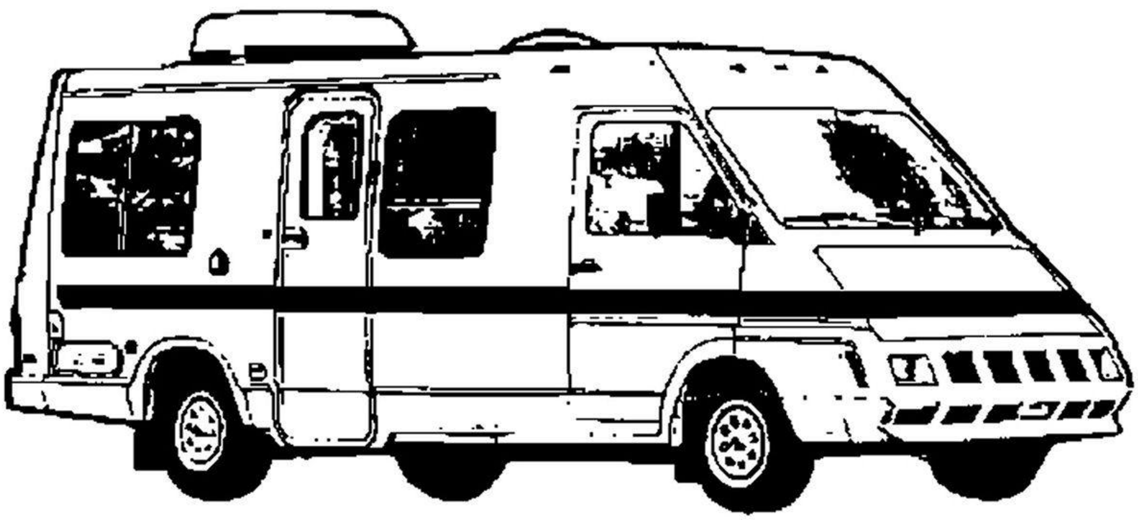
WINNEBAGO

SERVICE

Itasca



SERVICE MANUAL

Bosch Fuel Injection

1987 - 1989 LeSharo, Phasar, and Utility Van

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TABLE OF CONTENTS

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LE SHARO, UTILITY VAN, AND PHASAR BY WINNEBAGO INDUSTRIES

SERVICE MANUAL

This service manual describes and illustrates procedures for the removal, repair, and reinstallation of individual components and assemblies of the Winnebago LeSharo, Utility Van, and Itasca Phasar vehicles, also known cumulatively as the "H" body.

Keep this manual available for ready reference. It will aid the technician in providing quality service and repairs to the owners of the LeSharo, Utility Van, and Phasar vehicles.

The repair methods described in this manual are based upon the most recent information available at the time of publication. Winnebago Industries, Inc., reserves the right to make any changes without prior notice.

Winnebago Industries, Inc., reserves the right to make changes in design and to make additions to or improvement in its products without imposing any obligation upon itself to make such changes, improvements, or additions to products previously manufactured.

CAUTION
To properly reduce the chance of personnel injury and/or property damage, the following instructions must be carefully observed.

Proper service and repair are important to the safety of the service technician and the safe, reliable operation of all motor vehicles. If part replacement is necessary, the part must be replaced with one of the same part number or with an equivalent part. Do not use a replacement part of lesser quality.

The service procedures recommended and described in this manual are effective methods of performing service and repair. Some of these procedures require the use of tools specially designed for the purpose.

Accordingly, anyone who intends to use a replacement part, service procedure or tool, which is not recommended by the vehicle manufacturer, must first determine that neither his safety nor the safe operation of the vehicle will be jeopardized by the replacement part, service procedure, or tool selected.

It is important to note that this manual contains various "Cautions" and "Warnings" that must be carefully observed in order to reduce the risk of personal injury during service or repair, or the possibility that improper service or repair may damage the vehicle or render it unsafe. It is also important to understand that these "Cautions" and "Warnings" are not exhaustive, because it is impossible to warn of all the possible hazardous consequences that might result from failure to follow these instructions.

These vehicles contain some parts dimensioned in the metric system as well as in the domestic system. Some fasteners are metric and are very close in dimension to familiar customary fasteners in the inch system. It is important to note that, during any vehicle maintenance procedures, replacement fasteners must have the same measurements and strength as those removed, whether metric or domestic. (Numbers on the heads of metric bolts and on surfaces of metric nuts indicate their strength. Domestic bolts use radial lines for this purpose, while most domestic nuts do not have strength markings.) Mismatched or incorrect fasteners can result in vehicle damage or malfunction, or possibly personal injury. Therefore, fasteners removed from the vehicle should be saved for reuse in the same location unless otherwise indicated. Where the fasteners are not satisfactory for reuse, care should be take to select a replacement that matches the original.

Winnebago Industries, Inc.
Forest City, Iowa 50436

TERM DEFINITIONS

Throughout this manual, you will find the following headings which are an indication of the direction given in the text:

Disassemble	Indicates that a component or assembly be completely disassembled.
Assemble	Indicates that a component or assembly be completely reassembled.
Remove or Disconnect	Indicates that a part or assembly be removed from the prescribed component.
Install or Connect	Indicates that a part or assembly be installed to the prescribed component.
Tighten	Indicates that a specific torque is required.
Adjust	Indicates that an adjustment procedure is required.
Measure	Indicates that a specific measurement procedure is required.
Clean	Indicates that all grease, oil, dirt, and foreign material must be removed from a part or assembly.
Inspect	Indicates that a part or assembly must be checked as directed.
Important	Indicates a special point of information on assembly or procedure.

CAUTION

Indicates that a failure to observe can cause damage to equipment.

WARNING

Indicates that a failure to observe can cause damage to equipment or personal injury. This symbol is used throughout the manual to alert you to precautions that involve your personal safety. Read and follow them carefully.

SECTION "A"

General Information

Subsection 1 - General

Subsection 2 - Maintenance and Lubrication

VEHICLE IDENTIFICATION SPECIFICATIONS

The V.I.N. will identify the unit as either LeSharo, Utility Van, or Phasar. It also identifies the body type, the specific model, the G.V.W.R. chassis, the engine type, the year of manufacture, the consecutive serial number, and whether any major revisions have been made in the model line during the year.

1 W W B B 1 5 M 4 H F 2 1 2 3 4 5

REGISTERED I.D.

BODY TYPE

B = Class B
C = Class C

MODEL SERIAL

B = 200

G. V.W.R. CLASS (FROM TABLE 1)

12 = CLASS B (3001# to 4000#)
13 = CLASS C (4001# to 5000#)
14 = CLASS D (5001# to 6000#)
15 = CLASS E (6001# to 7000#)

ENGINE TYPE

M = Gas 2.20 Litre (134.2 CID)
Z = Diesel 2.068 Litre (126.2 CID)
Y = Diesel 2.068 Litre (126.2 CID) Turbocharged

CHECK DIGIT

MODEL YEAR

H = 1987
J = 1988
K = 1989

PLANT OF MANUFACTURE

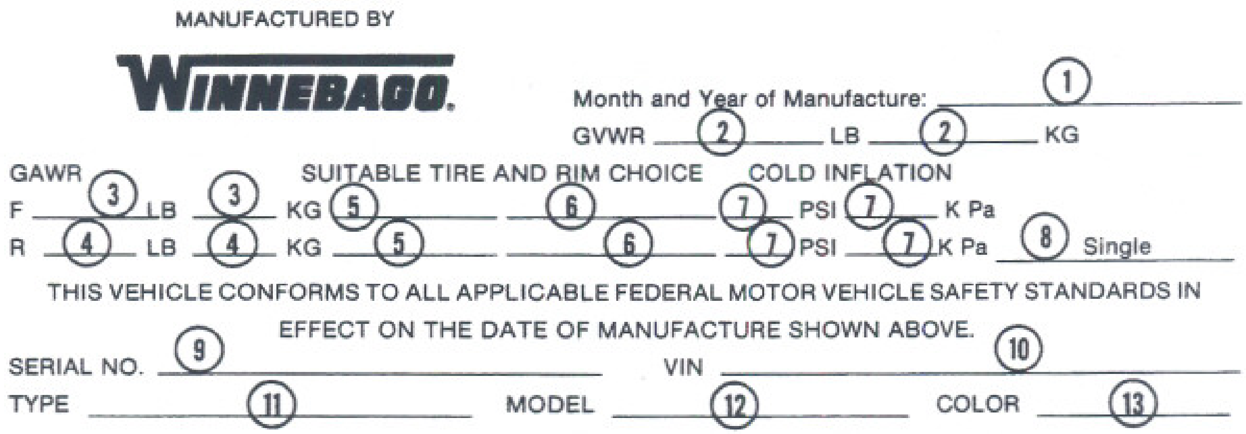
F = FOREST CITY, IOWA

MANUFACTURING CODE

SEQUENCE OF MANUFACTURE

VEHICLE IDENTIFICATION SPECIFICATIONS

Vehicle Certification Label - All LeSharo, Utility Van, and Phasar vehicles will display the vehicle certification label on the driver's door latch post or on the driver's door. This label contains important information, including manufacturing date, G.V.W.R. and G.A.W.R. limits, rim and tire size and inflation pressures, serial and model number, V.I.N. number, type of vehicle and color specifications. Never destroy or remove this label.



Explanation of Data

1. Month and year of manufacturer at Winnebago Industries, Inc.

2. Gross Vehicle Weight Rating: The total permissible weight of the vehicle, including driver, passengers, and the vehicle itself with all options, and the load it is carrying, including all liquids. (Given in pounds and kilograms.)

3. Gross Axle Weight Rating - Front: The total permissible weight allowed for the front axle. (Listed in pounds and kilometers.)

4. Gross Axle Weight Rating - Rear: The total permissible weight allowed for the rear axle. (Listed in pounds and kilograms.)

5. Suitable Tire Choice: Tire recommended to meet handling and safety requirements. When replacing any tires on your vehicle, always replace with a tire that meets or exceeds these specifications.

6. Suitable Rim Choice: Front/Rear: Wheel rim recommended to meet handling and safety requirements. When replacing any rim, always replace with a rim that meets these specifications.

7. Cold Inflation Pressure: Front/Rear: Inflation pressure recommended (while cold) for the tires originally equipped on your vehicle. These pressure levels must be maintained to assure proper handling, safety, and fuel economy.

8. Rear Axle Wheel Configuration: Single, Dual, etc.

9. Serial Number: This is the serial number assigned to your vehicle by Winnebago Industries.

10. Vehicle Identification Number: This number is the legal identification number of your vehicle which will be used on your vehicle's Title Certificate and Owner Registration Certificate. It is permanently attached to the front left of the dashboard bracket and can be seen through the windshield from the outside of the vehicle.

11. Type: States the NHTSA designated usage classification for your motor home. MPV signifies a Multipurpose Passenger Vehicle.

12. Model: Lists the Winnebago Industries product model number of your vehicle.

13. Color: Signifies the base color code number of the vehicle.

JACKING, HOISTING, AND RECOVERY TOWING

Hoisting

Conventional hydraulic hoist may be used to lift the vehicle only if the hoist adaptor plates make firm contact with the front lower control arms and the rear axle.

Jacking and Recovery Towing - Method 1

WARNING

No towing operation should be attempted which could jeopardize the safety of the wrecker operator, any bystanders, or other motorists.

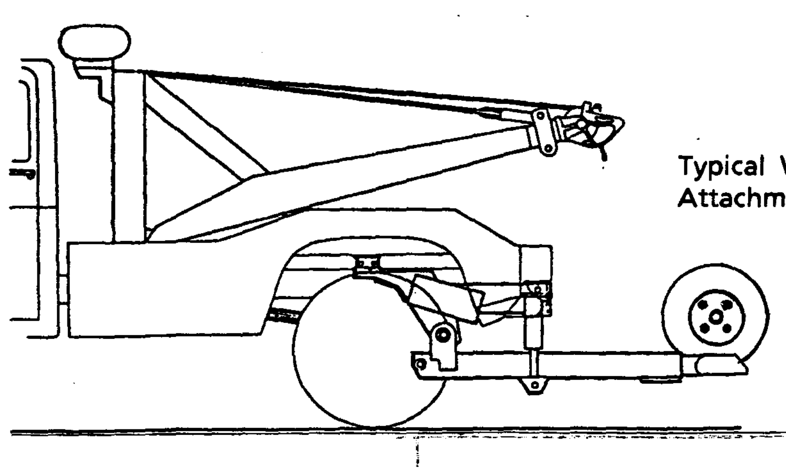
CAUTION

Do NOT tow, lift, or place force from a towing sling or similar device on the front bumper. Tow vehicle from the rear using a towing dolly under the front wheels.

A towing sling (Holmes TS-100 Universal or equivalent) is recommended when towing from the rear of the vehicle. In addition, a 4" x 4" lumber spacing material and safety chains around the rear axle assembly are required to prevent damage to the body, bumper, or other vehicle components.

Jacking and Recovery Towing - Method 2

A wheel lift wrecker attachment is also recommended (Holmes UTC 100, Sentry WL 300, Holmes DST 200, Sentry WL 600). This type of device lifts the vehicle by the front wheel and suspension and creates no danger to the front end components.



Typical Wheel Lift Attachment

CAUTION
Jack only at the approved jacking points. Never lift or hook up chains or towing devices on the drive shafts, front suspension arms, or rear spring blades.

Jacking Points

CONVERSION TABLE

DECIMAL AND METRIC EQUIVALENTS					
Fractions	**Decimal In.**	**Metric MM**	**Fractions**	**Decimal In.**	**Metric MM**
1/64	.015625	.39688	33/64	.515625	13.09687
1/32	.03125	.79375	17/32	.53125	13.49375
3/64	.046875	1.19062	35/64	.546875	13.89062
1/16	.0625	1.58750	9/16	.5625	14.28750
5/16	.078125	1.98437	37/64	.578125	14.68437
3/32	.09375	2.38125	19/32	.59375	15.08125
7/64	.109375	2.77812	39/64	.609375	15.47812
1/8	.125	3.1750	5/8	.625	15.87500
9/64	.140625	3.57187	41/64	.640625	16.27187
5/32	.15625	3.96875	21/32	.65625	16.66875
11/64	.171875	4.36562	43/64	.671875	17.06562
3/16	.1875	4.76250	11/16	.6875	17.46250
13/64	.203125	5.15937	45/64	.703125	17.85937
7/32	.21875	5.55625	23/32	.71875	18.25625
15/64	.234375	5.95312	47/64	.734375	18.65312
1/4	.250	6.3500	3/4	.750	19.05000
17/64	.265625	6.74687	49/64	.765625	19.44687
9/32	.28125	7.14375	25/32	.78125	19.84375
19/64	.296875	7.54062	51/64	.796875	20.24062
5/16	.3125	7.93750	13/16	.8125	20.63750
21/64	.328125	8.33437	53/64	.828125	21.03437
11/32	.34375	8.73125	27/32	.84375	21.43125
23/64	.359375	9.12812	55/64	.859375	21.82812
3/8	.375	9.52500	7/8	.875	22.22500
25/64	.390625	9.92187	57/64	.890625	22.62187
13/32	.40625	10.31875	29/32	.90625	23.01875
27/64	.421875	10.71562	59/64	.921875	23.41562
7/16	.4375	11.11250	15/16	.9375	23.81250
29/64	.453125	11.50937	61/64	.953125	24.20937
15/32	.46875	11.90625	31/32	.96875	24.60625
31/64	.484375	12.30312	63/64	.984375	25.00312
1/2	.500	12.70000	1	1.00	25.4000

CONVERSION TABLE

Multiply	By	To Get Equivalent Number of:
	LENGTH	
Inch	25.4	millimeters (mm)
Foot	0.304	meters (m)
Yard	0.914	meters
Mile	1.609	kilometers (km)
	AREA	
Inch	645.2	millimeters (mm)
	6.45	centimeters (cm)
Foot	0.092	meters (m)
Yard	0.836	meters
	VOLUME	
Inch	16.387	mm
	16.387	cm
	0.016	litres (1)
Quart	0.946	litres
Gallon	3.785	litres
Yard	0.764	meters (m)
	MASS	
Pound	0.453	kilograms (kg)
Ton	907.18	kilograms (kg)
Ton	0.907	tonne (t)
	FORCE	
Kilogram	9.807	newtons (N)
Ounce	0.278	newtons
Pound	4.448	newtons
	TEMPERATURE	
Degree Fahrenheit	(F-32) - 1.8	degree Celsius (C)
	ACCELERATION	
Foot/sec	0.304	meter/sec (m/s)
Inch/sec	0.025	meter/sec
	TORQUE	
Pound-inch	0.112	newton-meters (N-m)
Pound-foot	1.355	newton-meters
Pound-foot	.1355	deca-newton meters (daNm)
	POWER	
Horsepower	0.746	kilowatts (kW)
PRESSURE OR VACUUM		
Inches of water	.354	Bars
Pounds/sq. in.	.068	Bars
ENERGY OR WORK		
BTU	1.055	joules (J)
Foot-pound	1.355	joules
Kilowatt-hour	3 600 000 or 3.6 x 10	joules

CONVERSION TABLE

Multiply	By	To Get Equivalent Number of:
	LIGHT	
Foot candle	1.076	lumens/meter (lm/m)
	FUEL PERFORMANCE	
Miles/gal.	.0425	kilometers/liter (km/l)
Gal/mile	2.352	liter/kilometer (l/km)
	VELOCITY	
Miles/hour	1.609	kilometers/hr (km/h)

CAPACITIES AND SPECIFICATIONS

Vehicles Equipped with J7T-239 Fuel Injected Gasoline Engine

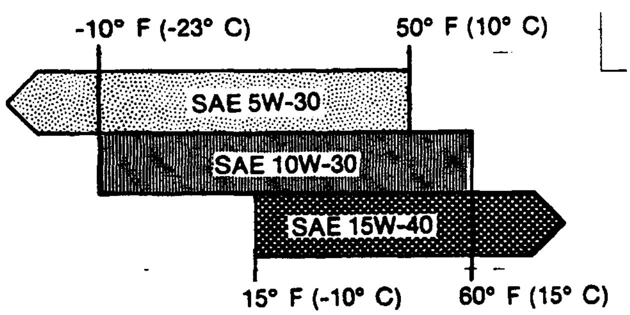
Fuel Tank	15.5 gallons	58.7 litres
Engine Oil (Crankcase)	5.3 quarts	5 litres
Engine Oil Filter	.52 quart	.50 litre
Cooling System*	10.4 quarts	9.8 litres
Automatic Transmission	2.1-2.6 quarts	2.0-2.5 litres
Final Drive - Drain & refill only/with cooler	.85/1.16 quart	0.8/1.1 litre
Brake Circuit (Dual)	.74 quart	0.7 litre
Power Steering	1.22 quart	1.15 litre
5-Speed Transmission	2.6 quarts	2.5 litre

* Without Motoraid Water Heater or Rear Heater

Oil Filter	- Part #R77007-30-077
Air Filter	- Part #R14636-35-132
Fuel Filter	- Part #R14636-35-181
Final Drive/5 Speed Transmission Oil	- API = GL5: SAE 80W-90 at 15° F or above SAE 75W below 15° F
Brake Fluid	- SAE J 1703F DOT 3-SAE J 1703 DOT 4
Coolant	- Prestone II brand antifreeze/coolant
Power Steering/Automatic Transmission Fluid	- Mobil 220 ATF Dexron II or equivalent
Engine Oil Drain Plug Seal	- Part #R79030-62-003
Automatic Transmission Draining Plug Seals	- Part #R77030-62-023 and R79030-62-003

OIL

Engine: Oil used must correspond to the standard MIL-L-46152B or API-SF. The term SF must appear on the container singly or in conjunction with other designations. Refer to the viscosity chart below for recommendations according to ambient temperatures. DO NOT use 10W-30 above 60° F (15° C). NEVER use 10W-40 oils in this engine.



ENGINE OIL LEVEL CHECK

The vehicle's engine oil must be maintained at the proper level to assure proper lubrication of the engine. It is the owner's responsibility to check the oil level regularly, such as at every fuel stop. It is common for gasoline engines to consume oil during and after the initial break-in period.

When adding oil, be sure that you use the same brand and grade of oil used during the last oil change. DO NOT overfill beyond the "max." notch on the dipstick. The level must NEVER be below the "min." mark.

CAUTION

The engine must not be flushed out under any circumstances.

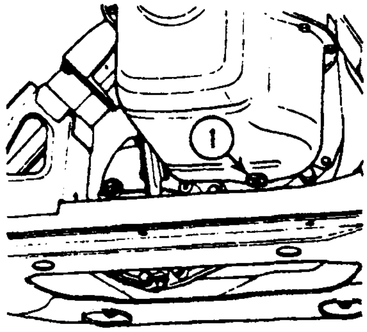
FLUID CHANGING
OIL DRAINING AND REFILLING

ENGINE, GEARBOX, AND FINAL DRIVE

Engine Oil Change

1. Remove drain plug 1. Allow time for old oil to drain.
2. Replace drain plug crush washer with new one.
3. Reinsert drain plug into drain hole.
4. Refill crankcase through filler hole on top of engine.

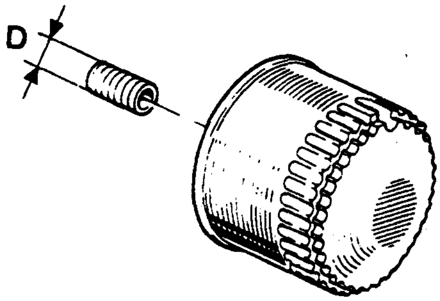
NOTE: Be sure to allow for the additional capacity of the oil filter (.52 qt./.50 litre) when refilling crankcase.



1. Engine Oil Drain Plug

Oil Filter

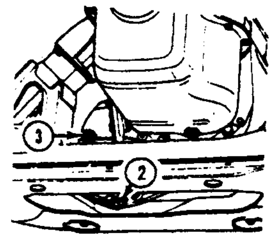
The oil filter is designed specifically for this engine. It has a special thread pitch and has internal flow characteristics to insure proper engine lubrication under all conditions. Use of improper filters could cause premature engine wear and possible engine failure.



TRANSMISSION, GEARBOX, AND FINAL DRIVE OIL CHANGE

To Change Final Drive

1 Remove drain plug 2. Allow adequate time for old oil to drain.
2. Reinsert plug into hole 2.
3. Refill reservoir through fill plug hole 3 until oil just starts to run out.
4. Reinsert plug into hole 3.

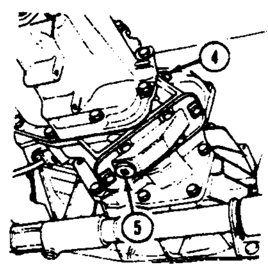


2. Final Drive Drain Plug
3. Final Drive Fill Plug

CAUTION
When replacing a system component only, such as the differential, radiator, oil line or pump filter, the system must be reprimed with oil. Refer to Section F - "Automatic Transaxle" or Section G - "Manual Transmission" for the correct procedure.

To Change Gearbox Oil (5-Speed)

1. Remove drain plug 5. Allow adequate time for old oil to drain.
2. Replace oil drain plug washer with new one.
3. Reinsert drain plug into drain.
4. Refill reservoir through fill plug hole 4 until oil just starts to run out.
5.-Reinsert plug into hole 4.

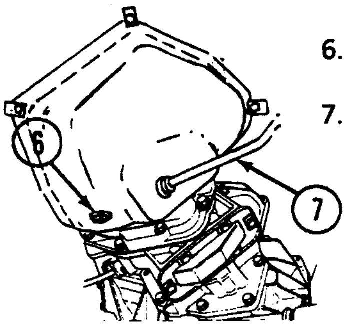


4. Gearbox Fill Plug
5. Gearbox Drain Plug

FLUID CHANGING

To Change Automatic Transmission Fluid:

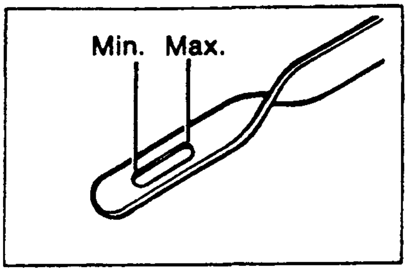
1. Remove drain plug 6. Allow adequate time for old oil to drain.
2. Replace drain plug crush washer with new one.
3. Reinsert drain plug into drain hole.
4. Refill reservoir with fluid through transmission dipstick tube 7.



6. Transmission Drain Plug
7. Transmission Fill (Dipstick Tube)

AUTOMATIC TRANSMISSION FLUID CHECK

Check the automatic transmission fluid level after driving a sufficient distance so that the engine and transmission are at operating temperature. With the handbrake engaged and the engine idling in **Park**, pull out dipstick and wipe clean. Reinsert into the tube momentarily, and pull out again to read the level. Do not allow the level to go below the "**MIN**" mark or above "**MAX**" or transmission damage may occur. If necessary, add the appropriate amount of transmission fluid through the dipstick tube using a funnel.



Automatic Transmission Dipstick

SERVICE AND MAINTENANCE

CHASSIS MAINTENANCE
The following pages list the required and recommended scheduled maintenance services for your Winnebago vehicle, with descriptions of the operations to be performed at each service.

Some operations listed in the maintenance schedule are required at the specific intervals to maintain emission control performance standards. Failure to have these services performed at the intervals stated may affect your warranty coverage.

NOTE: The vehicle may require additional maintenance if it is operated under extreme conditions such as non-use for long periods of time, excessive start and stop driving conditions, extreme cold or desert climates, sustained high-speed driving, frequent engine idling, heavy-duty loading, commercial use, or any other extreme operating condition.

It is the owner's responsibility to recognize the vehicle's operating conditions and to ensure that the vehicle is properly serviced according to the maintenance schedule.

The service intervals indicated on the charts are based on the odometer reading on your vehicle or the number of months since the vehicle was first used, whichever occurs first. Maintenance should be continued at the same intervals for mileage beyond that indicated on the charts.

Chart Code Explanation
The letter "R" opposite a service indicates that a replacement is necessary. An "A" denotes a necessary adjustment. The letter "I" indicates that an inspection is recommended. (Inspections may lead to adjustments or other mechanical operations.) The symbol "*" beside a letter indicates that the service specified is required to maintain the vehicle's emissions. Refer to "Service Operation Descriptions" for details.

It is the owner's responsibility to keep maintenance records since it may be necessary to prove that required and recommended maintenance has been performed. These records should be left in the glove compartment and passed on to the subsequent owner when the vehicle is sold.

Also, ensure that your dealer or other servicing establishment marks the corresponding box on the chart anytime a maintenance service is performed. Remember, proper service at the proper intervals protects your investment.

NOTE: All kilometer figures listed on the charts are approximate. For comparison, one mile equals 1.609 km.

NOTE: The need for service is determined by a mileage or time interval. In most cases, the odometer mileage will indicate when service is required. However, if driven very little, the vehicle should be serviced at least every twelve months. Under severe driving conditions, more frequent maintenance is required.

CHASSIS MAINTENANCE SCHEDULE

MONTHS	1	6	12	18	24	30	36	42	48	54	60	66	72
MILES x 1000	1	5	10	15	20	25	30	35	40	45	50	55	60
Ref. Operation													
1. Engine Oil*†	R	R	R	R	R	R	R	R	R	R	R	R	R
2. Oil Filter*†	R		R		R		R		R		R		R
3. Auto. Transmission Fluid	R	I	I	R	I	I	R	I	I	R	I	I	R
4. Manual Transmission Oil	R	I	I	R	I	I	R	I	I	R	I	I	R
5. Differential Oil	R	I	I	R	I	I	R	I	I	R	I	I	R
6. Clutch Adjustment	I			I			I			I			I
7. Idle Speed	*A						*A						*A
8. Air Filter							*R						*R
9. Spark Plugs							*R						*R
10. Drive Belts	I			I			*A			I			*A
11. Hoses/Connections	I					I					*I		
12. Oxygen Sensor											*I		
13. Valve Lash							*I						*I
14. PCV System											*I		
15. Fuel Filters†					R				*R				R
16. Exhaust System	I			I			I			I			I
17. Ignition System							I						I
18. Fluid Checks	I	I	I	I	I	I	I	I	I	I	I	I	I
19. Engine Coolant							R						R
20. Evaporative System				I			I			I			I
21. Timing Belt				I			*A			I			*R
22. Batteries	I	I	I	I	I	I	I	I	I	I	I	I	I
23. Brakes	I			I			I			I			I
24. Tires	I			I			I			I			I
25. Axles/Suspension/Steering	I			I			I			I			I
26. Wheels	I	I	I	I	I	I	I	I	I	I	I	I	I
27. Engine Mountings				I			I			I			I
28. Lights/Electrical System	I	I	I	I	I	I	I	I	I	I	I	I	I
29. Rocker Shaft Oil Filter							R						R
30. Road Test	I	I	I	I	I	I	I	I	I	I	I	I	I

After 60,000 miles, maintenance should be continued at equivalent intervals by repeating the chassis maintenance schedule (except for the 1,000 mile maintenance check). For reference, 5,000 miles would equal 65,000 miles, 10,000 would equal 70,000, etc.

R - Replacement necessary
A - Adjustment necessary
I - Inspect and adjust, add or replace if necessary
* - Required to maintain emissions standards and warranty

†Note: If the vehicle is used under unusual driving conditions such as driving in dusty areas, extensive engine idling, trailer towing or repeated short trips of 5 miles or less, more frequent service is recommended.

SERVICE OPERATION DESCRIPTIONS

NOTE: Your need for service is determined by a mileage or time interval. In most cases, the odometer mileage will indicate when service is required. However, if you drive very little, your vehicle should be serviced at least every twelve months. Under severe driving conditions, such as driving in dusty areas, extensive engine idling, towing a trailer or repeated short trips of 5 miles or less in freezing temperature, more frequent maintenance is recommended.

1. Engine Oil - Change engine oil during the 1000 mile maintenance check, and at each required service interval thereafter. Check oil at each fuel fill.*

NOTE: If you use your vehicle under unusual driving conditions, such as driving in dusty areas, extensive engine idling, towing a trailer, or repeated short trips of 5 miles or less in freezing temperatures, then change your oil every 3 months or 3000 miles.

2. Engine Oil Filter - Change engine oil filter during the 1000 mile maintenance check and, thereafter, at listed intervals. Use only Winnebago approved filter.*
3. Automatic Transmission Fluid - Change the automotive transaxle fluid and clean filters at the 1000 mile maintenance check and at specified intervals thereafter.*†
4. Manual Transmission Oil Change - Transmission oil must be changed during the 1000 mile maintenance service and at each prescribed interval thereafter. The drain plug crush washer must be replaced at each oil change. Be sure to thoroughly inspect for leaks around gaskets and drain plugs after an oil change.
5. Differential Oil - Change final drive oil during the 1000 mile maintenance check and, thereafter, at intervals listed.† Check level at each engine oil change.*
6. Clutch Check and Adjustment - Check operation clearance and adjust, if necessary, during the 1,000 mile maintenance service and at prescribed intervals thereafter.
7. Idle Speed (Qualified Technician Required) - Check and adjust the curb/fast idle at the 1,000 mile maintenance check and at specified intervals thereafter.
8. Air Filter - Replace air cleaner element at 30,000 miles.† Use only Winnebago approved air filter.*
9. Spark Plugs - Replace the spark plugs at 30,000 miles.† See Engine Specifications for recommended spark plugs.
10. Drive Belts (Qualified Technician Required) - Inspect condition and tension of belts driving the water pump, alternator and air conditioner compressor at the 1,000 mile maintenance check and at specified intervals thereafter.
11. Hoses and Connections - At each 15,000 mile interval, check the condition of hoses, connections and fittings of the following systems. Tighten connections, if necessary.
    - Cooling System
    - Brake system
    - Fuel system
    - Power steering
    - Vacuum system (emissions related)
12. Oxygen Sensor - At 50,000 miles, check sensor operation and replace if necessary.
13. Valve Lash - Adjust valve lash as required at each 30,000 mile interval.
14. PCV System - Check operation and replace, if necessary, at 50,000 miles.
15. Fuel Filter - (Qualified Technician Required) - Replace fuel filter at each 20,000 mile maintenance interval. Inspect fuel lines and tank for leakage and connections for tightness. Inspect fuel system electrical connections. Check filler cap for proper venting.
16. Exhaust System - At each 15,000 mile maintenance interval, inspect condition of all exhaust system components for leakage, damage, clearance and mounting. Replace components as necessary.
17. Ignition System (Qualified Technician Required) - Inspect distributor cap, rotor and ignition wiring and check timing.
18. Fluid Checks - During the 1,000 mile maintenance check, and at subsequent maintenance interval, check the level of fluids listed and add or replace as necessary.*†
    - transmission fluid
    - differential oil
    - brake fluid
    - power steering fluid
    - coolant
    - windshield washer solvent
19. Cooling System - Drain and replace coolant at 30,000 miles and at the beginning of each winter season thereafter. Check hoses and connections for leakage or flaws. Use only Prestone II® brand or equivalent anti-freeze/coolant when replacing or adding.

20. Evaporative System - Inspect evaporative system hoses and connections for leakage or cracks at the maintenance intervals indicated.
21. Timing Belt (Qualified Technician Required) - Replace the toothed timing belt at 60,000 miles.
22. Battery - At 1,000 miles and at each 5,000 mile maintenance interval, check; battery terminals (clean and tighten if necessary), voltage, battery case and hold-downs, and electrolyte level if applicable.
23. Brakes - Perform the following services at 1,000 miles and at each 15,000 mile maintenance interval:
    - Check operation and performance of service brakes. Add fluid if necessary.
    - Inspect condition and thickness of front pads and rear linings. Replace if necessary.
    - Adjust handbrake
    - Inspect brake servo filter and clean or replace as necessary.
24. Tires - Inspect tires (and spare) for abnormal wear or damage and adjust air inflation pressure, if necessary, at 1,000 miles and at each specified interval thereafter or whenever any visible or handling problem is apparent.
25. Axles/Suspension - During the 1,000 mile maintenance check and at each 15,000 mile maintenance interval, perform the following and replace as necessary:
    - Steering and suspension components - check for play and wear.
    - Drive axle boots - inspect for cracks.
    - Rear wheel bearings - inspect condition and repack.
    - Torque axle nuts to correct specification.
26. Wheels - Check tightness of lug nuts and inspect condition of wheels at 1,000 miles and at each 5,000 mile service interval.
27. Mountings - All engine and transmission mounting bolts must be torqued to proper specifications every 15,000 miles.
28. Lights and Electrical System - During the 1,000 mile maintenance check and at each 5,000 mile interval, check operation of all lights, turn signals, warning lights, hazard flashes, instruments, horn, wipers, heater fan, etc. Adjust headlight alignment, if necessary, at each 15,000 mile interval.
29. Rocker Shaft Oil Filter - Replace rocker shaft oil filter and check valve clearances at each 30,000 mile interval.
30. Road Test - During the 1,000 mile maintenance check and at 5,000 mile interval thereafter, road test the vehicle and check the following:
    - Acceleration and braking
    - Steering, suspension and handling
    - Fluid and body leakage
    - Doors and hood (lubricate if necessary)
    - Body components
    - Accessory operation

* See FLUIDS AND FILTERS for recommendations.

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SECTION "B"

2.2 Liter Gasoline Engine (With Bosch Electronic Fuel Injection System)

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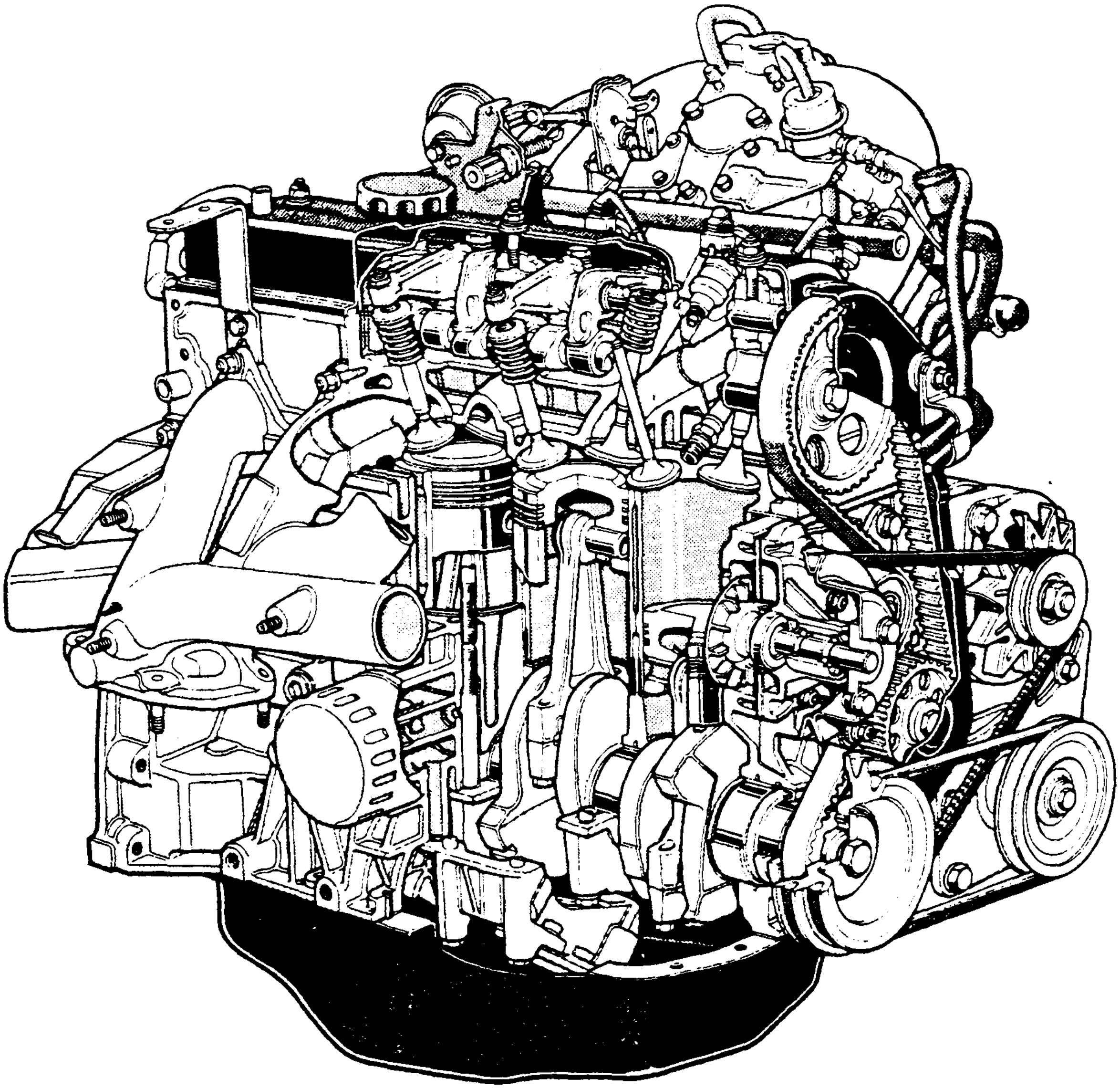
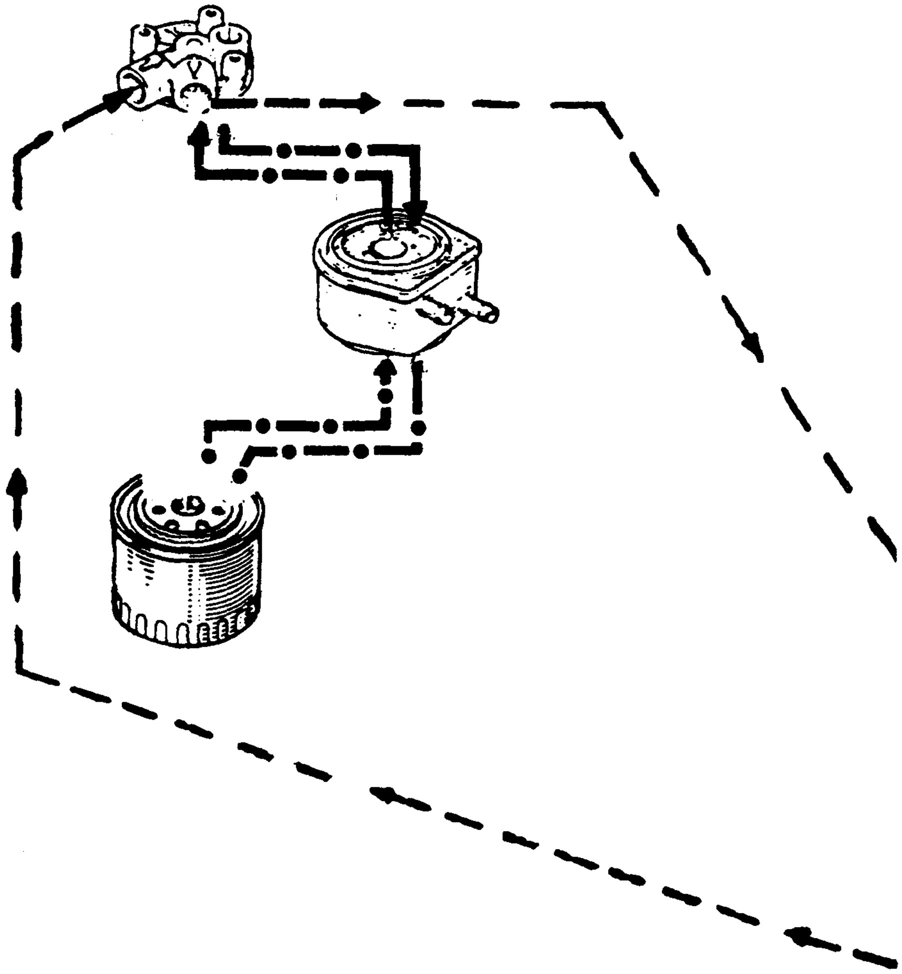
2.2L ENGINE
4-CYLINDER ALUMINUM

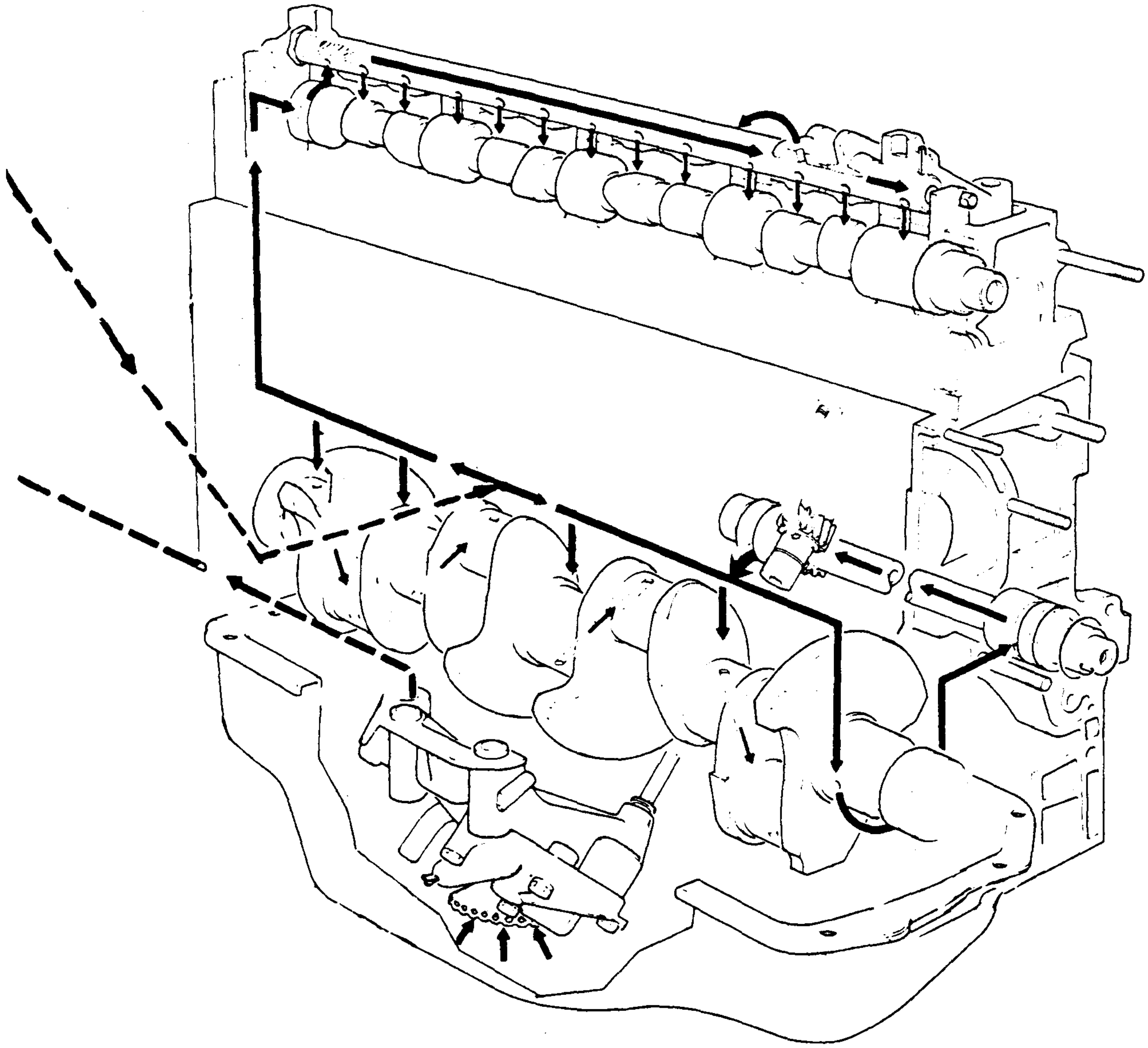


Engine Type	Suffix	Cubic Displacement	Compression Ratio	Stroke	Bore	Transmission Type
J7T	239	2165 cc (132 C.I.D.)	8.7:1	89 mm (3.50 in)	88 mm (3.46 in)	ML1-011 (Automatic Transmission)
J7T	238	2165 cc (132 C.I.D.)	8.7:1	89 mm (3.50 in)	88 mm (3.46 in)	NL5-30 (5-speed)

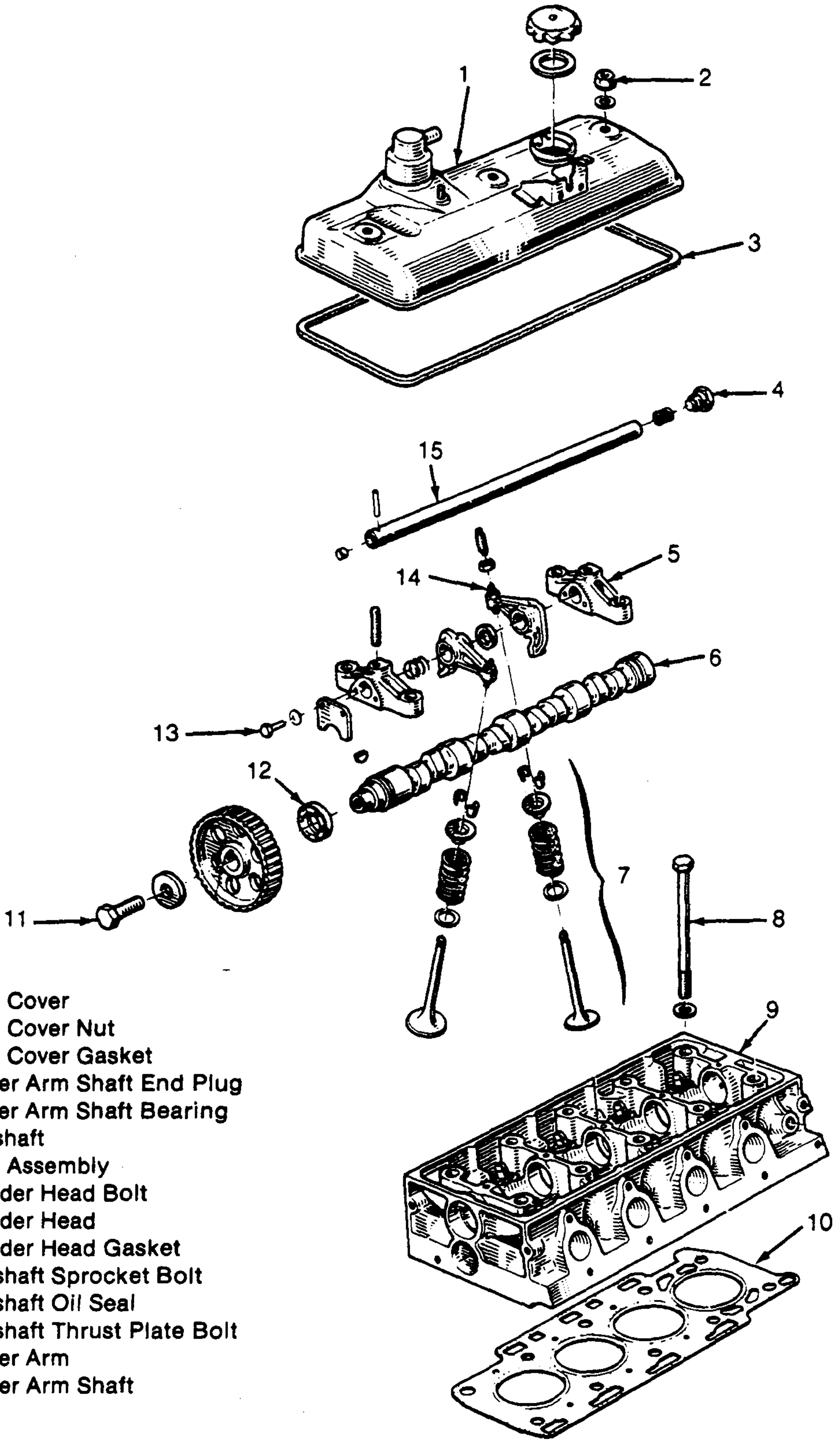
GENERAL INFORMATION
LUBRICATION CIRCUIT



GENERAL INFORMATION
GHOSTED VIEW

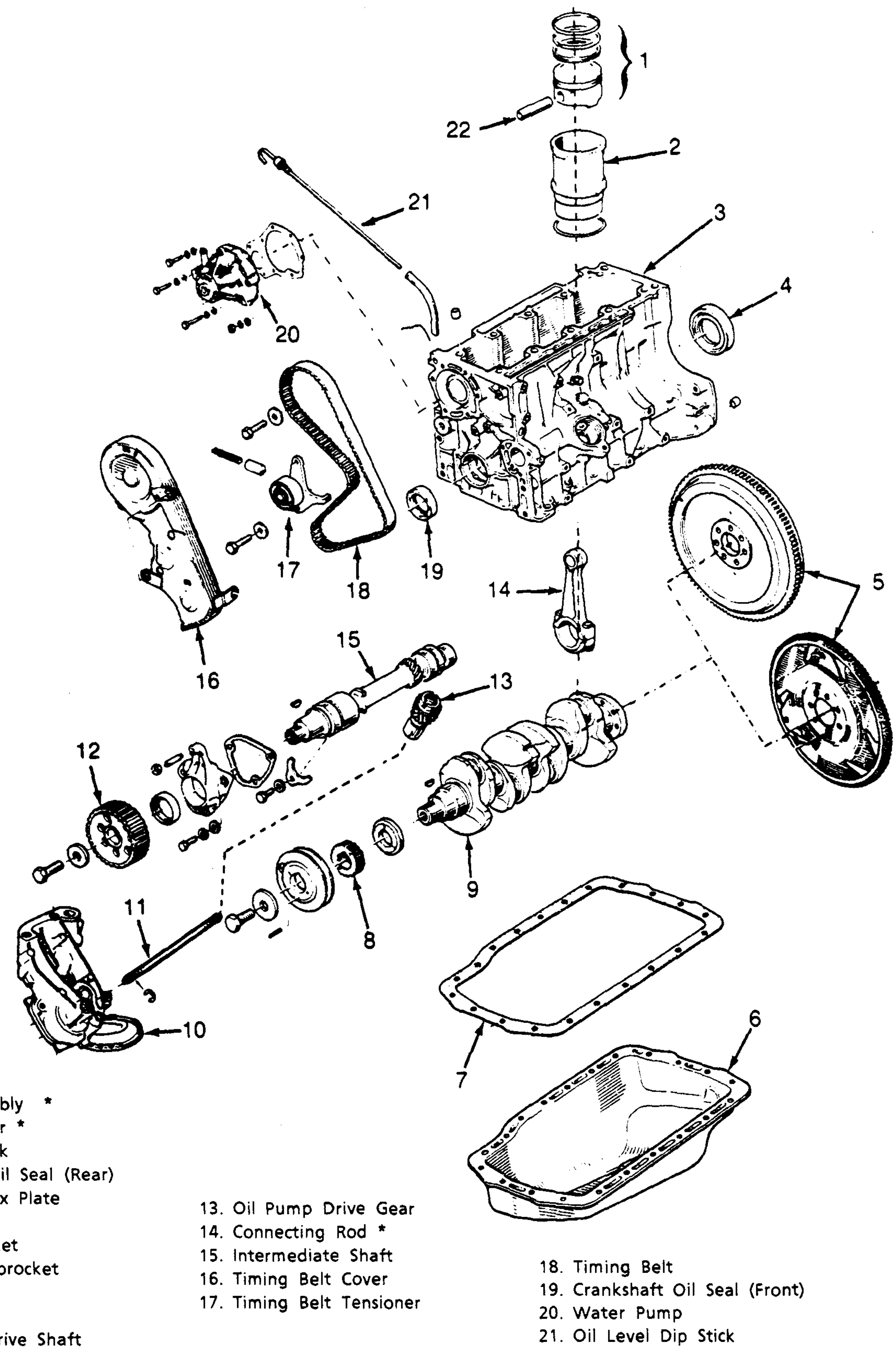


GENERAL INFORMATION
CYLINDER HEAD (EXPLODED VIEW)



1. Valve Cover
2. Valve Cover Nut
3. Valve Cover Gasket
4. Rocker Arm Shaft End Plug
5. Rocker Arm Shaft Bearing
6. Camshaft
7. Valve Assembly
8. Cylinder Head Bolt
9. Cylinder Head
10. Cylinder Head Gasket
11. Camshaft Sprocket Bolt
12. Camshaft Oil Seal
13. Camshaft Thrust Plate Bolt
14. Rocker Arm
15. Rocker Arm Shaft

GENERAL INFORMATION
CYLINDER BLOCK (EXPLODED VIEW)



1. Piston Assembly *
2. Cylinder Liner *
3. Cylinder Block
4. Crankshaft Oil Seal (Rear)
5. Flywheel /Flex Plate
6. Oil Pan
7. Oil Pan Gasket
8. Crankshaft Sprocket
9. Crankshaft
10. Oil Pump
11. Oil Pump Drive Shaft
12. Intermediate Shaft Sprocket
13. Oil Pump Drive Gear
14. Connecting Rod *
15. Intermediate Shaft
16. Timing Belt Cover
17. Timing Belt Tensioner
18. Timing Belt
19. Crankshaft Oil Seal (Front)
20. Water Pump
21. Oil Level Dip Stick
22. Piston Pin *

* Available in sets of 4 only.

GENERAL INFORMATION
ENGINE IDENTIFICATION

The engine identification plate is attached to the front, right side of the cylinder block.

The plate contains the following engine coded information.

A - The engine type code:
- J-the engine was manufactured at Douvrin, France,
- 7-the engine has hemispherical combustion chambers in the cylinder head and multi-point fuel injection.
- T-the engine has a cubic displacement of 2165 cc/2.2 liters/132 cu. in.

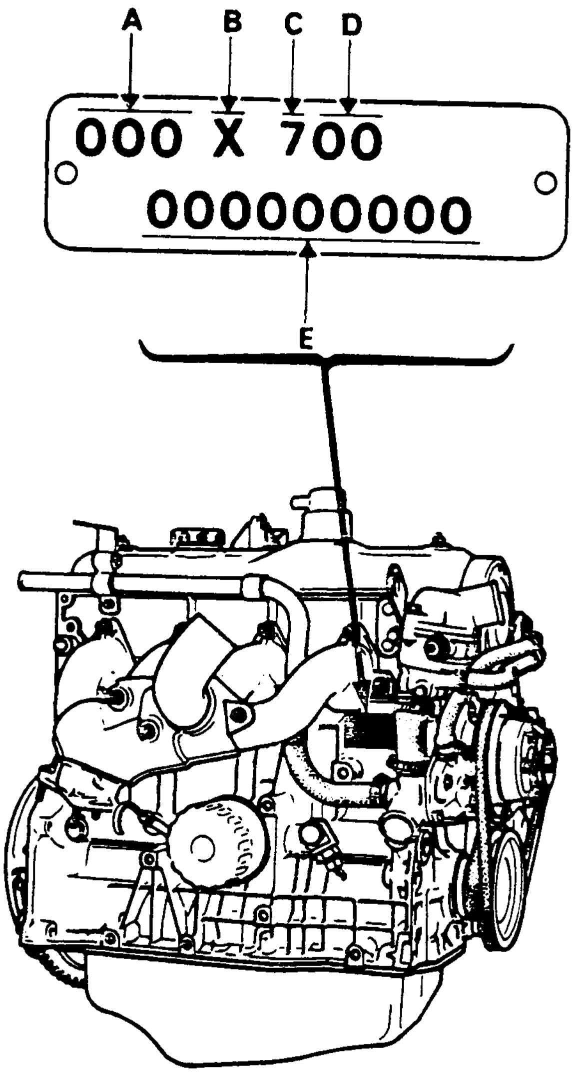
B - The engine certification code letter

C - Engine manufacturer identification code

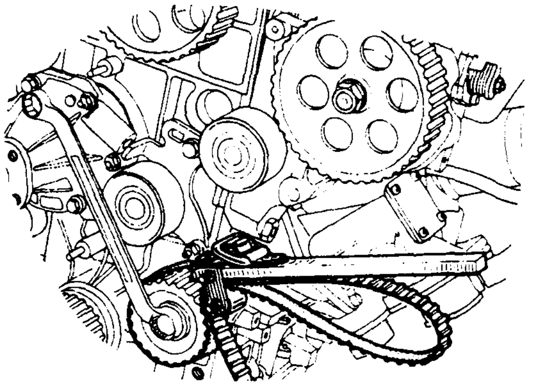
D - The engine identification code suffix

E - The engine serial number

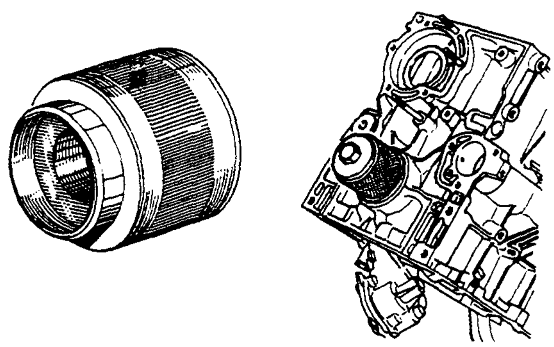
NOTE: The engine serial number (E) is preceded by a duplication of the engine identification code suffix (D).



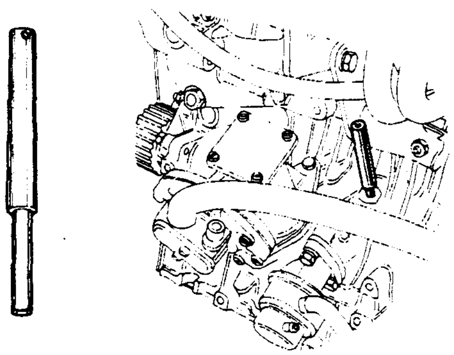
SPECIAL SERVICE TOOLS



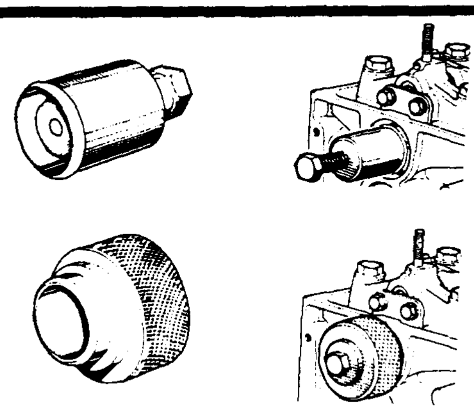
Mot. 855
Toothed belt idler sprocket locking strap
Order Tool No. 700000-85-500 EA



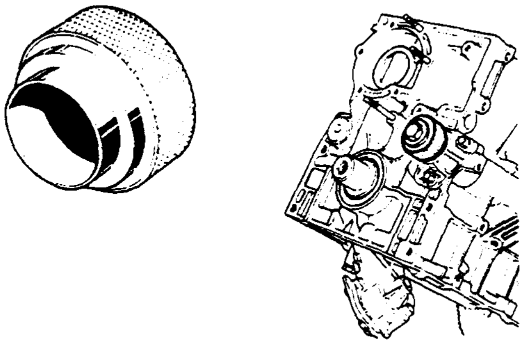
Mot. 789
Crankshaft oil seal inserting tool (timing cover end)
Order Tool No. 700000-78-900 EA



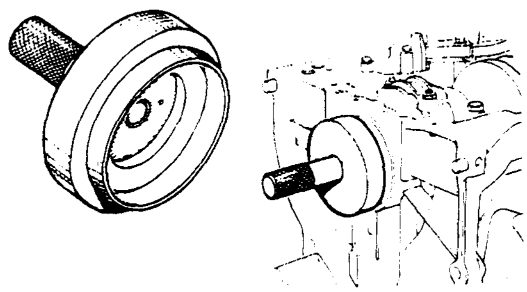
Mot. 861
TDC indicator rod
Order Tool No. 700000-86-100 EA



Mot. 791
Extracting/inserting tool for camshaft oil seal
Order Tool No. 700000-79-100 EA

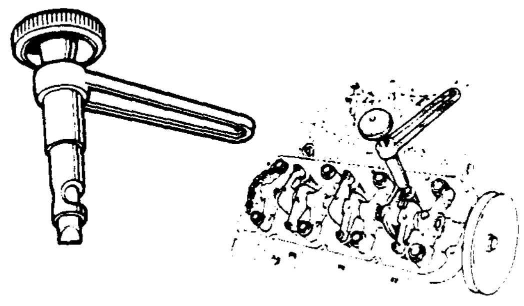


Mot. 790
Oil seal inserting and intermediate shaft bearing locating tool
Order Tool No. 700000-79-000 EA

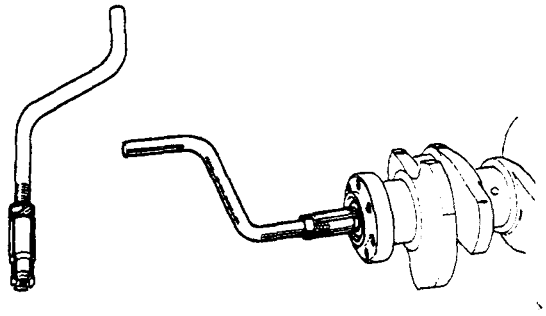


Mot. 788
Crankshaft oil seal inserting mandrel
Order Tool No. 700000-78-800 EA

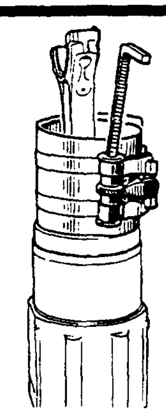
SPECIAL SERVICE TOOLS



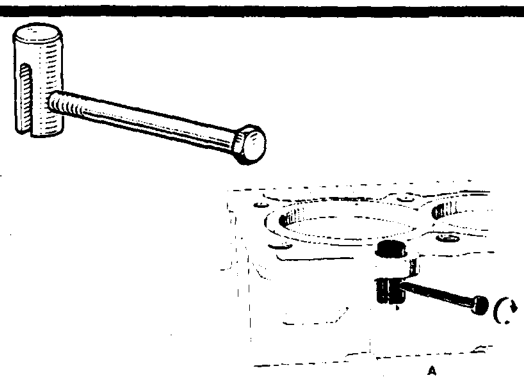
Mot. 647
Rocker arm clearance adjustment wrench
Order Tool No. 700000-64-700 EA



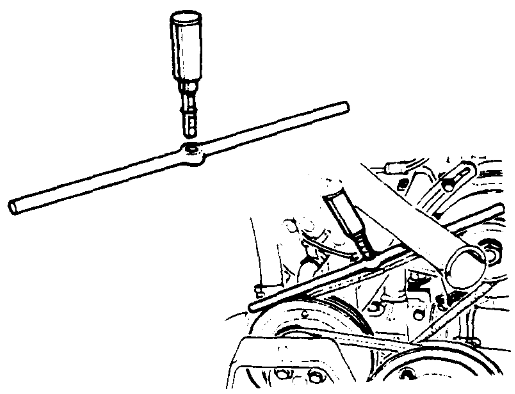
Mot. 11
Crankshaft bushing extractor
Order Tool No. 700010-72-500 EA



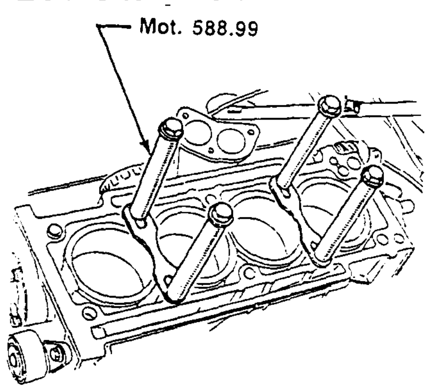
Mot. 851
Piston installation tool
Order Tool No. 700000-85-100 EA



Mot. 720
Cylinder head locating tool
Order Tool No. 700000-72-000 EA

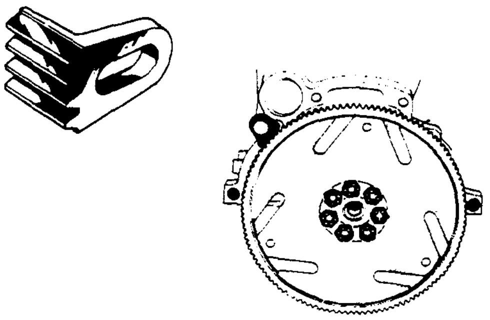


Ele. 346
Drive belt tensioning tool
Order Tool No. 700000-34-600 EA

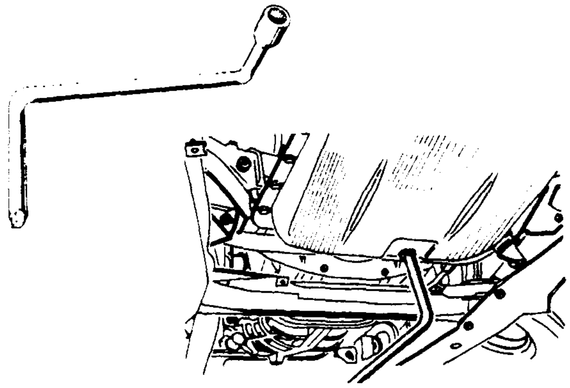


Mot. 588
Sleeve tubes
(for use with clamps Mot. 588)
Order Tool No. 700000-58-899 EA

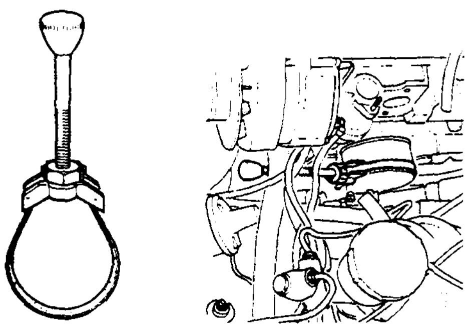
SPECIAL SERVICE TOOLS



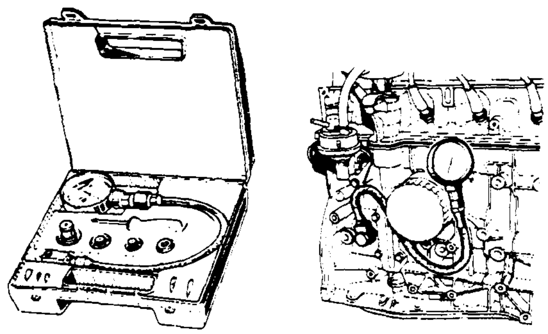
Mot. 582
Flywheel locking sector
Order Tool No. 700000-58-200 EA



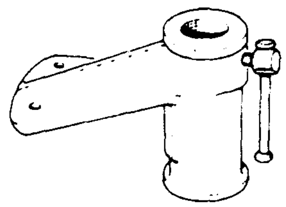
Mot. 593
Engine gearbox drain plug wrench (8 mm square)
Order Tool No. 700000-59-300 EA



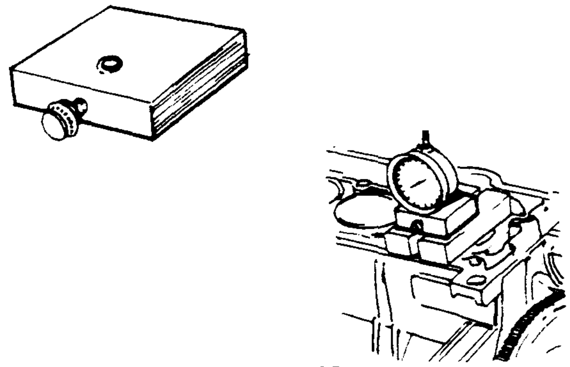
Mot. 445
Oil filter strap
Order Tool No. 700000-44-500 EA



Mot. 836
Boxed oil pressure testing kit
Order Tool No. 700000-83-603 EA

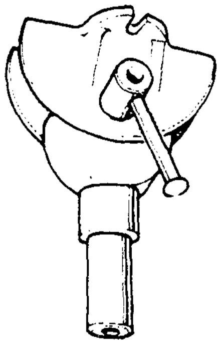


(No Number)
Bench stand for swivel base
Order Tool No. 700012-39-500 EA



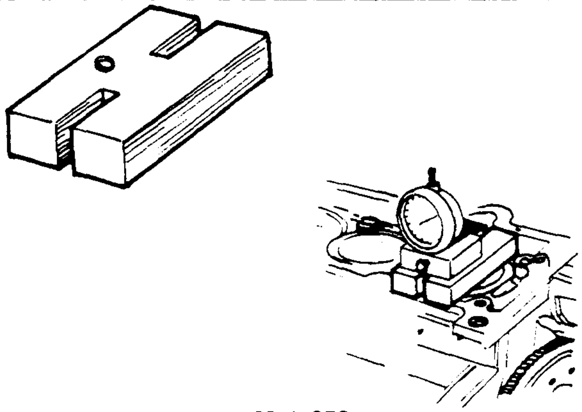
Mot. 251
Dial indicator support
(for checking sleeve protrusion and position)
Order Tool No. 700000-25-101 EA

SPECIAL SERVICE TOOLS



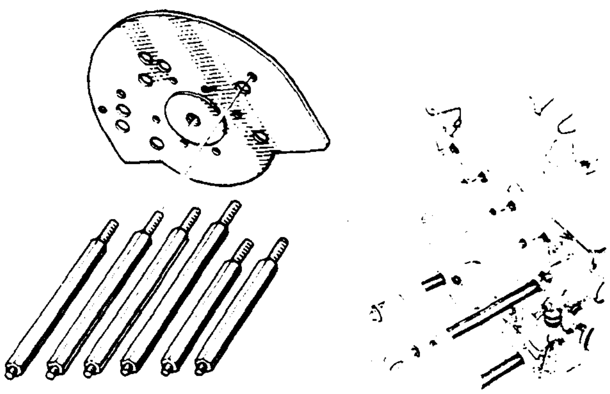
(No Number)
Fork end and swivel base for bench stand

Order Tool No. 700012-09-200 EA



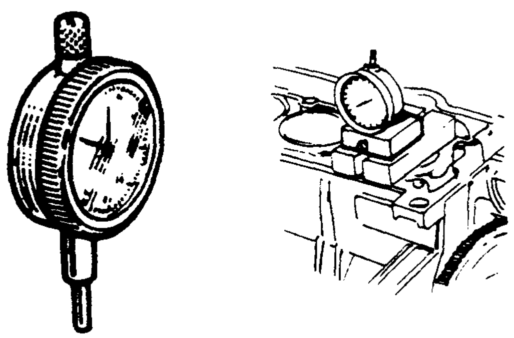
Mot. 252
Thrust plate (for checking sleeve protrusion)

Order Tool No. 700000-25-201 EA



Mot. 792
Engine plate for DESVIL stand

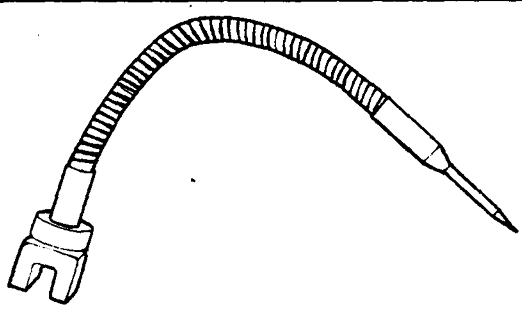
Order Tool No. 700000-79-200 EA



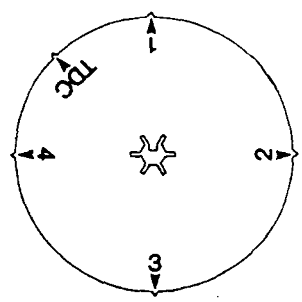
(No Number)

Dial indicator

Order Tool No. 72046E-B0-000 EA

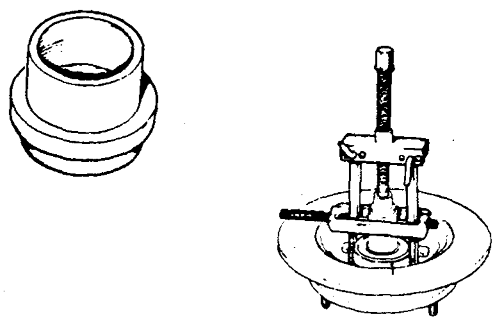
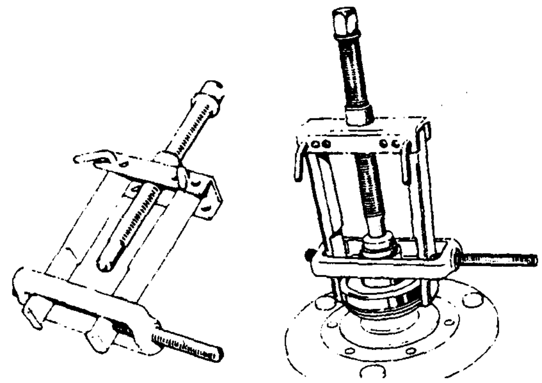
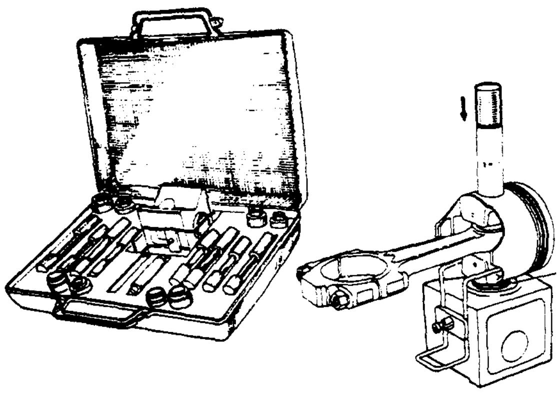
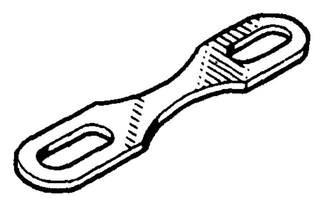


Mot. 591-02
Flexible pointer
(For valve adjustment procedure)
Order Tool No. 700000-59-102 EA



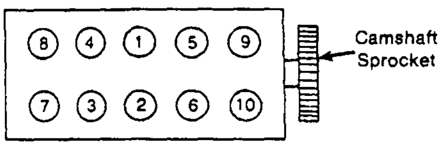
Ms. 1774
Ignition Alignment Rotor
(For valve adjustment procedure)
Order Tool No. 700001-77-400 EA

SPECIAL SERVICE TOOLS

 **Rou. 15-01** Shaft end protector Order Tool No. 700013-31-601 EA	 **B.VI. 28-01** Crankshaft sprocket removal tool Order Tool No. 700012-27-301 EA
 **Mot. 574-07** Piston pin removal/installation tool set Order Tool No. 700000-57-407 EA	 **Mot. 588** Sleeve clamp brackets Order Tool No. 700000-58-800 EA

GENERAL INFORMATION
TORQUE SPECIFICATIONS

Component	Set-To-Torque	Service Recheck Torque
Camshaft Sprocket Bolts	5 daNm (37 lbs./ft.)	
Connecting Rod Bolts/Nuts	6.3 daNm (46 lbs./ft.)	6.0-6.5 daNm (44-48 lbs./ft.)
Converter Drive Plate Bolts	6.8 daNm (50 lbs./ft.)	6.5-7.0 daNm (48-52 lbs./ft.)
Crankshaft (Vibration Damper) Pulley Bolt	13.0 daNm (96 lbs./ft.)	12.0-13.5 daNm (88-100 lbs./ft.)
Cylinder Head Bolts (Tightening sequence shown below)		
First Tightening	5.0 daNm (37 lbs./ft.)	
Second Tightening	8.0 daNm (59 lbs./ft.)	
Final Tightening	9.2 daNm (69 lbs./ft.)	8.8-9.8 daNm (65-72 lbs./ft.)
Cylinder Head Cover Nuts	0.5 daNm (3.5 lbs./ft.)	0.4-0.6 daNm (3-4.5 lbs./ft.)
Flywheel/Flexplate Bolts	6.0 daNm (44 lbs./ft.)	
Intermediate Shaft Sprocket Bolt	5.0 daNm (37 lbs./ft.)	
Main Bearing Cap Bolts	9.2 daNm (69 lbs./ft.)	8.8-9.8 daNm (65-72 lbs./ft.)
Oil Pan Screws	0.9 daNm (6.5 lbs./ft.)	0.8-1.0 daNm (5.8-7.3 lbs./ft.)
Oil Pump Screws	4.3 daNm (33 lbs./ft.)	4.0-4.5 daNm (29-37 lbs./ft.)
Rocker Arm Shaft Plug	2.0 daNm (15 lbs./ft.)	
Timing Belt Tensioner Bolts	2.5 daNm (18 lbs./ft.)	



Cylinder Head Bolt

Tightening Sequence

GENERAL INFORMATION
SPECIFICATIONS

General Specifications

Type .... In-Line, 4 Cylinder OHC
Bore .... 88 mm (3.46 in)
Stroke .... 89 mm (3.50 in)
Displacement .... 2.2 Liter (132 cu. in.)
Compression Ratio 8.7:1
Firing Order 1-3-4-2
Fuel Requirement .... Unleaded

Spark Plugs

Type .... Champion RS9YC or AC CR42LTS
Gap .... .022 to .026 in

Cylinder Block and Liners

Liner Height .... 148.5 mm (5.846 in)
Bore Diameter .... 88 mm (3.464 in)
Base Locating Diameter ...... 93.6 mm (3.685 in)
Line Protrusion
(w/O-ring) .... 0.08 to 0.15 mm (0.003 to 0.006 in)
Liner Height to Flange .... 93.065 to 93.096 mm (3.663 to 3.665 in)
Cyl. Block Depth
to Flange .... (92.942 to 92.985 mm) (3.659 to 3.660 in)
Cylinder Block Depth .... 149.25 to 149.75 mm (5.875 to 5.895 in)

Crankshaft

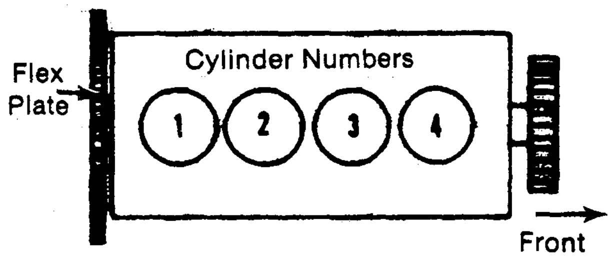
Number of Main Bearings 5
Main Bearing Journal Diameter .... 62.892 mm (2.476 in)
Regrind Diameter .... 62.842 mm (2.474 in)
Grinding Tolerance .... -0.0 to -0.019 mm (-0.- to -0.0007 in)
Connecting Rod Journal Dia .... 56.296 mm (2.215 in)
Regrind Diameter .... 0.25 mm (0.0010 in.)
Grinding Tolerance .... -0.01 to -0.029 mm (-0.0004 to -0.0011 in.)
End Play .... 0.13 to 0.30 mm (0.005 to 0.011 in)
Thrust Washers with different thicknesses are available

Pistons, Connecting Rods and Piston Pins

Piston-To-Connecting Rod Fit .... Press Fit
Connecting Rod End Play -
Small End .... 0.31 to 0.57 mm (0.012 to 0.022 in)
Piston Pin Length .... 75 mm (2.952 in)
Piston Pin External Diameter .... 23 mm (0.905 in)
Piston Pin Internal Diameter .... 14 mm (0.551 in)

Piston Rings

Piston Ring Thickness
Top Compression .... 1.75 mm (0.068 in)
Upper Compression .... 2.00 mm (0.078 in)
Oil Scraper .... 4.00 mm (0.157 in)
Piston Ring Gap .... Pre-Adjusted



Cylinder Head

Cylinder Head Height .... 111.6 mm (4.394 in)
Combustion Chamber Volume .... 58.15 cc
Valve Guide Inside Diameter .... 8 mm (0.315 in)
Valve Stem-To-Guide Clearance .... 0.1 mm (0.002 in)

Rocker Arm Clearance (Cold)

Intake .... 0.10 to 0.15 mm (0.004 to 0.006 in)
Exhaust ..... 0.20 to 0.25 mm (0.008 to 0.010 in)

Valve Train

Camshaft End Play .... 0.05 to 0.13 mm (0.002 to 0.005 in)

Intake Valve Timing
Opens .... 12° BTDC
Closes .... 52° ABDC
Exhaust Valve Timing
Opens .... 52° BBDC
Closes .... 12° ATDC
Valve Overlap .... 34°

Valves

Valve Stem Diameter .... Exhaust 0.313
Intake 0.314
Intake Valve Head
Diameter .... 44 mm (1.732 in)
Intake Valve Face Angle .... 30°
Exhaust Valve Head Diameter .... 38.5 mm (1.516 in)
Exhaust Valve Face Angle .... 45°

SPECIFICATIONS

Lubrication System

Oil Capacity

W/o Filter Change......... 5.0 liters (5.3 quarts)

With Filter Change........ 5.5 liters (5.8 quarts)

Operating Pressure at idle....... 0.8 bars (12 psi)

Operating Pressure at 3,000 rpm.......... 3.0 bars (44 psi)

Oil Pump-Gear End Clearance

Minimum........................... 0.05 mm (0.002 in)

Maximum.......................... 0.12 mm (0.005 in)

Oil Pump-Gear Body Clearance

Minimum........................... 0.02 mm (0.001 in)

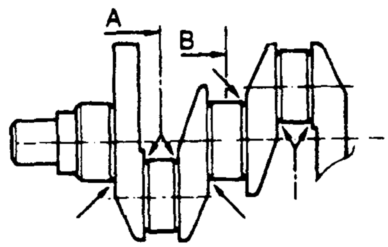
Maximum.......................... 0.10 mm (0.004 in)

CRANKSHAFT SERVICE

Use a micrometer to measure the main and connecting rod journals for out-of-round or taper conditions.

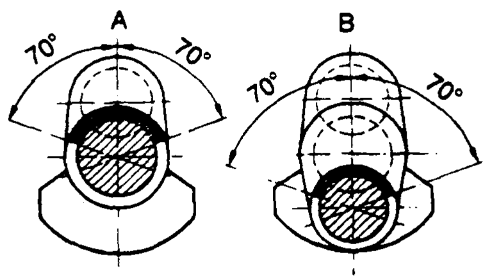
If the journals are not satisfactory, recondition or replace the crankshaft.

Use replacement bearings that are appropriate for the journal sizes.



RECONDITIONING

After the crankshaft has been ground, the roll-hardened areas on the journals must still remain intact over the 140° zone. The zones are illustrated below (A-rod journal, B-main journal.)

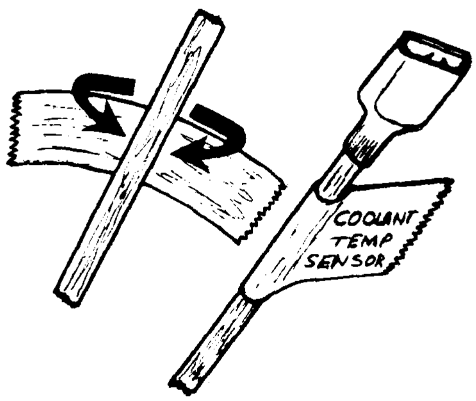


ENGINE REMOVAL AND REPLACE
REMOVAL PROCEDURE

REMOVE OR DISCONNECT;
- Battery negative cable
- Heater air intake
- Grill section - held by shoulder bolts and #2 phillips head screws
- Upper crossmember
- Hood release cable - lay aside
- Belly pan
- Transmission belly pan/scoop
- Upper radiator retaining supports
- Hood cable from fender connecting crossmember
  - Do not lose spring and plastic retainer
- Upper and lower hoses from radiator and drain anti-freeze into a container.
- Vacuum hoses from thermovalve on radiator

CAUTION
It is extremely important to reconnect vacuum hoses, water hoses and electrical wiring correctly.

CAUTION
Exercise extreme care during engine removal, since even minimal flywheel flexplate damage may result in a "no-run" condition.



Hoses and wire may be labeled using an ink pen on masking tape as shown. Labeling makes reconnection simple and accurate. We also advise drawing a reference diagram of connections, since this is easier than tracing each system to verify connections.

Refer to the vehicle emissions label (located on the upper crossmember) for the emissions system schematic, or see page C7-3.

ENGINE REMOVE AND REPLACE
REMOVAL PROCEDURE

Close both high and low side service valves of air conditioning compressor before continuing.

REMOVE OR DISCONNECT:
- High side hose from A/C compressor leading to condenser
- High side hose self-sealing disconnect joint at condenser
- Electric fan wiring
- A/C pressure switches
- Radiator and A/C condenser as a complete assembly
- Remove 4 bolts in lower radiator support crossmember
- Low side hose to A/C compressor
- Air conditioner clutch wire connection
- Hoses to heater, rear motoraid, and surge fill bottle
- Oil hoses to remote oil filter
- O_2 sensor
- Exhaust lead pipe from cast iron elbow - 4 nuts w/washers
- Engine harness at firewall, behind engine and at breaker plate including main feed cable at dual battery
- Coil wire and all wire and vacuum connections from ignition module
- Idle air bypass manifold with hoses attached, unplug fast idle solenoid. Lay assembly on engine.

ENGINE REMOVE AND REPLACE
REMOVAL PROCEDURE CONTINUED

REMOVE OR DISCONNECT:

- Supply hose from power steering reservoir to pump. Drain fluid into container.
- Pressure hose from rear of power steering pump
- Engine ground strap
- Air hoses from air flow meter to plastic elbow under intake manifold. Cover open elbow to prevent foreign material from getting into the engine.
- Vacuum hoses for E.G.R. system (behind left headlight area)
- Vacuum hose to brake booster
- Vacuum connections on top of intake manifold for cruise control and charcoal canister
- Vacuum hoses at left rear of engine to charcoal canister and automatic transaxle
- Fuel feed and return hoses at frame rail connections to metal piping. Mark connections for proper hook-up.
- Throttle and cruise cables from engine.
- Flywheel cover behind engine oil pan.
- All 3 torque converter to flexplate bolts (ATX only)
- Motor mount to transaxle mount on right side - 2 bolts rear of oil pan.
- Motor mount to transaxle mount on left side - 1 long bolt and lock nut.
- Bolts that hold T.D.C. sensor to flywheel housing. Set sensor aside.

CAUTION
Failure to remove sensor may cause damage to the flywheel.

- Bolts that hold transaxle to engine and starter.

ENGINE REMOVE AND REPLACE
REMOVAL PROCEDURE CONTINUED

REMOVE OR DISCONNECT:
- Lock nuts that hold motor mount to cross member assembly - one on each side - leave complete mount assemblies on engine.
- Install engine lift fixture or chain to engine.
- Lift engine high enough for motor mount studs to clear crossmember mounts. Place a 2" x 4" block under lower edge of transaxle for support.
- Pull engine forward and out of chassis.

CAUTION
Exercise extreme care during engine removal, since even minimal flywheel flexplate damage may result in a "no-run" condition.

ENGINE REMOVAL AND REPLACE
PREPARATION FOR REBUILDING

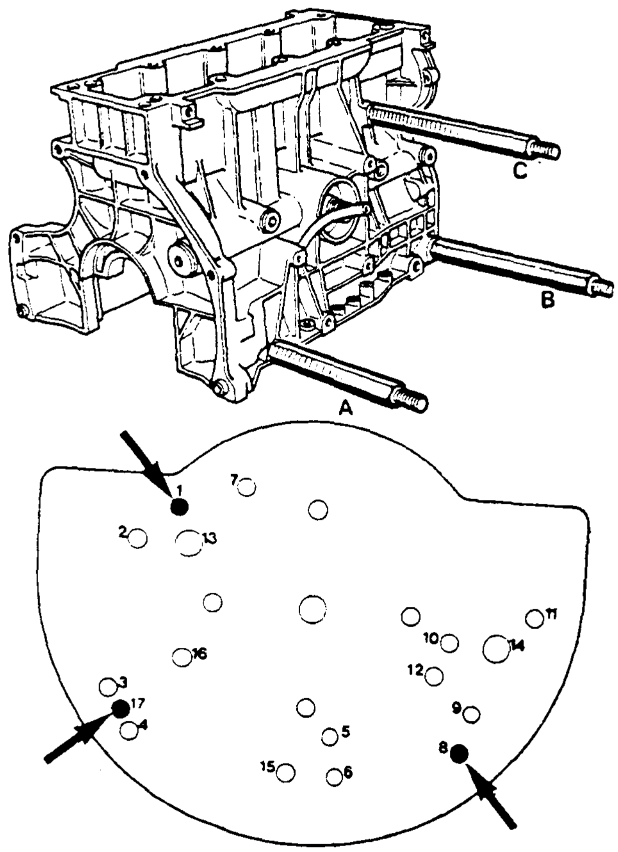
Remove or Disconnect

- Exhaust manifold
- Alternator
- A/C compressor, power steering pump and complete front bracket assembly.
- Motor mounts
- Dipstick
- Adapter for remote oil filter hoses
- Starter

Mounting the Engine to the Dismantling Support

- Screw studs A, B, and C (tool Mot. 792) into appropriate holes in the cylinder block.
- Place the engine with studs in position to the plate making use of holes (1, 8, and 17)

IMPORTANT
This support may be adapted to an existing engine stand.



WARNING
The fixture must be fastened to something that can safely support the weight of the engine without tipping over, which could cause personal injury or damage to the engine.

ENGINE REMOVAL AND REPLACE
PREPARING ENGINE FOR INSTALLATION

Clean

- All accessories to be reinstalled on engine.
- Flush all cooling system parts including radiator if contaminated (see Cooling System Section for procedure)
- Chassis and underhood area.

Replace

- Engine oil cooler, (located above oil filter) if engine had any kind of metallic part failure or fluids in the oil.

CAUTION
Serious internal engine damage will occur to a new or rebuilt engine if the oil cooler is contaminated and not replaced. When in doubt ... replace.

- Engine oil filter
- Fuel filter - make sure fuel in tank is not contaminated.
- Air filter element (after engine is installed).

Inspect and Replace if Necessary

- Serpentine belt.
- Power steering belt.
- Surge/fill bottle cap (See Cooling System Section for procedure)
- All hoses and clamps.
- Manifolds for warpage.
- Exhaust pipe sealing surface for cracks and irregularity.
- Oil hoses from the engine to the remote filter base.
- All vacuum hoses.
- Flywheel or flex plate for cracks and irregularities.

IMPORTANT!
Make sure engine-to-bell housing alignment sleeves are in place in lower bolt holes on each side.
Make sure starter-to-bell housing alignment sleeve is in place and tightened.
Leave starter loose to be aligned and tightened after engine is installed.

Install or Connect

- All items removed in "Preparing Engine for Rebuilding" using new gaskets where required.

Make sure that the flywheel flexplate aligns with the torque converter bolt holes and is not damaged during reinstallation of the engine. (ATX only)

NOTE: Refer to Section H - Clutch for precautions when reinstalling 5-speed gearbox.

INSTALLATION PROCEDURE

Install or Connect

- Connect and install all parts and assemblies in the reverse order of that described in "Engine Removal Procedure" using new gaskets, seals, etc., where required.

