



SERVICE MANUAL

COVERING MODELS

SFD112BR1*GW1

SFD112BR1B*GW1

SFD122AR1*GW1

SFD212BR1*GW1

SFD222AR1*GW1

SFD222BR1*GW1

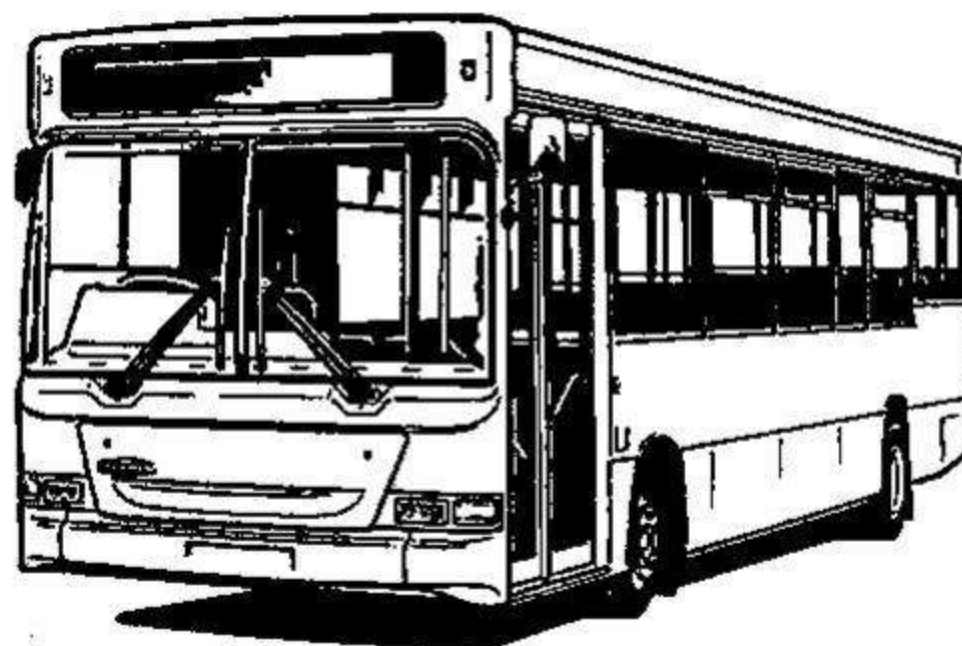
SFD322BR1*GW1

SFD322AR1*GW1

SFD322BR1*GW2

SFD322AR1B*GW1

SFD612BR1*GW1



PUBLICATION NO.: 2031

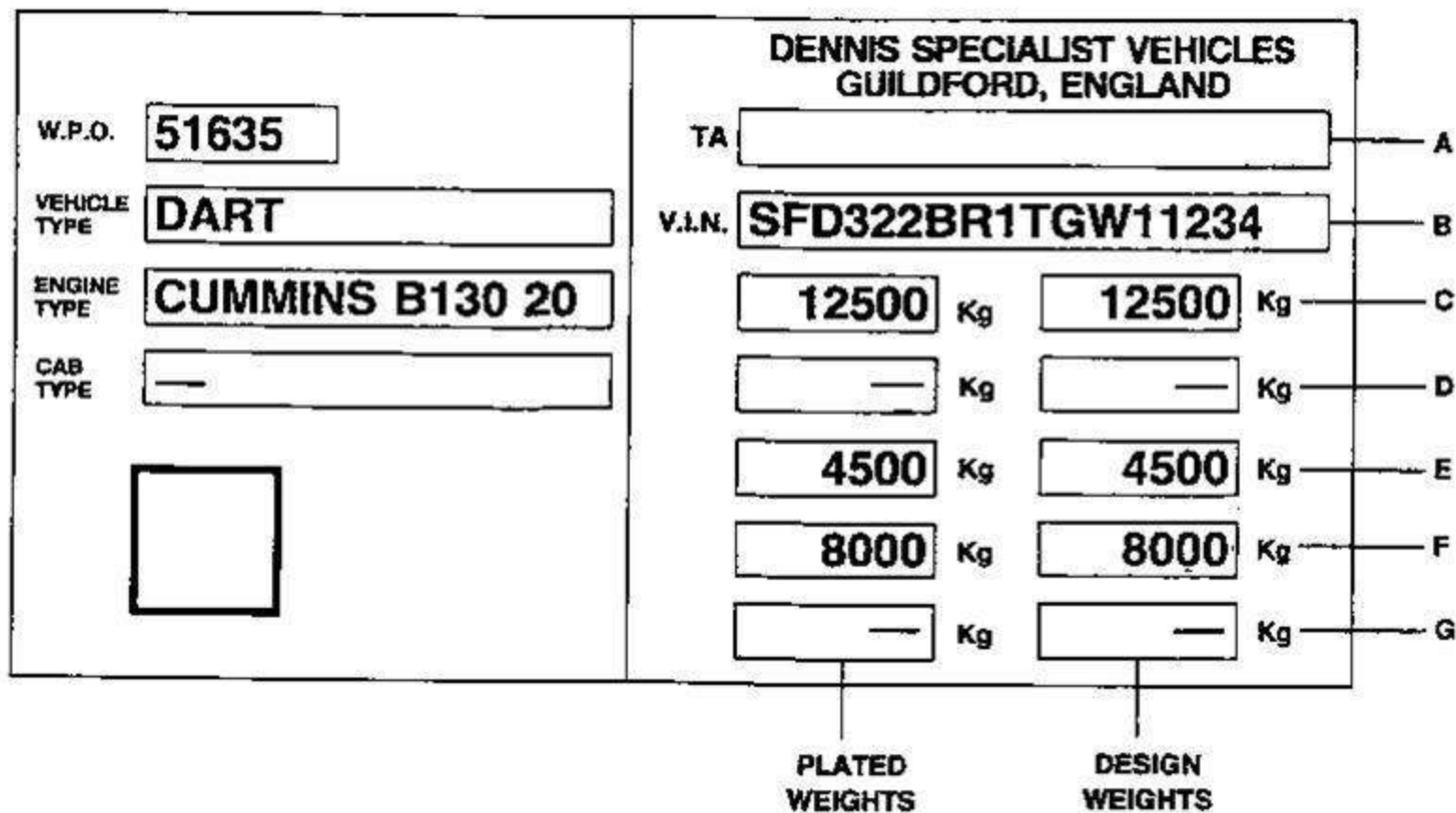
DATE: OCTOBER 1996

DENNIS

DRIVING AHEAD BY *DESIGN*

VEHICLE IDENTIFICATION PLATE

The Dart can be supplied in lengths to suit 9, 9.8 or 10.5 metre bodies
The exact vehicle is identified on the VIN plate shown below.



Typical Vehicle Identification Plate

Typical VIN

- | | | | | | |
|-----|---|------------------------------|-------|---|---------------|
| SFD | - | World Manufacturers identity | 1 | - | Series/Mark |
| 3 | - | Wheelbase | T (*) | - | Build Year |
| 2 | - | Engine | G | - | Build Plant |
| 2 | - | Transmission | W | - | Model |
| B | - | Air Conditioning | 1 | - | Frame Type |
| R | - | Hand of drive | 1234 | - | Serial number |

* Denotes build year in VIN number on front cover.

Typical vehicle type
Dart

Please quote VIN, vehicle type and WPO numbers with any enquires concerning this vehicle

Key to VIN plate

- | | | | | | |
|---|---|-------------------------------|---|---|---------------|
| A | - | Type approval number | E | - | Axle 1 weight |
| B | - | Vehicle identification number | F | - | Axle 2 weight |
| C | - | Gross weight | G | - | Axle 3 weight |
| D | - | Train weight | | | |

: This symbol, next to an item line, shows that the item has been modified for the current issue of the page.

INDEX

HEALTH & SAFETY NOTES
SERVICE SCHEDULE
MAINTENANCE
LUBRICATION
TOWING 1

AIR CLEANER
FRONT AXLE 2

REAR AXLE 3

BRAKING SYSTEM
PIPE CONNECTORS 4

COOLING SYSTEM
ELECTRICAL EQUIPMENT 5

ENGINE MOUNTING
ENGINE CONTROLS
EXHAUST SYSTEM 6

FUEL SYSTEM
GEARBOX 7

HYDRAULIC SYSTEM
PROPELLER SHAFT 8

RETARDER
STEERING
AIR SUSPENSION SYSTEM 9

FRONT SUSPENSION
REAR SUSPENSION
SHOCK ABSORBERS
WHEELS AND TYRES 10

DENNIS

Dennis Way
GUILDFORD
Surrey GU1 1AF
England
Tel: (01483) 571271
Fax: (01483) 301697

Service Training courses are available covering this vehicle.

For details please contact:
Customer Service Centre
Opus Park
Moorfield Road
Guildford
Surrey
GU1 1SZ

PLEASE READ FOR YOUR OWN SAFETY**MOVING THE VEHICLE**

During movement of the vehicle chassis, the hazards involved are normally associated with all forms of powered transport.

Before driving the vehicle, the operator should familiarise himself/herself with the vehicle drivers handbook.

With the vehicle in the unbodied condition, the following areas may present hazards additional to those normally encountered on a vehicle:

- Projections - chassis cross members, exhaust tail pipe.
- Moving parts - Cooling fan, propshaft, brake levers, steering linkage.
- Temporary components - drivers seat.
- Noise - engine and exhaust noise may exceed the levels achieved on a bodied vehicle.

WORKING ON THE VEHICLE

Before commencing work on the vehicle, take note of all the instructions relating to safety and hazardous items. The following potential hazards should be considered.

Stored Energy: Certain components and systems on the vehicle contain stored energy which must not be released in a non approved manner.

- Tyre air pressure
- Braking system air pressure
- Park brake spring compression
- Cooling system pressure
- Chassis lifting - adequate support required during jacking or lifting

Hazardous materials: Certain components on the vehicle contain, or can produce, material which must be handled cautiously. These materials are as follows:

Those which must not be taken internally or contact the eyes, skin, or mouth:

Battery acid: Diluted sulphuric acid can cause skin burns, eye damage and internal damage if ingested. Vapour from the solution can also irritate the respiratory system and the eyes.

Cooling system antifreeze: Based on ethylene glycol, and has significant toxicity if ingested, but can also be absorbed through the skin. Causes mild eye and skin irritation. Hot fluid can also scald.

PLEASE READ FOR YOUR OWN SAFETY**MINERAL OIL (ENGINE AND GEARBOX)**

This type of oil contains small quantities of polycyclic aromatic hydrocarbons, which can cause irritation, dermatitis and oil acne if allowed persistent contact with the skin. Toxicity through ingestion is of a low order, however this should be avoided.

HYDRAULIC FLUIDS

There are generally made from polyalkylene glycol ethers and can cause mild irritation of the skin and eyes. The toxicity through ingestion is generally regarded to be low order.

FRICITION MATERIAL DUST (BRAKE AND CLUTCH LININGS)

May consist of a high percentage of white asbestos bonded in a resin. Handling and fitting lined brake shoes or clutch plates is not regarded as a health risk. The dust produced by worn linings is degraded by the brake or clutch and is not believed to be hazardous. However it is prudent to avoid generating airborne dust concentration, therefore dust removal should be by the use of approved vacuum cleaner or by use of a damp cloth (for occasional exposure).

INSULATION MATERIALS

Man made fibres which include glass, rock, slag, and metal oxides. These may cause skin irritation. Inhalation of dust from the fibres should be kept below 1 fibre/ml.

FUEL

Diesel fuel is a mixture of hydrocarbons largely consisting of paraffinic hydrocarbons, with blended constituents such as refined vacuum distillants and catalytically cracked oil. Contact with the skin can cause irritation and dermatitis. Inhalation and ingestion are serious risks and can cause chemical pneumonitis.

EXHAUST EMISSIONS

Substances produced are carbon monoxide, hydrocarbons and oxides of nitrogen. Can be highly toxic if inhaled in sufficient quantity. Emissions in enclosed spaces should be minimised unless adequate extraction facilities are available.

WARNING! Those which may cause noxious fumes if allowed to burn:

Mineral oil (engine and gearbox): These do not present a fire or explosive hazard under normal circumstances.

Hydraulic fluids: These do not present a fire or explosive hazard under normal circumstances.

Fuel (diesel): Not classified as flammable for most purposes.


Rubber and synthetic alternatives (tyres, hoses, bushes, seals, insulation):
Natural and synthetic rubbers are combustible and will produce unpleasant and dangerous fumes. "Viton" seals are used in a small number of applications on the chassis and this material can leave highly corrosive residue if burned.

Coatings (Mebon chassis protection): Generally inert in the cured state, but should be removed from areas to be welded



SERVICE MANUAL

SERVICE SCHEDULE

Servicing schedule	Pages	1 - 8
Engine oil level - checking	Page	9
Gearbox - oil level	Page	9
Coolant level - checking	Page	10
Rear axle	Page	10
Steering/fan drive - oil level checking	Page	11
Fuel/water separator - draining water and sediment	Page	11
Hydraulic system filter	Page	11
Drive belt inspection	Page	12
Renewing the alternator drive belt	Page	12
Air cleaner restriction indicator	Page	13
Line filter - Air suspension	Page	13
Releasing spring brake actuators	Page	14
Towing	Page	14
 CRT exhaust system - diesel fuel type	Page	14
Lubrication chart	Page	15

First	Service	No later than 1000 miles (1600 km) from new
Daily	Service	Daily checks
Weekly	Service	Weekly checks
'A'	Service	6,000 miles, (10,000 km) or 3 months whichever occurs first
'B'	Service	12,000 miles, (20,000 km) or 6 months whichever occurs first
'C'	Service	24,000 miles, (40,000 km) or 12 months whichever occurs first

A-B-A-C Recommended Servicing sequence

The first service for a new vehicle must be carried out no later than 1600 km, 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.

AIR CLEANER	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
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		●			●	●	●

AIR CONDITIONING	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
Check belt tension		●		●	●	●	●
Check belt condition		●		●	●	●	●
Check compressor for oil leaks		●			●	●	●
Check compressor for gas leaks		●			●	●	●

FRONT AXLE	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
Check hub bearing end play	at 3,000 miles	●					●
Check oil seals for leakage		●			●	●	●
Check for wear in swivel pins						●	●
Check security of axle		●				●	●
Lubricate stub axle assembly intervals not exceeding	3,000 miles 4800 km or 3 weeks				●	●	●
Clean out and recharge hub bearings							●

REAR AXLE	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
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	100,000 Miles 160,000 km or Yearly	●					
Check axle oil level	Monthly, 5,000 miles (8,000 km)	●			●	●	●
Repack hub bearings with fresh grease							●

BRAKING SYSTEM (see section Test & Check List)	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
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					●	●	●
It is advisable to remove all valves from the vehicle, dismantle and renew any worn or damaged parts	Yearly						
Check function and cleanliness of air dryer					●	●	●
Check operation of exhaust brake (if fitted)							
Change air dryer cartridge	Yearly						
Drain air reservoirs					●	●	●
Renew all brake actuator diaphragms	100,000 miles (160,000 km), or 2 Yearly						

COOLING SYSTEM	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
Check cooling system level		●	●	●	●	●	●
Check security of radiator mountings		●			●	●	●
Check hoses for leaks and signs of deterioration					●	●	●
Check pressure cap spring and seal	Yearly						
Drain and flush out. Refill with the correct engine coolant (Autumn)	40,000 miles 64,000 km or 2 yearly						
Check strength of anti-freeze						●	●
Check radiator matrix and clear all debris					●	●	●
Check operation of low coolant alarm					●	●	●

ELECTRICAL	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
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		●					●
Overhaul starter motor	2 Yearly						
Lubricate alternator	50,000 Miles 80,000 km or Yearly						●
Lubricate alternator - 180A	60,000 Miles 96,000 km or Yearly						●

GEARBOX	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
Check oil level		●		●	●	●	●
Check idling speed of engine					●	●	●
Change oil							●
Change auxiliary filter	change at first 5,000 miles then at normal intervals						●
Check adjustment of shift linkage							●
Check modulator adjustment							●
Check gearbox breather							●
Check tightness of all fixings		●			●	●	●
Check for oil leaks and rectify		●			●	●	●
Change sump filter	Every 50,000 miles or every other oil change						

HYDRAULICS	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
Check hydraulic fluid level		●	●	●	●	●	●
Check security of all components as shown on the hydraulic system diagram						●	●
Check all pipework and connections for leaks					●	●	●
Change hydraulic oil	2 Yearly/100,000 miles						
Change return line filter	2 Yearly/100,000 miles (160,000 km)	●					
Change/clean reservoir filters	2 Yearly/100,000 miles						●

DRIVE SHAFT	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
Check tightness of all fixings		●			●	●	●
Check for wear on the universal & sliding joints		●				●	●
Grease universal and sliding joints					●	●	●

RETARDER	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
For additional data refer to section 9							
Wash retarder						•	
Check tightness and condition of earth terminal and cable						•	•
Check condition of main terminal block and cable					•	•	•
Check tightness of all fixings see torque chart						•	•
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					•	•	•

STEERING GEAR (see also Hydraulics)	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
Check overall play at steering wheel		•		•	•	•	•
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 wheel alignment adjust if necessary		•				•	•
Check all ball joints and linkages for play					•	•	•
Check bevel box oil level		•			•	•	•
Check bevel box for leakage		•			•	•	•
Lubricate steering relay shaft							•
Check for play in steering column							•
Check for play in relay shaft u.j.'s							•
Check hydraulic steering limiter							•

AIR SUSPENSION	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
Check spring mountings, tighten if necessary		●			●	●	●
Check the front and rear shock absorber mountings		●			●	●	●
Check shock absorbers for leaks					●	●	●
Check the ride height and set the levelling valves as necessary		●				●	
Remove dirt and grease deposits from air spring units		●				●	
Check air system for leaks (suspension)		●			●	●	●
Inspect and clean/change air suspension line filter element					●	●	●
Test levelling valve operation							●

WHEELS AND TYRES	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
Check all wheel nuts and tighten if necessary		●		●	●	●	●
Check tyres are free from damage, cuts and foreign matter		●		●	●	●	●
Check tyre pressures are correct including spare if fitted		●	●	●	●	●	●
Check tread depth is within legal limit				●	●	●	●
Check valves are positioned at 180 degrees to each other on twin wheel		●		●	●	●	●

DART SLF SERVICE SCHEDULE

SERVICE MANUAL

ENGINE AND ANCILLARIES	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
Carry out all service requirements indicated in the engine manufacturers literature		●	●	●	●	●	●
For all engine information consult the relevant routine maintenance section in the engine manufacturers operators manual		●	●	●	●	●	●
Check the security of engine and gearbox in chassis		●					
Check the security and efficiency of silencer and pipes		●			●	●	●
Check for leaks in oil, water and fuel systems		●			●	●	●
Check operation of the automatic drive		●		●	●	●	●
Check alternator drive belt tension		●		●	●	●	●
Check alternator drive belt condition		●		●	●	●	●
Change fuel filter						●	
Check fuel sedimenter for cleanliness		●			●	●	●
Drain water trap on fuel filter		●		●	●	●	●
Check security & lubricate throttle linkage					●	●	●
Check oil level		●	●	●	●	●	●
Change oil and filter	Severe Duty: *AOS-below 12mph (20kph)-change at 6250 miles (10,000km) Long Haul: *AOS-above 12mph (20kph)**AOM-37,500 (60,000km)-change 15,625 miles (25,000km) Short Haul: *AOS-above 12mph (20kph)**AOM-below 37,500 miles (60,000km)-change at 12,500miles (20,000km) *AOS:Average Operation Speed **AOM:Average Operational Mileage						
Adjust valve clearances							●
Inspect vibration damper	48,000 miles 77,000 km						
Check charge air piping for leaks cracks and loose connection		●			●		

GENERAL	SERVICE NOTE	FIRST	DAILY	WEEKLY	A	B	C
Check driver's seat for security & 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		●			●	●	●

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

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

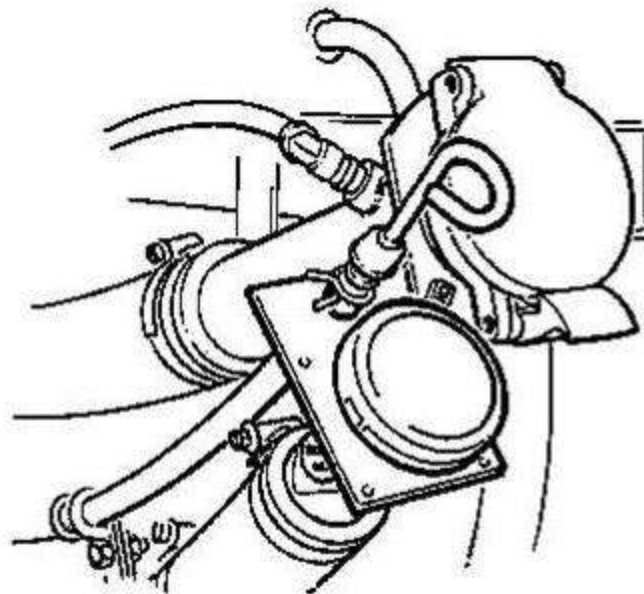
ENGINE OIL LEVEL - CHECKING

DAILY CHECK

The engine oil dipstick is situated at the rear right hand side of the vehicle, next to the fuel filler and above the engine oil filler.

CAUTION ! Never operate the engine with the oil level below the cross hatched area or above the full mark. Wait at least five minutes after shutting off the engine to check the oil. This allows time for the oil to drain back to the oil pan.

OIL GRADE - 15W/40



GEARBOX - OIL LEVEL - CHECKING

WEEKLY CHECK

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 the 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.

OIL GRADE - DEXRON III



COOLANT LEVEL CHECKING

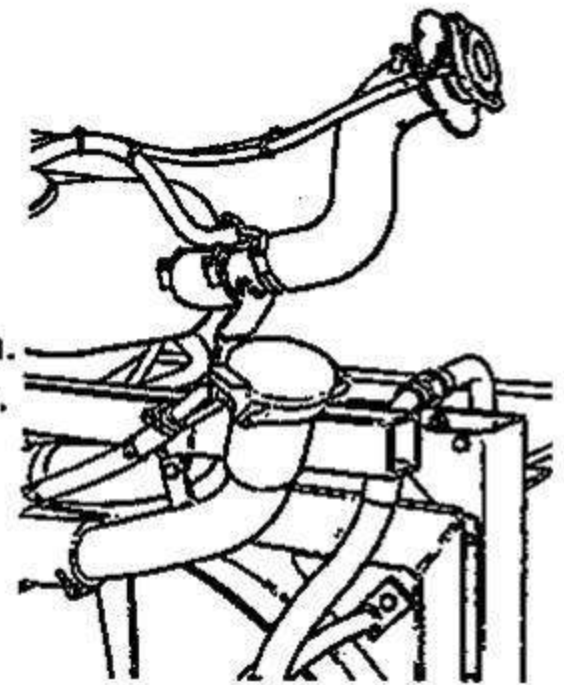
DAILY CHECK

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

WARNING! Check the coolant only when the engine is stopped. Wait until the temperature is below 50 degrees centigrade (120 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 antifreeze must be used.

**50% WATER
50% ANTIFREEZE**

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



DRIVE AXLE

FIRST A, B, C CHECK

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.

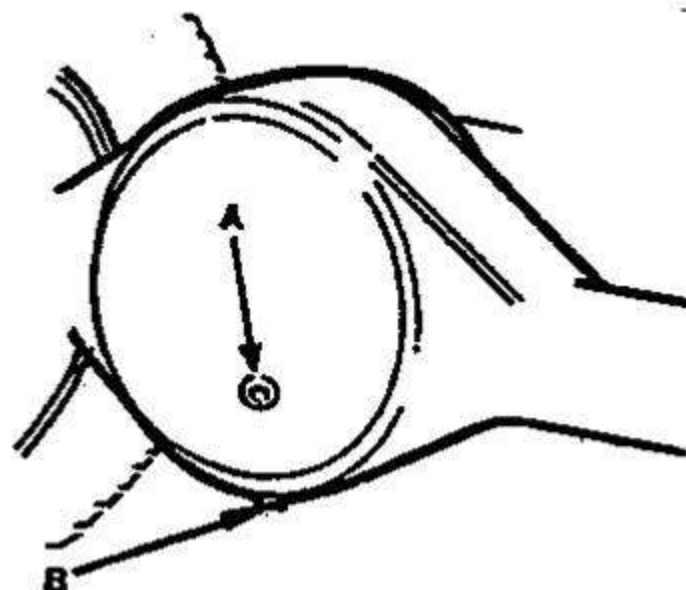
Filling

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.

