Part No: 801468

LTI
SERVICE

Fairway
Fairway
DRIVER

WORKSHOP MANUAL

CONTENTS

INTRODUCTION

This Workshop manual consists of a number of individual sections giving details about various areas of the Fairway and Fairway Driver range of taxis.

While every effort was made to ensure the illustrations and text of each section were representative of manufacture at the time each section was originally printed, there may subsequently have been alterations to the vehicle, to individual components, or to the suggested repair procedures because of improvements, convenience in manufacture, or any other reason without necessarily updating the original information issued, and of which copies are contained in this manual.

Recognized LTI Dealers are kept up to date with changes in vehicle specifications or servicing requirements and any specific detail about a particular vehicle may be referred to them for the latest available information.

LTI Ltd will not under any circumstances accept liability for any inaccuracies in, or omissions from the material in this manual or any loss, damage or injury caused by any errors in, or omissions from the information given.

PARTICULAR ATTENTION IS DRAWN TO THE GENERAL PRECAUTIONS WHICH FOLLOW THIS INTRODUCTION.

GENERAL PRECAUTIONS

Safe working conditions and procedures are often a matter of commonsense and taking reasonable precautions. Always treat safety as the first priority when working on a vehicle and if in any doubt seek advice from a trained vehicle technician who will be aware of how safety hazards can best be avoided.

Always use safety equipment such as goggles, paint masks etc. where appropriate, and only undertake repairs and replacement where you have the skills and knowledge required for the work contemplated. The following precautions, while not exhaustive, should be noted in addition to the general care which must always be taken.

1. It is essential that work is thoroughly inspected and tested following a repair. Where safety related items are involved, the vehicle should be road tested under controlled conditions before being put back into routine service.

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

3. Never start an engine without ensuring the transmission is in 'neutral' or 'Park' and that the handbrake is applied.

4. It is essential the steering lock is disengaged by turning the ignition key to its first position before releasing the handbrake and manoeuvring the vehicle without using the engine. Never push the vehicle without a qualified driver in position and remember brake servo assistance will not be available if the engine is not running.

5. Ensure loose clothing (ties, scarves etc) do not come into contact with rotating parts.

6. Always allow cooling systems to cool down completely before removing a cooling system pressure cap. Cover the pressure cap with a cloth and release the pressure slowly to prevent any chance of scalding.

7. Always disconnect the earth lead of the battery whenever carrying out a repair which could remotely involve affecting the electrical system or wiring. When starting a vehicle with a 'flat' battery, always follow the procedure in the vehicle handbook so that there is no risk of damage to the electrical and electronic equipment fitted to the vehicle.

Battery electrolyte is corrosive and should not be allowed to come into contact with the eyes or skin.

Batteries give off hydrogen gas and should never be exposed to a naked flame. Recharging of vehicle batteries should be carried out by a competent technician in a well ventilated area away from any naked flame.

8. Where an additional light is necessary to assist a repair, use only a low voltage or suitably designed and electrically protected mains voltage inspection lamp.

9. A number of parts fitted to vehicles (including brake/clutch linings, automatic transmission clutch plates and engine gaskets may contain asbestos which can be injurious to health when parts are serviced unless they are handled following the appropriate safety precautions.

Breathing asbestos dust is dangerous and parts containing asbestos should be handled with care in a well ventilated place. Never blow off asbestos dust and always dispose of it safely in a closed receptacle or through a suitable dust extractor system.

continued over/....

10. Prolonged and repeated contact with used engine oils may cause serious skin disorders, including dermatitis and cancer. Excessive contact with used oils should be avoided - wash thoroughly after contact.

Many liquids and other substances used in motor vehicles are poisonous and should under no circumstances be consumed or allowed to come into contact with open wounds. These substances, among others, include anti- freeze, brake fluid, fuel, windscreen washer additives, lubricants and adhesives. Keep all such substances out of the reach of children.

Always dispose of used oils/solvents etc. at an approved Public Waste Disposal facility. Never pour such materials into the public drainage system or allow them to seep into the soil.

11. The electrical systems fitted to the Fairway and Fairway Driver taxis incorporate equipment and electronic devices which are adequately wired, positioned and protected by fuses to minimise any risk of overheating or damage to the components or to the vehicle.

To prevent the risk of fire or noxious fumes resulting from incorrect electrical modifications or the fitting of additional equipment, modifications or additions should only be made by a competent auto electrician, so that the vehicle wiring is not overloaded and any additional equipment is suitably positioned with adequate wiring and fuses.

Always fit fuses of the capacity indicated on the label attached to the driver's sunvisor. Noxious fumes from overheating electrical components can be dangerous when inhaled. Never continue to operate a vehicle which is suspected of having an electrical failure.

12. Always use the specified brake fluid. Never use petrol or paraffin to clean braking system components. If solvent is required use methylated spirit.

13. Never leave unused brake fluid in unsealed containers where it will absorb moisture and can be dangerous if used in a braking system in this condition. Fluid drained from the system or used in bleeding should be discarded.

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

15. Never blow out brake drums even on those vehicles fitted with non asbestos brake linings. Remove brake dust with a vacuum cleaner designed for the purpose or wipe clean with a damp rag.

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

17. Self-locking nuts are used in a number of locations. It is strongly recommended that such nuts are only used once, and are replaced as a matter of routine when disturbed. Similarly, split pins should be replaced with new pins as a matter of routine when they are disturbed.

18. The use of air tools will assist in a number of repair operations provided that care is taken not to exceed the prescribed torque settings.

19. Nut and bolt torques should be observed whenever carrying out repairs. Do not guess the torque to be used. Have torque wrenches checked at regular intervals.

20. Take particular care to support components which may be heavy or under load when being dismantled (coil springs, suspension components, major assemblies etc.) There are often no short cuts to using the correct service tools in servicing the vehicle and this particularly applies to such components as coil springs where the correct tools are essential for safety reasons.

LTI
SERVICE

fairway

WORKSHOP MANUAL

SECTION 2

ENGINE AND FUEL SYSTEM

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

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

NISSAN

MODEL
TD SERIES
DIESEL ENGINE

QUICK REFERENCE INDEX

FOREWORD

This manual contains maintenance and repair procedures for the model TD series diesel engine.

All information in this manual is based on the latest product information at the time of publication. The right is reserved to make changes in specifications and methods at any time without notice.

IMPORTANT SAFETY NOTICE

The proper performance of service is essential for both the safety of the mechanic and the efficient functioning of the vehicle.
The service methods in this Service Manual are described in such a manner that the service may be performed safely and accurately.
Service varies with the procedures used, the skills of the mechanic and the tools and parts available. Accordingly, anyone using service procedures, tools or parts which are not specifically recommended by NISSAN must first completely satisfy himself that neither his safety nor the vehicle's safety will be jeopardized by the service method selected.

PRECAUTIONS.

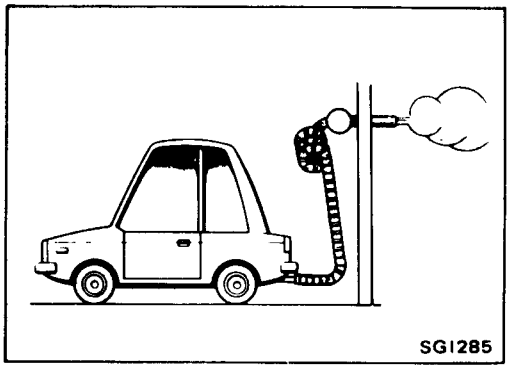
ENGINE OILS.
Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities should be provided.

GENERAL INFORMATION

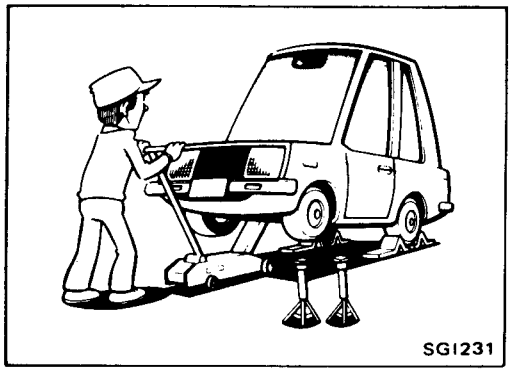
SECTION GI

CONTENTS

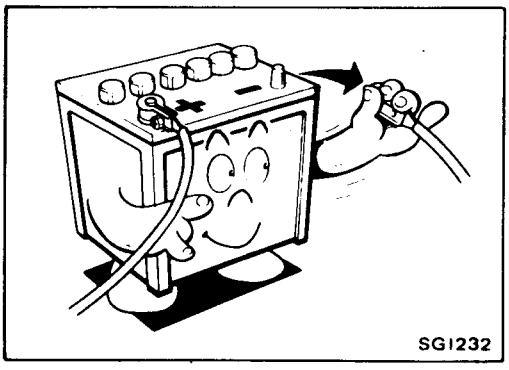
The following precautions should be observed to ensure safe and proper service operations. These precautions are not described in each individual section.


SGI285

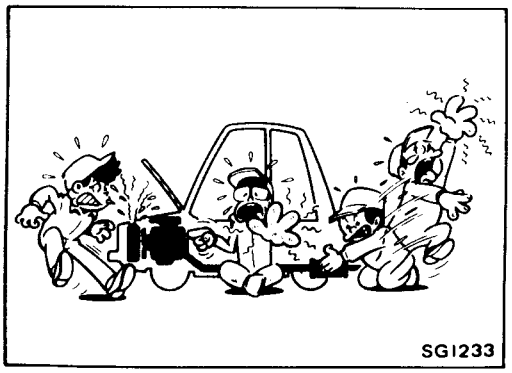
1. Do not operate the engine for an extended period of time without proper exhaust ventilation.
   Keep the work area well ventilated and free of any inflammable materials. Special care should be taken when handling any inflammable or poisonous materials, such as diesel fuel, refrigerant gas, etc. When working in a pit or other enclosed area, be sure to properly ventilate the area before working with hazardous materials.
   Do not smoke while working on the vehicle.


SGI231

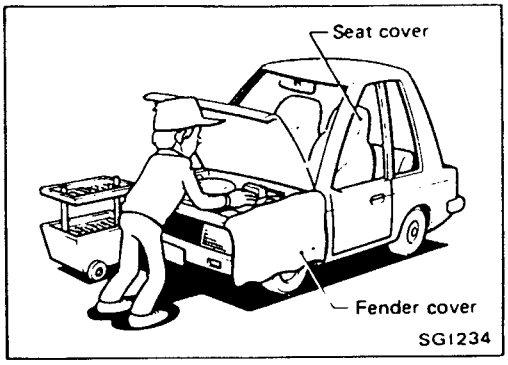
2. Before jacking up the vehicle, apply wheel chocks or other tire blocks to the wheels to prevent the vehicle from moving. After jacking up the vehicle, support the vehicle weight with safety stands at the points designated for proper lifting and towing before working on the vehicle.
   These operations should be done on a level surface.
3. When removing a heavy component such as the engine or transaxle/transmission, take care not to lose your balance and drop it. Also, do not allow it to hit against adjacent parts, especially brake tube and brake master cylinder.


SGI232

4. Before starting repairs which do not require battery power, always turn off the ignition switch, then disconnect the ground cable from the battery to prevent accidental short circuit.


SGI233

5. To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe and muffler.
   Do not remove the radiator cap when the engine is hot.



6. To prevent scratches and soiling, protect fenders, upholstery and carpeting with appropriate covers before starting servicing.
   Take caution that keys, buckles or buttons on your person do not scratch the paint.
7. Clean all disassembled parts in the designated liquid or solvent prior to inspection or assembly.
8. Replace oil seals, gaskets, packings, O-rings, locking washers, cotter pins, self-locking nuts, etc. as instructed and discard used ones.
9. Arrange the disassembled parts in accordance with their assembled locations and sequence.
10. Do not touch the terminals of electrical components which utilize microcomputers such as electronic control units. Static electrical charges stored in your body may damage internal electronic components.
11. After disconnecting vacuum hose or air hose, attach tag which indicates the proper connection to prevent incorrect connection.
12. Use only the lubricants specified in the applicable section or those indicated under "Recommended Fuel and Lubricants".
13. Use approved bonding agent, sealants or their equivalents when required.
14. The use of the proper tools and recommended essential tools should be used where specified for proper, safe and efficient service repairs.
15. When effecting repairs on the fuel, oil, water, vacuum or exhaust systems, make certain to check all affected lines for leaks.
16. Dispose of drained oil or the solvent used for cleaning parts in an appropriate manner.

Asbestos Safety Instructions (Based on regulations of United Kingdom)

This vehicle uses parts containing asbestos, most are not hazardous but Brake and Clutch linings can be. Consult the manufacturer or his agent for further details. When working with these please observe the "Garage Workers' Asbestos Code" available through your Nissan Dealer, Local Authority or Health and Safety Executive. In particular, work in a well ventilated place using where possible appropriate dust extraction equipment and avoid creating dust. Dampen all asbestos/dust where possible prior to machining, cutting, cleaning, etc. Use only hand or low speed tools.

Dispose of all asbestos waste, wet rags, etc., in a closed container as directed by your local waste disposal authority.

1. A QUICK REFERENCE INDEX, a black tab e.g. EM is provided on the first page. You can quickly find the first page of each section by matching it to the section's black tab.
2. THE CONTENTS are listed on the first page of each section.
3. THE TITLE is indicated on the upper portion of each page and shows the part or system.
4. THE PAGE NUMBER of each section consists of two letters, which designate the particular section, and a number (e.g. "EM-5").
5. THE LARGE ILLUSTRATION contains tightening torques and other information necessary to perform repairs. The illustration should be used in reference to the service matters only. When ordering parts, refer to the appropriate PARTS CATALOG.
6. THE SMALL ILLUSTRATION shows the important steps such as inspection, use of special tools, knacks of work and hidden or trickly steps which are not shown in the previous large illustration.
   Assembly, inspection and adjustment procedures for the complicated units such as injection pump, etc. are presented in a step-by-step format where necessary.
7. The followings SYMBOLS AND ABBREVIATIONS are used:

 : Tightening Torque

 : Should be lubricated with grease. Unless otherwise indicated, use recommended multi-purpose grease.

 : Should be lubricated with oil.

 : Sealing point

 : Checking point

 : Always replace when disassembled.

S.D S.:	Service Data and Specifications
L.H., R.H.:	Left-Hand, Right-Hand
M/T:	Manual Transaxle/Transmission
A/T:	Automatic Transaxle/Transmission
Tool:	Special Service Tools

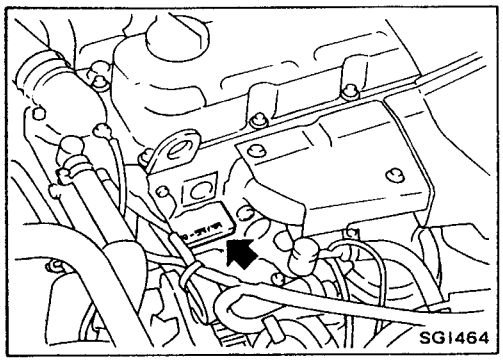
8. The UNIT given in this manual are primarily expressed with the SI UNIT (International System of Unit), and alternately expressed in the metric system and in the yard/pound system.

   "Example"

   Tightening torque
   59 - 78 N·m (6.0 - 8.0 kg-m, 43 - 58 ft-lb)

9. TROUBLE DIAGNOSES AND CORRECTIONS are included in sections dealing with complicated units.
10. SERVICE DATA AND SPECIFICATIONS is contained at the end of each section for quick reference of data.
11. The captions WARNING and CAUTION warn you of steps that must be followed to prevent personal injury and/or damage to some part of the engine.

Engine model		TD23	TD27
Cylinder arrangement		In-line	
Number of cylinders		4	
Valve arrangement		O.H.V.	
Bore x stroke	mm (in)	89 x 92 (3.50 x 3.62)	96 x 92 (3.78 x 3.62)
Displacement	cm^3 (cu in)	2,289 (139.67)	2,663 (162.50)
Firing order		1-3-4-2	
Number of piston rings	Compression	2	
	Oil	1	
Number of main bearings		5	
Compression ratio		21.8	



The engine serial number is stamped on the left-front side of cylinder block.

TDXX – XXXXXX

- Serial No.
- Engine model

Fuel

Europe and Hong Kong ... Diesel fuel of above 51 cetane
Except Europe and Hong Kong ... Diesel fuel of above 45 cetane

★ If two types of diesel fuel are available, use summer or winter fuel properly according to the following temperature conditions.
Summer type diesel fuel: Above −7°C (20°F)
Winter type diesel fuel: Below −7°C (20°F)

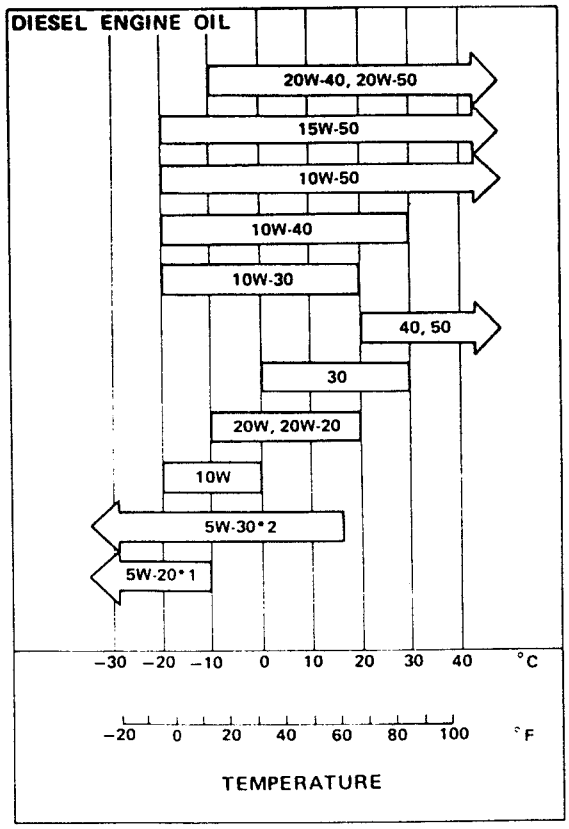
CAUTION:

- **Do not use home heating oil, gasoline, or other alternate fuels in your diesel engine. The use of those can cause engine damage.**
- **Do not use summer fuel at temperatures below −7°C (20°F). The cold temperatures will cause wax to form in the fuel. As a result, it may prevent the engine from running smoothly.**
- **Do not add gasoline or other alternate fuels to diesel fuel. Only under the following conditions may you use diesel fuel by mixing kerosene or regular gasoline (not preminum gasoline) to prevent the fuel from thickening due to wax separation:**
  If the summer type diesel fuel is used at an ambient temperature below 0°C (32°F), add kerosene or regular gasoline but not more than 30% by volume. If the winter type diesel fuel is used at an ambient temperature below −15°C (5°F), add kerosene or regular gasoline but not more than 30% by volume.
  However, keep in mind that there may be less engine output performance due to the proportion of added fuel.

Lubricants

Lubricant		Specifications	Remarks
Diesel engine oil	Non-turbo model	API CC or CD	For further details, refer to the recommended SAE viscosity chart.
	Turbo model	API CD	
Anti-freeze		–	Ethylene glycol base

SAE Viscosity Number



*1: Not recommended for sustained high speed driving.
*2: Use only below 0°C (32°F) for turbo models.
*3: On models equipped with a turbocharger, use 10W-30, 10W-40, 10W-50, 15W-50, 20W-20, 20W-40 or 20W-50 except under extremely cold conditions. Use 5W-30 only under extremely cold conditions.

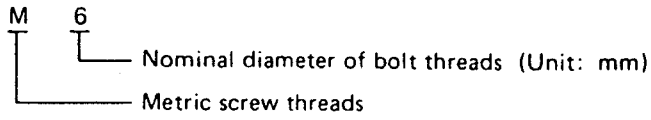
TIGHTENING TORQUE OF STANDARD BOLT

Grade	Bolt or nut size	Bolt or nut diameter* mm	Pitch mm	Tightening torque		
				N·m	kg·m	ft-lb
4T	M6	6.0	1.0	3 - 4	0.3 - 0.4	2.2 - 2.9
	M8	8.0	1.25	8 - 11	0.8 - 1.1	5.8 - 8.0
			1.0	8 - 11	0.8 - 1 1	5.8 - 8.0
	M10	10.0	1.5	16 - 22	1.6 - 2.2	12 - 16
			1.25	16 - 22	1.6 - 2.2	12 - 16
	M12	12.0	1.75	26 - 36	2.7 - 3.7	20 - 27
			1.25	30 - 40	3.1 - 4.1	22 - 30
	M14	14.0	1.5	46 - 62	4.7 - 6.3	34 - 46
7T	M6	6.0	1.0	6 - 7	0.6 - 0.7	4.3 - 5.1
	M8	8.0	1.25	14 - 18	1.4 - 1.8	10 - 13
			1.0	14 - 18	1.4 - 1.8	10 - 13
	M10	10.0	1.5	25 - 35	2.6 - 3.6	19 - 26
			1.25	26 - 36	2.7 - 3.7	20 - 27
	M12	12.0	1.75	45 - 61	4.6 - 6.2	33 - 45
			1.25	50 - 68	5.1 - 6.9	37 - 50
	M14	14.0	1.5	76 - 103	7.7 - 10.5	56 - 76
9T	M6	6.0	1.0	8 - 11	0.8 - 1.1	5.8 - 8.0
	M8	8.0	1.25	19 - 25	1.9 - 2.5	14 - 18
			1.0	20 - 27	2.0 - 2.8	14 - 20
	M10	10.0	1.5	36 - 50	3.7 - 5.1	27 - 37
			1.25	39 - 51	4.0 - 5.2	29 - 38
	M12	12.0	1.75	65 - 88	6.6 - 9.0	48 - 65
			1.25	72 - 97	7.3 - 9.9	53 - 72
	M14	14.0	1.5	109 - 147	11.1 - 15.0	80 - 108

1. **Special parts are excluded.**
2. **This standard is applicable to bolts having the following marks embossed on the bolt head.**

Grade	Mark
4T	4
7T	7
9T	9

*: Nominal diameter

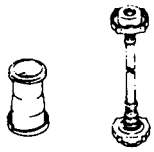


MAINTENANCE

SECTION MA

CONTENTS

SPECIAL SERVICE TOOL

Tool number Tool name	Description	
EG17650301 Radiator cap tester adapter		Checking cooling system

Retightening Manifold Bolts, and Nuts

MANIFOLD BOLTS AND NUTS

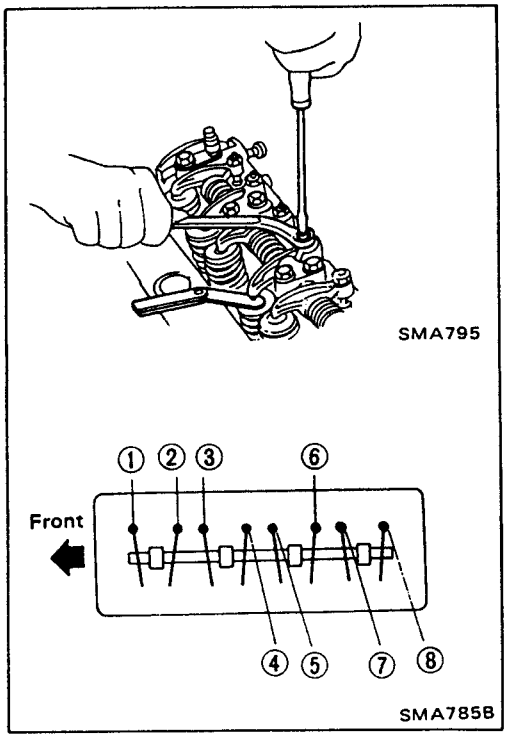
Intake ⟲ :

15 - 20 N·m (1.5 - 2.0 kg-m, 11 - 14 ft-lb)

Exhaust ⟲ :

25 - 29 N·m (2.5 - 3.0 kg-m, 18 - 22 ft-lb)

Retightening should be performed while engine is cold [approximately 20°C (68°F)].



Adjusting Intake and Exhaust Valve Clearance

Adjustment should be made while engine is warm but not running.

1. Set No. 1 cylinder in top dead center on its compression stroke, and adjust valve clearance ①, ②, ③ and ⑥.
2. Set No. 4 cylinder in top dead center on its compression stroke, and adjust valve clearance ④, ⑤, ⑦ and ⑧.

Valve clearance:

Intake ②, ④, ⑥ and ⑧

0.35 mm (0.014 in)

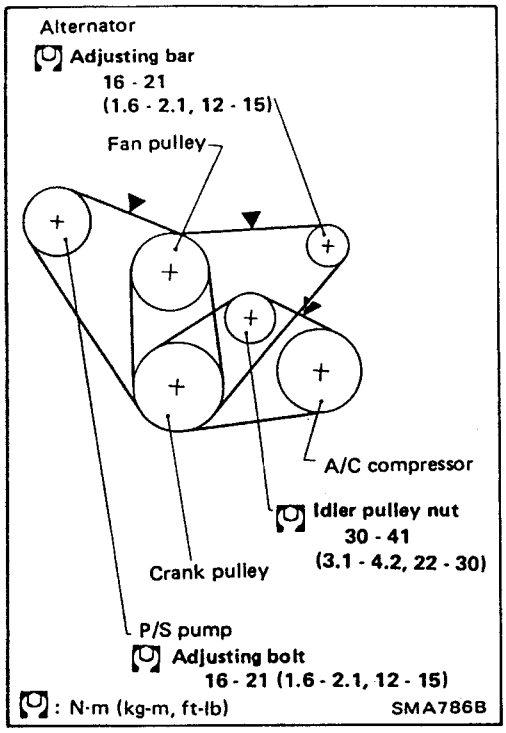
Exhaust ①, ③, ⑤ and ⑦

0.35 mm (0.014 in)

Adjusting screw lock nuts

⟲ : **14 - 18 N·m**

(1.4 - 1.8 kg-m, 10 - 13 ft-lb)



Drive Belt Inspection

1. Inspect for cracks, fraying, wear or oil adhesion. Replace if necessary.

The belts should not touch the bottom of the pulley groove.

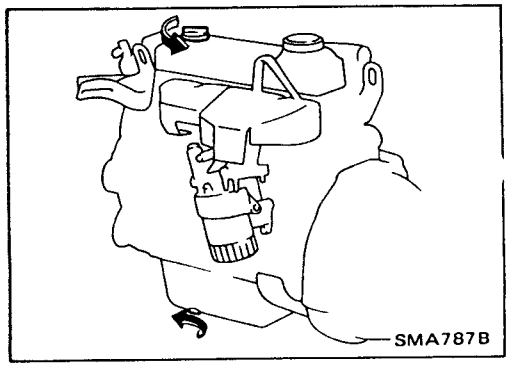
2. Check drive belt deflection by pushing on the belt midway between pulleys.

Adjust if belt deflections exceed the limit.

Unit: mm (in)

	Used belt deflection		Set deflection of new belt
	Limit	Adjusted deflection	
Alternator	20 (0.79)	11 - 13 (0.43 - 0.51)	9 - 11 (0.35 - 0.43)
Air conditioner compressor	12 (0.47)	6 - 7.5 (0.236 - 0.295)	5 - 6.5 (0.197 - 0.256)
Power steering oil pump	15 (0.59)	8 - 9.5 (0.315 - 0.374)	7 - 8.5 (0.276 - 0.335)
Applied pushing force	98 N (10 kg, 22 lb)		

Check drive belt deflections when engine is cold.
If engine is hot, check deflections after 30 minutes or more.



Changing Engine Oil

1. Warm up engine, and check for oil leakage from engine components.
2. Remove oil filler cap and drain plug.
3. Drain oil and fill with new engine oil.

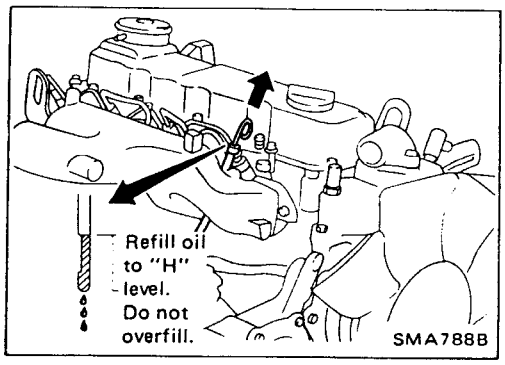
Oil capacity:

Refer to the GI section of applicable Service Manuals because oil capacity differs between models.

WARNING:

- **Be careful not to burn yourself, as the engine oil may be hot.**
- **Be sure to clean and install oil pan drain plug with washer.**
  : Drain plug
  44 - 54 N·m
  (4.5 - 5.5 kg-m, 33 - 40 ft-lb)
- **Use recommended engine oil. Refer to GI section.**

Changing Engine Oil (Cont'd)



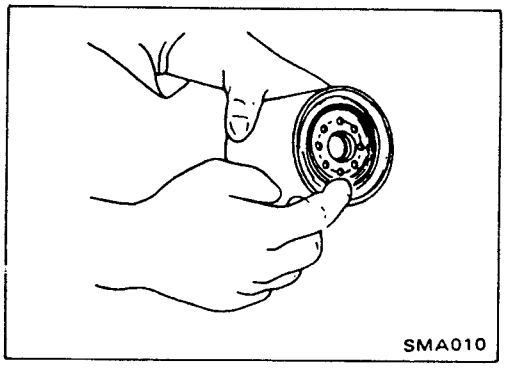
4. Check oil level.
5. Start engine. Check area around drain plug and oil filter for any sign of oil leakage.
6. Run engine for a few minutes, then turn it off. After several minutes check oil level.

Changing Oil Filter

1. Remove oil filter with a suitable wrench.

WARNING:

Be careful not to burn yourself as engine and engine oil is hot.

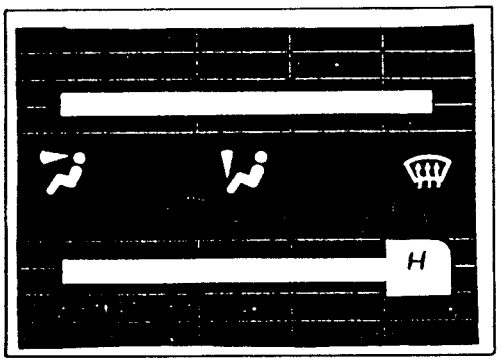


2. Before installing new oil filter, smear a little engine oil on rubber seal of oil filter and mounting surface on cylinder block.
3. Install oil filter.

When installing oil filter, screw it in until a slight resistance is felt, then tighten an additional 2/3 turn or more.

4. Add engine oil.

Refer to Changing Enging Oil.

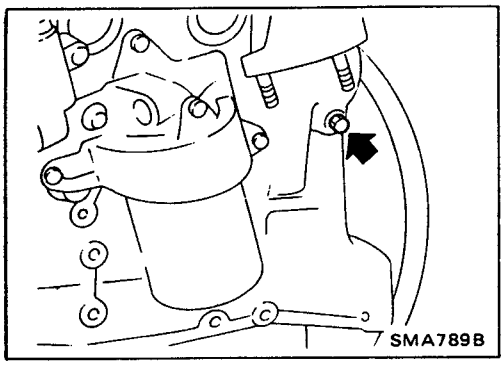


Changing Engine Coolant

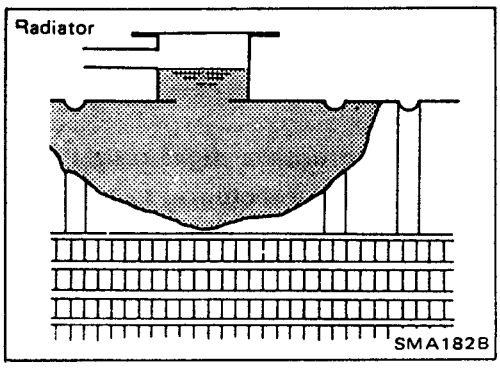
WARNING:

To avoid the danger of being scalded, never attempt to change the coolant when the engine is hot.

1. Set heater "TEMP" control lever all the way to "HOT" position.
2. Open drain cock at the bottom of radiator, and remove radiator cap.



3. Remove cylinder block drain plug located at left rear of cylinder block.
4. Drain coolant and then tighten drain plug securely.
5. Fill radiator with water and warm up engine.
6. Stop engine and wait until it cools down.
7. Repeat step 2 through step 5 two or three times.
8. Drain water.



9. Fill radiator with coolant up to filler opening.
   Follow instructions attached to anti-freeze container for mixing ratio of anti-freeze to water.

Coolant capacity:

Refer to the GI section of applicable Service Manuals because coolant capacity differs between models.

Slowly pour coolant through coolant filler neck to allow air in system to escape.

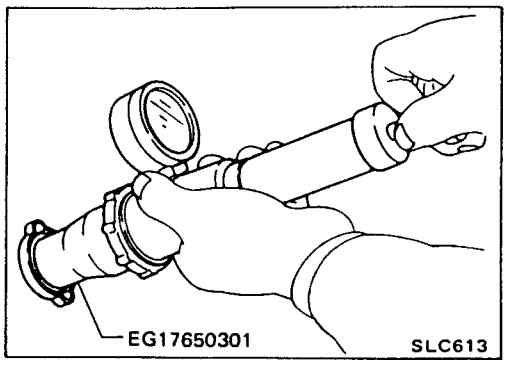
10. Fill reservoir tank up to "MAX" level.
11. Run the engine at approximately 2,000 rpm for about one minute.
12. Stop engine and cool it down, then refill the radiator and the reservoir tank.

Checking Cooling System

CHECKING HOSES

Check hoses for proper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.

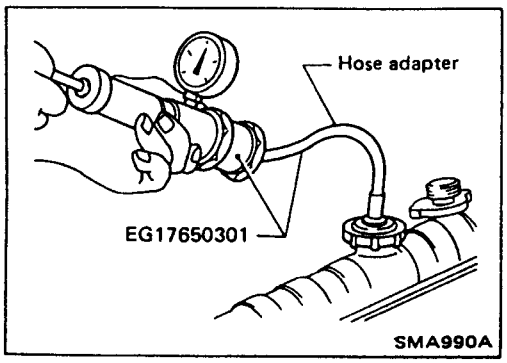
Checking Cooling System (Cont'd)



CHECKING RADIATOR CAP

Apply pressure to radiator cap by means of a cap tester to see if it is satisfactory.

Radiator cap relief pressure:
78 - 98 kPa
(0.78 - 1.0 bar, 0.8 - 1.0 kg/cm², 11 - 14 psi)

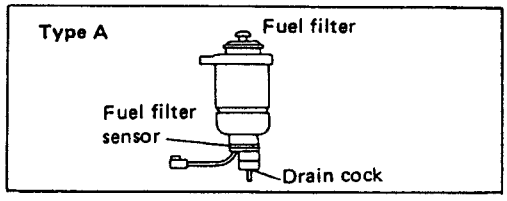


CHECKING COOLING SYSTEM FOR LEAKS

Apply pressure to the cooling system by means of a tester to check for leakage.

Testing pressure:
157 kPa (1.57 bar, 1.6 kg/cm², 23 psi)

CAUTION:
Higher than the specified pressure may cause radiator damage.

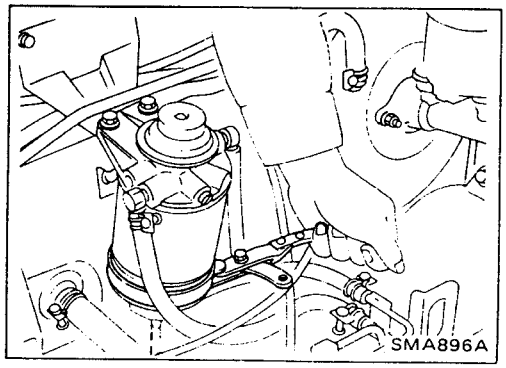


Checking and Replacing Fuel Filter and Draining Water

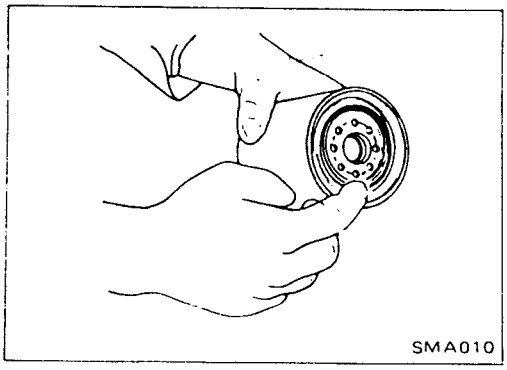
Be careful not to spill fuel in engine compartment. Place a rag to absorb fuel.

REPLACING FUEL FILTER

1. Remove fuel filter sensor and drain fuel. (Type A)



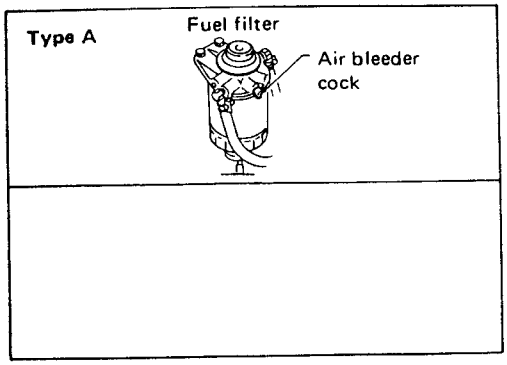
2. Remove fuel filter, using suitable tool.



3. Wipe clean fuel filter mounting surface on fuel filter bracket and smear a little fuel on rubber seal of fuel filter.
4. Screw fuel filter on until a slight resistance is felt, then tighten an additional more than 2/3 turn.
5. Install fuel filter sensor to new fuel filter. (Type A)
6. Bleed air from fuel line.

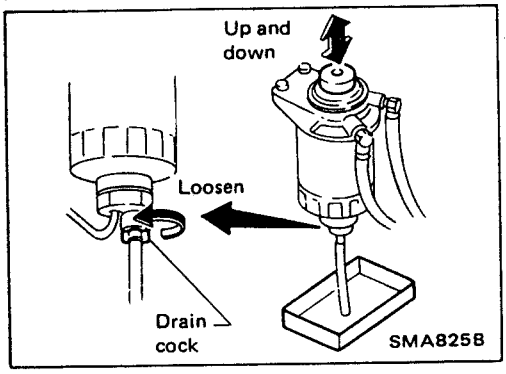
   Refer to Bleeding Fuel System in EF section.
7. Start engine and check for leaks.

Checking and Replacing Fuel Filter and Draining Water (Cont'd)



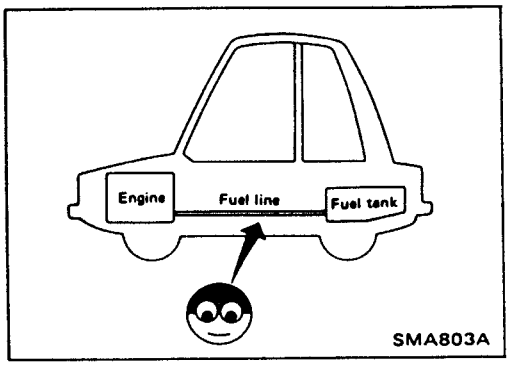
DRAINING WATER

1. (Type A)
   Loosen air bleeder cock of fuel filter cover (If so equipped).



2. Loosen drain cock and drain water.
   Loosening drain cock 4 to 5 turns causes water to start draining. Do not remove drain cock by loosening it excessively.
   In the case of a fuel filter cover not equipped with an air bleeder cock, if water does not drain properly, move the priming pump up and down.
3. Bleed air.
   Refer to section EF for fuel system bleeding instructions.

Checking Fuel System

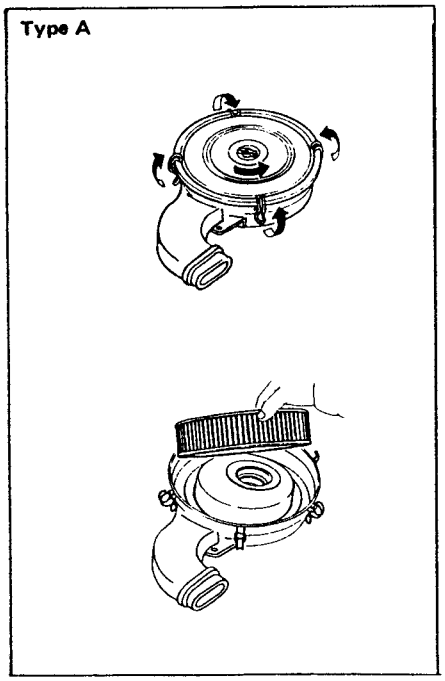


Check fuel lines and tank for proper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.

CAUTION:

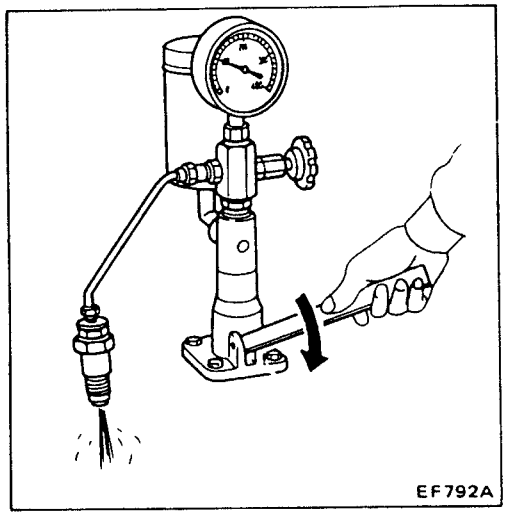
- **Keep clean parts with compressed air when assembling.**
- **Do not reuse fuel hose clamps after loosening them.**

Cleaning and Replacing Air Cleaner Filter



Replacing Air Cleaner Filter (Viscous Paper type)

The viscous paper type air cleaner filter does not require any cleaning operation between renewal.



Checking Injection Nozzle

WARNING:

When using nozzle tester, do not allow fuel sprayed from nozzle to contact your hand or body, and make sure that your eyes are properly protected with goggles.

1. Check initial injection pressure by pumping tester handle one time per second.

Initial injection pressure:

Used Nozzle

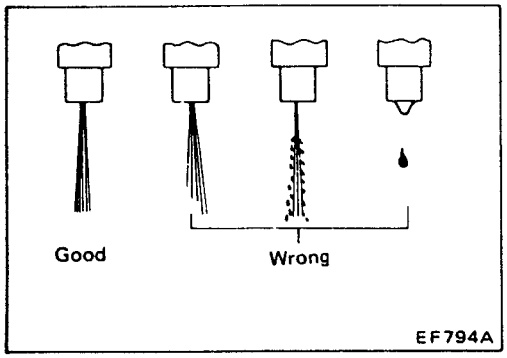
9,807 - 10,297 kPa
(98.1 - 103.0 bar, 100 - 105 kg/cm², 1,422 - 1,493 psi)

New Nozzle

10,297 - 11,278 kPa
(103.0 - 112.8 bar, 105 - 115 kg/cm², 1,493 - 1,635 psi)

- Always check initial injection pressure before installing new nozzle.

Checking Injection Nozzle (Cont'd)



2. Check spray pattern by pumping tester handle 4 to 6 times or more per second.
3. If spray pattern is not correct, clean injection nozzle tip or replace it.

- For details, refer to INJECTION NOZZLE ASSEMBLY in EF section.

▽ : **Injection nozzle to cylinder head**
54 - 64 N·m
(5.5 - 6.5 kg-m, 40 - 47 ft-lb)
Spill tube nut
29 - 39 N·m
(3.0 - 4.0 kg-m, 22 - 29 ft-lb)
Injection tube
20 - 25 N·m
(2.0 - 2.5 kg-m, 14 - 18 ft-lb)

Checking Idle Speed

Preparation

1. Make sure that injection timing is correct.
2. Make sure that injection nozzles are in good condition.
3. Make sure that the following parts are in good condition.

- Air cleaner clogging
- Glow system
- Engine oil and coolant levels
- Valve clearance
- Air intake system (Oil filler cap, oil level gauge, etc.)

4. Set shift lever in "Neutral" position. Engage parking brake and lock both front and rear wheels with wheel chocks.
5. Turn off air conditioner, lights and accessories.

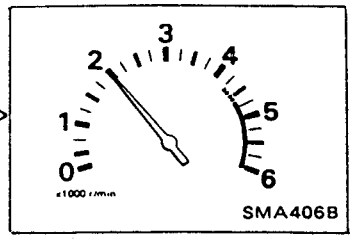
Checking Idle Speed (Cont'd)

- Warm up engine until water temperature indicator points to middle of gauge.
- Lights, heater fan and all accessories are off.
- Attach tachometer's pick-up to No. 1 fuel injection tube.

In order to take accurate reading of engine rpm, remove clamps that secure No. 1 fuel injection tube.

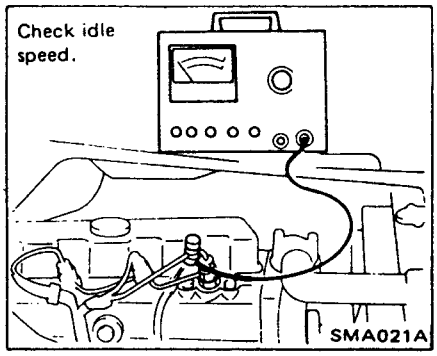
Start engine.

Run engine at about 2,000 rpm for about 2 minutes under no-load.



Run engine for one minute at idle speed.

Check idle speed.

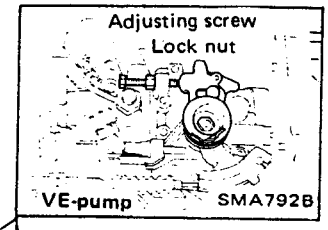


Check idle speed.

IDLE SPEED:
700 ± 50 rpm

O.K.

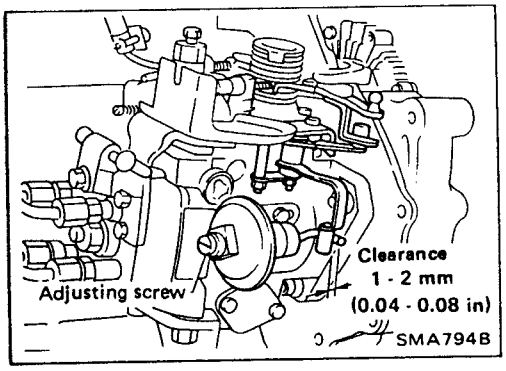
N.G.



Adjust idle speed by turning idle speed adjusting screw.

END

- Race engine two or three times and allow engine to return to idle speed. If idle speed is not within the specified range, check acceleration linkage for binding and correct it if necessary.



Checking Idle Speed (Cont'd)

AIR CONDITIONER EQUIPPED MODEL

1. Make certain that the clearance between the actuator idle control lever pin and the injection pump control lever is within the specified limits.
2. Adjust idle speed to specified rpm without the air conditioner operating.
3. Then check the idle speed when the air conditioner is operating and make sure it is correct.

Unit: rpm

Idle speed (Air conditioner "ON")	850±50

If not, adjust it by turning F.I.C.D. actuator stroke adjusting screw.

Engine Maintenance

INSPECTION AND ADJUSTMENT

Drive belt deflection

Unit: mm (in)

	Used belt deflection		Set deflection of new belt
	Limit	Adjusted deflection	
Alternator	20 (0.79)	11 - 13 (0.43 - 0.51)	9 - 11 (0.35 - 0.43)
Air conditioner compressor	12 (0.47)	6 - 7.5 (0.236 - 0.295)	5 - 6.5 (0.197 - 0.256)
Power steering oil pump	15 (0.59)	8 - 9.5 (0.315 - 0.374)	7 - 8.5 (0.276 - 0.335)
Applied pushing force	98 N (10 kg, 22 lb)		

Inspect drive belt deflections when engine is cold.
If engine is hot, check deflections in 30 minutes or more.

Injection nozzle

Injection pressure kPa (bar, kg/cm², psi)	
Used nozzle	9,807 - 10,297 (98.1 - 103.0, 100 - 105, 1,422 - 1,493)
New nozzle	10,297 - 11,278 (103.0 - 112.8, 105 - 115, 1,493 - 1,635)

Valve clearance

Intake and exhaust	mm (in)	0.35 (0.014)

Idle speed

		F.I.C.D. OFF	F.I.C.D. ON
Idle speed	rpm	700±50	850±50

COOLING SYSTEM

Radiator cap relief pressure kPa (bar, kg/cm², psi)	88 (0.88, 0.9, 13)
Cooling system leakage testing pressure kPa (bar, kg/cm², psi)	157 (1.57, 1.6, 23)

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Intake manifold nut/bolt	15 - 20	1.5 - 2.0	11 - 14
Exhaust manifold nut	25 - 29	2.5 - 3.0	18 - 22
Alternator adjusting bar bolt	16 - 21	1.6 - 2.1	12 - 15
Idler pulley nut (A/C compressor)	30 - 41	3.1 - 4.2	22 - 30
P/S oil pump adjusting lock bolt	30 - 41	3.1 - 4.2	22 - 30
Oil pan drain plug	44 - 54	4.5 - 5.5	33 - 40
Injection nozzle to cylinder head	54 - 64	5.5 - 6.5	40 - 47
Spill tube nut	29 - 39	3.0 - 4.0	22 - 29
Injection tube flare nut	20 - 25	2.0 - 2.5	14 - 18
Valve clearance adjusting screw lock nut	14 - 18	1.4 - 1.8	10 - 13
Rocker cover screw	1 - 2	0.1 - 0.2	0.7 - 1.4
Cylinder block drain plug	29 - 39	3.0 - 4.0	22 - 29

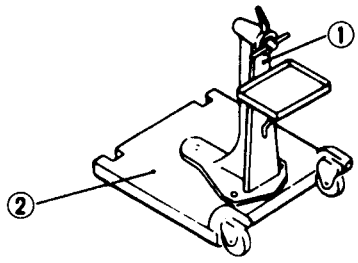
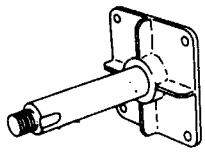
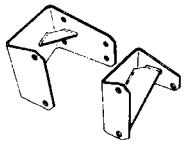
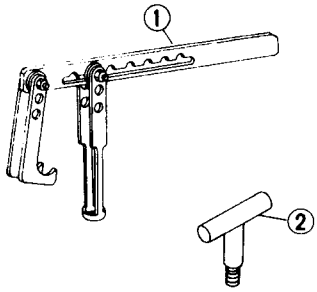
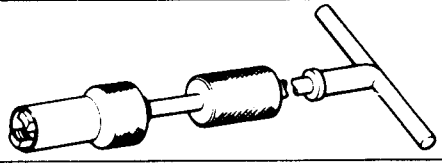
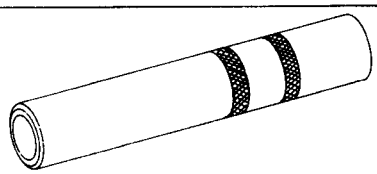
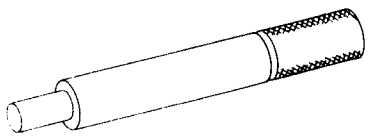
ENGINE MECHANICAL

SECTION EM

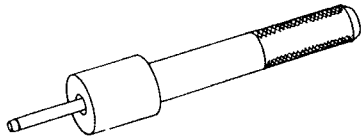
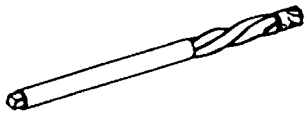
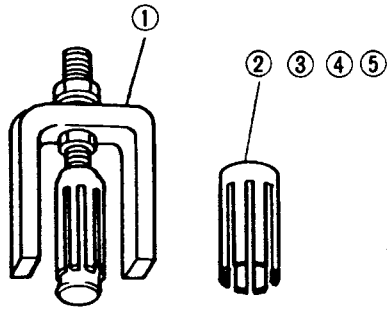
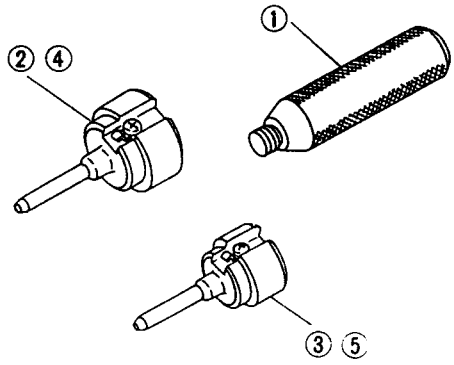
CONTENTS

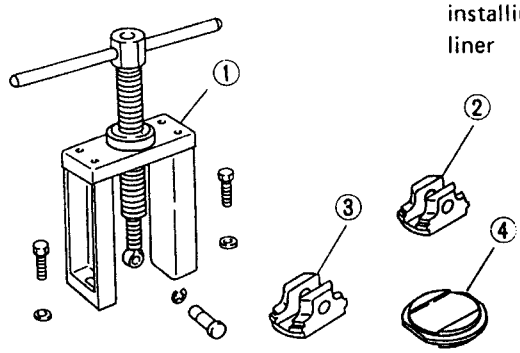
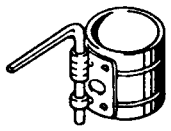
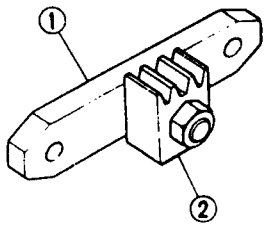
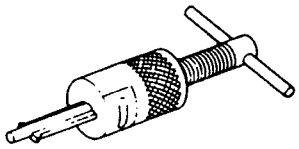
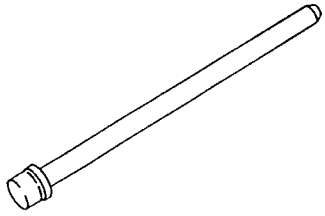
SPECIAL SERVICE TOOLS

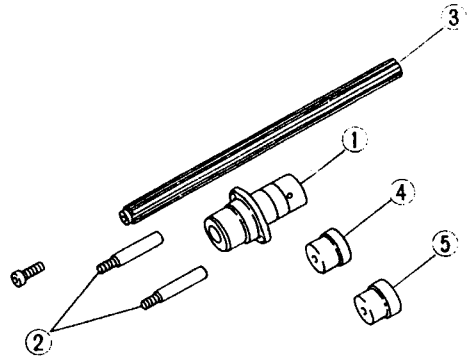
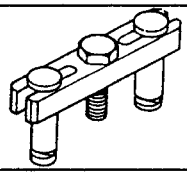
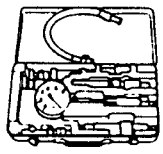
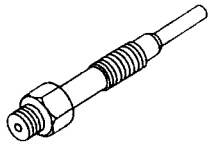
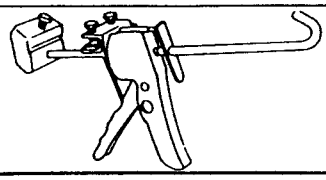
*: Special tool or commercial equivalent

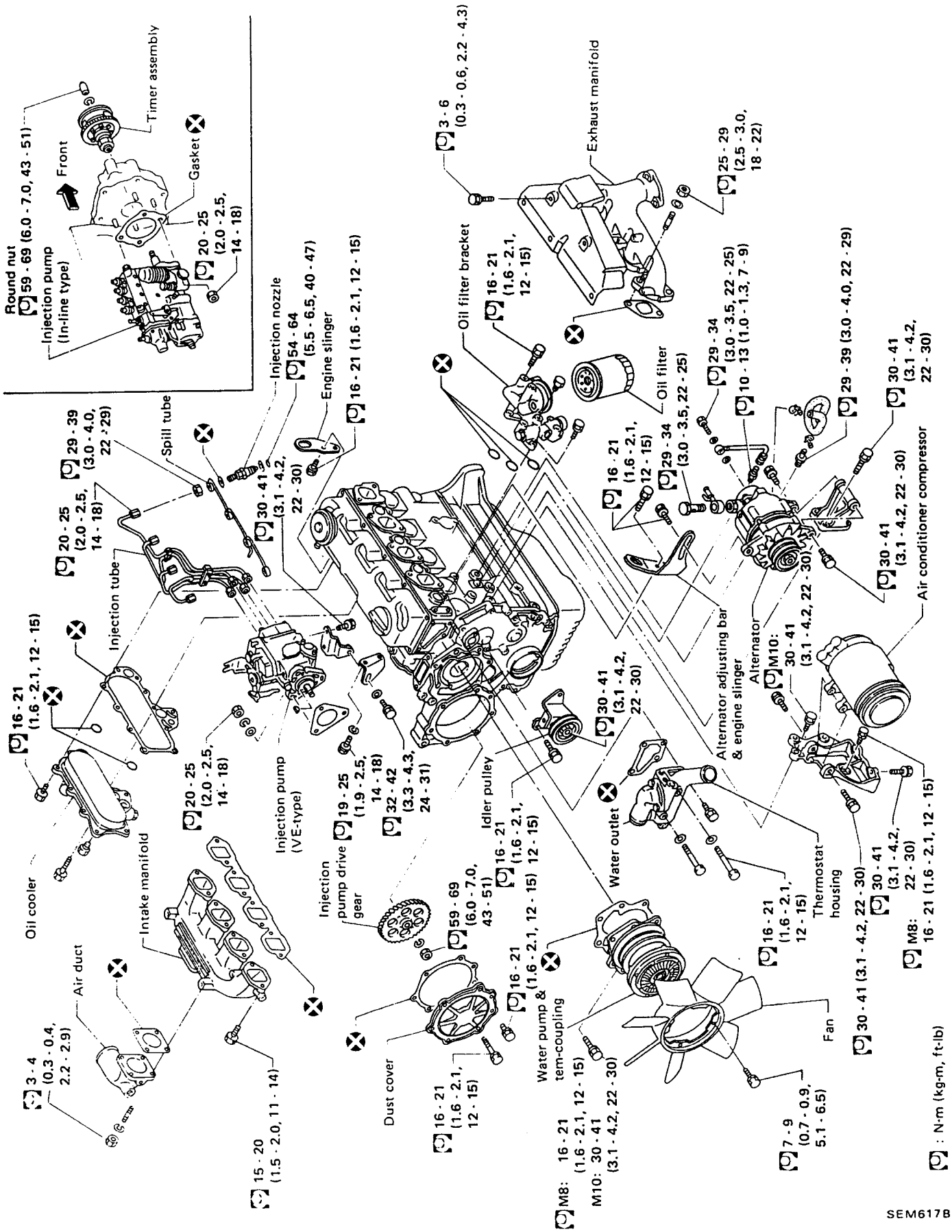
Tool number Tool name	Description		Engine application	
			TD23	TD27
ST0501S000* Engine stand assembly 1 ST05011000 Engine stand 2 ST05012000 Base		Disassembling and assembling	X	X
KV10106500* Engine stand shaft			X	X
KV11103200* Engine attachment			X	X
① KV10109210* Valve spring compressor ② KV10111200* Adapter		Disassembling and assembling valve components	X	⊗
KV10107900* Valve oil seal puller		Disassembling valve oil seal	X	⊗
KV11103400 Valve oil seal drift		Installing valve oil seal	X	⊗
ST11033000* Valve guide drift		Removing valve guide	X	⊗

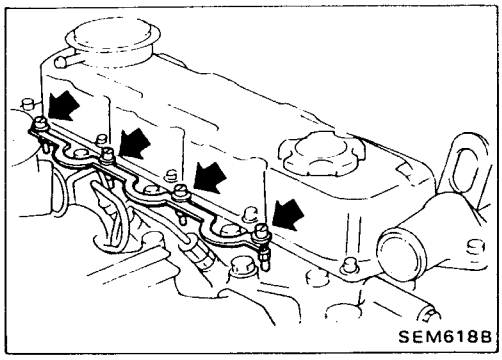
⊗BASIC TOOL REQUIREMENT

Tool number Tool name	Description	Engine application	
		TD23	TD27
KV11103900* Valve guide drift	 Installing valve guide	X	⊗
ST11032000* Valve guide reamer 8.0 mm (0.315 in) dia.	 Reaming valve guide	X	⊗
① KV11101110 Valve seat remover ② KV11103510 Adapter (Intake) ③ KV11103520 Adapter (Exhaust) ④ KV11103610 Adapter (Intake) ⑤ KV11103620 Adapter (Exhaust)	 Removing valve seat	X X X – –	X – – X X
① ST15243000 Valve seat drift ② KV11103710 Adapter (Intake) ③ KV11103720 Adapter (Exhaust) ④ KV11103810 Adapter (Intake) ⑤ KV11103820 Adapter (Exhaust)	 Installing valve seat	X X X – –	X – – X X

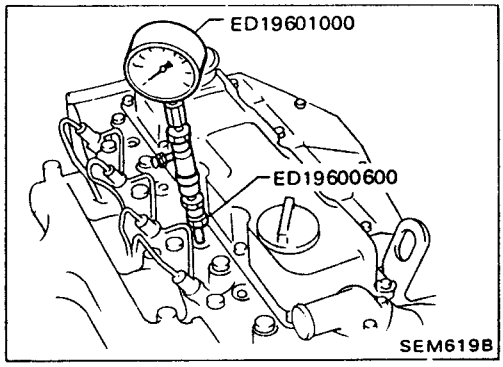
Tool number Tool name	Description		Engine application	
			TD23	TD27
① KV11104010 Cylinder liner tool ② KV11104020 Adapter for removing ③ KV11104110 Adapter for removing ④ KV11104030 Adapter for installing		Removing and installing cylinder liner	X X – X	X – X X
EM03470000* Piston ring compressor		Installing piston into cylinder	X	⊗
KV111033S0 Engine stopper ① KV11103310 Stopper plate ② KV10105630 Stopper gear		Preventing crankshaft from rotating	X	X
ST16610001* Pilot bushing puller		Removing pilot bushing	X	X
KV11104300* Cam bushing remover bar		Removing cam bushing	X	X

Tool number Tool name	Description	Engine application	
		TD23	TD27
KV111042S0 Cam bushing replacer set ① KV11104210 Replacer guide (Front) ② KV11104220 Guide bolt ③ KV11104230 Replacer bar ④ KV11104240 Adapter (4th and rear) ⑤ KV11104250 Adapter (2nd and 3rd)	Installing cam bushing 	X	X
KV10109300* Injection pump drive gear holder	 Preventing drive gear from rotating (VE-type)	X	⊗
KV11103000* Injection pump drive gear puller	 Removing drive gear (VE-type)	X	⊗
ED19601000 Compression gauge ED19600600 Compression gauge adapter	  Checking compression pressure	X	⊗
WS39930000* Tube presser	 Pressing the tube of liquid gasket	X	⊗

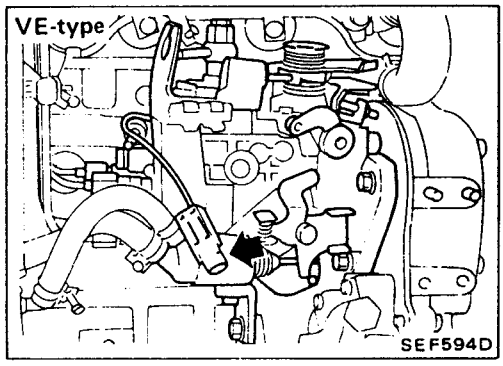

Round nut
59 - 69 (6.0 - 7.0, 43 - 51)
Injection pump (In-line type)
Front
Timer assembly
Gasket
20 - 25 (2.0 - 2.5, 14 - 18)
Injection nozzle
54 - 64 (5.5 - 6.5, 40 - 47)
Engine slinger
16 - 21 (1.6 - 2.1, 12 - 15)
Spill tube
29 - 39 (3.0 - 4.0, 22 - 29)
20 - 25 (2.0 - 2.5, 14 - 18)
30 - 41 (3.1 - 4.2, 22 - 30)
Injection tube
16 - 21 (1.6 - 2.1, 12 - 15)
Oil cooler
Intake manifold
Air duct
3 - 4 (0.3 - 0.4, 2.2 - 2.9)
15 - 20 (1.5 - 2.0, 11 - 14)
20 - 25 (2.0 - 2.5, 14 - 18)
Injection pump (VE-type)
19 - 25 (1.9 - 2.5, 14 - 18)
32 - 42 (3.3 - 4.3, 24 - 31)
Injection pump drive gear
59 - 69 (6.0 - 7.0, 43 - 51)
16 - 21 (1.6 - 2.1, 12 - 15)
Dust cover
16 - 21 (1.6 - 2.1, 12 - 15)
Idler pulley
16 - 21 (1.6 - 2.1, 12 - 15)
Water pump & tem-coupling
M8: 16 - 21 (1.6 - 2.1, 12 - 15)
M10: 30 - 41 (3.1 - 4.2, 22 - 30)
Water outlet
30 - 41 (3.1 - 4.2, 22 - 30)
3 - 6 (0.3 - 0.6, 2.2 - 4.3)
Oil filter bracket
16 - 21 (1.6 - 2.1, 12 - 15)
Exhaust manifold
25 - 29 (2.5 - 3.0, 18 - 22)
Oil filter
16 - 21 (1.6 - 2.1, 12 - 15)
29 - 34 (3.0 - 3.5, 22 - 25)
Alternator adjusting bar & engine slinger
29 - 34 (3.0 - 3.5, 22 - 25)
10 - 13 (1.0 - 1.3, 7 - 9)
Alternator
M10: 30 - 41 (3.1 - 4.2, 22 - 30)
29 - 39 (3.0 - 4.0, 22 - 29)
30 - 41 (3.1 - 4.2, 22 - 30)
30 - 41 (3.1 - 4.2, 22 - 30)
Air conditioner compressor
Thermostat housing
16 - 21 (1.6 - 2.1, 12 - 15)
30 - 41 (3.1 - 4.2, 22 - 30)
M8: 16 - 21 (1.6 - 2.1, 12 - 15)
Fan
30 - 41 (3.1 - 4.2, 22 - 30)
7 - 9 (0.7 - 0.9, 5.1 - 6.5)
: N·m (kg-m, ft-lb)
SEM617B



1. Warm up engine.
2. Remove glow plate and glow plugs.



3. Fit compression gauge adapter to cylinder head.
   : **Compression gauge adapter**
   15 - 20 N·m
   (1.5 - 2.0 kg-m, 11 - 14 ft-lb)



4. **Set no fuel injected condition.**
- VE-type
  Disconnect fuel cut solenoid wire.

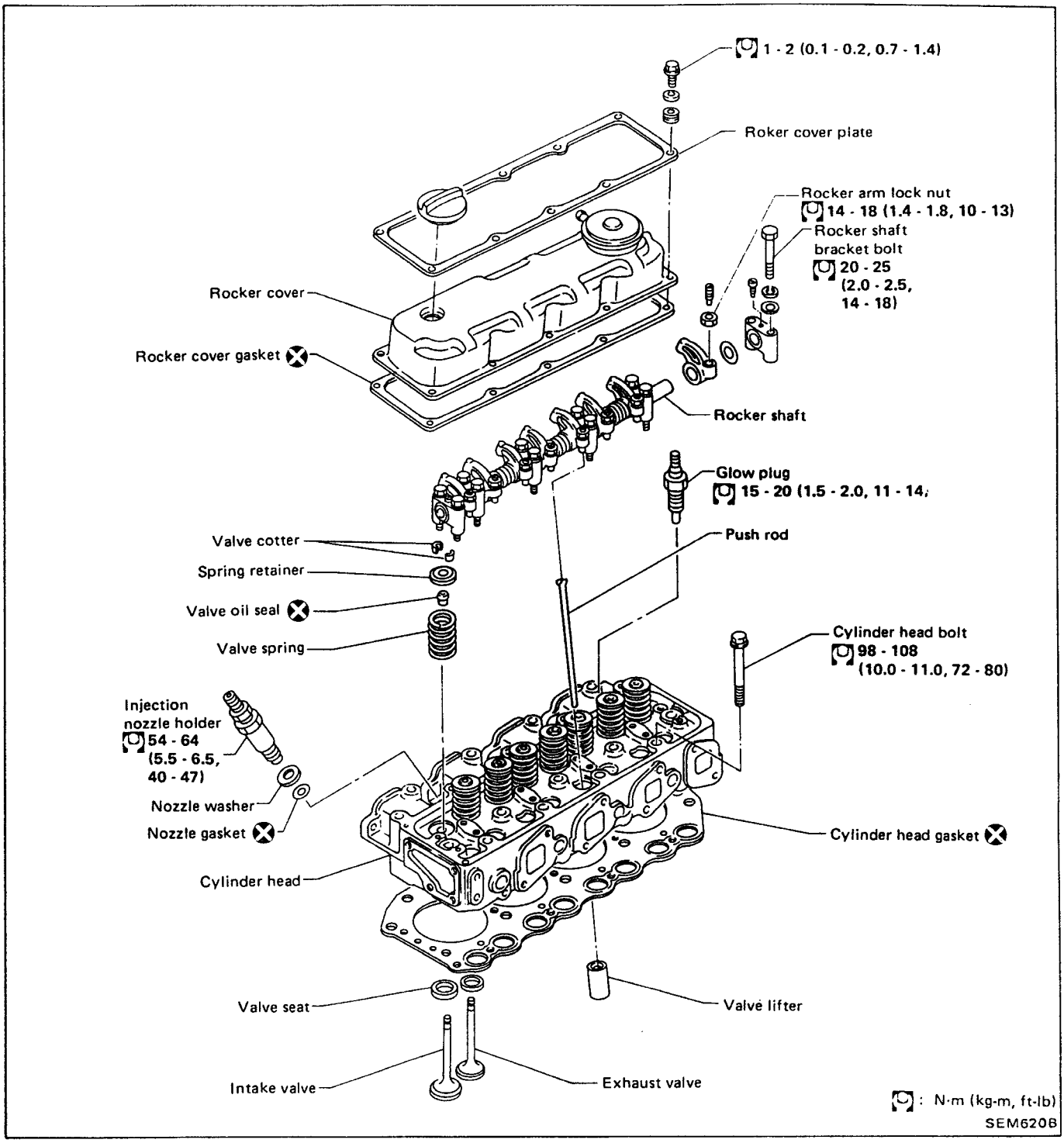
5. **Engine compression measurement should be made as quickly as possible.**

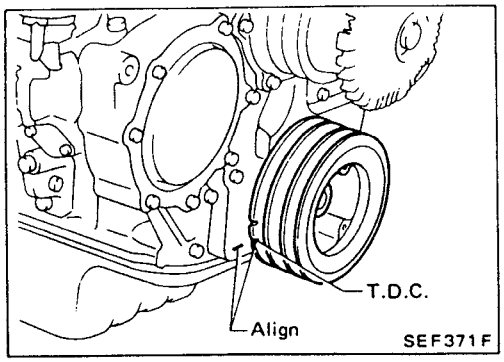
Compression pressure:

Unit: kPa (bar, kg/cm^2, psi)/200 rpm

Standard	2,942 (29.4, 30, 427)
Minimum	2,452 (24.5, 25, 356)
Differential limit between cylinders	294 (2.9, 3, 43)

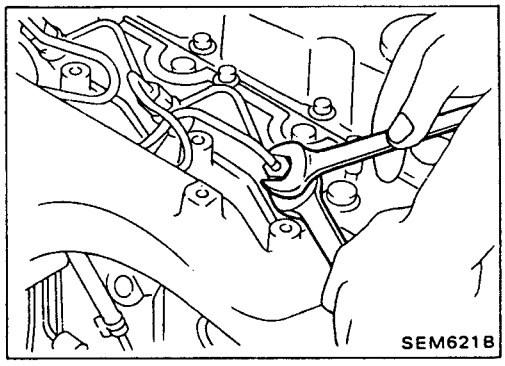
6. If cylinder compression in one or more cylinders is low, pour a small quantity of engine oil into cylinders through the glow holes and retest compression.
- If adding oil helps the compression pressure, chances are that piston rings are worn or damaged.
- If pressure stays low, valve may be sticking or seating improperly.
- If cylinder compression in any two adjacent cylinders is low, and if adding oil does not help the compression, there is leakage past the gasketed surface.
  Oil and water in combustion chambers can result from this problem.


1 - 2 (0.1 - 0.2, 0.7 - 1.4)
Roker cover plate
Rocker arm lock nut
14 - 18 (1.4 - 1.8, 10 - 13)
Rocker shaft bracket bolt
20 - 25 (2.0 - 2.5, 14 - 18)
Rocker cover
Rocker cover gasket
Rocker shaft
Glow plug
15 - 20 (1.5 - 2.0, 11 - 14)
Valve cotter
Spring retainer
Valve oil seal
Valve spring
Push rod
Cylinder head bolt
98 - 108 (10.0 - 11.0, 72 - 80)
Injection nozzle holder
54 - 64 (5.5 - 6.5, 40 - 47)
Nozzle washer
Nozzle gasket
Cylinder head gasket
Cylinder head
Valve seat
Valve lifter
Intake valve
Exhaust valve
: N·m (kg-m, ft-lb)
SEM620B

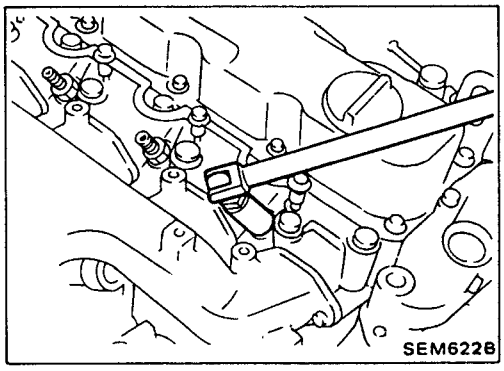


Removal

1. Set No. 1 cylinder at T.D.C. on its compression stroke.
2. Drain engine coolant.
3. Remove air cleaner and/or air duct.
4. Remove alternator adjusting bolt.
5. Disconnect exhaust manifold from front exhaust tube.
6. Disconnect radiator outlet hose and thermostat housing water inlet hose.

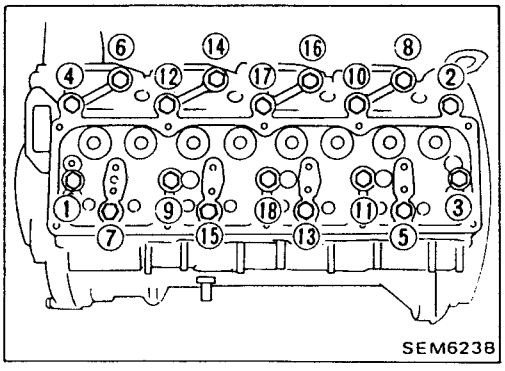


7. Remove fuel injection tube assembly and spill tube.



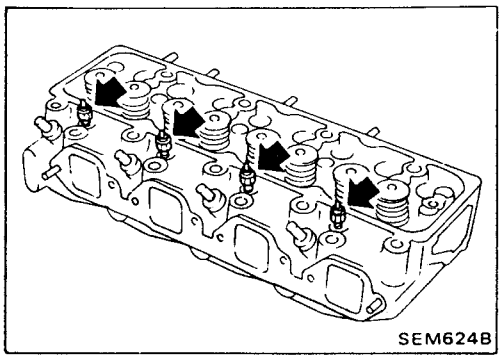
8. Remove injection nozzle holder and top nozzle gasket using deep socket wrench.

9. Remove rocker cover.
10. Remove rocker shaft with rocker arms.
11. Remove push rods.



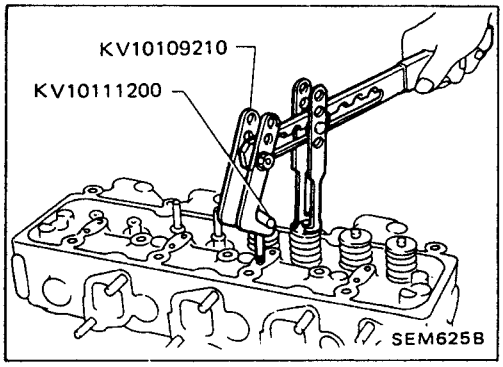
12. Remove cylinder head bolts in numerical order and remove cylinder head.

Head warpage or cracking could result from removing in incorrect order.

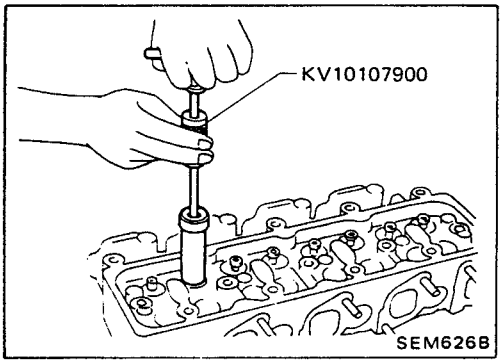


Disassembly

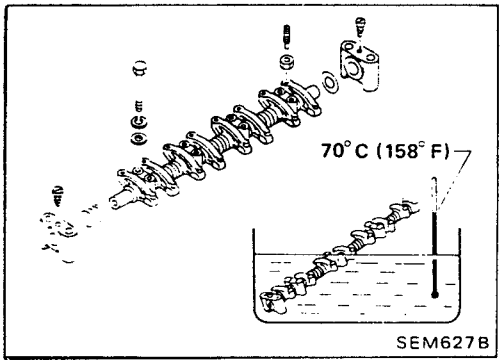
1. Remove following parts:
- Intake manifold
- Exhaust manifold
- Thermostat housing
- Alternator adjusting bar & engine slinger
- Glow plate and glow plugs



2. Remove valve component parts with Tool.

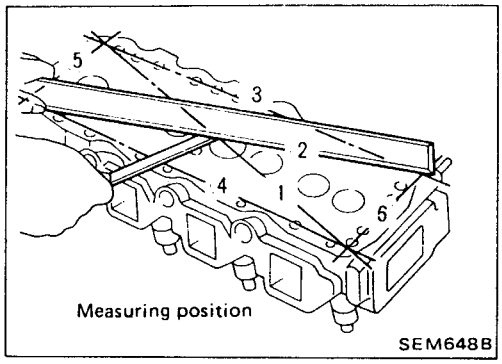


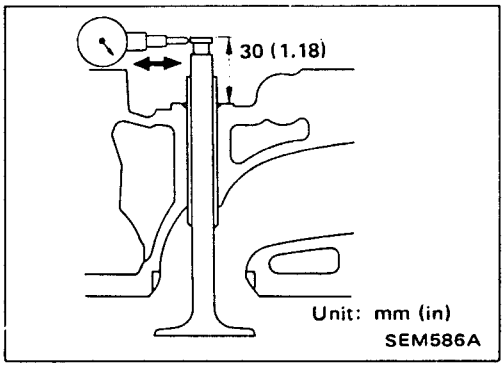
3. Remove valve oil seals with Tool.

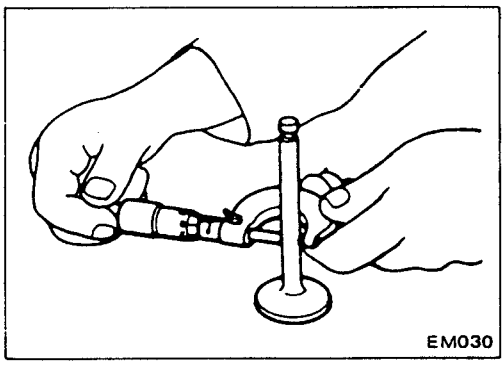


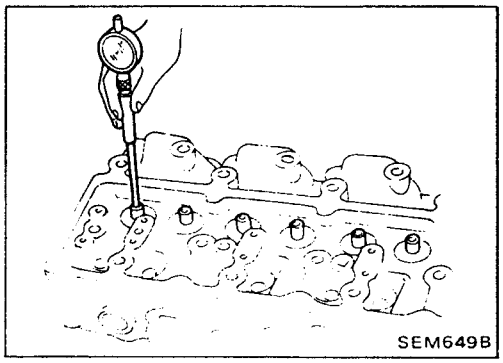
4. Disassemble rocker shaft assembly.
a. Remove rocker shaft lock bolt.
b. Remove valve rocker and rocker shaft bracket.

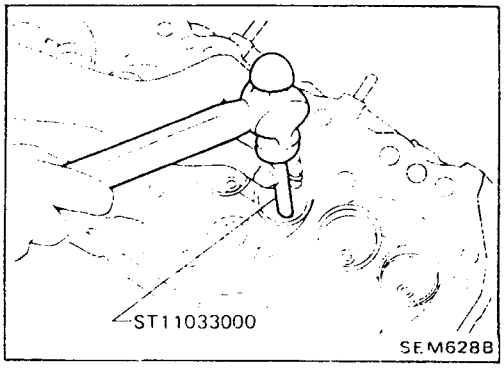
If it is difficult to remove rocker shaft bracket, immerse rocker shaft assembly in oil of 70°C (158°F) for a few minutes and then remove bracket.











CYLINDER HEAD DISTORTION

Cylinder head distortion:

Standard

Less than 0.07 mm (0.0028 in)

Limit

0.2 mm (0.008 in)

If beyond the specified limit, correct with a surface grinder. Cylinder head height should be greater than 89.7 mm (3.531 in) after surface has been ground.

VALVE GUIDE CLEARANCE

- **Valve guide clearance should be measured parallel with rocker arm. (Generally, a large amount of wear occurs in this direction.)**

Stem to guide clearance:

Limit

Intake	**0.15 mm (0.0059 in)**
Exhaust	**0.20 mm (0.0079 in)**

Maximum allowable deflection

(Dial indicator reading)

Intake	**0.30 mm (0.0118 in)**
Exhaust	**0.40 mm (0.0157 in)**

- **To determine the correct replacement part, measure valve stem diameter and valve guide inner diameter.**

Valve stem diameter:

Standard

Intake

7.962 - 7.977 mm (0.3135 - 0.3141 in)

Exhaust

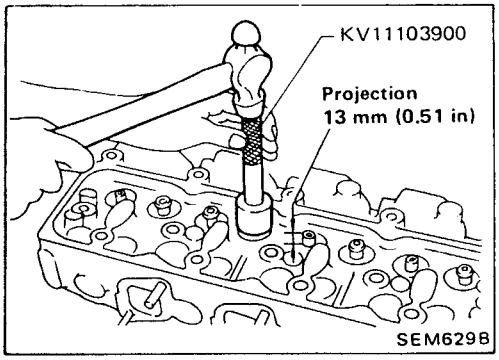
7.945 - 7.960 mm (0.3128 - 0.3134 in)

Valve guide inner diameter:

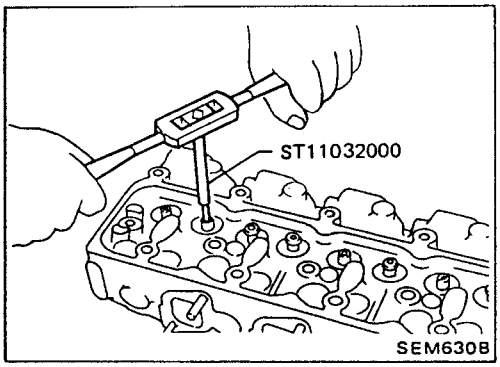
8.00 - 8.015 mm (0.3150 - 0.3156 in)

VALVE GUIDE REPLACEMENT

1. Drive out valve guide with a press [under a 20 kN (2t, 2.2 US ton, 2.0 Imp ton) pressure] or hammer, and suitable tool.



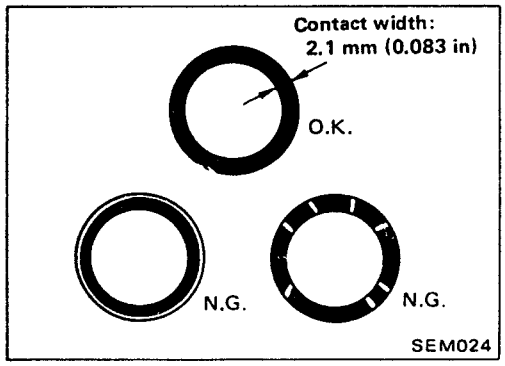
2. Press service valve guide onto cylinder head using suitable tool until the guide projects out 13 mm (0.51 in).



3. Ream valve guide.

Finished size:

8.000 - 8.015 mm (0.3150 - 0.3156 in)



VALVE SEATS

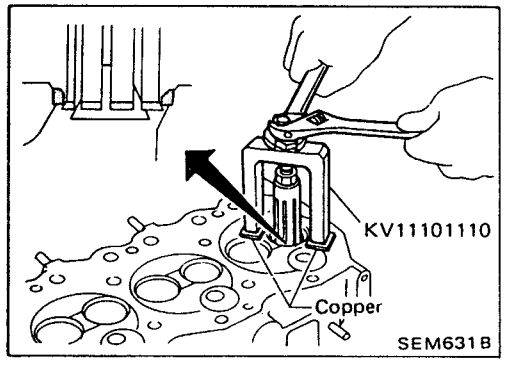
Check valve for any evidence of pitting at valve contact surface, and reseat or replace if worn out excessively.

- **When repairing valve seats, check valve and valve guide for wear beforehand. If worn, replace them. Then correct valve seat.**
- **The cutting should be done with both hands for uniform cutting.**

REPLACING VALVE SEAT FOR SERVICE PARTS

1. Bore out old seat until it collapses or remove valve seats with Tool.

Place a copper seat between contact surface of Tool and cylinder head.

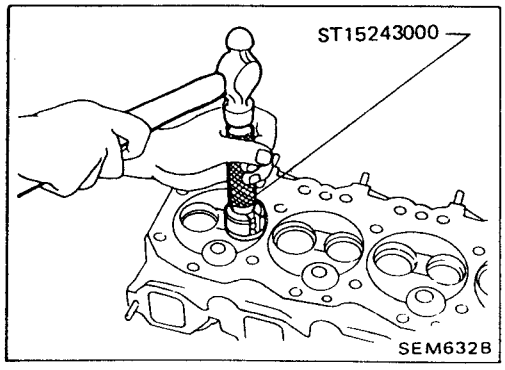


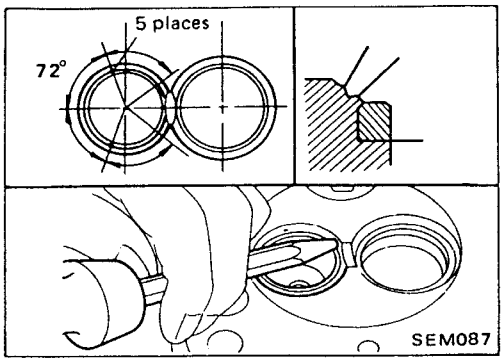
2. Place new valve seats on dry ice and allow them to cool for five minutes.

WARNING:

Do not touch cooled valve seats with bare hand.

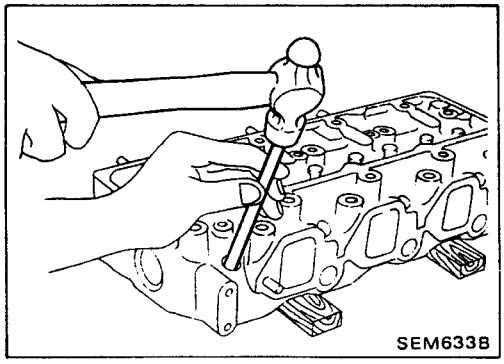
3. Heat cylinder head to 80°C (176°F).
4. Install cooled valve seats on cylinder head with Tool.





5. Stake exhaust valve seat at five places with punch.
When staking valve seat, select different places than those staked before.

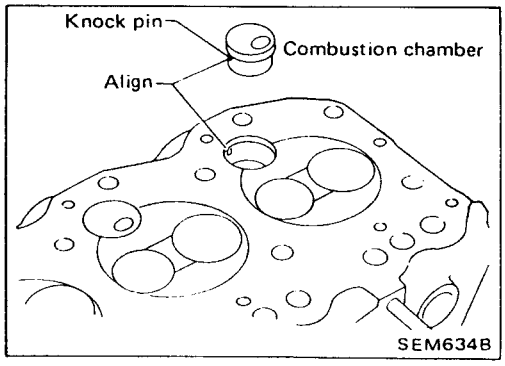
6. Cut or grind valve seat using suitable tool at the specified dimensions as shown in S.D.S.
7. After cutting, lap valve seat with a lapping compound.
8. Check contact condition of valve seat.



COMBUSTION CHAMBER
Check combustion chamber for cracks and other damage. If necessary, replace.

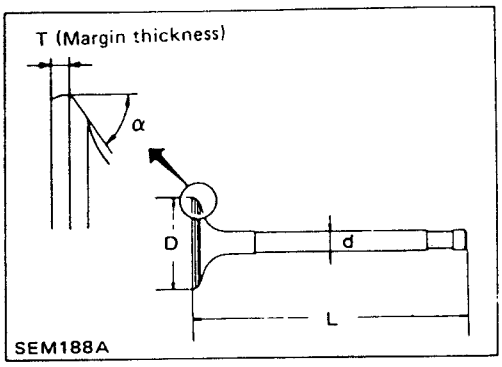
REPLACING COMBUSTION CHAMBER
Usually combustion chamber should not be removed.
1. **Remove combustion chamber so that cylinder head cannot be damaged.**
2. Install combustion chamber.
(1) Cool combustion chamber with dry ice for approximately 5 to 10 minutes.

WARNING:
Do not touch cooled combustion chamber with bare hand.



(2) Align combustion chamber knock pin with cylinder head notch, and drive in combustion chamber with a soft hammer.
3. Check amount of protrusion of combustion chamber.

Protrusion:
Standard
−0.05 to 0.10 mm (−0.0020 to 0.0039 in)

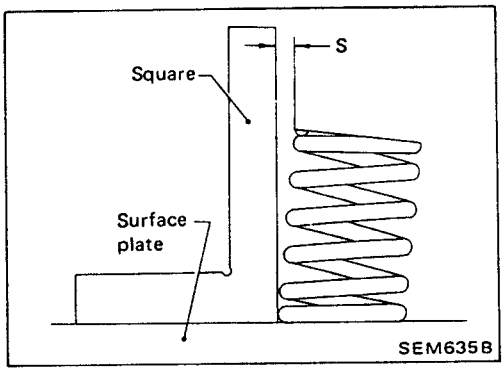


VALVE DIMENSIONS

Check dimensions in each valve. For dimensions, refer to S.D.S.

When valve head has been worn down to 0.5 mm (0.020 in) in margin thickness, replace the valve.

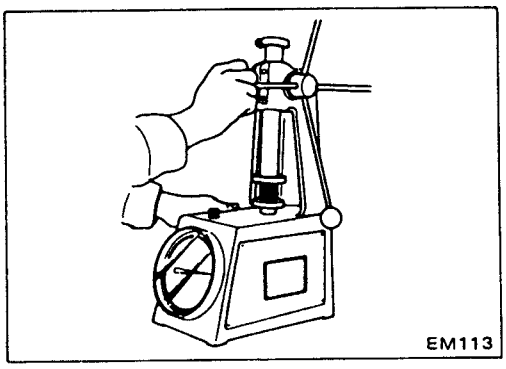
Grinding allowance for valve stem tip is 0.2 mm (0.008 in) or less.



VALVE SPRING SQUARENESS

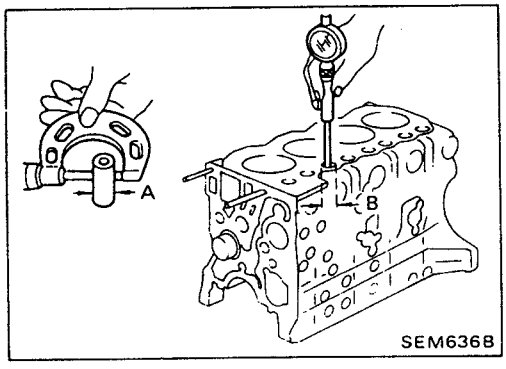
Out of square "S":

Less than 2.0 mm (0.079 in)



VALVE SPRING PRESSURE LOAD

Refer to S.D.S.



VALVE LIFTER AND PUSH ROD

Valve lifter

1. Check valve lifters for excessive wear on the face.
2. Replace with new ones if worn beyond repair.

a. Valve lifter end should be smooth.

b. Valve lifter to lifter hole clearance:

Standard

0.030 - 0.073 mm (0.0012 - 0.0029 in)

Limit

Less than 0.20 mm (0.0079 in)

Valve lifter outer diameter "A":

Standard

24.960 - 24.970 mm (0.9827 - 0.9831 in)

Cylinder block valve lifter hole diameter "B":

Standard

25.000 - 25.033 mm (0.9843 - 0.9855 in)

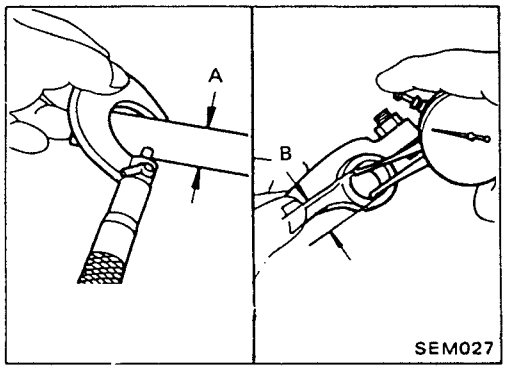
Push rod

1. Inspect push rod for excessive wear on the face.
2. Replace if worn or damaged beyond repair.
3. Check push rod for bend using a dial gauge.

Maximum allowable bend
(Total indicator reading):
Less than 0.5 mm (0.020 in)

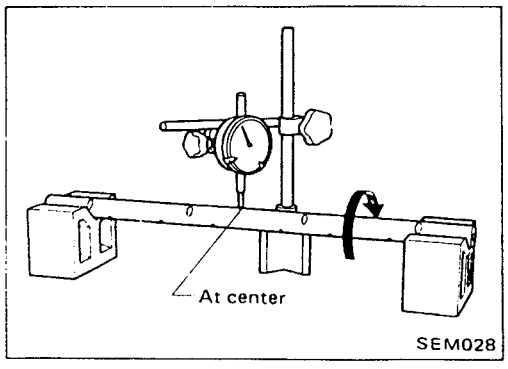
ROCKER SHAFT AND ROCKER ARM

1. Check valve rockers, brackets and rocker shafts for scoring, wear or distortion. Replace if necessary.



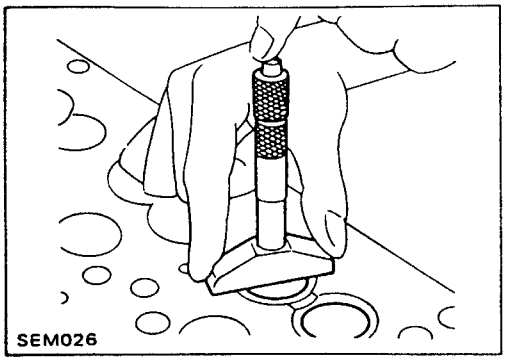
2. **Check clearance between valve rockers and rocker shaft. If specified clearance is exceeded, replace affected valve rockers or shafts.**

Specified clearance:
Limit
Less than 0.15 mm (0.0059 in)
Rocker shaft outer diameter "A":
Standard
19.979 - 20.000 mm (0.7866 - 0.7874 in)
Rocker arm inner diameter "B":
Standard
20.014 - 20.035 mm (0.7880 - 0.7888 in)



3. Check rocker shaft bend at its center. If bend is within specified limit, straighten it; and if it is greater than specified limit, replace rocker shaft.

Rocker shaft bend
(Total indicator reading):
Limit
Less than 0.3 mm (0.012 in)


SEM026

MEASURING CYLINDER HEAD TO VALVE DISTANCE

Measure distance from cylinder head surface to intake and exhaust valves. If specified distance is exceeded, replace valve(s) or valve seat(s).

Specified distance:

Standard

Intake

0.275 - 0.675 mm
(0.0108 - 0.0266 in)

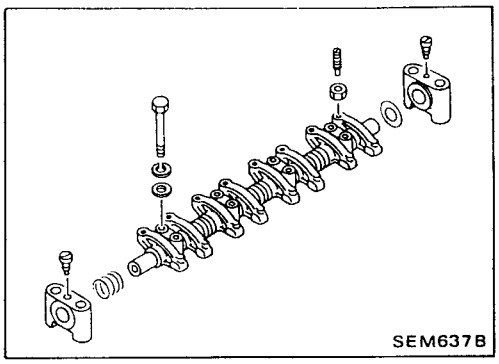
Exhaust

0.305 - 0.695 mm
(0.0120 - 0.0274 in)

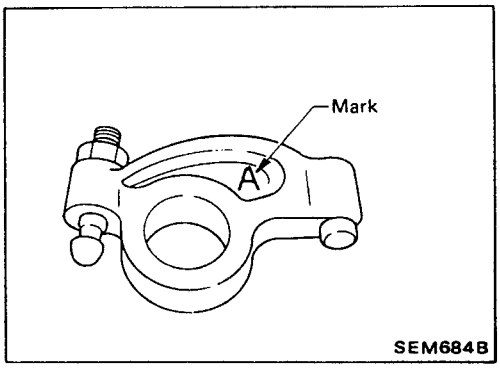
Limit

Less than

1.25 mm (0.0492 in)
for intake and exhaust valves


SEM637B

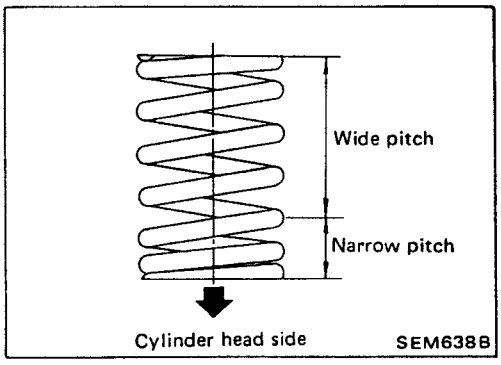
1. Assemble rocker shaft component parts.



SEM684B

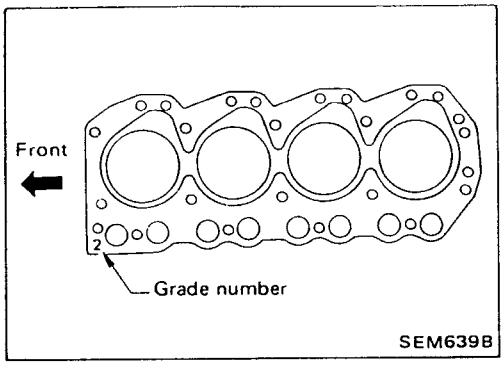
- Identification of rocker arms

Identification mark (on rocker arm)	Engine	For use with
A	TD23	Intake and exhaust
B	TD27	Intake
C	TD27	Exhaust



SEM638B

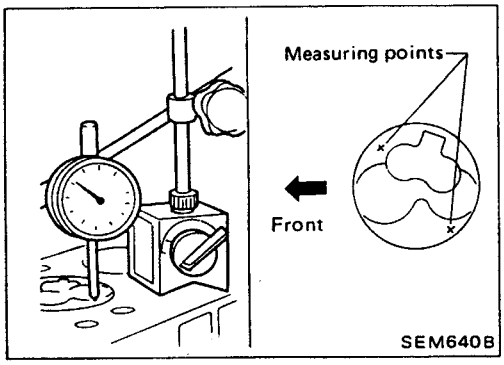
2. Install valve component parts.
- **Always use new valve oil seal. (Refer to OIL SEAL REPLACEMENT.)**
- **Install valve spring (uneven pitch type) with its narrow pitch side toward cylinder head side.**



1. Install cylinder head gasket.

a. When replacing only cylinder head gasket, install same grade gasket as the one formerly used.

b. When replacing or repairing cylinder block, cylinder head, piston, connecting rod and crankshaft, select gasket as follows:



(1) Measure piston projection.

- Set each piston at its Top Dead Center. With piston held in that position, measure its projections at two points.
- Calculate the average value of the two measurements.
- Determine the amount of projection of the other three pistons.

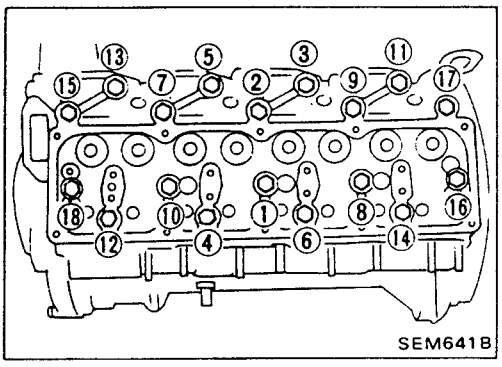
(2) Select suitable cylinder head gasket which conforms to the largest amount of projection of the four pistons.

Unit: mm (in)

Average values piston projections	Gasket thickness	Gasket grade number
Less than 0.118 (0.0046)	1.15 (0.0453)	1
0.118 - 0.168 (0.0046 - 0.0066)	1.20 (0.0472)	2
More than 0.168 (0.0066)	1.25 (0.0492)	3

Make sure that No. 1 piston is at T.D.C. on its compression stroke.

2. Install cylinder head.



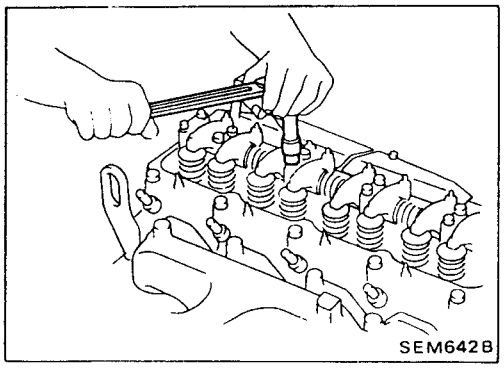
3. Apply oil to the thread portion and seat surface of bolts and tighten cylinder head bolts using Tool.

CAUTION:

- Tightening procedure

1st Tighten bolts to 49 - 59 N·m (5.0 - 6.0 kg-m, 36 - 43 ft-lb)

2nd Tighten bolts to 98 - 108 N·m (10.0 - 11.0 kg-m, 72 - 80 ft-lb)

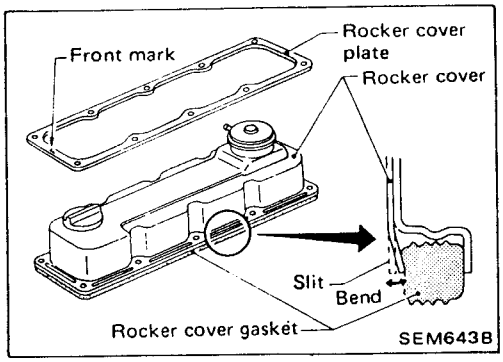


4. Apply engine oil and install push rods.

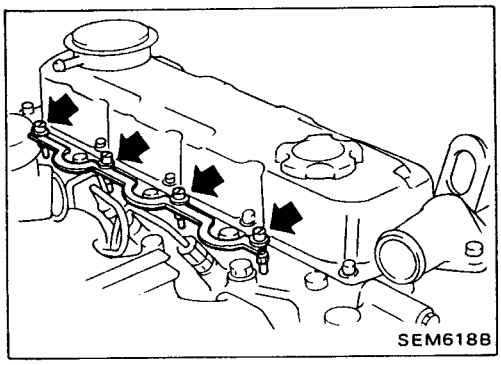
5. Install rocker shaft assembly.

Rocker shaft bracket bolt
20 - 25 N·m
(2.0 - 2.5 kg-m, 14 - 18 ft-lb)

Adjusting intake and exhaust valve clearance tentatively.
Refer to section MA.



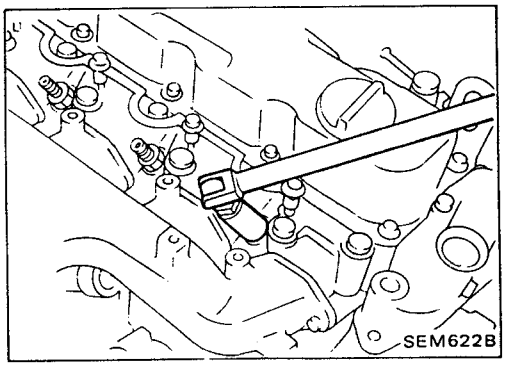
6. Install rocker cover with rocker cover plate.
- Be sure the "F" mark on rocker cover plate faces upward and is at the front end.
- When replacing rocker cover gasket, bend slit of rocker cover baffle plate a little to hold the gasket. Do not twist gasket.



7. Install glow plugs and glow plate.

Glow plug

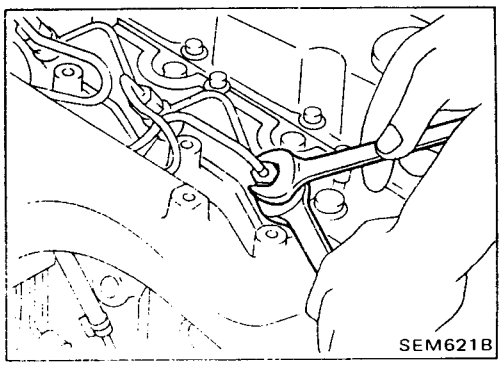
(O) : 15 - 20 N·m (1.5 - 2.0 kg-m, 11 - 14 ft-lb)



8. Install new top nozzle gasket and injection nozzle.

Injection nozzle tightening torque:

(O) : 54 - 64 N·m
(5.5 - 6.5 kg-m, 40 - 47 ft-lb)



9. Install spill tube and injection tube.

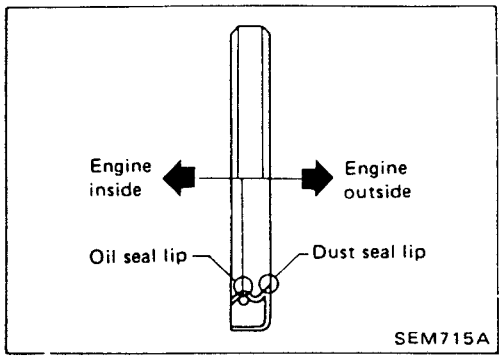
Spill tube fixing nut tightening torque:

(O) : 29 - 39 N·m
(3.0 - 4.0 kg-m, 22 - 29 ft-lb)

Injection tube flared nut tightening torque:

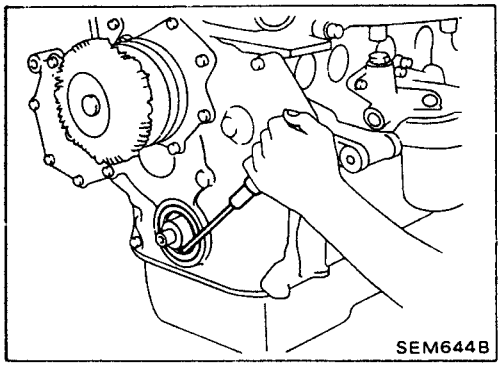
(O) : 20 - 25 N·m
(2.0 - 2.5 kg-m, 14 - 18 ft-lb)

10. Connect thermostat housing water inlet hose and radiator hose.
11. After assembling all disassembled parts, fill radiator and engine with new coolant up to filler opening.



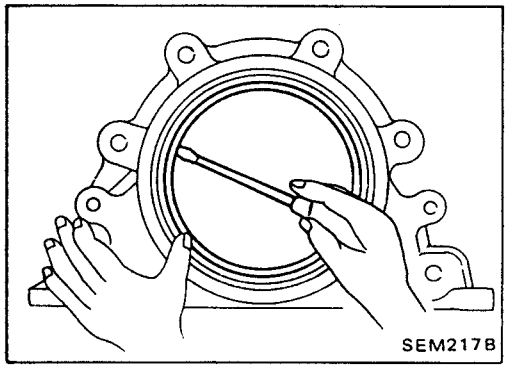
OIL SEAL INSTALLING DIRECTION

- When installing a new front or rear seal, make sure its mounting direction is correct.



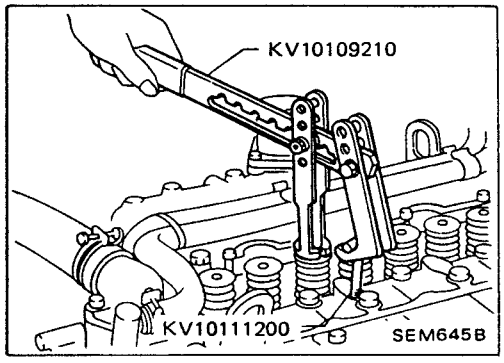
CRANKSHAFT FRONT OIL SEAL

1. Remove radiator shroud.
2. Remove cooling fan.
3. Remove drive belts.
4. Remove crank pulley.
5. Remove crankshaft oil seal.
- Be careful not to damage sealing surfaces of crankshaft.
6. Coat new oil seal with engine oil and install it in place.



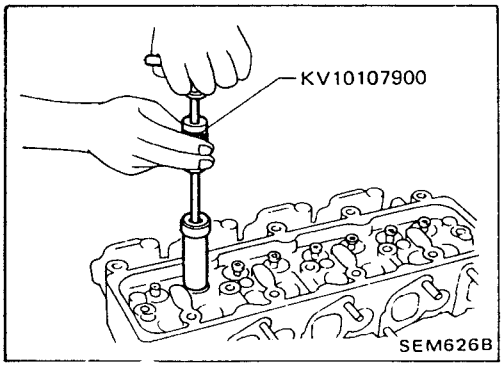
CRANKSHAFT REAR OIL SEAL

1. Dismount transmission.
2. Remove clutch cover assembly.
3. Remove flywheel and rear plate.
4. Remove engine gusset and oil pan.
5. Remove oil seal retainer assembly, then remove oil seal.
- Be careful not to damage sealing surfaces of crankshaft.
6. Coat new oil seal with engine oil and install it in place.

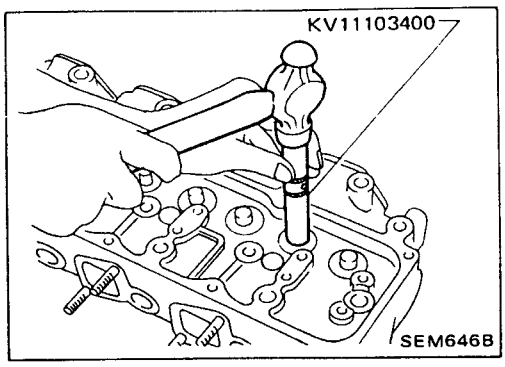


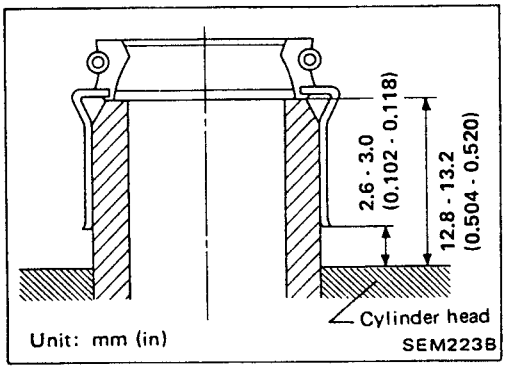
VALVE STEM OIL SEAL

1. Remove rocker cover.
2. Remove rocker shaft assembly.
3. Remove valve spring.

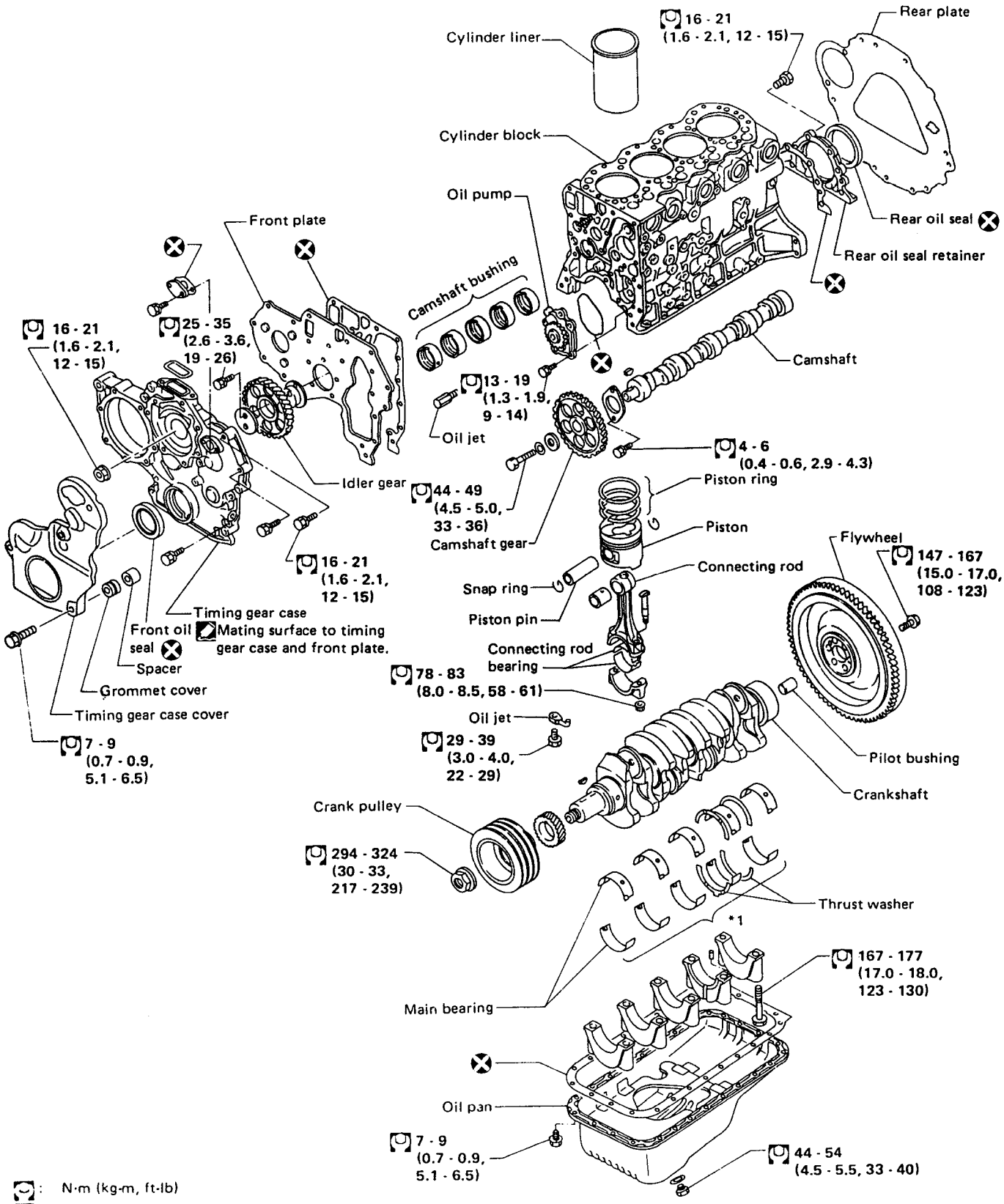


4. Remove valve oil seals.





5. Apply engine oil to valve oil seal and install it in place.

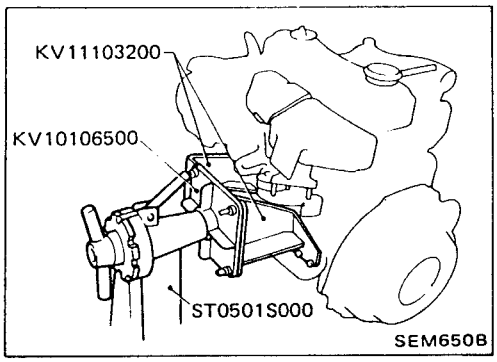


: N·m (kg-m, ft-lb)

: Apply recommended sealant (Nissan genuine part: KP610-00250) or equivalent.

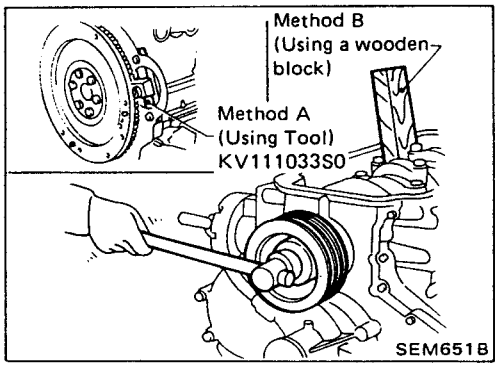
*1 : Keep in correct order.

SEM647B

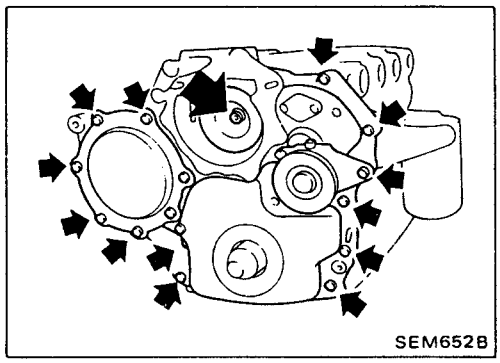


PISTON AND CRANKSHAFT

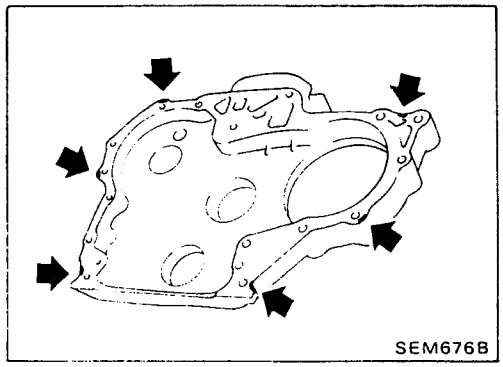
1. Remove oil filter.
2. Place engine on work stand.
3. Drain coolant and oil.
4. Remove drive belts.
5. Remove cylinder head.
6. Remove oil pan.



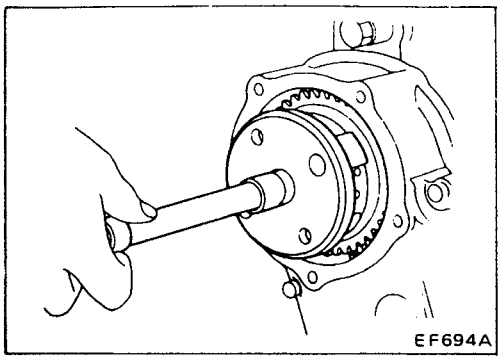
7. Remove crank pulley.



8. Remove water pump.
9. Remove timing gear case.

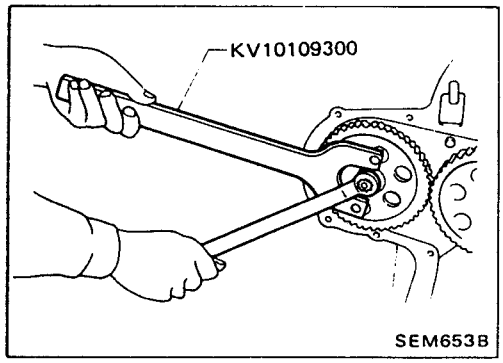


If the timing case is hard to remove due to liquid gasket, pry it off with a suitable tool at the cutout section.

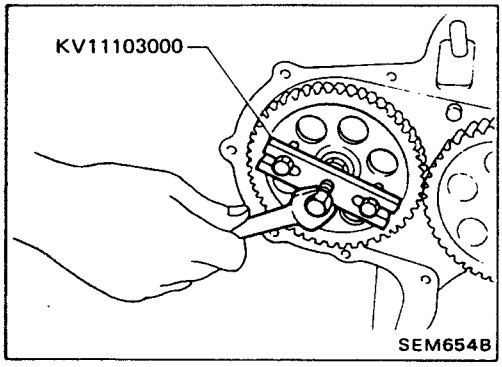


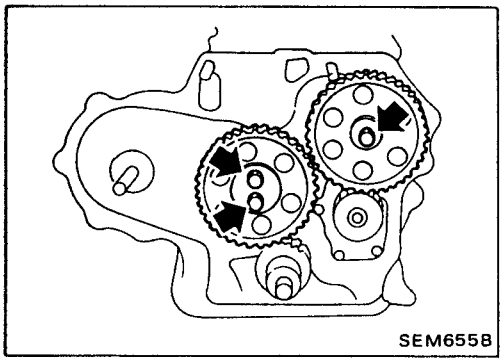
10.

- In-line pump
  Remove timer cover and timer.

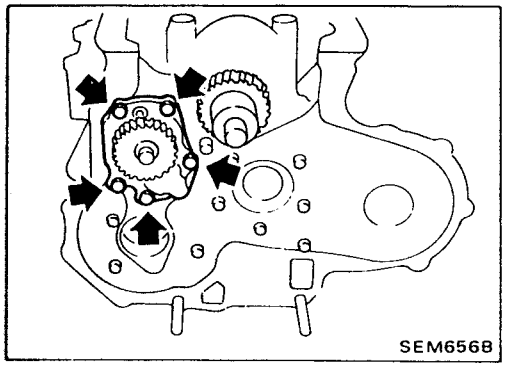


- VE-pump
  Remove injection pump gear.



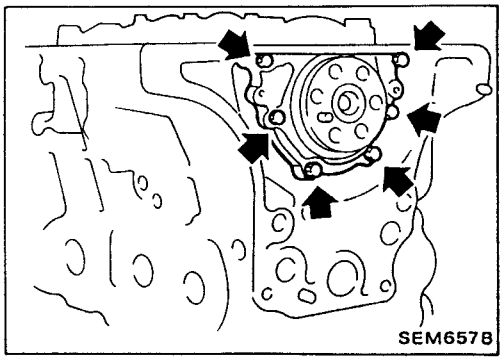


11. Remove idler gear and idler gear shaft.
12. Remove camshaft gear, camshaft and valve lifters.

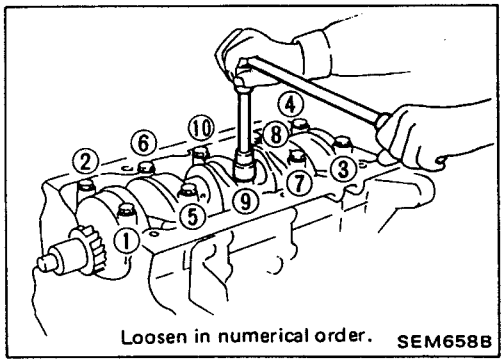


13. Remove oil pump assembly.

14. Remove crankshaft gear.
15. Remove flywheel and rear plate.
16. Remove connecting rod caps.
17. Remove pistons.

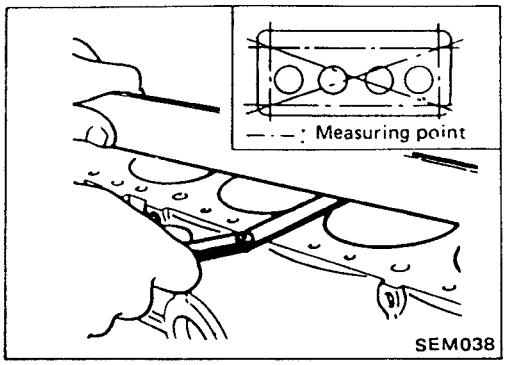

SEM657B

18. Remove rear oil seal retainer.



Loosen in numerical order. SEM658B

19. Remove bearing cap and crankshaft.
Place the bearings and caps in their proper order.



CYLINDER BLOCK DISTORTION

If beyond the specified limit, replace it.

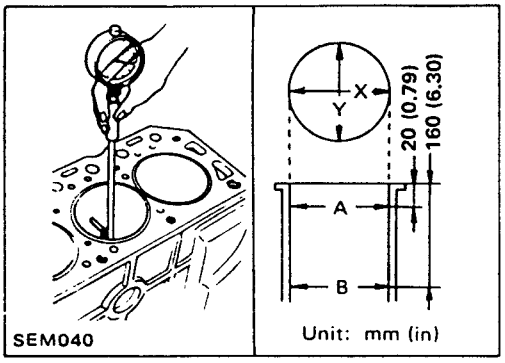
Cylinder block distortion:

Standard

Less than 0.05 mm (0.0020 in)

Limit

0.2 mm (0.008 in)



CYLINDER LINER WEAR

1. Measure cylinder liner bore for out-of-round and taper with a bore gauge. If beyond the limit, replace cylinder liner.

Standard inside diameter:

TD23

89.000 - 89.030 mm (3.5039 - 3.5051 in)

TD27

96.000 - 96.030 mm (3.7795 - 3.7807 in)

Refer to S.D.S.

Wear limit:

0.20 mm (0.0079 in)

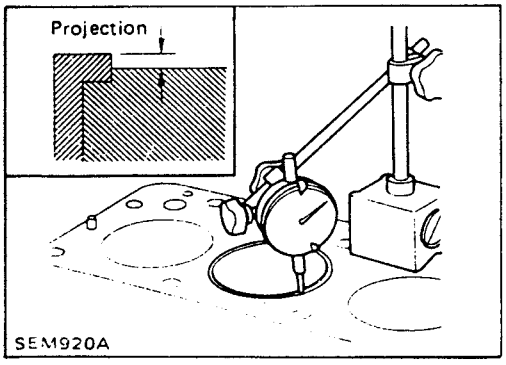
Out-of-round (X-Y) limit:

0.020 mm (0.0008 in)

Taper (A-B) limit:

0.020 mm (0.0008 in)

2. Check for scratches or seizure. If seizure is found, replace cylinder liner.



3. Check amount of projection of cylinder liner.

Cylinder liner projection:

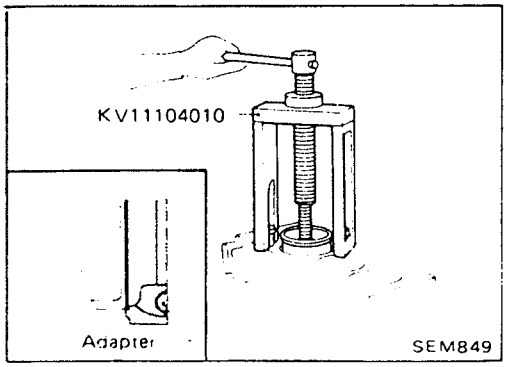
Standard

0.02 - 0.09 mm

(0.0008 - 0.0035 in)

Deviation of each cylinder:

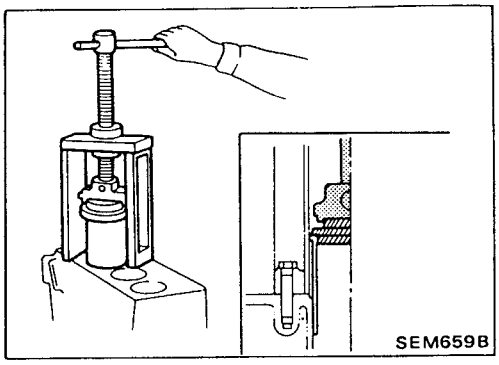
Less than 0.05 mm (0.0020 in)



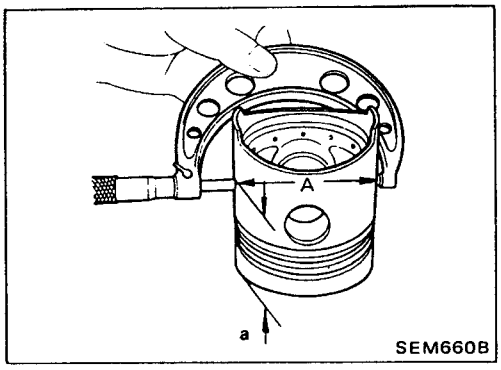
CYLINDER LINER

Replacement

1. Remove cylinder liner with Tool.


SEM659B

2. Install cylinder liner with Tool.
3. Check amount of projection of cylinder liner.



SEM660B

PISTON TO CYLINDER WALL CLEARANCE

Method A (Using micrometer)

1. Measure piston and cylinder bore diameter.

Piston diameter "A":

Refer to S.D.S.

Measuring point "a" (Distance from the top):

TD23

67 mm (2.64 in)

TD27

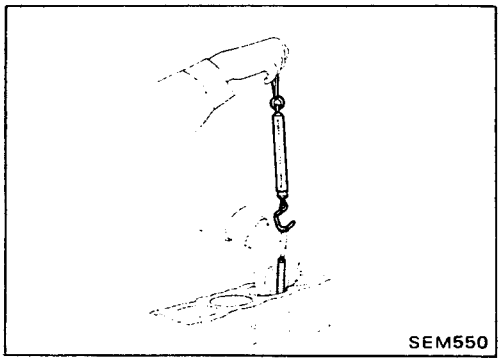
70 mm (2.76 in)

2. Check that piston clearance is within the specification.

Piston clearance:

0.05 - 0.07 mm

(0.0020 - 0.0028 in)


SEM550

Method B (Using feeler gauge)

Measure the extracting force, and pull feeler gauge straight upward.

It is recommended that piston and cylinder be heated to 20°C (68°F).

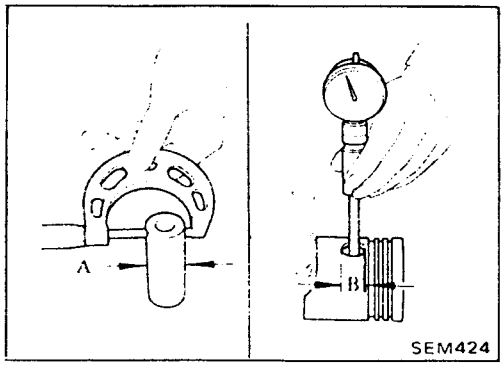
Feeler gauge thickness:

0.06 mm (0.0024 in)

Extracting force:

5.9 - 11.8 N

(0.6 - 1.2 kg, 1.3 - 2.6 lb)



SEM424

PISTON AND PISTON PIN CLEARANCE

Check clearance between pistons and piston pins.

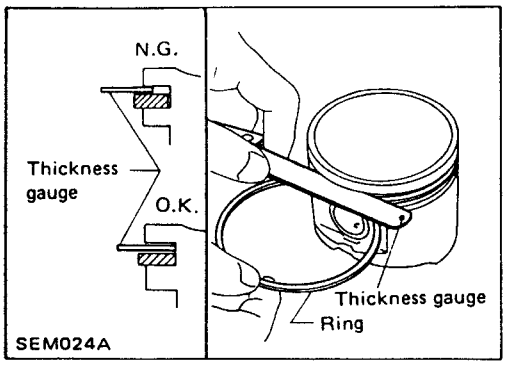
Clearance (A-B):

Standard

—0.008 to 0.007 mm (—0.0003 to 0.0003 in)

Limit

Less than 0.1 mm (0.004 in)



PISTON RING SIDE CLEARANCE

Side clearance:

Top ring

0.06 - 0.10 mm (0.0024 - 0.0039 in)

2nd ring

0.04 - 0.08 mm (0.0016 - 0.0031 in)

Oil ring

0.02 - 0.06 mm (0.0008 - 0.0024 in)

Max. limit of side clearance:

Top

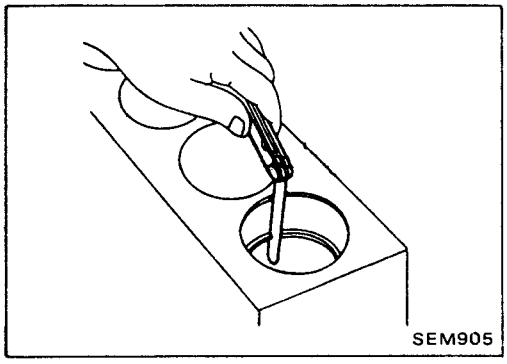
0.5 mm (0.020 in)

2nd

0.3 mm (0.012 in)

Oil

0.15 mm (0.0059 in)



PISTON RING GAP

Standard ring gap:

Top ring

0.30 - 0.45 mm (0.0118 - 0.0177 in)

2nd ring

0.20 - 0.35 mm (0.0079 - 0.0138 in)

Oil ring

0.30 - 0.50 mm (0.0118 - 0.0197 in)

Max. limit of ring gap:

1.5 mm (0.059 in)

MAIN BEARING CLEARANCE

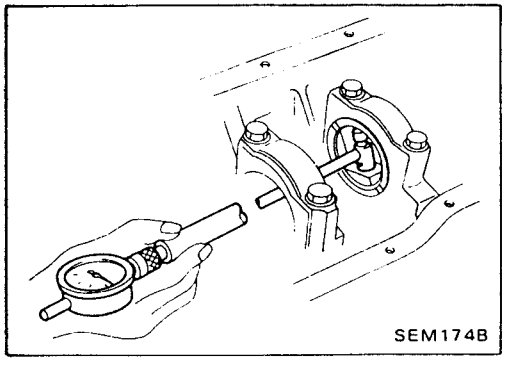
Main bearing clearance:

Standard

0.035 - 0.087 mm (0.0014 - 0.0034 in)

Limit

Less than 0.15 mm (0.0059 in)

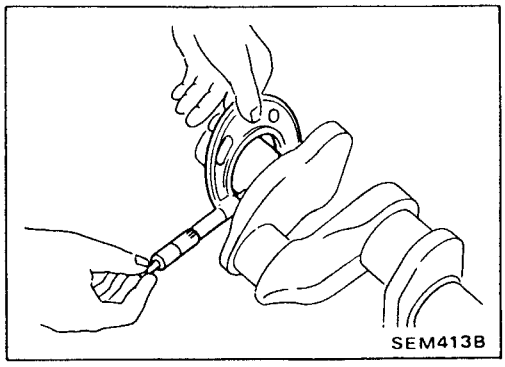


1. Install main bearings to cylinder block and main bearing cap.
2. Install main bearing cap to cylinder block.

Tighten all bolts in correct order and in two or three stages.

: 167 - 177 N·m
(17.0 - 18.0 kg-m, 123 - 130 ft-lb)

3. Measure inside diameter "A" of main bearing.



4. Measure outside diameter "Dm" of main journal in crankshaft.

5. Calculate main bearing clearance.
   Main bearing clearance = A – Dm

CONNECTING ROD BEARING CLEARANCE

Connecting rod bearing clearance:

Standard

0.035 - 0.081 mm

(0.0014 - 0.0032 in)

Limit

Less than 0.15 mm (0.0059 in)

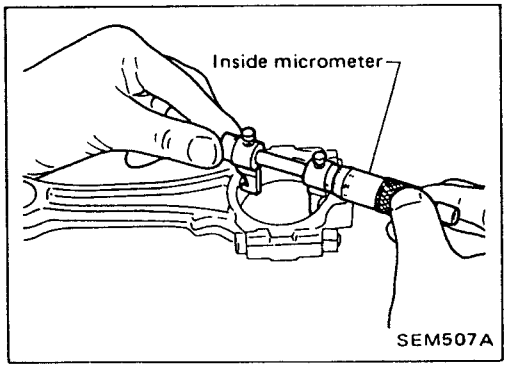
1. Install connecting rod bearing to connecting rod and cap.
2. Install connecting rod cap to connecting rod.

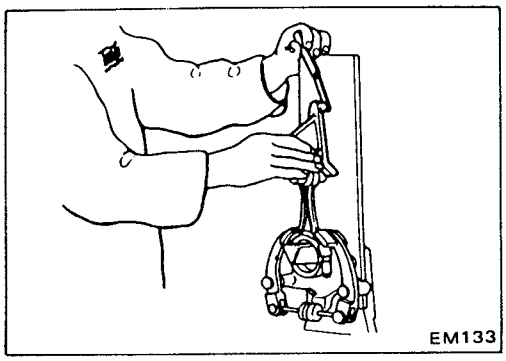
Apply oil to the thread portion of bolts and seating surface of nuts.

: 78 - 83 N·m

(8.0 - 8.5 kg-m, 58 - 61 ft-lb)

3. Measure inside diameter "A" of bearing.
4. Measure outside diameter "Dp" of pin journal in crankshaft.
5. Calculate connecting rod bearing clearance.
   Connecting rod bearing clearance = A – Dp




EM133

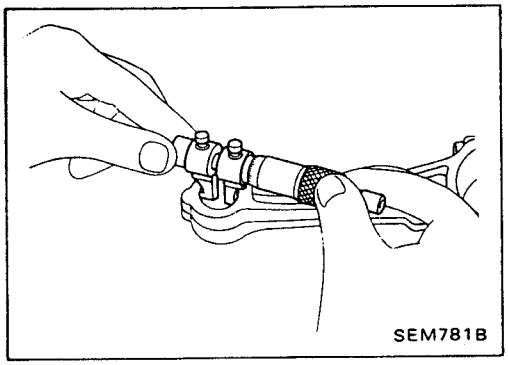
CONNECTING ROD BEND AND TORSION

Bend and torsion:

Limit

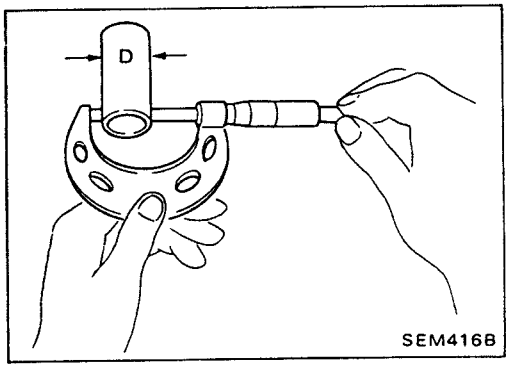
0.05 mm (0.0020 in)

per 100 mm (3.94 in) length


SEM781B

CONNECTING ROD SMALL END BUSHING CLEARANCE

1. Measure inside diameter "A" of connecting rod small end bushings.



SEM416B

2. Measure outside diameter "D" of piston pin.
3. Calculate connecting rod small end bushing clearance.

Connecting rod small end bushing clearance = A — D

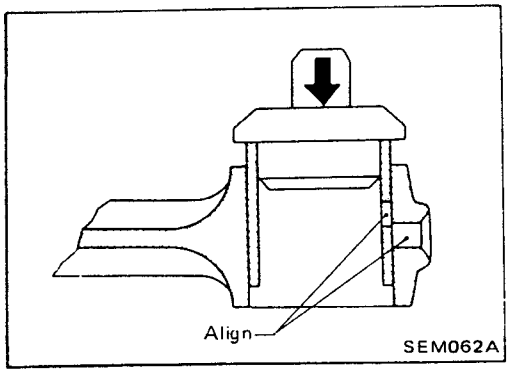
Bushing clearance:

Standard

0.025 - 0.045 mm (0.0010 - 0.0018 in)

Limit

0.15 mm (0.0059 in)



SEM062A

REPLACEMENT OF CONNECTING ROD SMALL END BUSHING

1. Drive in the small end bushing until it is flush with the end surface of the rod.

Be sure to align the oil holes.

2. After driving in the small end bushing, ream the bushing.

Small end bushing inside diameter:

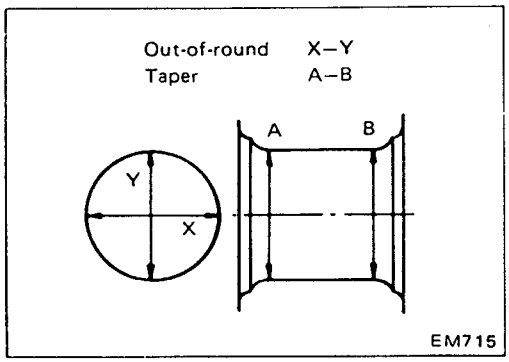
Finished size:

TD23

26.025 - 26.038 mm (1.0246 - 1.0251 in)

TD27

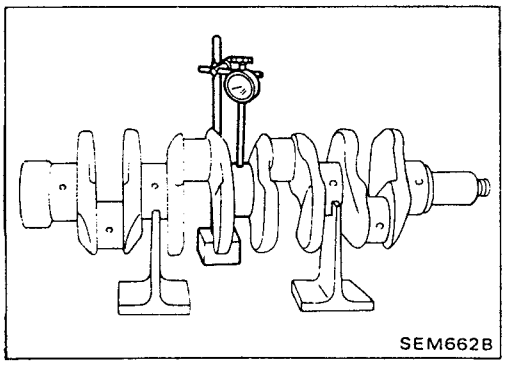
28.025 - 28.038 mm (1.1033 - 1.1039 in)



CRANKSHAFT

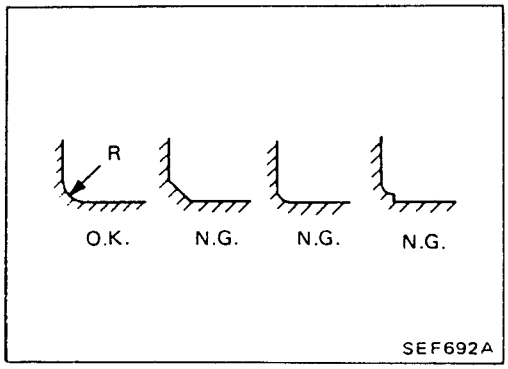
1. Check crankshaft journals and pins for score, bias, wear or cracks. If faults are minor, correct with fine crocus cloth.
2. Check journals and pins with a micrometer for taper and out-of-round.

Out-of-round (X-Y):
Standard
Less than 0.01 mm (0.0004 in)
Limit
0.02 mm (0.0008 in)
Taper (A-B):
Standard
Less than 0.01 mm (0.0004 in)
Limit
0.02 mm (0.0008 in)



3. Check crankshaft runout.

Runout [T.I.R. (Total Indicator Reading)]
Standard
0 - 0.03 mm (0 - 0.0012 in)
Limit
0.10 mm (0.0039 in)



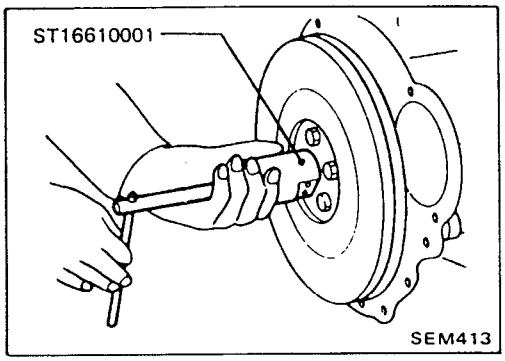
RESURFACING OF CRANKSHAFT JOURNAL AND CRANK PIN

When using undersize main bearings and connecting rod bearings, the crankshaft journals or crank pins must be finished to match the bearings.

R: Crank journal: 3.0 mm (0.118 in)
Crank pin: 3.5 mm (0.138 in)

CAUTION:

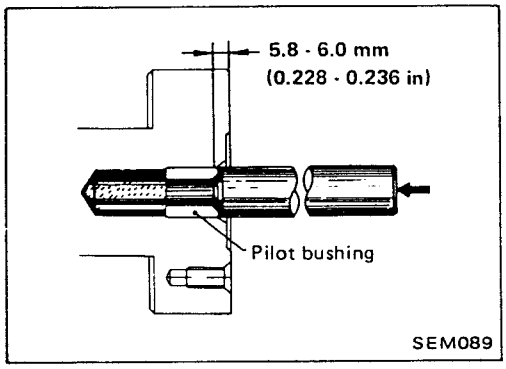
- At the same time make sure that the surface width does not increase.
- Do not attempt to cut counterweight of crankshaft.



CRANKSHAFT PILOT BUSHING

Crankshaft pilot bushing replacement

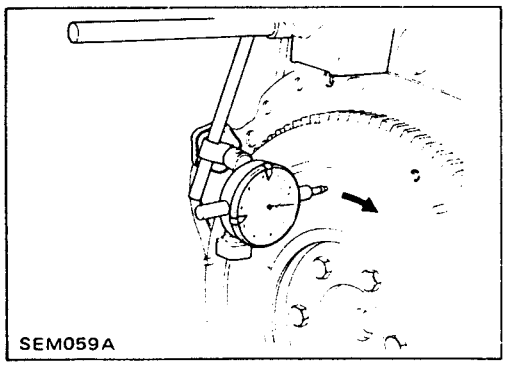
1. Pull out bushing with Tool.



2. Insert pilot bushing until distance between flange end and bushing is specified value.

Distance:

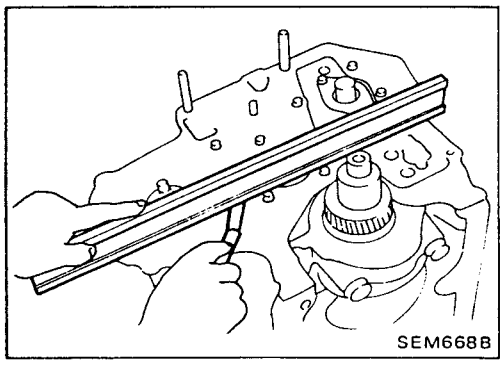
Approx. 5.8 - 6.0 mm (0.228 - 0.236 in)



FLYWHEEL RUNOUT

Runout (Total indicator reading):

Less than 0.15 mm (0.0059 in)

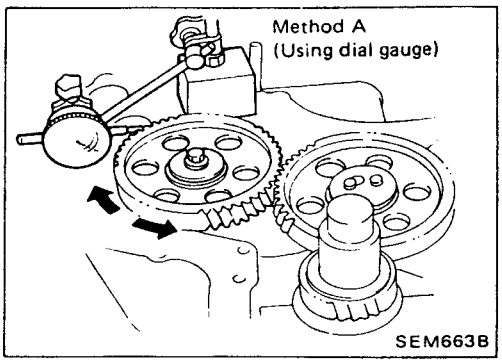


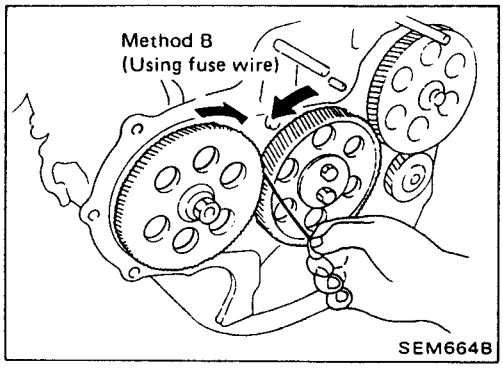
FRONT PLATE

Check front plate for warpage. If not within the limit, make flat or replace front plate.

Warpage limit:

0.2 mm (0.008 in)





GEAR TRAIN

Camshaft drive gear, injection pump drive gear, oil pump gear, idler gear and crankshaft gear

1. If gear tooth and key have scratches or are excessively worn, replace gear and key.
2. Check gear train backlash before disassembling and after assembling.
   Method A (Using dial gauge)
   Method B (Using fuse wire)
   If beyond the limit, replace gear.

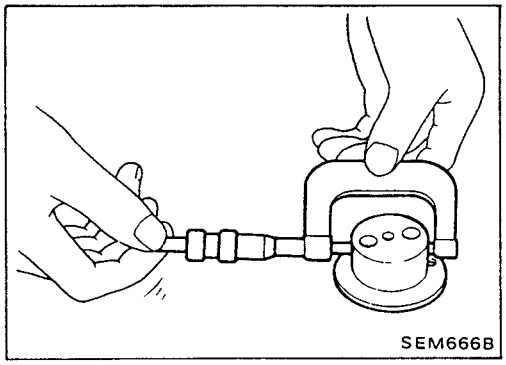
Backlash:

Standard

0.07 - 0.11 mm (0.0028 - 0.0043 in)

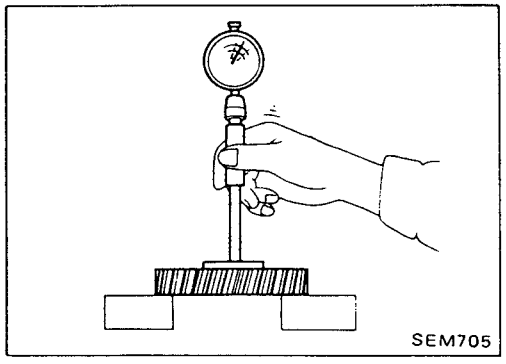
Limit

0.20 mm (0.0079 in)



IDLER GEAR BUSHING CLEARANCE

1. Measure idler gear shaft outer diameter.



2. Measure idler gear bushing inner diameter.
3. Calculate idler gear bushing clearance.

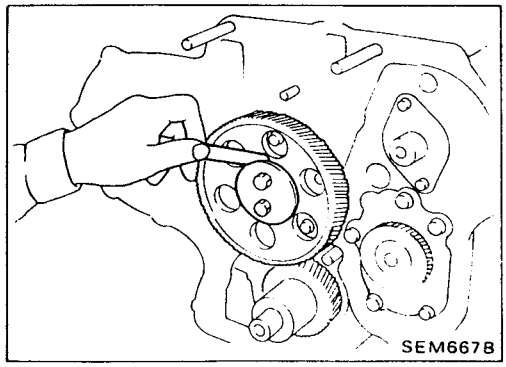
Bushing oil clearance:

Standard

0.025 - 0.061 mm (0.0010 - 0.0024 in)

Limit

0.20 mm (0.0079 in)



IDLER GEAR END PLAY

Measure idler gear end play between gear plate and gear.

Idler gear end play:

Standard

0.03 - 0.14 mm (0.0012 - 0.0055 in)

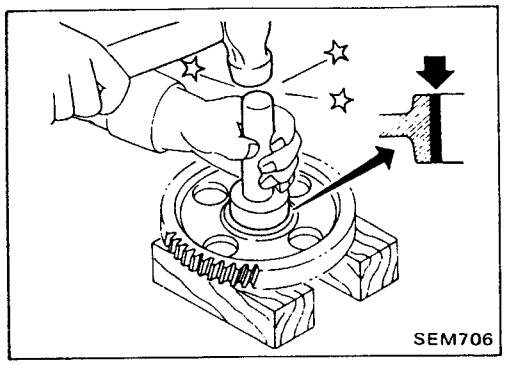
Limit

Less than 0.3 mm (0.012 in)

: **Idler gear shaft bolt**

25 - 35 N·m

(2.6 - 3.6 kg-m, 19 - 26 ft-lb)


SEM706

REPLACEMENT OF IDLER GEAR BUSHING

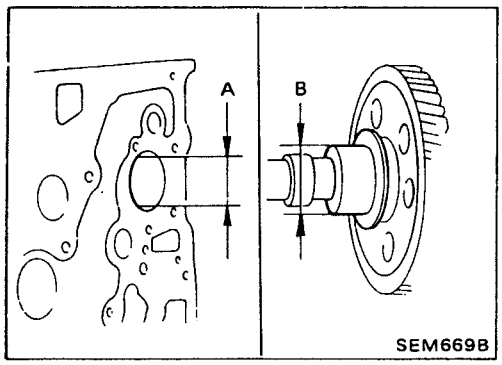
1. Use a suitable tool to replace bushing.
2. Ream idler gear bushing.

Finished size:

42.00 - 42.02 mm (1.6535 - 1.6543 in)

Idler gear shaft

Install idler gear shaft so that oil hole of shaft faces upward.



SEM669B

CAMSHAFT AND CAMSHAFT BUSHING

Camshaft bushing clearance

Measure inside diameter of camshaft bushing and outside diameter of camshaft journal with a suitable gauge.

Clearance between camshaft and bushing (A—B):

Standard

0.020 - 0.109 mm

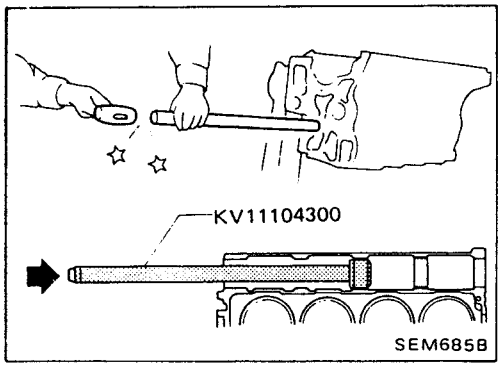
(0.0008 - 0.0043 in)

Limit

Less than 0.15 mm (0.0059 in)

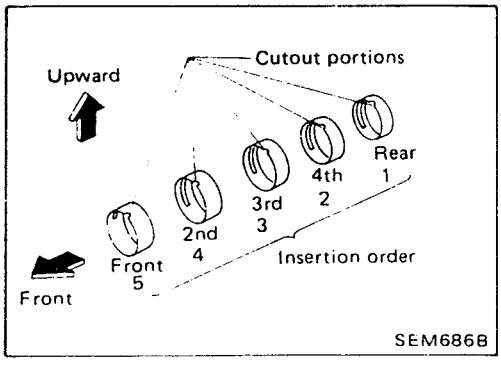
REPLACING CAMSHAFT BUSHING

1. Remove rear plug.



SEM685B

2. Using Tool, remove camshaft bushings from the engine. Some bushings must be broken in order to remove.

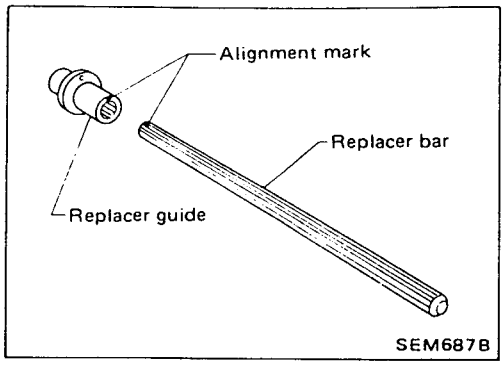


SEM686B

3. Using Tool, install camshaft bushings as follows:

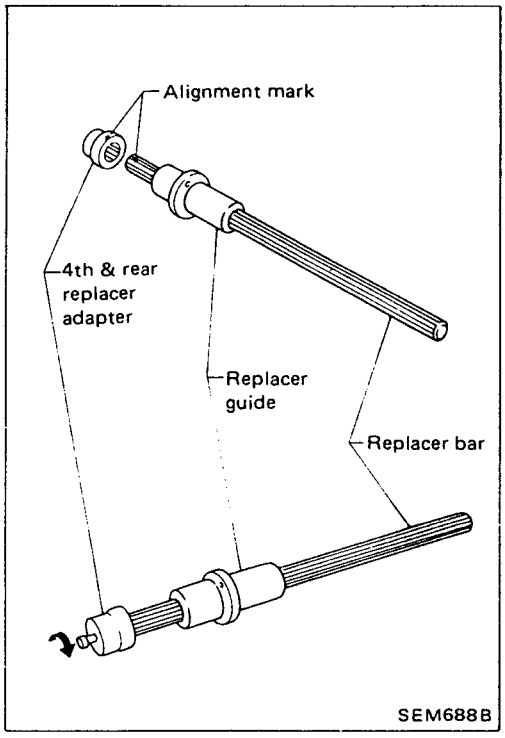
(1) Install camshaft bushings in the order of "rear", "4th", "3rd", "2nd" and "front". All bushings must be installed from the front.

(2) Face the cutout upward and toward the front of the engine during installation.

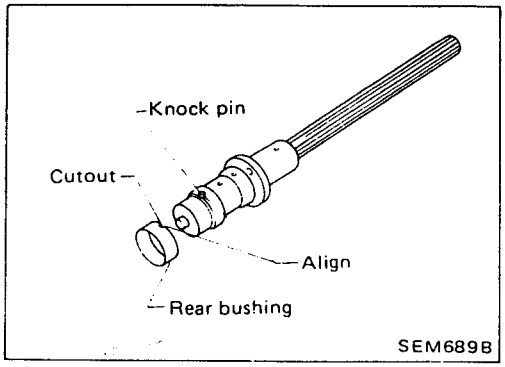


(3) Rear camshaft bushing

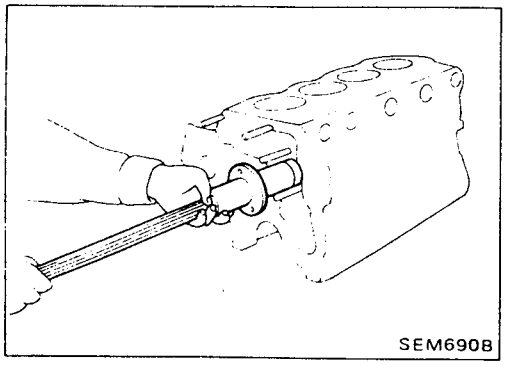
Align the alignment mark on replacer bar with that on replacer guide before installation.



Align alignment mark on replacer bar with that on 4th & rear replacer adapter before installation. After installation, tighten bolts.

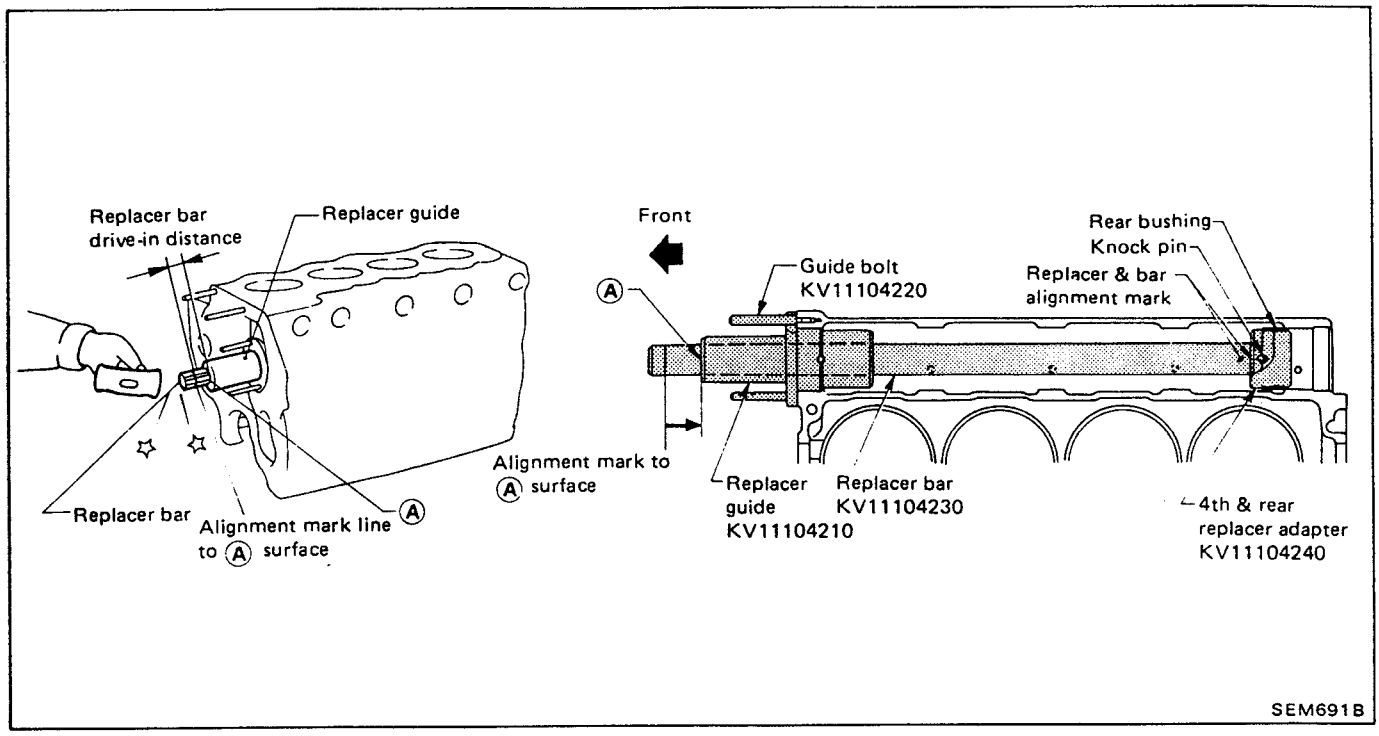


Align the cutout of rear bushing with knock pin of 4th & rear replacer adapter before installation.

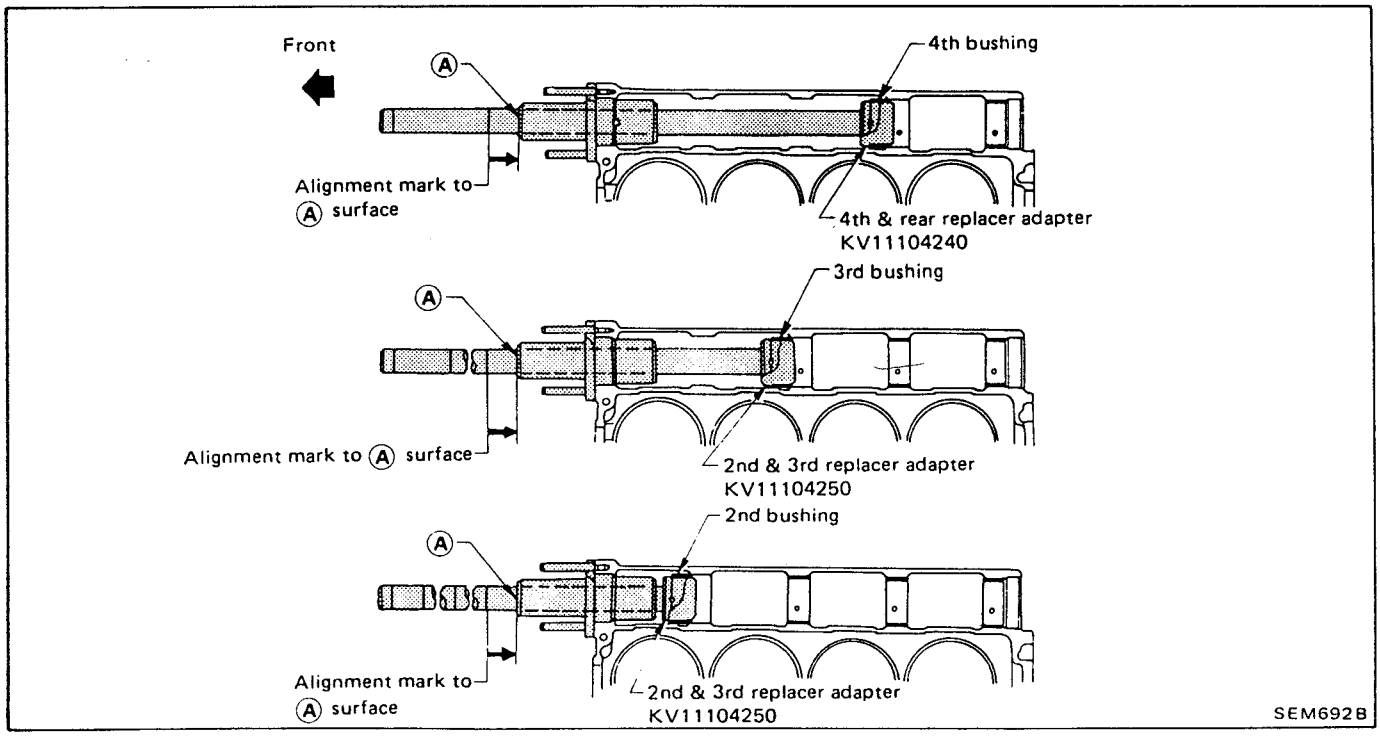


Insert rear bushing with replacer into the engine.

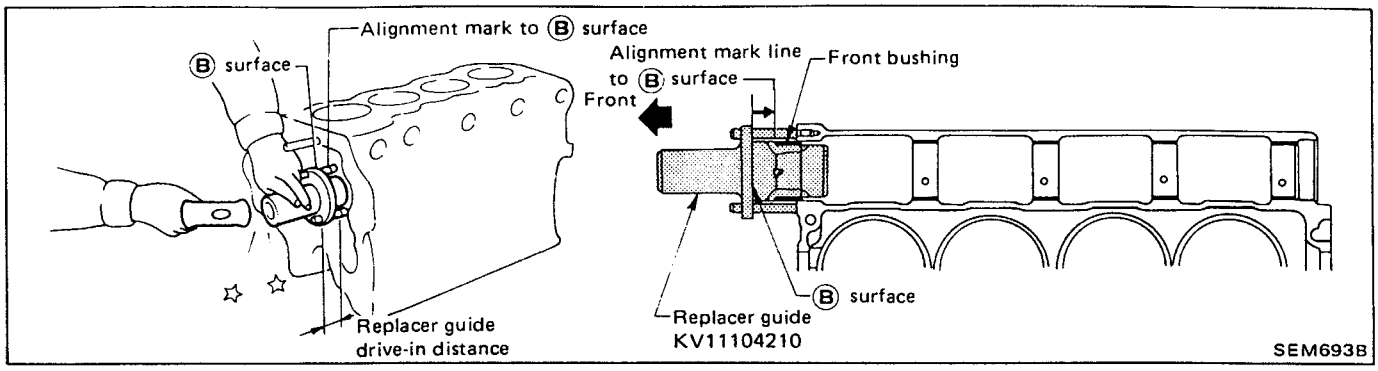
Drive replacer bar until the alignment mark on replacer bar is aligned with the end of replacer guide.
Remove replacer set.
After installation, check that oil holes 4.3 mm (0.169 in) dia. in camshaft bushings are aligned with oil holes 6 mm (0.24 in) dia. in the cylinder block.

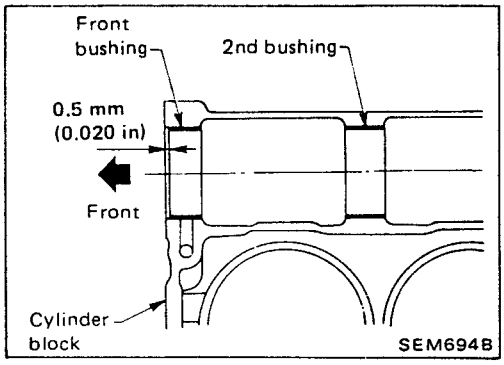


(4) 4th, 3rd and 2nd camshaft bushings
Install in the same manner as rear camshaft bushing.



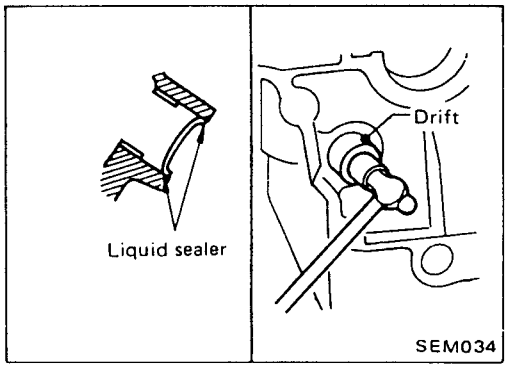
(5) Front camshaft bushing
Drive replacer guide until its flanged surface Ⓑ is aligned with the alignment mark on replacer guide bolt.



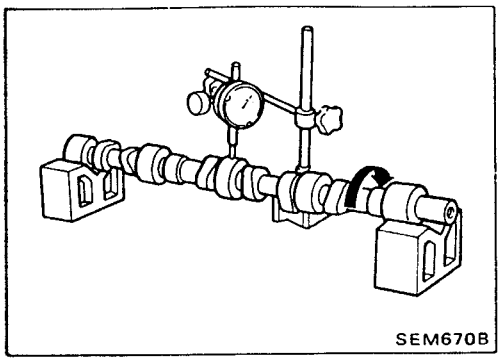


After installation, check that front camshaft bushing is positioned 0.5 mm (0.020 in) from the front of cylinder block.

4. Check camshaft bushing clearance.



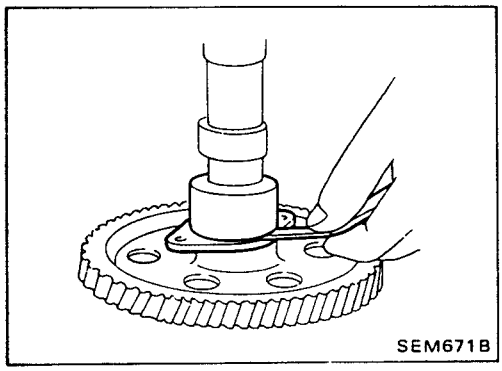
5. Install new rear plug with a drift.
Apply liquid sealer.


SEM670B

CAMSHAFT ALIGNMENT

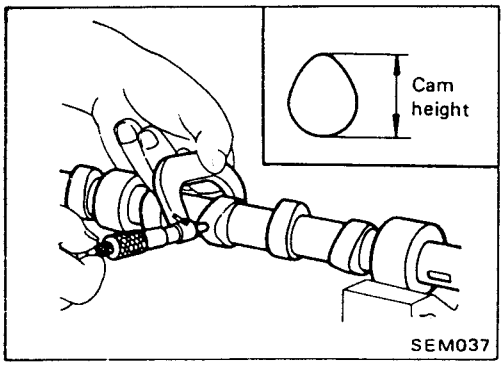
1. Check camshaft journal and cam surface for bend, wear or damage.
   If fault is beyond limit, replace.
2. Check camshaft bend at center journal.
   If bend is greater than specified limit, repair or replace camshaft.

Camshaft bend
(Total indicator reading):
Standard
Less than 0.02 mm (0.0008 in)
Limit
Less than 0.06 mm (0.0024 in)


SEM671B

3. Measure camshaft end play between locating plate and gear.
   If beyond the specified limit, replace camsahft locating plate.

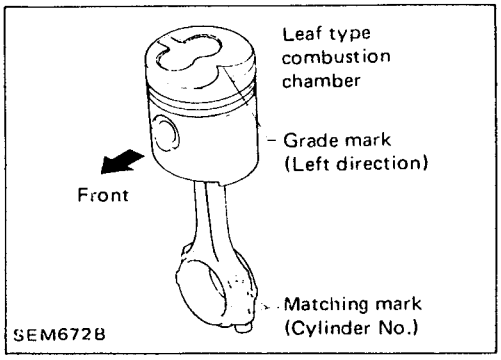
Camshaft end play:
Standard
0.08 - 0.28 mm (0.0031 - 0.0110 in)
Limit
Less than 0.5 mm (0.020 in)



SEM037

4. Measure camshaft cam height. If beyond the specified limit, replace camshaft.

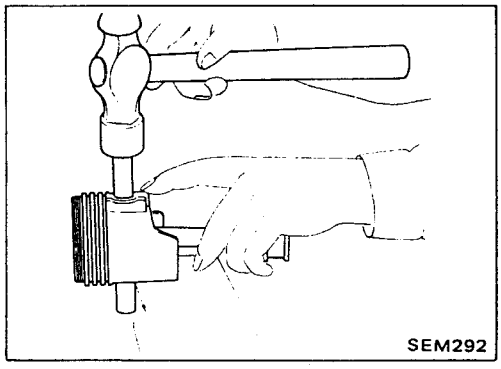
Cam height:
Standard
Intake
41.733 mm (1.6430 in)
Exhaust
41.900 mm (1.6496 in)
Limit
Intake
Less than 41.20 mm (1.6220 in)
Exhaust
Less than 41.40 mm (1.6299 in)



PISTON

Assemble pistons, piston pins, snap rings and connecting rods.

a. Numbers are stamped on the connecting rod and cap corresponding to each cylinder. Care should be taken to avoid a wrong combination including bearing.



b. When inserting piston pin in connecting rod, heat piston with a heater or hot water [approximately 60 to 70°C (140 to 158°F)] and apply engine oil to pin and small end of connecting rod.

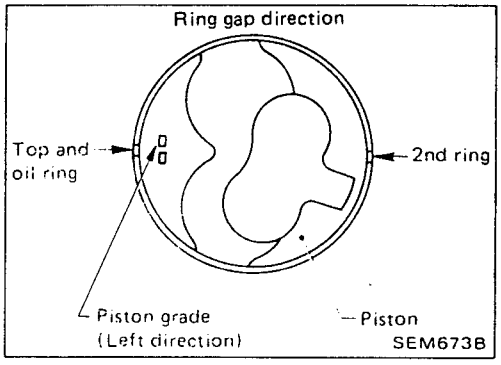
c. After assembling, ascertain that piston swings smoothly.

Install piston assembly.

CAUTION:

a. Stretch the piston rings only enough to fit them in the piston grooves.

b. Be sure the manufacturer's mark faces upward.



c. Install No. 1 piston ring in such a way that its gap faces the direction of the piston pin; and then install piston rings so that their gap positioned at 180° to one another.

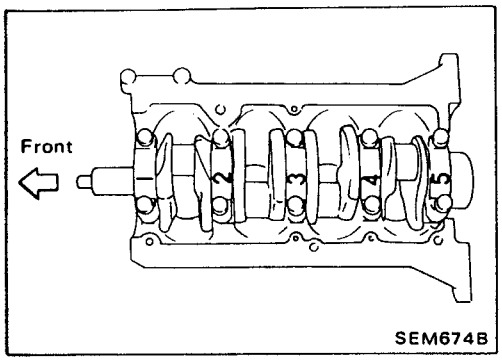
CRANKSHAFT

1. Install crankshaft.

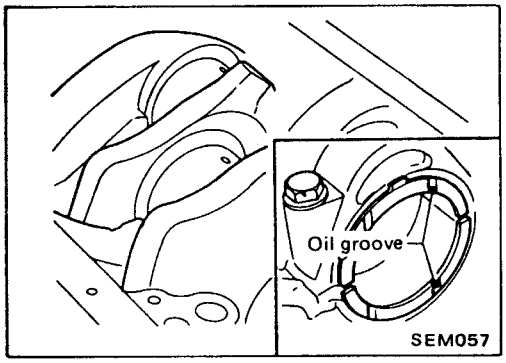
(1) Set main bearings in the proper position on cylinder block.

a. If either crankshaft, cylinder block or main bearing is reused again, it is necessary to measure main bearing clearance.

b. Upper bearings have oil hole and oil groove, however lower bearings do not.

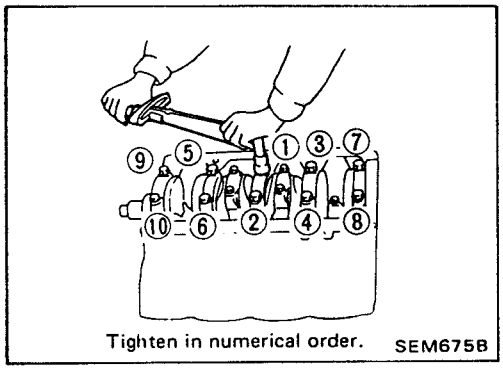


(2) Apply engine oil to crankshaft journal and pin and install crankshaft.
(3) Install main bearing caps.
a) Install main bearing cap with the number facing the front of vehicle.
b) Apply engine oil to main bearing cap and cylinder block contact surfaces.
c) Install rear oil seal assembly. Apply engine oil to contact surface of rear end oil seal and crankshaft.



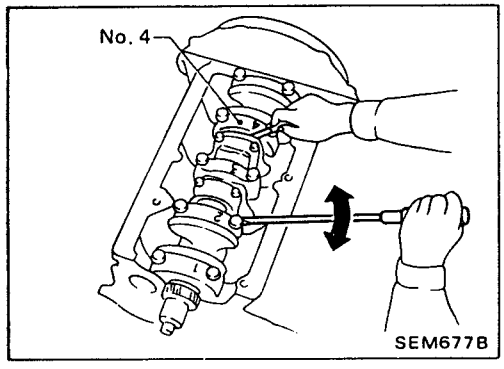
(4) Install crankshaft thrust washer at the 4th journal from front.

Install thrust washer so that oil groove can face crankshaft.



(5) Tighten bearing cap bolts gradually in stages, starting from two to three separate stages, from center bearing and moving outward in sequence.

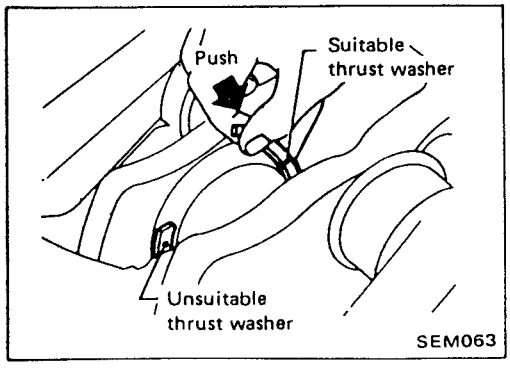
: Main bearing cap bolt
167 - 177 N·m
(17.0 - 18.0 kg-m, 123 - 130 ft-lb)

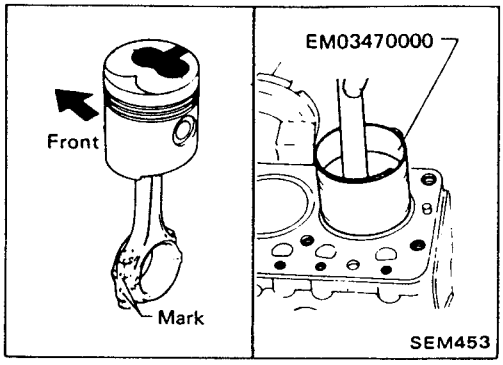


(6) Measure crankshaft free end play at No. 4 bearing.

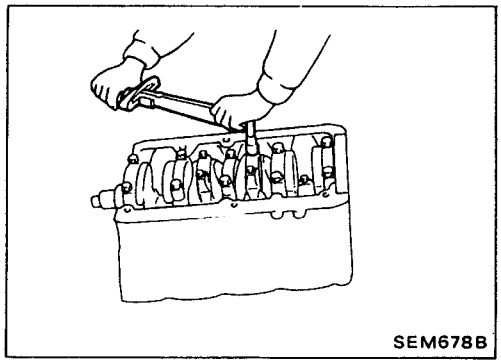
Crankshaft free end play:
Standard
0.055 - 0.140 mm (0.0022 - 0.0055 in)
Limit
0.4 mm (0.016 in)

If beyond the limit, replace No. 4 main bearing thrust washer. Refer to S.D.S.

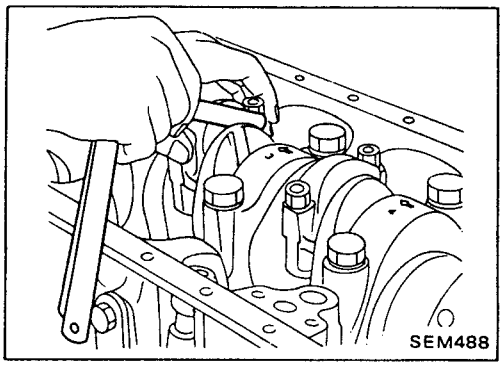




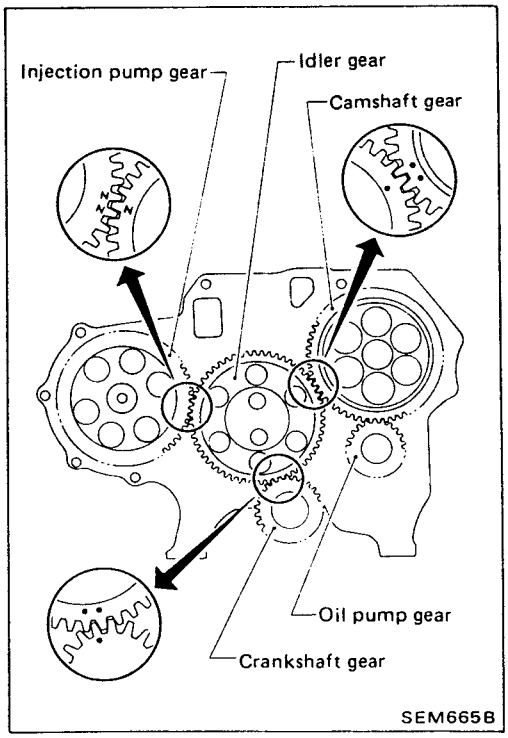
2. Install pistons with connecting rods.
(1) Install them into corresponding cylinder using Tool.
- **Be careful not to scratch cylinder wall with connecting rod.**
- **Apply engine oil to cylinder wall, piston and bearing.**
- **The leaf type combustion chamber on piston head must be at right side of engine.**



(2) Install connecting rod bearing caps.
: Connecting rod bearing nut
78 - 83 N·m
(8.0 - 8.5 kg-m, 58 - 61 ft-lb)

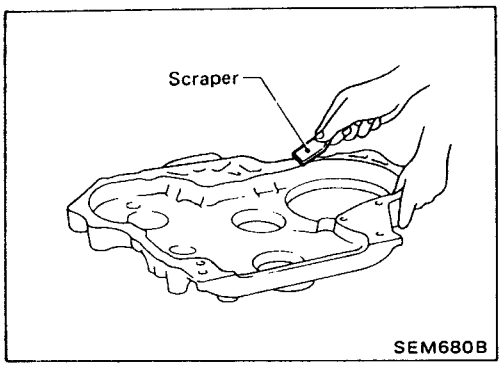


3. Measure connecting rod side clearance.
Connecting rod side clearance:
Standard
0.10 - 0.22 mm (0.0039 - 0.0087 in)
Limit
0.22 mm (0.0087 in)
If beyond the limit, replace connecting rod and/or crankshaft.



GEAR TRAIN

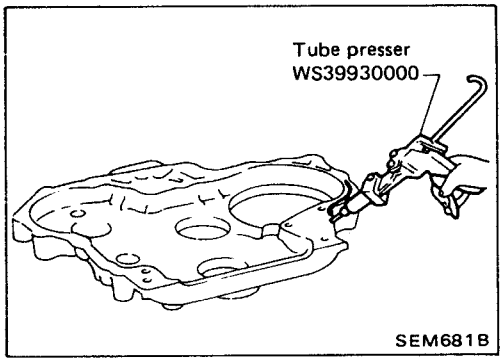
1. Set No. 1 piston at its top dead center.
2. Align each gear mark and install gears.



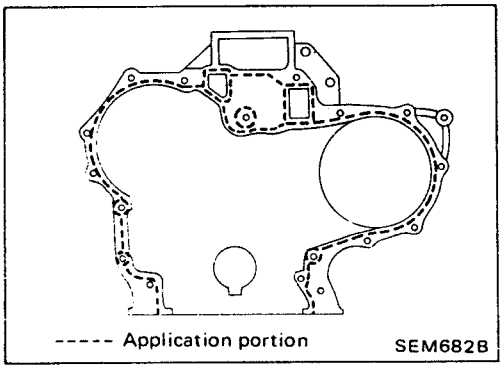
TIMING GEAR CASE

Installation

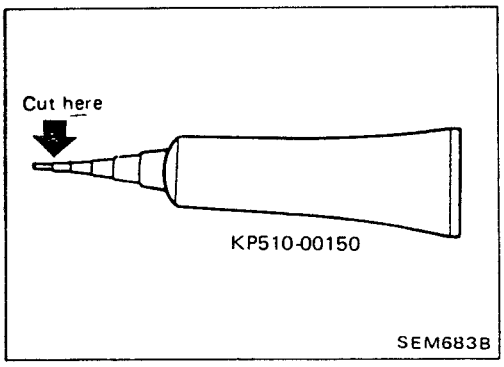
1. Before installing timing gear case, remove all traces of liquid gasket from mating surface using a scraper.
   Also remove traces of liquid gasket from mating surface of front plate.