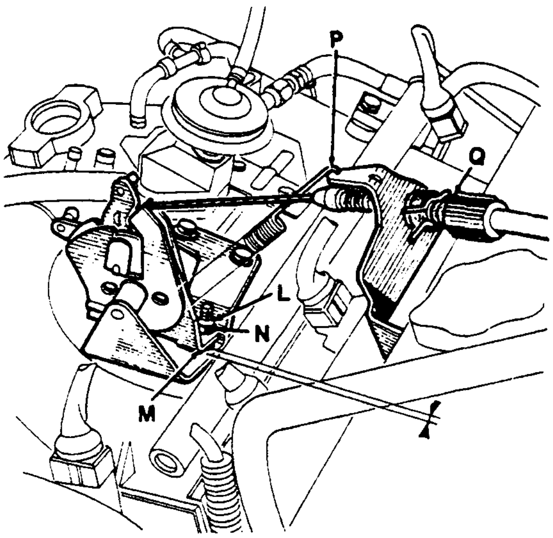
Tighten

- All the starter mounting bolts on the bell housing and on the side of the engine block.

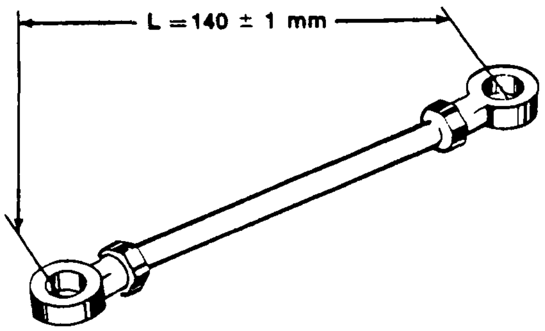
FINAL PROCEDURES AFTER INSTALLATION

Adjust

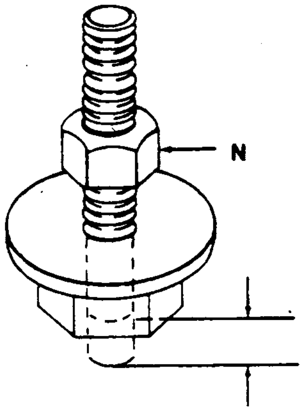
Check the operation of the throttle cable.



- Depress the accelerator pedal to the floor two or three times.
- Hold the pedal to the floor and measure the clearance between the throttle stop screw (L) and the return support (M)
- The clearance must be approximately 0.1 mm (.004 in). If not, check the length of the throttle body connecting linkage.



- Adjust the link to 139 mm - 141 mm (5.45 - 5.53 in) as shown.



- If the position of the throttle stop screw (L) is accidentally changed, it can be corrected by loosening the adjustment nut (N) and turning the screw to protrude 1 mm (0.04 in) below the weld nut.
- Depress the accelerator pedal to the floor and adjust the clearance between the throttle stop screw (L) and the support (M) for 0.1 mm (0.004 in).

NOTE: Apply a small amount of Loctite® or equivalent to the throttle stop screw before tightening the adjustment nut.

- Tighten the adjustment nut
- With the accelerator pedal depressed to the floor, the return (compensation) spring (P) must be compressed 5 mm (0.19 in). If not, change the position of the clip (Q).

NOTE: Ensure that the return spring (P) is correctly installed.

ENGINE REMOVE AND REPLACE
FINAL PROCEDURES AFTER INSTALLATION

IMPORTANT

- All rubber shrouds and shields must be in place.
- Use correct motor oil (See specifications section of vehicle operators manual)
- Use correct type and mixture of antifreeze.
- Make sure cooling system is properly bled of air and filled to proper level (See Cooling System, Section E)

CAUTION
It is extremely important to make sure the cooling system has all the air bled out of it and contains the proper level of coolant. Serious engine damage due to overheating will occur if this it not properly done.

- Pressure check cooling system for leaks (See Cooling System, Section E).
- All wiring and grounds must be properly connected.
- Check headlight alignment.
- Air conditioning should be properly charged and working correctly (See Air Conditioning, Section N.)
- Make sure that all reinstalled body parts and bumper fit correctly and hood latch pin properly aligns with the fender connecting crossmember. Adjust hood latch pin if necessary.

When the engine is reinstalled in the vehicle:

- Adjust all controls.
- Perform all functional checks as prescribed in section C5 to determine that all systems are adjusted and operating properly.
- Reset intergrator voltage adjustment at air flow meter and reinstall a new tamper-proof plug.

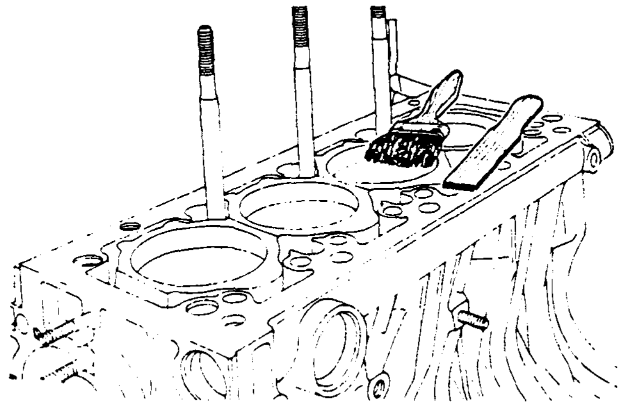
ENGINE OVERHAUL & REBUILD
GENERAL INFORMATION

SPECIAL MATERIALS

TYPE	APPLICATION
Parts cleaner solvent	Component cleaning
Gasket seal solvent	Cleaning cylinder head joint face
Petroleum Jelly	Clutch shaft and drive shaft splines
Loctite® (or equivalent)	Bolts for flywheel, crankshaft pulley, intermediate shaft cover
Loctite® (or equivalent)	Inlet manifolds studs
Loctite® (or equivalent)	Water pump studs and bolts
Loctite® (or equivalent)	Pilot bearing in crankshaft
Loctite® (or equivalent)	Flywheel thrust face on crankshaft side
Heatproof sealer	Exhaust pipe joints

IMPORTANT

Components To Be Replaced at Each Dismantling
- Flywheel bolts
- Flywheel bolts lockplate
- Connecting rod
- Rocker shaft oil filter
- All gaskets and seals

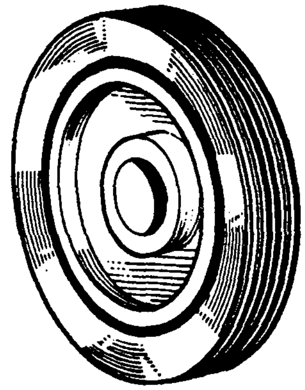


Cleaning Engine in Place
- Protect the timing belt and alternator from water and cleaning fluid.
- Take care not to let any water enter the intake manifold.
- Clean upper cylinder block surface when replacing cylinder.
- Great care must be taken with this operation to prevent foreign matter from entering the rocker shaft oil channels in the cylinder block and head.
- If the above advice is disregarded, the rocker shaft filter or rocker arm oil jet holes may become blocked leading to rapid cam and rocker arm finger wear.

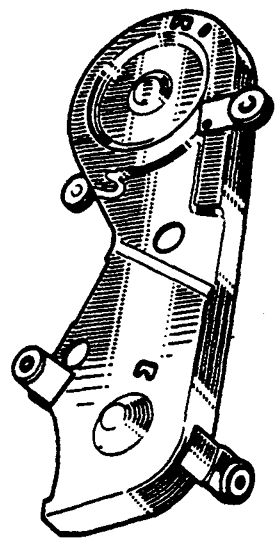
Installing Threaded Inserts
- Threaded holes in all engine components may be restored using thread inserts such as HeliCoil® or equivalent.

ENGINE OVERHAUL & REBUILD
ENGINE DISASSEMBLY

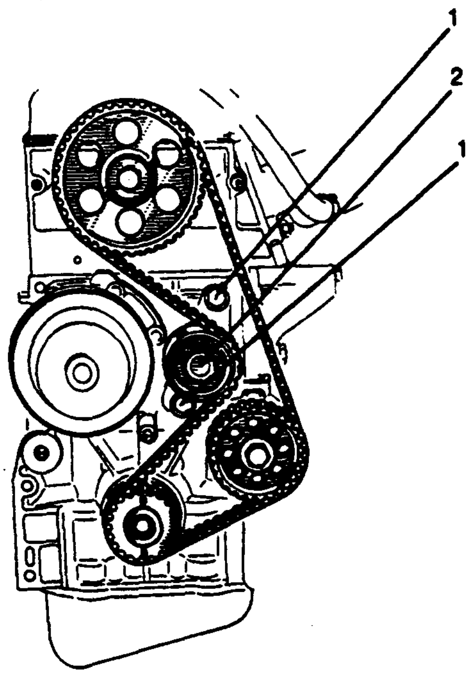
REMOVE OR DISCONNECT



- Crankshaft (vibration damper) pulley
- The intake and exhaust manifolds, and the brackets.



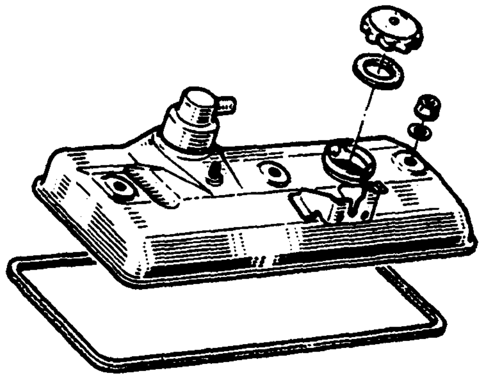
- Timing belt cover
- Loosen the bolts (1) and release the timing belt tensioner (2). Then retighten bolts (1).

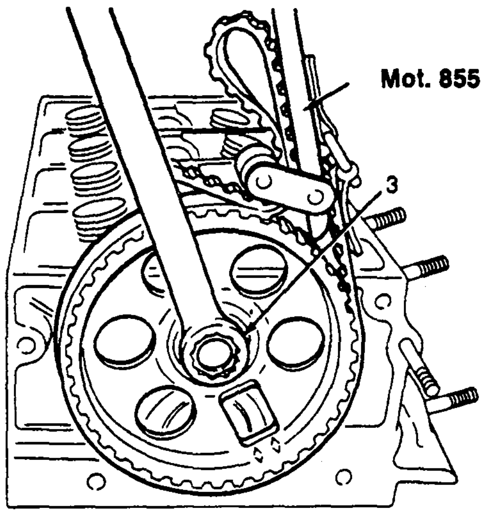


- The timing belt and discard.
- Belt tightener
- Water pump
- Thermostat housing

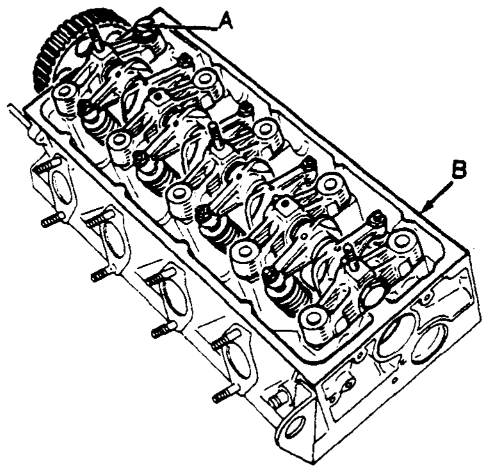
REMOVE OR DISCONNECT

- Cylinder head cover.
- Distributor assembly.





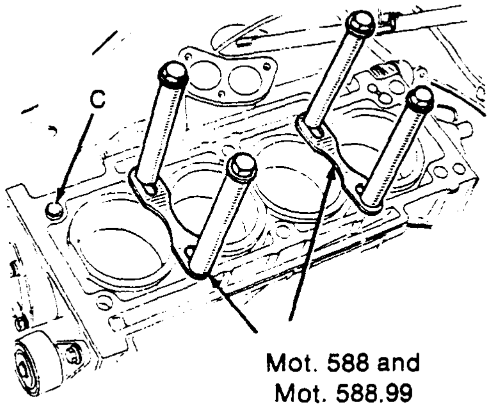
- Camshaft sprocket retaining nut (3)
- Hold the camshaft sprocket with Sprocket Holding Tool Mot. 855.
- Camshaft sprocket
- Woodruff key



- **Loosen** rocker arm adjustment cap nuts.
- Remove all cylinder head bolts **except bolt (A).**
- **Pivot the cylinder head on bolt (A)** by placing a block of wood at point (B) and striking it firmly with a hammer.
- Cylinder head bolt (A).
- Rocker assembly.
- Camshaft
- Cylinder head assembly.

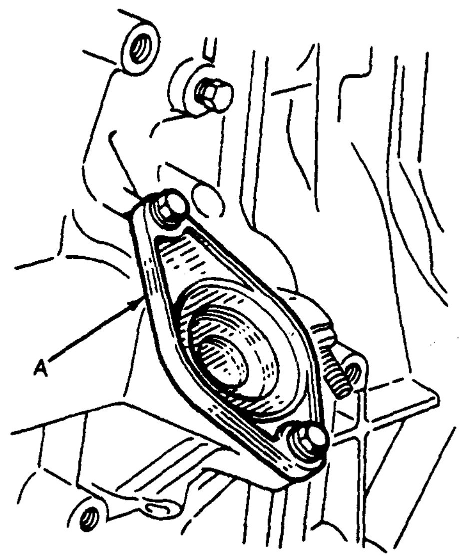
- Install cylinder liner clamps tool on the cylinder block using Mot. 588 and Mot. 588.99.

NOTE: The dowel (C) in the cylinder block is the cylinder head locator.

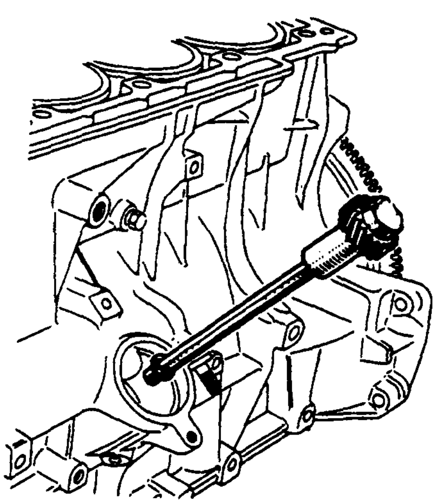


REMOVE OR DISCONNECT

- The cover plate (A) for access to the oil pump drive gear and shaft.

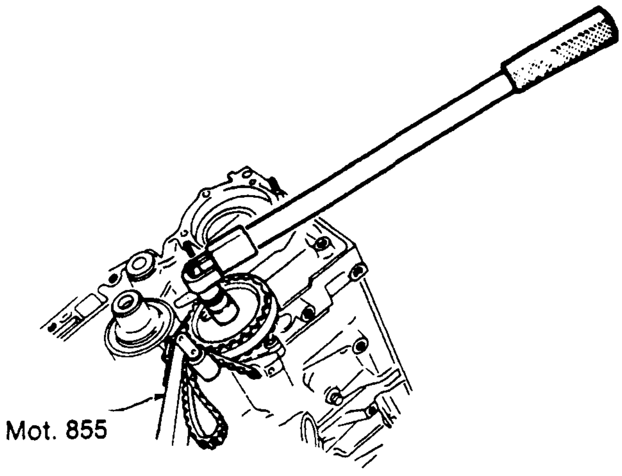


- The oil pump drive gear and shaft.

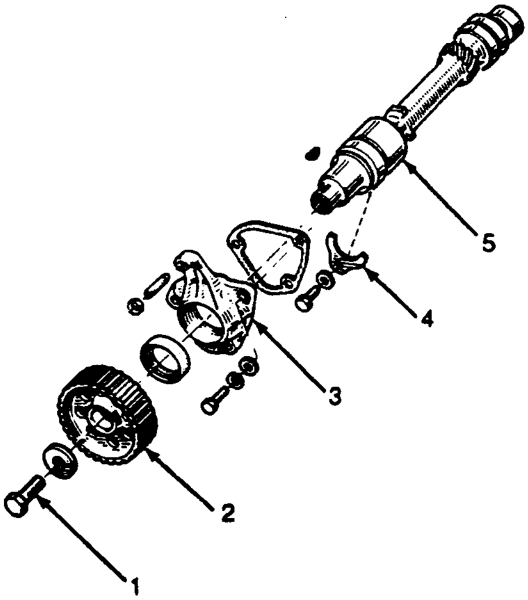


REMOVE OR DISCONNECT

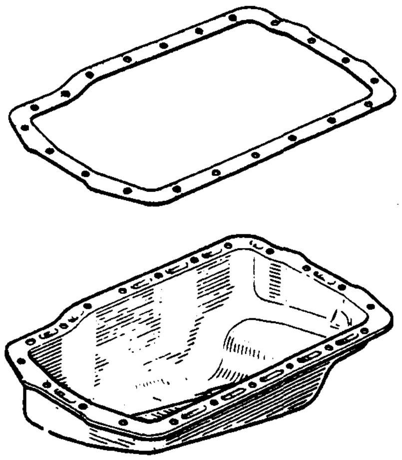
- Intermediate drive shaft sprocket retaining nut (1) using the hold tool (Mot. 855) and a socket/breaker bar assembly.



- Woodruff key from shaft
- Seal housing (3) - remove and discard used seal
- Shaft retaining fork (4)
- Intermediate shaft.

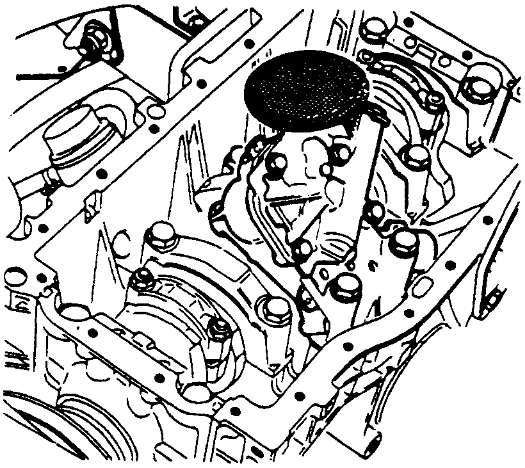


- Oil pan and gasket

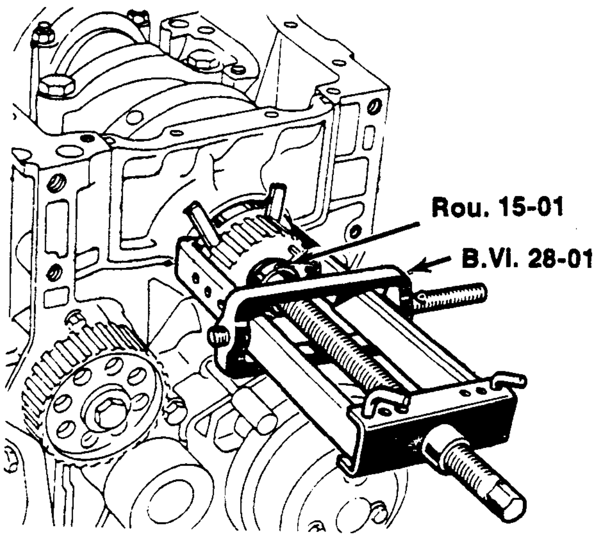


REMOVE OR DISCONNECT

- Oil pump

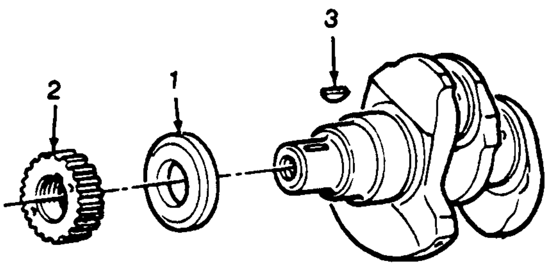


- Crankshaft timing sprocket
- Position sprocket removal tool B.Vi. 28-01 (with shaft end protector tool Rou. 15-01) with the jaws inserted behind the spacer (1).
- Pull the spacer (1) and sprocket (2) forward from the crankshaft until the spacer stops at the key (3).
- Do not force the spacer beyond this position.



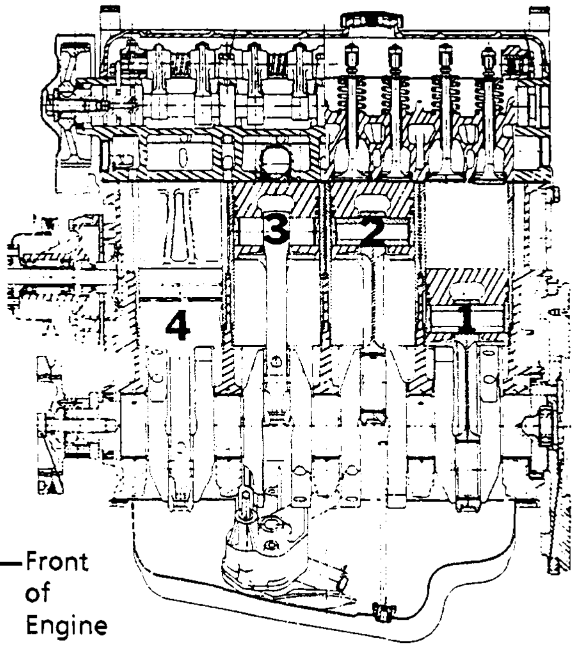
- Remove the tools, then install them with the jaws inserted between the spacer (1) and the sprocket (2).
- Pull the sprocket (2) from the crankshaft.

NOTE: If there is not enough space between the spacer (1) and the sprocket (2) to insert the tool jaws, insert 2 mm (0.078 in) metal strips between the washer and sprocket. Insert the jaws behind the washer and pull the spacer and sprocket from the crankshaft until the washer stops at the key.



ENGINE OVERHAUL AND REBUILD
ENGINE DISASSEMBLY

IMPORTANT
Hand stamp the cylinder number on the upper surface of each piston and sleeve. The pistons, sleeves, and connecting rods are not numbered. The pistons and sleeves should be reassembled in the same position that they were removed if they are to be reused. The cylinders are numbered 4 through 1 from front to back.

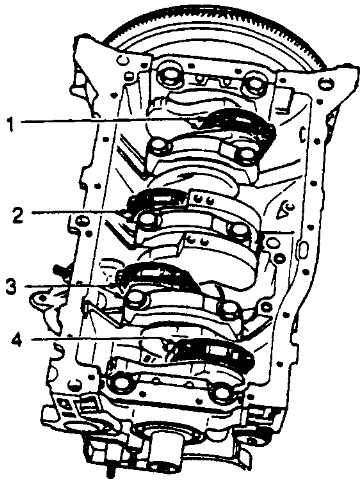


←Front of Engine

CAUTION
The rod and main bearing caps must be kept in the order they were disassembled. These items are not marked! This must be done to insure proper reassembly. Reminder: Cylinders are designated 4 to 1 from front to rear - #4 being closest to the timing belt.

REMOVE OR DISCONNECT

- Connecting rod bearing cap nuts and bearing inserts.
- Each connecting rod, cylinder liner and piston assembly as a unit from the cylinder block.



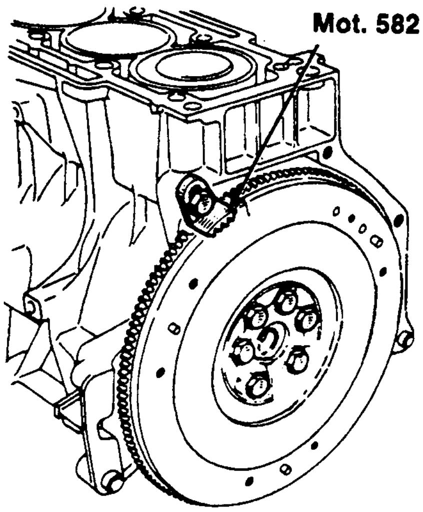
- Piston and connecting rod assemblies from the cylinder liners.

NOTE: Each piston and cylinder liner are matched as a set at the time of manufacture. Mark each piston and liner to ensure that they remain a matched set. This is especially important if the pistons and sleeves are to be reused but also applies to new assemblies.

ENGINE OVERHAUL AND REBUILD
ENGINE DISASSEMBLY

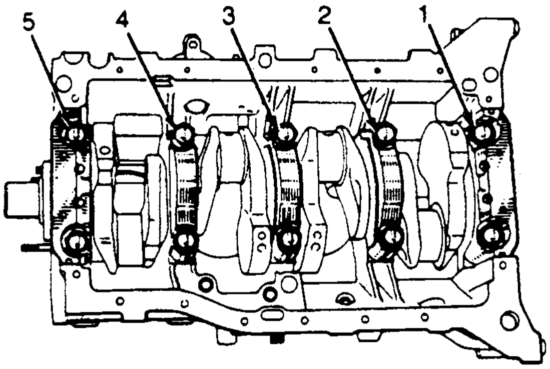
REMOVE OR DISCONNECT

- Flywheel
  - Install flywheel holding plate to prevent the crankshaft from turning and removing the flywheel/drive plate from the crankshaft.

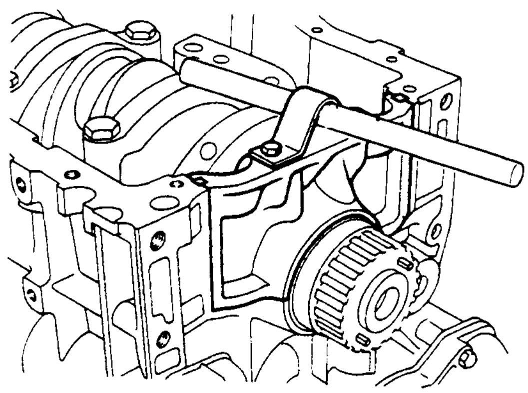


- Main bearing bolts and caps.

NOTE: The number one cylinder is located at the flywheel/drive plate end of the cylinder block.



NOTE: The number one (1) and number five (5) main bearing caps may be difficult to remove. For a removal aid, fabricate a tool as illustrated using 1/8" strap iron. Attach the tool to each bearing cap and use a pry bar to remove the bearing caps. Thoroughly clean the sealant from the sides of the bearing caps.

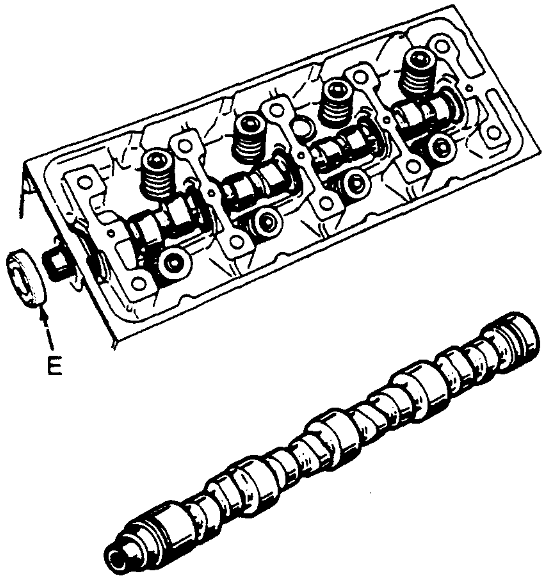


- The bearing inserts from the caps.
- The crankshaft and bearing upper inserts.

ENGINE OVERHAUL AND REBUILD
CYLINDER HEAD

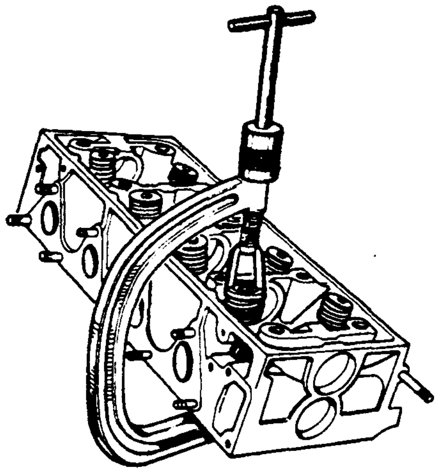
REMOVE OR DISCONNECT

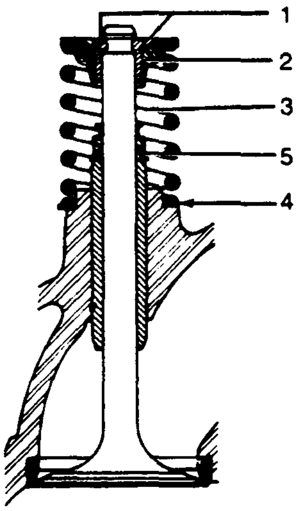
- Camshaft oil seal (E) by prying it out gently with a small pry tool.



CAUTION
When removing the camshaft oil seal, use care to prevent scratching the oil seal contact surface on the camshaft.

- Camshaft





- Compress each valve spring with a valve spring compressor and remove:

  valve locks (1)
  retainer (2)
  valve spring (3)
  washer (4)
  valve stem oil deflector (5)

- Remove the valves from the cylinder head.

ENGINE OVERHAUL AND REBUILD
CYLINDER HEAD

CLEANING

- Clean all components and keep matched items together.
- It is very important not to scrape the gasket faces on aluminum parts.
- Use a gasket solvent solution to disolve any part of the gasket still remaining stuck to the cylinder head.
  - Brush the liquid onto the area to be cleaned;
  - Wait about 10 minutes, then lift the remnants off with a wooden scraping tool.
  - Gloves should be worn during this operation.
- The valve chambers can be cleaned with a very fine wire brush in an electric drill.
- A soft abrasive scouring pad such as Scotchbrite® or equivalent may be used with solvent to clean surfaces.
- All grease, oil, & carbon should be removed with a good quality cleaning solvent and thoroughly dried with compressed air.
- Thoroughly clean and flush camshaft and its oil passages. Dry with the compressed air.

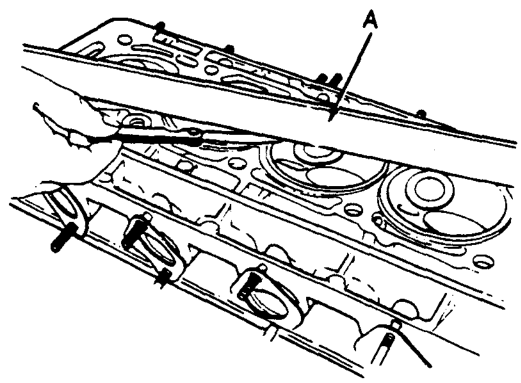
WARNING
Always keep sparks and open flame away from commercial solvents and cleaners to prevent fire from occuring. Always follow manufacturer's instructions when using these types of products. Safety eyewear should always be worn when working with compressed air.

MEASURE

- Use a straightedge (A) and a set of feeler gauges to measure the cylinder head for flatness.

  The maximum allowable distortion is 0.05 mm (0.002 in)

  IMPORTANT
  - The cylinder head must not be resurfaced. If it is not within the distortion specification, it must be replaced.



WARNING
A warped head could be caused by an overheat condition. Check cooling system (See Section E - Cooling System)

ENGINE OVERHAUL AND REBUILD
CYLINDER HEAD

INSPECT

- Inspect head for heat and stress cracks and warpage.
- Inspect valve seats for excessive wear and cracks.
- Inspect valve guides.
- Inspect cam bearing bores for scoring and wear. If the bores are excessively scored or worn, replace the cylinder head.
- Inspect camshaft lobes and journals for excessive wear and scoring. If the lobes are excessively worn or scored, be sure to inspect the rocker area for similar wear.
- Inspect for cracks in the combustion chambers and valve ports. Inspect for cracks in the gasket surfaces at each coolant passage.
- Inspect valve heads for burns, cracks, pitting or warpage.
- Inspect for scuffed or bent valve stems.
- Replace all damaged valves.

ENGINE OVERHAUL AND REBUILD
CYLINDER HEAD

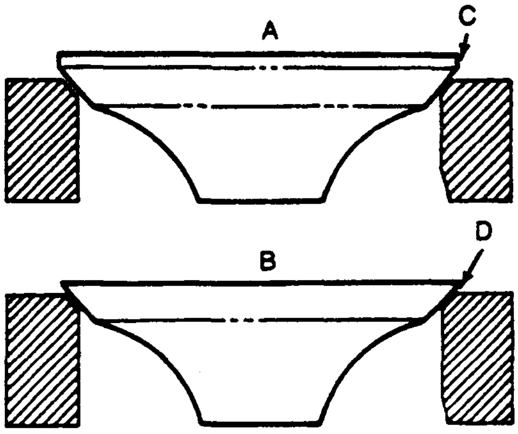
VALVE SEAT REFACING

Install the correct size pilot in each valve stem guide bore and reface each valve seat to the specified angle. Use a dressing stone that is in good condition.

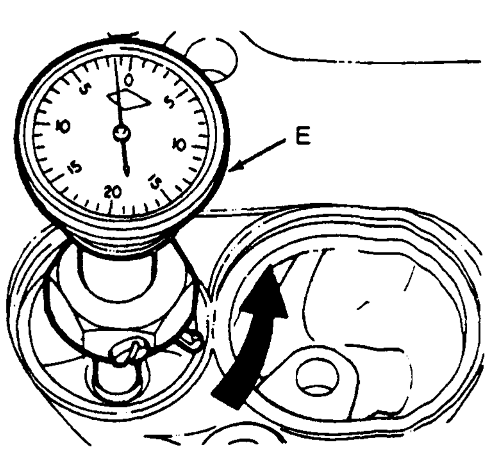
Use tapered stones to obtain the specified seat widths when necessary.

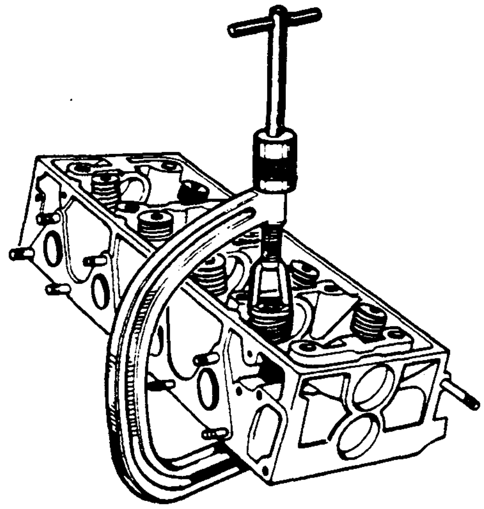
Refer to the Engine Specifications chart on page B1-13.

Measure the seat runout with a dial indicator (E) and control it to a maximum of 0.0635 mm (0.0025 in).



A. Correct Valve Facing
B. Incorrect Valve Facing
C. Valve Margin
D. No Valve Margin





VALVE REFACING

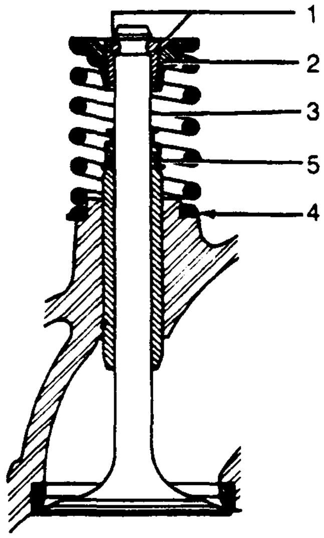
The valves cannot be refaced.

If any valve faces are excessively worn or the facing is incorrect, they must be replaced.

VALVE INSTALLATION

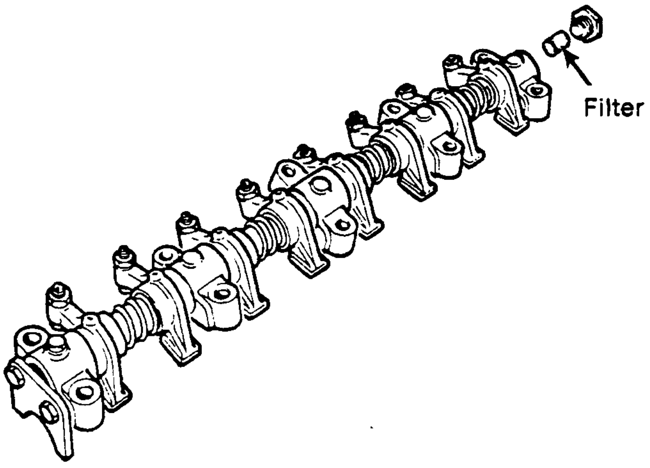
Install the valves, replacement valve stem oil deflectors (5), valve spring washers (4), valve springs (3), retainers (2) and locks (1).

Use valve spring compressor to compress the valve springs.



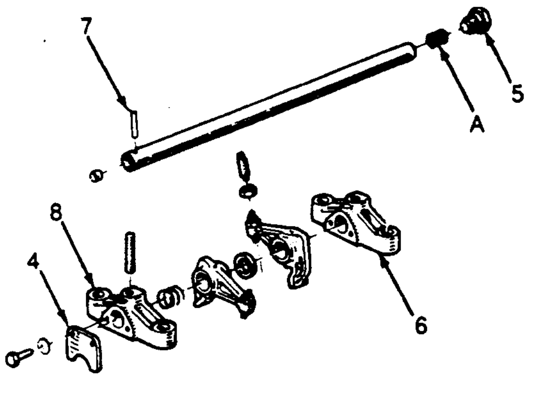
ENGINE OVERHAUL AND REBUILD
ROCKER SHAFT

IMPORTANT
The rocker shaft oil filter must be changed every 64,360 km (40,000 miles) and whenever repair operations are undertaken as a result of metal particles being found in suspension in the oil. If the above incident occurs, then the engine oil and main oil filter should be changed as well. Use Clamp Tool Mot. 445 on the oil filter.



REMOVE OR DISCONNECT

- the camshaft thrust plate (4)
- the end plug (5)
- the filter (A)
- the number one shaft bearing (6)
- the retaining pin (7)
- the number five shaft bearing (8)
- the remaining shaft bearings and rocker arms
- keep all the parts in the same order removed to aid installation at the original locations.



Clean

- All arms and springs with solvent and dry with compressed air.
- Shaft inside and out.

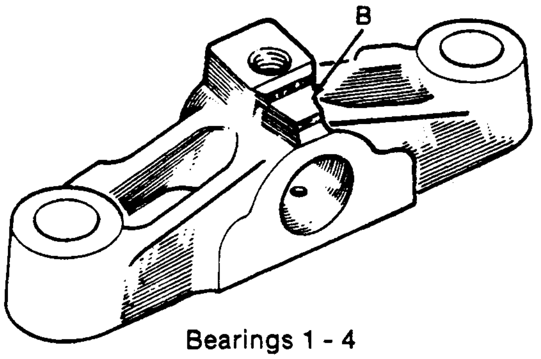
Inspect

- Arms for excessive wear
- Shaft for wear and grooves

ENGINE OVERHAUL AND REBUILD
ROCKER SHAFT

INSTALL OR CONNECT

- Reassemble rocker shaft assembly in the reverse order of disassembly. Lubricate with engine oil during assembly.

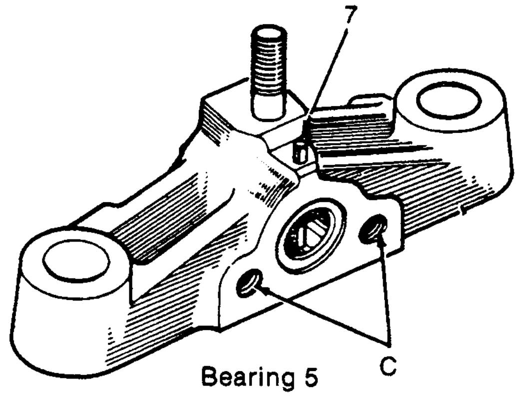


Bearings 1 - 4

NOTE: Shaft bearings number one, two, three and four (B) are identical. Shaft bearing number five has two threaded holes (C) for retaining the camshaft thrust plate and a hole for the retaining pin (7).

The intake and exhaust valve rocker arms are identical.

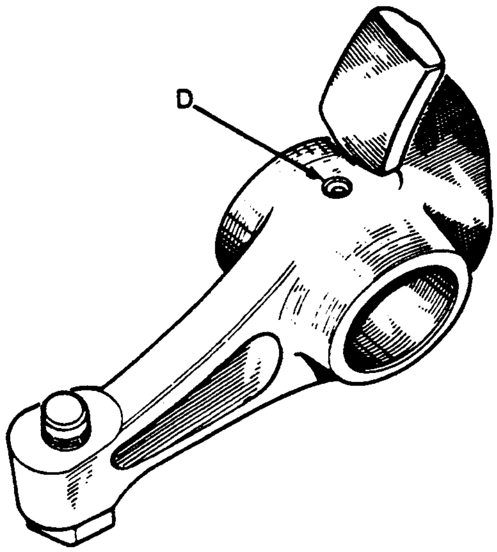
The oil hole (D) in each rocker arm is for camshaft lubrication.



Bearing 5

Tighten

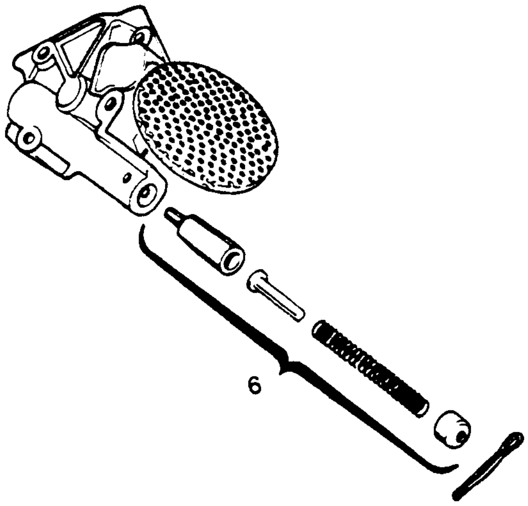
Torque tighten the plug to 2 daNm (15 lb./ft.) This torque setting must not be exceeded or damage will result to the roll pin in bearing 5.



ENGINE OVERHAUL AND REBUILD
OIL PUMP

REMOVE OR DISCONNECT

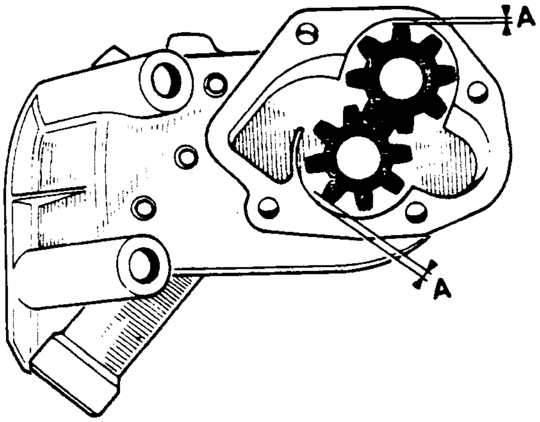
- the pressure relief valve (6) from the pump housing.
- oil pump housing cover



INSPECT

Measure the oil pump gear-to-housing clearance (A) with a feeler gauge.

- minimum clearance - 0.05 mm (0.002 in)
- maximum clearance - 0.12 mm (0.005 in)

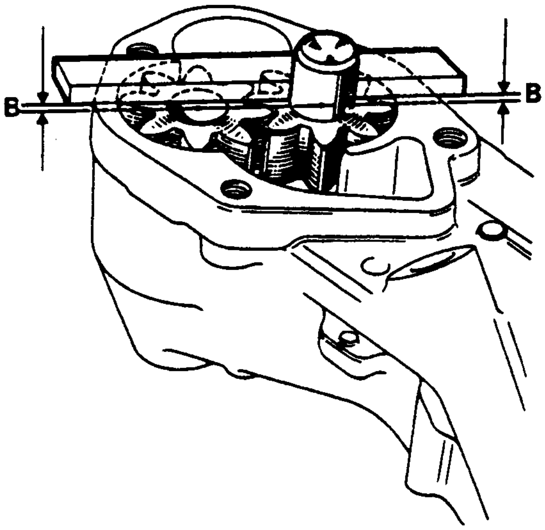


Measure the gear end-clearance (B) with a straight-edge and feeler gauge.

- minimum clearance - 0.02 mm (0.001 in)
- maximum clearance - 0.10 mm (0.004 in)

INSTALL OR CONNECT

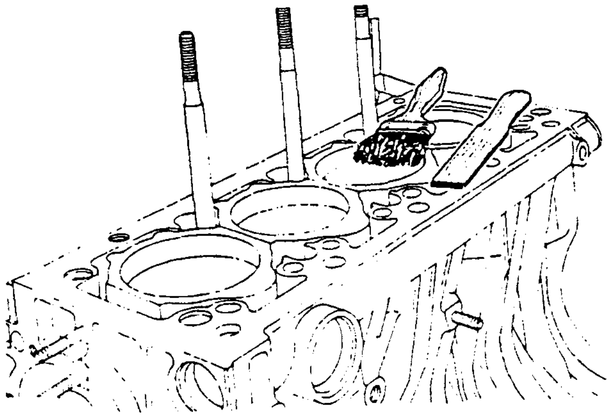
- Oil pump housing cover



ENGINE OVERHAUL AND REBUILD
CYLINDER BLOCK AND RELATED PARTS

CLEAN AND INSPECT

Clean



- Clean all components and keep matched items together
- It is very important not to scrape the gasket faces on aluminum parts.
- Use a gasket solvent solution to dissolve any part of the gasket still remaining stuck to the cylinder block.
  - Brush the liquid onto the area to be cleaned;
  - Wait about 10 minutes, then lift the remnants off with a wooden scraping tool
  - Gloves should be worn during this operation.
- Clean the gasket faces on:
  - cylinder head
  - and sleeves
- A soft abrasive scouring pad such as Scotchbrite® or equivalent may be used with solvent to clean surfaces.
- Clean the cylinder block, paying special attention to the lubrication channels.
- Blow dry with compressed air making sure all oil, solvent, and foreign particles are removed.

WARNING
Always wear safety eyewear when working with compressed air.

IMPORTANT
Always clean new machined parts in the same manner as reusable parts to make sure that no foreign material is on or inside.

ENGINE OVERHAUL AND REBUILD
CYLINDER BLOCK & RELATED PARTS - CLEAN & INSPECT

INSPECT

Cylinder block and related parts inspection.

BLOCK

- Check upper cylinder block for warpage. If over **.002"**, the block must be replaced.
- Check for cracks and irregularities in and around all openings, bolt holes and on surfaces.

> **CAUTION**
>
> A warped block could be caused by a cooling system malfunction. Check thoroughly (See Section E, Cooling System).

CRANKSHAFT

- Check for: Evidence of overheating. If found, replace crankshaft since the heat treatment has been destroyed.

  Check for: Scoring of bearing journals.

  Check: Oil seal contact surface for roughness or grooving.

NOTE: Any imperfections of the oil seal contact surface will result in oil leakage at this point. Slight ridges on the oil seal contact area may be cleaned up with emery cloth and crocus cloth. If the grooves are too deep, the crankshaft must be replaced.

- Inspect for wear of thrust washer surface area.
- Measure all journals - see specifications in General Section.

NOTE: Slight surface imperfection can be "cleaned up" by using crocus cloth on the journals. See "General Section" for crankshaft reconditioning.

MAIN AND CONNECTING ROD BEARINGS

If these are to be reused, check as follows:

INSPECT

- Inspect for excessive grooving, wear through aluminum tin coating, and foreign material embedded in bearing surfaces.
- Inspect the backs of the bearing shells for bright spots which indicate they have been moving in the bearing caps or bearing supports. If spots are present, discard bearings.

NOTE: Bearing failure may be the result of oil deterioration (acid formation), oil contamination, loss of oil pressure or insufficient oil level. An oil analysis may be required to determine actual cause of the failure.

> **CAUTION**
>
> Always discard bearings if oil has been contaminated with antifreeze or metallic particles from internal engine component failure. Always use lubricating oils that meet the recommended specifications and viscosity. See Maintenance and Lubrication Section of this manual or the Vehicle Owner's Manual.

ENGINE OVERHAUL AND REBUILD
CYLINDER BLOCK & RELATED PARTS - CLEAN & INSPECT

PISTONS AND SLEEVES
If these are to be reused, perform the following:

IMPORTANT
Failed or discarded parts should be inspected to determine cause of failure.

Clean
- Pistons and sleeves with solvent and dry them with compressed air.
- Ring grooves with a suitable tool or a piece of an old compression ring that has been ground to a bevel edge.

NOTE: Only the top of the piston may be cleaned with wire brush to remove carbon deposits. The top crown of the piston to the edge of the wrist pin may also be soaked with a multi-purpose household detergent such as Mr. Clean® or equivalent to aid in removal of carbon deposits. DO NOT wire brush the skirts of the pistons under any circumstances.

- Inside surfaces of the piston and the oil drain holes in the ring groove area. Exercise care to avoid enlarging the holes while cleaning them.
- Cylinder liners inside and out. Remove all carbon deposits. A wire brush may be used.

WARNING
Always wear safety eyewear when working with compressed air.

INSPECT
- Cylinder liner for excessive out-of-round, taper, or high spots which could cause failure of the piston.
- Sealing areas on top and around the bottom of the liner for wear, cracks, erosion, or any irregular condition.
- Pistons for score marks, cracks, damaged ring groove lands or indications of overheating. Any piston that has been severely scored or overheated must be replaced. Piston sleeves must be replaced in matched sets. Single piston/sleeve replacement is not acceptable. Indications of overheating or burned spots on the piston may be the result of an obstruction in the connecting rod oil passage. Be sure to check for cracks on the inside areas of the piston.

ENGINE OVERHAUL AND REBUILD
CYLINDER BLOCK AND RELATED PARTS

CAUTION

Excessively worn or scorned piston, rings and cylinder liners may be an indication of abnormal maintenance or operating conditions which should be corrected to avoid recurrence of failure.

In addition to performing proper maintenance, use of correct types of lubrication filters, fuel filters and air filters will reduce abrasive particles and other foreign materials introduced into the cylinders and oil passages, which will in turn reduce the rate of engine wear.

Always insist on using oil filters recommended by Winnebago Industries. The wrong filter could cause serious internal engine damage due to improper oil flow characteristics and by-pass functions.

Always maintain lubricating oils and engine coolant at the proper levels to prevent engine overheating.

Extended periods of engine idling and/or use of improper lubricating oil should be avoided, since a heavy formation of carbon may result causing piston rings to stick.

A used cylinder liner must be honed to break the glaze which results after long periods of operation. This insures good "seating" between the liner wall and the new piston rings. The honed/deglazed cylinder liner must meet specifications before it can be reused. See specifications in "General Information".

The top of the liner must also be "ridge-reamed" to prevent ridge impact by new compression rings, which could result in ring breakage.

Connecting Rods

Clean

- Connecting rod with solvent and dry with compressed air. Blow compressed air through the oil passage in the connecting rod to be sure it is clear of obstructions.

INSPECT

- Connecting rod for cracks and worn or irregular bearing areas. Replace the rods if the metal has changed colors due to overheating.

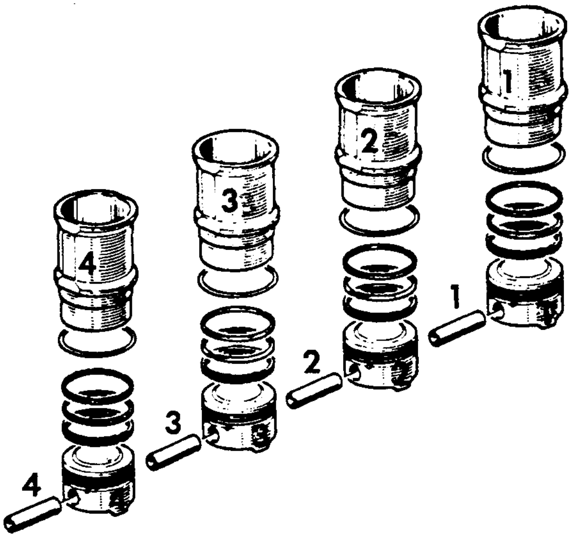
NOTE: If new connecting rods are required, stamp the cylinder number on the connecting rod and cap.

ENGINE OVERHAUL AND REBUILD
PISTON SLEEVE ASSEMBLIES

REMOVE OR DISCONNECT

- Sleeves from piston - connecting rod assemblies
- Rings from pistons.

IMPORTANT
The piston pins are pressed into the connecting rods and rotate freely in the piston bores. To remove and install the piston pins, use Piston Pin Removal and Installation Tool Set Mot. 574-07.

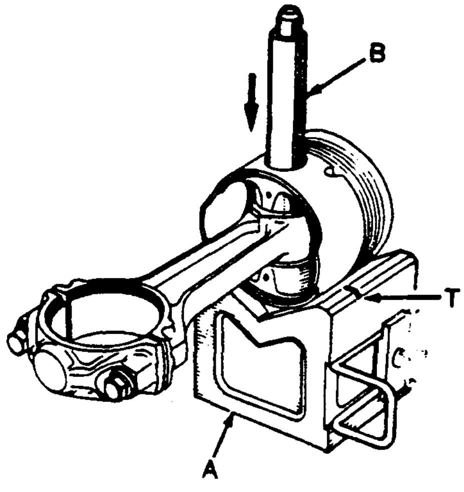


Tool 574-07 Consists of:
- Support block (A)
- Extraction Mandrel (B)
- Guides (C)
- Insertion Mandrels (D)

The block has two (2) grooves (T) for the purpose of alignment.

Press each piston pin out of each connecting rod with the extraction mandrel (B).

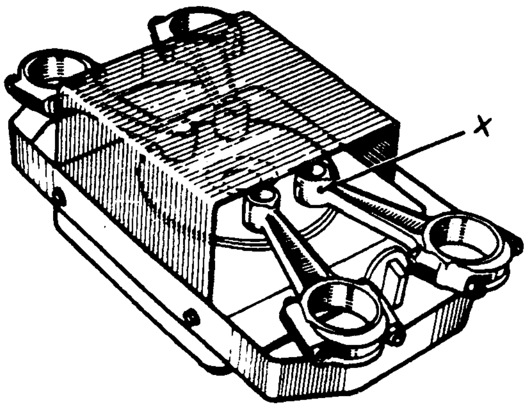
NOTE: The support block (A) and extraction mandrel (B) are part of the tool set 574-07.



REASSEMBLY

- Place the piston pin bore end (X) of the connecting rods on a 1500 watt hotplate. Ensure that they lay squarely on the hotplate.

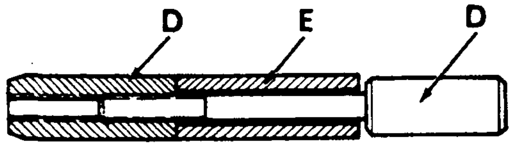
  NOTE: DO NOT use a torch to heat rod ends.



- Place a small piece of solder on each connecting rod end to be used as a temperature guide.

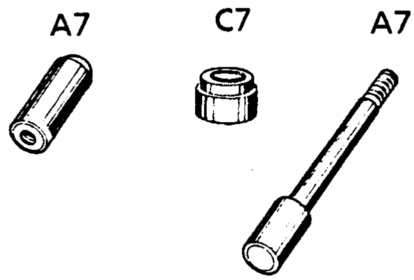
NOTE: The solder should have melting point of approximately 250°C (480°F).

- Heat the connecting rod ends until the solder liquifies.
- Insert and ensure that each replacement piston pin rotates freely in its respective piston bore.



- Install a replacement piston pin (E) in the applicable size insertion mandrel and guide (D).
- Screw the mandrel and guide together so they are snug, but not too tight. The piston pin must be free to rotate between the mandrel and the guide.

NOTE: The diameter in mm is stamped on each insertion mandrel and thrust collar.



Tool Mot. 574-07

Insertion mandrels used are marked as shown.

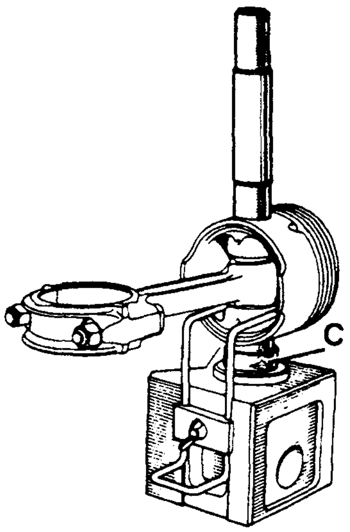
NOTE: Some insertion tools may be marked "23", specifying a 23 mm bore.

REASSEMBLY

- Install a thrust collar (C), which corresponds to the piston pin diameter, on the support block.
- Clamp a piston to the support block with the clip.

NOTE: When installed in the support block, the arrow on the piston top must face down.

- The recess on the outside of the piston bore must rest on the thrust collar (C).
- The following installation procedure must be performed quickly for each connecting rod to ensure that the heat loss is kept to a minimum.



WARNING
The connecting rods are HOT. Use protective hand wear and exercise care during installation.

When the solder liquifies and becomes a small drop:

- wipe off the solder
- insert the guide (with the piston pin and mandrel) into the piston bore.
- position a connecting rod in the applicable piston with the cylinder number mark (O) to the left and oil hole in rod to oil galley inside.

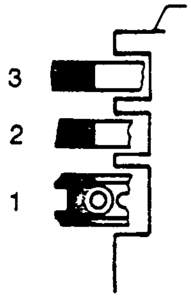
NOTE: The cylinder number mark made during removal must face the intermediate shaft when the connecting rod is installed in the cylinder block.

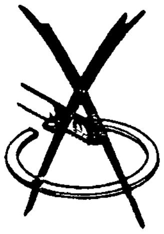
- QUICKLY insert the piston pin into the connecting rod bore until the guide contacts the support block. Pin should slide freely into bore. Do not install using a press.
- after a few seconds, remove the piston and connecting rod assembly from the support block
- remove the guide and mandrel assembly
- move the connecting rod from one extreme to the other and ensure that the piston pin is properly recessed from the outside perimeter of the piston at all positions.
- repeat the installation procedure for the remaining connecting rods and pistons.

ENGINE OVERHAUL & REBUILD
PISTON - SLEEVE ASSEMBLIES

PISTON PIN SPECIFICATIONS

Dimension	mm	in
Length	75	2.952
External Diameter	23	0.905
Bore	14	0.551

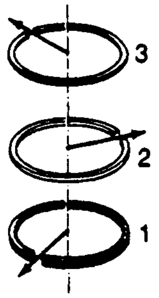




PISTON RING THICKNESS SPECIFICATIONS*

No. Description	mm	in
(1) Top Compression	1.75	0.068
(1) Taper Compression	2.00	0.078
(1) Oil Scraper	4.00	0.157

*Piston rings are pre-gapped.



Install replacement rings on each piston:

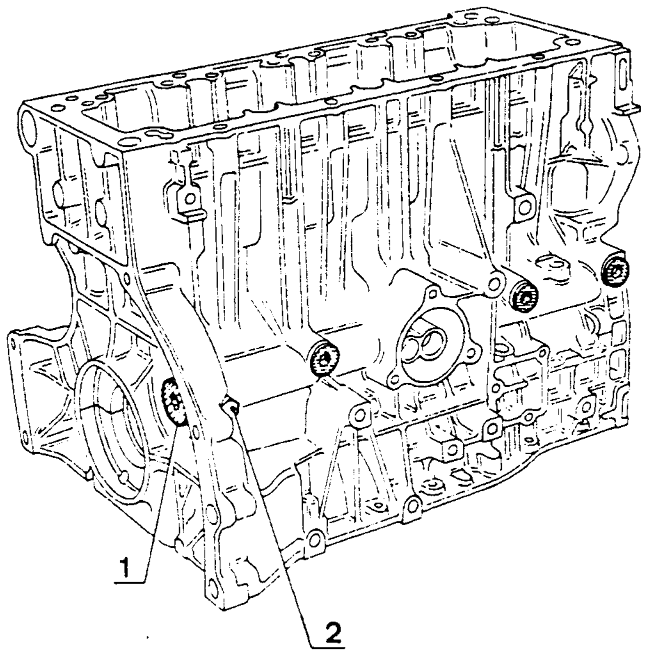
- the oil scraper ring (1)
- the taper compression ring (2) with the MARK facing up
- the top compression ring (3)
- the piston rings are pre-gapped and the existing gaps should not be changed.
- locate the gaps on the pistons at 120° intervals.

ENGINE OVERHAUL & REBUILD
REASSEMBLE CYLINDER BLOCK ASSEMBLY

INSTALL OR CONNECT

The core plugs must not be removed (frost plugs):

- check that each cylinder head bolt screws in easily.
- screw the bolts in and out several times if required to ease the threads.



TIGHTEN

If the oil galley plugs have been removed, reinstall and tighten them to:

- Plug 1 .... 8 daNm (60 lb./ft.)
- Plug 2 .... 2 daNm (15 lb./ft.)
- All other plugs.................. 4 daNm (30 lb./ft.)

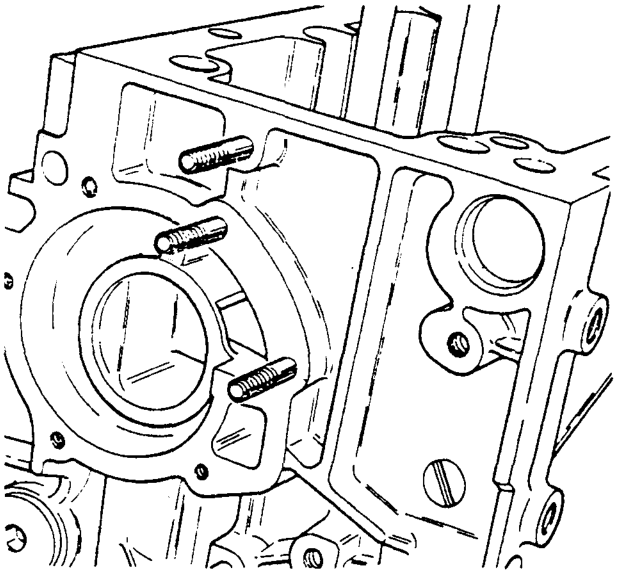
INSTALL OR CONNECT

- Insert the dipstick guide tube with its flange in contact with the block.
- Rub the outside of the dipstick tube with emery cloth if necessary to make it enter easier and coat the stem with Loctite® or equivalent.
- Attach the cylinder block to support Mot. 792.

ENGINE OVERHAUL & REBUILD
REASSEMBLE CYLINDER BLOCK ASSEMBLY

INSTALL OR CONNECT

- Insert the various studs. If removed, coat the threads on those for the water pump and timing belt cover with one or two drops of Loctite® or equivalent since the stud holes enter the cooling circuit.



ENGINE OVERHAUL & REBUILD
REASSEMBLE CYLINDER BLOCK ASSEMBLY

CYLINDER LINER PROTRUSION MEASUREMENT

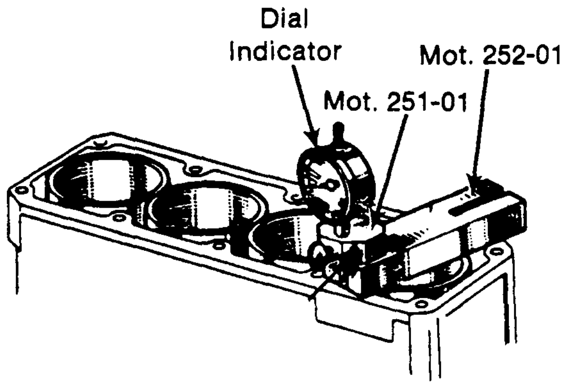
The cylinder liners are the WET type and require an O-ring seal to provide a seal between the liner and the cylinder block.

The cylinder liner protrusion above the cylinder block can be measured according to the following procedure:

- with the O-ring seal installed, insert each liner in its original position in the cylinder block
- insert a dial indicator into support block Mot. 251-01 and tighten the screw clamp
- place thrust plate Mot. 252-01 across each cylinder liner and measure the liner protrusion above the cylinder block with the dial indicator and support block.
- the liner protrusion tolerance specification is 0.08-0.15 mm (0.003-0.006 in)

If an incorrect liner protrusion is indicated, measure the protrusion using a replacement liner to determine if the cylinder block or the liner is defective.

Refer to the cylinder liner and block dimensions listed in the illustrations.

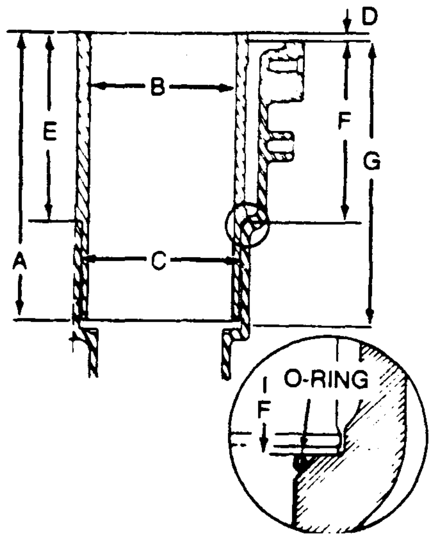


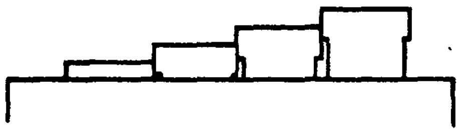
	Dimension	mm (in)
A	Liner height	148.5 mm (5.846 in)
B	Bore diameter	88 mm (3.464 in)
C	Base locating diameter	93.6 mm (3.685 in)
D	Liner protrusion w/o O-ring	0.08 to 0.15 mm (0.003 to 0.006)
E	Liner height to flange	(93.065 to 93.096) (3.663 to 3.665 in)
F	Cylinder block depth to flange	92.942 to 92.985 mm (3.659 to 3.660 in)
G	Cylinder block depth	149.25 to 149.75 mm (5.875 to 5.895 in)

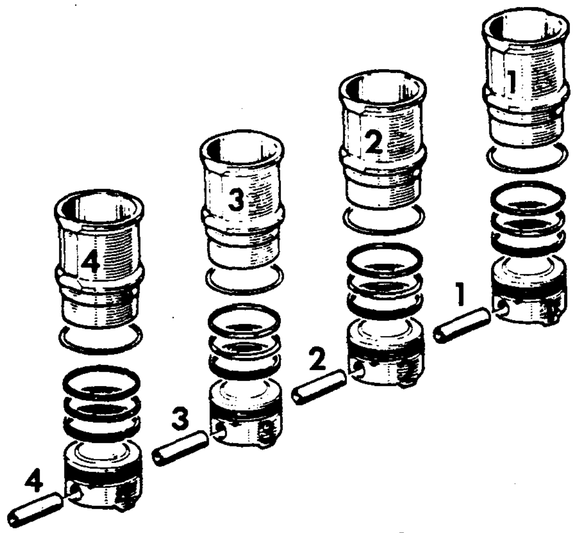
ENGINE OVERHAUL & REBUILD
REASSEMBLE CYLINDER BLOCK ASSEMBLY

With all the cylinder liner protrusions within tolerance, arrange them so that:

- the difference in protrusion between any two (2) adjacent liners does not exceed 0.04 mm (0.002 in)
- the protrusions are stepped down from the number one (1) cylinder to the number four (4) cylinder or from the number four (4) cylinder to the number one (1) cylinder.

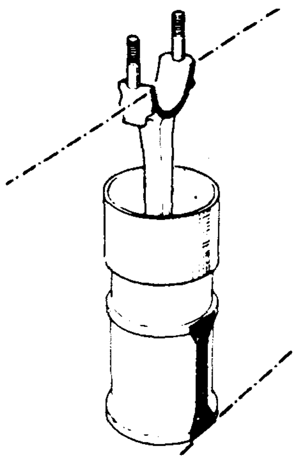




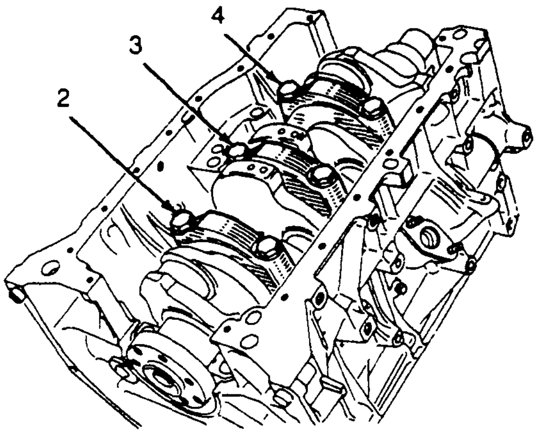


- when the correct protrusion arrangement has been decided, match each piston and connecting rod assembly with its original liner and re-mark each according to the new position.

Install the piston and connecting rod assemblies in their matched set liners with piston installation sleeve, Mot. 851.



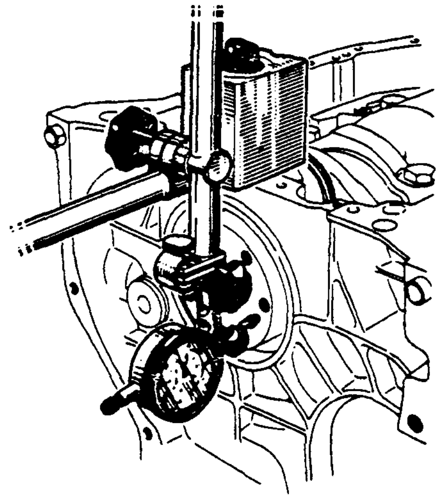
CRANKSHAFT INSTALLATION



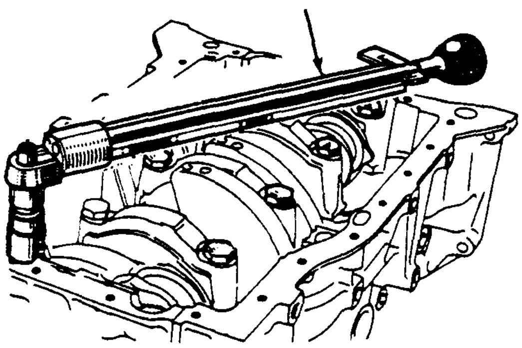
- Clean the main bearing upper insert surfaces in the cylinder block and install the replacement upper bearings.

NOTE: All the upper bearings have lubrication holes.

- Position the crankshaft in the cylinder block, lubricate and install main bearing caps numbers two (2), three (3) and four (4) with the replacement lower bearings in place.
- Insert and tighten the main bearing cap bolts to 8.8 - 9.8 daNm (65-72 lb./ft.).
- Use a beam type torque wrench.



- Install the number one (1) main bearing cap (with a replacement lower bearing) without the side seals.
- Position a dial indicator (with a magnetic base) on the number one (1) main bearing cap.
- Measure the crankshaft end-play.
- The end-play should be within 0.13-0.30 mm (0.005-0.012 in)
- If not correct, replace the thrust bearings as necessary to obtain the correct end-play.



- Install the number five (5) main bearing cap (with a replacement lower bearing).
- Insert and tighten the main bearing cap bolts to 8.8 - 9.8 daNm (65-72 lb./ft.) torque. Start with the center pair and move alternately outward as you tighten.
- Use a beam type torque wrench.

CAUTION

Be sure to mount the thrust bearings correctly. Oil grooves must face the crankshaft thrust surface. Make sure the locator pins seat into the holes provided in the upper bearings in the upper half of the block.

FRONT AND REAR MAIN BEARING SUPPORT SIDE SEALS

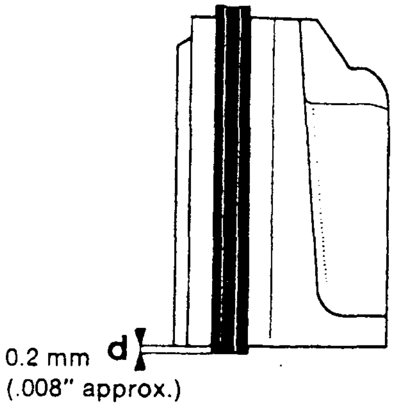
Method 1

Install or Connect

- Remove main bearing caps Nos. 1 and 5 and fit the side seals to them.

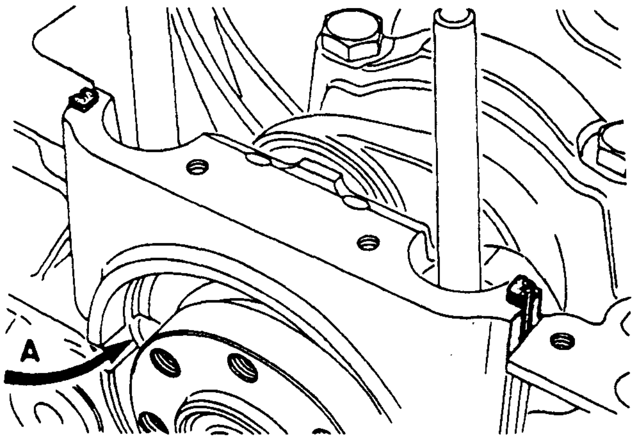
NOTE: This engine requires use of the thickest of the seals included in the gasket seal kit (5.40 mm - .212" thick = white code).

- Each seal should protrude below the surface of the bearing cap (see illustration).
- Lubricate bearing shells.
- Apply liberal amounts of petroleum jelly to seals and mating block surfaces.

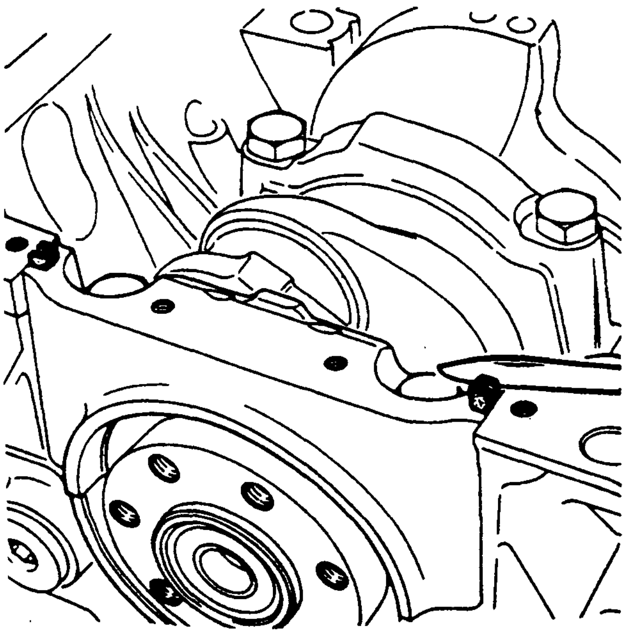


Install or Connect

- Screw two locating studs (12 mm dia. x 1.50 pitch) into the cylinder block.
- Place Nos. 1 and 5 main bearing caps on the studs.
- Lower the assembly into the block.
- When each bearing cap is almost seated, make sure that the side seals still protrude slightly by measuring at (A).
- Take out the studs and screw in the cap bolts.



- Cut the ends of the side seals leaving 0.5 to 0.7 mm (.020 to .028") protrude above the pan joint face.



ENGINE OVERHAUL & REBUILD
REASSEMBLE CYLINDER BLOCK ASSEMBLY

FRONT AND REAR MAIN BEARING SUPPORT SIDE SEALS (CONT.)

Method 2

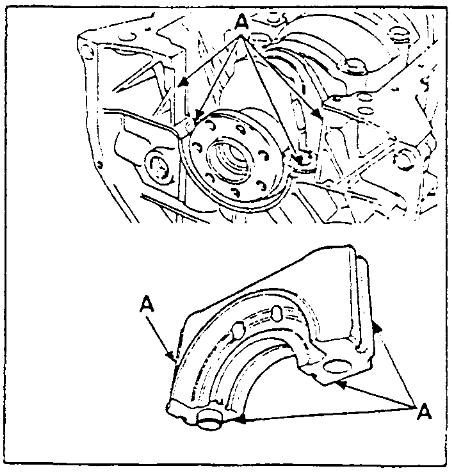
Due to matching modifications in engine production, lateral sealing of the main bearing caps cannot be ensured with the butyl seals provided in the gasket/seal kit.

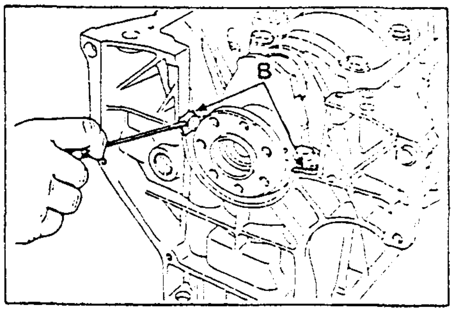
Therefore, described here is an alternate methods of sealing main bearing caps using Thixo-Caf 4/60 Silicone (50 ml tube). Thixo Silicone and an application kit are available from our Parts Sales Department. The applicatoin kit consists of:

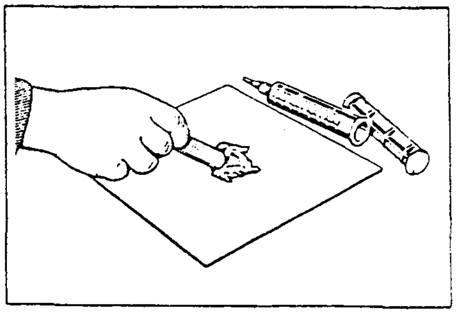
- 1 - 5 ml tube of hardener
- 1 - mixing stick
- 1 - 50 ml syringe
- 1 - set mixing/application instructions

IMPORTANT
The product must be injected within approximately 5 minutes to avoid the mixture hardening in the syringe.

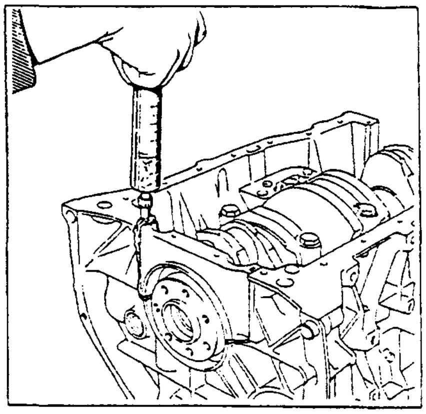
- Thoroughly clean the surfaces at (A) on the cylinder block and the main bearing cap using a cloth dampened with cleaning solvent.
- Lightly coat the lower faces of the cylinder block at (B) with CAF 4/60 THIXO but do not block the oil retention grooves.
- Attach the cap and tighten to 8.8-9.8 daNm (65-72 lb./ft.)
- Mix 45 ml of CAF 4/60 THIXO with the contents of the tube of hardener using the stick to blend the mixture thoroughly.







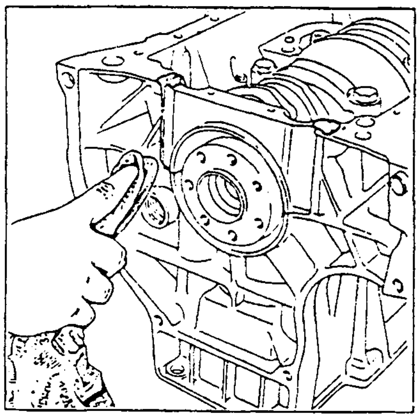
- Put the mixture in the syringe and inject it into the main bearing cap grooves.
- Allow the mixture to flow out slightly either side of the main bearing cap grooves to ensure that the injected mixture has filled the sealing groove completely.



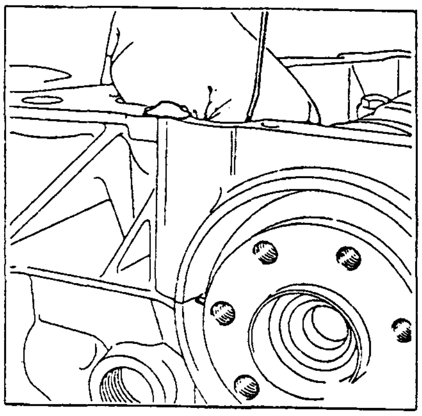
FRONT AND REAR MAIN BEARING SUPPORT SIDE SEALS (CONT.)

Method 2 (Cont.)

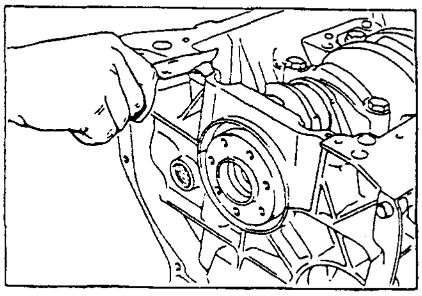
- Using a cloth, wipe away the excess mixture, both inside and outside the cylinder block.



- PASS A STEEL WIRE THROUGH THE LUBRICATION OIL WAYS TO CHECK THAT THEY ARE NOT BLOCKED.



- Allow the assembly to dry for a few minutes, then cut excess sealant from the joint face.

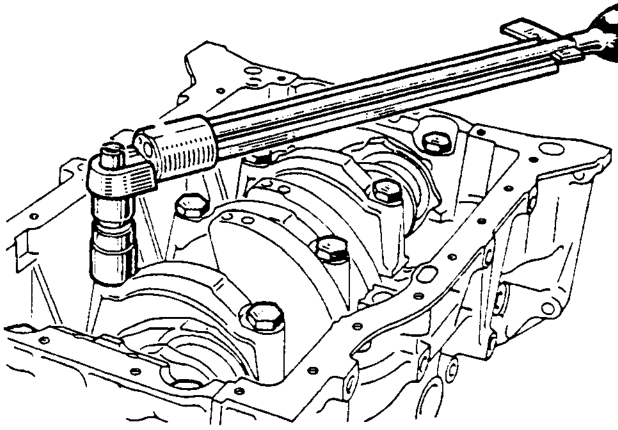


TIGHTEN

Torque tighten the main bearing cap bolts using a torque wrench.

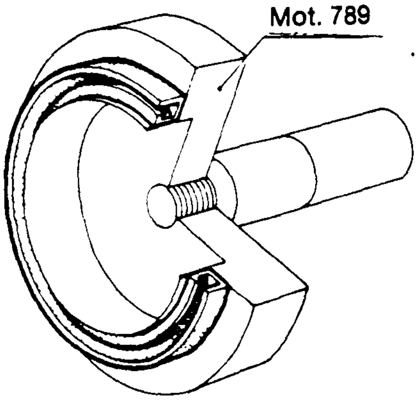
8.8 - 9.8 daNm (65-72 lb./ft.)

Check that the crankshaft rotates freely.

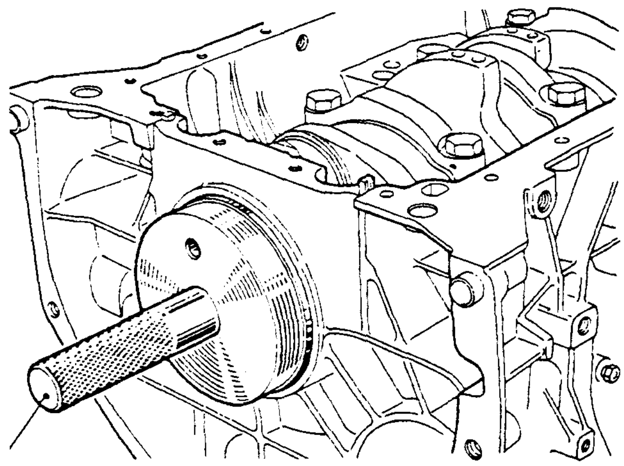


INSTALL OR CONNECT

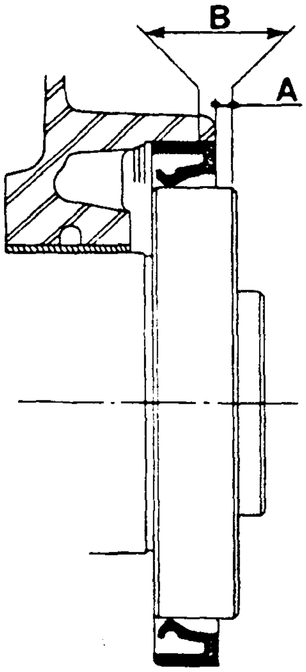
- Mount the oil seals to main bearings Nos. 1 and 5. The lips on these oil seals are delicate; be extremely careful when mounting them.
- No. 1 main bearing oil seal (flywheel end). Place the seal on Tool Mot. 789 and lubricate the outside of the seal.



- Insert the seal by tapping the end of the tool lightly until the tool contacts the crankshaft.



Mot. 789



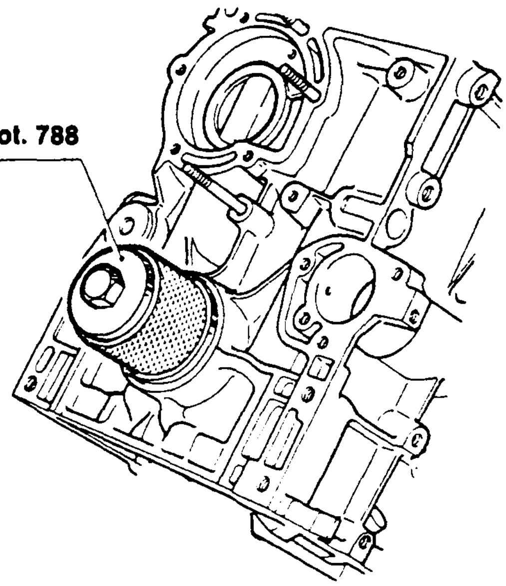
IMPORTANT
If the old oil seal lip has marked the crankshaft (flywheel end), a washer 1.5 mm (.059") thick must be inserted between the new oil seal and the tool. This will push the seal in further on the shaft and give the lip an unworn bearing surface when in position.

A. Normal position of oil seal using Tool Mot. 789.
B. Position the oil seal using Tool Mot. 787 and 1.5 mm washer (giving offset to lip on overhaul).

ENGINE OVERHAUL & REBUILD
REASSEMBLE CYLINDER BLOCK ASSEMBLY

INSTALL OR CONNECT

- No. 5 main bearing oil seal (timing end). Place the seal on Tool Mot. 788 and lubricate the outside of the seal.
- Position the tool-seal assembly to the crankshaft and draw it on with the pulley bolt. The seal is fully seated when the tool contacts the crankshaft.
- Woodruff key on crankshaft.
- Air conditioner pulley (or spacer if not A/C equipped).
- Crankshaft belt sprocket.

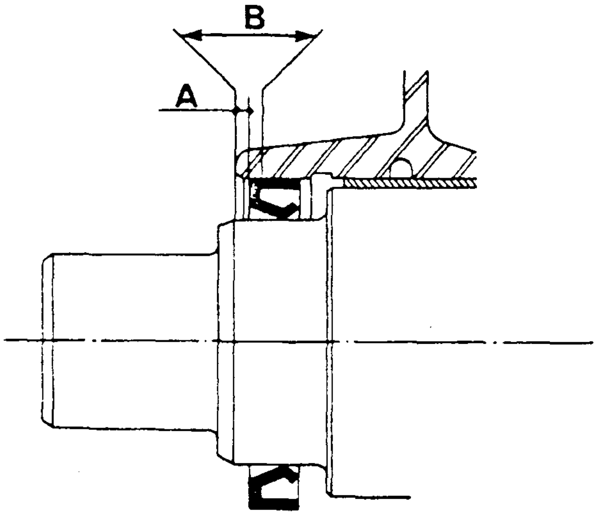


IMPORTANT

If the old oil lip has marked the crankshaft (timing gear end), a washer 1.5 mm (.059") thick must be inserted between the new oil seal and the tool. This will push the seal in further on the shaft and give the lip an unworn bearing surface when in position.

A. Normal position of oil seal using Tool Mot. 788.

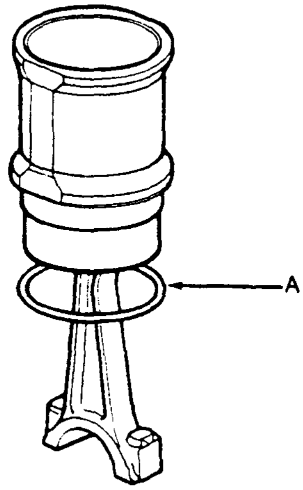
B. Position of oil seal using Tool Mot. 788 and 1.5 mm washer (giving offset to lip on overhaul).



Mount:
- the spacer
- key
- and timing sprocket, timing mark facing outwards.

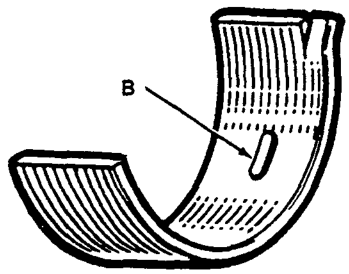
PISTON, CONNECTING ROD AND CYLINDER LINER INSTALLATION

- Install a replacement O-ring seal (A) on each cylinder liner.
- Ensure that the O-ring seal is not twisted.
- Install the appropriate size replacement upper bearings in the connecting rods.

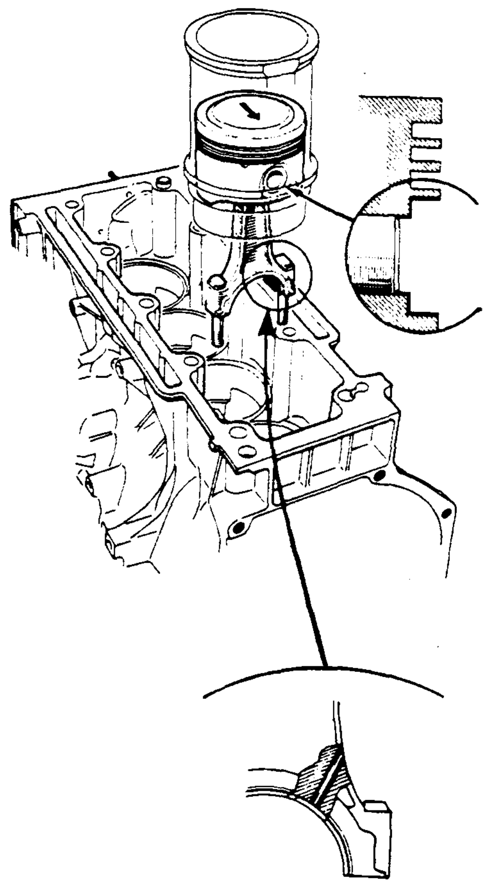


CAUTION

The upper bearings have lubrication holes (B); the lower bearings do not have lubrication holes. Ensure that the holes in the upper bearings are aligned with the lubrication holes in the connecting rods.



- Install the piston, connecting rod and liner assemblies in the cylinder block with the upper bearings and rods positioned on the crankshaft journals.



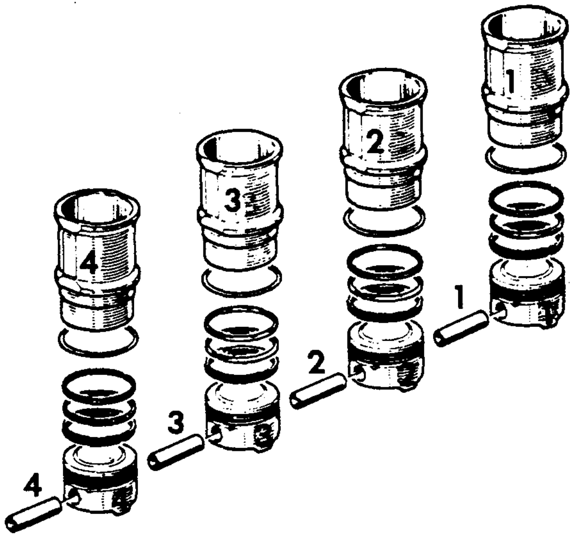
ENGINE OVERHAUL & REBUILD
REASSEMBLE CYLINDER BLOCK ASSEMBLY

Ensure that:

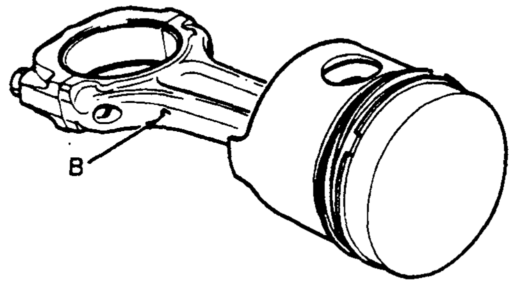
- the number one liner assembly is installed at the flex plate end of the cylinder block.

  The #1 liner assembly was determined by protrusion measurements shown on page B3-26.

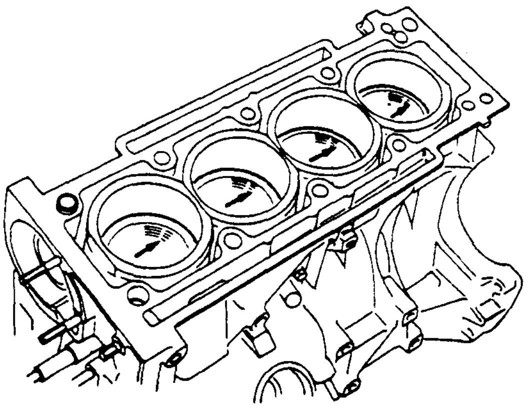
- A number is stamped on each connecting rod toward the intermediate shaft side of the cylinder block.