OIL GRADE - 85W/140

- A. Filler Plug
- B. Drain Plug

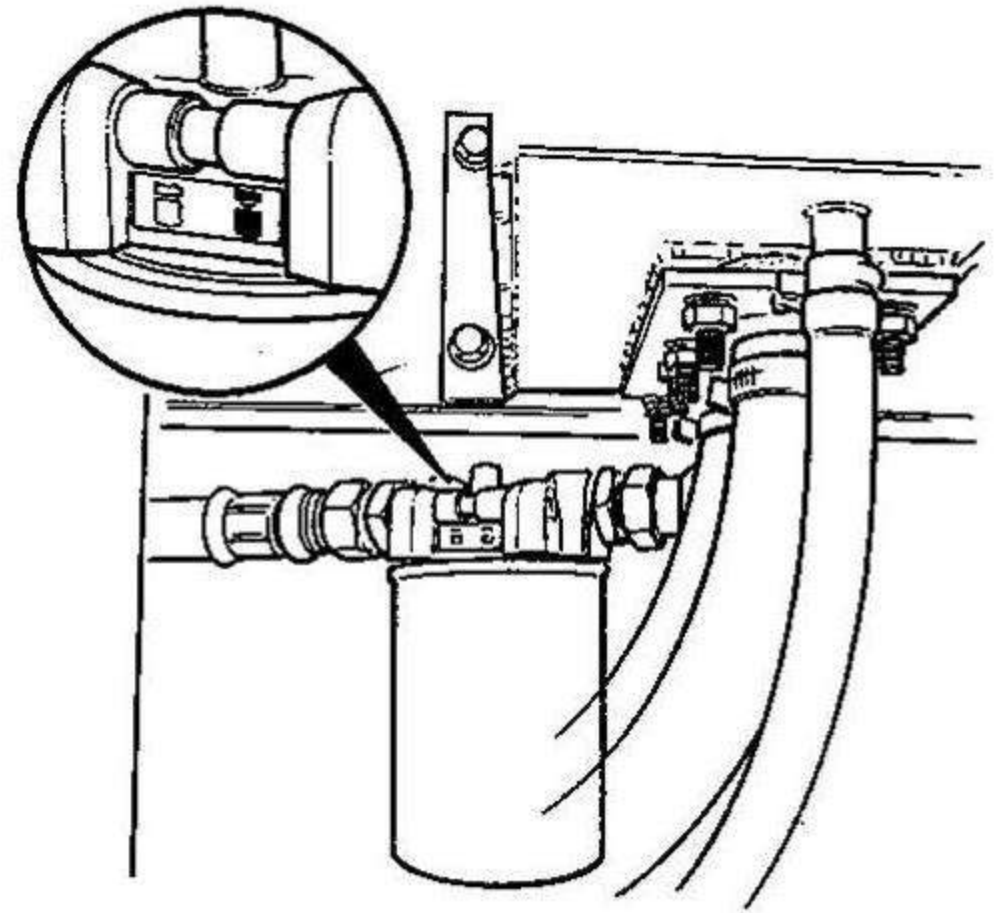


HYDRAULIC SYSTEM FILTER

The return line filter is of the canister type and incorporates an indicator in the filter head. The indicator should be checked, with the engine running, at the recommended intervals and the cartridge changed when the indicator changes from Green to Red.

The filter is situated at the rear right hand side of the vehicle, inboard of the hydraulic reservoir.

The indicator must be checked with the engine running at idle.



OIL GRADE - DEXRON III

STEERING & FAN DRIVE RESERVOIR - OIL LEVEL CHECKING

DAILY CHECK

The hydraulic oil filler is situated on the right side of the engine compartment above the compressor. The level should be checked with the oil cold.

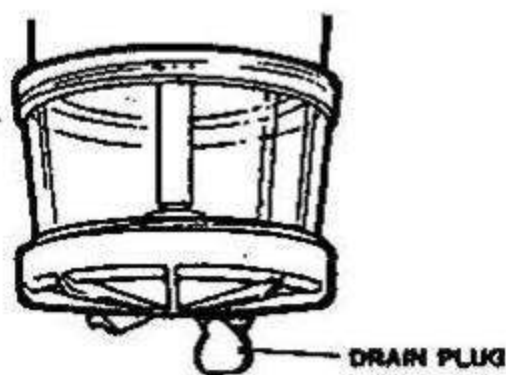
1. With the engine switched off, check whether the fluid is approximately on the uppermost line of the dipstick.
2. Top up as required.
3. Start the engine.
4. With the engine running at idle, the fluid level should go down to approximately the mid-point of the dipstick.

FUEL/WATER SEPARATOR - DRAINING WATER AND SEDIMENT

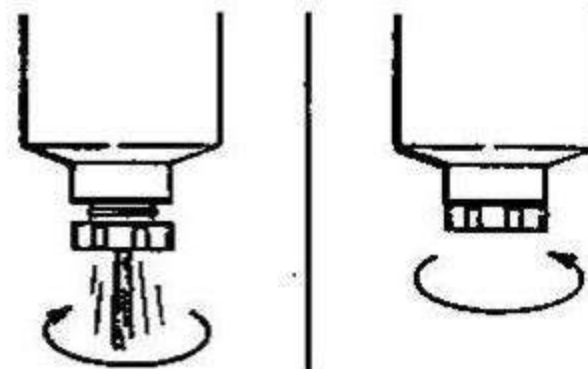
WEEKLY CHECK

Unscrew the plug on the bottom of the sedimenter, at the nearside of the vehicle at the rear of the fuel tank, to allow water to drain. Refit the plug when clean fuel is visible.

Note: Also drain the water separator fitted at the rear of the engine.



Sedimenter



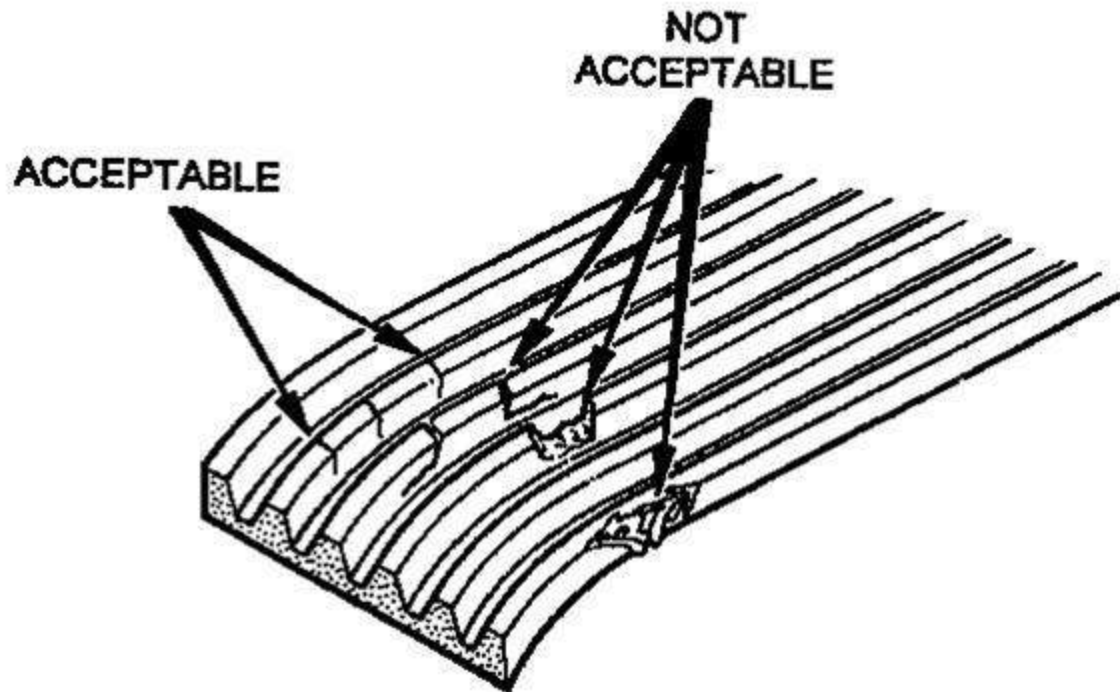
Engine Water Separator

DRIVE BELT INSPECTION

WEEKLY CHECK

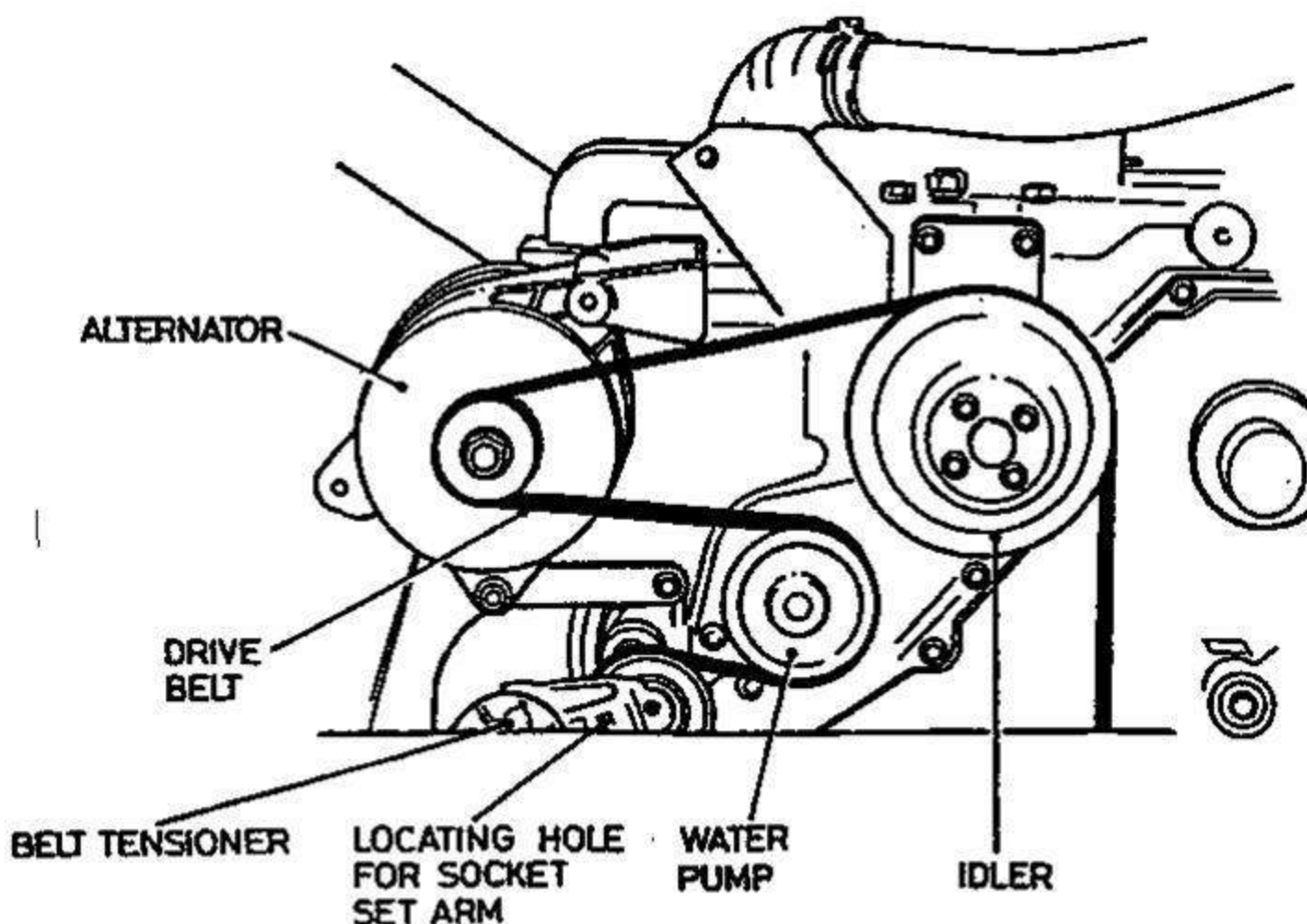
Visually inspect the belt. Check the belt for intersecting cracks. Transverse cracks (across the belt width) are acceptable. Longitudinal cracks (direction of belt length) intersecting with transverse cracks are **NOT** acceptable.

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



RENEWING THE DRIVE BELT

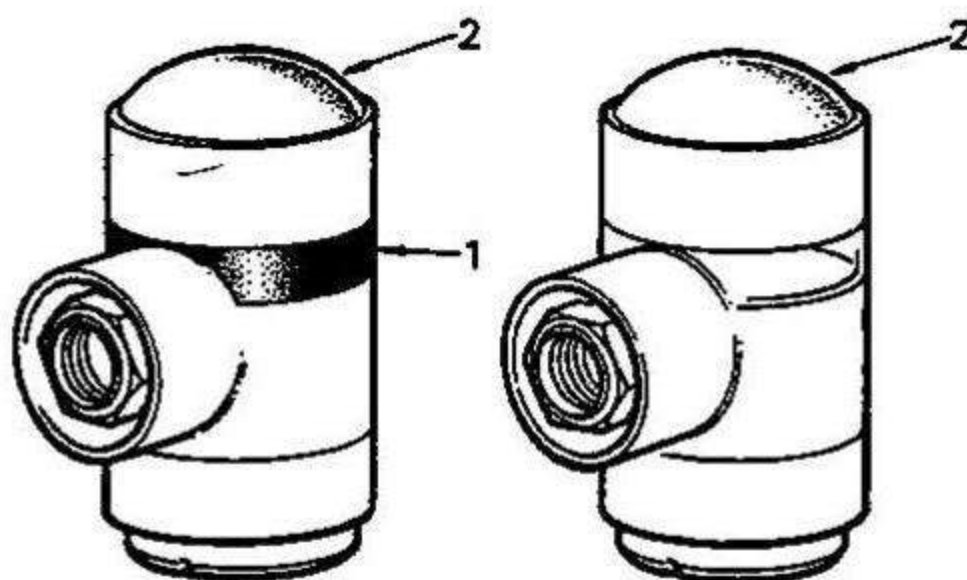
1. Check that the master switch is at **OFF** with the engine stopped.
2. Using a bar from a socket set in the square hole in the arm, turn the automatic belt adjuster clockwise to remove belt tension.
3. Holding the adjuster in the raised position, remove the old belt and fit the new one, ensuring that 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**WEEKLY CHECK**

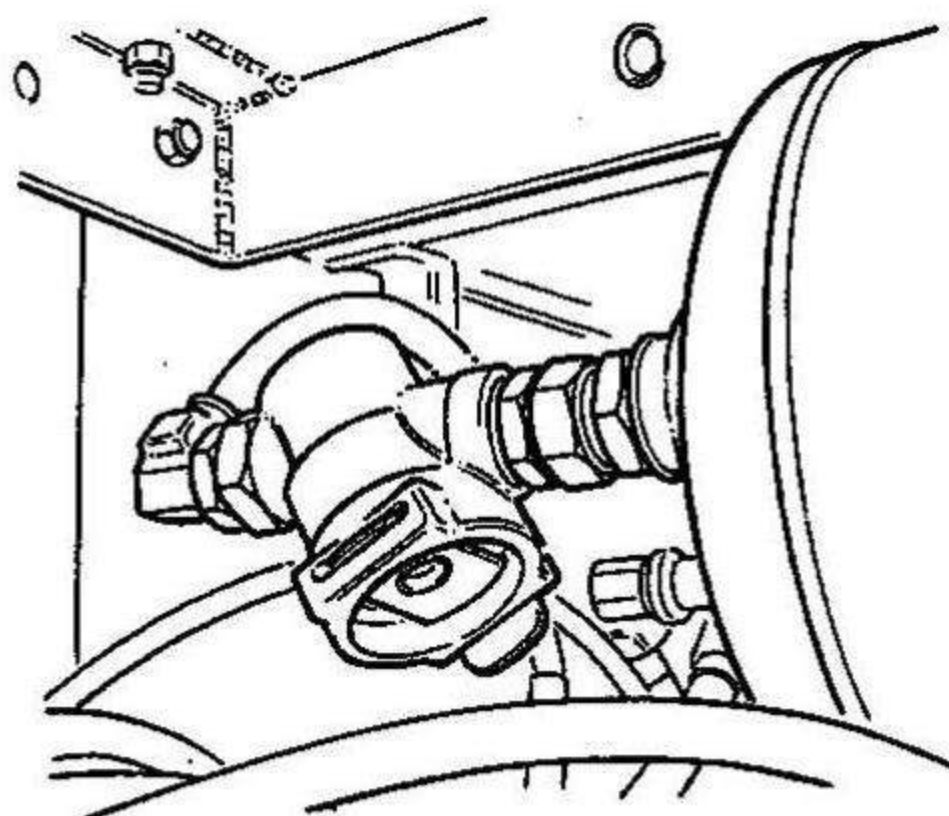
The restriction indicator is situated at the rear of the vehicle, above the air cleaner. The indicator is operated by the depression between the air cleaner and the engine, and at a preset figure, the red warning indicator will remain locked up in a visible position after the engine has stopped running.

When the red indicator band (1) appears, the air cleaner element must be removed and renewed. After the element has been renewed, reset the indicator by pushing on the diaphragm (2) at the top of the indicator.

**LINE FILTER - AIR SUSPENSION****CHECK A, B & C**

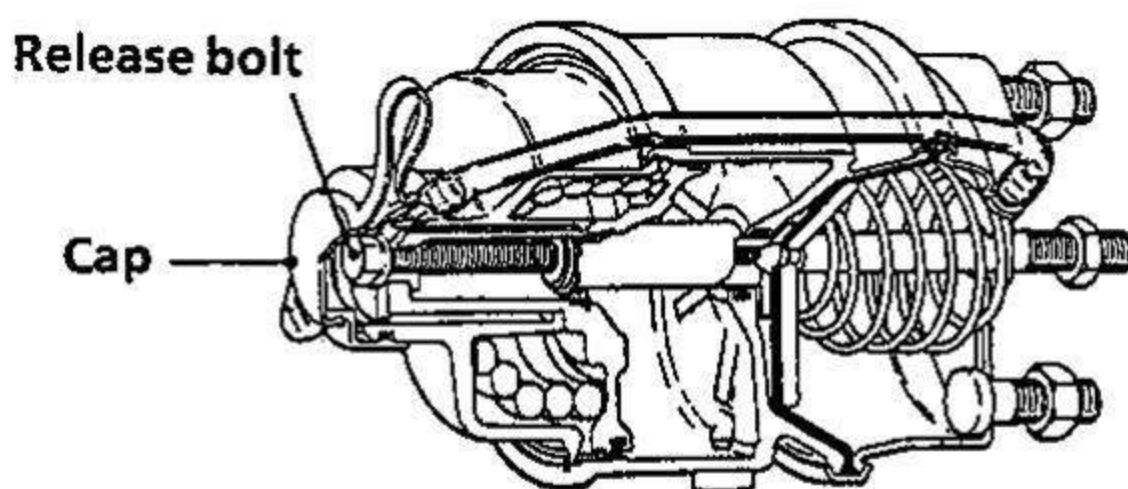
The line filter for the air suspension system is located on the front auxiliary air reservoir (top) situated on the front, right-hand side of the vehicle.

The line filter should be checked every 3 to 4 months, depending on the operating conditions. The filter should be removed and blown through with compressed air. If the filter is damaged the element should be replaced.



RELEASING SPRING BRAKE ACTUATORS

- Place chocks behind and in front of the wheels.
- Remove the cap from the end of both rear spring actuators.
- Unscrew the release bolts of both actuators until the brake shoes release from the drums.
- When resetting release bolts, tighten to 35ft lbs (47Nm) in a clockwise direction.
- Replace the spring brake actuator caps.



Rear spring brake actuator

TOWING

The vehicle should only be towed from the towing eyes. The towing eyes should be screwed into both of the the tapped sockets in the rear or front crossmember. A rigid tow bar should be used, utilising both towing eyes.

WARNING ! It is essential to disconnect and support the propshaft at the rear axle before attempting to tow the vehicle.

An air coupling is located on the front of the vehicle to provide a means of supplying air to the braking system while the vehicle is being towed.

Where there is no means of supplying air to the vehicle being towed the parking brake (spring brake) must be released.

DANGER! In this condition the brakes are completely inoperative. Towing must be carried out using a rigid tow bar.

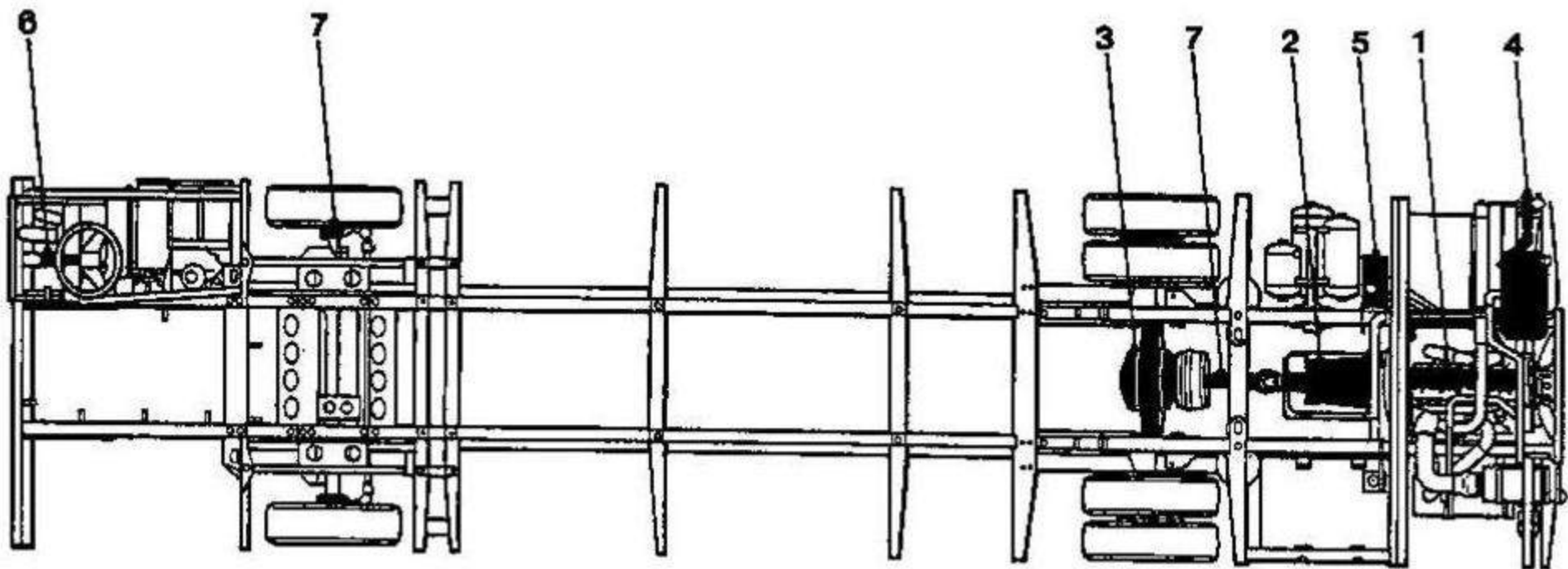
CRT EXHAUST SYSTEM (CONTINUOUSLY REGENERATING TRAP)

If the vehicle is fitted with a CRT exhaust system the vehicle **must** be run on a **low sulphur diesel fuel** (city diesel) with a sulphur content of no greater than 10 ppm, as sulphur inhibits the catalytic reactions.

LUBRICATION CHART

	Vehicle Component	Capacity in litres (approx)	General Specification	Recommended Brand
1	Engine	16.4	API:CF-4/SG or CF-4/SH 15W/40	Total Rubia XT
2	Gearbox Oil change	18.9 15	Dexron III	Total Fluid III Total Fluid ATX
3	Rear Axle	12	MIL-L-2105D API GL5 85W/140	Total EPB
4	Cooling System	38.0	Water/Antifreeze 50/50 Mix	Total Universal Antifreeze
5	Hydraulic Steering & Fan Drive system	17	Dexron II D or III *	Total Fluid II D or III
6	Steering Column	0.05	Dexron II D or III *	Total Fluid II D or III
7	Grease Points: Axle swivel pins Propshaft grease Battery carrier pivot	A/R	Multi purpose lithium based	Total Multis Complex EP2

* When using products other than supplied by Total, confirm compatibility with supplier.