2. Apply a continuous bead of liquid gasket to mating surface of timing gear case.



- **Be sure liquid gasket is 2.5 to 3.5 mm (0.098 to 0.138 in) wide.**
- **Attach timing gear case to front plate within 10 minutes after coating.**
- **Wait at least 30 minutes before refilling engine coolant or starting engine.**



Inspection and Adjustment

COMPRESSION PRESSURE

Unit: kPa (bar, kg/cm², psi)/rpm

Standard	2,942 (29.4, 30, 427)/200
Minimum	2,452 (24.5, 25, 356)/200
Differential limit between cylinders	294 (2.9, 3, 43)/200

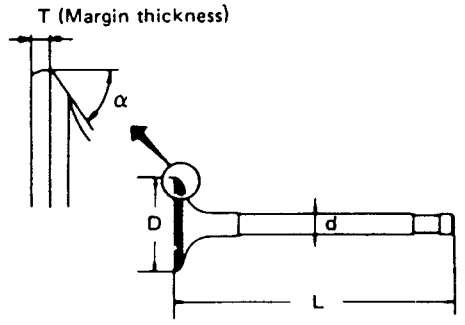
CYLINDER HEAD

Unit: mm (in)

	Standard	Limit
Head surface distortion	Less than 0.07 (0.0028)	0.2 (0.008)

VALVE

Unit: mm (in)



SEM188

Item \ Engine	TD23	TD27
Valve head diameter "D" Intake	39.9 - 40.1 (1.571 - 1.579)	43.4 - 43.6 (1.709 - 1.717)
Exhaust	34.9 - 35.1 (1.374 - 1.382)	37.9 - 38.1 (1.492 - 1.500)
Valve length "L" Intake	117 (4.61)	
Exhaust		
Valve stem diameter "d" Intake	7.962 - 7.977 (0.3135 - 0.3141)	
Exhaust	7.945 - 7.960 (0.3128 - 0.3134)	
Valve seat angle "α" Intake	45° - 45°30'	
Exhaust		
Valve margin "T" limit	1.0 (0.039)	
Valve stem end surface grinding limit	0.2 (0.008)	
Valve clearance (Hot) Intake	0.35 (0.0138)	
Exhaust		

Valve guide

Unit: mm (in)

	Standard	Service
Valve guide outside diameter	12.033 - 12.044 (0.4737 - 0.4742)	—
Valve guide inner diameter (Finished size)	8.00 - 8.015 (0.3150 - 0.3156)	
Cylinder head valve guide hole diameter	12.00 - 12.011 (0.4724 - 0.4729)	—
Interference fit of valve guide	0.022 - 0.044 (0.0009 - 0.0017)	

	Standard	Max. tolerance
Stem to guide clearance Intake	0.023 - 0.053 (0.0009 - 0.0021)	0.15 (0.0059)
Exhaust	0.04 - 0.07 (0.0016 - 0.0028)	0.20 (0.0079)
Valve deflection limit Intake	0.30 (0.0118)	
Exhaust	0.40 (0.0157)	

Valve spring

Free length mm (in) Painted red	52.15 (2.0531)
Painted yellow	53.0 (2.087)
Pressure height mm/N (mm/kg, in/lb) Painted red	32.3/672.8 - 759.1 (32.3/68.6 - 77.4, 1.272/151.3 - 170.7)
Painted yellow	31.8/697.3 - 779.7 (31.8/71.1 - 79.5, 1.252/156.8 - 175.3)
Assembled height mm/N (mm/kg, in/lb) Standard	42.3/287.3 - 330.5 (42.3/29.3 - 33.7, 1.665/64.6 - 74.3)
Limit	42.3/270.7 (42.3/27.6, 1.665/60.9)
Out of square mm (in)	2.0 (0.079)

Inspection and Adjustment (Cont'd)

VALVE LIFTER AND PUSH ROD

Unit: mm (in)

	Standard	Limit
Valve lifter outer diameter	24.960 - 24.970 (0.9827 - 0.9831)	–
Cylinder block valve lifter hole diameter	25.000 - 25.033 (0.9843 - 0.9855)	–
Valve lifter to lifter hole clearance	0.030 - 0.073 (0.0012 - 0.0029)	0.20 (0.0079)
Push rod bend (T.I.R.)*	Less than 0.3 (0.012)	0.5 (0.020)

*: Total indicator reading

Rocker shaft and rocker arm

Unit: mm (in)

	Standard	Limit
Rocker shaft Outer diameter	19.979 - 20.00 (0.7866 - 0.7874)	–
Rocker shaft bend (T.I.R.)	0 - 0.10 (0 - 0.0039)	Less than 0.30 (0.0118)
Rocker arm Inner diameter	20.014 - 20.035 (0.7880 - 0.7888)	–
Clearance between rocker arm and rocker shaft	0.014 - 0.056 (0.0006 - 0.0022)	0.15 (0.0059)

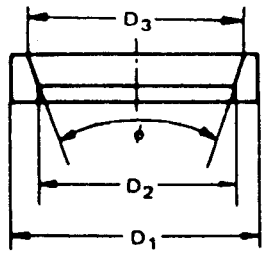
CYLINDER HEAD TO VALVE DISTANCE

Unit: mm (in)

	Standard	Limit
Intake	0.275 - 0.675 (0.0108 - 0.0266)	1.25 (0.0492)
Exhaust	0.305 - 0.695 (0.0120 - 0.0274)	1.25 (0.0492)

Valve seat

Unit: mm (in)



EM733

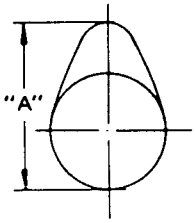
		TD23	TD27
Intake			
Outer diameter "D_1"		41.035 - 41.045 (1.6155 - 1.6159)	44.535 - 44.545 (1.7533 - 1.7537)
Inner diameter "D_2"		34.9 - 35.1 (1.374 - 1.382)	38.4 - 38.6 (1.512 - 1.520)
Diameter of seat "D_3"		38.2 - 38.4 (1.504 - 1.512)	41.7 - 41.9 (1.642 - 1.650)
Cylinder head valve seat diameter		41.000 - 41.015 (1.6142 - 1.6148)	44.500 - 44.515 (1.7520 - 1.7526)
Valve seat face angle "ϕ"		89° - 91°	89° - 91°
Exhaust			
Outer diameter "D_1"	Standard	36.535 - 36.545 (1.4384 - 1.4388)	39.535 - 39.545 (1.5565 - 1.5569)
	0.2 (0.008) Oversize (Service)	36.735 - 36.745 (1.4463 - 1.4467)	39.735 - 39.745 (1.5644 - 1.5648)
	0.4 (0.016) Oversize (Service)	36.935 - 36.945 (1.4541 - 1.4545)	39.935 - 39.945 (1.5722 - 1.5726)
Inner diameter "D_2"		29.9 - 30.1 (1.177 - 1.185)	32.9 - 33.1 (1.295 - 1.303)
Diameter of seat "D_3"		33.95 - 34.05 (1.3366 - 1.3405)	36.95 - 37.05 (1.4547 - 1.4587)
Cylinder head valve seat diameter	Standard	36.495 - 36.510 (1.4368 - 1.4374)	39.495 - 39.510 (1.5549 - 1.5555)
	0.2 (0.008) Oversize	36.685 - 36.710 (1.4443 - 1.4453)	39.685 - 39.710 (1.5624 - 1.5634)
	0.4 (0.016) Oversize	36.885 - 36.910 (1.4522 - 1.4531)	39.885 - 39.910 (1.5703 - 1.5713)
Valve seat face angle "φ"		89° - 90°	89° - 90°

Inspection and Adjustment (Cont'd)

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

	Standard	Limit
Camshaft journal to bushing clearance [Oil clearance]	0.020 - 0.109 (0.0008 - 0.0043)	0.15 (0.0059)
Camshaft journal diameter		
Front	50.721 - 50.740 (1.9969 - 1.9976)	–
2nd	50.521 - 50.540 (1.9890 - 1.9898)	–
3rd	50.321 - 50.340 (1.9811 - 1.9819)	–
4th	50.121 - 50.140 (1.9733 - 1.9740)	–
Rear	49.921 - 49.940 (1.9654 - 1.9661)	–
Camshaft bend (Total indicator reading)	Less than 0.02 (0.0008)	0.06 (0.0024)
Camshaft end play	0.08 - 0.28 (0.0031 - 0.0110)	0.50 (0.0197)

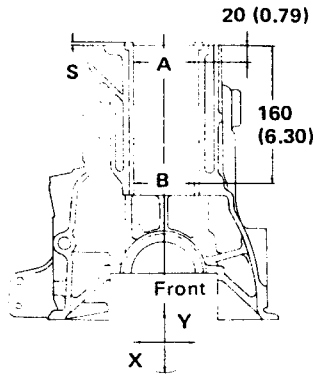


EM671

	Standard	Limit
Cam height "A"		
Intake	41.733 (1.6430)	41.20 (1.6220)
Exhaust	41.900 (1.6496)	41.40 (1.6299)

CYLINDER BLOCK AND CYLINDER LINER

Unit: mm (in)



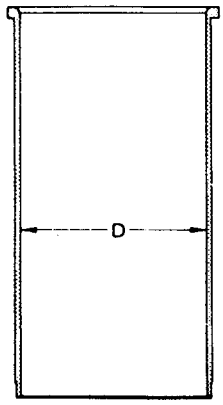
Unit: mm (in)

SEM679B

	TD23	TD27
Surface flatness (Without cylinder liner) Standard	Less than 0.05 (0.0020)	
Limit	0.2 (0.008)	
Cylinder bore Inner diameter Standard	92.000 - 92.020 (3.6220 - 3.6228)	99.000 - 99.020 (3.8976 - 3.8984)
Cylinder bore (With cylinder liner) Inner diameter Standard		
Grade No. 1	89.000 - 89.010 (3.5039 - 3.5043)	96.000 - 96.010 (3.7795 - 3.7799)
Grade No. 2	89.010 - 89.020 (3.5043 - 3.5047)	96.010 - 96.020 (3.7799 - 3.7803)
Grade No. 3	89.020 - 89.030 (3.5047 - 3.5051)	96.020 - 96.030 (3.7803 - 3.7807)
Wear limit	0.20 (0.0079)	
Out-of-round (X-Y)	Less than 0.020 (0.0008)	
Taper (A-B)	Less than 0.20 (0.0079)	
Projection "S"	0.02 - 0.09 (0.0008 - 0.0035)	
Division of each cylinder "S"	Less than 0.05 (0.0020)	
Interference fit cylinder liner to block	–0.01 to 0.03 (–0.0004 to 0.0012)	

Inspection and Adjustment (Cont'd)

Unit: mm (in)



SEM427

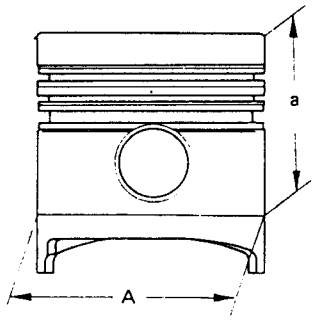
	TD23	TD27
Cylinder liner diameter "D" (service)**	89.050 - 89.070 (3.5059 - 3.5067)	96.050 - 96.070 (3.7815 - 3.7823)

** Before installing in cylinder block

PISTON, PISTON RING AND PISTON PIN

Available piston

Unit: mm (in)



SEM778A

	TD23	TD27
Piston skirt diameter "A" Standard		
Grade No. 1	88.940 - 88.950 (3.5016 - 3.5020)	95.940 - 95.950 (3.7772 - 3.7776)
Grade No. 2	88.950 - 88.960 (3.5020 - 3.5024)	95.950 - 95.960 (3.7776 - 3.7779)
Grade No. 3*	88.960 - 88.970 (3.5024 - 3.5027)	95.960 - 95.970 (3.7779 - 3.7783)
"a" dimension	67 (2.04)	70 (2.76)
Piston pin hole diameter	25.992 - 26.000 (1.0233 - 1.0236)	27.992 - 28.000 (1.1020 - 1.1024)
Piston to cylinder liner clearance	0.05 - 0.07 (0.0020 - 0.0028)	

* Grade No. 3 piston is not provided as a service part

Piston ring

Unit: mm (in)

	Standard	Limit
Side clearance		
Top	0.06 - 0.10 (0.0024 - 0.0039)	0.50 (0.0197)
2nd	0.04 - 0.08 (0.0016 - 0.0031)	0.30 (0.0118)
Oil	0.02 - 0.06 (0.0008 - 0.0024)	0.15 (0.0059)
Ring gap		
Top	0.30 - 0.45 (0.0118 - 0.0177)	1.5 (0.059)
2nd	0.20 - 0.35 (0.0079 - 0.0138)	
Oil (rail ring)	0.30 - 0.50 (0.0118 - 0.0197)	

Piston pin

Unit: mm (in)

	TD23	TD27
Piston pin outer diameter	25.993 - 26.000 (1.0233 - 1.0236)	27.993 - 28.000 (1.1021 - 1.1024)
Piston pin to piston clearance	−0.008 to 0.007 (−0.0003 to 0.0003)	
Piston pin to connecting rod clearance		
Standard	0.025 - 0.045 (0.0010 - 0.0018)	
Limit	0.15 (0.0059)	

CONNECTING ROD

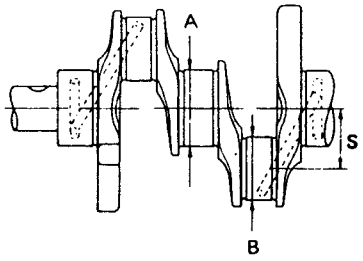
Unit: mm (in)

	TD23	TD27
Center distance	158.975 - 159.025 (6.2588 - 6.2608)	156.975 - 157.025 (6.1801 - 6.1821)
Bend, torsion [per 100 (3.94)]		
Limit	0.05 (0.0020)	
Piston pin bore dia.	26.025 - 26.038 (1.0246 - 1.0251)	28.025 - 28.038 (1.1033 - 1.1039)
Side clearance		
Standard	0.10 - 0.22 (0.0039 - 0.0087)	
Limit	0.22 (0.0087)	

Inspection and Adjustment (Cont'd)

CRANKSHAFT

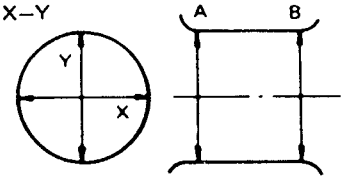
Unit: mm (in)



SEM100A

Journal diameter "A"	70.907 - 70.920 (2.7916 - 2.7921)
Pin diameter "B"	
TD23	52.913 - 52.926 (2.0832 - 2.0837)
TD27	56.913 - 56.962 (2.2407 - 2.2426)
Center distance "S"	46.00 (1.8110)

Out-of-round X–Y
Taper A–B



EM715

Taper of journal and pin "A-B"	
Standard	0.01 (0.0004)
Limit	0.02 (0.0008)
Out-of-round of journal and pin "X-Y"	
Standard	0.01 (0.0004)
Limit	0.02 (0.0008)
Crankshaft bend	
Standard	0 - 0.03 (0 - 0.0012)
Limit	0.10 (0.0039)
Crankshaft end play	
Standard	0.055 - 0.14 (0.0022 - 0.0055)
Limit	0.40 (0.0157)

AVAILABLE MAIN BEARING

Bearing clearance

Unit: mm (in)

Main bearing clearance	
Standard	0.035 - 0.087 (0.0014 - 0.0034)
Limit	0.15 (0.0059)
Connecting rod bearing clearance	
Standard	0.035 - 0.081 (0.0014 - 0.0032)
Limit	0.15 (0.0059)

Main bearing undersize

Unit: mm (in)

	Crank journal diameter
Standard	70.907 - 70.920 (2.7916 - 2.7921)
Undersize	
0.25 (0.0098)	70.657 - 70.670 (2.7818 - 2.7823)
0.50 (0.0197)	70.407 - 70.420 (2.7719 - 2.7724)
0.75 (0.0295)	70.157 - 70.170 (2.7621 - 2.7626)
1.00 (0.0394)	69.907 - 69.920 (2.7522 - 2.7528)

AVAILABLE CONNECTING ROD BEARING

Connecting rod bearing undersize

Unit: mm (in)

	Crank pin journal diameter	
	TD23	TD27
Standard	52.913 - 52.926 (2.0832 - 2.0837)	56.913 - 56.926 (2.2407 - 2.2412)
Undersize		
0.25 (0.0098)	52.663 - 52.676 (2.0733 - 2.0739)	56.663 - 56.676 (2.2308 - 2.2313)
0.50 (0.0197)	52.413 - 52.426 (2.0635 - 2.0640)	56.413 - 56.676 (2.2210 - 2.2313)
0.75 (0.0295)	52.163 - 52.176 (2.0537 - 2.0542)	56.163 - 56.176 (2.2111 - 2.2116)
1.00 (0.0394)	51.913 - 51.926 (2.0438 - 2.0443)	55.913 - 55.926 (2.2013 - 2.2018)

Inspection and Adjustment (Cont'd)

AVAILABLE THRUST WASHER

Thrust washer undersize

Unit: mm (in)

	Thrust washer thickness
Standard	
Stamped mark A	2.295 - 2.325 (0.0904 - 0.0915)
B	2.320 - 2.350 (0.0913 - 0.0925)
C	2.345 - 2.375 (0.0923 - 0.0935)
Oversize	
0.20 (0.0079)	2.495 - 2.525 (0.0982 - 0.0994)
0.40 (0.0157)	2.695 - 2.725 (0.1061 - 0.1073)

MISCELLANEOUS COMPONENTS

Unit: mm (in)

Gear train	
Backlash of each gear	0.07 - 0.11 (0.0028 - 0.0043)
Limit	0.20 (0.0079)
Flywheel	
Runout (Total indicator reading)	Less than 0.15 (0.0059)
Front plate	
Warpage limit	0.2 (0.008)

Tightening Torque

Engine outer parts

	N·m	kg-m	ft-lb
Water outlet bolt	16 - 21	1.6 - 2.1	12 - 15
Thermostat housing	16 - 21	1.6 - 2.1	12 - 15
Water pump bolt			
M8	16 - 21	1.6 - 2.1	12 - 15
M10	30 - 41	3.1 - 4.2	22 - 30
Cooling fan fixing bolt	7 - 9	0.7 - 0.9	5.1 - 6.5
Manifold nut			
Intake	15 - 20	1.5 - 2.0	11 - 14
Exhaust	25 - 29	2.5 - 3.0	18 - 22
Injection pump nut	20 - 25	2.0 - 2.5	14 - 18
Injection pump to bracket bolt	30 - 41	3.1 - 4.2	22 - 30
Injection nozzle to cylinder head	54 - 64	5.5 - 6.5	40 - 47
Injection pump drive gear nut	59 - 69	6.0 - 7.0	43 - 51
Injection tube flare nut	20 - 25	2.0 - 2.5	14 - 18
Spill tube with cap nut	29 - 39	3.0 - 4.0	22 - 29
Oil filter bracket bolt	16 - 21	1.6 - 2.1	12 - 15
Oil cooler bolt	16 - 21	1.6 - 2.1	12 - 15
Alternator bracket bolt	30 - 41	3.1 - 4.2	22 - 30
Alternator to adjusting bar bolt	16 - 21	1.6 - 2.1	12 - 15
Starter motor to transmission	39 - 44	4.0 - 4.5	29 - 33

Engine parts

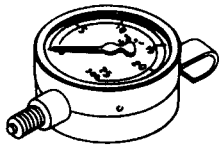
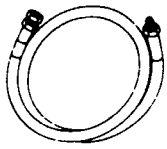
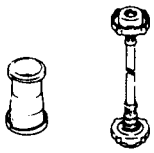
	N·m	kg-m	ft-lb
Main bearing cap bolt	167 - 177	17.0 - 18.0	123 - 130
Connecting rod big end nut	78 - 83	8.0 - 8.5	58 - 61
Crank pulley nut	294 - 324	30 - 33	217 - 239
Flywheel bolt	147 - 167	15.0 - 17.0	108 - 123
Timing gear case bolt	16 - 21	1.6 - 2.1	12 - 15
Timing gear case nut	16 - 21	1.6 - 2.1	12 - 15
Front end plate bolt	10 - 13	1.0 - 1.3	7 - 9
Camshaft gear bolt	44 - 49	4.5 - 5.0	33 - 36
Camshaft locating plate bolt	4 - 6	0.4 - 0.6	2.9 - 4.3
Idler gear shaft bolt	25 - 35	2.6 - 3.6	19 - 26
Oil pump bolt	13 - 19	1.3 - 1.9	9 - 14
Oil jet (for piston)	29 - 39	3 - 4	22 - 29
Oil pan bolt	7 - 9	0.7 - 0.9	5.1 - 6.5
Oil pan drain bolt	44 - 54	4.5 - 5.5	33 - 40
Cylinder head bolt			
1st	49 - 59	5.0 - 6.0	36 - 43
2nd	98 - 108	10.0 - 11.0	72 - 80
Glow plug	15 - 20	1.5 - 2.0	11 - 14
Rocker shaft bracket bolt	20 - 25	2.0 - 2.5	14 - 18
Rocker arm lock nut	14 - 18	1.4 - 1.8	10 - 13
Rocker cover screw	1 - 2	0.1 - 0.2	0.7 - 1.4

ENGINE LUBRICATION & COOLING SYSTEMS

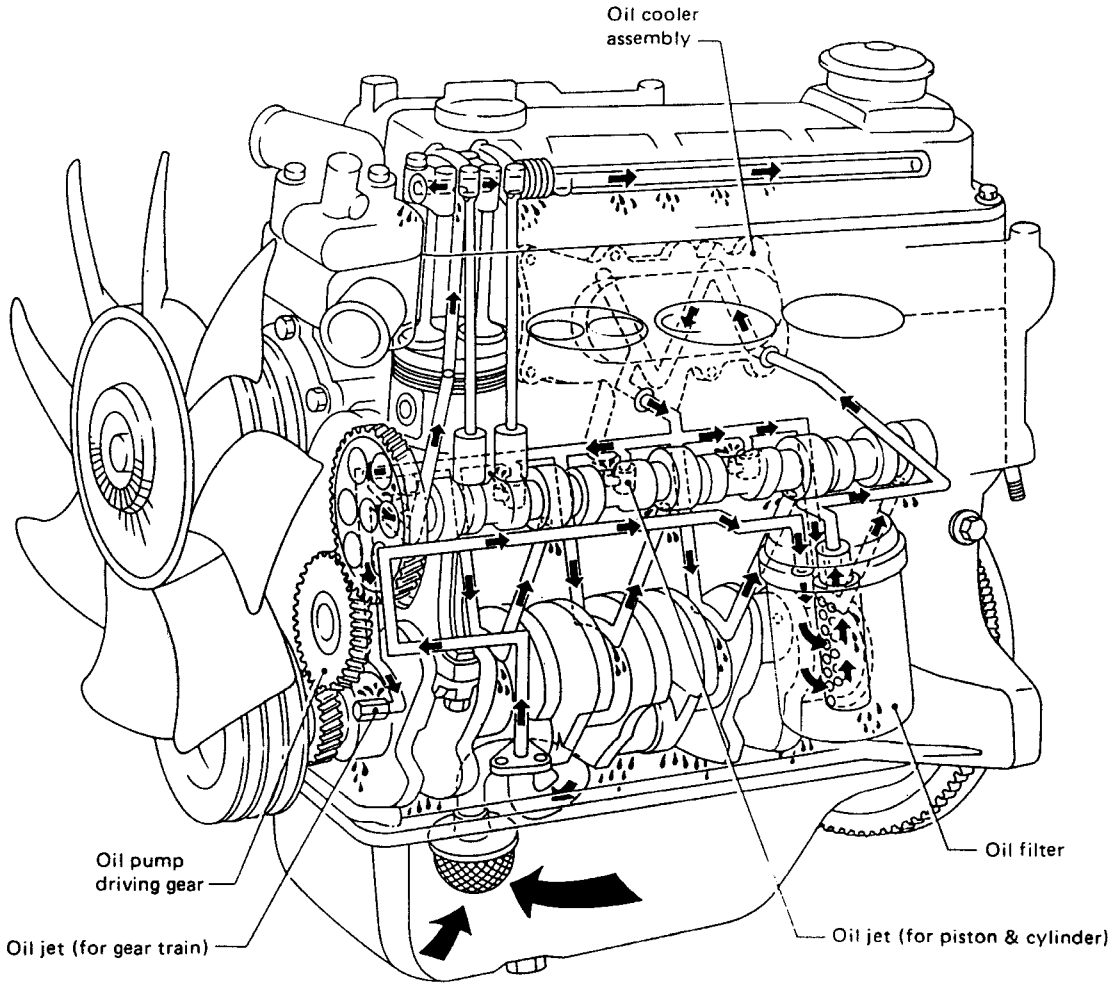
SECTION LC

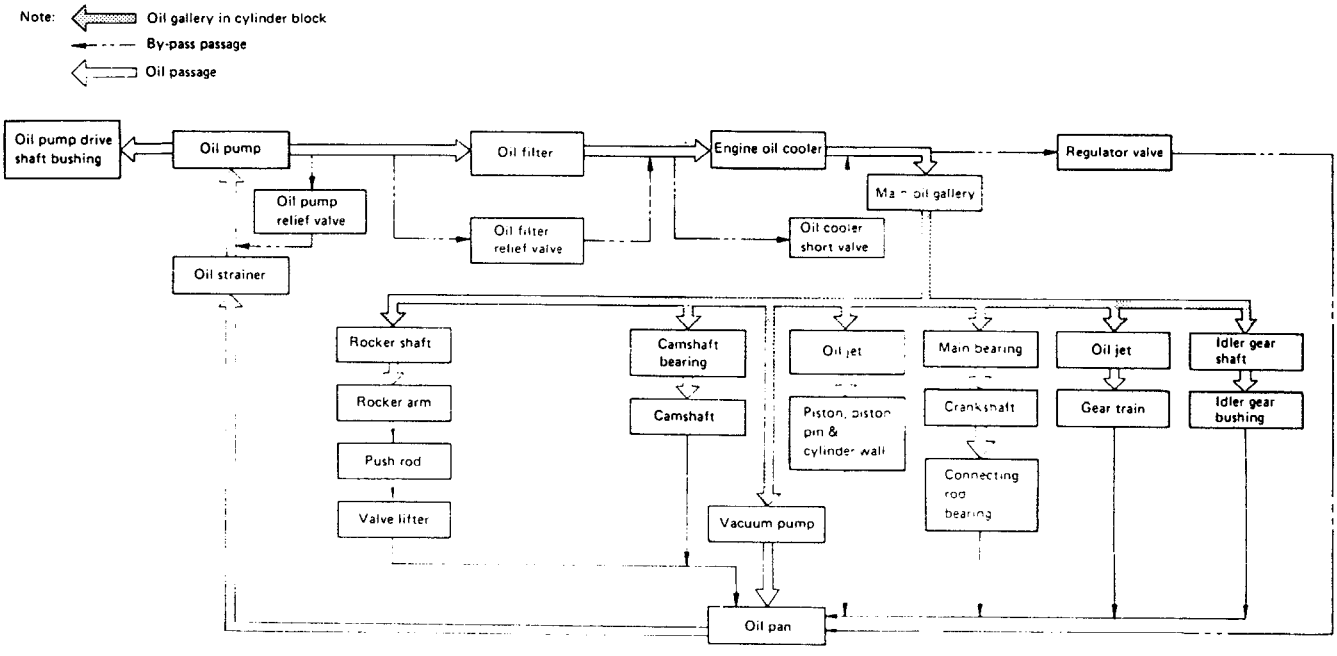
CONTENTS

SPECIAL SERVICE TOOLS

Tool number Tool name	Description	
ST25051001 Oil pressure gauge		
ST25052000 Hose		Adapting oil pressure gauge to cylinder block
EG17650301 Radiator cap tester adapter		Adapting radiator cap tester to radiator filler neck

Lubrication Circuit





SLC963

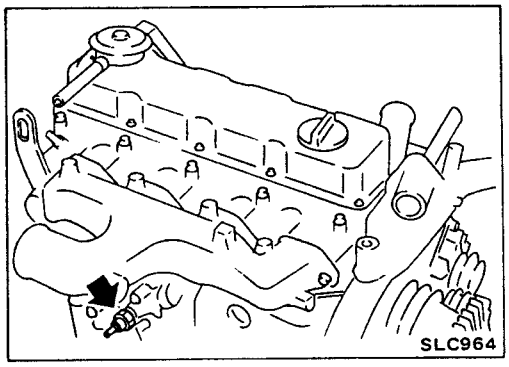
Oil Pressure Check (On-vehicle service)

WARNING

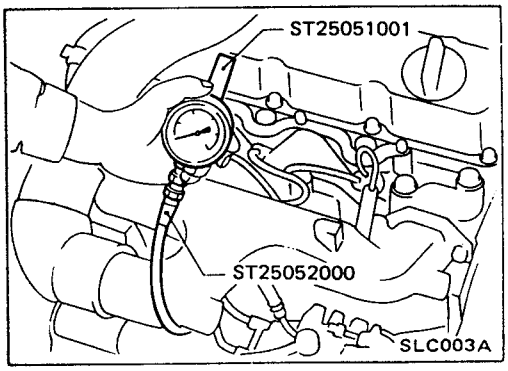
- Be careful not to burn yourself, as the engine and oil may be hot.
- Oil pressure check should be done in "Neutral" gear position.

CAUTION:

- The following data is tested using SAE10W-30 oil and with oil temperature between 77 and 83°C (171 and 181°F). Slight difference will be found because of oil viscosity or oil temperature. If difference is extreme, check oil passage and oil pump for oil leaks.



1. Warm up engine.
2. Stop engine and remove oil pressure switch.

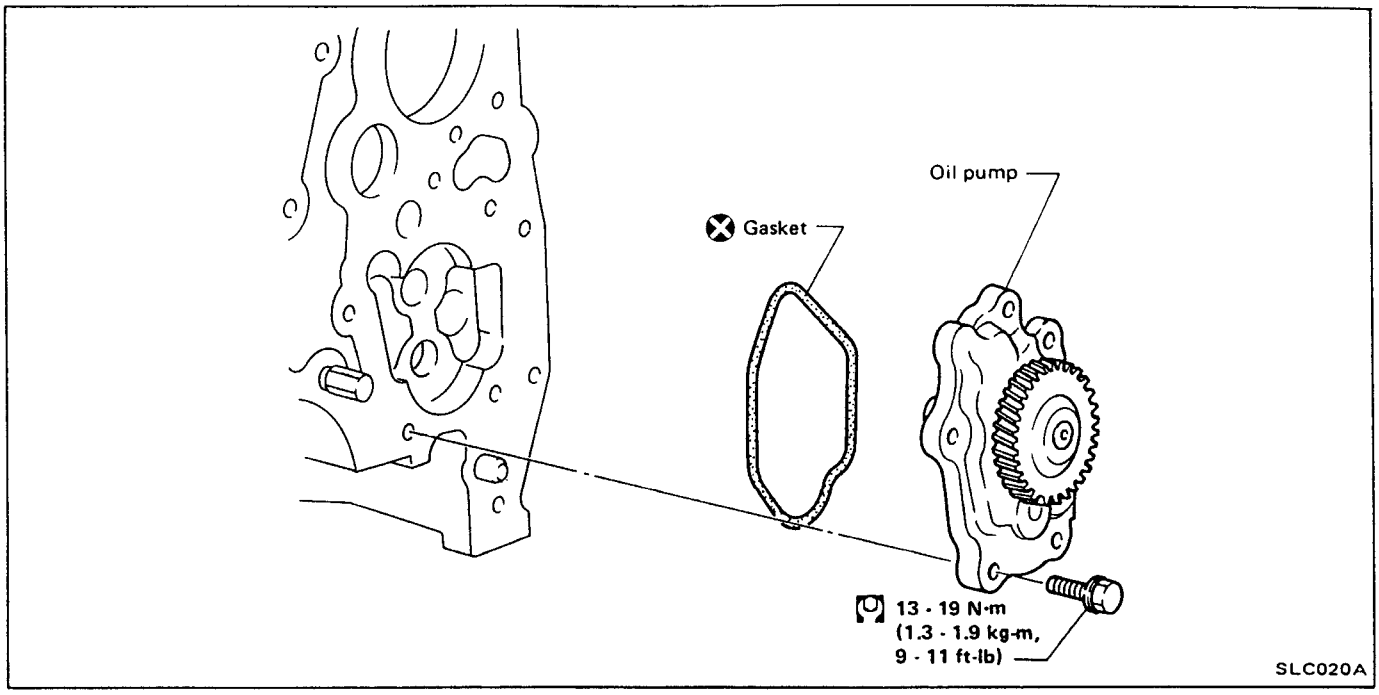


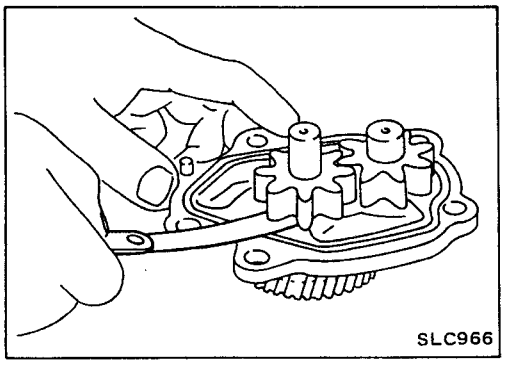
3. Install pressure gauge.
4. Start engine and check oil pressure with engine running under no-load.

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm^2, psi)
Idle speed	186 (1.86, 1.9, 27)
1,000	196 (1.96, 2.0, 28)
2,000	304 (3.04, 3.1, 44)
3,000	353 (3.53, 3.6, 51)

5. Install oil pressure switch with sealant.

Oil Pump

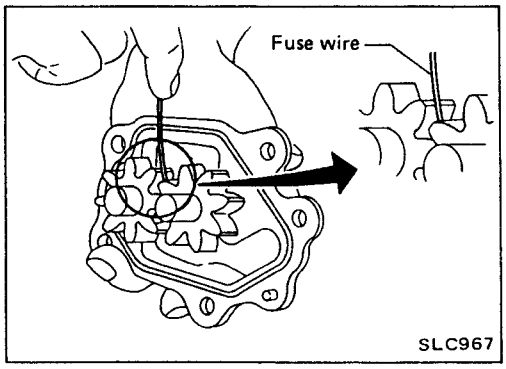




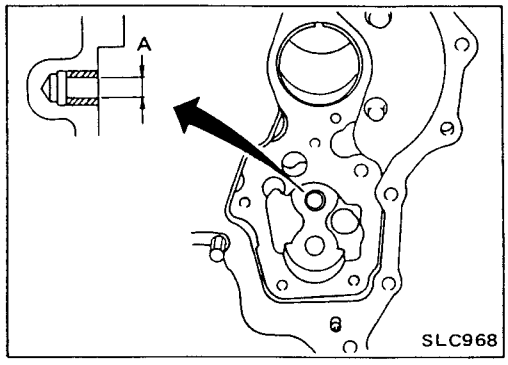
OIL PUMP INSPECTION

1. Inspect pump body, gears and drive shaft for wear and damage.
2. Using a feeler gauge and fuse wire, check the following clearances.

Gear side clearance:
Less than 0.13 mm (0.0051 in)

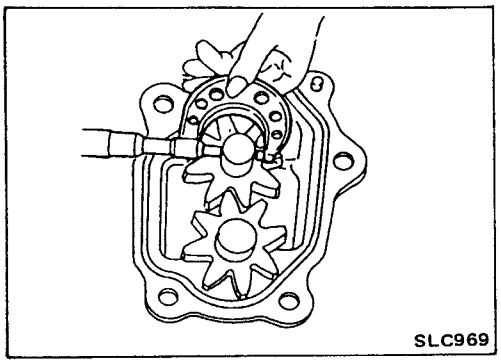


Gear backlash:
Less than 0.43 mm (0.0169 in)



3. Measure inside diameter "A" of bushing.
A: 13.012 - 13.098 mm (0.5123 - 0.5157 in)

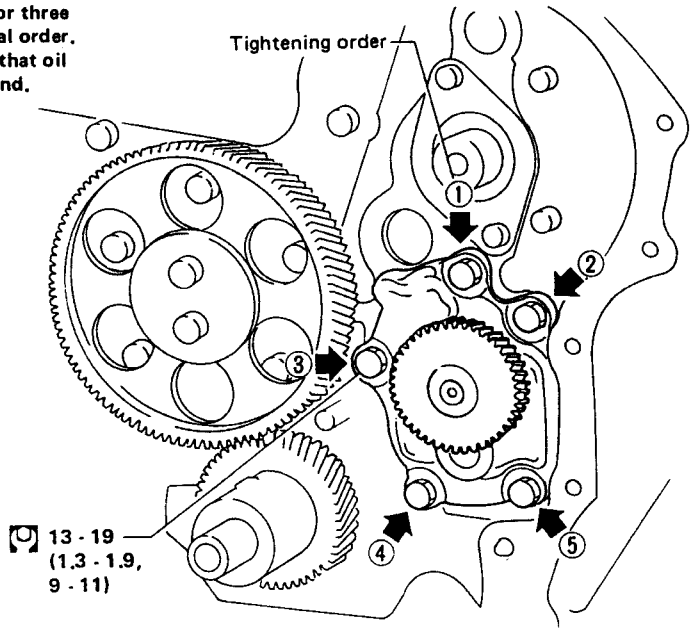
Oil Pump (Cont'd)


SLC969

4. Measure outside diameter "B" of drive gear shaft.
   B: 12.974 - 12.992 mm (0.5108 - 0.5115 in)
5. Calculate oil pump bushing clearance.
   Oil pump bushing clearance: A – B
   Less than 0.15 mm (0.0059 in)

If it exceeds the limit, replace oil pump bushing or entire oil pump assembly.

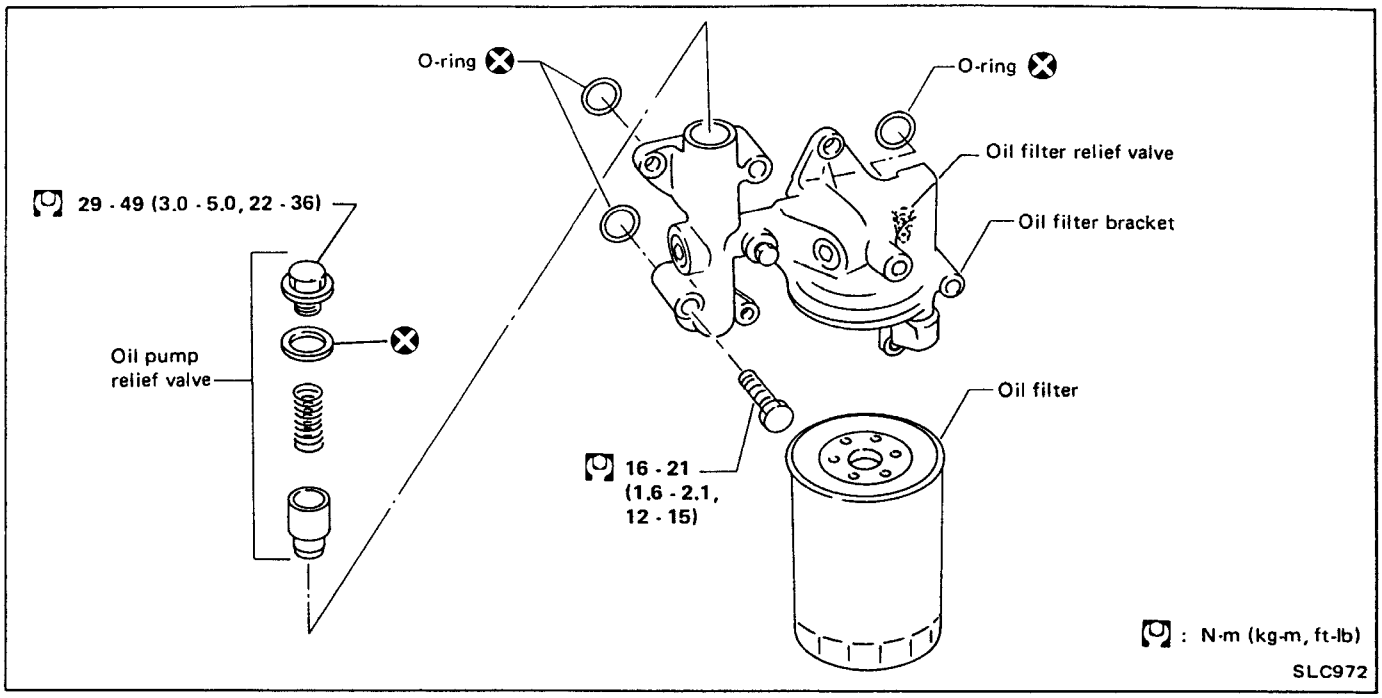
- When installing oil pump, the bolt should be tightened in two or three stages according to numerical order.
- After installation, ascertain that oil pump turns smoothly by hand.



: N·m (kg-m, ft-lb)

SLC965

Oil Filter Bracket



OIL PUMP RELIEF VALVE INSPECTION

1. Visually inspect components for wear and damage.
2. Coat relief valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

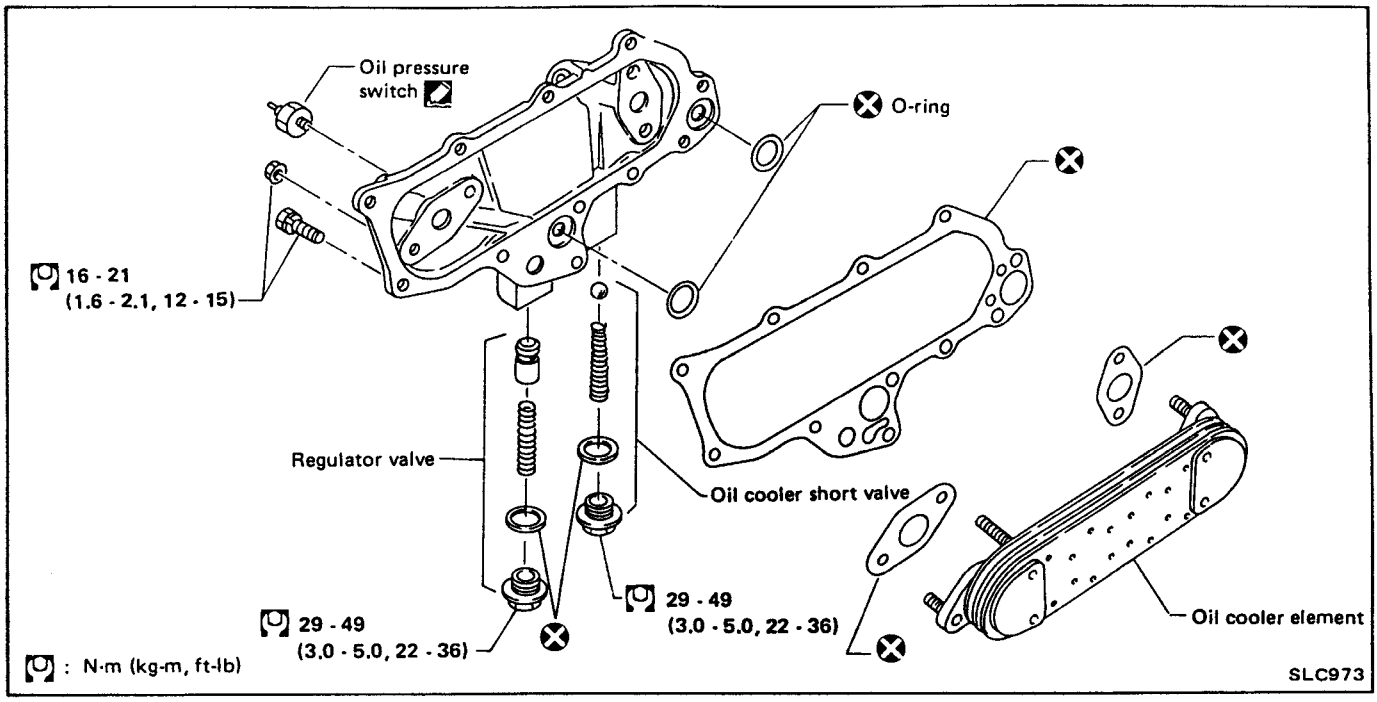
If damaged, replace oil pump relief valve set.

OIL FILTER RELIEF VALVE INSPECTION

Inspect oil filter short valve for movement, cracks and breaks by pushing the ball.

If damaged, replace oil filter bracket assembly.

Oil Cooler



OIL COOLER SHORT VALVE INSPECTION

Inspect oil cooler short valve for movement, cracks and breaks by pushing the ball.

If damaged, replace oil cooler short valve set.

REGULATOR VALVE INSPECTION

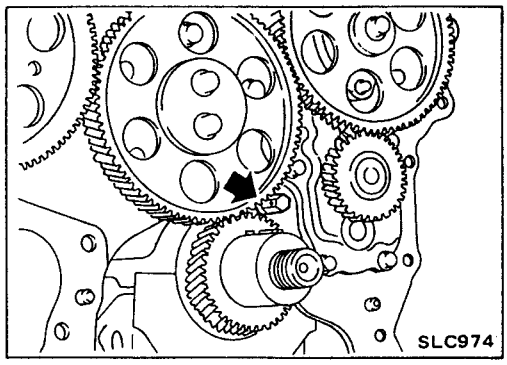
1. Visually inspect components for wear and damage.
2. Coat regulator valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

If damaged, replace regulator valve set.

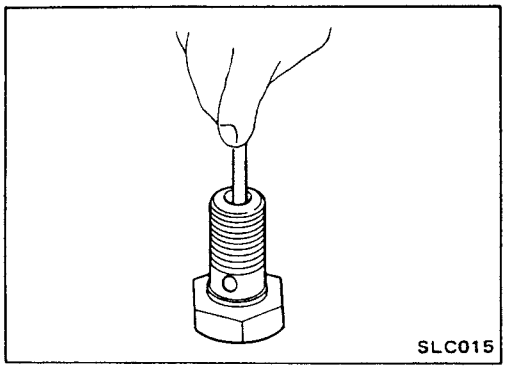
Oil Jet

INSPECTION (For gear train)

Make sure that the holes are not clogged. Clean them with a wire if necessary.

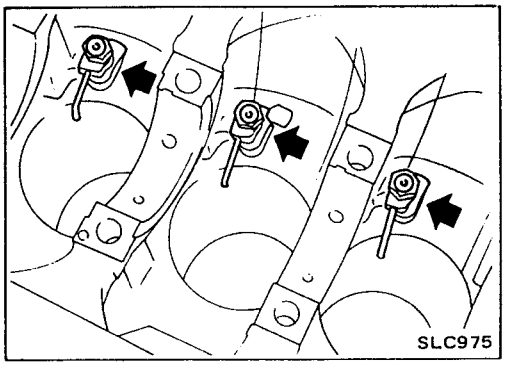


Oil jet has to be installed with oil hole facing crank gear and idler gear.



INSPECTION (For piston)

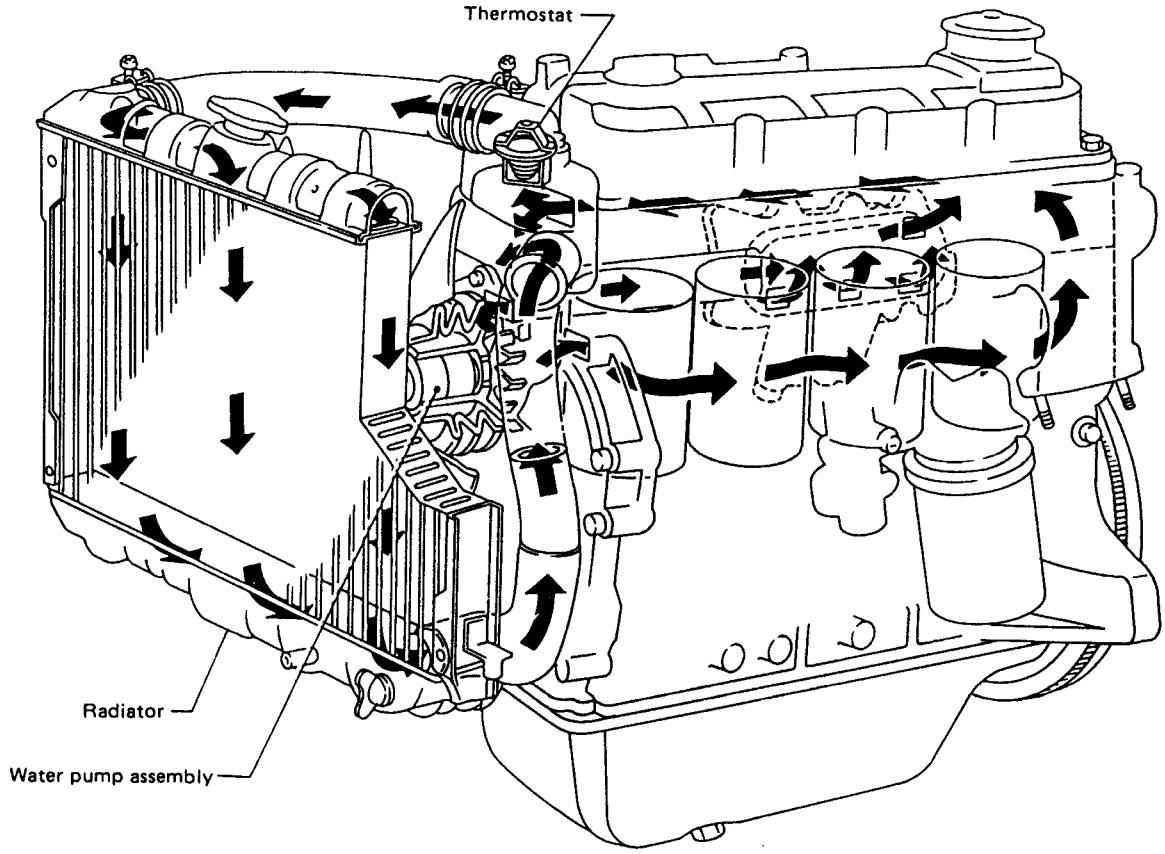
1. Blow through outlet of oil jet and make sure that air comes out of inlet.
2. Push cut-off valve of oil jet bolt with a clean resin or brass rod and make sure that cut-off valve moves smoothly with proper repulsion.

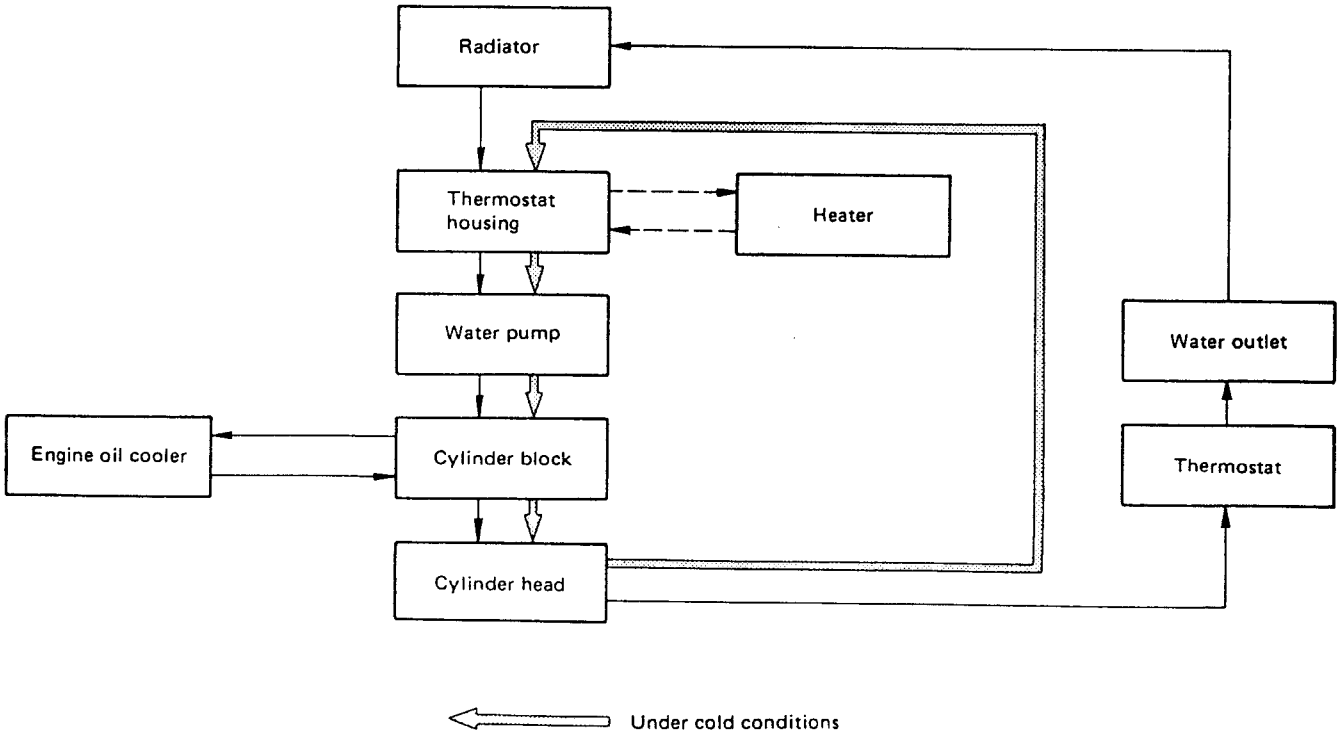


When installing oil jet, align oil jet's boss with hole on cylinder block.

[O] : Oil jet bolt
29 - 39 N·m (3.0 - 4.0 kg-m, 22 - 29 ft-lb)

Cooling Circuit



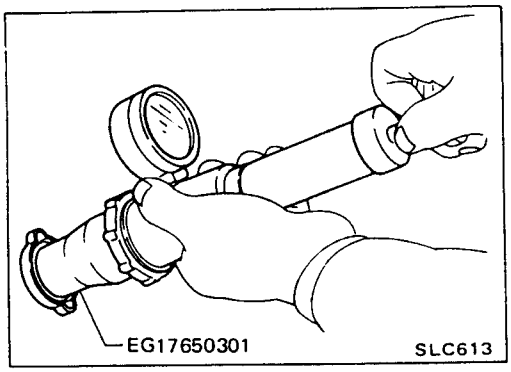


SLC976

Cooling System Inspection

CHECKING HOSES

Check hoses for proper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.



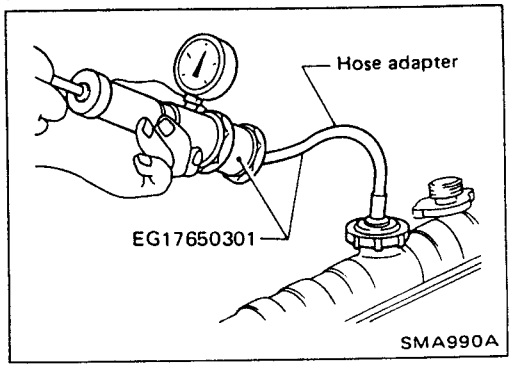
CHECKING RADIATOR CAP

Apply pressure to radiator cap by means of a cap tester to see if it is satisfactory.

Radiator cap relief pressure:

78 - 98 kPa

(0.78 - 0.98 bar, 0.8 - 1.0 kg/cm², 11 - 14 psi)



CHECKING COOLING SYSTEM FOR LEAKS

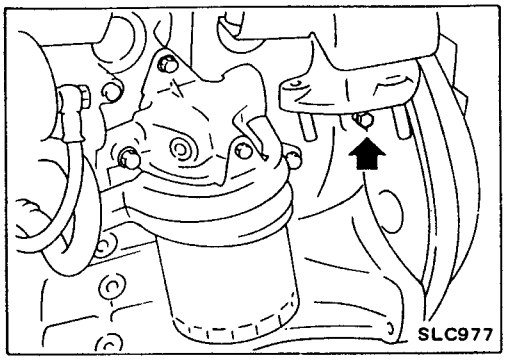
Apply pressure to the cooling system by means of a tester to check for leakage.

Testing pressure:

157 kPa (1.57 bar, 1.6 kg/cm², 23 psi)

CAUTION:

Higher than the specified pressure may cause radiator damage.

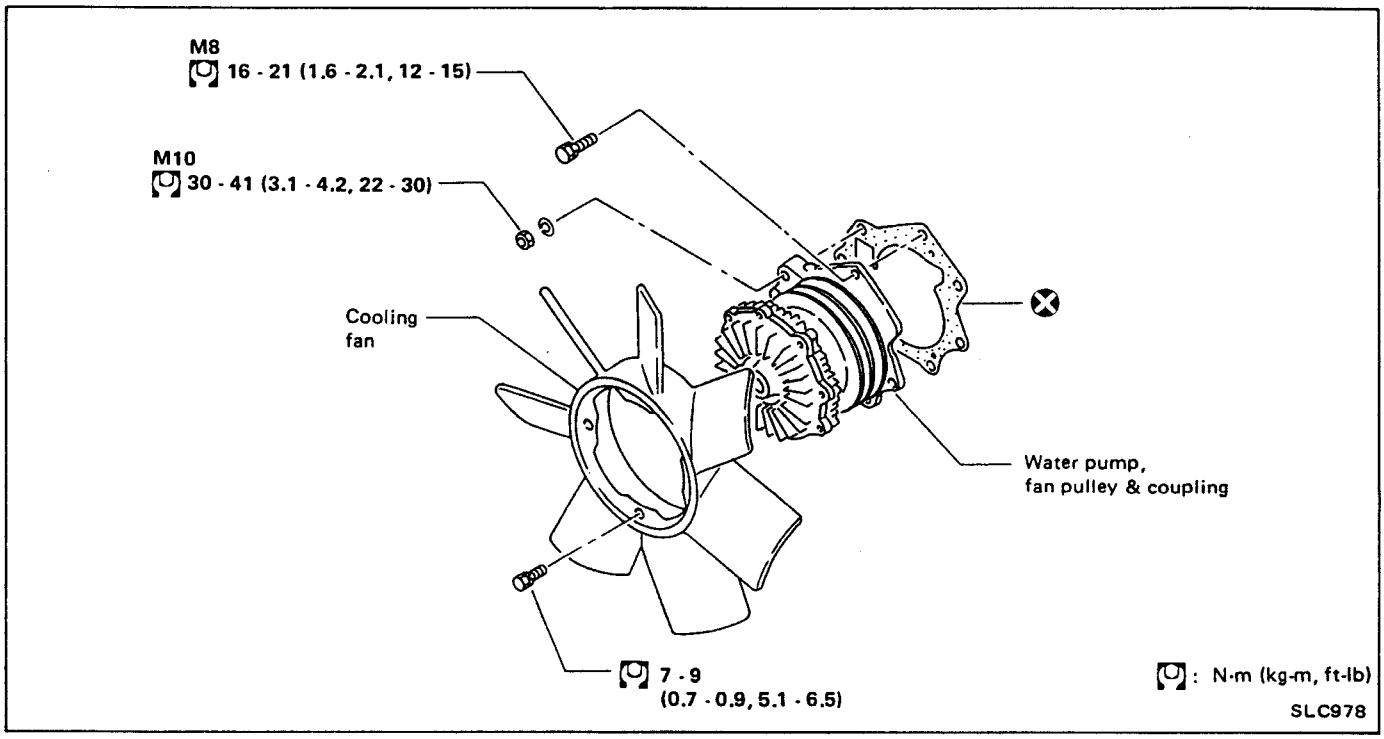


Water Pump

REMOVAL AND INSTALLATION

Drain coolant from drain plugs on cylinder block and radiator.

: Cylinder block drain plug
(Use proper sealant)
20 - 29 N·m (2.0 - 3.0 kg-m, 14 - 22 ft-lb)

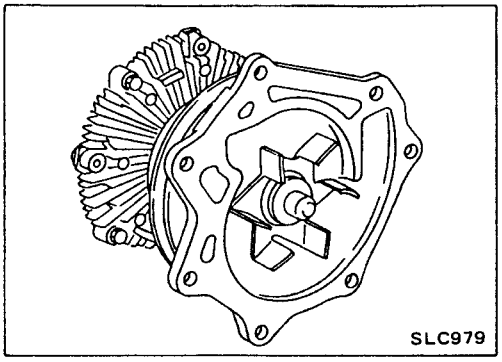


CAUTION:

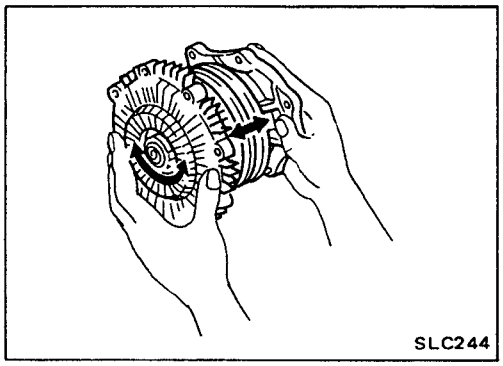
- When removing water pump assembly, be careful not to get coolant on drive belt.
- Water pump cannot be disassembled and should be replaced as a unit.
- Always replace with new gasket.
- After installing water pump, connect hose and clamp securely, then check for leaks using radiator cap tester.

Water Pump (Cont'd)

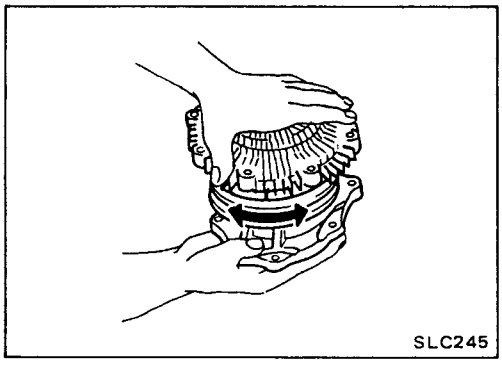
INSPECTION


SLC979

1. Check for badly rusted or corroded body assembly and vane.


SLC244

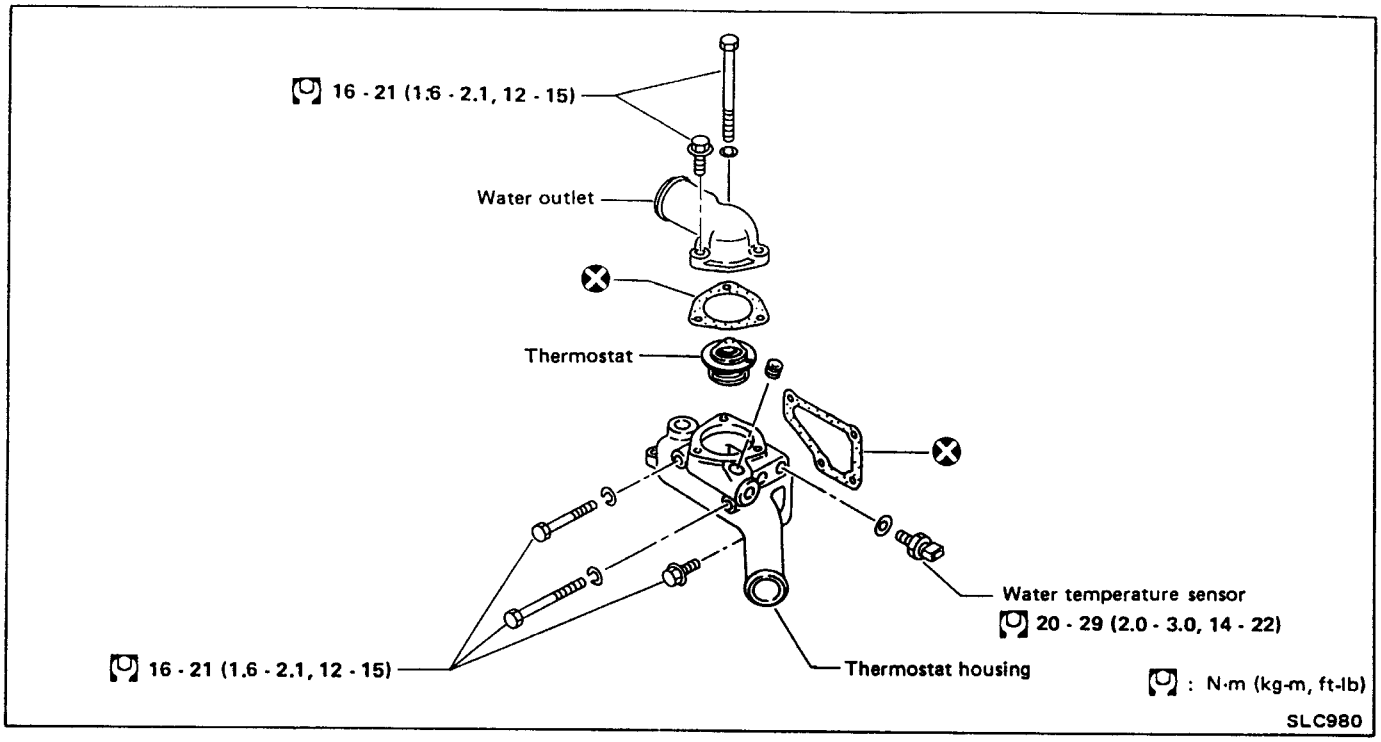
2. Check for rough operation due to excessive end play.


SLC245

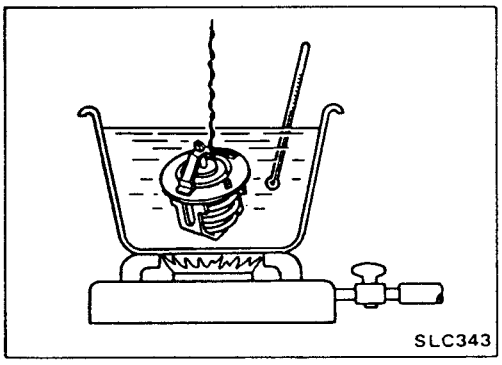
3. Check fan coupling for rough operation, oil leakage or bent bimetal.

The water pump and fan coupling cannot be disassembled and should be replaced as a unit.

Thermostat



- **After installation, run engine for a few minutes, and check for leaks.**
- **Be careful not to spill coolant over engine compartment. Place a rag to absorb coolant.**



INSPECTION

1. Check for valve seating condition at ordinary temperatures. It should seat tightly.
2. Check valve opening temperature and maximum valve lift.

	Tropical type	Standard type
Valve opening temperature °C (°F)	76.5 (170)	82 (180)
Max. valve lift mm/°C (in/°F)	8/90 (0.31/194)	8/95 (0.31/203)

3. Then check if valve closes at 5°C (9°F) below valve opening temperature.

Engine Lubrication System

Oil pressure check

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm², psi)
Idle speed	186 (1.86, 1.9, 27)
1,000	196 (1.96, 2.0, 28)
2,000	304 (3.04, 3.1, 44)
3,000	353 (3.53, 3.6, 51)

Oil pump inspection

Unit: mm (in)

Gear side clearance	Less than 0.13 (0.0051)
Gear backlash	Less than 0.43 (0.0169)
Oil pump bushing clearance	Less than 0.15 (0.0059)
Oil pump bushing inside diameter	13.012 - 13.098 (0.5123 - 0.5157)
Drive gear shaft outside diameter	12.974 - 12.992 (0.5108 - 0.5115)

Tightening torque

Unit	N·m	kg-m	ft-lb
Oil pump fixing bolt	13 - 19	1.3 - 1.9	9 - 14
Oil cooler securing bolt	16 - 21	1.6 - 2.1	12 - 15
Oil filter bracket fixing bolt	16 - 21	1.6 - 2.1	12 - 15
Oil jet bolt (for piston)	29 - 39	3.0 - 4.0	22 - 29
Oil pump relief valve	29 - 49	3.0 - 5.0	22 - 36
Oil cooler short valve	29 - 49	3.0 - 5.0	22 - 36
Regulator valve	29 - 49	3.0 - 5.0	22 - 36

Engine Cooling System

Thermostat

	Tropical type	Standard type
Valve opening temperature °C (°F)	76.5 (170)	82 (180)
Max. valve lift mm/°C (in/°F)	8/90 (0.31/194)	8/95 (0.31/203)

Radiator

Unit: kPa (bar, kg/cm², psi)

Cap relief pressure	78 - 98 (0.78 - 0.98, 0.8 - 1.0, 11 - 14)
Leakage test pressure	157 (1.57, 1.6, 23)

Tightening torque

Unit	N·m	kg-m	ft-lb
Water pump			
M8	16 - 21	1.6 - 2.1	12 - 15
M10	30 - 41	3.1 - 4.2	22 - 30
Thermostat housing bolt	16 - 21	1.6 - 2.1	12 - 15
Water outlet bolt	16 - 21	1.6 - 2.1	12 - 15
Fan securing bolt	7 - 9	0.7 - 0.9	5.1 - 6.5
Cylinder block drain plug	20 - 29	2.0 - 3.0	14 - 22
Water temperature sensor	20 - 29	2.0 - 3.0	14 - 22

ENGINE FUEL

SECTION EF

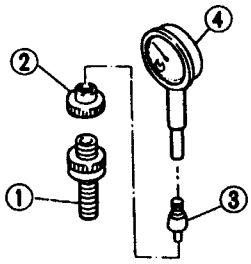
CONTENTS

FUEL INJECTION PUMPS USED ON
CARBODIES FAIRWAY MODELS ARE IDENTIFIED BY THE
FOLLOWING PARTS NUMBERS:

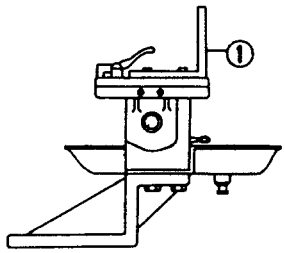
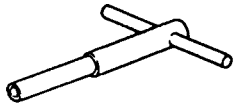
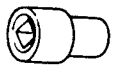
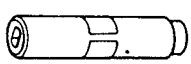
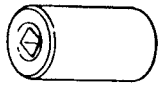
AUTOMATIC TRANSMISSION	16700-31 NO 1
MANUAL TRANSMISSION	16700-21 NO 1

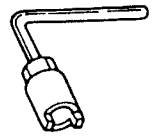
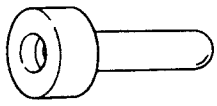
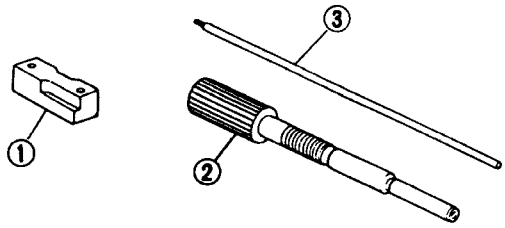
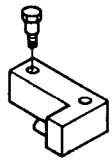
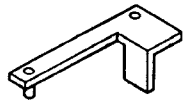
SPECIAL SERVICE TOOLS
VE-type injection pump

Adjusting device on car

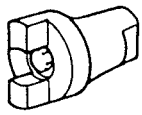
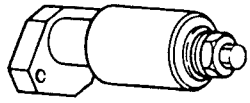
Tool number Tool name	Description
KV11229352 Measuring device (Set length of plunger spring) ① KV11229350 Holder ② KV11229360 Nut ③ KV11229370 Pin ④ KV11254410 Dial gauge	

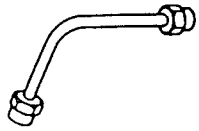
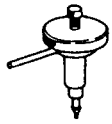
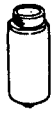
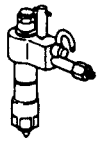
Disassembling and assembling tools

KV11294005 Universal vice assembly ① KV11244260 Injection pump attaching plate	
KV11229072 Insert device	
KV11214110 Socket wrench for delivery valve	
KV11214270 Socket wrench for governor pivot bolt	
KV11214260 Socket wrench for regulating valve	
KV11214250 Socket wrench for distributor head plug	

Tool number Tool name	Description
KV11215262 Governor shaft adjusting device	
KV11229540 Feed pump holder	
KV11229852 "MS" measuring device set ① KV11229110 Block gauge ② KV11229820 Dummy shaft ③ KV11229830 Rod	
KV11229752 Block gauge (For high altitude compensator)	
KV11229762 Block gauge (For high altitude compensator)	
KV11229042 "K" & "KF" measuring device	

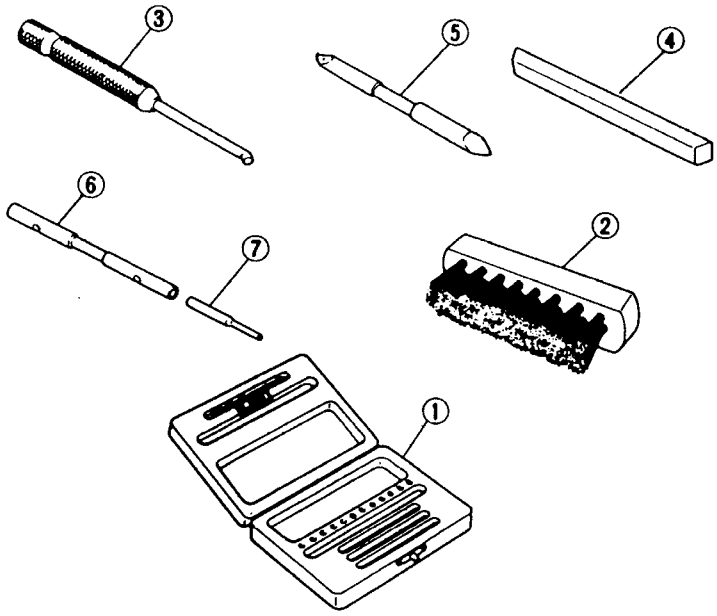
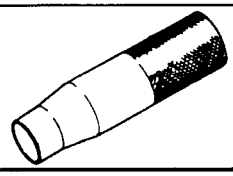
Adjusting device on pump tester

KV11281036 Fixing stand	
KV11242442 Coupling	
KV11282815 Measuring device (Timer advance angle)	

Tool number Tool name	Description
KV11205032 Injection pipe [840 mm (33.07 in)]	
KV11229462 Extractor (Disassembling of regulating valve)	
KV11229522 Insert device (Assembling of regulating valve)	
KV11257802 Nozzle holder (Bosch type EF8511-9A)	
KV11257800 Nozzle (Bosch type DN12SD12T)	

SPECIAL SERVICE TOOLS

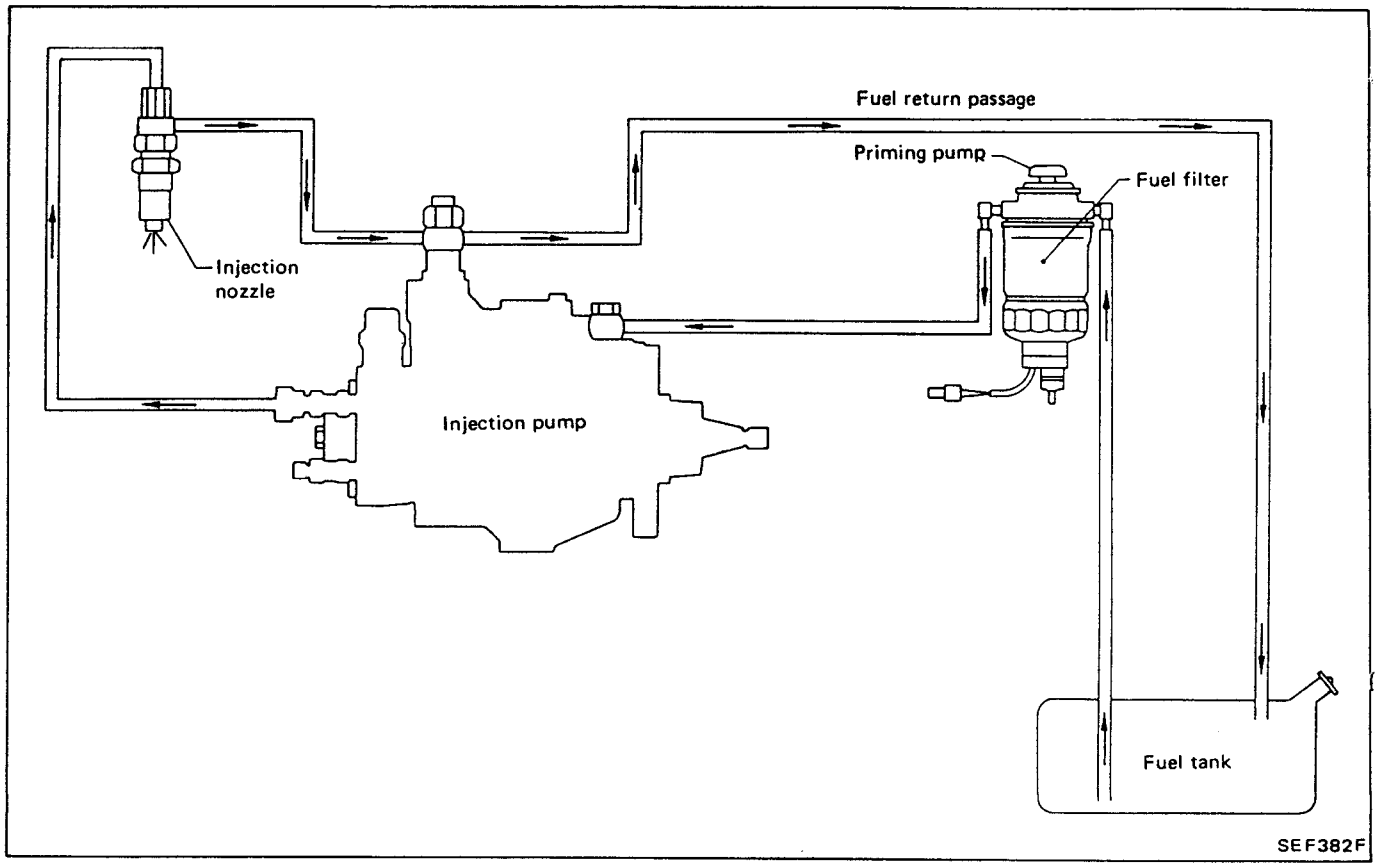
Injection nozzle

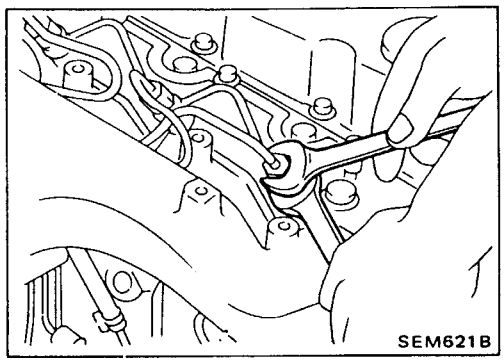
KV11289004 Nozzle cleaning kit ①KV11290012 Box ②KV11290110 Brush ③KV11290122 Nozzle oil sump scraper ④KV11290140 Nozzle needle tip cleaner ⑤KV11290150 Nozzle seat scraper ⑥KV11290210 Nozzle holder ⑦KV11290220 Nozzle hole cleaning needle	
KV11292210 Nozzle centering device	

CAUTION:

- Disassembly and assembly of the injection pumps should be done only in service shops authorized by NISSAN or by the pump manufacturer.
- The pump tester is required for servicing the pump.
- Before removing fuel injection pump from vehicle, check closely to make sure that it is definitely malfunctioning.

VE-TYPE INJECTION PUMP

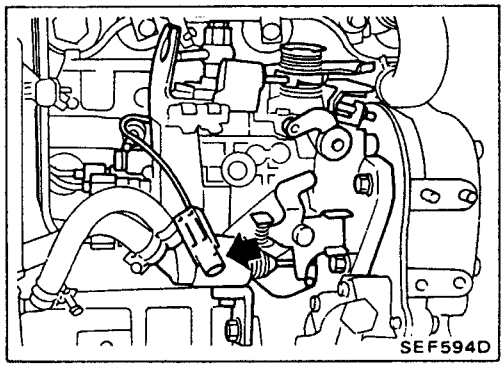




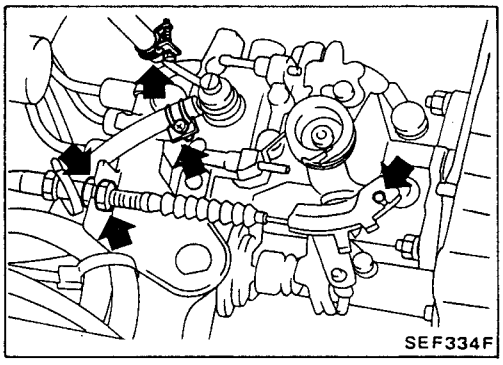
Removal

1. Remove injection tube.

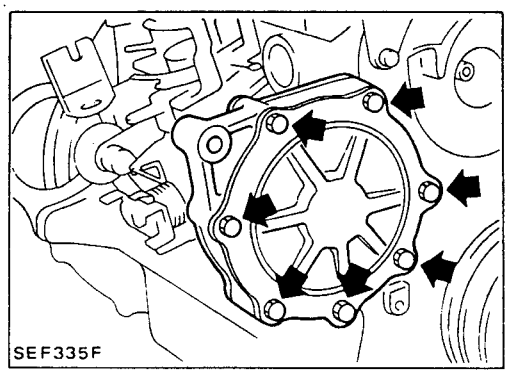
Cover the injection nozzle assembly with a plug to prevent dust entry.



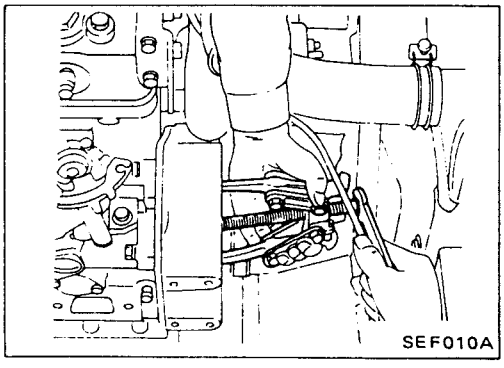
2. Remove fuel cut solenoid wire.



3. Remove accelerator wire and disconnect overflow hose, fuel inlet hose and fuel return hose.

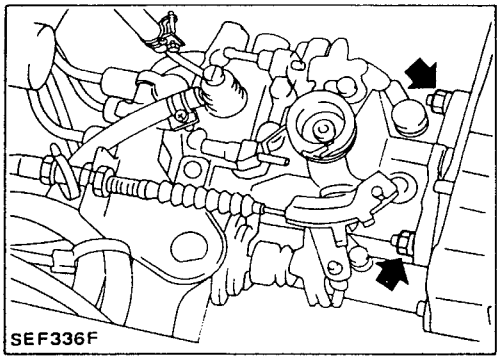


4. Remove injection pump drive gear cover.

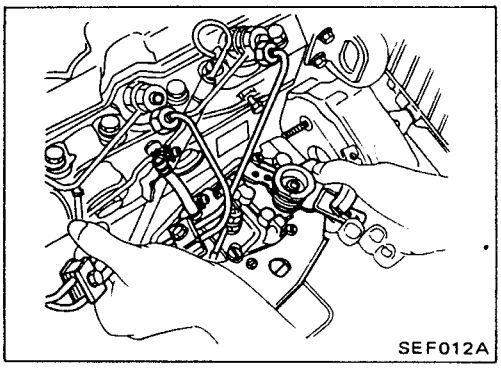


5. Loosen injection pump drive gear nut and remove drive gear by using puller.

Removal (Cont'd)


SEF336F

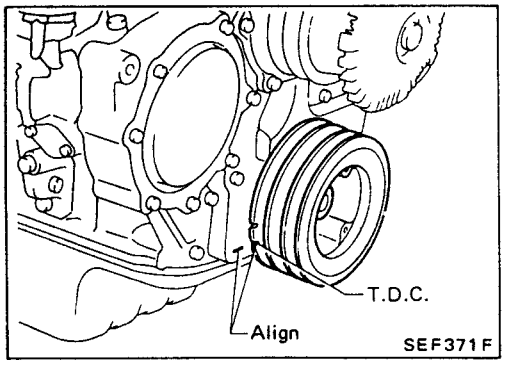
6. Remove injection pump fixing nuts and bolts.


SEF012A

7. Remove injection pump with injection tubes.

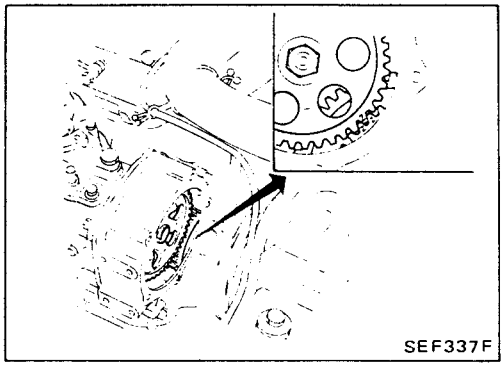
Disconnect injection tube from pump once it is removed.

Installation and Adjustment



SEF371F

1. Confirm that No. 1 piston is set at T.D.C. on its compression stroke.

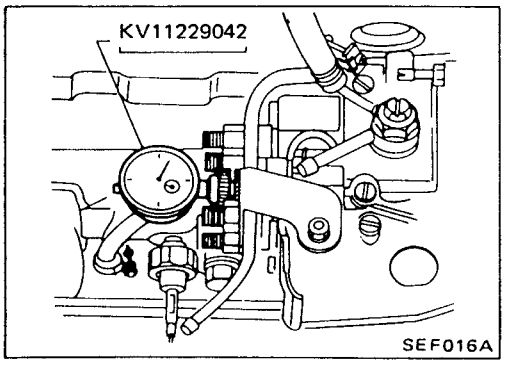

SEF337F

2. Install injection pump.
(1) Temporarily set injection pump so that the flange of pump is aligned with aligning mark on front cover.
(2) Install injection drive gear.

[O] : 59 - 69 N·m (6 - 7 kg-m, 43 - 51 ft-lb)

Make sure that the key does not fall into the front cover.
Make sure that "Z" marks are aligned.

(3) Install drive gear cover with new gasket.



SEF016A

PLUNGER LIFT ADJUSTMENT

1. Loosen injection pump mounting nuts and mounting bracket bolt.
2. Remove plug bolt from distributor head and install dial gauge.
3. Plunger lift measurement and adjustment.
(1) Turn crankshaft counterclockwise 20 to 25 degrees from No. 1 piston at T.D.C.
(2) Find dial gauge's needle rest position at step (1) set position, then set the gauge to zero.

Installation and Adjustment (Cont'd)

(3) Turn crankshaft clockwise until No. 1 piston is set at T.D.C.

(4) Read dial gauge indication.

TD23:
0.54±0.02 mm (0.0213±0.0008 in)
(equivalent to 5° B.T.D.C.)

TD27:
0.65±0.02 mm (0.0256±0.0008 in)
(equivalent to 5° B.T.D.C.)

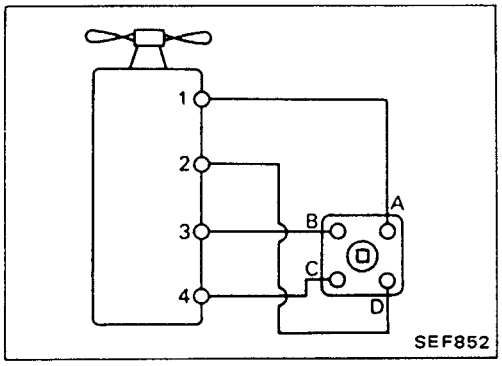
(5) If it is not within the above range, turn pump body until it comes within standard range.

a. If indication is smaller than the specified value, turn pump body counterclockwise.

b. If indication is larger than the specified value, turn pump body clockwise.

4. Tighten injection pump securely.

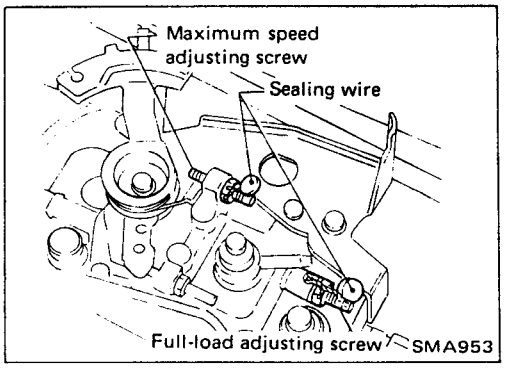
: **Injection pump fixing bolt**
19 - 25 N·m (1.9 - 2.5 kg-m, 14 - 18 ft-lb)
Injection pump to mounting bracket
30 - 41 N·m (3.1 - 4.2 kg-m, 22 - 30 ft-lb)



5. Disconnect dial gauge and reinstall plug bolt with new washer.
: **14 - 20 N·m (1.4 - 2.0 kg-m, 10 - 14 ft-lb)**

6. Connect injection tubes.
: **Flare nut**
20 - 25 N·m (2.0 - 2.5 kg-m, 14 - 18 ft-lb)

7. Bleed air from fuel system.



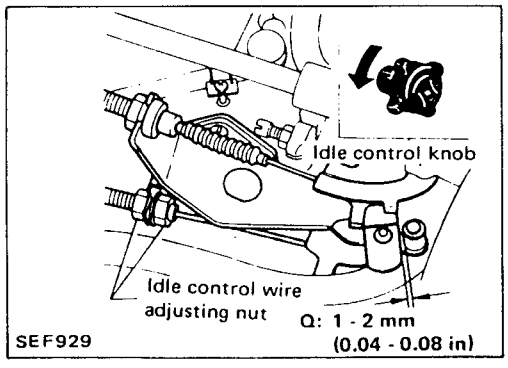
IDLE AND MAXIMUM SPEED ADJUSTMENT

CAUTION:

a. Do not remove sealing wires unless absolutely necessary.

b. Disturbing full-load adjusting screw will change fuel flow characteristics, resulting in an improperly adjusted engine. Readjustment of fuel injection pump should be done using a pump tester.

c. If maximum speed adjusting screw is turned in direction that increases control lever angle, engine damage may result.



Throttle control wire adjustment

1. Turn idle control knob fully counterclockwise.
2. Make sure that clearance between idle control lever pin and fuel injection pump control lever is within the specified range.

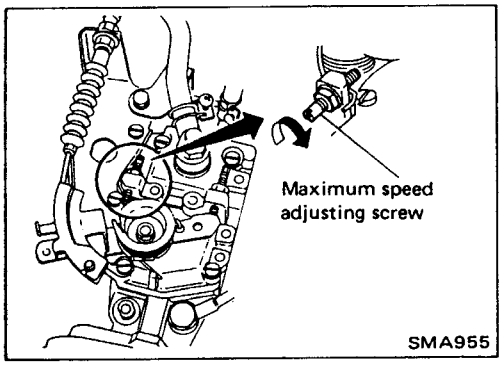
Clearance:
1 - 2 mm (0.04 - 0.08 in)

3. If not within the specified range, adjust with idle control wire adjusting nut.
4. After adjusting clearance, tighten lock nut.

Installation and Adjustment (Cont'd)

Idle adjustment

Refer to MA section.



Maximum speed adjustment

Maximum speed adjusting screw is retained by sealing wire and need not be adjusted under normal circumstances. However, if it becomes necessary to adjust it, the following procedure should be followed:

1. Start engine and warm it up until coolant temperature indicator points to middle of gauge.
2. Connect tachometer's pick-up to No. 1 fuel injection tube.

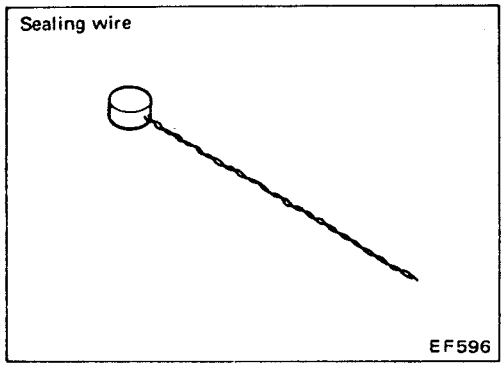
To obtain accurate reading of engine rpm, remove clamps that secure No. 1 fuel injection tube.

3. Depress accelerator pedal fully under no load and, at this point, read the tachometer indication.

Maximum engine speed (Under no load):

$5{,}100\ ^{+50}_{-150}$ rpm (Except for Europe)

$5{,}100\ ^{+50}_{-150}$ rpm (For Europe)



4. If indication is lower than specified maximum engine speed, turn maximum speed adjusting screw counterclockwise 1 or 2 rotations. Then depress accelerator pedal to floor under no load and, at this point, read indication.
5. If indication is still lower than specified speed, repeat step 4 above until specified engine speed is reached.
6. After adjustment, tighten lock nut securely.
7. Wind up with a sealing wire.

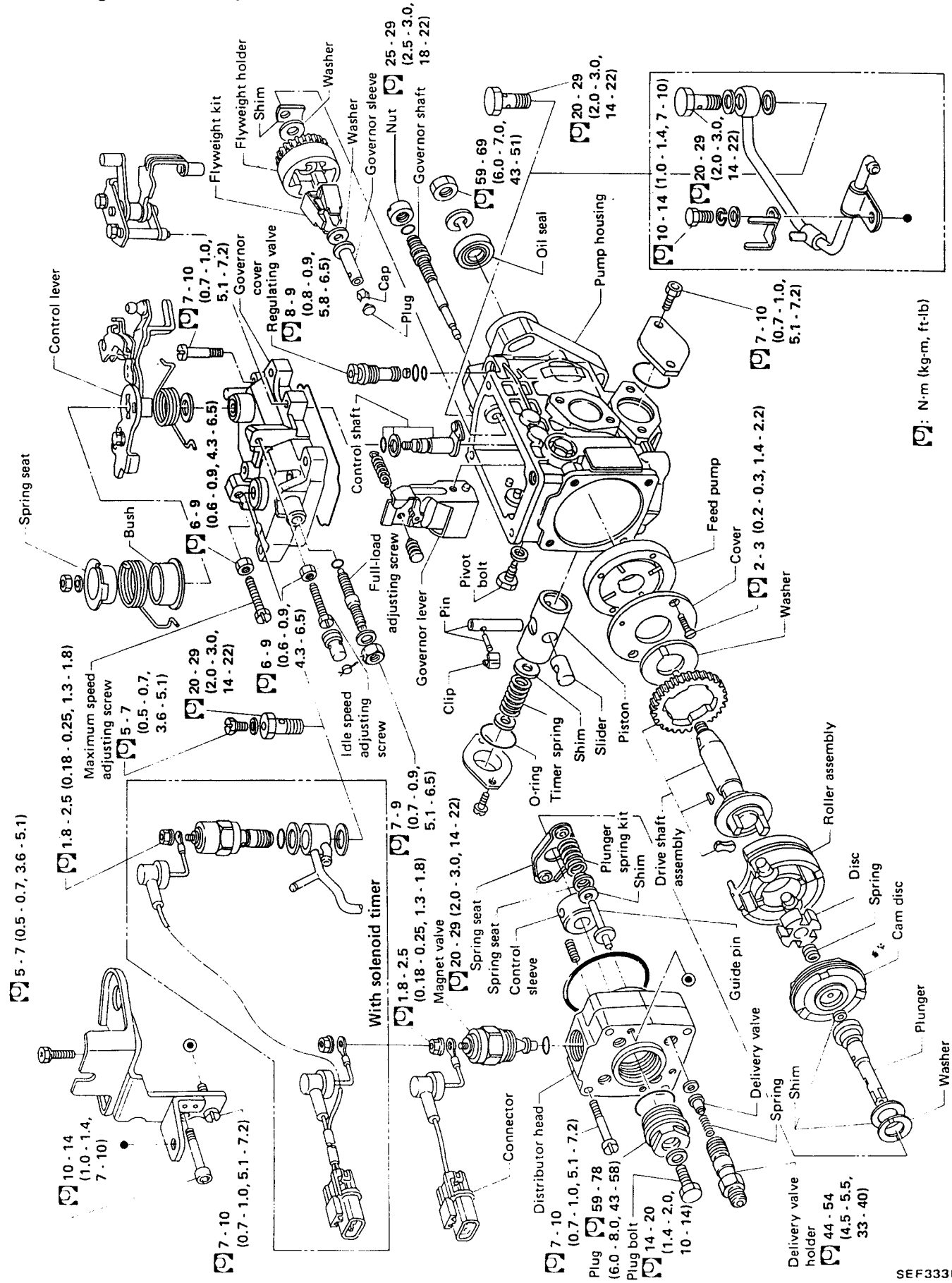
Disassembly

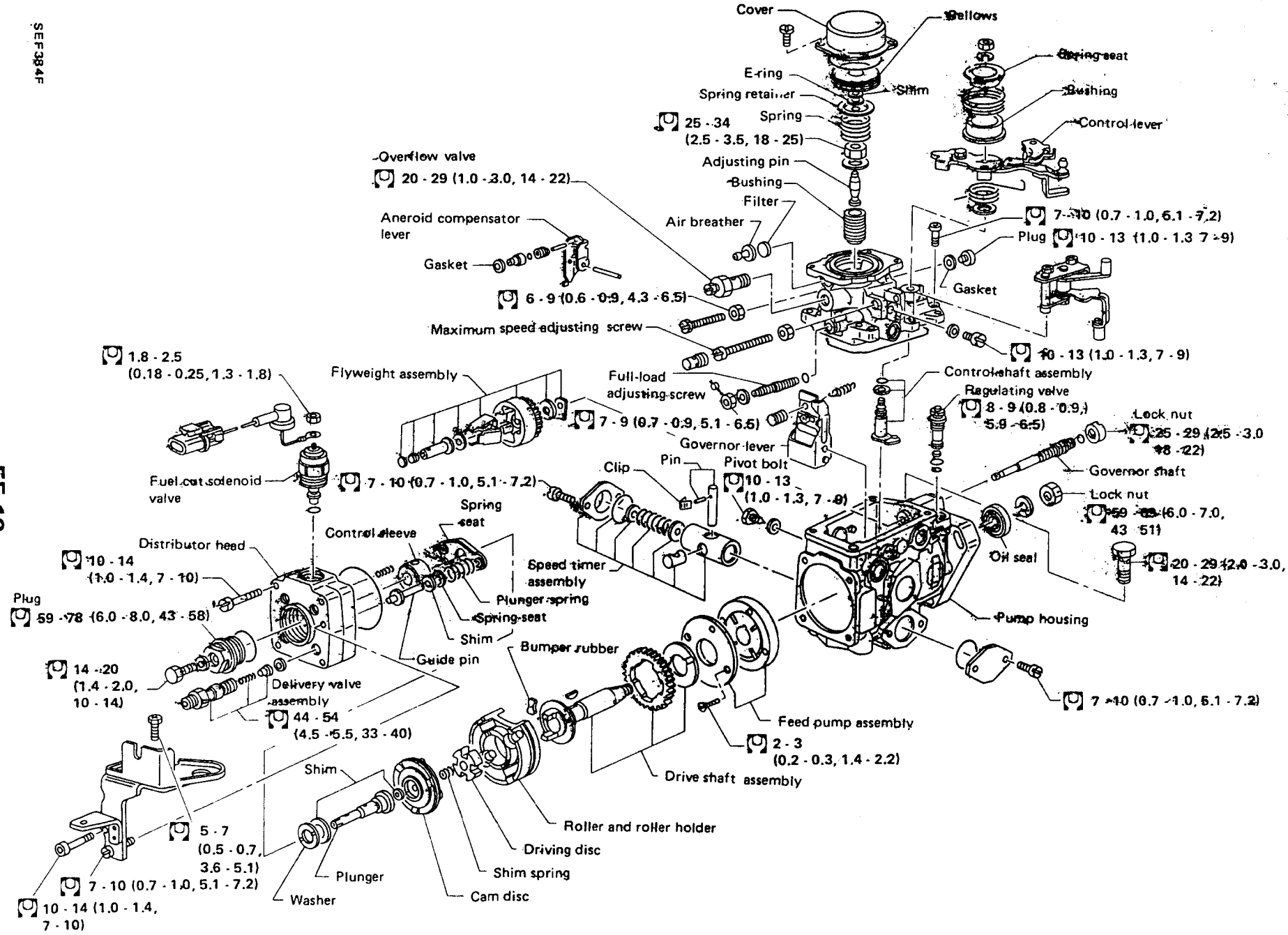
PREPARATION

- Before performing disassembly and adjustment, test the fuel injection pump and note test results.
- Prior to beginning disassembly of fuel injection pump, clean all dust and dirt from its exterior.
- Disconnect overflow valve and drain fuel.
- Clean work bench completely, removing all foreign matter.
- Collect only those service tools necessary for disassembling and reassembling.
- Be careful not to bend or scratch any parts.

Disassembly (Cont'd)

Without high altitude compensator

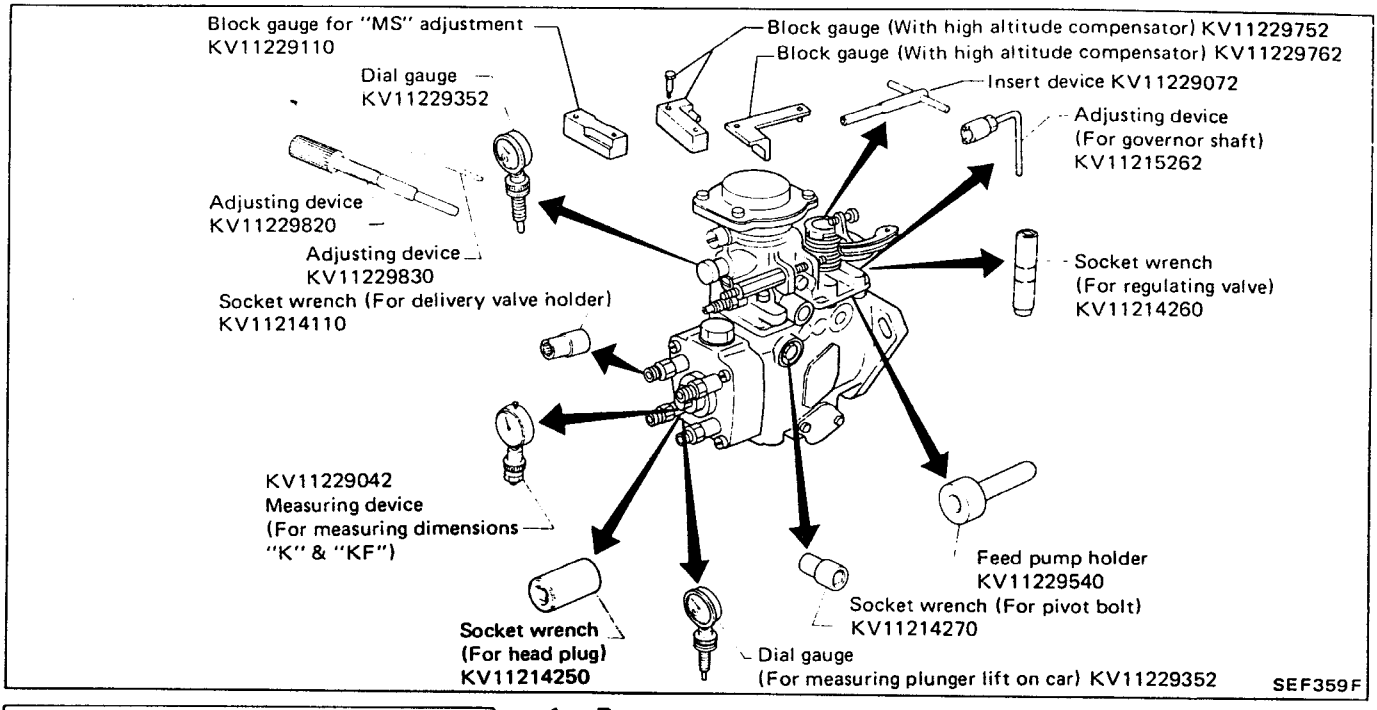


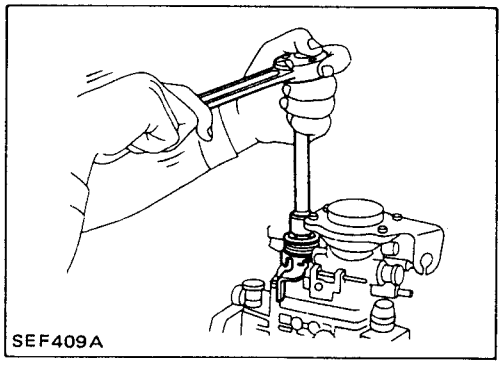

Cover
Bellows
E-ring
Spring retainer
Spring
Shim
Spring seat
Bushing
Control lever
25 - 34 (2.5 - 3.5, 18 - 25)
Overflow valve
20 - 29 (1.0 - 3.0, 14 - 22)
Adjusting pin
Bushing
Filter
Air breather
7 - 10 (0.7 - 1.0, 5.1 - 7.2)
Plug
10 - 13 (1.0 - 1.3, 7 - 9)
Aneroid compensator lever
Gasket
6 - 9 (0.6 - 0.9, 4.3 - 6.5)
Gasket
Maximum speed adjusting screw
10 - 13 (1.0 - 1.3, 7 - 9)
1.8 - 2.5 (0.18 - 0.25, 1.3 - 1.8)
Flyweight assembly
Full-load adjusting screw
Control shaft assembly
Regulating valve
8 - 9 (0.8 - 0.9, 5.9 - 6.5)
7 - 9 (0.7 - 0.9, 5.1 - 6.5)
Governor lever
Lock nut
25 - 29 (2.5 - 3.0, 18 - 22)
Governor shaft
Fuel cut solenoid valve
7 - 10 (0.7 - 1.0, 5.1 - 7.2)
Clip
Pin
Pivot bolt
10 - 13 (1.0 - 1.3, 7 - 9)
Lock nut
59 - 78 (6.0 - 7.0, 43 - 51)
Spring seat
Control sleeve
Distributor head
10 - 14 (1.0 - 1.4, 7 - 10)
Speed timer assembly
Oil seal
20 - 29 (2.0 - 3.0, 14 - 22)
Plug
59 - 78 (6.0 - 8.0, 43 - 58)
Plunger spring
Spring seat
Shim
Guide pin
Bumper rubber
Pump housing
14 - 20 (1.4 - 2.0, 10 - 14)
Delivery valve assembly
44 - 54 (4.5 - 5.5, 33 - 40)
7 - 10 (0.7 - 1.0, 5.1 - 7.2)
Feed pump assembly
2 - 3 (0.2 - 0.3, 1.4 - 2.2)
Drive shaft assembly
Shim
5 - 7 (0.5 - 0.7, 3.6 - 5.1)
Roller and roller holder
Driving disc
Shim spring
Plunger
Cam disc
Washer
7 - 10 (0.7 - 1.0, 5.1 - 7.2)
10 - 14 (1.0 - 1.4, 7 - 10)
N·m (kg-m, ft-lb)

SEF384F

Disassembly (Cont'd)

SPECIAL SERVICE TOOLS

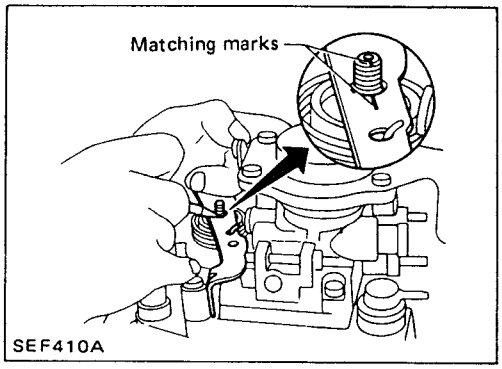




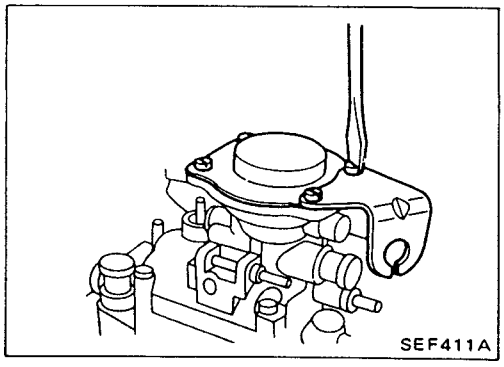
1. Remove pump cover.

With high altitude compensator

(1) Remove nut, spring washer, spring seat and spring from control lever.

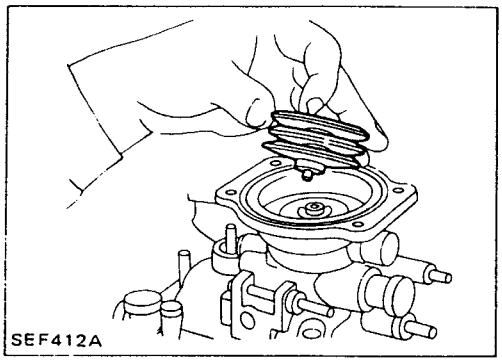


(2) Draw aligning marks on control lever and control shaft.

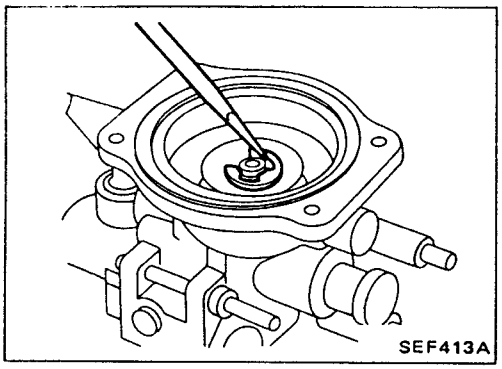


(3) Remove compensator cover.

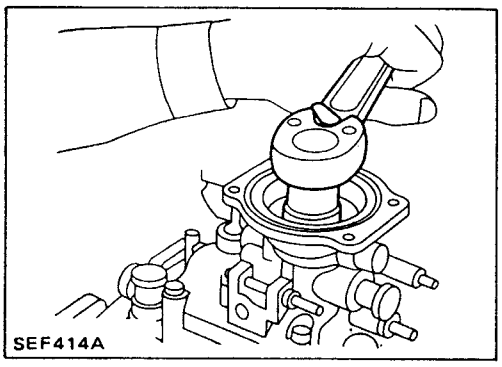
Disassembly (Cont'd)


SEF412A

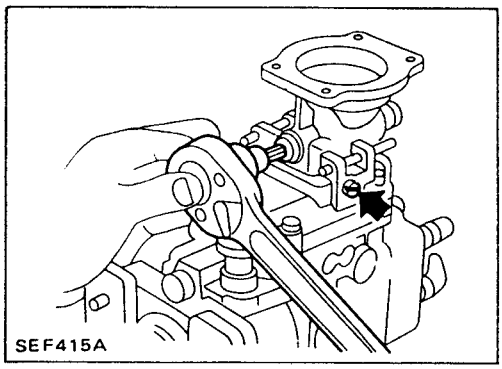
(4) Remove bellows and adjusting shim.


SEF413A

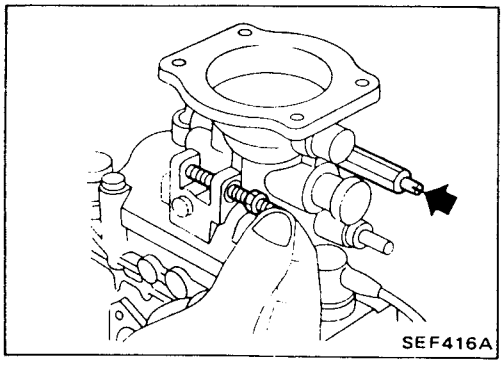
(5) Remove E-ring, then remove spring seat and spring.


SEF414A

(6) Loosen nut.


SEF415A

(7) Remove governor cover plugs.

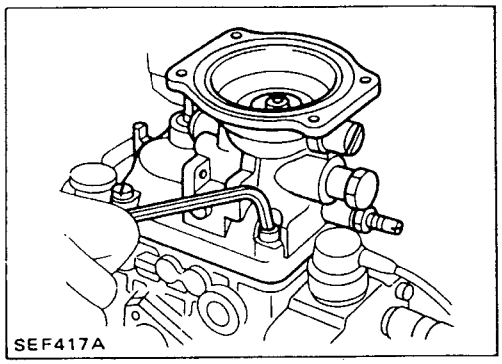

SEF416A

(8) Remove governor cover.

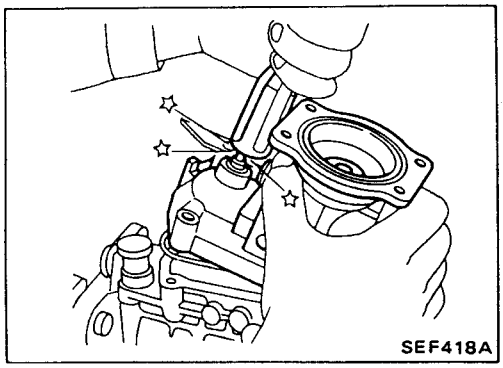
a. Remove sealing wire and idle and maximum speed adjusting screws.

Disassembly (Cont'd)

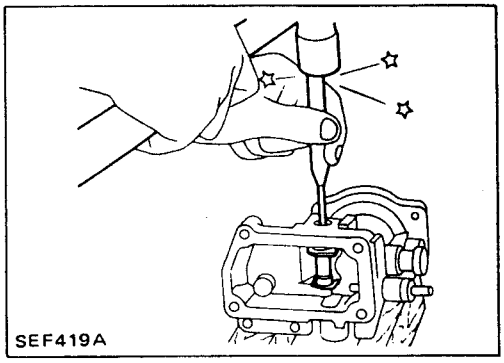
b. Remove governor cover fixing bolts and screws.
Use hexagon wrench.


SEF417A

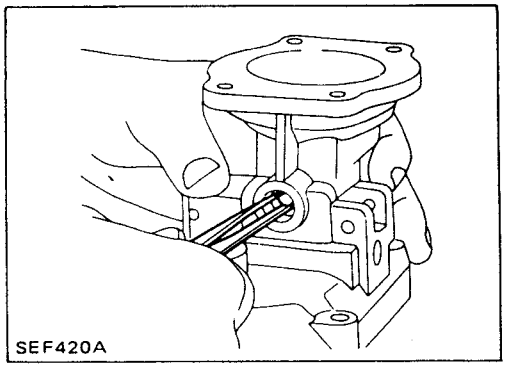
c. Move control shaft down by lightly tapping on the end with a wooden block.


SEF418A

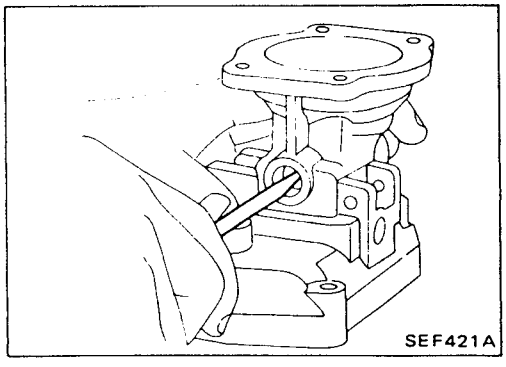
(9) Remove high altitude compensator parts.
a. Remove plugs.
b. Remove lever pin and lever using suitable drift.


SEF419A

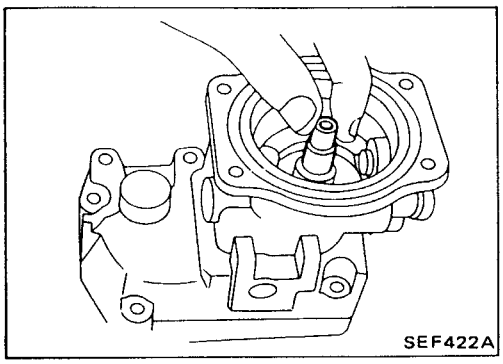
c. Remove plug and pin.


SEF420A

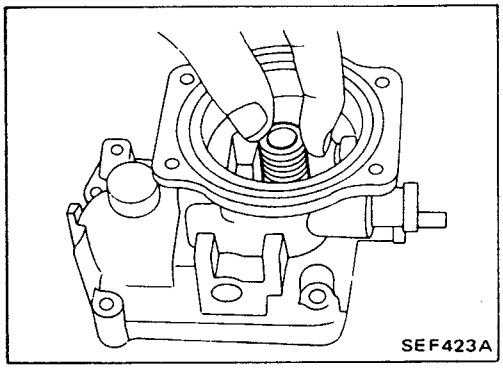
d. Remove retainer, sleeve and washer.
Use a suitable screwdriver to remove retainer.


SEF421A

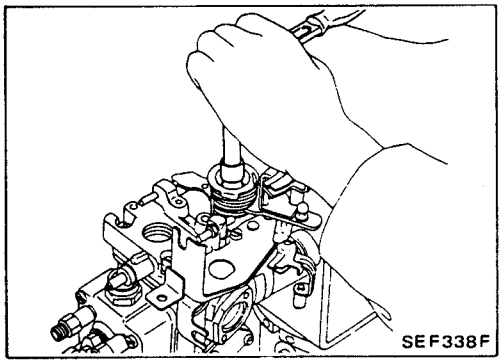
Disassembly (Cont'd)



e. Remove nut and adjusting rod.

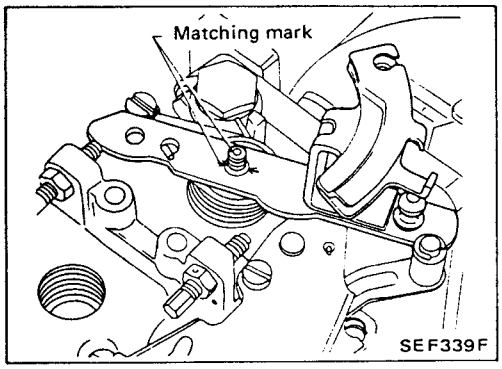


f. Remove bushing.

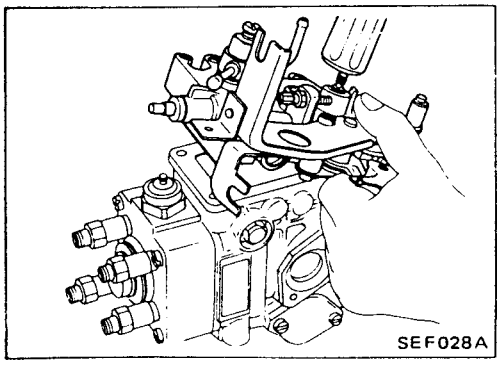


Without high altitude compensator

(1) Remove nut, spring washer, spring seat and spring from control lever.



(2) Check aligning marks on control lever and control shaft.

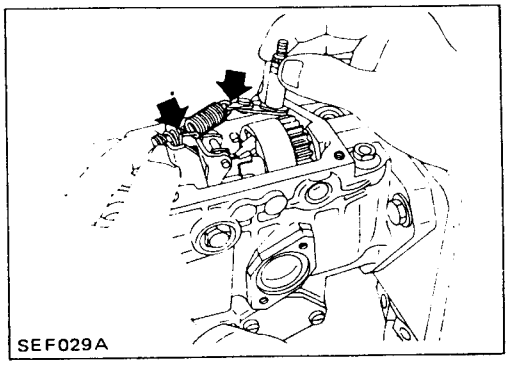


(3) Remove pump cover.

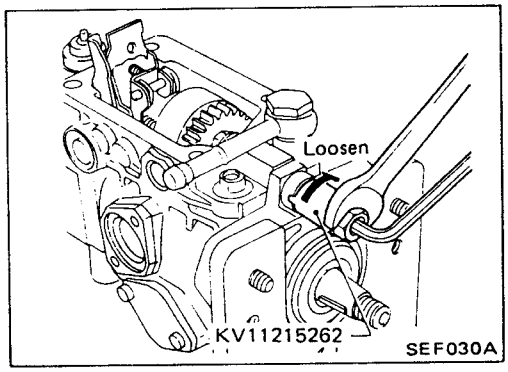
Move control shaft down by lightly tapping on the end with a wooden block.

Disassembly (Cont'd)

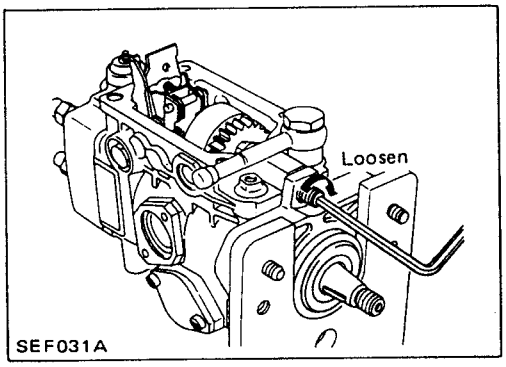
2. Remove control shaft from tension lever.


SEF029A

3. Remove governor shaft with special service tool.
Loosen lock nut by turning it clockwise.

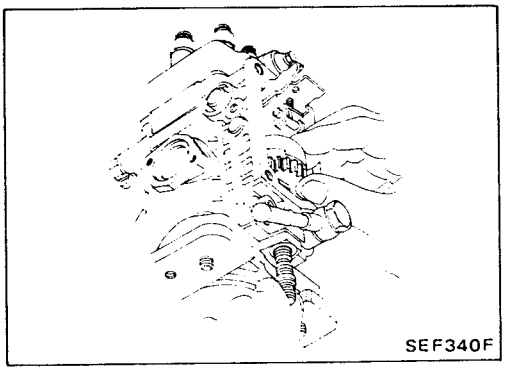


SEF030A

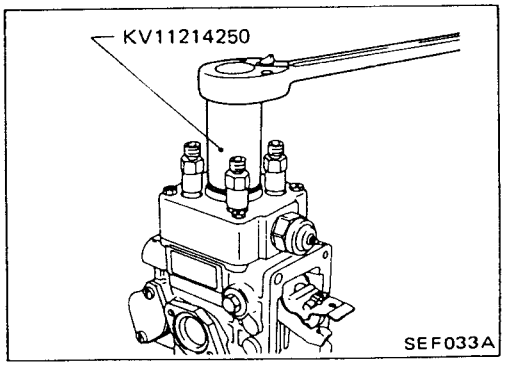


SEF031A

4. Remove governor sleeve, washer and flyweight, along with flyweight holder, then remove washer and shims.


SEF340F

5. Remove plug with special service tool.

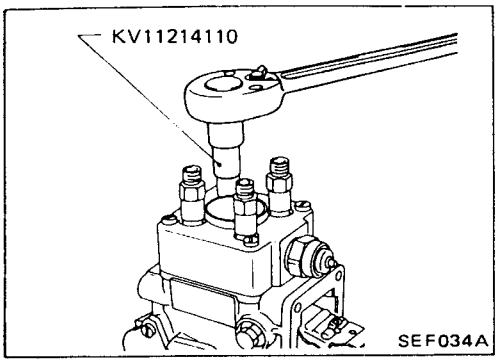


SEF033A

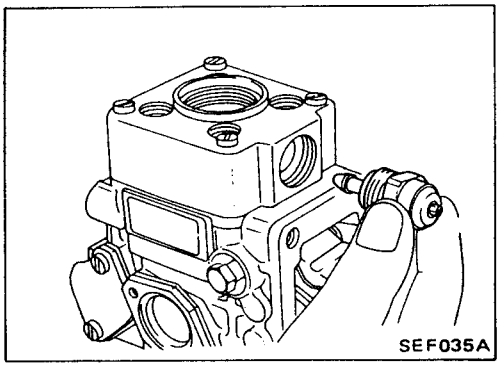
Disassembly (Cont'd)

6. Remove delivery holder, spring, delivery valve and gasket.

Distributor head has letters (A, B, C, D) stamped on it. Remove lettered parts in alphabetical order and arrange neatly.

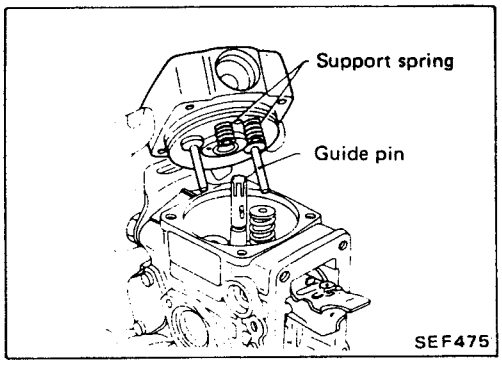


7. Remove fuel-cut solenoid valve.



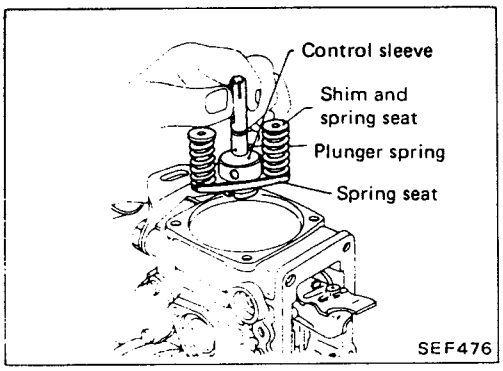
8. Remove distributor head.

Be careful not to drop the two support springs and guide pins.

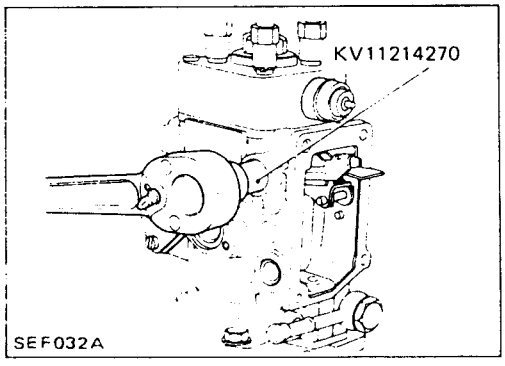


9. Remove plunger assembly.

Lift plunger, along with control sleeve, shim, spring seat, plunger spring, washer and shim.

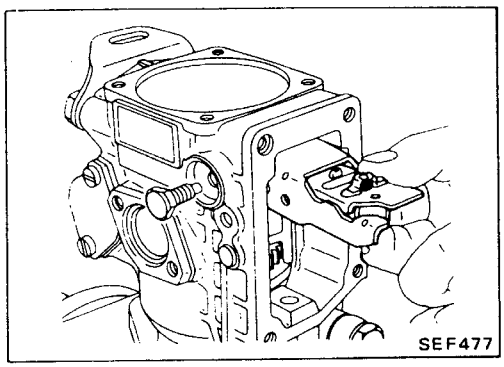


10. Loosen left and right governor pivot bolts.

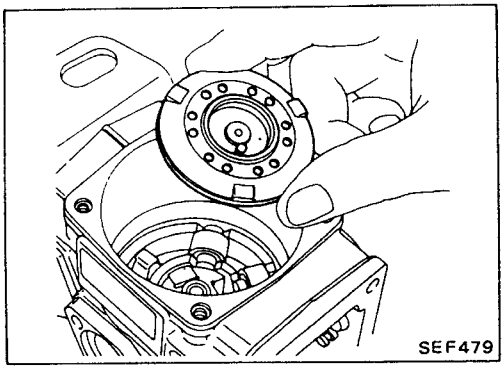


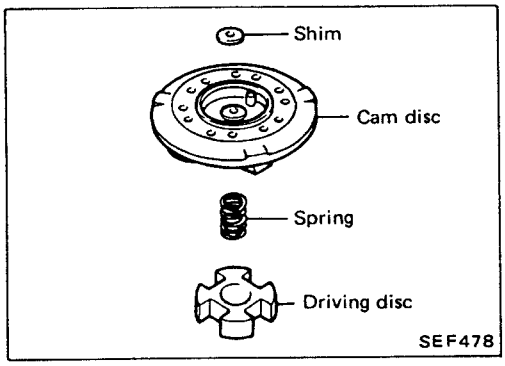
Disassembly (Cont'd)

11. Remove governor pivot bolts and lever assembly.
Avoid pulling on start spring and start idle spring.


SEF477

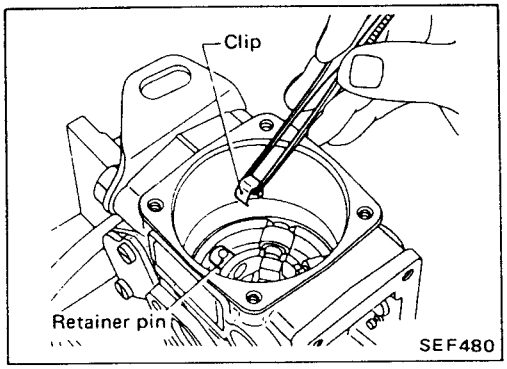
12. Remove shim, cam disc, spring and driving disc.


SEF479



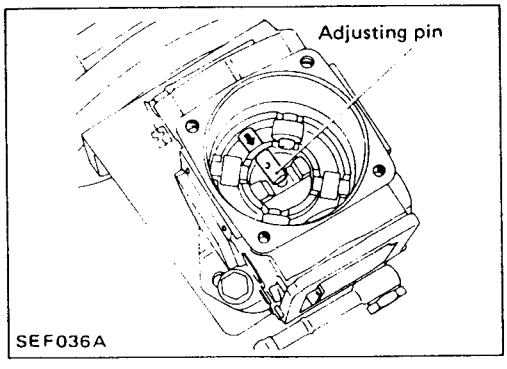
SEF478

13. Remove clips and pins.



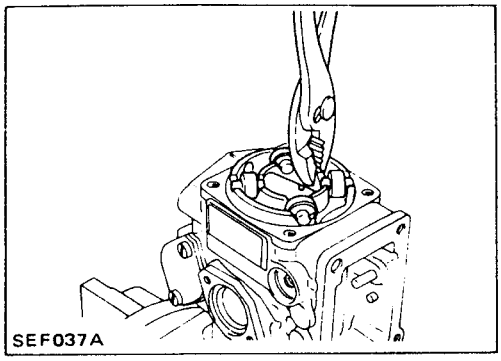
SEF480

14. Move adjusting pin to center of roller holder, as shown.

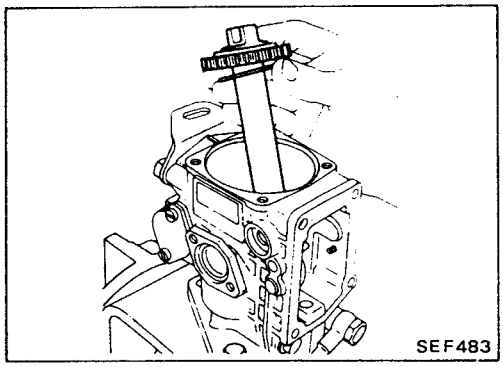


SEF036A

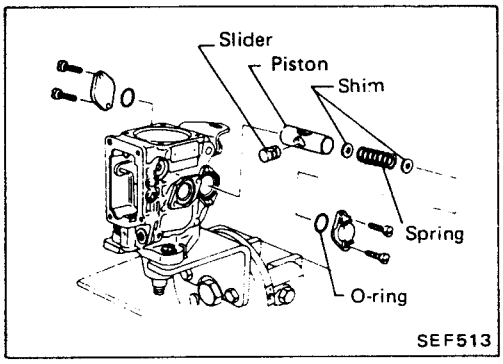
Disassembly (Cont'd)


SEF037A

15. Lift out roller holder with rollers without tilting.
Be careful not to drop rollers.

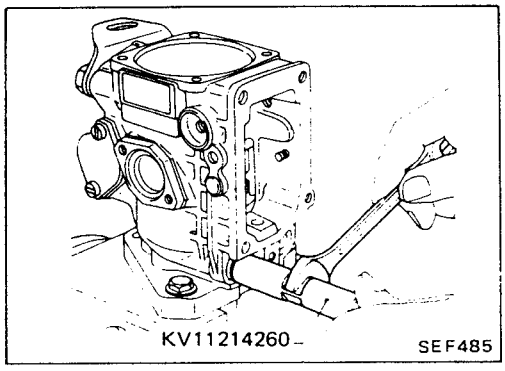

SEF483

16. Remove drive shaft.
a. **Be careful not to scratch inner surface of fuel injection pump body.**
b. **Remove drive gear side key.**
c. **Be careful not to drop the key.**



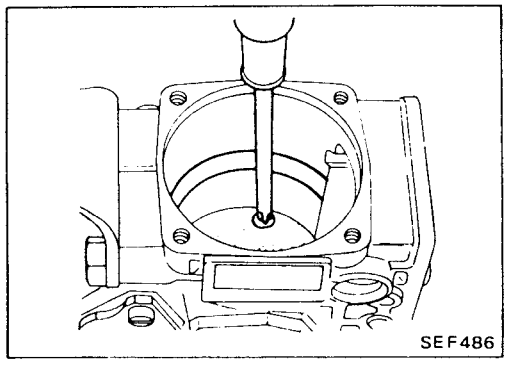
SEF513

17. Remove speed timer cover, O-ring, shims, spring, piston and slider.



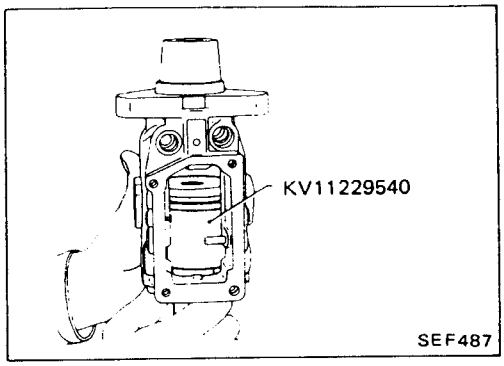
SEF485

18. Remove regulating valve with special service tool.


SEF486

19. Loosen screw from feed pump cover.

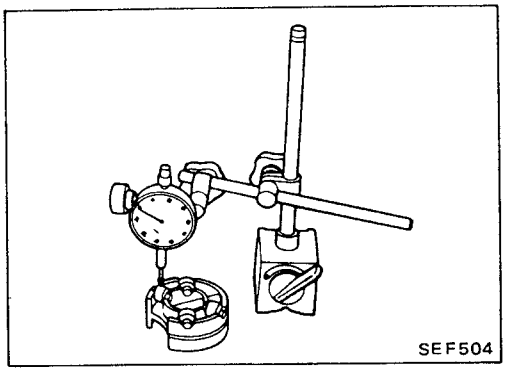
Disassembly (Cont'd)



20. Remove cover and feed pump assembly as a unit.
1) Insert feed pump holder (KV11229540) into fuel injection pump housing.
2) Turn injection pump upside down, as shown.
3) Remove cover and feed pump assembly as a unit.

a. If cover and feed pump assembly are hard to remove or stuck midway, strike the pump body lightly.

b. Do not change positions of vanes.



Inspection

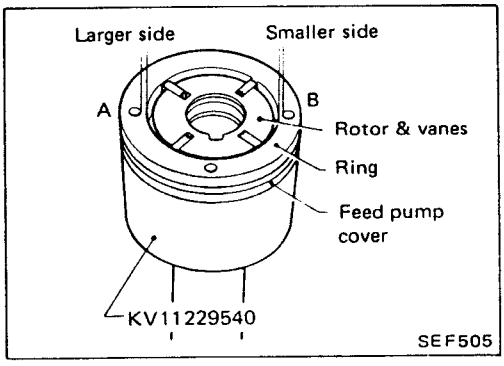
1. Wash all parts completely.
2. Replace worn or damaged parts.
3. Control edge of plunger must be sharp and contact surfaces must not exhibit any noticeable running tracks. If the condition is not good, replace plunger.
4. Check for height of all rollers.

Difference in maximum and minimum roller height should be less than 0.02 mm (0.0008 in).

Assembly

Always replace the following service parts as assembly units.

- Distributor head, control sleeve and plunger
- Feed pump assembly (pump impeller and vanes with eccentric ring)
- Plunger spring kit
- Roller assembly
- Flyweight kit
- Governor lever assembly

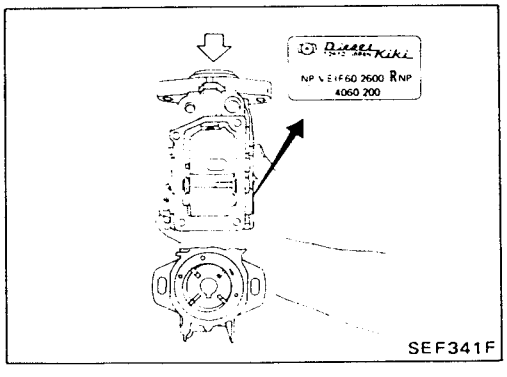


PREPARATION

Dip all movable parts and O-rings in test oil, then clean.

1. Set feed pump cover, rotor with vanes, and ring on special service tool KV11229540.

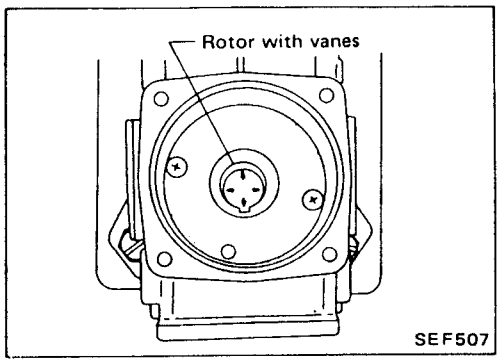
1) Align the three holes in feed pump cover and ring.
2) Do not change positions of vanes.
3) Holes A and B in ring are not equally spaced to inner wall of ring.



2. Install feed pump cover, rotor with vanes, and ring to pump housing.

Be careful to install ring correctly. If left and right are reversed, fuel will not be discharged from feed pump.

Assembly (Cont'd)



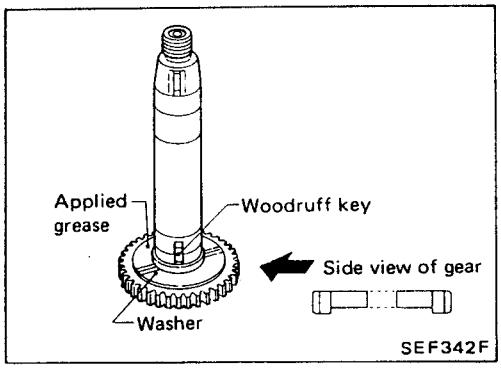
When fuel injection pump rotates in direction "R"

The following description applies to fuel injection pumps that rotate in direction "R".

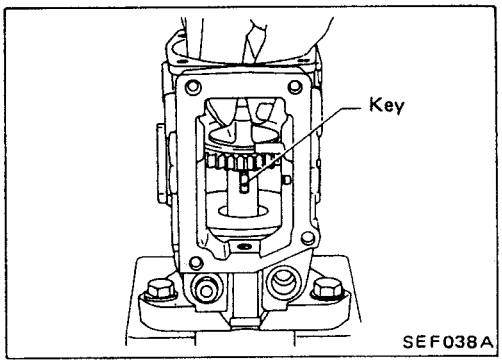
3. Turn fuel injection pump 180°, and remove special service tool KV11229540. Tighten screw to retain pump cover.

a. **When tightening screws, be careful not to scratch inner wall of pump housing.**

b. **After tightening screws, make sure that rotor with vanes moves smoothly.**

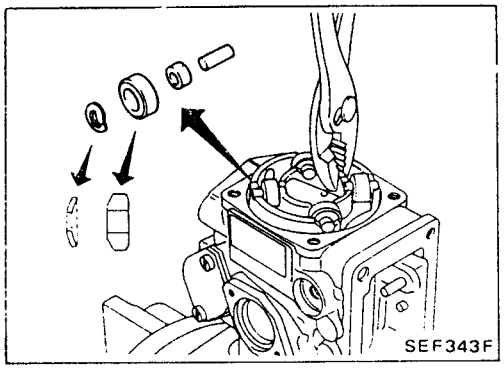


4. Make sure that drive shaft and gear are assembled properly, as shown.



5. Install drive shaft to housing while key in drive shaft engages with key groove in rotor.

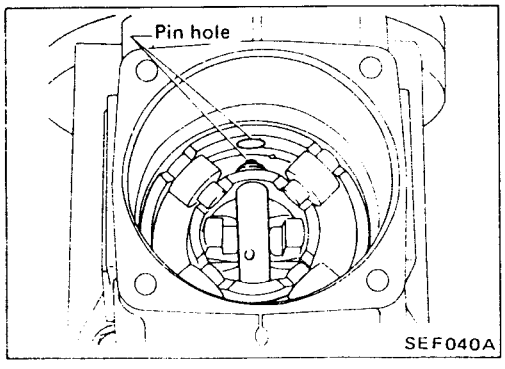
Be careful not to scratch oil seals and inner wall of housing.



6. Set drive shaft's nail parallel to timer.
7. Install roller and holder.

a. **Do not interchange roller positions. If they are interchanged, refer to Inspection for correction.**

b. **Make sure that washer is situated outward of rollers.**



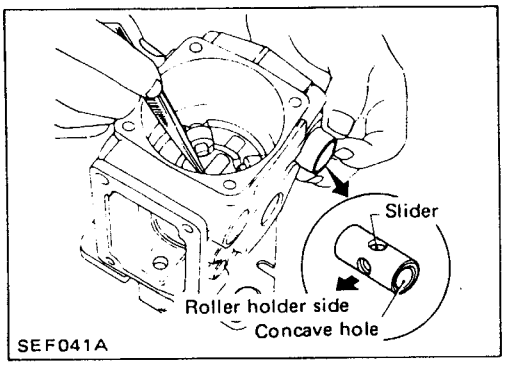
8. Align holder and timer adjusting pin holes.

Assembly (Cont'd)

9. Install timer piston and slider as a unit.

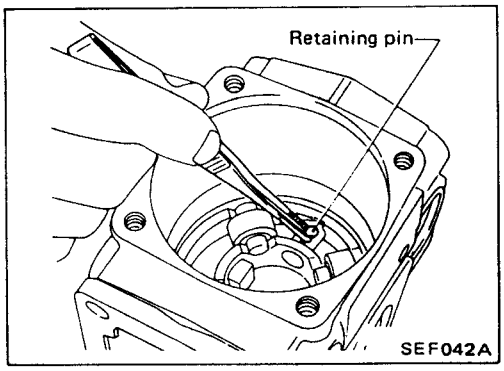
a. **Make sure that hole in slider faces towards roller holder.**

b. **Make sure that concave hole in piston is on same side as return hole.**



10. Insert timer adjusting pin into timer piston slider, and secure with retaining pin and clip.

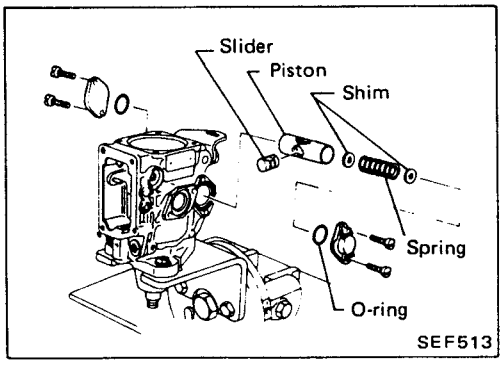
Make sure that timer piston moves smoothly.



11. **Install timer,** using a 0.6 mm (0.024 in) thick shim, then **install timer spring,** shim, O-ring, and cover, in that order.

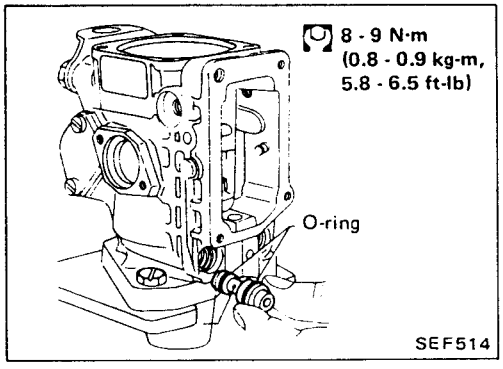
a. **Use at least one shim on each side of timer spring.**

b. **Use shims that were selected during bench test.**

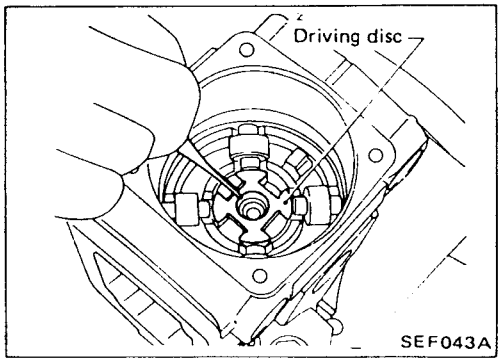


12. Install regulating valve.

Be careful not to scratch O-rings.



13. Install driving disc with its concave side facing up.



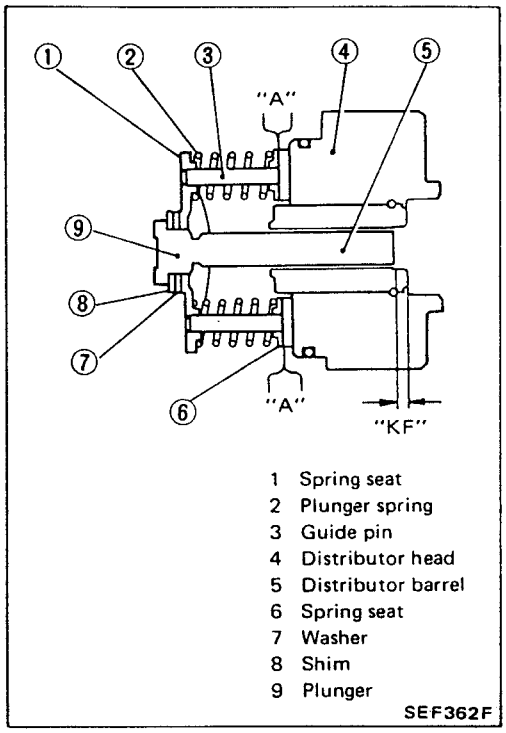
Assembly (Cont'd)

14. Measurement of plunger spring set length (dimension "KF")

Dimension "KF" is the distance between the end face of the distributor barrel and the end face of the plunger.

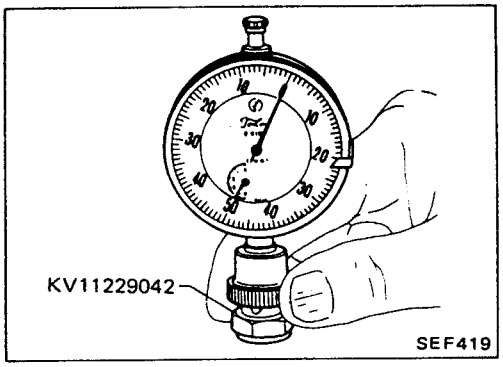
(1) Install distributor head, as shown.

- **Do not insert shim into "A" portion before measuring.**



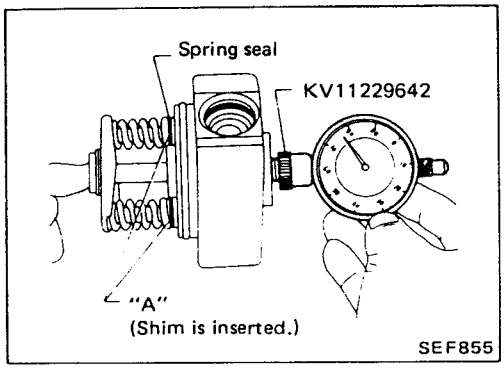
1 Spring seat
2 Plunger spring
3 Guide pin
4 Distributor head
5 Distributor barrel
6 Spring seat
7 Washer
8 Shim
9 Plunger

SEF362F



SEF419

(2) Set dial gauge so that it can compress 0 to 10 mm (0 to 0.39 in), and reset to zero.



SEF855

(3) Apply force (not enough to compress plunger spring) to plunger's bottom in axial direction, and measure dimension "KF" with dial gauge, as shown.

(4) Determine the shim to be used by calculating difference between standard and measured dimensions.

Standard dimension "KF":

5.7 - 5.9 mm (0.224 - 0.232 in)

[Example]

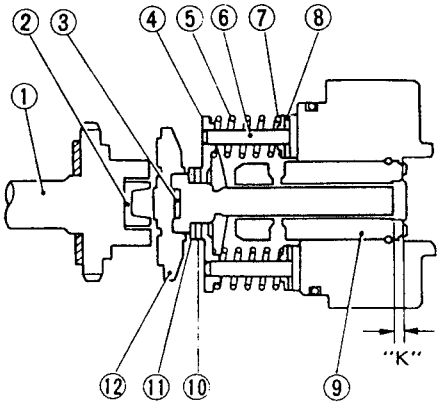
When measured (dial gauge reading) value is 5.2 mm,

5.7 mm – 5.2 mm = 0.5 mm (shim thickness to be used)

Assembly (Cont'd)

a. When there are no shims available of a thickness which matches specified dimensions, use slightly thicker shims.
b. Use selected shim with distributor head in step 14-(3) above.
c. Use the same size shim on each side of distributor head.
d. Shims are available in seven different thicknesses.

Part number	Thickness mm (in)
16882-43G00	0.5 (0.020)
16882-43G01	0.8 (0.031)
16882-43G02	1.0 (0.039)
16882-43G03	1.2 (0.047)
16882-43G04	1.5 (0.059)
16882-43G05	1.8 (0.071)
16882-43G06	2.0 (0.079)



1 Drive shaft
2 Driving disc
3 Shim
4 Spring seat
5 Plunger spring
6 Guide pin
7 Spring seat
8 Shim
9 Distributor barrel
10 Washer
11 Shim
12 Cam disc

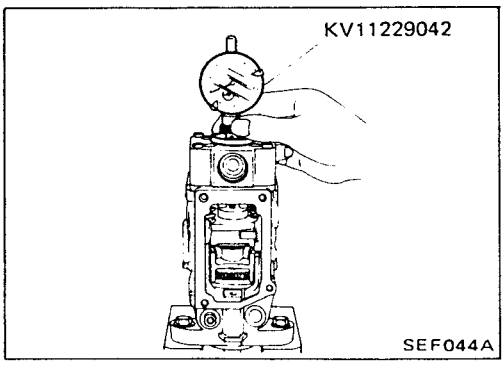
SEF370F

15. Adjustment of plunger dimensions (Measurement of dimension "K")

Dimension "K" is the distance from the end face of the distributor barrel to the end face of the plunger top, when the plunger is at the bottom dead center position.

(1) Install parts as shown.

a. **Do not install "spring" on driving disc.**
b. **When inserting plunger and shim into cam disc, make sure that drive pin is situated in groove at bottom of plunger.**

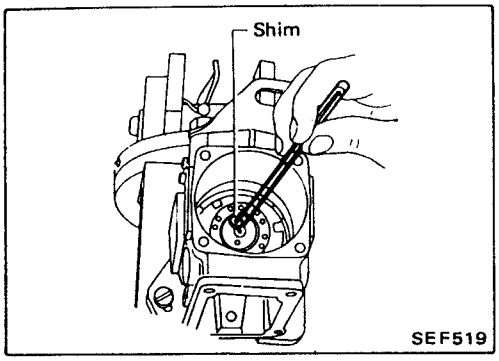


SEF044A

(2) Using a dial gauge, measure dimension as shown.

a. Rotate drive shaft so that plunger is set at bottom dead center.
b. Securely mount distributor head with screws.

Assembly (Cont'd)

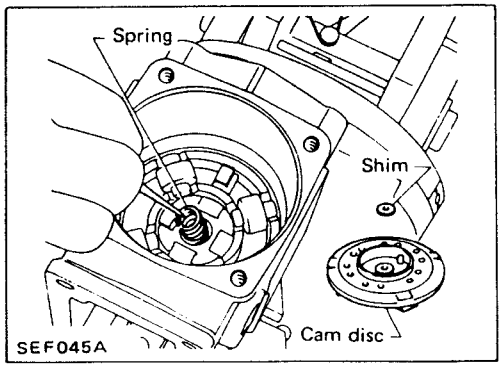


(3) Determine shim to be used by calculating difference between measured (dial gauge reading) value and standard dimension "K", and position that shim on plunger's bottom.

"K" = 3.2 - 3.4 mm
(0.126 - 0.134 in)

a. **When measured value is greater than standard dimension "K", use a thicker shim.**
b. **After shim has been positioned, measure dimension again to ensure that it is correct.**
c. **Shims are available in 25 different thicknesses.**

Part number	Thickness mm (in)	Part number	Thickness mm (in)
16884-V0700	1.92 (0.0756)	16742-R8100	1.96 (0.0772)
16884-V0701	2.00 (0.0787)	16742-R8101	2.04 (0.0803)
16884-V0702	2.08 (0.0819)	16742-R8102	2.12 (0.0835)
16884-V0703	2.16 (0.0850)	16742-R8103	2.20 (0.0866)
16884-V0704	2.24 (0.0882)	16742-R8104	2.28 (0.0898)
16884-V0705	2.32 (0.0913)	16742-R8105	2.36 (0.0929)
16884-V0706	2.40 (0.0945)	16742-R8106	2.44 (0.0961)
16884-V0707	2.48 (0.0976)	16742-R8107	2.52 (0.0992)
16884-V0708	2.56 (0.1008)	16742-R8108	2.60 (0.1024)
16884-V0709	2.64 (0.1039)	16742-R8109	2.68 (0.1055)
16884-V0710	2.72 (0.1071)	16742-R8110	2.76 (0.1087)
16884-V0711	2.80 (0.1102)	16742-R8111	2.84 (0.1118)
16884-V0712	2.88 (0.1134)		



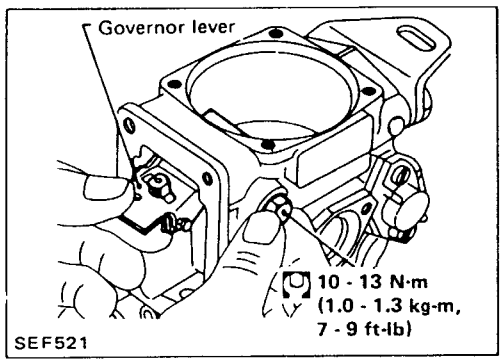
16. Install spring in top of driving disc, then install cam disc and shim.

Make sure cam disc drive pin and drive shaft key way face governor lever side.

Assembly (Cont'd)

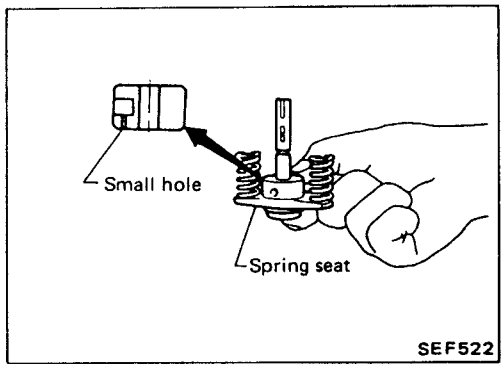
17. Install governor lever.

Avoid pulling on start spring and start idle spring.

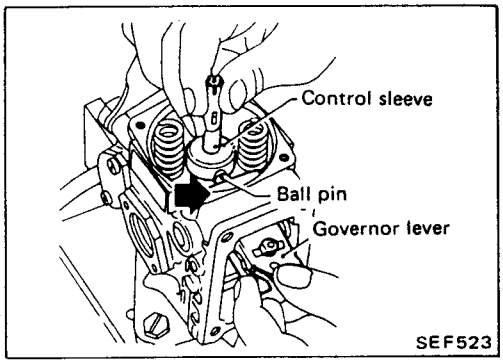


18. Install plunger assembly.

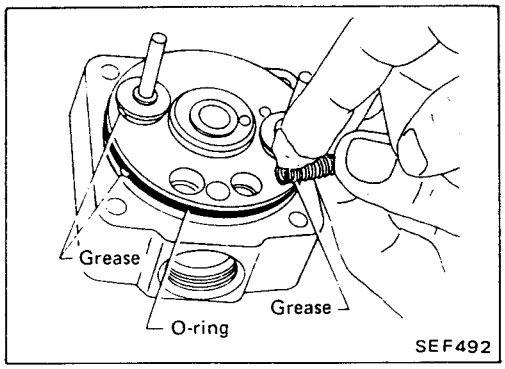
a. **Make sure control sleeve is installed with its small hole facing spring seat side.**



b. **Insert ball pin for governor lever into hole in control sleeve (shown by arrow).**

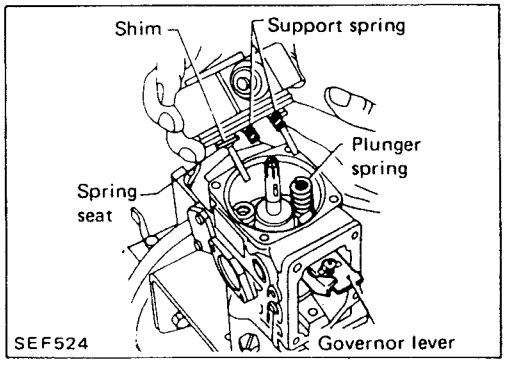


19. Apply a coat of grease to guide pin, shim and spring seat, and attach these parts to distributor head.

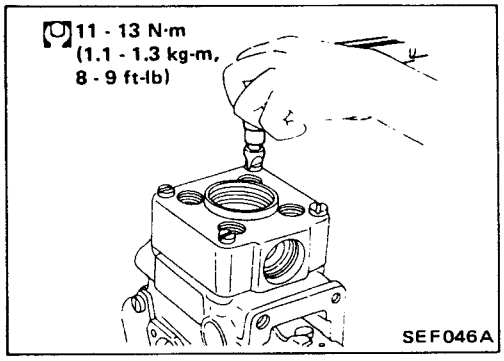


20. Install distributor head.

a. Always face support spring toward governor lever.
b. Be careful not to drop spring.
c. Make sure that ball pin for governor lever is inserted properly into hole in control sleeve.
d. After installing distributor head, make sure that plunger spring is at guide pin in spring seat.

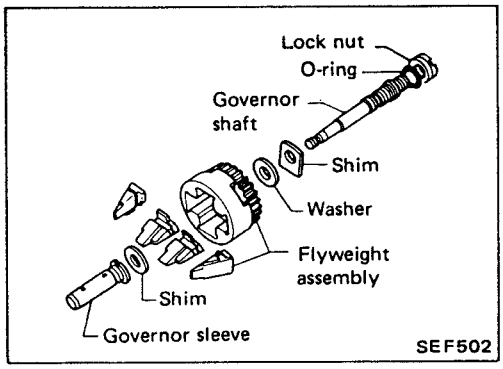


Assembly (Cont'd)



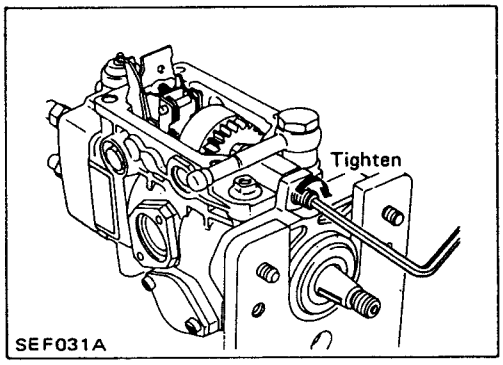
21. Tighten distributor head.

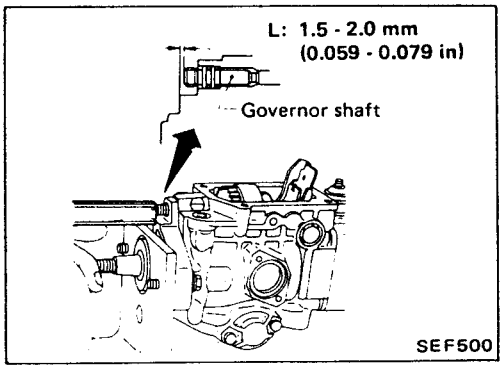
Distributor head bolts
11 - 13 N·m (1.1 - 1.3 kg-m, 8 - 9 ft-lb)



22. Attach flyweight assembly.

When installing governor shaft, be careful not to scratch O-rings.





23. Adjust dimension "L".

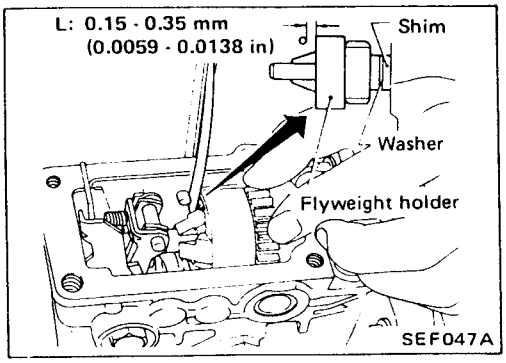
"L":
1.5 - 2.0 mm (0.059 - 0.079 in)

a. Tighten lock nut to specified torque.

25 - 29 N·m (2.5 - 3.0 kg-m, 18 - 22 ft-lb)

b. Governor shaft has a left-hand thread for injection pumps designed to rotate in "R" direction, and a right-hand thread for those rotating in "L" direction.

Assembly (Cont'd)



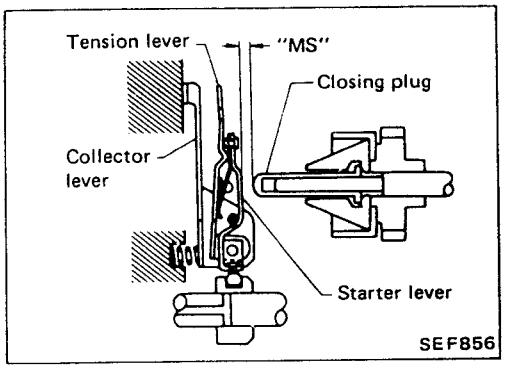
24. Measure axial play of flyweight holder. If it is not within specified range, adjust it by means of shims.

"L":

0.15 - 0.35 mm (0.0059 - 0.0138 in)

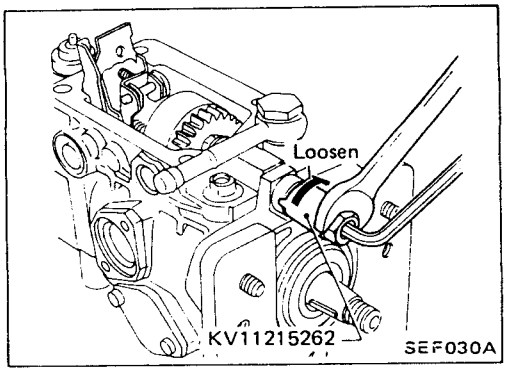
Shims are available in 5 different thicknesses.

Part number	Thickness mm (in)
19208-V0700	1.05 (0.0413)
19208-V0701	1.25 (0.0492)
19208-V0702	1.45 (0.0571)
19208-V0703	1.65 (0.0650)
19208-V0704	1.85 (0.0728)

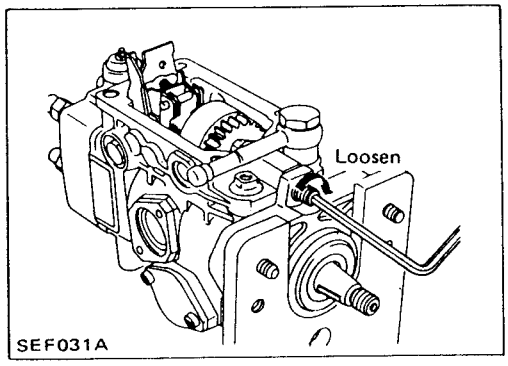


25. Measurement of dimension "MS" (for determining starting amount of fuel injection)

Dimensions "MS" is the distance between closing plug and start lever.

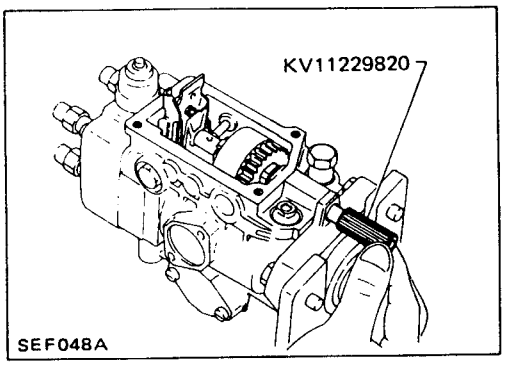


(1) Remove lock nut and governor shaft.

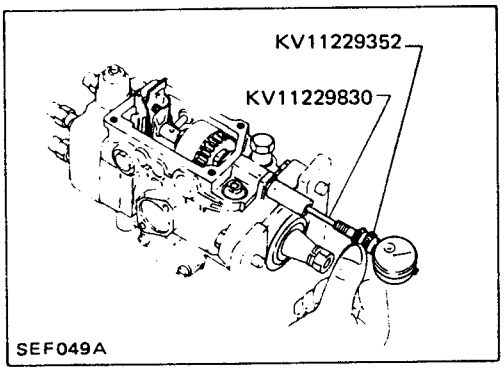


Assembly (Cont'd)

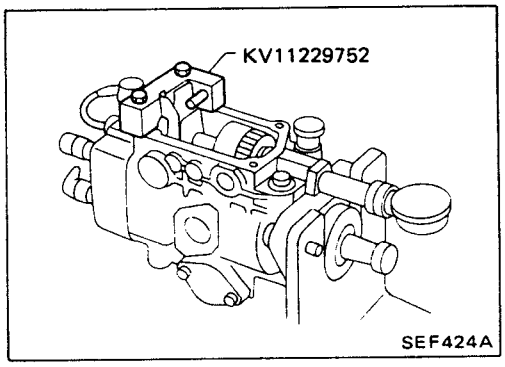
(2) Install special service tool at governor shaft position.



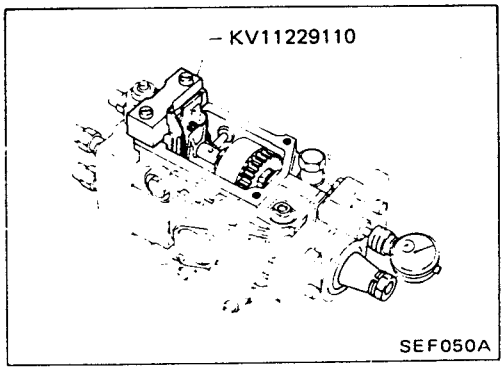
(3) Install special service tool (dial gauge) with rod.



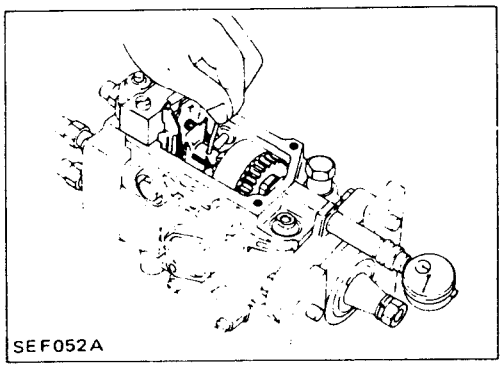
(4) Install special service tool (block gauge) to pump housing.
KV11229752 is for pump with high altitude compensator.



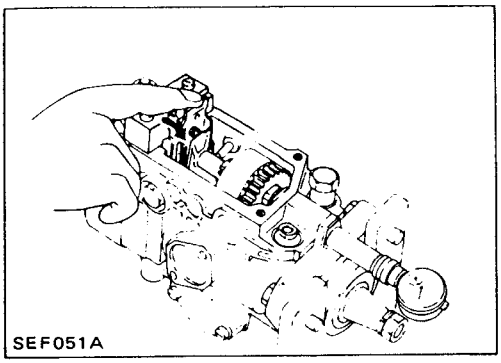
KV11229110 is for pump without high altitude compensator.



(5) Push governor sleeve against flyweight. Hold governor sleeve in that position and set dial gauge to zero.

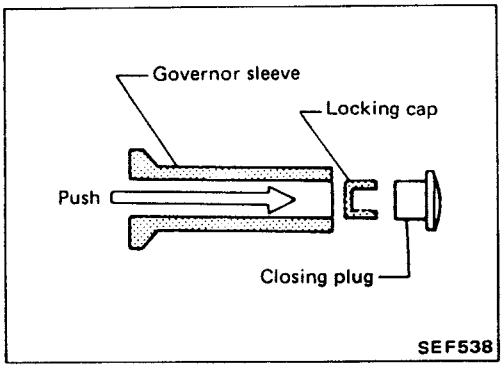


Assembly (Cont'd)


SEF051A

(6) Push tension lever until it touches stopper pin. Back governor sleeve up until start lever touches tension lever. At this point read dial gauge.

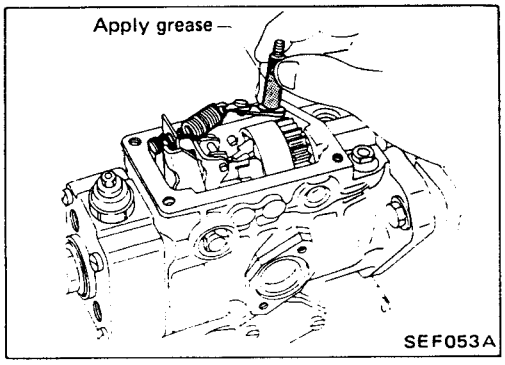
MS: Refer to S.D.S.



(7) If dial gauge indication is not within this range, replace closing plug and adjust dimension "MS" to that range.

Closing plugs are available in 8 different lengths.

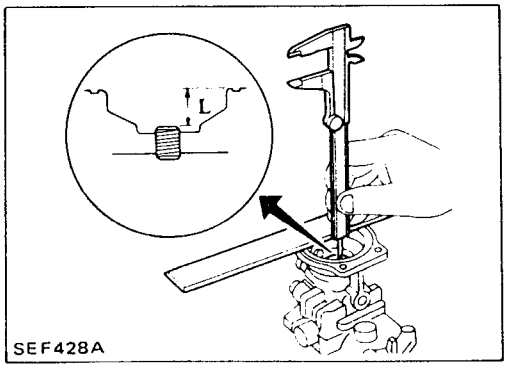
Part number	Length mm (in)
16268-R8100	3.10 (0.1220)
16268-R8101	3.30 (0.1299)
16268-R8102	3.50 (0.1378)
16268-R8103	3.70 (0.1457)
16268-R8104	3.90 (0.1535)
16268-R8105	4.10 (0.1614)
16268-R8106	4.30 (0.1693)
16268-R8107	4.50 (0.1772)



26. Install control lever shaft.

Apply a coat of grease to lever shaft end.

27. Install governor cover.



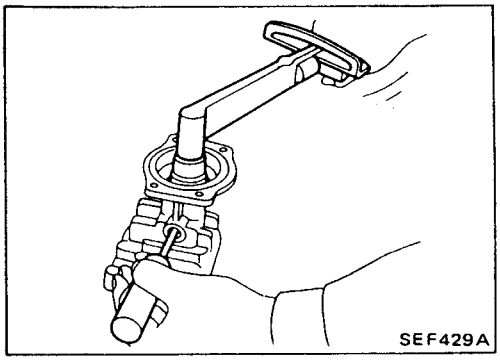
With high altitude compensator

(1) Position adjusting rod bushing so that its height above upper surface of governor cover is within specified range.

L = 20.5 ± 0.5 mm
(0.807 ± 0.020 in)

Ensure that holes in adjusting rod bushing and governor cover are aligned properly.

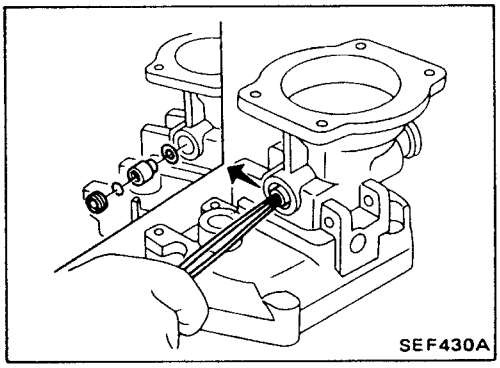
Assembly (Cont'd)



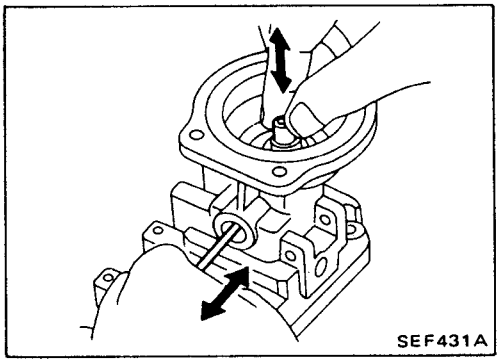
(2) Install adjusting rod.
(3) Install washer and nut.
(4) Tighten nut.

: Adjusting rod bushing lock nut
25 - 34 N·m (2.5- 3.5 kg-m, 18 - 25 ft-lb)

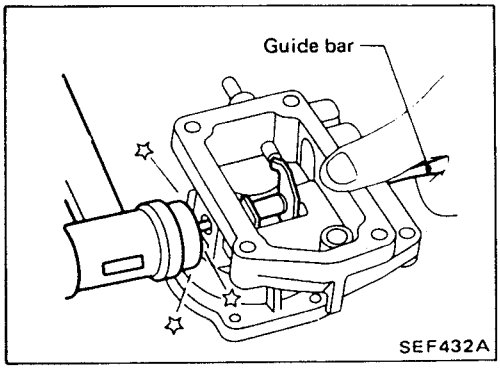
a. Prevent adjusting rod bushing from rotating by locking its nut.
b. If nut and bushing rotate together, bushing height above upper surface of governor cover is insufficient.



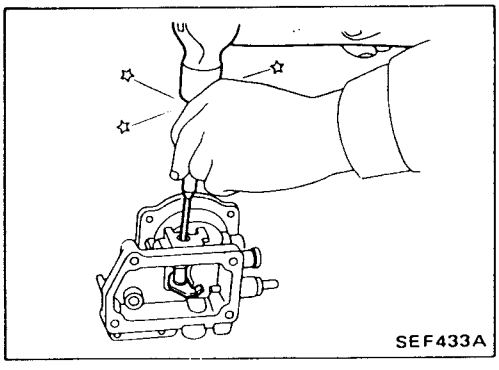
(5) Install washer, sleeve and retainer.



(6) Install pin.
Ensure that pin moves smoothly when adjusting rod is moved up or down.

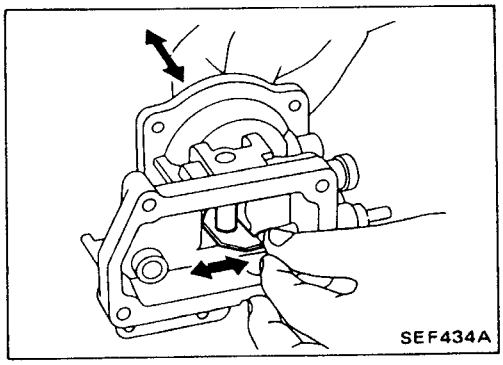


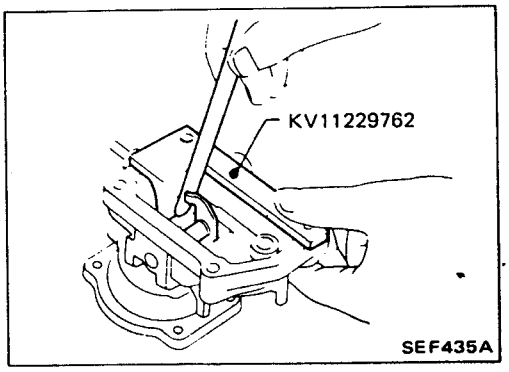
(7) Install lever.
Use a suitable bar as a guide to properly install lever.



Assembly (Cont'd)

Ensure that lever moves smoothly when adjusting rod is moved up or down.



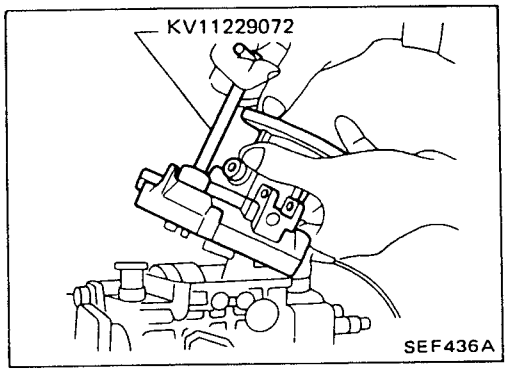


(8) Check clearance between block gauge and lever.
If not within specifications, change the pin.

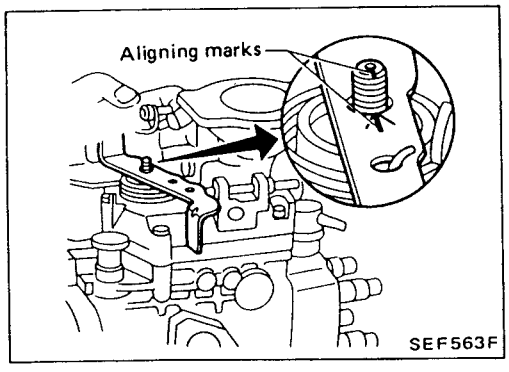
Clearance:
0.1 mm (0.004 in)

Pin

Part number	Length mm (in)
19276-W3300	24.6 (0.969)
19276-W3301	24.8 (0.976)
19276-W3302	25.0 (0.984)
19276-W3303	25.2 (0.992)
19276-W3304	25.4 (1.000)

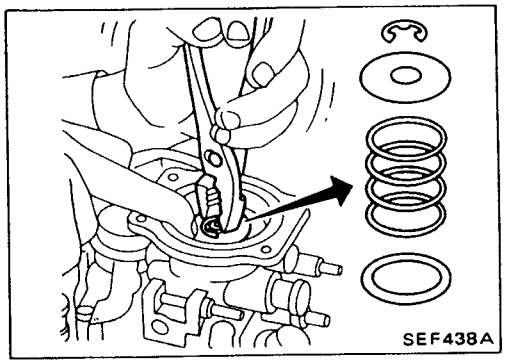


(9) Install governor cover.

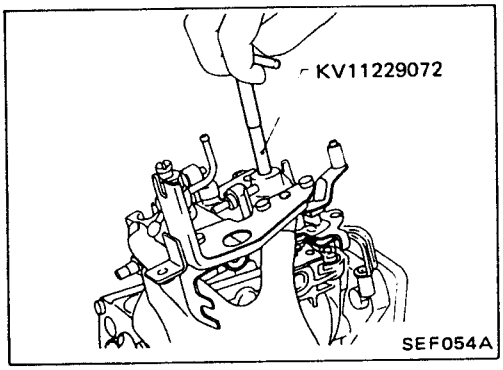


(10) Install control lever.
Align aligning marks of speed control lever and control lever shaft.

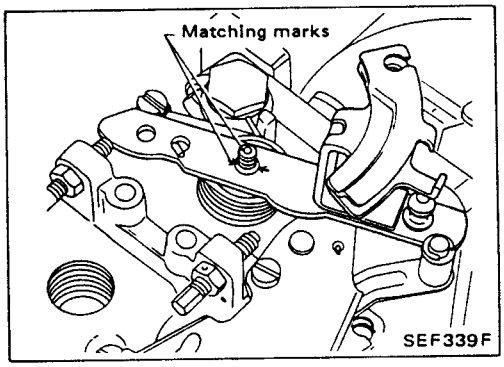
Assembly (Cont'd)



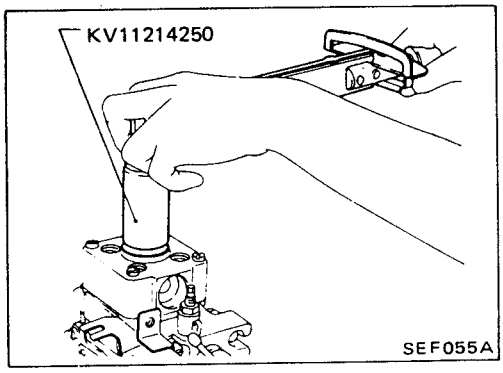
(11) Install spring seat, spring and E-ring.
(12) Install adjusting shim and bellows.
(13) Install compensator cover.



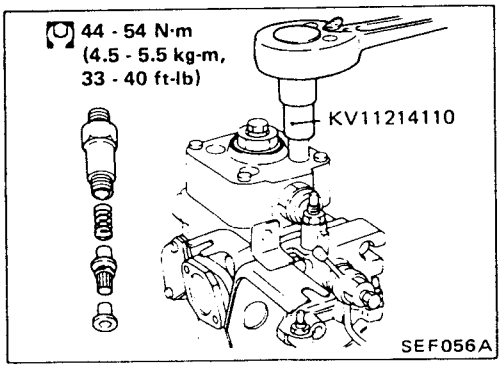
Without high altitude compensator
(1) Install pump governor cover.



(2) Install speed control lever assembly.
Align aligning marks of speed control lever and control lever shaft.



28. Install plug with new O-ring.



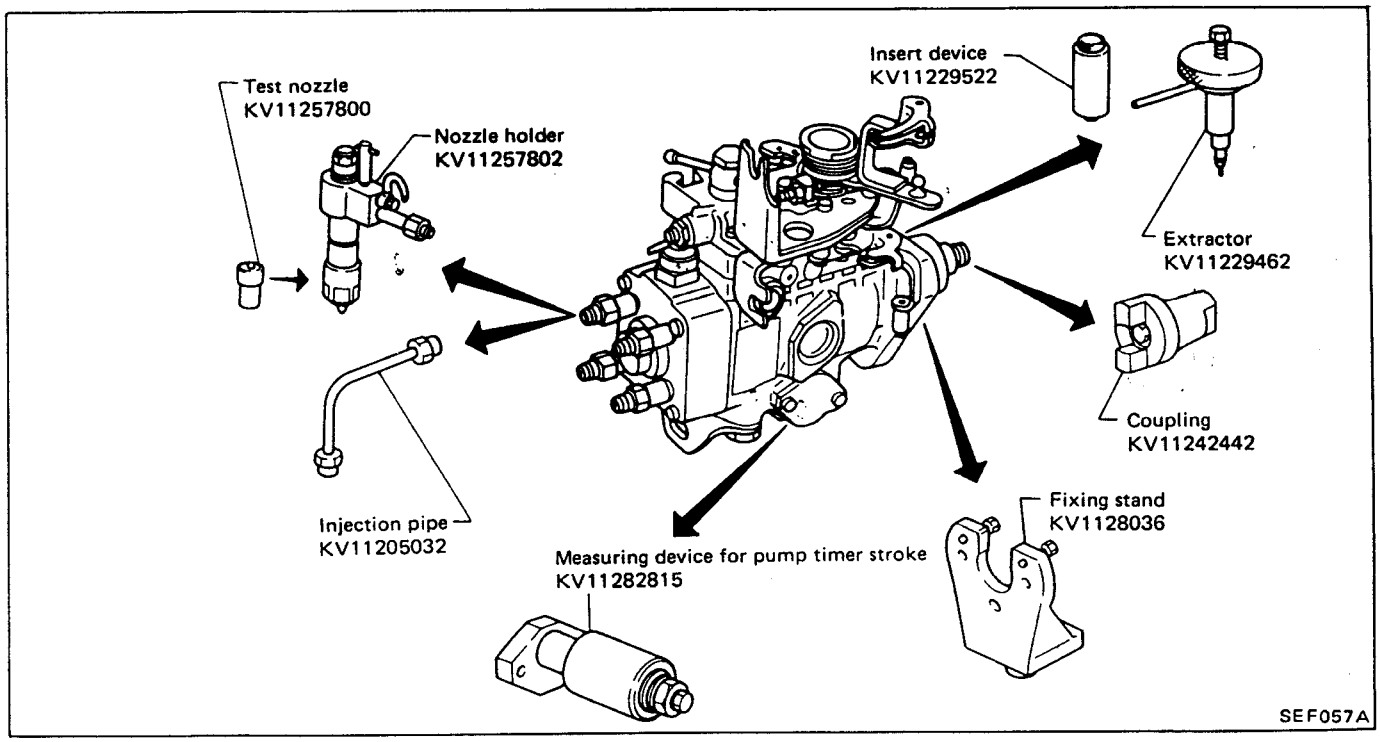
29. Install fuel-cut solenoid valve and plug.
Always replace plugs with new ones.
31. Install delivery valve.
a. **Always use new washers.**
b. **Make sure that delivery valve is reinstalled in its original position.**

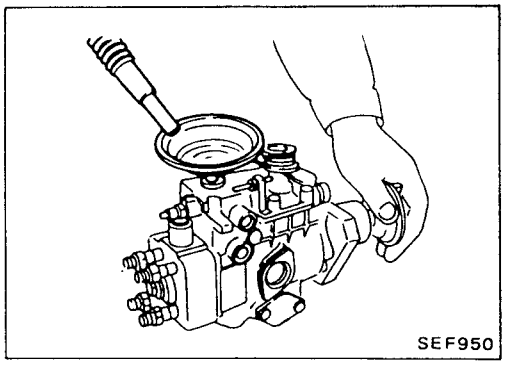
Test

PREPARATION

Nozzle		KV11257805
Nozzle holder		KV11257802
Nozzle starting pressure	kPa (bar, kg/cm^2, psi)	14,711 - 15,201 (147.1 - 152.0, 150 - 155, 2,133 - 2,204)
Nozzle tube Inner dia. x outer dia. x length	mm (in)	KV11257805 2.0 x 6.0 x 840 (0.079 x 0.236 x 33.07)
Fuel feed pressure	kPa (bar, kg/cm^2, psi)	20 (0.20, 0.2, 2.8)
Fuel (test oil)		ISO 4113 or SAE Standard Test Oil (SAE J967d)
Fuel temperature	°C (°F)	45 - 50 (113 - 122)
Rotating direction		Right (observed from the drive shaft)
Injection sequence		1-3-4-2

1. **Prepare necessary service tools.**

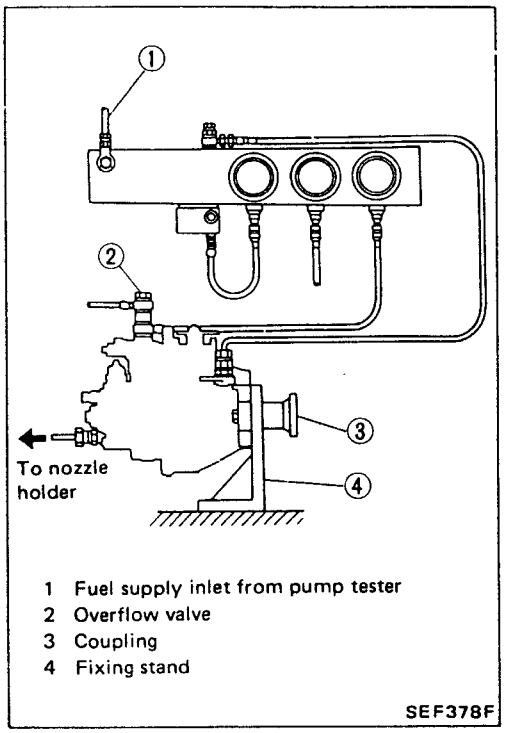




2. Pour test oil into fuel injection pump.
Test oil should be ISO 4113, SAE Standard Test Oil (SAE J967d) or its equivalent.

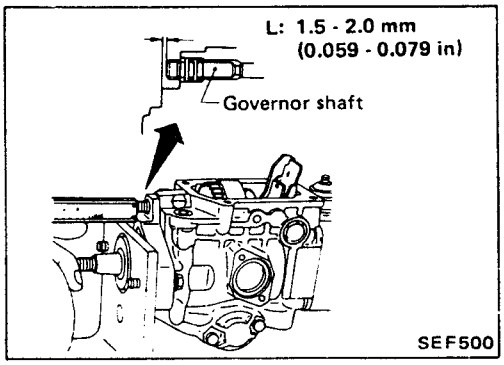
Test (Cont'd)

3. Install fuel injection pump to pump tester.
4. Connect necessary piping.



1 Fuel supply inlet from pump tester
2 Overflow valve
3 Coupling
4 Fixing stand

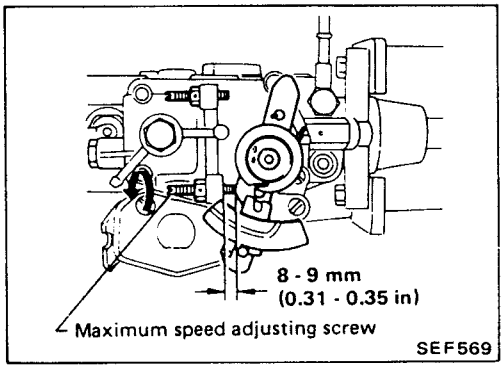
SEF378F



SEF500

5. Make sure that governor shaft is properly installed.

[O] : Governor shaft lock nut
25 - 29 N·m
(2.5 - 3.0 kg-m, 18 - 22 ft-lb)



SEF569

6. Run fuel injection pump as follows:
(1) Maintain test oil in tank at 45 to 50°C (113 to 122°F).
(2) Set control lever at "full load" using a spring.

Set maximum speed adjusting screw in position shown, by turning it counterclockwise.

(3) Furnish specified voltage of 12 volts to fuel-cut solenoid valve to activate it.
(4) Rotate fuel injection pump by hand to see if it moves smoothly.
(5) Rotate fuel injection pump at 300 rpm to make sure that all air inside pump chamber is discharged through overflow valve.
(6) Set feed oil pressure at 20 kPa (0.20 bar, 0.2 kg/cm^2, 2.8 psi).
(7) Run fuel injection pump at 1,000 rpm for ten minutes.

If fuel leakage, fuel injection failure or unusual noise is noticed, immediately stop pump tester operation and check fuel injection pump for abnormalities.

Test (Cont'd)

ADJUSTMENT

Preadjust full-load delivery

If equipped with high altitude compensator, remove high altitude compensator cover, bellows and adjusting shim.

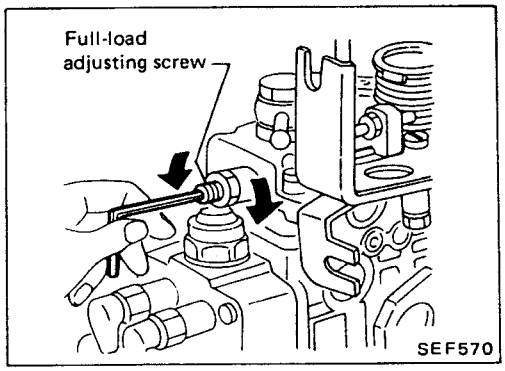
1. Set control lever at "full-load" using a spring.

Set maximum speed adjusting screw in position shown, by turning it counterclockwise. Refer to step 6-(2) in Preparation.

2. Furnish specified voltage of 12 volts to activate fuel-cut solenoid valve.
3. Rotate fuel injection pump at 1,100 rpm, and measure amount of fuel injection.

Standard fuel injection:

Refer to S.D.S.



4. **If fuel injection is less than standard, adjust it with full-load adjusting screw.**

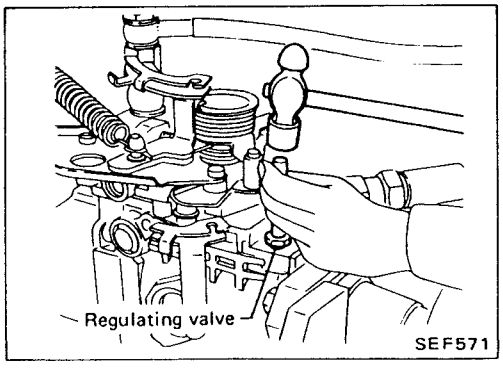
Turn adjusting screw clockwise to increase fuel injection.

Adjustment of feed pump pressure

1. Repeat steps 1 and 2 outlined under "Preadjust Full-Load Delivery" heading.
2. Measure feed pump pressure at specified fuel injection pump rpm.

Standard fuel injection:

Refer to S.D.S.

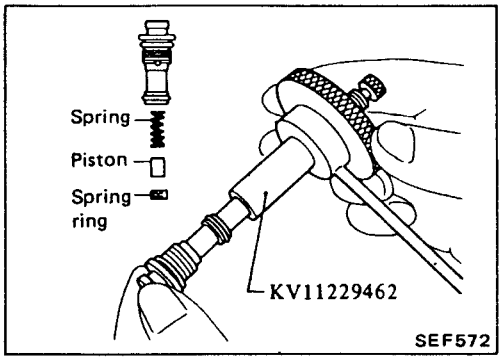


a. **When measured pressure is lower than specifications.**

Push in plug that is driven into regulating valve body.

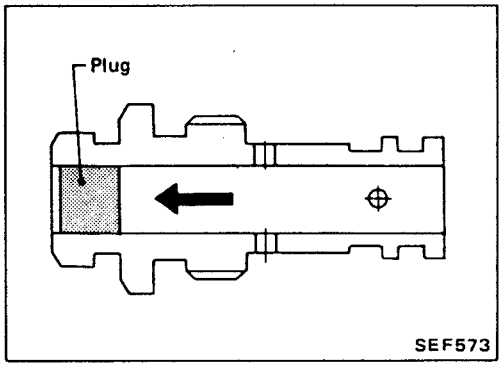
Be careful not to push plug in too far.

Test (Cont'd)



b. When measured pressure is higher than specifications.

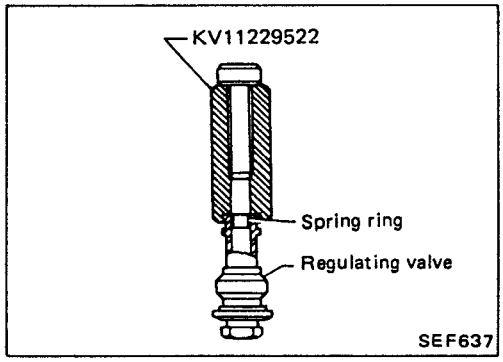
Remove regulating valve from fuel injection pump, and disassemble regulating valve using service tool KV11229462.



Drive plug out until it is flush with end face of regulating valve.

install spring, piston and spring ring, in that order, to regulating valve.

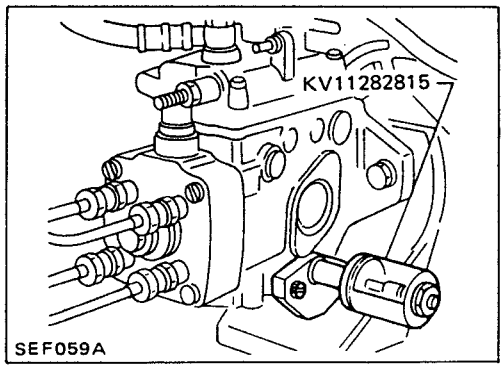
Make sure that spring ring is flush with end face of regulating valve body when it is pushed in.



Attach regulating valve to fuel injection pump.

: **Regulating valve**
8 - 9 N·m
(0.8 - 0.9 kg-m, 5.8 - 6.5 ft-lb)

Adjust supply pump pressure to specifications. Refer to step 2-a.

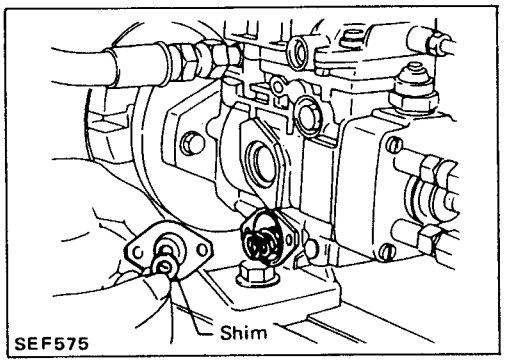


Adjustment of speed timer

1. Repeat steps 1 and 2 outlined under "Preadjust Full-Load Delivery" heading.
2. Remove cover from high-pressure side (side without spring) of timer, and attach service tool KV11282815 to that side.
3. Measure timer piston strokes at specified fuel injection pump rpm indicated below.

Standard fuel injection:
Refer to S.D.S.

Test (Cont'd)



4. If timer piston stroke is not within specified range, remove cover from low-pressure side of timer and adjust piston stroke by adding shim(s).

a. **Shims (service parts)**

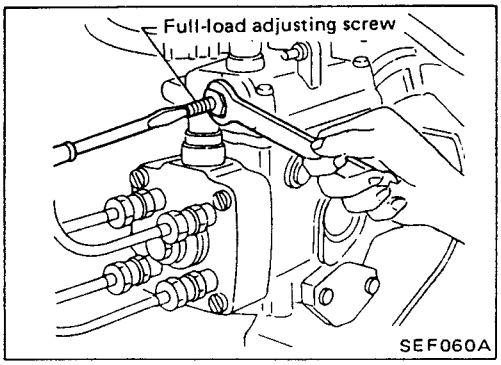
Part number	Thickness mm (in)
16880-02N00	0.6 (0.024)
16880-02N01	0.7 (0.028)
16880-02N02	0.9 (0.035)
16880-02N03	1.0 (0.039)
16880-02N04	1.2 (0.047)

b. **Make sure that at least one shim is used on each side of timer spring.**

Adjustment of fuel injection under full-load

1. Set control lever at "full-load" using a spring.
2. Furnish specified voltage of 12 volts to activate fuel-cut solenoid valve.
3. Measure fuel injection at each specified fuel injection pump rpm.

Standard fuel injection:
Refer to S.D.S.



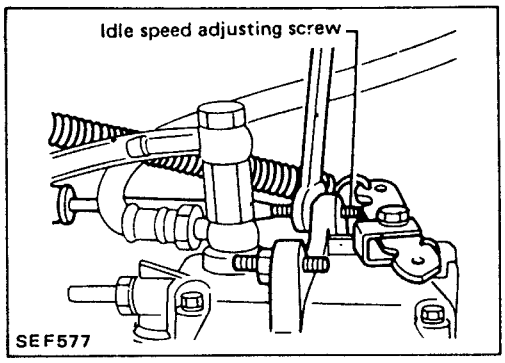
4. If fuel injection is not within standard range, adjust it using full-load adjusting screw.

Adjustment of fuel injection during idle

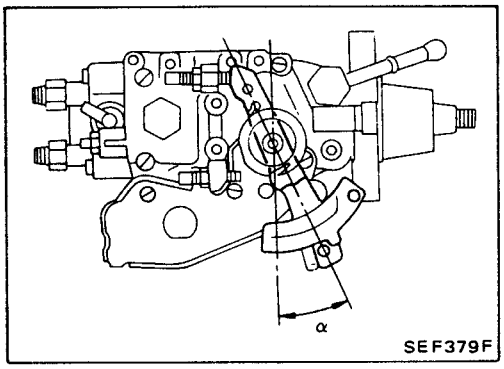
1. Pull spring until control lever touches idle speed adjusting screw.
2. Furnish specified voltage of 12 volts to activate fuel-cut solenoid valve.
3. Measure fuel injection at specified fuel injection pump rpm.

Standard fuel injection:
Refer to S.D.S.

Test (Cont'd)



4. If fuel injection is not within specified range, adjust using idle speed adjusting screw.



a. **Tightening this screw will increase fuel injection amount.**
b. **Make sure that control lever angle (α) is set at the specified range.**
   α: **Refer to S.D.S.**
   If control lever angle is not within specified range, adjust it by repositioning control lever on control shaft. (One serration pitch: 15°)
   After control lever has been repositioned, be sure to measure amount of fuel injection at idle speed again.

Adjustment of fuel injection during start

1. Set control lever at "full-load" by pulling spring.
2. Furnish specified voltage of 12 volts to activate fuel-cut solenoid valve.
3. Measure fuel injection at specified fuel injection pump rpm.

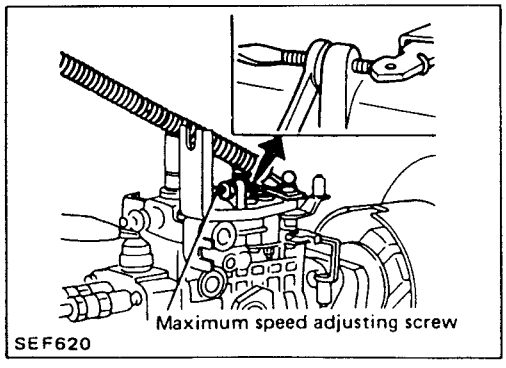
Standard fuel injection:
Refer to S.D.S.

4. If fuel injection is lower than standard, check, "MS" dimension. Refer to step 25 for Injection Pump Assembly.

Adjustment of fuel injection at maximum pump rpm

1. Set control lever at "full-load" by pulling spring.
2. Furnish specified voltage of 12 volts to activate fuel-cut solenoid valve.
3. Measure fuel injection at specified fuel injection rpm.

Standard fuel injection:
Refer to S.D.S.

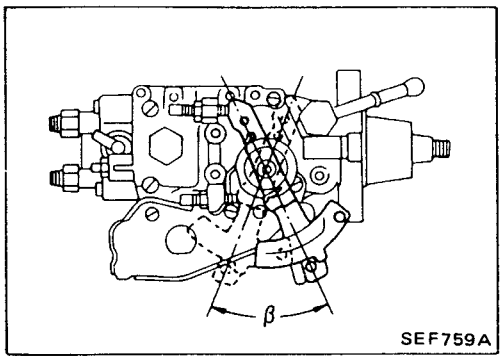


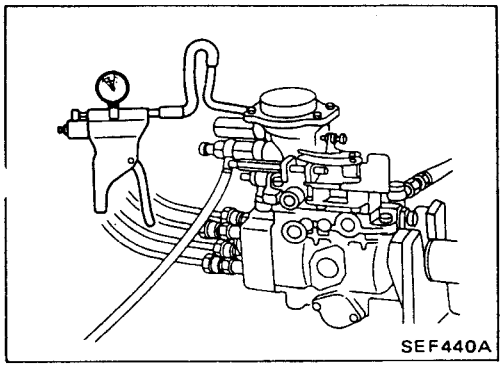
4. If fuel injection is not within standard range, adjust using maximum speed adjusting screw.

Test (Cont'd)

a. Tightening screw will increase fuel injection.
b. Make sure that control lever angle (β) is within the specified range.

β: Refer to S.D.S.





ADJUSTMENT OF HIGH ALTITUDE COMPENSATOR

1. Install bellows and adjusting shim.
2. Install a vacuum pump.

Check that there is no vacuum leakage.

3. Measure fuel injection volume.

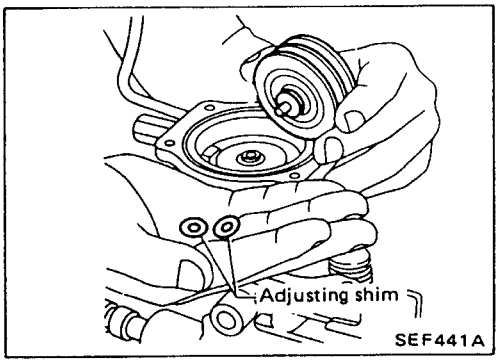
1) Below 2,000 m (6,562 ft)

Item \ Altitude m (ft)	0 (0)	250 (820)	500 (1,641)	750 (2,461)	1,000 (3,281)	1,250 (4,101)	1,500 (4,922)	1,750 (5,742)	2,000 (6,562)
Applied vacuum kPa (mbar, mmHg, inHg)	21.2 - 22.5 (212 - 225, 159 - 169, 6.26 - 6.65)	18.3 - 19.6 (183 - 196, 137 - 147, 5.39 - 5.79)	15.3 - 16.7 (153 - 167, 115 - 125, 4.53 - 4.92)	12.4 - 13.7 (124 - 137, 93 - 103, 3.66 - 4.06)	9.5 - 10.8 (95 - 108, 71 - 81, 2.80 - 3.19)	6.9 - 8.3 (69 - 83, 52 - 62, 2.05 - 2.44)	4.4 - 5.7 (44 - 57, 33 - 43, 1.30 - 1.69)	1.9 - 3.2 (19 - 32, 14 - 24, 0.55 - 0.94)	0 (0, 0, 0)
Fuel injection pump rpm	1,000								
Standard fuel injection mℓ (Imp fl oz)/ 1,000 stroke	29.4 - 33.4 (1.03 - 1.18)								

2) Above 2,000 m (6,562 ft)

Item \ Altitude m (ft)	2,250 (7,382)	2,500 (8,203)	2,750 (9,023)	3,000 (9,843)	3,250 (10,663)	3,500 (11,484)	3,750 (12,304)	4,000 (13,124)
Fuel injection pump rpm	1,000							
Standard fuel injection mℓ (Imp fl oz)/1,000 stroke	28.4 - 32.5 (1.00 - 1.14)	27.4 - 31.5 (0.96 - 1.11)	26.5 - 30.5 (0.93 - 1.07)	25.5 - 29.6 (0.90 - 1.04)	24.5 - 28.6 (0.86 - 1.01)	23.6 - 27.6 (0.83 - 0.97)	22.7 - 26.7 (0.80 - 0.94)	21.7 - 25.7 (0.76 - 0.90)

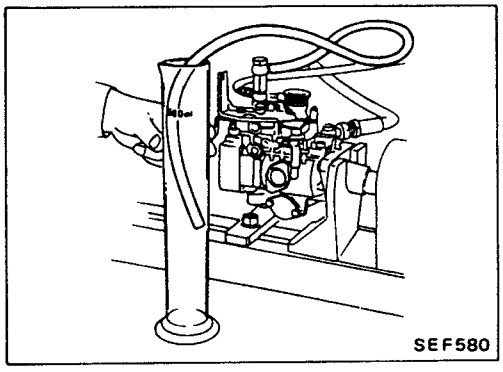
Test (Cont'd)



4. If fuel injection is not within the standard range, increase or decrease the adjusting shims.

Shims (Service parts)

Part number	Thickness mm (in)
19275-W3300	0.2 (0.008)
19275-W3301	0.3 (0.012)
19275-W3302	0.4 (0.016)
19275-W3303	0.6 (0.024)
19275-W3304	0.7 (0.028)



Measurement of overflow amount

1. Set control lever at "full-load" by pulling spring.
2. Furnish specified voltage of 12 volts to activate fuel cut solenoid valve.
3. Measure fuel overflow at specified fuel injection rpm.

Fuel overflow:

43 - 87 mℓ

(1.51 - 3.06 Imp fl oz)/10 sec. at 1,100 rpm

Operation check of fuel-cut solenoid valve

When engine is idling and fuel cut solenoid valve current is OFF, be sure there is no injection. This check has to be done for approx. 5 seconds.

Service Data and Specifications (S.D.S.)