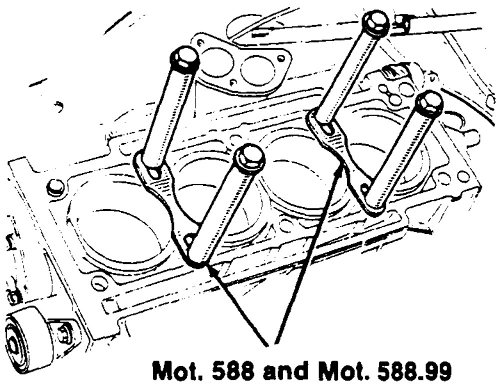
- the lubrication hole (B) in each connecting rod is adjacent to the oil filter side of the cylinder block on oil galley side.



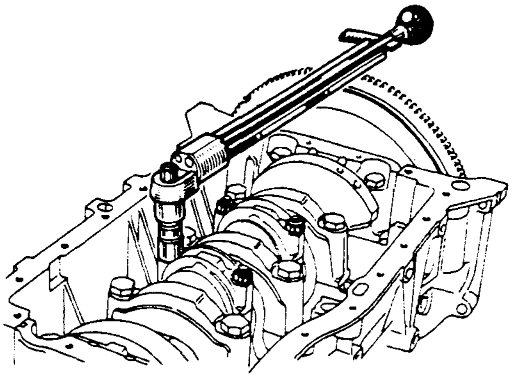
- the arrow stamped on each piston points toward the flywheel/drive plate end of the cylinder block.



- Install cylinder liner clamps Mot. 588 and spacers Mot. 588.99.



- Install an appropriate size replacement lower bearing in each connecting rod bearing cap and lightly lubricate them with engine oil.



CAUTION

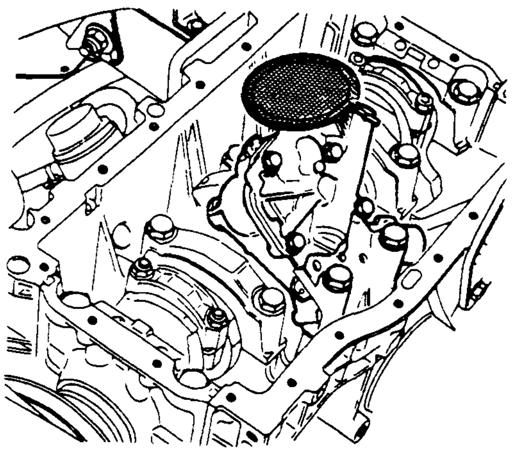
Ensure that each lower bearing is correctly matched with its corresponding upper bearing.

- Install each connecting rod bearing cap on its original connecting rod.

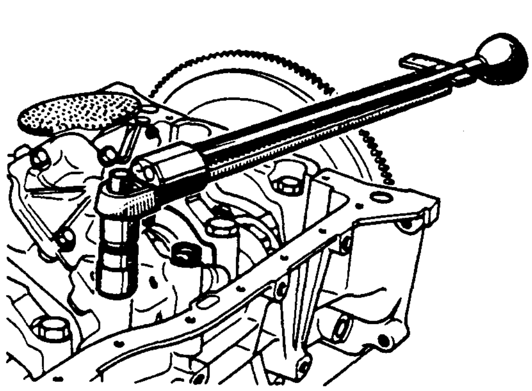
NOTE: The original connecting rod bearing cap bolts and nuts cannot be reused. Use replacement bolts and nuts when installing the connecting rods.

- Install the connecting rod bearing cap nuts and tighten with 6.0-6.5 daNm (44-48 lb./ft.) torque. Use a beam type torque wrench.
- Tap each connecting rod lightly parallel to the crankshaft and ensure that there is adequate clearance.
- Rotate the crankshaft and ensure that the pistons, connecting rods and the crankshaft function normally.

OIL PUMP AND OIL PAN INSTALLATION



- Install the oil pump.
- Check for locator pins.

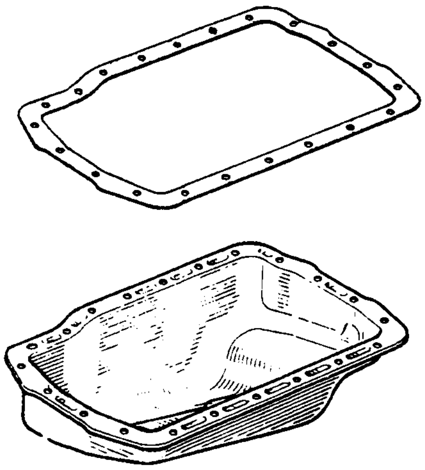


- Tighten the oil pump bolts to 4.0-4.5 daNm (29-37 lb./ft.)

ENGINE OVERHAUL & REBUILD
REASSEMBLE CYLINDER BLOCK ASSEMBLY

INSTALL OR CORRECT

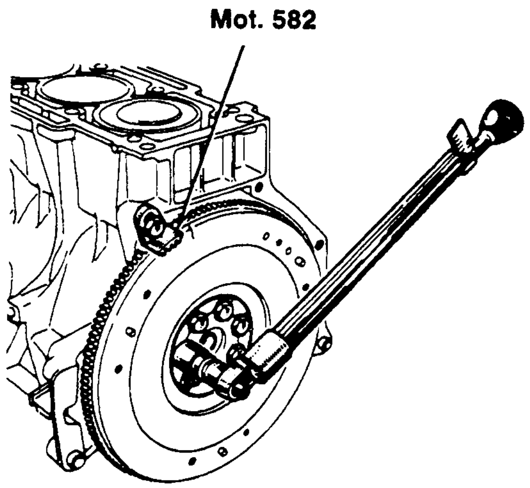
- Position the oil pan gasket and install the oil pan.
- Tighten the retaining bolts to .8-1.0 daNm (5.8-7.3 lb./ft.)



FLYWHEEL/DRIVE PLATE INSTALLATION

INSTALL OR CONNECT

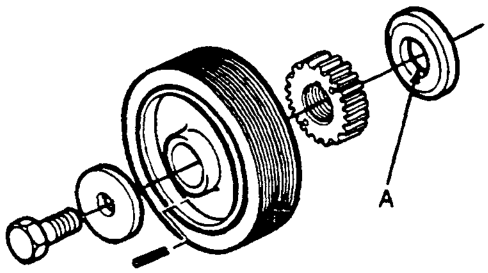
- Apply Loctite® or equivalent, on the crankshaft mating surface for the flywheel/drive plate.
- Position the flywheel/drive plate on the crankshaft and install Holding Tool Mot. 582.



NOTE: The original flywheel/drive plate self-locking bolts are not reusable. Use replacement bolts for each installation.

- Tighten the flywheel bolts to 6.0 daNm (44 lb./ft.) torque.
- Tighten the drive plate bolts to 6.8 daNm (50 lb./ft.) torque.
- Do not remove Holding Tool.

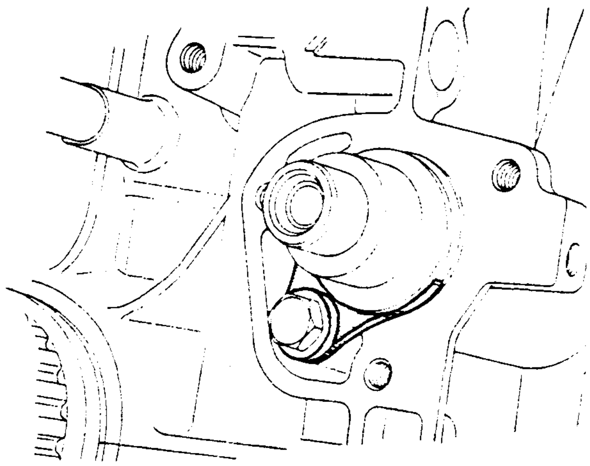
CRANKSHAFT SPROCKET AND CRANKSHAFT (VIBRATION DAMPER) PULLEY INSTALLATION



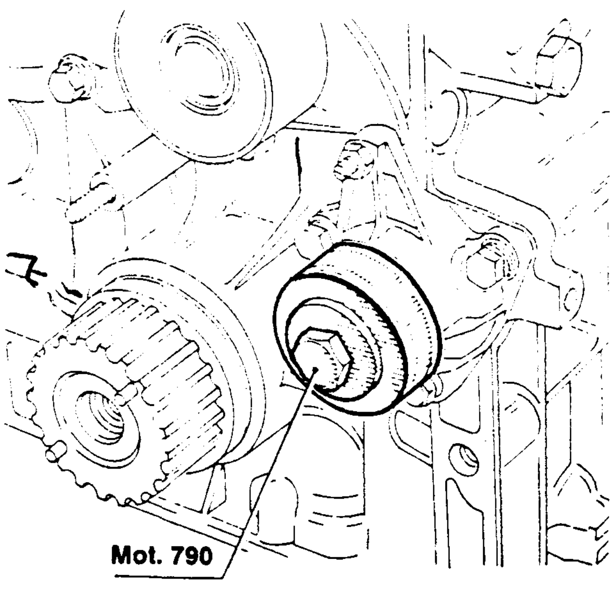
- The chamfered edge of the sprocket bore faces the washer (A).
- Apply Loctite® or equivalent, to the sprocket mating surface on the crankshaft (vibration damper) pulley.
- Position the crankshaft (vibration damper) pulley on the end of the crankshaft.
- Install the crankshaft (vibration damper) pulley washer and bolt. Tighten the bolt to 12.0 - 13.5 daNm (88-100 lb./ft.) torque.
- Remove Holding Tool from the flywheel drive plate.

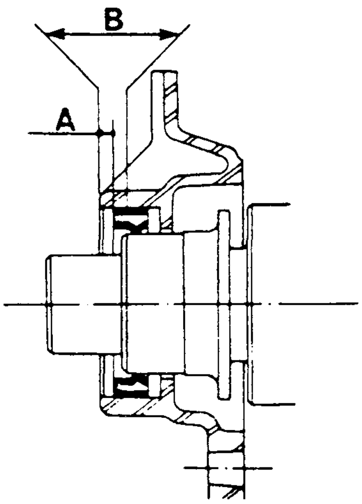
INSTALL OR CONNECT

- Insert the intermediate shaft, secure it by its flange plate.



- Install timing belt tightener. Do not tighten at this time.
- Position the intermediate shaft cover with a new paper gasket and new oil seal. Use inserting tool Mot. 790 in order not to damage the seal lip and to assist cover location.
- Coat the bolt threads with one or two drops of Loctite® or equivalent, since the holes pass through the cylinder block which could lead to oil leaks.





IMPORTANT
A washer 1 mm (.040") thick must be placed between the oil seal and the inserting tool so that the seal lip rides on a fresh surface if the intermediate shaft has been marked by the old oil seal.

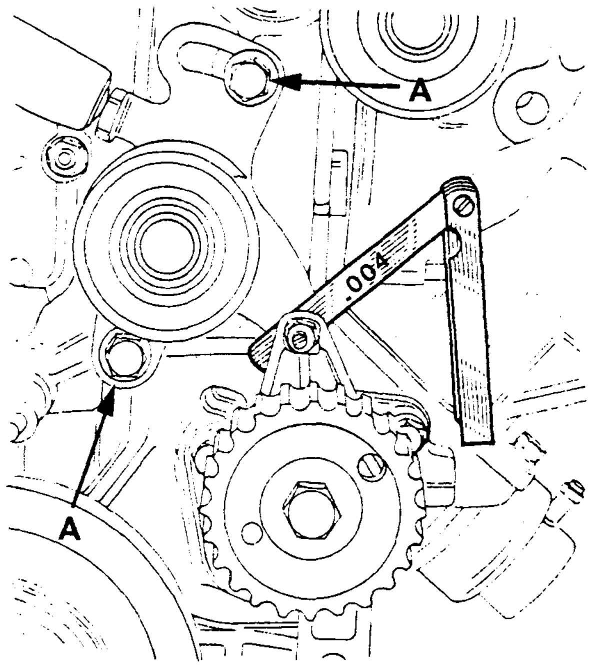
A. Position when inserted with Tool Mot. 790.
B. Position when inserted with Mot. 790 plus a 1 mm washer after overhaul.

INSTALL OR CONNECT

- The water pump with plunger and spring for the timing belt tightener.

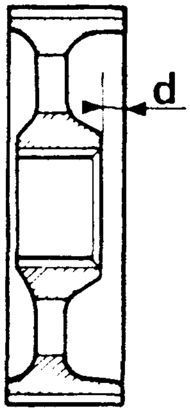
ADJUST

- Adjust the clearance between the tensioner and adjusting bolt to 0.1 mm (.004").
- Tensioner bolts (A) must be tight before making adjustment.

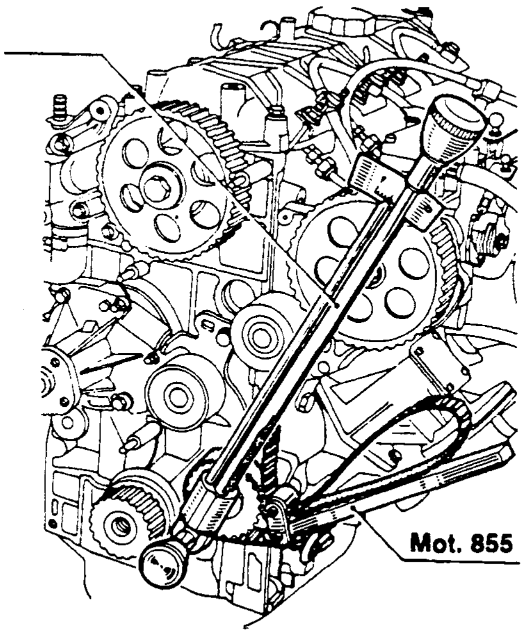


INSTALL OR CONNECT

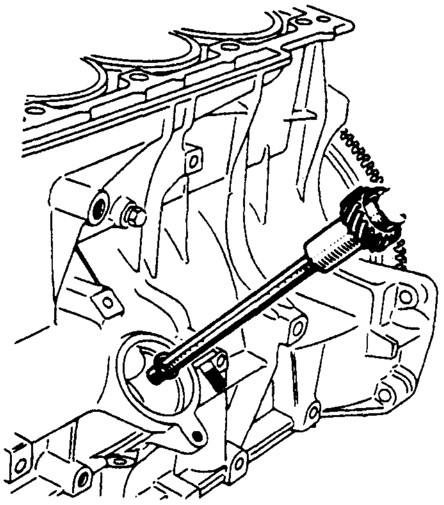
- The intermediate shaft key and the toothed sprocket, larger offset (d) facing outwards away from the cylinder block.



- Torque tighten the bolt to 5.0 daNm (37 lb./ft.) using Strap Tool Mot. 855 and a torque wrench.

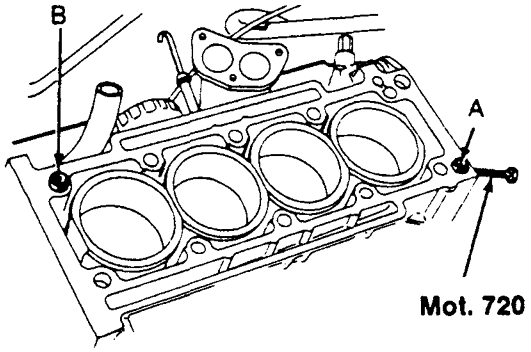


- Install oil pump angle shaft. Lubricate before installing.
- Check that the intermediate shaft/oil pump assembly revolves freely.

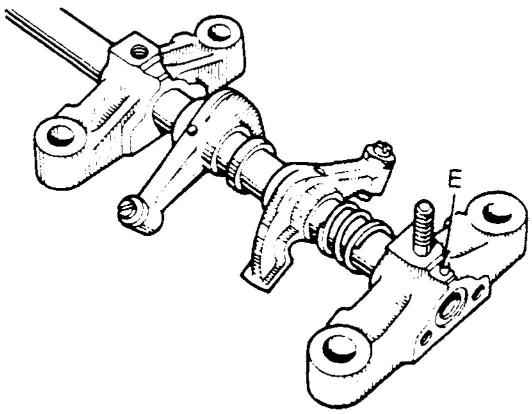


INSTALL CYLINDER HEAD ASSEMBLY

- Install Cylinder Head Locating Tool Mot. 720.
- Remove Cylinder Liner Clamps
- Install the cylinder head gasket.
- Use Locating Tool at (A) and the dowel (B) for alignment.

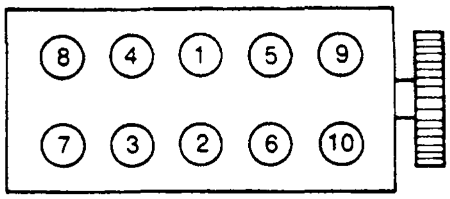


- Position the cylinder head on the cylinder block.
- Position the camshaft in the cylinder head.
- Position the rocker assembly in the cylinder head with the rocker arm adjusting screws backed off.
- When installing the rocker arm assembly components, ensure that the number five (5) bearing retainer pin (E) is correctly seated.
- Insert and tighten the cylinder head bolts.



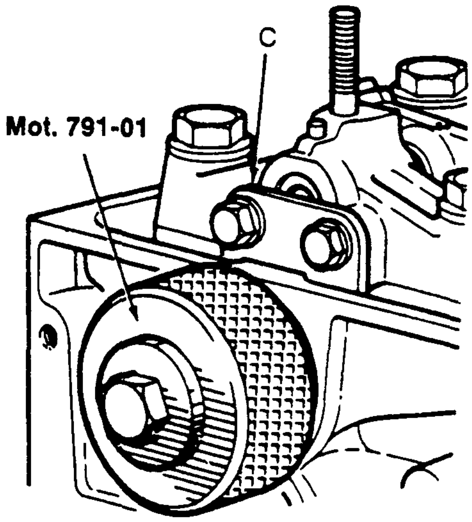
Cylinder head bolt tightening:

- Use the tightening sequence illustrated below.
- Initially tighten the bolts to 5.0 daNm (37 lb./ft.) torque.
- Next, tighten the bolts to 8.0 daNm (59 lb./ft.) torque.
- For the final tightening, loosen the bolts 1/2 turn and then tighten them to 8.8 - 9.8 daNm (65-72 lb./ft.) torque
- Remove Locating Tool

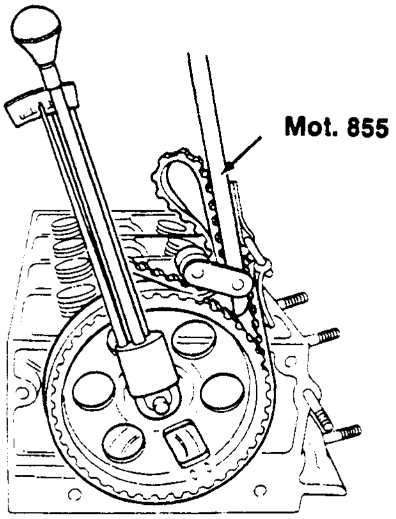


INSTALL OR CONNECT

- Install the camshaft thrust plate (C)
- Install the replacement camshaft oil seal with Oil Seal Installation Tool, Mot. 791-01.
- Measure the camshaft end play. Refer to the Specifications chart on B1-13.

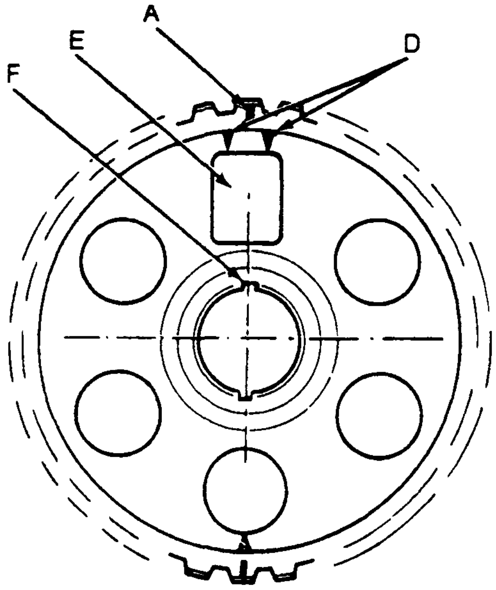


- Install the camshaft sprocket and retaining bolt on the end of the camshaft.
- Use Sprocket Holding Tool Mot. 855 and tighten the camshaft bolt to 5.8 daNm (37 lb./ft.)

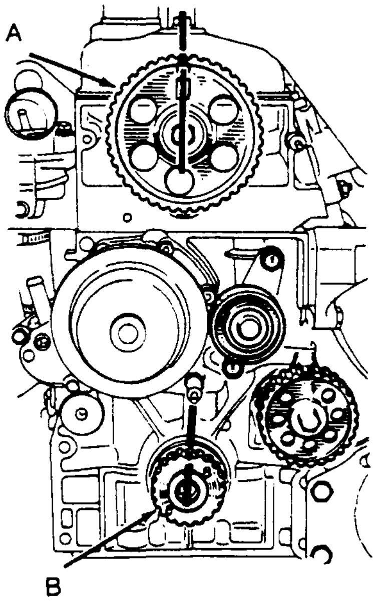


TIMING BELT INSTALLATION

NOTE: The camshaft sprocket has a timing index (A), two bosses (D), a rectangular hole (E) and a key way (F) that are all used for valve adjustments.



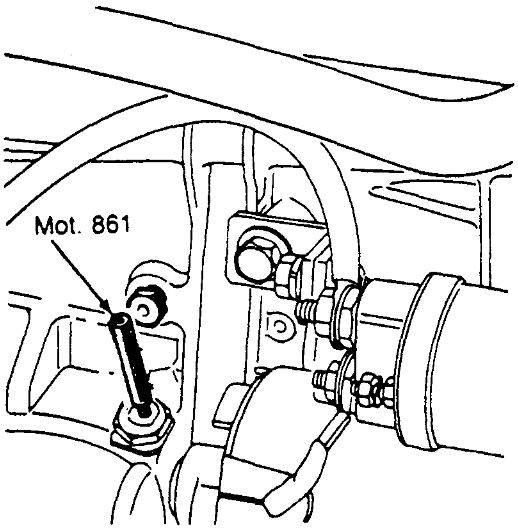
- Position the camshaft sprocket timing index in line with the static timing mark in the timing belt cover.
- Position the crankshaft so that the number one (1) piston is at top dead center (TDC) - compression stroke.
- Remove the plug in the cylinder block and insert TDC Rod Mot. 861 into the TDC hole in the crankshaft.



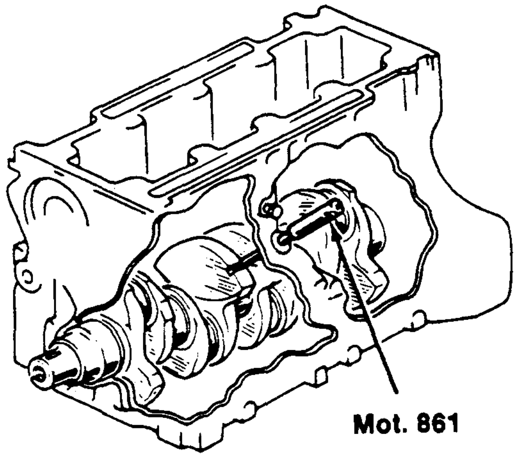
A. Camshaft Sprocket
B. Crankshaft Sprocket

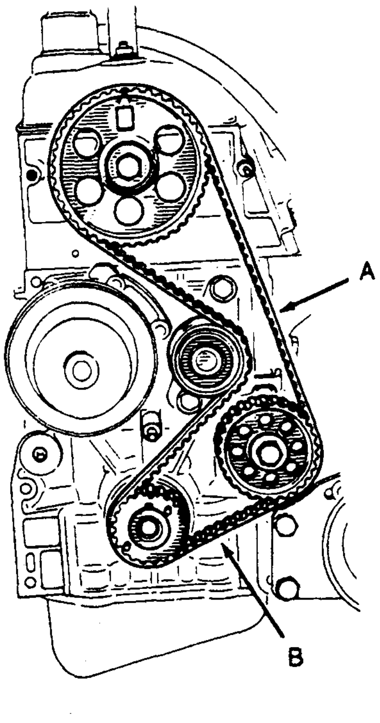
TIMING BELT INSTALLATION

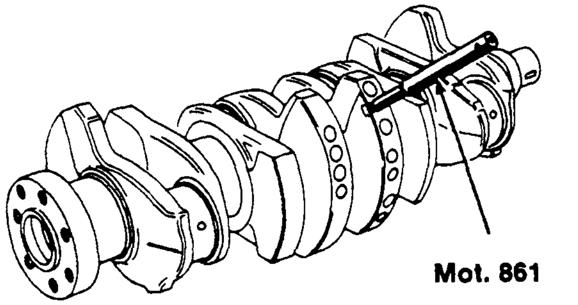
CAUTION
Do not use the TDC Rod (Mot. 861) to hold the crankshaft in place when loosening or tightening bolts. Use Flywheel Holding Plate Tool (Mot. 582).



- Install the timing belt on the spockets.
- The timing belt must be tight at the positions (A and B) indicated.

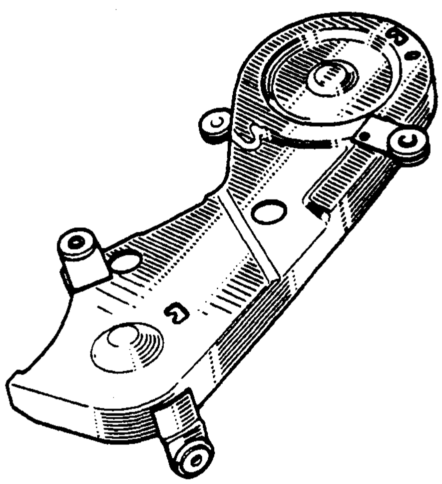






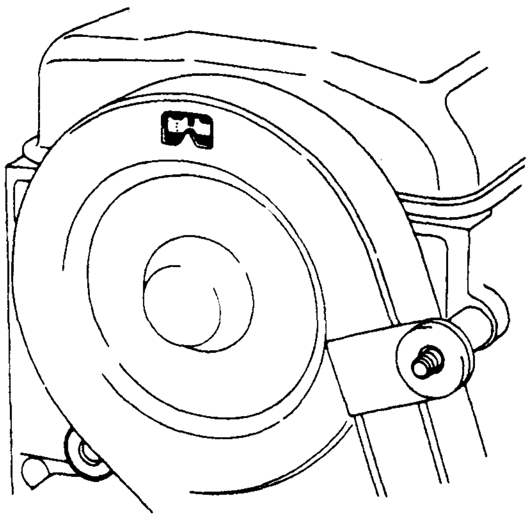
TIMING BELT INSTALLATION

- Position the timing belt cover over the sprockets and check the camshaft timing mark with the index on the cover.



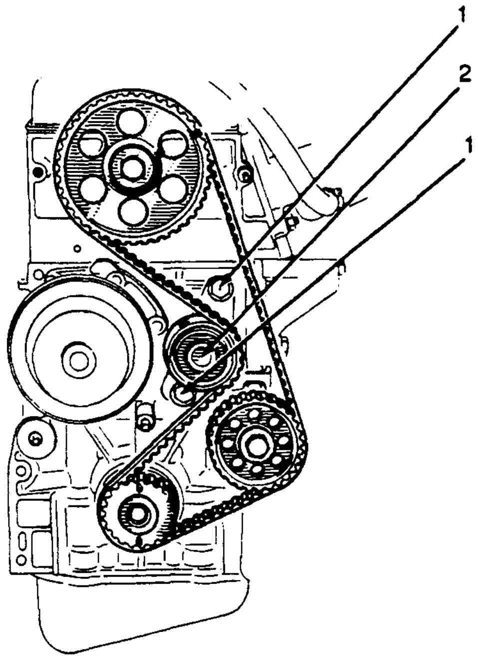
TENSION ADJUSTMENT

- Remove TDC Rod and install the plug in the cylinder block.
- Rotate the crankshaft clockwise (normal direction) two complete revolutions.



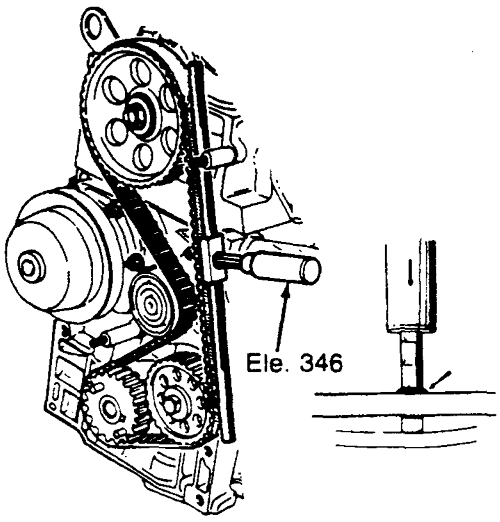
CAUTION
Never rotate the crankshaft counterclockwise when adjusting the timing belt tension.

- Remove the timing belt cover and loosen the timing belt tensioner bolts (1) 1/4 turn.
- The spring loaded timing belt tensioner (2), in contact with the belt, will automatically adjust to the correct position.
- Ensure that the clearance between the timing belt tensioner and the intermediate shaft cover is correct.



TIMING BELT INSTALLATION

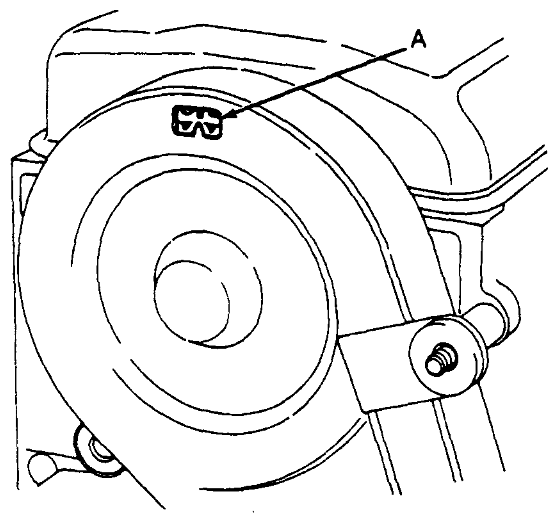
- See Belt Tensioning Procedure - page B7-1.
- Tighten the bottom timing belt tensioner bolt (first) and then the top bolt to 2.5 daNm (18 lb./ft.) torque.
- Test the timing belt tension with Tension Gauge Tool, Ele. 346.
- Check for proper deflection.
  Deflection: 5.5-7.0 mm (0.216 - 0.276 in)
- Install the timing belt cover.



ROCKER ARM CLEARANCE ADJUSTMENT (FIRST PROCEDURE)

IMPORTANT
If the engine is equipped with a timing belt cover rear window (on the back side of the timing belt cover), use the first procedure to adjust the rocker arm clearances.

If the engine is not equipped with a timing belt cover rear window, use the second procedure to adjust the rocker arm clearances.

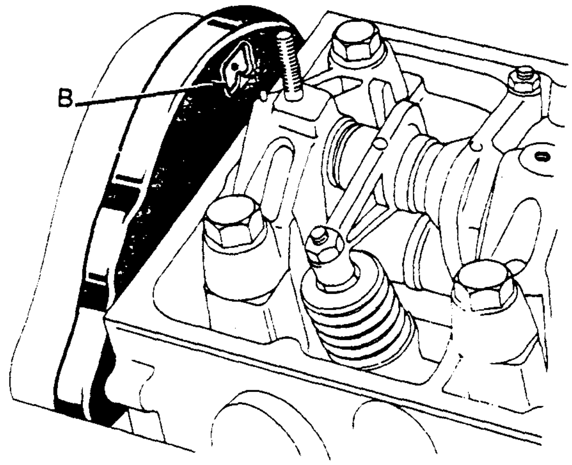


CLEARANCE ADJUSTMENT

Rotate the crankshaft clockwise (viewed from the front of the engine) and align the number one (1) piston TDC mark on the camshaft sprocket with the index (A) in the timing belt cover front window.

NOTE: Ensure that the mark on the camshaft sprocket represents TDC for the number one (1) piston and not for the number four (4) piston. This number one (1) piston is at the flywheel/drive plate end of the cylinder block.

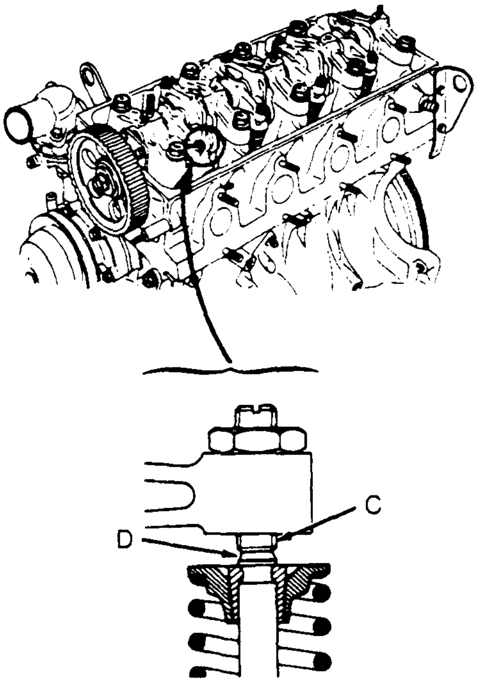
Rotate the crankshaft clockwise (viewed from the front of the engine) until the first mark (B) on the back side of the camshaft sprocket is aligned with the index in the timing belt cover rear window.



ROCKER ARM CLEARANCE ADJUSTMENT (FIRST PROCEDURE)

CAUTION

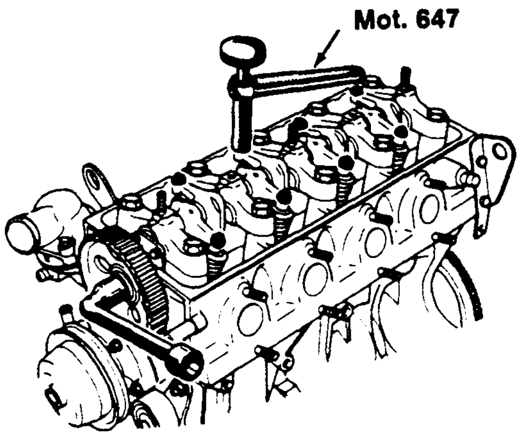
When tightening each adjustment screw (C), ensure that the bottom of the screw is aligned with the valve stem (D). If the adjustment screw is not aligned with the stem when tightened, it can cause the stem to bend.



Rocker Arm Clearances (Engine Cold)

Intake	0.10-0.15 mm (0.004-0.006 in)
Exhaust	0.20-0.25 mm (0.008-0.010 in)

- Use Tool Mot. 647 to perform the adjustments.



- Rotate the crankshaft clockwise until the second mark on the back side of the camshaft sprocket is aligned with the index in the rear window.
- Refer to the Rocker Arm Clearance Adjustment Sequence chart on page B5-3. Continue until all rocker arm clearances have been adjusted.

ROCKER ARM CLEARANCE ADJUSTMENT
(FIRST PROCEDURE)

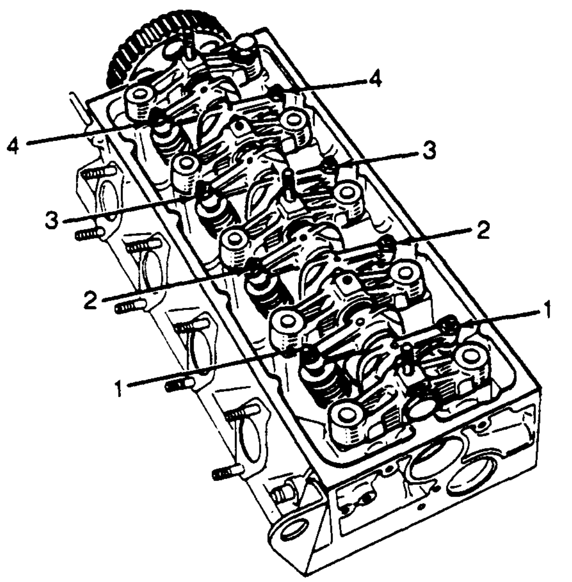
ROCKER ARM CLEARANCE ADJUSTMENT SEQUENCE

Mark on Sprocket	Intake	Exhaust
1	2	4
2	1	2
3	3	1
4	4	3

Valve Timing With Theoretical* Rocker Arm Clearance of 0.35 mm (0.014 in)

Intake Valve Opens B.T.D.C.	Intake Valve Closes A.B.D.C.	Exhaust Valve Opens B.B.D.C.	Exhaust Valve Closes A.T.D.C.
12°	52°	52°	12°

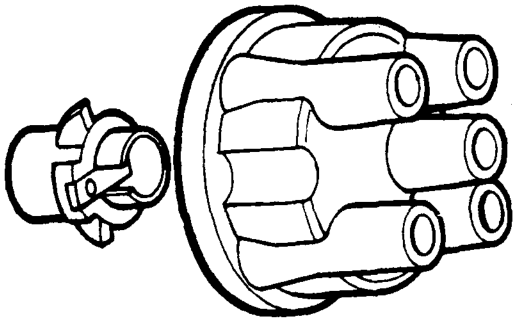
*Theoretical clearance is a reference for valve timing check only and does not indicate normal running clearances.



Valve Adjustment
Sequence

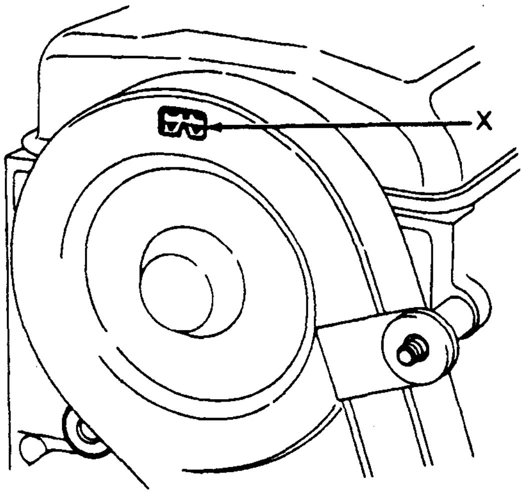
ROCKER ARM CLEARANCE ADJUSTMENT (SECOND PROCEDURE)

- Install the ignition distributor at the rear of the cylinder head.
- Remove the distributor cap and rotor.

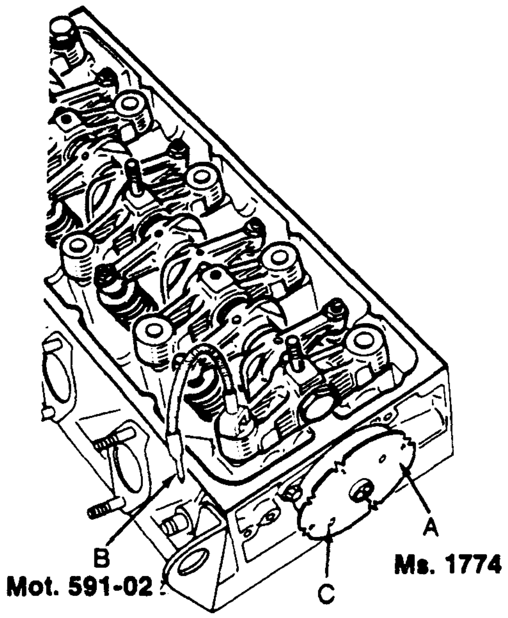


- Rotate the crankshaft clockwise (viewed from the front of the engine) and align the number one (1) piston TDC mark on the camshaft sprocket with the index (X) in the timing belt cover window.

NOTE: Ensure that the mark on the camshaft sprocket represents TDC for the number one (1) piston and not for the number four (4) piston. The number one (1) piston is at the flywheel/drive plate end of the cylinder block.

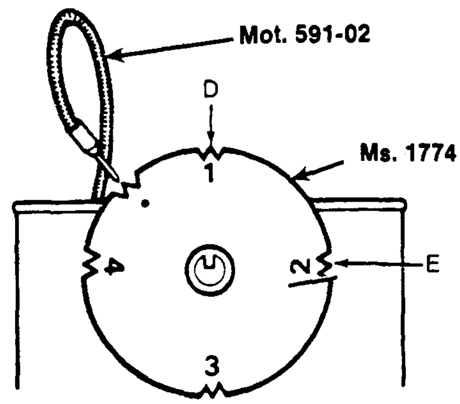


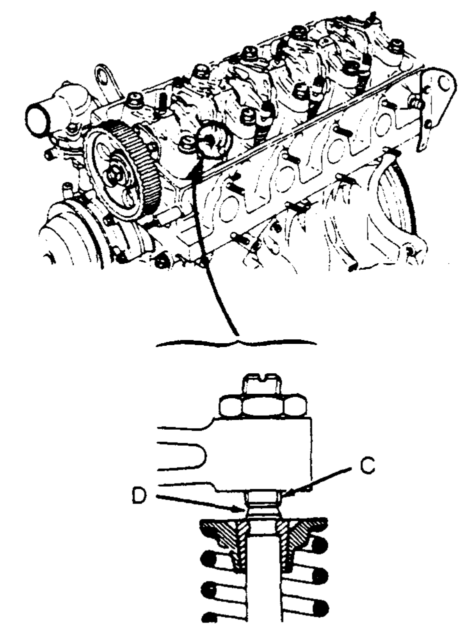
- Position Alignment Rotor Ms. 1774 (A) on the distributor shaft.
- Position Flexible Pointer Mot. 591-02 (B) on cylinder head bolt number 10 (tightening sequence number)
- Align the pointer with the TDC index (C) on the alignment rotor.



ROCKER ARM CLEARANCE ADJUSTMENT (SECOND PROCEDURE)

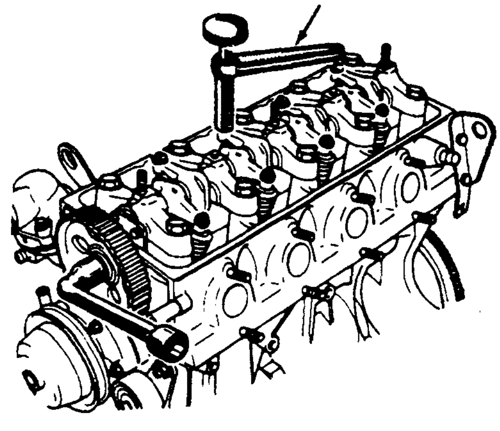
- Rotate the crankshaft clockwise (viewed from the front of the engine) two complete turns to ensure that the flexible pointer and the alignment rotor are aligned when the number one (1) piston is at TDC.
- Rotate the crankshaft clockwise slowly until the number one (1) index (D) on the alignment rotor is aligned with the flexible pointer.





CAUTION
When tightening each adjustment screw (C), ensure that the bottom of the screw is aligned with the valve stem (D). If the adjustment screw is not aligned with the stem when tightened, it can cause the stem to bend.

- Use Tool MOT 647 to perform adjustments.



ROCKER ARM CLEARANCE ADJUSTMENT (SECOND PROCEDURE)

- Adjust intake valve number two (2) and exhaust valve number four (4) with Adjustment Tool Mot. 647 to obtain the specified clearances. Refer to the Rocker Arm Clearances chart.
- Rotate the crankshaft slowly until the number two (2) index (E) on the alignment rotor (A) is aligned with the flexible pointer (B).
- Refer to the Rocker Arm Clearance Adjustment Sequence chart and continue until all the rocker arm clearances have been adjusted.

Intake	0.10-0.15 mm (0.004-0.006 in)
Exhaust	0.20-0.25 mm (0.008-0.010 in)

ROCKER ARM CLEARANCE ADJUSTMENT SEQUENCE

Mark on Alignment Rotor	Intake	Exhaust
1	2	4
2	1	2
3	3	1
4	4	3

Valve Timing with Theoretical* Rocker Arm Clearance of 0.35 mm (0.014 in.)

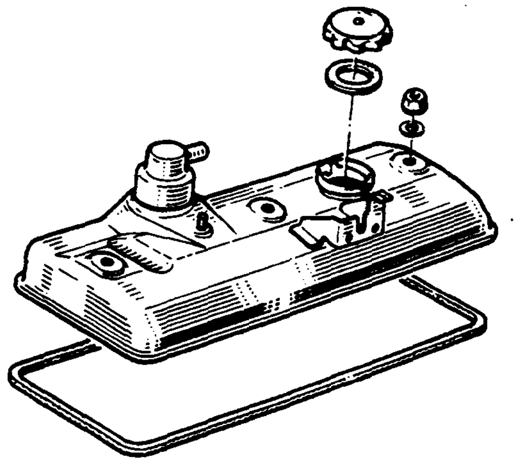
Intake Valve Opens B.T.D.C.	Intake Valve Closes A.B.D.C.	Exhaust Valve Opens B.B.D.C.	Exhaust Valve Closes A.T.D.C
12°	52°	52°	12°

*Theoretical clearance is a reference for valve timing check only and does not indicate normal running clearances.

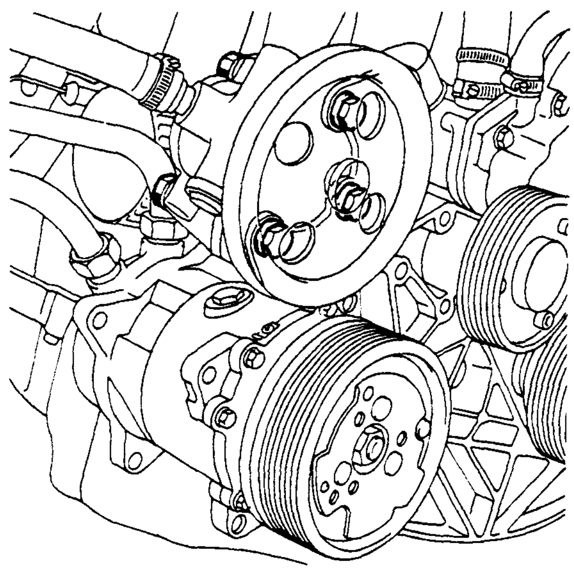
- Remove the flexible pointer from the cylinder head and the alignment rotor from the distributor.

FINAL ASSEMBLY

INSTALL OR CONNECT

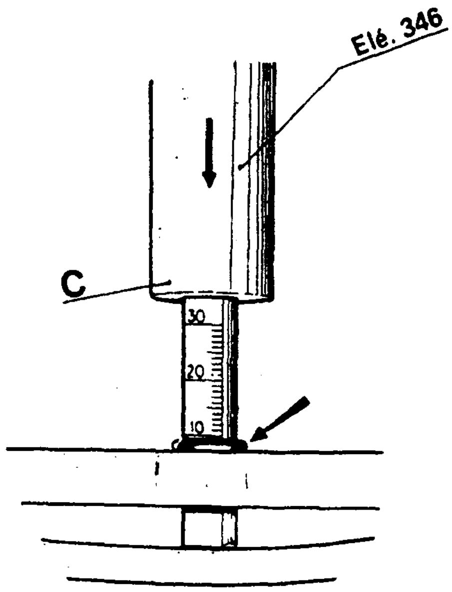


- Distributor assembly.
- Valve cover. Tighten nuts to 0.4-0.6 daNm (3.0-4.5 lb./ft.)
- Intake and exhaust manifolds.
- All accessory equipment.
- All drive belts (See Belt Tensioning, pages B7-1 & B7-2)



BELT TENSIONING PROCEDURE

The tensioner must be slack when installing a belt to avoid damaging the belt when forcing it over the pulley.



Belt Tensioning Tool - Ele. 346-02

Checking Method

- Make sure the underside of the rubber ring is aligned with the zero mark on the plunger.
- Lay the bar along the belt with the plunger centered between the pulleys.
- Press the top of the tool until the sliding pin (C) on the side just touches the top of the plunger slot.
- Remove the tool to read the amount of belt play at the underside of the rubber ring.

Timing Belt

See B4-4 - Timing Belt Installation

Deflection: 5.5-7.0 mm

Serpentine Drive Belt:

- Measure the deflection at (F)

  new - 1.5 mm/800-890 N (180-200 lbs.)

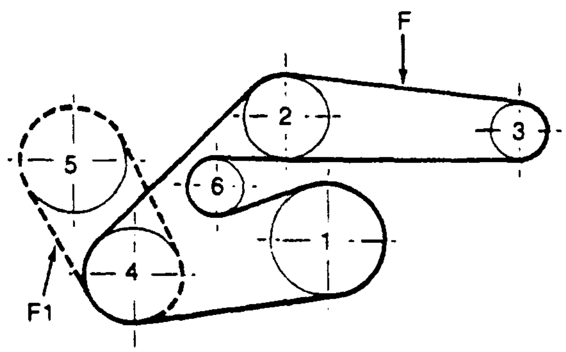
  existing - 2.5 mm/623-712 N (140-160 lbs.)

Power Steering Belt:

- Measure the deflection at (F1)

  new - 3.5 mm/556-689 N (125-155 lbs.)

  existing - 5.3 mm/400-512 N (90-115 lbs.)

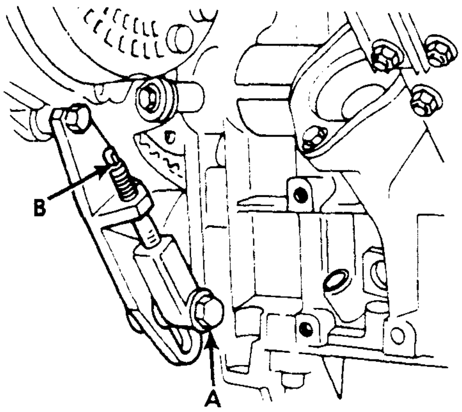


1. Crankshaft
2. Water Pump
3. Alternator
4. A/C Compressor
5. Power Steering Pump
6. Idler Pulley

BELT TENSIONING PROCEDURE

- Loosen bolt A and adjust serpentine belt tension by turning shaft B.

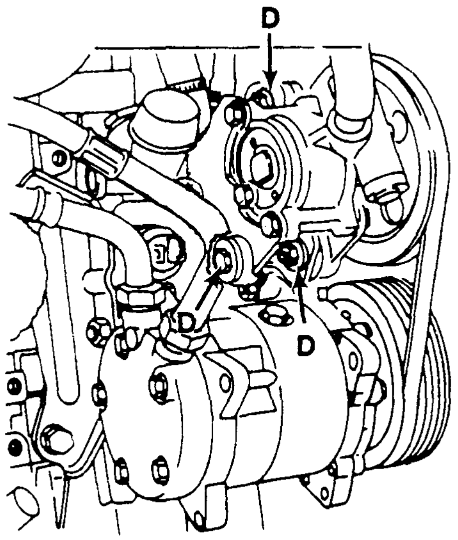
- When tension is correct, tighten bolt A.



Alternator/Serpentine Belt Adjuster

- Loosen power steering pump mounting bolts (D). Pivot the pump to adjust the belt tension.

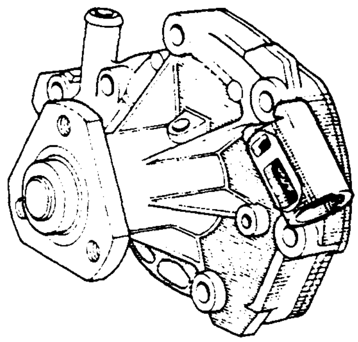
- Retighten pump mounting bolts.



Mounting Bracket Bolts (D)

ENGINE WATER PUMP
REMOVE AND REPLACE

IMPORTANT
The water pump cannot be repaired. Change the component if any part is worn.

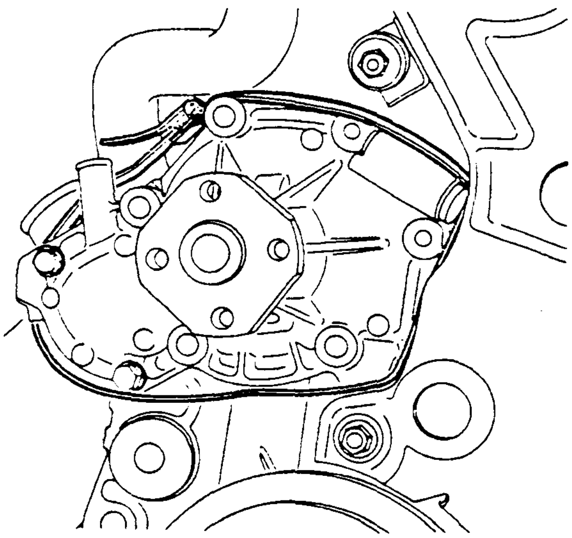


REMOVAL
The timing belt tensioner need not be removed:

- Using a long hose clamps as shown, hold the timing belt tensioner plunger in position and prevent spring from flying out.

- Remove the water pump.

Changing the gasket between the water pump and plate.



- Hold the water pump body in a vise and loosen the plate.

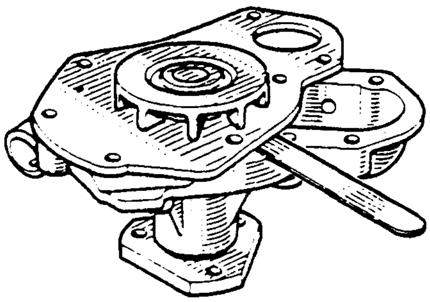
- Clean the joint faces by moving the plate around the pump shaft out of the way.

- Select the gasket which fits between the water pump and cylinder block. Make the cut-outs shown in the illustration below to allow the gasket to slip between the water pump body and the plate.

NOTE: Special points concerning refitting:

- Clean all joint faces before fitting new dry gaskets.

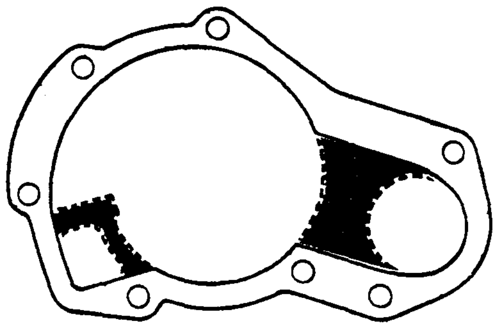
- Hold the timing belt tensioner plunger in position as before when refitting the pump.



INSTALLATION

- Mount the water pump to the cylinder block followed by the coolant hoes to the pump.

- Fill and bleed the cooling circuit - (See Section E - Cooling System)

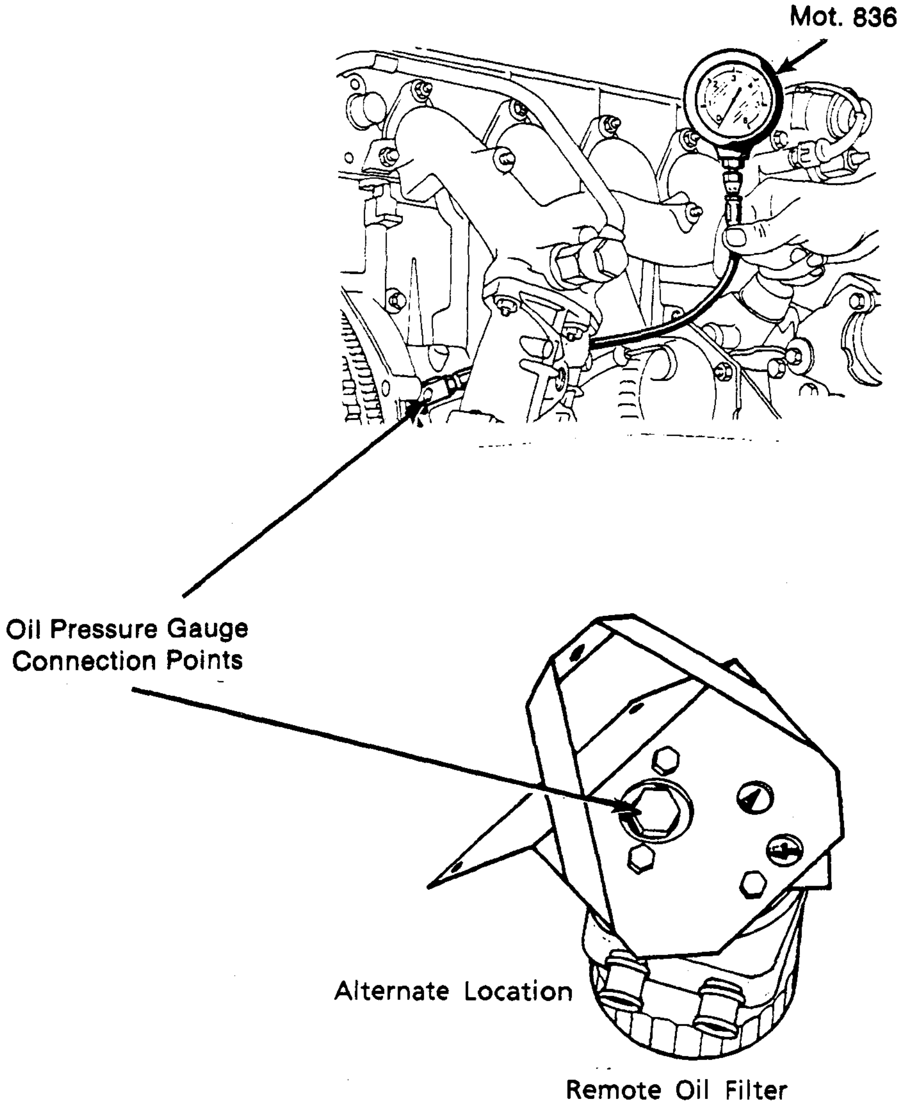


OIL PRESSURE CHECKING PROCEDURE

Check the oil pressure when the oil temperature reaches 80°C (176°F).

Run the engine and observe oil pressure:

at idle	0.8 bar (11 1/2 psi) minimum
at 3,000 rpm	3.0 bars (44 psi) minimum



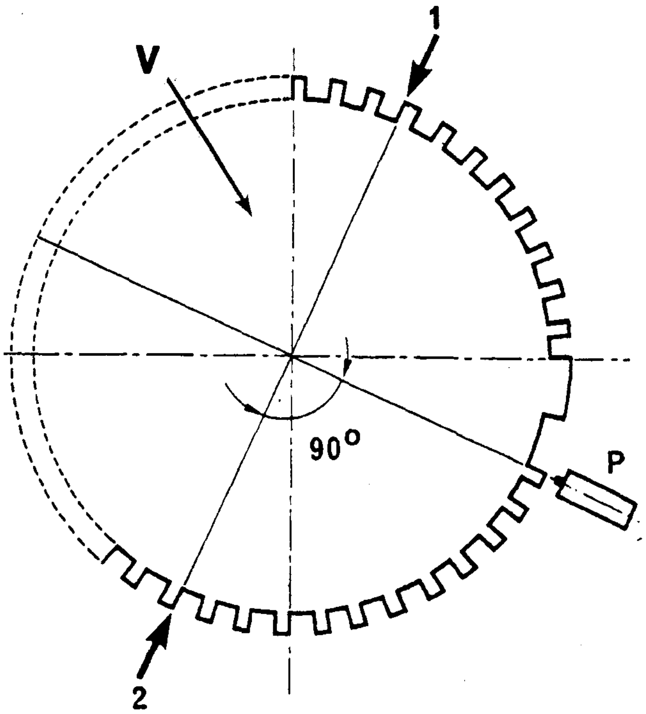
IGNITION SYSTEM
OPERATING PRINCIPLES

The ignition module is fed by two sources of information:

a. The magnetic position sensor (P).
b. The vacuum sensor (C).

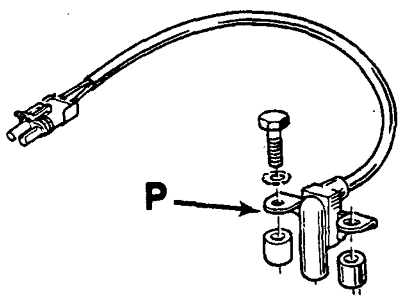
According to the information received from both sensors, the module sets the ignition advance ratio and regulates primary voltage which is then transformed into high voltage current through the coil.

The distributor cap sends this high tension current to the four spark plugs, in the correct firing order.



FLYWHEEL (V)
There are 44 evenly spaced tooth positions around the fly wheel circumference. Two teeth have been eliminated for each half-revolution in order to obtain a timing mark located at an absolute 90° angle from top and bottom dead center positions. (There are actually only 40 teeth on the flywheel.)

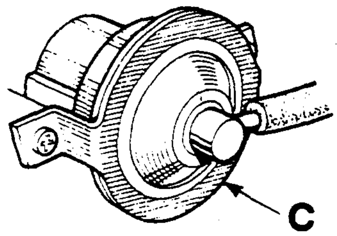
MAGNETIC POSITION SENSOR (P)



(T.D.C. Sensor)
It indicates:
- the position of the top dead center (T.D.C.) (1) and the position of the bottom dead center (B.D.C.) (2),
- the engine RPM.

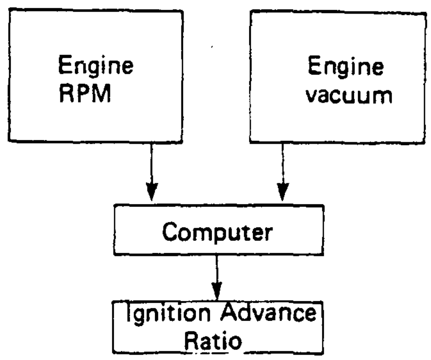
This sensor cannot be adjusted - it is preset on its support bracket.

It must be mounted on the clutch bell-housing with cap bolts.



VACUUM SENSOR (C)
Although this sensor appears to be identical to the vacuum diaphragm found in a conventional ignition system, its internal design is quite different.

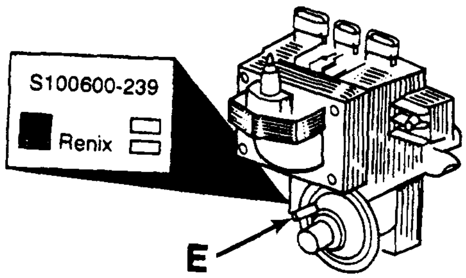
Do not remove this sensor. It is permanently connected to the ignition module by a small gauge wire which will break if any attempt is made to remove the sensor unit.



IGNITION MODULE (E)
The ignition module is an electronic device (microprocessor) that calculates the ignition timing advance ratio according to engine RPM and engine vacuum.

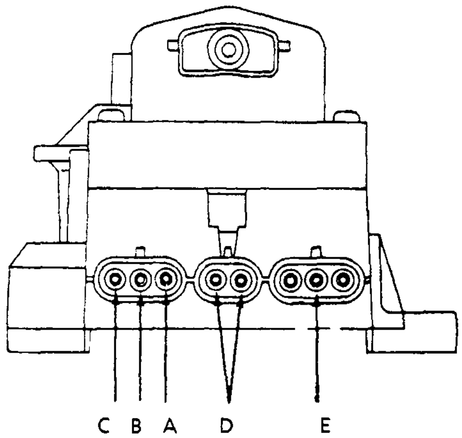
IGNITION SYSTEM
OPERATING PRINCIPLES

The ignition module identification label is affixed to the lower side as shown.



CONNECTOR IDENTIFICATION

C - Tachometer
A - Positive Lead (+)
B - Ground (-)
D - TDC Sensor
E - Center Terminal hooks to ground for timing modification of -2°



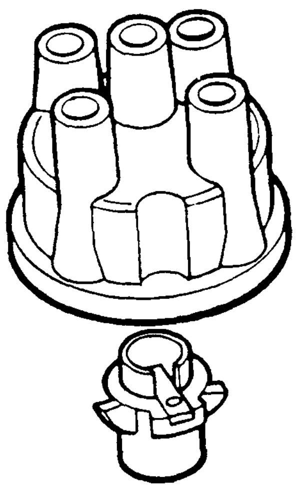
IGNITION TIMING

Ignition timing adjustment is not possible and should not be attempted.

The timing advance range is programmed into the ignition module, which responds to vacuum signal (indicating engine load) and TDC sensor signal (indicating engine flywheel position and rpm). Timing is then adjusted automatically to correspond with those conditions. (Refer back to IGNITION MODULE.)

If timing is incorrect, check:

- vacuum lines
- TDC sensor
- ignition module

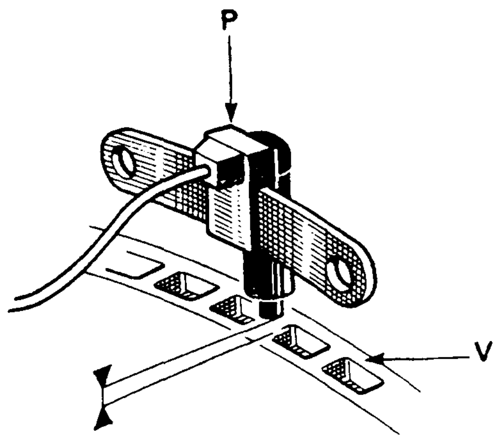


DISTRIBUTOR (M)

The distributor cap and rotor arm feed high voltage to each spark plug according to their firing order.

IGNITION SYSTEM
DIAGNOSTICS

MAGNETIC POSITION SENSOR (P)
(T.D.C. Sensor)



For correct operation the sensor must be at a distance (A) of between 0.5 and 1 mm (0.020 and 0.039 in) from the flywheel.

The sensor can be tested using an ohm meter connected between the wire connector pins.

The engine may be equipped with either a Siemens or a Renix sensor. These sensors have different resistance values as shown below.

Renix:	100-200 ohms (150 ohms ± 50)
Siemens:	170-270 ohms (220 ohms ± 50) @ 68° F. (20° C)

IMPORTANT
Absolutely no interference between the flywheel and the magnetic position (TDC) sensor can be tolerated. A warped, bent, or damaged flywheel can cause an interruption in the signal sent to the ignition module, resulting in either complete or intermittent ignition loss. An ignition analyzer oscilliscope is extremely useful in diagnosing ignition poblems. Do not rule out the possibility of bad spark plugs, plug wires, distributor cap and rotor in the case of an ignition interruption. Eliminate these possibilities before condemning the ignition module.

WARNING

Do not short out the high tension lead (coil wire) on the ignition module body. This can cause permanent damage to internal cicuitry of the module.

SPECIFICATIONS:

Firing Order: 1-3-4-2
Spark plug gap :.022 in - .026 in
Plug type - Champion RS9YC or AC CR42LTS

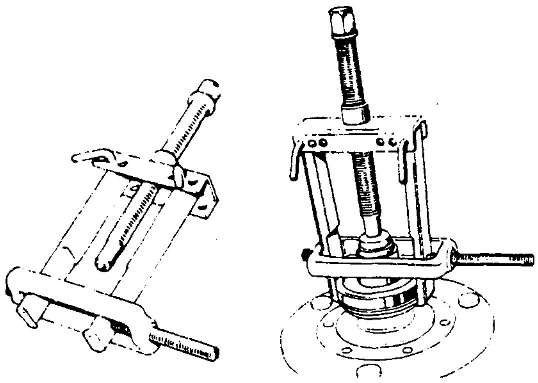
SECTION "C"

FUEL SYSTEM

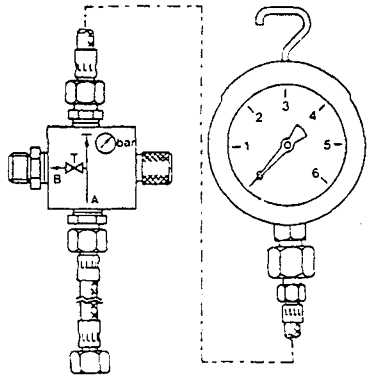
Subsection 7 - Emission Control

Subsection 8 - Fuel Tank

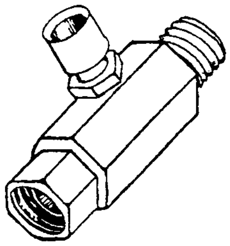
ENGINE FUEL SYSTEM
SPECIAL SERVICE TOOLS



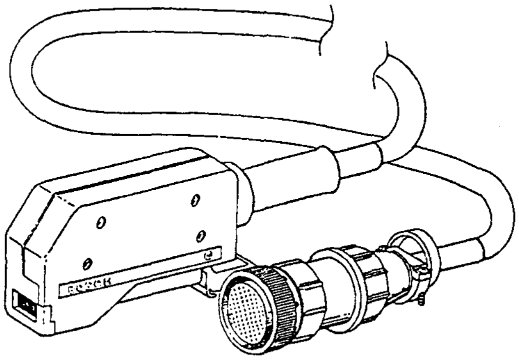
B.VI. 28-01
Crankshaft sprocket removal tool
Order Tool No. 700012-27-301 EA



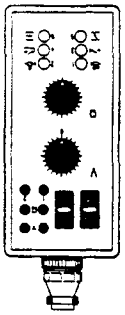
Fuel Pressure Gauge
Order Tool No. 700000-01-000 EA



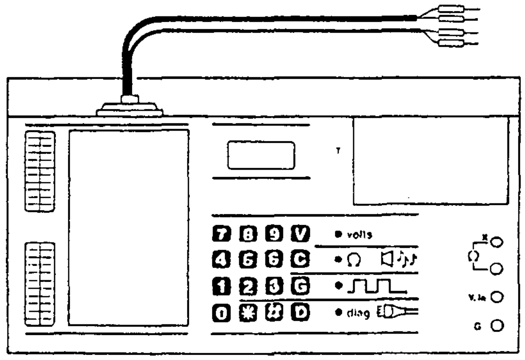
3-Way Adapter (for fuel gauge)
Order Tool No. 700000-02-700 EA



Bosch Test Harness
Order Tool No. 700000-03-000 EA



Bosch Injection Tester
Order Tool No. 700000-04-000 EA



XR25 Tester
Order Tool No. 700000-00-846 EA

ENGINE FUEL SYSTEM
GENERAL

SYSTEM DESCRIPTION

The fuel system consists of:

A. A multi-point fuel injection system with oxygen (O_2) sensor feedback for fuel and emission control

B. Four emission control systems:

1. the fuel vapor recovery system
2. the positive crankcase ventilation (PCV) system
3. the exhaust gas recirculation (EGR) system
4. the catalytic converter system

DIAGNOSIS

The fuel injection system can be tested with Electronic Diagnostic Tester. The system is equipped with diagnostic connectors for this purpose.

SYSTEM OPERATION

The electric fuel pump delivers fuel from the fuel tank, through a filter, to the injector ramp assembly.

The pressure regulator, connected to the fuel tank return hose, maintains a pressure of 2.5-3 bars/36-43 psi in the injector ramp assembly.

The regulator is connected to the intake manifold for pressure compensation based on the intake manifold vacuum.

The injectors are controlled by the electronic control unit (ECU).

They inject fuel twice per engine cycle, which allows the use of a conventional ignition distributor, with no extra contacts for timing the injected fuel.

The electrical input to the fuel pump is controlled by the control relay.

The electronic control unit (ECU) controls the injector time interval and changes it according to input from:

- the airflow meter, which continuously measures the volume and density of the air admitted into the engine by a potentiometer (located on the end of the flap shaft) and a temperature sensor
- the ignition coil, where the primary winding tach voltage is used to determine the engine speed.
- the coolant temperature sensor (located on the thermostat housing) for fuel mixture enrichment while the engine is cold
- The throttle position switch (TPS) located on the throttle plate shaft, which is used to indicate the idle and wide-open-throttle (WOT) positions.

There are two modes of operation for the feedback system:

- open loop
- closed loop

Basically, the system will be in the open loop mode of operation whenever the engine operating conditions do not conform to the programmed criteria for closed loop operation.

During open loop operation the air/fuel mixture is maintained at a programmed ratio that is dependent on the type of engine operation involved.

The oxygen (O_2) sensor data is ignored by the electronic control unit (ECU) during this mode of operation.

The following conditions involve open loop operation:

- engine start-up
- the coolant temperature less than 17°C (63°F)
- the engine is at idle speed and the coolant temperature is between 17° C and 45°C (63° F and 113°F)
- the oxygen (O_2) sensor temperature is too low
- the engine is at wide open throttle (WOT)

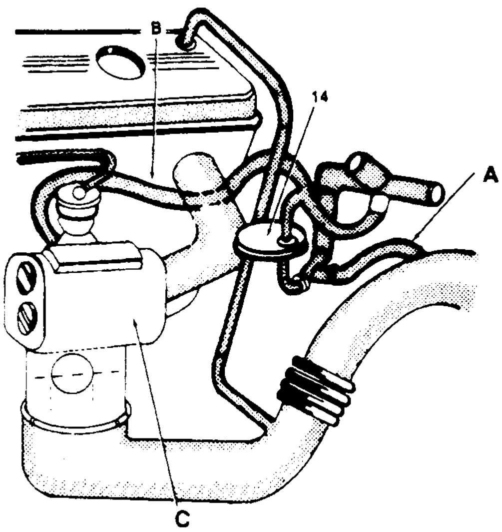
NOTE: The temperatures are nominal values.

When all input data conforms to the programmed criteria for closed loop, the oxygen content output voltage from the oxygen sensor is accepted by the electronic control unit (ECU).

This results in an air/fuel mixture that will be optimal for the engine operating conditions at the time.

Closed loop operation occurs when:

- the coolant temperature is greater than 45°C (113°F), except when the engine is at WOT
- the engine is above idle speed and the coolant temperature is between 17°C and 45°C (63°F and 113°F)



The cold start injector is controlled by the thermotime coolant switch.

When the starter motor is engaged, it provides the fuel enrichment necessary for cold starts.

The supplementary air regulator is controlled by a bimetallic spring that is heated by the ambient temperature of the engine and by an electric heater.

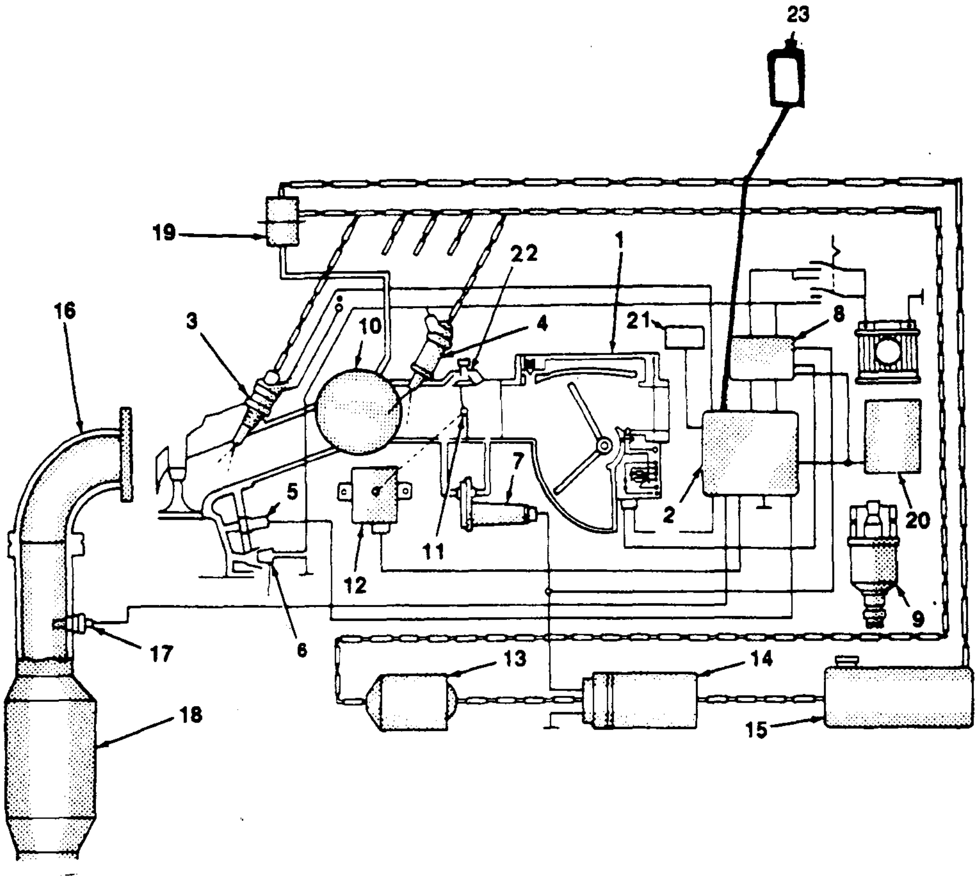
The variable amount of supplementary air required for cold engine operation is supplied by this regulator. The air bypasses the throttle plate.

The fast idle solenoid, attached to the air bypass unit near the idle speed adjustment screw, provides an additional air circuit that compensates for the decrease in idle speed that results from A/C compressor operation.

The fast idle solenoid is also operational when the starter motor is engaged.

The timer relay energized the fast idle solenoid for approximately 3 seconds after the starter motor is de-energized.

ENGINE FUEL SYSTEM
(FUEL/L-JETRONIC SYSTEM DIAGRAM)
SYSTEM COMPONENTS



1. Airflow meter (with air temperature sensor)
2. Electronic control unit (ECU)
3. Fuel injector
4. Cold start injector
5. Coolant temp. sensor
6. Coolant temp. thermo-time switch
7. Supplementary air control valve
8. Control relay
9. Ignition distributor
10. Air intake manifold chamber
11. Throttle plate
12. Throttle position switch
13. Fuel filter
14. Electric fuel pump
15. Fuel tank
16. Exhaust manifold
17. Oxygen sensor
18. Catalytic converter
19. Fuel pressure regulator
20. Ignition control module (ICM)
21. Atmospheric Pressure Sensor
22. Idle adjustment & idle solenoid
23. Tachometric relay (ATX) or Full Enrichment Time Delay System (5-Speed)

FUEL PUMP

The purpose of the fuel pump is to keep the injection system under operating pressure.

This pump is a roller type with a permanent magnet electric motor which is immersed in fuel. It has a check valve designed to keep the circuit under pressure after the engine has stopped.

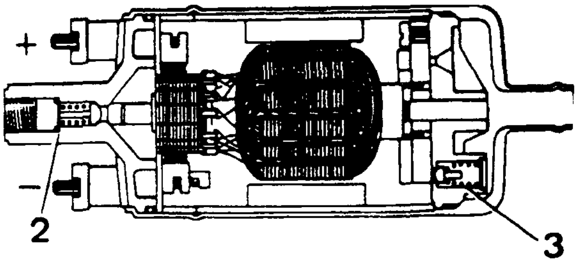
It is fed through two terminals, marked + and - to ensure that it rotates in the correct direction.

The pump is located next to the left front frame member.

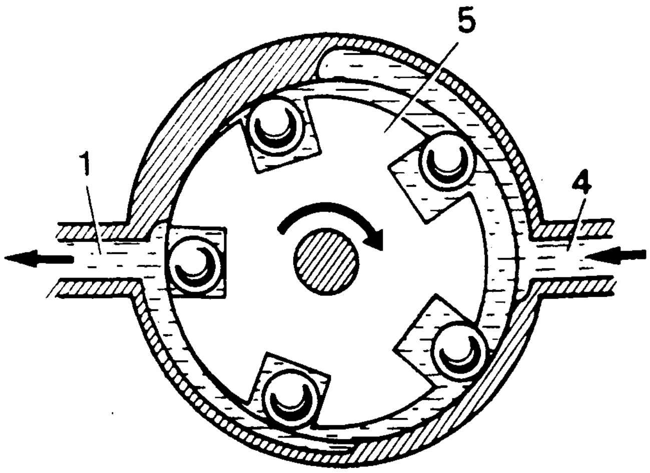
NOTE: Stopping the engine causes the pump to stop even if the ignition remains on.

J7T ENGINE - Current is routed through a control relay located near the test plugs in the engine compartment.

CAUTION
The sender pickup is equipped with a 50 micron filter screen for fuel pump protection. Removal or modification may result in pump failure.



2 - Check valve
3 - Safety valve



1 - Discharge side
4 - Suction side
5 - Multi-celled roller pump

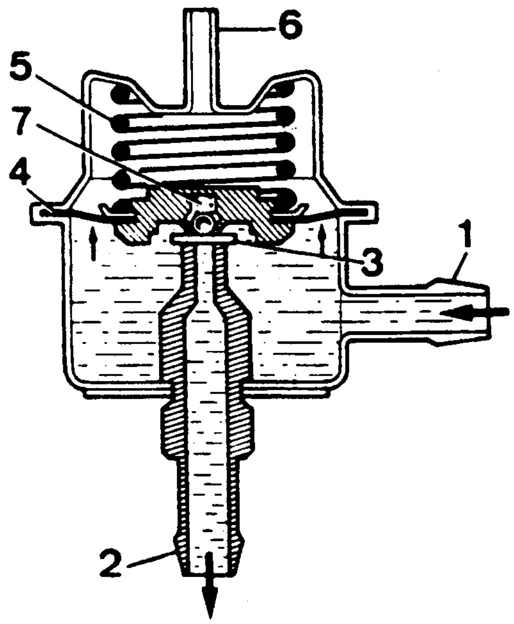
FUEL PRESSURE REGULATOR/INJECTORS

Fuel Pressure Regulator

Fuel pressure is maintained at a constant level by means of a pressure regulator. The regulator consists of a metal casing inside of which a spring-loaded diaphragm opens a discharge line whenever the pressure in the circuit exceeds the regulated pressure.

The spring chamber is connected by a tube to the intake manifold.

The difference between the manifold pressure and the fuel pressure is thereby kept constant, so that the pressure drop at the injectors is the same under all load conditions.



1 - Fuel line
2 - Fuel tank return line
3 - Valve carrier
4 - Diaphragm
5 - Spring
6 - Intake manifold connector
7 - Valve

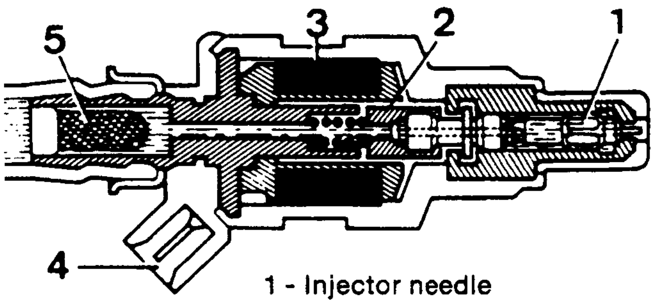
Fuel Injectors

The electronmagnetically controlled injector consists, basically, of a valve body and injector needle with a magnetic core. The moveable magnetic core is part of the needle, and the needle is compressed by a helical spring against the injector body seat. At the rear, the injector body has a magnetic winding; in front, it has a guide for the injector needle.

Signals from the control unit create a magnetic field in the winding; the core is attracted and the injector needle is pulled away from its seat. The passage for the fuel under pressure is now open. Core travel is about 0.15 mm (about 0.006 in.). Opening time is determined by the control unit depending on engine operating conditions at the time.

Each cylinder has one injector located in the intake tube, which atomizes the fuel ahead of the intake valve.

This method of injection has the advantage of not only requiring low injection pressure but also of allowing group injection, which simplifies the technical construction of the system.

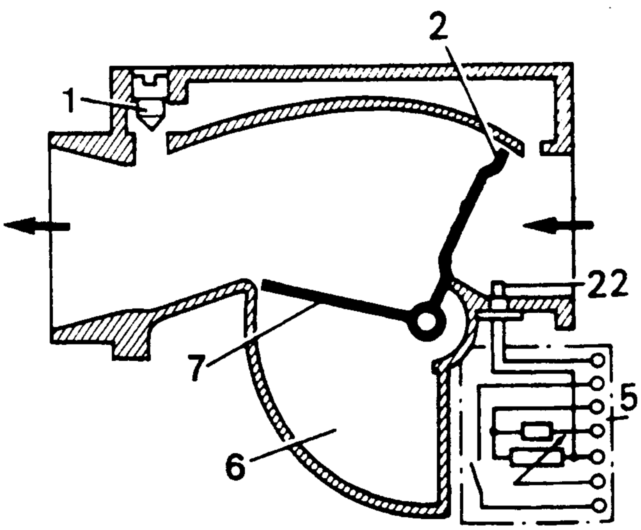


1 - Injector needle
2 - Magnetic core
3 - Magnetic winding
4 - Electrical connection
5 - Filter

ENGINE FUEL SYSTEM
AIRFLOW METER, THROTTLE PLATE & THROTTLE POSITION

In the L-Jetronic system, all injectors are controlled as one single group.

This method has the advantage of simplifying the system considerably. However, in order to ensure even fuel distribution, two injections occur for each rotation of the camshaft. Each injection contains half the amount of fuel required for one complete engine cycle.



1 - Integrator voltage adjustment screw
2 - Sensor flap
5 - Electrical connections
6 - Damping chamber
7 - Compensation flap
22 - Air temperature sensor

AIR FLOW METER

The function of the airflow meter is to supply a voltage signal that varies with the amount of air drawn in by the engine.

This air pushes against a movable sensor flap.

In response to the incoming airflow and the opposing action of a spring, the flap is moved into an angled position that is transmitted to a potentiometer.

A compensation flap is attached to the sensor flap. It has the same active surface area as the sensor flap, so it compensates for pulsations resulting from any possible back pressures. This keeps back pressure from affecting airflow measurement.

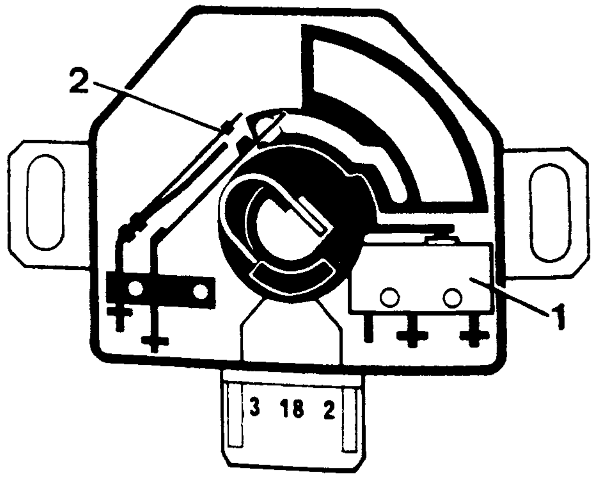
The sensor flap has a rubber damper to protect the sensor from any damage during back pressure peaks.

An air temperature sensor (22) is located in the air flow.

THROTTLE PLATE AND THROTTLE POSITION SWITCH

In order to control the amount of air admitted to the engine, a double throttle plate assembly with delayed throttle plate opening is located after the airflow meter.

A switch is attached to the throttle plate shaft with one contact for idling and one contact for full throttle. The control contact closes the idling contact or the full throttle contact for a given air throttle plate position. The control unit analyzes the output signals to calculate the length of injection time.

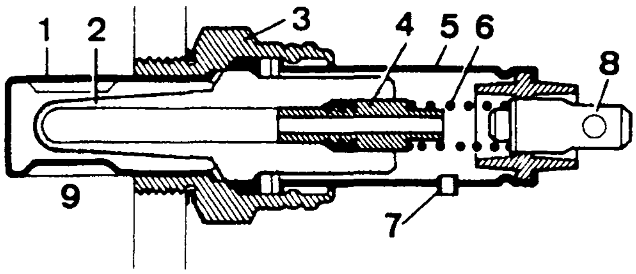


1 - Idling contact
2 - Full throttle contact

ENGINE FUEL SYSTEM
OXYGEN SENSOR & COLD START INJECTOR

OXYGEN SENSOR

The construction of the oxygen sensor is shown in the figure at right. The ceramic detector is housed in a threaded metal base that allows it to be screwed into the exhaust and also protects it from mechanical damage. The outer surface of the ceramic body (2) is located in the exhaust gas flow, while the inner surface is in contact with the outside air by way of an air passage (7).



OXYGEN SENSOR

Oxygen sensor cross section:

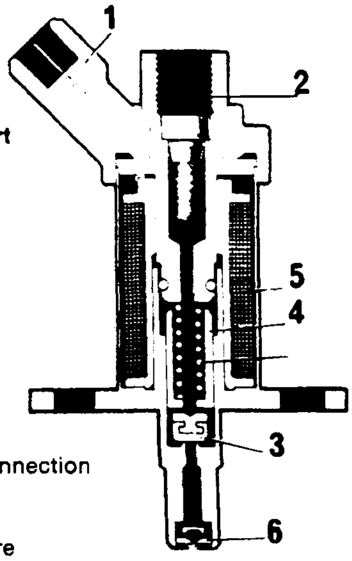
1 - Protective sleeve
2 - Ceramic sensor
3 - Base
4 - Contact cover
5 - Protective cover
6 - Contact spring
7 - Air opening
8 - Electrical connection
9 - Exhaust gas

The ceramic material acts as a conductor for oxygen ions above a temperature of about 300°C (572°F). If the oxygen content is different on the two sides of the sensor, a voltage develops across the contact surfaces. This voltage allows measurement of the difference in oxygen content on both sides of the sensor.

CAUTION
Use of leaded fuel will result in oxygen sensor damage.

COLD START INJECTOR

Located near the air throttle plate, the cold start injector is designed to enrich the air mixture by finely atomizing the fuel in the intake manifold. It is operative when the starter is activated and the thermo-time coolant switch has closed the electrical circuit.



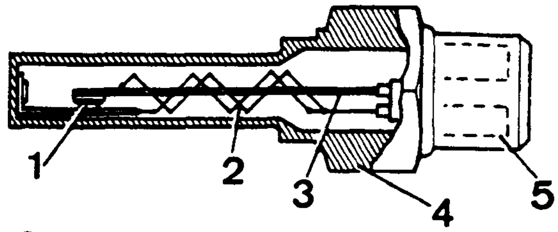
1. Electrical Connection
2. Fuel Inlet
3. Seal
4. Solenoid Core
5. Solenoid Coil
6. Rotary Nozzle

ENGINE FUEL SYSTEM
THERMO-TIME COOLANT SWITCH & AUXILIARY AIR REGULATOR

THERMO-TIME COOLANT SWITCH

The thermo-time coolant switch is located in the left front of the head. It limits the time the cold start injector is energized. It is used for 8 seconds when starting with a coolant liquid temperature of -20°C (-4°F). The use time is zero when the coolant temperature reaches 35°C (95°F).

The time limit determined by the thermo-time switch is obtained by means of a bi-metal strip heated by an electrical resistance. This bi-metal strip breaks the circuit depending on the temperature reached after a certain heating time.



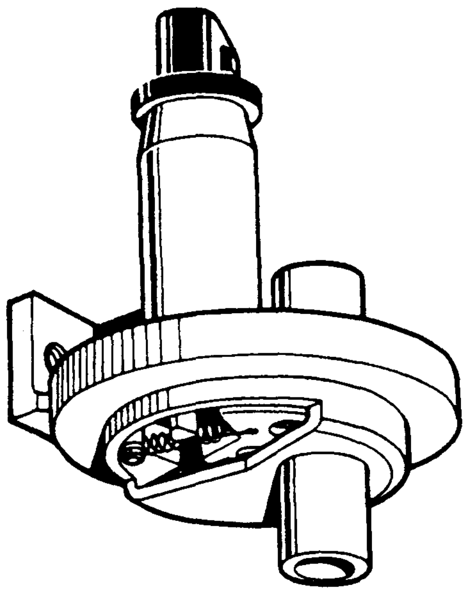
1 - Contact
2 - Heating resistances
3 - Bi-Metal Strip
4 - Housing
5 - Electrical connection

Thermo-Time Coolant Switch

AUXILIARY AIR REGULATOR

The amount of auxiliary air required when the engine is cold is supplied by a regulator that allows air to bypass the throttle plate.

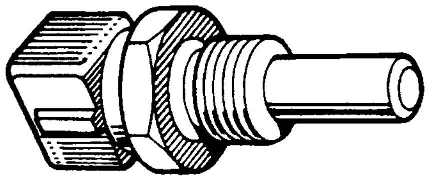
The opening section of the auxiliary air regulator is automatically controlled by the temperature of the cylinder head (to which it is attached) and by a built-in electrical heater element.



Auxiliary Air Regulator

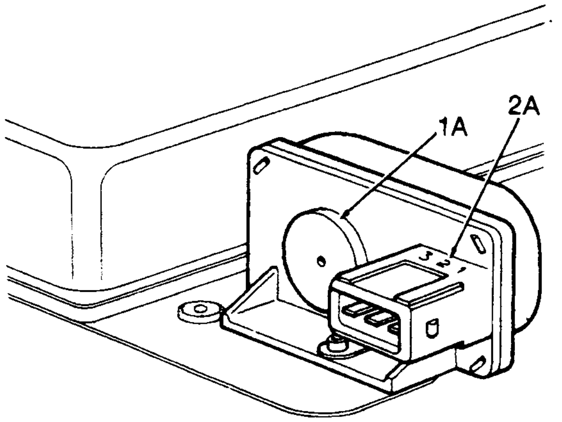
COOLANT TEMP. SENSOR - ATMOSPHERIC PRESSURE SENSOR - FAST IDLE SOLENOID AND IDLE SPEED CONTROLS

COOLANT TEMPERATUR SENSOR (CTS)



The coolant temperature sensor (threaded into the thermostat housing) provides input to the electronic control unit (ECU), which, in turn, corrects the air/fuel mixture ratio according to the engine coolant temperature.