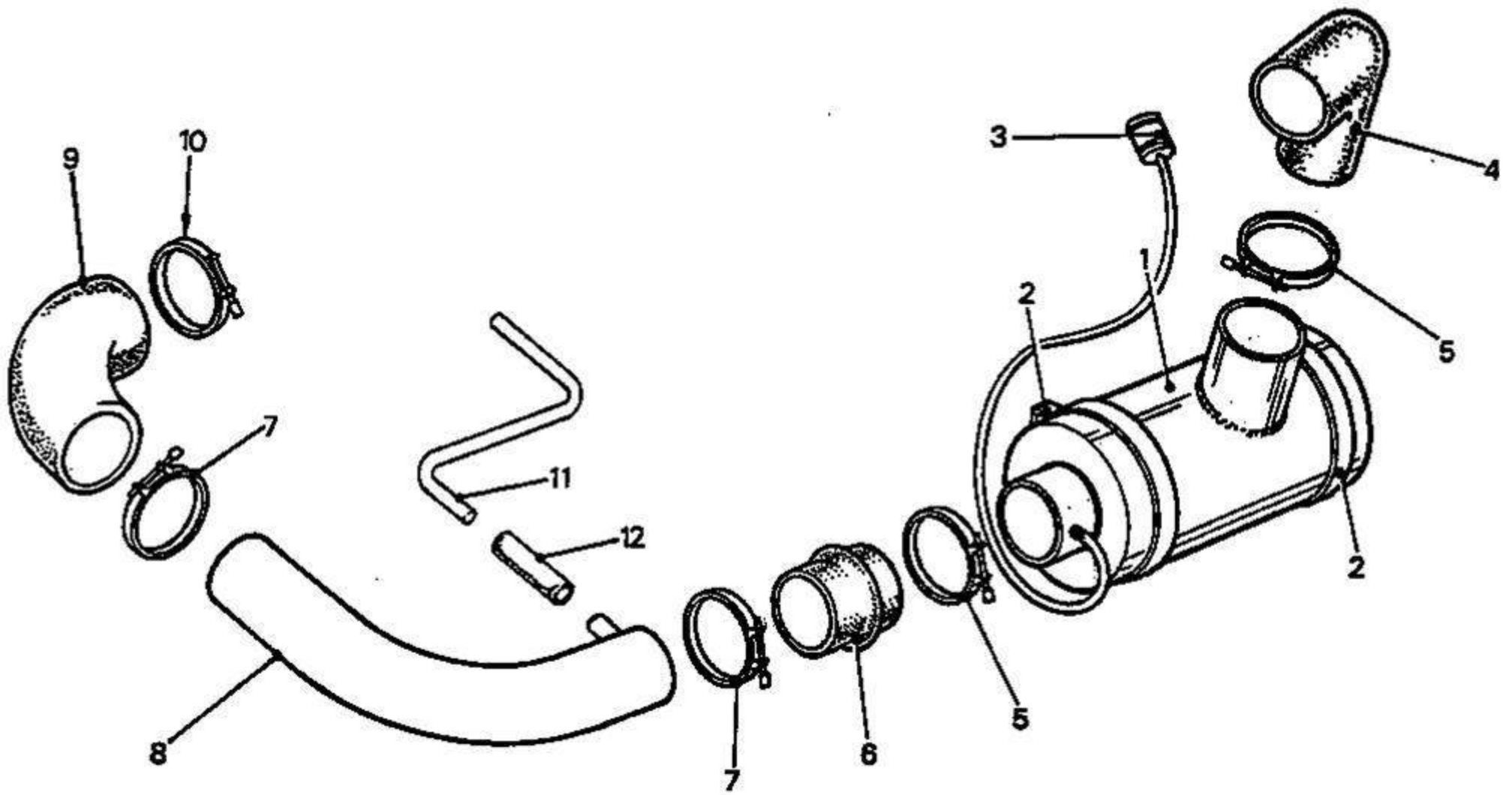


SERVICE MANUAL

AIR CLEANER

Description	Page	3
Servicing	Page	3
Vehicle checks	Page	3
Restriction indicator	Page	4

AIR CLEANER



- | | |
|--------------------------|----------------------------|
| 1. Air cleaner | 7. Clip |
| 2. Mounting band | 8. Intake pipe |
| 3. Restriction indicator | 9. Elbow |
| 4. Elbow | 10. Clip |
| 5. Clip | 11. Compressor intake pipe |
| 6. Hump hose | 12. Hose - intake pipe |

AIR CLEANER

MAINTENANCE

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.

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.

Vehicle checks

After reassembly but before restarting engine, the following system checks must be carried out.

- a) Check all cleaner to engine pipe work for defects to ensure good and 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.

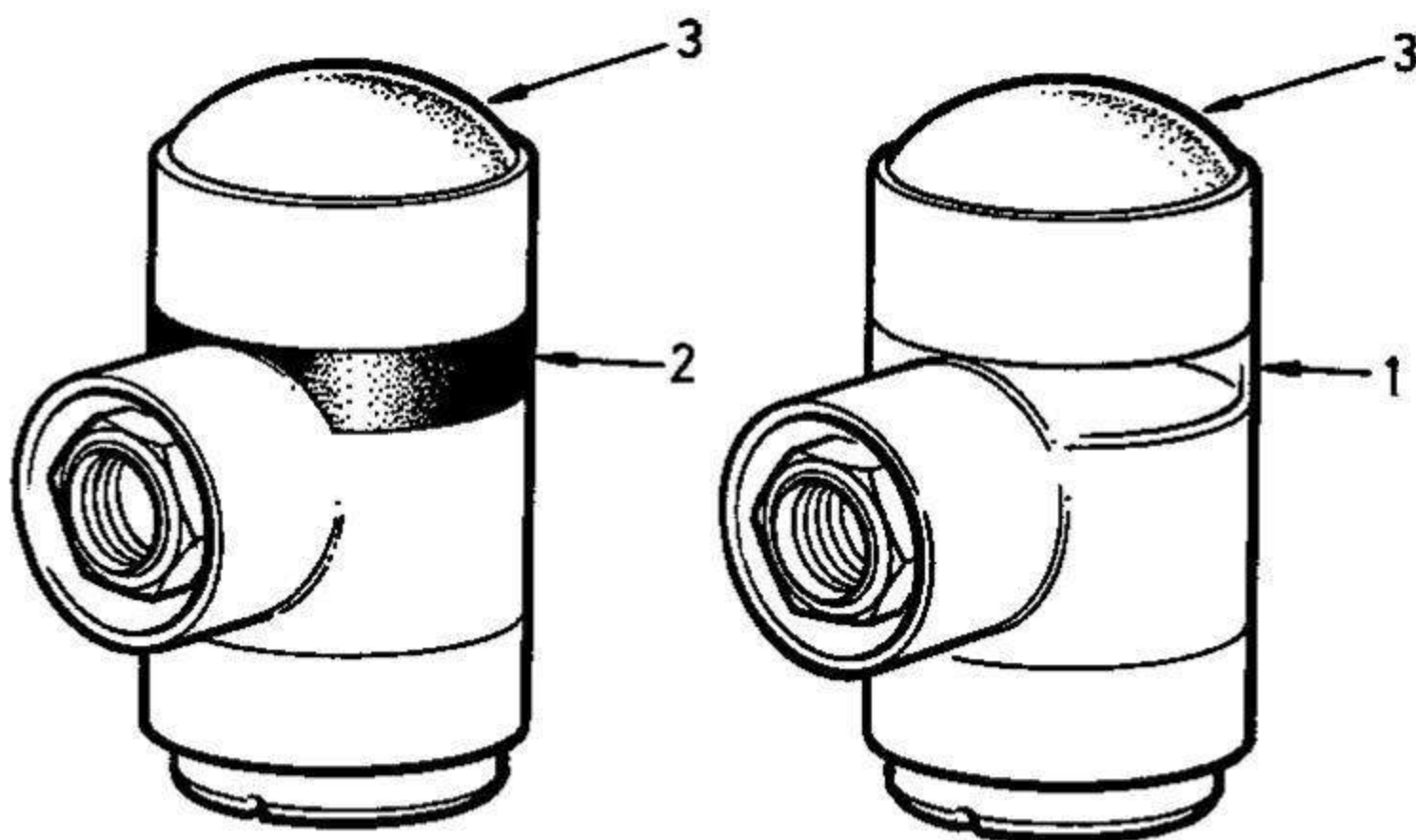
AIR CLEANER

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.



1. Transparent panel (no restriction)
2. Red panel (service the filter)
3. Resetting button



Description	Page	3
Routine maintenance	Page	3
Removing and dismantling of hub/brake units	Page	4
Removal and dismantling stub axle	Page	4
Inspection	Page	5
Re-assembly of axle stub/axle build unit	Page	5
Swivel setting and adjustment	Page	6
Swivel final assembly	Page	7
Fitting brake and hub units	Page	8
Hub bearing setting	Page	9
Final assembly	Page	10 - 11
Torque tightening table	Page	12
Lubrication instructions	Page	12 - 13

S46LF FRONT AXLE

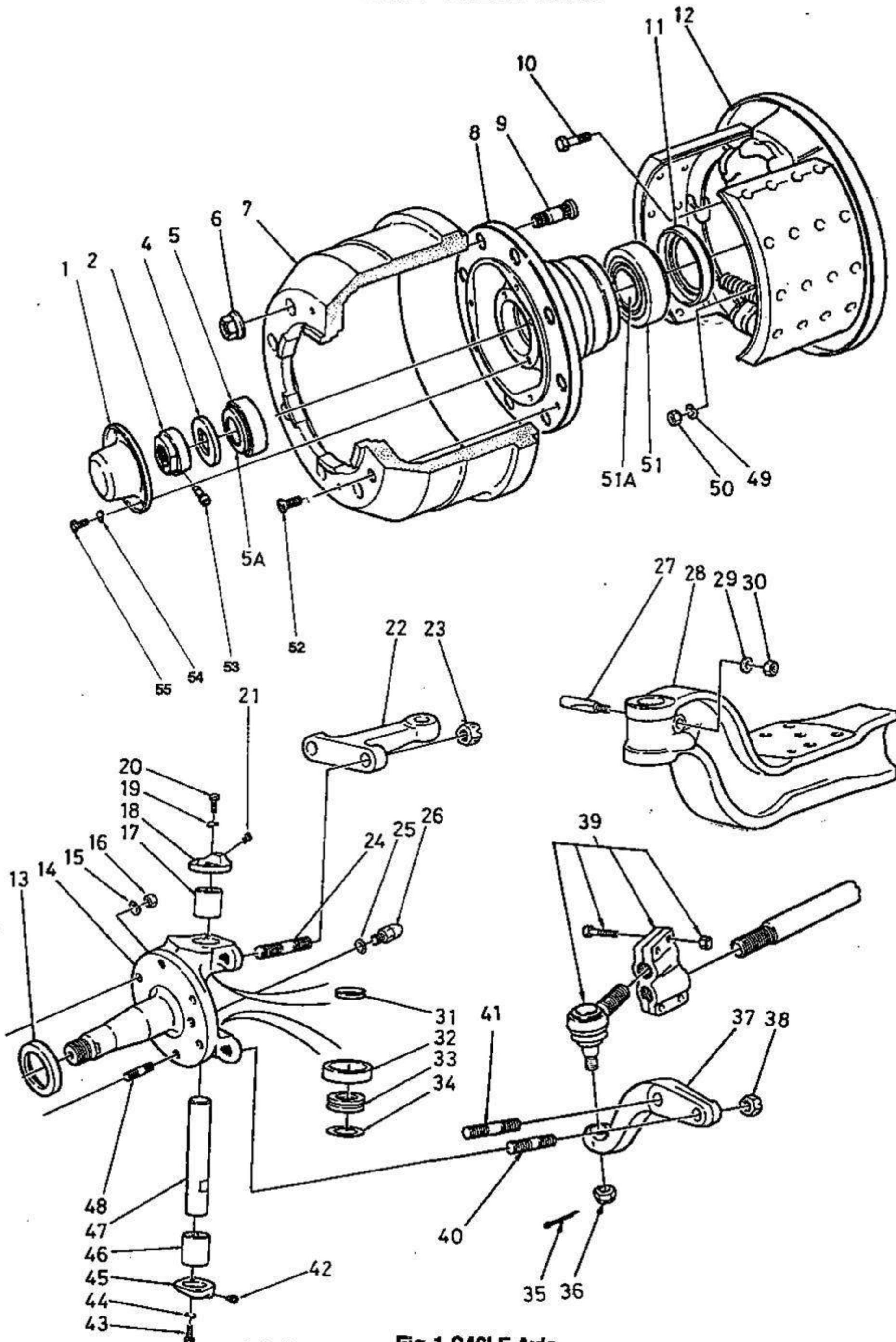


Fig 1 S46LF Axle

S46LF FRONT AXLE

1. DESCRIPTION

The axle is of the 'Reversed 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 top and bottom jaws.

The load is carried by a parallel roller thrust bearing fitted between bottom stub axle jaw and axle bed. The hub is fully floating, running on taper roller bearings which are secured and adjusted by means of a double locknut arrangement.

2. ROUTINE MAINTENANCE

The following checks should be made after the first 3,000 miles (4800 km) and then at intervals of 25,000 miles (40,000 km).

- a) **HUB BEARING ADJUSTMENT.** With wheels raised they should revolve quite freely without roughness. Hub bearing should have slight end float movement within limits 0.0005 " to 0.002 " (0.01 to 0.05mm) when rocked backwards and forwards on stub. See Section on Hub Bearing Setting if any adjustment needs to be made.
- b) **CHECK SWIVEL SETTING** and adjust when lift reaches 0.008 " (0.2 mm).
- c) **LUBRICATE STUB AXLE ASSEMBLY** at regular intervals not exceeding 3000 miles or 6 weeks which ever occurs first.

Checking front wheel alignment (see fig. 2).

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

- a) Set front wheels in straight ahead position.
- b) At a point level with the wheel centre, measure the distance over brake drums, both in front and behind axle centre.
- c) For correct 'Toe in ', front measurement 'B' should be 0.00" to 1/32" (0.0 to 0.8mm) smaller than rear measurement 'A'.

To allow for inaccuracies in the drums, the same check should be made with the drum rotated half a revolution.

- d) Any adjustment can be effected by slackening clamp bolts in ball sockets (39) and rotating track rod.
- e) After adjustment tighten clamp bolts to 33 - 41 lbs ft (45-56 Nm).

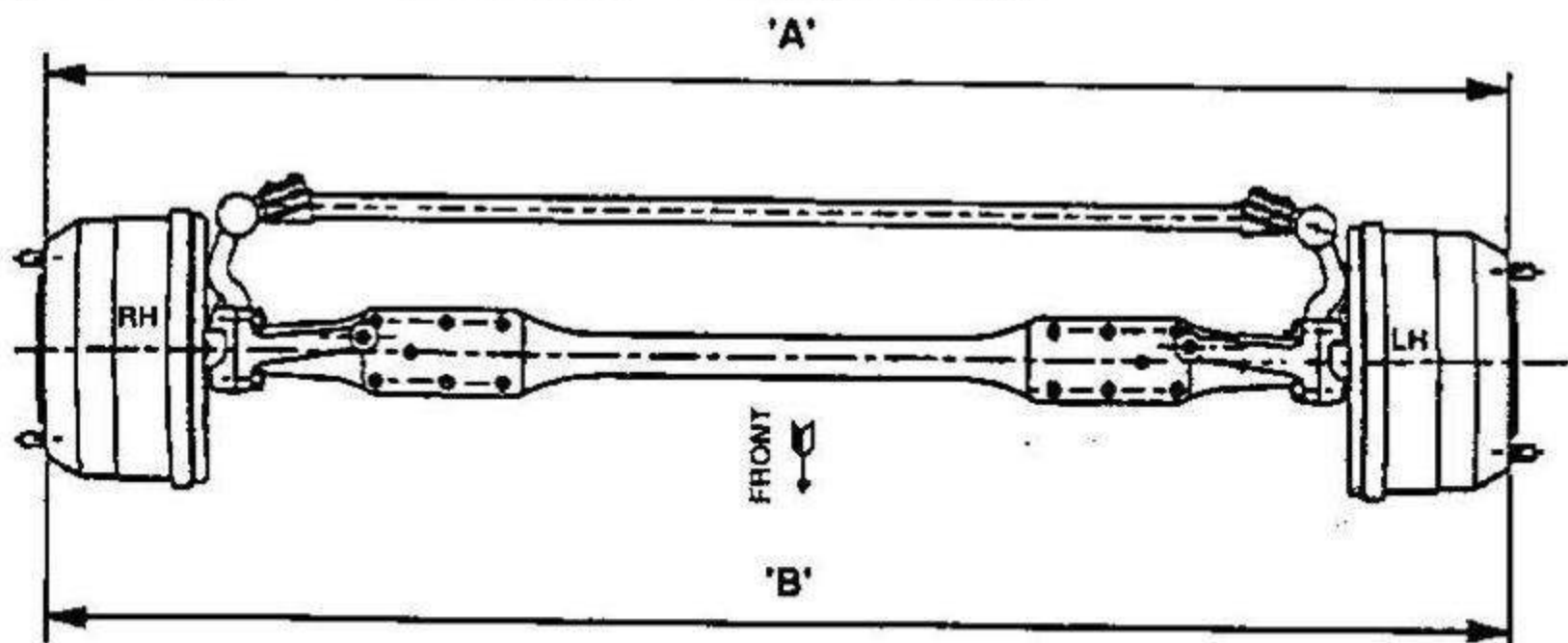


Fig 2

S46LF FRONT AXLE

3. Removing and Dismantling of Hub / Brake Units

- a) Loosen but do not remove, wheel nuts (6) then jack up axle and support on axle stands.
- b) Remove wheel nuts (6) and road wheels.
- c) Back off brake adjustment - see brakes section for details. Then disconnect air feed to brake.
- d) Remove brake drum retaining screws (52) then pull brake drum (7) from hub flange (8).
- e) Remove hub cap setscrews and washers (55 & 54) then pull off hub cap (53).
- f) Remove any sealant on hub cap and hub mating faces (53 & 8) using Loctite Chisel gasket remover or by carefully scraping off faces.
- ☞ g) Remove hub pinch bolt, followed by hubnut (2) (Suggest small tommy bar to wind off nut).
- h) Pull hub bearing collet nut (4) followed by hub outer bearing cone (5A) from axle stub (14).
- i) Pull hub (8) along with outer bearing cup (5), complete inner bearing (51 & 51A), wheel studs (9) and hub oil seal (11).
- j) Remove and discard oil seal (11) then lift out hub inner bearing cone (51A).
- k) Drift out hub bearing cups (5 & 51) from hub bore (8).
- l) If hub distance piece (wear sleeve) shows any signs of wear or corrosion, it must be removed for replacement.
- m) Remove brake bracket nuts and washers (16/15 & 50/49) then pull brake assembly (12) from axle stub (14).

4. Removal & Dismantling Stub Axle Unit

- a) Disconnect top steering lever (22) from steering gear then remove top steering lever nuts (23) followed by top lever, taking care not to damage top lever studs (24).
- b) Remove ball socket split pin (36) followed by nut (35) then, using a suitable extractor, separate ball socket assembly from bottom steering lever (37).

Note: When separating ball joint from steering lever, an extractor tool MUST be used. DO NOT strike areas around ball pin tapers with hammer blows under any circumstances due to possible ball pin taper deformation.

- c) Remove top cap setscrews with washers (20 & 19) then lift off top cap (18).
- d) Similarly remove bottom cap setscrews with washers (43 & 44) then lift off bottom cap (45).
- e) Clean sealant from mating faces of top and bottom caps (18 & 45) and swivel (14) using Loctite Chisel Gasket Remover or by carefully scraping sealant from faces.

S46LF FRONT AXLE

Removal & dismantling Stub Axle Unit (Continued)

- f) Remove swivel pin cotter pin nut and washer (30 & 29) then knock cotter pin (27) from axle bed (28) using a hammer with a soft metal drift.
Care must be taken so as not to damage cotter pin threads.
- g) rivet swivel pin (47) out, downwards, thus releasing stub axle (14) from axle bed (28)
- h) Lift out thrust bearing (33) and bearing seal (32), taking care not to lose swivel pin shims (34) from bottom of swivel.
- i) Separate seal from bearing (32 & 33) then discard seal.
- j) Take out and discard top bush oil seal (30) from swivel (14).
- k) Press out top and bottom bushes (17 & 46) from axle stub jaw (14).
- l) Check condition of stop screw (26) and remove, along with its adjusting washers (25) for replacement if required.

Inspection

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

5. Re-assembling Axle Stub / Axle Build Unit

- a) Check tightness in turn of bottom lever studs (40 & 41), 190 - 210 lbs ft. (258 - 285 Nm).
- b) Coat all internal surfaces / parts with clean grease (Shell Retinax LX or equivalent).
- c) Press swivel pin top bush (17) into position in top bore of swivel (14), level with swivel top face.
- d) Fit oil seal (31), metal end first, into position in inner top face, abutting top bush (17).
- e) Press bottom bush (46) into position, flush with swivel face, in lower bore in swivel (14).
- f) Make sure swivel pin bore in axle bed (28) is free from burrs and corrosion then apply grease (Shell Retinax LX or equivalent) to bore.
- g) Select a nominal shim pack (34) of 0.889mm (0.035") then place in position on swivel lower jaw (14).
- h) Assemble thrust bearing and seal ring (33 & 32) together then place onto shims (34).
- i) Position swivel assembly onto axle bed (28), taking care as not to damage thrust bearing seal (32) or to dislodge swivel pin bearing shims (34).
Suggest a thin piece of card / plastic is placed over seal / bearing assembly as swivel is offered to axle bed.

S46LF FRONT AXLE

Re-assembling Axle Stub / Axle Build Unit

- j) Push swivel pin (47) through swivel (14) and axle bed (28) ensuring that the machined groove in the pin is correctly aligned with the swivel pin cotter pin hole in axle bed.
- k) Fit swivel pin cotter pin (27), washer (29) and its nut (30) but Do Not tighten nut.
- l) Check that the tightening torque of steering lever studs (24, 40 & 41) is within limits 190 - 210 lbs ft. (258 - 285 Nm).
- m) Locate top steering lever (22) onto its studs (24) securing with nuts (23). Tighten nuts to 190 -275 lbs ft. (258 -387 Nm).

6. Swivel Setting and Adjustment

- a) Mount a dial test indicator on axle bed (28) and position pointer on top swivel jaw (14). See fig 3.

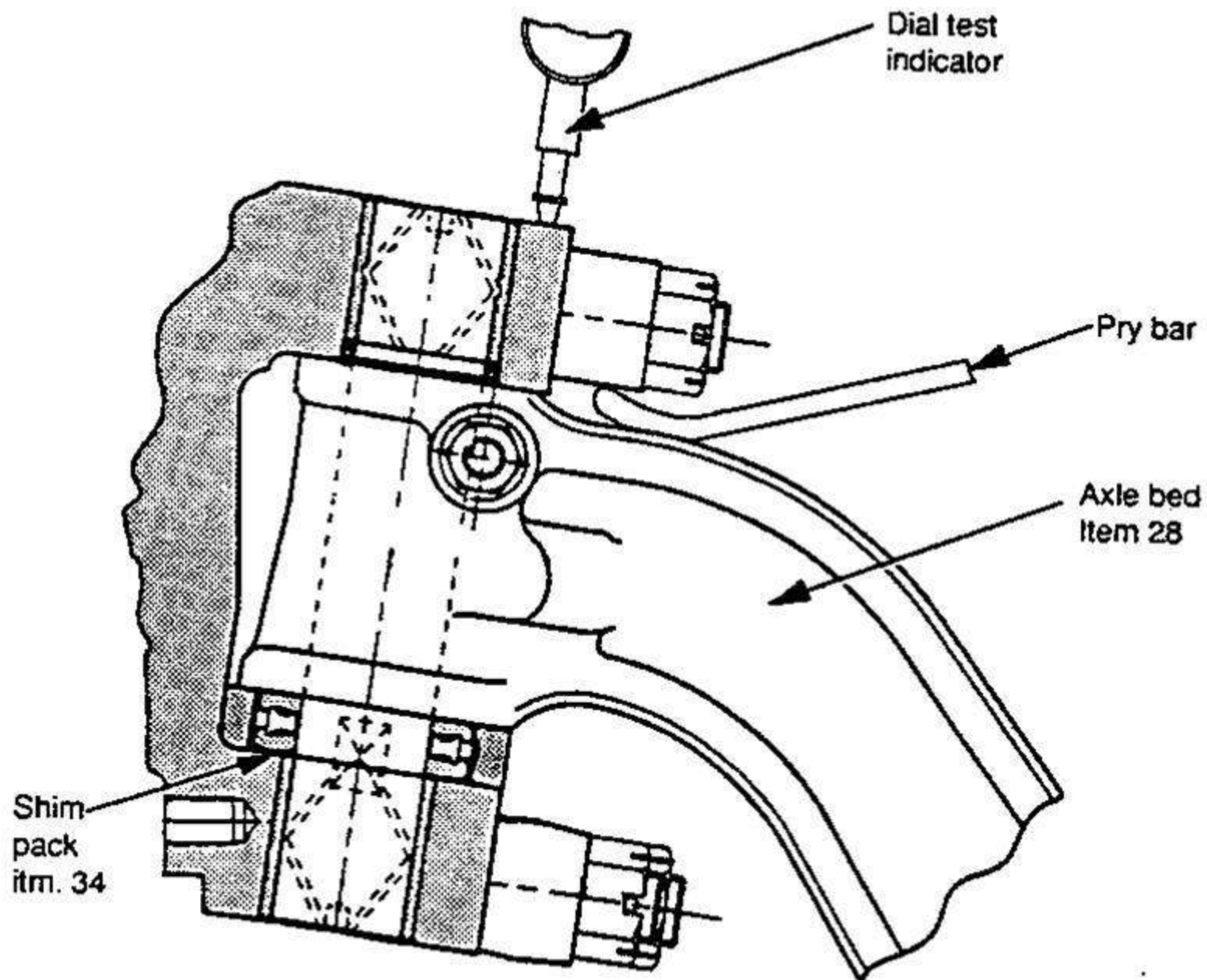


Fig. 3

- b) Position a suitable pry bar between axle bed (28) and swivel (14) to check for lift. The correct reading should be within the limits 0.002" to 0.005" (0.05 to 0.13mm).
- c) If reading is outside limits given, fit more or less shims (34) as necessary until reading is correct.
- d) When swivel is set correctly tighten swivel pin cotter pin nut (30) to 51 - 62 lbs ft. (69 - 84Nm)

S46LF FRONT AXLE

7. Swivel Final Assembly

- a) Clean mating faces of top cap and swivel. (18 & 14) using Loctite Superclean Safety Fluid 706 or similar chlorinated cleaning fluid then apply a complete 1/8" thick bead of Loctite Superflex to top cap (18).