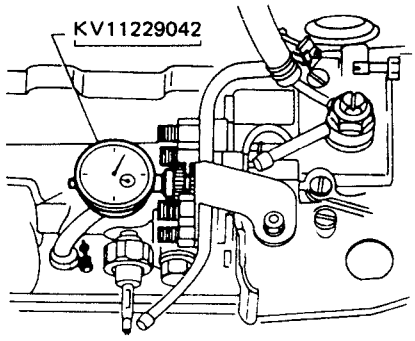
APPLICATION

Engine	Destination	Part No.	Pump No.	Applied model			Remarks
				E24	F22	H40	
TD23	Except Europe	16700-02N09	104740-9290	O	O	–	Without high altitude compensator
		16700-02N20	104740-9550				With high altitude compensator
		16700-02N14	104740-9340	O	–	–	For cold area
	Europe	16700-02N18	104740-9540	O	–	–	M/T
		16700-02N19	104740-9351				A/T
		16700-10T07	104740-9371	–	O	–	
TD27	Australia	16700-11T14	104740-9380	O	O	O	M/T without exhaust brake
		16700-11T15	104740-9390	–	O	O	M/T with exhaust brake
		16700-11T22	104740-9460	O	–	–	A/T

INSPECTION AND ADJUSTMENT

Injection timing

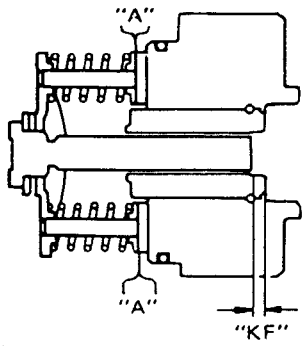
Engine	Plunger lift mm (in)
TD23	0.54±0.02 (0.0213±0.0008) (equivalent to 5° B.T.D.C.)
TD27	0.65±0.02 (0.0256±0.0008) (equivalent to 5° B.T.D.C.)



SEF016A

Use of adjustment value and adjusting shim when installing injection pump.

Dimension "KF" mm (in)	5.7 - 5.9 (0.224 - 0.232)



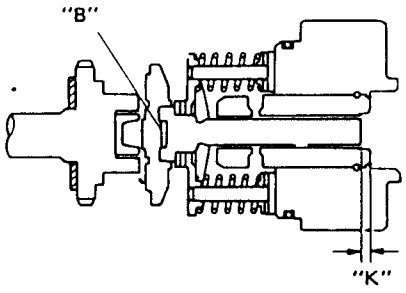
SEF638

Adjusting shim ("A" position)

Part number	Thickness mm (in)
16882-43G00	0.5 (0.020)
16882-43G01	0.8 (0.031)
16882-43G02	1.0 (0.039)
16882-43G03	1.2 (0.047)
16882-43G04	1.5 (0.059)
16882-43G05	1.8 (0.071)
16882-43G06	2.0 (0.079)

Service Data and Specifications (S.D.S.) (Cont'd)

Dimension "K" mm (in)	3.2 - 3.4 (0.126 - 0.134)

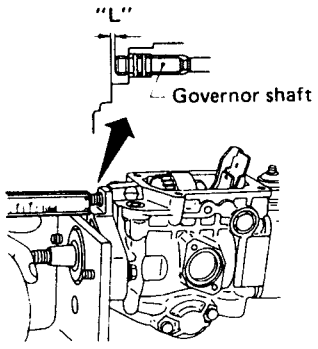


SEF639

Adjusting shim ("B" position)

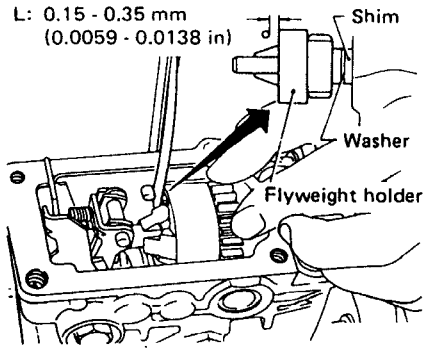
Part number	Thickness mm (in)	Part number	Thickness mm (in)
16884-V0700	1.92 (0.0756)	16742-R8100	1.96 (0.0772)
16884-V0701	2.00 (0.0787)	16742-R8101	2.04 (0.0803)
16884-V0702	2.08 (0.0819)	16742-R8102	2.12 (0.0835)
16884-V0703	2.16 (0.0850)	16742-R8103	2.20 (0.0866)
16884-V0704	2.24 (0.0882)	16742-R8104	2.28 (0.0898)
16884-V0705	2.32 (0.0913)	16742-R8105	2.36 (0.0929)
16884-V0706	2.40 (0.0945)	16742-R8106	2.44 (0.0961)
16884-V0707	2.48 (0.0976)	16742-R8107	2.52 (0.0992)
16884-V0708	2.56 (0.1008)	16742-R8108	2.60 (0.1024)
16884-V0709	2.64 (0.1039)	16742-R8109	2.68 (0.1055)
16884-V0710	2.72 (0.1071)	16742-R8110	2.76 (0.1087)
16884-V0711	2.80 (0.1102)	16742-R8111	2.84 (0.1118)
16884-V0712	2.88 (0.1134)		

Diemnsion "L" mm (in)	1.5 - 2.0 (0.059 - 0.079)



SEF500

Axial play of flyweight holder "L" mm (in)	0.15 - 0.35 (0.0059 - 0.0138)

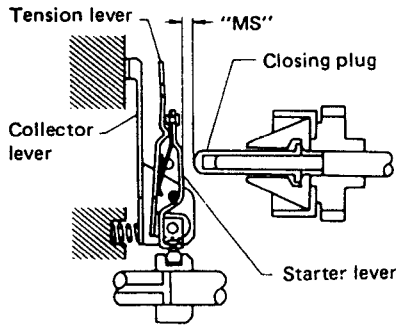


SEF047A

Adjusting shim

Part number	Thickness mm (in)
19208-V0700	1.05 (0.0413)
19208-V0701	1.25 (0.0492)
19208-V0702	1.45 (0.0571)
19208-V0703	1.65 (0.0650)
19208-V0704	1.85 (0.0728)

Dimension "MS" mm (in)	0.9 - 1.1 (0.035 - 0.043)



SEF856

Adjusting closing plug

Part number	Length mm (in)
16268-R8100	3.10 (0.1220)
16268-R8101	3.30 (0.1299)
16268-R8102	3.50 (0.1378)
16268-R8103	3.70 (0.1457)
16268-R8104	3.90 (0.1535)
16268-R8105	4.10 (0.1614)
16268-R8106	4.30 (0.1693)
16268-R8107	4.50 (0.1772)

Service Data and Specifications (S.D.S.) (Cont'd)

Model: TD23 except for Europe
Pump part No.: 16700-02N09, 16700-02N20, 16700-02N14

1. Adjustment value:

		Pump speed (rpm)	Adjustment value	Difference in delivery mℓ (Imp fl oz)
1 - 1	Timing device travel (Timer piston stroke)	1,700	4.4 - 4.8 mm (0.173 - 0.189 in)	–
1 - 2	Supply pump pressure (Feed pump pressure)	1,700	549 - 608 kPa (5.49 - 6.08 bar, 5.6 - 6.2 kg/cm², 80 - 88 psi) 481 - 539 kPa (4.81 - 5.39 bar, 4.9 - 5.5 kg/cm², 70 - 78 psi)*	–
1 - 3	Full load delivery without charge air pressure (Fuel injection quantity at Full-load)	1,100	45.1 - 46.1 mℓ (1.59 - 1.62 Imp fl oz)/1,000 st	3.0 (0.11)
1 - 4	Idle speed regulation (Fuel injection quantity at idle)	350	4.5 - 8.5 mℓ (0.16 - 0.30 Imp fl oz)/1,000 st	2.0 (0.07)
1 - 5	Start (Fuel injection quantity at Start)	100	45.0 - 80.0 mℓ (1.58 - 2.82 Imp fl oz)/1,000 st	–
1 - 6	Full-load speed regulation (Fuel injection quantity at Max. speed)	2,350	28.3 - 32.3 mℓ (1.00 - 1.14 Imp fl oz)/1,000 st	–

*: For cold area (P/N 16700-02N14)

2. Testing value:

2 - 1	Timing device (Timer piston stroke)	Pump speed (rpm)	1,100	1,700	2,550
		mm (in)	2.0 - 3.0 (0.079 - 0.118)	4.3 - 4.9 (0.169 - 0.193)	6.4 - 7.4 (0.252 - 0.291)
2 - 2	Supply pump (Feed pump pressure)	Pump speed (rpm)	1,100	1,700	2,150
		kPa (bar, kg/cm², psi)	402 - 461 (4.02 - 4.61, 4.1 - 4.7 - 58 - 67) 343 - 402 (3.43 - 4.02, 3.5 - 4.1, 50 - 58)*	549 - 608 (5.49 - 6.08, 5.6 - 6.2, 80 - 88) 481 - 539 (4.81 - 5.39, 4.9 - 5.5, 70 - 78)*	647 - 706 (6.47 - 7.06 6.6 - 7.2, 94 - 102) 569 - 628 (5.69 - 6.28, 5.8 - 6.4, 82 - 91)*
2 - 3	Overflow delivery	Pump speed (rpm)	1,100		
		mℓ (Imp fl oz)/10 sec.	43.0 - 87.0 (1.51 - 3.06)		

*: For cold area (P/N 16700-02N14)

Service Data and Specifications (S.D.S) (Cont'd)

2 - 4 Fuel deliveries

Speed control lever	Pump speed rpm	Fuel delivery mℓ (Imp fl oz)/ 1,000 st
End stop (Full-load)	2,700	Less than 5.0 (0.18)
	2,550	5.3 - 12.4 (0.19 - 0.44)
	2,350	27.8 - 32.8 (0.98 - 1.15)
	2,150	36.9 - 41.1 (1.30 - 1.45)
	1,100	44.6 - 46.6 (1.57 - 1.64)
	600	42.1 - 46.1 (1.48 - 1.62)
Switch OFF	350	0 (0)
Idle stop (Idle)	350	4.5 - 8.5 (0.16 - 0.30)
	450	Less than 2.0 (0.07)

2 - 5	Solenoid	Max. cut-in voltage: 8V Test voltage: 12 - 14V

3. Dimensions

mm (in)

K	3.2 - 3.4 (0.126 - 0.134)
KF	5.7 - 5.9 (0.224 - 0.232)
MS	0.9 - 1.1 (0.035 - 0.043)

4. Control lever angle

degree

α	50 - 58
β	37 - 47

Service Data and Specifications (S.D.S) (Cont'd)

Model: TD23 for Europe
Pump part No.: 1670-02N18, 16700-02N19, 16700-10T07

1. Adjustment value:

		Pump speed (rpm)	Adjustment value	Difference in delivery mℓ (Imp fl oz)
1 - 1	Timing device travel (Timer piston stroke)	1,100	2.3 - 2.7 mm (0.091 - 0.106 in)	–
1 - 2	Supply pump pressure (Feed pump pressure)	1,100	343 - 402 kPa (3.43 - 4.02 bar, 3.5 - 4.1 kg/cm², 50 - 58 psi)	–
1 - 3	Full load delivery without charge air pressure (Fuel injection quantity at Full-load)	1,100	45.1 - 46.1 mℓ (1.59 - 1.62 Imp fl oz)/1,000 st	3.0 (0.11)
1 - 4	Idle speed regulation (Fuel injection quantity at idle)	350	4.5 - 8.5 mℓ (0.16 - 0.30 Imp fl oz)/1,000 st	2.0 (0.07)
1 - 5	Start (Fuel injection quantity at Start)	100	45.0 - 80.0 mℓ (1.58 - 2.82 Imp fl oz)/1,000 st	–
1 - 6	Full-load speed regulation (Fuel injection quantity at Max. speed)	2,350	28.3 - 32.3 mℓ (1.00 - 1.14 Imp fl oz)/1,000 st	–

2. Testing value:

2 - 1	Timing device (Timer piston stroke)	Pump speed (rpm)	1,100	1,700	2,550
		mm (in)	2.2 - 2.8 (0.087 - 0.110)	4.1 - 5.1 (0.161 - 0.201)	6.4 - 7.4 (0.252 - 0.291)
2 - 2	Supply pump (Feed pump pressure)	Pump speed (rpm)	1,100	1,700	2,150
		kPa (bar, kg/cm², psi)	343 - 402 (3.43 - 4.02, 3.5 - 4.1, 50 - 58)	481 - 539 (4.81 - 5.39, 4.9 - 5.5, 70 - 78)	569 - 628 (5.69 - 6.28, (5.8 - 6.4, 82 - 91)
2 - 3	Overflow delivery	Pump speed (rpm)	1,100		
		mℓ (Imp fl oz)/10 sec.	43.0 - 87.0 (1.51 - 3.06)		

Service Data and Specifications (S.D.S) (Cont'd)

2 - 4 Fuel deliveries

Speed control lever	Pump speed (rpm)	Fuel delivery mℓ (Imp fl oz)/ 1,000 st
End stop (Full-load)	2,700	Less than 5.0 (0.18)
	2,550	5.3 - 12.4 (0.19 - 0.44)
	2,350	27.8 - 32.8 (0.98 - 1.15)
	2,150	36.9 - 41.1 (1.30 - 1.45)
	1,100	44.6 - 46.6 (1.57 - 1.64)
	600	42.1 - 46.1 (1.48 - 1.62)
Switch OFF	350	0 (0)
Idle stop (Idle)	350	4.5 - 8.5 (0.16 - 0.30)
	450	Less than 2.0 (0.07)

2 - 5	Solenoid	Max. cut-in voltage: 8V Test voltage: 12 - 14V

3. Dimensions

mm (in)

K	3.2 - 3.4 (0.126 - 0.134)
KF	5.7 - 5.9 (0.224 - 0.232)
MS	0.9 - 1.1 (0.035 - 0.043)

4. Control lever angle

degree

α	50 - 58
β	37 - 47

Service Data and Specifications (S.D.S) (Cont'd)

Model: TD27 for Australia
Pump part No.: 16700-11T14, 16700-11T15, 16700-11T22

Adjustment value:

		Pump speed (rpm)	Adjustment value	Difference in delivery mℓ (Imp fl oz)
1 - 1	Timing device travel (Timer piston stroke)	1,700	4.4 - 4.8 mm (0.173 - 0.189 in)	–
1 - 2	Supply pump pressure (Feed pump pressure)	1,700	549 - 608 kPa (5.49 - 6.08 bar, 5.6 - 6.2 kg/cm², 80 - 88 psi)	–
1 - 3	Full load delivery without charge air pressure (Fuel injection quantity at Full-load)	1,100	51.8 - 52.8 mℓ (1.82 - 1.86 Imp fl oz)/1,000 st	3.0 (0.11)
1 - 4	Idle speed regulation (Fuel injection quantity at idle)	350	4.5 - 8.5 mℓ (0.16 - 0.30 Imp fl oz)/1,000 st	2.0 (0.07)
1 - 5	Start (Fuel injection quantity at Start)	100	45.0 - 80.0 mℓ (1.58 - 2.82 Imp fl oz)/1,000 st	–
1 - 6	Full-load speed regulation (Fuel injection quantity at Max. speed)	2,350	31.8 - 35.8 mℓ (1.12 - 1.26 Imp fl oz)/1,000 st	–

2. Testing value:

2 - 1	Timing device (Timer piston stroke)	Pump speed (rpm)	1,100	1,700	2,550
		mm (in)	2.0 - 3.0 (0.079 - 0.118)	4.3 - 4.9 (0.169 - 0.193)	6.4 - 7.4 (0.252 - 0.291)
2 - 2	Supply pump (Feed pump pressure)	Pump speed (rpm)	1,100	1,700	2,150
		kPa (bar, kg/cm², psi)	402 - 461 (4.02 - 4.61, 4.1 - 4.7, 58 - 67)	549 - 608 (5.49 - 6.08, 5.6 - 6.2, 80 - 88)	647 - 706 (6.47 - 7.06, 6.6 - 7.2, 94 - 102)
2 - 3	Overflow delivery	Pump speed (rpm)	1,100		
		mℓ (Imp fl oz)/10 sec.	43.0 - 87.0 (1.51 - 3.06)		

Service Data and Specifications (S.D.S.) (Cont'd)

2 - 4 Fuel deliveries

Speed control lever	Pump speed (rpm)	Fuel delivery mℓ (Imp fl oz)/ 1,000 st
End stop (Full-load)	2,700	Less than 5.0 (0.18)
	2,550	7.4 - 14.4 (0.26 - 0.51)
	2,350	31.3 - 36.3 (1.10 - 1.28)
	2,150	42.4 - 46.6 (1.49 - 1.64)
	1,100	51.3 - 53.3 (1.81 - 1.88)
	600	49.4 - 53.4 (1.74 - 1.88)
Switch OFF	350	0 (0)
Idle stop (Idle)	350	4.5 - 8.5 (0.16 - 0.30)
	450	Less than 2.0 (0.07)

2 - 5	Solenoid	Max. cut-in voltage: 8V Test voltage: 12 - 14 V

3. Dimensions

mm (in)

K	3.2 - 3.4 (0.126 - 0.134)
KF	5.7 - 5.9 (0.224 - 0.232)
MS	0.9 - 1.1 (0.035 - 0.043)

4. Control lever angle

degree

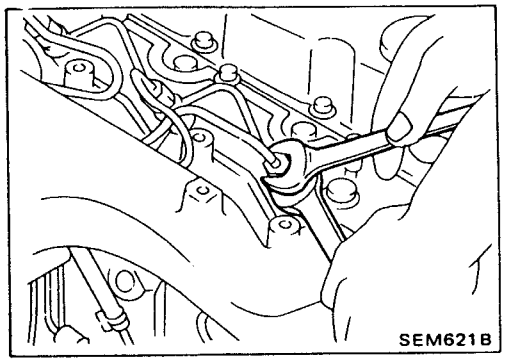
α	50 - 58
β	37 - 47

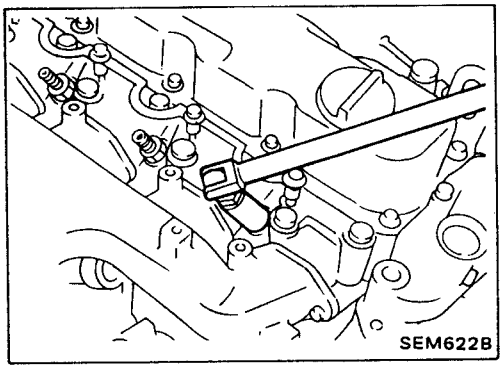
Service Data and Specifications (S.D.S) (Cont'd)

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Distributor head to pump housing	11 - 13	1.1 - 1.3	8 - 9
Plug to distributor head	59 - 78	6.0 - 8.0	43 - 58
Delivery valve to distributor head	44 - 54	4.5 - 5.5	33 - 40
Pivot pin to pump housing	10 - 13	1.0 - 1.3	7 - 9
Regulating valve to pump housing	8 - 9	0.8 - 0.9	5.8 - 6.5
Control shaft to control lever	7 - 10	0.7 - 1.0	5.1 - 7.2
Injection pump drive gear nut	59 - 69	6.0 - 7.0	43 - 51
Injection pump fixing bolt	19 - 25	1.9 - 2.5	14 - 18
Injection pump to mounting bracket	30 - 41	3.1 - 4.2	22 - 30
Injection nozzle to cylinder head*	54 - 64	5.5 - 6.5	40 - 47
Injection tube flare nut	20 - 25	2.0 - 2.5	14 - 18
Spill tube nut	29 - 39	3.0 - 4.0	22 - 29
Feed pump cover to pump housing	2 - 3	0.2 - 0.3	1.4 - 2.2
Speed timer cover to pump housing	6 - 8	0.6 - 0.8	4.3 - 5.8
Governor shaft lock nut	25 - 29	2.5 - 3.0	18 - 22
Overflow valve	20 - 29	2.0 - 3.0	14 - 22
Maximum and idle speed adjusting screw lock nuts	6 - 9	0.6 - 0.9	4.3 - 6.5
Full-load adjusting screw lock nut	7 - 9	0.7 - 0.9	5.1 - 6.5
Fuel cut solenoid valve	20 - 29	2.0 - 3.0	14 - 22
Plug bolt	14 - 20	1.4 - 2.0	10 - 14
Adjusting rod bushing lock nut	25 - 34	2.5 - 3.5	18 - 25

*: Part No. of injection nozzle: 16600-43G02





REMOVAL AND INSTALLATION

1. Remove injection tube assembly.
2. Remove spill tube assembly.

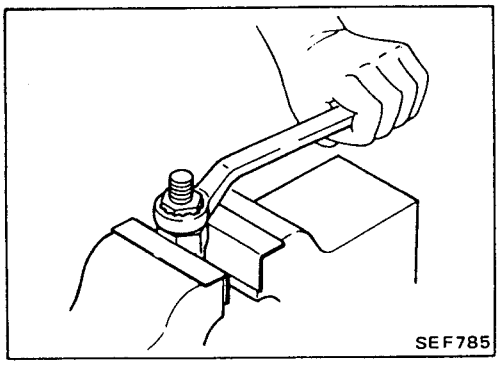
To prevent spill tube from breaking, remove it by gripping nozzle holder.

3. Remove injection nozzle assembly using deep socket wrench.
4. Install injection nozzle in the reverse order of removal.

[O] : **Injection nozzle to cylinder head**
54 - 64 N·m
(5.5 - 6.5 kg-m, 40 - 47 ft-lb)
Spill tube nut
29 - 39 N·m
(3.0 - 4.0 kg-m, 22 - 29 ft-lb)
Injection tube flare nut
20 - 25 N·m
(2.0 - 2.5 kg-m, 14 - 18 ft-lb)

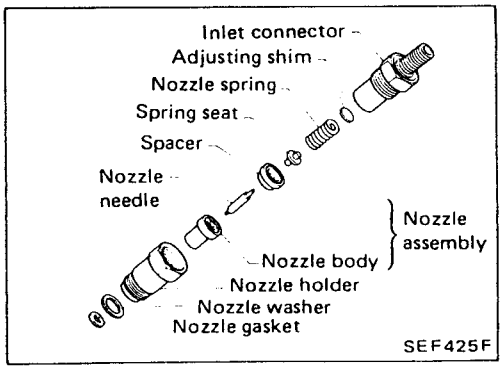
a. **Nozzle gaskets should always be replaced.**
b. **To prevent spill tube from breaking later, spill tube nuts should be tightened gradually in sequence.**

5. Bleed air from fuel system.
Refer to BLEEDING FUEL SYSTEM.



DISASSEMBLY

1. Loosen inlet connector while keeping nozzle top from turning.

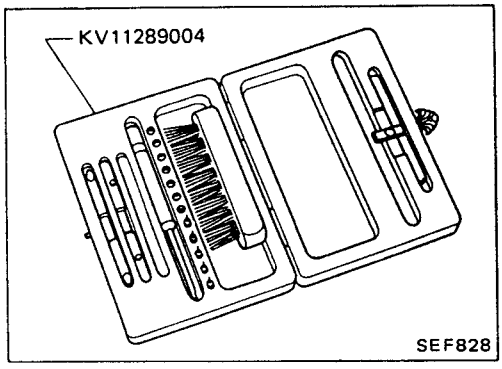


2. Arrange all disassembled parts in order shown at left.

INSPECTION

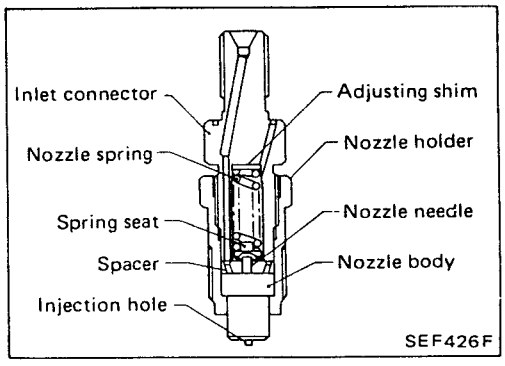
Thoroughly clean all disassembled parts with fresh kerosene or solvent.

- If nozzle needle is damaged or fused, replace nozzle assembly with a new one.
- If end of nozzle needle is seized or excessively discolored, replace nozzle assembly.
- Check nozzle body and distance piece for proper contact. If excessively worn or damaged, replace nozzle assembly or nozzle holder assembly.
- Check distance piece and nozzle holder for proper contact. If excessively worn or damaged, replace nozzle holder assembly.
- Check nozzle spring for excessive wear or damage. If excessively worn or damaged, replace nozzle holder assembly.

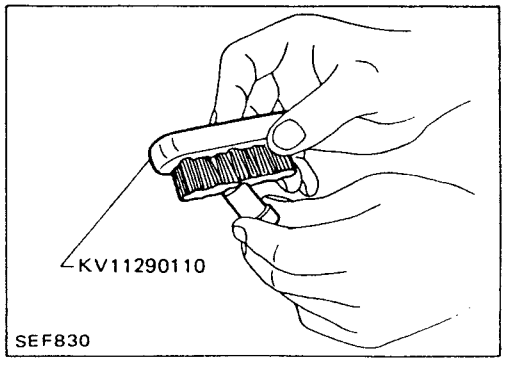


CLEANING

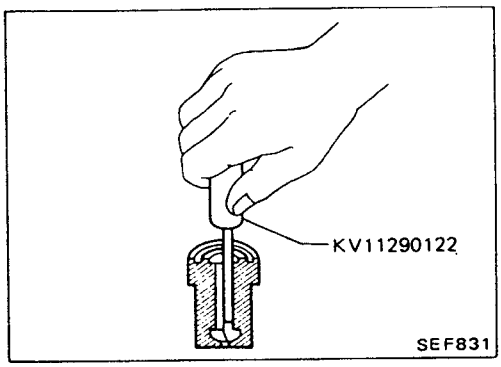
1. Clean nozzle assembly using the Nozzle Cleaning Kit.



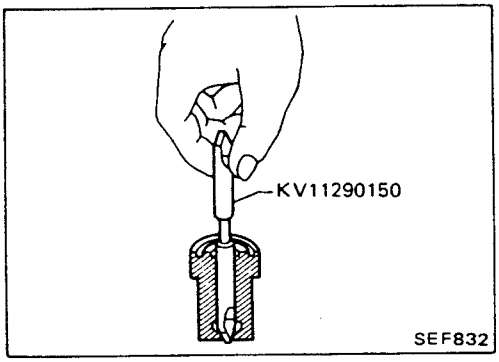
2. Portions which should be cleaned are indicated in the left figure.



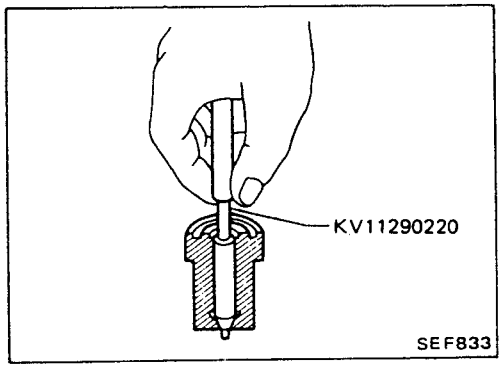
3. Remove any carbon from exterior of nozzle body (except wrapping angle portion) by using Tool.



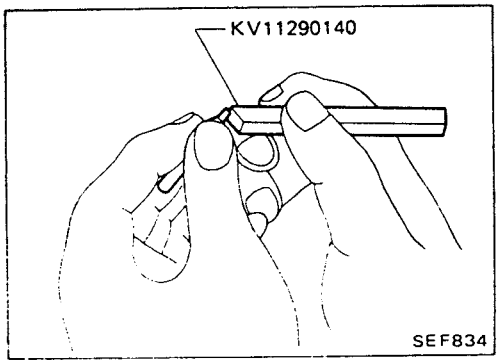
4. Clean fuel sump of nozzle body using Tool.



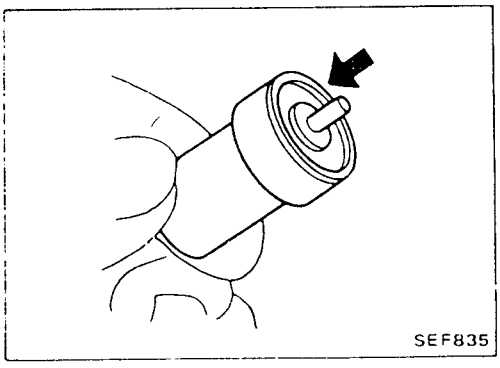
5. Clean nozzle seat by using Tool.
This job should be performed with extra precautions, since efficiency of nozzle depends greatly on a good nozzle seat.



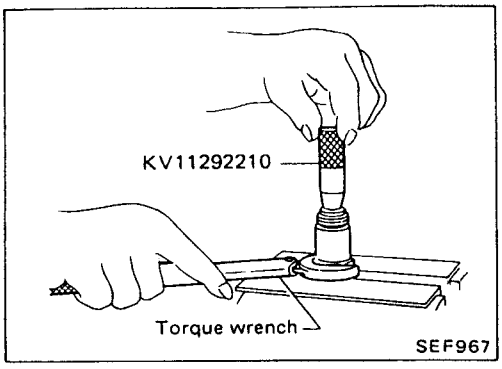
6. Clean spray hole of nozzle body by using Tool.
To prevent spray hole from canting, always clean it by starting with inner side and working towards outside.



7. Decarbon nozzle needle tip by using Tool.



8. Check needle for proper position.
(1) Pull needle about halfway out from body and then release it.
(2) Needle should sink into body very smoothly from just its own weight.
(3) Repeat this test and rotate needle slightly each time.
If needle fails to sink smoothly from any position, replace both needle and body as a unit.



ASSEMBLY

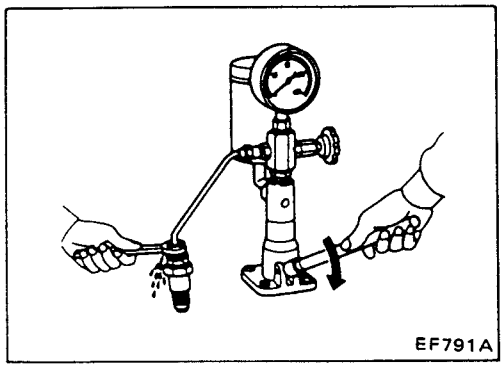
Assemble in the reverse order of disassembly.

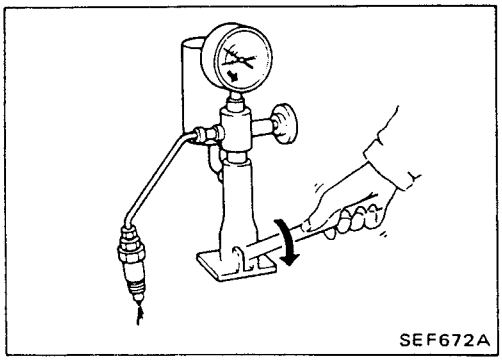
: Inlet connector to nozzle holder
29 - 49 N·m
(3.0 - 5.0 kg-m, 22 - 36 ft-lb)

TEST AND ADJUSTMENT

WARNING:

When using nozzle tester, be careful not to allow fuel sprayed from nozzle to come into contact with your hand or body, and make sure that your eyes are properly protected with goggles.





Injection pressure test

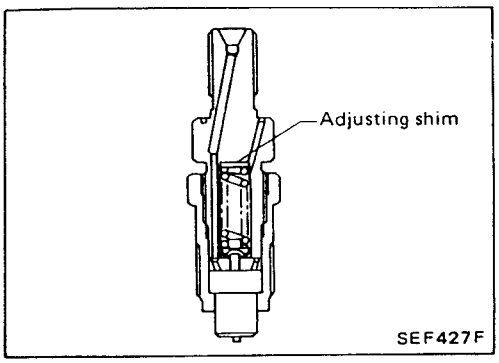
1. Install nozzle to injection nozzle tester and bleed air from flare nut.
2. Pump the tester handle slowly (one time per second) and watch the pressure gauge.
3. Read the pressure gauge when the injection pressure just starts dropping.

Initial injection pressure:

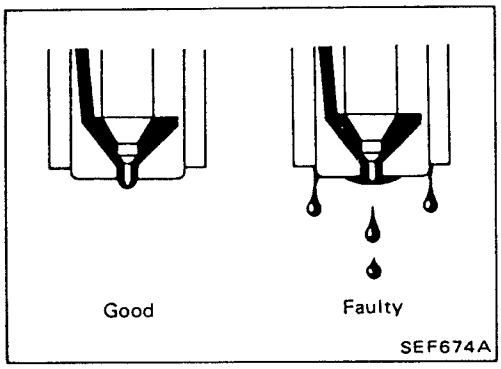
Used 9,807 - 10,297 kPa
(98.1 - 103.0 bar, 100 - 105 kg/cm^2, 1,422 - 1,493 psi)

New 10,297 - 11,278 kPa
(103.0 - 112.8 bar, 105 - 115 kg/cm^2, 1,493 - 1,635 psi)

New nozzle is required to always check initial injection pressure.

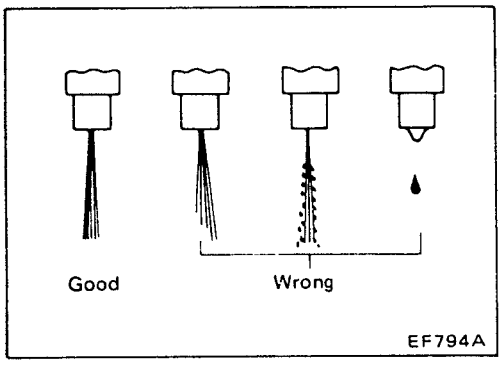


4. To adjust injection pressure, change adjusting shims.
a. Increasing the thickness of adjusting shims increases initial injection pressure. Decreasing thickness reduces initial pressure.
b. A shim thickness of 0.04 mm (0.0016 in) corresponds approximately to a difference of 471 kPa (4.71 bar, 4.8 kg/cm², 68 psi) in initial injection pressure.



Leakage test

1. Maintain the pressure at about 981 to 1,961 kPa (9.8 to 19.6 bar, 10 to 20 kg/cm², 142 to 284 psi) below initial injection pressure.
2. Check that there is no dripping from the nozzle tip or around the body.
3. If there is leakage, clean, overhaul injection nozzle or replace it.



Spray pattern test

1. Pump the tester handle 4 to 6 times per second or more.
2. Check the spray pattern.
3. If the spray pattern is not correct, clean injection nozzle or replace it.

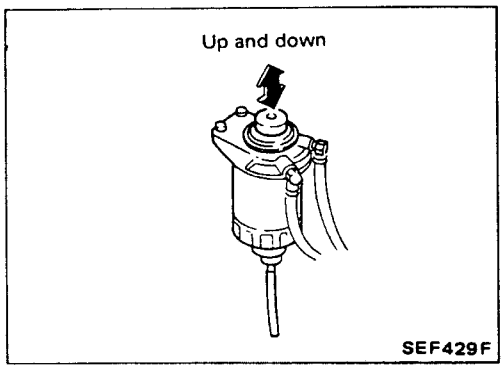
BLEEDING FUEL SYSTEM (Engine on vehicle)

Air should be bled out of fuel system when injection pump is removed or fuel system is repaired.

Protect pump and engine mounts from fuel splash with rags.

If engine will not start after bleeding air, loosen injection tubes at nozzle side and crank engine until fuel overflows from injection tube. Tighten injection tube flare nuts.

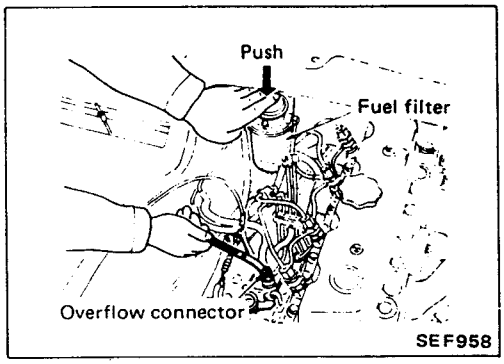
If the engine does not operate smoothly after it has started, race it two or three times.



VE pump

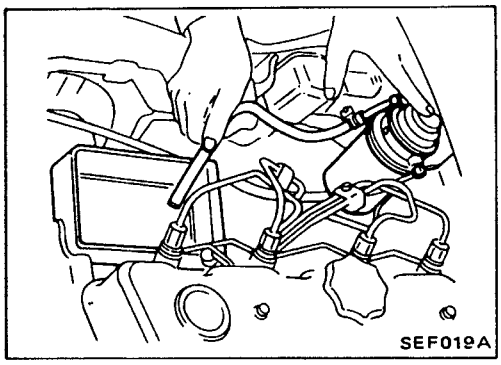
- **Method A**

Move the priming pump up and down until there is suddenly more resistance in the movement.



- **Method B**

1. Loosen injection pump bleeder screw/or disconnect return hose and priming.
2. Make sure that fuel overflows at bleeder screw/tube end, then tighten it/connect hose.



CHECKING PRIMING PUMP

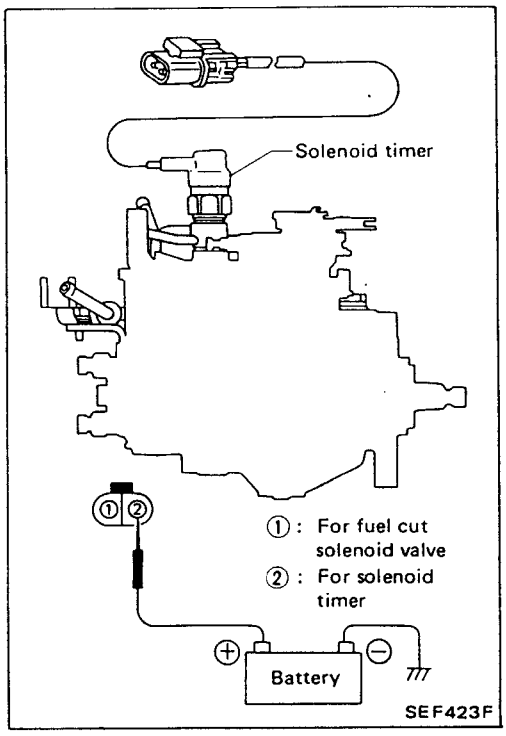
- VE pump

Before checking priming pump, make sure that fuel filter is filled with fuel.

1. Disconnect fuel return hose.

Place a suitable container beneath hose end.

2. Pump priming pump and check that the fuel overflows from the hose end. If not, replace priming pump.

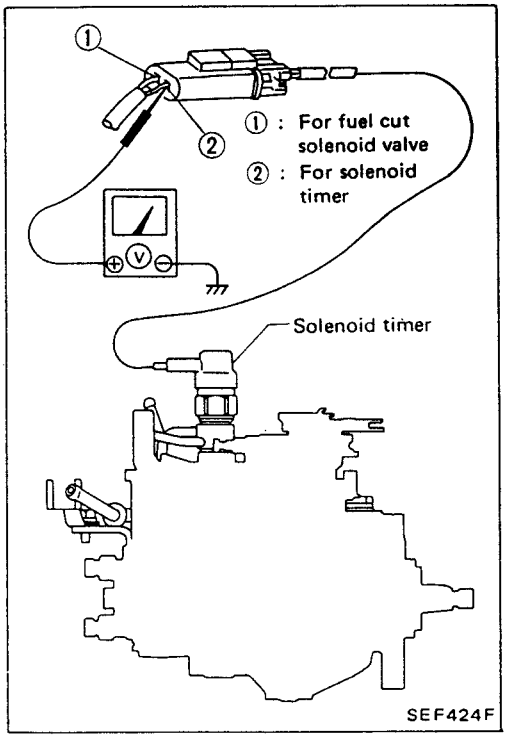


INSPECTION

Solenoid timer

1. Disconnect solenoid timer harness and check for "clicking" sound from solenoid when battery is connected and disconnected.
   If solenoid has malfunction, replace it.

After checking, reconnect the connector.



2. Disconnect water temperature sensor harness connector.
3. Start engine and check voltage between terminal ② and ground.

Battery voltage should exist for 30 seconds after starting engine.
If not, check harness and glow control unit.

Timer piston stroke (Using pump tester)

Measure timer piston strokes at specified fuel injection pump rpm when solenoid timer is on and off.

Refer to Section EF for adjustment of speed timer.

Part number	Fuel injection pump rpm	Timer piston stroke mm (in)	
		Solenoid timer is ON.	Solenoid timer is OFF.
16700-02N14	1,100	–	2.0 - 3.0 (0.079 - 0.118)
	1,700	5.5 - 7.4 (0.217 - 0.291)	4.3 - 4.9 (0.169 - 0.193)
	2,550	–	6.4 - 7.4 (0.252 - 0.291)
16700-10T07 16700-02N18 16700-02N19 16700-02N21 16700-02N22	1,100	3.7 - 4.7 (0.146 - 0.185)	2.2 - 2.8 (0.087 - 0.110)
	1,700	–	4.1 - 5.1 (0.161 - 0.201)
	2,550	–	6.5 - 7.4 (0.256 - 0.291)

LTI

SERVICE

Fairway

WORKSHOP MANUAL

SECTION 3

MANUAL GEARBOX AND CLUTCH

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

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

MANUAL TRANSMISSION

SECTION MT

CONTENTS

MANUAL TRANSMISSION FITTED TO SERIES 27 DIESEL ENGINE

TYPE FS5W71C 5 SPEED

PART NO CODE 32010

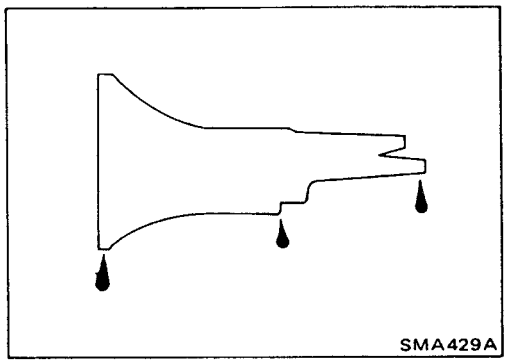
GEAR RATIOS

1st	3.592:1
2nd	2.246:1
3rd	1.415:1
4th	1.000:1
5th	0.821:1
REVERSE	3.657:1

SOME PARTS OF THIS SECTION DEAL WITH MORE THAN ONE TYPE OF GEARBOX ALWAYS REFER TO MODEL FS5W71C WITH THE ABOVE GEAR RATIOS.

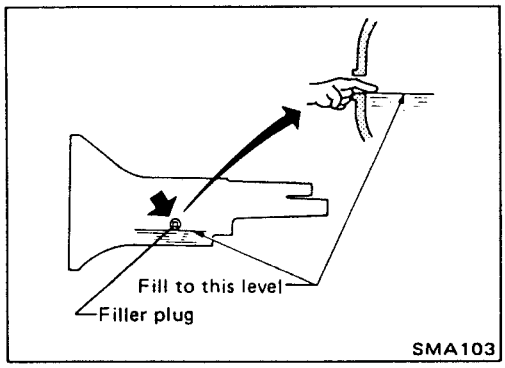
SPECIAL TOOLS

DEALERS WILL REQUIRE BASIC TOOLS FOR SEAL REMOVAL AND REFITTING.


SMA429A

Checking M/T Oil

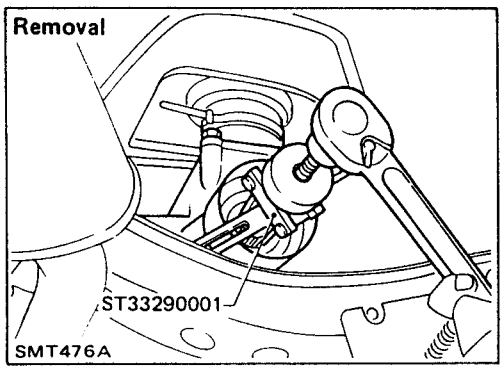
- Check manual transmission for leakage.



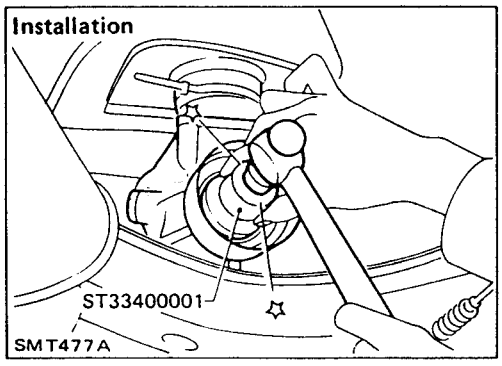
SMA103

- Check oil level.

Replacing Rear Oil Seal — 2WD Model

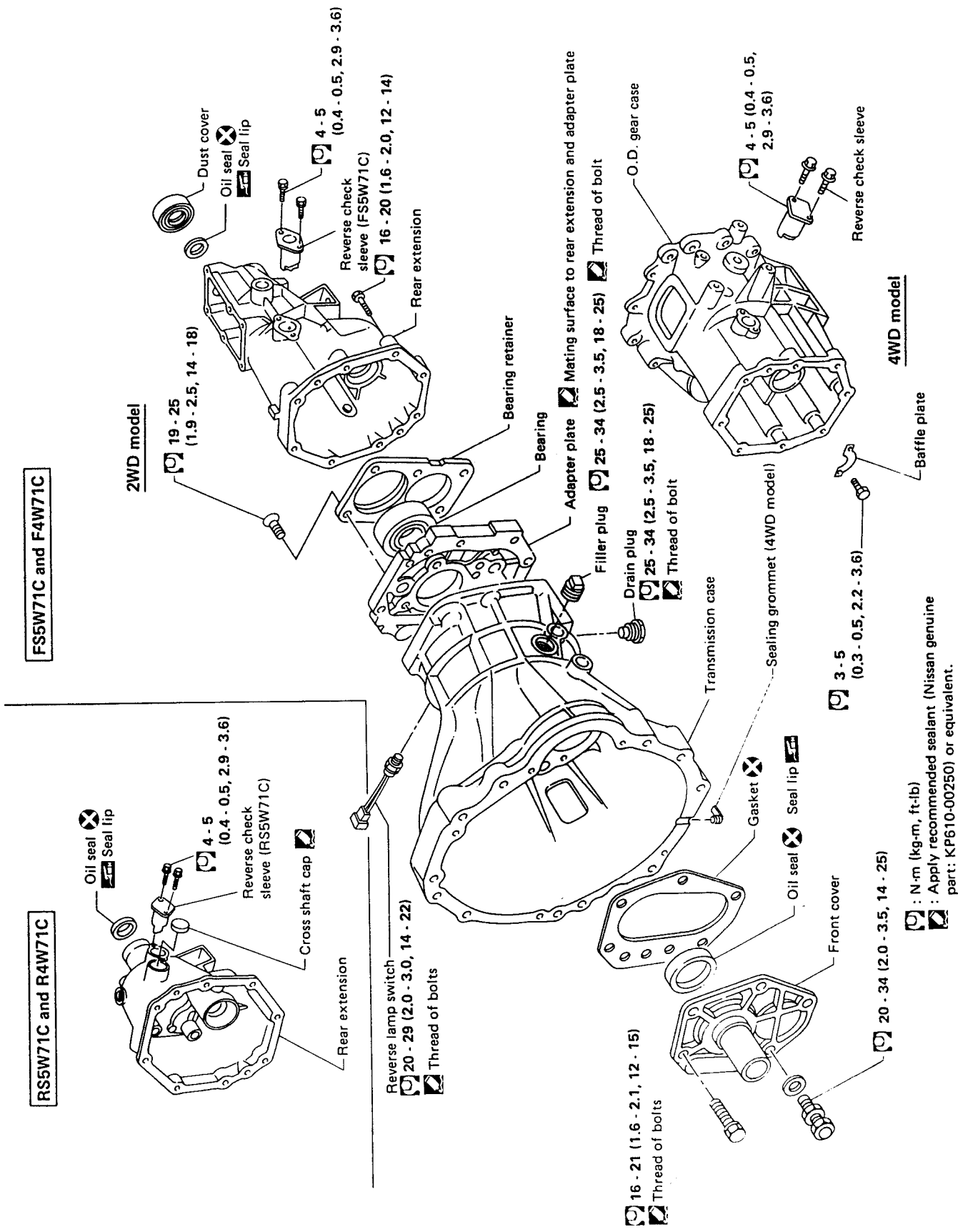


SMT476A



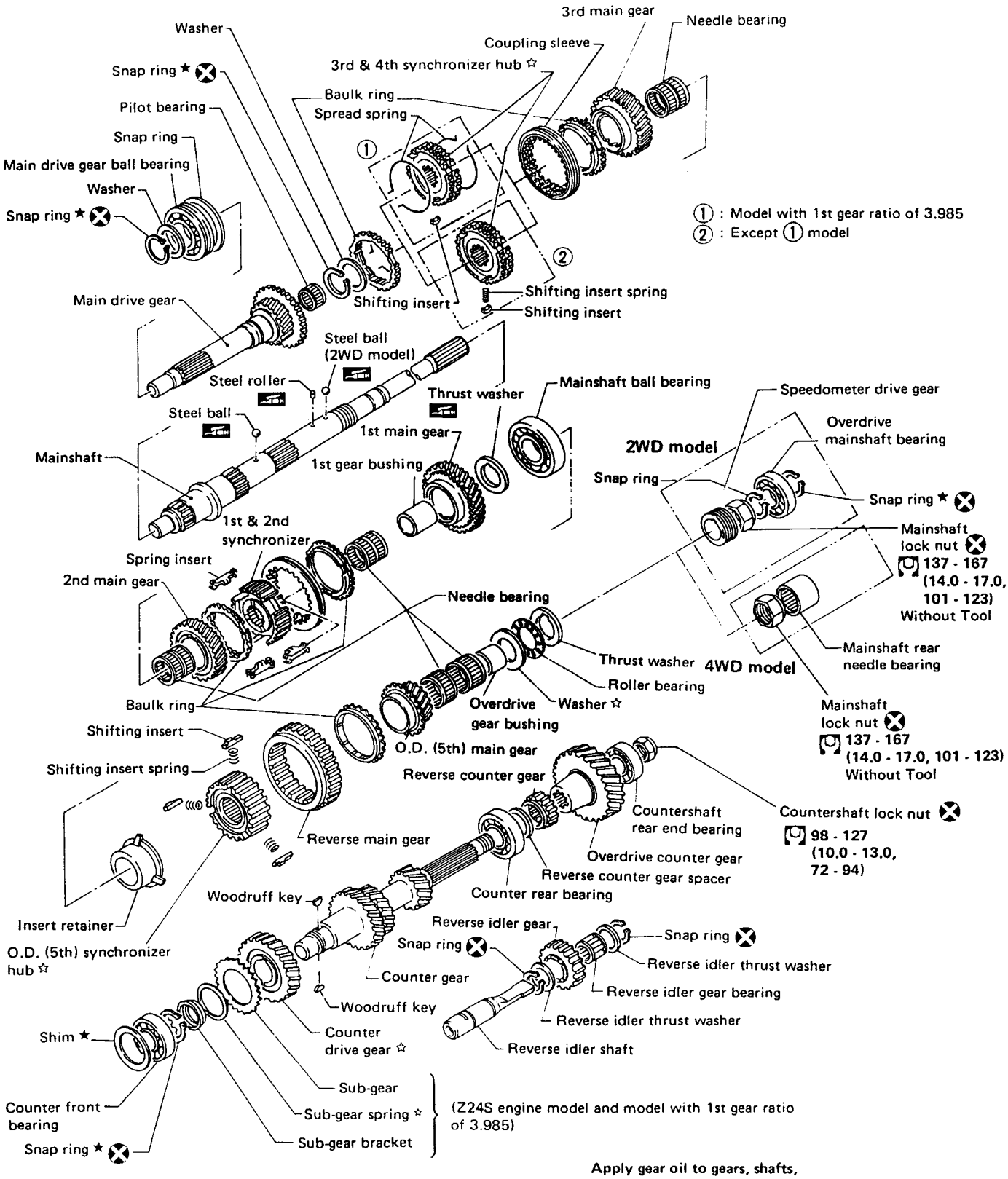
SMT477A

Case Components — FS5W71C, RS5W71C, F4W71C and R4W71C



SMT542A

Gear Components — FS5W71C and RS5W71C

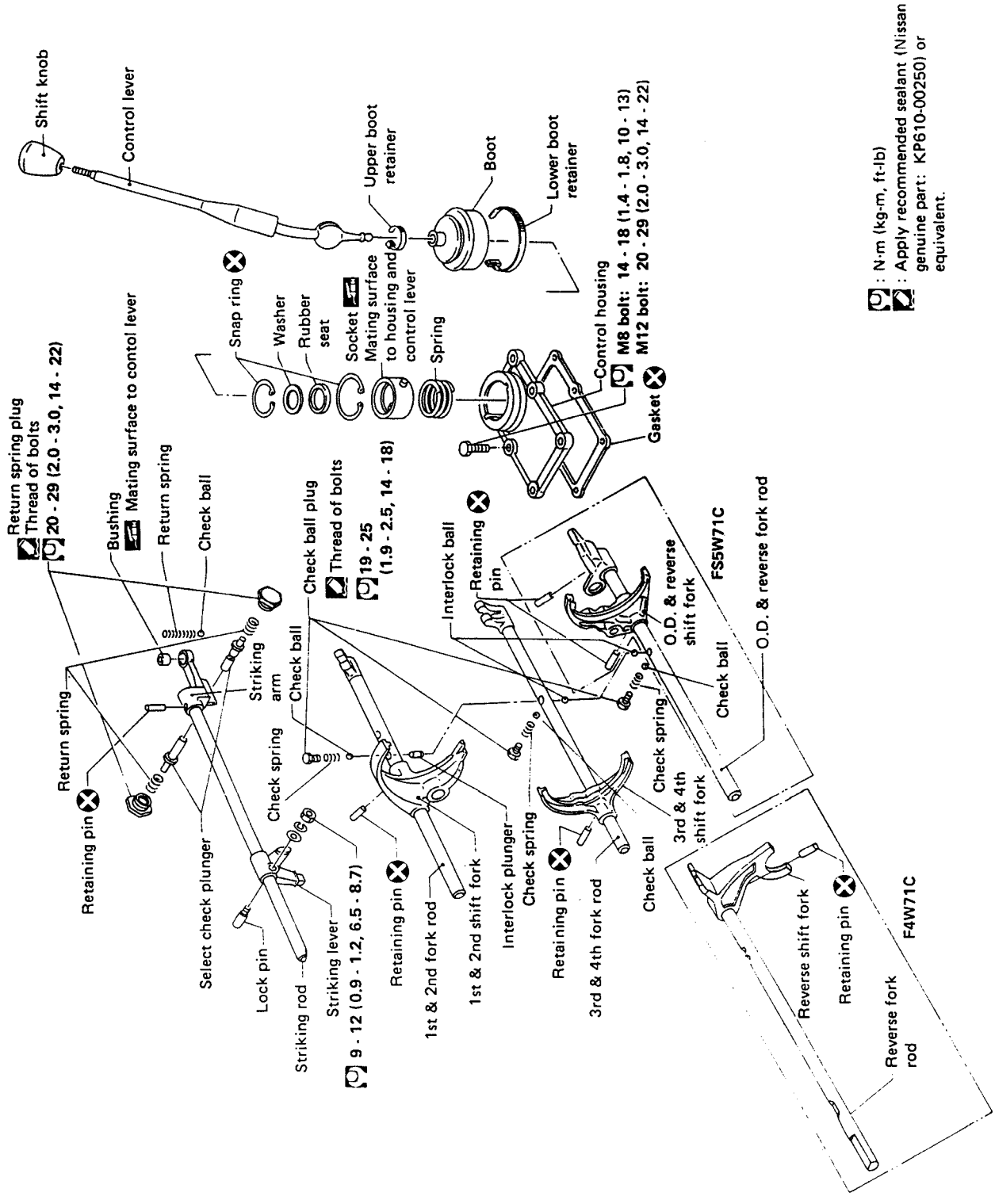


Apply gear oil to gears, shafts, synchronizers, and bearings when assembling.

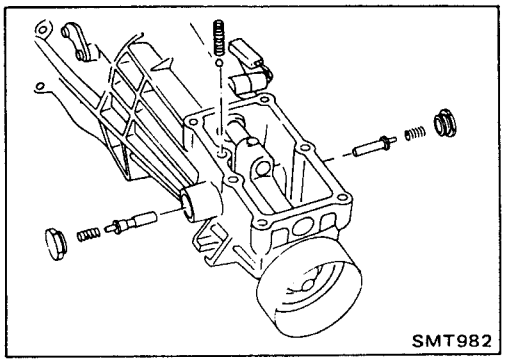
★ Select with proper thickness.
☆ Pay attention to its direction.
[O] : N·m (kg-m, ft-lb)

SMT552A

Shift Control Components — FS5W71C (2WD model) and F4W71C



SMT543A

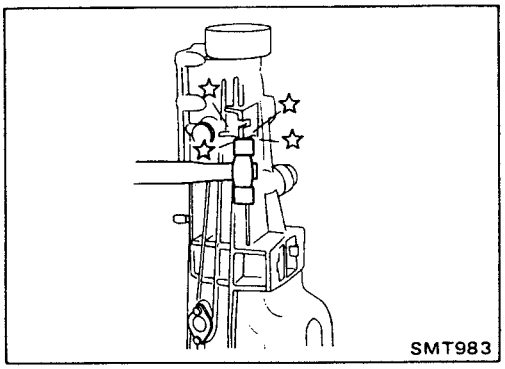

SMT982

Case Components

1. Remove rear extension.

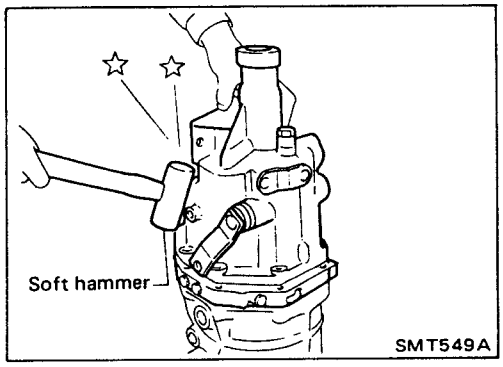
– FS5W71C and F4W71C –

a. Remove control housing, check ball, return spring plug, select check plunger and return springs.


SMT983

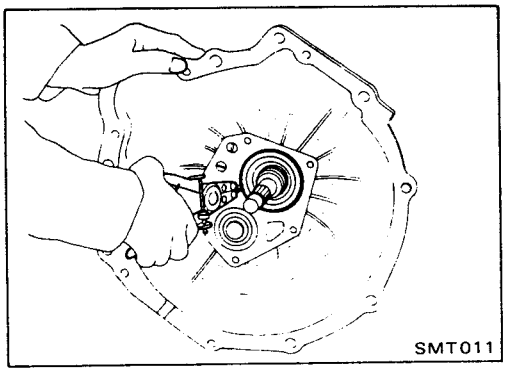
b. Remove rear extension by lightly tapping it.

– RS5W71C and R4W71C –

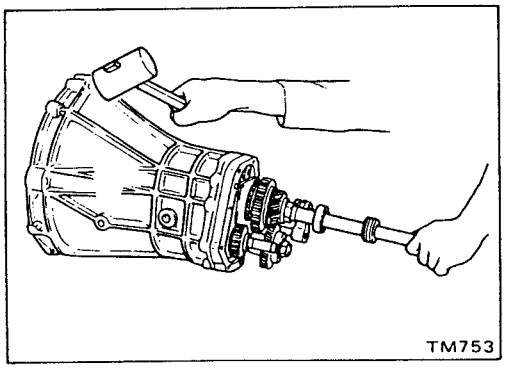


SMT549A

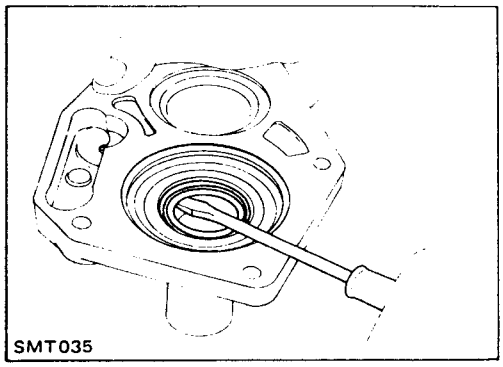
2. Remove front cover, gasket, countershaft front bearing shim, and main drive bearing snap ring.


SMT011

3. Separate transmission case from adapter plate.


TM753

Case Components (Cont'd)

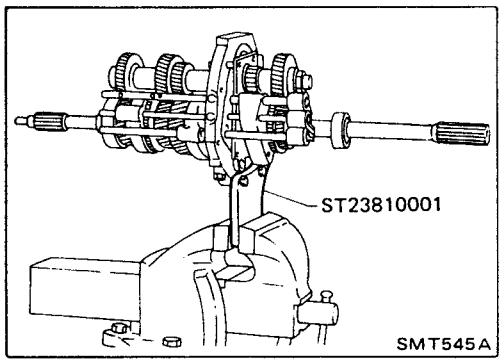

SMT035

4. Remove front cover oil seal.

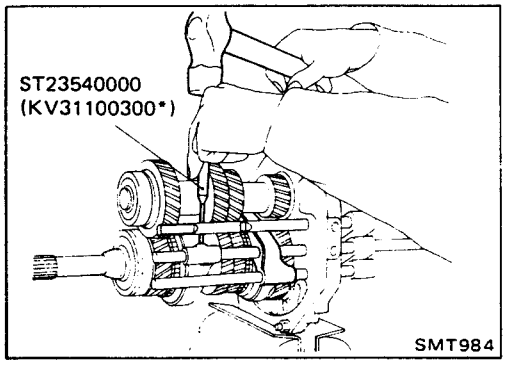
Be careful not to damage mating surface of front cover.

Shift Control Components

1. Set up Tool on adapter plate.
2. Remove check ball plugs, check springs, and check balls.



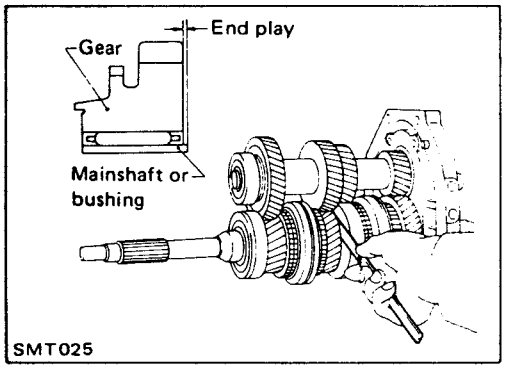
SMT545A



SMT984

3. Drive out retaining pins. Then drive out fork rods and remove interlock balls.

Gear Components



SMT025

1. Before disassembly, measure each gear end play.

- If end play is not within the specified limit, disassemble and check the parts.
- Replace any part which is worn or damaged.

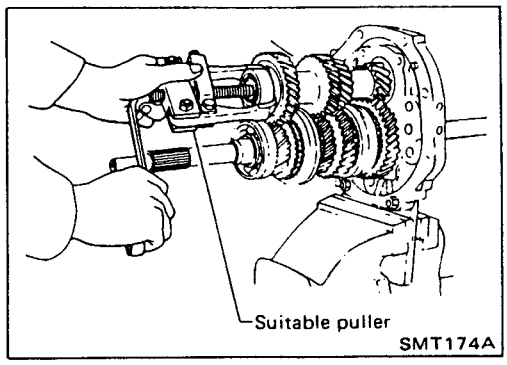
FS5W71C and RS5W71C

Gear	End play mm (in)
1st	0.31 - 0.41 (0.0122 - 0.0161)
2nd	0.11 - 0.21 (0.0043 - 0.0083)
3rd	0.11 - 0.21 (0.0043 - 0.0083)
O.D.	0.32 - 0.39 (0.0126 - 0.0154)

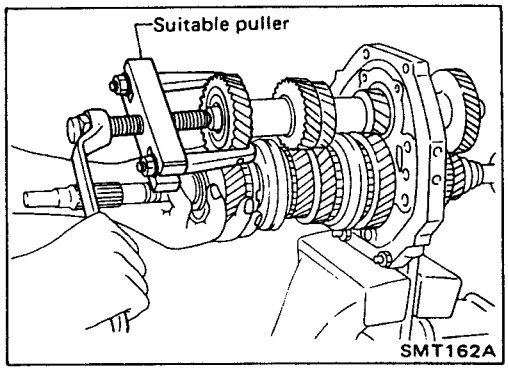
F4W71C and R4W71C

Gear	End play mm (in)
1st	0.31 - 0.41 (0.0122 - 0.0161)
2nd	0.11 - 0.21 (0.0043 - 0.0083)
3rd	0.11 - 0.21 (0.0043 - 0.0083)

Gear Components (Cont'd)



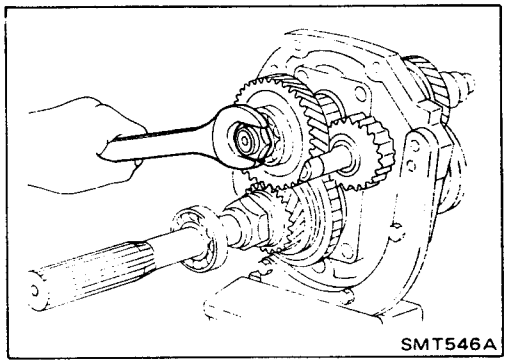
2. Mesh 2nd and reverse gear, then draw out counter front bearing with suitable puller.
3. Remove snap ring and then remove sub-gear bracket, sub-gear spring and sub-gear.



4. Draw out counter drive gear with main drive gear assembly with suitable puller.

- **When drawing out main drive gear assembly, be careful not to drop pilot bearing and baulk ring.**

5. Remove snap ring and draw out 3rd & 4th synchronizer and 3rd gear.

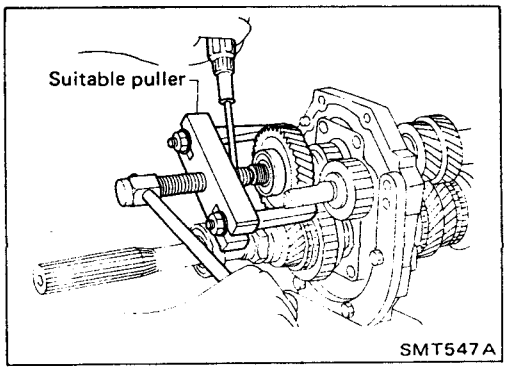


6. Disassemble parts at rear of adapter plate as follows.

– FS5W71C and RS5W71C –

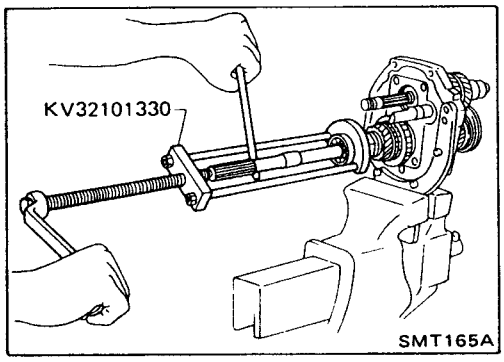
a. Release staking on countershaft nut and mainshaft nut and loosen these nuts.

Mainshaft nut: Left-hand thread

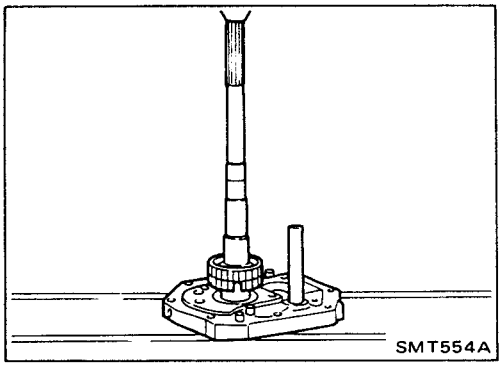


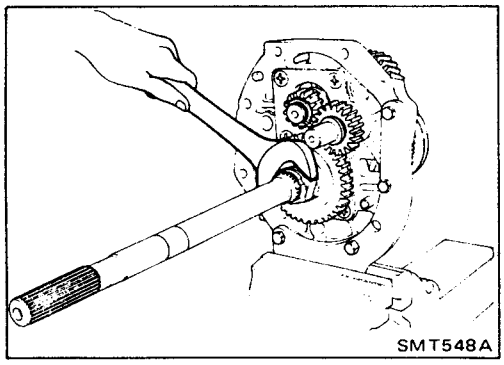
b. Pull out O.D. counter gear with bearing with suitable puller.
c. Draw out reverse counter gear and spacer.
d. Remove snap rings from reverse idler shaft, and draw out reverse idler gear, thrust washers and needle bearing.

Gear Components (Cont'd)



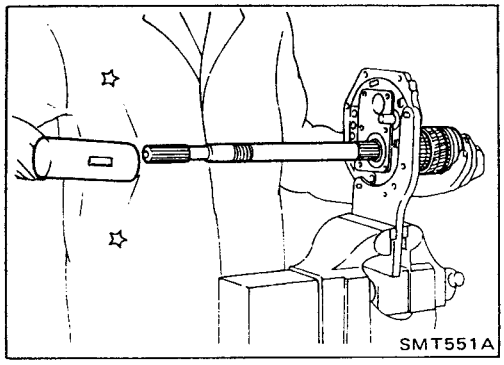
e. Remove snap ring and pull out overdrive mainshaft bearing. (2WD model)
f. Remove mainshaft nut.
g. Remove speedometer drive gear and steel ball. (2WD model)
h. Remove thrust washer, steel roller, roller bearing and washer.
i. Remove O.D. main gear, needle bearing and baulk ring (O.D.).
j. Remove O.D. coupling sleeve, shifting inserts and shifting insert springs.
k. Remove counter gear by tapping rear end of counter gear.
l. Press out O.D. gear bushing, insert retainer and O.D. synchronizer hub.





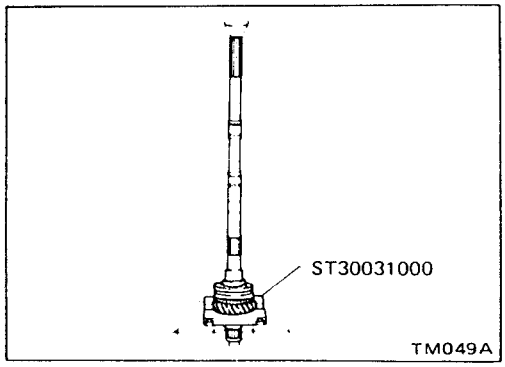
– F4W71C and R4W71C –

a. Remove snap rings, speedometer drive gear and steel ball.
b. Release staking on mainshaft nut and loosen it.
c. Remove mainshaft nut and reverse main gear.
d. Remove snap ring of countershaft rear end, and remove reverse counter gear.
e. Remove reverse idler gear.
f. Remove counter gear by tapping rear end of counter gear.



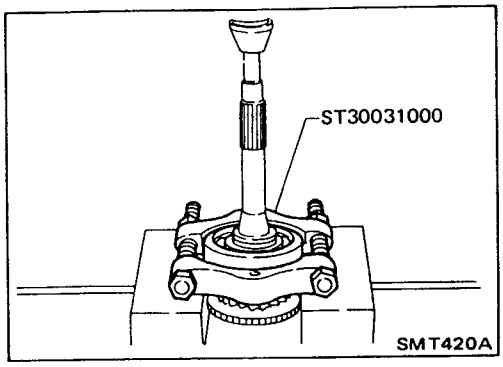
7. Draw out mainshaft assembly by tapping rear end of mainshaft.
8. Remove thrust washer, steel ball, 1st main gear and needle bearing.

Be careful not to lose steel ball.

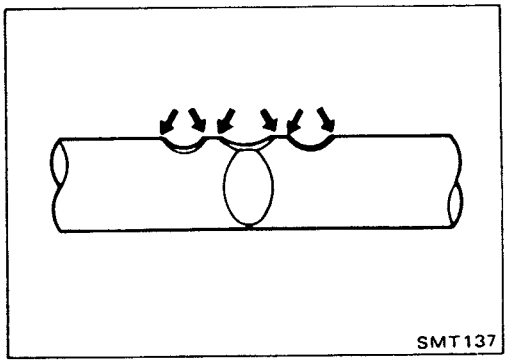


9. Press out 1st gear mainshaft bushing together with 2nd main gear with Tool.
   Then remove 2nd gear needle bearing.

Gear Components (Cont'd)

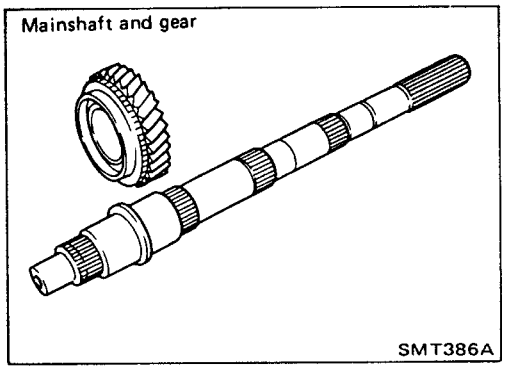


10. Remove main drive gear bearing.
a. Remove snap ring and washer.
b. Remove main drive gear bearing.


SMT137

Shift Control Components

- Check contact surface and sliding surface for wear, scratches, projections or other faulty conditions.

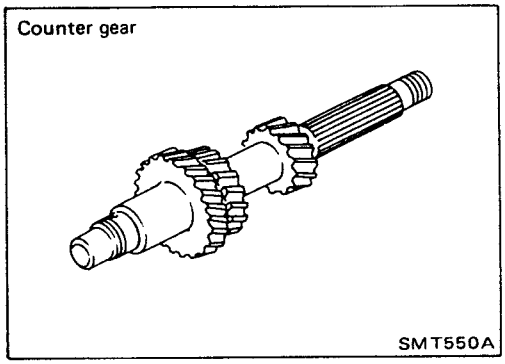


SMT386A

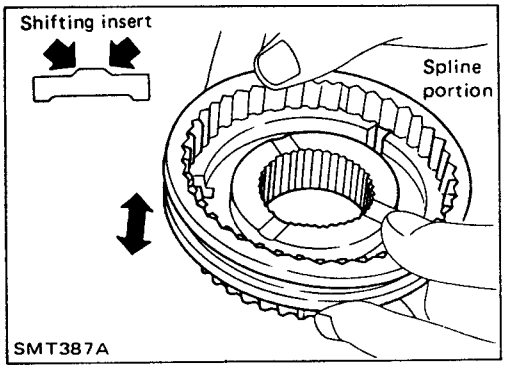
Gear Components

GEARS AND SHAFTS

- Check shafts for cracks, wear or bending.
- Check gears for excessive wear, chips or cracks.



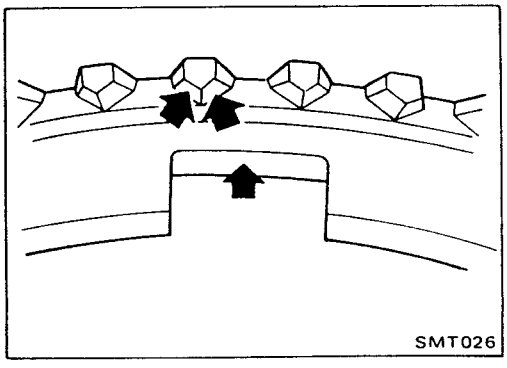
SMT550A



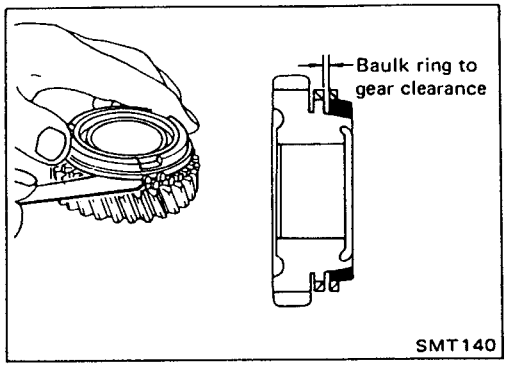
SMT387A

SYNCHRONIZERS

- Check spline portion of coupling sleeves, hubs and gears for wear or cracks.
- Check baulk rings for cracks or deformation.
- Check shifting inserts for wear or deformation.
- Check insert springs for deformation.


SMT026

Gear Components (Cont'd)

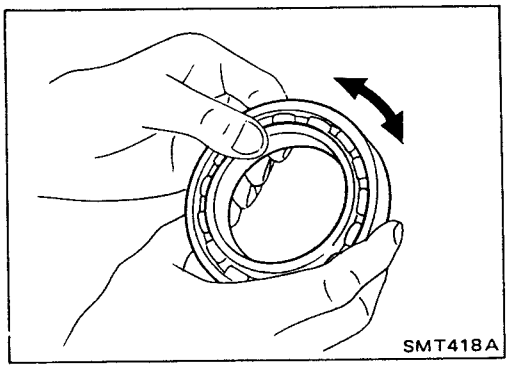


- Measure clearance between baulk ring and gear.

Clearance between baulk ring and gear

Unit: mm (in)

	Standard	Wear limit
1st & 2nd	1.20 - 1.60 (0.0472 - 0.0630)	0.8 (0.031)
3rd & main drive	1.20 - 1.60 (0.0472 - 0.0630)	0.8 (0.031)
O.D.	1.00 - 1.40 (0.0394 - 0.0551)	0.5 (0.020)

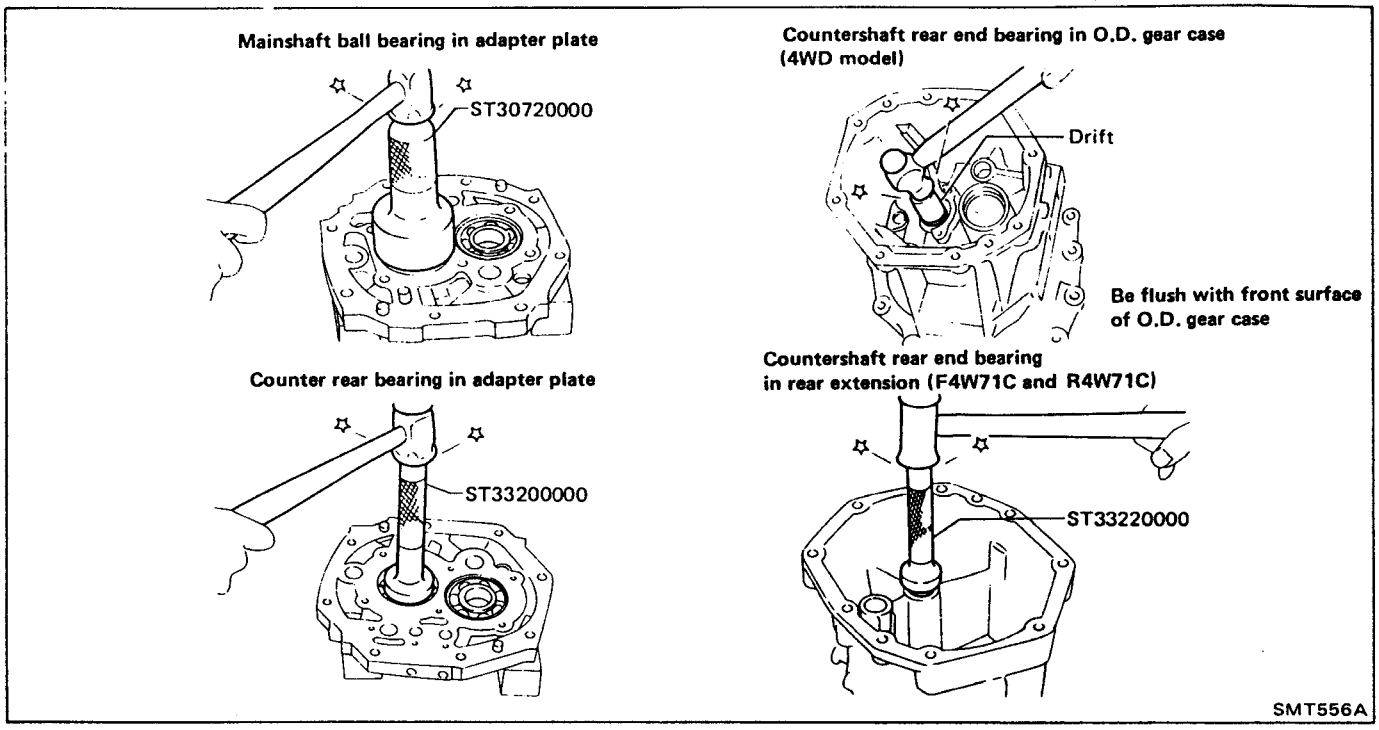


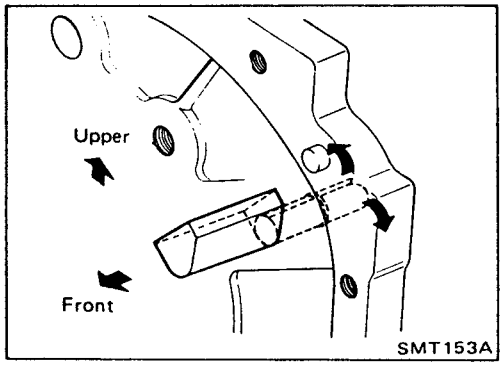
BEARINGS

- Make sure bearings roll freely and are free from noise, crack, pitting or wear.

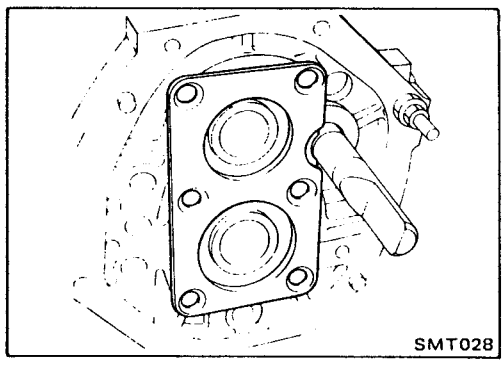
Gear Components

1. Install bearings into case components.





2. Assemble adapter plate parts.
- Install oil gutter on adapter plate and expand on rear side.

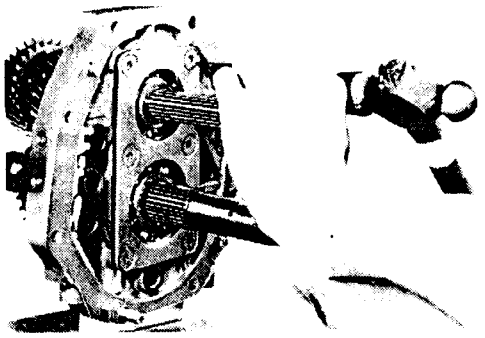


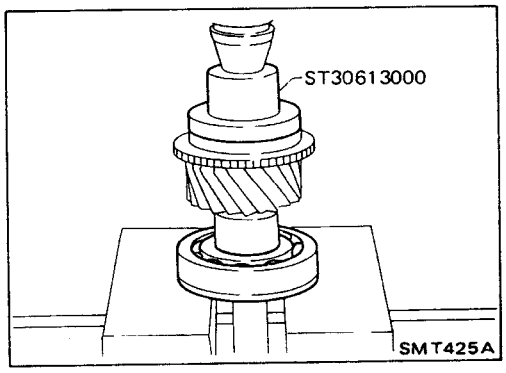
- Install bearing retainer.

a. Insert reverse shaft, then install bearing retainer.

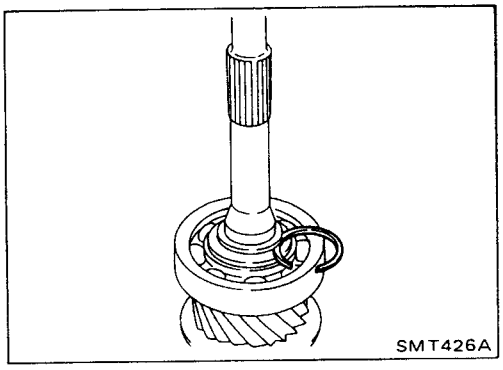
Gear Components (Cont'd)

b. Tighten each screw, then stake it at two points.





3. Install main drive gear bearing.
a. Press in main drive gear bearing.
b. Install main drive gear spacer.



c. **Select proper** main drive gear snap ring to minimize clearance of groove.

Allowable clearance of groove:

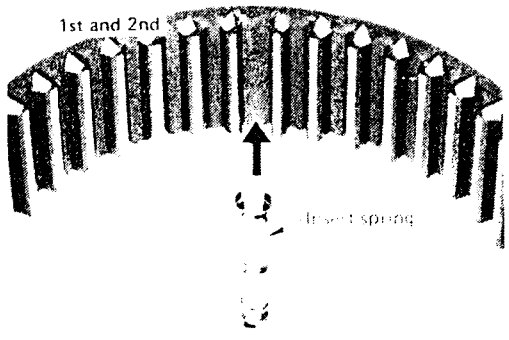
0 - 0.13 mm (0 - 0.0051 in)

Main drive gear snap ring

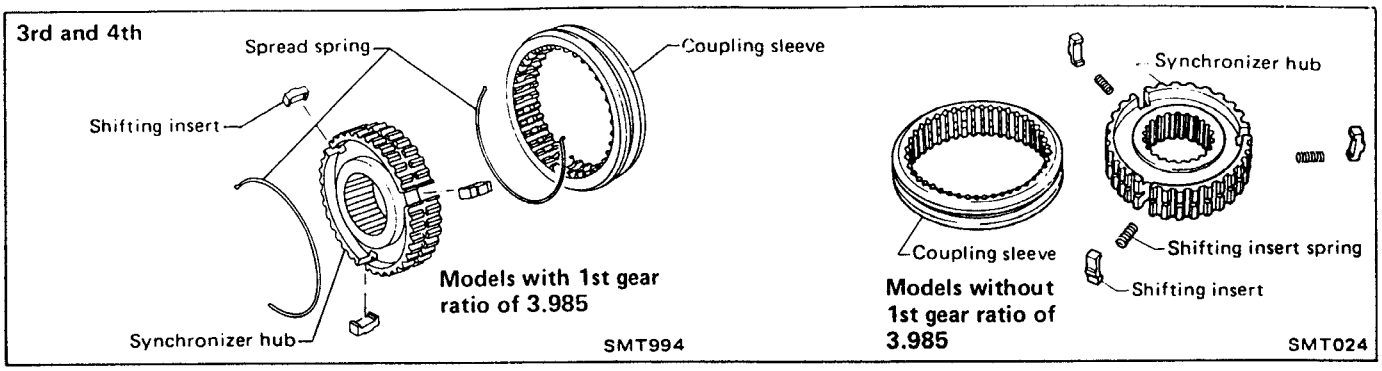
Thickness mm (in)	Part number
1.73 (0.0681)	32204-78005
1.80 (0.0709)	32204-78000
1.87 (0.0736)	32204-78001
1.94 (0.0764)	32204-78002
2.01 (0.0791)	32204-78003
2.08 (0.0819)	32204-78004

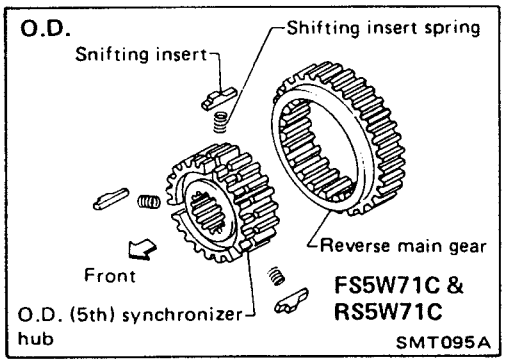
d. Install selected snap ring on main drive gear.

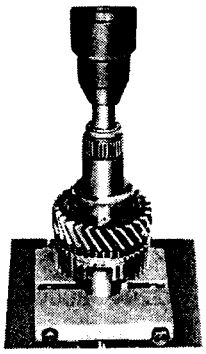
4. Assemble synchronizers.



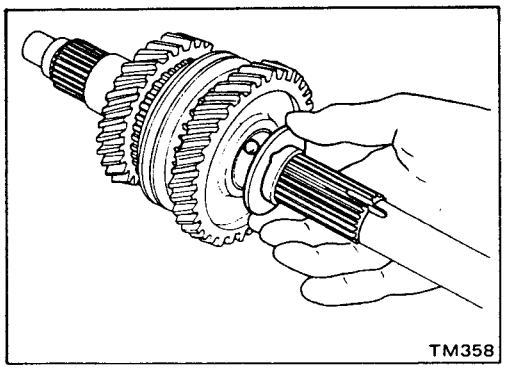
Gear Components (Cont'd)







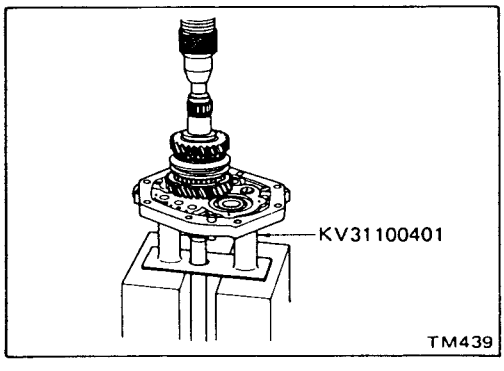
5. Assemble 2nd main gear, needle bearing and 1st & 2nd synchronizer assembly, then press 1st gear bushing on mainshaft.



6. Assemble 1st main gear, steel ball, and thrust washer on mainshaft.

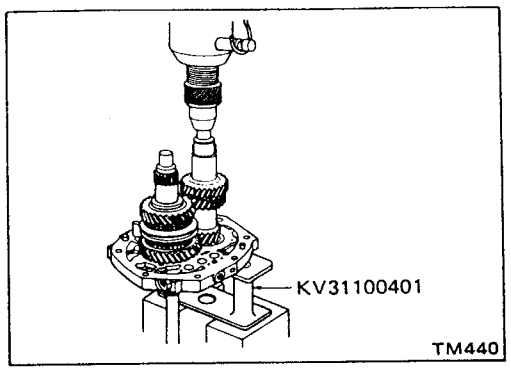
Before installing steel ball and thrust washer, apply grease to them.

7. Install counter rear bearing to adapter plate.



8. Press mainshaft assembly to adapter plate with Tool.

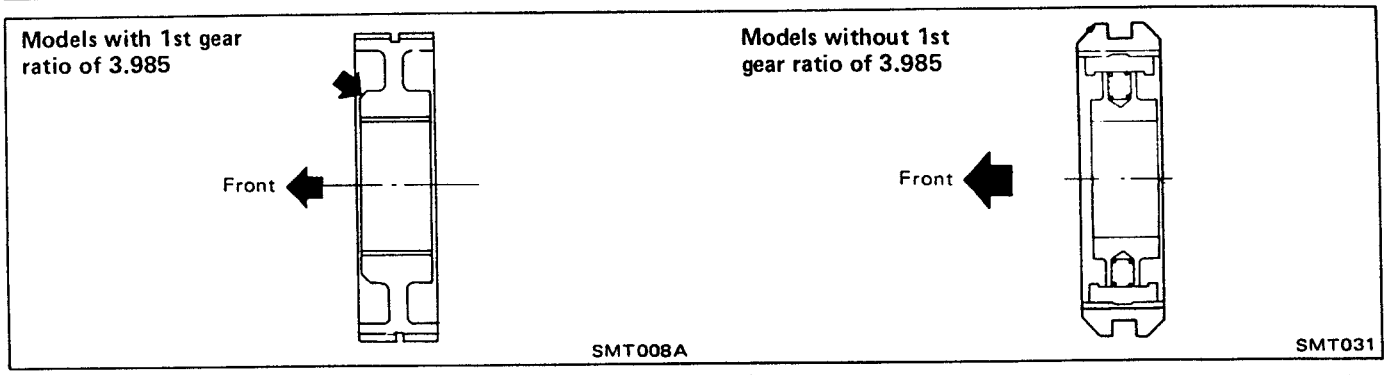
Gear Components (Cont'd)

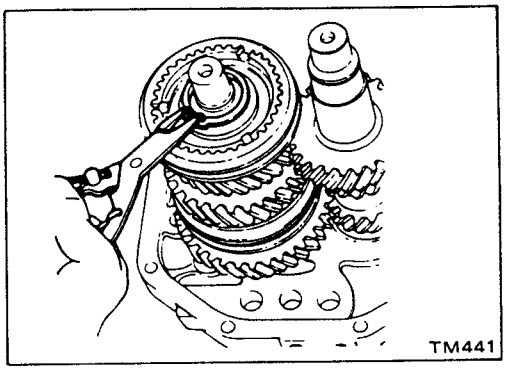


9. Press counter gear into adapter plate with Tool.

10. Install 3rd main gear and 3rd & 4th synchronizer assembly.

Pay attention to direction of synchronizer.





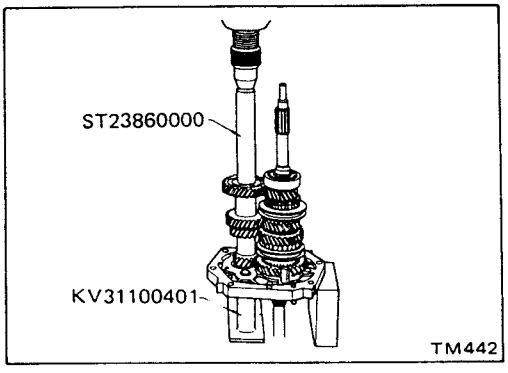
11. Install thrust washer on mainshaft and secure it with mainshaft front snap ring.

Select proper snap ring that will minimize clearance of groove in mainshaft.

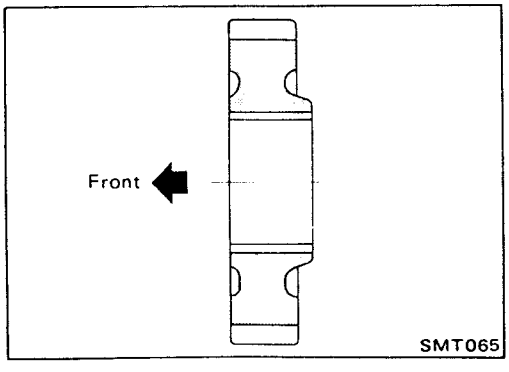
Mainshaft front snap ring:

Refer to S.D.S.

12. Apply gear oil to mainshaft pilot bearing and install it on mainshaft.



13. Press counter drive gear with main drive gear with Tool.



Pay attention to directio of counter drive gear.

Gear Components (Cont'd)

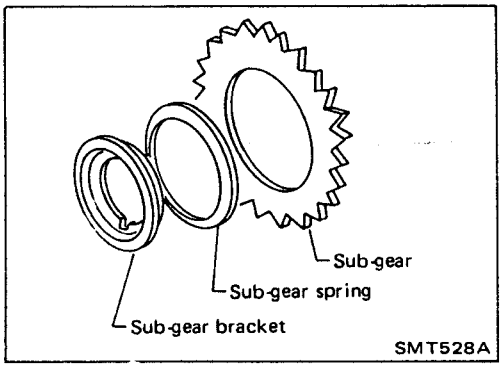
14. Install sub-gear components.

a. Install sub-gear and sub-gear bracket on counter drive gear and then select proper snap ring that will minimize clearance of groove in counter gear.

Allowable clearance of groove:
0 - 0.18 mm (0 - 0.0071 in)

Counter drive gear snap ring:

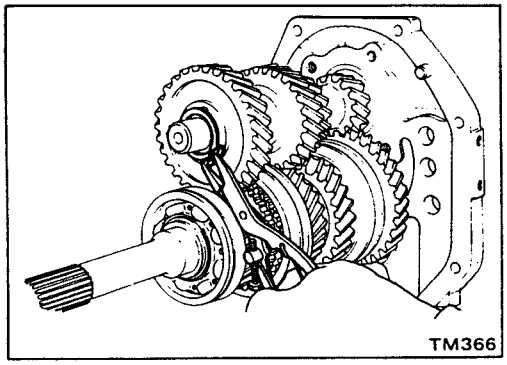
Parts number	Thickness mm (in)
32215-E9000	1.4 (0.055)
32215-E9001	1.5 (0.059)
32215-E9002	1.6 (0.063)



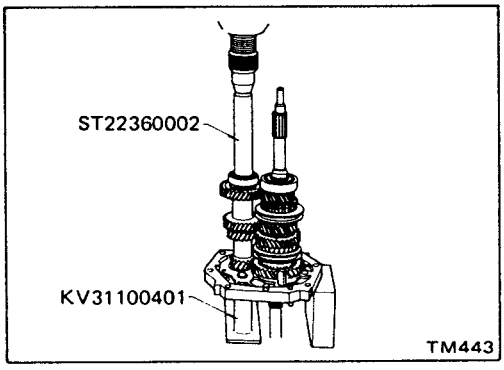
b. Remove snap ring, sub-gear bracket and sub-gear from counter gear.

c. Reinstall sub-gear, sub-gear spring and sub-gear bracket.

15. Install selected counter drive gear snap ring.



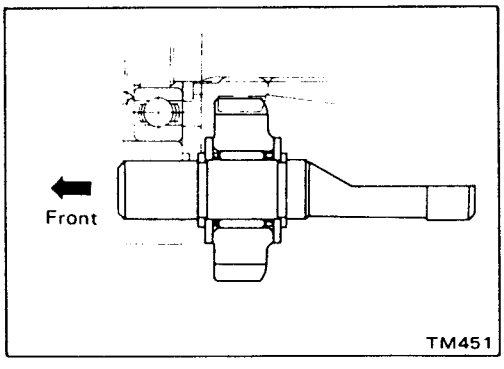
16. Press counter gear front bearing onto counter gear.



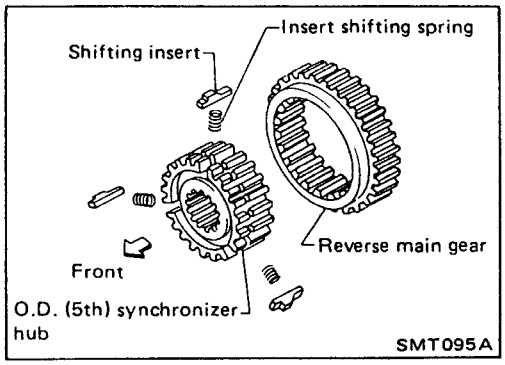
17. Assemble parts at rear of adapter plate as follows:

– FS5W71C and RS5W71C –

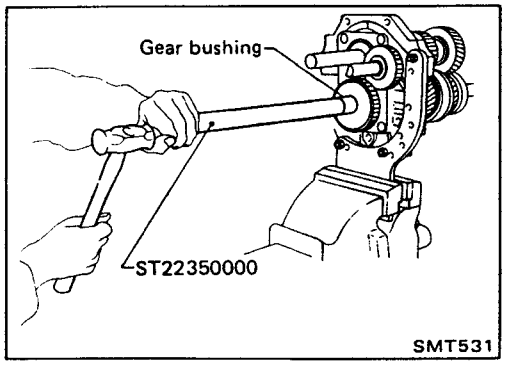
a. Install reverse idler gear to reverse idler shaft with spacers, snap rings and needle bearing.



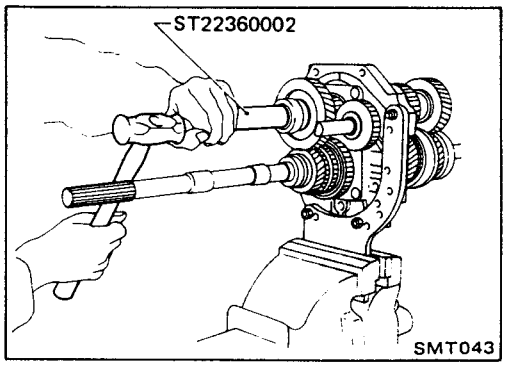
Gear Components (Cont'd)



b. Install insert retainer and O.D. synchronizer to mainshaft.
Pay attention to direction of hub.



c. Install O.D. gear bushing with Tool.
d. Install O.D. main gear, needle bearing.
e. Install spacer, reverse counter gear and O.D. counter gear.
O.D. main gear and O.D. counter gear should be handled as a matched set.
f. Install washer, roller bearing, steel roller, thrust washer, steel ball and speedometer drive gear.
g. Tighten mainshaft rock nut temporarily.
Always use new lock nut.

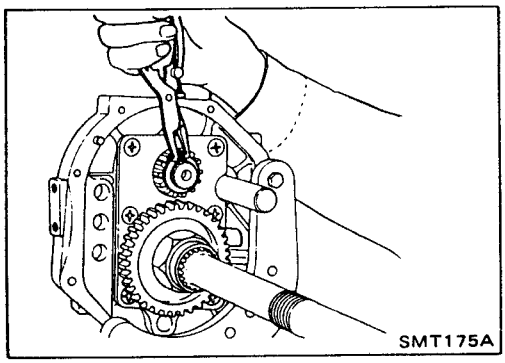


h. Install countershaft rear end bearing with Tool.

– F4W71C and R4W71C –

a. Install reverse main gear, plain washer and mainshaft nut. Then tighten mainshaft nut temporarily.
Always use new lock nut.

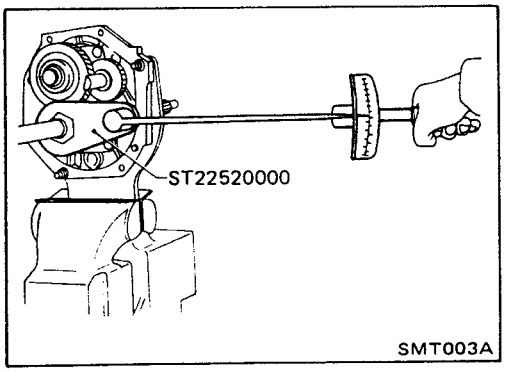
Gear Components (Cont'd)



b. Install counter reverse gear and secure with snap ring that will minimize clearance of groove in countershaft.

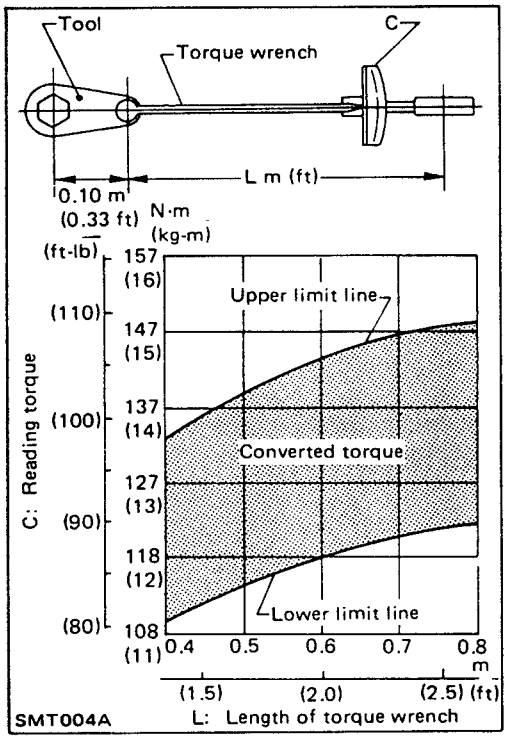
Counter reverse gear snap ring:

Part number	Thickness mm (in)
32228-E9200	1.4 (0.055)
32228-E9201	1.5 (0.059)
32228-E9202	1.6 (0.063)



c. Install reverse idler gear.

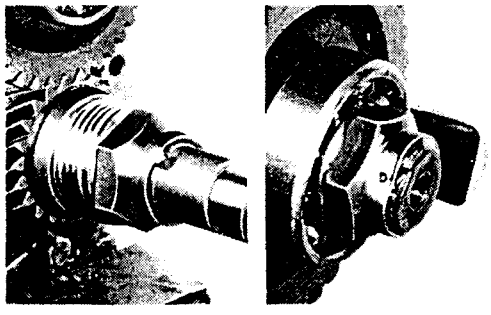
18. Mesh 2nd and reverse gears and tighten mainshaft lock nut with Tool.



Use the left chart when deciding the reading torque
(Length of torque wrench vs. setting or reading torque)

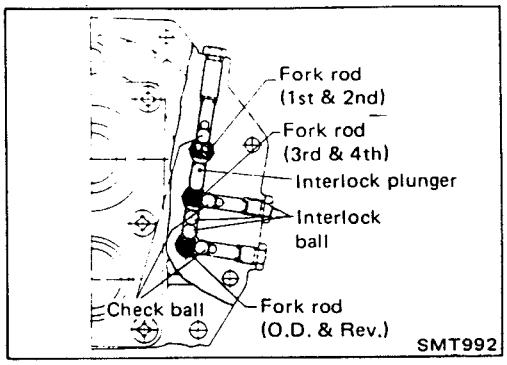
19. Tighten countershaft lock nut. (FS5W71C and RS5W71C)
Always use new lock nut.
20. Stake mainshaft lock nut and countershaft lock nut with a punch.
21. Measure gear end play. For the description, refer to Disassembly of Gear Components.

Mainshaft **Countershaft**

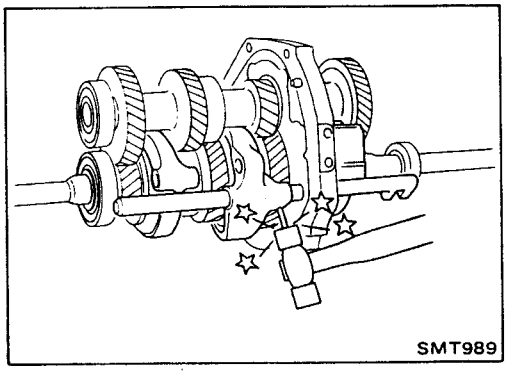


Shift Control Components

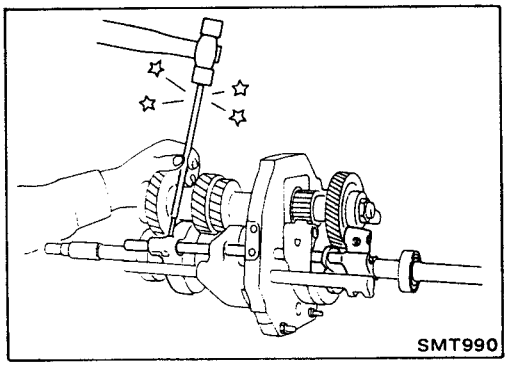
1. Install shift rods, interlock plunger, interlock balls and check balls.



a. 1st-2nd shift fork

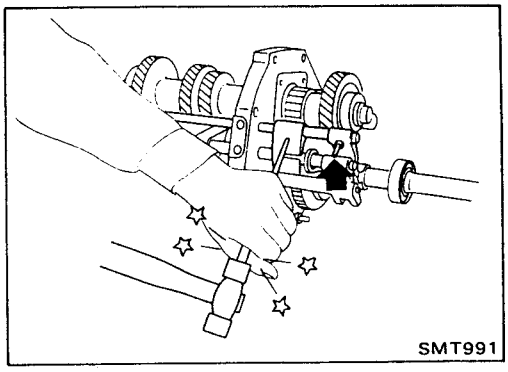


b. 3rd-4th shift fork

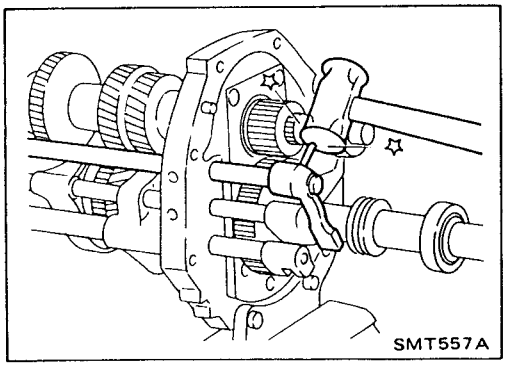


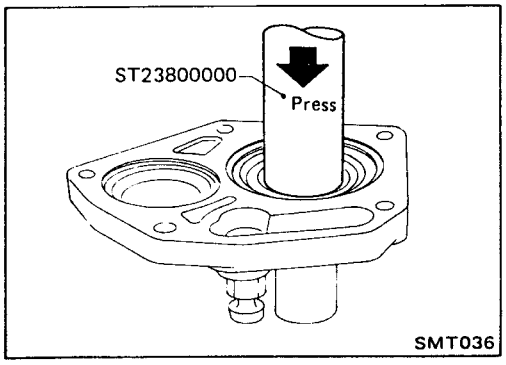
c. O.D.-reverse shift fork or reverse shift fork

– FS5W71C and RS5W71C –



– F4W71C and R4W71C –

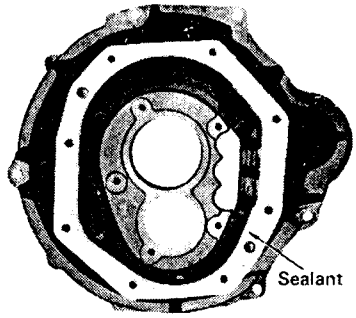




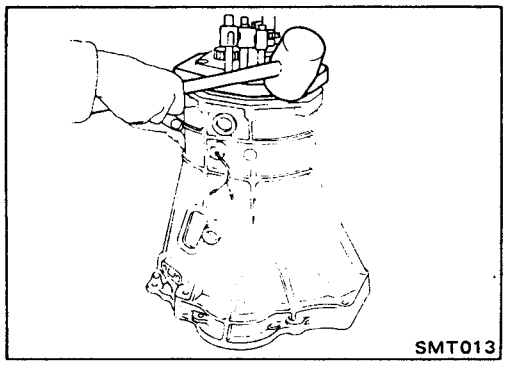
Case Components

1. Install front cover oil seal.

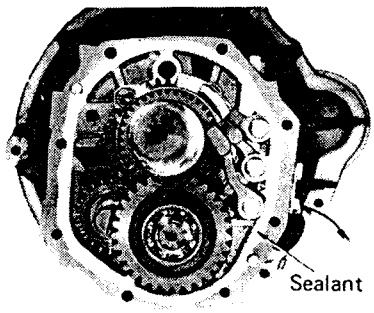
Apply multi-purpose grease to seal lip.



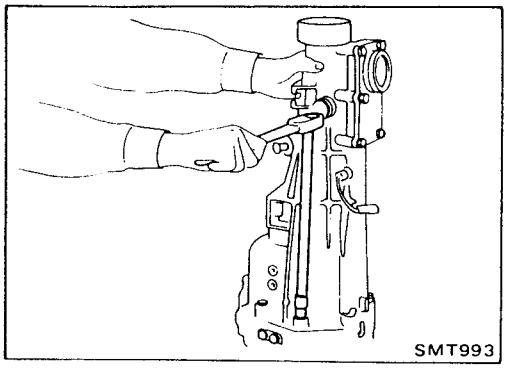
2. Apply sealant to mating surface of transmission case.



3. Slide gear assembly onto adapter plate by lightly tapping with a soft hammer.

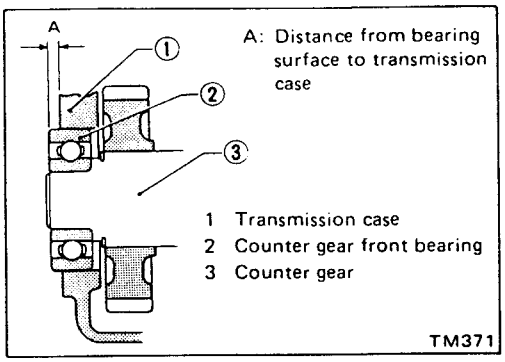


4. Apply sealant to mating surface of adapter plate.



5. Install rear extension.
6. Fit main drive bearing snap ring.

Case Components (Cont'd)

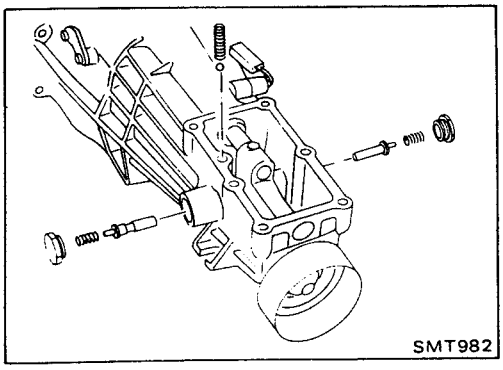


7. Select counter front bearing shim.

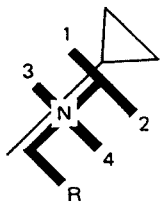
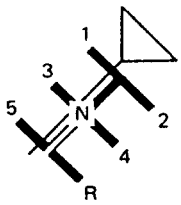
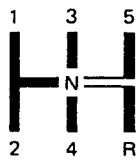
Unit: mm (in)

"A"	Thickness of shim	Part number
4.52 - 4.71 (0.1780 - 0.1854)	Not necessary	
4.42 - 4.51 (0.1740 - 0.1776)	0.1 (0.004)	32218-V5000
4.32 - 4.41 (0.1701 - 0.1736)	0.2 (0.008)	32218-V5001
4.22 - 4.31 (0.1661 - 0.1697)	0.3 (0.012)	32218-V5002
4.12 - 4.21 (0.1622 - 0.1657)	0.4 (0.016)	32218-V5003
4.02 - 4.11 (0.1583 - 0.1618)	0.5 (0.020)	32218-V5004
3.92 - 4.01 (0.1543 - 0.1579)	0.6 (0.024)	32218-V5005

8. Install gasket and front cover.
9. Install return spring plugs, check ball, return springs and select check plunger. (FS5W71C and F4W71C)
10. Install control housing and gasket. (FS5W71C and F4W71C)



General Specifications (Cont'd)

Vehicle model		2WD						4WD
Destination		All						
Transmission model		R4W71C		FS5W71C			RS5W71C	FS5W71C
Engine		Z20S		Z16S SD23	Z20S SD25	Z24S	SD23	Z24S SD25
No. of speeds		4		5				
Shift pattern								
Synchromesh type		Warner						
		Standard	Option	–				
Gear ratio	1st	3.985	4.218	4.220	3.985	3.592	4.220	3.592
	2nd	2.246	2.637	2.540	2.246	2.246	2.540	2.246
	3rd	1.415	1.662	1.641	1.415	1.415	1.641	1 415
	4th	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	O.D.	–	–	0.821	0.821	0.821	0.821	0.821
	Reverse	3.657	4.295	3.657	3.657	3.657	3.657	3.657
No. of teeth								
Mainshaft	Drive	21	19	21	21	21	21	21
	1st	34	33	36	34	33	36	33
	2nd	28	28	30	28	28	30	28
	3rd	26	26	28	26	26	28	26
	O.D.	–	–	21	21	21	21	21
	Reverse	36	36	36	36	36	36	36
Countershaft	Drive	32	34	32	32	32	32	32
	1st	13	14	13	13	14	13	14
	2nd	19	19	18	19	19	18	19
	3rd	28	28	26	28	28	26	28
	O.D.	–	–	39	39	39	39	39
	Reverse	15	15	15	15	15	15	15
Reverse idler gear		21	21	21	21	21	21	21
Oil capacity	ℓ (Imp pt)	1.7 (3)		2.0 (3-1/2)			2.0 (3-1/2)	4.0 (7)

Inspection and Adjustment

GEAR END PLAY

Unit: mm (in)

	FS5W71C RS5W71C	F4W71C R4W71C
1st gear	0.31 - 0.41 (0.0122 - 0.0161)	0.31 - 0.41 (0.0122 - 0.0161)
2nd gear	0.11 - 0.21 (0.0043 - 0.0083)	0.11 - 0.21 (0.0043 - 0.0083)
3rd gear	0.11 - 0.21 (0.0043 - 0.0083)	0.11 - 0.21 (0.0043 - 0.0083)
O.D. gear	0.32 - 0.39 (0.0126 - 0.0154)	–

CLEARANCE BETWEEN BAULK RING AND GEAR

Unit: mm (in)

	FS5W71C RS5W71C	F4W71C R4W71C
Standard		
1st & 2nd	1.20 - 1.60 (0.0472 - 0.0630)	1.20 - 1.60 (0.0472 - 0.0630)
3rd & main drive	1.20 - 1.60 (0.0472 - 0.0630)	1.20 - 1.60 (0.0472 - 0.0630)
O.D.	1.00 - 1.40 (0.0394 - 0.0551)	–
Wear limit		
1st & 2nd	0.80 (0.0315)	0.80 (0.0315)
3rd & main drive	0.80 (0.0315)	0.80 (0.0315)
O.D.	0.50 (0.0197)	–

AVAILABLE SNAP RINGS

Main drive gear bearing

Allowable clearance	0 - 0.13 mm (0 - 0.0051 in)
Thickness mm (in)	Part number
1.73 (0.0681)	32204-78005
1.80 (0.0709)	32204-78000
1.87 (0.0736)	32204-78801
1.94 (0.0764)	32204-78002
2.01 (0.0791)	32204-78003
2.08 (0.0819)	32204-78004

Mainshaft front

Allowable clearance	0 - 0.18 mm (0 - 0.0071 in)
Thickness mm (in)	Part number
2.4 (0.094)	32263-V5200
2.5 (0.098)	32263-V5201
2.6 (0.102)	32263-V5202

Mainshaft rear end bearing

- FS5W71C (2WD model) and RS5W71C

Allowable clearance	0 - 0.14 mm (0 - 0.0055 in)
Thickness mm (in)	Part number
1.1 (0.043)	32228-20100
1.2 (0.047)	32228-20101
1.3 (0.051)	32228-20102
1.4 (0.055)	32228-20103

Counter drive gear

Allowable clearance	0 - 0.18 mm (0 - 0.0071 in)
Thickness mm (in)	Part number
1.4 (0.055)	32215-E9000
1.5 (0.059)	32215-E9001
1.6 (0.063)	32215-E9002

Counter reverse gear

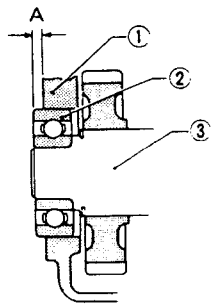
- F4W71C and R4W71C

Allowable clearance	0 - 0.18 (0 - 0.0071 in)
Thickness mm (in)	Part number
1.4 (0.055)	32228-E9200
1.5 (0.059)	32228-E9201
1.6 (0.063)	32228-E9202

AVAILABLE SHIMS

Counter front bearing

Unit: mm (in)



TM371

A: Distance from bearing surface to transmission case

1 Transmission case
2 Counter gear front bearing
3 Counter gear

"A"	Thickness of shim	Part number
4.52 - 4.71 (0.1780 - 0.1854)	Not necessary	
4.42 - 4.51 (0.1740 - 0.1776)	0.1 (0.004)	32218-V5000
4.32 - 4.41 (0.1701 - 0.1736)	0.2 (0.008)	32218-V5001
4.22 - 4.31 (0.1661 - 0.1697)	0.3 (0.012)	32218-V5002
4.12 - 4.21 (0.1622 - 0.1657)	0.4 (0.016)	32218-V5003
4.02 - 4.11 (0.1583 - 0.1618)	0.5 (0.020)	32218-V5004
3.92 - 4.01 (0.1543 - 0.1579)	0.6 (0.024)	32218-V5005

Tightening Torque

GEAR CONTROL (RS5W71C and R4W71C)

Unit	N·m	kg-m	ft-lb
Cross shaft bracket securing bolt	26 - 36	2.7 - 3.7	20 - 27
Select lever pivot bolt	50 - 68	5.1 - 6.9	37 - 50
Shift lever securing bolt	14 - 18	1.4 - 1.8	10 - 13
Lower support bracket securing bolt	6 - 7	0.6 - 0.7	4.3 - 5.1
Shift lever stopper fixing bolt	14 - 18	1.4 - 1.8	10 - 13
Trunnion lock nut	16 - 21	1.6 - 2.1	12 - 15

TRANSMISSION INSTALLATION

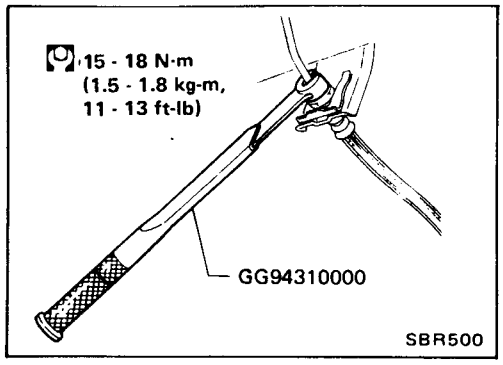
Unit	N·m	kg-m	ft-lb
Clutch operating cylinder	30 - 40	3.1 - 4.1	22 - 30
Transmission securing bolt	Refer to removal and Installation.		
Crossmember to frame	Refer to ER section.		
Rear mounting insulator to rear extension	Refer to ER section.		
Starter motor fixing bolt	Refer to EM section.		

GEAR ASSEMBLY

Unit	N·m	kg-m	ft-lb
Rear extension to transmission case	16 - 20	1.6 - 2.0	12 - 14
Front cover to transmission case	16 - 21	1.6 - 2.1	12 - 15
Control housing to rear extension (FS5W71C and F4W71C)			
M8 bolt	14 - 18	1.4 - 1.8	10 - 13
M12 bolt	20 - 29	2.0 - 3.0	14 - 22
Ball pin	20 - 34	2.0 - 3.5	14 - 25
Filler plug	25 - 34	2.5 - 3.5	18 - 25
Drain plug	25 - 34	2.5 - 3.5	18 - 25
Speedometer sleeve installation	4 - 5	0.4 - 0.5	2.9 - 3.6
Return spring plug	20 - 29	2.0 - 3.0	14 - 22
Reverse check sleeve to transmission case	4 - 5	0.4 - 0.5	2.9 - 3.6
Reverse lamp switch	20 - 29	2.0 - 3.0	14 - 22
Check ball plug	19 - 25	1.9 - 2.5	14 - 18
Mainshaft lock nut (without Tool)	137 - 167	14.0 - 17.0	101 - 123
Countershaft lock nut (FS5W71C and RS5W71C)	98 - 127	10.0 - 13.0	72 - 94
Inner select lever fixing nut (RS5W71C and R4W71C)	9 - 12	0.9 - 1.2	6.5 - 8.7
Striking lever lock nut (FS5W71C and F4W71C)	9 - 12	0.9 - 1.2	6.5 - 8.7
Bearing retainer to adapter plate	19 - 25	1.9 - 2.5	14 - 18
Baffle plate fixing bolt (4WD model)	3 - 5	0.3 - 0.5	2.2 - 3.6

SECTION CL

CONTENTS



- Recommended fluid is brake fluid "DOT 3".
- Do not reuse drained brake fluid.
- Be careful not to splash brake fluid on painted areas.
- When removing and installing clutch piping, use Tool.
- To clean or wash all parts of master cylinder, operating cylinder and clutch damper, use clean brake fluid.
- Never use mineral oils such as gasoline or kerosene.
  It will ruin the rubber parts of the hydraulic system.

WARNING:

Remove all dust from clutch disc with a dust collector after cleaning with waste cloth.

Clutch Master Cylinder

Remove

1. Disconnect the two hydraulic fluid pipes from the clutch master cylinder. Seal the pipe ends and plug the apertures in the master cylinder.
2. Remove screws securing pedal box cover, disconnect fuel cutoff switch and remove cover.
3. Detach the clutch pedal return spring and withdraw the split pin, washer and clevis pin securing the push rod to the clutch pedal.
4. Undo the two bolts and spring washers and remove the master cylinder assembly from the pedal box.

Dismantle

1. Slide the retaining band from the rubber boot and pull back the boot from the master cylinder.
2. Remove the circlip retaining the push rod to the master cylinder and withdraw the push rod and dished washer.
3. Withdraw the piston, spring and seal assembly from the master cylinder.
4. Straighten the spring of the spring thimble and detach the piston.
5. Remove the seal from the piston.
6. Release the valve stem from the keyhole slot in the thimble and remove the thimble and spring.
7. Remove the valve seal spacer, dished spring washer and seal from the valve stem.
8. Using clean brake fluid or methylated spirit thoroughly clean and examine all components. If the piston and/or the cylinder bore shows signs of scoring or corrosion a new master cylidner must be obtained.

Assemble

1. Fit new seals to the piston and valve stem.
2. Fit dished spring washer, spacer, spring and thimble to the valve stem. Ensure that the concave side of the spring washer is adjacent to the spacer.
3. Fit the thimble to the piston and carefully depress the thimble spring.
4. Lubricate the bore of the master cylinder with clean brake fluid and insert the valve stem, spring and piston assembly in the master cylinder.
5. Fit the push rod and dished washer and secure with the circlip.
6. Smear the ends of the cylinder and the inside of the new rubber boot with rubber grease.
7. Fit the rubber boot and retaining band.

Refit

1. Reverse the removal procedure 1 to 4.
2. Bleed the air from the system and check for leaks.

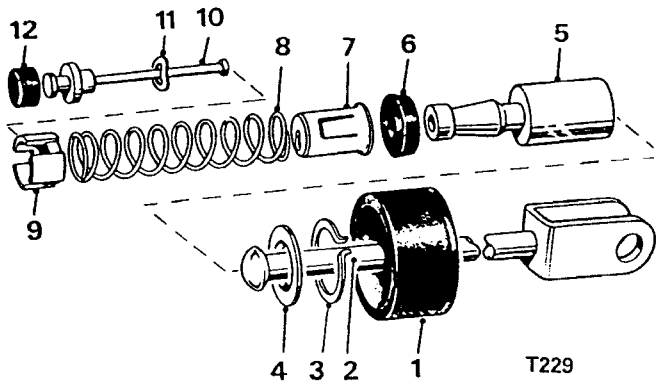


Fig. 3

1. *Boot retaining band*
2. *Push rod*
3. *Circlip*
4. *Dished washer*
5. *Piston*
6. *Piston seal*
7. *Spring thimble*
8. *Spring*
9. *Valve seal spacer*
10. *Valve stem*
11. Dished washer
12. Valve stem seal

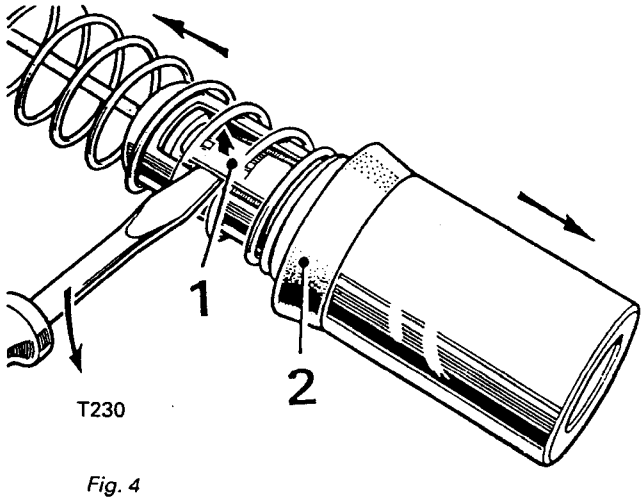


Fig. 4

Releasing the piston from the spring thimble
1. *The thimble locking tab*
2. *The piston seal*

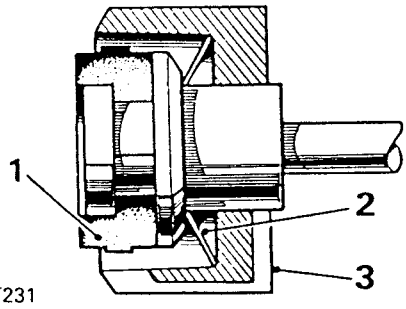
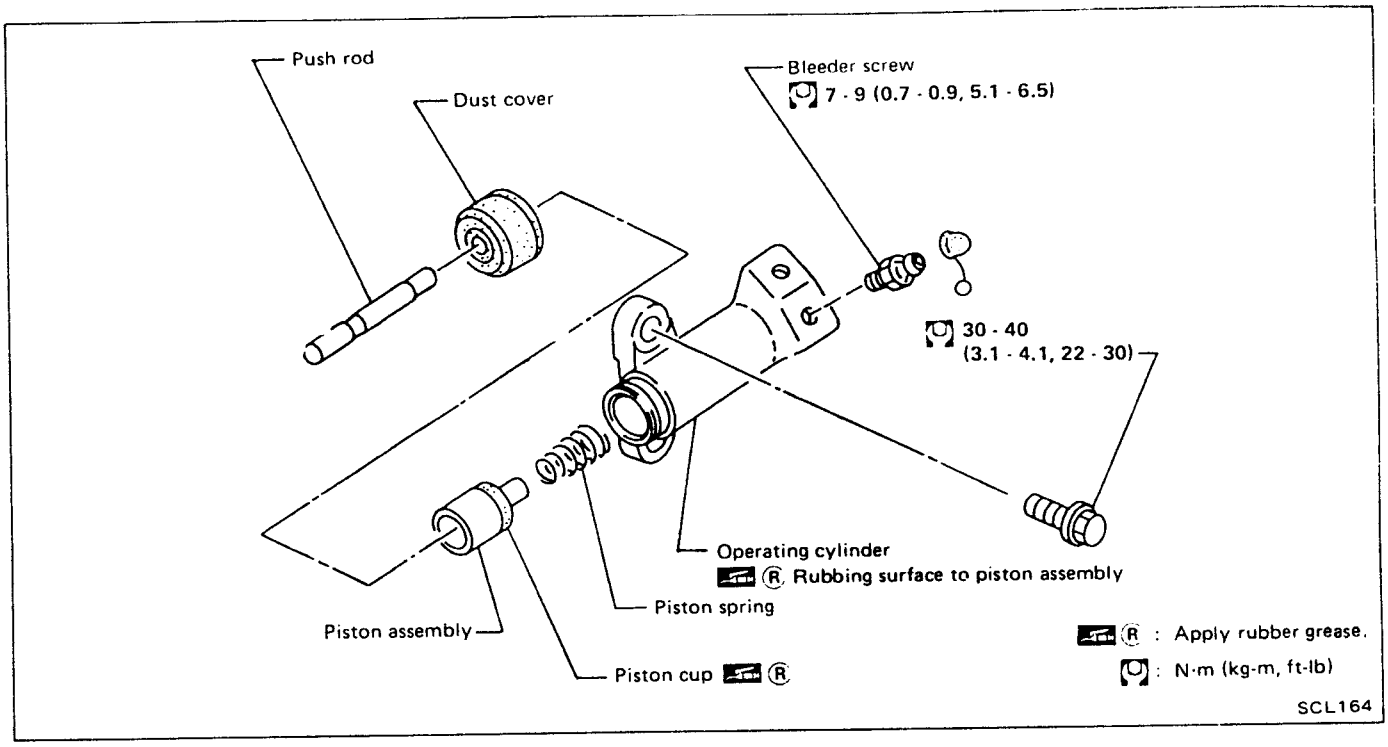


Fig. 5

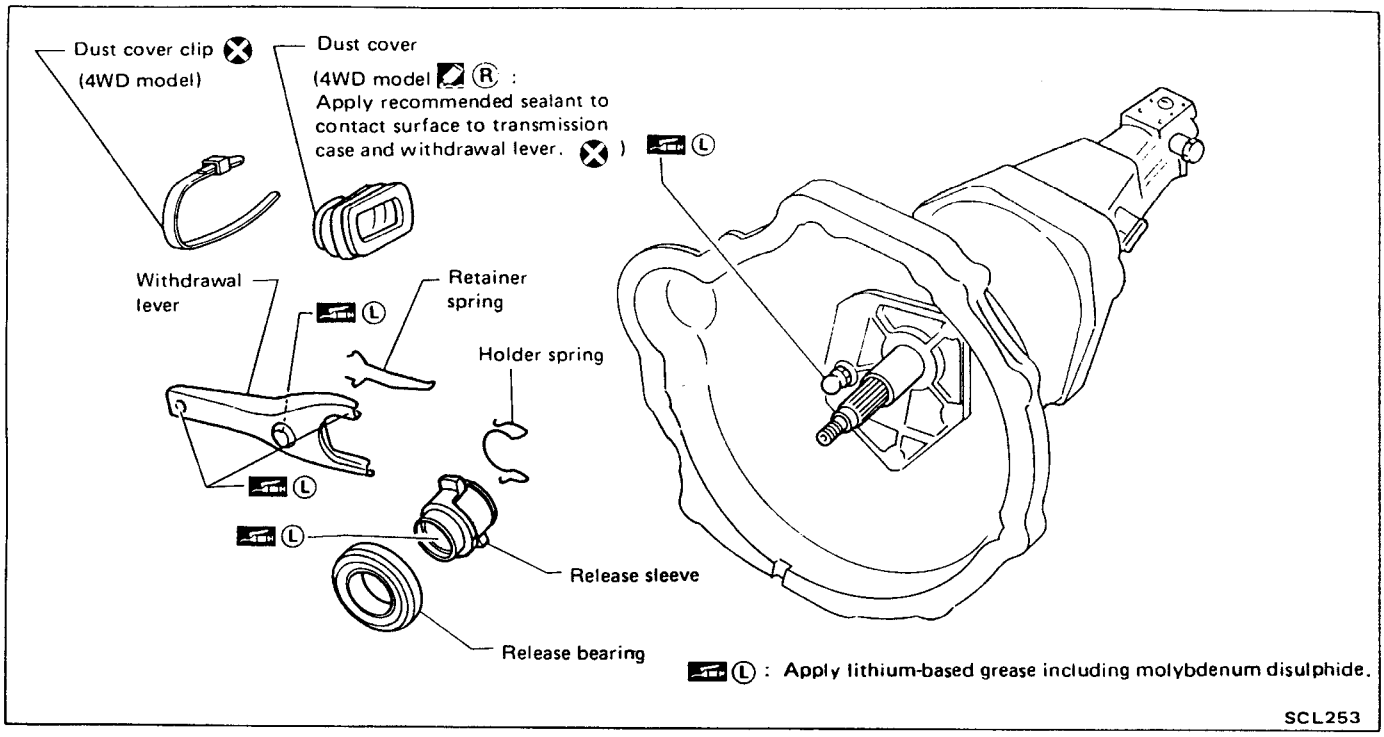
1. *The valve seal*
2. *The spring washer correctly fitted*
3. *The valve spacer*

Operating Cylinder

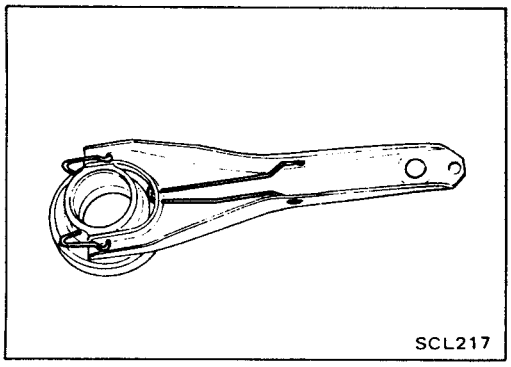


INSPECTION

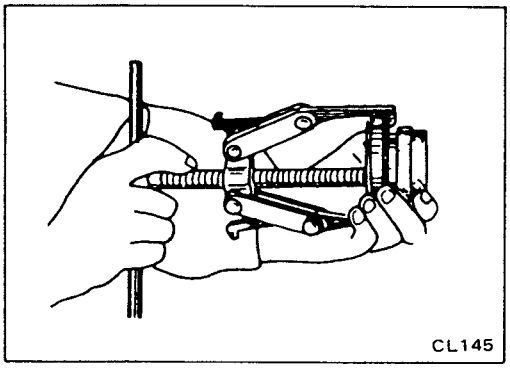
- Check rubbing surface of cylinder for wear, rust or damage. Replace if necessary.
- Check piston with piston cup for wear or damage. Replace if necessary.
- Check piston spring for wear or damage. Replace if necessary.
- Check dust cover for cracks, deformation or damage. Replace if necessary.



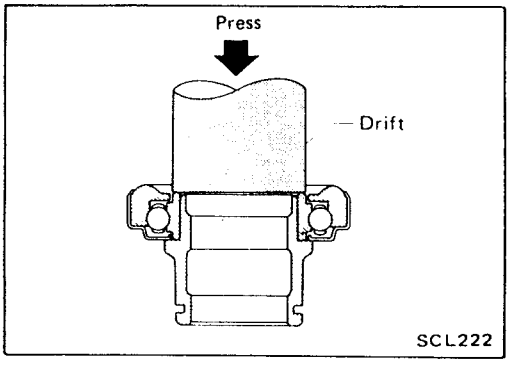
REMOVAL AND INSTALLATION



- Install retainer spring and holder spring.



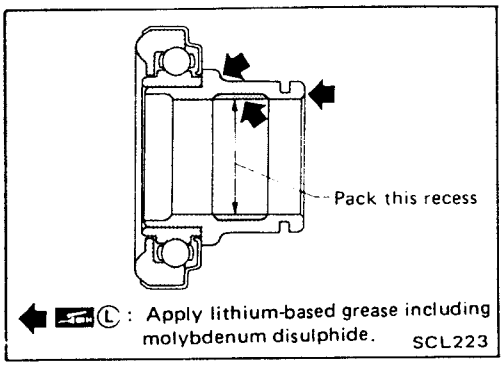
- Remove release bearing.



- Install release bearing with suitable drift.

INSPECTION

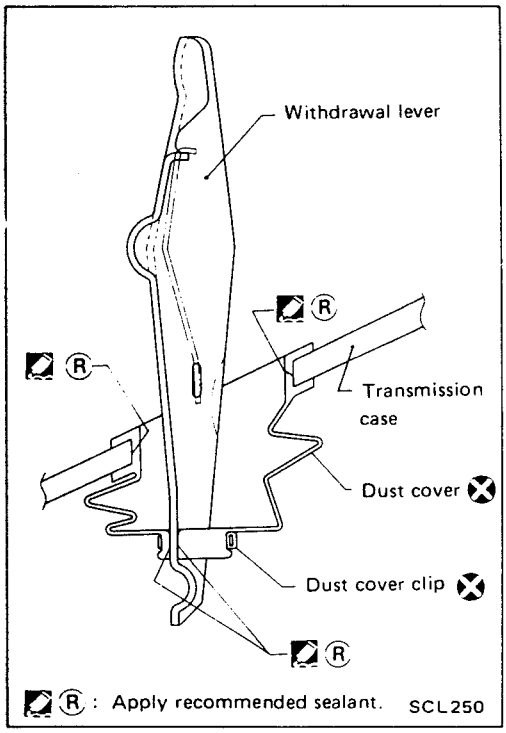
- Check release bearing to see that it rolls freely and is free from noise, crack, pitting or wear. Replace if necessary.
- Check release sleeve and withdrawal lever rubbing surface for wear, rust or damage. Replace if necessary.



LUBRICATION

- Apply recommended grease to contact surface and rubbing surface.

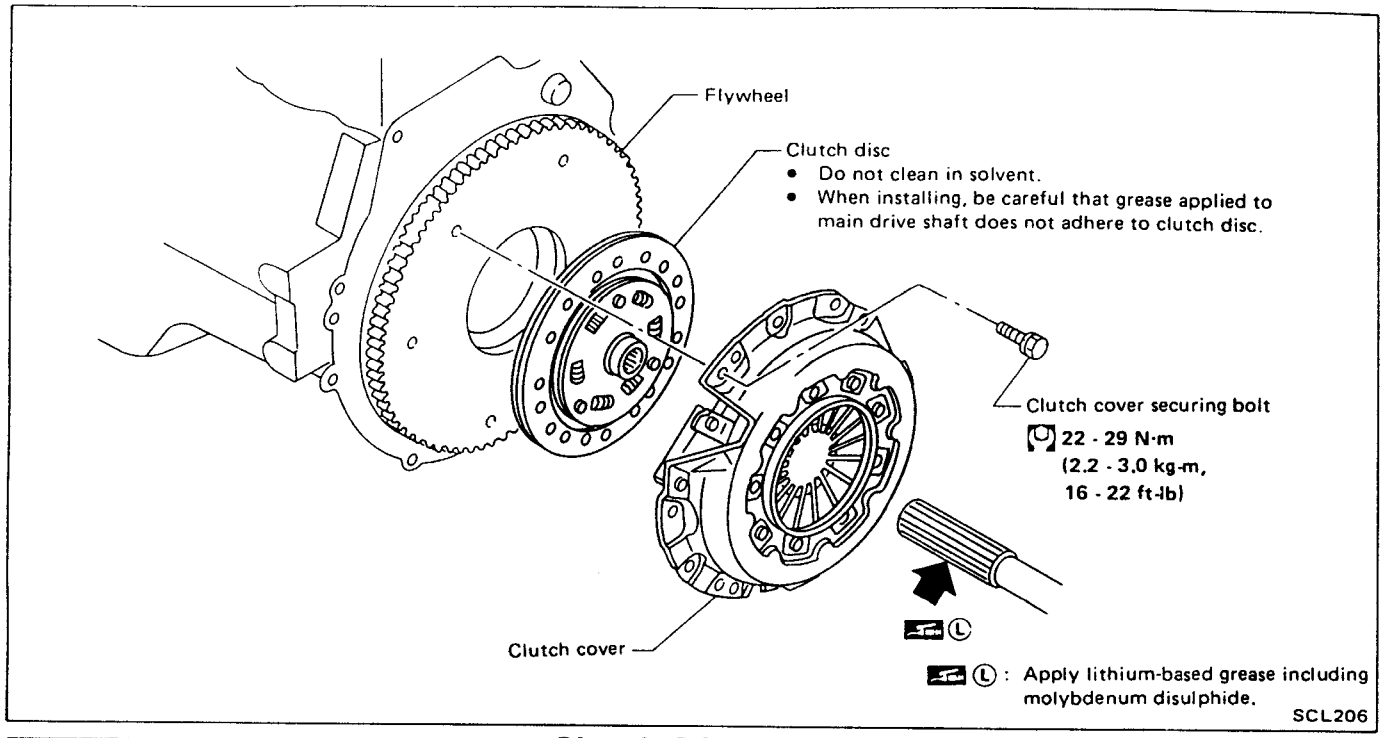
Too much lubricant might cause clutch disc facing damage.

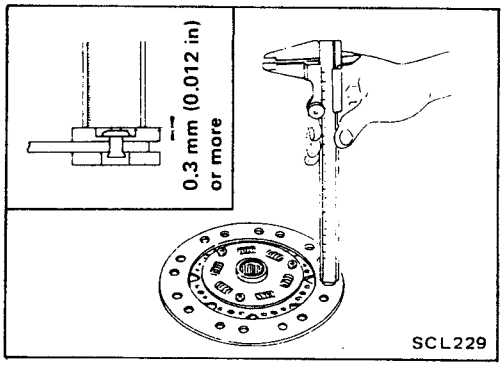


WATERPROOF — for 4WD model

- Apply recommended sealant to contact surface of dust cover to transmission case and withdrawal lever and then install dust cover clip.

Recommended sealant: Nissan genuine part (KP115-00100) or equivalent.



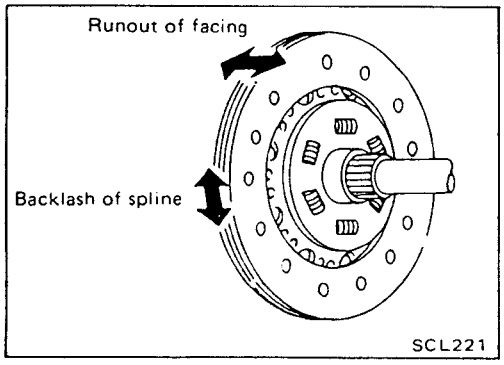


Clutch Disc and Flywheel

INSPECTION

Check clutch disc for wear of facing.

Wear limit of facing surface to rivet head:
0.3 mm (0.012 in)

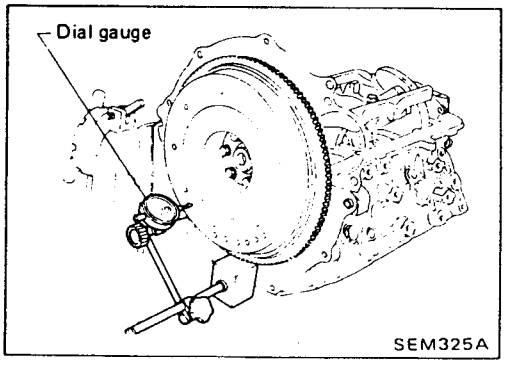


- Check clutch disc for backlash of spline and runout of facing.

Maximum backlash of spline (at outer edge of disc):
200TBL: 0.8 mm (0.031 in)
225TBL: 0.9 mm (0.035 in)
240TBL: 1.0 mm (0.039 in)

Runout limit:
1.0 mm (0.039 in)

Distance of runout check point (from hub center)
200TBL: 95 mm (3.74 in)
225TBL: 107.5 mm (4.23 in)
240TBL: 115 mm (4.53 in)



- Check clutch disc for burns, discoloration or oil or grease leakage. Replace if necessary.
- Check contact surface of flywheel for slight burns or discoloration. Repair flywheel with emery paper.
- Check flywheel runout.

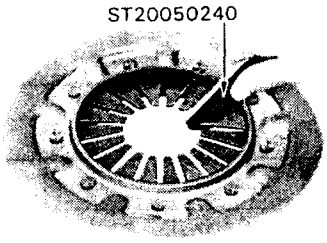
Runout (Total indicator reading):
Flywheel
Less than 0.15 mm (0.0059 in)

Clutch Disc and Flywheel (Cont'd)

INSTALLATION

- Apply recommended grease to contact surface of spline portion.

Too much lubricant might cause clutch disc facing damage.

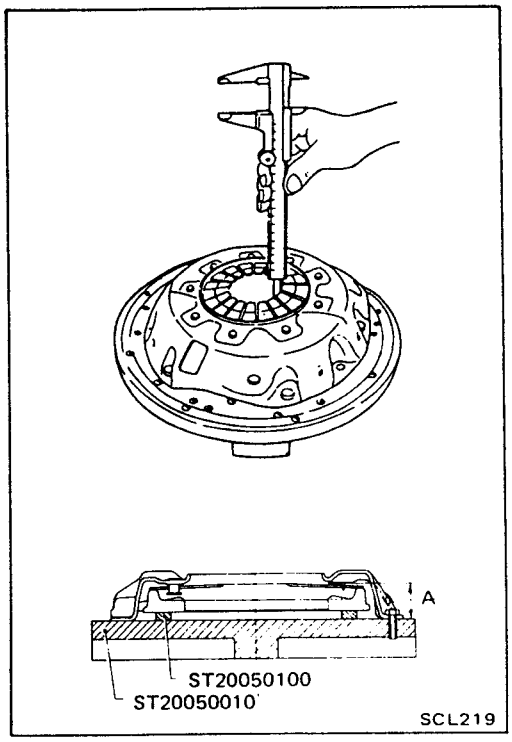


Clutch Cover

INSPECTION

- Adjust unevenness of diaphragm spring with Tool.

Uneven limit:
0.5 mm (0.020 in)



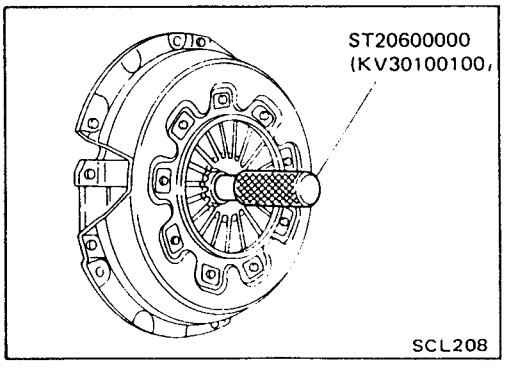
- Set Tool and check height and unevenness of diaphragm spring.

Set 0.2 mm (0.008 in) feeler gauges on distance pieces (ST20050100) when checking D240K or C240S.

Diaphragm spring height "A":

D200K:	**31 - 33 mm (1.22 - 1.30 in)**
D225K:	**33 - 35 mm (1.30 - 1.38 in)**
D240K:	**37.5 - 39.5 mm (1.476 - 1.555 in)**
C240S:	**37.5 - 39.5 mm (1.476 - 1.555 in)**

- Check thrust rings for wear or damage by shaking cover assembly up and down to listen for chattering noise, or lightly hammering on rivets for a slightly cracked noise. Replace clutch cover assembly if necessary.
- Check pressure plate and clutch disc contact surface for slight burns or discoloration. Repair pressure plate with emery paper.
- Check pressure plate and clutch disc contact surface for deformation or damage. Replace if necessary.



INSTALLATION

- Insert Tool into clutch disc hub when installing clutch cover and disc.

LTI

SERVICE

Fairway

WORKSHOP MANUAL

SECTION 4

AUTOMATIC TRANSMISSION

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

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

AUTOMATIC TRANSMISSION

SECTION AT

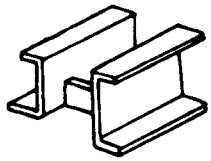
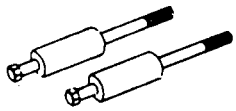
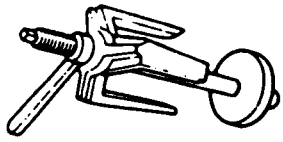
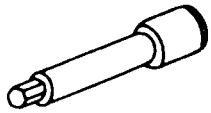
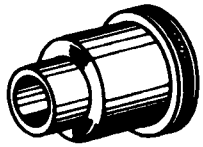
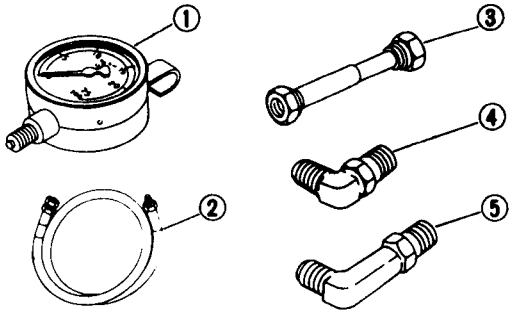
CONTENTS

AUTOMATIC TRANSMISSION

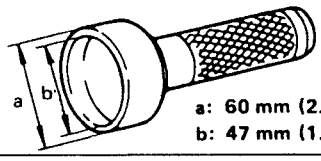
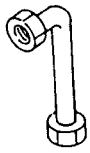
TYPE 4 SPEED WITH OVERDRIVE
MODEL TYPE CODE NUMBER X8780

FOR SPECIFICATION AND SERVICE DATA
REFER TO MODEL NUMBER X8802

SPECIAL SERVICE TOOLS

Tool number Tool name	Description	
ST07870000 Transmission case stand		Disassembly and assembly
ST25850000 Sliding hammer		Removing oil pump assembly
ST25420001 Clutch spring compressor		Removing and installing clutch springs
ST25570001 Hex head extension		Removing and installing one-way clutch inner race
ST25580001 Oil pump assembling gauge		Installing oil pump
ST2505S001 ① ST25051001 ② ST25052000 ③ ST25053000 ④ ST25054000 ⑤ ST25055000 Oil pressure gauge set		Measuring oil pressure ① Oil pressure gauge ② Hose ③ Joint pipe ④ Adapter ⑤ Adapter
11025-61501 Adapter		Adapter for oil pressure gauge

COMMERCIAL SERVICE TOOLS

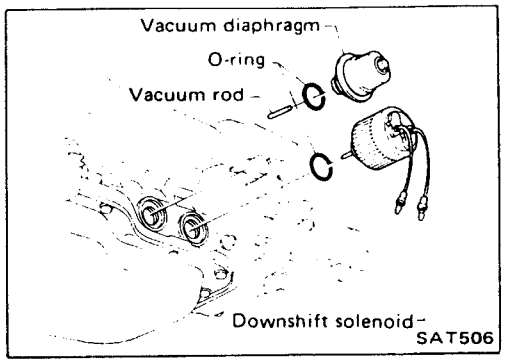
Tool name	Description
Extension oil seal puller	 Removing extension oil seal
Extension oil seal drift	 **a: 60 mm (2.36 in) dia.** **b: 47 mm (1.85 in) dia.** Installing extension oil seal
Joint pipe	 Measuring oil pressure (Make this pipe by bending ST25053000)

Service Notice

- Before proceeding with disassembly, thoroughly clean the outside of the transmission. It is important to prevent the internal parts of the transmission from becoming contaminated by dirt or other foreign matter.
- Disassembly should be done in a clean work area.
- Use a nylon cloth or paper towel for wiping parts clean. Common shop rags can leave lint that might interfere with the transmission's operation.
- When disassembling parts, be sure to place them in order in parts rack so they can be put back in the unit in their proper positions.
- All parts should be carefully cleaned with a general purpose, non-flammable solvent before inspection or reassembly.
- Gaskets, seals, and O-rings should be replaced. It is also very important to perform functional tests whenever it is designated.
- The valve body contains many precision parts and requires extreme care when parts are removed and serviced. Place removed parts on a parts rack so they can be put back in the valve body in the same positions and sequences. Care will also prevent springs and small parts from becoming scattered or lost.
- Before assembly, apply a coat of recommended A.T.F. to all parts. Vaseline may be applied to O-rings and seals. Do not use any grease.
- Care should be taken to avoid damaging O-rings, seals and gaskets when assembling.
- After overhaul, refill the transmission with new A.T.F.

Abbreviations used throughout this section stand for the following:

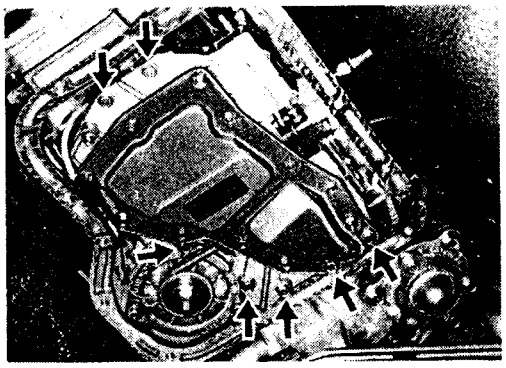
- A.T.F. ..... Automatic transmission fluid
- D_1 ..... Drive range 1st gear
- D_2 ..... Drive range 2nd gear
- D_3 ..... Drive range 3rd gear
- D_4 ..... Drive range 4th gear
- O.D. ..... Overdrive
- 1_2 ..... 1 range 2nd gear
- 1_1 ..... 1 range 1st gear



Control Valve

1. Drain fluid by removing oil pan.
2. Remove downshift solenoid and vacuum diaphragm & rod.

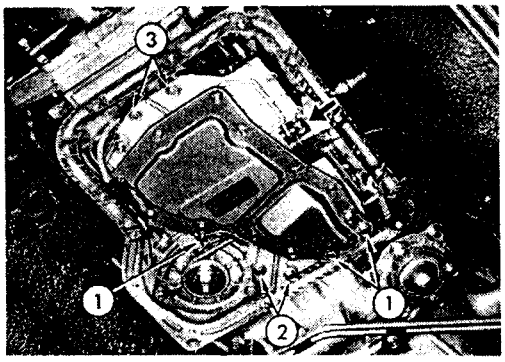
Be careful not to lose vacuum rod.



3. Remove control valve assembly.

Be careful not to drop manual valve out of valve body.

4. Disassemble, inspect and assemble control valve assembly. Refer to Control Valve Body.



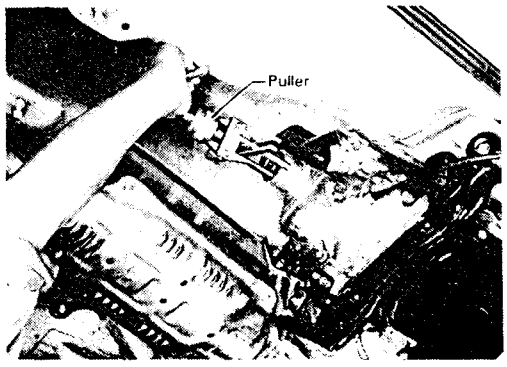
1 40 mm (1.57 in)
2 35 mm (1.38 in)
3 25 mm (0.98 in)

5. Install control valve assembly.

- **Set manual shaft at Neutral, then align manual plate with groove in manual valve of control valve assembly.**
- **Securing bolts come in 3 different lengths.**
- **After installing control valve to transmission case, make sure that control lever can be moved to all positions.**

6. Install kickdown solenoid and vacuum diaphragm & rod.

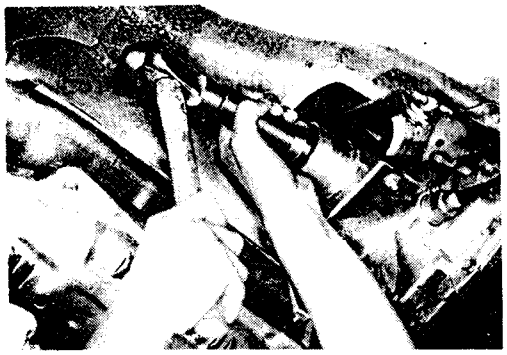
Make sure that vacuum diaphragm rod does not interfere with side plate of control valve.



Extension Oil Seal Replacement

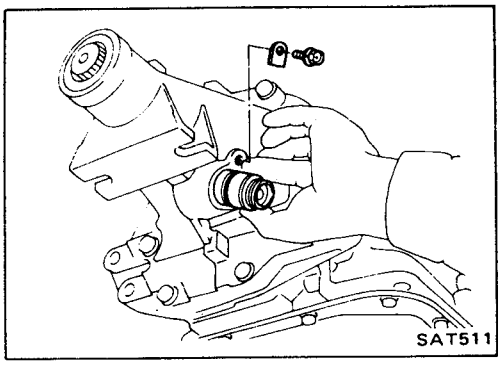
1. Remove oil seal.

Extension Oil Seal Replacement (Cont'd)

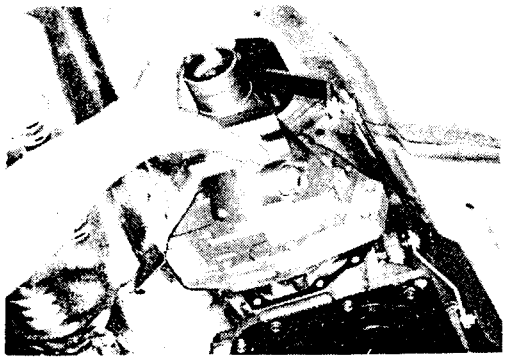


2. Apply coat of A.T.F. to oil seal surface, then drive new seal into place.
3. Coat sealing lips with vaseline, then install propeller shaft.

Parking Component

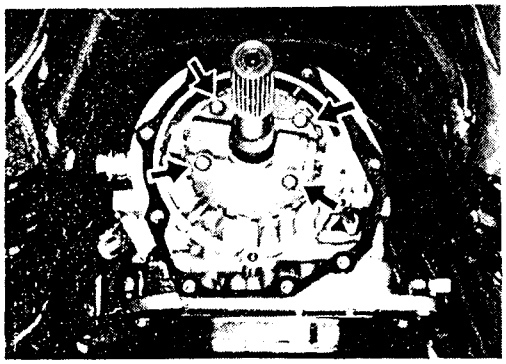


1. Remove oil pan.
2. Remove propeller shaft.
3. Remove speedometer pinion.
4. Support transmission with a jack, then remove rear mounting bolts.

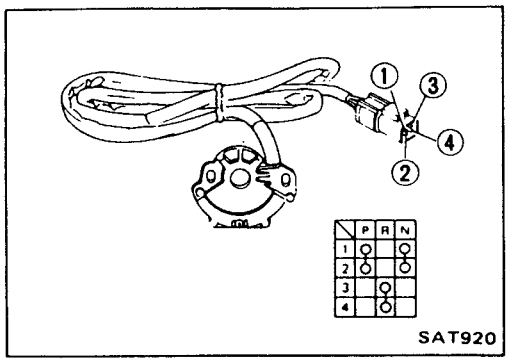


5. Remove rear extension bolts, then draw out rear extension with rear mounting.
6. Remove control valve assembly.
7. Inspect and repair parking components. Check component parts for wear or damage.

Governor Valve Assembly



1. Drain oil by removing oil pan.
2. Remove rear extension with rear mounting.
3. Remove governor valve assembly.
4. Inspect and repair governor valve assembly. Refer to Governor for inspection.



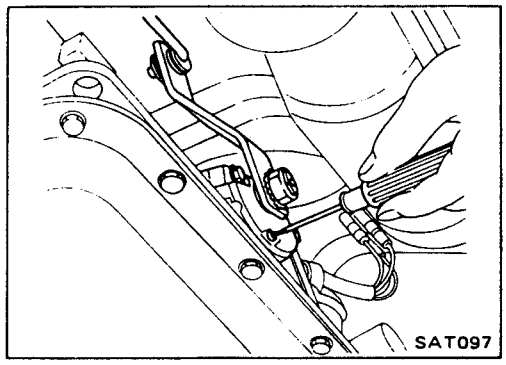
Inhibitor Switch Adjustment

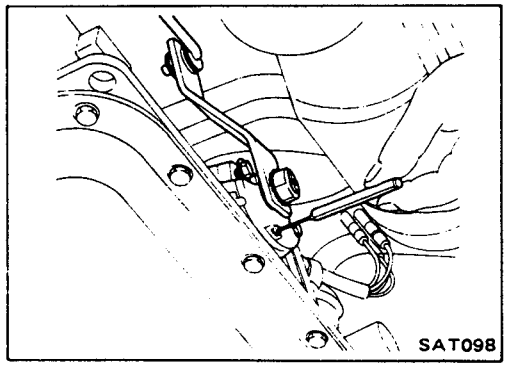
Disconnect harness at connector, then remove inhibitor switch.

- Check continuity at "N", "P" and "R" ranges.
- With selector lever held in "Neutral", turn manual lever an equal amount in both directions to see if current flow ranges are nearly the same. (Current normally begins to flow before manual lever reaches a angle of 1.5° in either direction.)
  If current flows outside normal range, or if normal flow range is out of specifications, properly adjust inhibitor switch.

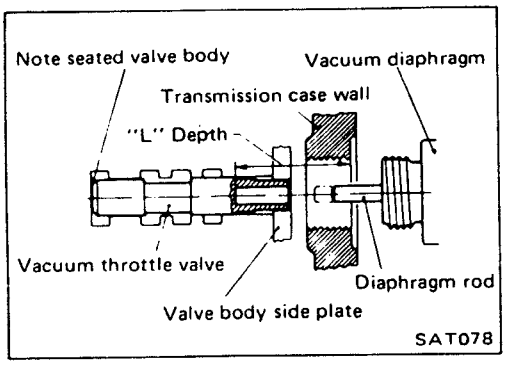
Adjust inhibitor switch as follows:

1. Place the manual valve in Neutral (vertical position).
2. Remove the screw.





3. Loosen the attaching bolts.
4. With an aligning pin [2.0 mm (0.079 in) dia.], move the switch until the pin falls into the hole in the rotor.
5. Tighten the attaching bolts equally.
6. Recheck for continuity. If necessary, replace the switch.



Vacuum Diaphragm Rod Adjustment

1. Remove diaphragm from transmission case.
2. With a depth gauge, measure depth "L". Be sure vacuum throttle valve is pushed into valve body as far as possible.
3. Check "L" depth with chart below and select proper length rod.

Vacuum diaphragm rod selection

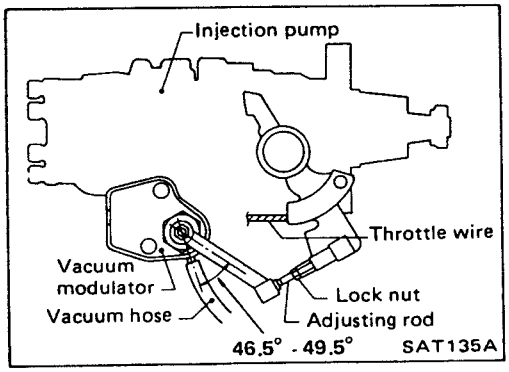
Measured depth "L" mm (in)	Rod length mm (in)	Part number
Under 25.55 (1.0059)	29.0 (1.142)	31932-X0103
25.65 - 26.05 (1.0098 - 1.0256)	29.5 (1.161)	31932-X0104
26.15 - 26.55 (1.0295 - 1.0453)	30.0 (1.181)	31932-X0100
26.65 - 27.05 (1.0492 - 1.0650)	30.5 (1.201)	31932-X0102
Over 27.15 (1.0689)	31.0 (1.220)	31932-X0101

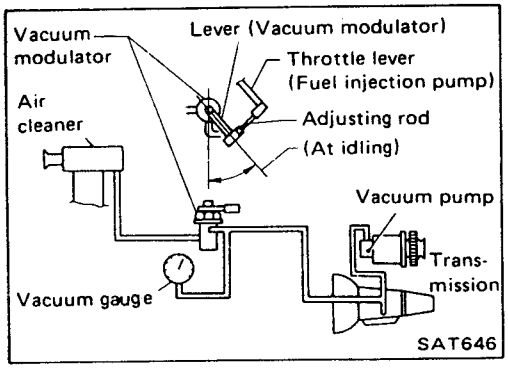
Downshift Solenoid and O.D. Cancel Solenoid

Refer to ELECTRICAL SYSTEM.

Kickdown Switch Adjustment

Refer to ELECTRICAL SYSTEM.





Vacuum Modulator Adjustment (TD23 and TD27 engine models)

1. Loosen the lock nut on the adjusting rod, and adjust the adjusting rod.
2. Install a vacuum gauge between the vacuum pump and the vacuum modulator.
3. Set the parking brake and depress the brake pedal.
4. Start the engine and place the control lever in "2" range.
5. Make adjustments with adjusting rod until the vacuum pressure is as shown in the following chart.

Throttle opening	2/8	4/8	6/8
Vacuum pressure kPa (mbar, mmHg, inHg)	64.0 - 72.0 (640 - 720, 480 - 540, 18.90 - 21.26)	38.7 - 46.7 (387 - 467, 290 - 350, 11.42 - 13.78)	22.7 - 30.7 (227 - 307, 170 - 230, 6.69 - 9.06)

6. Tighten the lock nut on the adjusting rod.
   ⓒ : 1.0 - 1.4 N·m (0.1 - 0.14 kg-m, 0.7 - 1.0 ft-lb)

Preliminary Checks

FLUID LEAKAGE

To detect a fluid leak:

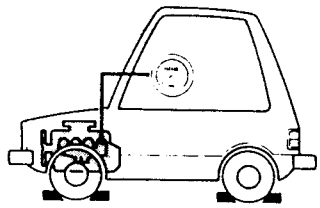
1) Raise vehicle.
2) Clean area suspected of leaking.
3) Start engine, apply foot brake, place selector lever in "D" range, and wait a few minutes.
4) Stop engine.
5) Check for fresh leakage.

FLUID CONDITION

1) Dark of Black Fluid:
   With a burned odor
   – Worn friction material.
2) Milky Pink Fluid: Water Contamination
   – Road water entering through filler tube or breather.
3) Varnished Fluid, light to dark brown and tacky: Oxidation
   – Over or Underfilling.
   – Overheating.

If these conditions exist, check operation of A/T as specified in Road Testing. Especially if the condition as described in 2) exists, it will be necessary to wash all parts in A/T or replace A/T assembly with new one.

Road Testing



SAT596

- **Before starting road tests, install vacuum gauge.**
- **Perform road tests, using "Symptom" chart, as follows:**

"P" RANGE

1. Place selector lever in "P" range and start the engine. Stop the engine and repeat the procedure in all other ranges and neutral.
2. Stop vehicle on a slight upgrade and place control lever in "P" range. Release parking brake to make sure vehicle remains locked.

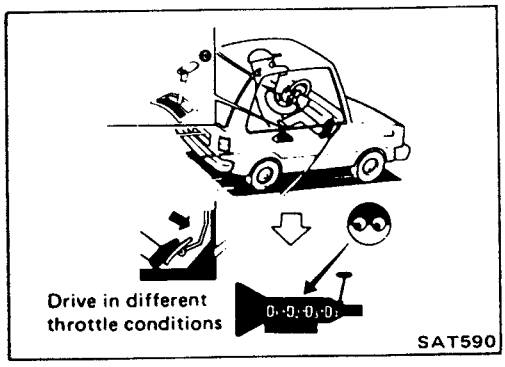
"R" RANGE

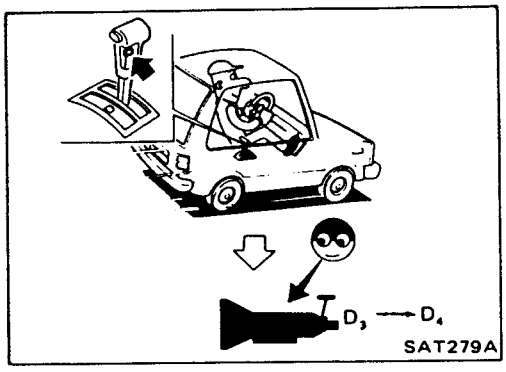
1. Shift selector lever from "P" to "R", and note shift quality.
2. Drive the vehicle in reverse long enough to detect slippage or other abnormalities.

"N" RANGE

1. Shift selector lever from "R" and "D" to "N" and note quality.
2. Release parking brake with control lever in "N" range. Lightly depress accelerator pedal to make sure vehicle does not move. (When vehicle is new or soon after clutches have been replaced, vehicle may move slightly. This is not a problem.)

Road Testing (Cont'd)





"D" RANGE

1. Manually shift selector lever from "N" to "D" range, and note shift quality.
2. Using the shift schedule as a reference, drive vehicle in "D" range. Record, on symptom chart, respective vehicle speeds at which upshifting and downshifting occur. Check that there is not a considerable jolt when shifting gears. Also determine the timing at which shocks are encountered during shifting and which clutches are engaged.
3. Check to determine if shifting to overdrive gear cannot be made while O.D. control switch is in "OFF".
4. When vehicle is being driven in the 65 to 85 km/h (40 to 53 MPH) in "D_3" range at half to light throttle position, fully depress accelerator pedal to make sure it downshifts from 3rd to 2nd gear.
5. When vehicle is being driven in the 25 to 35 km/h (16 to 22 MPH) ("D_2" range) at half to light throttle position, fully depress accelerator pedal to make sure it downshifts from 2nd to 1st gear.

"2" RANGE

1. While vehicle is being driven in "2" range, make sure that it does not shift into 1st or 3rd gear, despite speed changes.
2. Shift control lever to "D" range and allow vehicle to operate at 40 to 50 km/h (25 to 31 MPH). Then, shift to "2" range to make sure it downshifts to 2nd gear.

"1" RANGE

1. Shift selector lever to "1" range and allow vehicle to run. Ensure that it does not upshift from 1st to 2nd gear although vehicle speed increases.
2. While vehicle is being driven in "1" range, release accelerator pedal to make sure that engine compression acts as a brake.
3. Shift selector lever to "D" or "2" range and allow vehicle to run at 20 to 30 km/h (12 to 19 MPH). Then, shift selector lever to "1" range to make sure the downshift to 1st gear is made.

Road Test Symptom Chart

Numbers in chart below correspond with those indicated in Trouble-shooting chart.
It is not necessary to check shaded items.

			SHIFT QUALITY											
			ROUGH	SHIFT TIMING [Mark km/h (MPH)]	NO SHIFT	SHIFT SLIPPAGE	VEHICLE WON'T MOVE	CRUISE SLIPPAGE	POOR POWER/ ACCELERATION	NOISY	ENGINE WON'T START	VEHICLE WON'T STAND STILL	NO ENGINE BRAKING	COMMENTS
PARK RANGE	ENG. START										A			
	HOLDING									B		C		
"R" RANGE	Man. shift	P-R					A3			A4				
	REVERSE						E · A3	E	E	A4				
"N" RANGE	Man. shift	R-N								A4				
	ENG. START										A			
	N									B		D		
"D" RANGE	Man. shift	N-D	F				G · A3			A4				
	1st						G · A3		I	A4				
	Auto shift	1-2	O		J	R				A4				
	2nd								U	A4				
	Auto shift	2-3	P		K	S				A4				
	3rd								U	A4				
	Auto shift	3-4	Q		L	T				A4				
	4th								U	A4				
	Decel.	4-3			V	Z				A4				
	Kickdown	4-3			V	Z · A2				A4				
	Decel.	3-2			W	A1				A4				
	Kickdown	3-2			W	Y · A1				A4				
	Decel.	2-1			X					A4				
	Kickdown	2-1			X					A4				
"2" RANGE	Man. shift	D-2			A5		H · A3			A4				
	2nd						H · A3		I	A4				
"1" RANGE	Man. shift	2-1	A9		X · A8					A4				
	Man. shift	D-1			X · A6					A4				
	Acceleration						H · A3		I	A4				
	"1"	Engine Braking								A4			A7	

Road Test Symptom Chart (Cont'd)

Numbers are arranged in order of probability. Perform inspections starting with number one and working up. Circled numbers indicate that the transmission must be removed from the vehicle.

Reference		ON vehicle: Oil level	Range select linkage	Inhibitor switch and wiring	Vacuum diaphragm and piping	Kickdown solenoid, switch and wiring	Engine idling rpm	Line pressure	Control valve	Governor	2nd band servo	Transmission air check	Oil quality	Ignition switch and starter motor	Engine adjustment, brake inspection	O.D. band servo	O.D. control SW.	O.D. cancel solenoid	OFF vehicle: Direct clutch	Rear clutch	Front clutch	O.D. band brake	2nd band brake	Low and reverse brake	Oil pump	Oil passage leak	Torque converter	Transmission one-way clutch	Park linkage	Planetary gear	O.D. cancel valve	Lock-up control valve	Accumulator
Ⓐ	Engine does not start in "N", "P" ranges.		2	3										1																		
	Engine starts in range other than "N" and "P".		1	2																												
Ⓑ	Transmission noise in "P" and "N" ranges.	1						2																③								
Ⓒ	Vehicle moves when changing into "P" range or parking gear does not disengage when shifted out of "P" range.		1																									②				
Ⓓ	Vehicle runs in "N" range.		1						3				2							④												
Ⓔ	Vehicle will not run in "R" range (but runs in "D", "2" and "1" ranges). Clutch slips. Very poor acceleration.	1	2					3	5			6	4							⑧		⑦		⑩								
	Vehicle braked when shifting into "R" range.										3	2	1							④		⑤							⑥			
Ⓕ	Sharp shock in shifting from "N" to "D" range.				2		1	3	4											⑤												
Ⓖ	Vehicle will not run in "D" range (but runs in "2", "1" and "R" ranges).		1					2	3																		④					
Ⓗ	Vehicle will not run in "D", "1", "2" ranges (but runs in "R" range). Clutch slips. Very poor acceleration.	1	2					4	5			6	3		7					⑧ ⑩					⑨							
Ⓘ	Clutches or brakes slip somewhat in starting.	1	2		6			3	5			7	4											⑧ ⑨								
	Excessive creep.						1																									
	No creep at all.	1	2				3		5				4						⑧ ⑨ ⑩						⑥ ⑦							
Ⓙ	Failure to change gear from "1st" to "2nd".		1		2	3			5	6	8	7	4								⑨				⑩							
Ⓚ	Failure to change gear from "2nd" to "3rd".		1		2	3			5	6	8	7	4							⑨					⑩							
Ⓛ	Failure to change gear from "3rd" to "4th".		1		2	3			5	6	8	7	4								⑨				⑩							
	Too high a gear change point from "1st" to "2nd", from "2nd" to "3rd", from "3rd" to "4th".				1	2		3	5	6			4												⑦							
	Gear change directly from "1st" to "3rd" occurs.								2	4		3	1										⑤		⑥							
	Gear change directly from "2nd" to "4th" occurs.								2	4		3	1							⑤					⑥							

Road Test Symptom Chart (Cont'd)

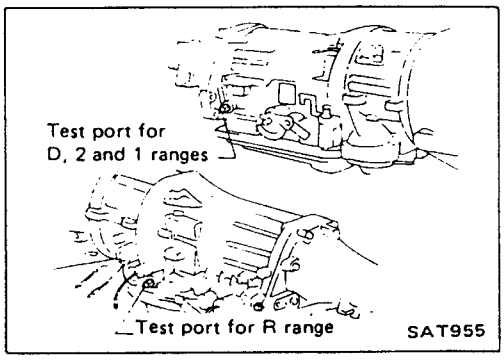
Numbers are arranged in order of probability. Perform inspections starting with number one and working up. Circled numbers indicate that the transmission must be removed from the vehicle.

Reference		ON vehicle												OFF vehicle											
		Oil level	Range select linkage	Inhibitor switch and wiring	Vacuum diaphragm and piping	Kickdown solenoid, switch and wiring	Engine idling rpm	Line pressure	Control valve	Governor	2nd band servo	Transmission air check	Oil quality	Ignition switch and starter motor	Engine adjustment, brake inspection	O.D. band servo	O.D. control SW.	O.D cancel solenoid	Direct clutch	Rear clutch	Front clutch	O.D. band brake	2nd band brake	Low and reverse brake	Oil pump	Oil passage leak	Torque converter	Transmission one-way clutch	Park linkage	Planetary gear	O.D. cancel valve	Lock-up control valve	Accumulator
O	Too sharp a shock in change from "1st" to "2nd".				1		2		4		5		3									⑥				⑧					⑦	
P	Too sharp a shock in change from "2nd" to "3rd".				1			2	3		5	4								⑥						⑧					⑦	
Q	Too sharp a shock in change from "3rd" to "4th".				1			2	3			7				4						⑧				⑩					⑨	
R	Almost no shock or clutches slipping in change from "1st" to "2nd".	1	2		3			4	6		8	7	5									⑨			⑩							
S	Almost no shock or slipping in change from "2nd" to "3rd". Engine races extremely fast.	1	2		3			4	6		8	7	5								⑨				⑩							
T	Almost no shock or slipping in change from "3rd" to "4th".	1	2		3			4	6		8	7	5									⑨			⑩							
	Vehicle braked by gear change from "1st" to "2nd".								2				1								④		③				⑤					
	Vehicle braked by gear change from "2nd" to "3rd".								3		2		1									④										
	Vehicle braked by gear change from "3rd" to "4th".								2				1						③		④											
U	Maximum speed not attained. Acceleration poor.	1	2				5	4	7		6		3		8					⑪	⑫		⑨	⑩		⑬	⑭						
V	Failure to change gear from "4th" to "3rd".				1				3	4		5	2				6	7	⑨		⑩	⑪				⑫					⑬	
W	Failure to change gear from "3rd" to "2nd" and from "4th" to "2nd".				1				3	4	6	5	2								⑦	⑩	⑧			⑨						
X	Failure to change gear from "2nd" to "1st" or from "3rd" to "1st".				1				3	4	6	5	2									⑦				⑧						
	Gear change shock felt during deceleration by releasing accelerator pedal.		1		2	3		4	5	6															⑦						⑧
	Too high a change point from "4th" to "3rd", from "3rd" to "2nd", from "2nd" to "1st".		1		2	3		4	5	6															⑧						
Y	Kickdown does not operate when depressing pedal in "3rd" within kickdown vehicle speed.				2	1			4	5			3									⑥			⑦						
	Kickdown operates or engine overruns when depressing pedal in "3rd" beyond kickdown vehicle speed limit.		1		2			3	5	6		7	4								⑧					⑨						
Z	Races extremely fast or slips in changing from "4th" to "3rd" when depressing pedal.				1			2	4		6	5	3						⑦		⑧	⑨				0						
A1	Races extremely fast or slips in changing from "3rd" to "2nd" when depressing pedal.				1			2	4		6	5	3								⑦		⑧			9						
A2	Kickdown does not operate when depressing pedal in "4th" within kickdown vehicle speed.				2	1			4	5			3						⑦		⑥					⑧						
	Kickdown operates or engine overruns when depressing pedal in "4th" beyond kickdown vehicle speed limit.		1		2			3	5	6		7	4									⑧				⑨						
	Shift pattern does not change.				1	3			6						5		2	4													7	

Road Test Symptom Chart (Cont'd)

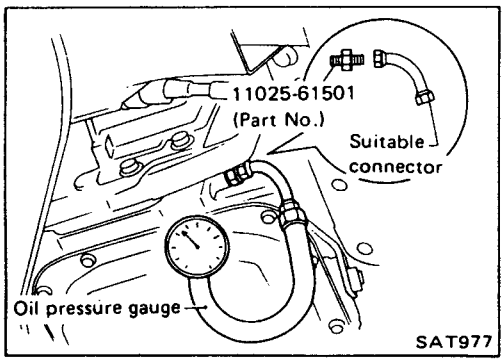
Numbers are arranged in order of probability. Perform inspections starting with number one and working up. Circled numbers indicate that the transmission must be removed from the vehicle.

Reference		ON vehicle														OFF vehicle													
		Oil level	Range select linkage	Inhibitor switch and wiring	Vacuum diaphragm and piping	Kickdown solenoid, switch and wiring	Engine idling rpm	Line pressure	Control valve	Governor	2nd band servo	Transmission air check	Oil quality	Ignition switch and starter motor	Engine adjustment, brake inspection	O.D. band servo	O.D. control SW.	O.D. cancel solenoid	Direct clutch	Rear clutch	Front clutch	O.D. band brake	2nd band brake	Low and reverse brake	Oil pump	Oil passage leak	Torque converter	Transmission one-way clutch	Park linkage	Planetary gear	O.D. cancel valve	Accumulator	Rear lubrication
(A3)	Vehicle will not run in any range.	1	2	.	.	.	.	3	5	.	.	6	4	.	.	.	.	.	.	.	.	.	.	.	⑦	⑧	.	.	⑨	.	.	.	.
(A4)	Transmission noise in "D", "2", "1" and "R" ranges.	1	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	③	.	⑥	④	.	⑤	.	.	.
(A5)	Failure to change from "3rd" to "2nd" when changing lever into "2" range.	.	1	.	.	.	.	2	4	.	5	.	3	.	.	.	.	.	.	.	.	.	⑥	.	.	⑦	.	.	.	.	.	.	.
	Gear change from "2" to "1st" or from "2nd" to "3rd" in "2" range.	.	1	.	.	.	.	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	No shock at change from "1" to "2" range or engine races extremely.	1	2	.	3	.	4	.	7	.	.	8	6	.	5	.	.	.	.	.	.	.	⑨	.	⑩	.	.	.	.	.	.	.	.
(A6)	Failure to change from "3rd" to "2nd" when shifting lever into "1" range.	.	1	.	.	.	.	2	4	5	7	6	3	.	.	.	.	.	.	.	⑧	.	⑨	.	.	⑩	.	.	.	.	.	.	.
(A7)	Engine brake does not operate in "1" range.	.	1	.	.	.	.	2	4	.	.	5	3	.	.	.	.	.	.	.	.	.	.	⑥	.	⑦	.	.	.	.	.	.	.
	Gear change from "1st" to "2nd" or from "2nd" to "3rd" in "1" range.	.	1	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	③	.	.	.	.	.	.	.
(A8)	Does not change from "2nd" to "1st" in "1" range.	1	2	.	.	.	.	.	4	5	6	7	3	.	.	.	.	.	.	.	.	.	.	⑧	.	⑨	.	.	.	.	.	.	.
(A9)	Large shock changing from "2nd" to "1st" in "1" range.	.	.	.	1	.	.	.	4	.	.	.	3	.	2	.	.	.	.	.	.	.	.	⑤	.	.	.	.	.	.	.	.	.	.
	Transmission overheats.	1	.	.	.	.	.	2	5	.	7	6	4	.	3	8	.	.	⑩	⑨	⑪	⑬	⑫	⑭	⑮	⑯	⑰	.	.	⑱	.	.	⑲
	Oil shoots out during operation. White smoke emitted from exhaust pipe during operation.	1	.	.	2	.	.	4	6	.	.	7	3	.	5	.	.	.	⑨	⑧	⑩	⑫	⑪	⑬	⑭	⑮	⑯	.	.	⑰	.	.	⑱
	Offensive smell at oil charging pipe.	1	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	.	.	⑫	.	.	.
	Transmission shifts to overdrive even if O.D. control switch is turned to "ON".	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	③	.	.
	Lamp inside of O.D. control switch does not glow even if O.D. control switch is turned to "OFF" (engine not started).	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.



Pressure Testing

- Location of line pressure test port



1. Install pressure gauge to line pressure port.

(1) Remove line pressure plug and install oil pressure gauge and adapters.

2. Warm up engine until engine oil and A.T.F. reach operating temperature.

A.T.F. temperature:
50 - 80°C (122 - 176°F)

3. Set parking brake and block wheels.

Pressure Testing (Cont'd)

4. Measure line pressure at idle and stall point while depressing brake pedal fully.

- **When measuring line pressure at stall point, follow the stall test procedure.**

Line pressure at idling

Unit: kPa (bar, kg/cm², psi)

Rauge \ Engine	Z24S	TD23	TD27
R	412 - 549 (4.12 - 5.49, 4.2 - 5.6, 60 - 80)	745 - 843 (7.45 - 8.43, 7.6 - 8.6, 108 - 122)	745 - 843 (7.45 - 8.43, 7.6 - 8.6, 108 - 122)
D	314 - 373 (3.14 - 3.73, 3.2 - 3.8, 46 - 54)	392 - 490 (3.92 - 4.90, 4.0 - 5.0, 57 - 71)	392 - 490 (3.92 - 4.90, 4.0 - 5.0, 57 - 71)
2	412 - 971 (4.12 - 9.71, 4.2 - 9.9, 60 - 141)	1,010 - 1,599 (10.10 - 15.99, 10.3 - 16.3, 146 - 232)	1,010 - 1,599 (10.10 - 15.99, 10.3 - 16.3, 146 - 232)
1	314 - 373 (3.14 - 3.73, 3.2 - 3.8, 46 - 54)	392 - 490 (3.92 - 4.90, 4.0 - 5.0, 57 - 71)	392 - 490 (3.92 - 4.90, 4.0 - 5.0, 57 - 71)

Line pressure at stall testing

Unit: kPa (bar, kg/cm² psi)

Range \ Engine	Z24S	TD23	TD27
R	1,402 - 1,589 (14.02 - 15.89, 14.3 - 16.2, 203 - 230)	1,952 - 2,109 (19.52 - 21.09, 19.9 - 21.5, 283 - 306)	1,952 - 2,109 (19.52 - 21.09, 19.9 - 21.5, 283 - 306)
D	971 - 1,089 (9.71 - 10.89, 9.9 - 11.1, 141 - 158)	1,040 - 1,216 (10.40 - 12.16, 10.6 - 12.4, 151 - 176)	1,040 - 1,216 (10.40 - 12.16, 10.6 - 12.4, 151 - 176)
2	902 - 1,089 (9.02 - 10.89, 9.2 - 11.1, 131 - 158)	1,432 - 1,608 (14.32 - 16.08, 14.6 - 16.4, 208 - 233)	1,432 - 1,608 (14.32 - 16,08, 14.6 - 16.4, 208 - 233)
1	971 - 1,089 (9.71 - 10.89, 9.9 - 11.1, 141 - 158)	1,040 - 1,216 (10.40 - 12.16, 10.6 - 12.4, 151 - 176)	1,040 - 1,216 (10.40 - 12.16, 10.6 - 12.4, 151 - 176)

JUDGMENT BY MEASURING LINE PRESSURE

If line pressure does not rise, first check to make sure that vacuum hose is connected properly.

1) When line pressure is low at all positions, the problem may be due to:

- Wear on interior of oil pump
- Oil leakage at or around oil pump, control valve body, transmission case or governor
- Sticking pressure regulator valve
- Sticking pressure modifier valve

2) When line pressure is low at a particular position, the problem may be due to the following:

- If oil leaks at or around rear clutch or governor, line pressure is low in "D", "2" or "1" range but is normal in "R" range.
- If oil leaks at or around low and reverse brake circuit, line pressure becomes low in "R" or "P" range but is normal in "D", "2" or "1" range.

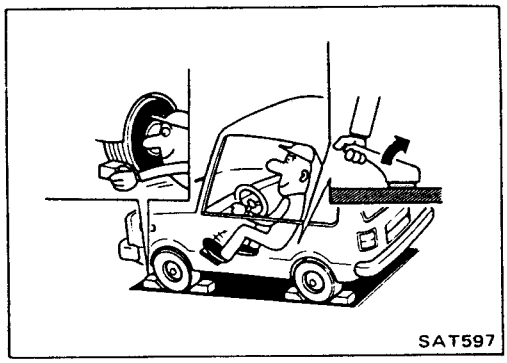
3) When line pressure is high, pressure regulator valve may have stuck.

Stall Testing

The stall test is an effective method of testing clutch and band holding ability, torque converter one-way clutch operation, and engine performance. A stall test should only be performed as a last resort because of the high fluid temperature it generates and the excessive load it places on the engine and transmission.

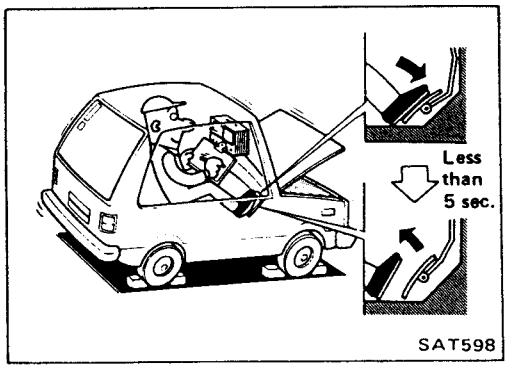
CAUTION:

a. **Transmission and engine fluid levels should always be checked and fluid added as needed.**
b. **Run engine to attain proper warm-up.**
c. **During test, never hold throttle wide-open for more than 5 seconds.**
d. **Do not test more than two gear ranges without driving vehicle to cool off engine and transmission.**


SAT597

STALL TEST PROCEDURE

1. Set parking brake and block wheels.
2. Install a tachometer where it can be seen by driver during test.
3. Start engine and place selector lever in "D" range.



SAT598

4. Apply foot brake and accelerate to wide-open throttle.
5. Quickly note the engine stall speed and immediately release throttle.

Stall revolution

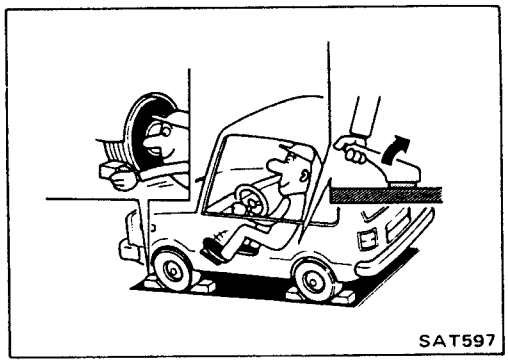
Z24S:	2,000 - 2,200 rpm
TD23:	2,050 - 2,250 rpm
TD27:	1,960 - 2,160 rpm

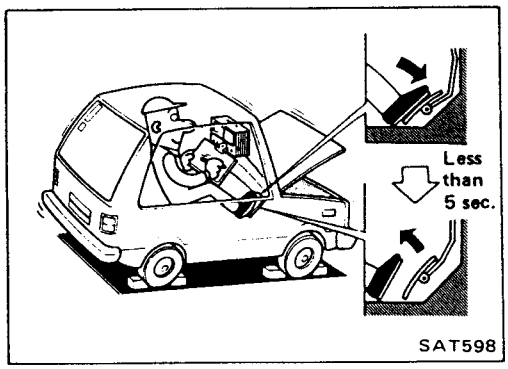
Stall Testing

The stall test is an effective method of testing clutch and band holding ability, torque converter one-way clutch operation, and engine performance. A stall test should only be performed as a last resort because of the high fluid temperature it generates and the excessive load it places on the engine and transmission.

CAUTION:

a. **Transmission and engine fluid levels should always be checked and fluid added as needed.**
b. **Run engine to attain proper warm-up.**
c. **During test, never hold throttle wide-open for more than 5 seconds.**
d. **Do not test more than two gear ranges without driving vehicle to cool off engine and transmission.**


SAT597



SAT598

STALL TEST PROCEDURE

1. Set parking brake and block wheels.
2. Install a tachometer where it can be seen by driver during test.
3. Start engine and place selector lever in "D" range.
4. Apply foot brake and accelerate to wide-open throttle.
5. Quickly note the engine stall speed and immediately release throttle.

