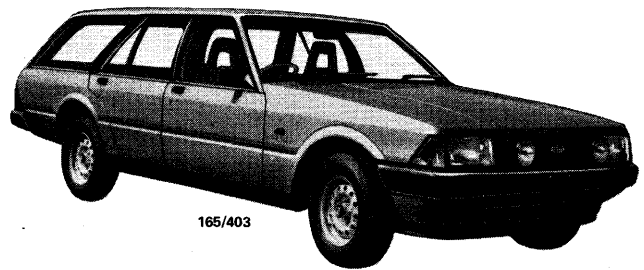




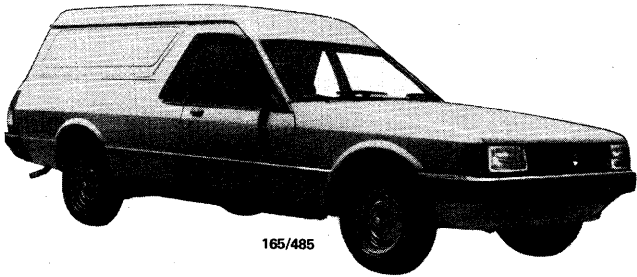
165/712

XD Falcon Sedan.



165/403

XD Falcon Station Wagon.



165/485

XD Falcon Panel Van.



165/378

XD Falcon Utility.

CONTENTS

INTRODUCTION	7
TOOLS-EQUIPMENT-SAFETY	8
LUBRICATION AND MAINTENANCE	11
ENGINE TUNE-UP	19
ROADSIDE TROUBLE SHOOTING	24
ENGINE	29
COOLING SYSTEM	51
FUEL SYSTEM	59
CLUTCH	68
MANUAL TRANSMISSION	72
AUTOMATIC TRANSMISSION	91
REAR AXLE	100
STEERING	109
FRONT SUSPENSION	122
REAR SUSPENSION	130
BRAKES	134
ELECTRICAL SYSTEM	153
BODY	182
EMISSION CONTROL	195
SUPPLEMENT – ALLOY HEAD MODELS	200
CONVERSION TABLES	210
GLOSSARY OF NAMES AND TERMS	212
INDEX	215

1. TOOLS AND EQUIPMENT

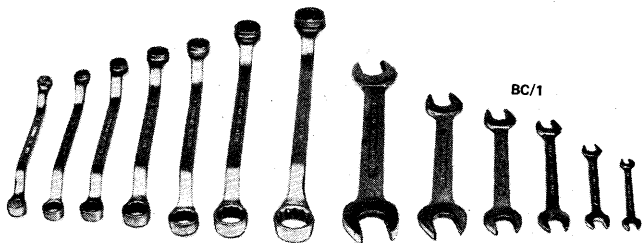
When servicing the modern motor vehicle, special tools are sometimes essential for overhaul and adjustment procedures on certain components. These special tools can be expensive and often require specialised knowledge to operate them, in which case it is more practical to take the vehicle or component to your authorised dealer for repair. Where possible the use of special tools is avoided in this manual and basic or substitute tools, which are described in the text, are used instead. Should it not be practical to carry out an operation without special equipment, then the reader is advised of this at the commencement of the operation.

To successfully carry out any form of mechanical repair work, adequate hand tools are essential. Do not be tempted to make do with old spanners, screwdrivers etc, that do not correctly fit the hardware on the vehicle, nor use new spanners of the wrong system such as A.F. on metric nuts and bolts. Besides damaging the hardware and/or 'rounding' the bolt heads and nuts, many a knuckle has been skinned by using inferior or incorrect tools.

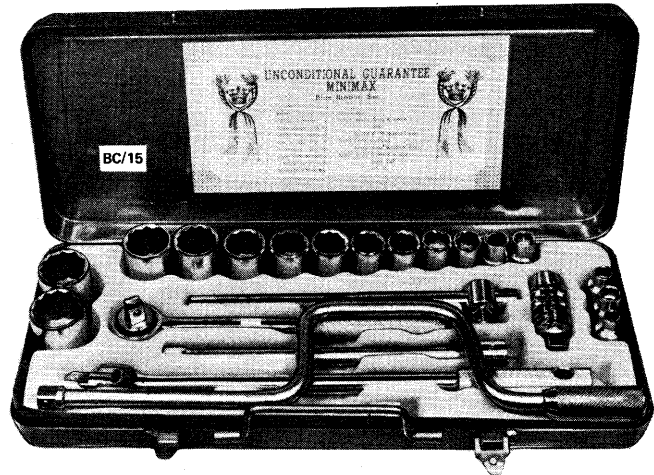
The following list of basic tools, miscellaneous equipment and stores are suggested as being the initial requirements to enable the maintenance and repair work described in this manual to be carried out.

BASIC TOOL KIT

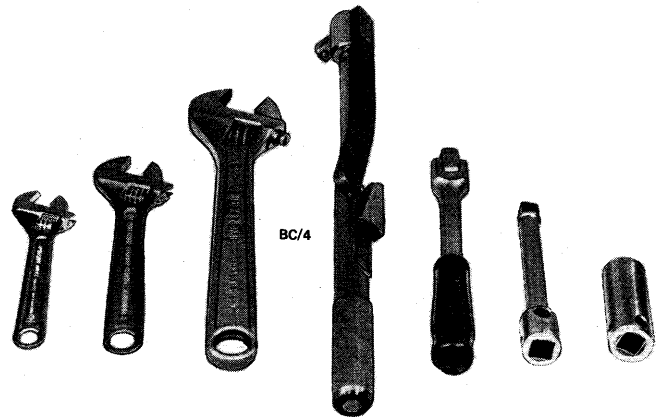
- 1 Set of open ended spanners.
- 1 Set of ring spanners.
- 1 Set of socket spanners.
- 1 Set of adjustable spanners.
- 1 Spark plug spanner.
- 1 Torque wrench.
- Assorted bladed screwdrivers.
- Assorted Philips screwdrivers.
- 1 Pair of ordinary pliers.
- 1 Pair of multigrip pliers.
- 1 Pair of vice grip pliers.
- 1 Pair of long nose pliers.
- 2 Pair of circlip pliers.
- 1 Engineers hammer.
- 1 Set of pin punches.
- 1 Set of feeler gauges.
- 1 Set of magneto spanners.
- 1 Points file.



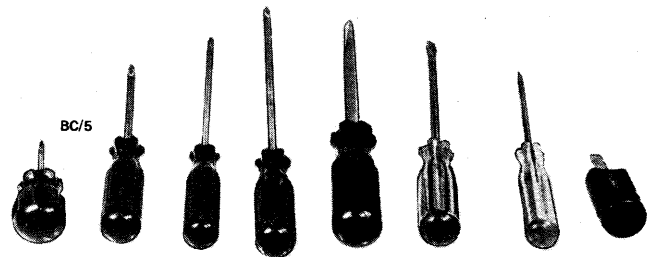
Ring and open ended spanners.



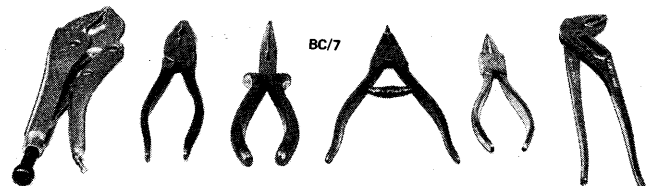
Socket spanner set.



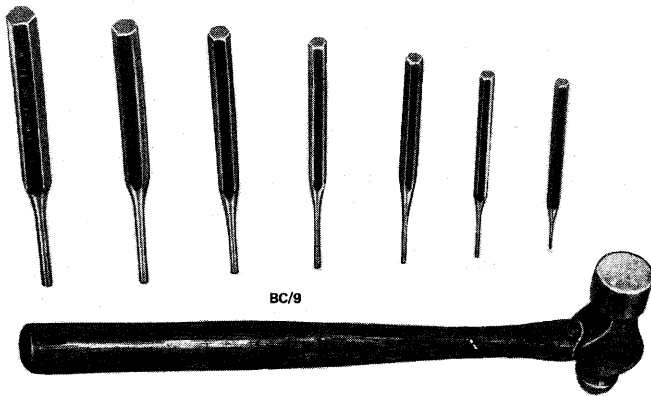
Adjustable spanners, torque wrench and spark plug socket spanner with socket extension and swivel bar.



Assorted Philips and bladed screwdrivers.



Vice grip pliers, ordinary pliers, long nose pliers, circlip pliers (expanding type), circlip pliers (contracting) type and multigrip pliers.



Engineers ball peen hammer and pin punch set.



Points file, magneto spanners and feeler gauge set.

TOOL SELECTION AND CARE

As sensible selection of tools can greatly influence the ease and quality of work performed by the operator, it is good advice to purchase the highest quality of tools that can be afforded. Tools which bear the makers name are usually the best. The cheaper case hardened variety of tools should be avoided as once the case hardening is worn through it will be found that the tools are no longer serviceable. Hand tools with joints such as adjustable spanners and pliers should have no appreciable slack in the joints. There is nothing more annoying than to set a crescent spanner to a given nut and find that the jaw dimensions keep altering.

To ensure that all hand tools see out a normal working life tool care is also very important. After each job undertaken, all tools should be thoroughly washed in kerosene or some other type of cleaning agent and then wiped dry with a clean cloth.

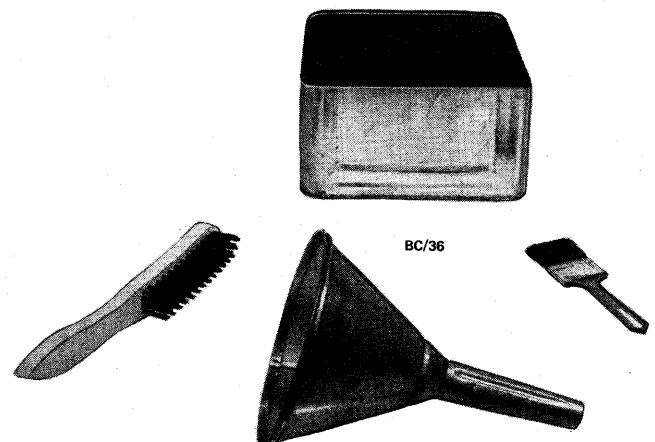
When cleaning the tools ensure that all grit is removed, especially from the joints in pliers and adjustable spanners. If the tools are to be stored for any

length of time it is also good policy to wipe them over with an oily cloth. Feeler gauges should be given particular attention and must be kept scrupulously clean at all times as grit on the blades will cause damage to the blades and inaccuracy when measuring. To prevent the feeler gauge blades from rusting and pitting through moisture the blades should be wiped over with an oily cloth after each use.

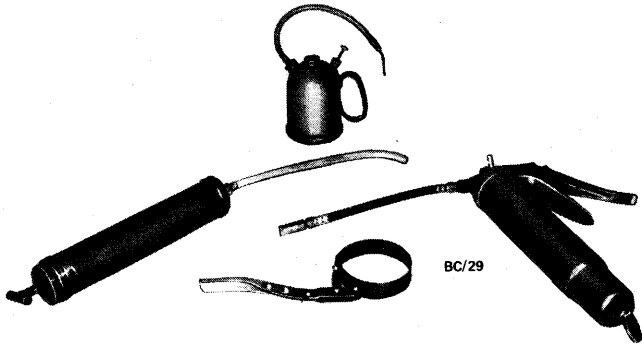
To prevent hand tools and other equipment from becoming mislaid and to ensure uncluttered working surroundings all hand tools should be stored in either a tool box or on a shadow board. If it is not intended to transport the tools then the latter method is recommended for the 'do-it-yourself' mechanic. Besides having all tools within easy reach, a visible check can be made of the shadow board at any time to see if any tools are missing.

MISCELLANEOUS EQUIPMENT AND STORES

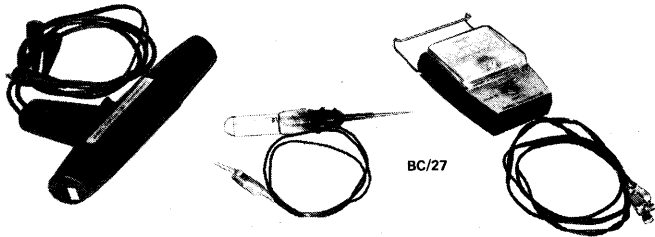
- 1 Hydraulic jack.
- 1 Set of car ramps.
- 1 Set of chassis stands.
- 1 Hand grease gun with flexible attachment.
- 1 Oil can.
- 1 Oil gun.
- 1 Filter removing tool.
- 1 Oil recepticle and parts washing tin.
- 1 Funnel.
- 1 Wire brush.
- 1 Parts washing brush.
- 1 Tin of brake fluid.
- 1 Tin of engine oil.
- 1 Tin of transmission oil.
- 1 Tin of rear axle oil.
- 1 Tin of chassis grease.
- 1 Test lamp.
- 1 Dwell/Tach meter.
- 1 Timing light.
- 1 Ohmmeter.



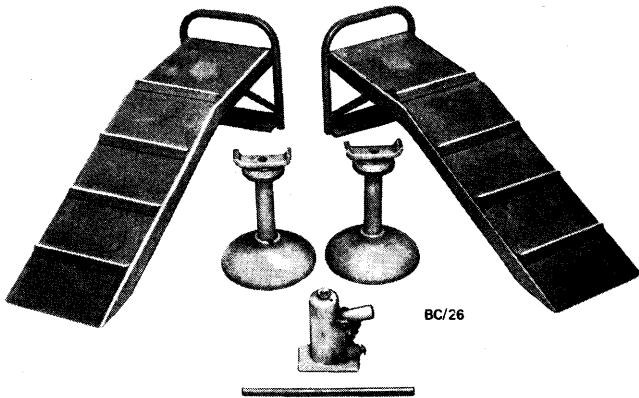
Wire brush, funnel and parts washing tin and brush.



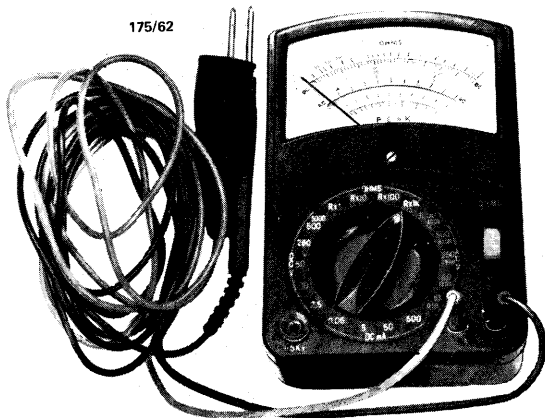
Oil gun, grease gun, oil can and filter removal tool.



Timing light, test lamp and dwell/tach meter.



Car ramps, chassis stands and hydraulic jack.



Ohmmeter (multimeter). An instrument for measuring electrical resistance.



Oils and greases are available in handy pack size for do-it-yourself lube jobs.

2. SAFETY

Never work *under* a vehicle which is supported only by the vehicle jack, bricks or similar materials as these are seldom stable. Always support the vehicle on chassis stands or use car ramps. Even in an emergency try to avoid jacking up the vehicle on soft or uneven ground.

When lifting either end of the vehicle ensure that the wheels remaining on the ground are fully chocked in both directions.

Avoid spilling oil or water around or under the working area, apart from the mess, you can easily lose your footing when exerting pressure on a particularly stubborn component.

When power tools are used make sure they are correctly fused and earthed with all connections and plugs tight and effectively insulated.

Always check that equipment being used for the lifting of heavy components such as engine and/or transmission is not exceeding its capacity and that ropes and slings are correctly secured and of adequate strength.

Every precaution should be taken when working on brake assemblies to avoid inhaling the brake dust which results from wear of the friction material. DO NOT attempt to remove dust by air pressure or vigorous brushing. A vacuum cleaner of either the domestic, or battery operated type designed for vehicles, with hose attachment is the most conveniently safe method of brake dust removal.

For the safety of the vehicle always disconnect the battery when carrying out any operation to the electrical or fuel systems. However, a battery should NOT be disconnected on a vehicle fitted with an alternator *when the engine is running*, or the alternator will be damaged.

The information in this manual is derived from the latest models available for our workshop research, and from other available sources at the time of writing. Any subsequent modifications will need to be taken into consideration by the operator.

While every precaution is taken to ensure the accuracy of the contents, onus can not be accepted for any misinterpretation of the described repair operations or for any errors or omissions inadvertently made, or for any injury or damage no matter how caused.

SPECIFICATIONS

CAPACITY AND GRADE

Engine:

Lubricant	20W/40 SF
Sump Capacity —	
With filter	4.5 litres
Without filter	3.6 litres

Cooling System:

* Capacity (including heater)	8.5 litres
-------------------------------------	------------

Manual transmission (all):

Lubricant	SAE 30
Capacity	1.85 litres

Automatic transmission:

Lubricant	ATF type F
Capacity (dry refill) —	
Borg warner	8.25 litres
C4	9.4 litres

Rear axle:

Lubricant —	
Standard differential	HYPOY C80W/90
Limited slip differential	HYPOY H-LS 90
Capacity	1.3 litres

Steering gear:

Lubricant	Self levelling lithium grease
Capacity	311 grams

Power steering:

Lubricant	ATF type F
Capacity	1.4 litres

Brakes:

Brake fluid type	Dot 3
------------------------	-------

Fuel tank:

Capacity —	
Sedan	77 litres
Utility and Van	68 litres
Station Wagon	72 litres

NOTE: Lubricant capacities are approximate only. The correct lubricant level should be checked at the filler plug or dipstick.

*The cooling system on vehicles fitted with a class 2 towing package should be filled with a mixture of 50 per cent ethylene glycol and 50 per cent water. No corrosion inhibitor is required with this mixture.

1. HOW TO GREASE AND OIL CHANGE

TOOLS NEEDED

A set of ring spanners, a set of small socket spanners and a large adjustable spanner.

NOTE: The ring spanners will be needed to remove the engine sump drain plug and the filler plug on the rear axle. The small socket spanners will be needed to remove the plugs and to fit grease nipples to the front suspension ball joints if this operation has not

already been performed. The adjustable spanner will be needed to remove the filler plug on the manual transmission.

STORES AND EQUIPMENT NEEDED

- 1 Hydraulic jack.
- 1 Set of car ramps.
- 1 Set of chassis stands.
- 1 Hand grease gun with flexible attachment.
- 1 Oil can.
- 1 Oil gun.
- 1 Filter removal tool.
- 1 Oil receptical and parts washing tin.
- 1 Funnel.
- 1 Wire brush.
- 1 Parts washing brush.
- 1 Tin of brake fluid.
- 1 Tin of engine oil.
- 1 Tin of transmission oil.
- 1 Tin of rear axle oil.
- 1 Tin of chassis grease.
- 1 Stick of dry lube.

NOTE: All lubricant capacities and grades for the various assemblies can be obtained by referring to the Specifications part of this section.

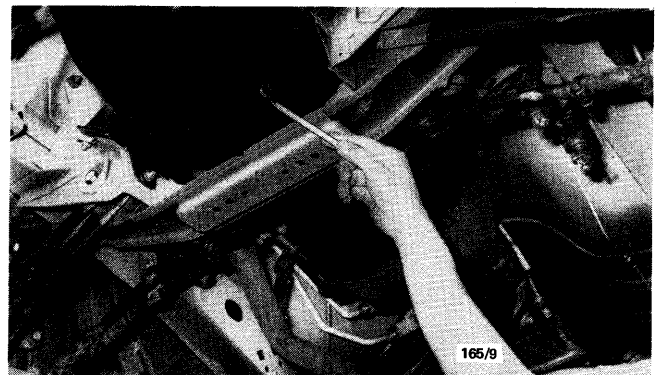
TO DO THE JOB

- (1) Run the front of the vehicle onto the car ramps and stop the engine.
- (2) Raise the rear of the vehicle with the jack and place chassis stands under the rear axle assembly.

NOTE: It is best if the vehicle is kept as level as possible to avoid false readings when checking the lubricant levels.

- (3) Using a wire brush and a cloth, clean around the engine sump drain plug, transmission and rear axle filler plugs and all grease nipples.

NOTE: It may be necessary to remove the plugs from the front suspension ball joints and fit grease nipples to allow these joints to be lubricated.



Location of engine sump drain plug.

(4) Place a drain tin under the engine sump, remove the engine sump drain plug with the appropriate size ring spanner and allow the engine sump to completely drain.

NOTE: It is best to drain the engine sump with the oil at operating temperature. However if the oil is hot take care to avoid scalding.

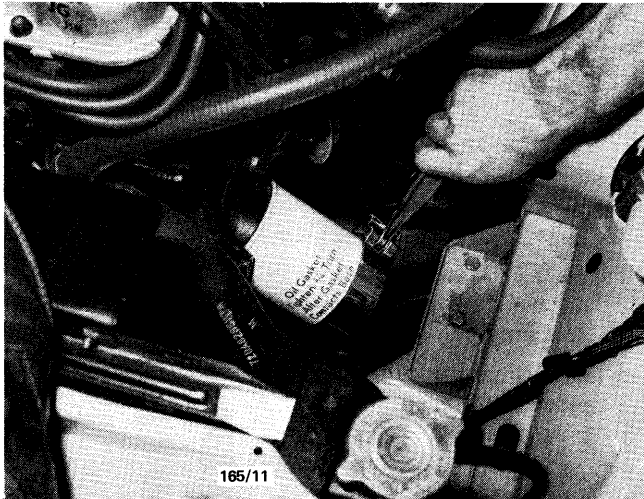
When the engine is completely drained, instal and firmly tighten the sump drain plug. Wipe around the plug after installing.

NOTE: Before installing the sump drain plug check the plug sealing gasket to ensure that it is serviceable.

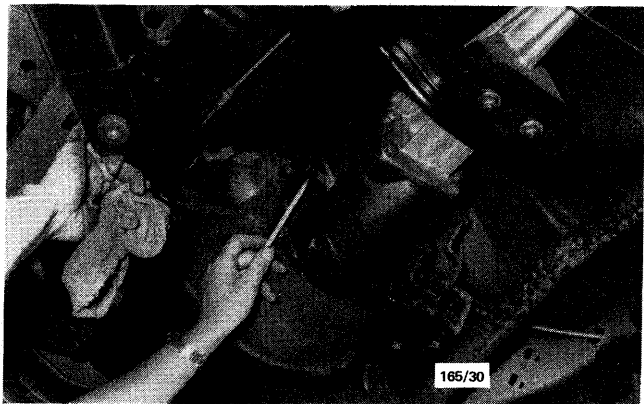
(5) If the engine oil filter is to be renewed, remove the oil filter with the filter removal tool and allow the residual engine oil to drain into the drain tin.

Ensure that the filter sealing gasket is not still adhered to the filter seat on the engine block.

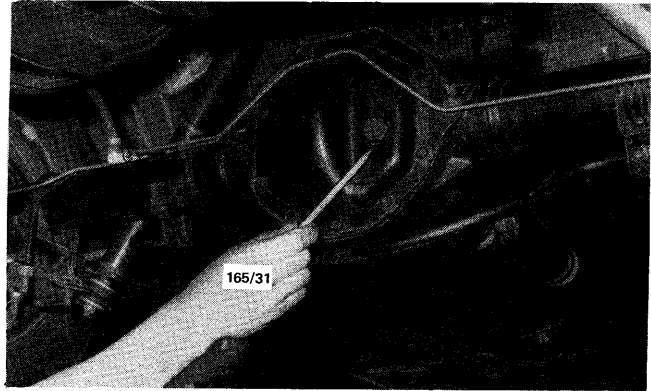
Smear oil onto the sealing gasket of the new filter and tighten the filter by hand as per the tightening instructions supplied with the new filter.



Removing engine oil filter using a filter removal tool.



Manual transmission filler plug location.



Rear axle filler plug location.

(6) Remove the filler plugs from the manual transmission and the rear axle. Use the finger or a bent piece of wire to check the oil levels. The correct oil level is when the oil is level with the bottom of the plug hole. Overfilled units should be drained until the oil is down to this level.

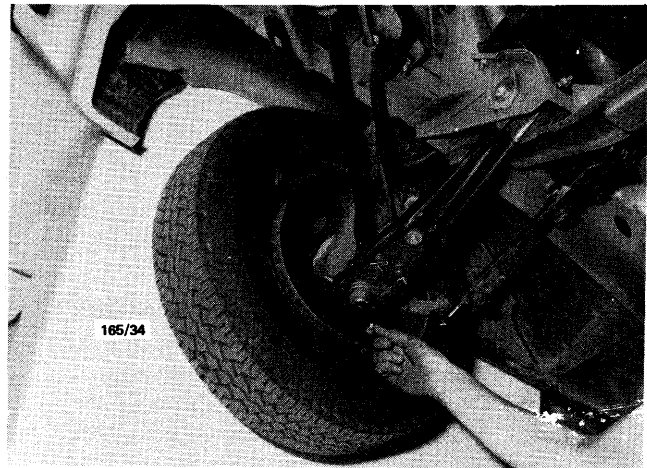
If the oil level is low use the oil gun to fill the transmission or rear axle to the correct level with the specified oil.

When satisfied that the levels are correct instal and firmly tighten the plugs. Wipe around the plugs with a cloth after installing.

(7) Fill the grease gun with chassis grease and if necessary grease the front suspension ball joints, see Lubrication Chart. Only a few strokes of the grease gun are required for adequate lubrication. Take care not to dislodge the dust and water seals from the ball joints. Renew grease nipples that are blocked or damaged.

NOTE: It may be necessary to remove the plugs and to fit grease nipples to lubricate the front suspension ball joints.

(8) Using a funnel, fill the engine with the specified amount and grade of engine oil and start and run the engine for a few minutes. Ensure that the oil light goes out.



Remove the plug and fit a grease nipple to the ball joint to allow the ball joint to be greased.

SPECIFICATIONS

CAPACITY AND GRADE

Engine:

Lubricant	20W/40 SF
Sump Capacity —	
With filter	4.5 litres
Without filter	3.6 litres

Cooling System:

* Capacity (including heater) 8.5 litres

Manual transmission (all):

Lubricant	SAE 30
Capacity	1.85 litres

Automatic transmission:

Lubricant	ATF type F
Capacity (dry refill) —	
Borg warner	8.25 litres
C4	9.4 litres

Rear axle:

Lubricant —	
Standard differential	HYPOY C80W/90
Limited slip differential	HYPOY H-LS 90
Capacity	1.3 litres

Steering gear:

Lubricant	Self levelling lithium grease
Capacity	311 grams

Power steering:

Lubricant	ATF type F
Capacity	1.4 litres

Brakes:

Brake fluid type	Dot 3
------------------------	-------

Fuel tank:

Capacity —	
Sedan	77 litres
Utility and Van	68 litres
Station Wagon	72 litres

NOTE: Lubricant capacities are approximate only. The correct lubricant level should be checked at the filler plug or dipstick.

*The cooling system on vehicles fitted with a class 2 towing package should be filled with a mixture of 50 per cent ethylene glycol and 50 per cent water. No corrosion inhibitor is required with this mixture.

1. HOW TO GREASE AND OIL CHANGE

TOOLS NEEDED

A set of ring spanners, a set of small socket spanners and a large adjustable spanner.

NOTE: The ring spanners will be needed to remove the engine sump drain plug and the filler plug on the rear axle. The small socket spanners will be needed to remove the plugs and to fit grease nipples to the front suspension ball joints if this operation has not

already been performed. The adjustable spanner will be needed to remove the filler plug on the manual transmission.

STORES AND EQUIPMENT NEEDED

- 1 Hydraulic jack.
- 1 Set of car ramps.
- 1 Set of chassis stands.
- 1 Hand grease gun with flexible attachment.
- 1 Oil can.
- 1 Oil gun.
- 1 Filter removal tool.
- 1 Oil receptical and parts washing tin.
- 1 Funnel.
- 1 Wire brush.
- 1 Parts washing brush.
- 1 Tin of brake fluid.
- 1 Tin of engine oil.
- 1 Tin of transmission oil.
- 1 Tin of rear axle oil.
- 1 Tin of chassis grease.
- 1 Stick of dry lube.

NOTE: All lubricant capacities and grades for the various assemblies can be obtained by referring to the Specifications part of this section.

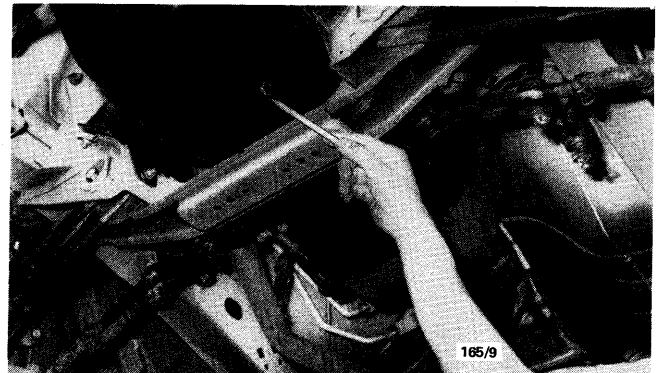
TO DO THE JOB

- (1) Run the front of the vehicle onto the car ramps and stop the engine.
- (2) Raise the rear of the vehicle with the jack and place chassis stands under the rear axle assembly.

NOTE: It is best if the vehicle is kept as level as possible to avoid false readings when checking the lubricant levels.

- (3) Using a wire brush and a cloth, clean around the engine sump drain plug, transmission and rear axle filler plugs and all grease nipples.

NOTE: It may be necessary to remove the plugs from the front suspension ball joints and fit grease nipples to allow these joints to be lubricated.



Location of engine sump drain plug.

(4) Place a drain tin under the engine sump, remove the engine sump drain plug with the appropriate size ring spanner and allow the engine sump to completely drain.

NOTE: It is best to drain the engine sump with the oil at operating temperature. However if the oil is hot take care to avoid scalding.

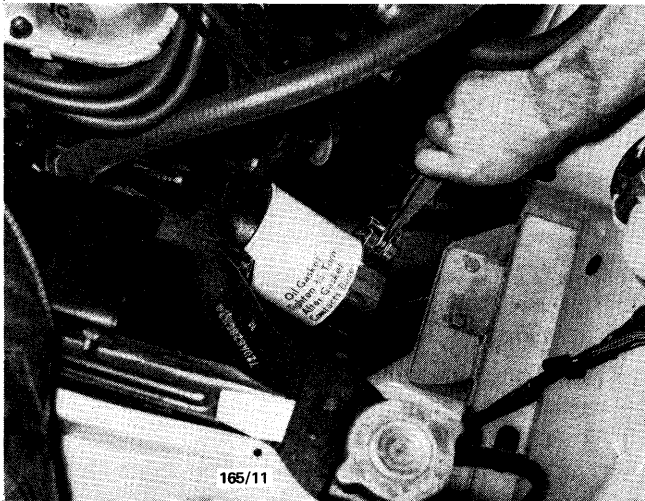
When the engine is completely drained, instal and firmly tighten the sump drain plug. Wipe around the plug after installing.

NOTE: Before installing the sump drain plug check the plug sealing gasket to ensure that it is serviceable.

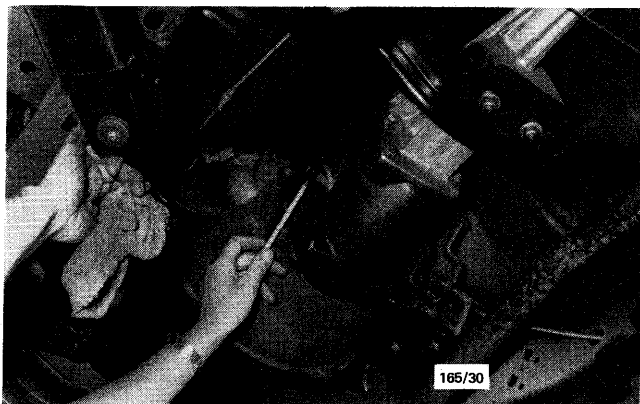
(5) If the engine oil filter is to be renewed, remove the oil filter with the filter removal tool and allow the residual engine oil to drain into the drain tin.

Ensure that the filter sealing gasket is not still adhered to the filter seat on the engine block.

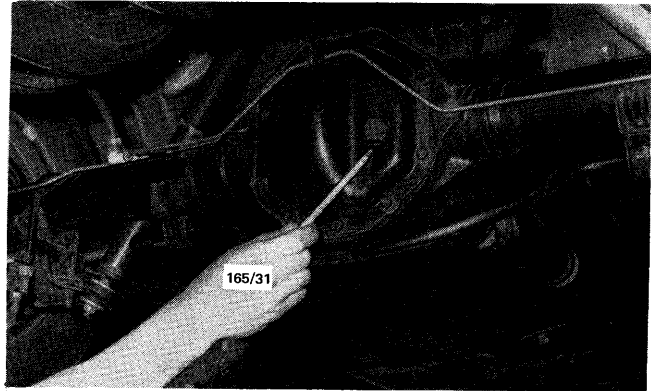
Smear oil onto the sealing gasket of the new filter and tighten the filter by hand as per the tightening instructions supplied with the new filter.



Removing engine oil filter using a filter removal tool.



Manual transmission filler plug location.



Rear axle filler plug location.

(6) Remove the filler plugs from the manual transmission and the rear axle. Use the finger or a bent piece of wire to check the oil levels. The correct oil level is when the oil is level with the bottom of the plug hole. Overfilled units should be drained until the oil is down to this level.

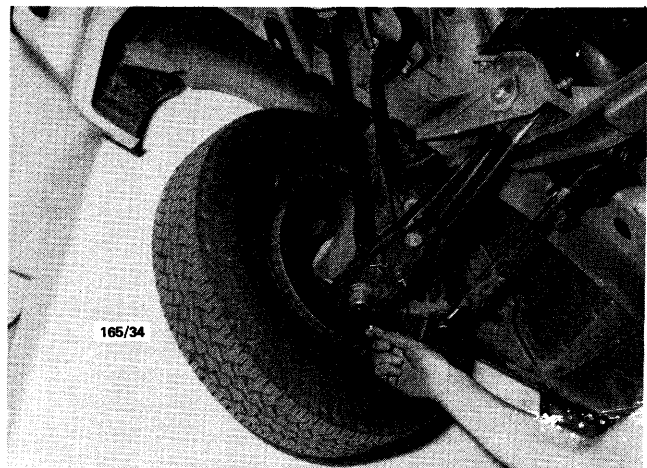
If the oil level is low use the oil gun to fill the transmission or rear axle to the correct level with the specified oil.

When satisfied that the levels are correct instal and firmly tighten the plugs. Wipe around the plugs with a cloth after installing.

(7) Fill the grease gun with chassis grease and if necessary grease the front suspension ball joints, see Lubrication Chart. Only a few strokes of the grease gun are required for adequate lubrication. Take care not to dislodge the dust and water seals from the ball joints. Renew grease nipples that are blocked or damaged.

NOTE: It may be necessary to remove the plugs and to fit grease nipples to lubricate the front suspension ball joints.

(8) Using a funnel, fill the engine with the specified amount and grade of engine oil and start and run the engine for a few minutes. Ensure that the oil light goes out.



Remove the plug and fit a grease nipple to the ball joint to allow the ball joint to be greased.

Stop the engine, wait a few minutes and check the oil level on the dipstick.

NOTE: To prevent overfilling initially, it is good policy not to pour all the specified amount of oil into the engine in one go as sometimes the amounts specified are only approximate. It is best to hold back at least half a litre and top up to the level mark on the

dipstick after the engine has been run and then stopped for a few minutes.

(9) Check thoroughly for oil leaks at the engine sump plug and engine oil filter if a new filter was fitted.

(10) Referring to the Lubrication and Maintenance Service Schedule lubricate and check all other items which coincide with the grease and oil change intervals.

(11) Lower the vehicle to the ground.

2. SERVICE SCHEDULE

JOB	daily or 1000 km	THOUSAND KILOMETRES							
		5	10	15	20	25	30	35	40
<p>ENGINE</p> <p>(1) Check the oil level on the dipstick each time the fuel tank is topped up or every 1,000 km. Top up as necessary with the correct grade of engine oil.</p> <p>(2) Drain and refill the crankcase and renew the oil filter every 10,000 km or six months.</p> <p><i>NOTE: When driving under severe or dusty conditions it is recommended that the engine oil and filter are changed more frequently.</i></p>	●		●		●		●		●
<p>COOLING SYSTEM</p> <p>(1) Check the coolant level in the radiator daily or every 1,000 km.</p> <p><i>NOTE: Do not remove the radiator cap if the engine is hot and there is any evidence of pressure in the cooling system.</i></p> <p>(2) Add corrosion inhibitor to the cooling system every 10,000 km or six months. If operating in cold climates, instal anti-freeze mixture. For vehicles fitted with a class 2 towing package refer to Specifications.</p> <p>(3) Check the radiator cap, hoses and heater hoses every 30,000 km or eighteen months.</p> <p>(4) Inspect the fan belt condition and adjust the tension every 10,000 km or six months.</p>	●		●		●		●		●
<p>FUEL SYSTEM</p> <p>(1) Inspect the air cleaner element for restriction every 10,000 km.</p> <p>(2) Renew the air cleaner element every 40,000 km or earlier if restrictions are found at inspection intervals.</p>		●		●		●		●	
<p>MANUAL TRANSMISSION</p> <p>(1) Remove the filler plug and check the oil level every 30,000 km or eighteen months.</p> <p>(2) Check the clutch pedal free play every 20,000 km.</p>				●		●		●	
<p>AUTOMATIC TRANSMISSION</p> <p>(1) Check the automatic transmission fluid level every 20,000 km or twelve months. The check should be</p>				●				●	

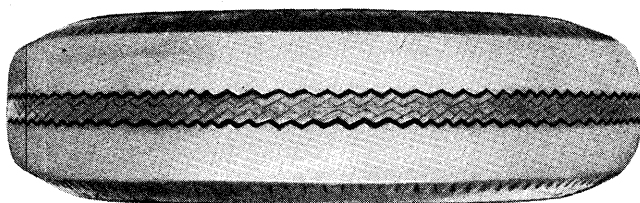
JOB	daily or 1000 km	THOUSAND KILOMETRES							
		5	10	15	20	25	30	35	40
<p>made after a run with the engine at operating temperature. The correct procedure to check and top up both the Borg Warner and C4 transmissions is fully described in the Automatic Transmission section.</p> <p>(2) Service the automatic transmission (adjust the bands) at 30,000 km and again at 90,000 km.</p>							●		
<p>REAR AXLE</p> <p>Remove the filler plug and check the oil level every 30,000 km or eighteen months.</p>							●		
<p>STEERING</p> <p>(1) Check the level of the fluid in the power steering pump reservoir every 1,000 km or when the engine oil is checked. The fluid should be at operating temperature.</p> <p>(2) Inspect the steering gear and linkages for security, damage, wear or leaks every 30,000 km or eighteen months.</p>	●						●		
<p>FRONT SUSPENSION</p> <p>(1) Repack the front wheel bearings every 40,000 km or two years using Castrol HTB grease.</p> <p>(2) Grease the suspension ball joints every 60,000 km.</p>									●
<p>BRAKE SYSTEM</p> <p>(1) Check and top up the master cylinder every 20,000 km or twelve months.</p> <p>(2) Inspect the brake pads and brake shoe linings every 20,000 km.</p> <p>(3) Inspect all hydraulic brake lines for damage or chafing paying particular attention to the flexible hoses every 30,000 km.</p>				●					●
<p>BATTERY</p> <p>Check and top up the electrolyte with distilled water as required or at least once a week. Never allow the electrolyte level to fall below the plates.</p>	●								
<p>DISTRIBUTOR AND SPARK PLUGS</p> <p>(1) Check and clean the inside and outside of the distributor cap every 10,000 km or six months.</p> <p>(2) Clean and reset the spark plugs every 10,000 km.</p> <p>(3) Check and reset the distributor dwell angle and the ignition timing every 10,000 km.</p> <p>(4) Renew the contact breaker points and the spark plugs every 20,000 km or twelve months.</p> <p>(5) Remove the rotor, place two drops of engine oil into the felt pad in the cam, and smear the lobes of the cam with high melting point grease every 20,000 km.</p>		●		●		●	●	●	●

JOB	daily or 1000 km	THOUSAND KILOMETRES							
		5	10	15	20	25	30	35	40
<p>BODY</p> <p>(1) Check and lubricate the following components every 10,000 km with dry lubricant: Door locks and strikers, bonnet catch, luggage compartment lid lock and striker.</p> <p>(2) Check and lubricate the following components every 10,000 km with a few drops of engine oil: Door hinges, bonnet hinges and luggage compartment hinges.</p> <p>(3) Check and lubricate the following components with a suitable grease every 10,000 km: Handbrake linkages and clutch linkages.</p>			●		●		●		●
<p>EMISSION CONTROL</p> <p>Check the condition and operation of the vacuum hoses and emission control components every 20,000 km. If necessary refer to the Emission Control section for checking procedure.</p>					●				●
<p>WHEELS AND TYRES</p> <p>(1) At least once a fortnight check and adjust the tyre pressures when the tyres are cold. Frequent loss of pressure should be investigated and the leakage rectified.</p> <p><i>NOTE: The recommended tyre pressures and sizes of tyres which can be fitted to the vehicle are printed on a placard which is positioned on the driver's side door.</i></p> <p>(2) Inspect the tyres regularly for damage and abnormal wear. Any abnormal wear may be due to one or more of the faults shown in the illustrations at the end of this section.</p> <p>(3) Rotate and balance the wheels and tyres to equalise tyre wear as necessary.</p>	●								

3. TYRE WEAR TROUBLE SHOOTING

ABNORMAL WEAR ON BOTH SIDES OF TREAD

- (1) Under inflation of tyres: Check and inflate to recommended pressures.
- (2) Over-loading: Reduce maximum loading.



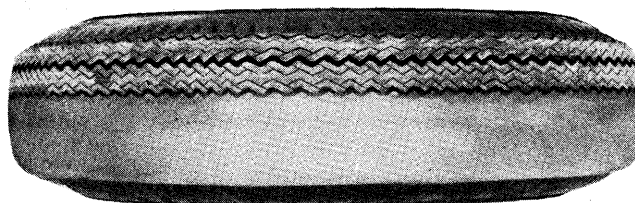
ABNORMAL WEAR IN CENTRE OF TREAD

- (1) Over inflation of tyres: Check and reduce to recommended pressures.

ABNORMAL WEAR ON INSIDE OF TYRES

Front Tyres

- (1) Insufficient camber angle: Check front end alignment.
- (2) Sagging front coil springs: Check and renew faulty springs.
- (3) Loose or worn front hub bearings: Check and adjust or renew hub bearings.
- (4) Bent stub axle: Check and renew faulty components.



(5) Loose or worn suspension arm components: Check and renew faulty components. Align front end.

Rear Tyres

- (1) Bent rear axle housing: Check and straighten or renew axle housing.
- (2) Broken spring main leaf: Renew spring or main leaf.

ABNORMAL WEAR ON OUTSIDE OF TREAD

Front Tyres

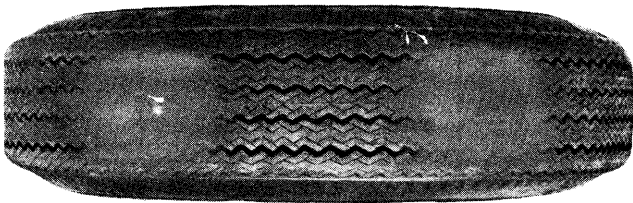
- (1) Excessive camber angle: Check front end alignment.
- (2) Incorrect coil springs fitted: Check and instal recommended replacement springs.

Rear Tyres

- (1) Excessive speed when cornering: Revise driving habits.
- (2) Bent axle housing: Check and straighten or renew axle housing.

SPOTTY OR IRREGULAR WEAR

- (1) Static or dynamic unbalance of wheel and tyre assembly: Check and balance wheel and tyre assembly.
- (2) Lateral run out of wheel: Check and true-up or renew wheel.
- (3) Excessive play in wheel hub bearings: Check and adjust or renew hub bearings.
- (4) Excessive play in front suspension ball joints: Check and renew ball joints.



LIGHTLY WORN SPOTS AT CENTRE OF TREAD

- (1) Static unbalance of wheel and tyre assembly: Check and balance wheel and tyre assembly.
- (2) Radial run out (eccentricity) of wheel: Check and renew wheel.

FLAT SPOTS AT CENTRE OF TREAD

- (1) Repeated severe brake application: Revise driving habits.
- (2) Lack of tyre rotation: Periodically rotate wheel and tyre assemblies.

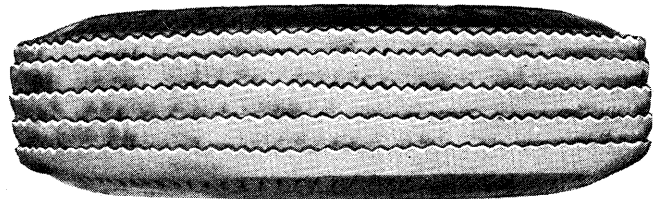
HEEL AND TOE WEAR (SAWTOOTH EFFECT)

- (1) Overloading: Revise maximum loading.
- (2) High speed driving: Avoid as far as possible.
- (3) Excessive braking: Revise driving habits.

FEATHERED EDGE ON THE SIDE OF TREAD PATTERN

Front Tyres

- (1) Sharp inside edge — excessive toe in: Check and adjust wheel alignment.
- (2) One tyre sharp inside edge, other tyre sharp outside edge: Check for bent steering arm or tie rod and renew.



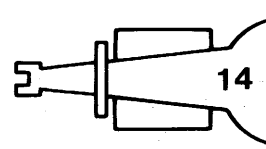
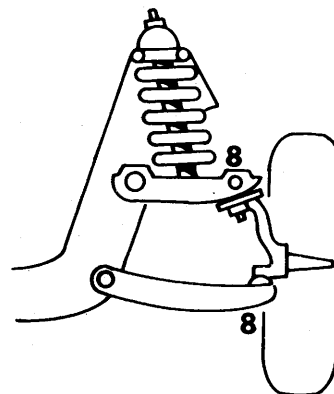
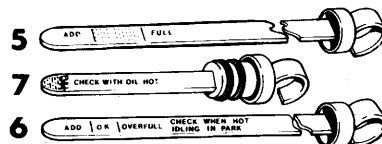
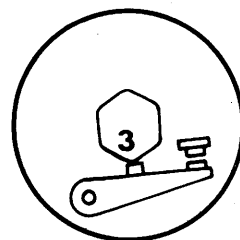
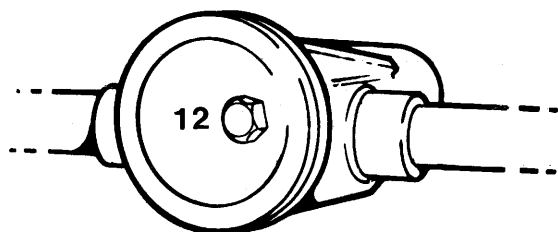
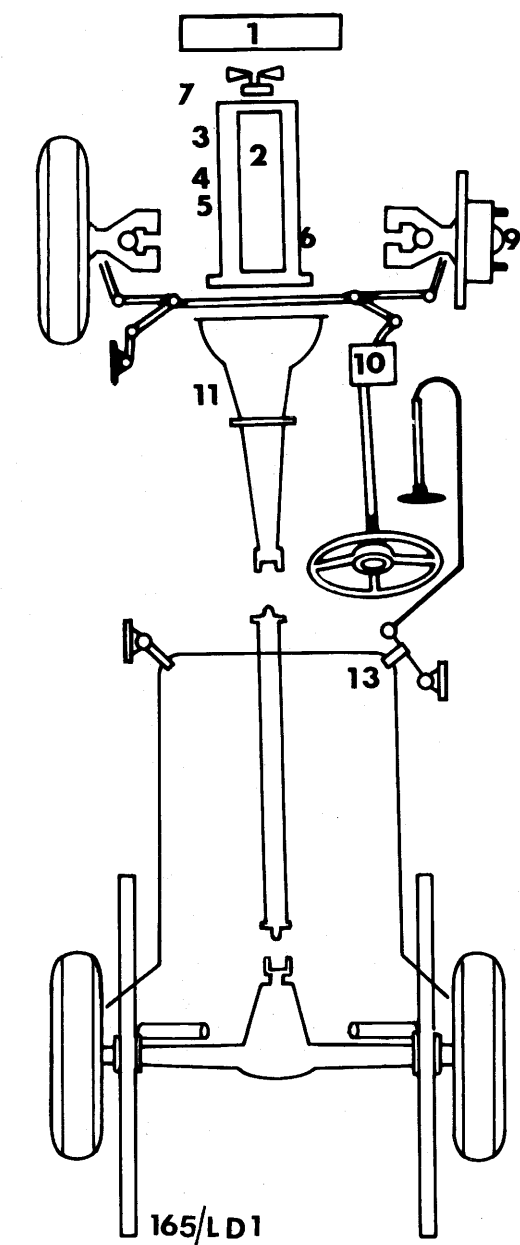
Rear Tyres

- (1) Worn spring eye bushes: Check and renew bushes.
- (2) Centre bolt broken or loose: Check and tighten or renew centre bolt.
- (3) Bent rear axle housing: Check and straighten or renew axle housing.
- (4) Broken spring main leaf: Renew spring or main leaf.

NOTE: To preserve tyre life it is good policy to periodically have the front wheels balanced and the steering geometry checked on a reliable wheel alignment machine.

Under no circumstances mix radial ply and conventional ply tyres. Fit only tyres of the same construction to all four wheels.

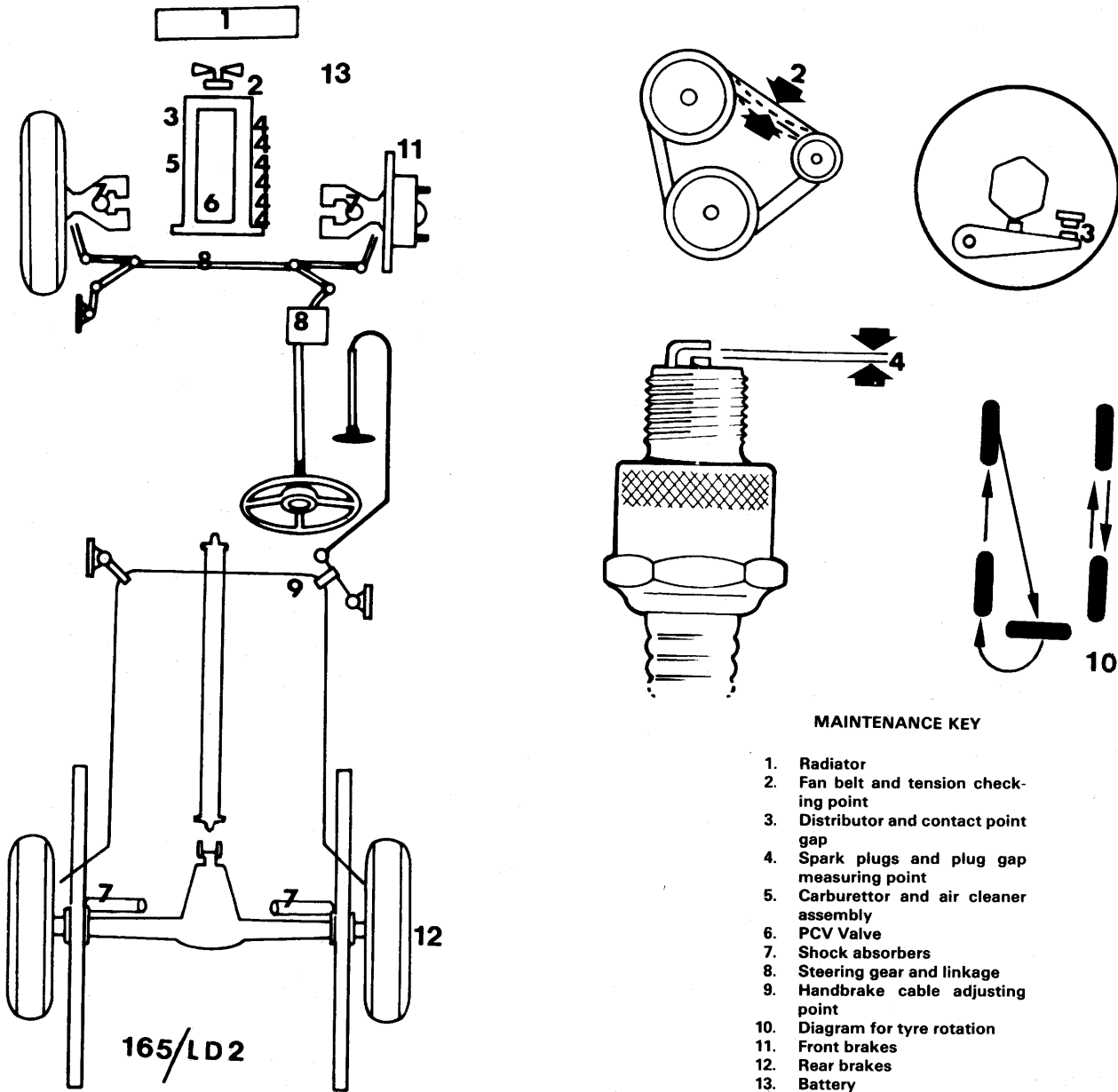
4. LUBRICATION CHART



LUBRICATION KEY

1. Radiator
2. Oil filler
3. Distributor
4. Oil filter
5. Engine oil dipstick
6. Automatic transmission dipstick
7. Power steering pump and reservoir dipstick
8. Front suspension ball joints
9. Front hub bearings
10. Manual steering gear
11. Manual transmission filler plug
12. Rear axle filler plug
13. Handbrake cable lubrication points.
14. Automatic transmission

5. MAINTENANCE CHART



MAINTENANCE KEY

- 1. Radiator
- 2. Fan belt and tension checking point
- 3. Distributor and contact point gap
- 4. Spark plugs and plug gap measuring point
- 5. Carburettor and air cleaner assembly
- 6. PCV Valve
- 7. Shock absorbers
- 8. Steering gear and linkage
- 9. Handbrake cable adjusting point
- 10. Diagram for tyre rotation
- 11. Front brakes
- 12. Rear brakes
- 13. Battery

1. SPECIFICATIONS

Firing order	1-5-3-6-2-4
Spark plug type	Motorcraft ARF 52
Spark plug gap	0.8-0.9 mm
Spark plug tightening torque	20 Nm
Contact breaker gap	0.3-0.4 mm
Distributor dwell angle	33-37 deg
* Ignition timing at 500 rpm	6 ± 2 deg btdc

Engine idle speed:

Manual transmission in neutral	900-950 rpm
Automatic transmission in D	600-630 rpm

** Compression pressure:

Low compression models	865-1065 kPa
High compression models	1035-1240 kPa

Fanbelt tension see text

* The timing is set with the vacuum advance hose removed and plugged, the throttle positioning solenoid deactivated and the air conditioner off.

** Typical compression pressures with the engine hot at cranking speed. Variation between highest and lowest reading cylinders should not exceed 100 kPa.

2. TUNE-UP OPERATIONS

Special Equipment Required:

To Test Compression — Compression gauge

TO SERVICE AIR CLEANER

The air cleaner is fitted with a paper type element. The element should be regularly inspected and cleaned in service.

The element should be renewed at the recommended intervals of 40,000 km. This distance is only a guide for normal operating conditions and should be reduced accordingly if the vehicle is operating under extremely dusty conditions.

NOTE: Paper air cleaner elements should not be washed in petrol or any other type of cleaning solvent. If the element has been washed in solvent or has become oil soaked then it should be discarded and a new element fitted.



The air cleaner element should be renewed at the recommended intervals.

(1) Remove the air cleaner assembly from the engine. If necessary refer to the Fuel System section for correct procedure.

(2) Remove the top cover from the main body and take out the air cleaner element.

(3) Clean or discard the paper element as necessary and wipe off any dust accumulation on the main body and top cover.

NOTE: Clean the element only by tapping it on a flat, vertical surface. Do not use compressed air or cleaning solvents. After cleaning inspect the element for damage or distortion.

(4) Place the element into the main body and position the assembly on the carburettor.

(5) Fit the top cover and connect up the various hoses to the air cleaner assembly.

TO RENEW OR CLEAN BREAKER POINTS

(1) Disconnect the high tension leads from the spark plugs and the ignition coil.

(2) Unclip the high tension leads from the rocker cover and unclip the spring retaining clips securing the distributor cap to the distributor body.

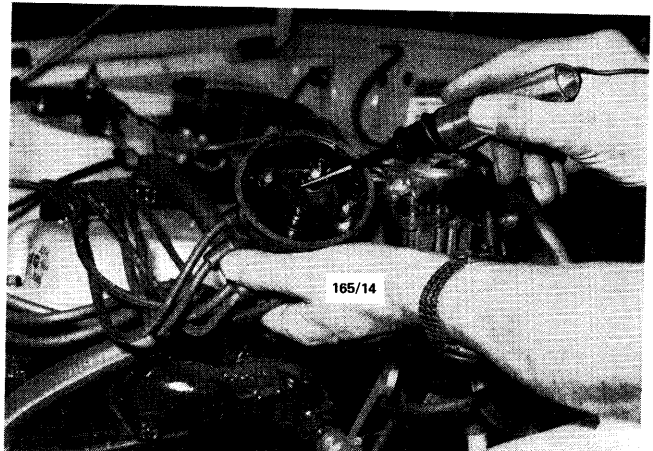
(3) Remove the distributor cap and check for cracks or tracking between the high tension terminals on both the inside and outside of the cap.

(4) Thoroughly clean the cap of any dust or oil. Remove any corrosion build up on the high tension terminals inside the cap and the lead connections on the outside of the cap. Check the carbon brush in the centre of the distributor cap for evidence of arcing and renew as necessary.

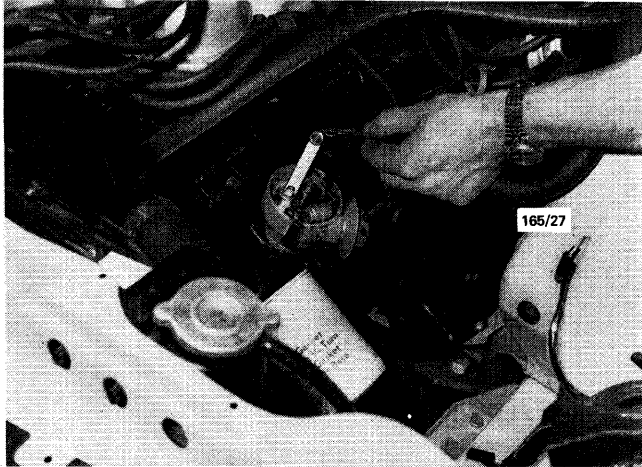
(5) Slide the rotor arm off the shaft assembly and thoroughly check it for hair line cracks.

(6) Disconnect the contact breaker lead terminal from the junction block.

(7) Remove the screw securing the breaker points to the breaker plate and withdraw the breaker point assembly.



Check the inside of the distributor cap for cracks or tracking between terminals.



Checking contact breaker point gap using feeler gauges.

(8) Inspect the breaker points and if they are not badly pitted, clean and reface them on a smooth oil stone or with a points file. Wash the breaker points in clean solvent to remove all traces of oil and dirt.

NOTE: New breaker points should be washed in solvent to remove the anti-corrosive dressing and thoroughly dried before installing.

(9) Pack the area behind the heel of the breaker arm rubbing block with high melting point grease and place the breaker point assembly into the distributor.

(10) Loosely install the breaker point retaining screw and reconnect the breaker point lead to the junction block.

(11) Rotate the engine until the heel of the breaker arm rubbing block is on the highest point of a cam lobe.

(12) Gently tighten the fixed contact plate retaining screw and using a suitable screwdriver, move the contact plate in the necessary direction until a clean feeler gauge blade of the specified thickness is a neat sliding fit in the point gap.

(13) Fully tighten the fixed contact plate retaining screw and again check the fit of the feeler gauge between the contact points.

(14) Install the rotor arm and distributor cap, fit the high tension leads to the spark plugs and secure the high tension leads to the rocker cover where removed.

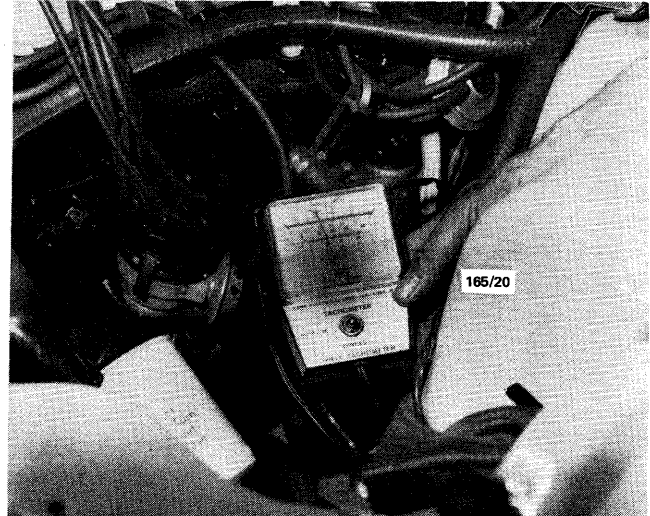
(15) Connect a dwell meter, tachometer and timing light to the engine and check the idle speed, dwell angle and ignition timing as described under the following headings.

TO ADJUST DWELL ANGLE AND IGNITION TIMING

(1) Connect a tachometer, dwell meter and timing light to the engine in accordance with the meter manufacturers instructions.

(2) Start the engine and bring to normal operating temperature.

(3) With the engine idling check the dwell angle (see Specifications) and if necessary adjust by increasing the



Checking distributor dwell angle using a dwell meter.

breaker point gap to decrease the dwell or decreasing the breaker point gap to increase the dwell.

The engine will have to be stopped and the distributor cap and rotor arm removed to carry out this operation.

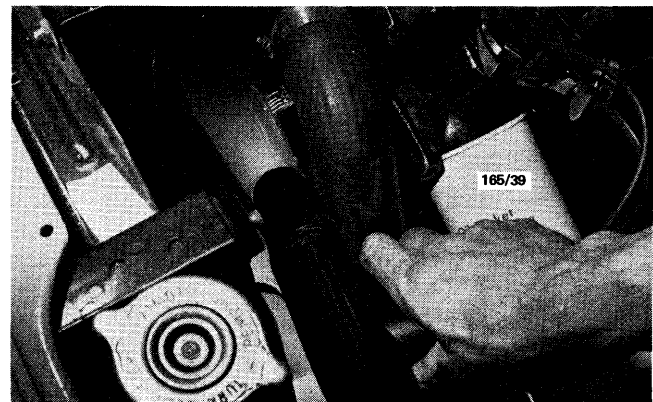
(4) When the correct dwell angle has been obtained fluctuate the engine between idle and 2000 rpm noting any variation in dwell angle reading.

If the dwell angle variation is excessive the following points should be checked and the necessary components renewed:

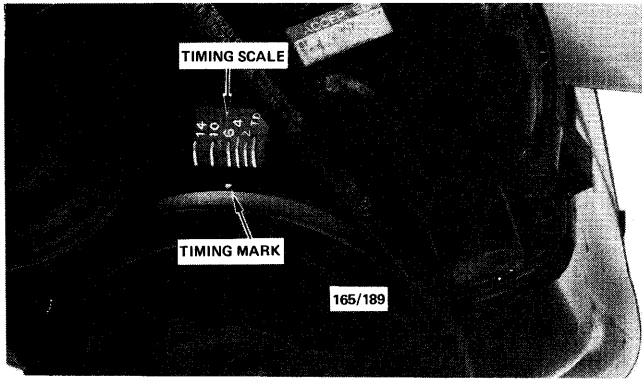
- Excessive side play in distributor shaft.
- Distributor cam worn.
- Faulty contact points.
- Breaker plate worn or loose.

NOTE: The ignition timing should always be checked after adjusting or renewing contact breaker points.

(5) Disconnect and plug the vacuum hose/s from the distributor vacuum unit. Disconnect and deactivate the throttle positioning solenoid and check the timing position with the timing light at the specified engine speed.



Checking the ignition timing using a timing light.



Timing marks in alignment for correct ignition timing.

Correct timing exists when the mark on the vibration damper is adjacent to the 6 degree mark on the timing cover scale.

(6) If necessary adjust the timing by loosening the distributor body clamp bolt and rotating the distributor body until the desired setting is obtained. Tighten the clamp bolt and recheck the timing.

TO SERVICE HIGH TENSION LEADS

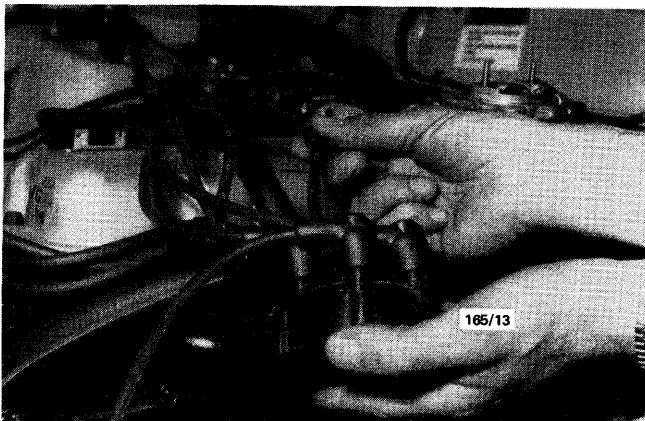
The high tension leads between the spark plugs and the distributor cap and the centre high tension terminal on the distributor cap and the ignition coil are of special manufacture and have a carbon impregnated core instead of a wire core.

This is to eliminate radio interference and care must be exercised when removing the leads from the spark plugs to ensure that the leads are not damaged by stretching, which will break the core and render the lead unserviceable.

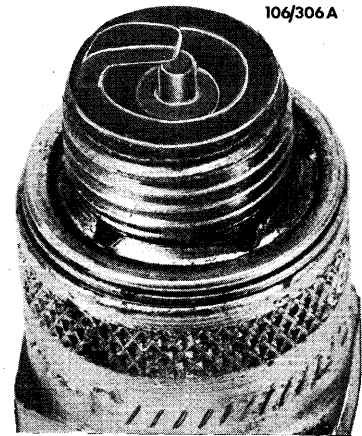
Always remove the lead from a spark plug by pulling on the terminal insulator. Use the same care when connecting the lead to the plug.

If a lead has a broken core it will cause misfiring. Check the leads for perishing or cracking and renew as necessary.

The leads may be carefully cleaned, using a cloth moistened with kerosene, then wiping completely dry.



Check the high tension leads for perishing or cracking.



Black damp deposits can be caused by excessive oil consumption or incorrect plug type. Spark plugs in this condition are usually not firing.

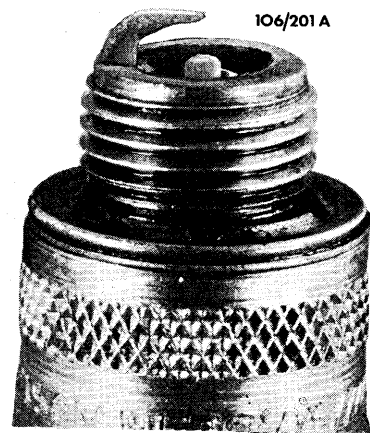
TO SERVICE SPARK PLUGS

The spark plugs should be removed for inspection, cleaning and resetting at intervals of 10,000 km.

Before removing the spark plugs ensure that the area around each plug is clean to prevent foreign matter entering the cylinders when the plugs are removed.

Spark plugs removed from an engine in good condition and operating under normal conditions should have a light powdery deposit ranging in colour from light brown to greyish tan. After considerable service the electrodes will show signs of wear or burning. Spark plugs showing a thick black oily deposit indicate an engine in poor mechanical condition or possibly, that a plug with too low a heat range has been fitted.

Spark plugs showing a white or yellowish deposit indicate sustained high speed driving or possibly that plugs of too high a heat range have been fitted, particularly when these deposits are accompanied by blistering of the porcelain and burning of the electrodes.



When plug electrodes are eroded to this degree the spark plug can be considered worn out and should be replaced using a spark plug of the recommended heat range.

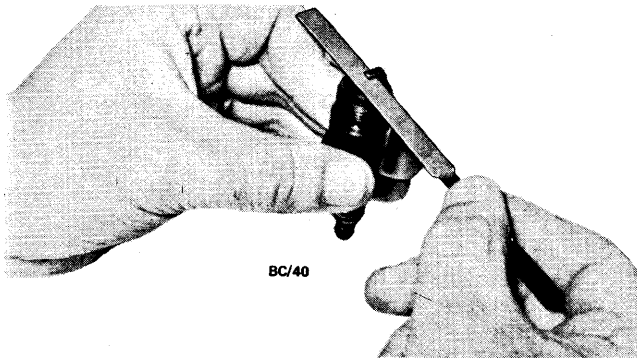


Spark plug with burnt electrodes and white blistered appearance. Possibly due to incorrect plug type, loose plug or motor running too hot.

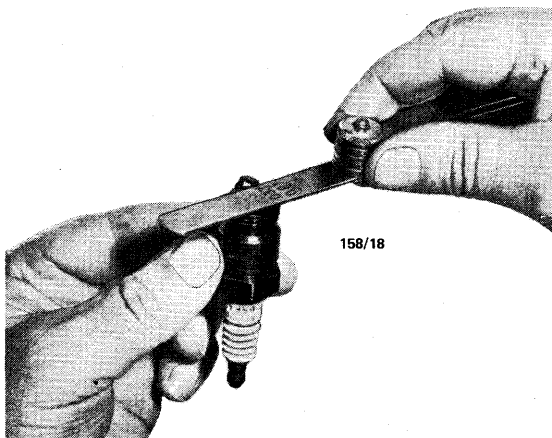
If the heat range is correct, clean the plugs on a sanding machine and blow clean with compressed air.

Ensure that all traces of abrasive grit are removed from the well in the plug body.

Lightly file the plug electrodes flat with a points file. Check the gaps between the electrodes preferably with clean wire gauges. If wire gauges are not available then



Lightly file the plug electrodes flat with a points file.



Checking spark plug electrode gap with feeler gauge.

use clean feeler gauges. If necessary move the side electrode towards or away from the centre electrode to obtain the correct gap.

Clean the spark plug threads, screw the plugs into the cylinder head finger tight then use a tension wrench to tighten the plugs to the specified torque.

NOTE: Do not overtighten taper seat spark plugs. If a torque wrench is unavailable, extreme care must be taken when tightening the spark plugs. If the plugs are tightened with the fingers and then taken up an additional 1/16 of a turn with the plug socket they will be tight enough.

TO TEST COMPRESSION

(1) Disconnect the high tension leads from the spark plugs.

(2) Ensure that the area around each spark plug is clean to prevent foreign matter entering the cylinders and then remove the spark plugs.

(3) Isolate the ignition by disconnecting the low tension wire between the coil and the distributor.

(4) Apply a compression gauge to No. 1 spark plug hole according to the instrument manufacturers instructions.

(5) Have an assistant fully open the throttle and operate the starter switch to rotate the engine. Observe the compression gauge and stop the engine when the highest reading is reached.

(6) Record the reading and then check the compression of the remaining cylinders in the same manner.

(7) Compare all readings taken. Refer to Specifications for minimum pressures and maximum cylinder variation.

(8) If a low reading is taken on one or more cylinders, the trouble source may be isolated as follows:

(a) Inject a small amount of engine oil into the spark plug hole of the cylinder and ensure the oil is evenly distributed by rotating the engine.

(b) Repeat the compression test on the cylinder concerned.

(c) A substantial increase of compression pressure indicates faulty or worn piston rings, piston or cylinder. No increase of compression pressure indicates burnt, obstructed or sticking valves, or a leaking or blown cylinder head gasket.

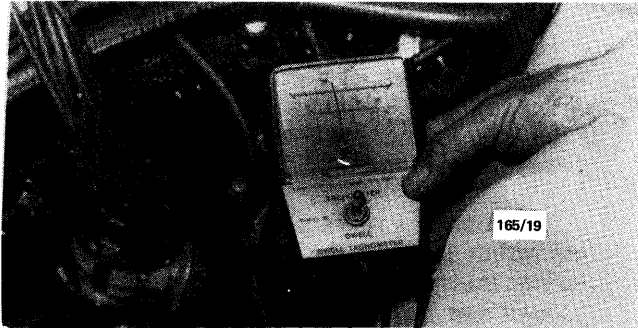
TO ADJUST IDLE SPEED

Before adjusting the idle speed the following conditions must be met:

The distributor dwell and ignition timing are correctly set.

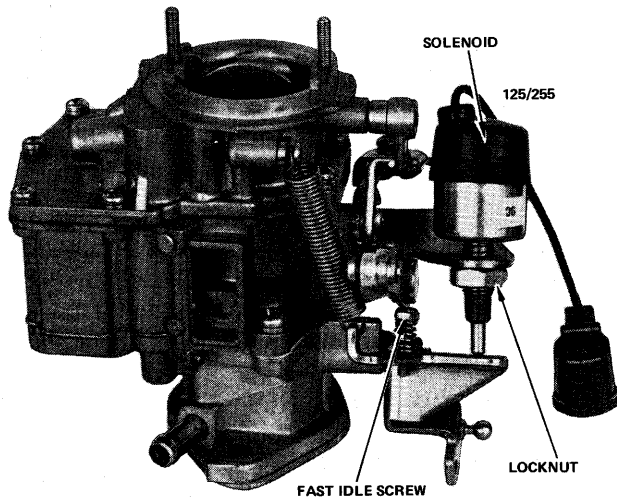
The engine is at operating temperature with the choke valve fully open, all emission systems operating correctly and the air conditioner, if fitted, is switched off.

(1) Remove the air cleaner assembly and plug the vacuum hose to the air cleaner.



Checking engine idle speed using a tachometer.

- (2) Firmly apply the handbrake.
- (3) Connect the tachometer to the engine, start and run the engine until a stable idle speed is reached. Select D (drive) on vehicles with automatic transmission. Compare the idle speed with Specifications.
- (4) Adjust the idle speed if necessary, by loosening the locknut and screwing the throttle positioning solenoid in or out until the specified idle speed is reached. Tighten the locknut.
- (5) Instal the air cleaner assembly and again check the idle speed on the tachometer. If necessary repeat the adjusting procedure.
- (6) Disconnect and remove the tachometer.

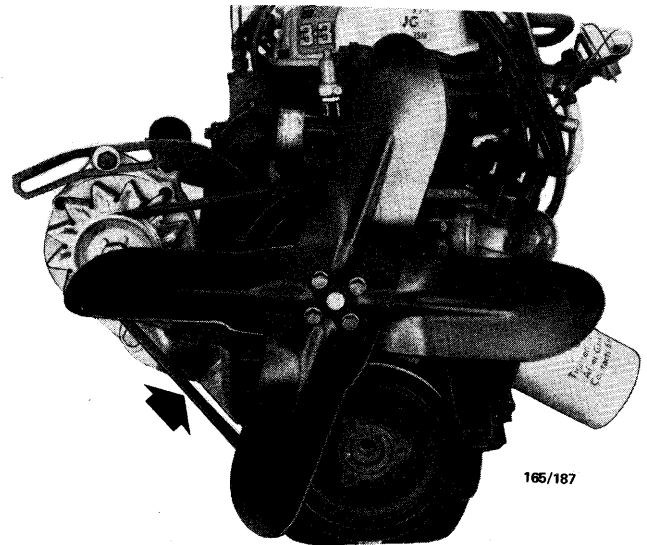


Left hand side view of carburettor showing idle speed adjusting points.

3. DRIVE BELTS

It is essential that all belts be adjusted to prevent slip but without imposing excessively upon the component bearings, particularly the alternator or water pump bearings.

The drive belts should be adjusted using the following procedure:



Drive belt deflection should be checked in the middle of the longest run.

- (1) Using finger and thumb pressure push firmly on the belt concerned in the middle of the longest run to assess the deflection.
- (2) Drive belts with a longest run of less than 300 mm should have a deflection of between 3 and 6 mm, whereas drive belts with a longest run of more than 300 mm should have a deflection of between 3 and 13 mm.
- (3) If necessary loosen the accessory pivot and adjusting bolts and move the accessory in the adjustment slot provided to achieve the correct drive belt tension.
- (4) When the correct drive belt tension is obtained tighten the accessory pivot and adjusting bolts securely and recheck the belt tension.

This section deals with the common causes of engine failure to start, as inevitably there will come a time when every driver will experience this problem and will therefore, need to call upon his own resources to rectify the trouble. Roadside breakdowns other than engine failure can be identified by reference to the Trouble Shooting chart on the particular component effected.

1. TROUBLE SHOOTING

Trouble shooting is only a process of elimination and provided the procedure is carried out correctly and systematically an accurate diagnosis of the trouble can be made in the minimum amount of time.

For an internal combustion engine to run there are three basic requirements, these are, ignition, fuel and compression. There are other factors of course but as a rule an engine's failure to start can be attributed to a fault in one of these three systems.

Reports from field engineers of motoring organisations prove that the biggest percentage of engine breakdowns are in the order of ignition or electrical failure first, followed by fuel, with mechanical or compression failure the least common.

Should the engine fail to start, first check that there is adequate fuel in the tank and if so, carry out the following checking procedures in the order described.

2. TO CHECK IGNITION AND ELECTRICAL SYSTEMS

(1) Switch on the ignition and check for warning light illumination on the dashboard.

(2) Operate the starter switch and check that the starter rotates the engine at a steady speed.

(3) Switch on the headlamps and check for good light intensity.

Should the lights not illuminate or the starter motor turn the engine, carry out the following action:

(a) Remove the battery terminals and clean both terminals and posts. Refit the terminals and tighten firmly but not excessively.

(b) Check that the earth lead from the battery to the engine or body frame is not broken and that the connections are clean and secure.

(c) Check that the lead from the battery to the starter motor or starter solenoid is intact and with a clean and secure connection.

(d) Where necessary carry out repairs to (b) and (c).

Again carry out the check procedure, should the starter motor still not operate, or the lights illuminate, then one or more of the following faults may be the cause:

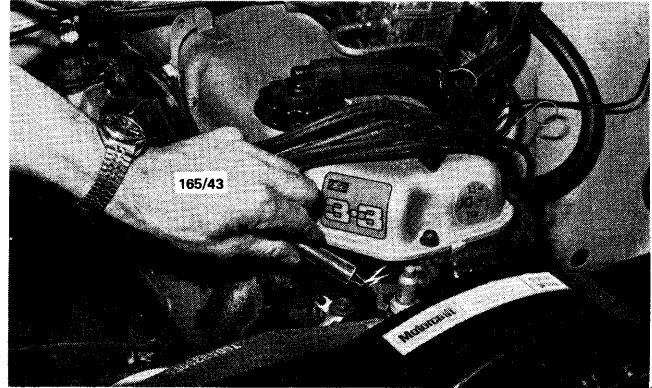
No starter motor operation or lights: Battery flat or defective.

Lights working but no starter operation: Starter motor drive jammed in mesh with flywheel ring gear. Starter motor or solenoid defective. Ignition/starter switch faulty.

Lights dim and starter operation sluggish: Discharged battery or fault in starter motor. Battery flat due to broken fan belt or defective alternator. Faulty battery due to cell breakdown.

If the battery and starter motor operation proves satisfactory but the engine still fails to start, continue as follows:

(1) Disconnect a spark plug lead and position the terminal within 3 mm of the cylinder head. It may be necessary on leads fitted with terminal insulators to use a piece of wire or screwdriver as an extension to the terminal.



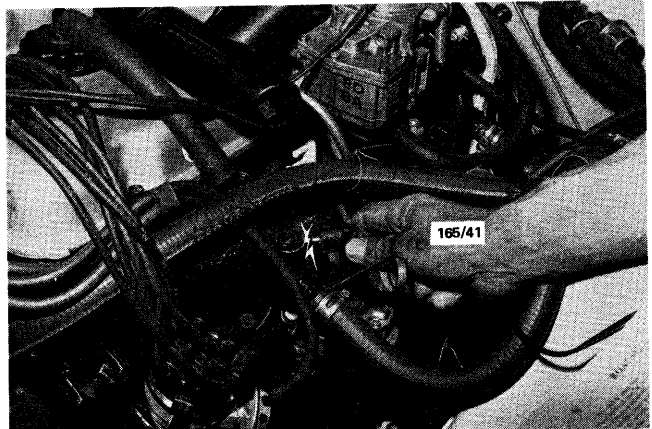
Checking for spark at spark plug high tension lead. Note split pin which can be used to extend recessed terminal.

(2) Have an assistant switch on the ignition and operate the starter switch.

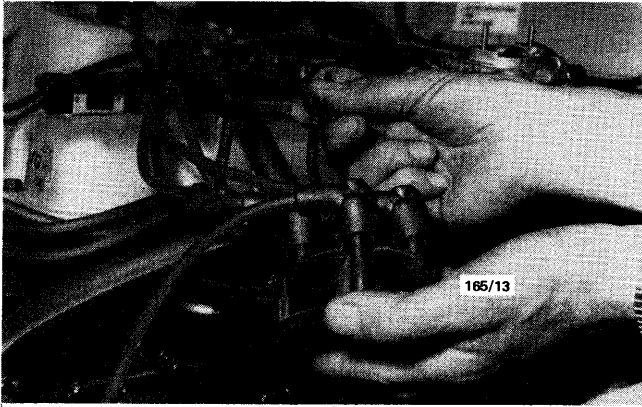
(3) Check that the spark, if any, jumps the gap to the cylinder head. If there is no spark or the spark is weak or yellow, carry on with point (4). If the spark is satisfactory proceed to point (5).

(4) Disconnect the coil lead from the distributor cap and carry out the check procedure previously described for the spark plug lead in points (1) to (3). If there is a strong blue spark then the fault lies within the distributor.

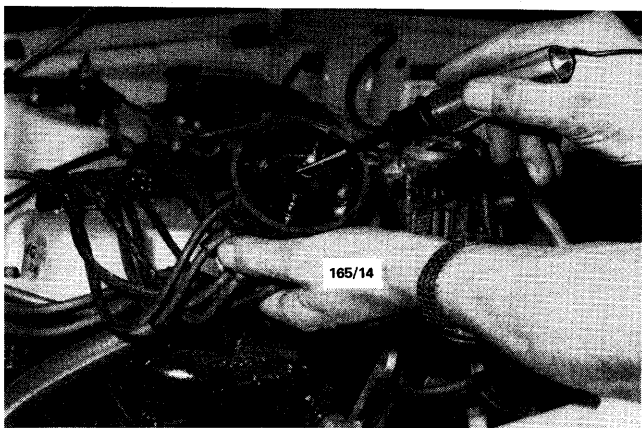
Should there be no spark or a weak and yellow spark



Checking for spark at coil high tension lead.



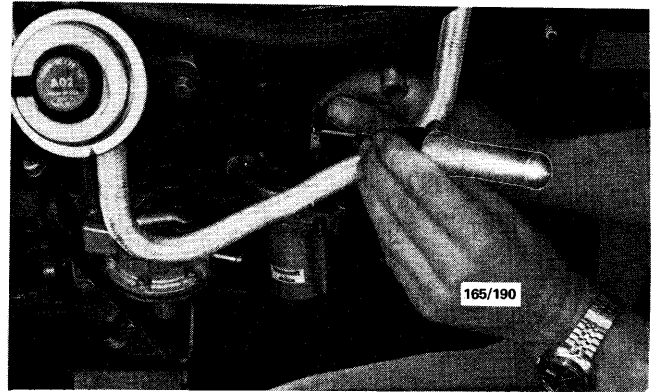
Check the high tension leads for perishing or cracking.



Check the inside of the distributor cap for cracks or tracking between terminals.

on both or either of the tests, then carry out the following action:

- (a) Check the spark plug leads to ensure that they are perfectly dry and that the insulation is not cracked.
- (b) Check the distributor cap to ensure that it is dry and clean. Examine both inside and outside of the cap for cracks or tracking, particularly between the spark plug segments in the cap.
- (c) Check the rotor arm for cracks, deposits or burning on the metal arm.
- (d) Ensure that the spark plug leads and the coil lead have dry, clean and secure connections in the distributor cap.
- (e) Check that the carbon brush in the centre of the distributor cap interior face is clean and dry and ensure that where the carbon is of the spring loaded type, it moves freely in and out of its locating hole.
- (f) Check that the low tension wires on the ignition coil are intact and have clean and secure connections.
- (g) Check that the low tension current is reaching the ignition coil when the ignition is switched 'ON'. Use a test lamp between the coil low tension terminals and a good earth. Ensure that the breaker points are open or insulated when making the test. Should the test lamp



Checking for low tension current at ignition switch side of ignition coil.

light on the ignition switch (+) side of the coil but fail to light on the distributor (-) side of the coil, then it is possible that the coil is faulty or that there is a short circuit in the lead from the coil to the breaker points. Check the lead to the breaker points and if necessary remove and test the coil or replace with a known serviceable unit.

NOTE: If a test lamp is unavailable the low tension lead can be disconnected from the ignition switch side of the coil and 'flashed' to some good earth to check for current flow. Similarly a small screwdriver can be 'flashed' across the open breaker points to check the ignition coil and the lead from the coil to the breaker points. As in test (g) ensure that the ignition switch is in the 'ON' position.

(h) Check, and if necessary, clean and adjust the contact breaker points, see appropriate heading in the Tune-Up section.

(i) Ensure that the low tension leads in the distributor and the earth wire are intact, clean and secure.

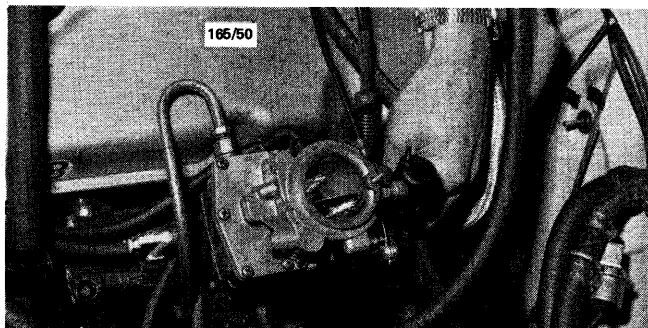
Again carry out the check procedure, should there still be no spark or a weak or yellow spark, then one or more of the following faults may be the cause:

Defective coil, capacitor or high tension leads. If the contact point check showed severe burning or pitting of the point faces then this would indicate a possible capacitor failure. Renew the capacitor and breaker points.

(5) If the above checks prove the spark to be satisfactory but the engine still fails to start, remove all spark plugs and check their condition and electrode gap against the information given in the Tune-Up section under the appropriate heading.

3. TO CHECK THE FUEL SYSTEM

(1) Assuming that the fuel tank does contain a quantity of clean fuel, the first test is to determine if there is fuel in the carburettor float chamber. To do this first remove the air cleaner from the carburettor and with the choke valve open look down the carburettor throat. While looking down the carburettor throat open and



Check for discharge of fuel at carburettor accelerator pump nozzle by actuating the throttle linkage by hand.

close the throttle several times by actuating the throttle linkage by hand. If squirts of fuel are seen to discharge from the accelerator pump discharge nozzle it is an indication that the carburettor float chamber is full of fuel and that the fuel system is functioning OK.

If on the other hand no fuel was being discharged from the accelerator pump nozzle then proceed checking as follows:

(2) Pull the lead out of the top of the coil or remove the distributor rotor arm to prevent the engine from possibly starting during the next part of the test.

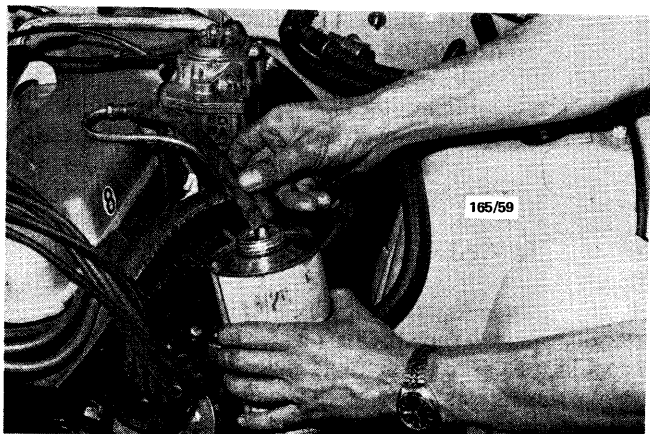
(3) Disconnect the fuel supply pipe at the carburettor and position the end in a suitable container. Have an assistant operate the starter and note if fuel is being discharged into the container. Proceed to point (7) if fuel flow is satisfactory, if not, continue with points (4) to (6).

(4) Disconnect the fuel supply pipe from the tank to the inlet side of the fuel pump.

(5) Remove the fuel tank filler cap and have an assistant listen at the tank filler aperture. Blow down through the fuel pipe towards the tank and provided the pipe is clear, air bubbles will be heard in the tank.

(6) Reconnect the fuel pipe to the pump and again check for fuel delivery from the fuel pump.

If there is no delivery of fuel to the carburettor side of the fuel pump then one or more of the following faults may be the cause:



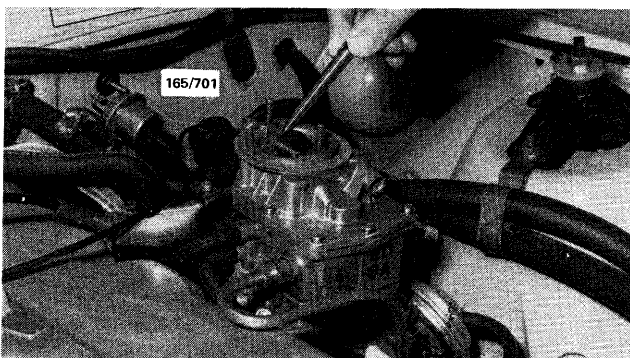
Checking for fuel flow at carburettor supply pipe.

No air bubbles heard on tank test: Fuel line obstructed or fractured.

Air bubbles heard in tank but no delivery from fuel pump: Faulty fuel pump. Refer to the appropriate headings in the Fuel System section of this manual for test and overhaul procedure.

(7) Should there be a satisfactory supply of fuel at the carburettor end of the fuel pipe but the engine will still not start, carry out the following additional procedure:

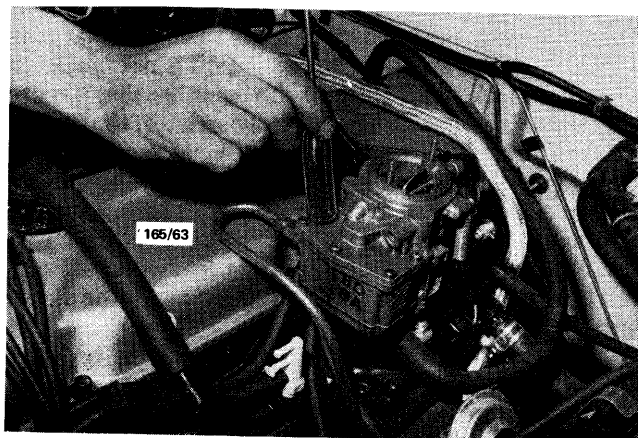
(a) First check that flooding is not the cause due to excessive use of choke and/or accelerator when attempting to start the engine.



When the engine is at operating temperature the choke valve should be fully open.

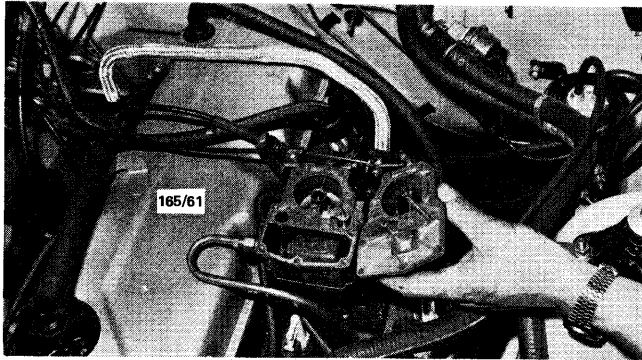
(b) Remove the spark plugs and check for petrol saturation of the electrodes, if evident thoroughly clean and dry before replacement.

(c) If flooding persists, check the float and needle valve for sticking and also ensure that the float is not punctured allowing it to fill with fuel.



Float chamber flooding can sometimes be rectified by tapping the carburettor float chamber in the vicinity of the needle and seat.

(d) Check the air cleaner for a choked element. If flooding is not the cause and there is an adequate supply of fuel to the carburettor, one or more of the following faults may be the cause:



Remove the carburettor top cover and check for stuck needle valve, punctured float, water or dirt contamination.

Where fitted, blocked carburettor gauze filter.

Stuck or obstructed needle valve.

Choke valve not closing correctly.

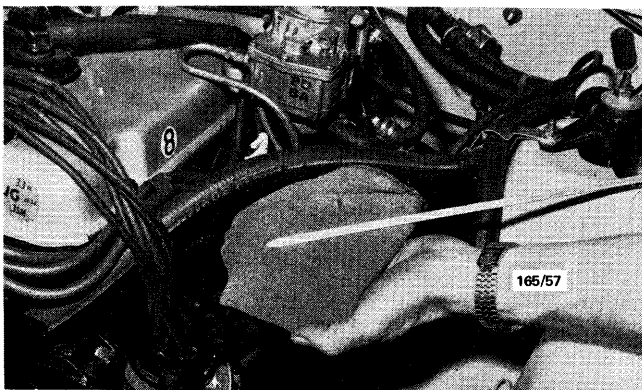
Air leaks around the inlet manifold or carburettor mounting flanges because of distortion or defective gaskets.

Fractured hose or loose connections between the brake servo unit and the inlet manifold.

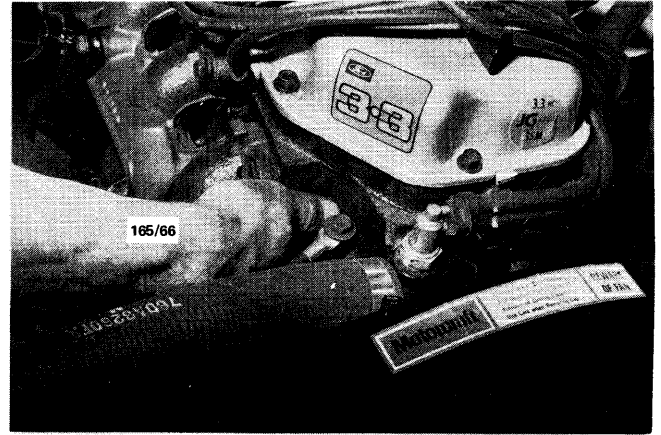
4. TO CHECK THE MECHANICAL SYSTEM

The following check procedure assumes that the starter motor will rotate the engine, if not, press in the clutch to disengage the engine from the transmission in case the fault lies within the transmission. If the starter will still not rotate the engine it will be necessary to remove the starter motor and attempt to turn the engine over manually. This will establish whether the fault lies with the starter motor which could be jammed or defective, or, the engine which could be seized or have broken internal components such as connecting rods, pistons and crankshaft etc. If the starter motor is not at fault and the engine will not rotate manually then refer to the heading Engine Mechanical Trouble Shooting in the Engine section for the possible causes.

It should be noted that the only way that compres-



Check the engine oil for correct level and dilution on the dipstick.



Rule of thumb method of checking the cylinder compression.

sion can be accurately tested is by means of a compression test meter. The crude method described in the following check procedure is only intended to give a rule of thumb indication when checking for causes of engine breakdown.

(1) Remove the radiator cap and check for loss of water from the radiator. If so, check carefully for any indication of external leakage and, remove the engine oil dipstick and check for emulsification of the oil — when water mixes with oil it will turn creamy and the oil level will also have increased. If the oil is emulsified the following checks are not required.

(2) Isolate the ignition by disconnecting the lead from the top of the coil. Remove each of the spark plugs in turn and firmly block the spark plug hole in the cylinder head with the pad of the thumb. Have an assistant fully open the throttle and operate the starter switch to rotate the engine, check that the compression is strong enough to force past the thumb sealing the plug hole and also examine the thumb and the spark plug previously removed for indications of water.

If the above checks show a loss of water and this is evident in the engine oil or on the thumb or spark plug, then one or more of the following faults may be the cause:

Blown cylinder head gasket.

Cracked cylinder or cylinder head.

Warped cylinder head or cylinder block faces.

If the crude compression check showed any weak, lack of or inconsistent compressions, then any of the above faults could also be the cause plus the following:

Broken pistons(s).

Burnt or broken valves.

Provided the previous checks do not indicate an internal leakage of water continue with the following:

(3) Remove the distributor cap and, with an assistant operating the starter switch, check that the rotor arm rotates as the engine turns over.

(4) Remove the rocker cover and, again with an assistant operating the starter switch, check that all the valves open and close as the engine turns over.

If the rotor arm or the valves do not operate with engine rotation then one of the following faults may be the cause:

Rotor arm does not turn but valves operate: Distributor drive shaft broken or drive gear stripped.

Rotor arm and valves do not operate: Broken timing chain. Broken camshaft. Sheared drive key in crankshaft sprocket.

Provided all the previous checks have been carried out correctly and the operator is quite satisfied that none of the components are at fault then all that remains is for the ignition and valve timing to be checked. It should be noted however, that if loss of timing proves to be the fault then the cause for this occurring must be sought, if the vehicle has started and run satisfactorily up to the point of engine failure.

NOTE: In order to check the ignition and valve timing it will be necessary to remove the distributor cap and the rocker cover and turn



Rotor pointing to No 1 cylinder position on distributor.

the engine clockwise via the crankshaft pulley until No 1 piston is at tdc on the compression stroke. In this position the valves of No 1 cylinder should be 'closed' and the distributor rotor should be pointing to the No 1 high tension lead segment in the distributor cap.

Refer to supplement
for more information.

ENGINE

SPECIFICATIONS

Type	6 cyl in line OHV
Models:	
Falcon	3.3 litre, 4.1 litre
Fairmont	4.1 litre
Capacity:	
Falcon 3.3 litre	3280 cc
Falcon 4.1 litre	4100 cc
Fairmont	4100 cc
Bore	93.47 mm
Stroke:	
3.3 litre	79.51 mm
4.1 litre	99.31 mm
Compression ratio:	
3.3 litre LC	7.87:1
3.3 litre HC	8.70:1
4.1 litre HC	8.96:1
Maximum output:	
3.3 litre LC	77 kW at 4000 rpm
3.3 litre HC	82 kW at 4000 rpm
4.1 litre HC	95 kW at 3700 rpm
Compression pressure:	
3.3 litre LC	965 kPa
3.3 litre HC	1137 kPa
4.1 litre HC	1137 kPa
Variation allowable between compression pressures	± 103 kPa
Engine idling speed:	
Manual transmission models	900 to 950 rpm
Automatic transmission models (in D range)	600 to 630 rpm
Ignition timing	6 deg ± 2 deg btdc
Firing order	1-5-3-6-2-4

CYLINDER BLOCK

Bore diameter — standard	93.472-93.563 mm
Maximum out of round	0.127 mm
Maximum taper	0.254 mm
Bore measuring points	Top, centre and bottom at right angles to shaft
Face warpage limit	0.18 mm

CYLINDER HEAD

Type	One piece cross-flow
Material	Cast iron
Valve seat width:	
Inlet	1.52-2.03 mm
Exhaust	1.78-2.29 mm
Valve seat angle:	
Inlet and exhaust	45 deg
Valve seat run out (maximum)	0.038 mm
Cylinder head face warp limit	0.18 mm
Valve guide type	Integral with head

VALVES AND SPRINGS

Valve head diameter:	
Inlet	43.94-44.19 mm
Exhaust	37.84-38.10 mm
Valve stem diameter:	
Inlet	8.663-8.681 mm
Exhaust	8.664-8.682 mm
Oversizes available	0.076, 0.38, 0.76 mm
Valve stem clearance:	
Inlet	0.050-0.081 mm
Exhaust	0.051-0.081 mm
Wear limit	0.114 mm
Valve face angle:	
Inlet	44 deg
Exhaust	44 deg
Valve springs:	
Free length (approx)	52.58 mm
Assembled height	46.0-46.8 mm

CRANKSHAFT AND MAIN BEARINGS

Number of main bearings	7
End thrust taken at number	5
End thrust clearance	0.102-0.254 mm
Clearance limit	0.305 mm
Main bearing journal diameter — standard	60.909-60.414 mm
Main bearing journal taper limit	0.008 mm per 25 mm
Main bearing journal ovality limit	0.010 mm
Main bearing clearance:	
Standard	0.013-0.038 mm
Maximum	0.056 mm
Crankpin diameter:	
Standard	53.929-53.950 mm
Maximum taper	0.010 mm per 25 mm

CONNECTING RODS AND BEARINGS

Connecting rod side clearance	0.089-0.267 mm
Side clearance wear limit	0.356 mm
Connecting rod bearing clearance:	
Standard	0.020-0.038 mm
Maximum	0.061 mm
Bend maximum limit	0.102 mm
Twist maximum limit	0.203 mm

PISTONS AND GUDGEON PINS

Piston diameter:	
Skirt diameter — Measured	Right angles to pin axis
Standard grades	Red, blue
Grade red	93.436-93.528 mm
Grade blue	93.447-93.462 mm
Oversizes	0.076, 0.508, 0.762, 1.016 mm
Skirt clearance in bore	0.025-0.046 mm

Ring groove width:	
Compression rings	2.03–2.06 mm
Oil ring	4.78–4.80 mm
Gudgeon pins:	
Length	76.45–77.22 mm
Diameter	23.162–23.175 mm
Clearance in piston	0.008–0.013 mm

PISTON RINGS

Number:	
Compression	2
Oil control	1
Width:	
Compression — both	1.956–1.984 mm
Oil control	Snug fit
Clearance in groove:	
Compression	0.051–0.102 mm
Wear limit	0.152 mm
Oil control	Snug fit
Ring gap:	
Compression	0.254–0.508 mm
Oil control —	
Top and bottom segment	0.381–1.397 mm

CAMSHAFT AND BEARINGS

Number of bearings	5
Journal diameter	45.96–45.99 mm
Journal maximum out of round	0.013 mm
Journal to bearing clearance	0.025–0.076 mm
Journal to bearing wear limit	0.152 mm
Camshaft end float	0.025–0.178 mm
Wear limit	0.305 mm
End float taken at	Thrust plate
Camshaft drive	Chain
Chain maximum deflection	13 mm

TAPPETS

Type	Hydraulic
Leak down rate	5–50 seconds
Outer diameter	22.199–22.212 mm
Clearance in bore	0.018–0.066 mm
Wear limit	0.127 mm

LUBRICATION

Oil pump type	Rotor
Outer rotor to body clearance	0.152–0.33 mm
Inner rotor tip clearance	0.038–0.102 mm
Shaft to bearing clearance	0.038–0.074 mm
Rotor end float	0.028–0.104 mm
Relief valve spring tension	40–45 Nm at 27.38 mm
Relief valve clearance	0.038–0.074 mm
Filter type	Disposable, externally mounted

TORQUE WRENCH SETTINGS

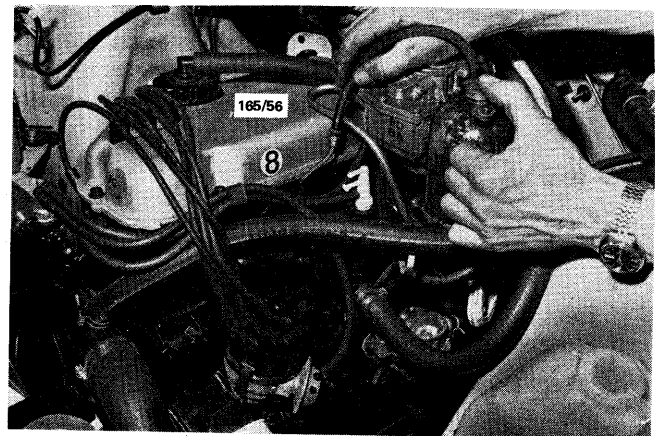
Main bearing bolts	95 Nm
Connecting rod nuts	33 Nm

Camshaft sprocket bolt	61 Nm
Camshaft thrust plate bolts	20 Nm
Rocker cover bolts	7 Nm
Rocker fulcrum bolts	34 Nm
Sump bolts	12 Nm
Oil pump to crankcase bolts	20 Nm
Oil pump cover bolts	12 Nm
Flywheel/drive plate bolts	115 Nm
Front engine mounting to frame	41 Nm
Front engine mounting to bracket	47 Nm
Front engine mounting to engine	31 Nm
Rear mounting to transmission bolts	61 Nm
Rear mounting to crossmember bolts	47 Nm
Rear crossmember to body bolts	75 Nm
Inlet manifold	24 Nm
Exhaust manifold	31 Nm
Timing case cover	12 Nm
Water pump to engine bolts	20 Nm
Cylinder head bolts:	
Stage 1	75 Nm
Stage 2	88 Nm
Stage 3	102 Nm

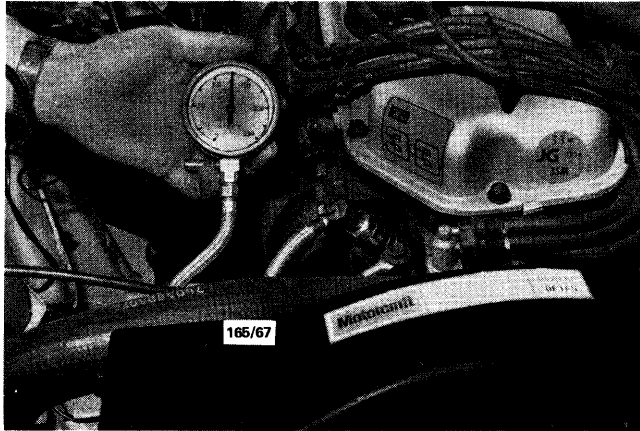
1. ENGINE MECHANICAL TROUBLE SHOOTING**ENGINE MISSES AT IDLING SPEED**

NOTE: For other causes of engine misfire first see Fuel and Electrical sections.

- (1) Air leak at inlet manifold gasket: Check for air leaks by applying oil around the manifold joints. Renew gasket if air leak is evident.
- (2) Burnt valves or seats in cylinder head: Check compressions and overhaul the cylinder head as necessary.
- (3) Broken or worn piston rings: Check cylinder compressions and overhaul engine as necessary.
- (4) Weak or broken valve springs: Remove rocker cover and check condition of valve springs. Renew defective components.



Air leaks at the inlet manifold can be located by running engine oil around the suspect joints.



Checking cylinder compression with a compression gauge.

NOTE: Use a compression gauge to check the pressure in each cylinder; this must be within Specifications.

NOISY VALVE OPERATION

- (1) Sticky or defective hydraulic tappet: Clean or renew hydraulic tappet as necessary.
- (2) Weak or broken valve springs: Remove rocker cover and check condition of valve springs.
- (3) Worn rocker arm: Remove rocker arm and check for wear. Renew faulty components.
- (4) Worn valve guides: Overhaul the cylinder head as described in this section.

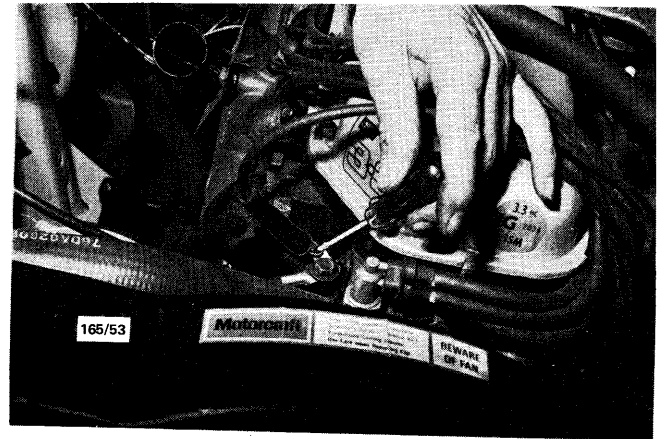
NOTE: If noisy valve operation is still evident after carrying out the foregoing checks, then the camshaft lobes or timing chain may be defective and need renewal.

BIG END NOISE

- (1) Lack of adequate oil supply: Check oil level in sump and check condition of oil pump.
- (2) Thin oil or oil diluted with petrol: Change to correct grade of oil. Check for source of oil dilution and rectify.
- (3) Low oil pressure: Check pressure relief valve and spring, oil filter bypass valve and renew oil filter.
- (4) Excessive bearing clearance: Renew bearing shells, check and regrind big end journals if worn or oval.
- (5) Misaligned big end bearings: Align connecting rods and renew big end bearing shells.

NOTE: Big end bearing noise is indicated by a metallic knock which is usually loudest at approximately 60 km/h with the throttle closed. The knock can be reduced or even eliminated by shorting out the spark plug on the offending cylinder.

Before dismantling the engine to inspect the big ends check the engine oil for correct level and dilution on the dipstick. Also



Main bearing knock can be confirmed by shorting out the spark plug adjacent to the offending bearing.

remove the oil pressure sender unit and connect an oil pressure gauge into the oil gallery to check out the oil pressure readings.

MAIN BEARING NOISE (APPARENT)

- (1) Loose flywheel: Tighten flywheel securing bolts to the specified torque.
- (2) Loose vibration damper: Renew the crankshaft pulley and vibration damper assembly.
- (3) Insufficient oil supply: Replenish the oil in the sump to correct level.
- (4) Low oil pressure: Check the bearing to journal clearance, check condition of the oil pump and pressure relief valve. Renew the oil pump if necessary.
- (5) Excessive crankshaft end play: Renew crankshaft main bearings.
- (6) Crankshaft journals out of round and excessive bearing to journal clearance: Regrind journals and renew bearings (undersize).

NOTE: Main bearing noise is indicated by a heavy but dull knock when the engine is under load. The knock can be confirmed by shorting out the spark plug adjacent to the offending bearing. The knock will be less audible or will even disappear when the plugs are shorted. This test is best done with the engine running at a fast idle. A loose vibration damper can be checked out by working the unit backwards and forward with the hands to check for looseness.

A loose flywheel is indicated by a thud or dull click when the ignition is turned off. It is usually accompanied by vibration.

Crankshaft end play noise is indicated by a sharp rap at idle speed. The crankshaft can be readily checked out for excessive end float by levering the crankshaft backwards and forward.

If the oil pressure checks out OK remove the main bearing caps and assess bearing clearance using the Plastigage method as out-

lined later in this section. Ovality and wear on the main bearing journals can only be checked with a micrometer after the crankshaft has been removed.

EXCESSIVE OIL CONSUMPTION

(1) Oil leaks: Check and renew engine gaskets and seals as necessary.

(2) Damaged or worn valve stem oil seals: Dismantle cylinder head and renew damaged or worn oil seals.

(3) Excessive clearance between valve stem and valve guide: Ream valve guides and fit valves with over-size stems.

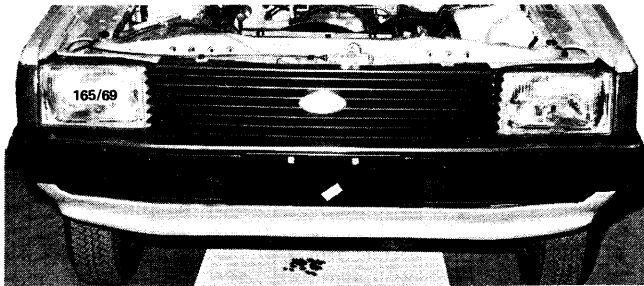
(4) Worn or broken rings: Renew piston rings on all pistons.

(5) Rings too tight or stuck in grooves: Renew piston rings and clean out ring grooves.

(6) Excessive wear in cylinders, pistons and rings: Recondition cylinders and renew pistons and rings.

(7) Compression rings incorrectly installed. Oil rings clogged or broken: Renew piston rings.

NOTE: Before checking the engine for oil leaks the engine should be completely degreased and cleaned. Run the engine at operating temperature for a period and then visually check for oil leakage. By placing white paper on the floor directly beneath the engine any excessive leak can be readily pinpointed.



Run the engine over a white piece of paper to check for oil leaks.

Damaged or worn valve stem seals which allow oil to be drawn down past the valve stems into the combustion chamber can be diagnosed by allowing the engine to idle for a few minutes and then open the throttle. If oil is being drawn down past the valve stems a heavy discharge of blue smoke will be seen at the tailpipe.

Piston, rings and cylinder bore troubles are always accompanied by a loss of compression. Cylinder compression can only be accurately assessed by using a compression gauge.

DROP IN OIL PRESSURE

(1) Oil level low in sump: Check and replenish oil

to full mark in sump.

(2) Thin or diluted oil: Change to correct grade of oil and rectify source of dilution.

(3) Oil pump relief valve stuck or spring broken: Free up relief valve or renew broken relief valve spring.

(4) Excessive bearing clearance: Renew bearing shells or recondition crankshaft journals as necessary.

(5) Excessive wear in oil pump components: Renew or recondition oil pump.

(6) Air leak in oiling system: Rectify as necessary.

NOTE: If the vehicle is not fitted with an oil pressure gauge remove the oil sender unit and connect a pressure gauge into the oil gallery. Check the oil pressure with the engine cold and hot. If the oil pump or relief valve is faulty low pressure will be indicated with the engine either hot or cold. However, if the bearings are at fault a fairly high pressure will be indicated when the engine is cold but a marked fall of pressure will be noted when the engine is hot.

The overhaul procedure for the oil pump and relief valve is fully explained later in this section.

ENGINE WILL NOT ROTATE

(1) Starter motor drive jammed: Remove starter motor, check and renew damaged drive and/or flywheel ring gear.

