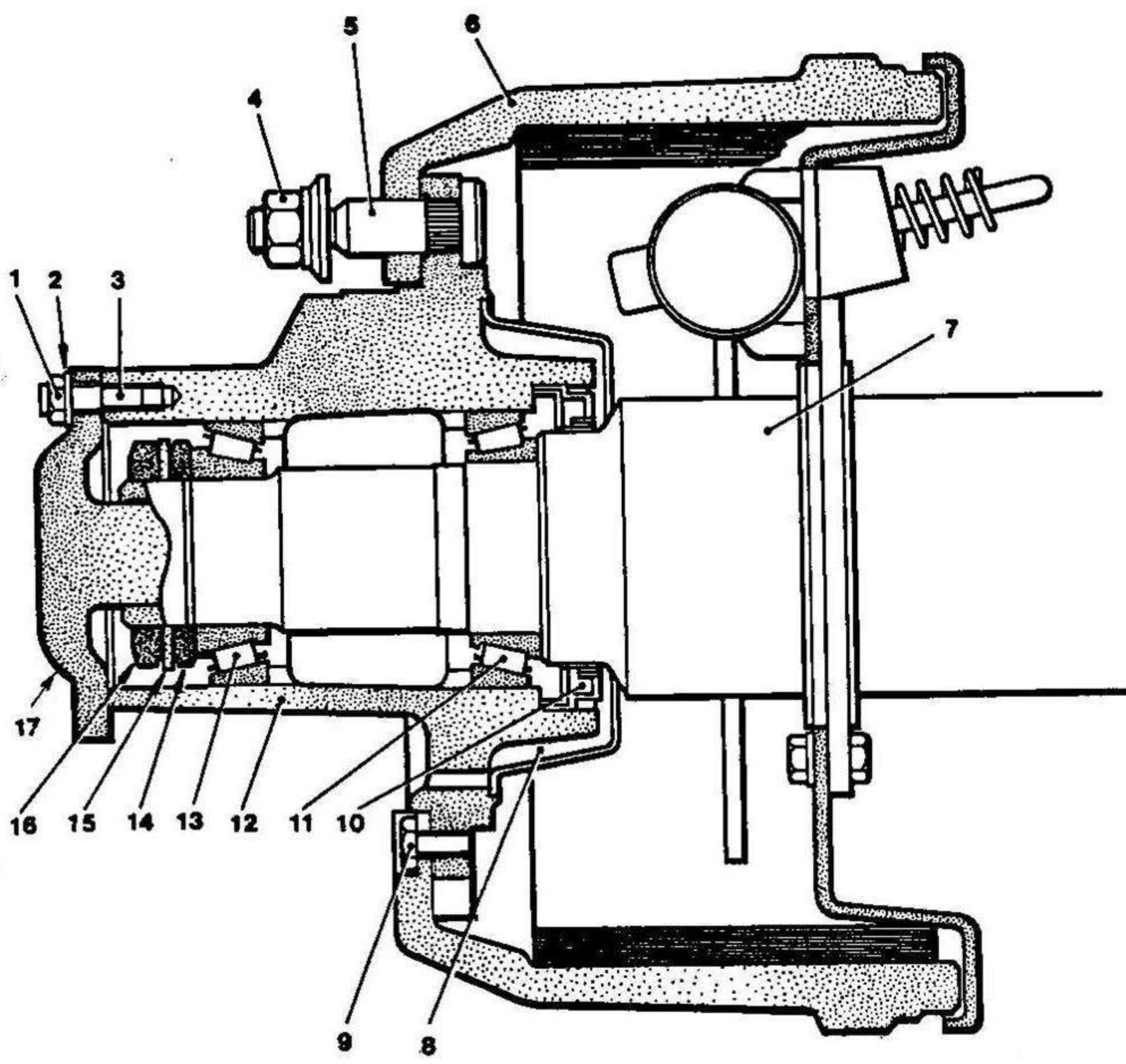
- (1) Support and raise the vehicle. Release the spring brakes.
- (2) Remove the wheel nuts (4) and the road wheel.
- (3) Remove the nuts (1) and washers (2). Withdraw the axle shaft (17).
- (4) Remove the brake drum retaining screws (9) and jack off the brake drum (6) using tapped holes provided.
- (5) Unscrew the hub nut (16), remove the lock washer (15) and remove the nut (14).
- (6) Pull off the hub (12).
- (7) Take out the outer bearing cone (13).
- (8) Drive out the inner bearing cone (11), the oil seal (10) using a soft drift on the bearing inner.
- (9) Press out the cups of bearings (11 and 13).

#### **4A. INSPECTION OF DISMANTLED PARTS**

- (1) Clean out all grease from hub and hub bearings with clean solvent and dry all parts thoroughly.
- (2) Check bearings for wear and pitting.
- (3) Renew oil seal (10).
- (4) Check wheel studs (5) for wear due to loose road wheel nuts (4).
- (5) Inspect axle case (7) hub end for damage to bearing and oil seal surfaces.
- (6) Check brake drum (6) for scoring due to worn brakes.
- (7) Check hub (12) for signs of bearing cups turning in the hub.
- (8) Check brakes for any oil leakage on the liners.

#### **4B HUB ASSEMBLY**

- (1) Press the cups of bearings (11 and 13) into the hub.
- (2) Press grease into each bearing cone, taking care not to overpack as this will result in damage to the seals with consequent leakage which can be dangerous if the grease finds its way on to the brake linings.
- (3) Position the oil seal (10).
- (4) Slide the hub (12) with bearings (11 and 13) on to the axle case (7).
- (5) Clean and grease the threads on the hub end. Fit the inner nut (14), greasing the contact faces and tighten finger tight.
- (6) Rotate the hub in both directions.
- (7) Tighten the inner nut (14) very firmly to 180–220 lb.ft (244–298 Nm) to fully seat the bearings. Rotate the hub.
- (8) Back off the inner nut (14) and retighten to 90–110 lb.ft (122–149 Nm). Then slacken the nut one quarter turn (90 deg).



REAR HUB

- (9) Fit the lock washer (15), ensuring that the locking peg on the locknut enters a hole in the washer.
- (10) Fit the outer nut (16), greasing the contact face. Using a torque wrench tighten to 330–370 lb.ft (448–502 Nm). This procedure will give the correct end float of 0 to 0.002 in. (0–0.05mm). Check that the hub rotates freely.
- (11) Ensure that the brake is held off and fit the brake drum so that the holes for set screws (9) align with those in the hub. Press fully home and fit the set screws, tightening to the correct torque.
- (12) Using new gaskets, install the axle shaft (17). Fit the washer (2) and nuts (1). Tighten to the correct torque.
- (13) Fit the road wheel and the nuts (4), tightening to the correct torque. The tightness of the nuts should be checked after a fully-loaded run.

#### 4C. TORQUE REQUIREMENT

This section gives the torque requirements for bolts, nuts and set-screws.

Correct tightening torque values are extremely important to assure long axle life and dependable performance. Over-tightening of attaching parts is just as harmful as under-tightening.

#### TORQUE SETTINGS

| Fixing                         | lb. ft    | Nm        |
|--------------------------------|-----------|-----------|
| Brake drum retaining screw (9) | 35 - 45   | 48 - 61   |
| Half shaft stud (3)            | 60 - 80   | 81 - 109  |
| Half shaft nut (1)             | 80 - 90   | 109 - 122 |
| Road wheel nuts (4)            | 285 - 315 | 385 - 425 |

|  |      |    |
|--|------|----|
| Data sheet .....                       | Page | 2  |
| Description .....                      | Page | 3  |
| Brake diagram - retarder .....         | Page | 5  |
| Brake diagram - non retarder .....     | Page | 6  |
| Test and check list .....              | Page | 7  |
| Raufoss air brake fitting system ..... | Page | 12 |
| Wheel brake .....                      | Page | 17 |
| Front brake actuator .....             | Page | 25 |
| Rear brake actuator .....              | Page | 26 |
| Compressor .....                       | Page | 29 |
| Air dryer .....                        | Page | 33 |
| Footbrake valve .....                  | Page | 41 |
| Hand control valve .....               | Page | 47 |
| Multi circuit protection valve .....   | Page | 49 |
| Variable load valve .....              | Page | 53 |
| Non return valve .....                 | Page | 56 |
| Proportioning valve .....              | Page | 57 |
| Quick release valve .....              | Page | 58 |

# DATA SHEET

## BRAKING SYSTEM

### BRAKE ASSEMBLIES

| Description                                    | Details                                     |
|--|---|
| Front Brake Assy. LH.<br>Front Brake Assy. RH. | Perrot single leading shoe<br>360mm x 170mm |
| Rear Brake Assy. LH.<br>Rear Brake Assy. RH.   |   |