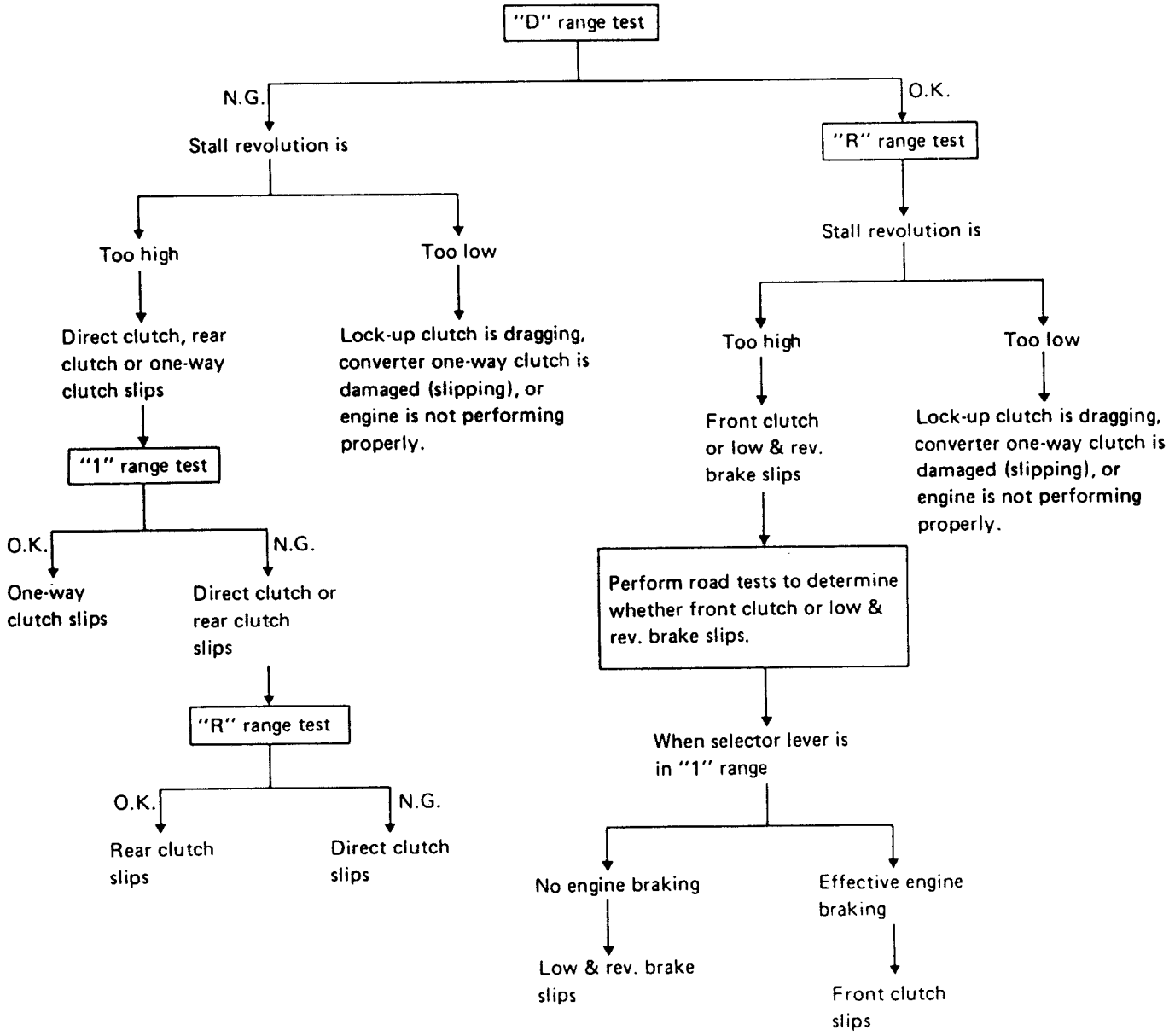
Stall revolution

Z24S:	2,000 - 2,200 rpm
TD23:	2,050 - 2,250 rpm
TD27:	1,960 - 2,160 rpm

Stall Testing (Cont'd)

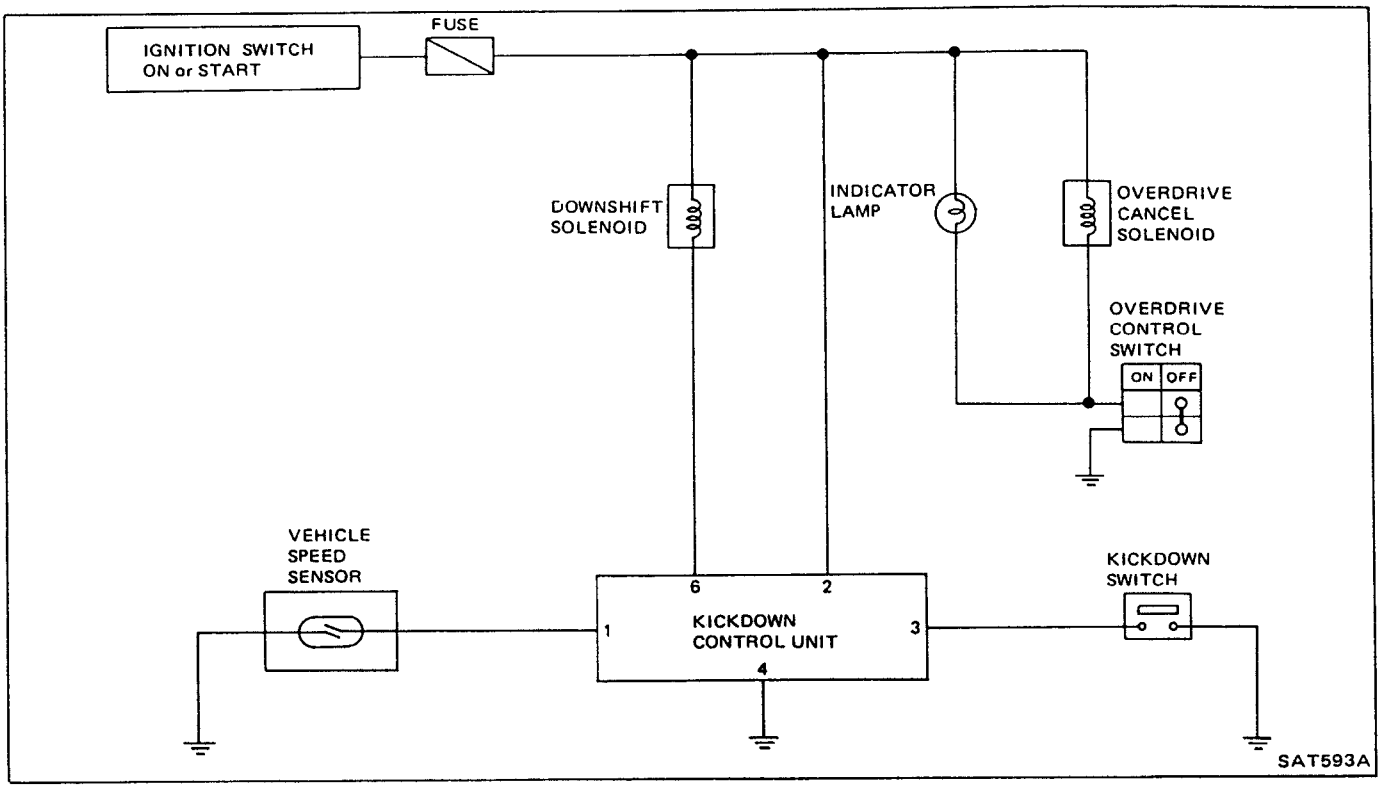
6. Shift selector lever to "N".
7. Cool off A.T.F.
8. Perform stall tests in the same manner as in steps 3 through 7 with selector lever in "1" and "R", respectively.

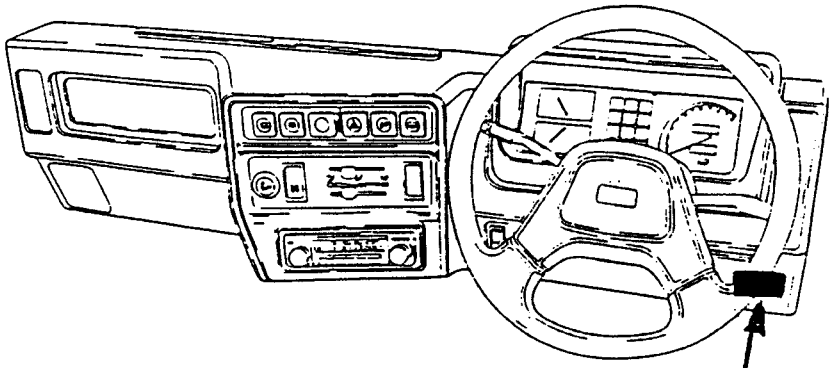
STALL TEST ANALYSIS

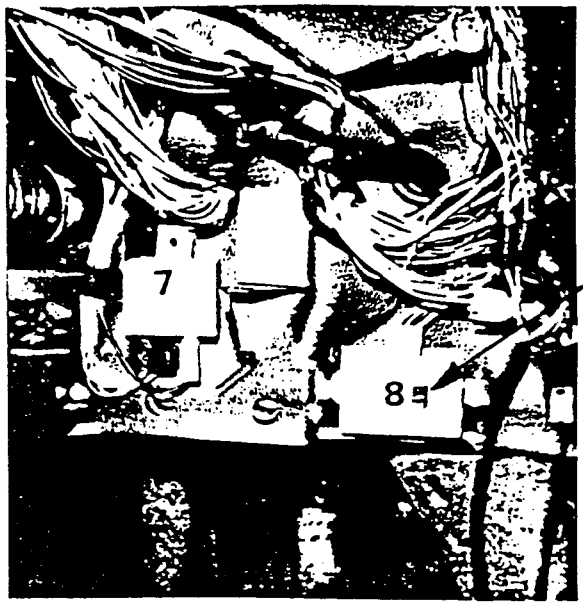


If converter one-way clutch is frozen, vehicle will have poor high speed performance and low engine rpm when it is raced in "N" range. If converter one-way clutch is slipping, vehicle will be sluggish up to 50 or 60 km/h (30 or 40 MPH).

Schematic

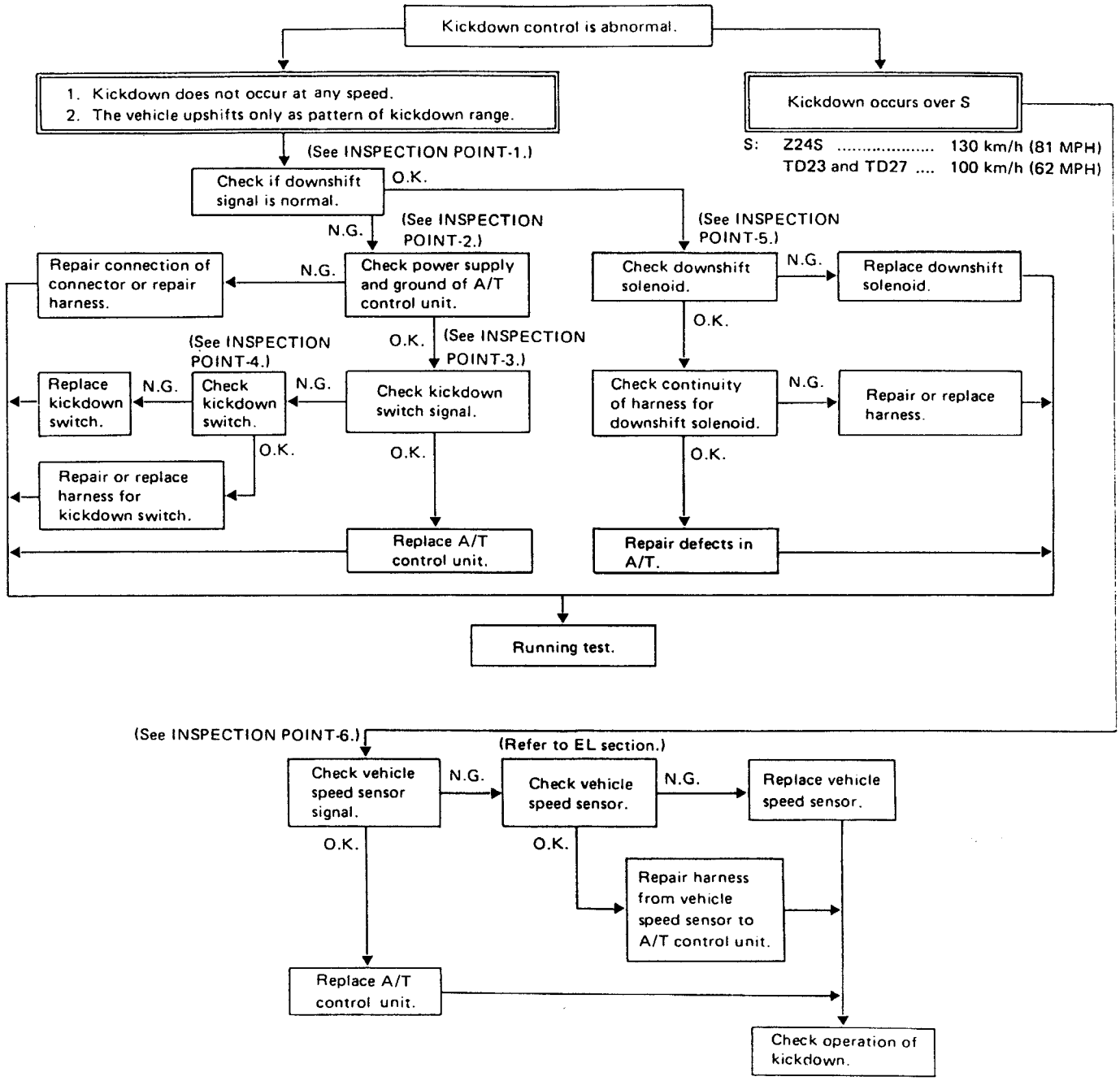

IGNITION SWITCH
ON or START
FUSE
DOWNSHIFT
SOLENOID
INDICATOR
LAMP
OVERDRIVE
CANCEL
SOLENOID
OVERDRIVE
CONTROL
SWITCH
ON
OFF
VEHICLE
SPEED
SENSOR
6
2
1
KICKDOWN
CONTROL UNIT
3
4
KICKDOWN
SWITCH
SAT593A



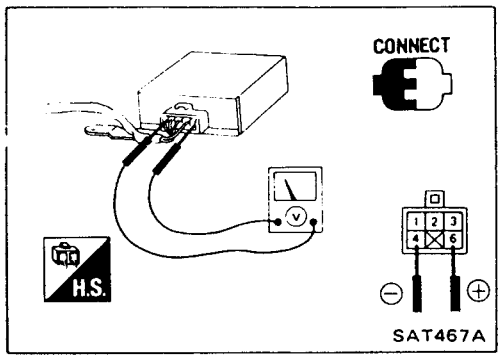


Location of A/T Control Unit

Inspection of Kickdown Control



Inspection of Kickdown Control (Cont'd)



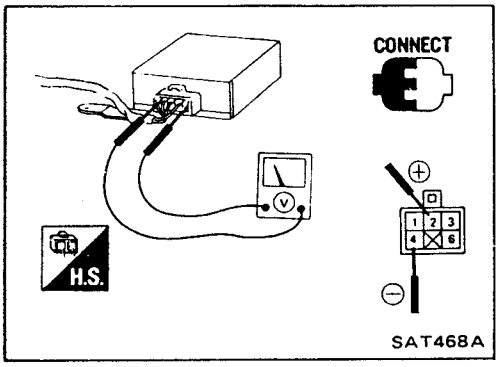
INSPECTION POINT-1

Downshift signal

Connect tester to control unit.

Measure while driving.

- **Fully open accelerator: Less than 1.0V**
- **Less than fully open: Battery voltage**

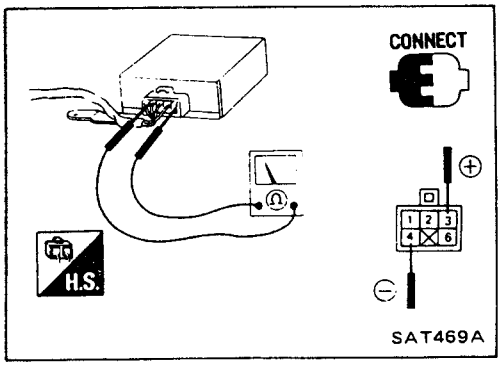


INSPECTION POINT-2

Power supply and ground

Connect tester to control unit.

Battery voltage at all times (Ignition switch "ON".)

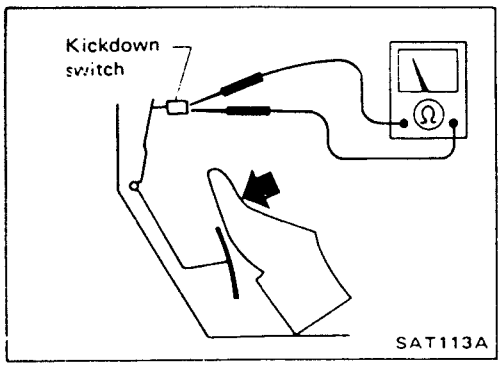


INSPECTION POINT-3

Kickdown switch signal

Connect tester to control unit.

- **Fully open accelerator: 0Ω**
- **Less than fully open: ∞**

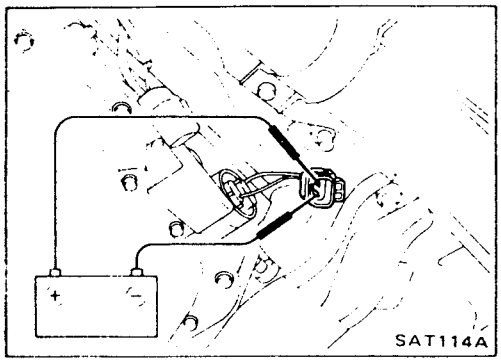


INSPECTION POINT-4

Kickdown switch

Check continuity while operating accelerator pedal.

- **Fully open accelerator: 0Ω**
- **Less than fully open accelerator: ∞**

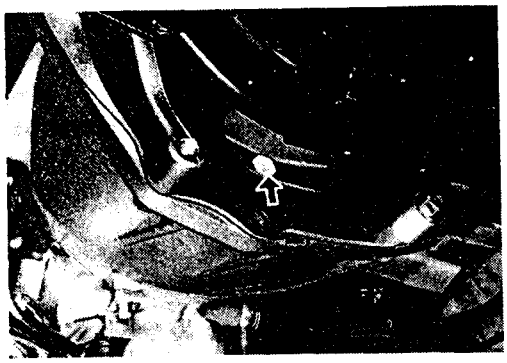


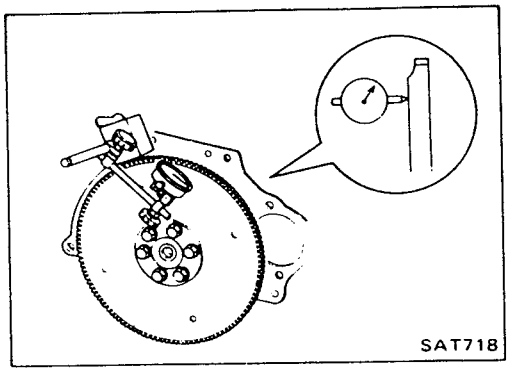
INSPECTION POINT-5

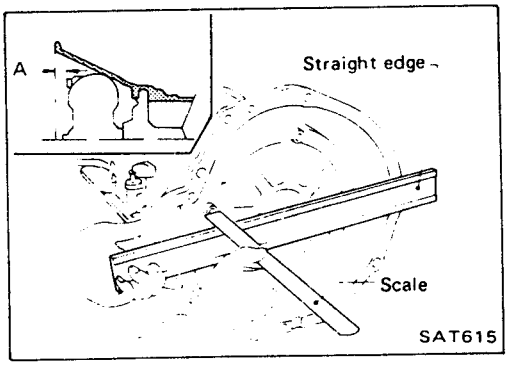
Downshift solenoid

Confirm that clicking sound is heard when power is applied. If necessary, remove downshift solenoid and check the operation.

Catch oil dropping out of the hole when removing downshift solenoid.







Removal

- Remove bolts securing torque converter to drive plate.

a. Remove those bolts turning crankshaft.

b. Before removing torque converter, inscribe matching marks on two parts so that they may be replaced in their original positions during assembly.

- Plug up openings such as oil charging pipe, etc.

CAUTION:

Take care not to strike any adjacent parts when dismounting transmission.

Installation

- Drive plate runout

  Maximum allowable runout:

  0.5 mm (0.020 in)

  If this runout is out of allowance, replace drive plate and ring gear.

- When connecting torque converter to transmission, measure distance "A" to be certain that they are correctly assembled.

  Distance "A":

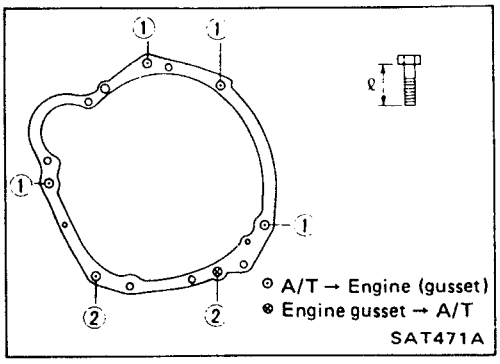
  35 mm (1.38 in) or more

- Install converter to drive plate.

Align matching marks painted across both parts during disassembly.

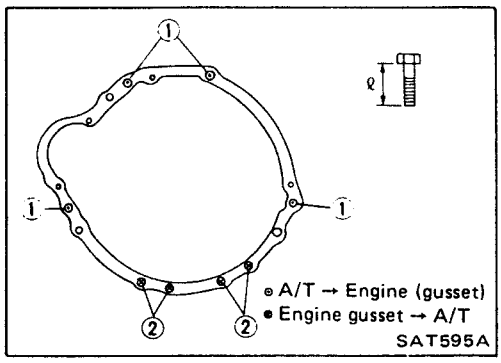
- After converter is installed, rotate crankshaft several turns and check to be sure that transmission rotates freely without binding.

Installation (Cont'd)



- Installation bolt
- Z24S engine model

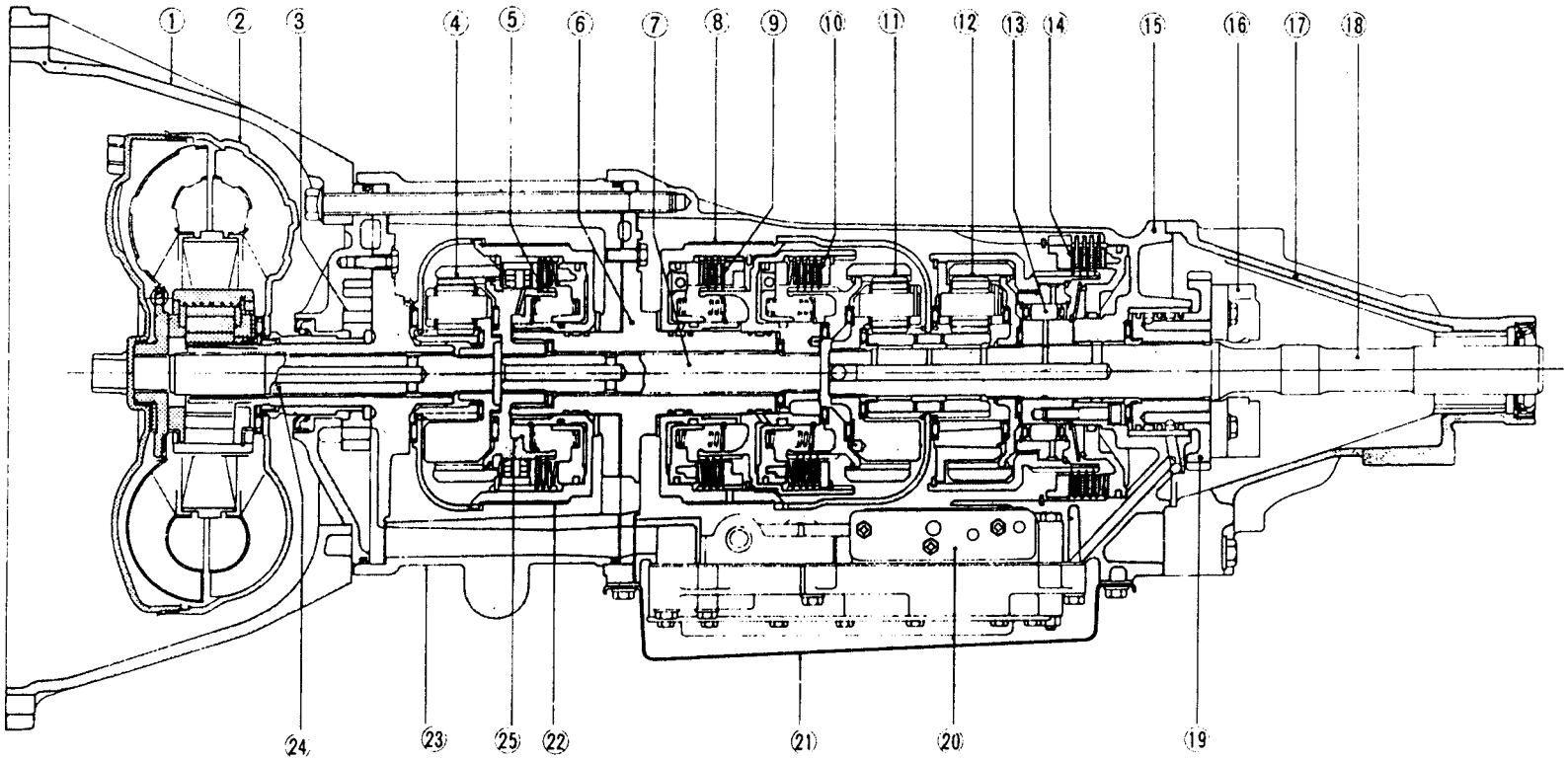
Bolt No.	Tightening torque N·m (kg-m, ft-lb)	Bolt length "ℓ" mm (in)
1	39 - 49 (4.0 - 5.0, 22 - 36)	45 (1.77)
2	26 - 32 (2.7 - 3.3, 20 - 24)	40 (1.57)



- TD23 and TD27 engine models

Bolt No.	Tightening torque N·m (kg-m, ft-lb)	Bolt length "ℓ" mm (in)
1	39 - 49 (4.0 - 5.0, 29 - 36)	60 (2.36)
2	29 - 39 (3.0 - 4.0, 22 - 29)	25 (0.98)

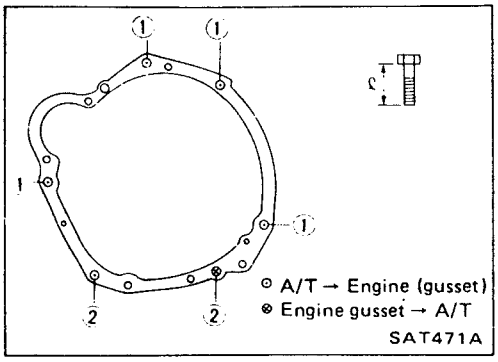
- Check inhibitor switch for operation.
- Check fluid level in transmission.
- Move selector lever through all positions to be sure that transmission operates correctly.
  With parking brake applied, rotate engine at idling. Move selector lever through "N" to "D", to "2", to "1" and to "R". A slight shock should be felt by hand gripping selector each time transmisson is shifted.
- Check to be sure that line pressure is correct. To do this, refer to Line Pressure Test.
- Perform stall test.



1 Converter housing
2 Torque converter
3 Oil pump assembly
4 O.D. planetary gear
5 Direct clutch
6 Drum support
7 Intermediate shaft
8 2nd band brake
9 Front clutch
10 Rear clutch
11 Front planetary gear
12 Rear planetary gear
13 One-way clutch
14 Low & reverse clutch
15 Transmission case
16 Governor valve assembly
17 Rear extension
18 Output shaft
19 Oil distributor
20 Control valve assembly
21 Oil pan
22 O.D. band brake
23 O.D. case
24 Input shaft
25 O.D. one-way clutch

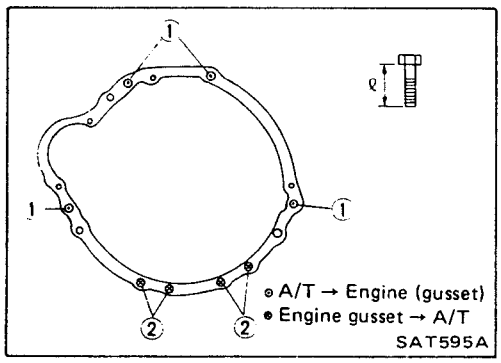
SAT472A

Installation (Cont'd)



- **Installation bolt**
- **Z24S engine model**

Bolt No.	Tightening torque N·m (kg-m, ft-lb)	Bolt length "ℓ" mm (in)
1	39 - 49 (4.0 - 5.0, 22 - 36)	45 (1.77)
2	26 - 32 (2.7 - 3.3, 20 - 24)	40 (1.57)



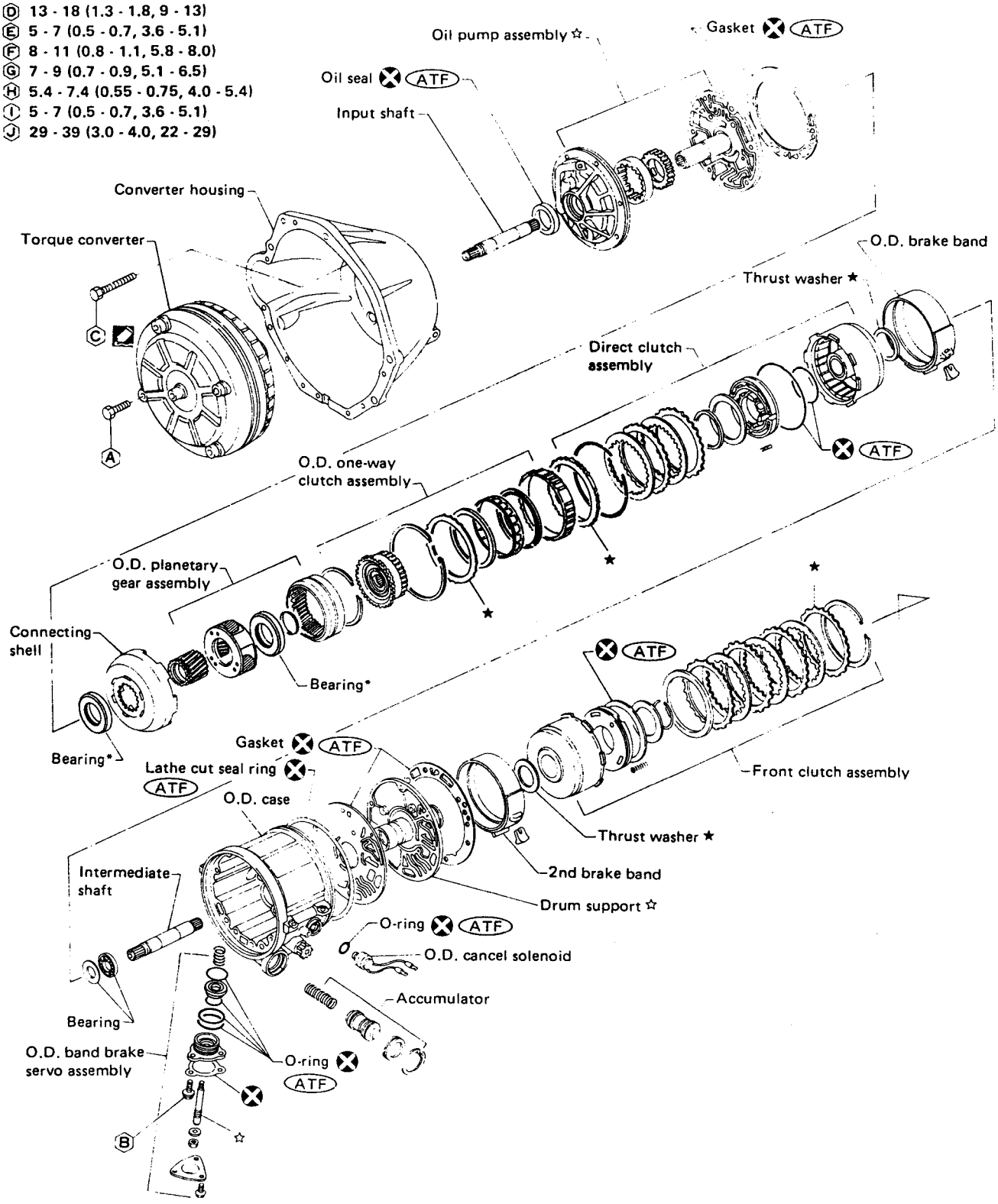
- **TD23 and TD27 engine models**

Bolt No.	Tightening torque N·m (kg-m, ft-lb)	Bolt length "ℓ" mm (in)
1	39 - 49 (4.0 - 5.0, 29 - 36)	60 (2.36)
2	29 - 39 (3.0 - 4.0, 22 - 29)	25 (0.98)

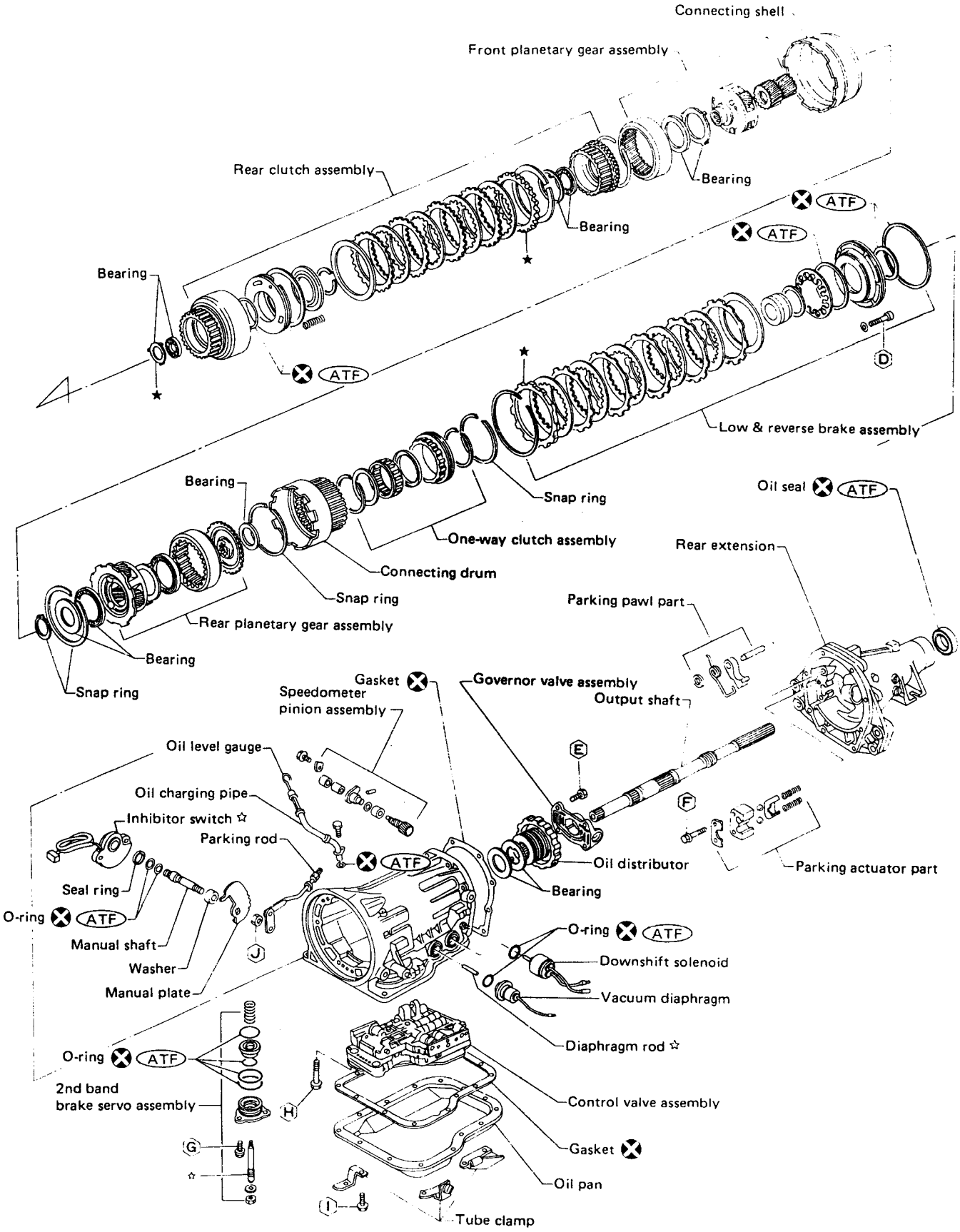
- Check inhibitor switch for operation.
- Check fluid level in transmission.
- Move selector lever through all positions to be sure that transmission operates correctly.
  With parking brake applied, rotate engine at idling. Move selector lever through "N" to "D", to "2", to "1" and to "R". A slight shock should be felt by hand gripping selector each time transmisson is shifted.
- Check to be sure that line pressure is correct. To do this, refer to Line Pressure Test.
- Perform stall test.

NOTE

: N·m (kg-m, ft-lb)
Ⓐ 39 - 49 (4.0 - 5.0, 29 - 36)
Ⓑ 10 - 15 (1.0 - 1.5, 7 - 11)
Ⓒ 44 - 54 (4.5 - 5.5, 33 - 40)
Ⓓ 13 - 18 (1.3 - 1.8, 9 - 13)
Ⓔ 5 - 7 (0.5 - 0.7, 3.6 - 5.1)
Ⓕ 8 - 11 (0.8 - 1.1, 5.8 - 8.0)
Ⓖ 7 - 9 (0.7 - 0.9, 5.1 - 6.5)
Ⓗ 5.4 - 7.4 (0.55 - 0.75, 4.0 - 5.4)
Ⓘ 5 - 7 (0.5 - 0.7, 3.6 - 5.1)
Ⓙ 29 - 39 (3.0 - 4.0, 22 - 29)

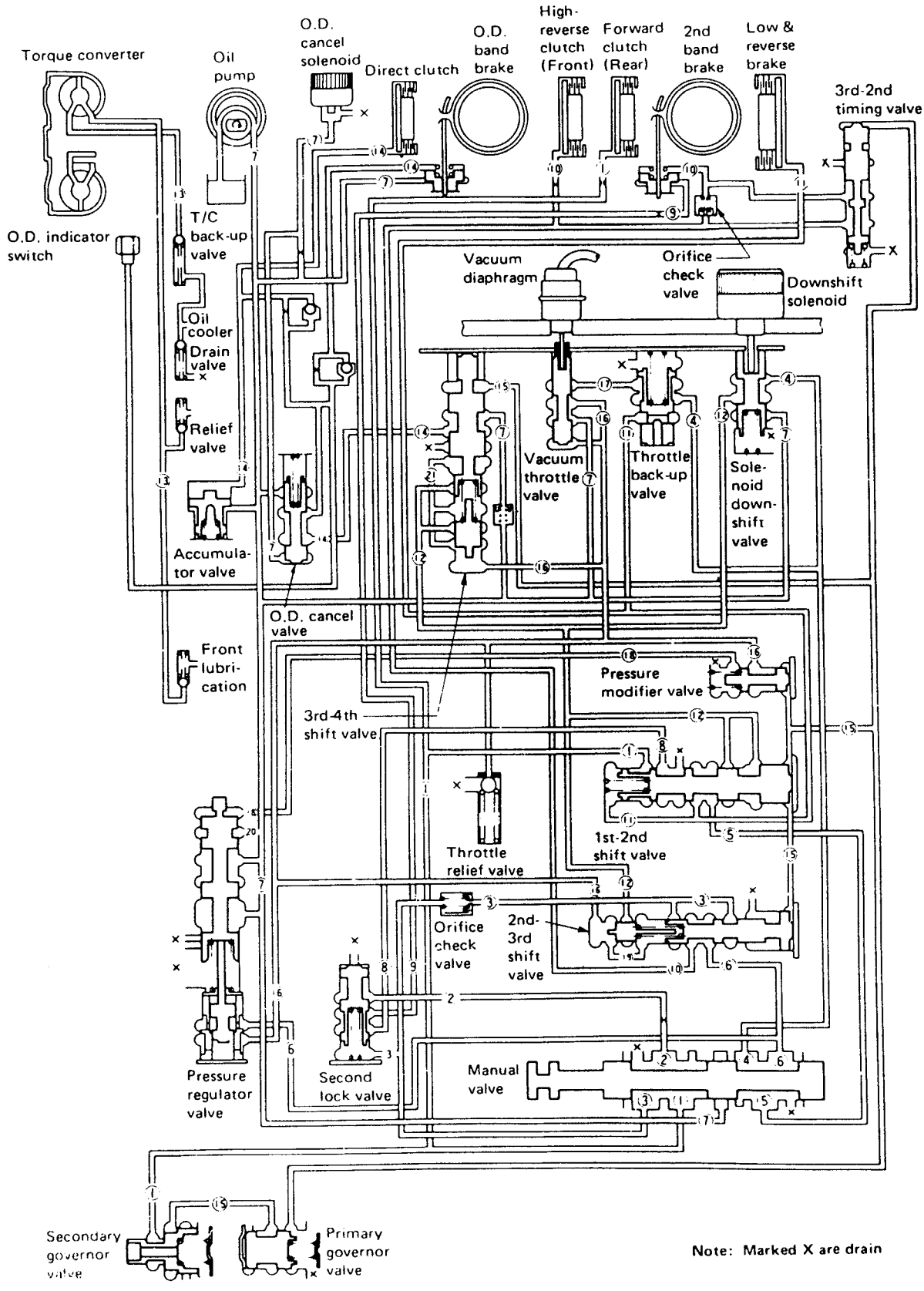


* : Black surface is front side.
★ : Select with proper thickness.
☆ : Adjustment is required.
ATF : Apply A.T.F.


Connecting shell
Front planetary gear assembly
Rear clutch assembly
Bearing
Bearing
Bearing
ATF
ATF
ATF
D
Low & reverse brake assembly
Bearing
Snap ring
One-way clutch assembly
Connecting drum
Snap ring
Rear planetary gear assembly
Bearing
Snap ring
Oil seal
ATF
Rear extension
Parking pawl part
Gasket
Speedometer pinion assembly
Governor valve assembly
Output shaft
Oil level gauge
E
Oil charging pipe
Inhibitor switch ☆
Parking rod
F
ATF
Oil distributor
Bearing
Parking actuator part
Seal ring
O-ring
ATF
Manual shaft
Washer
Manual plate
J
O-ring
ATF
Downshift solenoid
Vacuum diaphragm
Diaphragm rod ☆
O-ring
ATF
2nd band brake servo assembly
H
Control valve assembly
Gasket
G
☆
Oil pan
I
Tube clamp

SAT558A

Hydraulic Control Circuits



Note: Marked X are drain

SAT708

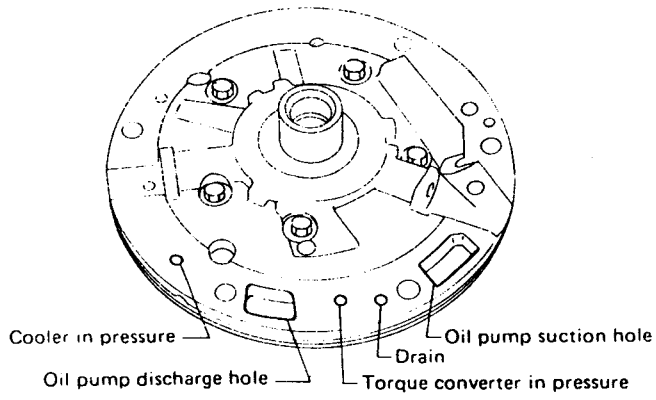
Mechanical Operation

Range		Direct clutch	O.D. band servo		Front clutch	Rear clutch	Low & reverse brake	2nd band servo		One-way clutch	Parking pawl
			Apply	Release				Apply	Release		
Park		ON	(ON)	ON			ON				ON
Reverse		ON	(ON)	ON	ON		ON		ON		
Neutral		ON	(ON)	ON							
D	D_1 (Low)	ON	(ON)	ON		ON				ON	
	D_2 (Second)	ON	(ON)	ON		ON		ON			
	D_3 (Top)	ON	(ON)	ON	ON	ON		(ON)	ON		
	D_4 (O.D.)		ON		ON	ON		(ON)	ON		
2	Second	ON	(ON)	ON		ON		ON			
1	1_2 (Second)	ON	(ON)	ON		ON		ON			
	1_1 (Low)	ON	(ON)	ON		ON	ON			ON	

The low & reverse brake is applied in "1_1" range to prevent free wheeling when coasting and allows engine braking.

Oil Channel

Oil pump
cover side

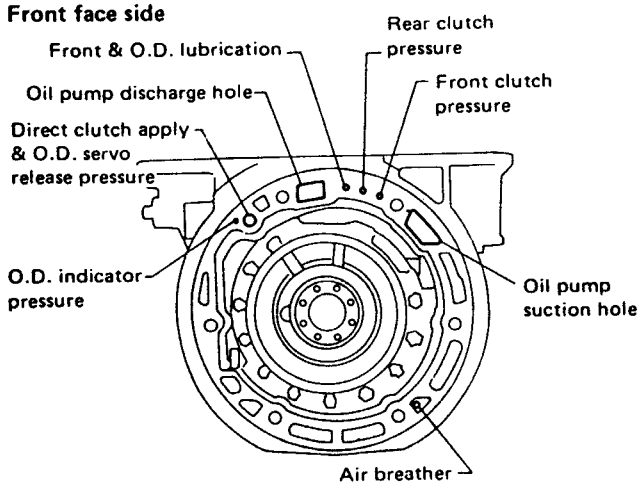


SAT499

Oil Channel (Cont'd)

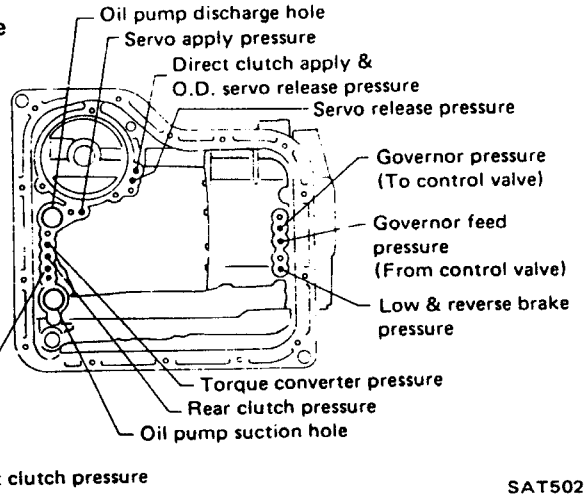
Transmission case

Front face side



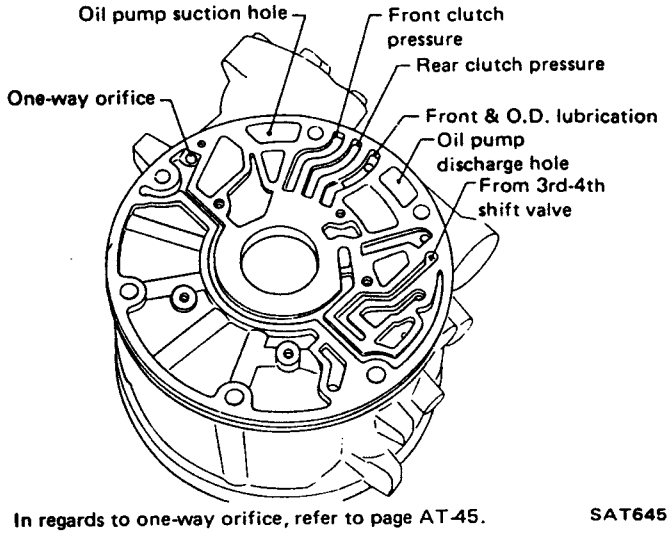
SAT501

Lower face side



SAT502

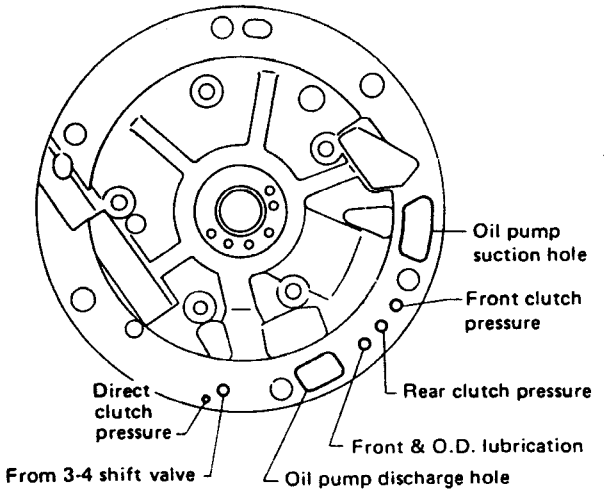
O.D.case



In regards to one-way orifice, refer to page AT-45.

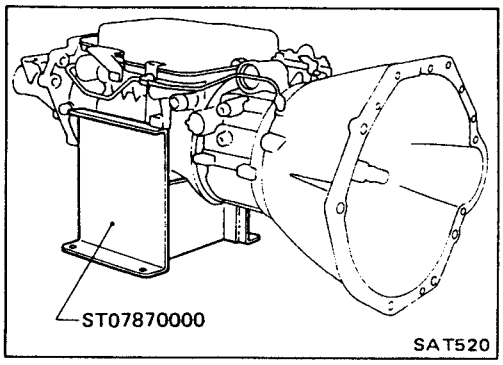
SAT645

Drum support

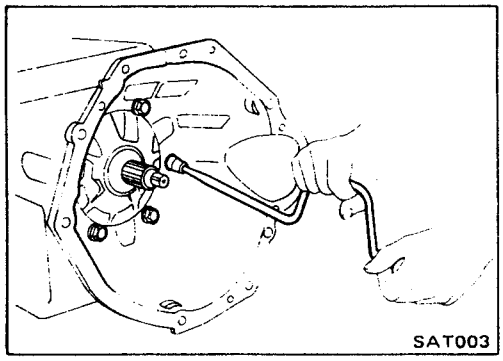


SAT503

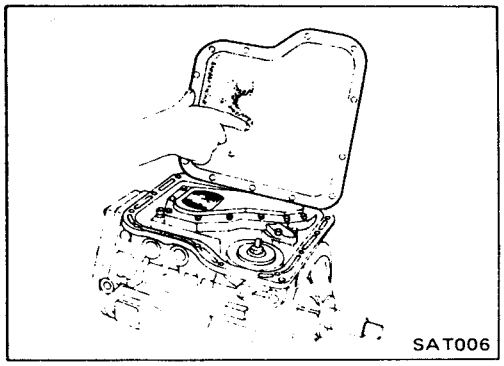
1. Remove torque converter, drain A.T.F. through end of rear extension.



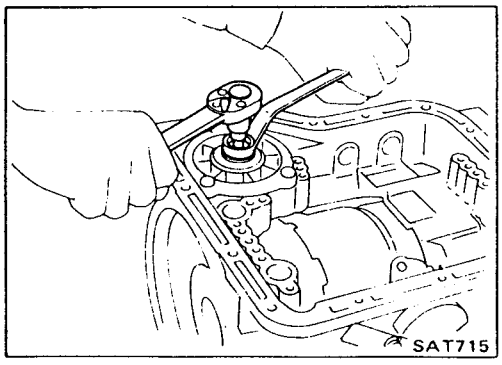
2. Place transmission on Tool.



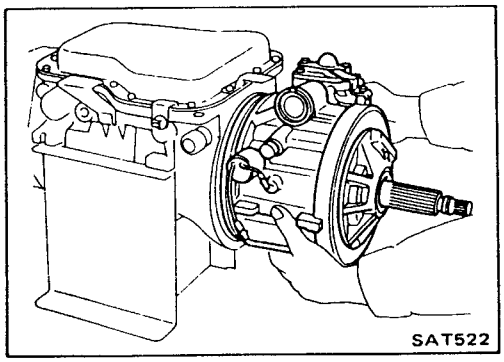
3. Remove converter housing.



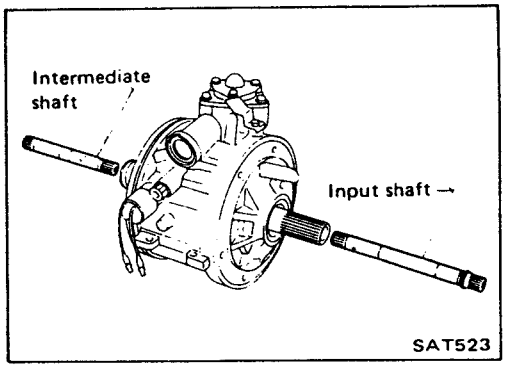
4. Remove oil pan and inspect its contents. An analysis of any foreign matter can indicate the types of problems to look for. If the fluid is very dark, smells burned, or contains foreign particles, the frictional material (clutches, band.) may need replacement. A tacky film that will not wipe clean indicates varnish build up which can cause valves, servo, and clutches to stick and may inhibit pump pressure.



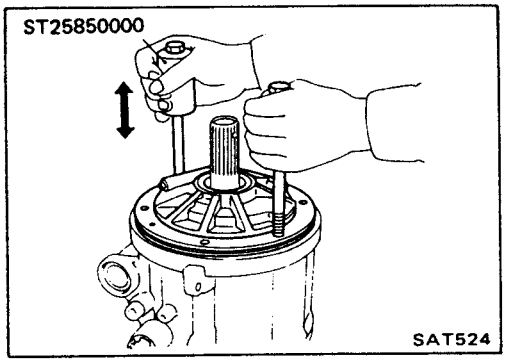
5. Loosen 2nd band servo piston stem lock nut and tighten piston stem.



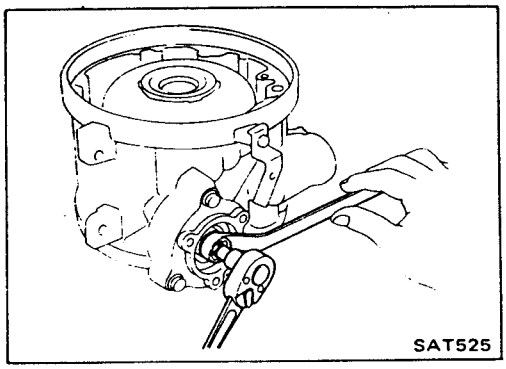
6. Remove O.D. component assembly, then remove front clutch thrust washer and needle bearing & race.



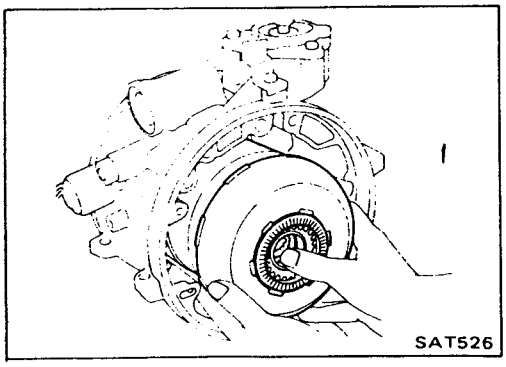
7. Draw out input shaft and intermediate shaft.



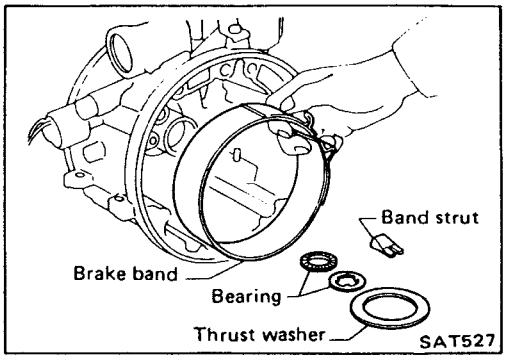
8. Attach Tool to pump and remove pump.



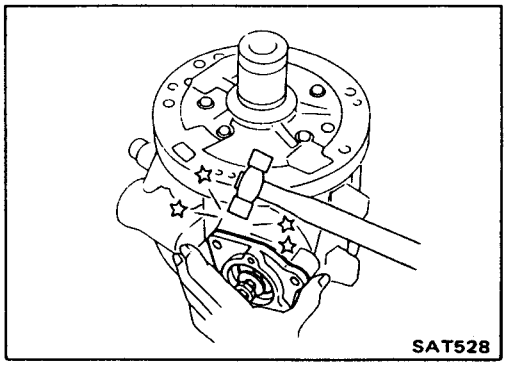
9. Remove O.D. servo cover, then loosen O.D. band servo piston stem.



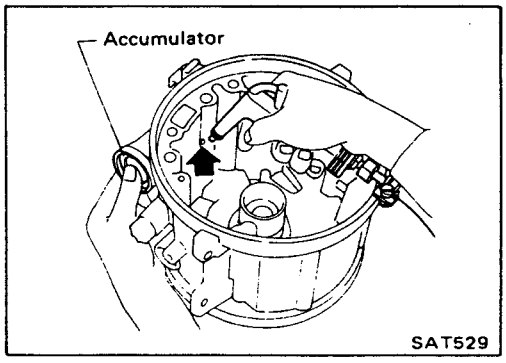
10. Remove O.D. pack (O.D. planetary gear & direct clutch assembly).



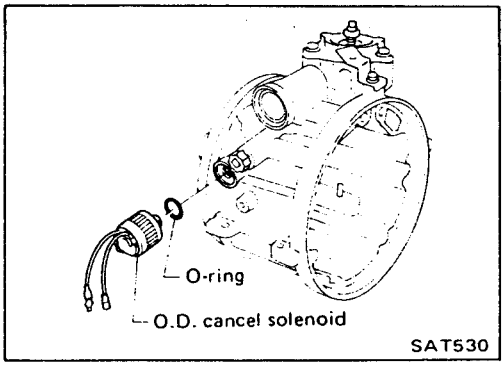
11. Remove needle bearing & race and direct clutch thrust washer, then remove O.D. brake band & strut.



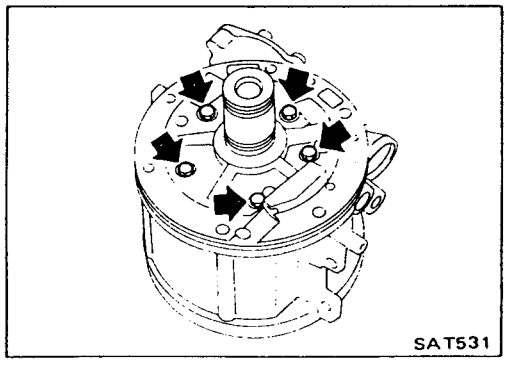
12. Remove O.D. servo assembly by lightly tapping retainer.



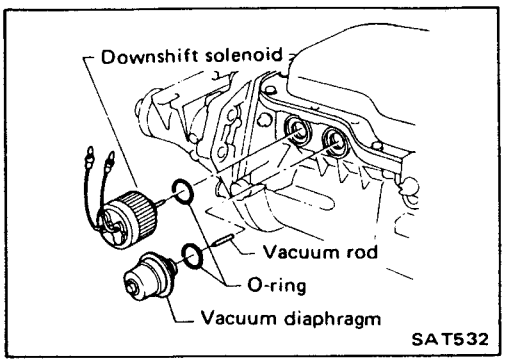
13. Remove accumulator snap ring, then apply pressure to remove accumulator plug, piston and spring.



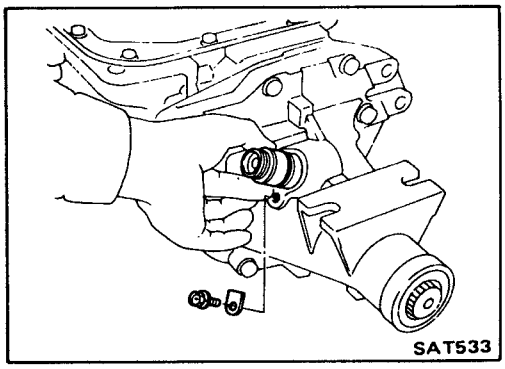
14. Remove O.D. cancel solenoid and O-ring.



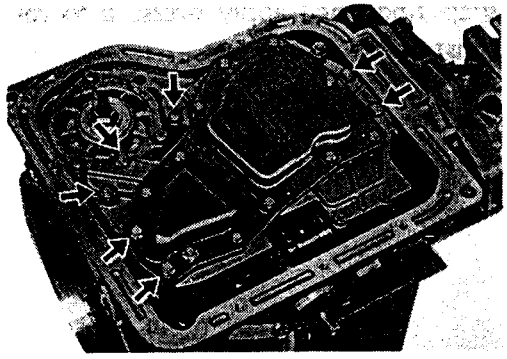
15. Remove drum support.



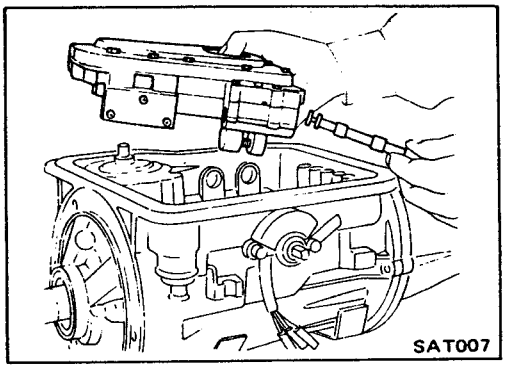
16. Remove downshift solenoid, vacuum diaphragm & rod and O-rings.



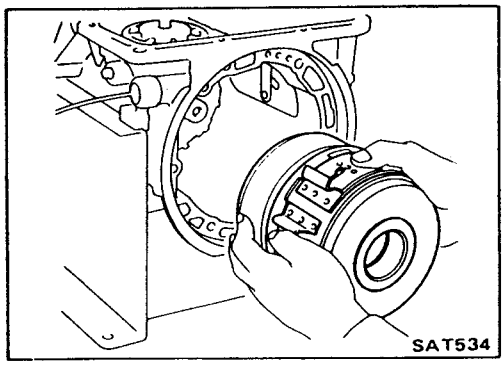
17. Remove speedometer pinion.



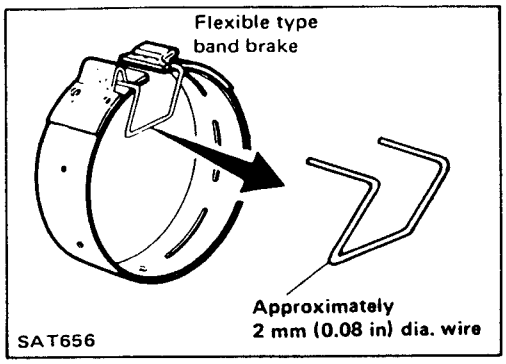
18. Remove control valve body.



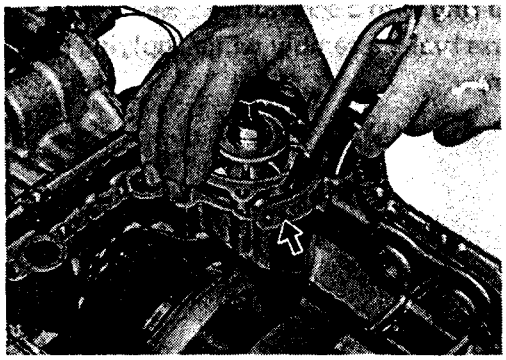
- Remove manual valve from valve body as a precaution, to prevent valve from dropping out accidentally.



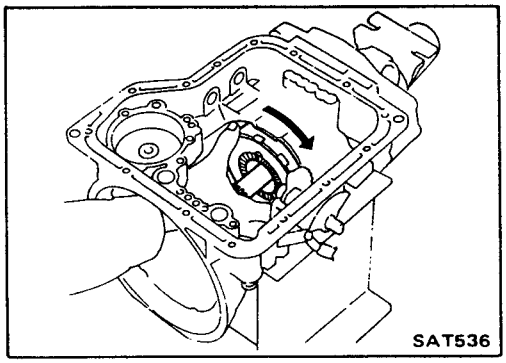
19. Remove 2nd brake band strut. Brake band and clutch & planetary gear pack [including front clutch, rear clutch and front planetary gear] may be removed together.



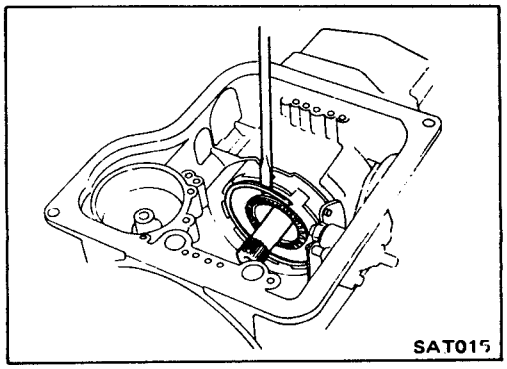
- To prevent brake linings from cracking or peeling, do not stretch the flexible band unnecessarily. Before removing the brake band, always secure it with a clip as shown in the figure to the left.
  Leave the clip in position after removing the brake band.



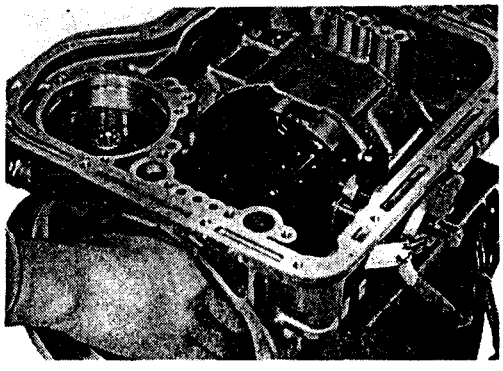
20. Remove 2nd band servo retaining bolts. Apply pressure to remove 2nd band servo.



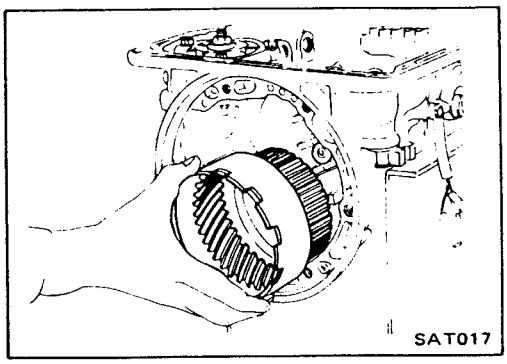
21. Check one-way clutch to see if it operates properly.



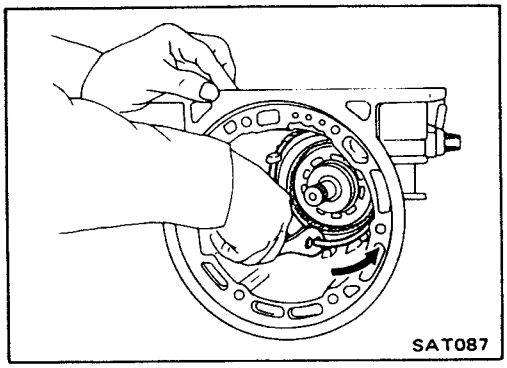
22. Remove rear planetary carrier snap ring and rear planetary carrier.



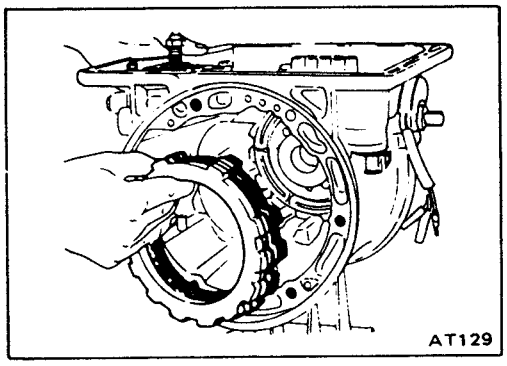
23. Remove output shaft snap ring.



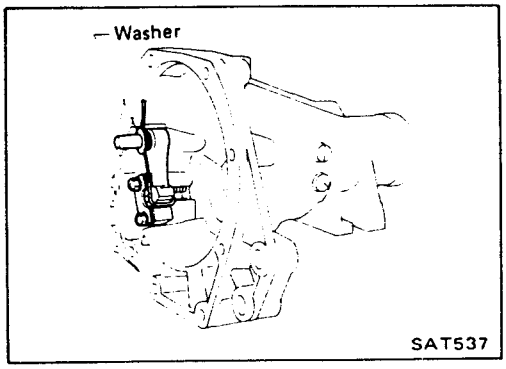
24. Remove connecting drum with internal gear.



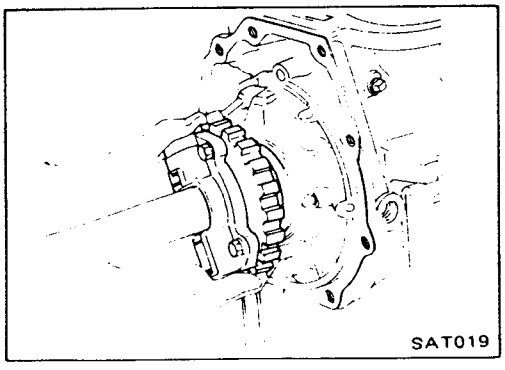
25. Pry off one end of snap ring with a screwdriver. Remove snap ring from low and reverse brake assembly while applying plier force in direction of arrow.



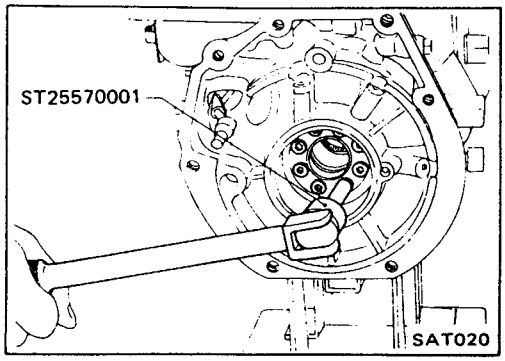
26. Remove low and reverse brake clutch assembly.



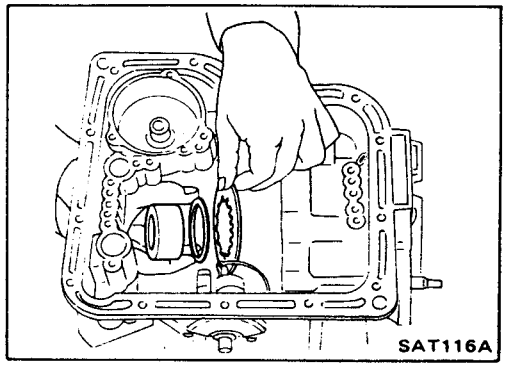
27. Remove rear extension.
Be careful not to lose retainer washer.



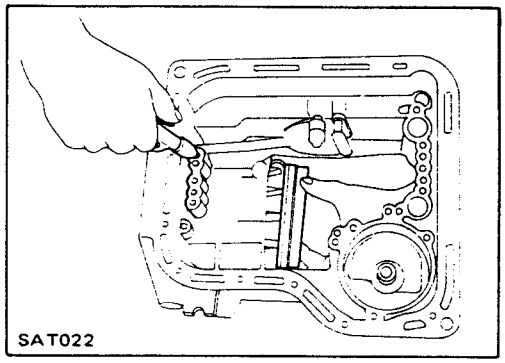
28. Remove output shaft with governor.



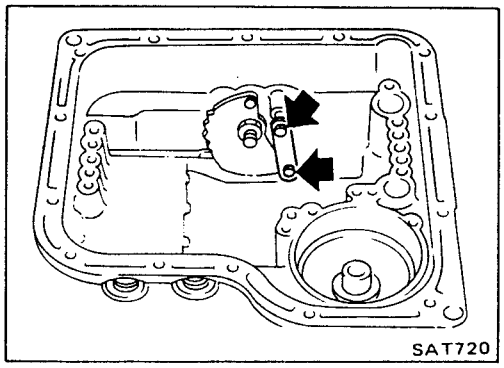
29. Remove governor thrust washer and needle bearing.
    Remove one-way clutch inner race attaching hex-head slotted bolts using Tool.



30. Remove one-way clutch inner race, return thrust washer, low and reverse return spring.



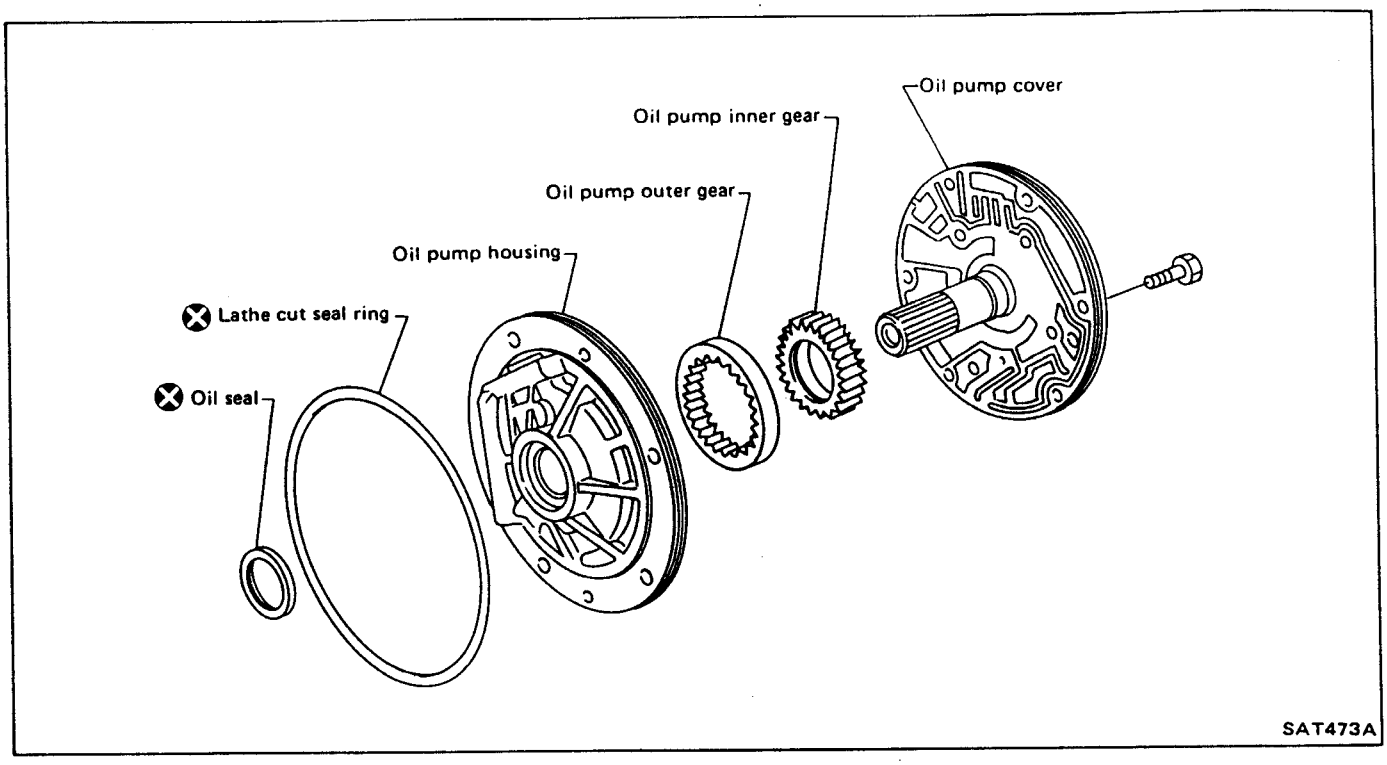
31. **Apply air pressure** to remove low and reverse brake piston.

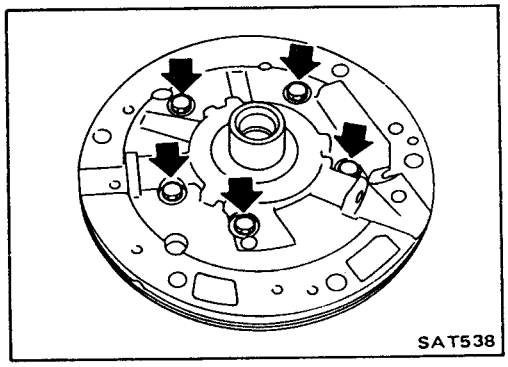


32. Remove snap ring, then remove lock nut, manual plate and parking rod.

33. Remove inhibitor switch and manual shaft.
34. Remove O.D. indicator switch and O-ring.

Oil Pump





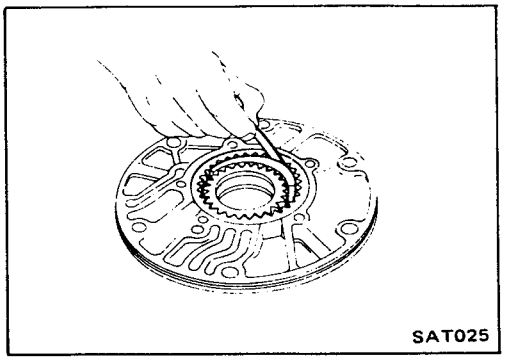
DISASSEMBLY

Remove pump cover from pump housing.

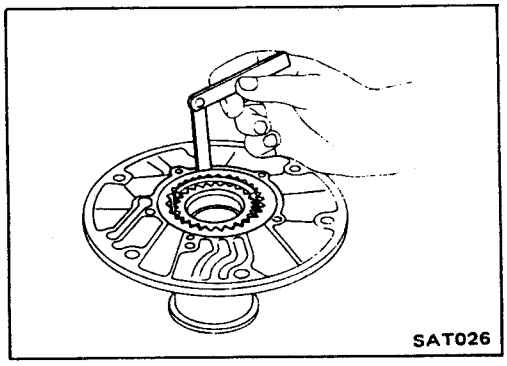
INSPECTION

1. Inspect pump body, bushing and pump shaft, for wear.
2. Inspect gears and all internal surfaces for damage and visible wear.

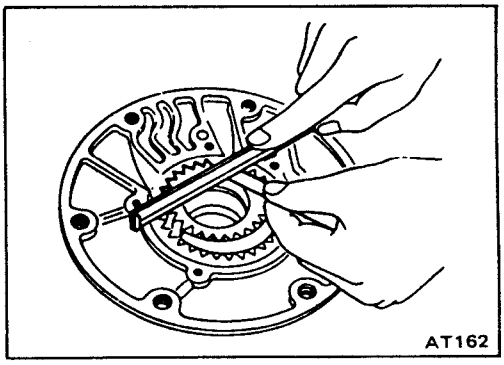
Oil Pump (Cont'd)


SAT025

3. Measure clearance between outer gear and crescent.
   Standard clearance:
   0.14 - 0.21 mm (0.0055 - 0.0083 in)
   Wear limit:
   0.25 mm (0.0098 in)


SAT026

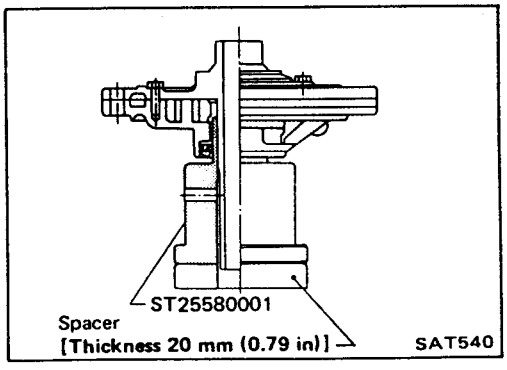
4. Measure clearance between outer gear and pump housing.
   Standard clearance:
   0.05 - 0.20 mm (0.0020 - 0.0079 in)
   Wear limit:
   0.25 mm (0.0098 in)


AT162

5. Using a feeler gauge and straight edge, measure clearance between gears and pump cover.
   Standard clearance:
   0.02 - 0.04 mm (0.0008 - 0.0016 in)
   Wear limit:
   0.08 mm (0.0031 in)

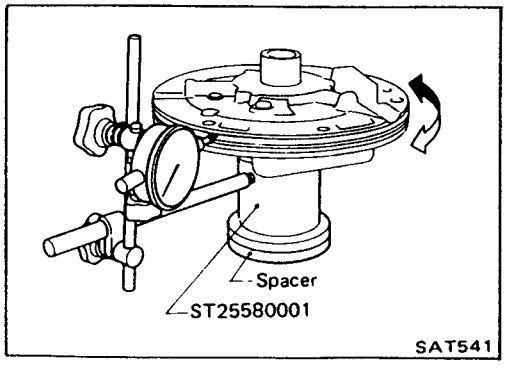
ASSEMBLY

1. Mount pump housing in Tool and suitable spacer. Set up pump housing with inner and outer pump gears on it and install pump cover to pump housing. Temporarily assemble oil pump.



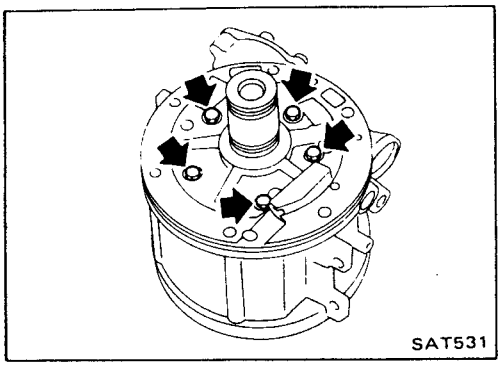
SAT540

2. Set the cover to within the runout of the specified total indicator reading.
   Total indicator reading:
   0.07 mm (0.0028 in) or less



SAT541

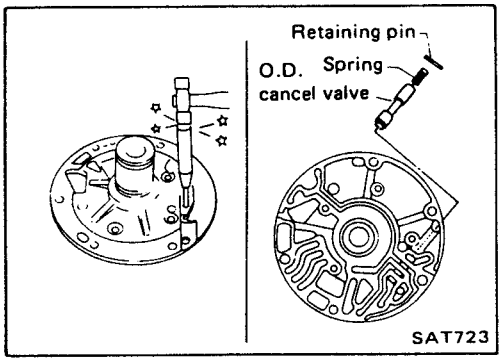
3. Tighten pump securing bolts to the specified torque. Recheck runout.


SAT531

Drum Support

DISASSEMBLY

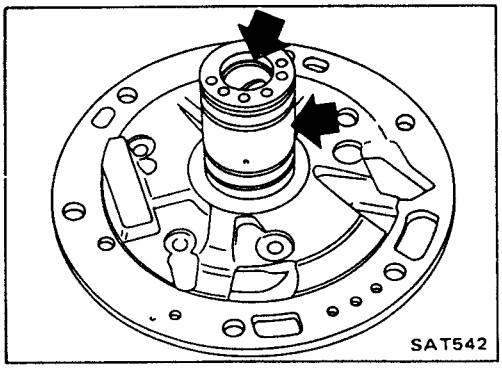
1. Remove drum support and gasket from O.D. case.



SAT723

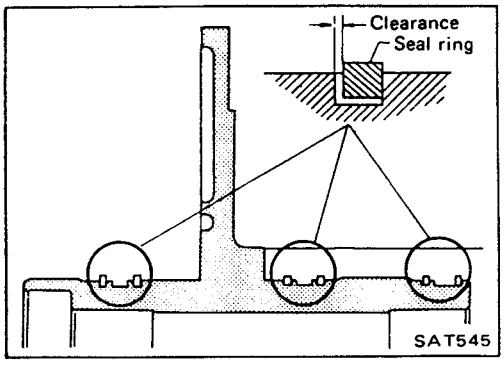
2. Stake off retaining pin using a punch [outer dia. 1.5 to 1.8 mm (0.059 to 0.071 in)], then remove O.D. cancel valve and spring.

Don't stake it off from contacting face side.


SAT542

INSPECTION

- Inspect drum support bushing and ring groove areas for wear.



SAT545

- Measure clearance between seal ring and ring groove.

  Standard clearance:

  0.05 - 0.20 mm (0.0020 - 0.0079 in)

  Wear limit:

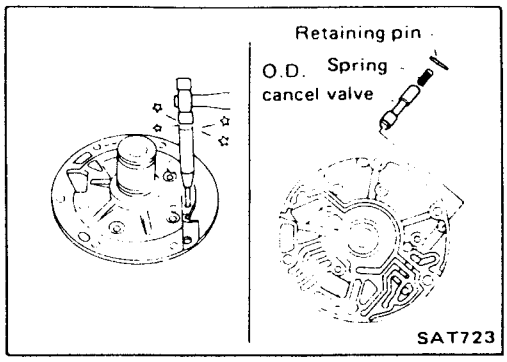
  0.20 mm (0.0079 in)

- Inspect O.D. cancel valve & spring and all internal surfaces for damage visible wear.

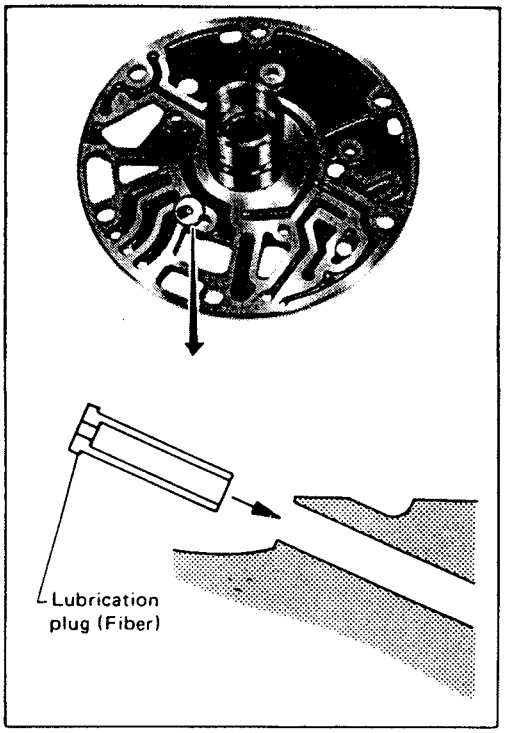
Drum Support (Cont'd)

ASSEMBLY

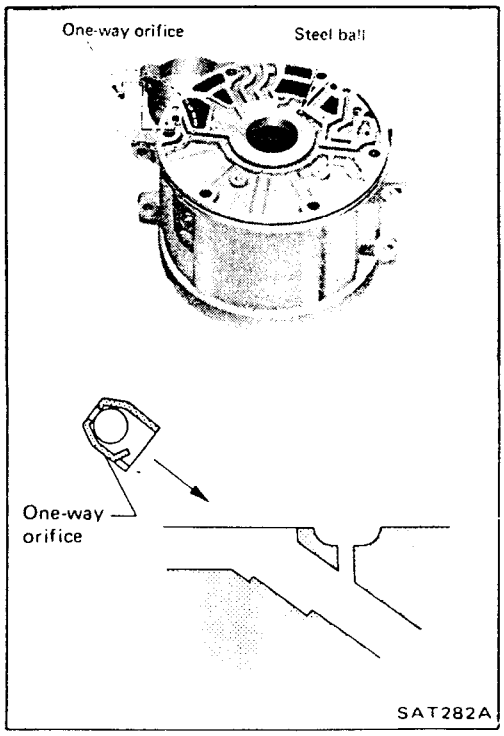
1. Install O.D. cancel valve and spring into drum support, then tap new retaining pins.



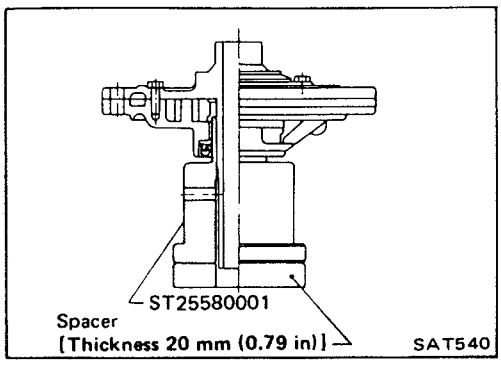
2. Install lubrication plug in drum support.



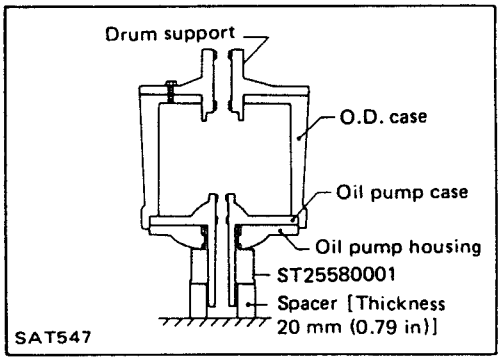
3. Install one-way orifice in O.D. case.



Drum Support (Cont'd)

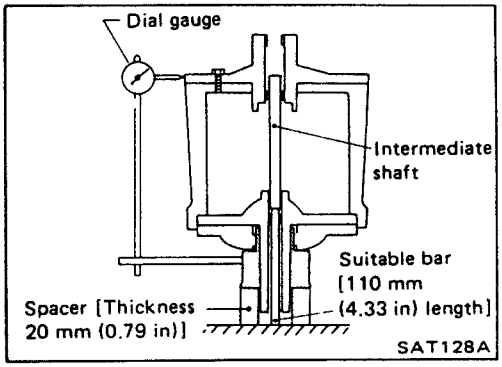


4. Mount oil pump assembly in Tool and suitable spacer.

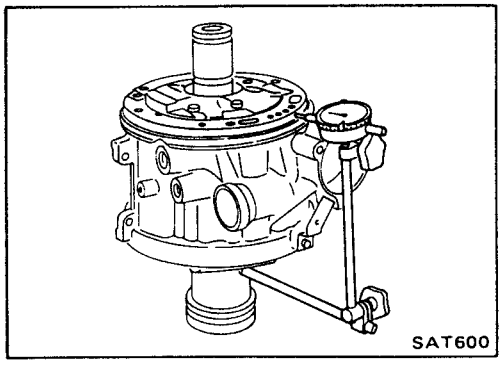


5. Mount O.D. case, drum support and gasket in oil pump assembly.

Ensure O.D. case is inserted properly into oil pump assembly.



6. Insert an approx. 110 mm (4.33 in) bar into bore in oil pump at shaft location and install intermediate shaft onto it.



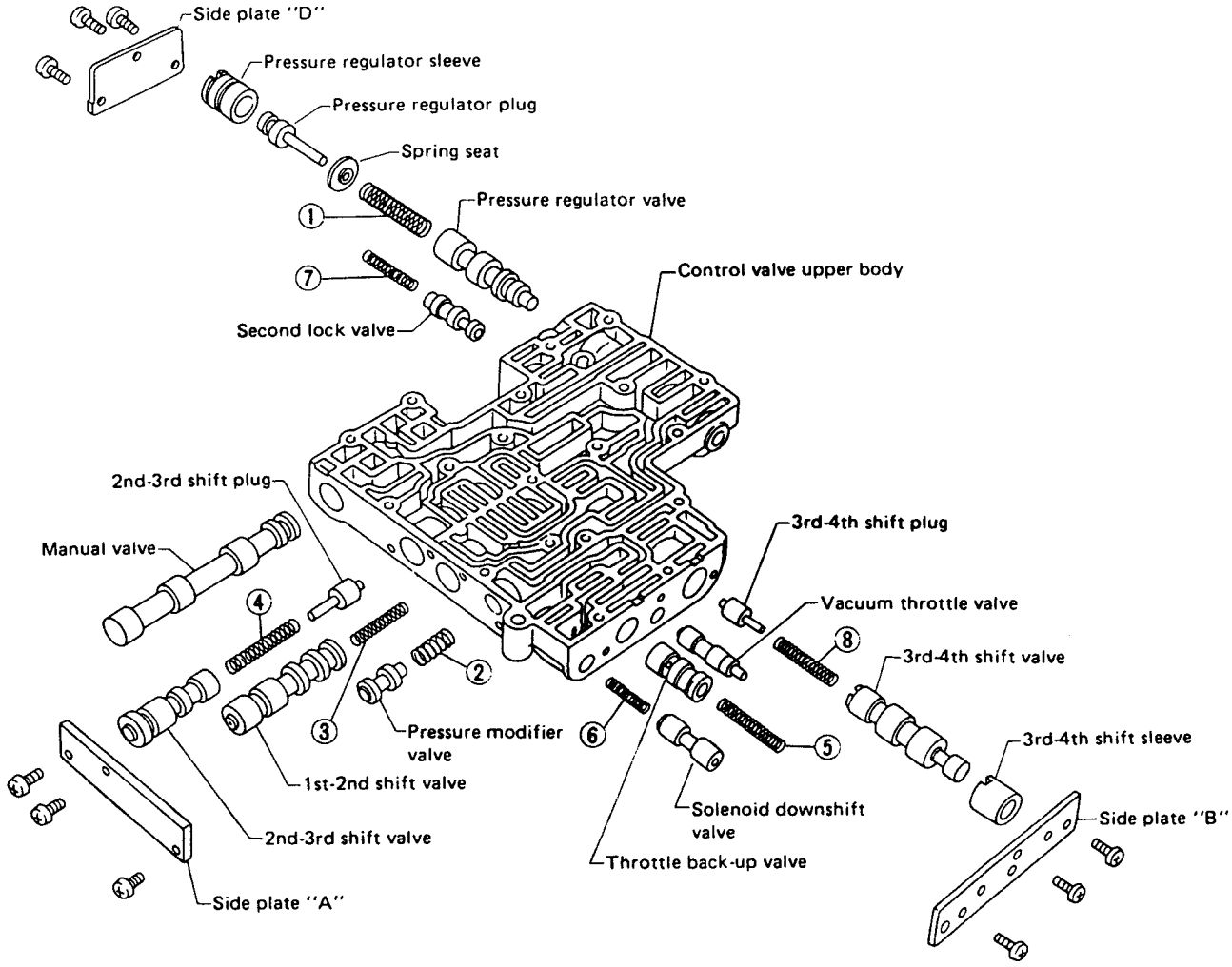
7. Set the drum support within the runout of the specified total indicator reading.

Total indicator reading:
0.05 mm (0.0020 in) or less

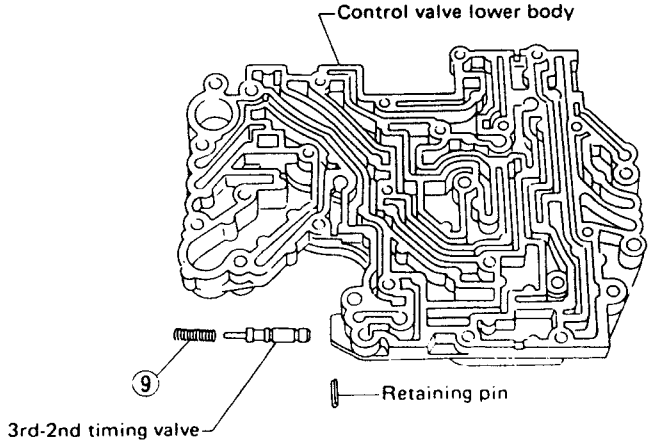
8. Tighten drum support securing bolts to the specified torque. Recheck runout.

Control Valve Body

Upper body side

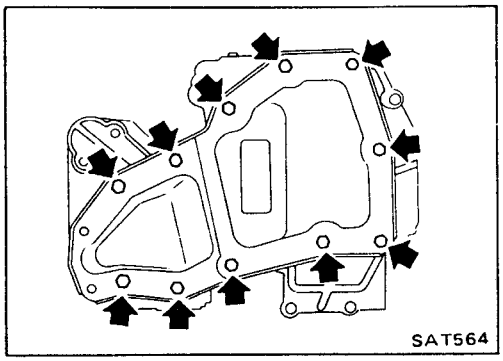


Lower body side



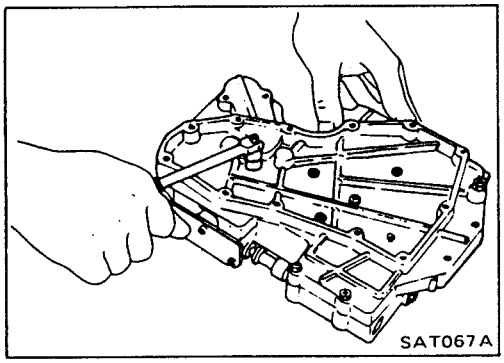
SAT621A

Control Valve Body (Cont'd)


SAT564

DISASSEMBLY

1. Remove oil strainer.


SAT067A

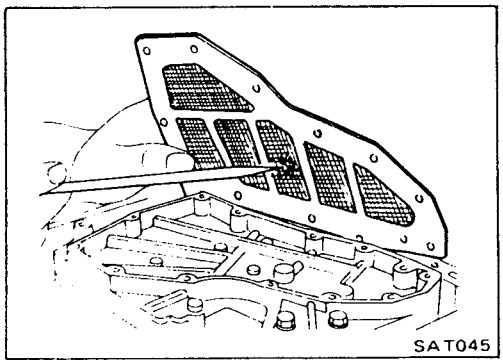
2. Separate lower body, separator plate and upper body.

Be careful not to scatter or lose orifice check valve, servo orifice check valve, or throttle relief check valve (ball) and related springs.

INSPECTION

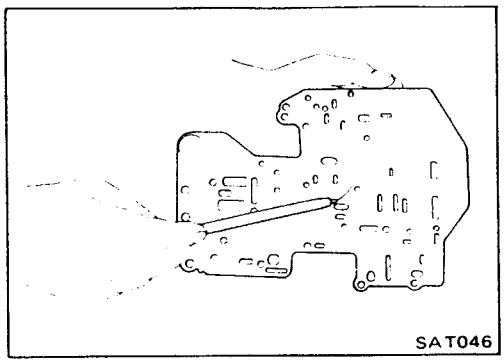
- If inspection reveals excessive clearances, 0.03 mm (0.0012 in) or more, between the valves and the valve body bores, replace the entire valve body.
- Always use crocus cloth, which is a very fine type of cutting material.
- During cleaning, do not remove the sharp edges of the valve.
- The valves may be cleaned using alcohol or lacquer thinner. The valve bodies can be dip cleaned with a good carburetor cleaner or lacquer thinner. Do not leave valve bodies submerged in carburetor cleaner longer than five minutes.
- Lubricate all parts in clean A.T.F. before reassembly.

1. Check valves for signs of burning. Replace if beyond clean-up.


SAT045

2. Check oil strainer for general condition. Replace if necessary.

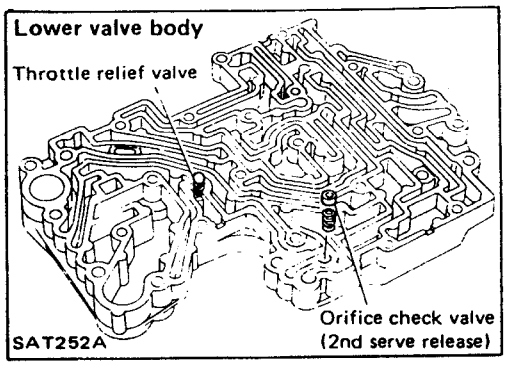
Control Valve Body (Cont'd)

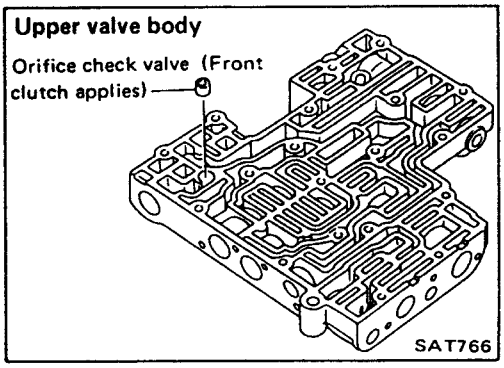


3. Check separator plate for scratches or damage. Replace if necessary. Scratches or score marks can cause oil to by-pass correct oil passages and result in system malfunction.

4. Check oil passages in upper and lower valve bodies for varnish deposits, scratches or other damage that would impair valve movement. Check threaded holes and related bolts and screws for stripped threads; replace as needed.
5. Check valve springs for damage. Measure free length of valve springs. If the free length is out of specification, replace it. Numbers of each valve spring listed in table below are the same as those in the figure on page 47.

Valve spring		Free length mm (in)
① Pressure regulator valve		43.0 (1.693)
② Pressure modifier valve	Z24S	20.4 (0.803)
	TD23, TD27	18.5 (0.728)
③ 1st-2nd shift valve	Z24S	33.25 (1.3091)
	TD23, TD27	32.2 (1.268)
④ 2nd-3rd shift valve	Z24S	31.6 (1.244)
	TD23, TD27	41.0 (1.614)
⑤ Throttle back-up valve	Z24S	31.8 (1.252)
	TD23,TD27	27.6 (1.087)
⑥ Solenoid downshift valve		22.0 (0.866)
⑦ Second lock valve		33.5 (1.319)
Throttle relief check valve		26.8 (1.055)
Orifice check valve		15.5 (0.610)
⑧ 3rd-4th shift valve		30.3 (1.193)
⑨ 3rd-2nd timing valve		22.7 (0.894)





Control Valve Body (Cont'd)

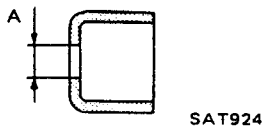
ASSEMBLY

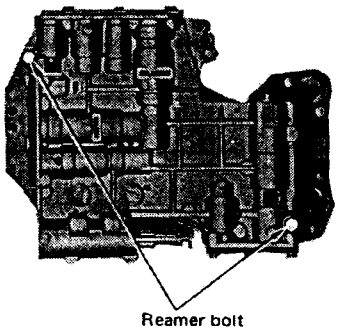
1. Install orifice check valves, valve springs, throttle relief valve spring and steel ball in valve body.

Orifice check valve

Unit: mm (in)

Orifice check valve		Diameter "A"	Identification
2nd servo release	Z24S	1.8 (0.071)	Gold
	TD23	1.7 (0.067)	Black
	TD27	1.5 (0.059)	Black
Front clutch applies		2.2 (0.087)	Black

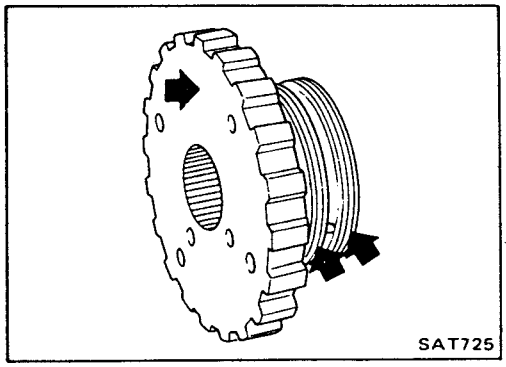




2. Assemble separator plate and upper valve body on lower valve body, then tighten bolts.

When installing these bolts, first be sure to install the two reamer bolts to their original positions.

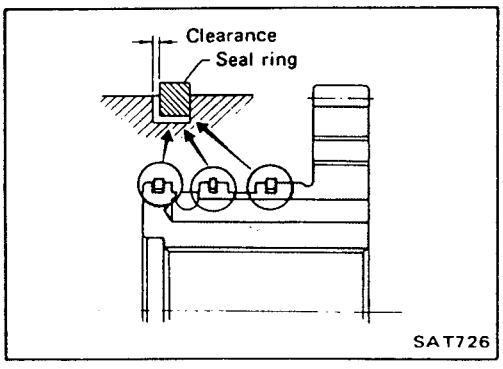
3. Install oil strainer.



Oil Distributor

INSPECTION

- Inspect contacting surface of oil distributor and ring groove areas for wear.



- Measure clearance between seal ring and ring groove.

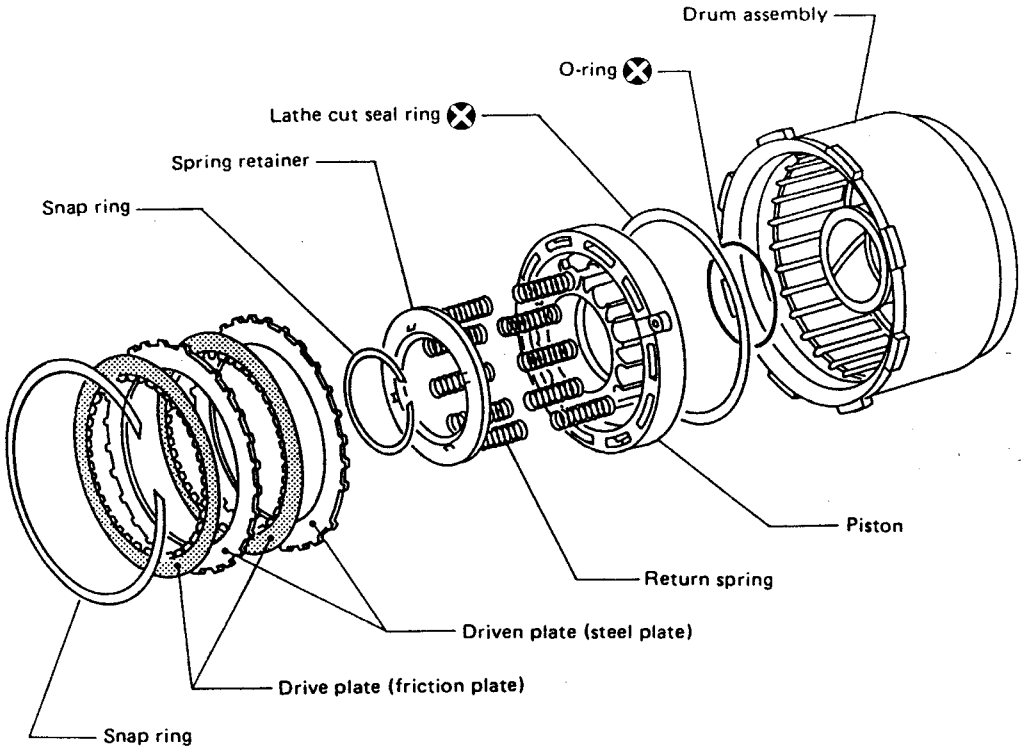
  Standard clearance:

  0.04 - 0.16 mm (0.0016 - 0.0063 in)

  Wear limit:

  0.16 mm (0.0063 in)

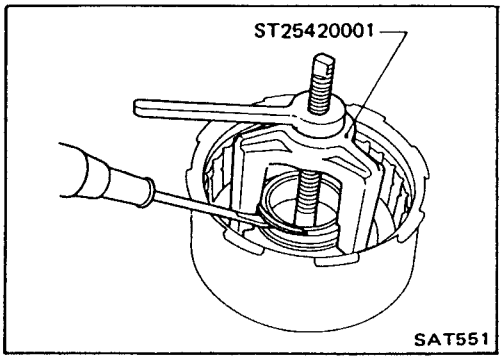
Direct Clutch



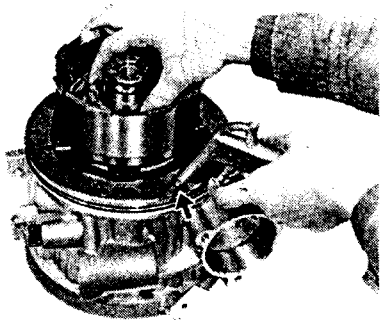
SST228A

Direct Clutch (Cont'd)

DISASSEMBLY



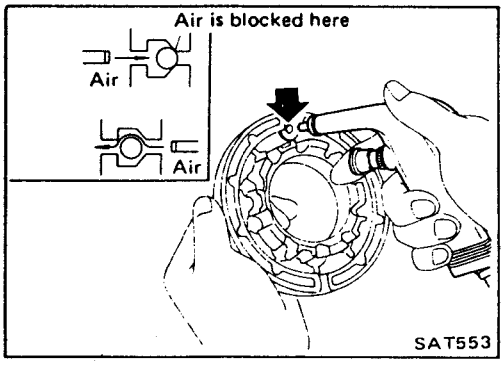
- Compress clutch springs and remove snap ring from spring retainer with Tool.



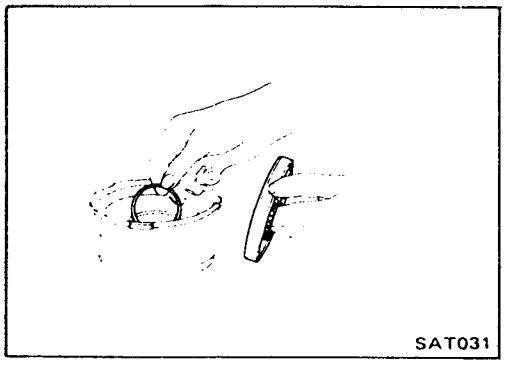
- For easy removal of piston from drum, mount clutch on drum support. Use an air gun with a tapered rubber up to carefully apply air pressure to loosen piston from drum.

INSPECTION AND ASSEMBLY

1. Check clutch drive plate facing for wear or damage.
   Standard thickness:
   1.50 - 1.65 mm (0.0591 - 0.0650 in)
   Wear limit:
   1.4 mm (0.055 in)
2. Check for wear on snapring, weak or broken coil springs, and warped spring retainer.

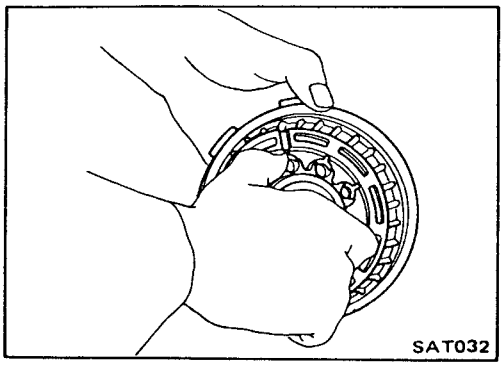


3. Check the operation of check ball in piston using compressed air.

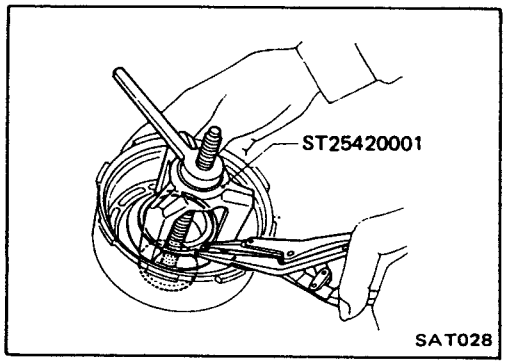


4. Lubricate clutch drum hub and seals, and install inner seal and piston seal as illustrated. Be careful not to stretch seals during installation.

Direct Clutch (Cont'd)

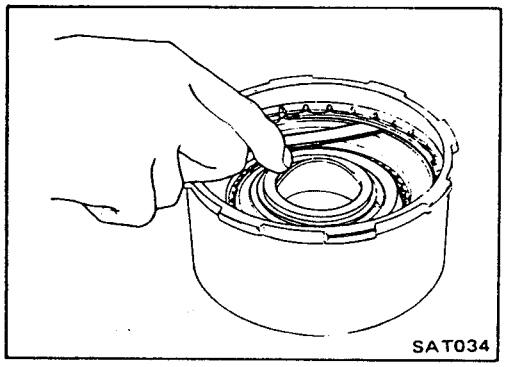


5. Assemble piston, being careful not to allow seal to kink or become damaged during installation. After installing, turn piston by hand to ensure that there is no binding.



6. Reassemble spring and retainer. Reinstall snap ring. Be sure snap ring is properly seated.

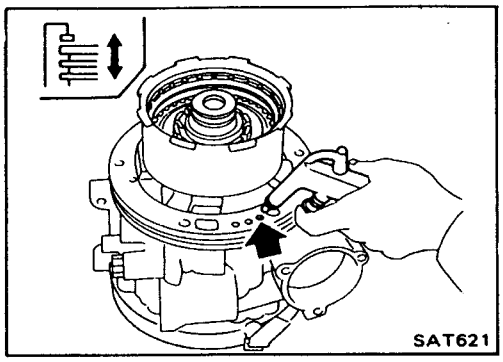
7. Install driven plates, drive plates, and secure with snap ring.
8. Install retainer plate, O.D. one-way clutch assembly, race side, and secure with snap ring.



9. Measure clearance between race side and snap ring.
   Specified clearance:
   0 - 0.2 mm (0 - 0.008 in)
   If necessary, try other race sides having different thicknesses until correct clearance is obtained.

Thickness mm (in)	Part number
0.4 (0.016)	31606-X8501
0.6 (0.024)	31606-X8502
0.8 (0.031)	31606-X8500
1.0 (0.039)	31606-X8503
1.2 (0.047)	31606-X8504

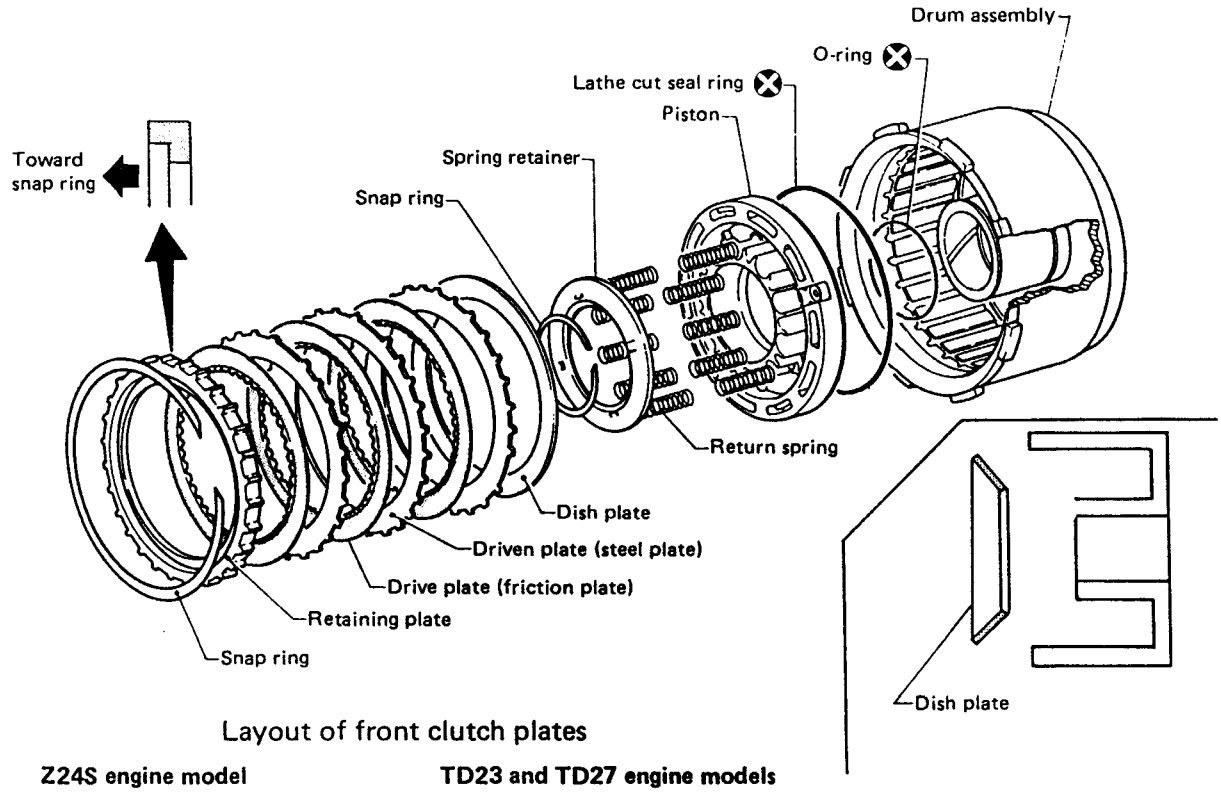
Direct Clutch (Cont'd)



10. Testing direct clutch.
    With direct clutch assembled on drum support, direct a jet of air into hole in clutch drum for definite clutch operation.

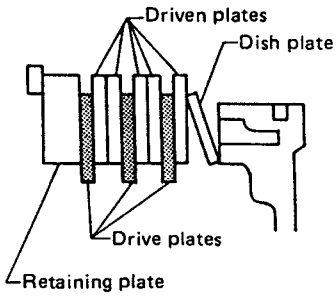
Front Clutch

Number of return springs 5

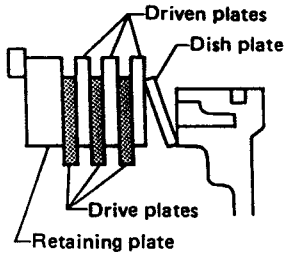


Layout of front clutch plates

Z24S engine model



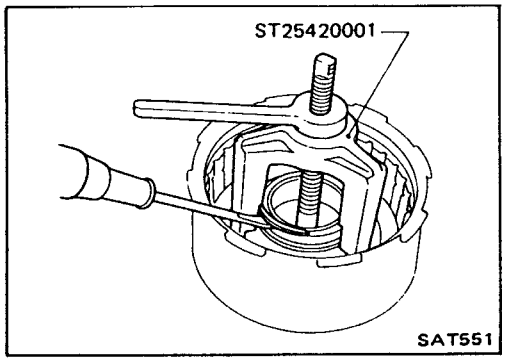
TD23 and TD27 engine models



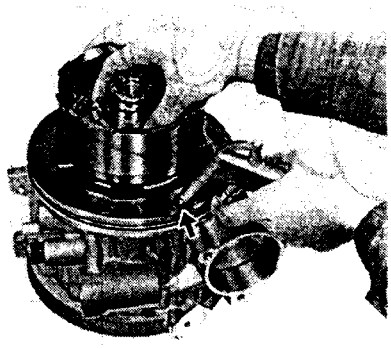
SAT600A

Front Clutch (Cont'd)

DISASSEMBLY



- Compress clutch springs and remove snap ring from spring retainer with Tool.



- For easy removal of piston from drum, mount clutch on drum support. Use an air gun with a tapered rubber up to carefully apply air pressure to loosen piston from drum.

INSPECTION AND ASSEMBLY

1. Check clutch drive plate facing for wear or damage.

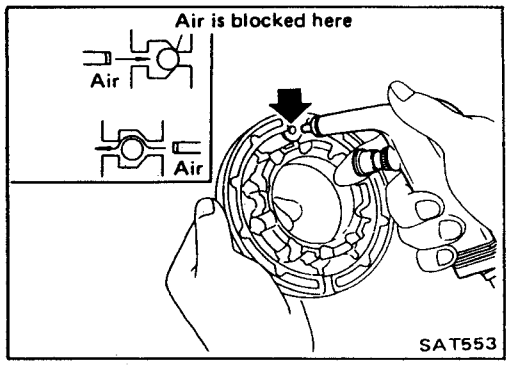
   Standard thickness:

   1.50 - 1.65 mm (0.0591 - 0.0650 in)

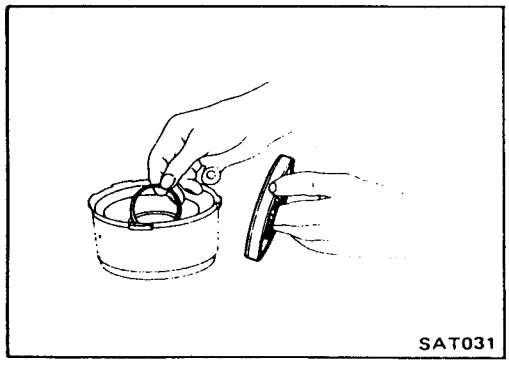
   Wear limit:

   1.4 mm (0.055 in)

2. Check for wear on snapring, weak or broken coil springs, and warped spring retainer.

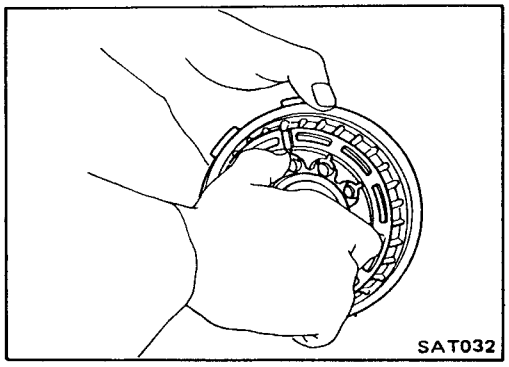


3. Check the operation of check ball in piston using compressed air.

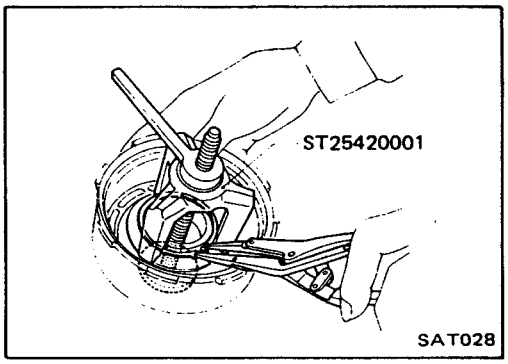


4. Lubricate clutch drum hub and seals, and install inner seal and piston seal as illustrated. Be careful not to stretch seals during installation.

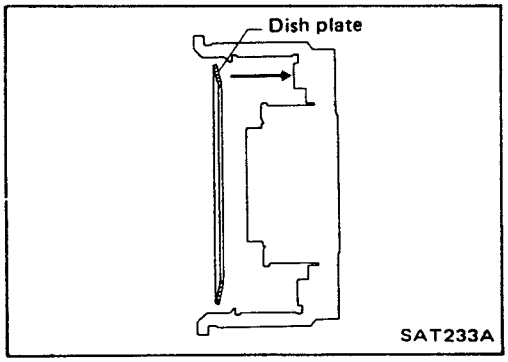
Front Clutch (Cont'd)



5. Assemble piston, being careful not to allow seal to kink or become damaged during installation. After installing, turn piston by hand to ensure that there is no binding.

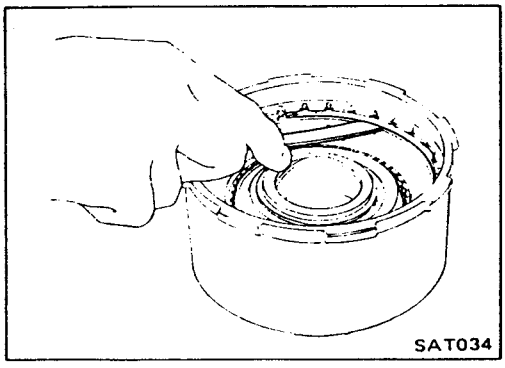


6. Reassemble spring and retainer. Reinstall snap ring. Be sure snap ring is properly seated.



7. Install dish plate.

8. Install driven plates, drive plates, and secure with snap ring.

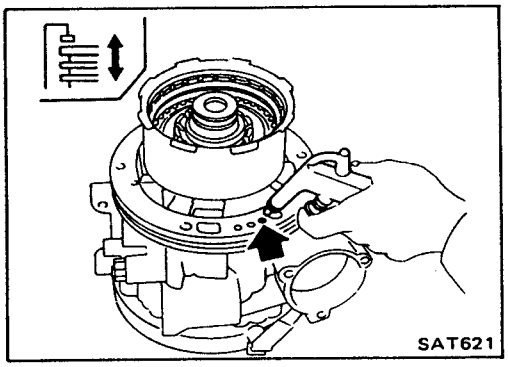


9. Measure clearance between retaining plate and snap ring.
   Specified clearance:
   1.6 - 1.8 mm (0.063 - 0.071 in)
   If necessary, try other retaining plates having different thicknesses until correct clearance is obtained.

Front Clutch (Cont'd)

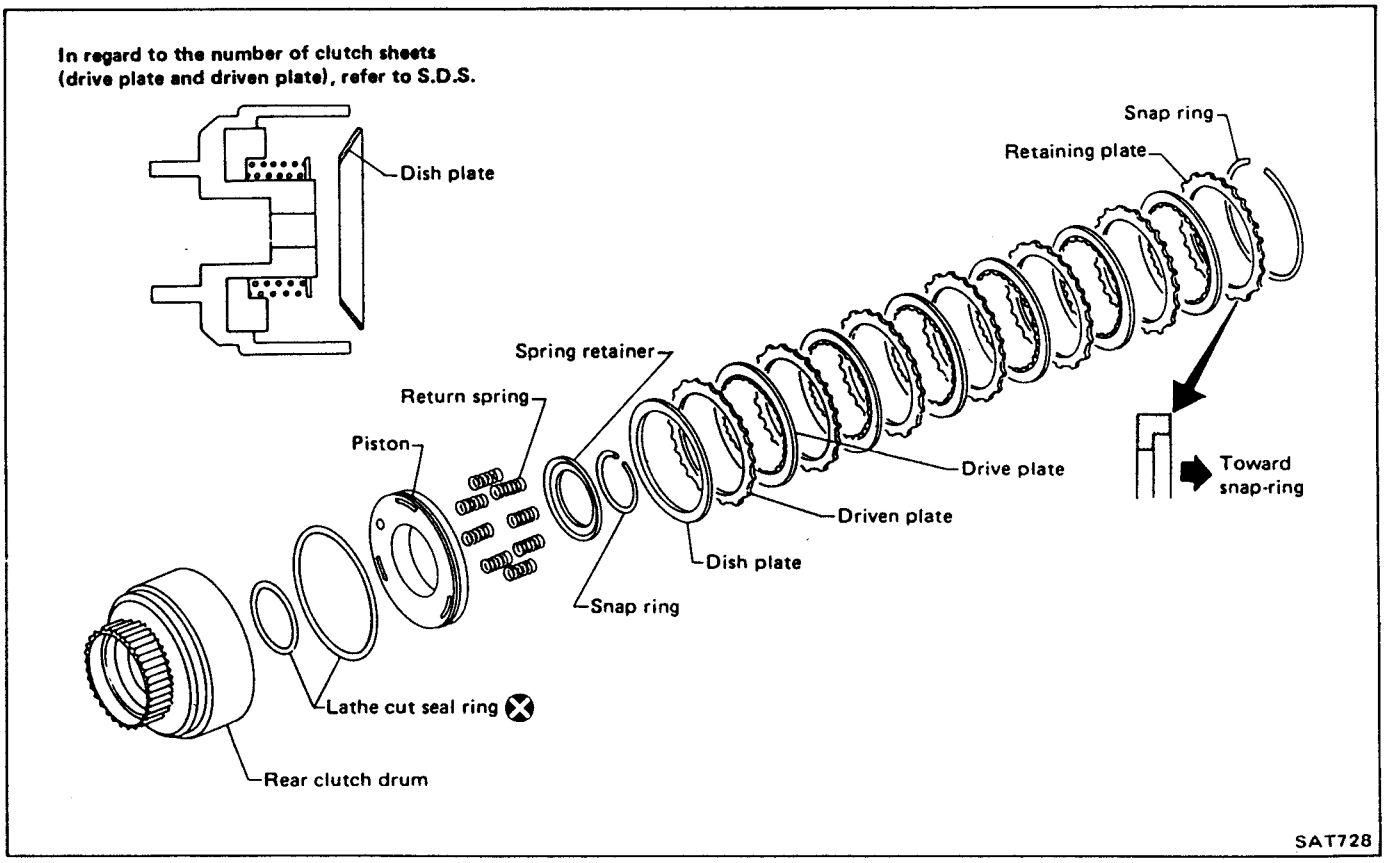
Available retaining plate

Thickness mm (in)	Part number
5.0 (0.197)	31567-X2900
5.2 (0.205)	31567-X2901
5.4 (0.213)	31567-X2902
5.6 (0.220)	31567-X2903
5.8 (0.228)	31567-X2904
6.0 (0.236)	31567-X2905

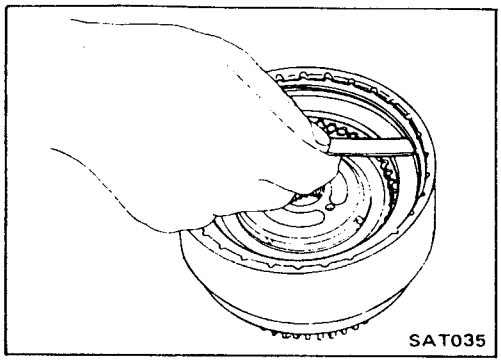


10. Testing front clutch.
    With Front clutch assembled on drum support, direct a jet of air into hole in clutch drum for definite clutch operation.

Rear Clutch

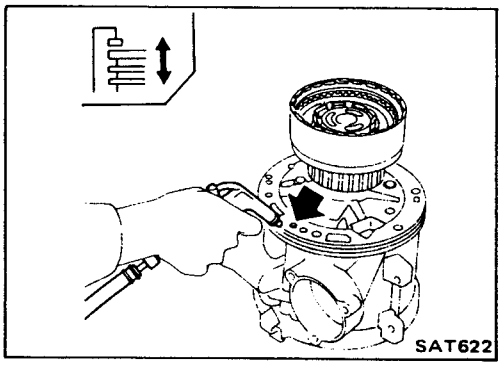


Rear Clutch (Cont'd)



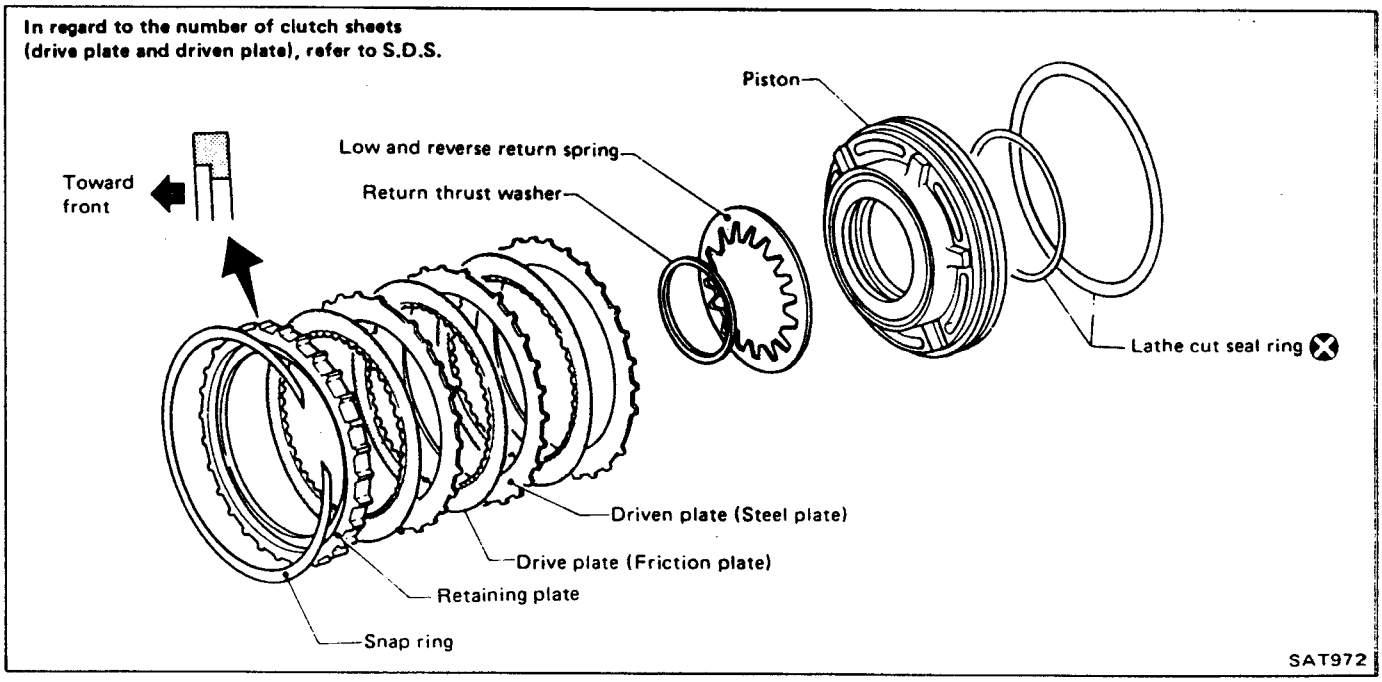
- Service procedures for rear clutch are essentially the same as those for front clutch, with the following exception:

I. **Specified clearance between retaining plate and snap ring:**
0.8 - 1.0 mm (0.031 - 0.039 in)



II. **Testing rear clutch**

Low & Reverse Brake



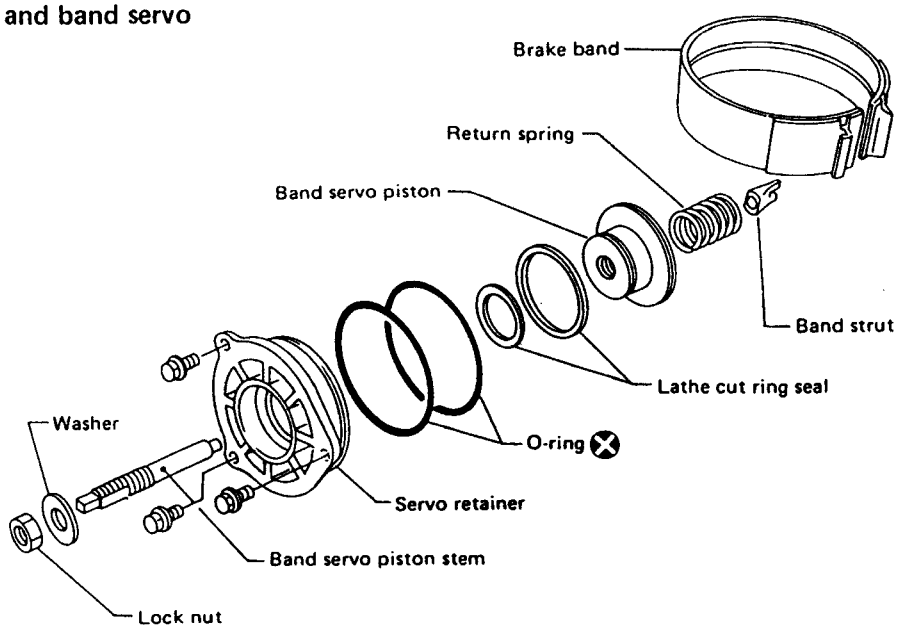
INSPECTION

- Examine for damaged drive plate facing and worn snap ring.
- Check drive plate facing for wear; if necessary, replace.

Drive plate thickness:
Standard
1.90 - 2.05 mm (0.0748 - 0.0807 in)
Allowable limit
1.8 mm (0.071 in)

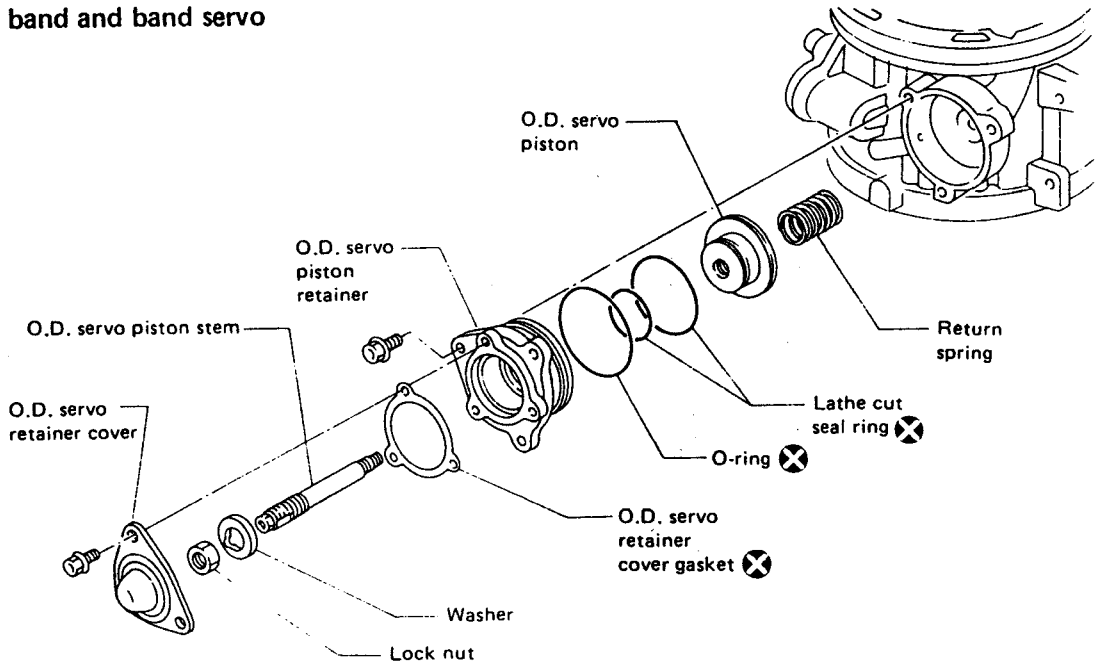
Brake Band and Band Servo

2nd brake band and band servo

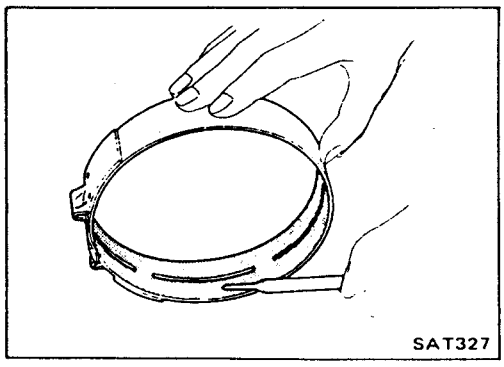


SAT559

O.D. brake band and band servo



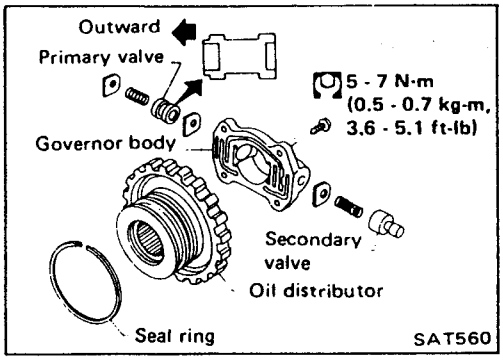
SST231A



SAT327

INSPECTION

- Inspect band friction material for wear. If cracked, chipped or burnt spots are apparent, replace the band.
- Check band servo components for wear and scoring.



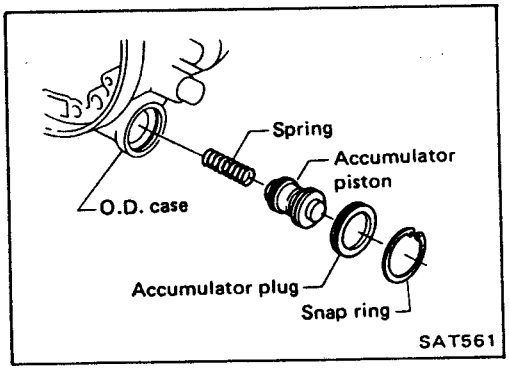
Governor

INSPECTION

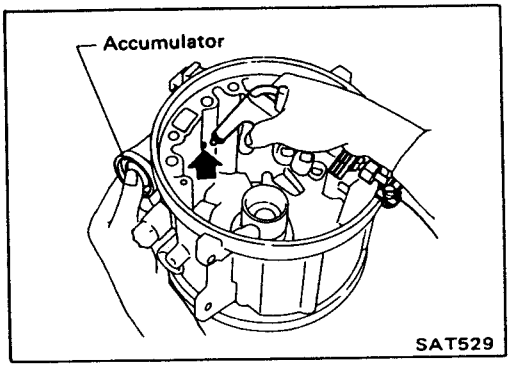
- Check governor valves and valve body for indication of burning or scratches.
- Check valve springs for damage.
  Measure free length of valve springs.

Valve spring		Free length mm (in)
Primary governor	Z24S	21.8 (0.858)
	TD23, TD27	10.5 (0.413)
Secondary governor	Z24S	25.1 (0.988)
	TD23, TD27	19.8 (0.780)

If any abnormalities are found, replace governor body, valves and springs as an assembly.

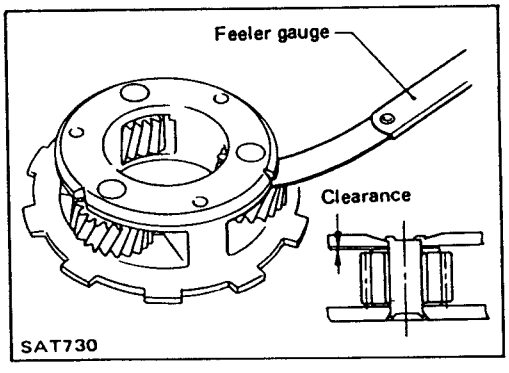


Accumulator



DISASSEMBLY & INSPECTION

- Remove snap ring, then apply pressure to remove accumulator plug, piston and spring.
- Check accumulator components for wear and scoring



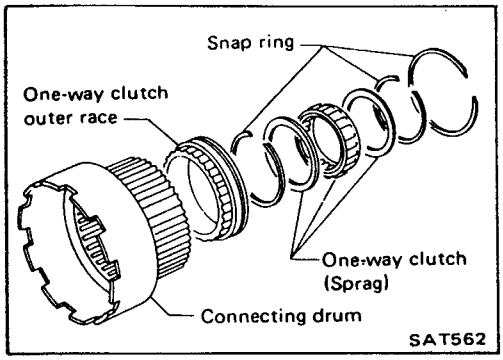
Planetary Carrier

INSPECTION

- Check clearance between pinion washer and planetary carrier with a feeler.

  Standard clearance:
  0.20 - 0.70 mm (0.0079 - 0.0276 in)
  Wear limit:
  0.80 mm (0.0315 in)

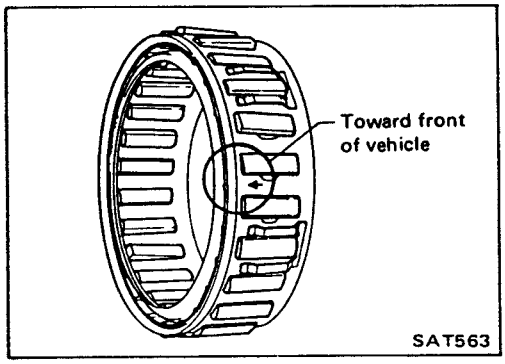
- Check planetary gear sets and bearings for damaged or worn gears.



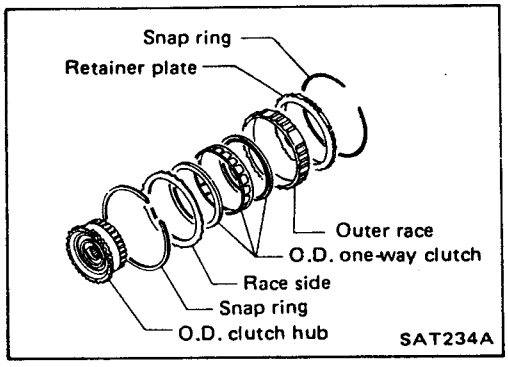
Connecting Drum Assembly

If one-way clutch is out of order as determined during disassembly, repair it as follows:

1. Remove each snap ring, then draw out one-way clutch inner & outer race.



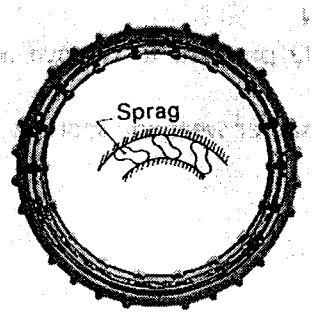
2. Inspect one-way sprag and contacting surface for wear or burns.
   Replace parts as necessary.
3. Assemble those parts.



O.D. One-way Clutch

If one-way clutch is out of order as determined during disassembly, repair it as follows:

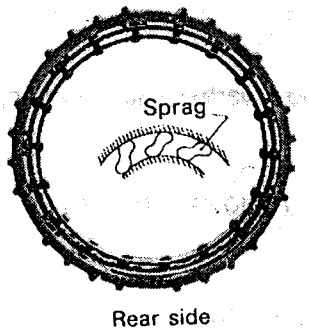
1. Remove each snap ring, then draw out O.D. one-way clutch.
2. Inspect one-way sprag and contacting surface for wear or burns.
   Replace parts as necessary.



Front side

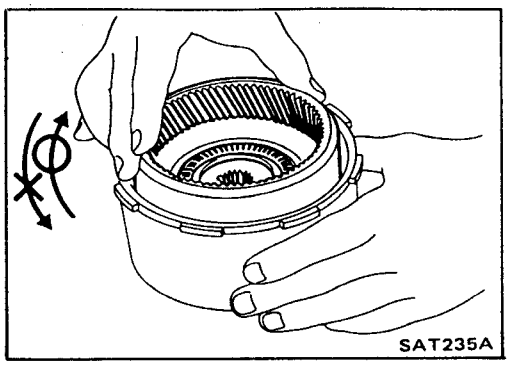
3. Assemble those parts.

Pay attention to direction of O.D. one-way clutch.



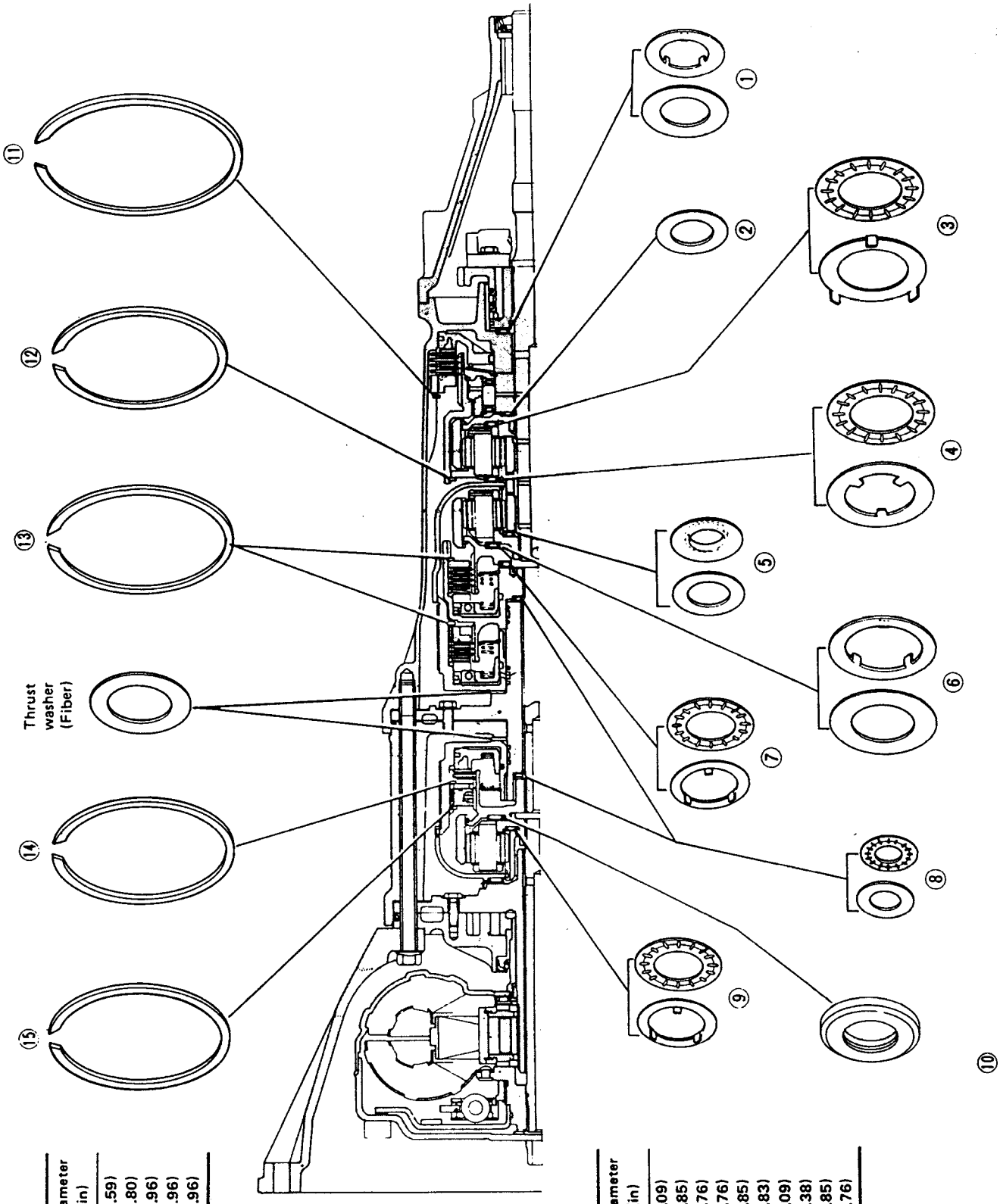
Rear side

O.D. One-way Clutch (Cont'd)



4. After assembly, check O.D. one-way clutch to see if it operates properly.

When installing/assembling needle bearing, bearing race, snap ring and thrust washer, use the following illustration as a guide to installation procedures and locations.

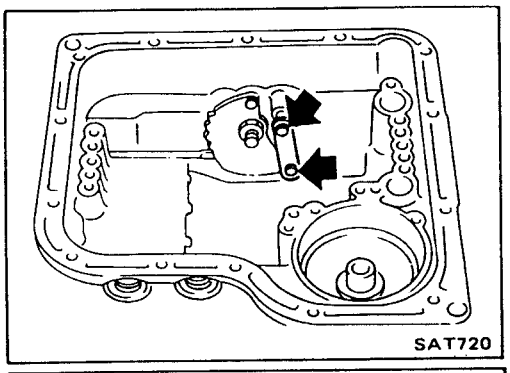


Snap ring

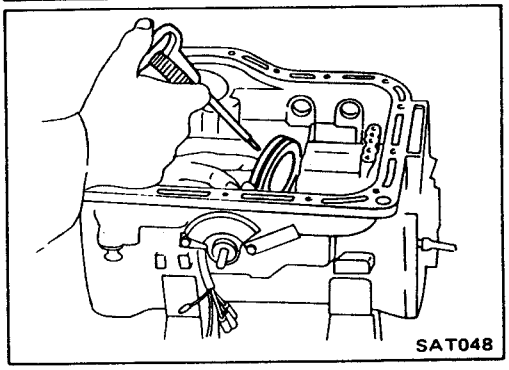
No.	Outer diameter mm (in)
11	142 (5.59)
12	122 (4.80)
13	126 (4.96)
14	126 (4.96)
15	126 (4.96)

Needle bearing

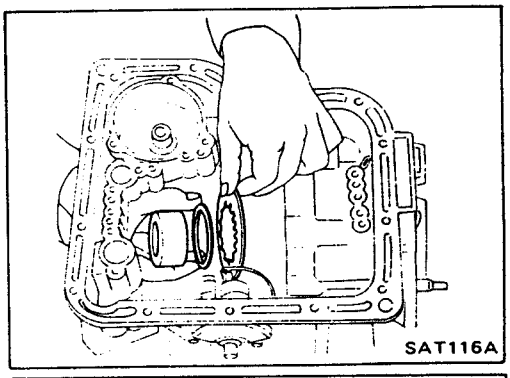
No.	Outer diameter mm (in)
1	53 (2.09)
2	47 (1.85)
3	70 (2.76)
4	70 (2.76)
5	47 (1.85)
6	72 (2.83)
7	53 (2.09)
8	35 (1.38)
9	47 (1.85)
10	70 (2.76)



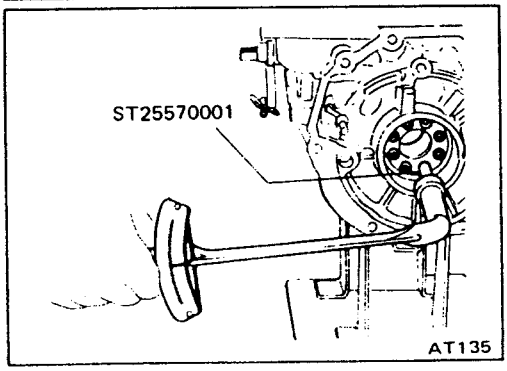
1. Install parking rod, manual plate, manual plate lock nut, parking brake lever and snap rings.



2. Lubricate and install low and reverse piston into the case.

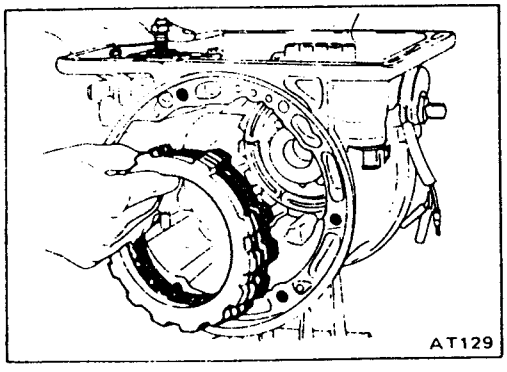


3. Install piston return spring, thrust washer and one-way clutch inner race.

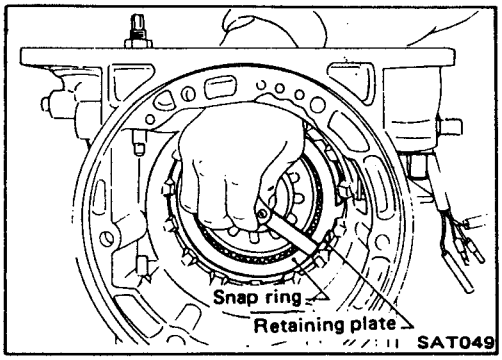


4. Install hex-head slotted bolts.

Check that return spring is centered on race before tightening.



5. Install steel dished plate first, then steel and friction plates, and, finally, retaining plate and snap-ring.

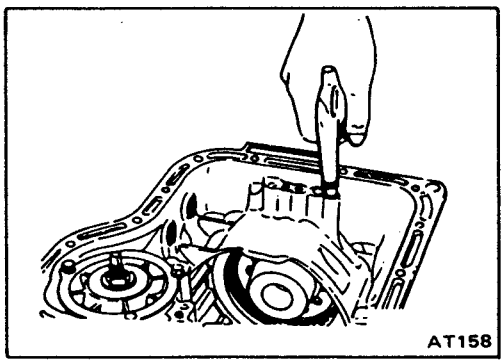


6. After low and reverse brake has been completely assembled, measure clearance between snap ring and retaining plate. If measurement exceeds specifications adjust by replacing retaining plate with one of a different thickness.

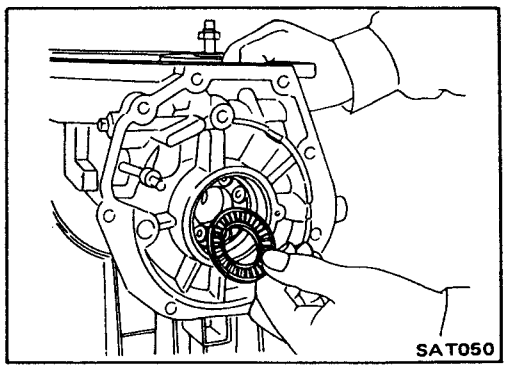
Low and reverse brake clearance:
0.80 - 1.05 mm (0.0315 - 0.0413 in)

Available retaining plates

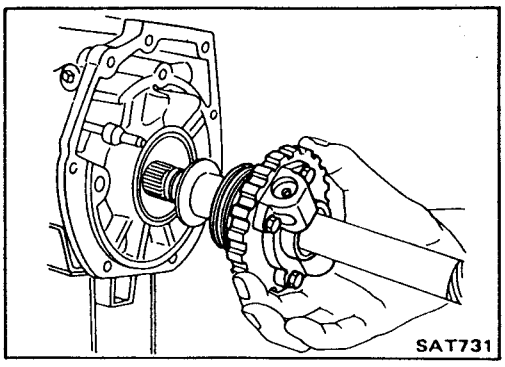
Z24S and TD27 engine models		TD23 engine model	
Thickness mm (in)	Part number	Thickness mm (in)	Part number
11.8 (0.465)	31667-X0300	7.8 (0.307)	31667-X0500
12.0 (0.472)	31667-X0301	8.0 (0.315)	31667-X0501
12.2 (0.480)	31667-X0302	8.2 (0.323)	31667-X0502
12.4 (0.488)	31667-X0303	8.4 (0.331)	31667-X0503
12.6 (0.496)	31667-X0304	8.6 (0.339)	31667-X0504
12.8 (0.504)	31667-X0305	8.8 (0.346)	31667-X0505



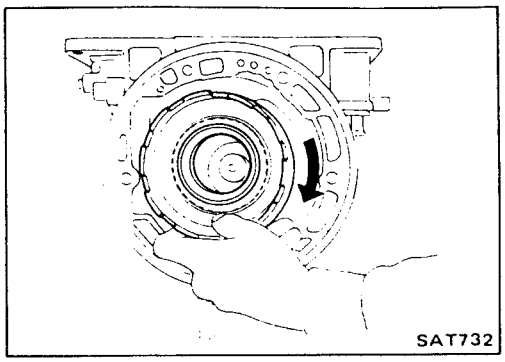
7. Check low and reverse brake operation using compressed air.



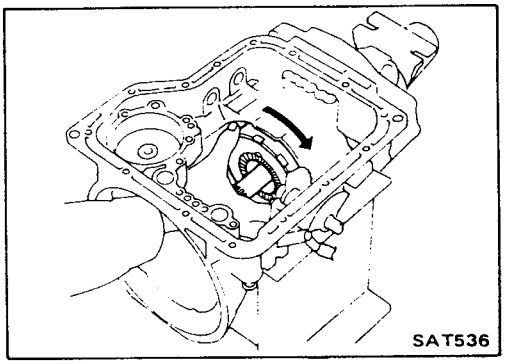
8. Install governor needle bearing.



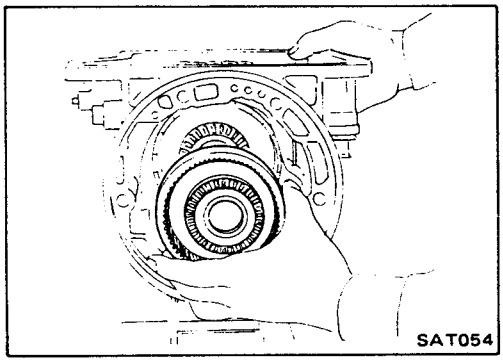
9. Install thrust washer, output shaft and governor distributor into case.



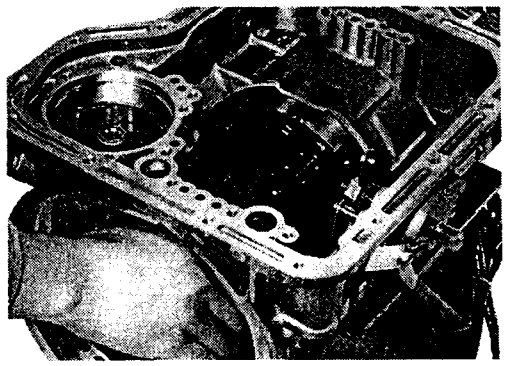
10. Install connecting drum with sprag by rotating drum clockwise.



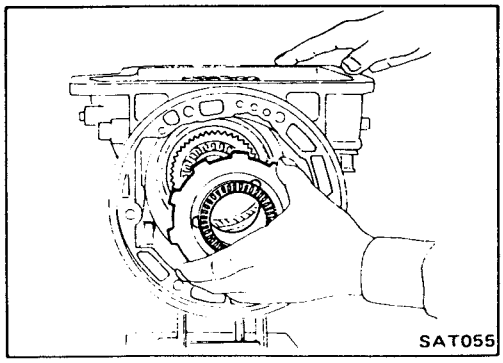
11. Check one-way clutch to see if it operates properly.



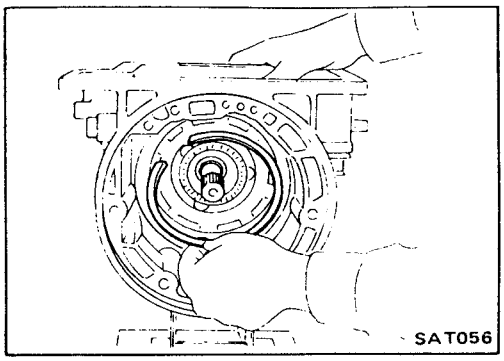
12. Install rear internal gear.



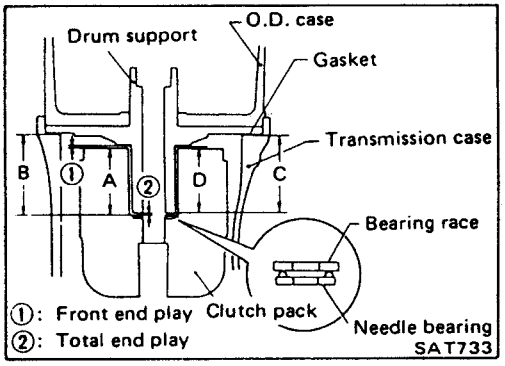
13. Install snap ring on shaft.



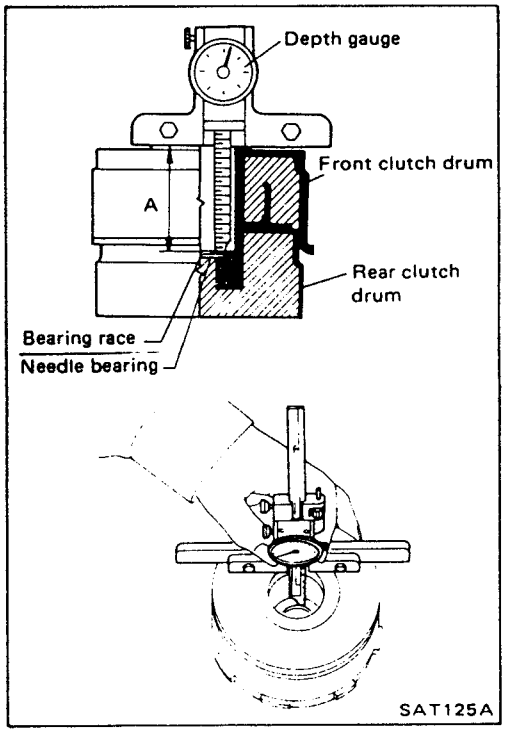
14. Secure thrust bearing and thrust washer with vaseline and install rear planetary carrier.


SAT056

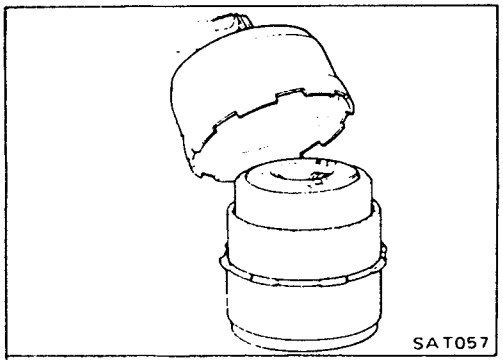
15. Install rear planetary carrier snap ring.
If you have insufficient space to install snap ring into drum groove, pull connecting drum forward as far as possible.



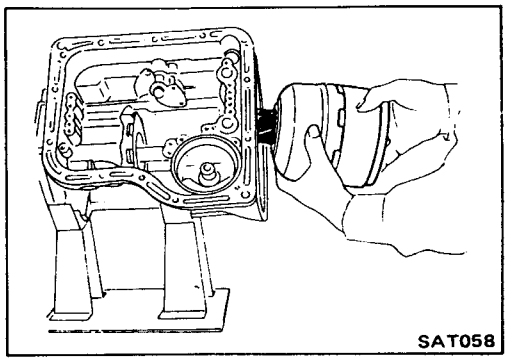
16. Adjust end play as follows:



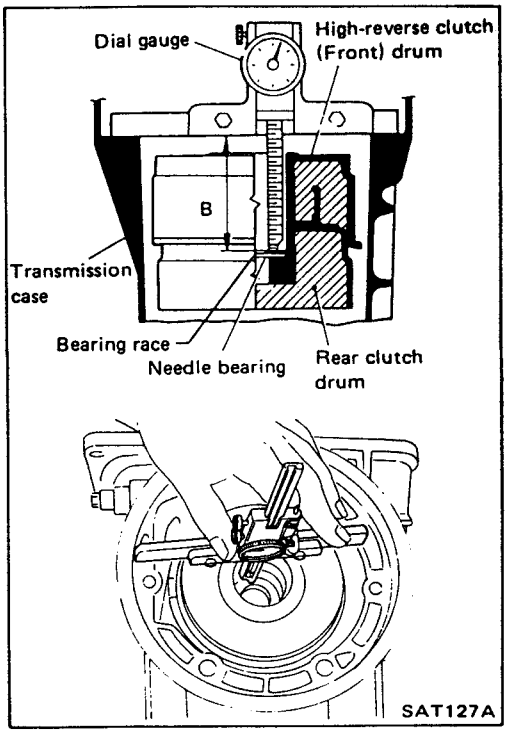
1) Assemble front clutch and rear clutch drum assemblies together and lay them flat on bench. Be sure rear hub needle bearing and bearing race are properly seated. Measure from face of clutch drum to top of bearing race (dimension A).


SAT057

2) Assemble front internal gear, front planetary carrier and connecting shell. Secure needle bearings with vaseline.

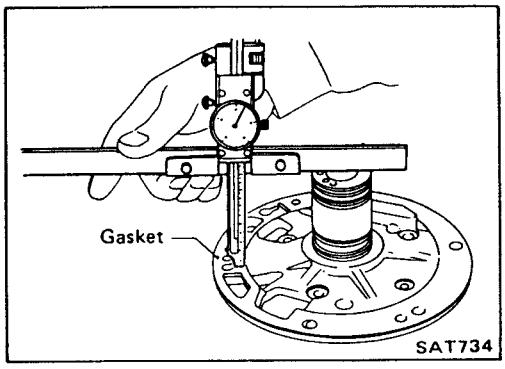

SAT058

3) Install assembly into transmission case. Check that parts are properly seated before proceeding with measurements.



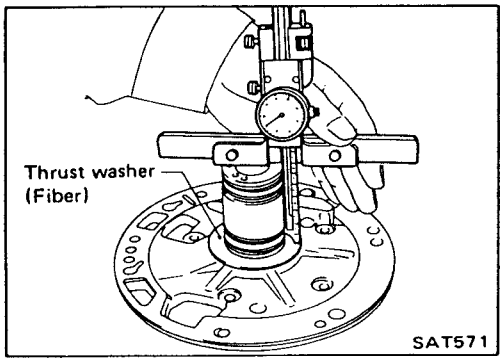
SAT127A

4) Using a dial gauge or caliper with a seven inch base, measure from rear hub bearing race to case (dimension B).



SAT734

5) Measure from top of drum support shaft (front clutch and rear clutch side) to installed gasket (dimension C).



SAT571

6) Install thrust washer. Measure from top of drum support shaft (front clutch and rear clutch side) to thrust washer (dimension D).

Front end play = [B – A – 0.1 mm (0.004 in)]
– (C – D)

Specified front end play:
0.5 - 0.8 mm (0.020 - 0.031 in)

Front end play can be adjusted with front clutch thrust washers.

Available front clutch thrust washer

Thickness mm (in)	Part number
1.3 (0.051)	31528-X0107
1.5 (0.059)	31528-X0105
1.7 (0.067)	31528-X0106
1.9 (0.075)	31528-X0100
2.1 (0.083)	31528-X0101
2.3 (0.091)	31528-X0102
2.5 (0.098)	31528-X0103
2.7 (0.106)	31528-X0104

Total end play

Total end play = [B – 0.1 mm (0.004 in)] – C

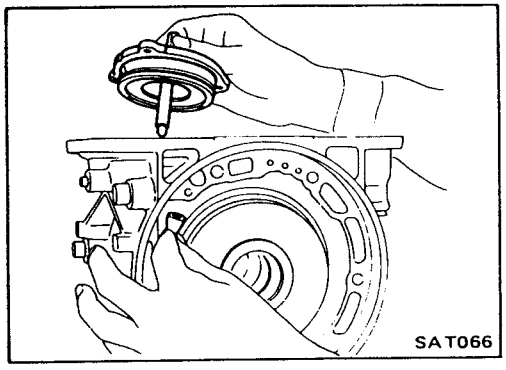
Specified total end play:

0.25 - 0.50 mm (0.0098 - 0.0197 in)

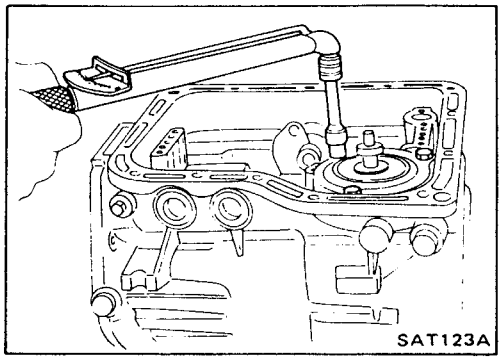
Total end play can be adjusted with bearing race.

Available oil pump cover bearing race

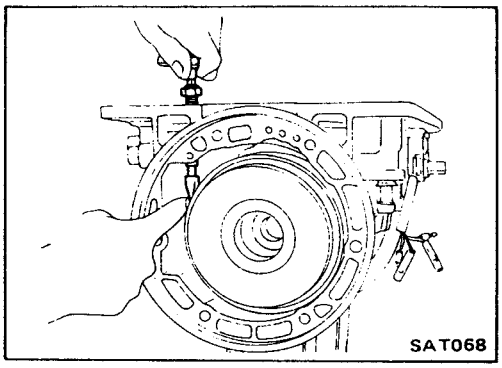
Thickness mm (in)	Part number
1.2 (0.047)	31556-X0100
1.4 (0.055)	31556-X0101
1.6 (0.063)	31556-X0102
1.8 (0.071)	31556-X0103
2.0 (0.079)	31556-X0104
2.2 (0.087)	31556-X0105



17. Install brake band, band strut, and band servo. Lubricate servo O-rings before installing.

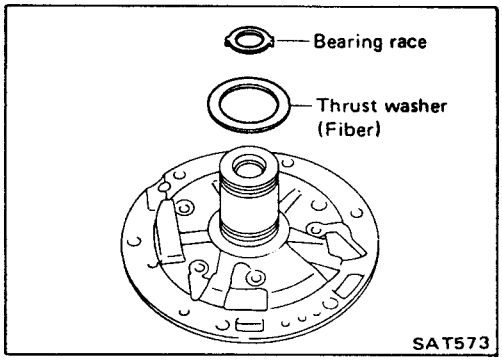

SAT123A

18. Install and tighten the retainer bolts. Then loosen piston stem.


SAT068

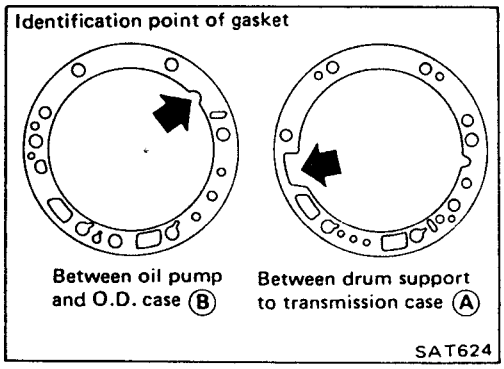
19. Tighten piston stem of brake band servo with finger enough to prevent brake band and strut from falling out.

Do not adjust brake band at this time.



SAT573

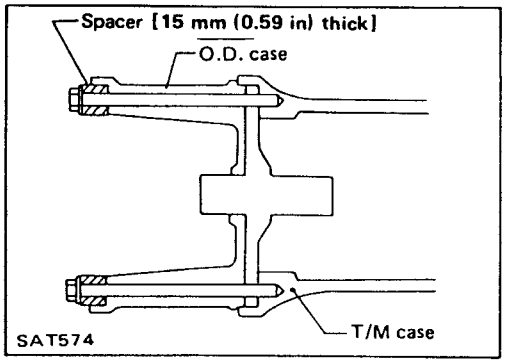
20. Apply vaseline to bearing race and thrust washer, then mount them on drum support.



SAT624

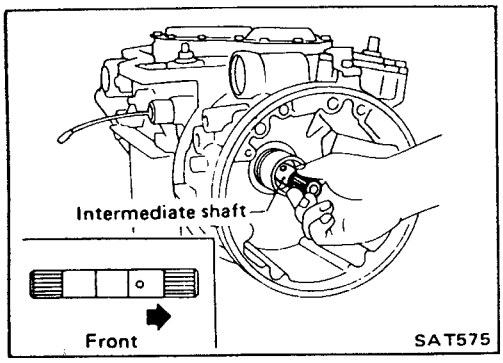
21. Mount drum support (A) on drum support after coating with vaseline. Apply A.T.F. to O-ring of drum support. Align drum support with O.D. case to transmission case and install.
22. Apply A.T.F. to O-ring of drum support, then install drum support and O.D. case.

Before installing drum support and O.D. case on transmission case, ensure that they have been centered properly. Refer to Component Parts for Drum Support.

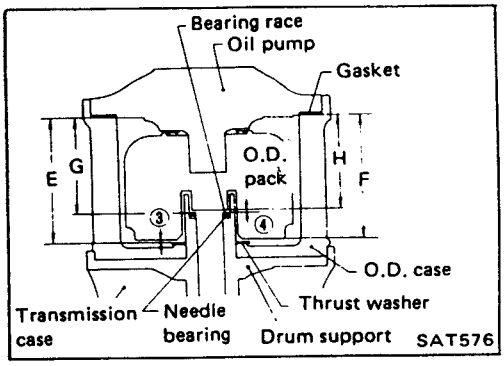


SAT574

23. Temporarily tighten O.D. case with two converter housing securing bolts.

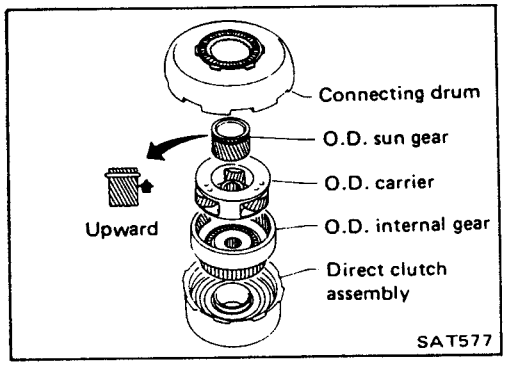


24. Insert intermediate shaft.
Be careful of shaft direction.

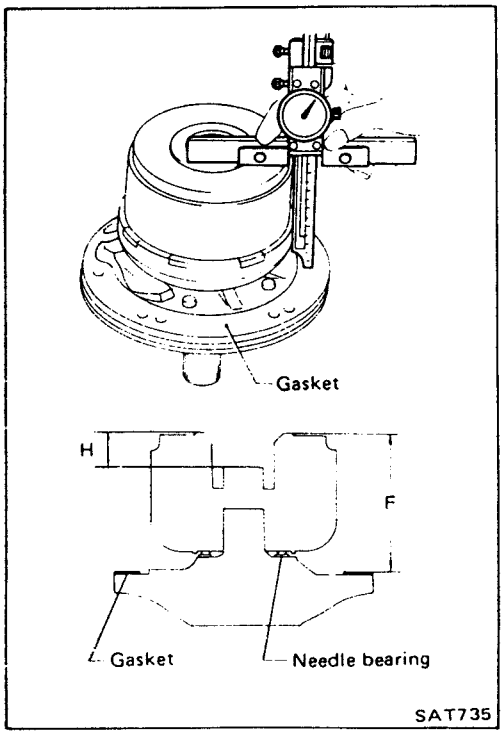


25. Adjust O.D. end play as follows.

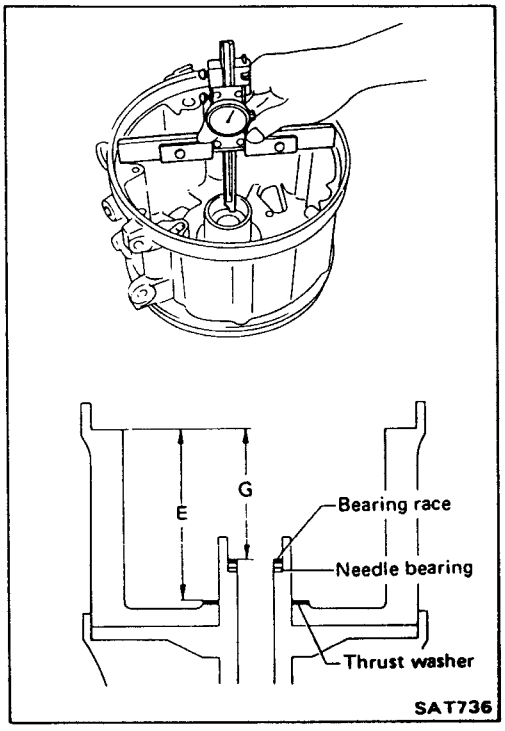
③: O.D. pack end play
④: O.D. total end play



1) **Assemble direct clutch assembly,** O.D. planetary gear set and **connecting drum, and install them on** O.D. pack.



2) Install oil pump bearing, gasket and O.D. pack on oil pump, and measure dimensions F and H.



3) Attach thrust washer and needle bearing to drum support and O.D. case, and measure dimensions E and G.

O.D. pack end play = [E – 0.1 mm (0.004 in)] – F

Specified O.D. pack and end play:

0.5 - 0.8 mm (0.020 - 0.031 in)

O.D. pack end play can be adjusted with O.D. thrust washers (these parts are the same as the front clutch thrust washers).

Available O.D. thrust washer

Thickness mm (in)	Part number
1.3 (0.051)	31528-X0107
1.5 (0.059)	31528-X0105
1.7 (0.067)	31528-X0106
1.9 (0.075)	31528-X0100
2.1 (0.083)	31528-X0101
2.3 (0.091)	31528-X0102
2.5 (0.098)	31528-X0103
2.7 (0.106)	31528-X0104

O.D. total end play

O.D. total end play = [G – 0.1 mm (0.004 in)] – (F – H)

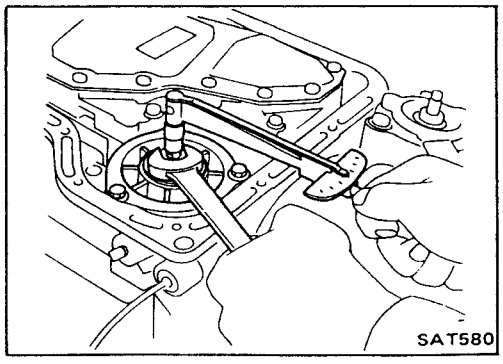
Specified O.D. total end play:

0.25 - 0.50 mm (0.0098 - 0.0197 in)

O.D. total end play can be adjusted with O.D. bearing race.

Available O.D. bearing races

Thickness mm (in)	Part number
1.2 (0.047)	31603-X8600
1.4 (0.055)	31603-X8601
1.6 (0.063)	31603-X8602
1.8 (0.071)	31603-X8603
2.0 (0.079)	31603-X8604
2.2 (0.087)	31603-X8605



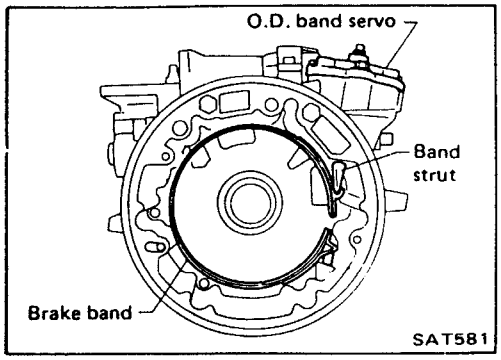
26. Adjust 2nd brake band. Tighten piston stem to the specified value. Back off three full turns and secure with lock nut.

: 2nd brake band piston stem

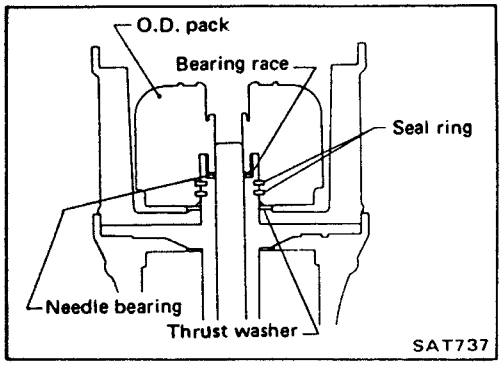
12 - 15 N·m (1.2 - 1.5 kg-m, 9 - 11 ft-lb)

Lock nut

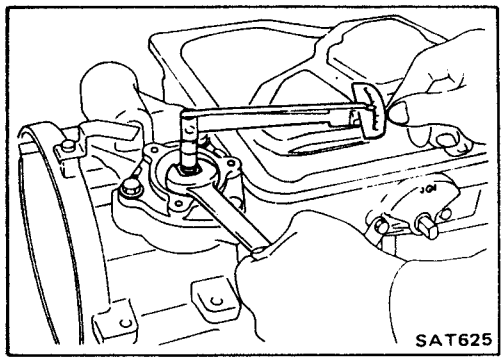
15 - 39 N·m (1.5 - 4.0 kg-m, 11 - 29 ft-lb)



27. Lubricate O.D. servo O-rings, then install O.D. band servo, brake band and band strut.

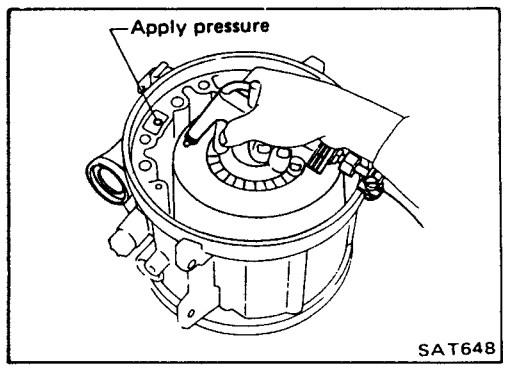


28. Lubricate seal ring of drum support, then install O.D. bearing & race, O.D. thrust washer and O.D. pack on drum support. Make sure that brake band strut is correctly installed.

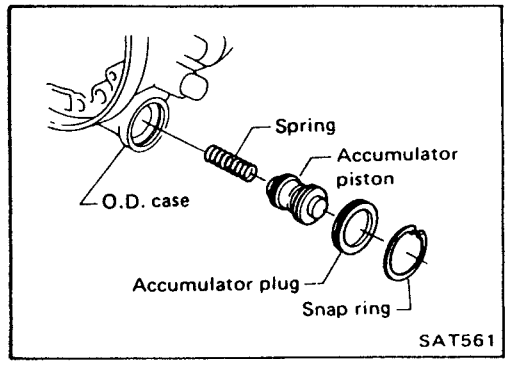


29. Adjust O.D. band. Tighten piston stem to the specified value. Back off two full turns and secure with lock nut.

    ☐ : **O.D. band piston stem**
    7 - 10 N·m (0.7 - 1.0 kg-m, 5.1 - 7.2 ft-lb)
    Lock nut
    15 - 39 N·m (1.5 - 4.0 kg-m, 11 - 29 ft-lb)



30. Test O.D. band servo operation using compressed air.

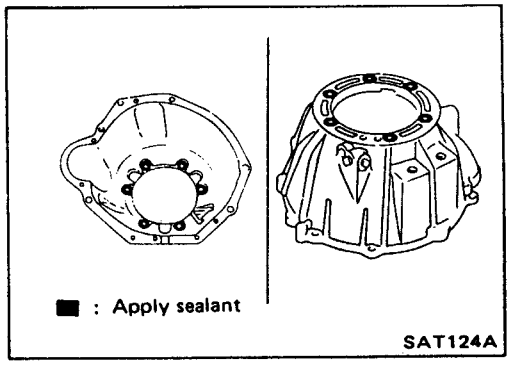


31. Install accumulator parts, then secure with snap ring.

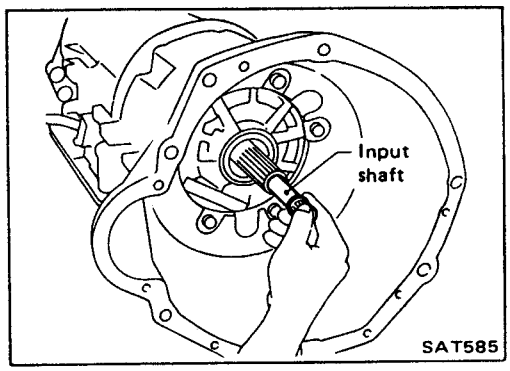
32. Lubricate O-ring of oil pump, then install needle bearing & race and oil pump.

Before installing oil pump housing and oil pump on O.D. case, ensure that they have been centered properly.

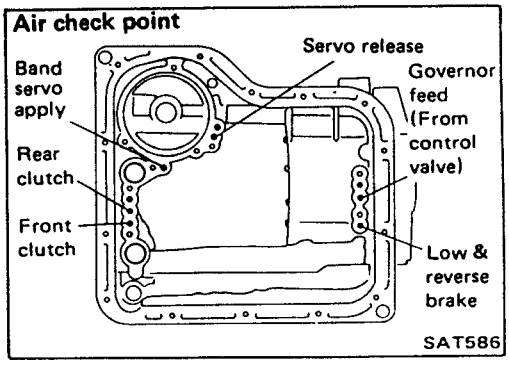
Refer to Oil Pump in Repair for Component parts.



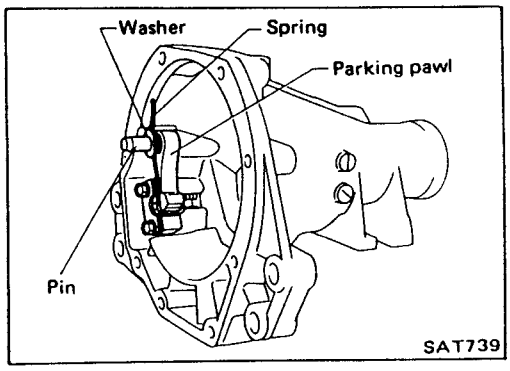
33. Remove the two bolts used to temporarily tighten O.D. case. Apply sealant to seating surface of converter housing around the bolt holes.
34. Install converter housing on O.D. case and tighten to the specified torque.



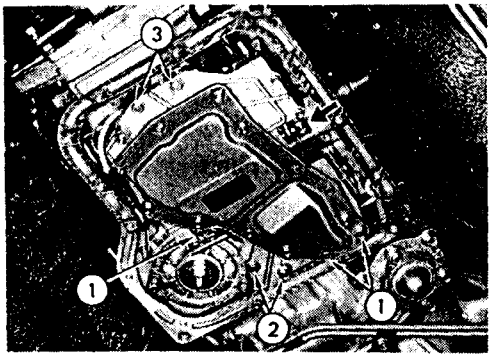
35. Install input shaft.



36. Before installing valve body assembly perform a final operation check of all assembled components, using compressed air.



37. Check that parking pawl, pin, spring and washer are assembled correctly.
38. Install rear extension.

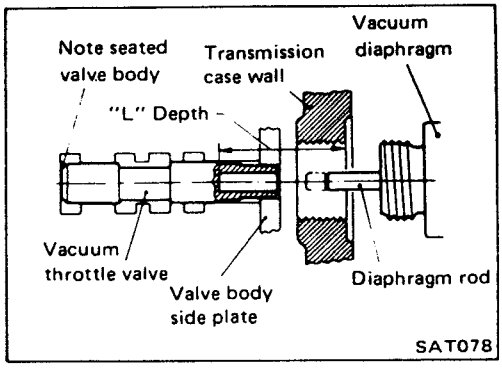


1 40 mm (1.57 in)
2 35 mm (1.38 in)
3 25 mm (0.98 in)

39. Install control valve assembly. Be sure manual valve is in alignment with selector pin. Tighten control valve body attaching bolts.

Securing bolt comes in three different lengths.

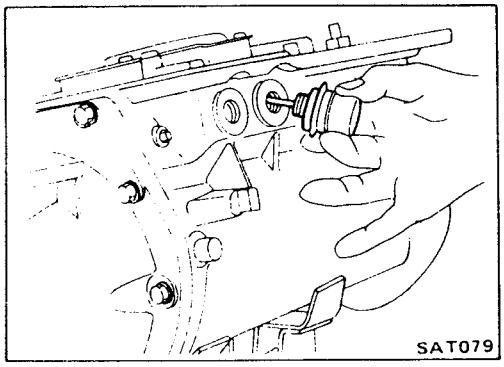
After installing control valve to transmission case, make sure that control lever can be moved to all positions.



40. **Before installing vacuum diaphragm valve, measure depth of hole in which it is inserted. This measurement determines correct rod length to ensure proper performance.**

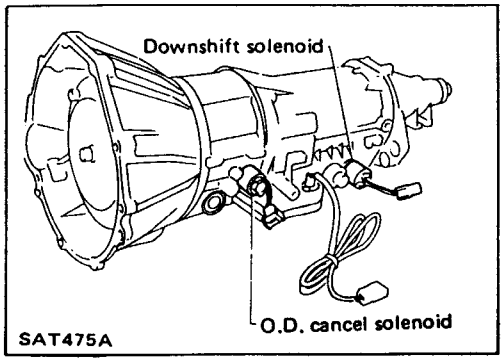
Vacuum diaphragm rod selection

Measured depth "L" mm (in)	Rod length mm (in)	Part number
Under 25.55 (1.0059)	29.0 (1.142)	31932-X0103
25.65 - 26.05 (1.0098 - 1.0256)	29.5 (1.161)	31932-X0104
26.15 - 26.55 (1.0295 - 1.0453)	30.0 (1.181)	31932-X0100
26.65 - 27.05 (1.0492 - 1.0650)	30.5 (1.201)	31932-X0102
Over 27.15 (1.0689)	31.0 (1.220)	31932-X0101

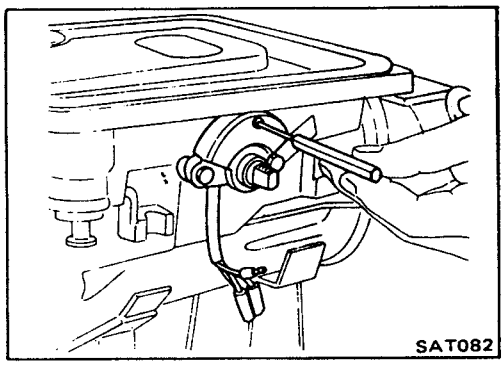


41. Install vacuum diaphragm.

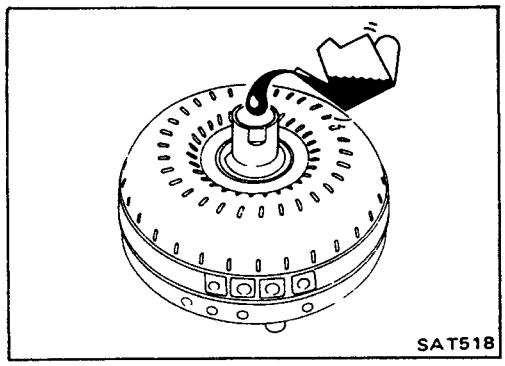
Make sure that vacuum diaphragm rod does not interfere with side plate of control valve.



42. Install downshift solenoid and O.D. cancel solenoid.



43. Install inhibitor switch. Check for proper operation in each range with a circuit tester. Refer to On-vehicle Servide.
44. Before installing oil pan, check parking pawl engagement.
45. Install oil pan with new gasket.



46. Pour approx. 2-liters (1-3/4 Imp qt) of A.T.F. into converter housing.
47. Install torque converter to converter housing.

Be careful not to scratch front oil seal.

General Specifications

Applied model	Z24S	TD23	TD27
Automatic transmission model	4N71B		
Transmission model code number	X8314	X8801	X8802
Stall torque ratio	2.0 : 1		
Transmission gear ratio			
1st	2.842		
2nd	1.542		
Top	1.000		
O.D.	0.686		
Reverse	2.400		
Recommended oil	Automatic transmission fluid Type DEXRON®		
Oil capacity	7.0 liters (6-1/8 Imp qt)		

Specifications and Adjustment

Transmission model code number	X8314	X8801	X8802
Torque converter assembly Stamped mark on the torque converter	GA	EA	GBA
Direct clutch Number of drive plates	2	2	2
Number of driven plates	2	2	2
Clearance mm (in) Standard Allowable limit	0 - 0.2 (0 - 0.008) 0.2 (0.008)		
Drive plate thickness mm (in) Standard Allowable limit	1.50 - 1.65 (0.0591 - 0.0650) 1.4 (0.055)		
Thickness of race side	Thickness mm (in)	Part number	
	0.4 (0.016)	31606-X8501	
	0.6 (0.024)	31606-X8502	
	0.8 (0.031)	31606-X8500	
	1.0 (0.039)	31606-X8503	
	1.2 (0.047)	31606-X8504	

Specifications and Adjustment (Cont'd)

Transmission model code number	X8314	X8801	X8802
Front clutch Number of drive plates	3	3	3
Number of driven plates	5	3	3
Clearance mm (in) Standard Allowable limit	1.6 - 1.8 (0.063 - 0.071) 2.2 (0.087)		
Drive plate thickness mm (in) Standard Allowable limit	1.50 - 1.65 (0.0591 - 0.0650) 1.4 (0.055)		
Thickness of retaining plate	Thickness mm (in) / Part number 5.0 (0.197) / 31567-X2900 5.2 (0.205) / 31567-X2901 5.4 (0.213) / 31567-X2902 5.6 (0.220) / 31567-X2903 5.8 (0.228) / 31567-X2904 6.0 (0.236) / 31567-X2905		
Rear clutch Number of drive plates	6	6	6
Number of driven plates	6	6	6
Clearance mm (in) Standard Allowable limit	0.8 - 1.0 (0.031 - 0.039) 1.5 (0.059)		
Drive plate thickness mm (in) Standard Allowable limit	1.50 - 1.65 (0.0591 - 0.0650) 1.4 (0.055)		
Thickness of retaining plate	Thickness mm (in) / Part number 6.2 (0.244) / 31567-X2906 6.4 (0.252) / 31507-X8600 6.6 (0.260) / 31507-X8601 6.8 (0.268) / 31537-X2800 7.0 (0.276) / 31537-X2801 7.2 (0.283) / 31537-X0900 7.4 (0.291) / 31537-X0901 7.6 (0.299) / 31537-X0902		

Specifications and Adjustment (Cont'd)

Transmission model code number	X8414	X8801	X8802
Low & reverse brake Number of drive plates	6	5	6
Number of driven plates	6	5	6
Clearance mm (in) Standard Allowable limit	0.8 - 1.05 (0.0315 - 0.0413) 2.0 (0.079)	0.8 - 1.05 (0.0315 - 0.0413) 1.8 (0.071)	0.8 - 1.05 (0.0315 - 0.0413) 2.0 (0.079)
Drive plate thickness mm (in) Standard Allowable limit	1.90 - 2.05 (0.0748 - 0.0807) 1.8 (0.071)		

Thickness of reatining plate

Thickness mm (in)	Part number	Thickness mm (in)	Part number	Thickness mm (in)	Part number
11.8 (0.465)	31667-X0300	7.8 (0.307)	31667-X0500	11.8 (0465)	31667-X0300
12.0 (0.472)	31667-X0301	8.0 (0.315)	31667-X0501	12.0 (0.472)	31667-X0301
12.2 (0.480)	31667-X0302	8.2 (0.323)	31667-X0502	12.2 (0.480)	31667-X0302
12.4 (0.488)	31667-X0303	8.4 (0.331)	31667-X0503	12.4 (0.488)	31667-X0303
12.6 (0.496)	31667-X0304	8.6 (0.339)	31667-X0504	12.6 (0.496)	31667-X0304
12.8 (0.504)	31667-X0305	8.8 (0.346)	31667-X0505	12.8 (0.504)	31667-X0305

2nd brake band Piston size mm (in) Big dia. Small dia.	80 (3.15) 44 (1.73)	72 (2.83) 44 (1.73)	72 (2.83) 44 (1.73)
O.D. brake band Piston size mm (in) Big dia. Small dia.	60 (2.36) 36 (1.42)	60 (2.36) 40 (1.57)	60 (2.36) 36 (1.42)
Front end pla mm (in)	0.5 - 0.8 (0.020 - 0.031)		

Thickness of front clutch thrust washer

Thickness mm (in)	Part number
1.3 (0.051)	31528-X0107
1.5 (0.059)	31528-X0105
1.7 (0.067)	31528-X0106
1.9 (0.075)	31528-X0100
2.1 (0.083)	31528-X0101
2.3 (0.091)	31528-X0102
2.5 (0.098)	31528-X0103
2.7 (0.106)	31528-X0104

Specifications and Adjustment (Cont'd)

Total end play mm (in)	0.25 - 0.50 (0.0098 - 0.0197)	
Thickness of oil pump cover bearing race	Thickness mm (in)	Part number
	1.2 (0.047)	31556-X0100
	1.4 (0.055)	31556-X0101
	1.6 (0.063)	31556-X0102
	1.8 (0.071)	31556-X0103
	2.0 (0.079)	31556-X0104
	2.2 (0.087)	31556-X0105
O.D. pack end play mm (in)	0.5 - 0.8 (0.020 - 0.031)	
Thickness of O.D. thrust washer	Thickness mm (in)	Part number
	1.3 (0.051)	31528-X0107
	1.5 (0.059)	31528-X0105
	1.7 (0.067)	31528-X0106
	1.9 (0.075)	31528-X0100
	2.1 (0.083)	31528-X0101
	2.3 (0.091)	31528-X0102
	2.5 (0.098)	31528-X0103
	2.7 (0.106)	31528-X0104
O.D. total end play mm (in)	0.25 - 0.50 (0.0098 - 0.0197)	
Thickness of O.D. bearing race	Thickness mm (in)	Part number
	1.2 (0.047)	31603-X8600
	1.4 (0.055)	31603-X8601
	1.6 (0.063)	31603-X8602
	1.8 (0.071)	31603-X8603
	2.0 (0.079)	31603-X8604
	2.2 (0.087)	31603-X8605

Oil pump clearance mm (in)	
Outer gear-pump housing	
Standard	0.05 - 0.20 (0.0020 - 0.0079)
Allowable limit	0.25 (0.0098)
Outer gear-crescent	
Standard	0.14 - 0.21 (0.0055 - 0.0083)
Allowable limit	0.25 (0.0098)
Gear-pump cover	
Standard	0.02 - 0.04 (0.0008 - 0.0016)
Allowable limit	0.08 (0.0031)
Drum support mm (in)	
Seal ring-ring groove	
Standard	0.05 - 0.20 (0.0020 - 0.0079)
Allowable limit	0.20 (0.0079)
Oil distributor mm (in)	
Seal ring-ring groove	
Standard	0.04 - 0.16 (0.0016 - 0.0063)
Allowable limit	0.16 (0.0063)
Planetary carrier mm (in)	
Clearance between pinion washer and planetary carrier	
Standard	0.20 - 0.70 (0.0079 - 0.0276)
Allowable limit	0.80 (0.0315)
Runout of oil pump cover to housing mm (in)	0.07 (0.0028) or less
Runout of oil pump cover to O.D. case mm (in)	0.05 (0.0020) or less

STALL REVOLUTION

Z24S engine	2,000 - 2,200 rpm
TD23 engine	2,050 - 2,250 rpm
TD27 engine	1,960 - 2,160 rpm

Tightening Torque

Unit	N·m	kg-m	ft-lb
Transmission installation			
Drive plate to torque converter	39 - 49	4.0 - 5.0	29 - 36
Converter housing to engine	Refer to Removal and Installation.		
Gusset to converter housing	Refer to Removal and Installation.		
Gusset to engine	26 - 32	2.7 - 3.3	20 - 24
Rear mounting bracket to transmission	Refer to section ER.		
Rear mounting bracket to rear insulator	Refer to section ER.		
Rear mounting member to body	Refer to section ER.		
Component part			
Transmission case to converter housing	44 - 54	4.5 - 5.5	33 - 40
Transmission case to rear extension	20 - 25	2.0 - 2.5	14 - 18
Oil pan to transmission case	5 - 7	0.5 - 0.7	3.6 - 5.1
2nd servo piston retainer to transmission case	7 - 9	0.7 - 0.9	5.1 - 6.5
2nd piston stem (when adjusting band brake) (RB30S engine)	12 - 15*1	1.2 - 1.5*1	9 - 11*1
2nd piston stem lock nut (RB30S engine)	15 - 39	1.5 - 4.0	11 - 29
One-way clutch inner rear to transmission case	13 - 18	1.3 - 1.8	9 - 13
Control valve body to transmission case	5.4 - 7.4	0.55 - 0.75	4.0 - 5.4
Lower valve body to upper valve body	2.5 - 3.4	0.25 - 0.35	1.8 - 2.5
O.D. servo piston retainer to O.D. case	10 - 15	1.0 - 1.5	7 - 11
O.D. piston stem (when adjusting band brake)	7 - 10*2	0.7 - 1.0*2	5.1 - 7.2*2
O.D. stem lock nut	15 - 39	1.5 - 4.0	11 - 29
Side plate to control valve body	2.5 - 3.4	0.25 - 0.35	1.8 - 2.5
Nut for control valve reamer bolt	5 - 7	0.5 - 0.7	3.6 - 5.1
Oil strainer to lower valve body	3 - 4	0.3 - 0.4	2.2 - 2.9
Governor valve body to oil distributor	5 - 7	0.5 - 0.7	3.6 - 5.1

Unit	N·m	kg-m	ft-lb
Oil pump housing to oil pump cover	6 - 8	0.6 - 0.8	4.3 - 5.8
Inhibitor switch to transmission case	5 - 7	0.5 - 0.7	3.6 - 5.1
Manual shaft lock nut	29 - 39	3.0 - 4.0	22 - 29
Oil cooler pipe to transmission case	29 - 49	3.0 - 5.0	22 - 36
Test plug (oil pressure inspection hole)	14 - 21	1.4 - 2.1	10 - 15
Support actuator (parking rod inserting position) to rear extension	8 - 11	0.8 - 1.1	5.8 - 8.0
Drum support to O.D. case	7 - 9	0.7 - 0.9	5.1 - 6.5

*1: Turn back three turns after tightening.
*2: Turn back two turns after tightening.