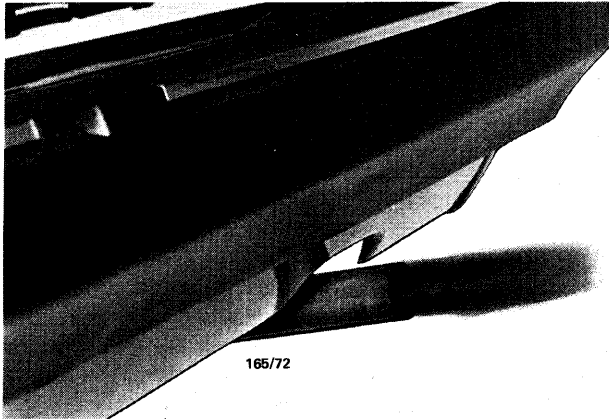
(2) Engine overheated and seized: Remove and dismantle engine, check and renew damaged components.

(3) Water in cylinders due to blown head gasket or cracked cylinder or head: Remove cylinder head, if gasket is blown, check for cylinder block and head warpage, reface if necessary. Renew cylinder head and/or cylinder block if cracked.

(4) Broken internal components due to overheating or fatigue: Remove and dismantle engine. Renew faulty or broken components.

NOTE: Frequent jamming of the starter motor drive with the flywheel ring gear can be due to a bent starter armature shaft, damaged teeth on the drive and/or ring gear. With the starter motor removed the flywheel ring gear teeth can be examined through the starter motor mounting aperture. Replacement of the ring gear requires removal of the engine and/or transmission, the clutch and flywheel on manual transmission engines. The checking for a bent armature shaft can be done by rotating the shaft by hand while the end is held in the close proximity to a fixed object.

Invariably when an engine seizes, because of overheating due to lack of oil and/or water, damage is done to the bearings, pistons, etc. Although there may be instances when an engine will restart and run after it has



Excessive steam or emulsified oil at the exhaust pipe indicates water leakage into the combustion chamber.

cooled down and the oil and water replenished, it will generally be found that oil consumption increases, oil pressure drops and the engine will be noisier, depending upon the degree of damage.

When a cylinder head gasket blows allowing water into the cylinders, or compression loss between cylinders, it is essential to check the gasket faces on the cylinder block and head for warpage. Sufficient water can enter a cylinder because of a blown head gasket, cracked cylinder head or cylinder to prevent the engine from rotating. Normally this is preceded by difficult starting, mis-firing, excessive steam from the exhaust and loss of water from the radiator.

By removing the radiator cap and allowing the engine to fast idle, bubbles may be seen in the top tank or alternatively with the radiator cap on, excessive discharge from the radiator pressure relief overflow.

2. DESCRIPTION

The 3.3 and 4.1 litre engine are almost identical in design. The 4.1 litre engine with its longer stroke and thus increased capacity develops more horsepower.

The six cylinder overhead valve, in line engine has a cast iron cross-flow cylinder head and a one piece cylinder block and crankcase.

The cylinders are numbered from 1 to 6 starting at the front of the engine.

The dynamically balanced crankshaft and flywheel are supported by seven main bearings. Crankshaft end thrust is controlled by the flanges of number five main bearing.

The pistons have two top compression rings and one oil control ring. The top compression ring is coated with molybdenum and the lower compression ring with phosphate. The oil control ring assembly consists of three segments, a serrated spring and two chrome plated steel spacers.

The distributor located on the front left of the engine drives the oil pump by a short shaft. The rotor type oil pump is situated in the crankcase.

Connecting rods are an 'H' section forged steel.

Gudgeon pins are a press fit in the connecting rod small end and this is their only means of retention in the rods.

The camshaft is driven by a morse chain and sprockets.

The cylinder head contains the valves, valve rocker arm assemblies, integrally cast valve guides, manifold coolant outlet and thermostat.

Inlet and exhaust valves are fitted with shroud type seals and single valve springs.

NOTE: All applicable internal engine components must be reassembled with clean light engine oil to ensure adequate lubrication for initial start-up.

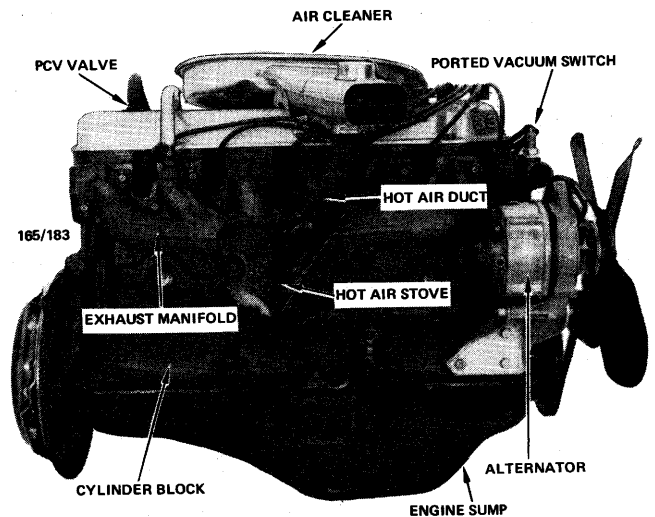
3. ENGINE ASSEMBLY

Special Equipment Required:

To Remove and Instal — Suitable lifting tackle

TO REMOVE

- (1) Mark around the bonnet hinges with a pencil to facilitate replacement and remove the bonnet.
- (2) Drain the coolant from the cooling system and the cylinder block, drain the engine sump.
- (3) Remove the air cleaner, remove the battery earth cable from the cylinder head and the battery. Disconnect and remove the radiator hoses. On vehicles with automatic transmission, disconnect the transmission cooler pipes from the radiator.
- (4) Remove the fan shroud if fitted then remove the radiator. Remove the fan belt, fan and pulley hub.



Right side of engine assembly showing location of components.

(5) On vehicles equipped with air conditioning, remove the compressor leaving the pressure hoses attached. To prevent damage to the heat exchanger, insert a piece of hardboard between the engine and the heat exchanger.

(6) Disconnect the heater hoses from the water pump and inlet manifold. Disconnect the alternator wiring from the back of the alternator and remove the cables from the starter motor. Disconnect and remove the choke and accelerator cables from the carburettor. Remove the kickdown cable on automatic transmission vehicles.

(7) Disconnect the vacuum hose from the rear of the manifold.

(8) Disconnect and plug the fuel line at the fuel pump.

(9) Disconnect the coil primary wire at the coil. Disconnect the oil and water temperature sending unit wires at the sending units.

(10) Withdraw the starter motor mounting bolts and remove the starter motor.

(11) Raise the vehicle and support it on chassis stands.

(12) Remove the clutch/converter housing cover plate.

(13) On vehicles with automatic transmission remove the converter to drive plate bolts and lever the converter back into the converter housing.

(14) Remove the hot air stove and disconnect the engine pipe from the exhaust manifold. Disconnect the engine pipe bracket located on the exhaust side of the engine.

(15) Lower the vehicle and support the transmission on a jack.

(16) Attach suitable lifting tackle to the engine and remove the remaining clutch/converter housing bolts. Support the front of the engine and remove the engine mounting bolts.

(17) Carefully lift the engine and remove from the engine compartment ensuring that the transmission, electrical wiring and all pipes are clear and disconnected.

TO INSTAL

Installation is a reversal of the removal procedure with attention to the following points:

(1) Instal guide pins to the rear of the engine to align the engine with the transmission assembly.

(2) On vehicles with manual transmission it may be necessary to turn the engine crankshaft with the transmission in gear to align the splines on the transmission input shaft with the corresponding splines in the hub of the clutch driven plate.

(3) On vehicles with automatic transmission, guide the torque converter spigot into the centre of the drive plate and tighten the bolts securing the converter to the drive plate evenly.

(4) Check the clutch pedal operation on vehicles with manual transmission and the control linkage on automatic transmission models.

(5) Place a new exhaust flange gasket on the engine pipe and ensure the exhaust is correctly positioned with the bracket on the clutch/converter housing.

(6) Replenish the oil and water and check for leaks. Recheck the levels when the engine reaches normal operating temperature.

4. ROCKER ARMS AND PUSH RODS

Special Equipment required:

To Check Valve Lash — Suitable hydraulic lifter compressing tool

TO REMOVE AND INSTAL

(1) Remove the air cleaner assembly and disconnect the PCV valve and hose from the rocker cover.

(2) Remove the fuel line between the carburettor and fuel pump and remove the carburettor to PVS valve vacuum hoses.

(3) Disconnect and remove the EGR pipe that runs from the exhaust manifold to the EGR valve.

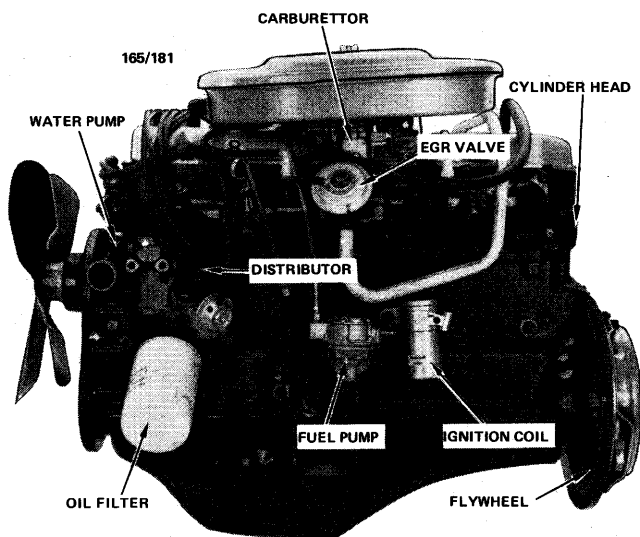
(4) Remove the high tension leads from the spark plugs and unclip the lead holders from the rocker cover.

(5) Take out the rocker cover retaining bolts, remove the rocker cover and discard the gasket.

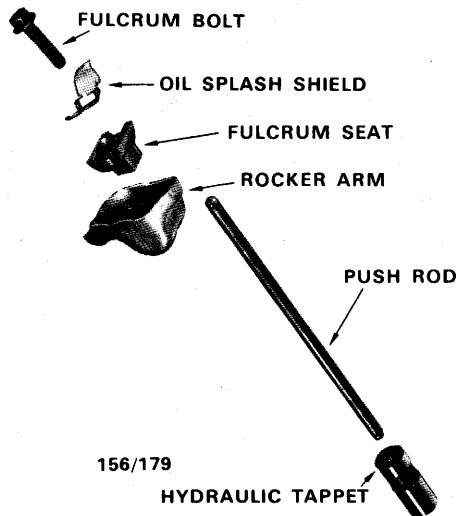
(6) Rotate the engine over until No 1 piston is on tdc on its compression stroke and then remove the following rocker arms and push rods — No 1 inlet, No 1 exhaust, No 2 inlet, No 3 exhaust, No 4 inlet and No 5 exhaust.

(7) Rotate the engine over until No 6 piston is on tdc on its compression stroke and then remove the remaining rocker arms and push rods.

NOTE: Keep each rocker arm and push rod so that it can be installed in the original position on installation.



Left side of engine showing location of components.



Dismantled view of valve rocker arm and associated operating components.

Installation is a reversal of the removal procedure with attention to the following points:

Lubricate the rocker arms and fulcrum seats with a suitable heavy engine oil prior to their installation.

NOTE: With the engine at tdc on No 1 cylinder and the following rocker arms and pushrods fitted — No 1 inlet, No 1 exhaust, No 2 inlet, No 3 exhaust, No 4 inlet and No 5 exhaust — check the valve lash before rotating the engine to tdc on No 6 or bent pushrods may result.

Ensure the rocker fulcrum bolts are tightened to Specifications and the valve lash is correct.

Thoroughly clean the rocker cover and mating gasket surface on the cylinder head before installing the rocker cover using a new gasket.

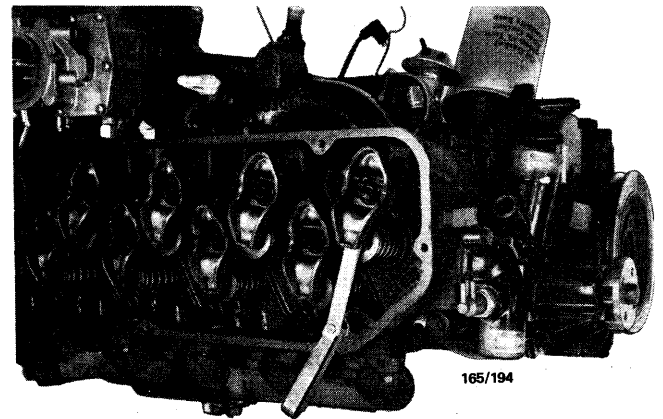
NOTE: Adhere the gasket to the rocker cover using an oil resistant sealer before installing the rocker cover.

TO CHECK VALVE LASH

(1) Rotate the engine until No 1 piston is on tdc on its compression stroke and check the following valves — No 1 inlet, No 1 exhaust, No 2 inlet, No 3 exhaust, No 4 inlet and No 5 exhaust.

(2) Rotate the engine until No 6 piston is on tdc on its compression stroke, check the rest of the remaining valves — No 2 exhaust, No 3 inlet, No 4 exhaust, No 5 inlet, No 6 inlet and No 6 exhaust.

(3) With the crankshaft in the positions in steps (1) and (2), position the hydraulic lifter compressor tool on the rocker arm and slowly apply pressure to the tool to bleed down the hydraulic lifter until it bottoms. Holding the rocker arm in this position check the clearance between the rocker arm and the valve stem. Clearance should not exceed 2.5–5.0 mm.



Checking valve lash. Bleed down tool not shown.

If the clearance is less than the nominated specification, an undersize push rod must be installed. If the clearance is greater than specification an oversize push rod must be installed.

5. CYLINDER HEAD

Special Equipment Required:

To Dismantle and Assemble — Valve spring compressor

To Inspect — Dial gauge

To Instal — Guide pins

TO REMOVE AND INSTAL

(1) Remove the radiator cap and drain the cooling system at the lower radiator hose and drain plug on the side of the cylinder block.

(2) Remove the rocker cover and rocker arms as previously described.

(3) Withdraw the push rods and place in sequence for correct reassembly.

NOTE: To keep the push rods and rocker arms in their correct sequence a suitable cardboard box with 12 holes numbered from 1 to 12 can be used. Place each push rod in its respective hole, starting from the front of the engine.

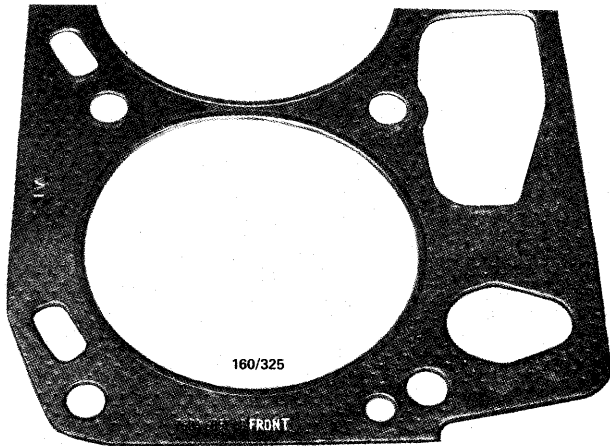
(4) Remove the engine exhaust pipe from the exhaust manifold and pull it down clear of the cylinder head.

(5) Remove the vacuum line from the vacuum advance unit on the side of the distributor.

(6) Remove the upper radiator hose from the thermostat housing and disconnect the wire from the water temperature gauge sender unit.

(7) Disconnect the manual choke cable from the carburettor. On automatic transmission models, disconnect the kickdown cable from the carburettor. Disconnect the throttle solenoid lead and place to one side.

(8) Remove the two water hoses from the inlet manifold.



Location mark on front of cylinder head gasket for correct assembly.

(9) Remove the cylinder head retaining bolts and remove the cylinder head and manifolds as a complete assembly.

(10) It may be found necessary to remove the inlet and exhaust manifold for further work to the cylinder head.

Installation of the cylinder head is a reversal of the removal procedure with particular attention to the following points:

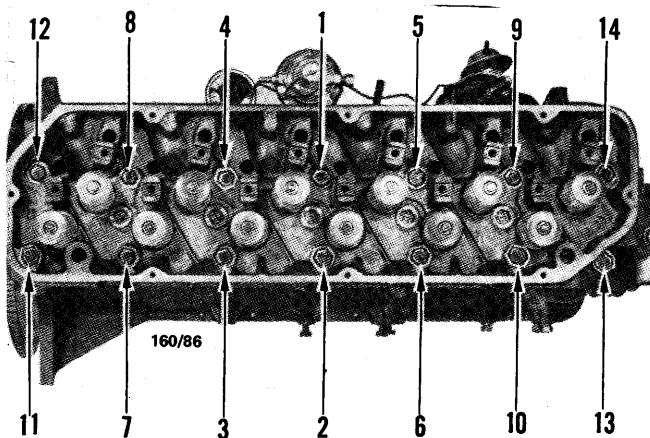
(1) Ensure that the cylinder block face, cylinder head bolts, cylinder head face and manifold faces are perfectly clean. Use new gaskets throughout, but do not apply sealant to the cylinder head gasket.

(2) Use suitable guide pins on each end of the cylinder block to assist in the installation of the new gasket and the cylinder head. Note that the cylinder head gasket is marked 'FRONT' for correct assembly.

(3) Coat the thread of No 13 head bolt with a small amount of water resistant sealer and initially screw in finger tight only.

(4) Tighten the cylinder head down in three stages and to the torque figures listed in Specifications.

(5) Inspect and renew the exhaust flange gasket if



Cylinder head bolt tightening sequence. See text.

necessary, then reconnect the engine pipe to the exhaust manifold.

(6) Instal the rocker arms and push rods as described previously.

(7) Replenish the cooling system and recheck the level after normal operating temperature is reached. See Cooling System section for correct refilling procedure.

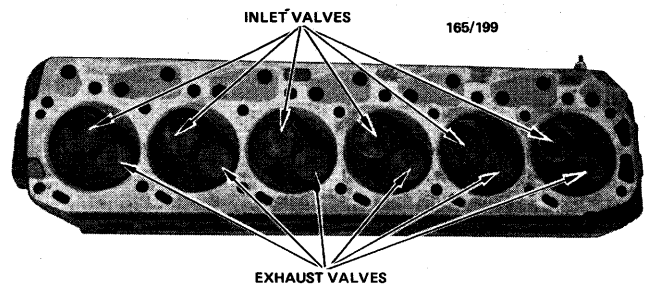
(8) Stop the engine and retension the cylinder head bolts. Replace the rocker cover gasket and refit the rocker cover.

TO DISMANTLE

(1) Remove the inlet and exhaust manifolds and discard the gaskets.

(2) Remove the thermostat housing and carefully place the thermostat aside. Discard the gasket.

(3) Before removing the valves the deposits in the combustion chambers should be cleaned off. This will protect the valve seats and care should be taken not to damage the cylinder head gasket face.



Cylinder head face showing valve arrangement and water circulation holes.

(4) Using a suitable valve spring compressor, remove the valve retaining collets, valve spring retainers, valve springs and the valve stem seals.

(5) Remove any burrs from the stem locking grooves to prevent damage to the valve guides when the valves are removed from the cylinder head.

(6) Remove the valves, keeping them in order for assembly in their original positions.

NOTE: To keep the valves in order have a rack numbered from 1 to 12 and instal the valves in this rack, starting from the front of the cylinder head.

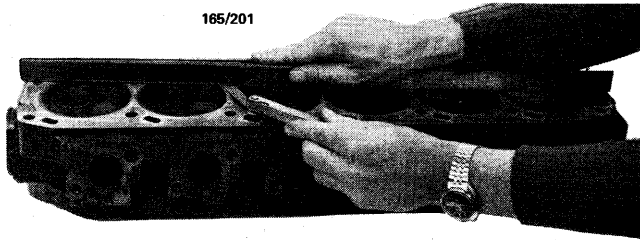
TO CLEAN AND INSPECT

(1) Clean the valves thoroughly and discard any burnt, warped or cracked valves.

(2) Carefully clean the deposits from the inlet and exhaust ports, valve guides and manifolds taking care not to damage any mating surfaces.

(3) Clean the cylinder head mounting face, water jacket holes, thermostat mounting and recess.

(4) Wash the cylinder head in kerosene and hose off with water then dry to prevent the machined surfaces from rusting.



Checking cylinder head for warp using a straight edge and feeler gauge.

(5) Measure the valve stem to guide clearance with a dial gauge. This is done by 'rocking' the valve back and forth in the valve guide and noting the reading on the dial gauge. If the clearance is outside Specifications then the valve guides will have to be reamed oversize and new valves fitted. This operation is best left to an engine reconditioning shop.

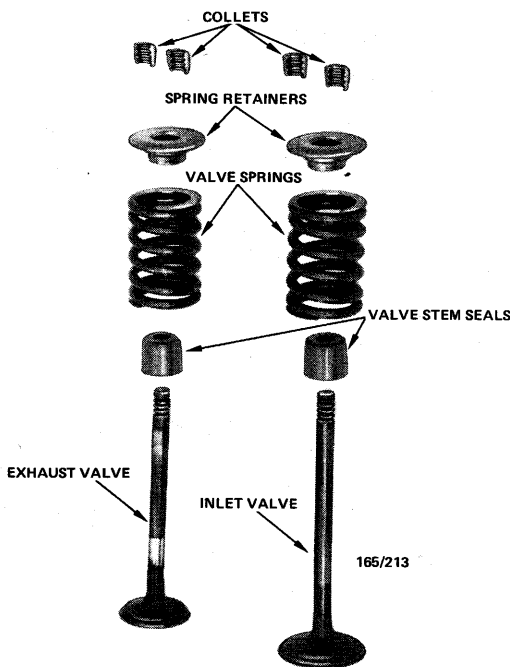
(6) Check the cylinder head for warpage diagonally and lengthwise using a straight edge and feeler gauges. Check Specifications for warpage limits. If the cylinder head is warped it must be machined to restore it to Specifications.

(7) Check the block face for warpage in a similar manner to the cylinder head. See Specifications for warpage limits.

(8) Check the manifold faces and manifolds for warpage and renew or machine as necessary.

(9) Check and test the thermostat for correct operation. See the Cooling System section for the correct procedure.

(10) Check the valve springs for distortion, wear, length and squareness.



Dismantled view of valve and spring components.

TO REFACE VALVES AND VALVE SEATS

(1) After thoroughly cleaning, reface each valve face to the recommended angle as shown in Specifications and each valve stem end flat and true on a suitable valve refacing machine.

(2) Inspect the remaining margin of the valve head after the valves have been refaced. Valves with less than 0.8 mm margin must be replaced.

(3) Check the condition of the valve seats. If burnt or pitted they may be recut with a valve seat cutter to the recommended angle and ensuring that the correct size cutting guide pilot is used.

NOTE: If the valve face angle and the valve seat angle have been correctly and accurately machined and cut to Specifications it will not be necessary to lap the valves to the seats.

(4) If the valve seats are in a serviceable condition but the valve faces have been reground, lightly lap the valves to the seats using fine lapping compound. Remove all traces of the compound after lapping. With a pencil place a mark every 90 degrees around the face of the valve after lapping and check the valves in their respective seats to ensure that a true and concentric seating has been obtained and that the valve is seating centrally on the ground face.

TO CHECK VALVE SPRINGS

(1) Check the valve spring free length, and length at fitted load, see Specifications.

(2) Check that the springs are not bent or distorted from heat.

If a valve spring tester is not available check the springs by comparison with new springs.

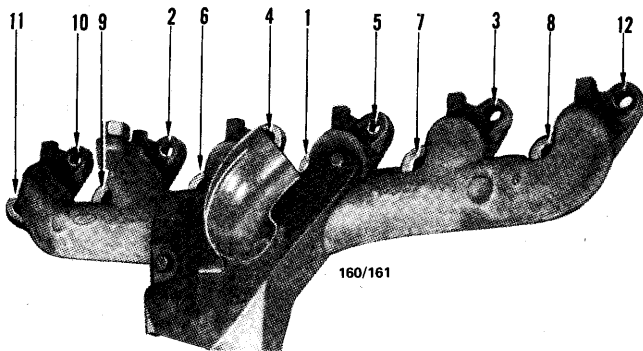
This can be done by using a surface plate and straight edge for checking the free length and by using a new spring and a used spring loaded in a vice end to end with a plate in between. Measure from the plate to the vice jaw adjacent to both the new and used springs. A used spring is serviceable if it does not show collapse in excess of five percent when subjected to this comparison test.

TO ASSEMBLE

The assembling procedure is a reversal of the dismantling operations with attention to the following points:

- (1) Instal the valves in their original position.
- (2) Instal the valve springs with the closed coils next to the cylinder head.
- (3) Instal new valve stem oil seals to each valve.
- (4) Instal the valve spring retainer and compress the spring using the valve spring compressor.
- (5) Instal the valve retaining collets and slowly release the spring compressor making sure that the collets remain correctly seated on the valve stem.

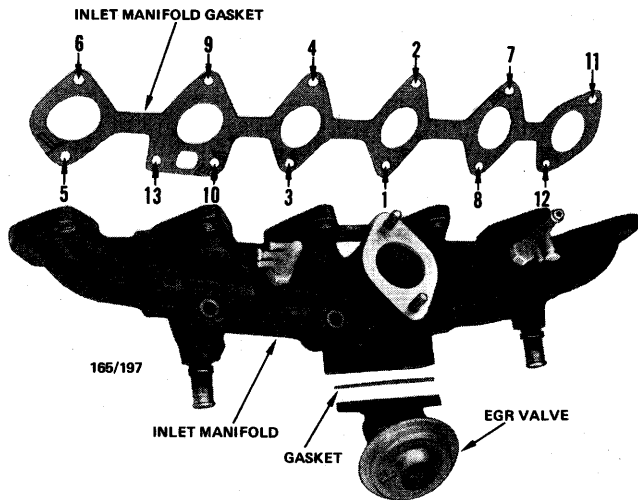
(6) Measure the fitted height of the valve spring measuring from the spring seat on the cylinder head to the underside of the spring retainer.



Exhaust manifold bolt tightening sequence.

(7) Fit the exhaust manifold and tighten to Specifications in the sequence shown. See illustration. Fit the inlet manifold and a new gasket and tighten the bolts to the specified torque in the sequence shown. See illustration.

(8) Instal the thermostat and thermostat housing using a new gasket.



Inlet manifold bolt tightening sequence.

6. ENGINE SUMP

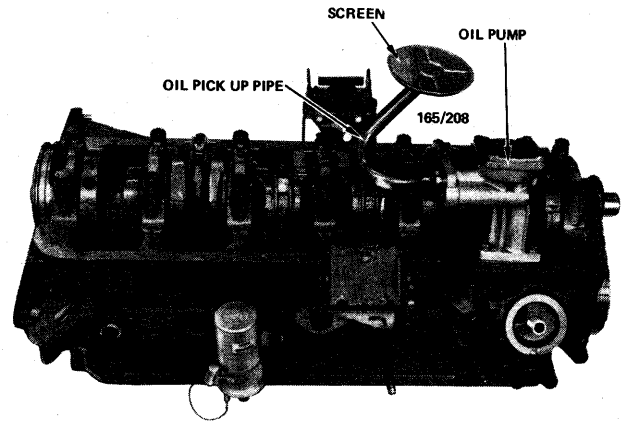
TO REMOVE AND INSTAL

- (1) Remove the engine as previously described.
- (2) Remove the sump retaining bolts, bump the side of the sump to loosen it from the gasket and remove the sump from the cylinder block. Discard the old gasket set.

NOTE: If the oil pump or sump gaskets only are to be renewed this can be done with the engine still in the vehicle by lowering the sump until it rests on the crossmember. The gasket and oil pump can then be removed.

Installation is a reversal of the removal procedure with attention to the following points:

- (1) Wash the sump in cleaning solvent and dry using a clean, lint free cloth. Inspect the bottom of the



View of engine with sump removed.

sump for foreign particles near the baffle and ensure the baffle is not loose.

(2) Clean off all traces of old gasket from the sump and crankcase.

(3) Check the sump for holes, cracks, dents or stripped drain plug threads and check the crankcase for burrs and cracks. Repair or renew damaged components as necessary.

(4) Ensure that the seal recess in the rear bearing cap and on the front cover are clean and free of old gasket and sealer.

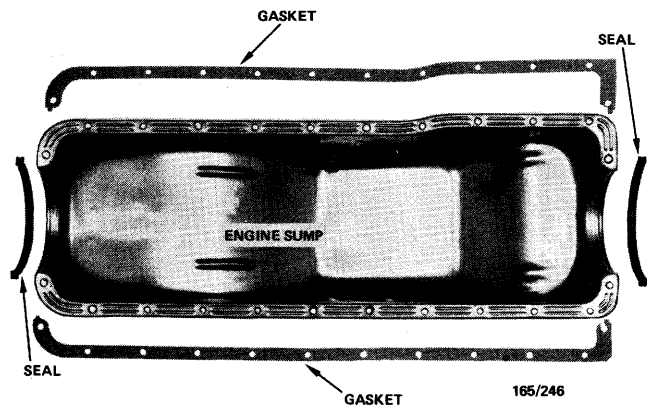
(5) If the oil pump has been removed it must be primed before refitting. Also check that the intermediate shaft is engaged in the hexagonal drive in the distributor socket.

(6) Lightly coat the crankcase side of the sump gasket halves and the gasket face with sealing compound.

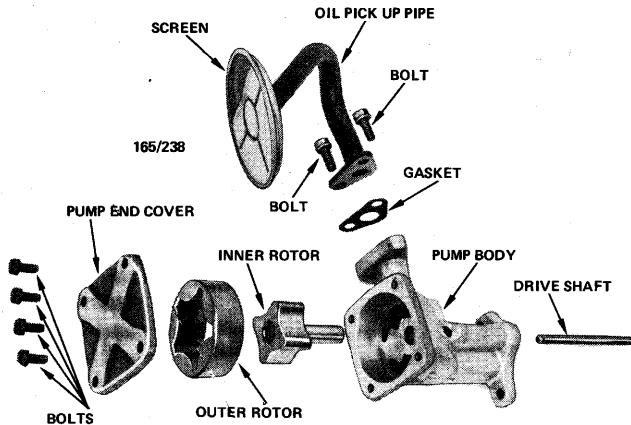
(7) Position the sump gasket halves so that the tabs fit into the recess of the rear bearing cap and front cover.

(8) Apply sealing compound to the end seals and position the seals in their respective grooves ensuring that the seal tabs are over the ends of the side gaskets.

(9) Apply a coating of sealing compound onto the sump faces and position the sump to the crankcase. Instal a retaining bolt finger tight on each side of the sump to hold it in position.



Engine sump, gaskets and oil seals.



Dismantled view of oil pump components.

(10) Instal the remaining bolts and tighten to Specifications, working from the centre on each side towards the front and rear alternately.

(11) Fill the sump to the correct level with the correct grade of engine oil and check thoroughly for oil leaks after running the engine.

7. OIL PUMP

TO REMOVE

(1) Lower or remove the engine sump as previously described.

(2) Remove the oil pump retaining bolts and remove the oil pump, filter screen assembly and drive shaft.

TO DISMANTLE

(1) Take out the two securing screws and remove the suction tube, screen assembly and gasket from the pump end cover.

(2) Take out the securing screws and remove the

cover plate from the pump body. Mark the cover plate and pump body to facilitate assembly.

(3) The faces of the inner and outer rotors are marked for correct assembly, withdraw the inner rotor and shaft and the outer rotor from the pump body.

(4) Remove the oil pressure relief valve retaining cover and withdraw the spring and relief valve plunger.

NOTE: Drill a small hole in the relief valve spring retaining plug and screw in a self tapping screw to be used as a means of withdrawing the plug. Before removing the plug measure the distance that the plug is installed down its bore so that the new plug can be pressed in to that measurement.

TO CHECK AND INSPECT

(1) Wash all pump components thoroughly in cleaning solvent, pay particular attention to the pick-up filter, blow dry with compressed air, check for wear and/or damage.

(2) Temporarily assemble the inner and outer rotors to the pump body and with a feeler gauge check the clearance between the outer rotor and the pump body. Clearance should not exceed Specifications.

(3) Check the clearance between the tips of the inner rotor and the shoulders of the outer rotor. Clearance at these points should not exceed Specifications.

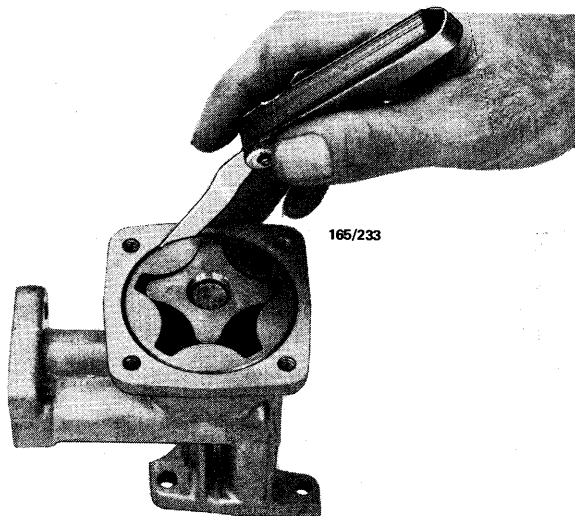
(4) Lay a straight edge across the end face of the pump and check the end clearance of the inner and outer rotor. Clearance should not exceed Specifications.

(5) Check the pump end cover for wear or scoring.

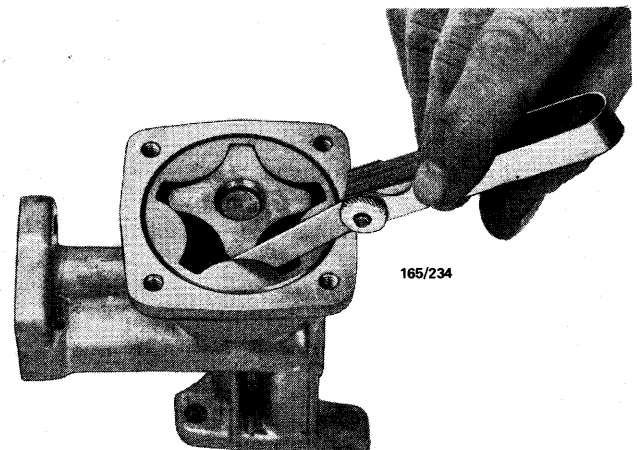
(6) Check the inner rotor drive shaft and pump body for wear, renew the pump body and rotor components if wear is apparent.

(7) Check the pressure relief valve for free fitting in its bore and the relief valve spring for weakness or broken coils.

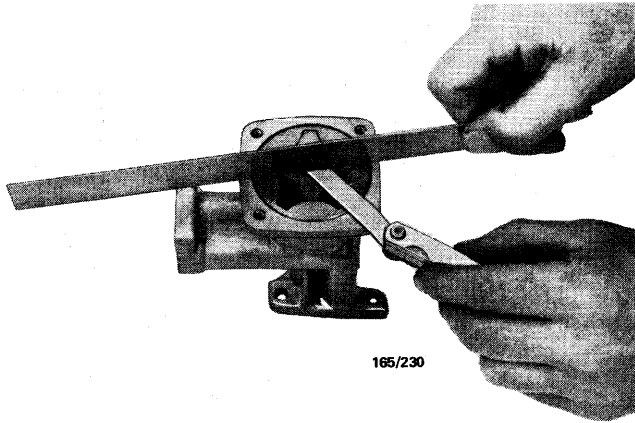
(8) Renew all components of the oil pump assembly that prove to be unserviceable. Both rotors of the oil pump should be renewed if one is found unserviceable.



Checking outer rotor to pump body clearance.



Checking the tip clearance of inner rotor.



Checking clearance between rotors and pump body end cover face.

TO ASSEMBLE

(1) Having cleaned all components and effected replacements as necessary, liberally oil the components with engine oil and insert the inner rotor and shaft into the pump body.

(2) Position the outer rotor to mesh with the inner rotor and instal in into the pump body with the mating marks facing the cover and adjacent to each other.

(3) Instal the pump end cover, lightly smear the mating faces with jointing compound and instal and tighten the cover retaining bolts.

(4) Lubricate the relief valve bore with engine oil and fit the plunger spring and new retaining plug.

(5) Refit the suction screen and tube assembly. Use a new gasket between the tube flange and end cover.

TO INSTAL

Installation is a reversal of the removal procedure with attention to the following points:

(1) Ensure the correct engagement of the oil pump to the short drive shaft from the distributor.

(2) Instal the engine sump following the procedures previously described.

8. PISTONS, CONNECTING RODS AND CYLINDER BORES

Special Equipment Required:

To Inspect — Micrometer, cylinder measuring gauge

To Remove Ridge from Bores — Ridge removal tool

To Deglaze Cylinder Bores — Cylinder surfacing hone

To Instal — Piston ring compressor

TO REMOVE

- (1) Remove the engine as previously described.
- (2) Place the engine in a suitable working position

so that the components are not damaged.

(3) Remove the sump and oil pump as previously described.

(4) Remove the cylinder head as previously described.

(5) Check that the connecting rods and caps are numbered in accordance with their respective cylinders and note their positions for correct assembly. Check the side clearance of each connecting rod big end using a feeler gauge.

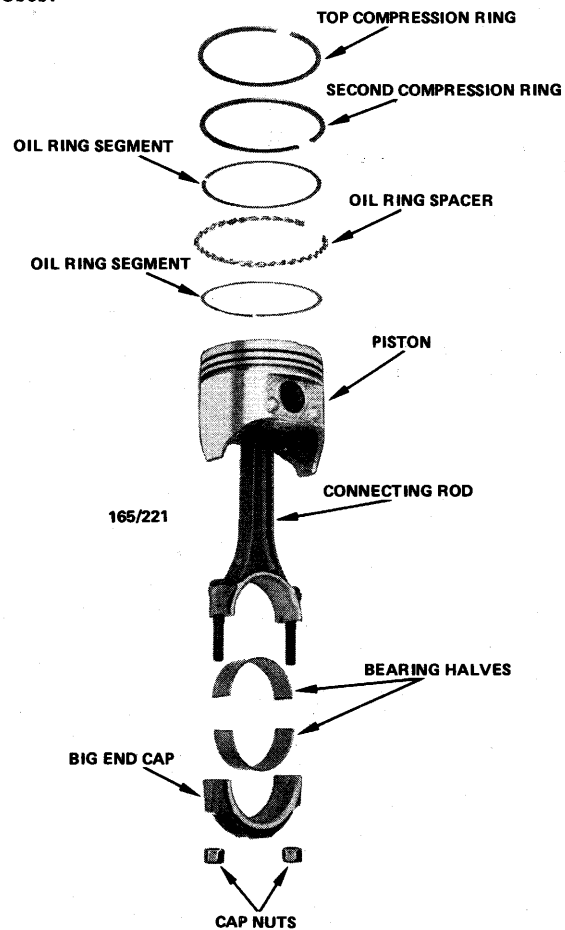
(6) With number one cylinder at the bottom of its stroke remove the big end bearing cap nuts and bearing cap.

Wipe the bearing shell and the exposed part of the crankpin with a piece of lint free cloth, insert a piece of Plastigage across the crankpin, instal the bearing cap and torque the nuts to Specifications.

Remove the nuts and cap and measure (with the scale on the packet) the spread width of the Plastigage to determine bearing clearance.

Compare the measurement to Specifications and if the bearing clearance exceeds the limit use a new bearing on assembly.

Repeat the procedure on the remaining cylinders and note each individual bearing clearance for reassembly purposes.



Piston and connecting rod components.

NOTE: Use a suitable ridge removing tool to remove the ridge in the upper end of each cylinder before attempting to withdraw each piston assembly. This will eliminate the possibility of damage to the piston ring lands as the pistons are withdrawn.

(7) Remove each bearing cap in turn keeping them in order and, using a wooden hammer handle, push each piston assembly from the cylinder block and instal its respective bearing cap to it.

(8) Remove the piston rings over the top of the piston and discard the piston rings.

TO INSPECT PISTONS AND CONNECTING RODS

(1) Inspect the pistons for scuff marks, scoring or burning.

(2) Clean all traces of carbon from the piston crowns and using a piece of broken ring, clean out the ring grooves.

(3) Inspect the ring grooves of the pistons for excessive wear. Use a new piston ring and check the side clearance of each ring in the ring grooves. Compare the side clearance with Specifications.

(4) Inspect each pair of bearing cap shells for wear on an outer edge only. If one or more pairs of the bearing shells are worn on the outer edge it is possible that the connecting rod is bent.

(5) Before proceeding to have a piston and/or connecting rod renewed inspect the cylinder block to see if it requires reboring or honing.

If the cylinder block requires reboring it is obvious that new pistons will have to be used.

NOTE: The gudgeon pin is an interference fit in the small end of the connecting rod and the piston and gudgeon pin are available only as an assembly.

(6) If it is necessary to renew a piston and/or connecting rod take each assembly to an engine recon-ditioner and have a new connecting rod or piston installed into the original piston or connecting rod.

TO INSPECT CYLINDER BLOCK AND BORES

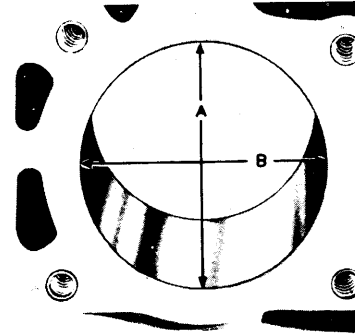
(1) With the pistons removed as previously described carry out the following checks and measuring procedures.

(2) Check the cylinder bores for cracks, scores or scuffs.

(3) Using an accurate cylinder gauge, measure each cylinder bore for wear, ovality and taper. Take the measurements at the upper, middle and lower sections of the bore in two directions — along and across the block.

(4) Take the minimum and maximum dimensions of the six measurements. The difference between them can be regarded as the nominal amount of wear present in the bore.

(5) If the wear in any cylinder exceeds the specified



Check for cylinder bore wear. Difference between 'A' and 'B' measurement at top of piston travel is out of round dimension. Difference between 'A' at top of piston and 'B' at bottom or piston travel is cylinder taper.

limit, rebore and hone all cylinders to the nearest specified oversize for pistons and rings.

NOTE: The cylinder that is most worn will be the one that determines which oversize is applicable.

(6) With a straight edge and feeler gauge, check the top face of the block for distortion using the same procedure described for the cylinder head. See Specifications for warpage limits.

NOTE: If the top of the block is distorted beyond Specifications completely dismantle the engine and have the block machined.

(7) With the engine completely dismantled thoroughly clean the block with a suitable solvent and compressed air paying particular attention to the oilways. Inspect the block for cracks and damage.

CHECKING PISTON CLEARANCE

(1) Using an accurate cylinder measuring gauge measure and note the diameter of each bore as previously described.

(2) Measure each piston skirt in line with the gudgeon pin bore and at right angles to the gudgeon pin axis.

(3) Note the difference between the bore and the piston skirt measurement. If the clearance exceeds Specifications then renew the piston, or bore and hone the cylinder, whichever is necessary.

(4) Cylinders that have been rebored and honed to take the appropriate oversize pistons should have the piston clearances checked in the manner described.

NOTE: Standard pistons are also graded into two sizes and identified by a red or blue paint mark on the piston crown and are for use in standard bores. See Specifications for sizes.

DEGLAZING CYLINDER BORES

Cylinder bores that are fit for further service with original pistons but require reringing should be deglazed with a hone.

(1) Use a surfacing hone with 280 grit stones for deglazing.

NOTE: When deglazing cylinder bores with the crankshaft installed, plenty of clean rag should be placed over the crankshaft to keep abrasive materials from entering the oilways.

(2) Move the hone up and down the cylinder walls sufficiently fast enough to achieve a cross hatch pattern.

The cross hatch pattern is most satisfactory for correct seating of piston rings when the hone marks intersect at 60 degrees.

NOTE: When deglazing, the cylinder should be honed only sufficiently to eliminate the glazed condition. Excessive honing will increase bore size and piston clearance.

(3) Use only honing oil for lubrication. Do not use engine oil or transmission oil, mineral spirits or kerosene.

(4) When honing is completed, ensure that the cylinder bore, crankcase area and oilways are thoroughly cleaned.

(5) After the cylinder block has been cleaned and dried, wipe the bores with a lint free cloth then smear them with engine oil to prevent rusting.

TO FIT NEW PISTON RINGS AND INSTAL

(1) Once the correct piston and bore relationship has been determined and the pistons cleaned or renewed as necessary proceed as follows:

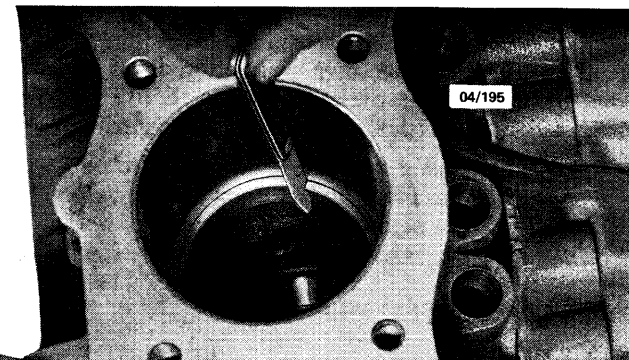
(2) Select a set of rings to suit the bore, standard or oversize, whichever is necessary.

(3) Place a ring into number one cylinder bore and using an inverted piston push the ring down into the bottom of the cylinder bore.

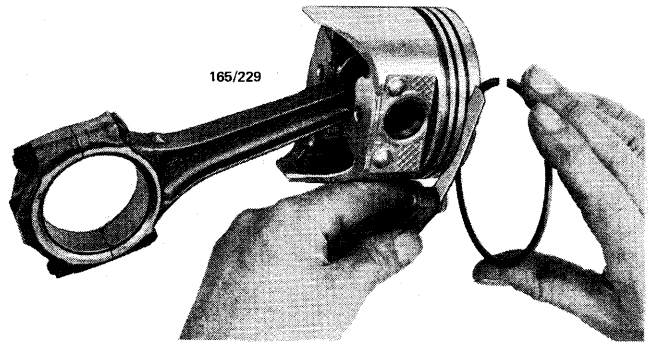
(4) Withdraw the piston and measure the gap in the ring with feeler gauges.

NOTE: Should the ring gap be greater than the specified gap, another ring set should be obtained and the ring gaps checked and compared with Specifications.

(5) Treat each ring and cylinder bore individually and ensure that rings are assembled to the respective



Checking end gap of piston ring using feeler gauges. Typical.



Piston and connecting rod assembly, showing method of measuring piston ring side clearance.

piston for the cylinder bore in which they were fitted for end gap check. Measure the piston ring side clearance and compare with Specifications.

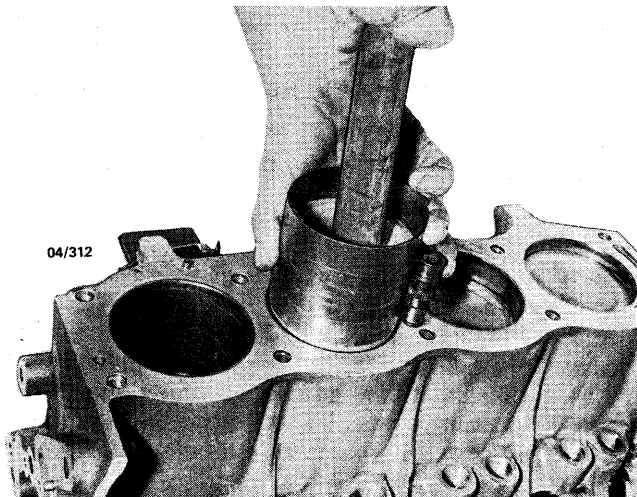
(6) Instal the rings to the piston according to the instructions supplied with the ring set.

(7) Position the oil ring spacer so that the ends do not overlap with the gap in line with the gudgeon pin and towards the rear of the engine, position the oil ring segments 120 degrees from the oil ring spacer gap and 120 degrees apart. Position the top compression ring gap opposite the exhaust valve and the second compression ring gap diagonally opposite the top ring gap.

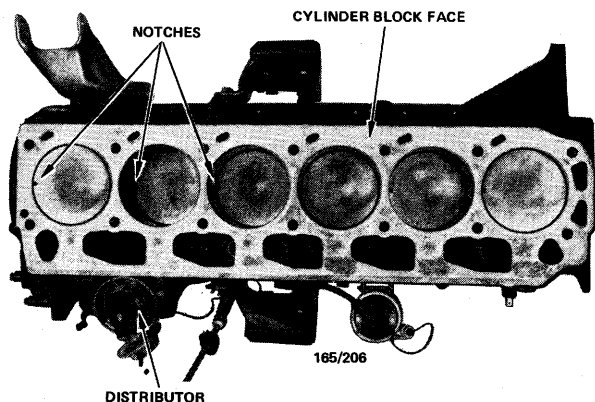
(8) Remove the cap retaining nuts and the cap of the piston and connecting rod assembly of number one piston. Turn the crankshaft so that number one journal is at the bottom of its stroke. Instal a piece of plastic tube over both big end bolts to protect the crankpin.

(9) Liberally coat the piston assembly and big end with engine oil.

(10) Instal the piston and connecting rod assembly into the cylinder bore so that the notch in the piston crown is to the front and the oil squirt hole in the big end bearing is facing away from the camshaft. Instal a suitable piston ring compressor over the piston and compress the rings into their grooves.



Installing piston assembly to cylinder bore. Typical.



View of engine with cylinder head removed showing notch in pistons facing to the front.

NOTE: Connecting rod and piston assemblies must be replaced in the cylinders from which they were removed on dismantling.

(11) Push the piston assembly down the cylinder bore and align the connecting rod and upper half of the big end bearing on the crankshaft crankpin.

NOTE: If on dismantling it was found that new bearing shells were needed place them into the connecting rod and cap before installing the cap to the connecting rod.

(12) Remove the plastic tube from the big end bolts and instal the big end bearing cap and bearing half, fit the retaining nuts and tighten to the specified torque.

(13) If new bearing shells were installed recheck the bearing clearance as previously described.

(14) With the bearing clearance as specified instal the remaining pistons in the same manner.

(15) With all connecting rod nuts torqued to Specifications instal the associated components by referring to the various sections and instal the engine assembly in the vehicle as previously described.

9. CRANKSHAFT AND BEARINGS

Special Equipment Required:

To Remove Crankshaft Pulley — Suitable pulley removal tool

To check End Float — Dial gauge

To Measure Journals — Micrometer

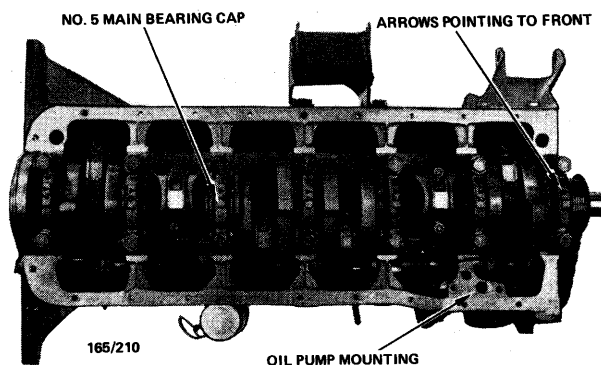
TO REMOVE

(1) With the engine removed from the vehicle and the sump and oil pump removed as previously described, proceed as follows:

(a) Rotate the crankshaft and align the timing marks for number one cylinder at tdc on the compression stroke.

(b) Using a suitable puller, withdraw the crankshaft pulley from the front of the crankshaft.

(c) Remove the timing cover retaining screws and



View of engine with sump removed showing correct location of main bearing caps.

take off the timing cover.

(d) Remove the woodruff key and the oil slinger from the front of the crankshaft.

(e) Check the timing chain for wear. Remove the camshaft sprocket retaining bolt and washer.

(f) Slide both timing gears and chain forward and remove them from their respective shafts.

(g) Remove the flywheel retaining bolts and remove the flywheel from the rear end of the crankshaft.

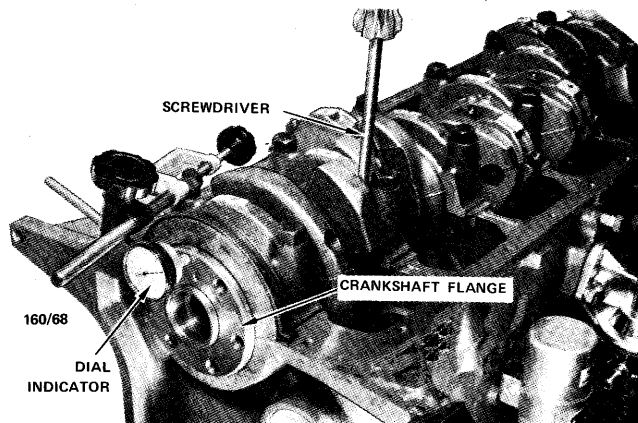
(2) Ensure that all main bearing and connecting rod bearing caps are numbered to ensure correct assembly.

(3) Remove the big end bearing nuts and take off the bearing caps, fit a piece of plastic tube to each cap bolt to protect the shaft. Carefully push each connecting rod and piston assembly up the bore as far as possible without exceeding the upper limits of the piston stroke.

(4) Check the crankshaft end float either with a feeler gauge at No. 5 main bearing or by attaching a dial gauge to the rear of the cylinder block with its plunger bearing on the crankshaft flange. Prise the crankshaft forward and zero the gauge pointer. Prise the crankshaft rearward and check the dial reading. The reading must be within the dimensions given in the Specifications.

(5) Check the main bearing clearance by the Plastigage method as follows:

(a) Remove one bearing cap and with a piece of



Checking crankshaft end float with dial indicator.

clean lint free cloth wipe the journal and bearing clean.

(b) Position a piece of Plastigage, the approximate length of the journal width, and slightly off centre, onto the bearing surface of the crankshaft journal.

(c) Instal the bearing cap and tighten the cap bolts to the specified torque.

IMPORTANT: Do not rotate the crankshaft while the Plastigage is in position.

(d) Remove the cap bolts and carefully detach the cap and bearing.

(e) With the Plastigage scale, measure the compressed Plastigage strip to determine the oil clearance.

(f) The widest point of the strip will indicate the minimum clearance and the narrowest point the maximum clearance.

(g) The remaining bearings can be checked in turn using the same procedure.

NOTE: If the bearing clearance on the big end bearings had not yet been measured, carry out the foregoing procedure on these bearings before removing the crankshaft.

(6) With all the bearing caps removed carefully lift the crankshaft from the engine and place it aside.

(7) If the main bearings are to be reused they should be carefully labelled, cleaned and placed to one side.

(8) Remove the oil seal half from the block and rear main bearing cap and clean the bearing shell seats thoroughly then blow out the oilways with compressed air.

TO CHECK AND INSPECT

After thoroughly cleaning the crankshaft in a suitable solvent and drying it off with compressed air, blow out all the oilways and make the following checks:

(1) Check and measure the main bearing journals and crankpins for wear, taper and scoring. If wear is excessive, the journals and/or crankpins should be reground to accommodate the nearest undersize bearing shells.

One worn or damaged journal or crankpin will necessitate the grinding of all journals or crankpins and the fitting of new undersize bearing shells.

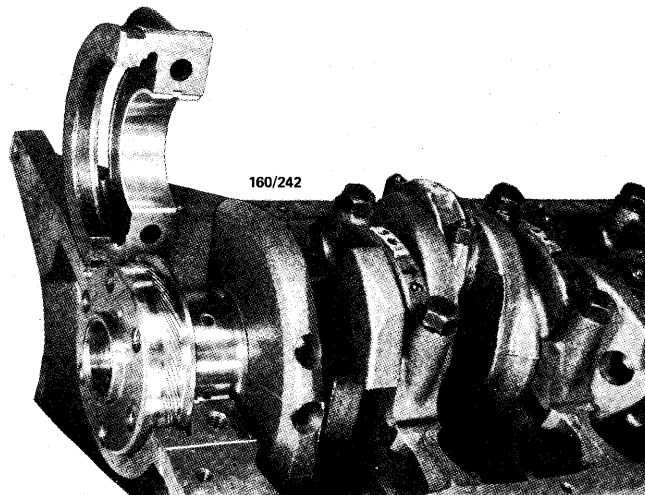
If wear or damage is such that the journals or crankpins cannot be reground to take any one range of the available undersize bearings then the crankshaft will have to be renewed.

(2) Check the bearing thrust faces for pitting or wear. If pitting or wear is evident renew the bearing shells which should bring the crankshaft end float back to Specifications.

(3) Even when bearing clearance and crankshaft end float are within Specifications inspect the bearing shells for scores, flaking and pitting. Replace as necessary with new bearing shells of the appropriate size.

TO INSTAL

(1) Clean the rear bearing housing of the crankcase



Rear main bearing with cap removed to show oil slinger and return thread on flange and oil seal.

and fit the new oil seal. Similarly clean the rear main bearing cap and fit the new oil seal. Cut the seal off flush and ensure no threads protrude onto the bearing face.

(2) Apply a thin coating of a suitable sealer to the cut faces of the seal halves. Ensure no sealer remains on the bearing face or in the oil slinger groove.

(3) Place the upper half of each main bearing in position in the crankcase so that the locating tang on the bearing engages the groove in the bearing housing. The oil feed holes in the bearing housing should coincide.

(4) Ensure that the crankshaft main bearing journals are clean. Lubricate the upper half bearings in the crankcase with clean engine oil.

(5) Carefully lower the crankshaft into position in the crankcase. Ensure the upper half bearings are not dislodged during this operation.

(6) Place the lower half of each bearing in its appropriate bearing cap so that the locating tangs on the bearing engages correctly with the groove in the bearing cap.

(7) Lubricate the bearing cap and bearing assembly with clean engine oil and position each cap assembly in its correct location, according to the numbers noted or made during removal and with the arrows on the caps pointing to the front of the engine.

(8) Instal the bearing cap retaining bolts and tighten progressively to the specified torque working from the centre main outwards.

(9) If removed replace the bearings in the connecting rods and caps.

(10) Lubricate the bearings and position the connecting rods onto the crankpins. Remove the plastic tubes and instal the connecting rod caps, refit the nuts and tighten to the specified torque.

(11) Rotate the crankshaft to ensure that no binding is evident. Again check crankshaft end float as previously described.

(12) Reassembly of the remaining components is a reversal of the removal procedure with particular atten-

tion to the following points:

Ensure that the engine is at tdc on number one cylinder and that the timing marks on the timing sprockets are adjacent to each other and in line with the centre of each shaft then refit the sprockets and timing chain to their respective shafts.

Use new gaskets throughout the assembly and renew the timing cover oil seal if necessary.

10. TIMING COVER AND OIL SEAL

Special Equipment Required:

To Remove Crankshaft Pulley — Suitable pulley removal tool

TO REMOVE AND INSTAL

(1) Raise the engine bonnet and fit fender covers to both front fenders and disconnect the battery earth cable.

(2) Drain the cooling system by releasing the lower radiator hose from the water pump inlet.

(3) Disconnect the upper radiator hose at the thermostat housing.

(4) On vehicles fitted with automatic transmission disconnect and plug the transmission cooler pipes at the radiator.

(5) Remove the radiator retaining bolts and lift out the radiator.

(6) Slacken the alternator mounting bolts and remove the alternator adjusting bracket and fan belt.

(7) Remove the retaining bolts and detach the fan and fan pulley from the water pump.

(8) Using a suitable puller remove the crankshaft pulley.

(9) Drain the engine sump and remove the sump retaining bolts. Lower the sump to the crossmember as previously described.

(10) Take out the securing bolts and remove the timing cover and gasket.

(11) Tap the timing cover oil seal out of the cover

using a hammer and suitable drift, clean off all traces of old gasket and sealer and wash the cover in a suitable solvent.

(12) Tap the new seal into the cover so that the lip of the seal faces towards the crankshaft gear. Apply grease to the seal lip.

NOTE: Ensure that the spring is properly positioned on the seal.

(13) Clean the sump gasket from the sump and crankcase.

(14) Clean the crankshaft pulley assembly and check for wear or damage. Remove any burrs or corrosion from the seal surface with fine emery cloth. If the seal surface is grooved a new pulley and damper assembly should be fitted.

(15) Check the pulley key and oil slinger for damage or wear and replace as necessary.

NOTE: The concave face of the oil slinger must face towards the oil seal in the timing cover when correctly assembled.

(16) Instal a new gasket between the timing cover and the front face of the cylinder block. Apply sealing compound to both sides of the gasket.

(17) Refit the timing cover and loosely instal the securing bolts.

(18) Apply a film of grease to the seal surface of the crankshaft pulley assembly and instal the pulley onto the crankshaft.

(19) Tighten the timing cover retaining bolts evenly and securely.

(20) Refit the engine sump as previously described ensuring that the tabs of both sump seals are over the gasket.

Further installation is a reversal of the removal procedure with attention to the following points:

Ensure the engine and automatic transmission oil levels are checked and topped up if necessary and that the radiator is refilled and checked for leaks.

11. CAMSHAFT AND TIMING CHAIN

Special Equipment Required:

To Check Camshaft End Float — Dial gauge

To Check Camshaft for Bend — Dial gauge and vee blocks

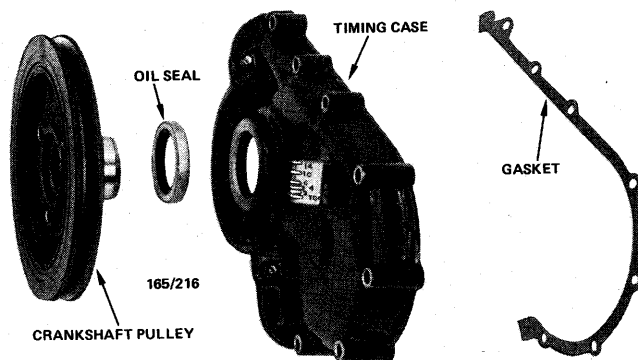
To Measure Camshaft Bearings — Suitable micrometers

TO REMOVE

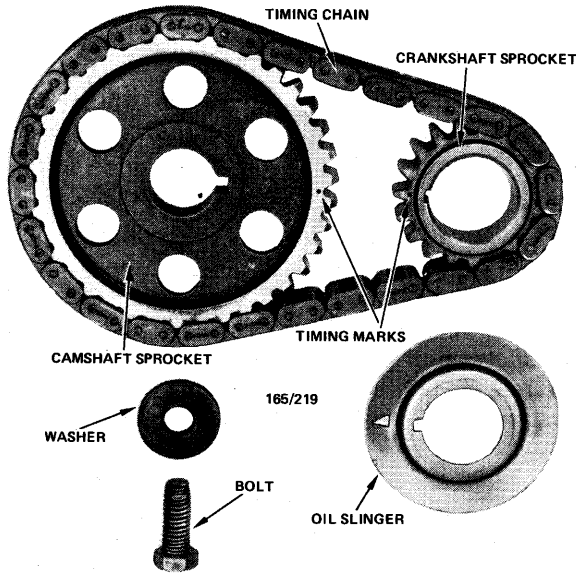
(1) With the engine removed from the vehicle remove the following components, referring as necessary to the appropriate sections.

- (a) Sump, oil pump and fuel pump.
- (b) Cylinder head, pushrods and distributor.
- (c) Crankshaft pulley and timing cover.

(2) Using a magnet remove each hydraulic tappet from the engine keeping them in order so that they can be



Dismantled view of crankshaft pulley and timing case cover.



Dismantled view of timing chain and sprocket components.

replaced in the same location from which they were removed.

(3) Mount a dial gauge on the front of the engine so that its plunger is located on the head of the camshaft sprocket retaining bolt.

(4) Push the camshaft towards the rear of the engine as far as it will go and zero the gauge.

(5) Using a screwdriver between the camshaft sprocket and the front of the crankcase, prise the camshaft forward and check the end float on the dial gauge against the Specifications. If the end float is excessive fit a new thrust plate on assembly.

(6) Remove the dial gauge from the front of the engine and slide the oil slinger off the front end of the crankshaft.

(7) Measure the amount of deflection of the timing chain as described and compare with Specifications.

Turn the crankshaft clockwise to take up the slack on the left side of the timing chain. Measure from a fixed point on the engine to the timing chain.

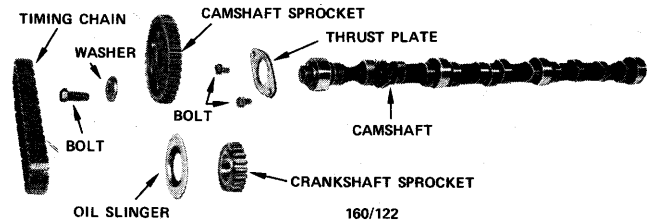
Turn the crankshaft in the opposite direction to take up the slack on the right side of the chain. Push the left side of the chain out and measure from the fixed point on the engine to the timing chain.

The difference in measurements is the chain deflection.

(8) Rotate the crankshaft until the valve timing marks are aligned. Take out the bolt and washer securing the camshaft sprocket to the camshaft and remove the timing chain and both sprockets together from the front of the engine.

(9) Take out the bolts securing the camshaft thrust plate to the front of the crankcase and withdraw the thrust plate.

(10) Carefully withdraw the camshaft from the front of the engine using care to avoid damaging the cam-



Camshaft, timing chain and sprocket components.

shaft bearings or lobes.

TO CHECK AND INSPECT CAMSHAFT

- (1) Check the camshaft lobes for pitting or wear.
- (2) Support the camshaft at each end on vee blocks and using a dial gauge with its plunger bearing on the centre journal rotate the camshaft and check for bend.
- (3) Using suitable micrometers measure the outside of each camshaft journal and the inside of each camshaft bearing. From these measurements calculate the bearing clearance.

If the bearing clearance is outside Specifications then new camshaft bearings will need to be fitted. This is best left to an engine reconditioning shop as specialised equipment is used in their installation.

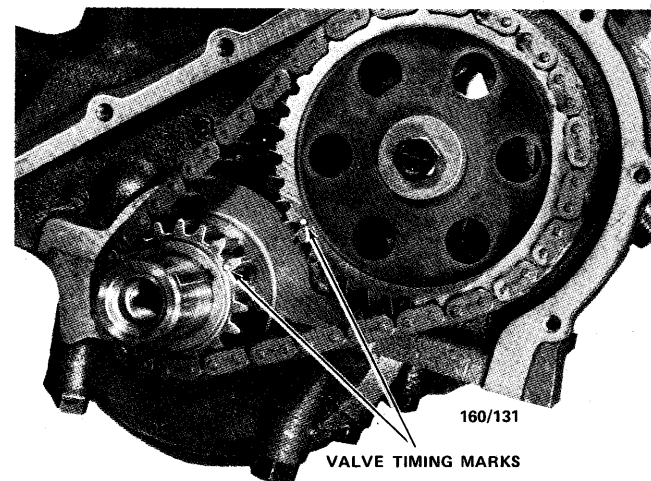
- (4) Check the camshaft thrust plate for wear or scoring and renew the plate as required.

TO CHECK AND INSPECT TIMING CHAIN AND SPROCKETS

- (1) Inspect the timing chain for damaged or worn links.
- (2) Inspect the timing chain sprockets for cracks, wear or damage.
- (3) Renew the timing chain and sprockets if wear or damage is apparent.

TO INSTALL

Installation is a reversal of the removal procedure



Marks on timing sprockets positioned for correct valve timing.

with attention to the following points:

(1) Blow out all oilways with compressed air to ensure they are free of any foreign matter.

(2) Apply a liberal coating of engine oil to all internal components when assembling.

(3) Ensure the two oil slots in the thrust face of the thrust plate face the camshaft flange.

(4) When refitting the timing chain sprockets, ensure the timing marks are adjacent to each other and in line with the centre of each shaft.

(5) Instal the oil slinger on the crankshaft with its concave side facing the pulley and ensure that the timing cover oil seal is serviceable and correctly fitted in the timing cover.

(6) Instal the hydraulic tappets in the crankcase bores from which they were removed.

12. HYDRAULIC TAPPETS

The hydraulic tappets can be dismantled for inspection and cleaning only.

The internal components of a hydraulic tappet are matched sets and individual components of a tappet must not be replaced.

If a hydraulic tappet cannot be made serviceable by cleaning or does not perform satisfactorily under test, the complete tappet assembly must be replaced.

There are two types of hydraulic tappet which, because of their differences, require a somewhat different procedure for dismantling and assembling.

TO REMOVE AND INSTAL

(1) Remove the rocker assembly and cylinder head as described earlier.

(2) With the aid of a magnet withdraw each tappet assembly in turn and place it in a rack so that each assembly can be returned to its original bore in the crankcase during assembly.

NOTE: If difficulty is encountered in withdrawing the tappet from the engine due to gum deposits on the tappet, use a pair of long nosed pliers and rotate the tappet back and forth until it is free to be lifted from its bore.

Installation is a reversal of the foregoing procedure with attention to the following points:

Lubricate each assembly liberally with engine oil before inserting it into its original bore.

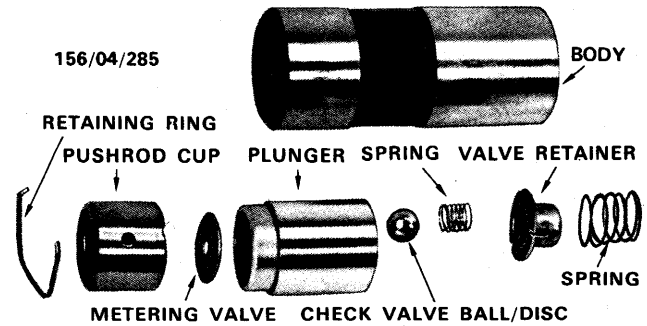
Ensure that they are completely clean and free from any varnish or gumminess.

Instal each pushrod in its original position and refit the cylinder head and rocker assembly.

Check the rocker arm to valve working clearance as described under To Check Valve Lash.

TO DISMANTLE (Type 1)

(1) Push down on the pushrod cup and plunger and use a pair of long nosed pliers to remove the retaining ring.



Dismantled view of Type 1 hydraulic tappet components. Typical.

(2) Withdraw the pushrod cup, metering valve, plunger and spring from the tappet body.

(3) Invert the plunger, prise out the check valve retainer and withdraw the check valve and spring.

(4) Clean all parts of the tappet thoroughly in solvent and blow dry with compressed air.

(5) Check each part of the tappet for wear, pitting or scoring; renew the complete tappet assembly if any part requires renewing.

TO ASSEMBLE (Type 1)

(1) Lubricate each component with clean engine oil.

(2) Invert the plunger and place on a clean bench.

(3) Place the check valve over the oil hole in the base of the plunger and position the spring on the check valve.

(4) Place the retainer over the valve and spring and push it down into place in the plunger.

(5) Place the plunger spring in the open end of the tappet body, followed by the plunger, check valve end first.

(6) Instal the metering valve in the upper open end of the plunger followed by the pushrod cup.

(7) Use a pushrod or similar clean rod to push the pushrod cup and plunger assembly down into the tappet body sufficiently to instal the lock ring in the groove in the tappet body.

(8) Again depress the plunger assembly and release it to correctly seat the lock ring.

(9) Fill the tappet body with light engine oil and instal it in the cylinder block bore from which it was removed.

(10) Instal the remaining components as previously described.

TO DISMANTLE (Type 2)

(1) Push down on the pushrod cup and plunger and use a pair of long nosed pliers to remove the retaining ring.

(2) Withdraw the pushrod cup and metering valve from the upper end of the plunger.

NOTE: Care should be taken to avoid bending the metering valve.

(3) Take out the plunger assembly and plunger spring from the tappet body.

(4) Invert the plunger and remove the plunger spring, check valve retainer and check valve with spring from the plunger base.

TO ASSEMBLE (Type 2)

(1) Lubricate each component with clean engine oil.

(2) Invert the plunger and place on a clean bench.

(3) Place the check valve on the base of the plunger and position the spring and retainer over the valve, rotate the retainer slightly until it bottoms. Install the plunger spring over the retainer and again rotate slightly until it seats.

(4) With the plunger assembly still in the inverted position, install the open end of the tappet body over the spring and plunger assembly and push down until the spring is lightly compressed.

(5) Position the assembly upright on the bench, install the upper metering valve centrally in the plunger open end.

NOTE: Care should be taken to avoid bending the metering valve.

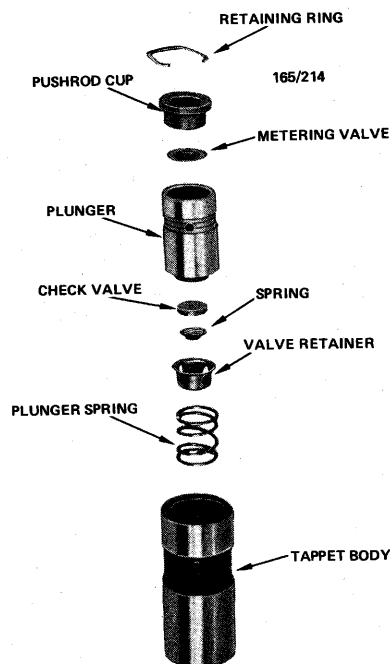
(6) Install the pushrod cup to the plunger.

(7) Push the pushrod cup and plunger assembly down sufficiently to install the retaining ring in the groove in the tappet body.

(8) Depress and release the plunger assembly to correctly seat the retaining ring.

(9) Fill the tappet body with light engine oil and install it in the crankcase bore from which it was removed.

(10) Install the remaining components as previously described.



Dismantled view of type 2 hydraulic tappet components.

13. EXHAUST SYSTEM

TO REMOVE

(1) Raise the front and rear of the vehicle and support on safety stands.

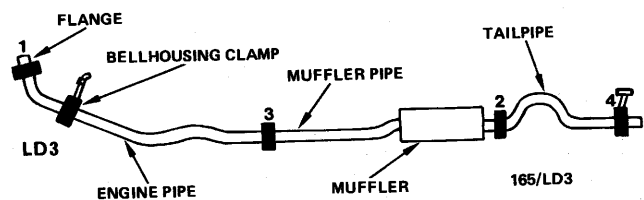
(2) Remove the nuts from the exhaust flange studs and the nut and bolt from the support bracket at the bellhousing.

(3) Remove the nuts, U bolts and clamps from the front and rear of the muffler.

(4) Remove the bolts from the mounting at the back of the muffler and the clamp on the tail pipe.

(5) Separate the rear pipe from the muffler and the muffler pipe from the front pipe.

(6) Disengage the rear pipe from the vehicle and remove the front pipe and muffler from under the vehicle.



Schematic layout of exhaust system.

NOTE: Should difficulty be experienced when separating the exhaust pipes, they may be cut with a hacksaw or pipe cutter when a replacement system is to be fitted. When heating 'frozen' joints to undo them, take extreme care near floor pans, fuel and brake lines or electrical wiring.

(7) Carefully inspect the exhaust system and discard any components which are cracked worn or corroded.

TO INSTALL

Installation is a reversal of the removal procedure with attention to the following points:

(1) Clean the exhaust manifold flange and engine pipe. Replace the manifold flange gasket.

(2) When fitting pipes together ensure the peg and notch are aligned and pushed fully home.

(3) Fit all components of the exhaust system to the underbody but initially, do not tighten any nut or bolt.

(4) Check the system for correct positioning. Ensure that all components are well clear of the underbody.

(5) Tighten all components from the front to the rear in the order given starting with the engine pipe to exhaust manifold flange retaining nuts.

(6) Start the engine and check for exhaust leaks then lower the vehicle to the ground.

14. FLYWHEEL/DRIVE PLATE

Special Equipment Required:

To Inspect — Dial gauge

To Renew Ring Gear — Suitable heat source

TO REMOVE AND INSTAL

(1) Remove the transmission from the engine as described in the Manual or Automatic Transmission sections.

(2) On manual transmission models remove the clutch plate as described in the Clutch section.

(3) Mark the flywheel or drive plate and crankshaft flange so that the units can be assembled in the original positions, remove the securing bolts and withdraw the flywheel or drive plate from the engine.

Installation is a reversal of the removal procedure with attention to the following points:

Align all marks made on removal and tighten the flywheel/drive plate bolts to the specified torque.

Instal the clutch plate and pressure plate as described in the Clutch section.

Top up the transmission if necessary after installing.

TO CHECK AND INSPECT

(1) Remove the spark plugs and lever the crankshaft to the front or rear of the crankcase so as to eliminate any end float.

(2) Attach a dial gauge to the crankcase so that its indicator bears against the clutch face contacting surface.

(3) Rotate the engine and check the flywheel runout. If runout exceeds 0.178 mm check the crankshaft flange and flywheel mounting face for burrs.

If runout exceeds this specification both on and off the crankshaft, renew the flywheel.

(4) Inspect the clutch face contacting surface of the flywheel for cracks or excessive scoring.

(5) Inspect the ring gear teeth for damage, cracks or wear. The ring gear on manual transmission models can be renewed separately from the flywheel but on automatic transmission models the complete drive plate must be renewed.

(6) Inspect the drive plate mounting bolt holes for wear caused by loose mounting bolts.

(7) Inspect the drive plate for cracks.

TO RENEW FLYWHEEL RING GEAR

(1) With the flywheel removed from the vehicle, drill a 3 mm diameter hole between two teeth of the ring gear.

NOTE: Do not drill right through the ring gear as this will damage the flange on the flywheel.

(2) Secure the flywheel, with the drilled hole uppermost, in a vice fitted with soft jaws.

(3) Place a cold chisel above the hole in the ring gear and hit it sharply to split the ring gear.

(4) Remove the ring gear, clean the mounting face on the flywheel and remove any burrs.

(5) Place the flywheel clutch side down on a bench.

(6) Polish a few spots of the new ring gear with emery cloth and heat the ring gear evenly until the polished spots turn dark blue.

NOTE: Do not heat the ring gear past the point required to achieve a dark blue color or the tempering of the gear teeth will be impaired.

(7) Quickly place the heated ring gear onto the flywheel, making sure that the chamfered ends of the ring gear teeth face upwards away from the flange on the flywheel, and also that the ring gear seats securely against the flywheel flange.

NOTE: Allow the ring gear to cool slowly. Do not quench in water.

15. ENGINE MOUNTINGS

TO REMOVE AND INSTAL

Front Mountings

(1) Support the engine on a jack placed under the front of the sump, use a block of wood between the jack head and sump to protect the sump.

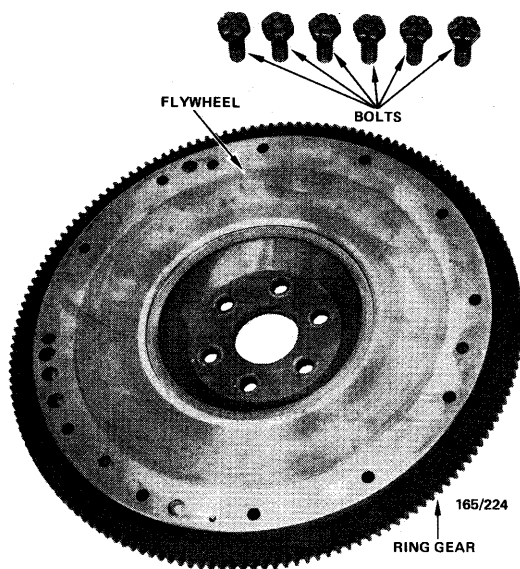
(2) Remove the through bolts holding the engine mounting to the frame supports on both sides.

(3) Raise the engine until the engine mountings clear the frame supports.

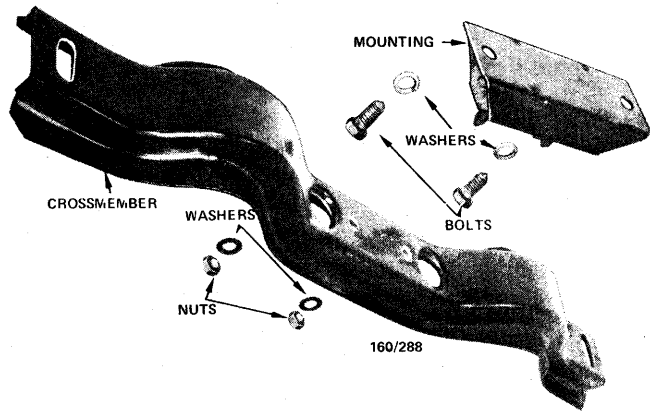
(4) Remove the nuts holding the engine mounting to the engine brackets.

(5) Lift out the engine mountings.

Installation is a reversal of the removal procedure.



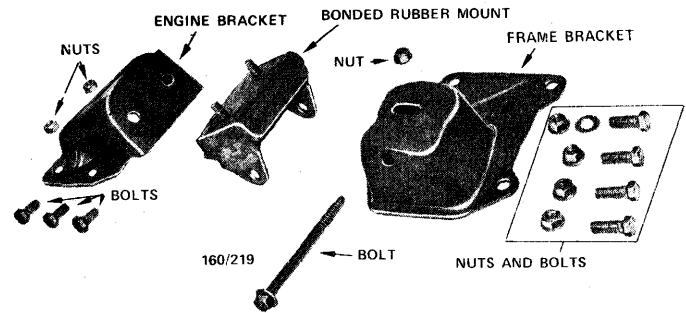
Flywheel and mounting bolts removed from engine.



Rear engine/transmission crossmember and mounting components.

Rear Mounting

- (1) Raise the vehicle and support it on stands.
- (2) Remove the two nuts and washers securing the rear mounting under the transmission extension housing to the supporting cross-member.
- (3) Place a jack under the rear of the transmission



Exploded view of front engine mounting components.

and raise the transmission assembly to just take the weight off the rear mounting.

(4) Take out the split pin where fitted and remove the bolt and nut securing each end of the support member to the frame and withdraw the support member clear of the mounting.

(5) Unscrew and remove the two bolts securing the rubber mounting to the transmissin extension housing and withdraw the mounting.

Installation is a reversal of the removal procedure using new split pins where fitted to secure the nuts.

Refer to supplement
for more information.

COOLING SYSTEM

SPECIFICATIONS

- Water pump:
Type Centrifugal impeller
Drive V-belt
Bearing type Pre-lubricated bearing and shaft
- Water pump assembly dimensions:
Impeller face to intermediate plate 13.40 mm
Pump housing to pulley flange 111.00 mm
- Thermostat:
Opening temperature 87-90 deg C
Fully open 100 deg C
- Radiator type Crossflow tube and fin
- Radiator cap:
Type Pressurised
Release pressure 103 kPa

TORQUE WRENCH SETTINGS

- Water pump to cylinder block bolts 20 Nm
Thermostat cover bolts 20 Nm
Fan to pulley hub bolts 20 Nm
Fan drive clutch bolts 24 Nm

1. COOLING SYSTEM TROUBLE SHOOTING

COOLANT LEAKAGE — EXTERNAL

- (1) Loose hose clips or faulty hoses: Tighten hose clips or renew faulty water hoses.
- (2) Leaking radiator core or tanks: Repair or renew radiator.
- (3) Leaking heater core or hoses: Repair or renew heater core, check hose clips and hoses and replace if necessary.
- (4) Leaks at thermostat cover and/or water pump joint gaskets: Renew gaskets.
- (5) Worn or damaged water pump seal assembly: Overhaul water pump assembly.
- (6) Worn or damaged water pump bearing assembly: Renew water pump bearing and shaft assembly including seal.
- (7) Loose or rusted welch plugs: Renew faulty welch plugs.



Check for cracked or damaged radiator hoses and welch plugs.

(8) Faulty cylinder head gasket or loose holding down bolts: Renew gasket and correctly tighten cylinder head bolts.

(9) External crack in cylinder block or head: Renew faulty components.

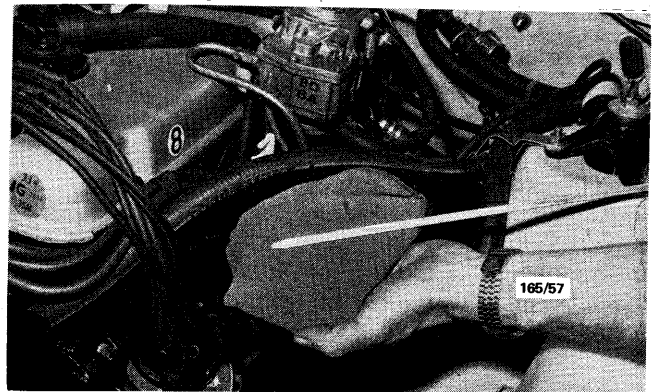
NOTE: Check system for external leakage by running vehicle engine to operating temperature over a dry floor and checking for leak source.

COOLANT LEAKAGE — INTERNAL

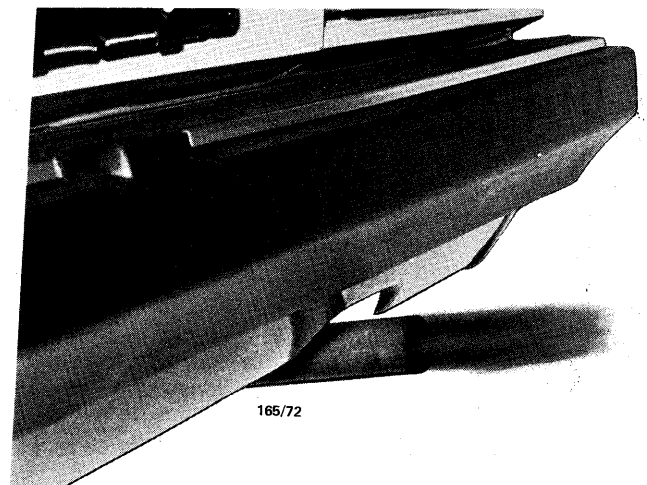
(1) Cylinder head gasket leak due to warped cylinder head or cylinder block gasket faces: Reface cylinder head or block and renew cylinder head gasket.

(2) Crack in cylinder head or cylinder block: Renew cylinder head or block as necessary.

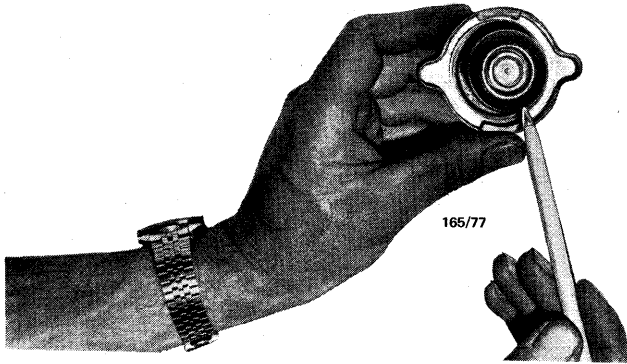
NOTE: Check the engine for internal leakage by withdrawing the dipstick and inspecting for emulsified oil. Also run the engine and check for excessive steam and emulsified oil at the exhaust pipe which would indicate water leakage into the combustion chamber.



Check the engine oil for correct level and dilution on the dipstick.



Excessive steam or emulsified oil at the exhaust pipe indicates water leakage into the combustion chamber.



Renew the radiator pressure cap if the sealing rubber is suspect.

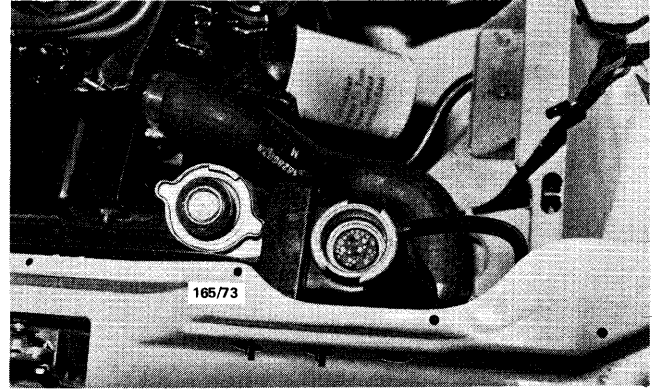
COOLANT LOSS BY OVERFLOW

- (1) Overfull system: Drain and refill to one inch below filler neck.
- (2) Faulty pressurised radiator cap: Renew faulty cap.
- (3) Blocked radiator core tubes: Clean or renew radiator core.
- (4) Coolant foaming due to poor quality anti-freeze or corrosion inhibitor: Drain system and renew coolant and additive.

ENGINE OVERHEATING

- (1) Radiator pressure cap defective: Renew radiator cap.
- (2) Obstructed air passage through radiator core from front to rear: Blow out obstruction from rear to front of radiator core with compressed air or water pressure.
- (3) Faulty thermostat: Check and renew thermostat.
- (4) Incorrect ignition timing: Check and reset ignition timing as described in the Tune-Up section.
- (5) Incorrect valve timing: Reset valve timing as described in the Engine section.
- (6) Loss of coolant due to overflow: Check and rectify as under Coolant Loss by Overflow.
- (7) Poor circulation: Check and rectify as under Coolant Circulation Faulty.
- (8) Low engine oil level: Stop engine immediately and replenish oil in sump.
- (9) Engine tight after overhaul: Check and if satisfactory stop engine and allow to cool out.
- (10) Restricted muffler or damaged tail pipe, accompanied by loss of power. Remove restrictions or renew components.
- (11) Incorrectly adjusted or dragging brakes: Check and rectify by adjustment or renewal of components.
- (12) Broken or slipping fan belt: Adjust or renew fan belt.

NOTE: Engine overheating is indicated by excessive rise in engine temperature shown by



A blown head gasket is indicated by bubbles in the radiator coolant.

gauge or warning light. Overheating is usually accompanied by steam emitting from radiator overflow pipe and loss of engine power. A blown head gasket is indicated by bubbles in radiator coolant.

COOLANT CIRCULATION FAULTY

- (1) Partial blockage of radiator core tubes: Reverse flush or renew radiator core.
- (2) Water sludge deposits in engine water jackets: Clean and flush engine water jacket and add rust inhibitor to coolant.
- (3) Fan belt broken or slipping: Renew or adjust fan belt.
- (4) Faulty water pump or thermostat: Overhaul or renew water pump, renew thermostat.
- (5) Collapsing lower radiator hose: Check and renew lower radiator hose and check radiator core tubes.
- (6) Insufficient coolant in system: Replenish coolant and check for leaks.

NOTE: This condition is best checked out by removing the radiator cap and running the engine until it reaches normal operating temperature. Check for water turbulence in the radiator. A normal system should show turbulence at part throttle. Check the radiator core tubes for blockage by partially draining the system and then checking visually for rust scale in tubes.

As most adverse conditions can be caused by more than one fault, diagnosis can only be made after checking out items by process of elimination in the order shown.

2. DESCRIPTION

The cooling system is the thermo-syphon type with fan and water pump assistance. The system is pressurised in order to raise the boiling point of the coolant and so increase the efficiency of the engine. Provision is made to

drain the cylinder block by means of a plug situated at the right hand side of the cylinder block. To drain the radiator it is necessary to disconnect the lower hose from the radiator outlet.

On vehicles fitted with air conditioning, a fan shroud is fitted to the radiator to assist the flow of air through the radiator. The radiator is a crossflow type with tanks positioned to the left and right of the core with the filler cap in the left hand tank.

On automatic transmission models an oil cooler is fitted into the left hand tank with inlet and outlet connections for the transmission oil cooler pipes.

NOTE: Do not remove the radiator cap when the radiator is hot.

The fan, water pump and alternator are driven by a vee belt from the crankshaft pulley.

The water pump is fitted with a shaft and ball bearing assembly which requires no lubrication in service.

The water pump seal is a spring loaded neoprene seal which runs on a ceramic thrust washer fitted to the impeller.

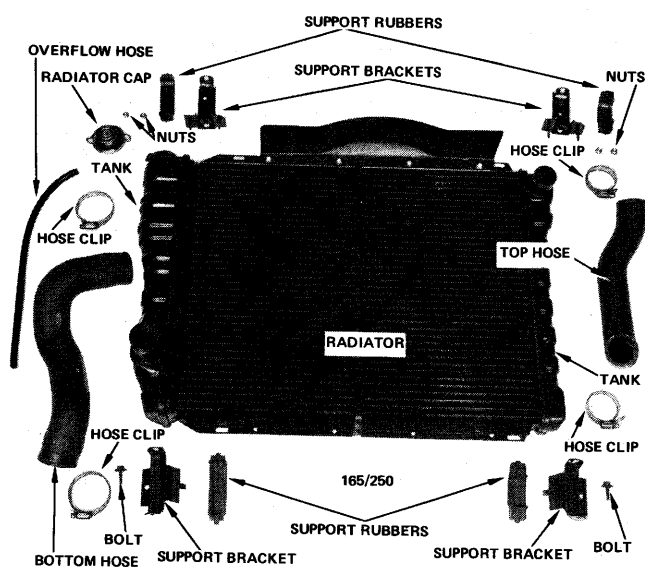
Temperature is controlled by a thermostat located in the cylinder head water outlet pipe housing.

3. RADIATOR

TO REMOVE

WARNING: To prevent scalding or injury only remove the radiator cap when the coolant is in a cool or cold state and there is no pressure in the radiator.

(1) Drain the cooling system by removing the lower radiator hose. It will be best to leave the radiator cap in position during this operation. This will cause a partial



The radiator and associated components removed from the vehicle.

vacuum in the radiator therefore avoiding heavy gushes of coolant when the bottom hose is removed. When the flow of coolant stops, the radiator cap may be 'cracked' open a little at a time until all the coolant has drained from the radiator.

(2) Disconnect the radiator top hose and overflow hose.

(3) On vehicles fitted with automatic transmission, remove the oil cooler pipes from the radiator and plug the pipes and unions to prevent any entry of foreign matter.

(4) Where applicable remove the screws holding the top of the fan shroud to the radiator and lift the shroud up to displace from the bottom holding brackets. Lay the shroud on the cooling fan so it does not interfere with future operations.

(5) Remove the radiator support bracket nuts and remove the brackets.

(6) Remove the radiator from the vehicle by lifting up and out of the lower mounts.

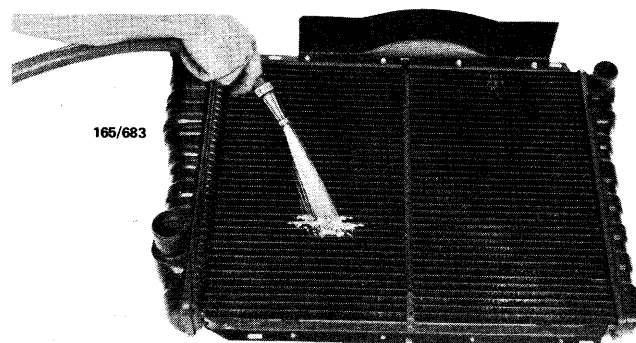
NOTE: When a radiator that has been in use for some time is removed from the vehicle to enable repairs to be carried out to the engine, it should not be allowed to stand empty for any length of time. The radiator should be immersed in a tank of fresh water or otherwise kept full. Failure to observe this precaution may result in overheating when the engine is put back into service. This is caused by internal deposits in the radiator drying and flaking, and so obstructing the circulation of the coolant in the system.

(7) Securely plug the water outlets in the right and left radiator tanks and fill the radiator with clean water.

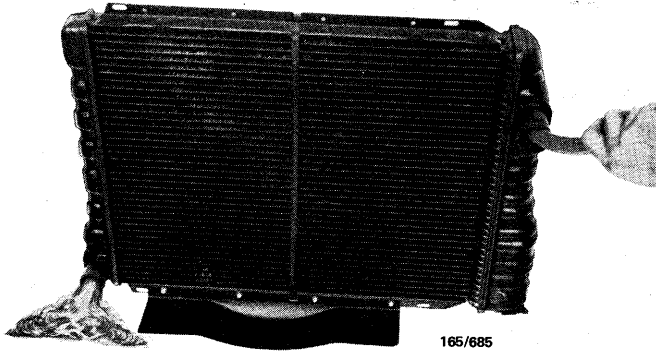
TO CLEAN

(1) With the radiator removed from the vehicle position it upside down and apply a hose to the bottom hose connection and reverse flush the unit.

(2) Stand the radiator upright and using a jet of water or air pressure to the rear side of the core, remove any dirt, insects or other foreign matter that may have accumulated on the front side of the core.



Clean obstructions from radiator core using water pressure.



Reverse flush the radiator using water pressure.

TO INSTAL

Installation is a reversal of the removal procedure with attention to the following points:

- (1) Position the radiator assembly in the front panel opening whilst checking that the lower support rubbers are positioned correctly.
- (2) Refit the radiator support brackets and nuts.
- (3) Where applicable, refit the fan shroud into the bottom brackets and instal the mounting screws.
- (4) Position the fan shroud to obtain even radial clearance from the fan and tighten the mounting screws.
- (5) Where fitted remove the plugs from the automatic transmission cooling pipes and unions, reconnect and secure the pipes.

NOTE: Inspect all hoses for cracking or perishing and renew if unserviceable.

- (6) Refit the top and bottom hoses preferably with a light smear of grease and tighten the hose clips.
- (7) Reconnect the overflow hose to the radiator and disconnect the heater hose from the water pump connection.
- (8) Slide the heater control lever on the dashboard to the HOT position.
- (9) Slowly fill the radiator with clean water.
- (10) When a full flow of water is evident at the water pump connection and the heater hose, reconnect the hose to the water pump.
- (11) Remove the top thermostat cover bolt.
- (12) Apply a suitable water resistant sealant to the thread of the bolt and place to one side.
- (13) When a full flow of water is evident at the bolt hole instal the bolt and torque to Specifications.
- (14) Add the specified corrosion inhibitor as necessary and top up the radiator.
- (15) Start the engine and check for leaks at any of the hose joints.
- (16) When the engine reaches normal operating temperature and the thermostat has opened, allowing full circulation of the coolant, recheck the radiator level and top up as necessary.

NOTE: Allow the engine to cool before rechecking the coolant level.

4. THERMOSTAT

Special Equipment Required:

To Check – Thermometer

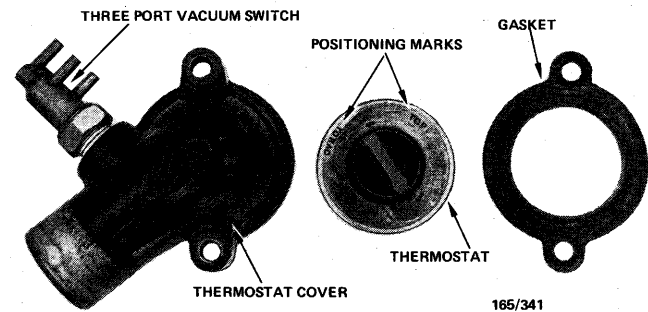
TO REMOVE AND INSTAL

- (1) Drain the cooling system as previously described under the heading Radiator.
- (2) Disconnect the top radiator hose from the thermostat cover.
- (3) Remove the two bolts securing the thermostat cover to the cylinder head.
- (4) Withdraw the thermostat from the cover and place the cover to one side ensuring not to damage the ported vacuum switch.

NOTE: A visual examination of the thermostat will often determine its serviceability and obviate the necessity for further testing. For instance, a thermostat with its valve fully open when removed from a cold engine is obviously faulty and should be discarded and a new unit fitted.

Installation is a reversal of the removal procedure with attention to the following points:

- (1) Ensure that the gasket surfaces are perfectly clean and that a new gasket is fitted when assembling.
- (2) Apply a suitable sealant to both sides of the gasket before fitting.
- (3) Apply a suitable water resistant sealant to both thermostat cover bolt threads and place to one side.
- (4) Refit the thermostat to the cover with the words on the thermostat 'To Rad' facing the radiator and the word 'Top' pointing uppermost.
- (5) Instal and secure the thermostat cover bolts.
- (6) Fill the radiator with water and add the specified corrosion inhibitor as necessary.
- (7) Start the engine and check for leaks at any of the hose joints and where fitted, automatic transmission oil pipes.
- (8) When the engine reaches normal operating temperature and the thermostat has opened, allowing full circulation of the coolant, recheck the radiator level and top up as necessary.



Dismantled view of the thermostat and housing components.

NOTE: Allow the engine to cool before rechecking the coolant level.

(9) On automatic transmission models check the transmission fluid level.

TO CHECK

- (1) Check that the thermostat is closed when cold.
- (2) Suspend and immerse the thermostat together with a reliable thermometer in a vessel of cold water, ensuring that neither the thermostat or thermometer is touching the sides or bottom of the vessel.
- (3) Progressively heat the water noting the temperature reading on the thermometer as the thermostat valve commences to open and when it is fully open. See Specifications for opening and fully open temperatures. A thermostat which is not opening and is not open at the specified temperature, should be renewed.

5. WATER PUMP

Special Equipment Required:

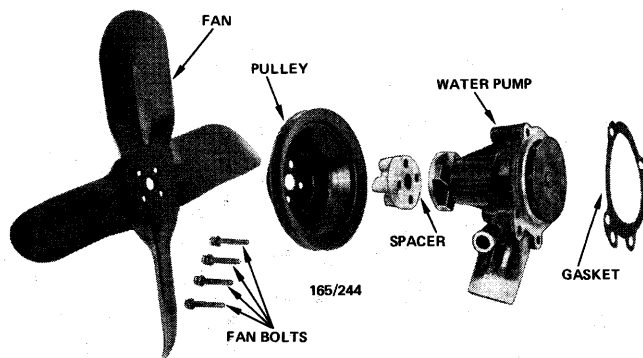
To Dismantle – Press and a puller

TO REMOVE AND INSTAL

- (1) Disconnect the battery earth lead.
- (2) Drain the cooling system at the lower radiator hose.
- (3) Remove the radiator and where fitted, remove the shroud. If necessary refer to the heading Radiator for the correct procedure.

NOTE: On vehicles fitted with power steering or air conditioning remove the drive belts.

- (4) Release the fan belt adjusting bracket, push the alternator towards the engine at the top and remove the fan belt.
- (5) Remove the bolts securing the fan blades to the water pump pulley and withdraw the fan blades, spacer and pulley.
- (6) Disconnect the heater hose from the water pump.
- (7) Remove the bolts securing the water pump assembly to the front of the cylinder block then detach and withdraw the water pump from the vehicle.



View of water pump and fan components.

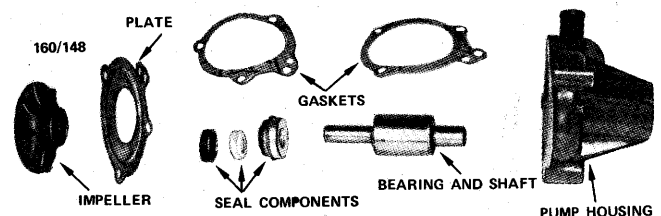
Installation is a reversal of the removal procedure with attention to the following:

CAUTION: When installing the water pump retaining bolts, the longest bolt must be installed in the hole which also attaches the alternator mounting bracket.

- (1) Use a new gasket between the intermediate plate and the front face of the cylinder block. Coat both sides of the gasket with a suitable jointing compound before installing.
- (2) Refit the water pump assembly to the cylinder block and instal and tighten the pump bolts to the specified torque.
- (3) Refit the fan blade and spacer and instal the bolts finger tight.

NOTE: Check all drive belts and hoses for cracking and deterioration and replace as necessary.

- (4) Refit the fan belt and adjust as described in the Tune-Up section.
- (5) Torque the fan bolts to Specifications.
- (6) Where fitted, instal the air conditioner and power steering drive belts.
- (7) Position the fan shroud, where fitted, over the fan assembly and instal the radiator as previously described under the heading Radiator.
- (8) Where applicable instal the fan shroud to the radiator and adjust as described under the heading Radiator.
- (9) Slide the heater control lever on the dashboard to the HOT position.
- (10) Slowly fill the radiator with clean water.
- (11) When a full flow of water is evident at the water pump connection and the heater hose, reconnect the hose to the water pump.
- (12) Remove the top thermostat cover bolt.
- (13) Apply a suitable water resistant sealant to the thread of the bolt and place to one side.
- (14) When a full flow of water is evident at the bolt hole instal the bolt and torque to Specifications.
- (15) Add the specified corrosion inhibitor as necessary and top up the radiator.
- (16) Start the engine and check for leaks at any of the hose joints.
- (17) When the engine reaches normal operating temperature and the thermostat has opened, allowing full circulation of the coolant, recheck the radiator level and top up as necessary.



Water pump components.

NOTE: Allow the engine to cool before rechecking the coolant level.

TO DISMANTLE

- (1) Using a suitable puller, withdraw the pump pulley flange from the shaft and bearing assembly.
- (2) Press the bearing and shaft assembly together with the impeller out towards the rear of the pump body.
- (3) Press the impeller off the end of the shaft and bearing assembly and withdraw the seal assembly.

TO CHECK

NOTE: It is generally not necessary to dismantle the water pump unless it is leaking water past the seal or the ball bearing has become noisy. It is therefore good policy to instal a new seal assembly, bearing and shaft assembly and impeller.

- (1) Check the pump body for any cracks or damage.
- (2) Check the bearing for looseness in the pump body bore.
- (3) Check that the water drain hole in the pump body is clear.

NOTE: When cleaning the pump components, do not immerse the shaft and bearing in cleaning fluid if the assembly is to be used again as it washes out any grease in the bearing.

TO ASSEMBLE

- (1) Using a small amount of waterproof sealing compound applied to the flange of the new seal assembly, press the seal assembly into the pump body so that the water slinger and thrust face of the seal will be facing the pump impeller.

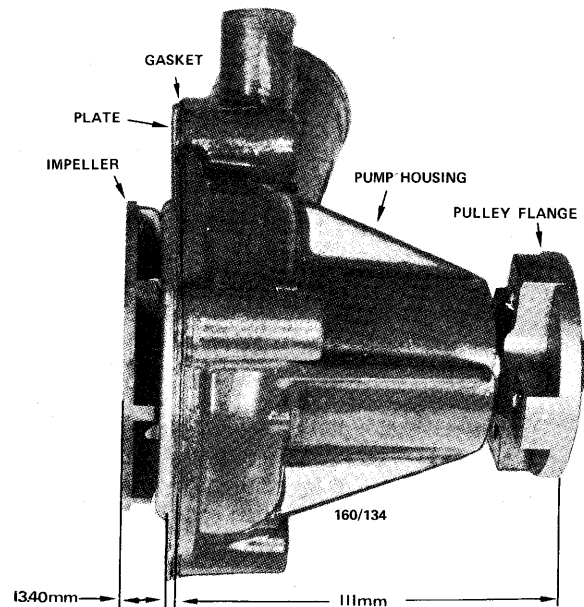
NOTE: The seal must be pressed on its outer periphery only.

- (2) Smear a little grease on the outside of the new bearing and then by applying pressure to the outer race of the bearing, press the bearing assembly into the pump body from the front of the pump.

NOTE: The bearing must be pressed into the pump housing until the outer end of the bearing is flush with the forward end of the housing bore.

It is also important that during the pressing operation it will be necessary to support both the seal and water slinger to prevent these components dislodging from the pump body.

- (3) Apply a small amount of waterproof sealing compound around the rubber seat and insert it into the back of the impeller. Place the ceramic thrust washer inside the rubber seat.



Water pump dimensions for correct assembly.

NOTE: Do not allow grease and/or sealing compound to come in contact with the ceramic seal face.

- (4) Applying a waterproof sealing compound to both sides of the gasket, place it on the water pump face. Then place the intermediate plate on top of the gasket.

NOTE: Make sure that there is no sealing compound covering or blocking the by-pass hole.

- (5) Support the pump on the front end of the shaft assembly, instal the new impeller with the blades facing the pump body and press it onto the shaft until a clearance of 13.40 mm exists between the impeller face and the intermediate plate.

NOTE: Ensure that the intermediate plate is held firmly against the pump body when checking the above measurement

- (6) Turn the pump over and support it on the impeller end of the shaft.

NOTE: When pressing the pulley flange onto the shaft as detailed in operation (7) ensure that the assembly is supported directly on the end of that shaft and not on the impeller, otherwise the clearance between the impeller face and the intermediate plate may be decreased with possible damage to the impeller and seal assembly.

- (7) With the plain face uppermost, press the pulley flange onto the front end of the shaft until a dimension of 111.0 mm is obtained between the front face of the pulley flange and the water pump mounting face.

6. WELCH PLUGS

To facilitate the casting of the cylinder block and cylinder head passages and water jackets a number of openings had to be made at manufacture.

These openings are plugged with welch plugs. The plugs may have to be renewed when cleaning the engine water jackets or when the plugs become defective due to corrosion.

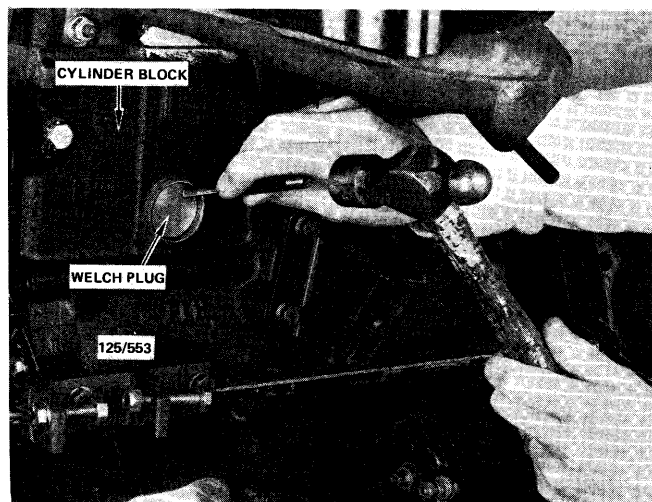
TO RENEW

NOTE: If a welch plug is found to be defective, it is good policy to renew all welch plugs.

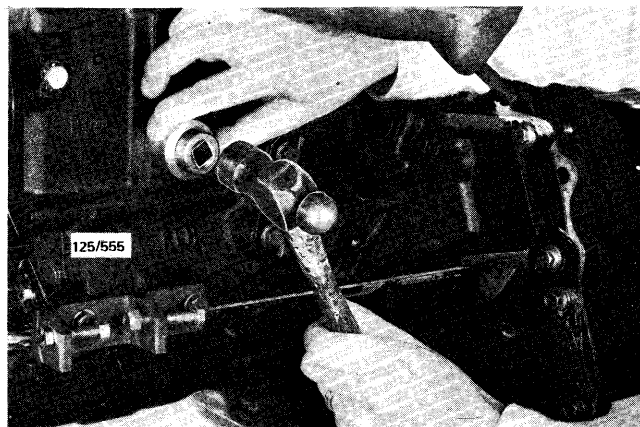
- (1) Drain the radiator and cylinder block.
- (2) Remove the necessary engine components or accessories to gain ample working space around the plug.
- (3) Use a suitable punch and hammer and tap the welch plug on its outer circumference into its opening.
- (4) Grasp the edge of the welch plug with a pair of multigrip pliers and using the shoulder of the multigrip pliers, lever the plug out of its opening.
- (5) Thoroughly clean and dry the welch plug opening.
- (6) Lightly smear the edge of a new welch plug and the opening with 'Stag' jointing compound.
- (7) Place the welch plug onto the opening and using a suitable tube or socket fitting the rim of the plug, drive the plug squarely into its opening.

NOTE: The plug must be driven into the opening straight and squarely or leaks may occur.

- (8) Instal the components which were removed to gain access to the plug.
- (9) Fill the cooling system as previously described. With the radiator cap installed run the engine until it reaches normal operating temperature and check for coolant leaks.



Tap the welch plug on its outer circumference into cylinder block.



Using a correct fitting tube or socket, drive the welch plug into its opening.

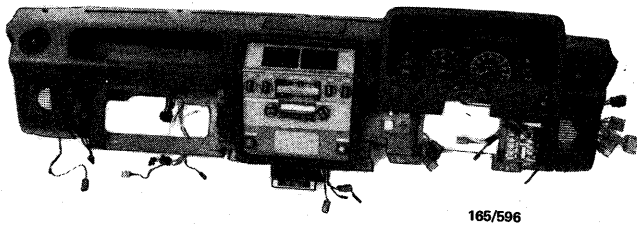
7. HEATER ASSEMBLY HEATER UNIT

To Remove and Instal

- (1) Remove the lower facia panel beneath the steering column by turning the retaining clips half a turn.
- (2) Remove the handbrake lever assembly. If necessary refer to the Brakes section for the correct procedure.
- (3) Remove the left hand side kick panel screw and remove the kick panel. Disconnect the battery earth lead.
- (4) Where a centre console is fitted, remove the two centre console retaining screws from inside the console glove compartment. Unscrew the remaining two screws from under the dash panel. Remove the gear shift knob or T bar handle. If necessary refer to the appropriate transmission section for the correct procedure.
- (5) Where applicable remove the dial indicator assembly by gently levering upwards. Disconnect the cigarette lighter wiring connector. Remove the console and place to one side.
- (6) Remove the nuts securing the steering column mounting bracket to the brake pedal support bracket and lower the column onto the seat.

NOTE: When lowering the steering column retrieve the wedged spacer from the front left hand stud, if fitted.

- (7) Remove the five screw dress cap covers from the top of the instrument panel near the windscreen and remove the retaining screws.
- (8) Remove the glove compartment attaching screws and place the glove compartment to one side.
- (9) Where fitted remove the ashtray from the centre lower facia panel and take out the lower facia panel retaining screws. Disconnect the cigarette lighter wiring plug and place the panel to one side. Unscrew the bonnet release cable mounting bracket screw and push the bracket forward.
- (10) Remove the two side and centre lower instru-



View showing instrument panel removed from vehicle.

ment panel attaching bolts noting the location of the earth wire.

(11) Disconnect the vacuum hoses and heater control cable.

(12) Pull the instrument panel assembly towards the rear of the vehicle enough to gain access to the electrical connectors.

(13) Separate the multipin electrical connections and disconnect the courtesy light wire at the switch.

(14) Remove the instrument panel assembly from the dash panel and place to one side.

(15) Disconnect the various vacuum hoses.

(16) Separate the electrical wire connector from the resistor.