Torque Settings:

*For brake brackets, hub to drum  
etc., see front and rear axle section*

### SPECIAL TOOLS

| Part No.  | Description         | Details              |
|-----------|---------------------|----------------------|
| 611627/13 | Dial test indicator |                      |
| 610224    | Brake tubing cutter |                      |
| 664352    | Spanner 24 mm       | Spring brake release |

### BRAKE ACTUATORS

| Description | Details                        |
|-------------|--------------------------------|
| Front       | Single Diaphragm Brake Chamber |
| Rear        | Spring Brake Actuator          |

### AIR PRESSURE SETTINGS

| Description                                  | Bar        | P.S.I.   |
|--|------------|----------|
| Low Pressure Switches                        | 5.3        | 78       |
| MCPV Pressure Setting                        | 6.3 / 6.0  | 91 / 87  |
| Air Dryer unloader valve<br>cut out pressure | 8.4 (±0.2) | 125 (±3) |

### COLOUR CODING OF PIPES

|        |                       |
|--------|-----------------------|
| Red    | Compressor Supply     |
| Yellow | Service brake Circuit |
| Orange | Parking brake Circuit |
| Green  | Auxiliary Circuit     |
| Black  | Signal Lines          |

## DESCRIPTION

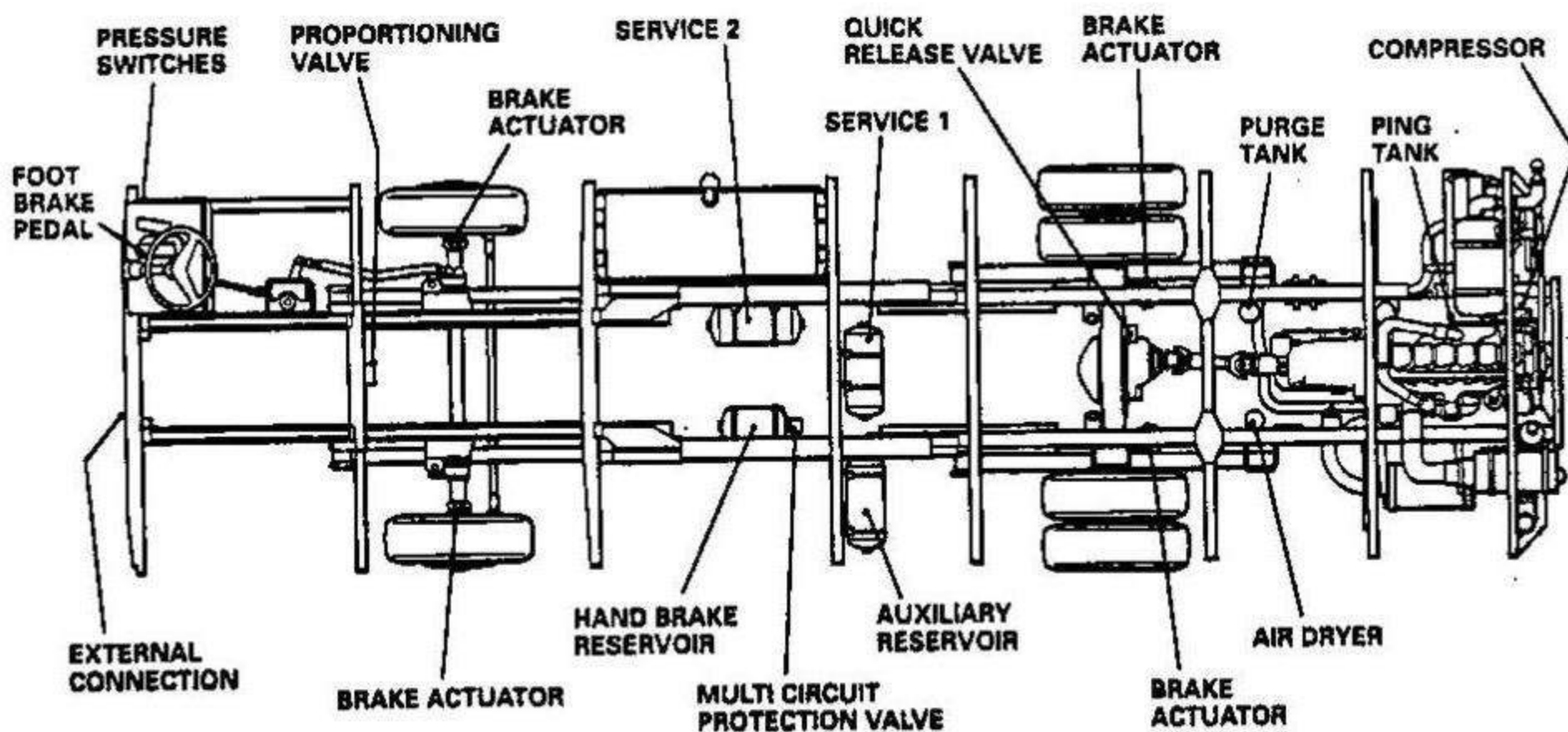
The braking system is fully air operated, the front wheel brakes being applied by diaphragm actuators while the rear actuators can be spring-applied in addition to pneumatic operation.

A compressor, driven by the engine, connects to a cartridge-type air drier through a small expansion tank which acts as a silencer. In addition to drying and filtering the air, the dryer purge cycle is used as an unloading device, diverting the compressor output to atmosphere when the pressure in the reservoirs is high. When the pressure falls again, the dryer unloader valve closes the purge valve and connects the compressor output to the multi-circuit protection valve.

This valve gives priority to charge the Service 1 and Service 2 reservoirs. It also ensures that downstream failure in any of the four circuits will lead to isolating that circuit. Service 1 reservoir feeds the front brakes through a 1.25:1 proportioning valve to give correct ratio between the front and rear braking effort. Service 2 reservoir connects directly to the rear brakes, both front and rear systems being controlled simultaneously through separate sections of the footbrake valve. The Park reservoir supplies the handbrake system. This connects the rear brake actuators via the handbrake valve and quick release valve. When the control valve is at OFF an air supply is connected to the brake actuators to compress a spring and hold the brakes off. When the valve is at PARK, the air supply is cut off and the pressure exhausted through the quick release valve to allow the springs in the actuators to apply the brakes.

The auxiliary reservoir supplies such services as the vehicle passenger doors.

Pressure gauges are fitted to show pressure in Service 1 and 2 systems. Low pressure switches sound a buzzer and bring up a warning light if the pressure in any of the three brake systems is below a safe figure. An external charging connection is provided on the front chassis crossmember.