ATMOSPHERIC PRESSURE SENSOR



The atmostpheric Pressure Sensor consists of:
- an atmospheric pressure capsule (1A)
- A potentiometer (2A)

The atmospheric pressure sensor is located beneath the front passenger seat adjacent to the electronic control unit (ECU).

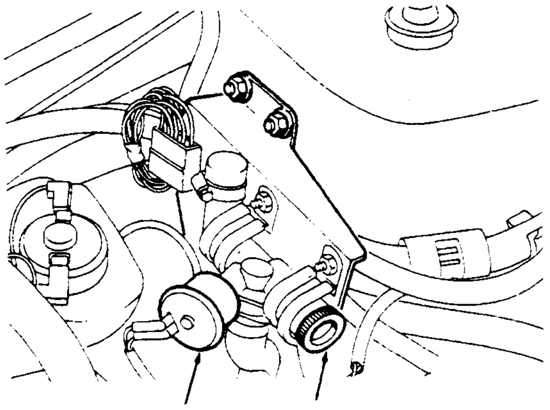
The potentiometer B + voltage is provided by the fuel injection relay.

The potentiometer wiper arm position is determined by the atmospheric pressure capsule.

The atmospheric pressure sensor provides a voltage input to the electronic control unit (ECU) that represents the current ambient atmospheric pressure.

The ECU uses the input to compensate for any altitude changes.

The voltage provided to the ECU is:
- low at sea level
- high at 1,230 meters (4,000 feet) - approximately 90% of the B + voltage.



FAST IDLE SOLENOID

The fast idle solenoid (2B) is attached to the idle bypass unit body.

Each time the engine is started, the fast idle solenoid is energized.

It is also energized when the air conditioner compressor is operating.

Two relays control the fast idle solenoid.

After engine start-up, the start-up time relay maintains the solenoid energized for approximately 3 seconds.

When the air conditioner compressor is turned ON, the A/C relay energizes the fast idle solenoid.

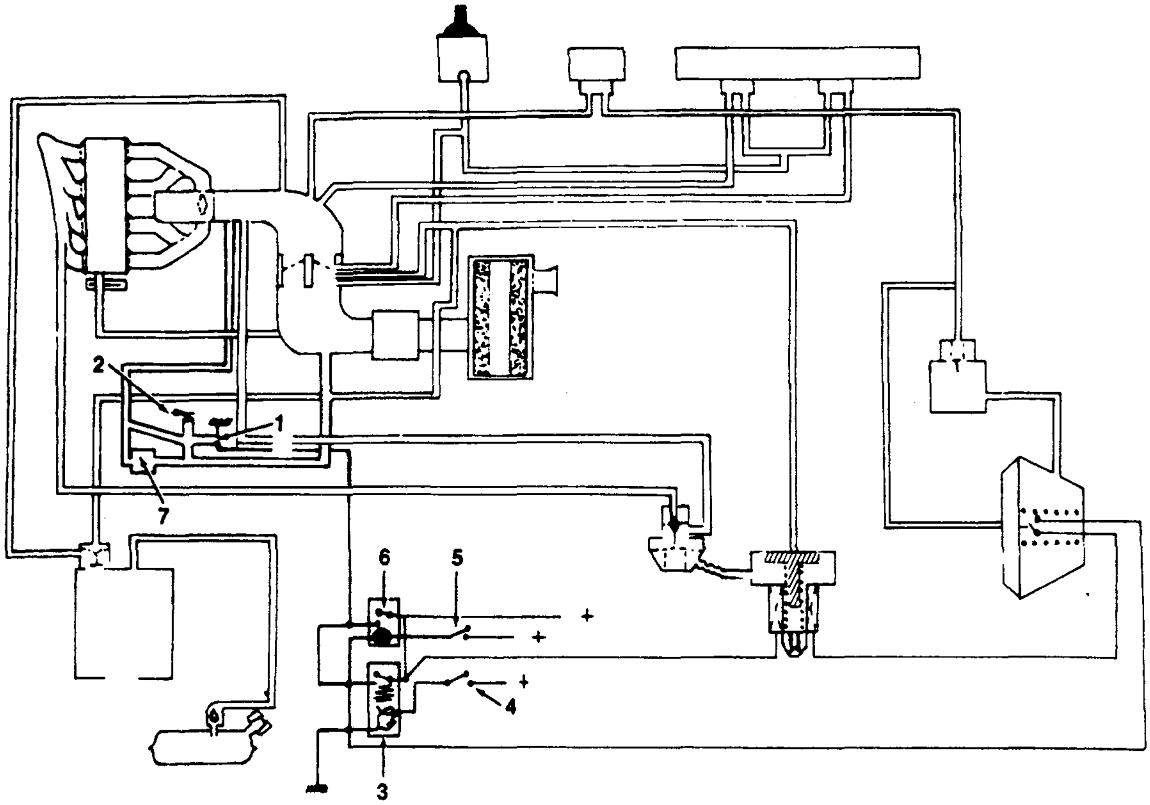
The timer relay is located near the left headlight and A/C relay behind right headlight.

IDLE SPEED CONTROLS

The engine idle speed is controlled by the position of the adjustment screw (1B) on the air bypass unit located on the firewall.

Engine idle speed (hot): vehicles equipped with an automatic transmission 700 $\pm$ 50 rpm in drive (D).

ENGINE FUEL SYSTEM
FAST IDLE DIAGRAM



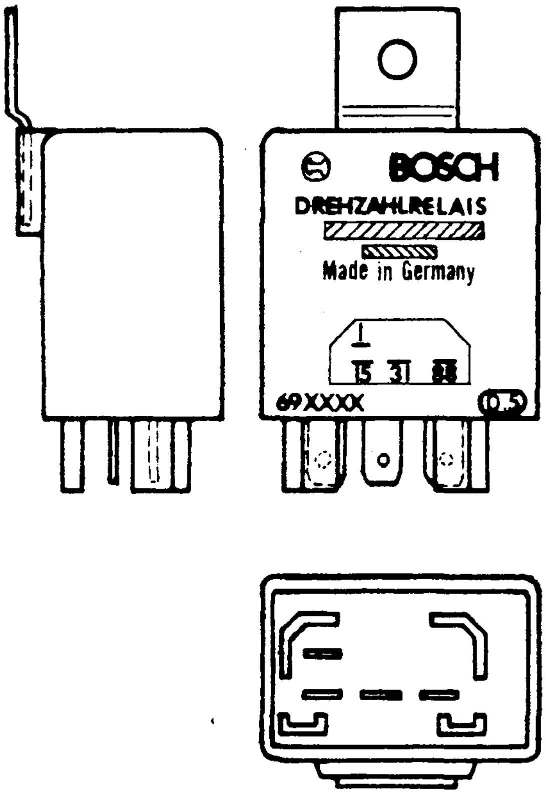
FAST IDLE DIAGRAM

1. Fast idle solenoid
2. Idle adjustment screw
3. Timer relay (located behind drivers side headlight)
4. Start/ignition switch
5. Air conditioner switch
6. A/C fast idle relay (located behind passenger side headlight)
7. Supplementary air regulator

ENGINE FUEL SYSTEM
TACHOMETRIC RELAY & FULL ENRICHMENT DELAY SYSTEM

TACHOMETRIC RELAY
(Vehicles with Automatic Transmission)
The Tachometric Relay is located under the passenger seat, near the ECU. The function of this relay is to prevent full fuel enrichment at WOT (wide open throttle) until the engine exceeds 4,100 rpm ($\pm$ 50 rpm). This provision is required for emission control purposes.

FULL ENRICHMENT TIME DELAY SYSTEM (Vehicles with 5-Speed Transmission)
The full enrichment time delay system is located under the passenger seat, near the ECU. The function of the system is to delay full fuel enrichment at WOT (wide open throttle) until about 14 seconds after the throttle position switch is moved from the idle position. This provision is required for emission control purposes.



THERMO-TIME COOLANT SWITCH TESTS

FIRST TEST PROCEDURE

WARNING

Do not loosen the coolant switch with the system hot and pressurized because serious burns from coolant can result.

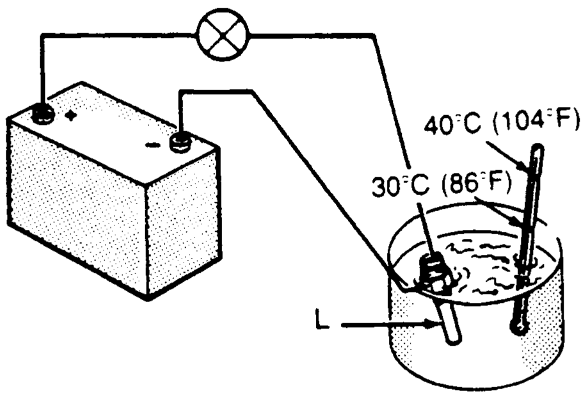
Remove the thermo-time coolant switch from the cylinder head and replace it with a plug to prevent loss of coolant.

Cool the thermo-time coolant switch by immersing it in cold water.

- connect the switch connector pin W to either of the test lamp wires
- connect the other test lamp wire to the positive (+) terminal of the battery
- connect a wire from the negative (-) terminal of the battery to the body of the thermo-time coolant switch

The lamp should light.

Place the thermo-time coolant switch (L) in a container of water and heat the water while monitoring its temperature.



The lamp should go out between 30° and 40°C (86° and 104°F).

The nominal values of the thermo-time coolant switch are marked on the six sides of the body.

For example: 35°C/8s (8 sec/35°C).

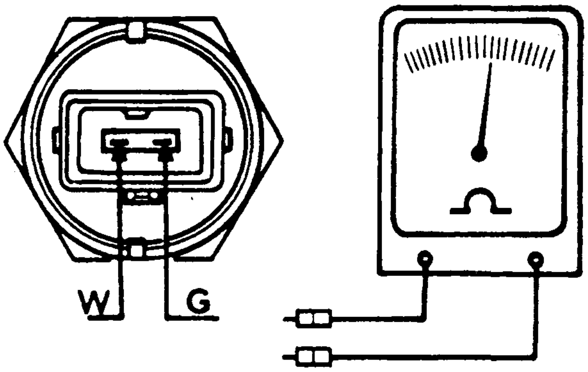
ENGINE FUEL SYSTEM
COMPONENT TESTING

THERMO-TIME COOLANT SWITCH TESTS

Second Test Procedure

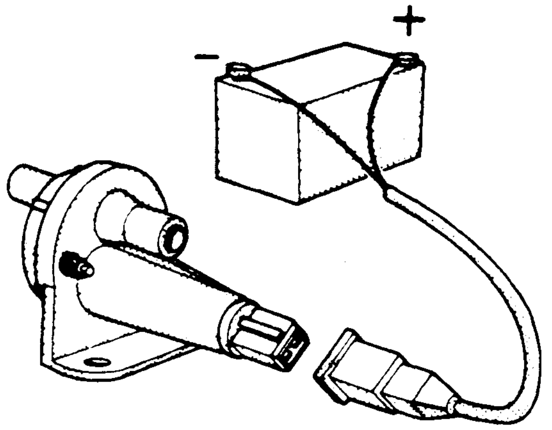
Test the resistance values between the thermo-time coolant switch wire connector pins (W and G) and ground for coolant temperatures lower than 30°C (86°F) and higher than 40°C (104°F).

Refer to the resistance chart.



	At a Coolant Temperature			Resistance Measured Between:	
TYPE	Lower Than	Higher Than	Terminal G and Ground (Housing)	Terminal W and Ground (Housing)	Terminal G and Terminal W
35°C/85 (95°F/85)	30°C (86°F)	40°C (104°F)	25-40 ohms 50-80 ohms	0 100-160 ohms	25-40 ohms 50-80 ohms

SUPPLEMENTARY AIR REGULATOR HEATER TEST



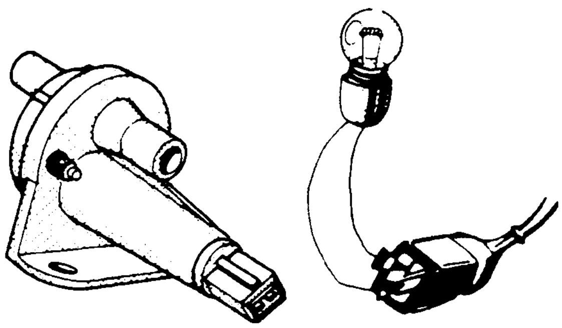
With the complete assembly at a temperature of approximately 20°C (68°F) and the wire harness connector and air hoses disconnected, visually inspect the inside of the air inlet and outlet to ensure that the diaghragm is partially open.

Use a test wire harness to connect the regulator heater directly to the battery.

After about 10 minutes, the diaphragm should be completely closed, depending on engine temperature.

If the diaphragm does not close, replace the air regulator.

SUPPLEMENTARY AIR REGULATOR WIRE HARNESS TEST



The engine should be cold.

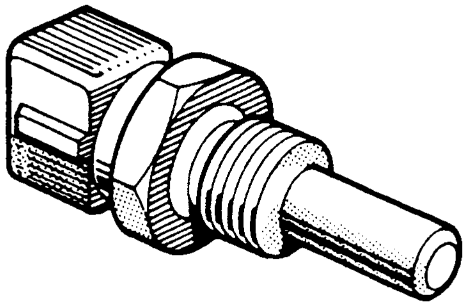
Connect a test lamp to the wire harness connector terminals.

Start the engine.

The lamp should light.

COOLANT TEMPERATURE SENSOR (CTS) TEST

(ECU Input)



WARNING

Do not loosen the temperature sensor with the system hot and pressurized because serious burns from coolant can result.

Remove the temperature sensor and replace it with a plug to prevent loss of coolant.

ELECTRICAL TEST

To simplify electrical tests, the wire harness connector terminals and pins are assigned with reference numbers.

Measure the sensor resistance in relation to temperature with an ohmmeter after a temperature stabilization time of at least 10 minutes.

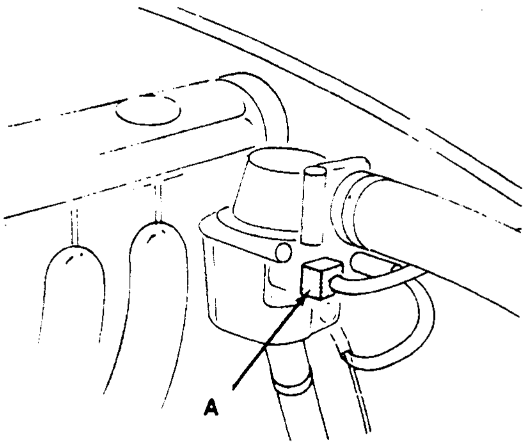
Refer to the resistance chart.

Temperature	19° - 21°C (66 - 70°F)	79° - 81°C (174° - 178°F)
Resistance	2.1k to 2.9k ohms	250 to 390 ohms

ENGINE FUEL SYSTEM
COMPONENT REPLACEMENT

COOLANT TEMPERATURE SENSOR REPLACEMENT

Disconnect the wire harness connector.



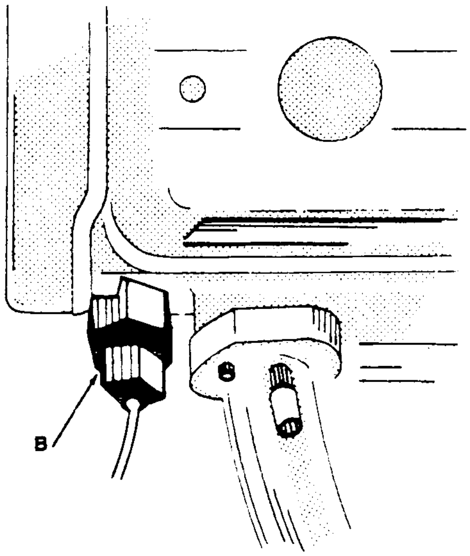
WARNING
Do not loosen the sensor with the system hot and pressurized because serious burns from coolant can result.

Remove the white sensor (A) and quickly plug the hole in the thermostat housing to prevent loss of coolant.

Install the replacement sensor and connect the wire harness connector.

THERMO-TIME COOLANT SWITCH REPLACEMENT

Disconnect the wire harness connector.



WARNING
Do not loosen the sensor with the system hot and pressurized because serious burns from coolant can result.

Remove the brown thermo-time coolant switch (B) and quickly plug the hole in the cylinder head to prevent loss of coolant.

Install the replacement switch and connect the wire harness connector.

ENGINE FUEL SYSTEM
COMPONENT REPLACEMENT

OXYGEN (O_2) SENSOR REPLACEMENT

Disconnect the wire harness connector.

Remove the oxygen (O_2) sensor from the exhaust pipe with a flare head crow foot wrench (22 mm x 3/8 in drive).

When installing the replacement sensor, apply antiseize compound to the threads.

CAUTION
Apply antiseize compound to the threads only and not to any other part of the sensor.

Hand start the replacement sensor into the adaptor.

Tighten the sensor with 3.8 - 4.6 daNm (28-34 lb./ft.) torque with a flare head crow foot wrench (22 mm x 3/8 in drive).

ELECTRONIC CONTROL UNIT (ECU) REPLACEMENT (Located under passenger seat)

Remove cover and then remove the retaining screw. Remove the ECU from the bracket. Disconnect the wire harness connector.

Connect the wire harness connector to the replacement ECU and install it in the bracket.

Tighten the screw.

CONTROL RELAY REPLACEMENT

Precautions

Never connect or disconnect a wire harness with the ignition switch on.

With the engine stopped and the ignition switch ON, the fuel pump should not be operate. Its input circuit passes through the control relay, which remains de-energized until the starter motor is engaged.

Procedure

Remove the relay from the right side of the firewall by first removing the bolt at the top of the relay. Remove the wire harness connector from the relay.

Connect the wire harness connector to the new replacement relay. Refasten the bolt on the top of the replacement relay. Refasten the bolt on the top of the relay to the firewall.

AIR INTAKE SYSTEM LEAK TEST

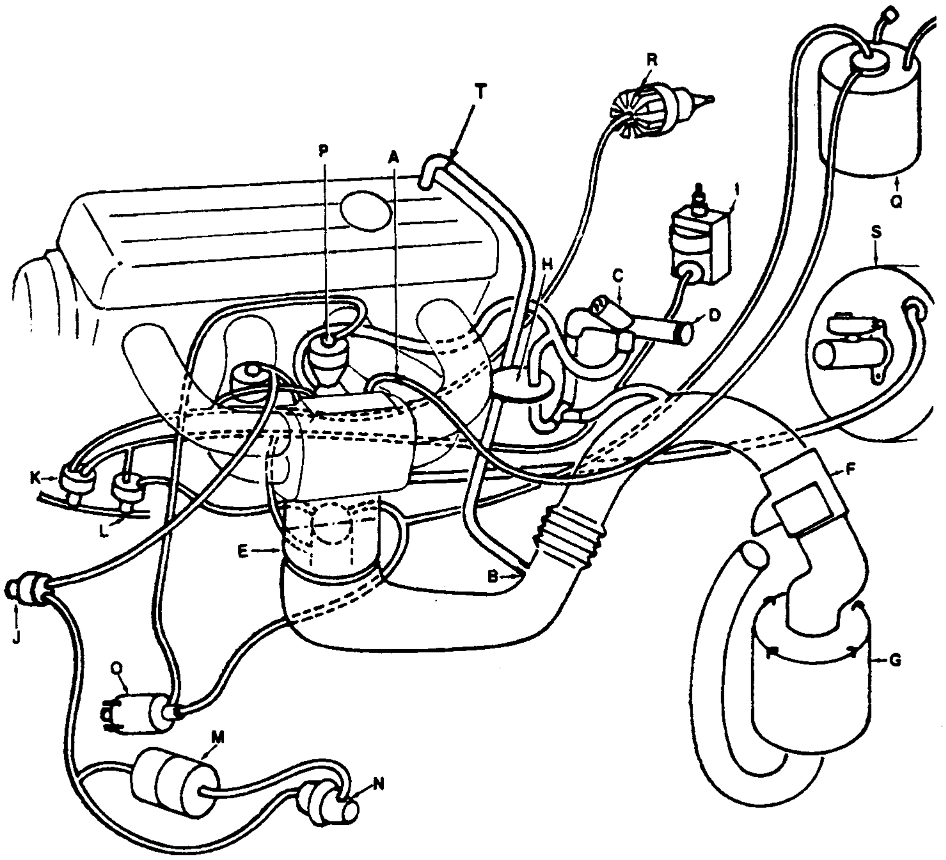
Special Precautions

Before performing any test, ensure:
- that the problem is not caused by something other than the fuel system (e.g., spark plugs, distributor, ignition timing, etc.)
- that no air is entering the intake or the exhaust system ahead of the catalytic converter.
- that fuel is actually reaching the injectors (check the pressure in the fuel circuit)

Procedure:
- Disconnect the hose from the valve cover.
- Use a brush and apply a soapy water solution to all components that are likely to develop leaks (seals, air hoses, etc.)
- Plug the exhaust pipe with a cloth or similar object.
- Force compressed air (1 bar/15 psi max.) into the air intake hose at **T**. (See illustration on following page.)
- Open the throttle plate.
  The appearance of bubbles or foam indicates location of an air leak in the system.

CAUTION
If the air temperature is likely to exceed 80°C/176°F (as in a body shop paint curing oven, for example), remove the electronic control unit (ECU) from the vehicle.

FUEL SYSTEM, VACUUM HOSES AND PCV SYSTEM



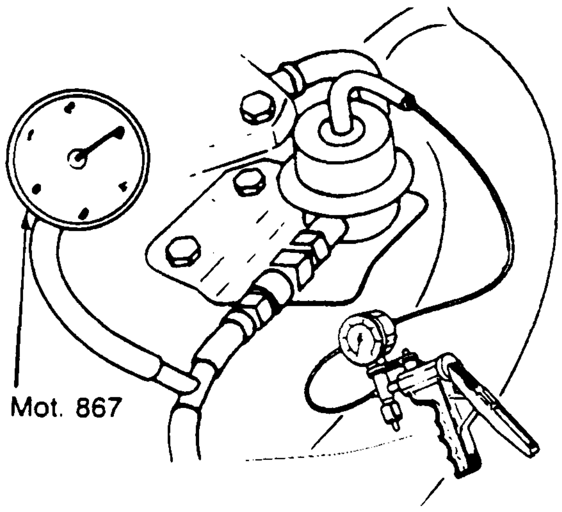
A - 1.8 mm (0.070 inch) orifice
B - 5.5 mm (0.216 inch) orifice
C - Fast idle solenoid
D - Idle screw adjustment
E - Throttle body
F - Air flow meter
G - Air filter
H - Supplementary air regulator
I - Integral electronic ignition module
J - Thermo valve (open T° above 59°F)
K - Thermo valve (open T° above 59°F)
L - Thermo valve (open T° above 113°F)
M - Vacuum reservoir
N - Differential pressure switch
O - Solenoid
P - EGR valve
Q - Canister
R - Vacuum capsule
S - Brake booster
T - PCV valve

Fuel Pressure Test

Disconnect the hose connected between the pressure regulator and the injector ramp assembly.

Connect Fuel Pressure Test Gauge Mot. 867 with a T-Fitting.

Disconnect the vacuum hose from the pressure regulator and connect a hand operated vacuum pump to the regulator.



WARNING

Use extreme caution when the engine is operating. Do not stand in a direct line with the fans. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

Start the engine.

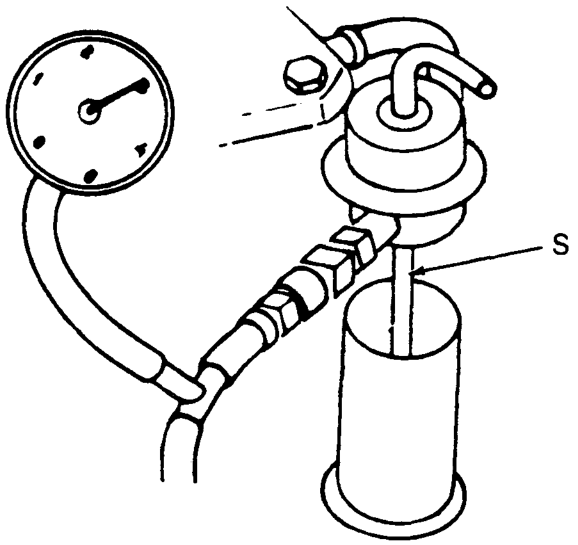
Test for a pressure of 2.8 - 3.2 bars/276 - 316 kPa/40 - 46 psi.

Apply a vacuum of 530 mbar/54 kPa/400 mm Hg/16 in Hg to the pressure regulator.

The fuel pressure should decrease approximately 0.5 bars/50 kPa/7 psi.

Fuel Pump Output Test

Disconnect the fuel tank return hose from the pressure regulator and connect a temporary hose (S) to the regulator.



Place the other end of the hose (S) in a 2000 cc, or 2000 ml (approx. 122 cu. in. or 2 U.S. qts.) graduated container.

Connect test terminals D1-5 and D1-6 (small diagnostic connector) with a jumper wire to activate the fuel pump.

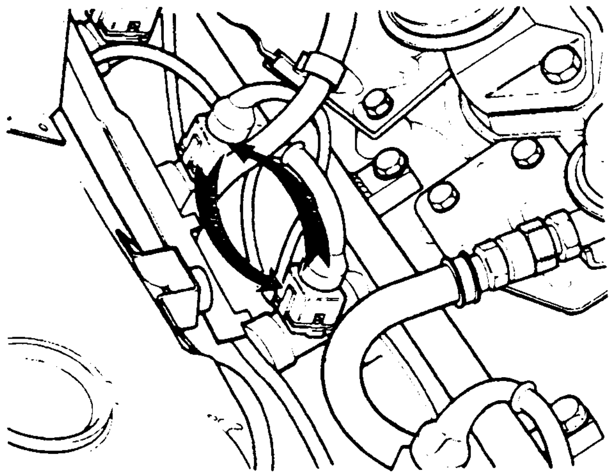
The minimum fuel pump output should be 1000 ml. (1 qt. approx.) for 30 seconds of fuel pump operation.

INJECTOR TEST

Test with the engine operating.

WARNING

Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.



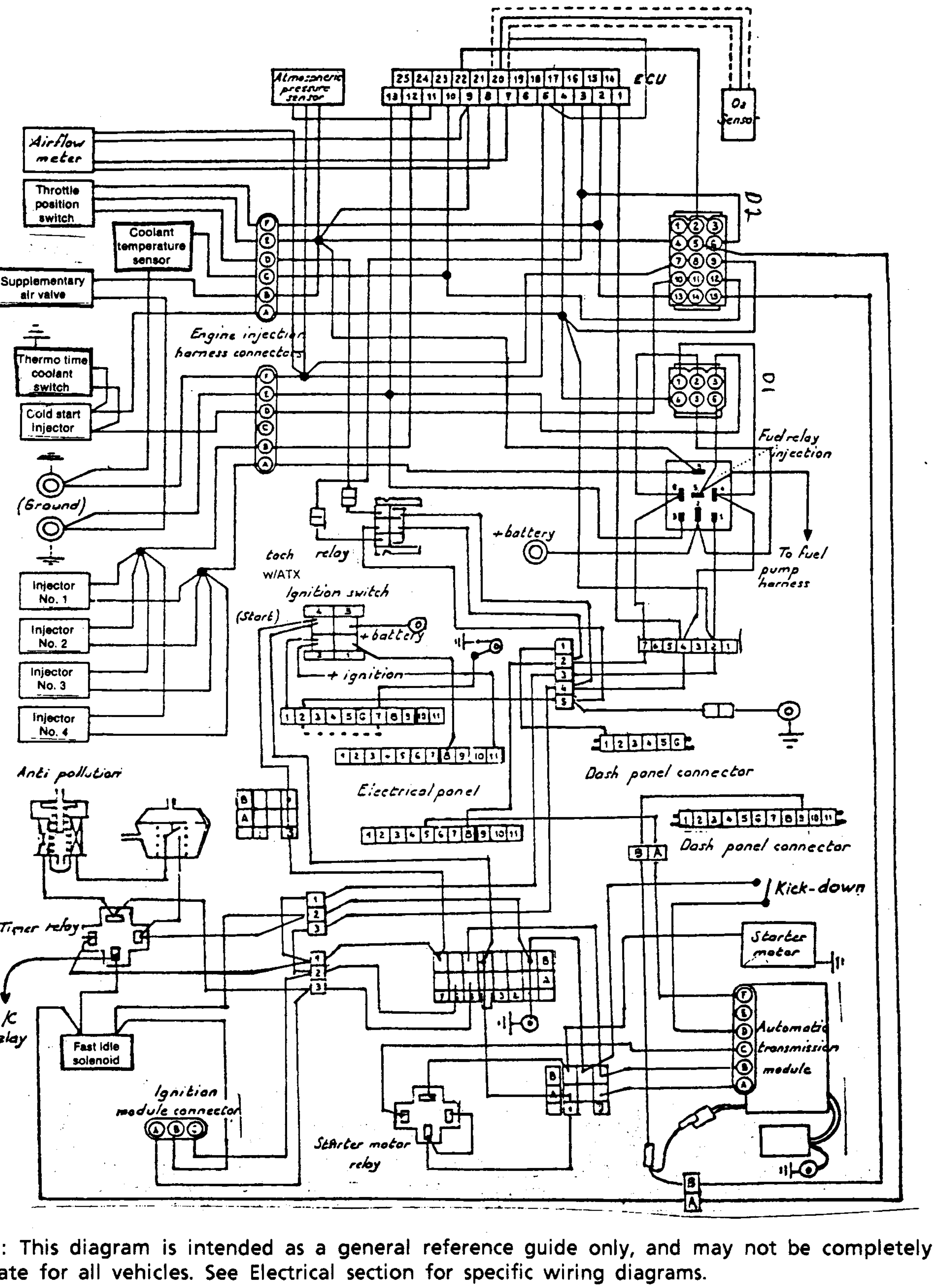
Disconnect an injector wire harness connector for a moment, then reconnect it. Repeat this on each of the other injectors.

A loss of engine speed should be noticed while each injector is inoperative.

If any one cylinder is not firing because of an inoperative injector, switch the wire harness connectors between the inoperative injector and one that is working.

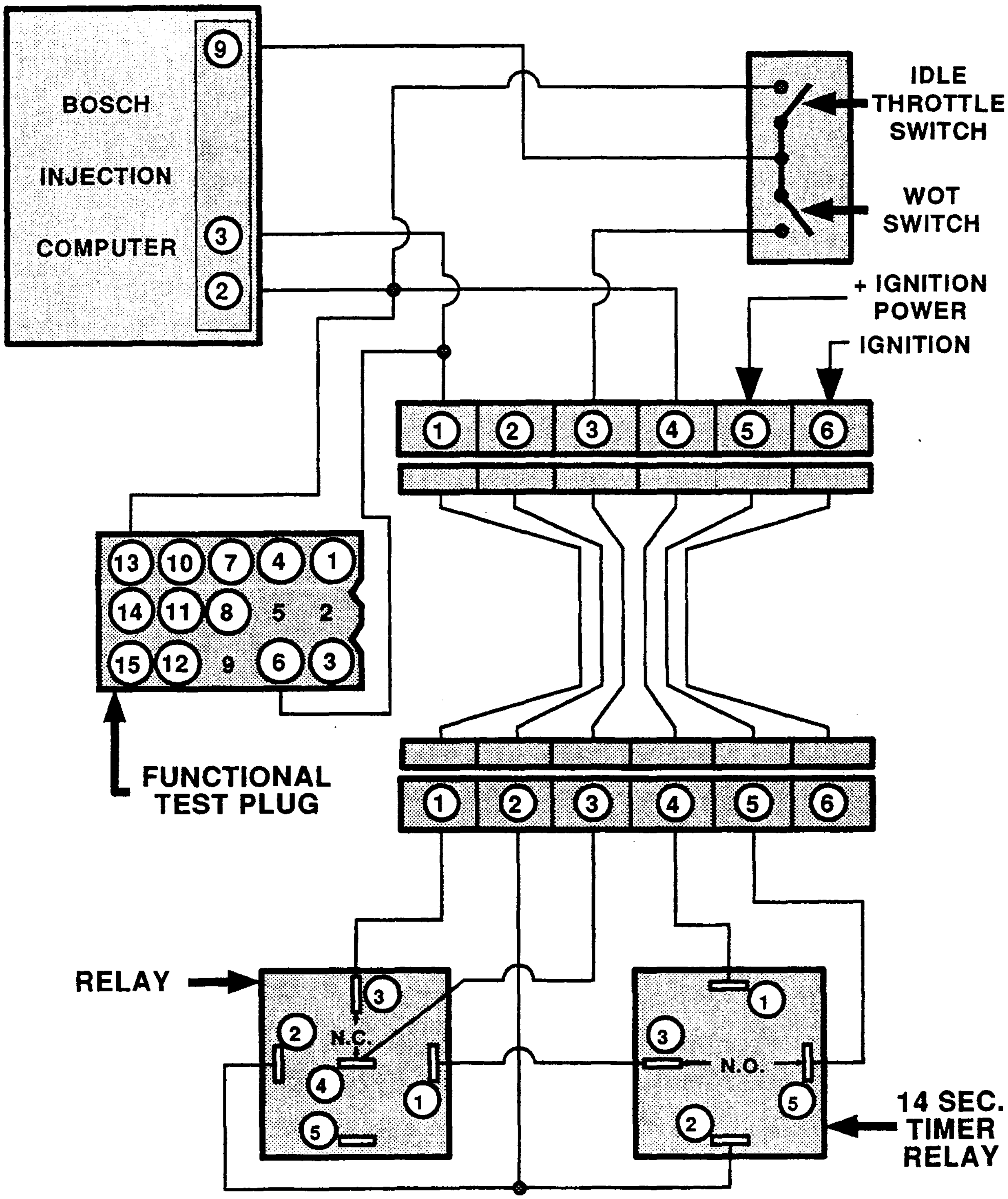
If the previously operational injector does not work, the wire harness is faulty.

ENGINE FUEL SYSTEM
WIRING DIAGRAM



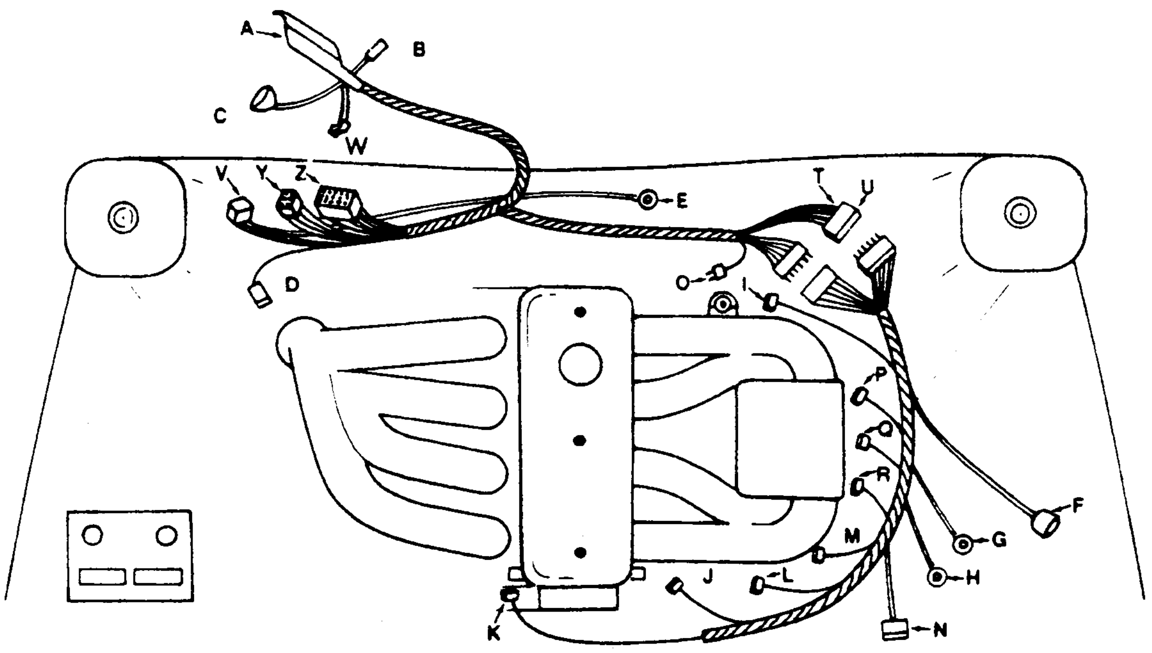
NOTE: This diagram is intended as a general reference guide only, and may not be completely accurate for all vehicles. See Electrical section for specific wiring diagrams.

FULL ENRICHMENT TIME DELAY SYSTEM (5-SPEED) WIRING DIAGRAM



ENGINE FUEL SYSTEM
WIRE HARNESS CONNECTIONS

A - ECU
B - +12V to fuel pump
C - Atmospheric pressure sensor
D - Oxygen sensor
E - +12V Battery
F - Airflow meter
G - Signal ground
H - Power ground
I - Supplementary air regulator
J - Thermo-time coolant switch
K - Coolant temperature sensor
L - Injector
M - Injector
N - Throttle position sensor
O - Fast idle solenoid
P - Injector
Q - Injector
R - Cold start injector
T - Tach voltage
U - Instrument panel harness
V - Control relay
W - Tach relay (ATX) or Full enrichment time delay (5-speed)
Y - Diagnostic connector D1
Z - Diagnostic connector D2



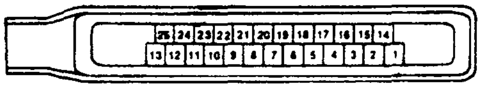
ENGINE FUEL SYSTEM
WIRE HARNESS CONNECTIONS

GENERAL INFORMATION

To simplify electrical tests, the wire harness connector terminals and pins are assigned reference numbers.

The ECU connector pin references appear on the injection system wiring diagram. They are not stamped on the connector.

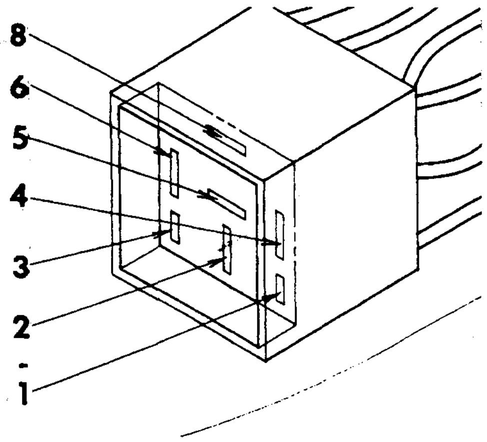
ECU (Electronic Control Unit) CONNECTOR PIN REFERENCE



PIN

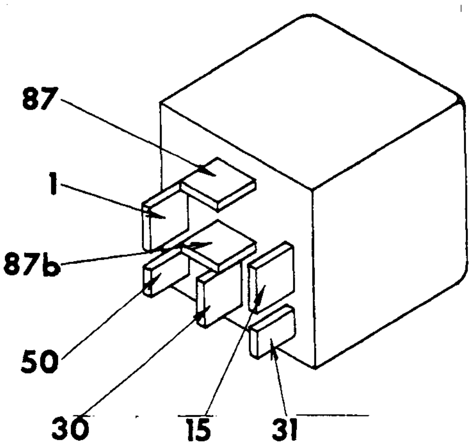
1 - Tach Voltage input
2 - Throttle Position Switch Idle Contact
3 - Throttle Position Switch WOT Contact
4 - Ignition Switch ("Hot" in Start Position)
5 - Vehicle Ground (Power Reference)
6 - Not Used
7 - Airflow Meter Potentiometer Source Voltage
8 - Airflow Meter Position Reference Voltage (Output)
9 - Battery Voltage in Start or Run Condition
10 - Coolant Temperature Sensor
11 - To Position 11 at ECU
12 - Fuel Injectors
13 - Injector Circuit Ground
14 - Not Used
15 - Not Used
16 - Not Used
17 - Not Used
18 - Not Used
19 - Not Used
20 - Oxygen (O_2) Sensor
21 - Not Used
22 - Integrator Voltage (Output to Diagnostic Connector)
23 - Not Used
24 - Not Used - Terminates at J2 connector
25 - Vehicle Ground (Power Reference)

CONTROL RELAY CONNECTOR



8 - Injection System Source Voltage
6 - Ignition (Ignition Control Module) + 12V
5 - Electric Fuel Pump
4 - Tach Voltage (Trigger)
3 - Vehicle Ground
2 - Battery Voltage
1 - Ignition Switch (Start) + 12V

CONTROL RELAY PIN REFERENCE



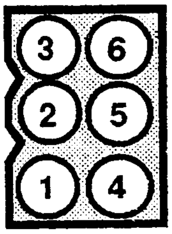
PIN

87 - Injection System Source Voltage
1 - Tach Voltage (Trigger)
87b - Electric Fuel Pump
50 - Energized in Ignition Start Position + 12V
30 - Relay Source Voltate (12V DC)
15 - Ignition ("Hot" in ON/Running Position) + 12V
31 - Ground

ENGINE FUEL SYSTEM
DIAGNOSTIC PLUGS

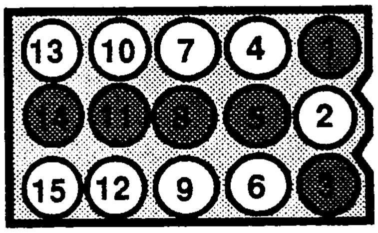
The diagnostic plugs are located near the coolant surge recovery reservoir on the passenger side of the engine compartment. They are equipped with yellow dust/debris covers.

IMPORTANT
Be sure to view the plugs in the same orientation as illustrated, using the "V" notches in the plugs as a guide.



D1 Plug

(D1) 6-Connector Plug
1 - Tachometer information
  (Ignition Module)
2 - + Ignition power
3 - Ground
4 - Starter
5 - + Battery
6 - Fuel Pump



D2 Plug

(D2) - 15 - Connector Plug
2 - Integrator Bosch air flow meter
4 - + Coil
6 - Full throttle switch
7 - Ground
9 - Cold Start Injector and Thermo-Time Coolant Switch
10 - Cold Start Injector and Thermo-Time Coolant Switch
12 - Coolant Temperature Sensor
13 - Throttle idle speed switch
15 - Automatic transmission computer

* Pins 1-3-5-8-11 & 14 are not used.

IMPORTANT
Always use a digital multi-meter for testing procedures. Analog (needle type) meters react too slowly to perform the required tests. Illustrations which display an analog meter are intended to show a specific gauge variation or position only. Digital multi-meters may be obtained locally at an electronics store or automotive supply center.

ENGINE FUEL SYSTEM
THROTTLE POSITION SWITCH (T.P.S.) CONNECTOR

Throttle Position Switch (T.P.S.) Operational Test

3 - WOT contact
18 - B+
2 - Idle contact

Ohmmeter Leads Connected to Pins:	Resistance at Pedal Position Rest/Idle	Mid Range	WOT
3 and 18	∞	∞	1-10 Ω
3 and 2	∞	∞	∞
18 and 2	1-10 Ω	∞	∞

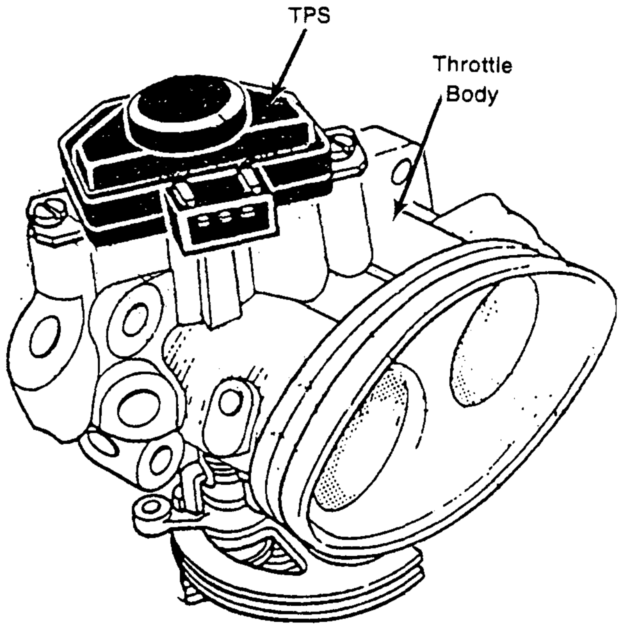
Throttle Position Switch Adjustment

With the throttle plate against its idle speed stop, slowly rotate the throttle position switch (TPS) in the direction of the throttle plate opening until the inner stop can be felt.

NOTE: The TPS adjustment can also be accomplished with an ohmmeter. Refer to the Functional Tests.

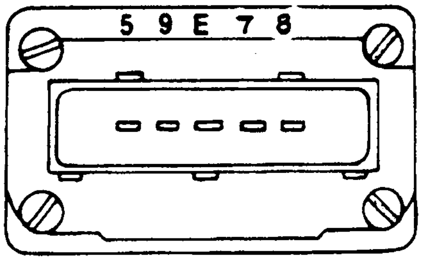
Tighten the two switch mounting screws.

If adjustment of the TPS will not produce the proper rest, mid-range and WOT specifications, replacement of the switch is necessary.



ENGINE FUEL SYSTEM
WIRE HARNESS CONNECTIONS

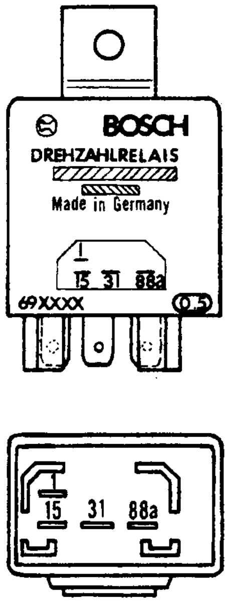
AIRFLOW METER PIN REFERENCE



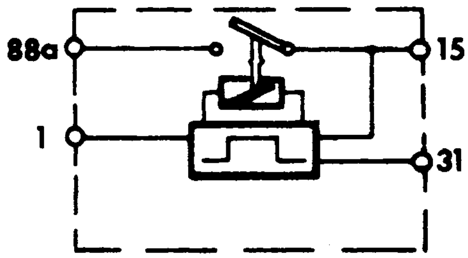
PIN

5 - Ground
9 - B +
E - Not Used
7 - Reference Voltage
8 - Wiper Arm Voltage (Output)

Tachometric Relay (Automatic Transmission)



Relay Schematic



1 - Tach signal voltage

15 - Full Throttle Switch

31 - Ground

88a - To pin 3 of ECU

ENGINE FUEL SYSTEM
INTEGRATOR VOLTAGE

Integrator Voltage is the "language" used between the oxygen (O_2) sensor and the ECU (Electronic Control Unit). Integrator voltage is an extremely helpful tool in diagnosing engine problems. This voltage may be monitored between pins 2 and 7 of diagnostic plug D2.

When the engine is at operating temperature, the oxygen sensor tells the ECU whether the exhaust gases going past it are high or low in oxygen content, which normally indicates either a rich or lean condition. The ECU receives this information and adjusts the incoming air/fuel mixture accordingly.

NOTE: The O_2 sensor is designed to detect only the oxygen content of the exhaust gases - it cannot detect unburned fuel.

At normal operating temperature, integrator voltage fluctuates rapidly. When the engine is below operating temperature, however, a steady voltage is indicated. This steady voltage is known as **baseline voltage**.

Baseline voltage is usually indicated at a value between 6 and 7 volts under the following conditions:

- all lights and electrical devices turned off
- battery fully charged
- battery mode switch in neutral
- radiator cooling fans off
- O_2 sensor disconnected

If baseline voltage is significantly above or below the normal 6-7 volt range; it may indicate one or more of the following conditions:

- electrical load drawing from the battery
- dead battery
- charging system malfunction

Three very important things to remember about Integrator Voltage are:

- Normal integrator voltage should be within 1 volt above baseline voltage.
- High voltage normally indicates a lean air/fuel mixture
- Low voltage normally indicates a rich air/fuel mixture.

NOTE: The integrator voltage reading is a very important tool when diagnosing engine problems.

A sampling of problems and causes are as follows:

LEAN MIXTURE:

1. Vacuum hose(s) leaking or disconnected.
   - A. Vacuum hose(s) leaking or disconnected.
   - B. Intake manifold gaskets, leaking or manifold cracked.
   - C. EGR valve not seated or open.
   - D. Idle adjustment screw leaking
   - E Auxiliary air device leaking
   - F. Crankcase vent hose leaking or disconnected
   - G. Vacuum capsule at automatic transmission leaking
   - H. Vacuum advance module on ignition module leaking or disconnected.
   - I. Leaking connections at air flow meter
   - J. Hoses to thermovalves (all three) disconnected or thermovalve broken)
   - K. Defective brake booster, booster valve or hose.
   - L. Leaking cruise control servo, dump valve, vacuum reservoir or leaking hose.
2. Defective or misadjusted air flow meter.
3. Wiring to air flow meter disconnected or bad.
4. Defective oxygen sensor.
5. Defective fuel pressure regulator causing low fuel pressure
6. Defective electric fuel pump
7. Insufficient fuel volume
8. Valve lash adjustment

RICH MIXTURE:

1. Defective fuel pressure regulator causing high fuel pressure.
2. Defective or leaking fuel injector or injectors
3. Leaking cold start injector
4. Electrical malfunction causing cold start injector to be on all the time.
5. Defective air flow meter
6. Defective oxygen sensor
7. Saturated evaporative emission charcoal canister.
8. Restricted exhaust system
9. Cam timing adjustment
10. Valve lash adjustment
11. EGR valve stuck shut
12. Misfiring spark plug(s)
13. Weak or defective ignition system (eg., coil, ignition module, TDC indicator, exciter ring on flywheel, distributor, spark plugs, spark plug wire, etc.)

ENGINE FUEL SYSTEM
INTEGRATOR VOLTAGE

IMPORTANT

Do not overlook the charcoal canister or fuel pressure when diagnosing an over-rich condition.

The most common problem with a lean mixture is vacuum leaks. These can be traced by pinching off various vacuum hoses while observing the effect on integrator voltage.

Pinching off the lines works well in a rich condition to isolate a bad cold start injector or a saturated charcoal canister.

IMPORTANT

One cylinder not firing ("Missing"):

NOTE: When diagnosing a possible injection problem be sure that the engine is running on all four cylinders. Also, be sure that there is **fuel, air and ignition** to all cylinders.

An ignition malfunction may seem like an over-rich condition, but integrator voltage indicates a lean condition. However, an ignition oscilloscope will reveal an ignition miss, which results in unburned fuel/air mixture being dumped into the exhaust manifold.

The O_2 sensor detects the higher oxygen content of the unburned mixture and passes this information on to the ECU. (Remember: The O_2 sensor detects oxygen content only - it cannot detect unburned fuel.)

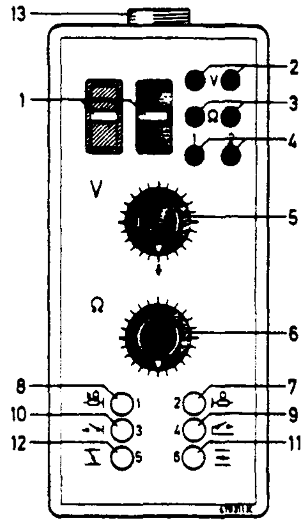
Since the ECU is incapable of determining that a cylinder is not firing, it will try to compensate for the higher oxygen content in the exhaust by further enriching the fuel/air mixture. This causes an abnormal running condition, which results in high integrator voltage and misfiring of the remaining cylinders.

NOTE: A disconnected or inoperative fuel injector will also produce similar symptoms.

When diagnosing a fuel injection system, be very careful not to overlook ignition problems or restricted air intake or exhaust systems.

FUNCTIONAL TEST (METHOD 1)

These tests are performed with the Bosch multi-function test box (700000-04-000) and test harness (700000-03-000).



1. Not used
2. Volt meter connections
3. Ohm meter connecting
4. Not used
5. "V" Knob 1 thru 23 and
6. Ω Knob 1 thru 24
   NOTE: "V" knob must be on position ↓ for Ω knob functions to work.
7. Not used
8. Not used
9. Not used
10. Not used
11. Not used
12. Not used
13. Test harness connection

Switch Position V		Mesurement	Remarks	Test Values (display)
5	-	Voltage impulses from term. 1 of ignit. coil Control unit plug, terminal 1 to terminal 5	Put gearshift in neutral, crank engine.	Observe ignition impulses on oscilloscope
6	-	Voltage from control relay, terminal 87. Control unit plug, terminal 9 to terminal 5	Put gearshift in neutral, crank engine.	8 ... 15V
7	-	Voltage from starter, terminal 50 Control unit plug, terminal 4 to terminal 5	Put gearshift in neutral, crank engine.	8 ... 15V
8	-	Voltage from altitude sensor, terminal 11 Control unit plug, terminal 11 to terminal 5	Put gearshift in neutral, start engine Air pressure: 980 mbar (≈300 m above sea level) 615 mbar (≈ 4000 m above sea level)	 2 ... 4V 8 ... 12V
↓	11	Resistance of temperature sensor NTC I in air flow sensor, terminal 8 Control unit plug, terminal 8 to terminal 5	—	100 ... 200 Ω
↓	12	Resistance of potentiometer in air flow sensor, terminal 7. Control unit plug, terminal 7 to terminal 5	Move sensor flap to stop	60 ... 1000 Ω
↓	13	Resistance of temperature sensor NTC II terminal 10 (engine temperature) Control unit plug, terminal 10 to terminal 5	60° F/ + 15° C ... +30° C/86° F° +80° C/176° F°	1.3 ... 3.6 k Ω 250 ... 390 Ω
↓	14	Resistance, ground to output stage term. 13 Control unit plug, terminal 13 to terminal 5	—	0 ... 10 Ω
↓	16	Resistance of idle contact in throttle valve switch, terminal 2. Control unit plug, terminal 2 to terminal 9	Accelerator in rest position Accelerator slightly depressed	0 ... 10 Ω ∞ Ω
↓	17	Resistance of full-load contact in throttle valve switch, terminal 3 Control unit plug, terminal 3 to terminal 9 * NOTE: Tach Relay must be by-passed for #17	Accelerator completely depressed Accelerator slightly depressed	0 ... 10 Ω ∞ Ω
↓	18	Resistance of all 4 parallel solenoid-operated injection vlaves, terminal 12 Control unit plug, terminal 12 to terminal 9		68° F/+20° C: 7.0 ... 9.5 176° F/+80° C:

ENGINE FUEL SYSTEM
FUNCTIONAL TESTS (METHOD 1)

The following tests are to be performed using Diagnostic plugs D1 and D2 and a digital VOM (Volt-Ohm-Milliammeter).

NOTE: The voltage and resistance values listed are nominal. The actual value will vary slightly from one vehicle to the next.

Test	Conditions	Test Points	Results
1. Control Relay Ground and ECU Ground	Ignition ON Engine OFF Engine coolant temp. less than (25°C (77°F)	Ohmmeter test probes between D1-3 and D2-7	0 ohms
2. Battery Voltage	same as test 1	Voltmeter test probes between D1-5(+) and D1-3(-)	12 volts (approx.)
3. Ignition Voltage	same as test 1	Voltmeter test probes between D1-2(+) and D1-3(-)	12 volts (approx.)
4a. Coolant Temperature Sensor	ECU Disconnected	Ohmmeter test probes between D2-12 and D2-7	2.5K ohms R2000 at 20°C (68°F) 320 ohms R250 at 80°C (176°F)
4b. Coolant Temperature Sensor	ECU Connected	Ohmmeter test probes between D2-12 and D2-7	1.5K ohms R1500 at 20°C (68°F)
5. Injectors	ECU Connected	Ohmmeter test probes between pins A & B of injector wire harness connector	16 ohms (approx.)
6. Fuel Pump	ECU Connected	Apply 12 volts with jumper wire between pins D1-5 and D1-6	Should hear fuel pump noise. See pg. C3-8 for volume and pressure testing information.
7. Throttle Position Switch	ECU Disconnected	Ohmmeter test probes between D2-13 and D2-6	Infinite ohms
		Ohmmeter test probes between D2-7 and D2-13 (Throttle at idle position)	0 - 10 ohms
		Ohmmeter test probes between D2-7 and D2-6 (WOT position)	0 - 10 ohms
8. Thermo-Time Coolant Switch and Cold Start Injector	ECU Disconnected	Voltmeter test probes between D2-9 (+) and D2-10 (-)	8 - 12 volts After a few seconds, 0 volts Time will vary with temperature

Test	Conditions	Test Points	Results
9. Start Voltage (Signal)	1. Starter motor engaged 2. Engine coolant temp. below 25°C (77°F)	Voltmeter test probes between D1-4 (+) and D1-3 (-)	8 - 12 volts
10. Tach. Voltage (Signal)	same as test 9	Voltmeter test probes between D1-1 (+) and D1-3 (-)	Oscillating voltage (pulses)
11. Integrator Voltage (open loop)	1. Engine running 2. Coolant temp. below 25°C (77°F) 3. Oxygen (O_2) sensor temp. below 250°C (480°F)	Voltmeter test probes between D2-2 (+) and D2-7 (-)	6.8 volts (approx.) Note voltage for test 12 and test 13
12. Integrator Voltage (closed loop)	1. Engine running at 800-850 rpm 2. Coolant temp. above 40°C (104°F) 3. Oxygen (O_2) sensor temp. above 250°C (480°F)	Voltmeter test probes between D2-2 (+) and D2-7 (-)	6.8 - 7.8 volts (approx.) Voltage from test 11 +1 volt tolerance.
13. Fuel Cut-off (during deceleration)	1. Increase engine speed to 3500 rpm and rapidly close throttle plate (idle position)	Voltmeter test probes between D2-2 (+) D2-7 (-)	6.8 volts (approx.) Same result as test 11.

ENGINE FUEL SYSTEM
FUNCTIONAL TESTS (METHOD 2)

Functional tests may also be performed by just using diagnostic plug D2 and a digital VOM. The following pages contain guide charts for these procedures. They explain component tests, engine conditions, test points and desired results.

These pages may be photocopied to accompany you as a worksheet while testing a vehicle. Record test results carefully to assist you in making a more efficient diagnosis.

NOTE TO DEALERSHIPS: Worksheet values are required when contacting Winnebago Technical Service for assistance.

FUNCTIONAL TEST FOR WINNEBAGO/ITASCA H-BODY EQUIPPED WITH GAS ENGINE AND AUTOMATIC TRANSMISSION

Date__________ Unit__________ Serial No. __________ Technician __________ Engine Serial No. __________

SECTION I Before Starting Engine

Component	Check	Engine Parameters	Normal Result	Actual Result & Notes
A) Coolant temperature sensor	Resistance between pins 12 and 7	Coolant temperature between 50° & 86°F	R 2000	
B) Throttle position switch				
1) Idle switch	Resistance between pins 13 and 7	Closed throttle	R ≈ 0 Ω	
		Slightly open throttle	R ≈ 2000 Ω	
2) Full load switch	Resistance between pins 6 and 7	Wide open throttle	R ≈ 0 Ω	
	Without tach. relay (electrical modification)	Closed throttle	R ≈ ∞	
C) Electronic ignition thermovalves	Vacuum pump: Δp on common hose	Coolant temperature between 66° and 95°F	Δp must remain at the same value	

SECTION II When Starting Engine or Just After Engine Start

Component	Check	Engine Parameters	Normal Result	Actual Result & Notes
A) Cold start injector	Voltage between pins 9 and 10	Engine cranking	8-12 volts. After a few seconds must be 0 volts.	
B) Fast idle solenoid	Voltage between pins of solenoid wire harness connector	Engine cranking and just after	8-12 volts during 3 seconds after crank operation.	
C) EGR	Visual check with engine RPM increase	Coolant temperature <59°F, engine running	Valve must remain closed	

SECTION III Engine Running and Warm

Component	Check	Engine Parameters	Normal Result	Actual Result & Notes
A) Idle speed	Engine RPM by adjusting air by pass screw	Engine warm & fan off. Transmission in drive.	700 ± 50	
B.) Idle mixture* See page E10-38 for details on this operation. *** Tamper proof plug on air flow meter must be removed for this operation.**	Voltage between pins 2 and 7 Voltage between pins 2 & 7. Adjust w/idle mixture screw on flowmeter.	Oxygen sensor disconnected Oxygen sensor connected	6 to 7 volts and record actual as X Set at X + 1 volt - 0 volt	

SECTION IV Engine Running and Warm

Component	Check	Engine Parameters	Normal Result	Actual Result & Notes
A) Atmospheric pressure sensor	Integrator voltage between pins 2 and 7	Altitude <330 ft. engine at idle.	Integrator voltage must remain the same with sensor connected or disconnected	
B) Tachometer relay	Voltage between pins 6 & 7 (w/check harness)	Increase RPM slowly to over 4100 Decrease RPM slowly to less than 4100	RPM = 4100 ± 50 when voltage changes from 0 to ≈12 RPM = 4050 ± 50 when voltage changes from ≈12 to 0	
C) Fast idle solenoid	Engine RPM	Air cond. "on" transmission in "drive"	RPM must remain between 650 & 850	
D) EGR	Visual	Coolant temperature >86°F Increase engine RPM to over 3000	Valve opens & must close when acceleration stops	
E) Fuel injection computer loom	Visual Wire 107, yellow/black disconnected & conector removed & wire taped	--------	--------	

SECTION IV (Cont'd)

Component	Check	Engine Parameters	Normal Result	Actual Result & Notes
F) Electronic ignition thermovalves 1) 59° F	Engine RPM	Connect thermovalve hoses together	RPM should increase ≈50	
2) 113° F	Vacuum between thermovalve and AM capsule	Engine RPM >2500	Vacuum ≥2.95 inches of mercury	

SECTION V Engine Off and Hot

Component	Check	Engine Parameters	Normal Result	Actual Result & Notes
A) Coolant temperature sensor	Resistance between pins 12 and 7	Coolant temperature >176° F	R ≤ 300 Ω	
B) Cold start injector	Voltage between pins 9 and 10	Engine cranking	No voltage	

NOTES: ______________________________

FUNCTIONAL TEST FOR WINNEBAGO H-BODY
EQUIPPED WITH 5-SPEED MANUAL TRANSMISSION

Date__________ Unit__________ S. N.__________ Insp.__________ Engine S.N.__________

SECTION I Before Starting Engine

Component	Check	Engine Parameters	Normal Result	Actual Result & Notes
A) Catalytic Convertor	Installation & Part No.	----	Converter Part# AC25104343	
B) Bosch Fuel Injection Computer	Installation & Part No.	----	0280000317	
C) Coolant temperature sensor	Resistance between pins 12 and 7	Coolant temperature between 50° & 86°F	R ≥ 2000 Ω	
D) Throttle position switch				
1) Idle switch	Resistance between pins 13 and 7	Closed throttle Slightly open throttle	R ≈ 0 Ω R ≈ 2000 Ω	
2) Full load switch	Resistance between pins 6 and 7	Wide open throttle Closed throttle	R ≈ 0 Ω R ≈ ∞	
E) Electronic ignition thermovalves	Vacuum pump: Δp on common hose	Coolant temperature between 66° and 95°F	Δp must remain at the same value	

SECTION II When Starting Engine or Just After Engine Start

Component	Check	Engine Parameters	Normal Result	Actual Result & Notes
A) Cold start injector	Voltage between pins 9 and 10	Engine cranking	8-12 volts. After a few seconds must be 0 volts.	
B) Fast idle solenoid	Voltage between pins of solenoid wire harness connector	Engine cranking and just after	8-12 volts during 3 seconds after crank operation.	
C) EGR	Visual check with engine RPM increase	Coolant temperature <59°F, engine running	Valve must remain closed	

SECTION III Engine Running and Warm

Component	Check	Engine Parameters	Normal Result	Actual Result & Notes
A) Idle speed	Engine RPM by adjusting air by pass screw	Engine warm & fan off. Transmission in drive.	700 ± 50	
B) Idle mixture	Voltage between pins 2 and 7	Oxygen sensor disconnected	6 to 7 volts and record actual as X	
	Voltage between pins 2 & 7. Adjust w/idle mixture screw on flowmeter.	Oxygen sensor connected	Set at X + 1 volt - 0 volt	

SECTION IV Engine Running and Warm

Component	Check	Engine Parameters	Normal Result	Actual Result & Notes
A) Atmospheric pressure sensor	Integrator voltage between pins 2 and 7	Altitude <330 ft. engine at idle.	Integrator voltage must remain the same with sensor connected or disconnected	
B) Timer Relay	Voltage between pins 6 & 7	Go to wide open throttle, momentarily	Voltage 0	
		Hold throttle slightly open for 14 sec. ± 4 sec. Then go to wide open throttle momentarily (Note: Throttle must not go back to idle)	Voltage changes from 0 to ≈12 after 14 seconds only at wide open throttle	
C) Fast idle solenoid	Engine RPM	Air cond. "on" transmission in "drive"	RPM must remain between 650 & 850	
D) EGR	Visual	Coolant temperature >86°F Increase engine RPM to over 3000	Valve opens & must close when acceleration stops	
E) Fuel injection computer loom	Visual Wire 107, yellow/black connected	———————	———————	

SECTION IV (Cont'd)

Component	Check	Engine Parameters	Normal Result	Actual Result & Notes
F) Electronic ignition thermovalves				
1) 59° F	Engine RPM	Connect thermovalve hoses together	RPM should increase ≈50	
2) 113° F	Vacuum between thermovalve and AM capsule	Engine RPM >2500	Vacuum ≥2.95 inches of mercury	

SECTION V Engine Off and Hot

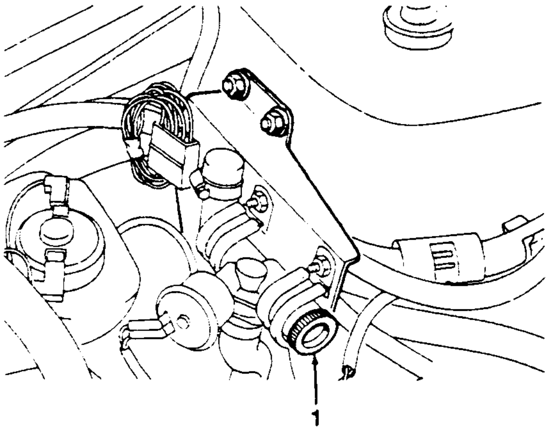
Component	Check	Engine Parameters	Normal Result	Actual Result & Notes
A) Coolant temperature sensor	Resistance between pins 12 and 7	Coolant temperature >176° F	R ≤ 300 Ω	
B) Cold start injector	Voltage between pins 9 and 10	Engine cranking	No voltage	

NOTES:

ENGINE FUEL SYSTEM
ADJUSTMENTS

IDLE SPEED ADJUSTMENT

The idle speed adjustment screw is located at the air bypass unit on the firewall.



WARNING
Use extreme caution when the engine is operating. Do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

Start and allow the engine to reach normal operating temperature.

Use test box Ms. 760.

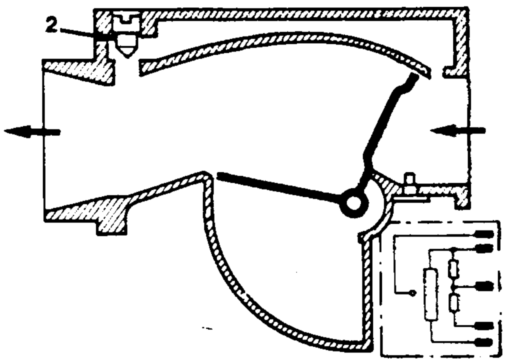
Turn all accessories off.

Wait for the cooling fan to cycle ON then OFF.

Adjust the idle speed (adjustment screw 1) to 700-750 rpm in DRIVE with automatic transmission.

AIRFLOW METER BYPASS AND ADJUSTMENT

In the event of major engine overhaul or airflow meter replacement, the bypass adjustment screw (2) must be adjusted to obtain the correct air/fuel mixture ratio.



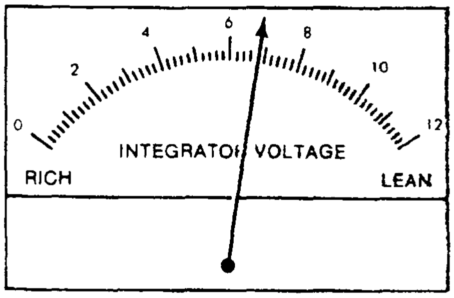
WARNING
Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

CAUTION
Do not remove the cap and readjust the airflow meter bypass screw unless involved in a major overhaul, airflow meter replacement or the presence of high idle CO has been determined by a competent authority.

ENGINE FUEL SYSTEM
ADJUSTMENTS

- Remove the tamper-resistant plug (21) for access to the screw.

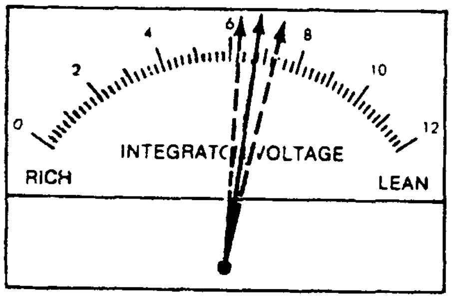
To remove the plug:
- Push the plug (50) down completely to prevent it from rotating.
- Drill a 3 mm (1/8") hole in the plug. A steel stopper (51) inside the plug will prevent the drill from going too deep. Do not use excessive force.
- Use a threaded extractor tip to pull the plug out.



Baseline Voltage (Steady)

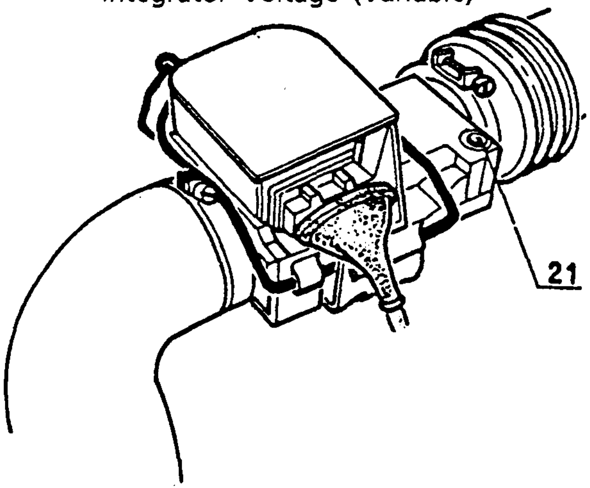
- Disconnect the oxygen (O_2) sensor wire harness connector
- Connect a **digital voltmeter** to diagnostic connector terminals D2-2 and D2-7.

NOTE: Battery must have a full charge with all switches and fans off to ensure no drain or draw on battery.



Integrator Voltage (Variable)

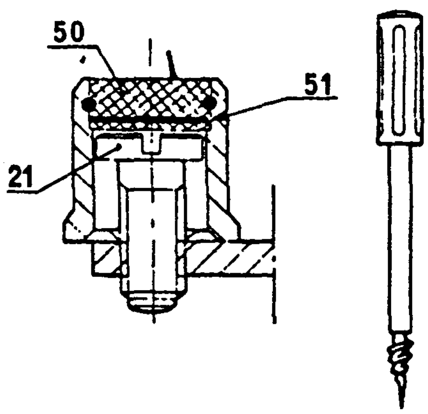
Record the voltage. It should be approximately 6-7 volts.



- Start vehicle and allow the engine to reach operating temperature (when the cooling fans must be off while testing.
- Connect the oxygen (O_2) sensor wire harness connector
- Observe the digital voltmeter and adjust the bypass screw to obtain the voltage recorded above plus + 1 volt.

NOTE: A misadjusted bypass screw can cause a voltage variance of $\pm$3 volts.

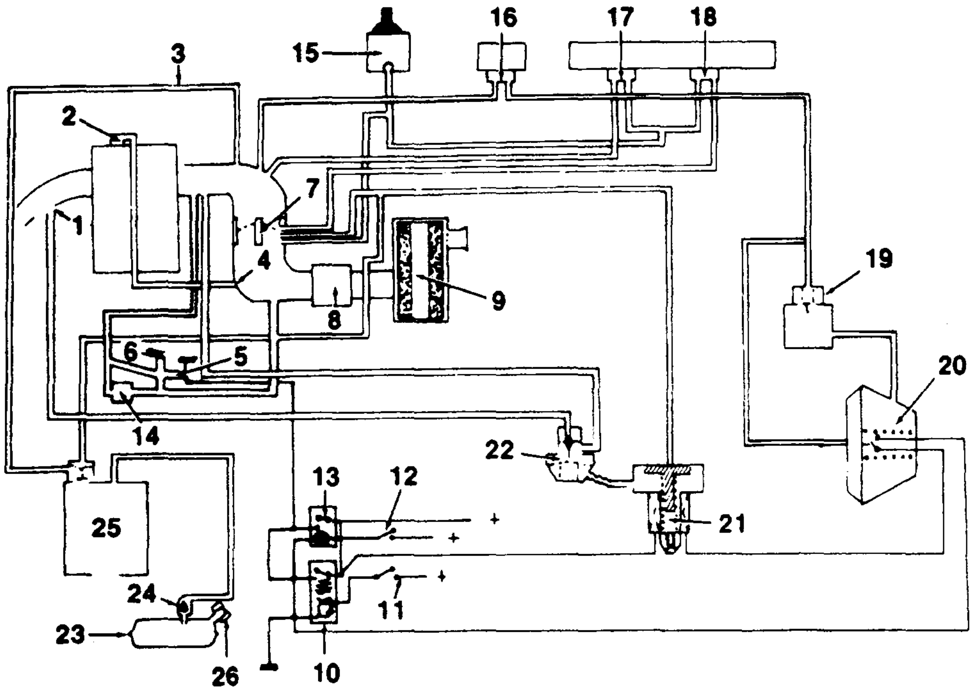
- After the bypass adjustment, check the idle speed and adjust, if necessary.



- Re-install the tamper-resistant plug.

NOTE: Federal regulation requires that the plug be replaced after completion of adjustment operations.

EMISSION CONTROL SYSTEMS
EMISSION CONTROL SYSTEM DIAGRAM



1. 4 mm (0.57 inch) orifice
2. Positive crankcase ventilation (PCV) valve
3. 1.8 mm (0.070 inch) orifice
4. 5.5 mm (0.216 inch) orifice
5. Fast idle solenoid
6. Idle speed adjustment screw
7. Throttle body
8. Airflow meter
9. Air filter
10. Timer relay
11. Start ignition switch
12. Air conditioner switch
13. Fast idle relay (A/C)
14. Supplementary air regulator
15. Integral electronic ignition module
16. Thermo valve (open T° above 59°F)
17. Thermo valve (open T° below 59°F)
18. Thermo valve (open T° above 113°F)
19. Vacuum reservoir
20. Differential pressure switch
21. EGR valve solenoid
22. EGR valve
23. Fuel tank
24. Roll-over valve
25. Vapor canister (charcoal)
26. Vacuum filler cap

GENERAL INFORMATION

The emission control systems are:
- the fuel vapor recovery system
- the positive crankcase ventilation (PVC) system
- the exhaust gas recirculation (EGR) system
- the catalytic converter system

The thermo valve (16) is connected to the radiator.

Below 15°C (59°F), the thermo valve is closed.

Above 15°C (59°F), the thermo valve opens the vacuum circuit from the intake manifold to the differential pressure switch (20) and to the vacuum reservoir (19).

The EGR valve (22) opens or closes the passage from the exhaust manifold to intake manifold.

The amount of exhaust gas allowed to pass is controlled by the orifice (1) located in the exhaust manifold.

Vacuum causes the EGR diaphragm to open the valve.

The source of the vacuum is close to the throttle.

The vacuum is controlled by the EGR valve solenoid (21).

The solenoid (21) has voltage applied at all times.

The differential pressure switch (20) has two chambers (A and B) separated by a diaphragm.

There is a calibrated hole located in the diaphragm.

One side of the diaphram is controlled by a spring.

The diaphragm either opens or closes the internal ground circuit contact.

Above 15°C (59°F) the thermo valve (16) is open.

Chamber B of the differential pressure switch is connected to the intake manifold via the thermo valve.

Chamber A of the differential pressure switch is also connected to the intake manifold, but via the vacuum reservoir (19).

When the engine is operating at a stabilized RPM, the pressure is equal on both sides of the diaphragm.

The ground circuit contact is open, the solenoid (21) is de-energized and the EGR valve (22) is closed.

If the throttle is opened, the vacuum in chamber B decreases immediately.

In chamber A and in the vacuum reservoir, there is no immediate pressure variation.

The vacuum differential between chamber A and B causes the diaphragm to move and close the ground circuit contact.

The solenoid (21) is then energized.

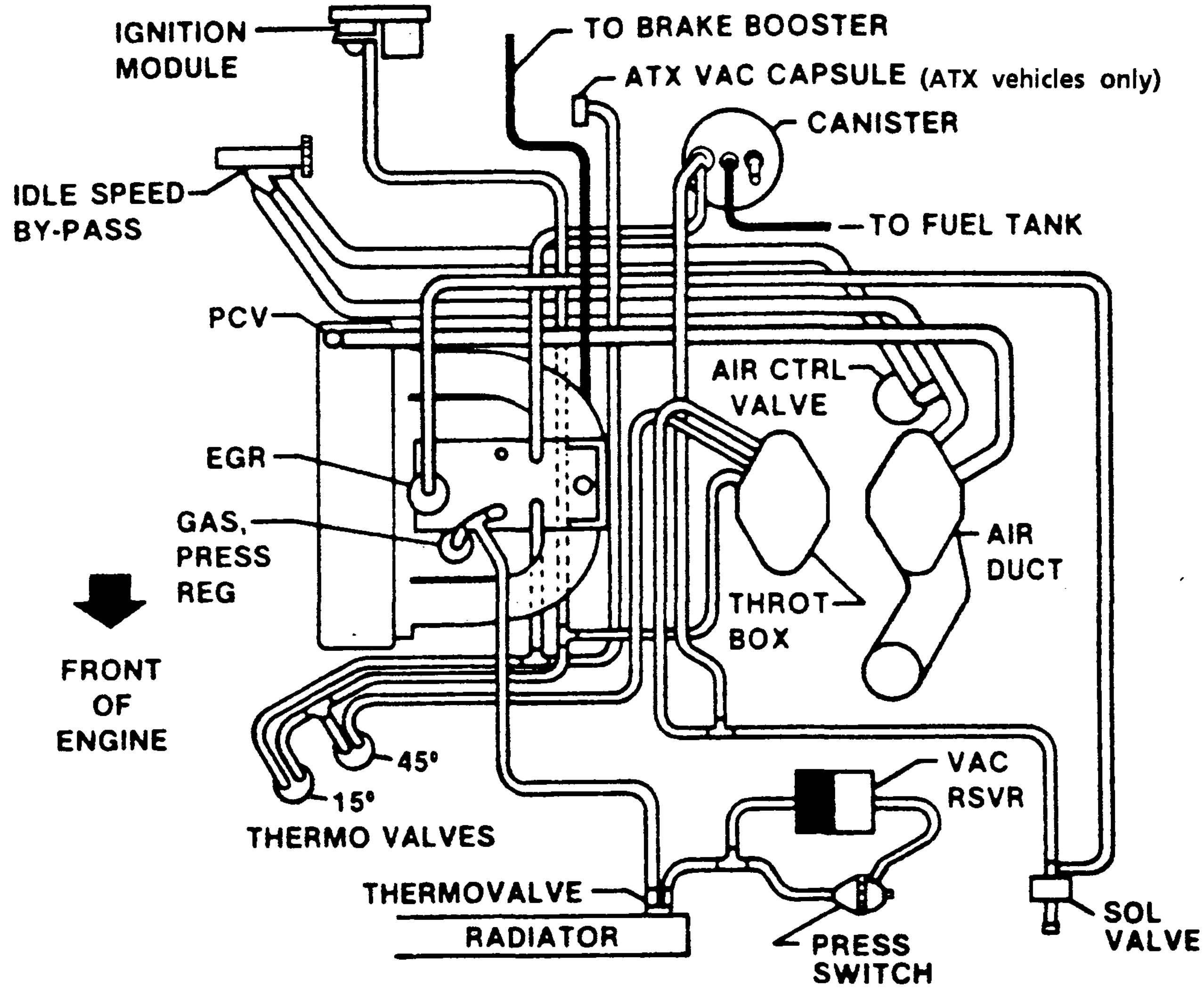
Vacuum is applied to the EGR valve diaphragm and the exhaust gas flows to the intake manifold.

The vacuum decreases slowly in the chamber A and in the vacuum reservoir (19).

The spring forces the diaphragm and opens the ground circuit contact.

The solenoid (21) is de-energized and EGR valve (22) is closed.

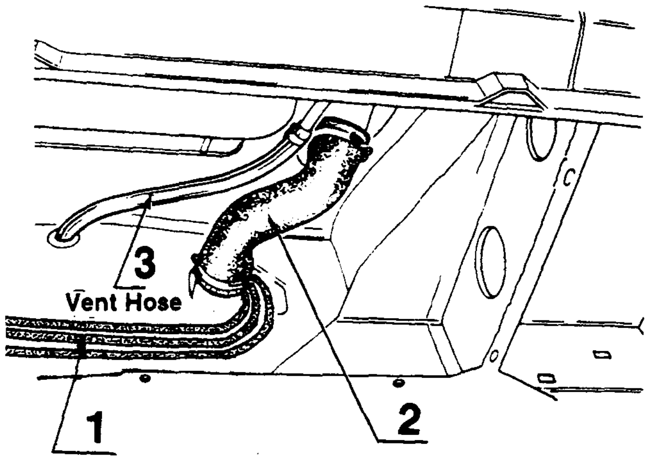
EMISSION HOSE ROUTING



FUEL TANK GAUGE SENDING UNIT
REMOVE AND REPLACE FUEL TANK

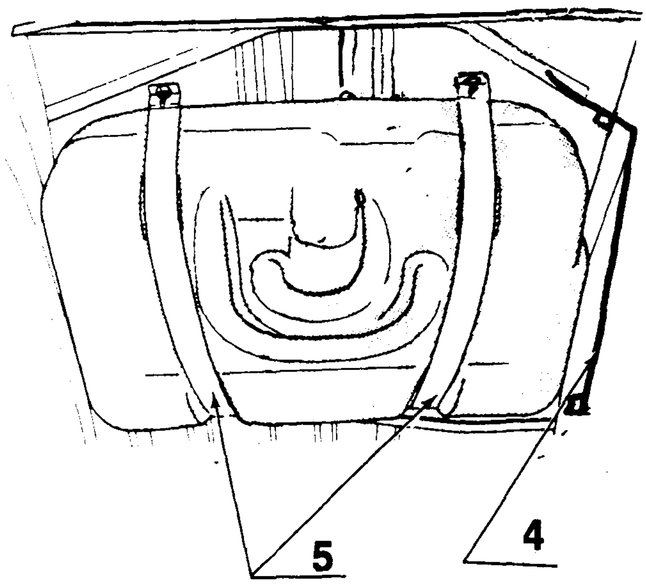
REMOVE FUEL TANK

- Start with a nearly empty fuel tank or siphon by removing the hose at the frame rail (1) that goes to the electric fuel pump. Create a negative pressure on this hose to start a siphon. Remove the fuel fill cap to allow air for fuel displacement. Fuel must be drained into approved fuel container.
- Disconnect fuel hoses from metal fuel neck (2) and metal lines (3) on the frame rail. Remove vent hose from external roll over valve on the front side of vehicle (when equipped w/external valve).
- Remove exhaust shield on right side of tank (4).
- Disconnect parking brake cable from rod - push rod rearward so it does not interfere with tank removal (Do not misplace or bend the spring at the rear end of the rod.
- Remove fuel tank retaining straps (5).
- Lower the right side of the fuel tank enough to disconnect the fuel sending wires (black = ground; orange = hot).
- Lower the right side of the tank far enough to pull it out to the right side letting the hoses come with the tank through the holes in the frame rail.



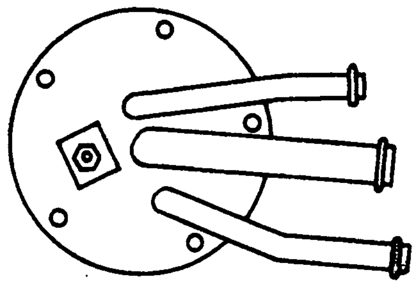
REINSTALL FUEL TANK

- Install in the reverse order of removal being careful not to pinch or crimp any hoses.
- Reconnect parking brake cable and rod making sure rear tension spring is installed.
- Check parking brake adjustment.



FUEL TANK GAUGE SENDING UNIT
REMOVE AND REPLACE

SENDING UNIT REMOVAL



- Remove retaining screws
- Pull sender up and out being careful not to bend or alter any of its components.

SENDING UNIT INSTALLATION

- Install new gasket on tank.

NOTE: Fuel sender mounting screw holes and gasket have an un-even pattern and can only be installed one way. This is to insure that the sender is always mounted correctly. Make sure the gasket holes align with the sender mount holes.

- Install sender being careful not to bend or alter any of its components.
- Install 4 of the 5 mounting screws - the fifth is for the ground wire when reinstalling the tank assembly in the vehicle.

SENDING UNIT TESTING

- Refer to Section D - Electrical for testing information (See pg. D2-1).

FUEL TANK GAUGE SENDING UNIT
ROLL OVER VALVE

PURPOSE AND OPERATION OF THE VALVE

The roll over valve is a device installed in all "H-body" vehicles to prevent fuel from escaping from the tank in case of an accident where the vehicle is tipped on it's side or top. A ball in the valve closes the vent in this condition to prevent fuel spillage. Under normal driving conditions, the valve simply functions as a tank vent.

NOTE: The roll over valve will not prevent the tank from being overfilled and is not intended for this purpose. See the vehicle's owner's manual for fuel tank filling procedure.

WARNING
Do not alter the valve or eliminate it from the system. This is a safety feature and must not be tampered with.

SECTION "D"
ELECTRICAL

See Section "Air Conditioning" for additional diagrams.

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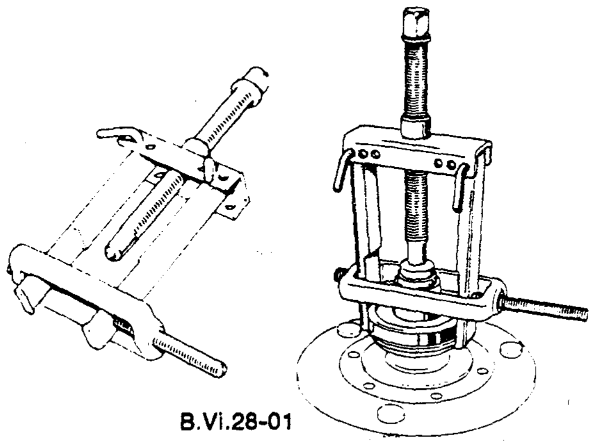
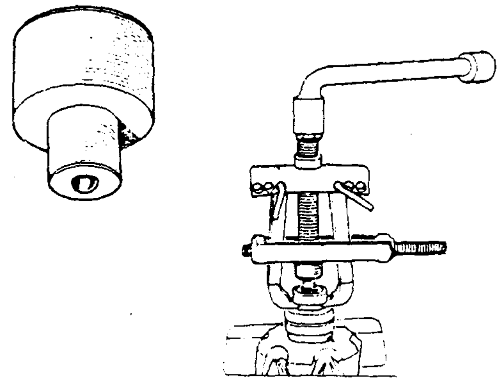
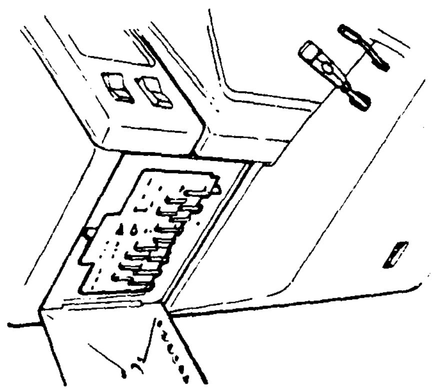
SPECIAL TOOLS

 B.Vi.28-01 Bearing extractor with jaws 146 mm long (use with Tool Ele. 22-01 for alternator bearing removal) Order Tool No. 700012-27-301 EA	 Ele.22-01 End fitting for extracting alternator bearing (Use with tool B.Vi. 28-01) Order Tool No. 700013-31-001 EA

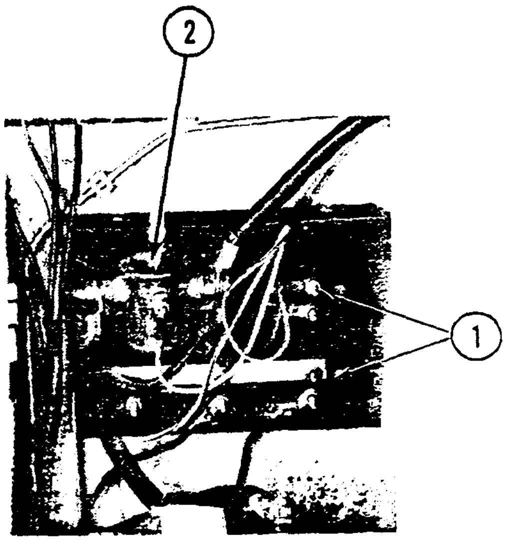
FUSES - AUTOMOTIVE

The fuse panel is located behind a hinged cover on the left hand side of the dash next to the hood release knob. It is advisable to disconnect the battery before changing a fuse. It is recommended that you carry spare fuses in your vehicle at all times. Always use the proper amp fuse for the proper circuit. Refer to the Vehicle Owner's Manual for fuse size and locations.



CIRCUIT BREAKER

The circuit breaker panel is located in the engine compartment. Disconnect the battery before changing a circuit breaker. Always use replacement circuit breaker of the proper rating.



GENERAL
AUXILIARY BATTERY

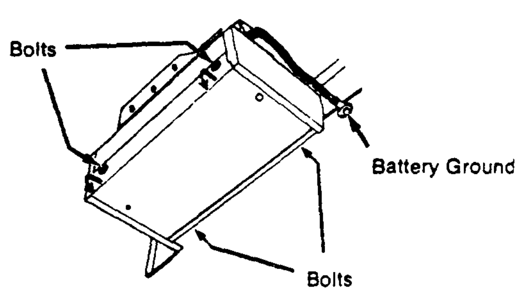
The 12-volt DC system consists of the automotive battery and the auxiliary battery. The automotive battery is used solely to operate the engine starter and all automotive accessories and controls found on the instrument panel. This includes the horn, cruise control, all exterior lights, radio, windshield wipers, heater fans, etc.

Auxiliary Battery
The auxiliary battery operates all 12-volt equipment located in the living area of the motor home. This includes the interior lights, furnace fan, water pump, water level and holding tank gauges, and the refrigerator. In addition, the auxiliary battery may be used to start the engine if for some reason the automotive battery is discharged.

Location
The auxiliary battery is located in a compartment (battery box) beneath the driver's seat on the underside of the vehicle. The battery should be removed from the compartment for periodic inspection or maintenance.

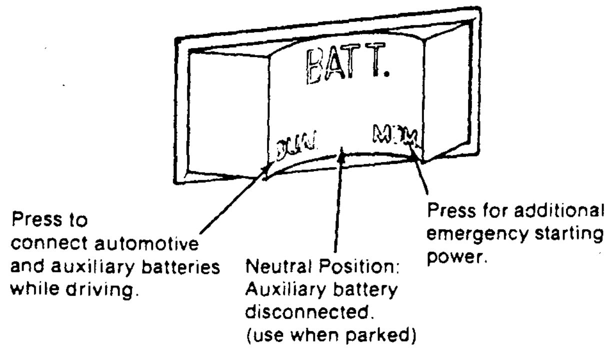
Aux. Battery Access:

1. Remove the ground cable from the vehicle frame to avoid sparks by accidental contact of the positive terminal with other metal parts of the vehicle.
2. Support the battery tray from beneath, using a jack or blocks, etc., then remove the 4 bolts that fasten the battery tray to the compartment frame.
3. Slide the battery toward the driver stepwell and carefully lower to the ground. (If the vehicle is on a ramp or hoist, the battery cables are not long enough to reach the ground, so a support platform must be used.
4. Reverse the above steps to return the battery to the compartment.



DUAL BATTERY SWITCH
The dual battery switch is located on the left side of the dash, next to the hazard flasher switch.

The DUAL position connects the coach battery to the engine alternator, allowing the battery to be charged while driving. When the ignition key is turned off, the coach battery is disconnected from the automotive system. This prevents the automotive (starting) battery from being discharged by coach equipment while parked.



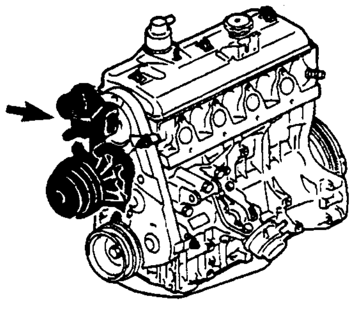
If the automotive battery fails, the engine may be started from the coach battery. To do this, press and hold the switch in the MOM (momentary) position while turning the ignition key. When the engine starts, release the switch and it will return to the middle (off) position.