(17) Remove the steering column support bracket.

(18) Prise the plenum chamber retaining clips off and remove the plenum chamber.

(19) Remove the left hand plenum chamber retaining nuts and remove the plenum chamber.

(20) Drain the cooling system by disconnecting the lower radiator hose. Disconnect the heater hoses at the inlet and outlet connections at the heater core.

(21) Remove the retaining nuts and washers from the heater unit.

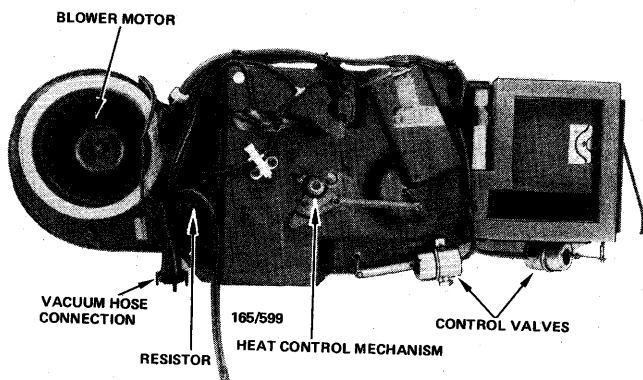
(22) Remove the heater assembly from the vehicle.

Installation is a reversal of the removal procedure.

HEATER CONTROLS

To Remove and Instal

(1) Remove the radio control knobs from the spindles and where fitted the power antenna control knob.



The heater assembly removed from the vehicle.

(2) Unscrew the spindle nuts and remove the radio facia panel.

(3) Remove the screws from the radio mounting bracket.

(4) Remove the radio and mounting bracket from the instrument panel and disconnect the multipin connections, antenna lead and where fitted, the power antenna switch lead.

(5) Remove the heater control knobs.

(6) Unscrew the spindle nuts and remove the heater control facia panel.

(7) Unscrew the spindle nuts securing the switches to the mounting bracket.

(8) Remove the mounting bracket from the instrument panel by removing the retaining screws.

(9) Disconnect the control cable from the lever and mounting bracket.

(10) Remove the mounting bracket and separate the vacuum hoses from the switches.

Installation is a reversal of the removal procedure with attention to the following point:

Position the mounting bracket and refit the outer control cable flush with the edge of the cable retaining clip bracket.

To Adjust Control Lever

(1) Take out the glove compartment.

(2) Slide the control lever to the WARM position.

(3) Slacken the control switch securing screws.

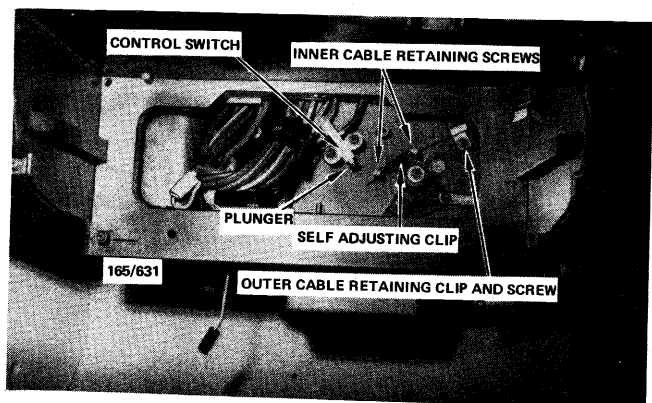
(4) Whilst holding the inner cable, push the self adjusting clip approximately 25 mm towards the outer cable.

NOTE: Where fitted slacken the inner cable retaining screws.

(5) Slide the control lever to the COOL position. This will automatically reset the self adjusting clip on the inner cable.

(6) Depress the plunger by pivoting the control switch and secure the retaining screws.

(7) Refit the glove compartment.



View of instrument panel with glove compartment removed showing heater control cable adjusting point.

Refer to supplement
for more information.

FUEL SYSTEM

SPECIFICATIONS

CARBURETTOR

- Make Stromberg BX
- Type—3.3 litre:
 - Manual 6DXA
 - Automatic 6DVA
- Type—4.1 litre:
 - Manual 6DUA
 - Automatic 6DTA
- Venturi diameter 32.54 mm
- Main jet 28–25
- Main metering jet 380
- Power by pass jet 0.55 x 1.39 mm
- Pump jet 0.75 mm
- Idle discharge nozzle 1.50 mm
- Idle feed tube:
 - 3.3 litre No 66
 - 4.1 litre No 62
- Float needle valve seat 1.85 mm
- Fuel level 16–17.5 mm
- Choke valve pull down clearance:
 - 3.3 litre Manual 3.8–4.2 mm
 - 3.3 litre Automatic 3.0–3.4 mm
 - 4.1 litre 3.8–4.2 mm
- Curb idle speed:
 - Manual transmission in neutral 900–950 rpm
 - Automatic transmission in D 600–630 rpm
- Fast idle speed 1100–1200 rpm

FUEL PUMP

- Make Carter
- Type Mechanical diaphragm
- Delivery pressure at idle 24–34 kPa
- Minimum volume at 1200 rpm 1.5 litre/minute

AIR CLEANER

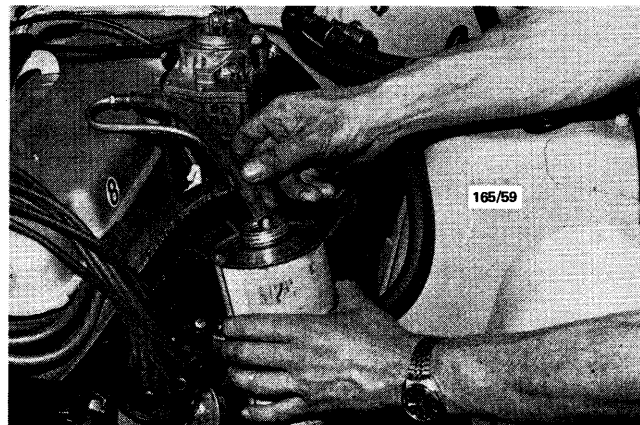
- Type Disposable dry element
- Control Vacuum operated bi-metal hot air valve

1. FUEL SYSTEM TROUBLE SHOOTING

ENGINE WILL NOT START

- (1) Lack of fuel in float chamber: Check fuel pump delivery, sticking or clogged needle valve.
- (2) Engine flooding with fuel when cold; by excessive use of choke or accelerator: Hold accelerator pedal flat until engine starts and revise starting procedure.
- (3) Engine flooding with fuel when hot by excessive use of choke and/or accelerator: Hold accelerator pedal flat until engine starts, revise starting procedure and check that the choke valve is fully open.

NOTE: Check for lack of fuel in float chamber as described in the Roadside Trouble



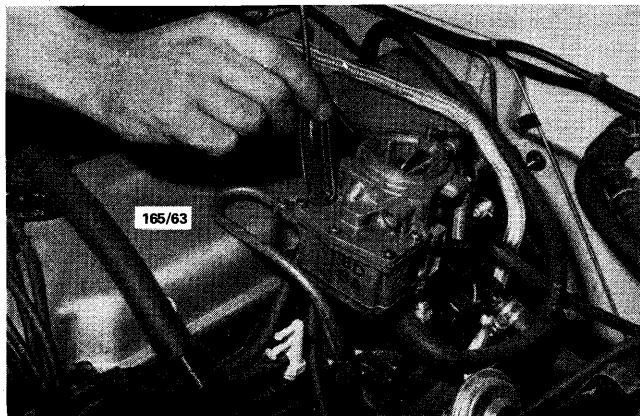
Checking for fuel flow at carburettor supply pipe.

Shooting section. Engine flooding is indicated by a heavy petrol smell and fuel leaking from the carburettor throttle shaft.

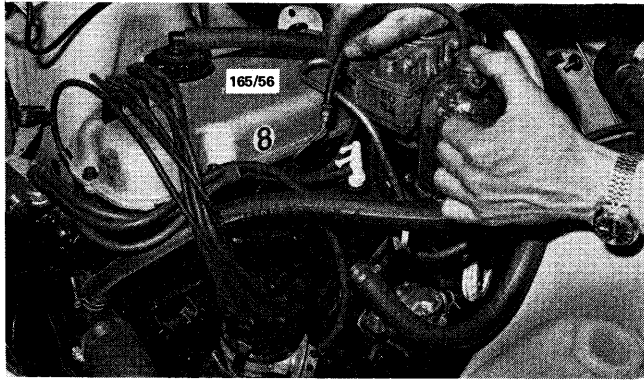
ENGINE STALLS AT IDLE SPEED

- (1) Incorrect adjustment of idling speed: Check and adjust as described in the Tune-Up section.
- (2) Carburettor float bowl flooding: Check for sticking needle valve or punctured float. Clean and blow out carburettor.
- (3) Carburettor starving for fuel: Check fuel delivery at needle valve.
- (4) Blocked idling tube or idle air bleed: Clean and blow out carburettor.
- (5) Carburettor to inlet manifold bolts or nuts loose: Tighten bolts and nuts and check for air leaks.
- (6) Leaking carburettor top cover or inlet manifold gaskets: Check and renew faulty gaskets.

NOTE: Check out this condition by a process of elimination in the fault order given. Only remove and dismantle the carburettor as a last resort. Air leaks of the manifold can be checked out by running engine oil around the suspect joints with the engine running.



Float chamber flooding can sometimes be rectified by tapping the carburettor float chamber in the vicinity of the needle and seat.



Air leaks at the inlet manifold can be located by running engine oil around the suspect joints.

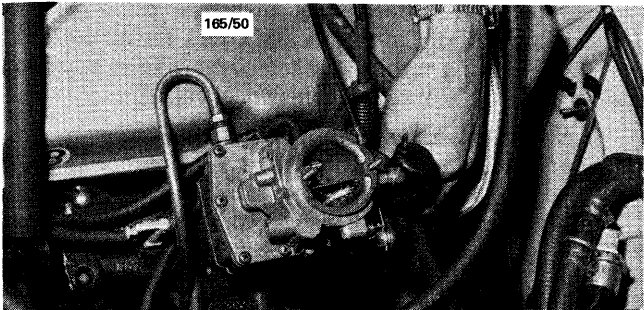
FLAT SPOT ON ACCELERATION

(1) Blocked accelerator pump discharge jet or sticking check valve: Clean and blow out carburettor as described in the appropriate section.

(2) Weak or broken accelerator pump spring: Renew pump spring.

(3) Faulty accelerator pump plunger cup: Renew pump plunger.

NOTE: Check out the pump circuit by removing the air cleaner and actuating the accelerator linkage by hand. A squirt of fuel should be seen in the carburettor throttle bore.



Check for discharge of fuel at carburettor accelerator pump nozzle by actuating the throttle linkage by hand.

ENGINE MISFIRES OR CUTS OUT AT HIGH SPEED

(1) Obstruction in main or power jets: Dismantle and blow out jets.

(2) Low fuel level in float chamber or float chamber starving for fuel: Check float level setting, check fuel pump and supply lines.

(3) Failure of fuel pump to deliver sufficient fuel: Renew fuel pump.

(4) Blockage in fuel tank pipe: Remove blockage and clean pipe.

(5) Air leak between fuel pump and tank: Rectify air leak.

(6) Air leak between carburettor top cover, main body and throttle flange assemblies: Check and renew gaskets, then tighten securing screws.

(7) Water in carburettor: Drain and Clean fuel system.

(8) Breakdown in ignition components: Refer to Tune-Up section for overhaul procedure.

NOTE: Check out possible faults by a process of elimination in the fault order given. Check out fuel pump delivery pressure and capacity as outlined in the appropriate part of this section. Check for water in the float chamber and low float level after removing the top cover.

EXCESSIVE FUEL CONSUMPTION

(1) Float level too high: Check and readjust float level.

(2) Choke valve partially closed: Check and rectify choke operation.

(3) Air cleaner element dirty: Renew air cleaner element.

(4) Faulty fuel pump diaphragm: Check and renew fuel pump.

(5) Leaks between fuel pump and carburettor: Check and rectify leaks.

(6) Fuel leaks at jet plug gaskets: Renew jet plug gaskets.

(7) Worn or damaged main jets: Check and renew faulty components.

(8) Excessive use of accelerator pump: Revise driving habits.

NOTE: Most common causes for excessive fuel consumption are blocked air cleaner element which can be removed and visually checked and external fuel leakage from system components which can also be checked visually.

2. STROMBERG BX CARBURETTOR

Special Equipment Required:

To Remove Jets — Suitable jet removing tool

DESCRIPTION

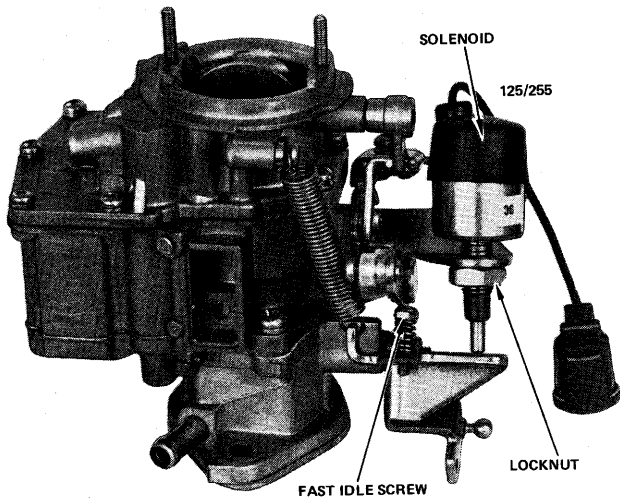
The carburettor is the single barrel down-draught type comprising three sub-assemblies, i.e. the top cover, main body and flange.

The power by-pass valve vacuum piston is located in the top cover, as is the choke valve and shaft.

The jets, power by-pass valve, fuel valve needle and seat, float and accelerator pump and valves are located in the main body.

The carburettor flange houses the throttle valve and shaft and the idle mixture screw.

The choke is manually operated by a control cable to an intermediate cam-lever mounted on the side of the main body.



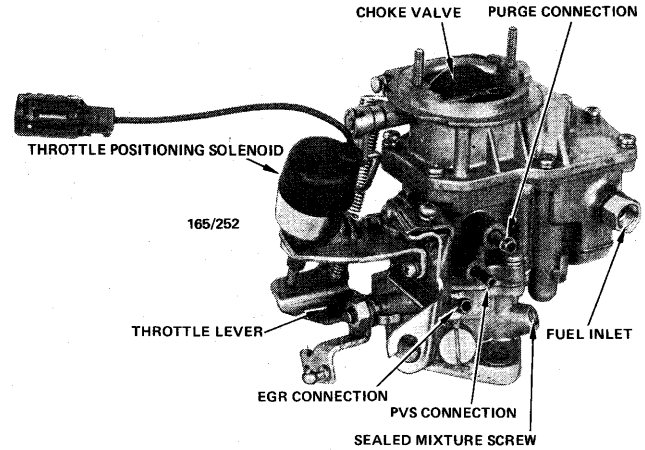
Left hand side view of carburettor showing idle speed adjusting points.

The cam-lever is connected by a link to the choke shaft lever to operate the choke valve. The cam-lever functions as a stop for the fast idle speed adjusting screw on the throttle shaft lever and thereby provides a fast idle speed adjustment when the choke cam-lever is operated when starting from cold.

A throttle idle positioning solenoid is located on the side of the carburettor main body so that the solenoid plunger contacts the throttle lever to provide an idle speed setting when the engine is running and the ignition is switched 'on'. When the ignition is turned 'off', the solenoid plunger retracts and the throttle valve is further closed to prevent engine 'run-on' or 'dieseling' when the engine is hot. The idling speed is adjusted by screwing the solenoid in the mounting bracket.

TO REMOVE AND INSTAL

- (1) Open the bonnet and fit covers to both front fenders.
- (2) Disconnect the hose to the PCV valve from the carburettor and the rear of the air cleaner body. Disconnect the hose to the oil filler cap from the air cleaner body.
- (3) Carefully separate the hot air tube from the exhaust stove on the exhaust manifold and disconnect the thermostatic valve vacuum hose at the inlet manifold.
- (4) Remove the nuts retaining the air cleaner to the carburettor and the bolt holding the air cleaner to the rocker cover. Remove the air cleaner from the vehicle.
- (5) Tag and disconnect the hoses to the carbon canister, EGR valve, and the PVS on the thermostat cover.
- (6) Disconnect the fuel delivery pipe from the union on the float chamber. Disconnect and remove the accelerator cable from the throttle lever and mounting bracket.
- (7) Disconnect and remove the choke cable from the carburettor.



Throttle lever side view of carburettor.

(8) Disconnect the kickdown cable on vehicles fitted with automatic transmission.

(9) Disconnect the electrical connection to the throttle positioning solenoid.

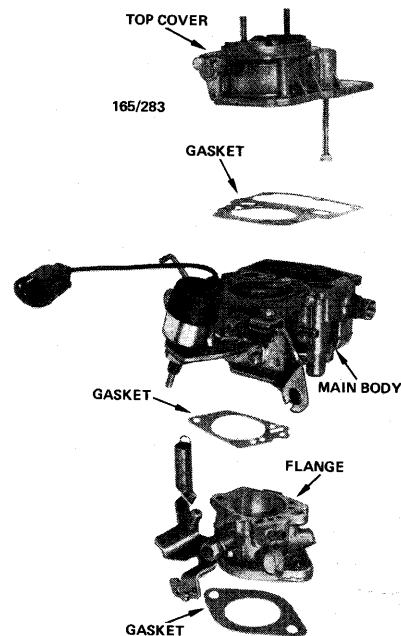
(10) Remove the nuts attaching the carburettor flange to the inlet manifold and lift off the carburettor. Remove and discard the flange gasket. Place a piece of clean rag over the inlet manifold to prevent the entry of dirt.

Installation is a reversal of the removal procedure with attention to the following points:

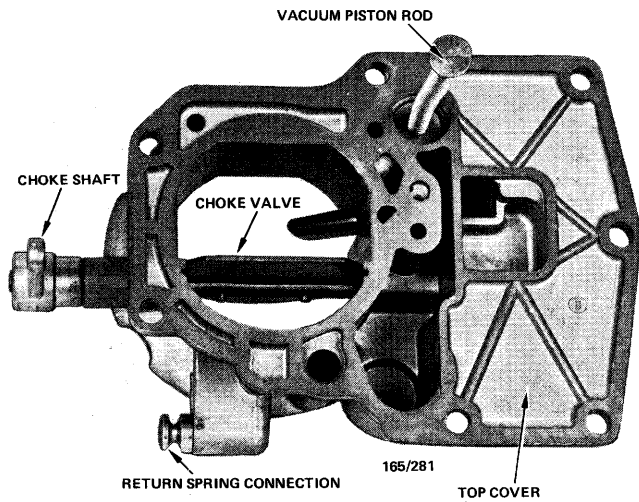
Use a new flange gasket and ensure that all traces of the old gasket are removed.

Ensure all pipes and hoses are correctly connected and all the connections are tight.

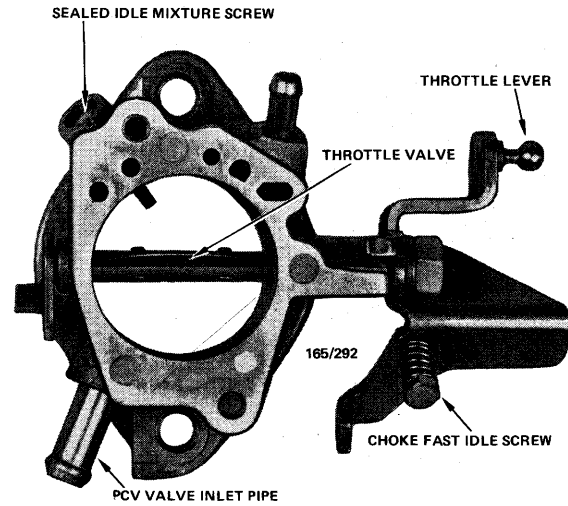
Check and reset the engine idle speed to Specifications if necessary.



Dismantled view of carburettor main components.



View of top cover removed from main body.



Carburettor flange and components.

TO DISMANTLE

(1) With the carburettor removed from the vehicle, remove the spring clip and disengage the link between choke cam lever and the choke spindle lever.

(2) Disconnect the throttle return spring and remove the screws retaining the top cover.

Lift the top cover from the main body and place it aside, do not allow the top cover to rest on the vacuum piston rod as it may be damaged.

(3) Unscrew the adjustment locknut and noting the number of turns required unscrew the throttle positioning solenoid out of its mounting bracket.

(4) Take out the screws attaching the main body to the throttle flange and separate the two assemblies.

TO SERVICE TOP COVER

The carburettor top cover which houses the choke valve and shaft assembly and the power valve vacuum piston normally requires very little attention.

Servicing the top cover consists of a clean up and blow through with compressed air, and the freeing off of any linkages which appear to be binding.

Any excessive wear or damage to the choke valve and shaft or vacuum piston will necessitate renewal of the top cover.

TO SERVICE THROTTLE FLANGE

Due to the close tolerances used by the manufacturers it would be impossible to reproduce the fit of the throttle valve shafts in the throttle flange. For this reason if any wear or damage is apparent in the throttle valve or shaft the complete throttle flange should be renewed.

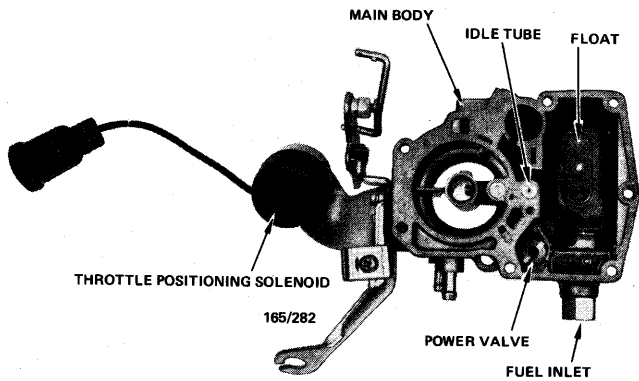
Servicing of the throttle flange consists of cleaning with a suitable solvent, and blowing out the fuel passages with compressed air. The throttle shaft should be checked for any evidence of binding and this should be rectified.

NOTE: The idle mixture screw is preset and sealed at the factory, it is therefore advisable not to remove the cover plug or the screw.

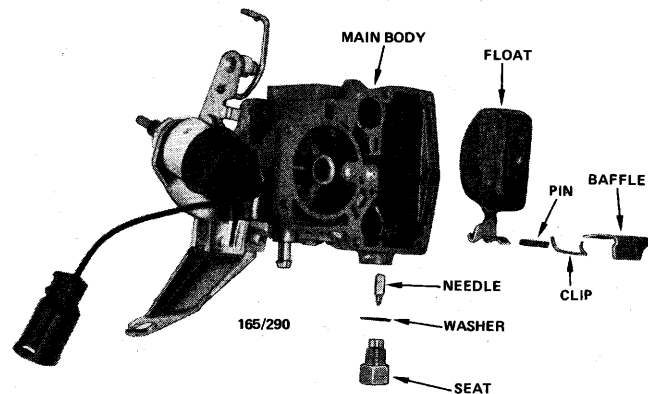
TO SERVICE MAIN BODY

It should not be necessary to remove the choke cam lever and bracket from the side of the main body unless the cam lever is excessively worn, in which case the complete main body assembly or carburettor should be renewed.

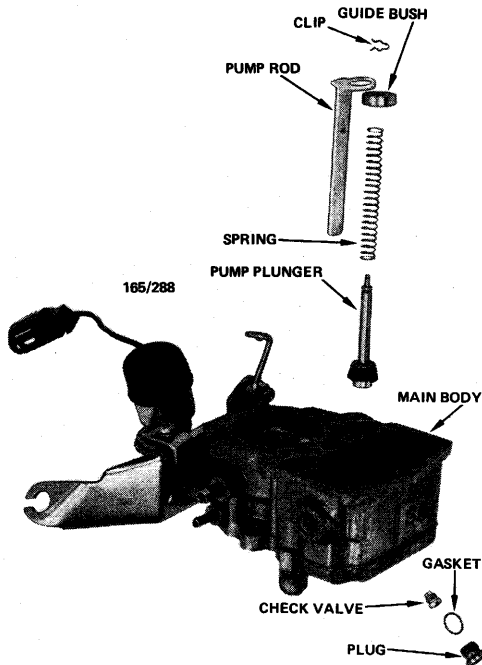
(1) Using a suitable spanner, unscrew and remove the float needle and seat, together with the seal washer from the side of the float chamber.



Top view of main body.



Main body with float components removed.



View of carburettor main body showing accelerator pump components.

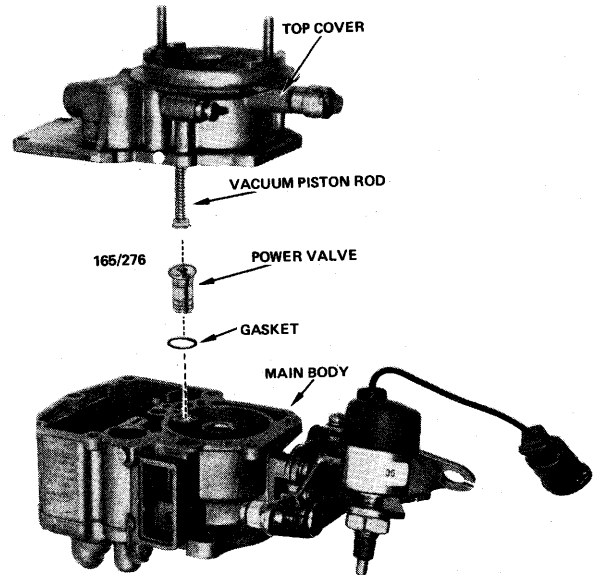
(2) Remove the baffle plate, extract the float pivot pin spring retainer and lift out the float and pin.

(3) Place a suitable screwdriver under the horizontal arm of the accelerator pump rod and prise the rod up to remove the spring retaining bush from the top of the accelerator pump bore in the main body.

(4) Withdraw the accelerator pump rod and plunger together with the top cover gasket from the main body. Remove the spring clip from the plunger and separate the pump rod, guide bush, spring and plunger from the gasket. Discard the gasket.

(5) Carefully withdraw the idle tube which is a push fit in the top centre of the main body.

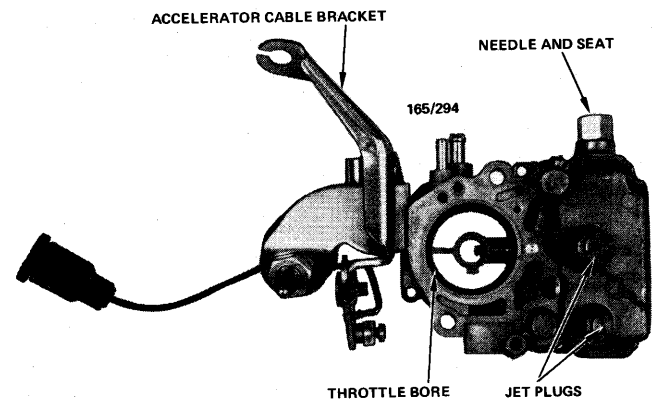
(6) Using a suitable screwdriver, unscrew and remove the power valve in the bottom of the float chamber, take care not to damage or bend the pin in the centre of the valve.



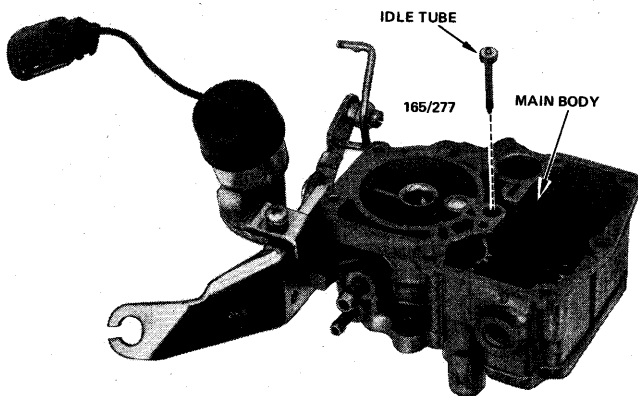
View of power valve components.

(7) Turn the carburettor main body over and unscrew and remove the two jet plugs and sealing washers from the bottom of the float chamber.

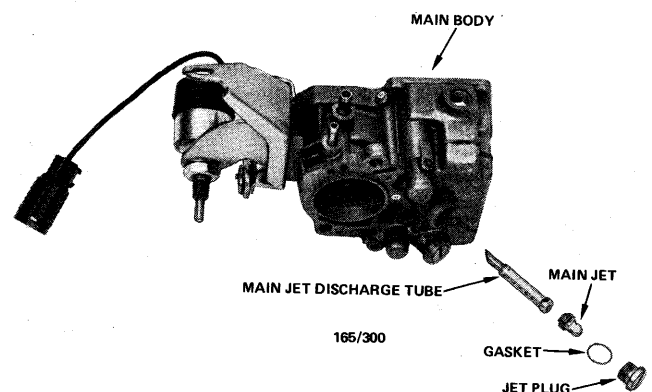
(8) Using a jet removal tool unscrew and remove both jets. The larger one is the main discharge jet and the smaller one the accelerator pump inlet check valve.



Underside view of main body with flange removed.



View of carburettor main body with idle tube removed.



View of main body with main jet components.

(9) Remove the retaining clip and fuel strainer gauze from the bottom of the accelerator pump bore.

(10) Now that the main body is dismantled wash all components in solvent and check for obvious signs of wear or damage. Renew doubtful parts.

NOTE: Use only compressed air to clear jets. Do not use wire or drills as jet orifices may become enlarged and poor fuel consumption or performance may result.

TO ASSEMBLE

Assembly is a reversal of the dismantling procedure with attention to the following points:

(1) Ensure all traces of old gaskets are removed and mating surfaces are not distorted.

(2) Always use a new gasket kit on reassembly.

(3) Do not apply any lubricant to the power valve vacuum piston.

(4) If the main jet discharge tube was removed ensure that its mitred face is parallel to the centre line of the venturi bore.

(5) When refitting the accelerator pump plunger to the main body ensure the leather cup is not creased. Lubricating the leather cup with clean engine oil and twisting on installation will help to eliminate damage or creases to the accelerator pump plunger. Instal the plunger spring and press the guide bush flush into the main body.

(6) After the accelerator pump components and the idle tube have been refitted then fit the new top cover gasket before fitting the pump rod and spring clip.

(7) Instal the carburettor on the vehicle and run the engine to operating temperature. Adjust the fuel level as described later.

With the fuel level adjusted, start the engine and check the idle speed with the throttle positioning solenoid activated. Reset the idle speed to Specifications if necessary.

ADJUSTMENTS

To Adjust Fuel Level

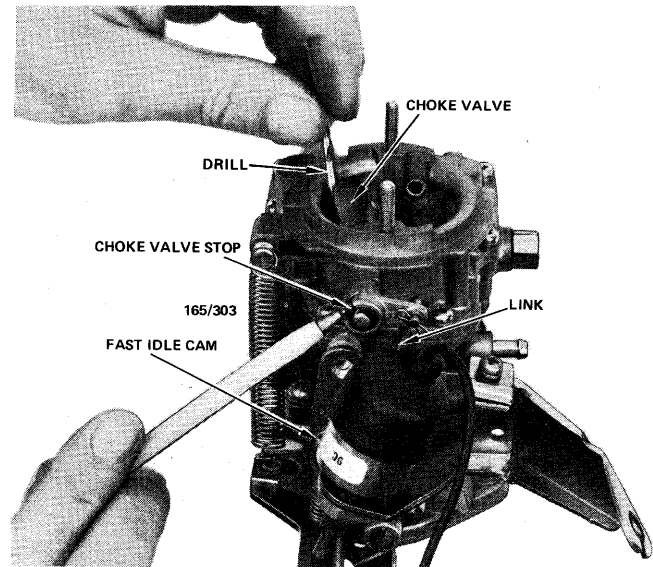
(1) The fuel level in the float chamber of the carburettor must be checked with the engine at operating temperature and the vehicle standing on a level floor. It is also important that the fuel pump pressure is accurate.

(2) With the engine stopped, remove the air cleaner and disconnect the choke control cable at the carburettor.

(3) Take out the retaining screws and remove the carburettor top cover.

(4) Using a suitable depth gauge, raise the gasket on the accelerator pump end of the float bowl and measure the distance from the gasket face of the bowl to the fuel level in the bowl. See Specifications for correct distance.

NOTE: This measurement must not be taken against the side wall of the bowl as the fuel



Use a drill shank of the appropriate size to measure the choke valve pull down.

has a tendency to climb the side wall of the bowl and this would give a false reading.

(5) If adjustment is necessary, reset by bending the lug on the float hinge. Bending the lug towards the float will raise the fuel level and bending it towards the needle valve will lower the fuel level.

(6) After adjustment is made, temporarily instal the top cover, start the engine, run at idle speed for a few minutes then remove the top cover and again check the fuel level.

(7) When the fuel level is satisfactory, instal the carburettor top cover and air cleaner.

To Adjust Choke Valve Pull Down.

(1) Remove the air cleaner from the carburettor and disconnect the choke cable.

(2) Operate the fast idle cam to close the choke valve.

(3) Hold the fast idle cam in the fully applied position and rotate the choke valve in the opening direction until it reaches its stop. Measure the clearance between the choke valve and the inner wall of the top cover and compare with Specifications.

(4) Adjust as necessary the clearance between the edge of the choke valve and the carburettor top cover to give the specified clearance. Adjustment is made by bending the link between the fast idle cam and the choke valve lever.

(5) Reconnect the choke cable and check its operation. Instal the air cleaner and reconnect the vacuum hose.

Idle Mixture

To comply with exhaust emission control regulations the idle mixture screw is sealed in the carburettor flange. The idle mixture has been set using a CO meter at manu-

facture to control the exhaust emissions and was sealed to prevent unauthorised adjustment.

To Adjust Fast Idle Speed

- (1) Remove the air cleaner from the carburettor and plug the vacuum pipe on the inlet manifold.
- (2) Connect up a tachometer and start and run the engine to normal operating temperature. Check that the curb idle speed is to Specifications.
- (3) Ensure the transmission is in neutral and that the choke pull down clearance is to Specifications.
- (4) Hold the choke valve in the open position and turn the fast idle cam in the choke closing direction until the linkage prevents further movement.
- (5) Check the engine fast idle speed and if necessary adjust to Specifications by turning the choke fast idle screw in the desired direction.
- (6) Instal the air cleaner and reconnect the vacuum hose.

3. AIR CLEANER

DESCRIPTION

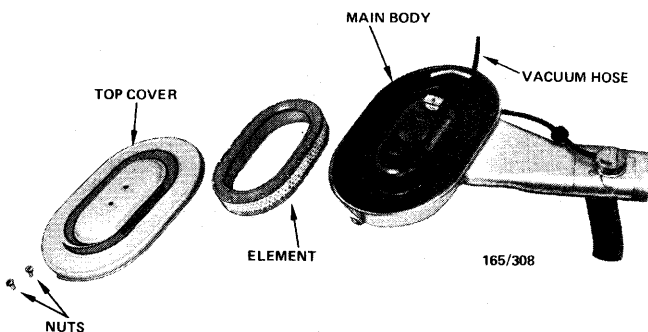
The air cleaner assembly contains a replaceable dry paper element. The cleaning and renewal operations are described in the Engine Tune-Up section .

The air cleaner intake houses the hot air intake system. This system is fully explained in the Emission Control section.

To avoid the possibility of dust from the element falling down the throat of the carburettor the throat of the carburettor should be covered with a cloth after the top cover is removed.

TO REMOVE AND INSTALL.

- (1) Disconnect the crankcase ventilation hose to the oil filler cap from the connection on the front of the air cleaner.
- (2) Disconnect the vacuum hose from the thermostatic valve at the inlet manifold.
- (3) Release the tube from the hot air stove on the exhaust manifold and remove the air cleaner retaining bolt from the rocker cover mounting bracket. Unclip the PCV valve hose from the rear of the air cleaner.



Dismantled view of air cleaner components.

(4) Remove the retaining nuts from the top cover. Lift off the top cover and place a piece of clean cloth in the throat of the carburettor.

(5) Lift the air cleaner assembly off the carburettor and place on a bench. Remove the gasket from the top cover of the carburettor and the cloth from the throat of the carburettor.

(6) Wipe all dust and dirt from the air cleaner body. Remove the spring clip and take out the crankcase ventilation filter pad.

(7) Wash the filter pad in solvent, allow to dry and refit the pad to the air cleaner body. Apply a few drops of oil to the filter pad.

(8) Tap the outer circumference of the element lightly on a bench to remove all dust and dirt.

Installation is a reversal of the removal procedure with attention to the following:

Place the gasket on the cover of the carburettor and fit the air cleaner main body. Connect all hoses and tubes to their respective fittings. Place the air cleaner element into the main body and fit the top cover to the air cleaner.

For testing the hot air intake system see the Emission Control Section.

4. FUEL PUMP

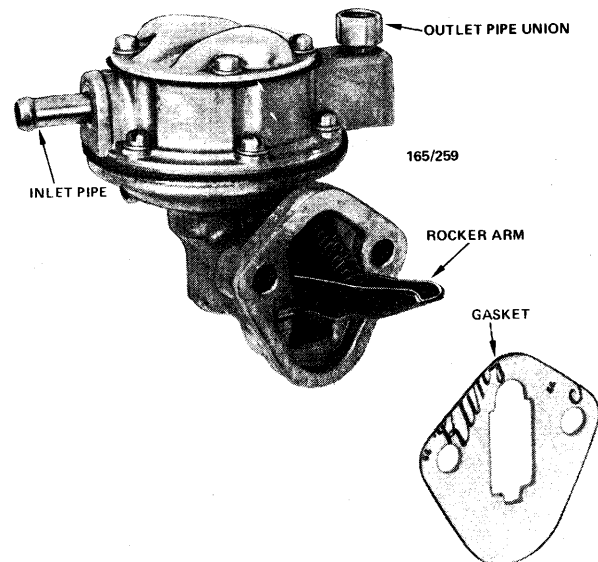
Speical Equipment Required:

To Test Pump Pressure — Pressure gauge

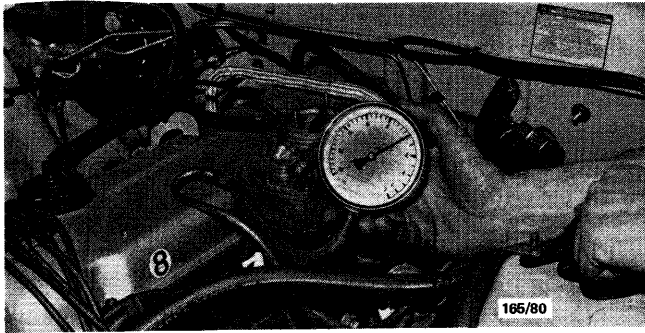
DESCRIPTION.

The fuel pump is a mechanically operated diaphragm type actuated by a lever driven from an eccentric on the camshaft. The pump is located on the left hand side of the engine.

The fuel pump is non-repairable and if faulty must be renewed.



Assembled view of the fuel pump.



Checking fuel pump delivery pressure.

TO REMOVE AND INSTAL

(1) Remove the inlet hose and outlet pipe from the pump.

(2) Loosen and remove the two mounting bolts and withdraw the pump assembly from the engine. Remove and discard the gasket.

Installation is a reversal of the removal procedure with attention to the following points:

Ensure that the mounting surfaces are clean and free from old gasket material.

Install the pump into position using a new gasket, making sure that the pump arm is correctly seated onto the cam.

Holding the pump firmly against its mounting, instal and firmly tighten the retaining bolts.

TO TEST PUMP

If the fuel pump is thought to be defective because incorrect supply of fuel to the carburettor, carry out the following tests before removing the fuel pump from the engine.

(1) Remove the air cleaner as previously described and instal a 'T' junction in the fuel line at the float chamber union, fit a pressure gauge at, or as near to the 'T' junction as possible.

(2) Start the engine and ensure that the fuel system is clear of trapped air, otherwise a false reading will result.

(3) With the engine running at idle, check the pressure reading on the gauge. This reading must be within Specifications.

(4) If the pressure reading is correct, stop the engine. Disconnect the pressure gauge and fit a length of hose to the 'T' junction. Insert the hose into a suitable container. Start and run the engine at 1200 rpm for one minute. Stop the engine and measure the amount of fuel in the container. This pump volume test must be also be to Specifications.

If the fuel pump is found to be defective it must be renewed.

5. ACCELERATOR CABLE

TO REMOVE AND INSTAL

(1) Raise the bonnet, fit covers to both front

fenders and remove the air cleaner as previously described.

(2) Slide the cable retaining clip off the accelerator cable and remove the cable from the throttle shaft ball socket.

(3) Compress the accelerator cable return spring and disengage the plastic sleeve from the lower end of the accelerator cable. Remove the sleeve and spring.

(4) Release the locknut and screw the adjusting sleeve down the threaded part of the outer cable until the cable can be withdrawn from the cable mounting bracket on the carburettor body.

(5) Remove the accelerator cable from the carburettor.

(6) Undo and remove the bolt retaining the accelerator cable to the bulkhead.

(7) Working inside the car, remove the plastic clip from the eye in the upper end of the accelerator pedal and feed the cable through the slot in the eye.

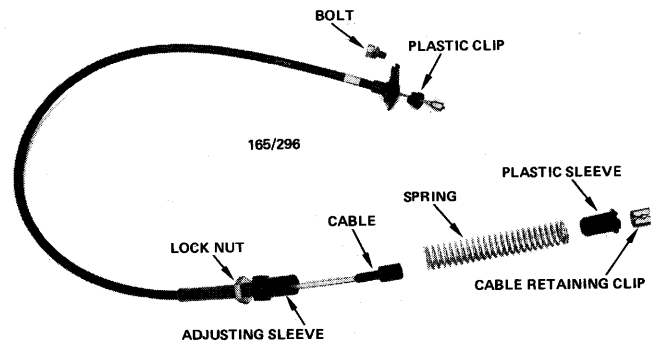
(8) Push the accelerator cable through the bulkhead and remove it from the engine compartment.

Installation is a reversal of the removal procedure with attention to the following points:

Ensure that the clip in the eye of the accelerator pedal is fully engaged.

Ensure the plastic sleeve on the carburettor end of the cable is correctly located on the cable and when fitted to the throttle lever the retaining clip and return spring are correctly seated.

Adjust the accelerator cable to obtain full throttle.



Dismantled view of accelerator cable components.

TO ADJUST.

(1) Remove the air cleaner as previously described.

(2) With the aid of a second operator fully depress the accelerator pedal. Loosen the locknut and adjust the cable by screwing the adjusting sleeve in or out to give full throttle at the carburettor. Tighten the locknut.

(3) Have the second operator release and reapply the accelerator pedal and ensure full travel is still being obtained at the throttle.

(4) Refit the air cleaner assembly.

6. FUEL TANK

TO REMOVE AND INSTAL

Sedan

(1) Raise and support the rear of the vehicle on chassis stands. Syphon the fuel from the tank into a suitable container.

(2) Working inside the luggage compartment fold back the floor mat and remove the screws retaining the tank sender unit cover plate.

(3) Carefully remove the multipin connector from the tank sender unit. Release the hose clips from the fuel delivery and breather hoses, pull the hoses off the tank sender unit.

(4) Working underneath the vehicle support the fuel tank. Remove the heat shield and remove the nuts retaining the tank support straps to the underside of the vehicle.

(5) Carefully lower the tank and disconnect the vapour hose. Lower the tank to the floor and remove it from under the vehicle.

Installation is a reversal of the removal procedure ensuring that all fuel pipe connections are securely tightened and leak free.

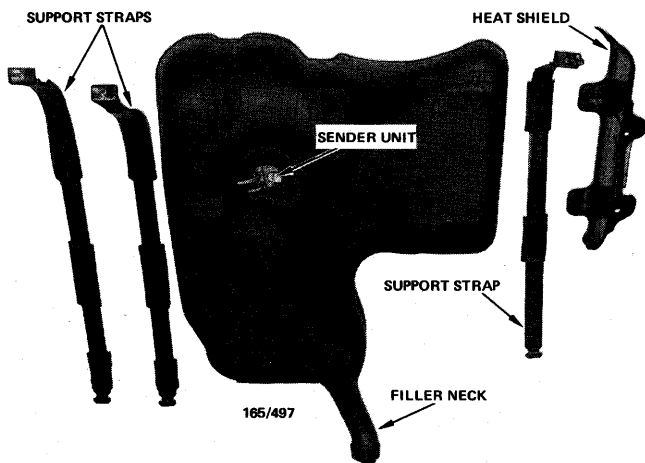
Station Wagon

(1) Syphon the fuel from the tank into a suitable container.

(2) Working inside the luggage compartment remove the floor mat and spare wheel.

(3) Carefully remove the multipin connector from the tank sender unit, release the hose clip and pull the fuel delivery hose off the tank unit pipe.

(4) Where fitted remove the trim panel covering the fuel filler neck. Loosen the hose clamps at the filler neck



View of fuel tank removed from the vehicle. Sedan model.

and tank then ease the hose out of the tank fuel filler and onto the filler neck.

(5) Mark and disconnect the tank venting hoses to the vapour separator and fuel filler neck at the tank connections.

(6) Remove the tank retaining bolts from the tank and lift the tank into the luggage compartment and then out of the vehicle.

Installation is a reversal of the removal procedure ensuring that all fuel pipe connections are securely tightened and leak free. Also check that all dust and water seals in the tank area are in good condition.

Utility and Van

(1) Syphon the fuel from the tank into a suitable container.

(2) Working inside the load area remove the inspection panels covering the filler neck and fuel tank.

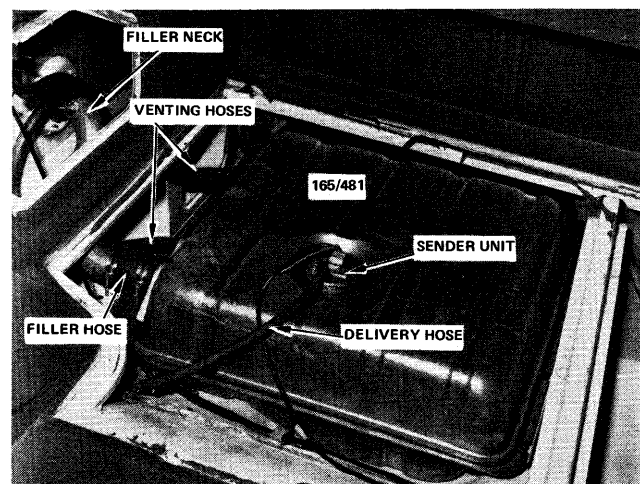
(3) Carefully remove the multipin connector from the tank sender unit, release the hose clip and pull the fuel delivery hose off the sender unit pipe.

(4) Remove the fuel filler cap and remove the screws retaining the fuel filler neck. Loosen the hose clamps at the tank and ease the fuel filler neck and hose out of the fuel tank inlet pipe.

(5) Mark and disconnect the tank venting hoses to the vapour separator and the fuel filler neck at the tank connections.

(6) Remove the tank retaining bolts from the tank and lift the tank up into the load area then out of the vehicle.

Installation is a reversal of the removal procedure ensuring that all fuel pipe connections are securely tightened and leak free. Also check that all dust and water seals in the tank area are in good condition.



Installed view of fuel tank. Utility and Van models.

CLUTCH

SPECIFICATIONS

Type	Single dry plate
Operation	Mechanical
Driven plate:	
Outside diameter	241.3 mm
Hub type	Spring cushion
Number of springs	6
Pressure plate type	Diaphragm
Clutch pedal height	178-182 mm
Clutch pedal free play	2.5-5.5 mm

TORQUE WRENCH SETTINGS

Pressure plate cover to flywheel bolts	28 Nm
Clutch housing to cylinder block bolts	61 Nm

1. CLUTCH TROUBLE SHOOTING

CLUTCH SLIPPING

- (1) Worn driven plate facings: Check and renew clutch driven plate.
- (2) Weak or broken pressure plate diaphragm spring: Check and renew pressure plate assembly.
- (3) Worn or scored pressure plate face: Check and renew pressure plate assembly.
- (4) Worn or scored flywheel face: Check and renew flywheel and ring gear.
- (5) Insufficient pedal free travel: Check and adjust the clutch pedal free travel.

NOTE: In most cases clutch slippage is first evident by a marked increase in engine revs for no apparent reason, when pulling up a steep hill. If the clutch pedal free play is correctly adjusted, clutch condition can be positively diagnosed as follows: With the hand-brake firmly applied, and with the road wheels chocked, place the transmission in top

gear and with the engine revving at approximately 1500 rpm, slowly release the clutch pedal. Clutch slippage is evident if the engine does not stall. Make the test as quickly as possible to prevent any further clutch damage.

CLUTCH SHUDDER

- (1) Oil on driven plate facings: Check and renew clutch driven plate. Check and rectify oil leak.
- (2) Loose or damaged driven plate hub: Check and renew clutch driven plate.
- (3) Loose driven plate facings: Renew clutch driven plate.
- (4) Cracked pressure plate face: Renew clutch pressure plate assembly.
- (5) Scored flywheel face: Renew or machine flywheel face.

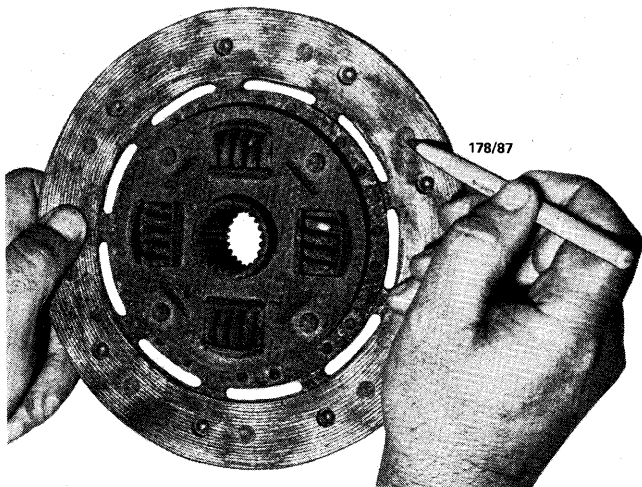
NOTE: Clutch shudder is usually most evident when reversing up an incline. As loose or damaged engine mountings can also cause clutch shudder, thoroughly check the engine mounting rubbers and mounting hardware for damage or looseness before removing the clutch for inspection.

CLUTCH GRAB

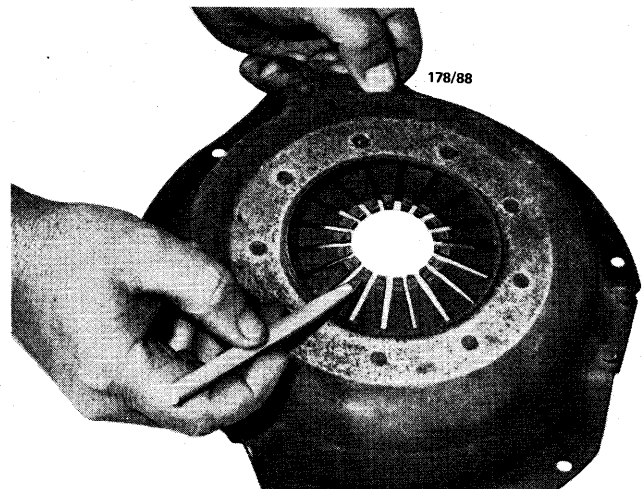
- (1) Oil on clutch driven plate: Renew clutch driven plate.
- (2) Fractured pressure plate face: Renew clutch pressure plate assembly.
- (3) Loose or broken engine mountings: Check and renew engine mountings as necessary.

INSUFFICIENT CLUTCH RELEASE

- (1) Clutch driven plate warped: Renew driven plate.
- (2) Clutch cable seized: Lubricate or renew clutch cable.
- (3) Clutch pedal seized: Lubricate or renew parts as required.



Renew the clutch driven plate if the friction material is worn down to or is within 0.3 mm of the rivets.



Check the clutch pressure plate diaphragm fingers for scoring or other damage.

RELEASE BEARING NOISE

(1) Dry or worn release bearing: Check and renew release bearing.

(2) Damaged pressure plate diaphragm spring: Check and renew clutch pressure plate assembly.

(3) Insufficient pedal free travel: Check and adjust pedal free travel.

NOTE: Lightly depress the clutch pedal with the engine running to check the release bearing. If the release bearing is faulty and has to be renewed, always check the other clutch components also.

2. DESCRIPTION

The clutch consists of a single dry driven plate assembly, splined to slide on the transmission input shaft. A diaphragm type pressure plate assembly is bolted to the engine flywheel.

The driven plate is sandwiched between the pressure plate and flywheel and transmits the drive from the engine to the transmission.

The release mechanism is activated by the clutch pedal via a clutch cable. The release mechanism consists of the release bearing, release lever and the diaphragm spring in the pressure plate assembly.

Operation of the clutch pedal moves the release lever which pushes the release bearing into contact with the diaphragm forcing the diaphragm centre towards the flywheel. When the outer edge of the diaphragm deflects, the clutch is caused to disengage.

Clutch pedal free play is adjusted at the clutch housing end of the clutch cable.

Clutch pedal height is adjusted at the pedal stop.

3. CLUTCH UNIT

Special Equipment Required:

To Instal — Clutch aligning tool

To Renew Spigot Bush — Suitable extractor

TO REMOVE

(1) Remove the transmission as described in the Manual Transmission section of this manual.

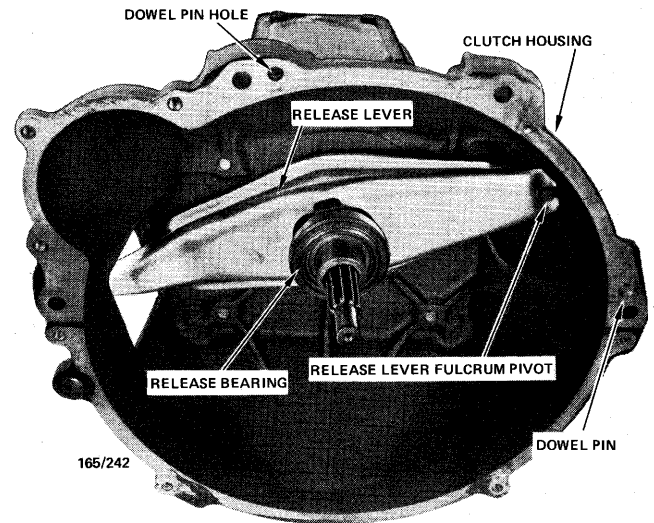
(2) Prise the dust excluder from the clutch housing, disconnect the clutch cable ball from the release lever and remove the clutch cable from the clutch housing.

(3) Disconnect the battery earth lead at the battery. Remove the starter motor cables and mounting bolts and remove the starter motor from the clutch housing.

(4) Disconnect the engine pipe support bracket at the clutch housing.

(5) Remove the bolts securing the clutch housing lower cover plate to the clutch housing and remove the cover plate.

(6) Remove the bolts that attach the clutch housing to the cylinder block and remove the housing and clutch release lever as a unit.



Clutch housing and components.

(7) Unscrew the three bolts securing the pressure plate assembly to the flywheel, slackening them off evenly to avoid distorting the pressure plate cover. Withdraw the pressure plate and cover assembly together with the clutch driven plate.

(8) If the clutch spigot bearing in the end of the crankshaft is to be renewed, use a suitable extractor to withdraw the bearing.

TO CHECK AND INSPECT

(1) Check that the driven plate facings are not glazed or gummed with oil.

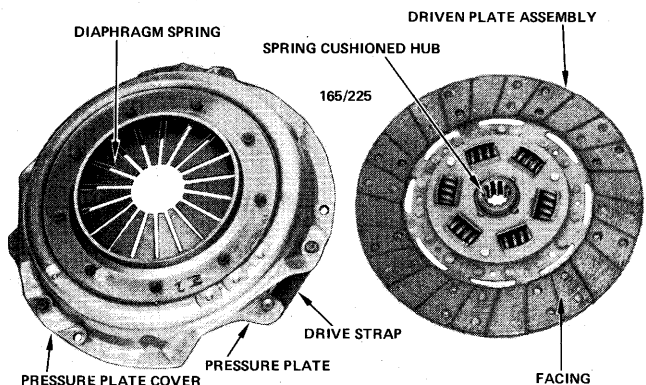
(2) If the driven plate facings are worn down to the rivets check the flywheel and pressure plate facings for scoring.

(3) Check the hub of the driven plate for wear.

(4) Check the pressure plate and flywheel for high spots, glazing and cracking.

(5) Check the diaphragm spring for bent, cracked or fatigued fingers.

(6) Check that the spigot bearing in the end of the crankshaft is in a serviceable condition.



Clutch pressure plate assembly and driven plate.

(7) Check the release bearing for noise or roughness. See Clutch Release Bearing Assembly part of this section for renewal procedure.

NOTE: When cleaning the clutch parts do not immerse the release bearing in cleaning fluid. This bearing is lubricated when assembled and requires no further lubrication in service.

TO INSTAL

Installation is a reversal of the removal procedure with particular attention to the following points:

Use a special aligning tool to align the centre of the driven plate hub with the spigot bearing in the rear end of the crankshaft.

NOTE: The raised side of the driven plate hub must face the pressure plate.

Tighten the three pressure plate securing bolts evenly and progressively to the specified torque.

Adjust the clutch cable after the transmission has been installed.

4. CLUTCH CABLE

TO REMOVE AND INSTAL

(1) Remove the cable clevis retaining clip from the clutch pedal, remove the clevis from the clutch pedal and separate the cable from the clevis.

(2) Pull the cable through the bulkhead into the engine compartment.

(3) Chock the front wheels, raise the rear of the vehicle and support on chassis stands.

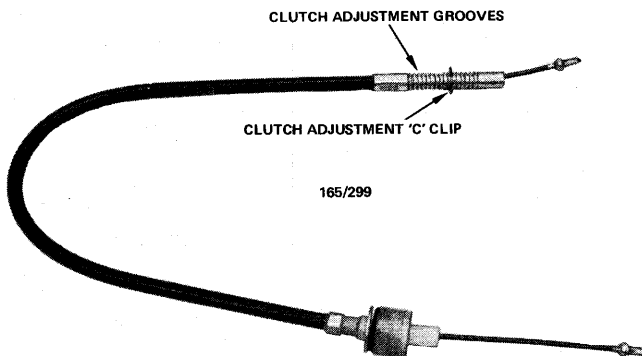
(4) Remove the 'C' clip retaining the cable to the clutch housing.

(5) Remove the dust excluder from the clutch housing and disconnect the cable from the release lever.

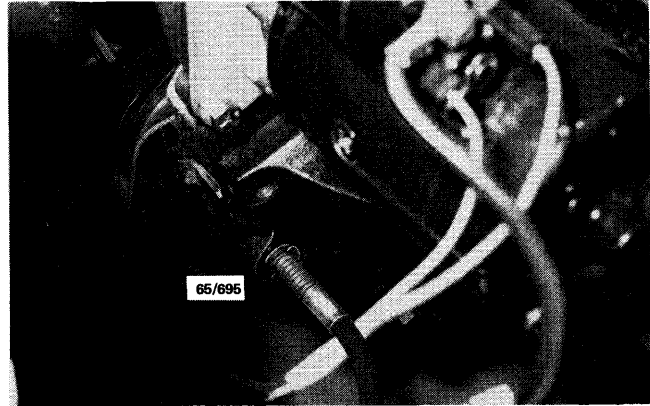
(6) Remove the cable from the vehicle by pulling forward from the clutch housing.

Installation is a reversal of the removal procedure with attention given to the following:

Adjust the clutch pedal free play as described under the following heading.



Clutch cable showing adjusting grooves.



View of clutch outer cable showing adjusting 'C' clip and adjustment grooves.

TO ADJUST

To adjust the cable and so adjust the clutch pedal free play, grasp the cable and pull firmly to lift the pedal to its stop and fit the 'C' clip in the groove which provides the correct free play adjustment.

NOTE: The correct free play adjustment measured between the 'C' clip and the clutch housing abutment must be 2.5-5.5 mm.

5. CLUTCH RELEASE BEARING ASSEMBLY

Special Equipment Required:

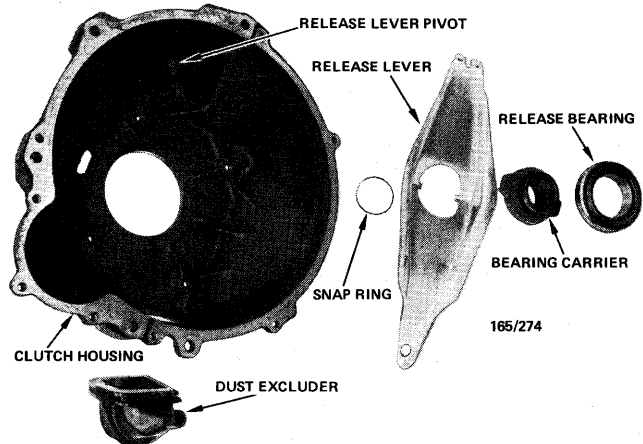
To Renew Bearing — Press, press plates

TO REMOVE AND INSTAL

(1) Remove the transmission as detailed in the Manual Transmission section.

(2) Remove the clutch housing as detailed in this section.

(3) Remove the clutch release lever from the clutch housing and remove the snap ring retaining the bearing and carrier assembly to the release lever. Separate the bearing and carrier assembly from the release lever.



Dismantled view of clutch release components.

(4) Place the release bearing in a press with the shoulders of the press plates retaining only the outer race of the release bearing. Using a piece of tubing, the exact outer diameter as that of the carrier centre, press the carrier through and out of the bearing.

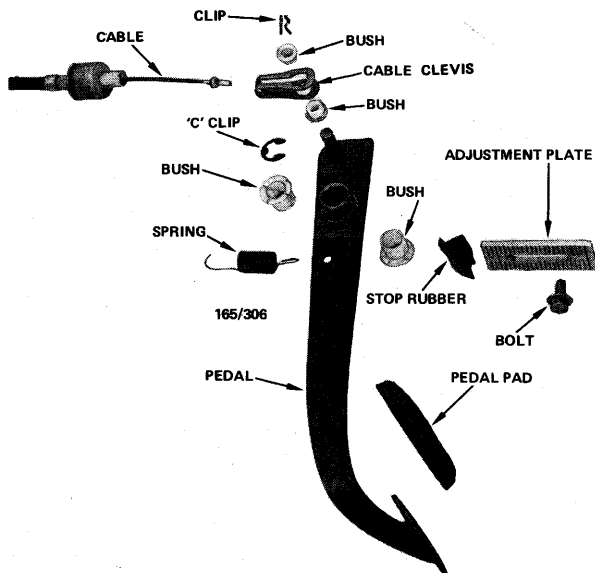
Installation is a reversal of the removal procedure with attention to the following points:

NOTE: Do not immerse the clutch bearing in any cleaning fluid. This bearing is prepacked with lubricant during assembly and requires no further lubrication.

Place the carrier into the press plates and centre the release bearing correctly on the carrier. Using a tubular drift and pressing on the bearing inner race press the bearing onto the carrier until the release bearing abuts the shoulder of the carrier.

Lightly lubricate all clutch release lever contact areas with grease.

Place the bearing and carrier assembly on the release lever and instal the snap ring.



Dismantled view of clutch pedal and associated components.

Instal the release lever by sliding the cable end of the release lever through the housing aperture and then locate the inner end of the release lever behind the pivot pin.

6. CLUTCH PEDAL

TO REMOVE AND INSTAL

- (1) Disconnect the clutch pedal spring.
- (2) Remove the cable clevis retaining clip from the clutch pedal and remove the clevis from the pedal.
- (3) Undo the clutch pedal height adjustment bolt and remove the adjustment plate.
- (4) Remove the 'C' clip retainer from the clutch pedal shaft pivot pin and remove the clutch pedal complete with bushes from the pedal support bracket. If necessary remove the bushes from the pedal.

Installation is a reversal of the removal procedure with attention to the following points:

Apply a light coat of grease to the pedal bushes and relocate the clutch pedal onto the pedal support bracket.

Instal the 'C' clip retainer and the clutch cable clevis retaining clip.

Adjust the clutch pedal height by undoing the bolt holding the pedal stop and sliding the adjustment plate until the pedal height is 178-182 mm. Tighten the pedal stop bolt.

Check and if necessary adjust the clutch pedal free play as outlined in the Clutch Cable part of this section.



Check and adjust clutch pedal height.

Refer to supplement
for more information.

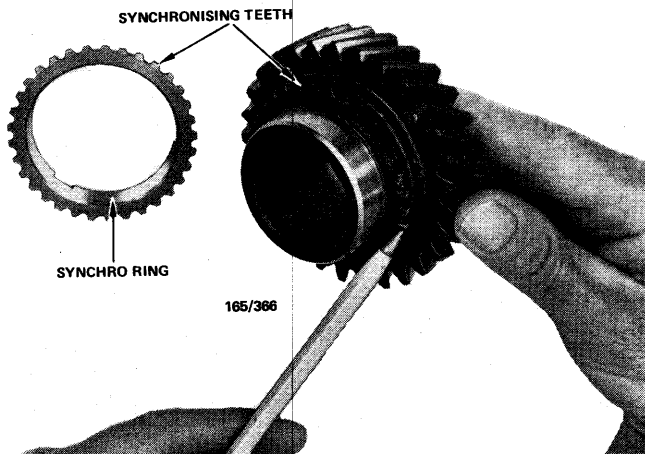
MANUAL TRANSMISSION

PART 1. MANUAL TRANSMISSION AND PROPELLER SHAFT TROUBLE SHOOTING

DIFFICULT GEAR CHANGE

- (1) Faulty clutch or clutch release mechanism: Check and overhaul clutch or release mechanism.
- (2) Worn selector mechanism: Check and renew faulty components in selector mechanism.
- (3) Faulty gear synchroniser mechanism: Overhaul transmission assembly.
- (4) Distorted transmission shaft splines: Renew worn or damaged components in transmission.

NOTE: First check the clutch for correct operation. If reverse gear can be selected without any sign of gear 'clash' this is a fairly good indication that the clutch is functioning normally. Also check that the correct type and viscosity oil is used in the transmission as this can also cause difficult gear changing.



Check the synchronising teeth on all gears and synchro rings for damage or wear.

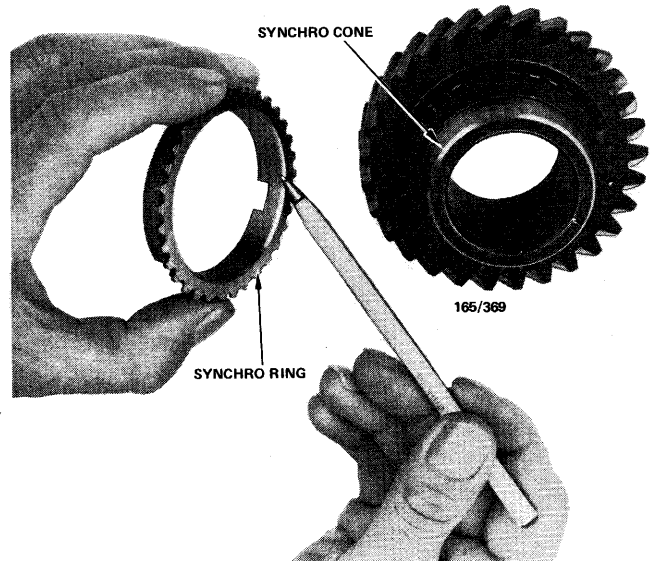
GEAR CLASH ON CHANGING DOWN

- (1) Faulty clutch or clutch release mechanism: Check and overhaul clutch or release mechanism.
- (2) Faulty synchro rings and cones: Check and overhaul transmission, renew components as required.
- (3) Broken or incorrect positioning of synchro shift plate retaining springs: Check and overhaul transmission, renew components as necessary.
- (4) Lubricating oil too heavy: Drain transmission case and refill with correct grade and quantity of oil.

NOTE: Here again check the clutch for correct operation as previously outlined before removing the transmission for dismantling and inspection. Also check that the correct type of transmission oil is being used.

SLIPPING OUT OF GEAR

- (1) Weak or broken detent spring: Renew detent spring.



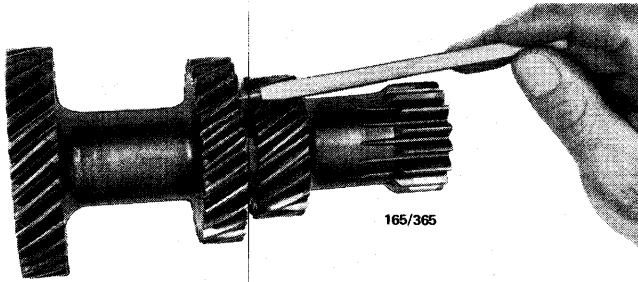
Check the friction surfaces of the synchro rings and cones for wear and damage.

- (2) Worn detent balls or interlock plungers: Renew components as necessary.
- (3) Worn or chipped synchro teeth: Check and overhaul transmission, renew components as required.
- (4) Excessive end float of laygear: Check and renew faulty laygear thrust washers.
- (5) Worn transmission front or rear bearings: Check and renew worn bearings.
- (6) Worn shift or selector mechanism: Check and renew faulty components.

NOTE: In most cases this condition is caused by wear or damage to components inside the transmission. However, check the engine mounting rubbers and mounting hardware as vibrations caused by deteriorated mountings can cause the transmission to slip out of gears.



Ensure that the selector bushes are not worn.



Check the teeth on all gears for wear or damage.

TRANSMISSION NOISE (IN NEUTRAL)

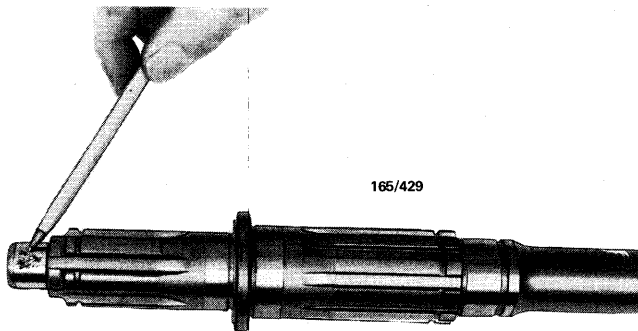
(1) Lack of sufficient lubricant: Fill transmission case with correct quantity and grade of lubricant.

(2) Worn transmission front bearing: Check and renew bearing.

(3) Chipped or pitted constant mesh gears or worn bearings (front drive gear, laygear, reverse idler gear or 1st, 2nd or 3rd mainshaft gears): Overhaul transmission and renew components as necessary.

(4) Excessive laygear end float: Check and renew laygear thrust washers.

(5) Worn mainshaft spigot bearing: Renew mainshaft spigot bearing and check all other bearings.



Check the mainshaft spigot for pitting.

NOTE: First check lubricant level in the transmission. To isolate transmission noise in neutral, run the engine, depress the clutch and engage any gear. If the noise ceases with the clutch depressed it is indicated that the noise is in the transmission.

TRANSMISSION NOISE (FORWARD GEARS ENGAGED, VEHICLE MOVING)

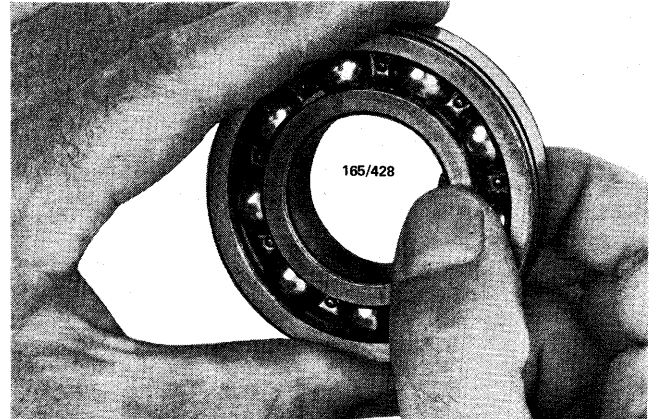
(1) Lack of sufficient lubricant: Fill transmission case with correct quantity and grade of lubricant.

(2) Worn front or rear ball bearings: Check and renew bearings.

(3) Chipped or pitted gears: Overhaul transmission and renew components as necessary.

(4) Excessive laygear end float: Check and renew laygear thrust washers.

(5) Worn laygear bearings: Overhaul transmission and renew components as required.



If the bearings are caged and cannot be checked visually, wash thoroughly in cleaning solvent, lightly oil and turn slowly by hand to check for roughness.

NOTE: Check the oil level in the transmission before dismantling the transmission.

PROPELLER SHAFT VIBRATION

(1) Bent propeller shaft: Renew propeller shaft as an assembly.

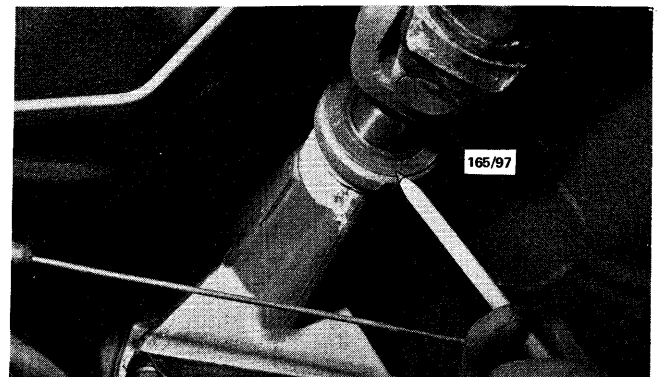
(2) Excessive wear in universal joint trunnion and bearings: Renew complete universal joint (trunnion and bearings).

(3) Propeller shaft out of balance: Balance or renew complete propeller shaft.

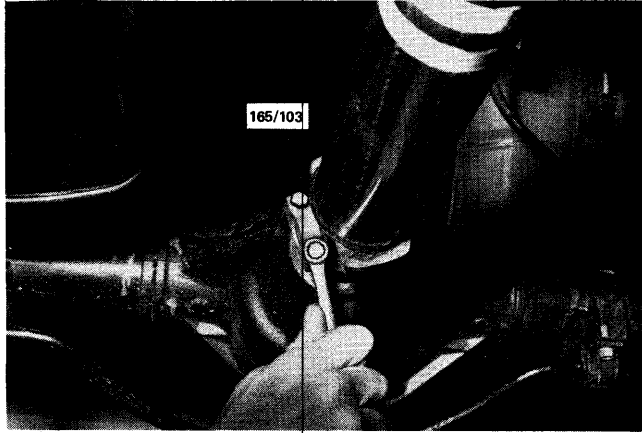
(4) Excessive wear of front joint sleeve in rear extension housing: Renew extension housing bush and sleeve.

(5) Rear universal joint to pinion flange bolts loose: Renew and tighten loose bolts.

NOTE: First check that all coupling bolts are tight. Check universal joints for wear by manual manipulation. It will be necessary to use a dial indicator gauge or pointer if propeller shaft run-out is suspected. Check that the propeller shaft is still carrying its balance weights.



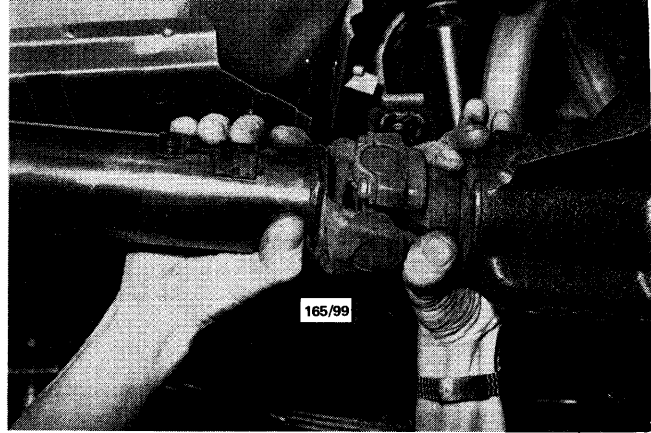
If the transmission oil level is low, check for cause of oil loss. The oil seal in the extension housing is a likely leak source.



Check that the universal joint to pinion flange bolts are tight.

EXCESSIVE PROPELLER SHAFT BACKLASH

- (1) Worn universal joint trunnion and bearings:
Renew joint trunnion and bearings as an assembly.
- (2) Worn mainshaft and universal joint sleeve:
Renew worn components.



Check the universal joints for wear by manipulation.

NOTE: Check the universal joints and the front universal joint splined sleeve for wear by manual manipulation. The test should be made with the transmission in neutral and with the rear of the vehicle clear of the floor so that the rear road wheels are free to turn.

PART 2. 3 SPEED TRANSMISSION

SPECIFICATIONS

Type	3 speed all forward synchromesh
Ratios:	
Third	1.00:1
Second	1.69:1
First	2.95:1
Reverse	3.67:1
First gear and float	0.15 - 0.48 mm
Second gear end float	0.15 - 0.48 mm
Laygear end float	0.15 - 0.40 mm
Mainshaft bearing end float	0.00 - 0.10 mm
Input shaft bearing end float	0.00 - 0.10 mm
Interlock sleeve lengths	32.817 - 32.868 mm, 32.943 - 32.994 mm, 33.071 - 33.132 mm
Input shaft and mainshaft bearing snap rings	Selective fit snap rings

TORQUE WRENCH SETTINGS

Transmission cover retaining bolts	16 Nm
Shift lever retaining nuts	34 Nm
Input shaft bearing retainer bolts	34 Nm
Extension housing to case bolts	75 Nm
Magnetic drain plug	34 Nm
Filler plug	34 Nm

1. DESCRIPTION

The three speed transmission has synchromesh on all forward gears.

The laygear is carried on three sets of needle roller bearings. Laygear end float is controlled by one large thrust washer at the front end and two smaller thrust washers at the rear end. A bronze bush is used in the reverse idler gear.

Mainshaft end float is controlled by the mainshaft ball bearing which is secured to the mainshaft and the gear case by snap rings.

The rear end of the mainshaft is splined to accommodate the internal splines of the front universal joint sleeve which runs in a bush in the rear end of the extension housing.

The input shaft ball bearing is a press fit on the shaft and is retained by a spacer washer and snap ring.

Oil seals are located in the input shaft bearing retainer and in the rear of the extension housing.

Gear selection is by column shift lever and linkage.

2. TRANSMISSION ASSEMBLY

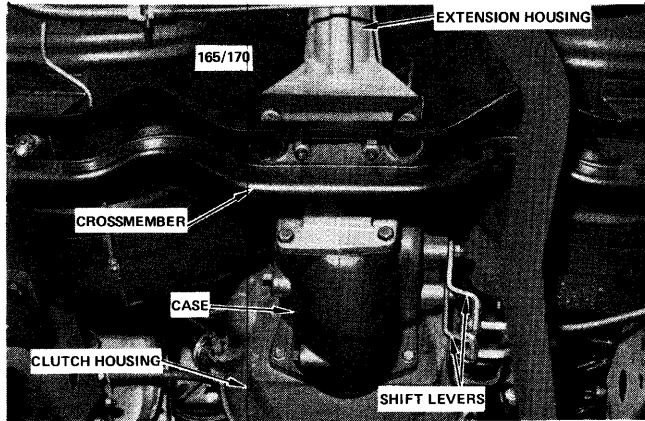
Special Equipment Required:

To Dismantle — Dummy layshaft, press and press plates

To Assemble — Dummy layshaft, press and press plates

TO REMOVE AND INSTAL

- (1) Raise the vehicle and support on chassis stands. Remove the transmission drain plug and allow the oil to drain into a suitable container. Instal the transmission drain plug.



Installed view of transmission assembly.

NOTE: If the transmission is not to be dismantled upon removal, then there is no need to drain the lubricant. Instead insert a suitable plug into the rear of the transmission extension housing after the propeller shaft is removed.

(2) Disconnect the rear universal joint at the rear axle pinion flange, withdraw the propeller shaft front joint sleeve out of the transmission rear extension housing and remove the propeller shaft from the vehicle.

(3) Remove the bolt and withdraw the speedometer drive unit from the extension housing. Disconnect the wires from the reverse lamp switch and remove the two gear shift levers on the right side of the transmission case.

(4) Remove the two bolts attaching the rear mounting to the transmission extension housing. Position a jack under the transmission and take the weight off the rear mounting.

(5) Remove the split pin, nut and bolt securing each end of the crossmember to the underframe, and withdraw the crossmember from the underframe.

(6) Remove the nut and disconnect the handbrake cable and equaliser from the handbrake adjuster.

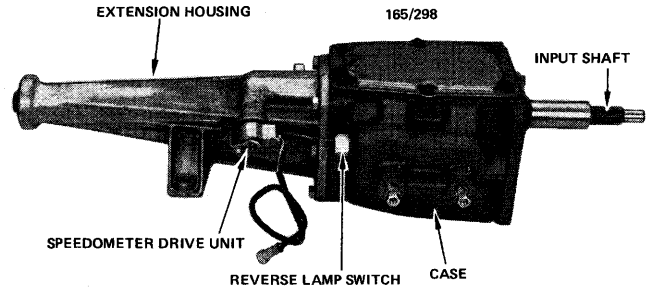
(7) Support the rear of the engine and remove the jack from under the transmission. Remove the bolts securing the transmission and draw it rearwards to clear the clutch assembly. Withdraw the transmission from the vehicle.

NOTE: Do not allow the weight of the transmission to be supported by the clutch driven plate or damage to the driven plate will result.

Installation is reversal of the removal procedure with attention to the following points:

(1) Ensure the face of the transmission and the corresponding face of the clutch housing are clean and free from burrs and paint.

(2) Where available instal guide pins in the two lower holes in the clutch housing. Position the transmission on the rear of the clutch housing. Push the transmission forward into the clutch housing until the face of the transmission contacts the clutch housing.



Right hand side view of transmission assembly.

NOTE: If the transmission will not slide forward freely, turn the input shaft to align the clutch driven plate splines with those on the transmission input shaft.

(3) Instal the top transmission mounting bolts and remove the guide pins.

(4) Torque all bolts to Specifications.

(5) Refill the transmission with the specified lubricant.

(6) Carry out any adjustments necessary to the clutch and handbrake cables as described in the appropriate sections.

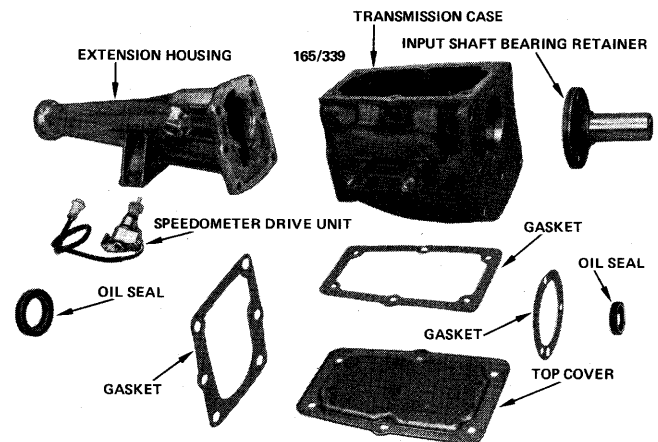
TO DISMANTLE

(1) With the transmission removed from the vehicle and the lubricating oil drained, remove the bolts securing the top cover, lift off the top cover and gasket.

(2) Remove the extension housing retaining bolts. Push forward on the end of the mainshaft and tap the side of the extension housing to break the seal to the gear case. Withdraw the extension housing from the gear case and discard the gasket.

(3) Turn the mainshaft until the groove in the bore of the speedometer drive gear is to the top, depress the clip, withdraw the drive gear and then lift the clip from the mainshaft.

(4) Tap out and remove the retaining plate from the grooves in the rear end of the layshaft and reverse



Dismantled view of transmission case components.

idler shaft.

(5) Using a dummy layshaft the exact length of the laygear, tap the layshaft out towards the rear of the gear case and using a suitable hook, lower the laygear to the bottom of the gear case.

(6) Take out the bolts and remove the input shaft bearing retainer from the front of the gear case. Remove and discard the gasket.

(7) Using a thin punch carefully tap out the input shaft. Ensure none of the 15 mainshaft spigot bearing rollers are lost.

(8) Remove the top gear synchroniser ring from the front of the mainshaft.

(9) Carefully turn the gear case upside down so that the top cover face rests firmly on the bench. Using a suitable pin punch drive out the tapered pins retaining the gearshift cam and shaft assemblies.

NOTE: These pins will only come out when driven towards the top of the gear case.

(10) Turn the gear case over and push both cam and shaft assemblies away from the mainshaft and against the inner wall of the gear case.

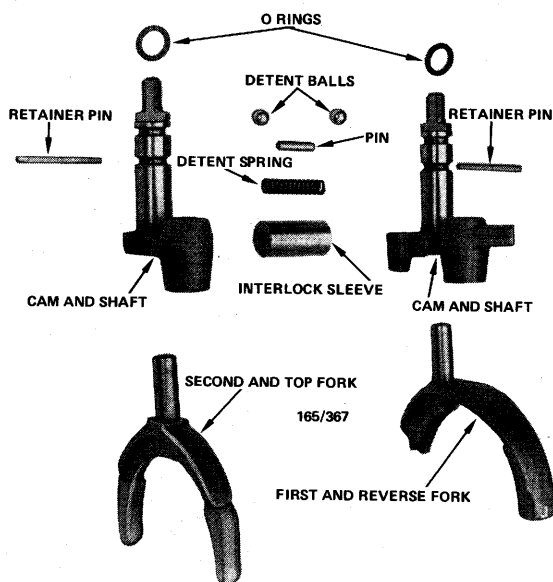
(11) Tap the mainshaft slightly to the rear and remove the snap ring from the groove in the mainshaft bearing outer race.

(12) Tap the mainshaft forward until the mainshaft bearing is inside the gear case. Move the mainshaft aside and slide the second and top gear synchroniser sleeve into the top gear position.

(13) Withdraw the second and top gear selector fork out of the cam assembly.

(14) With the mainshaft held away from the first and reverse selector fork, push the first gear synchroniser into the reverse gear position and move the first and reverse gear cam to the first gear position.

Manoeuvre the first and reverse gear selector fork out of the cam and remove it from the gear case.



Dismantled view of gear shift cam and fork components.

(15) Slide the second and top gear synchroniser sleeve into the second gear position. Tilt the mainshaft upward at the forward end and remove it through the opening in the top of the gear case.

(16) Using a punch carefully tap the reverse idler shaft into the gear case from the rear of the gear case. Lift out the reverse idler gear, idler gear shaft, laygear and thrust washers from the bottom of the gear case.

NOTE: Check the positions of both gears for reassembly and note there are two thrust washers on the small end of the laygear and the larger boss of the idler gear is to the front.

(17) To remove the shift cams, pull the second and top speed cam and shaft towards the centre of the gear case, remove the detent ball, spring and interlock pin and withdraw the cam and shaft assembly.

(18) Withdraw the interlock sleeve and the second detent ball. Pull the first and reverse cam and shaft towards the centre of the gear case and withdraw the cam and shaft from the gear case.

(19) The 'O' ring seals on the shafts may now be renewed if they are worn.

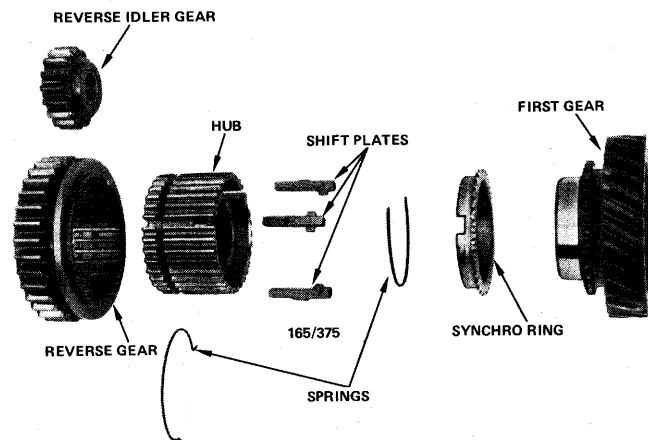
(20) Mark the second and top gear synchroniser assembly hub in relation to the splines on the mainshaft. Remove the snap ring from the forward end of the mainshaft and withdraw the synchroniser assembly, second gear synchroniser ring and second gear from the forward end of the mainshaft.

(21) Mark the second and top gear synchroniser sleeve position in relation to the hub outer splines, release the two synchroniser springs and slide the sleeve off the hub. Collect the three shift plates.

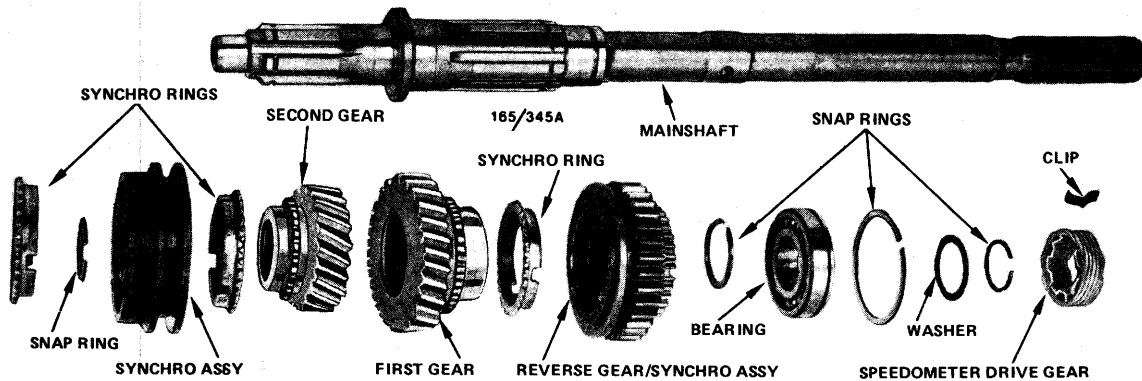
(22) Remove the snap ring and spacer washer from the mainshaft. Position the mainshaft in a press and press off the rear bearing.

NOTE: It is good policy to renew the bearing once it is pressed off the shaft as it is highly probable that the bearing will be damaged during the removal process.

(23) Mark the first gear synchroniser hub in rela-



View of first and reverse gear components.



Dismantled view of mainshaft components.

tion to the splines on the mainshaft and remove the snap ring from the mainshaft. Slide the first speed synchroniser and reverse gear assembly off the mainshaft followed by the synchroniser ring and the first speed gear.

(24) Mark the first gear synchroniser sleeve position in relation to the hub outer splines and remove the synchroniser spring on each side of the assembly. Push the sliding gear/sleeve off the hub and collect the three shift plates.

(25) If the input shaft bearing is to be renewed remove the snap ring and spacer from the input shaft. Position the input shaft in a press and press off the bearing. Remove the oil slinger from the input shaft.

NOTE: The bearing will be damaged in the removal process and therefore will have to be renewed.

(26) Slide the dummy layshaft out of the laygear together with the needle roller bearings, spacer washers and spacer tube.

(27) If necessary remove the oil seals from the input shaft bearing retainer and the extension housing.

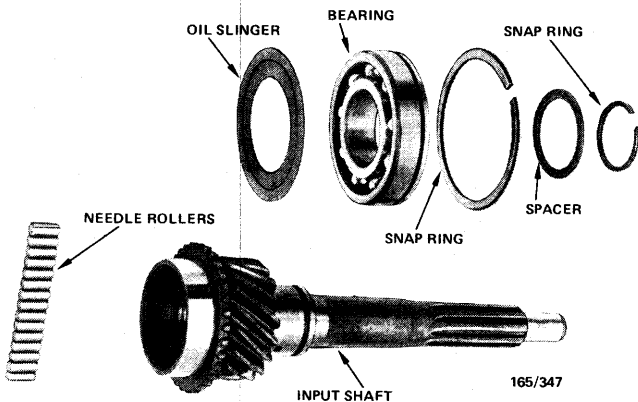
NOTE: The extension housing oil seal can also be renewed without removing the transmission assembly from the vehicle.

TO CHECK AND INSPECT

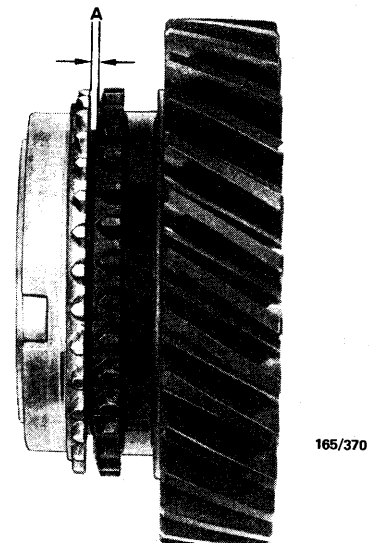
- (1) Clean all components in cleaning solvent and allow to dry.
- (2) Lightly oil the input shaft and mainshaft ball bearing races and check for roughness or excessive side play.

NOTE: If the bearing has been removed from the input shaft it should be renewed.

- (3) Check the teeth on all gears for wear, pitting or burrs on the ends of the teeth, particularly the reverse sliding and the reverse idler gear.
- (4) Check the needle rollers of the laygear bearings and mainshaft spigot for wear or pitting.
- (5) Check the layshaft bore and the mainshaft spigot for pitting.
- (6) Check the laygear thrust washers for wear.
- (7) Inspect the synchroniser rings for widened slots, rounded teeth or smooth internal surface.



Dismantled view of input shaft components.



Measure the distance between each synchro ring and the respective gear. Distance 'A' must be greater than 0.25 mm.

(8) Place each synchro ring on its respective gear cone and measure the distance between the synchroniser ring and the gear. This distance must be greater than 0.25 mm.

(9) Check the detent grooves on each cam and shaft assembly for wear, renew assemblies if necessary. Check the free length of the detent spring by comparison with a new spring.

(10) Renew all gaskets and oil seals that have been removed and lubricate components on reassembly. Renew all damaged or worn components as necessary.

TO ASSEMBLE

Assembly is a reversal of the dismantling procedure with attention to the following points:

(1) If the shift cam and shafts have been removed for 'O' ring renewal these should be fitted as follows:

(a) Smear one detent ball with grease, insert it into the interlock sleeve and instal the assembly into the gear case.

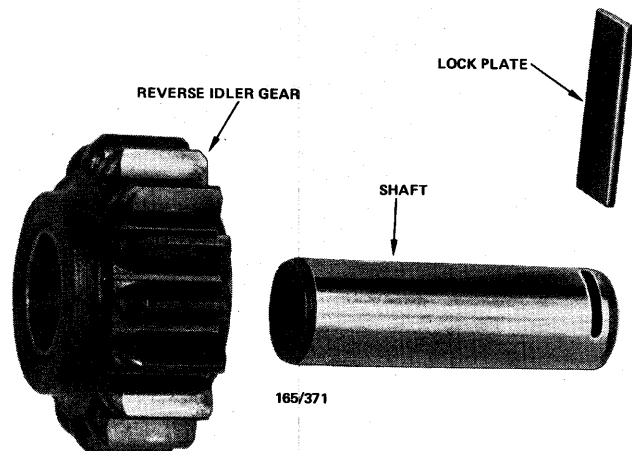
(b) Lubricate the shaft and instal the first and reverse shift cam and shaft so that the detent ball is resting in the neutral (centre) groove of the cam.

(c) Lubricate the second and top speed cam and shaft. Enter the shaft in the bore from the inside of the gear case and instal the interlock pin and detent spring followed by the second detent ball.

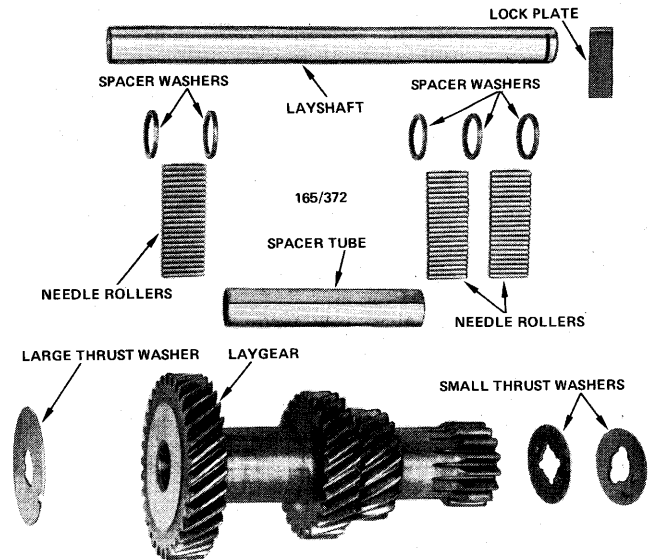
(d) Push the second installed ball against the spring and rotate the second and top speed cam into the top gear position so that the extended notch of the cam retains the ball against the spring.

NOTE: The interlock sleeve is a selective fit and axial free movement must be within the limits of 0.05 to 0.25 mm. Three sizes of interlock sleeve are available to enable the specified free movement to be obtained.

(2) Lubricate the bronze bush and instal the reverse idler gear into the gear case with the chamfered ends of the teeth forward and drift the reverse idler gear shaft in



View of reverse idler gear and shaft removed from transmission.



Dismantled view of laygear components.

from the rear of the gear case. The retaining groove in the end of the shaft must face squarely towards the bore of the layshaft.

(3) Instal the layshaft spacer tube and two spacer washers on the dummy layshaft. Apply a thin layer of grease to the bore of the laygear and fit the dummy layshaft and spacers into the bore of the laygear.

(4) Instal one lot of 22 needle rollers in the front end of the laygear and position a spacer washer to abut the ends of the rollers.

(5) Instal two lots of 22 needle rollers in the rear end of the laygear, with one spacer washer interposed between the two bearings and a second spacer to abut the ends of the rear bearing rollers.

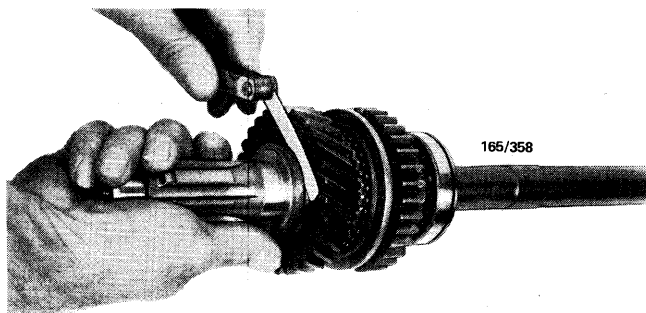
(6) Position the large laygear thrust washer on the front boss in the gear case, locating the lug on the washer in the slot in the case and adhere it to the gear case with grease.

(7) Locate the small steel thrust washer in a similar manner on the rear end of the laygear, locating the lug on the washer in the end of the gear. Position the small bronze thrust washer on the boss at the rear of the gear case locating its lug in the slot and retaining it with grease.

(8) Carefully place the laygear assembly into the bottom of the gear case ensuring that the thrust washers are not dislodged in the process.

(9) Lubricate the components of the first gear synchroniser and reverse gear assembly and instal the sleeve on the synchroniser hub according to the marks made on dismantling. If correctly assembled the selector fork groove on the sleeve and the groove in the synchroniser hub will be at opposite sides.

(10) Instal the three shift plates in the slots in the hub so that the heads of the plates will be to the cone or forward end of the synchroniser hub. Fit a synchroniser spring under the ends of the shift plates on each side of the hub. Fit the rear or white painted spring in the spring



Checking first gear end float.

groove in the hub. The hooked end of each spring must locate in the same shift plate with the tail of the spring running in opposite directions as viewed from the end of the assembly.

NOTE: The synchroniser springs for the first speed synchroniser are not interchangeable. The rear spring is painted white for identification.

(11) Lubricate the bore of the first gear and place it in position over the rear end of the mainshaft to abut the shoulder of the shaft. Place the first gear synchroniser ring over the cone on the gear.

(12) Lubricate the first gear synchroniser assembly hub inner splines and the splines on the mainshaft and instal the assembly on the mainshaft so that the shift groove in the sleeve and the recessed end of the hub face the first gear and synchroniser ring. Ensure that the shift plates engage the slots in the synchroniser ring.

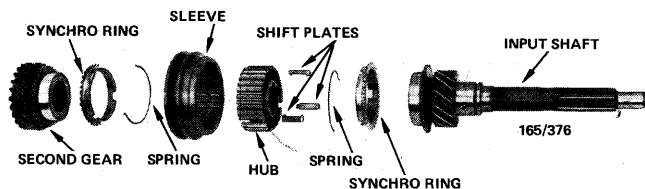
(13) Select and instal a snap ring which will keep the first gear end float within the specified limits, see Specifications.

(14) Press the bearing onto the mainshaft by pressing on the bearing inner track. Instal the spacer and a selective fit snap ring so that the bearing end float will be kept to a minimum, see Specifications.

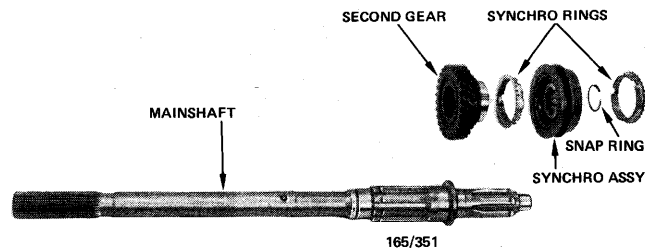
NOTE: The bearing snap ring groove must face the rear of the mainshaft when the bearing is installed.

(15) Lubricate the components of the second and top gear synchroniser assembly and instal the synchroniser sleeve on the hub so that the splines are mating according to the marks made on dismantling. If the components are assembled correctly the offset of both the sleeve and the hub centre will be on the same side.

(16) Slide the sleeve on the hub and instal the three synchroniser shift plates in the hub grooves. Fit a



View of transmission input shaft, second speed gear and second and top speed synchroniser components.



View of second gear and second and top speed synchroniser components removed from mainshaft.

synchroniser spring under the ends of the shift plates on each side of the hub so that the hooked end of each spring locates in the same plate, but the tails of the springs run in opposite directions as viewed from the end of the assembly.

(17) Lubricate the bore of the second gear and instal it on the mainshaft with the plain side of the gear abutting the shoulder on the shaft. Place the second speed synchroniser ring on the gear cone.

(18) Lubricate the second and top gear synchroniser assembly hub inner splines and the splines on the forward end of the mainshaft and instal the assembly on the mainshaft so that the offset sides of the sleeve and the hub centre face the spigot end of the mainshaft.

(19) Instal a new snap ring in the groove in the end of the mainshaft to retain the synchroniser assembly. Ensure that the snap ring locates correctly in its groove.

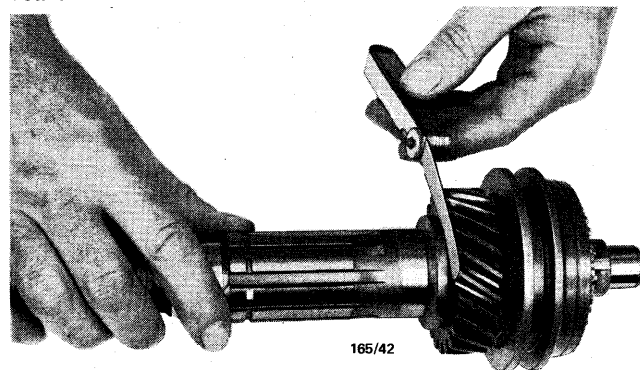
(20) Check the end float between the face of the second speed gear and the shoulder on the mainshaft. This clearance must be within the limits of Specifications.

(21) Move the second and top speed synchro sleeve to the second gear position and the first gear synchro sleeve to the first gear position.

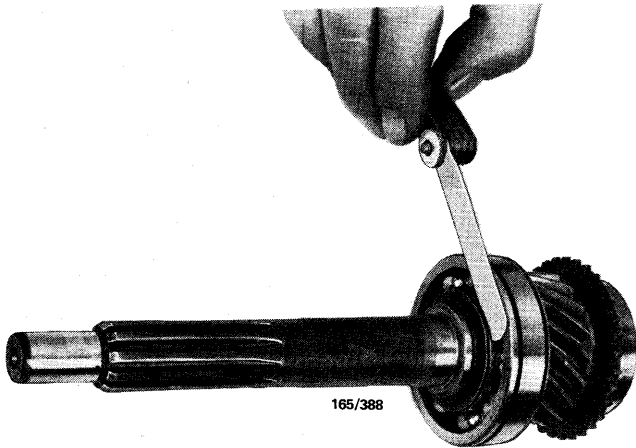
(22) Push both shift cam and shaft assemblies against the inner wall of the gear case and fit the mainshaft into the gear case so that the bearing and the mainshaft gears are inside the case.

(23) Set the shift cams so that top gear is selected and the first and reverse cam is in neutral.

(24) Move the mainshaft assembly away from the cam assemblies. Instal the first and reverse shift fork into the first and reverse shift cam ensuring the offset is to the rear.



Checking second gear end float.



Checking input shaft bearing end float.

(25) Instal the second and top gear shift fork into the second and top gear shift cam ensuring the "T" marking is to the top.

(26) Move the mainshaft and synchroniser sleeves to align with the shift forks and fit the shift forks into their respective synchronisers.

(27) Push the shift cams in toward the mainshaft until the retaining pin grooves in the cams align with the holes in the gear case. Coat each pin with sealer to prevent oil seepage and fit the cam retaining pins from the top of the gear case.

(28) Place the mainshaft bearing in its bore in the gear case and tap the mainshaft until the outer bearing retaining snap ring can be fitted to the bearing. Tap the mainshaft forward until the snap ring is firmly located against the rear face of the gear case.

(29) If a new bearing is to be fitted to the input shaft, position the oil slinger with the raised dot towards the gear. Press the bearing onto the input shaft by pressing on the bearing inner track.

(30) Instal a suitable spacer washer and snap ring to maintain the specified end float. Ensure that the snap ring locates correctly in the groove in the shaft and that the snap ring groove in the bearing outer race is to the front. Instal the snap ring to the groove in the outer race.

(31) Apply a thin layer of grease to the mainshaft spigot bearing bore in the back of the input shaft. Place the 15 needle rollers in the spigot bearing bore.

(32) Place the top gear synchroniser ring into its position in the top gear synchroniser assembly.

(33) Fit the input shaft into the front of the gear case taking care not to dislodge the needle rollers when entering the mainshaft spigot into the spigot bearing. Tap the front of the input shaft with a soft faced hammer until the front bearing outer snap ring is firmly located against the front face of the gear case.

(34) Instal a new oil seal in the input shaft bearing retainer. Position a new bearing retainer gasket on the front face of the gear case ensuring that the oil drain hole in the case aligns with the slot in the gasket. Place the bearing retainer on the gasket, again ensuring that the drain slot in the retainer also aligns with the hole in the

case. Instal the retaining bolts and tighten to the specified torque.

(35) Carefully turn the transmission assembly upside down to roll the laygear into mesh with the input shaft and mainshaft gears. Enter the layshaft from the rear of the case, carefully tap it forward to engage the thrust washers and laygear needle roller bearings and to displace the dummy layshaft from the gear case.

NOTE: Extreme care should be exercised during the foregoing operation to avoid displacing the laygear thrust washers and needle rollers.

(36) When the layshaft is in position, instal the lockplate in the slots in the reverse idler gear shaft and the layshaft. Tap both shafts forward to position the lockplate against the rear face of the gear case.

(37) Turn the mainshaft so that the speedometer drive gear clip slot is uppermost. Place the clip into the slot and slide the gear over the clip. The clip retaining lug should hold the gear firmly in place.

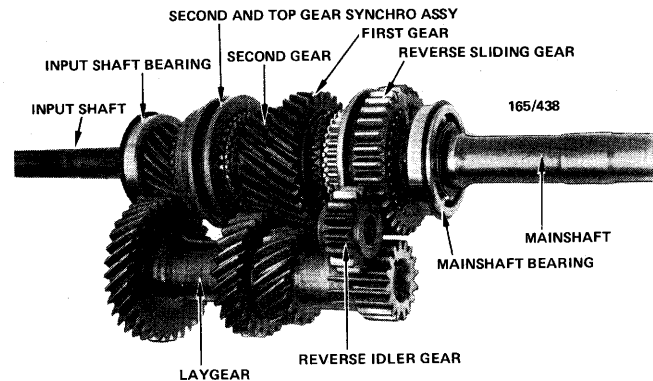
(38) Prior to installing a new oil seal in the rear end of the extension housing check and if necessary renew the extension housing bush. The bore diameter of the bush should be within the limits of 34.91 to 34.93 mm for the bush to be still serviceable.

(39) Apply a coating of grease to a new extension housing gasket. Instal the gasket on the rear face of the gear case so that the oil drain slot in the gasket aligns with the oil drain hole in the case.

(40) Instal the extension housing over the mainshaft and instal and tighten the retaining bolts to Specifications.

(41) Pour a small quantity of the correct grade of oil over the gears and rotate the shafts to distribute the oil throughout the gear case. Pour a small quantity of oil in through the speedometer drive opening in the extension housing to provide initial lubricant for the extension housing bush.

(42) If the expansion plug has been removed from the front face of the gear case, instal a new plug using a small amount of sealing compound on the plug to prevent possible oil leakage.



View of transmission components removed from gear case. Note reverse gear is engaged.

(43) Apply a coating of grease to a new top cover gasket. Position the top cover gasket on the top of the gear case, instal the top cover and retaining bolts and tension to Specifications.

(45) Check the operation of the gear shift mechanism and ensure the breather on the extension housing is clear. The breather should be installed with the flat side of the breather body on the left hand side, parallel to the centre line of the mainshaft.

(46) Instal the transmission assembly as previously described and refill with the correct grade and quantity of oil.

3. COLUMN CHANGE GEARSHAFT CONTROL ASSEMBLY

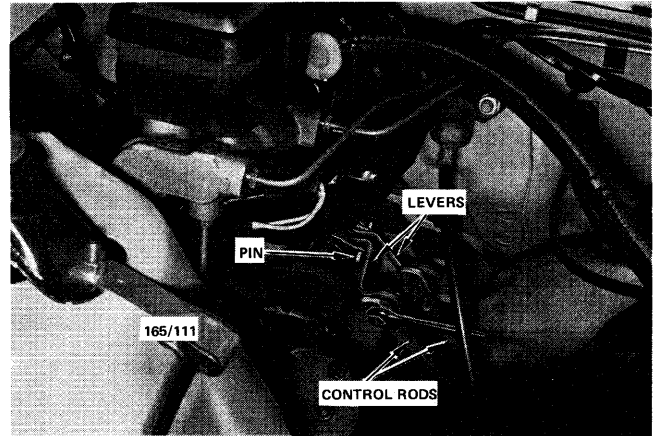
TO ADJUST

(1) Working inside the vehicle apply the handbrake and place the gearchange lever into the 'Neutral' position.

(2) Raise the engine bonnet and place a fender cover over the drivers side front fender.

(3) Loosen the nuts which retain the gearchange control rods to the steering column levers.

(4) Working beneath the vehicle ensure that the nuts which retain the transmission shift levers to the shafts have been tightened securely and that the two



Instal a gauge pin to adjust the gearshift control assembly.

levers are in the 'Neutral' position.

(5) Instal a gauge pin through the two levers and the bearing brackets at the bottom of the steering column.

(6) With the transmission levers in the neutral position torque the two gearshift adjusting nuts securely.

(7) Withdraw the gauge pin.

(8) Run the engine and check the shift through all gears.

PART 3. 4 SPEED TRANSMISSION

SPECIFICATIONS

Type 4 speed, synchromesh on all forward gears

Rations:

Fourth	1.00:1
Third	1.31:1
Second	1.84:1
First	3.06:1
Reverse	3.04:1
First gear end float	0.05—0.68 mm
Second gear end float	0.15—0.43 mm
Third gear end float	0.12—0.50 mm
Mainshaft bearing end float	0.00—0.10 mm
Input shaft bearing end float	0.00—0.10 mm
Laygear end float	0.15—0.45 mm
Input shaft and mainshaft bearing snap rings	Selective fit
Second gear hub snap rings	Selective fit

TORQUE WRENCH SETTINGS

Transmission cover retaining bolts	16 Nm
Shift lever housing bolts	75 Nm
Input shaft bearing retainer bolts	34 Nm
Extension housing to case bolts	75 Nm
Detent spring retaining screw	41 Nm
Drain and filler plugs	34 Nm

1. DESCRIPTION

The four speed transmission has synchromesh on all forward gears. All gears, with the exception of reverse, are helical cut and run in constant mesh with the laygear.

The reverse idler gear is of the sliding spur type and on engaging slides into mesh with its mating gear on the mainshaft.

The laygear runs on four sets of needle roller bearings with thrust washers interposed between each set of rollers, end float is controlled by selective fit thrust washers, two washers are installed at the rear end and one washer at the front end.

The mainshaft and input shaft assembly is supported in ball bearings located at each end of the transmission case with the end of the mainshaft supported in a bush in the rear end of the extension housing. Selective fit snap rings are available for adjustment of bearing and gear end float.

The spigot end of the mainshaft is supported in needle rollers located in the rear end of the input shaft while the front of the input shaft is supported in a bearing installed in the rear end of the crankshaft.

The gear change is of the remote control type with the control unit mounted on the side of the extension housing. Gear lever movement is transferred to the selector forks through a short shaft attached to the single

selector rail by a roll pin.

Gear selection is obtained by the selector rail pin, as the selector rail is moved back or forward and rotated the pin locates in the appropriate selector fork slot to move the selector fork to select the required gear.

An interlock spool prevents the selection of two gears at the same time.

2. TRANSMISSION ASSEMBLY

Special Equipment Required:

To Dismantle—Roll pin tool, dummy layshaft, press and press plates

To Assemble—Roll pin tool, dummy layshaft, press and press plates

TO REMOVE AND INSTAL

(1) Raise the vehicle to a suitable working height and support safely on chassis stands.