**Brake Component Location**

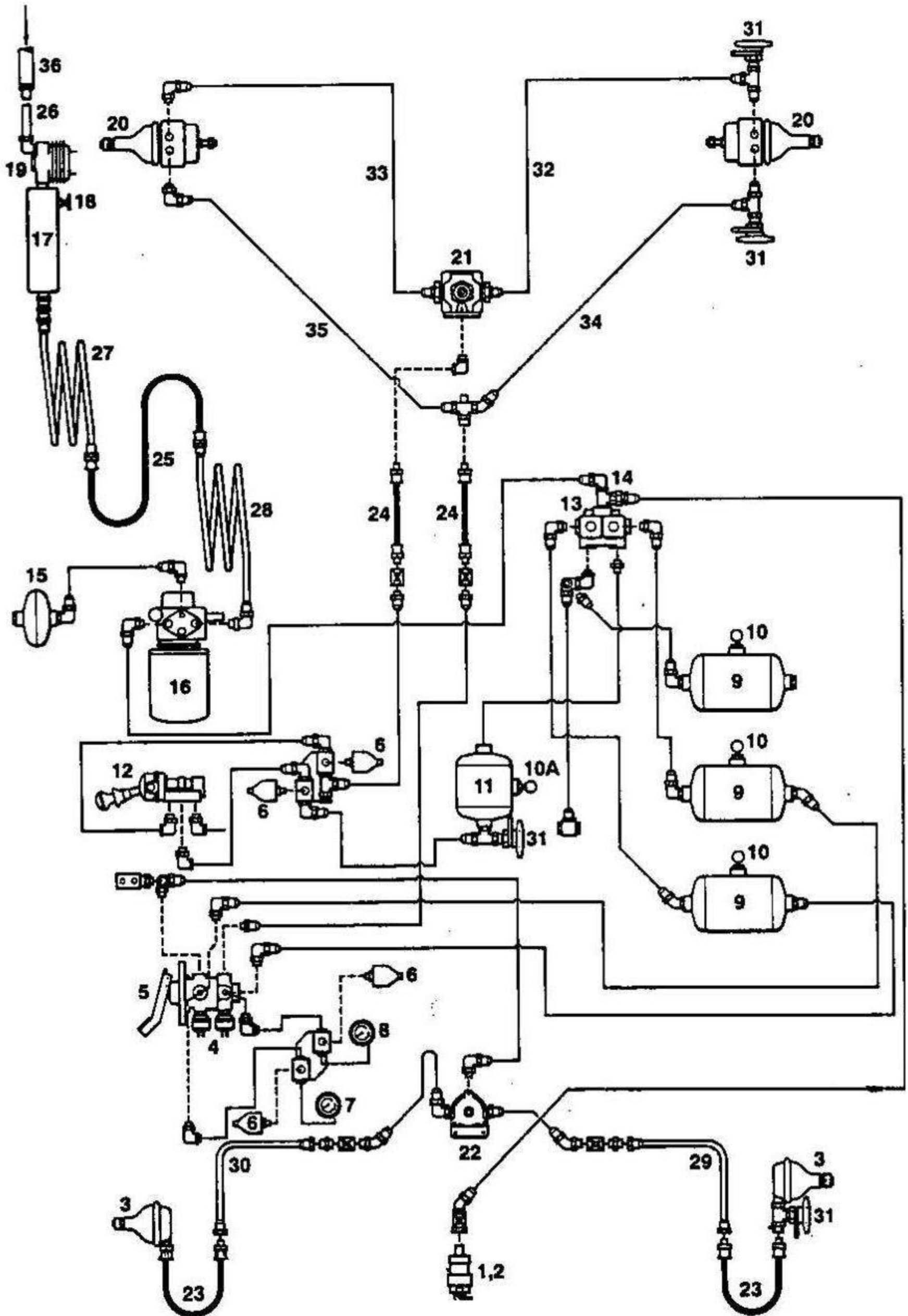
# KEY TO BRAKING SYSTEM DIAGRAM

- |   |                         |
|---|-------------------------|
| 1. Plug & chain                           | 20. Rear brake actuator |
| 2. Charge coupling                        | 21. Quick release valve |
| 3. Front brake actuator                   | 22. Proportioning valve |
| 4. Stop light switch                      | 23. Hose                |
| 5. Footbrake valve                        | 24. Hose                |
| 6. Low pressure switch                    | 25. Hose                |
| 7. Air gauge 1                            | 26. Pipe                |
| 8. Air gauge 2                            | 27. Pipe                |
| 9. Reservoirs - Aux - Service 1 Service 2 | 28. Pipe                |
| 10. Drain valve                           | 29. Pipe                |
| 10A. Drain valve                          | 30. Pipe                |
| 11. Reservoir - Park                      | 31. Test Connector      |
| 12. Handbrake valve                       | 32. Pipe                |
| 13. Multi circuit protection valve        | 33. Pipe                |
| 14. Non return valve                      | 34. Pipe                |
| 15. Purge tank                            | 35. Pipe                |
| 16. Air dryer                             | 36. Hose                |
| 17. Ping tank                             | 37. Load sensing valve  |
| 18. Drain tap                             |                         |
| 19. Compressor                            |                         |

**Note:** For vehicles with chassis no's **85 SDL 3030** onwards the brake diagram on page 6 applies to both retarder and non-retarder variants.

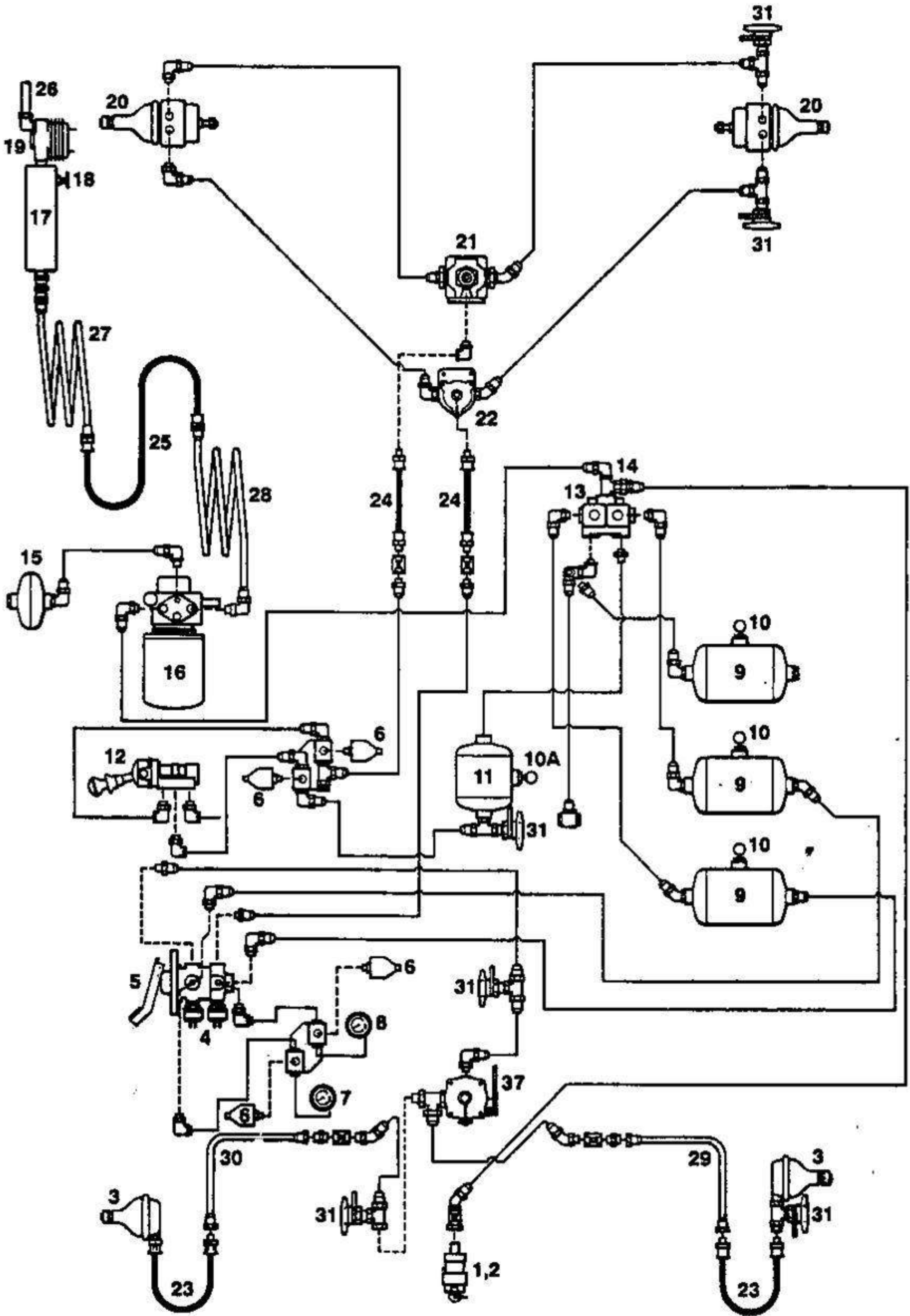
**Note:** Vehicles on and after chassis serial no. **1709** have a slightly revised braking system - see parts book for details.

# BRAKING SYSTEM DIAGRAM - Retarder





# BRAKING SYSTEM DIAGRAM - Non Retarder



# **BRAKING SYSTEM**

## **TESTS AND CHECK LIST**

### **● Important Notice**

**Before working on or around air brake system and components, the following precautions should be observed:**

- Stop the engine before working under a vehicle.
- Always chock the wheels because depleting vehicle air system pressure may cause the vehicle to roll. Keep hands away from actuator push rods; they may apply as system pressure drops.
- Never connect or disconnect a hose or line containing air pressure, it may whip as air escapes. Never remove a component or pipe plug unless you are sure that all system pressure has been depleted.
- Never exceed recommended air pressure and always wear safety glasses when working with air pressure. Never look into air jets or direct them at anyone.
- Never attempt to dismantle a component until you have read and understood recommended procedures. Some units contain powerful springs and injury can result if not properly dismantled. Use only correct tools and observe all precautions relative to the use of these tools.

The five tests outlined in this programme have been designed to discover the presence of air leaks and/or sluggish performance in a Dual Air Brake System. The entire system, from the compressor through to the actuators can easily be diagnosed in a short period of time by performing these tests.