LTI
SERVICE

Fairway

WORKSHOP MANUAL

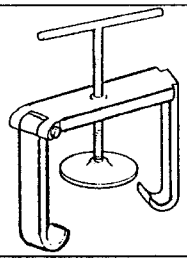
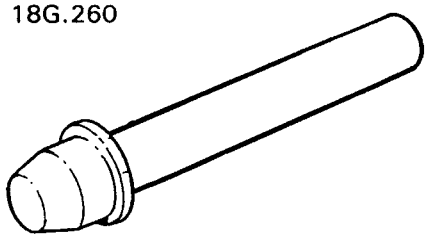
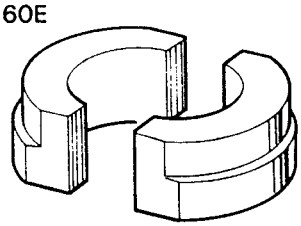
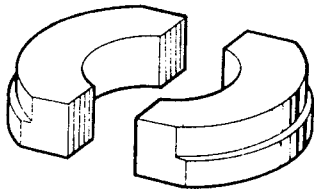
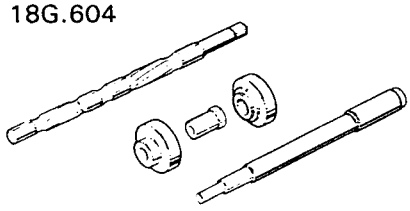
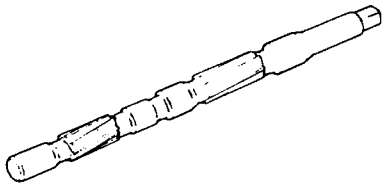
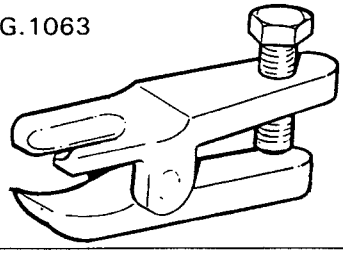
SECTION 5

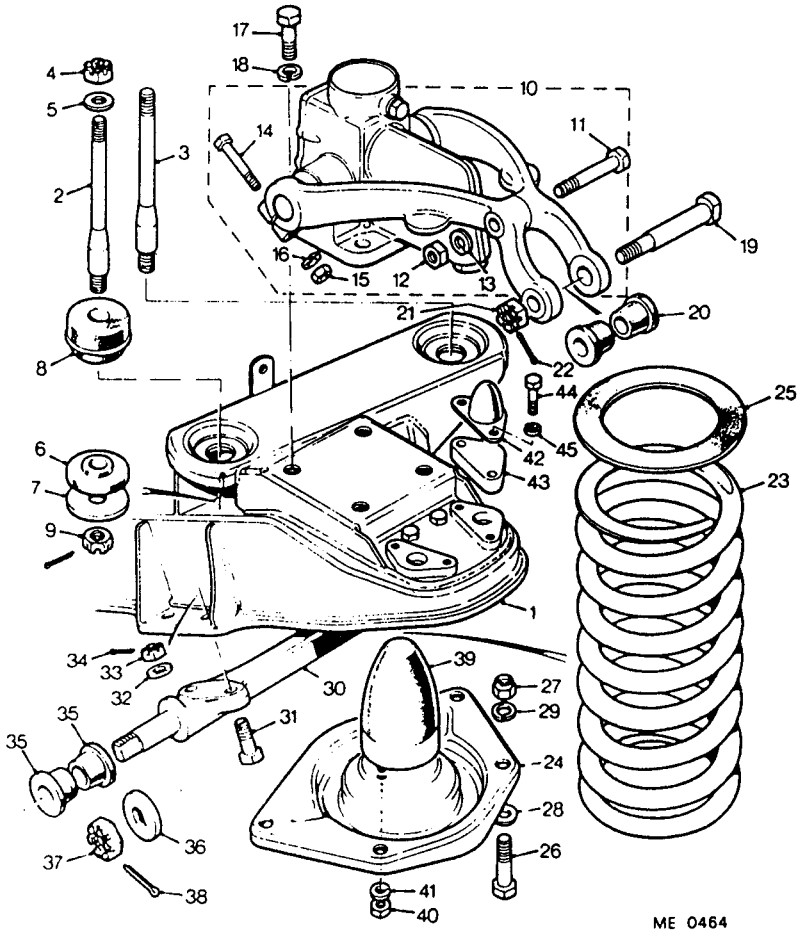
FRONT AXLE AND SUSPENSION

SECTION FA

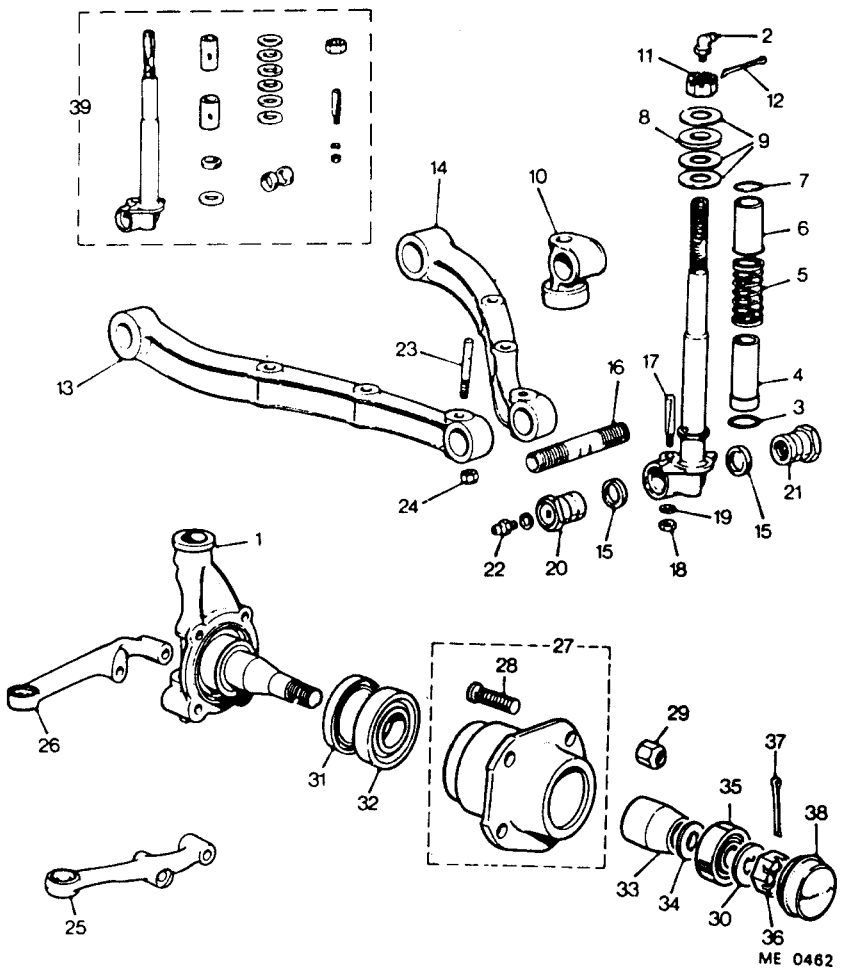
CONTENTS

FRONT SUSPENSION, HUBS AND STEERING

TOOL NUMBER	DESCRIPTION
FX.3088 	Front Spring Compressor
18G.260 	Remove Front Hub Bearing
18G.260E 	Adaptor Front Hub Outer Bearing Outer Race Remover Used with 18G.260
18G.260F 	Adaptor Front Hub Inner Bearing Outer Race Remover Used with 18G.260
18G.604 	Swivel Pin Bush Remover, Replacer and Reamer
18G.604A 	Swivel Pin Bush Reamer Replacement Reamer for 18G.604
18G.1063 	Remove Steering Ball Pins Lubrication with Rubber Grease Around the Seal Must be Used



Illus.	Part Number	123456	Description	Quantity
			FRONT SUSPENSION.	
	JHM	623	Front suspension and crossmember complete	1
1	JHM	79	Crossmember assembly	1
2	1B	4636	Stud-crossmember to chassis-front	2
3	1B	4637	Stud-crossmember to chassis-rear	2
4	ND	608041	Nut	4
			WASHER	
5	1B	4550	Mounting-crossmember(rubber)	4
6	6K	9418	Stud	4
7	1B	4551	Mounting rubber	4
8	1B	4553	Mounting-front suspension member	4
9	ND	608041	Nut-crossmember to body	4
10	13H	5765	ABSORBER ASSEMBLY-SHOCK	2
11	BH	606201	Bolt-arm	2
12	GHF	202	Nut	2
13	GHF	333	Washer-spring	2
14	BH	606161	Bolt-clamping	2
15	GHF	202	Nut	2
16	GHF	333	Washer-spring	2
17	53K	1025	Bolt-shock absorber to crossmember	8
18	GHF	333	Washer-spring	8
19	1G	4349	Pin-fulcrum	2
20	8G	621	Bearing-top link	4
21	NL	607041	Nut-fulcrum pin	2
22	GHF	502	Pin-split 0.09375" x 1.5"	2
23	1B	4631	Spring-coil-road	2
24	ACB	4066	Seat-road spring	2
25	1B	4561	Washer-spring seat(rubber)	2
26	BH	606181	Bolt-spring seat to lower link	8
27	GHF	223	Nut	8
28	GHF	302	Washer-plain	8
29	GHF	333	Washer-spring	8
30	1B	4598	Bracket-spindle-detachable	2
31	53K	1854	Bolt-bracket to crossmember	8
32	2K	5333	Washer-lock	4
33	FNZ	307	Nut-slotted	8
34	GHF	502	Pin-split	8
35	ACB	9274	Bearing-lower link	8
36	1G	4464	Washer-locating-lower links spindle	4
37	FNZ	810	Nut-spindle	4
38	GHF	504	Pin-split 0.125" x 2.25"	4
39	1B	4468	Buffer-suspension	2
40	GHF	201	Nut	4
41	LWZ	305	Washer-spring	4
42	1G	4276	Buffer-rebound	4
43	1B	4630	Piece-packing-buffer	4
44	SH	604071	Screw-buffer to crossmember	8
45	GHF	331	Washer-spring	8



Illus.	Part Number	123456	Description	Quantity
			FRONT SUSPENSION–Continued	
	NSP		FRONT SUSPENSION ASSEMBLY–RH	1
	NSP		FRONT SUSPENSION ASSEMBLY–LH	1
1	21B	226	Axle–swivel	2
2	UHN	490	Lubricator–swivel axle–top	2
3	TRS	1721	Ring–swivel axle(rubber)	2
4	21B	1480	Tube–dust excluder–bottom	2
5	1B	4607	Spring–dust excluder	2
6	1B	4605	Tube–dust excluder–top	2
7		271013 A	Ring–sealing	2
8	ATC	4264	Washer–thrust	2
			WASHER–FLOATING–THRUST	
9	ATC	4261	0.052–0.057"(1.32–1.44mm)	A/R
9	ATC	4262	0.058–0.063"(1.47–1.60mm)	A/R
9	ATC	4263	0.064–0.069"(1.63–1.75mm)	NLA
10	ATC	4249	Trunnion–suspension link	2
11	ATC	4265	Nut–trunnion to swivel pin	2
12	GHF	502	Pin–split 0.09375" x 1.5"	2
13	1B	4365	Link–lower–LH front–RH rear	2
14	1B	4366	Link–lower–LH rear–RH front	2
15	FAM	2746	Ring–fulcrum pin–lower link	4
16	21B	288	Pin–fulcrum–lower link	2
17	53K	1770	Pin–cotter–fulcrum pin to swivel pin	2
18	GHF	200	Nut	2
19	GHF	331	Washer–spring	2
			BUSH–LOWER LINK	
20	1G	4346	Front end	2
21	21B	1754	Front–rear	2
22	UHN	400	Lubricator–lower link bush	4
23	1G	4350	Pin–cotter–link to bush	NLA
24	GHF	272	Nut–cotter pin	4
25	21B	47	Lever–steering–RH	1
26	21B	48	Lever–steering–LH	1
27	1B	4618	HUB ASSEMBLY	2
28	ATC	7257	Stud–wheel	10
29	1D	8033	Nut–wheel stud	10
30	1B	4624	Washer–bearing retaining	2
31	1B	4623	Seal–oil	2
32	1B	4620	Bearing–hub–inner	2
33	1B	4622	Piece–distance–bearing	2
			SHIM	
34	1B	4626	0.003(0.076mm)	A/R
34	1B	4627	0.005"(0.127mm)	A/R
34	1B	4628	0.010"(0.254mm)	A/R
35	1B	4621	Bearing–hub–outer	2
36	1B	4625	Nut–swivel axle	2
37	GHF	513	Pin–split 0.1875" x 3"	2
38	ATC	4270	Cup–grease retaining	2
39	8G	4253	Kit–repair–swivel pin and bush	2

Front Suspension

To facilitate repair after accidental damage and to simplify servicing, the front cross-member complete with the front suspension units is attached by four main bolts to the chassis. The four chassis bolts are on rubber packing pieces, which considerably reduces body noises and steering-wheel rattles excited by road irregularities.

The two independent suspension units are of wishbone construction. Road undulations are absorbed by low-periodicity coil springs mounted between the upper and lower linkages, shocks are absorbed by double-acting dampers on the upper linkages.

Suspension Unit - Removal

1. Jack up the front of the car, place stands under the frame cross-member and remove the road wheels.

2. Disconnect the two drag links from the steering arms. See figure 1.

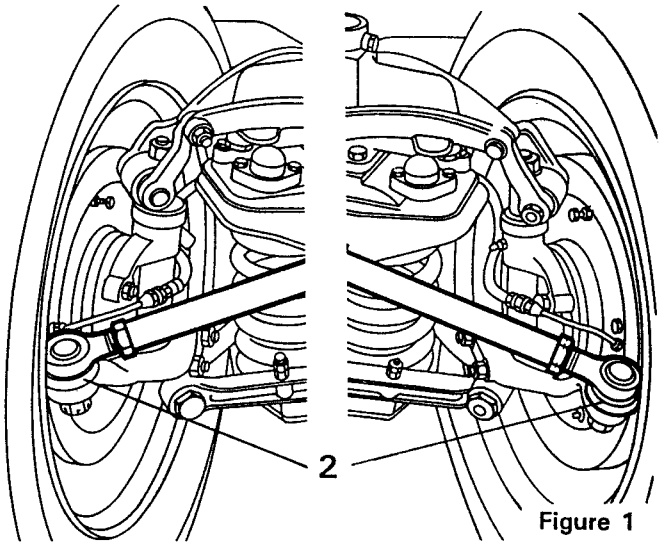


Figure 1

3. Position a suitable container under the chassis. From within the engine compartment disconnect the brake hoses from the chassis. See figure 2. Seal pipe ends to prevent the ingress of dirt into the brake system.

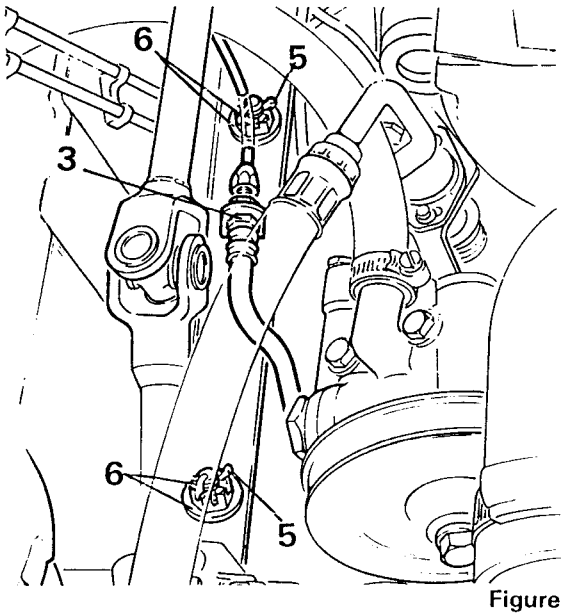


Figure 2

4. Position a moveable lifting jack under the suspension unit. Support the unit.

5. Remove the split pins for the four chassis mounting nuts.

6. Remove the castellated nuts and washers.

7. Carefully lower the jack and suspension unit to allow the mounting studs to clear the chassis. Withdraw the suspension unit from under the car.

8. The suspension unit is refitted in reverse order to that given for removal.

Coil Spring

1. Jack up the side of the car from which the spring is to be removed and place a stand under the frame side-member to the rear of the suspension assembly.

2. Remove the road wheel.

3. Position tool FX 3088 on the spring. See figure 3. Ensure that the tool is rigid.

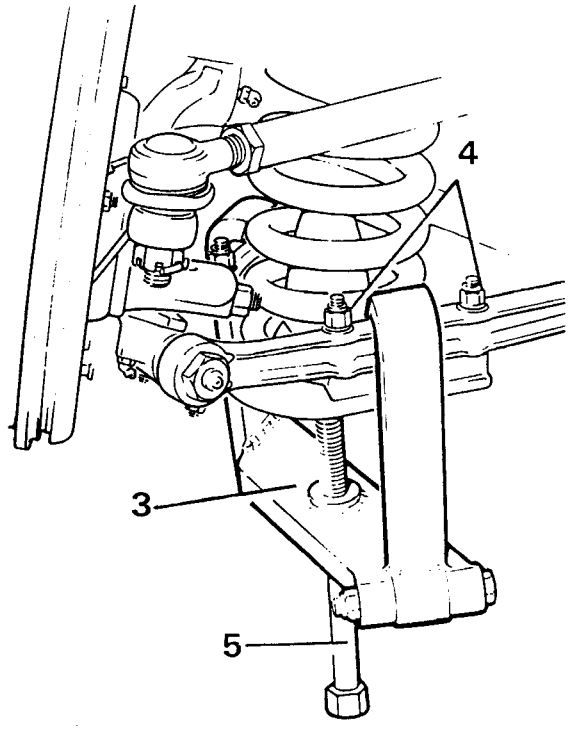


Figure 3

4. Remove the four screws, nuts and washers which secures the spring seat to the lower links.

5. Release the spring tension by unscrewing the compression tool centre screw. When the spring is fully extended, the spring and spring seat can be removed.

Note: Spacers are fitted between the seat and the suspension lower links on most models.

6. The spring is refitted in reverse order to that given for removal.

Suspension Unit - Dismantling

Note: With the drag link released and the spring removed the suspension unit can be serviced on the vehicle.

1. Unscrew the nut and remove the clamping bolt and washer from the top wishbone. See figure 4.

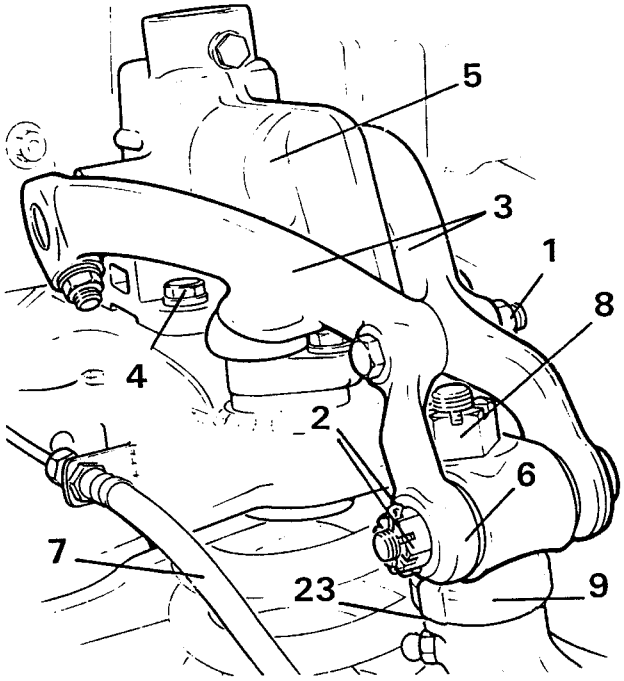


Figure 4

2. Remove the split pin and castellated nut from the upper trunnion fulcrum pin. Withdraw the pin.

3. Carefully part the top wishbone arms to allow the arms to pivot upwards from the top link boss.

4. Remove the four screws which secure the shock absorber to the crossmember assembly.

5. The shock absorber can now be removed complete with the top wishbone arms.

6. Withdraw the top link bearings from each end of the upper trunnion.

Note: These bearings fit into a groove in the swivel pin and must be removed before the swivel pin can be withdrawn.

7. Disconnect the flexible hose from the wheel hub. Seal pipe ends to prevent the ingress of dirt into the brake system.

8. Remove the split pin and castellated nut from the top of the swivel pin.

9. Remove the upper trunnion and thrust washers, lift off the hub assembly.

10. The lower fulcrum pin assembly can now be dismantled. Unscrew the nut on each of the cotters located in the ends of the lower wishbone arms. See figure 5.

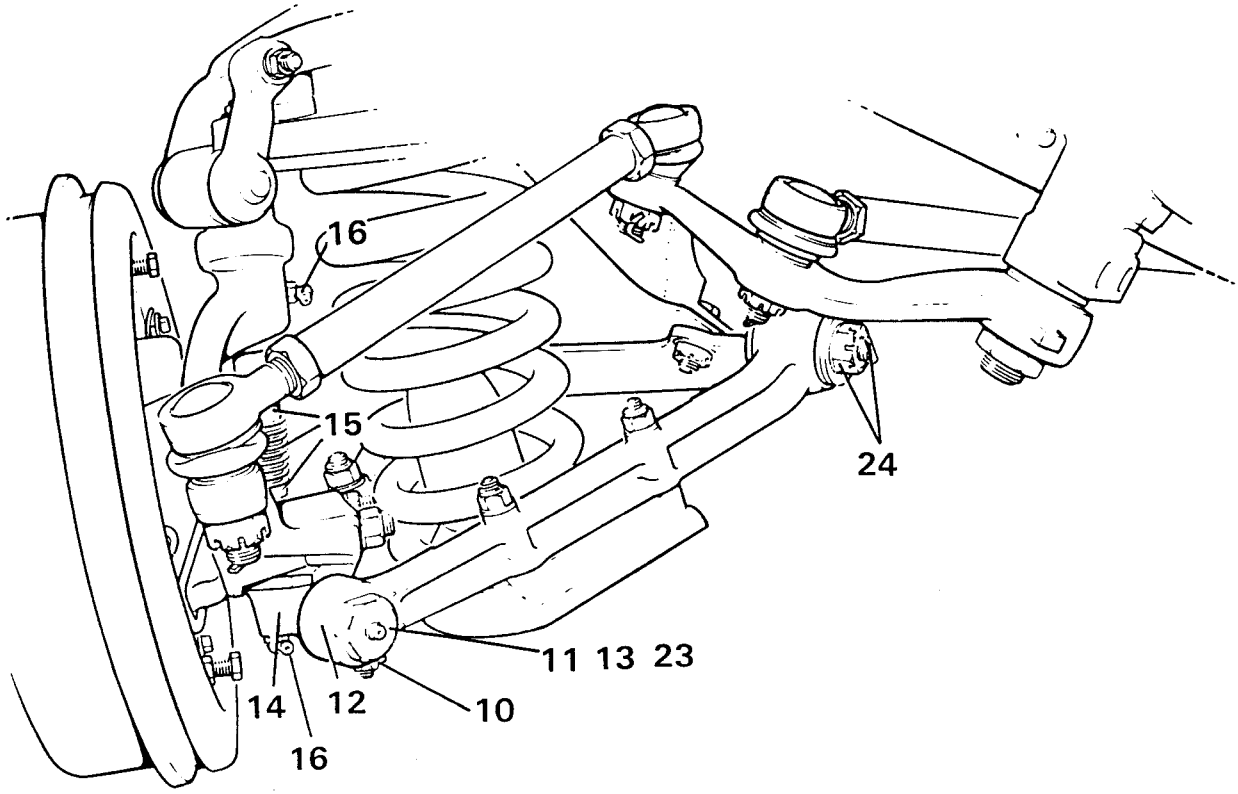


Figure 5

11. In order to release the threaded bushes, tap up the cotters approximately ⅛ in. Remove the threaded bushes from the lower wishbone ends.

Note: The cotters cannot be removed until the threaded bushes are removed as the cotters are disked to lock against the bushes.

12. Unscrew the nut located in the centre of the lower trunnion and tap out the cotter.

13. Withdraw the lower fulcrum pin and remove the sealing washer from each end of the trunnion.

14. Remove the swivel pin assembly. The (Kinpin) can now be serviced as follows:

15. Remove the top and bottom tube dust excluders and the central spring.

16. Remove the grease nipples from the swivel axle.

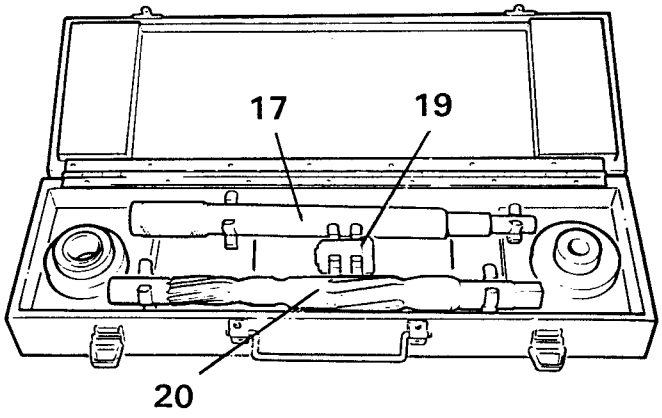
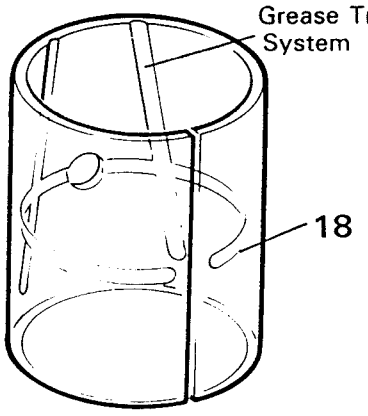


Figure 6

17. Remove both bushes from the top and bottom of the swivel axle using the special tool. (Kit No. 18G-604). See figure 6.

18. When fitting new top and bottom bushes, ensure that the grease nipple hole is aligned with the hole in the bush, also ensure that the bush is orientated so that the scroll located on the inside of the bush enables the grease to be transported upwards. See figure 7.



Note: Top and Bottom bushes to be orientated as illustrated.

Figure 7

19. Use special tool to position bushes in the top and bottom trunnions of the swivel axle. See figure 6.

20. Use special tool STM 7239 to ream the bushes to size. See figure 6. Ensure that all swarf is removed from the bushes before assembling the kingpin .

21. The suspension unit is reassembled in the reverse order to that given for dismantling. However, the following must be noted.

22. When fitting the spacer/ thrust washers between top trunnion of the swivel axle and the suspension link trunnion, ensure that 2 flat washers followed by a phosphor bronze thrust washer and finally a flat washer are fitted.

Note: The swivel pin castellated nut should be tightened down, then backed off to achieve an end float of between 0.025 and 0.15mm (0.001 and 0.006 in). Lock nut in position using a new split pin.

23. When fitting the threaded bushes to the lower wishbone ends, tighten until tight then slacken both off by approximately ½ a turn (4 flats).

Note: Should the lower wishbone rubber bushes require attention continue as follows after operation number 11.

24. Remove the split pin and castellated nut from the lower wishbone arms. Detach arms.

Brake-Drum and Hub

1. Jack-up the side of the car from which the hub is to be removed and place a stand under the frame side-member, to the near of the suspension assembly.

2. Remove the road wheel.

3. Remove the two countersunk screws that secure the brake-drum to the hub. Remove the brake-drum.

4. Prise out the hub cap. See figure 1.

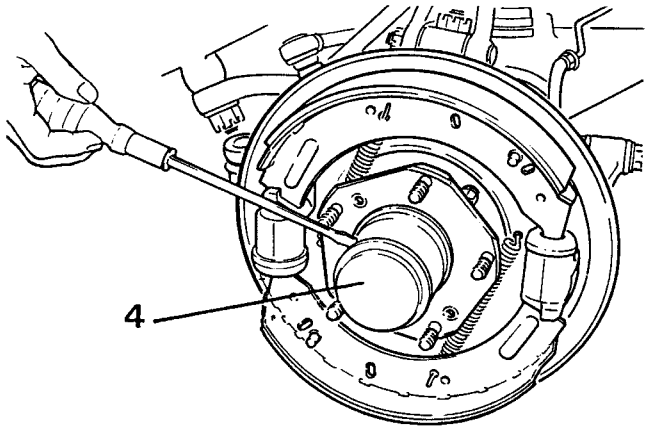


Figure 1

5. Remove the split pin, castellated nut and flat washer from the stub axle. See figure 2.

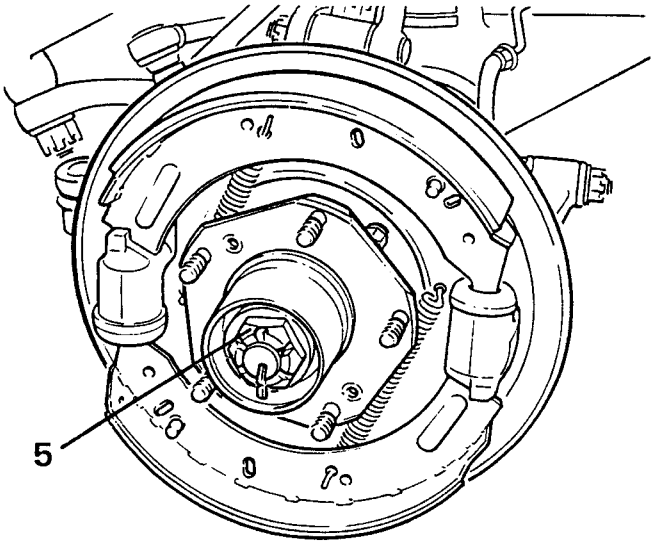


Figure 2

6. Withdraw the hub. The two bearings, distance piece and oil seal will also be withdrawn in this operation. See figure 3.

7. Remove the oil seal, which should be discarded.

8. Remove the inner race of the larger bearing, shims and distance piece from the hub.

9. Remove the outer race of the outer bearing.

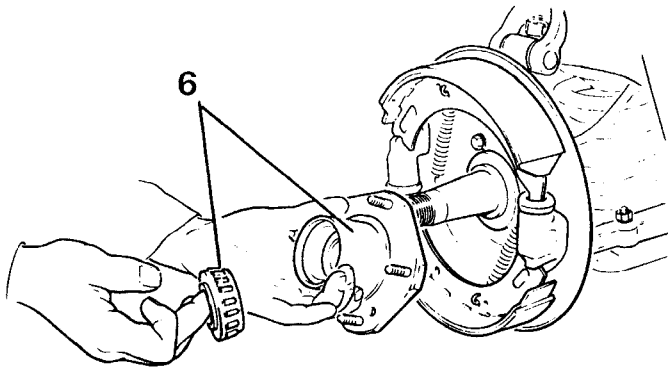


Figure 3

10. Remove the outer race of the inner-bearing

11. Replace the outer race of the outer bearing

12. Replace the outer race of the inner bearing

13. Pack the hub with the recommended grease but leave the space between the bearings and the hub cap free of grease. Insert the distance piece and refit the original shims in order to maintain the correct-end-float to between .05 and .10mm (.002 and .004in).

14. Fit a new oil seal.

15. Refit the bearing nut and tighten it to a torque figure of 8.3 to 11.0kgm (60 to 80 lbft), at the same time ensuring that the hub turns freely without binding.

16. If the rebuilt hub incorporates any new parts (other than oil seals) the end float must be re-checked. Using a suitably mounted dial guage, take a reading from the centre of the hub cap by gripping the brake-drum at diametrically opposite points and moving the hub to and fro axially. The hub must be kept stationary about the swivel axle, otherwise a false reading may be obtained.

17. Refit the hub cap, brake-drum and wheel, and remove the jacks.

Brake Back-Plate Assembly

1. Remove the brake-drum and hub.

2. Disconnect the brake pipe from the wheel cylinder.

3. If the desired attention can be given without disconnecting the flexible brake pipe the brake-plate assembly can be hung on a suitable portion of the frame to take the load off the flexible pipe.

4. Remove the three nuts and one hexagon screw retaining the brake backplate and take off the backplate complete with brake-shoes and wheel cylinders.

5. Reverse the above instructions for replacing and bleed the brakes.

SECTION 5

GENERAL DATA AND TORQUE FIGURES

FRONT SUSPENSION

TYPE	INDEPENDENT COIL SPRINGS
NO. OF COILS	7
WHEEL BEARING END FLOAT	0.002 - 0.004 INS.
FRONT SHOCK ABSORBER	LEVER ARM TYPE

TORQUE FIGURES

	1bft	Nm	Kgm
FRONT SUSPENSION MTG./CHASSIS	48-52	656-71	6.5-7.0
PACKING PLATE FIXING/SPACER SPRING PLATE	32-35	43-47	4.5-4.8
KING PIN/FLUCRUM PIN COTTER PIN NUT	8-15	11-20	1.1-2.1
SPINDLE/BEAM ATTACH	60	81	8.3
SHOCK ABSORBER/BEAM	35-40	47-54	4.8-5.5
SPINDLE/LOWER LINK	30	41	4.1
TOP FULCRUM PIN/NUT	30	41	4.1
RETAIN NUT/BOLT-STEERING ARM	45-50	61-68	6.2-6.9
BRAKE BACK PLATE/BOLTS	35-40	47-54	4.8-5.5
HUB NUT	60-80	681-108	8.3-11.0

Description

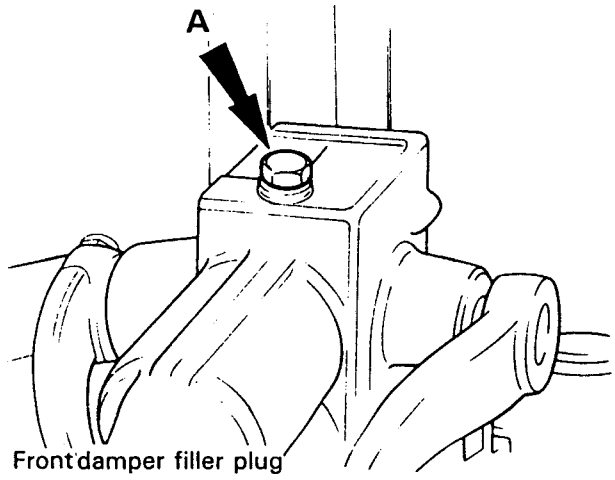
The hydraulic dampers are Armstrong double-acting, resistance being offered to the compression and to the recoil of the road springs.

All the working parts of the dampers are submerged in oil and no adjustment is required or provided for. The dampers are carefully set before dispatch, using special equipment, and any attempt to dismantle the piston assembly will seriously affect the performance of the damper.

A faulty damper should be returned to the makers for attention.

Testing

If there is any doubt that the road springs are adequately damped the condition of the springs and the tyre pressures should also be considered, as these have an appreciable bearing on the results obtained.



A Front damper filler plug

Figure 1

If the hydraulic dampers do not appear to function satisfactorily an indication of their resistance can be obtained by carrying out the following check.

Remove the dampers from the car.

Hold them in a vice and move the lever arm up and down through its complete stroke. A moderate resistance throughout the full stroke should be felt; if, however, the resistance is erratic, or free movement in the lever is noted, lack of fluid is indicated, or there may be air in front of the piston. The free movement should not exceed 3mm (1/8in) at the outer end of the arm.

If the addition of fluid and working the arm over its full range of travel a number of times give no improvement a new damper should be fitted.

Too much resistance, i.e. when it is not possible to move the lever arm slowly by hand, indicates a broken internal part or a seized piston; in such cases the damper should be changed for a new or reconditioned one.

Topping Up With Fluid

The dampers may be replenished in position, provided that the tops have been thoroughly cleaned to ensure that when the filler plug is extracted no dirt falls into the filler orifice.

This is most important, as it is absolutely vital that no dirt or foreign matter should enter the operating chamber.

The use of Armstrong Super (Thin) Shock Absorber Fluid in the Armstrong dampers is recommended. (If this fluid is not available any good-quality mineral oil to Specification S.A.E. 20W/20 should be used, but this alternative is **not** suitable for low-temperature operation).

Fluid should be added to the level of the bottom of the filler plug hole.

When fluid has been added the damper arm should be worked throughout its full stroke (by rocking the car) before the filler plug is replaced to expel any air that might be present in the operating chamber.

Removing and Replacing A Front Damper

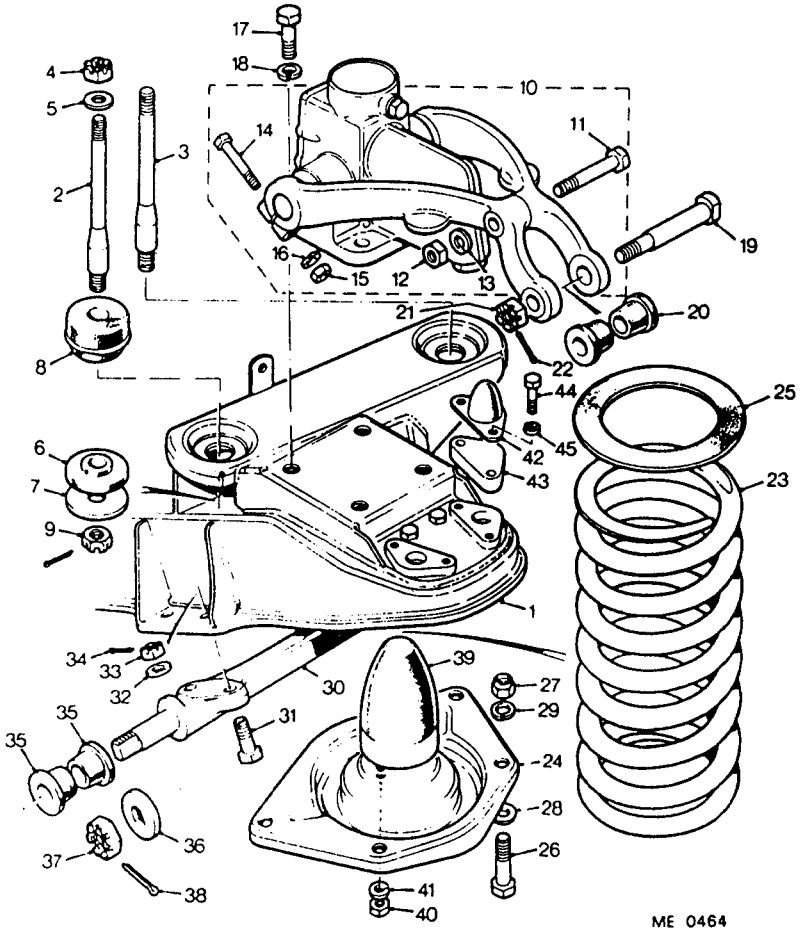
Raise the front of the car and remove the road wheel. Place a stand beneath the front cross-members to support the car in the unlikely event of the jack slipping. Place a further jack beneath the outer end of the lower wishbone arm and raise it until the damper arms are clear of their rebound rubbers on the top of the wishbone arms.

Extract the split pin and castellated nut from the upper trunnion fulcrum pin and take out the pin.

On removing the four set screws and spring washers the damper may be removed from its mounting on the front suspension cross-member assembly.

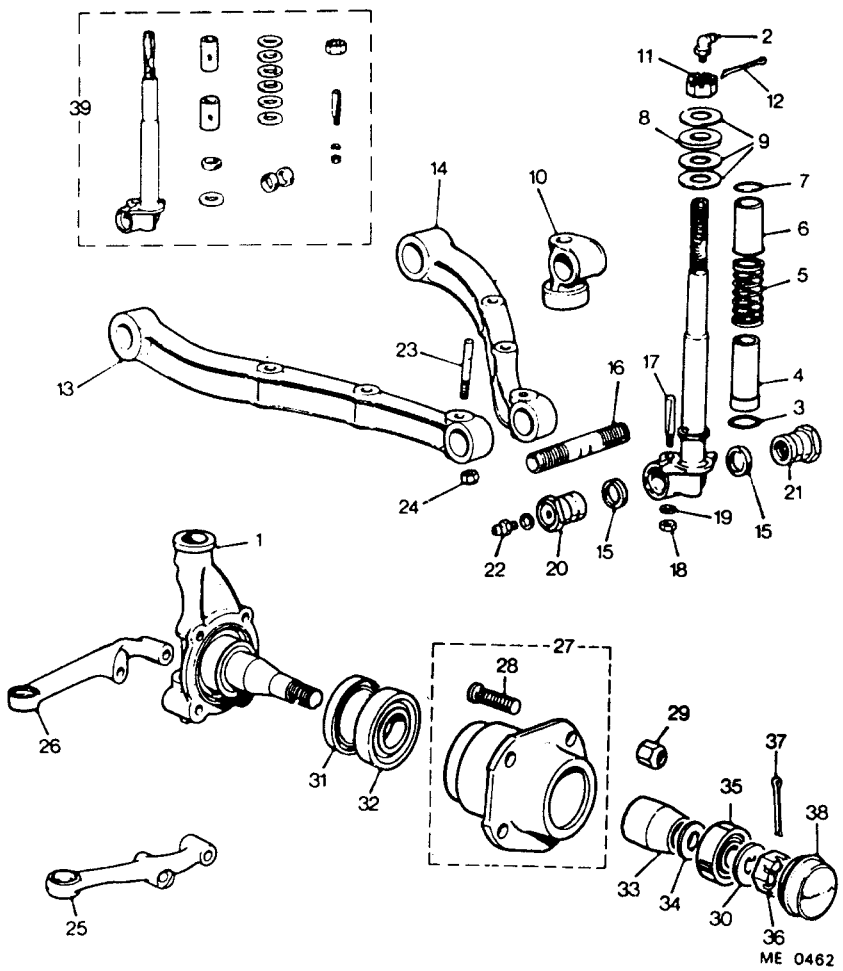
When handling dampers that have been removed from the car it is essential to keep the assemblies upright as far as possible, otherwise air may enter the operating chamber, resulting in free movement.

Replacement is a reversal of the removing procedure, but **before** fitting the upper trunnion fulcrum pin, work the damper arms a few times through their full travel to expel any air which may have found its way into the operating chamber.



FRONT SUSPENSION.

Illus.	Part Number	123456	Description	Quantity
	JHM	623	Front suspension and crossmember complete	1
1	JHM	79	Crossmember assembly	1
2	1B	4636	Stud-crossmember to chassis-front	2
3	1B	4637	Stud-crossmember to chassis-rear	2
4	ND	608041	Nut	4
			WASHER	
5	1B	4550	Mounting-crossmember(rubber)	4
6	6K	9418	Stud	4
7	1B	4551	Mounting rubber	4
8	1B	4553	Mounting-front suspension member	4
9	ND	608041	Nut-crossmember to body	4
10	13H	5765	ABSORBER ASSEMBLY-SHOCK	2
11	BH	606201	Bolt-arm	2
12	GHF	202	Nut	2
13	GHF	333	Washer-spring	2
14	BH	606161	Bolt-clamping	2
15	GHF	202	Nut	2
16	GHF	333	Washer-spring	2
17	53K	1025	Bolt-shock absorber to crossmember	8
18	GHF	333	Washer-spring	8
19	1G	4349	Pin-fulcrum	2
20	8G	621	Bearing-top link	4
21	NL	607041	Nut-fulcrum pin	2
22	GHF	502	Pin-split 0.09375" x 1.5"	2
23	1B	4631	Spring-coil-road	2
24	ACB	4066	Seat-road spring	2
25	1B	4561	Washer-spring seat(rubber)	2
26	BH	606181	Bolt-spring seat to lower link	8
27	GHF	223	Nut	8
28	GHF	302	Washer-plain	8
29	GHF	333	Washer-spring	8
30	1B	4598	Bracket-spindle-detachable	2
31	53K	1854	Bolt-bracket to crossmember	8
32	2K	5333	Washer-lock	4
33	FNZ	307	Nut-slotted	8
34	GHF	502	Pin-split	8
35	ACB	9274	Bearing-lower link	8
36	1G	4464	Washer-locating-lower links spindle	4
37	FNZ	810	Nut-spindle	4
38	GHF	504	Pin-split 0.125" x 2.25"	4
39	1B	4468	Buffer-suspension	2
40	GHF	201	Nut	4
41	LWZ	305	Washer-spring	4
42	1G	4276	Buffer-rebound	4
43	1B	4630	Piece-packing-buffer	4
44	SH	604071	Screw-buffer to crossmember	8
45	GHF	331	Washer-spring	8



FRONT SUSPENSION–Continued

Illus.	Part Number	123456	Description	Quantity
	NSP		FRONT SUSPENSION ASSEMBLY-RH	1
	NSP		FRONT SUSPENSION ASSEMBLY-LH	1
1	21B	226	Axle–swivel	2
2	UHN	490	Lubricator–swivel axle–top	2
3	TRS	1721	Ring–swivel axle(rubber)	2
4	21B	1480	Tube–dust excluder–bottom	2
5	1B	4607	Spring–dust excluder	2
6	1B	4605	Tube–dust excluder–top	2
7		271013 A	Ring–sealing	2
8	ATC	4264	Washer–thrust	2
			WASHER–FLOATING–THRUST	
9	ATC	4261	0.052–0.057"(1.32–1.44mm)	A/R
9	ATC	4262	0.058–0.063"(1.47–1.60mm)	A/R
9	ATC	4263	0.064–0.069"(1.63–1.75mm)	NLA
10	ATC	4249	Trunnion–suspension link	2
11	ATC	4265	Nut–trunnion to swivel pin	2
12	GHF	502	Pin–split 0.09375" x 1.5"	2
13	1B	4365	Link–lower–LH front–RH rear	2
14	1B	4366	Link–lower–LH rear–RH front	2
15	FAM	2746	Ring–fulcrum pin–lower link	4
16	21B	288	Pin–fulcrum–lower link	2
17	53K	1770	Pin–cotter–fulcrum pin to swivel pin	2
18	GHF	200	Nut	2
19	GHF	331	Washer–spring	2
			BUSH–LOWER LINK	
20	1G	4346	Front end	2
21	21B	1754	Front–rear	2
22	UHN	400	Lubricator–lower link bush	4
23	1G	4350	Pin–cotter–link to bush	NLA
24	GHF	272	Nut–cotter pin	4
25	21B	47	Lever–steering–RH	1
26	21B	48	Lever–steering–LH	1
27	1B	4618	HUB ASSEMBLY	2
28	ATC	7257	Stud–wheel	10
29	1D	8033	Nut–wheel stud	10
30	1B	4624	Washer–bearing retaining	2
31	1B	4623	Seal–oil	2
32	1B	4620	Bearing–hub–inner	2
33	1B	4622	Piece–distance–bearing	2
			SHIM	
34	1B	4626	0.003(0.076mm)	A/R
34	1B	4627	0.005"(0.127mm)	A/R
34	1B	4628	0.010"(0.254mm)	A/R
35	1B	4621	Bearing–hub–outer	2
36	1B	4625	Nut–swivel axle	2
37	GHF	513	Pin–split 0.1875" x 3"	2
38	ATC	4270	Cup–grease retaining	2
39	8G	4253	Kit–repair–swivel pin and bush	2

Front Suspension

To facilitate repair after accidental damage and to simplify servicing, the front cross-member complete with the front suspension units is attached by four main bolts to the chassis. The four chassis bolts are on rubber packing pieces, which considerably reduces body noises and steering-wheel rattles excited by road irregularities.

The two independent suspension units are of wishbone construction. Road undulations are absorbed by low-periodicity coil springs mounted between the upper and lower linkages, shocks are absorbed by double-acting dampers on the upper linkages.

Suspension Unit - Removal

1. Jack up the front of the car, place stands under the frame cross-member and remove the road wheels.

2. Disconnect the two drag links from the steering arms. See figure 1.

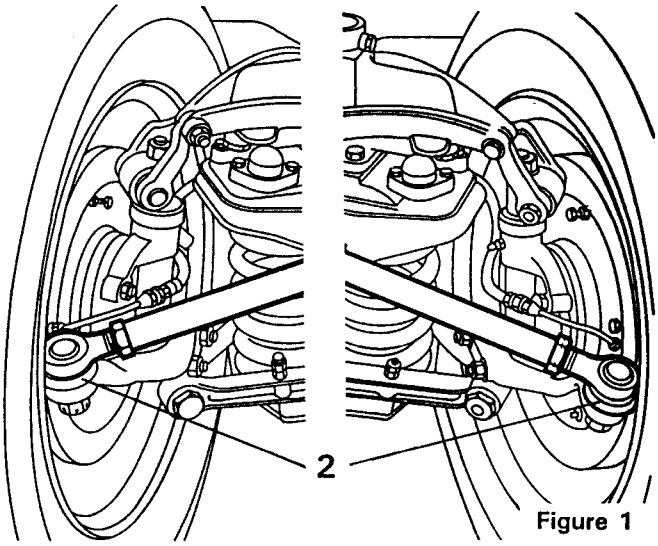


Figure 1

3. Position a suitable container under the chassis. From within the engine compartment disconnect the brake hoses from the chassis. See figure 2. Seal pipe ends to prevent the ingress of dirt into the brake system.

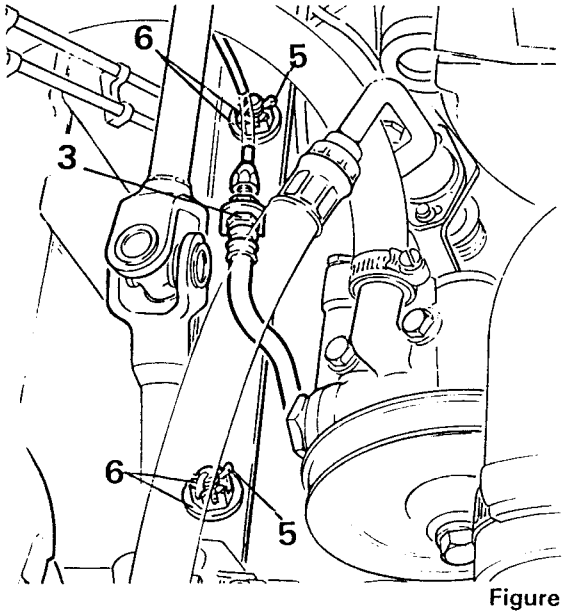


Figure 2

4. Position a moveable lifting jack under the suspension unit. Support the unit.

5. Remove the split pins for the four chassis mounting nuts.

6. Remove the castellated nuts and washers.

7. Carefully lower the jack and suspension unit to allow the mounting studs to clear the chassis. Withdraw the suspension unit from under the car.

8. The suspension unit is refitted in reverse order to that given for removal.

Coil Spring

1. Jack up the side of the car from which the spring is to be removed and place a stand under the frame side-member to the rear of the suspension assembly.

2. Remove the road wheel.

3. Position tool FX 3088 on the spring. See figure 3. Ensure that the tool is rigid.

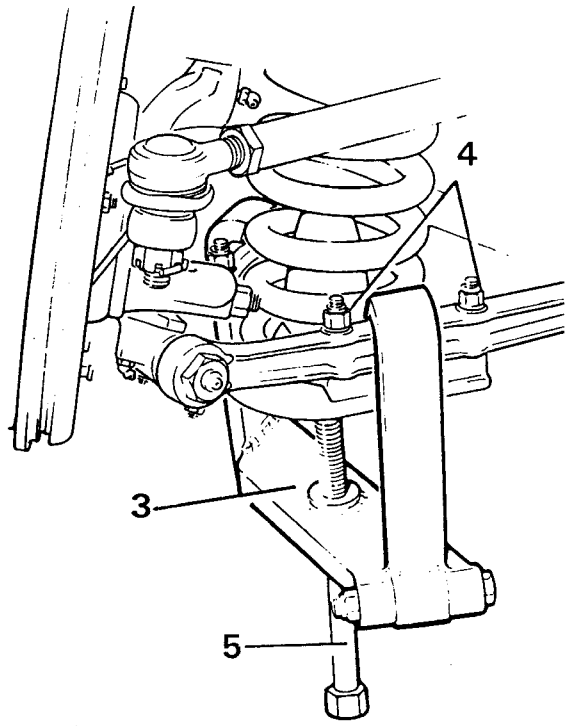


Figure 3

4. Remove the four screws, nuts and washers which secures the spring seat to the lower links.

5. Release the spring tension by unscrewing the compression tool centre screw. When the spring is fully extended, the spring and spring seat can be removed.

Note: Spacers are fitted between the seat and the suspension lower links on most models.

6. The spring is refitted in reverse order to that given for removal.

Suspension Unit - Dismantling

Note: With the drag link released and the spring removed the suspension unit can be serviced on the vehicle.

1. Unscrew the nut and remove the clamping bolt and washer from the top wishbone. See figure 4.

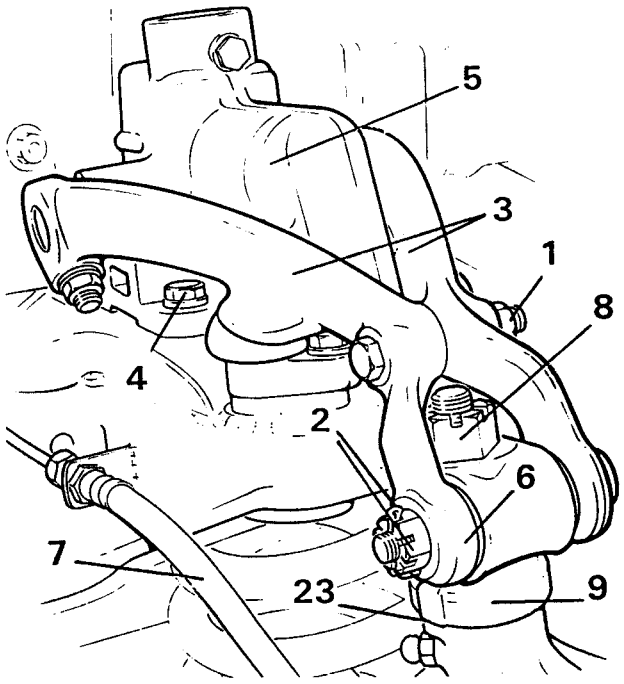


Figure 4

2. Remove the split pin and castellated nut from the upper trunnion fulcrum pin. Withdraw the pin.

3. Carefully part the top wishbone arms to allow the arms to pivot upwards from the top link boss.

4. Remove the four screws which secure the shock absorber to the crossmember assembly.

5. The shock absorber can now be removed complete with the top wishbone arms.

6. Withdraw the top link bearings from each end of the upper trunnion.

Note: These bearings fit into a groove in the swivel pin and must be removed before the swivel pin can be withdrawn.

7. Disconnect the flexible hose from the wheel hub. Seal pipe ends to prevent the ingress of dirt into the brake system.

8. Remove the split pin and castellated nut from the top of the swivel pin.

9. Remove the upper trunnion and thrust washers, lift off the hub assembly.

10. The lower fulcrum pin assembly can now be dismantled. Unscrew the nut on each of the cotters located in the ends of the lower wishbone arms. See figure 5.

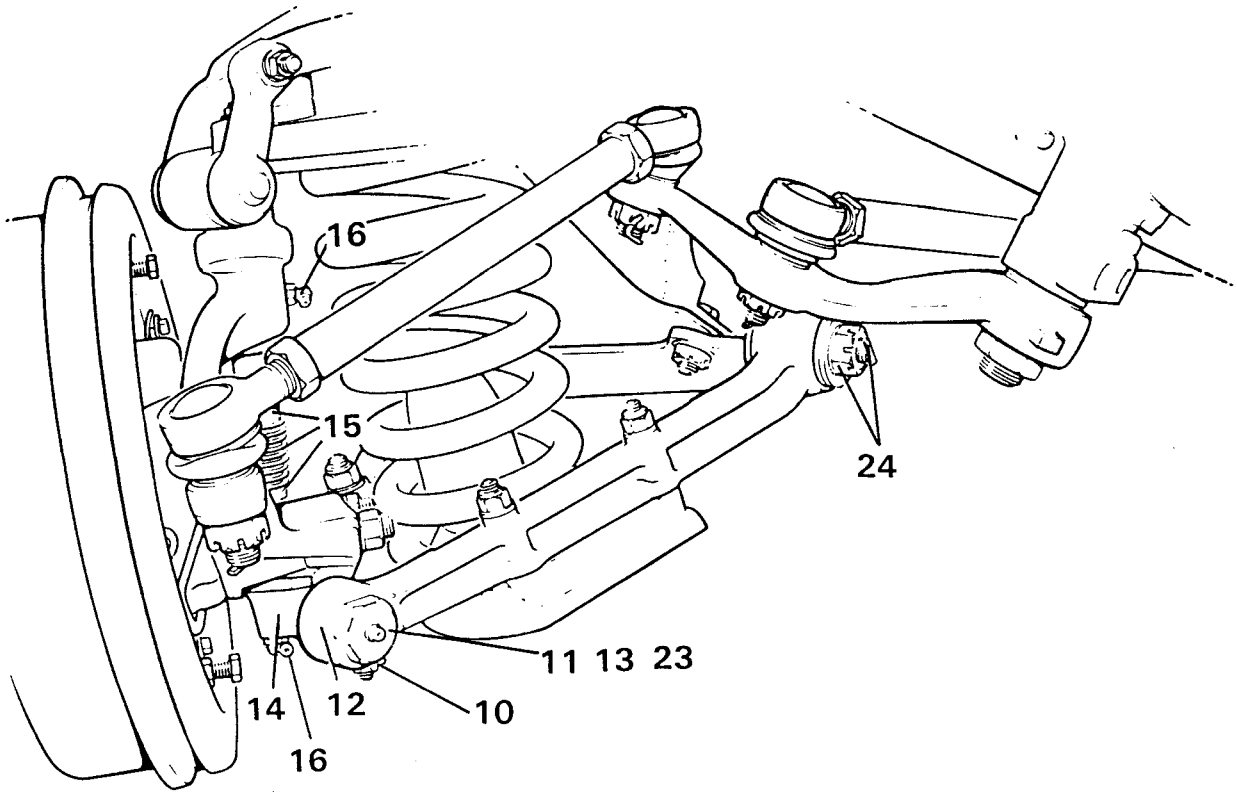


Figure 5

11. In order to release the threaded bushes, tap up the cotters approximately ⅛ in. Remove the threaded bushes from the lower wishbone ends.

Note: The cotters cannot be removed until the threaded bushes are removed as the cotters are disked to lock against the bushes.

12. Unscrew the nut located in the centre of the lower trunnion and tap out the cotter.

13. Withdraw the lower fulcrum pin and remove the sealing washer from each end of the trunnion.

14. Remove the swivel pin assembly. The (Kinpin) can now be serviced as follows:

15. Remove the top and bottom tube dust excluders and the central spring.

16. Remove the grease nipples from the swivel axle.

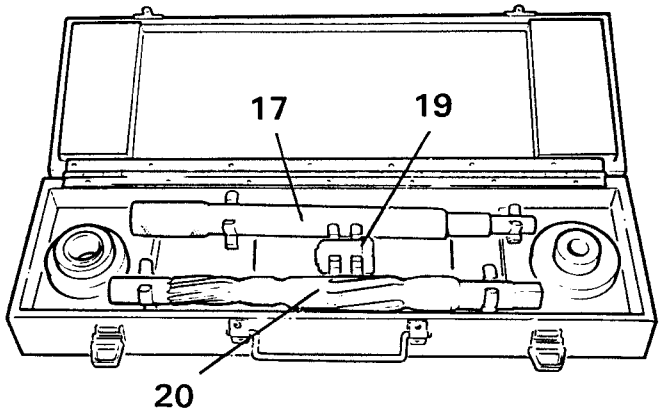
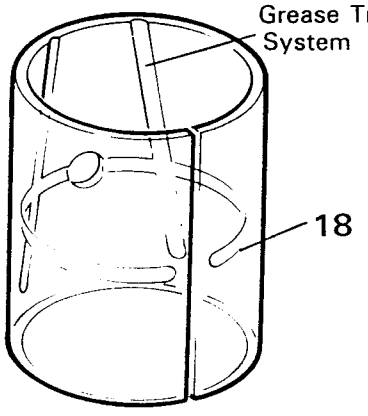


Figure 6

17. Remove both bushes from the top and bottom of the swivel axle using the special tool. (Kit No. 18G-604). See figure 6.

18. When fitting new top and bottom bushes, ensure that the grease nipple hole is aligned with the hole in the bush, also ensure that the bush is orientated so that the scroll located on the inside of the bush enables the grease to be transported upwards. See figure 7.



Note: Top and Bottom bushes to be orientated as illustrated.

Figure 7

19. Use special tool to position bushes in the top and bottom trunnions of the swivel axle. See figure 6.

20. Use special tool STM 7239 to ream the bushes to size. See figure 6. Ensure that all swarf is removed from the bushes before assembling the kingpin .

21. The suspension unit is reassembled in the reverse order to that given for dismantling. However, the following must be noted.

22. When fitting the spacer/ thrust washers between top trunnion of the swivel axle and the suspension link trunnion, ensure that 2 flat washers followed by a phosphor bronze thrust washer and finally a flat washer are fitted.

Note: The swivel pin castellated nut should be tightened down, then backed off to achieve an end float of between 0.025 and 0.15mm (0.001 and 0.006 in). Lock nut in position using a new split pin.

23. When fitting the threaded bushes to the lower wishbone ends, tighten until tight then slacken both off by approximately ½ a turn (4 flats).

Note: Should the lower wishbone rubber bushes require attention continue as follows after operation number 11.

24. Remove the split pin and castellated nut from the lower wishbone arms. Detach arms.

Brake-Drum and Hub

1. Jack-up the side of the car from which the hub is to be removed and place a stand under the frame side-member, to the near of the suspension assembly.

2. Remove the road wheel.

3. Remove the two countersunk screws that secure the brake-drum to the hub. Remove the brake-drum.

4. Prise out the hub cap. See figure 1.

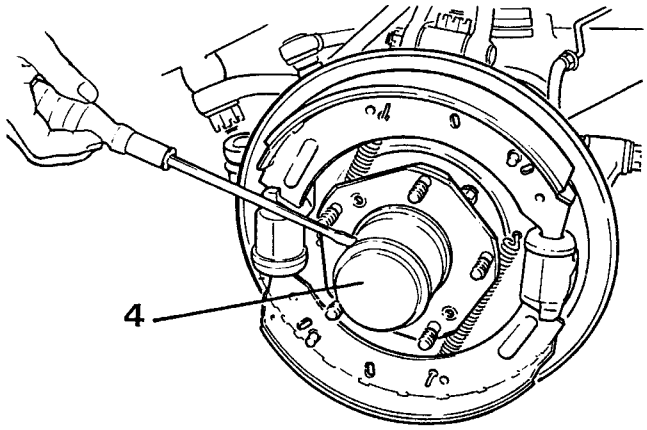


Figure 1

5. Remove the split pin, castellated nut and flat washer from the stub axle. See figure 2.

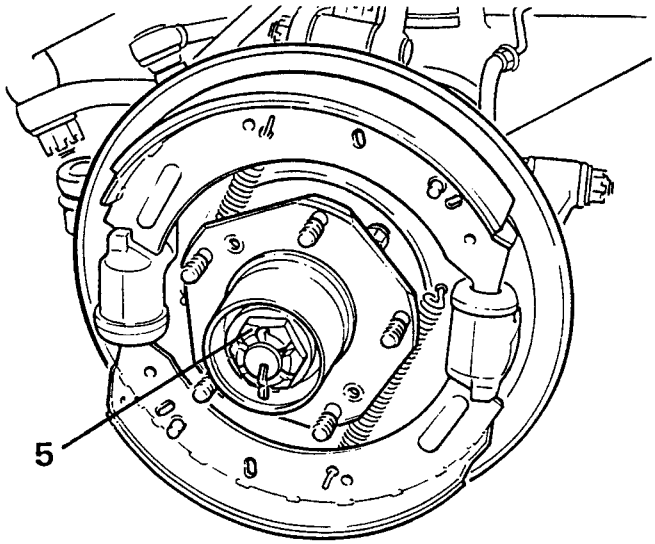


Figure 2

6. Withdraw the hub. The two bearings, distance piece and oil seal will also be withdrawn in this operation. See figure 3.

7. Remove the oil seal, which should be discarded.

8. Remove the inner race of the larger bearing, shims and distance piece from the hub.

9. Remove the outer race of the outer bearing.

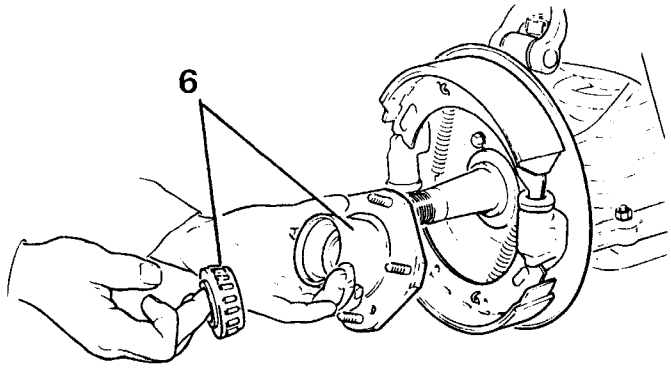


Figure 3

10. Remove the outer race of the inner-bearing

11. Replace the outer race of the outer bearing

12. Replace the outer race of the inner bearing

13. Pack the hub with the recommended grease but leave the space between the bearings and the hub cap free of grease. Insert the distance piece and refit the original shims in order to maintain the correct-end-float to between .05 and .10mm (.002 and .004in).

14. Fit a new oil seal.

15. Refit the bearing nut and tighten it to a torque figure of 8.3 to 11.0kgm (60 to 80 lbft), at the same time ensuring that the hub turns freely without binding.

16. If the rebuilt hub incorporates any new parts (other than oil seals) the end float must be re-checked. Using a suitably mounted dial guage, take a reading from the centre of the hub cap by gripping the brake-drum at diametrically opposite points and moving the hub to and fro axially. The hub must be kept stationary about the swivel axle, otherwise a false reading may be obtained.

17. Refit the hub cap, brake-drum and wheel, and remove the jacks.

Brake Back-Plate Assembly

1. Remove the brake-drum and hub.

2. Disconnect the brake pipe from the wheel cylinder.

3. If the desired attention can be given without disconnecting the flexible brake pipe the brake-plate assembly can be hung on a suitable portion of the frame to take the load off the flexible pipe.

4. Remove the three nuts and one hexagon screw retaining the brake backplate and take off the backplate complete with brake-shoes and wheel cylinders.

5. Reverse the above instructions for replacing and bleed the brakes.

SECTION 5

GENERAL DATA AND TORQUE FIGURES

FRONT SUSPENSION

TYPE	INDEPENDENT COIL SPRINGS
NO. OF COILS	7
WHEEL BEARING END FLOAT	0.002 - 0.004 INS.
FRONT SHOCK ABSORBER	LEVER ARM TYPE

TORQUE FIGURES

	1bft	Nm	Kgm
FRONT SUSPENSION MTG./CHASSIS	48-52	656-71	6.5-7.0
PACKING PLATE FIXING/SPACER SPRING PLATE	32-35	43-47	4.5-4.8
KING PIN/FLUCRUM PIN COTTER PIN NUT	8-15	11-20	1.1-2.1
SPINDLE/BEAM ATTACH	60	81	8.3
SHOCK ABSORBER/BEAM	35-40	47-54	4.8-5.5
SPINDLE/LOWER LINK	30	41	4.1
TOP FULCRUM PIN/NUT	30	41	4.1
RETAIN NUT/BOLT-STEERING ARM	45-50	61-68	6.2-6.9
BRAKE BACK PLATE/BOLTS	35-40	47-54	4.8-5.5
HUB NUT	60-80	681-108	8.3-11.0

LTI
SERVICE

Fairway

WORKSHOP MANUAL

SECTION 5a

STEERING

SECTION ST

CONTENTS

BLEED

CAUTION: When bleeding the hydraulic system take care to ensure the reservoir does not become empty.

1. Fill the steering fluid reservoir with one of the recommended fluids.

2. Start and run the engine at idle speed.

3. Slacken the bleed screw (1, Fig. 12B.3). When fluid seepage past the bleed screw is observed, retighten the screw.

4. Ensure that the fluid level is in alignment with the mark on the reservoir.

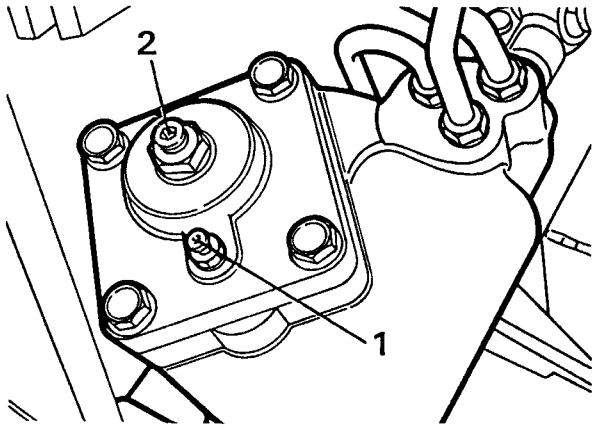


Figure 12B.3
Power steering box bleed screw.

5. Wipe off all fluid released during bleeding.

6. Check all hose joints, pump and steering box fluid leaks under pressure by holding the steering hard on full lock in both directions.

CAUTION: Do not maintain this pressure for more than 30 seconds in any one minute, to avoid causing the oil to overheat and possible damage to the seals. The steering should be smooth lock-to-lock in both directions, that is, no heavy or light spots when changing direction when vehicle is stationary.

7. Carry out a short road test. If necessary, repeat the complete foregoing procedure.

POWER STEERING BOX

It is important that whenever any part of the system, including the flexible piping, is removed or disconnected, that the utmost cleanliness is observed.

All ports and hose connections should be sealed off to prevent ingress of dirt etc. If metallic sediment is found in any part of the system, the complete system should be checked, the cause rectified and the system thoroughly cleaned.

CAUTION: Under no circumstances must the engine be started until the reservoir has been filled. Failure to observe this rule will result in damage to the pump.

Remove

Service Tool: 18G 75A

1. Park the vehicle on level ground.

2. Remove the filler cap from the power steering fluid reservoir. Disconnect the flexible hoses from the steering box and drain and discard the fluid. Replace the filler cap.

3. Blank off all disconnected hose connections to prevent ingress of foreign matter.

4. Remove the pinch bolt attaching the universal joint to the power steering box.

5. Remove split pins and castellated nuts from centre track rod and side arm ball joints. See figure 12B.4.

6. Carefully remove ball joints using tool 18G 1063.

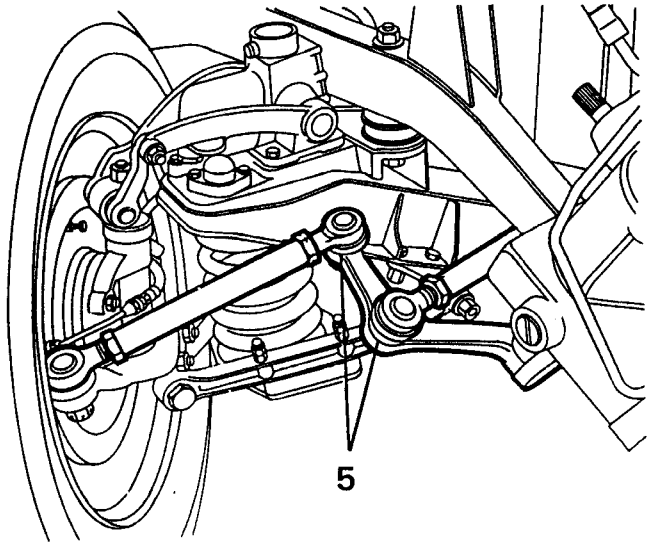


Figure 12B.4

7. Remove the fixings attaching the power steering box to the chassis member.

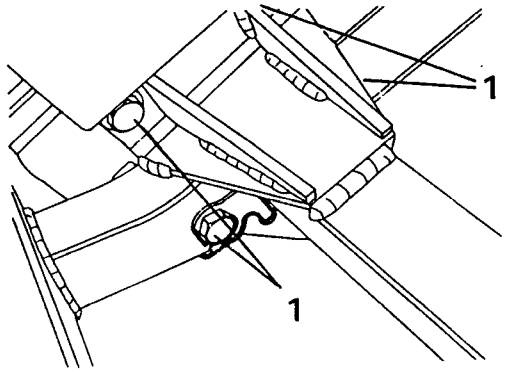


Figure 12B.5

8. Withdraw the power steering box.

POWER STEERING BOX

Replace

1. Refit steering box to chassis using new tab washers. See figure 12B.6.

2. Tighten bolts to correct torque figures.

3. Refit track rod ends torque nuts to specified torque and fit new split pins.

4. Insert and tighten the pinch bolt, attaching the universal joint to the power steering box.

5. Remove the blanks and reconnect the flexible hoses to the steering box.

6. Remove the filler cap from the power steering fluid reservoir. Fill the reservoir to the mark on the container using one of the recommended fluids, and bleed the power steering system.

7. Replace the reservoir filler cap.

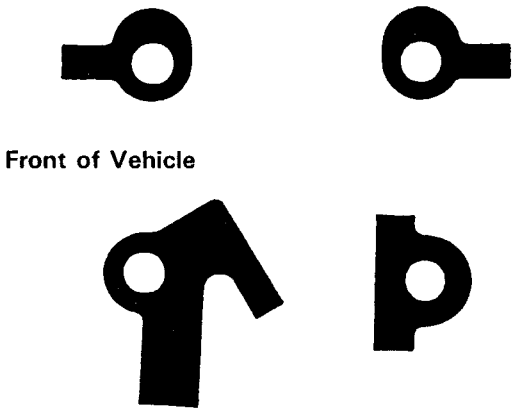


Figure 12B.6
Location of Lock Tabs

It is important that whenever any part of the system, including the flexible piping, is removed or disconnected, that the utmost cleanliness is observed.

All ports and hose connections should be suitably sealed off to prevent ingress of dirt, etc. If metallic sediment is found in any part of the system, the complete system should be checked, the cause rectified and the system thoroughly cleaned.

CAUTION: Under no circumstances must the engine be started until the reservoir has been filled. Failure to observe this rules will result in damage to the pump.

Adjusting Backlash in Sector Shaft

Note: The condition arrived at after final adjustment must be one of minimum backlash, without overtightness, when the wheels are in the straight ahead position.

1. Jack up the front of the vehicle until the wheels are clear of the ground.

WARNING: Rear wheels wust be checked in all circumstances.

2. Gently rock the steering wheel about the straight-ahead position to obtain the 'feel' of the backlash present.

3. Continue the rocking action whilst an assistant slowly tightens the steering box adjuster screw (2, 12B.3) after slackening the locknut until the rim movement is reduced to 9.5 mm (0.375 in) maximum.

4. Tighten the locknut, then turn the steering wheel from lock-to-lock and check that no excessive tightness exists at any point.

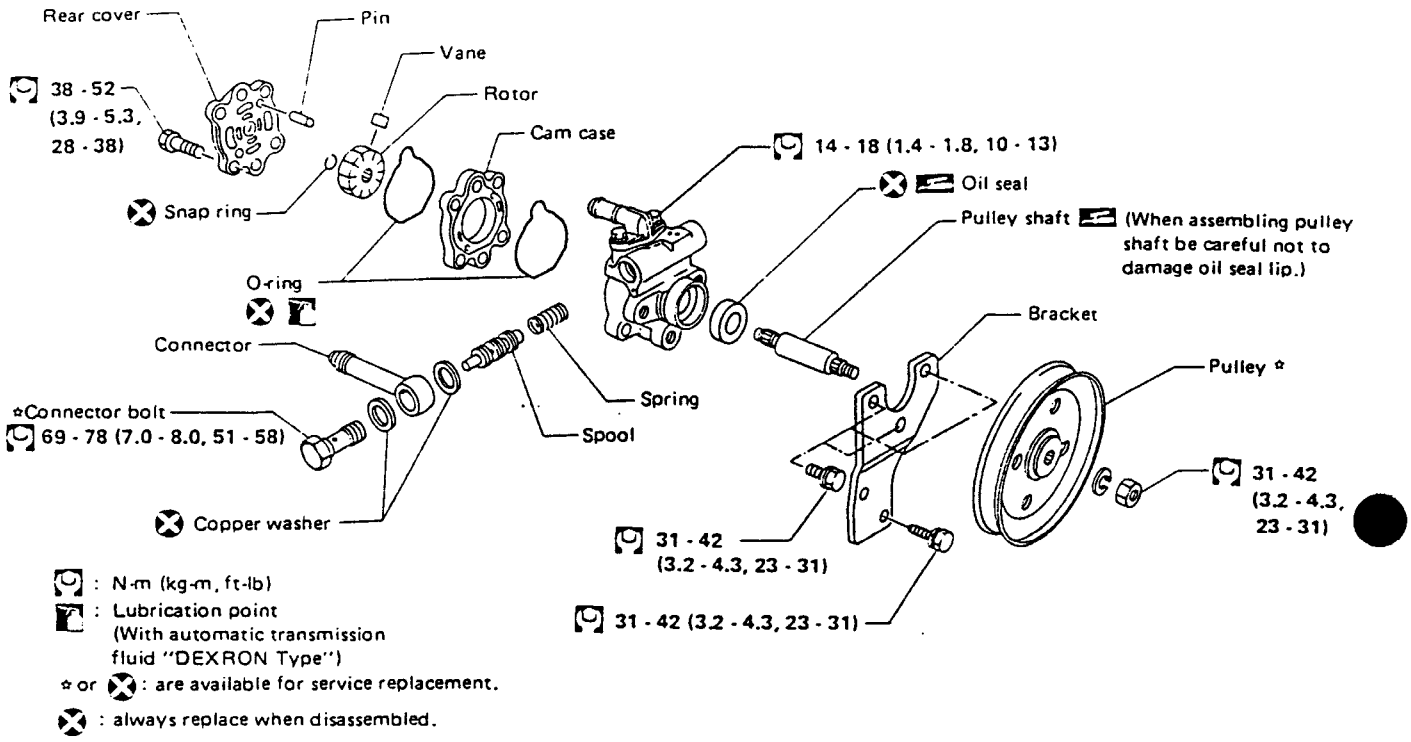
5. Lower the vehicle to ground level and remove the wheel chocks.

6. Test the steering system for leaks, with the engine running, by holding the steering hard on full lock in both directions.

CAUTION: Do not maintain this pressure for more than 30 seconds in any one minute, to avoid causing the oil to overheat and possible damage to the seals.

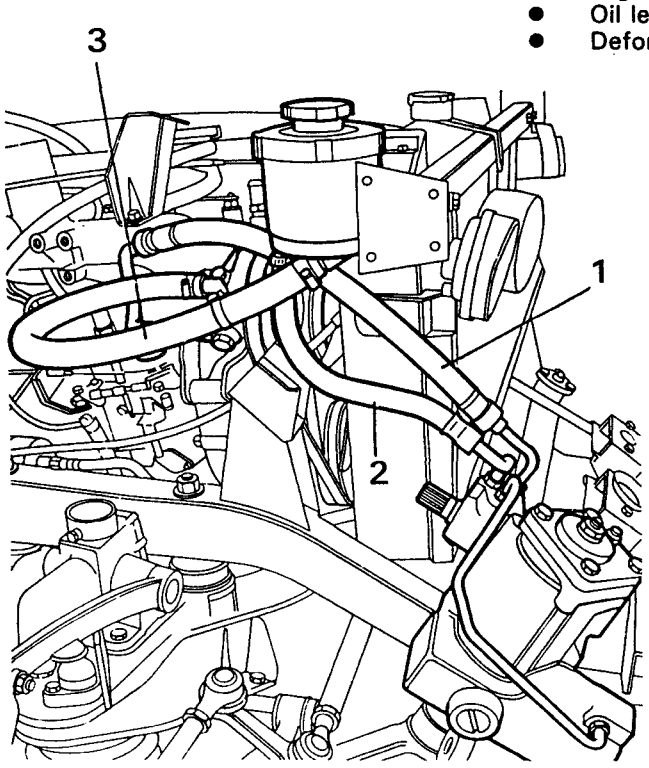
7. Road test the vehicle.

POWER STEERING OIL PUMP



The power steering oil pump should be disassembled only if any of the following conditions are observed:

- Oil leak
- Deformed or damaged pulley

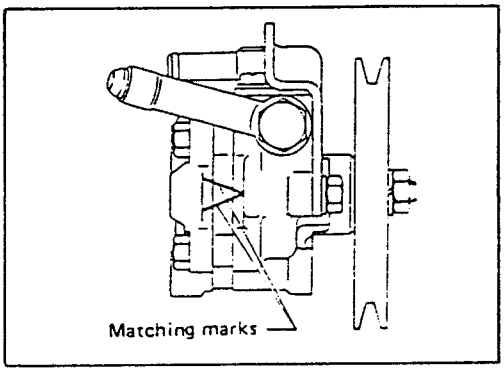


Identification of Hoses

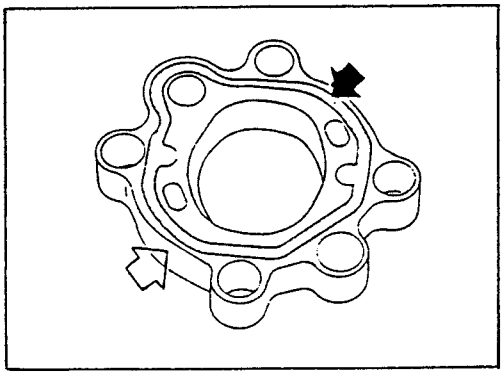
1. High pressure hose from pump to steering box reservoir.
2. Low pressure return from steering box to reservoir.
3. Feed to pump from reservoir.

Disassembly

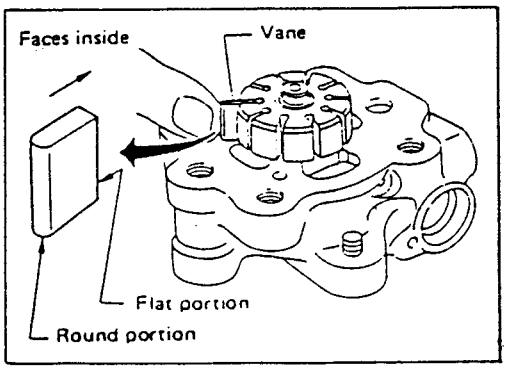
CAUTION:
- The parts which can be disassembled are strictly limited, and never disassemble other parts that the specified ones.
- Disassembly should be performed in a place as clean as possible.
- Hands should be cleaned before disassembly.
- Do not use a rag. Be sure to use nylon or paper cloth.
- Be sure to follow procedures and cautions indicated in the Service Manual.
- When disassembling and reassembling, do not allow any foreign matter to enter or contact any parts.



1. Inscribe matching marks.

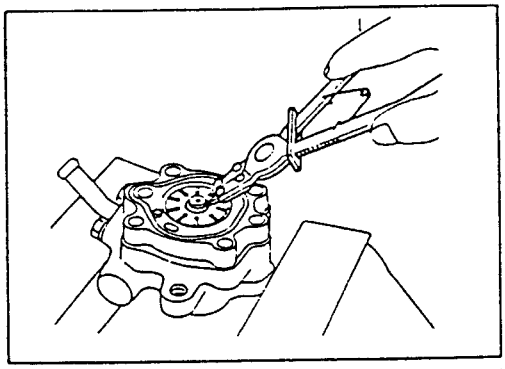


2. Remove rear cover.
3. Remove O-ring from cam case.

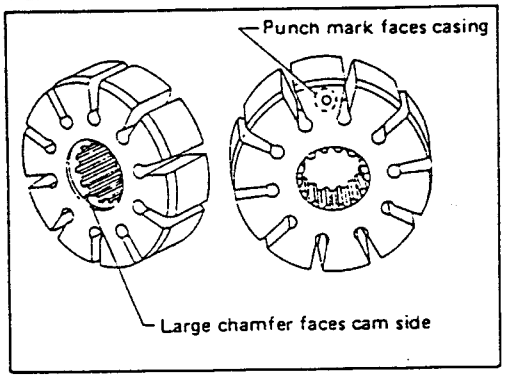


CAUTION:
- **When removing cam case, be sure that the vane does not come off the rotor.**

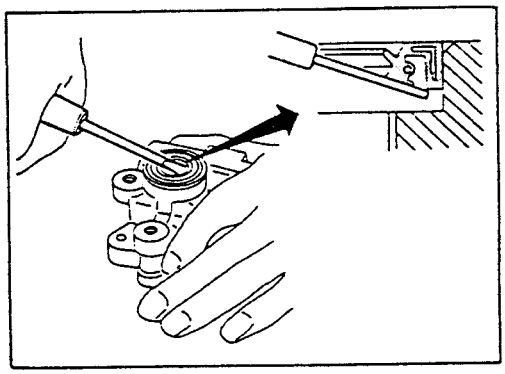
Disassembly (Cont'd)



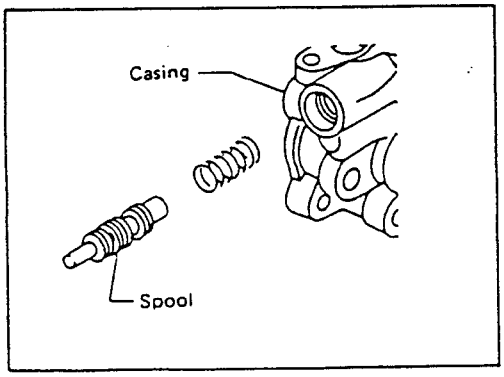
4. Remove snap ring, then draw pulley shaft out.
   - **Be careful not to drop pulley shaft.**



5. Pay attention to the direction of rotor.



6. Remove oil seal.
   - **Be careful not to damage casing.**

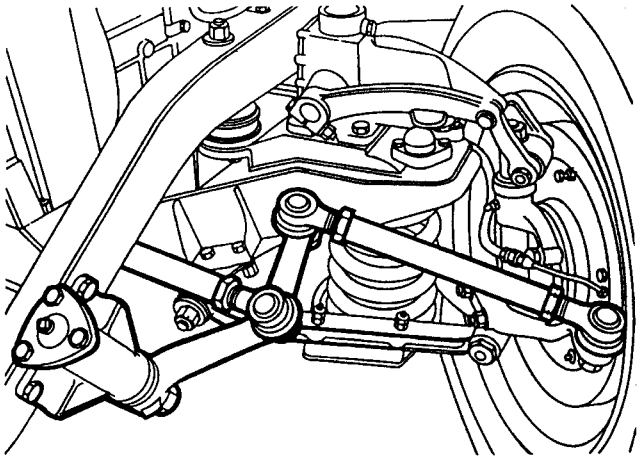


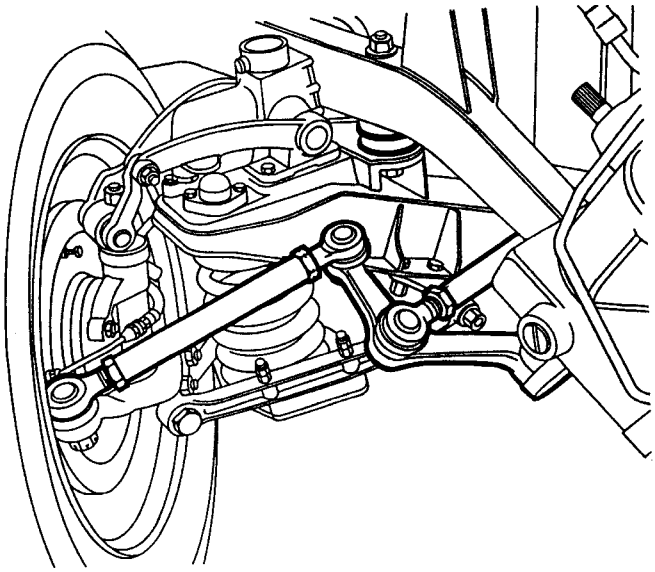
7. Remove connector.
   - **Be careful not to drop spool.**

8. Remove suction pipe, then remove O-ring.

Description

A double lever, secured by a castellated nut and cotter pin, is splined to the lower end of the shaft. This lever is connected to a similar lever on the steering idler at the opposite side of the car by an adjustable track-rod. Short adjustable draglinks connect the double levers to the steering-arms at each side.





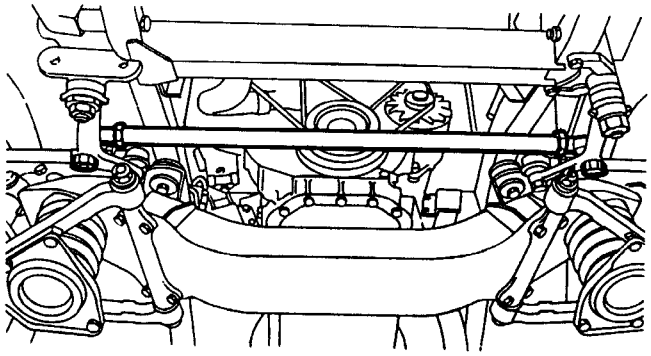
Adjusting the Track

The track-rod is threaded right-hand at one end and left-hand at the other, so that turning the rod in the required direction effects the correct setting after releasing the locknuts.

If the alignment is incorrect, slacken the nuts securing both ball joint assemblies to the track-rod and rotate the rod until the required alignment is obtained.

Note: Always reset the track by adjusting the centre track rod. The adjustable draglinks are pre-set to obtain the turning circle.

The correct setting for the tracking is $^{1}/_{16}$ in. toe in



Removing and Replacing A Draglink

The draglinks are held in position by a ball joint and castellated nut, locked with a split pin at either end.

To remove the links withdraw the split pins, remove the nuts, and carefully tap out the ball joints, using tool 18G 1063. When removing the ball joints from either end always support the levers to which they are attached to prevent any shock being transmitted to the steering gear, where damage may be caused.

Replacement is a reversal of the above instructions.

Removing and Replacing the Idler

Disconnect the draglink and track-rod from the idler double lever.

Remove the bolts securing the idler to the frame and withdraw the unit from the car.

The refitting of the idler is generally a reversal of the removal procedure, but care should be taken to ensure that it is secured firmly against the chassis frame.

Dismantling and Assembling the Idler

The top cap of the idler is secured to the body by three set screws with a joint washer between the cap and body.

Lubrication is by the removal of the plug in the cap and injecting oil into the body. See 2, figure 12B.8

Internally the body has a recess in the head and a plain bore right through. Two bronze bush bearings, with internal oil grooves, are pressed into the body - one at the top, the other at the bottom.

The idler shaft can be removed by hand once the body top cap has been released. The flange of the idler shaft locates in the recess within the body head and two highly finished portions of the shaft rotate within the bronze bushes. At the lower end of the shalf are splines for the location of the double lever, which in turn is retained by a castellated nut and split pin.

When refitting idler box to chassis fit new lock tab. See 1, figure 12B.8.

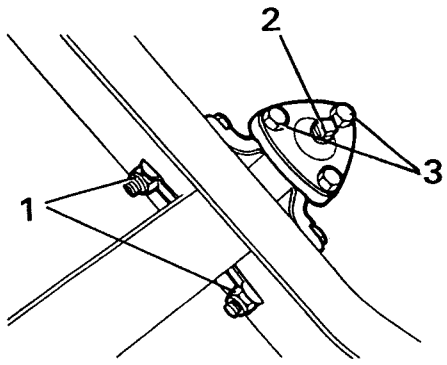


Figure 12B.8

Adjust the end-float 3, (Figure 12B.8) of the idler shaft by means of the gaskets under the top cover.

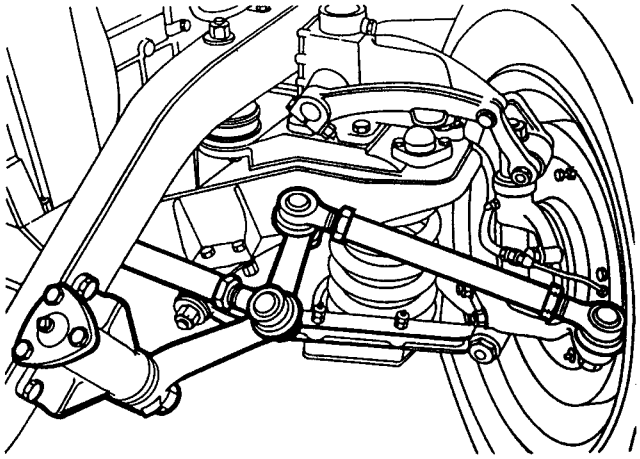
After reassembly refill the idler with the recommended oil.

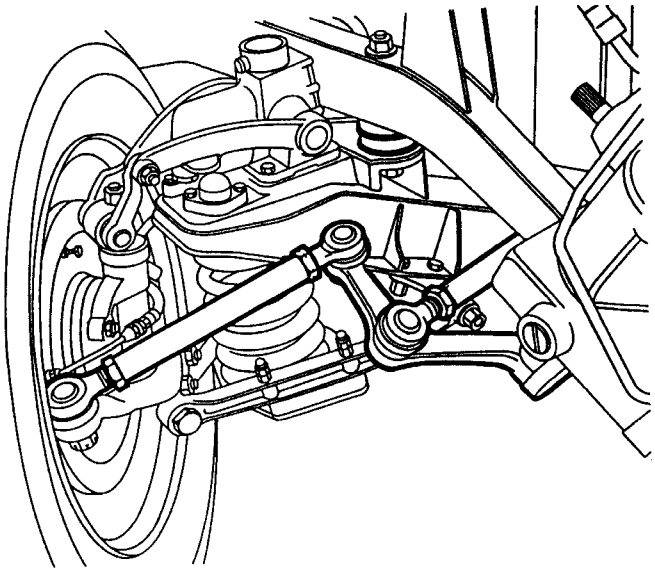
Steering idler end float:

0.001 to 0.006 in
0.0254 to 0.1524 mm

Description

A double lever, secured by a castellated nut and cotter pin, is splined to the lower end of the shaft. This lever is connected to a similar lever on the steering idler at the opposite side of the car by an adjustable track-rod. Short adjustable draglinks connect the double levers to the steering-arms at each side.





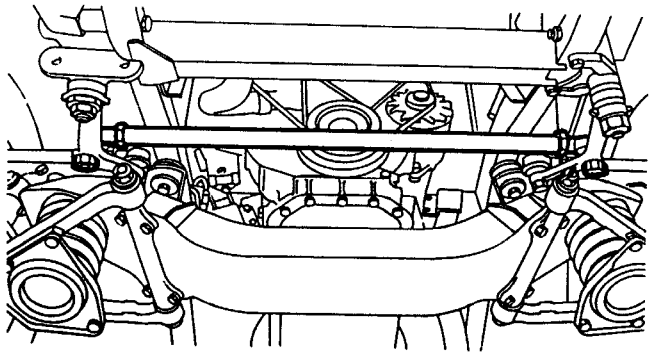
Adjusting the Track

The track-rod is threaded right-hand at one end and left-hand at the other, so that turning the rod in the required direction effects the correct setting after releasing the locknuts.

If the alignment is incorrect, slacken the nuts securing both ball joint assemblies to the track-rod and rotate the rod until the required alignment is obtained.

Note: Always reset the track by adjusting the centre track rod. The adjustable draglinks are pre-set to obtain the turning circle.

The correct setting for the tracking is $^{1}/_{16}$ in. toe in



Removing and Replacing A Draglink

The draglinks are held in position by a ball joint and castellated nut, locked with a split pin at either end.

To remove the links withdraw the split pins, remove the nuts, and carefully tap out the ball joints, using tool 18G 1063. When removing the ball joints from either end always support the levers to which they are attached to prevent any shock being transmitted to the steering gear, where damage may be caused.

Replacement is a reversal of the above instructions.

Removing and Replacing the Idler

Disconnect the draglink and track-rod from the idler double lever.

Remove the bolts securing the idler to the frame and withdraw the unit from the car.

The refitting of the idler is generally a reversal of the removal procedure, but care should be taken to ensure that it is secured firmly against the chassis frame.

Dismantling and Assembling the Idler

The top cap of the idler is secured to the body by three set screws with a joint washer between the cap and body.

Lubrication is by the removal of the plug in the cap and injecting oil into the body. See 2, figure 12B.8

Internally the body has a recess in the head and a plain bore right through. Two bronze bush bearings, with internal oil grooves, are pressed into the body - one at the top, the other at the bottom.

The idler shaft can be removed by hand once the body top cap has been released. The flange of the idler shaft locates in the recess within the body head and two highly finished portions of the shaft rotate within the bronze bushes. At the lower end of the shalf are splines for the location of the double lever, which in turn is retained by a castellated nut and split pin.

When refitting idler box to chassis fit new lock tab. See 1, figure 12B.8.

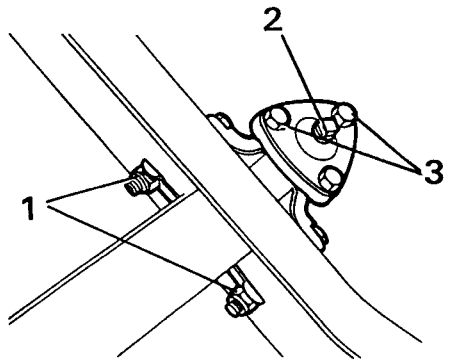


Figure 12B.8

Adjust the end-float 3, (Figure 12B.8) of the idler shaft by means of the gaskets under the top cover.

After reassembly refill the idler with the recommended oil.

Steering idler end float:

0.001 to 0.006 in
0.0254 to 0.1524 mm

SECTION 5A

GENERAL DATA AND TORQUE FIGURES

STEERING

Power Assisted Worm and Roller Type

Turning Circle ..... 25ft.

Toe In ..... 1/16 in.

TORQUE FIGURES

	1bft	Nm	Kgm
STEERING BOX TO CHASSIS FRAME	48-52	65-71	6.6-7.2
IDLER BOX TO CHASSIS FRAME	32-35	43-47	4.5-4.8
UNIVERSAL JOINTS TRACK RODS AND STEERING LINKS	55-60	74-81	7.6-8.3
STEERING COLUMN UNIVERSAL JOINTS	13-16	18-22	1.8-2.2

LTI SERVICE

Fairway DRIVER

WORKSHOP MANUAL

SECTION 5b

FRONT SUSPENSION

CONTENTS

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

While every effort is made to ensure the accuracy of the particulars contained herein, London Taxis International Ltd will not under any circumstances be held liable for any inaccuracies or the consequences thereof.

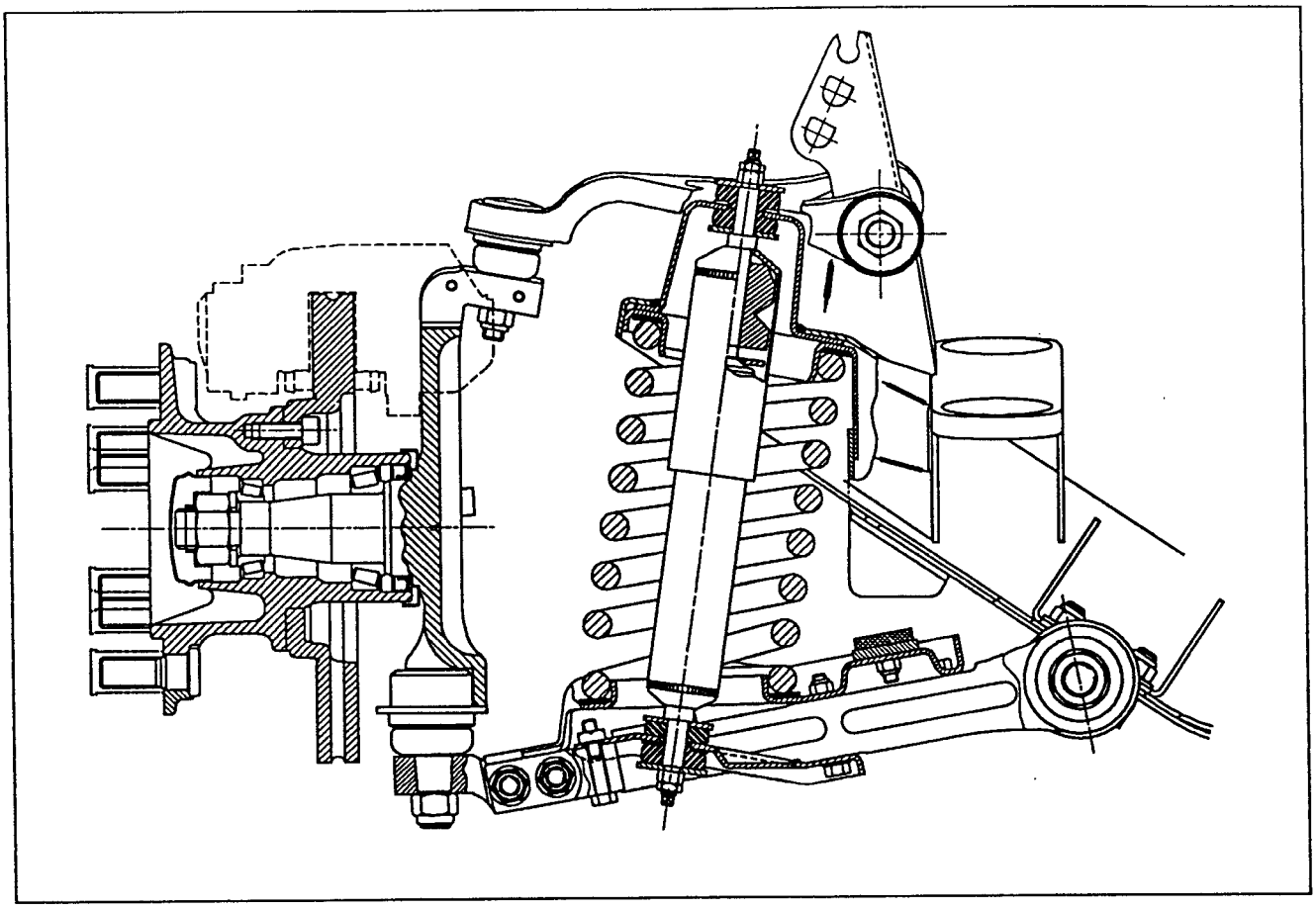


Fig 1. Front Suspension - layout

General description

The front suspension and steering have been purpose designed for taxi operation. Suspension and steering ball joints are lubricated for life. Rubber bushes are used throughout the design to minimize road noise and steering shock and reduce service costs. Telescopic dampers are mounted concentrically within the coil springs and may be serviced without disturbing other components.

The front suspension assembly is mounted to the front crossmember which is attached to the chassis at four points through rubber mountings. The outer ends of the fabricated crossmember carry the abutments for the coil springs and telescopic dampers and the pivot points for the inner mountings of the upper wishbones. Brackets welded to the lower edge of the crossmember provide the mounting point for the pivot brackets which carry the inner mountings of the lower wishbones. Separate bump stops are welded to the lower face of each side of the crossmember.

Forged wishbones are fitted. The upper wishbones are of one piece construction, the inner ends being mounted on large rubber bushes. The outer ends are fitted with pressed in upper ball joints. The lower wishbones are fabricated, the outer ends of the forged "I" section front and rear arms being bolted to lower ball joint carriers. The inner ends of the lower wishbones are mounted on large rubber bushes to pivot brackets which are bolted to the underside of the front crossmember.

Spring mounting plates and bump stops are bolted to the top face of the lower wishbones. Telescopic dampers are fitted concentric with the coil springs. The dampers can be replaced in service without disturbing other components.

The steering knuckles are fitted with the lower ball joints and complete the suspension assembly. The front hubs are mounted to the steering knuckles on taper roller bearings, with 10.9 inch ventilated discs bolted to the hub inner faces. 6 stud 16 inch wheels are fitted with full wheel covers.

FRONT SUSPENSION

KEY DATA

FRONT HUB END FLOAT:	O,O25 - 0,152 mm (0.001 - 0.006 in.)
BRAKE DISC:	
RUN OUT (MAX)	0,1 mm (0.004 in.)
WEAR (MAX)	1,0 mm (0.040 in.) per side
THICKNESS (MIN)	22,0 mm (0.875 in.)
FRONT HUB GREASE	Lithium 12 Hydroxy stearate or equivalent
BALL JOINT LIFT (MAX):	
UPPER	1,5 mm (0.060 in.)
LOWER	2,0 mm (0.080 in.)

TORQUE SETTINGS:	Nm	lbf ft.
Crossmember to chassis	64-70	47-52
Pivot bracket to crossmember	115-130	86-97
Lower wishbone to pivot bracket	100-110	74-82
Lower wishbone to ball joint carrier	115-130	86-97
Bump stop to spring mounting plate	25-35	18-26
Spring mtg. plate to wishbone set bolt	25-35	18-26
Damper mounting plate bolts	25-30	18-22
Lower ball joint to ball joint carrier	150-170	111-125
Lower ball joint to knuckle	65-70	47-52
Upper ball joint	58-64	43-47
Track rod end ball joints	74-81	55-60
Upper wishbone to crossmember	90-100	66-74
Brake caliper to knuckle	95-125	70-92
Brake disc to hub	45-55	33-41
Wheel nuts	200	150

Service requirements:

1,000 miles (1,500 km) and 6,000 miles (10,000 km) or every 3 months	Check security of suspension and crossmember bushes, steering and suspension ball joints and fixings. Check dampers for leaking.
12,000 miles (20,000 km) or every 6 months	Check/adjust front wheel bearings.
24,000 miles (40,000 km) or every year	Check torque of suspension ball joints.
36,000 miles (60,000 km) or every 18 months	Examine condition of front wheel bearings, regrease or replace as necessary, set wheel bearing end float. Replace front dampers.

Special tools:

REPLACER - UPPER WISHBONE BUSHES	Churchill FX 4201
REMOVER - LOWER WISHBONE BUSHES	Churchill FX 4199
REPLACER - LOWER WISHBONE BUSHES	Churchill FX 4215
REPLACER - FRONT HUB BEARING CUPS	Churchill FX 4260
REPLACER - FRONT HUB OIL SEAL	Churchill FX 4200
HANDLE	Churchill MS 550
BALL JOINT SPLITTER	Churchill 18G 1133
COIL SPRING COMPRESSOR	KLANN 0021 + 2 no. 5 Pressure plates

GENERAL PRECAUTIONS

1. Self-locking nuts are used throughout the front suspension because of their superior performance in service. It is strongly recommended that such nuts are only used once, and are replaced as a matter of routine when disturbed. New bolts should be fitted whenever the lower wishbone mounting pivot bracket or ball joint carrier are displaced in service.

2. Split pins are used to secure the castellated nuts fitted to the front crossmember mounting bolts, track rod ends and the hub nut. These split pins should be replaced with new pins as a matter of routine when they are disturbed.

3. The use of air tools will assist in a number of repair operations provided that care is taken not to exceed the prescribed torque settings. Impact air tools must never be used on the coil spring compressor however, use of an air operated nut runner is helpful.

4. Nut and bolt torques should be observed whenever carrying out repairs to the suspension. Do not guess the torque to be used. Have torque wrenches checked at regular intervals.

5. Take particular note of the warnings about operations which involve the use of a coil spring compressor. There are no short cuts to using the correct service tools in servicing the suspension.

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

7. If disturbed during a service operation, the lower wishbone mounting bushes must be finally tightened when the vehicle is standing on its wheels.

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

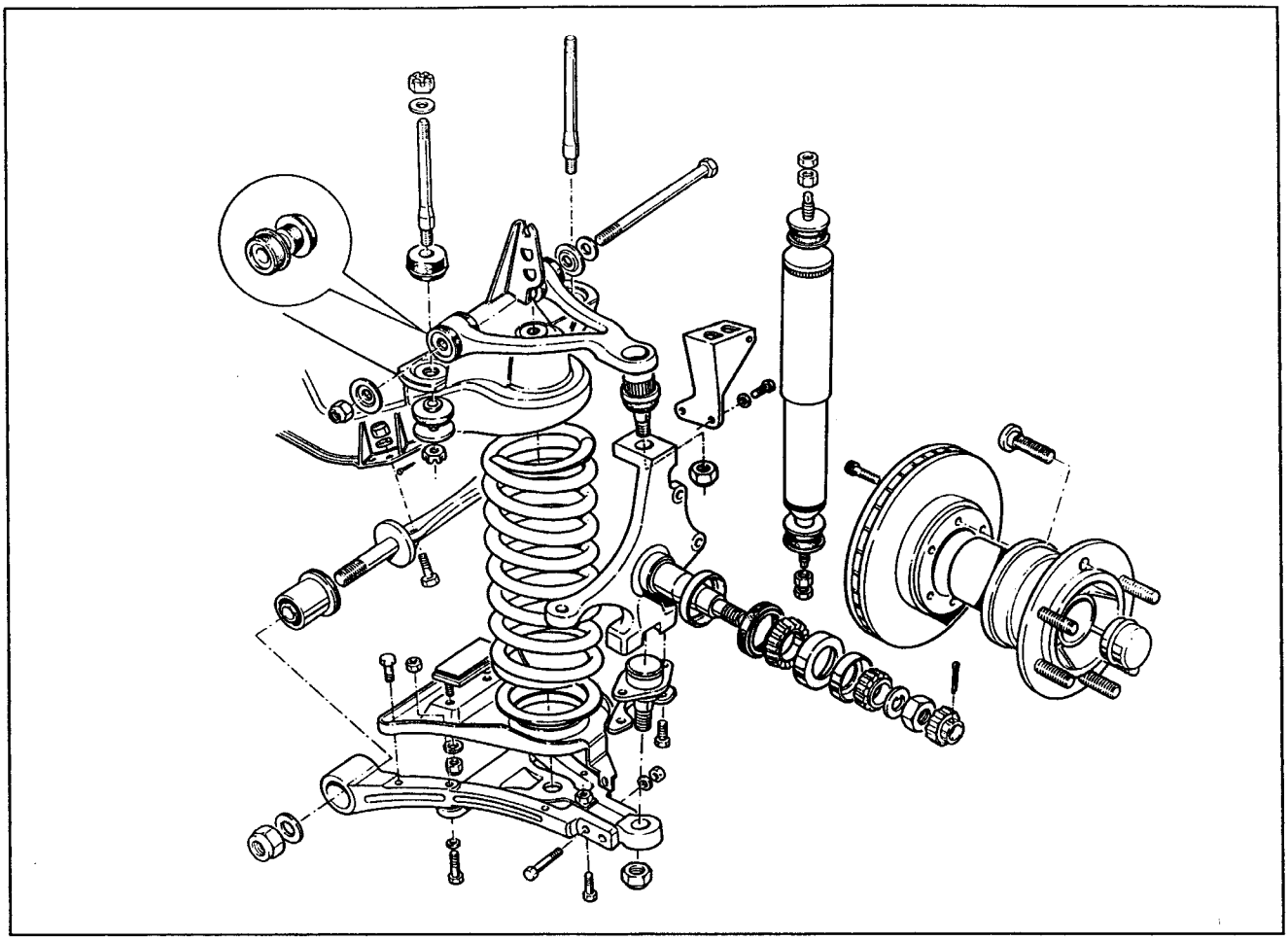


Fig 2. Front Suspension - exploded view

FRONT WHEEL STUD(S)

REMOVE/REPLACE

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

2. Drive out the wheel stud with a soft faced hammer. Fit a new wheel stud with Loctite applied to the serrations. Ensure the serrations of the new stud and the hole in the hub flange are lined up and draw the wheel stud into position through the hub flange using a wheel nut.

NOTE: The wheel stud should be drawn into the hub with a relatively low torque - far below that used to torque the wheel nut when tightening the wheels. If the torque is excessive, the replacement stud has not been aligned correctly in the hub flange. Never exceed the wheel nut torque as this will overstress the wheel stud.

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

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

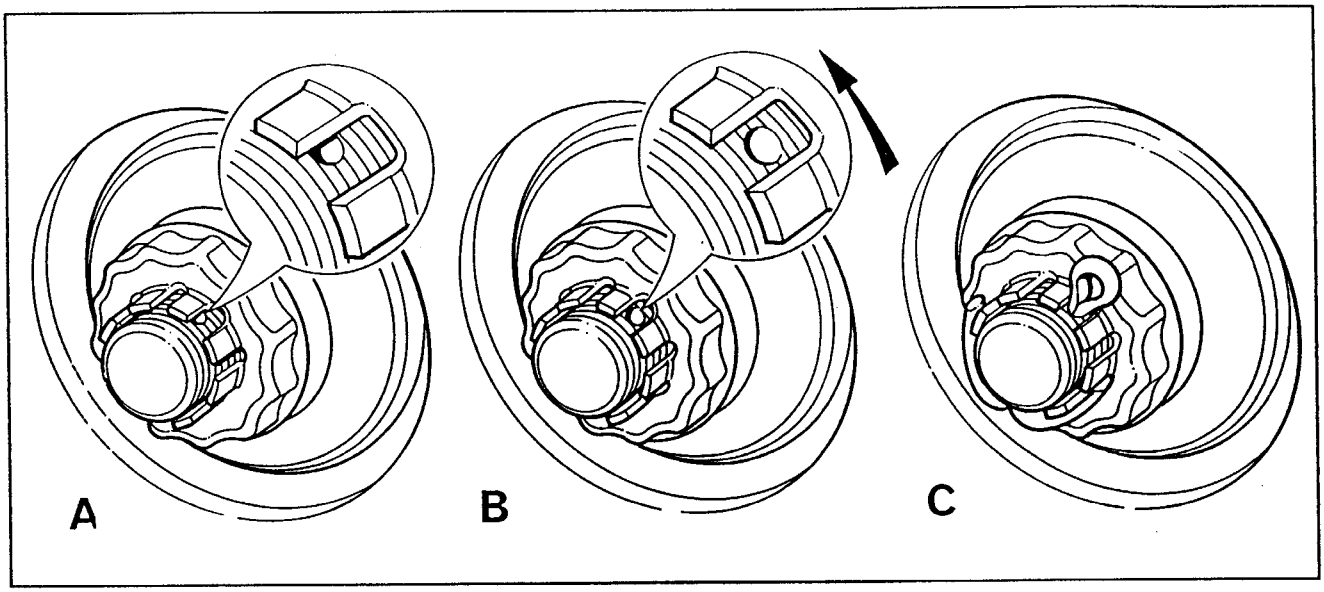


Fig 3. Front hub - adjustment sequence

FRONT WHEEL BEARINGS

ADJUST

1. Remove the hub cap and chock the rear wheels. Raise the front of the vehicle and support it on stands placed under the chassis members.

2. Remove the hub dust cap with a suitable lever. Remove the split pin and nut retainer. Loosen the hub bearing nut.

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

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

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

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

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

NOTE: The nut retainer has 8 tabs so it will be necessary to try a number of positions to obtain the correct setting.

6. Slacken the nut and nut retainer until the split pin hole is fully exposed (see Fig. 3. - illustration B), to give the correct bearing end float of 0,025 - 0,152 mm (0.001-0.006 in.)

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

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

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

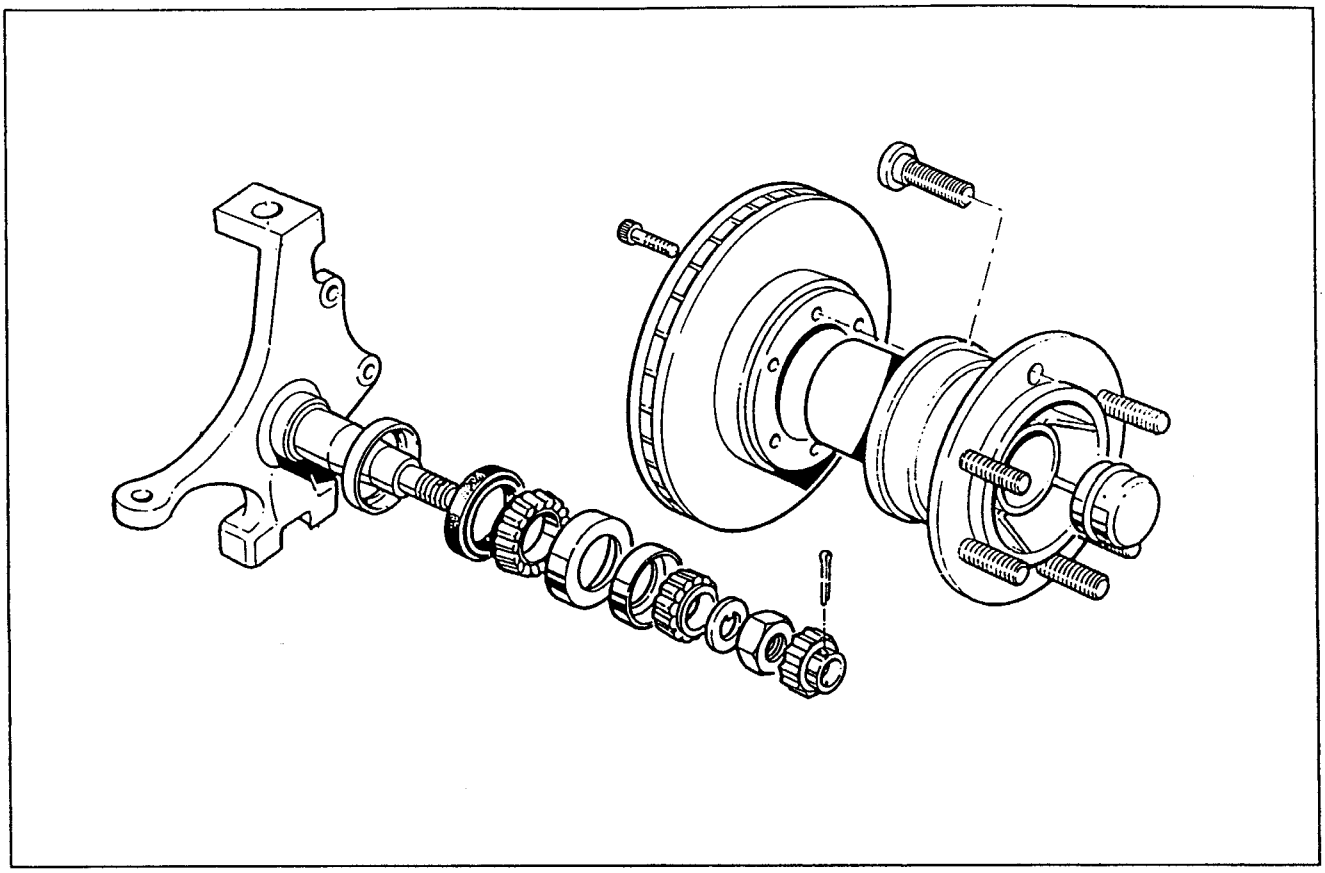


Fig 4. Front Hub - components

FRONT HUB/HUB BEARINGS/ HUB SEAL/BRAKE DISC

REMOVE/REPLACE

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

2. Make a suitable wire support for the brake caliper assembly and hang the support on the chassis side member behind the front suspension. Note the way in which the brake hoses are routed forward from the hose support bracket on the steering knuckle, then remove the two bolts securing the bracket to the steering knuckle.

NOTE: The earth lead for the brake wear sensor is under the head of the hose securing bracket inner bolt on the RHS of the vehicle.

Remove the two bolts securing the caliper assembly and carefully hang the assembly on the wire support so that the brake hoses are not stressed and the caliper is not damaged.

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

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

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

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

NOTE: Brake disc wear must not exceed 1mm (0.040) on either side of the disc, and disc thickness must not be less than 22mm (0.0875 in.) Brake discs may not be reground in service.

6. Prise out the hub oil seal and remove the inner bearing cone. If the hub assembly and bearings are to be refitted, clean all components and examine for wear or damage; renew as necessary - using a soft drift to knock out the inner and outer bearing cups as required.

7. Using the special tool adapter (FX 4260) and handle (MS 550), tap or press the new inner and outer bearing cups into the hub until they abut the machined shoulders in the bearing housing.

NOTE: New front hub assemblies are supplied with bearing cups fitted.

8. Pack the bearing cones and hub with the specified Lithium 12 Hydroxy stearate or equivalent grease and fit the inner bearing cone.

NOTE: Do not over pack the hubs with grease.

9. Lubricate a new inner bearing oil seal and tap it into position using the special tool (FX 4200) and handle (MS 550), so that the seal lip is towards the inner bearing.

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

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

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

12. Slacken the hub nut without disturbing the hub.

Tighten the hub nut again, **FINGER TIGHT ONLY.**

13. Fit the hub retainer following the detailed procedure in 'Front Hub Wheel Bearings - adjust' so that one of the tabs on the retainer partly covers the left hand side of the split pin hole in the stub axle (Fig 3. - illustration B)

14. Slacken the nut and nut retainer until the split pin hole is fully exposed (Fig 3. - illustration B), to give the correct bearing end float of 0,025 - 0,152 mm (0.001-0.006 in.)

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

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

NOTE: If a new brake disc has been fitted, the brake disc run out must be checked with a dial gauge. Brake disc run out must not exceed 0,1 mm, (0.004 in.)

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

17. Replace the brake hose securing bracket (and earth lead RHS only), ensuring the brake hoses follow their natural curve clear of the suspension.

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

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

20. Start the engine and pump the brake pedal to position the brake pads to their correct position. Stop the engine.

FRONT DAMPERS

REMOVE/REPLACE

NOTE: DAMPERS SHOULD NORMALLY BE REPLACED AS AN AXLE SET UNLESS THE REPLACEMENT IS DUE TO A FAULTY UNIT EARLY IN ITS LIFE.

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

2. Place a jack under the front suspension lower ball joint, place a wooden packer between the ball joint and the jack, and raise the jack to support the front suspension and compress the front spring just short of raising the vehicle from its chassis support previously fitted.

3. Remove the damper assembly lower mounting locknut, securing nut and mounting rubber. Remove the damper mounting plate from the lower wishbone by taking out the two bolts, washers and locknuts and one set bolt, easing the plate towards the centre of the vehicle complete with the remaining damper lower mounting rubber.

4. Remove the damper assembly upper mounting locknut, support the damper assembly and remove the securing nut and rubber mounting. The damper can then be removed by lowering it through the spring and lower wishbone.

5. Follow the reverse procedure to fit the new damper, its mounting rubbers and mounting plate. Torque the mounting plate fastenings to specification 25 - 30 Nm,18 - 22 lbf. ft.

6. Release the jack from beneath the front suspension lower ball joint.

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

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

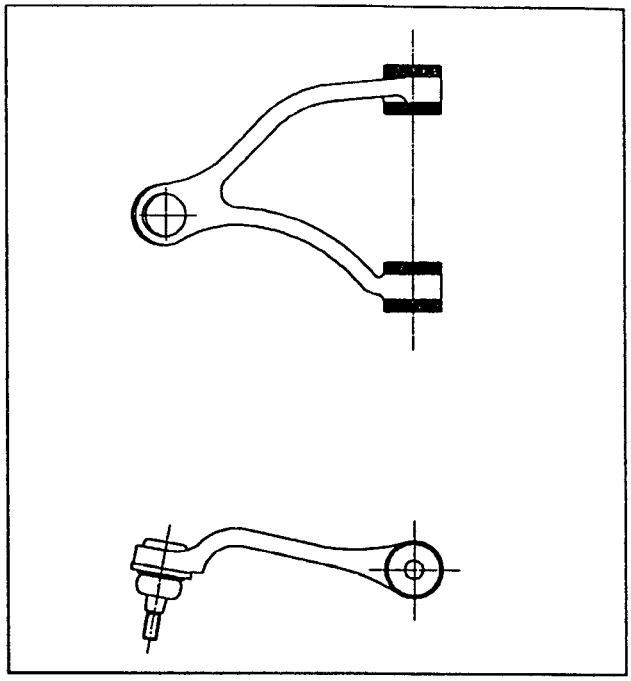


Fig 5. Upper wishbone - details

BALL JOINTS/UPPER WISH BONE/BUSHES

REMOVE/REPLACE

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

2. Place a jack under the front suspension damper mounting plate, place a wooden packer between the mounting plate and the jack (in a position to allow access to the lower ball joint self locking nut) and raise the jack to support the front suspension and compress the front spring just short of raising the vehicle from its chassis support previously fitted.

3. Make a suitable wire support for the brake caliper assembly and hang the support on the chassis side member behind the front suspension. Note the way in which the brake hoses are routed forward from the hose support bracket on the steering knuckle, then remove the two bolts securing the brake hose securing bracket to the steering knuckle. (When working on the right hand side, remove the brake pad wear sensor lead plug by pressing the square sides of its socket to release the latches on the side of the plug. The sensor earth lead is located under the head of the inner bracket bolt).

Remove the two bolts securing the caliper assembly and carefully hang the assembly on the wire support so that the brake hoses are not stressed and the caliper is not damaged.

4. If the lower ball joint is to be removed as part of this service operation, remove the split pin and castellated nut from the outer track rod end. Apply pressure to the ball joint with a ball joint separating tool, and tap the steering knuckle adjacent to the track rod end to release the ball joint.

5. Release the upper ball joint self locking nut and unscrew it a few turns. Apply pressure to the ball joint with a ball joint separating tool 18G 1133 and tap the end of the upper wishbone with a soft faced hammer to release the ball joint. Remove and discard the ball joint self locking nut.

6. Where required, remove the upper wishbone assembly by removing the pivot bolt self locking nut, washers, metal sealing washers. The upper wishbone assembly may then be removed.

NOTE: The metal sealing washers are fitted so that their dished sides are towards the mounting bushes.

7. Where required fit a new top wishbone assembly (the assembly is serviced complete with ball joint and bushes) or replace the ball joint and bushes.

BUSH REPLACEMENT:

The bushes may be removed by prising out the flat washers, removing the bush centre tubes and knocking out the remaining parts of the bush with a suitable drift.

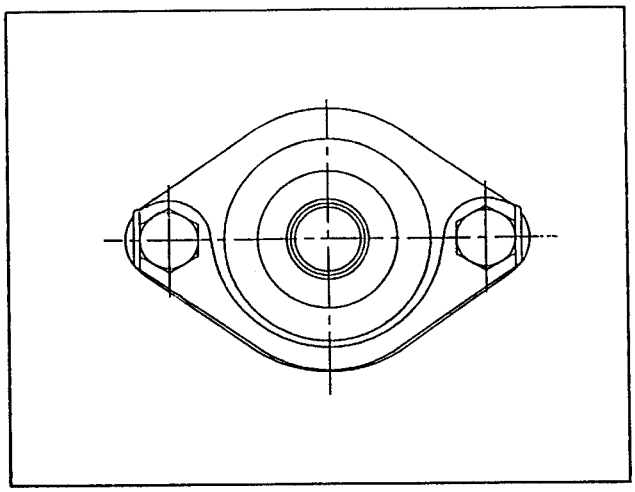


Fig. 6 Lower ball joint - tab washer

The new bushes may be fitted using the suitably protected jaws of a bench vice and the special service tool (FX 4201). Using the vice, push one half of the new bush into the inner face of the wishbone arm, using one of the pads of the special tool to spread the load over the whole bush. Position the bush centre tube and the other half of the bush and, using both pads of the special tool to spread the load over the bush, carefully squeeze the other half of the bush into position without over tightening the vice. Repeat this procedure to replace the other wishbone bushes.

NOTE: After fitting, there should be a small gap between the outer faces of the wishbone and the shoulders of the outer half of each bush. If this is not the case, tap the bushes to position them tight up onto the inner faces of the wishbone as this will assist when assembling the wishbone to its mounting.

BALL JOINT REPLACEMENT:

The upper ball joint is not serviced separately. If a new ball joint is required, a complete top wishbone assembly should be fitted.

8. Refit the upper wishbone assembly to the crossmember by fitting a plain washer and bush sealing washer (positioned so that the dished side will be towards the bush) to the pivot bolt. Pass the bolt forwards through the rubber bush on the rear arm of the wishbone, followed by another sealing washer (to sandwich the bush between the dished faces of the sealing washers) before passing the pivot bolt through the crossmember. Similarly, position sealing washers each side of the bush in the front arm of the wishbone, finally fitting a further plain washer and new self locking nut. Torque the self locking nut to 90-100 Nm, 66-74 lbf. ft.

9. Release the lower ball joint self locking nut and unscrew it a few turns. Apply pressure to the ball joint with a ball joint separating tool 18G 1133 and tap the end of the ball joint carrier with a soft faced hammer to release the ball joint. Remove and discard the ball joint self locking nut. Lift the hub and knuckle assembly out of the lower ball joint carrier.

10. Bend back the tab washer from the ball joint securing bolts and remove the bolts and lower ball joint from the steering knuckle.

11. Fit the new ball joint and new tab washer (the open side of the tab washer is to the hub). Torque the ball joint securing bolts to 65 Nm, 47 lbf. ft. Then tighten the bolts further, as required, so that the bolt heads are tangential to the ball joint boot and the tab washer can be bent into position (Fig 6) to secure the bolt heads.

12. Reposition the hub and steering knuckle assembly and fit a new lower ball self locking nut. Torque the self locking nut to 150-170 Nm, 111-125 lbf. ft.

13. Fit a new upper ball joint self locking nut. Torque the self locking nut to 58-64 Nm, 43-47 lbf.ft.

14. Refit the outer track rod end to the steering knuckle with the castellated nut. Torque the nut to specification and secure with a new split pin.

15. Refit the brake calipers and torque the two caliper securing bolts to specification 95-125 Nm, 70-92 lbf. ft. Remove the wire caliper support.

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

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

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

19. Start the engine and pump the brake pedal to position the brake pads to their correct position. Stop the engine.

COIL SPRINGS/SPRING MOUNTING PLATE

REMOVE/REPLACE

WARNING: NEVER ATTEMPT TO CARRY OUT ANY OPERATIONS INVOLVING THE COIL SPRING WITHOUT HAVING THE SPECIAL SPRING COMPRESSOR TOOL NECESSARY. ENSURE THE SPECIAL TOOL IS IN GOOD CONDITION AND IS WELL LUBRICATED. IF THE SPRING IS TO BE REPLACED OR MAY NOT BE REFITTED UNTIL A LATER OCCASION, RELIEVE THE SPRING AS SOON AS IT HAS BEEN REMOVED FROM THE VEHICLE. NEVER KEEP SPRINGS IN A COMPRESSED STATE IN THE SERVICE TOOL FOR LONGER THAN NECESSARY.

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

2. Place a jack under the front suspension lower ball joint, place a wooden packer between the ball joint and the jack, and raise the jack to support the front suspension and compress the front spring just short of raising the vehicle from its chassis support previously fitted.

3. Remove the damper assembly lower mounting locknut, securing nut and mounting rubber. Remove the damper mounting plate from the lower wishbone by taking out the two bolts, washers and locknuts and one set bolt, easing the plate towards the centre of the vehicle complete with the remaining damper lower mounting rubber.

4. Remove the damper assembly upper mounting locknut, support the damper assembly and remove the securing nut and rubber mounting. The damper can then be removed by lowering it through the spring and lower wishbone.

5. Remove the split pin and castellated nut from the outer track rod end. Apply pressure to the ball joint with a ball joint separating tool, and tap the steering knuckle adjacent to the track rod end to release the ball joint. Move the track rod out of position to give access to the coil spring on its removal.

6. Lubricate the centre screw of the coil spring compressor (Klann KL-0021). Insert the top pressure plate (with the 3-point safety interlock) of the special tool into the highest possible coil of the spring, so that the contoured safety lip at the edge of the plate is downwards. Similarly, position the bottom pressure plate of the tool into the lowest possible coil of the spring, so that the contoured lip of the plate is uppermost.

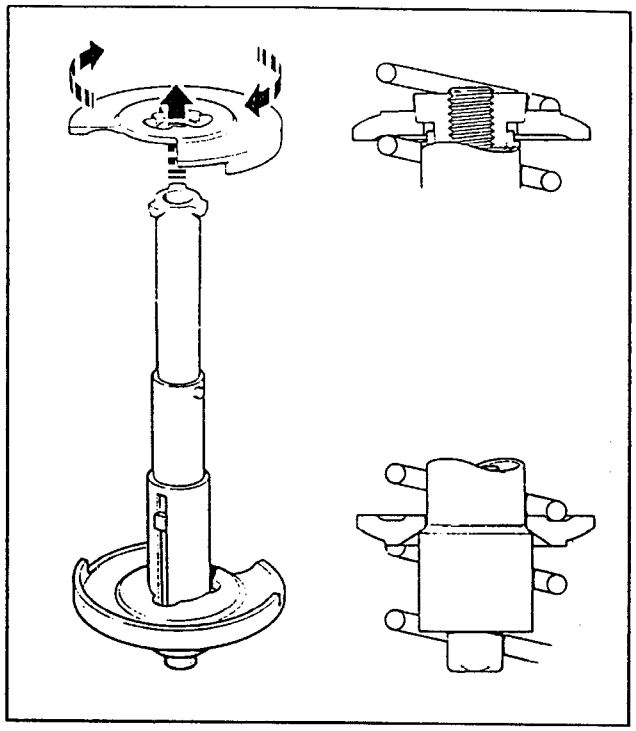


Fig 7. Coil spring compressor - details

7. Insert the telescopic centre screw of the tool up through the lower wishbone aperture and the bottom pressure plate; engage the screw body in the top pressure plate and twist it into position in the thrust recesses in the top pressure plate.

8. Commence tightening of the centre screw of the compressor, check the top and bottom plates of the tool are securely positioned into the spring before compressing the coil spring until the special tool is taking the full load of the spring. Partly lower the jack supporting the lower ball joint. The spring may then be withdrawn upwards, forward and out from the front suspension. Remove the spring insulating pads.

9. If required, the spring mounting plate may be replaced by removing the two set screws and the bolt securing the outer locating lug on the plate to the ball joint carrier. Torque the set screws to 25-35 Nm, 18-26 lbf.ft. Use a new self locking nut on the ball joint carrier bolt and torque to 115-130 Nm, 86-97 lbf. ft.

10. If the coil spring is to be replaced check the length of the compressed spring and mark the spring with chalk to show the position of the spring compressor end plates. Carefully relieve the spring pressure by unscrewing the centre nut of the compressor tool. Fit the compressor tool and end plates to the new spring in the same relative position as marked on the old spring (the coil spring is can be fitted either way). Compress the new spring to the length of the original spring taking great care to ensure all the parts of the tool are correctly positioned before applying pressure.

11. Position a new lower spring insulating pad (if required) into position on the spring mounting plate. Install the new spring and spring compressor tool in position on the spring mounting plate ensuring the upper insulating pad is in position on the top of the coil spring.

12. Carefully raise the jack support under the front suspension lower ball joint until the coil spring is correctly located into its upper and lower mountings. Raise the jack to put some pressure onto the coil spring. Slowly unscrew the centre screw of the spring compressor tool until it is free of pressure from the coil spring and remove the compressor tool.

13. Refit the damper, its mounting rubbers and mounting plate. Torque the mounting plate fastenings to specification 25-30 Nm, 18-22 lbf. ft.

14. Refit the outer track rod end to the steering knuckle with the castellated nut. Torque the nut to specification and secure with a new split pin.

15. Release the jack from beneath the front suspension lower ball joint.

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

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

LOWER WISHBONE/WISHBONE BUSHES/MOUNTING PIVOT BRACKET

REMOVE/REPLACE

WARNING: NEVER ATTEMPT TO CARRY OUT ANY OPERATIONS INVOLVING THE COIL SPRING WITHOUT HAVING THE SPECIAL SPRING COMPRESSOR TOOL NECESSARY. ENSURE THE SPECIAL TOOL IS IN GOOD CONDITION AND IS WELL LUBRICATED. IF THE SPRING IS TO BE REPLACED OR MAY NOT BE REFITTED UNTIL A LATER OCCASION, RELIEVE THE SPRING AS SOON AS IT HAS BEEN REMOVED FROM THE VEHICLE. NEVER KEEP SPRINGS IN A COMPRESSED STATE IN THE SERVICE TOOL FOR LONGER THAN NECESSARY.

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

2. Place a jack under the front suspension lower ball joint, place a wooden packer between the ball joint and the jack, and raise the jack to support the front suspension and compress the front spring just short of raising the vehicle from its chassis support previously fitted.

3. Make a suitable wire support for the brake caliper assembly and hang the support on the chassis side member behind the front suspension. Note the way in which the brake hoses are routed forward from the hose support bracket on the steering knuckle, then remove the two bolts securing the brake hose securing bracket to the steering knuckle. (When working on the right hand side, remove the brake pad wear sensor lead plug by pressing the square sides of its socket to release the latches on the side of the plug. The earth lead for the sensor is under the head of the inner bracket bolt).

Remove the two bolts securing the caliper assembly and carefully hang the assembly on the wire support so that the brake hoses are not stressed and the caliper is not damaged.

4. Remove the damper assembly lower mounting locknut, securing nut and mounting rubber. Remove the damper mounting plate from the lower wishbone by taking out the two bolts, washers and locknuts and one set bolt, easing the plate towards the centre of the vehicle complete with the remaining damper lower mounting rubber.

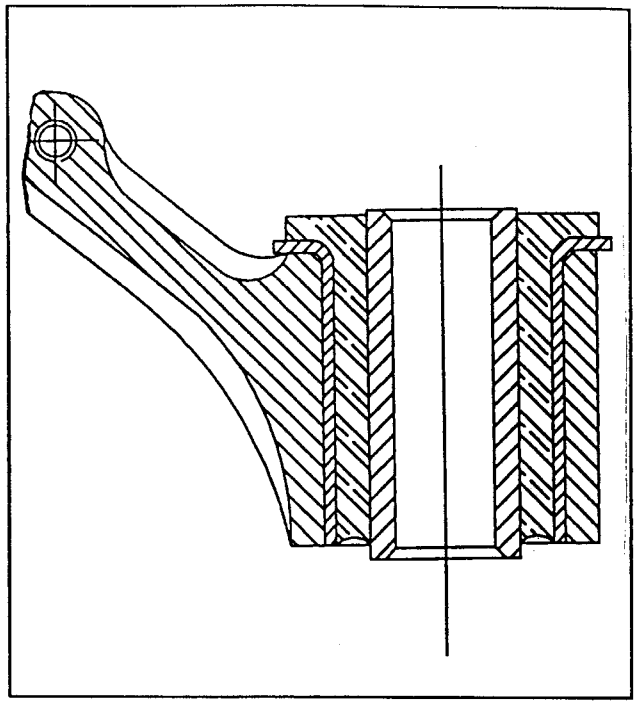


Fig 8. Lower wishbone bush - detail

5. Remove the damper assembly upper mounting locknut, support the damper assembly and remove the securing nut and rubber mounting. The damper can then be removed by lowering it through the spring and lower wishbone.

6. Remove the split pin and castellated nut from the outer track rod end. Apply pressure to the ball joint with a ball joint separating tool, and tap the steering knuckle adjacent to the track rod end to release the ball joint. Move the track rod out of position to give access to the coil spring on its removal.

7. Lubricate the centre screw of the coil spring compressor (Klann KL-0021). Insert the top pressure plate (with the 3-point safety interlock) of the special tool into the highest possible coil of the spring, so that the contoured safety lip at the edge of the plate is downwards. Similarly, position the bottom pressure plate of the tool into the lowest possible coil of the spring, so that the contoured lip of the plate is uppermost.

8. Insert the telescopic centre screw of the tool up through the lower wishbone aperture and the bottom pressure plate; engage the screw body in the top pressure plate and twist it into position in the thrust recesses in the top pressure plate.

9. Commence tightening of the centre screw of the compressor, check the top and bottom plates of the tool are securely positioned into the spring before compressing the coil spring until the special tool is taking the full load of the spring. Partly lower the jack supporting the lower ball joint. The spring may then be withdrawn upwards, forward and out from the front suspension. Remove the spring insulating pads.

10. Release the lower ball joint self locking nut and unscrew it a few turns. Apply pressure to the ball joint with a ball joint separating tool 18G 1133 and tap the end of the ball joint carrier with a soft faced hammer to release the ball joint. Remove and discard the ball joint self locking nut.

11. Release the upper ball joint self locking nut and unscrew it a few turns. Apply pressure to the ball joint with a ball joint separating tool 18G 1133 and tap the end of the upper wishbone with a soft faced hammer to release the ball joint. Remove and discard the ball joint self locking nut. Remove the hub and knuckle assembly.

12. Remove the two set screws securing the spring mounting plate to the lower wishbone arms. Remove and discard the self-locking nuts securing the ball joint carrier to the wishbone arms. Note the position of the ball joint carrier (they are handed) and remove the securing bolts.

13. Remove the self-locking nuts and washers securing the lower wishbone arms to the lower wishbone mounting pivot bracket and pull the wishbone arms from the bracket.

LOWER WISHBONE BUSH REPLACEMENT

14. Use a hacksaw to carefully cut away two sides of the metal flanges of the lower wishbone bushes (Fig. 9) without damaging the wishbone so that the wishbone can be supported between plates on a suitable press. Push out the lower wishbone bushes using the special tool (FX 4199).

Clean off the corrosion inhibitor from the metal outer surface of each new bush; lightly lubricate each bush with clean oil and, using a suitable press, support the wishbone while pressing the new bushes into the inner faces of the lower wishbone arms with the special tool (FX 4215). Ensure the bushes are pushed fully home into the wishbone arm.

Note: New wishbone arms and lower wishbone assemblies are supplied with the bushes fitted.

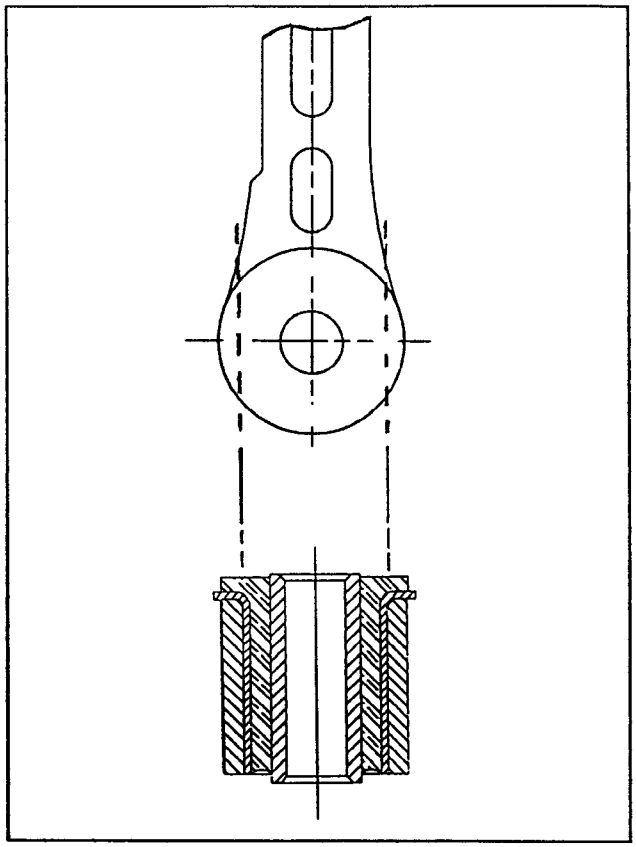


Fig. 9 Lower wishbone bush removal

15. If required, the lower wishbone mounting pivot bracket may be replaced by removing its four securing bolts. When fitting a new pivot bracket, always use new self-locking nuts. Torque the nuts to 115-130 Nm, 86-97 lbf.ft.

16. Refit the lower wishbone arms to the pivot bracket. Fit the washers and new self-locking nuts. Do not fully tighten these nuts at this stage.

17 Fit the ball joint carrier and spring mounting plate

to the lower wishbone arms. The lug on the spring plate fits below the head of the outer bolt through the ball joint carrier-both bolts being fitted the same way round. Torque the set screws to 25-35 Nm, 18-26 lbf.ft.

Fit the washer and use new self locking nuts on the ball joint carrier bolts; torque to 115-130 Nm, 86-97 lbf. ft.

18. Reposition the hub and steering knuckle assembly and fit a new lower ball self locking nut. Torque the self locking nut to 150-170 Nm, 111-125 lbf. ft.

19. Fit a new upper ball joint self locking nut. Torque the self locking nut to 58-64 Nm, 43 -47 lbf.ft.

20. Position a new lower spring insulating pad (if required) into position on the spring mounting plate. Install the new spring and spring compressor tool in position on the spring mounting plate ensuring the upper insulating pad is in position on the top of the coil spring.

21. Carefully raise the jack support under the front suspension lower ball joint until the coil spring is correctly located into its upper and lower mountings. Raise the jack to put some pressure onto the coil spring. Slowly unscrew the centre screw of the spring compressor tool until it is free of pressure from the coil spring and remove the compressor tool.

22. Refit the damper, its mounting rubbers and mounting plate. Torque the mounting plate fastenings to specification 25-30 Nm, 18-22 lbf. ft.

23. Refit the outer track rod end to the steering knuckle with the castellated nut. Torque the nut to specification and secure with a new split pin.

24. Refit the brake calipers and torque the two caliper securing bolts to specification 95-125 Nm, 70-92 lbf. ft. Remove the wire caliper support.

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

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

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

28. Finally torque the lower wishbone mounting pivot self-locking nuts to 100-110 Nm, 74-82 lbf. ft.

29. Start the engine and pump the brake pedal to position the brake pads to their correct position. Stop the engine.

FRONT SUSPENSION ASSEMBLY

REMOVE/REPLACE

Should it be necessary, the complete front suspension and front crossmember assembly may be detached from the vehicle a unit.

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

2. Disconnect and fit caps to the brake hydraulic pipes leading to the pressure reducing valve and master cylinder from the 3 - way connectors fitted to the front suspension crossmember below the right hand side of the engine. Fit plugs into the three way connectors.

3. Disconnect the brake wear indicator lead latch connector in the right hand side of the engine compartment and pull the lead and its grommet out through the front wing inner valance panel. Temporarily secure the lead to the front suspension.

4. Remove the split pins and castellated nuts from the outer track rod ends. Apply pressure to each ball joint with the ball joint separating tool, and tap the steering knuckle adjacent to the track rod end to release the ball joint. Move the track rod out of position to give access.

5. Support the front crossmember on a jack.

6. Remove the split pins, castellated nuts, washers and rubber lower mountings from the front crossmember mounting studs. Lower the front suspension and crossmember assembly and remove it from the vehicle. Remove the rubber upper mountings.

7. The front crossmember mounting studs are located up into the chassis side members, the tapered section of the studs engaging into the tapered end of tubes which are welded vertically into the chassis sidemembers. The front and rear studs differ and are not interchangeable. Examine the condition of the studs and replace as necessary by removing the split pins, nuts and flat washers from the tops of the studs. Note the difference between the studs, and fit new studs; the castellated nuts should be torqued to 64-70 Nm, 47-52 lbf. ft. and new split pins fitted.

8. Fit new upper mountings to the studs, so that the recess in the mountings are uppermost and fit to the conical supports welded to the chassis. Carefully raise the front suspension and crossmember assembly into position, ensuring the upper mountings are correctly positioned into the recesses in the crossmember. Fit the lower mountings, washers and castellated nuts. Torque the castellated nuts to 64-70 Nm, 47-52 lbf. ft. and fit new split pins. Remove the crossmember supporting jack.

9. Refit the outer track rod ends to the steering knuckles with castellated nuts. Torque the nuts to specification and secure with new split pins.

10. Reconnect the brake wear indicator lead passing the lead through the wing valance and refitting the grommet.

11. Reconnect the brake hydraulic pipes to the 3 - way connectors on the front crossmember.

12. Bleed the braking system with new brake fluid which complies with specification FMVSS 116 DOT 4 (see Brakes).

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

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

LTI

SERVICE

fairway

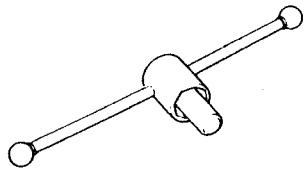
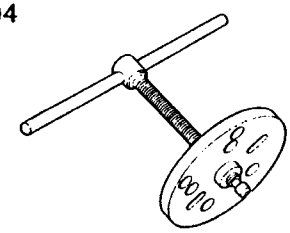
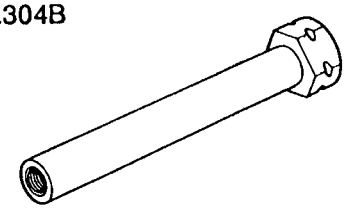
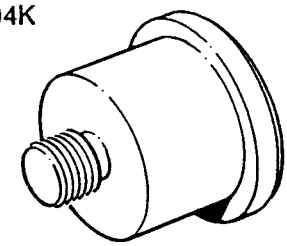
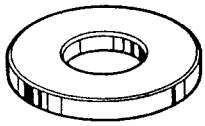
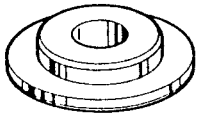
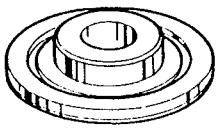
WORKSHOP MANUAL

SECTION 6

REAR AXLE AND SUSPENSION

SECTION RA

CONTENTS

TOOL NUMBER	DESCRIPTION
18G.258 	Wrench, Hub nut
18G.304 	Hub Remover Used with 18G.304B and 18G.304K
18G.304B  3 Required	Adaptor Bolt, Hub Remover Used with 18G.304 and 18G.304K
18G.304K 	Adaptor, Hub Remover Thrust Pad Used with 18G.304 and 18G.304B
FX.550-1 	Adaptor, Hub Bearing Remover Used with MS.550
FX.550-2 	Adaptor Hub Oil Seal Replacer Used with MS.550
FX.550-3 	Adaptor, Hub Bearing Replacer Used with MS.550

REAR AXLE COMPONENTS

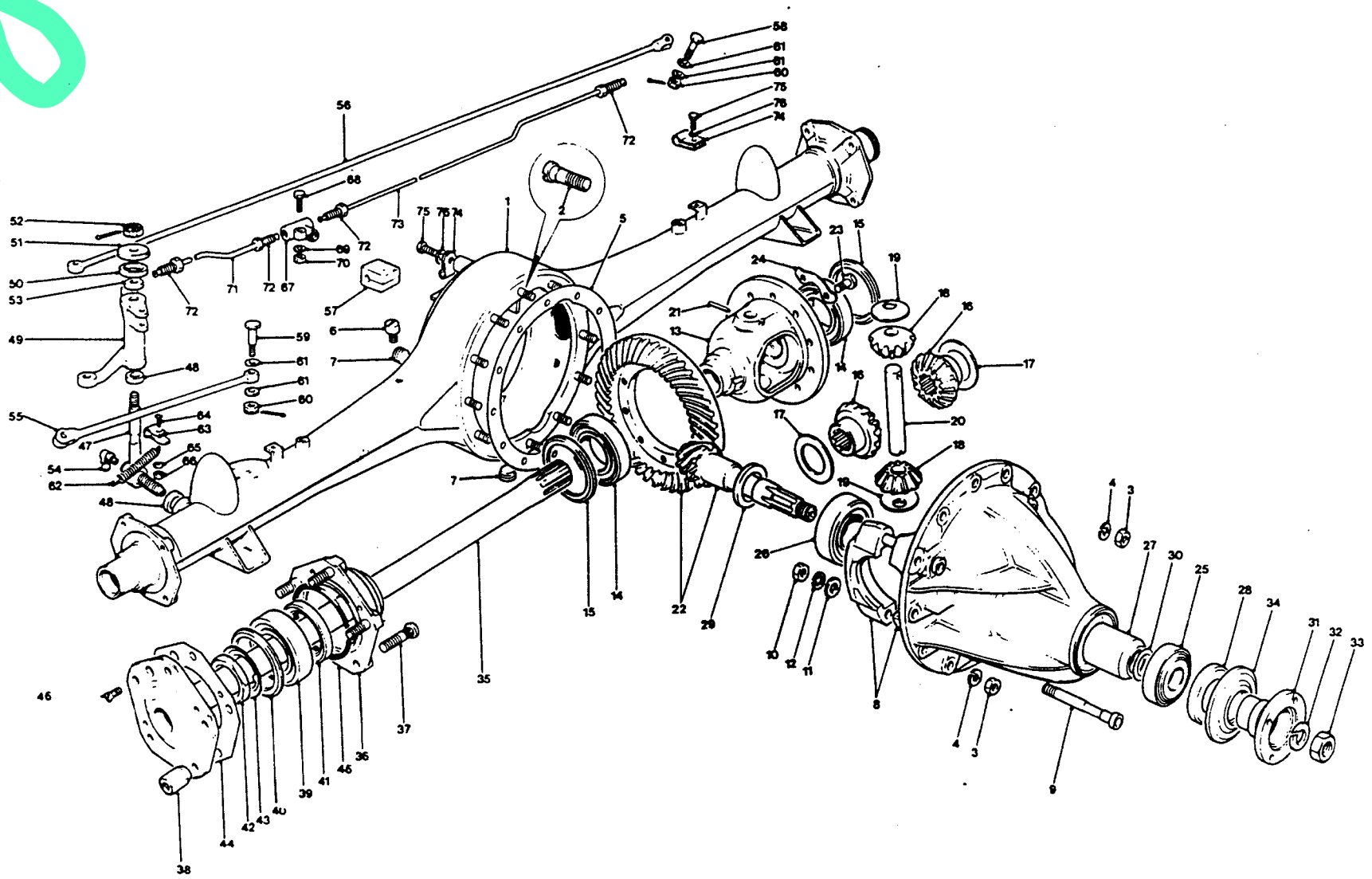


Figure 1

KEY TO FIG.1 REAR AXLE COMPONENTS

1. Case assembly
2. Bolt - differential carrier
3. Nut - axle case bolt
4. Washer - spring - axle case bolt
5. Joint to axle case
6. Breather assembly
7. Plugs - drain and filler
8. Carrier assembly
9. Bolt - serrated - cap
10. Nut for bolt
11. Washer for bolt - plain
12. Washer for bolt - spring
13. Cage - differential
14. Bearing - differential
15. Washer - bearing packing
16. Gear
17. Washer - thrust gear
18. Pinion
19. Washer - thrust pinion
20. Pin - pinion
21. Peg - pinion pin
22. Crown wheel and pinion
23. Bolt to cage
24. Washer for bolt - lock
25. Bearing - pinion - outer
26. Bearing - pinion - inner
27. Distance piece
28. Seal - oil
29. Washer - pinion thrust
30. Shim - outer bearing
31. Flange - universal joint
32. Washer - spring - to pinion
33. Nut to pinion
34. Cover - dust
35. Shaft - axle
36. Hub assembly
37. Stud - wheel
38. Nut - wheel stud
39. Bearing
40. Spacer - bearing
41. Seal - oil
42. Nut - bearing retaining
43. Washer for bearing retaining nut
44. Joint - shaft to hub
45. Seal - oil - ring
46. Screw - shaft to hub
47. Carrier for balance lever
48. Ring - felt (large)
49. Lever - balance
50. Felt ring for balance lever
51. Cup for felt
52. Nut
53. Washer
54. Lubricator
55. Rod - cross - R.H.
56. Rod - cross - L.H.
57. Ferrule for cross-rod
58. Pin - joint - wheel end
59. Pin - joint - lever end
60. Nut for joint pin
61. Washer for joint pin
62. Spring - pull off
63. Clip for spring on brake rod
64. Screw for clip
65. Washer for screw (spring)
66. Nut for screw
67. Connection - 3-way
68. Screw - 3-way connection to axle case
69. Washer for screw - spring
70. Nut for screw
71. Pipe - 3-way connection to R.H. brake
72. Nut - tube
73. Pipe - 3-way connection to L.H. brake
74. Clip - L.H. brake pipe to axle case
75. Screw for clip
76. Washer for screw

Description

The rear axle is of the three quarter - floating type incorporating hypoid final reduction gears. The axle shafts, pinion and differential assemblies can be withdrawn without removing the axle from the vehicle.

The wheel bearing outer races are located in the hubs, and the inner races are mounted on the axle tube and secured by nuts and lock washers. Wheel studs in the hubs pass through the brake drums and axle shaft driving flanges. Brake drums are located on the hub flange by two countersunk screws in each.

The differential and pinion shaft bearings are preloaded, the amount of preload being adjustable by shims and spacers. The position of the pinion in relation to the crown wheel is determined by a spacing washer. The backlash between the gears is adjustable by spacers.

The Composite Rear springs provided for rear suspension are secured beneath the rear axle by 'U' bolts.

The front ends of the springs are anchored in flexing rubber bushes, while the rear ends are mounted in similar bushes in swinging shackles.

Removing and replacing the axle

Raise the rear of the car and place suitable stands under the frame forward of the rear springs.

Remove the road wheels and release the hand brake.

Disconnect the flexible brake hose at the union on the chassis side-member.

Disconnect the brake cable from the relay lever.

Support the axle on a stand or trolley jack.

Disconnect the exhaust tail pipe support.

Remove the left-hand-side brake drum to give more body clearance.

Disconnect the rear end of the propeller shaft from the rear axle.

Unscrew the 'U' bolt nuts and locknuts, release the dampers from the axle and lower the axle to the ground.

Replacement is a reversal of the removal procedure, but it will be necessary to bleed the brakes to make sure that no air remains in the system.

Important points concerning axle attention

Dismantling the differential and pinion assembly and the renewal of these parts is not advised unless it is absolutely necessary and unless you are equipped with the necessary checking gauges and the full range of distance washers and spacers from which to select the required new sizes.
Consideration in this case should be given to the advisability of fitting a Service replacement axle.

Dismantling for examination and cleaning is permissable provided care is taken to refit the distance pieces and spacers in exactly the same locations.

The following parts may be renewed without the aid of special calculations and checking gauges:

1. The internal parts of the differential housing.

2. A crown wheel and pinion having markings identical to the originals.

3. A differential housing axle having markings identical to the original.

4. A pinion carrier having markings identical to the original.

The following parts may be renewed with the the aid of special calculations and checking gauges:

5. A crown wheel and pinion having markings different to the originals.

6. A differential housing having markings different to the original.

7. A pinion carrier having markings different to the original.

8. The differential housing bearings.

9. The bevel pinion taper - roller bearings.

Removing and replacing a brake drum and axle shaft

Jack up the car and remove the wheel.

Release the hand brake.

Unscrew and remove the two countersunk drum locating screws and tap the drum from the hub. It may be necessary to slacken off the brake adjustment slightly if the shoes hold the drum.

Unscrew the counter sunk locating screw in the axle shaft driving flange, see figure 2.

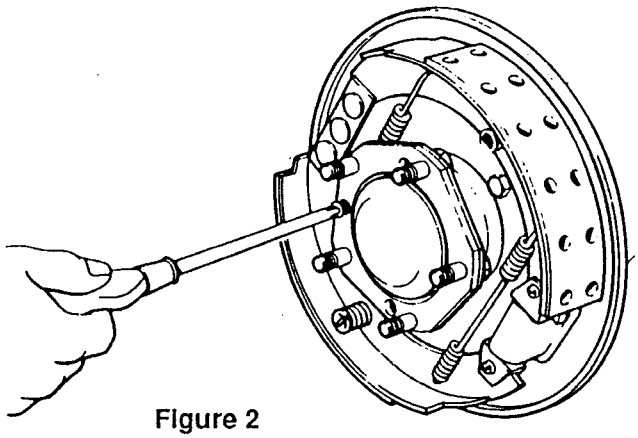


Figure 2

Remove the two countersunk screws and withdraw the shaft by gripping the flange.

Withdraw the axle shaft by gripping the flange or carefully prising it with a screwdriver. If the latter method is used the paper washer may be damaged and must then be renewed when reassembling.

To replace the shaft and drum reverse the above sequence of operations.

Removing and replacing a hub

Remove the brake-drum and axle shaft.

Remove the hub bearing spacer.

Knock back the tab of the axle tube nut locking washer and unscrew the nut, using tool 18G258, see figure 3. The left-hand axle tube nut has a left-hand thread.

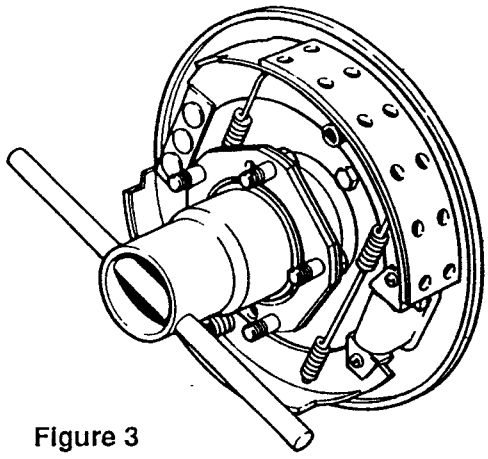


Figure 3

Removing the hub nut with tool 18G258

Tilt the lock washer to disengage the key from the slot in the threaded portion of the axle tube and remove the washer.

The hub can now be withdrawn, using tools 18G304, 18G304B and 18G304K see figure 4. The bearing and oil seal will be withdrawn with the hub.

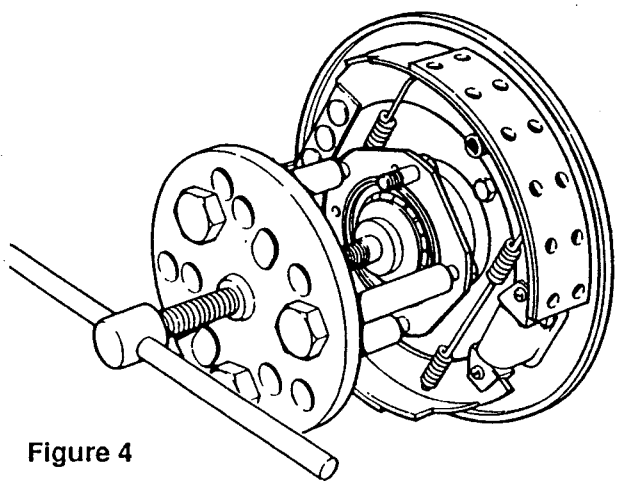


Figure 4

Withdrawing the hub, using tools 18G304, 18G304B and 18G304K

Drive out the oil seal and bearing from the hub.

Discard the oil seal.

When reassembling soak a new oil seal in engine oil and fit it with its sealing edge towards the wheel bearing, using tools MS.550 and FX.550-2. Drive the wheel bearing into the hub, using tools MS.550 and FX.550-3, see figure 5, ensuring that it butts up against the shoulder in the hub. The bearing is not adjustable and is replaced in one operation.

Pack the bearing with a recommended grade of bearing grease.

Refit the hub to the axle tube.

Refit the axle tube lock washer and nut. Fully tighten the nut and lock in position.

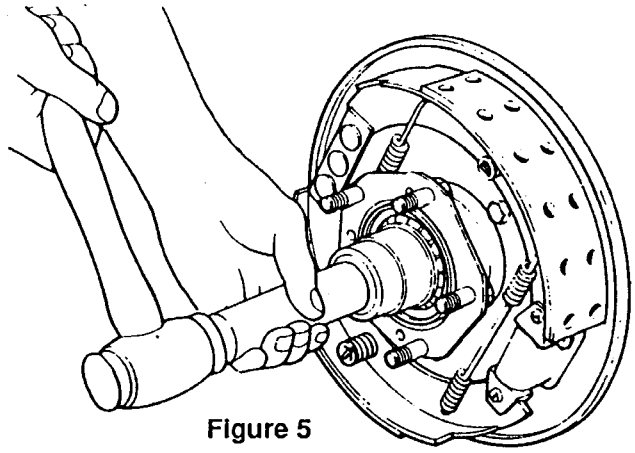


Figure 5

Fitting the bearing into the hub, using tools MS.550 and FX.550-3

Refit the hub bearing spacer, it is essential that the outer face of the spacer should protrude from .025 to .091mm (.001 to .004 in) beyond the outer face of the hub with the paper washer fitted. This ensures that the bearing is gripped tightly between the ambutment shoulder in the hub and the driving flange of the axle shaft.

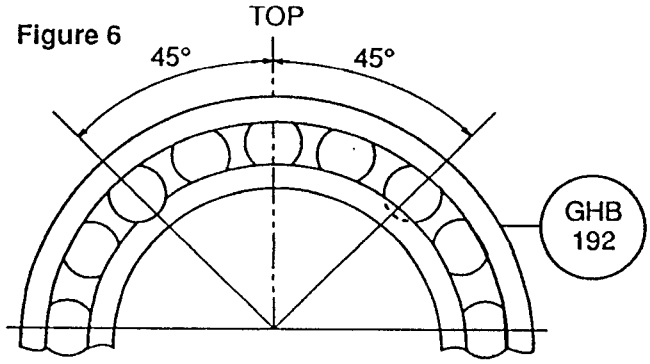
Refit the axle shaft, using a new joint gasket, and insert the screw locating the shaft flange to the hub.

Replace the brake drum, securing it with the two screws to the hub.

Replace the wheel.

When fitting the bearing it is essential that the ball assembly notches found on the inner and outer faces of the inner race are in the upper half of the bearing and positioned symmetrically about the vertical axis as shown in figure 6.

Figure 6



Notches on inner race to be positioned as drawn

Assembly of the bearing in any other position will result in noisy running and lead to premature failure.

Renewing differential unit

1. Jack up vehicle and support with axle stands.

2. Remove road wheels.

3. Release the hand brake.

4. Unscrew the two drum locating screws and remove brake drum.

5. Unscrew the countersunk screw locating the half shaft.

6. Withdraw both half shafts.

7. Remove four bolts from rear end of propshaft.

8. Remove twelve nuts and washers from differential flange, see figure 7.

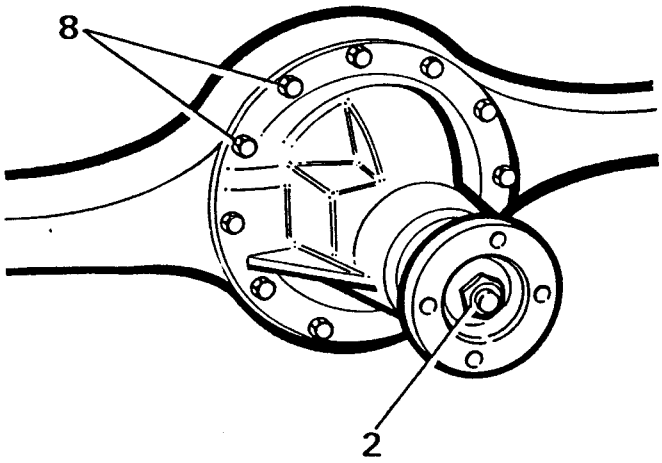


Figure 7

9. Pull out differential unit from the rear axle casing.

10. Replacement is reversal of the removal procedure. Always fit new gaskets between rear axle casing and differential unit and the half shaft and rear hub.

Renewing pinion oil seal

1. Disconnect the propshaft from the rear axle.

2. Remove nut and spring washer retaining driving flange, see figure 7.

3. Remove the driving flange.

4. Prise out the oil seal.

5. Press in new oil seal using tools MS550 and FX550-2.

6. Replace the driving flange.

7. Reconnect the propshaft.

Replacing rear shock absorber

NOTE: If the vehicle is jacked up the rear springs or road wheels must be supported. Without support the shock absorbers will be extended beyond their normal full open position.

1. Remove nut from top fixing and withdraw the bolt.

2. Unscrew lower bolt from spring support plate and remove shock absorber.

Replacing a rear spring

1. Jack up vehicle and support chassis with axle stands.

2. Remove road wheel.

3. Support the rear axle with additional axle stand.

4. Remove lower shock absorber bolt, see figure 8.

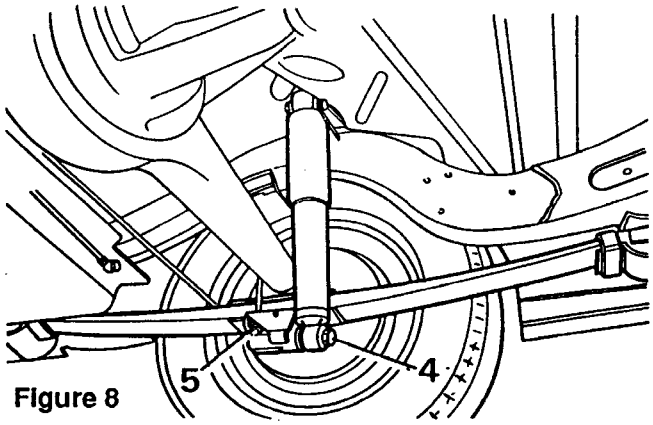


Figure 8

5. Remove nuts from 'U' bolts and withdraw 'U' bolts.

6. Remove nut securing front spring fixing and withdraw bolt. Lower the spring, see figure 9.

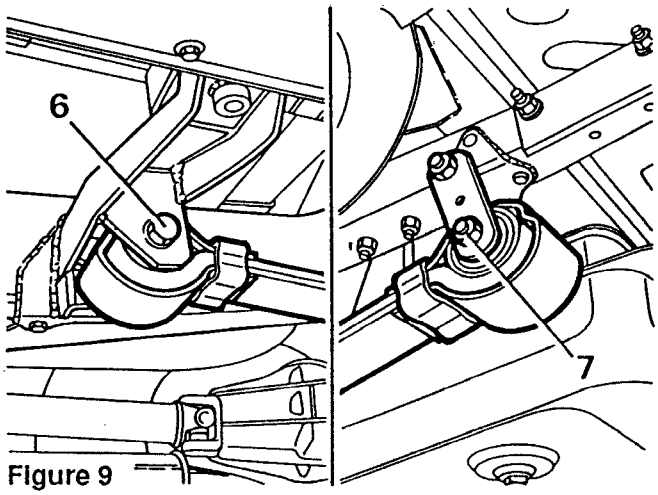


Figure 9

7. Remove outer locknuts on rear shackle fixing and remove outer plate.

8. Slide off spring.

9. Replacing a rear spring is the reversal of remove procedure use new self locking nuts.

NOTE: During the replacement procedure do not fully tighten the shackle pin nuts (fig 9 ref. 6 & 7) until the road wheels have been replaced and the springs are loaded by the vehicle weight.

SECTION RA

CONTENTS

6 THE PROPELLER SHAFT

Description

The propeller shaft is the tubular type with needle-bearing universal joints. Variations due to engine and axle movement are provided for by a sliding joint on the splined end of the shaft.

The joint members are to be marked in order to be reassembled in the original position. This is essential to ensure the correct relative position of the yokes of the universal joints and to avoid shaft vibrations.

Testing for wear

Wear on the thrust faces is ascertained by testing the lift in the joint either by hand or with the aid of a length of wood suitably pivoted.

Any circumferential movement of the shaft relative to the flange yokes indicates wear in the needle-roller bearings.

Removing the propeller shaft

Remove the four nuts and bolts from the flange couplings, marking both couplings to ensure correct balancing when refitting.

Remove the assembly downwards and rearwards from the vehicle, and fit a dummy shaft in rear of gearbox to prevent loss of transmission oil and ingress of dirt.

Note

The propeller shafts are different for the automatic and the synchromatic, also the dummy shafts, see figure 1.
The larger dummy shaft for the automatic
The smaller dummy shaft for the synchromatic

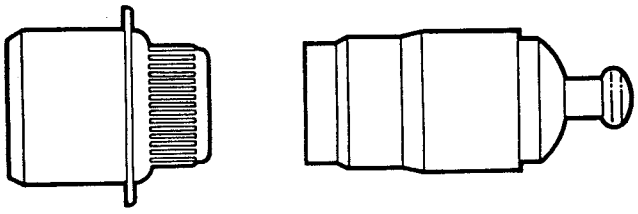


Figure 1

Dismantling the propeller shaft

Remove any enamel and dirt from the snap-rings and bearing faces. Remove all the snap-rings by pinching their ears together with a pair of thin-nosed pliers and prising them out with a screwdriver.

If a ring does not slide out of its groove readily tap the end of the bearing race slightly to relieve the pressure against the ring. Remove the lubricator from the journal and, holding the joint in one hand tap the radius of the yoke lightly with a copper hammer (see fig.2). The bearing should begin to emerge; turn the joint over and finally remove with the fingers. If necessary, tap the bearing race from inside with a small-diameter bar (see fig.3), taking care not to damage the bearing face, or grip the needle-bearing race in a vice and tap the flange yoke clear.

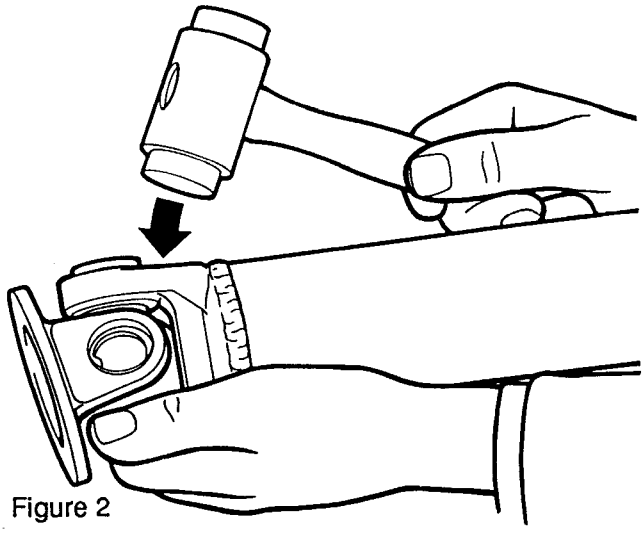


Figure 2

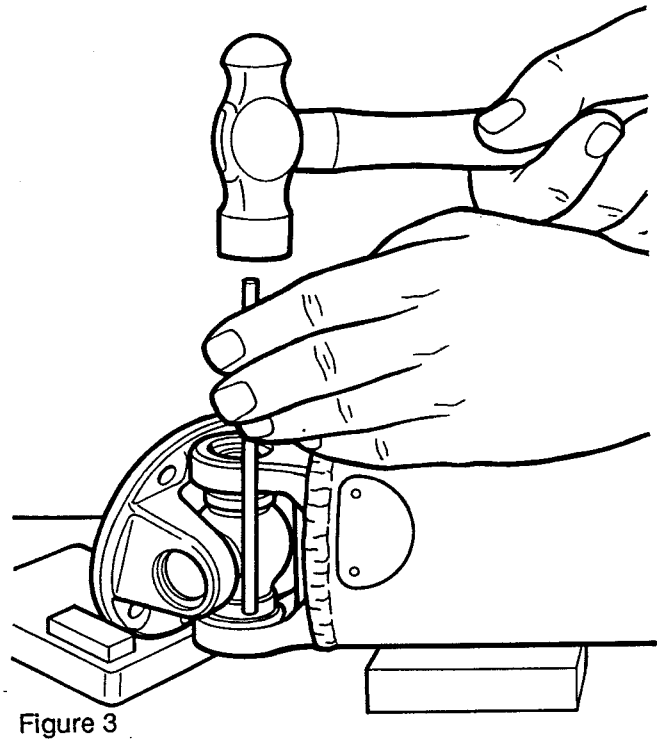


Figure 3

Be sure to hold the bearing in a vertical position, and when free remove the race from the bottom side to avoid dropping the needle rollers.

Repeat this operation for the opposite bearing.
Rest the two exposed trunnions on wood or lead blocks to protect their ground surfaces, and tap the top lug of the flange yoke to remove the bearing race.

Turn the yoke over and repeat the operation.

Examining and checking for wear

The parts most likely to show signs of wear after long usage are the bearing races and the spider journals. Should looseness, load markings, or distortion be observed, the affected part must be renewed complete; no oversized journals or races are provided.

It is essential that the bearing races are a light drive fit in the yoke trunnions. In the event of wear taking place in the yoke cross-holes, rendering them oval, the yokes must be renewed. In the case of wear in the cross-holes in the fixed yoke, which is part of the tubular shaft assembly, it should be replaced by a complete tubular shaft assembly.

Reassembling the propeller shaft

See that all the drilled holes in the journals are thoroughly cleaned out and free of grease.
Assemble the needle rollers in the bearing races and fill with grease. Should difficulty be experienced in retaining the rollers under control, smear the walls of the races with grease to retain the needle rollers in position while reassembling.

Insert the spider in the flange yoke, ensuring that **the lubricator boss is fitted away from the yoke.** Using a soft-nosed drift, about .8mm (1/32in) smaller in diameter than the hole in the yoke, tap the bearing into position. Repeat this operation for the other three bearings. Replace the circlips and be sure that these are firmly located in their grooves. If the joint appears to bind, tap lightly with a wooden mallet: this will relieve any pressure of the bearings on the ends of the journals.

It is always advisable to replace the cork gaskets and the gasket retainers on the spider journals by means of a tubular drift shown in Fig.4.

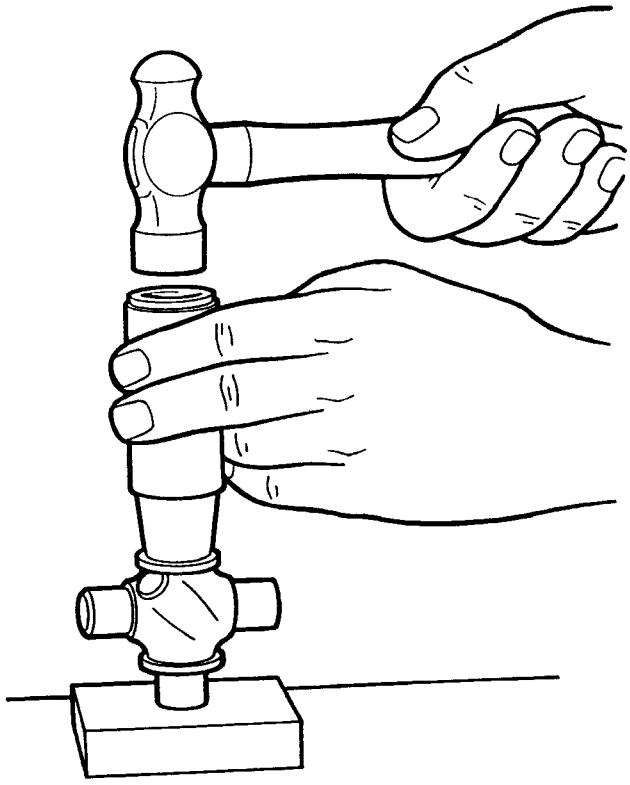


Figure 4.

Replacing the propeller shaft

Wipe the faces of the flange clean and place the propeller shaft in position on the car. Ensure that the flange registers engage correctly, and that the joint faces bed down evenly all round. Insert the bolts and tighten the nuts to a torque of between 35 and 40 lbs/ft.

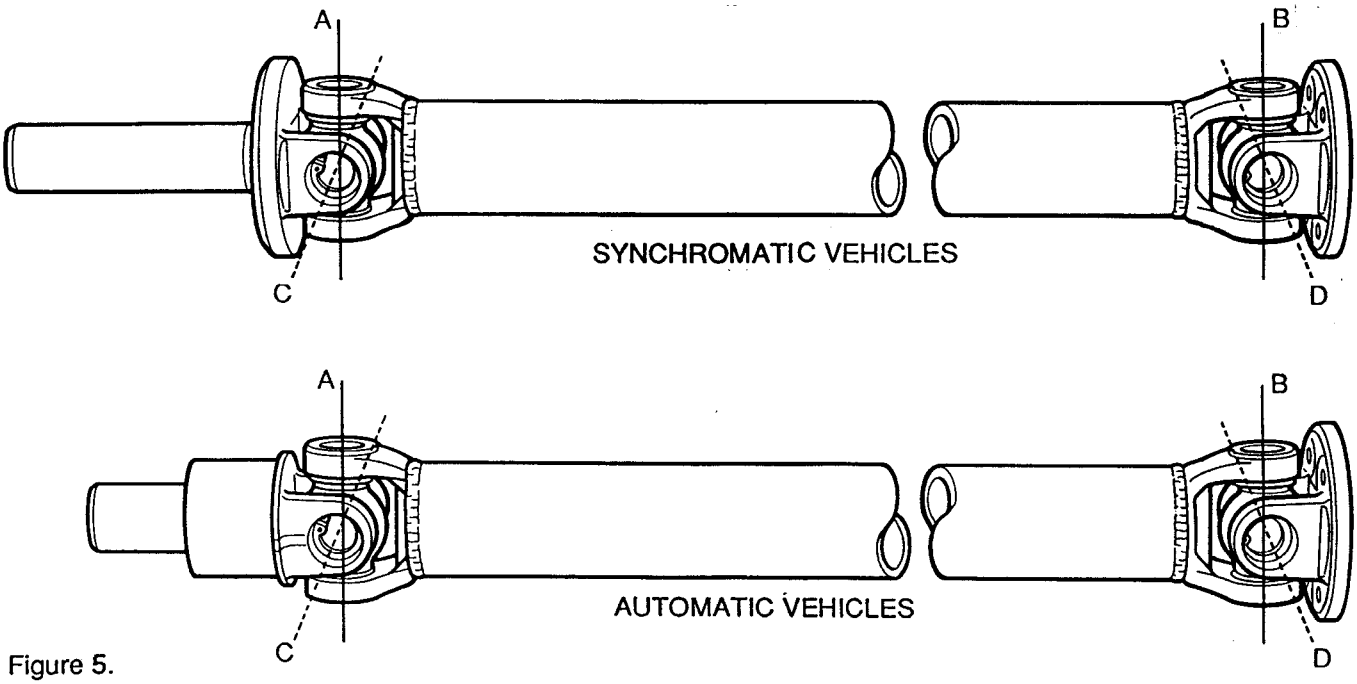


Figure 5.

SECTION 6

GENERAL DATA AND TORQUE FIGURES

REAR AXLE

TYPE	HYPOID THREE QUARTER FLOATING
RATIO	3.909:1

PROPELLER SHAFT

TYPE	OPEN TUBULAR
UNIVERSAL JOINTS	ONE NEEDLE ROLLER

REAR SUSPENSION

SPRING	SINGLE LEAF COMPOSITE
SHOCK ABSORBER	TELESCOPIC

TORQUE FIGURES

	lbft	Nm	Kgm
WHEEL NUTS	65	88-0	9.0
PROPSHAFT FLANGE NUTS	35-40	47-55	4.8-5.5
'U' BOLTS	50-55	68-75	6.9-7.6
REAR SHOCK ABSORBER TOP	40-45	54-61	5.5-6.2
REAR SHOCK ABSORBER LOWER	70-80	95-108	9.7-11.1
DIFFERENTIAL FLANGE NUTS (12)	32-38	43-52	4.5-5.0
DRIVING FLANGE NUT	140	190	19.4
HUB NUT	150	203	20.7
SHACKLE BOLTS	35-40	47-55	4.8-5.5

LTI SERVICE

fairway DRIVER

WORKSHOP MANUAL

SECTION 6a

REAR AXLE

REAR AXLE

CONTENTS

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

While every effort is made to ensure the accuracy of the particulars contained herein, London Taxis International Ltd will not under any circumstances be held liable for any inaccuracies or the consequences thereof.

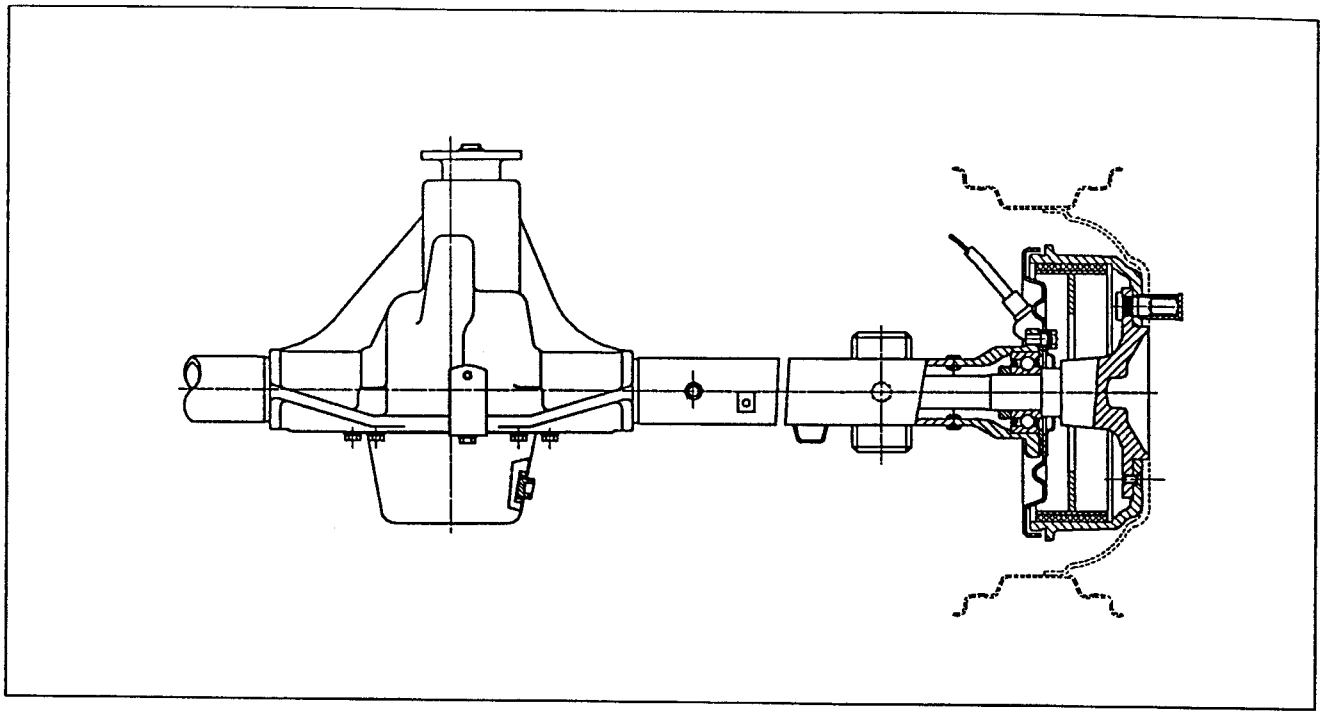


Fig. 1 Rear Axle - general layout

General description

The Fairway Driver is fitted with a semi floating rear axle. The crown wheel and differential case assembly and the pinion are mounted directly into the axle casing. A collapsible spacer is fitted to the pinion to provide pre-load to the pinion bearings. The pinion is flanged to accept the propeller shaft.

The axle casing is compressed during assembly to provide pre-load to the differential case bearings. An inspection cover is provided to the rear of the axle casing. The rear hub bearings are mounted onto the half shafts and are retained in recesses in the axle casing tubes. The hub bearings are prepacked and do not require lubrication in service.