(2) Raise the engine bonnet and disconnect the battery earth lead.

(3) Drain the transmission lubricant into a suitable container. Instal and tighten the drain plug.

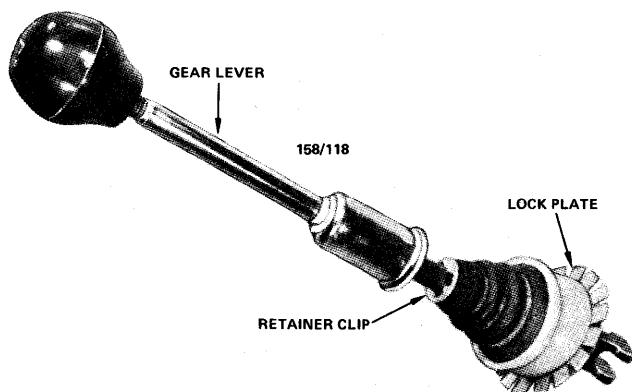
NOTE: If the transmission is not to be dismantled upon removal, then there is no need to drain the lubricant. Instead, insert a suitable plug into the rear of the transmission extension housing after the propeller shaft has been removed.

(4) Disconnect the rear universal joint at the rear axle pinion flange, withdraw the propeller shaft front joint sleeve out of the transmission rear extension housing and remove the propeller shaft from the vehicle.

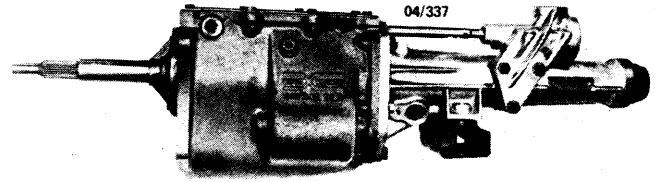
(5) Remove the bolt and withdraw the speedometer drive unit from the extension housing. Disconnect the wires from the reversing lamp switch.

(6) Remove the bolts attaching the rear mounting to the transmission extension housing. Position a jack under the transmission and take the weight off the rear mounting.

(7) Remove the split pin, nut and bolt securing each end of the crossmember to the underframe and withdraw



Gear selector lever removed from transmission.



Left hand view of transmission assembly.

the crossmember from the underframe.

(8) Remove the nut and disconnect the handbrake cable and equaliser from the handbrake adjuster.

(9) Lower the jack under the transmission sufficiently to gain access to the lock tab on the shift lever ball seat. Release the lock tab and unscrew the pivot ball seat from the extension housing.

(10) Support the rear of the engine and remove the jack from under the transmission. Remove the bolts securing the transmission to the clutch housing and draw it rearwards to clear the clutch assembly. Withdraw the transmission from the vehicle.

NOTE: Do not allow the weight of the transmission to be supported by the clutch driven plate or damage to the driven plate will result.

Do not depress the clutch pedal while the transmission is removed.

Installation is a reversal of the removal procedure with attention to the following points:

(1) Ensure the face of the transmission and the corresponding face of the clutch housing are clean and free from burrs and paint.

(2) Where available instal guide pins in the lower holes in the clutch housing. Position the transmission on the rear of the clutch housing. Push the transmission forward into the clutch housing until the face of the transmission contacts the clutch housing.

NOTE: If the transmission will not slide forward freely, turn the input shaft to align the clutch driven plate splines with those on the transmission input shaft.

(3) Instal the transmission mounting bolts and remove the guide pins.

(4) Slightly raise the transmission and instal the shift lever ball seat. Securely tighten the shift lever ball seat and bend over a lock tab.

(5) Torque all bolts to Specifications.

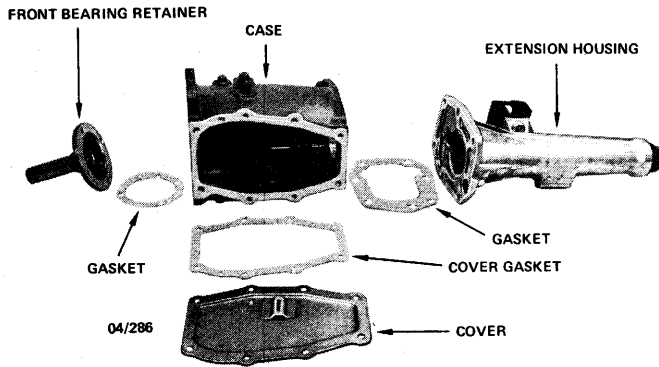
(6) Refill the transmission with the specified lubricant. Refer to Specifications in the Lubrication and Maintenance section.

(7) Carry out any adjustments necessary to the clutch and handbrake cables as described in the appropriate section.

TO DISMANTLE

(1) Remove the transmission as previously described.

(2) Clean the exterior of the transmission assembly to remove all road dirt.



Transmission case components.

(3) Using the roll pin tool remove the roll pin connecting the gear lever shaft to the selector rail.

(4) Remove the gear shift housing bolts and remove the housing from the extension housing.

(5) Clean burrs and/or rust from the protruding end of the selector rail.

(6) Remove the extension housing to transmission case mounting bolts.

(7) Remove the extension housing from the case, remove and discard the old gasket and selector rail oil seal.

(8) Remove the transmission case cover bolts, remove the cover and discard the old gasket.

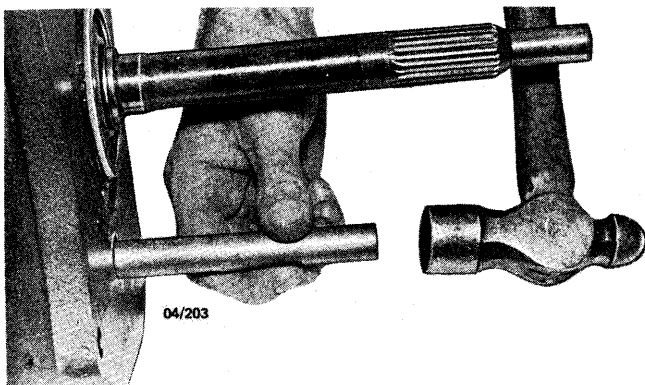
(9) Remove the front bearing retainer bolts and remove the retainer, discard the old gasket.

(10) Remove the layshaft and reverse idler shaft lock plate, it may be necessary to drive both shafts slightly to the rear to release the lock plate, use a soft drift when driving the shafts.

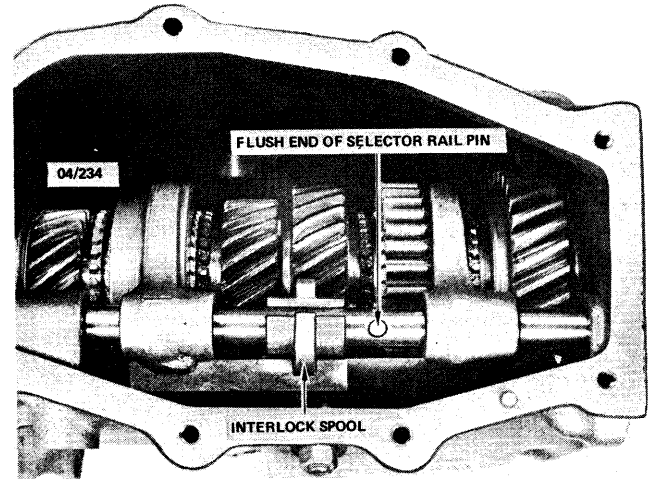
(11) Use a dummy layshaft to drive out the layshaft towards the rear of the case, allow the laygear to rest in the bottom of the transmission case with the dummy layshaft holding the needle rollers in place.

(12) Remove the selector rail detent screw, tilt the case to remove the spring and plunger.

(13) Rotate and move the selector rail towards the rear of the case to clear the selector rail pin from the interlock spool.



Use a dummy layshaft to drive the layshaft out towards the rear of the case.



Selector rail moved towards the rear with the flush end of the pin uppermost in preparation for removal.

(14) Remove the selector rail pin using the roll pin tool, take care not to damage the gear teeth as the pin is pressed out.

NOTE: When removing the pin press on the flush side not the protruding side. Do not use a hammer and punch to remove the pin as there is a possibility of bending the selector rail using this method.

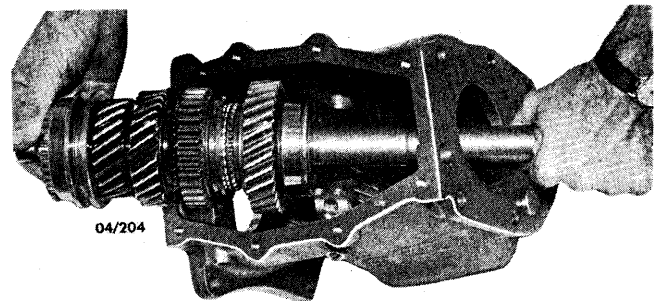
(15) Remove any burrs from the selector rail pin hole in the selector rail and remove the selector rail out towards the rear of the case, remove the interlock spool when clear of the shaft.

(16) Lift out the selector forks noting their fitted positions.

(17) Remove the input shaft assembly taking care not to drop any of the needle rollers into the transmission case, remove the fourth gear synchroniser ring.

(18) Remove the speedometer drive gear from the rear end of the shaft by pressing down on the rear of the retaining clip and sliding the drive gear over the clip, remove the gear and retaining clip.

(19) Tap the mainshaft towards the rear of the transmission using a soft drift, only tap the shaft out sufficiently to clear the bearing outer snap ring.



Removing the mainshaft assembly from the transmission case.

(20) Remove the rear bearing outer snap ring.

(21) Move the third and fourth speed synchroniser assembly towards the rear to engage third gear.

(22) Carefully push the mainshaft assembly into the transmission case and remove it out through the top of the case.

(23) Remove the nut and lock washer from the reverse selector lever eccentric pivot pin, remove the pin and selector lever.

(24) Tap the reverse idler gear shaft out of the transmission case and remove the reverse idler gear.

(25) Lift the laygear up into its running position and instal the layshaft pushing out the dummy shaft.

(26) Check the laygear end float using feeler gauges, if the end float is not to Specifications select new thrust washers that will bring the end float to within the specified limits when assembling the gear case.

NOTE: When installing a new laygear, assemble and position it in the gearcase so that the end float may be checked as described above.

(27) After checking the end float remove the layshaft by using the dummy shaft and remove the laygear and dummy shaft as an assembly with the thrust washers. Note the fitted position of the thrust washers and put them to one side.

(28) Remove the needle rollers from the bore of the input shaft, if the bore is serviceable and the needle

rollers are to be reused, put them carefully to one side.

(29) If the input shaft and gear are serviceable, but the bearing is to be renewed, remove the bearing retaining snap ring and press the bearing from the shaft. Remove the oil slinger.

NOTE: Should the input shaft and bearing be serviceable do not remove the bearing from the shaft, check the bearing end float and adjust to Specifications using selective thickness snap rings.

(30) Before dismantling the mainshaft assembly check, using feeler gauges, the end float of third gear, second gear and first gear, note and record the clearance readings.

Should the end float not be within Specifications then the gears and synchroniser hubs will have to be measured after dismantling to determine if the gears, synchroniser hubs or snap rings are to be renewed on assembly.

(31) Remove the snap ring from the front end of the mainshaft and mark the third and fourth gear synchroniser in relation to the mainshaft.

(32) Remove the third and fourth gear synchroniser hub and sleeve as an assembly.

(33) Remove the third gear synchroniser ring and third gear from the shaft.

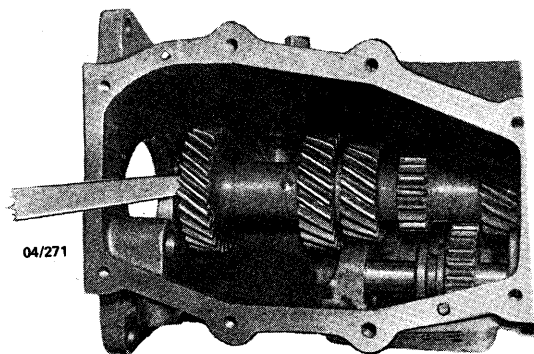
(34) Remove the bearing retaining snap ring and a using a press and press plates on the front face of first gear, press the bearing and first gear off the mainshaft.

(35) Mark the first and second gear synchroniser hub in relation to the mainshaft.

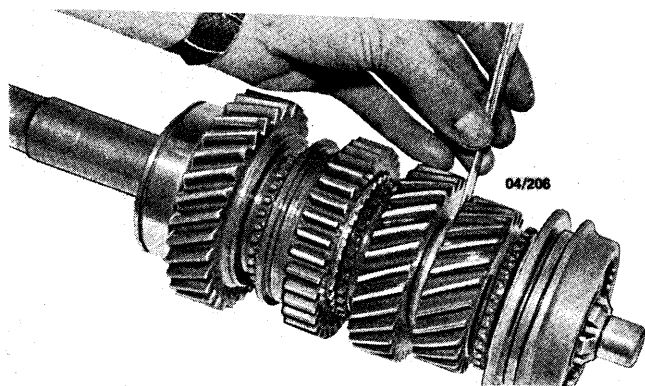
(36) Remove the snap ring retaining the first and second gear synchroniser hub to the mainshaft.

(37) Position the press plates on the front face of second gear and ensuring the mainshaft is vertical, press off the synchroniser hub and second gear.

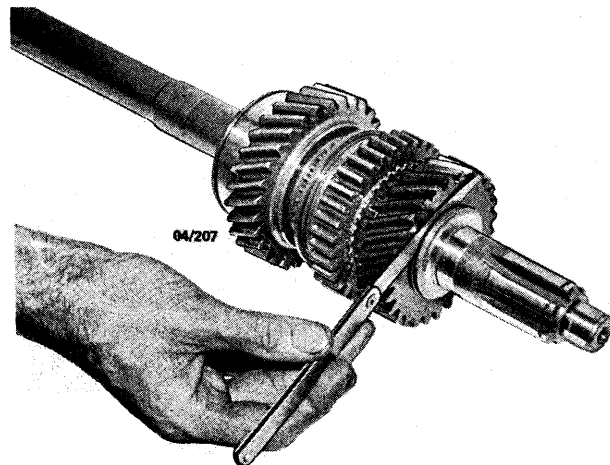
(38) To dismantle the synchroniser hub and sleeve assemblies first check for or instal mating marks on the hub and sleeve, then slide the sleeve from the hub and remove the shift plates and springs, keep the components of each synchroniser assembly separate.



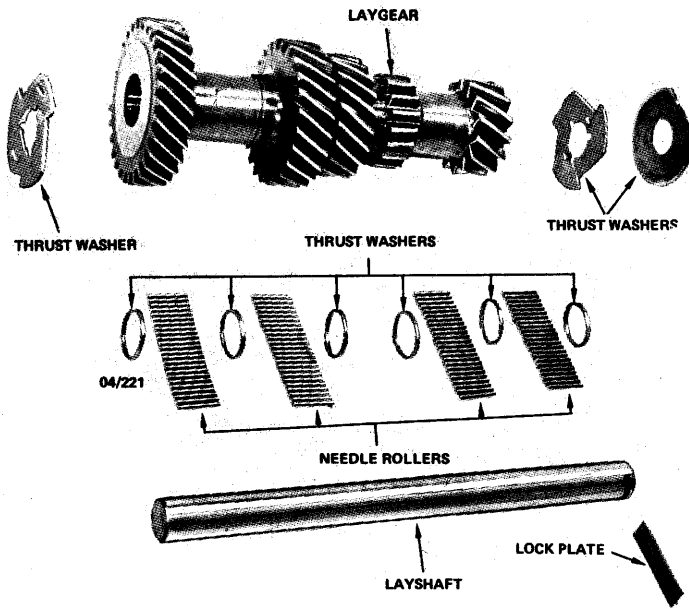
Checking the end float of the laygear.



Checking the end float of third gear.



Checking the end float of second gear.



Dismantled view of laygear components.

(39) Remove the dummy shaft from the laygear and remove the needle rollers and needle roller thrust washers from the bore of the laygear. Note the location and number of needle rollers fitted.

(40) Remove the reverse lamp switch from the gear shift housing.

(41) Remove the cup from the rear of the gear shift housing.

(42) Remove the gear lever shaft from the housing.

NOTE: Do not remove the thrust block for reverse, if it shows signs of wear or damage renew the gear shift housing.

TO CLEAN AND INSPECT

Extension Housing

(1) Wash the extension housing in cleaning solvent and blow dry with compressed air.

(2) Check the extension housing bush for wear and damage, to renew, lever the oil seal from the end of the housing and using a suitable tool drive the old bush into the extension housing. Place the new bush into position and using a suitable tool drive the bush into its correct fitted position. Instal a new seal.

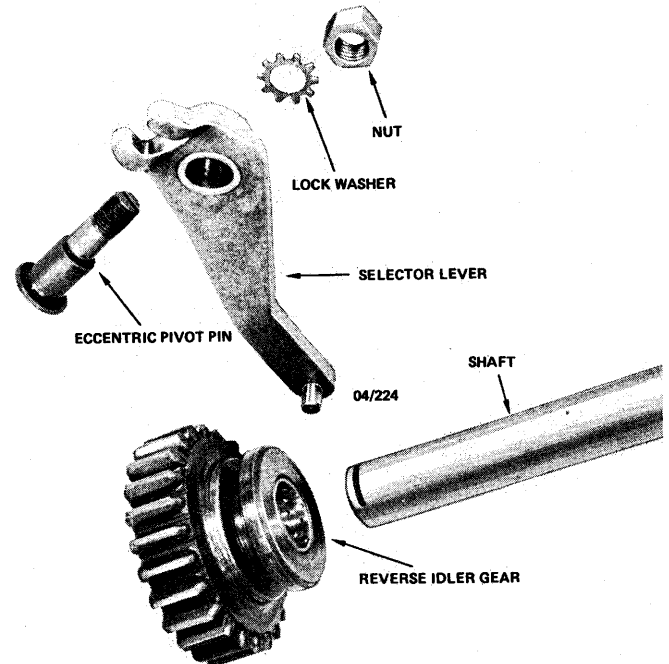
(3) Should the extension housing bush be serviceable but the oil seat shows signs of wear or leaking lever the oil seal from the housing using a suitable lever, lubricate a new oil seal and tap it into position.

Transmission Case Components

(1) Wash all components in cleaning solvent and blow dry with compressed air, do not spin the dry bearing as damage to the bearing will result.

(2) Inspect all gears for chips and scores and damaged parts.

(3) Inspect all bearings for worn or chipped balls



Reverse idler gear, shaft and selector components.

and tracks. Renew damaged bearings.

(4) Inspect all shafts for wear and damage, renew as necessary.

(5) Inspect the bore of the laygear for wear and break through of hardening.

(6) Inspect the running surfaces and thrust surfaces of all gears.

(7) Inspect the bore of the input shaft for wear and break through of hardening, check the spigot end for wear and roughness, renew as necessary.

(8) Renew all needle rollers and needle thrust washers.

(9) Renew all gaskets and oil seals.

TO ASSEMBLE

Assembly of the transmission is a reversal of the dismantling procedure with attention to the following points:

(1) Lubricate the bore of the laygear with grease.

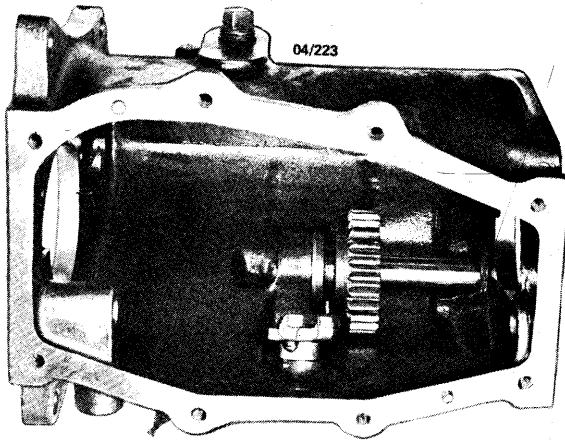
(2) Insert the dummy layshaft into the bore of the laygear.

(3) Instal a needle roller thrust washer to each end of the dummy shaft.

(4) Insert two rows of needle rollers to each end of the laygear, separate each row of needle rollers with a thrust washer.

(5) Instal a needle roller thrust washer to the outer end of each set of needle rollers and instal the laygear thrust washers as selected to maintain the correct end float, hold the thrust washers in place with grease.

NOTE: Two thrust washers one steel one bronze are fitted to the rear of the laygear and one bronze washer to the front, the thrust washers are not interchangeable.



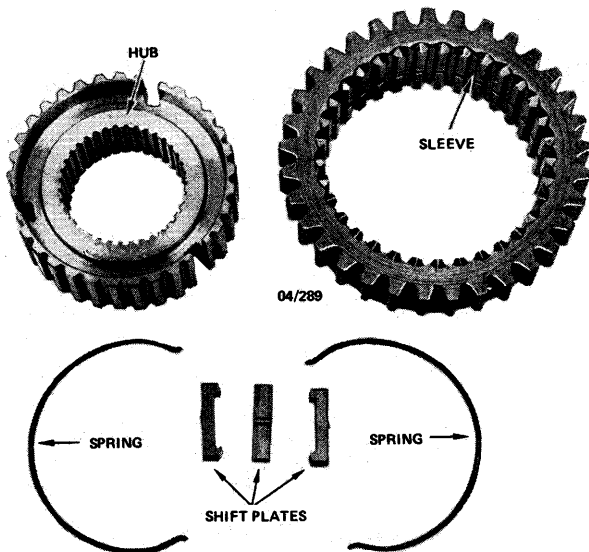
Reverse idler gear correctly installed in the transmission.

(6) Position the reverse idler gear in the transmission case with the selector groove of the gear towards the front, instal the reverse idler gear shaft with the lock plate groove to the rear and facing towards the laygear shaft position.

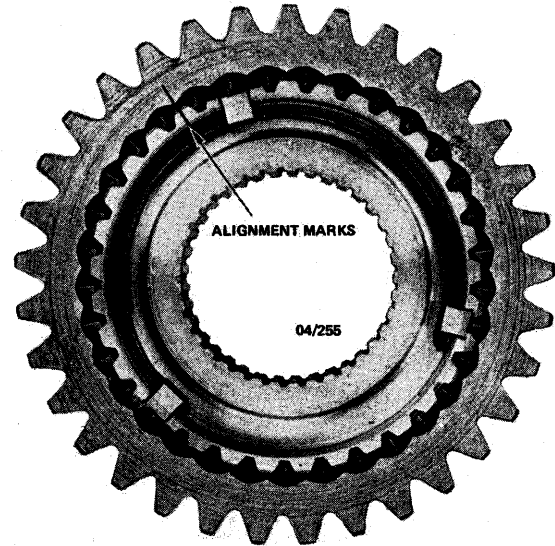
(7) Instal the reverse gear selector lever into the case with the end of the lever in the groove of the reverse idler gear, instal the eccentric pivot bolt with the centre pop mark towards the top of the case, fit the lock washer and instal the nut finger tight.

(8) Position the assembled laygear in the bottom of the transmission case with the tangs of the thrust washers correctly positioned in the grooves of the case and gear.

(9) Assemble the first and second gear synchroniser assembly, if it has been dismantled. Lubricate the components with oil and slide the reverse gear and sleeve over the hub so that the gear teeth and the inner hub spline protrusion are at opposite ends and the mating marks aligned.



Dismantled view of 1st/2nd gear synchroniser components.



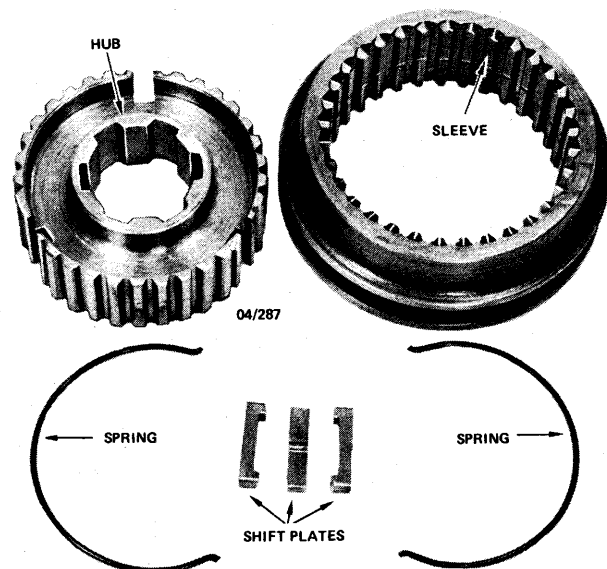
Assembled view of 1st/2nd gear synchroniser assembly.

Position the hub and sleeve so that the shift plates can be installed, fit the springs under the shift plates with the long point of each spring located at the same shift plate but so that the openings of the springs are not opposite each other.

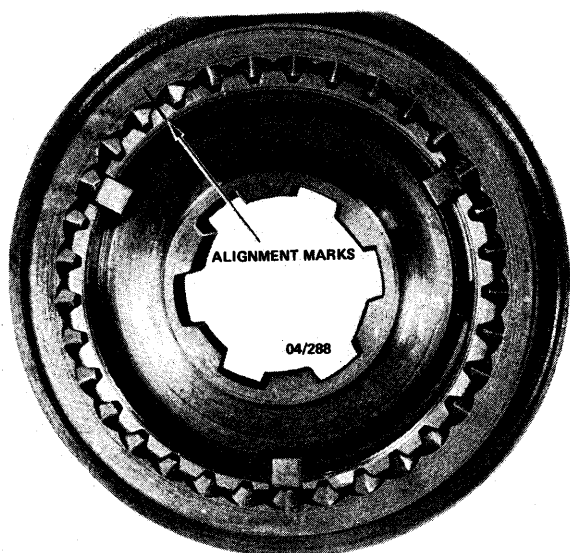
(10) Assemble the third and fourth gear synchroniser assembly, if it has been dismantled. Lubricate the components with oil and slide the sleeve over the hub so that the selector groove of the sleeve and the inner hub splines are at opposite ends and the mating marks are aligned.

Instal the shift plates and springs in the same manner as for the first and second synchroniser assembly.

(11) Lubricate the mainshaft and all components with oil before assembling.



Dismantled view of 3rd/top gear synchroniser components.



Assembled view of 3rd/top gear synchroniser assembly.

(12) Instal second gear and the synchroniser ring on to the mainshaft.

(13) Instal the first and second gear synchroniser assembly to the mainshaft with the reverse gear teeth towards the front of the shaft.

(14) Instal the selected synchroniser hub snap ring and check the end float as described in dismantling.

(15) Instal the first gear synchroniser ring followed by the first gear.

(16) Instal the mainshaft bearing with the snap ring groove to the rear of the shaft, fit the selected bearing retaining snap ring and check the end float.

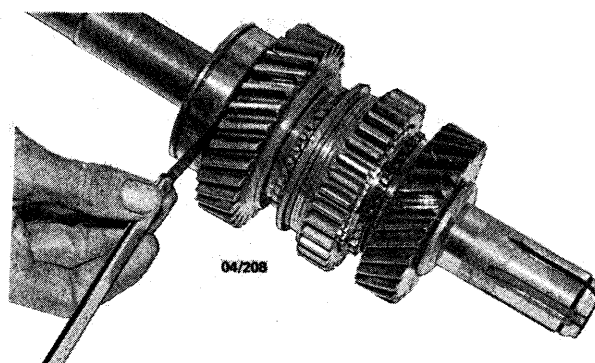
(17) Slide third gear on to the front of the mainshaft followed by the synchroniser ring.

(18) Instal the third and fourth gear synchroniser assembly on to the shaft with the spline protrusion of the hub towards the front of the shaft.

(19) Instal the selected snap ring to retain the components and check the end float.

(20) Recheck the mainshaft components end float and compare with Specifications.

(21) When installing a new bearing to the input shaft instal the oil slinger with the centre step of the



Checking the end float of first gear.

slinger towards the bearing. Press the bearing on to the shaft, with the snap ring groove to the front, applying the fitting pressure to the centre of the bearing. Instal the selected snap ring to maintain the specified end float.

(22) Apply grease to the bore of the input shaft and instal the 15 needle rollers.

(23) Instal the fourth gear synchroniser ring on to the input shaft gear.

(24) Move the third and fourth gear synchroniser sleeve to engage third gear on the mainshaft.

(25) Move the first and second gear synchroniser sleeve to engage second gear on the mainshaft.

(26) Instal the mainshaft assembly into the transmission case through the top of the case entering the rear end of the shaft first.

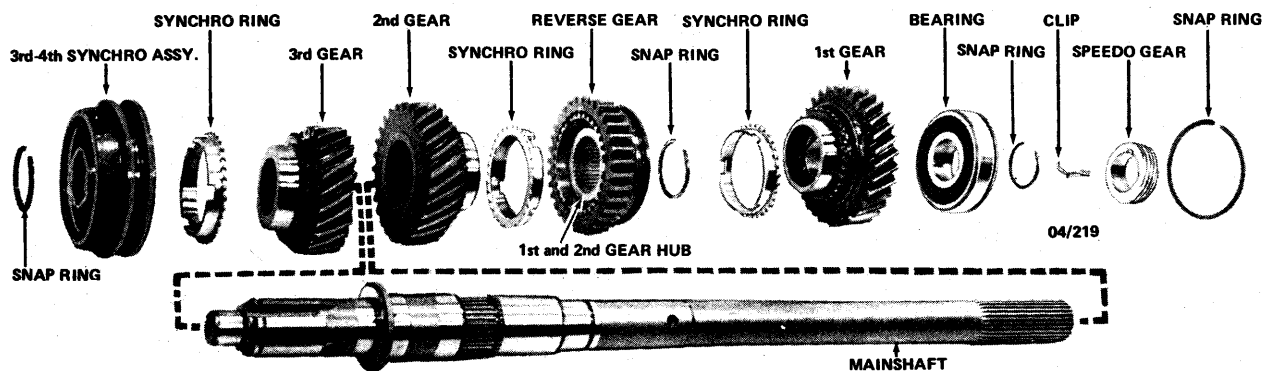
(27) Position the bearing in the bore of the case, it may be necessary to tap the end of the shaft with a soft faced hammer to position the bearing correctly, instal the bearing snap ring so that it is outside the case.

(28) Instal the outer snap ring to the input shaft bearing.

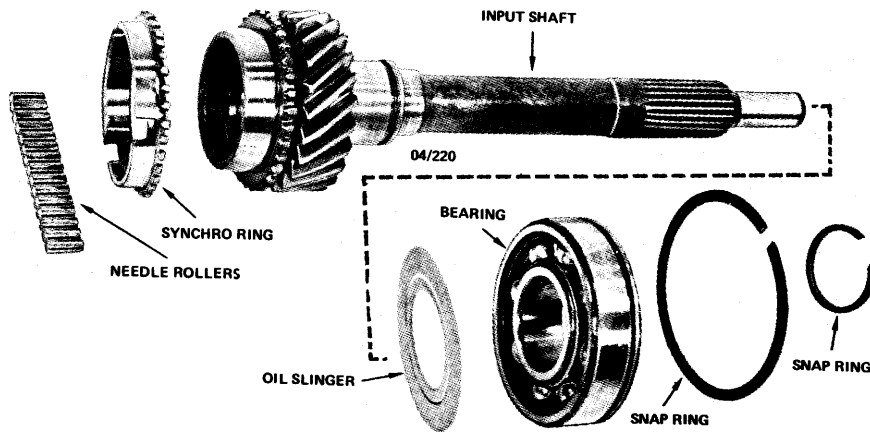
(29) Instal the input shaft assembly into the front of the transmission case aligning the components as the assembly is installd, ensure that the snap ring is against the face of the case.

(30) Tap the old oil seal out of the input shaft bearing retainer, coat the outside edge of a new seal with sealing compound and instal the new seal into the retainer, apply grease to the lips of the new seal.

(31) Apply a coating of sealing compound to a new



Exploded view of mainshaft components.



Exploded view of input shaft components.

bearing retainer gasket and install the bearing retainer and new gasket to the transmission case, apply sealing compound to the retaining bolt threads and install the bolts and tighten to specifications.

(32) Carefully turn the transmission case to roll the laygear into mesh with the mainshaft and input shaft gears.

(33) Install the layshaft from the rear of the transmission case driving the dummy shaft out of the front of the case. Align the lock plate groove of the shaft adjacent

to that of the reverse idler shaft, tap the shaft in until the groove is flush with the face of the case.

(34) Install the reverse idler and layshaft lock plate, tap both shafts forward to hold the lock plate against the transmission case.

(35) Move the synchroniser sleeves from third and second gear to the neutral positions.

(36) Hold the speedometer drive gear retaining clip in position and slide the speedometer gear over the clip, ensure that the gear is correctly located, it may be necessary to increase the bend in the clip to retain the gear firmly on the shaft.

(37) Position the selector forks in the grooves of the synchroniser sleeves, check that the slots in the forks and the slot in the reverse lever are aligned.

(38) Install the selector rail through the rear of the case and the first and second gear shift fork.

(39) Position the interlock spool between the two shift forks with the flange positioned in the fork arm slots, push the selector rail through the interlock spool.

(40) Push the selector rail through the third and fourth gear shift fork.

(41) Turn the selector rail to position the shift pin hole vertical with the detent grooves on the end of the rail facing the top of the transmission case.

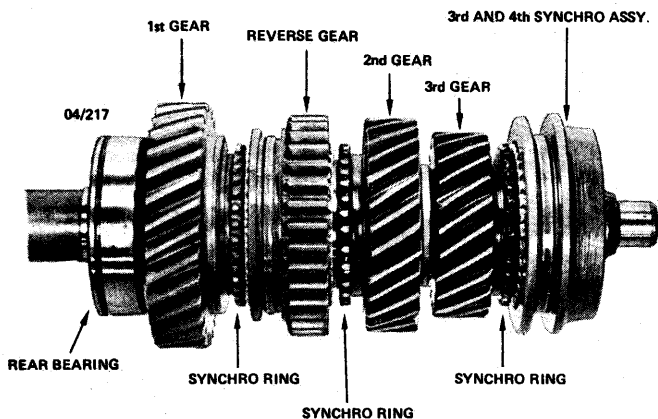
(42) Push the shift rail in until the shift pin hole is midway between the interlock spool and first and second gear shift fork.

(43) Press the shift pin into the rail, using the roll pin tool until the dimension from the end of the pin to the opposite side of the shaft will fall within the limits of 26.8-26.5 mm.

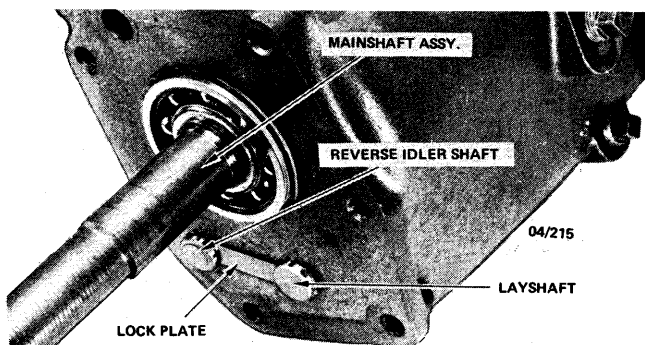
NOTE: Do not drive the shift pin in with a hammer and punch as there is a possibility of bending the shift rail using this method.

(44) Align the slot in the interlock spool with the shift pin and push the shift rail forward to enter the shift pin into the interlock spool, align the pin and flange and turn the shift rail to engage the shift pin with the slots in the shift forks.

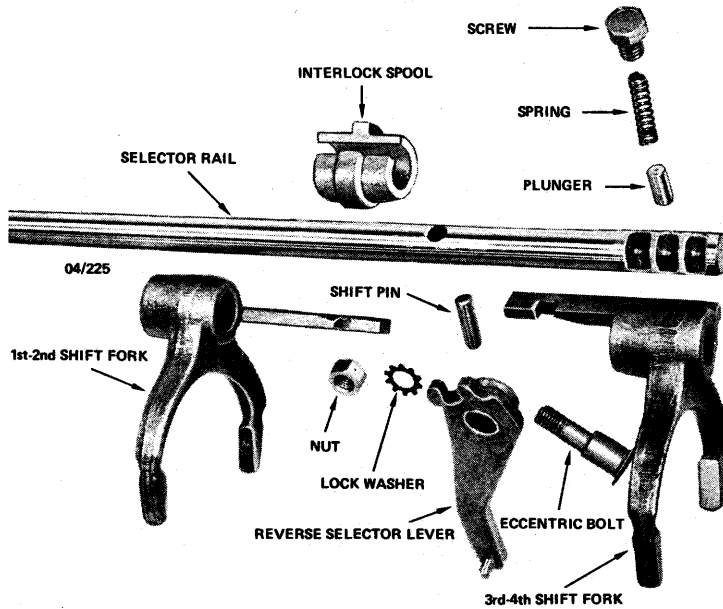
(45) Install the detent plunger, spring and screw,



Mainshaft gears and synchroniser assemblies correctly installed on the mainshaft.



View of transmission showing reverse idler shaft and layshaft with lock plate correctly installed.



Dismantled view of the transmission shift components.

tighten the screw to Specifications.

(46) Instal a new shift rail oil seal and washer into the front flange of the extension housing, lubricate the seal and shift rail with grease.

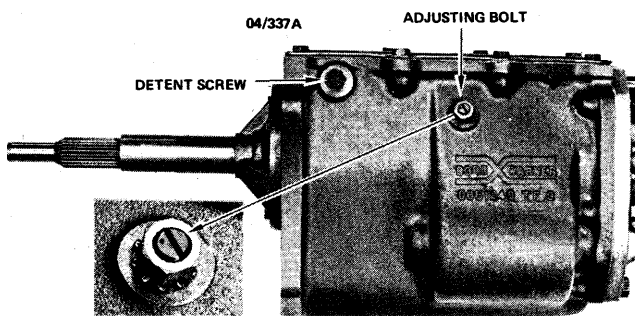
(47) Smear both sides of a new extension housing gasket with sealing compound and position it on the rear face of the transmission case.

(48) Instal the extension housing taking care not to damage the shift rail oil seal. Instal and tighten the extension housing bolts to Specifications.

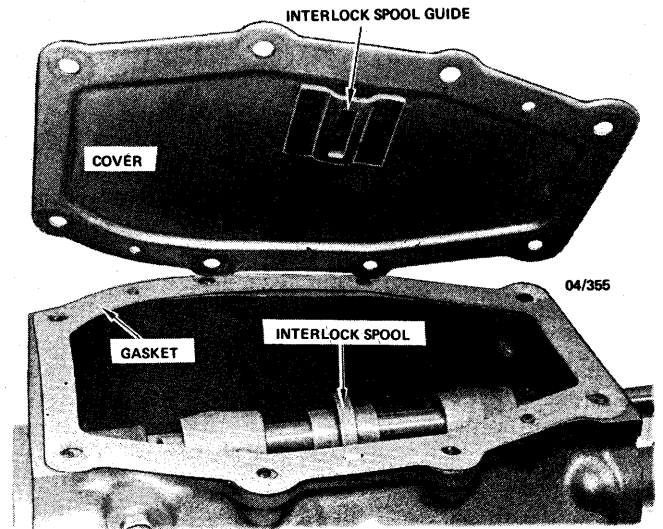
(49) Assemble the gear shift housing as follows:

Instal a new oil seal into the gear lever shaft bore.

Apply high melting point grease into the reverse lamp switch hole.



Showing reverse idler gear position adjusting bolt and locknut.



Showing relationship of transmission case cover and interlock spool.

Instal the gear lever shaft.

Apply a liberal quantity of high melting point grease into the housing.

Coat a new cup plug outer edge with sealing compound and instal the cup plug into the rear of the housing.

(50) Instal the gear shift housing to the extension housing and tighten the bolts to Specifications.

Coat a new transmission case cover gasket on both sides with sealing compound instal the gasket and cover plate, ensure that the interlock spool is correctly positioned in its guide, tighten the bolts securely to Specifications.

(52) Adjust the reverse idler gear position as follows:

Ensure that the shift rail is in the neutral position.

Check that the centre pop mark on the end of the eccentric pivot pin is to the top of the case.

Using a screwdriver turn the eccentric pivot pin in a clockwise direction until it becomes tight then turn it slightly in an anti-clockwise direction until the shift rail will rotate freely in the neutral position, tighten the locknut. Check that the shift rail still rotates freely, make any minor adjustment to achieve this result.

(53) Fit the gear lever shaft into the slot of the shift rail and instal the roll pin using the roll pin tool.

(54) Check the operation of the gear selector mechanism and the free rotation of the input shaft through the various speeds.

PART 4. PROPELLER SHAFT

DESCRIPTION

The one piece propeller shaft is fitted with two needle roller and trunnion (cross) type universal joints.

Two of the rear universal joint bearings are attached to the rear axle pinion flange by clamps and bolts.

The other two bearings of the rear universal joint are secured in the yoke on the rear end of the propeller shaft by two snap ring type retainers.

The four bearings of the front universal joint are retained in the joint yokes by snap ring type retainers.

The front yoke sleeve of the front universal joint has internal splines which slide on mating splines on the rear end of the transmission mainshaft and is supported on its outer circumference by a bush with an oil seal in the transmission extension housing.

TO REMOVE AND INSTAL

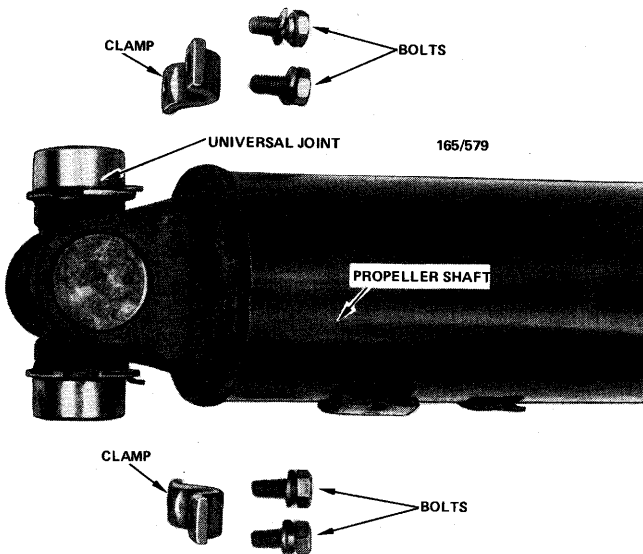
(1) Raise the rear of the vehicle and support it securely on chassis stands.

(2) Scribe a mark across one rear propeller shaft yoke and the rear axle pinion flange to ensure correct reassembly.

(3) Remove the bolts and clamps securing the universal joint bearings to the pinion flange.

(4) Disconnect the propeller shaft from the pinion flange and tape or similarly secure the bearings to the rear trunnion.

(5) Withdraw the propeller shaft rearwards out of



Installed view of rear universal joint showing mounting clamps and bolts.

the extension housing.

(6) Insert a spare yoke sleeve or suitable plug into the transmission extension housing to avoid loss of lubricant.

Installation is a reversal of the removal procedure with attention to the following points:

Clean the rear axle pinion flange and the front sliding sleeve of the propeller shaft before installation.

When connecting the rear universal joint bearings to the pinion flange align the marks made on removal.

With the vehicle level, check the transmission lubricant.

TO RENEW UNIVERSAL JOINT

(1) Remove the propeller shaft from the vehicle as previously described.

(2) Remove the snap ring type retainers securing the bearings in the yokes.

(3) Support the propeller shaft on a partially open vice and using a suitable drift, tap one of the bearing cups in to drive the other bearing cup out of the yoke.

(4) Again using the drift, tap on the end of the trunnion of the bearing just removed to drive the other bearing cup back into and then out of the yoke.

NOTE: The propeller shaft is balanced to fine tolerances and must not be dented or otherwise damaged.

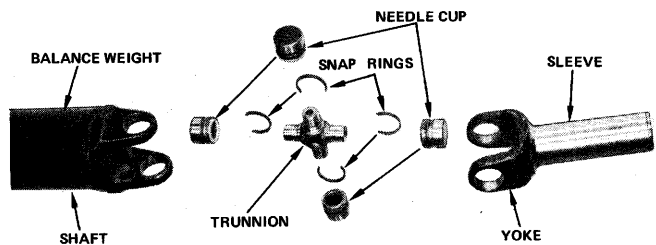
(5) Manoeuvre the yoke over the end of the trunnion and separate the components.

(6) Where necessary repeat this operation on the remaining two bearings of the universal joint to dismantle the joint completely.

(7) Clean and remove all burrs from the eyes in the yoke.

Assembly of the universal joint is a reversal of the dismantling procedure.

Ensure that the needles in the bearing cups are not dislodged and the snap ring type retainers are positioned correctly in their grooves.



Dismantled view of front universal joint components.

SPECIFICATIONS

Models Borg Warner or C4
 Type 3 forward speeds and reverse,
 epicyclic gear train with torque converter
 Operation Automatic hydraulic

Band adjustment — Borg Warner:

*Front band Tighten adjusting screw to
 1.1 Nm and secure with locknut
 Rear band Tighten adjusting screw to
 14 Nm, back off 3/4 turn
 and secure with locknut

Band adjustment — C4:

**Front intermediate band Tighten adjusting
 screw to 14 Nm, back off 1 3/4 turns
 and secure with locknut
 **Rear band Tighten adjusting screw to
 14 Nm, back off 3 turns
 and secure with locknut

*With a 6.35 mm spacer inserted between the servo
 piston pin and the adjusting screw.

**Fit new locknuts when adjusting front or rear bands.

TORQUE WRENCH SETTINGS

Drive plate to crankshaft bolts 115 Nm
 Drive plate to converter bolts or nuts 41 Nm
 Front band adjuster locknut (Borg Warner) 27 Nm
 Rear band adjuster locknut (Borg Warner) 41 Nm
 Front and rear band adjuster locknuts (C4) 61 Nm

1. AUTOMATIC TRANSMISSION TROUBLE SHOOTING

NO DRIVE IN D RANGE

- (1) Low fluid level in transmission: Check fluid level in transmission and top up.
- (2) Incorrectly adjusted selector rod: Check and adjust selector rod as detailed.
- (3) Incorrect or contaminated transmission fluid in unit: Drain and refill with recommended grade of fluid. (See Specifications in the Lubrication and Maintenance section).

NO REVERSE DRIVE IN R POSITION

- (1) Low fluid level in transmission: Check fluid level and top up.
- (2) Incorrectly adjusted selector rod: Check and adjust selector rod as detailed.
- (3) Reverse band incorrectly adjusted: Adjust reverse band as detailed.

NO TRANSMISSION KICKDOWN

- (1) Incorrectly adjusted accelerator cable: Check and adjust cable as detailed in the Fuel System section.
- (2) Incorrectly adjusted kickdown cable: Check and adjust cable as described in this section.
- (3) Broken kickdown cable: Renew cable and

adjust as detailed.

NOTE: Check the accelerator cable and kick-down cable for fraying. Adjust the accelerator cable before adjusting the kickdown cable.

NO UPSHIFT

- (1) Broken or stretched kickdown cable (Borg Warner transmission): Instal new cable and adjust.
- (2) Vacuum hoses leaking or detached from vacuum source (C4 transmission): Renew or reconnect vacuum hose.
- (3) Faulty vacuum modulator (C4 transmission): Check out vacuum modulator as detailed and renew where necessary.

NO HOLD IN PARK POSITION

- (1) Worn or loose selector rod, linkage, bushes or pins: Check out and repair as necessary.
- (2) Selector lever loose on selector shaft: Repair or renew selector lever.

SLIPPING OR ROUGH IN UPSHIFT

- (1) Incorrectly adjusted accelerator cable: Check and adjust cable as detailed in the Fuel System section.
- (2) Incorrectly adjusted kickdown cable (Borg Warner transmission): Check and adjust cable.
- (3) Faulty vacuum modulator or hose (C4 transmission): Check out vacuum modulator and hose as described in this section.
- (4) Faulty front band adjustment: Check and adjust front band as detailed.
- (5) Kickdown cable sticking (Borg Warner transmission): Disconnect kickdown cable and check for freeness.
- (6) Kickdown lever obstructed with mud etc. (C4 transmission): Check out and rectify as necessary.

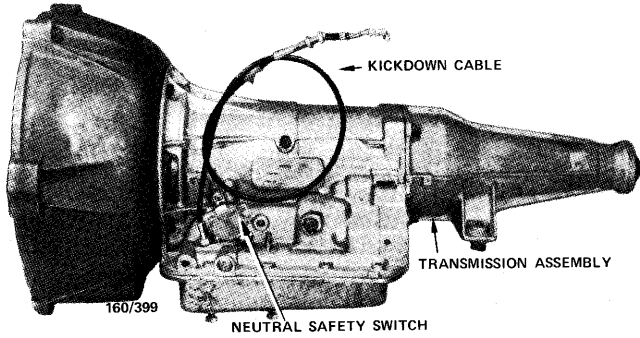
STARTER MOTOR WILL NOT OPERATE IN P OR N POSITIONS, OR WILL OPERATE IN ANY POSITION.

- (1) Incorrectly adjusted or worn selector linkage and bushes: Adjust selector rod or renew linkage and bushes.
- (2) Neutral safety switch faulty (Borg Warner transmission): Check out and renew as necessary.
- (3) Neutral safety switch faulty or out of adjustment (C4 transmission): Adjust or renew neutral safety switch as described in this section.

NOTE: Check out possible causes in the order given.

2. DESCRIPTION

The automatic transmission consists of a torque converter and hydraulically controlled epicyclic gear system which provides three forward and one reverse gear.



Left side of Borg Warner transmission assembly.

The hydraulic system consists of a pump and a valve body.

The hydraulic fluid is circulated through an oil cooler situated in the radiator. The oil cooler is connected to the transmission case by pipes. The fluid level is checked by a dipstick type indicator located in the oil filler tube.

The selector lever may be mounted either on the column or on the floor, the range chosen showing in the quadrant located on the floor console on floor shift models, or above the steering wheel centre on column shift models.

The selector lever must be lifted, or a button depressed to clear a gate on the change mechanism in order to select either reverse, park, first or second positions. This is a safety device to prevent the driver from accidentally selecting these positions while the vehicle is travelling forward. It is necessary for the selector lever to show N (neutral) or P (park) before the engine can be started.

When tuning or testing the engine the handbrake must be firmly applied and the selector lever must be in the park or neutral position, otherwise the vehicle will move when the engine speed is increased.

When adjusting the idling speed, firmly apply the handbrake and move the selector lever to the drive position in order that the correct idling speed adjustment may be obtained.

For towing, the propeller shaft should be disconnected at the rear universal joint and removed from the vehicle and a suitable plug applied to the rear of the transmission case to prevent loss of fluid and entry of dirt.

An alternative method is to tow the vehicle suspended from the rear.

It is not possible to start the engine by either towing or pushing the vehicle.

3. HYDRAULIC FLUID

Only the recommended automatic transmission fluid should be used in the transmission when topping up or changing the fluid in the system (see Specifications in the Lubrication and Maintenance section).

The fluid level in the transmission case should be

165/691



View of automatic transmission dipstick fitted to Borg Warner transmissions.

checked at regulator intervals. It is good policy to check the fluid at each chassis lubrication service.

At the 30,000 km and 90,000 km service the fluid in the transmission should be drained off while the transmission assembly is at operating temperature.

As it is necessary to remove the oil pan in order to adjust the front band, (except on C4 models) the band checking and adjusting procedure should be carried out at the same time that the hydraulic fluid is drained and renewed.

TO CHECK AND TOP UP

Borg Warner Models

- (1) Place the vehicle on a level floor, firmly apply the handbrake and open the engine bonnet.
- (2) Carefully clean around the top of the transmission case filler tube and dipstick to ensure that no dirt or foreign matter enters the transmission case filler tube when the dipstick is withdrawn.
- (3) Start the engine and run at a fast rate to bring the engine and transmission to normal operating temperature.

NOTE: As an alternative to operation (3) run the vehicle on the road for a distance of approximately eight kilometres.

- (4) Return the engine to the correct idling speed, withdraw and wipe the dipstick clean and place it to one side.
- (5) Move the selector control lever to the D (drive) and R (reverse) positions and then to the P (park) position on the selector quadrant.
- (6) Turn the engine off, replace the dipstick immediately and then remove the dipstick and check the fluid level. Where necessary top up the transmission through the filler tube and repeat the above procedure until the fluid level is at the OK mark on the dipstick.

NOTE: When replacing the dipstick to check the fluid level take no longer than 10 seconds after turning the engine off. Always check the fluid at operating temperature and use only recommended automatic transmission fluid (see Specifications in the Lubrication and Maintenance section). Do not overfill the transmission case or foaming and unsatisfactory operation of the assembly will result.

- (6) Replace the dipstick in the filler tube, ensuring no dirt or dust can enter the transmission case.

C4 Models

- (1) Place the vehicle on a level floor, firmly apply the handbrake and open the engine bonnet.
- (2) Carefully clean around the top of the trans-

mission case filler tube and dipstick to ensure that no dirt or foreign matter enters the transmission case filler tube when the dipstick is withdrawn.

(3) Start the engine and run at a fast rate to bring the engine and transmission to normal operating temperature.

NOTE: As an alternative to operation (3) run the vehicle on the road for a distance of approximately eight kilometres.

(4) Return the engine to the correct idling speed, withdraw and wipe the dipstick clean and place to one side.

(5) Slide the selector control lever to the D (drive) and R (reverse) positions and then to the P (park) position on the selector quadrant.

(6) With the engine running at normal idle speed, replace the dipstick fully into the filler tube, remove it and check the fluid level. Where necessary top up the transmission through the filler tube and repeat the above procedure until the fluid level is at the OK mark on the dipstick.

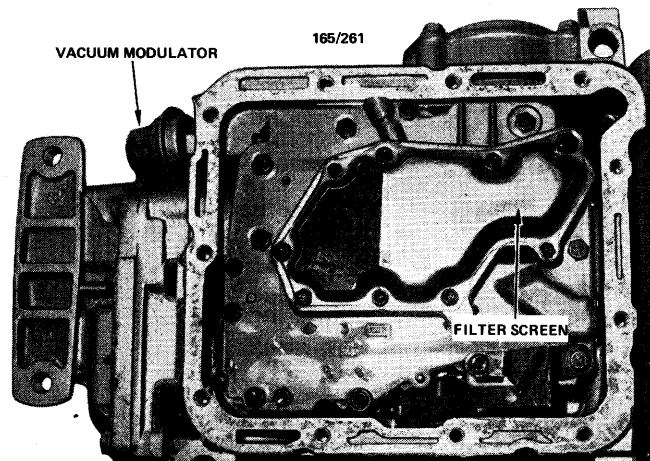
NOTE: Always check the fluid at operating temperature and use only the recommended automatic transmission fluid (see Specifications in the Lubrication and Maintenance section). Do not overfill the transmission case or foaming and unsatisfactory operation of the assembly will result.

(6) Replace the dipstick in the filler tube, ensuring that no dirt or dust can enter the transmission case.

TO DRAIN AND REFILL

(1) Bring the transmission to operating temperature, raise the vehicle and support it on stands so that the transmission oil pan is reasonably level.

NOTE: On vehicles fitted with C4 transmissions the torque converter may be drained via two drain plugs situated behind the lower torque converter cover plate.



View of C4 transmission with oil pan removed.

(2) Remove the protection plate between the torque converter housing and the oil pan (Borg Warner only).

(3) Place a suitable container under the transmission oil pan and slacken the rear transmission oil pan to case retaining bolts.

NOTE: Use care to avoid scalding if the fluid is very hot after a long run.

(4) Remove the remaining bolts along with the gear linkage support bracket (where fitted), tilt the oil pan and allow the transmission fluid to drain.

(5) Remove the rear oil pan retaining bolts, remove the oil pan and discard the gasket.

(6) Remove the filter screen retaining screws or bolts (where fitted) and remove the filter screen.

NOTE: On vehicles fitted with the C4 transmission take care not to lose the pressure limit valve and spring when removing the filter screen.

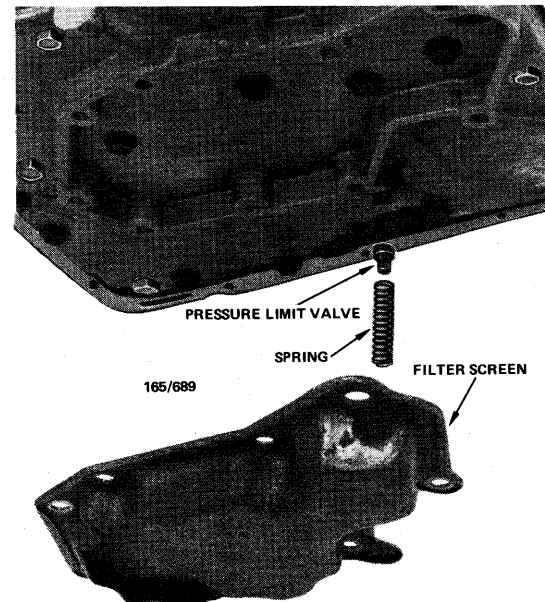
(7) Clean the oil pan and filter screen in a suitable cleaning solvent and check the filter screen for deterioration or large deposits of clutch or band material on the screen and renew where necessary.

NOTE: If large deposits of clutch or band material are found refer to a reputable automatic transmission specialist.

(8) Replace the filter screen and secure the retaining screws or bolts.

NOTE: On C4 transmissions do not omit to instal the pressure limit valve and spring before fitting the filter screen.

(9) Clean the mating surfaces of the transmission case and the oil pan.



View of C4 transmission with oil pan and filter screen removed.

NOTE: To make installation easier apply a light film of petroleum jelly to the pan. Do not use grease.

(10) Check that the fluid transfer pipes are secure (Borg Warner only). Instal the oil pan using a new gasket and tighten the securing bolts.

(11) Fit the protection plate to the oil pan and torque converter housing. (Borg Warner only).

(12) Refill the transmission case with approximately 3.5 litres of the correct automatic transmission fluid, start the engine and bring the engine and transmission to the normal operating temperature.

NOTE: On C4 transmissions, if the torque converter has been drained, an additional quantity of transmission fluid will be required to refill the transmission.

(13) Check the fluid level on the dipstick and top up as previously described under the appropriate heading.

(14) Check for any oil pan gasket leaks and road test the vehicle.

4. FRONT BAND

Special Equipment Required:

To Adjust — Small tension wrench and adaptor, 6.35 mm spacer

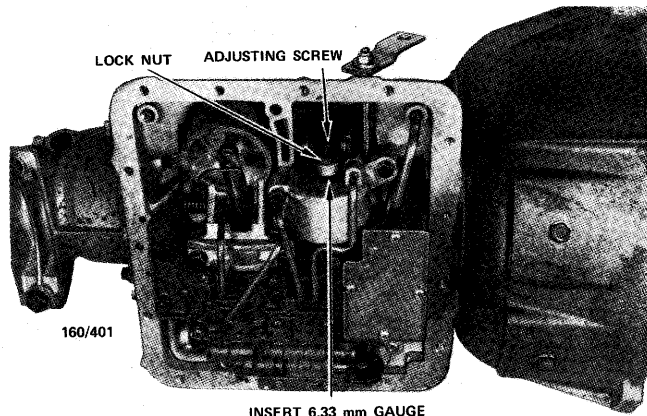
TO ADJUST

Borg Warner Models

It is necessary to drain the transmission fluid in order to adjust the front band and if the transmission fluid has seen considerable service the transmission should be refilled with new fluid of the correct grade after the adjustment procedure has been completed.

(1) Remove the transmission oil pan as described under the heading Hydraulic Fluid — To Drain and Refill.

(2) Release the front band adjusting screw locknut and undo the adjusting screw several turns.



INSERT 6.33 mm GAUGE

Front band adjustment. Borg Warner transmission. Typical.

(3) Hold the servo lever outwards and place a 6.35 mm spacer between the servo piston pin and the adjusting screw.

(4) Using a suitable tension wrench tighten the adjusting screw to 1.1 Nm and secure the adjusting screw by tightening the locknut. Remove the spacer from between the servo piston pin and the adjusting screw.

(5) Instal the transmission oil pan and top up the fluid as described under the appropriate headings.

C4 Models

(1) Raise the vehicle and support on chassis stands.

(2) Clean around the band adjusting screw and locknut on the left hand side of the transmission case.

(3) Remove the adjusting screw locknut and loosely instal a new locknut.

NOTE: Hold the band adjusting screw in the fixed position when removing the old locknut.

(4) Tighten and back off the band adjusting screw to Specifications.

(5) Hold the adjusting screw in this position and tighten the locknut to Specifications.

(6) Lower the vehicle to the ground and road test.

5. REAR BAND

Special Equipment Required:

To Adjust — Small tension wrench and adaptor

TO ADJUST

(1) Raise the vehicle and support on chassis stands.

(2) Clean around the band adjusting screw and locknut on the right hand side of the transmission case.

NOTE: It may be necessary to lower the rear transmission crossmember to gain access to the rear band adjuster on Borg Warner models.

(3) Slacken the adjusting screw locknut several turns. On C4 models remove the adjusting screw locknut and loosely instal a new locknut.

NOTE: Hold the band adjusting screw in the fixed position when removing the old locknut.

(4) Tighten and back off the band adjusting screw to Specifications. Hold the band adjusting screw in this position and tighten the locknut to Specifications.

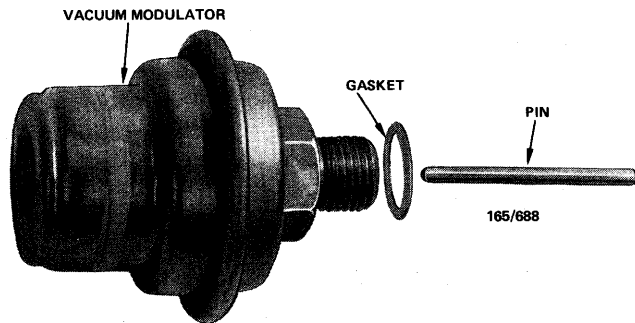
(5) Lower the vehicle to the ground and road test.

6. VACUUM MODULATOR (C4 MODELS ONLY)

TO REMOVE

(1) Raise the vehicle and support on chassis stands.

(2) Place a suitable container directly under the vacuum modulator.



View of vacuum modulator and associated components removed from transmission. C4 transmission.

- (3) Disconnect the vacuum hose from the modulator.
- (4) Using the correct size spanner slacken the vacuum modulator.
- (5) Unscrew and remove the vacuum modulator and actuating pin from the transmission, allowing the transmission fluid to drain into the container.
- (6) Ensure the primary throttle valve remains in the transmission case.

TO CLEAN AND TEST

- (1) Clean the outside of the vacuum modulator and check the condition of the gasket. Do not allow cleaning fluid to enter the vacuum pipe connection on the modulator.
- (2) Clean the actuating pin and around the aperture in the transmission case.

NOTE: Use extreme care to prevent any dirt or foreign matter from entering the transmission case.

- (3) Insert the actuating pin in the inner end of the vacuum modulator until it contacts the diaphragm pad.
- (4) Push in on the pin against the spring pressure and place a finger over the vacuum connection pipe on the modulator.
- (5) Wait several seconds to ensure that the vacuum holds, then remove the finger and listen for a hissing sound. If the sound is present the diaphragm is not punctured or damaged.

NOTE: The presence of transmission fluid in the vacuum pipe and loss of fluid from the automatic transmission with no apparent leaks is indicative of a punctured or damaged vacuum diaphragm.

TO INSTAL

Installation is a reversal of the removal procedure with attention given to the following points:

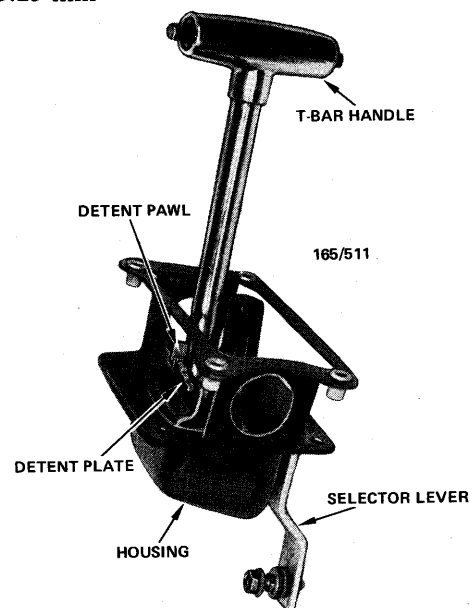
- (1) Position the actuating pin in the vacuum modulator.
- (2) Instal and securely tighten the vacuum modulator.
- (3) Check the condition of the vacuum hose and renew if necessary.

- (4) Top up the transmission with the correct grade of fluid as described under the appropriate heading.

7. T-BAR DETENT PAWL

TO ADJUST

- (1) Working from beneath the vehicle, disconnect the transmission control rod from the selector lever.
- (2) Working from inside the vehicle, remove the screw securing the T-bar handle to the selector lever and remove the handle.
- (3) Remove the centre console. If necessary refer to the heading Heater and Controls in the Cooling System section for the correct procedure.
- (4) Remove the indicator lamp from the selector lever.
- (5) Remove the screws securing the selector lever and housing to the floor and remove the selector lever and housing. Temporarily instal the T-bar handle.
- (6) With the selector lever positioned in P (park), measure the clearance between the detent pawl and detent plate using a gauge wire. The clearance should be 0.12-0.25 mm



View of selector lever and housing assembly removed from vehicle.

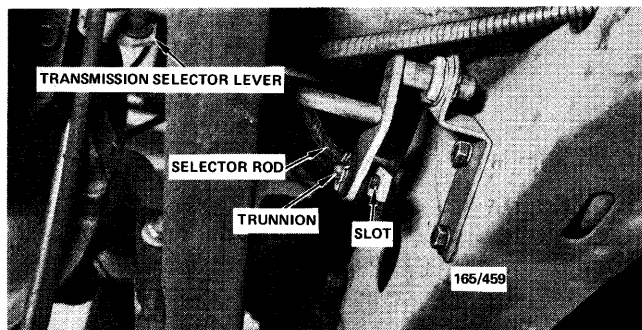
- (7) If adjustment is necessary remove the rubber plug from the housing. Loosen the detent pawl adjusting screw locknut and rotate the adjusting screw in the desired direction until the specified clearance is obtained. Tighten the locknut and fit the rubber plug.

Installation of the selector lever and centre console is a reversal of the removal procedure.

8. TRANSMISSION SHIFT LINKAGE

TO ADJUST

- (1) Raise the front and rear of the vehicle and



Underbody view showing selector rod adjusting point. Borg Warner column shift model shown.

support on chassis stands. Release the handbrake.

(2) Using a spanner of correct size, loosen the locknut on the trunnion at the end of the speed selector rod so that the trunnion can slide smoothly in the selector rod slot.

(3) Set the selector lever on the transmission assembly in the D (drive) position, ensuring that the detent plunger is fully seated by moving the lever back and forth to eliminate any slackness.

(4) Move the selector lever in the vehicle so that the indicator is on the D (drive) position on the selector quadrant slightly favouring N (neutral). Working beneath the vehicle tighten the trunnion locknut against the flat side of the selector rod. Ensure that the selector lever on the transmission case has not been moved during this operation.

(5) Move the speed selector lever through all speed detent positions to ensure that the quadrant indicator points centrally to the appropriate speed letter on the quadrant.

(6) Select the P (park) position and check the parking pawl engagement by trying to turn the propeller shaft.

(7) Check and if necessary adjust (C4 transmission only) the starter neutral safety switch. See Neutral Safety Switch — To Adjust.

(8) Select the R (reverse) position with the engine off and the ignition switch on and check the reverse lamp operation.

(9) Lower the vehicle to the ground.

9. NEUTRAL SAFETY SWITCH

TO ADJUST

Borg Warner Models

The neutral safety switch on this make of transmission is a non adjustable unit. If the starter motor will not operate in the P or N positions or will operate in any position and the manual linkage is not worn and is correctly adjusted, the switch then should be renewed.

C4 Models

(1) Adjust the manual linkage correctly. See Transmission Shift Linkage — To Adjust.

(2) Place the selector lever in neutral, raise the

vehicle and support on chassis stands.

(3) Slacken the two switch retaining bolts.

(4) Using a number 43 drill shank insert the shank of the drill into the gauge pin hole of the switch.

(5) Rotate the switch slowly until the shank of the drill slips through the switch to a depth of 12.3 mm.

(6) Tighten the two retaining bolts with the shank of the drill still inserted through the switch.

(7) Remove the drill and check the operation of the switch.

TO REMOVE AND INSTAL

(1) Raise the vehicle and support it on chassis stands.

(2) Disconnect the neutral safety switch wires at the connector.

(3) Remove the two retaining bolts or screws and remove the switch.

NOTE: On C4 models remove the transmission kickdown lever locknut and disconnect the lever before removing the switch retaining bolts.

Installation is a reversal of the removal procedure ensuring the vehicle only starts in the N or P positions.

10. TRANSMISSION KICKDOWN CABLE

TO REMOVE AND INSTAL

Borg Warner Models

(1) Open the engine bonnet and remove the air cleaner assembly.

(2) Remove the nut and washer securing the outer cable to the cable bracket and disconnect the inner cable from the throttle linkage.

(3) Raise the front of the vehicle and support on chassis stands. Place the selector lever in the N (Neutral) position.

(4) Remove the transmission oil pan and drain the transmission fluid. If necessary refer to the heading Hydraulic Fluid — To Drain and Refill for correct procedure.

(5) Rotate the cam on the valve body in the transmission to enable the inner cable end to be removed from the mounting hole in the cam assembly.

(6) Remove the outer cable from the transmission by unscrewing the adaptor from the transmission case. Remove the sealing washer.

(7) Release the cable assembly from any retaining clips and remove the cable assembly from the vehicle.

(8) Instal the outer cable into the transmission case using a new sealing washer between the adaptor and the case. Tighten the adaptor securely.

(9) Instal the inner cable to the cam assembly in the reverse order to the removal method.

(10) Instal the transmission oil pan using a new gasket and tighten the retaining bolts securely.

(11) Secure the cable assembly with the retaining clips.

(12) Lower the vehicle to the ground.

(13) Flex the inner cable to remove any kinks and connect the cable to the throttle linkage.

(14) Fit the outer cable to the bracket and secure the assembly with the retaining nut and washer.

(15) Adjust the outer cable length by turning the adjusting nut until all slack is removed from the inner cable. Tighten the locknut.

(16) Fully open the throttle and check that the cable pull is 44.5 mm minimum.

(17) Move the ferrule on the inner cable so that the distance of the ferrule to the outer cable end is 0.02–0.25 mm. Crimp the ferrule firmly to the inner cable at this position.

(18) Refill the transmission case with the recommended grade and quantity of transmission fluid.

(19) Instal the air cleaner assembly. Road test the vehicle and check the change pattern.

(20) Recheck the fluid level and top up as necessary.

C4 Models

(1) Raise the engine bonnet and fit covers to both front fenders.

(2) Remove the air cleaner assembly if necessary referring to the Fuel System section for the correct procedure.

(3) Release the inner cable from the throttle linkage.

(4) Remove the locknut holding the top of the outer cable to the bracket.

(5) Raise the vehicle and support it securely on chasis stands.

(6) Remove the retaining clip, washers and cable from the kickdown lever.

(7) Release the locknut securing the outer cable to the mounting bracket.

(8) Slide the locknut and protective cover away from the outer cable, far enough to release the cable from the mounting bracket.

(9) Remove the cable assembly from the vehicle.

Installation is a reversal of the removal procedure with attention to the following:

Adjust the kickdown cable as described under the appropriate heading.

TO ADJUST CABLE

Borg Warner Models

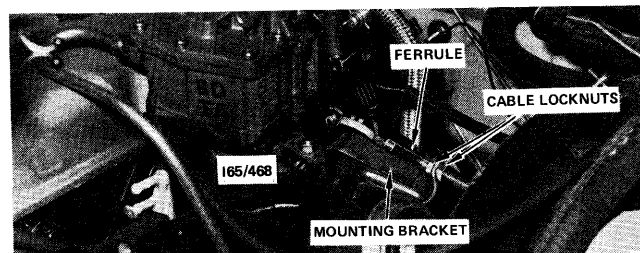
(1) Raise the engine bonnet and fit covers to both front fenders.

(2) Remove the air cleaner assembly, if necessary refer to the Fuel System section for the correct procedure.

(3) Check the carburettor for full throttle opening and that the choke valve is fully open. If necessary refer to the Fuel System section for the adjustment procedure.

(4) Check the idle speed and adjust. If necessary refer to the Tune-Up section for the correct procedure.

(5) With the engine switched off slacken off the



Kickdown cable adjusting point. Borg Warner models.

locknut securing the outer cable to the mounting bracket.

(6) Adjust the outer cable until a clearance of 0.25 mm is obtained between the plastic ferrule on the inner cable and the end of the threaded part of the outer cable. Tighten the locknut. The inner cable should now be under slight tension.

(7) When satisfied that the desired adjustment is obtained fully open the throttle and check that the cable pull is 44.45 mm minimum.

(8) Refit the air cleaner assembly and road test the vehicle.

C4 Models

(1) Raise the engine bonnet and fit covers to both front fenders.

(2) Remove the air cleaner assembly. If necessary refer to the Fuel System section for the correct procedure.

(3) Check the carburettor for full throttle opening and ensure that the choke valve is fully open. If necessary refer to the Fuel System section for the adjustment procedure.

(4) Disconnect the kickdown cable trunnion from the throttle linkage.

(5) With the aid of an assistant hold the throttle in the full open position.

(6) Slacken the locknuts securing the outer cable to the mounting bracket.

(7) Pull the cable trunnion hard up. This will place the kickdown lever on the transmission in the full kickdown position.

(8) Adjust the outer cable until the inner cable trunnion can be connected to the throttle linkage without slackness in the inner kickdown cable.

(9) Secure the inner cable trunnion to the throttle linkage.

(10) Secure the outer cable locknut ensuring that the inner cable is taut.

(11) Refit the air cleaner assembly and road test the vehicle.

11. TRANSMISSION ASSEMBLY

Special Equipment Required:

To Remove and Instal — Suitable trolley jack to which the transmission can be secured

TO REMOVE

(1) Disconnect the earth lead at the battery and the

power lead at the starter solenoid terminal.

(2) Disconnect the starter switch control wire at the small terminal on the solenoid.

(3) Take out the bolts and remove the starter motor.

(4) Raise the vehicle to a suitable working height and support it front and rear on chassis stands. Loosen the oil pan retaining bolts and drain the transmission fluid.

(5) Remove the retaining bolt, disconnect the transmission filler tube and dipstick assembly and withdraw the filler tube from the transmission case. Plug the filler tube aperture in the transmission case.

NOTE: On vehicles fitted with C4 transmissions the torque converter may be drained via two drain plugs.

(6) Disconnect the transmission kickdown cable from the accelerator linkage.

(7) Disconnect and remove the transmission shift linkage at the lever on the side of the transmission.

(8) Disconnect the propeller shaft at the rear universal joint and tape the joint bearing assemblies to the trunnion. Withdraw the propeller shaft from the rear of the transmission case and remove the shaft assembly from the vehicle. Plug the rear of the transmission case to prevent entry of dirt and loss of transmission fluid from the rear extension housing.

(9) Unplug the speedo electrical wiring connection and disconnect the handbrake cable from the equaliser bar.

(10) Disconnect the oil cooler pipes at the transmission unions and plug both the pipes and pipe unions.

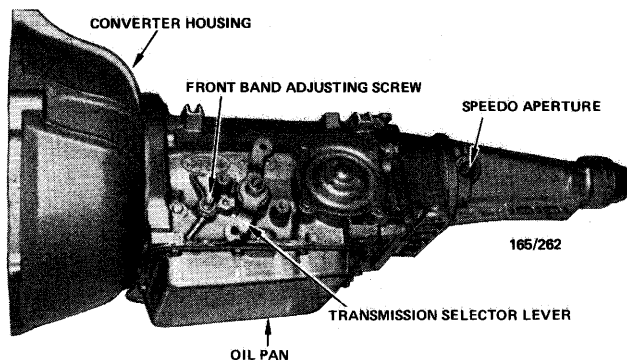
(11) Disconnect the neutral safety switch wires.

(12) On C4 transmissions only disconnect the vacuum hose from the transmission vacuum modulator and detach the pipe from the retaining clip.

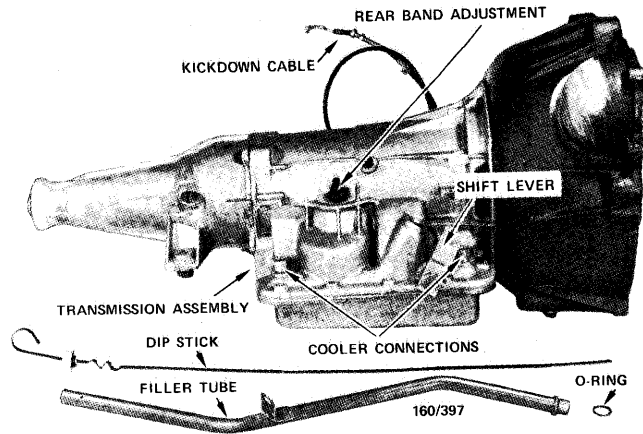
(13) Disconnect the exhaust pipe flange from the manifold.

(14) With a suitable protection on the jack head, support the rear of the engine and transmission under the rear of the engine sump.

(15) Remove the attachment bolts securing the transmission mounting support to the underbody cross-member. Remove the two nuts and washers and remove



Left hand side view of C4 transmission.



Right side of Borg Warner transmission assembly.

the crossmember from the underbody.

(16) Take out the attaching bolts and remove the converter housing lower cover plate.

(17) Mark the drive plate and converter so that they may be assembled in the original position.

(18) Lower the engine and transmission assembly on the jack sufficiently to allow access to the transmission to engine securing bolts and suitably support the transmission assembly.

NOTE: Ensure that the transmission assembly is supported on and secured to a suitable jack so that it cannot become dislodged when it is withdrawn from the vehicle.

(19) Remove the bolts or nuts securing the torque converter to the drive plate and lever the torque converter back into the housing.

(20) Remove the bolts securing the transmission to the engine and carefully withdraw the assembly rearwards off the dowels in the rear of the crankcase to clear the converter from the drive plate.

(21) Using a bolt, attach a suitable retaining strap to the converter housing, bolting it to one of the housing cover plate holes so that it retains the converter in position when the transmission is withdrawn.

(22) Lower the jack supporting the transmission assembly and withdraw it from under the vehicle.

NOTE: It is important that the jack supporting the transmission assembly is placed under the oil pan flange to avoid damage to the internal fluid transfer pipes. Care should also be taken not to dent the oil pan, for the same reason, if the transmission is placed on the floor or a bench.

TO INSTAL

Installation is a reversal of the removal procedure with particular attention to the following points:

(1) Ensure that the converter is fully engaged in the front of the transmission.

(2) Ensure that the front face of the transmission case and the rear face of the engine crankcase are both

perfectly clean and free of any burrs.

(3) Turn the engine crankshaft to align the marks on the drive plate and converter, made when removing the transmission assembly.

(4) Instal the bolts or nuts securing the converter to the drive plate and tighten evenly to the specified torque.

(5) Tighten the bolts securing the converter housing to the engine.

(6) Fit a new 'O' ring to the oil filler tube and instal

it in the transmission case.

(7) Fill the transmission with the specified grade of recommended hydraulic fluid.

(8) Check, and if necessary, adjust the selector rod, throttle kickdown cable and neutral safety switch as previously described. Adjust the handbrake cable.

(9) Road test the vehicle to ensure that the transmission operates satisfactorily and check the fluid level as described under Hydraulic Fluid — To Check and Top Up.

Refer to supplement
for more information.

REAR AXLE

SPECIFICATIONS

Type Semi floating hypoid final drive

Ratios:

Conventional differential 2.92:1, 3.23:1, 3.50:1

*Limited slip differential 2.92:1, 3.23:1

Bearing type:

Drive pinion Tapered roller

Crownwheel carrier Tapered roller

Axle shaft Tapered roller

Maximum axle shaft end float 0.63 mm

**Carrier bearing preload:

New bearings 1.1 - 2.8 Nm

Used bearings 0.5 - 1.4 Nm

Pinion bearing preload:

New bearings with oil seal 1.7 - 3.4 Nm

Used bearings with oil seal 0.9 - 1.7 Nm

Crownwheel to pinion backlash 0.13 - 0.18 mm

Crownwheel run out limit 0.127 mm

*Rear axles fitted to 750 kg vans and utilities with 3.3 and 4.1 litre engines have a four pinion differential.

**Measured without axle shafts or pinion.

TORQUE WRENCH SETTINGS

Crownwheel retaining bolts 145 Nm

Bearing cap bolts 61 Nm

Rear cover bolts 30 Nm

Axle bearing retainer plate nuts 47 Nm

Rear spring 'U' bolt nuts 68 Nm

Shock absorber to spring plate nuts 50 Nm

Stabiliser bar clamp bolts 21 Nm

Radius rods 75 Nm

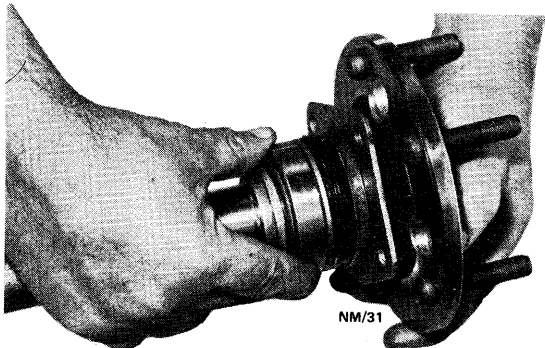
Pinion flange nut Tighten to achieve specified bearing preload

Differential case bolts (Limited slip only) 35 Nm

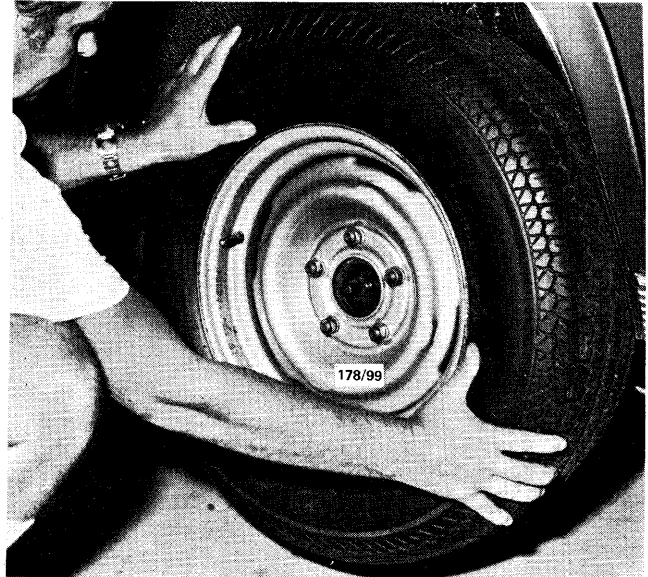
1. REAR AXLE TROUBLE SHOOTING

REAR WHEEL NOISE

(1) Wheel loose on axle flange: Check condition of axle and road wheel. Tighten or renew faulty components.



With the axle shaft removed turn the bearing by hand to check for roughness.



Axle shaft bearing noise can be diagnosed by spinning one wheel at a time and listening for a rumble.

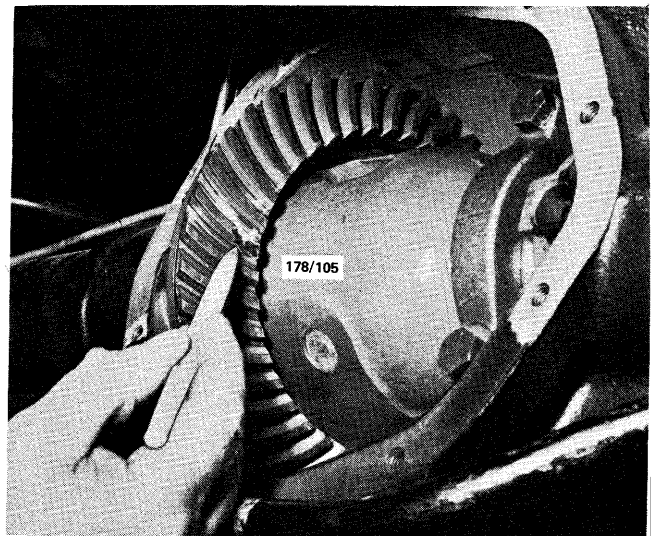
(2) Defective brake components: Overhaul brakes as described in the Brakes section.

(3) Defective axle shaft bearing: Remove axle shaft and instal a new bearing and seal as described in this section.

(4) Bent axle housing or shaft: Renew axle housing and/or shaft.

(5) Wheel bent or out of balance: Renew wheel and/or balance wheel and tyre assembly.

NOTE: Raise and support the rear of the vehicle. Check the wheel nuts for tightness and spin the wheel to check for run out. Axle shaft bearing noise can be diagnosed by spinning one wheel at a time and listening for a rumbling noise. When carrying out the wheel



Final drive gear noise can also be caused by internal damage or wear.

bearing test, place the transmission in neutral. If the axle shaft is suspected of being bent, remove the axle shaft and check for run out between centres.

FINAL DRIVE GEAR NOISE

- (1) Lack of Lubricant: Rectify oil leak and top up with correct grade of oil.
- (2) Loose bearing cap bolts: Torque bolts to Specifications.
- (3) Loose pinion nut: Tighten pinion nut. Check pinion preload.

NOTE: Check out possible causes in the order given. Final drive gear noise can also be caused by internal damage or wear, in which case the differential assembly will have to be removed for overhaul. In most cases if the differential assembly is damaged it is best to instal an exchange unit.

REPEATED AXLE SHAFT BREAKAGE

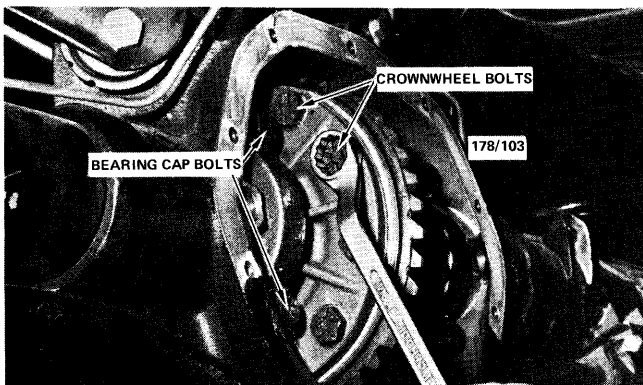
- (1) Bent axle housing: Renew housing.
- (2) Repeated overloading: Revise load capacity.
- (3) Abnormal clutch operation: Revise driving habits. Check clutch condition.

NOTE: If the clutch is operating correctly and overload not the cause, check the rear axle housing for bent condition.

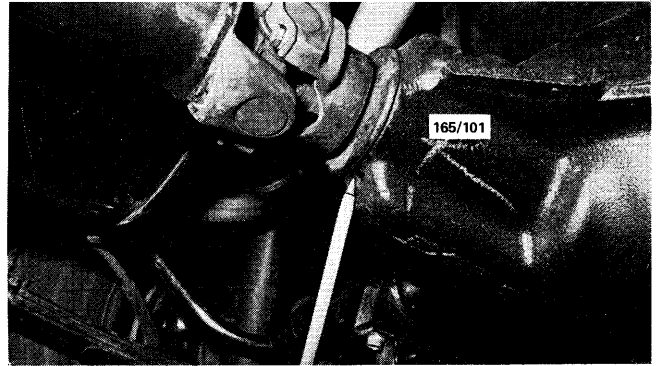
PINION SHAFT WILL ROTATE BUT NOT DRIVE VEHICLE

- (1) Broken axle shaft: Check and renew axle shaft.
- (2) Sheared crownwheel bolts: Renew crownwheel bolts.

NOTE: Withdraw the axle shafts and check for breakage. Remove the differential cover plate and check crownwheel bolts. It is imperative that all foreign metal particles are removed from the rear axle assembly before replacing cover and filling with oil.



Check the crownwheel and bearing cap bolts for tightness.

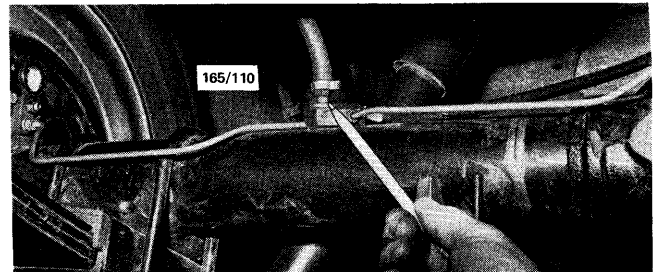


If the rear axle is loosing oil, check the pinion shaft oil seal as a likely leakage source.

LOSS OF LUBRICANT

- (1) Leaking pinion oil seal: Renew oil seal and inspect flange.
- (2) Leaking axle shaft oil seal: Renew as necessary.
- (3) Leaking cover gasket: Renew gasket.
- (4) Porous or cracked rear axle assembly: Repair or renew assembly.

NOTE: Check breather for clogging before thoroughly washing down the rear axle assembly and checking for leaks. If oil leakage is not apparent when the rear axle is cold, run the vehicle on the road until the rear axle reaches operating temperature. Check thoroughly for small cracks in the rear axle housing. Normally small cracks do not open up and leak oil until the rear axle reaches operating temperature.



If the rear axle breather is clogged, internal pressure will force lubricant out of the axle shaft and pinion seals.

LIMITED SLIP DIFFERENTIAL OPERATING NOISE

- (1) Whirring sound: This noise does not indicate failure of the differential, it is usually contributed to severely unbalanced drive conditions.
- (2) Groaning or chattering noise: Possible lubrication failure. Drain and refill the differential using the correct lubricant. Road test, if noise remains remove differential and inspect.

NOTE: If a limited slip differential is fitted ensure that both rear tyres are exactly the same size.

2. DESCRIPTION

The rear axle is the integral carrier, semi-floating type with hypoid final drive gears.

The differential assembly can be one of two types, i.e., conventional or limited slip. With the exception of this unit all other aspects of both rear axles are similar.

The crownwheel and differential assembly is carried on tapered roller bearings. Axial adjustment of the assembly controlling the bearing preload and crownwheel to pinion backlash is obtained by the use of spacer shims installed between the bearing outer cups and the differential housing abutments.

Pinion bearing pre-load is controlled by a collapsible spacer, installed between the inner cones of the front and rear pinion bearings.

Axle shaft and bearing assemblies and axle shaft and pinion oil seals can be removed and installed without removing the axle housing from the vehicle.

Removal and installation of the axle assembly is necessary to facilitate the dismantling, assembling and adjusting procedures of the differential.

The roller type axle shaft bearings are installed from the splined end of the shaft to abut a locating shoulder on the shaft, and are retained by a collar which is an interference fit on the shaft and which bears against the bearing inner race.

The axle shaft oil seals are located outboard of the axle bearing assemblies on the axle shafts, therefore if the oil seal is faulty the bearing must be removed to gain access to the oil seal. It is recommended that once the axle bearing assembly has been pressed from the axle shaft it should be discarded and a new bearing fitted in its place.

A rear axle fitted with a limited slip differential can be identified by a metal tag under the oil filler plug.

3. AXLE SHAFT AND BEARING

Special Equipment Required:

To Renew Bearing and Oil Seal — Vertical press and press plates

TO REMOVE AND INSTAL

Drum Brake Models

- (1) Loosen the road wheel nuts.
- (2) Raise the rear of the vehicle and support on stands placed under the rear axle housing. Remove the road wheel, slacken off the brake shoe adjuster and remove the brake drum. Refer to the Brakes section if the brake drum is hard to remove.
- (3) Using the correct size socket and a socket wrench, work through the large access hole in the axle shaft flange to remove the nuts from the bolts securing the axle shaft retaining plate and the brake backing plate to the axle tube flange.
- (4) Withdraw the axle shaft assembly, manoeuvring the bearing carefully through the centre of the backing plate and remove the axle shaft from the vehicle.

NOTE: If the bearing cup remains in the axle tube then withdraw the cup from its seat in the axle tube flange by prising it out evenly with a suitable screwdriver.

(5) Remove and discard the axle shaft retainer plate gasket.

Installation is a reversal of the removal procedure with attention to the following points:

Ensure the drain hole between the axle shaft tube and the brake backing plate is clear of obstructions.

Coat both sides of a new retainer plate gasket lightly with a suitable gasket sealer and instal it onto the backing plate.

If necessary instal the axle bearing outer cup onto the bearing. Lubricate the axle bearing with rear axle oil before installing the outer cup.

Carefully engage the axle shaft splines into the differential side gear splines and manoeuvre the bearing and axle seal squarely into place in the axle tube.

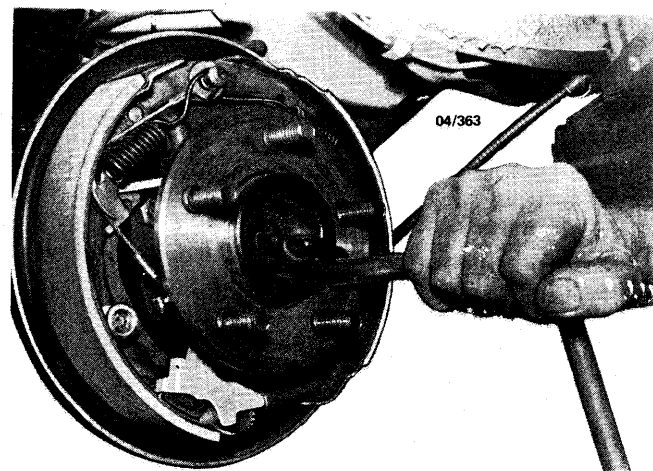
Instal the retainer plate nuts and tighten them evenly and gradually to ensure the axle shaft bearing and seal abut squarely against the axle tube. Tighten the retainer plate nuts finally to 47 Nm.

Adjust the brakes as described in the Brakes section.

Check the rear axle oil level and top up with the correct grade lubricant.

Disc Brake Models

- (1) Loosen the rear road wheel nuts.
- (2) Raise the rear of the vehicle and support on chassis stands placed under the rear axle housing. Remove the road wheel.
- (3) Disconnect the handbrake cable at the caliper as described in the Brakes section.
- (4) Bend back the lock tabs on the caliper mounting bolts and remove the two bolts.
- (5) Lift the caliper from the disc and support the caliper out of the way, ensuring the brake flexible hose does not take the weight of the caliper.
- (6) Undo the screw retaining the brake disc to the



Removing rear axle bearing retaining plate nuts. Drum brake models.

axle shaft flange and remove the brake disc.

(7) Undo and remove the four retainer plate nuts, working through the axle shaft flange access hole.

(8) Withdraw the axle shaft assembly from the axle tube.

NOTE: If the axle shaft is found to be tight in the axle tube, reverse the brake disc and loosely instal on the axle flange studs with the wheel nuts. Use the disc assembly as a slide type puller. Under no circumstance may the disc be hammered.

(9) Remove and discard the retainer plate gasket.

NOTE: If the bearing cup remains in the axle tube, then prise the cup evenly from its seat by using a screwdriver.

Installation is a reversal of the removal procedure with attention to the following points:

Smear both sides of a new retainer plate gasket lightly with a suitable gasket sealer and instal it onto the backing plate.

Lubricate the axle shaft bearing with rear axle oil and assemble the outer cup if necessary onto the axle bearing.

Engage the splines on the axle shaft with those of the differential side gear before pushing the axle shaft bearing and seal into the axle tube.

Instal the retainer plate nuts. Slowly tighten them in such a manner as to allow the axle bearing and seal to be drawn squarely into the axle tube. Finally tighten the retaining nuts to 47 Nm.

Position the brake disc on the axle flange, instal and



52/135

Installing rear axle bearing cup to axle housing. Drum brake models.

tighten the securing screw.

Slide the caliper over the brake disc and instal the lock plate and the two caliper bolts. Securely tighten the bolts, then bend over the lock tabs.

Check the rear axle oil level and top up with the correct grade of lubricant.

Connect the handbrake cable and adjust the handbrake.

Pump the brake pedal to return the brake pads to their correct position before road testing the vehicle.

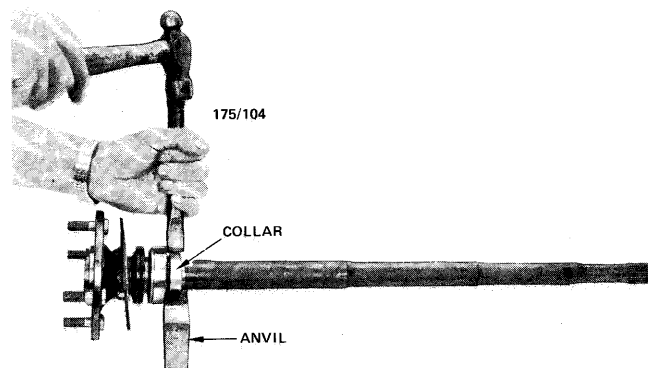
TO RENEW BEARING AND OIL SEAL

NOTE: The use of a proper press and press plates are essential when renewing an axle shaft bearing. If this equipment is not available, it is recommended that the axle shaft and bearing be taken to a workshop with this necessary equipment.

(1) Remove the axle shaft as previously described.

(2) Position the bearing retaining collar on an anvil. Using a cold chisel, make several shallow cuts in the collar to expand it sufficiently to be removed by hand.

NOTE: Care must be taken not to damage the axle shaft with the cold chisel.



Method of removing axle shaft bearing retaining collar.

(3) Press the bearing from the axle shaft and slide the oil seal and the bearing retainer plate from the axle shaft.

(4) Inspect the bearing retainer plate for distortion. Repair or renew if necessary.

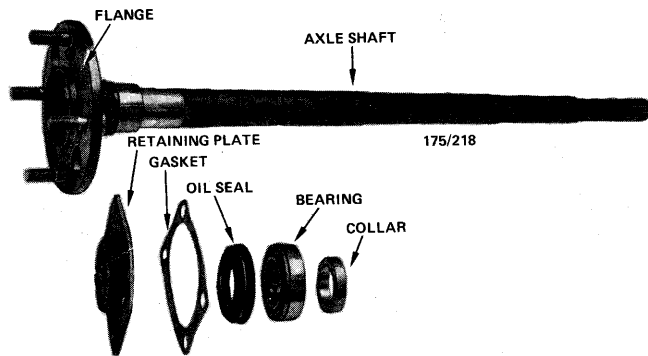
(5) If necessary remove the bearing cup from the axle tube. Clean and inspect the axle tube for damage.

(6) Place the bearing retainer plate on the axle shaft making sure the plate surface faces away from the axle flange.

(7) Fill the lip cavity of the new seal with grease and place the seal over the axle shaft, ensuring the lip cavity is facing away from the axle flange.

(8) Position the new bearing on the axle shaft ensuring that the rib-ring is towards the axle flange and retaining plate.

(9) Check that the bearing is positioned squarely



Dismantled view of axle shaft components.

on that axle shaft and manoeuvre the retaining collar over the axle to abut the bearing cone assembly. Using the press, press the bearing and the retainer simultaneously to seat the bearing against the flanged shoulder of the axle shaft.

NOTE: The new unit type bearing uses a protective grease which provides initial lubrication until the differential lubrication oil reaches the bearing when in service. If for any reason the bearing is washed in solvent, it must be relubricated before installing.

(10) Instal the axle shaft in the vehicle, refer-To Remove And Instal Axle Shaft.

4. DRIVE PINION OIL SEAL

Special Equipment Required:

To Renew Oil Seal — Pinion flange puller, Stillson

TO RENEW OIL SEAL

(1) Chock the front wheels. Raise the rear of the vehicle and support on chassis stands placed under the rear axle housing.

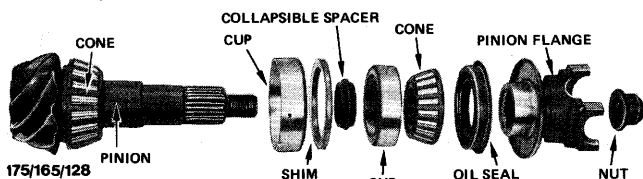
(2) Mark the relationship of the pinion flange to the propeller shaft to ensure correct reassembly.

(3) Remove the bolts and plates holding the propeller shaft to the pinion flange.

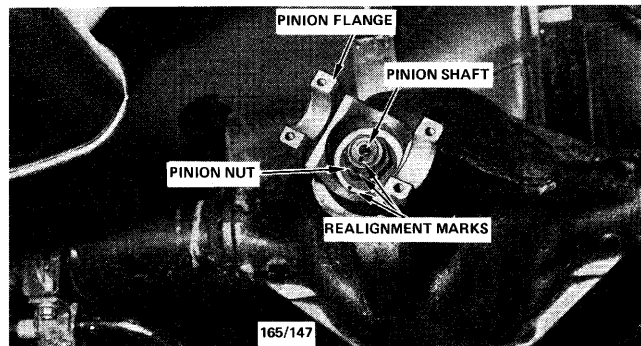
(4) Disconnect the propeller shaft from the pinion flange and tie to one side. Tape the universal joint trunnions in position to prevent damage or loss of the trunnion needle bearings.

(5) Carefully mark the pinion shaft, pinion nut and pinion flange to ensure correct assembly.

(6) Using a suitable size Stillson wrench hold the pinion flange stationary, then undo and remove the retaining nut.



Dismantled view of the drive pinion components.



Realignment marks placed on the pinion components prior to removing oil seal.

(7) Place a drain tin under the differential to receive the overflow of oil once the pinion flange has been removed.

(8) Use a suitable puller to remove the pinion flange.

(9) Clean all dirt from around the pinion seal area. Prise the oil seal out of the rear axle housing, taking care not to damage the pinion oil seal seat.

(10) Wash and clean the oil seal seat and inspect for burrs or damage.

Installation is a reversal of the removal procedure with attention to the following points:

Lubricate the lip of the new seal with grease. Smear the outer circumference of the seal with a suitable sealing compound and instal the seal squarely into the axle housing using a suitable sized tubular drift and hammer. Ensure the lip of the seal is facing towards the pinion bearing.

Align the marks on the pinion shaft with those on the pinion flange, made during the dismantling procedure and gently push the pinion flange onto the pinion shaft.

Instal the pinion flange retaining nut and tighten the nut until the marks made on dismantling are exactly aligned.

NOTE: It is imperative that all marked components are assembled in the same position as they were prior to dismantling. If the pinion flange nut is tightened excessively, then the collapsible preload spacer may collapse causing excessive preload on the pinion bearings.

Align the propeller shaft mark with the mark made on the pinion flange and instal and tighten the propeller shaft retaining plates and bolts.

Check and if necessary top up the rear axle assembly with the correct grade of lubricant.

5. COVER PLATE GASKET

TO RENEW

(1) Raise the rear of the vehicle and support on stands placed beneath the axle housing as close as

possible to the road wheels.

(2) Place a drain tin beneath the differential, wash and clean all dirt and road grime from around the cover plate. Loosen all the cover plate retaining bolts and carefully prise the cover plate away from the axle housing. Allow the axle oil to flow into the drain tin.

(3) Carefully prise up the brake pipe retaining tab and move the brake pipe slightly away from the cover plate.

(4) Remove the cover plate retaining bolts and carefully manoeuvre the cover plate past the brake pipe and remove it from the vehicle.

(5) Thoroughly clean all traces of the old gasket from the axle housing cover plate face, ensuring that no pieces of the old gasket fall into the housing.

(6) Wash the cover plate and remove all traces of the old gasket from the cover plate face.

(7) Check the bearing cap bolts and crownwheel bolts for correct tension. Torque to Specifications.

(8) Coat both sides of the new gasket with a suitable sealer and position the gasket on the axle housing.

(9) Manoeuvre the cover plate past the brake pipe and place it in position on the axle housing.

(10) Fit the cover plate retaining bolts and tighten securely. Position the brake pipe correctly and bend over the retaining tab.

(11) Fill the rear axle housing with the correct grade and quantity of oil, refer to Specifications in the Lubrication and Maintenance section. Remove the drain tin.

(12) Carefully lower the vehicle to the ground.

6. REAR AXLE ASSEMBLY

TO REMOVE AND INSTALL

(1) Loosen all the rear wheel nuts.

(2) Raise the rear of the vehicle and support on stands placed carefully just forward of the rear spring front mountings.

(3) Remove the rear road wheels.

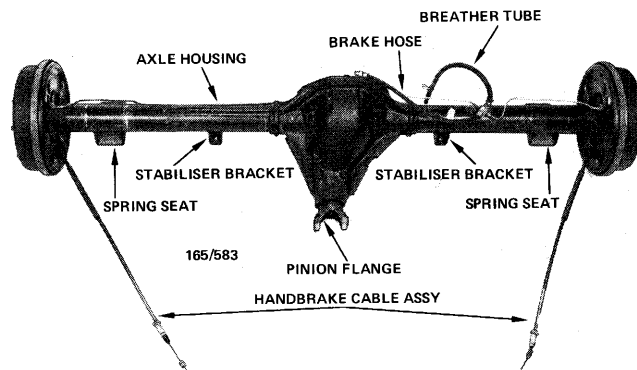
(4) Disconnect the rear handbrake cable as described in the Brakes section.

(5) Mark the propeller shaft and pinion flange to ensure the correct assembly. Disconnect the propeller shaft.

NOTE: It is advisable to tape the two needle roller bearing cups to the propeller shaft. The loss of any needle roller will render the universal joint unserviceable and a new universal joint will have to be fitted.

(6) Disconnect the brake pipe from the brake flexible hose at the underbody retaining bracket. Plug the flexible hose and the brake pipe to prevent loss of fluid and the ingress of dirt. Remove the retaining clip securing the flexible hose to the underbody bracket.

(7) Undo and remove the bolt retaining the axle housing breather tube to the underbody of the vehicle



View of rear axle assembly removed from vehicle.

and gently pull the tube from its locating hole in the body.

(8) Disconnect the shock absorber lower mountings from the spring mounting plate and push the shock absorbers out of the way.

(9) Remove the nuts from the spring mounting 'U' bolts, take off the lower mounting plates and where fitted the insulators.

(10) Remove the stabiliser bar mounting brackets from the axle housing.

(11) Move the axle assembly across to one side to clear the spring and lower that end to the ground. Carefully slide the axle assembly across to clear the other spring and lower the assembly to the ground.

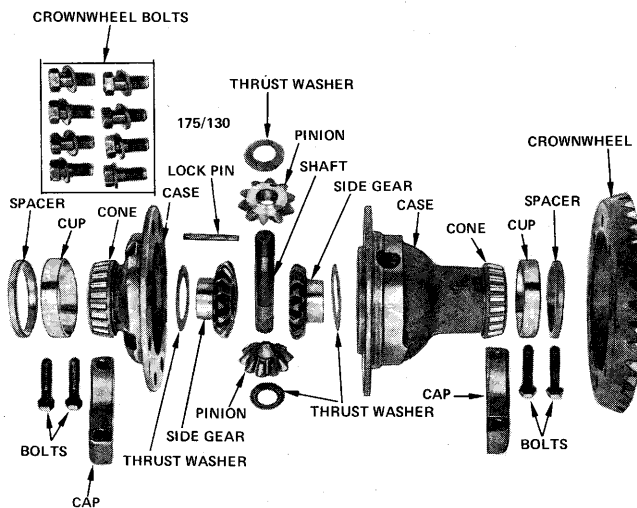
(12) Withdraw the assembly from beneath the vehicle. Installation is a reversal of the removal procedure with attention to the following points:

Adjust the foot brake and handbrake.

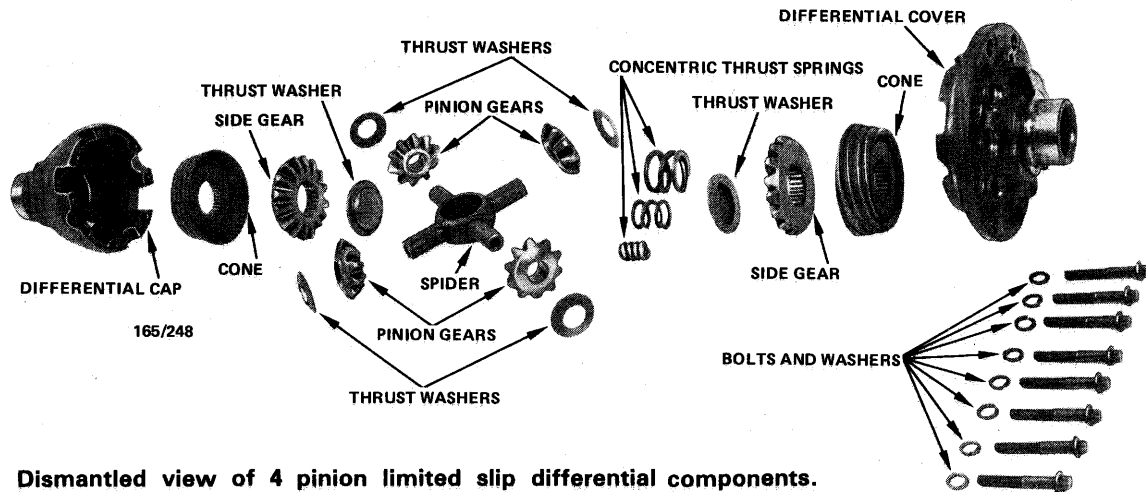
The rear brakes will have to be bled to remove all air from the brake lines.

With the vehicle level, check the axle oil level. Top up with the correct grade or lubricant.

Top up the brake master cylinder when the vehicle has been lowered to the ground.



Dismantled view of the crownwheel and differential case components.



Dismantled view of 4 pinion limited slip differential components.

7. DIFFERENTIAL AND FINAL DRIVE ASSEMBLY

Extensive knowledge and specialised equipment is required to carry out internal repairs to the differential and final drive assembly.

As the cost of the equipment required normally exceeds repair costs by a specialist or a factory exchange unit, it is not a worthwhile proposition for the owner/driver or the person of limited knowledge and equipment to attempt the overhaul procedure.

Specifications, illustrations and a tooth marking chart are included in the section for those who may feel competent and sufficiently equipped to undertake the operation.

8. LIMITED SLIP DIFFERENTIAL

Special Equipment Required:

To check Operation — Suitable axle hub adaptor

The limited slip differential unit is almost identical to the conventional unit regarding preload settings and general maintenance aspects, but testing, operating procedures and precautions are slightly different.

TO TEST PRELIMINARY

A chatter emanating from the differential side cones may be due to lack of lubricant between the cone friction surfaces. To ensure lubrication of the friction surfaces proceed as follows:

(1) Drive the vehicle at approximately eight kilometres per hour and execute five left and right hand turns on full steering lock.

(2) If the chatter is still noticeable, change the lubricant. Use only the specified oil when filling. Refer to the Lubrication and Maintenance section for Specifications.

(3) Should the chatter still persist, after carrying out operations (1) and (2), it will be necessary to dismantle the differential for further examination.

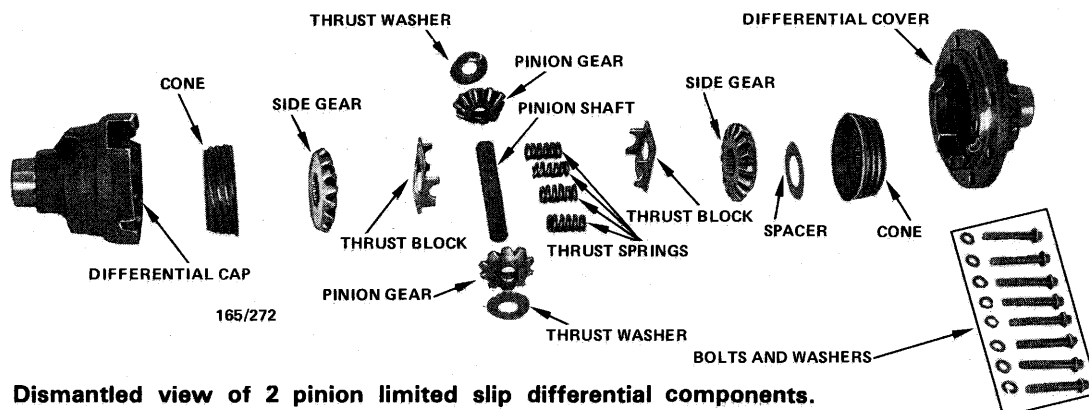
TO CHECK OPERATION

To check the differential for correct operation carry out the following test:

(1) Jack up one rear road wheel and place a stand under the axle tube.

(2) With the transmission in neutral, chock the front wheels and release the handbrake.

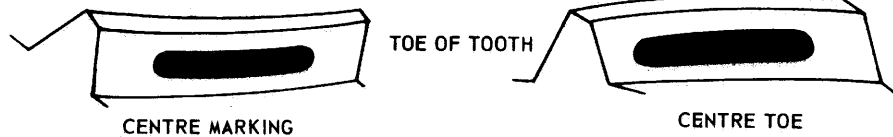
(3) Using a torque wrench of sufficient range in conjunction with the adaptor, rotate the axle and note the torque required to do so.



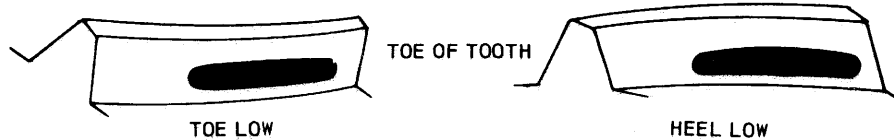
Dismantled view of 2 pinion limited slip differential components.