After completion, you will know whether or not the system is building pressure rapidly enough, if there is any leakage and if the emergency components are functioning properly. In some cases you may find that corrections will need to be made. Each test is followed by a check list that gives a guide to the more common causes for the vehicle failing the test. Please note that these are static tests only. They must not be interpreted as overruling the importance and necessity of functional, dynamic controllability tests and other tests required to assure vehicle safety and performance.

**Before you begin testing the air brake system, perform the following checks:**

1. Examine all tubing for signs of kinks or dents.
2. Examine all hoses for signs of wear, drying out or overheating.
3. Check suspension of all tubing. It should be supported and not vibrate.
4. Check suspension of all hoses. Position so that hoses will not abrade or be subject to excessive heat.

## TEST PROCEDURE FOR VEHICLE BRAKING SYSTEM

### TEST 1

*Unloader Cut-Out  
Low Pressure Warning  
Pressure Build-Up*

1. Drain all reservoirs to zero pressure.
2. Start engine (run at fast idle). Low pressure warning light should be on, buzzer should sound.
3. Low pressure warning light should go off and buzzer should stop at approximately 5.8 bar.
4. Dryer unloader should cut-out at recommended pressure (see Data Sheet).
5. Build up time. Pressure should rise from 6 bar to 7 bar within 40 seconds.

Make all necessary repairs before proceeding to Test 2; See Check List 1 for common corrections.

### CHECKLIST 1

*If the low pressure warning light or buzzer fails to operate:*

- a Check the bulb.
- b Check the wiring.
- c Check the buzzer, replace if faulty.
- d Check the low pressure switch, replace if faulty.

*If dryer unloader does not cut-out at pressure specified on Data Sheet:*

- a Adjust unloader using a gauge of known accuracy.
- b Repair or renew unloader as required.
- c Check operation of the air dryer purge valve.

*If the low pressure warning occurs below 5.8 bars:*

- a Check dash gauge against gauge of known accuracy.
- b Repair or renew low pressure switch.

*If pressure build-up time exceeds 40 seconds or greatly exceeds previously recorded figures::*

- a Examine compressor air intake filter and clean or renew.
- b Ensure that inlet line and engine intake filter are not restricted. Delivery pipes that are 'carboned up' are extremely difficult to clean.
- c Clean any excessive carbon from discharge port and delivery line.
- d If compressor is belt driven check for drive slippage.
- e Check for compressor inlet or discharge valve leakage.
- f Check for leakage from air dryer purge valve.

*Retest to check out all items repaired or replaced.*

## TEST 2

### *Leakage (Reservoir Air Supply)*

- *(Full Pressure Engine Stopped)*

1. Allow pressure to stabilise for at least 1 minute.
2. Observe dash gauge pressures for 2 minutes and note any pressure drop.

*0.15 bar maximum for each reservoir.*

Make all necessary repairs before proceeding to Test 3; See Check List 2 for common corrections.

## CHECKLIST 2

- *If there is excessive leakage in the supply side of the pneumatic system, one or more of the following devices could be causing the problem:*

NOTE: (A leak detector or soap solution will aid in locating the faulty component).

- a Supply lines and fittings (tighten).
- b Low pressure indicators.
- c Multi-circuit protection valve.
- d Dual brake valve.
- e Hand control valve.
- f Dryer unloader.
- g Compressor delivery valve(s).

- *Retest to check out all items repaired or renewed.*

## TEST 3

- *Leakage (Service Air Delivery)*

*(Full Pressure, Engine Stopped)*

1. Make and hold a brake application. (A block of wood can be used to hold down the foot valve).
2. Allow pressure to stabilise for 1 minute, then begin timing for 2 minutes whilst watching the dash gauges for a pressure drop.

- *0.030 bar maximum for each reservoir.*

Make all necessary repairs before proceeding to Test 4; Checklist 3 for common corrections.

## CHECKLIST 3

- *If there is excessive leakage in the service side of the system, one or more of the following devices could be causing the problem.*

NOTE: A leak detector or soap solution will aid locating the faulty component.

- a Service lines and fittings (tighten).
- b Stoplight switch(es).
- c Quick release valve(s).
- d Dual brake valve.
- e Test point.

- *Retest to check out all items repaired or replaced.*

#### **TEST 4**

- *Handbrake (Secondary/Parking System)*

*(Full Pressure, Engine Idling 600–900 rpm)*

- Operate hand control valve. Spring brakes should apply brakes promptly.
- Move hand control valve to park position. Handle should lock securely.
- Move hand control valve to off position. Brakes should release promptly.

Make all necessary repairs before proceeding to Test 5; see Checklist 4 for common corrections.

#### **CHECKLIST 4**

- *If defective performance is noted in either test, check for:*
  - Dented or kinked lines.
  - Improperly installed hose fittings.
  - Faulty quick release valve(s).
  - A faulty hand control valve.
- *Retest to check out all items repaired or renewed*

#### **TEST 5**

- *Secondary/Emergency System*

*(Full Pressure, Engine Stopped)*

1. Drain front brake reservoir to zero pressure.
  - Remaining reservoir pressures should not fall below the closing setting of the multi-circuit reservoir protection valve.  
(See Data Sheet).
2. Without recharging front reservoir make a brake application.
  - rear brakes should apply and release.
  - The stop lights should come on.
3. Re-charge the front brake reservoir and drain the rear brake reservoir to zero pressure.
  - The remaining reservoir pressures should not fall below the closing setting of the multi-circuit protection valve.  
(See Data Sheet).
4. With no pressure in the rear brake reservoir make a brake application.
  - The front brakes should apply and release.
  - The stop lights should come on.

5. Re-charge the rear brake reservoir, drain the Park reservoir feeding the spring brakes
  - a The remaining reservoir pressures should not fall below the closing setting of the multi-circuit protection valve.
  - b The spring brake actuator should apply.
  - c The spring brake cab warning light and stop lights should come on.
6. Re-charge the spring brake reservoir.

#### **CHECKLIST 5**

*If the vehicle fails to pass any of the prescribed tests, check the following components for leakage and operation:*

- a Fittings
- b Kinked hose or tubing.
- c Multi-circuit protection valve.
- d Double check valve.
- e Hand control valve.
- f Non-return valve.

*Retest to check out all items repaired or renewed.*

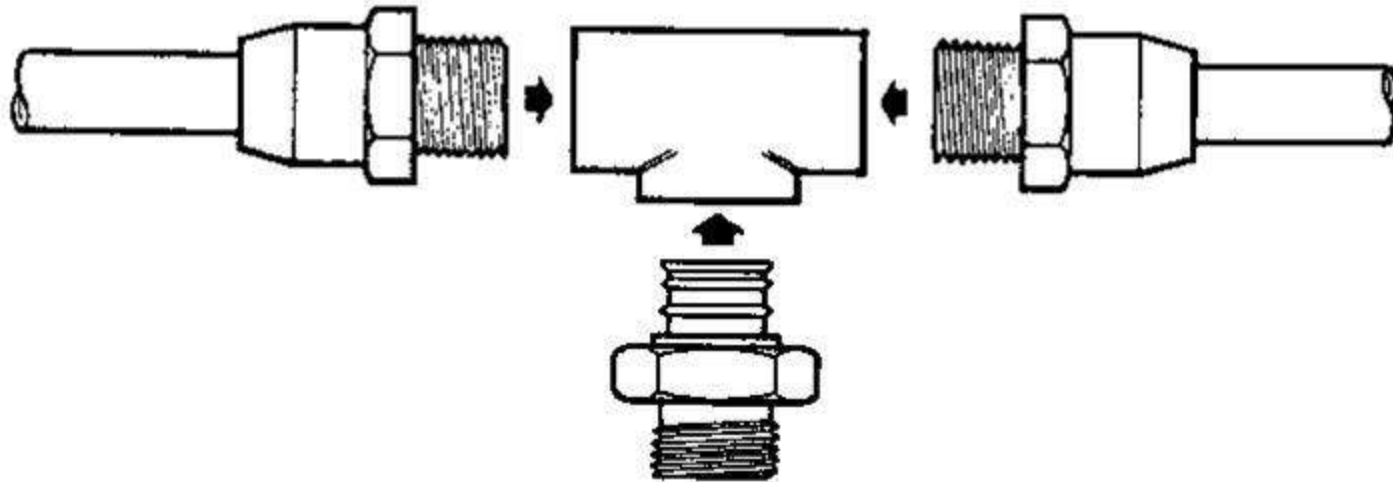
NOTE: Other possible fault.