Note: Top cap must be assembled to swivel within 5 minutes after applying Loctite.

- b) Assemble top cap (18) onto swivel (14) securing with washers and setscrews (19 & 20) then tighten setscrews to 26 - 32 lbf ft. (35 - 43 Nm).
- c) Clean mating faces of bottom cap (45 & 14) using Loctite Superclean Safety Fluid 706 or similar chlorinated cleaning fluid then apply a complete bead of Loctite Superflex (black) to bottom cap (45).
- d) Assemble bottom cap (45) onto swivel (14) securing with washers and setscrews (43 & 44) then tighten setscrews to 26 - 32 lbf ft. (35 - 43Nm).

Note: Bottom cap must be assembled to swivel within 5 minutes after applying Loctite.

- e) Refit lubricators (21 & 43) into position on top and bottom caps (18 & 45) respectively.
- f) Charge swivel assembly with grease (Shell Retinax LX or equivalent), swivel is full when grease seeps between upper face of axle bed (28) and swivel bush seal (31), also from between thrust bearing seal (32) and lower face of axle bed. See fig 4.

Note: Rotate the swivel periodically when greasing to ensure full lubrication of faces.

- g) Re-connect ball socket and tie rod assembly (39) to bottom lever (37).

Note: Ball pin (39) and ball pin tapers in bottom steering levers (37) must be clean, dry and free from oil prior to assembly.

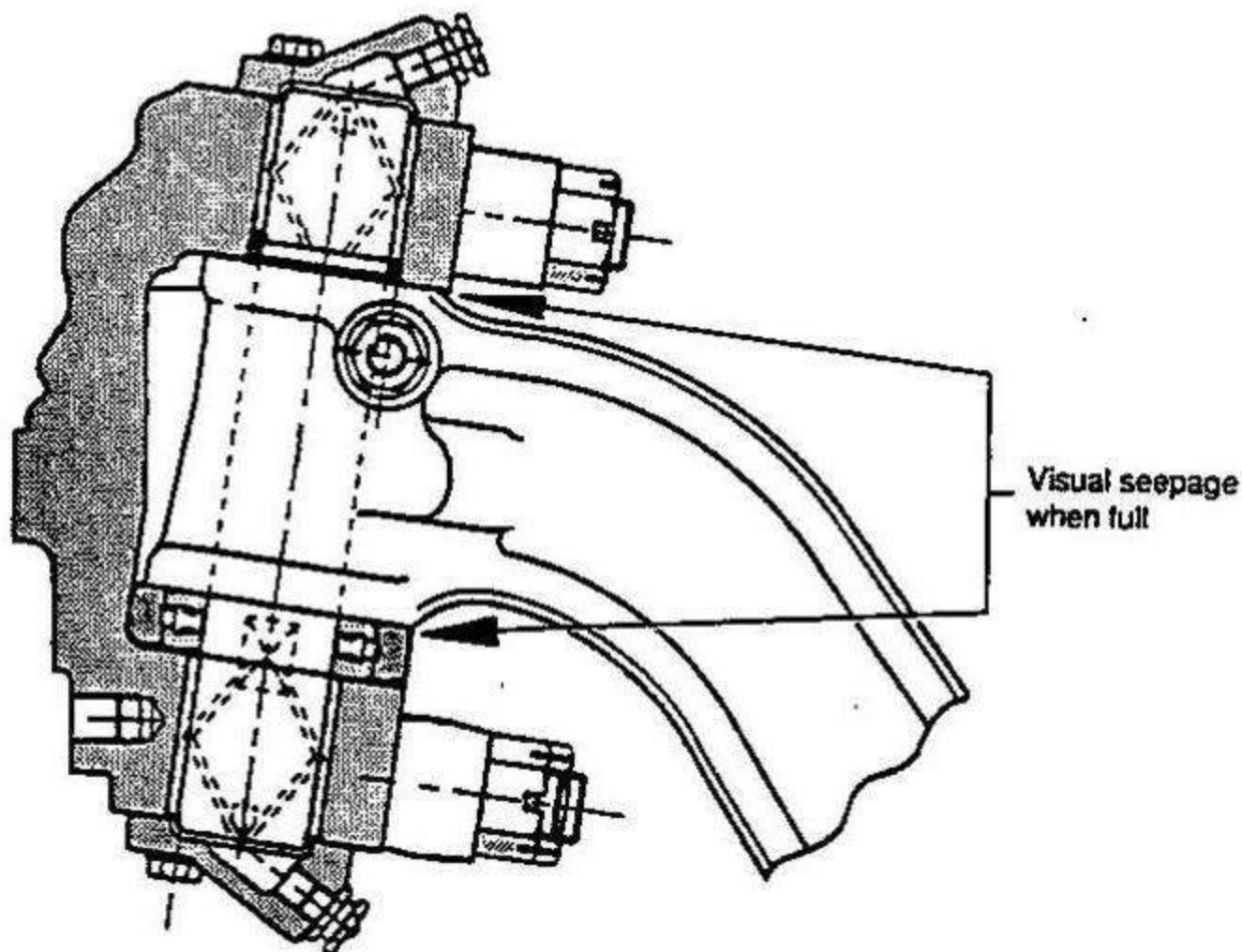


Fig. 4

S46LF FRONT AXLE

8. Fitting Brake and Hub Units

- a) Fit brake assembly (12) onto its register on stub (14) and secure in place with washers and nuts (49 & 50) also bolts, washers and nuts (10, 15 & 16).
Tighten nuts to 85 -103 lbs ft. (115 - 140Nm) tightening torque.
- b) Re-fit hub distance piece (13) on to stub axle (14).
- c) Fit hub bearing cups (5 & 51) into their respective bores in hub, then pack hub cavity with grease (Shell Retinax LX or equivalent) to a depth equivalent to bearing centre line. See fig 5.

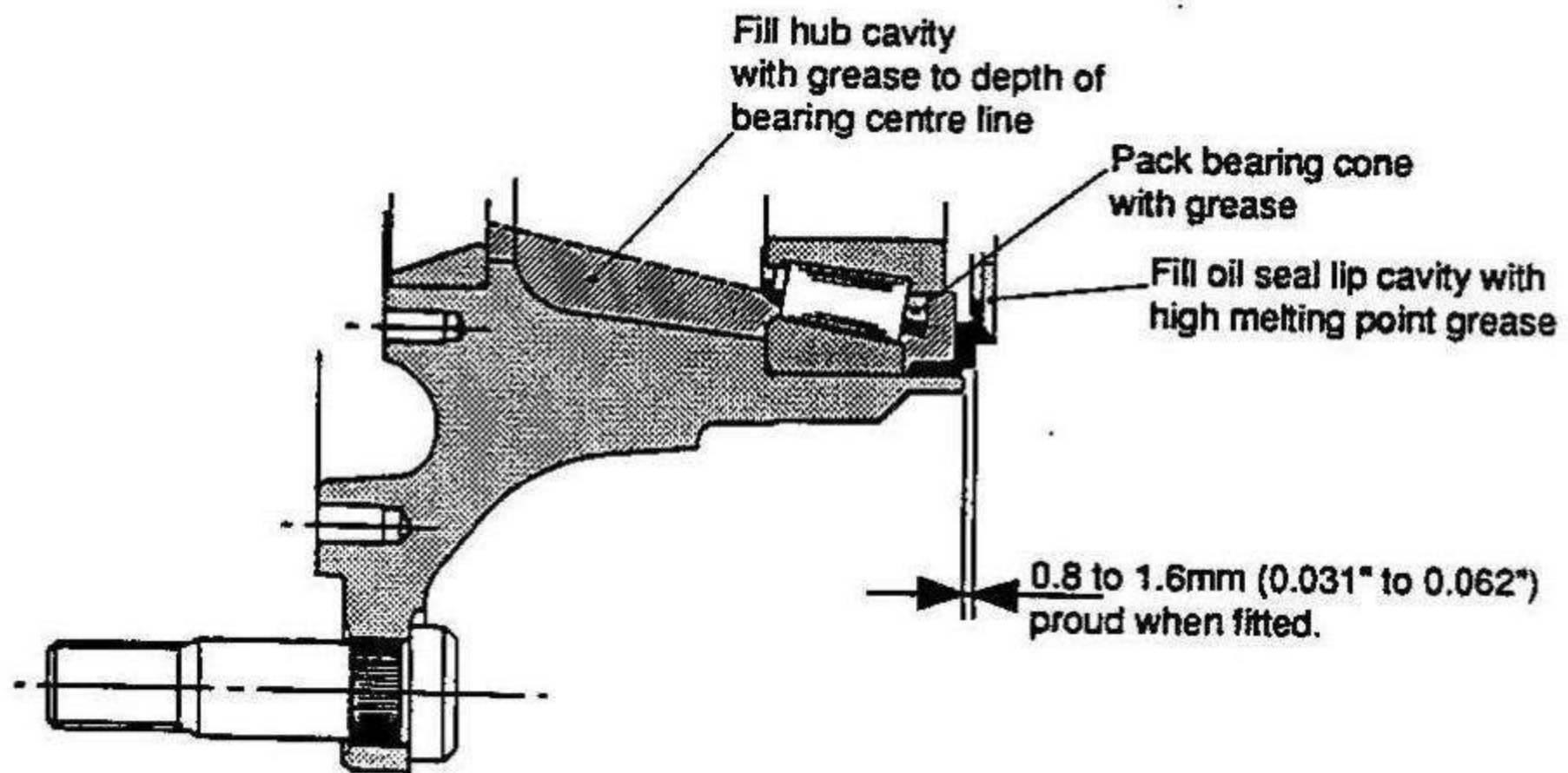


Fig.5

- d) Completely fill bearing cones (5A & 51A) with grease (Shell Retinax LX or equivalent) using a bearing packer or manually kneading grease between rollers, race and cage.
- e) Place inner hub bearing cone (51A) into position abutting its cup (51) in hub (8) .
- f) Fit oil seal (11), open side first, into position in hub (8), with metal case of seal protruding between 0.8 to 1.6mm (0.031" to 0.062") when fitted. See fig 5.
- g) Fill oil seal lip cavity (11) with high melting point grease (BP Keenomax L2 or equivalent) then offer hub assembly to axle stub (14) taking care not to damage oil seal lips (11) in the process.
- h) Tap hub outer bearing cone (5A) into place abutting its cup (5) followed by collet washer (4).
- i) Fit inner bearing nut (3) and tighten hard with special tool No E456.

S46LF FRONT AXLE

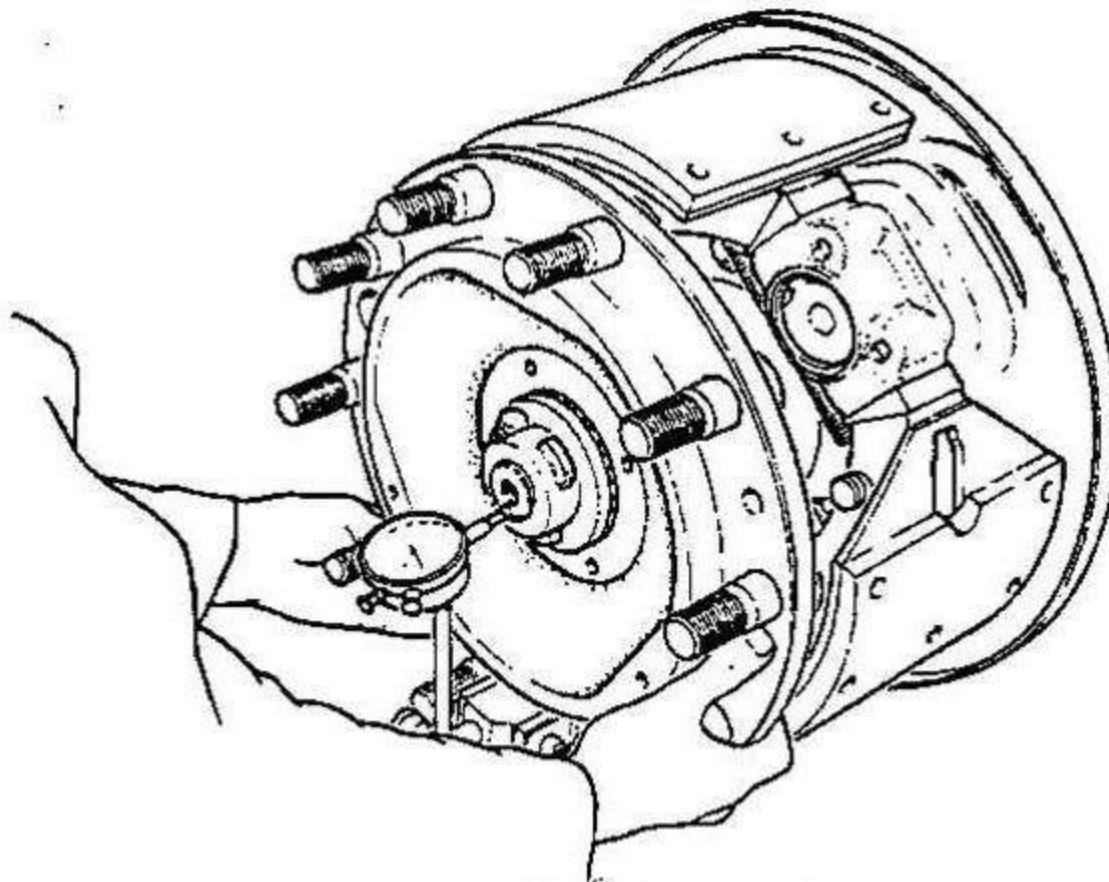
9. Hub Bearing Setting

- a) Rotate hub whilst shock loading the assembly by knocking hub flange backwards and forwards along axle stub using a hide mallet.

Note: It is very important to 'shock load' the hub in this way because:

- i) The rotation serves to ensure that the bearing rollers settle in their correct tracks.
- ii) The shock loads to ensure that the bearings are seated correctly up their abutment shoulders.

- b) Check tightness of hub bearing locknut (2), if loose re-tighten hard.
- c) Rotate and shock load the hub assembly again.
- d) Continue this procedure until hub bearing locknut (2) cannot be tightened further after the hub has been rotated and shock loaded.
- e) Back off hub bearing locknut (2) by approximately 10° then rotate hub again and knock outwards along axle arm to release bearings.
- f) Fit outer pinch bolt (1) and tighten to 30 - 35 lbs ft (41 - 47 Nm).
- g) Mount a dial indicator on hub flange (8) and position its pointer on end of axle stub (14). Push and pull hub (8) along axle arm (14) and note reading on dial indicator - see fig 6. Correct reading should be within limits 0.0005" to 0.002" (0.01 to 0.05mm).



Bearing setting of typical hub unit

Fig. 6

S46LF FRONT AXLE

10. Final Assembly

- a) Smear inside of hub cap (53) with a thin (1/16" thick) film of grease (Shell Retinax LX or equivalent).
- b) Clean hub cap and hub mating faces (53 & 8) with Loctite Superclean Safety Fluid 706 or similar chlorinated cleaning fluid then apply a complete bead of Loctite Superflex or equivalent sealant to hub cap face. See fig 7.

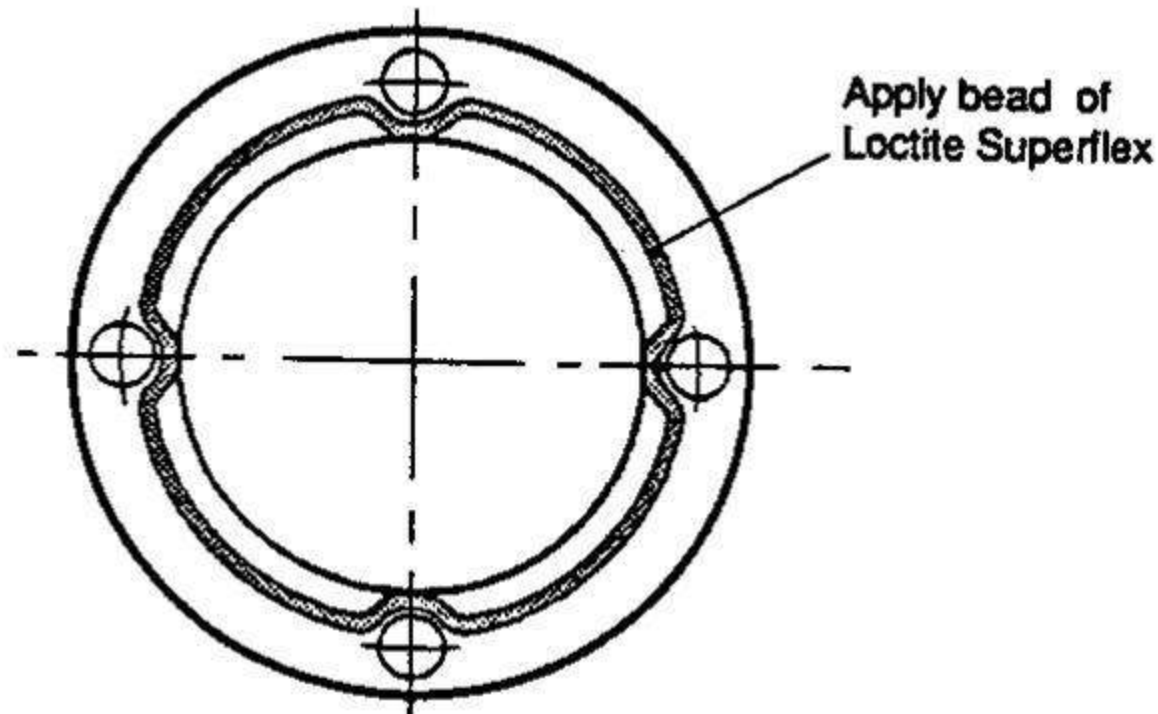


Fig. 7

- c) Fit washers and setscrews (54 & 55) then tighten setscrews to 26 - 32lbs ft. (35 - 43Nm).
- d) Fit brake drum (4) and secure with brake drum retaining screw (52).
- e) Fit lockstops with adjusting washers (31 & 33) and adjust to give correct lock angles as shown in fig 8.

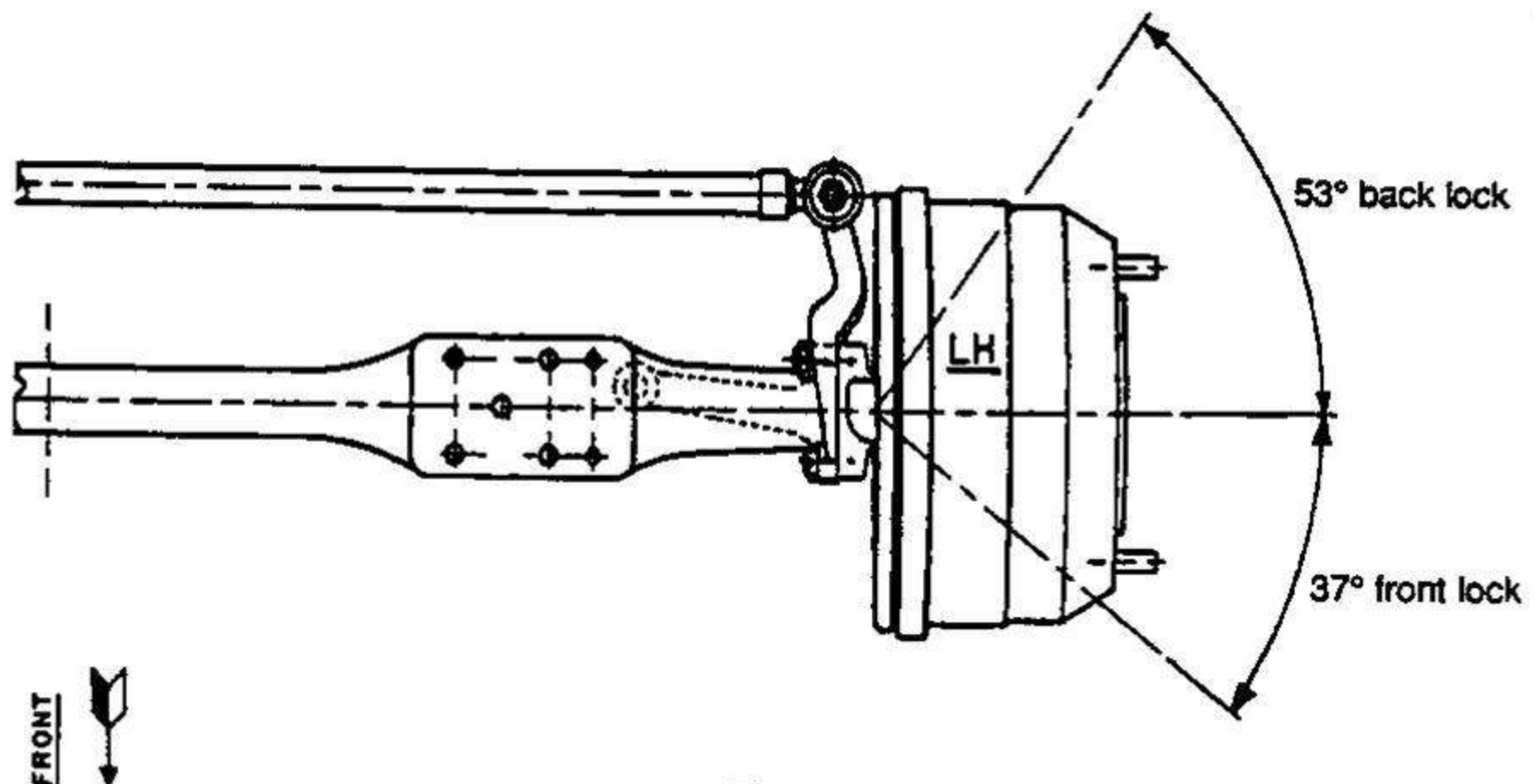


Fig. 8

S46LF FRONT AXLE

Final Assembly (Continued)

- f) Check wheel alignment as follows (fig. 9)
 - i) Set axle in straight ahead position.
 - ii) At a point level with wheel centre, measure distance over brake drums (4), both in front and behind axle centre.
 - iii) Front measurement 'B' should be 0.0" to 1/32" (0.0 to 0.8mm) LESS than rear measurement 'A'.
 - iv) Any adjustment can be effected by slackening clamp bolts in ball sockets (39) and rotating track rod tube .
 - v) After adjustment, tighten clamp bolts to 33 - 41lbs ft. (45 - 56Nm).
- g) Refit axle to vehicle.
- h) Re-connect brake to vehicle air system.
- i) Fit road wheels and secure in position with wheel nuts (6).
Tighten wheel nuts to 285 - 315 lbs ft. (385 - 425Nm).