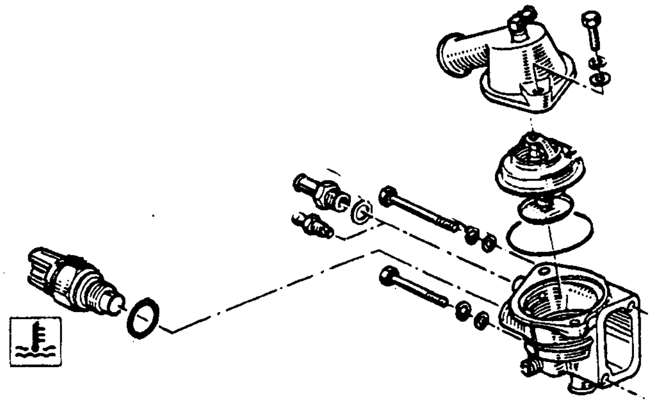
GENERAL
ENGINE COOLANT TEMPERATURE SWITCH

Max. tightening torque: 4 daNm (30 lb./ft.)

LOCATION ON ENGINE

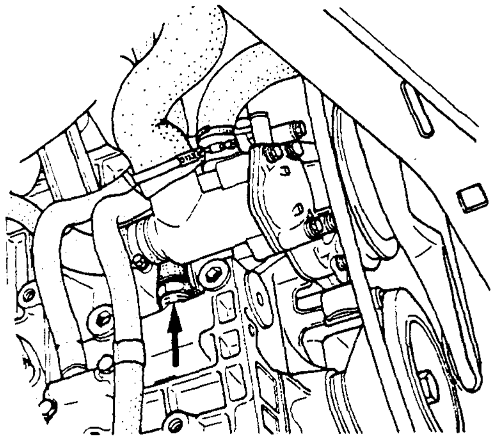
The coolant temperature switch is located in the thermostat housing on the right side of the engine. This switch has two spade terminals. (The other sensor, with a plug type connector, goes to the ECU.)





GENERAL
ENGINE OIL PRESSURE SWITCH

Tightening torque : 2 daNm (15 lb./ft.)

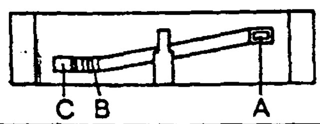


LOCATION ON ENGINE
The oil pressure switch is on the R.H. (passenger) side of the engine behind the water pump.

CHECKING
- There should be electrical contact between the switch terminal and the switch body when the engine is not running.
- As soon as the oil pressure exceeds 0.36 bar (5.1 psi), electrical contact should be broken.

Oil Level Gauge This gauge should be read before starting the engine, with the key in the ON position. The needle will move to the left after the engine starts.

Oil Level Gauge



A - Oil level FULL
B - ADD SOON: Oil level is low but vehicle is still driveable.
C - CAUTION: ADD OIL before driving vehicle.

STEERING COLUMN SWITCHES

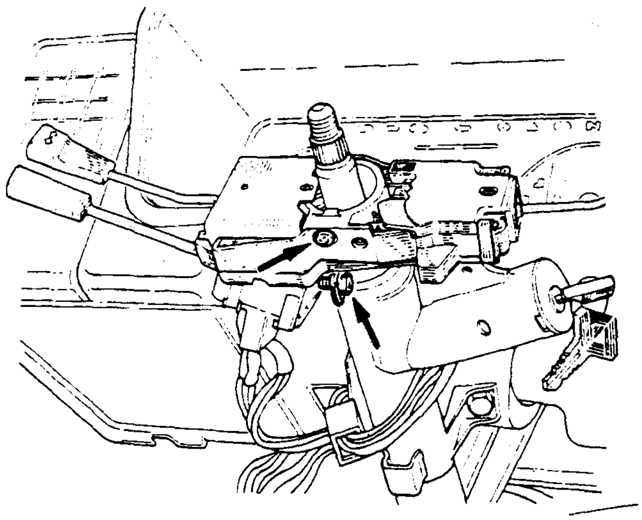
REMOVAL
Disconnect the battery.

Remove:
- the steering wheel
- and both steering column covers

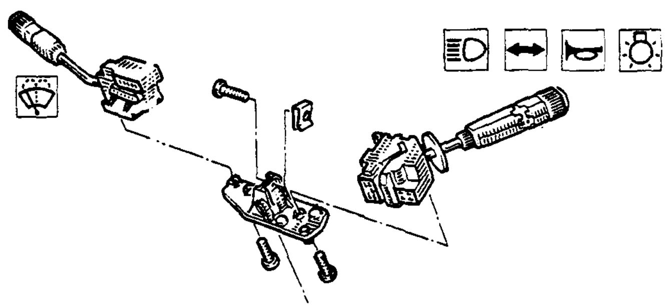
Disconnect switch wiring plugs.

Remove the screw.

Slide the switch assembly off the column.



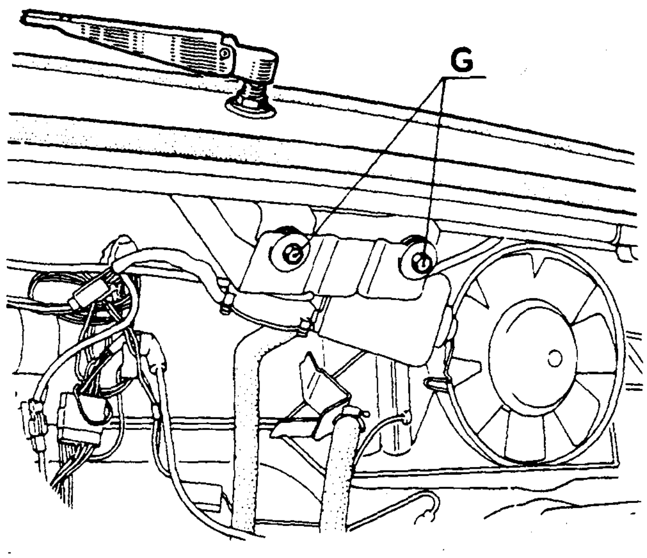
Both switches may be removed and replaced separately.



MECHANISM REMOVAL

- Disconnect the battery
- Remove the air inlet elbow
- Remove:
  - the windshield wiper arms
  - windshield wiper arm spindle nuts
  - connector
  - and 2 bolts (G).

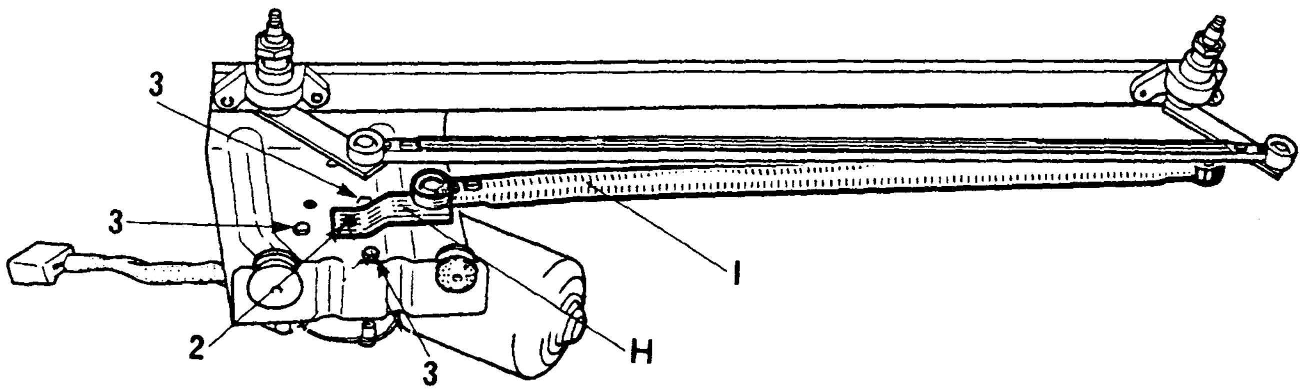
Remove the windshield wiper assembly.



SPECIAL POINT CONCERNING REASSEMBLY

With the motor in the "Stop" position, make sure that crank (H) and link (I) are in line.

Remove and replace the motor (Mechanism removed).



REMOVAL

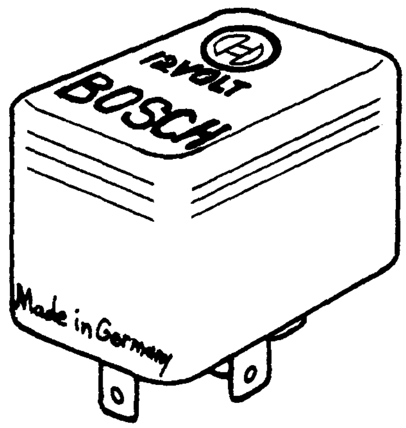
- Unscrew nut (2) holding the crank
- Unscrew screws (3).

SPECIAL POINTS CONCERNING REASSEMBLY

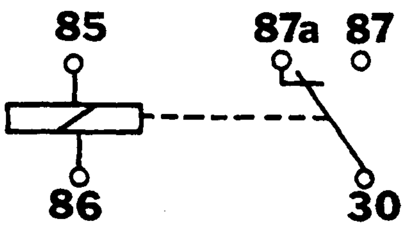
- Set the motor in the "Stop" position.
- Attach the motor to its plate, tighten crank (H) when it is in line with link (I).

GENERAL
BOSCH 5-PRONG RELAY

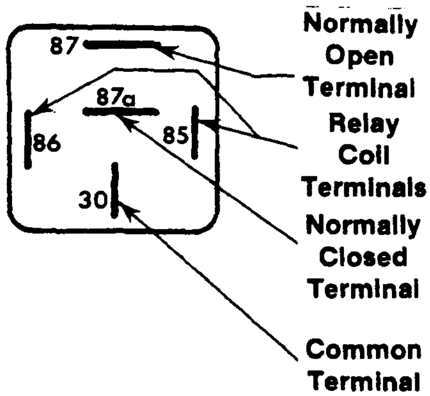
Various electrical systems throughout the coach use a Bosch 5 prong relay (or equivalent by another manufacturer). The relay schematic is shown here.



RELAY SCHEMATIC



5-Pin Relay (Typical)



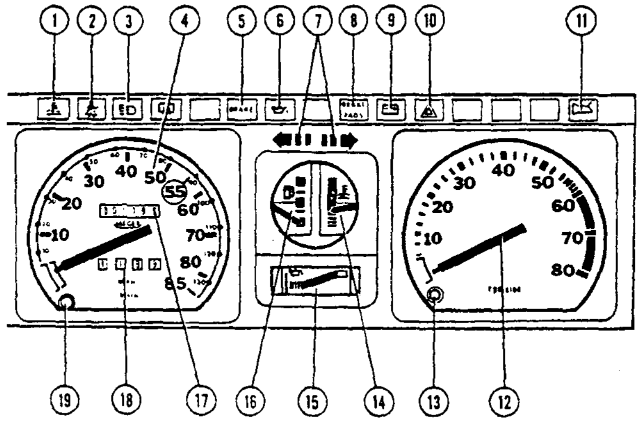
FUEL TANK SENDING UNIT TESTING

Fuel tank must be removed for this operation. See Fuel Tank Section "S".

- Connect an ohmmeter between the feed wire terminal and the tank gauge unit body or mount plate.
- Raise the float the desired level and note the resistance reading.

Fuel Level	Resistance Range (Ohms)
Full	2 - 12
3/4	46 - 60
1/2	86 - 108
1/4	150 - 180
Empty	280 - 320

INSTRUMENT CLUSTER
LAYOUT



INSTRUMENT PANEL

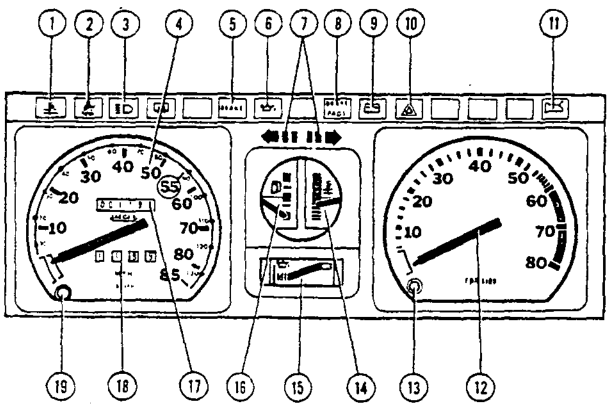
1. Coolant Temperature Warning - If this light comes on or you have other reasons to suspect that the engine is overheating, pull the vehicle over to the side of the road and shut the engine off immediately. Contact your dealer for assistance.

WARNING
Operating the vehicle under an engine overheating condition for even a short period of time can result in a risk of personal injury and serious vehicle damage.

2. Seat Belt Reminder - Lights comes on and tone sounds for 4-8 seconds after ignition is switched on as a reminder to fasten safety belts.
3. High Beam Indicator - Illuminated while headlight high beams are in use.
4. Speedometer
5. Brake Warning - Lights while handbrake is applied to any degree. Also lights if brake fluid level is low or if a brake circuit malfunction exists. If the light is on, be sure that the handbrake is fully released. If the light remains lit, stop the engine and check the brake fluid level. If the brake fluid level is normal, do not operate the vehicle until you have consulted your dealer.
6. Oil Pressure Warning - Illuminates when the ignition is switched on. It should go out as engine starts. If the light comes on while driving, stop the engine immediately and check oil. If the oil level is normal, a malfunction exists and your dealer should be consulted.
7. Turn Indicator Lights - Both arrows flash in unison while signaling either direction and during use of hazard flashers.
8. Brake Pad Wear Indicator - Light comes on when either of the front brake pads is worn to a predetermined level as a warning that brake service is needed.
9. Battery Charge Indicator - Light should go out as soon as the engine starts. If it illuminates while driving, stop the engine immediately and check drive belts. Tighten or replace as necessary. If drive belts are satisfactory, a malfunction of the charging system may exist.
10. Hazard Warning Indicator - Flashes while the hazard warning flashers are engaged.
11. Automatic Transmission Monitor - Lights up when the key is switched to the ON position to verify that all systems are functioning properly. The light should go out as soon as the engine is started. If the light comes on while driving, pull over to a level area on the side of the road, set the handbrake and check the transmission fluid level with the engine idling in Park. Add fluid if necessary. If fluid level is normal, contact your dealer for assistance.
12. Tachometer - Measures engine speed in revolutions per minute (rpm).
    * 0 - 5500 rpm: normal operating range
    * 5500 - 6000 rpm (red lined zone): power reserve for extremely short periods only
    * 6000 rpm or higher (solid red zone): engine rpm must be kept below this range or severe damage may result.

WARNING
Be sure to shut off the engine before attempting to check belts.

13. Panel Lighting Dimmer Knob - Controls the intensity of the instrument panel lighting.



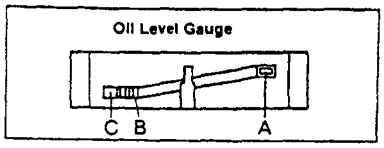
14. Coolant Temperature Gauge - If the gauge needle moves into the red zone (indicating an overheating condition) or you have other reasons to suspect that the engine is overheating, pull the vehicle over to the side of the road and shut the engine off immediately. Contact your dealer for assistance.

WARNING

Operating the vehicle during an engine over heating condition for even a short time can result in risk of personal injury and serious vehicle damage. Contact your dealer for assistance.

15. Oil Level Gauge - This gauge should be read before starting the engine, with the key in the ON position. The needle will move to the left after the engine starts.

    Vehicle must be on level surface for accuracy.
    A - Oil level FULL
    B - ADD SOON: Oil level is low but vehicle is still driveable.
    C - CAUTION: ADD OIL before driving vehicle.



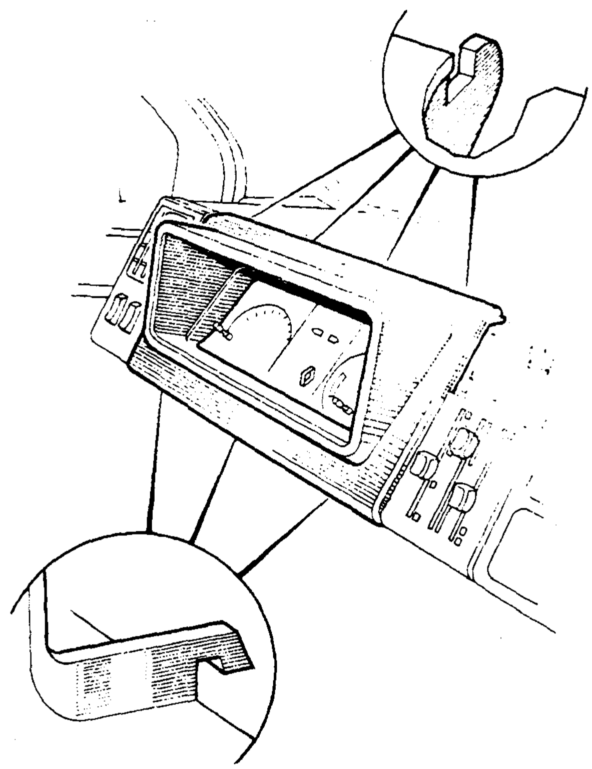
16. Fuel Gauge - As the needle moves into the red zone, fuel refilling is advisable.
17. Odometer - Records accumulated mileage on vehicle.
18. Trip Recorder - Records mileage on trips or between fuel fills.
19. Trip Recorder Reset Knob - Push in and turn to the right to reset display back to "O".

CAUTION

Stop vehicle and shut off engine at once if any of the warning lights come on, any gauge enters the "danger" zone, smoke or steam emits from beneath the hood, engine suddenly loses power, or any sudden change in engine operation occurs. Failure to do so may result in severe engine damage.

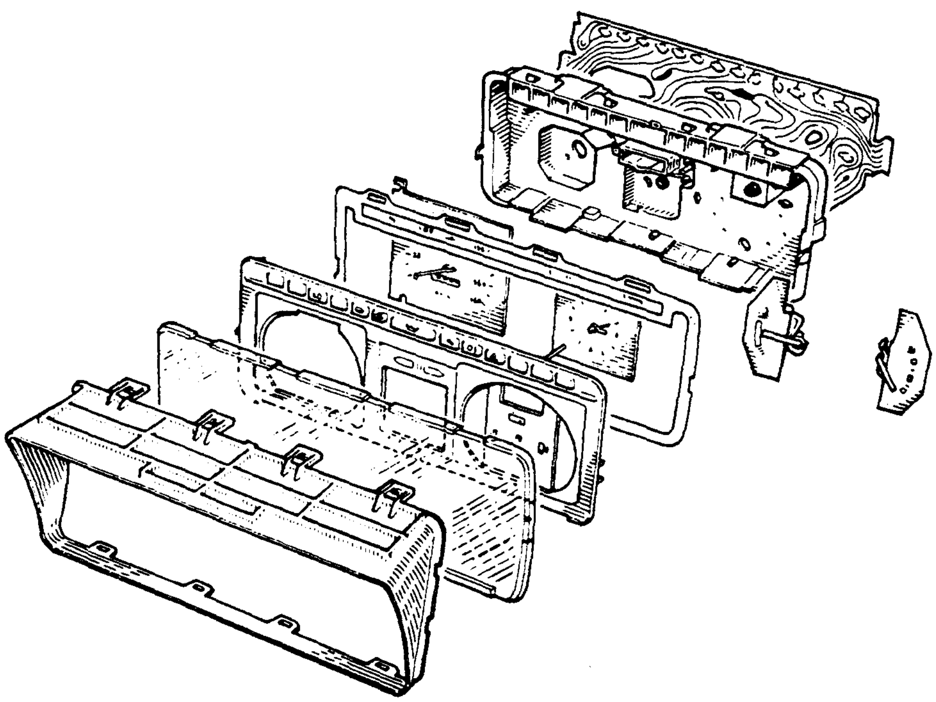
INSTRUMENT CLUSTER
REMOVE AND REPLACE

CAUTION
Stop vehicle and shut off engine at once if any of the warning lights come on, any gauge enters the "danger" zone, smoke or steam emits from beneath the hood, engine suddenly loses power, or any sudden change in engine operation occurs. Failure to do so may result in severe engine damage.

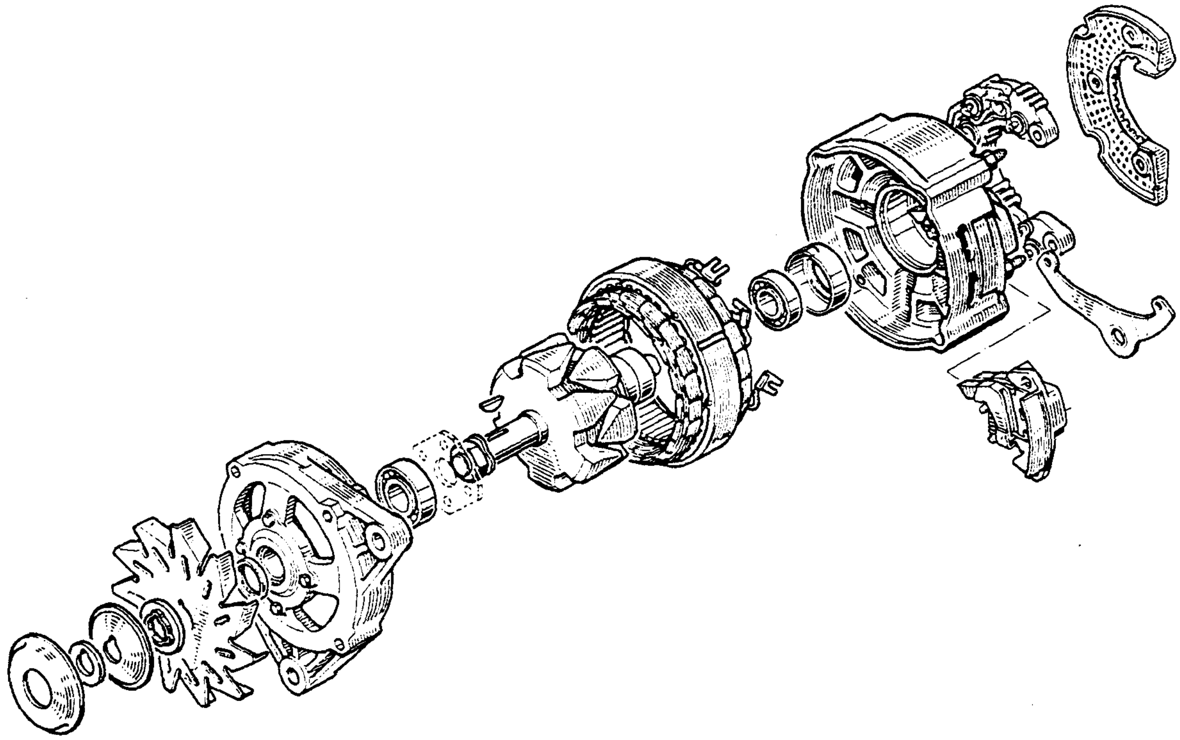


REMOVAL
Disconnect battery.

- Remove the instrument panel cowl.
- Press down on the top of the cowl then pull it towards the steering wheel.
- Remove gauge cluster assembly. Depress upper retaining clips and tip toward steering wheel. Harnesses and speedometer cable can now be disconnected for complete removal.



ALTERNATOR
EXPLODED VIEW



ALTERNATOR

OPERATION - DIAGNOSIS

ALTERNATOR
WITH
BUILT-IN REGULATOR

These vehicles have alternators with a built-in regulator. The warning light works as follows:
- it is illuminated as soon as the ignition is switched on.
- it goes out as soon as the engine starts.
- there is a failure in the charging circuit if it illuminates while the engine is running.

Diagnosing Problems

WARNING
Disconnect the battery and regulator if any electric arc welding is to be done on the vehicle.

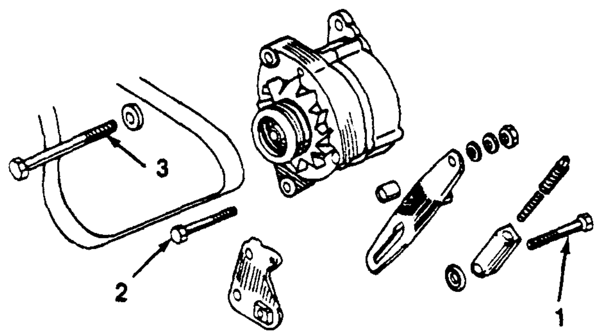
Checking the current:
- Connect a voltmeter across the battery terminals and read of the battery current
- Start the engine and increase the revs. until the voltmeter needle remains steady on the regulated current figure. This should be between 13.5 and 15v.
- Switch on as many accessories as possible; the controlled current should remain steady between 13.5 and 15v.
- If the warning light does not illuminate when the ignition is switched on, check for:
  - broken alternator drive belt,
  - broken charging wire,
  - internal alternator failure (rotor, starter, diodes or brushes),
  - faulty regulator.

If the customer complains of a charging failure although the warning light functions correctly:
- check the regulator if the regulated current is less than 13.5v. The problem may be due to:
  - a faulty diode,
  - a severed phase,
  - or carboned-up tracks.

The regulator should be replaced only after the first 3 possibilities have been checked and found correct.

ALTERNATOR
REMOVE AND REPLACE

Do not use a screwdriver or similar tool to force the belt off or onto a pulley as the synthetic fibers will be damaged and the belt will fail prematurely.



REMOVAL
Disconnect the negative battery cable.

Remove the splash shield.

Loosen the tensioner bolt (1).

Remove the mounting bolt (2) and swing the tensioner to the side.

Remove the serpentine belt.

Remove the mounting bolt (3) and lower the alternator.

Disconnect the wire harness from the alternator.

INSTALLATION
Connect the wire harness to the alternator.

Position the alternator at the mounting bracket and install the attaching bolt (3).

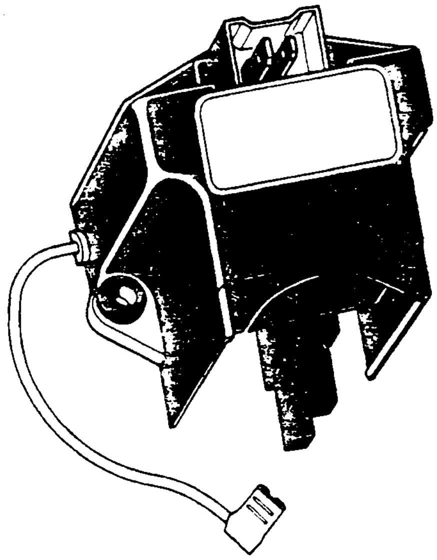
Install the serpentine belt.

Position the tensioner and install the mounting bolt (2).

Adjust the belt tension. Refer to page B7-1 for the adjustment procedure.

REMOVING REGULATOR

These alternators are similar to others of rear mount regulator design; the disassembly procedures are similar, the regulator being mounted to the brush holder; remove in similar fashion to a brush holder:
- Disconnect the wire from the diode bridge
- Remove both hex, head bolts from the regulator
- Remove regulator



NOTE: The alternator need not be removed for this operation.

Changing a brush holder.

Unsolder the 3 terminals and remove the brush holder.

Bolt the new brush holder to the regulator to prevent straining it when mounting it to the alternator and possible damage to the regulator printed circuit.

Resolder the 3 terminals taking care not to melt the plastic.

STARTER
REMOVE AND REPLACE

NOTE: The starter is removed from below.

REMOVAL

- Disconnect the negative battery cable.
- Disconnect the intake manifold support brackets (1) at the base plate (2) and remove the base plate from the engine block (gas engine vehicles only).
- Remove the three starter motor-to-bellhousing mounting bolts (4).
- Remove the starter mounting bracket bolts (3).
- Lower the starter and disconnect the wire harness to the starter solenoid.

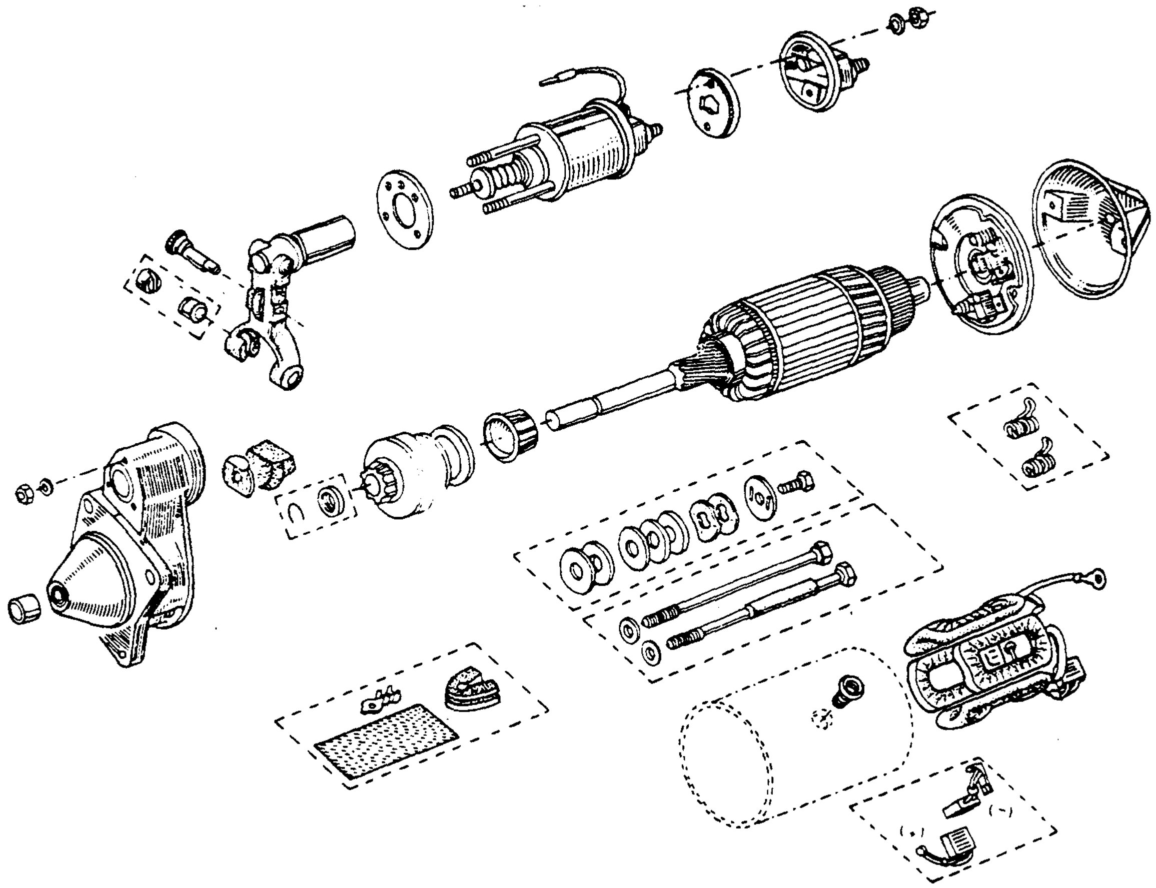
INSTALLATION

- Connect the wire harness to the starter solenoid.
  IMPORTANT
  Make sure alignment dowel is mounted in the starter or bell housing. Mounting the starter without the dowel will result in starter drive-to-flywheel misalignment.
- Position the starter in the bellhousing and install the three mounting bolts (4).

NOTE: Tighten these bolts before proceeding to the next step.

- Install the starter mounting bracket attaching bolts (3).
- Install the base plate (2) on the engine block and the brackets (1) on the base plate.
- Connect the negative battery cable.

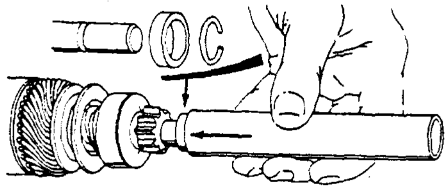
STARTER
PARIS-RHONE D10E 88



COMPONENT REPLACEMENT

STARTING DRIVE MECHANISM

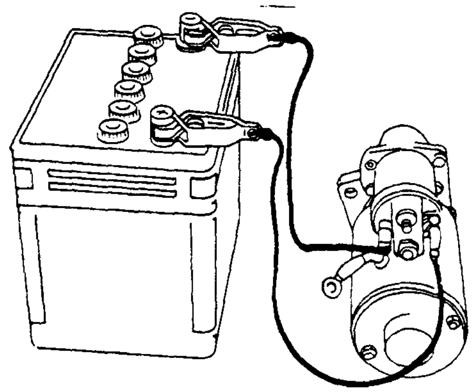
After removing the armature, tap the stop collar with a drift to disengage the retaining clip.



When installing the starter drive mechanism, put the clip back in place and push the stop collar over the clip.

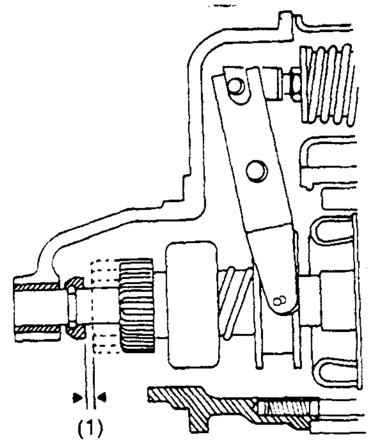
ADJUSTING THE STARTING DRIVE MECHANISM - SOLENOID LINKAGE FORK

Connect the solenoid to a battery.

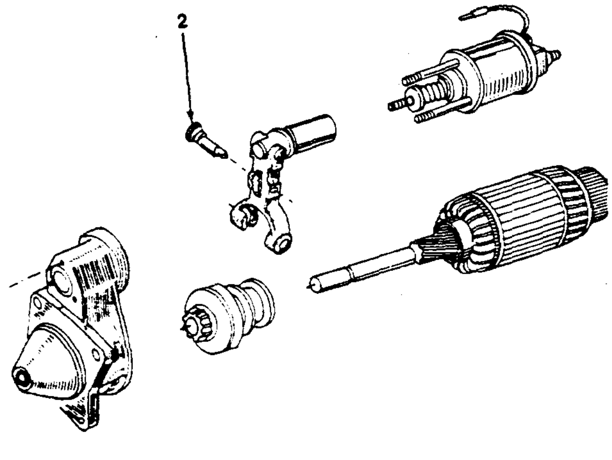


With the solenoid energized, measure the clearance (1) between the drive pinion and the stop.

NOTE: Clearance = 1.5 mm (0.059 in)



If the clearance is not correct, adjust it with an eccentric pin (2) in the fork.

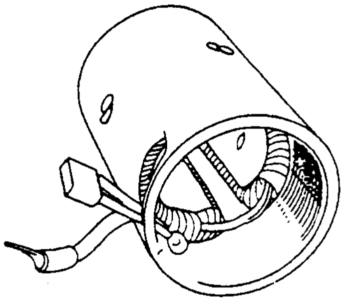


STARTER
PARIS-RHONE D10E88

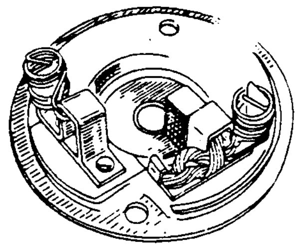
BRUSH REPLACEMENT

Remove:

- the starter
- the case

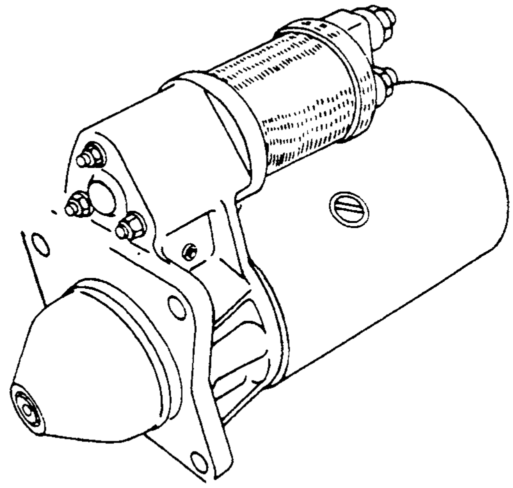


- Unsolder the brushes to be replaced.
- Solder on the replacement brushes.
- Check the armature and reinstall the starter.

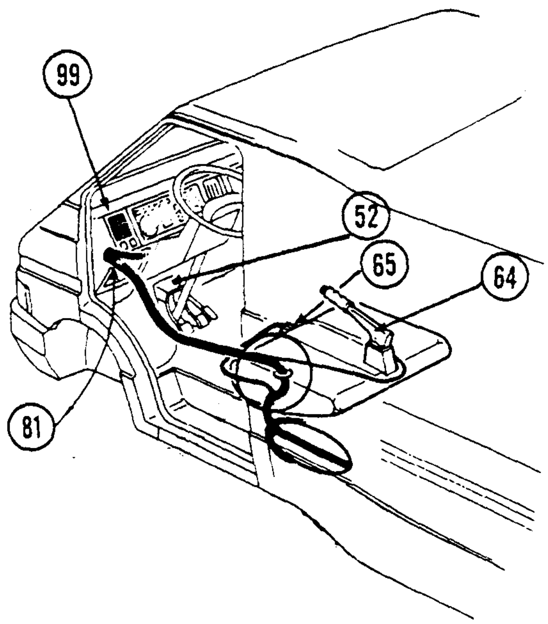


SOLENOID REPLACEMENT

Unscrew:
- the electrical connection
- the mounting nuts
- Remove the solenoid
- During installation, put the spring in place and check the seal.

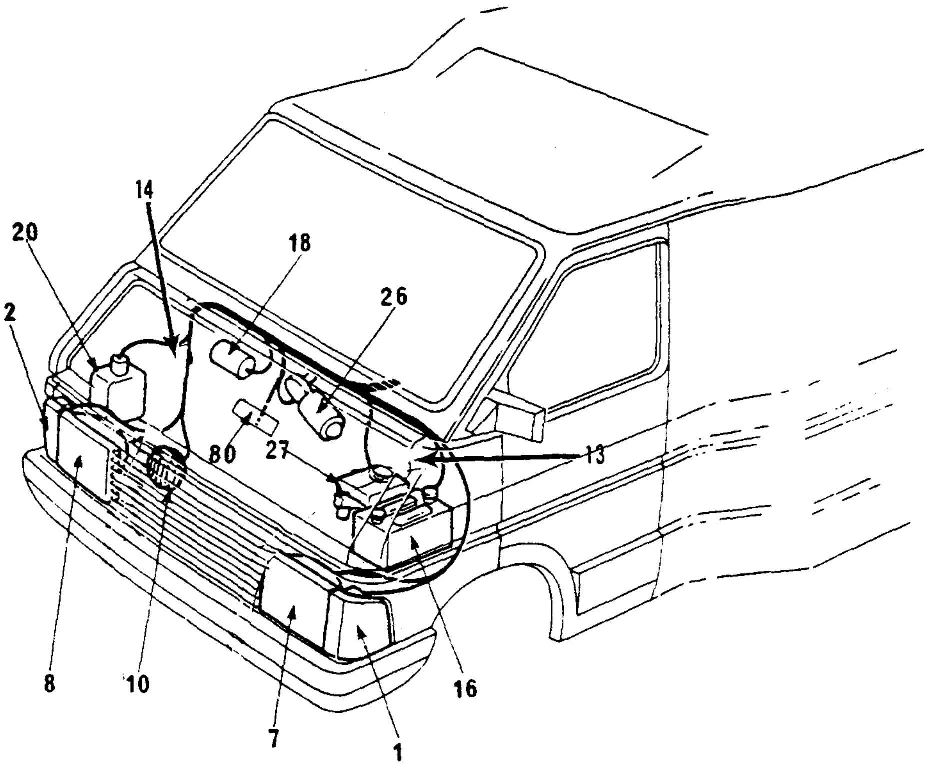


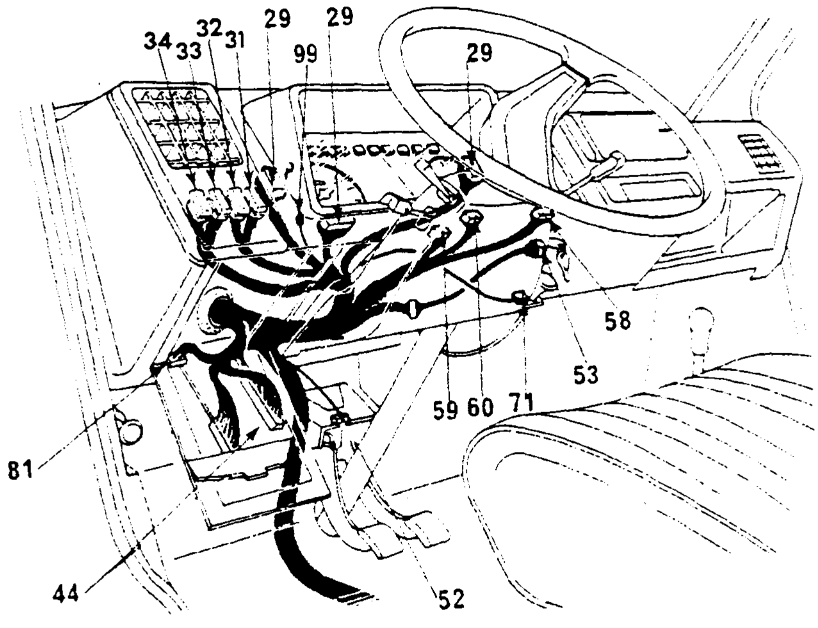
WIRE HARNESS
REAR WIRING HARNESS
ROUTING



52 - Brakelights switch
64 - Handbrake
65 - Fuel tank gauge unit
81 - Front harness junction block
99 - Dashboard ground

WIRE HARNESS
ENGINE AND FRONT HARNESS
ROUTING





WIRE HARNESS
ENGINE AND FRONT HARNESS ROUTING

1 - L.H. sidelight and turn signal
2 - R.H. sidelight and turn signal
7 - L.H. headlight
8 - R.H. headlight
10 - R.H. horn
13 - L.H. ground
14 - R.H. ground
16 - Battery
18 - Ignition coil
20 - Windshield washer pump
26 - Windshield wiper motor plate
27 - Brake master cylinder

29 - Instrument panel junction blocks
31 - Rear auto heater switch
32 - Rear wiper/washer switch
33 - Dual battery switch
34 - "Hazard" warning lights switch
44 - Accessories plate
52 - Brake light switch
53 - Ignition - starter - anti-theft switch
58 - Windshield wiper-washer switch
59 - Combination lighting switch
60 - Turn signal switch
80 - Connector - front and engine harness
81 - Connector - front and rear harnesses
99 - Dashboard ground
106 - Dual battery switch

WIRING DIAGRAMS

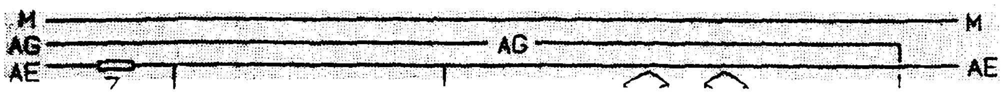
Wiring Diagram Index:

WIRE ASSEMBLY IDENTIFICATION

The Harness Code tables at the beginning of each set of diagrams list the letter codes and descriptions of wire assemblies in that set of diagrams.

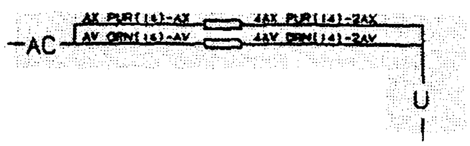
Figure 1 on the following page illustrates the symbols used to identify wire assemblies and splices within wire assemblies as described below.

1. A wire assembly is coded with one or two letters in configuration like this:



2. An internal splice within a given wire assembly looks like these examples:

3. A splice that connects two separate wire assemblies or a wire assembly to a component will look like this:



(Note absence of letter code beside splice symbol)

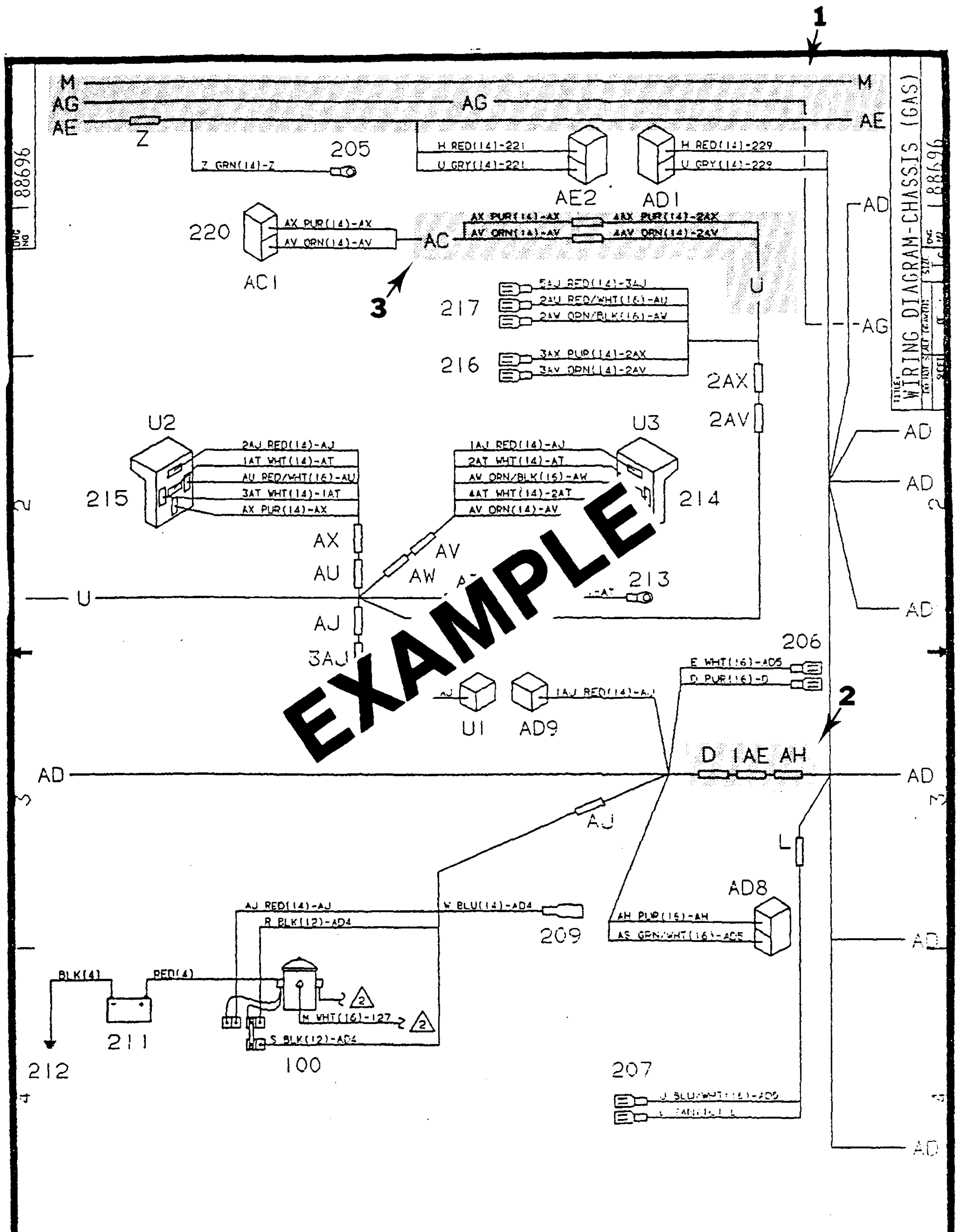

1
2
3
M
AG
AE
Z
Z GRN(14)-Z
205
H RED(14)-221
U GRY(14)-221
AE2
AD1
H RED(14)-229
U GRY(14)-229
220
AX PUR(14)-AX
AV ORN(14)-AV
AC1
AC
AX PUR(14)-AX
AV ORN(14)-AV
4AX PUR(14)-2AX
4AV ORN(14)-2AV
U
217
216
2AX
2AV
U2
U3
215
214
2AJ RED(14)-AJ
1AT WHT(14)-AT
AU RED/WHT(16)-AU
3AT WHT(14)-1AT
AX PUR(14)-AX
1AJ RED(14)-AJ
2AT WHT(14)-AT
AV ORN/BLK(16)-AW
4AT WHT(14)-2AT
AV ORN(14)-AV
AX
AU
AV
AW
213
AJ
3AJ
EXAMPLE
206
E WHT(16)-AD5
D PUR(16)-D
U1
AD9
1AJ RED(14)-AJ
AD
D 1AE AH
AJ
L
AD8
AJ RED(14)-AJ
R BLK(12)-AD4
W BLU(14)-AD4
209
AH PUR(16)-AH
BLK(4)
RED(4)
211
212
100
M WHT(16)-127
S BLK(12)-AD4
207
WIRING DIAGRAM-CHASSIS (GAS)
188696

Figure 1

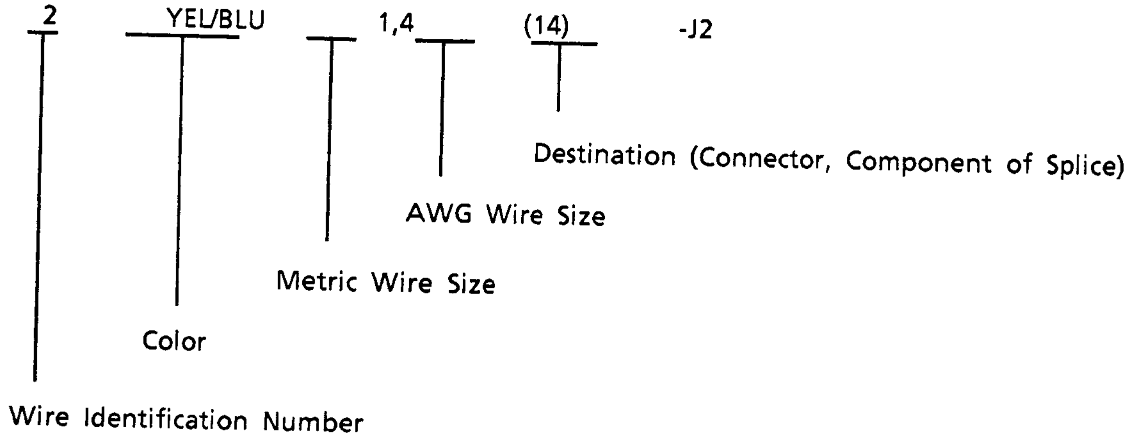
WIRE IDENTIFICATION

Each wire in the diagram is identified with a code that includes a wire identification number, color, gauge and destination or origin of the wire.

CHASSIS ASSEMBLY WIRES

Each wire within a chassis wire assembly is identified on a diagram with a code as shown below. The code contains two wire gauge sizes - one in Metric wire thickness and the other in AWG (American Wire Gauge) size.

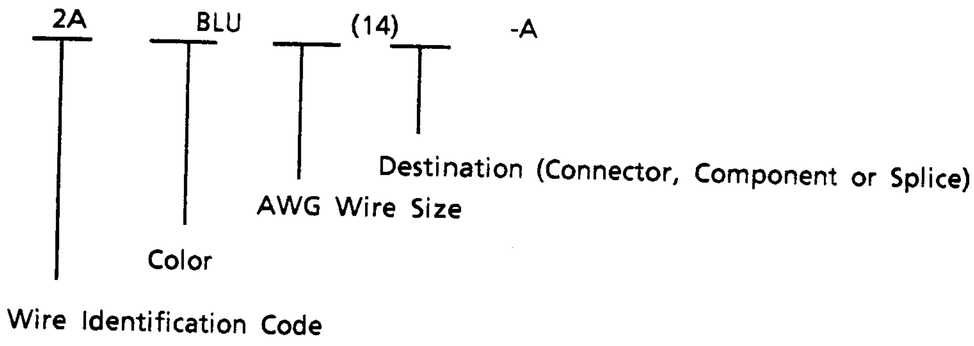
Example: 2YEL/BLU1,4 (14)-J2



WINNEBAGO ASSEMBLY WIRES

Wires in a Winnebago wire assembly are identified similarly to the chassis wires, except that the code does not include a Metric wire size.

Example: 2A BLU(14)-A



COMPONENT LOCATIONS

NO.	NAME	SHT. NO.
16	WINDSHIELD WASHER FLUID RESERVOIR	03
27	COOLING FANS	02
28	ALTERNATOR	02
29	SENSOR-RADIATOR COOLANT TEMP,LOWER	03
30	A/C COMPRESSOR	03
31	PRESSURE SWITCH-P/S,A/C	03
32	PRESSURE SWITCH-COOLING FANS	03
33	PRESSURE SWITCH-A/C,LOW	03
34	PRESSURE SWITCH-A/C,HIGH	03
35	SENSOR-RADIATOR COOLANT TEMP,UPPER	03
36	CONNECTOR-TO 209	02
37	RELAY-FAN	02
38	RELAY-A/C CLUTCH	02
39	RELAY-FAN	02
40	CIRCUIT BREAKER-20 AMP	02
41	CIRCUIT BREAKER-20 AMP	02
42	DIODE	03
43	DIODE	03
44	DIODE	03
45	SOLENOID VALVE	02
46	PRESSURE SWITCH	02
48	RELAY-EMISSION TIMER	02
49	AUTOMATIC TRANSMISSION COMPUTER	03
50	HEADLAMP,RIGHT	01
51	HEADLAMP,LEFT	01
52	HORN	01
53	AIR BY-PASS VALVE	03
55	IGNITION MODULE	03
57	RELAY-NEUTRAL START	04
58	ACCELERATOR CABLE TERMINALS OR CRUISE CNTRL	04
60	SPLICE-TO CRUISE CONTROL	07
64	OVERFLOW BOTTLE	04
65	BRAKE FLUID RESERVOIR	03
67	STARTER	03
70	AIRFLOW METER	02
72	TURN AND PARK LAMP,RIGHT FRONT	01
73	SIDEMARKER,RIGHT FRONT	01
74	TURN AND PARK LAMP,LEFT FRONT	01
75	SIDEMARKER,LEFT FRONT	01
78	RELAY-RPM	06
79	LAMBDA SENSOR	06
85	BAROMETRIC PRESSURE SENSOR	10
86	FUEL PUMP	11
87	INJECTION COMPUTER	11
92	RELAY-TACHYMETRIQUE	10
97	HEATER FAN	04
98	WINDSHIELD WIPER MOTOR	04
100	BREAKER PLATE	05,13,17
102	HAZARD FLASHER SWITCH	07
109	CONNECTOR-TO AD08	07
110	CONNECTOR-TO AD(P16 ORN/BLK)	07
112	FUSE PANEL	07
113	BRAKE LIGHT SWITCH	07
114	IGNITION SWITCH	08
119	HEATER CONTROL SWITCH	08
120	INSTRUMENT CLUSTER	08
125	HEATER CONTROL LIGHTS	08
127	BATTERY CHANGEOVER SWITCH	07
129	WATER TEMPERATURE FLASHER	09
130	TAILLIGHT ADAPTER ASSEMBLY	10
131	RELAY-CLEARANCE LIGHTS	10
133	RELAY-HIGH ENGINE TEMP	10
134	DIODE	09
135	CAB DOOR SWITCH,LEFT	09
137	PARK BRAKE	10
138	PARK BRAKE LIGHT	10
139	SEAT BELT	10
140	FUEL TANK SENDING UNIT	11
141	SPLICE-RENAULT TO WINNEBAGO	11
142	ASHTRAY LIGHT,LEFT	11,16
144	FRONT CLEARANCE LIGHT-LEFT	12,16
145	FRONT CLEARANCE LIGHT-CENTER	12,16
146	FRONT CLEARANCE LIGHT-RIGHT	12,16
147	FRONT CLEARANCE LIGHT-RIGHT SIDE	12,16
148	DOME LIGHT	12,16
149	ASHTRAY LIGHT,RIGHT	12,16
150	FOOT LIGHT,RIGHT	12,16
151	VISOR LIGHT	12,16
152	REAR CLEARANCE LIGHT-LEFT SIDE	15,18
153	REAR CLEARANCE LIGHT-LEFT	15,18
154	REAR CLEARANCE LIGHT-CENTER	15,18
155	REAR CLEARANCE LIGHT-RIGHT	15,18
156	REAR CLEARANCE LIGHT-RIGHT SIDE	15,18
157	SIDE MARKER,RIGHT REAR	15,18
158	TAIL LIGHT,RIGHT	15,18
159	SIDE MARKER,LEFT REAR	15,18
160	TAIL LIGHT,LEFT	15,18
161	LICENSE PLATE LIGHT	15,18
163	GROUND	10
164	INTERNAL SPLICE	05
165	INTERNAL SPLICE	05
166	AIR BYPASS SOLENOID	05
167	INJECTOR-CYLINDER #1	05
168	INJECTOR-CYLINDER #2	05
169	INJECTOR-CYLINDER #3	05
170	INJECTOR-COLD START	05
171	GROUND	05
172	THROTTLE POSITION SWITCH	05
173	INJECTOR-CYLINDER #4	05
174	WATER TEMPERATURE SWITCH-THERMO TIME	05
175	WATER TEMPERATURE SENSOR-INJECTION SYSTEM	05
176	CAB DOOR SWITCH,RIGHT	09
177	TURN SIGNAL/HEADLAMP/WASHER MECHANISM	09
178	FRONT LEFT CLEARANCE LIGHT-LEFT SIDE	12,16
187	CONNECTOR-UNUSED	08
188	CONNECTOR-UNUSED	08
189	CONNECTOR-UNUSED	09
190	RELAY-PUMP,FNL DRIVE	02
191	SWITCH-THERMO	02
192	PUMP-FNL DRIVE	02
193	CIRCUIT BREAKER-20 AMP	02
194	CONNECTOR TO AD6	08
195	BATTERY CONDITION SWITCH	07
196	BATTERY CONDITION GAUGE	07
197	DIODE-IGNITION SWITCH	08
199	CIGARETTE LIGHTER	07
200	BRAKE PAD SENSOR	01
201	AUTO A/C PLUG	12,16
202	AUTO A/C GROUND	12,16
203	RELAY-REAR W/W AND AUTO HEATER	12
204	RADIO PLUG	12
205	GROUND BAR	13
206	LEFT DOOR SPEAKER	13,17
207	RIGHT DOOR SPEAKER	13,16
209	TO 36	13,17
211	BATTERY (CHASSIS)	13,17
212	BATTERY GROUND	13,17
213	POWER DOOR LOCK,GROUND	13,17
214	RELAY-POWER DOOR LOCK(UNLOCK)	13,17
215	RELAY-POWER DOOR LOCK(LOCK)	13,17
216	MOTOR-POWER DOOR,RIGHT	13,17
217	SWITCH-POWER DOOR,RIGHT	13,17
218	MOTOR-POWER DOOR,LEFT	14,17
219	SWITCH-POWER DOOR,LEFT	14,17
220	MOTOR-POWER DOOR,COACH	13,17
221	REAR AUTO HEATER	14
222	MOTOR-REAR AUTO HEATER	14
223	SWITCH-AISLE LIGHT	14
224	AISLE LIGHT-DOOR	14
225	AISLE LIGHT-REAR	14
226	SPEAKER-RIGHT REAR	14,17
227	SPEAKER-LEFT REAR	14,17
228	SWITCH REAR WIPER/WASHER	14
229	SWITCH-REAR AUTO HEATER	14
230	GROUND-TAIL LIGHTS	15,18
231	REAR WIPER MOTOR	15
232	REAR WASHER BOTTLE	15
234	GROUND-RELAY	12
235	CIRCUIT BREAKER-15 AMP	17
236	CONNECTOR-UNUSED	10

TITLE: WIRING DIAGRAM-CHASSIS (GAS)

DWG NO 188696

DO NOT SCALE DRAWING

DWG NO 188696

CONNECTOR LOCATIONS

NO.	NAME	SHT.NO.
A1	CONNECTOR-FUSE PANEL (WHITE)	07
A2	CONNECTOR-FUSE PANEL (YELLOW)	07
A3	CONNECTOR-FUSE PANEL (BROWN)	07
A4	CONNECTOR-FUSE PANEL (GREEN)	07
A5	CONNECTOR-FUSE PANEL (RED)	07
A7	CONNECTOR-TURN SIGNAL SWITCH	09
A8	CONNECTOR-WINDSHIELD WIPER SWITCH	09
A9	CONNECTOR-LIGHT SWITCH	09
A10	CONNECTOR-INSTRUMENT CLUSTER	08
A11	CONNECTOR-INSTRUMENT CLUSTER	08
A12	CONNECTOR-INSTRUMENT CLUSTER	08
A13	CONNECTOR-EMERGENCY FLASHER SWITCH	07
A14	CONNECTOR-WINDSHIELD WIPER MOTOR	04
A15	CONNECTOR-TO M1	06
A16	CONNECTOR-TO M3	09
A17	CONNECTOR-TO G1	04
A19	CONNECTOR-TO X1	08
A20	CONNECTOR-HEATER SWITCH	08
A21	CONNECTOR-HEATER MOTOR	04
A22	CONNECTOR-UNUSED	01
A23	CONNECTOR-TO C1	03
A26	CONNECTOR-UNUSED	07
A27	CONNECTOR-BRAKE LIGHT SWITCH	07
A28	CONNECTOR-IGNITION SWITCH	08
A29	CONNECTOR-IGNITION SWITCH	08
A31	CONNECTOR-TO K3	03
A32	CONNECTOR-WIPER DELAY RELAY	08
A35	CONNECTOR-TO J1	08
A36	CONNECTOR-TO K4	03
A38	CONNECTOR-TO M2	06
A39	CONNECTOR-TO A41	08
A40	CONNECTOR-TO F5	04
A41	CONNECTOR-TO A39	08
A42	CONNECTOR-UNUSED	01
A46	CONNECTOR-FUSE PANEL	07
A61	CONNECTOR-TO G6	04
A62	GROUND-FIREWALL	03
A66	SPLICE-RADIO MEMORY	07
A67	CONNECTOR-UNUSED	08
A68	CONNECTOR-TO L56	01
A69	CONNECTOR-BRAKE PAN SENSOR	01
A70	CONNECTOR-BRAKE PAN SENSOR	01
A71	INTERNAL SPLICE	03
A72	INTERNAL SPLICE	06
A73	SPLICE-TO 72 AND 73	01
A74	SPLICE-TO 74 AND 75	01
A76	GROUND-FIREWALL	03
A77	INTERNAL SPLICE	06
A78	INTERNAL SPLICE	06
A79	INTERNAL SPLICE	06
C1	CONNECTOR-TO A23	03
C2	CONNECTOR-TO WINDSHIELD WASHER PUMP	03
D1	CONNECTOR-TO A69 AND A70	01
E1	CONNECTOR-INJECTION COMPUTER	11
E2	CONNECTOR-BAROMETRIC PRESSURE SENSOR	10
E3	CONNECTOR-TO J2	09
E4	DIAGNOSTIC PLUG	06
E5	CONNECTOR-RELAY-RPM	06
E6	CONNECTOR-TO T2	05
E7	DIAGNOSTIC PLUG	06
E8	CONNECTOR-TO T1	05
E9	CONNECTOR-AIR FLOW METER	02
E10	CONNECTOR-TO K2	03
E11	CONNECTOR-TO J4	10
E12	CONNECTOR-TO J3	10
E20	INTERNAL SPLICE	10
E21	INTERNAL SPLICE	10
E22	INTERNAL SPLICE	11
E23	INTERNAL SPLICE	10
E24	INTERNAL SPLICE	10
E25	INTERNAL SPLICE	09
E26	INTERNAL SPLICE	09
F1	CONNECTOR-TO G2	04
F3	CONNECTOR-AUTOMATIC TRANSMISSION COMPUTER	03
F4	CONNECTOR-RELAY-NEUTRAL START	04
F5	CONNECTOR-TO A40	04
F11	CONNECTOR-TO K18	04
G1	CONNECTOR-TO A17	04
G2	CONNECTOR-TO F1	04
G3	CONNECTOR-ALTERNATOR	02
G4	CONNECTOR-TO H	04
G6	CONNECTOR-TO A61	04
G10	TERMINAL-ALTERNATOR,POSITIVE	02
G11	WATER TEMPERATURE SENSOR (LIGHT)	02
G12	WATER TEMPERATURE SENSOR (GUAGE)	02
G13	OIL PRESSURE SENSOR	02
H	CONNECTOR-TO G4	04
J1	CONNECTOR-TO A35	08
J2	CONNECTOR-TO E3	09
J3	CONNECTOR-TO E12	10
J4	CONNECTOR-TO E11	10
J5	CONNECTOR-RELAY-TACHYMETRIQUE	10

NO.	DESCRIPTION	SHT.NO.
K1	CONNECTOR-IGNITION MODULE	03
K2	CONNECTOR-TO E10	03
K3	CONNECTOR-TO A31	03
K4	CONNECTOR-TO A36	03
K5	CONNECTOR-RELAY-EMISSION TIMER	02
K6	CONNECTOR-PRESSURE SWITCH	02
K18	CONNECTOR-TO F11	04
K24	CONNECTOR-TO L44	02
L1	CONNECTOR-RELAY-FAN	02
L2	CONNECTOR-RELAY-A/C CLUTCH	02
L3	CONNECTOR-RELAY-FAN	02
L4	CONNECTOR-PRESSURE SWITCH-P/S,A/C	03
L5	CONNECTOR-PRESSURE SWITCH-COOLING FANS	03
L6	CONNECTOR-PRESSURE SWITCH-A/C,LOW	03
L7	CONNECTOR-PRESSURE SWITCH-A/C,HIGH	03
L10	CONNECTOR-COOLING FANS	02
L12	CONNECTOR-COOLING FANS	02
L24	TERMINAL-ALTERNATOR,NEGATIVE	02
L44	CONNECTOR-TO K24	02
L56	CONNECTOR-TO A68	01
L74	INTERNAL SPLICE	02
M1	CONNECTOR-TO A15	06
M2	CONNECTOR-TO A38	06
M3	CONNECTOR-TO A16	09
M4	CONNECTOR-TO W21	10
M5	CONNECTOR-RELAY CLEARANCE LIGHTS	10
M6	CONNECTOR-TAIL LIGHT ADAPTER ASSEMBLY	10
M9	CONNECTOR-RELAY-HIGH ENGINE TEMP	10
M10	CONNECTOR-TO AD3 OR (AG1)	12
M11	CONNECTOR-TO AE1	12
M12	CONNECTOR-TO AD2	12
M13	CONNECTOR-TO S1	14
M14	CONNECTOR-TO S2	14
M15	CONNECTOR-TO S3	14
M16	CONNECTOR-TO S4	14
M17	UNUSED	16
M18	CONNECTOR-TO N	10
M19	CONNECTOR-TO S6	18
M20	CONNECTOR-TO P	10
M21	CONNECTOR-TO S5	18
S1	CONNECTOR-TO M13	14
S2	CONNECTOR-TO M14	14
S3	CONNECTOR-TO M15	14
S4	CONNECTOR-TO M16	14
S5	CONNECTOR-TO M21	18
S6	CONNECTOR-TO M19	18
T1	CONNECTOR-TO E8	05
T2	CONNECTOR-TO E6	05
T3	CONNECTOR-THROTTLE POSITION SWITCH	05
T4	CONNECTOR-AIR BYPASS SOLENOID	05
T5	CONNECTOR-INJECTOR-CYLINDER #1	05
T6	CONNECTOR-INJECTOR-CYLINDER #2	05
T7	CONNECTOR-INJECTOR-COLD START	05
T8	CONNECTOR-INJECTOR-CYLINDER #3	05
T9	CONNECTOR-INJECTOR-CYLINDER #4	05
T10	CONNECTOR-WATER TEMPERATURE SWITCH	05
T11	CONNECTOR-WATER TEMPERATURE SENSOR	05
U1	CONNECTOR-TO AD9	13
U2	CONNECTOR-TO RELAY (LOCK)	13.17
U3	CONNECTOR-TO RELAY (UNLOCK)	13.17
W1	CONNECTOR-CHIME	10
W21	CONNECTOR-TO M4	10
X1	CONNECTOR-TO A19	08
X2	UNUSED	07
X3	CONNECTOR-CIGARETTE LIGHTER	07
AB1	CONNECTOR-RELAY-PUMP,FNL DRIVE	02
AB2	CONNECTOR-PUMP-FNL DRIVE	02
AB3	INTERNAL SPLICE	02
AB4	INTERNAL SPLICE	02
AC1	MOTOR-POWER DOOR LOCK,COACH	13.17
AD1	CONNECTOR-TO AE2	12
AD2	CONNECTOR-TO M12	12
AD3	CONNECTOR-TO M10 OR AG1	12
AD4	CONNECTOR-AUTO A/C	12.16
AD5	CONNECTOR-RADIO	12.16
AD6	CONNECTOR-TO 194	12.16
AD7	CONNECTOR-RELAY-REAR W/W AND AUTO HEATER	12
AD8	CONNECTOR-TO 109	13.17
AD9	CONNECTOR-TO U1	13
AD10	CONNECTOR-TO AH1	16
AD11	CONNECTOR-TO AG2	16
AE1	CONNECTOR-TO M11	12
AE2	CONNECTOR-TO AD1	13
AE3	CONNECTOR-TO 222	14
AG1	CONNECTOR-TO AD3	12
AG2	CONNECTOR-TO AD11	16
AH1	CONNECTOR-TO AD10	16

TITLE: WIRING DIAGRAM-CHASSIS (GAS)

DO NOT SCALE DRAWING | SIZE T | DWG NO 188696 | SHEET

DWG NO 88696

HARNESS CODES

WIRE ASM	DESCRIPTION
A	WIRE ASM-AUTO,FRONT
C	WIRE ASM-PUMP,W/S WASHER
D	WIRE ASM-BRAKE PAD WEAR
E	WIRE ASM-INJECTION,ELECT
F	WIRE ASM-TRANS,AUTO
G	WIRE ASM-ENGINE
H	WIRE ASM-OVERFLOW BOTTLE LIGHT
J	WIRE ASM-INJECTION SYSTEM
K	WIRE ASM-EMISSION CONTROL
L	WIRE ASM-COOLING FANS
M	WIRE ASM-EXTERIOR LIGHTING
N	WIRE ASM-PARK BRAKE
P	WIRE ASM-SHIFT LEVER LIGHT
R	WIRE ASM-FUEL TANK SENDER
S	WIRE ASM-BACKWALL
T	WIRE ASM-INJECTION,ENGINE
U	WIRE ASM-LOCK,DOOR,CAB
W	WIRE ASM-CHIME
X	WIRE ASM-RADIO/CIG LIGHTER
Y	WIRE ASM-DISTRIBUTOR IGNITION
Z	WIRE ASM-SENSOR,MAGNETIC
AA	WIRE ASM-GROUND,IGNITION MDL
AB	WIRE ASM-PUMP,FNL DRIVE
AC	WIRE ASM-LOCK,DOOR,COACH
AD	WIRE ASM-FRONT RISER,LEFT
AE	WIRE ASM-CONTROL CENTER
AF	WIRE ASM-LICENSE PLATE
AG	WIRE ASM-ROOF COVE,RIGHT 1
AH	WIRE ASM-ROOF COVE,LEFT

2

WIRE COLOR CODES

CODE	COLOR	CODE	COLOR
BLK	BLACK	PNK	PINK
BLU	BLUE	RED	RED
BRN	BROWN	VLT	VIOLET
GRN	GREEN	WHT	WHITE
GRY	GRAY	YEL	YELLOW
ORN	ORANGE	BGE	BEIGE
MAR	MAROON	PUR	PURPLE
SAL	SALMON		

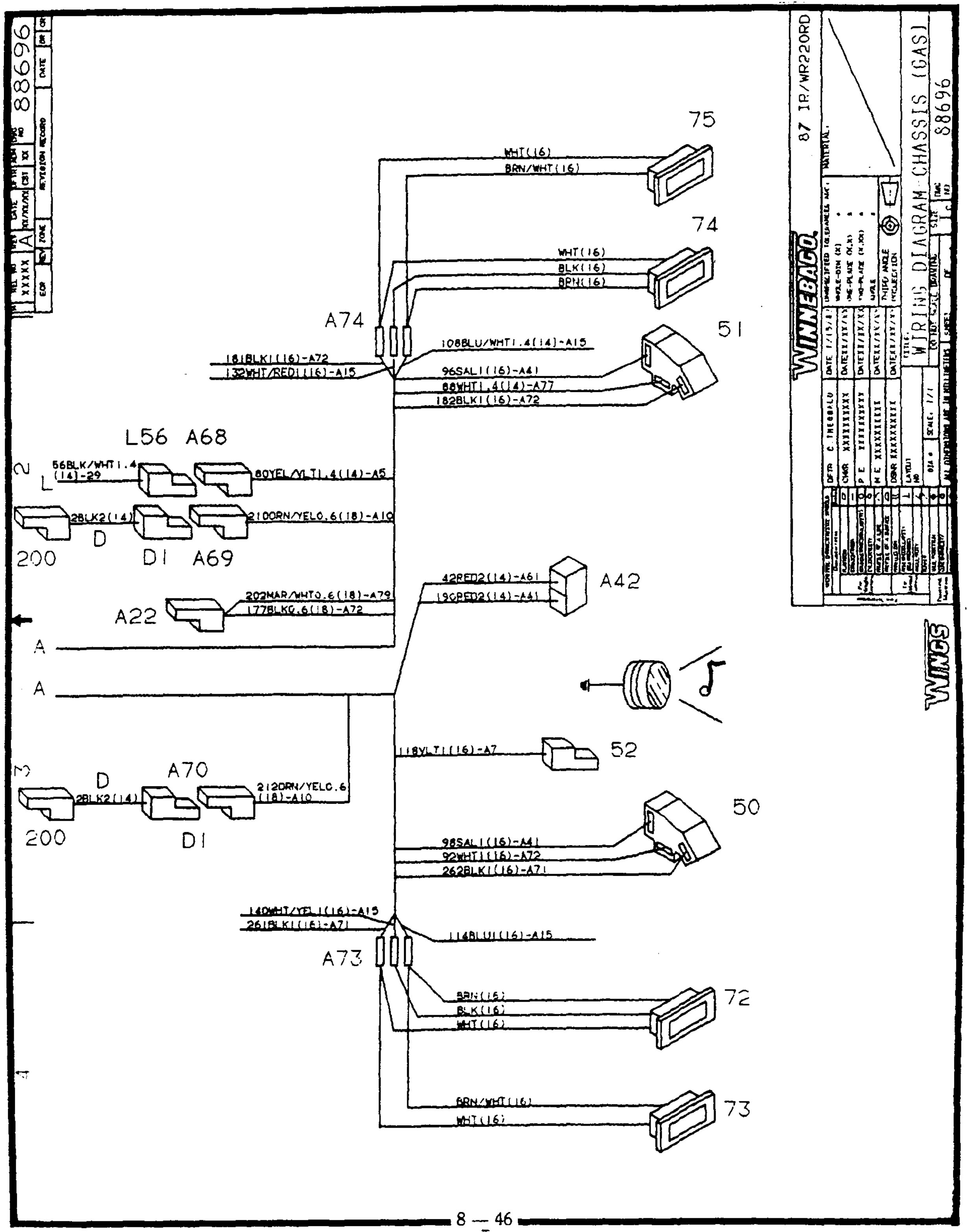
2 SEE WIRING DIAGRAM-BODY FOR EACH MODEL FOR ADITIONAL WIRING.

1 USE WITH W/IR220RC ONLY.

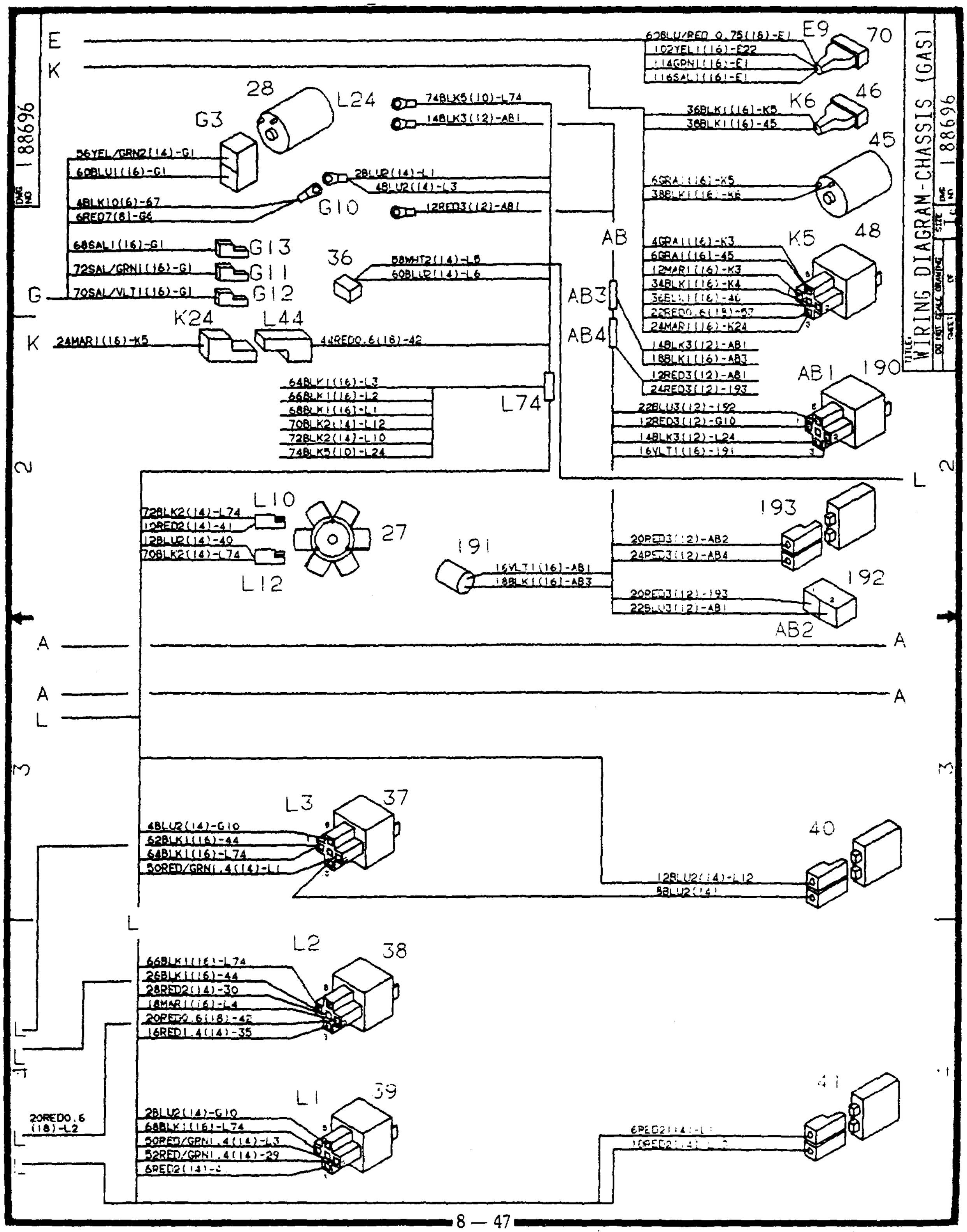
NOTES:

TITLE: WIRING DIAGRAM-CHASSIS (GAS)

DO NOT SCALE DRAWING | SIZE T | DWG NO 188696 | SHEET OF

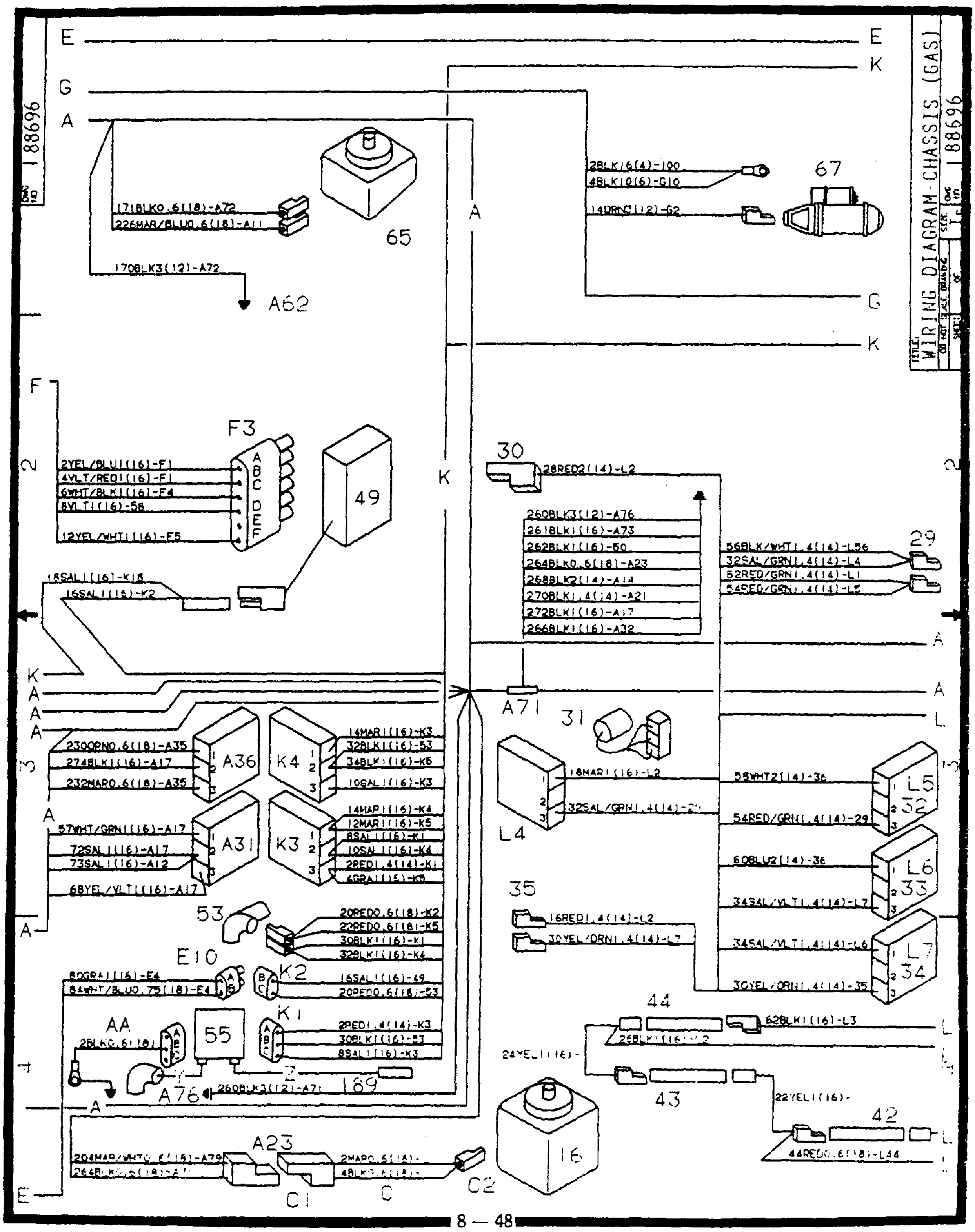


75
WHT(16)
BRN/WHT(16)
74
WHT(16)
BLK(16)
BRN(16)
A74
51
108BLU/WHT1.4(14)-A15
181BLK1(16)-A72
132WHT/RED1(16)-A15
96SAL1(16)-A41
88WHT1.4(14)-A77
182BLK1(16)-A72
L56 A68
56BLK/WHT1.4(14)-29
80YEL/YLT1.4(14)-A5
28LK2(14)
210ORN/YELO.6(18)-A10
200
D
D1
A69
202MAR/WHT0.6(18)-A79
177BLK0.6(18)-A72
A22
42RED2(14)-A61
190RED2(14)-A61
A42
A
A
118YLT1(16)-A7
52
D
A70
28LK2(14)
212ORN/YELO.6(18)-A10
200
D1
50
98SAL1(16)-A41
92WHT1(16)-A72
262BLK1(16)-A71
140WHT/YEL1(16)-A15
261BLK1(16)-A71
114BLU1(16)-A15
A73
BRN(16)
BLK(16)
WHT(16)
72
BRN/WHT(16)
WHT(16)
73
88696
WINNEBAGO
WINGS
87 IR/WR220RD
WIRING DIAGRAM-CHASSIS (GAS)
88696


WIRING DIAGRAM-CHASSIS (GAS)
188696
E9
70
K6
46
45
K5
48
AB1
190
193
192
AB2
191
27
L10
L12
L74
L3
37
40
L2
38
L1
39
41
28
L24
G3
G10
G13
G11
G12
36
K24
L44
AB
AB3
AB4