1. Failure of one reservoir to charge.
  - a Possible problem with MCPV.
  - b Kinked or crushed pipework.

## Raufoss Air Brake Fitting System

### Service Aspects

The fittings are not designed for re-use after disassembly. However, the fitting may be loosened without being disconnected from the nylon tubes. The connector rotates on the tube end and the swivel rotates in the tee piece. This will enable the replacement of valves or other parts, without disassembly of the fitting itself.



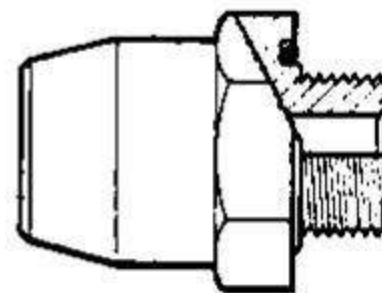
### The O-ring Seal

All the air brake fittings with metric threads are equipped with O-ring seals.

When assembling fittings both, new and old, make the following checks of the O-ring.

- a) Make sure the O-ring is in place.
- b) Check O-ring for cuts.
- c) Check the O-ring for deformation.
- d) Check the O-ring for mouldering.

**Note:** If the O-ring has any kind of deformations it should be replaced.



### Installation

#### Screw in the connector

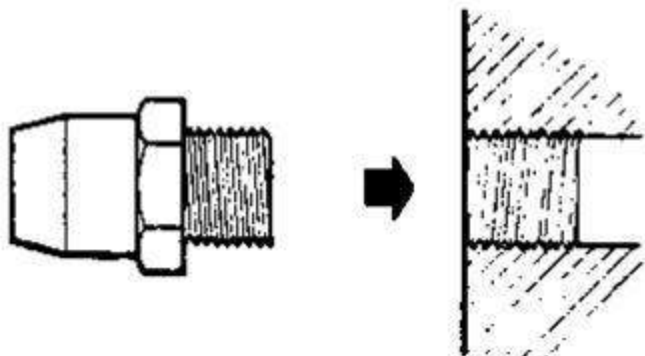


Table 'A'

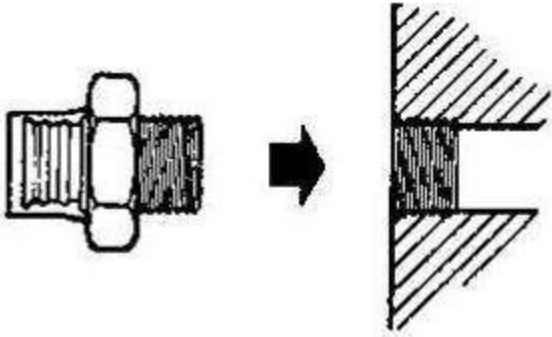
| Metric Threads<br>(with O-ring seal) | Tension<br>Nm<br>tolerance 2 | Torque<br>(lb. ft.)<br>(1.5) |
|--------------------------------------|------------------------------|------------------------------|
| M10 × 1                              | 18                           | (13.3)                       |
| M12 × 1.5                            | 24                           | (17.7)                       |
| M14 × 1.5                            | 28                           | (20.7)                       |
| M16 × 1.5                            | 35                           | (25.8)                       |
| M22 × 1.5                            | 40                           | (29.5)                       |

Tension torque for dryseal threads depends on materials and if packing compound is to be used. Check the O-ring seal.

# Raufoss Air Brake Fitting System

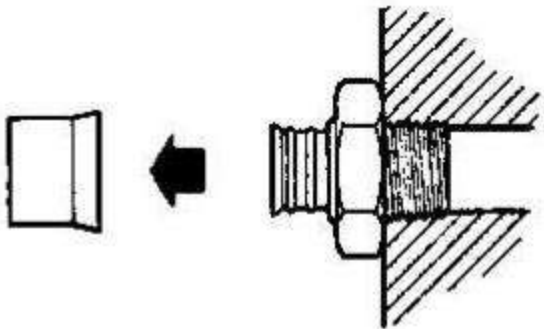
## Swivels and Fittings

### Screw in the swivel



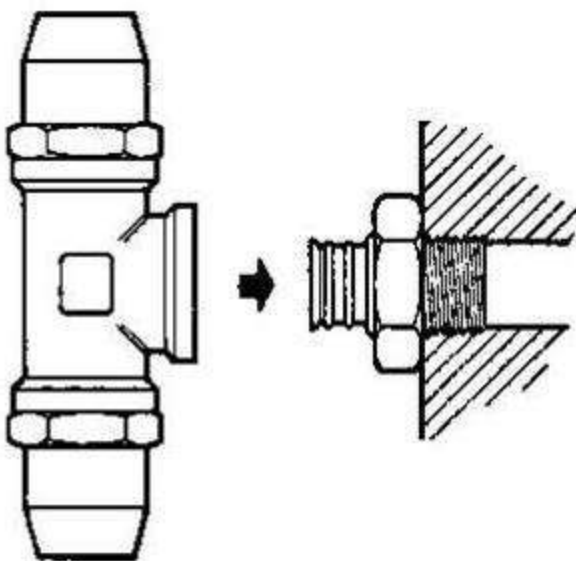
Apply tension torque according to table 'A'  
Check the O-ring seal.

### Remove the plastic cap



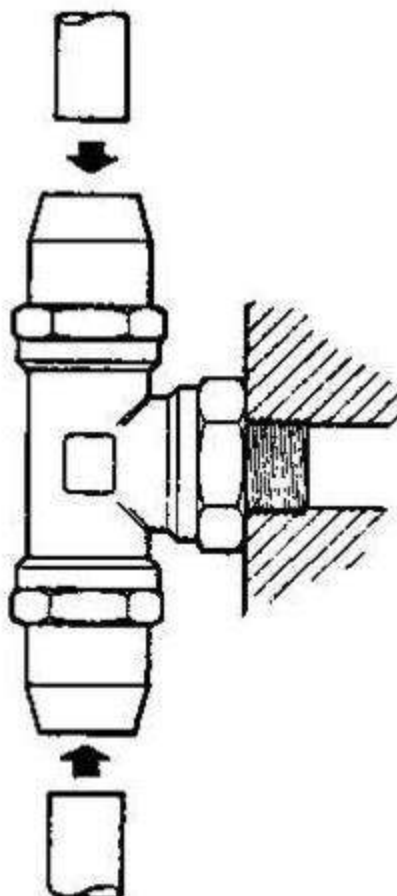
After the appropriate tension torque has been applied, the plastic cap is removed.

### Push on the fitting equipped with connectors



Connect the swivel and the fitting with a push, a simultaneous turn will ease the operation.  
A pull is then applied to ensure the connection.

### Push in the tubes



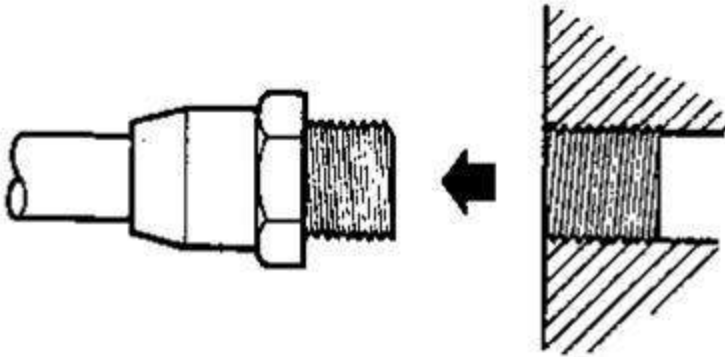
For connection of the tubes, the procedure is the same as before.



## Raufoss Air Brake Fitting System

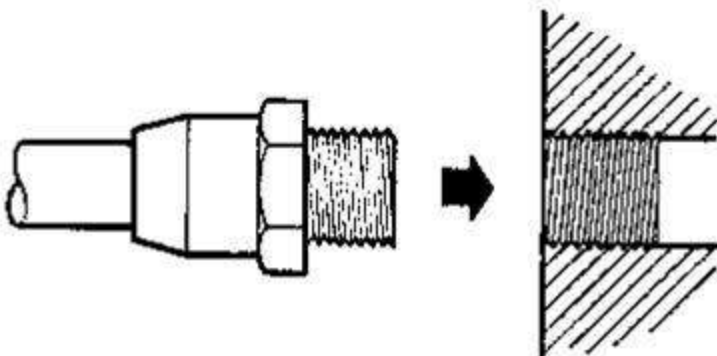
### Replacing valves or other parts with connectors screwed in

Disconnect the connectors



The connector rotates on the tube end and may be loosened from its device, without being disconnected from the tube.