REAR AXLE

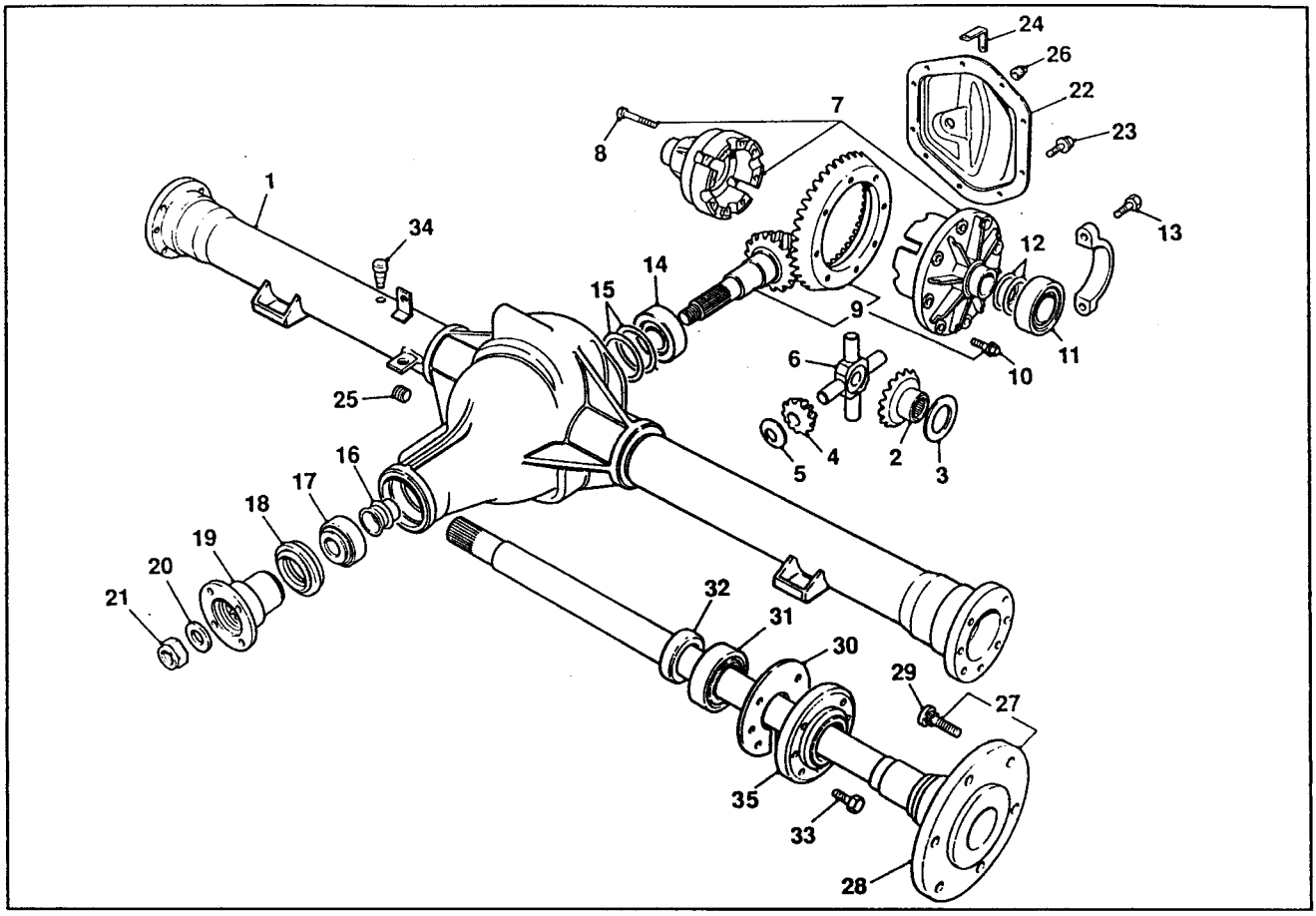


Fig *2. Rear axle components*

1 Axle casing assembly
2 Differential side gear
3 Thrust washer - differential side gear
4 Differential pinion gear
5 Thrust washer - differential pinion gear
6 Shaft - differential pinion
7 Differential case
8 Differential case bolt
9 Crown wheel and Pinion assembly
10 Bolt - crown wheel to diff. casing
11 Bearing assembly - diff. unit
12 Shim - diff. bearing
13 Bolt - diff bearing cap
14 Bearing assembly - pinion inner
15 Shim - pinion inner bearing
16 Spacer - collapsible
17 Bearing assembly - pinion outer
18 Pinion oil seal
19 Flange assembly
20 Washer - pinion flange to pinion
21 Locknut - pinion flange to pinion
22 Cover assembly - axle housing
23 Washer bolt - cover to housing
24 Bracket - handbrake cable support
25 Plug - drain
26 Plug - filler
27 Axle shaft and stud assembly
28 Shaft - axle
29 Wheel stud
30 Retainer plate - bearing
31 Bearing and seal assembly
32 Retaining ring - hub bearing
33 Bolt - axle shaft/brake assembly to axle
34 Breather
35 Oil catcher

KEY DATA

TYPE	12HA Hypoid gear drive, semi floating		
RATIO	4.10 : 1		
BEARING PRELOADS			
Torque- to- turn:		**Nm**	**lbf.in.**
Pinion	New bearings	1.35 - 2.48	12 - 22
	Old bearings	0.73 - 1.30	6.5 - 11.5
Pinion and differential *	New bearings	0.79 - 1.69	7 - 15
	Old bearings	0.40 - 0.85	3.5 - 7.5

* In addition to pinion torque- to- turn

Differential bearing preload:	0,075 mm (0.003 in.) each side
Crown wheel backlash variation:	0,075 mm (0.003 in.)
Crown wheel total backlash:	0,125 - 0.225 mm (0.005 - 0.009 in)

SERVICE REQUIREMENTS

1,000-1,500 miles (1,500-2,500km)	Drain/refill
Every 6,000 miles (10,000 km)	Check/top up
Every 36,000 miles (60,000 km)	Drain/refill
LUBRICANT	SAE 90 grade oil MIL-L-2105C A.P.I. GL 5

REAR AXLE

Torque settings

APPLICATION	Nm	l bf. ft
Axle bearing retainer to axle	68-81	52-60
Axle rear cover	26-30	18-22
Crown wheel to diff. case	104-115	78-86
Differential bearing cap	51-58	38-43
Differential case	26-30	18-22
Rear spring shackles	45-52	35-40
Rear damper lower mountings	60-73	45-55
Rear damper upper mountings	52-60	40-45
Spring ' U' bolts	66-73	50-55

Special tools

Axle shaft/hub assembly slide hammer	Churchill MS 16B
Axle shaft/hub assembly remover	Churchill FX 4237
Axle shaft bearing/retainer remover	Churchill FX 4205
Axle shaft bearing/retainer replacer	Churchill FX 4263
Flange holding tool	Churchill 18G 1205
Flange remover	Churchill 18G 2
Pinion oil seal replacer	Churchill FX 4209
Screw press	Churchill MS 47
Pinion bearing cone remover/replacer	Churchill FX 4279
Handle	Churchill MS 550
Pinion head bearing cup replacer	Churchill FX 4236
Pinion tail bearing cup replacer	Churchill FX 4213
Differential side bearing remover	Churchill FX 4212
Differential side bearing replacer	Churchill FX 4235
Axle casing compressor	Churchill GKN 131
Pinion height gauge	Churchill FX 4280
Pinion height gauge button	Churchill FX 4214
Backlash gauge	Standard workshop dial gauge
Torque-to-turn gauge	Standard dial torque wrench 0-17 Nm (0-120 lbf. in.)

PINION OIL SEAL

REMOVE/REPLACE

1. Remove the rear hub caps and partly release the wheel nuts. Chock the front wheels and release the handbrake. Raise the rear of the vehicle and support the axle on stands. Position a suitable drain pan and remove the filler and drain plugs to drain the axle. Refit the drain plug. Remove the rear wheels.

2. Remove the rear brake drum retaining screws and withdraw the brake drums to ensure there is no drag on the axle when measuring the pinion torque-to-turn.

NOTE: If the brake drum is worn it may be necessary to release the brake self adjuster mechanism before the drum can be removed (see BRAKES). If the drum is tight on its centre spigot, lightly tap the drum off the hub using a soft faced mallet.

3. Mark the prop shaft and pinion drive flange for correct re-alignment, then disconnect the prop shaft by removing the four retaining nuts and bolts. Discard the self locking nuts (to be replaced with new nuts). Support the propshaft by placing a suitable wooden block between the chassis and propshaft immediately behind the transmission.

4. Scribe a line across the pinion drive flange and the end of the pinion shaft to identify the original fitted position on re-assembly.

5. Measure the torque-to-turn of the pinion.

NOTE: Record the torque to keep the pinion turning, not the torque to start it turning.

6. Bolt on the pinion flange holding tool 18G 1205. Remove the pinion shaft self locking nut and plain washer.

7. Pull off the pinion flange using the special tool 18G 2. Never attempt to drift the flange off the pinion shaft as this could damage the pinion gear teeth.

8. Prise the pinion oil seal out of the axle casing.

Note: Particular care must be taken not to damage the oil seal recess.

9. Clean the pinion seal bore and shoulder in the axle casing. Grease the lips of the new oil seal and clip it onto the special tool FX 4209. Drive the seal (lips facing inwards) squarely into the axle housing until it is seated against the shoulder in the casing.

10. Check the condition of the pinion flange oil seal diameter to ensure it is completely free of any scratches, nicks or other damage. If damaged in any way, replace the drive flange. Position the pinion flange so that the marks previously applied line up. Using a suitable wooden block to protect the flange, tap the flange onto the pinion until it is possible to bolt on the flange holding tool 18G 1205 and to use the old pinion nut to pull the flange into position - **DO NOT OVER TIGHTEN.** Remove and discard the old self-locking nut.

Refit the plain washer and fit a new pinion flange self-locking nut holding the flange with the special tool 18G 1205. Progressively tighten the pinion shaft nut checking the pinion torque-to-turn at intervals until it reaches the figure noted before dismantling, then continue to tighten the nut only until an additional 0.40 - 0.85 Nm (3.5 - 7.5 lbf in.) torque-to-turn is achieved.

CAUTION: Considerable effort is required to turn the pinion flange nut so it is essential to use adequate tools for this operation. If the torque-to-turn becomes too great, the collapsible spacer within the axle must be replaced.

12. Check the axle breather is not blocked.

13. Remove the propshaft support and fit the propshaft using new self-locking nuts and aligning the shaft with the markings made previously on the pinion drive flange.

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

NOTE: Maximum permitted brake drum wear may not exceed 1.0 mm (0.040 in.). Brake drums may not be reground.

15. Operate the brake pedal to align the brake shoes. Check the handbrake operation. Refit the road wheels tightening the securing nuts as much as possible. Refill the rear axle with the specified oil until it just flows from the filler hole; refit the filler plug.

16. Lower the vehicle and torque the wheel nuts to specification (torque 200 Nm, 150 lb ft). Replace the hub caps.

REAR AXLE

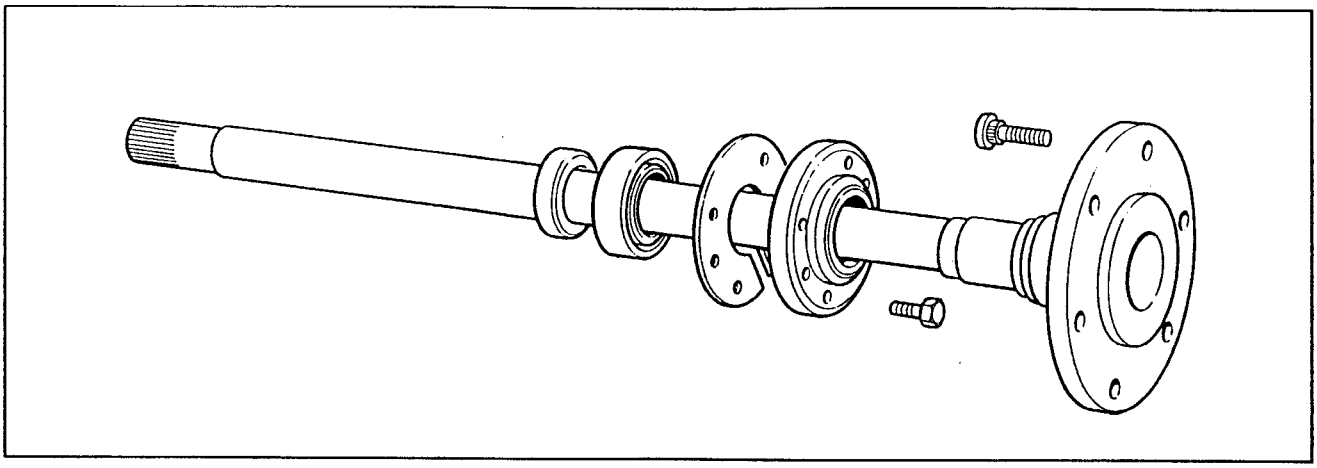


Fig. 3 Rear axle shaft - components

REAR WHEEL STUD

REMOVE/REPLACE

1. Remove the rear hub cap and partly release the wheel nuts. Chock the front wheels and release the handbrake. Raise the rear of the vehicle and support the axle on stands. Remove the rear wheel.

2. Remove the rear brake drum retaining screw and withdraw the brake drum.

NOTE: If the brake drum is worn it may be necessary to release the brake self adjuster mechanism before the drum can be removed (see BRAKES). If the drum is tight on its centre spigot, lightly tap the drum off the hub using a soft faced mallet.

3. Using a soft faced mallet, knock out the wheel stud. Pull back the trailing brake shoe as required to release the wheel stud.

4. Fit a new wheel stud with Loctite applied to the serrations. Ensure the serrations of the stud and stud hole are in alignment and draw the stud through the flange using a wheel nut.

5. Lightly grease the brake drum spigot and replace the brake drum and its securing screw.

NOTE: Maximum permitted brake drum wear may not exceed 1.0 mm (0.040 in.). Brake drums may not be reground.

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

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

REAR AXLE BEARING/SEAL ASSEMBLY

REMOVE/REPLACE

1. Remove the hub cap and partly release the wheel nuts. Chock the front wheels and fully release the handbrake. Raise the rear of the vehicle and support the axle on stands.

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

NOTE: If the brake drum is very worn it may be necessary to release the brake self adjuster mechanism before the drum can be removed (see BRAKES).

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

4. Take careful note of the position of the brake shoes and springs. Depress and turn the brake shoe steady retainers to release the pins and springs. Extract the steady pins from the inboard side of the backplate.

5. Pull the heel of the leading shoe and the toe of the trailing shoe out of the fixed abutment slots against the load of the tension spring taking care not to over stretch the spring. Unhook and remove the spring hooks from the brake shoe webs.

6. Ease the toe of the leading shoe followed by the heel of the trailing shoe out off the piston slots. Unhook the pull-off spring. Disengage the handbrake cable from the handbrake lever on the trailing shoe and remove the brake shoes. Prevent ejection of the wheel cylinder pistons by restraining

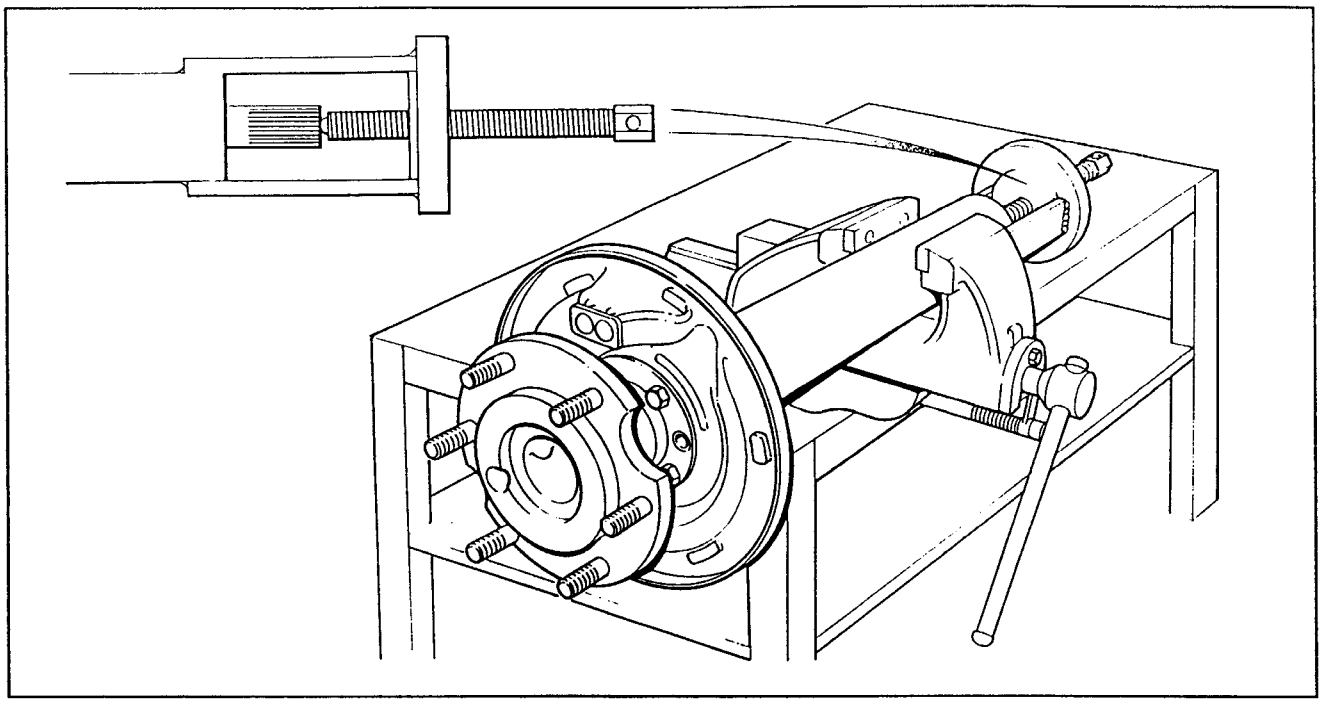


Fig. 4 Rear axle bearing removal

them with an elastic band or soft wire around the brake cylinder body. Ease the clip retaining the rear handbrake cable to the brake backplate (new clips are serviced if the clip is damaged) and pull the cable from the backplate.

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

7. Disconnect the brake pipe from the rear brake wheel cylinder and fit plugs to the pipe and cylinder.

8. Using a socket wrench through the hole in the rear hub, remove the bolts securing the oil catcher, brake back plate and bearing retainer to the axle casing.

9. Position a drain tray under the end of the axle and pull the half shaft and rear brake assembly from the axle casing using the slide hammer MS 16B and adapter plate FX 4237 if the bearing is tight in the rear axle casing.

Note the location of the rear hub bearing and seal assembly, oil catcher, brake back plate assembly and bearing retainer plate on the axle shaft.

10. Position the axle shaft bearing and bearing retainer remover tool FX 4205 in a vice (Fig. 4) and lubricate the centre screw of the tool. Bolt the axle shaft and bearing assembly to the tool using 4 of the bolts which retained the assembly in the vehicle. Screw in the centre screw of the service tool on to the inner end of the axle shaft to push the axle shaft from its bearing and bearing retainer ring. Remove the bearing retainer plate, brake back plate and oil catcher from the service tool. Discard the bearing retaining ring.

Note: The holes in the service tool are offset in the same way as the axle casing so it is necessary to line up all the holes in the oil catcher, brake backplate and bearing retainer plate so that the bolts may be fitted into the tool.

11. Check the condition of the components ensuring all parts to be reused are clean and undamaged. **THE DISPLACED BEARING RETAINING RING MUST NOT BE REUSED.**

Referring to Fig. 5, position the axle shaft bearing and retainer replacer tool (FX 4263) in a bench vice so that the vice jaws firmly grip the shaded portion of the bottom plate (1) of the tool. Take off the top plate (5) of the tool and locate the adaptor ring (2) in position in the bottom plate.

Place the spacer (3) supplied as part of the service tool into the adaptor ring (2), then position the axle shaft bearing and seal assembly (4) into the adaptor ring so that the 'O' ring round the outside of the bearing and the seal within the bearing assembly are towards the base plate of the tool.

Place the bearing retainer, brake backplate (brake

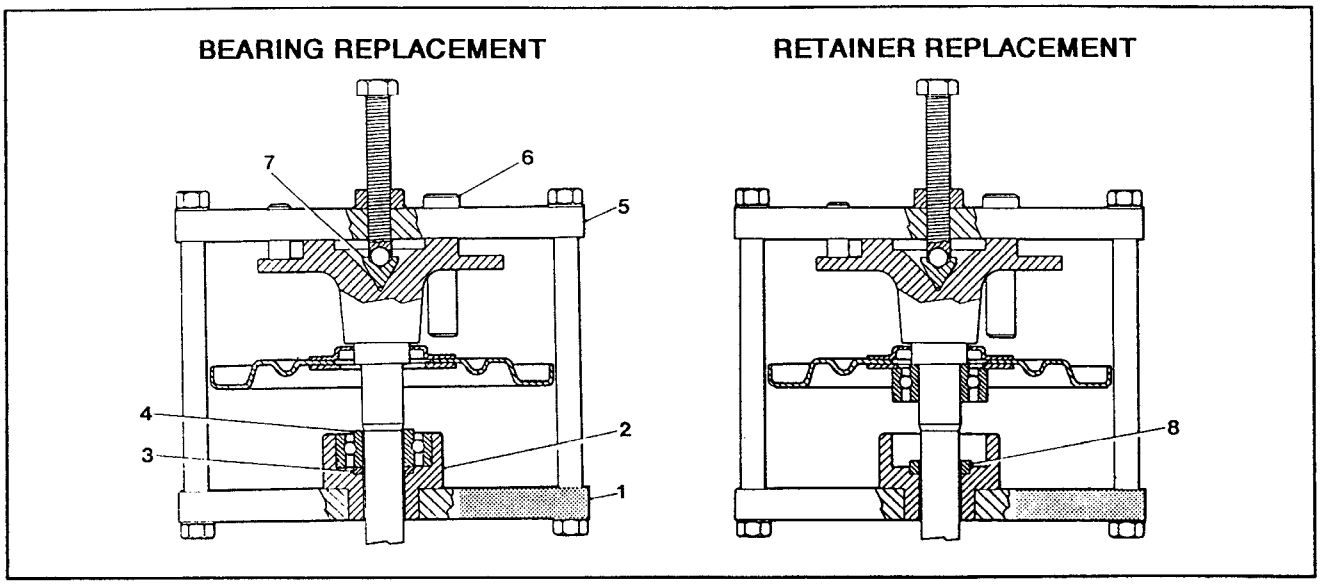


Fig 5. Axle bearing and retainer replacement

shoe abutment uppermost), and oil catcher in position on top of the adaptor ring (2) and then insert the axle shaft through the components into the service tool. Refit the top plate of the service tool (5) inserting the guide (6) through the hole in the axle shaft flange. Position the pressure pad (7) and screw down the centre screw of the service tool until the bearing is located against its shoulder on the shaft taking care to hold the loose components so that they are not trapped as the bearing is pushed into position.

NOTE: DO NOT OVERTIGHTEN THE SERVICE TOOL ONCE THE BEARING IS IN ITS CORRECT POSITION ON THE AXLE SHAFT AS THIS COULD DAMAGE THE TOOL. NEVER ATTEMPT TO FIT THE BEARING RETAINING RING AT THE SAME TIME AS THE BEARING AS THIS WILL OVERLOAD THE EQUIPMENT.

Take off the top plate of the service tool and remove the axle shaft and the associated components. Remove the spacer supplied as part of the service tool (3) and insert a **NEW** bearing retaining ring (8) into the adaptor ring (2). Reposition the axle shaft assembly in the service tool; refit the top plate (5), guide (6) and pressure pad (7) and tighten the centre screw of the tool to push the retaining ring into position against the axle shaft bearing.

NOTE: DO NOT OVERTIGHTEN THE SERVICE TOOL ONCE THE BEARING RETAINING RING IS IN POSITION. RETAIN THE LOAD ON THE RETAINING RING FOR 30 SECONDS BEFORE RELEASING THE PRESSURE ON THE TOOL.

12. Check the condition of the axle shaft bearing recess in the axle casing. Grease the outer diameter of the bearing assembly (the bearing is prepacked) and insert the shaft assembly into the axle casing tube bore and tap home with a soft faced mallet.

13. Position the bearing retaining plate so that the slot in the plate lines up with the drain hole in the bottom of the axle casing flange. Position the brake backplate and oil catcher to line up the bolt holes with those in the axle casing and then secure the assembly with the retaining bolts (torque 68-81 Nm, 52-60 lbf. ft.)

14. Feed the end of the brake cable through the brake backplate (do not clip it into the backplate at this stage). Fit the end of the handbrake cable to the handbrake lever in the trailing brake shoe assembly and then fit the trailing brake shoe to the backplate, positioning the crosslever under the wheel cylinder. Fit the brake shoe webs into the slot in the abutment and wheel cylinder piston. Refit the steady pin, spring and retainer. Reconnect the brake cable to the brake backplate using a new spring clip if required.

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

16. Fit the brake pull off springs (the stronger spring fits in the upper position). Reconnect the front handbrake cable to the handbrake lever securing the clevis pin with a new split pin.

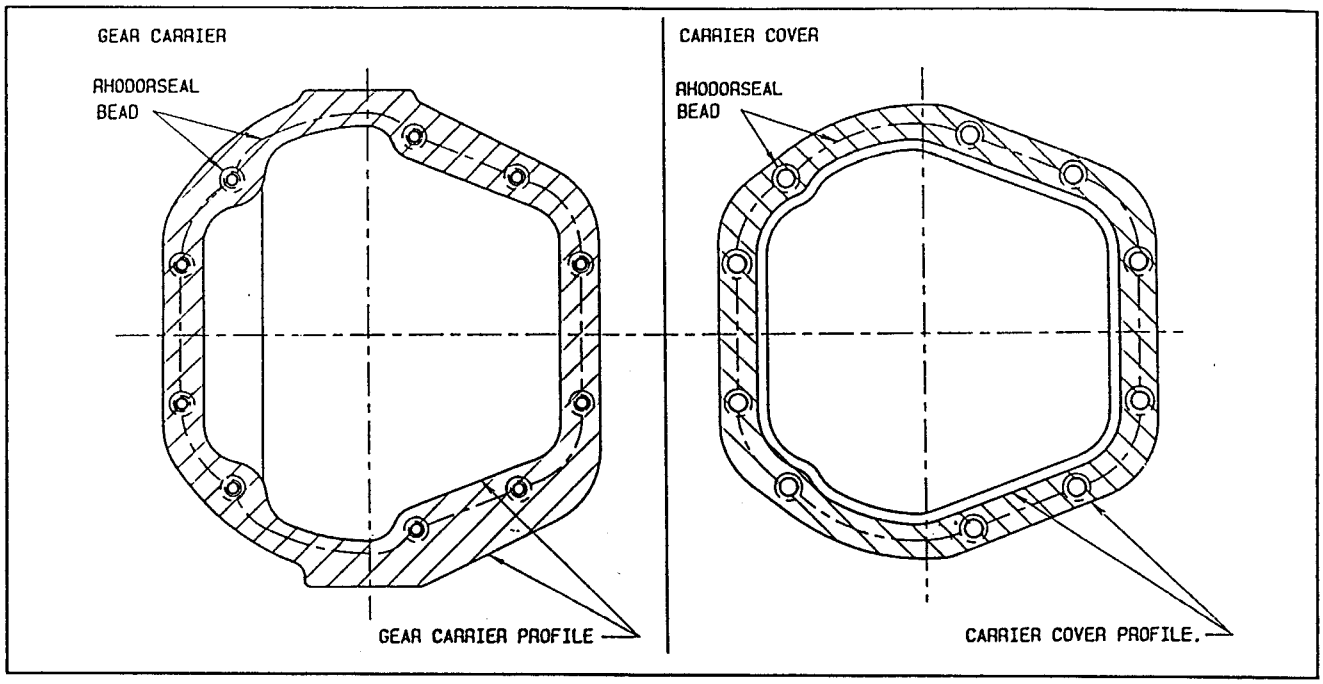


Fig 6. Rear axle cover sealing

17. Lightly grease the brake drum spigot and replace the brake drum and its securing screw.

18. Reconnect the brake pipe to the wheel cylinder.

19. Bleed the rear brakes. If plugs have not been fitted during the removal procedure it may be necessary to bleed the entire braking system to achieve a satisfactory 'pedal' (see-BRAKES). Operate the brake pedal to align the rear brake shoes. Check the operation of the handbrake and that the brake drums rotate freely when the handbrake is released.

20. Lower the vehicle and torque the wheel nuts to specification (torque 200 Nm, 150 lb ft). Replace the hub cap. Top up the rear axle if there has been any significant loss of oil.

REAR AXLE COVER

REMOVE/REPLACE OR RESEAL

1. Raise vehicle on lift. Position a suitable container and remove the filler and drain plugs to drain oil from the axle. Clean and replace drain plug.

2. Remove cover bolts and handbrake support bracket and retain together with any identification tags.

3. Using soft faced mallet, remove cover from housing face.

4. Clean housing joint face and cover joint face with solvent to remove sealant and oil.

5. Referring to Fig. 6, apply a continuous bead of Rhodorseal sealer to either the cover or the axle casing (not both), ensuring that sealer does not penetrate into the bolt holes in the axle casing. Fit the cover within 10 minutes of applying the sealer. Refit the handbrake support bracket and any identification tags and tighten the securing bolts to the correct torque 26-30 Nm (18-22 lbf. ft.).

6. Refill axle to correct level with specified gear oil. Clean and replace filler plug.

REAR AXLE ASSEMBLY

REPLACE COMPLETE WITH REAR HANDBRAKE CABLE

1. Remove the rear hub caps and partly release the wheel nuts. Chock the front wheels and fully release the handbrake. Disconnect the rear damper lower mountings and push up each rear damper as far as possible. Raise the rear of the vehicle and fit stands under the chassis. Remove the rear wheels.

2. Mark the prop shaft and pinion drive flange for correct re-alignment, then disconnect the prop shaft by removing the four retaining nuts and bolts. Discard the self locking nuts (to be replaced with new nuts). Support the propshaft by placing a suitable wooden block between the chassis and propshaft immediately behind the transmission.

3. Remove the filler and drain plugs and drain the oil from the rear axle into a suitable container. Replace the two plugs.

4. Disconnect the hand brake front cable from the handbrake lever by removing the split pin and clevis pin (this makes access to the rear handbrake connection more simple). Similarly, disconnect the rear handbrake cable at the compensator. If the clevis pins are worn they should be discarded. Remove the 'E' clip and unscrew the adjuster nuts securing the rear handbrake cable to the abutment bracket on the chassis. Remove the cable from its 2 'P' clip supports on the chassis.

5. Disconnect the rear brake hydraulic pipe from the front of the rear brake hose. Disconnect the flexible hose from the chassis bracket and plug the pipe and hose ends to prevent dirt ingress and brake fluid loss.

6. Disconnect the rear silencer mounting from the chassis. Support the axle assembly and undo and remove the 'U' bolts. Remove the rear spring rear shackles and drop the rear of the springs to give access to the axle assembly. Remove the axle assembly from the vehicle.

7. Disconnect the brake pipes from the brake back plates and the 3-way connector and flexible hose from the axle assembly. Fit these parts to the replacement axle (fit a new brake hose where condition, or time and mileage suggest a replacement is advisable). Plug the wheel cylinders of the old axle with the plugs fitted to the replacement unit. Transfer the 'P' clip handbrake cable support to the handbrake cable supplied as part of the replacement axle assembly. Clean and transfer the axle breather to the new axle.

8. Fill the replacement axle with the specified gear oil (approx. 1.25 litres, 2.25 pints).

9. Position the replacement axle assembly under the vehicle. Replace the rear spring rear shackles and the 'U' bolts tightening all fixings as much as possible so that they can be fully torqued to specification later. Remove the axle support. Refit the rear silencer mounting to the chassis.

10. Secure the rear handbrake cable into position (do not attempt to adjust the cable at this stage). Fit the 'E' clip retainer to secure the cable to the lower position on the abutment bracket. Refit the 'P' clips round the cable guides and secure both parts of the cable to the chassis support bracket. Reconnect the rear handbrake compensator to the front handbrake and then the front handbrake to the handbrake lever (use new clevis pins as required) and new split pins.

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

11. Connect the rear brake flexible hose to the chassis bracket and reconnect the rear brake hydraulic pipe.

12. Refit the propshaft using new self-locking nuts.

13. Bleed the rear brakes. If plugs have not been fitted during the removal procedure it may be necessary to bleed the entire braking system to achieve a satisfactory 'pedal' (see-Brakes). Operate the brake pedal to align the rear brake shoes. Check the brake drums rotate freely.

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

NOTE: Correctly adjusted, there should be no pre-load in the handbrake cables.

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

16. Lower the vehicle and torque the wheel nuts to specification (torque 200 Nm, 150 lb ft). Replace the hub caps.

17. Reconnect the rear damper lower mountings (torque 60 - 73 Nm 45 - 55 lbf. ft.) Torque the 'U'bolts to 66 - 73 Nm (50 - 55 lbf. ft.) and shackles to 45 - 52 Nm (35 - 40 lbf. ft.)

18. Check/top up axle oil level as required.

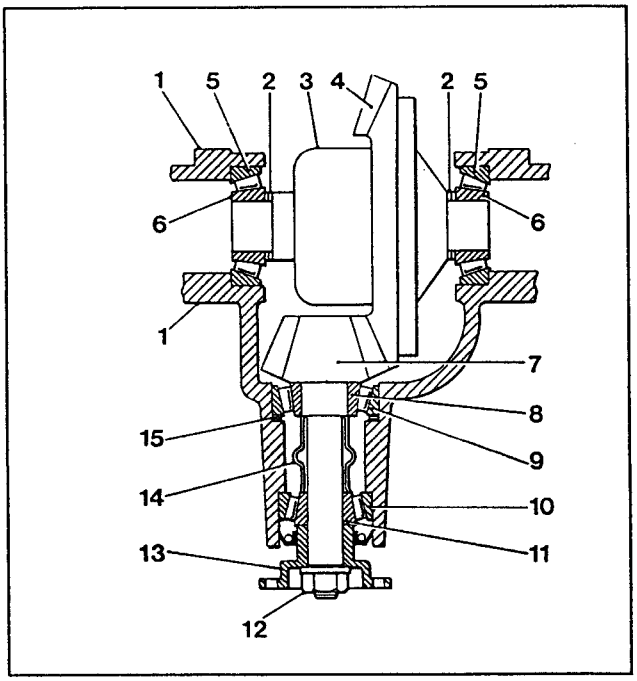


Fig 7. Differential housing layout

1 Axle casing
2 Differential bearing shims
3 Differential casing
4 Crown wheel
5 Differential bearing cup
6 Differential bearing cone
7 Pinion
8 Pinion head bearing cone
9 Pinion head bearing cup
10 Pinion tail bearing cup
11 Pinion tail bearing cone
12 Pinion nut
13 Pinion flange
14 Collapsible spacer
15 Pinion head bearing shims

REAR AXLE ASSEMBLY OVERHAUL PROCEDURES

SETTING UP AN AXLE

The performance, quietness and durability of an axle is dependent on accurate positioning of the pinion relative to the crown wheel and the preload on the pinion and differential case bearings. Fig. 7 shows the layout of the pinion and differential case components in detail.

PINION BEARING PRELOAD

Pinion bearing preload must be set to ensure the pinion bearings operate at the correct load. Excessive preload will cause premature failure of the bearings, and loss of preload will allow the pinion to move under load causing the axle to become noisy.

Preloading of the pinion bearings is achieved by tightening the pinion flange nut (Fig. 7, item 12) until a precise running torque-to-turn figure is achieved. The bearings are positively located by a spacer (Fig. 7, item 14) which progressively collapses as the pinion flange nut is tightened.

PINION HEIGHT

Machining tolerances in manufacture affect the relative position of the pinion and crown wheel. The pinion height is adjustable to cater for the tolerances which can occur and this is achieved by shims placed under the pinion head bearing (Fig, 7, item 15).

To determine the nominal dimension of the shim pack, it is necessary to install a dummy pinion into the axle using the pinion bearings which will be used on final assembly, and to measure the height of the dummy pinion relative to a ground shaft located on the centre line of the differential case bearings (Fig. 7, item 6). The machining tolerances of the pinion are then added to (or subtracted from) the measured height determined by using the dummy pinion.

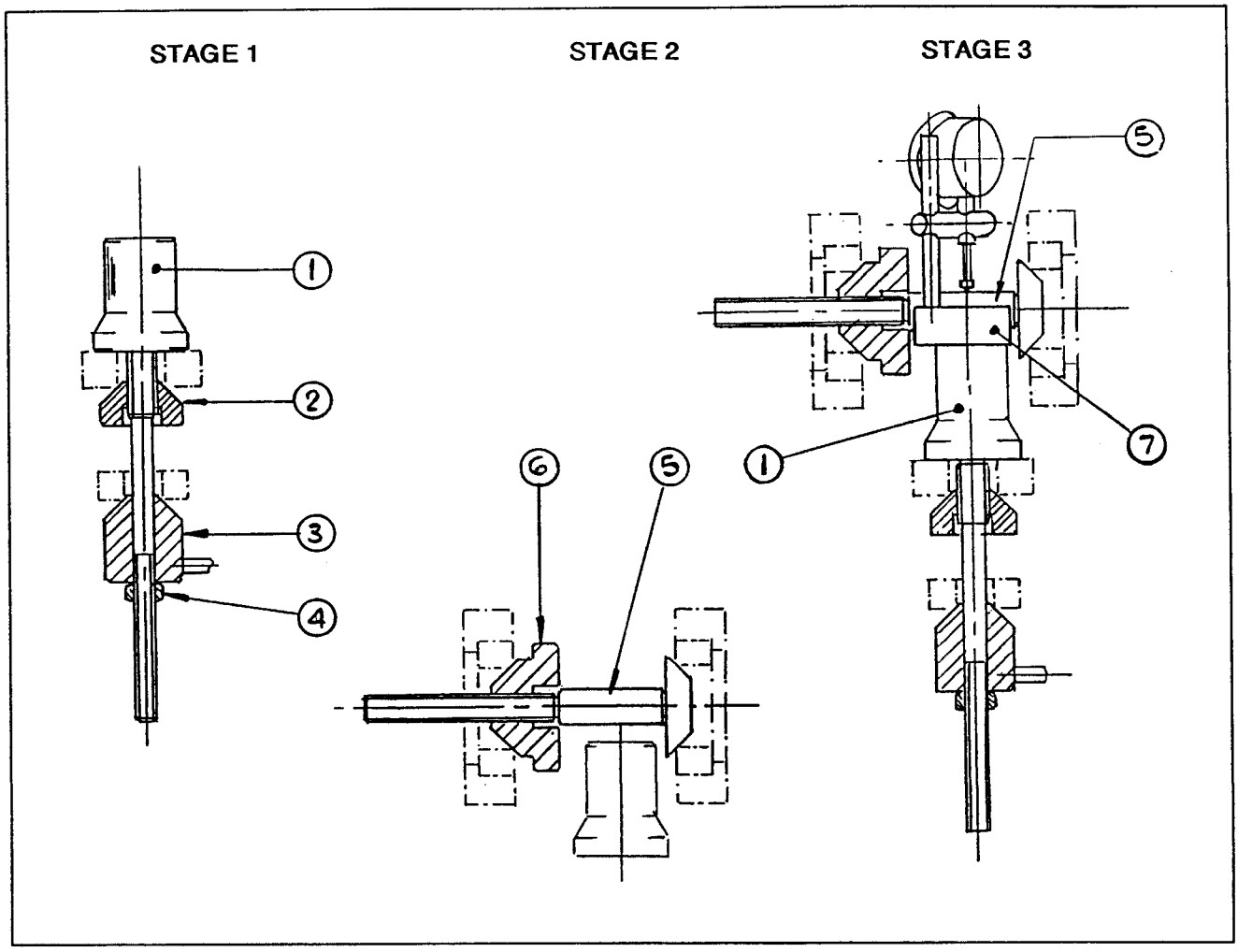


Fig 8. Pinion height setting procedure

The height of the dummy pinion is determined using a pinion height gauge FX 4280 and setting button FX 4214 as follows.

Stage 1 (Fig 8)

The dummy pinion (1) is installed so that it is centralized between the pinion bearing cones using the tapered locators (2 and 3) of the service tool as illustrated. Lock the locators with the lock nut (4).

Stage 2 (Fig.8)

Position the differential bearing cups into the axle casing, fitting the bearing caps to ensure the bearings are upright in the axle casing.

Install the ground shaft of the service tool (5) using the tapered locators (6) of the tool to centralize it between the differential bearings.

Stage 3 (Fig. 8)

Set up the base of the dial gauge (7) on the top of the dummy pinion (1) so that it is angled correctly to rest on the ground shaft (5) between the two differential bearings (Fig. 9). When a satisfactory position has been established, tighten up the gauge on its mounting so that it cannot move position relative to the base.

NOTE: The stylus of the dial gauge will be pushed in when taking the reading so in setting up the gauge, due allowance must be made to allow the stylus to move in freely by at least 2.5 mm (0.100 in.)

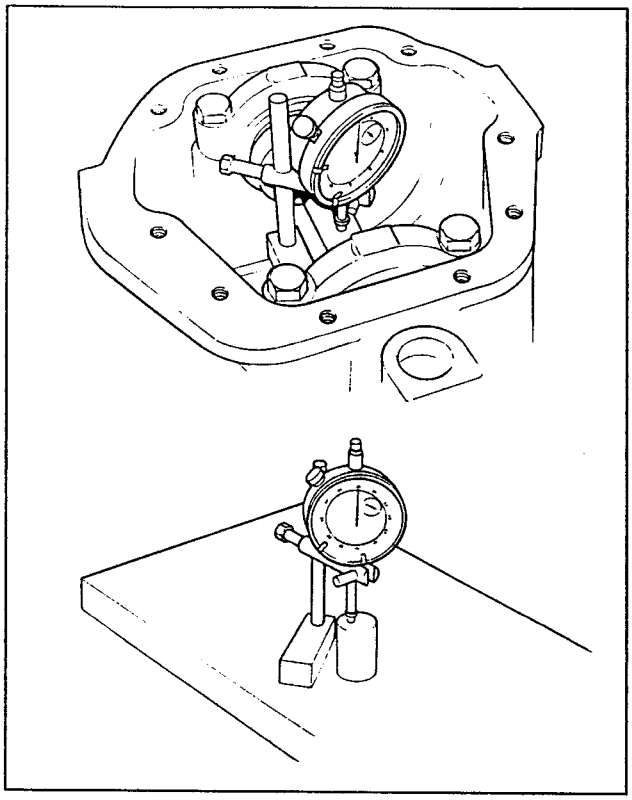


Fig 9. Setting up the dial gauge

Before taking the measurement, the dial gauge must be 'zeroed' on a surface plate (Fig. 9) using the setting button FX 4214. The 'zeroed' gauge must then be transferred to the axle so that the base of the gauge can be located on the top of the dummy pinion and the stylus can be moved back and forth over the top of the ground shaft to register its maximum height.

The dial gauge will move clockwise from its 'zeroed' position and will indicate the amount by which the dummy pinion is set 'low' into the pinion housing. Repeat this procedure at three positions of the dummy pinion noting the reading on each occasion. The average reading obtained is the nominal thickness of the shim pack required to which must be added (or subtracted) the individual machining tolerance of the actual pinion to be fitted.

Two variations affect the dimension of the shim pack required:

a. The best running position of the pinion relative to its matching crown wheel (etched on the pinion head), and
b. The thickness of the pinion head. The variation from the maximum (always a "-" figure) is etched on the shank of the pinion behind the pinion head bearing ground diameter.

The head of the new pinion is etched with a number which when "0" indicates no correction is necessary to the nominal thickness of the shim pack. The marking may be prefixed by a "+" or "-". For example, a "+ 3 " mark indicates that to achieve the best running position 0,075 mm or 0.003 in. must be **subtracted** from the nominal shim pack measurement. Conversely, a "-" mark will indicate that the measurement indicated must be **added** to the nominal shim pack measurement.

Finally, the etched marking showing the variation in pinion thickness (this will always be a "-" figure) must be **added** to the nominal thickness of the shim pack.

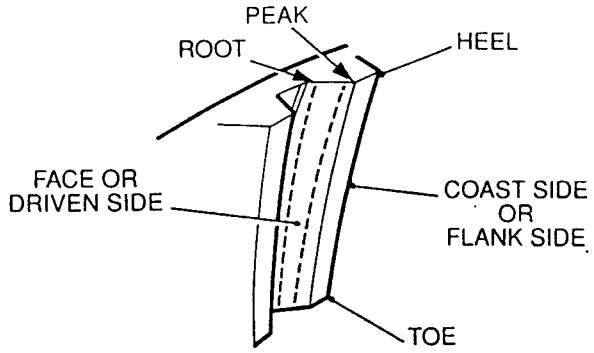
NOTE: The pinion markings and dimensional equivalents are as shown below.

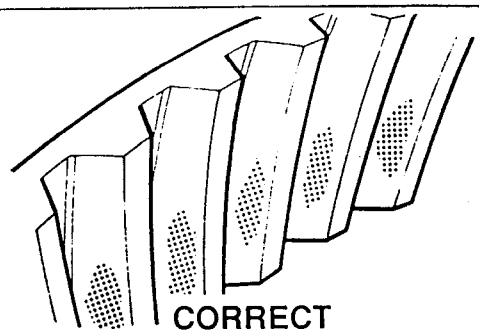
Pinion Mark	Inches	Millimetres
1	0.001	0,025
2	0.002	0,050
3	0.003	0,075
4	0.004	0,100
5	0.005	0,125
6	0.006	0,150
7	0.007	0,175
8	0.008	0,200
9	0.009	0,225
10	0.010	0,250
11	0.011	0,275

The service tools and bearings cones are then removed. The pinion head bearing cup is also removed so that it can be refitted with a shim pack of the dimension calculated sandwiched between the bearing cup and axle casing (Fig. 7 item 15). This will then ensure the pinion is fitted correctly relative to the crown wheel.

NOTE: While shims are marked with their thickness, always check the thickness of the shim pack with a micrometer before fitting.

REAR AXLE





CORRECT
Contact evenly spread and nearer to toe (the smaller inner end of the tooth).

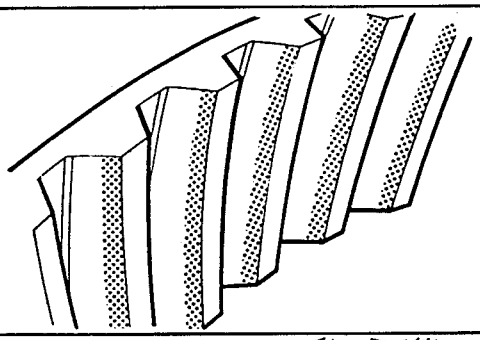
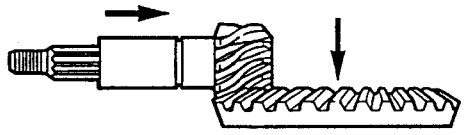
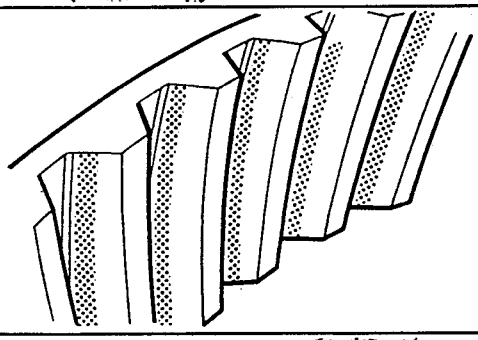
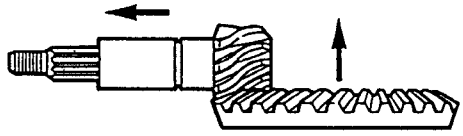
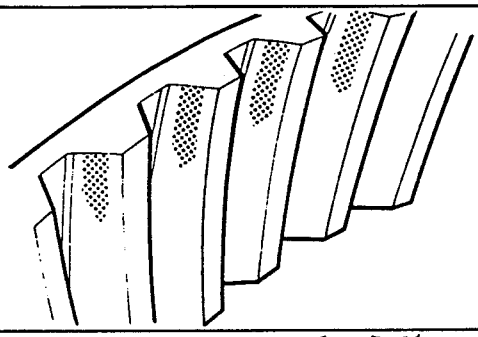
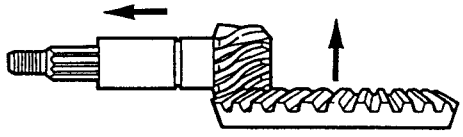
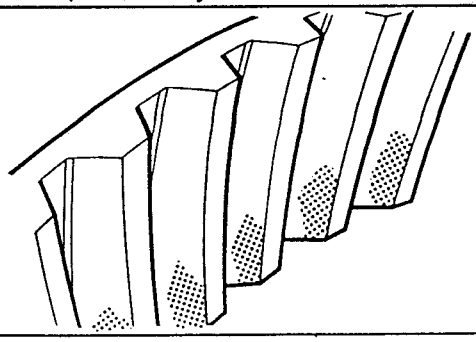
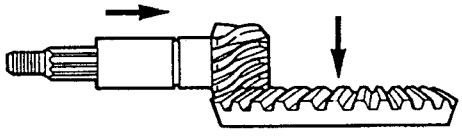
TOOTH CONTACT CONDITION	CORRECTION REQUIRED
	 **High tooth contact** Move the pinion deeper into mesh by adding to the pinion shim pack. It will then be necessary to move the crown wheel out to maintain backlash.
	 **Low tooth contact** Move the pinion out of mesh by reducing thickness of pinion shim pack. It will then be necessary to move the crown wheel in to maintain backlash.
	 **Toe tooth contact** Move the crown wheel into mesh by transferring some differential housing shims to the crown wheel side. Then remove shims from pinion to maintain backlash.
	 **Heel tooth contact** Move the crown wheel out of mesh by transferring some differential housing shims to the non crown wheel side. Then add shims to pinion to maintain backlash.

Fig 10 Rear axle tooth contact

DIFFERENTIAL BEARING PRELOAD AND BACKLASH

The differential case is supported between two bearings (Fig. 7, item 6) which must be correctly preloaded on assembly to prevent excessive bearing load and ensure the bearings cannot move under load. In addition, the crown wheel (fig. 7, item 4) must be positioned correctly relative to the pinion (fig. 7, item 7), with the correct amount of free 'play' or 'backlash' between the gears. This is achieved by means of shims under the differential bearing cones (Fig. 7, item 2).

To achieve the correct preload, shim packs are selected to eliminate all side movement of the crown wheel, and then the shim pack thickness is increased on either side by 0,075 mm (0.003 in) to provide the preload.

To obtain the correct backlash, shims are moved from one shim pack to the other until the correct backlash is noted on a dial gauge. The total combined thickness of the two sets of shims must not be altered so that the correct preload is maintained on the bearings.

TOOTH CONTACT

The tooth marking achieved after rebuilding an axle must be checked to ensure the axle has been set up correctly.

Check the tooth contact area by painting each side of the crown wheel teeth with engineers marking paint. Rotate the pinion both ways and compare the markings on the crown wheel teeth with those shown in Fig. 10. If the correct marking has not been achieved, the position of the pinion and/or crown wheel must be adjusted accordingly until the correct tooth contact is achieved. Failure to correct a tooth contact error will result in excessive axle noise.

If the tooth contact area differs around the crown wheel this may be due to excessive crown wheel run out. Check the run out using a dial gauge with the probe at right angles to the back edge of the crown wheel. Run out should not exceed 0,075 mm (0.003 in.).

NOTE: A SATISFACTORY AXLE REBUILD HAS BEEN ACHIEVED ONLY WHEN THE TOOTH CONTACT PATTERN, BEARING PRELOADS AND BACKLASH FIGURES ARE TO SPECIFICATION.

REAR AXLE

OVERHAUL

1. Remove the rear hub caps and partly release the wheel nuts. Chock the front wheels and fully release the handbrake. Disconnect the rear damper lower mountings and push up each rear damper as far as possible. Raise the rear of the vehicle and fit stands under the chassis. Remove the rear wheels.

2. Mark the prop shaft and pinion drive flange for correct re-alignment, then disconnect the prop shaft by removing the four retaining nuts and bolts. Discard the self locking nuts (to be replaced with new nuts). Support the propshaft by placing a suitable wooden block between the chassis and propshaft immediately behind the transmission.

3. Remove the filler and drain plugs and drain the oil from the rear axle into a suitable container. Replace the two plugs. Remove the 'P' clip securing the rear handbrake cable to the bracket on the axle housing cover.

4. Disconnect the hand brake front cable from the handbrake lever by removing the split pin and clevis pin.

5. Disconnect the rear brake hydraulic pipe from the front of the rear brake hose. Disconnect the flexible hose from the chassis bracket and plug the pipe and hose ends to prevent dirt ingress and brake fluid loss.

6. Remove the complete axle shaft assemblies from each side of the vehicle (see - Rear Axle Bearing/ Seal Assembly, operations 2 - 9).

7. Disconnect the rear silencer mounting from the chassis. Support the axle assembly and undo and remove the 'U' bolts. Remove the rear spring rear shackles and drop the rear of the springs to give access to the axle assembly. Remove the axle assembly from the vehicle.

8. Remove the brake 3-way connector and brake pipes from the axle casing. Fit plugs to the pipes and store to prevent damage to the components.

9. Remove the axle cover bolts and handbrake support bracket and retain together with any identification tags.

10. Using soft faced mallet, remove cover from housing face.

11. Clean housing joint face and cover joint face with solvent to remove sealant and oil.

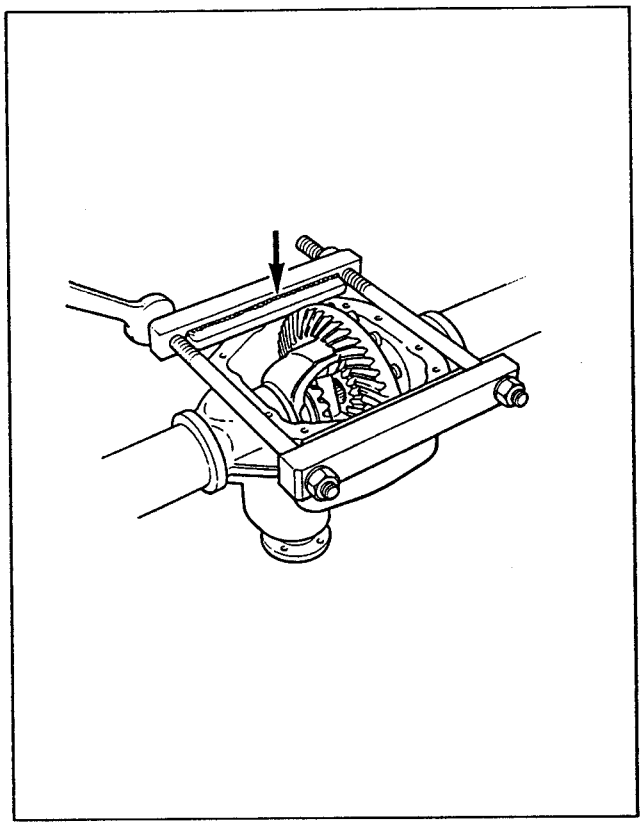


Fig. 11 Axle compression

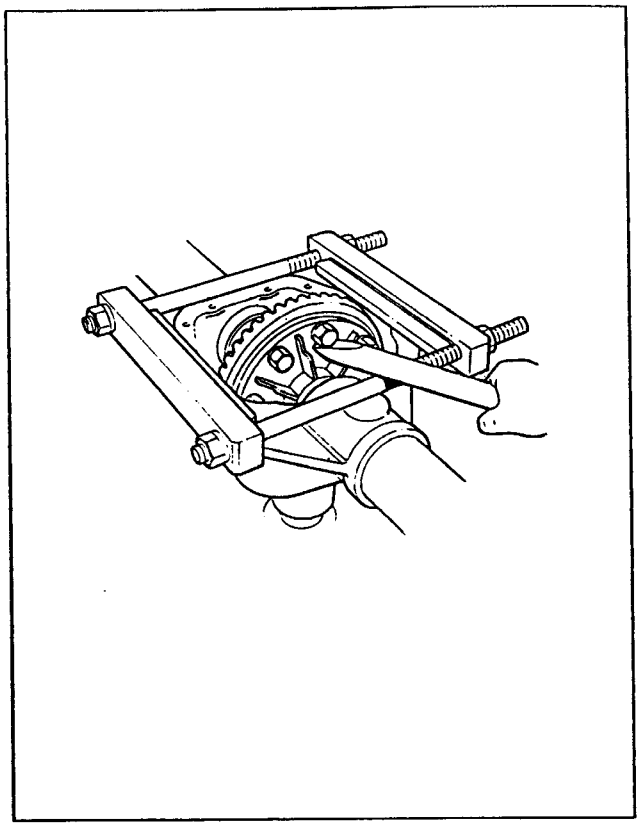


Fig. 12 Removing the differential assembly

NOTE: If it has been diagnosed that only the bearings require replacement, (i.e. the crown wheel and pinion are serviceable, and have satisfactory meshing), it is recommended that a backlash reading and tooth contact marking check is made at this stage before dismantling, and the contact area noted. On rebuild, the crown wheel and pinion can then be refitted to give the same tooth contact and ensure satisfactory running. See Fig. 10 for tooth marking details.

12. Note the bearing caps are stamped with identification marks because the caps must always be refitted in the same location. If the marking is unclear, suitably mark the caps. Remove the bearing caps.

13. To remove the differential case assembly it is necessary to relieve the preload from the differential bearings. A special axle compression tool GKN 131 is used for this operation which must be carried out with great care to avoid permanent damage to the casing. Referring to Fig. 11, position the tool GKN 131 on the axle casing so that the welded area on the tool is uppermost, and the through bolts are at right angles to the axle tubes. Tighten the through bolt nuts finger tight, keeping the frame of the tool square. Then tighten each through bolt nut **ONE** flat at a time up to a **MAXIMUM** of **THREE** flats.

CAUTION: If the nuts are over tightened, the axle casing will be over compressed and will have to be replaced.

14. Insert a suitable lever (Fig. 12) under a crown wheel bolt and, taking care not to bruise the gear teeth or axle casing, carefully lever the differential case assembly out of the axle casing. Unbolt the axle compression tool.

NOTE: If the bearings are to be refitted, ensure the bearing cups are retained with their respective cones and identify each bearing assembly so that it can be replaced in the same relative position on the differential casing on refitting.

15. Bolt the flange holding tool 18G 1205 to the pinion flange and remove the pinion shaft self locking nut and plain washer.

16. Pull off the pinion flange (Fig. 13) using the special tool 18G 2. Never attempt to drift the flange off the pinion shaft.

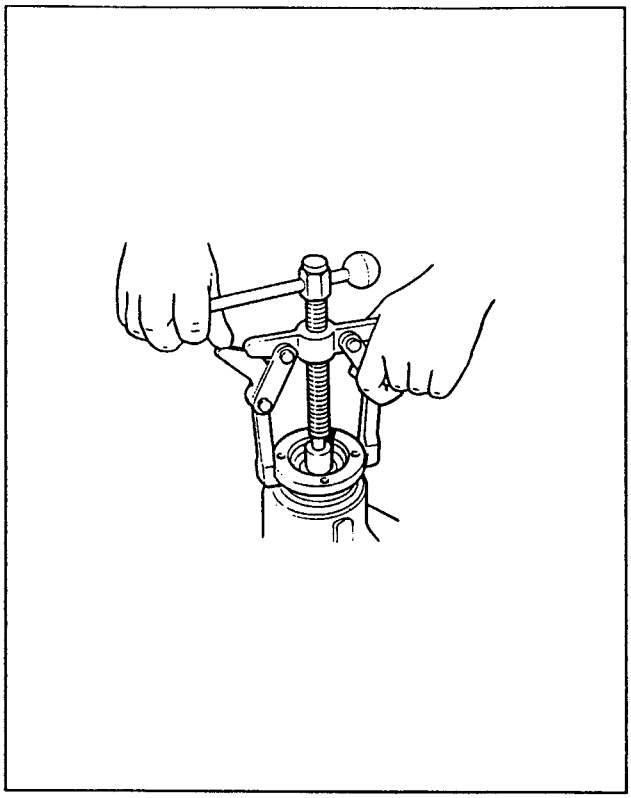


Fig. 13 Removing the pinion flange

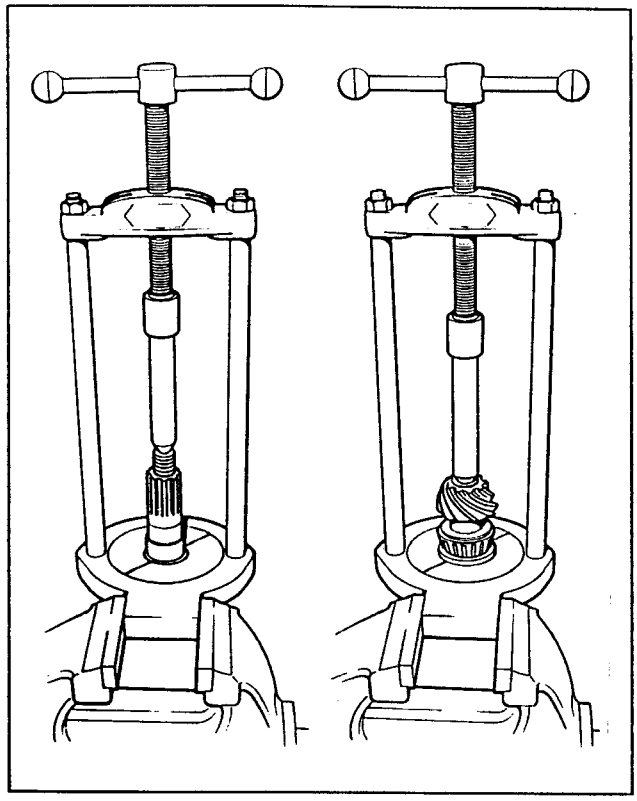


Fig. 14 Removing/replacing the pinion head bearing

17. Use a soft faced mallet to drive the pinion out of the axle casing: do not allow the pinion to drop, as this could damage its ground end face or its teeth. Discard the collapsible spacer.

18. Prise out and discard the pinion oil seal, lift out the pinion tail bearing cone.

19. Position a suitable soft metal drift in the cut-outs in the pinion housing, and drive out the pinion tail bearing cup. Invert the axle and drive out the pinion head bearing cup together with the pinion height setting shims located under the bearing cup.

20. Remove the pinion head bearing cone (Fig. 14) using the screw press MS 47 and adaptors FX 4279 ensuring the collars on the puller adaptors are correctly located over the bearing cone.

21. Remove the differential case bearing cones (Fig. 15) using the screw press MS 47 and adaptors FX 4212 ensuring the collars on the puller adaptors are correctly located over the bearing cones. Retain the bearing cones with their respective cups if they are to be re-used.

22. Noting the position in which they were fitted, remove and retain the differential casing adjustment shims located behind each bearing cone.

23. Remove and discard the crown wheel bolts, and release the crown wheel from the differential casing.

24. Note the markings on the adjacent halves of the differential casing. Mark the two halves of the casing if the markings are unclear, and remove the casing securing bolts. Split the halves of the casing and take out the cross shaft, gears and thrust washers.

25. Clean all components and degrease the bearings. Take particular care to ensure bearing and shim locations in the axle casing and differential casing are free from burrs, damage and foreign matter. Carefully examine the bearing cups and cones for wear, damage and blueing. Examine all gear teeth for wear, chips and blueing and the crown wheel and pinion for uneven tooth contact.

NOTE: Careful examination is necessary to ensure the correct shimming of components on reassembly and which is essential to achieve quiet operation and durability.

26. If examination of the crown wheel and pinion reveals an uneven tooth contact problem, this may be due to distortion of the differential carrier crown wheel flange. If distortion is suspected it may be checked by refitting the carrier bearing cones to the

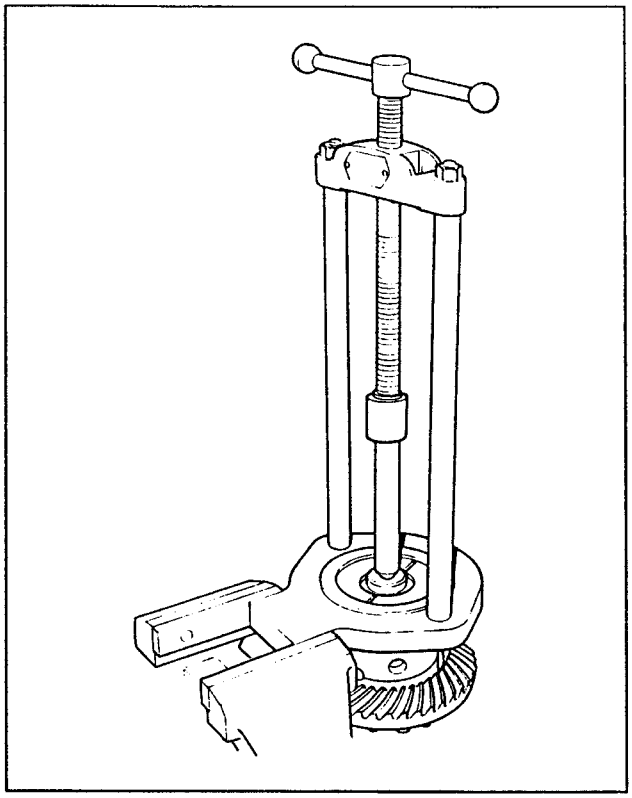


Fig. 15 Removing the differential bearing cones

differential casing, with the original shim packs, tapping them into position with the special tool handle MS 550 and the adaptor FX 4235.

NOTE: Care must be taken to support the differential case so that the bearing cone fitted first is not damaged when the second cone is fitted.

Refit the differential carrier into the axle casing (see operations 54 and 55). Mount a dial gauge onto the axle casing with the gauge probe at right angles to the crown wheel flange. Slowly turn the differential casing. If the run-out exceeds 0,075mm (0.003 in.) the differential casing must be renewed.

27. Renew damaged and worn components as necessary. New pinion height shims will be required to replace those damaged when removing the pinion head bearing cup. A new collapsible spacer will be necessary.

NOTE: Differential gears and thrust washers should be replaced as a complete set. The crown wheel and pinion must be replaced as a matched pair.

28. Fit the pinion head bearing cup into the axle casing using the handle MS 550 and adaptor FX 4236.

NOTE: The shims are not fitted at this stage.

29. Fit the pinion tail bearing cup using the handle MS 550 and adaptor FX 4213.

30. Referring to Fig. 8, lightly oil the pinion bearing cones to be used to rebuild the axle, then install the dummy pinion (1) of the pinion height gauge FX 4280 in the pinion bearings and axle casing using the tapered locators (2 & 3) of the service tool as illustrated. Lightly tighten the bearing locators while rotating the bearings. Tighten the locknut to retain a light load on the bearings. Under this light loading, all bearing end float has been eliminated and the bearings are in their running position.

31. Referring to Fig. 8, position the differential bearing cups into the axle casing, fitting the bearing caps to ensure the bearings are upright in the axle casing. Install the ground shaft of the service tool (5) using the tapered locators (6) of the tool to centralize it between the differential bearings.

32. Position the base of the dial gauge (7) on the top of the dummy pinion so that it is angled correctly to rest on the ground shaft between the two differential bearings (Fig. 9). When a satifactory position has been achieved, tighten up the gauge on its mounting so that it cannot move relative to the base.

NOTE: The stylus of the dial gauge will be pushed in when taking the reading so in setting up the gauge, due allowance must be made to allow the stylus to move in freely by up to 2.5 mm (0.100 in.)

33. Before taking the measurement, the dial gauge must be 'zeroed' on a surface plate (Fig. 9) using the setting button FX 4214. The 'zeroed' gauge must then be transferred to the axle so that the base of the gauge can be located on the top of the dummy pinion and the stylus can be moved back and forth over the top of the ground shaft to register its maximum height.

34. The dial gauge will move clockwise from its 'zeroed' position and will indicate the amount by which the dummy pinion is set 'low' into the pinion housing. Repeat this procedure at three positions of the dummy pinion noting the reading on each occasion. The average reading obtained is the nominal thickness of the shim pack required to which must be added (or subtracted) the individual machining tolerances of the actual pinion to be fitted.

Two variations affect the dimension of the shim pack required:

a. The best running position of the pinion relative to its matching crown wheel (etched on the pinion head), and
b. The thickness of the pinion head. The variation from the maximum (always a "-" figure) is etched on the shank of the pinion behind the pinion head bearing ground diameter.

35. The head of all new pinions is etched with a number which when "0" indicates no correction is necessary to the thickness of the shim pack. The marking may be prefixed by a "+" or "-". For example a "+ 3" mark indicates that to achieve the best running position 0,075 mm (0.003 in.) must be **subtracted** from the shim pack measurement. Conversely, a "-" mark will indicate that the measurement must be **added** to the shim pack.

Finally, the etched marking showing the variation in pinion thickness (this will always be a "-" figure) must be **added** to the nominal thickness of the shim pack.

NOTE: The pinion markings and dimensional equivalents are as shown below.

Pinion Mark	Inches	Millimetres
1	0.001	0,025
2	0.002	0,050
3	0.003	0,075
4	0.004	0,100
5	0.005	0,125
6	0.006	0,150
7	0.007	0,175
8	0.008	0,200
9	0.009	0,225
10	0.010	0,250
11	0.011	0,275

36. Remove the service tools and bearings. Knock out the pinion head bearing cup and refit it with a shim pack of the dimension calculated sandwiched between the bearing cup and axle casing in the position shown (Fig. 7 item 15) using the handle MS 550 and adaptor FX 4236.
NOTE: Before the bearing cup is tapped fully home, ensure the shim pack is centrally located in the pinion housing. While shims are marked with their thickness, always check the thickness of the total shim pack with a micrometer before fitting.

37. Fit the pinion head bearing cone (Fig. 14) onto the pinion using the screw press MS 47, adapters, and pressure ring FX 4279.

NOTE: Do not press on the ground face of the pinion.

38. Using the correct gear oil, lightly lubricate the pinion bearings, then position the pinion and its head bearing into the axle casing. Fit a new collapsible spacer (flared end to the drive flange end of the pinion) and push on the tail bearing cone.

39. Lightly oil the lips of a new pinion oil seal, clip it onto the special tool FX 4209 so that the lip of the seal will be towards the tail bearing. Taking care to support the pinion, tap the seal squarely into its recess in the axle casing.

40. Carefully examine the seal surface of the drive flange to ensure it is free from scoring or damage (replace the flange if necessary) and then fit the flange with its plain washer and the original nut.

41. Using the flange holding tool 18G 1205, tighten the flange nut to pull on the flange until the collapsible spacer has started to compress (this will require considerable effort).

42. Remove the old nut and fit a new one (remember to fit the flat washer); tighten the nut progressively while rotating the pinion to settle the bearings until the correct torque-to-turn figure given below is achieved. The pinion should be rotated at least 20 times before the final torque-to-turn reading is taken. Note the final torque-turn-reading achieved as this will be required later.

New bearings: 1.35 - 2.48 Nm (12 - 22 lbf. in.)
Old bearings: 0.73 - 1.30 Nm (6.5 - 11.5 lbf. in.)

NOTE: The torque-to-turn figure is the torque to keep the pinion turning, not that required to start it turning. If the torque-to-turn figure specified is exceeded, a new collapsible spacer must be fitted.

43. Lubricate the components of the differential case assembly and fit the side gears to the two halves of the casing using new thrust washers. Assemble the differential gears to the cross shaft then locate them into one half of the casing with new thrust washers. Align the two halves of the differential casing to the original markings and secure with new bolts. Torque the bolts to specification 26-30 Nm, (18-22 lbf. ft.) checking to ensure the differential gears are free to turn correctly.

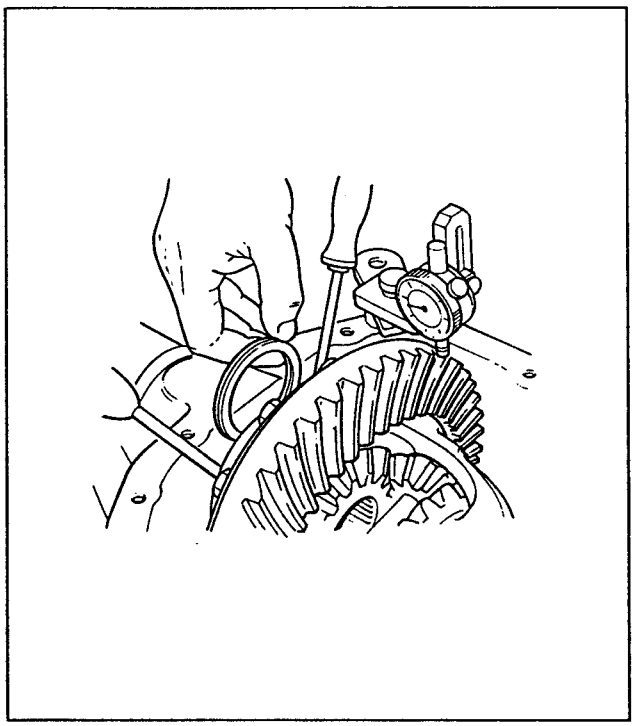


Fig. 16 Positioning the crown wheel

44. Ensure the machined faces of the differential casing and crown wheel are clean and free from burrs or damage. Apply Loctite Studlock 273 to the new crown wheel bolt threads and then fit the crown wheel to the differential case tightening the bolts progressively to specification 104-115 Nm, (78-86 lbf. ft.)

45. Ensure the differential bearings and mating surfaces of the casing are clean and free from burrs or damage, then fit the bearing cones, less shims to the casing with handle MS 550 and adaptor FX 4235.

NOTE: Care must be taken to support the differential case so that the bearing cone fitted first is not damaged when the second cone is fitted.

46. Fit the bearing cups to their respective bearing cones, then locate the differential case assembly into the axle casing.

47. Using suitable levers positioned one each side of the differential casing bearing cup on the toothed side of crown wheel, push the differential casing away from the pinion. Ensure the bearing cups remain vertical in the axle casing.

48. Using suitable levers positioned one each side of the differential casing bearing cup on the back face side of crown wheel, push the differential casing towards the pinion and eliminate all backlash between the crown wheel and pinion. Again ensure the bearing cups remain vertical in the axle casing.

49. Select a shim pack which will eliminate the clearance between the bearing cup on the back face of the crown wheel and the axle casing. Mount a dial gauge so that the probe on the gauge is at right angles to one of the teeth on the crown wheel Fig. 16 and check that all backlash has been eliminated when the selected shim pack is held in position between the bearing cup and axle casing. Subtract shims from the pack to a thickness of 0,125-0,225 mm (0.005-0.009 in.) then place the remaining shims in position.

NOTE: Shims are available in measuring from 0,711 to 1,143 mm in steps of approximately 0,025 mm. The shim sizes are marked on the face of the shim.

50. Using suitable levers positioned one each side of the differential casing bearing cup on the toothed side of crown wheel, push the differential casing away from the pinion. Ensure the bearing cups remain vertical in the axle casing. Check the crown wheel backlash is between 0,125 - 0,225 mm (0.005 - 0.009 in.). If not, adjust the shim pack on the other side of the differential casing accordingly.

51. Make up a second shim pack to fit between the differential casing bearing cup and the axle casing on the toothed side of the crown wheel to eliminate all clearance on that side of the axle casing. The two shim packs must then be adjusted to pre-load the bearings. This is achieved by making up shim packs to increase the overall shim pack thicknesses as follows:

Old bearings 0,25 mm (0.001 in).
New bearings 0,75 mm (0.003 in).

52. Lift out the differential casing assembly from the axle. Ensure the bearing cups remain identifiable with their bearing cones and shim packs.

53. Pull the bearing cones off the differential case (Fig. 15) with screw press MS 47 and adapter FX 4212. Fit one of the shim packs to the side of the differential case for which it was selected and then refit the bearing cone, tapping it into position with the handle MS 550 and adapter FX 4235. Repeat the procedure for the other side bearing cone and shim pack.

NOTE: Care must be taken to support the differential case so that the bearing cone fitted first is not damaged when the second cone is fitted.

54. To refit the differential case assembly and preload the bearings it is necessary to compress the axle casing. Position the axle compression tool GKN 131 on the axle casing so that the welded area on the tool is uppermost, and the through bolts are at right angles to the axle tubes (Fig. 11). Tighten the through bolt nuts finger tight, keeping the frame of the tool square. Then tighten each through bolt nut ONE flat at a time up to a MAXIMUM of THREE flats.

CAUTION: If the nuts are over tightened, the axle casing will be over compressed and will have to be replaced.

55. Lubricate the differential bearings with the correct gear oil, locate the bearing cups on the correct sides of the assembly and then fit the assembly into the axle casing.

NOTE: Do not use the bearing caps to pull the differential assembly into position in the axle casing. If necessary, tap the bearings into position with a soft faced mallet.

56. Fit the bearing caps in their correct locations by ensuring the cap and axle markings correspond. Lightly nip up new bearing cap securing bolts, unbolt and remove the axle compression tool and tighten the cap bolts to specification **51-58 Nm**, (38-43 lbf. ft.)

57. The differential bearing preload must now be checked by first turning the pinion to rotate the crown wheel at least 20 times to settle the bearings. Check the torque-to-turn at the pinion and compare the figure obtained with that recorded previously when checking the pinion bearing preload. The additional torque to turn figures should be as follows:

New bearings: 0.79 - 1.69 Nm (7 - 15 lbf. in.)
Old bearings: 0.40 - 0.85 Nm (3.5 - 7.5 lbf. in.)

If the reading is too low, it means the differential bearing preload is too low and there is insufficient shimming between the differential casing bearings and axle casing. The shim packs must be increased by an equal amount each side in 0,025 mm. (0.001 in.) increments until the correct torque-to-turn figure is achieved. If the reading is too high, the shim packs must be decreased by an equal amount each side in 0,025 mm (0.001 in.) increments until the correct torque-to-turn figure is achieved.

NOTE: Both shim pack thicknesses must be always be adjusted by equal amounts so that the correct crown wheel to pinion backlash is maintained.

58. Check the crown wheel to pinion backlash with a dial gauge positioned as shown in Fig. 16 at right angles to the crown wheel teeth at three points equidistant around the crown wheel. The correct backlash is 0,125-0,225 mm (0.004-0.0009 in). Backlash variation must not exceed 0,075 mm (0.003 in.) If the backlash is outside this tolerance, adjust the differential bearings shims by reducing the shim pack on one side and increasing the shim pack by the same amount on the other side.

NOTE: The total shim pack thickness must not be changed, otherwise the previously set bearing preload will be altered away from specification.

59. Always finally check the tooth contact area achieved by painting each side of the crown wheel teeth with engineers marking paint. Rotate the pinion both ways and compare the markings on the crown wheel teeth with those shown in Fig. 10. If the correct marking has not been achieved, the position of the pinion and/or crown wheel must be adjusted accordingly until the correct tooth contact is achieved. Failure to correct a tooth contact error will result in excessive axle noise.

60. If the tooth contact area differs around the crown wheel this may be due to excessive crown wheel run out. Check the run out using a dial gauge with the probe at right angles to the back edge of the crown wheel. Run out should not exceed 0.075 mm (0.003 in.).

NOTE: A SATISFACTORY AXLE REBUILD HAS BEEN ACHIEVED ONLY WHEN THE TOOTH CONTACT PATTERN, BEARING PRELOADS AND BACKLASH FIGURES ARE TO SPECIFICATION.

61. Rotate the axle so that the cover may be fitted. Prime the axle with 0.3 litres (0.5 pint) of the specified gear oil to ensure the pinion tail bearing is lubricated.

62. Referring to Fig. 6 apply a continuous bead of Rhodorseal sealer to either the cover or the axle casing (not both), ensuring that sealer does not penetrate into the bolt holes in the axle casing. Fit the cover within 10 minutes of applying the sealer. Refit the handbrake support bracket and any identification tags and tighten the securing bolts to the correct torque 26-30 Nm (18-22 lbf. ft.).

63. Refit the hydraulic brake pipes, 3-way connector and brake hose to the axle assembly.

64. Position the axle assembly under the vehicle. Replace the rear spring rear shackles (torque 45-52 Nm, 35-40 lbf. ft.) Replace the 'U' bolts (torque 66-73 Nm, 50-55 lbf. ft.) Replace the rear silencer mounting.

65. Reconnect the rear brake flexible hose to the chassis bracket and reconnect the hydraulic brake pipe.

66. Refit the propshaft using new self-locking nuts.

67. Replace the rear axle shaft assemblies and refit the rear handbrake cable (see - Rear Axle Bearing/ Seal Assembly, operations 12-15).

68. Reconnect the front handbrake cable to the handbrake lever, securing the clevis pin with a new split pin.

69. Reconnect the brake pipes to the wheel cylinders.

70. Bleed the rear brakes. If plugs have not been fitted during the removal procedure it may be necessary to bleed the entire braking system to achieve a satisfactory 'pedal' (see-Brakes). Operate the brake pedal to align the rear brake shoes. Check the operation of the handbrake and that the brake drums rotate freely.

71. Lower the ramp and reconnect the rear dampers (torque 60-73 Nm, 45-55 lbf. ft.). Torque the wheel nuts to 200 Nm, 150 lb ft). Replace the hub caps.

72. Fill the axle with oil to specification and replace filler plug.

73. Lower the ramp and road test the vehicle and check for oil leaks.

LTI SERVICE

Fairway

WORKSHOP MANUAL

SECTION 7

BRAKE SYSTEM

Master Cylinder

The brake fluid reservoir mounted on the Master Cylinder is divided internally, each half having a single outlet to a fluid chamber and piston in the master cylinder.

When the footbrake is applied the primary piston moves up the master cylinder bore and creates pressure in the fluid to operate the wheel cylinders connected to the rear outlet. The piston also continues up the bore to apply pressure to the secondary piston which operates the other two wheel cylinders.

Should failure occur in one circuit, brake pedal travel will increase and the remaining circuit will operate.

Remove

1. Disconnect the electrical warning light connector from the reservoir filler cap.

2. Place a small container beneath the master cylinder and disconnect the two brake pipes.

3. Remove the two retaining nuts and washers and withdraw the master cylinder from off the end of the brake vacuum servo unit.

Refit

4. Reverse the procedure in operations 1 to 3.

5. Fill the master cylinder reservoir with a recommended brake fluid.

6. Bleed the braking system and top up the cylinder reservoir with brake fluid.

Master Cylinder Overhaul

Dismantle

1. Remove the master cylinder, see 'MASTER CYLINDER - Remove'.

2. Drain any fluid remaining in the reservoir, plug the pipe connections and thoroughly clean the exterior of the unit.

3. Hold the cylinder horizontally in a soft-jawed vice with the reservoir uppermost, drift out the two hollow retaining pins and remove the reservoir uppermost, drift out the two hollow retaining pins and remove the reservoir from the cylinder; remove the sealing washers from the recesses in the cylinder body, see figure 15B.2.

4. Push the piston in and extract the nylon circlip.

5. Withdraw the primary piston and spring complete with seals, see figure 15B.2.

6. Use a soft metal rod and press down the secondary piston whilst using a pair of pliers to extract the piston stop pin from the recess in the cylinder body, see figure 15B.2. The secondary piston and spring assembly can now be extracted with thin nosed pliers or by tapping the cylinder on a soft or wooden surface.

7. Remove the spring, retainer and seals from each piston keeping the primary and secondary components separate. While both springs may look alike, the secondary piston spring is stronger and has a thicker coil.

Inspect

8. Clean the master cylinder components and check that the inlet and outlet ports are free of obstruction.

9. Check the bore of the master cylinder and renew the assembly if the bore is scored or ridged.

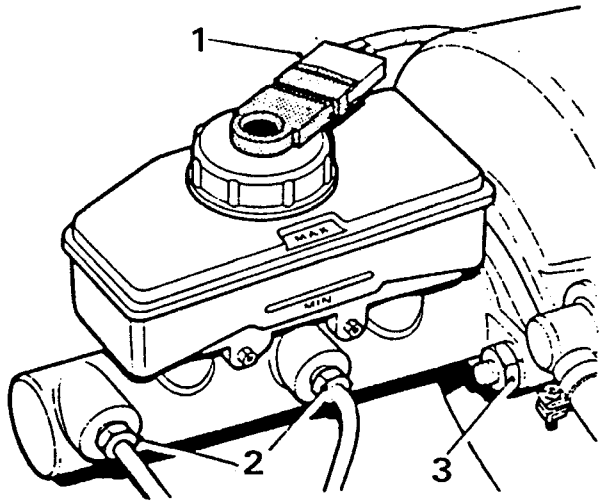


Figure 15B.1
Removing the master cylinder.

1. Electrical connector.
2. Brake pipes.
3. Securing nuts - master cylinder.

Reassemble

10. Lubricate the cylinder bore, pistons and new seals with clean brake fluid and fit the seals onto the pistons using fingers only, ensure that the seals are fitted as shown in figure 15B.2. Refit the springs to the pistons.

11. Refit the secondary piston assembly into the cylinder bore, taking care not to turn back the lip of the piston seal, push the assembly down the bore using a soft metal rod, and insert the stop pin, see figure 15B.2.

12. Refit the primary piston assembly into the bore, taking care not to turn back the lips of the piston seals, push the assembly down the bore and secure with the nylon retaining circlip.

13. Position the two reservoir seals into the cylinder body recesses, refit the reservoir and secure with the two hollow retaining pins.

14. Refit the master cylinder.

15. Bleed the braking system.

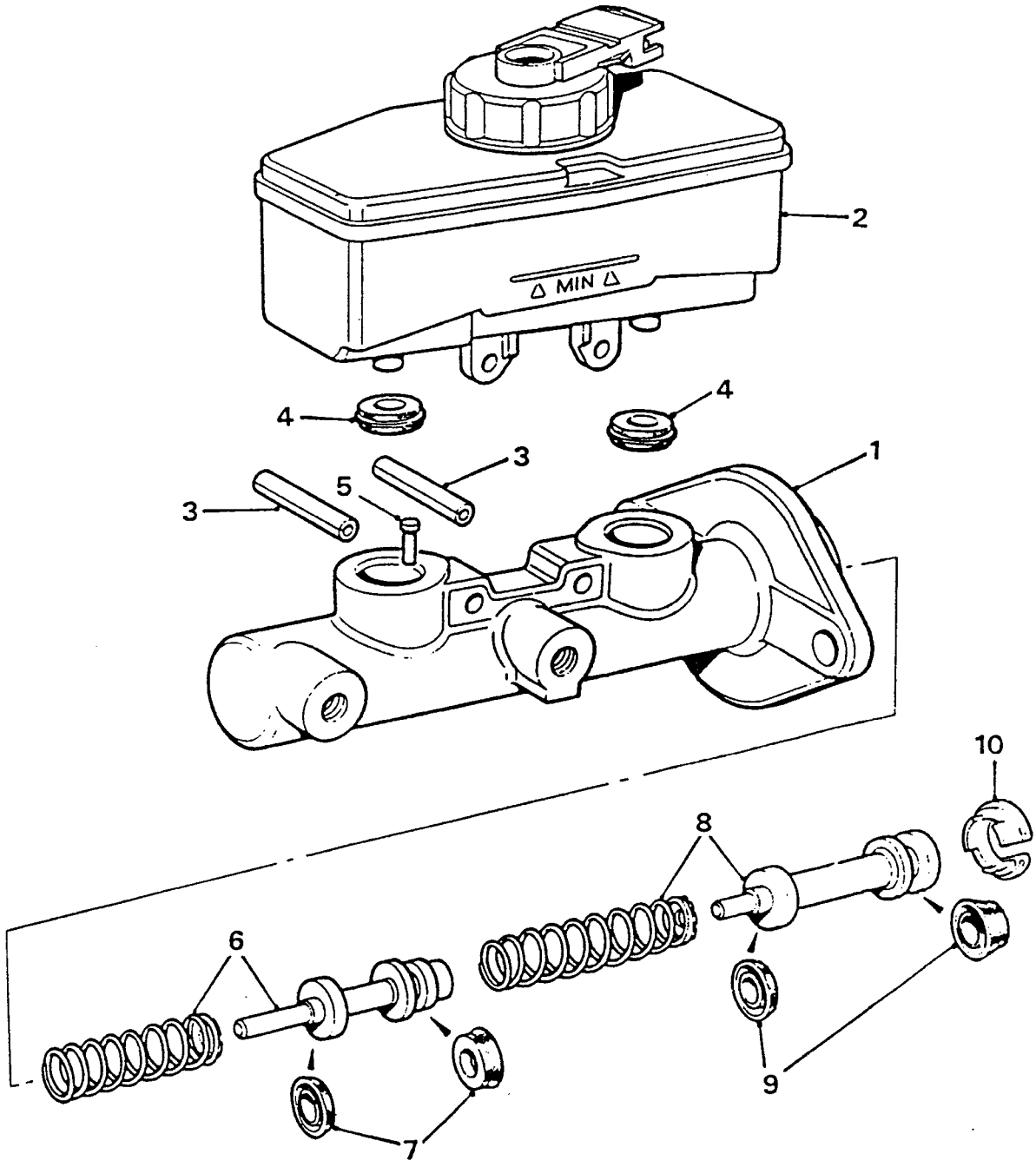
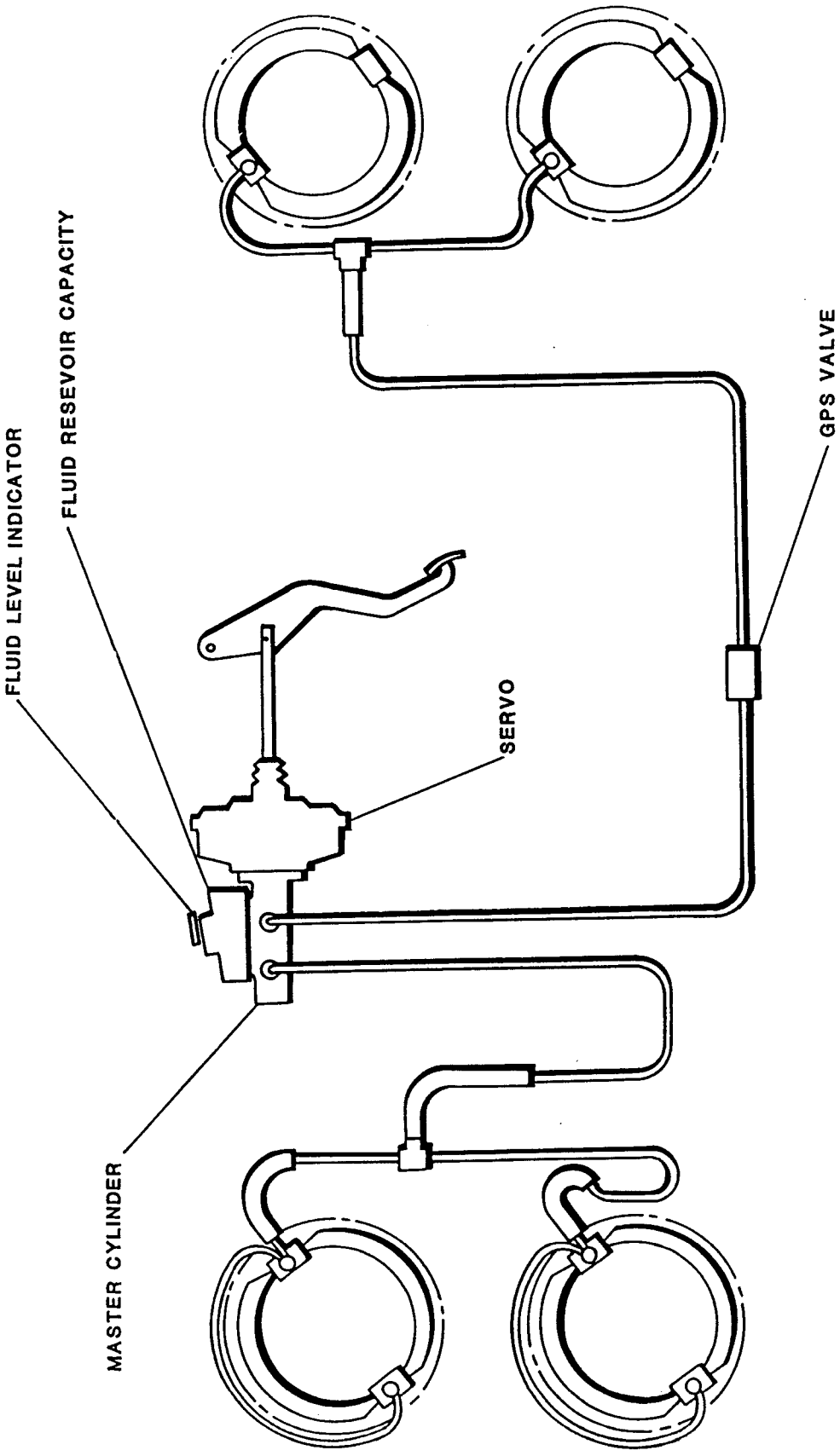


Figure 15B.2

Master Cylinder components.

1. Master cylinder body
2. Reservoir
3. Hollow pins - retaining reservoir
4. Sealing washers
5. Secondary piston stop pin
6. Secondary piston, spring and cup washer
7. Secondary piston seals
8. Primary piston, spring and cup washer
9. Primary piston seals
10. Circlip (Nylon)


FLUID LEVEL INDICATOR
FLUID RESEVOIR CAPACITY
SERVO
GPS VALVE
MASTER CYLINDER

Bleeding the System (Expelling Air)

When any part of the system has been disconnected, or the level of fluid in the supply reservoir has fallen so low that air has been drawn into the master cylinder, the air must be removed from all pipelines and cylinders.

When seals are worn air also can enter the wheel cylinders and cause the pedal to feel spongy. This may be the first indication of air bubbles in the system although fluid is not leaking.

Observe scrupulous cleanliness during the bleeding operation. Do not use a fluffy cloth when wiping components and ensure that dirt and grit are not allowed to enter the system or the supply tank.

Prepare

1. Slacken off (turn anti-clockwise) the adjusters on the front drum brakes until they are against their stops.

2. Turn the rear wheel brake adjuster clockwise until the wheel is locked. This will reduce space in the rear wheel cylinders and economise in time and fluid.

3. Top up the fluid reservoir from a can of unused brake fluid to the correct specification.

WARNING: Do not use a fluid which has been bled from a system to top up the reservoir as it may be aerated, have too much moisture content and possibly be contaminated. Use Unipart Universal.

WARNING: Use Unipart Universal Brake Fluid or other brake fluid having a minimum boiling point of 260·C (500·F) and complying with specification FMVSS 116, DOT 3 or SAE J 1703C specification. Do not use any other type of fluid.

CAUTION: Brake fluid will damage paintwork.

Note: The reservoir must continually be topped up with unused fluid during the bleeding operation as it is essential that the fluid level is not allowed to fall to a point where air may be admitted into the hydraulic system via the brake fluid reservoir.

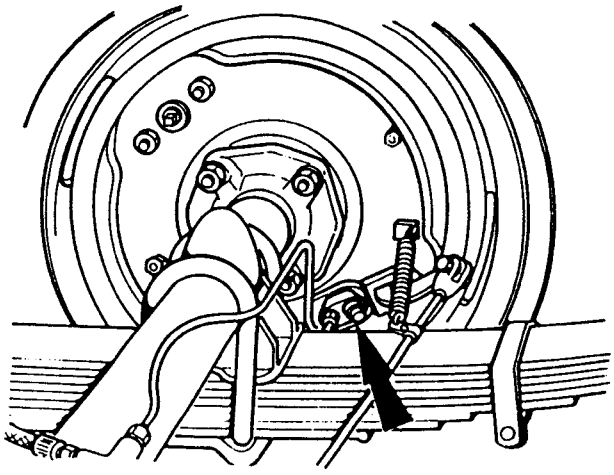


Figure 15A.10

The rear brake bleeder screw.

Bleed - system primed

1. Bleed the rear brakes first.

2. Clean off all dust from around the bleed screw. Attach a flexible tube to the nipple on the screw and immerse the free end of the tube in a clean jar containing a little fluid.

3. Unscrew the bleed screw just enough to allow the fluid to be pumped out (half a turn is normally sufficient). Do not open the bleed screw far enough to allow air to be drawn into the system around the threads.

4. Press the pedal smartly to the extent of its travel, pause and then allow the pedal to return quickly. Pause again before repeating the procedure. Keep the reservoir topped up.

5. As soon as all air has been dispelled and bubbles no longer appear in the collecting jar, tighten the bleed screw immediately after the last downward stroke. Keep the reservoir topped up.

6. Bleed the front brakes.

7. Adjust the brakes on each wheel.

Bleed - system unprimed

To bleed air from a replacement cylinder or a fully drained system:

1. Top up the reservoir.

2. Open all bleed screws and allow gravity to prime system.

3. Close all bleed screws.

4. Bleed as a primed system.

5. Adjust the brakes on each wheel.

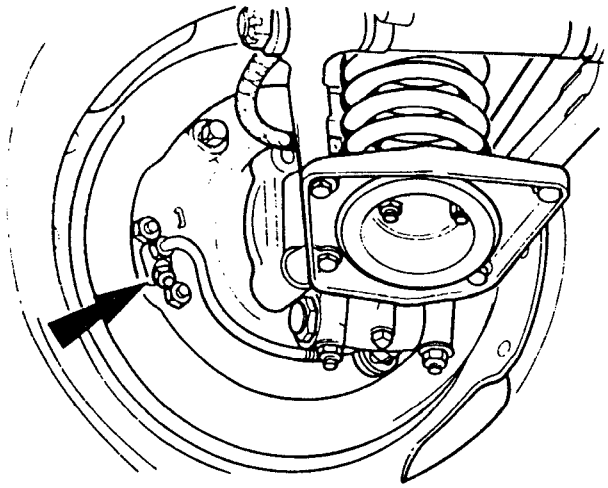


Figure 15A.9

The front brake bleeder screw is indicated by the lower left-hand-side arrow.

Servo Unit

The servo unit obtains power from the vacuum created by the pump assembly on the alternator. If the vacuum fails, the push rods connecting the servo unit between the brake pedal and the master cylinder will operate as a single rod and operate the brakes when the pedal is pressed. Without the aid of the servo unit vacuum, which normally boosts the ratio by 3:1, a much greater effort is required on the brake pedal.

Test

It is assumed faults such as contamination of fluid, lack of adjustment, leaks and air in the system have been eliminated.

1. Raise the front of the vehicle and confirm one of the wheels turns easily. Run the engine until the vacuum has built up in the unit and apply the brakes several times. It should be possible to turn the wheel almost immediately the pedal is released. If the brakes bind, suspect a major fault in the unit.

2. With the engine running apply the brake pedal several times and check the operation of the pedal. If response is slow the vacuum hose may be faulty.

3. Allow a vacuum to build up in the servo unit, stop the engine and try the brake action. Two or more applications should be power assisted as indicated by the effort required on the pedal. If the pedal action is not power assisted the non-return valve may be faulty or there is a leak in the vacuum system.

4. Stop the engine and apply the brake pedal several times until the vacuum has been used. Apply the brake with light pressure on the pedal and start the engine. The pedal will fall away under the foot pressure and less pressure will be required to hold the pedal in the applied position if the servo unit is operating.

5. The need for a hard pedal application and apparent lack of power assistance may be caused by a faulty vacuum hose or non-return valve, or vacuum leakage from the unit.

Remove

1. Disconnect the warning light connector from the brake fluid reservoir filler cap.

2. Place a container beneath the master cylinder and disconnect the two brake pipes.

3. Release the vacuum hose from the non-return valve on the servo unit front cover.

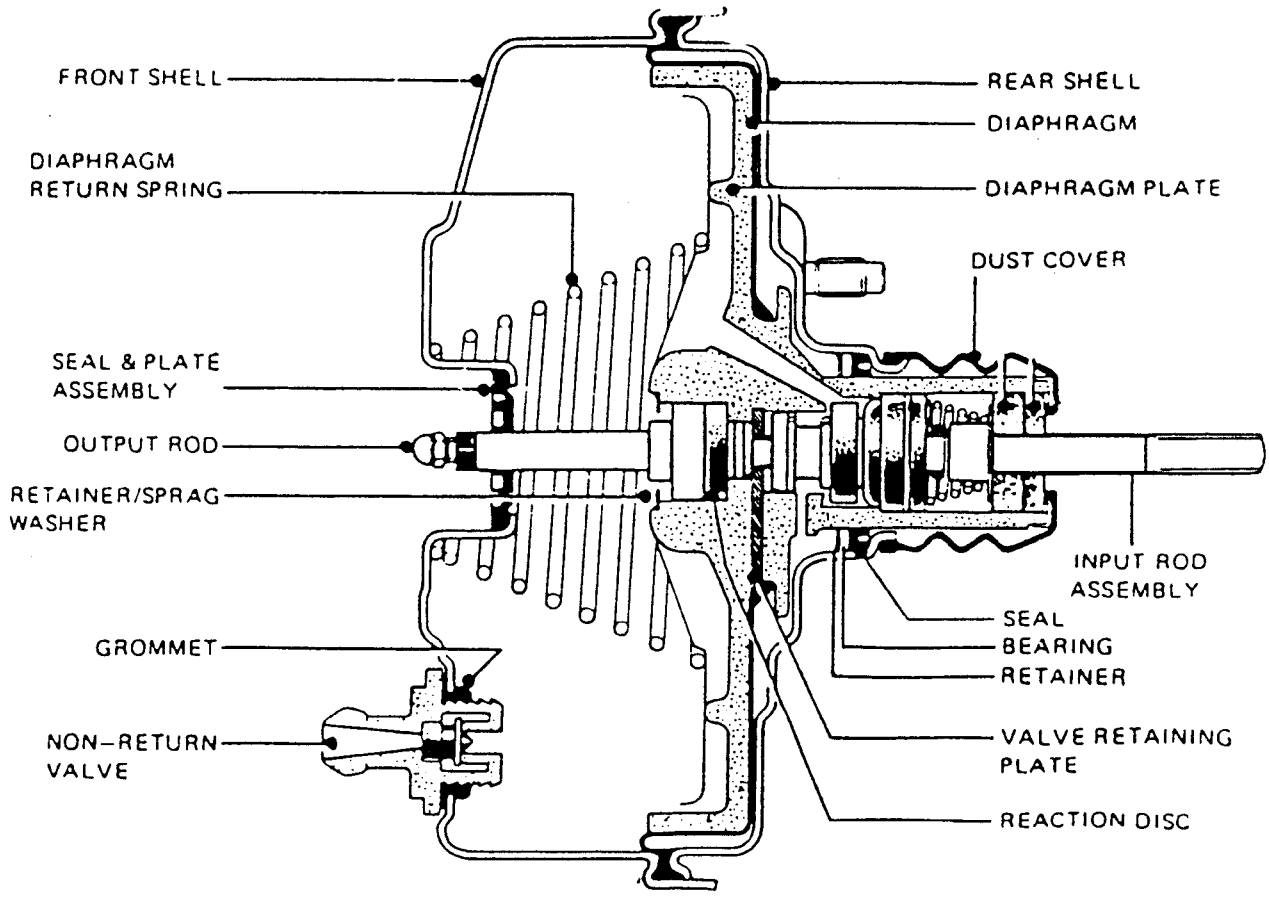
4. Remove the pedal fulcrum box cover.

5. Withdraw the clevis pin securing the servo unit push rod to the brake pedal quadrant.

6. Undo the four nuts with washers and withdraw the servo unit and master cylinder assembly from the vehicle.

Refit

1. Reverse the removal instructions.
2. Bleed the hydraulic system of air.
3. Test the brakes.



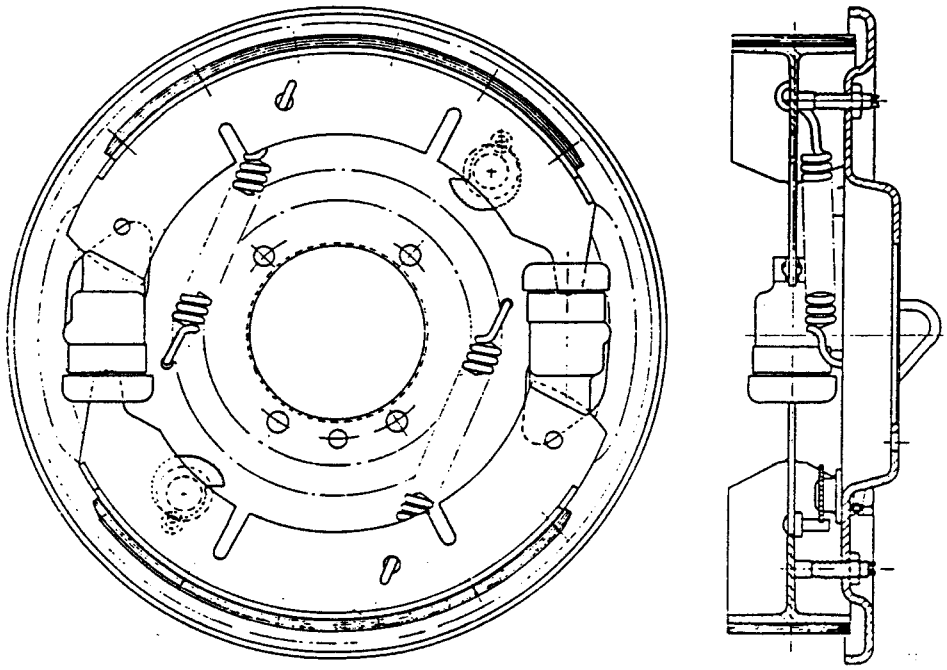
Description

The brakes on all four wheels are hydraulically operated by a foot pedal directly connected to the master cylinder.

Two shoes, one leading and one trailing, are expanded in each rear assembly by a single-acting hydraulic cylinder and piston assembly floating on the backplate.

Two springs are fitted and connected between the shoes. The shoes are not fixed but are able to slide on their abutments and centralize in the drum. At the cylinder end the leading shoe is located in a slot in the piston while the trailing shoe rests in a slot formed in the cylinder body; at the adjuster ends they rest in slots in the adjuster links. The shoes are supported by adjustable steady posts screwed into the backplate. Inclined innerfaces on the adjuster links bear on the inclined faces of the adjuster wedge, which has finely threaded spindle and a squared end projecting through the backplate. Rotating the spindle therefore will expand the shoes or allow them to come together under the influence of the return springs.

The handbrake lever is pivoted in the cylinder body and when operated the lever tip expands the leading shoe independently of the hydraulic piston and the pivot moves the cylinder body to apply the trailing shoe.



The handbrake is mounted on the floor of the car convenient to the driver. It is of the conventional ratchet and pawl type, operating on the rear wheels only by means of rods, a compensator mounted on the rear axle, and transverse rods to the brake-shoe levers.

Two leading shoes in each front assembly are expanded by individual, single-acting hydraulic cylinders connected by tubing and bolted to the backplate. Each shoe pivots and slides on one of the cylinders with its opposite end in contact with the piston of the cylinder diametrically opposite. Two pull-off springs are fitted, each connected from one show to the backplate.

An adjuster controls the movement of each shoe without interfering with its normal braking function.

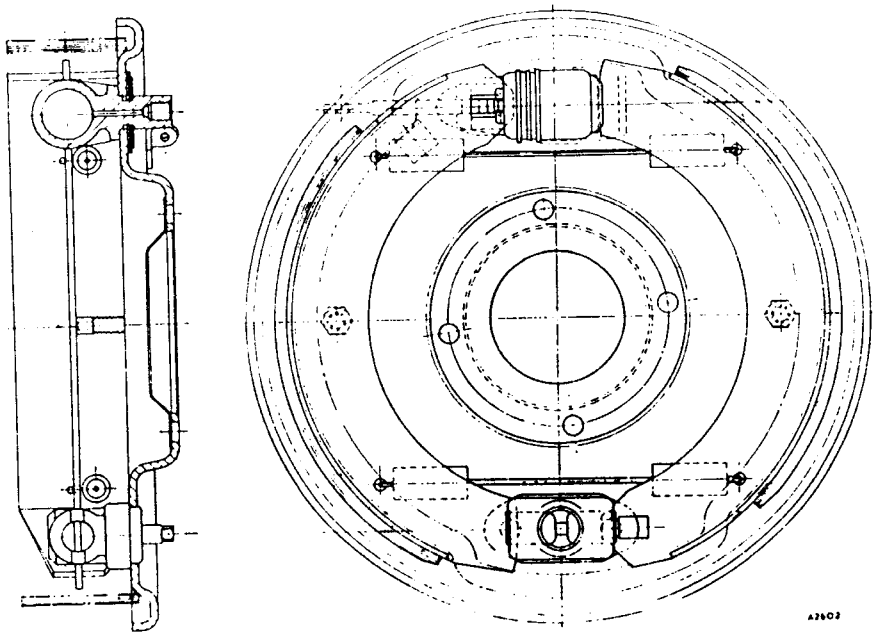
IMPORTANT: Always exercise extreme cleanliness when dealing with any part of the hydraulic system.

Do not handle any rubber or internal parts with greasy hands or greasy rags and clean all parts with the recommended brake fluid from clean containers; do not use a container that has been washed with trichlor-ethylene.

Examine all seals, hoses and other parts for damage when overhauling the system and renew any damaged or unserviceable component.

Do not refill the reservoir with dirty fluid when bleeding the system; use new fluid from a sealed container.

Do not allow paraffin, petrol, or trichlor-ethylene to contact any part of the system.



Adjusting The Brake-Shoes

Front

The front brake-shoes are adjusted independently by the wo square-headed bolts indicated.

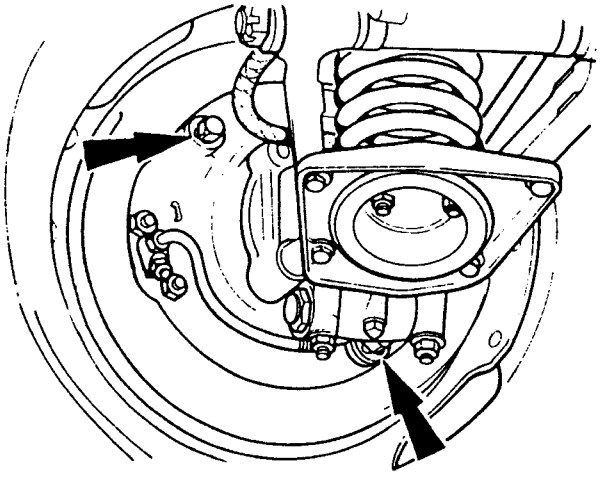


Figure 15A.3

Jack up the wheel or wheels requiring adjustment. Turn one of the square-headed adjuster bolts in a clockwise direction until the drum is locked against rotation and then slacken off just enough to free the drum (two 'clicks'). Repeat the adjustment with the other shoe.

Rear

Jack up the wheel or wheels to be adjusted.

Apply a few drops of oil to the adjuster stem to prevent seizure of the threads.

Rotate the squared adjuster screw in a clockwise direction until the drum is locked and then slacken off enough to free the drum (two 'clicks').

Adjustment of the shoes in the manner indicated also automatically adjusts the handbrake and no seperate adjustment is required.

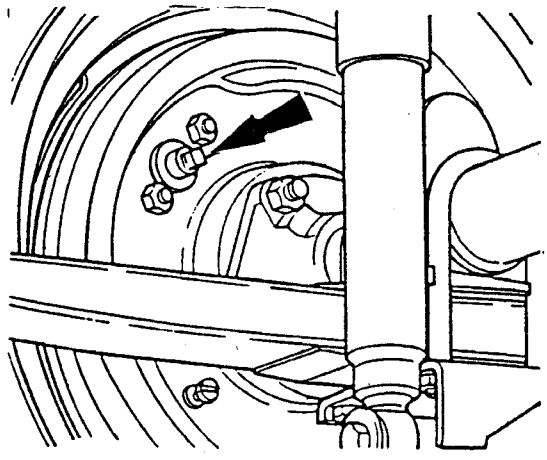


Figure 15A.4

The rear brake-shoes are adjusted by the squared end of the wedge-type adjuster indicated.

Removing and Replacing the Brake-Shoes

Front

Jack up and remove the wheel and brake-drum.

Lift the trailing end of a shoe from the abutment on the wheel cylinder and the leading end from the piston of the opposite cylinder; detach the spring and shoe. Repeat with the other shoe. Prevent the pistons from falling out of the cylinders by the use of rubber bands or wire.

Wash all dust from the backplate assembly and drum with Girling cleaning fluid or denatured alcohol; allow to dry.

WARNING: Do not use an air line to blow dust from the brake assemblies. Asbestos dust from brake linings can be a serious health risk if inhaled.

Before refitting the shoes lightly smear the steady posts and both ends of the shoes with Girling White Brake Grease, but take care to keep all grease from the rubber parts and pistons and from the linings.

Fit the shoes. The shorter hook of each spring must be connected to a brake shoe. Fit the brake drum and adjust as detailed on page 15A.3.

If replacement brake-shoes are fitted or if there is any sign of uneven wear across the surface of the linings it will be necessary to adjust the steady posts.

Slacken the locknut at the rear of the backplate and unscrew the post about three or four turns.

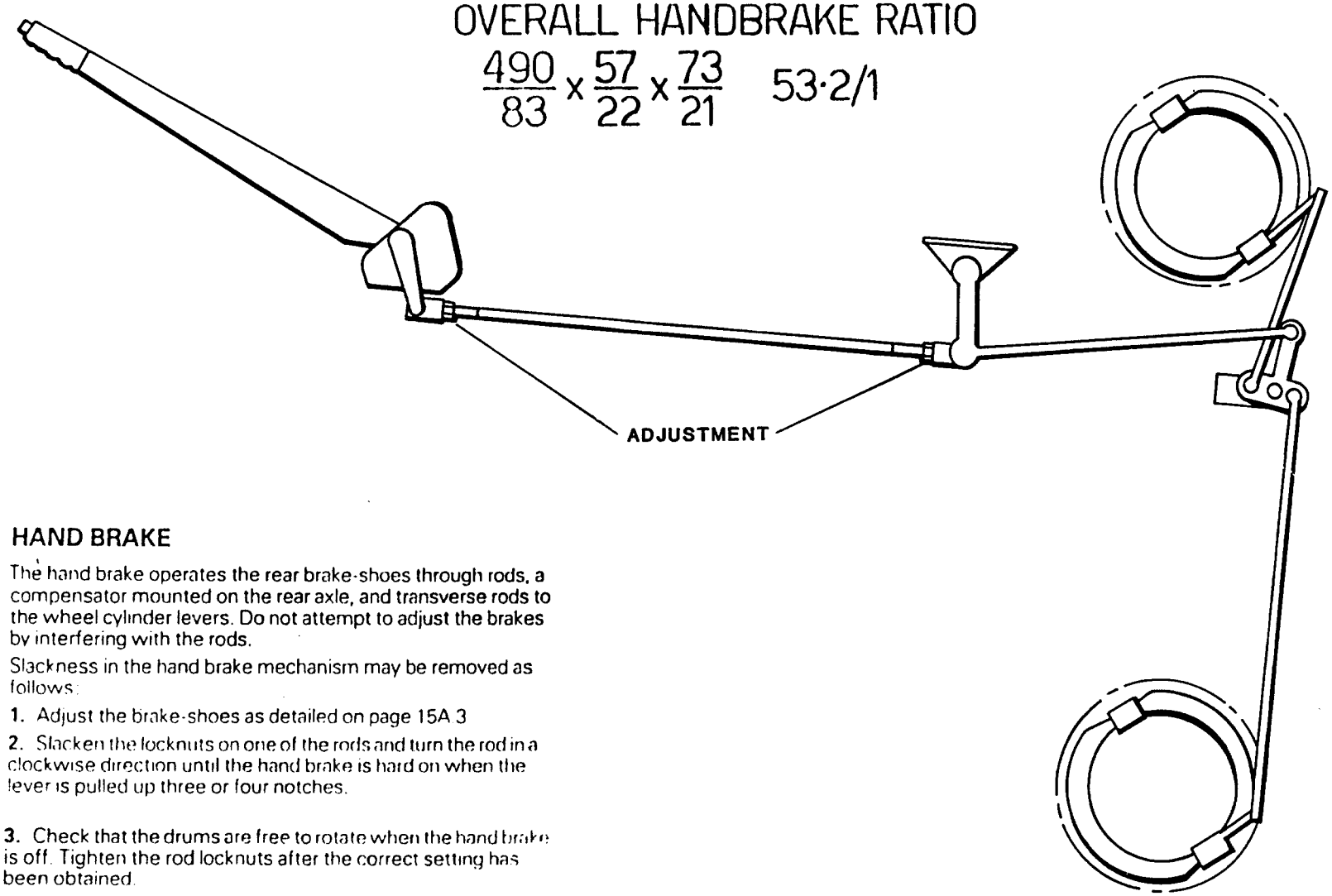
Apply the brakes hard and then rotate the post in a clockwise direction until it contacts the shoe webb; hold the post and tighten the locknut.

Renew front brake-shoe and lining assemblies as a complete set.

Rear

Jack up and remove the wheel and brake-drum; it may be necessary to slacken off all the adjustment in order to fit replacement shoes. Note that the lining of the leading shoe is fitted towards the trailing end and that of the trailing shoe towards the leading end. Both springs are connected between the shoes. Apply the handbrake partially to detach the rear shoe.

The instructions for fitting the rear brake-shoes follow in general those for the front.



HAND BRAKE

The hand brake operates the rear brake-shoes through rods, a compensator mounted on the rear axle, and transverse rods to the wheel cylinder levers. Do not attempt to adjust the brakes by interfering with the rods.

Slackness in the hand brake mechanism may be removed as follows:

1. Adjust the brake-shoes as detailed on page 15A 3
2. Slacken the locknuts on one of the rods and turn the rod in a clockwise direction until the hand brake is hard on when the lever is pulled up three or four notches.

3. Check that the drums are free to rotate when the hand brake is off. Tighten the rod locknuts after the correct setting has been obtained.

G.P.Valve

The single G.P. (inertia pressure) valve attached to the chassis frame on the right-hand side controls the hydraulic pressure applied to the rear brakes. The valve helps to prevent the rear brakes locking the road wheels and causing a skid.

The valve is mounted at an angle and above a pre-determined level of braking, a ball within the valve rolls up the angled ramp to close a valve and operate a differential piston to reduce the hydraulic pressure to the rear wheel cylinders.

Whithout specialist equipment it is not possible to test a valve and components are not serviceable. If there is cause to suspect the valve is faulty a new one must be fitted as a unit.

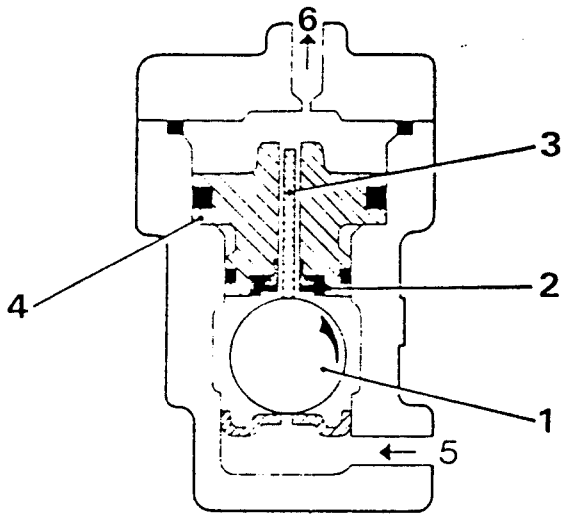


Figure 15B.4

A section through the G.P. valve showing the valve and differential piston in the normal position.

Brake Stop Lamp Switch

Remove

1. Raise and prop open the bonnet.

2. Remove the screws and lift off the pedal box top cover plate, see figure 9.

3. Disconnect the elctrical connections from the switch.

4. Slacken the locknut and unscrew the switch, see figure 9.

Refit

5. Screw the locknut onto the switch, screw the switch into the retaining bracket and adjust as follows:

Adjustment: Connect the switch wiring, switch on the ignition and adjust the position of the switch so that the brake stoplights operate on the first 15mm (0.50 in) of brake pedal movement.

6. Reverse the operations 1 and 2.

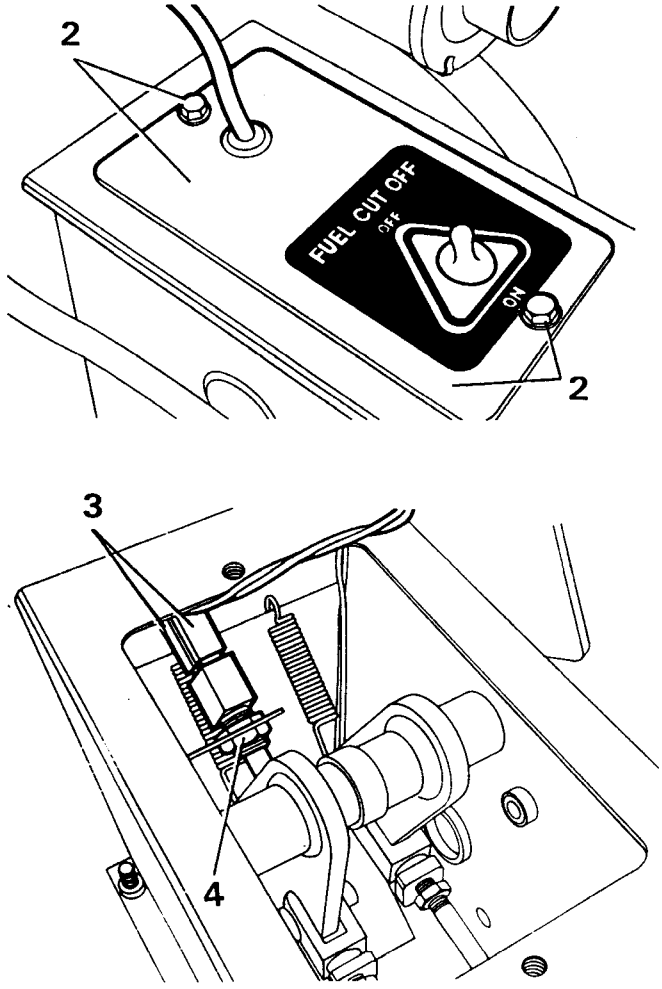
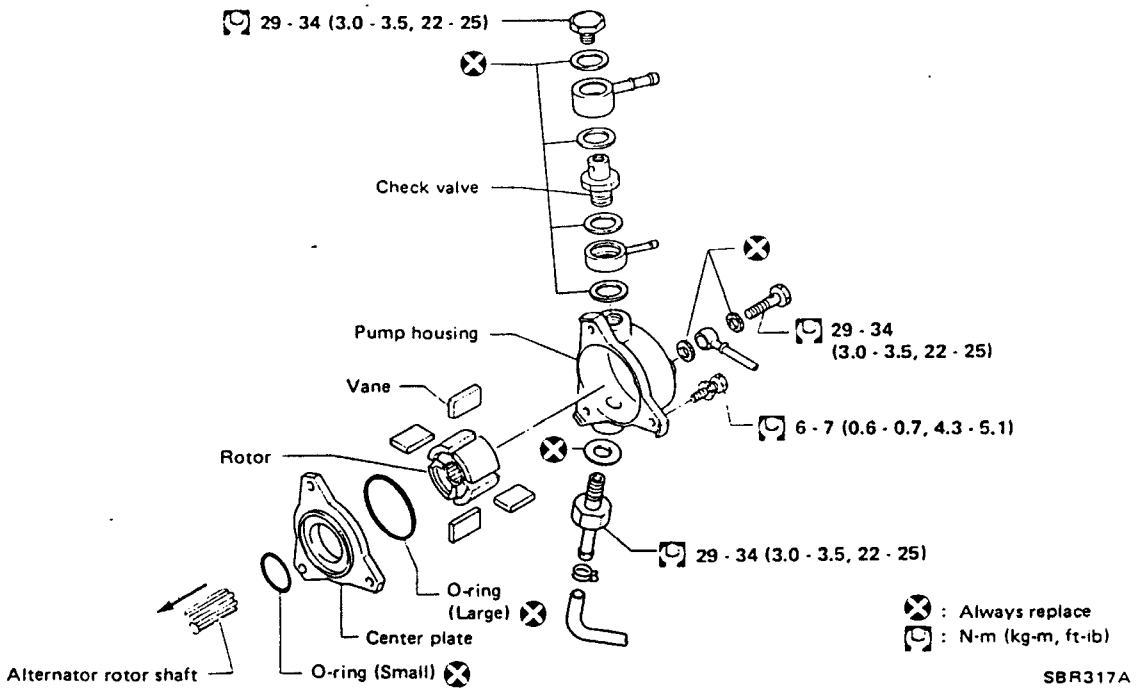


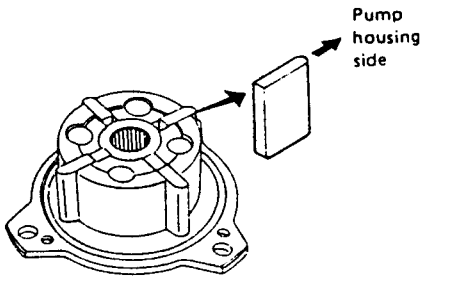
Figure 9

Removal and Installation



- Drain oil from vacuum pump before removal.

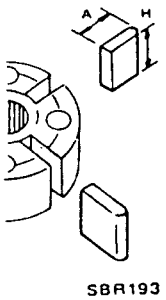
Manually rotate fan belt clockwise to discharge any oil which may have accumulated in vacuum pump.



- When inserting vane, take care that the vane does not get on the vane guide of the centre plate.
- Install vane so that its round surface faces the pump housing.
- After installing vacuum pump assembly on alternator, apply 5ml (0.2 Imp fl oz) of engine oil into vacuum pump assembly and make sure that the pulley of the alternator can be smoothly rotated by hand.

Unit: mm (in)

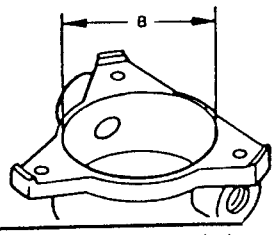
Type	M/T	A/T
Vane length "A"	12.5 - 13.5 (0.492 - 0.531)	14.0 - 15.0 (0.551 - 0.591)
Vane width "H"	25 (0.98)	39 (1.54)



Inspection

Clean all parts and check them as follows:

- Check for wear or scratches on mating surfaces of rotor and vacuum pump housing and of rotor and centre plate. If wear or scratches are noted, replace those parts.
- Check for wear or scratches on vanes. if necessary, repace.

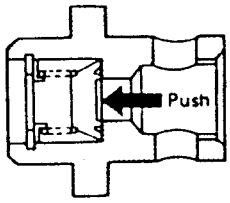


Type	Inner diameter "B" mm (in)
M/T	57.0 - 57.1 (2.244 - 2.248)
A/T	60.0 - 60.1 (2.362 - 2.366)

SBR912

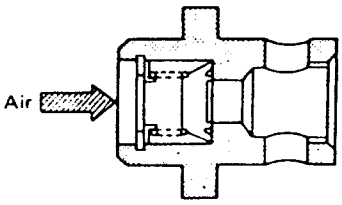
Inspection (Cont'd)

- Check inner wall of vacuum pump housing for wear. If necessary, replace.
- Check rotor shaft for wear. If necessary, replace.
- Check valve locations and copper washers for bending or deformity. If necessary, replace.



Checking valve operation

- Check valve operation. Check if the valve operates smoothly when slightly pushed by a screwdriver or other instrument. Replace if necessary.



Checking air leakage of valve

Check for air leakage with 98 to 490 kPa (1.0 to 4.9 bar, 1 ro 5 kg/cm^2, 14 to 71 psi) of air pressure.
Replace if necessary.

Changing Output Seal and Plate Assembly

NOTE: DO NOT OPERATE BRAKE PEDAL DURING STAGES 1 TO 7

1. Unscrew the master cylinder retaining nuts and remove together with the spring washers. Carefully ease the master cylinder from the servo mounting studs without disturbing the hydraulic connections or kinking the pipework.

2. Ease the master cylinder to one side to give access to the output rod seal recess in the servo.

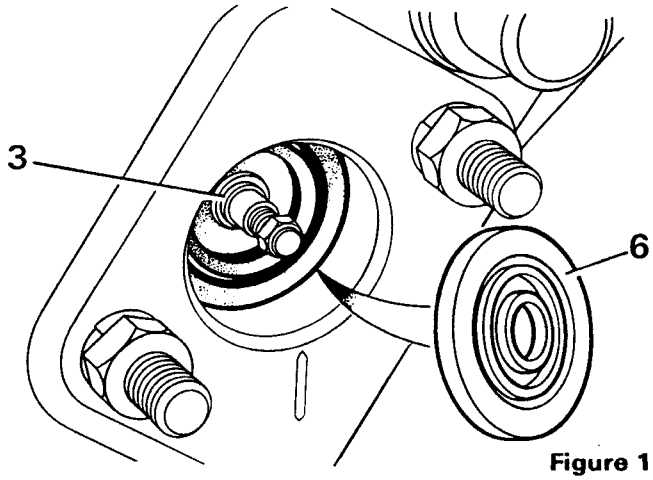


Figure 1

3. Remove the seal and plate assembly from the front shell recess, by gripping the centre rib of the assembly with a pair of long nosed pliers, and dispose of it, see Figure 1.

IMPORTANT: DO NOT ATTEMPT TO REMOVE THE OUTPUT ROD. DO NOT IMPOSE ANY SIDE LOADING ON THE ROD AS THIS MAY DISPLACE THE SPRAG RING. DO NOT USE ANY CLEANING SOLVENT.

4. Wipe clean the output rod and recess wall. Lubricate them only with the grease provided, ensuring that the output rod is lubricated along its full length.

5. Take the new seal and plate assembly, apply only the grease provided liberally all over, ensuring that there is a blob on both sides around the centre hole.

6. With the plate side leading, fit the seal and plate assembly over the output rod and into the recess, ensuring that it seats squarely in the bottom of the recess.
Ensure that there is a reservoir of grease present in the area where the output rod passes through the rubber.

7. Ease the master cylinder back into position on the servo and torque up the nuts on the mounting studs (21 to 26.5 Nm or 15.5 to 19.5 lbf.ft.).

8. Check correct functioning of the servo as follows:
(a) With light pressure applied to the brake pedal, start engine. If the unit is working the pedal will fall away slightly under foot pressure.
(b) Allow vacuum to build up in unit, stop engine and press the brake pedal. Two or more applications should be power assisted as indicated by the effort required on the pedal. If the pedal action is not power assisted, the non return valve may be faulty or there is a leak in the vacuum system or the servo itself is faulty.

Removing and Replacing a Wheel Cylinder

Front

Jack up and remove the wheel, drum and shoes.

Disconnect the bridge pipe unions from the cylinder.

Unscrew the two securing nuts and remove the cylinder(s).

When refitting, tighten the wheel cylinder nuts to a torque wrench reading of .69 to 1.03kgm (5 to 7.5 lbft).

After refitting bleed the brakes.

Rear

Jack up the wheel and remove the wheel, drum and shoes.

Disconnect the pipe from the union, the rod at the hand brake lever, and remove the rubber boot from the rear of the backplate.

With a screwdriver prise the retainer and spring plates apart and tap the retaining plate from below the neck of the wheel cylinder.

Withdraw the handbrake lever from between the backplate and wheel cylinder.

Remove the spring plate and distance pieces and finally the cylinder from the backplate.

To refit, smear the backplate and cylinder with Girling White Brake Grease and mount the cylinder onto the backplate with the neck through the large slot. Replace the distance piece between the cylinder neck and the backplate with the open end away from the handbrake location; the two cranked lips must also be away from the backplate.

Replace the handbrake lever. Locate the retaining plate between the distance piece and the spring plate (open end towards the handbrake lever) and tap into position until the two cranked lips of the spring plate locate in the retaining plate.

Fit the rubber cover. Connect the pipe to the union and the rod to the handbrake lever. Replace the shoes, drum and wheel.

Bleed and adjust the brakes.

Dismantling and Assembling a Wheel Cylinder

Front

Remove the cylinder.

Remove the rubber dust cover; the piston seal, spreader and spring can be extracted by air pressure.

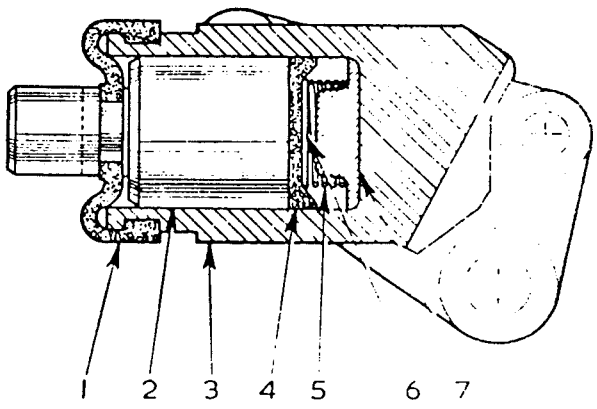


Figure 15A.7

A front wheel cylinder.

1. Dust cover
2. Piston
3. Body
4. Seal
5. Spring
6. Seal Support
7. Spring Support

Rear

Remove the cylinder.

Remove the spring clip and rubber dust cover.

Blow out the piston and seal.

Replacement in both front and rear cylinders is a reversal of the dismantling procedure.

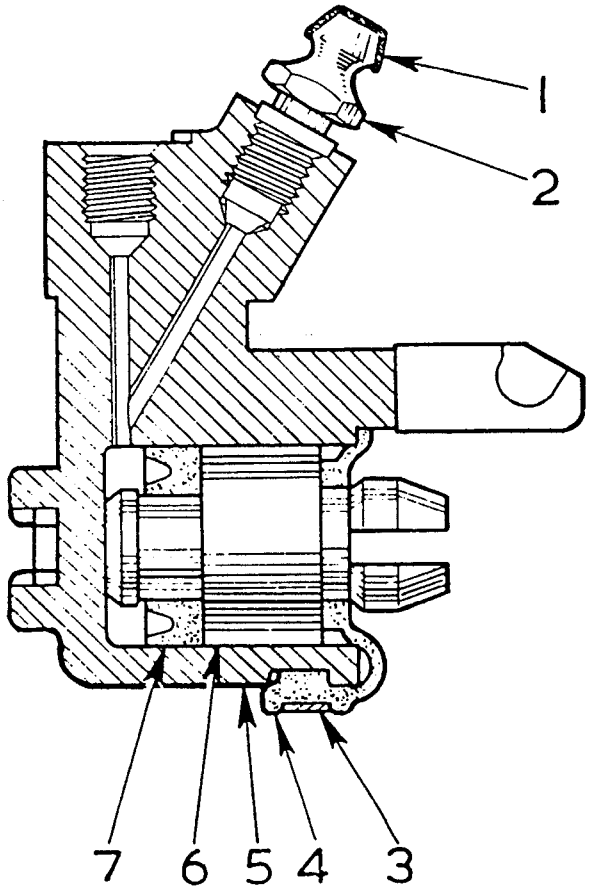


Figure 15A.8

A rear wheel cylinder

1. Cover for bleeder screw
2. Bleeder screw
3. Retainer for dust cover
4. Dust cover for piston
5. Body
6. Piston
7. Seal

Removing a Flexible Hose

Do not attempt to release a flexible hose by turning either end with a spanner; it should be removed as follows:

Unscrew the metal pipe line union nut from its connection to the hose.

Hold the hexagon on the flexible hose and remove the locknut securing the flexible hose union to the bracket.

Unscrew the flexible hose from the cylinder end.

LTI SERVICE

Fairway DRIVER

WORKSHOP MANUAL

SECTION 7a

BRAKES

BRAKES

CONTENTS

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

While every effort is made to ensure the accuracy of the particulars contained herein, London Taxis International Ltd will not under any circumstances be held liable for any inaccuracies or the consequences thereof.

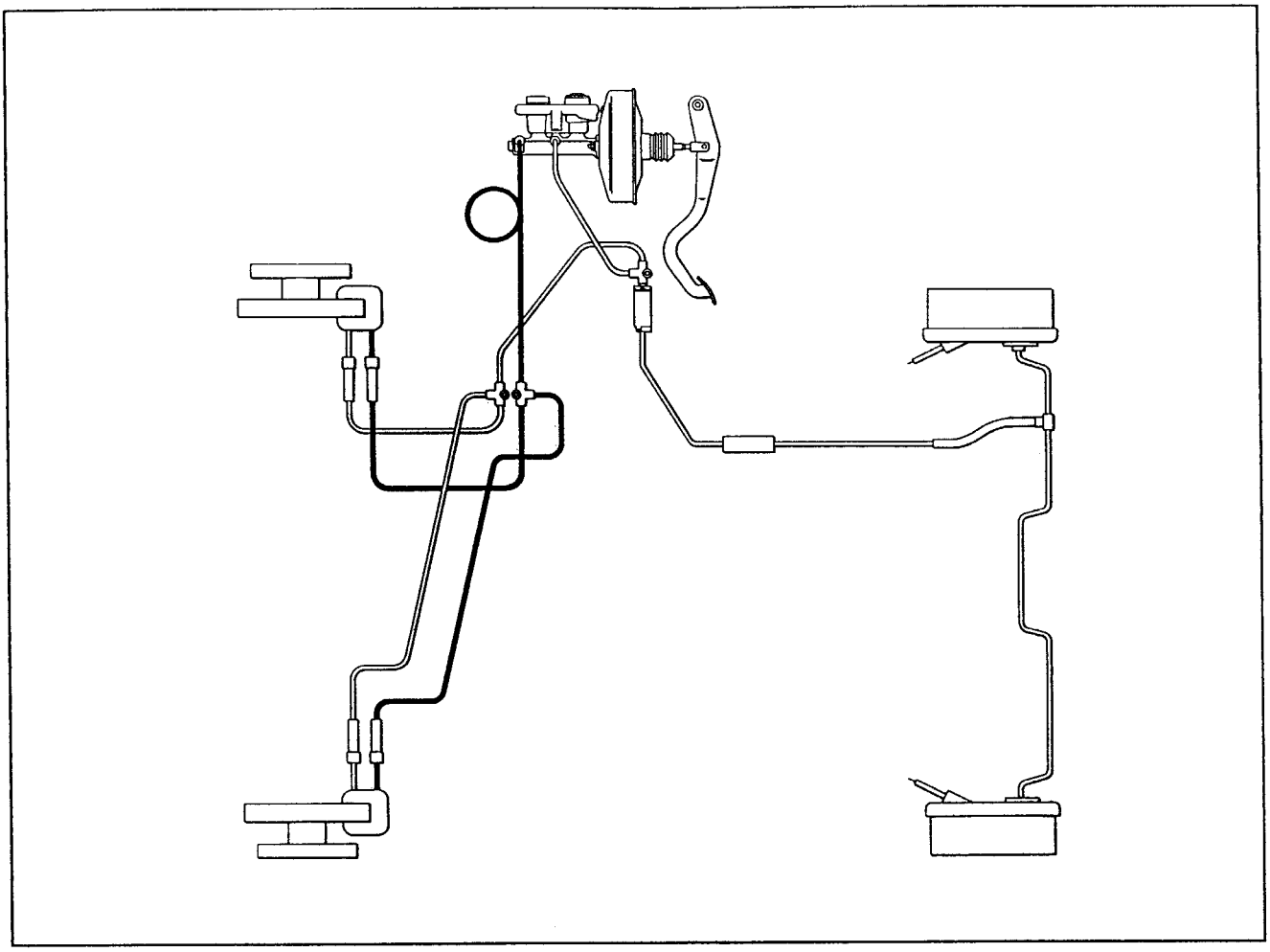


Fig 1. Braking system - hydraulic layout

General description

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

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

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

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

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

BRAKES

KEY DATA

BRAKE FLUID	FMVSS 116 DOT 4
FRONT BRAKE DISCS:	
RUN OUT	0,1 mm (0.004 in.)
MAXIMUM WEAR PER SIDE	1.0 mm (0.040 in.)
MINIMUM THICKNESS	22,0 mm (0.875 in.)
REAR DRUM BRAKES:	
RUN OUT	0.1 mm (0.004 in.)
MAXIMUM WEAR	2.0 mm (0.080 in.)
MAX DRUM OVALITY	0.05 mm (0.002 in.)

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

Service requirements:

1,000 miles (1,500 km) or each month	Check fluid level in master cylinder reservoir.
6,000 miles (10,000 km) or every 3 months	Check front brake pads for wear. Remove rear brake drums, clean out brake dust and check rear linings for wear. Check brake pipes, hoses and connectors for leaks and chafing.
12,000 miles (20,000 km) or every 6 months	Remove front brake pads, check condition and for signs of cracking between the friction material and backplates and replace as necessary. Check calipers for signs of leakage. Clean out rear brake drums, check brake linings for wear and replace if necessary. Examine brake mechanism condition and cylinders for fluid leakage.

Service requirements : (continued)

48,000 miles (80,000 km) or every 2 years	Replace brake system fluid and bleed brakes.
60,000 miles (100,000 km) or every 3 years	Examine the master cylinder, caliper and wheel cylinders for wear and replace all fluid seals and flexible hoses. Refill and bleed the system using new fluid.

Special tools:

'E' clip fitting tool	Automotive Products STL 107
Caliper piston clamp	Churchill MS 331
Rear Brake Steady Post Retainer compressor	Snap on S 6118 (adapter), TM9CSA (handle)

GENERAL PRECAUTIONS

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

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

2. Over a period, brake fluid absorbs moisture and becomes contaminated with minute particles from the seals in the hydraulic system. The fluid should be changed completely every 48,000 miles (80,000Km) or 2 years whichever is the sooner.

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

4. All fluid seals in the hydraulic system and all hoses should be replaced every 60,000 miles (100,000 Km) or 3 years whichever is the sooner. At the same time, the working surfaces of the pistons and bores in the master cylinder, calipers and wheel cylinders should be examined and new parts fitted where necessary.

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

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

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

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

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

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

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

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

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

TROUBLE DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	ACTION NECESSARY
Fall of fluid level in master cylinder reservoir.	1. Normal friction pad or brake wear.	Top up the fluid reservoir to the correct level, then check daily for the next few days. If the level again falls significantly carry out the procedure for 'hydraulic fluid leak'.
	2. Hydraulic fluid leak.	Visually check the hydraulic connections for leaks, including the master cylinder, PRV, calipers and wheel cylinders, peeling back rubber boots where necessary. Tighten any loose connections found, but if the leak persists the suspect component must be repaired or replaced.
Excessive travel of footbrake pedal or the handbrake lever.	1. Failure of one hydraulic circuit in the braking system.	Carry out procedure for 'hydraulic fluid leak' to isolate fault. If no leak is apparent, dismantle the master cylinder, and if the bore and pistons are in perfect condition, service the assembly with the appropriate repair kit, otherwise replace the complete master cylinder.
	2. Excessive run-out of brake disc caused by worn or out of adjustment wheel bearings.	Renew or adjust the wheel bearings as specified in the workshop manual. Disc run out can sometimes be improved by fitting the brake disc to the hub in an alternative position. Disc run out should not exceed a dimension of 0,1mm (0.004 in.).
	3. Handbrake cable out of adjustment or inoperative rear brake adjuster mechanism	Adjust the handbrake rear cable as detailed in the workshop manual. If the fault persists, remove the rear brake drums and check that the automatic rear adjusters are functioning correctly. Rectify as necessary.
Spongy brake pedal.	1. Fluid level drop in master cylinder reservoir allowing air into the hydraulic system.	Thoroughly bleed the system, refill reservoir to the correct level and carry out the procedure for 'hydraulic fluid leak'.
	2. Faulty brake hose.	Check all hoses for leakage or ballooning under pressure. Replace any defective hoses as necessary.

SYMPTOM	POSSIBLE CAUSE	ACTION NECESSARY
Brake drag - all brakes	1. Mechanical binding or obstruction of foot pedal.	Check that the footbrake pedal returns to the 'off' position and is not obstructed for any reason.
	2. Hydraulic pressure build up in the master cylinder.	Slacken the tube nuts at the master cylinder, if this releases the brakes there may be contaminated brake fluid in the system causing rubber components to swell blocking the by-pass ports and trapping hydraulic pressure. Refer to the 'action necessary' below.
	3. Rubber cups or seals swollen due to brake fluid contamination by petrol, parrafin or mineral oil., etc.	Contamination may sometimes be confirmed by the characteristic smell in the fluid reservoir. Although the degree of swelling is relative to the severity of contamination, when withdrawn from the cylinder usually the swollen rubber seals may be easily recognized as oversize. All rubber parts such as cups, seals, and flexible hoses must be changed. Thoroughly flush the system with new brake fluid before fitting the new parts.
Brake Drag - one brake.	1. Disc pads seized or sticking in a caliper recess.	Remove the split pins, retaining pins and springs, withdraw the pads and clean the caliper recess with a damp rag. Do not blow out with an air line as it could be harmful to inhale the dust. Clean all dirt from the pads and inspect the condition of the anti-sqeal material on the back of the pads. Ensure the specified pads have ben fitted. Refit the pads, retaining pins, springs and split pins and check that the disc spins freely.
	2. Seized piston in disc brake caliper or wheel cylinder.	Remove the disc pads or brake drum as applicable, then carefully depress the foot pedal to check the movement of the pistons in the suspect assembly. If a piston is seized the complete caliper or wheel cylinder must be replaced.
	3. Obstruction in a flexible hose.	Isolate the fault, disconnect the brake hose to confirm the complaint then renew the defective brake hose.

SYMPTOM	POSSIBLE CAUSE	ACTION NECESSARY
Brake Drag - one brake.	4. Incorrect adjustment or seizure of the handbrake assembly.	Examine the handbrake cable, clevis pins and yokes etc., also the handbrake mechanism at the brake backplate, if necessary removing the brake drum to confirm correct operation of the self-adjusting mechanism. Adjust the rear handbrake as necessary.
	5. Weak or broken brake shoe pull off springs.	Remove the brake drum and carefully examine the assembly. If a weak spring is suspected replace all the pull off springs.
Unbalanced braking with pull or judder	1. Loose caliper mounting bolts, loose backplate, steering and suspension components, tyre pressures or condition.	Check the security of the brake assemblies and for wear on the steering and suspension parts. Ensure the tyres are at the recommended pressures and are in good condition and of the correct type.
	2. Disc brake pads or shoe linings contaminated with oil, grease, or hydraulic fluid.	Examine the brake pads and shoes to confirm complaint then establish the cause of contamination and rectify by replacing any defective parts. A minor degree of friction material contamination may be removed with fine emery cloth, but at the same time moisten with a damp rag as it could be harmful to inhale the dust. Otherwise if contamination is severe the disc pads and brake shoes must be replaced in sets irrespective of their state of wear.
	3. Different grades of pad lining material used in an axle set.	Remove the disc pads or brake shoes and check that the friction material is not of different grades. Otherwise replace the pads or shoes in complete axle sets.
	4. Seized pistons in disc brake caliper or wheel cylinder.	Remove the disc pads or brake drum as applicable, then carefully depress the footbrake pedal to check movement of the pistons in the suspect assembly. If a piston is seized the complete caliper or wheel cylinder must be replaced.

SYMPTOM	POSSIBLE CAUSE	ACTION REQUIRED
Unbalanced braking with pull or judder (continued).	5. If associated with judder, surface condition and run out of discs, or excessive run out of brake drums.	Ensure that the wheel bearings are not worn or out of adjustment, replace or adjust as necessary. Miner disc friction surface imperfections may be removed with a fine emery cloth, if in doubt replace the disc. Check the disc run out which must not exceed a dimension of 0,1mm (0.004 in.). Check and compare the thickness of the disc at various points around the friction surface. If a thick/thin condition is confirmed replace the disc. Brake discs should not be reground in service. Disc wear must not exceed 0,1mm (0.004 in.). each side and disc thickness must not be less than 22,0mm (0.875 in.). Rear brake drum judder may be detected by gently applying the handbrake at low speed. Drum run out may be checked with a dial gauge by fitting the brake drum to the hub the wrong way round. Run out must not exceed a dimension of 0,1mm (0.004 in.). Drum ovality must not exceed a dimension of 0.025mm (0.001 in.).
Brake inefficient giving increased brake pedal effort.	1. Servo unit inoperative.	With the engine 'off' depress the brake pedal several times to relieve all vacuum from the servo unit, during this operation the air control valve should hiss every time the pedal is pressed. With all vacuum released, apply light pressure to the brake pedal and start the engine, if the servo is working the pedal will appreciably sink down as the servo operates. With the brakes held on there should be no hiss from the air inlet. These tests are not exhaustive, therefore, if the servo unit gives cause for doubt as to its performance it is advisable to replace the unit. A continous hiss from the servo may indicate a worn or faulty servo unit vacuum seal.

SYMPTOM	POSSIBLE CAUSE	ACTION NECESSARY
Brakes inefficient giving increased brake pedal effort (continued).	2. Glazed or worn out pads or liningss.	Glazed surfaces on pads or shoes can be removed by rubbing down with rough sandpaper, but at the same time moisten with a damp rag as it could be harmful to inhale the dust. Otherwise if worn down to the stated limits replace the pads or shoes.
	3. Damaged or rusty friction surface of brake discs.	Examine the brake discs for cracks, scoring, or a rust deposit which after being subject to heat by the pads gives the friction surfaces a black appearance. Minor surface imperfections may be removed with fine emery cloth but such faults may render the disc inefficient, therefore, if any doubt exists renew the disc.
	4. Disc pads or shoes contaminated with oil, grease or hydraulic fluid.	Examine the pads or shoes to confirm complaint then establish the cause of contamination and rectify by replacing any defective parts. A minor degree of friction contamination may be removed with a fine emery cloth, but at the same time moisten with a damp rag as it could be harmful to inhale the dust. Otherwise if contamination is severe the disc brake pads or brake shoes must be replaced in axle sets irrespective of their state of wear.
	5. Seized piston(s) in disc brake caliper or wheel cylinder	Remove the disc pads or brake drum as applicable, then carefully depress the footbrake pedal to check movement of the pistons in the suspect assembly. If a piston is seized the complete caliper or wheel cylinder assembly must be replaced.
Disc brake squeal.	1. High frequency pad vibration.	Withdraw the disc brake pads. Clean all dirt from the pads and inspect the condition of the anti-squeal coating on the back of the pads. Ensure the specified pads have been fitted. Refit the pads and secure with the retaining pins, springs and split pins.

SYMPTOM	POSSIBLE CAUSE	ACTION REQUIRED
Disc brake squeal (continued).	2. Loose caliper mounting bolts.	Confirm this possible cause and rectify by tightening the mounting bolts to 95 - 125 Nm (70 -92 lbf. ft.)
Brake drum squeal.	1. Lack of lubrication and/or excessive dust in brake assembly.	Remove the brake drum, then the shoes and other parts and clean the assembly. Do not blow out with an air line as it could be harmful to inhale the dust, but remove the dust with a vacuum cleaner or wipe clean with a damp rag. Lightly smear with Lockheed Expander lubricant the tips of the brake shoes, the cylinder and abutments slots, also the area of the backplate where the brake shoe platforms make contact. Ensure that the friction surface of the drum is clean, do not allow the grease to contact the shoe linings, rubber parts or the friction surface of the drum.

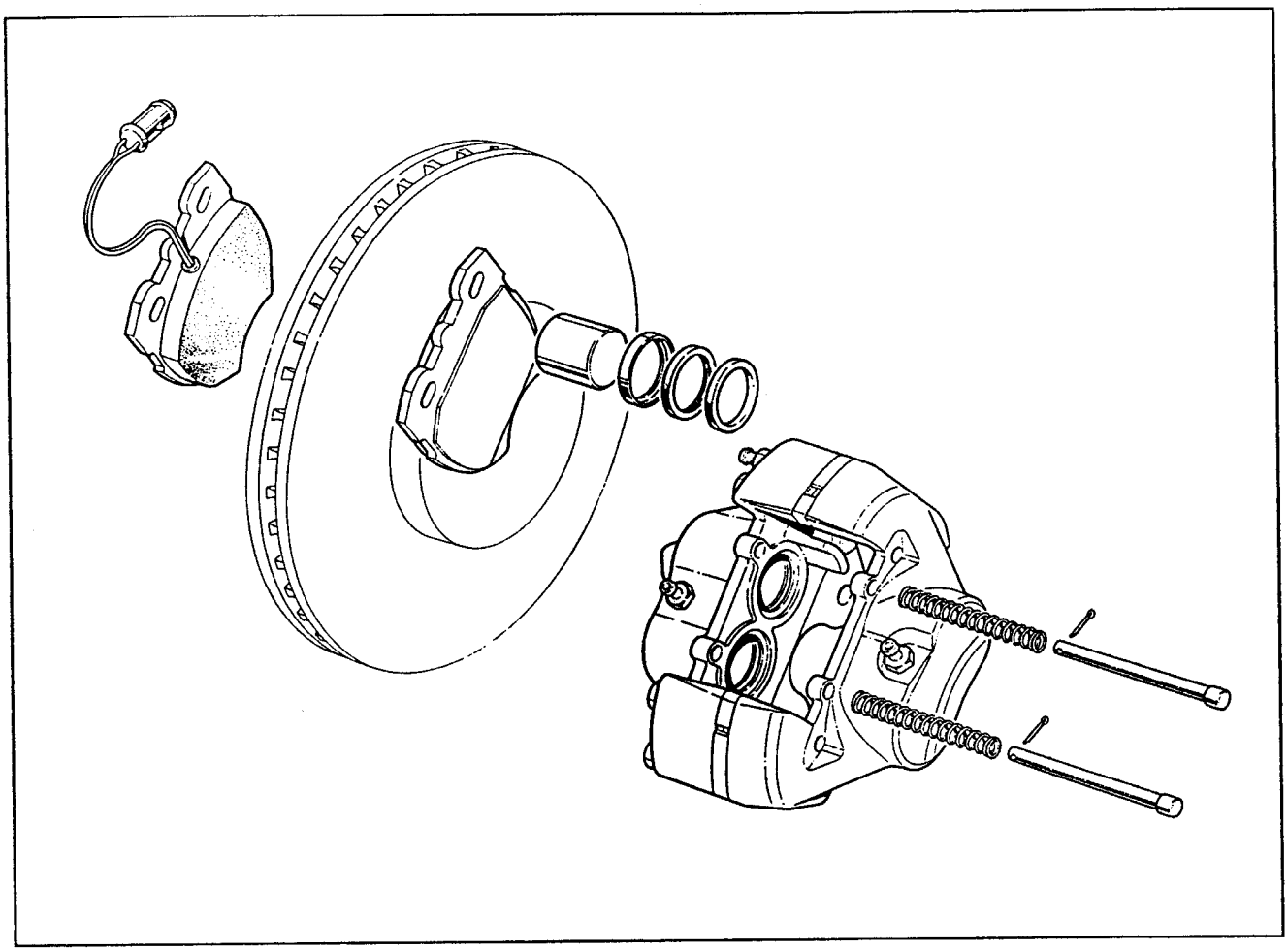


Fig 2. Front disc brake components

FRONT BRAKE PADS

REMOVE/REPLACE/EXAMINE

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

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

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

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

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

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

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

NOTE: When new pads are replacing well worn pads it will be necessary to carefully press the brake

pistons into the caliper housings. During this operation brake fluid will be displaced. To prevent the reservoir overflowing, fit a bleed tube to the relevant brake bleed screw and release the brake fluid into a container. Retighten the bleed screw when the pistons are fully retracted. Discard the removed brake fluid.

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

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

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

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

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

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

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

FRONT BRAKE DISC

REMOVE/REPLACE

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

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

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

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

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

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

NOTE: Brake disc wear must not exceed 1mm (0.040) on either side of the disc, and disc thickness must not be less than 22mm (0.0875 in.) Brake discs may not be reground in service.

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

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

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

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

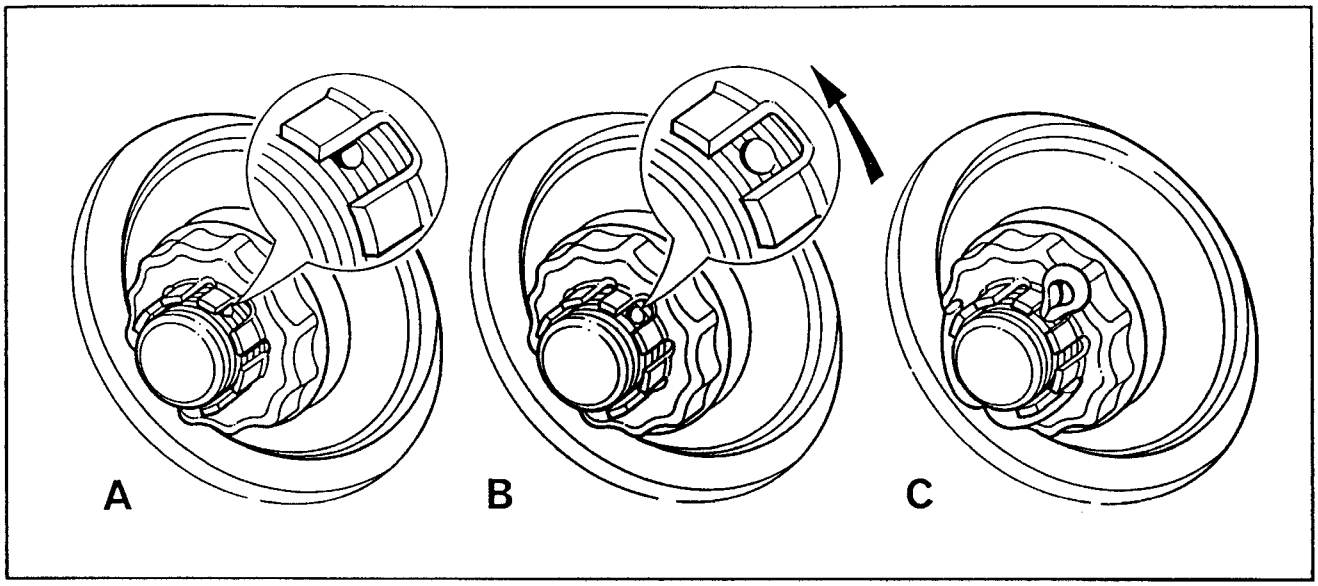


Fig 3. Front hub - adjustment sequence

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

10. Slacken the nut and nut retainer until the split pin hole is fully exposed (see Fig 3. illustration B), to give the correct bearing end float of 0,025 - 0,152 mm (0.001-0.006 in.)

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

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

NOTE: If a new brake disc has been fitted, the brake disc run out must be checked with a dial gauge. Brake disc run out must not exceed 0,1 mm, 0.004 in.

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

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

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

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

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

FRONT BRAKE CALIPERS

REMOVE/REPLACE/OVERHAUL

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

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

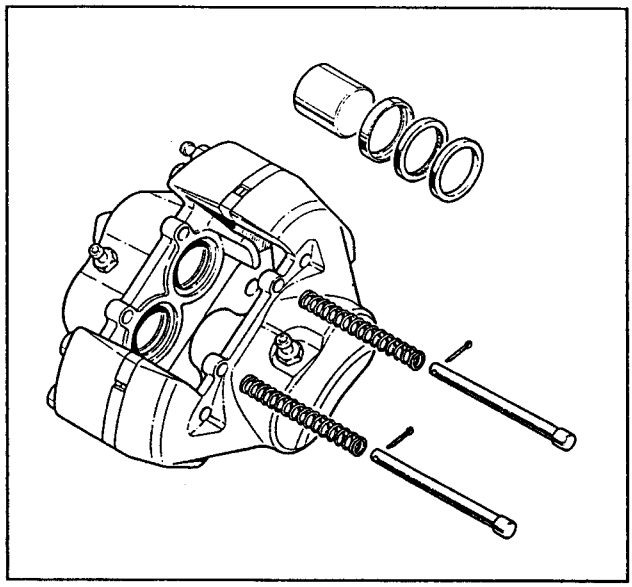


Fig 4. Caliper - piston seals

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

FRONT BRAKE HOSES

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

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

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

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

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

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

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

Ensure each clip is pushed fully home into its recess in the hose pipe end fitting. Route the end of the hose leading from the upper position in the crossmember hose support bracket in a natural curve round and down into to the rear hole on the support bracket attached to the steering knuckle, and secure it with a clip. Similarly route the other hose to the front hole in the lower support bracket. Ensure each clip is pushed fully home into its recess in the hose pipe end fitting. Reconnect the hydraulic pipes at each end of each hose.

Repeat the procedure on the other side of the vehicle. Use a new tie to secure the lead to the brake wear sensor to the secondary hose on the right hand side of the vehicle.

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

REAR BRAKE DRUMS/SHOES/ BRAKE ADJUSTERS

REMOVE/REPLACE

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

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

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

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

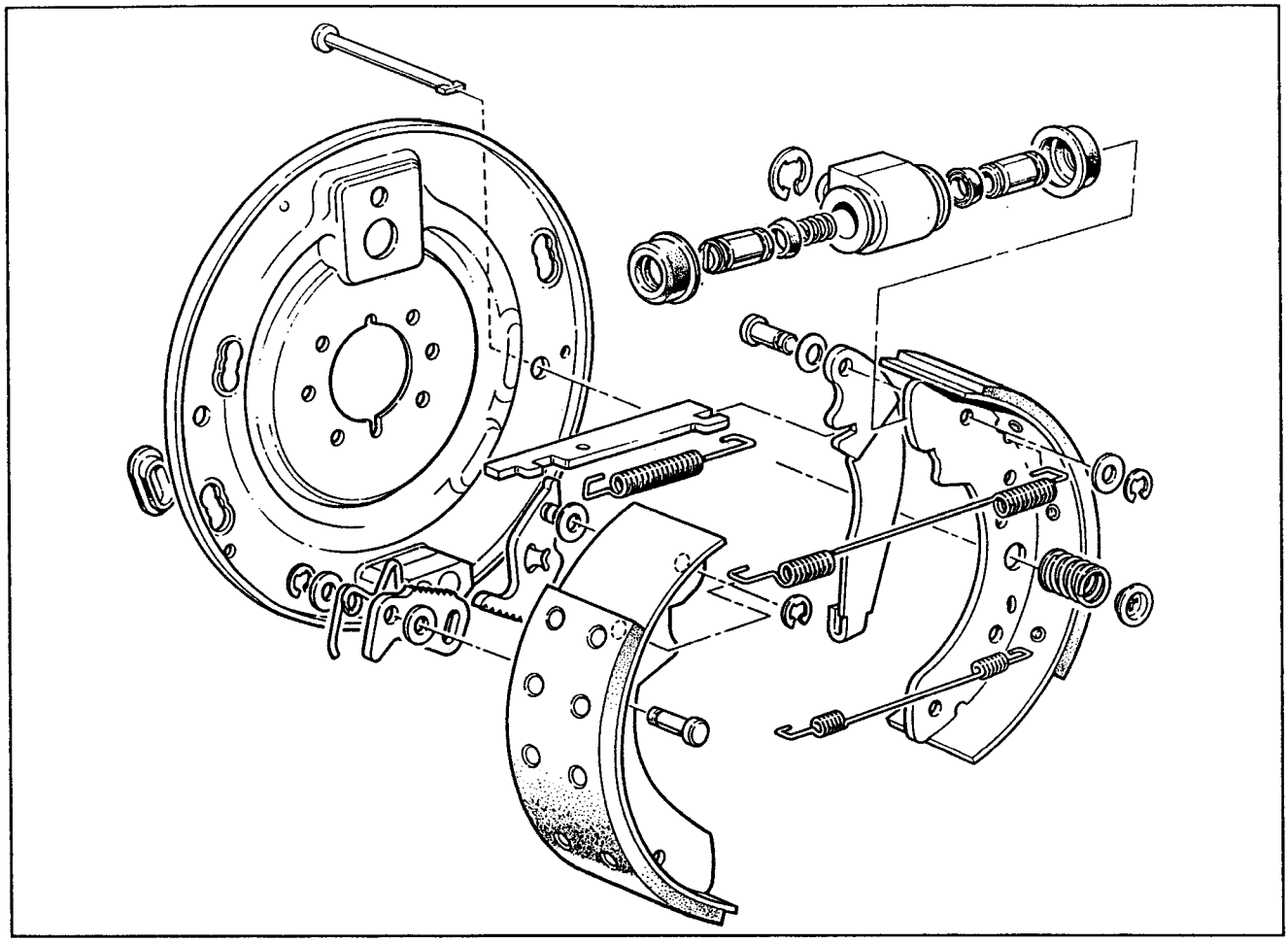


Fig 5. - Rear brake assembly

adjuster towards the shoe platform.

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

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

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

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

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

6. Remove all dust and deposits from the original parts and the friction surface of the brake drum. **DO NOT BLOW OUT WITH AN AIR LINE - IT COULD BE HARMFUL TO INHALE THE DUST.** Remove with a vacuum cleaner or wipe clean with a damp rag. NOTE: Do not use petrol or paraffin - if solvent is required use methylated spirit.

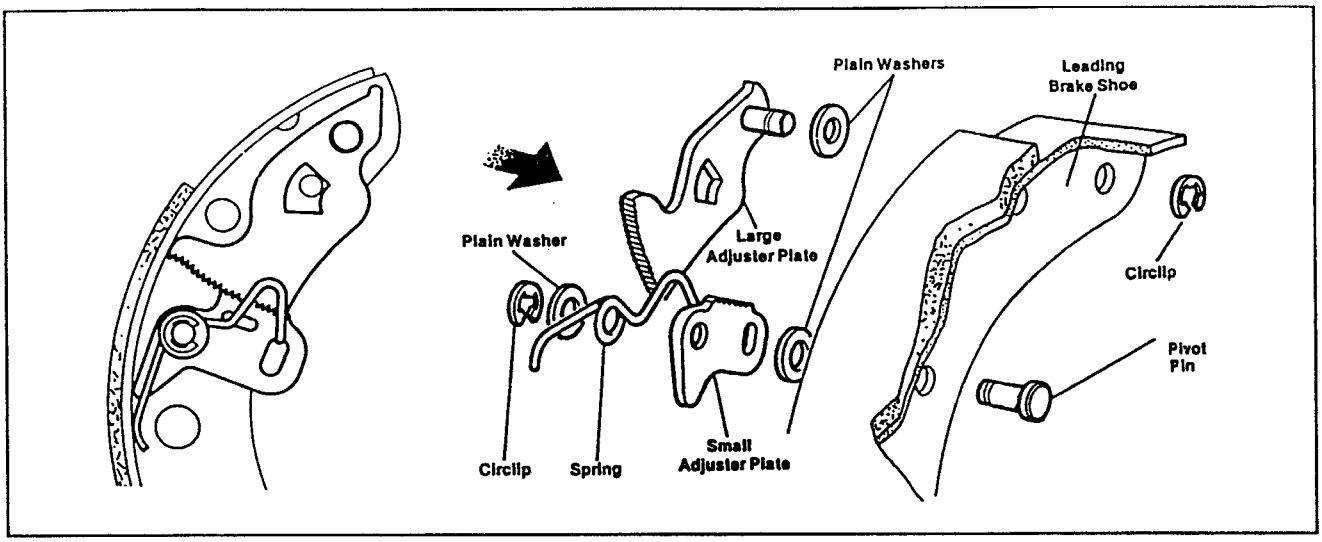


Fig 6. Rear brake adjuster mechanism

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

NOTE: The lining material fitted to the leading shoe, with the auto adjust mechanism, is considerably thicker than the lining material on the trailing shoe, with the integral handbrake lever. It is most important that the shoes are fitted in their correct positions.

8. Carefully inspect all the components for faults or wear. Check the pull-off springs and cross lever tension spring for signs of weakness or stretching. If in doubt fit new springs. Check for any signs of hydraulic fluid leakage and examine the condition of the wheel cylinder rubber boots. Examine the brake drum friction surface for scoring, cracks or distortion and renew where there is any doubt about its condition.

NOTE: Maximum permitted brake drum wear may not exceed 1.0 mm (0.040 in.). Brake drums may not be reground.

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

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

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

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

11. Hook the longer end of the crosslever tension spring into the hole towards the end of the trailing shoe web. Engage the other end of the spring in the notch in the crosslever to hold the crosslever in position.

The crosslever spring is not interchangeable with the spring on the opposite brake.

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

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

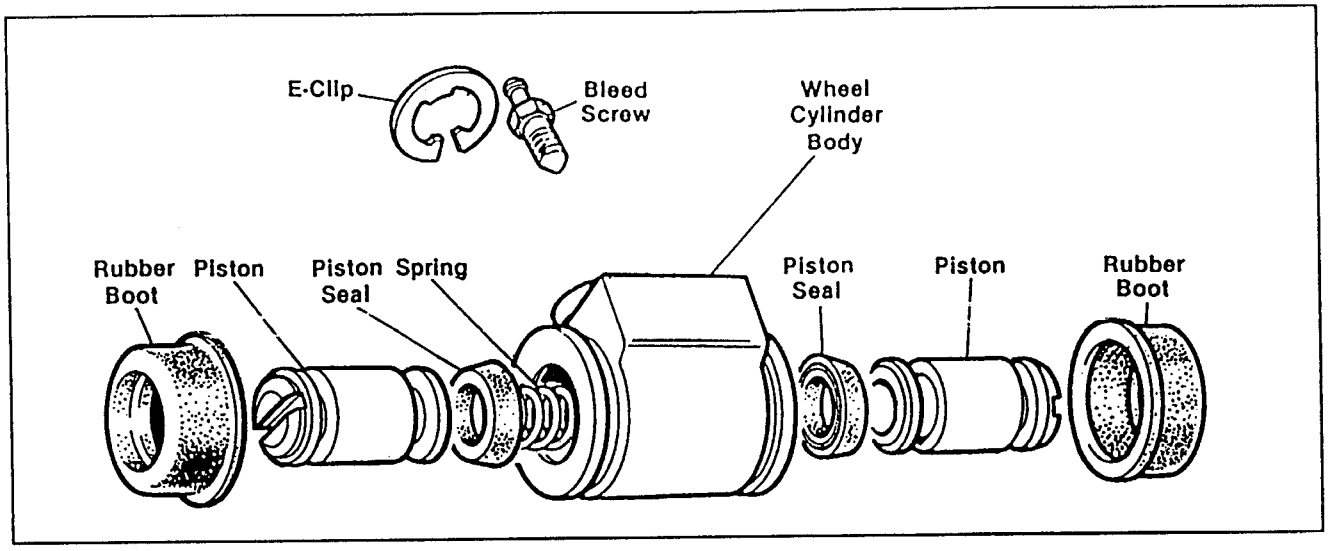


Fig 7. Rear brake cylinder components

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

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

15. Lightly grease the brake drum spigot and replace the brake drum and its securing screw.

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

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

REAR WHEEL CYLINDER

REMOVE/REPLACE/OVERHAUL

1. Remove brake shoes and springs as previously described.

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

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

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

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

5. Coat a new piston seal with clean brake fluid and, using only the fingers, fit the seal into the piston groove, the larger diameter facing away from the

slotted end of the piston. Repeat the process for the other piston. Smear the cylinder bore with brake fluid then push the pistons into the bore taking care that the lip of each seal is not bent back, and that the spring is seated correctly in the piston counterbores.

6. Smear the beaded edges and inside of the boots with Lockheed Rubberlube Part No: LBK 102/94 and push into position. Ensure each boot locates correctly in the piston and cylinder body grooves.

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

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

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

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

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

REAR BRAKE BACKPLATE

REMOVE/REPLACE

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

REAR BRAKE HOSE

REMOVE/REPLACE

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

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

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

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

MASTER CYLINDER

REMOVE/REPLACE/OVERHAUL

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

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

2. Connect bleed tubes to the bleed screws each side of the right hand front caliper (LHS on LHD vehicles) and immerse both tubes into clean brake fluid in a glass jar of sufficient size to contain all the brake fluid in the brake fluid reservoir. Unscrew the

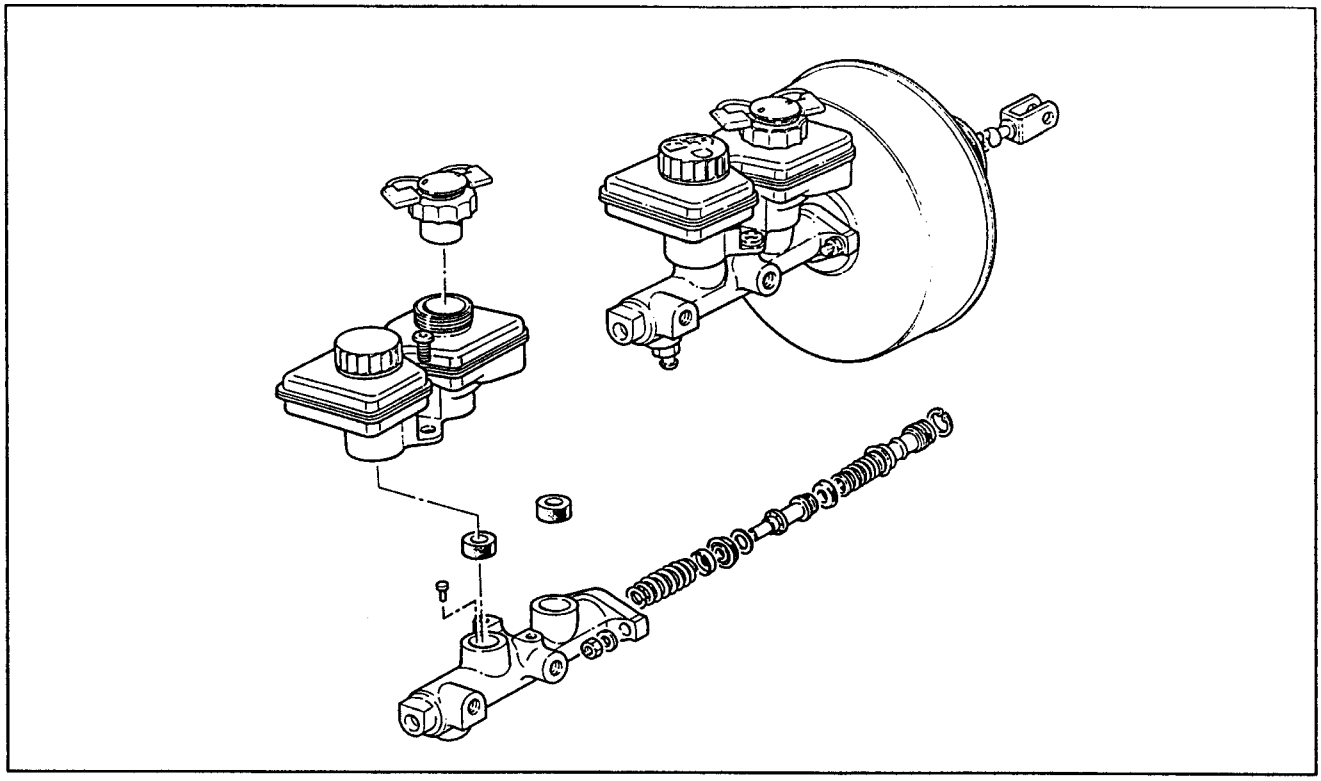


Fig 8. Brake master cylinder components

bleed screws half a turn and have an assistant fully depress the brake pedal several times until the brake fluid reservoir is empty. Tighten the bleed screws, discard the removed fluid and clean the glass jar for the later brake bleeding operations.

3. Remove the hydraulic pipes from the brake master cylinder and plug the exposed ports to prevent any residual fluid loss and dirt ingress. Disconnect the wires to the fluid level sensor and unscrew the two nuts securing the master cylinder to the servo unit so that the master cylinder may be withdrawn. NOTE: The brake pedal must not be depressed while the master cylinder is disconnected from the servo unit.

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

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

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

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

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

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

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

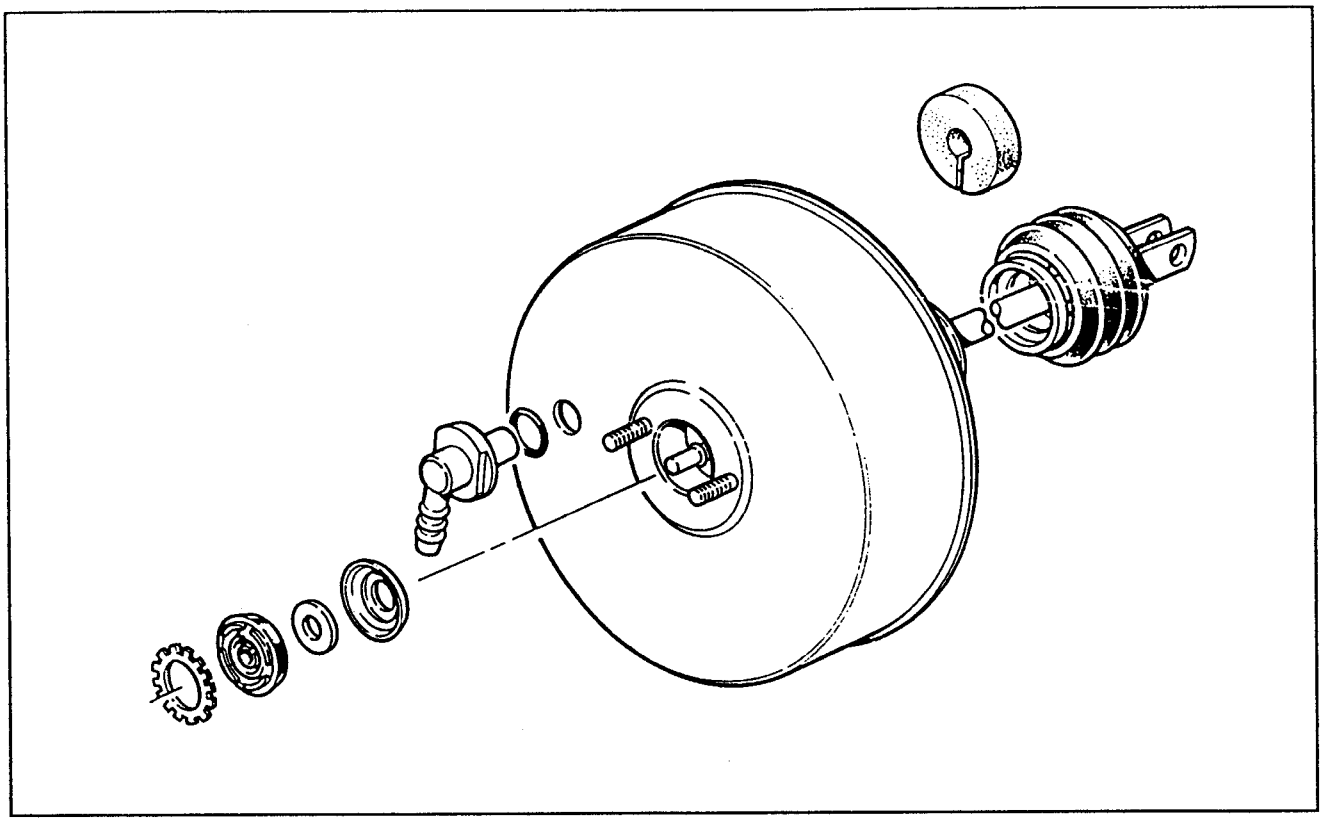


Fig 9. Brake servo components

9. Scrupulous cleanliness is essential, therefore ensure the hands are free of any grease or dirt. Check the fluid feed ports are clear. Lubricate the cylinder bores and new components with new brake fluid. Locate a new piston washer on the head of the secondary piston. Using the fingers only, ease the new main seal over the piston nose, lip last, so that it is seated up to the piston head holding the washer in place. Fit the remaining seal, lip last, into the groove on the other end of the piston.

10. Place the spring retainer onto the secondary piston nose followed by the return spring. Insert the return spring, spring retainer and secondary piston into the master cylinder bore, taking care not to bend back the lip of the leading seal. Enter the new primary piston sub assembly into the bore again ensuring the seal lips are not bent back. Refit the circlip at the mouth of the master cylinder bore and check it is correctly seated in its groove. Push the primary piston fully into the master cylinder with a push rod, then insert the secondary cylinder stop pin into either of the two secondary cylinder feed port holes.

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

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

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

BRAKE SERVO ASSEMBLY/ VACUUM SEAL/AIR FILTER

REMOVE/REPLACE COMPONENTS

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

Vacuum seal replacement:

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

Servo assembly replacement:

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

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

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

Air filter replacement:

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

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

BRAKE BLEEDING

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

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

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

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

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

Two bleed tubes are required to bleed the front brakes. First, connect the two bleed tubes to the bleed screws each side of the left hand front caliper (RHS on LHD vehicles) and immerse both tubes into the clean fluid in the glass jar. Unscrew the outer bleed screw half a turn and have an assistant

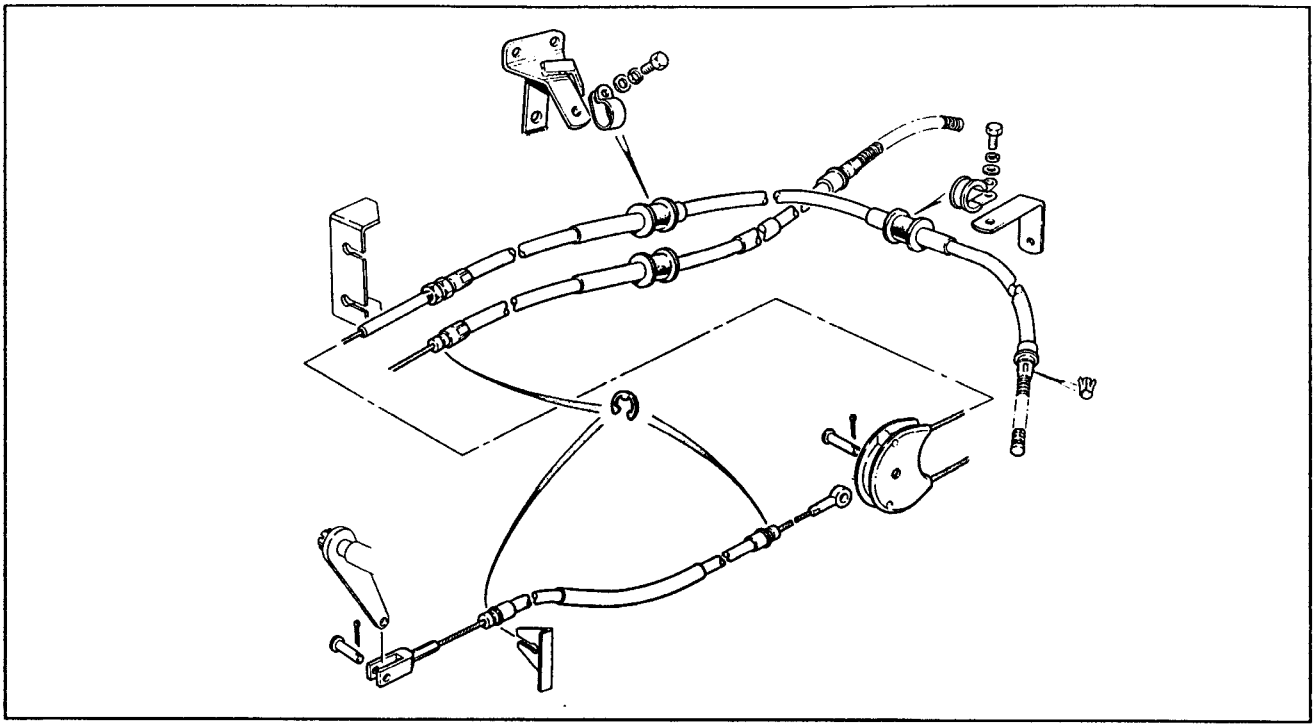


Fig 10. Handbrake cables- layout

fully depress the brake pedal several times until brake fluid flows from the bleed tube into the fluid in the glass jar without any sign of air bubbles. Tighten the bleed screw at the brake pedal is depressed.

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

Repeat this operation for the other front brake.

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

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

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

HANDBRAKE REAR CABLE

REMOVE/REPLACE

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

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

3. Release the handbrake cable guides from the 'P' clip fastenings on the rear axle and the cable support bracket on the chassis sidemember.

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

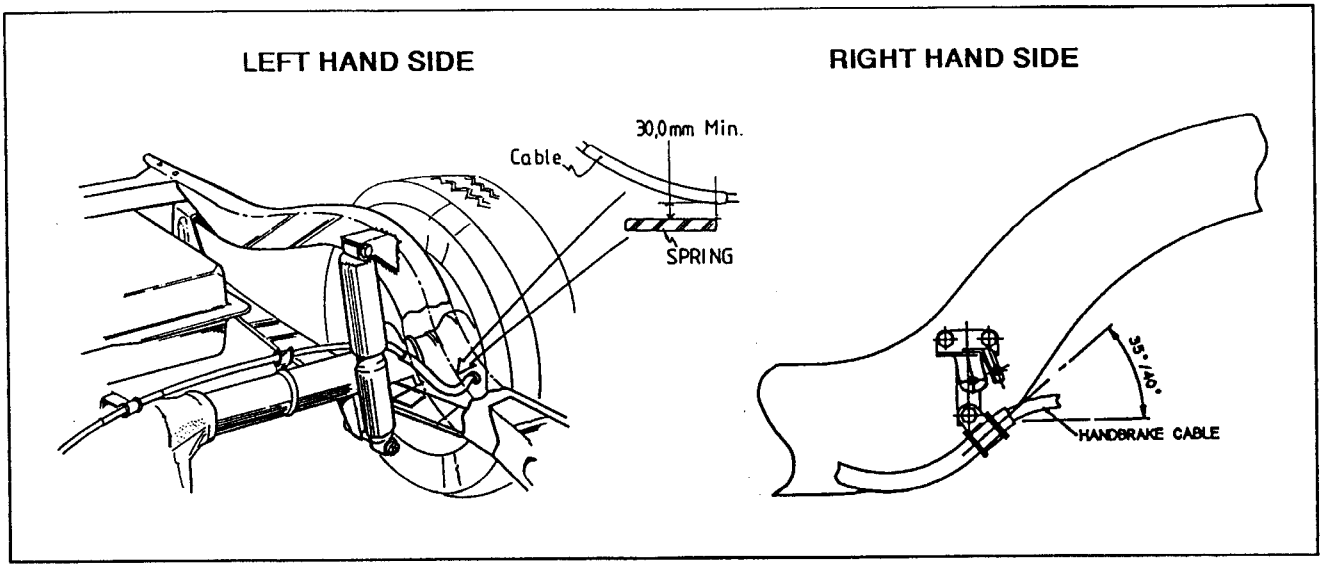


Fig. 10 Handbrake routing

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

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

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

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

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

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

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

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

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

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

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

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

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

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

13. Lower the vehicle and torque the wheel nuts to specification (torque 200 Nm, 150 lb ft). Replace the hub caps.

HANDBRAKE FRONT CABLE

REMOVE/REPLACE

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

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

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

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

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

LTI

SERVICE

Fairway

WORKSHOP MANUAL

SECTION 8

ENGINE ELECTRICS, STARTER, ALTERNATOR, HEATER PLUGS

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

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

ELECTRICAL SYSTEM

SECTION EL

CONTENTS

STARTING MOTOR FITTED TO SERIES 2.7 DIESEL ENGINE

TYPE S13-107A
MODEL HITACHI-GEAR REDUCTION TYPE
PART NO CODE 23300

SOME PARTS OF THIS SECTION DEAL
WITH OTHER TYPES OF STARTING MOTORS
ALWAYS REFER TO HITACHI-S13-107A MODEL

SPECIAL TOOLS

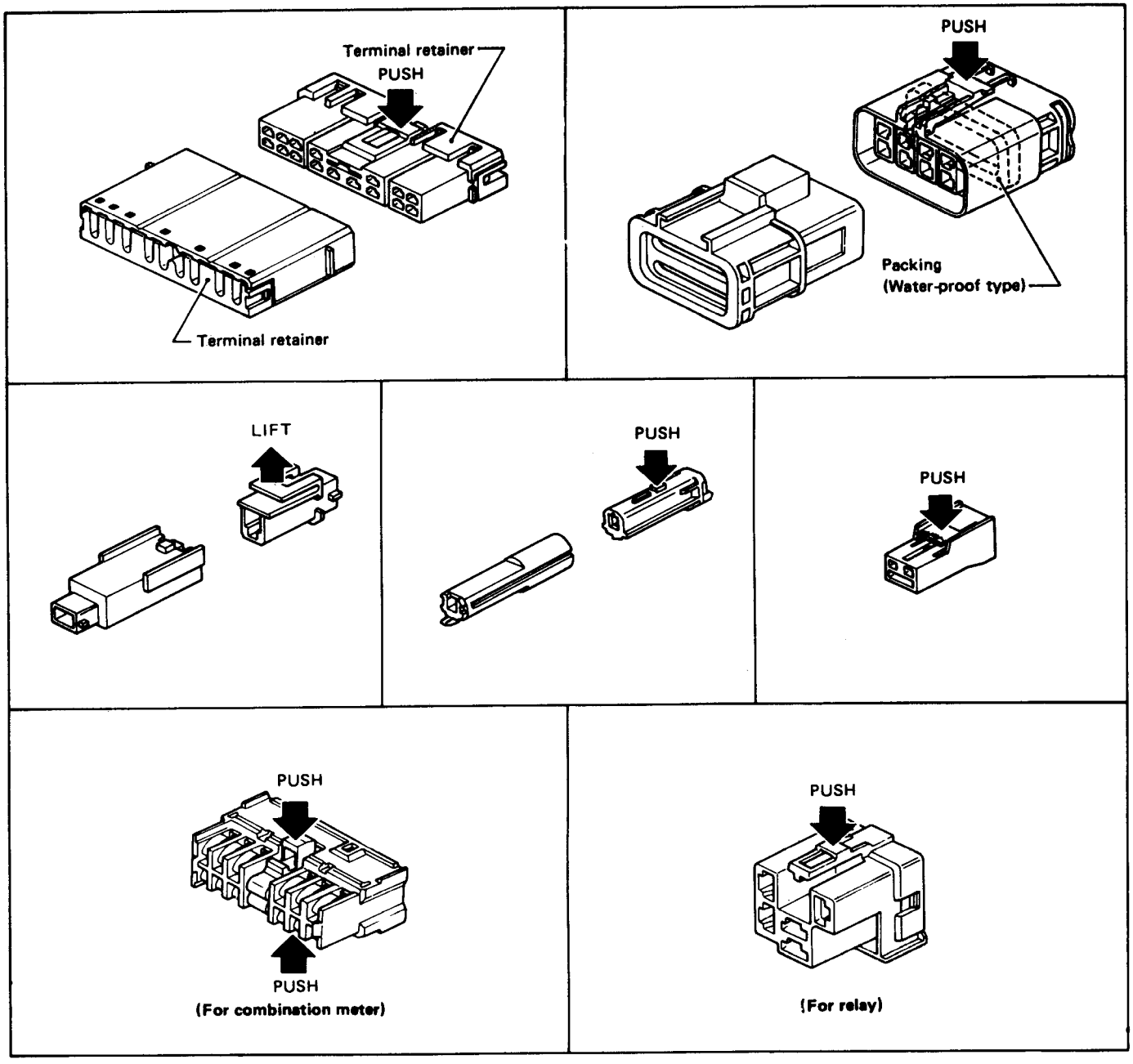
A SUITABLE MULTI METER

HARNESS CONNECTOR

- All harness connectors have been modified to prevent accidental looseness or disconnection.
- The connector can be disconnected by pushing or lifting the locking section.

CAUTION:
Do not pull the harness when disconnecting the connector.

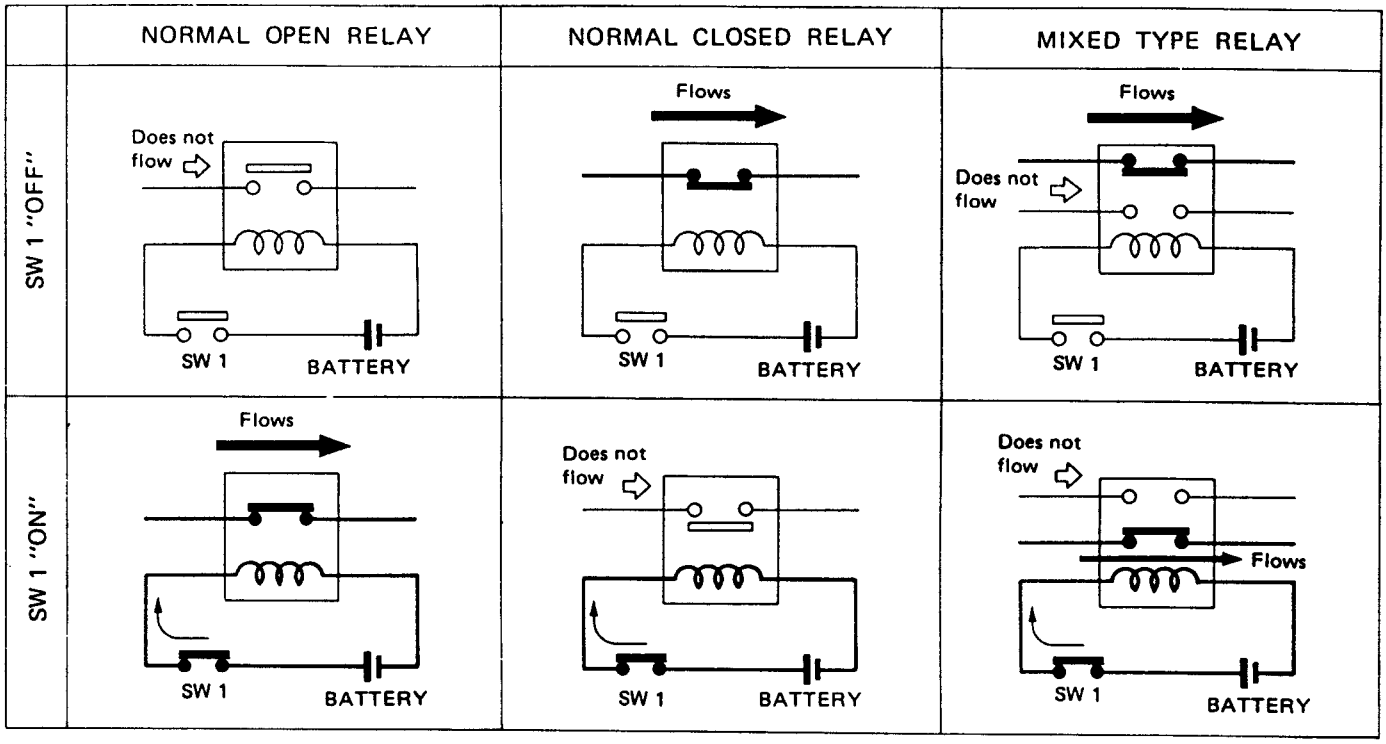
[Example]



SEL769D

Normal Open, Normal Closed and Mixed Type Relays

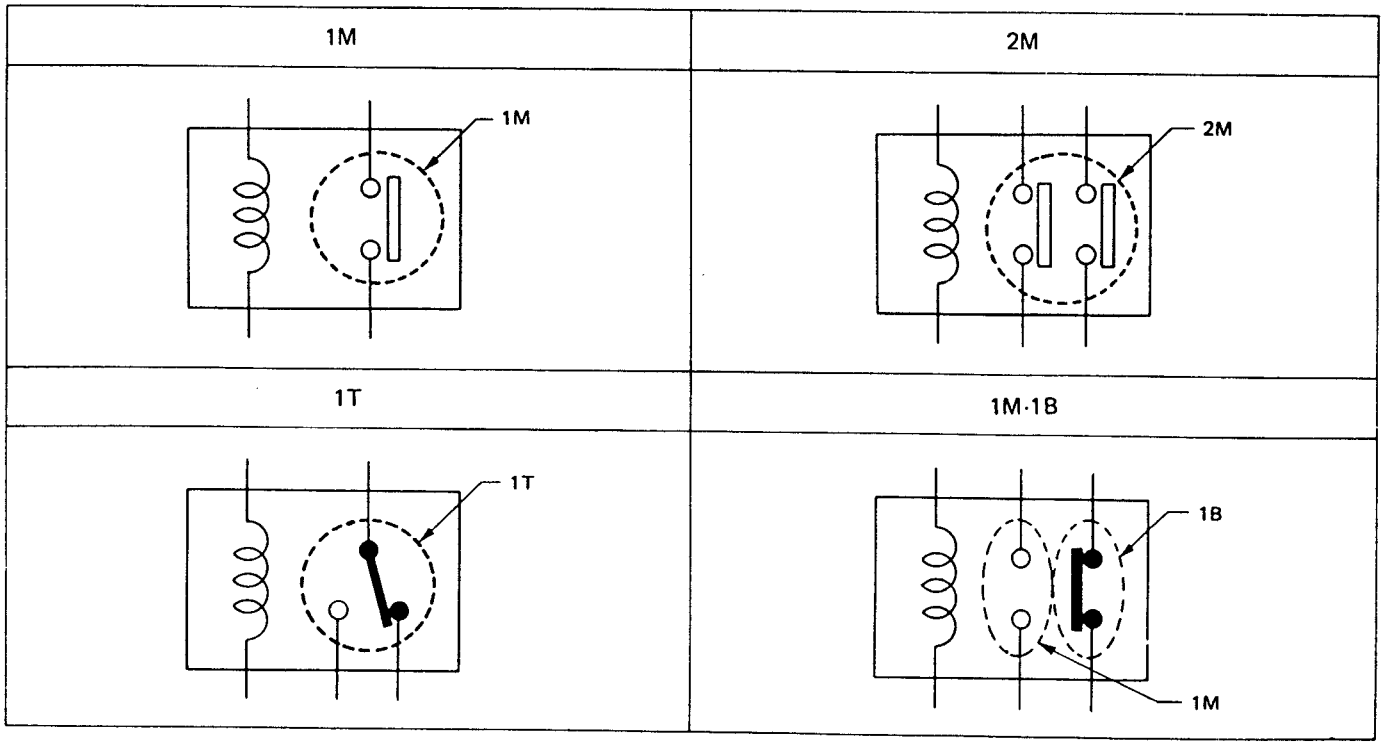
Relays can mainly be divided into three types: normal open, normal closed and mixed type relays.