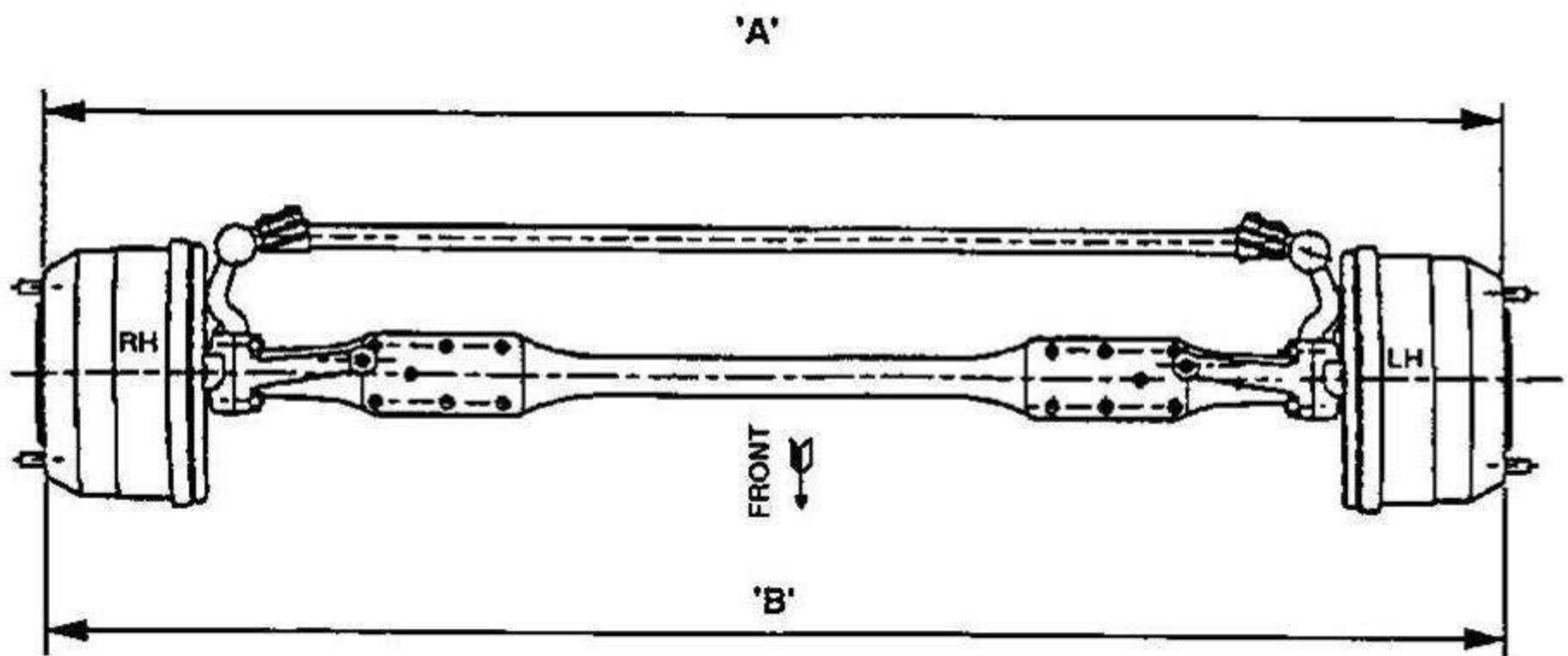


Fig. 9

S46LF FRONT AXLE

TIGHTENING TORQUE TABLE - S46LF AXLE

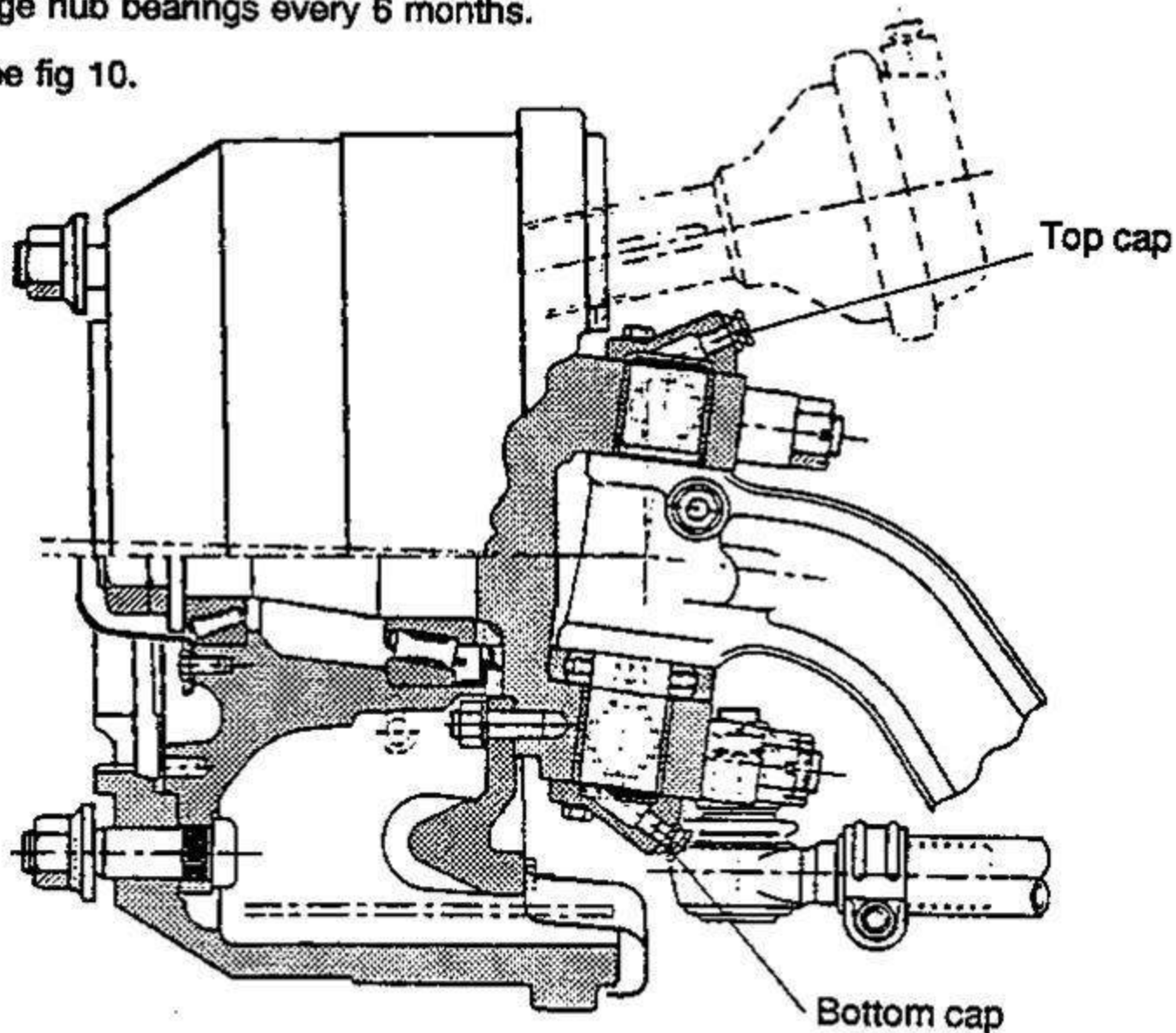
Item No.	Description	Torque
6	Wheel nut	285 - 315 lbs ft (385 - 425 Nm)
16	Brake backplate nut	85 - 103 lbs ft (115 - 140 Nm)
20	Top cap setscrew	26 - 32 lbs ft (35 - 43 Nm)
23	Top steering lever nut	190 - 275 lbs ft (258 - 373 Nm)
24	Top steering lever stud	190 - 210 lbs ft (258 - 285 Nm)
26	Swivel stop screw	85 - 103 lbs ft (115 - 140 Nm)
30	Cotter pin nut	51 - 62 lbs ft (69 - 84 Nm)
36	Ball socket nut	155 - 170 lbs ft (210 - 231 Nm)
39	Socket adaptor pinch bolt nut	33 - 41 lbs ft (45 -56 Nm)
41	Bottom lever stud	190 - 210 lbs ft (258 - 285 Nm)
42	Bottom lever stud	190 - 210 lbs ft (258 - 285 Nm)
43	Bottom cap setscrews	26 - 32 lbs ft (35 - 43 Nm)
48	Brake backplate stud	51 - 62 lbs ft (69 -84 Nm)
50	Brake backplate nut	85 - 103 lbs ft (115 - 140 Nm)
52	Brake drum setscrew	26 - 32 lbs ft (35 - 43 Nm)
55	Hub cap setscrew	26 - 32 lbs ft (35 - 43 Nm)
1	Hub pinch bolt	30 - 35 lbs ft (41 - 47 Nm)

Lubrication Instructions

Lubricate stub axle assembly with one of the following recommended greases at regular intervals not exceeding 3,000 miles or 6 weeks which ever occurs first.

Clean out and re-charge hub bearings every 6 months.

For greasing points see fig 10.



S46LF FRONT AXLE

Grease Specification

Lithium based roller bearing grease NLGI - No 2.

Mobil	BP	Castrol	Esso	Shell	Texaco	Caltex	Gulf
Mobilgrease MP	Energrease L2	Castrol LMX	Unirex EP2	Retinax LX	Multifak Multi Purpose 2 (UK) Marfak HD2 (o/seas)	Starplex 2	Sovereign 801

Recommendation For Correct Amount of Grease In Wheel Hub - See Fig 11.

Bearings

Fill with grease using bearing packer or manually knead grease into space between roller, race and cage.

Hub Cavity

Smear inside hub with grease to depth of bearing centre line.

Important: do not fill hub cavity.

Hub Cap

Paint inner face with a thin layer of grease ($1/16$ " thick).

Note: Too much grease in hub caps, will result in seal failure. The thin coating of grease is for corrosion protection only. A space is necessary to allow room for any expanded grease from bearings.

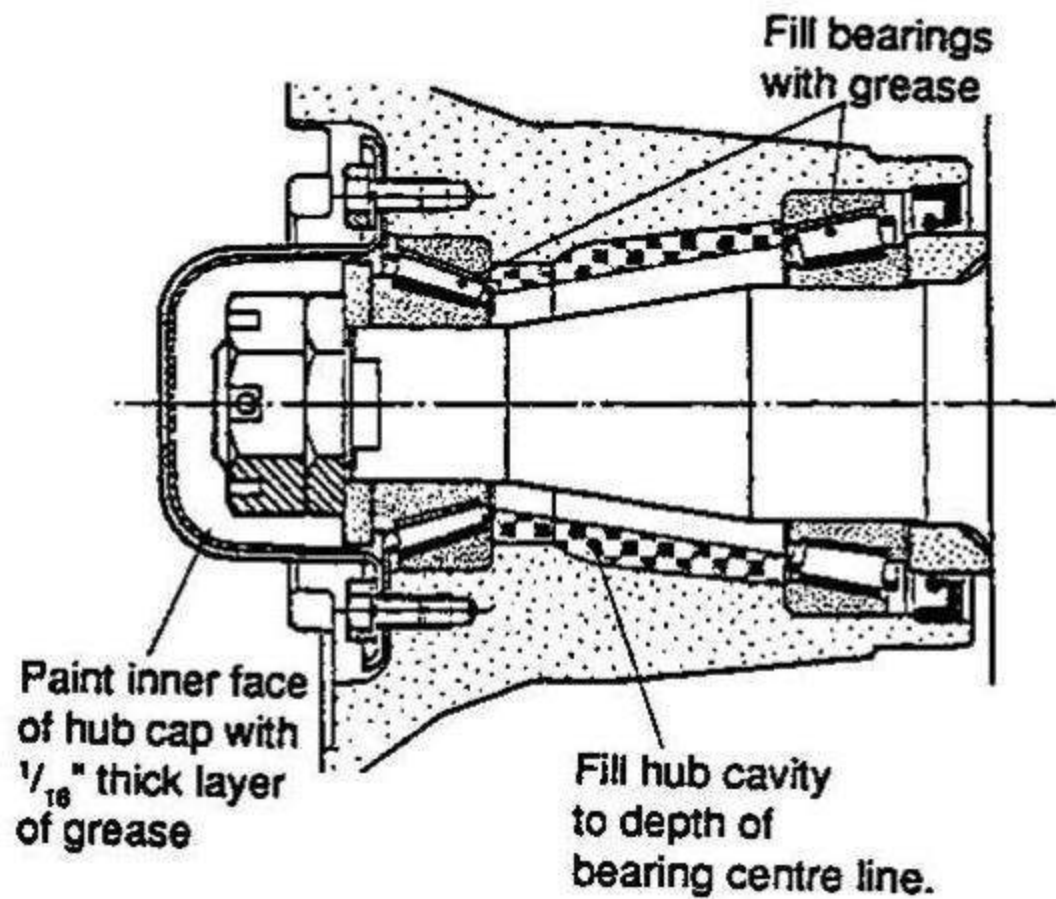


Fig 11



Section 1: General

Ring gear and pinion identification	Page	3
---	------	---

Section 2: Periodic Service

2A Lubrication	Page	4
2B Change intervals	Page	4
2C Changing oil	Page	4
2D Wheel bearing lubrication	Page	5
2E Wheel bearing adjustment	Page	5
2F Cleaning	Page	6
2G Inspection	Page	6
2H Repair and renewal	Page	6

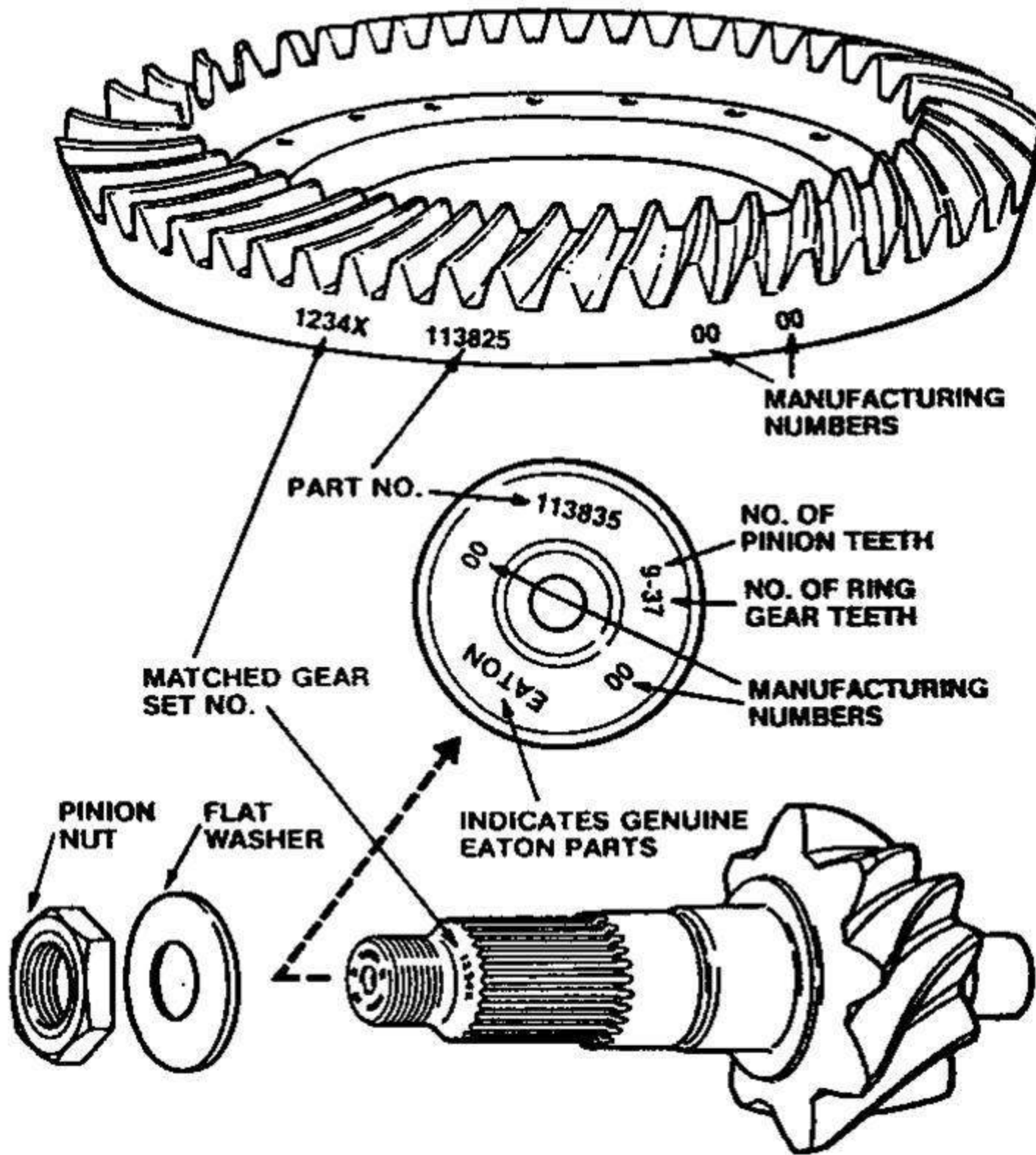
Section 3: Drive Axle Overhaul

3 Removal/Disassembly		
3A Differential carrier assembly removal	Page	7
3B Disassemble differential carrier	Page	7
3C Disassemble drive pinion	Page	9
3D Disassemble wheel differential	Page	11
Installation/Assembly/Adjustment		
3E Assemble wheel differential	Page	12
3F Assemble drive pinion	Page	13
3G Pinion bearing preload adjustment	Page	14
3H Install drive pinion	Page	17
3J Install differential and ring gear assembly	Page	17
3K Adjust differential bearing preload	Page	18
3L Adjust ring gear backlash	Page	19
3M Adjust ring gear tooth contact	Page	20
3N Install and adjust ring gear thrust screw	Page	22
3P Install differential carrier assembly	Page	22
3Q Fastener torque settings	Page	23

Section 4: Hub overhaul

4 Hub dismantling	Page	24
4A Inspection of dismantled parts	Page	24
4B Hub assembly	Page	24

REAR AXLE



Ring Gear and Pinion Identification

REAR AXLE

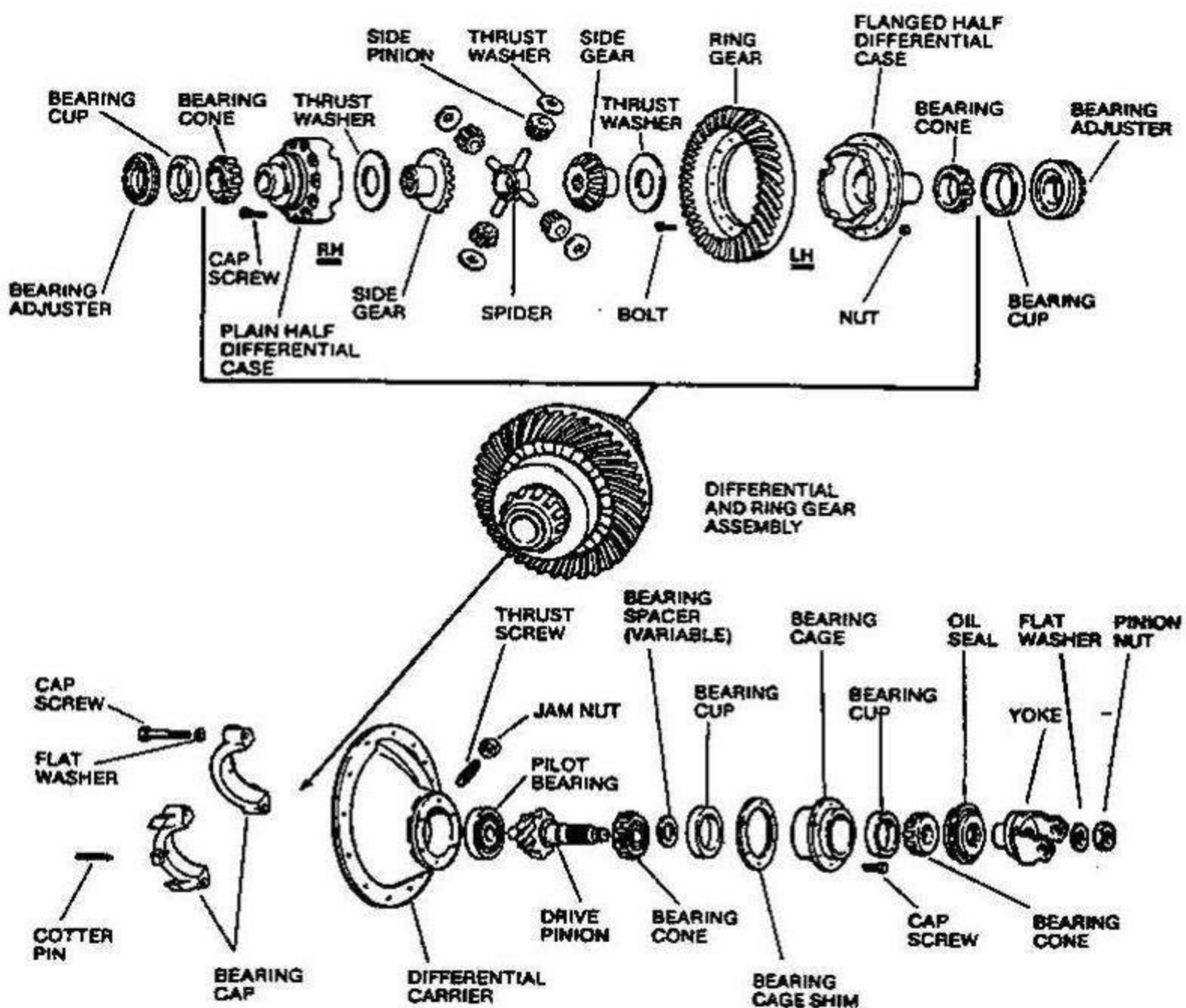
SECTION 1 GENERAL

RING GEAR AND PINION IDENTIFICATION

Ring gear and drive pinion are matched parts and must be renewed as a set, the part number being listed in the parts catalogue.

To aid in identifying gear sets, parts are stamped with such information as number of pinion and ring gear teeth, individual part number and matched set number (refer to drawing).

Differential Carrier Assembly



SECTION 2 MAINTENANCE AND ADJUSTMENT

2A LUBRICATION

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

The recommended multigrade 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.

REAR AXLE

SECTION 2 MAINTENANCE AND ADJUSTMENT

2B OIL CHANGE INTERVALS

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

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

2C DRAINING AND FILLING OIL

Draining: Drain into suitable container with oil at normal operating temperature. Inspect drain plug for excessive metal particle accumulation symptomatic of extreme wear. Clean and refit plug after draining. For axles fitted with additional drain plugs in the hub casings, rotate the hub until the plug is facing downwards. Remove the plug and allow the oil to drain from the hub.

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

Note: The following procedure applies only to axles equipped with an oil filler plug in the hub.

1. Rotate the wheel end hub until the oil filler hole is up.
2. Remove the oil filler plug.
3. Pour 0.5 litres of oil into each hub through the hub oil filler hole.
4. Install oil fill plug applying Loctite 572 (DSV Part No. 650189) and tighten to 65 ± 10 Nxm (48 ± 7 Lbx Ft).
5. Once the axle is levelled and wheel ends are assembled, add oil through the filler hole in the axle housing cover until fluid is level with the bottom of the filler hole.

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

Do not remove the lower plug.

If the wheel hub does not have an oil fill hole:

1. Fill axle with lubricant through filler hole in axle housing.
2. Raise left side of axle 152mm or more for 1 minute or until right hub cavity is filled with lubricant.
3. Lower the left side, and raise the right side of the axle 152mm or more. Maintain this position for more than 1 minute or until the left hub cavity is filled with lubricant.
4. With axle level add lubricant until fluid level is at the bottom of the filler hole.

REAR AXLE

SECTION 2 MAINTENANCE AND ADJUSTMENT

2E WHEEL BEARING ADJUSTMENT (SPINDLE WASHER TYPE)

1. Tighten the inner nut to 244 - 298 Nm (180 - 220 lb ft) of torque while rotating the wheel.
2. Loosen the nut one full turn.
3. Retorque the nut to 122 - 149 Nm (90 - 110 lb ft) while rotating the wheel.
4. Back off the nut 45° to 60° of a turn.

Warning: failure to back off the inner as described will cause the bearing to run hot and be damaged. If this happens during operation the wheel may lock or come off.

5. Install the doweled tanged washer. If the dowel or tang does not line up, turn the washer over. If it still cannot be lined up, loosen the nut slightly to allow alignment.

Install the outer nut and torque to: 448 - 502Nm (330-370 lb ft).

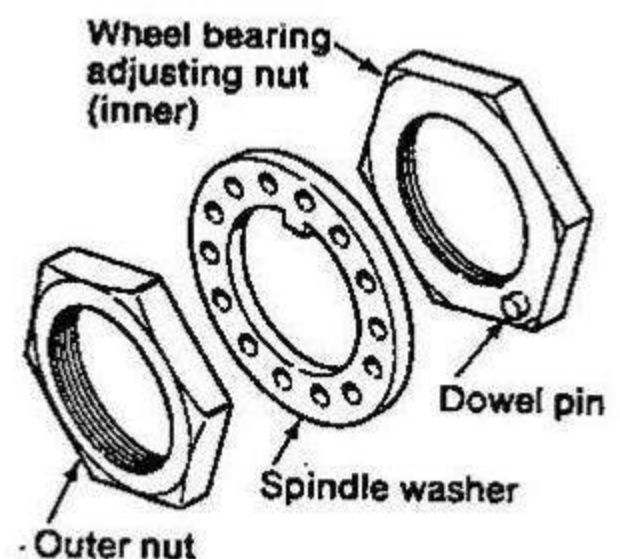
This adjustment procedure should allow the wheel to rotate free with 0.03 - 0.15mm (0.001 - 0.006") end play. If the endplay is not within this range, disassemble and inspect the components. If there are no defective parts, reassemble and inspect the components. If there are no defective parts, reassemble and repeat wheel bearing adjustment procedure.

The endplay should be measured using a large based magnetic indicator with a 0 - 0.76 (.000 - .030) scale and 0.03 (.001) resolution. The base should be placed on the axle spindle end with the indicator probe touching the axle shaft flange surface on the hub. If the tyres and wheels are on the hub pulling back and forth on the sides of the tyre 2 or 3 times before making the endplay measurement will promote a more accurate reading.

The hub should be pushed fully inboard while oscillating the hub with the dial zeroed at this position. Pull the hub fully outboard again while oscillating the hub and make the dial endplay reading.

Install axle shaft and torque bolts to recommended specification.

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.

REAR AXLE

SECTION 2 MAINTENANCE AND ADJUSTMENT

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 discoloration 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 effects the alignment or structural integrity of the housing requires housing renewal. Repair by welding or straightening must not be attempted. Such processes can effect 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.