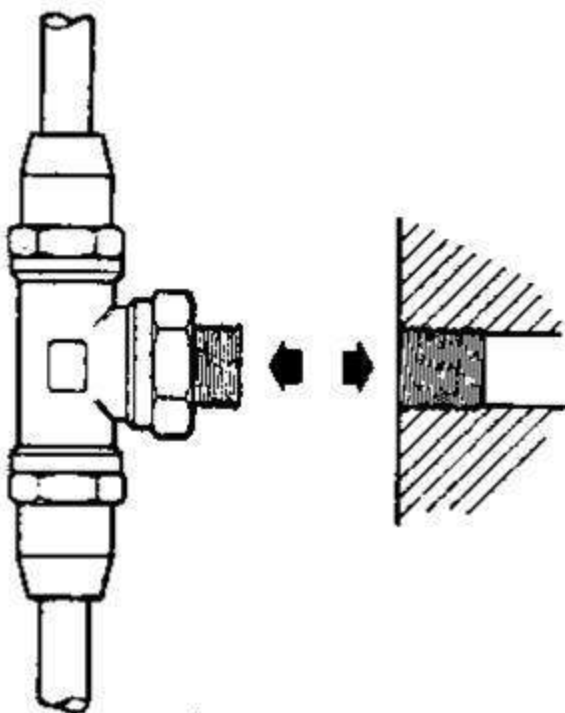
Screw in the connector in the replaced part



Apply tension torque according to table 'A'.  
Check the O-ring seal.

### Replacing valves or other parts with swivels screwed in.

Disconnect the swivel



The swivel rotates in the fitting and may be loosened from its device, without disconnecting the connectors.

Screw in the swivel in the Replaced part

Apply tension torque according to table 'A'.  
Check the O-ring seal.

# Raufoss Air Brake Fitting System

Push in the tube

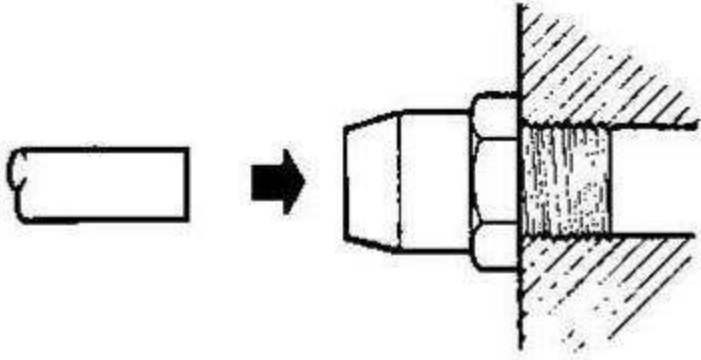
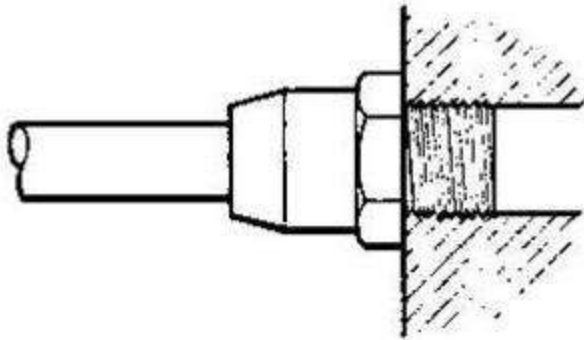


Table 'B'

| Diameter of tube | Push-in length of tube into fitting (mm) |
|------------------|--|
| 6 mm             | 19.6                                     |
| 8 mm             | 20.5                                     |
| 12 mm            | 25.0                                     |
| 16 mm            | 27.1                                     |
| 1/4 in.          | 19.6                                     |
| 3/8 in.          | 23.4                                     |
| 1/2 in.          | 25.4                                     |
| 5/8 in.          | 27.6                                     |

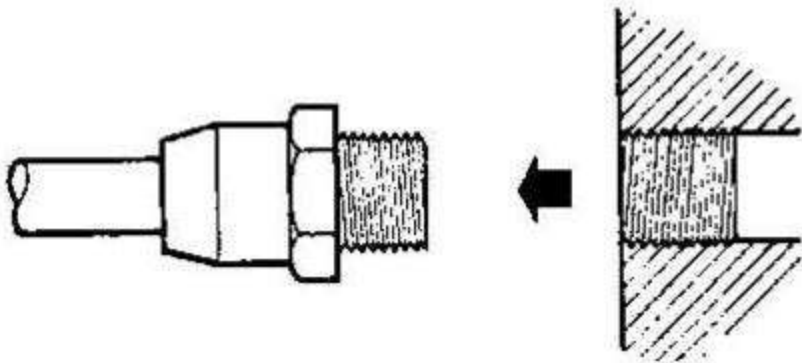
The tube ends to be cut right-angled. The push-in length should be marked onto the tube end, to make a subsequent visual control possible. After connecting, a pull at the tubing will verify a correct connection.

The Connection is done



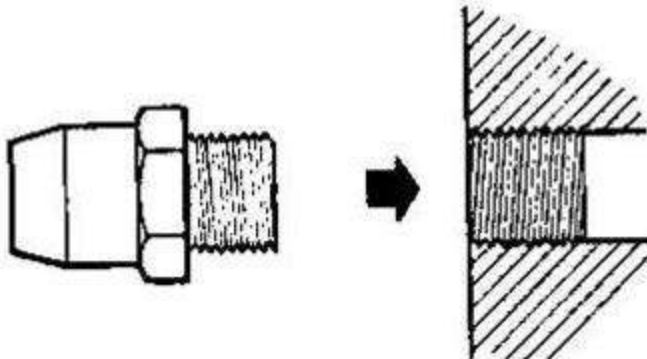
## Replacing Tubes and Connectors

Disconnect the Connectors



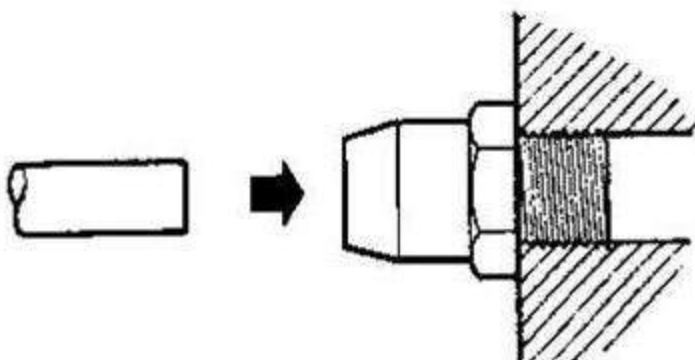
The connector rotates on the tube end and may be loosened from its device, without being disconnected from the tube.