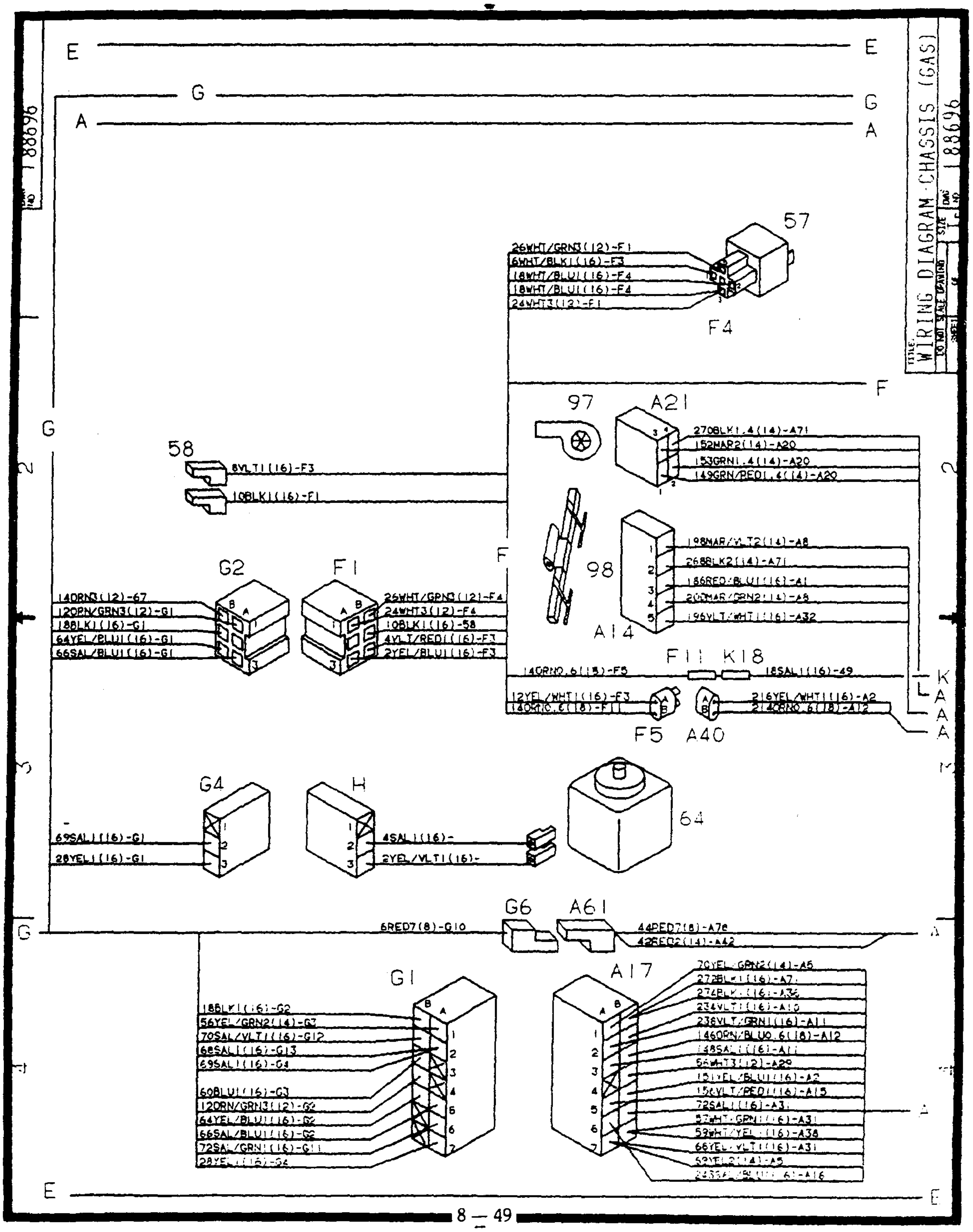
8 — 47

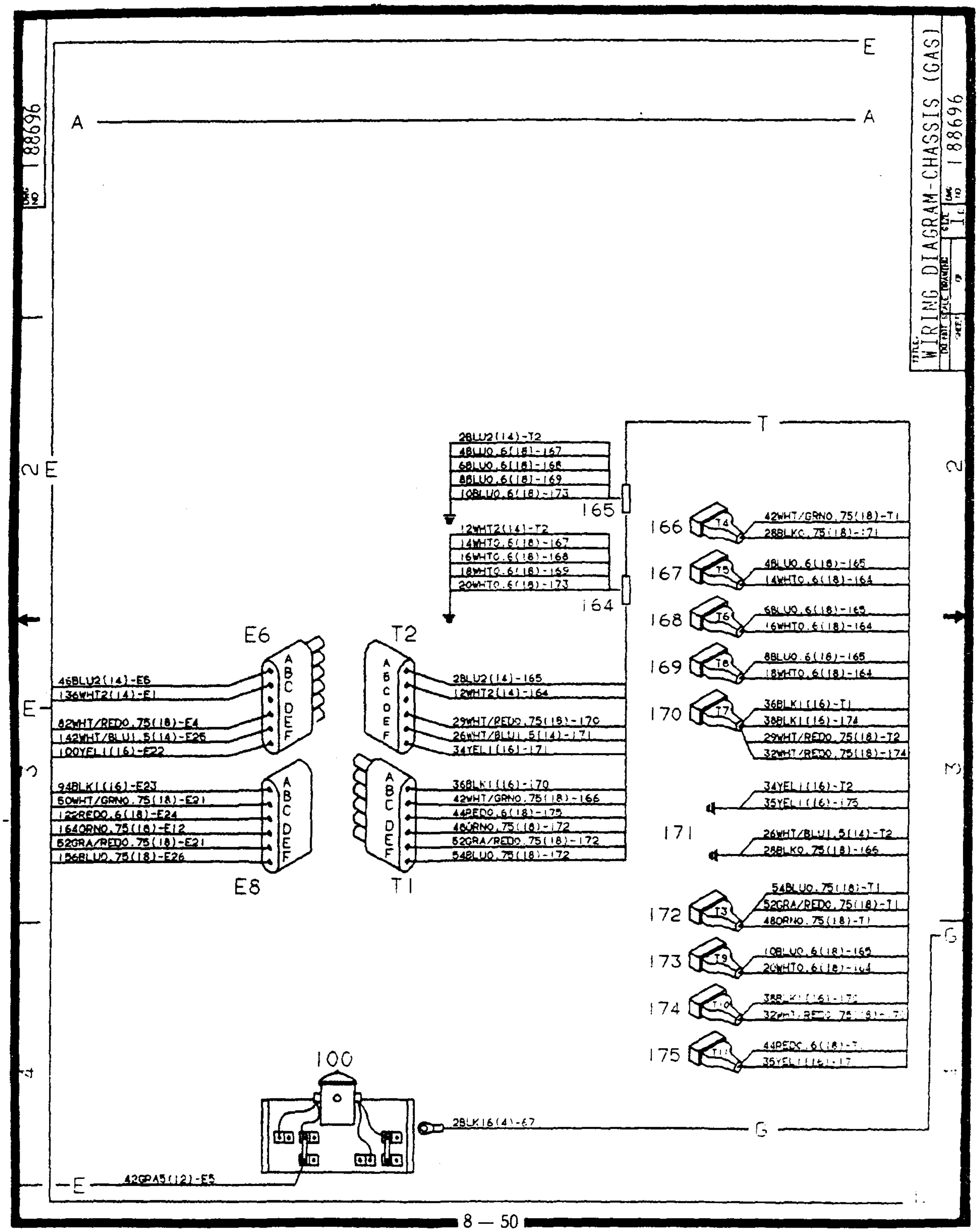
SHT NO. 2

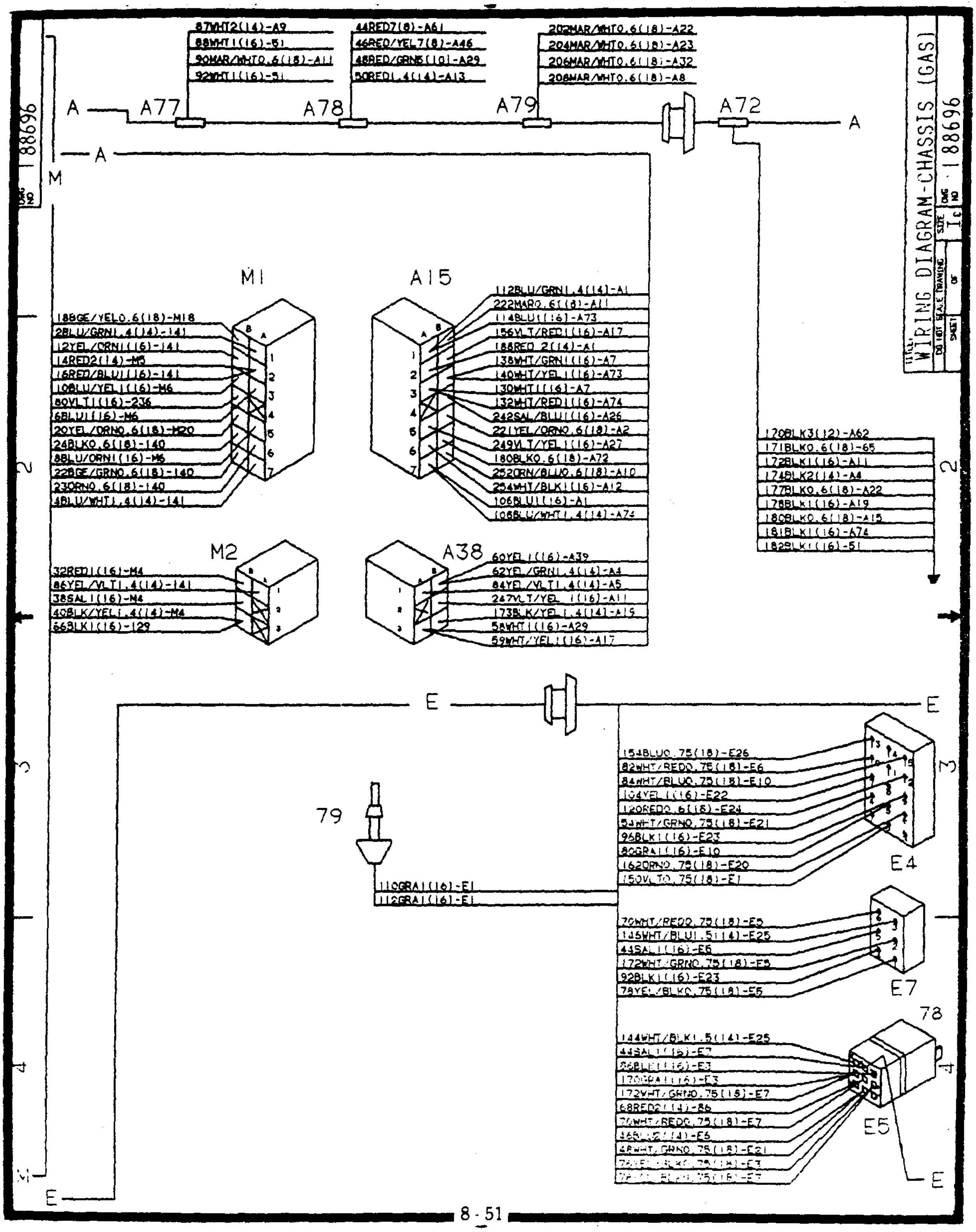


8 — 48

SHT NO. 3

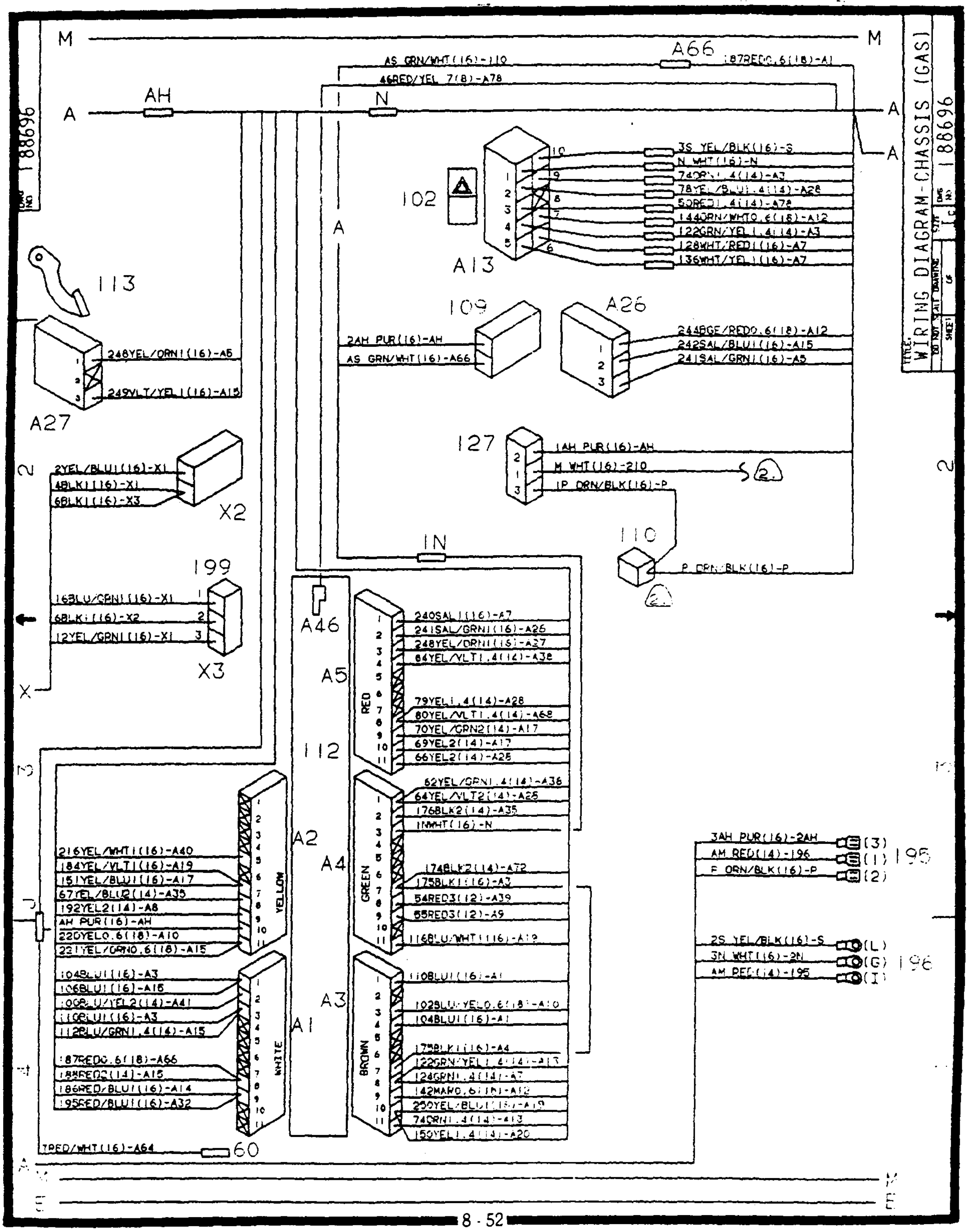

WIRING DIAGRAM-CHASSIS (GAS)
188696
57
F4
58
97
A21
98
A14
G2
F1
F11 K18
F5 A40
G4
H
64
G6 A61
G1
A17
26WHT/GRN3(12)-F1
6WHT/BLK1(16)-F3
18WHT/BLU1(16)-F4
24WHT3(12)-F1
8VLT1(16)-F3
10BLK1(16)-F1
270BLK1.4(14)-A71
152MAR2(14)-A20
153GRN1.4(14)-A20
149GRN/RED1.4(14)-A20
198MAR/VLT2(14)-A8
268BLK2(14)-A71
186RED/BLU1(16)-A1
196VLT/WHT1(16)-A32
140RN3(12)-67
12ORN/GRN3(12)-G1
18BLK1(16)-G1
64YEL/BLU1(16)-G1
66SAL/BLU1(16)-G1
26WHT/GRN3(12)-F4
24WHT3(12)-F4
10BLK1(16)-58
4VLT/RED1(16)-F3
2YEL/BLU1(16)-F3
14ORN0.6(15)-F5
18SAL1(16)-49
12YEL/WHT1(16)-F3
216YEL/WHT1(16)-A2
69SAL1(16)-G1
28YEL1(16)-G1
4SAL1(16)-
2YEL/VLT1(16)-
6RED7(8)-G10
44RED7(8)-A7
42RED2(14)-A42
18BLK1(16)-G2
56YEL/GRN2(14)-G7
70SAL/VLT1(16)-G12
68SAL1(16)-G13
69SAL1(16)-G4
60BLU1(16)-G3
12ORN/GRN3(12)-G2
64YEL/BLU1(16)-G2
66SAL/BLU1(16)-G2
72SAL/GRN1(16)-G11
28YEL1(16)-G4
70YEL/GRN2(14)-A5
272BLK1(16)-A7
274BLK1(16)-A36
234VLT1(16)-A10
236VLT/GRN1(16)-A11
146ORN/BLU0.6(18)-A12
148SAL1(16)-A11
56WHT3(12)-A29
151YEL/BLU1(16)-A2
156VLT/RED1(16)-A15
72SAL1(16)-A3
57WHT/GRN1(16)-A31
59WHT/YEL1(16)-A38
66YEL/VLT1(16)-A31
52YEL2(14)-A5


WIRING DIAGRAM-CHASSIS (GAS)
188696
E6
T2
E8
T1
E
A
T
G
100
164
165
166
167
168
169
170
171
172
173
174
175
28LU2(14)-T2
4BLU0.6(18)-167
6BLU0.6(18)-168
8BLU0.6(18)-169
10BLU0.6(18)-173
12WHT2(14)-T2
14WHT0.6(18)-167
16WHT0.6(18)-168
18WHT0.6(18)-169
20WHT0.6(18)-173
46BLU2(14)-E6
136WHT2(14)-E1
82WHT/RED0.75(18)-E4
142WHT/BLU1.5(14)-E26
100YEL1(16)-E22
94BLK1(16)-E23
50WHT/GRN0.75(18)-E21
122RED0.6(18)-E24
164ORN0.75(18)-E12
52GRA/RED0.75(18)-E21
156BLU0.75(18)-E26
28LU2(14)-165
12WHT2(14)-164
29WHT/RED0.75(18)-170
26WHT/BLU1.5(14)-171
34YEL1(16)-171
36BLK1(16)-170
42WHT/GRN0.75(18)-166
44RED0.6(18)-175
48ORN0.75(18)-172
52GRA/RED0.75(18)-172
54BLU0.75(18)-172
42WHT/GRN0.75(18)-T1
28BLK0.75(18)-171
4BLU0.6(18)-165
14WHT0.6(18)-164
6BLU0.6(18)-165
16WHT0.6(18)-164
8BLU0.6(18)-165
18WHT0.6(18)-164
36BLK1(16)-T1
38BLK1(16)-174
29WHT/RED0.75(18)-T2
32WHT/RED0.75(18)-174
34YEL1(16)-T2
35YEL1(16)-175
26WHT/BLU1.5(14)-T2
28BLK0.75(18)-166
54BLU0.75(18)-T1
52GRA/RED0.75(18)-T1
48ORN0.75(18)-T1
10BLU0.6(18)-165
20WHT0.6(18)-164
28LK16(4)-67
42GPA5(12)-E5


WIRING DIAGRAM-CHASSIS (GAS)
1 88696
A77
A78
A79
A72
M1
A15
M2
A38
E4
E7
E5
79
78
8 - 51

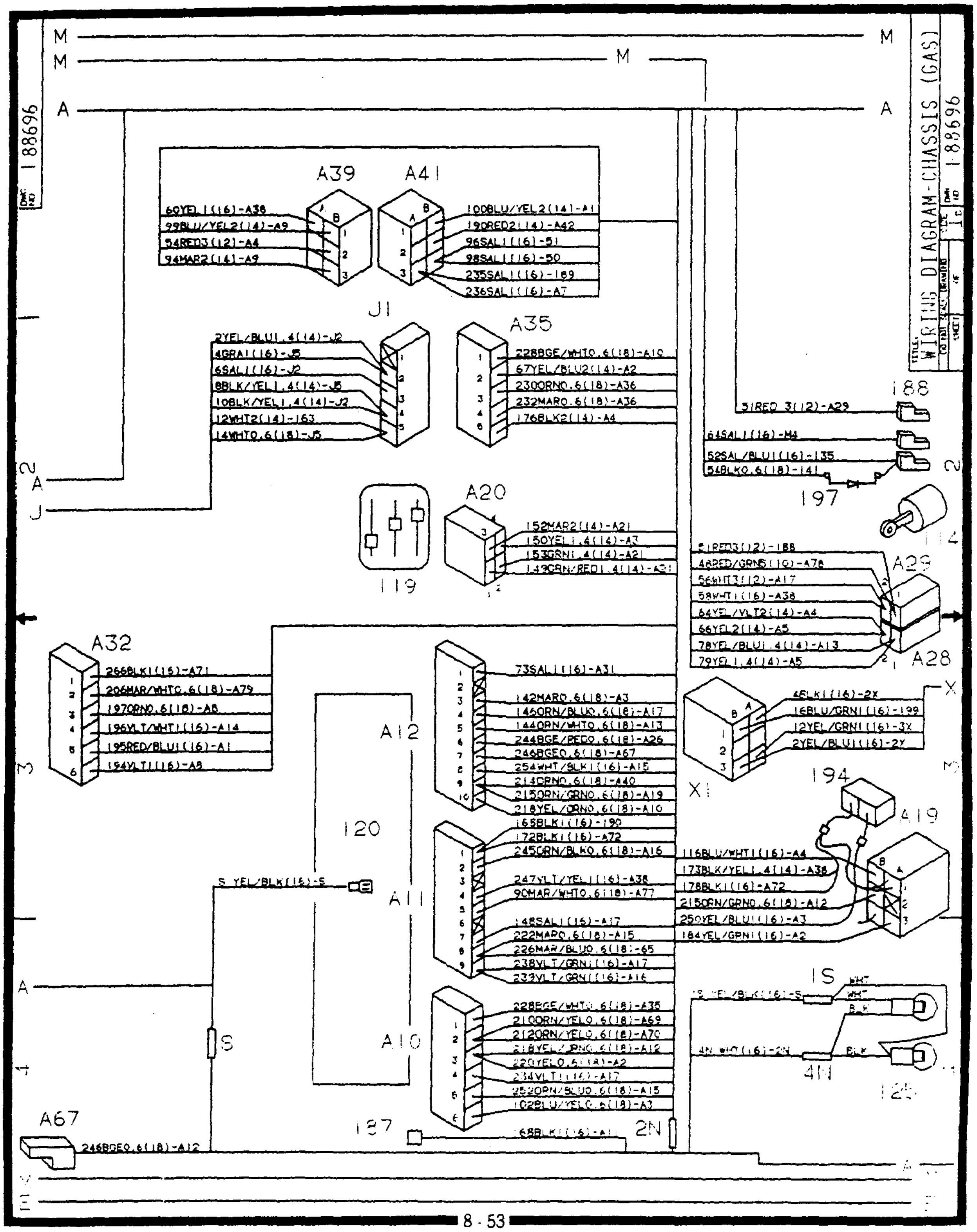
SHT NO. 6

1987 PRODUCTION

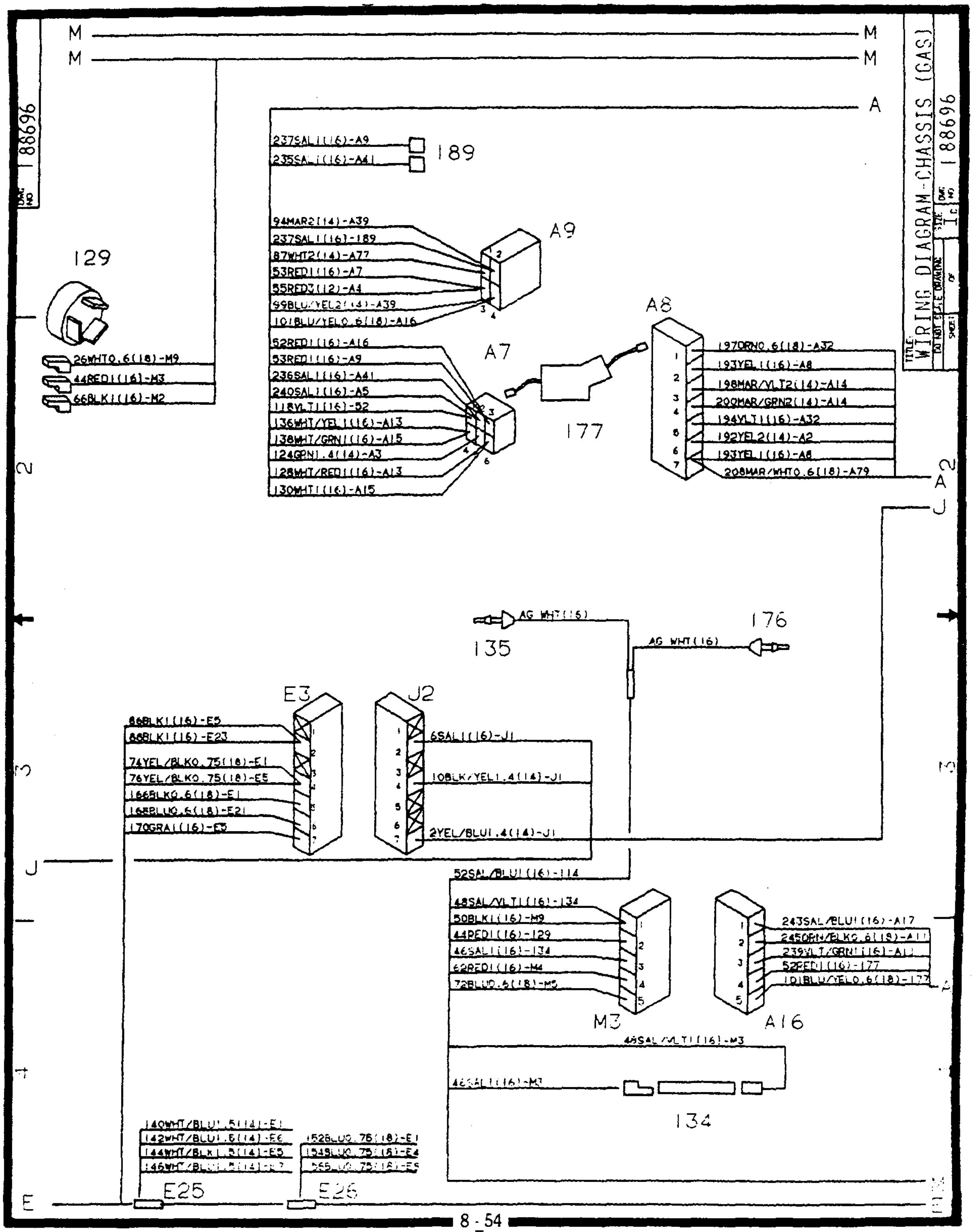


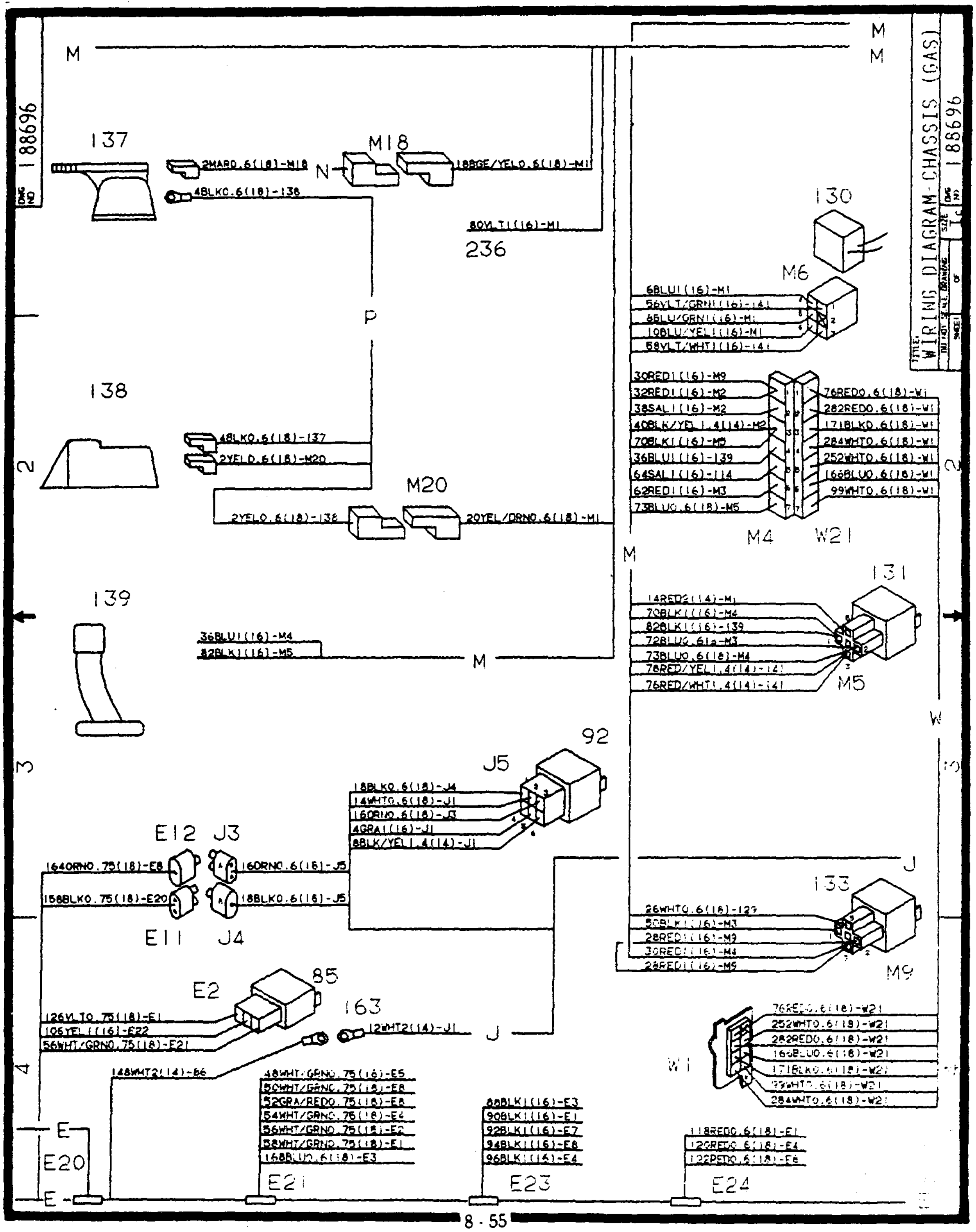
8 - 52

SHT NO. 7


WIRING DIAGRAM-CHASSIS (GAS)
1 88696
A39
A41
J1
A35
A20
119
A32
A12
120
A11
A10
A67
187
2N
188
197
A29
A28
X1
194
A19
1S
4N
125
60YEL1(16)-A38
99BLU/YEL2(14)-A9
54RED3(12)-A4
94MAR2(14)-A9
100BLU/YEL2(14)-A1
190RED2(14)-A42
96SAL1(16)-51
98SAL1(16)-50
235SAL1(16)-189
236SAL1(16)-A7
2YEL/BLU1.4(14)-J2
4GRA1(16)-J5
6SAL1(16)-J2
8BLK/YEL1.4(14)-J5
10BLK/YEL1.4(14)-J2
12WHT2(14)-163
14WHT0.6(18)-J5
228BGE/WHT0.6(18)-A10
67YEL/BLU2(14)-A2
230ORN0.6(18)-A36
232MAR0.6(18)-A36
176BLK2(14)-A4
51RED3(12)-A29
64SAL1(16)-M4
52SAL/BLU1(16)-135
54BLK0.6(18)-141
152MAR2(14)-A21
150YEL1.4(14)-A3
153GRN1.4(14)-A21
149GRN/RED1.4(14)-A21
51RED3(12)-188
48RED/GRN5(10)-A78
56WHT3(12)-A17
58WHT1(16)-A38
64YEL/YLT2(14)-A4
66YEL2(14)-A5
78YEL/BLU1.4(14)-A13
79YEL1.4(14)-A5
266BLK1(16)-A71
206MAR/WHT0.6(18)-A79
197ORN0.6(18)-A8
196YLT/WHT1(16)-A14
195RED/BLU1(16)-A1
194YLT1(16)-A8
73SAL1(16)-A31
142MAR0.6(18)-A3
146ORN/BLU0.6(18)-A17
144ORN/WHT0.6(18)-A13
244BGE/RED0.6(18)-A26
246BGE0.6(18)-A67
254WHT/BLK1(16)-A15
214ORN0.6(18)-A40
215ORN/GRN0.6(18)-A19
218YEL/ORN0.6(18)-A10
46BLK1(16)-2X
16BLU/GRN1(16)-199
12YEL/GRN1(16)-3X
2YEL/BLU1(16)-2Y
165BLK1(16)-190
172BLK1(16)-A72
245ORN/BLK0.6(18)-A16
247YLT/YEL1(16)-A38
90MAR/WHT0.6(18)-A77
148SAL1(16)-A17
222MAR0.6(18)-A15
226MAR/BLU0.6(18)-65
238YLT/GRN1(16)-A17
232YLT/GRN1(16)-A16
116BLU/WHT1(16)-A4
173BLK/YEL1.4(14)-A38
178BLK1(16)-A72
215ORN/GRN0.6(18)-A12
250YEL/BLU1(16)-A3
184YEL/GRN1(16)-A2
S YEL/BLK1(16)-S
228BGE/WHT0.6(18)-A35
210ORN/YEL0.6(18)-A69
212ORN/YEL0.6(18)-A70
218YEL/ORN0.6(18)-A12
220YEL0.6(18)-A2
234YLT1(16)-A17
252ORN/BLU0.6(18)-A15
102BLU/YEL0.6(18)-A3
168BLK1(16)-A1
246BGE0.6(18)-A12
1S YEL/BLK1(16)-S
4N WHT1(16)-2N
WHT
BLK
M
A
J
X

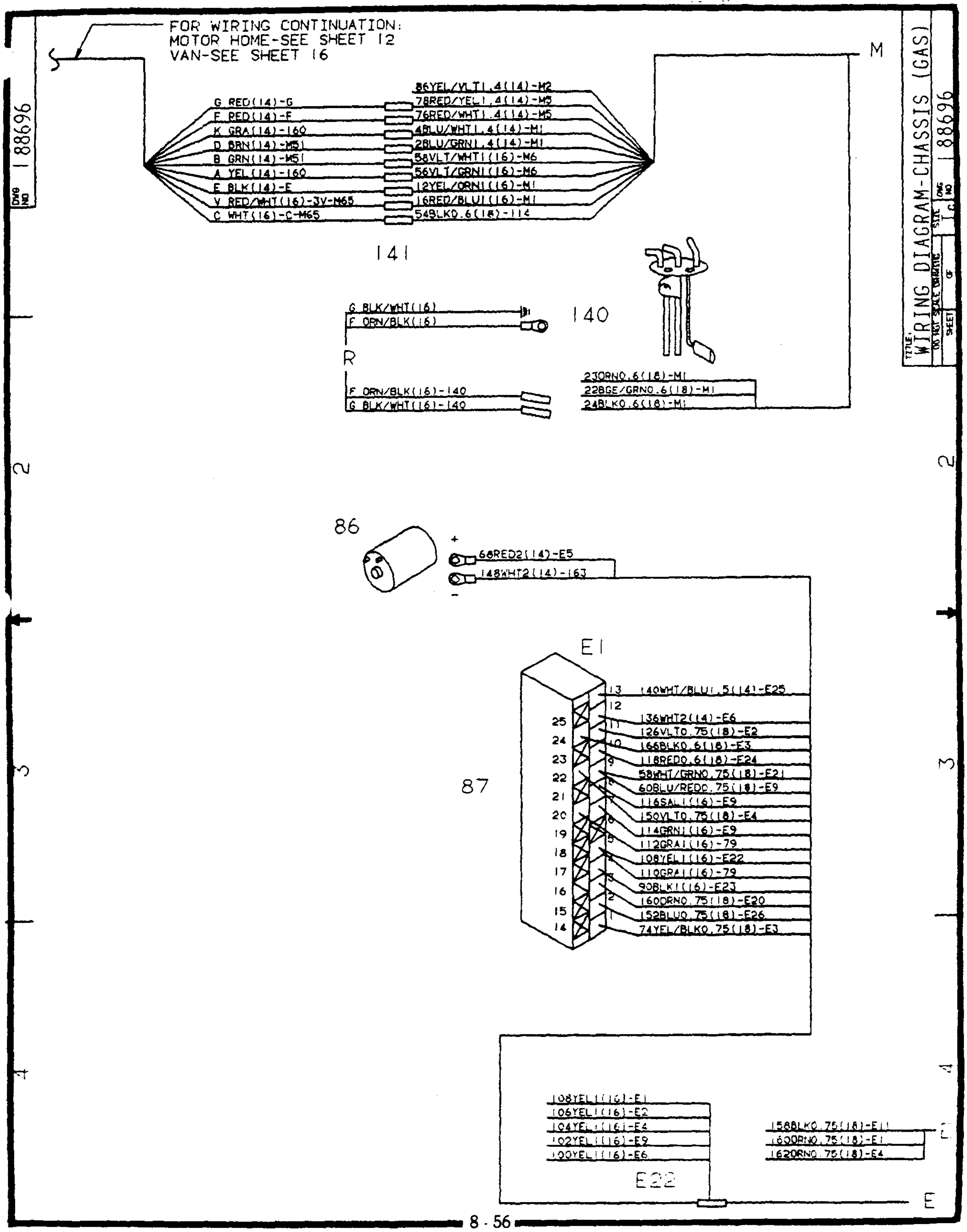
SHT NO. 8


WIRING DIAGRAM-CHASSIS (GAS)
188696
189
A9
129
A8
A7
177
176
135
E3
J2
M3
A16
134
E25
E26

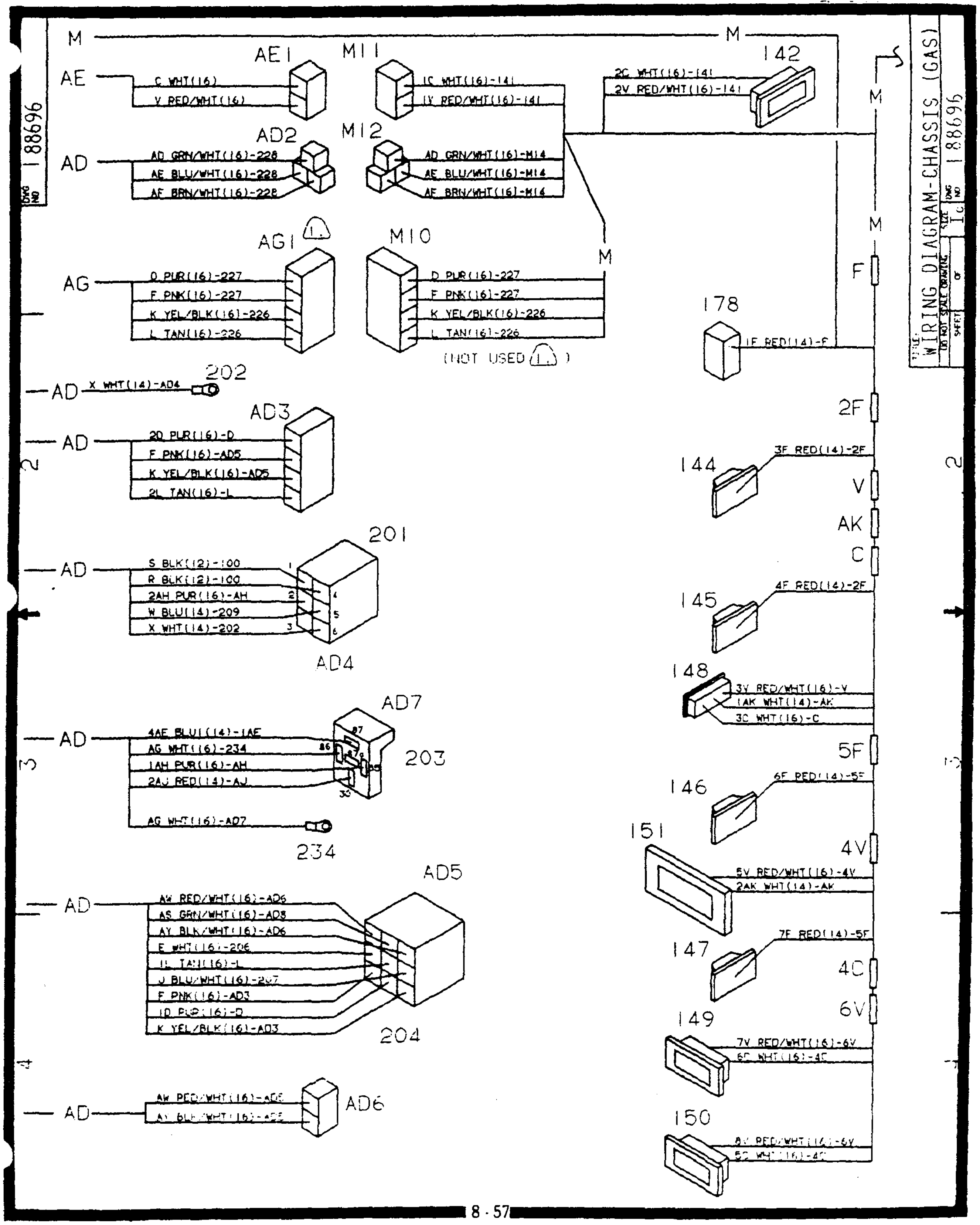


8 - 55

SHT NO. 10

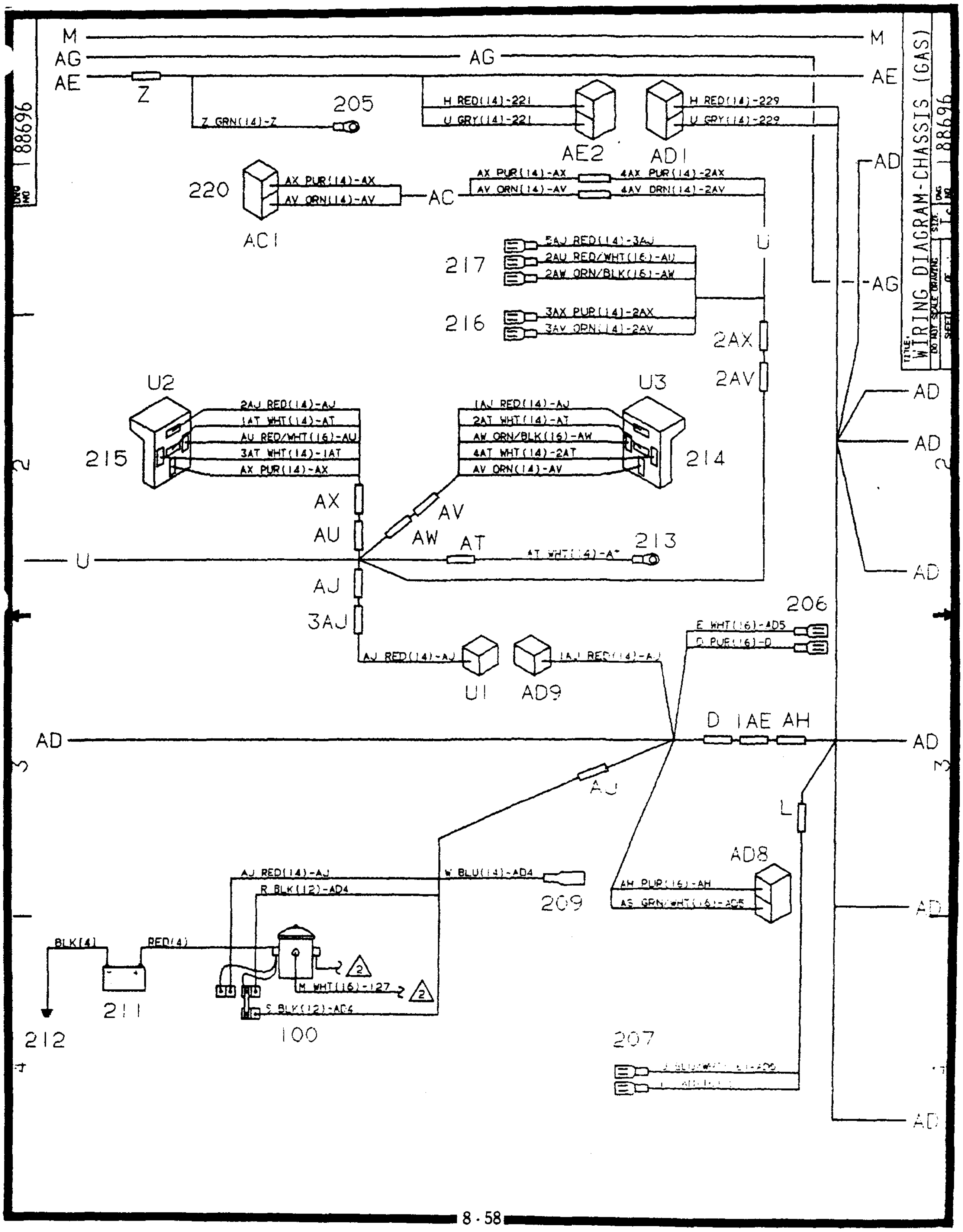


FOR WIRING CONTINUATION:
MOTOR HOME-SEE SHEET 12
VAN-SEE SHEET 16
M
WIRING DIAGRAM-CHASSIS (GAS)
DWG NO 188696
G RED(14)-G
F RED(14)-F
K GRA(14)-160
D BRN(14)-M51
B GRN(14)-M51
A YEL(14)-160
E BLK(14)-E
V RED/WHT(16)-3V-M65
C WHT(16)-C-M65
86YEL/VLT1.4(14)-M2
78RED/YEL1.4(14)-M5
76RED/WHT1.4(14)-M5
4BLU/WHT1.4(14)-M1
2BLU/GRN1.4(14)-M1
58VLT/WHT1(16)-M6
56VLT/GRN1(16)-M6
12YEL/ORN1(16)-M1
16RED/BLU1(16)-M1
54BLKO.6(18)-114
141
G BLK/WHT(16)
F ORN/BLK(16)
140
R
F ORN/BLK(16)-140
G BLK/WHT(16)-140
23ORNO.6(18)-M1
22BGE/GRNO.6(18)-M1
24BLKO.6(18)-M1
86
68RED2(14)-E5
148WHT2(14)-163
E1
87
140WHT/BLU1.5(14)-E25
136WHT2(14)-E6
126VLTO.75(18)-E2
166BLKO.6(18)-E3
118REDO.6(18)-E24
58WHT/GRNO.75(18)-E21
60BLU/REDO.75(18)-E9
116SAL1(16)-E9
150VLTO.75(18)-E4
114GRN1(16)-E9
112GRA1(16)-79
108YEL1(16)-E22
110GRA1(16)-79
90BLK1(16)-E23
160ORNO.75(18)-E20
152BLUO.75(18)-E26
74YEL/BLKO.75(18)-E3
108YEL1(16)-E1
106YEL1(16)-E2
104YEL1(16)-E4
102YEL1(16)-E9
100YEL1(16)-E6
E22
158BLKO.75(18)-E11
160ORNO.75(18)-E1
162ORNO.75(18)-E4
E


WIRING DIAGRAM-CHASSIS (GAS)
188696
AE1
M11
M12
AD2
AG1
M10
142
178
202
AD3
144
201
145
AD4
148
AD7
203
146
234
151
AD5
147
149
204
AD6
150
(NOT USED 1.)

8 - 57

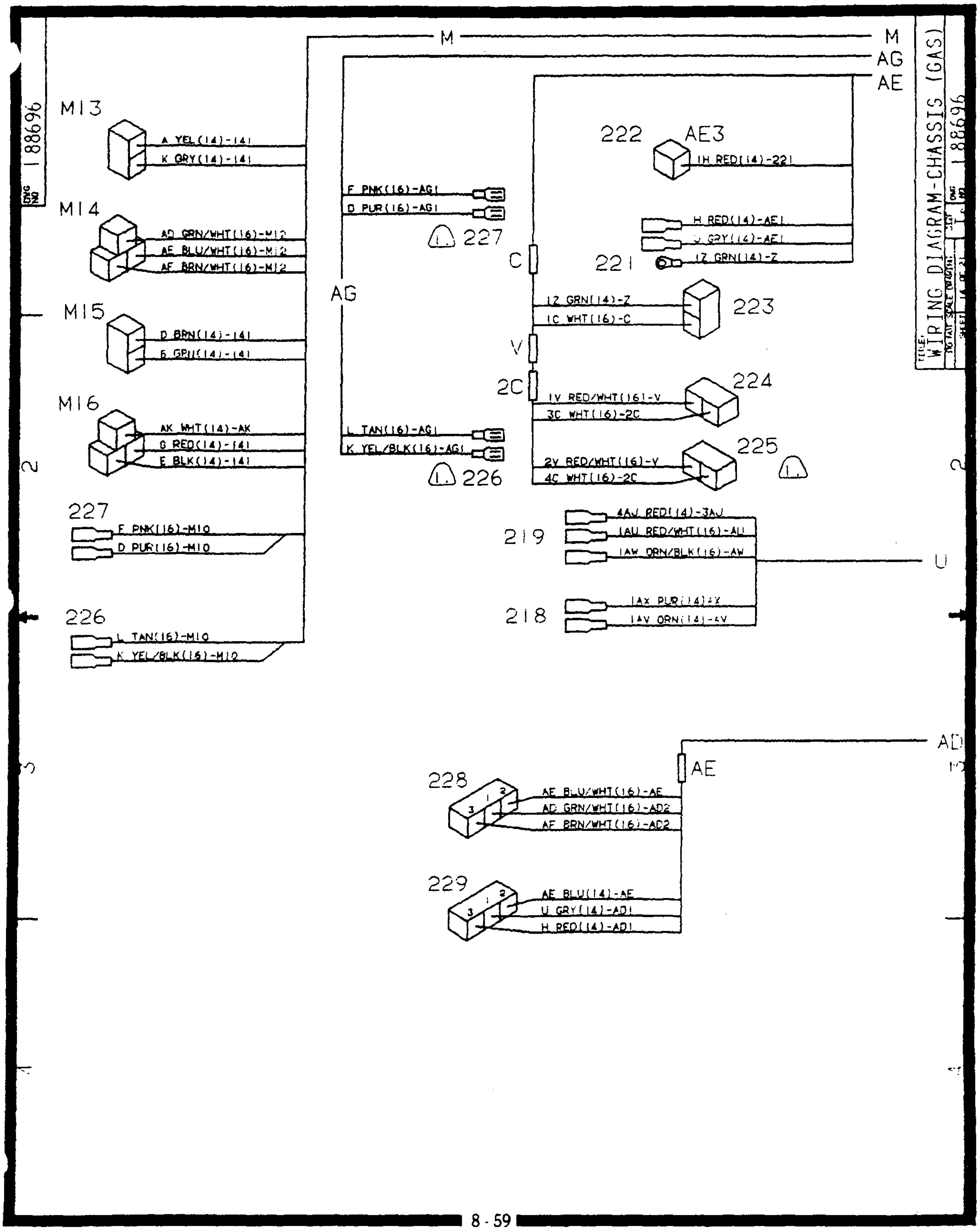
SHT NO. 12



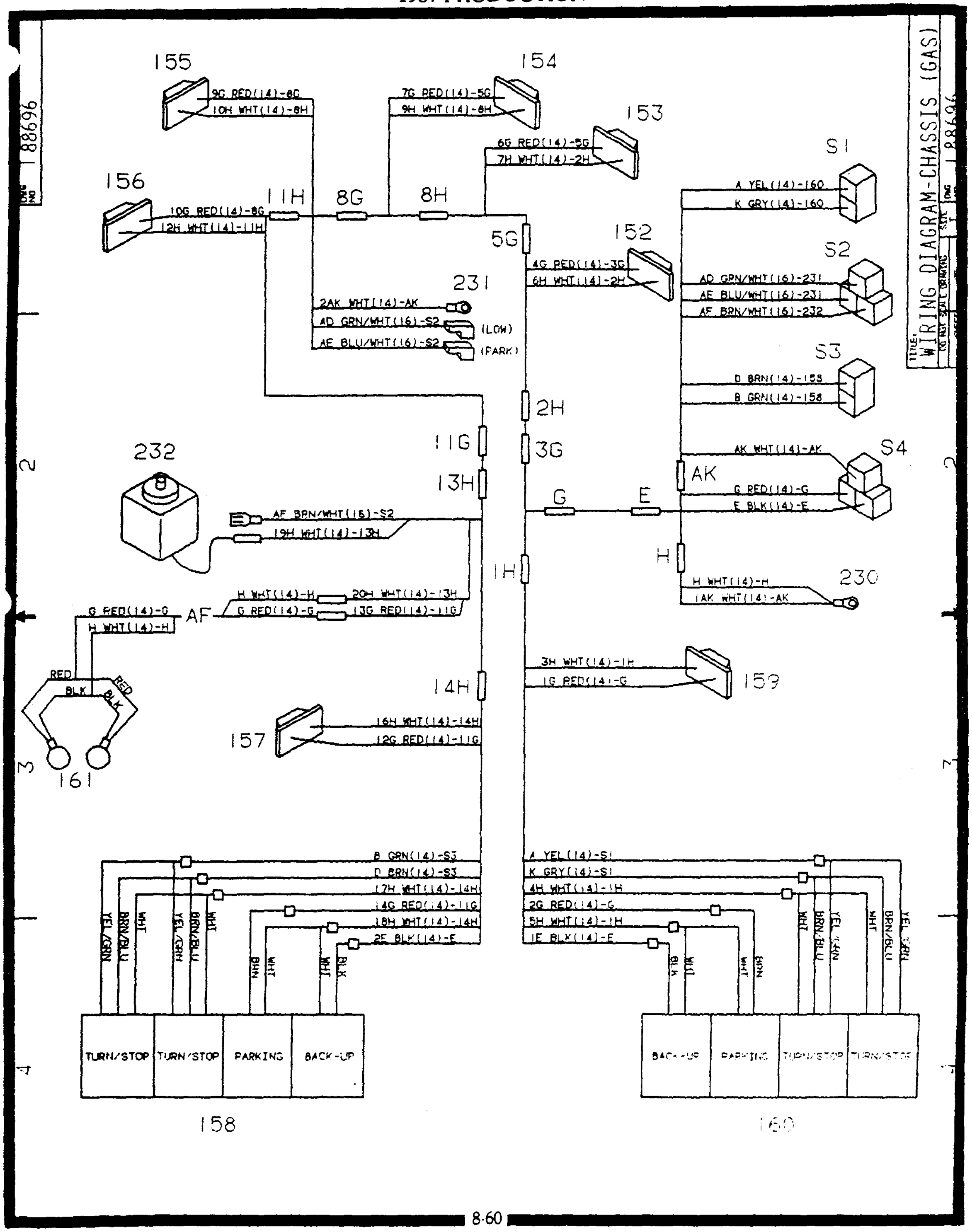
WIRING DIAGRAM-CHASSIS (GAS)
188696
M
AG
AE
Z
Z GRN(14)-Z
205
H RED(14)-221
U GRY(14)-221
AE2
H RED(14)-229
U GRY(14)-229
AD1
AD
220
AX PUR(14)-AX
AV ORN(14)-AV
AC
AC1
AX PUR(14)-AX
AV ORN(14)-AV
4AX PUR(14)-2AX
4AV ORN(14)-2AV
U
217
5AJ RED(14)-3AJ
2AU RED/WHT(16)-AU
2AW ORN/BLK(16)-AW
216
3AX PUR(14)-2AX
3AV ORN(14)-2AV
2AX
2AV
U2
215
2AJ RED(14)-AJ
1AT WHT(14)-AT
AU RED/WHT(16)-AU
3AT WHT(14)-1AT
AX PUR(14)-AX
U3
214
1AJ RED(14)-AJ
2AT WHT(14)-AT
AW ORN/BLK(16)-AW
4AT WHT(14)-2AT
AV ORN(14)-AV
AX
AU
AV
AW
AT
213
AJ
3AJ
206
E WHT(16)-AD5
D PUR(16)-D
AJ RED(14)-AJ
1AJ RED(14)-AJ
U1
AD9
D
1AE
AH
L
AD8
AH PUR(16)-AH
209
W BLU(14)-AD4
AJ RED(14)-AJ
R BLK(12)-AD4
BLK(4)
RED(4)
M WHT(16)-127
S BLK(12)-AD4
2
211
212
100
207

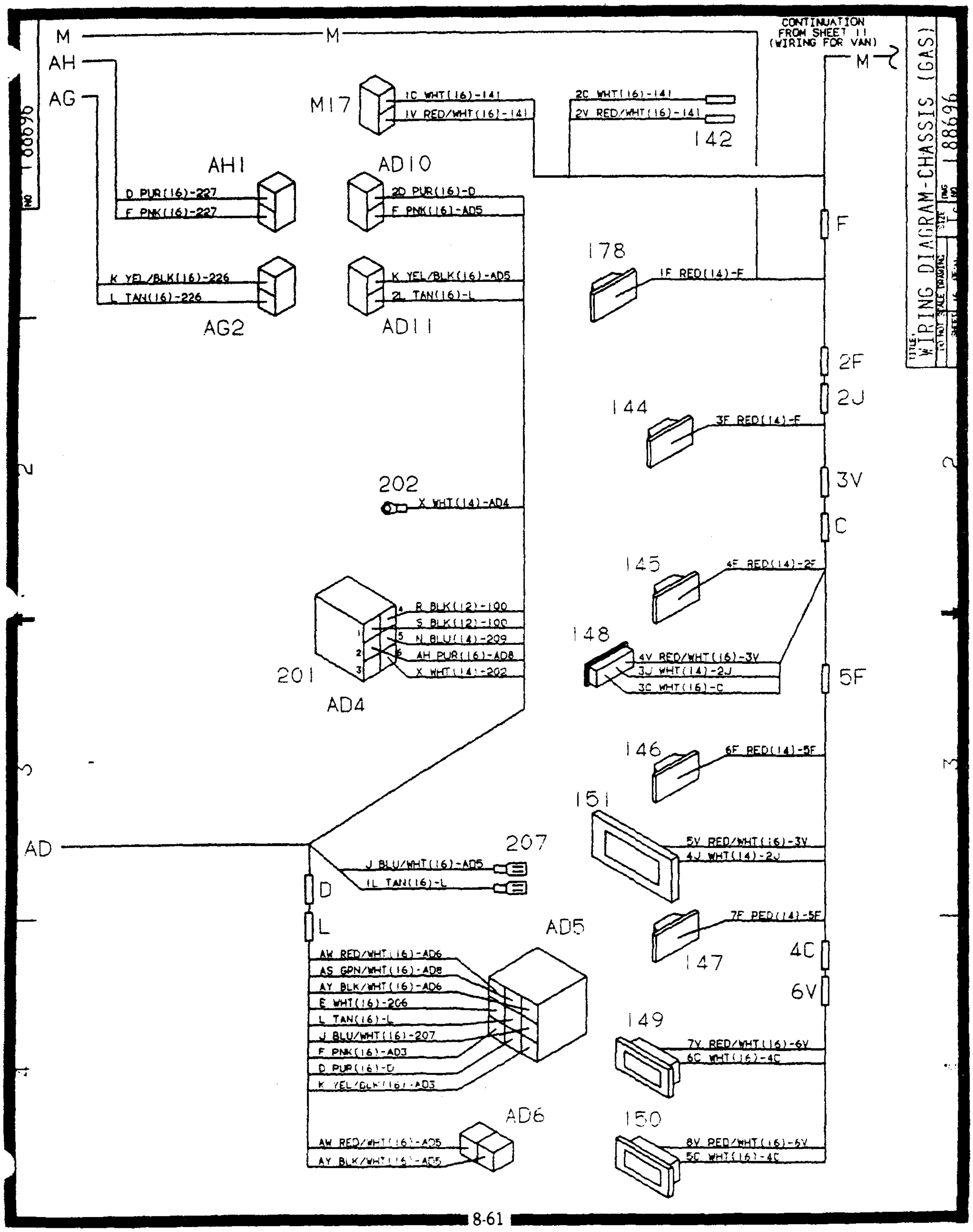
8 - 58

SHT NO. 13



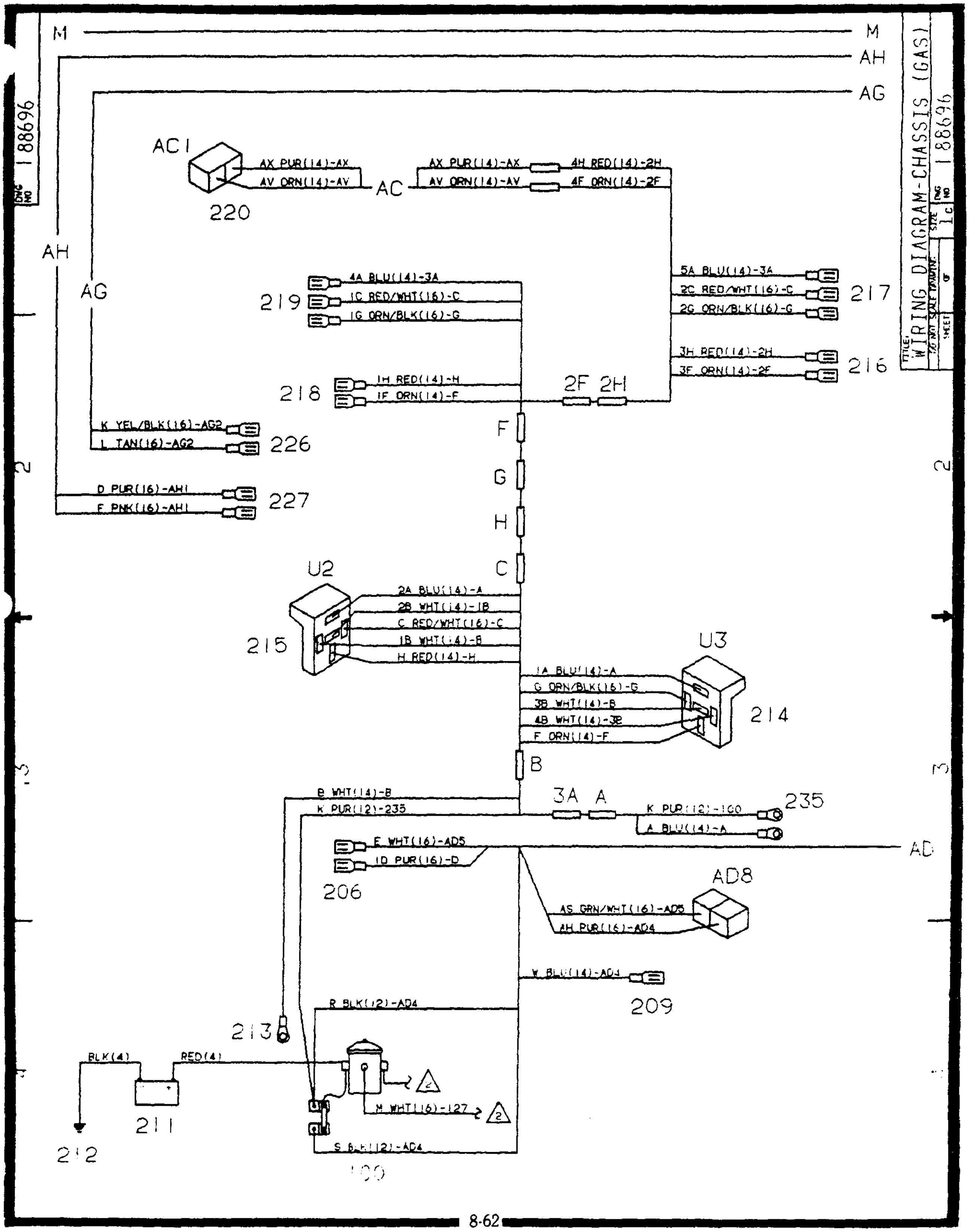
WIRING DIAGRAM-CHASSIS (GAS)
1 88696
M
AG
AE
M13
A YEL(14)-141
K GRY(14)-141
M14
AD GRN/WHT(16)-M12
AE BLU/WHT(16)-M12
AF BRN/WHT(16)-M12
M15
D BRN(14)-141
M16
AK WHT(14)-AK
G RED(14)-141
E BLK(14)-141
227
F PNK(16)-M10
D PUR(16)-M10
226
L TAN(16)-M10
K YEL/BLK(16)-M10
F PNK(16)-AG1
D PUR(16)-AG1
L TAN(16)-AG1
K YEL/BLK(16)-AG1
222
AE3
1H RED(14)-221
H RED(14)-AE1
221
1Z GRN(14)-Z
C
1Z GRN(14)-Z
1C WHT(16)-C
223
V
2C
1V RED/WHT(16)-V
3C WHT(16)-2C
224
2V RED/WHT(16)-V
4C WHT(16)-2C
225
219
4AJ RED(14)-3AJ
1AU RED/WHT(16)-AU
1AW ORN/BLK(16)-AW
U
218
1AX PUR(14)-X
1AV ORN(14)-AV
AD
AE
228
AE BLU/WHT(16)-AE
AD GRN/WHT(16)-AD2
AF BRN/WHT(16)-AD2
229
AE BLU(14)-AE
U GRY(14)-AD1
H RED(14)-AD1


WIRING DIAGRAM-CHASSIS (GAS)
188696
155
9G RED(14)-8G
10H WHT(14)-8H
154
7G RED(14)-5G
9H WHT(14)-8H
153
6G RED(14)-5G
7H WHT(14)-2H
156
10G RED(14)-8G
12H WHT(14)-11H
11H
8G
8H
5G
152
4G RED(14)-3G
6H WHT(14)-2H
231
2AK WHT(14)-AK
AD GRN/WHT(16)-S2
AE BLU/WHT(16)-S2
(LOW)
(PARK)
S1
A YEL(14)-160
K GRY(14)-160
S2
AD GRN/WHT(16)-231
AE BLU/WHT(16)-231
AF BRN/WHT(16)-232
S3
D BRN(14)-158
B GRN(14)-158
S4
AK WHT(14)-AK
G RED(14)-G
E BLK(14)-E
AK
2H
3G
11G
13H
232
AF BRN/WHT(16)-S2
19H WHT(14)-13H
G
E
H
1H
230
H WHT(14)-H
1AK WHT(14)-AK
AF
H WHT(14)-H
G RED(14)-G
20H WHT(14)-13H
13G RED(14)-11G
G RED(14)-G
H WHT(14)-H
RED
BLK
161
14H
157
16H WHT(14)-14H
12G RED(14)-11G
159
3H WHT(14)-1H
1G RED(14)-G
B GRN(14)-S3
D BRN(14)-S3
17H WHT(14)-14H
14G RED(14)-11G
18H WHT(14)-14H
2E BLK(14)-E
A YEL(14)-S1
K GRY(14)-S1
4H WHT(14)-1H
2G RED(14)-G
5H WHT(14)-1H
1E BLK(14)-E
YEL/GRN
BRN/BLU
WHT
BRN
TURN/STOP
PARKING
BACK-UP
158
160


CONTINUATION FROM SHEET 11 (WIRING FOR VAN)
WIRING DIAGRAM-CHASSIS (GAS)
188696
M
AH
AG
AD
M17
1C WHT(16)-141
1V RED/WHT(16)-141
2C WHT(16)-141
2V RED/WHT(16)-141
142
AH1
D PUR(16)-227
F PNK(16)-227
AD10
2D PUR(16)-D
F PNK(16)-AD5
AG2
K YEL/BLK(16)-226
L TAN(16)-226
AD11
K YEL/BLK(16)-AD5
2L TAN(16)-L
178
1F RED(14)-F
F
2F
2J
144
3F RED(14)-F
3V
C
202
X WHT(14)-AD4
145
4F RED(14)-2F
148
4V RED/WHT(16)-3V
3J WHT(14)-2J
3C WHT(16)-C
201
AD4
R BLK(12)-100
S BLK(12)-100
N BLU(14)-209
AH PUR(16)-AD8
X WHT(14)-202
5F
146
6F RED(14)-5F
151
5V RED/WHT(16)-3V
4J WHT(14)-2J
207
J BLU/WHT(16)-AD5
1L TAN(16)-L
D
L
AD5
AW RED/WHT(16)-AD6
AS GRN/WHT(16)-AD8
AY BLK/WHT(16)-AD6
E WHT(16)-206
L TAN(16)-L
J BLU/WHT(16)-207
F PNK(16)-AD3
D PUR(16)-D
K YEL/BLK(16)-AD3
7F RED(14)-5F
147
4C
6V
149
7V RED/WHT(16)-6V
6C WHT(16)-4C
AD6
AW RED/WHT(16)-AD5
AY BLK/WHT(16)-AD5
150
8V RED/WHT(16)-6V
5C WHT(16)-4C

8-61

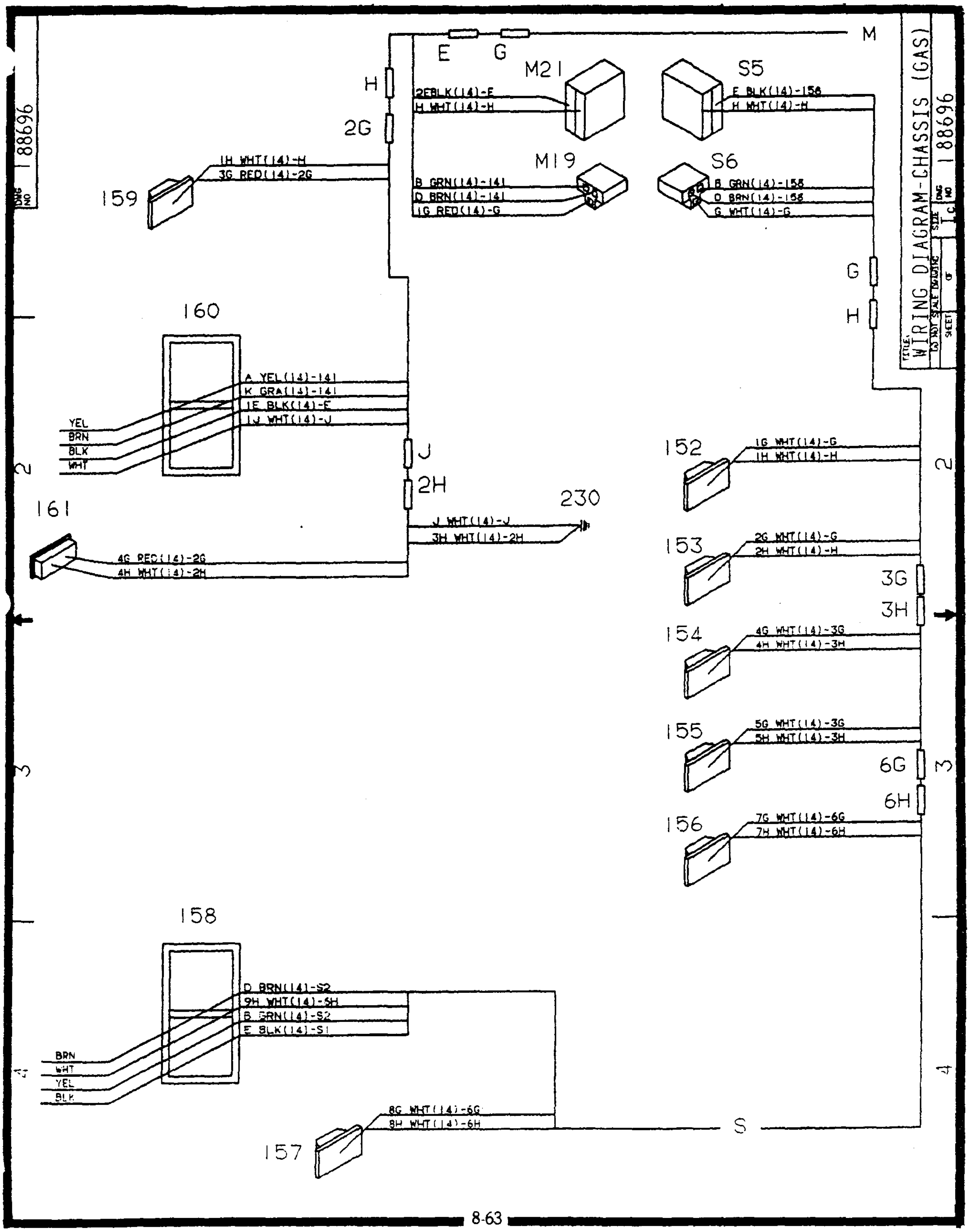
SHT NO. 16



M
AH
AG
AC1
AX PUR(14)-AX
AV ORN(14)-AV
AC
220
4H RED(14)-2H
4F ORN(14)-2F
4A BLU(14)-3A
1C RED/WHT(16)-C
1G ORN/BLK(16)-G
219
5A BLU(14)-3A
2C RED/WHT(16)-C
2G ORN/BLK(16)-G
217
3H RED(14)-2H
3F ORN(14)-2F
216
1H RED(14)-H
1F ORN(14)-F
218
2F 2H
K YEL/BLK(16)-AG2
L TAN(16)-AG2
226
D PUR(16)-AH1
E PNK(16)-AH1
227
F
G
H
C
U2
2A BLU(14)-A
2B WHT(14)-1B
C RED/WHT(16)-C
1B WHT(14)-B
H RED(14)-H
215
U3
1A BLU(14)-A
G ORN/BLK(16)-G
3B WHT(14)-B
4B WHT(14)-3B
F ORN(14)-F
214
B
B WHT(14)-B
K PUR(12)-235
3A A
K PUR(12)-100
A BLU(14)-A
235
E WHT(16)-AD5
1D PUR(16)-D
AD
206
AD8
AS GRN/WHT(16)-AD5
AH PUR(16)-AD4
W BLU(14)-AD4
209
R BLK(12)-AD4
213
BLK(4)
RED(4)
211
M WHT(16)-127
S BLK(12)-AD4
212
WIRING DIAGRAM-CHASSIS (GAS)
188696

8-62

SHT NO. 17



WIRING DIAGRAM-CHASSIS (GAS)
188696
M
E
G
H
2G
M21
S5
M19
S6
159
160
161
230
152
153
154
155
156
157
158
3G
3H
6G
6H
J
2H
S
2EBLK(14)-E
H WHT(14)-H
E BLK(14)-158
B GRN(14)-141
D BRN(14)-141
1G RED(14)-G
B GRN(14)-158
D BRN(14)-158
G WHT(14)-G
1H WHT(14)-H
3G RED(14)-2G
A YEL(14)-141
K GRA(14)-141
1E BLK(14)-E
1J WHT(14)-J
YEL
BRN
BLK
WHT
J WHT(14)-J
3H WHT(14)-2H
4G RED(14)-2G
4H WHT(14)-2H
1G WHT(14)-G
1H WHT(14)-H
2G WHT(14)-G
2H WHT(14)-H
4G WHT(14)-3G
4H WHT(14)-3H
5G WHT(14)-3G
5H WHT(14)-3H
7G WHT(14)-6G
7H WHT(14)-6H
D BRN(14)-S2
9H WHT(14)-5H
B GRN(14)-S2
E BLK(14)-S1
BRN
WHT
YEL
BLK
8G WHT(14)-6G
8H WHT(14)-6H

8-63
SHT NO. 18

DWG NO 91303

COMPONENT LOCATIONS

NO.	NAME	SHT.NO.
16	WINDSHIELD WASHER FLUID RESERVOIR	03
27	COOLING FANS	02
28	ALTERNATOR	02
29	SENSOR-RADIATOR COOLANT TEMP,LOWER	03
30	A/C COMPRESSOR	03
31	PRESSURE SWITCH-P/S,A/C	03
32	PRESSURE SWITCH-COOLING FANS	03
33	PRESSURE SWITCH-A/C,LOW	03
34	PRESSURE SWITCH-A/C,HIGH	03
35	SENSOR-RADIATOR COOLANT TEMP,UPPER	03
36	CONNECTOR-TO 209	02
37	RELAY-FAN	02
38	RELAY-A/C CLUTCH	02
39	RELAY-FAN	02
40	CIRCUIT BREAKER-20 AMP	02
41	CIRCUIT BREAKER-20 AMP	02
42	DIODE	03
43	DIODE	03
44	DIODE	03
45	SOLENOID VALVE	02
46	PRESSURE SWITCH	02
48	RELAY-EMISSION TIMER	02
49	AUTOMATIC TRANSMISSION COMPUTER 6.	03
50	HEADLAMP,RIGHT	01
51	HEADLAMP,LEFT	01
52	HORN	01
53	AIR BY-PASS VALVE	03
55	IGNITION MODULE	03
57	RELAY-NEUTRAL START 6.	04
58	ACCELERATOR CABLE TERMINALS OR CRUISE CNTRL	04
60	SPLICE-TO CRUISE CONTROL	07
64	OVERFLOW BOTTLE 6.	04
65	BRAKE FLUID RESERVOIR	03
67	STARTER	03
70	AIRFLOW METER	02
72	TURN AND PARK LAMP,RIGHT FRONT	01
73	SIDEMARKER,RIGHT FRONT	01
74	TURN AND PARK LAMP,LEFT FRONT	01
75	SIDEMARKER,LEFT FRONT	01
78	RELAY-RPM	06
79	LAMBOA SENSOR	06
85	BAROMETRIC PRESSURE SENSOR	10
86	FUEL PUMP	11
87	INJECTION COMPUTER	11
92	RELAY-TACHYMETRIQUE 6.	10
97	HEATER FAN	04
98	WINDSHIELD WIPER MOTOR	04
100	BREAKER PLATE	05,14
102	HAZARD FLASHER SWITCH	07
109	CONNECTOR-TO AD08	07
110	CONNECTOR-TO ADIP16 ORN/BLK)	07
112	FUSE PANEL	07
113	BRAKE LIGHT SWITCH	07
114	IGNITION SWITCH	08
119	HEATER CONTROL SWITCH	08
120	INSTRUMENT CLUSTER	08
125	HEATER CONTROL LIGHTS	08
127	BATTERY CHANGEOVER SWITCH	07
129	WATER TEMPERATURE FLASHER	09
130	TAILLIGHT ADAPTER ASSEMBLY	10
131	RELAY-CLEARANCE LIGHTS	10
133	RELAY-HIGH ENGINE TEMP	10
134	DIODE	09
135	CAB DOOR SWITCH,LEFT	09
137	PARK BRAKE	10
138	PARK BRAKE LIGHT	10
139	SEAT BELT	10
140	FUEL TANK SENDING UNIT	11
141	SPLICE-RENAULT TO WINNEBAGO	11
142	ASHTRAY LIGHT,LEFT	13
144	FRONT CLEARANCE LIGHT-LEFT	12
145	FRONT CLEARANCE LIGHT-CENTER	12
146	FRONT CLEARANCE LIGHT-RIGHT	12
147	FRONT CLEARANCE LIGHT-RIGHT SIDE	12
148	DOME LIGHT	12
149	ASHTRAY LIGHT,RIGHT	12
150	FOOT LIGHT,RIGHT	12
151	VISOR LIGHT	12
152	REAR CLEARANCE LIGHT-LEFT SIDE	17,18
153	REAR CLEARANCE LIGHT-LEFT	17,18
154	REAR CLEARANCE LIGHT-CENTER	17,18
155	REAR CLEARANCE LIGHT-RIGHT	17.18
156	REAR CLEARANCE LIGHT-RIGHT SIDE	17,18
157	SIDE MARKER,RIGHT REAR	17,18
158	TAIL LIGHT,RIGHT	17,18
159	SIDE MARKER,LEFT REAR	17,18
160	TAIL LIGHT,LEFT	17,18
161	LICENSE PLATE LIGHT	17,18
163	GROUND	10
164	INTERNAL SPLICE	05
165	INTERNAL SPLICE	05
166	AIR BYPASS SOLENOID	05
167	INJECTOR-CYLINDER #1	05
168	INJECTOR-CYLINDER #2	05
169	INJECTOR-CYLINDER #3	05
170	INJECTOR-COLD START	05
171	GROUND	05
172	THROTTLE POSITION SWITCH	05
173	INJECTOR-CYLINDER #4	05
174	WATER TEMPERATURE SWITCH-THERMO TIME	05
175	WATER TEMPERATURE SENSOR-INJECTION SYSTEM	05
176	CAB DOOR SWITCH,RIGHT	09
177	TURN SIGNAL/HEADLAMP/WASHER MECHANISM	09
178	FRONT LEFT CLEARANCE LIGHT-LEFT SIDE	12
186	CONNECTOR-UNUSED	09
187	CONNECTOR-UNUSED	08
188	CONNECTOR-UNUSED	08
189	TO TANSMISSION BELL HOUSING	03
190	RELAY-PUMP,FNL DRIVE	02
191	SWITCH-THERMO	02
192	PUMP-FNL DRIVE	02
193	CIRCUIT BREAKER-20 AMP	02
194	CONNECTOR TO AD6	08
195	BATTERY CONDITION SWITCH	06
196	BATTERY CONDITION GAUGE	06
197	DIODE-IGNITION SWITCH	08
199	CIGARETTE LIGHTER	07
200	BRAKE PAD SENSOR	01
202	AUTO A/C GROUND	13
203	RELAY-REAR W/W AND AUTO HEATER	13
204	RADIO PLUG	13
205	GROUND BAR	14
206	LEFT DOOR SPEAKER	14
207	RIGHT DOOR SPEAKER	14
209	CONNECTOR-TO 36	14
210	BATTERY CHANGEOVER SOLENOID	14
211	BATTERY (CHASSIS)	14
212	BATTERY GROUND	14
213	POWER DOOR LOCK,GROUND	14
214	RELAY-POWER DOOR LOCK(UNLOCK)	14
215	RELAY-POWER DOOR LOCK(LOCK)	14
216	MOTOR-POWER DOOR,RIGHT	14
217	SWITCH-POWER DOOR,RIGHT	14
218	MOTOR-POWER DOOR,LEFT	15
219	SWITCH-POWER DOOR,LEFT	15
220	MOTOR-POWER DOOR,COACH	14
221	REAR AUTO HEATER	15
222	MOTOR-REAR AUTO HEATER	15
223	SWITCH-AISLE LIGHT	15
224	AISLE LIGHT-DOOR	15
225	AISLE LIGHT-REAR	15
226	SPEAKER-RIGHT REAR	15,16
227	SPEAKER-LEFT REAR	15,16
228	SWITCH REAR WIPER/WASHER	15
229	SWITCH-REAR AUTO HEATER	15
230	GROUND-TAIL LIGHTS	16,18
231	REAR WIPER MOTOR	17
232	REAR WASHER BOTTLE	17
234	GROUND-RELAY	13
236	CONNECTOR-UNUSED 1.	10
237	RELAY	10
238	RELAY-DELAY	10
239	SENDING UNIT-OIL LEVEL	09
240	RELAY-WIPER DELAY	08
241	TRANSMISSION	04
242	FUSE-25A	13
243	EVAPORATOR FAN MOTOR	12,13
244	RELAY-A/C (SPST,NORMALLY OPEN)	12
245	THERMOSTAT-A/C	12
246	FAN SPEED SWITCH 1.	12
247	TRAILER PLUG	16
248	RELAY-TURN SIGNAL	07
249	OVERHEAD LIGHT	15,16

TITLE: WIRING DIAGRAM-CHASSIS (GAS) DWG NO 91303 SIZE DO NOT SCALE DRAWING SHEET

CONNECTOR LOCATIONS

NO.	NAME	SHT. NO.
T2	CONNECTOR-TO E6	05
T3	CONNECTOR-THROTTLE POSITION SWITCH	05
T4	CONNECTOR-AIR BYPASS SOLENOID	05
T5	CONNECTOR-INJECTOR-CYLINDER #1	05
T6	CONNECTOR-INJECTOR-CYLINDER #2	05
T7	CONNECTOR-INJECTOR-COLD START	05
T8	CONNECTOR-INJECTOR-CYLINDER #3	05
T9	CONNECTOR-INJECTOR-CYLINDER #4	05
T10	CONNECTOR-WATER TEMPERATURE SWITCH	05
T11	CONNECTOR-WATER TEMPERATURE SENSOR	05
U1	CONNECTOR-TO AD9	14
U2	CONNECTOR-TO RELAY (LOCK)	14
U3	CONNECTOR-TO RELAY (UNLOCK)	14
U4	SPLICES-WIRE ASM,COACH DOOR LOCK	14
U5	INTERNAL SPLICE	14
U6	INTERNAL SPLICE	14
U7	INTERNAL SPLICE	14
U8	INTERNAL SPLICE	14
U9	INTERNAL SPLICE	14
U10	INTERNAL SPLICE	14
U11	INTERNAL SPLICE	14
U12	INTERNAL SPLICE	14
U13	INTERNAL SPLICE	14
W1	CONNECTOR-CHIME	10
W21	CONNECTOR-TO M4	10
X1	CONNECTOR-TO A19	08
X2	CONNECTOR-UNUSED	07
X3	CONNECTOR-CIGARETTE LIGHTER	07
Y	TO IGNITION MODULE	03
Z	TO 189	03
AA	TO IGNITION MODULE	03
AB1	CONNECTOR-RELAY-PUMP,FNL DRIVE	02
AB2	CONNECTOR-PUMP-FNL DRIVE	02
AB3	INTERNAL SPLICE	02
AB4	INTERNAL SPLICE	02
AC1	MOTOR-POWER DOOR LOCK,COACH	14
AC2	SPLICE-TO U4	14
AD1	CONNECTOR-TO AE2	13
AD2	CONNECTOR-TO M12	13
AD3	CONNECTOR-TO M10	13
AD4	CONNECTOR-TO AM1	13
AD5	CONNECTOR-RADIO	13
AD6	CONNECTOR-TO 194	13
AD7	CONNECTOR-RELAY-REAR W/W AND AUTO HEATER	13
AD8	CONNECTOR-TO 109	14
AD9	CONNECTOR-TO U1	14
AD10	INTERNAL SPLICE	14
AD11	INTERNAL SPLICE	14
AD12	INTERNAL SPLICE	14
AD13	INTERNAL SPLICE	14
AD14	INTERNAL SPLICE	14
AD15	INTERNAL SPLICE	15
AE1	CONNECTOR-TO M11	13
AE2	CONNECTOR-TO AD1	14
AE3	CONNECTOR-TO REAR AUTO HEATER	15
AE4	INTERNAL SPLICE	14
AE5	INTERNAL SPLICE	15
AE6	INTERNAL SPLICE	15
AE7	INTERNAL SPLICE	15
AF	SPLICE-TO S28	17
AG1	CONNECTOR-TO AP1	15
AJ1	CONNECTOR-TO G2	04
AK1	CONNECTOR-TO 247	16
AK2	INTERNAL SPLICE	16
AK3	INTERNAL SPLICE	16
AK4	INTERNAL SPLICE	16
AK5	INTERNAL SPLICE	16
AK6	INTERNAL SPLICE	16
AK7	INTERNAL SPLICE	16
AK8	CONNECTOR-TO S4	16
AK9	CONNECTOR-TO M16	16
AK10	CONNECTOR-TO S3	16
AK11	CONNECTOR-TO M15	16
AK12	CONNECTOR-TO S1	16
AK13	CONNECTOR-TO M13	16
AL1	CONNECTOR-TO OIL SENDING UNIT	09
AM1	CONNECTOR-TO AD4	13
AM2	FUSE-25A	13
AM3	FUSE-25A	13
AM4	INTERNAL SPLICE	13
AM5	CONNECTOR-TO FAN MOTOR,LEFT	12
AM6	RELAY-FAN,HIGH SPEED,LEFT	12
AM7	RELAY-FAN,HIGH SPEED,RIGHT	12
AM8	RELAY-SWITCH POWER	12
AM9	CONNECTOR-TO FAN SPEED SWITCH	12
AM10	CONNECTOR-TO FAN MOTOR,RIGHT	13
AN1	CONNECTOR-TO DELAY RELAY	10
AN2	CONNECTOR-TO RELAY	10
AN3	CONNECTOR-TO J5	10
AP1	CONNECTOR-TO AG1	15
AP2	CONNECTOR-TO M11	13
AP3	CONNECTOR-TO M10	13
AP4	INTERNAL SPLICE	15
AP5	INTERNAL SPLICE	15
AP6	CONNECTOR-TO AR	16
AP7	INTERNAL SPLICE	16
AP8	INTERNAL SPLICE	16
AP9	CONNECTOR-TO AR	16
AP10	CONNECTOR-TO AR	15
AR	CONNECTOR-TO 249	15,16

DWG NO 91303

TITLE WIRING DIAGRAM-CHASSIS (GAS)

DWG NO 91303

DWG NO 91303

CONNECTOR LOCATIONS

NO.	NAME	SHT.NO.
A1	CONNECTOR-FUSE PANEL (WHITE)	07
A2	CONNECTOR-FUSE PANEL (YELLOW)	07
A3	CONNECTOR-FUSE PANEL (BROWN)	07
A4	CONNECTOR-FUSE PANEL (GREEN)	07
A5	CONNECTOR-FUSE PANEL (RED)	07
A7	CONNECTOR-TURN SIGNAL SWITCH	09
A8	CONNECTOR-WINDSHIELD WIPER SWITCH	09
A9	CONNECTOR-LIGHT SWITCH	09
A10	CONNECTOR-INSTRUMENT CLUSTER	08
A11	CONNECTOR-INSTRUMENT CLUSTER	08
A12	CONNECTOR-INSTRUMENT CLUSTER	08
A13	CONNECTOR-EMERGENCY FLASHER SWITCH	07
A14	CONNECTOR-WINDSHIELD WIPER MOTOR	04
A15	CONNECTOR-TO M1	06
A16	CONNECTOR-TO M3	09
A17	CONNECTOR-TO G1	04
A19	CONNECTOR-TO X1	08
A20	CONNECTOR-HEATER SWITCH	08
A21	CONNECTOR-HEATER MOTOR	04
A22	CONNECTOR-UNUSED	01
A23	CONNECTOR-TO C1	03
A26	CONNECTOR-UNUSED	07
A27	CONNECTOR-BRAKE LIGHT SWITCH	07
A28	CONNECTOR-IGNITION SWITCH	08
A29	CONNECTOR-IGNITION SWITCH	08
A31	CONNECTOR-TO K3	03
A32	CONNECTOR-WIPER DELAY RELAY	08
A35	CONNECTOR-TO J1	08
A36	CONNECTOR-TO K4	03
A38	CONNECTOR-TO M2	06
A39	CONNECTOR-TO A41	08
A40	CONNECTOR-TO F5	04
A41	CONNECTOR-TO A39	08
A42	CONNECTOR-UNUSED	01
A46	CONNECTOR-FUSE PANEL	07
A61	CONNECTOR-TO G6	04
A62	GROUND-FIREWALL	03
A66	SPLICE-RADIO MEMORY	07
A67	CONNECTOR-UNUSED	08
A68	CONNECTOR-TO L56	01
A69	CONNECTOR-BRAKE PAN SENSOR	01
A70	CONNECTOR-BRAKE PAN SENSOR	01
A71	INTERNAL SPLICE	03
A72	INTERNAL SPLICE	06
A73	SPLICE-TO 72 AND 73	01
A74	SPLICE-TO 74 AND 75	01
A76	GROUND-FIREWALL	03
A77	INTERNAL SPLICE	06
A78	INTERNAL SPLICE	06
A79	INTERNAL SPLICE	06
A80	INTERNAL SPLICE	08
A81	INTERNAL SPLICE	07
A82	INTERNAL SPLICE	08
A83	INTERNAL SPLICE	07
C1	CONNECTOR-TO A23	03
C2	CONNECTOR-TO WINDSHIELD WASHER PUMP	03
D1	CONNECTOR-TO A69 AND A70	01
E1	CONNECTOR-INJECTION COMPUTER	11
E2	CONNECTOR-BAROMETRIC PRESSURE SENSOR	10
E3	CONNECTOR-TO J2	09
E4	DIAGNOSTIC PLUG	06
E5	CONNECTOR-RELAY-RPM	06
E6	CONNECTOR-TO T2	05
E7	DIAGNOSTIC PLUG	06
E8	CONNECTOR-TO T1	05
E9	CONNECTOR-AIR FLOW METER	02
E10	CONNECTOR-TO K2	03
E11	CONNECTOR-TO J4	10
E12	CONNECTOR-TO J3	10
E13	CONNECTOR-TO J6	10
E20	INTERNAL SPLICE	10
E21	INTERNAL SPLICE	10
E22	INTERNAL SPLICE	11
E23	INTERNAL SPLICE	10
E24	INTERNAL SPLICE	10
E25	INTERNAL SPLICE	09
E26	INTERNAL SPLICE	09
F1	CONNECTOR-TO G2	04
F3	CONNECTOR-AUTOMATIC TRANSMISSION COMPUTER	03
F4	CONNECTOR-RELAY-NEUTRAL START	04
F5	CONNECTOR-TO A40	04
F11	CONNECTOR-TO K18	04
G1	CONNECTOR-TO A17	04
G2	CONNECTOR-TO F1 OR AJ1 △1.	04
G3	CONNECTOR-ALTERNATOR	02
G4	CONNECTOR-TO H	04
G6	CONNECTOR-TO A61	04
G10	TERMINAL-ALTERNATOR,POSITIVE	02
G11	WATER TEMPERATURE SENSOR (LIGHT)	02
G12	WATER TEMPERATURE SENSOR (GUAGE)	02
G13	OIL PRESSURE SENSOR	02
H	CONNECTOR-TO G4	04

NO.	DESCRIPTION	SHT.NO.
J1	CONNECTOR-TO A35	08
J2	CONNECTOR-TO E3	09
J3	CONNECTOR-TO E12	10
J4	CONNECTOR-TO E11	10
J5	CONNECTOR-RELAY-TACHYMETRIQUE OR AN3 △1.	10
J6	CONNECTOR-TO E13	10
K1	CONNECTOR-IGNITION MODULE	03
K2	CONNECTOR-TO E10	03
K3	CONNECTOR-TO A31	03
K4	CONNECTOR-TO A36	03
K5	CONNECTOR-RELAY-EMISSION TIMER	02
K6	CONNECTOR-PRESSURE SWITCH	02
K18	CONNECTOR-TO F11	04
K24	CONNECTOR-TO L44	02
L1	CONNECTOR-RELAY-FAN	02
L2	CONNECTOR-RELAY-A/C CLUTCH	02
L3	CONNECTOR-RELAY-FAN	02
L4	CONNECTOR-PRESSURE SWITCH-P/S,A/C	03
L5	CONNECTOR-PRESSURE SWITCH-COOLING FANS	03
L6	CONNECTOR-PRESSURE SWITCH-A/C,LOW	03
L7	CONNECTOR-PRESSURE SWITCH-A/C,HIGH	03
L10	CONNECTOR-COOLING FANS	02
L12	CONNECTOR-COOLING FANS	02
L24	TERMINAL-ALTERNATOR,NEGATIVE	02
L44	CONNECTOR-TO K24	02
L56	CONNECTOR-TO A68	01
L74	INTERNAL SPLICE	02
M1	CONNECTOR-TO A15	06
M2	CONNECTOR-TO A38	06
M3	CONNECTOR-TO A16	09
M4	CONNECTOR-TO W21	10
M5	CONNECTOR-RELAY CLEARANCE LIGHTS	10
M6	CONNECTOR-TAIL LIGHT ADAPTER ASSEMBLY	10
M9	CONNECTOR-RELAY-HIGH ENGINE TEMP	10
M10	CONNECTOR-TO AD3 OR AP3 △3.	13
M11	CONNECTOR-TO AE1 OR AP2 △3.	13
M12	CONNECTOR-TO AD2 △5.	13
M13	CONNECTOR-TO S1 OR AK13 △1.	16
M14	CONNECTOR-TO S2	16
M15	CONNECTOR-TO S3 OR AK11 △1.	16
M16	CONNECTOR-TO S4 OR AK9 △1.	16
M17	CONNECTOR-SEAT BELT	10
M18	CONNECTOR-TO N	10
M19	CONNECTOR-TO S6	18
M20	CONNECTOR-TO P	10
M21	CONNECTOR-TO S5	18
M22	INTERNAL SPLICE	12
M23	INTERNAL SPLICE	12
M24	INTERNAL SPLICE	12
M25	INTERNAL SPLICE	12
M26	INTERNAL SPLICE	12
M27	INTERNAL SPLICE	12
M28	INTERNAL SPLICE	12
M29	INTERNAL SPLICE	12
M30	INTERNAL SPLICE	12
M31	INTERNAL SPLICE	18
M32	INTERNAL SPLICE	18
M33	INTERNAL SPLICE	18
M34	INTERNAL SPLICE	18
M35	INTERNAL SPLICE	18
N	CONNECTOR-TO M18	10
P	CONNECTOR-TO M20	10
R	CONNECTOR-TO FUEL SENSOR	11
S1	CONNECTOR-TO M13 OR AK12 △1.	16
S2	CONNECTOR-TO M14	16
S3	CONNECTOR-TO M15 OR AK10 △1.	16
S4	CONNECTOR-TO M16 OR AK8 △1.	16
S5	CONNECTOR-TO M21	18
S6	CONNECTOR-TO M19	18
S7	INTERNAL SPLICE	17
S8	INTERNAL SPLICE	16
S9	INTERNAL SPLICE	17
S10	INTERNAL SPLICE	16
S11	INTERNAL SPLICE	17
S12	INTERNAL SPLICE	17
S13	INTERNAL SPLICE	17
S14	INTERNAL SPLICE	17
S15	INTERNAL SPLICE	17
S16	INTERNAL SPLICE	17
S17	INTERNAL SPLICE	17
S18	INTERNAL SPLICE	17
S19	INTERNAL SPLICE	17
S20	INTERNAL SPLICE	17
S21	INTERNAL SPLICE	17
S22	INTERNAL SPLICE	18
S23	INTERNAL SPLICE	18
S24	INTERNAL SPLICE	18
S25	INTERNAL SPLICE	18
S26	INTERNAL SPLICE	18
S27	INTERNAL SPLICE	18
S28	INTERNAL SPLICE	17
T1	CONNECTOR-TO E8	05

TITLE: WIRING DIAGRAM-CHASSIS (GAS)
DO NOT SCALE DRAWING
SIZE
DWG NO 91303
SHEET

DWG NO 91303

HARNESS CODES

WIRE ASM	DESCRIPTION	#
A	WIRE ASM-AUTO,FRONT	
C	WIRE ASM-PUMP,W/S WASHER	
D	WIRE ASM-BRAKE PAD WEAR	
E	WIRE ASM-INJECTION,ELECT	
F	WIRE ASM-TRANS,AUTO --------------	6
G	WIRE ASM-ENGINE	
H	WIRE ASM-OVERFLOW BOTTLE LIGHT	
J	WIRE ASM-INJECTION SYSTEM	
K	WIRE ASM-EMISSION CONTROL	
L	WIRE ASM-COOLING FANS	
M	WIRE ASM-EXTERIOR LIGHTING	
N	WIRE ASM-PARK BRAKE	
P	WIRE ASM-SHIFT LEVER LIGHT	
R	WIRE ASM-FUEL TANK SENDER	
S	WIRE ASM-BACKWALL	
T	WIRE ASM-INJECTION,ENGINE	
U	WIRE ASM-LOCK,DOOR,CAB	
W	WIRE ASM-CHIME	
X	WIRE ASM-RADIO/CIG LIGHTER	
Y	WIRE ASM-DISTRIBUTOR IGNITION	
Z	WIRE ASM-SENSOR,MAGNETIC	
AA	WIRE ASM-GROUND,IGNITION MDL	
AB	WIRE ASM-PUMP,FNL DRIVE	
AC	WIRE ASM-LOCK,DOOR,COACH	
AD	WIRE ASM-FRONT RISER,LEFT ---------	5
AE	WIRE ASM-CONTROL CENTER ----------	4,5
AF	WIRE ASM-LICENSE PLATE -----------	5
AG	WIRE ASM-ROOF COVE,RIGHT ----------	3
AJ	WIRE ASM-BACK-UP LIGHTS -----------	1
AK	WIRE ASM-TRAILER LIGHTS -----------	1
AL	WIRE ASM-OIL LEVEL	
AM	WIRE ASM-EVAPORATOR FAN	
AN	WIRE ASM-INJECTION	
AP	WIRE ASM-INTERIOR LIGHTING --------	3
AR	WIRE ASM-OVERHEAD LIGHTS ----------	3

WIRE COLOR CODES

CODE	COLOR	CODE	COLOR
BLK.....	BLACK	PNK.....	PINK
BLU.....	BLUE	RED.....	RED
BRN.....	BROWN	VLT.....	VIOLET
GRN.....	GREEN	WHT.....	WHITE
GRY.....	GRAY	YEL.....	YELLOW
ORN.....	ORANGE	BGE.....	BEIGE
MAR.....	MAROON	PUR.....	PURPLE
SAL.....	SALMON		

6. NOT USED WITH 5-SPEED TRANSMISSION.
5. NOT USED ON SR220RS.
4. NOT USED ON SR220DS.
3. NOT USED ON W/IR220RD AND W/IR220DD.
2. SEE WIRING DIAGRAM-BODY FOR EACH MODEL FOR ADITIONAL WIRING.
1. NOT USED W/AUTOMATIC TRANSMISSION.