REAR AXLE

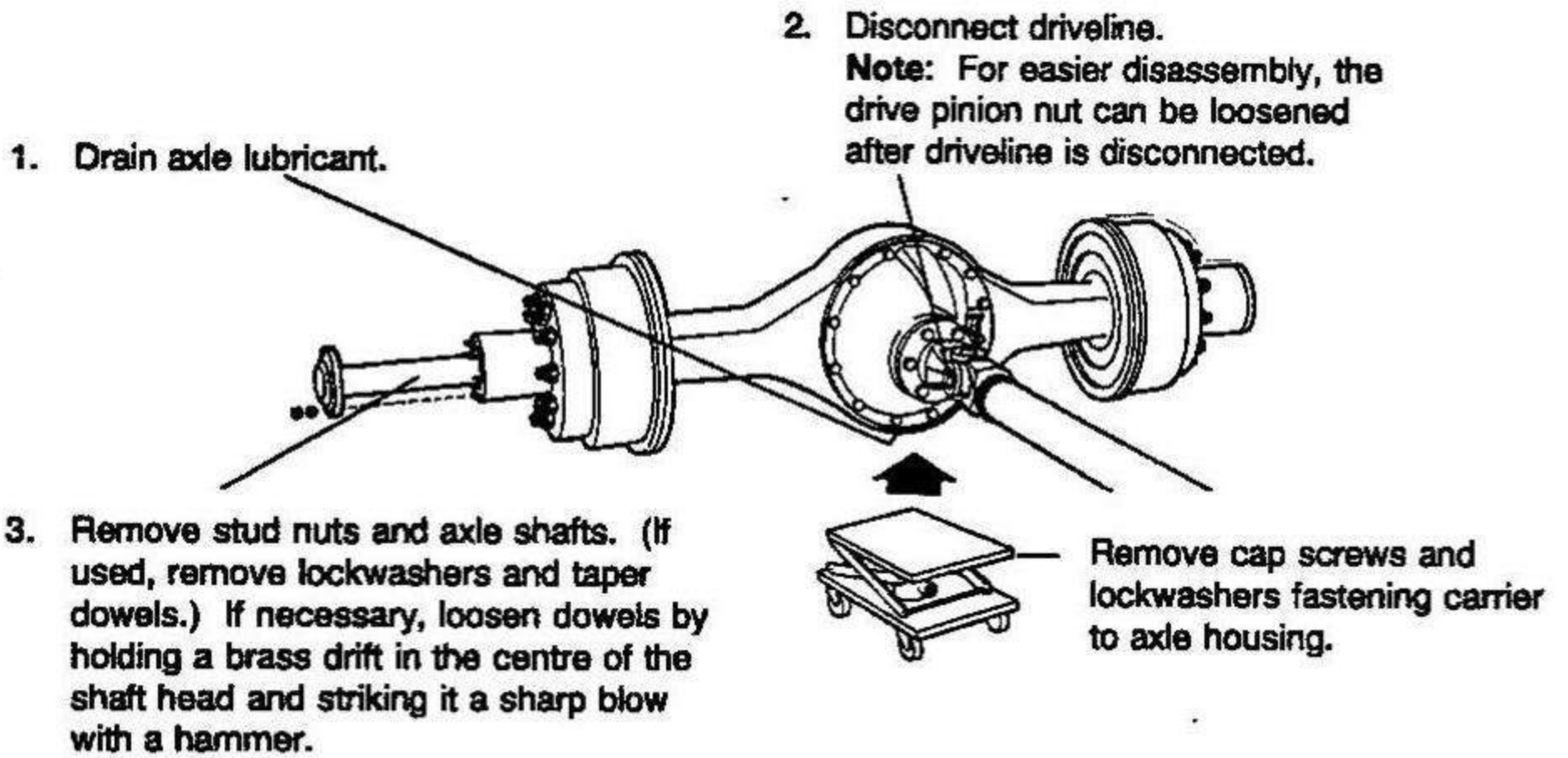
SECTION 3 OVERHAUL

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

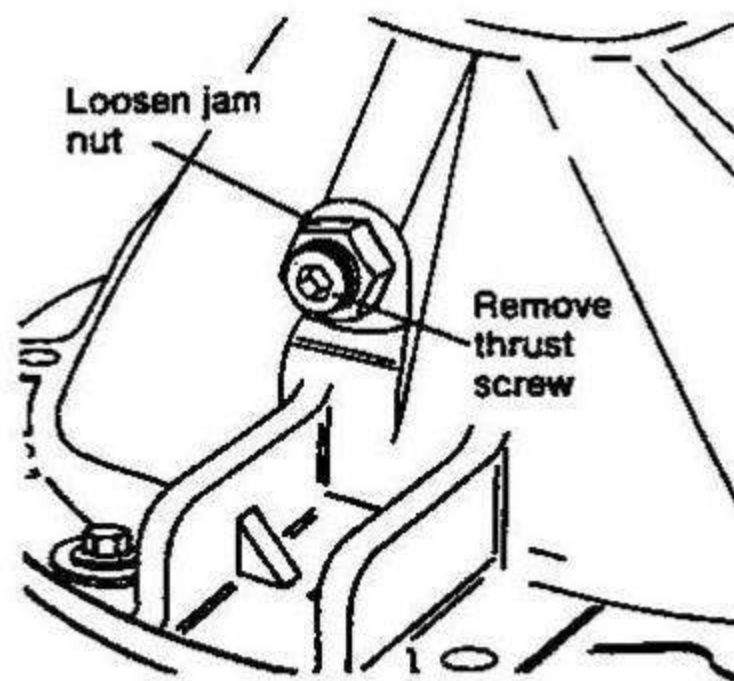
DIFFERENTIAL CARRIER ASSEMBLY REMOVAL (follow procedure in numerical sequence)



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.



Thrust screw removal

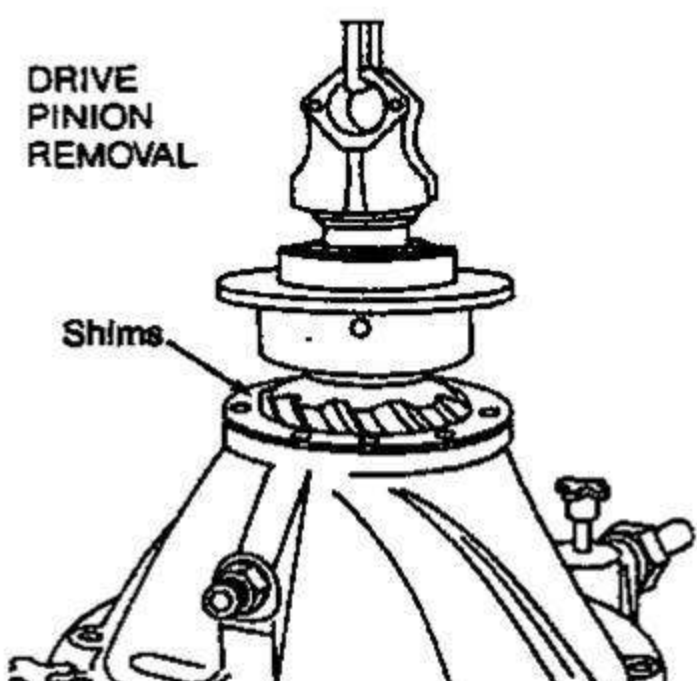
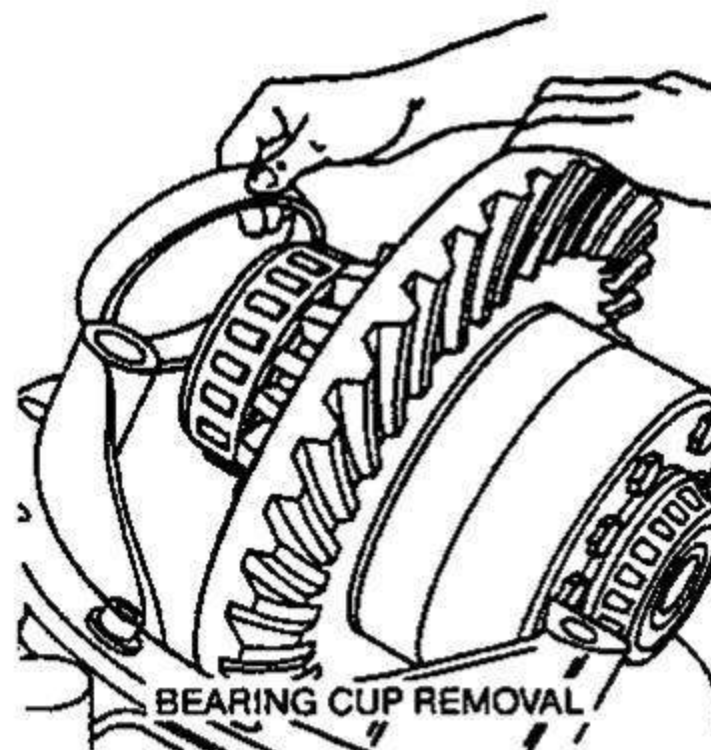
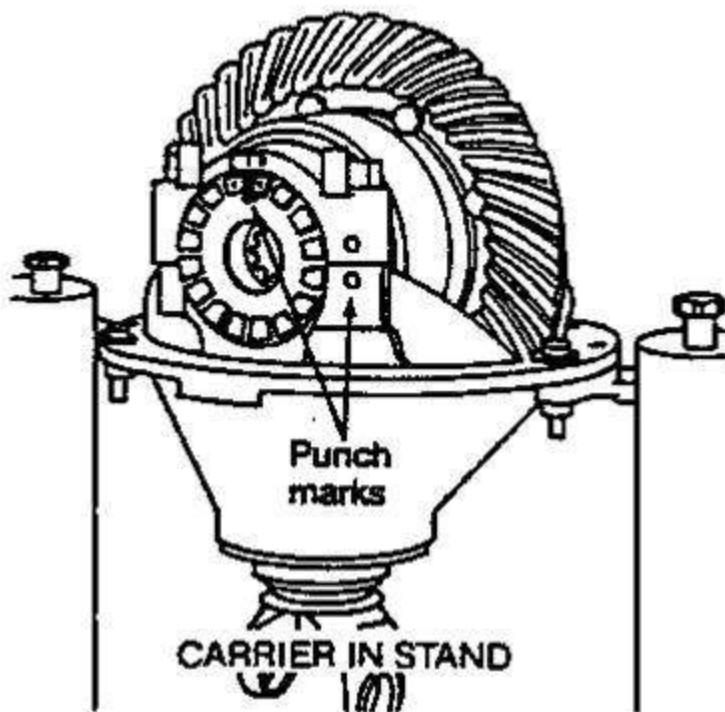
REAR AXLE

SECTION 3 OVERHAUL

3B DISASSEMBLE DIFFERENTIAL CARRIER (continued)

2. Loosen locking nut on ring gear thrust screw. Remove thrust screw.
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.



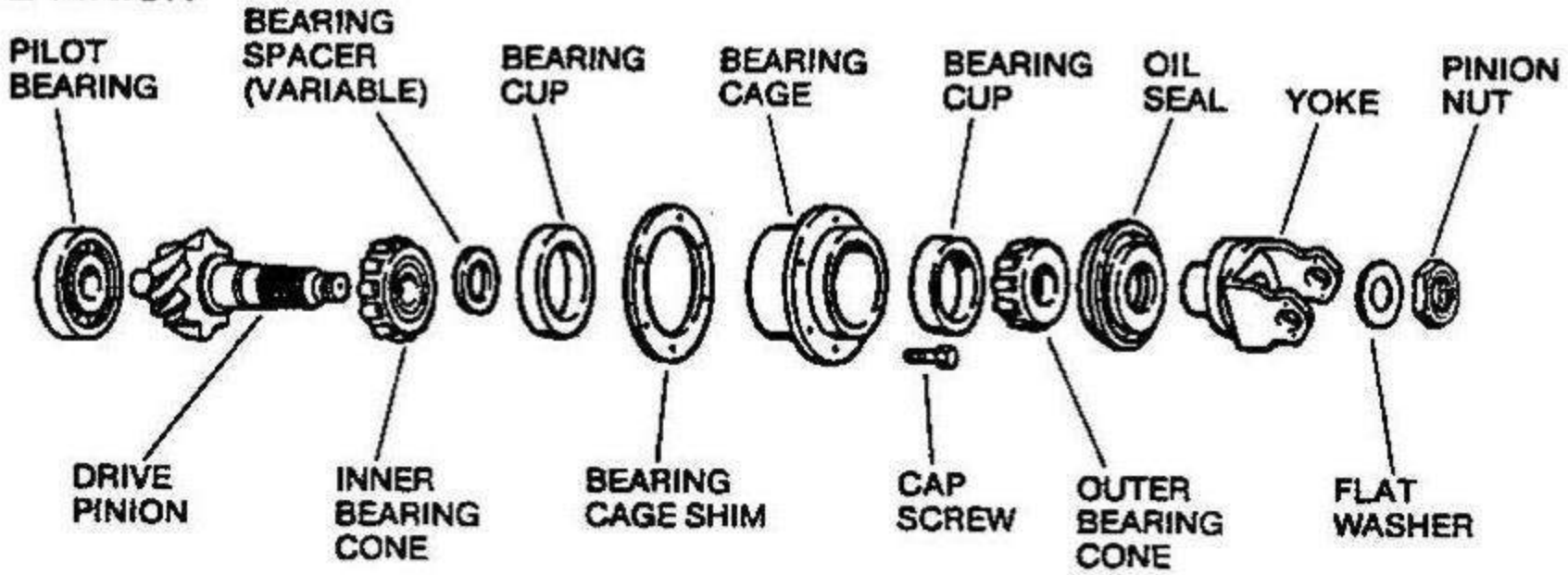
REAR AXLE

SECTION 3 OVERHAUL

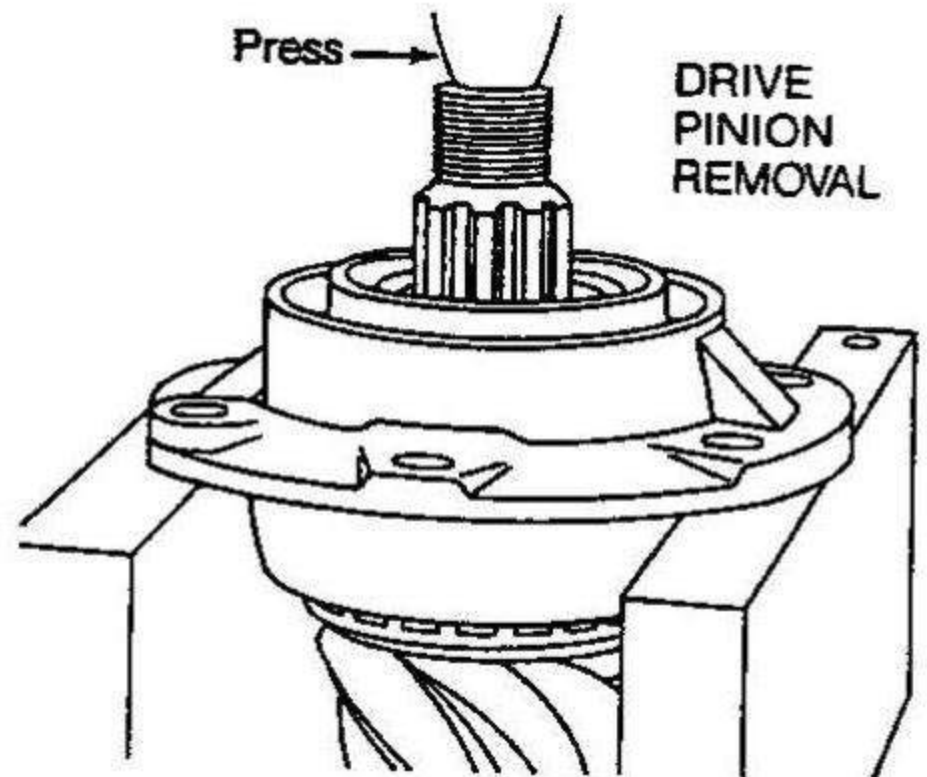
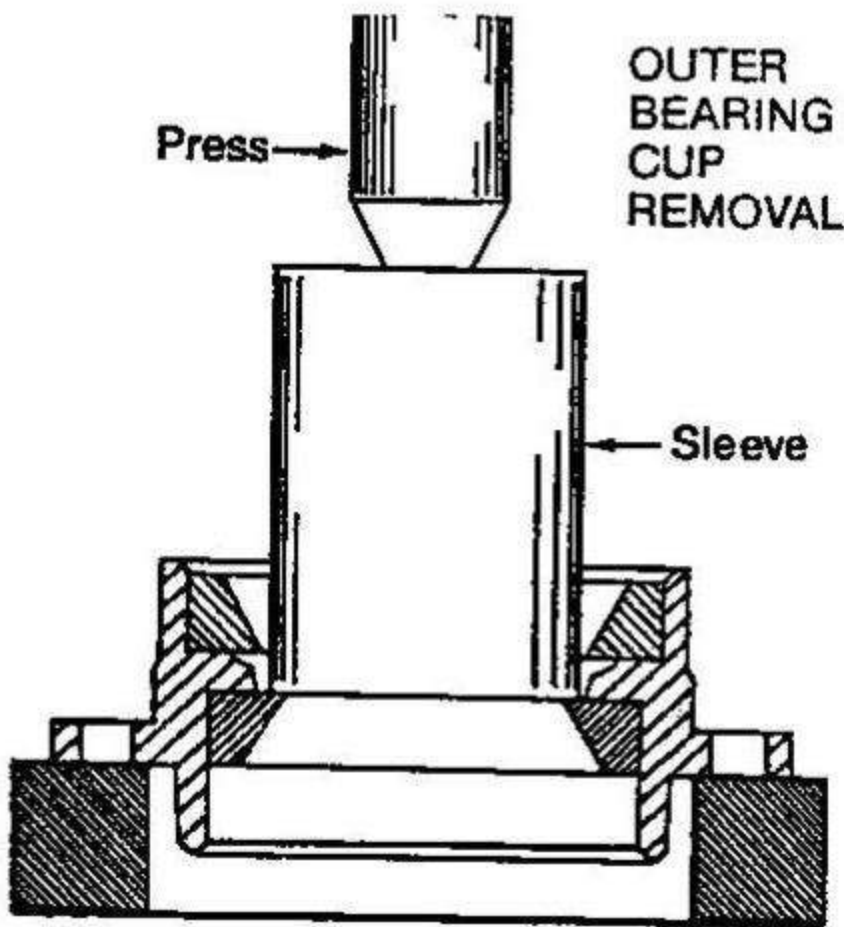
3C DISASSEMBLE DRIVE PINION

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.



REAR AXLE

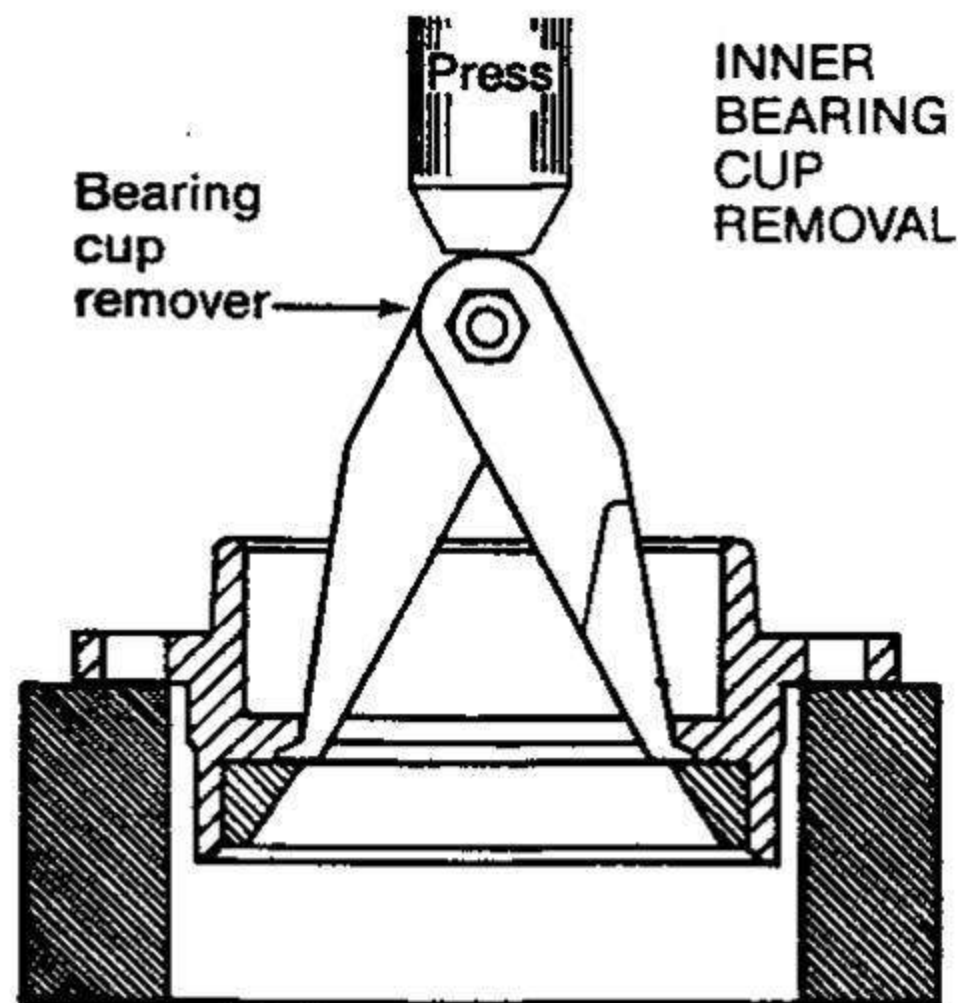
SECTION 3 OVERHAUL

3C DISASSEMBLE DRIVE PINION (Continued)

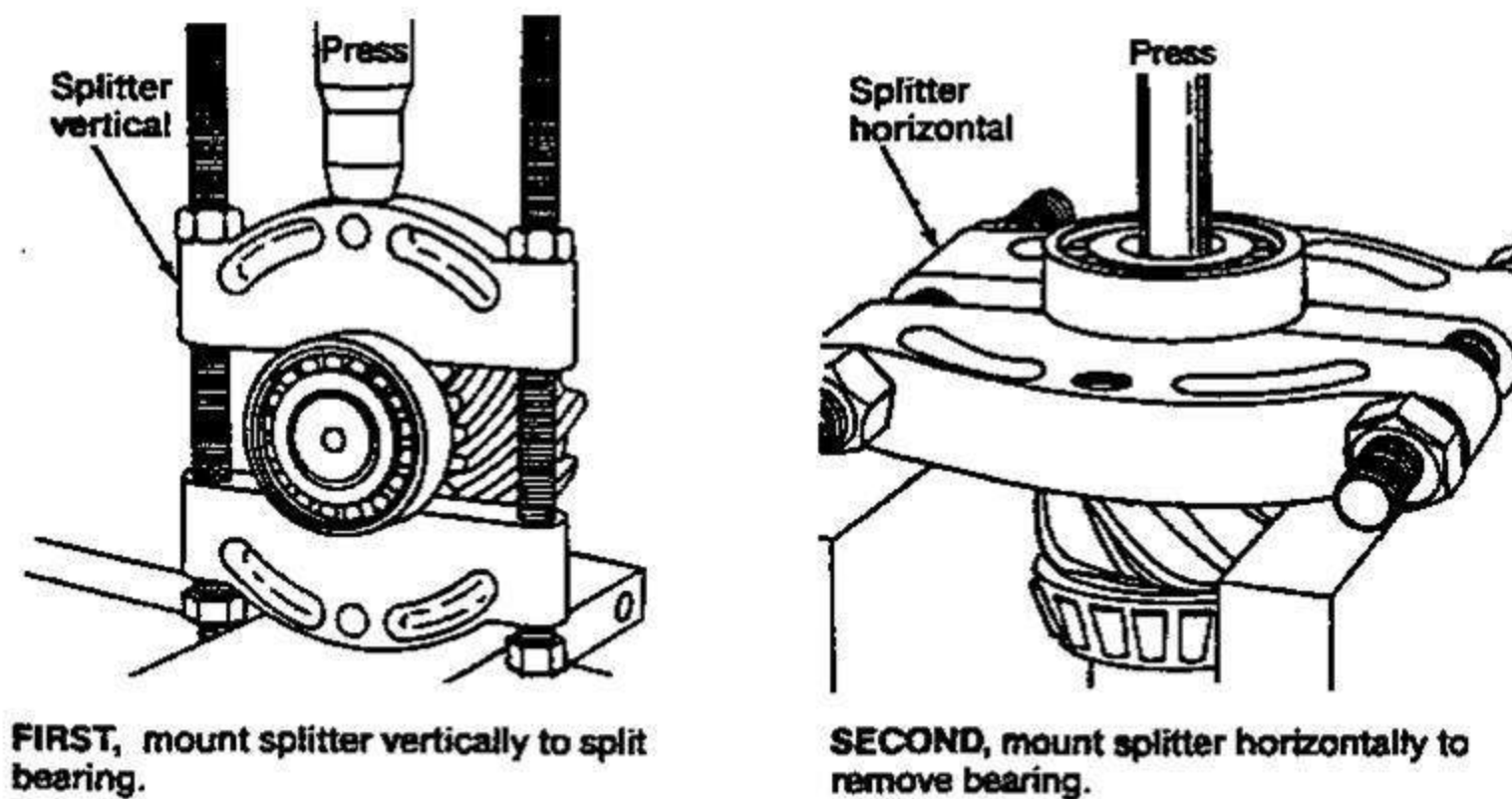
4. Remove and retain bearing spacer from pinion.
5. Using a bearing cup remover, remove inner bearing cup.