Screw in new connectors



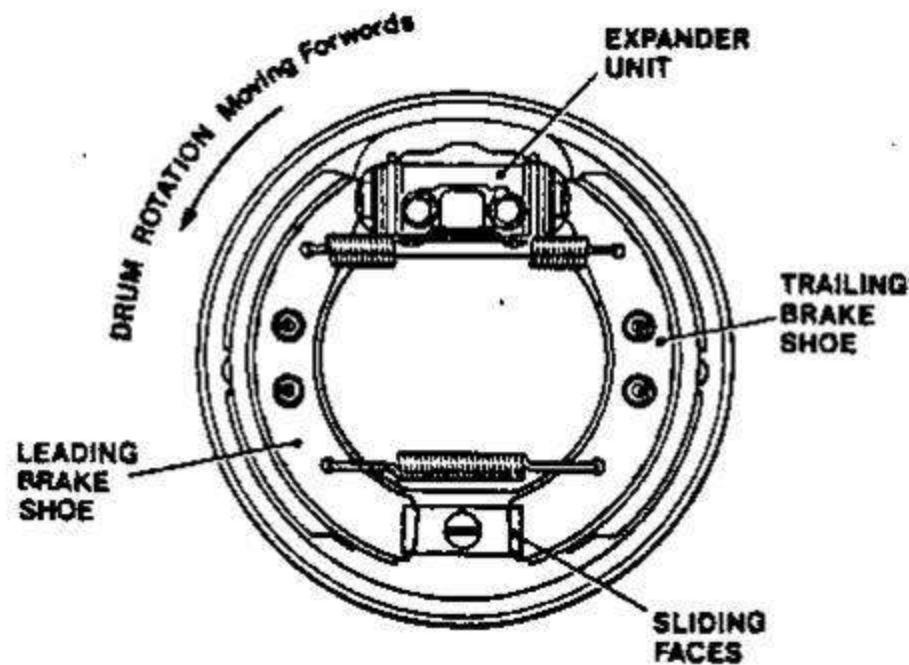
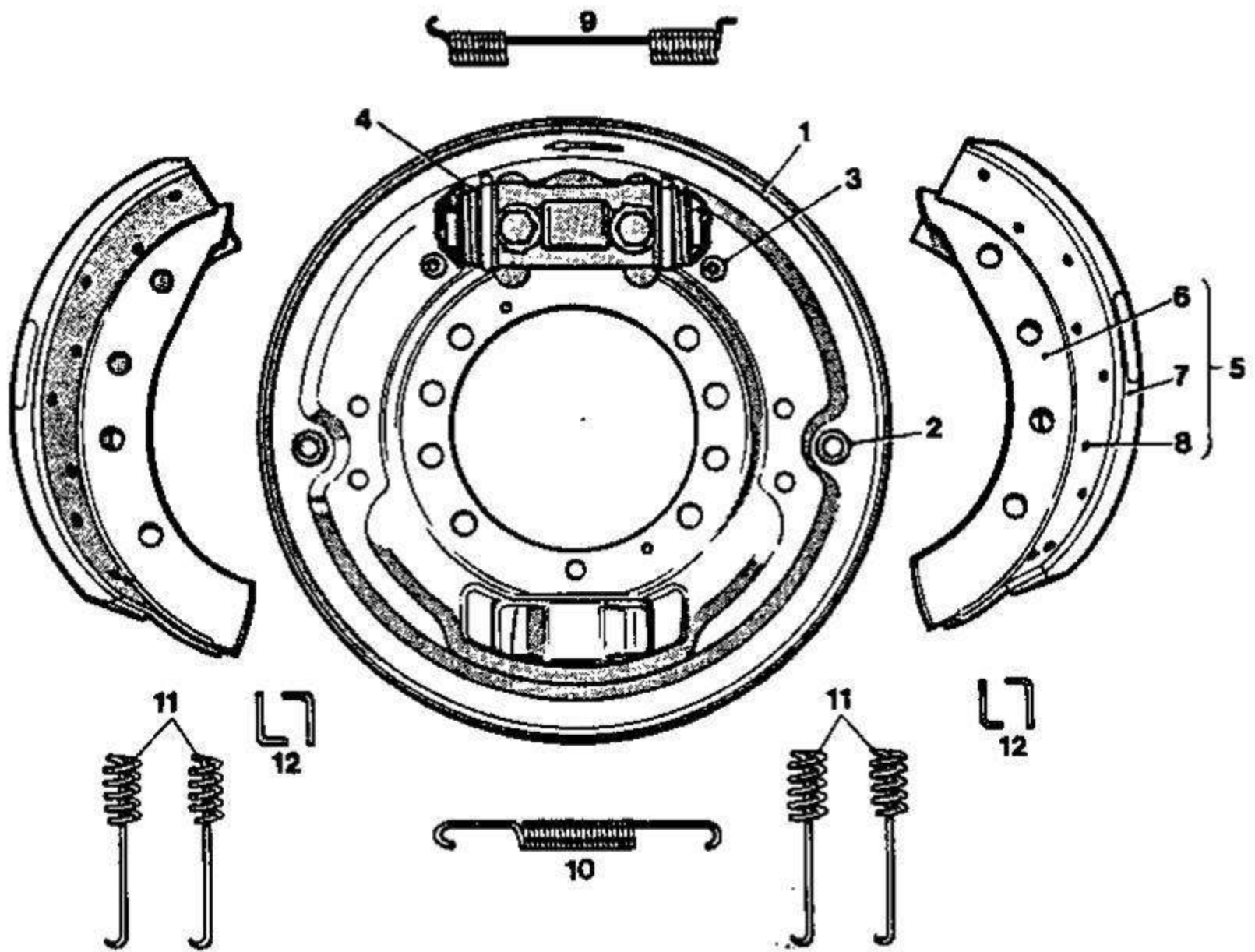
Apply tension torque according to table 'A'. Check the O-ring seal.

Push in a new tube



For connection of the tube, the procedure is the same as before.

Note: For vehicles with chassis no's 85 SDL 3020 to 98 SDL 3025 inclusive.



- |                        |                          |
|------------------------|--------------------------|
| 1. Back plate          | 7. Lining                |
| 2. Rubber plug         | 8. Rivet                 |
| 3. Rubber plug         | 9. Brake release spring  |
| 4. Expander unit       | 10. Brake release spring |
| 5. Brake shoe complete | 11. Pressure spring      |
| 6. Shoe                | 12. Spring retainer      |

Fig. 1 Brake Assembly

# WHEEL BRAKE

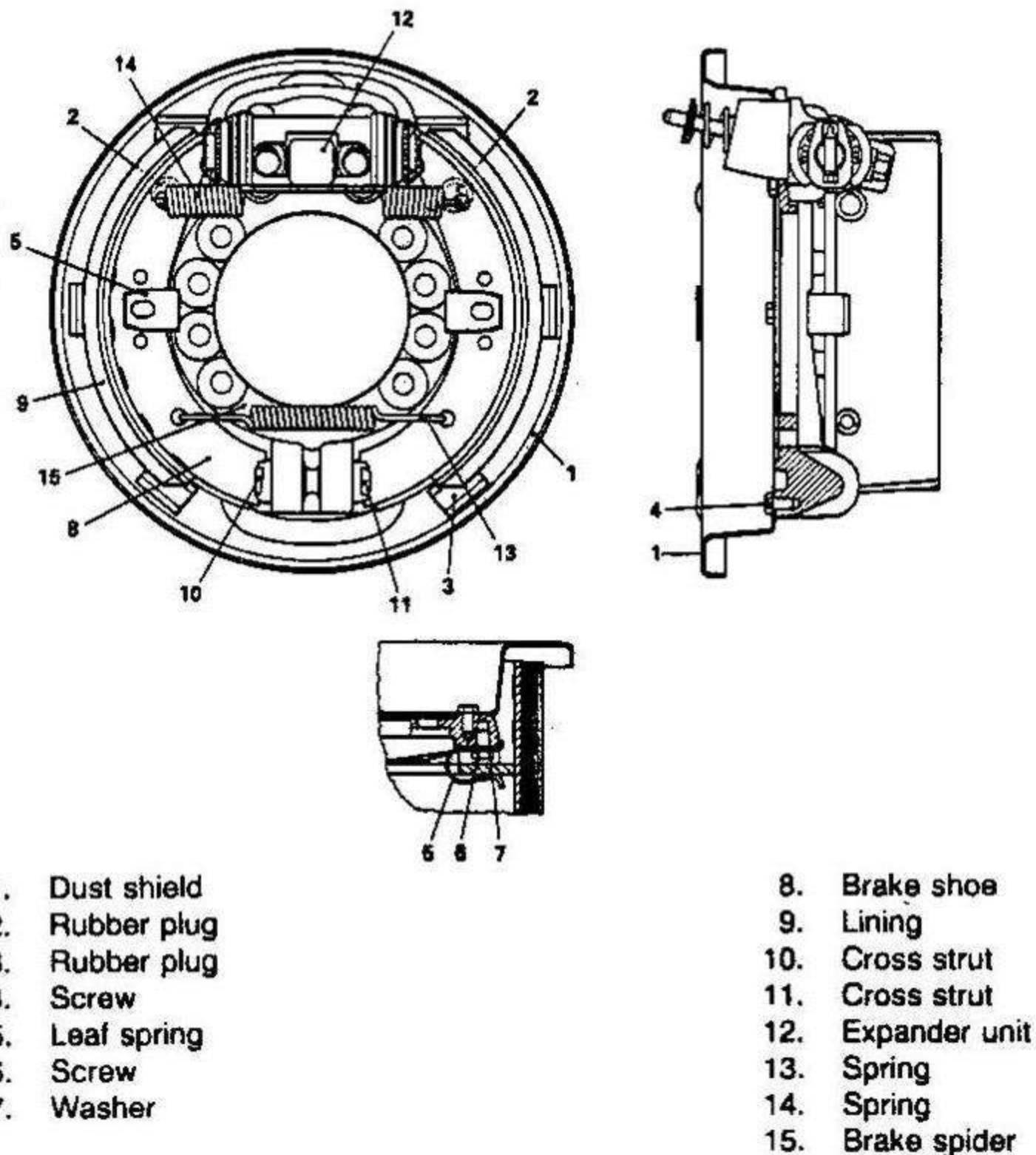
## 1. Description of Brake Assembly (fig.1)

The brake is a single leading shoe unit with a wedge-type expander and sliding shoes. The expander is operated by an external air cylinder screwed to a spigot on the inner face of the brake. On the rear brakes, a spring in the actuator applies the brakes while the vehicle is at rest. When the handbrake lever is moved to the "released" position, air pressure compresses the spring to release the brake.