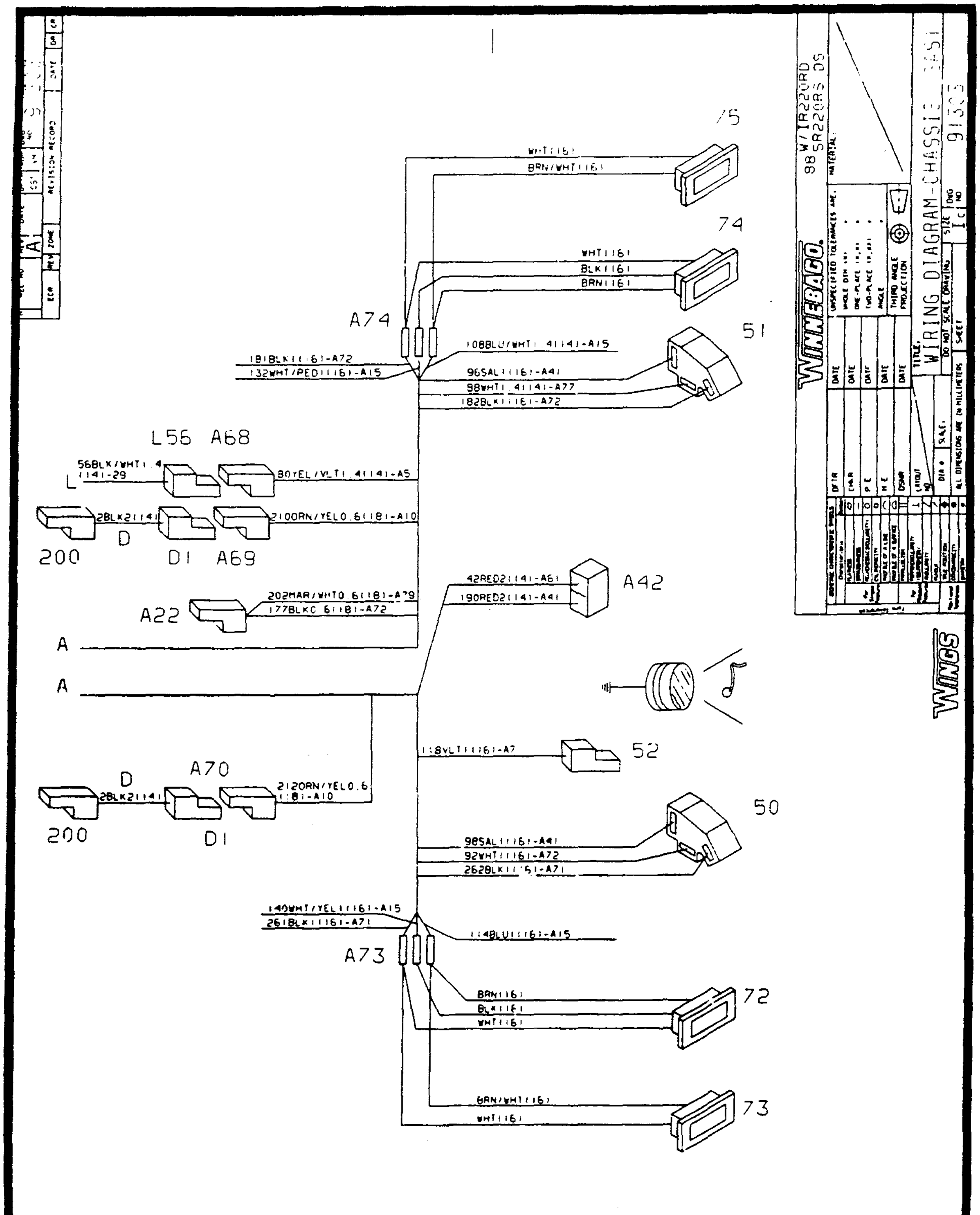
NOTES:

TITLE: WIRING DIAGRAM-CHASSIS

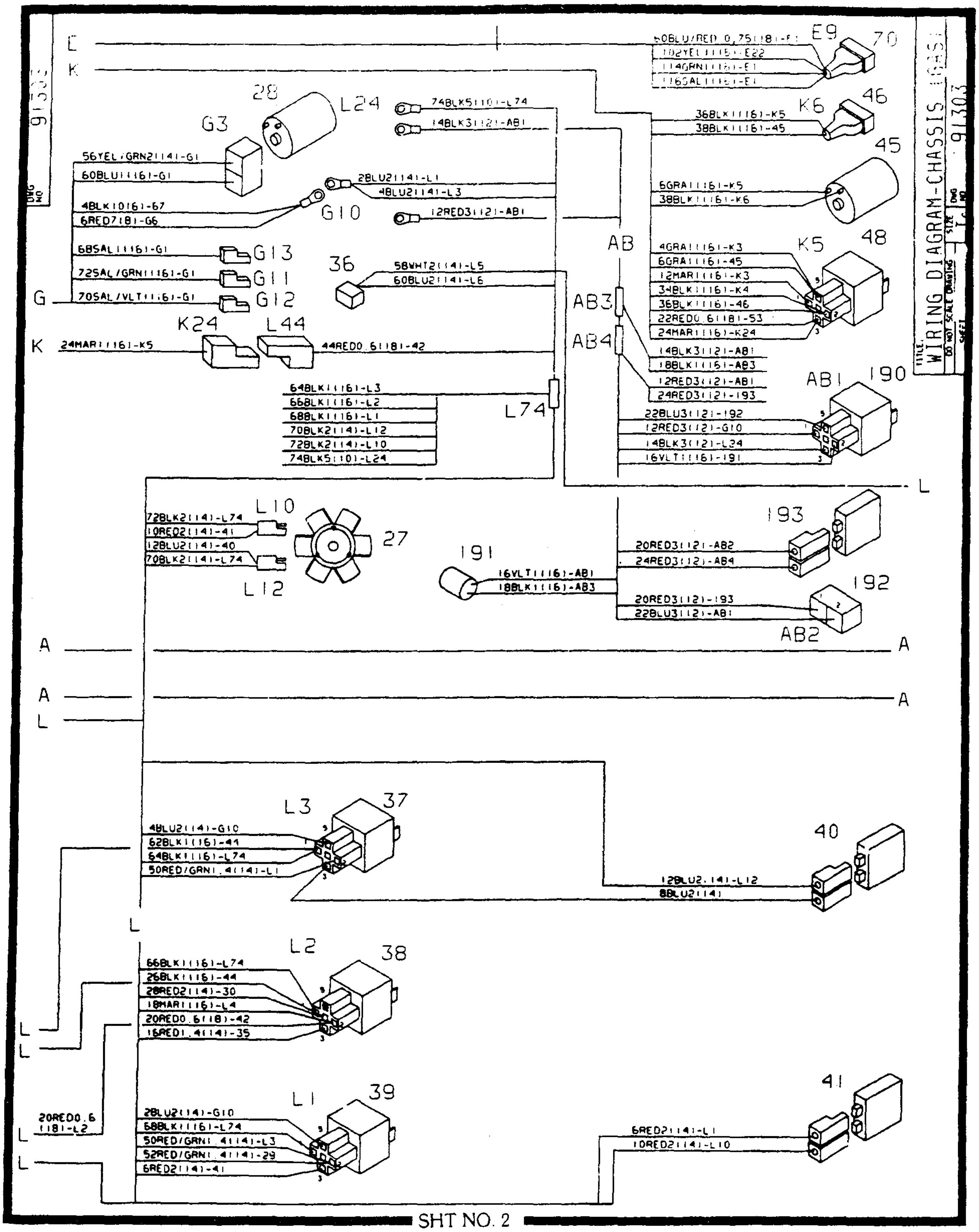
DO NOT SCALE DRAWING

SIZE | DWG NO 91303

SHEET

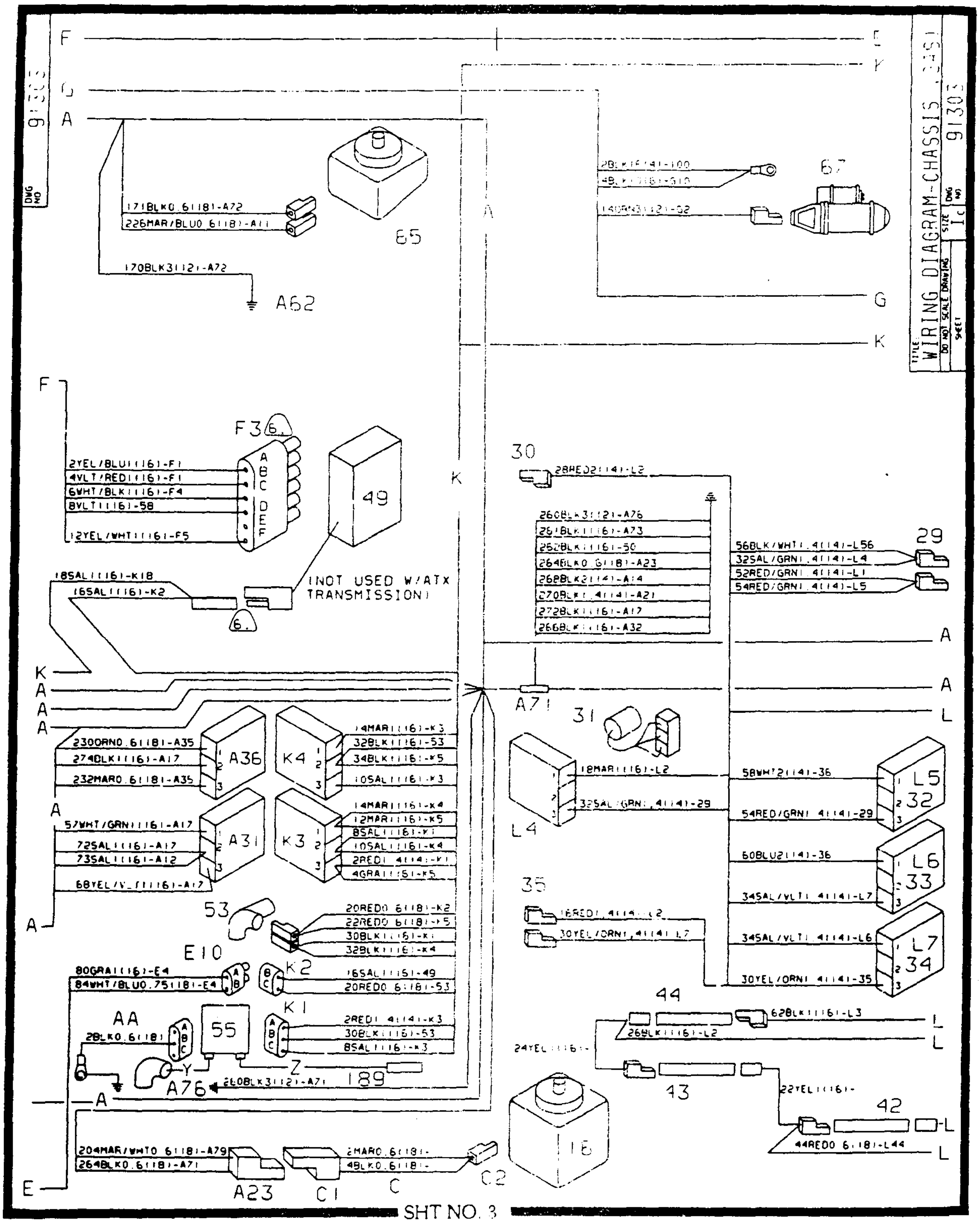

75
74
51
A74
L56
A68
L
200
D
D1
A69
A22
A
A
A42
52
50
D
A70
200
D1
A73
72
73
WINNEBAGO
WINGS
WIRING DIAGRAM-CHASSIS

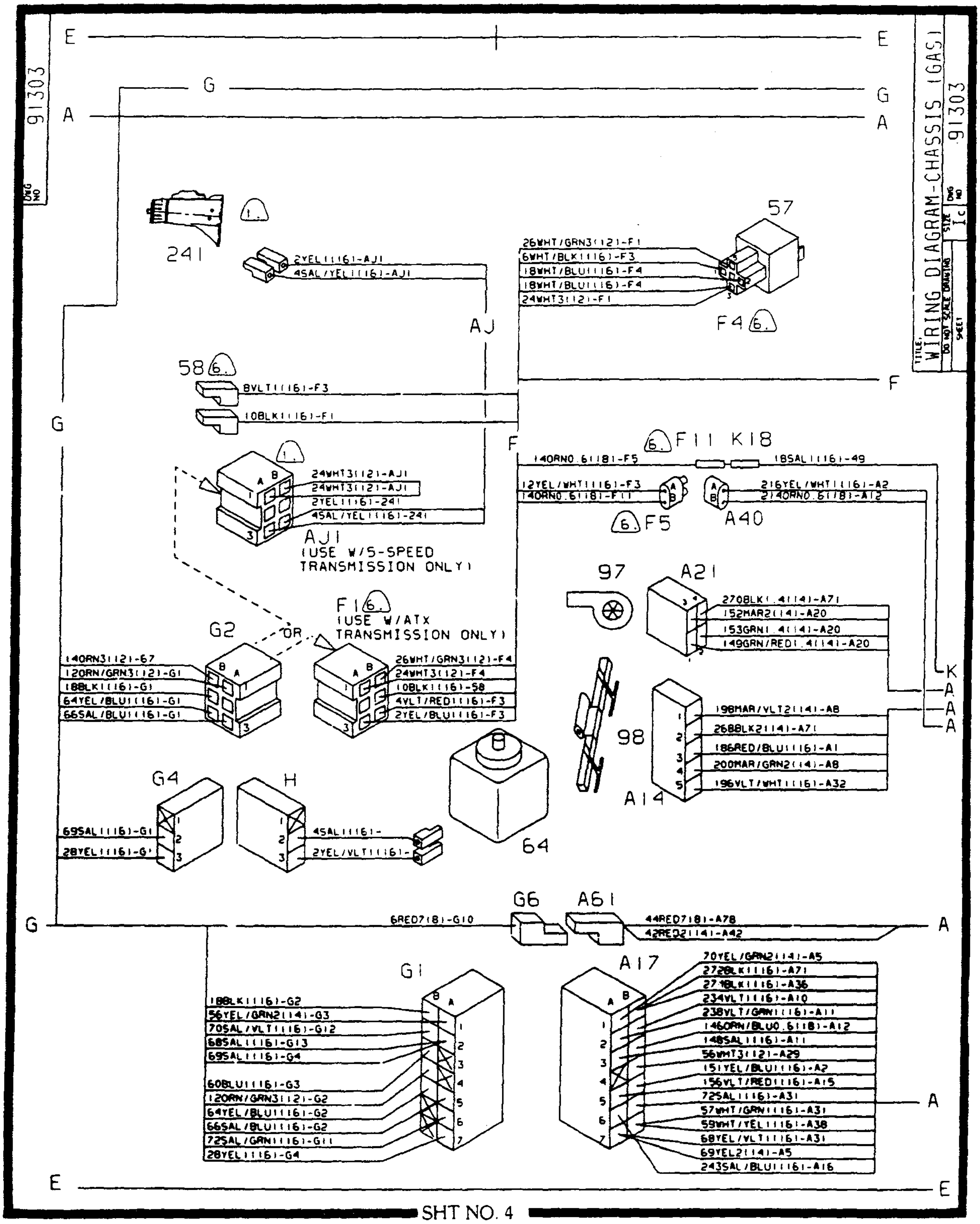
SHT NO. 1

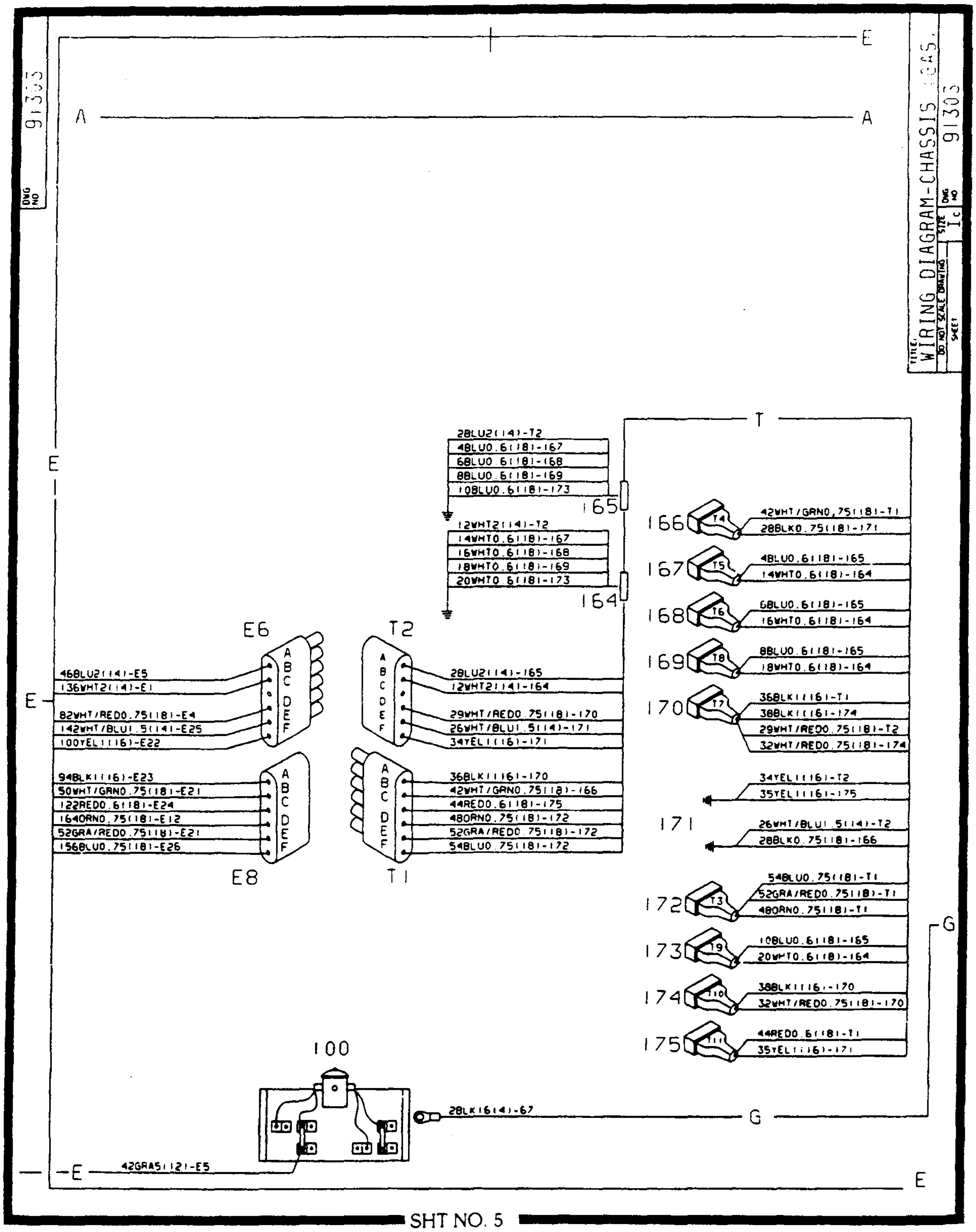

WIRING DIAGRAM-CHASSIS
91303
28
L24
G3
G10
G13
G11
G12
36
K24
L44
AB
AB3
AB4
AB1
190
L74
E9
70
K6
46
45
K5
48
L10
27
L12
191
193
192
AB2
L3
37
40
L2
38
L1
39
41

SHT NO. 2

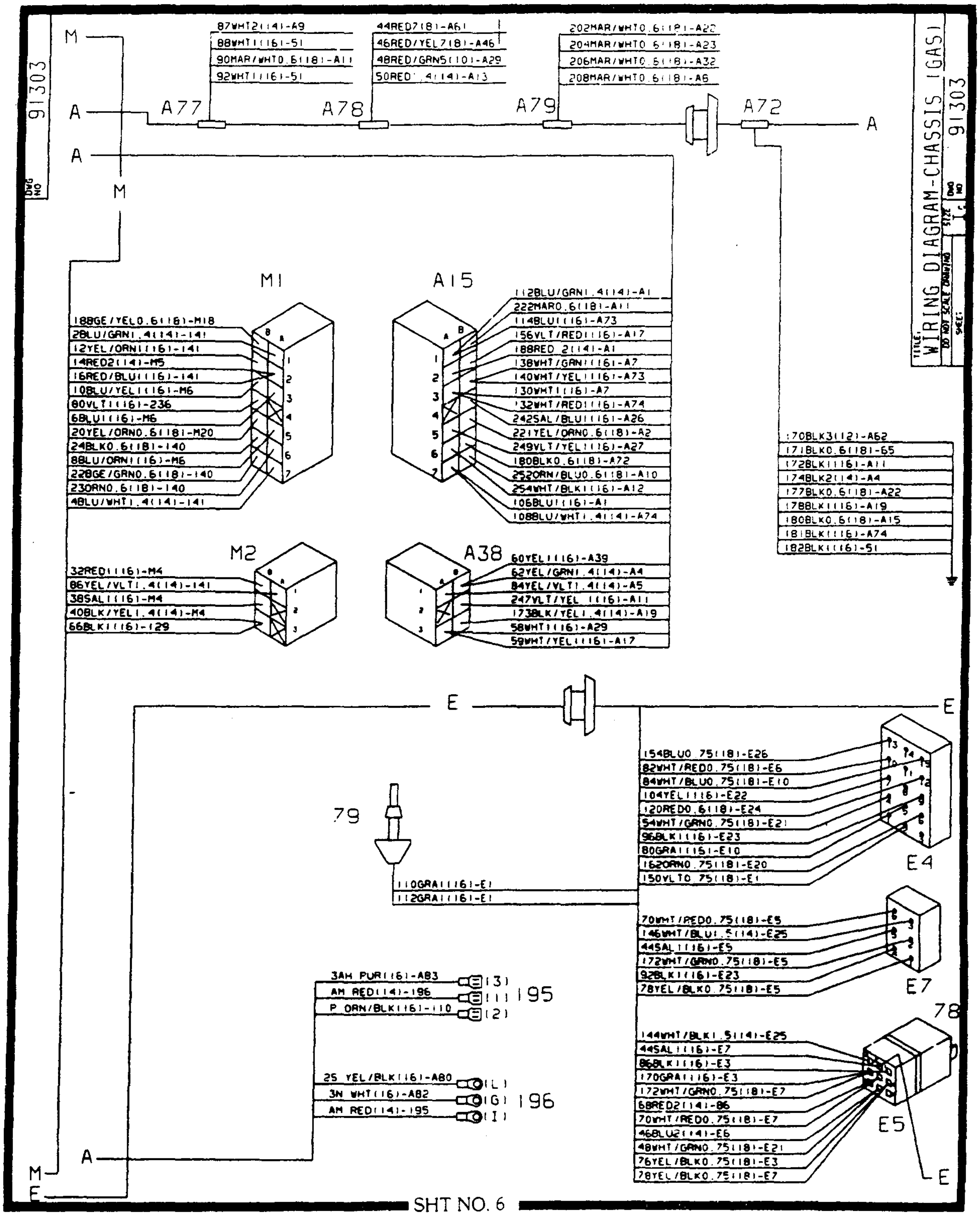
1988 PRODUCTION




91303
DWG NO
E
G
A
TITLE: WIRING DIAGRAM-CHASSIS (GAS)
DO NOT SCALE DRAWING
SIZE 1c
DWG NO 91303
SHEET
241
2YEL1(16)-AJ1
4SAL/YEL1(16)-AJ1
AJ
57
26WHT/GRN3(12)-F1
6WHT/BLK1(16)-F3
18WHT/BLU1(16)-F4
18WHT/BLU1(16)-F4
24WHT3(12)-F1
F4
F
58
8VLT1(16)-F3
10BLK1(16)-F1
24WHT3(12)-AJ1
24WHT3(12)-AJ1
2YEL1(16)-241
4SAL/YEL1(16)-241
AJ1
(USE W/5-SPEED TRANSMISSION ONLY)
F11 K18
140RN0.61(18)-F5
18SAL1(16)-49
12YEL/WHT1(16)-F3
140RN0.61(18)-F11
216YEL/WHT1(16)-A2
2140RN0.61(18)-A12
F5
A40
97
A21
270BLK(.4)(14)-A71
152MAR2(14)-A20
153GRN1.4(14)-A20
149GRN/RED1.4(14)-A20
K
A
F1
(USE W/ATX TRANSMISSION ONLY)
G2
OR
140RN3(12)-67
120RN/GRN3(12)-G1
18BLK1(16)-G1
64YEL/BLU1(16)-G1
66SAL/BLU1(16)-G1
26WHT/GRN3(12)-F4
24WHT3(12)-F4
10BLK1(16)-58
4VLT/RED1(16)-F3
2YEL/BLU1(16)-F3
98
198MAR/VLT2(14)-A8
268BLK2(14)-A71
186RED/BLU1(16)-A1
200MAR/GRN2(14)-A8
196VLT/WHT1(16)-A32
A14
G4
H
69SAL1(16)-G1
28YEL1(16)-G1
45AL1(16)-
2YEL/VLT1(16)-
64
G6
A61
6RED7(8)-G10
44RED7(8)-A78
42RED2(14)-A42
G1
18BLK1(16)-G2
56YEL/GRN2(14)-G3
70SAL/VLT1(16)-G12
68SAL1(16)-G13
69SAL1(16)-G4
60BLU1(16)-G3
120RN/GRN3(12)-G2
64YEL/BLU1(16)-G2
66SAL/BLU1(16)-G2
72SAL/GRN1(16)-G11
28YEL1(16)-G4
A17
70YEL/GRN2(14)-A5
272BLK1(16)-A71
271BLK1(16)-A36
234VLT1(16)-A10
238VLT/GRN1(16)-A11
146ORN/BLU0.61(18)-A12
148SAL1(16)-A11
56WHT3(12)-A29
151YEL/BLU1(16)-A2
156VLT/RED1(16)-A15
72SAL1(16)-A31
57WHT/GRN1(16)-A31
59WHT/YEL1(16)-A38
68YEL/VLT1(16)-A31
69YEL2(14)-A5
243SAL/BLU1(16)-A16
SHT NO. 4

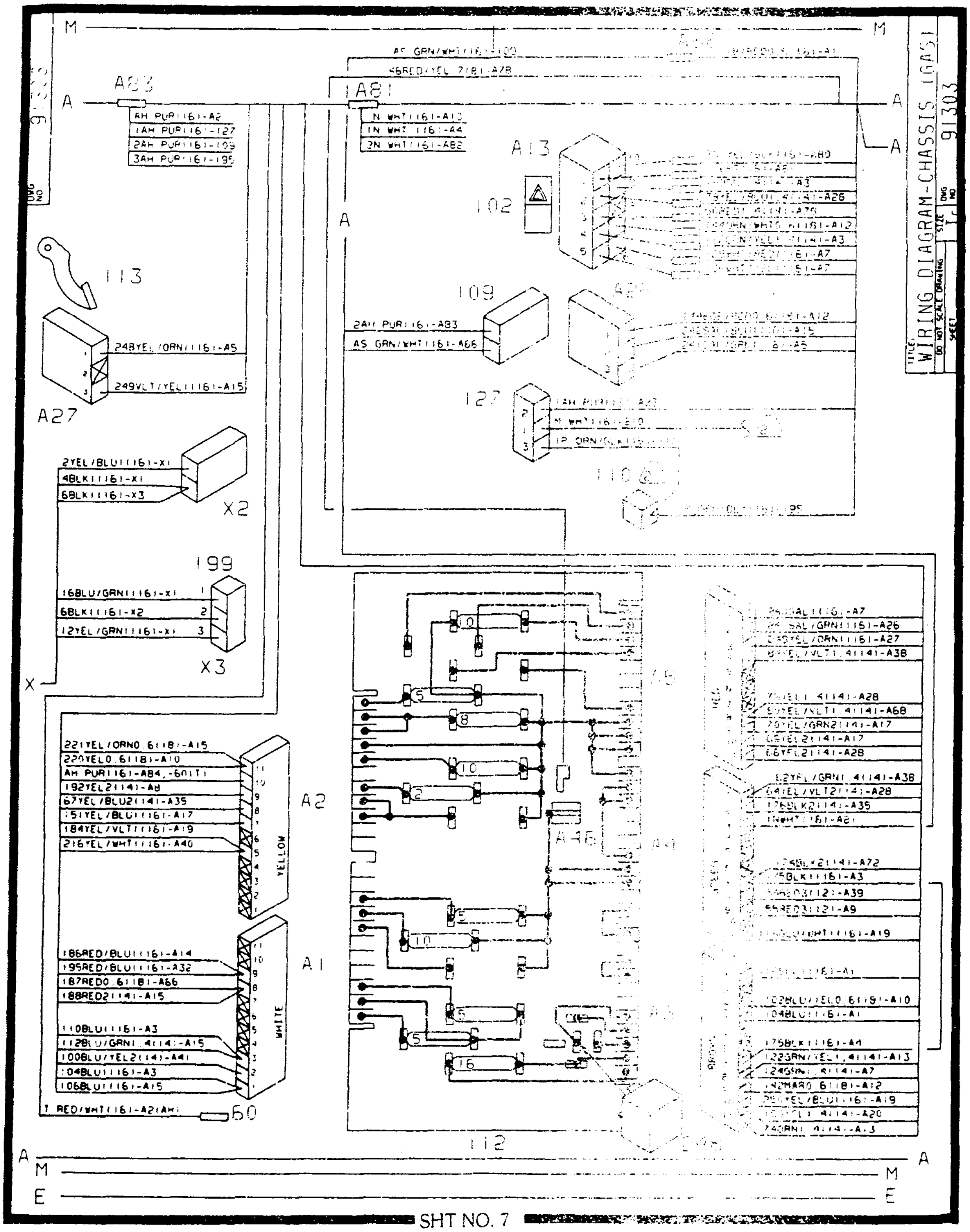


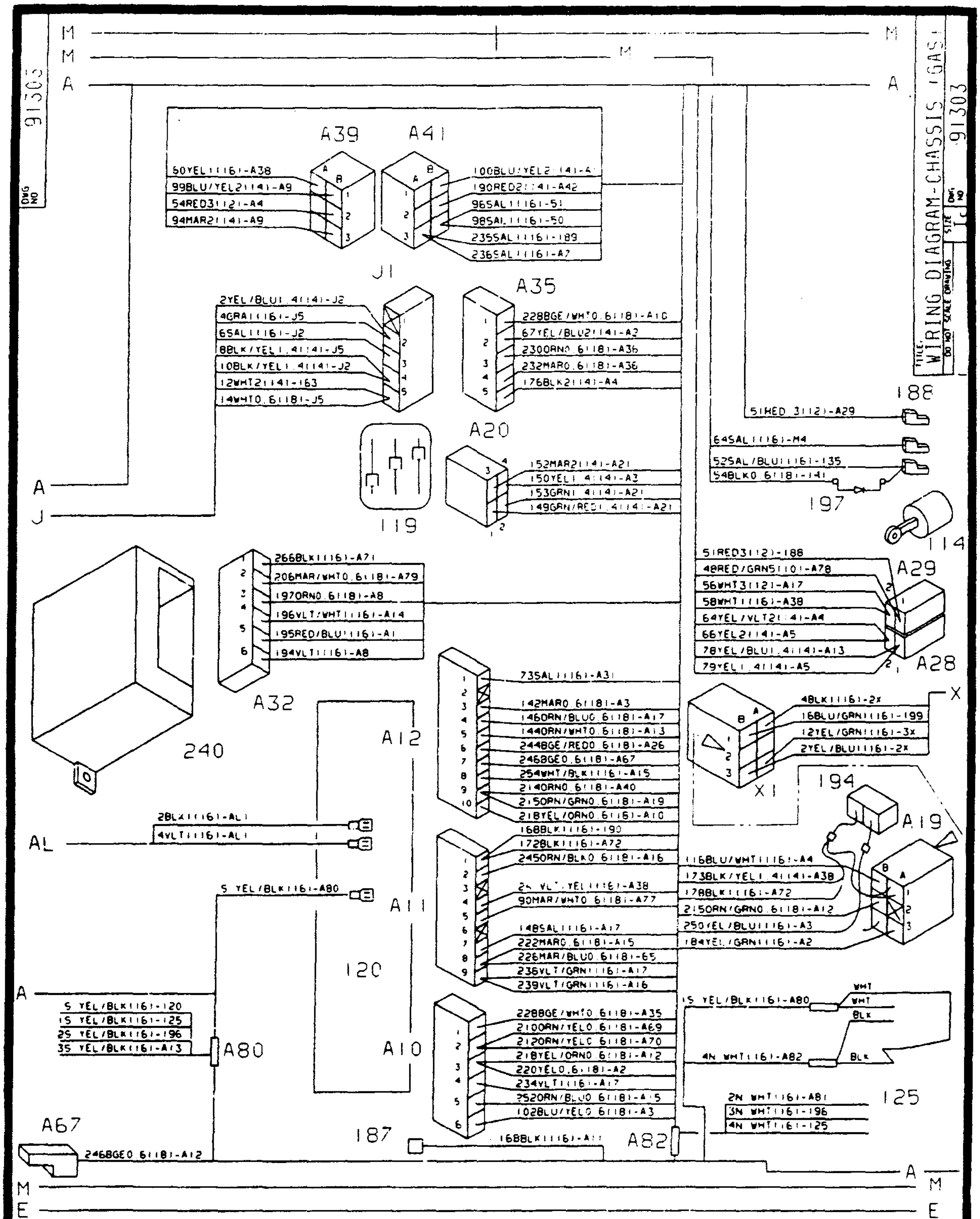
WIRING DIAGRAM-CHASSIS
91303
DWG NO
SHT NO. 5
E6
T2
E8
T1
100
165
164
166
167
168
169
170
171
172
173
174
175



WIRING DIAGRAM-CHASSIS (GAS)
91303
SHT NO. 6
M1
A15
M2
A38
A77
A78
A79
A72
E4
E7
E5
79
195
196
78

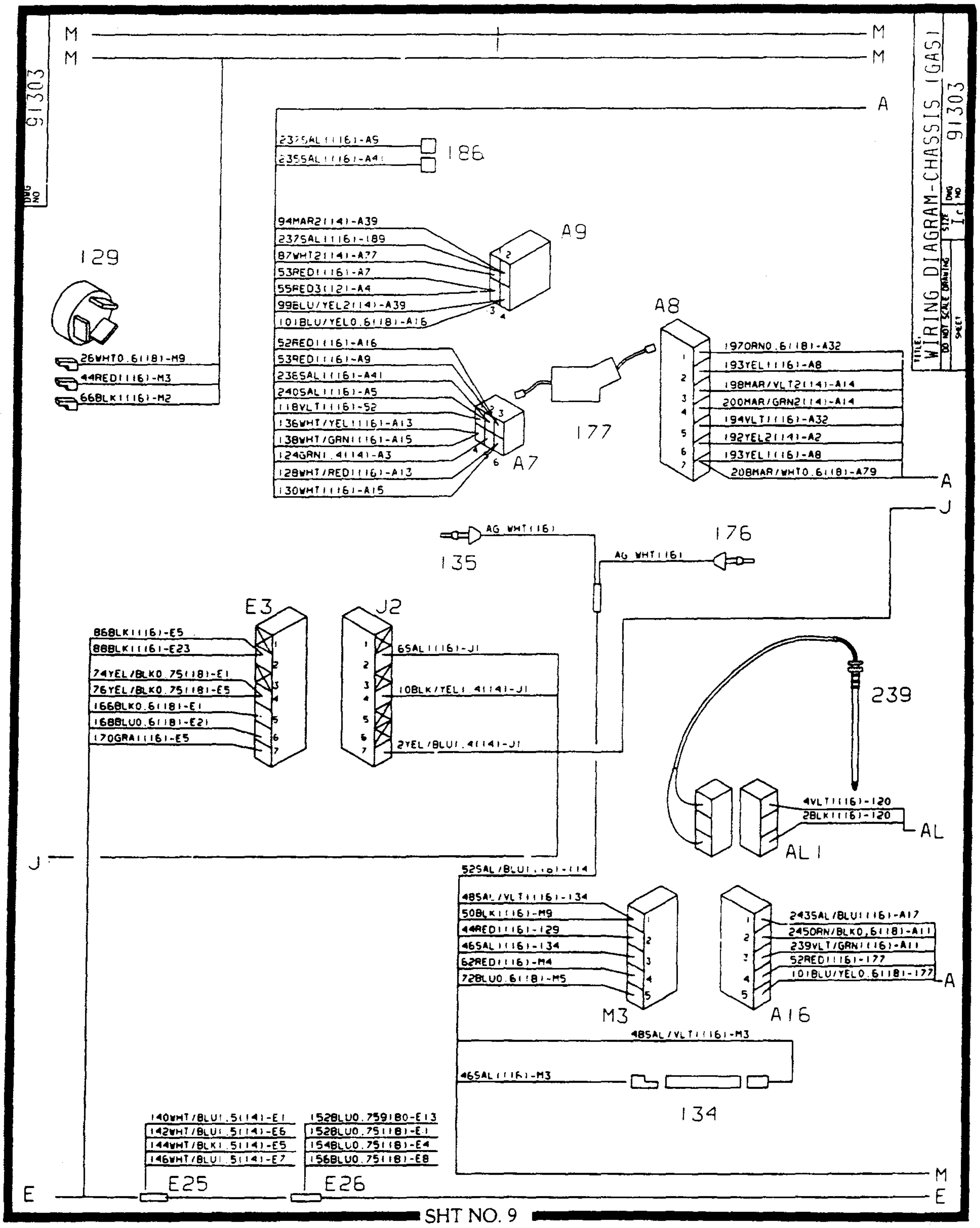
8 — 73


WIRING DIAGRAM-CHASSIS (GAS)
91303
A83
A81
A13
102
113
109
127
110
A27
X2
199
X3
A2
A1
60
112
YELLOW
WHITE
AH PUR(16)-A2
1AH PUR(16)-127
2AH PUR(16)-109
3AH PUR(16)-195
1N WHT(16)-A12
1N WHT(16)-A4
2N WHT(16)-A82
2AH PUR(16)-A83
AS GRN/WHT(16)-A66
248YEL/ORN(16)-A5
249VLT/YEL(16)-A15
2YEL/BLU(16)-X1
4BLK(16)-X1
6BLK(16)-X3
16BLU/GRN(16)-X1
6BLK(16)-X2
12YEL/GRN(16)-X1
221YEL/ORN0.6(18)-A15
220YEL0.6(18)-A10
AH PUR(16)-A84,-60(T)
192YEL2(14)-A8
67YEL/BLU2(14)-A35
151YEL/BLU(16)-A17
184YEL/VLT(16)-A19
216YEL/WHT(16)-A40
186RED/BLU(16)-A14
195RED/BLU(16)-A32
187RED0.6(18)-A66
188RED2(14)-A15
110BLU(16)-A3
112BLU/GRN1.4(14)-A15
100BLU/YEL2(14)-A41
104BLU(16)-A3
106BLU(16)-A15
1 RED/WHT(16)-A2(AH)
SHT NO. 7

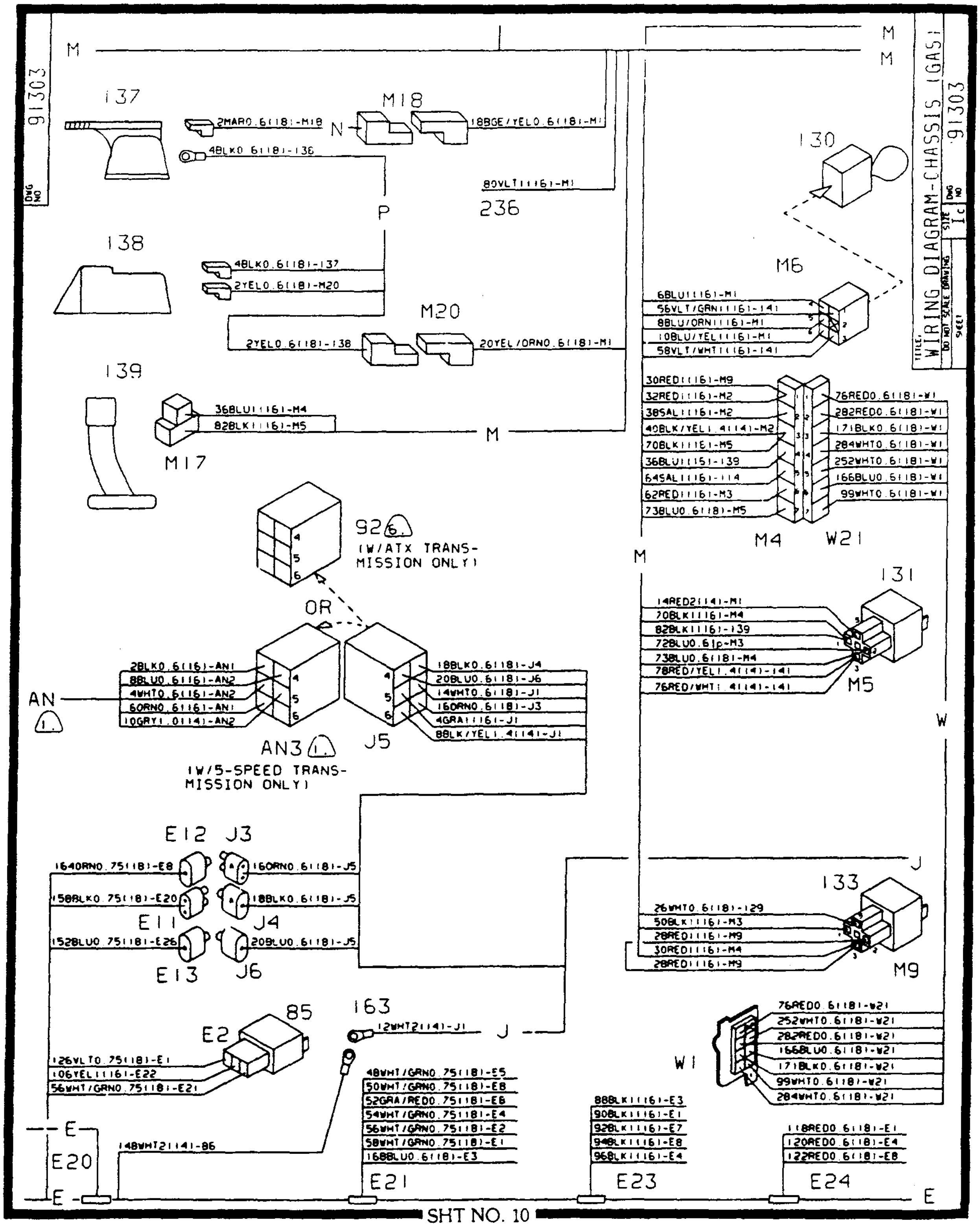

WIRING DIAGRAM-CHASSIS (GAS)
91303
A39
A41
J1
A35
A20
119
188
197
114
A29
A28
A32
240
A12
X1
194
A19
AL
A11
120
A10
A80
A67
187
A82
125

SHT NO. 8

8 — 75



WIRING DIAGRAM-CHASSIS (GAS)
91303
186
A9
129
A8
177
A7
135
176
E3
J2
239
AL 1
AL
M3
A16
134
E25
E26
M
A
J
E
94MAR2(14)-A39
237SAL(16)-189
87WHT2(14)-A77
53RED(16)-A7
55RED3(12)-A4
99BLU/YEL2(14)-A39
101BLU/YELO.6(18)-A16
52RED(16)-A16
53RED(16)-A9
236SAL(16)-A41
240SAL(16)-A5
118VLT(16)-52
136WHT/YEL(16)-A13
138WHT/GRN(16)-A15
124GRN1.4(14)-A3
128WHT/RED(16)-A13
130WHT(16)-A15
26WHT0.6(18)-M9
44RED(16)-M3
66BLK(16)-M2
197ORN0.6(18)-A32
193YEL(16)-A8
198MAR/VLT2(14)-A14
200MAR/GRN2(14)-A14
194VLT(16)-A32
192YEL2(14)-A2
193YEL(16)-A8
208MAR/WHT0.6(18)-A79
AG WHT(16)
86BLK(16)-E5
88BLK(16)-E23
74YEL/BLK0.75(18)-E1
76YEL/BLK0.75(18)-E5
166BLK0.6(18)-E1
168BLU0.6(18)-E21
170GRA(16)-E5
65AL(16)-J1
10BLK/YEL1.4(14)-J1
2YEL/BLU1.4(14)-J1
4VLT(16)-120
2BLK(16)-120
48SAL/VLT(16)-134
50BLK(16)-M9
44RED(16)-129
46SAL(16)-134
62RED(16)-M4
72BLU0.6(18)-M5
243SAL/BLU(16)-A17
245ORN/BLK0.6(18)-A11
239VLT/GRN(16)-A11
52RED(16)-177
101BLU/YEL0.6(18)-177
48SAL/VLT(16)-M3
46SAL(16)-M3
140WHT/BLU1.5(14)-E1
142WHT/BLU1.5(14)-E6
144WHT/BLK1.5(14)-E5
146WHT/BLU1.5(14)-E7
152BLU0.75(18)-E13
152BLU0.75(18)-E1
154BLU0.75(18)-E4
156BLU0.75(18)-E8
SHT NO. 9



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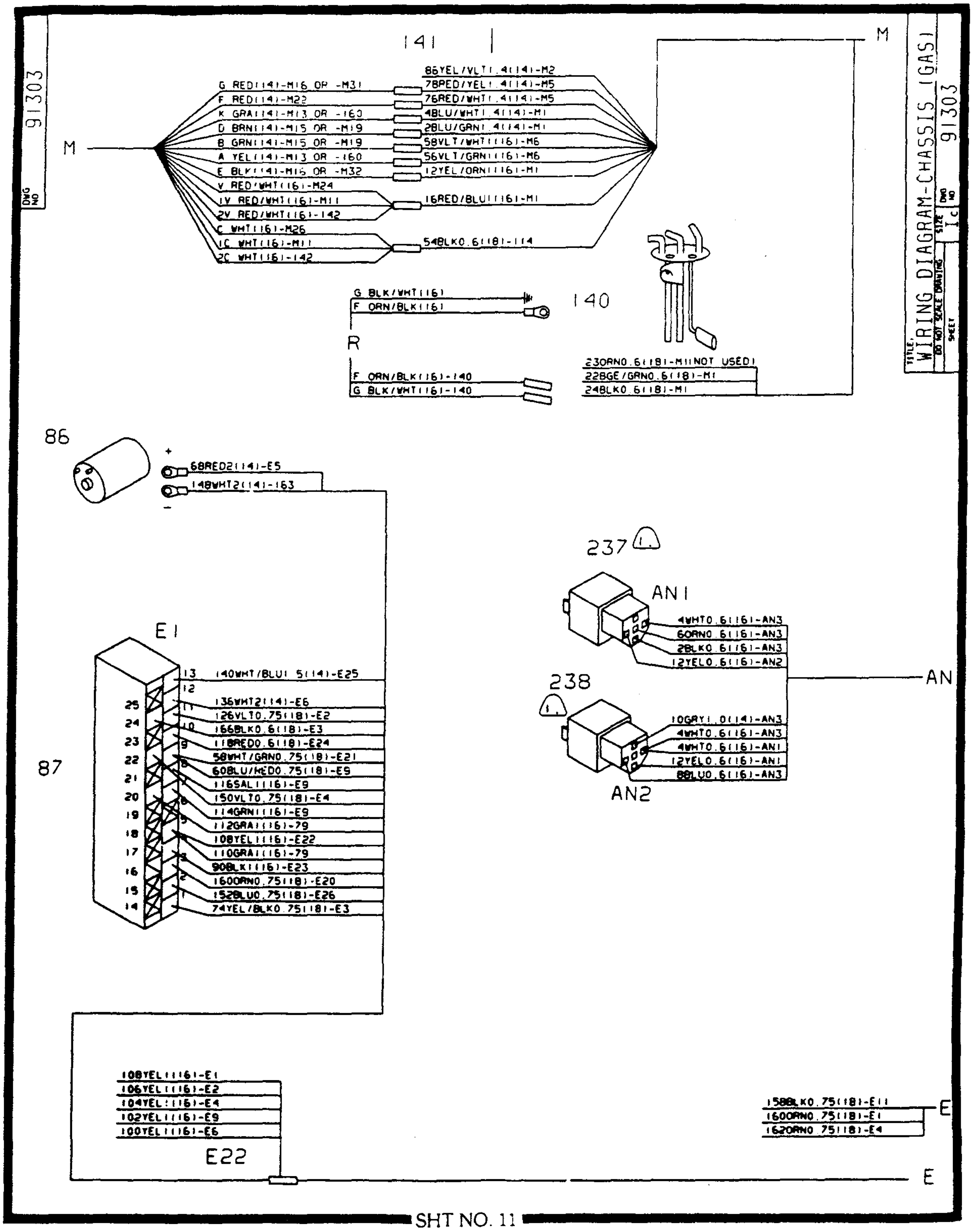
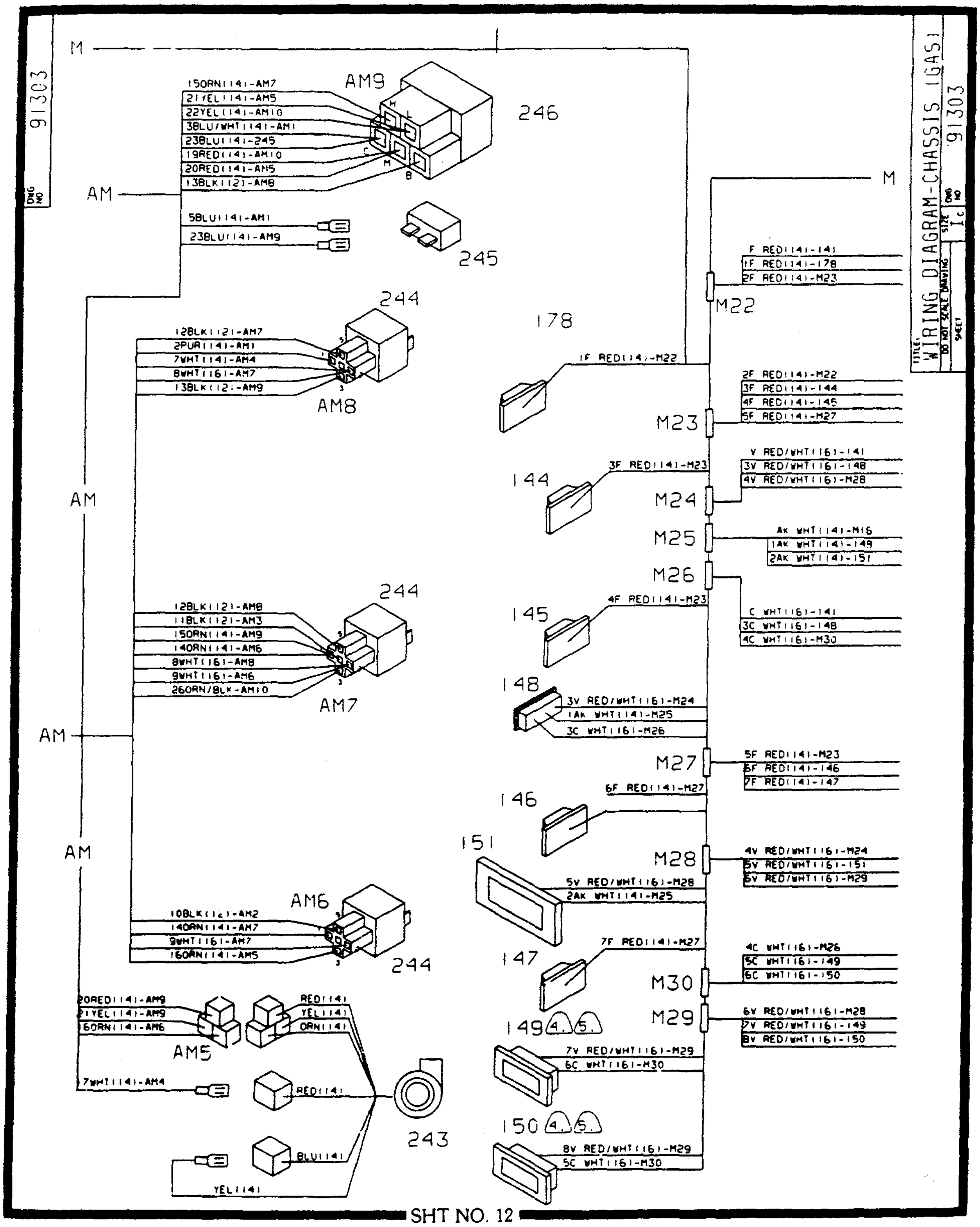
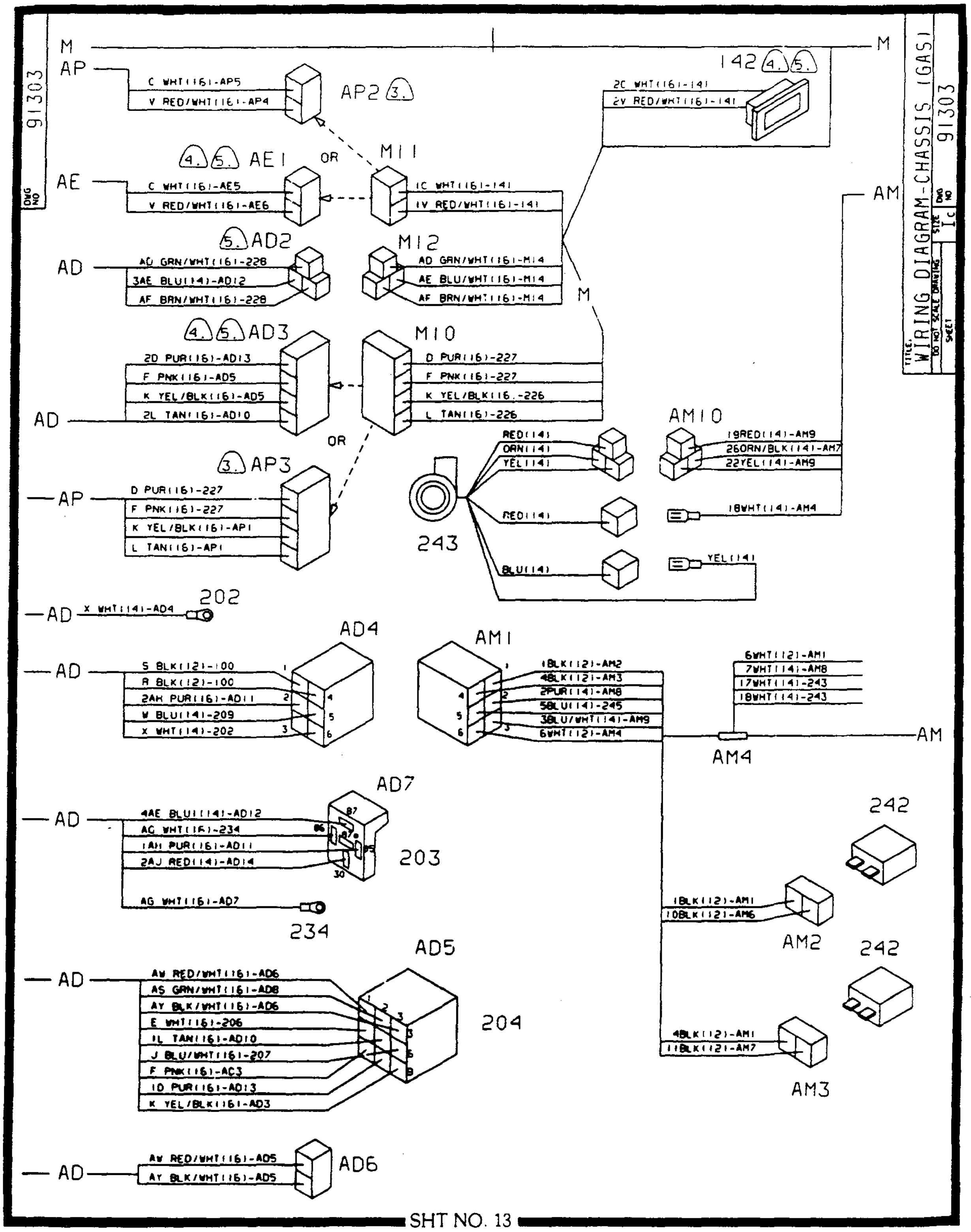
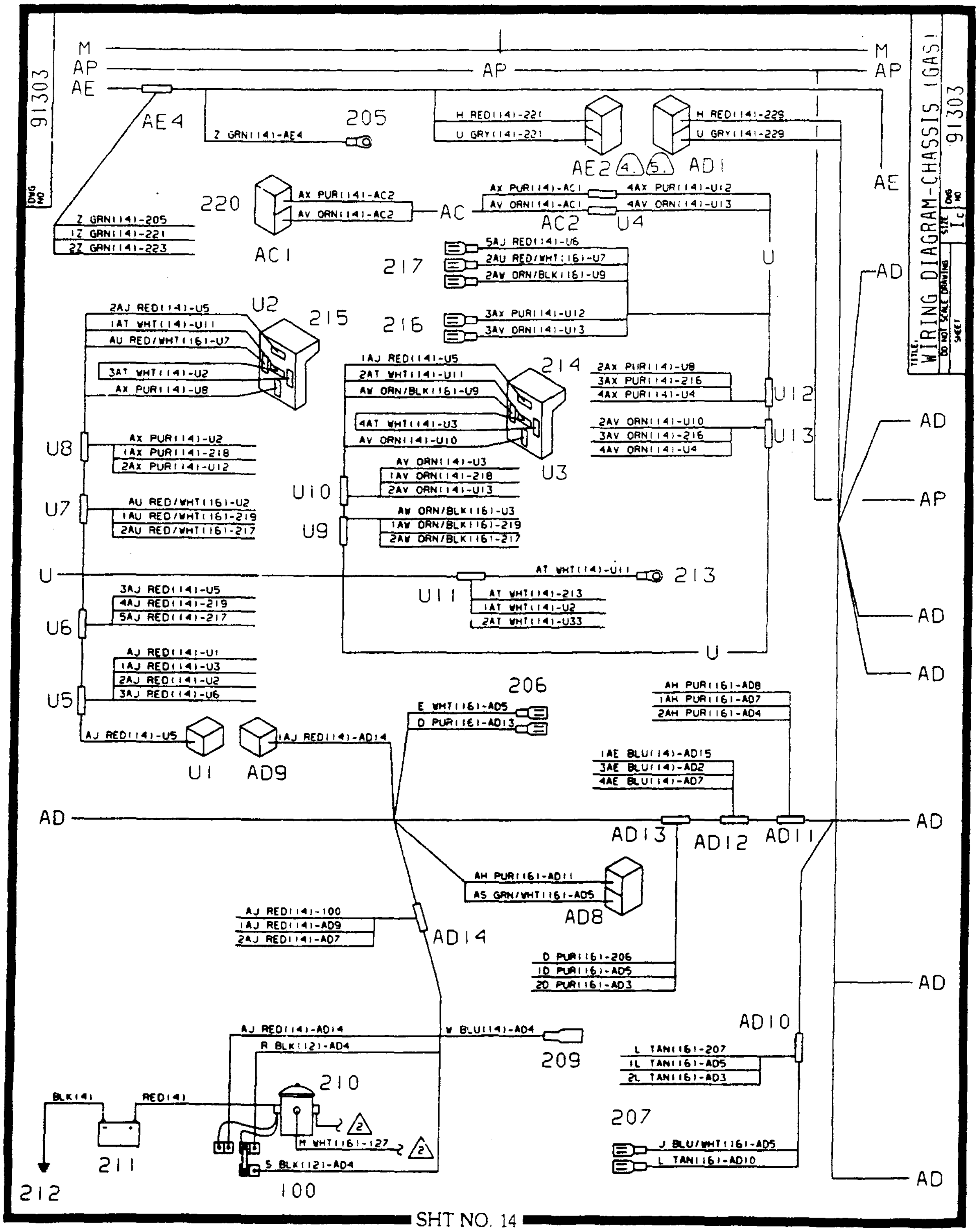


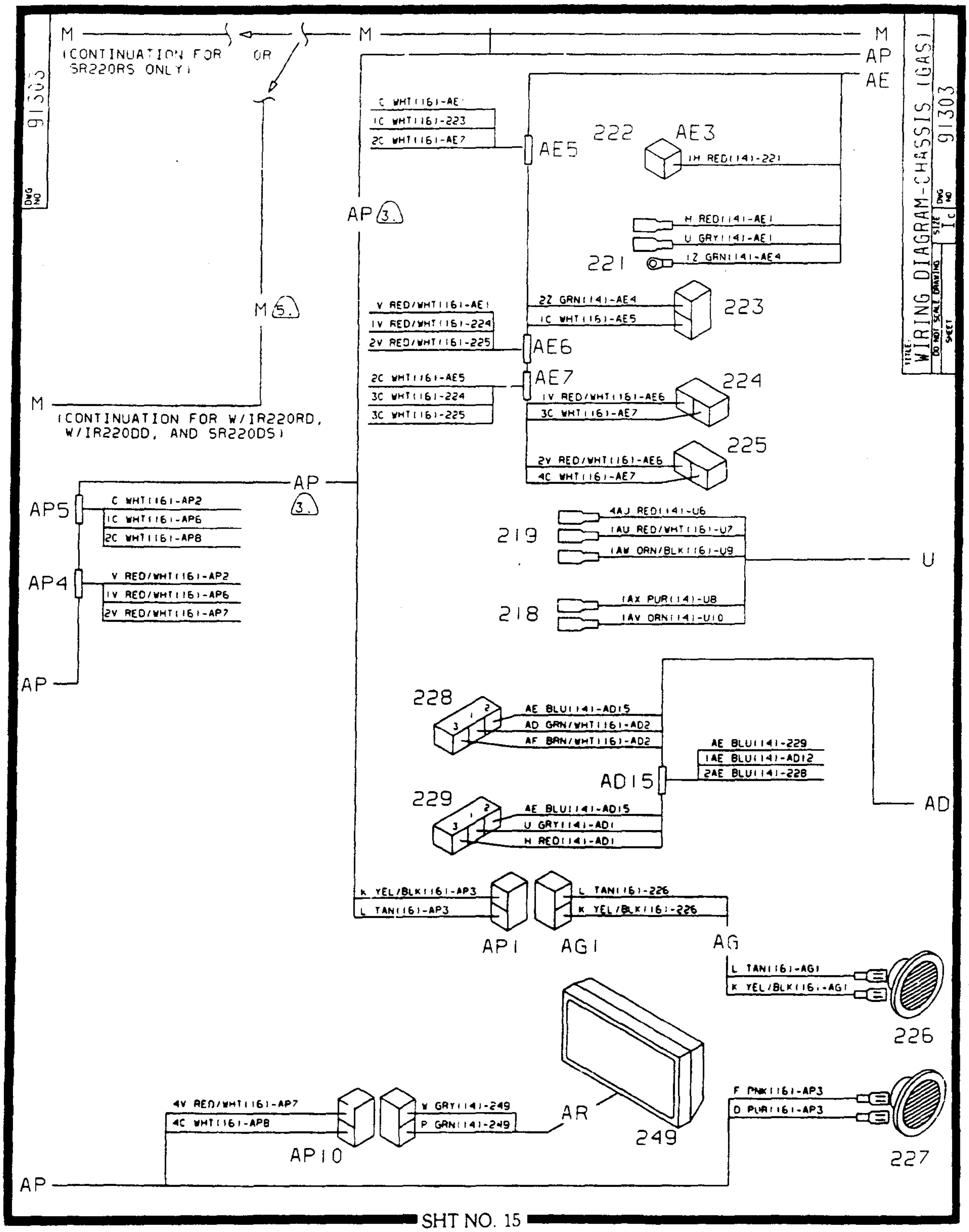

WIRING DIAGRAM-CHASSIS (GAS)
DWG NO 91303
SIZE C
DO NOT SCALE DRAWING
91303
M
AM
AM9
246
245
244
AM8
AM7
AM6
AM5
243
178
144
145
148
146
151
147
149
150
M22
M23
M24
M25
M26
M27
M28
M29
M30
15ORN(14)-AM7
21YEL(14)-AM5
22YEL(14)-AM10
3BLU/WHT(14)-AM1
23BLU(14)-245
19RED(14)-AM10
20RED(14)-AM5
13BLK(12)-AM8
5BLU(14)-AM1
23BLU(14)-AM9
12BLK(12)-AM7
2PUR(14)-AM1
7WHT(14)-AM4
8WHT(16)-AM7
13BLK(12)-AM9
12BLK(12)-AM8
11BLK(12)-AM3
15ORN(14)-AM9
14ORN(14)-AM6
8WHT(16)-AM8
9WHT(16)-AM6
26ORN/BLK-AM10
10BLK(12)-AM2
14ORN(14)-AM7
9WHT(16)-AM7
16ORN(14)-AM5
20RED(14)-AM9
21YEL(14)-AM9
16ORN(14)-AM6
17WHT(14)-AM4
RED(14)
YEL(14)
ORN(14)
BLU(14)
F RED(14)-141
1F RED(14)-178
2F RED(14)-M23
1F RED(14)-M22
2F RED(14)-M22
3F RED(14)-144
4F RED(14)-145
5F RED(14)-M27
V RED/WHT(16)-141
3V RED/WHT(16)-148
4V RED/WHT(16)-M28
3F RED(14)-M23
AK WHT(14)-M16
1AK WHT(14)-149
2AK WHT(14)-151
4F RED(14)-M23
C WHT(16)-141
3C WHT(16)-148
4C WHT(16)-M30
3V RED/WHT(16)-M24
1AK WHT(14)-M25
3C WHT(16)-M26
5F RED(14)-M23
6F RED(14)-146
7F RED(14)-147
6F RED(14)-M27
4V RED/WHT(16)-M24
5V RED/WHT(16)-151
6V RED/WHT(16)-M29
5V RED/WHT(16)-M28
2AK WHT(14)-M25
7F RED(14)-M27
4C WHT(16)-M26
5C WHT(16)-149
6C WHT(16)-150
6V RED/WHT(16)-M28
7V RED/WHT(16)-149
8V RED/WHT(16)-150
7V RED/WHT(16)-M29
6C WHT(16)-M30
8V RED/WHT(16)-M29
5C WHT(16)-M30
SHT NO. 12

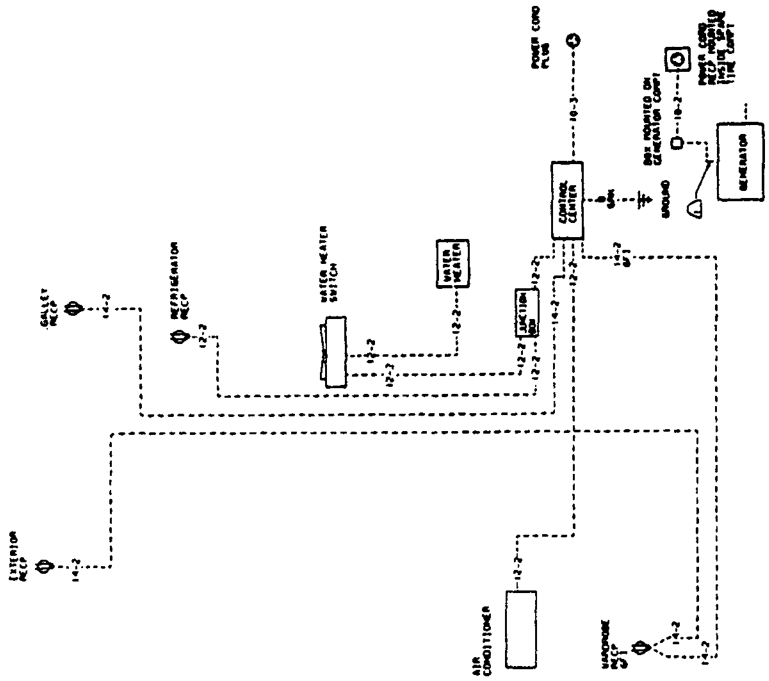


WIRING DIAGRAM-CHASSIS (GAS)
91303
M
AP
C WHT(16)-AP5
V RED/WHT(16)-AP4
AP2
142
2C WHT(16)-141
2V RED/WHT(16)-141
AE1
OR
M11
AE
C WHT(16)-AE5
V RED/WHT(16)-AE6
1C WHT(16)-141
1V RED/WHT(16)-141
AM
AD2
M12
AD
AD GRN/WHT(16)-228
3AE BLU(14)-AD12
AF BRN/WHT(16)-228
AD GRN/WHT(16)-M14
AE BLU/WHT(16)-M14
AF BRN/WHT(16)-M14
AD3
M10
2D PUR(16)-AD13
F PNK(16)-AD5
K YEL/BLK(16)-AD5
2L TAN(16)-AD10
D PUR(16)-227
F PNK(16)-227
K YEL/BLK(16)-226
L TAN(16)-226
AM10
RED(14)
ORN(14)
YEL(14)
19RED(14)-AM9
26ORN/BLK(14)-AM7
22YEL(14)-AM9
AP3
D PUR(16)-227
F PNK(16)-227
K YEL/BLK(16)-AP1
L TAN(16)-AP1
RED(14)
18WHT(14)-AM4
243
BLU(14)
YEL(14)
202
X WHT(14)-AD4
AD4
AM1
S BLK(12)-100
R BLK(12)-100
2AH PUR(16)-AD11
W BLU(14)-209
X WHT(14)-202
1BLK(12)-AM2
4BLK(12)-AM3
2PUR(14)-AM8
5BLU(14)-245
3BLU/WHT(14)-AM9
6WHT(12)-AM4
6WHT(12)-AM1
7WHT(14)-AM8
17WHT(14)-243
18WHT(14)-243
AM4
AD7
4AE BLU(14)-AD12
AG WHT(16)-234
1AH PUR(16)-AD11
2AJ RED(14)-AD14
203
AG WHT(16)-AD7
234
242
1BLK(12)-AM1
10BLK(12)-AM6
AM2
AD5
AW RED/WHT(16)-AD6
AS GRN/WHT(16)-AD8
AY BLK/WHT(16)-AD6
E WHT(16)-206
1L TAN(16)-AD10
J BLU/WHT(16)-207
F PNK(16)-AC3
1D PUR(16)-AD13
K YEL/BLK(16)-AD3
204
4BLK(12)-AM1
11BLK(12)-AM7
AM3
AW RED/WHT(16)-AD5
AY BLK/WHT(16)-AD5
AD6
SHT NO. 13

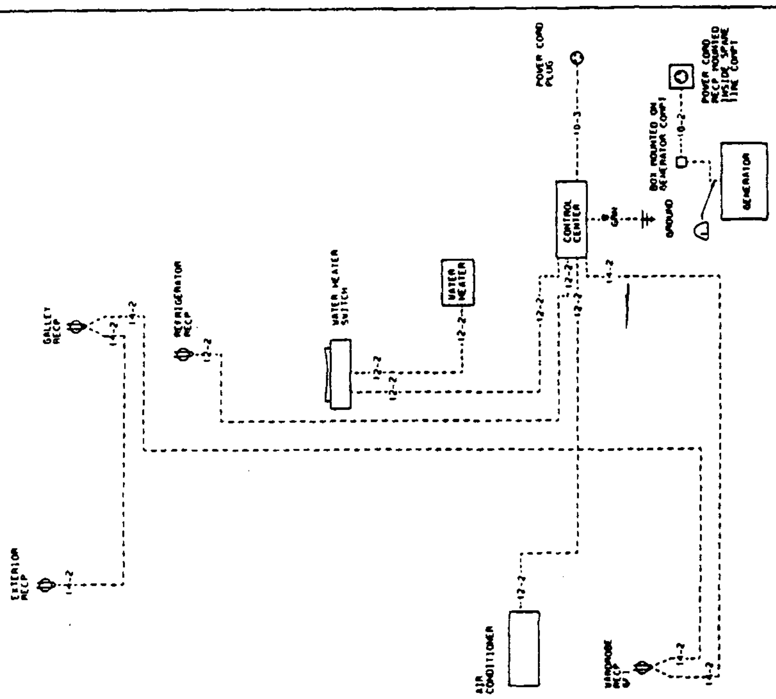

WIRING DIAGRAM-CHASSIS (GAS)
91303
M
AP
AE
AE4
205
Z GRN(14)-AE4
H RED(14)-221
U GRY(14)-221
H RED(14)-229
U GRY(14)-229
AE2
AD1
AE
220
AX PUR(14)-AC2
AV ORN(14)-AC2
AC
AX PUR(14)-AC1
AV ORN(14)-AC1
4AX PUR(14)-U12
4AV ORN(14)-U13
AC2
U4
AC1
Z GRN(14)-205
1Z GRN(14)-221
2Z GRN(14)-223
217
5AJ RED(14)-U6
2AU RED/WHT(16)-U7
2AV ORN/BLK(16)-U9
U
AD
U2
215
216
3AX PUR(14)-U12
3AV ORN(14)-U13
2AJ RED(14)-U5
1AT WHT(14)-U11
AU RED/WHT(16)-U7
3AT WHT(14)-U2
AX PUR(14)-U8
214
1AJ RED(14)-U5
2AT WHT(14)-U11
AV ORN/BLK(16)-U9
4AT WHT(14)-U3
AV ORN(14)-U10
2AX PUR(14)-U8
3AX PUR(14)-216
4AX PUR(14)-U4
U12
2AV ORN(14)-U10
3AV ORN(14)-216
4AV ORN(14)-U4
U13
U8
AX PUR(14)-U2
1AX PUR(14)-218
2AX PUR(14)-U12
AV ORN(14)-U3
1AV ORN(14)-218
2AV ORN(14)-U13
U3
U10
U7
AU RED/WHT(16)-U2
1AU RED/WHT(16)-219
2AU RED/WHT(16)-217
AV ORN/BLK(16)-U3
1AV ORN/BLK(16)-219
2AV ORN/BLK(16)-217
U9
AP
AT WHT(14)-U11
213
U11
AT WHT(14)-213
1AT WHT(14)-U2
2AT WHT(14)-U33
3AJ RED(14)-U5
4AJ RED(14)-219
5AJ RED(14)-217
U6
AJ RED(14)-U1
1AJ RED(14)-U3
2AJ RED(14)-U2
3AJ RED(14)-U6
U5
206
E WHT(16)-AD5
D PUR(16)-AD13
AH PUR(16)-AD8
1AH PUR(16)-AD7
2AH PUR(16)-AD4
AJ RED(14)-U5
1AJ RED(14)-AD14
U1
AD9
1AE BLU(14)-AD15
3AE BLU(14)-AD2
4AE BLU(14)-AD7
AD13
AD12
AD11
AH PUR(16)-AD11
AS GRN/WHT(16)-AD5
AD8
AJ RED(14)-100
1AJ RED(14)-AD9
2AJ RED(14)-AD7
AD14
D PUR(16)-206
1D PUR(16)-AD5
2D PUR(16)-AD3
AD10
AJ RED(14)-AD14
R BLK(12)-AD4
W BLU(14)-AD4
209
L TAN(16)-207
1L TAN(16)-AD5
2L TAN(16)-AD3
210
BLK(4)
RED(4)
H WHT(16)-127
2
207
J BLU/WHT(16)-AD5
L TAN(16)-AD10
S BLK(12)-AD4
211
212
100

SHT NO. 14

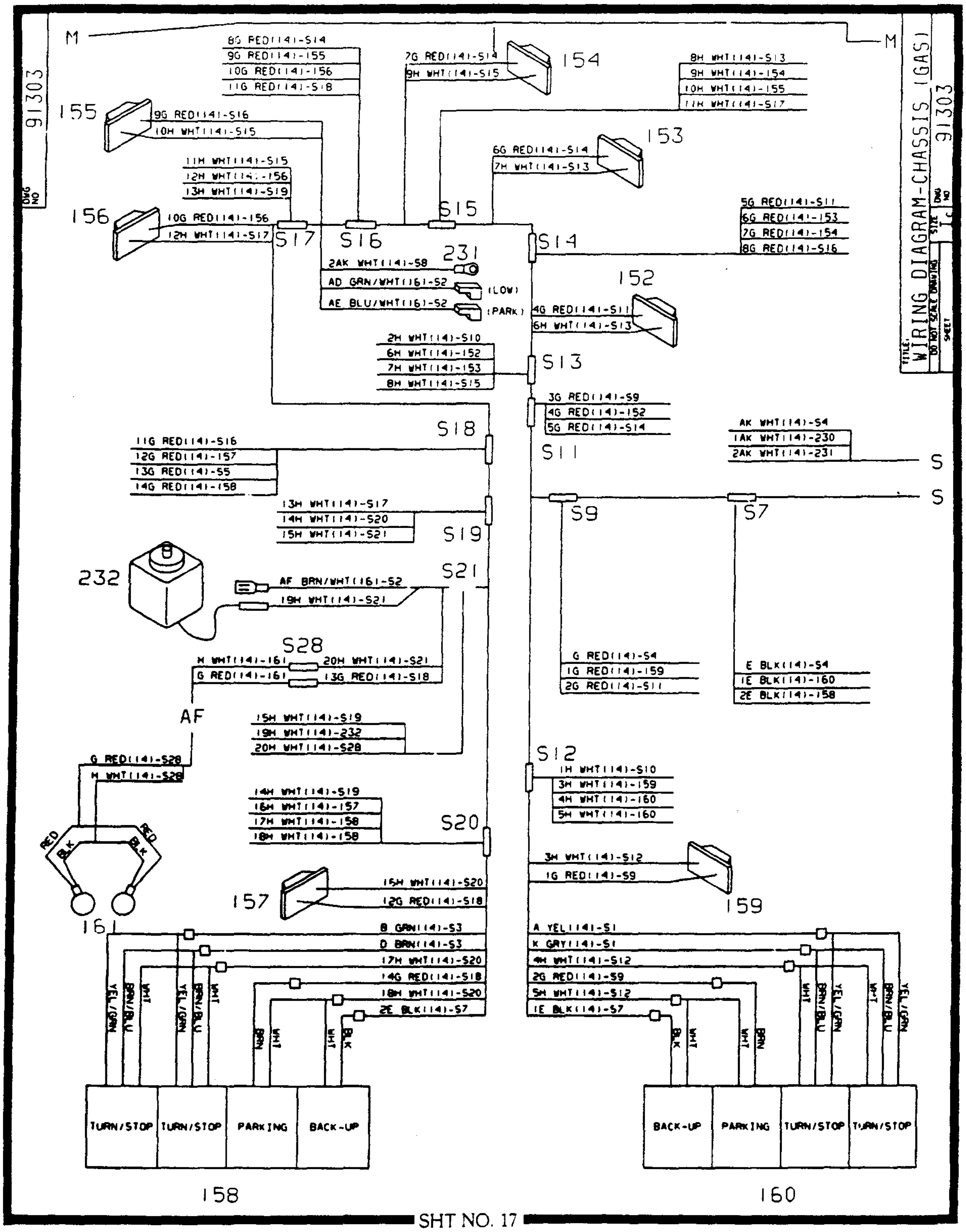

WIRING DIAGRAM-CHASSIS (GAS)
91303
M
(CONTINUATION FOR SR220RS ONLY)
OR
M
AP
AE
AE5
222
AE3
221
223
AE6
AE7
224
225
219
218
U
AP5
AP4
AP
228
229
AD15
AD
AP1
AG1
AG
226
249
AR
AP10
227
M
(CONTINUATION FOR W/IR220RD, W/IR220DD, AND SR220DS)
SHT NO. 15



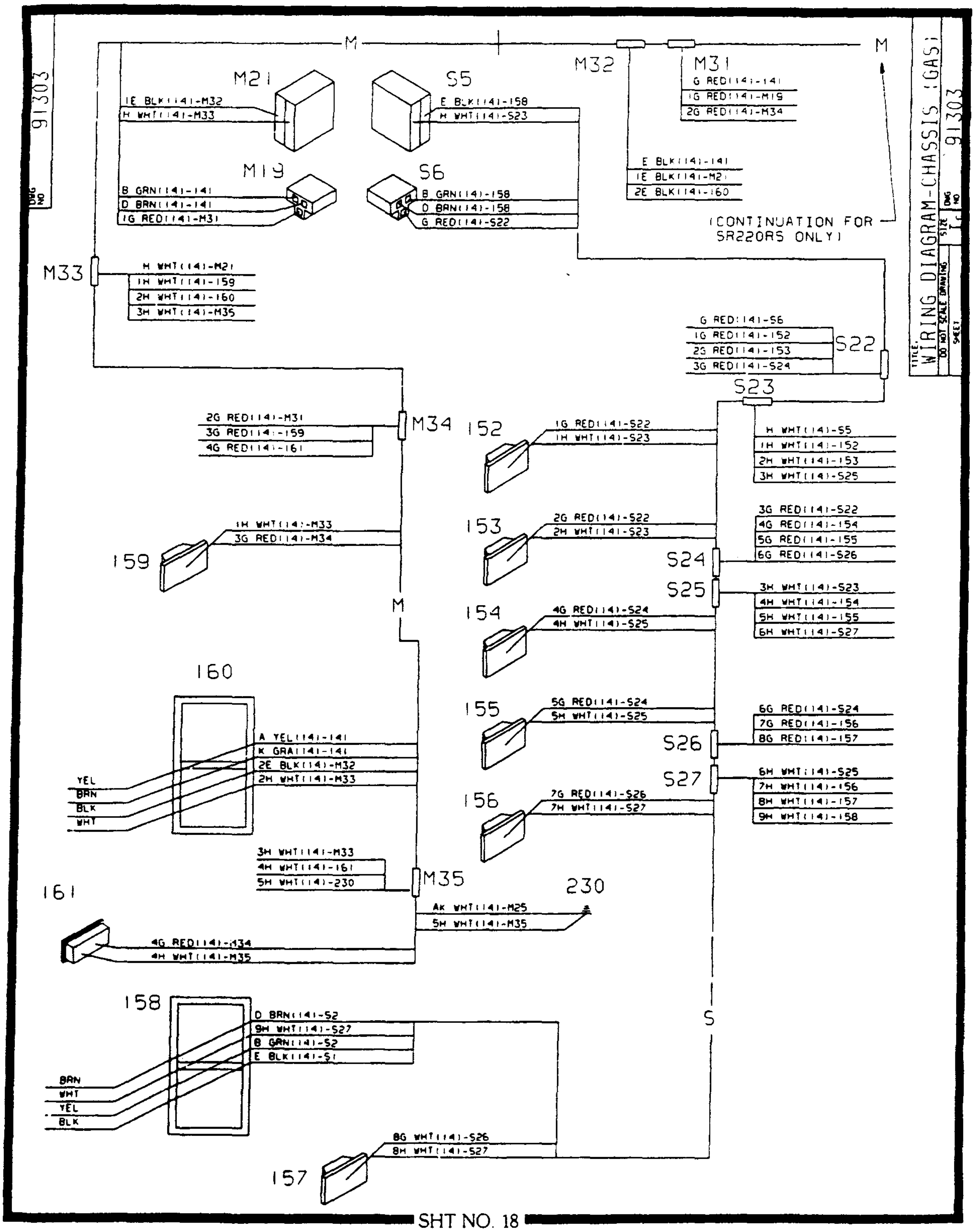
CAN 110 VOLT WIRING



US 110 VOLT WIRING

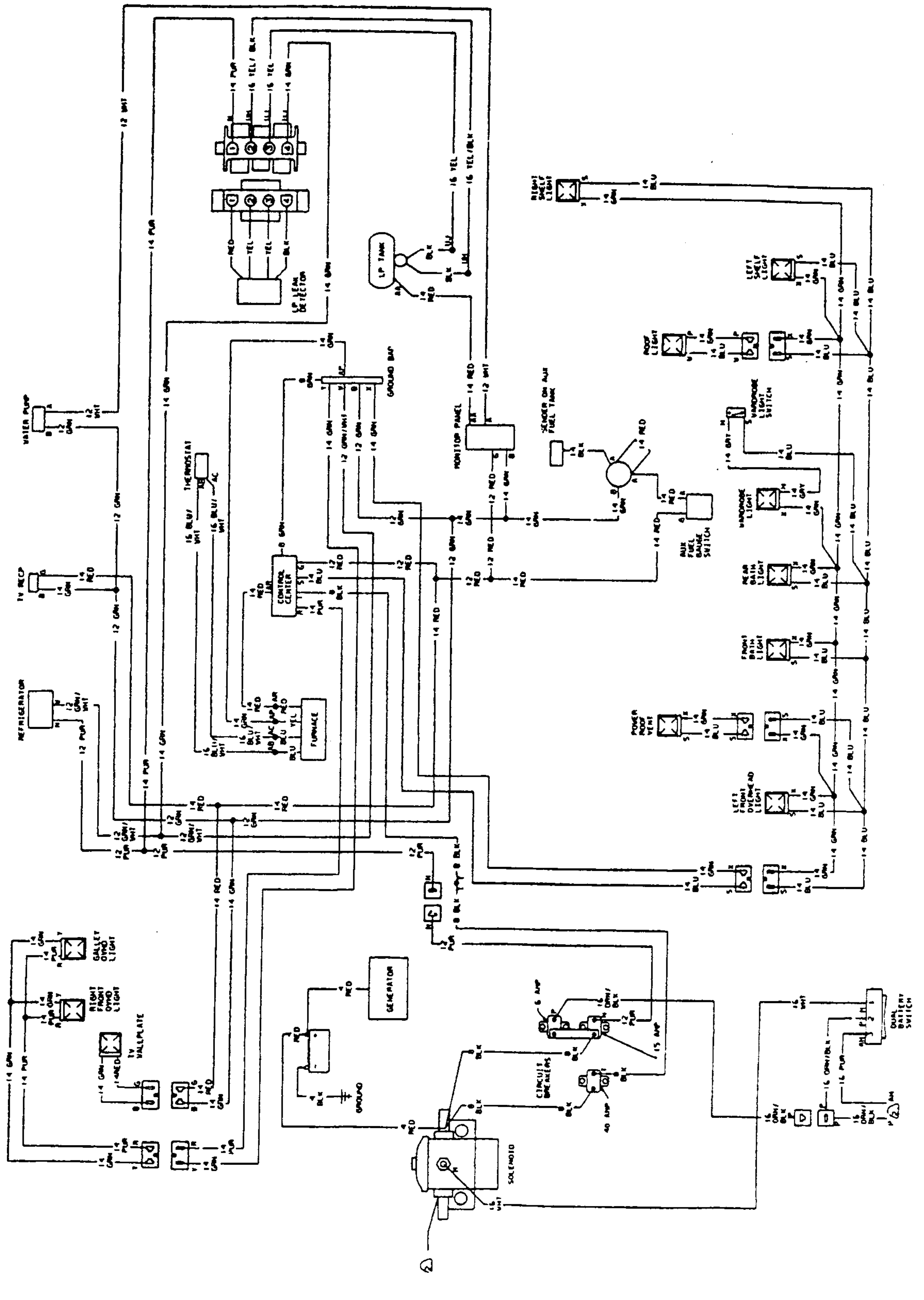


WIRING DIAGRAM-CHASSIS (GAS)
91303
M
154
155
156
153
152
231
232
157
159
161
158
160
S14
S15
S16
S17
S13
S11
S18
S19
S21
S28
S9
S7
S12
S20
S
AF
8G RED(14)-S14
9G RED(14)-155
10G RED(14)-156
11G RED(14)-S18
7G RED(14)-S14
9H WHT(14)-S15
8H WHT(14)-S13
9H WHT(14)-154
10H WHT(14)-155
11H WHT(14)-S17
9G RED(14)-S16
10H WHT(14)-S15
6G RED(14)-S14
7H WHT(14)-S13
11H WHT(14)-S15
12H WHT(14)-156
13H WHT(14)-S19
10G RED(14)-156
12H WHT(14)-S17
5G RED(14)-S11
6G RED(14)-153
7G RED(14)-154
8G RED(14)-S16
2AK WHT(14)-S8
AD GRN/WHT(16)-S2
AE BLU/WHT(16)-S2
(LOW)
(PARK)
4G RED(14)-S11
6H WHT(14)-S13
2H WHT(14)-S10
6H WHT(14)-152
7H WHT(14)-153
8H WHT(14)-S15
3G RED(14)-S9
4G RED(14)-152
5G RED(14)-S14
AK WHT(14)-S4
1AK WHT(14)-230
2AK WHT(14)-231
11G RED(14)-S16
12G RED(14)-157
13G RED(14)-S5
14G RED(14)-158
13H WHT(14)-S17
14H WHT(14)-S20
15H WHT(14)-S21
AF BRN/WHT(16)-S2
19H WHT(14)-S21
H WHT(14)-161
20H WHT(14)-S21
G RED(14)-161
13G RED(14)-S18
G RED(14)-S4
1G RED(14)-159
2G RED(14)-S11
E BLK(14)-S4
1E BLK(14)-160
2E BLK(14)-158
15H WHT(14)-S19
19H WHT(14)-232
20H WHT(14)-S28
G RED(14)-S28
H WHT(14)-S28
1H WHT(14)-S10
3H WHT(14)-159
4H WHT(14)-160
5H WHT(14)-160
14H WHT(14)-S19
16H WHT(14)-157
17H WHT(14)-158
18H WHT(14)-158
3H WHT(14)-S12
1G RED(14)-S9
15H WHT(14)-S20
12G RED(14)-S18
RED
BLK
B GRN(14)-S3
D BRN(14)-S3
17H WHT(14)-S20
14G RED(14)-S18
18H WHT(14)-S20
2E BLK(14)-S7
A YEL(14)-S1
K GRY(14)-S1
4H WHT(14)-S12
2G RED(14)-S9
5H WHT(14)-S12
1E BLK(14)-S7
YEL/GRN
BRN/BLU
WHT
BRN
BLK
TURN/STOP
PARKING
BACK-UP
SHT NO. 17



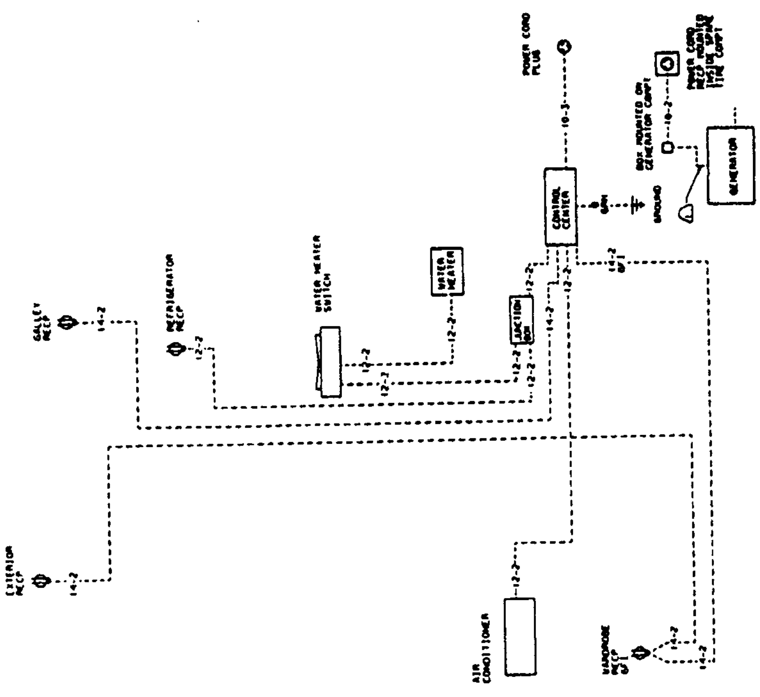
WIRING DIAGRAM-CHASSIS (GAS)
91303
M21
S5
M19
S6
M32
M31
M33
M34
M35
S22
S23
S24
S25
S26
S27
152
153
154
155
156
157
158
159
160
161
230
(CONTINUATION FOR SR220RS ONLY)

SHT NO. 18

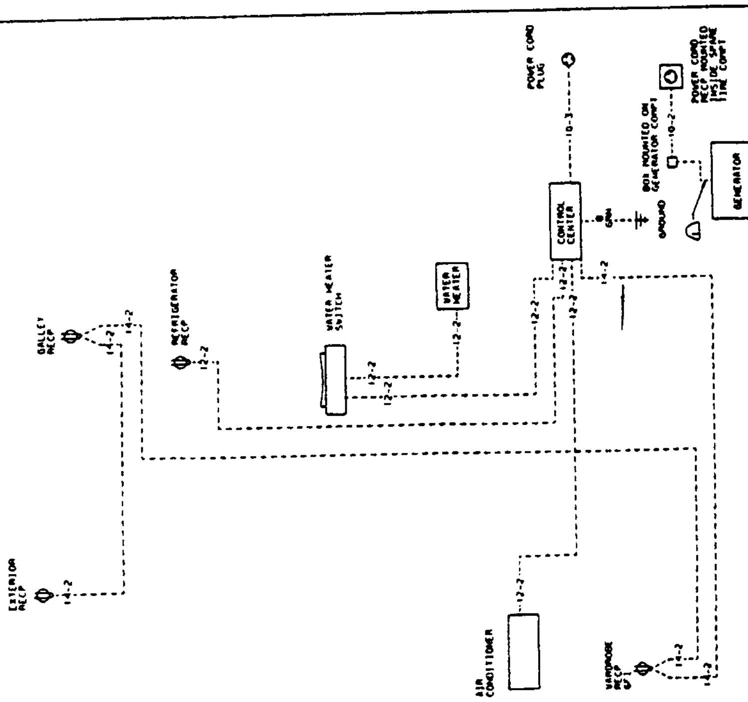


88/89 W/IR220RD

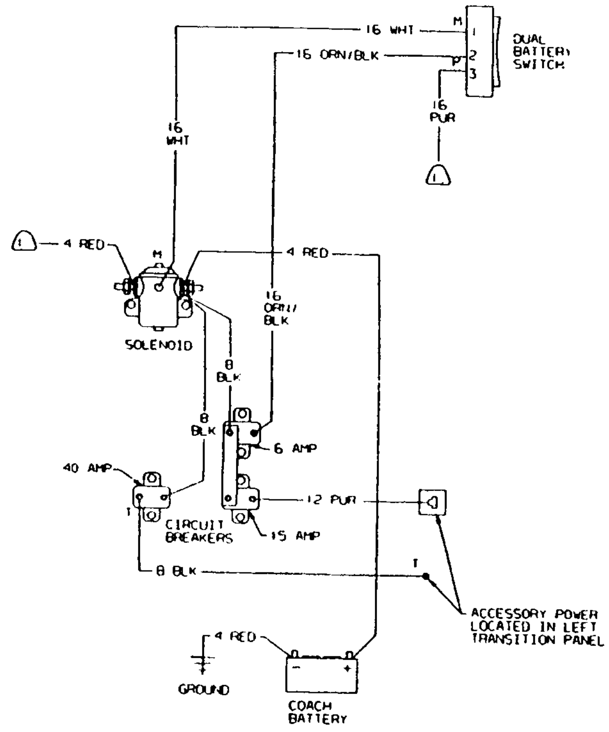
SEE SERVICE BULLETIN 07-88-07G FOR ADDITIONAL WIRING

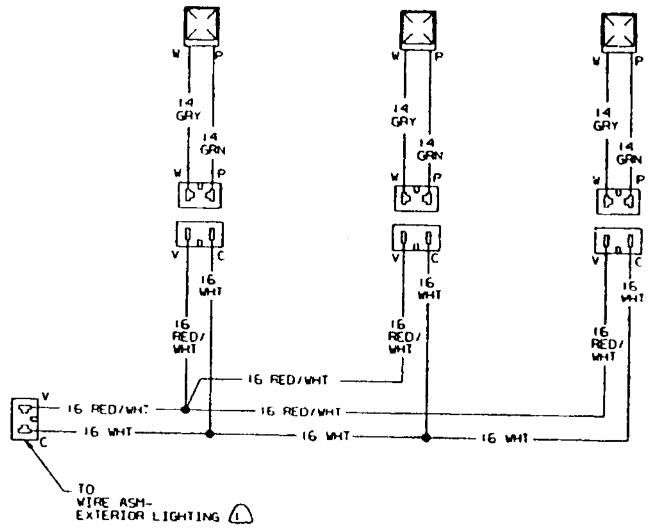


CAN 110 VOLT WIRING



US 110 VOLT WIRING





SEE SERVICE BULLETIN 07-88-076 FOR ADDITIONAL WIRING

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SECTION "E"

COOLING SYSTEM

See specific Engine Section for:

Radiator R & R - See Engine Remove and Replace
Water Pump R & R
Belt Tightening Information

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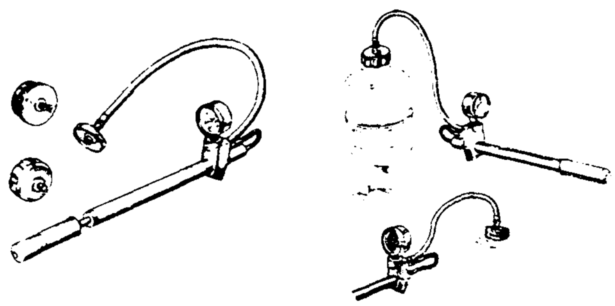
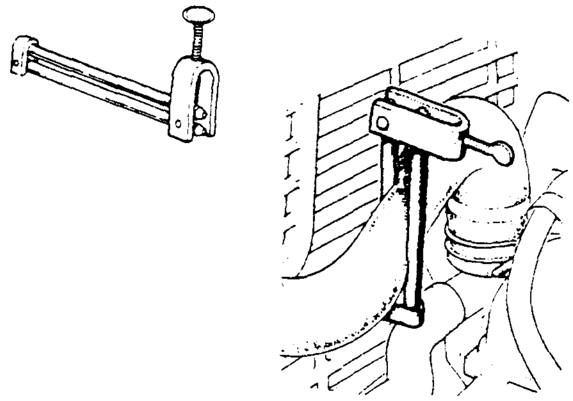
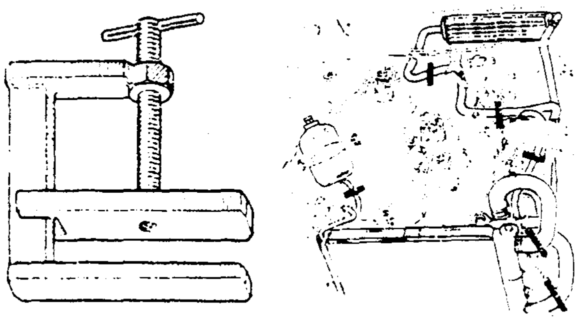


Ms. 554-03
Cooling Circuit pressure tester
Order Tool No. 700000-55-403 EA



Ms. 583
Hose clamp (maxi dia 50mm)
Order Tool No. 700000-58-300 EA



Mot. 453-01
Hose clamp (maximum dia. 25 mm)
Order Tool No. 700000-45-301 EA

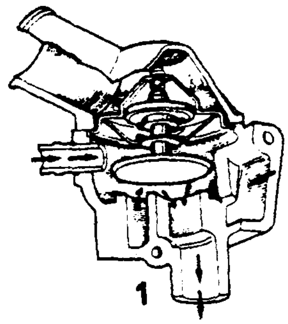
Thermostat
The thermostat has two operating conditions.