DRIVE

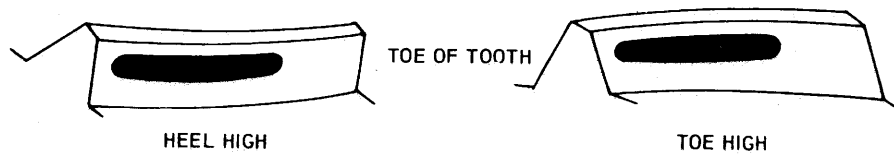
OVERDRIVE



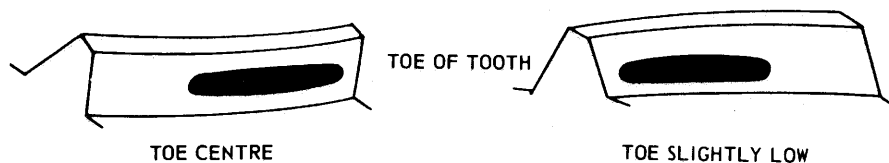
Crownwheel Tooth Marking for Correctly Adjusted Crownwheel and Pinion. Marking will be slightly Closer to Toe of Tooth on Overdrive or Concave Side. Changes in Thickness of Pinion Positioning Shims will Affect Tooth Marking on Overdrive to Greater Extent than on Drive or Convex Side of Tooth. Changes in Backlash have a more Pronounced Effect on Drive Side Markings (All models.)



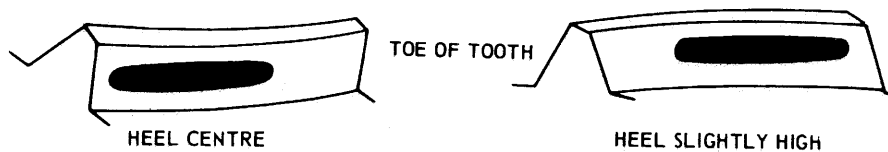
Low Profile Marking on Both Sides of Tooth. Rectify by Reducing Thickness of Pinion Positioning Shims and Reset Backlash (All models.)



High Profile Marking on Both Sides of Crownwheel Tooth. Rectify by Increasing of Pinion Positioning Shims and Reset Backlash (All models.)



Toe Marking on Drive Side and Low Profile Marking on Overdrive Side of Crownwheel Tooth. To Rectify, Increase Backlash. It may be Necessary to Increase Thickness of Pinion Positioning Shims to Maintain Backlash within Specified Limits (All models.)



Heel Marking on Drive Side and High Profile Marking on Overdrive Side of Crownwheel Tooth. To Rectify, Reduce Backlash. It may be Necessary to Decrease Thickness of Pinion Positioning Shims to Maintain Backlash within Specified Limits (All models.)

NOTE: After the initial movement of the axle, which may require a higher torque, rotation of the axle should require a minimum of 68 Nm.

- (4) In the event of the torque not being as specified, it will be necessary to dismantle the differential for further examination.
- (5) Carry out the same test on the opposite side

road wheel.

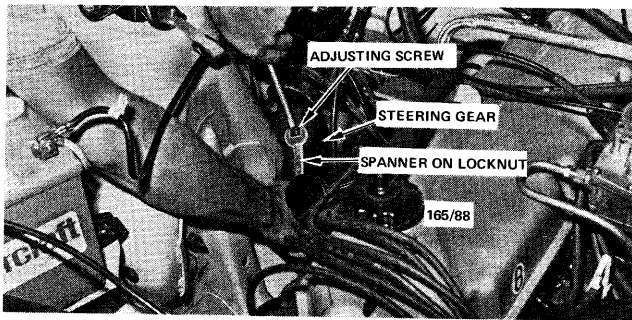
CAUTION: Never run the engine with the transmission in gear and one wheel raised. The drive force transmitted by the cone arrangement may cause the vehicle to move.

A whirring noise emanating from the differential does not indicate failure of the unit. It is usually contributed to severely unbalanced drive conditions.

PART 1. STEERING TROUBLE SHOOTING

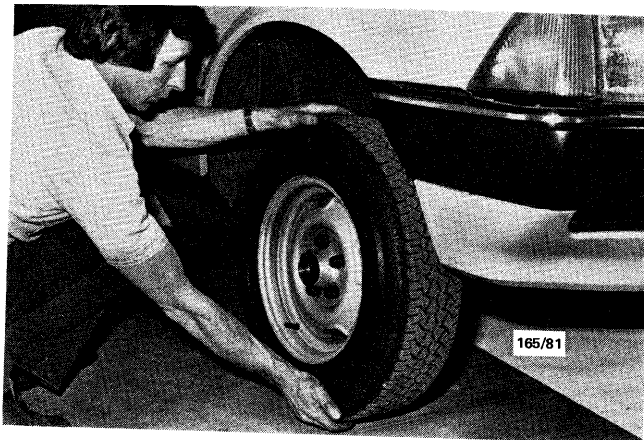
EXCESSIVE PLAY OR LOOSENESS IN STEERING GEAR

- (1) Steering gear worn or out of adjustment: If after adjustment looseness is still apparent then overhaul steering gear, renew faulty components and readjust.
- (2) Steering linkage ball joints worn or loose: Tighten or renew faulty components.
- (3) Pitman arm loose on sector shaft: Tighten pitman arm retaining nut.
- (4) Idler arm bushes worn: Renew idler arm bushes.
- (5) Steering gear loose on sub-frame mounting bolts: Tighten mounting bolts and check alignment of steering gear mounting.



Check and adjust steering gear.

NOTE: Looseness in the steering linkage is best assessed with the weight of the vehicle on the front wheels. Have an assistant turn the steering wheel backwards and forwards while the inspection for wear is made. If looseness in the steering gear is evident with the road wheels in the straight ahead position and with the steering gear centered, the steering gear will need to be adjusted. If after adjustment, looseness is still apparent then it will be necessary to overhaul the steering gear as outlined in this section.



Checking for looseness in front wheel bearings.

HEAVY STEERING

- (1) Low or uneven tyre pressure: Check tyres and inflate to recommended pressures.
- (2) Steering gear incorrectly adjusted: Check and re-adjust steering gear.
- (3) Front suspension worn or out of alignment: Check front end for wear, renew worn components and re-align.
- (4) Misalignment between steering gear and column mounting: Check and align steering gear and column mountings.
- (5) Soft or sagging front coil springs: Renew coil springs and adjust front end alignment.
- (6) Power steering drive belt broken: Renew drive belt and adjust.
- (7) Power steering fluid level low due to fluid leak: Check fluid level and rectify leak where necessary.

NOTE: Ensure that both front tyres have ample depth of tread and are inflated to the correct pressure. Check the front suspension components for wear before having the steering geometry checked. See Front Suspension section for component checking procedure.

STEERING PULLS TO ONE SIDE

- (1) Uneven tyre wear or pressure: Check condition of tyres and inflate to recommended pressure.
- (2) Incorrect front end alignment: Check and align front end.
- (3) Dragging brakes: Check brakes.
- (4) Broken or sagging rear spring(s): Renew faulty springs.
- (5) Broken rear spring centre bolt: Renew faulty components.
- (6) Damaged front suspension or front frame members: Check and renew damaged components.
- (7) Faulty or damaged front lower suspension arm mounting: Check, renew and adjust front lower suspension arm mounting.

NOTE: If tyre condition and steering geometry have been checked out and found to be OK, raise the front of the vehicle and spin



Checking idler arm assembly for wear.

both front wheels to check for brake drag. To check if the vehicle has a broken rear spring or centre bolt measure from the centre of the front wheels to the centre of the rear wheels on both sides. Compare the measurements which should be equal. Before measuring ensure that the front wheels are in the straight ahead position.

FRONT WHEEL WOBBLE OR SHIMMY

(1) Looseness in steering gear: Adjust or overhaul steering gear.

(2) Uneven tyre wear or incorrect tyre pressures: Check condition of tyres and inflate to recommended pressure.

(3) Tyre and/or wheel unbalance: Check and balance as necessary.

(4) Front end damaged or out of alignment: Check and rectify front end damage and re-align front end.

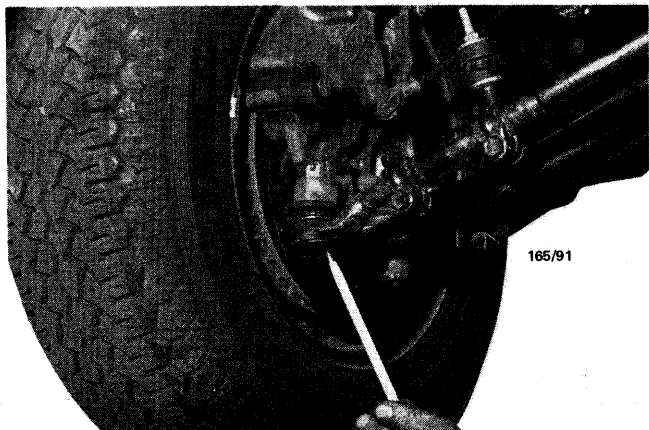
(5) Worn or badly adjusted front wheel bearing: Check condition and adjust wheel bearings.

(6) Front wheel alignment incorrectly adjusted: Check and adjust toe in.

(7) Loose or worn tie rod end ball joints: Check and renew faulty components.

(8) Faulty suspension components: Check and renew as necessary.

NOTE: Check the steering linkage as previously described. Raise the front of the



Check the steering linkage ball joints for looseness and wear.

vehicle and check the adjustment of the wheel bearings by working the road wheel in and out at the top and bottom. No perceptible movement in the wheel bearings should be felt.

STEERING ERRATIC OR WANDERING

(1) Incorrect or uneven camber and/or caster setting: Check and adjust front end alignment or renew worn components.

(2) Smooth front tyres: Check and renew tyres as necessary.

(3) Excessive play in steering gear and/or linkage: Check and renew faulty components, readjust.

(4) Excessive high or low tyre pressure. Check and inflate to recommended pressure.

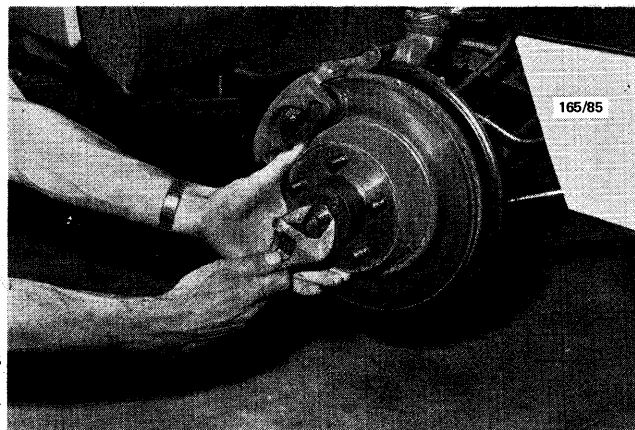
(5) Loose or incorrectly adjusted front wheel bearings: Check and adjust front wheel bearings.

NOTE: Incorrect or uneven camber is indicated by uneven wear of the tyres. The vehicle will have to be set up on a reliable wheel alignment machine and the error corrected.

NOISE IN POWER STEERING

(1) Loose or defective drive belt: Adjust or renew drive belt.

(2) Air in power steering system: Purge system of air.



Adjust the front wheel bearings as outlined in the front suspension section.

PART 2. CONVENTIONAL STEERING

SPECIFICATIONS

Type	Recirculating ball nut and sector
Ratio	20:1
Steering turns from lock to lock	5
Worm shaft bearing pre-load	339—904 mNm
Sector shaft end float	0.0—0.05 mm
Overall pre-load to rotate steering shaft over centre position	1130—1808 mNm
Number of ball nut balls	54

Bearing type:

Worm Shaft	Caged ball
Sector shaft	Needle roller
Steering column (upper)	Single row ball

TORQUE WRENCH SETTINGS

Steering gear to frame bolts	88 Nm
Column to brake pedal support bracket bolts ...	27 Nm
Pitman arm to steering connecting rod joint ...	64 Nm
Pitman arm to sector shaft nut	305 Nm
Flexible coupling nuts	27 Nm
Flexible coupling pinch bolt	52 Nm
Flexible coupling attaching nut	68 Nm
Ball return guide clamp screw	7 Nm
Sector shaft adjuster locknut	54 Nm
Sector shaft cover bolts	41 Nm
Idler arm bracket securing bolts	47 Nm
Steering wheel retaining nut	41 Nm
Idler arm to steering connecting rod joint ...	108 Nm
Tie rod ball joints	60 Nm

1. DESCRIPTION

The working arrangement of the recirculating ball type steering consists of a ball nut connected to the steering worm and in mesh with the sector gear. Helical grooves inside the ball nut match similar grooves on the worm and it is in these grooves that the balls circulate as the steering wheel is turned.

There are two complete ball circuits within the ball nut. To keep the balls from running out the end of either circuit the nut is equipped with two external tubular ball guides, which deflect the balls away from their helical path at one end of their travel, guides them diagonally across the back of the nut and returns them to their helical path between the ball nut and the worm at the other end of their travel.

The balls within the helical path constitute a thread between the worm and ball nut, so that when the worm shaft is turned, the nut moves along the worm. At the same time, the balls roll freely between the worm and the ball nut, circulating within their closed circuits so that screw motion is obtained with rolling instead of sliding contact between the parts.

Teeth on the ball nut engage teeth on a sector, forged integral with the sector. The teeth of the sector are tapered to allow lash to be adjusted by endwise movement of the sector shaft and this is effected by means of

an adjusting screw which extends through the gear housing end cover. The screw is locked by a locknut.

The teeth of the ball nut are cut so that when the sector is adjusted to take out all backlash at the centre of travel, or in the straight ahead position, there will be slight backlash when the steering is turned from the straight ahead position, thus ensuring freedom from binding when the steering is turned to left or right.

The sector shaft is supported by two bearings in the housing.

The worm shaft is mounted in the steering gear housing between the ball bearing assemblies. The outer race of the upper bearing is pressed into the worm bearing adjuster which screws into the housing and is locked by a special nut. The steering shaft is supported at the steering wheel end by a ball bearing pressed into the bearing support.

The steering linkage is the parallelogram type employing a connecting rod supported on one side of the frame by the pitman arm and at other side by an idler arm. Tie rods incorporating ball pivots connect each front wheel. Threaded sleeve adjustments are provided at each tie rod, the sleeves being prevented from turning by a screwhead clamp at each end.

The idler arm swings on rubber bushes turning on the idler arm support which is bolted to the front chassis side member.

A number of safety features are incorporated in the steering column assembly to lessen the possibility of injury to the vehicle driver in the event of an accident. The steering column is of the collapsible type which on severe impact would collapse at the column jacket.

In addition the shift tube and steering shaft sections are designed to collapse on impact. The upper mounting brackets of the column assembly are fitted with shearoff retainers which on impact allow the column to break free.

All models incorporate a combined steering and ignition lock which is situated on the right hand side of the column jacket. The ignition lock must be in the locked position in order to remove the ignition key.

2. STEERING WHEEL AND COLUMN

Special Equipment Required:

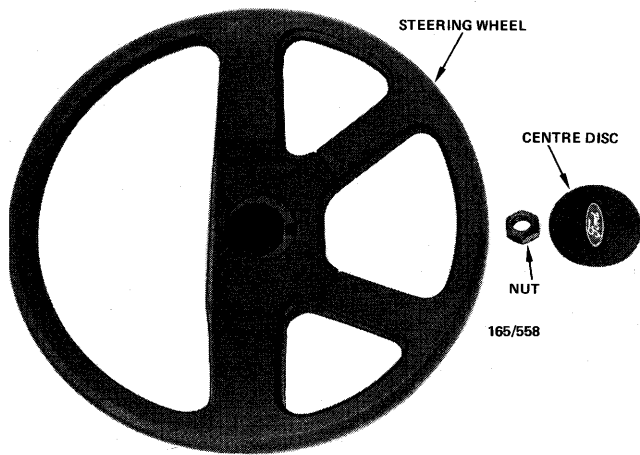
To Remove Steering wheel — Steering wheel puller

STEERING WHEEL AND UPPER SUPPORT BEARING

To Remove and Instal

- (1) Disconnect the negative (-) battery terminal.
- (2) Remove the centre disc from the steering wheel by levering out with a blunt instrument.
- (3) Unscrew the nut securing the steering wheel to the steering shaft.
- (4) Attach a suitable puller to the steering wheel and remove the wheel.

NOTE: Do not strike the steering shaft end with a hammer or use a knock off type puller



Steering wheel removed from vehicle.

to remove the steering wheel, as damage to the collapsible components may occur.

- (5) Slide the turn signal cancelling cam and spring off the steering shaft and place to one side.
- (6) Take out the screws securing the steering column flange shroud and remove the shroud ensuring not to lose the filler pieces from the shroud.
- (7) On automatic transmission models with column change remove the indicator lamp bulb.
- (8) Unscrew the wiper switch and turn signal switch screws and place the switches to one side.
- (9) Unscrew the bearing retainer plate screws and remove the plate.
- (10) Remove the bearing snap ring from the steering shaft.
- (11) Loosen the two nuts holding the bearing support housing and dislodge the bolts from their seats in the column jacket.

NOTE: When removing the steering column upper bearing support housing, the two retaining nuts may have to be completely removed to facilitate the removal of the support housing. Ensure that the square headed bolts do not fall into the steering column when removing the support housing.

- (12) Gently tap the bearing support housing and remove it from the column.

NOTE: To prevent damaging the bearing support housing when removing, use a soft faced hammer and note the position of the support housing to facilitate correct reassembly.

- (13) The bearing may now be removed from the housing.

Reassembly is a reversal of the removal procedure paying attention to the following points:

- (1) Instal the bearing support housing then push the bearing as far down the steering shaft as possible.
- (2) Place a piece of tube 19 mm inner diameter and

54 mm long over the steering shaft. Fit the steering wheel nut and tighten the nut until the bearing is correctly fitted in the support housing.

- (3) When refitting the turn signal switch ensure that the automatic indicator bulb wires (where fitted) are not trapped behind the switch.
- (4) Fit a new steering wheel self locking nut.

STEERING COLUMN ASSEMBLY

To Remove and Instal

NOTE: It is possible to leave the steering gear in position while removing the steering column.

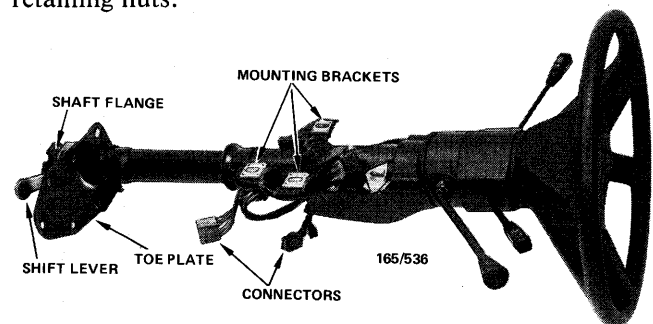
- (1) From under the engine bonnet disconnect the battery negative terminal at the battery.
- (2) On column shift models, disengage the transmission control linkage at the levers on the lower end of the column.
- (3) Remove the two nuts attaching the steering shaft flange to the flexible coupling.
- (4) Remove the lower facia panel beneath the steering column by turning the retaining clips half a turn.
- (5) Disconnect the turn signal switch and wiper switch wires at their connectors.
- (6) Disconnect the ignition switch wires at the connector.
- (7) Remove the bolts securing the column jacket toe plate and seal to the floor. Loosen the steering column to toe plate clamp bolt.
- (8) Remove the nuts securing the steering column mounting brackets to the brake pedal support bracket.

NOTE: When lowering the steering column retrieve the wedged spacer from the front left hand stud where fitted.

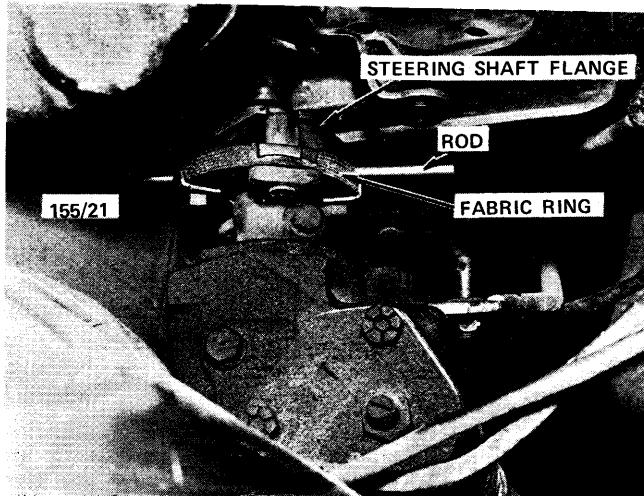
- (9) Remove the steering column assembly through the interior of the vehicle.

Installation is a reversal of the removal procedure with attention to the following points:

- (1) Position the steering column assembly in the vehicle and engage the flexible coupling bolts with the holes in the steering shaft flange.
- (2) Attach the steering column top mounting brackets to the brake pedal support bracket and loosely fit the retaining nuts.



Steering column assembly removed from vehicle. Manual transmission, column shift model shown.



Spacing the steering column assembly.

NOTE: Where fitted do not omit to fit the wedged spacer to the front left hand stud.

- (3) Instal and tighten the flexible coupling retaining nuts.
- (4) Insert a 6.3 mm dia. rod or drill shank between the steering shaft flange and the fabric ring to space the flexible coupling and the steering column assembly.
- (5) Ensure that the steering shaft is located in the centre of the column or shift tube at the lower end of the column.
- (6) Working inside the vehicle tighten the two rear top steering column mounting nuts. Where applicable position the wedged spacer as far rearward as possible and tighten the third retaining nut.
- (7) Instal the toe plate and securing bolts and tighten the four bolts surrounding the steering column first, then tighten the remaining three bolts.
- (8) Tighten the bolt fitted to the steering column clamp.

NOTE: Whilst carrying out operations (6), (7) and (8) check that the steering column shaft remains centralised each time.

- (9) Remove the 6.3 mm rod or drill previously installed in the coupling.
- (10) On column shift models connect the transmission control linkage(s).
- (11) Connect all the electrical wiring previously disconnected.
- (12) Fit the lower facia panel.
- (13) Connect the negative battery terminal.
- (14) Check that all the switches operate correctly.

STEERING SHAFT

To Remove and Instal

- (1) Remove the steering column assembly from the vehicle as previously described.

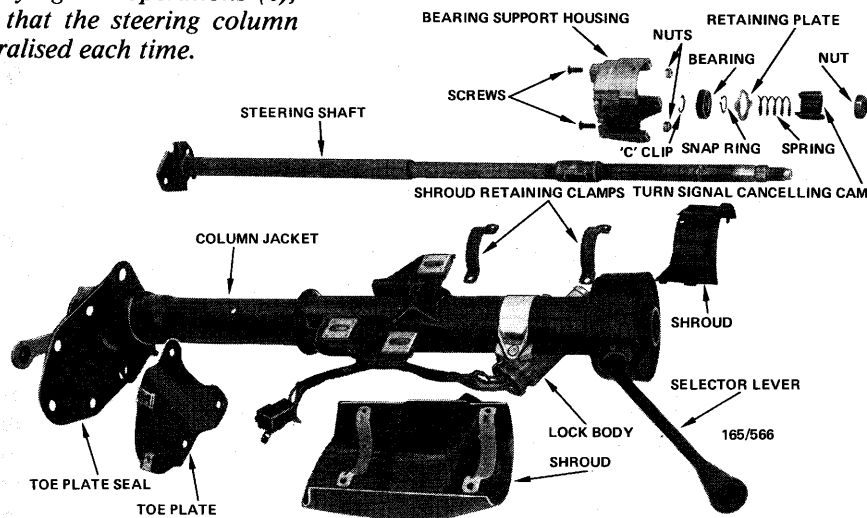
NOTE: To protect the finish on the steering column and associated components ensure that the column assembly is supported on a suitable padded or protective mounting while carrying out any dismantling or assembly work.

- (2) Remove the centre disc from the steering wheel by levering out with a blunt instrument.
- (3) Unscrew the nut securing the steering wheel to the steering shaft. Remove the steering wheel using a suitable steering wheel puller.

NOTE: Do not use a 'knock off' type puller or hit the wheel or shaft with a hammer as irreparable damage may be caused to the collapsible steering column.

- (4) Remove the shroud and the turn signal cam and spring.
- (5) Remove the upper bearing retaining plate and the snap ring.
- (6) Gently tap the top of the steering shaft with a rubber or wooden mallet to free it from the top bearing.
- (7) Withdraw the shaft through the bottom of the steering column.

Installation is a reversal of the removal procedure.



Dismantled view of steering column components.

3. STEERING GEAR ASSEMBLY

Special Equipment Required:

To Remove — Pitman arm puller

To Assemble and Adjust — Small tension wrench

TO REMOVE AND INSTAL

(1) Remove the two nuts attaching the steering shaft flange to the flexible coupling and disengage the two components.

(2) If the pitman arm and sector shaft are not already marked for reassembly, suitably mark them so that they can be reassembled in the original position.

(3) Remove the pitman arm retaining nut and lock washer and, using a pitman arm puller, withdraw the pitman arm off the sector shaft.

(4) Remove the bolts securing the steering gear to the frame side member and detach the gear assembly.

Installation is a reversal of the removal procedure with attention to the following points:

(1) Position the steering gear assembly against the frame side member and instal and tighten the securing bolts to the specified torque.

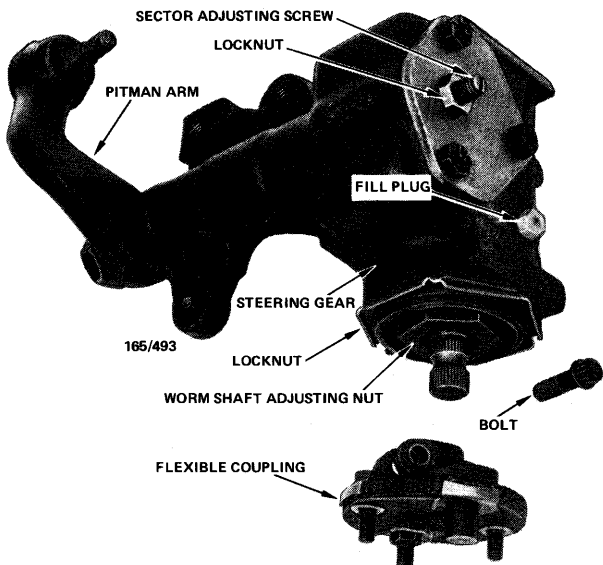
(2) Instal the two nuts at the flexible coupling to secure the steering shaft flange, and tighten to specifications.

(3) Instal the pitman arm on the sector shaft aligning the marks made on dismantling and tighten the retaining nut to the specified torque.

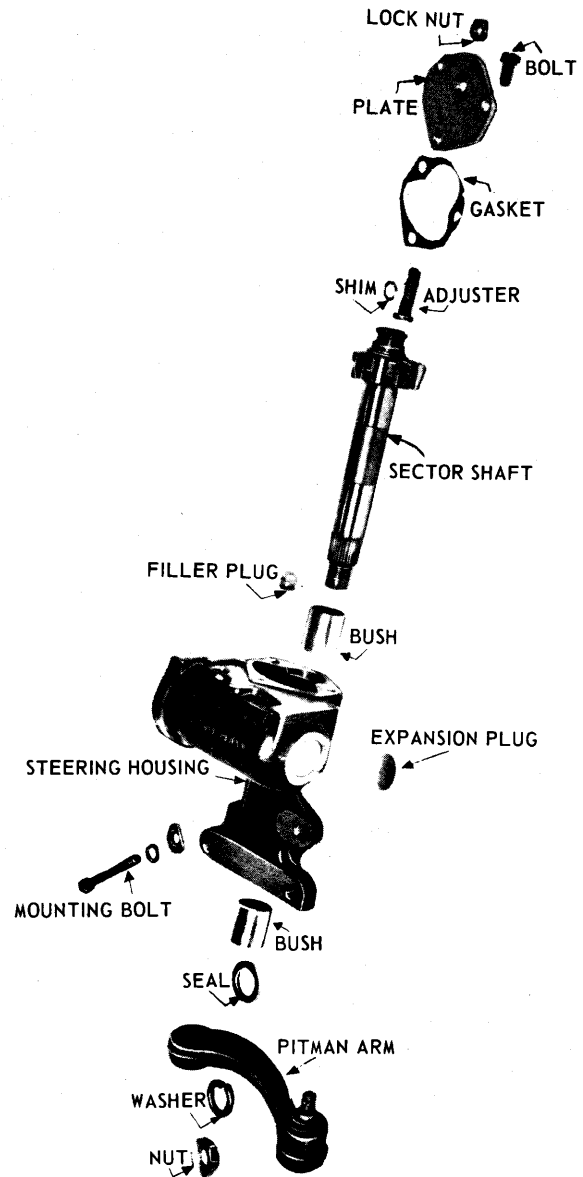
TO DISMANTLE

(1) With the steering gear removed from the vehicle, support in a vice by the case mounting lugs and remove the lock nut from the sector shaft adjusting screw.

(2) Turn the worm shaft to centre the ball nut and



Assembled view of steering gear and associated components.



Exploded view of steering gear sector shaft components. Typical.

sector and remove the three top cover plate retaining bolts. Remove the sector shaft with the cover plate.

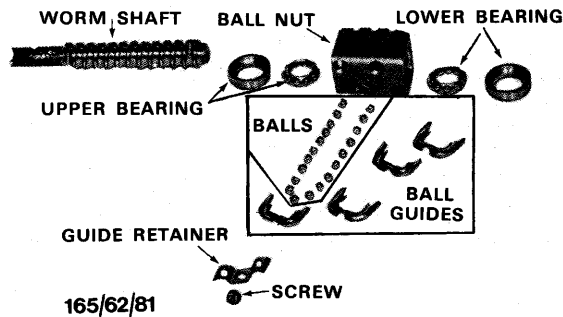
(3) Separate the sector shaft from the cover plate by screwing the adjusting screw in a clockwise direction. Retain the shim with the adjusting screw.

(4) Mark the flexible coupling in relation to the worm shaft. Remove the retaining bolt and remove the flexible coupling from the worm shaft.

(5) Remove the locknut and upper worm shaft bearing adjuster from the upper end of the steering gear case, together with the upper ball bearing.

(6) Withdraw the worm shaft and ball nut assembly from the upper end of the steering gear case and remove the lower ball bearing.

NOTE: Do not allow the ball nut to run down



Dismantled view of worm shaft and ball nut components. Typical

against the end of the worm or the adjacent ball guide or the ball nut will become damaged.

(7) Remove the retaining screw and clip securing the ball guides to the ball nut withdraw the guides and remove the balls retained in each guide.

NOTE: Operation (6) should be carried out on a clean cloth placed on a bench, so that none of the balls will be lost when removing the guides or the ball nut. All models have a total of 54 balls.

(8) Place the ball nut with the ball openings facing down, turn the worm slightly back and forth so that all the balls will fall out of the nut onto the cloth and remove the nut from the worm shaft.

(9) Tap out the sector shaft oil seal.

TO CLEAN AND INSPECT

(1) Wash all components in cleaning solvent and allow to dry.

(2) Check the steering shaft worm bearing inner cones for wear or pitting and renew the worm as required.

(3) Check the outer cups and balls of the steering worm shaft bearings for wear and pitting and renew as required.

(4) Check that the ball guides are not damaged or distorted.

(5) Check the ball nut teeth for damage or pitting.

(6) Check the teeth on the sector shaft for damage or pitting.

(7) Check the sector shaft and bearing for wear or damage and renew as necessary.

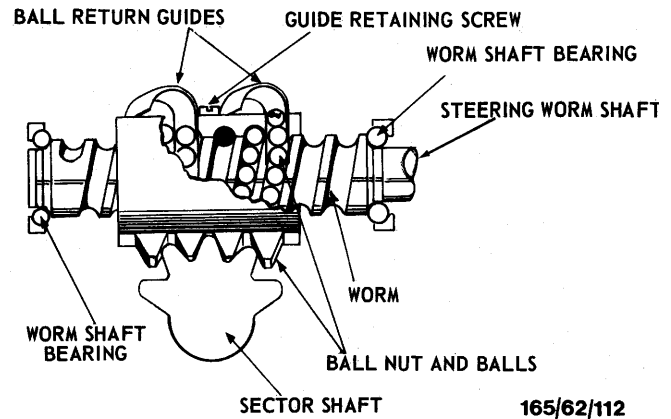
(8) Check the ball tracks on the steering worm for wearing and pitting.

(9) Instal a new seal into the bearing adjuster if necessary.

TO ASSEMBLE AND ADJUST

NOTE: Lubricate all moving parts and oil seals on assembly, using the specified type of lubricant. Refer to the Lubrication and Maintenance section.

(1) Instal a new sector shaft oil seal with the lip



Sectional view of worm shaft, ball nut, balls and sector assembly.

facing into the steering gear case.

(2) Place the ball nut on a clean bench with the teeth down, position the worm shaft centrally in the ball nut with the ball holes in the nut aligned with the grooves in the worm.

Divide the ball nut balls into two lots of 27, taking one lot of balls, feed them into one of the circuits in the ball nut, until the circuit is full.

NOTE: It may be necessary to rotate the worm slightly back and forth in order to completely fill the circuit.

(3) Place the remainder of the first lot of balls in the ball guide for this circuit. Plug the ends of the guide with light grease to retain the balls while fitting the guide assembly to the ball nut.

(4) Using the remaining lot of balls, fill the other ball nut circuit and ball guide and, with both ball guides in position on the ball nut, fit the guide retaining clip and secure with the screw and spring washer.

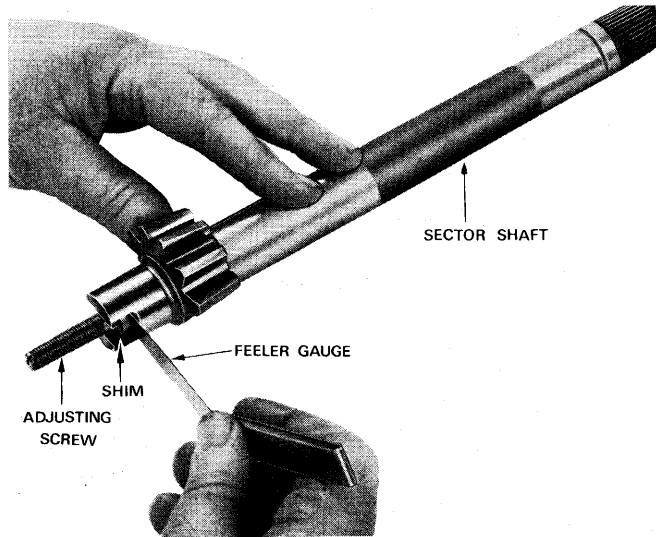
NOTE: Check that the worm shaft will turn freely in the ball nut, but do not allow the nut to run down hard against either end of the worm.

(5) Apply the recommended steering gear lubricant to the gear components, fit the worm lower ball bearing in position on its inner cone on the lower end of the worm.

(6) Insert the worm shaft assembly into the steering gear case from the upper end, fit the upper worm ball bearing and screw the bearing adjuster into the end of the steering gear case just far enough to remove all end float in the worm shaft bearings. Instal the adjuster locknut.

NOTE: Use a non-hardening sealing compound on the external threads of the bearing adjuster before installing to prevent lubricant seepage. Do not apply sealer to the internal thread in the steering gear case.

(7) Set the worm shaft axis to the horizontal position and clamp the gear case in a vice.



Measuring clearance between adjusting screw head and sector shaft.

(8) Attach a mNm tension wrench to the end of the worm shaft, tighten the pre-load nut until a pull of 339-904 mNm is required to turn the worm shaft. Tighten the adjuster lock nut.

(9) Check the clearance between the head of the sector shaft back lash adjusting screw and the abutment face of the sector shaft spigot with the adjusting screw assembled in the spigot end of the sector shaft.

(10) This clearance must not exceed a maximum of 0.05 mm. If necessary select a shim to give a zero clearance without binding. Turn the worm shaft so that the ball nut is in the centre of the worm and insert the sector shaft so that the centre tooth of the sector will mesh between the two centre teeth of the ball nut.

(11) Using a new gasket, position the top cover so that the sector shaft adjusting screw on the spigot end of the sector shaft can be screwed into position.

NOTE: Ensure that the sector shaft adjusting screw is screwed sufficiently through the top cover so that no pre-load is subjected onto the sector shaft when the cover bolts are installed in the cover.

(12) Instal and tighten the top cover bolts.

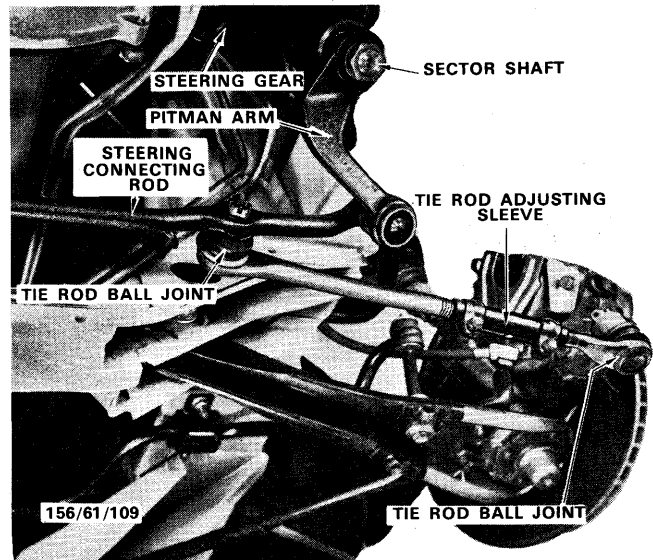
(13) Fit the locknut to the sector shaft adjusting screw and fill the steering gear with lubricant.

(14) Attach a mNm tension wrench to the end of the worm shaft. Tighten the sector shaft adjusting screw to give a total pre-load (worm bearing plus sector mesh) reading of 1130-1808 mNm while rotating the worm shaft through the centre high point. Hold the sector shaft adjusting screw in this position and tighten the locknut.

4. STEERING LINKAGE

TO REMOVE AND DISMANTLE

(1) Jack up the front of the vehicle, block the rear



Drivers side view of steering linkage and pitman arm assembly.

wheels and support the vehicle on stands.

(2) Take out the split pins and remove the castellated nuts securing the ball joint studs to the steering arms.

(3) Disconnect each ball joint stud by placing a suitable dolly or hammer against one side of the steering arm eye and striking the opposite side with a hammer.

(4) Repeat operations (2) and (3) to detach the inner end of each tie rod from the steering connecting rod and withdraw the tie rods from the vehicle.

(5) Take out the split pin and remove the castellated nut on the pitman arm joint stud at the steering connecting rod.

(6) Using the above method, remove the stud out of the end of the connecting rod.

(7) Remove the split pin and castellated nut from the idler arm end and disconnect the steering connecting rod from the forward end of the idler arm and withdraw the connecting rod from the vehicle.

(8) Where necessary loosen the clamp retaining bolt and nut and unscrew the tie rod ball joint from the adjustable sleeve. Count and note the number of turns necessary to unscrew the tie rod ball joint to ensure correct assembly.

TO CHECK AND INSPECT

Clean all components in a suitable solvent and inspect for the following:

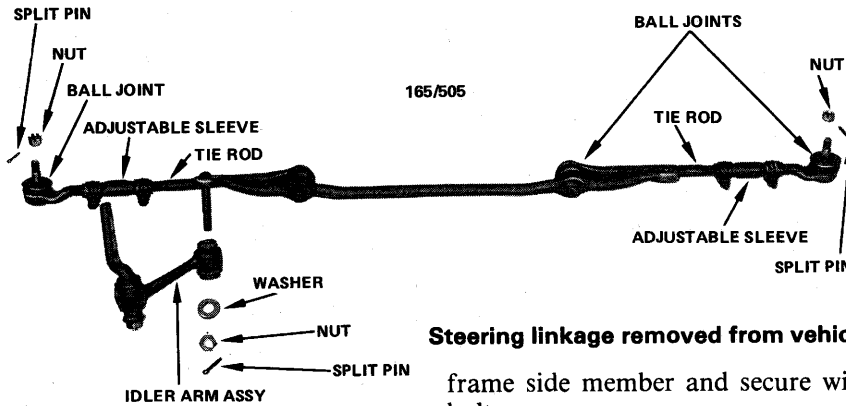
(1) Inspect the tie rod ball joints for excess wear and the dust seals for damage or deterioration.

(2) Check the tie rods and connecting rods for alignment and fatigue.

(3) Renew all worn or damaged components where necessary.

TO ASSEMBLE AND INSTAL

(1) Position the connecting rod on the pitman arm



Steering linkage removed from vehicle.

and idler arm and secure with the castellated nuts and new split pins. Refer specifications for torque settings.

(2) Attach the inner ball joint of each tie rod to the connecting rod, tighten the castellated nut and secure with a new split pin.

(3) Attach the outer ball joint of each tie rod to its respective steering arm, tighten the castellated nut and instal a new split pin.

(4) Centre the steering with the wheels facing straight ahead and adjust the toe in as described under the appropriate heading in the Front Suspension section.

NOTE: Ensure that the tie rods are of equal length on completion of adjustment.

5. STEERING IDLER ARM AND BRACKET

TO REMOVE AND INSTAL

NOTE: It may be necessary to renew the idler arm assembly as a complete unit in the event of wear or damage.

(1) Raise the front of the vehicle and support on chassis stands.

(2) Take out the split pin and remove the nut attaching the steering connecting rod joint to the end of the idler arm.

(3) Disconnect the steering connecting rod from the idler arm.

(4) Loosen off and remove the two nuts and bolts attaching the idler arm assembly to the frame side member and detach the assembly.

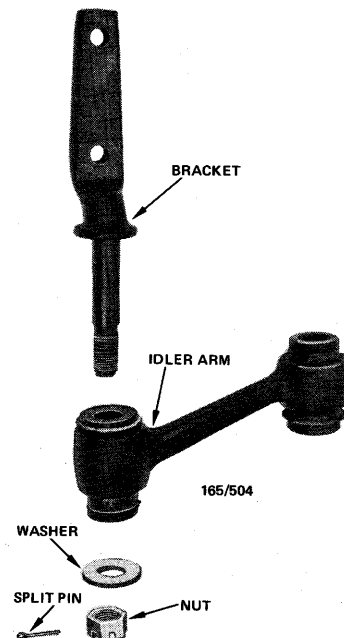
(5) Position the new idler arm assembly on the

frame side member and secure with the two nuts and bolts.

(6) With the front wheels and idler arm in the straight ahead position connect the steering connecting rod to the end of the idler arm.

(7) Instal and tighten the retaining nut and washer, renew the split pin.

(8) Lower the front of the vehicle to the floor and check the front wheel toe in. If adjustment is necessary, adjust both tie rods by equal amounts to maintain the steering wheel in a straight ahead position. Refer to the Front Suspension section for correct adjusting procedure.



Dismantled view of idler arm and bracket.

PART 3. POWER STEERING

SPECIFICATIONS

Type Bendix-Bishop integral steering gear incorporating a variable ratio worm

Ratio:

Maximum on centre 17.5:1

Minimum on turns 11:1

Steering wheel turns lock to lock 2.6

Normal pump pressure at idle speed 1034 kPa max

TORQUE WRENCH SETTINGS

Steering gear mounting bolts 88 Nm

Pitman arm to sector shaft nut 305 Nm

Pipe nut to power steering pump 20 Nm

Pipe nut to steering gear 41 Nm

1. DESCRIPTION

The power steering unit is of the Bendix-Bishop type and incorporates a variable pitch hourglass worm and integral power cylinder and valve assembly.

The steering is substantially less direct in the straight ahead position than it is when executing a left or right hand turn to the extent that where four or five steering wheel turns would normally be required from one lock to the other on the manual steering type, by virtue of the hourglass worm design only two and a half turns are required.

An oil flow of about nine litres per minute is continually pumped to the steering gear from the constant displacement oil pump. Normal driving requires very little pressure to maintain this oil flow, therefore very little power is absorbed from the engine. However, when parking or turning the rotary valve which is integral with the worm shaft restricts the free flow of the oil and pressure builds up almost immediately.

This pressure is directed by the rotary valve to the appropriate end of the power cylinder, to assist the driving effort, hence engine power is absorbed only when required.

Excessive hydraulic pressure will develop within the system when a full lock position is held by the steering wheel on either a left or right turn, or when excessive road loading is evident. For this purpose a pressure relief valve is incorporated. When the fluid pressure in the system reaches a pre-determined maximum the fluid by-passes through the relief valve and returns to the reservoir.

If a fault is encountered within the hydraulic system, such as pump failure or pressure drop due to a broken delivery pipe or leaking seals, the vehicle may still be driven, although steering loads will be substantially increased. In the interests of safety the vehicle should be driven in this condition for only short distances or to the nearest repair station where attention to the damaged components can be obtained.

NOTE: Refer to the Conventional Steering section for removal, dismantling and installa-

tion procedure for the steering column and steering linkage etc which is common for both conventional and power steering systems.

2. PRELIMINARY INSPECTION AND TESTING

If the power steering system becomes partially or fully inoperative it is most important that the following preliminary inspection and testing procedure be performed prior to undertaking any trouble shooting or repair operations.

PUMP DRIVE BELT

Inspect the pump drive belt for breakage, glazing or wear. If any of these characteristics are evident then renew the belt using only a genuine replacement of the same type.

If the belt is loose but still serviceable then adjust it using the procedure as outlined in the adjustment section.

NOTE: In most cases a loose drive belt can be heard squealing when a load is placed on the pump when the steering wheel is turned or as the engine is accelerated.

TO CHECK FLUID LEVEL

Start the engine and run it until the power steering fluid is at its normal operating temperature of approximately 76 deg C. Turn the steering wheel from lock to lock several times and stop the engine.

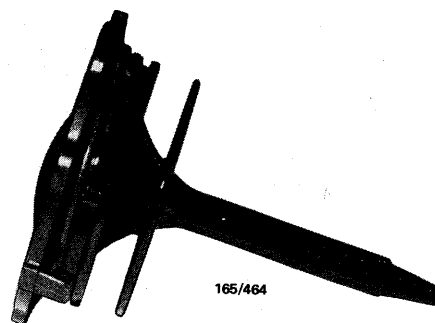
Check the fluid level in the power steering reservoir using the dip stick provided.

If it is necessary to top up the fluid, fill to the full mark indicated on the dip stick using Castrol TQF automatic transmission fluid.

CAUTION – Do not overfill the reservoir.

TO CHECK FOR FLUID LEAKS

Using a suitable solvent clean around all power steering assemblies and hose or pipe fittings where fluid leakage might prevail and then start the engine. Turn the steering wheel from one steering lock to the other several



View of power steering reservoir dipstick.

times and stop the engine. Check for leakage. Where leakage is found at pipe or hose fittings, tighten and recheck.

NOTE: The pump outlet pipe is fitted with a swivel type fitting, allowing the pipe to move freely in conjunction with engine movement.

If the leak remains, refer to In Car Adjustments and Minor Repairs for hose or pipe removal procedure.

Where leakage is found in items such as the steering gear assembly or pump and reservoir assembly specialist attention is necessary.

TO CHECK TURNING EFFORT

With the tyre pressure and front wheel alignment correctly adjusted and the vehicle placed on a dry bitumen or concrete surface start the engine and apply the handbrake.

With the engine at correct operating temperature and idling speed, turn the steering wheel from one lock to the other several times to warm the power steering fluid.

Suitably attach a torque wrench to the steering wheel hub and check the effort required to turn the wheel at least one complete turn in both directions from the straight ahead position. The turning effort should be approximately equal in both directions.

3. IN CAR ADJUSTMENT AND MINOR REPAIRS

PUMP BELT TENSION

Special Equipment Required:

To Purge Power Steering System of Air—Vacuum pump with gauge

(1) The use of a belt tension gauge is recommended when checking or adjusting the pump belt tension. The correct tension for a new belt is 680 N and a used belt 530 N.

(2) It is most essential that the pump belt be adjusted enough to prevent slip, but without imposing excessive load on the pump bearings.

(3) To adjust the pump belt, loosen the adjusting bolts situated on the front of the pump mounting plate.

(4) Insert a half inch drive socket bar into the square hole provided in the pump front cover plate.

(5) Raise the pump front cover plate far enough to obtain correct belt tension and tighten the pump adjusting bolts.

NOTE: When adjusting the pump belt tension, do not lever against the pump or reservoir tank, as damage could be done and a leak at the reservoir could result. Where a belt deflection gauge is unavailable refer to the Tune-Up section for a temporary adjustment procedure.

(6) Recheck the pump belt tension using the tension gauge.

TO REMOVE AND INSTAL PUMP TO STEERING GEAR HOSES AND PIPES

NOTE: The steering system will have to be purged after all service operations which allow air into the system.

(1) Drain the fluid from the pump reservoir by disconnecting the fluid return hose at the reservoir.

(2) Remove the fluid return hose from the oil cooler tube and disconnect the oil pressure pipe at the pump.

NOTE: The pump pressure pipe is fitted with a swivel type fitting, allowing the pipe to move freely in conjunction with engine movement. If a leak is evident at the swivel fitting the leak could be caused by a faulty 'O' ring, pipe end or nut, snap ring, pump outlet fitting or pump port. When rectifying a leak at the swivel fitting a tube nut wrench should be used. The 'O' ring and pump outlet fitting may be renewed separately. If renewal of the 'O' ring and pump outlet fitting does not rectify a leak, renew the pressure pipe as an assembly.

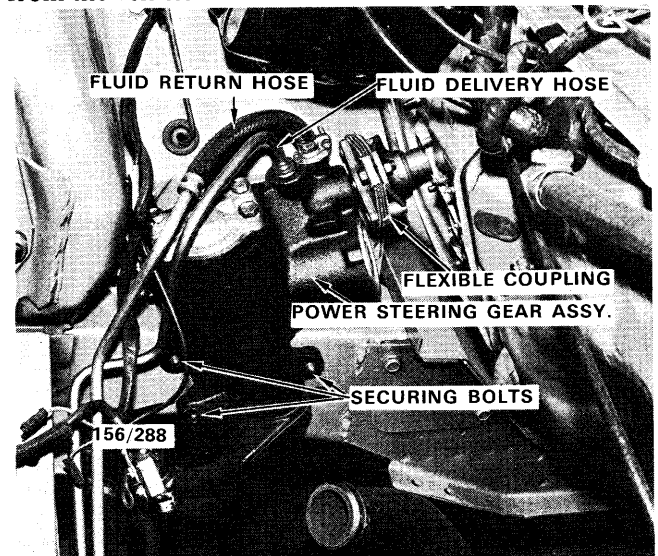
(3) Separate the oil return hose from the oil cooler tube at the right hand side front of the vehicle.

(4) Disconnect the fluid return hose and the delivery pipe from the steering gear.

(5) Raise the front of the vehicle and support on chassis stands placed under the front lower suspension arms.

(6) Disconnect the pipe clamps and insulators from the front crossmember by removing the attaching bolts from the side rail and left and right hand engine mounting brackets.

(7) Remove the pipes, clamps and the insulators from the vehicle.



View of power steering gear in its mounted position. Typical.

(8) If necessary remove the clamps and insulators from the fluid pipes by levering the locking tongue and legs apart with a screw driver.

(9) Thoroughly check the hoses and pipes for cracks, brittleness or abnormal wear through rubbing.

(10) Check the condition of the hose union seats and 'O' rings and renew as necessary.

Installation is a reversal of the removal procedure with attention to the following points:

(1) Manoeuvre the insulators and retaining clamps over the power steering pipes, position the clamps over the insulators and compress the clamps sufficiently to snap the locking tongues into place.

(2) Loosely instal the fluid pipes and clamps to their mounting positions.

(3) Reconnect the fluid pressure pipe to the steering gear and pump and securely tighten the nuts to Specifications using a pipe nut wrench. Do not overtighten the nuts.

(4) Reconnect the fluid return hoses to the steering gear and oil cooler tube.

(5) Securely tighten the pipe clamps ensuring that the pipes are correctly positioned.

(6) Purge the power steering system of air as described under the following heading.

TO PURGE POWER STEERING SYSTEM OF AIR

(1) Check and if necessary top up the power steering pump reservoir using the recommended fluid to the "cold" full mark on the pump dipstick.

(2) Disconnect the high tension lead from the ignition coil.

(3) Raise the front of the vehicle enough for the wheels to clear the ground and support on chassis stands.

(4) Rotate the engine by means of the starter motor ensuring that the steering wheel is not turned.

(5) Check and if necessary top up the power steering pump reservoir using the recommended fluid to the "cold" full mark on the pump dipstick.

(6) Rotate the engine by means of the starter motor whilst at the same time turning the steering wheel from lock to lock.

(7) Ensure that the pump reservoir fluid level is correct.

(8) Fit the vacuum pump to the pump reservoir filler neck.

NOTE: Do not use vacuum from the vehicle engine.

(9) Connect the high tension lead to the coil which was previously disconnected.

(10) Start the engine and allow to idle.

Apply the maximum of 50 kPa of vacuum to the pump reservoir for a minimum of 3 minutes. Whilst air is purging from the system ensure that the vacuum is maintained at a maximum of 50 kPa.

(12) Remove the vacuum pump from the reservoir filler neck.

(13) Check and if necessary top up the power steering pump reservoir to the correct fluid level. Fit the vacuum pump to the reservoir filler neck.

(14) With the engine idling apply the maximum of 50 kPa of vacuum to the pump reservoir.

(15) Turn the steering wheel from lock to lock every 30 seconds ensuring not to hold the steering wheel on the steering stops.

(16) Carry out operation (15) for approximately 5 minutes ensuring that the vacuum is maintained at a maximum of 50 kPa.

(17) Stop the engine and remove the vacuum pump from the reservoir filler neck.

(18) Check and if necessary top up the power steering pump reservoir to the correct fluid level and reinstall the pump dipstick.

(19) With the engine running turn the steering wheel from lock to lock and check for any oil leaks at the pipe or hose fittings.

NOTE: It may be required to carry out operations (8) to (18) repeatedly in severe cases of aeration.

(20) Raise the vehicle, remove the chassis stands and lower to the ground.

(21) Road test the vehicle.

4. POWER STEERING PUMP

TO REMOVE AND INSTAL

(1) Drain the fluid from the pump reservoir by disconnecting the fluid return hose at the reservoir.

(2) Disconnect the fluid pressure pipe from the pump. Where available use a pipe nut wrench.

NOTE: Leave the pump outlet fitting attached to the pump.

(3) Slacken the adjusting bolts and remove the drive belt from the pump pulley.

(4) Unscrew and remove the bottom retaining bolt along with the two adjusting bolts and remove the pump.

Installation is a reversal of the removal procedure with attention to the following points:

(1) Position the power steering pump on the mounting bracket and instal the three retaining bolts.

(2) Reposition the drive belt onto the pump pulley, adjust the belt tension as previously described and securely tighten the pump retaining bolts.

(3) Connect the fluid pressure pipe and the fluid return hose at the power steering pump and the reservoir and tighten to Specifications. Do not over tighten the pressure pipe nut.

(4) Purge the power steering system of air as previously described.

5. STEERING GEAR

TO REMOVE AND INSTAL

The removal and installation procedure for the steer-

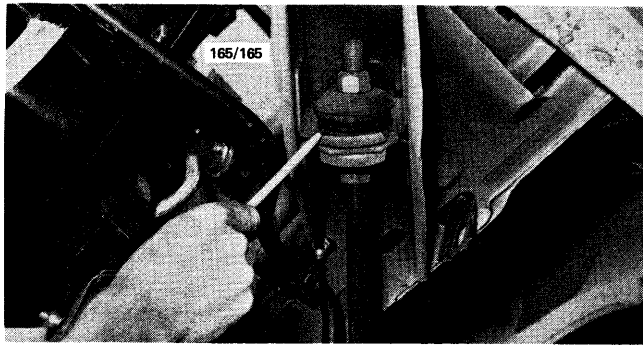
ing gear is the same as that covered in the conventional steering section with exception and attention to the following.

Disconnect the fluid hose and pipe attached to the steering gear housing.

Upon installation it will be necessary to reconnect the hose and pipe to the steering gear.

Purge the power steering system of air as previously described.

Check all pipe and hose fittings for leakage.



Inspect the radius rod rubbers for deterioration or wear.

POOR OR ERRATIC ROAD HOLDING ABILITY

- (1) Low or uneven tyre pressures: Inflate tyres to correct pressures.
- (2) Defective shock absorber operation: Check and renew faulty unit, preferably in pairs.
- (3) Incorrect front end alignment: Check and adjust the alignment if necessary.
- (4) Loose or defective stabiliser bar mounting rubbers: Check and tighten or renew mounting rubbers.
- (5) Weak or uneven front coil spring: Check and renew front coil spring, preferably in pairs.
- (6) Broken or weak rear leaf spring: Renew both rear springs as a matching pair.

NOTE: If the front of the vehicle is laying down further on one side than the other, remove the coil spring and check its free length against a new spring. If the spring is found to be unserviceable it is good practice to fit two new springs as a matching pair. This also applies to the springs on the rear of the vehicle.

As a quick guide to shock absorber condition, bounce the front of the vehicle up and down (one side at a time) and observe that the vehicle should come to rest in a single movement. If it bounces two or three times before stopping, the shock absorbers should be renewed.

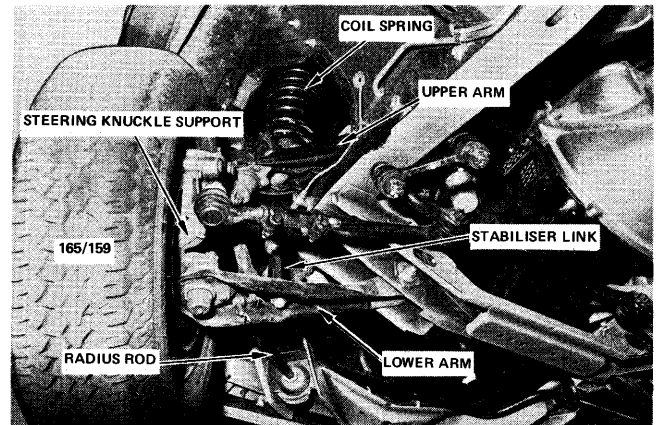
2. DESCRIPTION

The independent front suspension units comprise the following:

A lower swinging arm, pivoted at its inner end on the underbody crossmember and at its outer end by a ball joint to the lower end of the steering knuckle support.

An upper wishbone type arm, attached at the inner end to a pivot bolted to the wheel arch inner body panel and at its outer end by means of a ball joint to the upper end of the steering knuckle support.

The coil spring is mounted between the upper suspension arm and the underside of the body wheel arch. The tubular shock absorber works within the coil



Underbody view showing front suspension components.

spring attached at the top to the body panel bracket and at the bottom to the spring seat bracket on top of the upper suspension arm. A bump rubber is mounted on the body member above the outer end of the upper suspension arm.

A stabiliser bar, attached to the front of the body frame, is connected between both side lower suspension arms by rubber bushed links. It contributes considerably to the riding qualities of the front suspension units.

A radius rod is rigidly attached at its rear end to the outer end of the lower suspension arm and at its front end to a bracket on the body. The forward end of the radius rod is adjustable to provide adjustment of the caster angle. The camber angle on these models is adjustable by a cam or eccentric at the lower suspension arm pivot bolt.

Toe out on turns is not adjustable and is controlled by the set of the steering arms.

Toe in of the front wheels is adjustable by the steering linkage tie-rods.

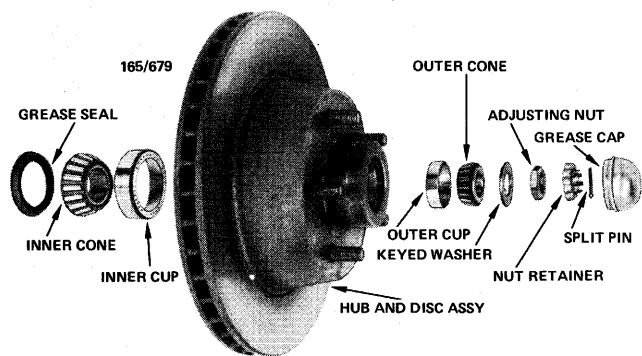
3. FRONT HUB ASSEMBLY

TO REMOVE AND DISMANTLE

- (1) Loosen the front wheel nuts.
- (2) With the transmission in gear or Park and with the handbrake applied, raise the front of the vehicle and support on stands.
- (3) Remove the road wheel.
- (4) Undo the locking wires and unscrew the bolts attaching the brake caliper and anchor plate assembly to the stub axle flange.
- (5) Lift the caliper assembly from the brake disc and support it from the body with tie wire.

NOTE: Never let the brake flexible hose take the weight of the caliper assembly.

- (6) Remove the hub grease cap, take out the split pin and remove the castellated nut retainer. Unscrew the hub bearing adjusting nut and remove the keyed washer.
- (7) Withdraw the bearing, hub and disc assembly from the stub axle.



Dismantled view of front hub and bearing components.

(8) Remove the outer bearing cone and roller assembly from the hub.

(9) Carefully tap the inner cone and roller assembly out of the hub inner bearing cup together with the hub grease seal.

(10) Using a suitable drift, drive the two bearing cups out of the hub. The inner bearing cup is removed from the inner end of the hub and the outer bearing cup from the outer end of the hub.

TO CLEAN AND INSPECT

(1) Remove all the old grease and wash all the components in cleaning solvent.

NOTE: Do not spin the bearings with compressed air as damage to the wheel bearings may result.

(2) Check the bearing rollers and cups for wear, pitting or damage and renew as necessary.

NOTE: Individual components of bearings should not be renewed separately. If any part of a bearing is faulty the complete bearing must be renewed.

(3) Check the threads on the end of the stub axle and in the bearing adjusting nut for damage. If the thread on the stub axle is unserviceable the stub axle and steering knuckle support assembly must be renewed.

TO ASSEMBLE AND INSTAL

(1) Using a drift instal the two bearing cups in the hub so that their tapers face outwards and oppose each other.

(2) Apply wheel bearing grease to the rollers of the inner bearing cone assembly and place it in position in the hub.

NOTE: Only the recommended high melting point wheel bearing grease must be used for the wheel bearings on disc brake models.

(3) Place a new grease retaining seal in the inner end of the hub and tap it into position.

NOTE: The new grease retaining seal lip should smeared with wheel bearing grease

prior to installation. The flat face side of the seal faces outward.

(4) Apply wheel bearing grease to the cone and roller assembly of the outer hub bearing, place the hub and brake disc assembly on the stub axle and position the cone and roller assembly in the outer end of the hub.

(5) Instal the keyed washer and the adjusting nut onto the stub axle and while rotating the hub, tighten the nut to 34 Nm, back off the nut one and a half flats or 90 deg.

(6) Place the nut retainer onto the nut so that the castellations line up with the split pin holes in the stub axle and instal a new split pin. Bend the ends of the split pin around the castellated flange of the nut retainer.

(7) Check that the wheel hub and disc assembly rotates satisfactorily and check the runout of the disc. This should not exceed 0.08 mm.

(8) Instal the caliper to disc. Tighten the caliper retaining bolts to Specifications as described in the Brakes section. Rewire the bolt heads.

(9) Replace the front wheel and tighten the front wheel nuts.

(10) Lower the vehicle to the ground. Pump the brake pedal a few times before road testing the vehicle.

4. SHOCK ABSORBERS

TO REMOVE AND INSTAL

(1) Loosen the front wheel nuts.

(2) With the transmission in gear or Park and with the handbrake applied, raise the front of the vehicle and support on stands placed under the lower suspension arms.

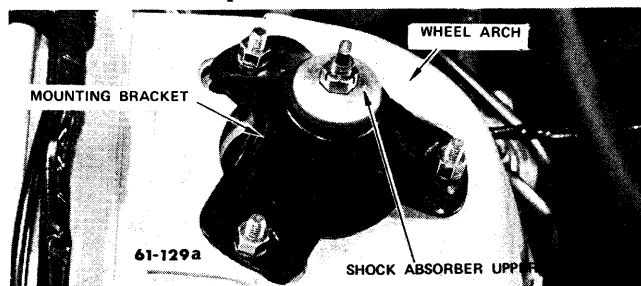
(3) Remove the road wheel.

(4) Remove the nuts and washers securing the lower end of the shock absorber to the coil spring lower mounting bracket on the upper suspension arm.

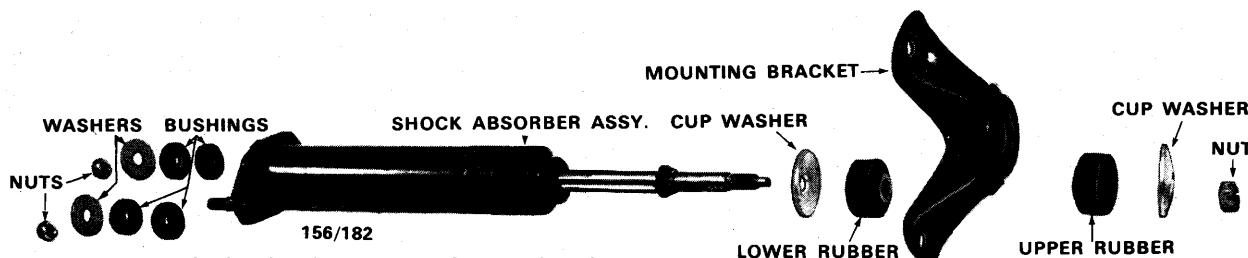
(5) Raise the bonnet and remove the nuts and lock washers securing the legs of the shock absorber upper mounting bracket to the top of the wheel arch.

(6) Withdraw the shock absorber and bracket assembly out through the top of the wheel arch and remove the assembly from the vehicle.

(7) Unscrew and remove the nut and the cup washer from the top stem of the shock absorber. Lift off



Front shock absorber and upper mounting bracket assembly.



Dismantled view of shock absorber and associated components.

the upper rubber followed by the upper mounting bracket, lower rubber and cup washer.

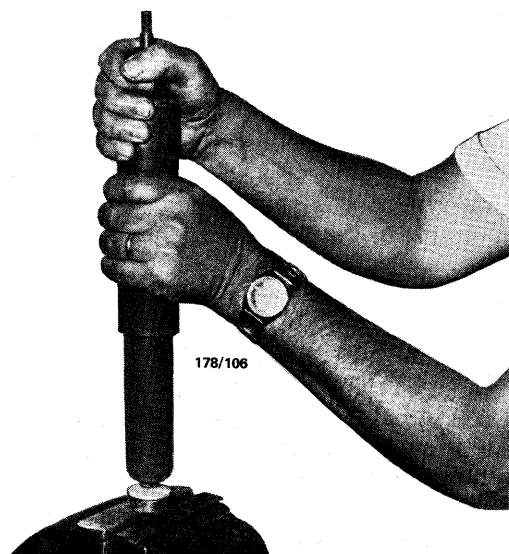
(8) Remove the bushings from the shock absorber lower mounting.

Installation is a reversal of the removal procedure.

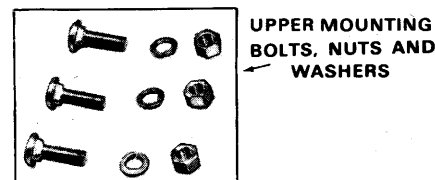
TO TEST AND BLEED

The extent to which a shock absorber can be tested without special testing equipment is limited to the following:

- (1) Mount the shock absorber upright in a vice with soft jaws by the lower mounting flange.
- (2) Grasp the top stem of the shock absorber and pull up to the fully extended position then slowly push down until the shock absorber is fully compressed.
- (3) Carry out operation (2) about six or eight times to remove any slack spots caused by air in the system. If slack spots exist and if it is impossible to remove them by this method, then the shock absorber is defective and should be renewed.
- (4) Check the mounting bushes, rubbers and washers for signs of wear or deformation and renew as required.
- (5) Check the body of the shock absorber for dents or damage and for fluid leakage. The shock absorbers cannot be repaired in service and if defective must be renewed.



Check for defective shock absorber operation. Typical.



5. LOWER SUSPENSION ARM

Special Equipment Required:

To Remove — Ball joint removal tool

TO REMOVE AND INSTAL

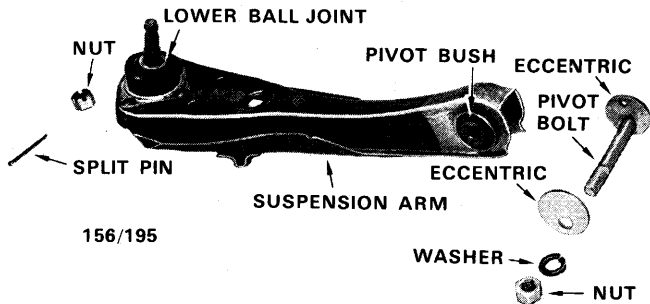
- (1) Loosen the front wheel nuts.
- (2) Raise the front of the vehicle and support on stands placed at suitable points under the body frame. Remove the road wheel.
- (3) Remove the stabiliser bar link retaining nut and withdraw the washers, bushes, spacer and the link bolt from the lower suspension arm.
- (4) Remove the two split pins, nuts and bolts securing the radius rod to the lower suspension arm.
- (5) Withdraw the split pin from the lower ball joint and loosen the nut approximately two turns.
- (6) Position a ball joint removal tool between the ends of the upper and lower ball joint studs and screw the tool to expand it against the ball joint stud ends to a reasonable pressure. Tap the boss of the steering knuckle support around the taper of the lower ball joint stud until the ball stud is loosened in the taper.

NOTE: Always press on the ends of the studs and not against the nuts. Do not loosen the ball joint stud by tool pressure alone.

When a ball joint removing tool is unavailable tap the boss of the steering knuckle support around the taper of the lower ball joint stud until the ball stud is loosened in the taper. In obstinate cases hold a dolly or hammer against one side of the support and strike the opposite side of the boss sharply with a hammer once or twice to free the stud taper.

(7) When the ball stud is loose in the taper remove the ball joint removal tool, take off the castellated nut and disengage the steering knuckle support from the lower suspension arm.

(8) Remove the securing nut and washer from the suspension lower arm pivot bolt and drift the bolt out



Dismantled view of lower suspension arm.

towards the front of the vehicle. Withdraw the suspension arm from the bracket on the body side member.

NOTE: The lower arm pivot has an eccentric on each side of the arm to facilitate wheel camber adjustment. Mark the positions of the eccentrics at the lower arm to underbody attachment.

Installation is a reversal of the removal procedure with attention to the following points:

- (1) Inspect the pivot bush for fatigue and the pivot bolt for wear.
- (2) Check the lower suspension arm for fatigue and distortion.
- (3) Renew worn or damaged components where necessary.

NOTE: Special tools are required to renew the pivot bush. For this reason, should the bush require renewal, the arm should be taken to a reliable workshop or the proper tools obtained.

- (4) Align the marks on the eccentrics and the underbody attachment.

(5) With the weight of the vehicle on the front wheels hold the pivot bolt stationary and tighten the pivot bolt nut.

(6) Check and if necessary adjust the caster and camber angles and the toe in. Refer to Specifications.

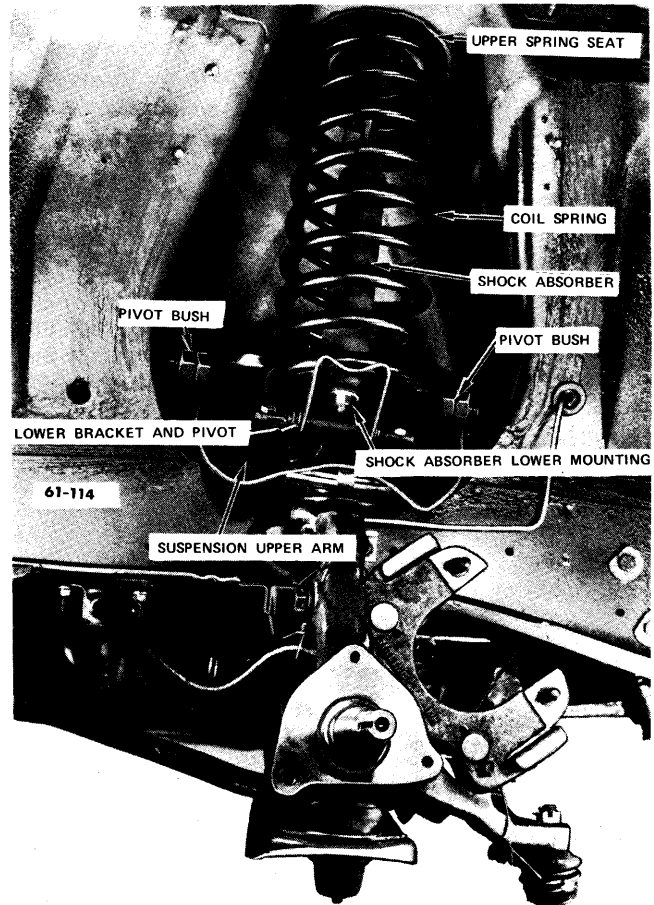
6. UPPER SUSPENSION ARM AND COIL SPRING

Special Equipment Required:

To Remove and Instal — Spring compressing clamp, ball joint removal tool

TO REMOVE

- (1) Raise the vehicle at the front and support on stands placed at suitable points under the body frame.
- (2) Remove the road wheel.
- (3) Remove the shock absorber. Refer to Shock Absorbers — To Remove and Instal.
- (4) Using a suitable spring compressing tool through the shock absorber aperture in the top of the wheel arch, compress the spring until it is clear of the



Suspension upper arm and coil spring assembly. Typical.

lower spring seat.

(5) Remove the split pin from the upper ball joint castellated nut and loosen the nut approximately two turns.

(6) Position a ball joint removal tool between the ends of the upper and lower ball joint studs and screw the tool to expand it against the ball joint stud ends to a reasonable pressure.

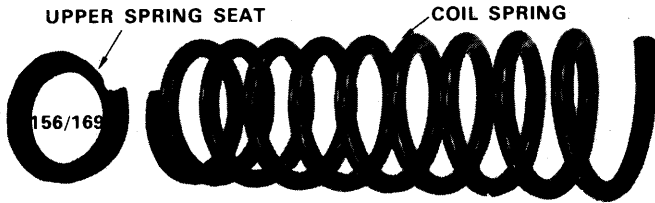
NOTE: Always press on the ends of the studs and not against the nuts. Do not use tool pressure alone to loosen the stud.

(7) Tap the boss of the steering knuckle support around the taper of the upper ball joint with a hammer until the ball stud is loosened in the taper.

(8) When the ball stud is loose in the taper, remove the ball joint removal tool, take off the castellated nut and disengage the steering knuckle support from the upper suspension arm.

NOTE: It is advisable to support the lower suspension arm and steering knuckle support to prevent any undue weight or tension falling on the hydraulic line of the brake assembly.

(9) Remove the two nuts and washers securing the upper arm pivot shaft to the wheel arch and remove the



Coil spring and seat.

arm from the vehicle.

(10) Remove the two nuts and bolts and remove the spring pivot from the upper suspension arm.

(11) Where necessary, release the spring compressor and remove the spring compressor, spring and spring seat from the wheel arch.

TO CHECK AND INSPECT

(1) Clean the suspension arm and pivot shaft and check for cracks, damage or wear. Renew as necessary.

(2) Check the upper steering knuckle support ball joint stud taper for wear, or wear in the ball joint or damage to the rubber boot. Renew the complete joint if any of the above components are worn or damaged.

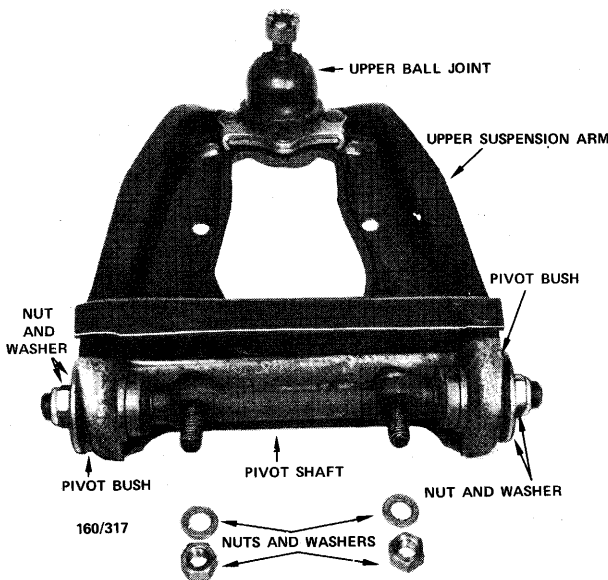
(3) Check the rubber pivot bushes for deterioration or wear, also check the pivot shaft for wear.

NOTE: Special tools are required to renew the pivot bushers. For this reason, should the bushers require renewal, the arm should be taken to a reliable workshop or the proper tools obtained.

(4) Check the lower spring seat bracket, bush and pivot pin assembly and renew if worn.

TO INSTAL

(1) Tape the spring seat to the spring and position the assembly in the wheel arch. Fit the spring, com-



Upper suspension arm assembly.

pressor and compress the coil spring.

(2) Position the spring pivot onto the upper arm, instal the two retaining nuts and securely tighten the nuts.

(3) Instal the upper arm to the wheel arch and tighten the pivot shaft retaining nuts to Specifications. Fit the ball joint stud to the upper end of the steering knuckle support.

NOTE: When the ball joint stud has been fitted to the steering knuckle support, instal but do not tighten the joint stud nut at this time.

(4) Release the spring compressor, at the same time line up the spring with the upper arm spring pivot then carefully remove the compressor.

(5) Torque the ball joint nut to Specifications and fit a new split pin.

(6) Instal the shock absorber and tighten both the upper and lower mounting nuts securely.

(7) Replace road wheel and lower the vehicle. Tighten the road wheel.

(8) Check and if necessary adjust the front wheel alignment.

7. BALL JOINTS

UPPER BALL JOINT

To Check and Renew

(1) Position a support plate between the upper suspension arm and the body frame.

(2) Raise the vehicle and support on stands placed at suitable points under the body frame.

(3) Check the wheel bearing adjustment and adjust if necessary. Refer to the Front Hub section.

(4) Grasping at the top and bottom of the road wheel attempt to rock the wheel and observe any movement in the Upper ball joint.

NOTE: The upper ball joint will be unloaded in the above check and will move. Movement measured at the top of the wheel rim should not exceed 6.35 mm.

(5) If the ball joint is to be renewed, remove the road wheel.

(6) Disconnect the upper suspension arm ball joint from the steering knuckle as previous by described.

(7) Using the correct size drill, drill out and remove the rivets locating the ball joint in the upper arm. Withdraw the ball joint.

Installation is a reversal of the removal procedure with attention to the following points:

Clean and inspect the end of the upper arm and remove all burrs from the ball joint apertures. Renew the upper suspension arm if any cracks or metal fatigue is evident.

Do not rivet the new ball joint into place. Use only genuine replacement nuts, bolts and washers.

Follow all quoted torque wrench specifications during assembly.

Lubricate the ball joint with the recommended grease on installation.

Check the caster, camber and toe in adjustments, refer Specifications.

LOWER BALL JOINT

To Check and Renew

(1) Raise the vehicle and support on stands placed at suitable points under the body frame.

(2) Check the wheel bearing adjustment and adjust if necessary. Refer to the Front Hub section.

(3) Grasping at the top and bottom of the road wheel attempt to rock the wheel and observe any wear in the lower ball joint.

NOTE: The upper ball joint will be unloaded in the above check and will move. Disregard all such movement in this ball joint.

(4) If any wear is observed in the lower ball joint the lower suspension arm and ball joint must be renewed as an assembly. Refer to Lower Suspension Arm — To Remove and Instal.

(5) Lubricate the ball joint with the recommended grease on installation.

8. STABILISER BAR

TO REMOVE AND INSTAL

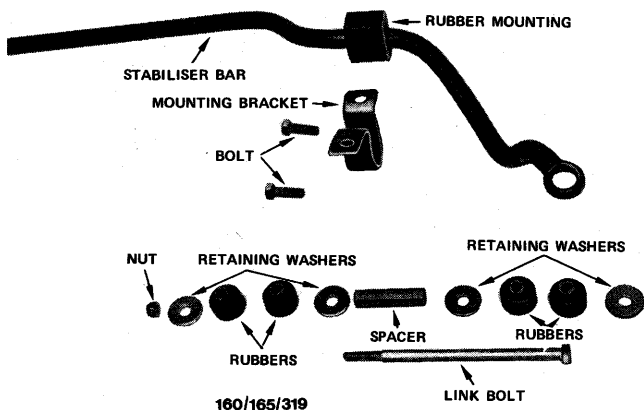
(1) Raise the front of the vehicle and support on stands placed under the lower suspension arms.

(2) Remove the retaining nuts from the top end of the stabiliser bar links at the lower suspension arms and withdraw the retaining washers and rubbers.

(3) Raise the arms of the stabiliser bar off the connecting links and remove the second rubber and retaining washers from each link.

(4) Take out the bolts, spring washers and nuts and remove both stabiliser bar mounting brackets. Remove the stabiliser bar from the vehicle.

(5) Remove the stabiliser link bolts from the lower suspension arms and withdraw the spacers, washers and lower rubber bushings.



Stabiliser bar link and mounting components.

Installation is a reversal of the removal procedure with attention to the following points:

Coat the necessary components of the stabiliser with a suitable rubber lubricant.

Ensure that the rubbers on the connecting links are in a serviceable condition. Tighten the link nuts securely.

Ensure that the mounting rubbers are in a serviceable condition and a good fit in the mounting bracket. Tighten the mounting bracket bolts to Specifications.

9. RADIUS ROD

TO REMOVE AND INSTAL

(1) Raise the front of the vehicle and support on stands placed at suitable points under the body frame.

(2) Undo the radius rod retaining nut at the front mounting bracket and withdraw the washer and bushing from the front of the radius rod.

(3) Withdraw the split pins and remove the two nuts and bolts attaching the radius rod to the lower suspension arm. Remove the radius rod from the vehicle.

(4) Remove the remaining bushing, sleeve and washer from the radius rod.

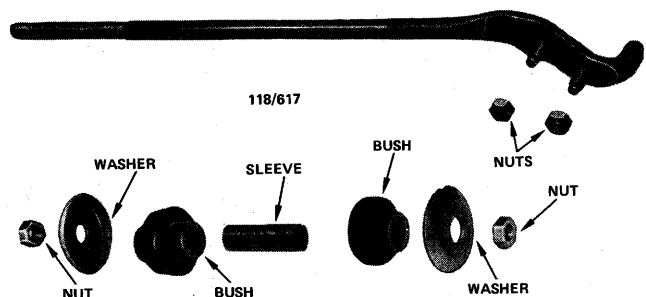
Installation is a reversal of the removal procedure with attention to the following points:

Check the radius rod for distortion and fatigue.

Renew the rubber bushes and washers if necessary. Instal the rear nut on the radius rod 108 mm from the end of the rod.

Refer to Specifications for torque wrench settings.

Check and if necessary adjust the caster, camber and toe in. Refer to Specifications.



View of radius rod and associated components.

10. SUSPENSION AND STEERING ANGLES

ADJUSTMENT

NOTE: Extensive knowledge and specialised equipment is required to measure and correct the suspension and steering angles except the front wheel toe in. It is therefore not a worthwhile proposition for the average person to do a complete wheel alignment and the vehicle should be taken to a wheel alignment specialist.

Prior to carrying out a wheel alignment the suspension should be completely checked to ascertain that it is in a serviceable condition.

Carry out a thorough inspection of the steering linkages, front wheel bearing adjustments, suspension joints and rods, springs and suspension recoil action. Renew or repair where necessary.

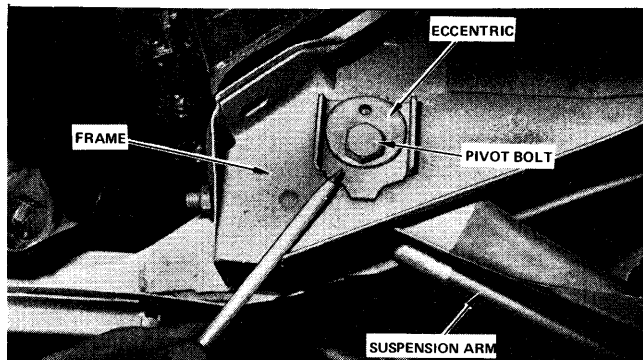
The tread of the front tyres should be examined for excessive or uneven wear, as certain conditions of tyre wear are indicative of damaged or worn components in the suspension, steering linkage or the wheels and bearings. Refer to Tyre Wear Diagnosis in the Lubrication and Maintenance section.

If tyres are found to be defective renew with serviceable tyres.

The vehicle should be unladen except for the normal amount of petrol and the tyres inflated to the correct pressures.

The camber angle adjustment is controlled by an eccentric pivot adjuster on the frame end of the lower suspension arm. Caster angle adjustment is by means of the threaded front section of the suspension radius rod.

King pin inclination is built into the component parts during manufacture and cannot be altered or adjusted. Any deviation in the value to that of the Specifications is indicative of bent or otherwise damaged parts and in such instances the stub axle must be renewed.



View of camber eccentric adjuster.

Toe in adjustment is provided by threaded sleeves on each tie rod which incorporate left and right hand threads which permit the adjustments to be carried out without the removal of any of the assembly parts.

TO CHECK AND ADJUST TOE IN

(1) With the vehicle on a level floor, jack up the front of the vehicle and support on stands.

(2) Spin each front wheel in turn and using a piece of chalk, mark a line around the periphery at the inside of each tyre as near to the centre as possible.

(3) Lower the front of the vehicle to the ground and bounce the suspension to achieve normal levels.

(4) Set the wheels in a straight ahead position.

(5) Mark the centre chalk line on both tyres at a point approximately 200 mm above the floor and in front of the suspension.

(6) Using a suitable telescopic gauge, measure and record the distance between the two points on the tyre centres.

(7) Maintain the wheels in the straight ahead position, roll the vehicle forward until the marks are the same distance from the floor but to the rear of the suspension.

(8) Again use the telescopic gauge to measure and record the distance between the marks on the tyres. The distance measured at the front of the wheels must be less to the extent of the specifications than the measurement taken at the rear of the wheels.

(9) If any adjustment of the tie rods is necessary loosen the clamp bolts on each end of the adjustable sleeves and turn each sleeve equal amounts until the desired toe in is obtained.

(10) Lock the tie rod sleeves and bounce the vehicle up and down several times and recheck the toe in.

NOTE: It is important to make equal adjustments on each tie rod to maintain the central position of the steering gear and steering wheel.

If an optical or other type of toe in gauge is used, always follow the manufacturers instructions.

Refer to supplement
for more information.

REAR SUSPENSION

SPECIFICATIONS

Type Semi elliptic leaf springs
with double acting shock absorbers
Shock absorber Double acting hydraulic

TORQUE WRENCH SETTINGS

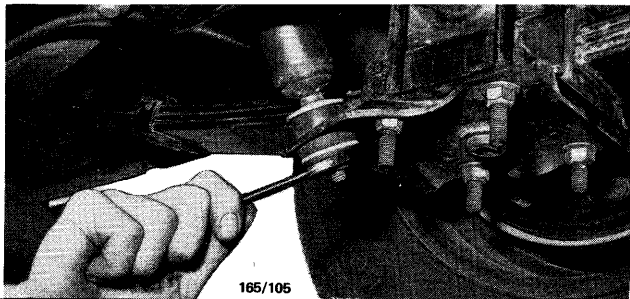
Shock absorber:
Upper mounting 50 Nm
Lower mounting 50 Nm
'U' bolt nuts 68 Nm
Front anchor bolt 190 Nm
Rear shackle nut 30 Nm
Stabiliser bar:
To mounting bracket 14 Nm
To axle housing 21 Nm
Radius rod front 75 Nm
Radius rod rear 75 Nm

1. REAR SUSPENSION TROUBLE SHOOTING

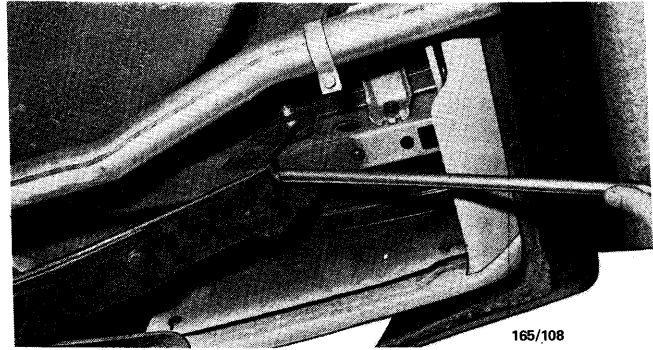
NOISE IN SUSPENSION

- (1) Defective shock absorber and/or mountings: Renew faulty components.
- (2) Loose or worn rear shackle bolts and bushes: Tighten or renew loose or worn shackle components.
- (3) Loose or worn spring anchor bolt or bush: Tighten or renew loose or worn spring anchor components.
- (4) Broken rear spring leaf or leaves: Renew broken leaves or complete spring.
- (5) Sprung or bent axle housing: Renew axle housing.
- (6) Worn or deteriorated spring leaf insulators: Check and renew the insulators.
- (7) Loose or broken spring leaf clamps: Tighten or renew faulty clamps.

NOTE: As a quick guide to shock absorber condition, bounce the vehicle up and down (one side at a time) and observe if the vehicle comes to rest in a single movement. If the vehicle bounces two or three times before



Checking the shock absorber nuts for security.



To check shackle bushes place suitable lever between the spring eye and chassis member and lever the spring up and down.

coming to rest the shock absorber is suspect. Remove the shock absorber and test on the bench as described in this section.

To check shackle and anchor bushes place a bar between the spring eye and the chassis and lever the spring up and down. Check the rear spring leaves visually for breaks. Also check the spring insulators for damage or deterioration.

REAR WHEELS NOT IN ALIGNMENT WITH FRONT WHEELS

- (1) Broken main leaf of spring forward of spring seat: Renew the main leaf or complete spring.
- (2) Broken main leaf of spring at rear of spring seat: Renew the main leaf or complete spring.
- (3) Broken spring anchor bolt or rear shackle: Renew all faulty components.
- (4) Spring badly sagged on one side: Renew the defective spring.
- (5) Sprung or bent axle housing: Renew the axle housing.
- (6) Broken spring centre bolt: Renew the spring centre bolt.

NOTE: To check out this condition, measure from the centre of the front wheels to the centre of the rear wheels on both sides. Compare the measurements which must be equal. Before measuring ensure that the front wheels are in the straight ahead position.

REAR BRAKE LOCKED ON ONE SIDE

- (1) Broken spring main leaf: Renew the main leaf or the complete spring.
- (2) Broken spring centre bolt: Renew the spring centre bolt.
- (3) Broken spring anchor bolt: Renew the anchor bolt and bush.

NOTE: Make the wheel base measurement

check as just previously described. If the measurements are unequal check the possible causes out in the order given. A broken spring anchor bolt will readily show up by levering between the spring eye and chassis.

2. DESCRIPTION

The suspension consists of semi elliptic leaf springs and double acting tubular shock absorbers. The springs are mounted on rubber bushes. The spring is mounted at the front end on an anchor bolt and at the rear end on a swivel shackle pin.

The shock absorbers are mounted on rubber bushes. The lower mounting is attached to the spring mounting plate while the top is mounted to the underbody.

The rear axle housing is mounted on the rear springs and is located by the spring centre bolt. The axle housing is retained by 'U' bolts and nuts. The spring is sandwiched between spring seat pads to prevent noise and vibration.

The stabiliser bar is mounted to the underside of the rear axle housing by means of two mounting brackets, while the outer ends are attached through links and rubbers to the underbody.

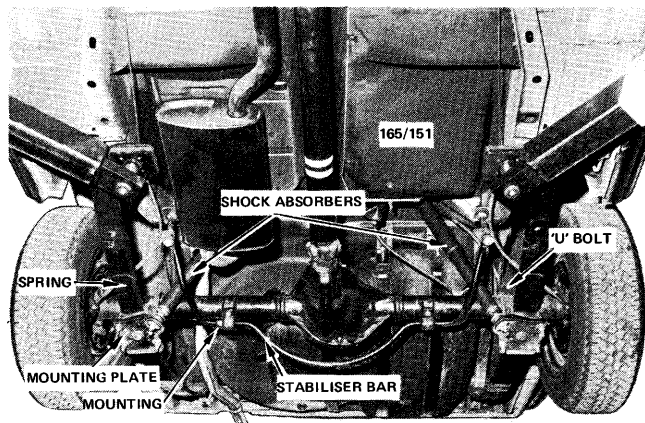
Bump rubbers are fitted to the chassis frame above each side of the axle tubes. An additional bump rubber is fitted to the underbody above the differential pinion housing.

3. SHOCK ABSORBERS

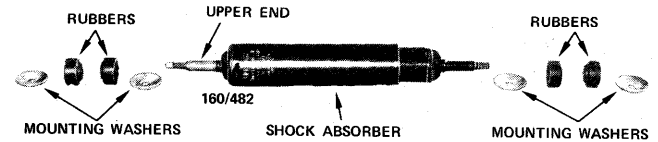
TO REMOVE

(1) Raise the luggage compartment lid, fold back the floor mat and remove the two shock absorber access covers. Remove the shock absorber top stem retaining nut, rubber and cup washer.

NOTE: On station wagon models it will be necessary to remove the floor bed panel to gain access to the shock absorber upper mountings.



Underbody view showing rear suspension components.



Rear shock absorber and mounting components.

(2) Raise and support the rear of the vehicle on safety stands placed under the rear axle housing.

(3) Remove the nut, cup washer and rubber securing the shock absorber lower mounting to the spring mounting plate and remove the shock absorber from the vehicle.

TO INSPECT

NOTE: The shock absorber is non repairable. If any of the following checks are unsatisfactory, renew the shock absorber.

(1) Check for dents, cracks or oil leaks at the shock absorber body.

(2) Check the piston stem for straightness.

(3) Replace any rubber bushes which are damaged or worn.

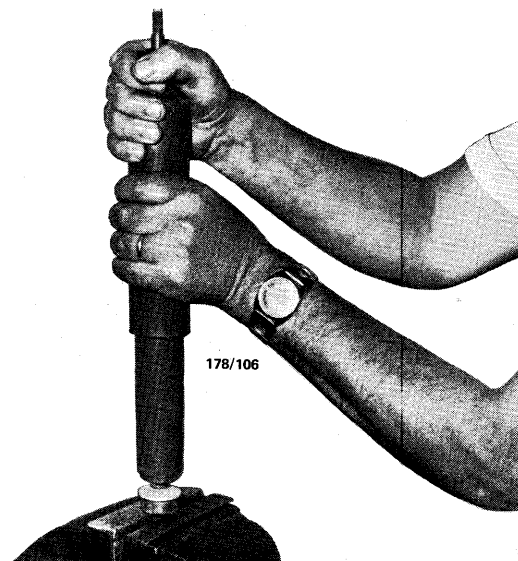
TO TEST AND BLEED

(1) Grip the shock absorber lower mounting in a vice with soft jaws and with the unit in a vertical position.

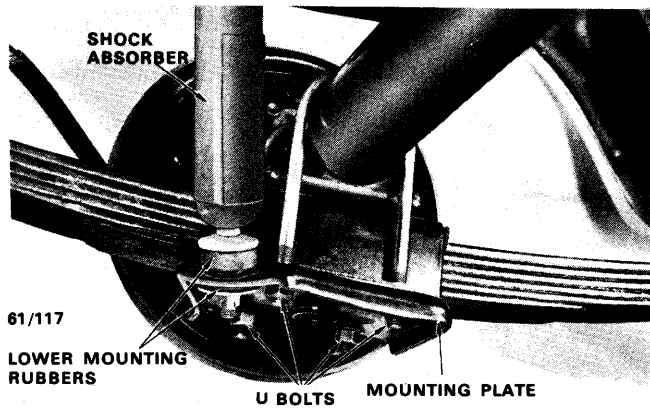
(2) Grasp the upper stem of the shock absorber, pull it up to the fully extended position and then slowly push it down until the shock absorber is fully compressed.

(3) Repeat operation (2) six to eight times. If any slack spots in the unit cannot be removed by this method, the shock absorber is defective and should be renewed.

NOTE: The resistance will be slightly greater on the upward stroke than on the downward stroke.



Check for defective shock absorber operation.



Rear spring and shock absorber attachment to rear axle assembly.

TO INSTAL

Installation is a reversal of the removal procedure with attention to the following point:

Tighten all retaining nuts to the correct torque wrench specifications.

4. SPRINGS

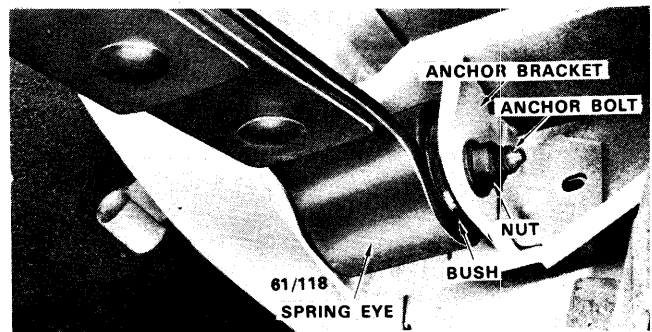
TO REMOVE AND INSTAL

(1) Raise the rear of the vehicle and place on stands just forward of the rear spring front anchor bracket.

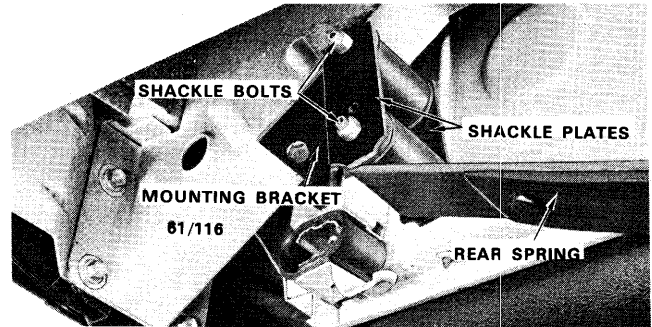
(2) With a jack under the centre of the rear axle housing raise the rear axle housing sufficiently to take the strain off the shock absorber.

(3) Disconnect the shock absorber lower mounting at the spring mounting plate and push the shock absorber up clear of the axle housing. Note the position of the cup washers and mounting rubbers.

(4) Lower the rear axle housing to take the weight off the springs, remove the nuts from the 'U' bolts and



Rear spring front attachment to underframe.



Rear spring rear shackle assembly. Station Wagon and commercial models shown.

take off the mounting plate and insulator.

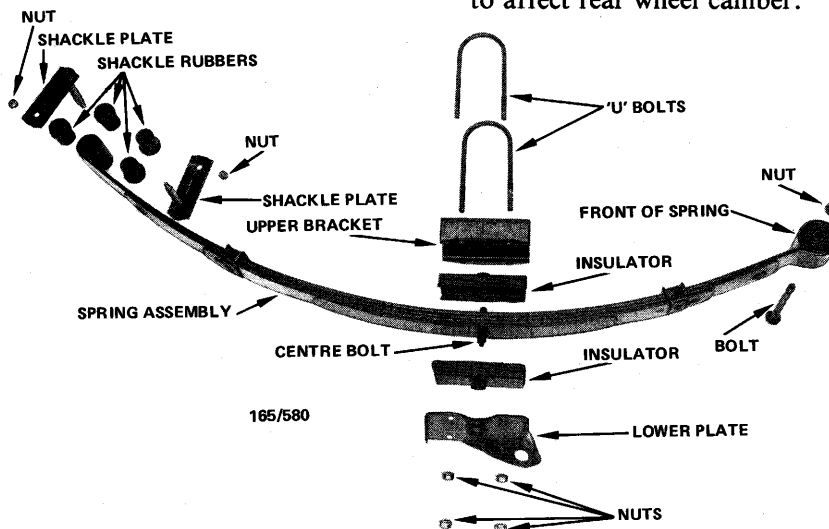
(5) Raise the jack slightly to support the rear axle housing to facilitate removal of the spring.

(6) Remove the rear shackle nuts, take out the shackle bolts and plates and lower the rear of the spring.

(7) Remove the spring anchor bolt attaching the front of the spring to the anchor bracket and withdraw the spring from the vehicle.

Installation is a reversal of the removal procedure with attention to the following points:

Do not tighten the 'U' bolt nuts in excess of the specified torque or the axle tube may be sprung enough to affect rear wheel camber.



Dismantled view of rear spring and mounting components.

Do not fully tighten the shackle nuts and anchor bolt until the full weight of the vehicle is on the rear wheels. This will prevent the rubber bushes from being overstressed when in the normal working position.

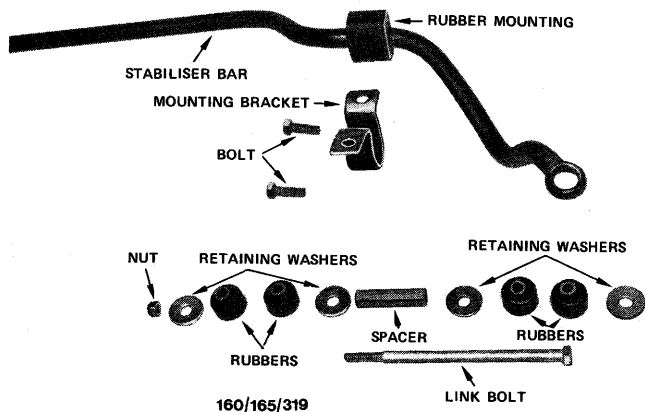
NOTE: The spring mounting plate insulators are fitted to sedan and wagon and 500 kg utility and van models only.

5. REAR STABILISER BAR

TO REMOVE AND INSTAL

- (1) Raise the rear of the vehicle and place on stands just forward of the rear spring front anchor bracket.
- (2) Undo the nuts on the upper end of the link bolts connecting the stabiliser bar to the underbody. Dismantle the link bolt components noting the relative positions of all components.
- (3) Undo the axle housing bracket bolts and withdraw the stabiliser bar from the vehicle.

Installation is a reversal of the removal procedure with attention to the following points:



Stabiliser bar link and mounting components.

Ensure that the link bolts are correctly assembled with a rubber mount and cupped washer on each side of the upper mounting plate and each side of the stabiliser bar eyelet. Instal the tube spacer between the inner two cup washers.

Tighten all retaining nuts and bolts to the correct torque wrench specifications.

6. REAR SUSPENSION RADIUS ROD

TO REMOVE AND INSTAL

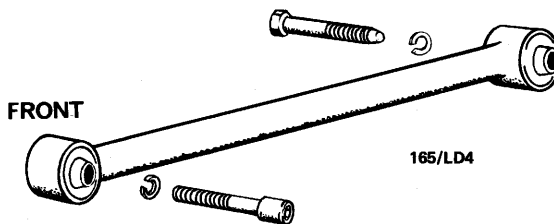
- (1) Raise the vehicle at the rear and place on stands just forward of the rear spring front anchor bracket.
- (2) Remove the rear wheel.
- (3) Remove the radius rod front mounting retaining bolt.
- (4) Remove the radius rod to rear axle housing bracket retaining bolt and remove the radius rod from the vehicle.

Installation is a reversal of the removal procedure with attention to the following points:

Instal the mounting bolt with the internal hexagon to the front of the radius rod.

Tighten all retaining bolts to the correct torque wrench specifications.

NOTE: The rear suspension must be at curb weight position before torquing the retaining bolts to ensure that the bushes are not overstressed when in the normal working position.



Radius rod and mounting bolts.

SPECIFICATIONS

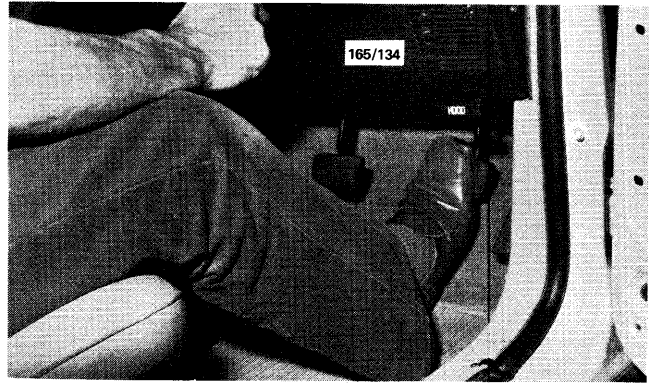
Type:	
Front	Disc
Rear	Drum or disc
Operation:	
Footbrake	Hydraulic
Handbrake	Mechanical on rear wheels
Brake drums:	
Diameter	254.0 mm
Machining limit	1.5 mm
Minimum brake shoe lining thickness	0.8 mm
Brake discs front and rear:	
Thickness	23.9 mm
Machining limit	22.7 mm
Run out limit	0.8 mm
Minimum brake pad thickness	0.8 mm
Master cylinder:	
Make	PBR dual circuit
Bore diameter	25.4 mm
Calipers:	
Front caliper bore diameter	60.3 mm
Rear caliper bore diameter	49.2 mm
Wheel cylinder bore diameter	20.64 mm
TORQUE WRENCH SETTINGS	
Master cylinder to servo unit	34 Nm
Servo unit to body panel	34 Nm
Front caliper anchor plate upper bolt	190 Nm
Front caliper anchor plate lower bolt	102 Nm
Rear caliper plate	102 Nm
Brake hoses to calipers	34 Nm

1. BRAKES TROUBLE SHOOTING

BRAKE PEDAL HARD

- (1) Incorrect brake pads or shoe linings fitted: Check and replace with the recommended type.
- (2) Frozen pedal pivot: Rectify or renew pivot pin and bushes.
- (3) Restricted brake line from master cylinder: Check brake lines and remove restriction or renew line.
- (4) Frozen wheel cylinder or caliper pistons: Check, free up or renew pistons.
- (5) Vacuum servo system inoperative: Check servo system and rectify.

NOTE: The vacuum servo system can be checked out as follows: With the engine switched off, pump the brake pedal several times to deplete any vacuum in the system. With the engine still switched off, press down firmly on the brake pedal and hold it there, noting the position and pressure required. Holding down on the brake pedal start the engine. If the servo unit is operating correctly, the brake pedal will sink slightly and the pressure required to hold it may even



Checking vacuum servo system.

reduce. If the pedal does not sink slightly when the engine is started, then the brake servo unit can be considered inoperative.

BRAKE DRAG

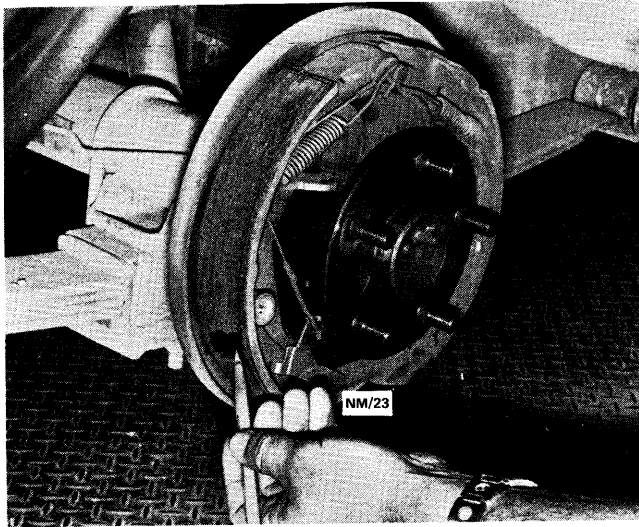
- (1) Clogged master cylinder ports: Check and clean the master cylinder and the fluid reservoir.
- (2) Frozen wheel cylinder or caliper pistons: Check, free up or renew pistons.
- (3) Frozen handbrake linkage: Free up or renew the linkages.
- (4) Broken or stretched brake shoe return springs: Renew defective springs.
- (5) Frozen handbrake cables: Free up or renew the cables.

NOTE: To check out this condition, jack up the vehicle and place on stands. Spin the wheels one at a time to check for binding. If the wheels are not binding, have an assistant apply the brakes and release them. Check if the brakes are immediately releasing. A clogged master cylinder port will cause binding on the two wheels fed by that particular circuit from the master cylinder. Open the bleeder valve on one of the offending wheels to check if pressure build up is the cause of the binding. A frozen handbrake cable will usually cause binding on both rear wheels. To check out this condition disconnect the handbrake cable at or as close to the rear backing plates as possible and check if the wheels will then turn freely.

LOW SPONGY BRAKE PEDAL

- (1) Incorrectly adjusted rear brake shoes: Check and adjust the rear brakes.
- (2) Lack of sufficient fluid in the system: Check for leaks, replenish fluid and bleed the system.
- (3) Air in brake hydraulic system: Bleed hydraulic system.

NOTE: A spongy brake pedal in most cases is caused by air in the hydraulic system. For air to enter the system one or more of the sealing



Check the brake linings for oil contamination.

rubbers or pipes must be sucking in air. Always rectify the cause of the trouble before bleeding the brake system. Faulty components usually show up as fluid leakage.

BRAKES LOCK ON APPLICATION

- (1) Gummy linings or brake pads due to oil or fluid contamination: Renew the linings or brake pads.
- (2) Bent or eccentric brake drums: Check and renew any faulty drums.
- (3) Incorrect brake linings fitted: Check and renew the linings as a set, with the recommended type.
- (4) Broken or stretched brake shoe return springs: Check and renew all the springs.

NOTE: If this condition arises, first remove all the wheels and check the condition of the friction material for both oil contamination and excessive wear. Check the shoe return springs for stretching by comparing their free length with new springs. A bent or eccentric brake drum will be indicated by pulsating on the brake pedal when the brakes are lightly applied.

BRAKE PEDAL PULSATES

- (1) Bent or eccentric brake drum or disc: Check and renew the brake drums or discs as required.
- (2) Loose or worn front hub bearings: Adjust or renew the front hub bearings.
- (3) Bent rear axle shaft: Check and renew all faulty components.

NOTE: Adjust the front hub bearings as outlined in the Front Suspension section. Brake drums or discs that prove to be running out must be machined. This job is best entrusted to a brake specialist who will also be able to determine if a new drum or disc needs to be fitted.

BRAKE FADE

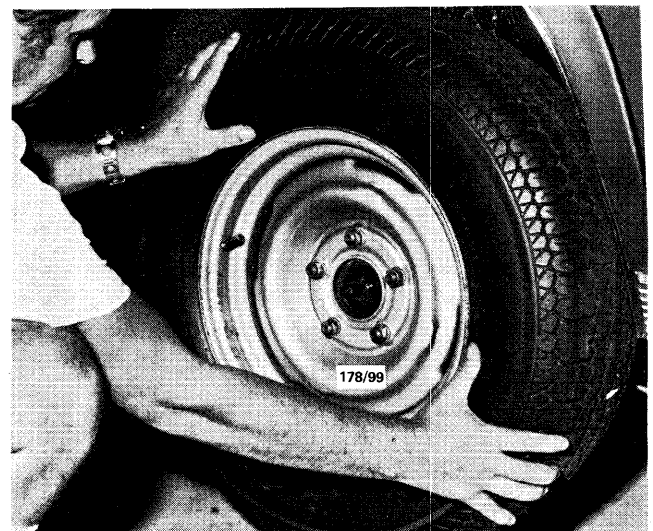
- (1) Incorrect shoe adjustment: Check and adjust the rear drum brakes.
- (2) Eccentric or bent brake drum: Check and rectify the faulty component.
- (3) Brake pads or linings saturated with hydraulic fluid: Renew as a complete set all contaminated pads or linings.
- (4) Incorrect linings fitted: Check and instal new recommended linings in sets.

NOTE: In most cases brake fade is caused by overuse of the foot brake, which in turn causes a build up of heat at the friction material and drums or discs. Once this excessive build up of heat is allowed to dissipate the brakes should again function normally.

BRAKES OVERHEATING

- (1) Incorrect rear brake shoe adjustment: Check and adjust rear drum brakes.
- (2) Broken shoe return spring: Renew all the springs.
- (3) Faulty handbrake cables or adjustment: Check the cables, renew or adjust.
- (4) Frozen wheel cylinder or caliper pistons: Free up or renew all faulty components.
- (5) Obstructed or damaged hydraulic hose or line: Remove obstruction or renew the hydraulic hose or line.
- (6) Obstructed master cylinder compensating port: Clear the compensating port.
- (7) Blocked vent in the master cylinder reservoir cap: Check and remove obstruction in vent.
- (8) Broken rear axle spring main leaf or centre bolt: Check and renew faulty components.
- (9) Overuse of foot brake: Revise driving habits.

NOTE: To check for brake binding, raise the vehicle and spin each wheel in turn by hand.



Spin each wheel by hand to check for binding brakes.

If it is found that one wheel cylinder piston is sticking then it is advisable to overhaul all wheel cylinders including the master cylinder.

BRAKE FAILURE

- (1) Faulty master cylinder: Remove and overhaul the master cylinder.
- (2) Loss of brake fluid due to a leaking wheel cylinder: Overhaul or renew the wheel cylinder and bleed the hydraulic system.
- (3) Loss of brake fluid due to a leaking caliper: Overhaul or renew the caliper assembly and bleed the hydraulic system.
- (4) Loss of brake fluid due to a fractured hose, pipe or faulty union: Renew faulty components as necessary and bleed the hydraulic system.
- (5) Air in the hydraulic system: Locate the source of air leak and rectify. Bleed the hydraulic system.
- (6) Water in hydraulic fluid: Drain, flush, refill and bleed the hydraulic system.

NOTE: To locate the source of a brake fluid leak, refill the master cylinder and reservoir with brake fluid and have an assistant pump the brake pedal. Check for obvious signs of external leakage, prior to dismantling and overhauling the braking system.

2. DESCRIPTION

The front and rear brakes are applied by independent circuits by means of the dual circuit master cylinder. Should a malfunction occur in one circuit, the remaining circuit is capable of stopping the vehicle safely.