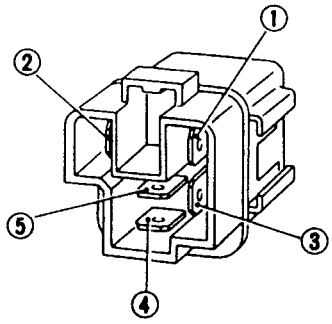
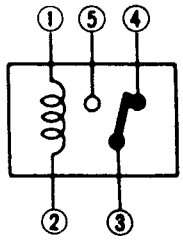
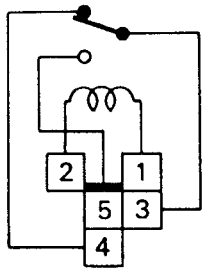
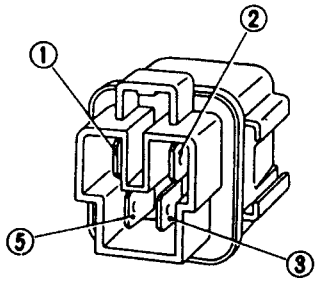
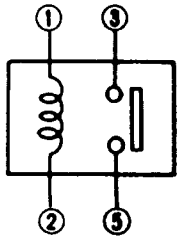
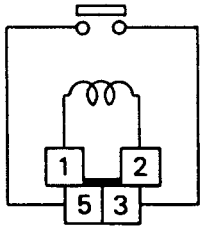
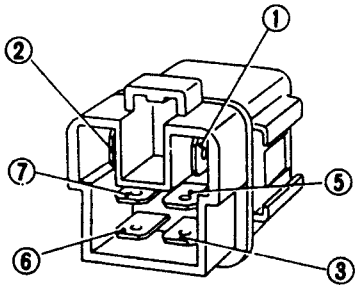
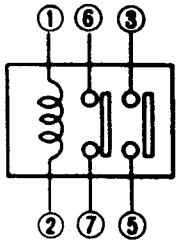
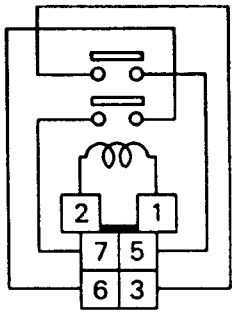
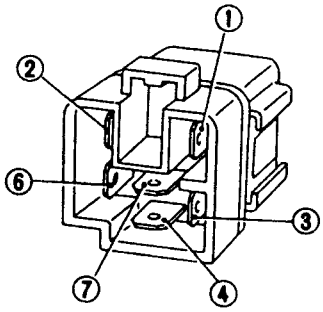
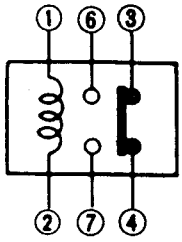
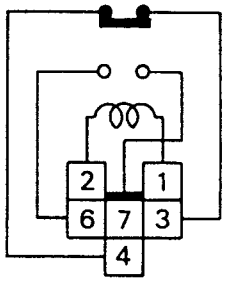
SEL881H

Type of Standardized Relays

1M ..... 1 Make
1T ..... 1 Transfer
2M ..... 2 Make
1M·1B ..... 1 Make 1 Break

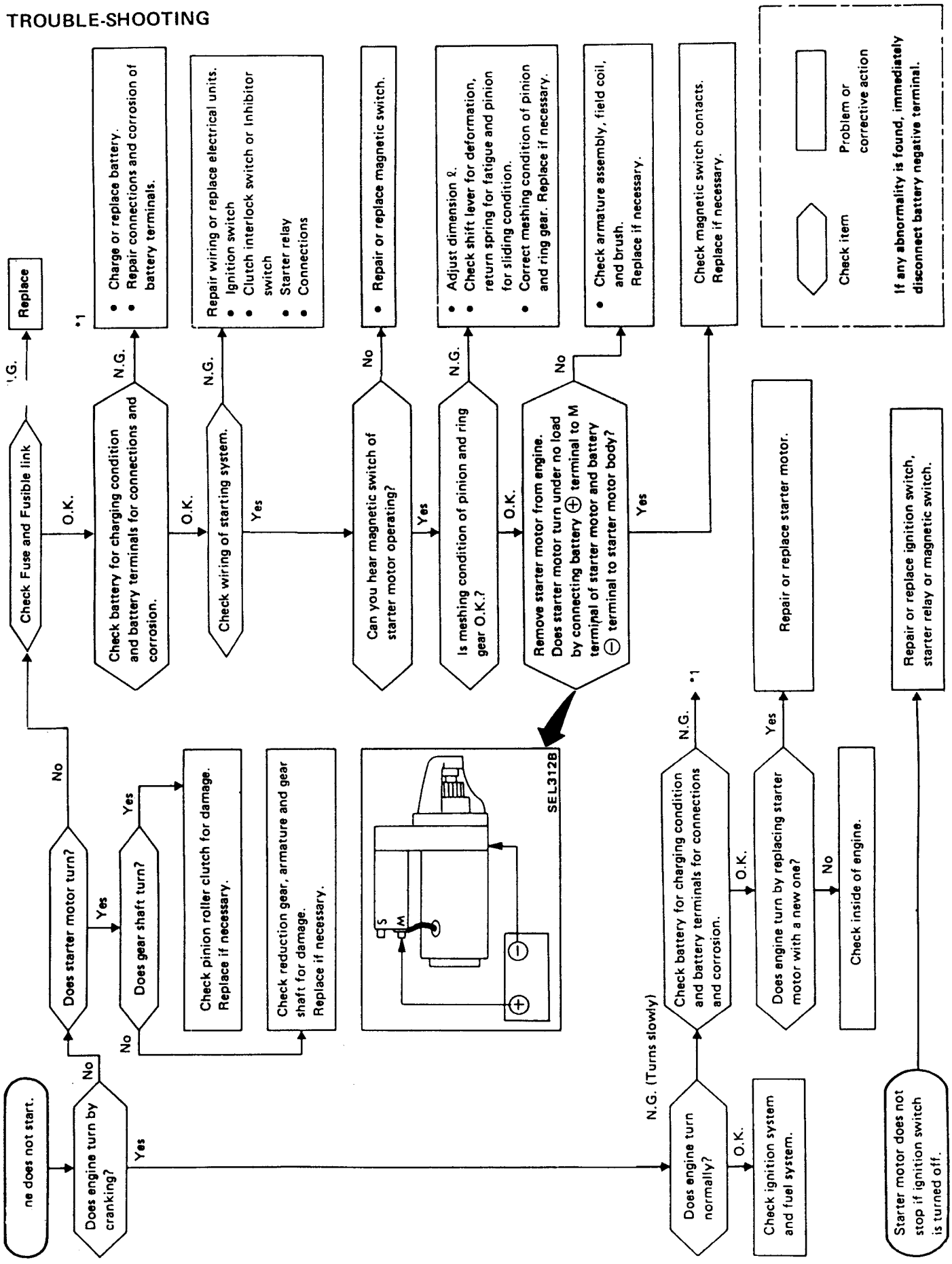


SEL882H

Type	Outer view	Circuit	Connector symbol and connection	Case color
1T				BLACK
1M				BLUE
2M				BROWN
1M·1B				GRAY

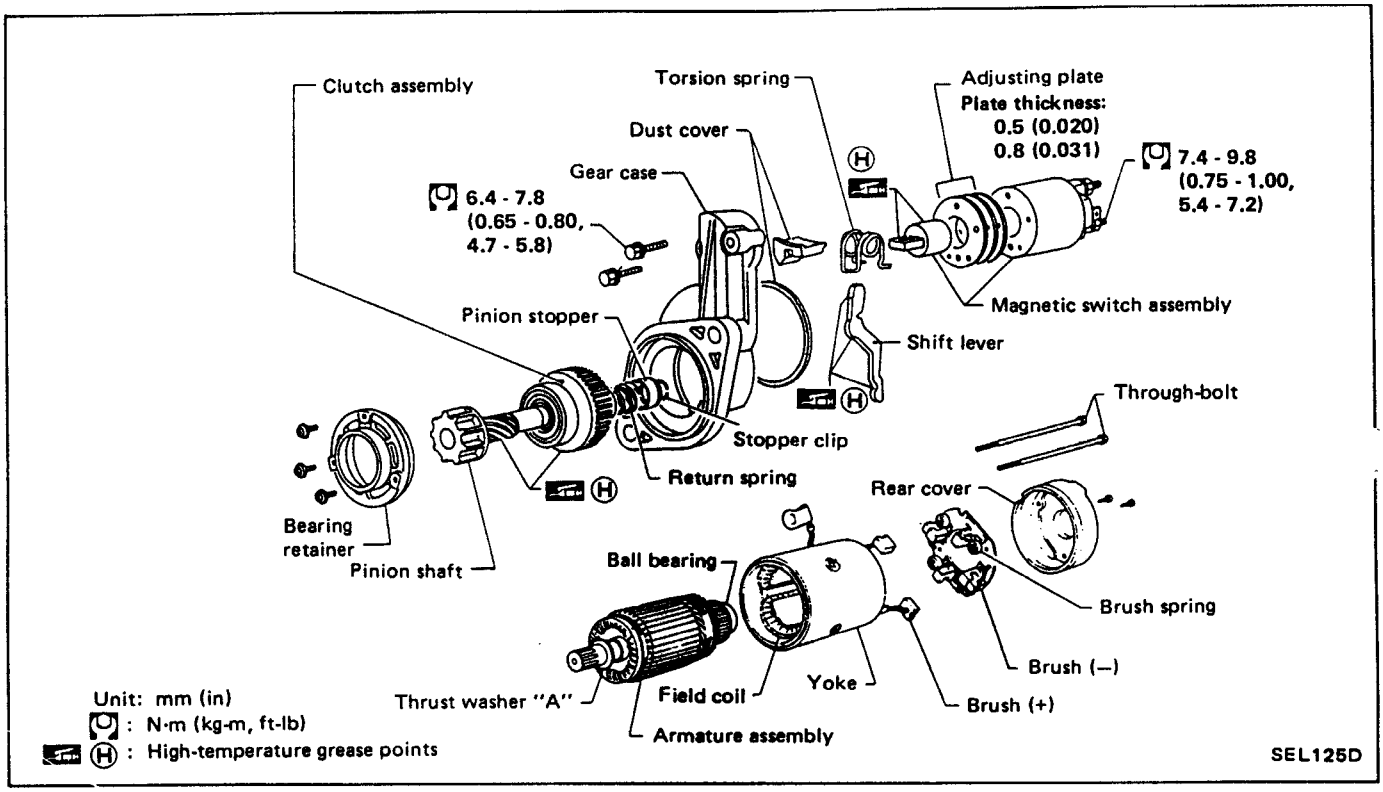
SEL883H

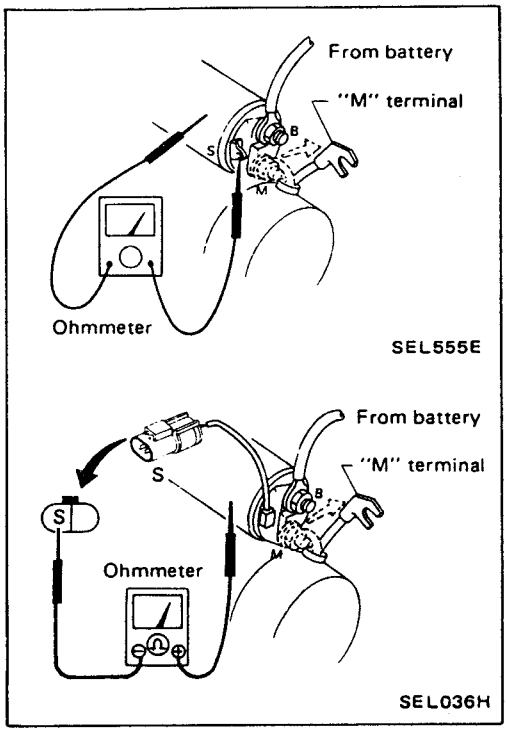
TROUBLE-SHOOTING



Construction (Cont'd)

DIESEL ENGINE MODEL
S13-106A, -107A

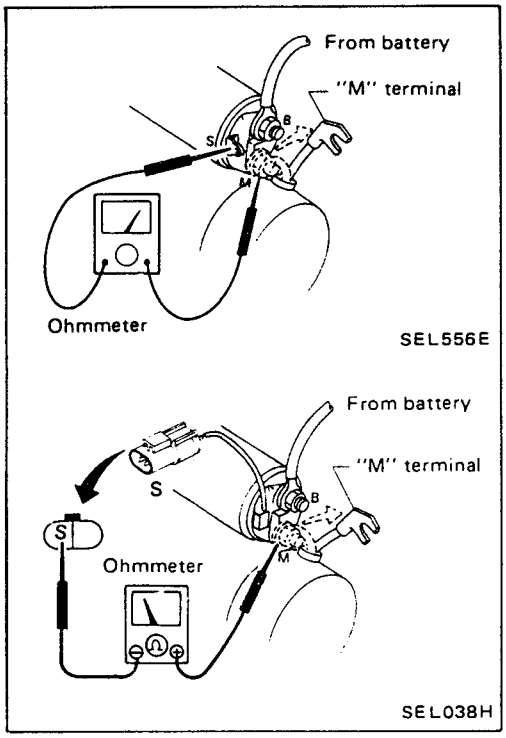




Magnetic Switch Check

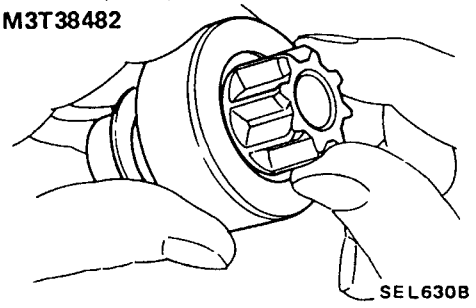
- Before starting to check, disconnect battery ground cable.
- Disconnect "M" terminal of starter motor.

1. Continuity test (between "S" terminal and switch body).
- No continuity ... Replace.

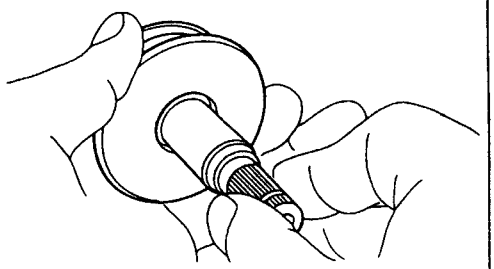


2. Continuity test (between "S" terminal and "M" terminal).
- No continuity ... Replace.

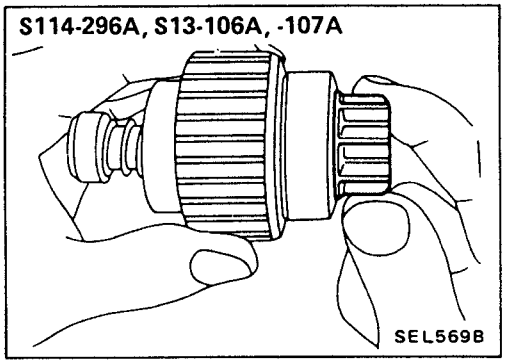
S114-348, -607, -608, M3T29482D, M3T38482

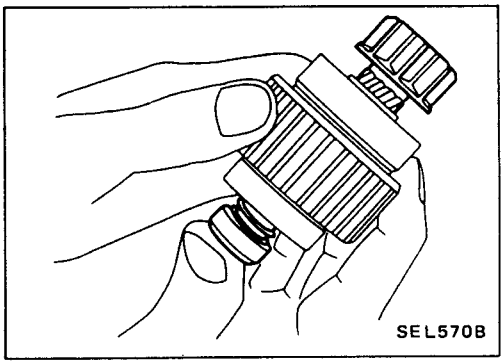


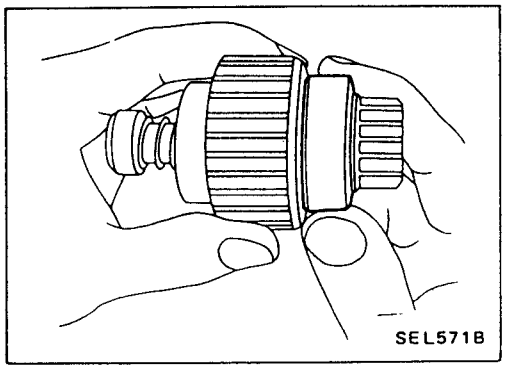
M2T52881



S114-296A, S13-106A, -107A







Pinion/Clutch Check

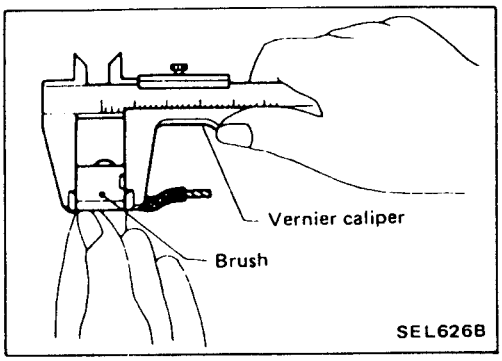
1. Check to see if pinion locks in one direction and rotates smoothly in the opposite direction.
- If it does not lock (or locks) in either direction or unusual resistance is evident ... Replace.

2. Check pinion movement. (S114-296A and S13-106A, -107A)
- If it is hard to move, apply grease or, if necessary, replace.

3. Check ball bearing. (S114-296A, and S13-106A, -107A)
   Spin outer race of ball bearing to ensure that it turns smoothly without binding.
- Abnormal resistance ... Replace.

4. Inspect pinion teeth.
- Replace pinion if teeth are worn or damaged. (Also check condition of ring gear teeth.)

5. Inspect reduction gear teeth.
- Replace reduction gear if teeth are worn or damaged. (Also check condition of armature shaft gear teeth.)



Brush Check

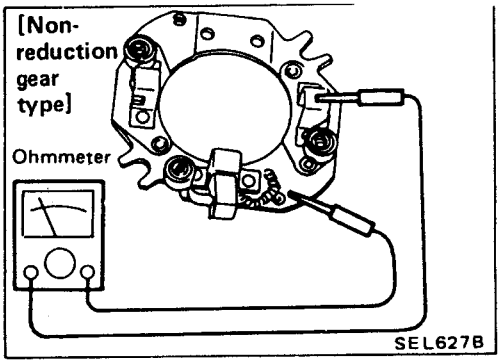
BRUSH

Check wear of brush.

Wear limit length:

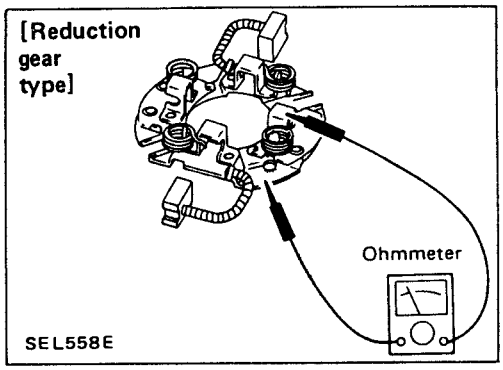
Refer to "Service Data and Specifications."

- Excessive wear ... Replace.



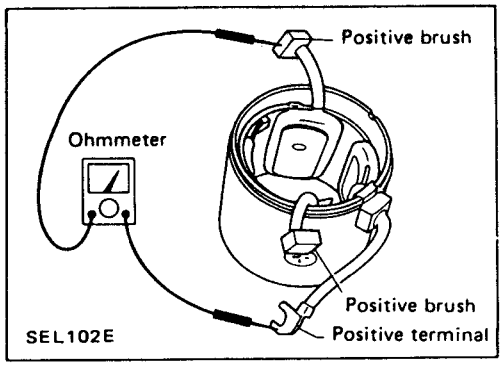
BRUSH HOLDER

1. Perform insulation test between brush holder (positive side) and its base (negative side).
   - Continuity exists ... Replace.
2. Check brush to see if it moves smoothly.
   - If brush holder is bent, replace it; if sliding surface is dirty, clean.

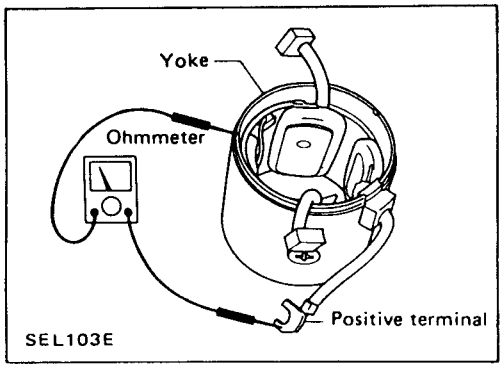


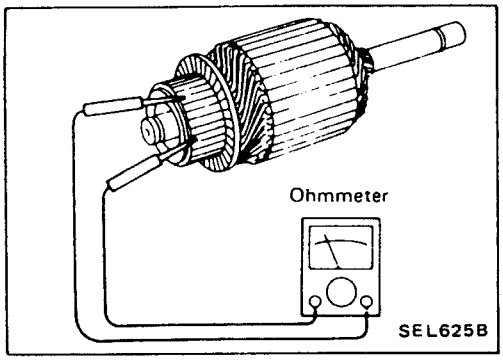
Field Coil Check

1. Continuity test (between field coil positive terminal and positive brushes).
   - No continuity ... Replace field coil.



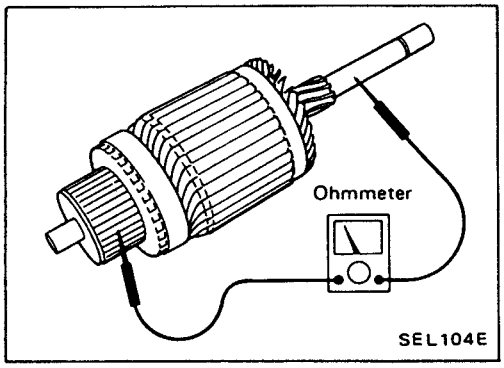
2. Insulation test (between field coil positive terminal and yoke).
   - Continuity exists ... Replace field coil.



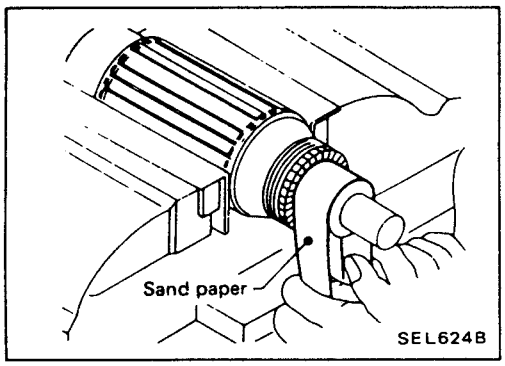


Armature Check

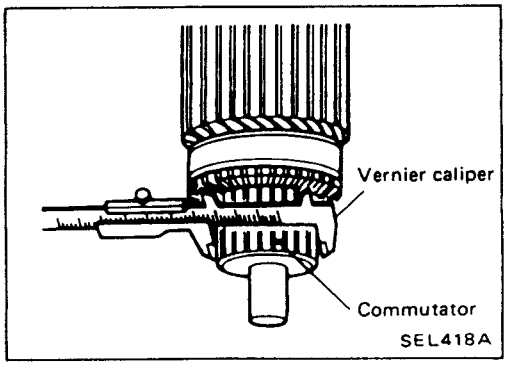
1. Continuity test (between two segments side by side).
   - No continuity ... Replace.



2. Insulation test (between each commutator and shaft).
   - Continuity exists ... Replace.

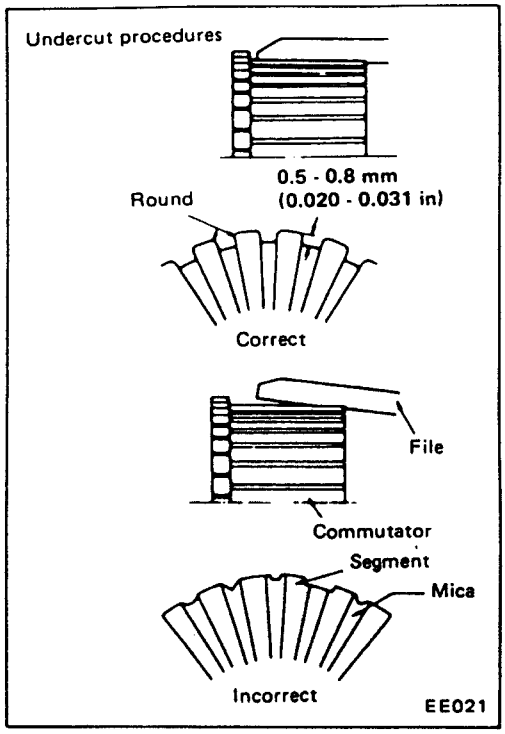


3. Check commutator surface.
   - Rough ... Sand lightly with No. 500 - 600 sandpaper.



4. Check diameter of commutator.
   Commutator minimum diameter:
   Refer to "Service Data and Specifications."
   - Less than specified value ... Replace.

Armature Check (Cont'd)



5. Check depth of insulating mica from commutator surface.
   - Less than 0.2 mm (0.008 in) ... Undercut to 0.5 - 0.8 mm (0.020 - 0.031 in)

Assembly

Carefully observe the following instructions.

HIGH TEMPERATURE GREASE POINT

- Rear cover metal
- Gear case metal
- Center bracket metal
- Frictional surface of pinion
- Moving portion of shift lever
- Plunger of magnetic switch
- Reduction gear
- Armature shaft gear

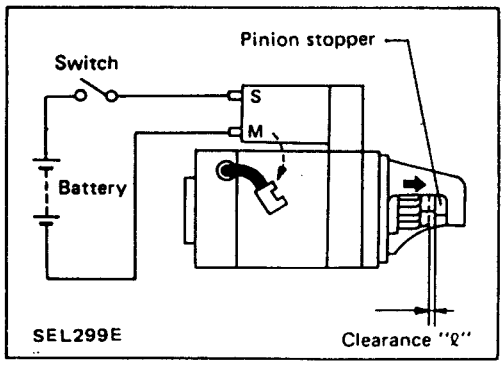
PINION PROTRUSION LENGTH ADJUSTMENT

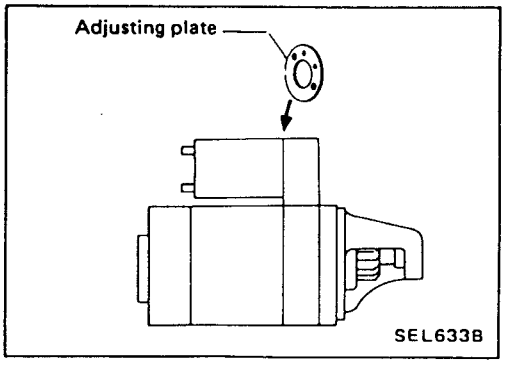
Non-reduction gear type

With pinion driven out by magnetic switch, push pinion back to remove slack and measure clearance "ℓ" between the front edge of the pinion and the pinion stopper.

Clearance "ℓ":

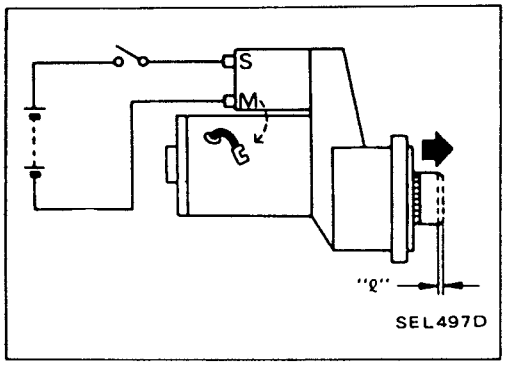
Refer to "Service Data and Specifications."





- Not in the specified value ... Adjust with adjusting plate.

Assembly (Cont'd)

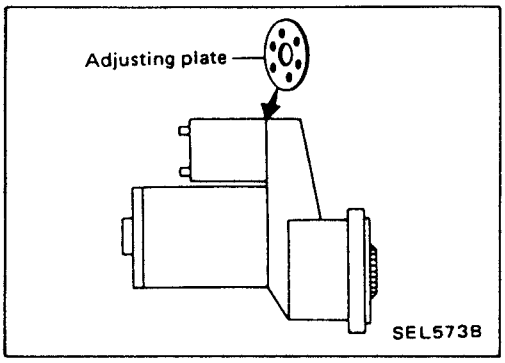


Reduction gear type

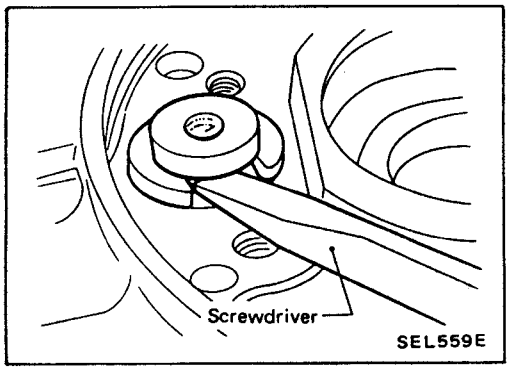
Measure movement "ℓ" in height of pinion when pinion is pushed out with magnetic switch energized and when pinion is pulled out by hand until it touches stopper.

Movement "ℓ":

Refer to "Service Data and Specifications."



- Not in the specified value ... Adjust by adjusting plate.



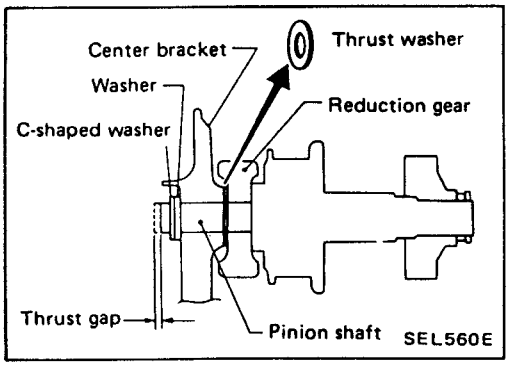
PINION SHAFT THRUST GAP ADJUSTMENT

M2T52881

Check thrust gap with a gap gauge by pulling pinion shaft in the axial direction with a screwdriver.

Maximum of thrust gap:

0.5 mm (0.020 in)



- If thrust gap is over the specified value, adjust it with thrust washer.

STARTER

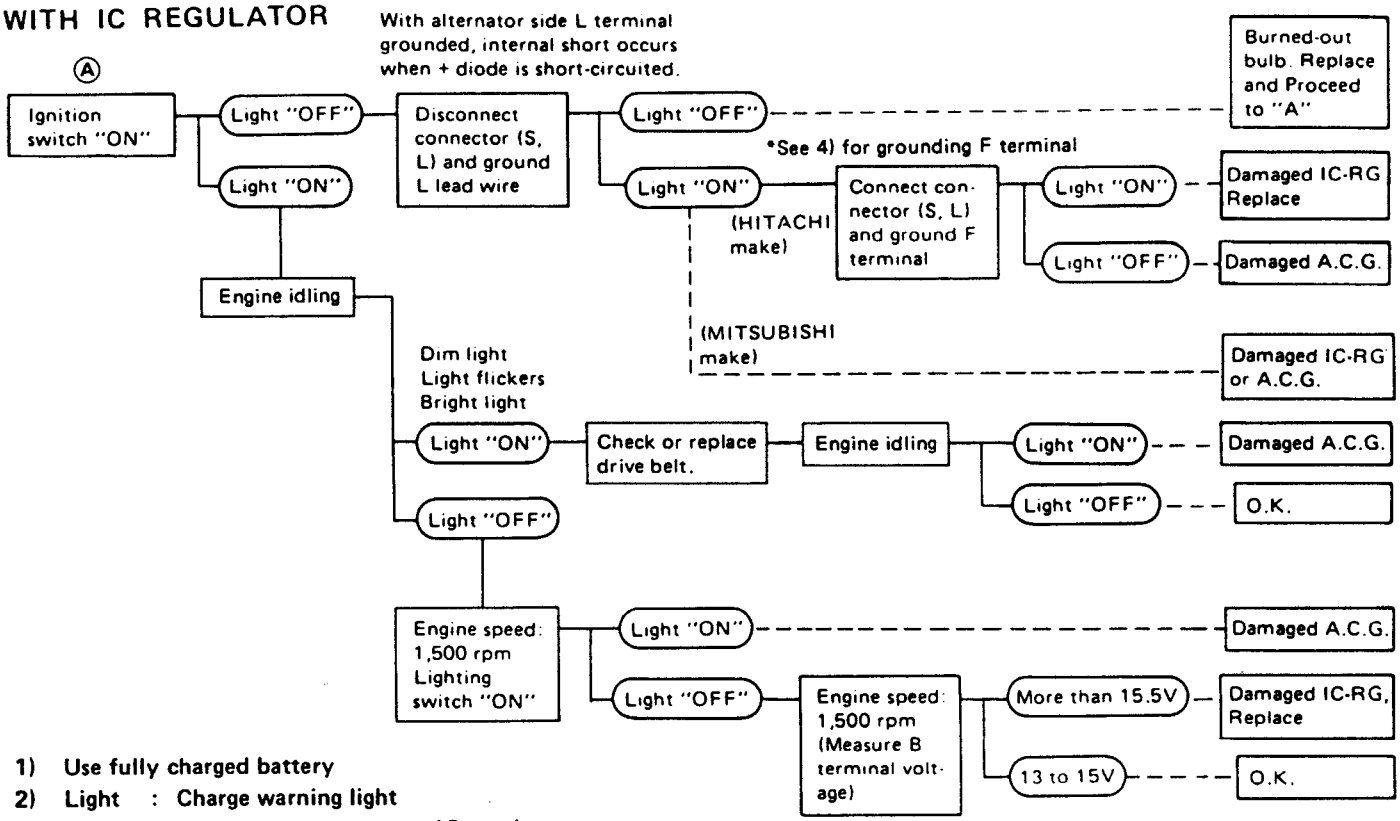
Type	S114-348	M3T29482D	S114-296A	M2T52881	S114-607	M3T38482	S114-608	S13-106A	S13-107A
	HITACHI	MITSUBISHI	HITACHI	MITSUBISHI	HITACHI	MITSUBISHI	HITACHI		
	Non-reduction		Reduction		Non-reduction			Reduction	
Applied model	Z20S M/T				Z24S			TD23, 27 Except Europe	TD23 Europe & cold area
	4-speed		5-speed, Optional for 4-speed		M/T		A/T		
System voltage V	12								
No-load Terminal voltage V	11.5		11	11.5				11	
Current A	Less than 60		Less than 100			Less than 60	Less than 100		
Revolution rpm	More than 7,000	More than 6,500	More than 3,900	More than 3,000	More than 7,000	More than 6,500	More than 6,000	More than 3,900	
Minimum diameter of commutator mm (in)	39 (1.54)	31.4 (1.236)	29 (1.14)	31 (1.22)	39 (1.54)	31.4 (1.236)	39 (1.54)	35.5 (1.398)	
Minimum length of brush mm (in)	12 (0.47)	11.5 (0.453)	11 (0.43)	11.5 (0.453)	11 (0.43)	11.5 (0.453)	11 (0.43)	9 (0.35)	
Brush spring tension N (kg, lb)	17.7 - 21.6 (1.8 - 2.2, 4.0 - 4.9)	16.7 - 21.6 (1.7 - 2.2, 3.7 - 4.9)	15.7 - 19.6 (1.6 - 2.0, 3.5 - 4.4)	16.7 - 22.6 (1.7 - 2.3, 3.7 - 5.1)	17.7 - 21.6 (1.8 - 2.2, 4.0 - 4.9)	13.7 - 25.5 (1.4 - 2.6, 3.1 - 5.7)	17.7 - 21.6 (1.8 - 2.2, 4.0 - 4.9)	26.5 - 32.4 (2.7 - 3.3, 6.0 - 7.3)	
Clearance of bearing metal and armature shaft mm (in)	Less than 0.2 (0.008)		–	–	Less than 0.2 (0.008)	–	Less than 0.2 (0.008)	–	
Clearance "ℓ" between pinion front edge and pinion stopper mm (in)	0.3 - 2.5 (0.012 - 0.098)	0.5 - 2.0 (0.020 - 0.079)	–	–	0.3 - 2.5 (0.012 - 0.098)	0.5 - 2.0 (0.020 - 0.079)	0.3 - 2.5 (0.012 - 0.098)	–	
Movement "ℓ" in height of pinion mm (in)	–	–	0.3 - 1.5 (0.012 - 0.059)	0.5 - 2.0 (0.020 - 0.079)	–	–	–	0.3 - 1.5 (0.012 - 0.059)	

Trouble-shooting

Before conducting an alternator test, make sure that the battery is fully charged. A 30-volt voltmeter and suitable test probes are necessary for the test. The alternator can be checked easily by referring to the Inspection Table.

Before starting trouble-shooting, inspect the fusible link.

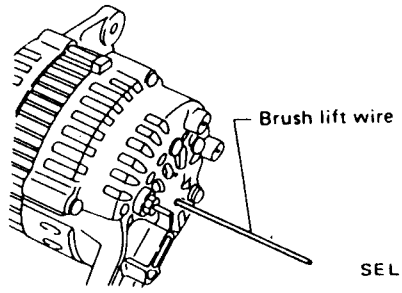
WITH IC REGULATOR



1) Use fully charged battery
2) Light : Charge warning light
   A.C.G. : Alternator parts except IC regulator
   IC-RG : IC regulator
   O.K. : IC-alternator is in good condition
   When reaching "Damaged A.C.G.", remove alternator from vehicle and disassemble, inspect and correct or replace faulty parts
4) *Method of grounding F terminal (HITACHI make only)

Gasoline engine model

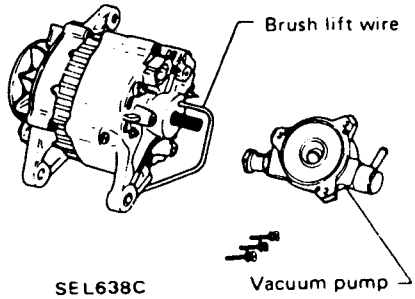
Connect tip of wire to brush and attach wire to alternator body.



SEL766D

Diesel engine model

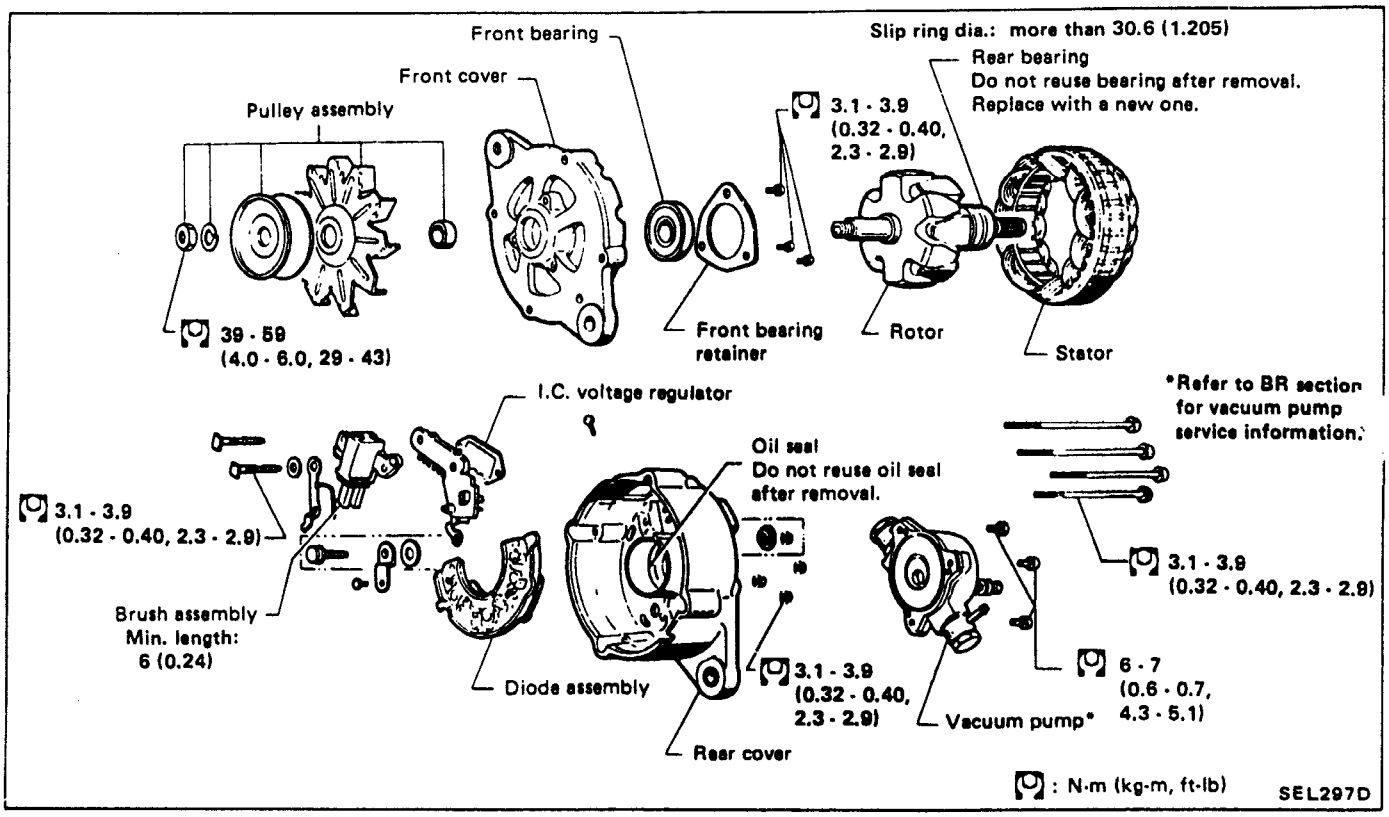
Remove vacuum pump and connect tip of wire to brush and attach wire to alternator body.



SEL638C

5) Terminals "S", "L", "B" and "E" are marked on rear cover of alternator.

DIESEL ENGINE MODEL
LR150-428E and -430C, LR170-408C and -407E

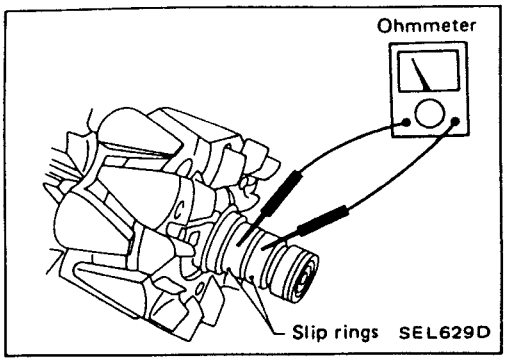


HITACHI

AUTOMATIC LR170 - 412 70 AMP
MANUAL LR170 - 413 OUTPUT

AUTO – 23100 – 02N19
SYN – 23100 – 02N18

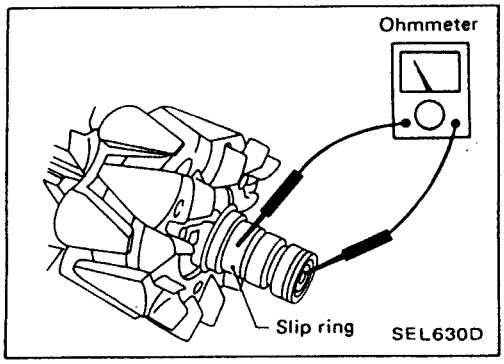
COMPLETE WITH VAC PUMP



Disassembly

ROTOR SLIP RING CHECK

1. Continuity test
   - No continuity ... Replace rotor.

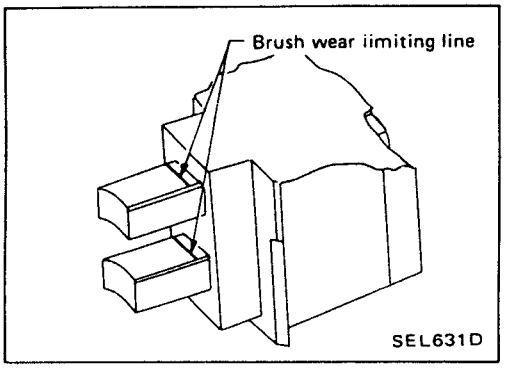


2. Insulator test
   - Continuity exists ... Replace rotor.
3. Check slip ring for wear.

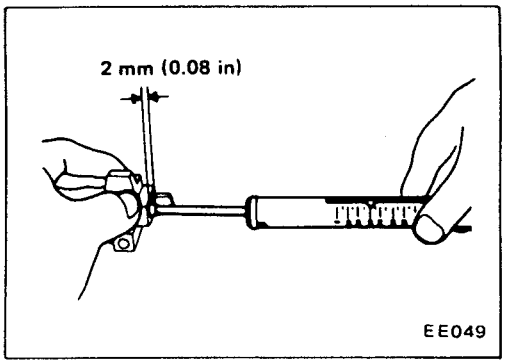
   Slip ring minimum outer diameter:

   Refer to "Service Data and Specifications."

BRUSH CHECK



1. Check smooth movement of brush.
   - Not smooth ....Check brush holder and clean.
2. Check brush for wear.
   - Replace brush if it is worn down to the limit line.



3. Check brush lead wire for damage.
   - Damaged ... Replace.
4. Check brush spring pressure.

   Measure brush spring pressure with brush projected approximately 2 mm (0.08 in) from brush holder.

   Spring pressure:

   Refer to "Service Data and Specifications."
   - Not within the specified values ... Replace.

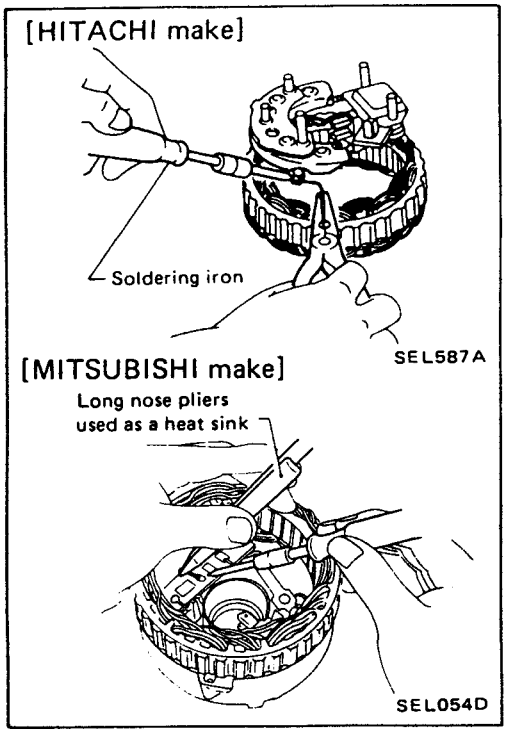
Disassembly (Cont'd)

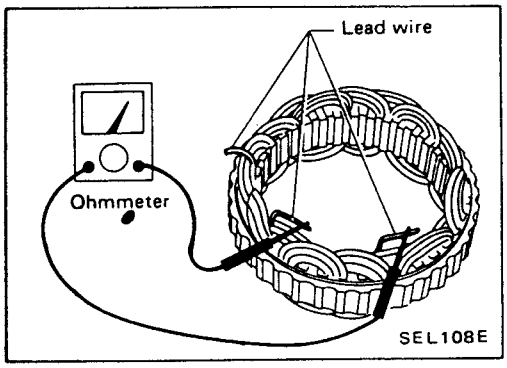
STATOR CHECK

To test the stator or diode, separate them by unsoldering the connecting wires.

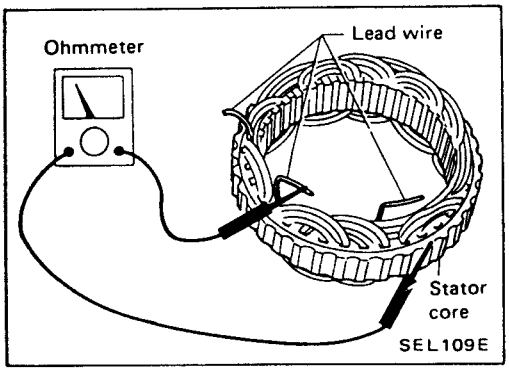
CAUTION:

Use only as much heat as required to melt solder. Otherwise, diodes will be damaged by excessive heat.





1. Continuity test
   - No continuity ... Replace stator.



2. Ground test
   - Continuity exists ... Replace stator.

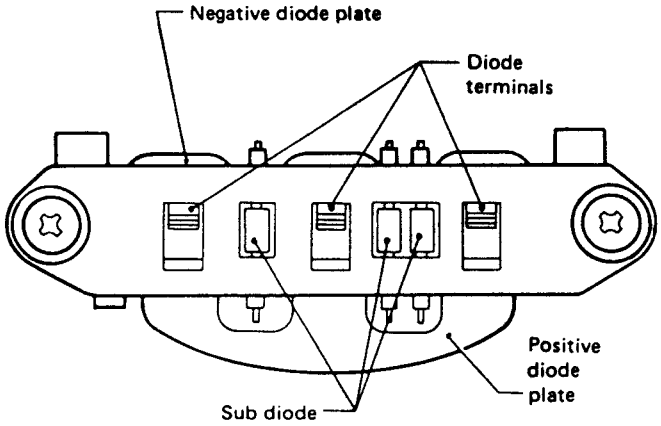
Diode Check

MAIN DIODES

- Use an ohmmeter to check condition of diodes as indicated in chart below.
- If any of the test results is not satisfactory, replace diode assembly.

	Ohmmeter probes		Continuity
	Positive ⊕	Negative ⊖	
Diodes check (Positive side)	Positive diode plate	Diode terminals	Yes
	Diode terminals	Positive diode plate	No
Diodes check (Negative side)	Negative diode plate	Diode terminals	No
	Diode terminals	Negative diode plate	Yes

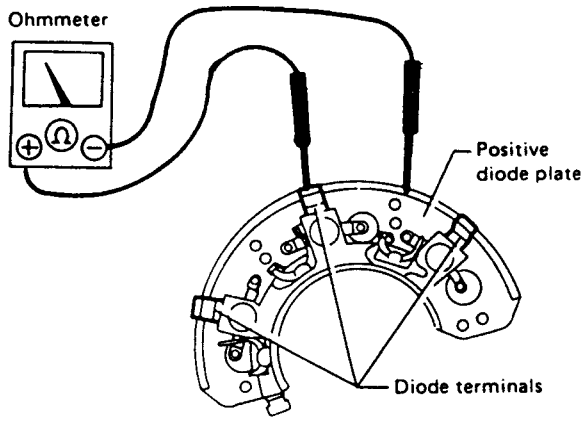
[MITSUBISHI make]



SEL767D

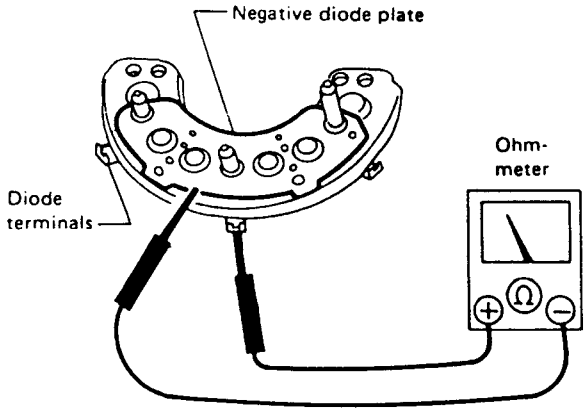
[HITACHI make]

Positive side



SEL319E

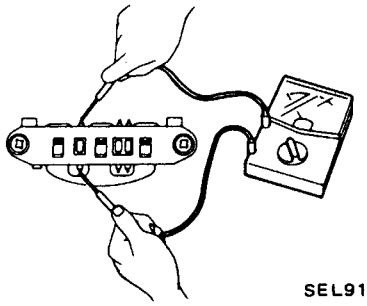
Negative side



SEL320E

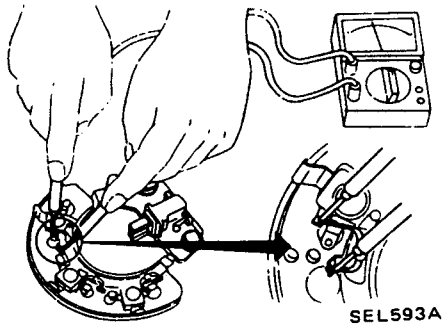
Diode Check (Cont'd)

[MITSUBISHI make]



SEL910A

[HITACHI make]



SEL593A

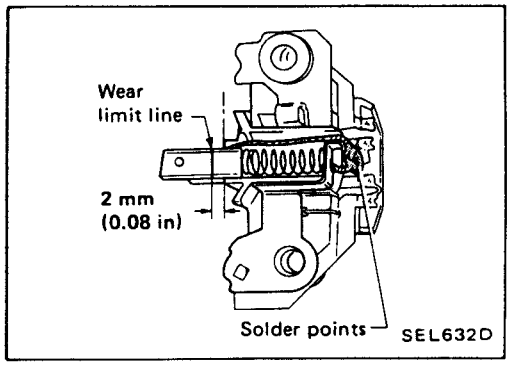
SUB-DIODES

- Attach ohmmeter's probe to each end of diode to check for continuity.
- Continuity is N.G. ... Replace diode assembly.

Assembly

Carefully observe the following instructions.

- When soldering each stator coil lead wire to diode assembly terminal, carry out the operation as fast as possible.

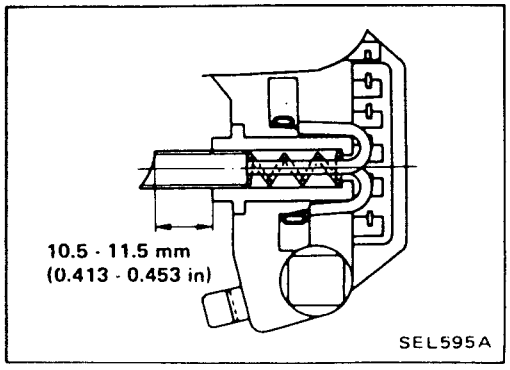


SEL632D

WHEN SOLDERING BRUSH LEAD WIRE

[MITSUBISHI make]

- Position brush so that its wear limit line protrudes 2 mm (0.08 in) beyond end face of brush holder.

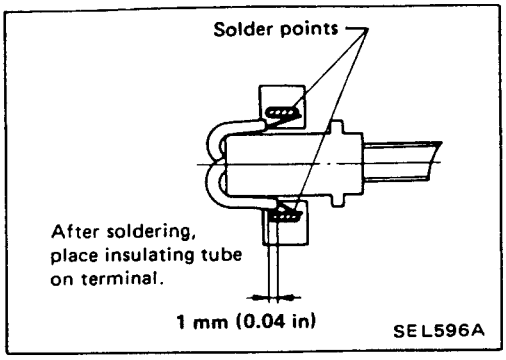


SEL595A

[HITACHI make]

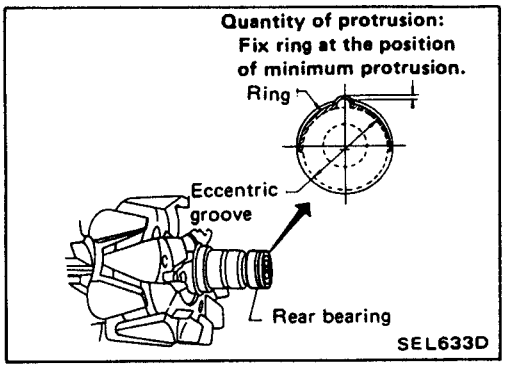
(1) Position brush so that it extends 10.5 to 11.5 mm (0.413 to 0.453 in) from brush holder.

Assembly (Cont'd)



(2) Coil lead wire 1.5 times around terminal groove. Solder outside of terminal.

When soldering, be careful not to let solder adhere to insulating tube as it will weaken the tube and cause it to break.

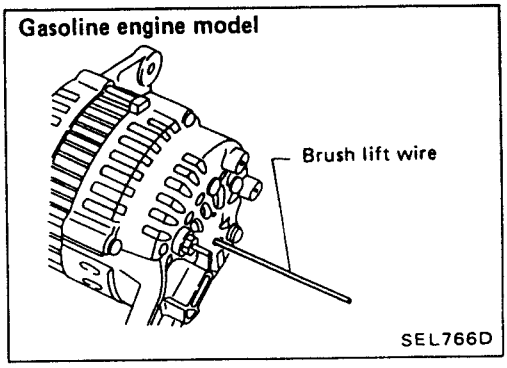


RING FITTING IN REAR BEARING
(Except for A1T22971, A5T20972, A2T40972 and A3T40472)

- Fit ring into groove in rear bearing so that it is as close to the adjacent area as possible.

CAUTION:

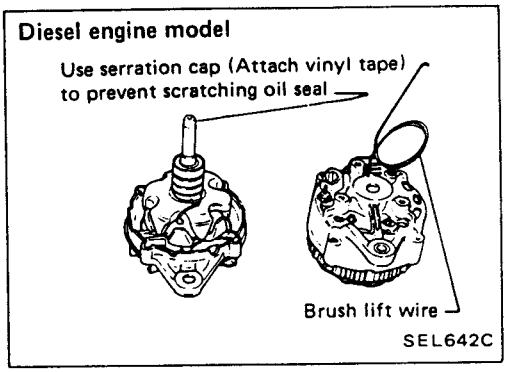
Do not reuse rear bearing after removal.

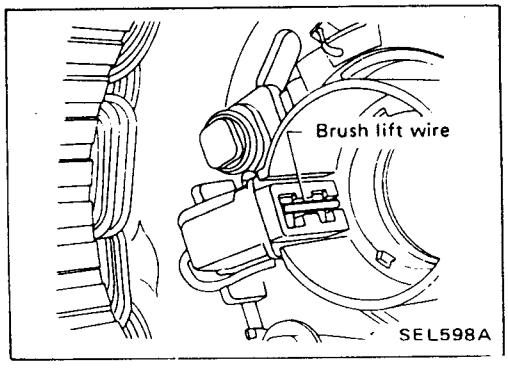


REAR COVER INSTALLATION

(1) Before installing front cover with pulley and rotor with rear cover, push brush up with fingers and retain brush, by inserting brush lift into brush lift hole from outside.

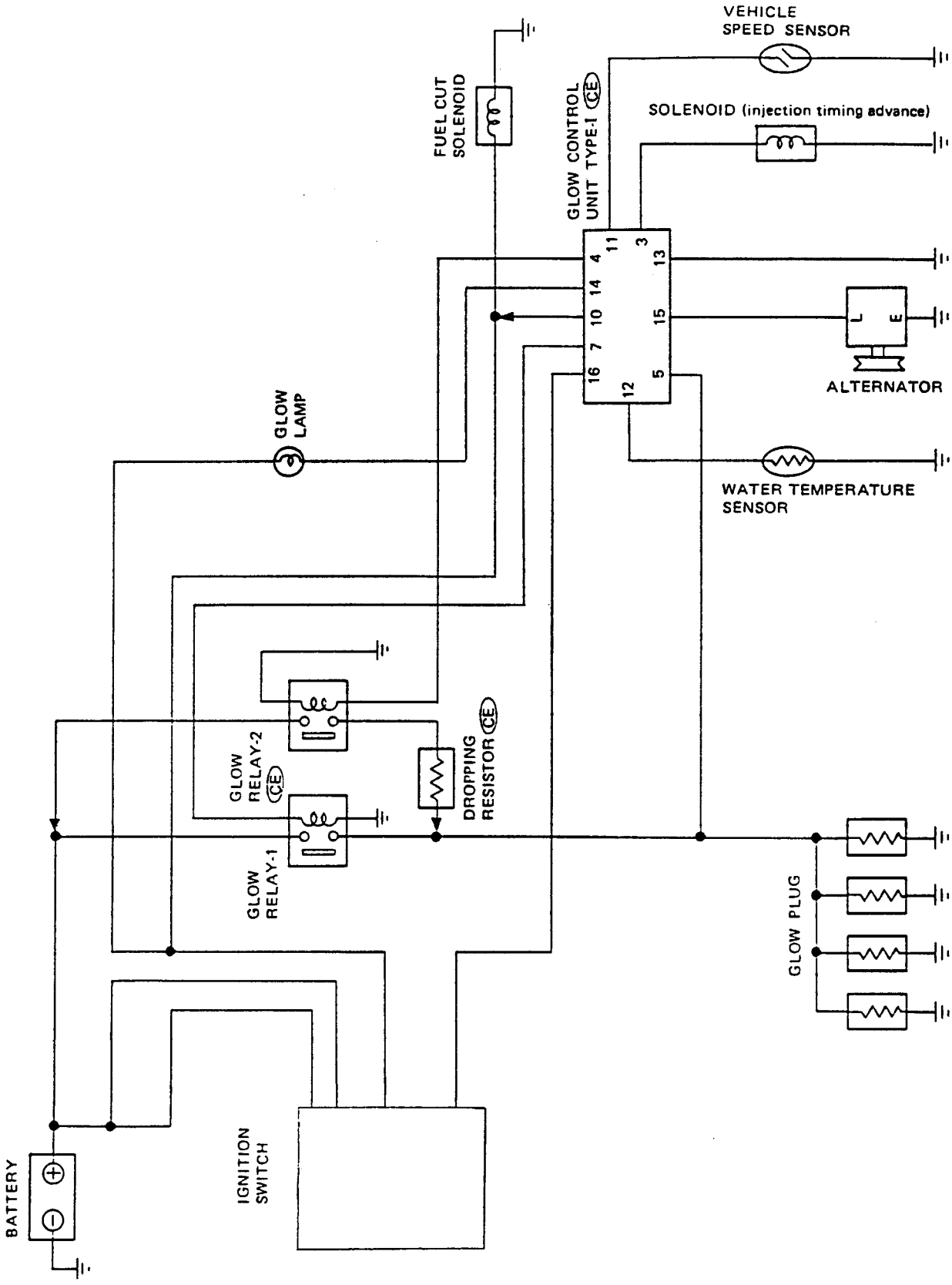
(2) After installing front and rear sides of alternator, pull out brush lift wire.





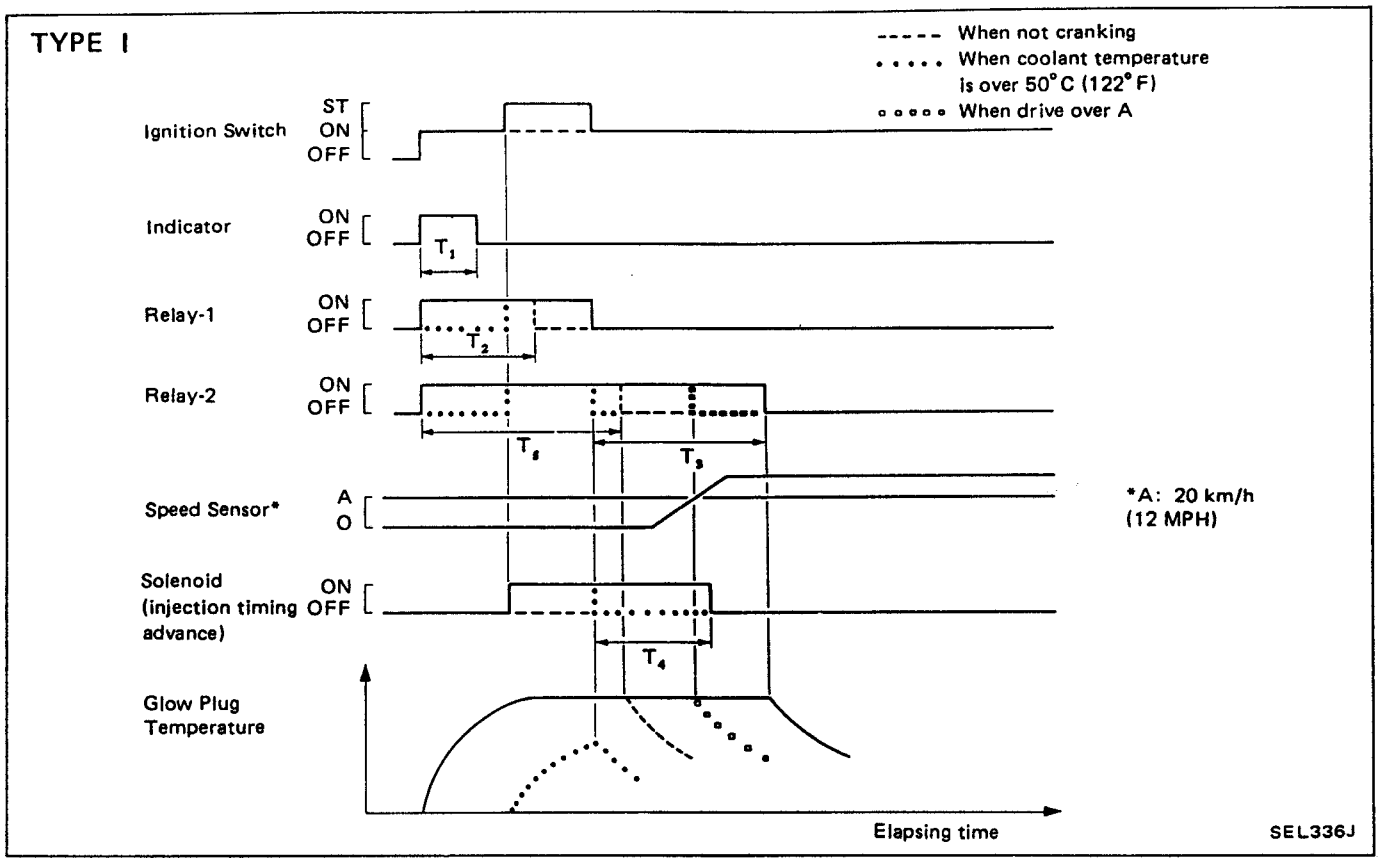
Type	A1T22971	LR135-61B	A5T20972	LR150-988	A2T40972	LR160-78B	A3T40472	LR160-109	LR150-428E	LR150-430C	LR170-408C	LR170-407E
	IC regulator built-in type											
	MITSUBISHI	HITACHI	MITSUBISHI	HITACHI	MITSUBISHI	HITACHI	MITSUBISHI	HITACHI				
Applied model	Z20S except Europe, Australia and Middle East		Z20S, Z24S Europe, Australia and Middle East		Z20S optional for Europe		Z20S, Z24S optional for except Europe		TD23 A/T Europe	TD23 M/T except Australia	TD27 M/T Australia TD23 M/T optional for except Australia	TD27 A/T Australia TD23 A/T optional for except Australia
Nominal rating V-A	12-35		12-50		12-60		12-70		12-50		12-70	
Ground polarity	Negative											
Minimum revolution under no-load (When 14 volts is applied) rpm	Less than 1,300	Less than 1,000	Less than 1,100	Less than 1,000	Less than 1,100	Less than 1,000	Less than 1,300	Less than 1,000				
Hot output current A/rpm	More than 27.5/2,500 More than 35/5,000		More than 40/2,500 More than 50/5,000		More than 50/2,500 More than 60/5,000		More than 50/2,500 More than 70/5,000	More than 21/1,300 More than 50/2,500 More than 70/5,000	More than 16/1,300 More than 42/2,500 More than 50/5,000		More than 26/1,300 More than 58/2,500 More than 68/5,000	
Regulated output voltage V	14.1 - 14.7	14.4 - 15.0	14.1 - 14.7	14.4 - 15.0	14.1 - 14.7	14.4 - 15.0	14.1 - 14.7	14.4 - 15.0				
Minimum length of brush mm (in)	7 (0.28)								6 (0.24)			
Brush spring pressure N (g, oz)	3.040 - 4.217 (310 - 430, 10.93 - 15.17)	2.501 - 3.383 (255 - 345, 8.99 - 12.17)	3.040 - 4.217 (310 - 430, 10.93 - 15.17)	2.501 - 3.383 (255 - 345, 8.99 - 12.17)	3.040 - 4.217 (310 - 430, 10.93 - 15.17)	2.501 - 3.383 (255 - 345, 8.99 - 12.17)	3.040 - 4.217 (310 - 430, 10.93 - 15.17)	2.501 - 3.383 (255 - 345, 8.99 - 12.17)				
Slip ring minimum outer diameter mm (in)	32.4 (1.276)	30.6 (1.205)	32.4 (1.276)	30.6 (1.205)	32.4 (1.276)	30.6 (1.205)	32.4 (1.276)	30.6 (1.205)				

Schematic



SEL446J

Description



When coolant temperature is lower than 50°C (122°F), the relay-1 and the relay-2 are turned on at the same time that the ignition switch is turned on. From this time, the "high-level" electric current flows through the glow plugs and heats them up quickly. After T_1 seconds have passed, the control unit turns off the indicator. The relay-1 automatically turns off after it has been on for T_2 seconds or the cranking time, whichever is longer.

The solenoid valve (for advance injection timing) is turned on at the time that the ignition switch is turned to "START". The relay-2 remains on for T_3 seconds and the solenoid valve remains on for T_4 seconds after the ignition switch has returned to "ON" from "START". The relay-2 allows the "low-level" current to flow through the glow plugs. The solenoid valve advances injection timing. These features improve the combustion performance of the engine after it has started.

When the coolant temperature is higher than 50°C (122°F), the relay-2 is turned on only during engine cranking.

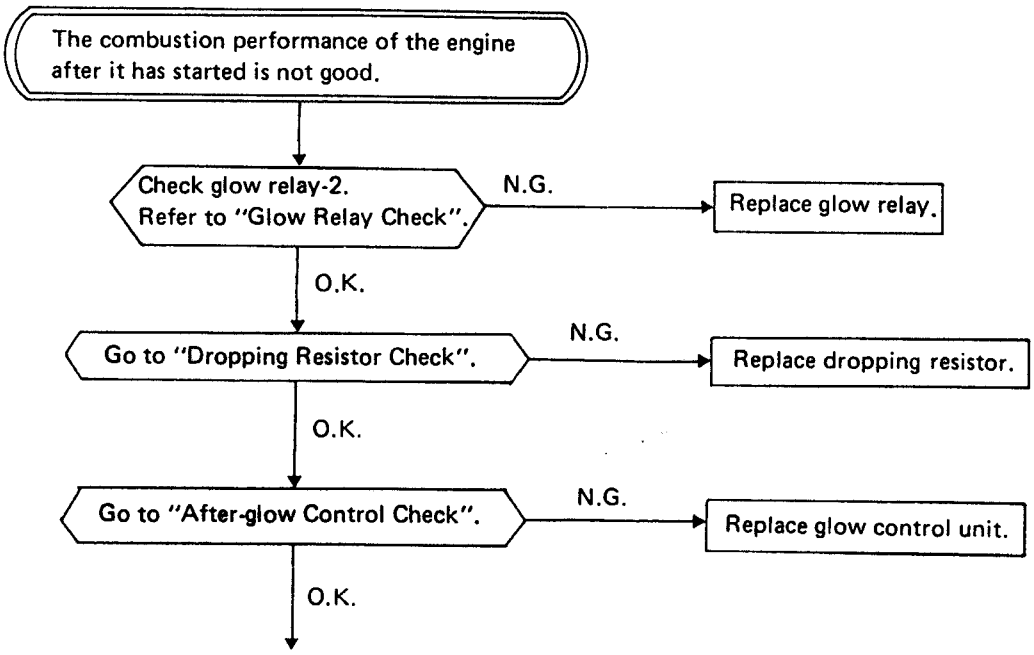
When the coolant temperature is higher than 10°C (50°F), the solenoid valve is turned on only during engine cranking.

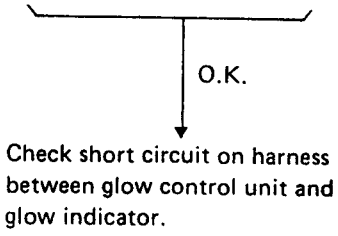
T_1:	approx. 2 - 6	[sec.]	(Varies with coolant temperature and glow plug terminal voltage.)
T_2:	approx. 3 - 11	[sec.]	(Varies with glow plug terminal voltage.)
T_3:	approx. 60 - 180	[sec.]	[When coolant temperature is below 50°C (122°F), varies with coolant temperature.]
	0	[sec.]	[When coolant temperature is over 50°C (122°F).]
T_4:	approx. 30	[sec.]	[When coolant temperature is below 10°C (50°F).]
	0	[sec.]	[When coolant temperature is over 10°C (50°F).]
T_5:	approx. 30	[sec.]	

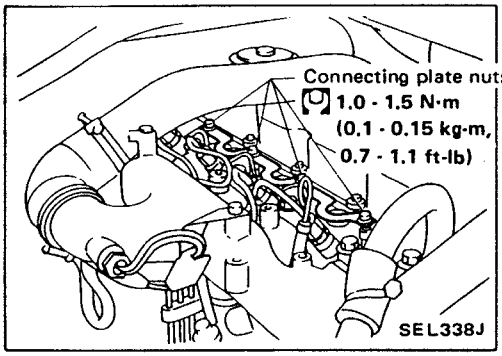
- When the ignition switch is repeatedly turned "ON" and "OFF", T_2 becomes shorter.

Trouble-shooting (Cont'd)

For models with system type I only



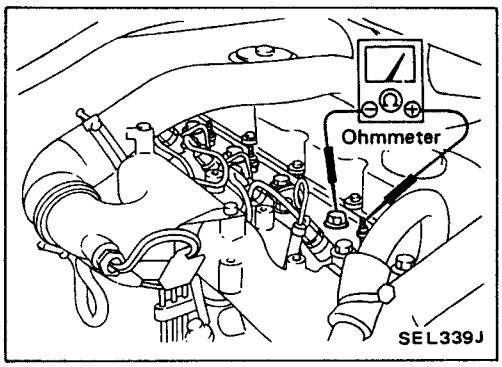




Check

GLOW PLUG CONNECTING PLATE NUTS CHECK

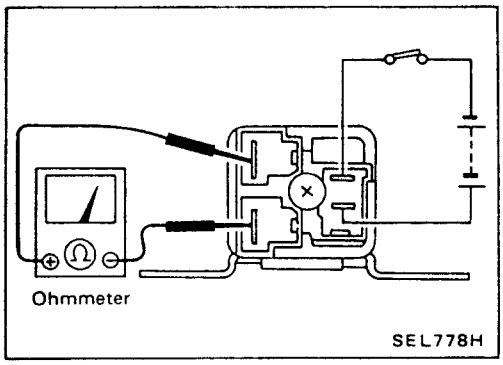
Check that all glow plug connecting plate nuts and harness nut are installed securely.



GLOW PLUG CHECK

Remove glow plug connecting plate and perform continuity test between each glow plug and cylinder head.

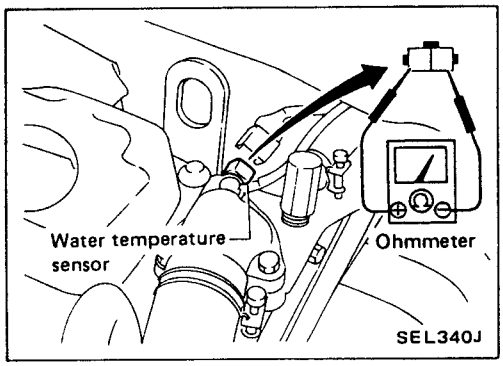
No continuity ... Replace glow plug.



GLOW RELAY CHECK

The glow relay is normally open.

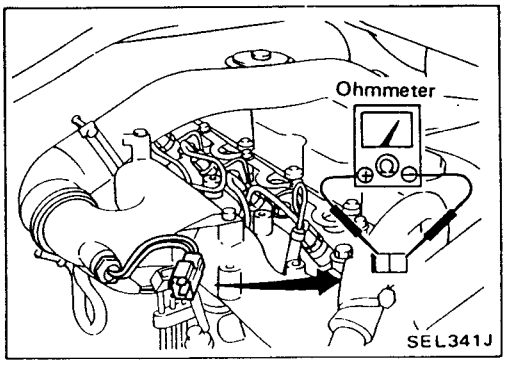
For check, refer to STANDARDIZED RELAY.



WATER TEMPERATURE SENSOR UNIT CHECK

Measure resistance to temperature as shown.

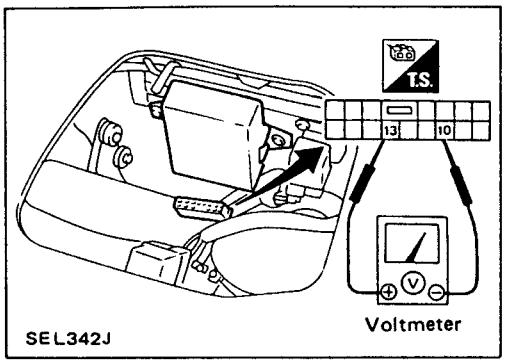
Coolant temp. °C (°F)	Resistance kΩ
−15 (5)	11.5
0 (32)	5.6
10 (50)	3.7
40 (104)	1.2



DROPPING RESISTOR CHECK (For type I only)

Measure resistance between terminals.

Resistance: approx. 0.3 Ω



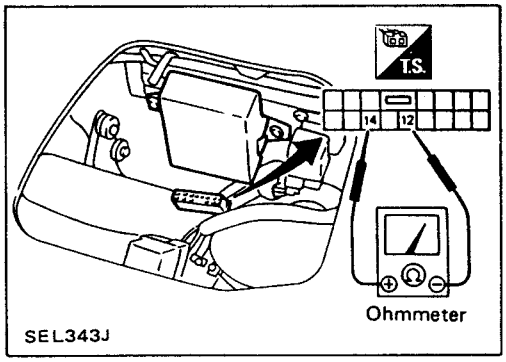
Control Unit Check (For Type I only)

POWER SUPPLY CIRCUIT CHECK

Disconnect harness connector from glow control unit and perform voltage check and continuity check.

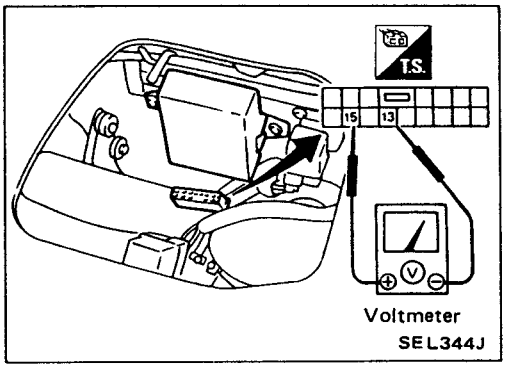
Voltmeter terminals		Ignition switch position		
(+)	(−)	OFF	ACC	ON
⑩	⑬	0V	0V	Approx. 12V

Ohmmeter terminals		Ignition switch OFF
(+)	(−)	
⑬	Body ground	Continuity exists



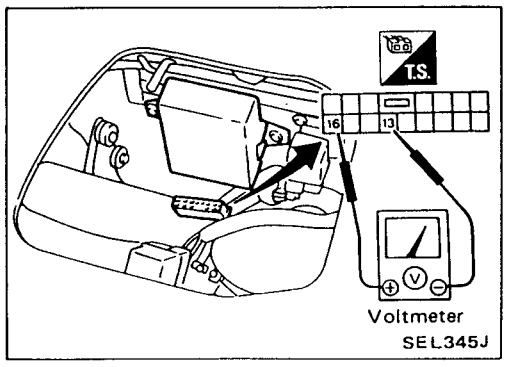
WATER TEMPERATURE SENSOR CIRCUIT CHECK

- Check continuity between terminals ⑫ and ⑭.
  Measure resistance to temperature approximately as shown in "Water temperature sensor check".



CIRCUIT TO ALTERNATOR'S "L" TERMINAL CHECK

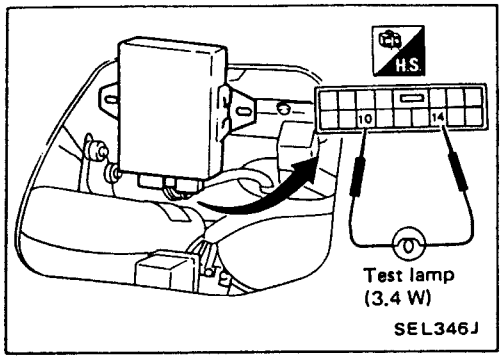
1. Turn ignition switch OFF.
2. Disconnect harness connector from glow control unit.
3. Disconnect harness connector from the alternator's "L" terminal.
4. Check terminal voltage between ⑮ and ⑬ when the ignition switch is turned to ON.
   Voltage: approx. 12V



START SIGNAL INPUT CHECK

1. Turn ignition switch OFF.
2. Disconnect harness connector from the starter motor's "S" terminal.
3. Check terminal voltage between ⑯ and ⑬ when the ignition switch is at "START".
   Voltage: approx. 12V

Control Unit Check (For Type I only) (Cont'd)

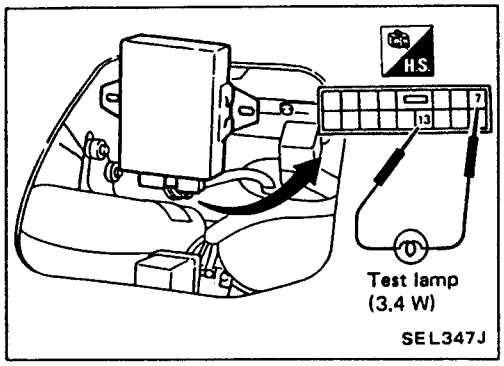


GLOW INDICATOR CONTROL CHECK

1. Turn ignition switch OFF.
2. Leave harness connector joined to glow control unit.
3. Connect test lamp to glow control unit as shown.
4. Turn ignition switch to ON and measure the time the test lamp stays lit.

Time the test lamp should stay lit.

Approx. 2 - 6 seconds.
(Varies with coolant temperature and glow plug terminal voltage.)



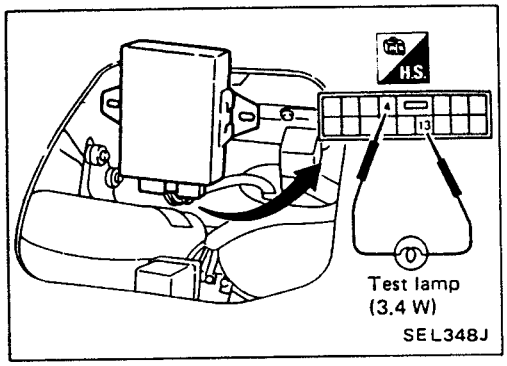
PRE-GLOW CONTROL CHECK

1. Turn ignition switch OFF.
2. Leave harness connector joined to glow control unit.
3. Connect test lamp to glow control unit as shown.
4. Turn ignition switch to ON and measure the time the test lamp stays lit.

Time the test lamp should stay lit.

Approx. 3 - 11 seconds.
(Varies with glow plug terminal voltage)

The time will be shortened if ignition switch is OFF only a short time.
Therefore, when measuring the time, leave ignition switch OFF for more than 5 minutes, and then turn ignition switch to ON.



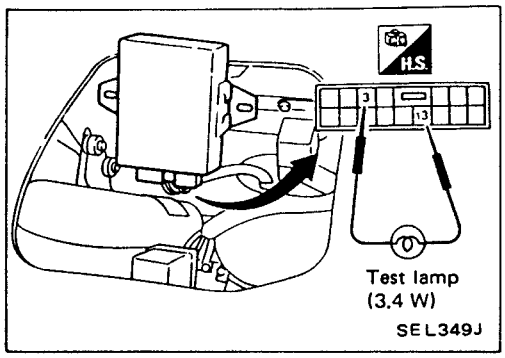
AFTER-GLOW CONTROL CHECK

1. Connect test lamp to glow control unit as shown.
2. Disconnect the harness connector from starter motor "S" terminal.
3. Make sure that test lamp comes on when ignition switch is turned to START.
4. Measure the time the test lamp stays lit when ignition switch is turned to ON from START.

Time the test lamp should stay lit.

Below 50°C (122°F)	Approx. 60 - 180 seconds (Varies with coolant temperature)
Over 50°C (122°F)	0 second

Control Unit Check (For Type I only) (Cont'd)

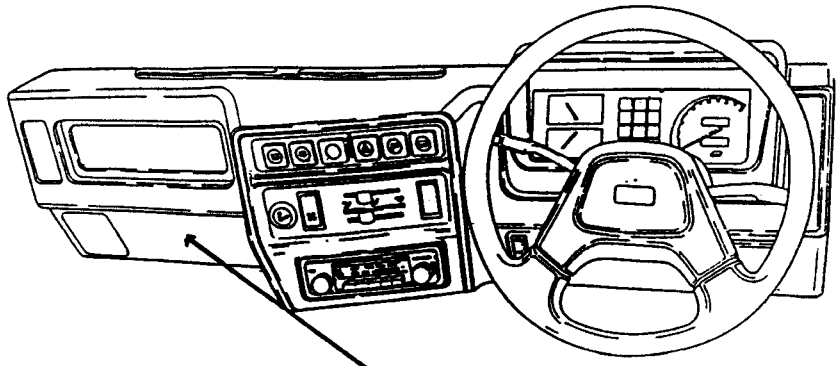


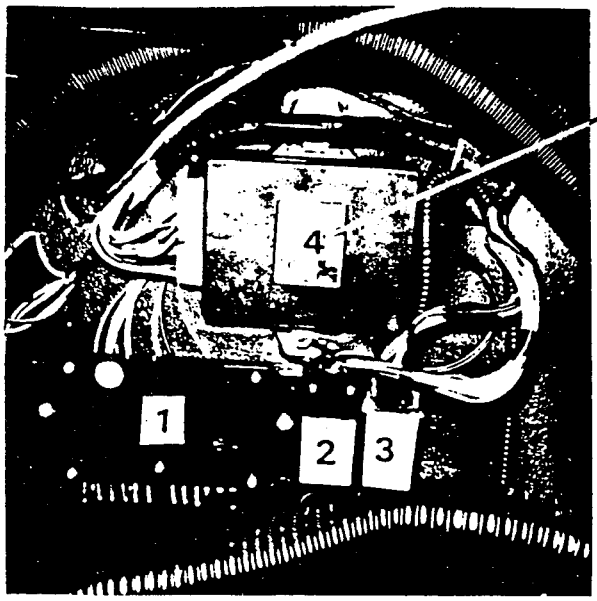
SOLENOID (injection timing advance) CONTROL CHECK

1. Connect test lamp to glow control unit as shown.
2. Disconnect the harness connector from starter motor "S" terminal.
3. Make sure that test lamp comes on when ignition switch is turned to START.
4. Measure the time the test lamp stays lit when ignition switch is turned to ON from START.

Time the test lamp should stay lit.

Below 10°C (50°F)	**Approx. 30 seconds**
Over 10°C (50°F)	**0 second**





LOCATION
OF GLOW CONTROL
UNIT

LTI
SERVICE

Fairway

WORKSHOP MANUAL

SECTION 8a

WIRING DIAGRAMS, VEHICLE ELECTRICS

SECTION EL

CONTENTS

Key to wiring diagram

Item No	Description	Location
A1	Battery	1
A2	Horn	3
A3	Radio	127
A4	Speaker right	123
A5	Speaker left	123
A6	Alternator	6
B1	Link lead (manual transmission)	8-12
C1	Instrument stabiliser	15
C2	Wiper delay unit	22-27
C3	Central door lock.cont.box	133-135
C4	Clock	76-78
C5	Control box door locking	61-70
C6	Taxi meter connector block-bulkhead	52-53
C7	Taxi meter connector block-devision	57-58
C8	Glow control box	26-32
C9	Kickdown control box (auto transmission)	51
D1	Diode	45
D2	Diode	49
D3	Temperature gauge	16
D4	Fuel gauge	17
D5	Diode	19-20

Item No	Description	Location
F1	Fuse block B6	21
F2	Fuse block B2	29
F3	Fuse block B1	60
F4	Fuse block B7	31
F5	Fuse block C6	33
F6	Fuse block C1	40
F7	Fuse block B5	68
F8	Fuse block C1	56
F9	Fuse block B3	72
F10	Fuse block B4	101
F11	Fuse block A2	85
F12	Fuse block A1	82
F13	Fuse block A4	87
F14	Fuse block A3	89
F15	Fuse block A6	91
F16	Fuse block A5	93
F17	Fuse block A7	96
F18	Fuse block C3	99
F19	Fuse block C7	109
F20	Fuse block C4	136
F21	Fuse block C5	127
F22	Line fuse (pick up for two way radio)	129
H1	Diesel heater plugs	9-15
H2	Cigar lighter	58
H3	Heated rear screen	103

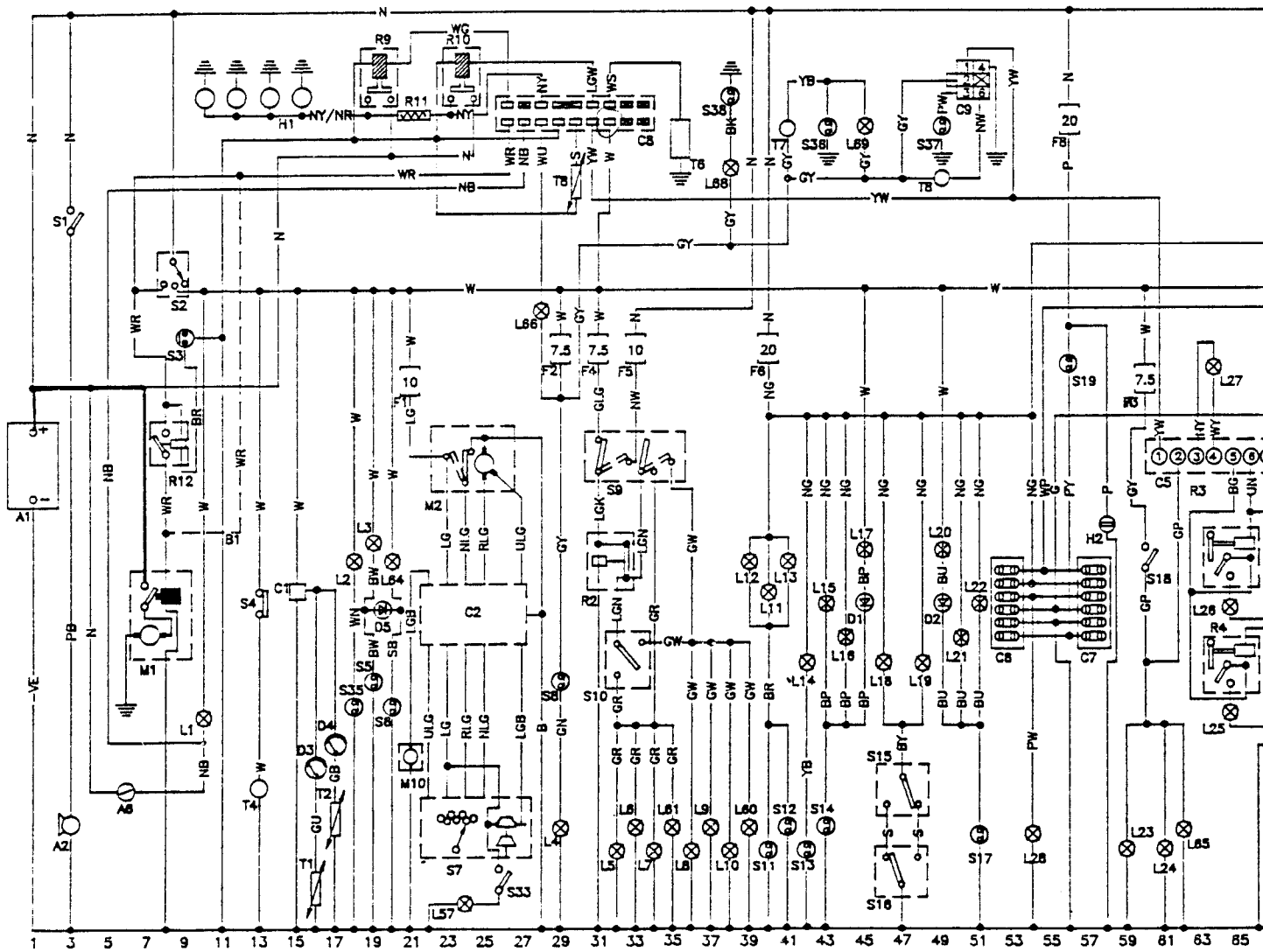
Item No	Description	Location
S1	Horn push	3
S2	Ignition switch	8-10
S3	Gearbox inhibitor switch	9
S4	Fuel cut off switch	13
S5	Low brake fluid switch	19
S6	Handbrake on w/light switch	20
S7	Screen wash/wipe switch	22-27
S8	Reverse light switch	29
S9	Hazard switch	31-35
S10	Indicator switch	32-33
S11	Courtesy switch R/L front	40
S12	Courtesy switch L/H front	41
S13	Drivers interior light switch	42
S14	Courtesy switch L/H rear	43
S15	Interior light switch-passenger	46-48
S16	Interior light switch-driver	46-48
S17	Courtesy switch R/H rear	51
S18	Brake light switch	60
S19	Hire sign switch	56
S20	Front heater switch	71
S21	Rear heater on-off sw-driver	74-76
S22	Rear heater on-off sw-passenger	74-76
S23	Rear heater high-low speed sw	74
S24	Rear screen heater switch	101
S25	Main light switch	86-87
S26	Headlamp dip switch	86-87
S27	Rear fog guard switch	96
S28	Front fog lamp switch	98
S29	Window lift switch L/H front	106-108
S30	Window lift switch R/H front	110-112
S31	Mirror switch	113-122
S32	Micro switch-drivers door	133
S33	Low wash level switch	26
S34	Panel light switch	80
S35	Oil pressure switch	18
S36	Overdrive switch (auto transmission)	43
S37	Kickdown switch (auto transmission)	49
S38	Sedimentor switch	38
S39	Key operated central door lock switch	133
S40	Drivers operated central door lock sw	133

Colour abreviation

B - Black
G - Green
K - Pink
N - Brown
O - Orange
P - Purple
R - Red
S - Slate Grey
U - Blue
W - White
Y - Yellow

Wire Identification

First letter - primary colour
Second letter - tracer colour
(lighter shade preceded by L)

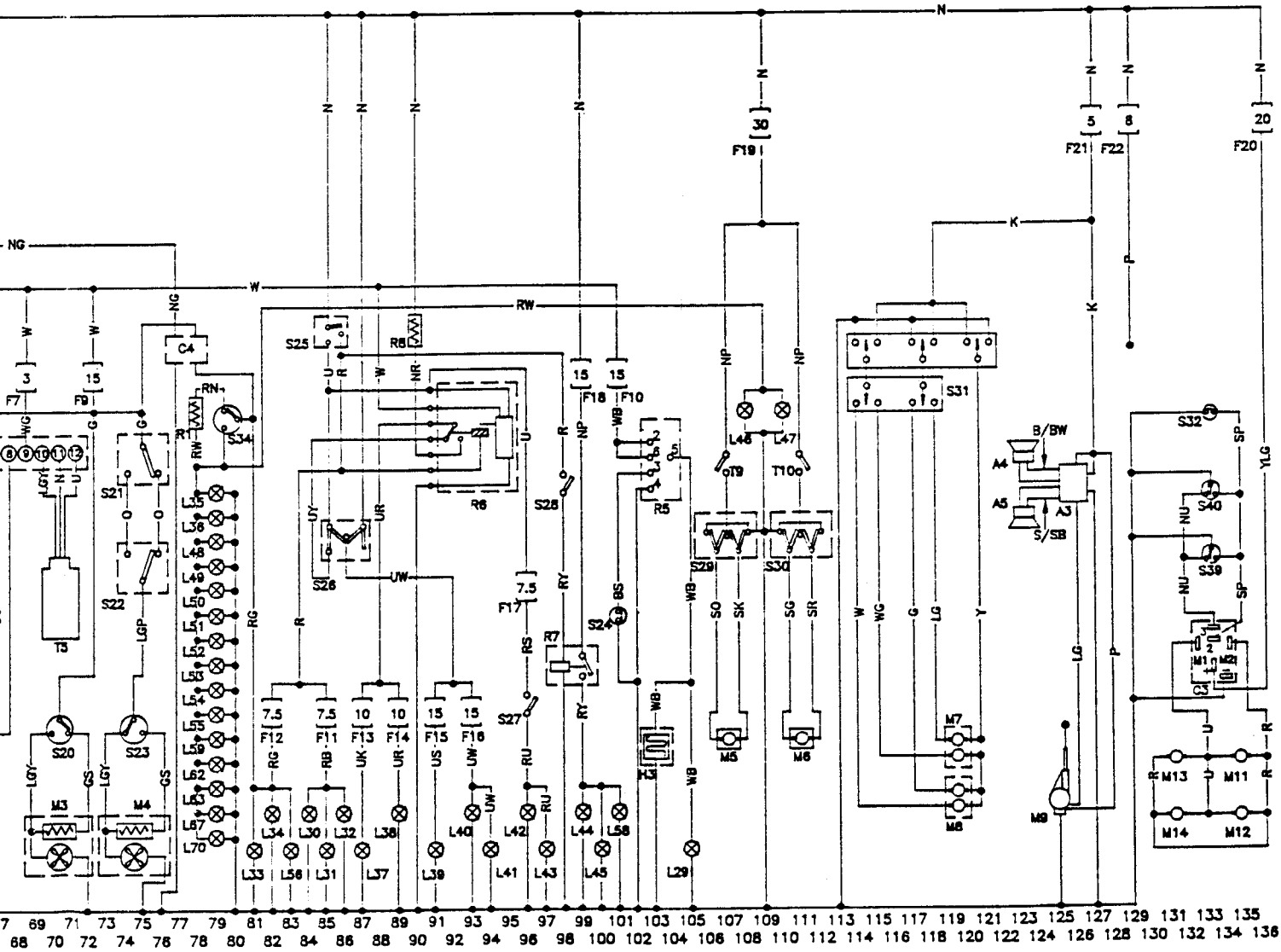


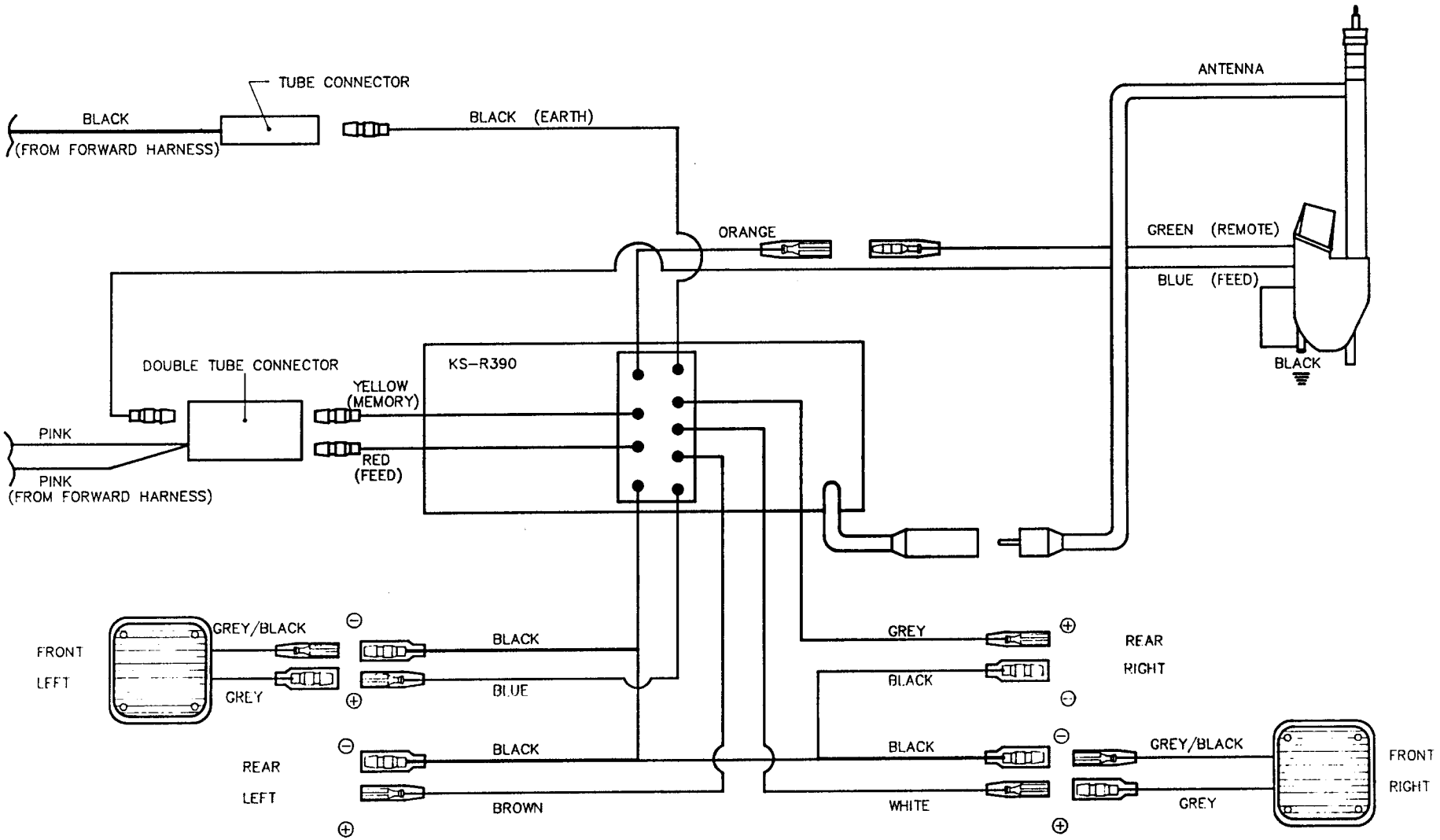
Description	Location
Ignition W/light	10
Oil pressure W/light	18
Low brake fluid W/light	19
Reverse light	29
Indicator light L/H rear	32
Indicator light L/H front	33
Indicator light W/light L/H side	34
Indicator light R/H rear	36
Indicator light R/H front	37
Indicator W/light R/H side	38
Courtesy light-roof console	40
Courtesy light-L/H side facia	39
Courtesy light-R/H side facia	41
Drivers interior light	42
Courtesy light-L/H rear	43
Puddle light-L/H rear	44
L/H rear door not closed W/light	45
Interior light-passenger L/H rear	46
Interior light-passenger R/H rear	48
R/H rear door not closed W/light	49
Puddle light R/H rear	50
Courtesy light R/H Rear	51
Brake light L/H side	59
Brake light R/H side	61
Door locked W/light L/H rear	64
Door locked W/light R/H rear	64
Rear door not closed W/light	63
Hire sign light	54
Rear screen heater W/light	105
No. plate light	84
Tail light L/H side	85
Side lamp L/H front	86
Tail light R/H side	81
Side light R/H front	82
Instrument cluster illumination L/H	79
Instrument cluster illumination R/H	79
Dipped beam L/hand	87
Dipped beam R/hand	89
Main beam L/hand	91
Main beam R/hand	93

Item No	Description	Location
L41	Main beam W/light	94
L42	Rear fog guard	96
L43	Rear fog guard W/light	97
L44	Fog lamp L/H side	99
L45	Fog lamp R/H side	100
L46	Window lift switch illumination L/side	108
L47	Window lift switch illumination R/side	110
L48	Rear fog & heated rear screen sw illumination	79
L49	Drivers interior light switch illumination front	79
L50	Hire sign switch illumination	79
L51	Front heater switch illumination	79
L52	Rear heater drivers on-off switch illumination	79
L53	Rear heater passenger on-off sw illumination	79
L54	Rear heater high-low speed switch illumination	79
L55	Drivers interior light switch illumination rear	79
L56	Side lights on W/light	83
L57	Low wash W/light	24
L58	Fog lamp W/light	101
L59	Cigar lighter illumination	79
L60	Indicator repeater R/H side	39
L61	Indicator repeater L/H side	35
L62	Autogear selector illumination	79
L63	Ashtray illumination	79
L64	Handbrake on W/light	20
L65	High level stop lamp	62
L66	Glow plug W/light	28
L67	Panel light switch illumination	79
L68	Sedimentor W/light	38
L69	Overdrive W/light	45
L70	Drivers cent.door lock switch illumination	79

Item No	Description	Location
M1	Starter motor	6-9
M2	Front screen wiper motor	22-26
M3	Front heater	69-72
M4	Rear heater	73-76
M5	Window lift motor L/H front	107
M6	Window lift motor R/H front	111
M7	Electrically operated door mirror motorsL/side	119
M8	Electrically operated door mirror motors R/side	119
M9	Electrical aerial	125
M10	Front screen wash motor	21
M11	Central door locking motor R/H side front	135
M12	Central door locking motor R/H side rear	135
M13	Central door locking motor L/H side front	131
M14	Central door locking motor L/H side rear	131
R1	Resistor panel light	78
R2	19 FL flasher unit	31-32
R3	R/H rear door lock relay	63-65
R4	L/H rear door lock relay	63-65
R5	Heated rear screen timer	102-104
R6	Dip relay	91-94
R7	Front fog lamp relay	98-99
R8	Dim dip resistor	90
R9	Glow plug relay - 1	19-20
R10	Glow plug relay - 2	23-24
R11	Resistor induction manifold	21
R12	Inhibitor Relay (auto trans)	8-9
T1	Temperature transmitter	16
T2	Fuel gauge transmitter (tank unit)	17
T4	Fuel cut off solenoid	13
T5	Sender unit (gearbox)	70
T6	Solenoid (injection timing advance)	35
T7	Overdrive cancel solenoid (auto trans)	41
T8	Kick down solenoid (auto trans	49
T9	Thermal overload switch L.H.	107
T10	Thermal overload switch R.H.	111

SECTION 8A ELECTRICS CIRCUIT WIRING DIAGRAM - FAIRWAY

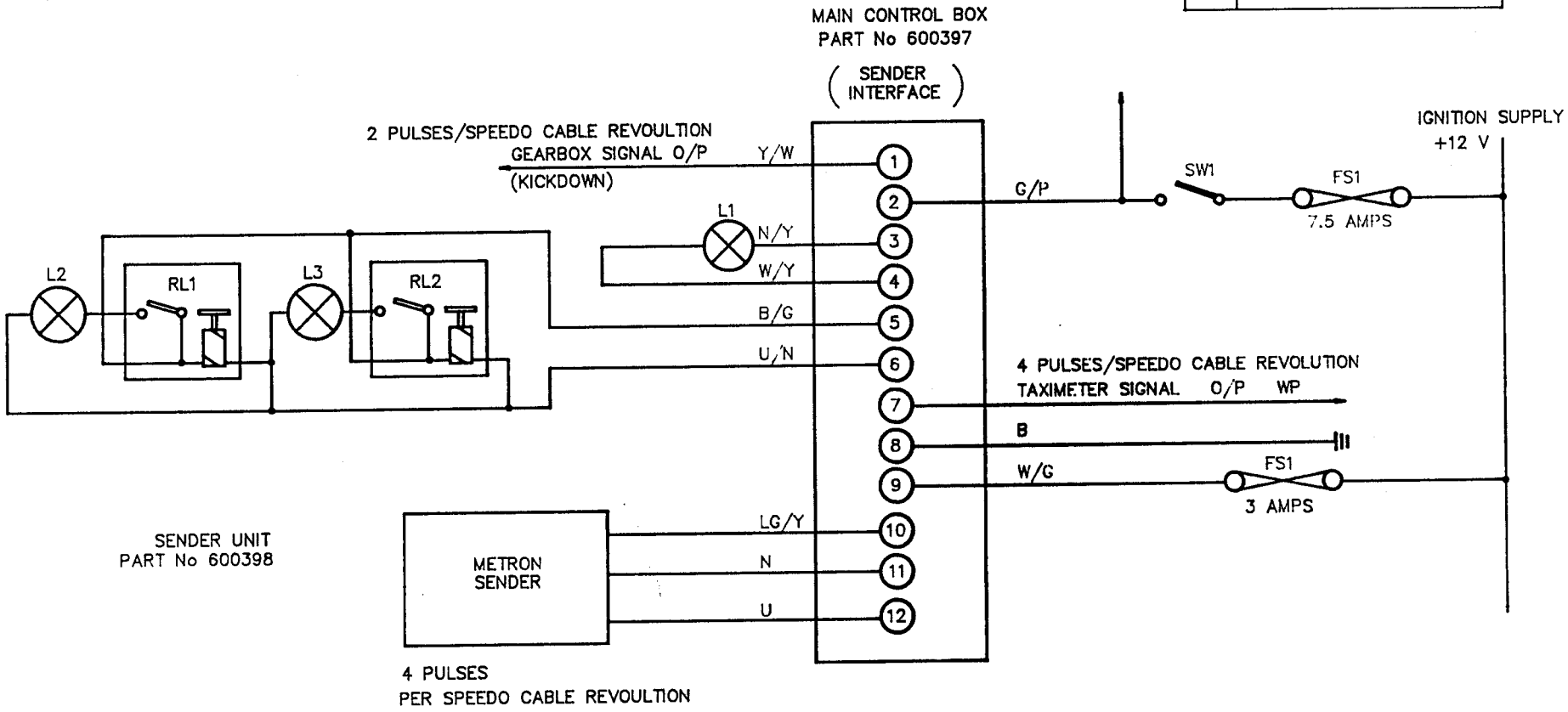




WIRING DIAGRAM - CASSETTE CAR RECEIVER

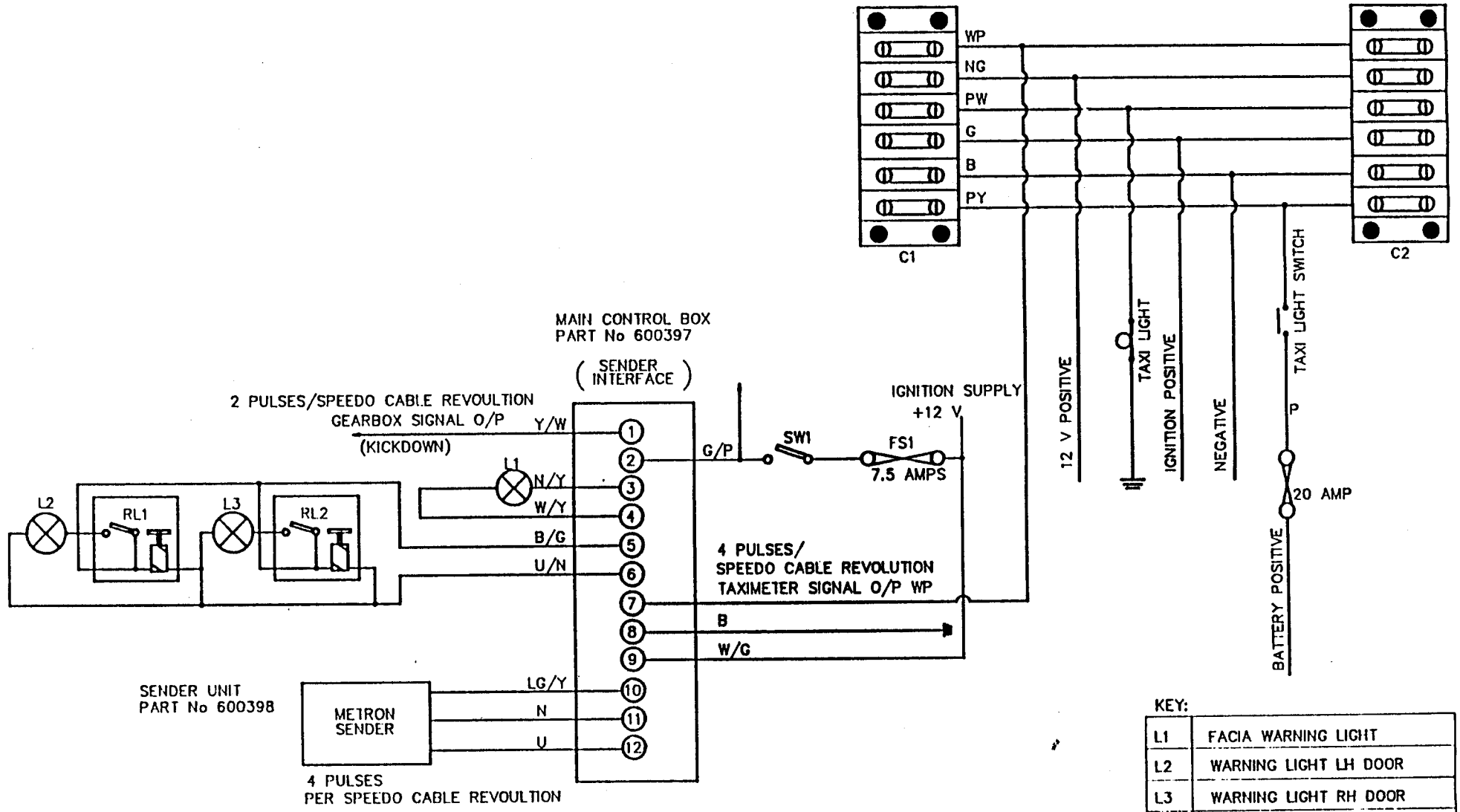
KEY:

L1	FACIA WARNING LIGHT
L2	WARNING LIGHT LH DOOR
L3	WARNING LIGHT RH DOOR
RL1	LH DOOR LOCK SOLENOID
RL2	RH DOOR LOCK SOLENOID
SW1	BRAKE LIGHT SWITCH



ELECTRONIC CONTROLS : AUTO GEARBOX KICKDOWN
Q.G.S. SYSTEM
ELECTRONIC DOOR LOCK
TAXIMETER DRIVE

WIRING DIAGRAMS FOR ELECTRONIC CONTROL



KEY:

L1	FACIA WARNING LIGHT
L2	WARNING LIGHT LH DOOR
L3	WARNING LIGHT RH DOOR
RL1	LH DOOR LOCK SOLENOID
RL2	RH DOOR LOCK SOLENOID
SW1	BRAKE LIGHT SWITCH
C1	CONNECTOR BLOCK – FACIA
C2	CONNECTOR BLOCK – DIVISION

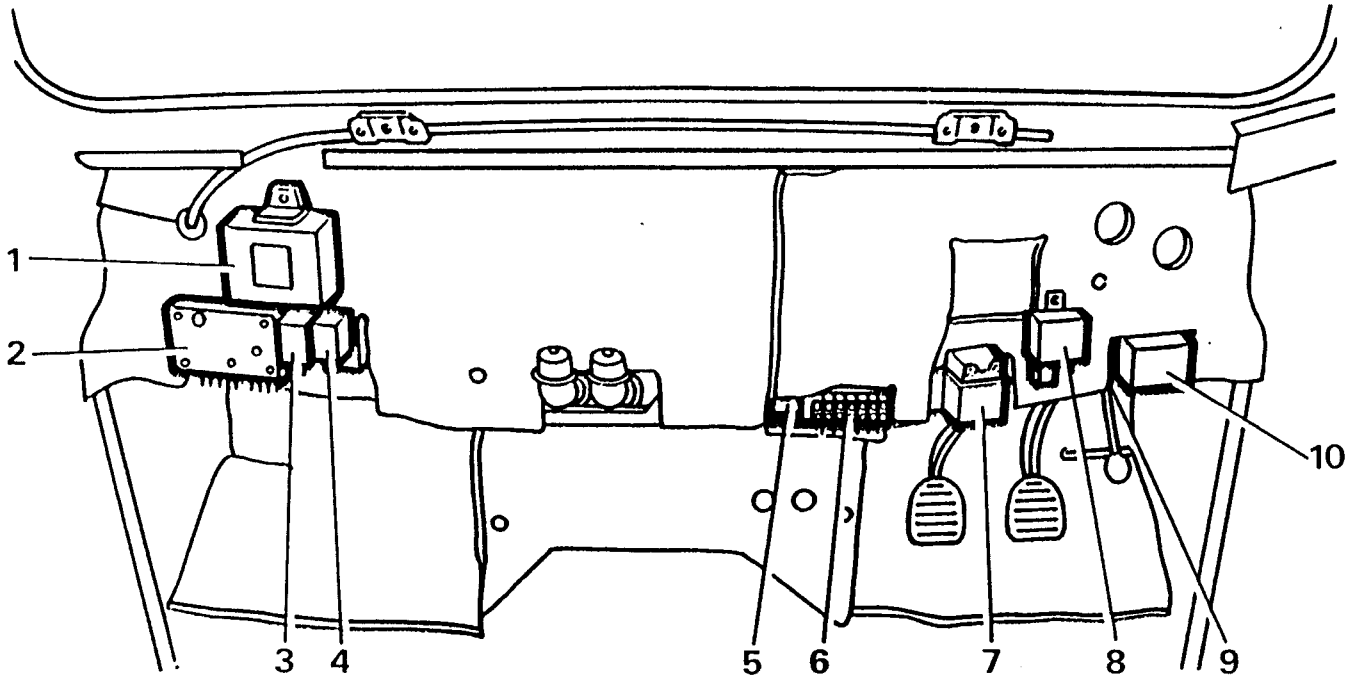
ELECTRONIC CONTROLS

AUTO GEARBOX KICKDOWN
Q.G.S. SYSTEM
ELECTRONIC DOOR LOCK
TAXIMETER DRIVE

NOTE : ALL CABLES FROM TERMINAL 7 TO CONNECTOR BLOCKS INCORPORATED IN MAIN HARNESS

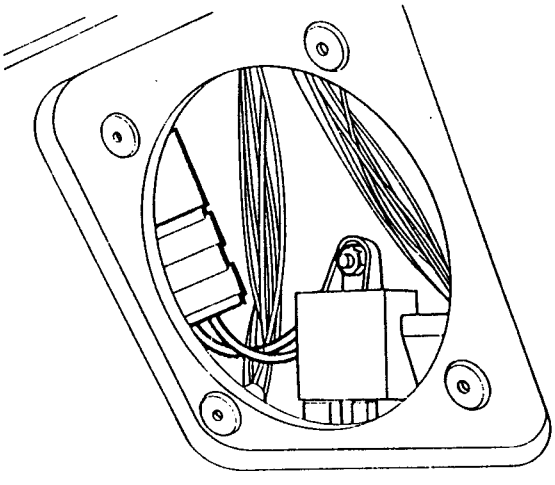
WIRING DIAGRAM FOR TAXIMETER CONNECTOR BLOCKS

Driver's compartment



Vehicle bulkhead

1 Quick glow control.
2 Main control unit incorporating security rear door locking.
3 Heated rear screen timer.
4 Dim Dip relay.
5 Resistor, 2 level panel lights.
6 Meter terminal block.
7 Windscreen wash wipe relay.
8 Central door locking control box.
9 Kick down switch (automatic vehicles only).
10 Kick down relay (automatic vehicles only).



Hazard warning and direction indicator relay

To gain access to this relay first remove right hand speaker grille

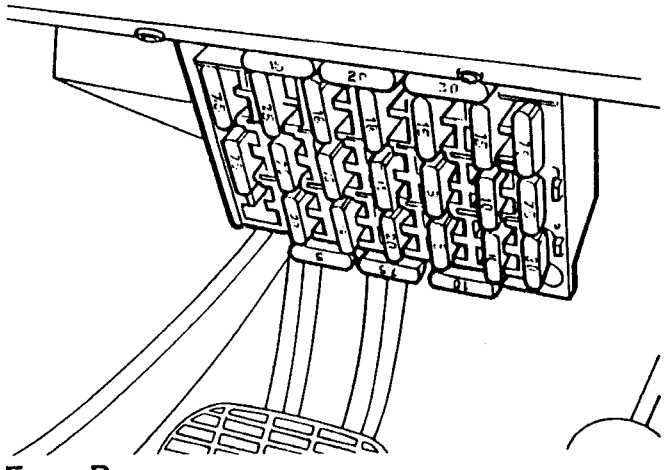
FUSE BOX LAYOUT & RATINGS

	1	2	3	4	5	6	7
A	R/H SIDE LAMPS 7·5A	L/H SIDE LAMPS 7·5A	R/H DIP 10A	L/H DIP 10A	R/H HEAD 15A	L/H HEAD 15A	REAR GUARDS 7·5A
B	STOP LAMPS 7·5A	REVERSE LAMPS 7·5A	HEATERS 15A	H/R SCREEN 15A	DOOR LOCK 3A	WIPER & WASH 10A	INDICATORS 7·5A
C	INT-LIGHTS METER & CLOCK 20A	HIRE SIGN & CIG LIGHTER 20A	FOG LAMPS 15A	CENT. LOCK 20A	RADIOS & DOOR MIRRORS 5A	HAZARDS 10A	AUX 30A

FOR FURTHER INFORMATION PLEASE REFER TO THE OWNER MANUAL

Fuse label

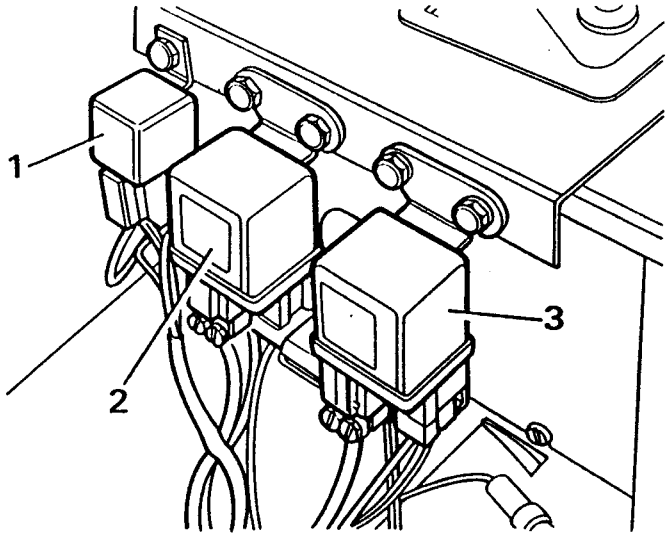
The fuse label is located on the back of the driver's sunvisor.

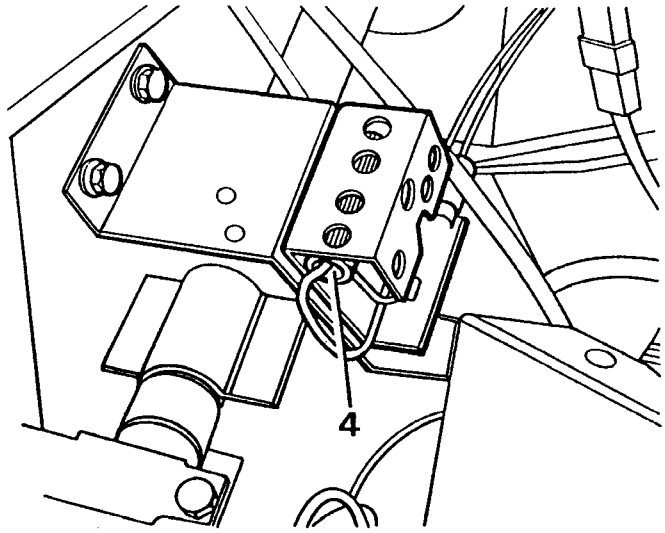


Fuse Box

The fuse box is located under the fascia above the brake pedal.

Engine compartment





These three relays are located on the right hand side of the pedal box when viewed from the driver's seat.

1 Inhibitor switch relay (automatic vehicles only).

2,3 Quick glow system relays (heater plugs).

4 Dim dip system resistor. This is located on the other side of the pedal box.

Introduction

All four access doors can be locked from the inside of the vehicle by means of the central locking switch located forward of the gear shift lever on the centre console. The doors are then locked against access from outside. Activation of the system is audible on its operation.

The doors may be locked or unlocked simultaneously by inserting the key in the driver's door and turning it anti-clockwise to lock, clockwise to unlock.

A door locking motor is fitted to each door and connected to a control box located under the fascia in front of the steering wheel. A 20 amp fuse is incorporated to protect the system, see figure 1.

A key operated microswitch is incorporated in the driver's door locking motor. When the key is turned either to lock or unlock the door the microswitch is activated and sends a signal to the control box which in turn energises all four door locking motors.

In addition a microswitch is fitted to the inside of the driver's door and is activated by the door release lever linkage. On operating the door release lever the central locking motors will be energised to the unlocked mode even if the central locking switch on the centre console has been set at the locked position.

If any fault occurs in the central locking system the following tests should be used to eliminate the various components.

Test 1. Fuse

If the 20 amp fuse protecting the circuit blows the central locking system will be completely inoperative. However all four doors can still be locked or unlocked manually by inserting the key in the individual door locks.

The fuse box is fitted under the fascia light above the brake pedal and the fuse ratings and positions are shown on a label on the back of the driver's sun visor. If on checking the fuse, the central locking system is still inoperative carry on to Test 2.

Test 2. Key operated central door lock switch (drivers door)

1. Remove the driver's door casing.

2. Disconnect the black and white plugs of the system and using a slave battery connect a test lamp circuit as shown in figure 2. Ensure that the positive lead from the battery is connected to the brown lead of the white plug.

Figure 2

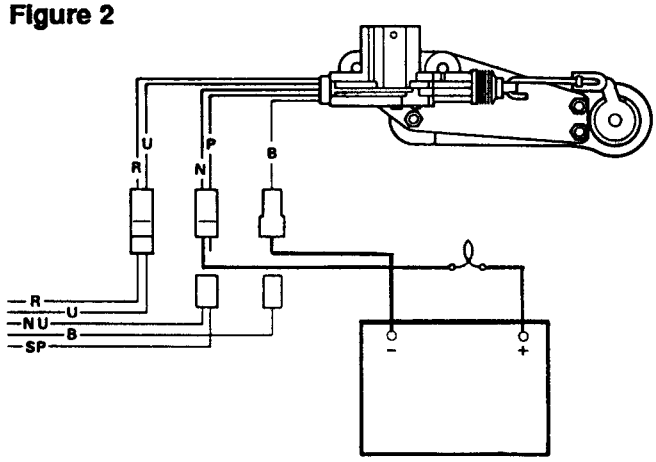
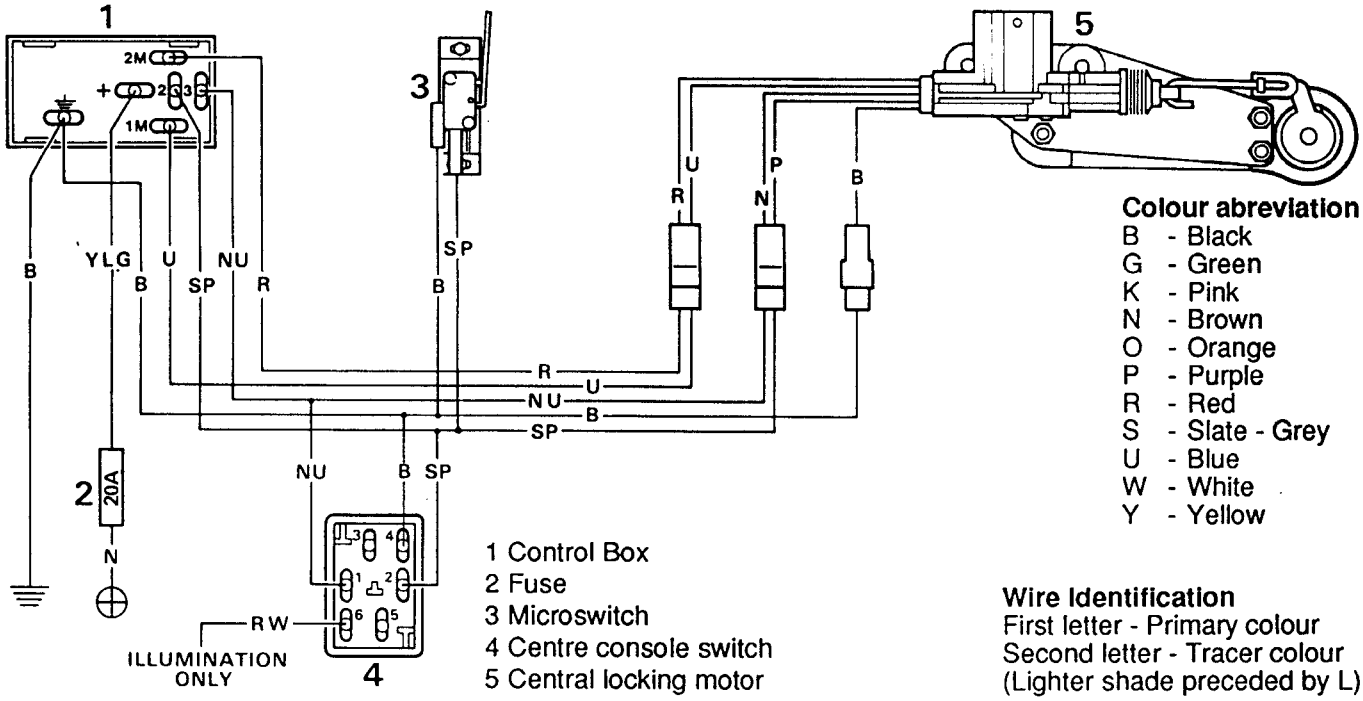


Figure 1



Colour abreviation

B - Black
G - Green
K - Pink
N - Brown
O - Orange
P - Purple
R - Red
S - Slate - Grey
U - Blue
W - White
Y - Yellow

Wire Identification

First letter - Primary colour
Second letter - Tracer colour
(Lighter shade preceded by L)

3. If the test lamp does not illuminate this would indicate a faulty key operated switch. However if the test lamp does illuminate this would indicate that the door locked side of the switch is functioning. The door unlocked side of the switch must still be checked as instructed in the next operation.

4. Connect the positive lead from the battery to the purple lead of the white plug.

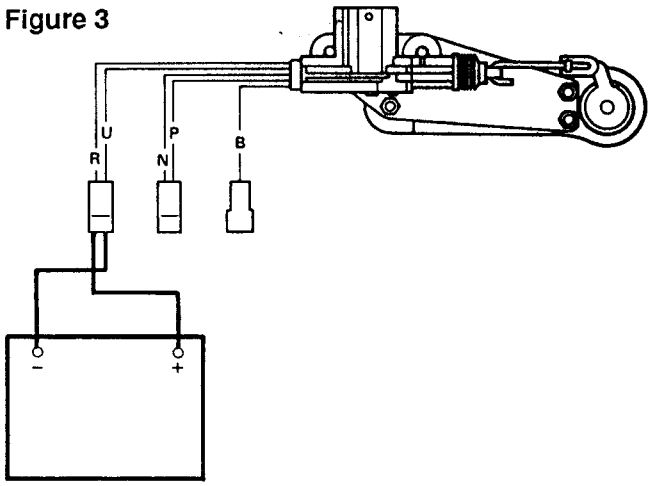
5. If the test lamp does not illuminate this would indicate a faulty key operated switch. If the test lamp illuminates then this would indicate a fault in one of the other components in the central locking system.

Test 3. Central door locking motor (all doors)

1. Disconnect the blue plug from the door locking motor circuit.

2. Connect the positive lead from the slave battery to the red lead in the plug and the negative lead to the blue lead of the plug, see figure 3. In this condition the door locking motor should operate to the locked mode with the push rod and gaiter moving to the extended position.

Figure 3



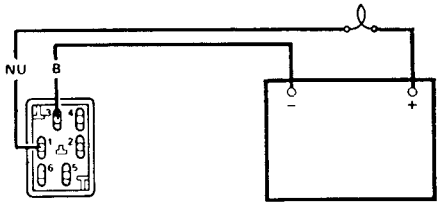
3. Reverse the leads to the blue plug, i.e., positive lead to blue lead and negative lead to red lead. In this condition the door locking motor should operate to the unlocked mode. Therefore if both locked and unlocked modes of the motor are activated the fault lies in other areas of the central locking system.

Test 4. Centre console switch

1. Prise the switch from the centre console and disconnect the switch plug.

2. Using a slave battery connect a test lamp circuit to the switch, ie positive lead to terminal 1 and negative lead to terminal 3, see figure 4.

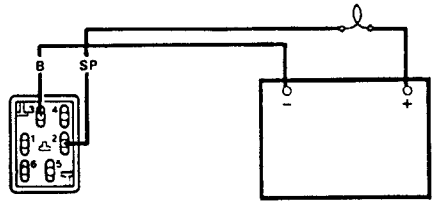
Figure 4



3. Press the switch to the doors locked position. If the test lamp does not illuminate this would indicate a faulty switch. However if the test lamp illuminates this would only indicate that the door locked side of the switch is functioning. The door unlocked side of the switch must still be checked as described in the next operation.

4. Connect the positive lead from the slave battery to terminal 2 of the switch, see figure 5.

Figure 5



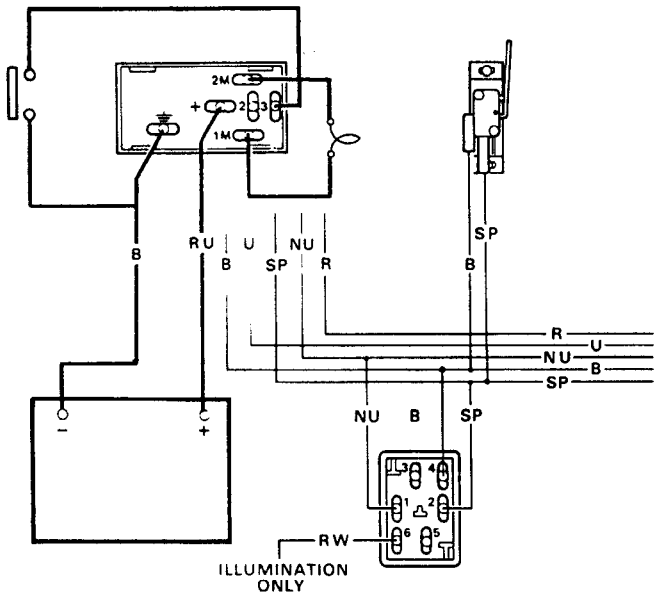
5. Press the switch to the doors unlocked position and check the circuit as in operation 3. If the switch is functioning normally and all previous tests have been carried out a faulty control box would be indicated.

Test 5. Central door locking control box.

1. Disconnect the multi-plug and earth lead from the control box.

2. Using a slave battery connect a test lamp and an on/off switch circuit as shown in figure 6.

Figure 6



3. Press the on/off switch to the on position and the test lamp should illuminate for approximately two seconds. Repeat the test as a final check. If the test lamp fails to illuminate a faulty control box is indicated.

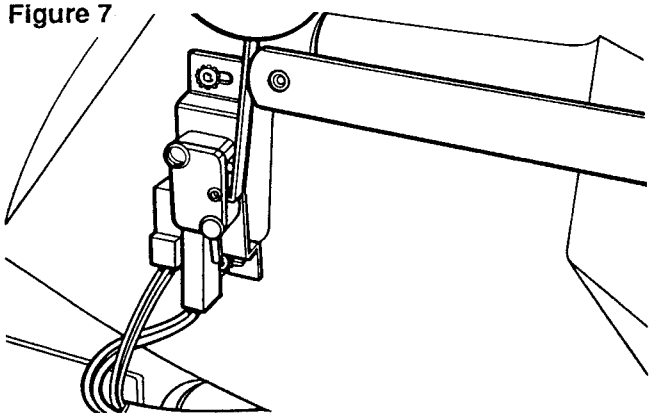
Test 6. Driver's door microswitch

This microswitch is fitted as a secondary door opening function to override the centre console door locking switch if it has been activated to the doors locked position.

1. Remove the door casing.

2. First check that the microswitch is correctly adjusted on its mounting bracket, see figure 7. With the door handle in the closed position the door release linkage should just abut the switch lever.

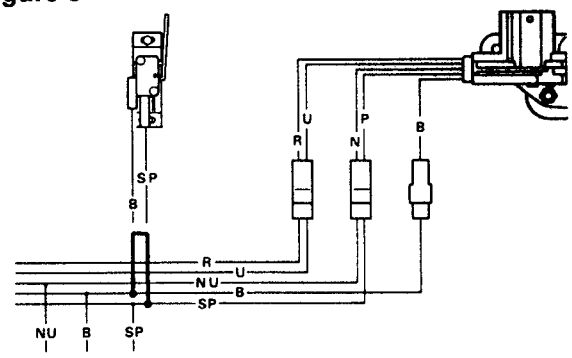
Figure 7



3. Pull the door lock release handle and the switch should energise and activate the central locking motors of all four doors to the unlocked mode. If the microswitch is faulty the driver's door central locking motor will be operated manually only but the motor of the other doors will remain locked.

4. As a final check press the centre console switch to the doors locked position, remove the two leads from the micro switch and connect together, see figure 8. This should activate the central door locking motors to the unlocked position thus indicating a faulty microswitch.

Figure 8



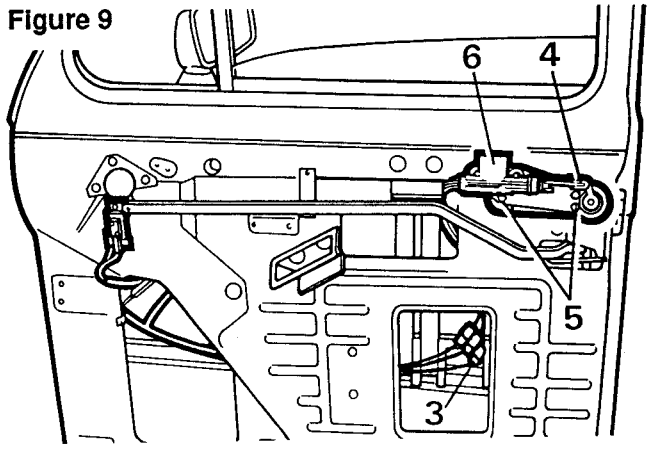
Replacing central door locking motor

1. With the door window in the raised position, disconnect the vehicle battery.

2. Remove door casing.

3. Disconnect central locking motor wiring plug/s, See figure 9.

Figure 9



4. Release retaining clip and disconnect connecting rod from door handle.

5. Remove three nuts and washers securing locking motor mounting plate to door handle studs.

6. While supporting the door handle, remove the locking motor assembly through the bottom aperture of the door panel.

7. Refit in reverse order.

Replacing central locking control box

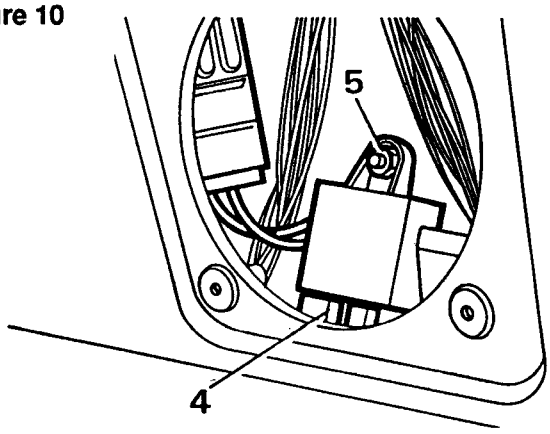
1. Disconnect battery.

2. Remove right hand radio speaker/grille from fascia.

3. Pivot down fuse box to facilitate next operation.

4. Disconnect electrical plug and earth lead from control box, see figure 10.

Figure 10



5. Unscrew retaining nut and remove control box from vehicle bulkhead through radio speaker aperture.

6. Replace in reverse order.

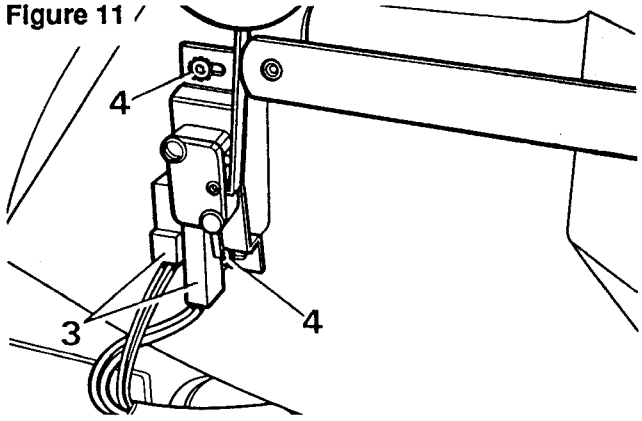
Replacing driver's door microswitch

1. Disconnect battery.

2. Remove door casing.

3. Disconnect the two leads from microswitch, see figure11.

Figure 11



4. Remove two retaining screws and detach microswitch, complete with mounting bracket.

5. Fit new microswitch in reverse order ensuring it is correctly adjusted. With the interior door handle in the closed position the door release linkage should just abut the switch lever, see figure 11.

SECTION EL

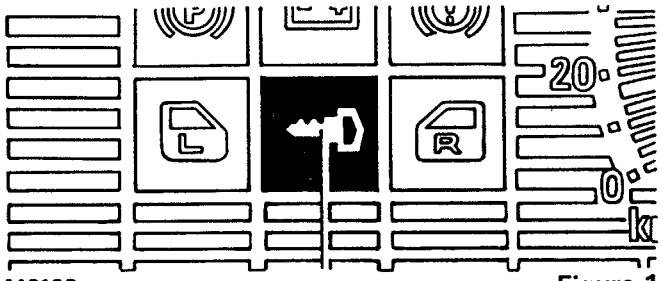
CONTENTS

Introduction

When the electronic door security locking system is fitted the rear door locks are activated by the motion of the vehicle or the driver applying the footbrake.

If the ignition is switched on while the vehicle is stationary the fascia warning light will illuminate and the rear doors can be opened.

Note: A key symbol is used and is located at the bottom centre of the warning lights, see figure 1.



M0182 **Figure 1**

As soon as the footbrake is applied the locks will operate automatically, activated by seperate relays through the brakelight switch circuit. The fascia warning light will extinguish and the doors will remain locked from the inside until the footbrake is released.

When the vehicle moves the rear doors will again lock automatically through the operation of the relays, this time activated by a proximity sensor located at the rear of the gearbox. The fascia warning light will extinguish and the doors will remain locked until the vehicle comes to rest. If the vehicle comes to rest without the footbrake being applied there will be a two second delay before the locks release.

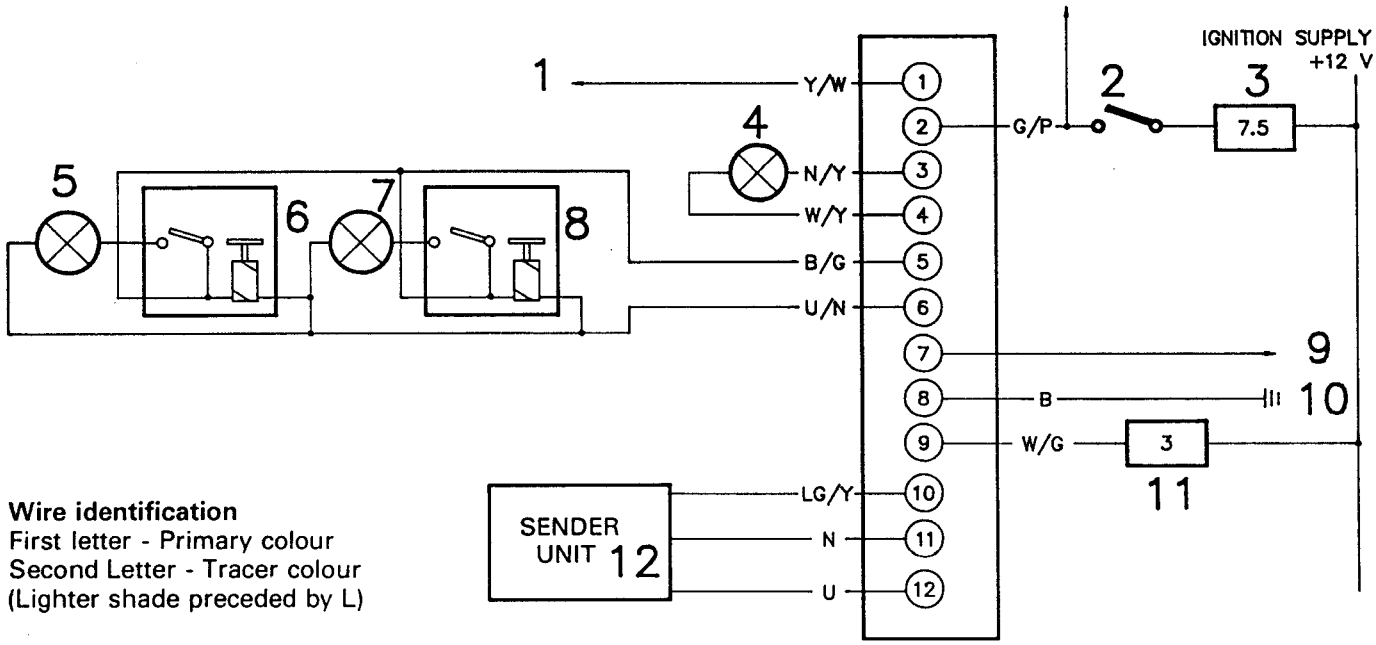
If the vehicle comes to rest with the footbrake applied the locks will not release until a few seconds after the handbrake is applied and the footbrake is released. The locks will release immediately the ignition is switched off.

When the automatic locks are activated, the rear doors can only be opened from the outside. In cases of emergency occupants can open a door by lowering the window and pressing the release button on the external handle.

When the red light, fitted on the rear doors, extinguishes the door lock is released.

If at any time the fascia warning light illuminates when the vehicle is in motion this will indicate a fault in the door security locking system and must be investigated as soon as possible.

SECURITY LOCKING SYSTEM



Wire identification
First letter - Primary colour
Second Letter - Tracer colour
(Lighter shade preceded by L)

Colour abreviation
B - Black
G - Green
K - Pink
N - Brown
O - Orange
P - Purple
R - Red
S - Slate - Grey
U - Blue
W - White
Y - Yellow

Figure 2

Key to wiring diagram

1. Output to automatic gearbox kickdown control unit and quick glow heater control unit.
2. Brake light switch.
3. 7.5 amp fuse.
4. Instrument panel warning lamp.
5. Warning light L.H. door.
6. Relay (solenoid and microswitch) L.H. door.
7. Warning light R.H. door.
8. Relay (solenoid and microswitch) R.H. door.
9. Output to Taxi meter.
10. Earth connection.
11. 3 amp fuse.
12. Sender U (Gearbox).

Test 1 Fuses

Two fuses are used in the electrical circuit of the locking system, see items 3 and 11 figure 2. If the brake light circuit 7.5 amp fuse blows the fascia warning light will illuminate. However, if the 3 amp fuse in the main supply to the control box fails this will render the locking system completely inoperative and therefore the warning light will **not** illuminate. Always check the fuses first before investigating other components in the system.

The fuse box is fitted under the fascia above the brake pedal and the fuse ratings and positions are shown on a label on the back of the driver's sun visor.

Test 2 Sender Unit

If the fascia warning light flickers or illuminates continuously when the vehicle is moving this could indicate that the sender unit, see figure 3, is faulty and should be checked.

1. The control box is fitted under the fascia below the left hand radio speaker, see figure 4. To facilitate access to the control box terminals, remove speaker grille.

2. Remove sensor connections 10, 11 and 12 from control box.

Note: On some vehicles a sealing plate may be fitted, covering terminals 7 - 12.

3. Connect a test circuit, including a pulse meter and slave battery, to the sender unit leads at the control box, as shown in figure 5.

4. Push the vehicle slowly to rotate the sender unit drive and this should give a pulse reading of four pulses per revolution.

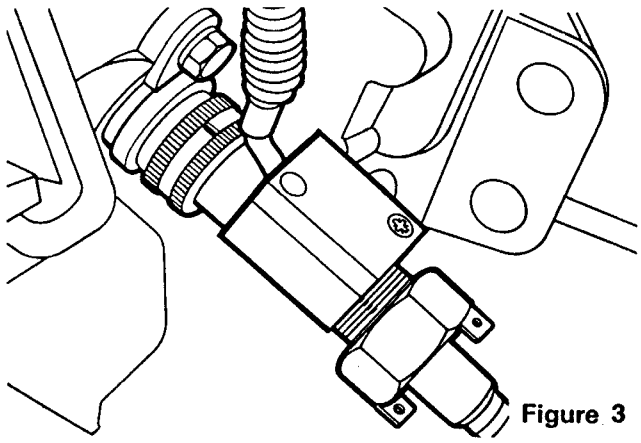


Figure 3

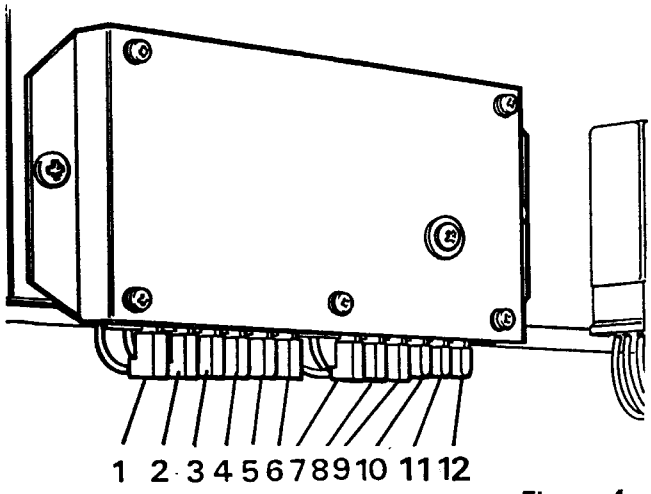


Figure 4

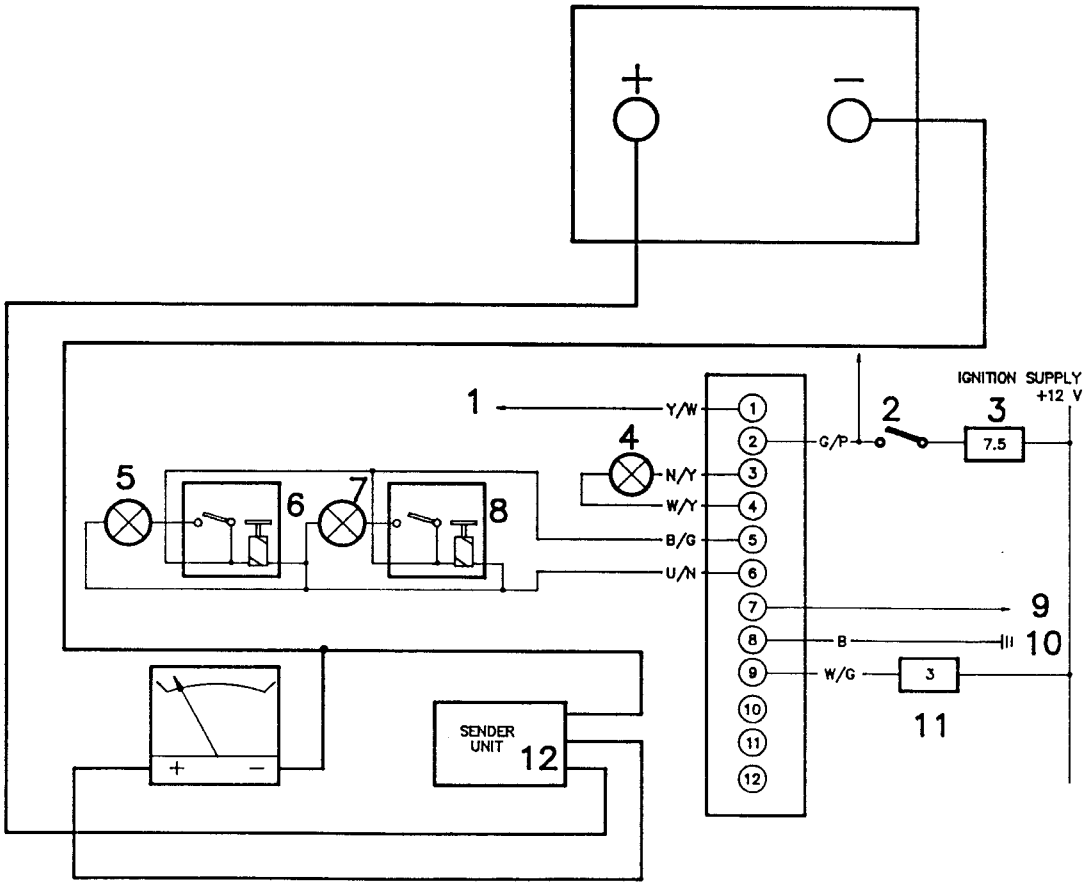


Figure 5

Test 3 Rear door solenoids and microswitches

1. Disconnect leads from terminals 5 and 6 on control box.

2. Connect positive lead from the 12 volt slave battery to the blue/brown coded wiring supply to the door solenoids and the negative lead from the battery to the black/green coded wiring as shown in figure 6. Making connection should result in the audible operation of both door solenoids.

Note: The door solenoid and microswitch can only be serviced as a combined relay, complete with mounting bracket.

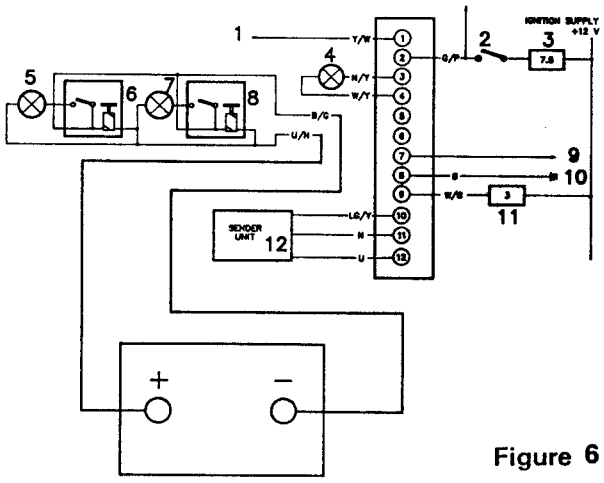


Figure 6

Test 4 Control box/door solenoids

1 Disconnect leads from terminals 5 and 6 on control box.

2 Connect a 12 volt test lamp across both terminals, see figure 7

3 Switch on vehicle ignition and apply foot brake. The test lamp should illuminate.

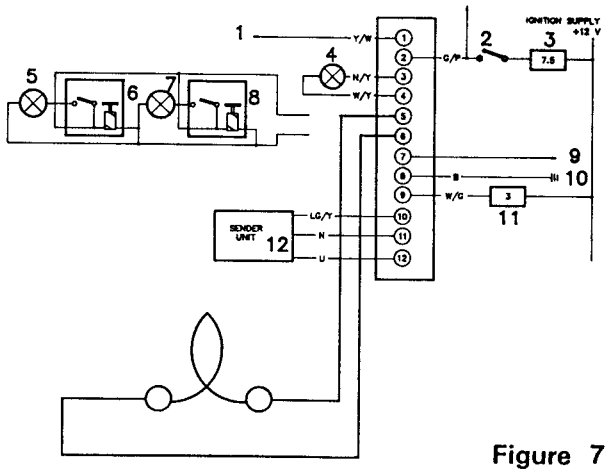
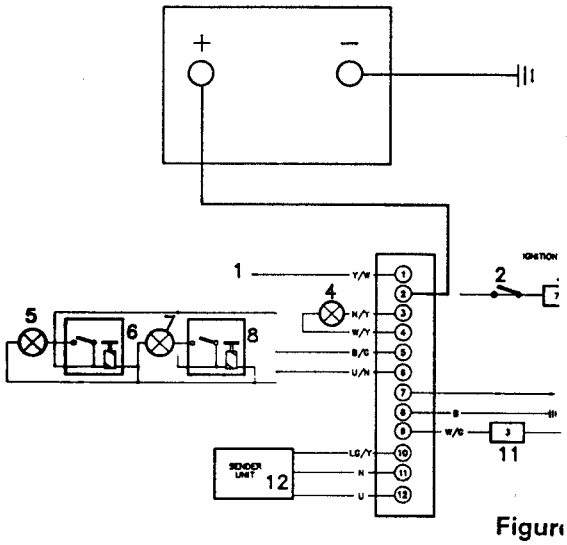


Figure 7

Test 5 Control box/brake light switch

1 Disconnect lead from terminal 2 on control

2 Connect positive lead from 12 volt slave ba terminal 2 as shown in figure 8 and switch on ignition. This should simulate the operation of th light switch and activate the rear door locks.



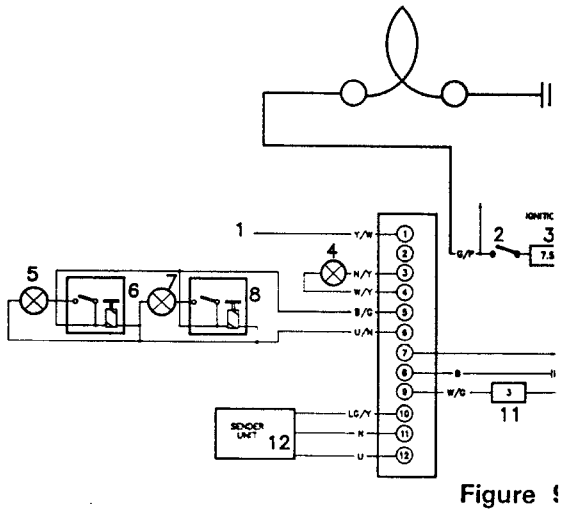
Figur

Test 6 Brake light switch and cable

1 Disconnect lead from terminal 2 on control b

2 Connect a 12 volt test lamp between the lead suitable earth, see figure 9.

3 Switch on vehicle ignition and apply foot b Operation of the brake light switch should illum the test lamp. Failure to do so would indicate fail the switch or a fault in the circuit cable.



Figure

Test 7 Fascia warning light/control box

1 Disconnect leads from terminals 3 and 4 on co box.

2 Connect a 12 volt test lamp between the terminals as shown in figure 10

3 Switch on vehicle ignition and the test lamp sh illuminate. Failure to illuminate would indicate a f in the warning light/wiring circuit or control box.

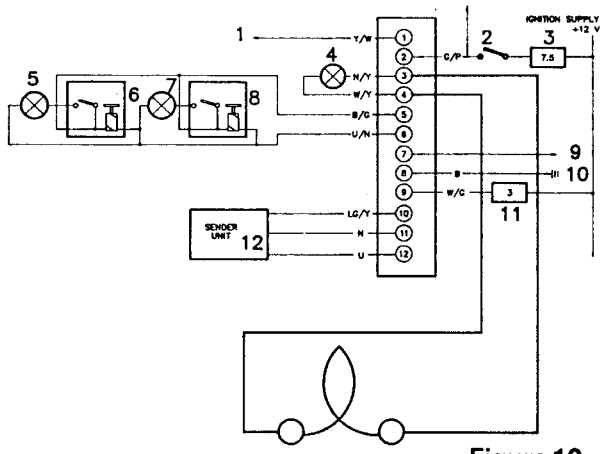


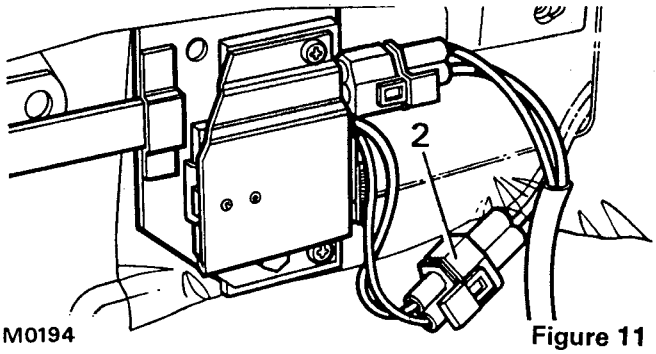
Figure 10

Test 8 Rear door warning lights

The rear door microswitches operate the warning lights mounted on both doors and inform the rear occupants that the doors are locked.

1 Switch on the vehicle ignition and apply the foot brake. This will energise the solenoids lock the doors and should illuminate the warning lights through the microswitches.

Failure to illuminate will indicate a failure in the microswitch or warning light bulb.



M0194

Figure 11

2 Disconnect the warning lamp lead as shown in figure 11.

3 Connect a 12 volt supply to the lamp harness, see figure 12. The warning lamp should illuminate thus indicating a microswitch failure.

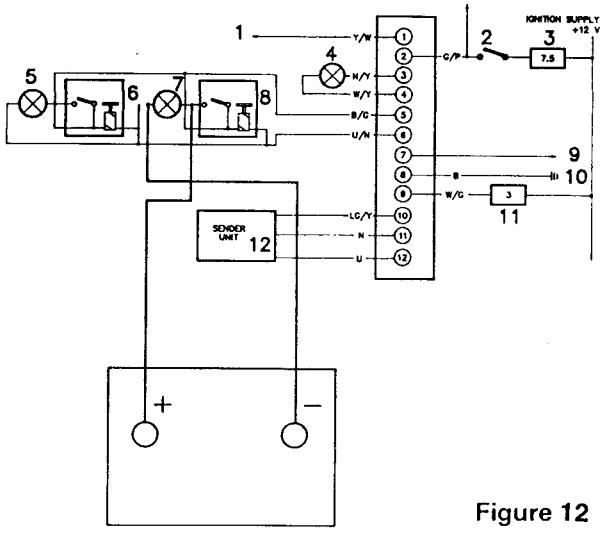


Figure 12

Replacing the sender unit

1. Disconnect terminals 10, 11, and 12 from control box.

2. Pull back carpet/matting, if fitted, and carefully release sender unit cable.

3. From under the vehicle remove rubber grommet, release cable from retaining clips and pull cable through grommet aperture.

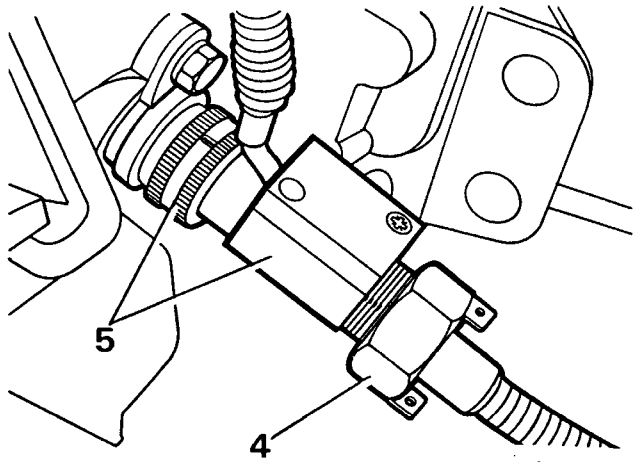


Figure 13

4. Unscrew speedometer cable adaptor from sender unit.

5. Unscrew sender unit from gearbox and fit new assembly.

6. Reroute sender unit cable, secure with retaining clips, fit rubber grommet and reconnect terminals 10, 11 and 12 at control box.

Replacing control box

1. Remove two retaining screws, carefully lower control box from under fascia, and disconnect the twelve terminals, see Figure 14.

Note: On some vehicles a sealing plate may be fitted, covering terminals 6-12.

2 Reconnect terminals to new control box, ensuring they are correctly fitted, see figure 3, wiring diagram.

3 Secure control box to bulkhead.

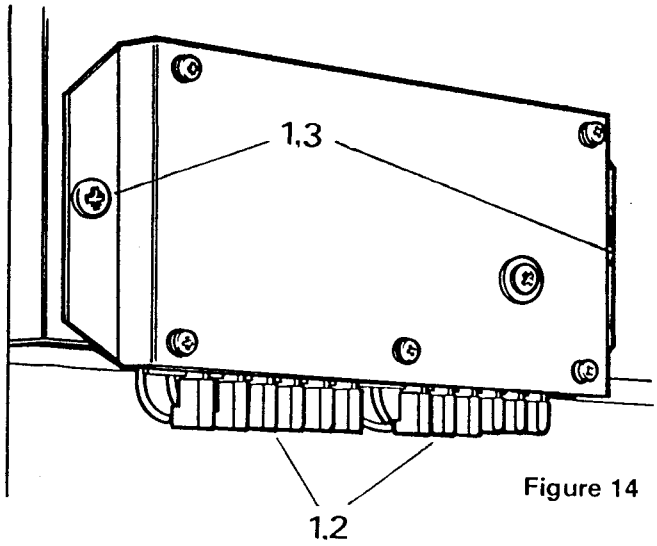


Figure 14

Replacing rear door relay (solenoid and microswitch)

1 Carefully prise out end cappings, remove retaining screws and detach grab handle, see figure 15.

2 Remove door lock release handle cover, remove single screw and withdraw handle from its spindle.

3 Remove window lock escutcheon.

4 Remove door trim panel.

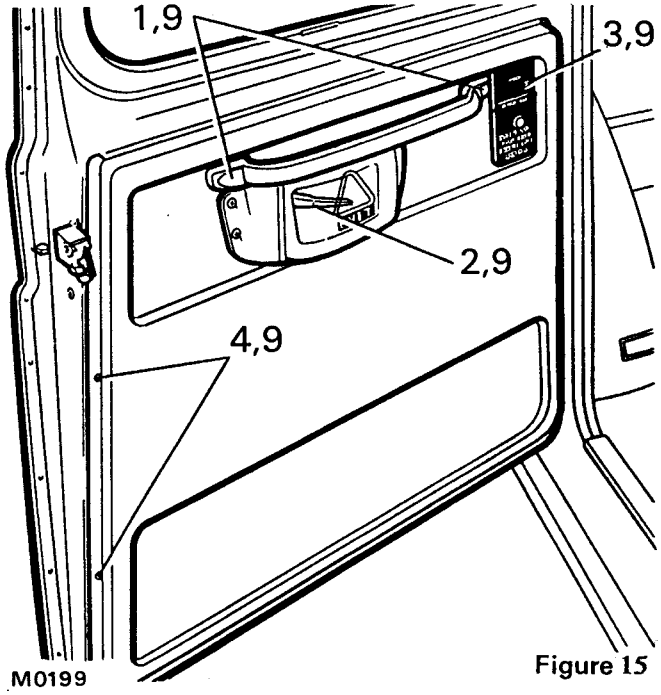


Figure 15

5 Peel back protective sheet and disconnect warning light lead plug and relay supply cable plug, see figure 16.

6 Slacken grab handle mounting bracket screws.

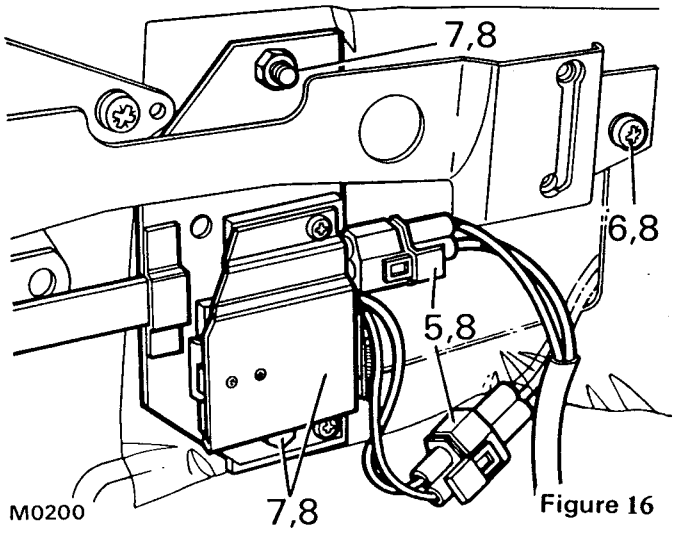


Figure 16

7 Remove top and bottom fixings, disengage relay mounting plate from retaining stud and door lock lever and lower assembly from door.

8 Fit new relay assembly, ensuring door lock lever is correctly engaged and reconnect solenoid and warning light plugs. Retighten mounting bracket screw.

9 Refit trim panel, door release handle, cover and grab handle window lock escutcheon.

Replacing rear door warning light

1 Remove door trim panel as previously described.

2 Disconnect warning light lead plug, see figure 17.

3 Peel back tape retaining warning light lead.

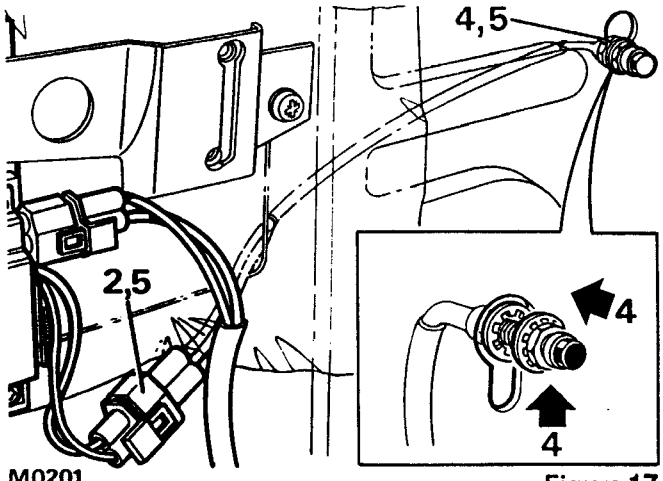


Figure 17

4 Support the warning light from inside the door panel, slacken the locknut and release the light inwards from the key hole slot.

5 Refit new warning light, connect wiring plug and replace door trim panel.

Replacing brake light switch

1 Remove two retaining bolts and carefully lift access plate from pedal box, see figure 18.

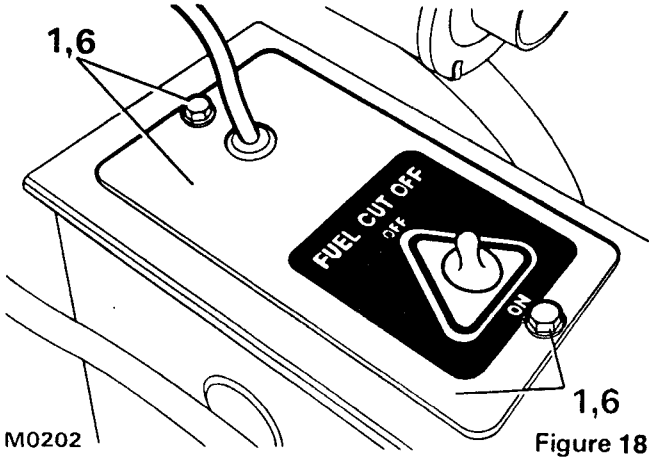
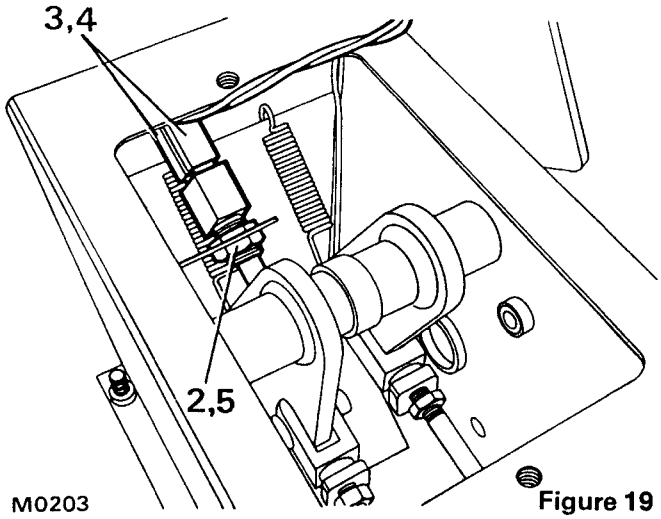


Figure 18

2 Unscrew locknut and remove brake light switch from mounting bracket.

3 Disconnect the two leads from the brake light switch, see figure 19

4 Reconnect leads to new switch.



M0203 Figure 19

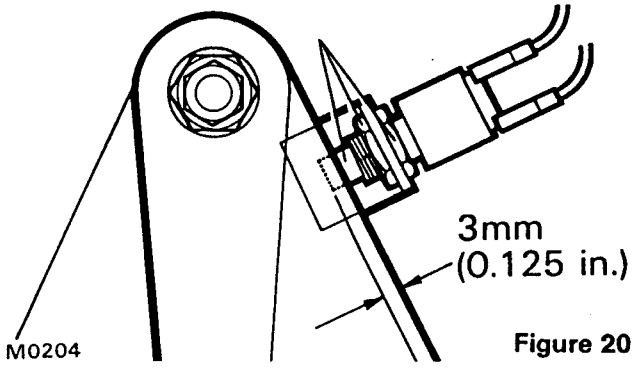
5 Fit new switch, secure loosely with locknuts and adjust as follows:-

(a) Position the switch so that the operating plunger abuts the brake pedal lever, see figure 20

(b) Push the switch down so that the plunger depresses 3mm (0.125in) and tighten locknuts.

(c) Depress brake pedal and check that the switch plunger springs out to its full travel.

(d) Release brake pedal and recheck measurement of plunger depression as in (b).



M0204 Figure 20

6 Refit pedal box access plate.

To replace fascia warning light

1 Prise out centre pad, unscrew retaining bolt, and remove, steering wheel, see figure 21.

2 Remove top and bottom multi-switch covers.

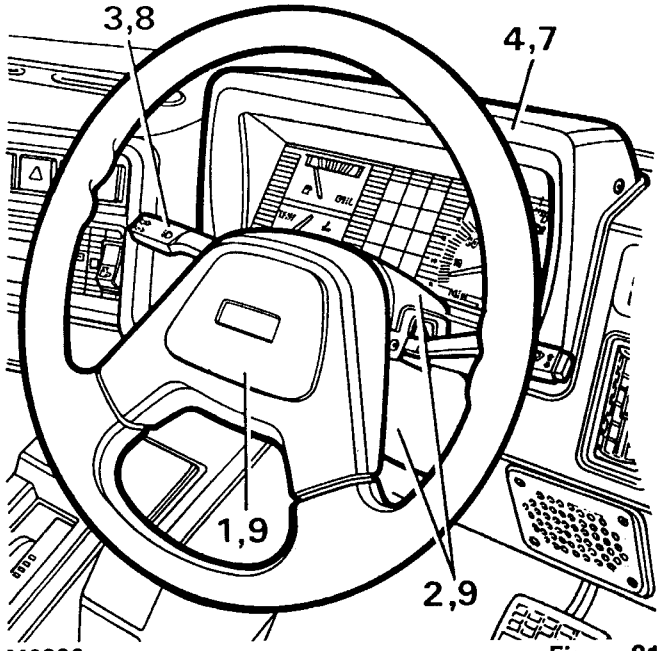
3 Remove multi-switch assembly from steering column.

4 Remove instrument binnacle cover.

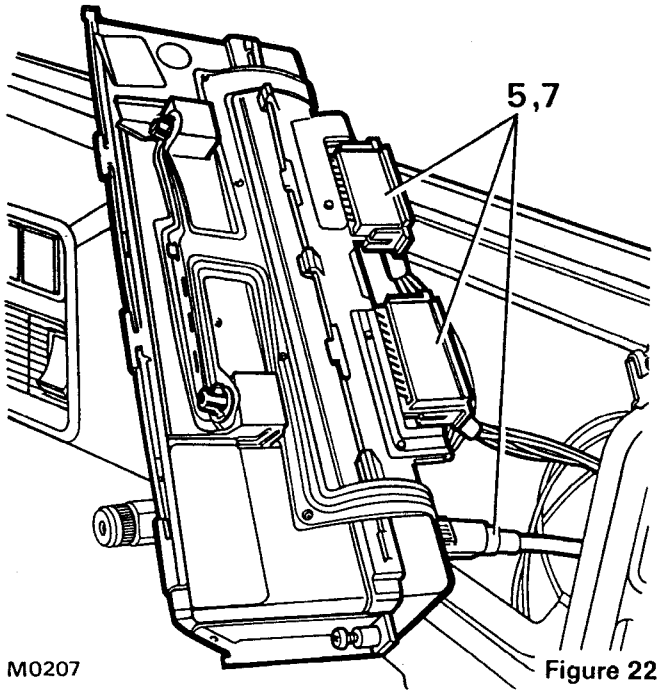
5 Remove instrument binnacle and disconnect multi-plugs and speedo cable, see figure 22.

6 Remove fascia warning light bulb, see figure 23. **Note:** Fascia warning light bulbs are serviced complete with holders.

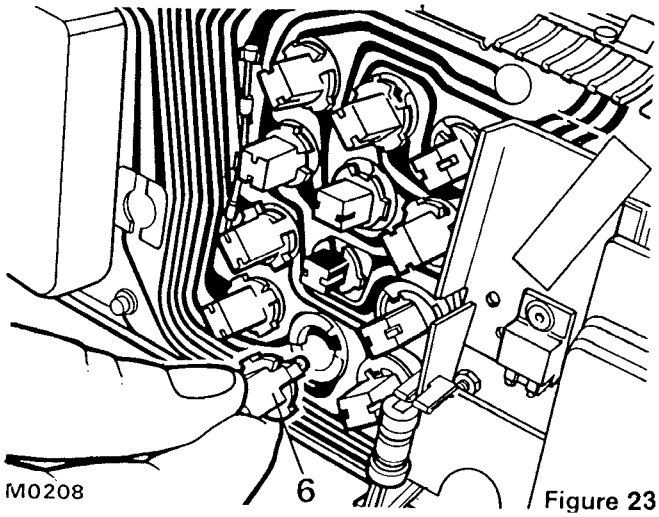
7 Reconnect multi-plugs, speedo cable and refit fascia binnacle and cover.



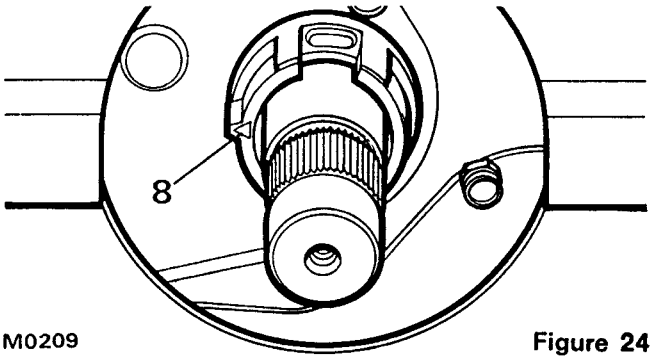
M0206 Figure 21



M0207 Figure 22



M0208 Figure 23



M0209 **Figure 24**

8 Refit multi-switch assembly to steering column, ensuring that the blue self cancelling boss is correctly positioned, i.e with the arrow pointed to the left as shown in figure 24.

9 Refit top and bottom multi-switch covers, steering wheel and centre pad.

Introduction

On most vehicles electrically operated windows are fitted to the nearside front door only, although depending on the vehicle specification they can also be fitted to the driver's door. The windows lift assembly consists of a 12 volt electric motor fitted to a mounting bracket that also supports the motor drive rack and window slide channel.

Each window is operated by a two way switch on the centre console. On automatic vehicles the switch is mounted on the front face of the storage compartment. On manual vehicles the switch is locatd next to the ash-tray at the front of the console.

A thermal overload switch is incorporated in the circuit and is located in the wiring harness just before the window lift switch. If an overload situation arises the relay will cut off the electric supply to the window lift motor for approximately three to four seconds.

A 30 amp fuse is fitted to protect the system which is shown in the schematic diagram of figure 1.

If the window lift motors fail to operate the following tests should be used to eliminate the various components.

Test 1 - Fuse

If the 30 amp fuse protecting the circuit blows, the window lift motor of each door will be inoperative. The fuse box is fitted under the fascia above the brake pedal and the fuse ratings and positions are shown on a label located on the back of the driver's sun visor. If on checking the fuse the window lift motor/s is still inoperative carry on to Test 2.

Test 2 - Window Lift Motor

1. Remove the door casing.

2. Disconnect the electrical plug from the window lift motor.

3. Connect the positive and negative leads from a slave battery to the lift motor plug, see figure 2. In this condition the window lift motor should operate.

Note: If the window is in the raised or lowered position and the lift motor fails to operate, first reverse the polarity of the leads, the motor should then operate.

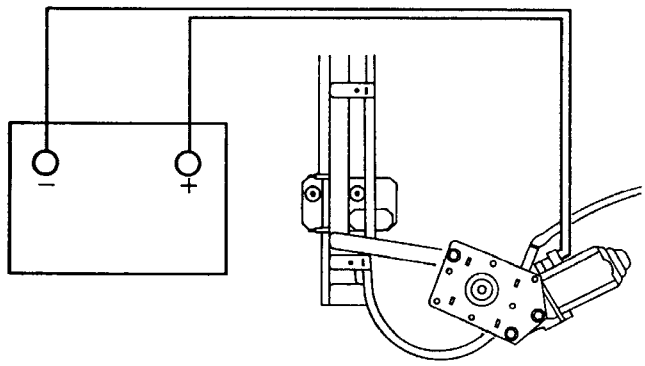
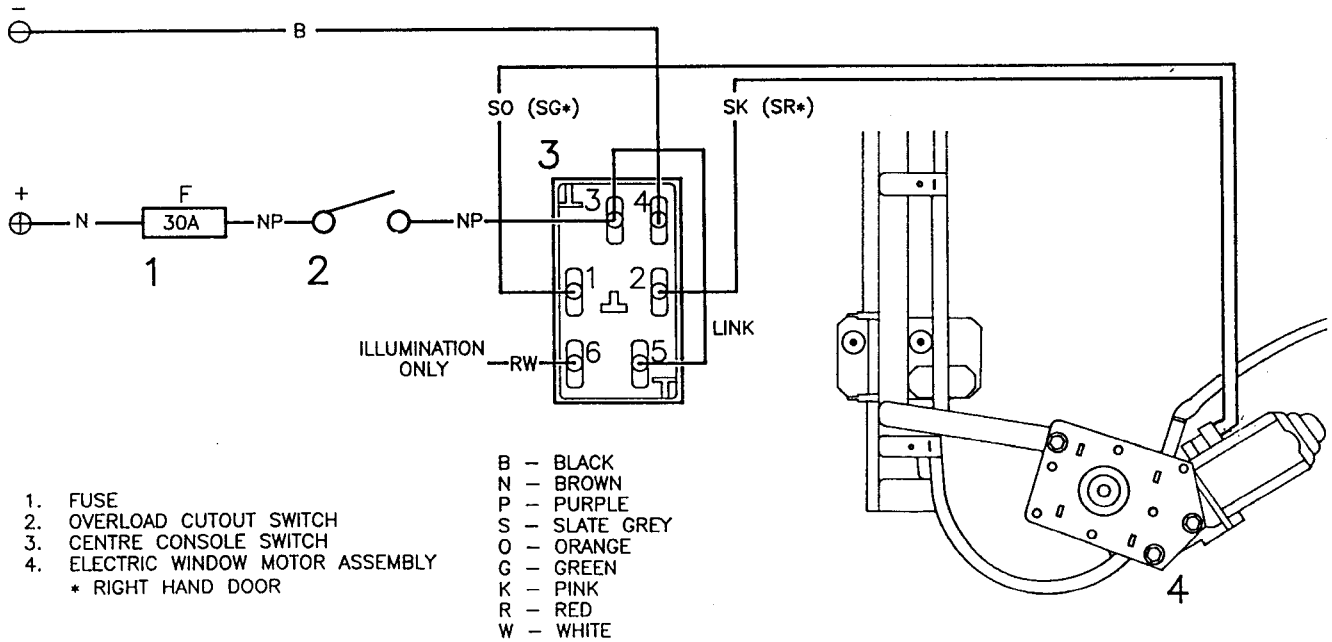


Figure 2



1. FUSE
2. OVERLOAD CUTOUT SWITCH
3. CENTRE CONSOLE SWITCH
4. ELECTRIC WINDOW MOTOR ASSEMBLY
   * RIGHT HAND DOOR

B – BLACK
N – BROWN
P – PURPLE
S – SLATE GREY
O – ORANGE
G – GREEN
K – PINK
R – RED
W – WHITE

Figure 1

Test 3 - Window Lift Motor Switch

1. Prise the switch from the centre console and disconnect the switch plug.

2. Using a slave battery connect a test lamp circuit to the switch, ie. positive lead to terminal 3 and negative lead to terminal 4, see figure 3.

3. Presss the switch to the windows lowered position. If the lamp does not illuminate this would indicate a faulty switch. However, if the test lamp does illuminate this would only indicate that the window lowering side of the switch is functioning. The window raised side of the switch must still be checked as described in the next operation.

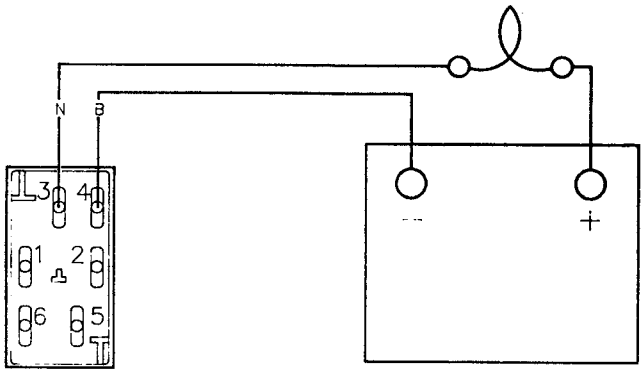


Figure 3

4. Connect the positive lead from the slave battery to terminal 2 of the switch.

5. Press the switch to the windows raised position and check the circuit as in operation 3. If the switch is functioning normally and all previous tests have been carried out and the window lift motor still fails to operate a faulty thermal overload switch would be indicated.

Test 4 - Thermal Overload Switch

1. Remove two screws and lift the trinket tray from the centre console to gain access to ther thermal overload switch, see figure 4.

Note: If electric windows are fitted in both front doors two overload switches are used, one for each lift motor.

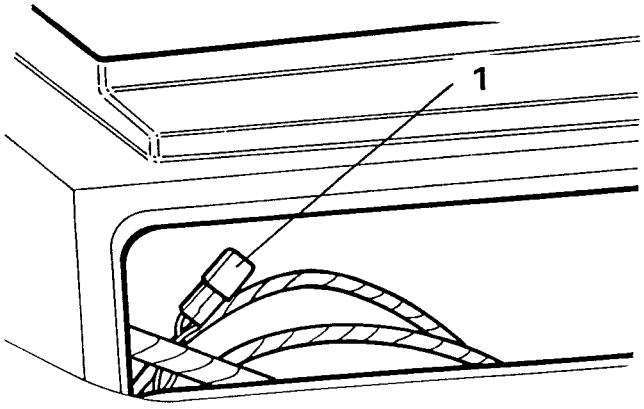


Figure 4

2. Disconnect the two leads from the switch and link them together.

3. Press the two way switch on the centre console and the window lift motor should operate, thus confirming a faulty thermal overload switch.

Replacing Window Lift Motor Assembly

1. Lower window.

2. Disconnect lift motor wiring plug, see figure 5.

3. Remove two allen bolts securing the slide channel mounting to the window.

4. Remove two bolts securing the tip of the slide channel to the door panel.

5. Unscrew three bolts, detach lift motor from door panel and remove complete assembly through access aperture, nearest hinge end of door.

6. Replace in reverse order.

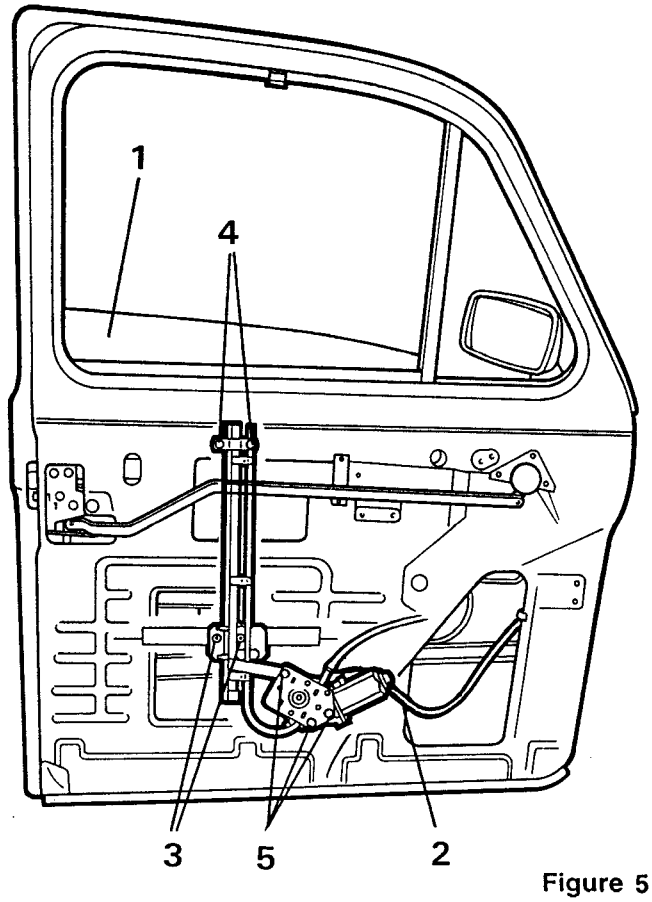


Figure 5

LTI SERVICE

Fairway DRIVER

WORKSHOP MANUAL

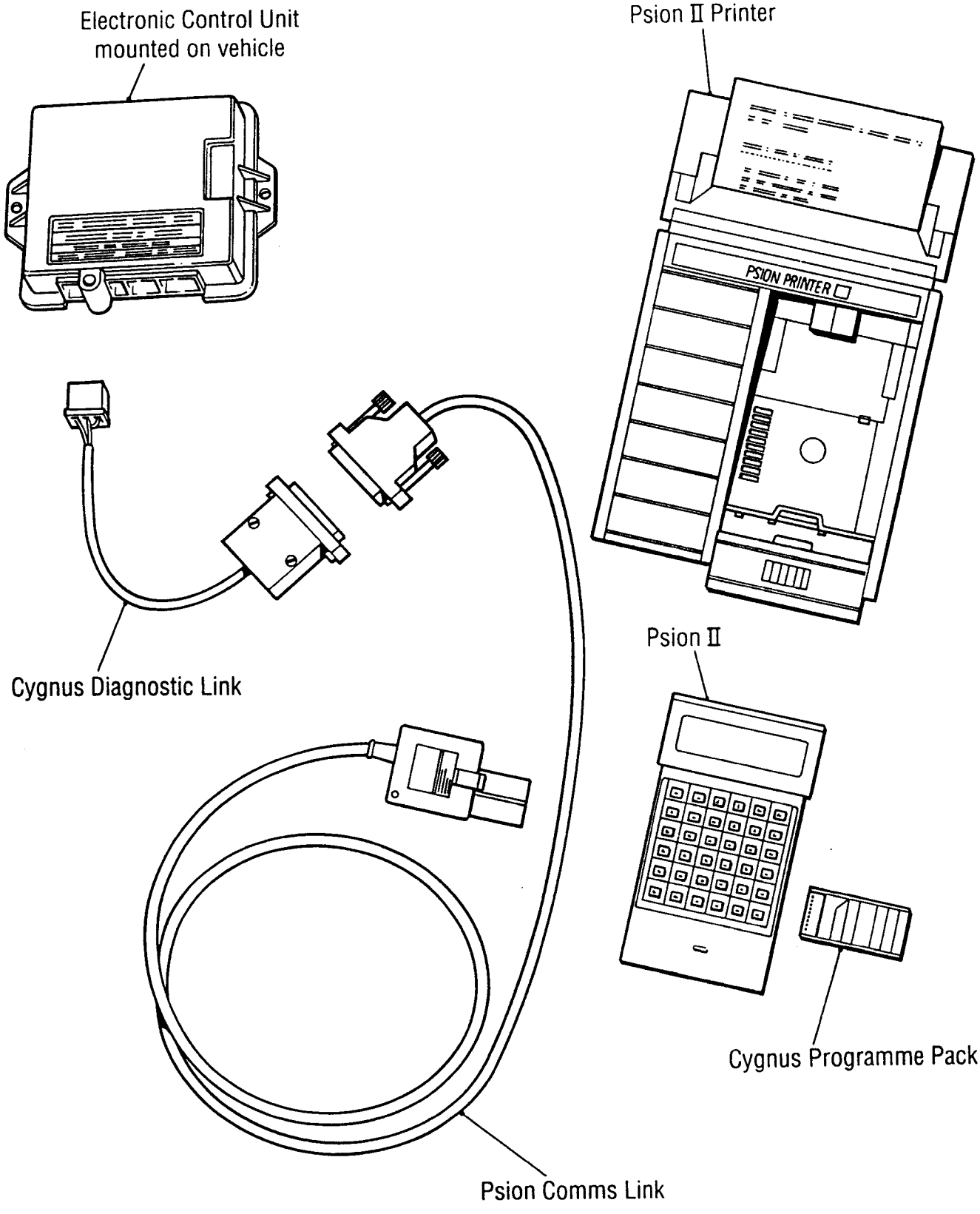
SECTION 8b

I.D.D.S DIAGNOSTICS

I.D.D.S. DIAGNOSTICS

CONTENTS

DIAGNOSTIC EQUIPMENT



8b I.D.D.S DIAGNOSTICS

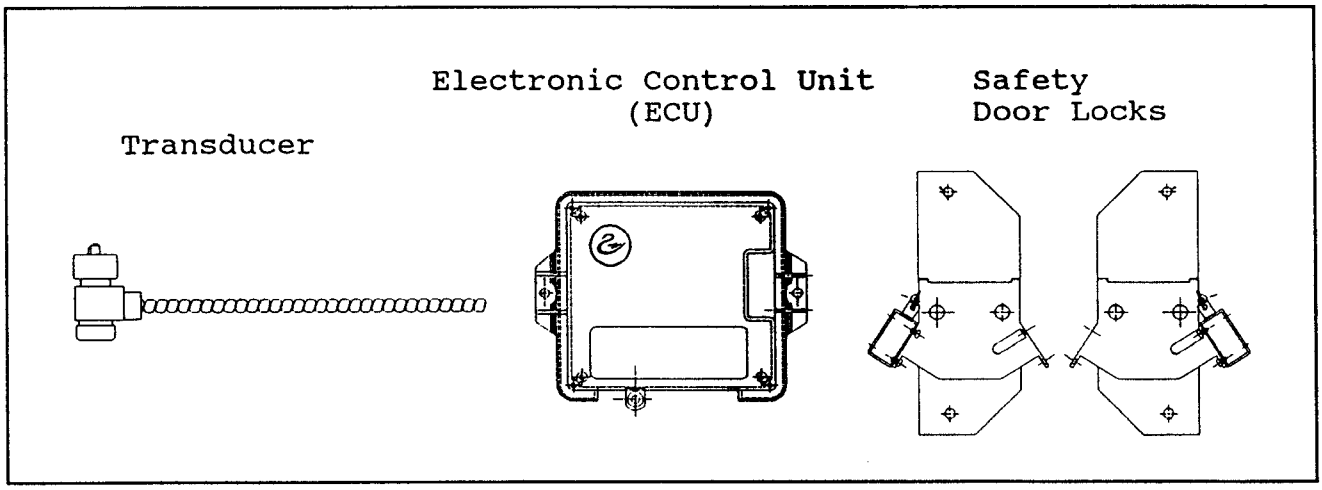
1. Scope and purpose of this document

This document describes the diagnostic and fault-finding facilities of the Cygnus IDDS as fitted to Carbodies Fairway Driver taxis from January 1992.