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



REAR AXLE

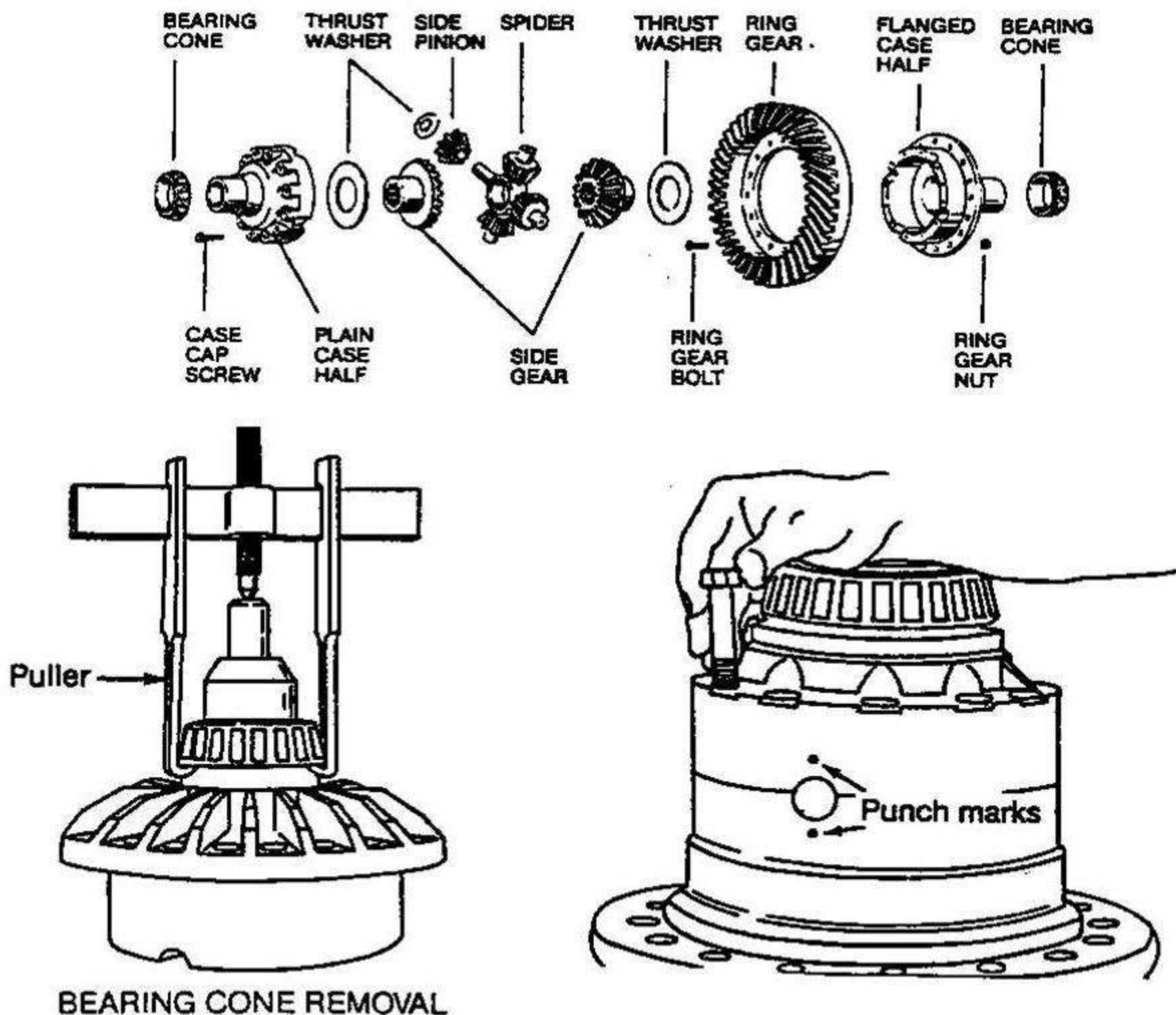
SECTION 3 OVERHAUL

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



REAR AXLE

SECTION 3 OVERHAUL

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

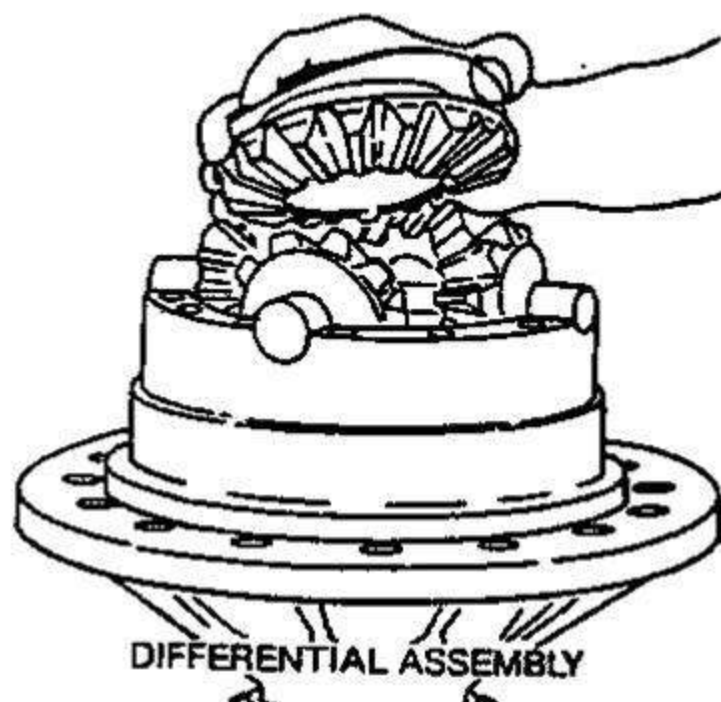
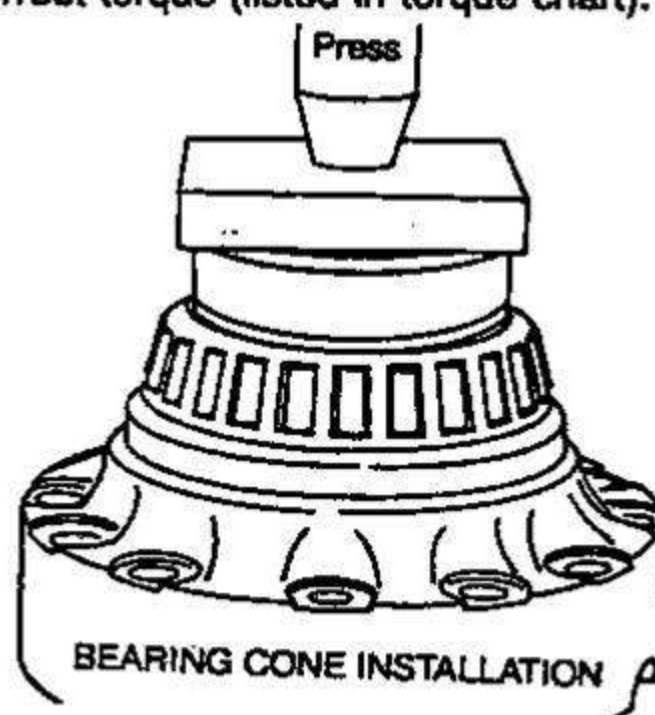
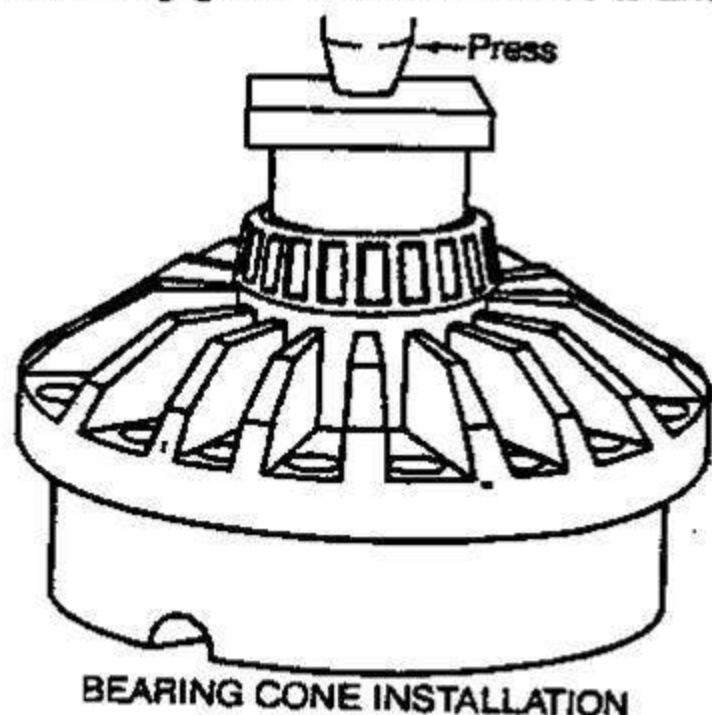
3. Place thrust washer and side gear in flanged differential case.
4. Assemble side pinions and thrust washers on spider. Place this assembly in flanged differential case. Rotate gears and check for proper mesh.
5. Place side gear and thrust washer on side pinions.

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.

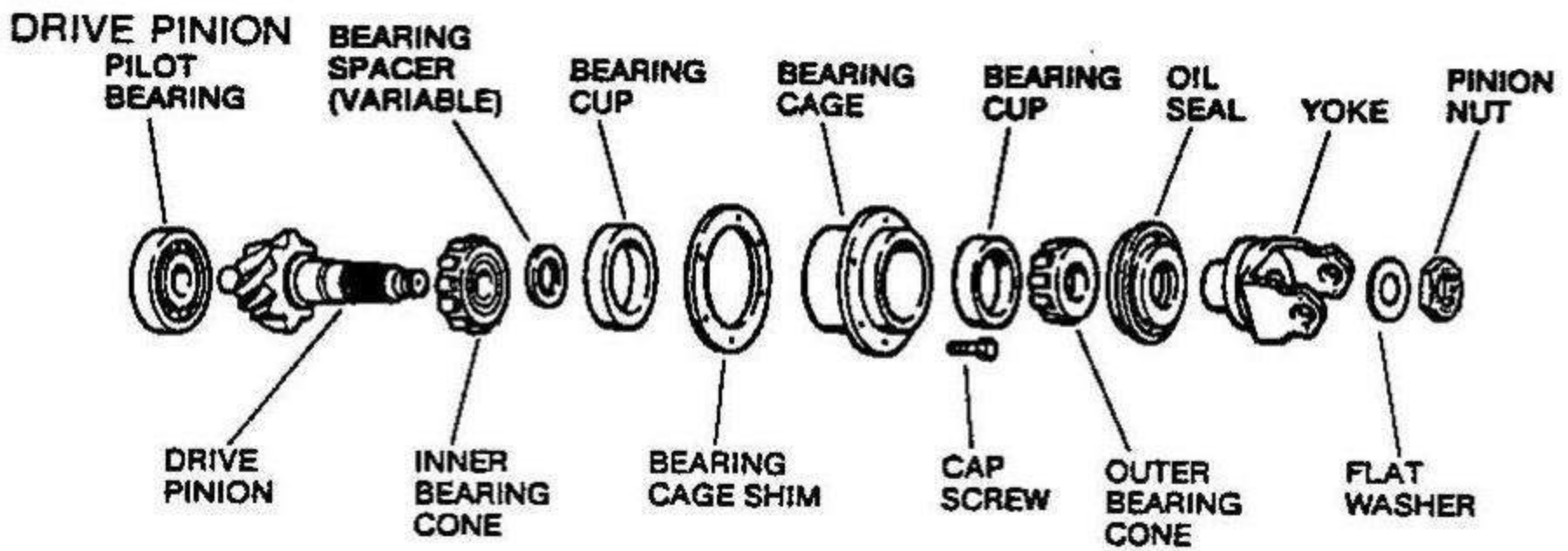
7. Install ring gear. Secure with bolts and nuts and tighten to correct torque (listed in torque chart).



REAR AXLE

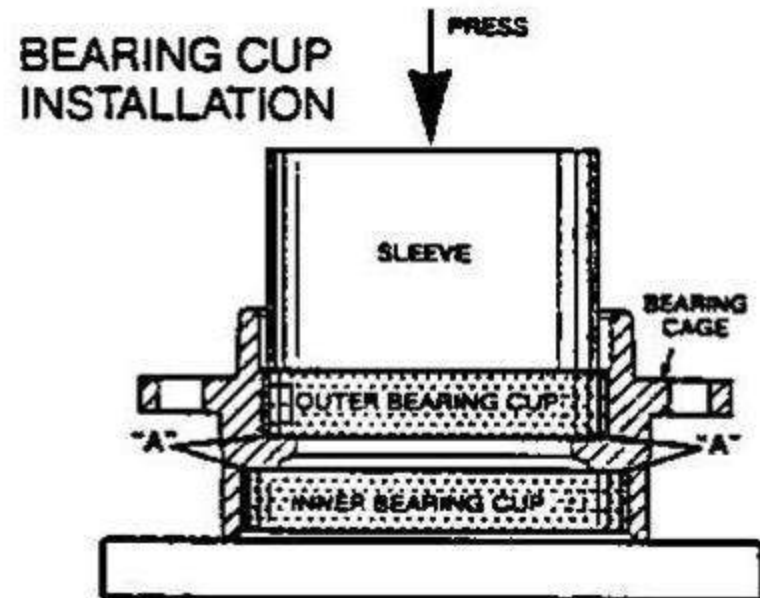
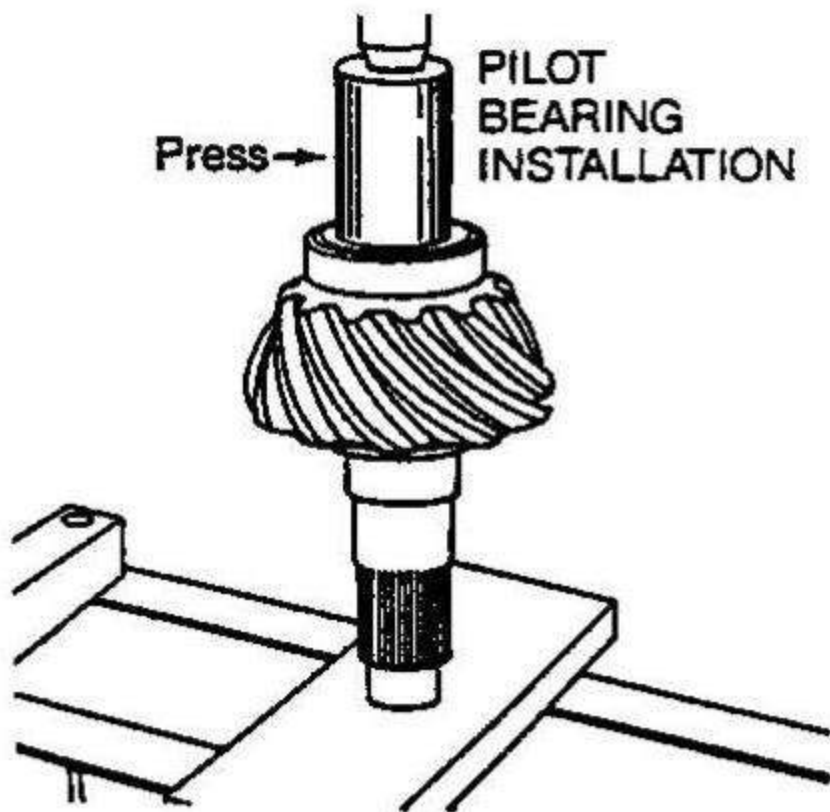
SECTION 3 OVERHAUL

3F ASSEMBLE DRIVE PINION

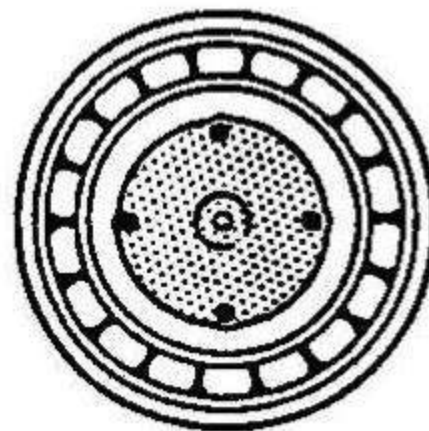


Note: Lubricate parts with gear oil during reassembly. When installing bearing cones and pilot bearing, use properly-sized sleeves that only contact the inner bearing race.

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.



"A" — Cups must be firmly seated in cage. Check with feeler gauge (0.001") after installation.
NOTE: Install cups one at a time.



PINION PILOT BEARING
STAKE PATTERN

REAR AXLE

SECTION 3 OVERHAUL

3G PINION BEARING PRELOAD ADJUSTMENT (TRIAL BUILD - UP)

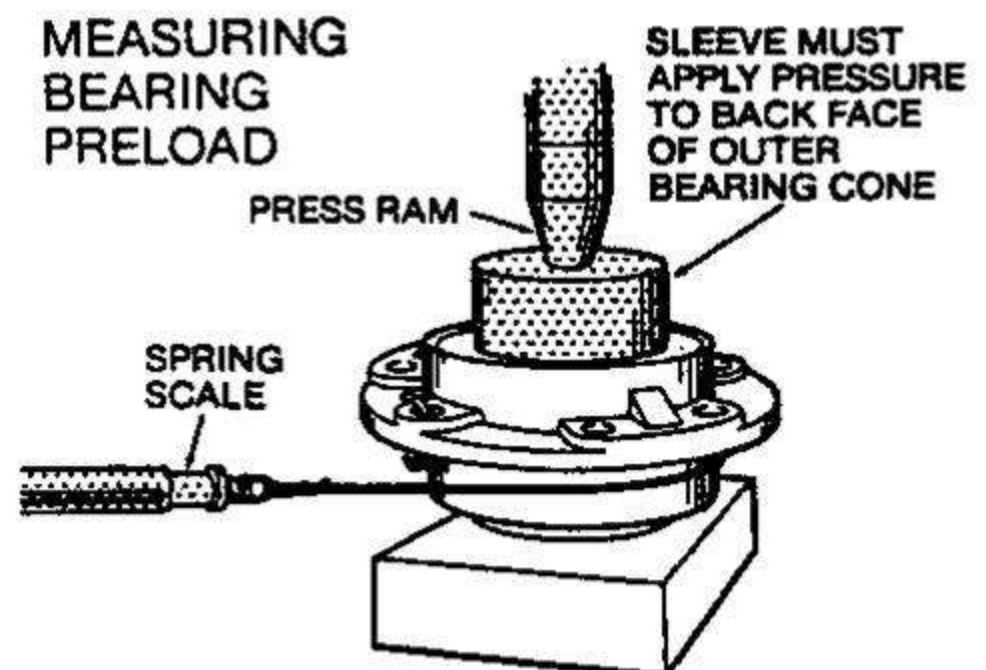
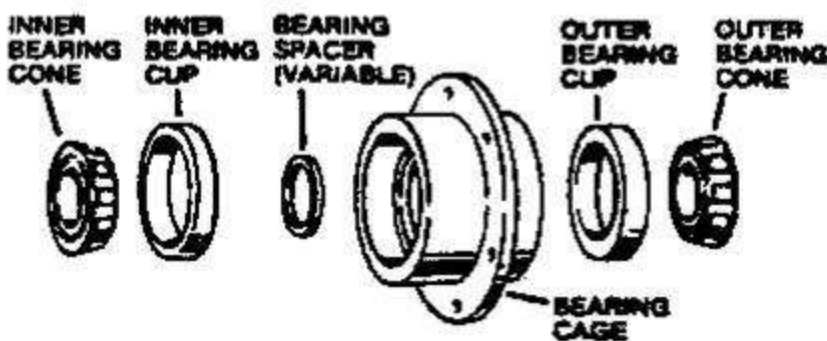
Pinion bearing spacer thickness should be predetermined using a trial build-up. This procedure will result in proper bearing preload in three out of four cases, saving time in subsequent procedures.

1. Assemble pinion bearing cage, cups, bearings, and nominal size spacer (0.703 in, 17.86 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 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. (1.1-2.3 Nm). This is equivalent to a spring balance reading of 4-7 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 use 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



REAR AXLE

SECTION 3 OVERHAUL

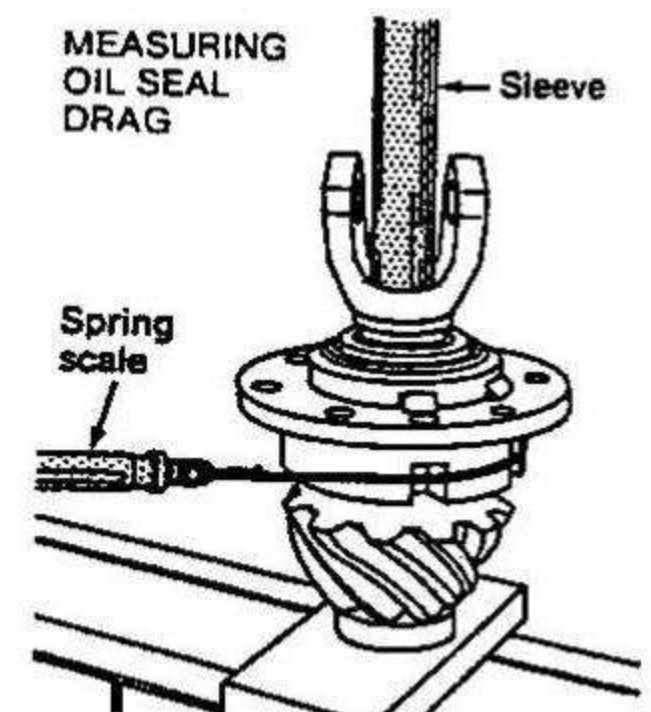
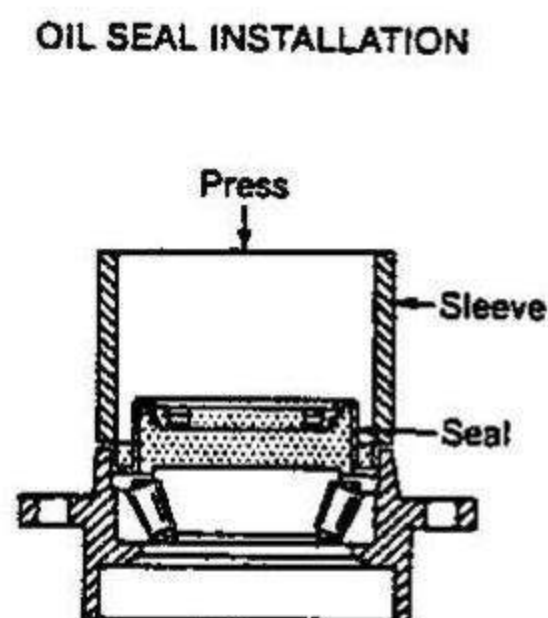
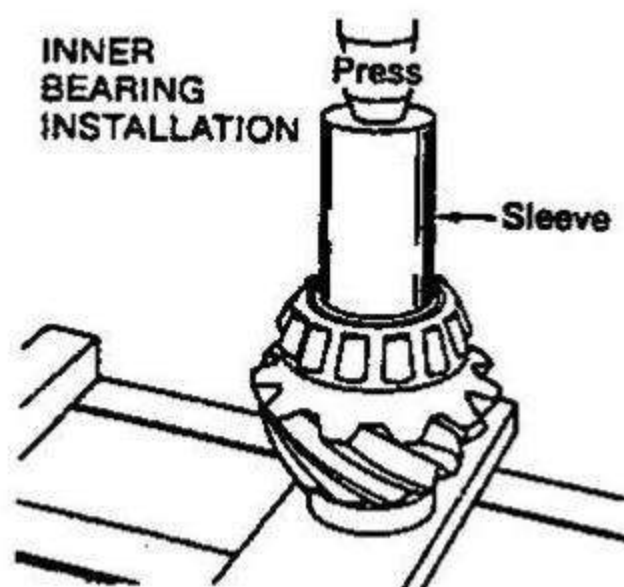
3G PINION BEARING PRELOAD ADJUSTMENT (TRIAL BUILD - UP) (Continued)

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 slight amount of freeplay in the bearings enough to allow approximately $1/16$ in. vertical movement of the bearing cage.
9. Measure the oil seal drag using a spring balance as described in the trial build-up instructions. Record the reading.



REAR AXLE

SECTION 3 OVERHAUL

3G PINION BEARING PRELOAD TEST

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 6-13 lb.