The four wheel hydraulically operated brakes utilise drum brakes on the rear wheels and disc brakes on the front wheels. Some models have disc brakes fitted to all four wheels.

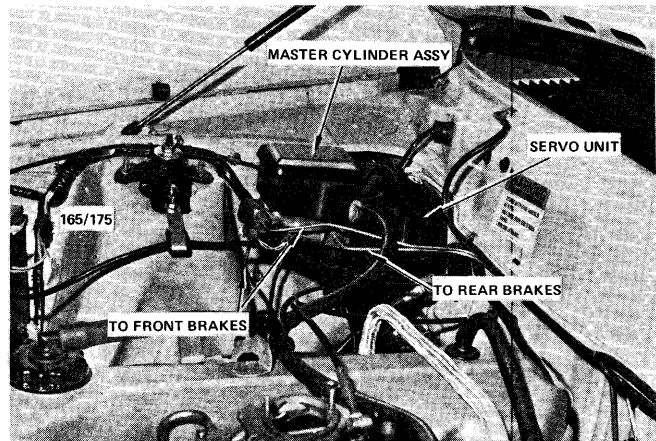
The rear drum brakes are of the self adjusting type.

On all models a vacuum servo unit is installed between the master cylinder and the bulkhead.

All the calipers are of the floating type and are self adjusting. The single piston hydraulic brake caliper automatically compensates for brake pad wear by the sliding caliper feature. The caliper floats on two guide pins located in the anchor plate.

3. DUAL CIRCUIT MASTER CYLINDER

The dual circuit master cylinder incorporates a proportioning valve, a pressure differential valve assembly and a switch to activate a brake fail warning lamp located on the instrument panel. The master cylinder bodies and internal components differ between vehicle body models. For identification purposes, master cylinders fitted to all Sedans have a yellow fluid reservoir while all Station Wagons and Commercial vehicles are fitted with a blue reservoir master cylinder. It is important when ordering a master cylinder or service repair kit that the correct model identification is given.



Installed view of brake master cylinder.

TO REMOVE

- (1) Raise the engine bonnet and place fender covers on both fenders.
- (2) Disconnect the wiring from the pressure differential switch, located on the engine side of the master cylinder.
- (3) Disconnect the three brake fluid pipes from the outlets on the master cylinder and plug all pipes to prevent the entry of dirt.
- (4) Unscrew the two nuts securing the master cylinder to the brake servo unit and remove the master cylinder assembly.

NOTE: Care should be exercised when removing or installing the master cylinder assembly to ensure that brake fluid is not permitted to drop onto the surrounding paint-work of the vehicle. Brake fluid, if accidentally spilt, should be immediately washed away with water and then allowed to dry naturally and not wiped with a cloth.

TO DISMANTLE

- (1) Remove the reservoir cap and seal. Drain the fluid from the reservoirs.
- (2) Remove the reservoir retaining nut and washer located inside the plastic reservoir.
- (3) Take the reservoir off the cylinder body and remove the two reservoir sealing grommets from the cylinder body.
- (4) Remove the piston retaining cap by prising up the two locating lugs. Hold the cap firmly to ensure that the primary piston does not spring out.
- (5) Withdraw the primary piston together with the return spring from the cylinder bore.
- (6) Using a suitable blunt rod, press the secondary piston into the cylinder bore and at the same time remove the reservoir retaining stud and copper washer from the cylinder body.
- (7) Remove the pressure differential switch from the side of the cylinder body.
- (8) Tap the cylinder gently on a block of wood and

allow the secondary piston and return spring to be dislodged from the cylinder body.

(9) Carefully remove the plug from the rear of the cylinder body.

NOTE: When the plug has been loosened, unscrew the plug by hand. Care must be taken to prevent the internal components from springing out.

(10) Withdraw the aluminium seal block and piston assembly. If the assembly cannot be readily removed by hand, lightly tap the cylinder body on a block of wood to assist removal.

(11) Withdraw the spring and the pressed steel poppet valve retainer.

(12) Withdraw the plastic poppet valve and spool assembly using long nose pliers gripping the outer edge of the poppet valve.

Should the valve separate from the spool, then remove the spool by gripping the poppet valve retaining extension on the end of the spool using long nose pliers.

TO CLEAN AND INSPECT

(1) Wash all components thoroughly in methylated spirits. Do not use petrol, kerosene or other cleaning solvents.

(2) Check the master cylinder bore for wear, corrosion or pitting.

NOTE: Do not hone the master cylinder bore. If the bore is pitted or worn, renew the master cylinder as an assembly.

(3) Ensure that all inlet and compensating ports between the reservoir and the cylinder bore are free of any obstruction.

(4) Discard all rubber parts and the piston assemblies.

TO ASSEMBLE

NOTE: Always use a genuine major repair kit which contains pre-assembled rubber seals and pistons. The use of a major kit will ensure a thorough overhaul and long service from the unit.

Assembly is a reversal of the dismantling procedure with attention to the following points:

(1) Liberally lubricate the cylinder bores and all internal parts with clean brake fluid.

NOTE: Instal all the parts supplied with the repair kit. The aluminium seal block and piston assembly supplied in the sealed plastic bag must not be washed. It is pre lubricated and no further lubrication on assembly is necessary.

(2) Fit the 'O' ring into the groove at the end of the differential spool.

(3) Instal the spring into the small spigot end at the 'O' ring end of the spool. The last coil of this spring may have to be bent in to firmly grip the small diameter spigot.

(4) Position on the other end of the spool the smaller of the two metal sleeves.

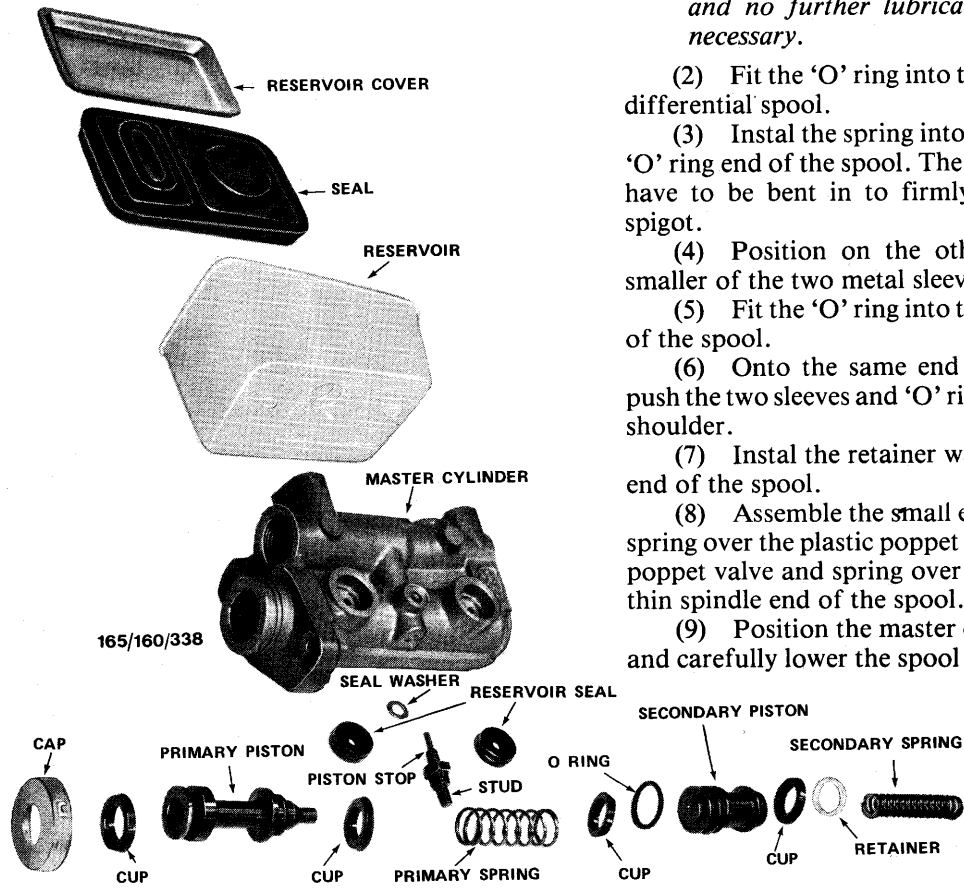
(5) Fit the 'O' ring into the sleeve locating diameter of the spool.

(6) Onto the same end fit the wider steel sleeve, push the two sleeves and 'O' ring together and against the shoulder.

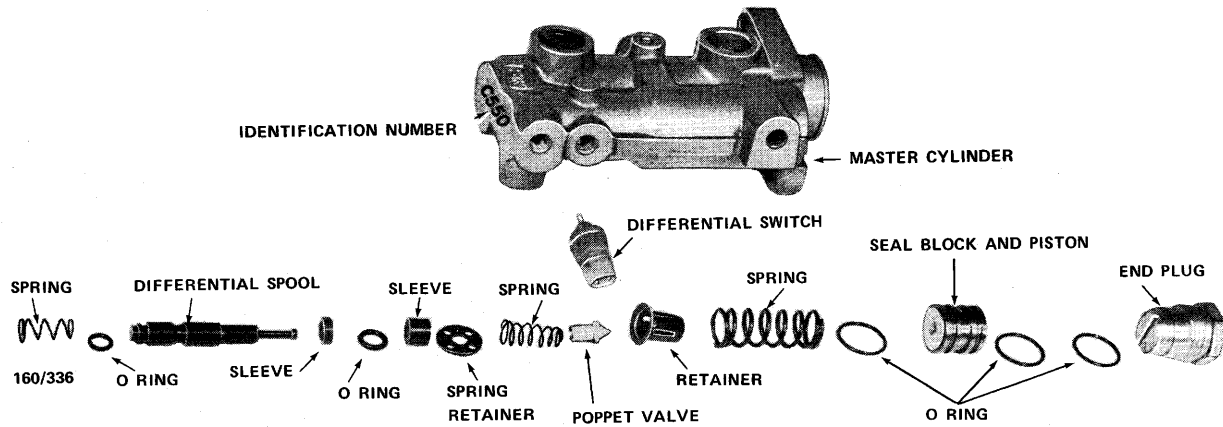
(7) Instal the retainer washer over the thin spindle end of the spool.

(8) Assemble the small end of the light conical coil spring over the plastic poppet valve, then click the plastic poppet valve and spring over the larger diameter on the thin spindle end of the spool.

(9) Position the master cylinder vertically in a vice and carefully lower the spool assembly, spring end first,



Dismantled view of brake master cylinder components.



Pressure differential and proportioning valve components.

into the bore making sure that the spring remains assembled on the spool.

(10) Instal the steel poppet retainer, large end first, into the bore and over the plastic poppet valve.

(11) Push down on the poppet retainer until the spool is correctly positioned in the bore. The measurement, from the top of the bore to the top of the small end of the poppet retainer should be 44.5 mm when positioned correctly.

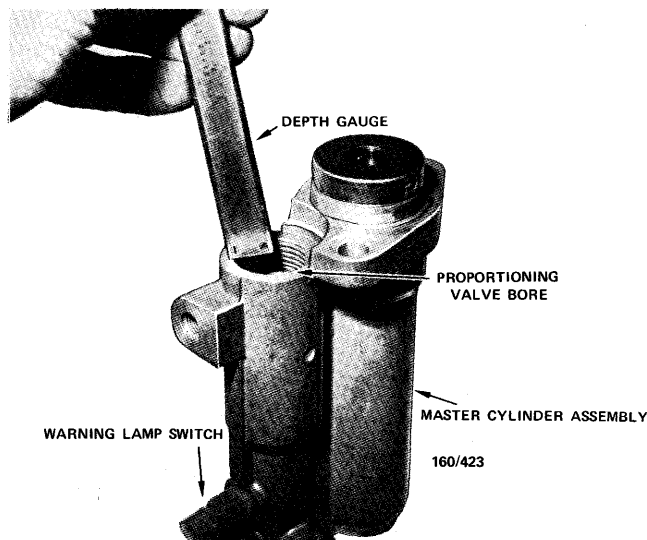
(12) Instal the large spring over the poppet retainer.

(13) Instal the seal block, washer end first, into the bore onto the large spring.

(14) Screw the plug into place by hand then torque to 40 Nm.

(15) Instal and tighten the pressure differential warning lamp switch.

(16) Instal the 'O' ring seal into the smaller groove at the end of the secondary piston. In the larger groove instal one of the three identical cup seals ensuring that the seal lip faces away from the 'O' ring seal.



When assembling valve, check dimension from the small end of the poppet valve retainer to end face of cylinder.

(17) Fit the second of the three identical cup seals onto the groove at the return spring side of the secondary piston, making sure that the seal lip faces away from the 'O' ring fitted previously.

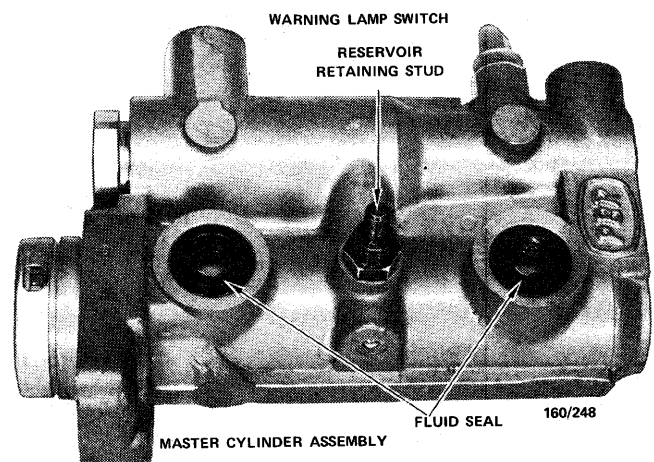
(18) Instal the third of the identical cup seals to the shallow groove opposite the push rod hole end of the primary piston, ensuring that the seal lip faces away from the push rod hole end.

(19) Instal the secondary seal into the groove at the push rod end of the primary piston, ensuring that the lip faces away from the push rod hole end of the piston.

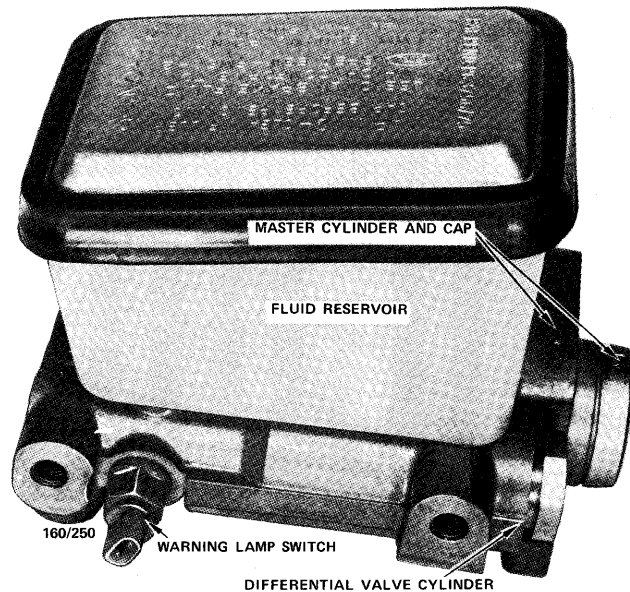
(20) Slide the secondary return spring into the end of the secondary piston. Carefully instal the secondary piston into the master cylinder bore. Using a suitable screwdriver, push the piston down to its full travel and instal the secondary piston stop and reservoir attaching stud with a new copper washer. Screw the stud down by hand and then tighten the stud using a spanner.

(21) Fit the primary piston return spring onto the piston opposite the push rod end and carefully instal the piston assembly into the master cylinder bore.

(22) Press down the primary piston until the push rod hole is flush with the end of the master cylinder bore



Master cylinder with fluid reservoir removed to show fluid seals.



Master cylinder assembly viewed from left side.

and then instal the retainer cap over the end of the cylinder bore. Bend the two fixing lugs into the machined groove on the master cylinder body.

(23) Place the reservoir sealing grommets into the recess on top of the master cylinder body and a new 'O' ring onto the reservoir retaining stud.

(24) Place the reservoir over the retaining stud and into the sealing grommets. Fit the reservoir retaining nut and washer.

(25) Match the "front" markings and fit a new seal and diaphragm assembly to the reservoir cap.

(26) Instal the master cylinder to the vehicle.

TO INSTAL

Installation is a reversal of the removal procedure with attention to the following:

(1) Pour a small amount of new brake fluid into the reservoirs and pump the piston assemblies with a suitable blunt rod until fluid begins to emerge from the outlets.

(2) Loosely instal the master cylinder to the brake servo unit.

(3) Loosely instal the brake pipes and then tighten the master cylinder retaining nuts.

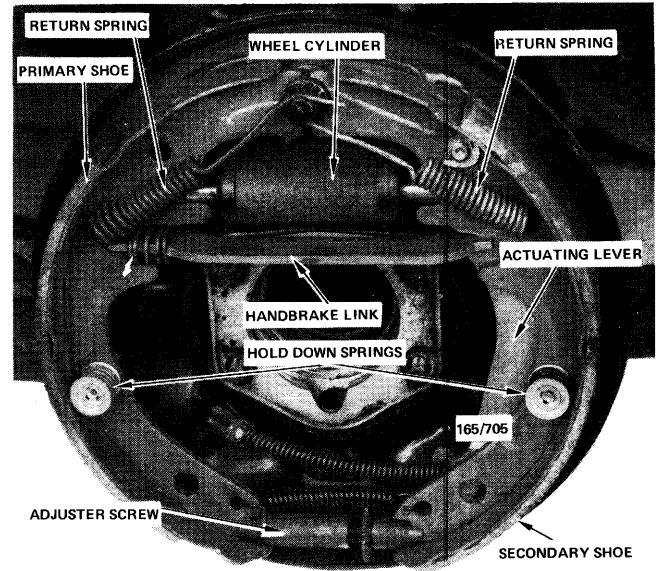
(4) Tighten the brake pipe union nuts and bleed the brakes as described under the heading Hydraulic System — To Bleed.

4. REAR DRUM BRAKE ASSEMBLY

TO REMOVE AND DISMANTLE

(1) Loosen the road wheel nuts, chock the front wheels and jack up the rear of the vehicle. Support the vehicle on stands placed under the rear axle housing and remove the road wheel. Release the handbrake.

(2) Remove the plug from the lower section of the backing plate. Loosen the brake shoe adjusting screw



Assembled view of rear drum brake. Taxi model shown.

several turns by holding the adjuster up and rotating the screw wheel so that there is adequate clearance between the shoes and the brake drum, then remove the brake drum from the axle shaft flange.

NOTE: Mark the primary shoe and return spring with a daub of quick drying paint or lacquer so that they may be installed in their original positions during assembly.

(3) Using suitable pair of pliers, remove the brake shoe return springs from the top anchor pin and remove the self adjuster mechanism actuating cable and guide.

(4) Unhook and remove the brake shoe self adjuster mechanism spring and lever.

NOTE: Delete the operations concerning the removal of the self adjuster mechanism if the vehicle is a taxi as these vehicles do not incorporate self adjusters.

(5) Unhook and remove the brake shoe holding down springs and pins from each shoe and remove the adjuster screw and wheel assembly from between the lower ends of the shoes.

(6) Spread the top of the brake shoes to clear the anchor pin and wheel cylinder push rods and withdraw the shoes from the brake backing plate with the handbrake link and spring.

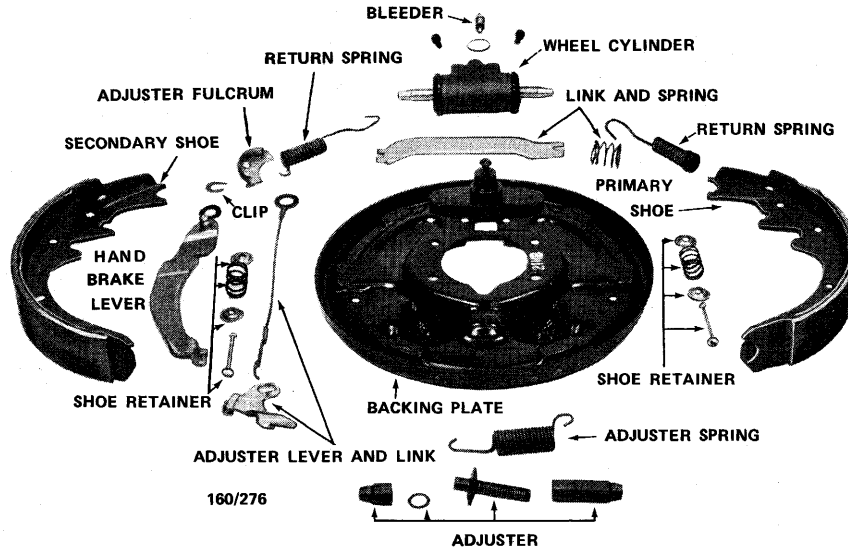
(7) Disengage the handbrake cable at the actuating lever situated on the secondary shoe.

(8) Remove the retaining clip securing the handbrake actuating lever to the secondary shoe and remove the lever from the shoe.

(9) Disconnect the hydraulic brake pipe at the wheel cylinder on the back of the brake backing plate and plug the open brake pipe to prevent contamination.

(10) Take out the two screws securing the wheel cylinder to the brake backing plate and remove the wheel cylinder from the vehicle.

Brakes



Dismantled view of rear drum brake components.

(11) Withdraw the two shoe push rods and the rubber boots from the ends of the wheel cylinder and take out the two pistons, wheel cylinder cups and spring from the cylinder bore.

(12) Unscrew and remove the wheel cylinder bleeder valve.

TO CLEAN AND INSPECT

(1) Check the brake linings for wear and renew as necessary.

(2) If the linings are still serviceable, check for oil saturation and gumminess and renew as required.

NOTE: Linings must be renewed as sets with corresponding linings on the opposing rear wheel.

(3) Check the brake drum for cracks, scoring and out of round and renew or regrind as necessary.

(4) Wash the wheel cylinder components in methylated spirits and blow dry with compressed air.

(5) Check the wheel cylinder pistons and the

cylinder bore for wear and pitting and renew or hone as necessary.

NOTE: Once having dismantled the wheel cylinder, renew all rubber components.

(6) Check the tension of the brake shoe return springs by comparison with new springs.

(7) Check the handbrake actuating lever and link for damage or distortion.

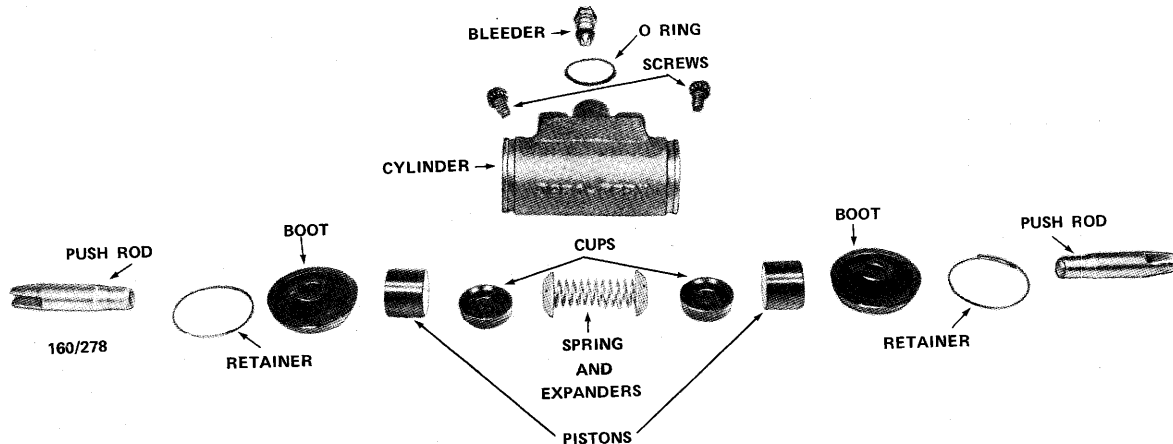
(8) Check the backing plate for distortion or fatigue and tension the four nuts connecting the backing plate to the axle housing.

(9) Wash the backing plate with methylated spirits and blow dry with compressed air.

TO ASSEMBLE AND INSTALL

Assembly and installation is a reversal of the removal and dismantling procedure with attention to the following points:

(1) Dip the internal components of the wheel cylinder in clean brake fluid.



Dismantled view of rear wheel cylinder components. Drum brakes.

(2) Instal one of the wheel cylinder cups in each end of the cylinder bore with the lipped edges facing each other and the spring interposed between the two cups.

(3) Smear each piston with hydraulic brake grease and instal one in each end of the cylinder bore with the flat face of the piston to the flat face of the wheel cylinder cup.

(4) Instal a rubber boot and shoe pushrod to each end of the wheel cylinder and instal the brake bleeder valve. Fit a suitable clamp to hold the components in place.

(5) Fit the cylinder assembly to the backing plate and secure with the two retaining screws.

(6) Reconnect the hydraulic pipe to the back of the wheel cylinder and tighten securely.

(7) Smear a coating of high melting point grease onto the friction surfaces where the brake shoes contact the backing plate.

(8) Fit the handbrake actuating lever onto the secondary brake shoe and secure into position with the waved washer and the 'C' clip.

(9) Refit the handbrake cable into the elbow on the end of the actuating lever.

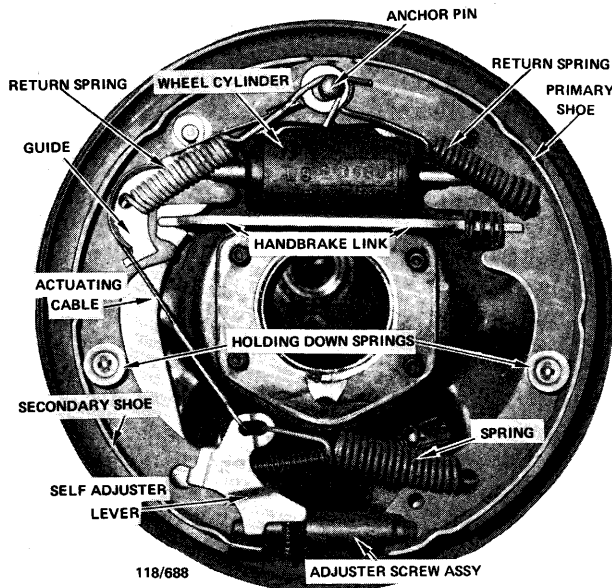
(10) Position the brake shoes on the backing plate and secure them in position with the hold down pins and springs. Instal the handbrake link and spring correctly between the primary shoe and the actuating lever.

(11) Place the self adjuster mechanism actuating cable eye over the anchor pin with the crimped side facing the backing plate.

(12) Using a suitable pair of pliers instal the primary shoe to anchor pin return spring.

(13) Instal the hooked section of the cable guide into the hole in the secondary shoe and thread the cable around the guide groove.

(14) Using the pair of pliers instal the secondary



Assembled view of rear drum brake fitted with self adjuster.

shoe to anchor pin return spring. Remove the wheel cylinder clamp.

NOTE: All components attached to the anchor pin should be flat and not cocked or binding.

(15) Lubricate the adjusting screw thread with a high melting point grease. Turn the adjusting screw and wheel assembly in until it reaches the limit of its inward travel then back off half a turn.

(16) Position the adjusting screw and wheel between the lower ends of the brake shoes with the adjusting wheel end towards the secondary shoe.

NOTE: The brake shoe adjusting screw cannot interchanged from one side of the vehicle to the other. To prevent incorrect installation the socket ends are stamped 'R' for right hand side and 'L' for the left.

(17) Fit the self adjuster lever and spring, and using a screwdriver, extend the lever up against the pressure of the return spring and instal the actuating cable into position in the lever. Check the operation of the self adjuster by pulling on the cable and observing the action of the self adjuster.

(18) Instal the brake drum onto the axle flange. Instal the road wheel and tighten the wheel nuts.

(19) Bleed and adjust the brakes as described under the appropriate heading in this section.

(20) Lower the rear of the vehicle to the floor.

5. FRONT DISC BRAKES

Special Equipment Required:

To Check Disc Run-Out — Dial gauge

TO REMOVE AND INSTAL BRAKE PADS

(1) With the handbrake applied, raise the front of the vehicle, support on stands and remove the road wheel.

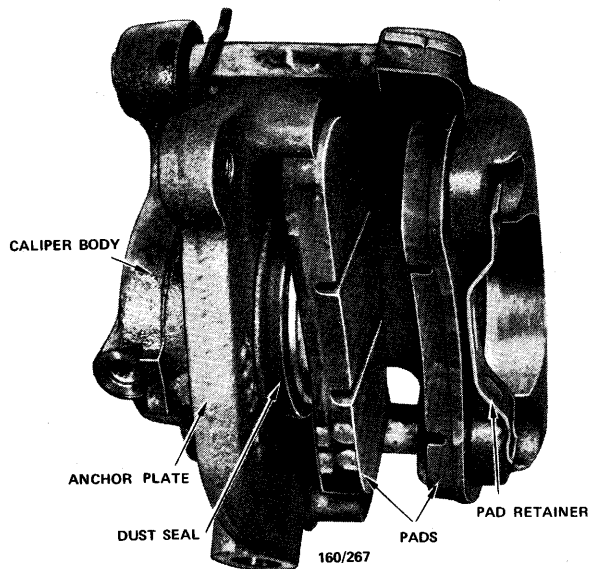
(2) Drain approximately two thirds of the brake fluid from the master cylinder reservoir which feeds the front brakes. This can be done by loosening the disc brake line at the master cylinder connection and bleeding down the fluid into a container.

NOTE: Do not completely remove the brake pipe or drain all of the fluid from the reservoir otherwise it will be necessary to bleed the hydraulic system. The fluid is drained from the reservoir in order to prevent overflow when the caliper piston is pushed back into its bore to facilitate pad renewal.

(3) Remove the locking wire and the two bolts attaching the caliper anchor plate to the stub axle flange.

(4) Lift the caliper assembly from the brake disc. Suspend or support the caliper in such a manner that the caliper weight is not taken on the brake hose.

(5) Withdraw the outer brake pad from the caliper by applying pressure towards the inner pad while sliding



Under side view of front disc brake caliper assembly.

the spring clip over the anchor points.

(6) Now lever the inner brake pad away from the caliper piston and remove the pad complete with the anti-rattle spring.

(7) By levering upon a spent brake pad, slowly ease the caliper piston into its bore and then centralise the caliper in relation to the brake disc.

(8) Ensure that the caliper piston seal is not leaking and that the dust seal is in good condition. Renew as necessary.

Installation is a reversal of the removal procedure with attention to the following points:

(1) Instal the inner pad and seat it firmly by locating the round anti-rattle spring in the caliper piston body.

(2) Instal the outer pad to the caliper housing by inserting one end first and levering the retaining clip over with a screwdriver. Repeat the procedure to locate the other end of the pad and ensure that both pad posts finally locate correctly in the two holes provided in the caliper housing.

(3) Position the caliper assembly over the disc and align the holes on the anchor plate with those in the stub axle flange.

(4) Fit the lower mounting bolt finger tight, then instal and tighten the top bolt to Specifications.

The lower bolt can now be tightened to the specified torque and both bolts retained with locking wire.

(5) Instal the road wheel, tighten the wheel nuts and lower the vehicle to the ground. Pump the brake pedal three or four times and top up the master cylinder reservoir to the correct height with clean brake fluid.

NOTE: Brake pads must be fitted as sets of four to ensure even braking.

TO OVERHAUL FRONT CALIPER

(1) Loosen the front wheel nuts, apply the hand-

brake and raise the front of the vehicle. Support on stands and remove the road wheel.

(2) Disconnect the hydraulic brake hose at the caliper and plug the end to prevent contamination and loss of fluid.

(3) Remove the locking wire and the two bolts attaching the caliper anchor plate to the stub axle flange. Remove the caliper from the vehicle.

(4) Remove the two brake pads as previously described in this section.

(5) Using a vice with soft metal jaws, mount the caliper assembly and remove the two split pins retaining the guide pin ends and then withdraw the anti-rattle clips.

(6) Clean the guide pins before removing them, working from the inboard side of the caliper, using a pointed probe, prise out one guide pin from the caliper.

(7) Separate the caliper and the anchor plate.

(8) Remove the remaining guide pin from the caliper.

(9) Remove the seals from the guide pins and discard them. Check the guide pins for damage or wear and renew if necessary.

NOTE: Before removing the piston, insert a piece of masonite or plywood in the position of the outboard pad. This will prevent damage to the piston if it ejects from its bore.

(1) Using a low pressure of air applied to the caliper hydraulic hose aperture, gently force the piston from the caliper bore at the same time easing the dust seal out of the radial groove in the piston.

(11) Detach the dust seal from the locating groove in the caliper bore and discard.

(12) Check the piston for scoring, pitting and corrosion or areas where the chrome plating is worn off. If the piston is damaged in any way it should be renewed.

(13) Using a thin blunt probe, preferably made from wood or plastic, lift and remove the piston seal from its groove in the cylinder bore.

(14) Clean all parts with methylated spirits and blow dry with compressed air, making sure that drilled passages and cylinder bore are clear of any foreign material.

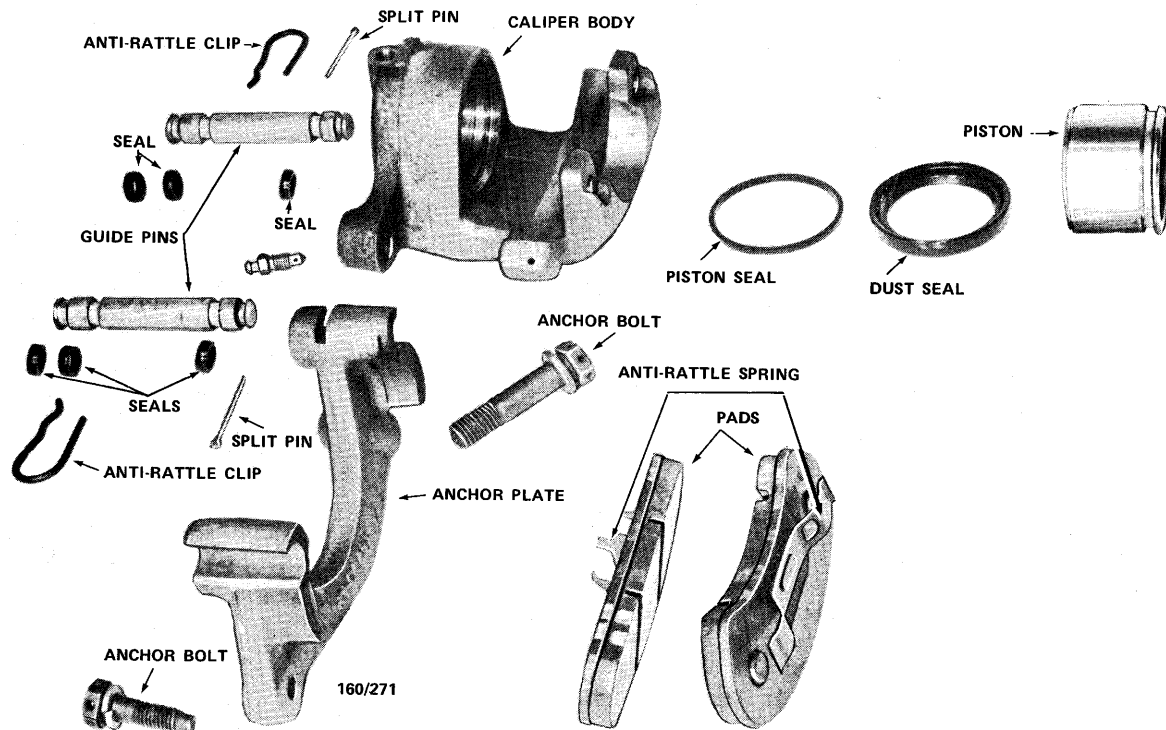
Assembly and installation is a reversal of the removal and dismantling procedure with attention to the following points:

(1) Dip a new piston seal in clean hydraulic brake fluid and insert it in the groove in the caliper bore ensuring that the seal is seating correctly and not twisted.

(2) Coat a new dust seal with rubber grease and position the dust seal over the end of the piston, opposite the groove. Instal the dust seal so that it is correctly located in the groove provided in the caliper bore.

(3) Coat the piston with rubber grease and position the piston over the caliper bore and evenly press the piston down into the bore and through the dust seal until it bottoms. Locate the dust seal into the groove in the piston.

(4) Smear the guide pin holes with a high melting point grease.



Dismantled view of front disc brake caliper components.

(5) Smear the guide pins and seals with high melting point grease and fit the seals to the guide pins.

(6) Taking care not to damage the seals, tap one of the guide pins into the caliper.

(7) Smear the guide pin bearing surface of the anchor plate with high melting point grease.

(8) Assemble the anchor plate to the guide pin with the two brake pad retaining lugs facing towards the outer brake pad position.

(9) Taking care not to damage the seals, assemble the remaining guide pin to the caliper. Fit new split pins to retain the guide pins in the caliper. Fit the anti-rattle clips.

(10) Fit the inner pad to the caliper piston, at the same time locate the anti-rattle spring inside the caliper piston.

(11) Using a screwdriver raise one end of the retaining clip and slide the outer pad into the caliper. Repeat the above to the remaining side of the clip.

NOTE: When fitting the outer pad ensure that the two locating posts are seated in the two holes in the caliper housing.

(12) Position the caliper and caliper anchor plate over the disc and align the holes in the anchor plate with those in the stub axle flange.

(13) Instal the lower mounting bolt finger tight, instal the top mounting bolt and tighten to Specification. Tighten the lower mounting bolt to Specifications then instal new locking wire to retain both mounting bolts.

(14) Connect the hydraulic brake hose with new sealing washers and tighten to Specifications.

(15) Carry out the bleeding operations as described in this section under the heading Hydraulic System — To Bleed.

Instal the road wheel and tighten the wheel nuts in a diagonal sequence. Lower the vehicle and road test.

TO REMOVE AND INSTAL FRONT DISC

(1) With the handbrake applied, raise the front of the vehicle and support on stands, remove the road wheel and the grease cap.

(2) Remove the caliper as previously described in this section. Do not disconnect the flexible brake hose.

(3) Using tie wire, attach the caliper to the underbody of the vehicle.

(4) Where necessary, using a dial gauge, check the run out of the disc. See Specifications for disc run out limit.

(5) Remove the split pin, take off the castellated nut retainer and unscrew and remove the adjusting nut on the end of the stub axle.

(6) Remove the thrust washer and the outer hub bearing cone and roller assembly. Withdraw the hub and disc assembly from the stub axle.

(7) Gently drift the inner bearing cone and roller assembly with the grease retaining seal out of the inner hub section.

(8) Clean the disc with solvent and examine for wear, damage of scoring.

NOTE: Should the disc require machining, remove only that amount required to eliminate the scoring or chipping. See Specifications for disc thickness limit.

Installation is a reversal of the removal procedure with attention to the following points:

Assemble the disc hub and bearings as described in the Front Suspension section.

When the caliper is installed, tighten the upper and then the lower mounting bolts to Specifications and instal new locking wire.

Pump the brake pedal to align the brake pads before road testing the vehicle.

6. REAR DISC BRAKES

Special Equipment Required:

To Instal Brake Pads — Piston resetting tool

DESCRIPTION

The rear disc brakes are basically the same as the front disc brakes in as much as they are the single piston floating caliper type.

However the caliper and piston also incorporate a self adjusting handbrake mechanism comprising a lever, cam with three balls and an adjusting screw and nut.

These components are activated by the handbrake lever and cables. Adjustment is by movement of the caliper piston during normal service brake application.

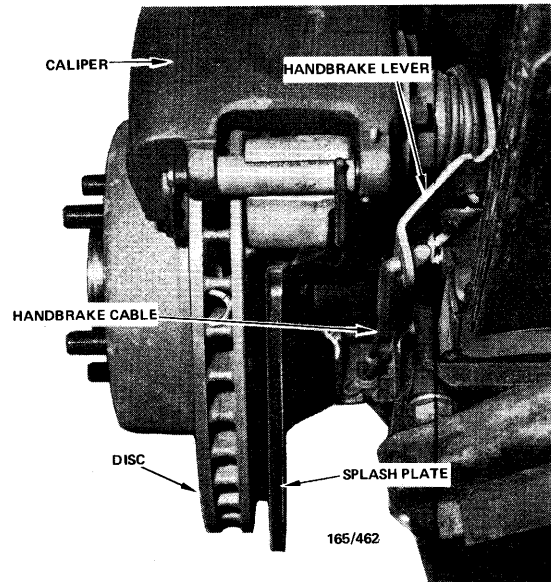
TO REMOVE AND INSTAL BRAKE PADS

(1) Chock the front wheels and loosen the rear road wheel nuts. Raise the rear of the vehicle and support on stands placed beneath the axle housing.

(2) Remove the road wheel and disconnect the brake pipe from the flexible hose at the disc shield. Plug the ends of the pipe and the hose to prevent the loss of brake fluid and the ingress of dirt.

(3) Remove the locknut retaining the flexible hydraulic hose to the disc shield and remove the hose from the shield.

(4) With the handbrake in the released position, remove the cable adjusting nut at the equaliser to release



Handbrake lever side of rear caliper.

the cable and allow the hook fitted to the caliper lever to be turned approximately 90 degrees.

(5) Detach the cable hook from the caliper lever.

(6) Bend open the lock plate at the mounting bracket to anchor plate bolts and remove the bolts.

(7) Withdraw the caliper from the vehicle.

(8) Remove the outboard brake pad from the caliper by pressing down on the pad towards the inboard brake pad and sliding the pad from the caliper.

(9) Withdraw the inboard pad by first overcoming the anti-rattle spring resistance at the rear of the brake pad and then sliding the pad from the caliper piston.

(10) Ensure that the caliper piston seal is not leaking and that the dust seal is in good condition. Renew as necessary.

Installation is a reversal of the removal procedure with attention to the following points:

(1) Prior to the installation of the brake pads screw the caliper piston into the housing in a clockwise direction, using the piston resetting tool until the piston bottoms. From the full in position, rotate the piston one tenth of an turn in an anti-clockwise direction.

(2) With the brake pads installed in the caliper, slide the caliper over the disc and instal the two retaining bolts and a new lock plate and torque to Specifications. Bend over the lock plate tabs.

(3) Fit the flexible hose to the disc shield and secure it with the locknut.

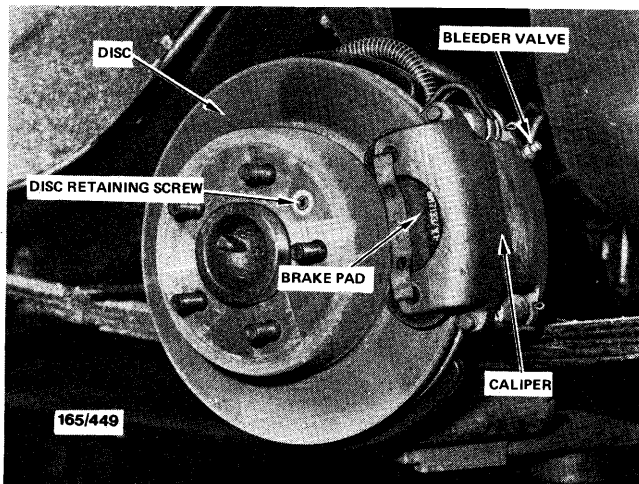
(4) Reconnect the brake pipe to the brake hose.

(5) Bleed the hydraulic system as described under Hydraulic System — To Bleed.

(6) To adjust the pads to the brake disc, firmly apply the foot brake several times.

(7) Fit the handbrake cable to the caliper lever and connect it up to the adjusting stud with the equaliser.

(8) Adjust the handbrake cable as described under Brake Adjustments.



Installed view of rear caliper.

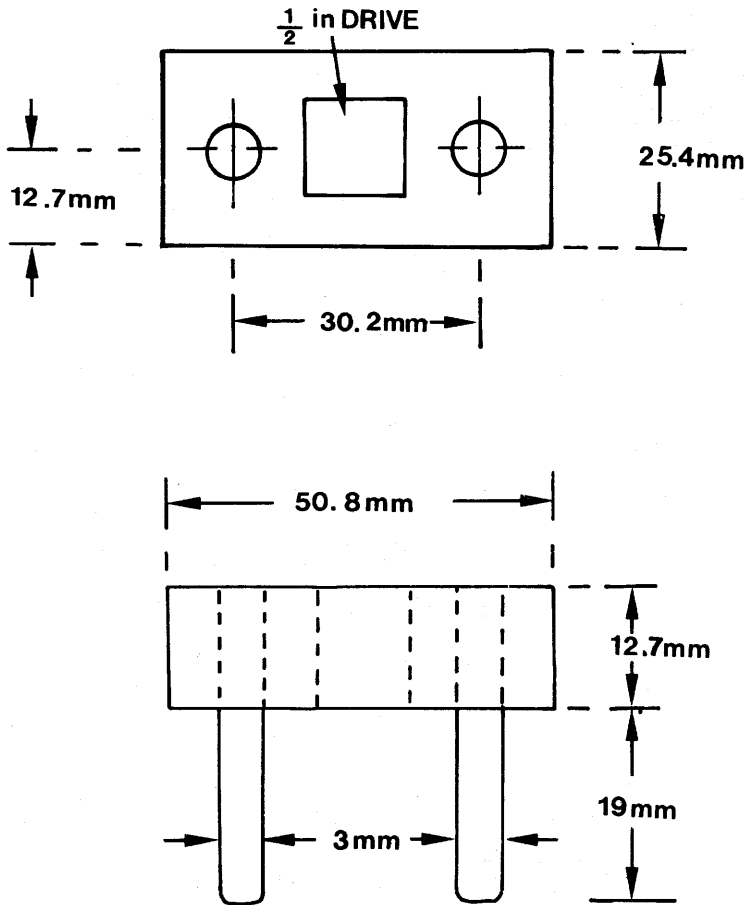


Illustration showing rear caliper piston resetting tool dimensions. The tool body should be of mild steel with pins of hardened steel.

(9) Replace the road wheel and lower the vehicle to the ground. Tighten the wheel nuts in a diagonal sequence.

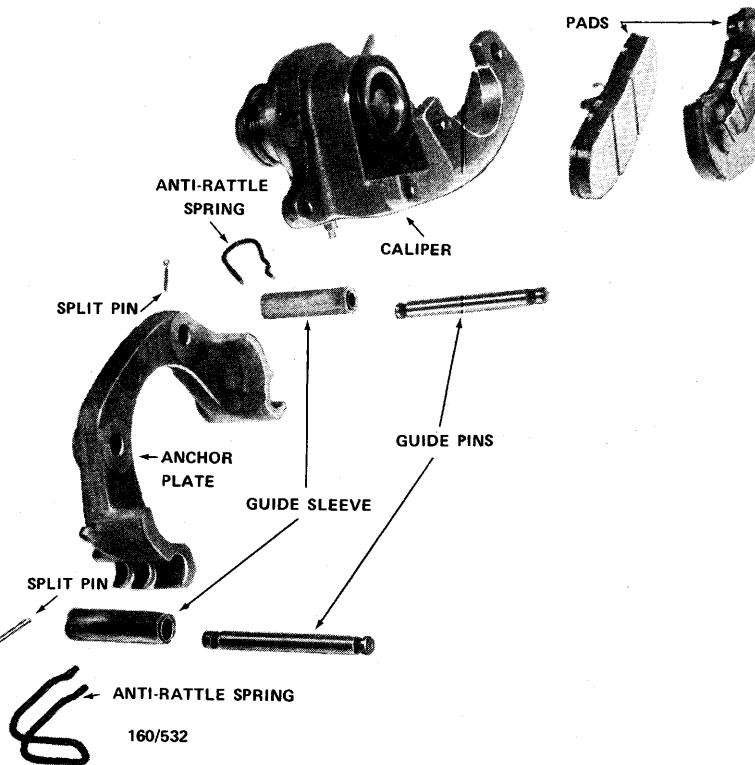
TO OVERHAUL REAR CALIPER

- (1) Chock the front wheels, raise the rear of the vehicle and support on stands placed beneath the axle housing.
- (2) Remove the caliper and brake pads as described under To Remove and Instal Brake Pads.
- (3) Place the caliper in a vice fitted with soft jaws.
- (4) Remove the handbrake lever retaining bolt.
- (5) Remove the lever from the end of the cam by levering between the lever and the housing.
- (6) Remove the two split pins from the guide pins and using a suitable pin punch and hammer, tap the guide pins from the handbrake lever side out of the caliper.
- (7) Remove the anti-rattle spring from the anchor plate.
- (8) Remove the anchor plate and remaining anti-rattle spring and guide sleeve.
- (9) Clamp the bracket in a vice and using a suitable screwdriver, remove the anti-rattle spring from the

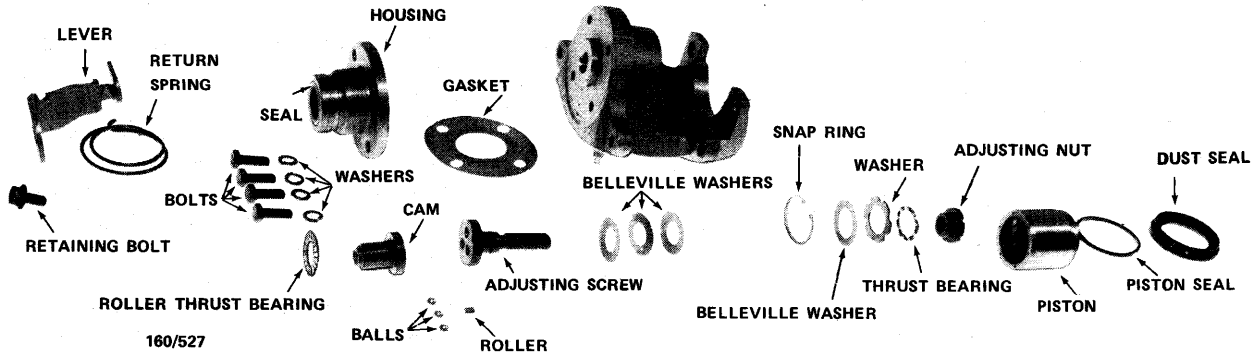
- anchor plate and guide sleeve.
- (10) Remove the four guide pin seals and discard. Check for any wear or plating deterioration on the guide pins and renew if necessary.
- (11) With the handbrake housing in the vertical position, remove the spring from the housing.
- (12) Remove the four attaching bolts securing the handbrake housing and remove it from the caliper.
- (13) Note the positions of the components in relation to each other and remove the thrust bearing, cam, balls and locating roller. By turning the adjusting screw anti-clockwise remove it from the adjusting nut together with the three Belleville washers. Remove and discard the square sectional rubber seal which is fitted to the adjusting screw.
- (14) Using a screwdriver as a lever, remove the rear handbrake housing seal and discard.

NOTE: Extreme care must be taken in this operation so as not to damage in any way the handbrake housing.

- (15) Withdraw the piston from the caliper bore and remove the snap ring from the rear of the piston. Withdraw the Belleville washer, thrust washer, thrust bearing and the adjusting nut.
- (16) Remove the piston dust seal from the caliper and discard.
- (17) Using a thin blunt probe, remove and discard the piston seal from the groove in the caliper bore.
- (18) Clean all components except the brake pads in



Dismantled view of rear caliper anchor plate components.



Dismantled view of rear brake caliper components.

methylated spirits and examine carefully for wear. Discard all seals and rubber boots.

(19) Pay particular attention to the piston. Check for scoring, pitting or flaking of the chrome plating on the piston. If the piston is damaged or worn, renew the piston.

Assembly and installation is a reversal of the dismantling and removal procedure with attention to the following points:

(1) Instal the self adjusting nut to the piston with the long boss facing out.

(2) Instal the thrust bearing, thrust washer and the Belleville washer, with its inner diameter against the thrust washer, to the piston and secure with the snap ring.

(3) Lubricate the piston and a new piston seal with clean brake fluid. Instal the seal to the groove in the caliper bore, ensure that the seal is correctly located in the groove and that it is not twisted.

(4) Fit a new dust seal over the lower end of the piston. Instal the dust seal so that it is correctly located in the groove provided in the caliper bore.

(5) Push the piston into the caliper bore through the dust seal until it bottoms. Ensure that the dust seal is correctly located in the groove provided in the piston.

(6) Lubricate the inside of the guide pin sleeves and the four guide pin seals with grease. Assemble the guide pin seals to the sleeves with the lips outwards and insert the retainers.

(7) Place one of the guide pin sleeves in position, line up the sleeve with the holes in the caliper body and instal the guide pin.

NOTE: When installing the guide pin take care not to damage the guide pin seals.

The guide pin must be installed with the narrow groove end first through the outboard hole in the caliper and tapped into position using a pin punch and hammer.

(8) Instal the anchor plate with the hook end adjacent to the bleeder valve and instal the remaining sleeve and guide pin as previously described.

(9) Secure the guide pins with new split pins.

(10) Instal the single loop anti-rattle spring.

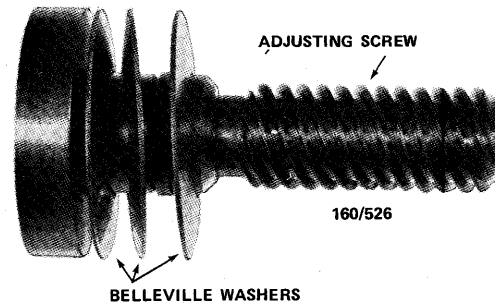
(11) Using a thin piece of brass shim, place the shim over the sleeve and then instal the second anti-rattle

spring by pressing the spring over the sleeve. Remove the shim.

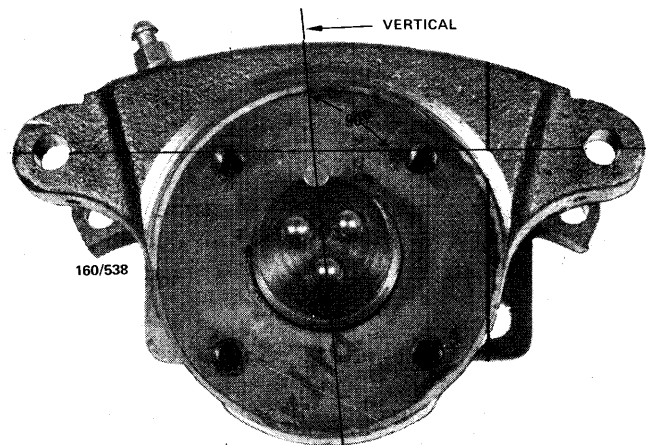
(12) Instal a new seal to the handbrake housing. Use a suitable piece of tube and, taking care not to damage the seal, tap the seal into the housing until it just bottoms.

(13) Lubricate the inside of the handbrake housing and the seal lip with rubber grease.

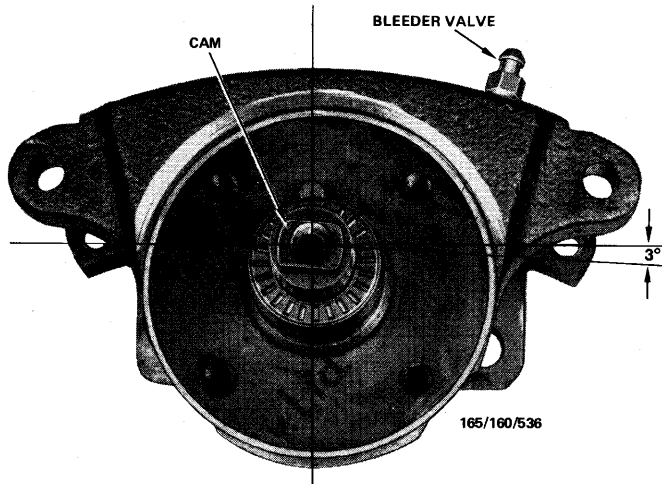
(14) Instal the three Belleville washers with the following sides towards the thread end of the adjusting screw: First washer — convex side, second washer — concave side, third washer — convex side.



Rear disc brake caliper adjusting screw showing correct location of Belleville washers.



Correct location of adjusting screw, balls and roller before fitting the handbrake cam and housing.



Handbrake cam correctly located on left hand side caliper. The right hand side caliper is symmetrically opposite.

(15) Fit a new seal into the groove in the adjuster screw. Ensure not to damage the seal and that it rests in the groove without twists.

(16) Smear the adjuster screw threads and the seal with clean brake fluid and screw the adjuster screw into the nut in the piston. When the Belleville washers touch each other tighten the screw finger tight and leave it in a position that the roller groove faces towards the caliper bridge.

(17) Smear the head of the adjuster screw and the groove liberally with rubber grease and place the roller and the balls into their positions.

(18) Smear the cam and ball ramps with rubber grease and position the cam onto the balls on the adjuster screw so that the flats on the end of the cam are at a 3 degree angle to the horizontal position and are pointing to the opposite side of the bleeder valve.

(19) Lubricate the thrust bearing and washer with rubber grease and fit the bearing and then the washer to then cam.

(20) Fit the handbrake housing with a new gasket over the cam to the caliper. Ensure that the groove in the housing aligns with the roller positioned against the adjuster screw in operation (17). Do not damage the seal.

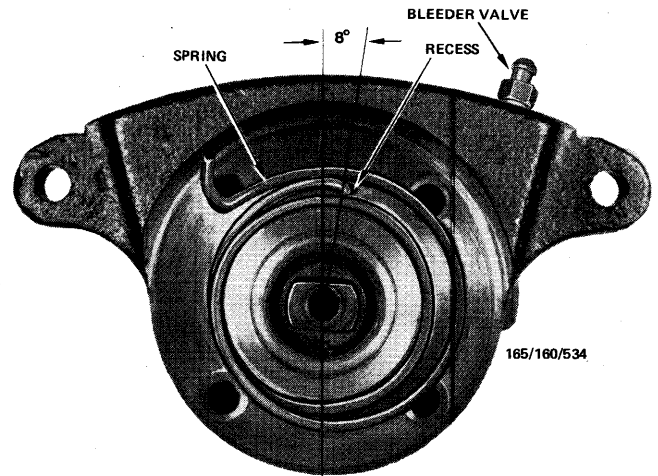
(21) Fit and tighten the handbrake housing retaining bolts.

NOTE: When the housing is correctly assembled, the spring location recess in the handbrake housing should be pointing 8 deg from the vertical towards the bleeder valve on top of the caliper body.

(22) Place the handbrake lever return spring with its smaller coil first onto the handbrake housing. Fit the small coil and the hook into their recess in the housing.

NOTE: The spring is fitted correctly when the small coil, coils away from the bleeder valve.

(23) Do not engage the spring but fit the handbrake lever with the offset facing down onto the cam. The lever



Correct location of handbrake lever return spring on left hand side caliper. The right hand side caliper is symmetrically opposite.

should engage in the flats of the cam and face away from the bleeder screw. Instal the retaining bolt finger tight.

(24) Now check the free movement of the mechanism by rotating the lever approximately 45 degrees. When released in this position the lever should snap back to the original place.

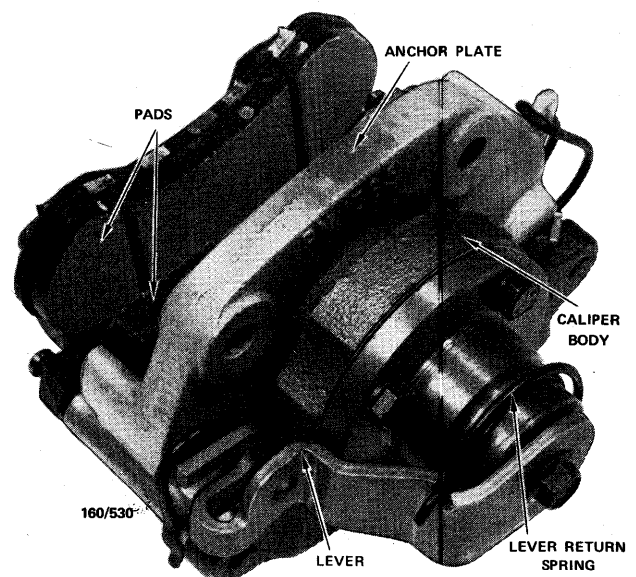
(25) Should the lever be tight, loosen the handbrake housing retaining bolts and move the housing until the lever moves freely.

(26) Remove the lever to hook the return spring into the groove in the lever. Turn the lever against the pressure of the return spring and engage the flats of the lever hole with the flats of the cam.

(27) Tap the lever fully onto the cam.

(28) Fit the retaining bolt and torque to 30 Nm.

(29) Refit the brake pads into the caliper and instal it on the vehicle as described in To Remove and Instal Brake Pads.



Under side view of rear disc brake caliper. Typical.

Bleed the hydraulic system as detailed in Hydraulic System — To Bleed.

(30) Adjust the handbrake as detailed under Brake Adjustments.

7. BRAKE ADJUSTMENTS

TO ADJUST REAR DRUM BRAKES

(1) Jack up the rear of the vehicle and support on stands placed under the rear axle housing.

(2) Prise out and remove the adjusting slot cover in the lower section of the brake backing plate for each rear wheel.

(3) Release the handbrake and loosen the handbrake cable adjusting nut at the equaliser rod.

(4) Insert the brake adjusting tool through the adjusting slot in the brake backing plate to engage the teeth of the adjusting screw wheel.

(5) Insert a thin bladed screwdriver also through the backing plate slot, to push the self-adjusting mechanism lever out of engagement with the adjusting screw wheel and, holding the lever clear, move the outer end of the adjusting tool down to rotate the adjusting screw wheel. Expand the shoes until they just lock the road wheel, then reverse the action of the tool until the wheel and brake drum will just turn freely. Remove the adjusting tool and screwdriver blade.

(6) Repeat the adjustment procedure on the other rear wheel and instal the adjusting slot covers in the brake backing plates.

(7) Check the travel of the brake pedal and adjust the handbrake cable as described under the following heading.

TO ADJUST HANDBRAKE

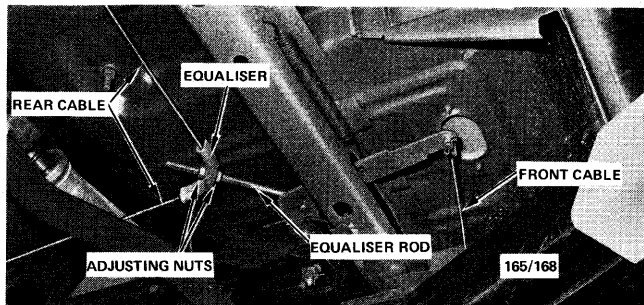
Rear Drum Brakes

(1) Jack up the rear of the vehicle and adjust the rear brake shoes.

(2) Check the cables for free operation in their respective conduits and set the handbrake lever in the full off position.

(3) Adjust the equaliser rod nuts sufficiently to remove all slack in the rear cable assembly.

(4) Tighten the locknuts securing the rear cable equaliser to the equaliser rod.



Underbody view showing handbrake cable adjusting point.

(5) Ensure that both rear wheels are free to rotate but will lock when the handbrake lever is pulled out approximately half way.

(6) Lower the rear of the vehicle to the ground.

Rear Disc Brakes

(1) Apply and release the foot brake pedal several times to adjust the rear calipers.

(2) Firmly apply the handbrake and release. Raise the rear of the vehicle and support on stands placed beneath the rear axle housing.

(3) Adjust the nuts at the equaliser rod so that both the caliper levers are just in the fully off position. At this point, if a return force of 210 N is applied to one caliper lever the other lever should move 0.5 to 4.5 mm.

NOTE: This adjustment must be carried out with the weight of the vehicle on the wheels or axles.

(4) With the handbrake released ensure that both rear wheels are force to rotate.

8. BRAKE SERVO UNIT

DESCRIPTION

The brake servo unit is installed between the brake pedal and the brake master cylinder.

The valve and rod assembly of the servo unit and the pedal push rod are on the same axis and in case of a vacuum failure act as a single push rod without assistance.

The servo unit is connected by a hose to the inlet manifold.

The only items which normally require attention are the one way check valve and the hose connection.

TO CHECK OPERATION

(1) With the engine switched off, apply the foot brake several times to exhaust all vacuum from the system.

(2) Again apply the foot brake, but this time hold the brake pedal fully depressed.

(3) Start the engine. If the servo unit is functioning satisfactorily a distinct downward movement of the brake pedal should be noticed.

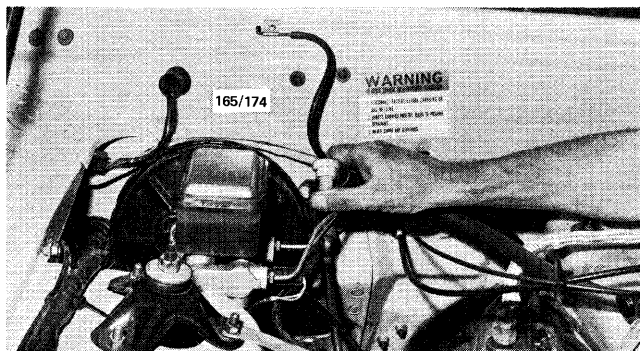
Should the pedal fail to fall away when the engine has been started, then the vacuum system can be considered inoperative.

NOTE: If the pedal continues to fall away then there is a fault in the hydraulic system.

(4) Ensure that the brake pedal is fully off, start the engine and run it at medium speed. Stop the engine.

Let the vehicle stand for 1-2 minutes, then press the brake pedal two or three times and check its operation.

If there is no vacuum assistance, then the vacuum system has developed a leak or the one way check valve is defective.



Disconnect check valve at servo unit and using a finger check for vacuum. The engine must be running for this test.

NOTE: Before removing the servo unit from the vehicle for inspection, disconnect the vacuum supply hose at the unit, then start the engine and check that the manifold vacuum is in fact reaching the servo unit. Also check the one way check valve as described below.

TO TEST ONE WAY CHECK VALVE

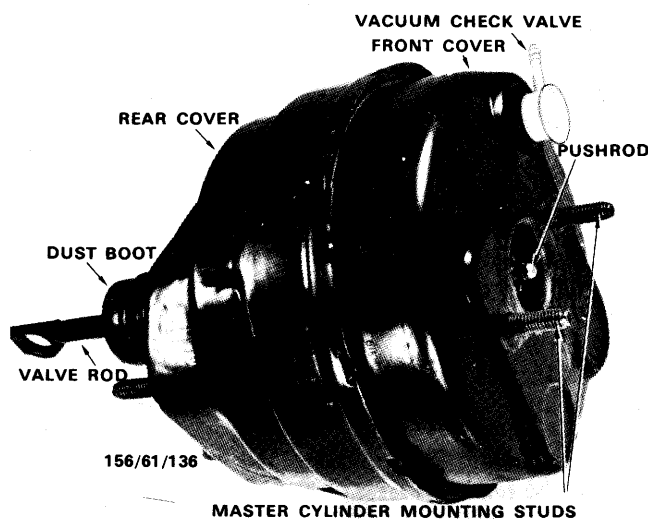
(1) Release the hose clip and remove the check valve from the vehicle.

(2) Check the valve for sticking. Suction on the manifold side should allow air to flow freely. Air blown into the valve from the manifold side should not be able to flow through the valve.

(3) Check the 'O' ring for deterioration and renew if necessary.

(4) Instal the valve and check the operation of the servo unit as previously described.

NOTE: Check that there are no air leaks at the hose connections and that the hose clips are tight. Also check that the hose is not bulged or collapsed due to deterioration.



Brake servo unit removed from vehicle.

TO REMOVE AND INSTAL

(1) Take out the retaining clip and disengage the servo unit pushrod complete with spacer and bushing from the brake pedal pin.

(2) Raise the engine bonnet and place fender covers on both front fenders.

(3) Disconnect the master cylinder front and rear outlet pipes and plug the ends to prevent entry of dirt.

(4) Disconnect the wires at the pressure differential warning lamp switch.

(5) Loosen off and remove the nuts and lock washers securing the master cylinder to the servo unit and withdraw the master cylinder assembly from the unit.

(6) Disconnect the vacuum hose from the servo unit.

(7) Loosen off and remove the nuts securing the servo unit to the bulkhead panel from the interior of the vehicle and withdraw the unit complete with pushrod from the engine side of the bulkhead panel.

Installation is a reversal of the removal procedure with attention to the following points:

Ensure that the vacuum hose, when connected, is free of leaks.

It will be necessary to bleed the hydraulic system on completion of the installation. Refer to the Hydraulic System — To Bleed.

9. HYDRAULIC SYSTEM

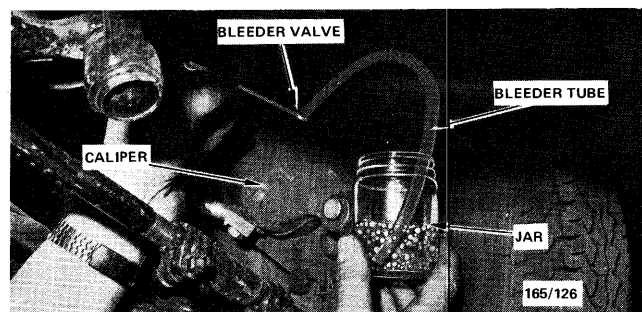
TO BLEED

Bleeding the hydraulic system is not a routine maintenance operation and will only be necessary when some portion of the brake equipment has been disconnected or fluid drained off, thereby allowing air to enter the system.

(1) Fill the fluid reservoirs with clean hydraulic brake fluid and maintain at least one-third full throughout the entire bleeding operation.

(2) Attach a rubber bleeder tube to the bleeder valve on one of the brake cylinders and allow the other end of the tube to be immersed in a small amount of clean fluid contained in a clean glass jar.

NOTE: The front and rear brakes are independent systems. Bleed either system commencing with the cylinder furthest away from the master cylinder.



Bleeding front caliper.

(3) Unscrew the bleeder valve one complete turn.

(4) Have an assistant depress the brake pedal slowly to the full extent of its travel. Close the bleeder valve and allow the brake pedal to return without assistance.

(5) Repeat operation (4) until a constant stream of fluid, without any air bubbles, is being discharged into the glass jar, hold the brake pedal down and tighten the bleeder valve.

(6) Carry out the bleeding operation on the other side of the system.

NOTE: Do not allow the fluid level in the reservoir to fall below one third full level at any time during the bleeding operation or air will enter the system and a fresh start will have to be made. Always use new brake fluid for topping up the reservoir.

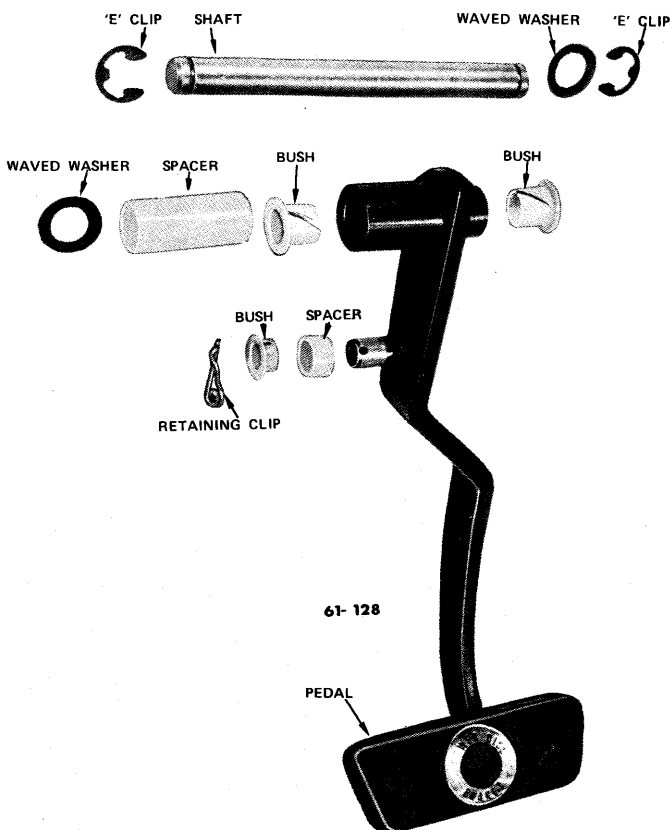
(7) Finally top up the reservoirs to the level indicated and instal the reservoir cap.

10. BRAKE PEDAL ASSEMBLY

TO REMOVE AND INSTAL

(1) Take out the retaining clip and disengage the servo unit pushrod complete with spacer and bushing from the brake pedal.

(2) Using suitable pliers remove the 'E' clip



Dismantled view of brake pedal components.

retaining the pedal shaft at the right side of the support bracket.

(3) Withdraw the brake pedal shaft, the brake pedal spacer, the waved washers and the pedal and bushings from the brake pedal support bracket.

(4) Clean and inspect the bushings for wear or damage and renew if necessary.

Installation is a reversal of the removal procedure with attention to the following points:

Lubricate the bushing with light grease and place them into position in the pedal boss. Instal the pedal shaft from the left of the support bracket and position the waved washer, the spacer and the brake pedal assembly onto the shaft.

Centre the shaft and instal the remaining waved washer at the right hand end followed by the 'E' clip.

Instal the spacer and engage the pushrod on the brake pedal pin, refit the bushing and the retaining clip. Refer to the Electrical System section — To Adjust Stop Lamp Switch, if adjustment is required.

11. HANDBRAKE LEVER AND CABLES

HANDBRAKE LEVER ASSEMBLY

To Remove and Instal

(1) Disconnect the clip from the clevis pin retaining the front handbrake cable to the fulcrum lever, remove the clevis pin and the front cable yoke from the front brake cable.

(2) Remove the handbrake handle facia panel by turning the four plastic retaining plugs through 90 degrees each. Lift the facia panel away from the dash facia.

(3) Remove the clip and pull out the clevis pin retaining the front cable guide wheel and remove the guide wheel.

(4) Using a pair of pliers remove the front outer cable to handbrake bracket retaining clip.

(5) Working from the engine compartment, undo and remove the two nuts retaining the handbrake bracket to the bulkhead.

(6) Undo and remove the handbrake assembly to body retaining bracket, situated just under the lower dashboard panel.

(7) Allow the handbrake assembly to lie on the floor, undo the two nuts retaining the handbrake warning lamp switch and lift the switch away from the assembly.

(8) With the handbrake in its fully released position, use a pair of long nosed pliers to lift the front handbrake cable ball out of its seat. Pull the cable through the handbrake retaining bracket and out of the assembly.

Installation is a reversal of the removal procedure with attention to the following points:

(1) Inspect the front cable guide wheel for distortion or wear and renew if necessary.

(2) Inspect the spring steel anti-rattle plate for wear or distortion and renew if necessary.

(3) Inspect the handbrake ratchet and pawl for wear and renew all necessary parts.

(4) Feed the front cable through the handbrake bracket and place the inner cable and ball into its seat.

(5) Instal the handbrake warning lamp switch and retain by tightening the two retaining nuts.

(6) Lift the handbrake assembly and push the two handbrake bracket studs into their holes in the bulkhead.

(7) Instal the under dash handbrake assembly to body bracket but do not tighten the retaining nuts at this time.

(8) Working from the engine compartment, instal and tighten securely the two handbrake bracket to bulkhead retaining nuts.

(9) Place the guide wheel into the handbrake bracket, centre the cable on the wheel and lift until the clevis pin can be installed through the handbrake bracket and wheel. Instal the clevis pin retaining clip.

(10) Instal the outer cable to handbrake bracket retaining clip.

(11) Centre the dash facia panel to the dashboard and retain by turning the four plugs through 90 degrees.

(12) Connect the handbrake cable to the fulcrum lever. Apply and disengage the handbrake 2-3 times to centre the handbrake assembly and then tighten the under dash support bracket.

HANDBRAKE FRONT CABLE

To Remove and Instal

(1) Remove the handbrake lever assembly as described previously in this section.

(2) Working from the engine compartment undo and remove the three nuts holding the front handbrake cable retaining plate to the bulkhead.

(3) Unclip the outer cable to body retaining clip and remove the cable from the body.

Installation is a reversal of the removal procedure with attention to the following points:

Fit the outer cable into the seat on the underbody and secure by installing the retaining clip.

Instal the handbrake lever assembly, as previously described.

With the handbrake cable positioned, place the handbrake cable retaining plate over the cable and onto its retaining studs. Instal and tighten the three retaining plate securing nuts.

HANDBRAKE REAR CABLE

To Remove and Instal — Disc Brake Models

(1) Raise the rear of the vehicle and support on stands placed under the rear axle housing.

(2) Undo and remove the locking nut retaining the rear handbrake cable equaliser and slide the equaliser off the pull rod. Remove the equaliser from the cable.

(3) Remove the clip retainers and disengage the outer cable from the retaining brackets on the underbody.

(4) Disconnect the cable ends from the caliper levers by turning the cable end hooks through 90 degrees.

(5) Remove the cable assembly from the vehicle.

Installation is a reversal of the removal procedure with attention to the following points:

Engage the rear cable to one caliper lever and secure the cable to the underbody brackets, working towards the cable equaliser.

Engage the other end of the cable to its caliper lever and secure the cable to the underbody brackets.

Adjust the handbrake cable as previously described.

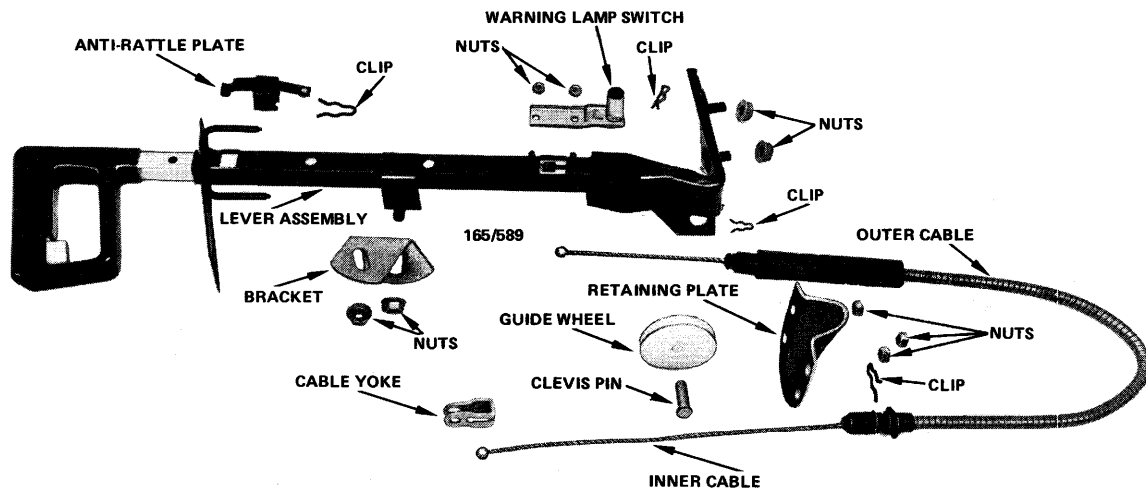
To Remove and Instal — Drum Brake Models

(1) Raise the rear of the vehicle and support on stands placed under the rear axle housing.

(2) Disconnect the rear handbrake cable at the equaliser.

(3) Remove the clip retainers and disengage the cable from the brackets on the underbody.

(4) Remove the rear wheels and the rear brake



Dismantled view of handbrake lever assembly, front cable and associated components.

drums as previously described.

(5) Disconnect the rear ends of the cables from the brake shoe levers.

(6) Disengage the cable retaining grommets from the backing plates and withdraw the cable from the backing plates.

(7) Withdraw the cable from the vehicle.

Installation is a reversal of the removal procedure with attention to the following points:

Ensure the cable is correctly positioned to the under-

body brackets and instal the retaining clips.

Instal the cable to each backing plate ensuring that the flat of the 'D' shaped hole in the cable yoke is uppermost.

Connect the cable ends to the handbrake cable levers on the brake shoes and instal the brake drums.

Position the equaliser on the cable, connect the equaliser to the pull rod by installing the adjusting nut.

Adjust the handbrake as previously described.

SPECIFICATIONS

BATTERY

Type 12 volt
 Polarity to earth Negative
 * Specific gravity:
 Fully charged Above 1260
 Fully discharged Below 1120
 * Electrolyte specific gravity varies 0.007 for every 10 deg C rise or fall in temperature above or below 20 deg C. For above temperatures add, for below temperatures subtract.

ALTERNATOR

Type 14V AC
 Make Bosch
 Model:
 Bosch U-K1 (R) 14V40A22
 Bosch U-K1 (R) 14V55A20
 Polarity to earth Negative
 Maximum output:
 Bosch - 40A 40 amps
 Bosch - 55A 55 amps
 Rotor coil resistance at 20 deg C:
 Bosch 40A and 55A 2.9 ohms + 10%
 Stator coil resistance at 20 deg C:
 Bosch 40A 0.22 ± 0.01 ohms
 Bosch 55A 0.14 ohms + 10%
 Brush length:
 New 8.89 mm
 Wear limit minimum 3.81 mm
 Pulley nut tension 68 Nm

ALTERNATOR REGULATOR

Model EE14V3
 Type Integral non adjustable
 Regulated voltage 13.6 - 14.5 volts

STARTER MOTOR

Make Bosch
 Type Pre-engaged
 Commutator type Barrel
 Number of brushes 4
 Brush length - minimum 12.7 mm
 Brush spring tension:
 3.3 litre 11.5 - 13.0 N
 4.1 litre 15 - 17 N
 Undercut of commutator - maximum 0.793 mm
 Armature end float 0.05 - 0.30 mm
 Solenoid pull in 6 volt maximum

DISTRIBUTOR

Make Bosch
 Rotation of rotor Clockwise
 Firing order 1-5-3-6-2-4
 Control Centrifugal and vacuum advance
 Contact point gap 0.3-0.4 mm

Dwell angle 33-37 deg
 Capacitor capacity 0.18-0.22 mfd

IGNITION COIL

Make Bosch
 Primary resistance at 24 deg C 1.25-1.35 ohms
 Secondary resistance at 24 deg C 8000-10,000 ohms

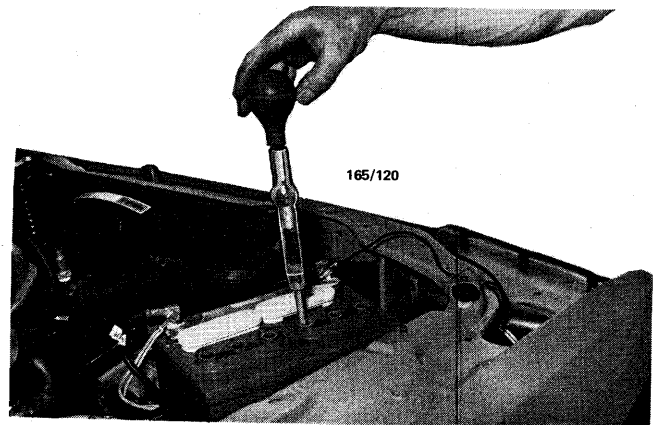
1. BATTERY AND CHARGING SYSTEM TROUBLE SHOOTING

BATTERY UNDERCHARGED

- (1) Loose or broken drive belt(s): Adjust or renew drive belt(s).
- (2) Faulty alternator regulator: Renew regulator unit.
- (3) Faulty battery: Instal a new battery of the recommended type and capacity.
- (4) Faulty alternator: Overhaul or renew alternator.
- (5) Fault in charging circuit wiring: Check and repair or renew wiring harness
- (6) Faulty connections in charging circuit: Check and renew or repair component(s).

NOTE: The first thing to do is to test the state of charge of the battery with a hydrometer. As specific gravity varies with temperature it is advisable to use a hydrometer with an inbuilt thermometer so that the necessary variation can be calculated. Also an accurate hydrometer reading cannot be taken if distilled water has recently been added to the electrolyte. If the electrolyte level is below the battery plates it will be necessary to add water and charge the battery before testing with the hydrometer.

The specific gravity should not vary more than 0.030 between cells. If the variation is more than this then the serviceability of the battery is questionable and the battery should



Check the specific gravity of the battery electrolyte in each cell with a hydrometer.

Refer to supplement
for more information.

ELECTRICAL SYSTEM

SPECIFICATIONS

IGNITION COIL
Dwell angle 33-37 deg
Capacitor capacity 0.18-0.22 mfd

Make Bosch
Primary resistance at 24 deg C 1.25-1.35 ohms
Secondary resistance at 24 deg C 8000-10,000 ohms

1. BATTERY AND CHARGING SYSTEM TROUBLE SHOOTING

BATTERY UNDERCHARGED

- (1) Loose or broken drive belt(s): Adjust or renew drive belt(s).
- (2) Faulty alternator regulator: Renew regulator unit.
- (3) Faulty battery: Install a new battery of the recommended type and capacity.
- (4) Faulty alternator: Overhaul or renew alternator.
- (5) Fault in charging circuit wiring: Check and repair or renew wiring harness
- (6) Faulty connections in charging circuit: Check and renew or repair component(s).

NOTE: The first thing to do is to test the state of charge of the battery with a hydrometer. As specific gravity varies with temperature it is advisable to use a hydrometer with an inbuilt thermometer so that the necessary variation can be calculated. Also an accurate hydrometer reading cannot be taken if distilled water has recently been added to the electrolyte. If the electrolyte level is below the battery plates it will be necessary to add water and charge the battery before testing with the hydrometer.

The specific gravity should not vary more than 0.030 between cells. If the variation is more than this then the serviceability of the battery is questionable and the battery should



Check the specific gravity of the battery electrolyte in each cell with a hydrometer.

BATTERY

Type 12 volt
Polarity to earth Negative
* Specific gravity:
Fully charged Above 1260
Fully discharged Below 1120
* Electrolyte specific gravity varies 0.007 for every 10 deg C rise or fall in temperature above or below 20 deg C. For above temperatures add, for below temperatures subtract.

ALTERNATOR

Type 14V AC
Make Bosch
Model:
Bosch U-K1 (R) 14V40A22
Bosch U-K1 (R) 14V55A20
Polarity to earth Negative
Maximum output:
Bosch - 40A 40 amps
Bosch - 55A 55 amps
Rotor coil resistance at 20 deg C:
Bosch 40A and 55A 2.9 ohms + 10%
Stator coil resistance at 20 deg C:
Bosch 40A 0.22 ± 0.01 ohms
Bosch 55A 0.14 ohms + 10%
Brush length:
New 8.89 mm
Wear limit minimum 3.81 mm
Pulley nut tension 68 Nm

ALTERNATOR REGULATOR

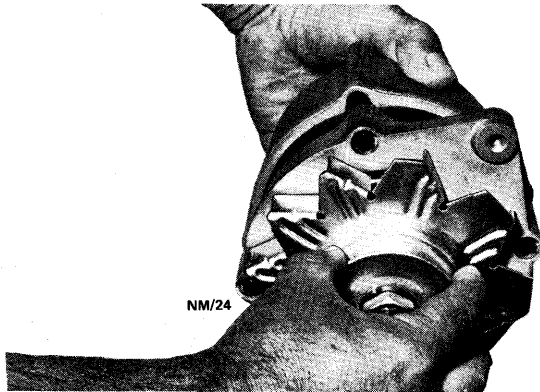
Model EE14V3
Type Integral non adjustable
Regulated voltage 13.6 - 14.5 volts

STARTER MOTOR

Make Bosch
Type Pre-engaged
Commutator type Barrel
Number of brushes 4
Brush length - minimum 12.7 mm
Brush spring tension:
3.3 litre 11.5-13.0 N
4.1 litre 15-17 N
Undercut of commutator - maximum 0.793 mm
Armature end float 0.05-0.30 mm
Solenoid pull in 6 volt maximum

DISTRIBUTOR

Make Bosch
Rotation of rotor Clockwise
Firing order 1-5-3-6-2-4
Control Centrifugal and vacuum advance
Contact point gap 0.3-0.4 mm



Spin the alternator pulley over by hand to check bearings for noise.

nator or drive belt loosen off the alternator and remove the drive belt. If the noise is gone when the engine is run for a short time check the serviceability of the belt and alternator components.

2. BATTERY AND STARTING SYSTEM TROUBLE SHOOTING

STARTER LACKS POWER TO CRANK ENGINE

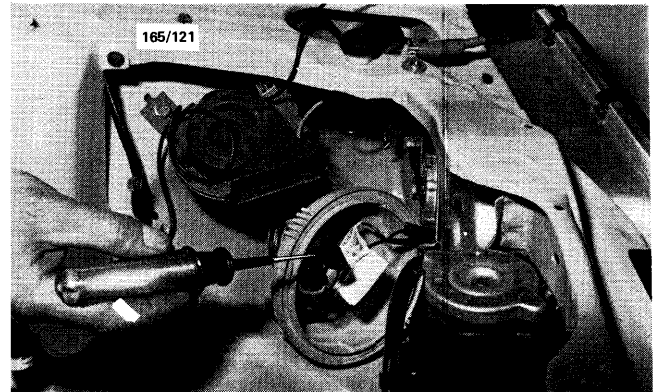
- (1) Battery undercharged: Check charging system and rectify as necessary.
- (2) Battery faulty, will not hold charge: Check and renew battery.
- (3) Battery leads or terminals loose or corroded: Clean and tighten leads or terminals.
- (4) Faulty starter motor: Check and overhaul starter motor.
- (5) Faulty starter solenoid switch or contacts: Check and renew solenoid as necessary.

NOTE: Check the state of charge of the battery and check all terminals for cleanliness and security. If necessary test and overhaul the starter motor as described in this section.

STARTER WILL NOT ATTEMPT TO CRANK ENGINE

- (1) Open circuit in starting system: Check for dirty or loose leads or terminals, dirty commutator, faulty solenoid or faulty switch.
- (2) Discharged battery: Check for fault or short circuit in system.
- (3) Battery fully charged but will not crank engine: Check for locked drive and ring gear, internal starter fault or seized engine.

NOTE: Turn engine over by hand to ensure that the starter drive is not locked with the fly-wheel ring gear and that the engine is not seized. Ensure that the ignition key is turned off before turning.



Using a test lamp check that the headlamp circuits are operating.

3. HEADLAMP SYSTEM TROUBLE SHOOTING

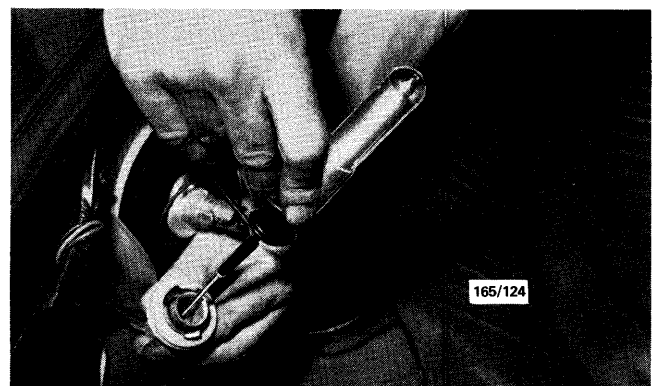
LAMPS FAIL TO LIGHT

- (1) Burnt out headlamp bulb(s): Check and renew bulb(s).
- (2) Open circuit in wiring or connections: Check and rectify.
- (3) Faulty light switch: Check and renew switch.
- (4) Burnt out fuse, if fitted: Eliminate cause and renew fuse.
- (5) Faulty circuit breaker: Renew circuit breaker.

NOTE: Switch on the headlamps and using a test lamp check that the headlamp circuits are operating. This is best done by starting at the headlamp wiring connector and working back to the power source.

LAMPS FLARE WITH ENGINE SPEED INCREASE

- (1) Faulty battery: Check and renew or repair battery.
- (2) Battery in low state of charge: Recharge battery and check charging system.
- (3) High resistance or faulty connections between



Check the tail lamp circuit starting at the bulb holder contact.

alternator and battery: Check circuit and rectify condition.

(4) Poor earth connection between battery and engine or alternator: Check battery earth lead and strap between engine and body.

(5) Voltage regulator faulty: Check voltage regulator.

NOTE: The most common cause for this condition is dirty terminals on the earth leads. Check all earth leads at their earthing points.

4. DIRECTION INDICATOR LIGHT SYSTEM TROUBLE SHOOTING

INDICATOR WARNING LAMP DOES NOT BURN AND NO AUDIBLE CLICKING FROM FLASHER UNIT WHEN TURN IS SELECTED ON SWITCH LEVER

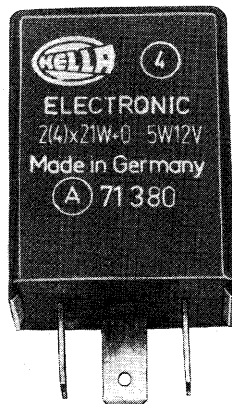
- (1) Fuse blown: Rectify fault and renew fuse.
- (2) Bulb blown on one or both sides. Check system and renew bulb(s).
- (3) Faulty flasher unit: Renew flasher unit. Do not attempt to repair.
- (4) Faulty direction indicator switch: Renew or repair switch.
- (5) Fault in wiring circuit: Check and repair fault.

NOTE: If the bulbs and fuse are functional check the flasher unit for serviceability by replacing with a known serviceable unit.

INDICATOR WARNING LAMP DOES NOT FLASH BUT AUDIBLE CLICKING FROM FLASHER UNIT, WHEN TURN IS SELECTED ON SWITCH LEVER

- (1) Warning lamp bulb blown: Check and renew bulb.
- (2) Front bulb blown on opposite side to turn selected: Check and renew bulb.

NOTE: When renewing bulbs ensure that a new bulb of the correct wattage is used.



165/675

If the bulb and fuse are functional check the flasher unit by replacing with a known serviceable unit.

WARNING LAMP FLASHES AT GREATER THAN NORMAL SPEED WHEN TURN IS SELECTED ON SWITCH LEVER

- (1) Front bulb blown on turn side: Check and renew bulb.
- (2) Rear bulb blown on turn side: Check and renew bulb.
- (3) Faulty flasher unit: Check and renew flasher unit.

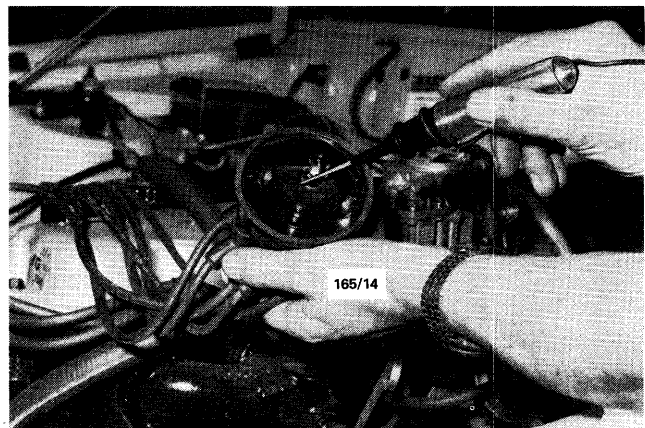
NOTE: If one lamp unit is constantly blowing bulbs check for high resistance in circuit.

5. IGNITION SYSTEM TROUBLE SHOOTING

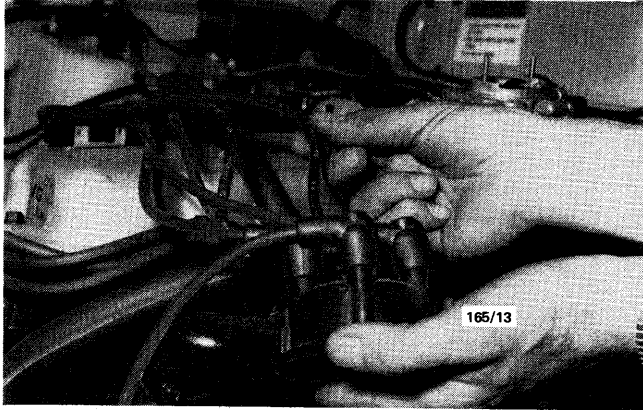
ENGINE WILL NOT START

- (1) Fault in ignition primary circuit wiring: Check ignition primary circuit and repair as necessary.
- (2) Faulty ignition switch: Renew ignition switch.
- (3) Fault in coil primary winding: Renew ignition coil.
- (4) Burnt or dirty contact breaker points: Clean or renew and adjust contact breaker points.
- (5) Faulty capacitor or capacitor lead: Check and renew capacitor.
- (6) Fused or broken low tension wire from breaker points to low tension terminal: Renew breaker points.
- (7) Fault in coil high tension circuit: Test and renew ignition coil as necessary.
- (8) Cracks in distributor cap: Renew distributor cap.
- (9) Crack in distributor rotor: Renew distributor rotor.
- (10) Faulty high tension leads: Check and renew high tension leads.
- (11) Faulty or incorrectly adjusted spark plugs: Renew or clean and adjust spark plugs.

NOTE: Refer to the Roadside Trouble Shooting section and make the necessary tests to ensure that the trouble is in the ignition



Check the inside of the distributor cap for tracking between terminals.

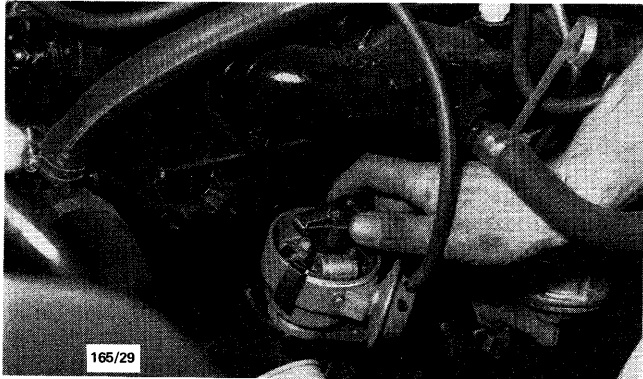


Check the high tension leads for perishing or cracking.

system. To determine if low tension current is reaching the coil remove the lead from the ignition side of the coil and check with a test lamp. It will be necessary to turn the ignition switch to the 'ON' position for this test. If current is reaching the ignition side of the coil disconnect the low tension wire from the distributor. If low tension current is reaching the distributor check out the distributor and high tension circuit. If the distributor is serviceable and still no spark is evident renew the ignition coil.

ENGINE STARTS BUT MISFIRES UNDER LOAD

- (1) Faulty, dirty or incorrectly adjusted spark plugs: Renew or clean and adjust spark plugs.
- (2) Dirty or incorrectly adjusted contact points: Clean, adjust or renew contact breaker points.
- (3) Uneven wear on distributor cam: Check and overhaul distributor.
- (4) Condensation moisture in distributor cap: Check and dry out and examine cap for cracks.
- (5) Cracked spark plug insulator(s): Renew faulty spark plug(s).
- (6) Faulty ignition coil: Check and renew ignition coil.



To check if the centrifugal advance mechanism is operating twist the rotor in the direction of normal rotation. It should spring back to its original position.

NOTE: Check out possible causes in the order given.

ENGINE RUNS BUT LACKS POWER

- (1) Ignition timing incorrectly set or contact points require adjusting: Check and readjust timing and/or contact points.
- (2) Centrifugal advance mechanism seized or excessively worn: Overhaul distributor.
- (3) Vacuum advance unit inoperative: Check for broken vacuum pipe or faulty unit.
- (4) Vacuum advance unit operates but ineffective: Advance unit link disconnected or broken.

NOTE: To check if the centrifugal advance mechanism is operating correctly remove the distributor cap and twist the rotor in the direction of normal rotation. It should spring back to its original static position.

6. TEST EQUIPMENT AND SOME APPLICATIONS

TO MAKE A TEST LAMP

When working on the electrical system, a test lamp will be found to be most helpful for checking the continuity of live circuits. A simple test lamp can be made from two suitable lengths of 4 millimetre wire, two small alligator type clips, a double contact bulb holder and a 12 volt single filament double contact bulb.

- (1) Bare both ends of the two lengths of 4 millimetre wire.
- (2) Solder an alligator clip to one end of each wire lead.
- (3) Connect the other end of each lead to the double contact bulb holder terminals and ensure that they are insulated from each other and from the bulb holder base.
- (4) Instal the bulb in the bulb holder.
- (5) To test the unit connect it across a 12 volt battery, the bulb should light up if the wiring is correct and the bulb serviceable.

TO MAKE A JUMPER LEAD

When testing components of the electrical system a jumper lead is very handy.

- (1) Bare both ends of a suitable length of 4 millimetre wire.
- (2) Connect a small alligator clip to each end of the wire. Solder and tape the connections.
- (3) Test the jumper lead for continuity by removing one battery cable and connecting the lead between the cable and the battery terminal. Turn the ignition key to ON and the dash warning lamps should operate indicating a completed circuit through the jumper lead.
- (4) Remove the jumper lead from the circuit and reconnect the battery.

NOTE: Make a few test leads of various

lengths using different sizes and types of alligator and battery clips.

TO TEST SWITCHES

If a switch is suspected of being faulty, remove the wires from the switch and using a test lamp (see To Make a Test Lamp) test each lead to find the power wire. It may be necessary to turn the ignition key ON as the switch may be wired through the ignition circuit.

After noting the color/position of the wire, disconnect the test lamp and using a suitable jumper lead, connect the jumper lead from the power wire of the switch to the other switch wire. If the circuit functions, the switch is faulty and should be renewed. See Switches and Controls.

TO TEST BULBS

If a bulb is suspected of being faulty, remove the bulb from the bulb holder and using a small jumper lead connect one end of the jumper lead to the power terminal of a serviceable battery and the other end of the jumper lead to a lug on the side of the bulb.

Connect one end of a second jumper lead from the earth terminal of the battery and touch the other end of the jumper lead to the bulb contact. The bulb should light.

If the bulb has two filaments, touch the other bulb contact with the end of the jumper lead. The bulb should light. If the bulb fails to light the bulb should be replaced with a bulb of the correct voltage and wattage.

TO TEST CIRCUITS

If a circuit is suspect of being faulty, turn the switch ON in the ordinary manner so as to supply power to the circuit.

Where connections are in the circuit disconnect the connection and connect one lead of the test lamp to the power or switch side of the disconnected circuit and the other lead of the test lamp to a clean earth (e.g. bolt or screw). If the lamp does not light, check the circuit towards the power or switch end of the circuit.

If the lamp lights, continue checking towards the motor or bulb in the circuit.

NOTE: A fuse or its associated connections is always a good starting point, but reconnect each connector or fuse after testing that particular connector or fuse.

7. BATTERY

Special Equipment Required:

To Test — Hydrometer

MAINTENANCE

Maintenance consists mainly of regular inspection and servicing.

(1) Keep the battery and its surroundings clean and dry. Give the top of the battery particular attention to

prevent electrical leakage between the cell terminals.

(2) Remove the vent plugs and see that the vent holes are clear.

(3) Check the electrolyte level and top up as necessary. The correct level is just over the top of the separators. Do not overfill or acid will escape through the vent holes with detrimental effect to the connections and to adjacent parts of the vehicle.

(4) Use only distilled water for topping up.

NOTE: Never use a naked light when examining the battery, as the gases given off by the battery can be dangerously explosive.

(5) If the battery required an excessive amount of topping up, the cause should be sought. If overcharging is suspected, then have the regulator checked by an automotive electrical specialist.

(6) If one cell in particular is at fault, check the case for cracks. Never transfer electrolyte from one cell to another.

(6) Keep the positive and negative terminals clean and apply a small amount of petroleum jelly to the terminals to prevent corrosion.

TO REMOVE AND INSTAL

(1) Loosen the retaining nut and remove the negative terminal and bolt from the battery post.

(2) In the same manner remove the positive terminal.

(3) Undo the retaining bolt, remove the battery holding clamp and lift the battery from the vehicle.

Reverse the above operations to instal the battery. Do not overtighten the clamp bolt and terminal nuts and make sure of the correct polarity.

After installation coat the terminals with petroleum jelly to prevent corrosion.

TO CLEAN BATTERY CASE

(1) Remove the battery from the vehicle as previously described.

(2) Pour hot water over the battery being careful not to pour water through the vent holes of the filler caps.

(3) Wipe the battery case clean.

(4) If there is a crack in the case or around the base of the terminal(s) the faulty components should be repaired. Take the battery to an automotive electrical shop or battery agent for the necessary servicing.

TO CLEAN BATTERY CARRIER

If the battery electrolyte has overflowed and contaminated the surrounding body panels it will be necessary to remove this contamination and repaint the surfaces where necessary. The contamination can be neutralised by using an alkaline solution consisting of two table-spoons of washing soda to a quart of boiling water. Cloudy Ammonia can also be used in concentrated form. Both these items are readily available at grocery stores.

After neutralising the contaminated body panels allow them to dry. Clean off the old paint and repaint the

surfaces with an anti-rust based paint.

TO TEST

Use a hydrometer to check the specific gravity of the battery electrolyte. Refer to Specifications for a fully charged and fully discharged battery.

If the battery is in a low state of charge or completely flat take it to an automotive electrical shop to have it charged and load tested.

8. ALTERNATOR

Special Equipment Required:

To Test on Vehicle — Voltmeter, 0-60-0 ammeter

To Dismantle — Soldering iron, press, bearing puller

To Assemble — Soldering iron, press

DESCRIPTION

In the alternator the 'field and pole shoe assembly' is the moving part and it is shaped to form the rotor. Since only a low amperage current flows between the slip rings on the rotor shaft and the brushes, wear on brushes and slip rings is very slight and maintenance is reduced to a minimum.

The output current is generated in the fixed stator windings and is a three phase alternating current (AC). The stator windings are wound on a laminated soft iron former, are star connected and fitted between the end brackets.

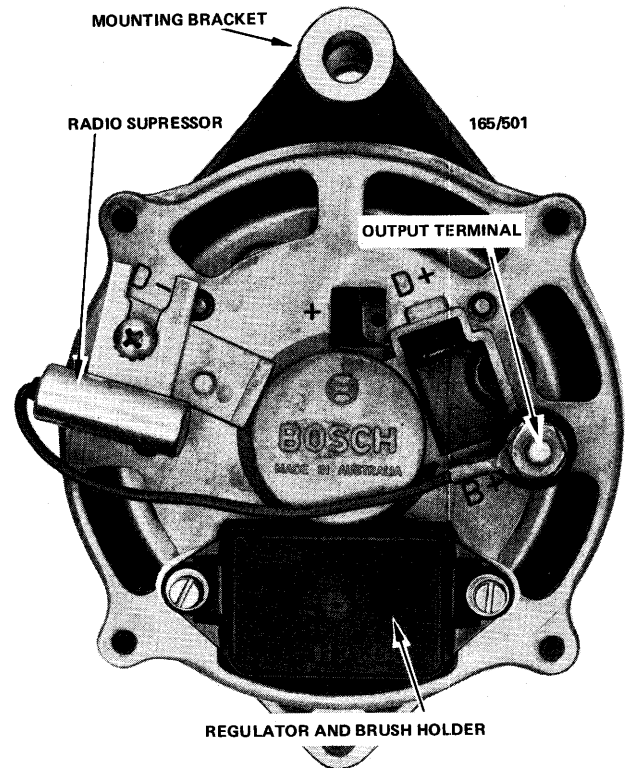
As it is not possible to recharge a storage battery with alternating current, it is necessary to rectify the output of the stator windings to direct current (DC). This is done by a bank of diodes mounted within the alternator slip ring end bracket.

The output of the alternator is governed by the regulator and built in characteristics of the alternator. The regulator and brush holder assembly is fitted to the outside of the slip ring end bracket.

An electrical cut out unit is not necessary with the alternator charging system as the diodes prevent a reverse current flow through the alternator.

SERVICE PRECAUTIONS

- (1) Make sure the battery is connected with the correct polarity to earth. Refer Specifications.
- (2) Do not short out or ground any terminals common to the charging circuit.
- (3) Always disconnect the battery before connecting a battery charger.
- (4) If a booster battery is used always connect it in a parallel circuit i.e. positive to positive (+ to +) and negative to negative (- to -) to maintain a 12 volt supply pressure.
- (5) Never disconnect the battery or terminals in the charging circuit while the engine is running.
- (6) Regularly check the drive belt tension.
- (7) Keep the battery terminals clean and all elec-



End view of alternator.

trical connections tight.

(8) Disconnect the battery and alternator when electric welding on the vehicle.

TO TEST ON VEHICLE

If the ignition warning lamp stays on after the engine has been started and run at approximately 1000 rpm, carry out the following tests and precautions.

- (1) Stop the engine, do not open circuit and parts of the charging circuit while the engine is running.
- (2) Check the condition and adjustment of the alternator drive belt.
- (3) Clean the battery terminals, tighten all electrical connections, check the wiring for shorts to earth and/or bridged circuits, make sure the battery is fully charged. If the battery is low either charge it or replace it with one fully charged.
- (4) Start the engine and allow it to run until normal operating temperature is reached.
- (5) Stop the engine then disconnect the negative battery terminal.
- (6) Remove the nut and washer from the alternator output terminal (B+) and disconnect the alternator output lead.
- (7) Connect one lead of a 0-60-0 ammeter to the alternator output terminal and the other lead to the lead removed from the output terminal.
- (8) Reconnect the negative battery terminal and connect a 0-20 voltmeter across the battery terminals.
- (9) Switch on all lamps and allow them to burn for approximately five minutes to reduce the charge of the

battery and to apply a load to the circuit.

(10) Start the engine and gradually increase the speed to approximately 2500 rpm. The reading on the ammeter should be approximately 75% of the rated output of the alternator. See Specifications.

(11) Switch off all the lamps and run the engine at 1500-2000 rpm until the indicated charge is below 10 amps. The voltmeter should now read in excess of 13.6 volts.

NOTE: Should the alternator fail to reach the specified output the unit will have to be removed and overhauled or a replacement unit fitted.

Should the voltage reading be above or below Specifications, the regulator will have to be renewed.

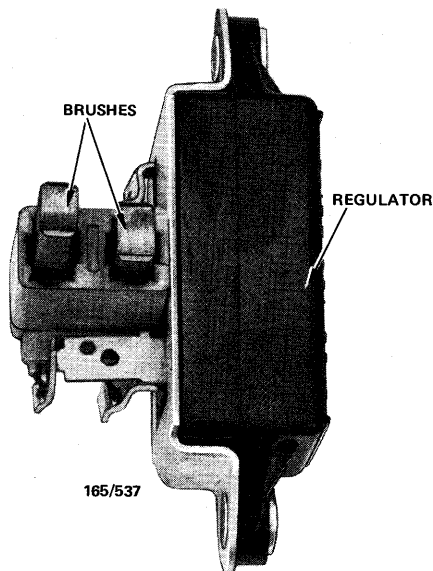
TO REMOVE AND INSTAL

- (1) Disconnect the battery negative terminal.
- (2) Disconnect the terminal block at the alternator by pulling on the terminal block, not the wires, and remove the terminal nut and lock washer to remove the wiring from the B + terminal.
- (3) Disconnect the drive belt adjusting bracket from the alternator.
- (4) Remove the mounting bolt nut, push the alternator towards the engine and remove the drive belt from the pulley.
- (5) Withdraw the mounting bolt whilst supporting the alternator with the other hand. Remove the alternator from the vehicle.

Installation is a reversal of the removal procedure with attention to the following points:

Do not over tension the drive belt. See the Tune-Up section for correct belt adjusting procedure.

Apply pressure to the mounting end bracket only



View of regulator and brush holder removed from alternator.

when adjusting the drive belt.

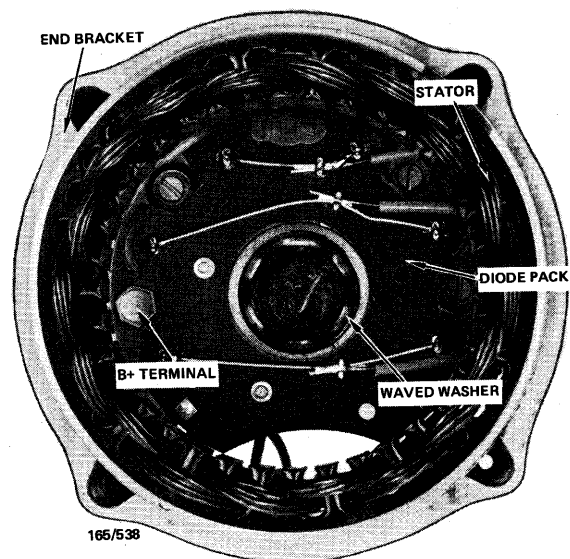
Check the wiring where soldered to the terminals.

TO DISMANTLE

- (1) Remove the alternator from the vehicle as previously described.
- (2) Scribe a mark across the drive end bracket, stator and slip ring end bracket to facilitate correct alignment during assembly.
- (3) Remove the two screws and washers securing the regulator and brush holder assembly. Withdraw the regulator and brush holder assembly far enough to unsolder the lead at the assembly or where applicable to unclip the lead from the regulator.
- (4) Remove the four long screws securing the drive end bracket to the slip ring end bracket and withdraw the drive end bracket, rotor and pulley assembly.

NOTE: Ensure that the waved washer behind the rear bearing in the slip ring end bracket is not lost.

- (5) Holding the rotor in a vice with suitable protection between the vice jaws and the rotor, unscrew and remove the drive pulley retaining nut and spring washer.
- (6) Withdraw the drive pulley, fan and spacer from the rotor shaft.
- (7) Using a soft faced hammer, drive the rotor and shaft assembly out of the drive end bracket and where necessary, withdraw the smaller spacer from the shaft.
- (8) If the drive end bracket bearing is to be renewed, take out the two securing screws, remove the bearing retaining plate and withdraw the bearing from the drive end bracket.
- (9) Remove the nut, spring washer, flat washer and insulating washer from the B + terminal on the outside of the slip ring end bracket.
- (10) Working inside the slip ring end bracket, remove the screws securing the diode pack to the bracket



Internal view of alternator slip ring end bracket.

and withdraw the stator and diode pack as an assembly. Take the insulating spacer and washer from the B + terminal.

NOTE: The diode pack is supplied as an integral unit and in the event of a component failure, the diode pack must be renewed as a complete unit.