IDDS is a complex system with connections to a number of other components on the taxi. Fault finding might therefore be difficult and time consuming. To further complicate matters, because of its connection to the taximeter, various elements in the IDDS may be sealed by the Public Carriage Office or Hackney Carriage Officer; breaking a seal to replace a component could involve further time off the road for the taxi for re-testing and re-sealing. IDDS has been designed to permit fault finding to a certain level **without removing components from the vehicle**, by the use of dashboard indicators and plug-in diagnostics. In most cases the faulty component can be identified quickly, replacement of non-faulty parts can be avoided, and seals should only be broken where necessary.

2. Summary of the IDDS and its functions

IDDS stands for Intelligent Drive Detection System and comprises the following system elements:



The IDDS has the following additional inputs and outputs:

Inputs:

* Brake light switch
* Rear door courtesy light switches

Outputs:

* Taximeter distance pulse
* Gearbox kickdown inhibit
* Dashboard warning lamps (see below)

The main functions of the system are:

* To automatically engage the rear door safety locks when the vehicle travels faster than 2 mph, thereby preventing the rear doors from being opened from the inside.

* To provide an electronically compensated signal to the taximeter.

* To provide a signal to the gearbox kickdown inhibit control unit.

* To provide various visual and audible indications and warnings to the driver concerning the status of the rear doors.

* To provide various diagnostic and other information, including the vehicle mileage, using a hand-held Psion Organiser.

3. IDDS indicators and warnings

The IDDS controls the 3 warning lamps at the bottom of the dashboard warning lamp cluster:

In this document they are shown as follows:


indicates that the lamp is OFF

indicates that the lamp is ON continuously

indicates that the lamp is FLASHING

The IDDS also emits audible warning sounds from the ECU; these take 2 possible forms:

■ ■ ■ ■ ■ ("pip .. pip .. pip .. ") - warning beep.

▬▬▬▬ ("beeeeeee.... ") - continuous high pitched alarm.

In addition to the above warnings from the IDDS itself, each rear door is fitted with a red warning light which indicates when the safety lock for that door is engaged.

4. Explanation of warning lamps and sounds


indicates that at least one rear door is UNLOCKED. This may be normal - if the vehicle is stationary, or it may indicate a fault. Whenever this lamp is lit it is possible for a passenger to open a rear door from the inside.

When a left or right door warning lamp is flashing it indicates that that door is OPEN. A flashing lamp should always be accompanied by an audible warning.

When a left or right door warning lamp is on continuously it indicates that the safety lock in that door has failed. This warning should always be accompanied by the green "key" lamp.

■ ■ ■ This audible warning accompanies a flashing door warning lamp to indicate that a rear door is OPEN.

▬▬ A continuous alarm accompanies a flashing door warning lamp when the vehicle is moving at a speed greater than 2mph with a rear door OPEN.

5. Fault finding - first stage

5.1. Power on self test

The IDDS performs the following self test sequence whenever the ignition is turned on:

5.1.1.  **Both rear door safety locks engage (red warning lights in the doors are lit) for approximately 2 seconds**

5.1.2.  Both rear door safety locks disengage.

With the vehicle at rest, this is the normal condition.

If this self test sequence does not occur at all, the most likely causes are that either there is no power to the ECU (check fuse) or that the ECU has completely failed.

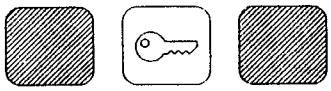
If the self test sequence does occur but with incorrect results, continue with the fault-finding process.

5.2. Brake Pedal Test

Press the brake pedal. With the brake pedal pressed all 3 dashboard indicator lamps should be off and both rear door safety locks engaged (as in 5.1.1). With the vehicle stationary this condition persists until the brake pedal is released, when the system immediately reverts to normal (as in 5.1.2).

5.3. Common warning and indication conditions

Once successfully past the self-test and brake pedal test, conclusions can be drawn from the following conditions:



(No audible warning)
If stationary - normal condition, no fault.
If moving faster than 2 mph, FAULT - suspect transducer failure - refer to 6.2.

(Audible warning: ■ ■ ■ ■ ■ ■)
Vehicle stationary.
The left hand rear door is open. Not normally a fault (unless the door is physically closed which would indicate a failed courtesy light switch).

(Audible warning: ▬▬▬▬)
The left hand rear door is open and the vehicle is being driven faster than 2 mph. Not a fault (unless the door is physically closed which would indicate a failed courtesy light switch).

(No audible warning)
FAULT : the right hand rear door safety lock has failed, either due to mechanical failure (eg jammed) or electrical failure of some kind. Investigate by inspecting the lock mechanism itself and/or by the use of plug-in diagnostics (see 7).
This warning condition occurs whenever the rear door safety locks should be engaged, whether the vehicle is moving or at rest.

(Audible warning: ▬▬▬▬ , vehicle moving)
SERIOUS FAULT : The left hand rear door safety lock has failed, the door is open and the vehicle is moving faster than 2 mph.

Warnings or indications other than those shown above (apart from juxtaposition of left and right) normally require more in depth diagnostics to determine possible causes.

6. Checking for known or suspected faults:

6.1. Taximeter not recording

If the taximeter does not appear to be recording on distance, or is recording very slowly, follow this procedure to determine the fault.

6.1.1. Perform power-on self test (5.1). If this does not occur at all then the most likely causes are that either there is no power to the ECU (check fuse) or that the ECU has completely failed. If this test is successful proceed to next step.

6.1.2. Perform brake test (5.2) to confirm that the door locks function and that the green key lamp is extinguished when the doors lock. If so proceed to the next step. If not then the next step cannot be used, but the transducer is suspect - go to 6.2.4.

6.1.3. Do the doors lock and the green key light extinguish when the vehicle is driven? If so it is unlikely that the transducer is at fault, proceed to next step. If not then the transducer is suspect - go to 6.2.4.

6.1.4. At this stage the most likely causes of failure are:

6.1.4.1. Wiring fault between ECU and taximeter.
6.1.4.2. Taximeter fault
6.1.4.3. ECU fault
6.1.4.4. A combination of the above, e.g. faulty wiring causing damage to taximeter.

Useful information may be gained at this stage by using the pulse count mode of the taximeter if it has one, but it is more likely that substitution of known working units will be the most effective method of identifying the fault.

6.2. Suspect transducer

6.2.1. Perform power-on self test (5.1). If this does not occur at all then the most likely causes are that either there is no power to the ECU (check fuse) or that the ECU has completely failed. If this test is successful proceed to next step.

6.2.2. Perform brake test (5.2) to confirm that the door locks function and that the green key lamp is extinguished when the doors lock. If so proceed to the next step. If not then the next step cannot be used, but the transducer is still suspect - go to 6.2.4.

6.2.3. Do the doors lock and the green key light extinguish when the vehicle is driven? If so it is unlikely that the transducer is at fault. If not then the transducer is still suspect - go to 6.2.4.

6.2.4. Plug in the Psion Organiser diagnostic link, press ON/CLEAR twice to turn on, select the IDDS option from the main menu and then select the PULSES option.

The Psion will now count incoming pulses from the transducer (NB maximum speed 30 mph). On a Fairway Driver there should be approximately 4000 - 4200 pulses to a mile depending on tyres etc. If this test

shows a correct pulse count then the transducer is not at fault. If an incorrect count is shown then the most likely cause is a failed transducer, but before replacing it perform the quick test in the next step.

6.2.5. With the Psion diagnostic link still connected, disconnect the transducer plug from the ECU and plug in a known, working transducer held by hand in the luggage space. Rotate the shaft of the transducer by hand whilst observing the Psion display - there should be 4 pulses per complete turn. If 4 pulses per turn are observed then the transducer fitted to the vehicle is faulty and should be replaced. If no pulses are observed from the known, working transducer then the ECU is suspect and should be replaced.

6.3. Door safety lock(s) not engaging

The door safety locks should engage when either the brake pedal is pressed or when the vehicle travels faster than 2 mph.

The possible causes of failure are:

6.3.1. Faulty lock
6.3.2. Jammed lock mechanism
6.3.3. Other mechanical failure in door
6.3.4. Faulty wiring between ECU and lock
6.3.5. Faulty ECU

Door safety lock failure is reported on the dashboard by the green key lamp accompanied by a red door warning lamp continuously on. For example

means that there is a fault with the right hand safety lock.

Having arrived at the conclusion that a safety lock is suspect the next stage is to remove the door casing and examine the lock mechanism and its associated components. If the door lock unit does not prove faulty, or there is no obvious jamming or other mechanical problem, plug-in diagnostics should be used to further analyse the system before removing the ECU.

7. Plug-in diagnostics using Psion Organiser

Where faults appear more complex than those described above, plug in diagnostics can be used to obtain further information about the system.

To use the plug-in diagnostic facilities, connect a Psion Organiser fitted with the Cygnus program pack to the ECU using the special connecting link. Make sure that the ignition is turned on. Select

the IDDS option from the Psion main menu; this will lead to a second menu showing the available options:

```
INFO STATUS
PULSES EXIT
```

If the message "COMMS FAILURE ... Check Connection" appears instead of this menu it means that the ECU is not responding, possible causes are connecting link failure or ECU failure. Having successfully reached this menu, various functions can be performed:

INFO displays a static list of items of information stored within the ECU

STATUS provides a dynamic display of the ECU's inputs and outputs.

PULSES provides a dynamic count of pulses received from the transducer.

EXIT Exits from IDDS menu back to Psion main menu

7.1. Checking the serial number of the ECU

Select the INFO option from the menu. The serial number is displayed on the top line. The top line will always show the serial number during the INFO function while the second line can be caused to show other items listed in 7.2 below. If a printer is connected then this list will automatically be printed out.

7.2. Reading the mileage and other information

Having selected the INFO function, pressing the up and down arrow keys on the Psion Organiser will scroll through the following list of items on the second line of the display:

Ratio: Must be 4224 for the Fairway Driver. **Any other value here will cause inaccurate taximeter recording.**

Version: The software version of the ECU.

Date: The week and year of manufacture of the ECU.

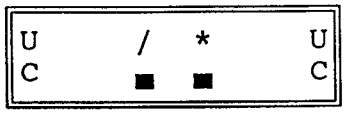
Mileage: The total recorded mileage.

Error status: If this is a '1' then there has been an error in the ECU's memory and the mileage total will not be accurate. If this is a '0' then the mileage total should be accurate.

Pressing any other key from the INFO display will cause an exit to the IDDS menu (INFO STATUS PULSES).

7.3. The status display

Selecting the STATUS option from the IDDS menu causes the following display:



Each symbol on the display represents a component of the IDDS system and will change according to the status of that component.

The <u>top row</u> represents the door safety locks, the brake pedal and the green "key" lamp in the dashboard instrument panel.

The extreme left and right symbols represent the left and right safety lock respectively; a **U** indicates that the lock should be unlocked or disengaged, an **L** indicates that it should be locked, and an **F** indicates that a fault has been detected with it.

When 'F' is displayed there will be an adjacent number indicating the class of fault, see 7.4.

The leftmost of the two centre symbols represents the condition of the brake pedal: / indicates that the pedal is not pressed and _indicates that it is.

The rightmost of the two centre symbols represents the condition of the green "key" lamp: * indicates that it is lit, ■ indicates that it is not, and an **F** indicates that there is a fault with the bulb - usually a short circuit.

The <u>bottom row</u> represents the left and right rear doors and the corresponding red warning lamps in the instrument panel.

A **C** indicates that a door is closed, an O indicates that it is open.

Each lamp is represented in the same way as the green "key" lamp: * indicates that it is lit, ■ indicates that it is not, and an F indicates that there is a fault with the bulb - usually a short circuit. When these lamps flash the corresponding symbol on the Psion display may not flash in correct sync - this does not represent a fault, merely a limitation of the speed of communication between ECU and Psion.

The STATUS display can be printed out at any time by pressing the P key on the Psion.

To exit from the STATUS display press any key except P.

7.4. Fault codes for the safety door locks

When an F symbol is displayed for a door safety lock there will be an adjacent fault code which can be interpreted as follows:

1 ECU fault

2 ECU fault

3 ECU fault

4 Door lock fault - possible microswitch failure

6 Door lock or wiring fault - there is a short circuit between the door lock drive and +12V.

7 Door lock or wiring fault - the door lock is using too much current - possible solenoid failure.

7.5. Checking transducer pulses.

Selecting the PULSES option from the IDDS menu shows a count of incoming transducer pulses. The count is reset to zero every time the function is selected.

Important note: because of the limitation of speed of communication between the ECU and the Psion, the pulse count may not be accurate over 30 mph.

To exit from the PULSES function, press any key - in some circumstances this may not work first time in which case repeat.

LTI SERVICE

Fairway DRIVER

WORKSHOP MANUAL

SECTION 8c

WIRING DIAGRAMS

WIRING DIAGRAM RHD - KEY

WIRING COLOURS

B	BLACK	P	PURPLE
G	GREEN	S	SLATE/GREY
K	PINK	U	BLUE
N	BROWN	W	WHITE
O	ORANGE	Y	YELLOW

WIRING IDENTIFICATION

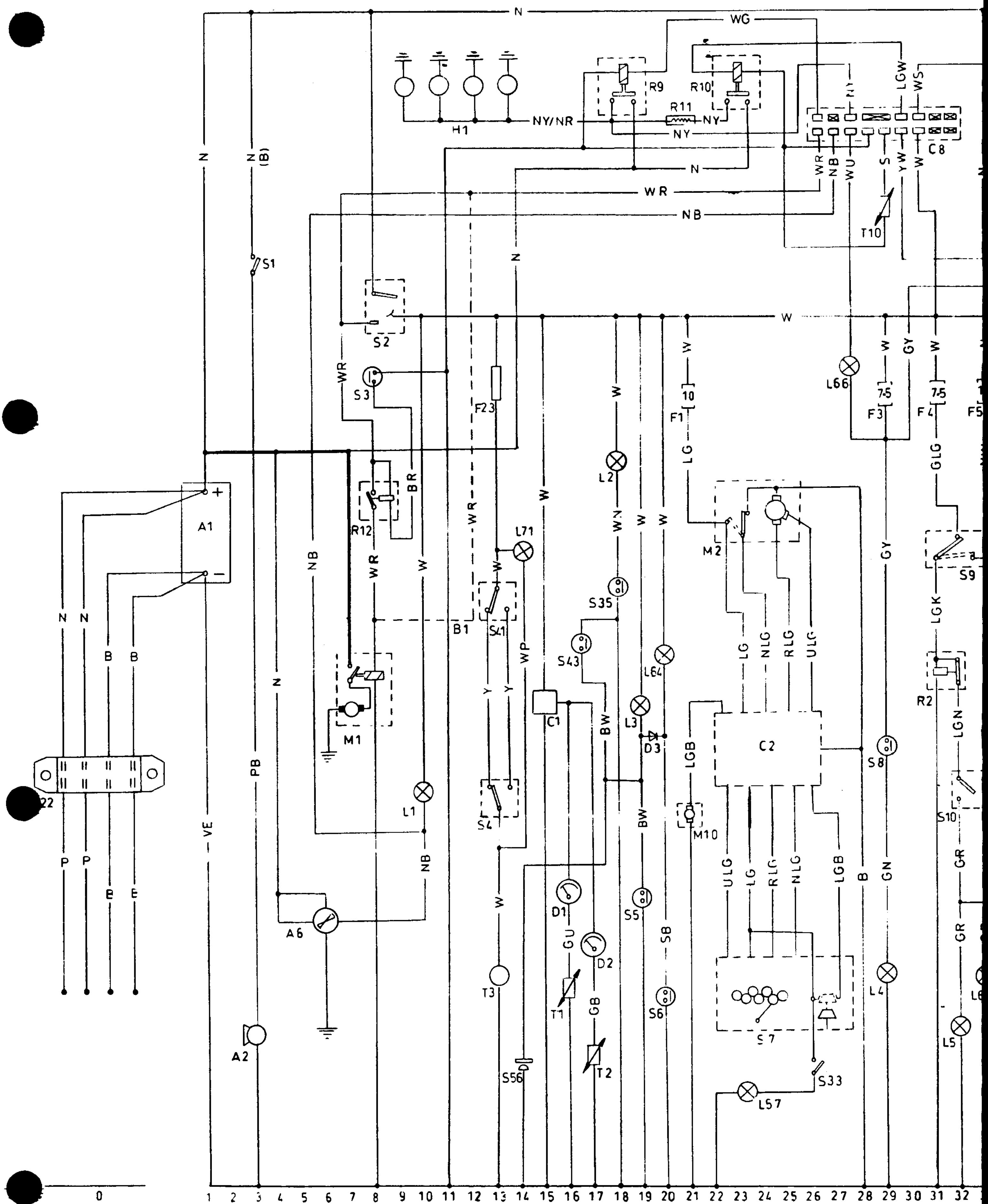
FIRST LETTER	PRIMARY COLOUR
SECOND LETTER	TRACER COLOUR
LIGHTER SHADE	PRECEDED BY LETTER L

ITEM	DESCRIPTION	LOCATION
A1	BATTERY	1
A2	HORN	3
A3	RADIO	130
A4	SPEAKER - RIGHT	126
A5	SPEAKER - LEFT	126
A6	ALTERNATOR	6
B1	LINK LEAD (MANUAL TRANSMISSION)	8-12
C1	INSTRUMENT STABILISER	15
C2	WIPER DELAY UNIT	22-26
C3	CENTRAL DOOR LOCK CONTROL BOX	137
C4	CLOCK	80-81
C5	CONTROL BOX-DOOR LOCKING	51-63
C6	TAXI METER CONNECTOR BLOCK	44
C7	TAXI METER LIGHT BOX	69
C8	GLOW CONTROL BOX	26-32
C9	KICKDOWN CONTROL BOX (AUTO TRANS)	53-54
C10	CONTROL BOX-REMOTE DOOR LOCKING	142-144
C11	CONTROL BOX-WINDOW LIFT LH FRONT (AUTO)	118-120
C12	CONTROL BOX-WINDOW LIFT RH FRONT (AUTO)	122-124
D1	TEMPERATURE GAUGE	16
D2	FUEL GAUGE	17
D3	DIODE	19-20
F1	FUSE BLOCK B7	21
F2	FUSE BLOCK B2	64
F3	FUSE BLOCK B3	29
F4	FUSE BLOCK B8	31
F5	FUSE BLOCK C7	33
F6	FUSE BLOCK C2	40
F7	FUSE BLOCK B6	65
F8	FUSE BLOCK C3	69
F9	FUSE BLOCK B4	70
F10	FUSE BLOCK B5	105
F11	FUSE BLOCK A3	89
F12	FUSE BLOCK A2	86
F13	FUSE BLOCK A5	91
F14	FUSE BLOCK A4	93
F15	FUSE BLOCK A7	95
F16	FUSE BLOCK A6	97
F17	FUSE BLOCK A8	100
F18	FUSE BLOCK C4	103
F19	FUSE BLOCK C8	113
F20	FUSE BLOCK C5	140
F21	FUSE BLOCK C6	131
F22	FUSE BOX FOR RADIO TELEPHONE	0
F23	FUSIBLE LINK	13
H1	DIESEL HEATER PLUGS	9-14
H2	CIGAR LIGHTER	48
H3	HEATED REAR SCREEN	107
L1	IGNITION WARNING LIGHT	10
L2	OIL PRESSURE WARNING LIGHT	18
L3	LOW FLUID, LOW VACUUM AND BRAKE PAD W/L	19
L4	REVERSE LIGHT	29
L5	INDICATOR LIGHT LH REAR	32
L6	INDICATOR LIGHT LH FRONT	33
L7	INDICATOR WARNING LIGHT LH SIDE	34
L8	INDICATOR WARNING LIGHT RH REAR	36
L9	INDICATOR LIGHT RH FRONT	37
L10	INDICATOR WARNING LIGHT RH SIDE	38
L11	COURTESY LIGHT - ROOF CONSOLE	40
L12	COURTESY LIGHT LH SIDE FACIA	39

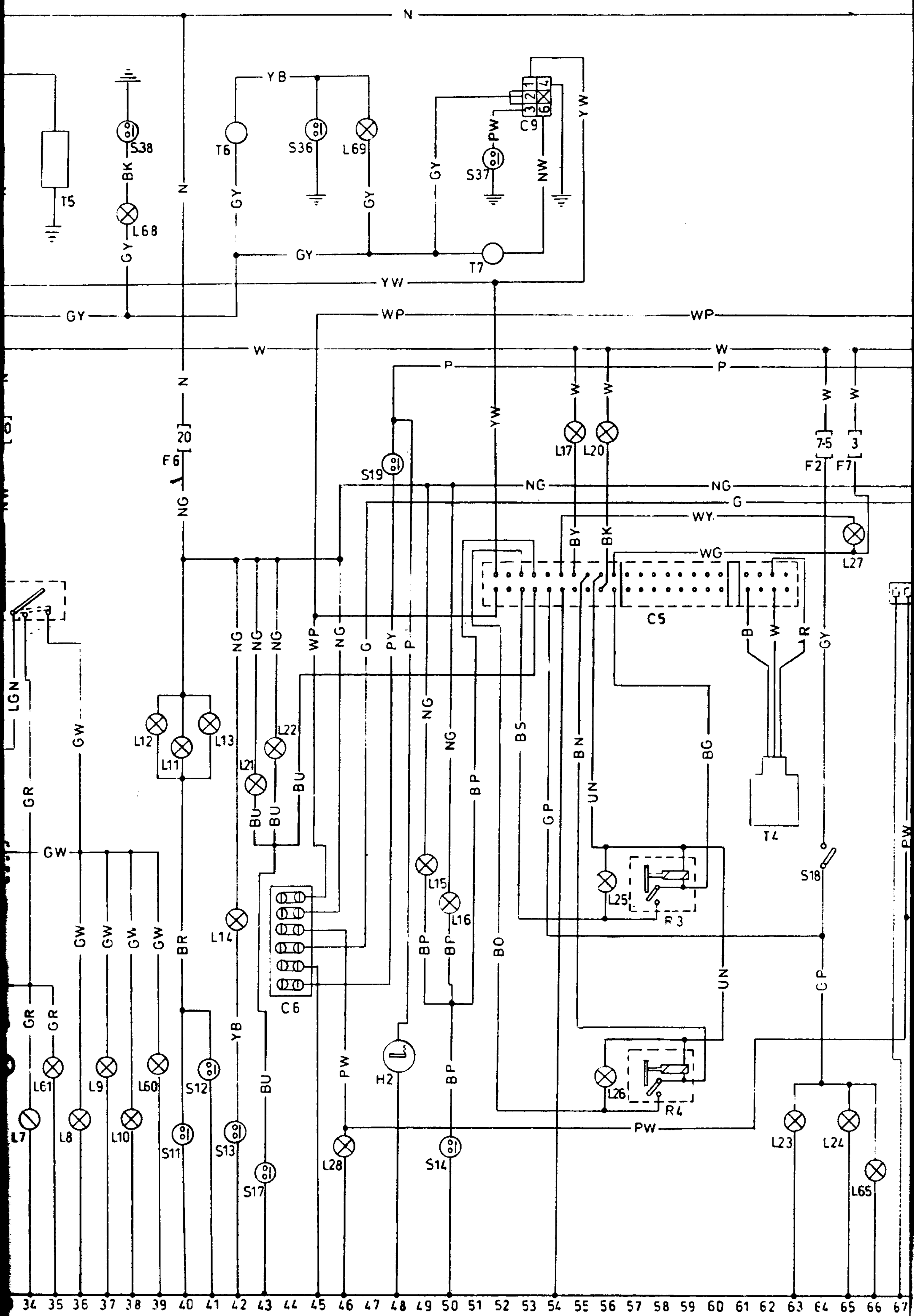
ITEM	DESCRIPTION	LOCATION
L13	COURTESY LIGHT RH SIDE FACIA	41
L14	DRIVERS INTERIOR LIGHT	42
L15	COURTESY LIGHT LH REAR	49
L16	PUDDLE LIGHT LH REAR	50
L17	LH REAR DOOR NOT CLOSED WARNING LIGHT	54-55
L18	INTERIOR LIGHT-PASSENGER LH REAR	71
L19	INTERIOR LIGHT-PASSENGER RH REAR	73
L20	RH REAR DOOR NOT CLOSED WARNING LIGHT	56
L21	PUDDLE LIGHT RH REAR	42-43
L22	COURTESY LIGHT RH REAR	43
L23	BRAKE LIGHT LH SIDE	63
L24	BRAKE LIGHT RH SIDE	65
L25	DOOR LOCKED WARNING LIGHT LH REAR	56
L26	DOOR LOCKED WARNING LIGHT RH REAR	56
L27	REAR DOORS NOT CLOSED WARNING LIGHT	65
L28	HIRE SIGN LIGHT	46
L29	REAR SCREEN HEATER WARNING LIGHT	109
L30	NO PLATE LIGHT	88
L31	TAIL LIGHT LH SIDE	89
L32	SIDE LIGHT LH FRONT	90
L33	TAIL LIGHT RH SIDE	85
L34	SIDE LIGHT RH FRONT	86
L35	INSTRUMENT CLUSTER ILLUMINATION LHS	81-84
L36	INSTRUMENT CLUSTER ILLUMINATION RHS	81-84
L37	DIPPED BEAM LH SIDE	91
L38	DIPPED BEAM RH SIDE	93
L39	MAIN BEAM LH SIDE	95
L40	MAIN BEAM RH SIDE	97
L41	MAIN BEAM WARNING LIGHT	98
L42	REAR FOG GUARD	100
L43	REAR FOG GUARD WARNING LIGHT	101
L44	FOG LAMP LH SIDE	103
L45	FOG LAMP RH SIDE	104
L46	WINDOW LIFT SWITCH ILLUMINATION LH SIDE	112
L47	WINDOW LIFT SWITCH ILLUMINATION RH SIDE	114
L48	REAR FOG GUARD & HEATED REAR SCREEN-SWITCH ILLUMINATION	82-83
L49	DRIVERS INTERIOR LIGHT SWITCH-ILLUMINATION (FRONT)	82-83
L50	HIRE SIGN SWITCH ILUMINATION	82-83
L51	FRONT HEATER SWITCH ILLUMINATION	82-83
L52	DRIVERS REAR HEATER ON-OFF SWITCH-ILLUMINATION	82-83
L53	PASSENGERS REAR HEATER ON-OFF SWITCH-ILLUMINATION	82-83
L54	REAR HEATER HIGH-LOW SPEED SWITCH-ILLUMINATION	82-83
L55	DRIVERS INTERIOR LIGHT SWITCH-ILLUMINATION (REAR)	82-83
L56	SIDE LIGHTS ON WARNING LIGHT	87
L57	LOW WASHER FLUID WARNING LIGHT	23
L58	FOG LAMP WARNING LIGHT	105
L59	CIGAR LIGHTER ILLUMINATION	82-83
L60	INDICATOR REPEATER RH SIDE	39
L61	INDICATOR REPEATER LH SIDE	35
L62	AUTO GEAR SELECTOR ILLUMINATION	82-83
L63	ASHTRAY ILLUMINATION	82-83
L64	HANDBRAKE ON WARNING LIGHT	20
L65	HIGH LEVEL BRAKE LIGHT	66
L66	GLOW PLUG WARNING LIGHT	27-28
L67	PANEL LIGHT SWITCH ILLUMINATION	82-83
L68	SEDIMENTOR WARNING LIGHT	37-38
L69	OVERDRIVE WARNING LIGHT	46-47
L70	DRIVERS CENTRAL DOOR LOCKING SWITCH-ILLUMINATION	82-83
L71	FUEL SWITCH OFF WARNING LIGHT	14
L72	BELT RELEASED WARNING LIGHT (WHEEL CHAIR)	79

8c WIRING DIAGRAM RHD-KEY

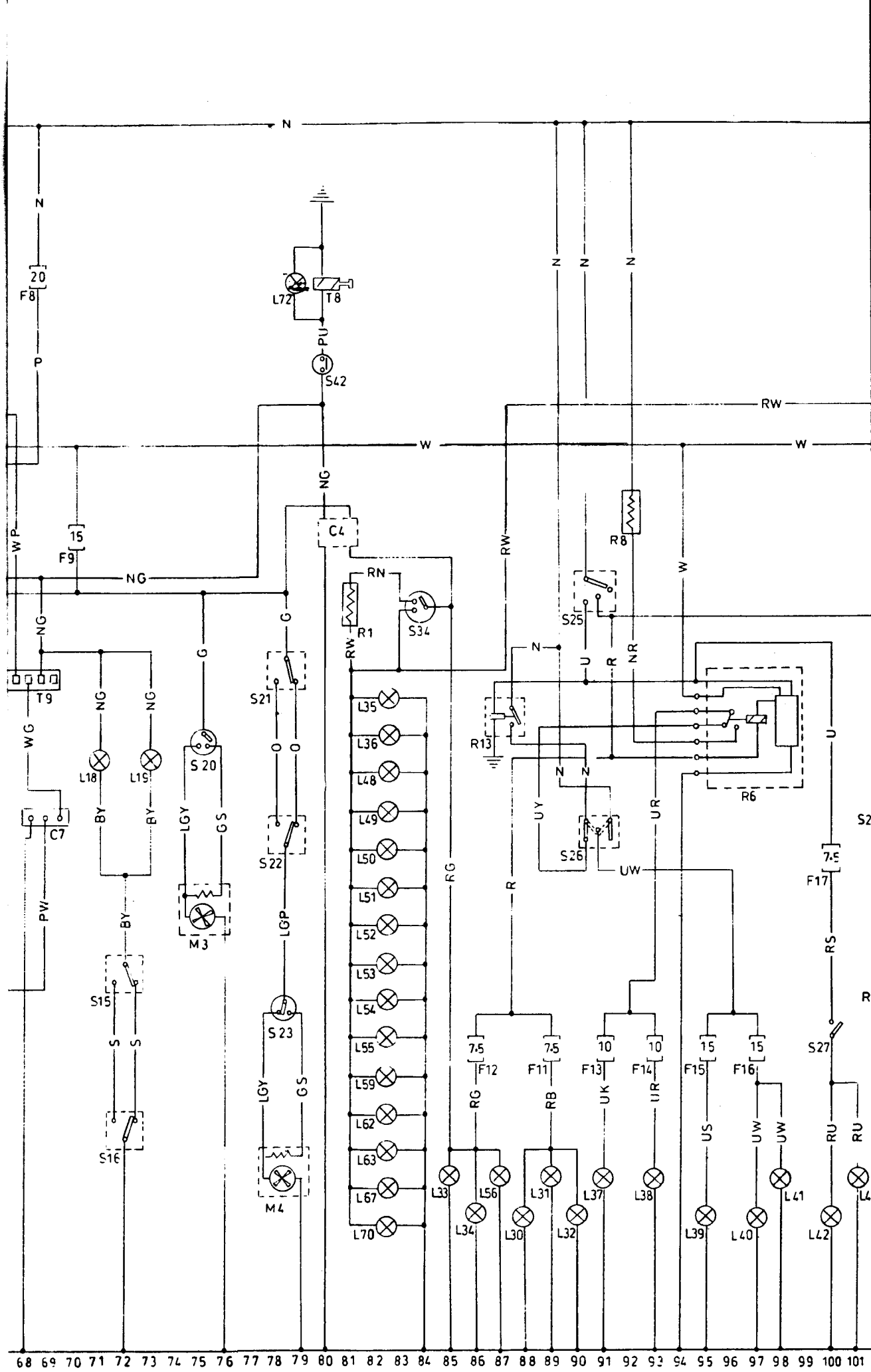
ITEM	DESCRIPTION	LOCATION
L73	WINDOW LIFT SWITCH ILLUMINATION LHS (AUTO)	120
L74	WINDOW LIFT SWITCH ILLUMINATION RHS (AUTO)	122
L75	REAR WINDOW LIFT SWITCH ILLUMINATION LH SIDE-DRIVER	157
L76	REAR WINDOW LIFT SWITCH ILLUMINATION RH SIDE-DRIVER	157
L77	REAR WINDOW LIFT SWITCH ILLUMINATION LH SIDE-PASSENGER	157
L78	REAR WINDOW LIFT SWITCH ILLUMINATION RH SIDE-PASSENGER	157
M1	STARTER MOTOR	6-8
M2	FRONT SCREEN WIPER MOTOR	22-25
M3	FRONT HEATER	74-76
M4	REAR HEATER	78-79
M5	WINDOW LIFT MOTOR LH SIDE FRONT	111-112
M6	WINDOW LIFT MOTOR RH SIDE FRONT	114-115
M7	ELECTRICALLY OPERATED DOOR MIRROR LH SIDE	150-151
M8	ELECTRICALLY OPERATED DOOR MIRROR RH SIDE	150-151
M9	ELECTRICALLY OPERATED AERIAL	129
M10	FRONT SCREEN WASH MOTOR	21
M11	CENTRAL DOOR LOCKING MOTOR RH SIDE FRONT	139-140
M12	CENTRAL DOOR LOCKING MOTOR RH SIDE REAR	139-140
M13	CENTRAL DOOR LOCKING MOTOR LH SIDE FRONT	135-136
M14	CENTRAL DOOR LOCKING MOTOR LH SIDE REAR	135-136
M15	WINDOW LIFT MOTOR LH SIDE FRONT (AUTO)	118-119
M16	WINDOW LIFT MOTOR RH SIDE FRONT (AUTO)	122-123
M17	WINDOW LIFT MOTOR LH SIDE REAR	154-156
M18	WINDOW LIFT MOTOR RH SIDE REAR	158-160
R1	RESISTOR PANEL LIGHTS	81
R2	19 FL FLASHER UNIT	31-32
R3	RH REAR DOOR LOCKING SOLENOID	57-59
R4	LH REAR DOOR LOCKING SOLENOID	57-59
R5	HEATED REAR SCREEN TIMER	106-109
R6	DIM DIP RELAY	95-99
R7	FRONT FOG LAMP RELAY	102-103
R8	DIM DIP RESISTOR	92
R9	GLOW PLUG RELAY 1	18-19
R10	GLOW PLUG RELAY 2	22-23
R11	RESISTOR-INDUCTION MANIFOLD	20-21
R12	INHIBITOR RELAY (AUTO TRANSMISSION)	8-9
R13	HEADLAMP SWITCH OVERLOAD RELAY	87-88
S1	HORN PUSH	3
S2	IGNITION SWITCH	8-9
S3	GEARBOX INHIBITOR SWITCH	8
S4	FUEL CUT OFF SWITCH	13
S5	LOW BRAKE FLUID SWITCH	19
S6	HANDBRAKE ON WARNING LIGHT SWITCH	20
S7	SCREEN WASH/WIPE SWITCH	22-27
S8	REVERSE LIGHT SWITCH	29
S9	HAZARD SWITCH	31-35
S10	INDICATOR SWITCH	31-33
S11	COURTESY SWITCH RH FRONT	40
S12	COURTESY SWITCH LH FRONT	41
S13	DRIVERS INTERIOR LIGHT SWITCH	42
S14	COURTESY SWITCH LH REAR	50
S15	INTERIOR LIGHT SWITCH-PASSENGER	72
S16	INTERIOR LIGHT SWITCH-DRIVER	72
S17	COURTESY SWITCH RH REAR	43
S18	BRAKE LIGHT SWITCH	64
S19	HIRE SIGN SWITCH	47
S20	FRONT HEATER SWITCH	75
S21	REAR HEATER ON-OFF SWITCH - DRIVER	78-79
S22	REAR HEATER ON-OFF SWITCH - PASSENGER	78-79
S23	REAR HEATER HIGH-LOW SPEED SWITCH	78
S24	HEATED REAR SCREEN SWITCH	105
S25	LIGHT SWITCH	90-91
S26	HEADLAMP DIP SWITCH	90-91
S27	REAR FOG GUARD SWITCH	100
S28	FRONT FOG LAMP SWITCH	102
S29	WINDOW LIFT SWITCH LH FRONT	110-112
S30	WINDOW LIFT SWITCH RH FRONT	114-116
S31	ELECTRIC MIRROR SWITCH	146-152
S32	MICRO SWITCH-DRIVERS DOOR	137
S33	LOW WASH LEVEL SWITCH	26
S34	PANEL LIGHT SWITCH	83-84
S35	OIL PRESSURE SWITCH	18
S36	OVERDRIVE SWITCH-AUTOMATIC TRANSMISSION	45
S37	KICKDOWN SWITCH-AUTOMATIC TRANSMISSION	51-52
S38	SEDIMENTOR WARNING LIGHT SWITCH	38
S39	KEY OPERATED CENTRAL DOOR LOCKING SWITCH	137
S40	DRIVER OPERATED CENTRAL DOOR LOCKING SWITCH	137
S41	DRIVERS FUEL CUT OFF SWITCH	13
S42	BELT RELEASE SWITCH	80
S43	LOW VACUUM SWITCH	16-17
S44	WINDOW LIFT SWITCH LH FRONT (AUTO)	118-120
S45	WINDOW LIFT SWITCH RH FRONT (AUTO)	122-124
S46	WINDOW LIFT-THERMAL OVERLOAD SWITCH L H FRONT	110-111
S47	WINDOW LIFT-THERMAL OVERLOAD SWITCH RH FRONT	115-116
S48	WINDOW LIFT-THERMAL OVERLOAD SWITCH LH FRONT	116-117
S49	WINDOW LIFT-THERMAL OVERLOAD SWITCH RH FRONT	125-126
S50	WINDOW LIFT SWITCH LH SIDE REAR-PASSENGER	154-156
S51	WINDOW LIFT SWITCH RH SIDE REAR-PASSENGER	158-160
S52	WINDOW LIFT SWITCH LH SIDE REAR - DRIVER	154-156
S53	WINDOW LIFT SWITCH RH SIDE REAR- DRIVER	158-160
S54	WINDOW LIFT-THERMAL OVERLOAD SWITCH LH REAR	154-155
S55	WINDOW LIFT-THERMAL OVERLOAD SWITCH RH REAR	159-160
S56	LOW BRAKE PAD WARNING CONTACTS	14
T1	TEMPERATURE TRANSMITTER	16
T2	FUEL GAUGE TRANSMITTER (TANK UNIT)	17
T3	FUEL CUT OFF SOLENOID	13
T4	SENDER UNIT (GEARBOX)	61-63
T5	SOLENOID (INJECTION TIMING ADVANCE)	35
T6	OVERDRIVE CANCEL SOLENOID (AUTO TRANS)	42
T7	KICK DOWN SOLENOID (AUTO TRANSMISSION)	51-52
T8	BELT RELEASE SOLENOID	80
T9	TERMINAL BLOCK FOR CYGNUS TAXI METER	67-69
T10	THERMISTOR-GLOW CONTROL BOX	29

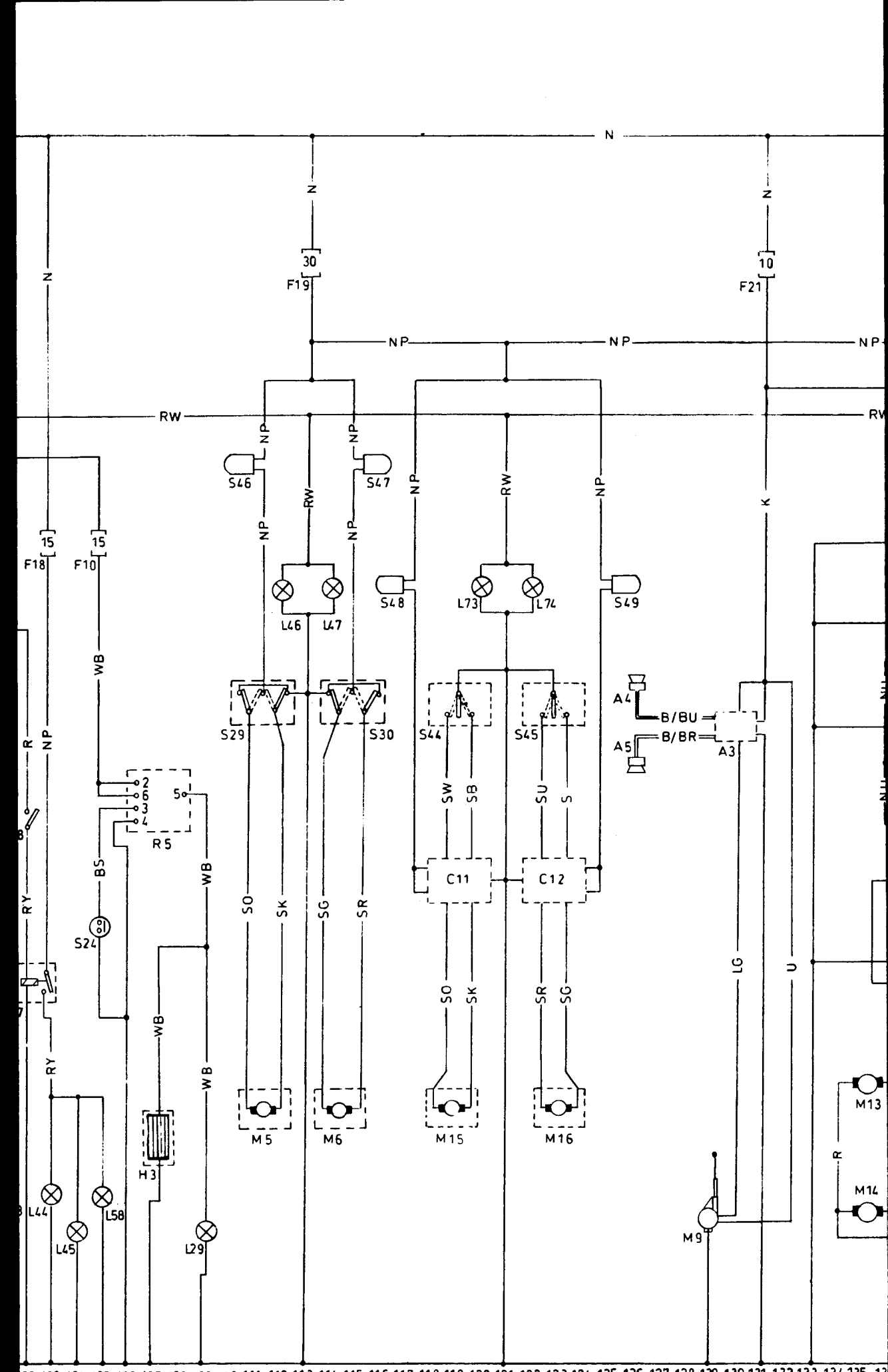


N
WG
H1
NY/NR
R9
R10
R11
NY
C8
WR
NB
WU
S
YW
W
LGW
WS
T10
S1
S2
S3
F23
N (B)
A1
R12
BR
L71
B1
S41
WP
Y
M1
S4
L1
C1
PB
VE
A6
T3
A2
S56
D1
GU
T1
D2
GB
T2
L2
WN
S35
S43
BW
L64
L3
D3
S5
SB
S6
F1
LG
M2
NLG
RLG
ULG
C2
LGB
M10
S7
S33
L57
L66
F3
F4
F5
GY
GLG
S8
GN
L4
S9
LGK
R2
LGN
S10
GR
L5
P
B
E
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32



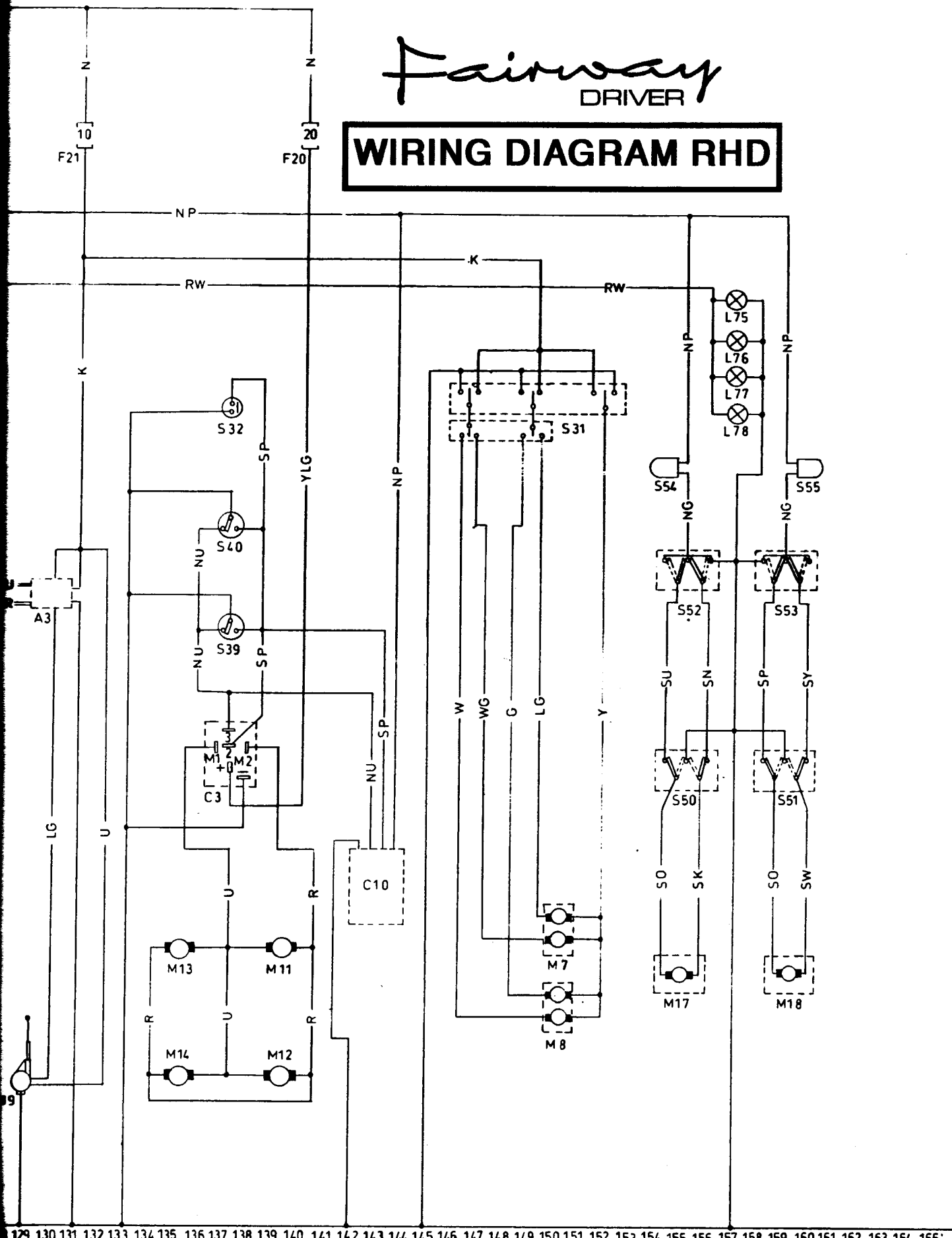
T5
S38
L68
T6
S36
L69
S37
C9
T7
F6
20
S19
L17
L20
7·5
3
F2
F7
L27
C5
T4
L12
L11
L13
L21
L22
L14
C6
L15
L16
S18
L25
R3
L26
R4
H2
L7
L61
L8
L9
L10
L60
S11
S12
S13
S17
L28
S14
L23
L24
L65
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67


N
20
F8
P
L72
T8
PU
S42
RW
W
NG
C4
15
F9
WP
RN
R1
S34
R8
S25
T9
WG
L18
L19
BY
C7
PW
S20
LGY
GS
M3
S21
S22
LGP
S23
M4
S15
S16
L35
L36
L48
L49
L50
L51
L52
L53
L54
L55
L59
L62
L63
L67
L70
R13
S26
R6
UY
UR
UW
RG
R
RB
UK
UR
7.5
10
F12
F11
F13
F14
L33
L34
L56
L30
L31
L32
L37
L38
F15
F16
US
UW
L39
L40
L41
F17
RS
S27
RU
L42
68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101


N
30
F19
10
F21
NP
RW
K
S46
S47
S48
L73
L74
S49
L46
L47
15
F18
15
F10
WB
R
RY
BS
S24
R5
S29
S30
S44
S45
SW
SB
SU
S
C11
C12
SO
SK
SG
SR
M5
M6
M15
M16
H3
L44
L45
L58
L29
A4
A5
B/BU
B/BR
A3
LG
U
M13
M14
M9
102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135

Fairway
DRIVER

WIRING DIAGRAM RHD



WIRING DIAGRAM LHD - KEY

WIRING COLOURS

B	BLACK	P	PURPLE
G	GREEN	S	SLATE/GREY
K	PINK	U	BLUE
N	BROWN	W	WHITE
O	ORANGE	Y	YELLOW

WIRING IDENTIFICATION

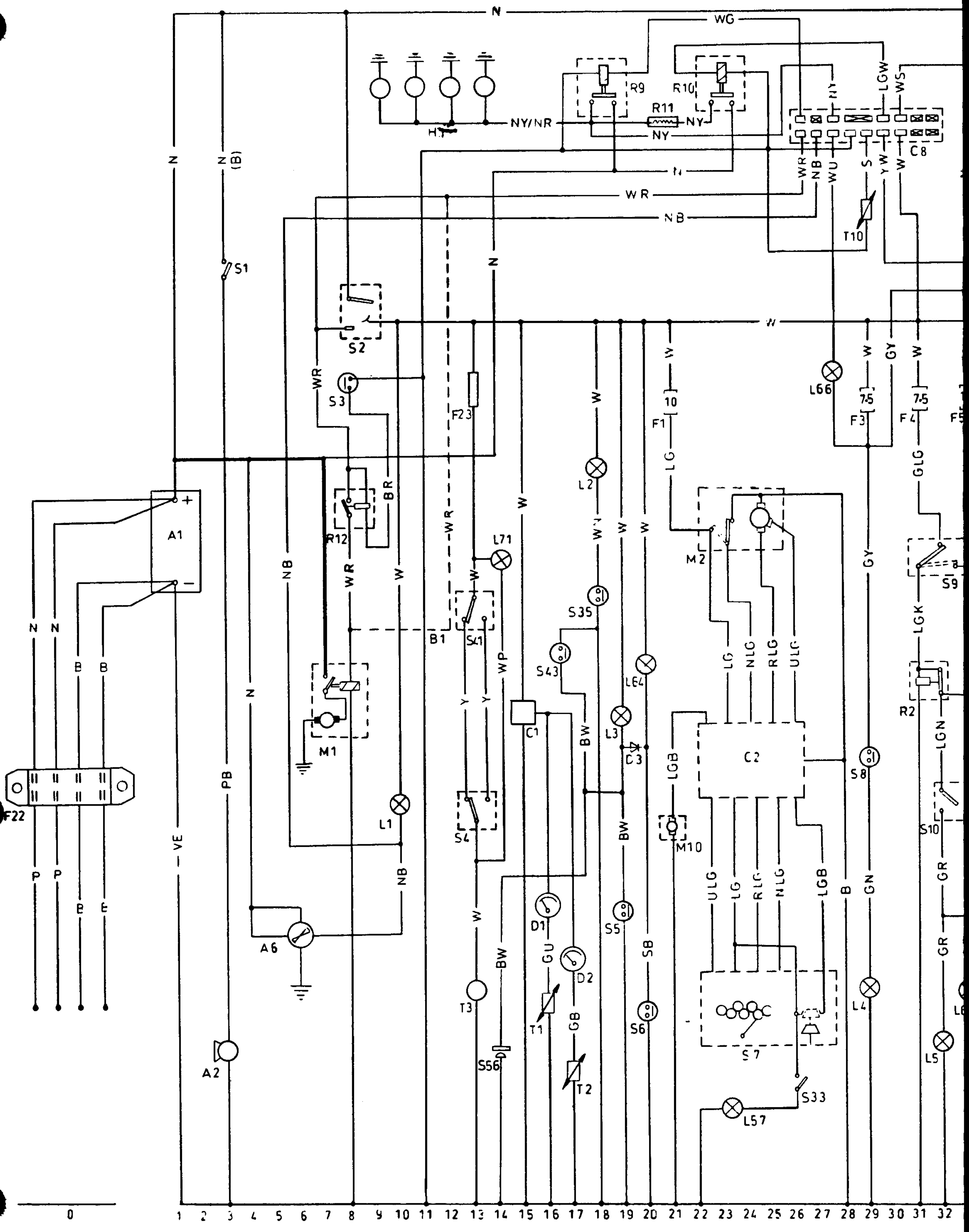
FIRST LETTER	PRIMARY COLOUR
SECOND LETTER	TRACER COLOUR
LIGHTER SHADE	PRECEDED BY LETTER L

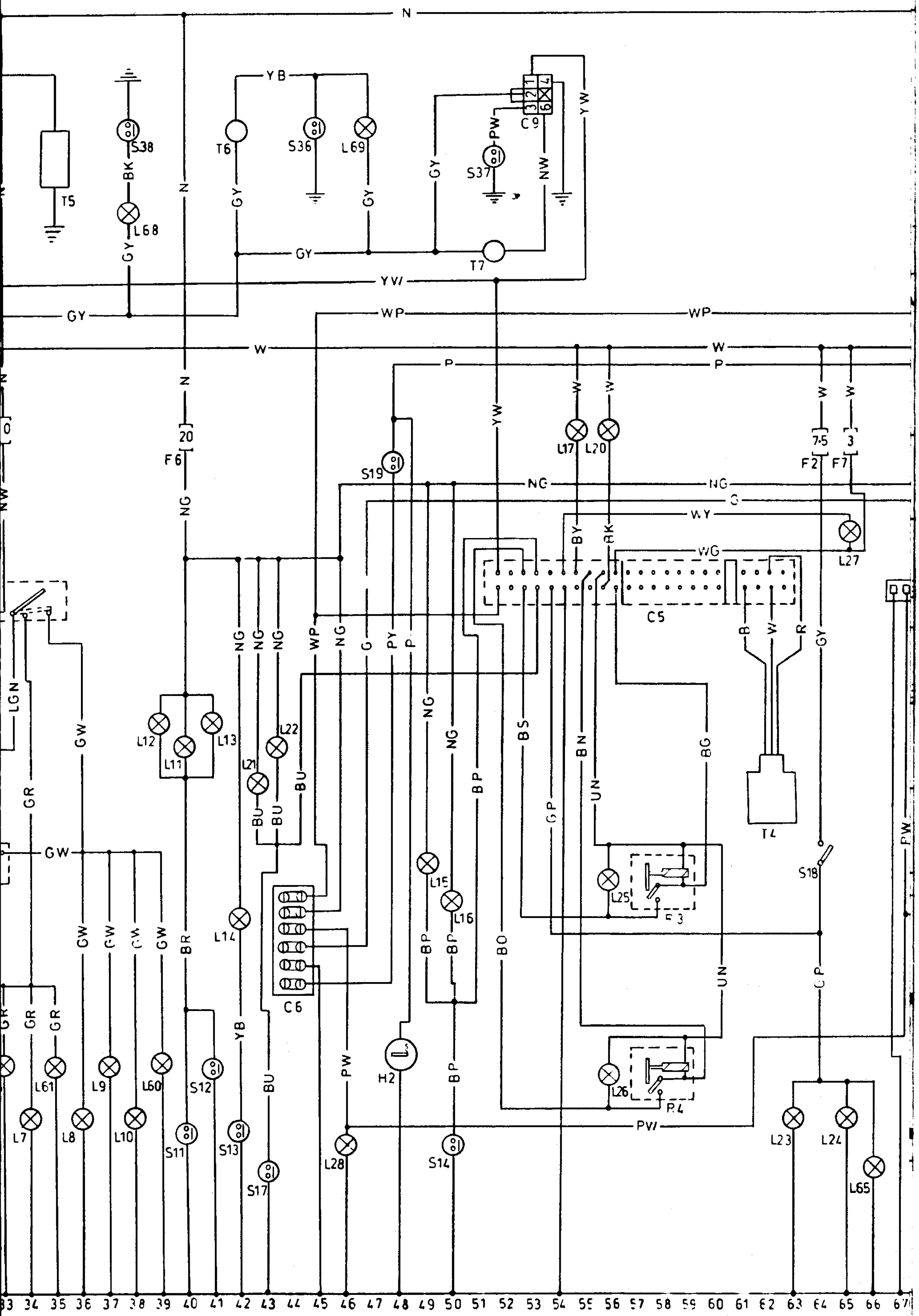
ITEM	DESCRIPTION	LOCATION
A1	BATTERY	1
A2	HORN	3
A3	RADIO	130
A4	SPEAKER - LEFT	126
A5	SPEAKER - RIGHT	126
A6	ALTERNATOR	6
B1	LINK LEAD (MANUAL TRANSMISSION)	8-12
C1	INSTRUMENT STABILISER	15
C2	WIPER DELAY UNIT	22-26
C3	CENTRAL DOOR LOCK CONTROL BOX	137
C4	CLOCK	80-81
C5	CONTROL BOX-DOOR LOCKING	51-63
C6	TAXI METER CONNECTOR BLOCK	44
C7	TAXI METER LIGHT BOX	69
C8	GLOW CONTROL BOX	26-32
C9	KICKDOWN CONTROL BOX (AUTO TRANS)	53-54
C10	CONTROL BOX-REMOTE DOOR LOCKING	142-144
C11	CONTROL BOX-WINDOW LIFT RH FRONT (AUTO)	118-120
C12	CONTROL BOX-WINDOW LIFT LH FRONT (AUTO)	122-124
D1	TEMPERATURE GAUGE	16
D2	FUEL GAUGE	17
D3	DIODE	19-20
F1	FUSE BLOCK B7	21
F2	FUSE BLOCK B2	64
F3	FUSE BLOCK B3	29
F4	FUSE BLOCK B8	31
F5	FUSE BLOCK C7	33
F6	FUSE BLOCK C2	40
F7	FUSE BLOCK B6	65
F8	FUSE BLOCK C3	69
F9	FUSE BLOCK B4	70
F10	FUSE BLOCK B5	105
F11	FUSE BLOCK A3	89
F12	FUSE BLOCK A2	86
F13	FUSE BLOCK A5	91
F14	FUSE BLOCK A4	93
F15	FUSE BLOCK A7	95
F16	FUSE BLOCK A6	97
F17	FUSE BLOCK A8	100
F18	FUSE BLOCK C4	103
F19	FUSE BLOCK C8	113
F20	FUSE BLOCK C5	140
F21	FUSE BLOCK C6	131
F22	FUSE BOX FOR RADIO TELEPHONE	0
F23	FUSIBLE LINK	13
H1	DIESEL HEATER PLUGS	9-14
H2	CIGAR LIGHTER	48
H3	HEATED REAR SCREEN	107
L1	IGNITION WARNING LIGHT	10
L2	OIL PRESSURE WARNING LIGHT	18
L3	LOW FLUID, LOW VACUUM AND BRAKE PAD W/L	19
L4	REVERSE LIGHT	29
L5	INDICATOR LIGHT RH REAR	32
L6	INDICATOR LIGHT RH FRONT	33
L7	INDICATOR WARNING LIGHT LH SIDE	34
L8	INDICATOR WARNING LIGHT LH REAR	36
L9	INDICATOR LIGHT LH FRONT	37
L10	INDICATOR WARNING LIGHT RH SIDE	38
L11	COURTESY LIGHT - ROOF CONSOLE	40
L12	COURTESY LIGHT RH SIDE FACIA	39

ITEM	DESCRIPTION	LOCATION
L13	COURTESY LIGHT LH SIDE FACIA	41
L14	DRIVERS INTERIOR LIGHT	42
L15	COURTESY LIGHT LH REAR	49
L16	PUDDLE LIGHT LH REAR	50
L17	RH REAR DOOR NOT CLOSED WARNING LIGHT	54-55
L18	INTERIOR LIGHT-PASSENGER RH REAR	71
L19	INTERIOR LIGHT-PASSENGER LH REAR	73
L20	LH REAR DOOR NOT CLOSED WARNING LIGHT	56
L21	PUDDLE LIGHT LH REAR	42-43
L22	COURTESY LIGHT LH REAR	43
L23	BRAKE LIGHT RH SIDE	63
L24	BRAKE LIGHT LH SIDE	65
L25	DOOR LOCKED WARNING LIGHT RH REAR	56
L26	DOOR LOCKED WARNING LIGHT LH REAR	56
L27	REAR DOORS NOT CLOSED WARNING LIGHT	65
L28	HIRE SIGN LIGHT	46
L29	REAR SCREEN HEATER WARNING LIGHT	109
L30	NO PLATE LIGHT	88
L31	TAIL LIGHT RH SIDE	89
L32	SIDE LIGHT RH FRONT	90
L33	TAIL LIGHT LH SIDE	85
L34	SIDE LIGHT LH FRONT	86
L35	INSTRUMENT CLUSTER ILLUMINATION RHS	81-84
L36	INSTRUMENT CLUSTER ILLUMINATION LHS	81-84
L37	DIPPED BEAM RH SIDE	91
L38	DIPPED BEAM LH SIDE	93
L39	MAIN BEAM RH SIDE	95
L40	MAIN BEAM LH SIDE	97
L41	MAIN BEAM WARNING LIGHT	98
L42	REAR FOG GUARD	100
L43	REAR FOG GUARD WARNING LIGHT	101
L44	FOG LAMP RH SIDE	103
L45	FOG LAMP LH SIDE	104
L46	WINDOW LIFT SWITCH ILLUMINATION RH SIDE	112
L47	WINDOW LIFT SWITCH ILLUMINATION LH SIDE	114
L48	REAR FOG GUARD & HEATED REAR SCREEN-SWITCH ILLUMINATION	82-83
L49	DRIVERS INTERIOR LIGHT SWITCH-ILLUMINATION (FRONT)	82-83
L50	HIRE SIGN SWITCH ILLUMINATION	82-83
L51	FRONT HEATER SWITCH ILLUMINATION	82-83
L52	DRIVERS REAR HEATER ON-OFF SWITCH-ILLUMINATION	82-83
L53	PASSENGERS REAR HEATER ON-OFF SWITCH-ILLUMINATION	82-83
L54	REAR HEATER HIGH-LOW SPEED SWITCH-ILLUMINATION	82-83
L55	DRIVERS INTERIOR LIGHT SWITCH-ILLUMINATION (REAR)	82-83
L56	SIDE LIGHTS ON WARNING LIGHT	87
L57	LOW WASHER FLUID WARNING LIGHT	23
L58	FOG LAMP WARNING LIGHT	105
L59	CIGAR LIGHTER ILLUMINATION	82-83
L60	INDICATOR REPEATER LH SIDE	39
L61	INDICATOR REPEATER RH SIDE	35
L62	AUTO GEAR SELECTOR ILLUMINATION	82-83
L63	ASHTRAY ILLUMINATION	82-83
L64	HANDBRAKE ON WARNING LIGHT	20
L65	HIGH LEVEL BRAKE LIGHT	66
L66	GLOW PLUG WARNING LIGHT	27-28
L67	PANEL LIGHT SWITCH ILLUMINATION	82-83
L68	SEDIMENTOR WARNING LIGHT	37-38
L69	OVERDRIVE WARNING LIGHT	46-47
L70	DRIVERS CENTRAL DOOR LOCKING SWITCH-ILLUMINATION	82-83
L71	FUEL SWITCH OFF WARNING LIGHT	14
L72	BELT RELEASED WARNING LIGHT (WHEEL CHAIR)	79

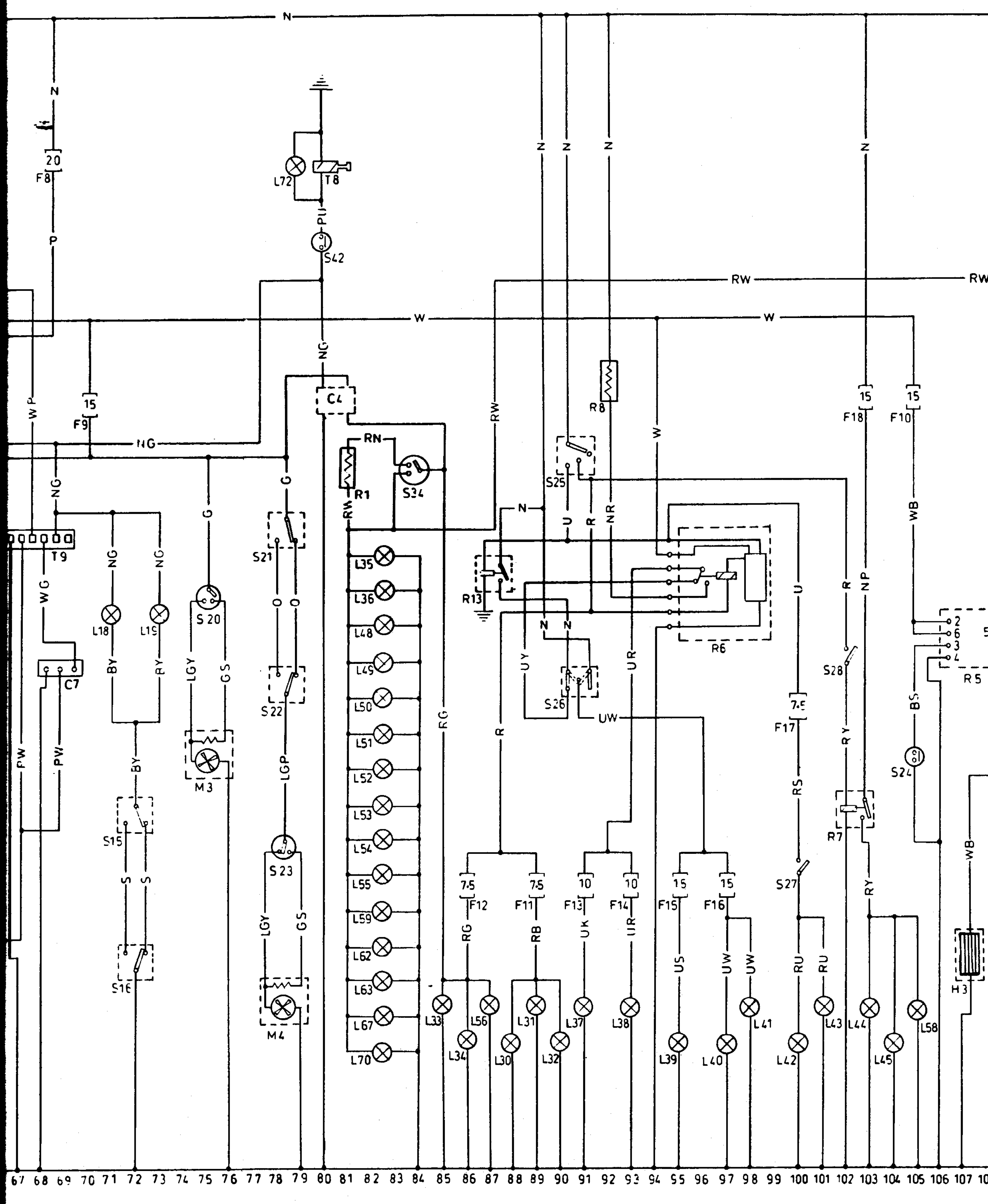
8c WIRING DIAGRAM LHD-KEY

ITEM	DESCRIPTION	LOCATION
L73	WINDOW LIFT SWITCH ILLUMINATION LHS (AUTO)	120
L74	WINDOW LIFT SWITCH ILLUMINATION RHS (AUTO)	122
L75	REAR WINDOW LIFT SWITCH ILLUMINATION RH SIDE-DRIVER	157
L76	REAR WINDOW LIFT SWITCH ILLUMINATION LH SIDE-DRIVER	157
L77	REAR WINDOW LIFT SWITCH ILLUMINATION RH SIDE-PASSENGER	157
L78	REAR WINDOW LIFT SWITCH ILLUMINATION LH SIDE-PASSENGER	157
M1	STARTER MOTOR	6-8
M2	FRONT SCREEN WIPER MOTOR	22-25
M3	FRONT HEATER	74-76
M4	REAR HEATER	78-79
M5	WINDOW LIFT MOTOR RH SIDE FRONT	111-112
M6	WINDOW LIFT MOTOR LH SIDE FRONT	114-115
M7	ELECTRICALLY OPERATED DOOR MIRROR RH SIDE	150-151
M8	ELECTRICALLY OPERATED DOOR MIRROR LH SIDE	150-151
M9	ELECTRICALLY OPERATED AERIAL	129
M10	FRONT SCREEN WASH MOTOR	21
M11	CENTRAL DOOR LOCKING MOTOR LH SIDE FRONT	139-140
M12	CENTRAL DOOR LOCKING MOTOR LH SIDE REAR	139-140
M13	CENTRAL DOOR LOCKING MOTOR RH SIDE FRONT	135-136
M14	CENTRAL DOOR LOCKING MOTOR RH SIDE REAR	135-136
M15	WINDOW LIFT MOTOR RH SIDE FRONT (AUTO)	118-119
M16	WINDOW LIFT MOTOR LH SIDE FRONT (AUTO)	122-123
M17	WINDOW LIFT MOTOR RH SIDE REAR	154-156
M18	WINDOW LIFT MOTOR LH SIDE REAR	158-160
R1	RESISTOR PANEL LIGHTS	81
R2	19 FL FLASHER UNIT	31-32
R3	LH REAR DOOR LOCKING SOLENOID	57-59
R4	RH REAR DOOR LOCKING SOLENOID	57-59
R5	HEATED REAR SCREEN TIMER	106-109
R6	DIM DIP RELAY	95-99
R7	FRONT FOG LAMP RELAY	102-103
R8	DIM DIP RESISTOR	92
R9	GLOW PLUG RELAY 1	18-19
R10	GLOW PLUG RELAY 2	22-23
R11	RESISTOR-INDUCTION MANIFOLD	20-21
R12	INHIBITOR RELAY (AUTO TRANSMISSION)	8-9
R13	HEADLAMP SWITCH OVERLOAD RELAY	87-88
S1	HORN PUSH	3
S2	IGNITION SWITCH	8-9
S3	GEARBOX INHIBITOR SWITCH	8
S4	FUEL CUT OFF SWITCH	13
S5	LOW BRAKE FLUID SWITCH	19
S6	HANDBRAKE ON WARNING LIGHT SWITCH	20
S7	SCREEN WASH/WIPE SWITCH	22-27
S8	REVERSE LIGHT SWITCH	29
S9	HAZARD SWITCH	31-35
S10	INDICATOR SWITCH	31-33
S11	COURTESY SWITCH LH FRONT	40
S12	COURTESY SWITCH RH FRONT	41
S13	DRIVERS INTERIOR LIGHT SWITCH	42
S14	COURTESY SWITCH RH REAR	50
S15	INTERIOR LIGHT SWITCH-PASSENGER	72
S16	INTERIOR LIGHT SWITCH-DRIVER	72
S17	COURTESY SWITCH LH REAR	43
S18	BRAKE LIGHT SWITCH	64
S19	HIRE SIGN SWITCH	47
S20	FRONT HEATER SWITCH	75
S21	REAR HEATER ON-OFF SWITCH - DRIVER	78-79
S22	REAR HEATER ON-OFF SWITCH - PASSENGER	78-79
S23	REAR HEATER HIGH-LOW SPEED SWITCH	78
S24	HEATED REAR SCREEN SWITCH	105
S25	LIGHT SWITCH	90-91
S26	HEADLAMP DIP SWITCH	90-91
S27	REAR FOG GUARD SWITCH	100
S28	FRONT FOG LAMP SWITCH	102
S29	WINDOW LIFT SWITCH RH FRONT	110-112
S30	WINDOW LIFT SWITCH LH FRONT	114-116
S31	ELECTRIC MIRROR SWITCH	146-152
S32	MICRO SWITCH-DRIVERS DOOR	137
S33	LOW WASH LEVEL SWITCH	26
S34	PANEL LIGHT SWITCH	83-84
S35	OIL PRESSURE SWITCH	18
S36	OVERDRIVE SWITCH-AUTOMATIC TRANSMISSION	45
S37	KICKDOWN SWITCH-AUTOMATIC TRANSMISSION	51-52
S38	SEDIMENTOR WARNING LIGHT SWITCH	38
S39	KEY OPERATED CENTRAL DOOR LOCKING SWITCH	137
S40	DRIVER OPERATED CENTRAL DOOR LOCKING SWITCH	137
S41	DRIVERS FUEL CUT OFF SWITCH	13
S42	BELT RELEASE SWITCH	80
S43	LOW VACUUM SWITCH	16-17
S44	WINDOW LIFT SWITCH RH FRONT (AUTO)	118-120
S45	WINDOW LIFT SWITCH LH FRONT (AUTO)	122-124
S46	WINDOW LIFT-THERMAL OVERLOAD SWITCH R H FRONT	110-111
S47	WINDOW LIFT-THERMAL OVERLOAD SWITCH LH FRONT	115-116
S48	WINDOW LIFT-THERMAL OVERLOAD SWITCH RH FRONT	116-117
S49	WINDOW LIFT-THERMAL OVERLOAD SWITCH LH FRONT	125-126
S50	WINDOW LIFT SWITCH RH SIDE REAR-PASSENGER	154-156
S51	WINDOW LIFT SWITCH LH SIDE REAR-PASSENGER	158-160
S52	WINDOW LIFT SWITCH RH SIDE REAR - DRIVER	154-156
S53	WINDOW LIFT SWITCH LH SIDE REAR- DRIVER	158-160
S54	WINDOW LIFT-THERMAL OVERLOAD SWITCH RH REAR	154-155
S55	WINDOW LIFT-THERMAL OVERLOAD SWITCH LH REAR	159-160
S56	LOW BRAKE PAD WARNING CONTACTS	14
T1	TEMPERATURE TRANSMITTER	16
T2	FUEL GAUGE TRANSMITTER (TANK UNIT)	17
T3	FUEL CUT OFF SOLENOID	13
T4	SENDER UNIT (GEARBOX)	61-63
T5	SOLENOID (INJECTION TIMING ADVANCE)	35
T6	OVERDRIVE CANCEL SOLENOID (AUTO TRANS)	42
T7	KICK DOWN SOLENOID (AUTO TRANSMISSION)	51-52
T8	BELT RELEASE SOLENOID	80
T9	TERMINAL BLOCK FOR CYGNUS TAXI METER	67-69
T10	THERMISTOR-GLOW CONTROL BOX	29

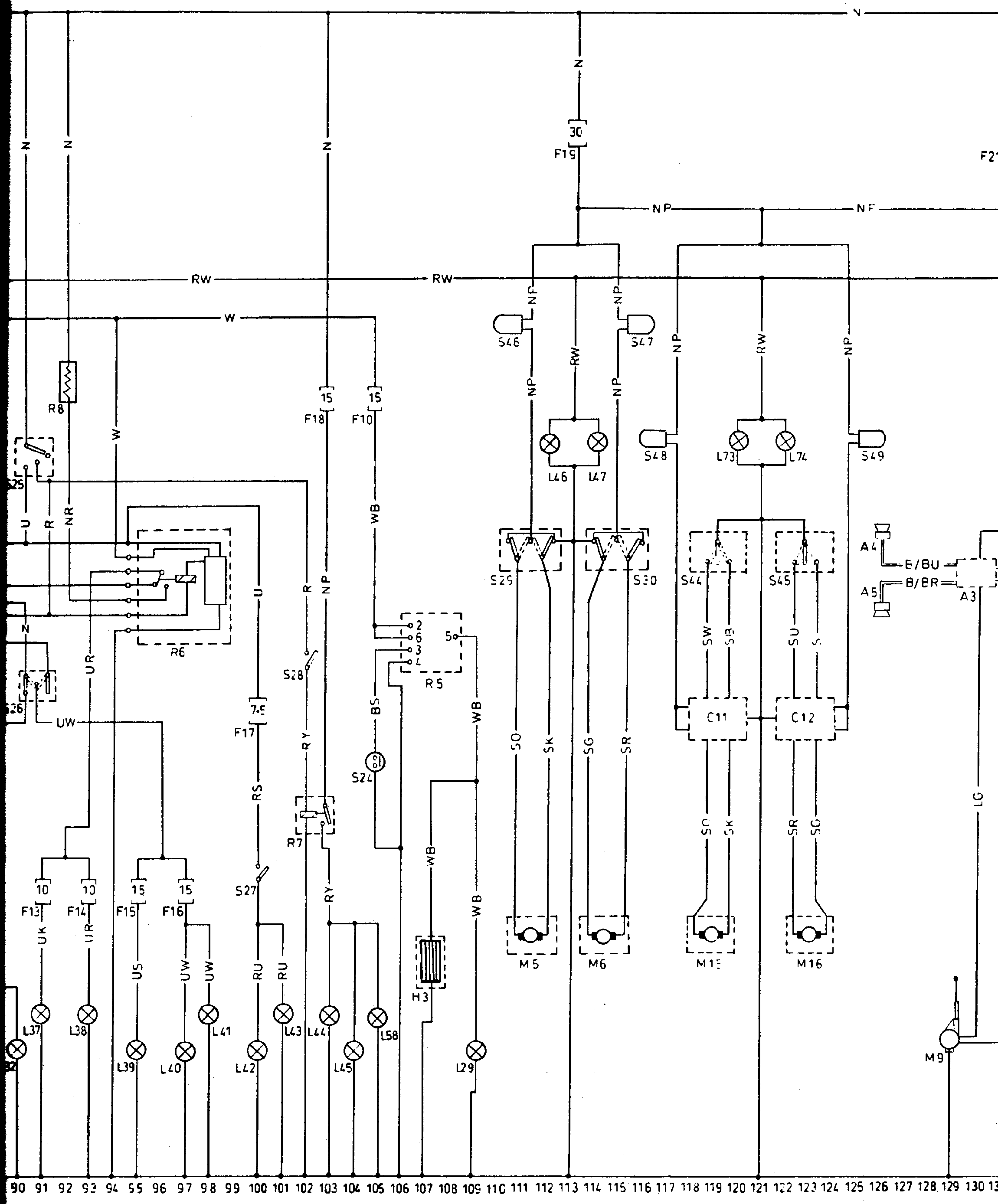

N
WG
R9
R10
R11
NY/NR
NY
H1
C8
LGW
WS
WR
NB
WU
S
YW
W
T10
N (B)
S1
S2
S3
F23
W
L66
7.5
F3
F4
10
F1
LG
GY
GLG
A1
+
−
R12
BR
L2
M2
L71
S9
LGK
B1
S41
S35
S43
WP
Y
L64
C1
L3
D3
C2
R2
LGN
LGB
S8
M1
S4
M10
S10
L1
NLG
RLG
ULG
F22
P
B
E
PB
VE
NB
BW
A6
D1
S5
GU
D2
T3
T1
GB
S6
SB
GR
GN
S7
L4
L5
S56
T2
S33
L57
A2
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32



N
YB
YW
C9
T6
S36
L69
S38
S37
BK
T5
L68
GY
NW
T7
YW
WP
W
P
F6
20
S19
L17
L20
7·5
3
F2
F7
NG
G
WY
L27
BY
WG
C5
B
R
PY
BU
L12
L11
L13
L21
L22
BS
BN
BG
BP
GP
UN
T4
LGN
GW
GR
L15
L16
L25
R3
S18
PW
C6
L14
BR
BO
H2
L26
R4
PW
L61
L9
L60
S12
L7
L8
L10
S11
S13
S17
L28
S14
L23
L24
L65
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67



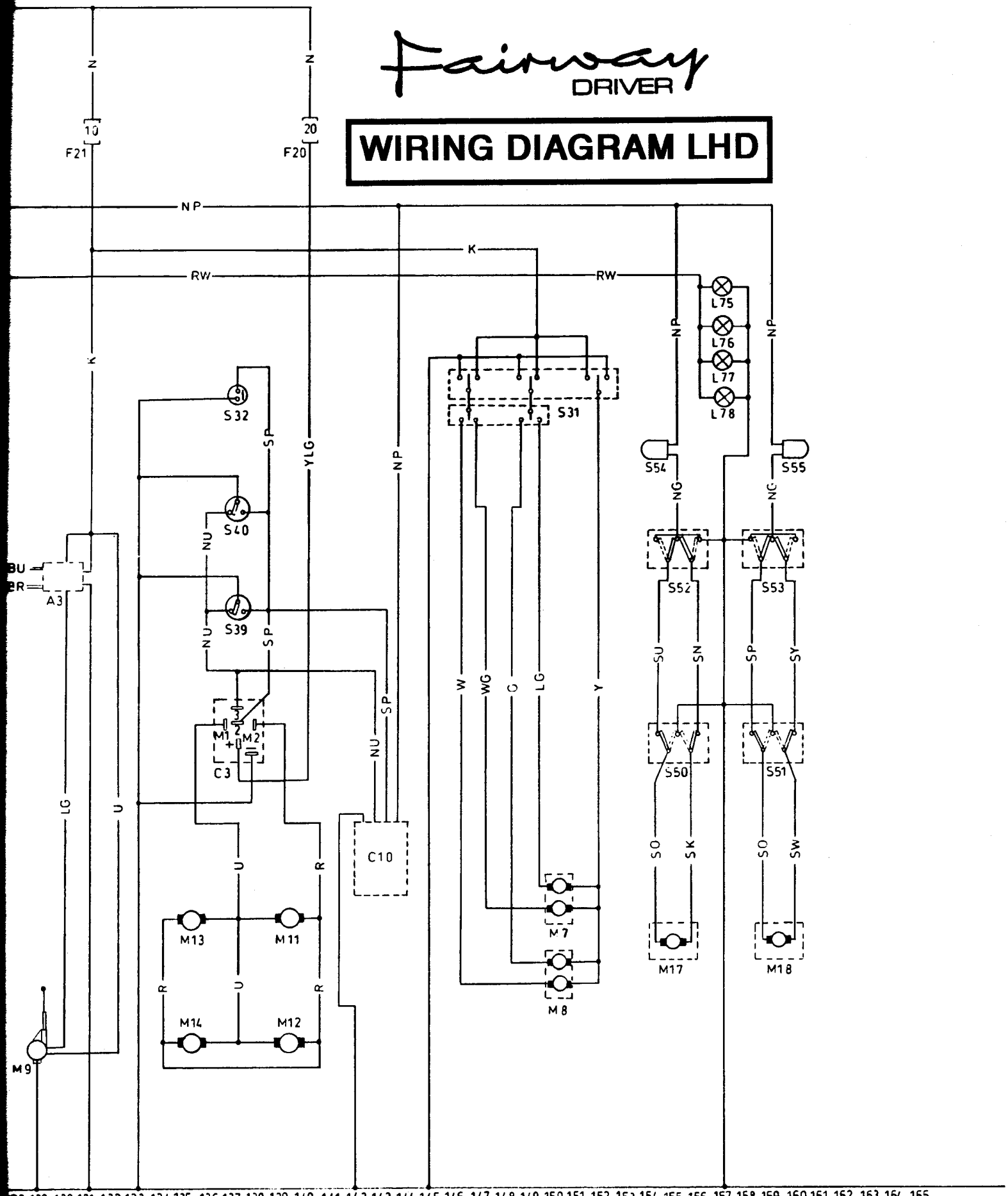
F8
F9
F10
F11
F12
F13
F14
F15
F16
F17
F18
T8
T9
C4
C7
L72
S42
S34
R1
R8
R13
R6
R5
R7
S15
S16
S20
S21
S22
S23
S24
S25
S26
S27
S28
M3
M4
H3
L18
L19
L30
L31
L32
L33
L34
L35
L36
L37
L38
L39
L40
L41
L42
L43
L44
L45
L48
L49
L50
L51
L52
L53
L54
L55
L56
L58
L59
L62
L63
L67
L70
67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107



N
F19
30
NP
RW
W
S46
S47
S48
S49
L46
L47
L73
L74
S29
S30
S44
S45
C11
C12
M5
M6
M15
M16
A3
A4
A5
B/BU
B/BR
LG
M9
R8
S25
R6
S26
UW
UR
F18
F10
15
WB
R5
S28
RY
F17
7.5
RS
S24
BS
R7
S27
H3
F13
F14
F15
F16
10
L37
L38
L39
L40
L41
L42
L43
L44
L45
L58
L29
90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130

Fairway
DRIVER

WIRING DIAGRAM LHD



LTI SERVICE

fairway

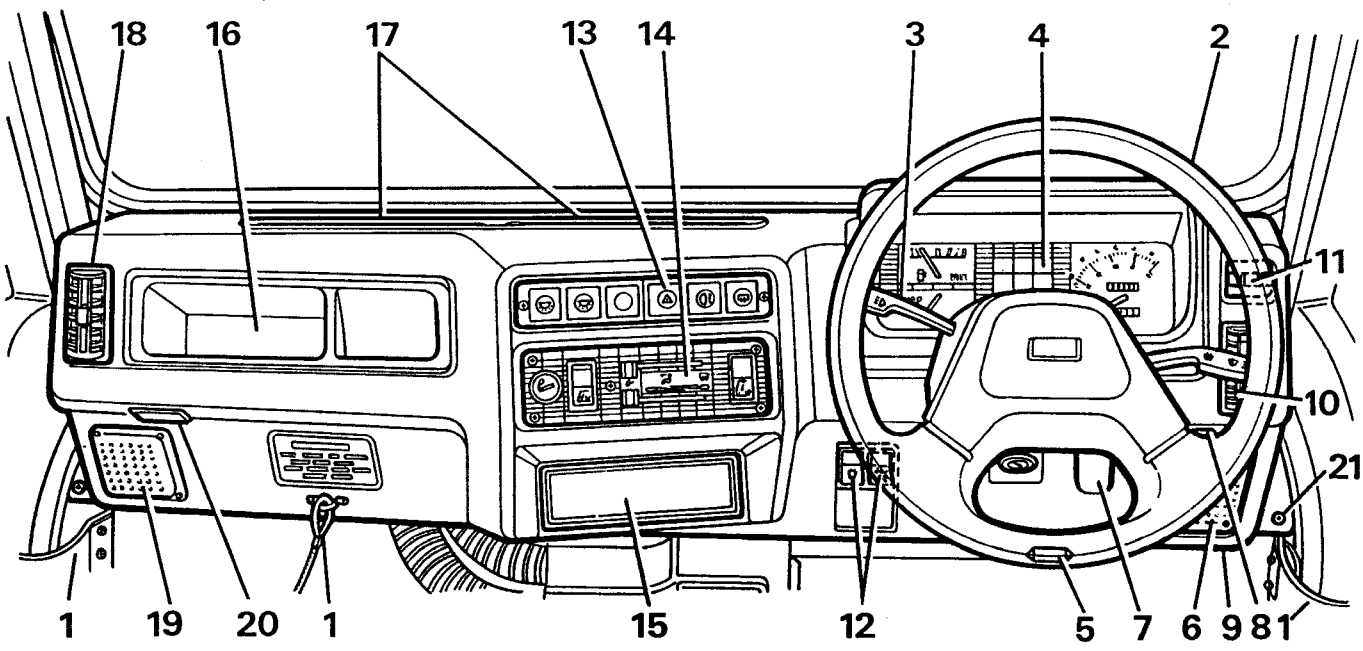
WORKSHOP MANUAL

SECTION 10

BODY

SECTION BF

CONTENTS



M0220

Figure 1

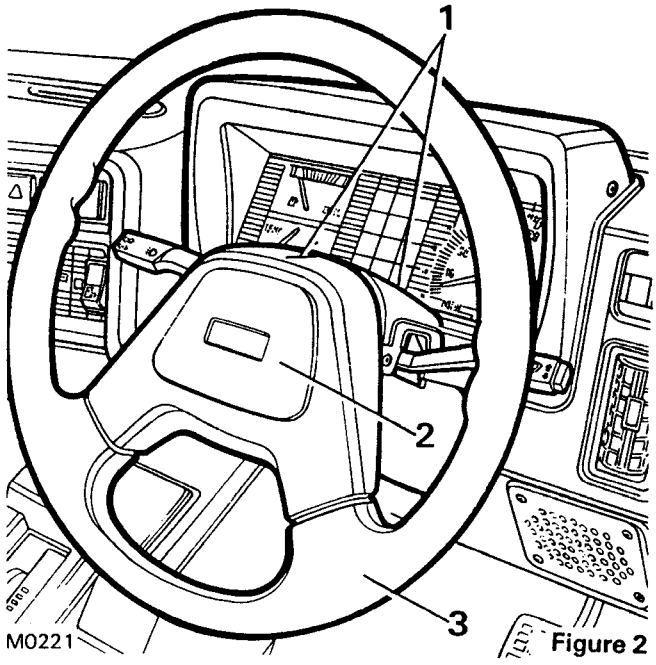
Fascia Panel

The fascia panel comprises a single ABS plastic moulding that accomodates the instrument binnacle, electrical components and heater controls. Individual components can be serviced or replaced without disturbing the fascia fixings. However, if structural damage has occured around the bulkhead area it will be necessary to remove the complete fascia moulding to fascilitate repair operations.
It is important that the correct procedure is adopted to prevent possible damage to ancilliary components, therefore first read the summary of the removal sequence, shown in Figure 1, as follows:-

1. After disconnecting battery, remove door checkstraps.
2. Remove steering wheel.
3. Remove multi-switch assembly from steering column.
4. Remove instrument binnacle
5. Disconnect wiper motor relay wiring plug.
6. Remove R.H. radio speaker grille.
7. Remove hazard warning relay.
8. Disconnect R.H. footwell lamp leads.
9. Remove fuse box.
10. Remove R.H. fresh air vent hose.
11. Disconnect warning light.
12. Disconnect 'taxi hire' and dimmer switch plugs.
13. Remove fascia switch panel.
14. Remove heater control panel.
15. Remove radio, if fitted.
16. Remove glove box.
17. Remove windscreen vent hoses.
18. Remove L.H. fresh air vent hose.
19. Remove L.H. radio speaker/grille.
20. Disconnect L.H. footwell lamp leads.
21. Remove fascia panel fixings.

Detailed instructions on how to remove the fascia moulding are contained in the following pages.

Remove steering wheel



M0221

Figure 2

1. Chalk a mark on the steering wheel boss and multi- switch cover to ensure correct alignment in the refitting procedure, see Figure 2.

2. Carefully prise out centre pad and unscrew retaining nut.

3. Remove steering wheel from splined column.

Remove multi-switch assembly

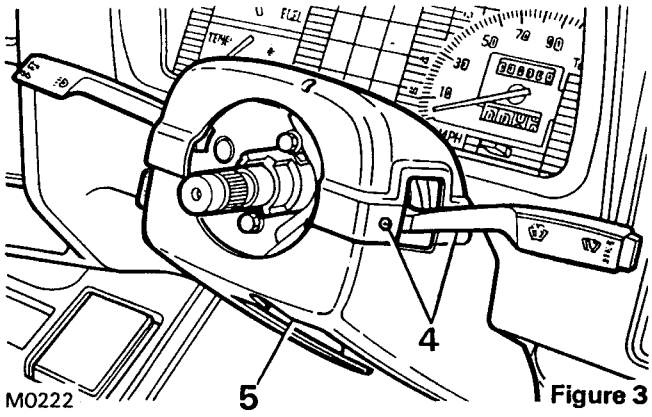


Figure 3

4. Remove four screws and remove top cover from multi-switch, see Figure 3.

5. Remove single screw and remove bottom cover.

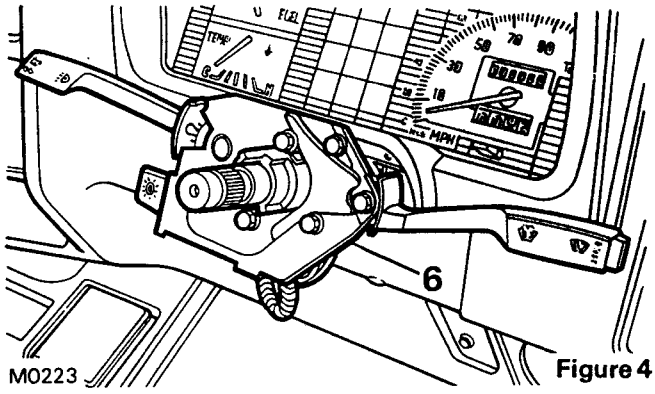


Figure 4

6. Slacken clamping screw and remove multi-switch from steering column, see Figure 4. The wiring plugs have to be disconnected after the instrument binnacle is detatched from the fascia.

Remove instrument binnacle

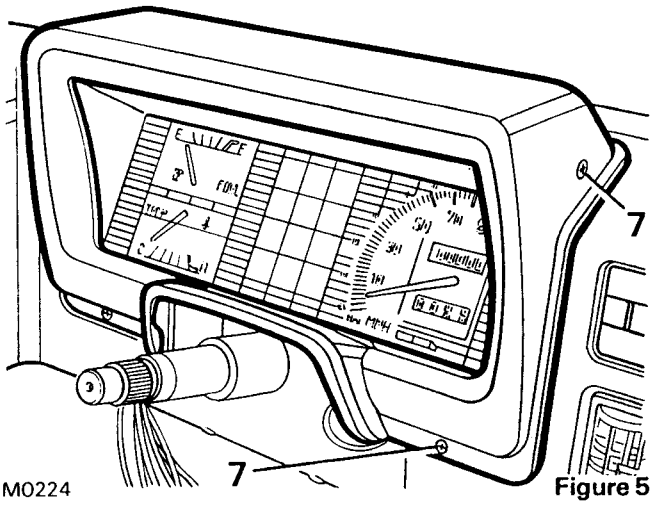


Figure 5

7. Remove four retaining screws and lift binnacle cover from fascia, see Figure 5.

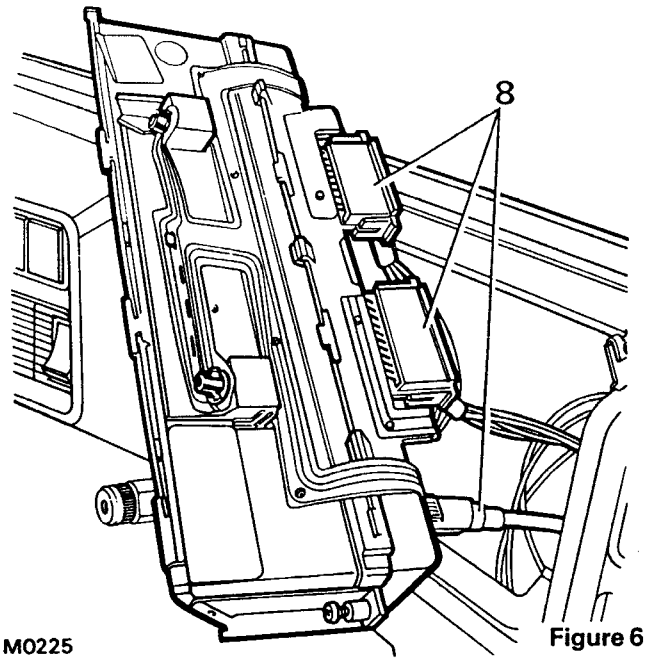


Figure 6

8. Remove fixing screws, pull binnacle forward from fascia location and disconnect multi-plugs and speedo cable, see Figure 6.

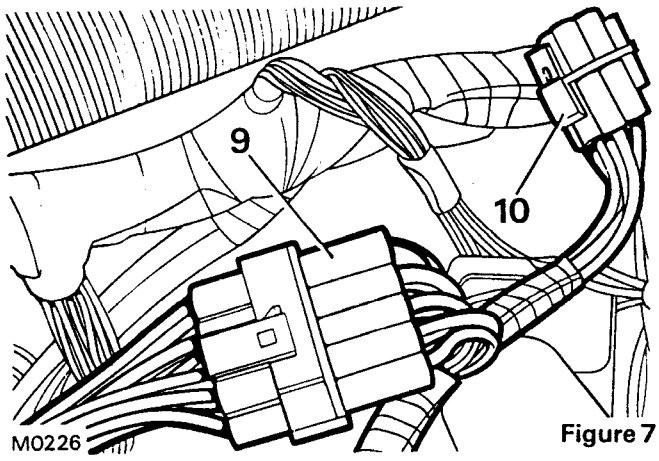


Figure 7

9. Disconnect multi-switch wiring plug, see Figure 7.

10. Disconnect wiring plug from wiper motor control relay, see Figure 8.

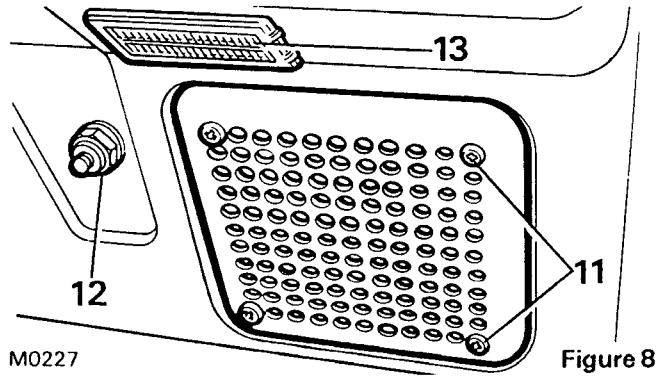
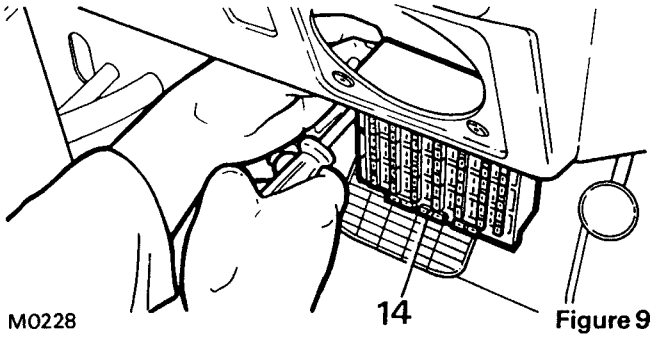


Figure 8

11. Remove four retaining screws and withdraw radio speaker grille, see Figure 8, and disconnect speaker wires if radio is fitted.

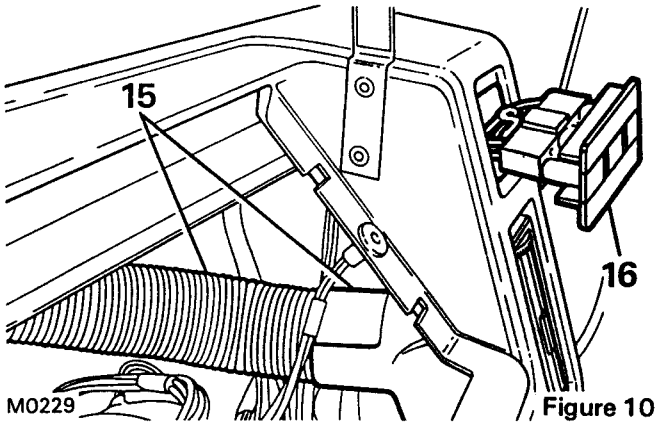
12. Remove single bolt and detach hazard warning relay from rear of fascia, see Figure 8.

13. Carefully prise R.H. footwell illumination lamps from fascia and disconnect wiring leads. Refit lamp.



M0228 Figure 9

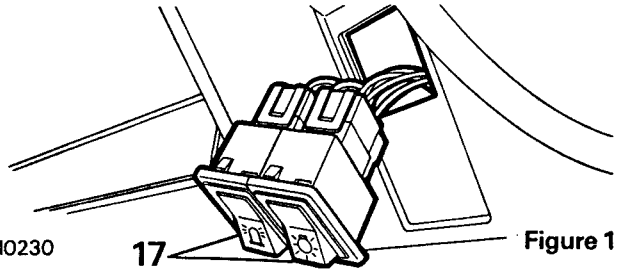
14. Hinge down fuse box, remove hinge retaining screws and detach fuse box from rear of fascia complete with wiring harness, see Figure 9.



M0229 Figure 10

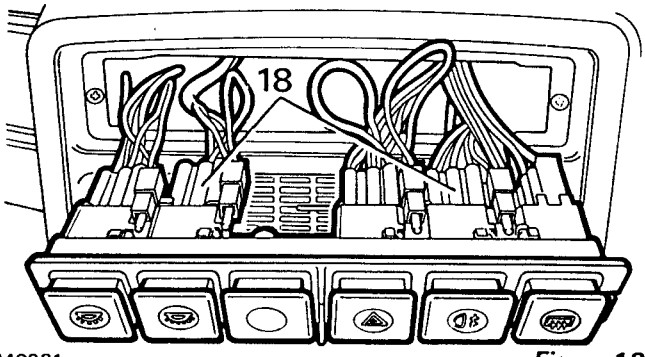
15. Remove R.H. fresh air vent boot, complete with hose, see Figure 10.

16. Disconnect warning light leads.



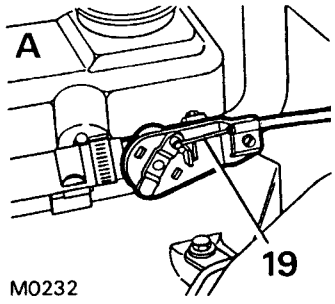
M0230 Figure 11

17. Disconnect 'taxi hire' and dimmer switch wiring plugs, see Figure 11.



M0231 Figure 12

18. Remove retaining screws, pull fascia switch panel forward and disconnect wiring plugs, see Figure 12.



M0232

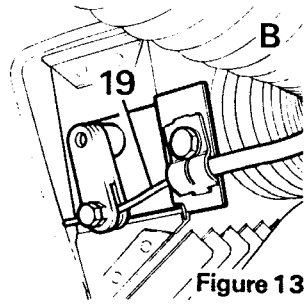
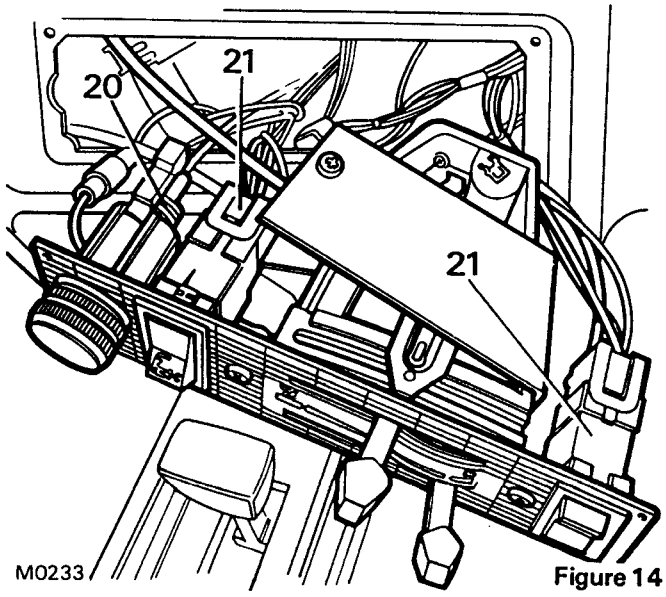


Figure 13

19. Disconnect heater control cables from water valve A in the engine compartment and at vent control B in the L.H. footwell, see Figure 13.

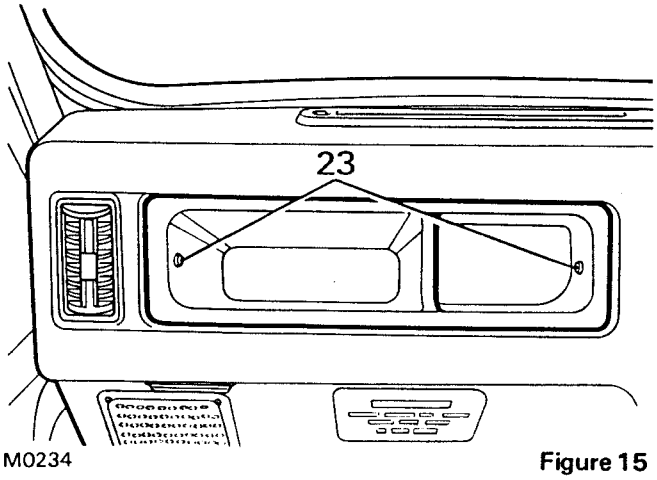


M0233 Figure 14

20. Remove four retaining screws, pull heater control panel forward and disconnect cigar lighter lead, see Figure 14.

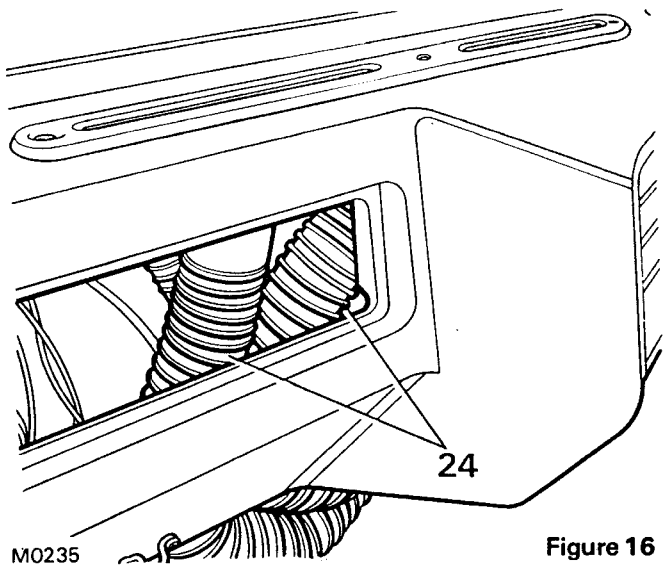
21. Disconnect driver and passenger fan heater switch plugs and remove heater control panel, complete with control cables.

22. Remove radio, if fitted. Refer to manufacturers instructions.



M0234 Figure 15

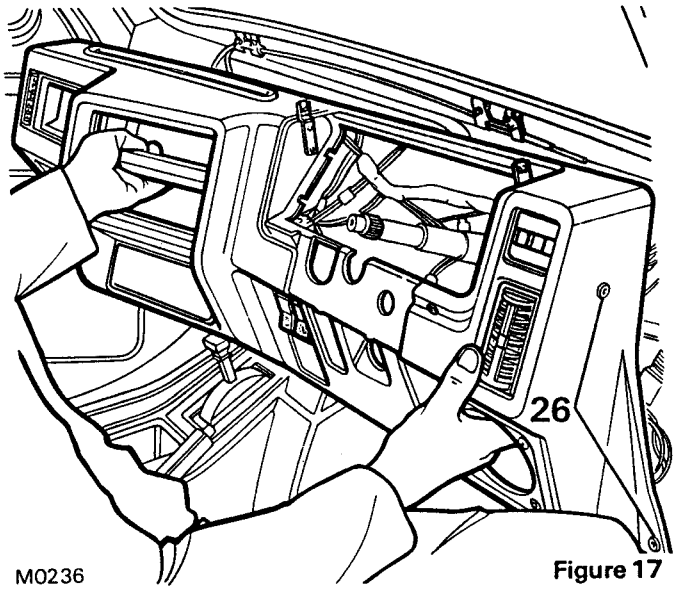
23. Remove retaining screws and withdraw glove box from fascia, see Figure 15.



M0235 Figure 16

24. Disconnect windscreen de-mist vent hoses through glove box aperture, see Figure 16.

25. Remove L.H. fresh air vent boot complete with hose, footwell illumination lamp and radio speaker grille as for R.H. side.



M0236 Figure 17

26. Carefully prise off four finishing caps, two either side, remove retaining screws and withdraw fascia panel from bulkhead as shown in Figure 17.

Refit fascia panel

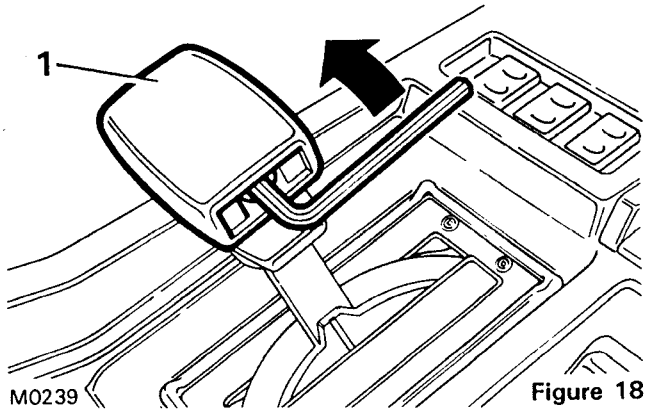
1. Refit fascia panel to bulkhead and secure with retaining screws and cappings. To facilitate following operations pull wiring leads etc of ancillary components through relevant fascia apertures.
2. Reconnect L.H. footwell illumination lamp leads.
3. Refit radio speaker/grille.
4. Reconnect fresh air vent hose.
5. Reconnect windscreen de-mist vent hoses.
6. Refit glove box.
7. Refit radio, if applicable.
8. Refit heater control panel.
9. Refit fascia switch panel.
10. Reconnect 'taxi hire' and dimmer switch plugs.
11. Reconnect warning light leads.
12. Reconnect R.H. fresh air vent hose.
13. Refit fuse box.
14. Reconnect footwell illumination lamp leads.
15. Refit hazard warning relay.
16. Refit R.H. radio speaker/grille.
17. Refit instrument binnacle.
18. Refit multi-switch assembly to steering column. Ensure the self cancelling boss is correctly positi-oned. i.e. with the arrows pointing to the left.
19. Refit steering wheel.
20. Refit door checkstraps and reconnect battery.

Centre Console (Automatic Vehicles)

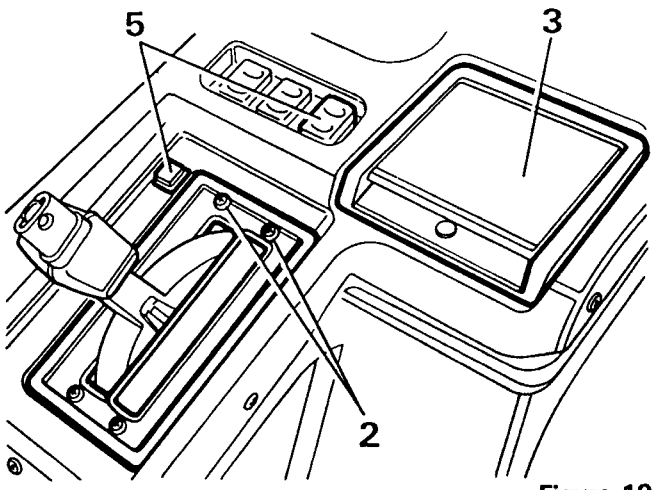
The centre console comprises three main panels; the R.H. plastic moulding, the L.H. board complete with carpet or matting and the top plastic moulding, which also houses a storage box under the arm rest. Individual components housed within the centre console such as the drivers ash tray or storage box lid can be serviced without disturbing the console fixings.

Removal

1. Carefully prise out the end cap from the gear lever knob and unscrew the socket head screw revealed. Withdraw the screw and remove gear lever knob, see Figure 18.



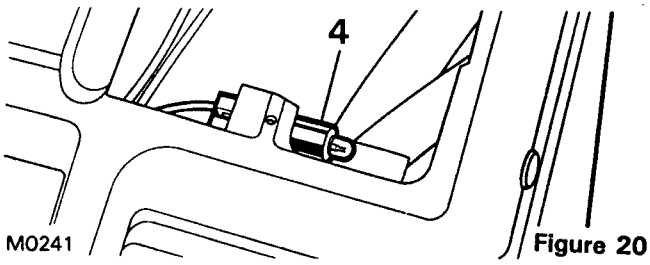
M0239 Figure 18



M0240 **Figure 19**

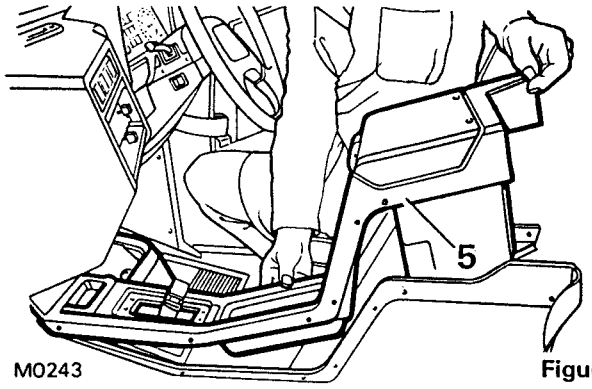
2. Remove the four screws and detach the gear lever plate, see Figure 19.

3. Raise the ash tray cover and remove the complete assembly from the console, see Figure 19.



M0241 **Figure 20**

4. Disconnect the ash tray illumination bulb from the centre console, see Figure 20.

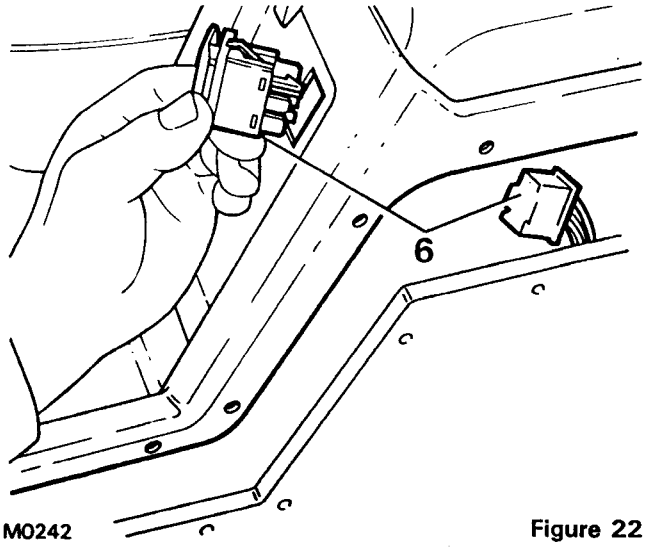


M0243 **Figure 21**

5. Remove the retaining screws (16 Off) securing the top console and lift the console from the rear to clear fascia and gear lever. Disconnect the electrical connections from the central locking switch and gearbox overide switch. See Figures 19 and 21.

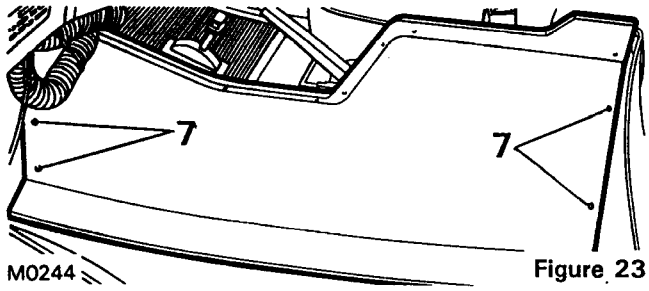
Note
This will facilitate the removal of the gear change mechanism.

Note: If electric window lifts are fitted, disconnect the wiring plugs from the rear of the switches before removing the top console completely.



M0242 **Figure 22**

6. **The R.H. side will now be loose and can be lifted out.**



M0244 **Figure 23**

7. Remove the four retaining screws and lift out the L.H. console panel, see Figure 23.

Install

1. To install the centre console, reverse the above procedure.

Centre Console (Manual Vehicles)

The centre console comprises four main panels; the R.H. front plastic moulding, the R.H. rear plastic moulding, the L.H. board complete with carpet or matting and the top plastic moulding. Individual components housed within the centre console such as the drivers ash tray or ash tray illumination can be serviced without disturbing the console fixings, see Figure 24.

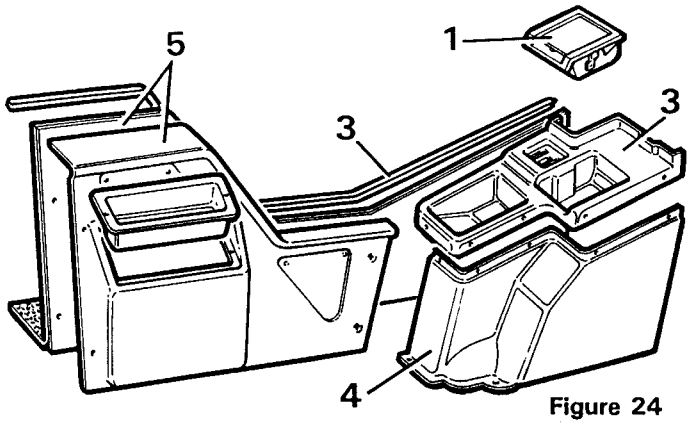


Figure 24

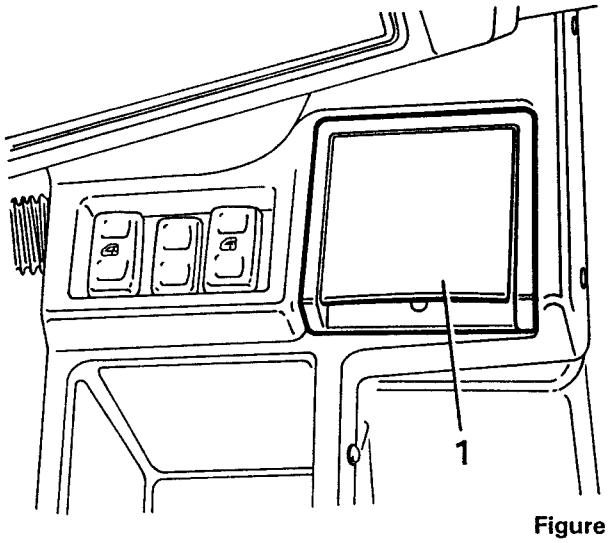


Figure 25

Removal

1. Raise the ash tray cover and remove the complete assembly from the console, see Figure 25.

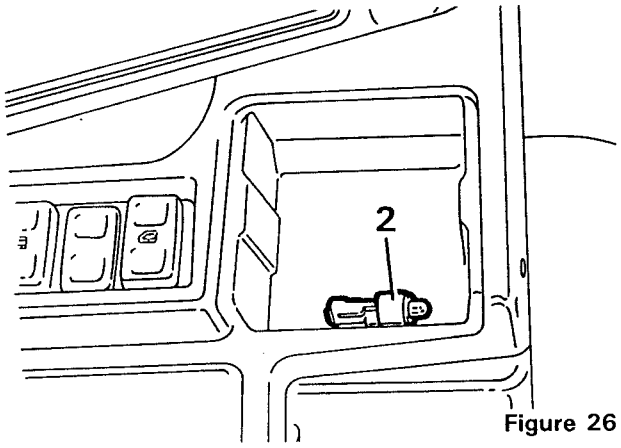


Figure 26

2. Disconnect the ash tray illumination bulb holder from the centre console, see Figure 26.

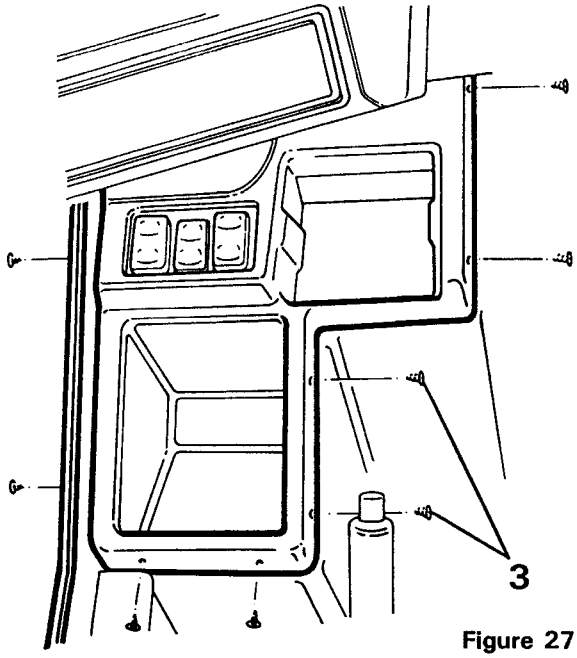


Figure 27

3. Remove the edging strip and the retaining screws (8 Off) securing the top console and lift the console from the rear to clear fascia and gear lever, see Figure 24 and Figure 27.

Note: If electric window lifts are fitted, disconnect the wiring plugs from the rear of the switches before removing the top console completely, see Figure 28.

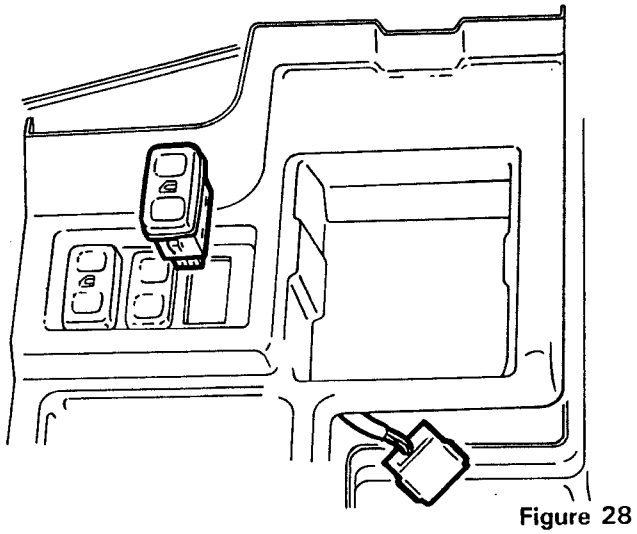
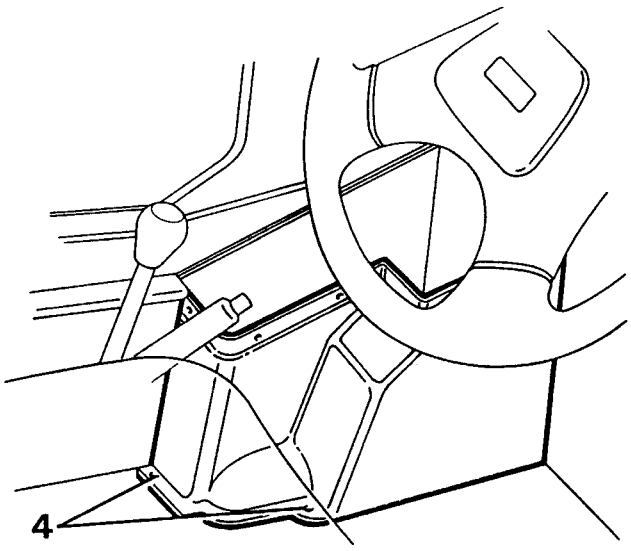


Figure 28



4. To remove the front R.H. side panel remove the retaining screws (2 Off) and the panel can be lifted out.

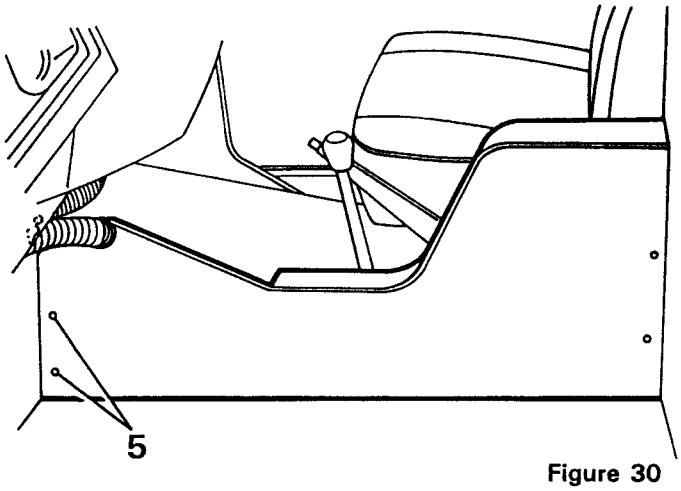


Figure 30

5. The rear R.H. side panel and the L.H. side panel are removed as one assembly:

6. Remove the retaining screws (4 Off) and lift out the L.H. console panel with the R.H. side panel as one, see Figure 30.

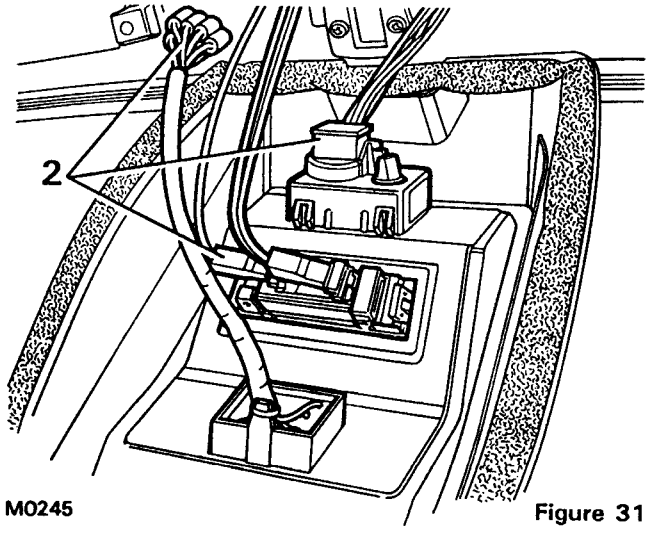
Note: To separate the R.H. side panel from the L.H. side panel remove the retaining screws (6 Off) and the panels can be split.

Install

1. To install the centre console, reverse the above procedure.

Roof Console

The roof console houses the drivers cab interior lamp a digital clock and the electric door mirror switch. Each of these can be serviced without detaching the console from the headlining. However, it will be necessary to remove the console to gain access to the 'taxi for hire' sign illumination bulb and to remove the headlining.



M0245 Figure 31

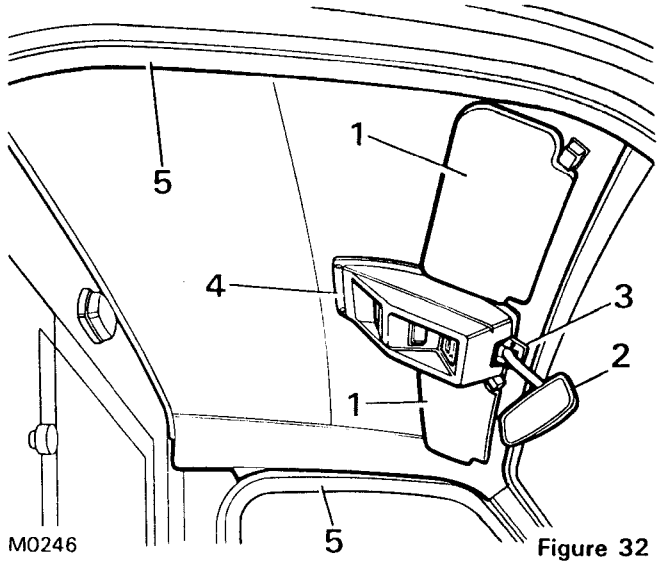
1. Remove two retaining screws, detach console from front mounting bracket and swing down as shown in Figure 31

2. Disconnect wiring plug from digital clock leads from interior lamp and the electric door mirror switch. Remove roof console.

3. Replace in reverse order.

Roof Headlining (Drivers Cab)

The headlining comprises a single moulded panel and would normally only be removed if structural damage had occured.



M0246 Figure 32

1. Remove retaining screws and detach both sun visors, see Figure 32.

2. Remove rear view mirror, complete with stem from retaining bracket.

3. Remove two screws and detach bracket.

4. Remove roof console as previously described.

5. Remove door aperture seals.

6. Carefully break the adhesive securing the headlining panel on both sides, pull the headlining forward to clear the division panel and remove from the vehicle.

7. Replace in reverse order ensuring the correct adhesive is used on both sides of the headlining panel.

Occasional Seat and Back Rest

Two occasional seats are provided within the passenger compartment, one on the rear side and one on the offside of the vehicle.

Back Rest - Nearside

1. In the luggage compartment remove the cab licence frame and the two rubber grommets from the partition, to reveal the back rest retaining screws. See Figure 1.

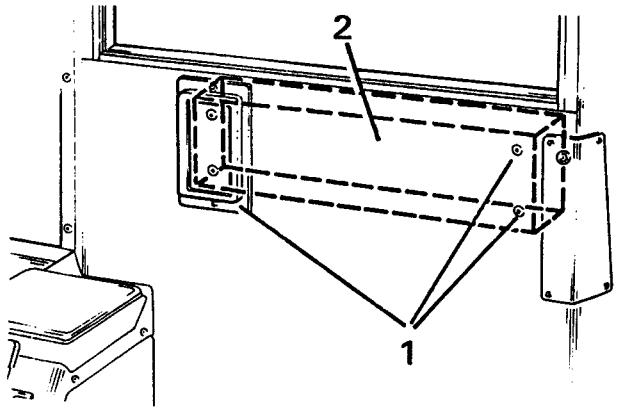


Figure 1

2. Remove the four retaining screws and detach the back rest

3. Refit the back rest in reverse order.

Back Rest - Offside

1. Remove or slide the drivers seat into the forward position

2. Drill out the five rivets and detach the division panel. See Figure 2.

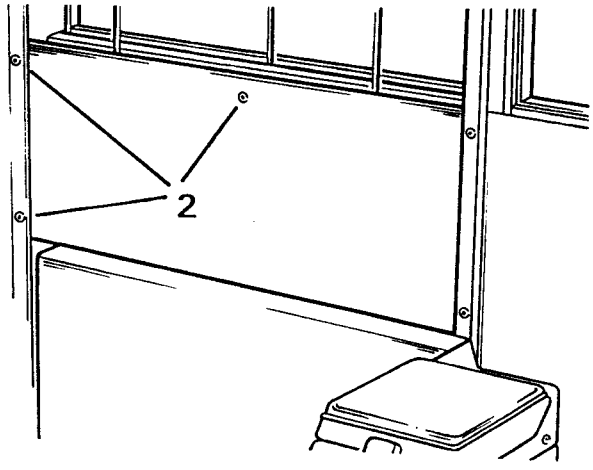


Figure 2

3. Remove the four retaining screws and detatch the back rest. See Figure 3.

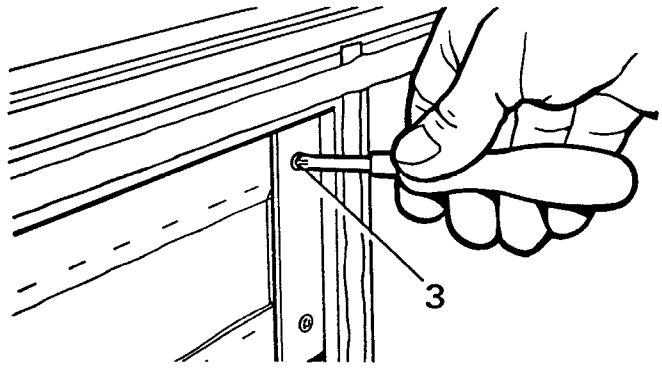


Figure 3

4. Refit the back rest in reverse order ensuring the division panel is correctly positioned. See Figure 4.

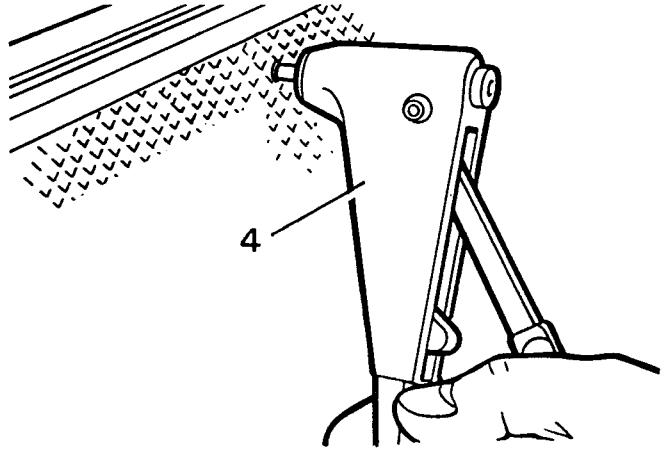


Figure 4

Occasional Seat - Nearside

1. Remove the four screws which secure the access panel to the partition. See figure 5.

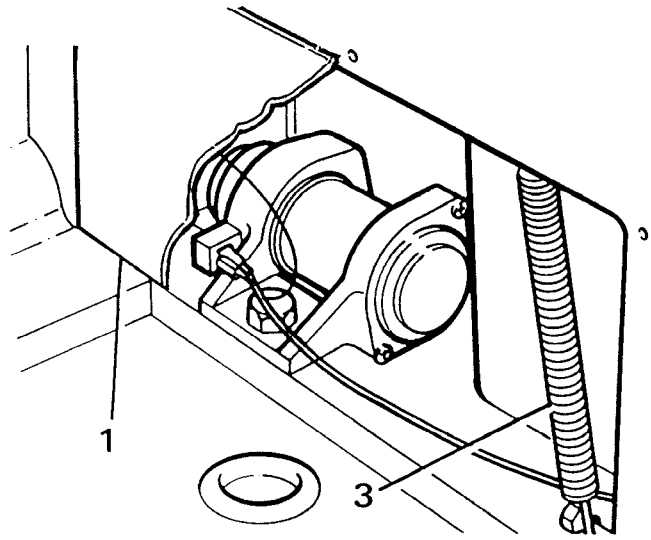


Figure 5

2. Remove the two bolts securing the seat to the support frame. Note the position of the spacer for reassembly. See figure 6.

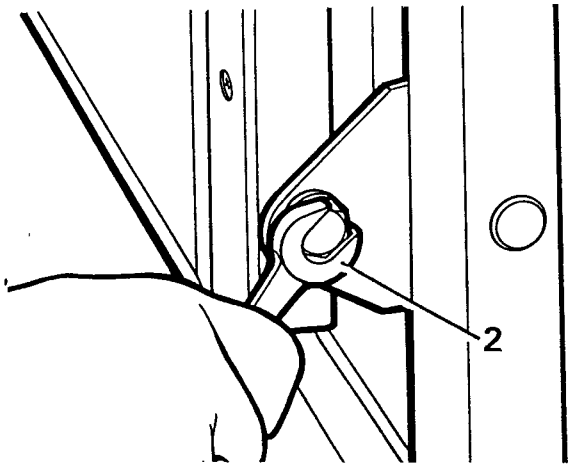


Figure 6

3. Disconnect return spring from seat bracket. See figure 5. Remove seat assembly.

4. Refit the seat assembly in reverse order.

Occasional Seat - Offside

1. The offside occasional seat is removed in the same manner as the near side seat. However, access to the return spring is gained by moving the drivers seat forward.

Rear Seat Cushion and Squab

1. Raise the seat cushion and remove the three screws, which secure the cushion to the seat brackets. See figure 7.

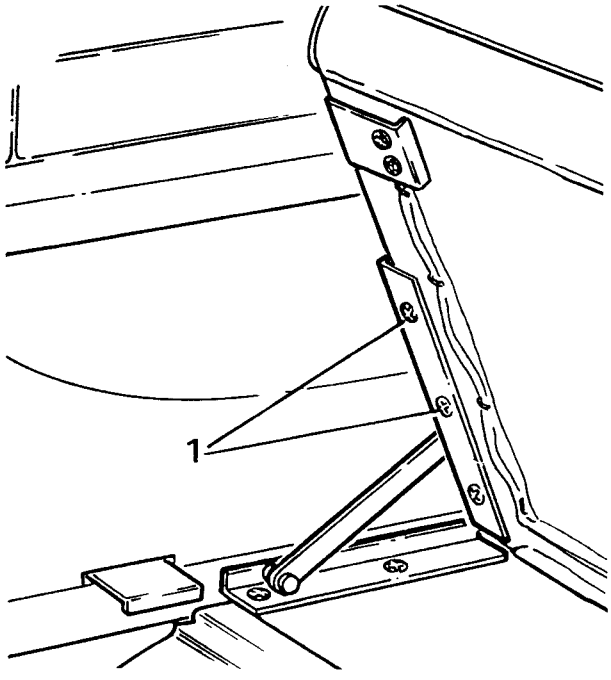


Figure 7

2. To remove seat squab first remove bottom fixings located on both sides of the squab, see figure 8.

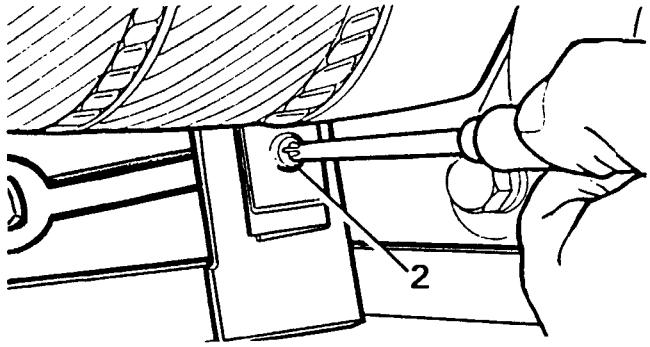


Figure 8

3. From inside of the boot remove two retaining screws from top corners securing the squab frame to the vehicle body, see figure 9.

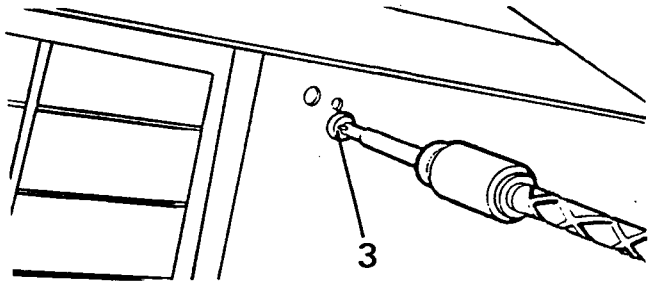


Figure 9

4. Extend L.H. and R.H. seat belts and lift out the seat squab.

5. Refit seat squab and cushion assemblies in reverse order.

Note: The seat squab is fitted with a draught excluding strip, this strip must be clipped into position on reassembly.

Rear Quarter Trim Panel

1. Raise the seat cushion. See figure 7.

2. Remove six screws and ease out the rear quarter trim. See figure 10.

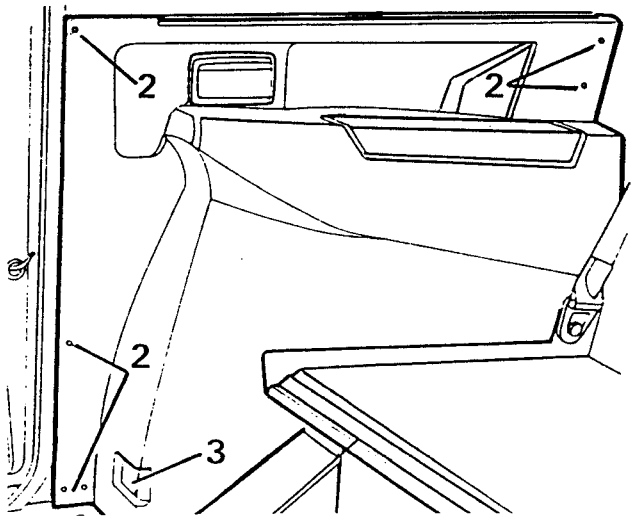


Figure 10

3. Prise out interior light from the bottom of the trim panel and disconnect the wiring leads.

4. Lift out trim panel. If necessary the complete ash-tray assembly can be removed from the trim panel by releasing the retaining clip. For details of the heater switches refer to appropriate section.

5. Refit the trim panel in reverse order.

Rear Door Trim Panel

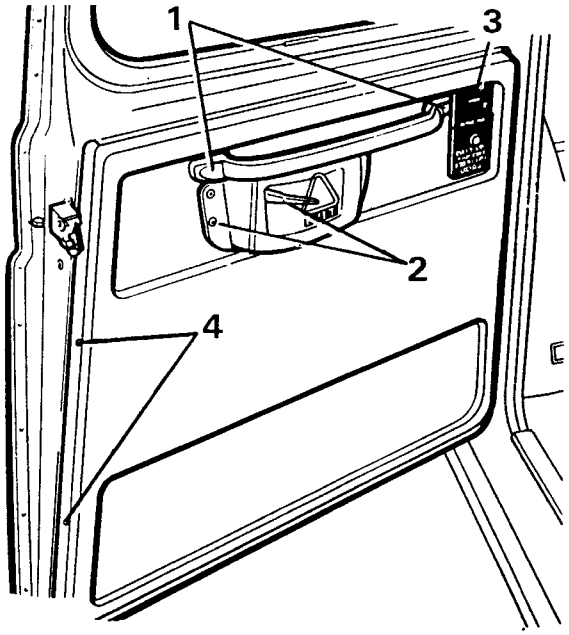


Figure 11

1. Carefully prise out end cappings, remove retaining screws and detach grab handle, see figure 11.

2. Remove door lock release handle cover, remove single screw and withdraw handle from its spindle.

3. Remove two screws and detach window lock escutcheon. Disconnect the security lock electrics.

4. Remove eight screws, release top of trim panel from retaining lip and lift from door.

5. Refit rear door trim panel in reverse order.

Grab Handles

In addition to the grab handles on the rear doors, grab handles are also fitted to the body above the rear quarter trim panel. To detach them carefully prise out end cappings and remove retaining screws.

Headlining

The removal and refitting of the headlining is a specialist operation and therefore it is advised that the operation is carried out by qualified personnel.

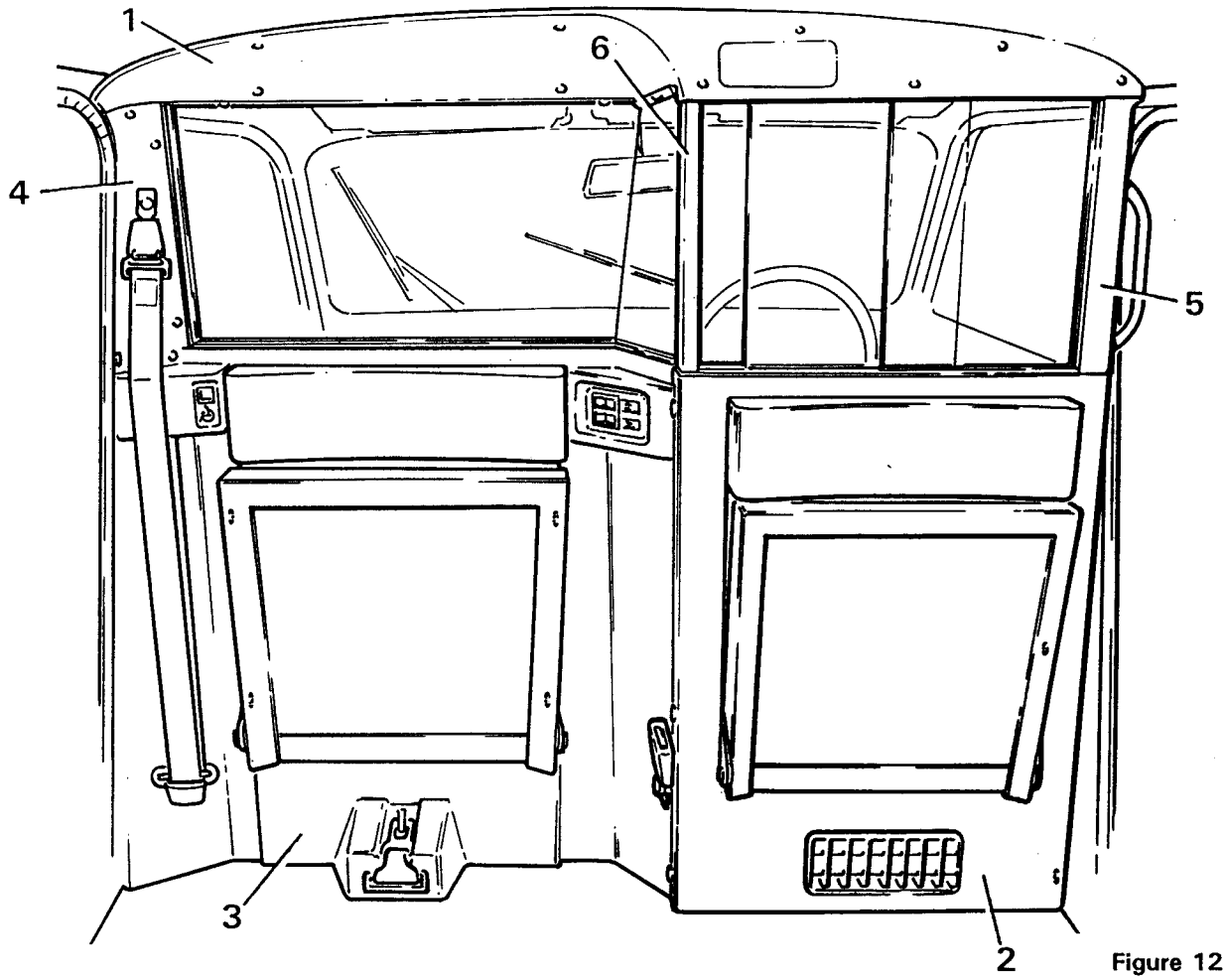


Figure 12

1. Top trim panel
2. Base panel - offside
3. Base panel - nearside
4. Pillar trim - nearside
5. Pillar trim - offside
6. Pillar trim - centre

Centre Partition

The centre partition is constructed from a metal framework, with the following trim panels secured to the framework by self tapping screws. See figure 12.

The partition is also provided with a glazed area. The glazed section located behind the driver can be slid open/shut as required.

The following procedures provide removal/refitting instructions for the glazed area and each panel.

Glazing - Nearside

1. Remove the screws from the upper glass frame trim. See figure 13.

WARNING: ALWAYS USE APPROPRIATE HAND PROTECTION WHEN HANDLING GLASS.

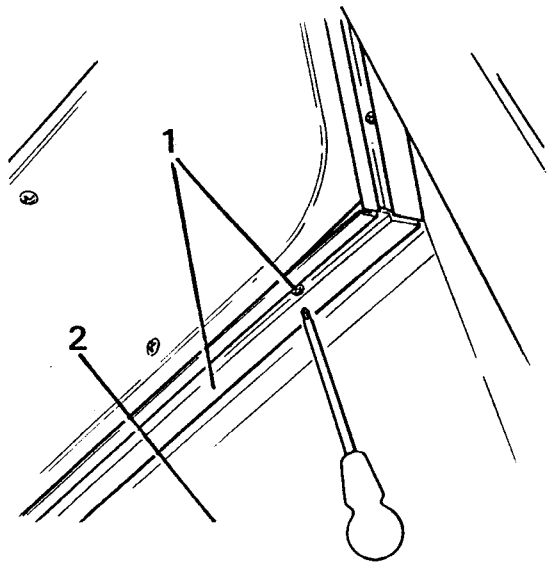


Figure 13

2. Supporting the glass remove the upper glass frame trim and lift out the glass.

3. The glass is fitted in a reverse order to that given for removal.

Glazing - Offside

1. From within the drivers compartment remove or slide the drivers seat into the forward position.

2. Drill out the five rivets and detatch the division panel. See figure 2.

3. From within the passenger compartment, remove the inset strip from the glass runner frame. See figure 14.

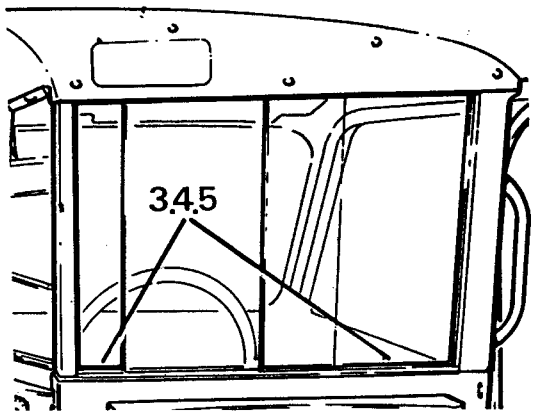


Figure 14

4. Remove the screws which secures the glass runner to the partition.

WARNING: ALWAYS USE APPROPRIATE HAND PROTECTION WHEN HANDLING GLASS

5. From within the drivers compartment, carefully remove the glass runner and the glass.

6. The glass is fitted in a reverse order to that given for removal, ensuring that the division panel is correctly positioned. See figure 4.

Top Trim Panel

1. Support the top trim panel and remove the self tapping screws, which secure the panel to the roof and partition frame. Remove the trim panel.

Pillar Trim - Nearside

1. Release the buckle from the upper buckle release. See figure 15.

2. Prise off the plastic screw cover from the upper buckle release. Remove the screw washer and buckle release.

3. Carefully prise off the door draught strip from the pillar area.

4. Prise out the plastic screw caps and remove the screws which secure the trim to the pillar and partition frame.

5. Refit in reverse order to that given for removal.

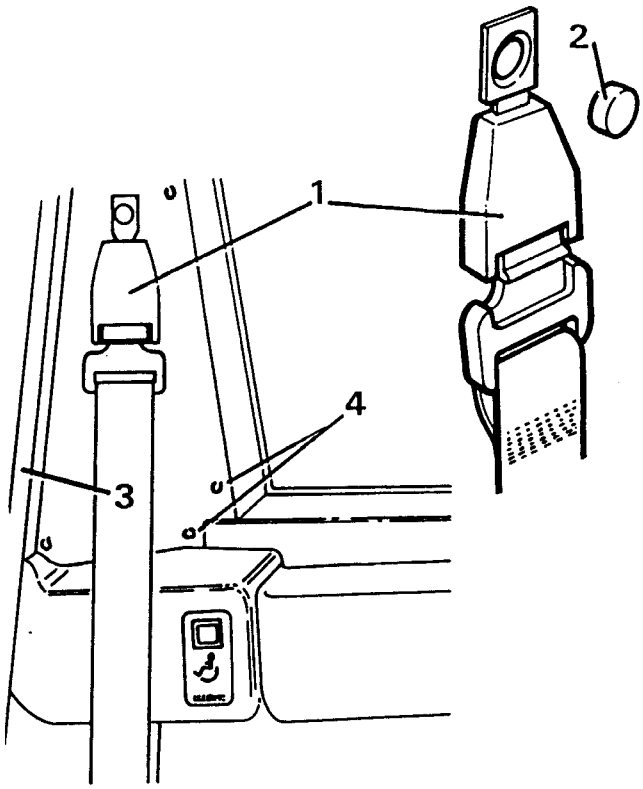


Figure 15

Pillar Trim - Centre

1. Prise out the plastic screw caps and remove all screws securing the trim to the central pillar. Remove the trim.

2. Refit in reverse order to that given for removal.

Pillar Trim - Offside

1. Remove the caps from the pillar mounted grab handle. Remove screws and handle.

2. Carefully prise off the door draught strip from the pillar area.

3. Prise out the plastic screw caps and remove the screws which secure the trim to the pillar and partition frame.

4. Refit in reverse order to that given for removal.

Base Panel - Offside

1. Remove the pillar trims offside and centre.

2. Remove the occasional seat and backrest (offside).

3. Remove the screw trim caps and screws, which secure the panel to the partition frame. Remove the panel.

4. The panel is fitted in a reverse order to that given for removal.

Base Panel - Nearside

1. Remove the pillar trims nearside and centre.

2. Remove the occasional seat and backrest (nearside).

3. Release the buckle from the upper buckle release. See figure 16.

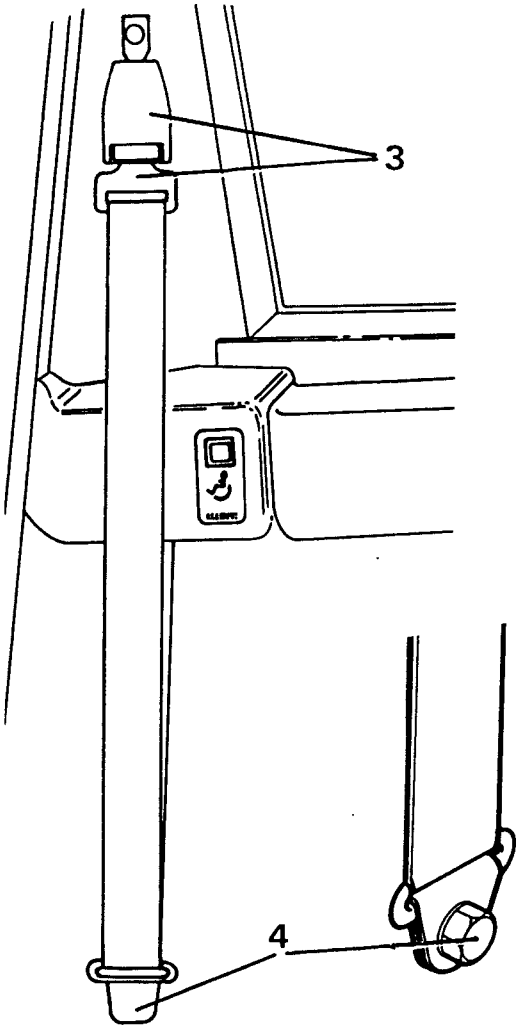


Figure 16

4. Prise off the plastic cover of the pillar anchorage point. Remove screw and washer.

5. Prise off the plastic screw cover from the lower buckle release.

6. Unclip the buckle from the retaining clip and prise out the running escutcheon. See figure 17.

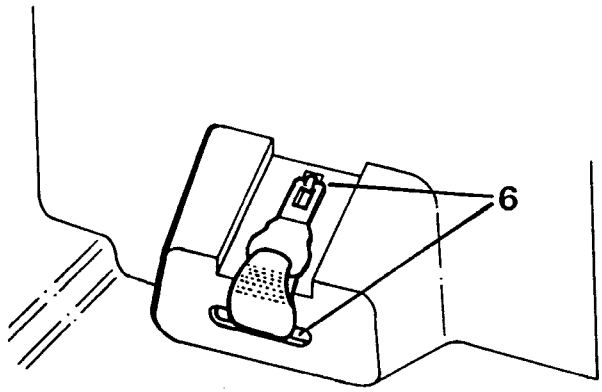


Figure 17

7. Prise out the heater control switches and disconnect the wiring from both switches. See figure 18.

8. Prise out the motor driven reel unit switch and disconnect the wiring from the switch.

9. Prise out the plastic screw caps and remove all screws securing the panel to the partition frame. Carefully remove the panel ensuring that the seat belt buckles are fed through the running aperture.

10. Refit in reverse order to that given for removal, ensuring that the seat belt buckles are fed through the running aperture.

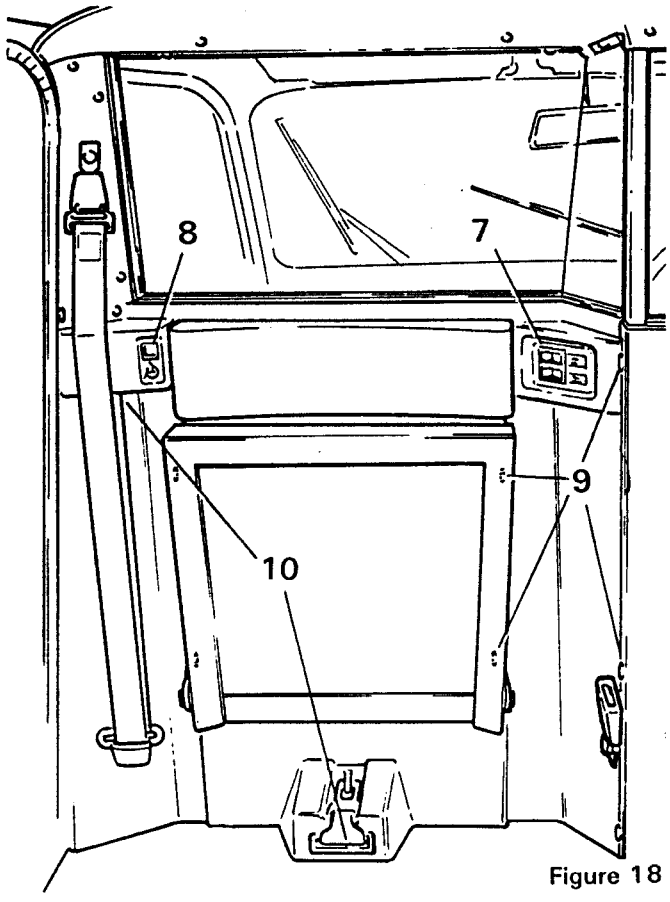


Figure 18

Windscreen - Fitting

WARNING: ALWAYS USE APPROPRIATE HAND PROTECTION WHEN HANDLING GLASS.

1. Locate the position of the moulding flash mark. This must be positioned in the middle of the windscreen top edge. Starting from this point, fit the weatherseal to the edge of the windscreen so that the glass engraving "LAMINATE" can be read from outside the cab after fitting. See Figure 1.

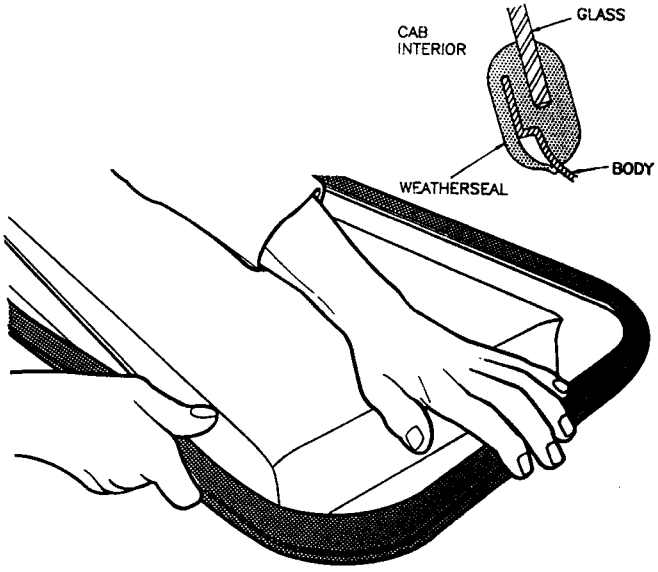


Figure 1

Note: To facilitate the assembly of seal to glass, and to minimise the possibility of scratching the glass, it is recommended that the glass be supported on a soft foam rubber pad.

2. Using a piece of bundy tubing (or similar) approx ¼" (6mm) inside diameter, feed a suitable length of cord (approx ⅛" (3mm) dia) into the weatherseal. See Figure 2.

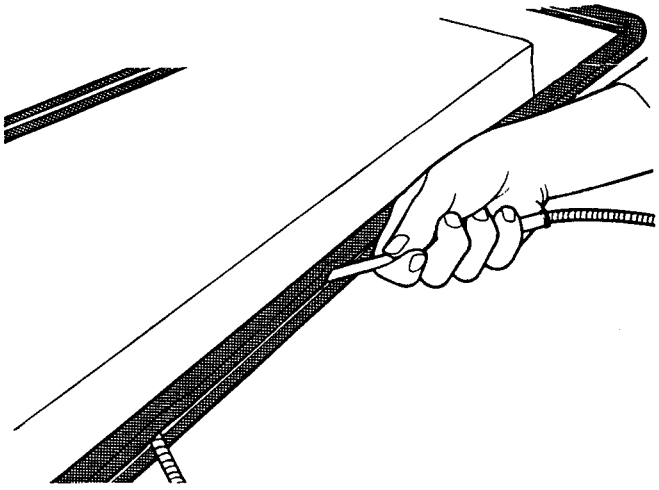
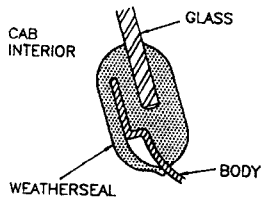


Figure 2

3. Place the windscreen into position on the outside of the cabs windscreen aperture. Check that the weatherseal flash mark is at the top centre of the aperture and that the engraving of "LAMINATE" is readable from outside. Whilst being held firmly in position a second person should pull the cord steadily out of the weatherseal enabling it to take up an assembled position. See Figure 3.



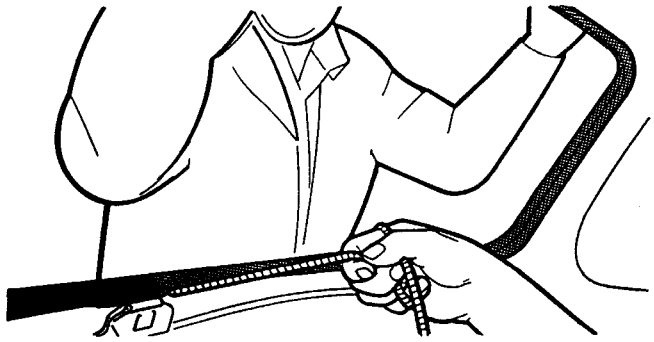


Figure 3

Left hand and Right hand sides will finish at the top centre of the windscreen. See Figure 4.

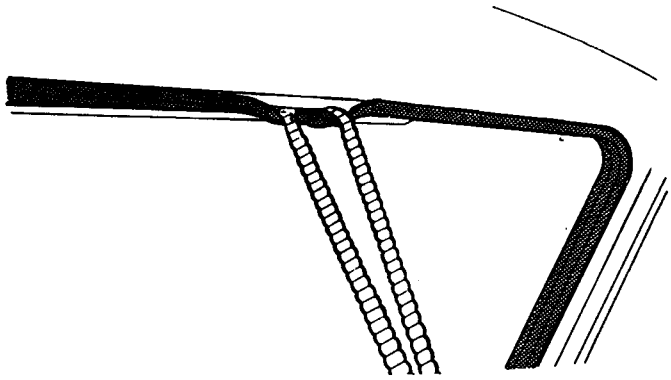


Figure 4

4. The outside lip of the weatherseal should be checked for correct positioning using a suitable tool. See Figure 5.

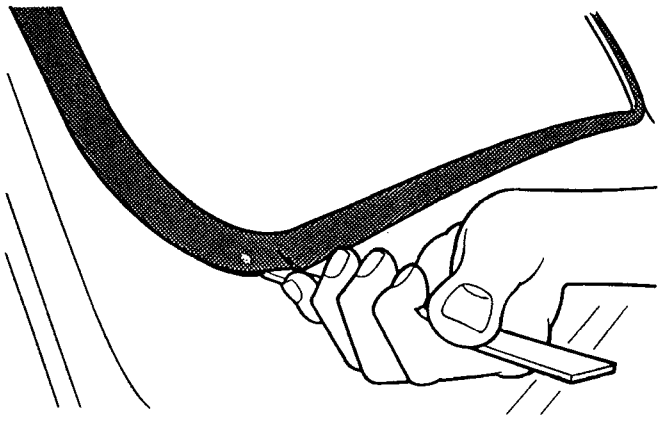


Figure 5

5. The windscreen seal will benefit from a light but firm tapping along its entire length to assist in the settling process. This should be done ideally with a sand filled bag or similar such fitting aid. See Figure 6.

CAUTION: Care should be taken to restrict this last operation to the weatherseal itself avoiding contact with the windscreen.

Figure 6

6. Finally the assembly should be completed with an application of sealant between the weatherseal and cab body utilising a suitable commercial applicator.

7. Remove sealant residue.

Rear Screen - Removal

1. Isolate the power to the heated rear windscreen (HRW), by removing the appropriate fuse from the fuse box.

2. Disconnect the HRW connections, located within the boot.

Note: The power connector is located on the offside of the boot and the earth is connected to the rear side light cluster.

3. Remove the beading from the window rubber surround.

WARNING: ALWAYS USE APPROPRIATE HAND PROTECTION WHEN HANDLING GLASS.

4. From within the vehicle, carefully push the glass out of the frame from the top.

CAUTION: Care must be taken not to damage the HRW wires when removing the rear screen.

Rear Screen - Fitting

1. Ensure that the window frame is clean and free from old sealant.

WARNING: ALWAYS USE APPROPRIATE HAND PROTECTION WHEN HANDLING GLASS.

2. A new seal must be fitted if the old seal is damaged.

3. Using a detergent based water solution paint the seal lip prior to inserting the glass

4. Offer up the windscreen and rubber surround and fit into position. See Figure 7

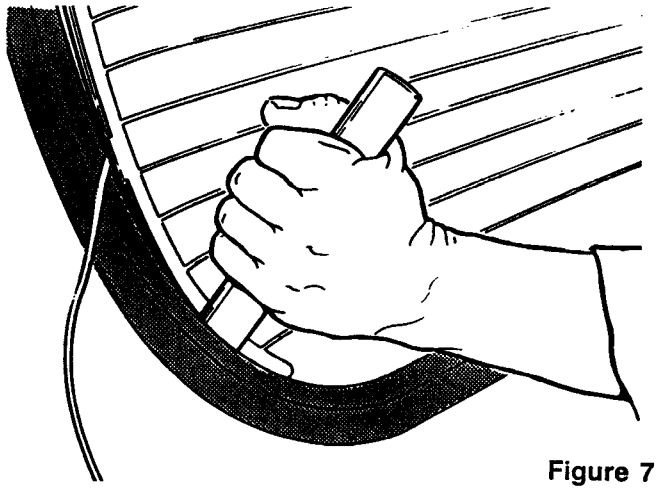


Figure 7

5. Feed the HRW wires through the body into the boot area. See Figure 8

6. Using a suitable sealant seal the rear screen and rubber surround to the body frame.

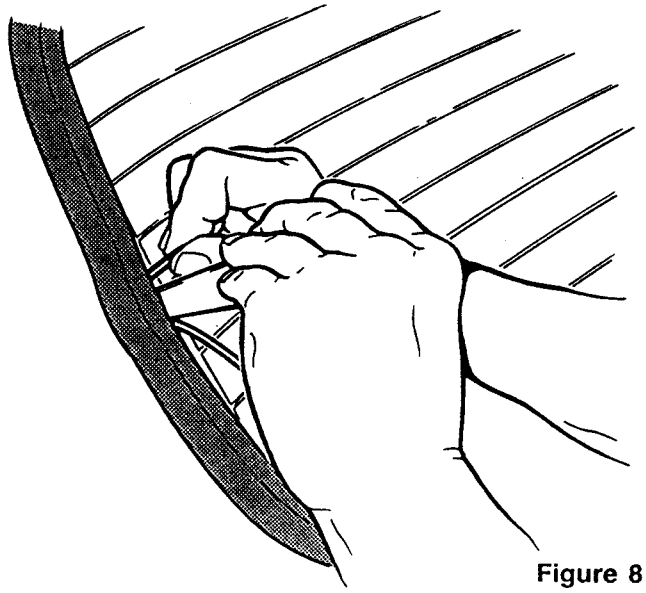


Figure 8

7. Using the special tool insert the beading into the rubber surround. See Figure 9.

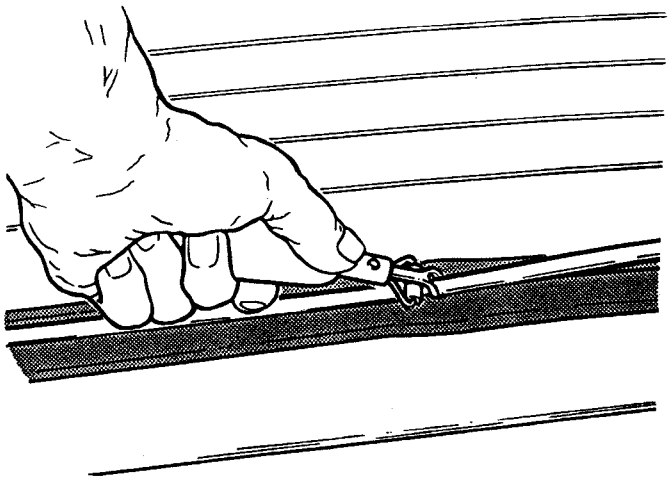


Figure 9

8. Remove any excess sealant from the bodywork.

9. Within the boot connect the HRW power connector and earth connection. Ensure Earth connection is fitted securely.

10. Refit the fuse into the vehicle fuse box.

Rear Side Window

The procedure for removing and fitting of the rear side window is the same as that given for the rear screen.

Door Glass Removal, Manual and Electric

1. Remove door casing.

2. Lower door glass and slide finisher retaining clips to one side, see figure 10

3. Remove interior and exterior glazing finishers.

4. Peel back silent channel and remove quarterlight frame upper retaining screw/rivet.

5. Remove quarterlight frame lower retaining screws.

6. Tilt quarterlight glass and frame rearwards and remove assembly from door.

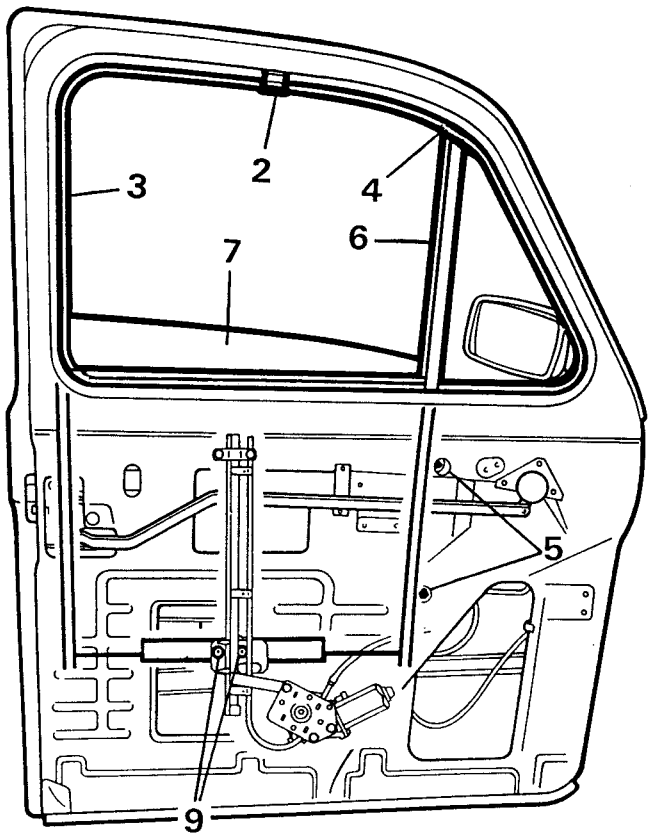
7. Carefully support the window glass and raise to the closed position.

8. On manually operated windows remove two screws retaining window support springs mounting to door panel.

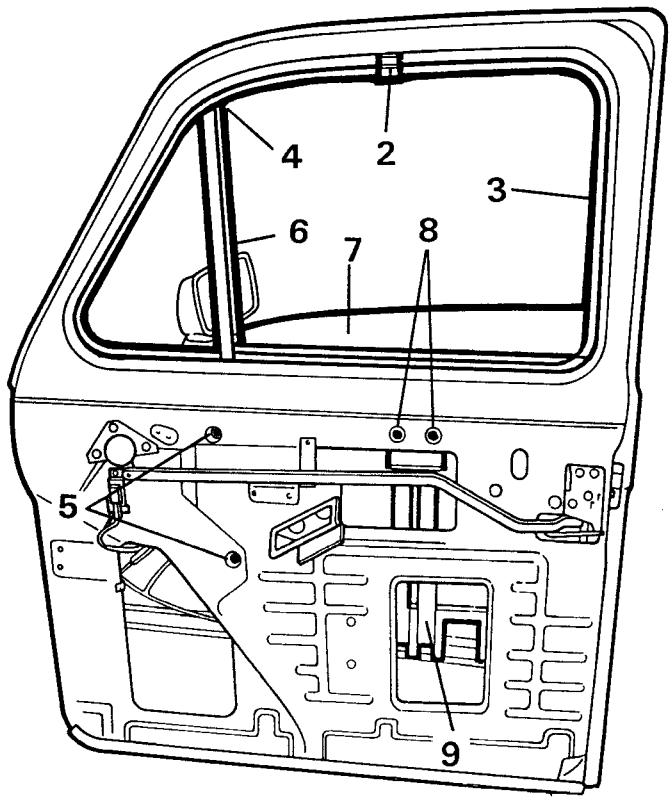
9. Disconnect support springs from window rail. On electric windows remove two allen bolts securing the slide channel mounting to the window rail.

10. Remove window glass from the door.

11. Replace in reverse order.



ELECTRICALLY OPERATED WINDOW



MANUALLY OPERATED WINDOW

Figure 10

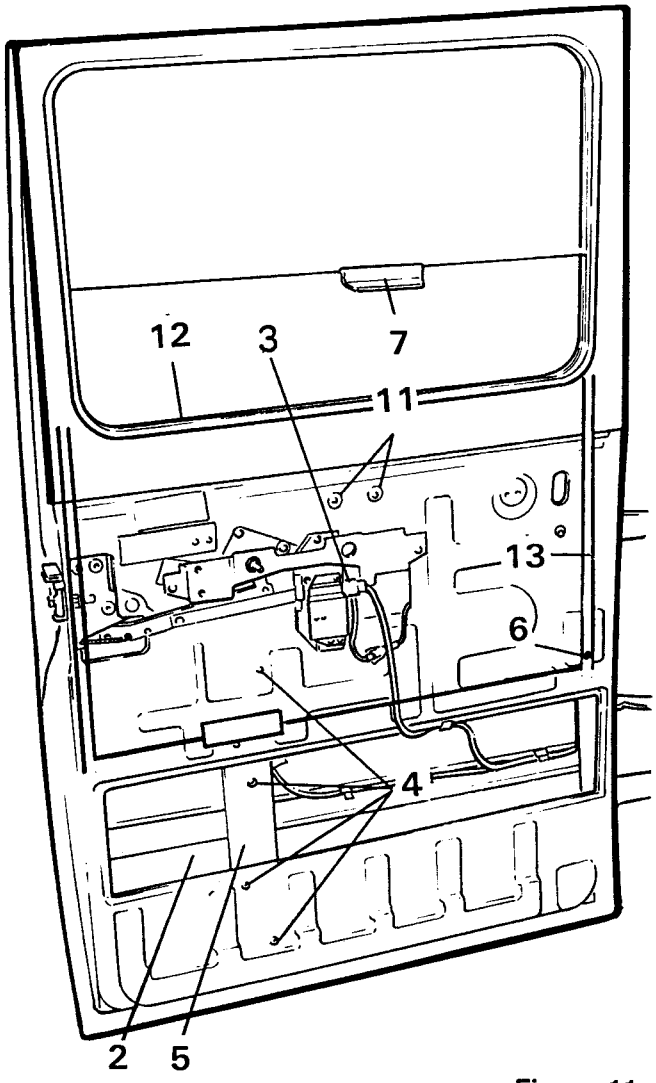


Figure 11

Rear Door Glass

The procedure for removing the door glass is the same for both doors.

1. Remove the rear door trim. Refer to Passenger Compartment, Internal Trim.

2. Remove the polythene sheet from the glass access hold. Refer to figure 11

3. Disconnect the plug to the door locking mechanism.

4. Remove the four screws and washers securing the glass stop and bracket.

5. Lift out the glass stop and bracket.

6. Remove the screw from the bottom of the RH glass guide.

7. Remove the glass lift from the glass.

8. Remove the split pin, pin and washers from the door stop body anchor point. See figure 2.

CAUTION: WITH THE DOOR STOP REMOVED THE DOOR MAY OPEN ONTO THE REAR WING CAUSING DAMAGE TO THE PANEL.

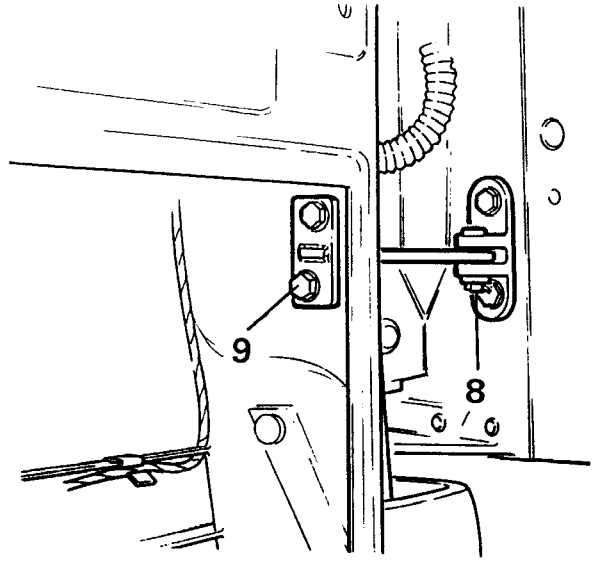


Figure 12

9. Remove the two screws which secure the door stop to the door body. Remove the door stop .

10. Supporting the glass, remove the two screws . See figure 11

11. Remove the bottom glass stop.

12. Remove the weather strip by easing each clip from the outside of the vehicle. Care should be taken not to damage the strip.

13. Pull the (RH) guide down so that the guide can be pulled out from the top of the window opening.

14. Carefully remove the window from the door.

15. The window is refitted in the reverse order to that given for removal.

Note: When refitting ensure that the glass is correctly inserted into the RH/LH glass guides, before securing the guides, stop and brackets.

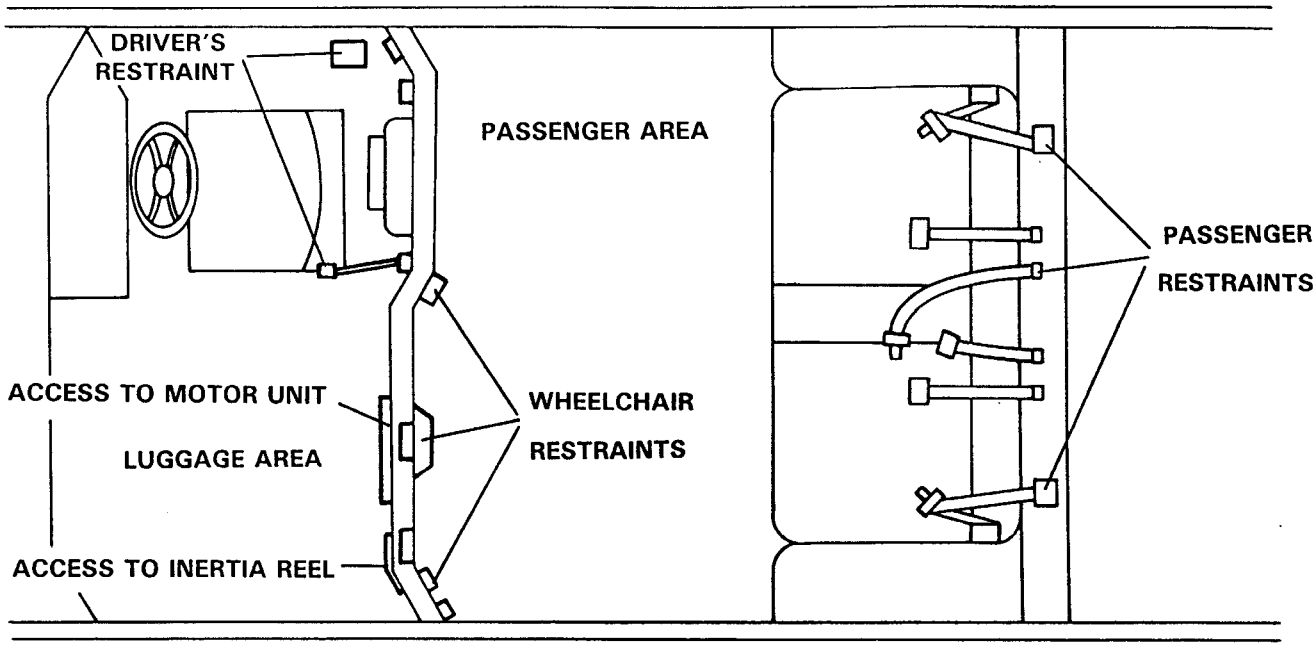


Figure 1

Safety Belts

The vehicle is provided with the following Safety Belts:

1. Drivers Restraint
2. Passenger Rear Seat Restraint
3. Wheelchair Restraint

Figure 1 shows the approximate location of each belt and it's anchorage point.

Inertia Reel Mechanism Check

1. Whilst seated, fasten the seat belt, then grip the shoulder belt at approximately shoulder level with the opposite hand.

2. Pull the belt sharply in a downward direction; the belt should lock.

3. If after several attempts the belt fails to lock a new Inertia Reel Mechanism MUST be fitted.

WARNING: ON NO ACCOUNT MUST THE INERTIA REEL MECHANISM BE TAMPERED WITH.

Seat Belt Cleaning

1. Using warm soapy water, clean the harness.

WARNING: DO NOT USE BLEACH OR DYES AS THIS MAY ADVERSELY AFFECT THE EFFICIENCY OF THE WEBBING.

2. If during cleaning there is evidence that the belts are frayed, cut, damaged or have been subject to strain in a severe accident, the belts must be renewed.

Drivers Restraint

1. The drivers restraint consists of a floor mounted inertia reel unit with an anchorage point located on the side pillar, and a floor mounted buckle release unit. See figure 2.

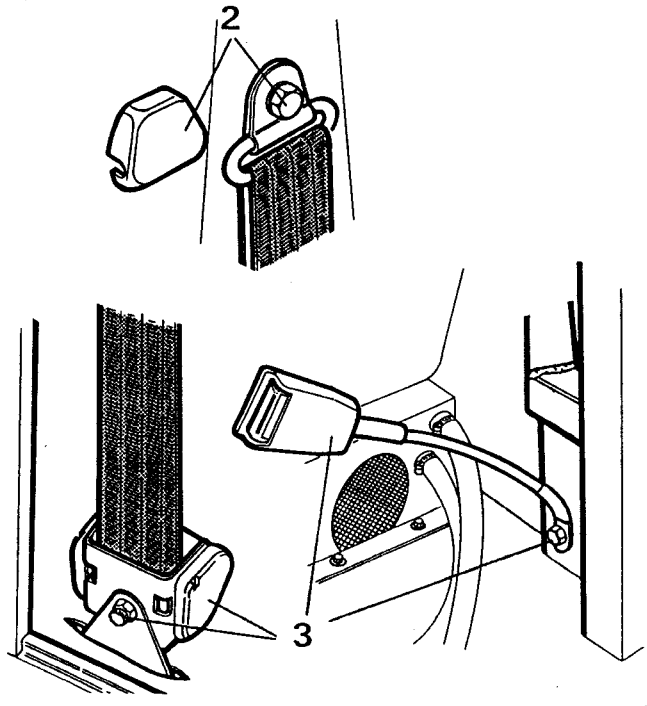


Figure 2

2. To remove the Inertia Reel mechanism, prise off the plastic cover of the pillar anchorage point. Remove the screw and washer.

3. Remove the screw and washer, which secure the Inertia Reel unit and the floor mounted Buckle Release Unit to the floor. Remove the seat belts from the vehicle.

4. The seat belts are fitted in a reverse order to that given for removal.

Passenger Restraints

1. The passenger restraints consist of rear parcel shelf mounted inertia reel mechanisms, one at each side of the vehicle. A lap strap arrangement is also provided for centre seated passengers. See figure 1.

2. Lift up the rear passenger seat.

3. Remove the three screws securing the seat to its bracket. See figure 3. Remove the seat.

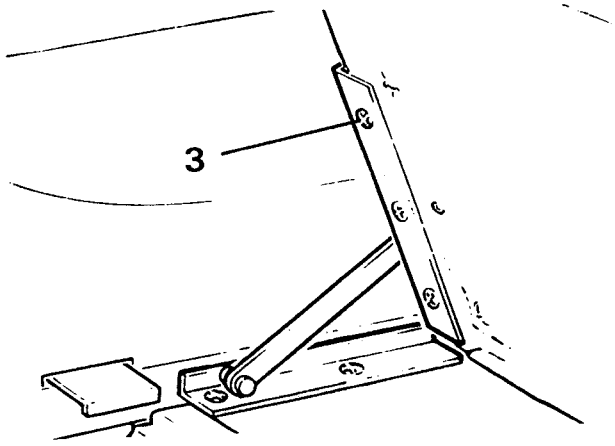


Figure 3

4. Remove the four-fasteners securing the seat squab. See Figure 4. Remove the seat squab.

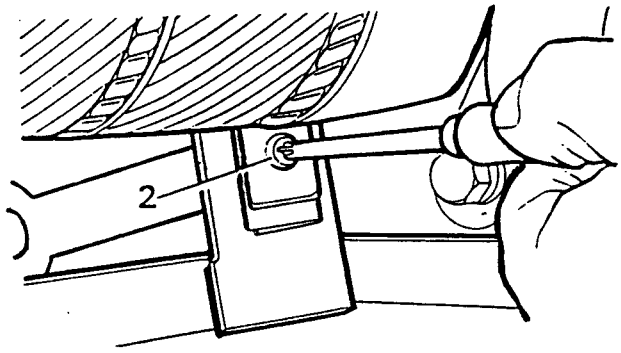


Figure 4

5. Remove the screw and washer which secure the seat belts to the floor mounting points. See figure 5.

6. Clip off the inertia reel unit trim cover. Unscrew the mounting bolt and washer and remove the inertia reel and belt.

7. Refit in reverse order to that given for removal.

Wheelchair Restraint

1. The wheelchair restraint consists of an inertia reel unit mounted within the partition and a pillar mounted anchor point. Buckle release units are provided on the pillar and the centre of the partition. A floor mounted motor driven seatbelt reel unit is fitted within the partition. See figure 9.

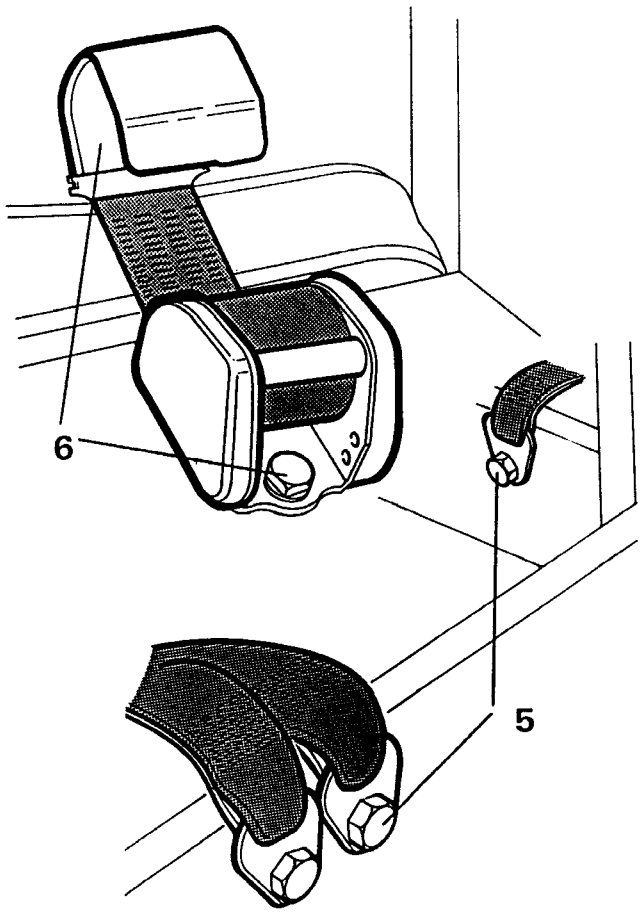


Figure 5

Inertia Reel Unit

1. Unclip the buckle from the pillar buckle release.

2. Prise off the plastic cover of the pillar anchorage point. Remove the screw and washer. See figure 6.

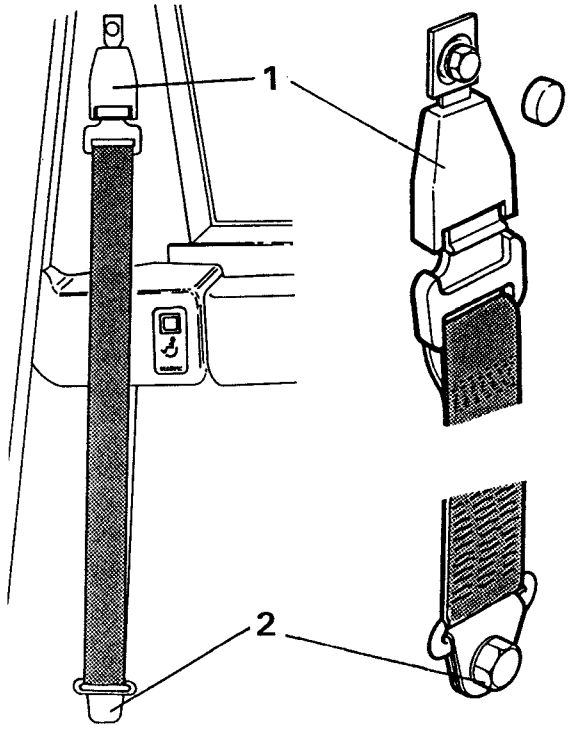


Figure 6

3. From within the luggage compartment, remove the four screws securing the access panel to the partition. See figure 7.

4. Remove the screw and washer, which secure the Inertia Reel unit to the partition framework. Remove the Inertia Reel, by feeding the belt through the access hole.

5. Refit in reverse order to that given for removal.

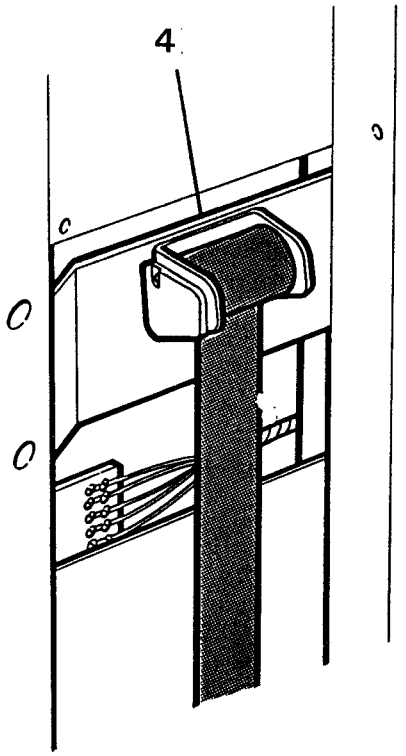
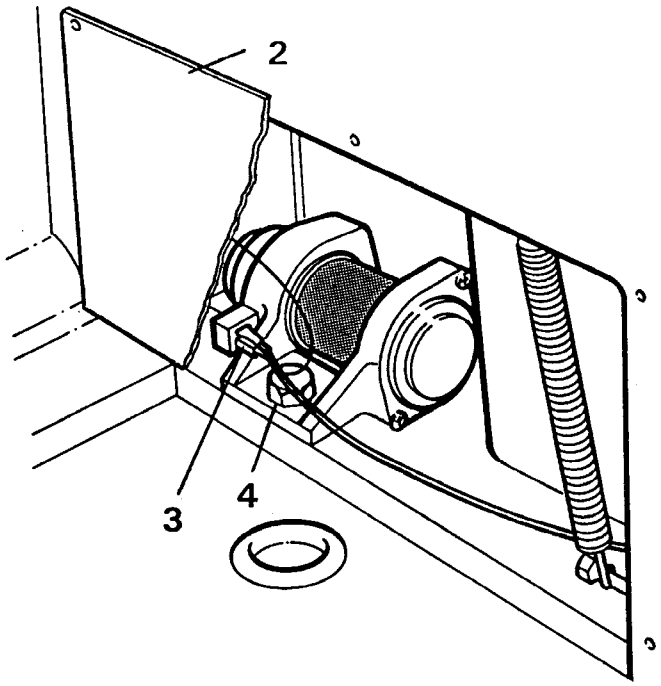


Figure 7



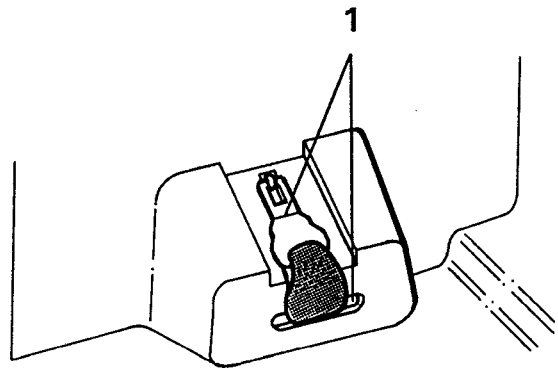


Figure 8

Motor Driven Reel Unit

1. Unclip the buckle from the retaining clip. Prise out running escutcheon.

2. From within the luggage compartment, remove the four screws, securing the access panel to the partition. See figure 8.

3. Disconnect the two leads from the Motor Driven Reel unit.

4. Remove the screw and washer, which secure the motor driven reel unit to the floor. Remove the unit, by feeding the belt through the access hole.

5. Refit in reverse order to that given for removal.

Figure 9