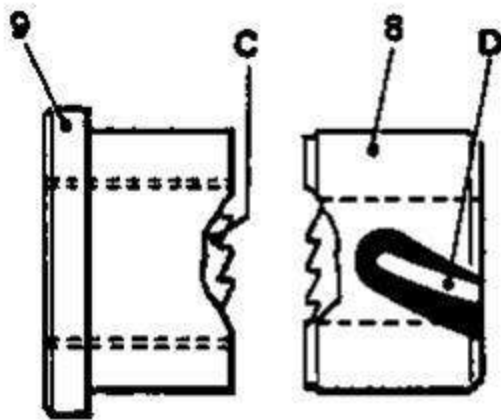
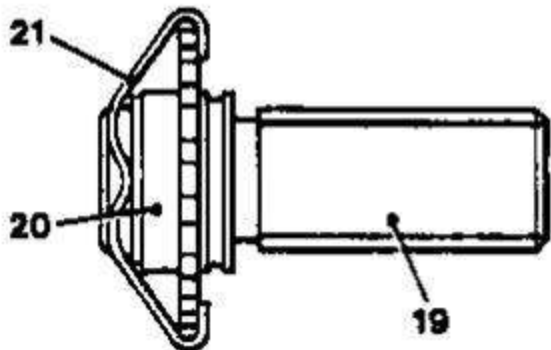
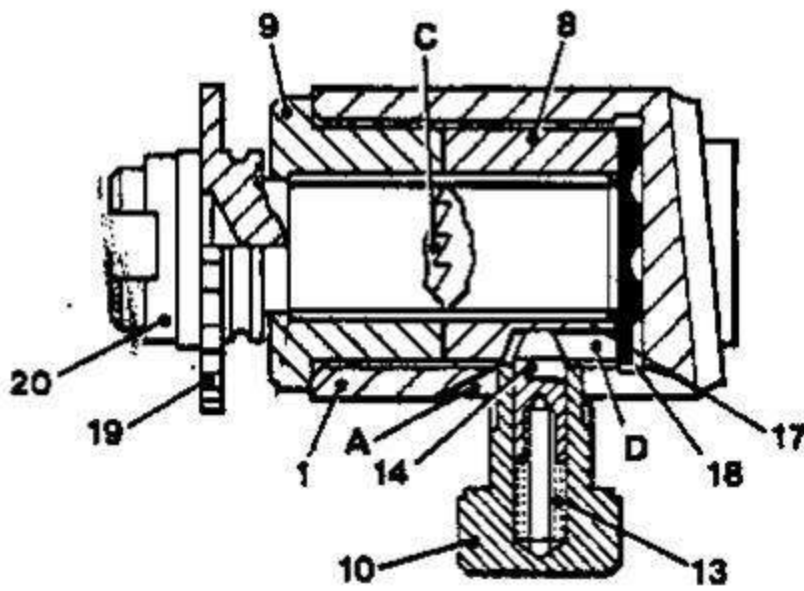
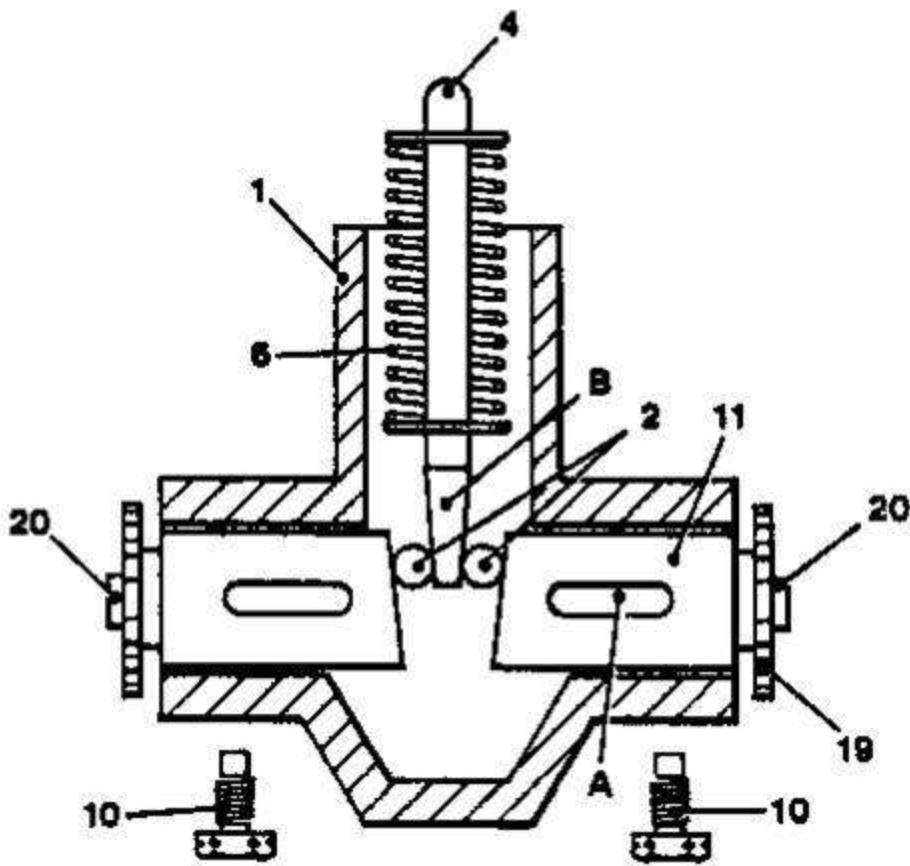
The expander has two pistons, both with automatic lining wear adjusters. Slotted end caps in the outer ends of the adjuster screws locate on the ends of the brake shoes.

When the brake is applied, the wedge is pressed into the expander unit by the air cylinder. The shoes are moved out to bear against the brake drum, the slotted end locations enabling them to self centralise. This ensures that the full surface area of the linings contact the drum.

**Note:** For vehicles with chassis no's 85 SDL 3030 to 98 SDL 3035 inclusive



**Fig. 1 Brake Assembly**



1. Piston
2. Roller
3. Strap plate
4. Wedge
5. Spring plate
6. Return spring
7. Washer
8. Adjuster sleeve
9. Adjuster nut
10. Hollow screw
11. Lock plate
12. Spring
13. Spring
14. Plunger
15. Seal
16. Hose clip
17. Adjuster spring
18. Adjuster washer
19. Adjuster screw
20. Brake shoe locator
21. Adjuster seal securing spring

Fig.2. Brake Expander

## 2. Description of Expander (fig.2)

The expander unit is secured to the brake back plate by four screws. The spigot on the housing (1) is threaded to accept the actuating cylinder and projects out towards the axle centreline.

The inner end of the wedge (4) contacts the plunger in the actuator while the inner, tapered end (B) is located between two rollers (2) which are in contact with the pistons (1). The wedge is held in the non-operated position by the spring (6). Locaters (20) with slotted ends fit into the adjuster screws (19) to locate the ends of the brake shoes and are held in place by springs (21).

Both pistons enclose automatic wear adjusters. The adjuster screw (19) incorporates a toothed wheel for manual adjustment, has an adjuster nut threaded on to it and an adjuster sleeve fitted over it, the latter incorporating a spiral groove. The sleeve and nut have meshing teeth (C) on their contact faces which are kept together by a washer (18) and a spring (17).

Two hollow screws (10) in the expander body locate in the longitudinal slots A in the pistons (1). Spring-loaded plungers in the screws (10) locate in spiral slots (D) in the adjuster sleeves (8). The screws (10) are secured by locking plates.

When the brake is applied, the actuator forces the taper section (B) between the two rollers (2) moving the pistons (1) and consequently the brake shoes outwards. The wedge is flexibly mounted so that the shoes can move to the positions where both make total contact with the drum.

When the brake is released, the spring (6) moves the wedge (4) back and the brake pull-off springs move the shoes back to the released position.

Longitudinal movement of the piston (1) causes the spring-loaded plunger (14) to move round the spiral groove D in the adjuster sleeve (8), so imparting a rotary movement to the sleeve. If the movement exceeds the pitch of the teeth (C), they jump into the next mesh. This action turns adjuster screws out 0.026mm to progressively take up any slack.

## 3. Maintenance and Repairs of Brake

New brakes are set correctly on delivery. During operation, the linings are automatically adjusted by the wear compensators, to allow for gradual friction-material wear. As a result, operating travel of the cylinders remains more or less constant.

At intervals, depending on the severity of operating conditions, check the brake lining thickness at the inspection holes in the brake backplate (fig. 3). The remaining thickness of the lining on the leading shoe (at front when the wheel is turned forwards) should be used as a guide.