(11) Tag and mark all wiring connections prior to removal to avoid incorrect connections during reassembly.

(12) Using a very hot soldering iron and a pair of long nosed pliers, unsolder the stator leads from the connector terminals to separate the diode pack.

NOTE: Do not apply undue heat to the connections as damage may result to the terminal insulator and/or diodes.

(13) Using a suitable puller, remove the bearing from the slip ring end of the rotor shaft.

TO CLEAN PARTS

(1) Do not immerse units of the alternator in cleaning solvents as damage to the windings will result.

(2) The end brackets may be washed in kerosene or similar cleaning fluid after they have been completely dismantled. They should be thoroughly dried after cleaning.

(3) Compressed air can be used to carefully blow out the dust from the stator winding and the field winding on the rotor.

(4) Slip rings that are burned or scored should be polished using very fine glass paper.

(5) Clean the brushes and brush holders using a

petrol damp rag and check and remove any burns from the holders.

(6) Check the sealed ball type bearings for wear, roughness and lack of lubrication and renew as necessary.

TO CHECK AND TEST COMPONENT PARTS

All parts being electrically tested should be resting on a non-conductive pad.

Field Windings and Rotor Assembly

(1) The insulation to earth test is done with an ohmmeter. Connect one of the test prods to one of the field wires or slip rings and the other test prod to one pole piece of the rotor.

(2) If the ohmmeter shows a reading and no visual earthing can be seen and rectified, a new rotor assembly will have to be fitted.

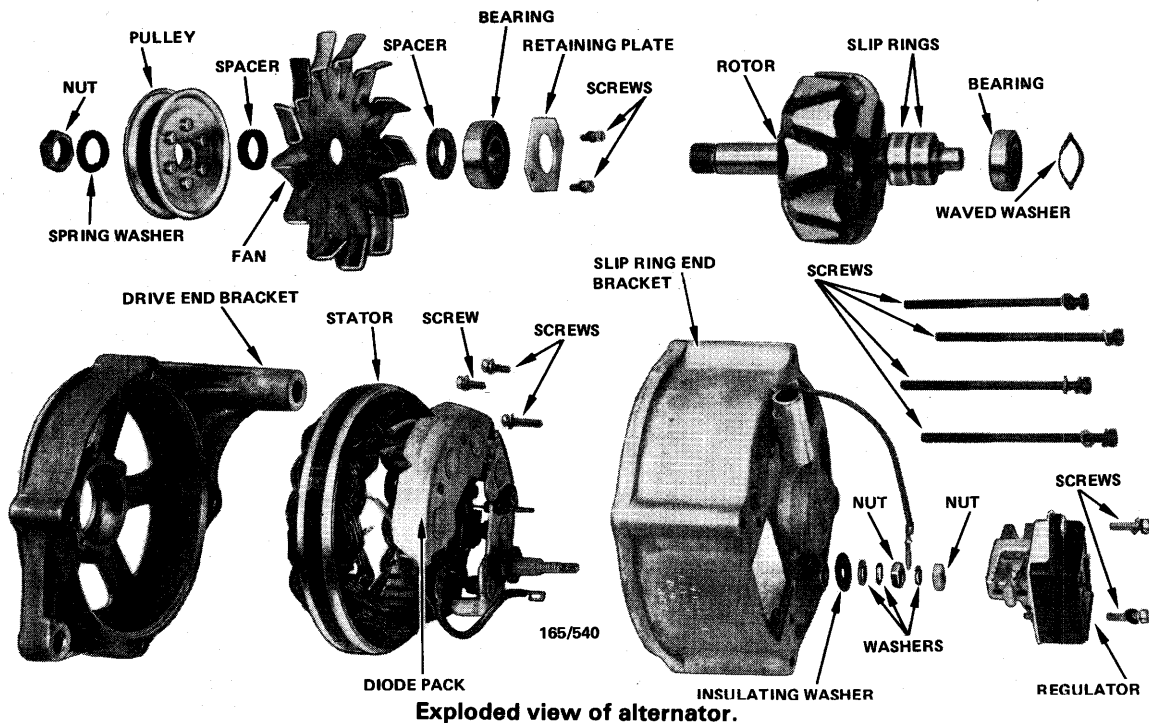
(3) To check for bridged or internal shorting of the field coils, use an ohmmeter and check the resistance of the rotor windings. Compare the readings with Specifications. A low reading indicates a bridged circuit internally, a high reading indicates an open circuit or high resistance in windings. In both cases a new rotor assembly will have to be fitted.

Stator Windings

The stator test is carried out using an ohmmeter and a test lamp.

(1) The stator leads must be detached from the diode pack.

(2) Connect one test probe of the ohmmeter to one



stator lead and the other test probe to another stator lead. Note the ohmmeter reading.

(3) Repeat the operation to the remaining leads alternatively to check each phase.

(4) If there is any variation in resistance between phases it will be necessary to renew the stator assembly.

(5) Connect a jumper lead from the negative terminal of a charged 12 volt battery to the stator winding frame. Connect one end of a test lamp to the battery positive terminal, the other end of the test lamp to the stator lead, one at a time.

(6) Should the test lamp light or burn dimly, a short circuit is indicated and the stator assembly must be renewed.

Diodes

The diodes may be tested after their disconnection using a 12 volt battery and a 1.5 watt bulb in series with a jumper lead.

(1) Connect a jumper lead from the negative terminal of a charged battery to the carrier/bracket holding the diode to be tested.

(2) Connect one end of a test lamp to the battery positive terminal and the other end of the lamp to the diode lead. Note whether the lamp is illuminated and then reverse the connections on the battery.

(3) If the lamp was illuminated in both directions or was not illuminated at all, the diode is faulty and the heat sink/diode pack must be renewed.

Brush Springs and Brushes

(1) Where necessary, unsolder the brush leads. Check the brush springs for overheating and distortion, check for binding in the brush holders.

(2) Check the brushes and replace as necessary. Refer to Specifications for the correct dimension.

TO ASSEMBLE

The assembling procedure is a reversal of the dismantling operation with attention to the following points:

(1) Fit a new bearing onto the slip ring end of the rotor shaft.

(2) Using a hot soldering iron and a long nosed pair of pliers as a heat sink, solder the stator leads to their respective terminals on the diode pack.

(3) Fit an insulating washer and spacer to the B + terminal post and place the diode pack and stator assembly onto the slip ring end bracket. Secure the diode pack to the slip ring end bracket with the long screw through the insulated hole and the shorter screws through the other holes.

(4) Working on the exterior of the slip ring end bracket, instal an insulating washer, flat washer and spring washer on the B + terminal and secure it with the retaining nut.

(5) Fit a new bearing to the drive end bracket and secure the bearing with the retaining plate and screws.

(6) Hold the rotor in a vice with suitable protection

and place the smaller of the shouldered spacers with the shoulder to the bearing side onto the rotor shaft.

(7) Push the drive end bracket and bearing onto the shaft. place the larger shouldered spacer onto the shaft with the shoulder towards the bearing.

(8) Instal the fan, pulley and lock washer and secure the assembly with the retaining nut.

(9) Position the wave washer in the bearing recess of the slip ring end bracket and insert the rotor in the stator and end bracket assembly.

(10) Align the marks made at dismantling and instal and tighten the through screws.

(11) Solder or reconnect the lead to the brush holder and regulator assembly. Fit the regulator and brush holder assembly to the slip ring end bracket and tighten the retaining screws.

(12) Fit the alternator to the vehicle and test its operation as previously described.

9. STARTER MOTOR

Special Equipment Required:

To Check and Inspect — 110 volt test prod equipment

To Renew Brushes — Soldering iron

DESCRIPTION

The starter motor is the induced pole type with four brushes and four pole shoes with field coils.

A solenoid switch is attached to the starter drive end bracket. The solenoid plunger is connected to the over-running clutch and drive pinion assembly through a link, lever and pivot bolt arrangement.

When the solenoid windings are energised, the plunger acting on the lever and pivot engages the drive pinion with the flywheel ring gear and at the same time closes the switch supplying power from the positive lead of the battery to the starter motor field coils and armature to operate the motor.

As the engine fires, the over-running clutch of the drive pinion assembly prevents high speed rotation of, and possible damage to, the starter armature if the solenoid windings are not immediately de-energised by releasing the switch key.

The starter solenoid switch windings are energised by the key operated combination ignition and starter switch.

TO TEST ON VEHICLE

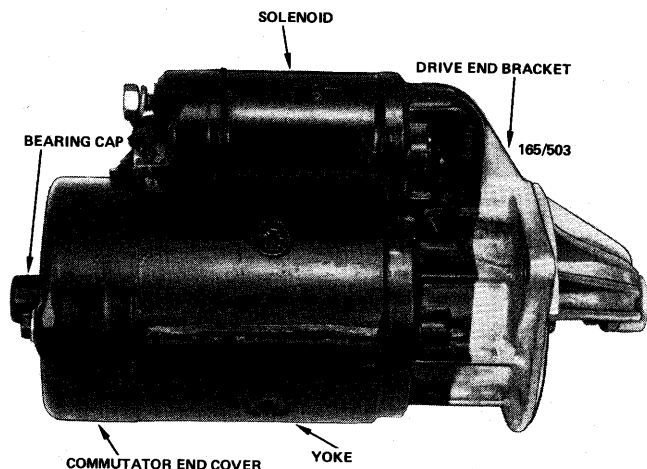
Should the starter fail to operate when the switch is moved to the start position check the following points:

(1) Check the battery condition and state of charge, refer to Battery section of this manual.

(2) Clean the battery terminals, taking particular care to remove the scale from the positive (+) terminal post and terminal.

(3) Check the earth connections for tightness and cleanliness.

(4) Switch on the headlamps and operate the starter control switch. If the lamps go dim but the starter



Assembled view of starter motor.

is not heard to operate, it could indicate that a short circuit or high resistance has developed in the starting system which could be either external or internal.

Also check that the engine is not 'seized' or 'locked up' as this condition would give the same indication as above.

(5) If the lamps do not dim and the starter does not operate this would indicate an open circuit such as a broken or disconnected wire or a switch not operating. If the vehicle is fitted with automatic transmission operate the starter control switch and move the selector lever through all the gear selection range, if the starter operates in any position other than N or P, the neutral safety switch is either faulty or maladjusted.

(6) Check all the external wiring to make sure the fault is not external, if the external circuit proves satisfactory, indicating that the problem is in the starter assembly, the unit will have to be removed and bench checked.

TO REMOVE AND INSTAL

(1) Disconnect the negative lead from the battery terminal.

(2) Disconnect the battery lead from the starter solenoid.

(3) Disconnect the switch wires from the solenoid.

(4) Remove the bolts securing the starter motor and remove the starter motor from the vehicle.

Installation is a reversal of the removal procedure.

TO DISMANTLE

(1) With the starter motor removed from the vehicle, disconnect the field connector strap from the lower terminal on the solenoid switch.

(2) Remove the engaging lever pivot bolt and allow the lever to drop slightly.

(3) Remove the solenoid attaching screws and withdraw the solenoid from the drive end bracket.

(4) Take out the two bearing cap retaining screws and remove the cap and gasket from the commutator end cover.

(5) Remove the 'C' clip and thrust washers from the end of the armature shaft, noting the numbers of washers installed.

(6) Remove the two through bolts and separate the commutator end cover from the yoke.

(7) Withdraw the yoke and field coil assembly together with the brush holder and brushes from the armature and drive end bracket.

(8) Slide the drive end bracket from the armature shaft until the shaft clears the bearing bush in the bracket, tilt the bracket to clear the engaging lever from the drive assembly and place the armature and drive assembly aside.

(9) Remove the dust seal and plate from the drive end bracket and withdraw the engaging lever.

(10) Support the armature in a vertical position with the drive assembly uppermost.

(11) Using a suitable drift, tap the stop collar towards the drive pinion and clutch assembly and remove the circlip from the armature shaft.

(12) Remove any burrs from the shaft and withdraw the stop collar and the pinion and clutch assembly from the armature shaft.

(13) Clean all parts thoroughly but do not immerse the yoke, armature, solenoid or drive clutch in cleaning solvent.

(14) Visually check all parts for wear and burned insulation.

TO CHECK AND INSPECT

(1) With the starter motor dismantled check the brush holder insulation, using a 110 volt test prod equipment in series with one lead.

Connect one test prod lead on the brush holder positive side and the other lead on the negative side. If there is any indication of leakage the globe will light or an arcing will occur at the point of shorting, either repair or renew the brush holder if a short circuit is evident.

(2) Check the brushes for adequate length. Brushes should be renewed when their length is below Specifications. They should be a free sliding fit in the brush guides.

(3) Check the brush springs, and compare with new springs.

(4) Check that the commutator is free from pitting and burning, clean with a petrol moistened cloth, and polish with a strip of fine glass paper.

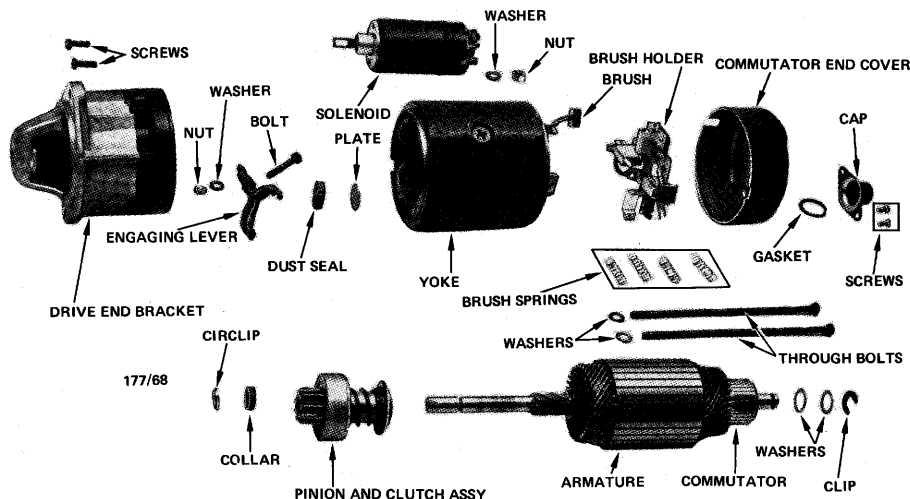
A badly worn commutator may be cleaned up by mounting in a lathe, spinning at high speed, and a light cut taken with a very sharp tool. After turning undercut the insulation between segments.

(5) Check the armature for short circuit, using a growler or by using the 110 volt prods and globe.

(6) Place one of the test prods on the armature core or shaft and move the other prod around the circumference of the commutator. If the test lamp lights at any point, the armature is faulty and should be renewed.

(7) Test the field coils for continuity by connecting the test prods in series with the field windings.

Failure of the lamp to light indicates an open circuit



Dismantled view of starter motor components. Typical.

in the wiring of the field coils.

(8) Check the field coil for ground by placing one test prod on the field coil lead and the other lead on the starter yoke. If the globe lights or an arcing occurs between the field coils and earth, remove the field coils and repair or renew.

(9) Check the drive assembly clutch pinion teeth for wear, scoring or chipping. A clutch is good condition should take up the drive in one direction only. It should rotate easily and smoothly in the non-drive direction and the assembly should move smoothly along the armature helical splines.

NOTE: Do not wash the drive assembly or clutch in solvent as this will destroy the clutch lubricant and cause early failure of the unit.

(10) Check the armature shaft bushes for wear and replace as necessary. The old bushes must be removed and the new ones pressed into the end brackets using a polished mandrel of the exact diameter of the armature shaft.

NOTE: The new bushes must not be reamed to size, as reaming will impair the porosity of the bushes and cause early failure. New bushes should be allowed to stand immersed in clean light engine oil for one hour before fitting.

TO ASSEMBLE

Assembly is a reversal of the dismantling procedure with attention to the following points:

(1) Lubricate the helix on the armature shaft lightly with graphite grease and fit the drive pinion and clutch assembly to the armature shaft.

(2) Fit the stop collar and circlip, slide the stop collar over the circlip to lock the clip in position.

(3) Lubricate the bearings in both ends brackets sparingly with engine oil.

(4) Position the armature together with the engaging lever into the drive end bracket and fit the round plate

and dust seal to the drive end bracket.

(5) Instal the engaging lever pivot bolt loosely, ensuring that the pivot bolt fits through the lever.

(6) Engage the solenoid plunger and the lever and instal the solenoid with the battery (longer) terminal at the rear uppermost. Secure the solenoid with the retaining screws.

(7) Fit the yoke over the armature and the brush holder and brushes over the commutator.

To instal the brush holder with the brushes fitted it is necessary to push the brushes against the brush spring tension into the holder and then slide the assembly onto the commutator.

NOTE: When new brushes are installed, place the brush holder over the commutator, insert the brushes and brush springs and then bend over the brush spring retaining lugs.

(8) Fit the commutator end cover and the two through bolts. Ensure that the field connector strap and insulator are seated correctly in the yoke.

(9) Instal the thrust washers to the end of the armature shaft and secure them with the 'C' clip. Check the armature end-float and, if necessary, adjust the armature end-float by adding or subtracting thrust washers. Refer to Specifications.

(10) Place the bearing cap and gasket over the armature shaft and instal the retaining screws. Instal both screws loosely before tightening.

(11) Connect the field connector strap to the lower terminal on the solenoid switch, tighten the switch and the connector nut, tighten the engaging lever pivot bolt.

10. DISTRIBUTOR

DESCRIPTION

The distributor uses two methods of control — centrifugal and vacuum.

Maintenance is at a minimum requiring only periodic cleaning of the contact points. The contact

points are serviced as a unit and require only fitting and adjusting after the preservative has been washed off, spring tension and point alignment have been preset.

A series resistance in the ignition low tension circuit reduces the applied voltage to the ignition coil under running conditions. During starting operations the resistance is by-passed allowing full voltage to be applied to the ignition coil, this circuitry reduces the voltage drop in the low tension ignition circuit maintaining the high tension voltage output of the ignition coil during heavy current draw of the starter motor.

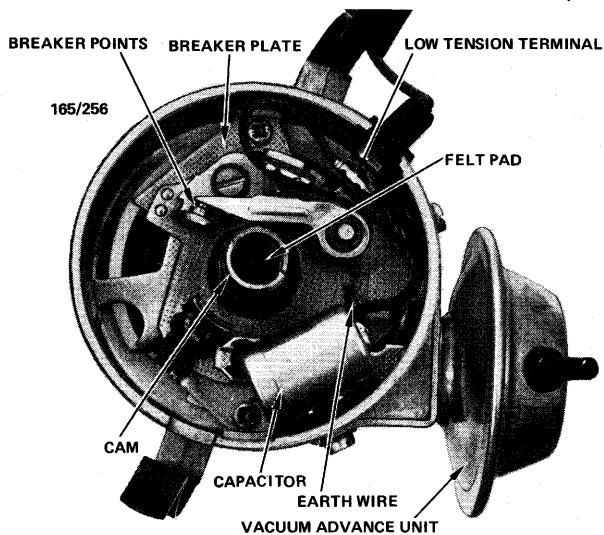
TO REMOVE AND INSTAL

- (1) Remove the distributor cap and secure it out of the way.
- (2) Crank the engine until the rotor points in the direction that would fire No. 1 cylinder and the mark on the crankshaft pulley aligns with the tdc marking on the timing scale.
- (3) Disconnect the distributor low tension wire at the coil terminal and the vacuum advance pipe at the advance unit on the side of the distributor.
- (4) If not already marked scribe a line on the top edge of the distributor body beneath the centre of the rotor bottom.
- (5) Scribe a line across the bottom of the distributor and the cylinder block to assist in assembly.
- (6) Remove the distributor clamp bolt and the clamp.
- (7) Remove the distributor from the engine and note the direction the rotor button turns as the distributor is withdrawn.

NOTE: Do not crank the engine while the distributor is removed.

Installation is a reversal of the removal procedure with attention to the following points:

- (1) If the engine has been disturbed after removal of the distributor crank the engine until No 1 piston is



View of distributor with cap and rotor arm removed.

approaching tdc on the compression stroke and align the mark on the crankshaft pulley with the tdc mark on the timing scale.

NOTE: If No. 1 spark plug is removed and a finger is held over the plug hole to seal the cylinder when No. 1 piston is approaching compression the pressure will be felt on the finger.

- (2) Position the distributor above the cylinder block with the housing in the normal position as indicated by the scribe line made during removal on the cylinder block and the distributor body.
- (3) Position the rotor to point to the No. 1 firing position and then turn the rotor an eighth of a turn in the direction that the rotor button rotated during the withdrawal of the distributor and push the distributor down to mesh with the camshaft gear.

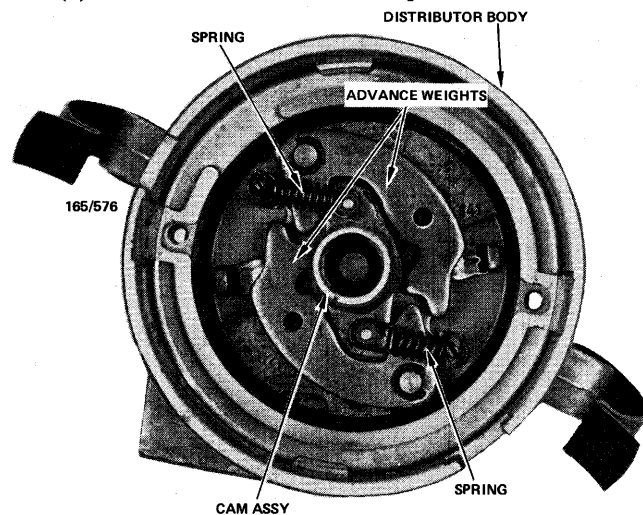
NOTE: The rotor will move slightly when meshing the distributor drive gear with the camshaft gear and the scribe mark made on the top edge of the distributor body should be in line with the centre of the rotor button. Repeat operations (2) and (3) if necessary.

- (4) Instal the distributor clamp and lightly tighten the bolt.
- (5) Connect the low tension wire to the coil and plug the open end of the vacuum pipe.
- (6) Fit the distributor cap, ensure that all high tension leads are firmly seated in the cap and check and adjust the ignition timing as necessary. See To Adjust Ignition Timing in the Tune—Up section.

TO DISMANTLE

With the distributor removed from the engine and the distributor cap and rotor arm removed proceed to dismantle the distributor as follows:

- (1) Disconnect the breaker point lead from the



View of distributor with breaker plate removed showing centrifugal advance components.

terminal on the inside of the distributor body.

(2) Remove the capacitor screw from the side of the distributor.

(3) Remove the low tension lead terminal block and the capacitor from the distributor body.

(4) Remove the clip securing the vacuum advance unit arm to the breaker plate.

(5) Remove the remaining screw securing the vacuum advance unit to the side of the distributor body and withdraw the assembly.

NOTE: When removing the above-mentioned screw securing the vacuum advance mechanism to the distributor body, hold the small square nut behind the screw with a suitable spanner. This nut secures the inside earth lead to the distributor body.

(6) Remove the breaker point screw from the breaker plate and lift out the breaker points.

(7) Remove the two screws securing the breaker plate to the distributor body, the screws are mounted vertically and are located inside the distributor body. Withdraw the breaker plate assembly from the distributor body.

TO CLEAN AND INSPECT

(1) Inspect the rotor arm and the distributor cap for fine cracks or carbon tracking and the centre carbon

for wear and protrusion.

(2) Wash the contact breaker points and the breaker plate in cleaning solvent and allow them to dry.

(3) Check the breaker points for wear, burrs or pitting. If the breaker points are excessively burnt or pitted renew the breaker points and the capacitor.

NOTE: Breaker points that are in a serviceable condition should be cleaned with a contact file or oil stone. Never use emery cloth or sandpaper.

(4) Test the capacitor on a capacitor tester according to the manufacturers instructions. If a capacitor tester is unavailable it is good policy to renew the capacitor. Refer to Specifications for the capacity range.

(5) Check the low tension and earth wires for possible fractures.

(6) Test the vacuum advance unit by applying vacuum to the hose connection on the vacuum advance unit. This will force the link and diaphragm into the advance unit. Whilst maintaining vacuum on the hose connection, observe that the link does not move. Should the link move out of the advance unit it will indicate a leaking diaphragm in which case a new advance unit will have to be fitted.

(7) Inspect the advance weight springs for damage and renew if necessary.

(8) Check the advance weights for binding on the pivot pins and free up if necessary.

TO ASSEMBLE

The assembly procedure is a reversal of the dismantling procedure with attention to the following points:

(1) Oil and grease must be kept away from the breaker points and insulating parts.

(2) Lubricate the advance weight pivot pins and associated moving parts.

(3) Apply a small dab of grease in the corner of the breaker point rubbing block and lubricate the felt pad in the cam assembly with lights engine oil.

(4) When the breaker plate and breaker points are fitted adjust the breaker gap to Specifications. Refer to the Tune—Up section for the correct procedure.

11. SWITCHES AND CONTROLS

HEADLAMP SWITCH

To Remove and Instal

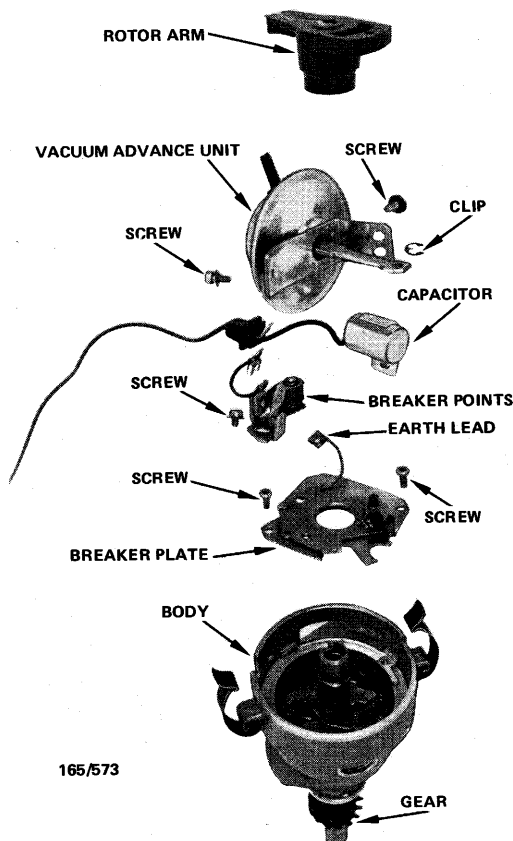
(1) Raise the bonnet and disconnect the battery earth cable from the battery.

(2) Remove the lower fascia panel beneath the steering column by turning the retaining clips 90 deg.

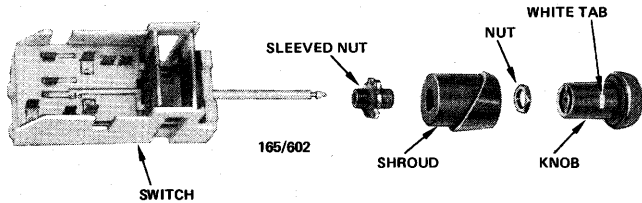
(3) Press in the white tab on the headlamp switch knob and remove the knob.

(4) Unscrew the spindle nut from the headlamp switch and remove the nut and switch shroud.

(5) Take out the retaining screws from the instrument surround panel at the front face and lower left hand



Dismantled view of distributor components.



Dismantled view of headlamp switch and associated components.

cover of the panel.

(6) Remove the instrument surround panel from the dash panel ensuring to disconnect the driving lamp switch wires where fitted.

(7) Unscrew the sleeved switch retaining nut from the spindle.

(8) Remove the switch and unplug the wiring connector from the switch.

Installation is a reversal of the removal procedure.

DRIVING LAMP SWITCH

To Remove and Instal

(1) Remove the instrument surround panel from the dash panel as previously described under the heading Headlamp Switch.

(2) Press in the white tab on the driving lamp switch knob and remove the knob.

(3) Unscrew the spindle nut from the driving lamp switch and remove the nut and switch shroud.

(4) Remove the switch from the instrument surround panel.

(5) Installation is a reversal of the removal procedure.

WASH/WIPER AND MULTIPURPOSE SWITCH

To Remove and Instal

(1) Remove the steering wheel and column flange shroud. If necessary refer to the Steering section for the correct procedure.

(2) Unscrew the switch retaining screws.

(3) Remove the lower facia panel beneath the steering column by turning the retaining clips 90 deg.

(4) Slacken the lower steering column clamp retaining bolt.

(5) Remove the nuts securing the steering column mounting bracket to the brake pedal support bracket and lower the steering column.

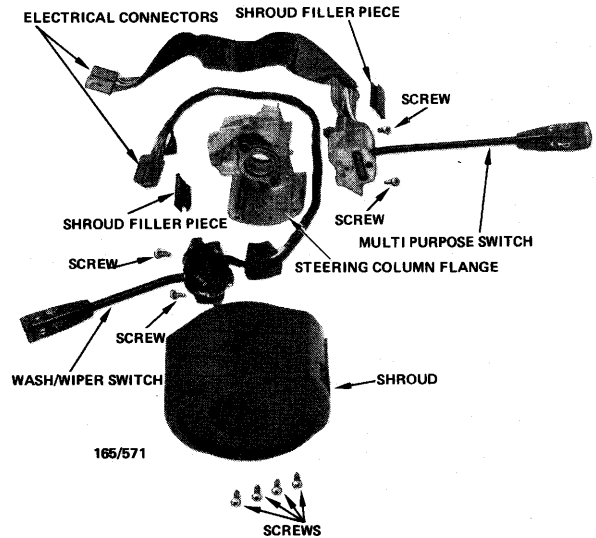
(6) Separate the top steering column shroud from the lower shroud.

(7) Take out the screws and remove the clamps securing the lower shroud to the steering column.

(8) Manoeuvre the shroud over the ignition switch and remove the shroud.

(9) Unplug the wash/wiper and multi-purpose switch wiring connectors and remove the switches from the steering column.

Installation is a reversal of the removal procedure with attention to the following points:



Dismantled view of the wash/wiper and multi purpose switches.

Ensure all wires are positioned correctly and not trapped when securing the switch retaining screws.

Check the lower steering column shroud for clearance around the ignition switch.

STOP LAMP SWITCH

The stop lamp switch is fitted on a support bracket at the top of the brake pedal.

To Remove

- (1) Disconnect the negative battery terminal.
- (2) Disconnect the electrical wires from the connector.
- (3) Unscrew the switch from the mounting bracket.

To Instal and Adjust

(1) With the brake pedal in the released position, screw the switch into the bracket until it is just touching the brake pedal lever.

(2) Connect the electrical wires, connect the battery terminal and switch on the ignition.

NOTE: At this point the stop lamps should be on. If the stop lamps are not on, check that the wiring to the switch is firmly connected.

(3) Slowly screw the switch into the bracket until the stop lamps go out. Screw the switch a further 1.3 mm into the bracket.

NOTE: To facilitate the above operation the electrical wires may have to be disconnected and reconnected until the switch is in its correct position.

(4) Apply and release the brake pedal and check for on/off operation of the stop lamps.

To Test on Vehicle

(1) Disconnect the electrical stop lamp switch wires at the connector.

- (2) Apply a jumper wire between the two electric connections (not the switch).
- (3) Switch on the ignition.

NOTE: if the stop lamps operate, the switch is either maladjusted or faulty. If the stop lamps do not operate there is either a wiring fault or the stop lamp bulbs are faulty.

VENTILATION, FAN AND DEMIST SWITCHES

To Remove and Instal

- (1) Remove the climate and vent control knobs.
- (2) Remove the demister and fan control knobs.

NOTE: The control knob removal procedure is common to all control switches. To remove, pull the knobs from the switches and controls.

- (3) Unscrew the switch spindle nuts and remove the fascia panel.
- (4) Remove the nuts securing the switches to the mounting bracket.
- (5) Take out the retaining screws and remove the mounting bracket.
- (6) Mark and disconnect the appropriate electrical wiring or vacuum hoses from the switches and remove the switches as required.

Installation is a reversal of the removal procedure.

HAZARD FLASHER SWITCH

To Remove and Instal

- (1) Remove the radio control knobs from the spindles.
 - (2) Where fitted remove the power antenna and fader control knobs.
 - (3) Unscrew the spindle nuts and remove the radio fascia panel.
 - (4) Prise the cover from the choke control knob.
 - (5) Unscrew the choke control knob retaining nut and remove the knob.
 - (6) Press in the white tab on the hazard switch knob and remove the knob.
 - (7) Remove the clock (if fitted), blanking panel or ashtray from the fascia panel.
 - (8) Take out the fascia panel retaining screw at the rear of the clock or ashtray aperture and remove the fascia panel.
 - (9) Remove the hazard switch spindle nut and disconnect the electrical wiring.
 - (10) Remove the switch from the fascia panel.
- Installation is a reversal of the removal procedure.

TAILGATE WIPE/WASH SWITCHES

To Remove and Instal

- (1) Remove the lower fascia panel beneath the steering column by turning the retaining clips 90 degrees.

- (2) Disconnect the electrical wiring from the switches.
 - (3) Remove the switches from the fascia panel.
- Installation is a reversal of the removal procedure.

NEUTRAL SAFETY SWITCH

Refer to the Automatic Transmission section of this manual for the removal, installation and adjustment procedures.

POWER WINDOW SWITCHES (WHERE FITTED)

All door windows may be either controlled from a master switch panel in the centre console or the rear windows from individual switches mounted in each rear door trim panel. A 'lock-out' switch is incorporated in the master switch panel which prevents the individual switches from operating the windows.

To Remove and Instal Rear Door Switch

- (1) Unscrew the switch escutcheon retaining screw and ease the escutcheon from the trim panel.
 - (2) Take out the arm rest retaining screws and place the arm rest to one side.
 - (3) Unclip the door trim and withdraw the trim far enough to disconnect the electrical connections.
 - (4) Remove the switch from the trim panel.
- Installation is a reversal of the removal procedure.

To Remove and Instal Master Switch

- (1) Remove the switch bezel and the blanking plate from the switch cover plate by levering the right hand end up and sliding it to the right.
 - (2) Remove the switch cover retaining screws.
 - (3) Lift the switch assembly up and disconnect the electrical connections.
 - (4) Unscrew the switch retaining nuts and remove the switch assembly from the switch cover.
- Installation is a reversal of the removal procedure.

REVERSE LAMP SWITCH

There are two types of switches fitted to Falcon and Fairmont vehicles:

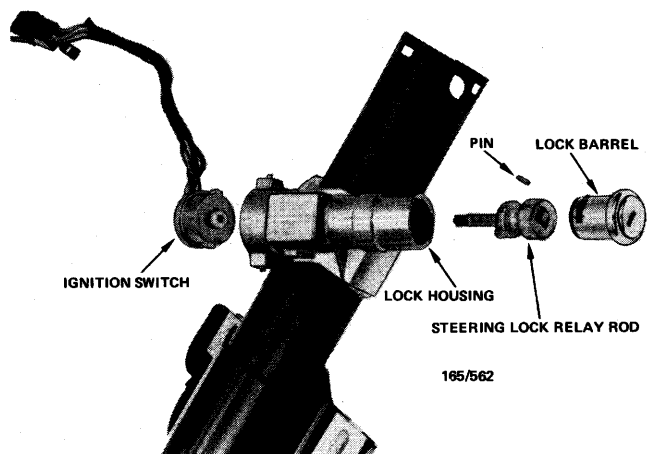
(a) On vehicles fitted with automatic transmission the reverse lamp switch is incorporated in the neutral safety switch. Refer to the Automatic Transmission section for adjustment and removal procedure.

(b) On all vehicles fitted with manual transmission the switch is fitted into the side of the transmission. The switch is not adjustable and if found to be faulty it must be renewed.

IGNITION SWITCH AND LOCK BARREL

To Remove and Instal Ignition Switch

- (1) Disconnect the negative battery terminal.
- (2) Remove the lower fascia panel beneath the steering column by turning the retaining clips 90 degrees.



Dismantled view of ignition switch and associated components.

- (3) Loosen the clamp which is located at the steering column toe plate.
- (4) Remove the steering column retaining nuts which are located on the brake pedal support bracket and lower the steering column.
- (5) Remove the upper shroud, remove the screws and clamps retaining the lower shroud and remove the lower shroud.
- (6) Disconnect the switch electrical wire connector.
- (7) Unscrew the switch retaining screws and remove the switch.

Installation is a reversal of the removal procedure with attention to the following point:

Check the lower steering column shroud for clearance around the ignition switch.

To Renew Lock Barrel

- (1) Disconnect the negative battery lead from the battery terminal.
- (2) Select the accessories position on the ignition switch.
- (3) Using a 1.5 mm pin insert it into the hole in the lower steering column shroud and the corresponding hole in the lock housing.

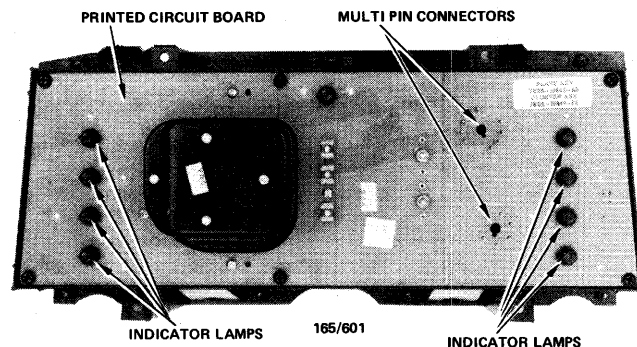
NOTE: The hole in the steering column shroud is located beneath the lock housing.

- (4) Push the pin in and depress the retaining spring then remove the lock barrel.
- (5) Position the new lock barrel in the lock housing with the eyes of the snap ring in the recess in the lock housing.
- (6) Rotate the lock barrel to position the projections on the barrel in the lock housing and push the barrel fully home.

12. INSTRUMENT CLUSTER

TO REMOVE AND INSTAL

- (1) Remove the instrument surround panel and the



Rear view of instrument cluster.

headlamp switch as previously described.

- (2) Remove the headlamp switch mounting bracket retaining screws and lower the bracket.

- (3) Take out the instrument cluster retaining screws and unplug the instrument illumination bulb sockets.

- (4) Ease the instrument cluster from the dash panel far enough to disconnect the electrical multi pin connectors from the instrument cluster.

- (5) Remove the instrument cluster from the vehicle.

- (6) Removal of any instrument or gauge from the circuit board is similar to each component. Separate the printed circuit from the instrument cluster, ensuring not to damage the instruments or gauges. Remove the instruments or gauges as necessary from the circuit board.

Installation is a reversal of the removal procedure particularly ensuring that no electrical connections are touching the vehicle body.

13. LAMP UNITS

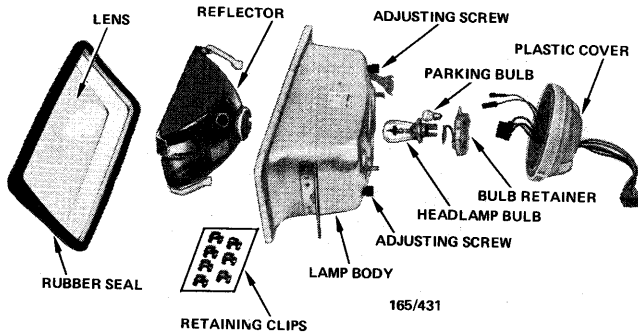
HEADLAMPS

To Remove and Instal

- (1) Remove the retaining screws from the radiator grille and remove the grille.
- (2) Remove the plastic cover on the rear of the headlamp by turning it anti-clockwise and detaching it from the headlamp.
- (3) Disconnect the headlamp, parking lamp and earth wires from the rear of the headlamp.
- (4) Unclip the turn signal lamp from the headlamp and ease the lamp from the vehicle.
- (5) Rotate the turn signal lamp bulb holder and remove the bulb holder from the lamp assembly.
- (6) Remove the headlamp retaining screws from the mounting bracket and body and remove the headlamp from the vehicle.

NOTE: Do not remove the headlamp mounting bracket from the body as it will be necessary to realign the headlamps.

- (7) Push the bulb retainer in and rotate it anti-clockwise, the bulb and retainer will now be released



Dismantled view of headlamp assembly.

from the headlamp. Remove the retainer with the parking lamp bulb and the headlamp bulb from the assembly.

NOTE: Care must be taken not to handle the glass portion of the headlamp bulb as this will shorten the life of the bulb. Any accidental marks placed on the bulb may be removed by applying methylated spirits and drying with a clean tissue or cloth.

Installation is a reversal of the removal procedure.

To Dismantle

- (1) Remove the headlamp from the vehicle as previously described.
- (2) Remove the retaining clips securing the headlamp lens to the headlamp body and remove the lens.

NOTE: To facilitate the reassembly procedure note the positioning of the retaining clips.

- (3) Remove the headlamp reflector by rotating the adjusting screws in an anti-clockwise direction.

NOTE: When removing the headlamp reflector count the number of turns on each adjusting screw to ensure that correct headlamp alignment is maintained.

Reassembly is a reversal of the dismantling procedure with attention to the following point:

Ensure the rubber seal is fitted correctly and is in a serviceable condition.

To Renew Headlamp and Parking Lamp Bulbs

- (1) Remove the plastic cover on the rear of the headlamp by turning anti-clockwise and detaching it from the headlamp.
- (2) Disconnect the headlamp, parking lamp and earth wires from the rear of the headlamp assembly.
- (3) Push the bulb retainer in and rotate it anti-clockwise, the bulb and retainer will now be released from the headlamp. Remove the retainer and parking lamp bulb from the headlamp assembly.
- (4) Remove the headlamp bulb from the headlamp assembly.
- (5) Remove the parking lamp bulb from the bulb retainer by pushing in and rotating in an anti-clockwise direction.

- (6) Instal the new headlamp bulb into the headlamp assembly ensuring that the locating lugs are positioned correctly.

NOTE: Care must be taken not to handle the glass portion of the headlamp bulb as this will shorten the life of the bulb. Any accidental marks placed on the bulb may be removed by applying methylated spirits on the bulb and drying with a clean tissue or cloth.

- (7) Instal the new parking lamp bulb into the bulb retainer ensuring that the bulb is positioned correctly.

- (8) Fit the bulb retainer to the rear of the headlamp assembly.

- (9) Connect the headlamp bulb, parking lamp bulb and earth wires to the headlamp assembly.

- (10) Fit the plastic cover to the headlamp assembly.

To Adjust Headlamps

When adjusting the headlamps ensure that the fuel tank is approximately half full, the vehicle is unloaded, the luggage compartment is empty of unnecessary items and there are two persons seated in the front of the vehicle.

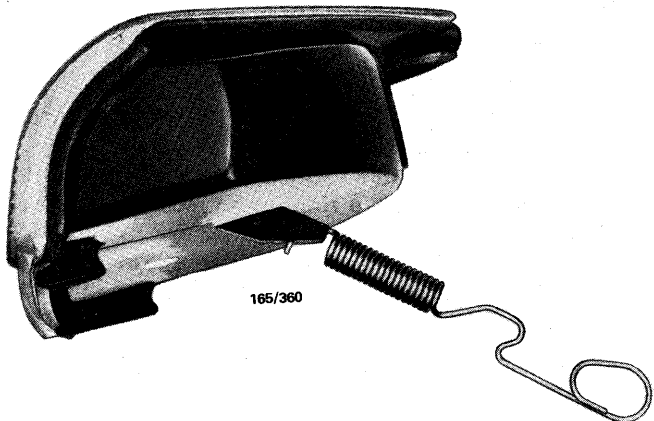
- (1) Make sure that the tyres are inflated to their correct pressures and that the vehicle is on level ground.
- (2) Bounce the front and rear of the vehicle to ensure that the vehicle is leveled.
- (3) If a headlamp aiming machine is used, follow the manufacturers instructions for operating procedure.
- (4) Adjust the headlamps by rotating the adjusting screws at the rear of the headlamp assembly.

NOTE: Reference should be made to the local regulations governing headlamp aim and the lamps should be aimed accordingly.

FRONT TURN SIGNAL LAMP

To Remove and Instal Lamp and Bulb

- (1) Open the engine bonnet and unclip the turn signal lamp retaining spring from the headlamp. Ease the turn signal lamp from the vehicle.



View of right hand front turn signal lamp and retaining spring.

(2) Rotate the turn signal bulb holder and remove the holder from the lamp assembly.

(3) Remove the turn signal lamp from the vehicle.

(4) The bulb is a bayonet type connection. To remove the bulb, push the bulb in and rotate anti-clockwise. The bulb will now be released from the holder.

Installation is a reversal of the removal procedure.

INSTRUMENT LAMPS

To Renew Bulbs

(1) To renew the instrument cluster illumination bulbs it is necessary to remove the lower facia panel beneath the steering column and the instrument cluster surround panel. If necessary refer to Instrument Cluster — To Remove and Instal for the correct procedure.

(2) Remove the bulb holders from the instrument cluster and renew the bulbs.

Installation is a reversal of the removal procedure.

REAR COMBINATION LAMP

To Renew Bulbs—Sedan and Station Wagon

(1) Working from inside the luggage compartment remove the rear facia panel or trim panel retaining screws and place the panel to one side.

(2) Rotate the appropriate bulb holder in an anti-clockwise direction and remove the bulb holder from the lamp assembly.

(3) Remove the bulb from the holder by pushing in and rotating in an anti-clockwise direction.

(4) Fit the new bulb and replace the bulb holder in the lamp.

(5) Check the operation of the bulb and refit the facia panel or trim.

To Renew Bulbs—Van and Utility

(1) Remove the lamp assembly retaining screws

and ease the lamp from the vehicle body.

(2) Rotate the appropriate bulb holder in an anti-clockwise direction and remove the holder from the lamp assembly.

(3) Remove the bulb from the holder by pushing in and rotating in an anti-clockwise direction.

(4) Fit the new bulb and replace the bulb holder in the lamp.

(5) Check the operation of the bulb and fit the lamp assembly to the vehicle body.

To Remove and Instal Lamp—Sedan and Station Wagon

(1) Working from inside the luggage compartment remove the rear facia panel or trim panel retaining screws and place the panel to one side.

(2) Rotate the bulb holders in an anti-clockwise direction and remove the holders from the lamp assembly.

(3) Remove the lamp assembly retaining nuts and remove the lamp from the vehicle.

Installation is a reversal of removal procedure with attention to the following points:

Ensure the sealing gasket is in a serviceable condition.

Secure the lamp retaining nuts taking care not to overtighten the nuts.

Check the operation of all the bulbs.

To Remove and Instal Lamp—Van and Utility

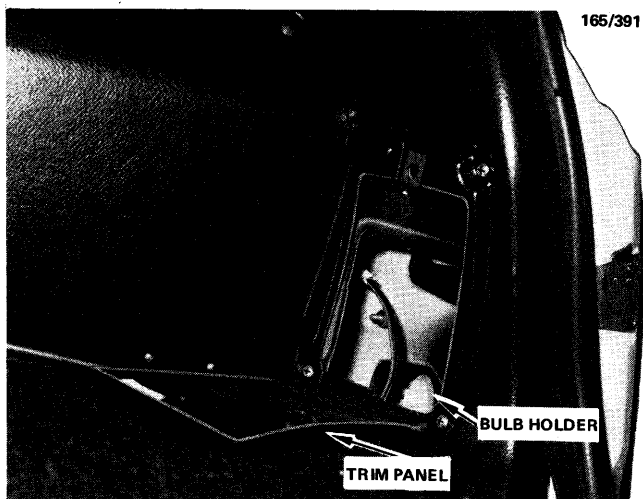
(1) Remove the lamp assembly retaining screws and ease the lamp from the vehicle body.

(2) Rotate the bulb holders in an anti-clockwise direction and remove the bulb holders from the lamp assembly.

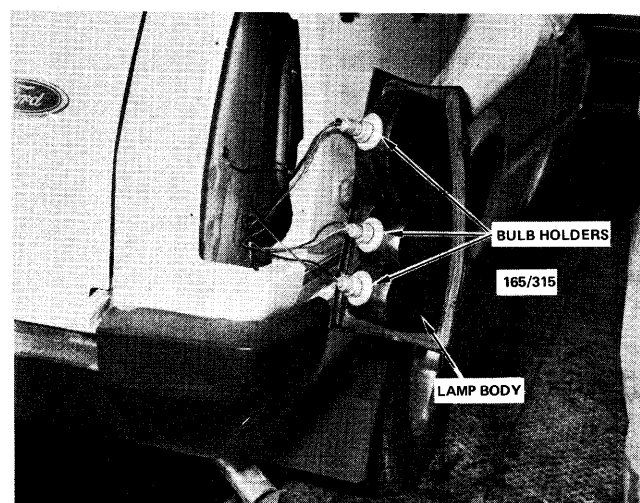
(3) Remove the lamp assembly from the vehicle.

(4) Instal the bulb holders to the new lamp.

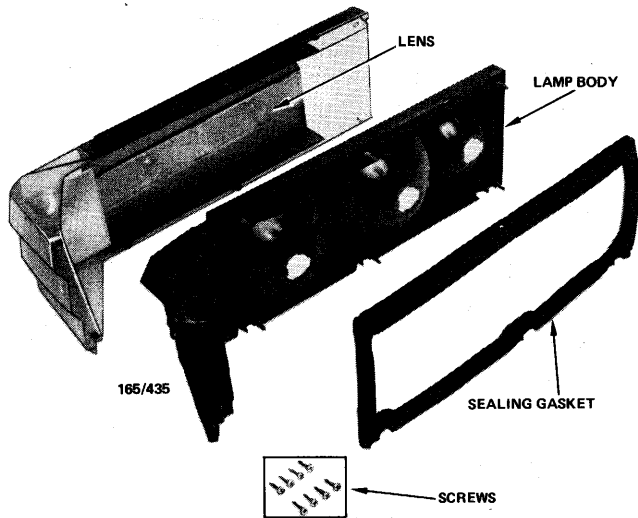
(5) Fit the lamp assembly of the vehicle and instal the retaining screws.



View showing rear trim panel removed to permit access to rear combination lamp. Station Wagon.



Rear combination lamp removed from vehicle Utility and Van.



Dismantled view of the rear combination lamp components.

To Remove and Instal Lens — Sedan Only

- (1) Remove the lamp as previously described,
- (2) Remove the lens retaining screws from the lamp assembly.
- (3) Remove the lens from the lamp body.
Installation is a reversal of the removal procedure.

NUMBER PLATE LAMP (SEDAN)

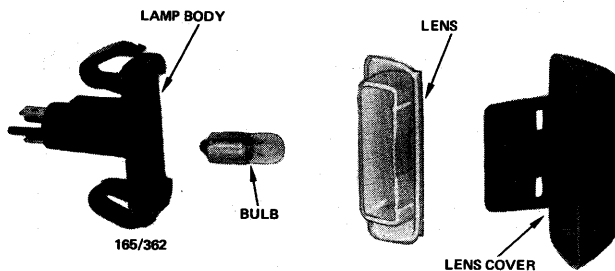
To Remove and Instal Lamp and Bulb

- (1) Remove the lamp from the bumper bar by levering each end of the lamp up.
- (2) Disconnect the electrical wiring from the lamp and remove the lamp.
- (3) Detach the lens from the lamp body by prising off the lens cover.
- (4) Remove the bulb from the lamp body.
Installation is a reversal of the removal procedure.

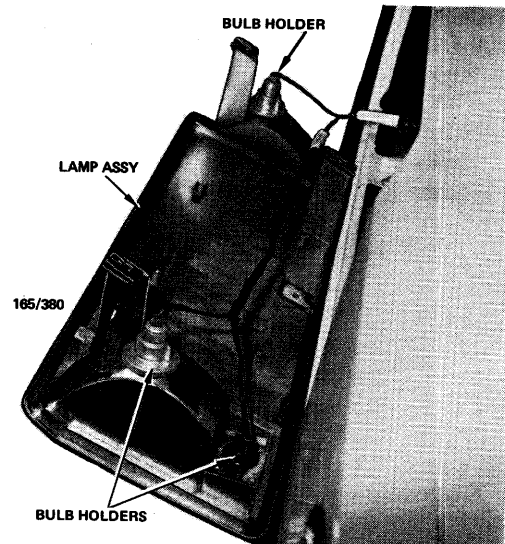
COMBINATION NUMBER PLATE AND REVERSE LAMP (STATION WAGON)

To Remove and Instal Lamp and Bulb

- (1) Working on the inside panel of the tailgate remove the lamp assembly retaining screws.



Dismantled view of number plate lamp. Sedan.



Combination number plate and reverse lamp removed from tailgate. Station Wagon.

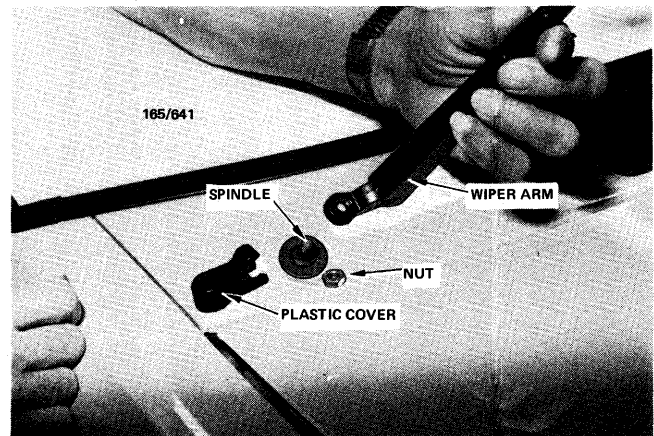
- (2) Ease the lamp assembly from the tailgate and remove the appropriate bulb holder by rotating anti-clockwise.
- (3) Remove the bulb from the holder by pushing in and rotating in an anti-clockwise direction.
- (4) Fit the new bulb to the bulb holder. Refit the bulb holder to the lamp assembly and reposition the lamp assembly on the tailgate.
- (5) Check the operation of the bulb(s), instal the lamp assembly and tighten the retaining screws.

14. WINDSCREEN WIPERS

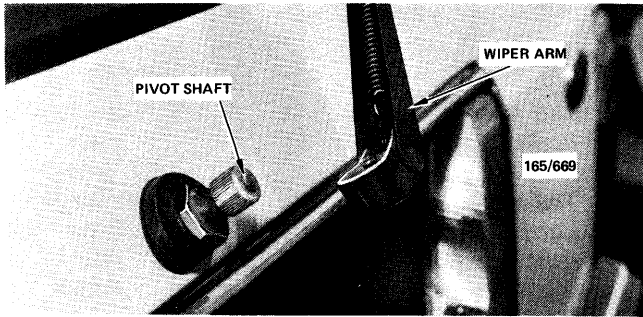
WIPER ARMS AND BLADES

To Remove and Instal Wiper Arms

- (1) Take off the plastic cover and remove the nut retaining the wiper arm to the spindle.
- (2) Carefully prise the wiper arm from the spindle taking care not to damage the paintwork.



Windscreen wiper arm removed from spindle.



Rear window wiper arm removed from pivot shaft.

Installation is reversal of the removal procedure with attention to the following point:

With the wipers in the park position, the wiper blade should be approximately 30 mm away from the lower windscreen moulding.

To Renew Wiper Blades

- (1) Pull the wiper arm and blade away from the windscreen until it locks in the vertical position.
- (2) Holding the arm in one hand and the blade in the other, depress the spring in the centre of the blade and slide the blade from the pin on the arm.

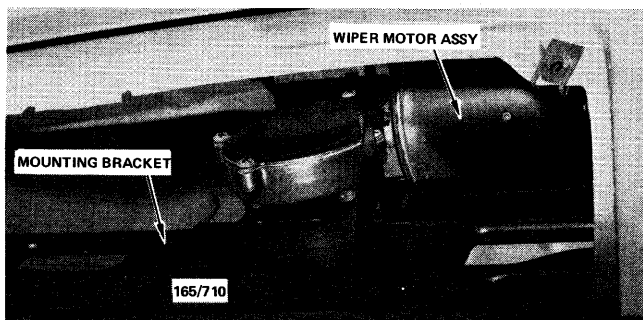
Installation is a reversal of the removal procedure ensuring that the blade is fully home before lowering the arm.

WIPER MOTOR AND LINKAGE

To Remove and Instal

- (1) Remove the wiper arms as previously described.
- (2) Raise the engine bonnet and disconnect the battery earth lead.
- (3) Disconnect the wiper motor electrical wiring.
- (4) Remove the windscreen washer jets.
- (5) Take out the outer mounting bracket retaining screws.
- (6) Remove the retaining screws and remove the cowl top grille.
- (7) Unscrew the retaining screws from the top edge of the mounting bracket and withdraw the wiper motor and linkage assembly from the plenum chamber.

Installation is a reversal of the removal procedure



Installed view of windscreen wiper motor.

procedure with attention to the following point:

When refitting the wiper arms ensure that the blades are approximately 30 mm away from the lower windscreen moulding with the wiper motor in the park position.

15. REAR WINDOW WIPER (STATION WAGON)

WIPER ARM AND MOTOR

To Remove and Instal

- (1) Remove the number plate lamp assembly as previously described.
- (2) Release the wiper arm securing clip and withdraw the wiper arm and blade assembly.
- (3) Unscrew the pivot shaft retaining nut and remove the nut, spacer and pad.
- (4) Release the retaining clip from the motor crank pivot and remove the link.
- (5) Remove the link and pivot shaft assembly.
- (6) Disconnect the wiper motor electrical wiring.
- (7) Take out the screws securing the wiper motor support bracket to the inner tailgate panel.
- (8) Withdraw the wiper motor and support bracket through the number plate lamp aperture.

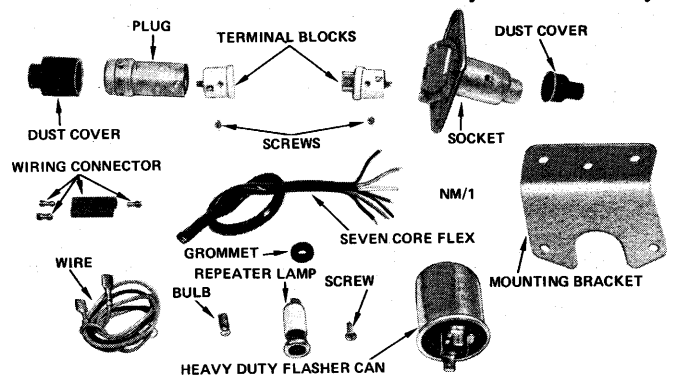
Installation is a reversal of the removal procedure with attention to the following:

Before installing the wiper arm and blade assembly ensure that the wiper motor is in the park position. The wiper blade should be approximately 30 mm away from the lower edge of the rear window when installed.

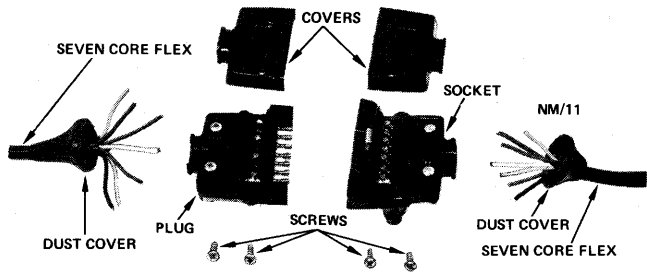
16. HOW TO WIRE UP A TRAILER

There are many different makes of trailer electrical combination plugs and sockets on the market. Some makes can even be obtained with a varying number of circuit pin connections. Most manufacturer's however, now choose to market the seven pin variety only. The seven pin plug and socket provides for two auxiliary circuits and in caravan use these are usually used for the 12 volt interior lights and the electric brakes.

If the trailer which is to be towed by the car already



Minimum material needed for wiring up a trailer. Utilux trailer socket and plug shown.



The Brylite seven pin trailer plug and socket.

has a connector plug then the matching type of socket will have to be fitted to the car. If on the other hand, the trailer has no plug then it is advisable to fit a seven pin type unit to the car and trailer so that if at a later time auxiliary circuits are needed, it is only a matter of using the vacant pins.

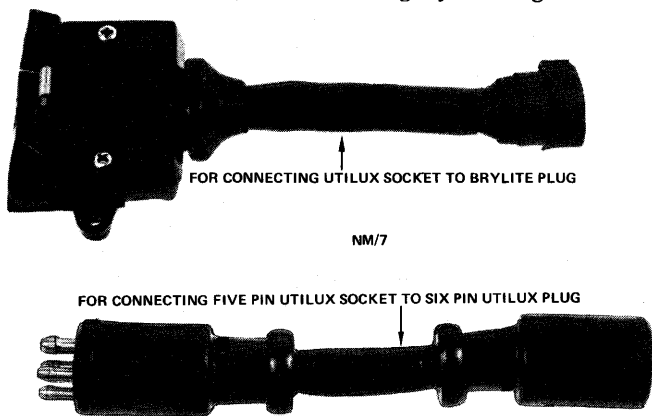
FITTING THE SOCKET AND PLUG

NOTE: The minimum amount of material needed to fit the socket and plug will be:

Trailer socket and plug, socket mounting bracket kit, multi core flex, wiring connectors, grommet, heavy duty flasher can with repeater lamp.

- (1) Disconnect the earth lead from the battery.
- (2) Locate the main wiring harness at the rear of the vehicle and using the length of multi core flex, cut if necessary and tap into the right flasher wire, left flasher wire, tail lamp wire, stop lamp wire and an earth wire. Use insulated connectors when tapping into the wires.

NOTE: To determine which color wire on the vehicle is for each particular rear lamp refer to the wiring diagram in this section which shows the colors for the various wires. Ensure that the right diagram for the applicable vehicle model is used. When tapping into the rear wires on the vehicle conform to the standard caravan colour coding by mating the



Useful connections which can be used if trailer to be towed is fitted with different type plug to towing vehicle socket.

right color wire of the multi core flex to its applicable lamp or earth wire on the vehicle. The standard caravan coding is as follows:

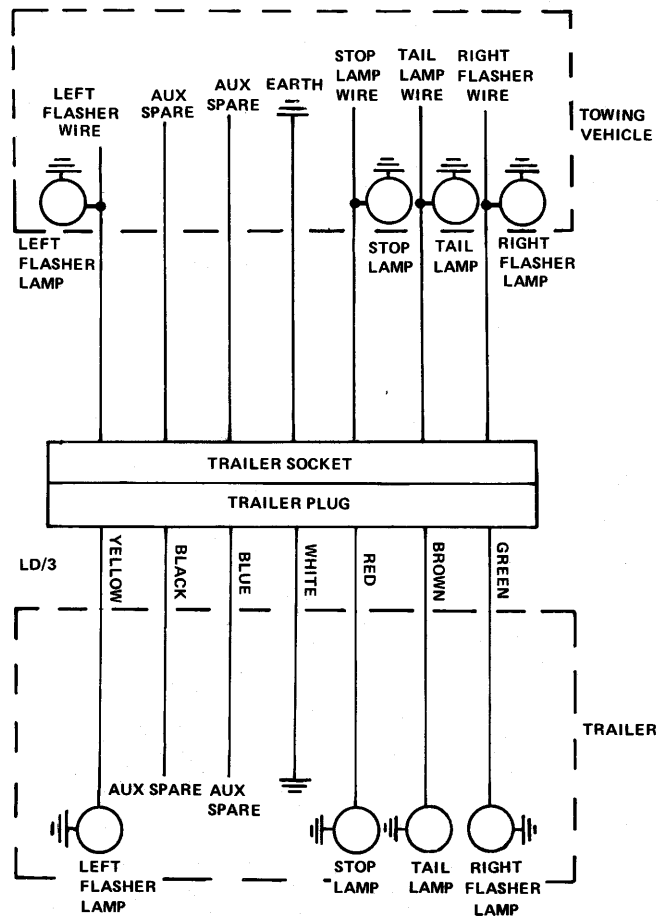
- Left flasher Yellow
- Right flasher Green
- Stop lamp Red
- Tail lamp Brown
- Earth White
- Auxiliary spare Blue
- Auxiliary spare Black

This color coding has nothing to do with the wiring on the vehicle. It is only for the caravan or trailer wiring.

- (3) Drill a suitable sized hole through the vehicle floor, fit a rubber grommet and push through the multi core flex.

NOTE: Before drilling a hole through the floor check to see if there is an existing hole which will take the multi core flex. It may even be convenient to use the number plate lamp wire hole. Whichever hole is used ensure that a rubber grommet is fitted to prevent the wires from chafing.

- (4) Cut the multi core flex to length and slide the



Typical for wiring up a trailer.

socket dust cover onto the flex. Strip about 15 mm of covering from each wire and connect the wires to the terminals of the socket. Ensure that each colored wire is connected to its correct terminal. On the brands of sockets where the terminals are only numbered it will be necessary to refer to the instruction sheet which comes with the unit to find out the correct circuit connection for each pin number.

(5) After wiring up and reassembling the socket mount the socket to the rear of the vehicle. Try to mount the socket as near as possible to the tow bar ball and high enough to prevent damage to the socket if the rear of the vehicle happens to scrape on driveways, etc. On brands of socket that do not have an in-built mounting bracket it will be necessary to make up a mounting bracket or use the optional mounting bracket for that particular socket.

(6) Using the same wiring up procedure, wire the plug to the trailer wiring. If the wiring on the trailer is not to the standard color code and is an unknown quantity then it will be necessary to check out and connect up the wiring as follows:

(a) Locate the earth wire for the trailer first even if all wires have to be traced on the trailer. Connect the earth wire only to the wiring plug and connect the plug to the connector on the car.

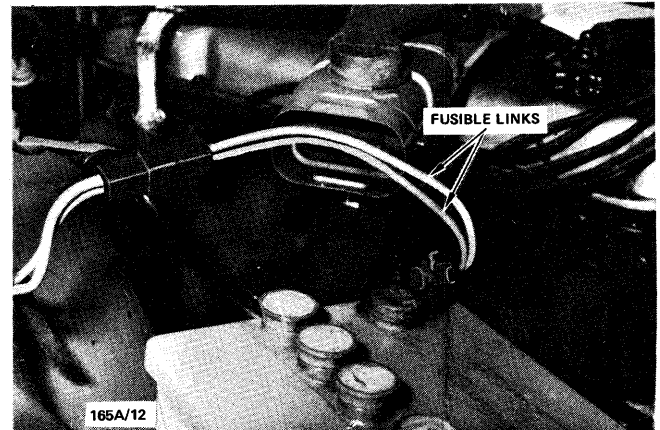
(b) Connect up the battery on the car and switch on the tail lamps. Connect each trailer wire in turn to the live tail lamp terminal on the plug until the trailer tail lamp illuminates. When the trailer tail lamp wire is found connect this to the lamp terminal on the plug. Switch off the tail lamps and using the same procedure turn the other lamps on in turn and find the applicable trailer lamp by connecting to the live terminal on the plug.

NOTE: On some makes of sockets and plugs it will be necessary to dismantle the terminal blocks from the plug and/or sockets in order to expose the terminals.

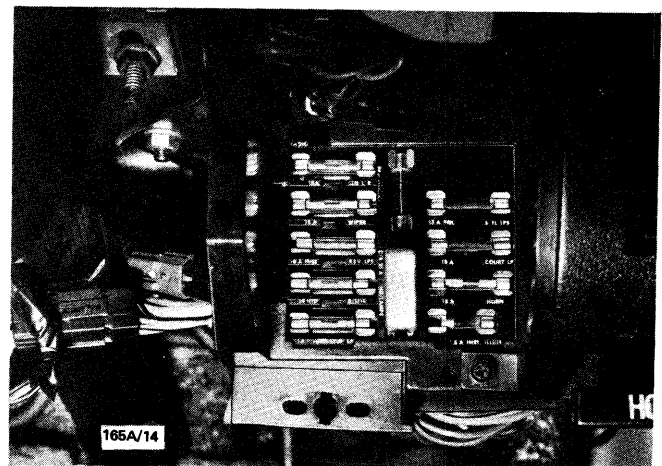
(7) Instal the heavy duty flasher can and repeater lamp to the vehicle following the wiring-up instructions which are enclosed in the flasher can and repeater lamp kit. Ensure that the right kit is purchased for the applicable model of vehicle.

The heavy duty flasher can keeps the flash rate constant regardless of additional load. The repeater lamp, which should be mounted in some easy-to-see position on the dash panel, indicates if the trailer turn signal lamps are operating.

17. FUSES AND FUSIBLE LINKS



View of fusible links showing location in engine compartment.



View of fuse panel showing location of fuses.

Wiring diagram for all models.

COLOR CODE

The first letter of the code represents the main wire color, the other letters represent the trace colors and where a sleeve is installed on the wire the color of the sleeve is indicated by the letters enclosed in brackets.

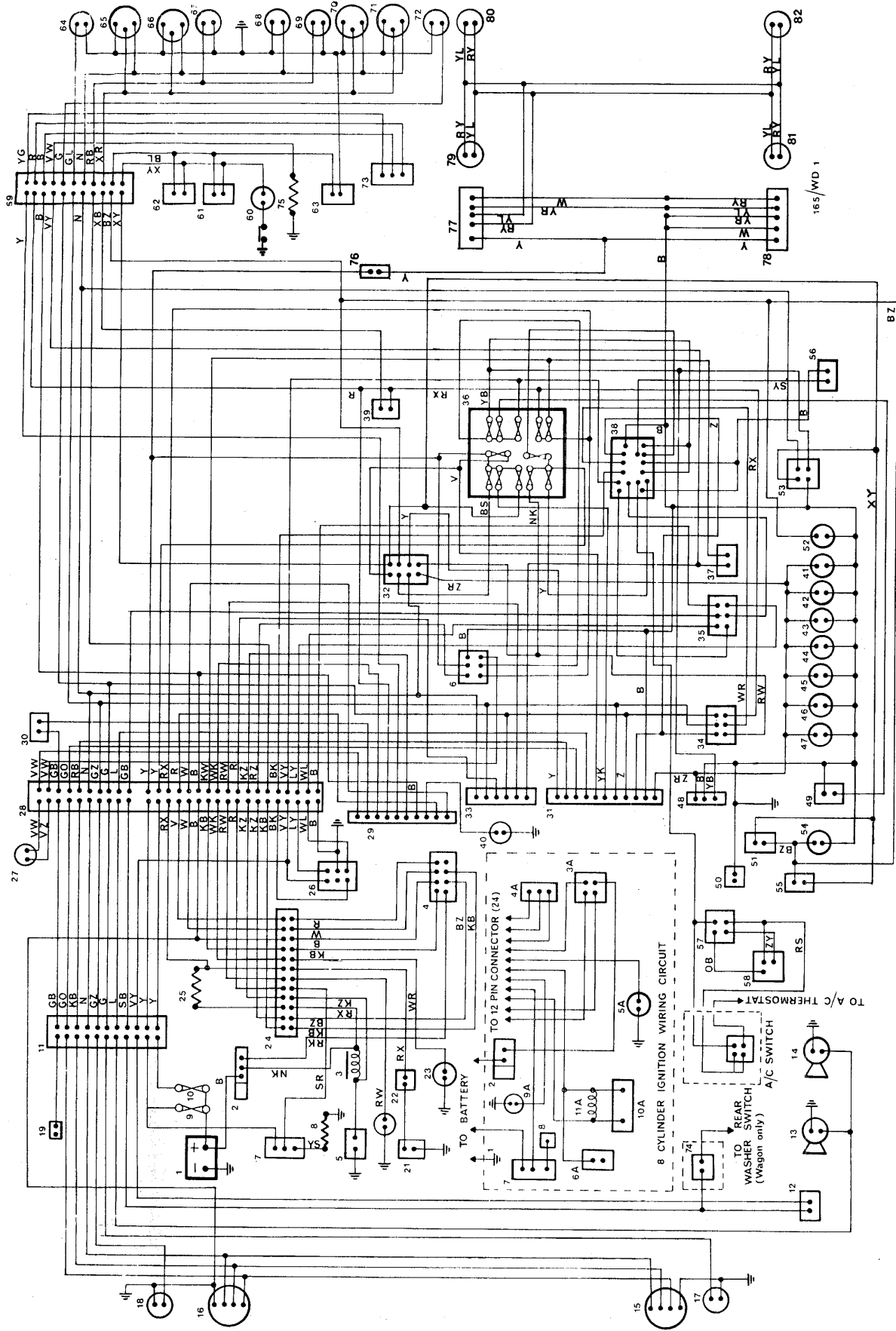
- B - BLACK
- L - BLUE
- G - GREEN
- R - RED
- Y - YELLOW
- W - WHITE
- N - BROWN
- O - ORANGE
- K - PINK
- S - GREY
- V - VIOLET
- P - PURPLE
- X - LIGHT GREEN
- Z - LIGHT BLUE
- M - DARK GREEN
- T - DARK BLUE
- A - LIGHT BROWN
- E - SLATE
- D - TAN

KEY

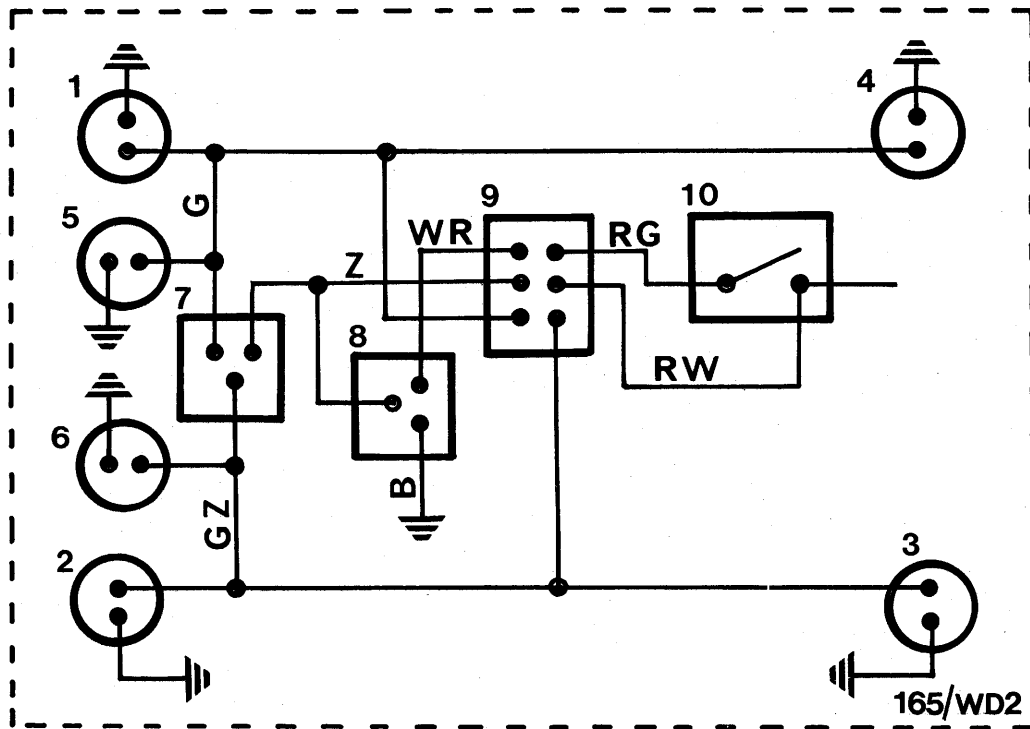
- 1. Battery.
- 1A. Engine earth lead.
- 2. Starter motor.
- 3. Ignition coil.
- 3A. Starter circuit, neutral safety switch and reverse lamps multipin connector.
- 4. Electronic speedo, neutral safety switch/reverse lamps multipin connector.
- 4A. Electronic speedo transducer.
- 5. Distributor.
- 5A. Oil sender switch.
- 6. Ignition switch.
- 6A. Throttle solenoid connector.
- 7. Alternator.
- 8. Automatic choke.
- 8A. Automatic choke connector.
- 9. Fusible link.
- 9A. Temperature sender unit.
- 10. Fusible link.
- 10A. Distributor.
- 11. Multipin connector.
- 11A. Ignition coil.
- 12. Windscreen washer motor.
- 13. Horn.
- 14. Horn.
- 15. L.H. headlamp.
- 16. R.H. headlamp.
- 17. L.H. turn signal lamp.
- 18. R.H. turn signal lamp.

- 19. Driving lamp connector.
- 20. Temperature sender unit.
- 21. Throttle positioning solenoid.
- 22. Throttle solenoid connector.
- 23. Oil sender switch.
- 24. Multipin connector.
- 25. Series resistance.
- 26. Windscreen wiper motor.
- 27. Dual brake warning lamp switch.
- 28. Main engine wiring multipin connectors.
- 29. Instrument cluster multipin connector.
- 30. Driving lamp switch.
- 31. Multipurpose switch multipin connector.
- 32. Headlamp switch.
- 33. Instrument cluster multipin connector.
- 34. Hazard flashers multipin connector.
- 35. Windscreen wiper switch.
- 36. Fuse panel.
- 37. Rear demist switch.
- 38. Relay block with connections for flasher unit, intermittent wipers and heater/air conditioning.
- 39. Stop lamp switch.
- 40. Parking brake warning lamp switch.

- 41. Instrument illumination lamp.
- 42. Instrument illumination lamp.
- 43. 44. Switch panel illumination lamp.
- 45. 46. Switch panel illumination lamp.
- 47. Quadrant lamp (automatic transmission).
- 48. Radio connector.
- 49. Cigarette lighter connector.
- 50. Earth connector.
- 51. L.H.F. courtesy lamp switch connector.
- 52. R.H.F. footwell lamp.
- 53. Clock.
- 54. L.H.F. footwell lamp.
- 55. L.H.R. courtesy lamp switch connector.
- 56. Power windows connector.
- 57. Heater/air conditioner blower switch connector.
- 58. Air conditioning switch connector.
- 59. Rear lamps multipin connector.
- 60. Luggage compartment lamp and switch.
- 61. R.H.F. courtesy lamp switch connector.
- 62. R.H.R. courtesy lamp switch connector.
- 63. Dome and C pillar lamp connector.
- 64. R.H. rear turn signal lamp.
- 65. R.H. stop/tail lamp.
- 66. R.H. stop/tail lamp.
- 67. R.H. reverse lamp.
- 68. Number plate lamp.
- 69. L.H. reverse lamp.
- 70. L.H. stop/tail lamp.
- 71. L.H. stop/tail lamp.
- 72. L.H. turn signal lamp.
- 73. Fuel sender unit connector.
- 74. Front and rear windscreen washer solenoid (Station Wagon).
- 75. Rear demister.
- 76. Power door lock circuit breaker.
- 77. R.H.F. power door lock switch connector.
- 78. L.H.F. power door lock switch connector.
- 79. R.H.F. power door lock actuator.
- 80. R.H.R. power door lock actuator.
- 81. L.H.F. power door lock actuator.
- 82. L.H.R. power door lock actuator.



Wiring diagram for all models.



Wiring diagram for turn signal and hazard flashers.
All models.

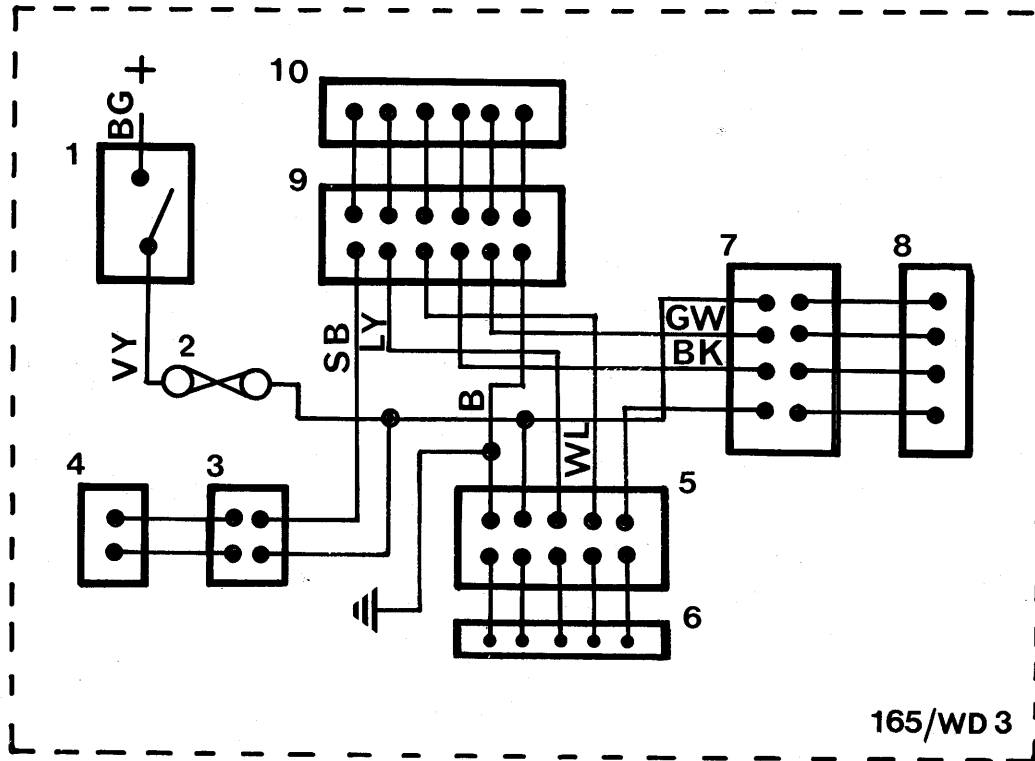
COLOR CODE

The first letter of the code represents the main wire color, the other letters represent the trace colors and where a sleeve is installed on the wire the color of the sleeve is indicated by the letters enclosed in brackets.

B	-	BLACK
L	-	BLUE
G	-	GREEN
R	-	RED
Y	-	YELLOW
W	-	WHITE
N	-	BROWN
O	-	ORANGE
K	-	PINK
S	-	GREY
V	-	VIOLET
P	-	PURPLE
X	-	LIGHT GREEN
Z	-	LIGHT BLUE
M	-	DARK GREEN
T	-	DARK BLUE
A	-	LIGHT BROWN
E	-	SLATE
D	-	TAN

KEY

1. R.H. Front turn signal lamp.
2. L.H. front turn signal lamp.
3. L.H. rear turn signal lamp.
4. R.H. rear turn signal lamp.
5. R.H. indicator turn signal lamp.
6. L.H. indicator turn signal lamp.
7. Turn signal switch.
8. Flasher unit.
9. Hazard flasher switch.
10. Ignition switch.



Wiring diagram for windscreen wipers and washers with intermittent wiper.

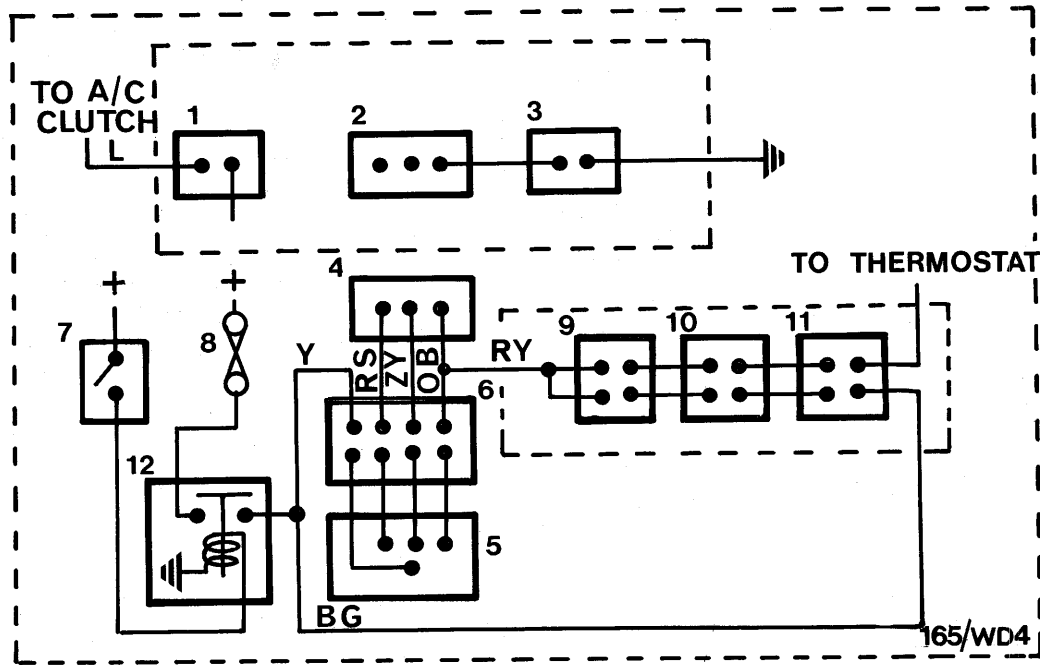
COLOR CODE

The first letter of the code represents the main wire color, the other letters represent the trace colors and where a sleeve is installed on the wire the color of the sleeve is indicated by the letters enclosed in brackets.

- B - BLACK
- L - BLUE
- G - GREEN
- R - RED
- Y - YELLOW
- W - WHITE
- N - BROWN
- O - ORANGE
- K - PINK
- S - GREY
- V - VIOLET
- P - PURPLE
- X - LIGHT GREEN
- Z - LIGHT BLUE
- M - DARK GREEN
- T - DARK BLUE
- A - LIGHT BROWN
- E - SLATE
- D - TAN

KEY

- 1. Ignition switch.
- 2. Fuse.
- 3. Washer motor connector.
- 4. Washer motor connector.
- 5. Wiper motor connector.
- 6. Wiper motor connector.
- 7. Electronic timer connector.
- 8. Electronic timer connector.
- 9. Wiper and washer switch connector.
- 10. Wiper and washer switch.



Wiring diagram for models fitted with integral heater and air conditioning.

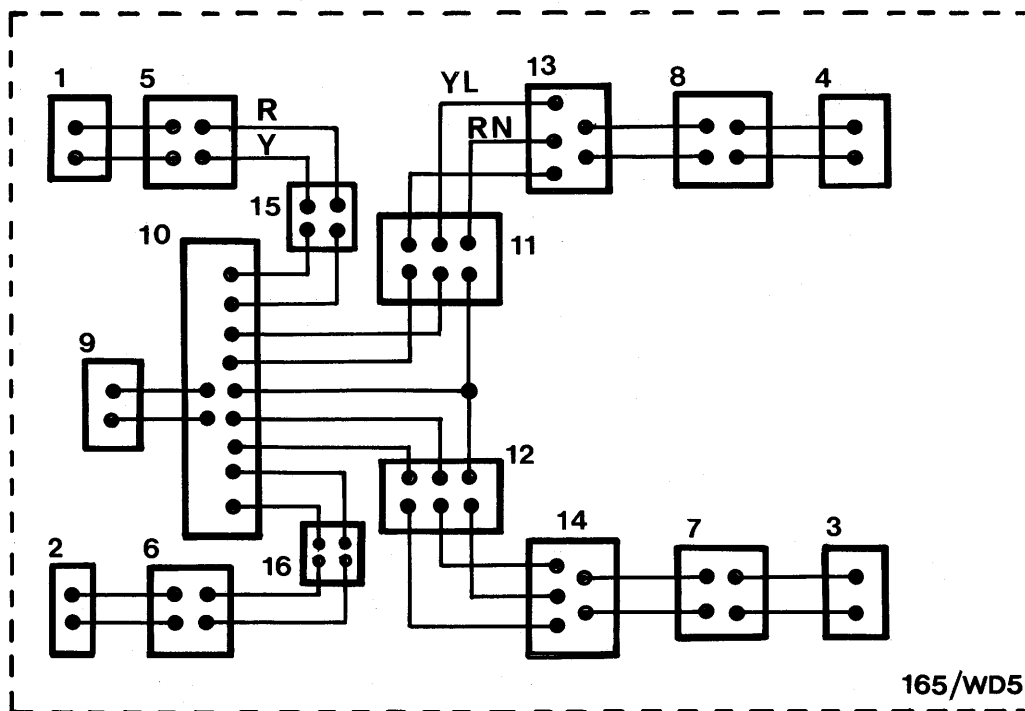
COLOR CODE

The first letter of the code represents the main wire color, the other letters represent the trace colors and where a sleeve is installed on the wire the color of the sleeve is indicated by the letters enclosed in brackets.

B	—	BLACK
L	—	BLUE
G	—	GREEN
R	—	RED
Y	—	YELLOW
W	—	WHITE
N	—	BROWN
O	—	ORANGE
K	—	PINK
S	—	GREY
V	—	VIOLET
P	—	PURPLE
X	—	LIGHT GREEN
Z	—	LIGHT BLUE
M	—	DARK GREEN
T	—	DARK BLUE
A	—	LIGHT BROWN
E	—	SLATE
D	—	TAN

KEY

1. Thermostat (air conditioning only).
2. Heater/air conditioning resistor unit.
3. Heater/air conditioning motor.
4. Wiring plug.
5. Fan switch.
6. Connector.
7. Ignition switch (accessory circuit).
8. Fuse.
9. Connector.
10. Clutch/fan switch.
11. Connector.
12. Heater/air conditioning motor relay (in relay block).



165/WD5

Wiring diagram for models fitted with power windows.

COLOR CODE

The first letter of the code represents the main wire color, the other letters represent the trace colors and where a sleeve is installed on the wire the color of the sleeve is indicated by the letters enclosed in brackets.

- B - BLACK
- L - BLUE
- G - GREEN
- R - RED
- Y - YELLOW
- W - WHITE
- N - BROWN
- O - ORANGE
- K - PINK
- S - GREY
- V - VIOLET
- P - PURPLE
- X - LIGHT GREEN
- Z - LIGHT BLUE
- M - DARK GREEN
- T - DARK BLUE
- A - LIGHT BROWN
- E - SLATE
- D - TAN

KEY

- 1. R.H. front window motor.
- 2. L.H. front window motor.
- 3. L.H. rear window motor.
- 4. R.H. rear window motor.
- 5. Connector.
- 6. Connector.
- 7. Connector.
- 8. Connector.
- 9. Connector.
- 10. Power window switch (console).
- 11. Connector.
- 12. Connector.
- 13. R.H. rear door switch.
- 14. L.H. rear door switch.
- 15. Connector.
- 16. Connector.

1. WINDSCREEN OR REAR WINDOW GLASS

The renewal or replacement of the windscreen and the rear window glass follows the same basic procedure.

The successful fitting and sealing of the windscreen or rear glass will depend to a large extent on the technical knowledge and experience of the operator. It is not recommended that rear window glass or windscreen replacement be attempted by anyone lacking in previous experience.

2. FRONT DOORS

INTERIOR HANDLES AND TRIM PANEL

To Remove and Instal

(1) Using a suitable size Philips screwdriver, unscrew the retaining screws holding the arm rest and remove the arm rest.

(2) Prise the glued screw cover off the centre of the window regulator handle and using the correct size Philips screwdriver unscrew the handle retaining screw and remove the handle.

(3) Lift the door lock sniper button to the open position then unscrew and remove the sniper button.

(4) Insert a thin wide bladed lever between the trim panel and the door, near a retaining clip, lever the clip out of its retaining plug taking care not to damage the door panel paint work.

(5) Lever each clip free in turn and remove the door

trim panel.

(6) Carefully remove the plastic sealing sheet from the inner door panel by lifting out all the retaining plugs.

Installation is a reversal of the removal procedure with attention to the following points:

(1) Locate the plastic sealing sheet correctly on the inner door panel and instal all the retaining plugs.

(2) Fit the door trim to the inner door panel, shoulder first, press in the retaining clips one at a time taking care not to damage the trim backing panel. Press gently around the door trim after assembly with the palm of the hand, to lock the clips.

(3) Screw the sniper button onto the door lock rod.

(4) Place the window regulator handle over the splines and tighten the retaining screw. Adhere a new screw cover to the centre of the window regulator handle.

(5) Replace the arm rest and tighten the retaining screws taking care not to strip the plastic inserts.

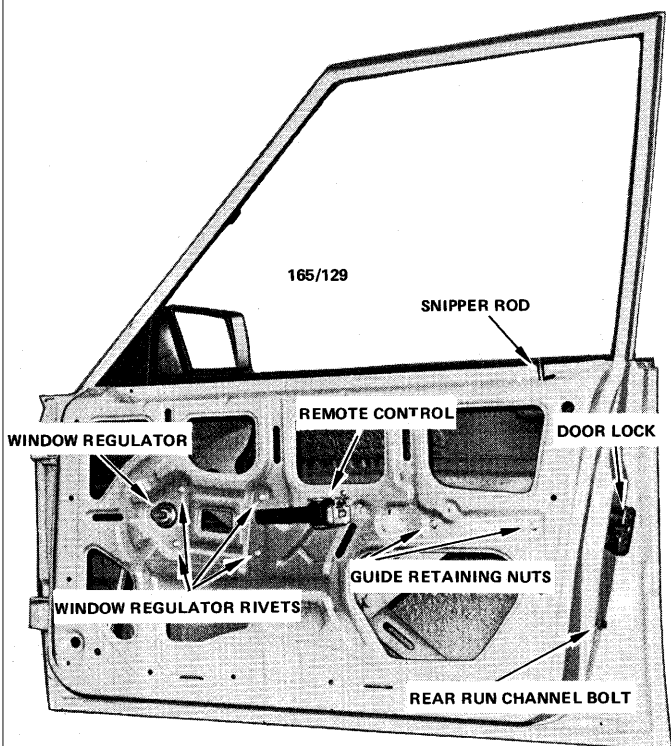
DOOR GLASS

To Remove and Instal

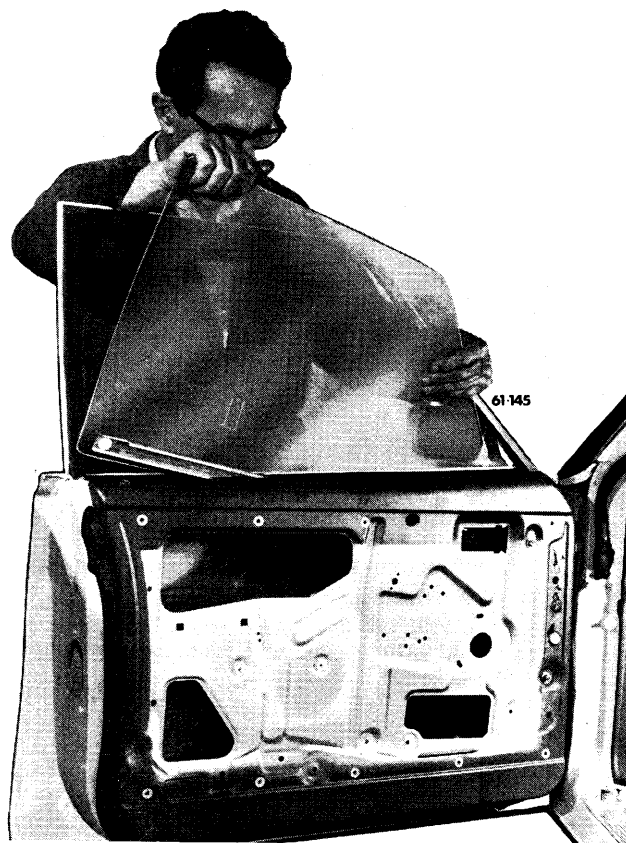
(1) Remove the door trim panel and sealing sheet as previously described in this section.

(2) Wind the door glass down until the glass retainers can be seen at the access holes in the inner door panel.

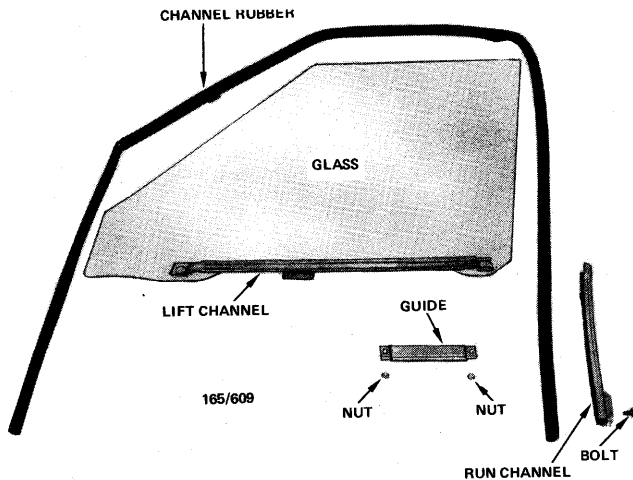
(3) Remove the front run channel lower attaching



Front door with trim panel removed.



Removing front door glass. Typical.



View of front door glass and associated parts.

bolt on the inner panel.

(4) Remove the rear run channel lower attaching bolt at the side inner panel.

(5) Tilt the front of the glass down and carefully disengage the glass from the front run channel. Slide the glass forward and slip the rear nylon runner out of the lift channel. Lift the door glass rear end first out of the door from the inside.

Installation is a reversal of the removal procedure with attention to the following points:

Lower the glass into the door front first, taking care not to damage the outer weatherstrip. Working from the inside, engage the nylon runners into the window lift channel, gently push the glass to the rear and carefully manoeuvre the front run channel onto the glass. Position the glass into the rear run channel.

Fit the rear run channel lower attaching bolt and tighten the bolt.

Fit the front channel lower attaching bolt and push the run channel onto the glass. Tighten the bolt and check the end float by winding the glass up and down two or three times. Front glass end float is adjusted at the front run channel lower attaching bolt.

WINDOW REGULATOR

To Remove and Instal

(1) Remove the trim panel and door glass as previously described.

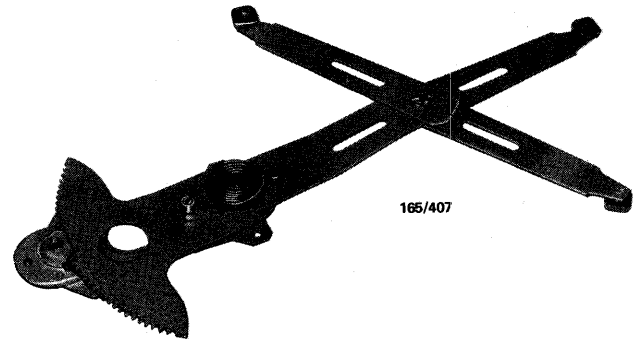
(2) Remove the regulator arm guide retaining nuts and withdraw the regulator arm guide.

(3) Drill out the regulator retaining rivets and remove the regulator from the door through the inner panel access hole.

Installation is a reversal of the removal procedure with attention to the following points:

Position the regulator inside the door. Retain the regulator with new screws and nuts but do not tighten at this stage.

Lower the glass installing it to the regulator as previously described. Slide the regulator arm guide into



Right hand front window regulator.

place and hold in place with the two retaining nuts. Do not tighten the nuts at this stage.

Fit the glass into both front and rear channelling, instal and tighten the rear channel attaching bolt.

Fit the front run channel lower attaching bolt, push the run channel firmly onto the glass and tighten the bolt.

Wind the window up to its full extent and tighten all the regulator retaining screws. Wind the window up and down 2-3 times to centre the regulator arm guide then tighten the regulator arm guide retaining nuts.

REMOTE CONTROL AND DOOR LOCK

To Remove and Instal

(1) Remove the regulator handle, arm rest, door trim and sealing sheet as previously described.

(2) Wind the window to the closed position.

(3) Remove the remote control retaining screw.

Disconnect the remote control assembly from the rod and remove the assembly from the vehicle.

(4) Disconnect the remote control rod from the plastic retainer on the lock assembly lever.

(5) Disconnect the door lock cylinder rod at the rear of the lock cylinder.

(6) Disconnect the outer door handle actuating rod from the plastic retaining clip at the handle.

(7) Remove the rear run channel retaining bolt and gently pull the rear run channel down and remove it from the door.

(8) Using the correct size Philips screwdriver remove the retaining screws from the door lock and remove the lock guide assembly from the door. Remove the lock assembly out of the door through the access hole in the inner door panel.

Installation is a reversal of the removal procedure.

LOCK CYLINDER

To Remove and Instal

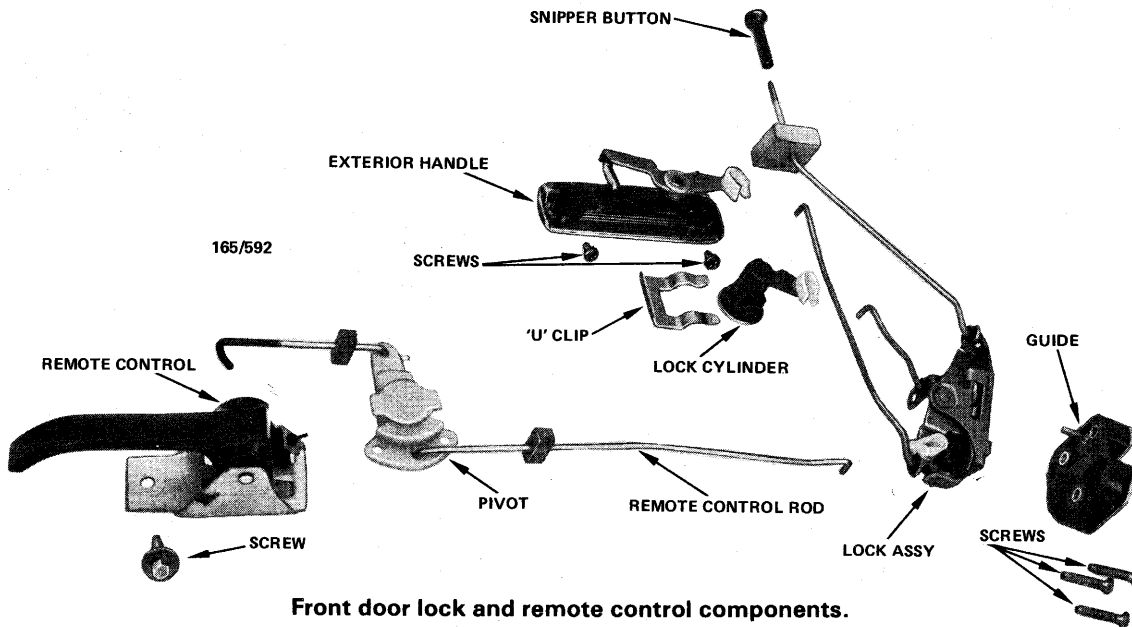
(1) Remove the door trim panel and plastic sealing sheet as previously described.

(2) Disconnect the door lock cylinder rod from the rear of the lock cylinder.

(3) Pull the lock cylinder retaining 'U' clip forward to release the cylinder and remove the cylinder from the door.

Installation is a reversal of the removal procedure.

Body



Front door lock and remote control components.

**EXTERIOR DOOR HANDLE
To Remove and Instal**

- (1) Remove the door trim panel and plastic sealing sheet as previously described.
- (2) Disconnect the exterior door handle actuating rod at the plastic retaining clip on the handle.
- (3) Undo the exterior door handle retaining screws and remove the door handle from the door.

Installation is a reversal of the removal procedure with attention to the following point:

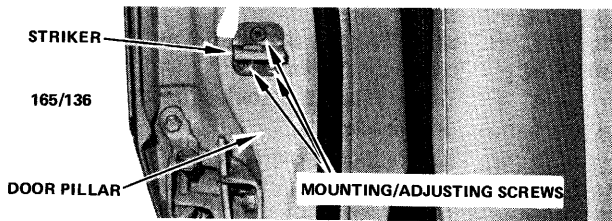
Check the operation of the door handle and lock assembly before completely finishing the assembly procedure.

NOTE: Care must be taken when replacing the outer door handle or lock cylinder assemblies so as not to damage the surrounding paintwork.

**LOCK STRIKER
To Renew and Adjust**

- (1) Mark the position of the striker plate on the door pillar with a soft lead pencil to facilitate correct replacement of the striker plate.
- (2) Remove the three Philips head screws and remove the striker plate and shims. Inspect and renew parts as required.

Installation is a reversal of the removal procedure with attention to the following points:



Front door striker plate mounted on door pillar.

- (1) Refit the striker plate and shims according to the pencil marks made on removal. Refit the three set screws but only tighten them sufficiently to hold the striker plate in position.

- (2) Close the door and push it firmly shut.
- (3) Lift the outer door handle and carefully open the door without moving the striker plate.

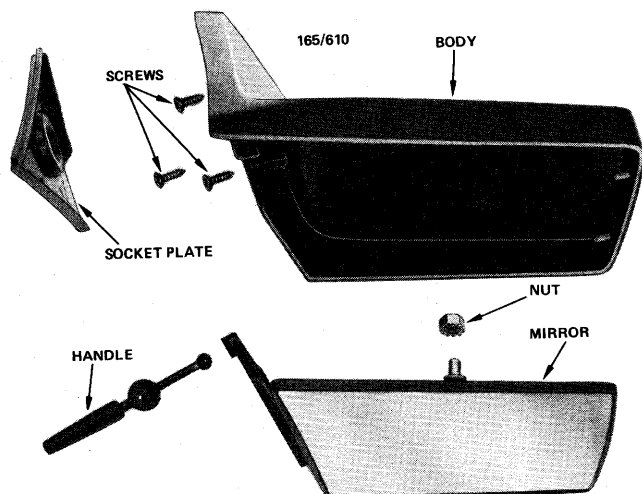
- (4) Tighten the three screws and again close the door, checking the operation of the door lock and striker plate. If further adjustment is necessary open the door and slacken off the three set screws and move the striker plate a small amount in the direction required and retighten the screws.

**EXTERIOR DOOR MIRROR
To Remove and Instal**

- (1) Remove the door trim panel as described in this section.
- (2) Carefully lever the exterior mirror adjusting arm cover panel from the door frame.
- (3) Carefully lever out the glass channelling rubber from around the mirror area.
- (4) Drill out the two pop rivets retaining the mirror assembly.
- (5) Working outside the vehicle remove the two screws retaining the seal and mirror assembly to the door frame.
- (6) Loosen the front run channel lower attaching bolt to aid removal of the mirror.
- (7) Remove the mirror assembly.

Installation is a reversal of the removal procedure with attention to the following points:

- (1) Locate the mirror assembly in the door frame ensuring that the seal is correctly located in the door frame.
- (2) Fit the outer weather seal and secure the mirror assembly to the door with the two retaining screws. Tighten the front run channel attaching bolt.



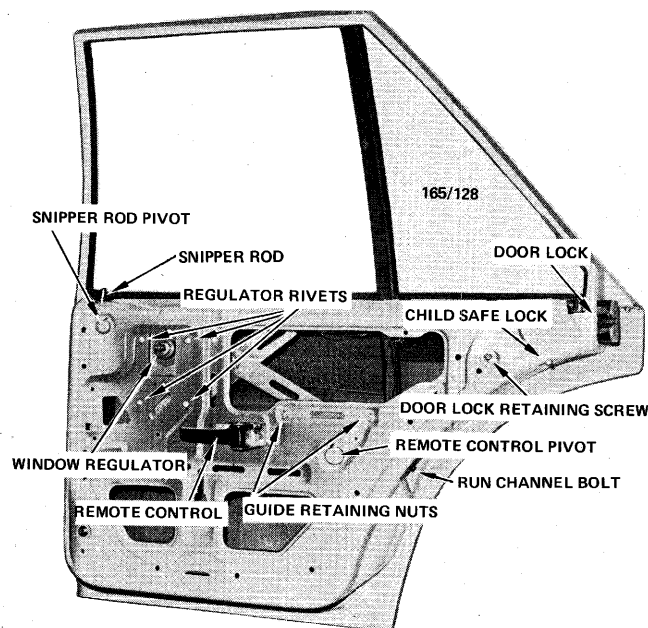
Dismantled view of exterior rear vision mirror.

- (3) Using a 3.20 mm drill, drill through the glass run channel and mirror assembly and pop rivet the mirror into position.
- (4) Refit the glass channel rubber.
- (5) Check the mirror movement and door glass operation and adjust if necessary.
- (6) Refit the door trim panel and the mirror cover panel.

3. REAR DOORS

INTERIOR HANDLES AND TRIM PANEL To Remove and Instal

- (1) Lift the door lock sniper button to the open position then unscrew and remove the sniper button.
 - (2) Unscrew the three Philips head screws holding the arm rest and remove the arm rest.
 - (3) Prise the glued screw cover off the centre of the window regulator handle, unscrew the handle retaining screw and remove the handle.
 - (4) Using a thin wide bladed lever inserted between the trim and the door, near a retaining clip, lever the clip out of its retaining plug taking care not to damage the door panel paintwork.
 - (5) Lever each clip free in turn and remove the door trim panel.
 - (6) Carefully remove the plastic sealing sheet from the inner door panel by removing all the retaining plugs.
- Installation is a reversal of the removal procedure with attention to the following points:
- (1) Locate the plastic sealing sheet on the inner door panel and instal all the retaining plugs.
 - (2) Fit the door trim to the inner door panel, shoulder first, press in the retaining clips one at a time, taking care not to damage the trim backing panel. Press gently around the door trim after assembly, with the palm of the hand, to lock the clips into place.
 - (3) Screw the sniper button onto the door lock rod.
 - (4) Place the window regulator handle over the



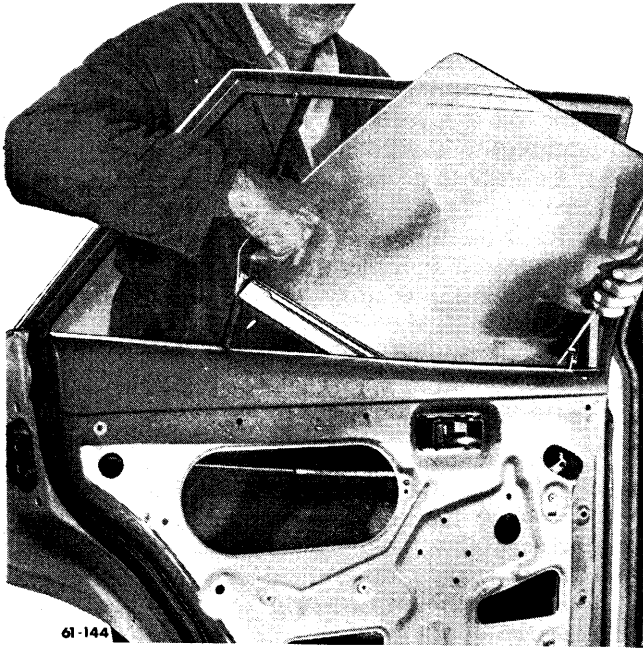
Rear door with trim panel removed.

splines and tighten the retaining screw. Adhere a new screw cover to the centre of the window regulator handle.

- (5) Replace the arm test. Care must be taken when tightening the three retaining screws so as not to strip the plastic inserts.

DOOR GLASS To Remove and Instal

- (1) Remove the door trim panel, and sealing sheet as previously described in this section.
 - (2) Raise the glass to the full closed position. Undo and remove the front lower run channel retaining bolt. Gently pull the front lower run channel rail down and remove it from the door.
 - (3) Wind the glass down until the plastic glass retainers can be seen through the inner panel access hole.
 - (4) With an assistant holding against the glass at the retainers, use a suitable pin punch and hammer, to carefully tap the centre pin through the retainer at each end of the lift channel.
 - (5) Remove the retainers, slide the glass out of the run channels front and rear, tilt and lift the glass clear and out of the door.
- Installation is a reversal of the removal procedure with attention to the following points:
- (1) Position the glass in the door and align the two holes in the glass with the two holes in the lift channel.
 - (2) Instal the two retainers by pressing them into the lift channel and the glass. Insert the centre pin into each retainer and gently tap the pins until the pins are flush with the retainer flange.
 - (3) Position the glass back into the front and rear run channels and wind the glass up to the full closed position.
 - (4) Refit the front lower run channel rail and secure



Removing rear door glass. Typical.

it with the retaining bolt. Wind the window midway down, push the front run channel onto the glass and tighten the retaining bolt.

(5) Wind the glass up and down two or three times to centre the glass. If any adjustments are required, loosen the front lower channel bolt and move the channel to obtain correct alignment. Retighten the bolt upon completion.

(6) Assemble the door trim, arm rest and regulator handle to the inner door panel.

STATIONARY GLASS

To Remove and Instal

(1) Remove the door trim and sealing sheet as previously described.

(2) Remove the door glass as previously described.

(3) Undo the rear lower run channel retaining bolt. Working through the inner door panel access hole, undo and remove the centre rear run channel retaining bolt. Using a Philips screwdriver undo the two screws retaining the top of the rear run channel.

(4) Gently pull the run channel away from the stationary glass and remove the channel from the door.

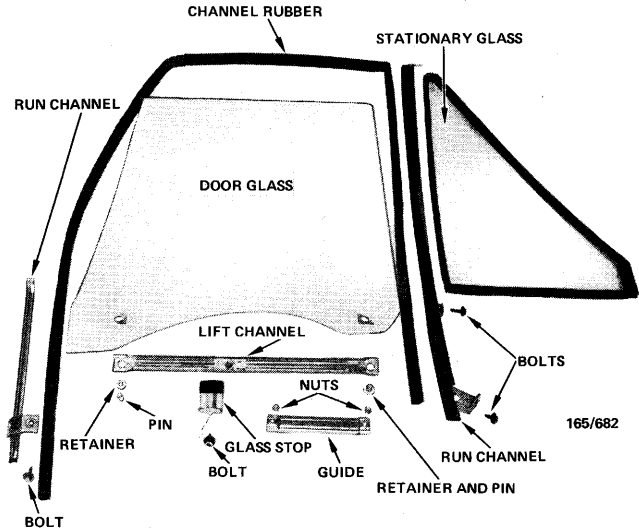
(5) Carefully pull the stationary glass out of the door frame and remove it from the door.

Installation is a reversal of the removal procedure with attention to the following points:

Make sure the stationary glass is centred correctly in the door frame before tightening the rear run channel retaining bolts.

Ensure that all the channel rubbers are correctly in place before fitting the door glass.

Check door glass adjustments and tighten the lower front channel retainer bolt before fitting the door trim panel.



Rear door glass, stationary glass and associated components.

WINDOW REGULATOR

To Remove and Instal

(1) Remove the door trim panel as previously described.