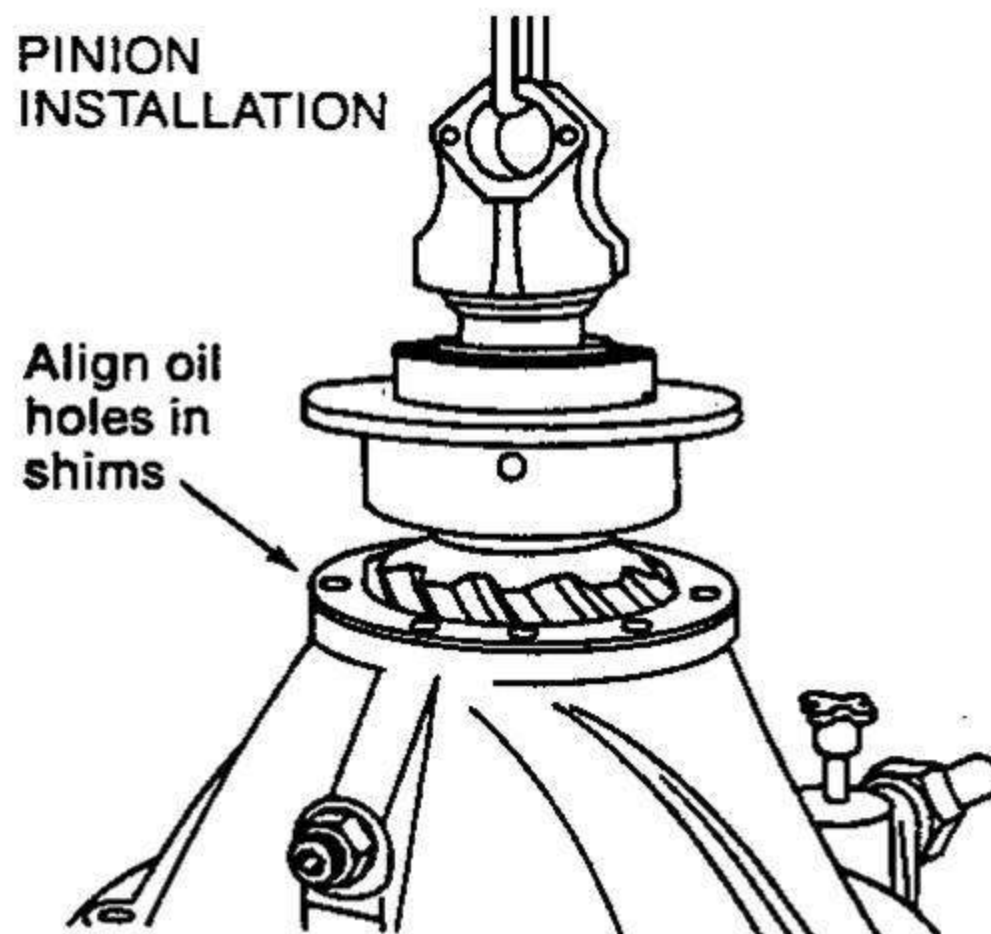
VICE METHOD: Install pinion nut and tighten to 376-461 lb ft 510-625 Nm torque. Clamp the yoke in a vice allowing the bearing cage to rotate. Check the rolling resistance of the bearing cage seal assembly using a spring balance as previously described. Subtract oil seal drag measured earlier from the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

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.



REAR AXLE

SECTION 3 OVERHAUL

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 211 on threaded surface of differential carrier. Reused fasteners should be wiped clean of excess oil, but do not require special cleaning.

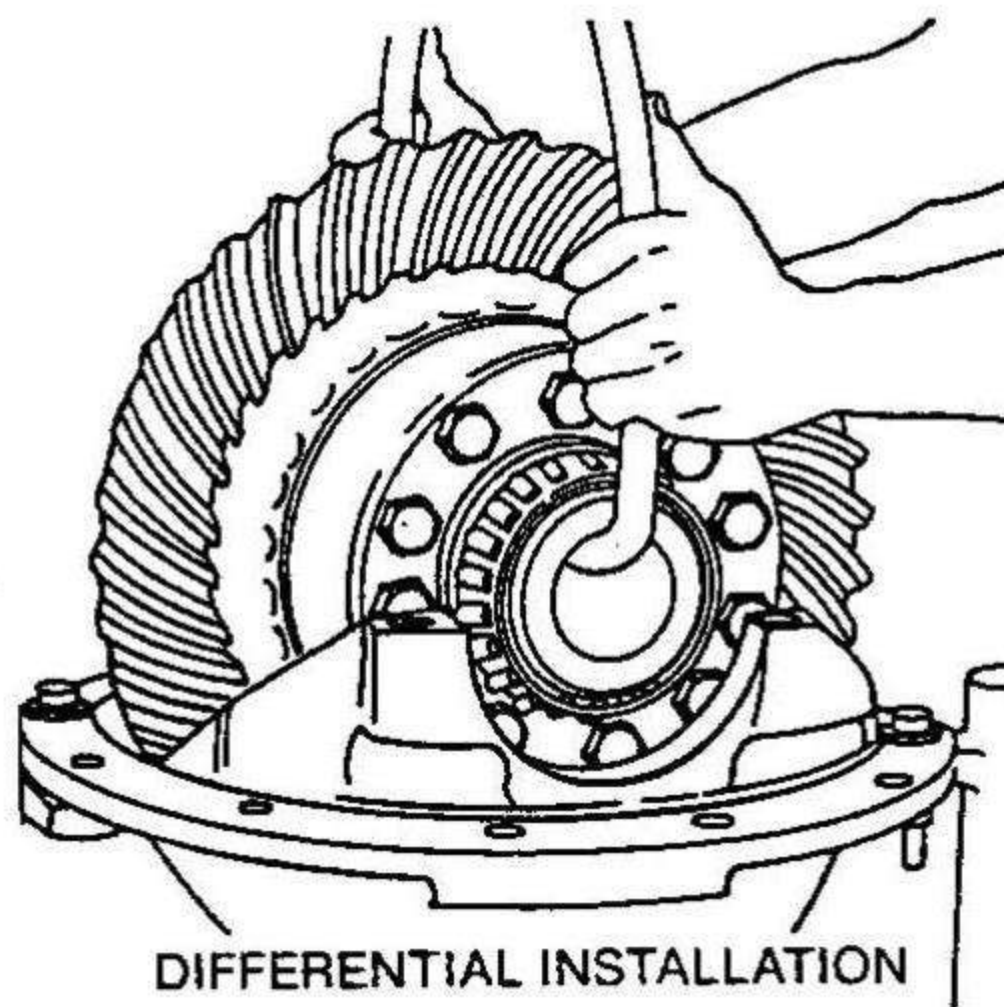
3J INSTALL DIFFERENTIAL AND RING GEAR ASSEMBLY

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).



REAR AXLE

SECTION 3 OVERHAUL

3K ADJUST DIFFERENTIAL BEARING PRELOAD

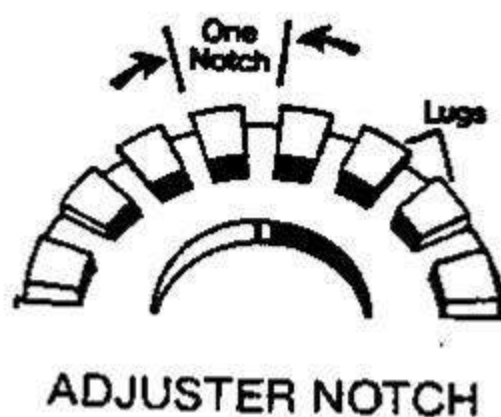
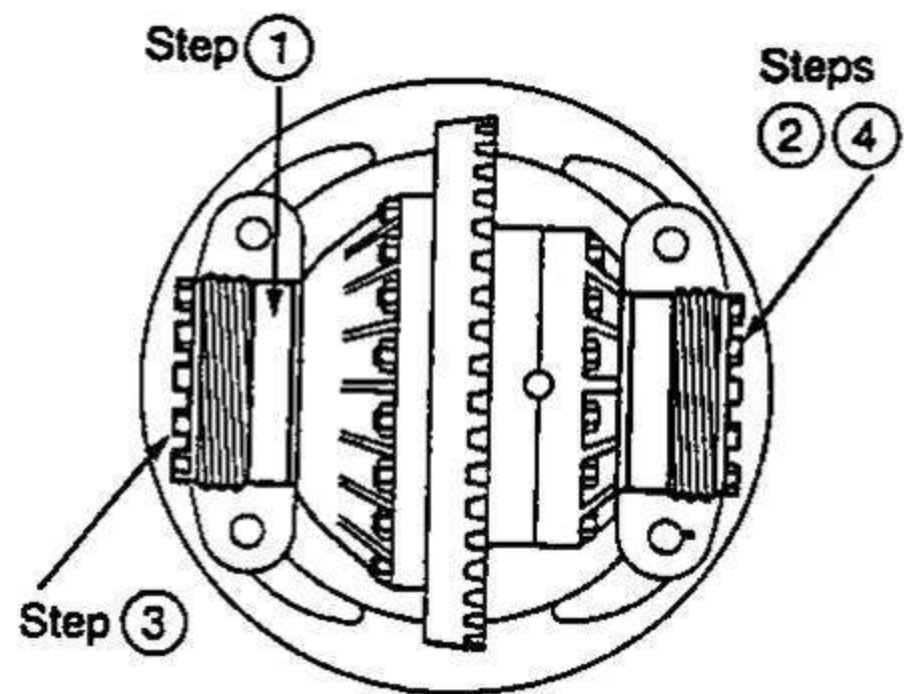
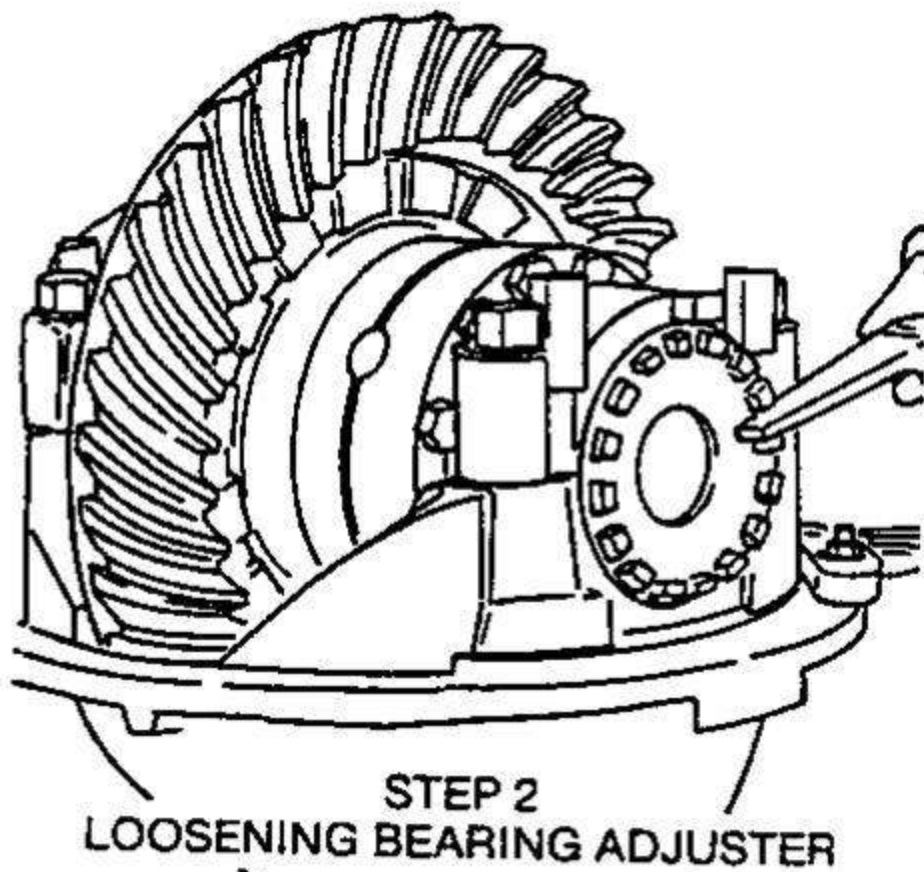
Correct differential bearing preload ensures proper location of these bearings under load and helps position the ring gear for proper gear tooth contact.

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).



REAR AXLE

SECTION 3 OVERHAUL

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.

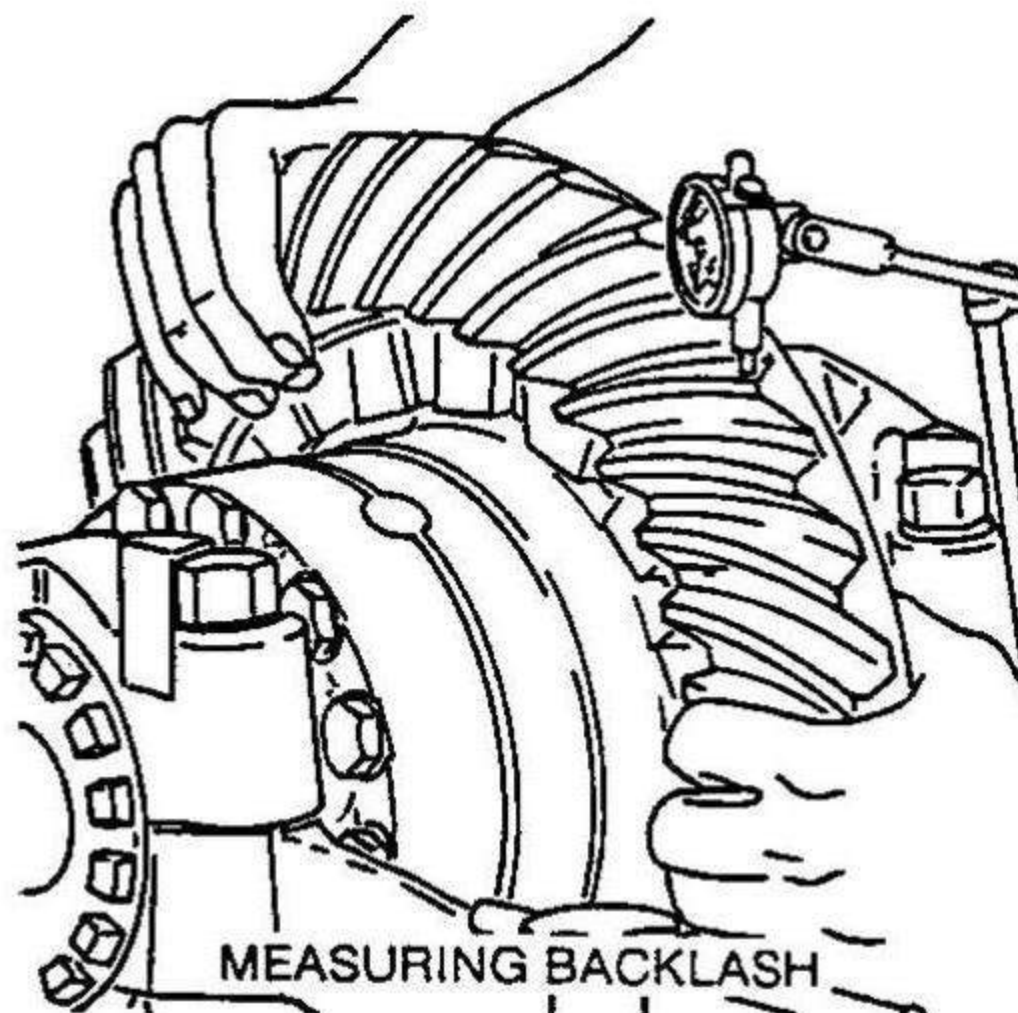
Note: For new gearing, check ring gear backlash after each shim change and adjust if necessary. For used gearing reset to normal backlash recorded before disassembly.

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.



REAR AXLE

SECTION 3 OVERHAUL

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.

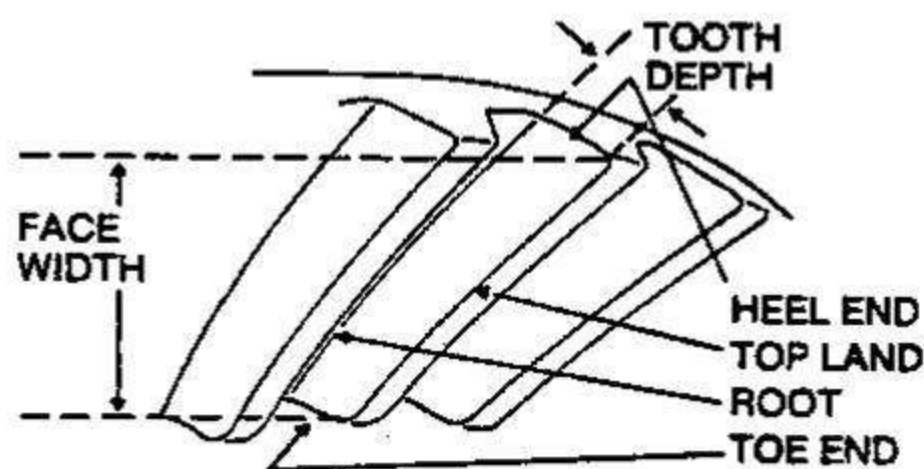
Correct Tooth Contact Pattern (Used Gearing)

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.

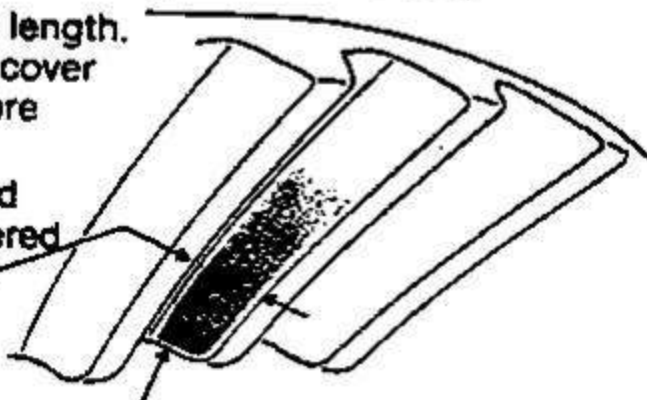
Note: Tooth contact patterns are a function of the relative position of the gear ring and pinion. An improper pattern will require relocation of either or both. Always adjust pinion position first, if necessary, then ring gear position. Recheck backlash when done.

RING GEAR TOOTH NOMENCLATURE



CORRECT PATTERN (NEW GEARING)

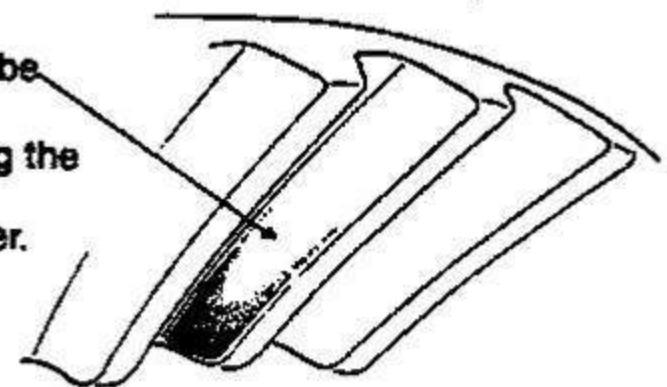
- Could vary in length. Pattern should cover 1/2 tooth or more (face width).
- Pattern should be evenly centered between tooth top land and root.



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

TYPICAL PATTERN (USED GEARING)

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



REAR AXLE

SECTION 3 OVERHAUL

3M ADJUST RING GEAR TOOTH CONTACT (Continued)

Adjust Pinion Position

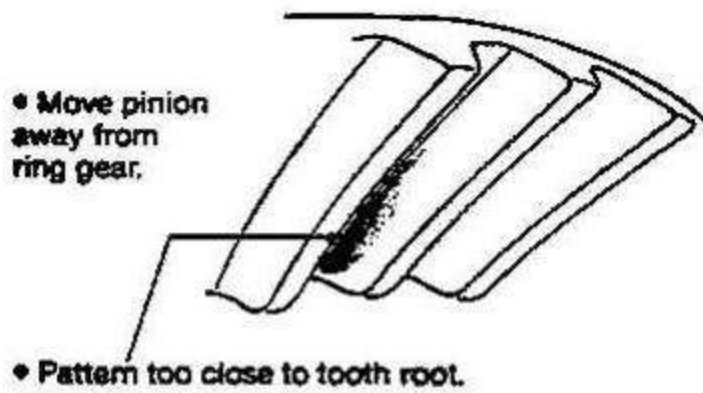
If the contact pattern shows incorrect tooth depth contact, change drive pinion position by altering the shim pack under the cage and cup assembly. Used gears should achieve proper contact with the same shims removed from the axle at disassembly.

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

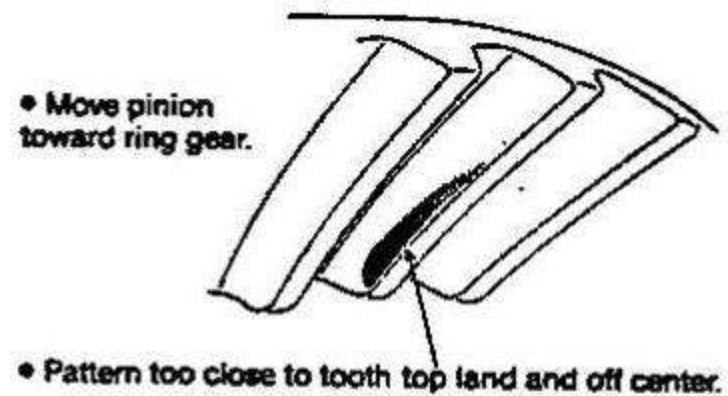
If the pattern is too close to the top of the gear tooth, remove pinion shims.

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



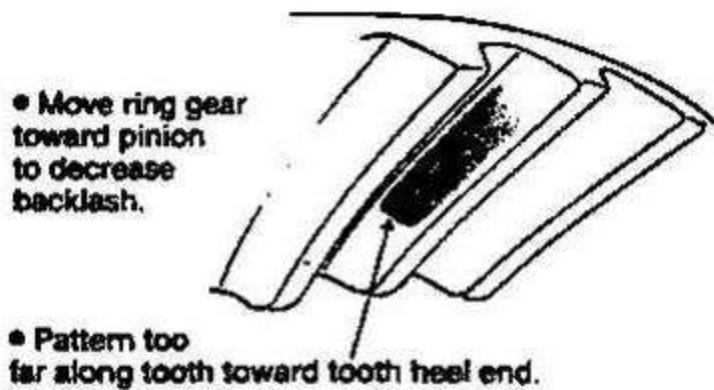
Adjust Backlash

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

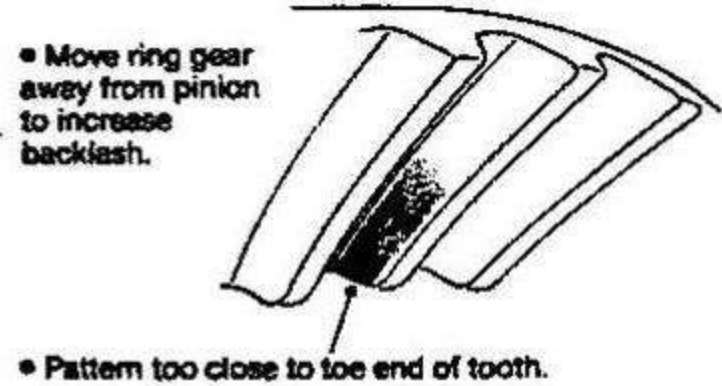
With the pattern concentrated at the toe (too far down the tooth), **ADD BACKLASH** by loosening the bearing adjuster on the teeth side of ring gear several notches. Loosen the opposite adjuster one notch. Return to adjuster on teeth side of ring gear and tighten adjuster until it contacts the bearing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



REAR AXLE

SECTION 3 OVERHAUL

3M ADJUST RING GEAR TOOTH CONTACT (Continued)

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.

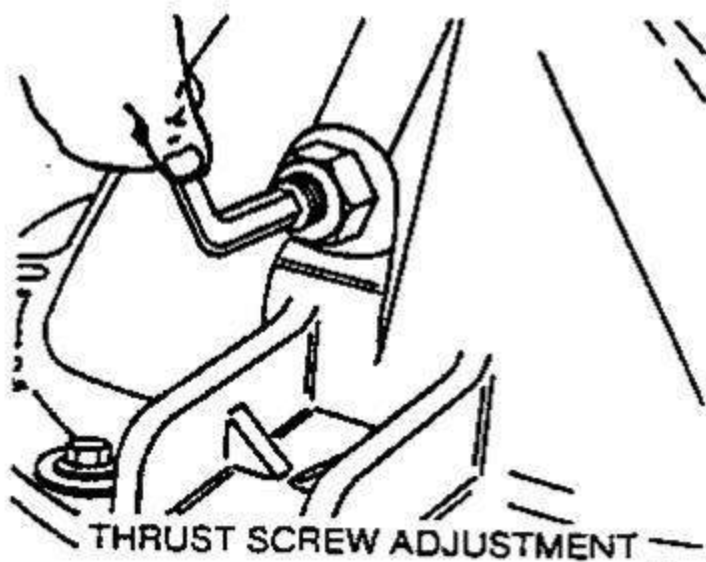
Note: Use silicone rubber gasket compound on axle housing mating surface as shown in the illustration. Gasket compound will set in 20 minutes. Install carrier before compound sets or reapply.

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 cleaning.

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