(2) Remove the door glass as previously described.

(3) Undo the two retaining nuts holding the regulator guide to the inner door panel and remove the regulator guide from the door.

(4) Drill out the four pop rivets attaching the regulator to the inner door panel and remove the regulator from the door.

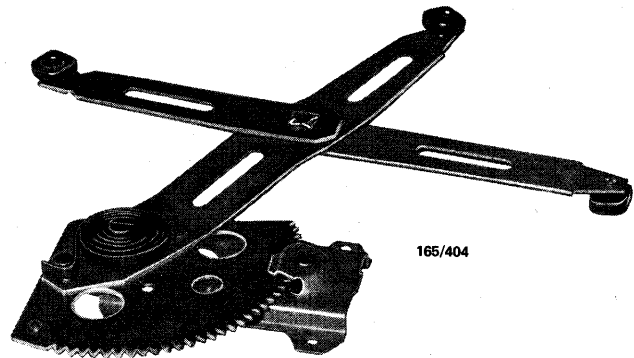
Installation is a reversal of the removal procedure with attention to the following points:

Position the regulator correctly in the door and instal new attaching screws.

Fit the regulator guide onto the regulator arm. Fit but do not tighten the two guide retaining nuts.

Wind the door glass closed and tighten the two guide retaining nuts.

Adjust the run channels if necessary and instal the door trim panel.



Right hand rear window regulator.

REMOTE CONTROL AND DOOR LOCK**To Remove and Instal**

(1) With the door glass in the fully raised position remove the trim panel and sealing sheet as previously described.

(2) Remove the remote control retaining screw, unhook the actuating rod from the rear of the remote control and remove the remote control from the door. Disconnect the remote central rod from the pivot.

(3) Disconnect the sniper rod at the sniper pivot assembly. Unhook the sniper rod out of the anti-rattle plastic guide and raise the rod through the door glass aperture.

(4) Working through the inner door panel access hole, disconnect the outer door handle actuating rod at the outer door handle pivot assembly. Unscrew the outer door handle pivot assembly retaining screw, unhook the lock actuating rod and remove the door handle pivot assembly from the door.

(5) Remove the door lock retaining screw from the inner door panel and unscrew the screws retaining the door lock and guide assembly. Remove the guide. Carefully remove the door lock through the access hole and out of the door.

Installation is a reversal of the removal procedure with attention to the following points:

Instal the door lock making sure all actuating rods are positioned in their correct place.

Support the door lock and align the outer door lock guide and the screws with the door lock. Tighten the screws. Instal the inner panel to door lock retaining screw and tighten the screw.

Hook the door lock actuating rod to the outer door handle pivot and fit the outer door handle pivot to the inner door panel. Clip the outer door handle actuating rod to the pivot assembly.

Connect the remote control actuating rod and instal the remote control. Tighten the retaining screw.

Clip the sniper rod into the plastic guide and connect the rod to the sniper button pivot assembly.

Check the operation of the locking unit before refitting the door trim panel.

EXTERIOR DOOR HANDLE**To Remove and Instal**

(1) Remove the door trim panel and sealing sheet as described previously.

(2) Remove the remote control and door lock as previously described.

(3) Undo the two outer door handle retaining screws and remove the door outer handle from the door.

(4) Installation is a reversal of the removal procedure with attention to the following points:

Place the outer door handle onto the door, align the retaining screw holes, instal and tighten the screws.

Check the operation of the door handle and lock before completely finishing the assembly procedure.

LOCK STRIKER**To Renew and Adjust**

(1) Mark the position of the striker plate on the door pillar with a soft lead pencil to facilitate correct replacement of the striker plate.

(2) Remove the three Philips head screws and remove the striker plate and shims. Inspect and renew parts are required.

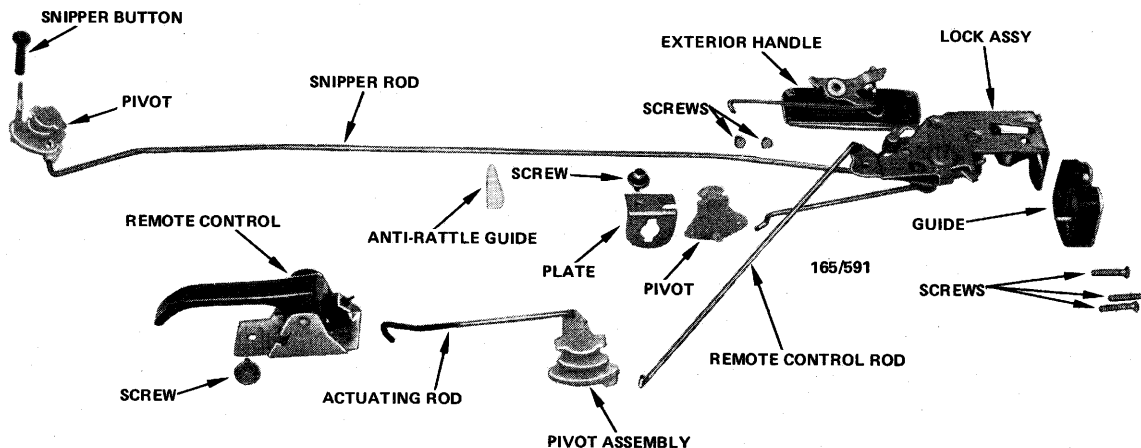
Installation is a reversal of the removal procedure with attention to the following points:

(1) Refit the striker plate and shims according to the pencil marks made on removal. Refit the three screws but only tighten them sufficiently to hold the striker plate in position.

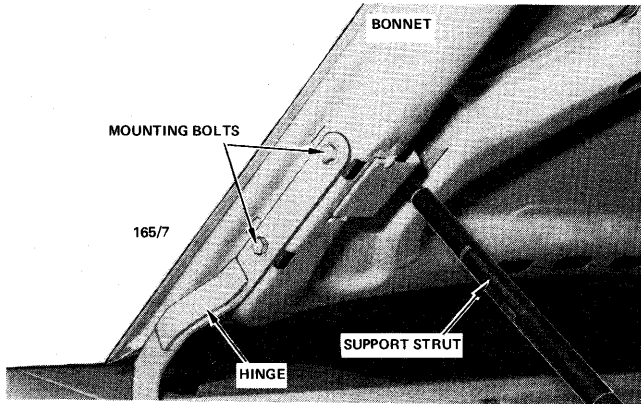
(2) Close the door and push it firmly shut.

(3) Lift the outer door handle and carefully open the door without moving the striker plate.

(4) Tighten the three set screws and again close the door, checking the operation of the door lock and striker plate. If further adjustment is necessary open the door and slacken off the three set screws and move the striker plate a small amount in the direction required and retighten the set screws.



Rear door lock and remote control components.



Engine bonnet mounting.

4. ENGINE BONNET

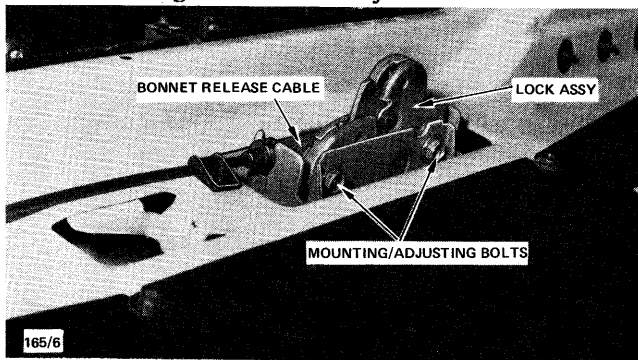
TO REMOVE, INSTAL AND ADJUST

- (1) Raise the bonnet and place fender covers on both the front fenders.
- (2) Mark around the bonnet hinge plates on the bonnet with a soft lead pencil to facilitate accurate refitting.
- (3) With the aid of an assistant supporting the bonnet, disconnect the bonnet support strut at the bonnet end ball joint.
- (4) Undo the four bonnet to hinge plate retaining bolts and lift the bonnet clear of the vehicle.

NOTE: Once the bonnet has been removed, the bonnet hinges can be withdrawn from the body by removing the rubber hinge seal and sliding the hinge sideways towards the vehicle centre line.

Installation is a reversal of the removal procedure with attention to the following points:

- (1) Holding the bonnet in the position previously marked, fit the bonnet hinge bolts and tighten to just over finger tight.
- (2) Close the bonnet and by pushing with the hand, position the bonnet evenly in its opening.
- (3) Open the bonnet carefully and tighten the mounting bolts.
- (4) Recheck for correct positioning. If necessary loosen one hinge at a time to adjust.



Engine bonnet lock assembly in position.

(5) Check the bonnet catch. When the catch is released the bonnet should pop up sufficiently to enable the fingers to release the safety catch and lift the bonnet.

(6) If adjustment is necessary, first mark the base position with a pencil then loosen the retaining bolts and move the catch in the desired direction. Tighten the bolts and recheck.

(7) Reconnect the bonnet support strut ball joint to the bonnet.

5. LUGGAGE COMPARTMENT LID

COMPARTMENT LID

To Remove, Instal and Adjust

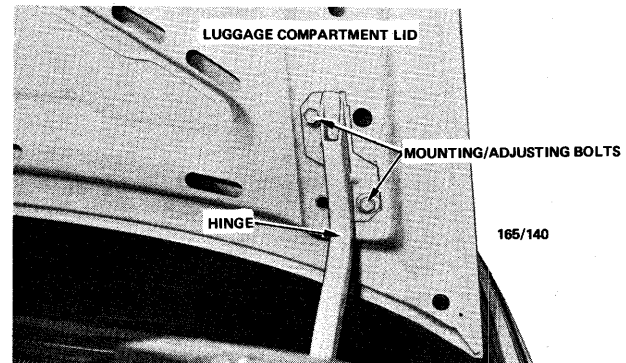
(1) Open the lid and with a soft lead pencil mark around the edges of the mounting plate to lid position on both sides.

(2) With an assistant supporting the lid remove the two bolts from each hinge plate and remove the lid.

Installation is the reversal of the removal procedure with the addition of the following points:

Tighten the mounting bolts to just over finger tight and close the lid. Check for even clearance around the lid and push into position with the hands.

When the lid is correctly positioned, carefully open and tighten the hinge bolts and recheck the lid alignment.



Luggage compartment lid mounting.

TORSION BARS

To Remove and Instal

(1) Open the luggage compartment lid and support it in the raised position.

(2) Grasp the end of the left torsion bar and pull the end out of the body locating aperture.

(3) Disengage the left torsion bar from the bracket and left hand side hinge and remove the torsion bar.

(4) Remove the right torsion bar in the same manner.

Installation is a reversal of the removal procedure with attention to the following points:

Engage the hinge end of the right torsion bar with the hinge first.

Slip the other end into the bracket and pull the end of the torsion bar rearwards to engage with the body locating aperture.

Install the left torsion bar in the same manner.

After both torsion bars have been located in their correct positions remove the lid support. The luggage compartment lid should not fall under its own weight.

LOCK AND LOCK CYLINDER

To Remove and Instal

(1) With the lid in the open position, remove the lock cylinder retaining clip from inside the lid panel and remove the lock cylinder.

(2) Remove the retaining bolts holding the lock and manoeuvre the lock from the lid.

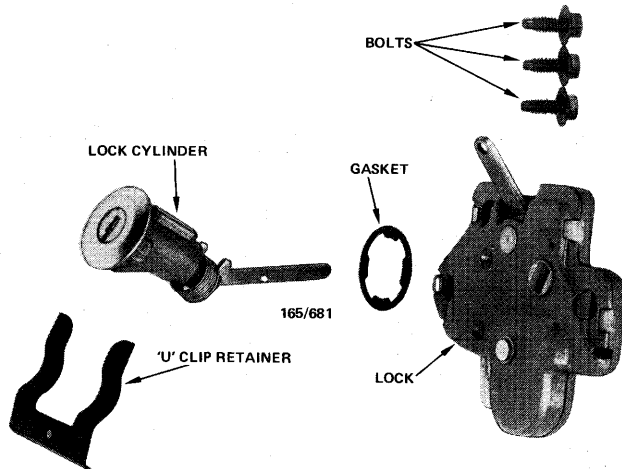
Installation is a reversal of the removal procedure.

To Adjust

(1) Ensure that the luggage compartment lid is centred correctly and squarely in its opening. If necessary align as previously described.

(2) Loosen the lock retaining bolts and carefully lower the luggage compartment lid until it is completely closed. Carefully open the lid so as not to move the lock assembly and tighten the lock assembly retaining bolts.

(3) Check and if necessary readjust until the lock assembly makes good contact with the striker plate.



Luggage compartment lock and lock cylinder removed from lid.

LOCK STRIKER

To Adjust

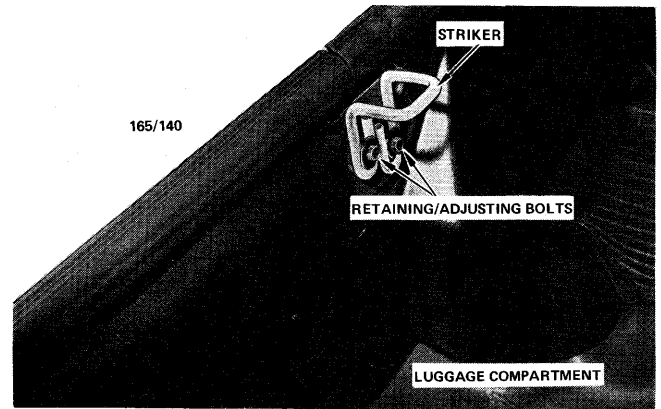
(1) Loosen the retaining bolts to just over finger tight.

(2) Lower the luggage compartment lid until it is completely closed.

(3) Carefully open the lid so as not to move the striker plate. Tighten the striker plate retaining bolts.

(4) Lower the luggage lid and ensure that the striker enters centrally into the lock assembly. Once again close and open the lid to check the lock and striker operation.

(5) By raising or lowering the striker plate as necessary, increase or decrease the clearance between the



Luggage compartment lock striker.

luggage compartment lid and the weather seal to correctly adjust and seal the luggage compartment lid.

6. TAILGATE ASSEMBLIES

STATION WAGON MODELS

To Remove and Instal

(1) Open the tailgate.

(2) Detach the tailgate weatherseal from the roof lining and disconnect the wiring connectors.

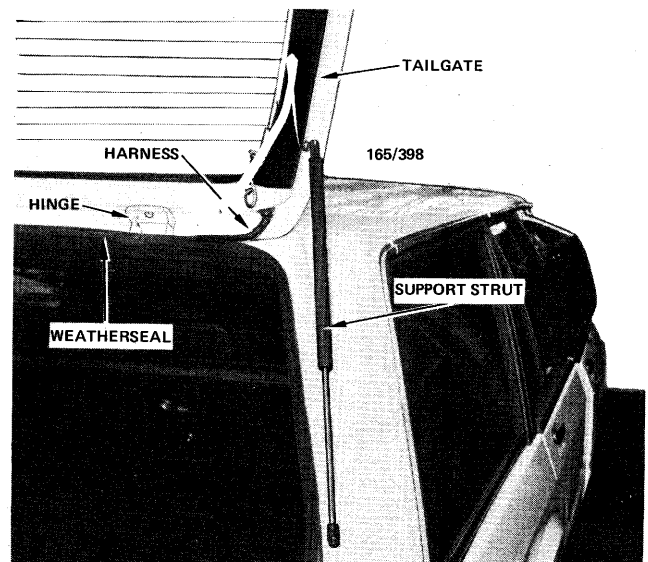
(3) Remove the wiring harness retainers from the hinges, remove the nuts retaining the grommets and remove the grommets.

(4) With the aid of an assistant disconnect and remove the tailgate support struts.

(5) Close the tailgate completely.

(6) Working inside the vehicle remove the hinge to body retaining nuts.

(7) Carefully open the tailgate and with the aid of an assistant, lift the tailgate with its wiring harness from the vehicle.



View of tailgate hinge and support. Station Wagon.

NOTE: Spacers, located on the hinge studs, will most probably fall away as the tailgate is being removed. Be sure to replace the same spacers on the same side tailgate hinge when installing.

Installation is a reversal of the removal procedure with attention to the following points:

(1) With the aid of an assistant, position the tailgate in its opening with the spacers located on the hinge studs. Position the studs, wiring harness and grommets in the body rail.

(2) Close the tailgate completely.

(3) Align the tailgate correctly in the body and tighten the hinge retaining nuts from inside the vehicle. Install the grommet securing nuts. Connect the wiring harness.

(4) Open the tailgate and install the tailgate support struts.

(5) Install the wiring harness retainers to the hinges.

(6) Check the tailgate fit in the body and the adjustment of the lock and striker assemblies.

(7) Replace the roof lining and the weatherseal.

To Remove, Install and Adjust Lock.

(1) Remove the reverse and number plate lamp.

(2) With a soft lead pencil, scribe a line around the lock body and the tailgate.

(3) Remove the nuts securing the lock to the tailgate and remove the lock.

Installation is a reversal of the removal procedure with attention to the following points:

(1) Position the lock to the tailgate with the lock release handle on top of the lock cylinder.

(2) Align the lock with the pencil lines drawn before dismantling and retain the lock by tightening the retaining nuts just over finger tight.

(3) Close the tailgate fully then carefully open the tailgate and tighten the lock retaining nuts.

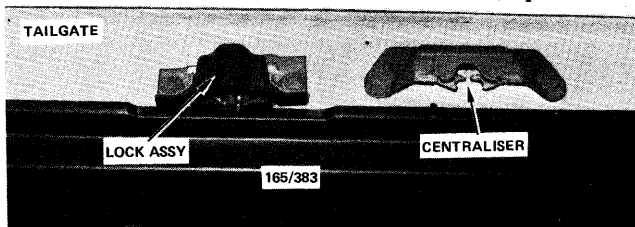
(4) Check and readjust if necessary. Replace the reverse and licence plate lamp.

To Renew and Adjust Lock Striker

(1) Mark the position of the striker assembly on the vehicle with a soft lead pencil to facilitate correct replacement of the striker assembly.

(2) Remove the bolts retaining the striker and remove the striker assembly. Inspect and renew the striker where necessary.

Installation is a reversal of the removal procedure



Tailgate lock assembly in position. Station Wagon.

with attention to the following points:

(1) Fit the striker assembly according to the pencil marks made on removal. Install the retaining bolts but only tighten them sufficiently to hold the striker in position.

(2) Close the tailgate and push it firmly shut.

(3) Carefully open the tailgate without moving the striker assembly.

(4) Tighten the retaining bolts and again close the tailgate checking the operation of the tailgate lock and striker assembly. If further adjustment is necessary open the tailgate, loosen the retaining bolts and move the striker assembly a small amount in the required direction and retighten the retaining bolts.

To Remove and Install Lock Cylinder

(1) Remove the lock as described previously.

(2) Remove the lock cover panel.

(3) Pull the lock cylinder retainer off the cylinder and remove the lock cylinder from the tailgate.

Installation is a reversal of the removal procedure with attention to the following points:

Position the lock cylinder in the tailgate and install the retainer.

Refit the lock in the tailgate, place the lock cover panel over the lock studs and install retaining nuts.

Check and carry out all necessary adjustments.

UTILITY AND PANEL VAN MODELS

To Remove and Install Tailgate — Utility and Panel Van

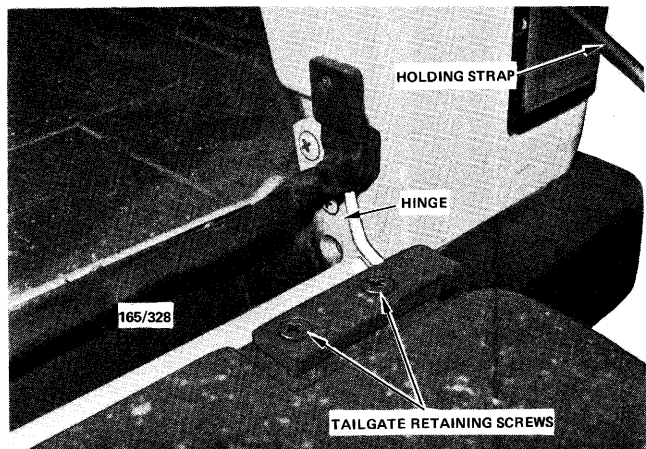
(1) Open the tailgate and rest it on the holding straps. Mark the tailgate around the hinge plates with a soft lead pencil.

(2) Loosen but do not remove the hinge to tailgate retaining screws.

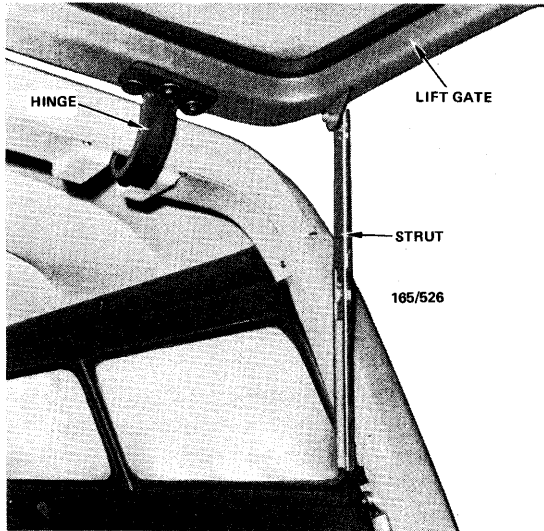
(3) With an assistant supporting the tailgate, disconnect the holding straps at the tailgate.

(4) Undo the hinge to tailgate retaining screws and remove the tailgate from the vehicle.

Installation is a reversal of the removal procedure with attention to the following points:



View of right hand tailgate hinge. Utility and Panel Van.



Installed view of lift gate showing hinge and support strut.

With an assistant supporting the tailgate, install and tighten the hinge to tailgate retaining screws, after aligning the marks made on removal.

Connect both holding straps to the tailgate. Raise the tailgate and check the alignment of the tailgate in its opening.

To Remove and Install Lift Gate — Panel Van

(1) With an assistant holding the lift gate open, undo and remove the nuts securing the lift gate support struts to the lift gate.

(2) Using a soft lead pencil, scribe a line around the hinges at the lift gate.

(3) Remove the three retaining bolts from both hinges and remove the lift gate from the vehicle.

Installation is a reversal of the removal procedure with attention to the following points:

Locate the lift gate to the vehicle and tighten the retaining bolts just over finger tight.

Adjust the lift gate to obtain an equal gap between the body and the lift gate.

Adjust the striker plates if necessary to obtain the correct opening and closing action.

Refit the lift gate support struts and recheck the lift gate and body line. Tighten the hinge bolts.

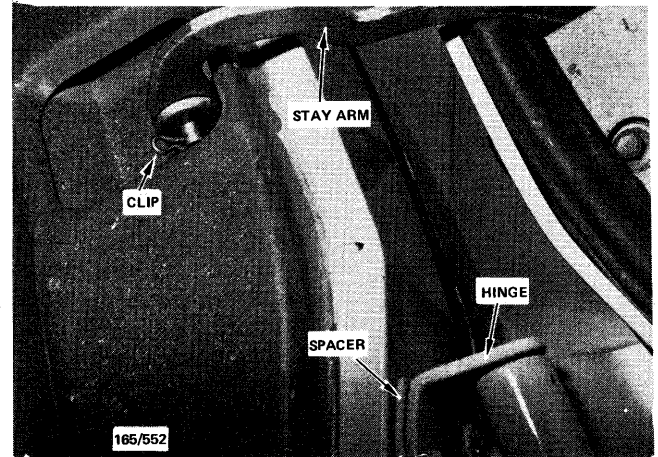
To Remove and Install Rear Doors — Panel Van

(1) Open the rear doors to their full extent.

(2) Remove the clip retaining the rear door stay arm and by lifting, disconnect the door stay arm from the body.

(3) With the aid of an assistant supporting the door, undo and remove the two retaining screws from each hinge to body plate and remove the door from the vehicle. When removing the door note the position of the hinge spacer plates to facilitate correct installation.

Installation is a reversal of the removal procedure with attention to the following points:



View of rear door hinge and stay arm. Panel Van.

With the aid of an assistant, place the door to the vehicle with the hinges in the open position. Fit the retaining screws and the correct spacer plates to the hinges and tighten the retaining screws to just over finger tight.

By lifting the door up or down and pulling sideways position the door squarely in its opening in the body. Carefully open the door and tighten the hinge retaining screws.

Recheck the door position and realign if necessary.

Place the door stay arm onto its retaining bracket and refit the clip.

To Remove and Install Tailgate Lock

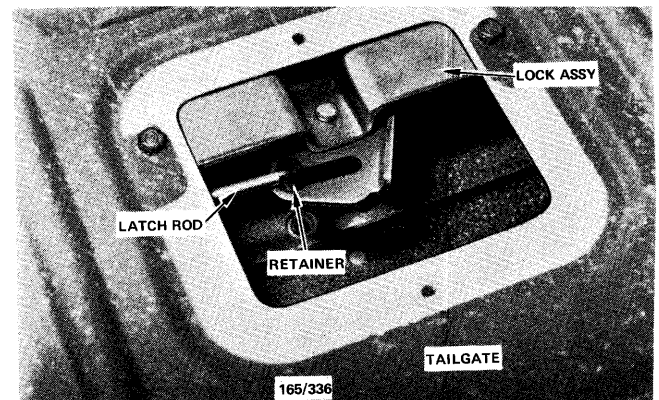
(1) Open the tailgate and allow the tailgate to lay on its retaining straps.

(2) Remove the two screws and lift off the lock cover plate.

(3) Undo the two screws retaining the tailgate handle cover and remove the cover.

(4) Disconnect the two latch rods by unclipping them from their plastic retainers.

(5) Undo the two lock assembly retaining bolts and remove the lock assembly through the access hole and out of the tailgate.



View of tailgate internal mechanism. Utility and Panel Van.

NOTE: The spring loaded latch rod can be removed by undoing the two screws retaining the tailgate retaining strap. If both straps are to be removed the tailgate will have to be supported.

Installation is a reversal of the removal procedure with attention to the following points:

When refitting the latch rods make sure the taper on the striker pin is facing upwards with the tailgate open.

Upon completion of the assembly of the tailgate lock unit, check the locking action by opening and closing the tailgate two or three times. If adjustment is necessary, loosen the striker plate retaining screws and by moving the striker plate diagonally in and out, obtain the best possible lock adjustment.

To Remove and Instal Rear Door Lock

(1) Open the rear door and with a flat bladed screwdriver carefully lever out the inner door panel trim retaining plugs, one at a time, taking care during this operation not damage the inner panel trim.

(2) Working through the access hole, unclip the lock cylinder rod from the door lock.

(3) Using a pair of pliers pull the lock cylinder 'U' clip retainer plate away from the cylinder body and remove the lock cylinder.

(4) Undo the two Allen screws retaining the outer door handle and carefully remove the outer door handle.

(5) Undo the two screws retaining the door lock to the door side panel, undo the two screws retaining the door lock to the inner door panel and remove the lock out of the door.

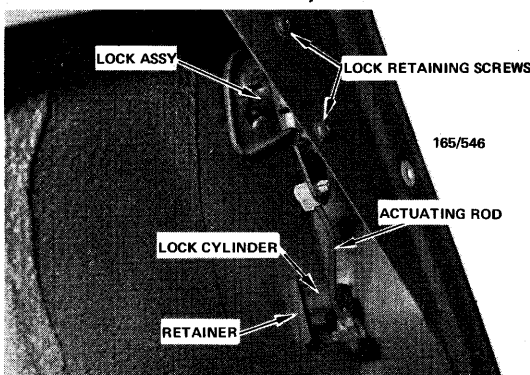
Installation is a reversal of the removal procedure with attention to the following points:

Fit the door lock into the door and retain by tightening the four retaining screws.

Lift the door lock actuating lever and fit the outer door handle to the door and under the actuating lever. Instal and tighten the outer door handle retaining screws.

Place the lock cylinder into the door and retain by sliding the 'U' clip retainer onto the lock cylinder.

Connect the lock cylinder rod to its clip and check the lock operation before closing the door.



View of right hand panel van rear door lock and lock cylinder.

Close the door two or three times to test the operation of the door lock. Carefully fit the inner panel door trim.

7. REAR QUARTER GLASS (UTILITY AND VAN)

TO REMOVE AND INSTAL

(1) Remove the two screws securing the glass catch to the rear pillar.

(2) Hold the glass and remove the two screws securing the hinges to the door pillar and remove the glass.

NOTE: The hinge is made of one piece spring steel and it must not be bent in any way. If the weatherstrip is to be renewed, remove and clean the glass and surrounding body areas thoroughly with suitable solvent. Use the correct type contact adhesive to adhere the weatherstrip to the body.

Installation is a reversal of the removal procedure with attention to the following points:

Position the glass to the window opening and instal the two hinge screws loosely.

Position the glass catch correctly and instal the two catch screws loosely.

Adjust the glass position and tighten the two hinge screws.

Tighten the two catch screws and check glass alignment. Readjust if necessary.

8. RADIATOR GRILLE

The grille is a multi vane one piece moulding. Screws secure the grille to its position on the body of the vehicle.

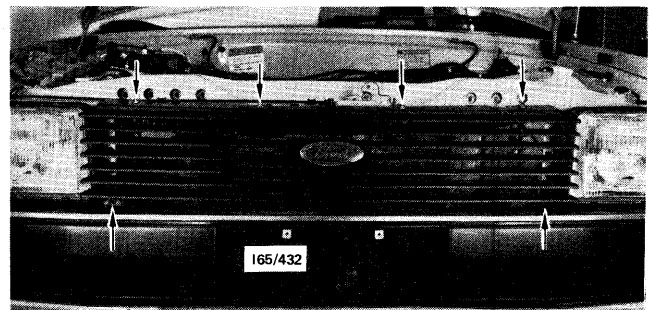
TO REMOVE AND INSTAL

(1) Remove the screw retaining each lower corner of the grille.

(2) Undo and remove the four screws retaining the top rail of the grille to the body.

(3) Remove the grille from the vehicle.

Instal the grille in the reverse order, placing the grille central between the head lamps with all the screw holes aligned for easy assembly. Tighten all the screws securely.



View showing the location of the grille retaining screws.

9. VEHICLE CLEANING

CLEANING THE EXTERIOR

In order to remove dirt and road grime and thus preserve paint finish, vehicles in continuous use should be washed at least once a week.

Before washing the paintwork it is good policy to first hose all dirt from the underbody and clean out the drain holes in the doors and sill panels.

Hose the vehicle first to remove as much grit as possible then wash using a clean chamois or sponge, ensuring that the chamois or sponge is free from dirt or grit which could scratch the paint surface.

Avoid washing the vehicle in bright sunlight with high temperatures as this will give the paintwork a streaky watermarked finish.

If necessary wash the vehicle using a reputable brand 'Wash and Wax' liquid. The 'Wash and Wax' liquid will restore the paint lustre and leave the paintwork with a protective coating of wax.

After a period it may become necessary to polish the vehicle in order to remove built up foreign matter and to give the paintwork maximum protection from industrial fall-out and salt from sea air etc. Before polishing the paintwork always wash the surface to remove as much road grime as possible. When polishing follow the polishing instructions which come with the polish.

NOTE: Grease, oil or tar on the paint surface can be removed with a little kerosene or white spirits. To prevent from staining, wash and polish the affected area as soon as the grease, oil or tar is removed.

GENERAL CLEANING OF VINYL UPHOLSTERY AND TRIM

To maintain the vinyl upholstery and interior trim in good condition it should be regularly vacuumed over to remove loose dirt and then wiped over with a dry or damp cloth.

If the upholstery is soiled or stained the following cleaning procedure is recommended:

- (1) Using warm water, cheese cloth and a mild soap thoroughly wash the affected areas.
- (2) Repeat the operation using damp cheese cloth only.
- (3) To complete the cleaning operation wipe the upholstery over with a dry piece of cheese cloth.

NOTE: If the upholstery or interior trim is badly soiled or stained, wash with a reputable brand of upholstery cleaner carefully following the makers instructions.

TO REMOVE STUBBORN STAINS ON VINYL UPHOLSTERY AND TRIM

NOTE: The following cleaning procedures with recommended removal agents should be used before contemplating trim renewal.

Chewing Gum

- (1) Apply an ice cube to harden the gum.
- (2) Remove as much of the gum as possible with the edge of a spoon.
- (3) Wipe the remaining gum off with a cloth moistened with methylated spirits.
- (4) Finish by washing the affected area with warm soapy water and drying with a clean cloth.

Grease and Other Fatty Stains

- (1) Use a clean dry cloth and remove as much of the grease as possible taking care not to spread the grease any further.
- (2) Carefully wipe away the remaining grease using a cotton cloth moistened with methylated spirits or mineral turps.
- (3) Finish by washing the affected area with warm soapy water and drying with a clean cloth.

Chocolate

- (1) Remove as much of the chocolate as possible with the edge of a spoon.
- (2) Wipe the remaining chocolate off with a cloth moistened with methylated spirits.
- (3) Finish by washing the affected area with warm soapy water and drying with a clean cloth.

Ballpoint Pen Inks

- (1) Mix up equal parts of fresh Calcium Chloride and Fullers Earth. The Calcium Chloride and Fullers Earth can be purchased at the local chemist.
- (2) Add a few drops of methylated spirits and mix all ingredients into a thick paste.
- (3) Apply the paste to the ink stain and allow it to dry.
- (4) Remove the dried paste with a damp cloth.
- (5) Finish by wiping the affected area with a wet cloth and drying with a clean cloth.
- (6) If some of the ink stain still remains, repeat the cleaning procedure.

NOTE: If the removal of the ink stain leaves the affected area dull, the affected area can be revived by wiping over with cotton wool moistened with glycerine

Toffee

- (1) Remove as much of toffee as possible with the edge of a spoon.
- (2) Wash as much of the remaining toffee off using a soft cloth and very hot water.
- (3) To finish the cleaning operation first wipe the affected area over with a cloth moistened with methylated spirits then wash with warm soapy water and dry with a clean cloth.

Blood

- (1) Wash the affected area immediately with cold water.

- (2) If the affected area is still stained, wipe over with household ammonia.
- (3) Finish by washing with warm soapy water and drying with a clean cloth.

Liquor and Fruit Stains

- (1) Wash the affected area with very hot water and allow it to dry.
- (2) When dry wipe over with a clean cloth moistened with methylated spirits.
- (3) Finish by washing the affected area with cold water.

Tar

- (1) Wipe with a clean cloth moistened with mineral turps or kerosene.
- (2) Finish by washing affected area with cold water.

NOTE: Quick action is most essential with tar stains. If the tar is left on the upholstery for

any length of time permanent staining will result.

Ice Cream

- (1) Wash the affected area with warm soapy water.
- (2) If the stain still remains wash repeatedly with very hot soapy water.
- (3) Finish by wiping over the affected area with a cloth moistened with methylated spirits and washing again with warm soapy water.

CLEANING CLOTH TRIM

Loose dirt and dust on cloth trim should be removed with a vacuum cleaner or a very soft brush. Do not use a whisk brush or any other type of coarse brush or damage to the cloth could result. If the fabric is soiled the following cleaning procedure is recommended:

- (1) Sponge the fabric lightly with warm water containing a little detergent and household ammonia.
- (2) After sponging rub the fabric lightly. If soiling is still apparent repeat the sponging operation.
- (3) Use a clean dry cloth to soak up excess fluid.

INTRODUCTION

To reduce the output level of carbon monoxide, hydrocarbons and oxides of nitrogen, which are the three primary automotive emissions and thus comply with the legislation on the maintenance of clean air, three distinct types of emission control systems are used in the range of vehicles.

The systems are known as and will be discussed under the headings of (1) Positive Crankcase Ventilation System, (2) Exhaust Control System and (3) Evaporative Control System.

1. POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

DESCRIPTION

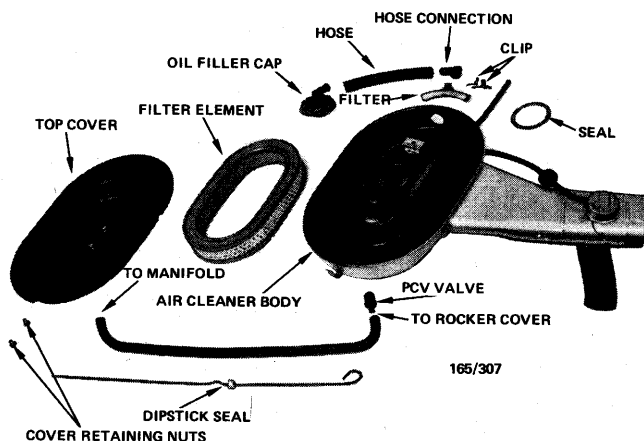
To prevent the emission of unburnt crankcase gases to the atmosphere, a closed type of crankcase ventilation (PCV) system has been introduced.

The closed system draws clean air from the air cleaner and passes it via a filter and hose into the engine through the oil filler cap. The air is then circulated through the engine, then out of a regulating (PCV) valve situated in the rocker cover, through a hose and into the base of the carburettor. Crankcase vapours are therefore fed back into the cylinders and consumed by the engine.

The engine oil dipstick and filler cap are also sealed from atmosphere.

The system is most effective during acceleration or constant high speed operation as manifold depression is low and allows maximum flow through the PCV valve. When the engine is idling and manifold vacuum is high the valve allows minimum flow, thus preventing drivability problems due to excessive air induction at low rpm.

At wide open throttle, manifold depression is insufficient to scavenge the crankcase vapours and the ventilation flow reverses with the fumes entering the air cleaner instead of the base of the carburettor.



Dismantled view of PCV system showing connection points of hoses and valve.

If the engine is excessively worn and blow-by is at a high level, then irrespective of throttle operation a certain amount of crankcase vapour will re-cycle back through the rocker cover and into the air cleaner.

A baffle plate which is located in the rocker cover prevents engine oil from being drawn upwards into the air cleaner and the inlet manifold.

SERVICING THE SYSTEM

The system should be serviced at regular intervals with particular attention given to the regulating valve (PCV valve) and the ventilation filter.

(1) Service the ventilation filter by removing the filter from the air cleaner main body and washing it thoroughly in petrol. Allow the filter to air dry then impregnate with engine oil before installing back to the air cleaner main body.

NOTE: The ventilation filter is secured to the air cleaner main body by a "U"-shaped retaining clip. In order to remove the filter it will be necessary to take off the air cleaner top cover, remove the ventilation hose and clip and withdraw the filter from the main body.

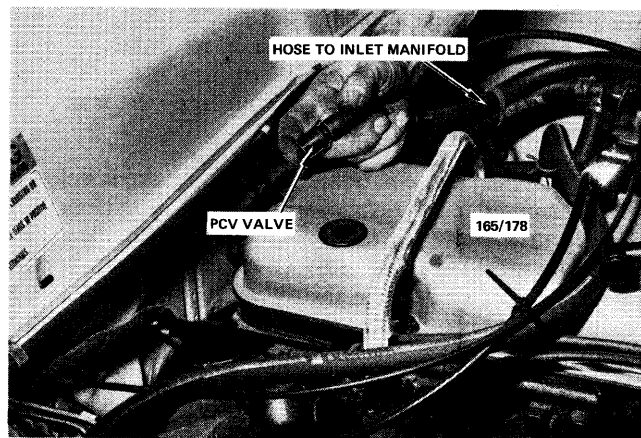
When installing the filter ensure that the filter locating notch is fully engaged in the air cleaner body before fitting the retaining clip and ventilation hose.

(2) Check the condition of the oil filler cap to air cleaner assembly hose and also the rocker cover to carburettor hose. Carefully check for blocking, collapsing or deterioration. Renew the hoses as found necessary. It is also advisable to check the sealing grommets in the rocker cover and oil filler cap.

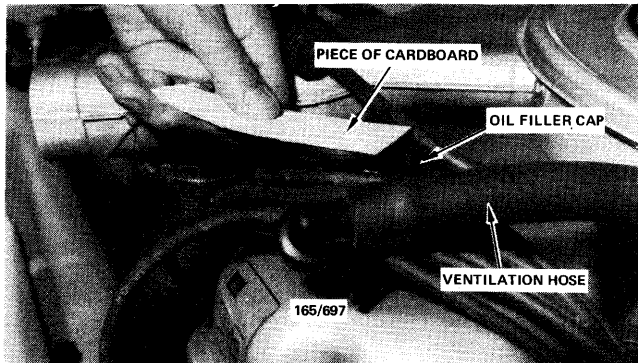
(3) Check the sealing gasket in the engine oil filler cap and the felt seal in the dipstick. Renew the seals if they are damaged or if their sealing qualities are suspect.

(4) Check the operation of the ventilation regulating valve (PCV valve) as follows:

With the engine running at a steady idle speed pull the valve and hose from the rocker cover.



Checking operation of PCV valve.



Checking operation of crankcase ventilation system.

A sharp hissing noise should be heard at the valve when it is pulled from the rocker cover.

Now place a finger over the valve inlet. A strong vacuum should be immediately felt as the finger is placed over the valve.

Refit the valve to the rocker cover and remove the ventilation hose from the oil filler cap. Place a piece of cardboard over the filler cap opening. If the system is functioning correctly the piece of cardboard will be pulled with noticeable force against the filler cap opening.

Stop the engine and as a last test pull the ventilation valve from the rocker cover and shake it. If the valve is free, a rattling noise should be heard.

If the valve is found to be partially or fully inoperative then renew the valve as a complete assembly.

2. EXHAUST CONTROL SYSTEM

This is the greatest source of pollutant emission from the internal combustion engine and therefore it is towards curbing emission from this source most systems are employed. Control of the exhaust emission is achieved by using several control systems.

CONTROLLED COMBUSTION SYSTEM (CCS)

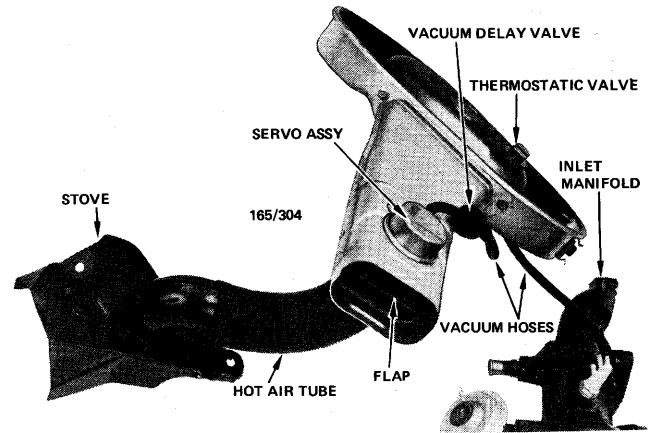
Description

Efficient combustion of the air/fuel mixture is dependent upon a constant inlet gas temperature. This is achieved by thermostatically controlling a flap situated in the air cleaner intake throat to direct either cold air from the under hood position or hot air generated around the exhaust manifold into the carburettor intake.

Operation

When the engine starts and the air intake is below a predetermined temperature the bimetal spring closes the thermostatic valve in the air cleaner. With the valve closed manifold vacuum is effective through the hoses to the servo arrangement on the air cleaner intake.

Vacuum then draws the servo diaphragm inwards and through a linkage closes the cold air flap. As soon as the flap closes warm air is permitted to enter the air cleaner by way of the warm air intake port which now has no restriction. This warm air is conducted from the stove around the exhaust manifold to the air cleaner via a



View of controlled combustion system components.

flexible tube.

As the temperature rises in the carburettor body the bimetal spring in the valve actuates, opening the valve to atmosphere which in turn collapses the vacuum in the two hoses. Flap action takes place cutting off the hot air flow and opening the underhood air supply.

Irrespective of temperature the system is also designed to draw in underhood air at high speeds when decreasing manifold vacuum and a higher differential pressure across the flap permits the flap to open.

To Check Operation

(1) Open the engine bonnet and check the flap in the air cleaner spout. The flap should be lowered and cover the hot air port. If the flap is raised and covers the cold air port check the flap and linkage for binding and free up as necessary.

(2) Start the engine from cold and again check the flap. The flap should now be raised and cover the cold air port.

(3) Run the engine until it reaches normal operating temperature. If the flap is lowered and now covers the hot air port the system is functioning correctly. If the flap is still raised and there is a vacuum at the hose on the vacuum motor, renew the thermostatic valve.

PORTED VACUUM SWITCHES

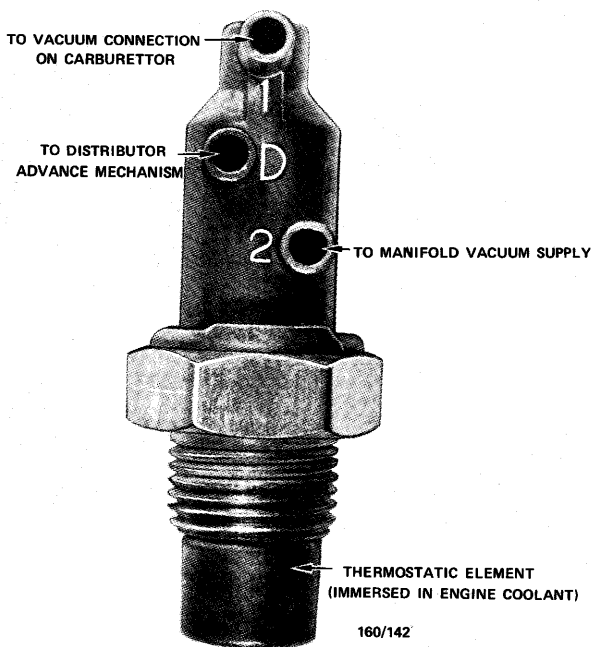
Description

As many of the emission control units fitted to the internal combustion engine alter air/fuel ratios or prevent ignition vacuum advance, serious driveability problems can arise under cold or overheat operating conditions.

To prevent these undesirable effects, heat sensitive switches are used to determine when the emission control unit will operate. These switches are called ported vacuum switch (PVS).

2 Port PVS

The 2 port PVS controls the operation of the exhaust



Three port vacuum switch (PVS).

gas recirculation (EGR) valve on automatic transmission models. In a cold condition no passage between the ports is possible. When the 2 port PVS warms up, (coolant temperature above approximately 30 deg C) the valve opens and manifold vacuum applied to one port is applied to the other port and via a hose to the EGR valve.

3 Port PVS

In a cold condition on a 3 port PVS the centre port is open to the top port. When the PVS warms up, at a pre-determined temperature, the centre port is switched over

to open to the bottom port. Any vacuum applied to the top or bottom port can therefore be switched to the centre port depending on the engine temperature.

On all models a 102 deg C PVS allows manifold vacuum to advance the ignition timing when the engine reaches overheat conditions. Under normal conditions only ported vacuum from the carburettor advances the ignition timing.

EXHAUST GAS RECIRCULATION

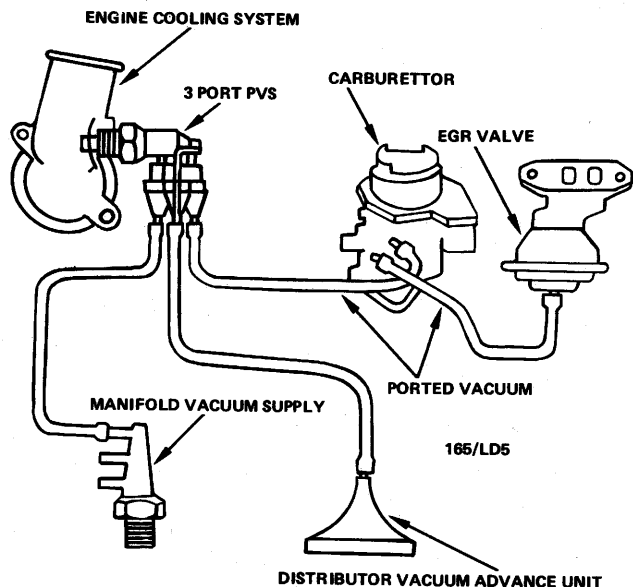
Description

In order to keep the oxides of nitrogen level of the burnt fuel to an acceptable minimum, up to 15 percent of the exhaust gas is recirculated through the combustion chambers. This has the effect of reducing both the peak combustion temperature and the amount of air/fuel mixture in the combustion chambers which are the main causes of oxides of nitrogen.

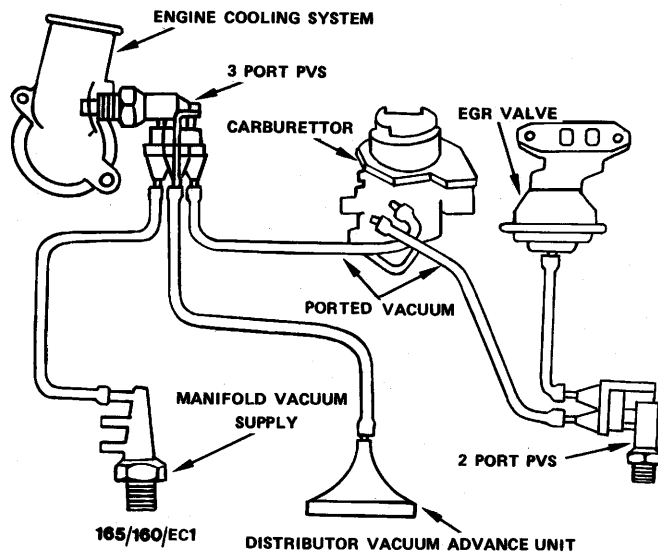
The EGR valve is mounted on the inlet manifold and has in its construction a vacuum operated spring loaded diaphragm to control a gas flow valve.

On manual transmission vehicles vacuum direct from the carburettor is directed to the upper side of the diaphragm. When vacuum reaches a predetermined level, the diaphragm overcomes spring pressure and the valve begins to open, allowing burnt gases from the exhaust manifold to be drawn into the inlet manifold. As vacuum increases the valve opens further to allow a progressively greater volume of burnt gas to be drawn into the inlet manifold.

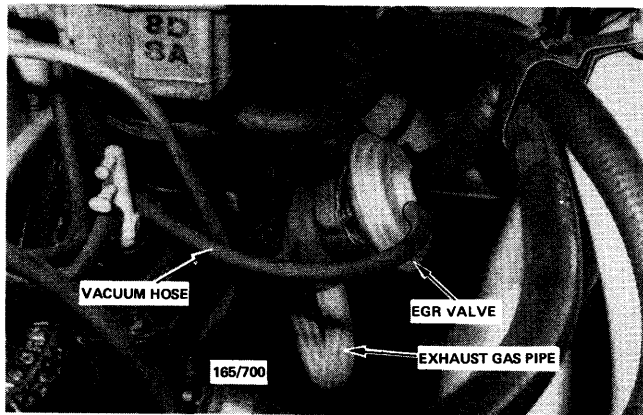
On automatic transmission vehicles a two port vacuum switch is included in the system to prevent vacuum supply to the EGR valve when the engine is cold, thus preventing injection of exhaust gases during engine warm up.



Schematic layout of the EGR system and the distributor vacuum advance system. Manual transmission models.



Schematic layout of the EGR system and the distributor vacuum advance system. Automatic transmission models.



Installed view of exhaust gas recirculation (EGR) valve.

To Check the EGR Valve Operation

- (1) Warm the engine to normal operating temperature.
- (2) Increase engine speed to approximately 2500 rpm.
- (3) With a finger placed through the aperture in the EGR valve, pull the vacuum supply hose OFF and ON several times. The diaphragm and operating rod should be felt to move smoothly backwards and forwards during this test and engine rpm should alter.
- (4) Should the diaphragm be felt to operate satisfactory in operation (3) but no alteration in engine rpm be noticed, the valve will have to be removed and cleaned.

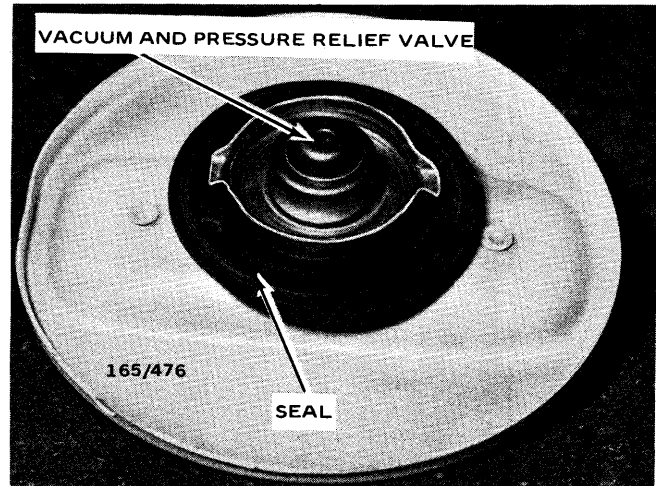
To Clean EGR Valve

- (1) Remove the vacuum hose from the EGR valve.
- (2) Disconnect and remove the exhaust gas pipe at the EGR valve.
- (3) Remove the retaining bolts and remove the EGR valve.
- (4) Remove the old gasket and clean the gasket surfaces.
- (5) The port in the valve body which does not contain the valve may be cleaned using a scraper and/or a wire brush.
- (6) The port which contains the valve must NOT be cleaned using cleaning tools as damage to the valve seat may occur.
- (7) If a spark plug cleaner is available the port containing the valve may be abrasive blasted. If a spark plug cleaner is not available blow out the port as far as possible with compressed air.
- (8) Using a 13 mm drill which has a liberal coating of grease, clean the port in the manifold by twirling the drill in the port until all the carbon is removed.
- (9) Refitting is a reversal of the removal procedure ensuring all hoses are airtight.

3. EVAPORATIVE CONTROL SYSTEM

DESCRIPTION

Prior to the fitment of control equipment, approxi-



Vacuum and pressure relief type fuel tank cap.

mately 20 per cent of all automotive hydrocarbon emissions stemmed from evaporative loss from the fuel tank and carburettor.

To maintain vapour loss to a minimum, an absorption/regeneration system is used which utilises a canister of activated charcoal to trap and hold the fuel vapours until such time as they can be fed into the induction system for burning in the combustion chambers.

In this system, the fuel tank is not vented to atmosphere but the tank cap is fitted with a valve which gives both pressure and vacuum relief. The basic components of the system are:

- (a) Fuel tank with combined vacuum/pressure relief filler cap.
- (b) Charcoal canister.
- (c) Interconnecting hoses.

When the engine is at rest, fuel vapour caused by evaporation gradually fills the air space in the fuel tank.

As the fuel tank is not vented to atmosphere, pressure builds up in the system and forces the vapour into the charcoal filled canister which acts as a storage space when the engine is not running.

Steel fuel tanks have vapour spaces built into each of the upper four corners above the full fuel level. Moulded fuel tanks have two vapour lines, one from the sender unit and the other from the filler neck.

A restricting orifice is located in a vapour union mounted on the vehicle body high above the fuel tank.

Its purpose is to prevent liquid fuel from entering the canister when the fuel tank is full, or when the vehicle is parked on an incline.

SERVICING THE SYSTEM

Servicing the system is limited to a visual inspection of all hoses and fittings, checking all connections for tightness and renewing the charcoal canister if any external damage or cracks can be observed. The tank cap must periodically be inspected for sealing gasket damage or deterioration. The tank cap relief valve can be tested by gently pushing a suitable probe through the hole in the

valve housing and by applying slight pressure on the valve, check that the valve leaves and returns smoothly to its seat. If not the valve is defective and the cap must be renewed.

TO RENEW THE CHARCOAL CANISTER

(1) Raise the bonnet and place fender covers on the front fenders.

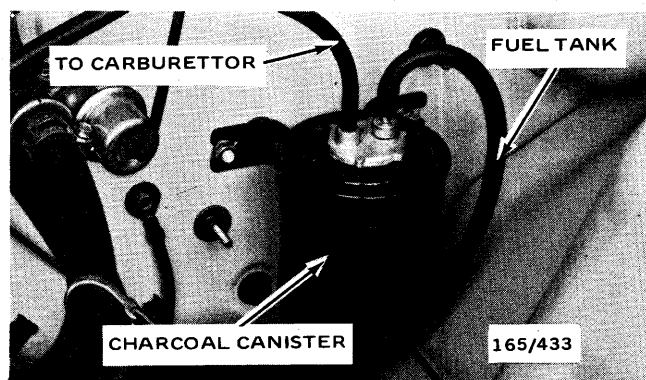
(2) Remove the hoses from the connections on top of the charcoal canister.

(3) Disconnect the drain hose from beneath the charcoal canister.

(4) Undo and remove the two nuts retaining the charcoal canister strap to the bulkhead and remove the canister with its strap from the vehicle.

(5) Undo but do not remove the canister strap squeeze bolt and slide the canister from the strap.

Installation is a reversal of the removal procedure with attention to the following points:



Hose connection and view of charcoal canister.

Ensure that the short port on the canister top faces the engine when the canister is installed to the bulkhead. Do not overtighten the canister strap squeeze bolt. Connect and check all hose fittings.

ALLOY HEAD MODELS PRODUCED AFTER MID 1980

This supplement provides additional specifications and service procedure information to cover alloy head models produced after mid 1980. If the information required is not given in this supplement refer to the relevant sections of the main manual.

SPECIFICATIONS

Type	One piece crossflow
Material	Aluminium alloy
Valve seat type	Renewable cast iron inserts
Valve seat width:	
Inlet	1.52–2.03 mm
Exhaust	1.78–2.29 mm
Valve seat angle	45 deg
Valve seat runout (maximum)	0.038 mm
Cylinder head face warp limit	0.18 mm
Valve guide type	Renewable cast iron
Compression:	
3.3 litre MC	8.35 : 1
3.3 litre HC	9.15 : 1
4.1 litre HC	9.35 : 1

TORQUE WRENCH SETTINGS

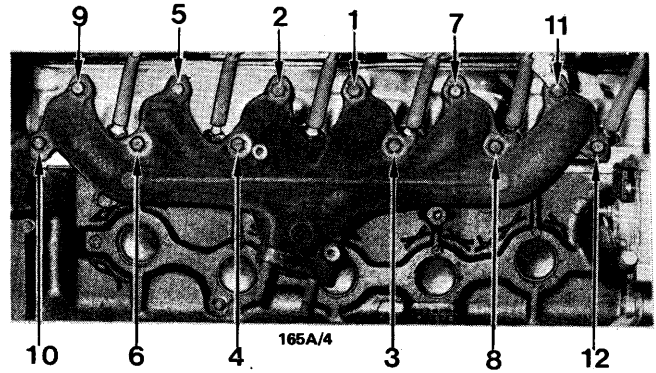
Cylinder head bolts:	
Stage 1	68 Nm
Stage 2	82 Nm
Stage 3	95 Nm
Inlet manifold	24 Nm
Exhaust manifold	31 Nm

DESCRIPTION

The aluminium cylinder head was introduced to assist in the combating of exhaust gas pollutants. It has revised gas flow characteristics, more central spark plug location and better heat dissipation control.

The valve seats and the valve guides in the alloy head are made of cast iron and are renewable. As these operations require specialised machining equipment and knowledge the head should be taken to a reputable engine reconditioning shop.

A gasket is now fitted between the exhaust manifold and the cylinder head. On new vehicles or following any repair necessitating the removal of the exhaust manifold the manifold retaining nuts have to be retensioned. The nuts should be retensioned in the correct sequence and the operation carried out after 1500 km and then again after 10,000 km.



Tightening sequence for exhaust manifold retaining bolts.

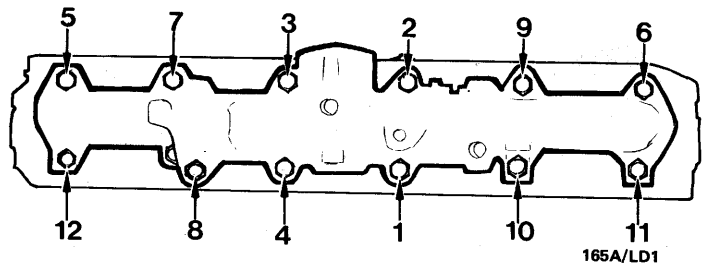


Diagram showing tightening sequence of inlet manifold retaining nuts.

SPECIFICATIONS

Radiator cap:

Type	Pressurised
Release pressure	110 kPa
Cooling system capacity	10 litres

TORQUE WRENCH SETTINGS

Thermostat bleed nipple	4 Nm
-------------------------------	------

DESCRIPTION

The cooling system fitted to the alloy head 3.3 and 4.1 litre engines is of the sealed coolant recovery type. A plastic reserve tank is connected to the radiator overflow pipe and the coolant level is checked at this tank.

In this system the radiator cap is fitted with a seal between the top of the cap and the upper face of the radiator filler neck to prevent coolant overflow at this point. The coolant is directed through the overflow pipe and into the reserve tank.

As the coolant volume expands due to an increase in temperature, the pressure valve in the cap opens and allows excess coolant to pass into the reserve tank.

When the engine is stopped and the temperature of the coolant in the radiator falls, the radiator pressure is reduced to below that of the reserve tank. Coolant is then syphoned back into the radiator to maintain the original coolant level. The necessity for frequent topping up of the coolant in the cooling system is eliminated.

NOTE: Do not remove the cap from the radiator header tank while the engine is hot.

RADIATOR

TO DRAIN AND REFILL COOLING SYSTEM

- (1) Raise the engine bonnet and fit covers to both of the front fenders.
- (2) Slide the heater control lever on the instrument panel to the hot position.
- (3) Position a suitable drain tin below the bottom radiator hose.

NOTE: To prevent scalding or injury drain the radiator when the coolant is cool and there is no pressure in the radiator.

- (4) Drain the cooling system by disconnecting the bottom radiator hose at the radiator and removing the drain plug fitted to the engine block. The drain plug is located at the right rear of the engine block, forward of the starting motor.

When draining the radiator it is advisable to leave the radiator cap in position. This will create a partial vacuum in the radiator and help avoid a large gush of coolant when the bottom hose is disconnected. When the flow of coolant stops, the radiator cap may be cracked open in small increments until all the coolant has drained from the radiator.



View of coolant reserve tank installed in vehicle.

- (5) If necessary remove the expansion tank and drain the remaining coolant. Refit the expansion tank to its mounting position.

- (6) Reconnect the bottom radiator hose to the radiator and refit the drain plug to the engine cylinder block.

- (7) Loosen the air bleed nipple located in the top of a thermostat housing bolt and then slowly fill the radiator with water.

- (8) When a full flow of water is evident at the air bleed nipple tighten the nipple.

- (9) Add the specified corrosion inhibitor or anti-freeze as necessary and then finish filling the radiator.

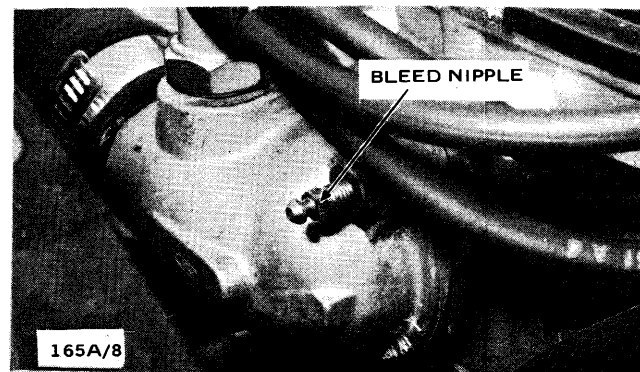
NOTE: Should anti-freeze solution or corrosion inhibitor come in contact with the skin or vehicle/paint work wash it off immediately with clean water.

- (10) Ensure that the reserve tank water level is 15–20 mm above the cold level mark and then refit the radiator cap. Start and run the engine for two minutes.

- (11) After stopping the engine release any air trapped in the system by loosening the air bleed nipple.

- (12) Top up the radiator and ensure that there is 15–20 mm of coolant above the cold level mark.

- (13) Start and run the engine until normal operating temperature is reached and check for leaks at any of the hose joints.



Bleed nipple location at the thermostat housing.

SPECIFICATIONS

CARBURETTOR

Make	Stromberg BX
Type:	
3.3 litre –	
Manual	ODSA
Automatic	ODRA
4.1 litre –	
Manual	ODUA
Automatic	ODTB
Venturi diameter	32.6 mm
Main jet	28–25
Main metering jet:	
All except ODUA	370
ODUA	360
Power bypass jet	0.55 x 1.39 mm
Pump jet	0.75 mm
Idle discharge nozzle	1.8 mm
Idle tube feed:	
ODSA and ODRA	No 68
ODUA and ODTB	No 66
Float needle valve seat	1.85 mm
Fuel level	16–17.5 mm
Accelerator pump stroke:	
Manual transmission	8.7–9.5 mm
Automatic transmission	6.8–7.6 mm
Choke pulldown clearance:	
ODSA	3.6–4.0 mm

ODRA	3.0–3.4 mm
ODUA and ODTB	3.3–3.7 mm

Curb idle speed:

Manual transmission	
in neutral	880–930 rpm
Automatic transmission	
in D	580–620 rpm
Fast idle speed	1100–1200 rpm

FUEL PUMP

Pump pressure at idle	32–40 kPa
-----------------------------	-----------

FUEL PUMP

TO SERVICE

NOTE: A gauze fuel filter has been fitted to the fuel pump inlet valve housing and should be serviced at 1500 km then at 40,000 km intervals.

- (1) Remove the top cover to main body retaining screws. Lift off the top cover and the air dome diaphragm.
- (2) Prise the gauze filter from the inlet valve housing then wash the filter in a solvent. Remove any foreign matter from around the inlet valve and then blow both the housing and the filter clean with compressed air.
- (3) Press the filter back onto the inlet valve housing ensuring that the rib on the filter faces toward the pump housing.
- (4) Replace the air dome diaphragm and the top cover. Refit the retaining screws and tighten.

204 MANUAL TRANSMISSION, REAR AXLE, CLUTCH

SPECIFICATIONS

MANUAL TRANSMISSION

Ratios economy pack transmission:

Fourth	1.00 : 1
Third	1.43 : 1
Second	2.00 : 1
First	3.23 : 1
Reverse	3.29 : 1

REAR AXLE

New ratio introduced 2.77 : 1

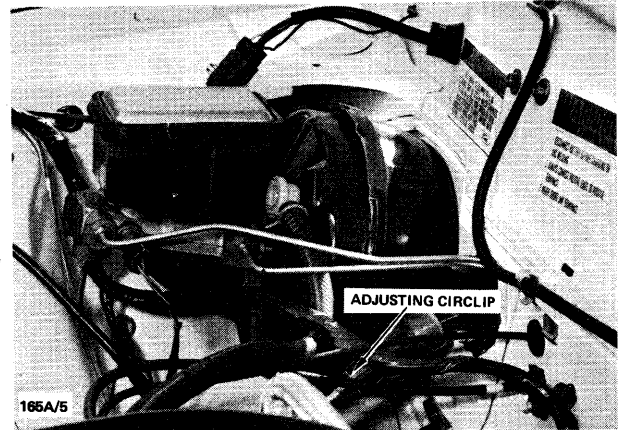
NOTE: The new 2.77 : 1 axle ratio is fitted as standard equipment on 3.3 litre sedan models with four speed manual transmission and on 4.1 litre models with manual transmission and automatic transmission.

CLUTCH

Cable free play 2.5–5.5 mm

NOTE: The clutch pedal free play is adjusted by the location of a 'C' clip on the upper end

of the outer cable. To assess free play grasp the outer cable firmly and pull it away from the engine bulkhead. Insert the 'C' clip in the groove which provides the correct free play adjustment, which is measured between the 'C' clip and the engine bulkhead cable abutment.



Clutch cable adjusting point at the engine bulkhead.

STEERING

TO PURGE POWER STEERING SYSTEM OF AIR

Special Equipment Required:

To Purge Power Steering System of Air – Vacuum pump with gauge

(1) Ensure that the power steering pump reservoir is filled to the full when cold mark on the pump dipstick. Use the recommended fluid only.

(2) Remove the drive belt from the power steering pump and the low tension lead from the coil.

(3) Rotate the pump pulley in a clockwise direction while visually inspecting the fluid in the reservoir. Continue this operation, topping up the fluid as necessary, until the fluid level remains static and there are no air bubbles visible.

(4) Refit the power steering pump drive belt.

(5) Raise the front of the vehicle so that the wheels just clear the ground and then support the vehicle on chassis stands.

(6) While turning over the engine with the starter motor rotate the steering wheel one complete turn to the left and right of the central position. Repeat this process until the fluid level in the reservoir remains static. Top up the reservoir to the full when cold mark with recommended fluid as necessary.

NOTE: Do not turn the engine over with the starter motor for periods exceeding 5 seconds at a time.

(7) Ensuring that the pump reservoir fluid level is correct fit the vacuum pump to the pump reservoir filler neck.

NOTE: Do not use vacuum from the vehicle engine.

(8) Reconnect the low tension lead to the coil.

(9) Start the engine and allow it to idle. Apply 50 kPa of vacuum to the pump reservoir for a minimum of 3 minutes. Ensure that the vacuum is maintained at 50 kPa during the purging operation.

(10) Remove the vacuum pump from the reservoir filler neck and top up the fluid to the correct level.

(11) Fit the vacuum pump to the filler neck and with the engine idling apply 50 kPa of vacuum to the pump reservoir.

(12) Rotate the steering wheel from lock to lock

every 30 seconds. Do not hold the steering wheel so that the steering is on the lock stops.

(13) Carry out operation (12) for approximately 5 minutes ensuring that the vacuum is maintained at 50 kPa.

(14) Stop the engine and remove the vacuum pump from the reservoir filler neck.

(15) Check and if necessary top up the power steering pump reservoir to the correct fluid level. Refit the pump dipstick.

(16) With the engine running turn the steering wheel from lock to lock and check for any leaks at the pipe or hose fittings.

NOTE: It may be necessary to carry out operations (7) to (15) repeatedly in severe cases of aeration.

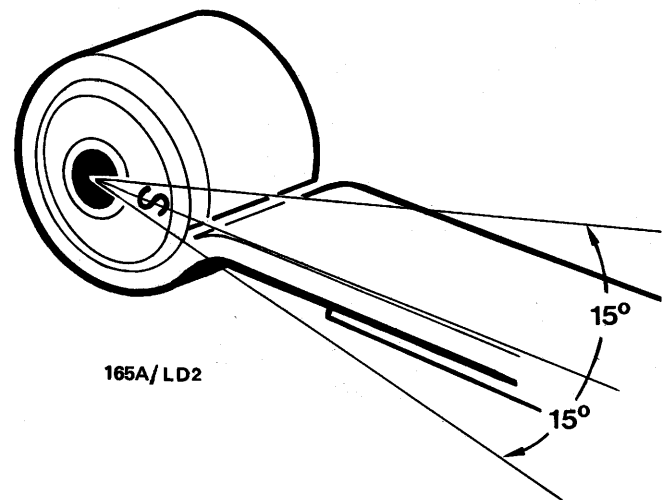
(17) Raise the vehicle, remove the chassis stands, and then lower the vehicle to the ground.

(18) Road test the vehicle.

REAR SUSPENSION

TO ALIGN SPRING EYE BUSH

When installing the bush in the front of the rear spring eye ensure that the 'S' identification mark on the bush is aligned within plus or minus 15 degrees of the datum line of the spring main leaf.



Spring eye bush alignment.

CAUTION: To prevent severe electrical shock extreme care must be taken when working on or near the electronic ignition system as dangerous high tension voltages are produced in both the primary and secondary circuits. See text for precautionary notes.

SPECIFICATIONS

SPARK PLUGS

Type	Motorcraft AGR 52
Gap	0.8-0.9 mm
Tightening torque	14-20 Nm

DISTRIBUTOR

Make	Bosch
Rotation of rotor	Clockwise
Firing order	1-5-3-6-2-4
Control	Centrifugal and vacuum advance
Dwell angle	Fixed and non-adjustable
Shaft end play	0.61-1.09 mm

IGNITION COIL

Make	Bosch
Primary resistance at 24 deg C	0.76-0.84 ohms
Secondary resistance at 24 deg C	4860-5940 ohms
Amperage draw (engine stopped)	7 ohms

SOLID STATE IGNITION SYSTEM

Special Equipment Required:

To Test - 0-60-0 ammeter, voltmeter

DESCRIPTION

The solid state ignition system consists of the distributor, control unit, pulse generator, ignition coil and associated wiring.

The distributor is basically the same as that in conventional ignition systems. The difference lies in the fact that the capacitor and breaker points are not used. These are replaced by a pulse generator which consists of a reluctor, which rotates with the distributor shaft, and a stator and pick up coil which are mounted on the distributor base plate. As there is no contact between the moving parts of the pulse generator, the system is virtually maintenance free. Ignition advance is achieved by the same methods used in the conventional distributor, i.e. centrifugal weights and a vacuum advance unit. All models are fitted with a temperature controlled ported vacuum switch mounted on the engine, which allows ignition advance at idle rpm during overheat conditions.

The control unit is a sealed non-adjustable electronic component which determines the period during which current will flow in the primary circuit, or in other words the dwell angle. The control unit also interrupts the primary circuit when triggered by impulses from the pulse generator. This induces high current to flow in the secondary circuit. Dwell angle is non adjustable in solid

state ignition systems and can only be measured by an oscilloscope.

The ignition coil is specially designed to suit solid state ignition systems and should not be replaced by a conventional unit. Some types of tachometers and timing lights are unsuited to solid state ignition systems. Always ensure that suitable testing equipment is used.

ELECTRICAL CHECKS

NOTE: Solid state ignition systems can produce dangerous high tension voltages in both the primary and secondary circuits. For this reason extreme care must be taken when carrying out these checks. When disconnecting the wiring plug from the engine wiring harness ensure that the ignition switch is in the OFF position. This will prevent damage to the solid state circuitry in the control unit.

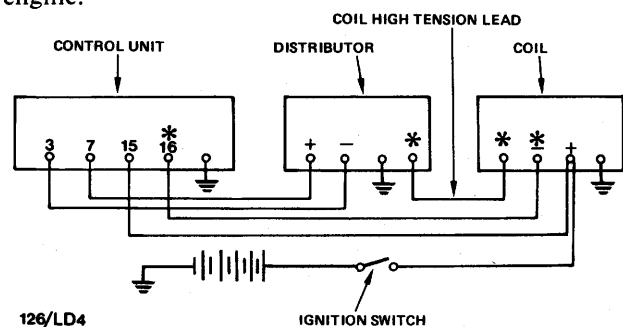
Should engine problems arise and the ignition system be suspect first ensure the ignition system components are clean and dry, and all terminals are secure. Ensure the battery is fully charged and the ignition timing is correctly set.

If after checking the previous points the engine will not start carry out the following tests:

NOTE: At the conclusion of each check ensure the ignition is switched OFF.

(1) Visually check the coil for oil leakage. If the coil is leaking it must be replaced with a new unit of the correct type.

(2) Remove a spark plug lead and insert a split pin into the lead to extend the terminal. Using insulated pliers hold the lead 6 mm away from a good earth on the engine.



Schematic diagram of solid state ignition system. Note high voltage occurs at terminals marked.*

(3) Have a second operator crank the engine. If no spark is evident proceed with the following tests.

(4) Remove the coil high tension lead, from the distributor cap and using insulated pliers hold the lead 6 mm from a good earth on the engine.

Have a second operator crank the engine and check for a spark. If a strong high tension spark is evident then the fault probably lies in the distributor cap, rotor arm or spark plug leads. Carefully inspect these components for cracks or loose terminals.

(5) If no high tension spark exists turn off the ignition and remove the screws and metal cap from the control unit on the side of the distributor body. Place an ammeter in series with the wire on terminal 16 of the control unit. See diagram.

(6) Turn the ignition on but do not crank the engine, the ammeter should read zero. If not turn off the ignition and replace the control unit.

(7) Connect a voltmeter between the (+) terminal of the coil and a good earth. Turn on the ignition. The voltage must be 11 volts or more.

(8) Connect a voltmeter between terminal 15 and a good earth. Turn on the ignition. The voltage must be 11 volts or more.

If in the two preceding checks the voltage was below 11 volts then the voltage drop must be rectified before proceeding.

(9) With the ignition switched off test the ignition coil primary resistance with an ohmmeter between terminal 15 on the control unit and the (-) terminal on the coil. The resistance should be between 0.72 and 0.88 ohms, if not then the ignition coil should be renewed.

(10) With the ignition switched off test the ignition coil secondary resistance with an ohmmeter between the centre tower of the coil and the (-) terminal on the coil. The resistance should be between 4590 and 6210 ohms, if not then the ignition coil should be renewed.

(11) Disconnect terminals 3 and 7 from the connectors on the control unit and with the ignition switched off test the pickup coil resistance with an ohmmeter. This resistance should be 1,000 to 1,200 ohms.

(12) Test for continuity between the base of the control unit and the distributor body and if necessary renew the coating of silicon grease to ensure this earth is good.

(13) Visually check the pulse generator for damage. Check that there is an air gap between the reluctor and the stator. Renew any damaged parts.

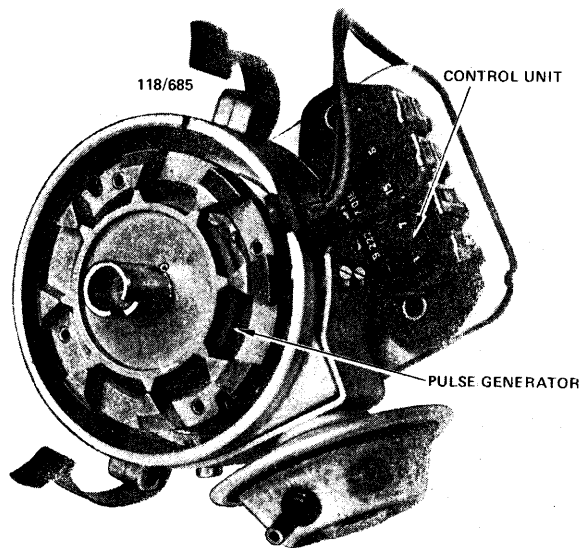
(14) If after all these tests have been carried out the engine still refuses to start or lacks power then a mechanical defect must exist elsewhere in the vehicle.

TO REMOVE AND INSTAL

(1) Disconnect the wiring connector from the engine wiring harness.

(2) Disconnect the high tension lead from the coil.

(3) Remove the distributor cap and after noting the position of No 1 spark plug terminal post lay it aside.



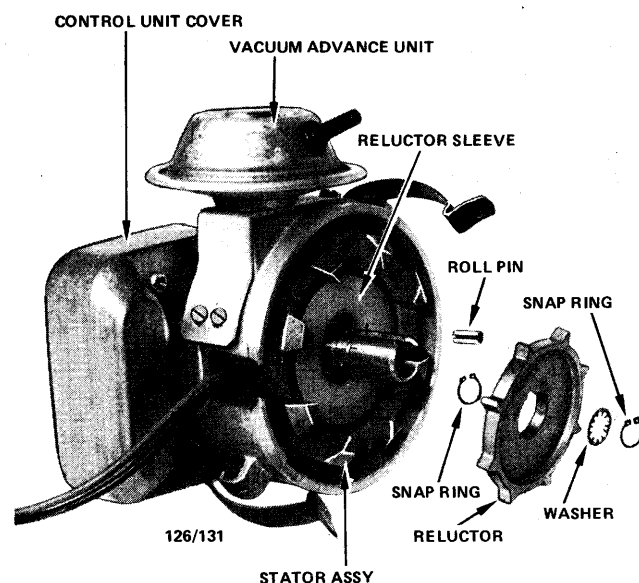
View of distributor showing pulse generator and control box. Typical.

(4) Disconnect the vacuum advance hose from the distributor.

(5) Turn the engine in the direction of rotation until the timing mark on the crankshaft pulley and the tdc timing mark on the timing cover are in line, and the rotor button is pointing to the position of the No 1 spark plug terminal post.

(6) Mark the distributor body and the cylinder block to aid in resetting the timing on installation.

(7) Remove the distributor retaining plate bolt and retaining plate and lift the distributor up and out of the engine, noting the amount of movement and position of the rotor button as the distributor is removed. Mark this position as an aid when installing the distributor.



View of distributor with reluctor removed. Typical.

Installation is a reversal of the removal procedure with attention to the following points:

(1) Check that the engine has not been turned while the distributor has been removed. If the engine has been turned check that the timing marks are again brought into line and that both valves of No 1 cylinder are closed, that is with No 1 cylinder on the compression stroke.

NOTE: After the engine has been reset on the timing marks, ensure the intermediate drive shaft is properly seated in the oil pump.

(2) Check the O ring oil seal. Renew the seal if in doubt as to its serviceability.

(3) Position the rotor button to align with the mark made when the distributor was removed and instal the distributor.

(4) Align the distributor body and the cylinder block marks made on removal and replace the retaining plate and bolt loosely.

(5) Ensure the rotor is pointing towards the No 1 spark plug terminal position and that the correct point of the reluctor is opposite the pick up stator.

(6) Check and adjust the ignition timing as described in the Engine Tune-Up section and tighten the distributor retaining plate bolt securely.

TO DISMANTLE

(1) Remove the distributor as previously described.

(2) Remove the rotor button.

(3) Push the distributor shaft hard into the body of the distributor from the top and check the shaft end play with a feeler gauge between the distributor body and the shaft collar. This must be to Specifications.

(4) Remove the vacuum advance unit retaining screws, tilt the vacuum advance unit to disconnect the link from the stator and remove the vacuum advance unit.

(5) Remove the snap ring and washer then gently pull or prise the reluctor from the reluctor sleeve taking care not to lose the locating roll pin.

(6) Rotate the stator to gain access to the Allen head screws. Remove the screws.

(7) Remove the snap ring from the distributor shaft sleeve.

(8) Remove the screws securing the control unit and its dust cover then disconnect the wires from the control unit terminals.

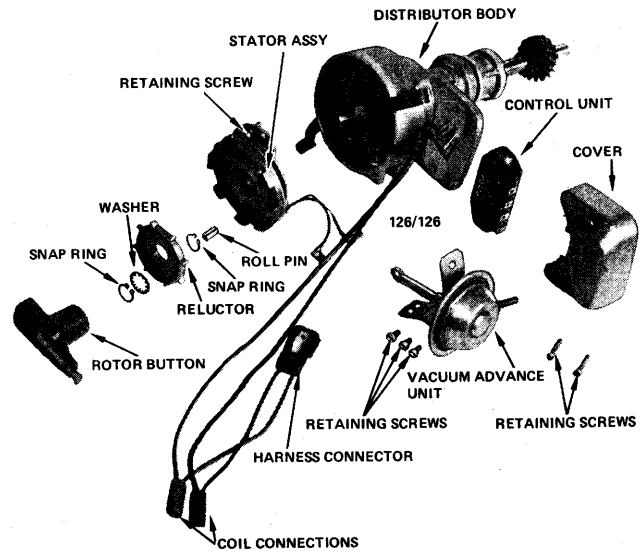
(9) Carefully lift the stator out of the distributor body while feeding the wires to the control unit through the hole in the distributor body.

(10) Lift the control unit off the distributor body.

(11) Further dismantling of the distributor is not normally necessary unless the top bush is worn or the body has been damaged.

TO INSPECT

(1) Check the control unit leads for damage or fractures.



Dismantled view of distributor components. Typical.

(2) Visually inspect the pulse generator components for damage.

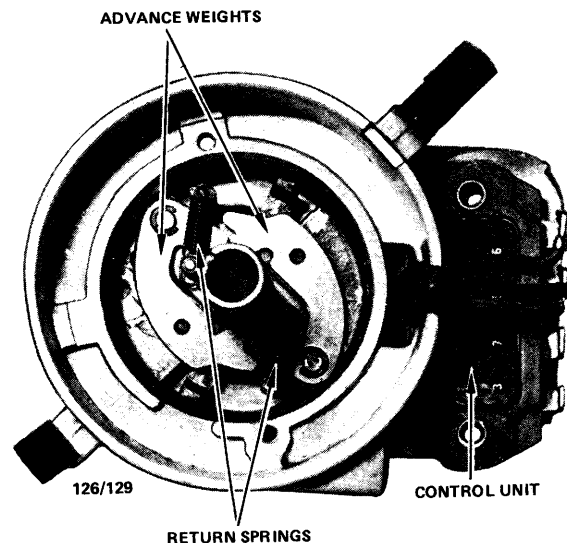
(3) Check that the centrifugal advance weights are not binding on the pivot pins.

(4) Inspect the distributor cap for cracks, tracking or corroded terminals.

(5) Check the centre carbon in the cap for wear. The carbon brush should protrude sufficiently to contact the rotor button.

(6) Inspect the rotor arm for cracks, damage or wear.

(7) Check the vacuum advance unit for a leaking diaphragm by sucking on each of the vacuum hose connections in turn and noting if the unit maintains vacuum.



View of distributor with stator removed. Typical.

TO ASSEMBLE

Assembly is a reversal of the dismantling procedure with attention to the following points:

- (1) Ensure oil, grease or foreign matter is kept away from the pulse generator components.
- (2) For heat sink purposes, apply a small quantity

of silicon based grease between the control unit and the distributor body.

- (3) Ensure the locating roll pin is inserted between the reluctor and the reluctor sleeve.
- (4) Lubricate the centrifugal advance weight pivots with high melting point grease.

CONVERSION TABLES

Quantity	Imperial Unit	Metric Unit	Conversion Factors (Approximate)	
			Imperial to Metric Units	Metric to Imperial Units
LENGTH	inch (in)	millimetre (mm) or centimetre (cm)	1 in = 25.4 mm	1 cm = 0.394 in
	foot (ft)	centimetre or metre (m)	1 ft = 30.5 cm	1 m = 3.28 ft
	yard (yd)	metre (m)	1 yd = 0.914 m	1 m = 1.09 yd
	furlong (fur)	metre (m) or kilometre (km)	1 fur = 201 m	1 km = 4.97 fur
	mile (for navigation)	kilometre (km) or international nautical mile (n mile)	1 mile = 1.61 km 1 n mile = 1852 m	1 km = 0.621 mile
MASS	ounce (oz)	gram (g)	1 oz = 28.3 g	1 g = 0.0353 oz
	pound (lb)	gram (g) or kilogram (kg)	1 lb = 454 g	1 kg = 2.20 lb
	stone	kilogram (kg)	1 stone = 6.35 kg	1 kg = 0.157 stone
	ton	tonne (t)	1 ton = 1.02 t	1 t = 0.984 ton
AREA	square inch (in ²)	square centimetre (cm ²)	1 in ² = 6.45 cm ²	1 cm ² = 0.155 in ²
	square foot (ft ²)	square centimetre (cm ²) or square metre (m ²)	1 ft ² = 929 cm ²	1 m ² = 10.8 ft ²
	square yard (yd ²)	square metre (m ²)	1 yd ² = 0.836 m ²	1 m ² = 1.20 yd ²
	perch (p)	square metre (m ²)	1 p = 25.3 m ²	1 m ² = 0.0395 p
	rood (rd)	hectare (ha)	1 rd = 0.101 ha	1 ha = 9.88 rd
	acre (ac)	hectare (ha)	1 ac = 0.405 ha	1 ha = 2.47 ac
	square mile	square kilometre (km ²)	1 square mile = 2.59 km ²	1 km ² = 0.386 square mile
VOLUME	cubic inch (in ³)	cubic centimetre (cm ³)	1 in ³ = 16.4 cm ³	1 cm ³ = 0.0610 in ³
	cubic foot (ft ³)	cubic metre (m ³)	1 ft ³ = 0.0283 m ³	1 m ³ = 35.3 ft ³
	cubic yard (yd ³)	cubic metre (m ³)	1 yd ³ = 0.765 m ³	1 m ³ = 1.31 yd ³
	bushel (bus)	cubic metre (m ³)	1 bus = 0.0364 m ³	1 m ³ = 27.5 bus
VOLUME (fluids)	fluid ounce (fl oz)	millilitre (ml)	1 fl oz = 28.4 ml	1 ml = 0.0352 fl oz
	pint (pt)	millilitre (ml) or litre (l)	1 pt = 568 ml	1 litre = 1.76 pt
	gallon (gal)	litre (l) or cubic metre (m ³)	1 gal = 4.55 litre	1 m ³ = 220 gal
	acre foot	cubic metre (m ³) or megalitre (Ml)	1 acre foot = 1230 m ³ = 1.23 Ml	1 Ml = 0.811 acre foot
FORCE	pound-force (lbf)	newton (N)	1 lbf = 4.45 N	1 N = 0.225 lbf
	ton-force (tonf)	kilonewton (kN)	1 tonf = 9.96 kN	1 kN = 0.100 tonf
PRESSURE	pound per square inch (psi)	kilopascal (kPa)	1 psi = 6.89 kPa	1 kPa = 0.145 psi
	atmosphere (atm)	kilopascal (kPa) or megapascal (MPa)	1 atm = 101 kPa	1 MPa = 9.87 atm
	ton per square inch (ton/in ²)	megapascal (MPa)	1 ton/in ² = 15.4 MPa	1 MPa = 0.0647 ton/in ²
	psi	kg/cm ²	1 kg/cm ² = 14.22 psi	1 psi = 0.070 kg/cm ²
VELOCITY	mile per hour (mph)	kilometre per hour (km/h)	1 mph = 1.61 km/h	1 km/h = 0.621 mph
	(for navigation)	knot (kn)	1 kn = 1.85 km/h	
TEMPERATURE	temperature (°F)	temperature (°C)	°C = $\frac{5}{9} (°F - 32)$	°F = $\frac{9}{5} °C + 32$
DENSITY	pound per cubic inch (lb/in ³)	gram per cubic centimetre (g/cm ³) = tonne per cubic metre (t/m ³)	1 lb/in ³ = 27.7 t/m ³	1 t/m ³ = 0.0361 lb/in ³
	ton per cubic yard	tonne per cubic metre (t/m ³)	1 ton/yd ³ = 1.33 t/m ³	1 t/m ³ = 0.752 ton/yd ³
ENERGY	British thermal unit (Btu)	kilojoule (kJ)	1 Btu = 1.06 kJ	1 kJ = 0.948 Btu
	therm (for electrical energy)	megajoule (MJ) kilowatt hour (kWh)	1 therm = 106 MJ 1 kWh = 3.60 MJ	1 MJ = 9.48 × 10 ³ therm
POWER	horsepower (hp)	kilowatt (kW)	1 hp = 0.746 kW	1 kW = 1.34 hp
TIME		second (s)		
		minute (min)	1 min = 60 s	
		hour (h)	1 h = 3600 s	
FREQUENCY	cycle per second (c/s)	hertz (Hz)	1 c/s = 1 Hz	1 Hz = 1 c/s
ANGULAR VELOCITY	revolution per minute (rpm)	radian per second (rad/s)	1 rpm = 0.105 rad/s	1 rad/s = 9.55 rpm
		revolution per minute (rpm)		
TORQUE	lb-ft	Nm	1 Nm = 0.737562 lb-ft	1 lb-ft = 1.35582 Nm

INCHES	DECIMALS	MILLI-METRES	INCHES TO MILLIMETRES		MILLIMETRES TO INCHES		FAHRENHEIT & CELSIUS E				
			Inches	m.ms.	m.ms.	Inches	°F	°C	°C	°F	
	1/64	.015625	.3969	.0001	.00254	0.001	.000039	-20	-28.9	-30	-22
	1/32	.03125	.7937	.0002	.00508	0.002	.000079	-15	-26.1	-28	-18.4
	3/64	.046875	1.1906	.0003	.00762	0.003	.000118	-10	-23.3	-26	-14.8
1/16		.0625	1.5875	.0004	.01016	0.004	.000157	-5	-20.6	-24	-11.2
	5/64	.078125	1.9844	.0005	.01270	0.005	.000197	0	-17.8	-22	-7.6
	3/32	.09375	2.3812	.0006	.01524	0.006	.000236	1	-17.2	-20	-4
	7/64	.109375	2.7781	.0007	.01778	0.007	.000276	2	-16.7	-18	-0.4
1/8		.125	3.1750	.0008	.02032	0.008	.000315	3	-16.1	-16	3.2
	9/64	.140625	3.5719	.0009	.02286	0.009	.000354	4	-15.6	-14	6.8
	5/32	.15625	3.9687	.001	.0254	0.01	.00039	5	-15.0	-12	10.4
	11/64	.171875	4.3656	.002	.0508	0.02	.00079	10	-12.2	-10	14
3/16		.1875	4.7625	.003	.0762	0.03	.00118	15	-9.4	-8	17.6
	13/64	.203125	5.1594	.004	.1016	0.04	.00157	20	-6.7	-6	21.2
	7/32	.21875	5.5562	.005	.1270	0.05	.00197	25	-3.9	-4	24.8
	15/64	.234375	5.9531	.006	.1524	0.06	.00236	30	-1.1	-2	28.4
1/4		.25	6.3500	.007	.1778	0.07	.00276	35	1.7	0	32
	17/64	.265625	6.7469	.008	.2032	0.08	.00315	40	4.4	2	35.6
	9/32	.28125	7.1437	.009	.2286	0.09	.00354	45	7.2	4	39.2
	19/64	.296875	7.5406	.01	.254	0.1	.00394	50	10.0	6	42.8
5/16		.3125	7.9375	.02	.508	0.2	.00787	55	12.8	8	46.4
	21/64	.328125	8.3344	.03	.762	0.3	.01181	60	15.6	10	50
	11/32	.34375	8.7312	.04	1.016	0.4	.01575	65	18.3	12	53.6
	23/64	.359375	9.1281	.05	1.270	0.5	.01969	70	21.1	14	57.2
3/8		.375	9.5250	.06	1.524	0.6	.02362	75	23.9	16	60.8
	25/64	.390625	9.9219	.07	1.778	0.7	.02756	80	26.7	18	64.4
	13/32	.40625	10.3187	.08	2.032	0.8	.03150	85	29.4	20	68
	27/64	.421875	10.7156	.09	2.286	0.9	.03543	90	32.2	22	71.6
7/16		.4375	11.1125	.1	2.54	1	.03937	95	35.0	24	75.2
	29/64	.453125	11.5094	.2	5.08	2	.07874	100	37.8	26	78.8
	15/32	.46875	11.9062	.3	7.62	3	.11811	105	40.6	28	82.4
	31/64	.484375	12.3031	.4	10.16	4	.15748	110	43.3	30	86
1/2		.5	12.7000	.5	12.70	5	.19685	115	46.1	32	89.6
	33/64	.515625	13.0969	.6	15.24	6	.23622	120	48.9	34	93.2
	17/32	.53125	13.4937	.7	17.78	7	.27559	125	51.7	36	96.8
	35/64	.546875	13.8906	.8	20.32	8	.31496	130	54.4	38	100.4
9/16		.5625	14.2875	.9	22.86	9	.35433	135	57.2	40	104
	37/64	.578125	14.6844	1	25.4	10	.39370	140	60.0	42	107.6
	19/32	.59375	15.0812	2	50.8	11	.43307	145	62.8	44	112.2
	39/64	.609375	15.4781	3	76.2	12	.47244	150	65.6	46	114.8
5/8		.625	15.8750	4	101.6	13	.51181	155	68.3	48	118.4
	41/64	.640625	16.2719	5	127.0	14	.55118	160	71.1	50	122
	21/32	.65625	16.6687	6	152.4	15	.59055	165	73.9	52	125.6
	43/64	.671875	17.0656	7	177.8	16	.62992	170	76.7	54	129.2
11/16		.6875	17.4625	8	203.2	17	.66929	175	79.4	56	132.8
	45/64	.703125	17.8594	9	228.6	18	.70866	180	82.2	58	136.4
	23/32	.71875	18.2562	10	254.0	19	.74803	185	85.0	60	140
	47/64	.734375	18.6531	11	279.4	20	.78740	190	87.8	62	143.6
3/4		.75	19.0500	12	304.8	21	.82677	195	90.6	64	147.2
	49/64	.765625	19.4469	13	330.2	22	.86614	200	93.3	66	150.8
	25/32	.78125	19.8437	14	355.6	23	.90551	205	96.1	68	154.4
	51/64	.796875	20.2406	15	381.0	24	.94488	210	98.9	70	158
13/16		.8125	20.6375	16	406.4	25	.98425	212	100.0	75	167
	53/64	.828125	21.0344	17	431.8	26	1.02362	215	101.7	80	176
	27/32	.84375	21.4312	18	457.2	27	1.06299	220	104.4	85	185
	55/64	.859375	21.8281	19	482.6	28	1.10236	225	107.2	90	194
7/8		.875	22.2250	20	508.0	29	1.14173	230	110.0	95	203
	57/64	.890625	22.6219	21	533.4	30	1.18110	235	112.8	100	212
	29/32	.90625	23.0187	22	558.8	31	1.22047	240	115.6	105	221
	59/64	.921875	23.4156	23	584.2	32	1.25984	245	118.3	110	230
15/16		.9375	23.8125	24	609.6	33	1.29921	250	121.1	115	239
	61/64	.953125	24.2094	25	635.0	34	1.33858	255	123.9	120	248
	31/32	.96875	24.6062	26	660.4	35	1.37795	260	126.6	125	257
	63/64	.984375	25.0031	27	690.6	36	1.41732	265	129.4	130	266

GLOSSARY OF NAMES AND TERMS

ENGINE

BIG END BEARINGS — Connecting rod bearings, con-rod bearings.
CAMSHAFT SPROCKET or **GEAR** — Timing gear, timing wheel.
CONNECTING ROD — Con-rod.
CRANKSHAFT SPROCKET or **GEAR** — Timing gear, timing wheel.
CYLINDER BLOCK — Crankcase, engine block.
END FLOAT — End play, end clearance.
ENGINE — Motor.
ENGINE STEADY — Stabiliser, support.
ENGINE MOUNTING — Mounts, supports.
FLYWHEEL RING GEAR — Starter ring gear, starter driven gear.
FUEL PUMP — Petrol pump.
GUDGEON PIN — Piston pin, wrist pin, small end pin.
INLET MANIFOLD — Intake manifold, induction manifold.
INLET VALVE — Intake valve, induction valve.
MAIN BEARING — Crankshaft bearing.
OIL CONTROL RING — Scraper ring, oil ring.
OIL PUMP (Rotor type) — Inner rotor, outer rotor.
OIL PUMP (Gear type) — Drive gear, driven gear.
O-RING — Neoprene O-ring, oil seal.
POWER UNIT — Engine and gearbox.
RELIEF VALVE — Release valve.
ROCKER ARM — Rocker, tappet.
ROCKER COVER — Valve cover, tappet cover.
SCREEN (Gauze type) — Filter.
SILENCER — Muffler, expansion box.
SMALL END — Little end.
SUMP — Oil pan.
TAPPET (Hydraulic or solid) — Valve lifter, cam follower.
TIMING CHAIN TENSIONER — Chain tightener.
VALVE COTTER — Valve collet, valve keep, valve key.
WATER PUMP IMPELLER — Rotor.
WELCH PLUG — Core plug, expansion plug.

FUEL

ACCELERATOR — Throttle pedal.
ACCELERATOR PUMP — Throttle pump, carburetor pump.
AIR CLEANER — Air filter, air silencer.
BI-METAL SPRING — Thermostat spring.
CHOKE — Strangler, cold starter.
CHOKE VALVE — Choke butterfly.
COMPENSATING JET — Secondary jet.
DASHPOT — Piston damper.
FUEL PUMP — Petrol pump, lift pump.
IDLE JET — Slow running jet, low speed jet.
IDLING MIXTURE SCREW — Volume control screw, mixture control screw, mixture timing screw.
MAIN JET — Primary jet.

SECONDARY JET — Compensating jet.
THROTTLE STOP SCREW — Idling speed screw.
THROTTLE VALVE — Accelerator butterfly.
VENTURI — Choke tube.

CLUTCH

CLUTCH HOUSING — Clutch cover, clutch bell housing.
DRIVEN PLATE — Clutch plate, driven disc, clutch disc.
DRIVEN PLATE FACINGS — Driven plate linings, clutch linings, friction facings.
PRESSURE PLATE — Clutch drive plate.
PRESSURE PLATE COVER — Clutch housing, clutch cover.
RELEASE BEARING — Throw-out bearing, thrust bearing, withdrawal bearing.
RELEASE BEARING PLATE — Throw-out bearing plate, thrust plate.
RELEASE LEVER — Clutch fork, release fork, throw-out lever, withdrawal lever.
SLAVE CYLINDER — Clutch cylinder, operating cylinder, actuating cylinder.

TRANSMISSION

FIRST SPEED — Low gear, first gear, bottom gear.
GEAR SHIFT LEVER — Change speed lever, gear selector lever, gear change lever.
INPUT SHAFT — Clutch shaft, first motion shaft, main drive shaft, primary shaft, main drive gear, spigot shaft.
LAYGEAR — Cluster gear, second motion gear, intermediate gear.
LAYSHAFT — Cluster gear shaft, second motion shaft, intermediate shaft, counter shaft.
MAINSHAFT — Third motion shaft, output shaft, secondary shaft.
NEEDLE BEARINGS — Roller bearings.
PROPELLER SHAFT — Propshaft, drive shaft, tail shaft.
REVERSE IDLER GEAR — Reverse pinion.
SELECTOR SHAFT — Selector rod, selector rail, shift rail, shift rod, shifter shaft.
SHIFT FORK — Selector fork, shifter fork.
SNAP RING — Circlip, spring clip.
SPIGOT BEARING — Pilot bearing, support bearing.
SYNCHRO HUB — Clutch hub.
SYNCHRO PLATE — Synchro bar, synchro key.
SYNCHRO RING — Baulk ring, synchro cone.
SYNCHRO SLEEVE — Clutch sleeve.
SYNCHRO SPRING — Clutch spring, energising spring.
TOP GEAR — High gear, high speed.
TRANSMISSION — Gearbox.
UNIVERSAL JOINT — Drive coupling, Hardy-Spicer joint.
UNIVERSAL JOINT CROSS — Joint trunnion.
UNIVERSAL JOINT YOKE — Universal joint fork.

REAR AXLE

AXLE SHAFT — Drive shaft, half shaft.
AXLE SHAFT BEARING — Rear wheel bearing, rear axle race, rear hub bearing.
CARRIER BEARING — Differential bearing, side bearing.
CROWNWHEEL — Ring gear, final drive gear, spiral drive gear.
DIFFERENTIAL PINION — Spider pinion, pinion gear, planet wheel.
DIFFERENTIAL SIDE GEAR — Axle shaft gear, spider gear, sun wheel.
DRIVE PINION — Final drive pinion, bevel pinion, spiral drive pinion.
PINION FLANGE — Drive coupling.

SUSPENSION/STEERING

BUMP RUBBER — Bumper, bump stop, rebound rubber.
CONTROL ARM — Wishbone, suspension arm, link, track control arm.
CONTROL ARM BALL JOINT — Upper ball joint, lower ball joint.
CONTROL ARM SHAFT — Fulcrum pin, fulcrum shaft, pivot pin.
IDLER ARM — Intermediate lever or arm.
PITMAN ARM — Steering arm, drop arm, sector shaft arm.
SECTOR SHAFT — Roller shaft, pitman arm shaft, drop arm shaft.
SHOCK ABSORBER — Damper.
STABILISER BAR — Ride stabiliser, away bar, anti-roll bar.
STEERING ARM — Knuckle arm, steering lever, pitman arm.
STEERING CONNECTING ROD — Relay rod, drag link.
STEERING GEAR — Steering gearbox, steering box, rack and pinion.
STEERING LINKAGE — Track rods, tie rods.
STEERING SHAFT — Steering column.
STUB AXLE — Swivel axle.
STUB AXLE SUPPORT — Steering knuckle support, swivel link, control arm link.
SUSPENSION STRUT — Suspension leg, MacPherson Strut.
TIE ROD BALL JOINT — Tied rod end, track rod end.
TORQUE RODS — Anti-tramp rods.
WHEEL ALIGNMENT — Toe-in, track alignment, tracking.
WISHBONE — Control arm, suspension arm.

BRAKES

BACKING PLATE — Brake plate, back plate.
FLEXIBLE BRAKE PIPE — Brake hose. flexible connector.

HANDBRAKE — Parking brake.
LININGS — Shoe facings, friction facings.
PISTON — Plunger.
PRESSURE DIFFERENTIAL VALVE AND WARNING SWITCH — Brake line pressure warning switch, hydraulic safety switch.
PRESSURE LIMITING VALVE — Brake pressure regulator, pressure reduction valve, pressure conscious reducing valve.
PRIMARY CUP — Main cup, main rubber seal.
RETURN SPRING — Pull-off spring, retractor spring.
SECONDARY CUP — Piston seal.
VACUUM SERVO UNIT — Servo, power brake unit, brake booster unit.
WHEEL CYLINDER — Actuating cylinder, brake cylinder.
WHEEL CYLINDER CUP — Wheel cylinder rubber, wheel cylinder seal.

ELECTRICAL

ALTERNATOR — AC Generator.
ALTERNATOR-REGULATOR — Voltage regulator, control box.
BUEB — Lamp, globe.
CAPACITOR — Condenser.
CONTACT BREAKER POINTS — Contact points, circuit breaker contacts.
COURTESY LAMP — Interior light, roof light.
DIPPER SWITCH — Dimmer switch.
DISTRIBUTOR — Timer.
FUEL GAUGE — Petrol gauge.
GENERATOR — Dynamo.
GENERATOR-REGULATOR — Voltage regulator, control box.
HARNESS — Loom.
HAZARD WARNING SYSTEM — Emergency flashers.
HEADLAMP — Head light, main light.
HIGH TENSION LEADS — Plug wires, plug leads.
HORN PUSH — Horn switch, horn button.
INSTRUMENT LAMP — Panel light.
LAMP — Light.
LENS — Glass, crystal.
MEDALLION — Name plate, cover, motif, emblem.
NUMBER PLATE LAMP — Licence plate light.
PARKING LAMP — Side light, side lamp.
ROTOR ARM — Rotor button.
STOP LAMP — Brake light.
STARTER — Starter motor.
STARTER DRIVE — Bendix gear, drive pinion.
TAIL LAMP — Rear light, tail light.
TEMPERATURE GAUGE — Heat gauge.
TURN SIGNAL LAMP — Direction indicator light, flasher light, trafficator light.
TURN SIGNAL RELAY — Flasher unit.
TURN SIGNAL SWITCH — Direction indicator switch, flasher switch, trafficator switch, indicator stalk.

VACUUM ADVANCE UNIT — Advance and retard unit, vacuum advance, vacuum capsule.

WARNING LAMP — Indicator light.

WINDSCREEN WIPER — Windshield wiper.

BODY

BONNET — Hood, engine compartment lid.

BULKHEAD — Scuttle, firewall.

BUMPERS — Bumper bar, fender.

DOOR GLASS — Door window, window glass.

FENDER — Mudguard, wing.

GLASS LIFT CHANNEL — Window lift channel.

GLASS REGULATOR — Window lift regulator, window winder.

GLASS RUN CHANNEL — Glass channel, glass runner, bailey channel.

HEADLINING — Roof lining, head cloth.

LUGGAGE COMPARTMENT — Boot.

MOULDING — Chrome strip, finishing strip.

PANEL — Skin.

REAR GLASS — Back light, rear screen, back window.

VENTILATOR GLASS — Quarter light, no draught ventilator, vent glass, quarter glass, flipper window.

WEATHERSTRIP — Weathershield, glazing channel, door belt weatherstrip.

WINDSCREEN — Windshield.

COMMON ABBREVIATIONS

AC — Alternating current.

APS — Air preheat system.

atdc — After top dead centre.

bbdc — Before bottom dead centre.

bdc — Bottom dead centre

bhp — Brake horse power

btdc — Before top dead centre

cc — Cubic centimetre.

CVJ — Constant velocity joint.

Cyl — Cylinder.

DC — Direct current.

Deg — Degrees.

EEC — Evaporative emission control.

EGR — Exhaust gas recirculation.

EP — Extreme pressure.

FWD — Front wheel drive.

HC — High compression.

HD — Heavy duty.

HT — High tension.

LC — Low compression.

LH — Left hand.

LT — Low tension.

MS — Manufacturers' specification.

OHC — Overhead camshaft.

OHV — Overhead valves.

PCV — Positive crankcase ventilation.

RH — Right hand.

rpm — Revolutions per minute.

SC — Single carburettor.

TC — Twin carburettor

TCS — Transmission control switch.

tdc — Top dead centre.

TVS — Thermal vacuum switch.

UJ — Universal joint.

VAC — Vacuum advance control.

INTRODUCTION 7

TOOLS-EQUIPMENT-SAFETY

- Safety 10
- Tools and equipment 8

LUBRICATION AND MAINTENANCE

- How to grease and oil change 11
- Lubrication chart 17
- Maintenance chart 18
- Service schedules 13
- Specifications 11
- Tyre wear trouble shooting 15

ENGINE TUNE-UP

- Drive belts 23
- Tune up operations 19
- Tune up specifications 19

ROADSIDE TROUBLE SHOOTING

- To check fuel system 25
- To check ignition and electrical system 24
- To check mechanical system 27
- Trouble shooting 24

ENGINE

- Camshaft and timing chain 45
- Crankshaft and bearing 43
- Cylinder head 35
- Description 33
- Engine assembly 33
- Engine mechanical trouble shooting 30
- Engine mountings 49
- Engine sump 38
- Exhaust system 48
- Flywheel/drive plate 49
- Hydraulic tappets 47
- Oil pump 39
- Pistons, connecting rods and cylinder bores 40
- Rocker arms and pushrods 34
- Specifications 29
- Timing cover and oil seal 45

COOLING SYSTEM

- Cooling system trouble shooting 51
- Description 52
- Heater assembly 57
- Radiator 53
- Specifications 51
- Thermostat 54
- Water pump 55
- Welch plugs 57

FUEL SYSTEM

- Accelerator cable 66
- Air cleaner 65
- Fuel pump 65
- Fuel system trouble shooting 59
- Fuel tank 67
- Specifications 59
- Stromberg RX carburettor 60

CLUTCH

- Clutch cable 70
- Clutch pedal 71
- Clutch release bearing assembly 70
- Clutch trouble shooting 68
- Clutch unit 69
- Description 69
- Specifications 68

MANUAL TRANSMISSION

- Part 1. Manual transmission and propeller shaft trouble shooting 72
- Part 2. 3 speed transmission 74
- Column change gearshaft control assembly 81
- Description 74
- Specifications 74
- Transmission assembly 74
- Part 3. 4 speed transmission 81
- Description 81
- Specifications 81
- Transmission assembly 82
- Part 4. Propeller shaft 90

AUTOMATIC TRANSMISSION

- Automatic transmission trouble shooting 91
- Description 91
- Front band 94
- Hydraulic fluid 92
- Neutral safety switch 96
- Rear band 94
- Specifications 91
- T-bar detent pawl 95
- Transmission assembly 97
- Transmission kickdown cable 96
- Transmission shift linkage 97
- Vacuum modulator 94

REAR AXLE

- Axle shaft and bearings 102
- Cover plate gasket 104
- Description 102
- Drive pinion oil seal 104
- Limited slip differential 106
- Rear axle assembly 105
- Rear axle trouble shooting 100
- Specifications 100

STEERING

- Part 1. Steering trouble shooting 109
- Part 2. Conventional steering 111
- Description 111
- Specifications 111
- Steering gear assembly 114
- Steering idler arm and bracket 117
- Steering linkage 116
- Steering wheel and column 111
- Part 3. Power steering 118
- Description 118
- In car adjustments and minor repairs 119
- Power steering pump 120
- Preliminary inspection and testing 118

Specifications	118
Steering gear	120

FRONT SUSPENSION

Ball joints	127
Description	123
Front hub assembly	123
Front suspension trouble shooting	122
Lower suspension arm	125
Radius rod	128
Shock absorbers	124
Specifications	122
Stabiliser bar	128
Suspension and steering angles	128
Upper suspension arm and coil spring	126

REAR SUSPENSION

Description	131
Rear stabiliser bar	133
Rear suspension radius rod	133
Rear suspension trouble shooting	130
Shock absorbers	131
Specifications	130
Springs	132

BRAKES

Brake adjustments	148
Brake pedal assembly	150
Brake servo unit	148
Brakes trouble shooting	134
Description	136
Dual circuit master cylinder	136
Front disc brakes	141
Handbrake lever and cables	150
Hydraulic system	149
Rear disc brakes	144
Rear drum brake assembly	139
Specifications	134

ELECTRICAL SYSTEM

Alternator	159
Battery	158
Battery and charging system trouble shooting	153
Battery and starting system trouble shooting	155
Direction indicator light system trouble shooting	156
Distributor	164
Fuses and fusible links	175
Headlamp system trouble shooting	155
How to wire up a trailer	173
Ignition system trouble shooting	156
Instrument cluster	169
Lamp units	169
Rear window wiper (Station Wagon)	173
Specifications	153
Starter motor	162
Switches and controls	166
Test equipment and some applications	157
Windscreen wipers	172
Wiring diagrams	176

BODY

Engine bonnet	188
Front doors	182
Luggage compartment lid	188
Radiator grille	192
Rear doors	185
Rear quarter glass (Utility and Van)	192
Tailgate assemblies	189
Windscreen or rear window glass	182
Vehicle cleaning	193

EMISSION CONTROL

Evaporative control system	198
Exhaust control system	196
Introduction	195
Positive crankcase ventilation system	195

SUPPLEMENT-ALLOY HEAD MODELS

PRODUCED AFTER MID 1980	200
Alloy Cylinder Head	201
Cooling System	202
Fuel System	203
Manual Transmission, Rear Axle, Clutch	204
Steering, Rear Suspension	205
Electrical	206

CONVERSION TABLES

GLOSSARY OF NAMES AND TERMS	212
--	-----



This disc was created and copyrighted by [karamar38](#) and as such it is prohibited to copy (except as a backup) or resell without the express written consent of the creator.