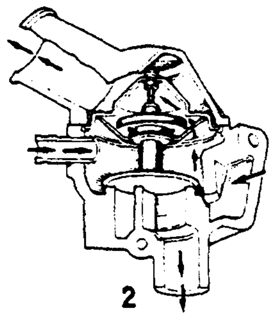
When the coolant is cold (1):

- the thermostat valve is closed and prevents the flow of coolant from the engine to the radiator
- the thermostat bypass is open and allows coolant to circulate within the engine.

When the coolant is hot (2):

- the thermostat valve is open and allows coolant to flow from the engine to the radiator
- the thermostat bypass is closed


1


2

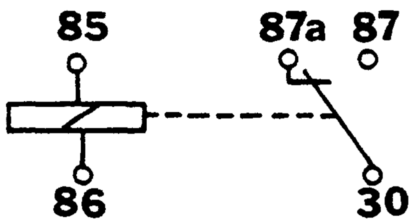
WARNING
Do not loosen the coolant bottle cap or remove the cylinder block drainplugs with system hot and pressurized because serious burns from coolant can result.

Electric Cooling Fan Operation
The electric fans are powered by a relay for each fan and a thermo-switch mounted in the **bottom right** (passenger) side of the radiator. When the coolant in the radiator reaches the specified temperature, the thermo-switch closes completing the circuit to the relays, which in turn switches the 12-volt current to each fan.

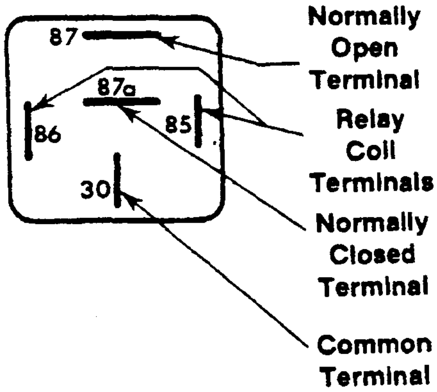
Relay Locations:
Black relay and diode box behind right headlight.

See Electrical and/or Air Conditioning Section for specific wiring information.

RELAY SCHEMATIC



5-Pin Relay (Typical)



ANTI-FREEZE MIXTURE STRENGTH CHECKING

- The coolant mixture must be changed every 2 years or after (30,000 miles) 48,270 km (whichever comes first).
- A suitable anti-freeze or anti-freeze mixture must be used in the cooling system that is compatible with aluminum components.
- Do not use borax based anti-freeze.
- The use of Prestone II® brand anti-freeze/coolant meets the specification.
- In this cooling system, the coolant circulates continually through the expansion bottle to aid removal of air in suspension.

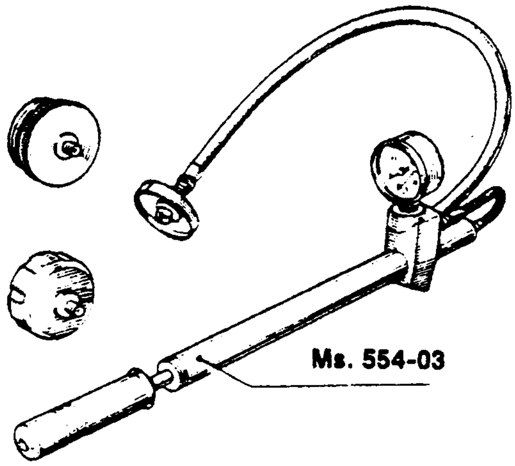
Testing

1. Run the engine until the coolant in the expansion bottle reaches a temperature of approximately 40°C (140°F).
2. Remove the expansion bottle cap and test anti-freeze with an anti-freeze tester.

COOLING CIRCUIT
CHECKING FOR LEAKS

Install the cap from pressure tester Ms. 554-03 in place of the coolant bottle cap.

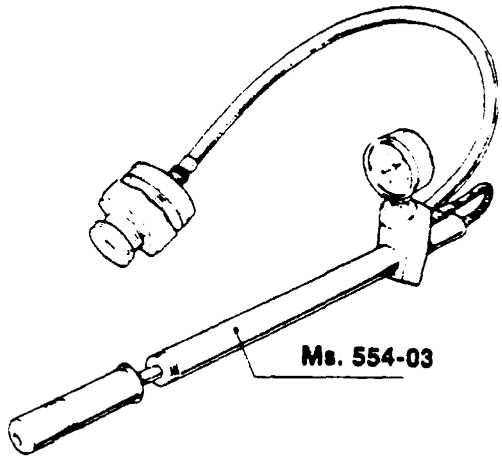
- Connect pressure tester Ms. 554-03 to this cap.
- Open the heater valve.
- Run the engine to warm it up then switch off.
- Pump tester to pressurize the circuit. Stop pumping when the gauge indicates 1.6 bar (23 psi) (red zone limit) which is 0.4 bar (6 psi) over the calibration of the valve.
- The pressure should remain steady; if it does not, locate and repair the leak.
- Decompress the cooling circuit by gradually unscrewing the union on the pressure tester. Then remove the cap adapter and replace the expansion bottle cap after checking its pressure release value as described on the following page.



COOLING CIRCUIT
CHECKING COOLANT BOTTLE
CAP CALIBRATION

IMPORTANT

The cap must be changed if coolant has passed through it.



- Mount adaptor to pressure tester Ms. 554-03 and mount the cap to the adaptor.
- Operate the pump and note the pressure on the gauge. It should maintain the calibrated value.
- Calibrated value of cap:
  - hold value 1.1 to 1.2 bar (16 to 17 1/2 psi)
  - release pressure 1.2 bars (17 1/2 psi)

IMPORTANT

If the cap does not meet specifications it must be replaced.

- Prepare a 50/50 mixture of anti-freeze and water prior to filling.
- Check that the hoses and the drain plug in the cylinder block are tight.
- Open the bleed screw on the heater core.
- Open the heater valve.
- Unclip the expansion bottle and support it as high as possible.
- Fill the cooling system through the expansion bottle.
- Close the bleed screw as soon as coolant flows out.
- The coolant level in the expansion bottle should be about 25% full (cold).
- Place the cap on the expansion bottle.

WARNING
Be careful to keep hot coolant from contacting the eyes or skin. Always wear protective eyewear and clothing.

Bleeding

- Run the engine until the thermostat opens and let it continue to run a few minutes.
- Open the bleed screw on the heater core. Close it when coolant flows out without any trace of air.
- Mount the expansion bottle.
- Recheck that the coolant level in the expansion bottle is correct after the engine has cooled down completely.

  Coolant level in expansion bottle
  Cold - 25% full
  Hot - 50% full

Vehicles Equipped with Rear Automotive Heater and/or Motoraid Water Heater

The air bleeding procedure is identical to the previous directions, however extreme care must be exercised to insure that all air has been purged from the rear system. The rear heater valve must be opened for at least 50% of the time during the air bleeding procedure to insure that all lines are bled. Elevating the front of the vehicle and shutting off the dash heater will assist air bleeding.

WARNING
The coolant level must be repeatedly checked and filled as necessary after bleeding the system to ensure that all air has been purged. Failure to do this may cause overheating which could result in serious engine damage.

OIL IN COOLING CIRCUIT

The following must be carried out if oil is found contaminating the cooling system:

Find the source of the oil leakage
Check for:
- Defective oil cooler (above oil filter) if equipped.
- Cracked cylinder block (See Engine Section)
- Cracked or warped cylinder head (See Engine Section)
- Automatic transmission cooler leak (if the contaminant is transmission fluid)

Cleaning An Oil Contaminated Cooling System (After source of leakage is repaired)
This may be accomplished using a solution of water and a **grease emulsifying** liquid dishwashing detergent such as Dawn®. The procedure for cleaning is as follows:

1. Drain and refill the system with clean water (no antifreeze) allowing space to add 8-12 oz. of Dawn® liquid dishwashing soap or an equivalent grease emulsifying liquid dish soap.
2. Run the engine for approximately **5 minutes at operating temperature** to thoroughly circulate the solution.
3. Drain the system and allow the engine to cool.
4. Refill the system with clean water only and rinse by running the engine at operating temperature for 5 minutes. Then drain the system.
5. Repeat steps 1-4 until all traces of oil are eliminated.
6. Perform an additional rinse to ensure removal of soap residue.
7. Fill system with a 50/50 mixture of water and antifreeze/coolant.
8. Bleed air from the system and recheck level (Refer to "Bleeding" - pg. E-6).

SECTION "F"

AUTOMATIC TRANSAXLE

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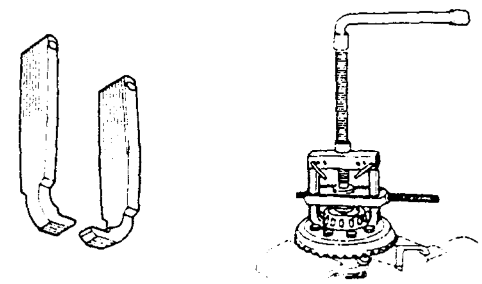
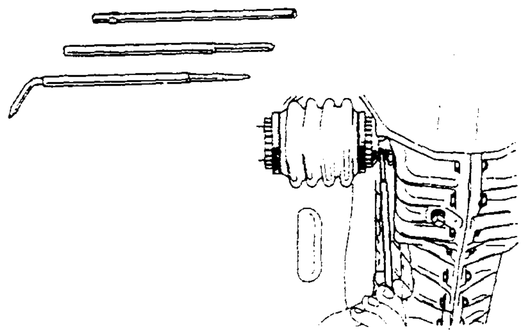
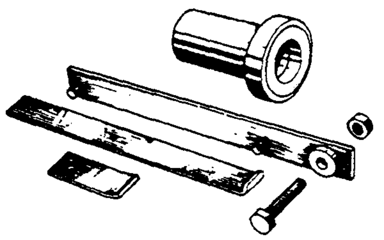
GENERAL INFORMATION
SPECIAL TOOLS



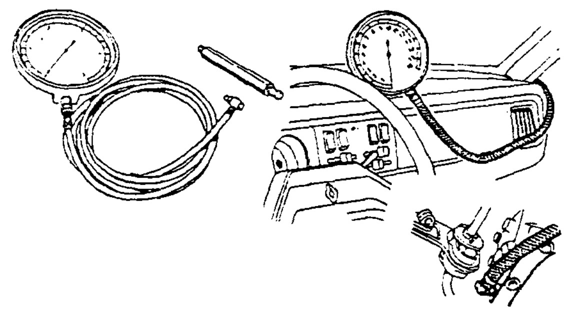
B.VI. 48
Set of two jaws with large tips
for extracting differential bearings
(Use with tool B.Vi. 28-01.)
Order Tool No. 700013-30-300 Set



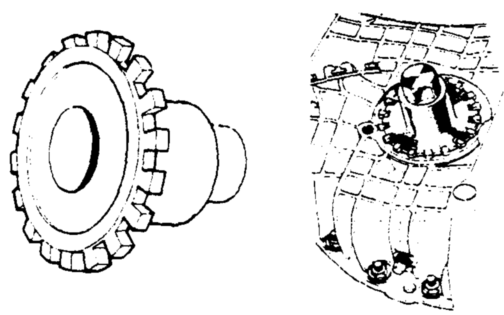
B.VI. 31-01
Set of 3 drifts for fitting 5 mm dia. rollpins.
Order Tool No. 700012-59-401 EA



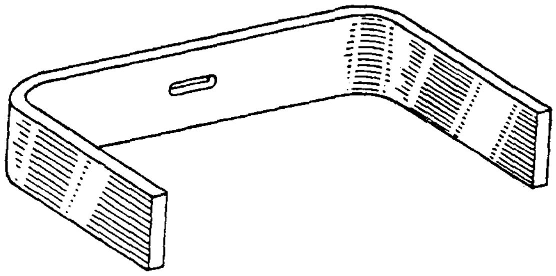
B.VI. 465
Converter seal replacing tool.
Converter holding lug
Order Tool No. 700000-46-500 EA



B.VI. 466-04
Oil pressure gauge
Order Tool No. 700000-46-604 EA

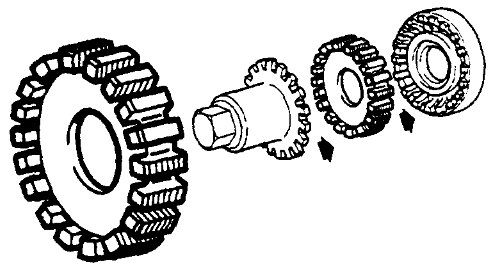


B.VI. 645
Castellated wrench for adjusting differential play
Order Tool No. 700000-64-500 EA

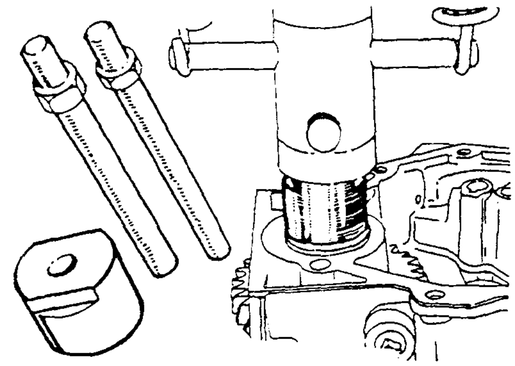


B.VI. 715
Tool from kit B.Vi. 710
Order Tool No. 700000-71-000 EA

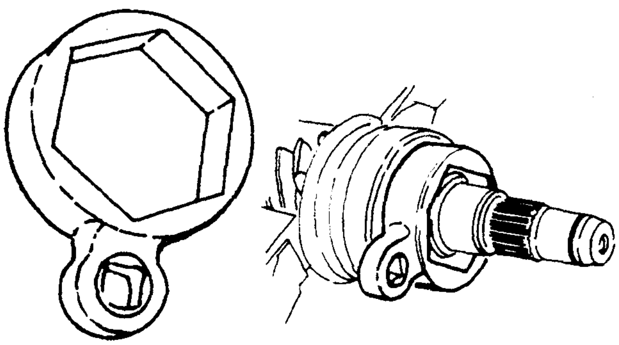
GENERAL INFORMATION
SPECIAL TOOLS



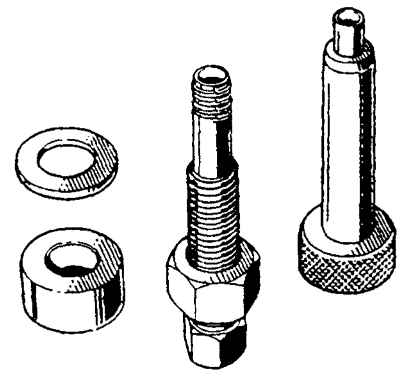
B.VI. 805
Differential nut wrench
Order Tool No. 700000-80-500 EA



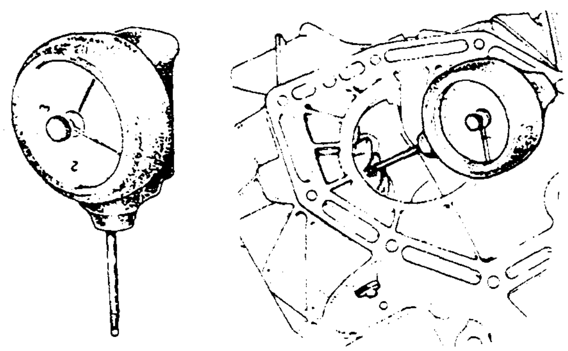
B.VI. 902-01
Circlip fitting tool
Order Tool No. 700000-90-201 EA



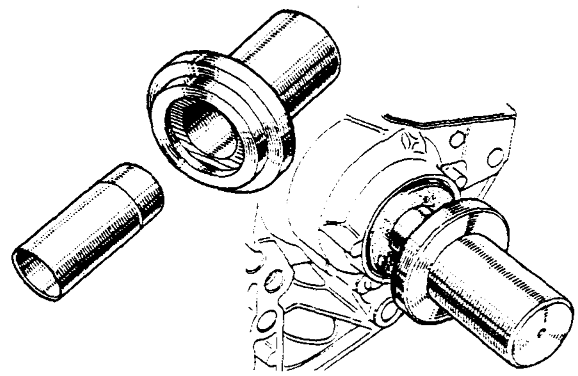
B.VI. 903
Ring spanner for final drive pinion nut
Order Tool No. 700000-90-300 EA



B.VI. 905-02
Speedometer drive shaft seal replacing tool (kit)
Order Tool No. 700000-90-502 EA

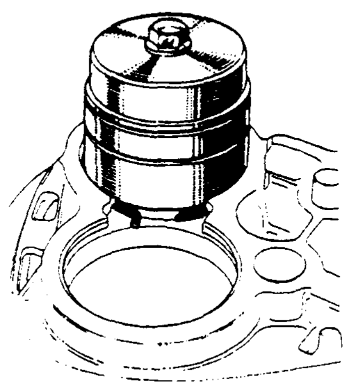


B.VI. 906
Torque-measuring device
Order Tool No. 700000-90-600 EA

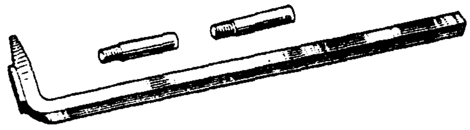


B.VI 945
Sun wheel seal installation tool
Order Tool No. 700000-94-500 EA

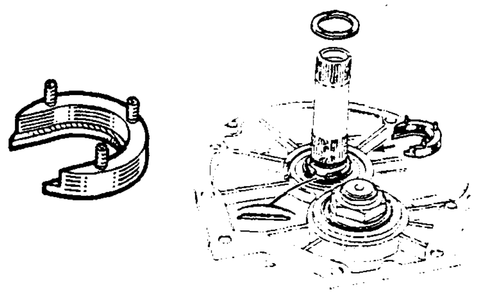
GENERAL INFORMATION
SPECIAL TOOLS



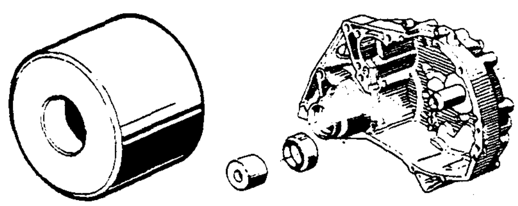
B.Vi. 947
Tool for installing bearings in separator housing
Order Tool No. 700000-94-700 EA



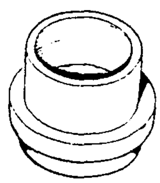
B.Vi. 952
Feed hub centering tools and tool for removing F2 piston
Order Tool No. 700000-95-200 EA



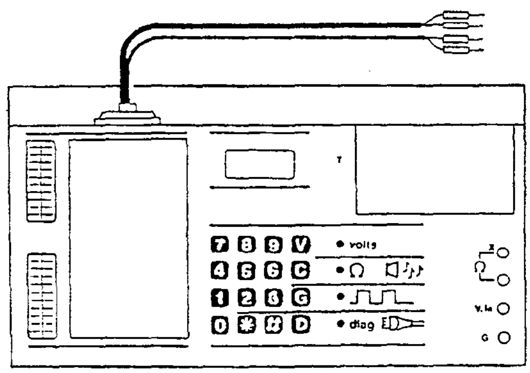
B.Vi. 959
Tool for attaching circlip to output shaft
Order Tool No. 700000-95-900 EA



B.Vi. 962
Tool for installing converter seal
Order Tool No. 700000-96-200 EA



Rou. 15-01
Shaft-protecting tool with 16 mm bore
Order Tool No. 700013-31-601 EA



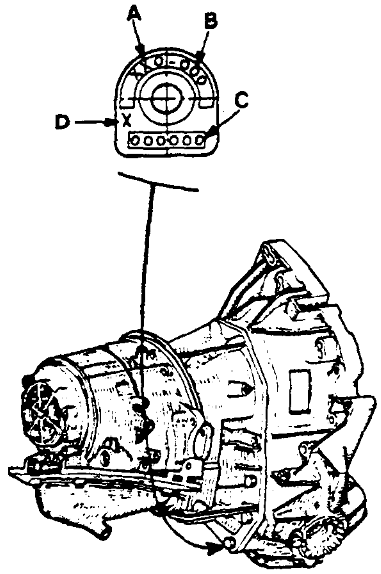
M.S. 1019
XR25 box for testing microprocessor systems
Order Tool No. 700000-00-846 EA

GENERAL INFORMATION
SPECIFICATIONS

The type, suffix and fabrication number are stamped on a plate secured by a casing bolt. (See right) Always refer to this number when ordering replacement parts.

The identification plate indicates:
A - type of automatic transmission
B - type suffix
C - fabrication number
D - manufacturing factory

ML 1-011



GENERAL INFORMATION
SPECIFICATIONS

TRANSMISSION FLUID

Mobil ATF 220 (Dexron® II type) or equivalent.

Approximate Capacities:

If converter is empty	5 litres
Fluid change	2.5 litres

FINAL DRIVE OIL:

API-GL5 SAE 80W-90

Capacity 1.1 litre (1.16 qt.)*
*Does not include capacity of final drive cooler system.

OIL CHANGE INTERVALS:

See Section "A" General for specific intervals and servicing procedures.

TRANSMISSION FLUID CHANGE PROCEDURE

Draining

Fluid should be drained while hot.

Procedure:
- take out the dipstick
- unscrew the drain plug
- allow the fluid to drain for as long as possible.
- refit the plug, using a new seal.

Refilling

The transmission is refilled through the dipstick tube.

Use a funnel equipped with a strainer to avoid dirt entering the reservoir.,

After draining out the old fluid refill using Mobil ATF 220 (Dexron® II Type) or equivalent.

Checking the Fluid Level after Refill

Park the vehicle on a level surface.

Place the selector lever in the "Park" (P) position.

Start the engine and wait for one or two minutes to allow the torque converter and cooler to fill with fluid.

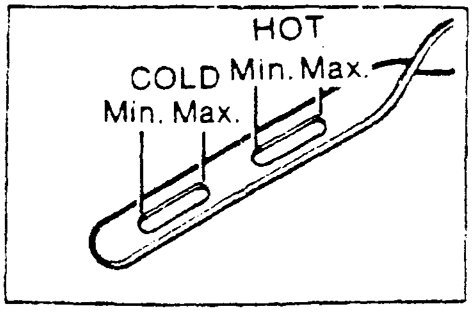
Move the shifter through the entire shift selection range.

CAUTION

Be careful to keep service brake and parking brake applied throughout shift selection range.

Check Fluid Level at Operating Temperature

Never allow the fluid level to be **above the "Maximum"** mark or **below the "Minimum"** mark. This could cause damage to the clutch/brake assembly due to overheating or leakage.



GENERAL INFORMATION
SPECIFICATIONS

Standard service exchange units are available in two forms.

Complete Automatic Transmission	Clutch/Brake Assembly Only
⬇	⬇

Whenever replacing a unit following damage to a clutch or brake, where the fluid is black or full of suspended particles, the torque converter must also be replaced since it acts as a centrifugal fluid filter.

Complete Automatic Transmission	Clutch/Brake Assembly Only
⬇	⬇
Check the fluid pressure and adjust it if necessary. (See page F2-34.)	Clean out the differential casing. Check and adjust the end play. Check and adjust the fluid pressure (See page F2-34).

Anaerobic Sealant
Assembly of gearbox and transmission cases may require use of a special type of silicone sealant known as **anaerobic sealer.** This compound is used as a gasket material in specified applications.

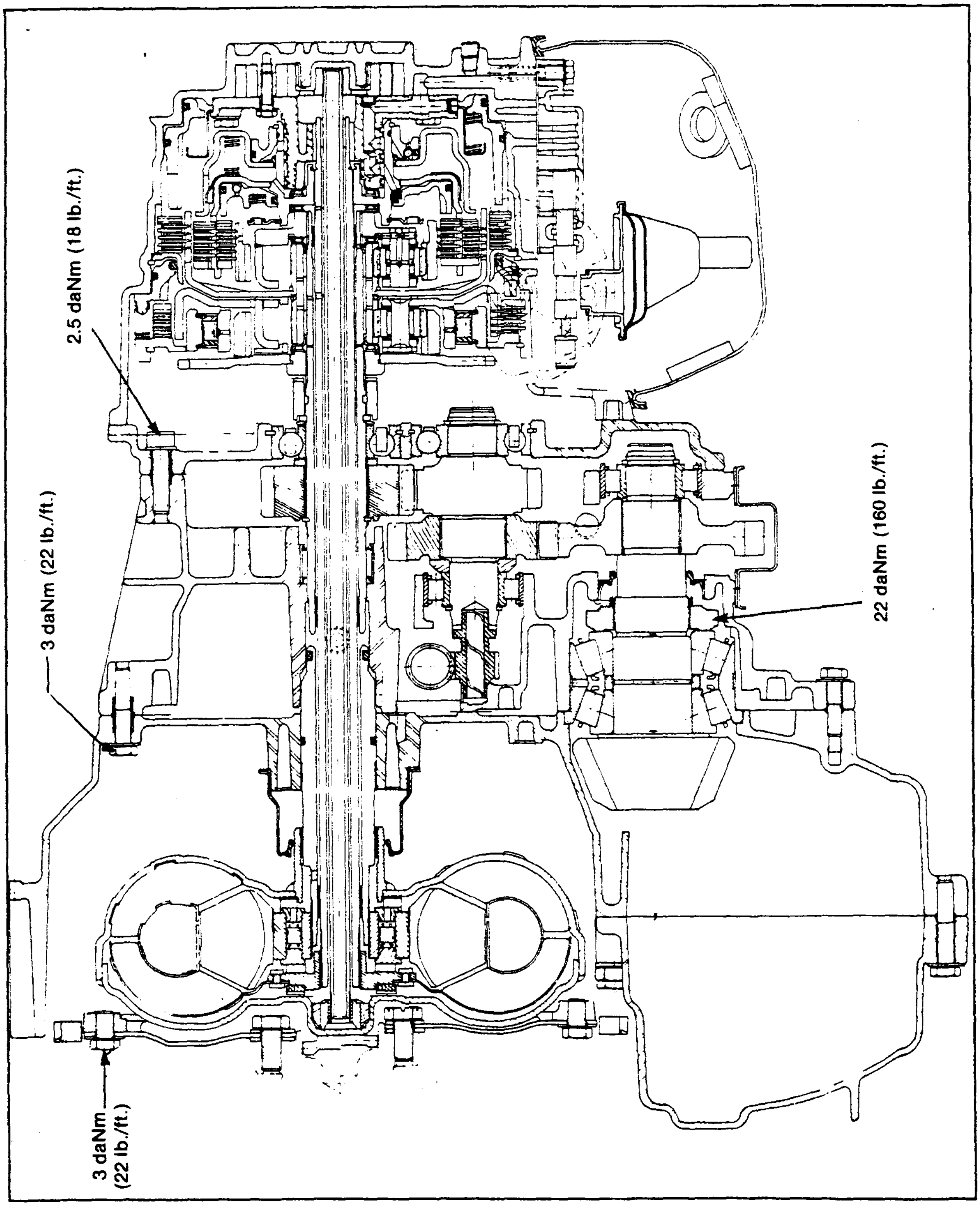
In each application which specifies anaerobic sealant, we recommend using Loctite® "518" or "515" or NAPA/Balkamp® Part No. 765-1189 or an equivalent anaerobic sealant.

CAUTION

Do not substitute anaerobic sealant with RTV silicone sealant or other adhesive gasket materials. These do not possess the characteristics required to produce a durable seal.

Improper sealing could allow fluid leakage, resulting in serious mechanical damage.

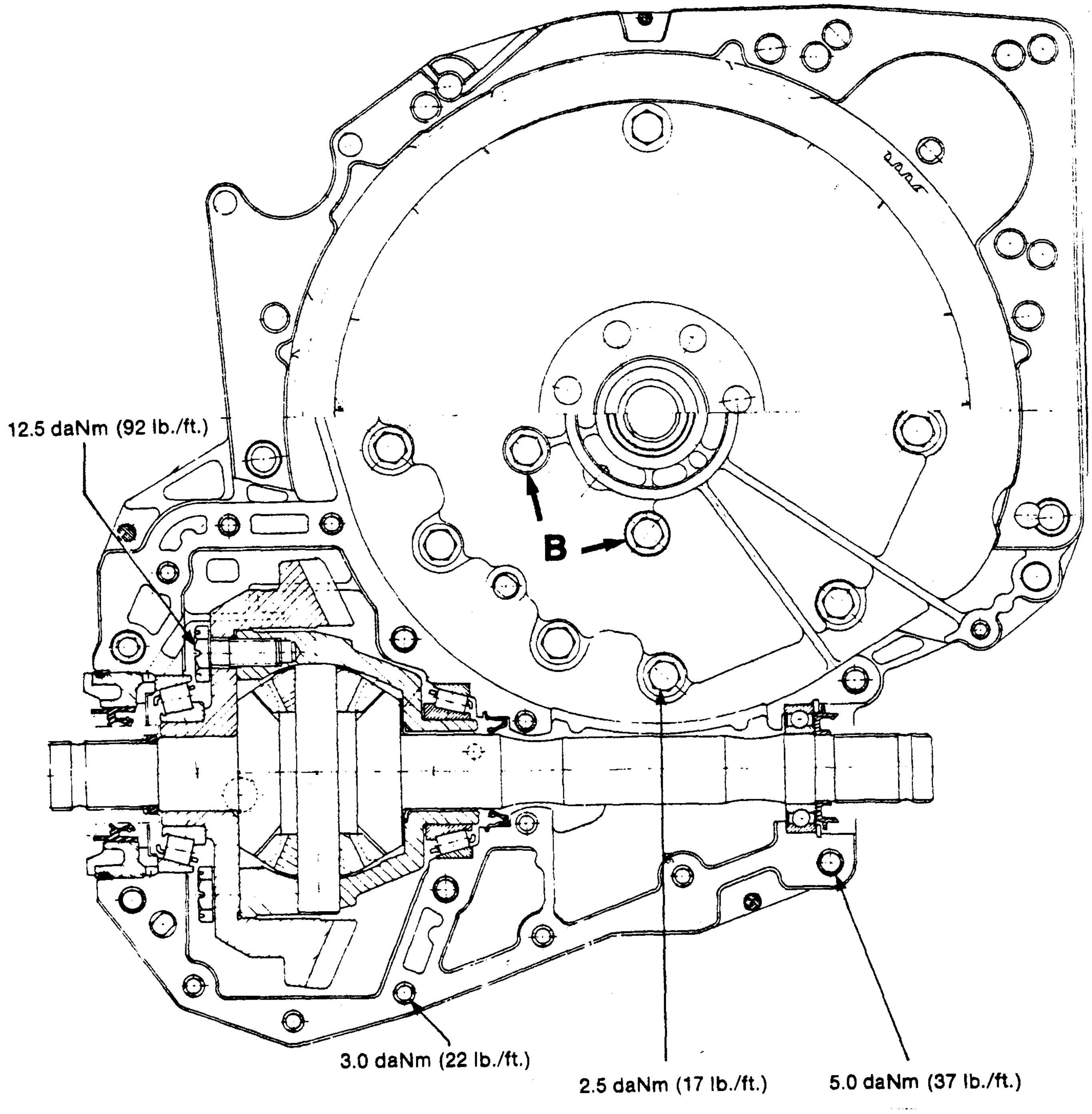
SECTIONAL VIEWS AND TIGHTENING TORQUES



Gear section to separator casing bolts .... 2.5 daNm (18 lb./ft.)

SECTIONAL VIEWS AND TIGHTENING TORQUES

* The converter case bolts (B) must be coated with silicone sealant before reassembly (See pg. F7-21).



GENERAL INFORMATION
SECTIONAL VIEWS AND TIGHTENING TORQUES

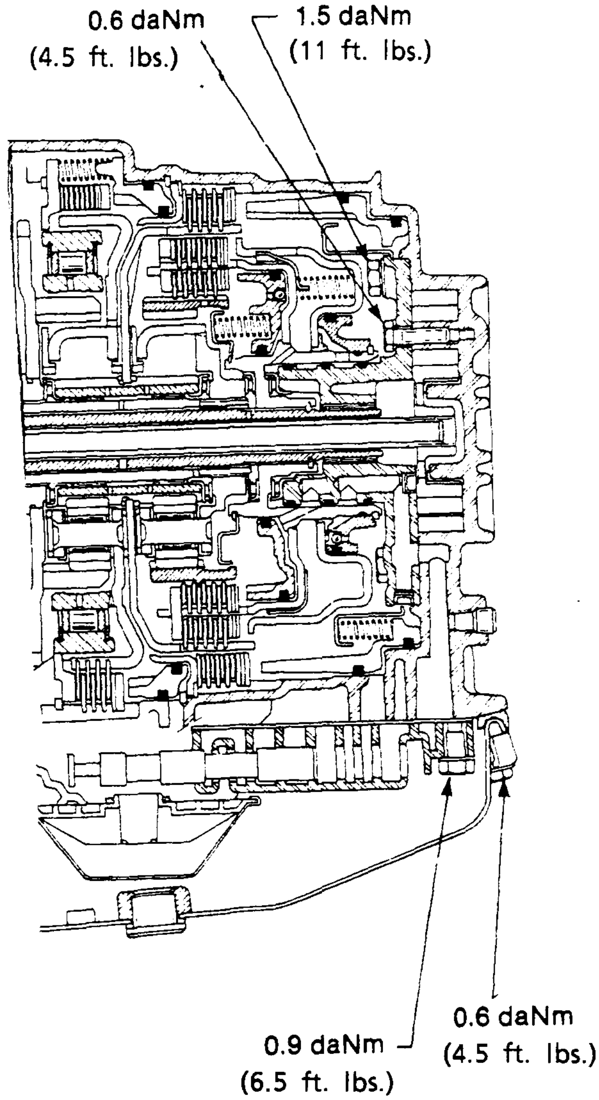
TIGHTENING TORQUES

Sump mounting bolts.............................. 0.60 daNm
(4.5 lb./ft.)

Hydraulic control unit mounting bolts (see tightening order, page F3-9)...................................... 0.9 daNm
(6.5 lb./ft.)

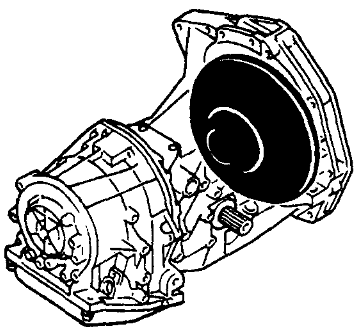
Fluid pump hub mounting bolts............ 1.5 daNm
(11 lb./ft.)

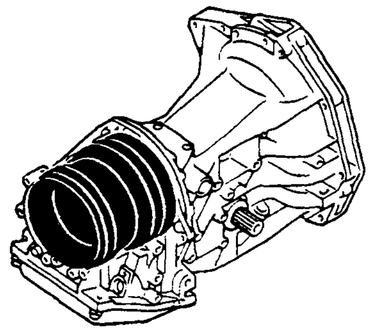
0.6 daNm
(4.5 lb./ft.)



GENERAL INFORMATION
PRINCIPLES OF OPERATION

The automatic transmission consists of 3 main sections.





1. TORQUE CONVERTER

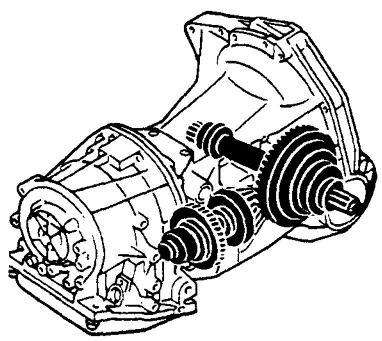
This ensures a FLEXIBLE and AUTOMATIC connection between the ENGINE and the CLUTCH/BRAKE ASSEMBLY: it is an AUTOMATIC CLUTCH.

In addition, it multiplies the torque delivered by the engine when the vehicle starts.

2. CLUTCH/BRAKE ASSEMBLY

This provides one reverse gear and 3 forward gears by way of two EPICYCLIC GEAR TRAINS. Gear changes are AUTOMATIC and WITHOUT INTERRUPTION in torque transfer. Three types of unit control the epicyclic gear trains to obtain these results:

- the MECHANICAL units,
- the HYDRAULIC units,
- the ELECTRICAL and ELECTRONIC units



3. FINAL DRIVE SECTION

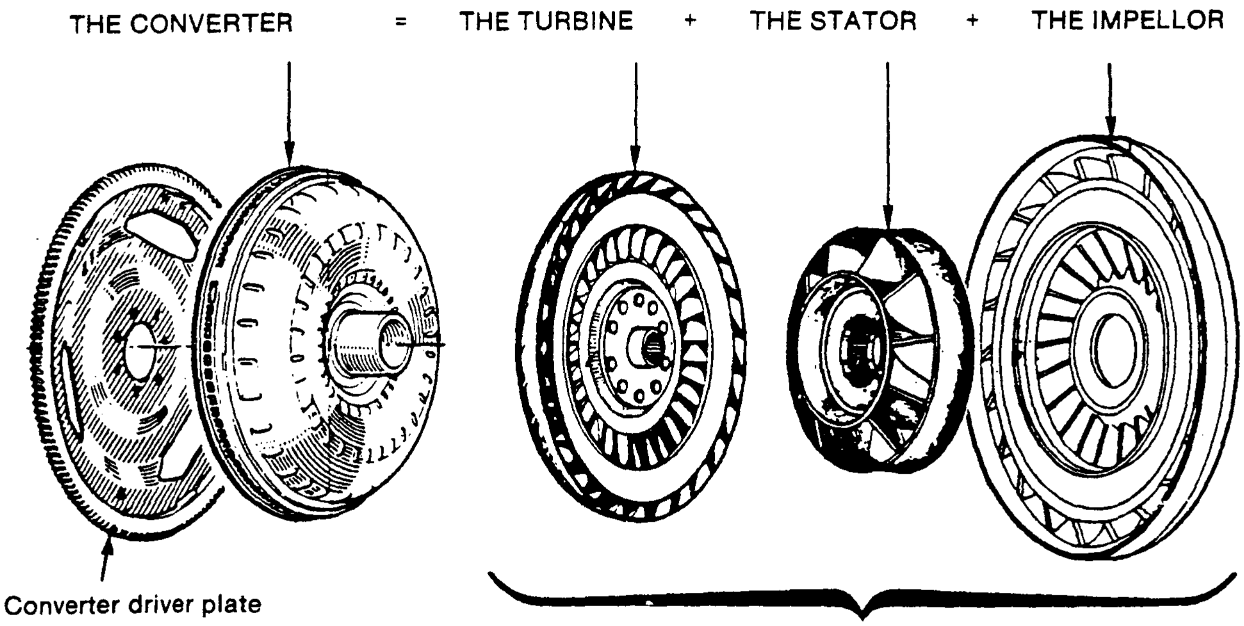
Its purpose and component parts are similar to those in a mechanical gearbox-final drive assembly. However, it also includes a change in the line of drive which is achieved by means of a pair of external gears known as STEP-DOWN gears. These step-down gears play a part in the overall drive reduction.

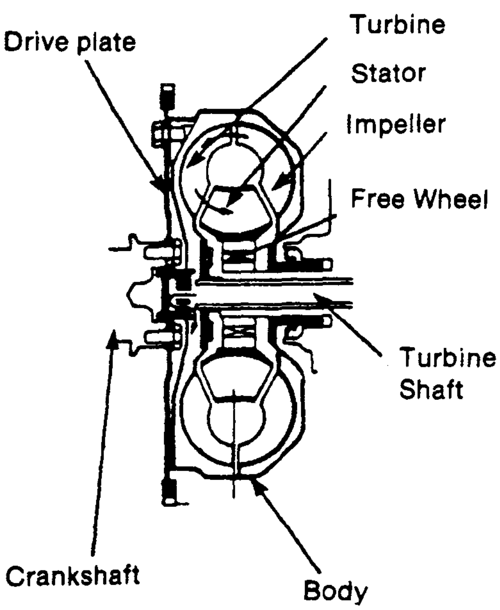
GENERAL INFORMATION
PRINCIPLES OF OPERATION

The torque converter is a hydraulic clutch system which provides a flexible, automatic link between the engine and the automatic transmission mechanism. Its method of operation can be divided into 2 stages.

WHEN STARTING	AT HIGH SPEED
It multiplies the engine torque. THIS IS THE CONVERTER FUNCTION	It transmits the engine torque. THIS IS THE COUPLING FUNCTION

The CONVERTER body contains 3 wheels with vanes.





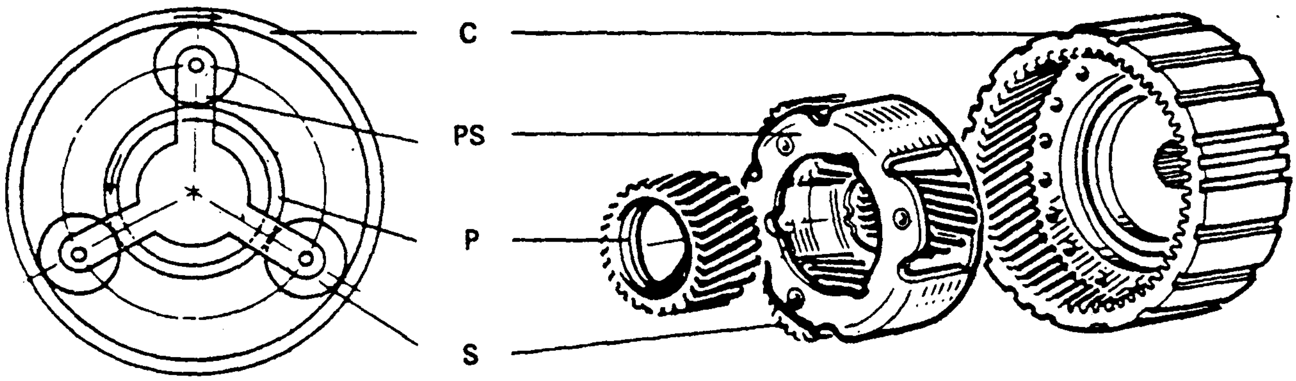
- The converter BODY consists of 2 half-shells welded together. It is coupled to the engine CRANKSHAFT by the DRIVE PLATE. In operation it is full of fluid.
- The IMPELLOR is integral with the converter body and hence with the engine.
- The TURBINE is linked with the CLUTCH/BRAKE UNIT of the automatic transmission by the TURBINE SHAFT.
- The STATOR is located between the impeller and the turbine.
- The STATOR rests on the free wheel.

GENERAL INFORMATION
PRINCIPLES OF OPERATION
THE EPICYCLIC GEAR TRAINS

1 - DEFINITION
This is a set of internal and external helically cut gears. They can provide different reduction ratios depending on the manner in which they are activated. The gears are always in mesh.

2 - DESCRIPTION
A "SINGLE" EPICYCLIC GEAR TRAIN contains:
- a SUNWHEEL P with external teeth
- a number of planet wheels S
- a planet wheel carrier PS
- a ring C, with internal teeth.

This type of gear train can provide a number of ratios. Only TWO of the gear components need to be used to obtain each reduction.



The Mechanical Control Units
To activate TWO units in the EPICYCLIC GEAR TRAIN, multi-disc oil bath type hydraulic receivers are used.
- The movement input component is driven by a Clutch "E1" or "E2"
- The reactive component is locked by a Brake "F1" or "F2."

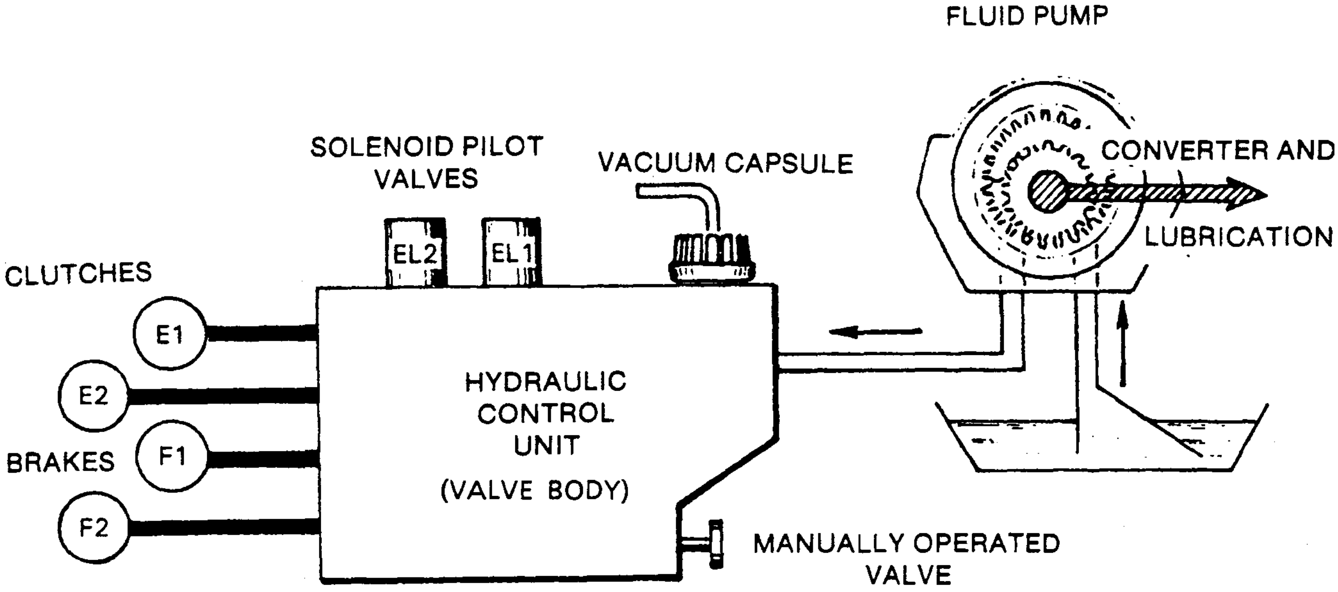
They are controlled by the HYDRAULIC CONTROL UNITS.

GENERAL INFORMATION
PRINCIPLES OF OPERATION

THE HYDRAULIC CONTROL UNITS

- The Fluid Pump lubricates and feeds the converter and ensures operation of brakes and clutches (line pressure)

- The Hydraulic Distributor (valve body) supplies the components in question depending on the engine conditions (load, speed) by means of valves whose positions are controlled hydraulically by solenoid valves known as solenoid pilot valves.

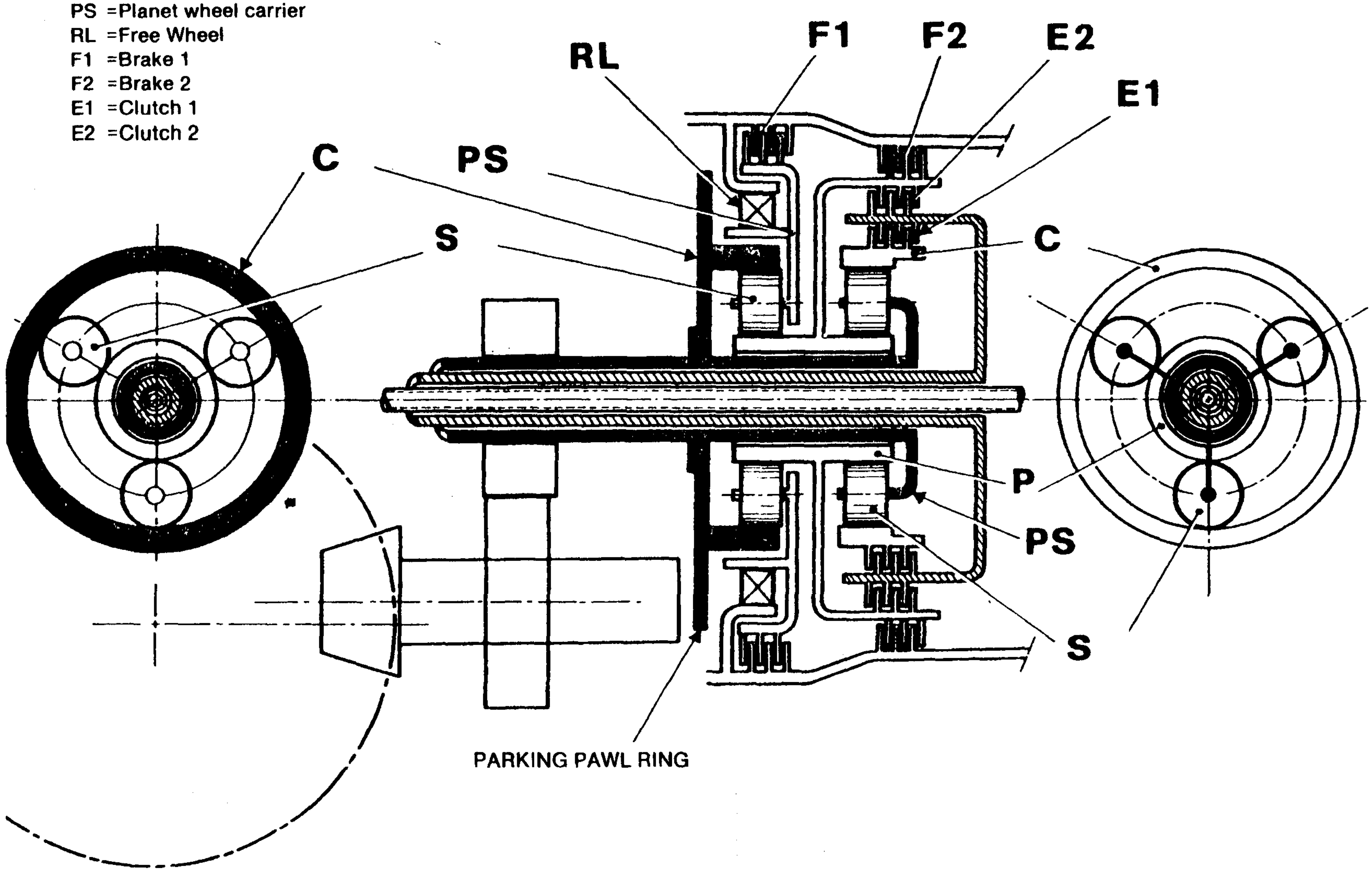


THE ELECTRICAL CONTROL UNITS

Their purpose is to decide when to change gear and to control the gear change.

To do this, they trigger the activation of the solenoid pilot valves and thus control the hydraulic distributor valve movements which result in the changes in speed.

C =Ring Gear (Internal Tooth)
S =Planet wheel(s)
P =SunWheel
PS =Planet wheel carrier
RL =Free Wheel
F1 =Brake 1
F2 =Brake 2
E1 =Clutch 1
E2 =Clutch 2

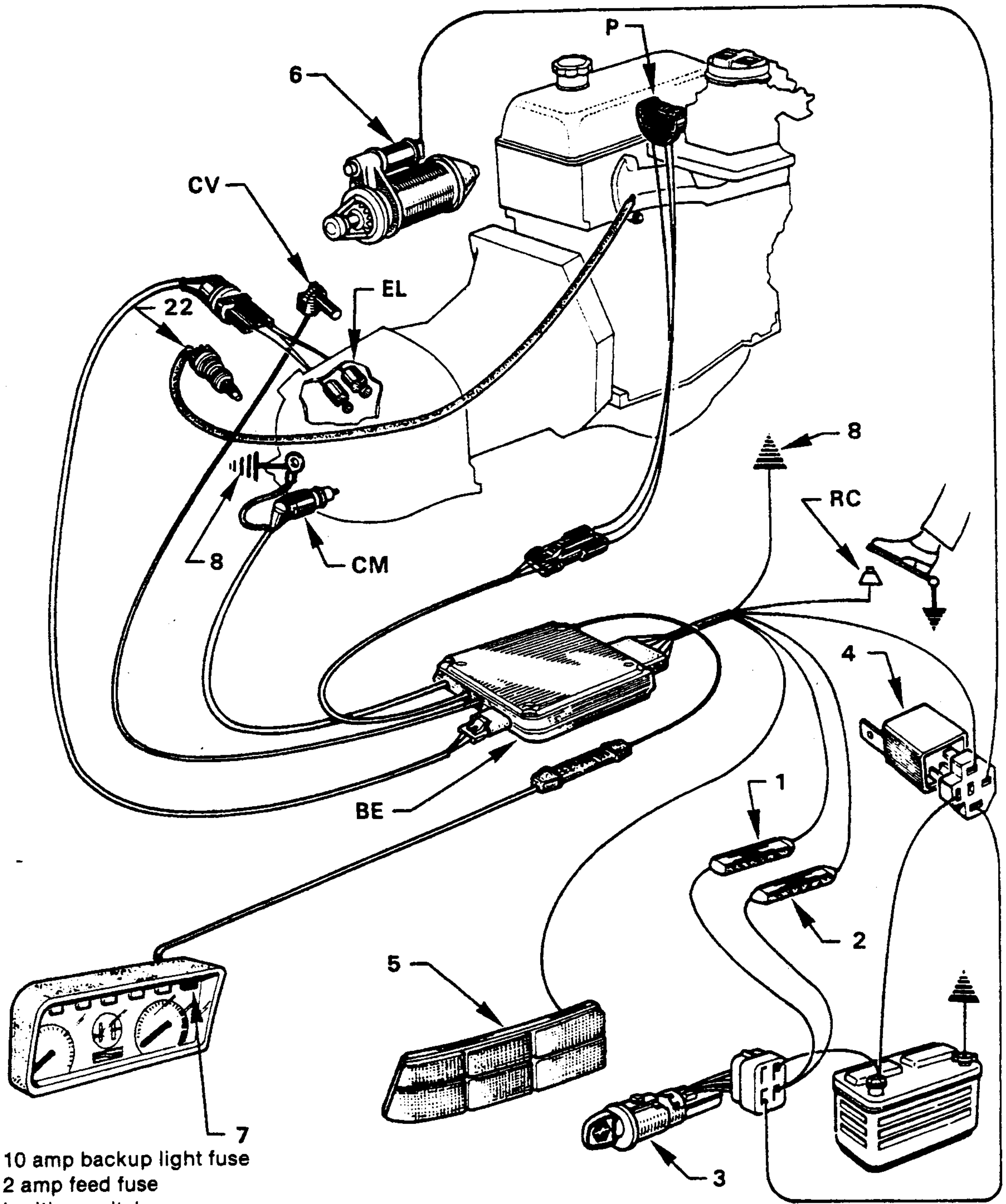


Lever Position		RL	E1	E2	F1	F2	EL1	EL2
P								X
R				X	X			X
N								X
D	1	X	X					X
	2		X			X	X	X
	3		X	X				
2nd gear "Hold"			X			X	X	X
1st gear "Hold"			X		X			X

☒ = **COMPONENTS OPERATING**

RL = Free Wheel
E1 = Clutch 1
E2 = Clutch 2
F1 = Brake 1
F2 = Brake 2
EL1 = Solenoid pilot valve 1
EL2 = Solenoid pilot valve 2

GENERAL INFORMATION
COMPONENT DESCRIPTIONS



1 - 10 amp backup light fuse
2 - 2 amp feed fuse
3 - ignition switch
4 - starter relay
5 - back-up lights
6 - starter
7 - instrument panel (warning light)
8 - automatic transmission ground on computer connector (BE) or on multi-purpose switch connected to automatic transmission

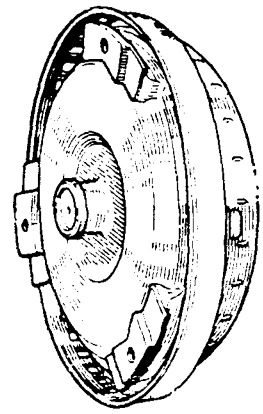
P - Potentiometer
CM - Multipurpose switch
EL - Solenoid pilot valves
RC - Kickdown switch
CV - Speed sensor
22 - Vacuum capsule
BE - Computer

GENERAL INFORMATION
COMPONENT DESCRIPTIONS

The automatic transmission selects through the three forward drive ratios, without disconnecting the drive.

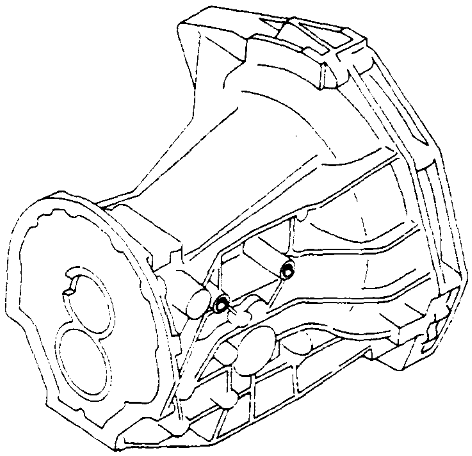
It consists of three main units:

- the torque converter,
- the differential section,
- the clutch/brake unit.



The Torque Converter

- provides a flexible drive from the engine through to the mechanical section
- acts as an automatic clutch,
- increases the torque output during the starting phase.



The Differential

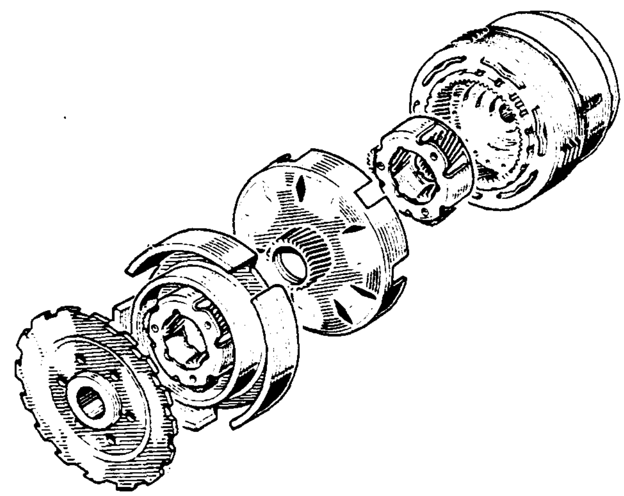
This carries the drive from the transmission mechanism through to the wheels.

It consists of:
- the output train that lowers the drive centerline.
- the ring gear and pinion set that drives the differential.

The Clutch/Brake Unit

This provides three reduction ratios in forward drive and one in reverse.

It contains:
- planetary gear train
- the units that control this train which can be separated into three categories:
- mechanical units
- hydraulic units
- electrical units.



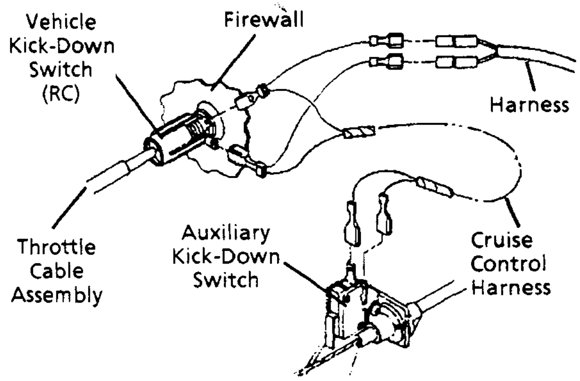
Planetary Gear Train

This is a set of helical cut gears that provide the various ratios (3 forward ratios and 1 reverse ratio) depending on the way in which the control units (E1 - E2 - F1 - F2) are selected.

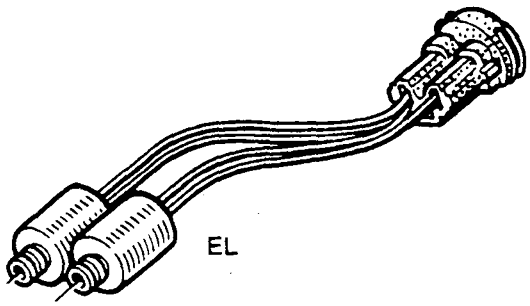
GENERAL INFORMATION
COMPONENT DESCRIPTIONS

KICK-DOWN SWITCH (RC)
This switch is integrated into the accelerator cable and is non-adjustable and non-serviceable. The switch is closed at full throttle position of the accelerator pedal travel, signalling the computer to down-shift.

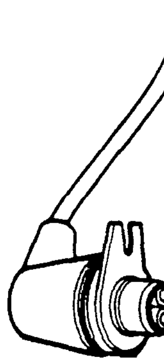
There is also a kick-down switch incorporated into the cruise control system. This switch is located at the throttle cable assembly on the valve cover. If either of these switches are malfunctioning or misadjusted, it will affect down-shift operation.



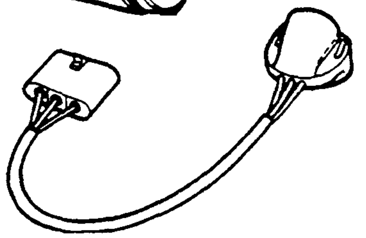
PILOT SOLENOID VALVES (EL)
These are ball type solenoid valves that are controlled by the computer. They are mounted to the hydraulic valve body. Their function is to seal off or allow by-pass of high pressure fluid, which controls movement of the spool valves, resulting in gear changes.


EL

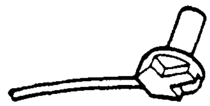
MULTI-PURPOSE SWITCH (CM)
This switch is mounted on the rear of the transmission. It is operated by a cam (with a series of lobes) actuated by the shift selector cable. The cam lobes open and close the pins on the switch in various combinations to tell the computer which gear position has been selected.
The multi-purpose switch controls:
- the starter circuit (current is supplied only while in N or P)
- back-up light circuit (position R)
- solenoid valves (EL 1 & EL 2)


CM

LOAD POTENTIOMETER (P)
This is a variable resistor mounted to the rear of the throttle body assembly. It monitors the position of the throttle plate (butterfly) to feed engine load information to the computer. The computer uses this input along with input from the speed sensor to determine shift thresholds. (See Speed Sensor below).

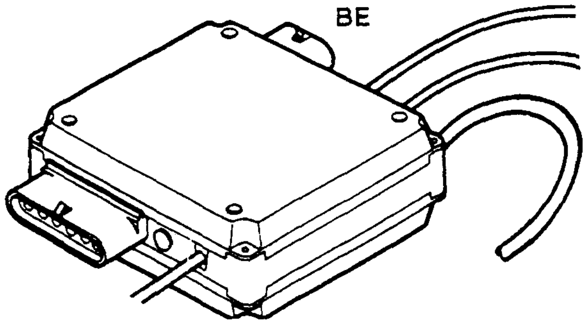

P

SPEED SENSOR (CV)
This is mounted to the side of the transmission directly over the park wheel. The rotation of the teeth on the park wheel interrupts the magnetic field generated by the sensor. This sends a signal indicating transmission RPM to the computer. This input is combined with that of the load potentiometer to determine shift thresholds. (See Load Potentiometer above.)


CV

COMPUTER MODULE/RENIX© BOX (BE)
The computer module is mounted to the driver side firewall. It receives input from:
- the kick-down switch
- the multi-purpose switch
- the load potentiometer
- the speed sensor

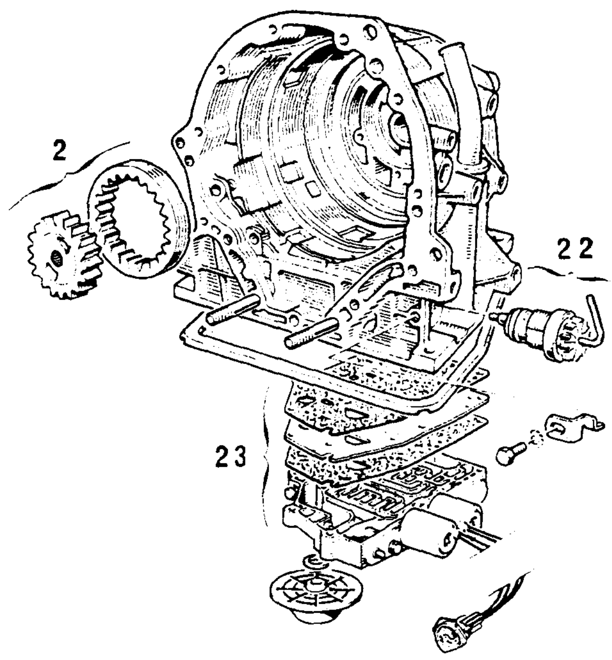
The computer then interprets these signals and sends a control signal to the pilot solenoid valves to initiate gear changes.

BE


GENERAL INFORMATION
COMPONENT DESCRIPTIONS

THE FLUID PUMP
The fluid pump is an internal gear type, driven directly by the engine through the torque converter flange plate. It provides the pressurized fluid required:

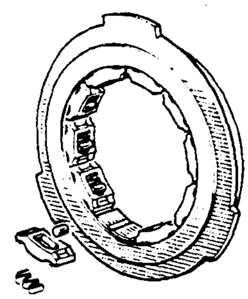
- to feed the converter,
- to lubricate the gears,
- to control the brakes and clutches.



VACUUM CAPSULE (22)
The vacuum capsule is located on the side of the transmission case. Its function is to regulate transmission fluid pressure according to engine load, which is indicated by engine manifold vacuum.

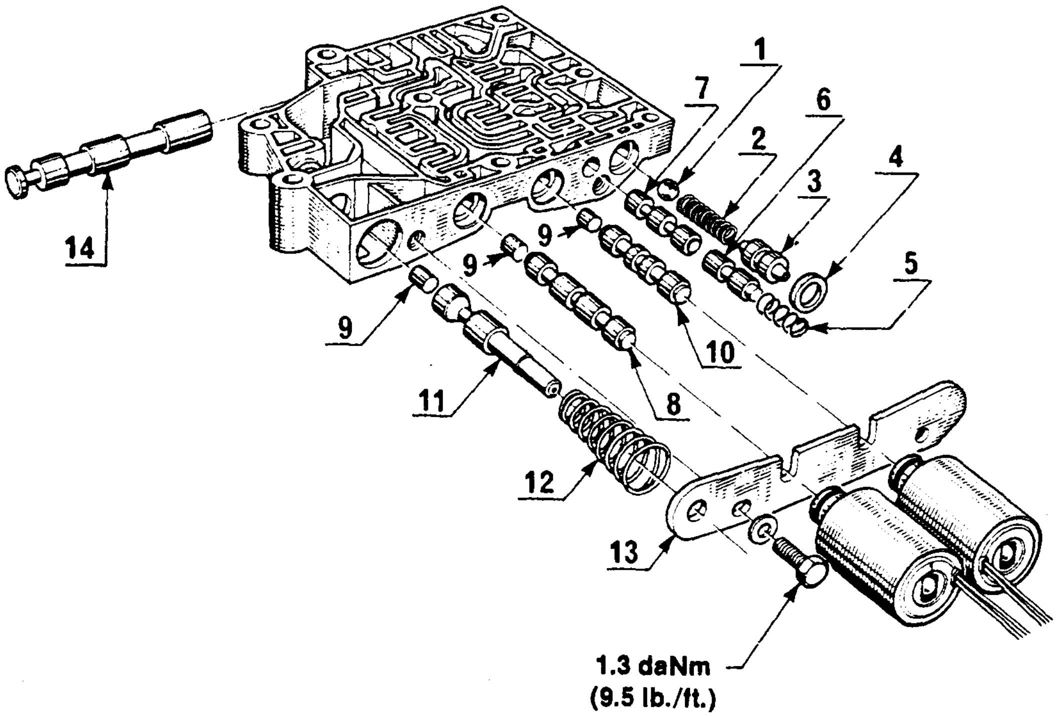
HYDRAULIC CONTROL UNIT OR VALVE BODY (23)
The valve body is an integral part of the transmission assembly and is located between the main case and the fluid pan. The valve body distributes hydraulic fluid to the proper clutches and brakes to provide gear selection according to the positions of the pilot valves.

FREE WHEEL
The free wheel permits torque to be transferred to the drive wheels while under engine load but allows a free-wheel or "coasting" effect under no-load conditions. The exception is that, in 1st gear, the free wheel locks to provide engine braking during deceleration.



CLUTCHES (E1 & E2) and BRAKES (F1 & F2)
The clutches and brakes are multi-disc, oil-bath type. The different gears are determined by application of clutches and brakes in various combinations according to fluid distribution from the valve body.

GENERAL INFORMATION
COMPONENT DESCRIPTIONS



HYDRAULIC CONTROL UNIT (VALVE BODY)

1 - PLV ball
2 - PLV spring (medium size)
3 - Pressure limiting valve (PLV)
4 - PLV seal
5 - SV spring (small)
6 - Sequence valve (SV)
7 - Sequence valve (SV)
8 - No. 1 selector valve (SV1)
9 - Plungers
10 - No. 2 selector valve (SV2)
11 - Pressure regulating valve (PRV)
12 - PRV spring (large)
13 - Cover plate
14 - Manually selected valve (MV)

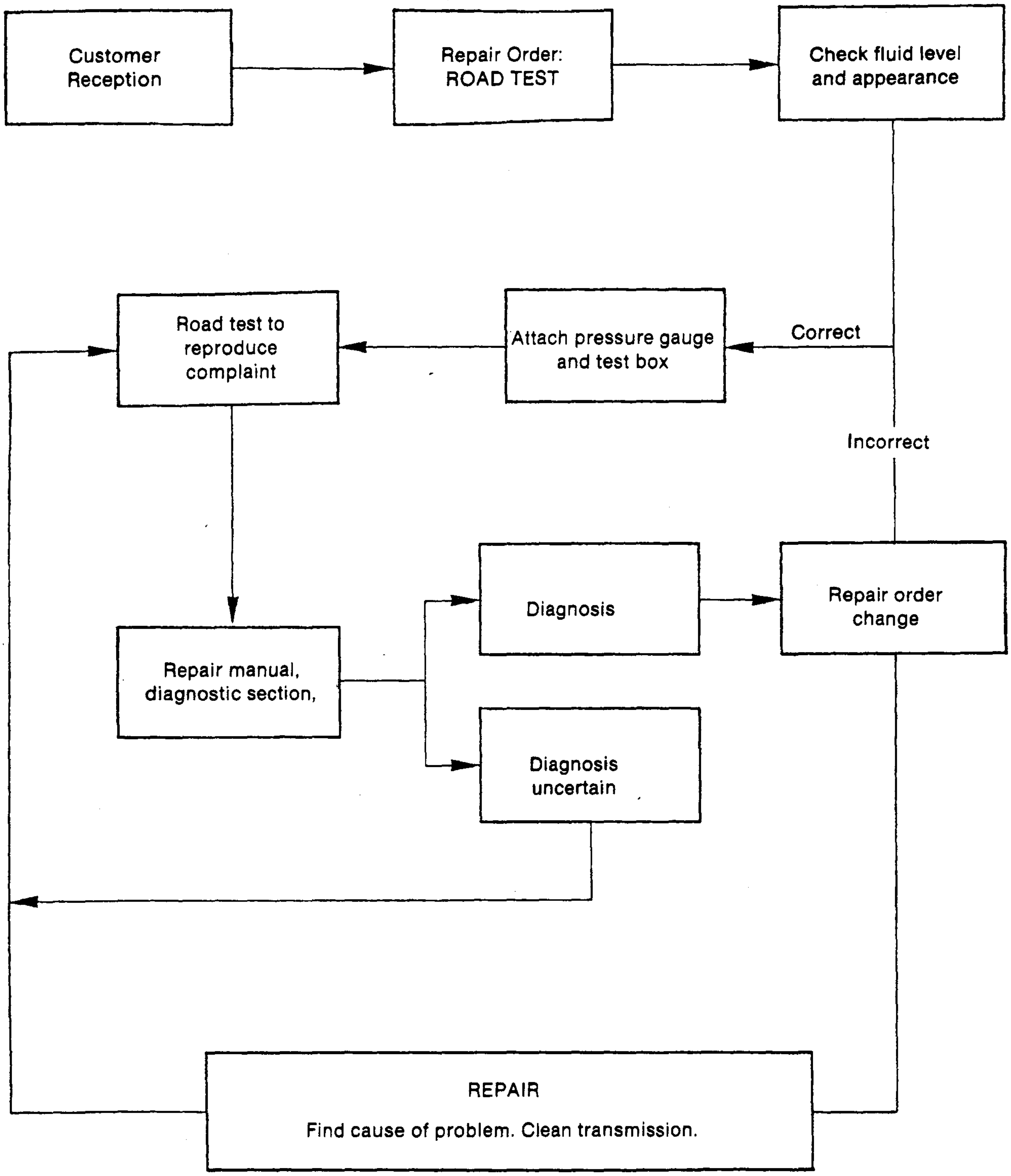
The plungers (9) are identical on valves 8 & 10. The PRV plunger is different - 5.5 mm in diameter.

Valves (3-7-8-10) are symmetrical.

Valve (6) is not symmetrical.

DIAGNOSTIC PROCEDURE

What to do when you receive a defective automatic transmission.



DIAGNOSTIC PROCEDURE

What to do when you receive a defective automatic transmission.

1. Reception of vehicle - ask customer about complaint noted.
2. Prepare the repair order but do not enter work to be performed; only the vehicle road test.
3. Prepare the vehicle for a road test and check the level and condition of the transmission fluid:
   - if the fluid level is OK and fluid does not look dark or smell burned, proceed to step 5.
   - if fluid level is OK but looks dark or smells burned, proceed to step 4.
   - if fluid level is low but fluid looks and smells OK, fill fluid and proceed to step 5.
   - if fluid level is low and fluid looks dark and smells burned, proceed to step 4.
4. If the fluid appears dark or smells burned, the problem is mechanical. Connect the XR25 tester and attach oil pressure gauge B.Vi 466-07 then proceed to road test, step 5.
5. Test the vehicle on the road until the complaint recurs. At the end of the road test, the person performing the test must prepare a precise diagnosis of the failure using the necessary documents (repair manual, diagnostic section) and according to the information supplied by the various testing means and observations noted.
6. Depending on the diagnosis made, complete the repair order indicating the vehicle component causing the problem. **Never begin repairs if the diagnostic sequence has not been performed.**
7. Perform the necessary repairs.
8. After repairing the vehicle, perform a road test to make sure that all complaints have been corrected.

REMEMBER: The transmission warning light comes on only if there is an electrical problem or there is interference in the engine compartment (faulty connections or high voltage leaks).

CAUTION

All electronic systems operate at very low voltages and current intensities (millivolts and milli-amps). The supply voltages and grounds must be absolutely accurate. A voltmeter/ohmmeter must be used to check:
- the grounds -
- the power supply +
- the connectors

Test bulbs should never be used for checking systems containing electronic components.

DIAGNOSTICS
FAULT - CORRECTION CHART

DIAGNOSTICS
FAULT - CORRECTION CHART

ENGINE STALLS, UNEVEN IDLING AND GRABS WHEN CHANGING GEAR

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Engine not tuned proper	Tune the engine
2. Vacuum capsule hose punctured, cut or disconnected.	Check the condition and routing of the hose and of the connection of the inlet manifold.
3. Punctured vacuum capsule	Check the capsule (see subsection on "Vacuum capsule")

GRABS ON START

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Lack of fluid in clutch/brake section	Check the fluid level and fill if necessary. Check to see if fluid is leaking.
2. Improperly adjusted engine idling speed.	Adjust the engine idling speed.

Jerk when changing from 2nd-3rd with light throttle.

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Light throttle fluid pressure incorrect	Check fluid pressure at light throttle when hot : vehicle traveling at 37 mph (60 km/h), foot off accelerator, fluid pressure must be 3.5 - 3.6 bars. Otherwise change hydraulic distributor, its plate and seals (see "Hydraulic Control Unit" subsection).
2. Defective hydraulic distributor plate	Change plate and its seals.

DIAGNOSTICS
FAULT - CORRECTION CHART

GRABS WHEN CHANGING GEAR

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Engine not tuned properly.	Tune the engine
2. Lack of fluid in gear section	Check the fluid level. Check for leaks.
3. Vacuum capsule hose kinked or capsule damaged	Check condition and routing of hose and capsule
4. Incorrect fluid pressure	Check fluid pressure and adjust (F2-34)
5. Incorrect assembly or operation of hydraulic control unit.	- Check that the hydraulic control unit is tightened properly - Check position and condition of its seal - Check hydraulic distributor (see "Hydraulic Control Unit" Subsection)

CREEP IN "N"

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Fluid appearance	- Check appearance of the fluid (if it is dirty and smells burnt, see point 3)
2. Adjustment of gear selector lever incorrect.	- Adjust selector lever
3. E1-E2 clutch damaged	Change damaged components

Excessive creep in "D"

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Engine idling speed not adjusted.	Adjust engine idling speed.
2. Damaged converter (metallic noise)	Change the converter

DIAGNOSTICS
FAULT - CORRECTION CHART

Slippage while starting off in "D-2-1-R"

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Level and appearance of fluid	Check fluid level and appearance
2. Clogged filter screen.	Clean or replace filter screen as necessary
3. Damaged vacuum capsule or trapped pipe	Check the capsule and pipe routing.
4. Incorrect fluid pressure	- Check that the hydraulic control unit is properly tightened - Check the condition and position of its seals - Check the hydraulic control unit (see "Hydraulic Control Unit" Subsection)
6. Stuck or damaged feed hub rings	Check the feed hub rings of E1 - E2 (condition and free rotation)

Slippage while starting off in "D" and "2" (More sensitive when passing from 3rd to 1st at full throttle)

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Automatic transmission freewheel not engaging.	Change the freewheel

Slippage while starting off when cold.

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Fluid level	Check the fluid level and fill if necessary

Continually or intermittently difficult to start moving but operates normally above 15 mph to 20 mph (20 to 30 km/h) (Also noticeable on slopes)

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Faulty converter	- Change the converter (be sure the stator shaft is installed correctly)

DIAGNOSTICS
FAULT - CORRECTION CHART

Slippage during gear changing

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Lack of fluid in gear section	Fill if necessary, and check the appearance of the fluid (if it is dirty and smells burnt, see point 6). Check to see whether oil is leaking.
2. Incorrect fluid pressure	Check the fluid pressure
3. Damaged vacuum capsule or trapped pipe	Check the capsule and pipe routing
4. Incorrect fitting or operation of hydraulic control unit.	- Check that the hydraulic control unit properly tightened - Check the condition and position of its seals - Check the hydraulic control unit (sequence valve) (See subsection "Hydraulic Control Unit)
5. Stuck or damaged feed hub rings	Check the feed hub rings of E1 - E2 (freely rotating and their condition)
6. Worn or burnt out brakes and clutches	Change the damaged components
7. Cut seals on F2	Check seals and F2 brake and change as necessary

Threshold values for gear changing incorrect and warning light not illuminating

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Kick-down wire or kick down devices defective	Check the routing and condition of the kick-down wire and the kick-down devices
2. Clogged air filter (at full throttle the engine remains at an idling speed which does not allow you to change to higher gear)	Change the air filter
3. Load potentiometer	Incorrect adjustment of the potentiometer : driving lug not engaging, is broken or seized.
4. Incorrect operation of hydraulic control unit (passage valve rings)	- Check that the hydraulic control unit is tightened properly - Check the hydraulic control unit (passage valve) (See subsection "Hydraulic Control Unit" and solenoid pilot valves)

DIAGNOSTICS
FAULT - CORRECTION CHART

Fixed gear changing speeds with or without warning light illuminating

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Load potentiometer not adjusted properly, disconnected or defective.	Using tool XR25 check and adjust the load potentiometer. Check the connection.

No drive regardless of gear selected.

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Level and appearance of fluid	Check the fluid level and fill if necessary. Check the appearance of the fluid (if it is dirty and smells burnt, see point 8)
2. Selector lever and cable	Check the selector control adjustment. Check the displacement of the manual controlled spool valve
3. Clogged filter screen	Clean or replace filter screen as needed.
4. Damaged fluid pump or shaft	- Withdraw the dipstick with engine stopped - Withdraw the dipstick with engine running. If the fluid level does not alter, the pump shaft is no longer driving the pump. Change the damaged components depending on the extent of the damage
5. Incorrect fluid pressure	Check the fluid pressure
6. Broken drive plate or screws (metallic noise)	Change the drive plate (check that the centering dowels are present and the condition of the converter centering device and the crankshaft.)
7. Incorrect fitting or operation of hydraulic control unit	- Check that the hydraulic control unit is tightened properly - Check the condition and position of its seals - Check the hydraulic control unit (see Hydraulic Control Unit subsection)
8. Burnt-out mechanism or broken bearing	Change the damaged parts depending on the extend of damage
9. Defective impeller shaft	Change the impeller shaft
10. Damaged converter	Change the converter

DIAGNOSTICS
FAULT - CORRECTION CHART

No forward drive

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Check the appearance of the fluid	If it is dirty and smells burnt, see point 2
2. Defective E1 clutch or E1 piston seal	Change E1-E2 assembly (see point 3)
3. Stuck or damaged feed hub rings	Check the feed hub rings of E1-E2 (condition and free rotation)
4. Incorrect fitting or operation hydraulic control unit	- Check that the hydraulic control unit is tightened properly - Check the condition and position of its seals - Check the hydraulic control unit (See subsection "Hydraulic Control Unit")

No reverse and no engine braking in 1st gear "Hold"

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Appearance of fluid	If it is dirty or smells burnt, see point 4
	Check the condition of the circlip grooves, change the circlips.
3. F1 piston seals	Check and change the piston seals
4. Worn F1 brake	Check F1 brake

No drive in 1st Automatic but drive in 1st gear "Hold"

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Freewheel	Change freewheel

DIAGNOSTICS
FAULT - CORRECTION CHART

No drive in 2nd speed and warning light does not illuminate

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Appearance of fluid.	If dirty and smells burnt, see point 4
2. EL1 solenoid valve (stuck ball)	Check the correct displacement of the ball and that the EL1 solenoid valve is clean
3. F2 piston seals	Check and change the F2 piston seals
4. Worn F2 brake	Change the F2 brake

No 3rd

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Faulty multipurpose switch	Use XR25 tester to check that the multipurpose switch is operating
2. Solenoid valve (ball stuck)	Check that the balls are moving correctly and that the solenoid valve is clean
3. Defective computer	Change the computer

No 3rd and no reverse

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Appearance of fluid	If dirty and smells burnt, see point 2
2. Defective E2 piston or E2 clutch seals	Change the E1 - E2 assembly (see points 3 and 4)
3. Stuck or damaged feed hub rings	Check the feed hub rings of E1 - E2 (their condition and free rotation)
4. Incorrect fitting or operation of hydraulic control unit	- Check that the hydraulic control unit tightened properly - Check the condition and position of its seals - Check the hydraulic control unit (sequence valve) (See "Hydraulic Control Unit")

DIAGNOSTICS
FAULT - CORRECTION CHART

No 1st gear "Hold" or 2nd gear "Hold"

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Control adjustment	- Check selector control adjustment
2. Defective multipurpose switch	- Use XR25 tester to check that the multipurpose switch is operating correctly

No 3rd in "D" but operates normally when changing from 1st to 2nd, and warning light illuminates (remove the fuse and the vehicle should stay in 3rd)

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Ground connection in computer melted	Change computer

Remains in 1st with warning light illuminated

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Speed sensor 2. Defective solenoid valve(s)	After a road test, if the light stays illuminated, connect XR25 tester. Change the speed sensor if faulty.

Stays in 3rd with light illuminated

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. "+" feed to computer faulty	Connect XR25 Tester. (See XR25 tester section) Check: - the fuse and condition of fuse holder - the computer feed connectors
2. Faulty solenoid pilot valves	Connect XR25 Tester. (See XR25 tester section) Check: - the valve and sealed connector
3. Faulty computer	Change the computer

DIAGNOSTICS
FAULT - CORRECTION CHART

Stays in 3rd or gears change at random and warning light does not illuminate

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Lack of ground or poor ground to computer	Check grounding at the multipurpose switch. Check the vehicle wiring harness.
2. Kick-down switch wire poorly connected or damaged wire affecting ground.	Check routing and condition of kick-down switch wire.

No park function in "P"

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Badly adjusted selector lever	Adjust selector lever
2. Ratchet arm and its spring and internal control device defective	Check the various parts

Starter inoperative in "N" or "P"

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Battery and its terminal	Check the battery charge and the condition of its terminals to ensure that they are clean
2. Badly adjusted selector lever	Adjust the selector lever
3. Defective multipurpose switch	Check that the multipurpose switch is operating correctly. Perform test using XR25
4. 6-way connector wire of computer from starter relay cut or disconnected	Check the voltage at the 6-way connector at computer with the starter activated - The ground wire at the multipurpose switch.
5. Defective starter relay	Check the starter relay
6. Defective switch	Check the key switch
7. Starter inoperative	Check the starter

DIAGNOSTICS
FAULT - CORRECTION CHART

Starter operates in all lever positions

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Start relay defective (located on the firewall near the transmission computer)	Replace defective relay

Back-up lights inoperative in "R"

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Badly adjusted selector lever	Adjust the selector lever
2. Defective light bulbs	Check the bulbs
3. Defective multipurpose switch	Check that the multipurpose switch is working properly using the XR25 tester
4. Feed and return to reversing lights on 6-way connector cut, disconnected, etc.	Check the voltage at the 6-way connector.
5. No voltage to the multipurpose switch	Check 10 amp. fuse

Noise from hydraulic distributor (valve body) in "P" or "N" when cold.

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Noisy pressure regulating valve	Change the hydraulic distributor plate and gaskets

DIAGNOSTICS
FAULT - CORRECTION CHART

Rumbling noise between 40 and 50 mph (60 and 80 km/h)

FAULT - PROBABLE CAUSE	CHECKS - CORRECTIVE ACTION
1. Tires	Check the balance and inflation pressure of the tires
2. Noisy final drive gears	Change Final Drive gears (See Subsection "Final Drive Assembly")

SPECIAL POINTS
If the warning light illuminates, it is important to check that all the computer cables (speed sensor, kick-down switch, load potentiometer, feed) are at least 15 cm away from the high voltage ignition wires and that the computer is correctly supplied with current (+ 6-way connector, fuse, vehicle harness).

XR25 INSTRUCTIONS FOR USE

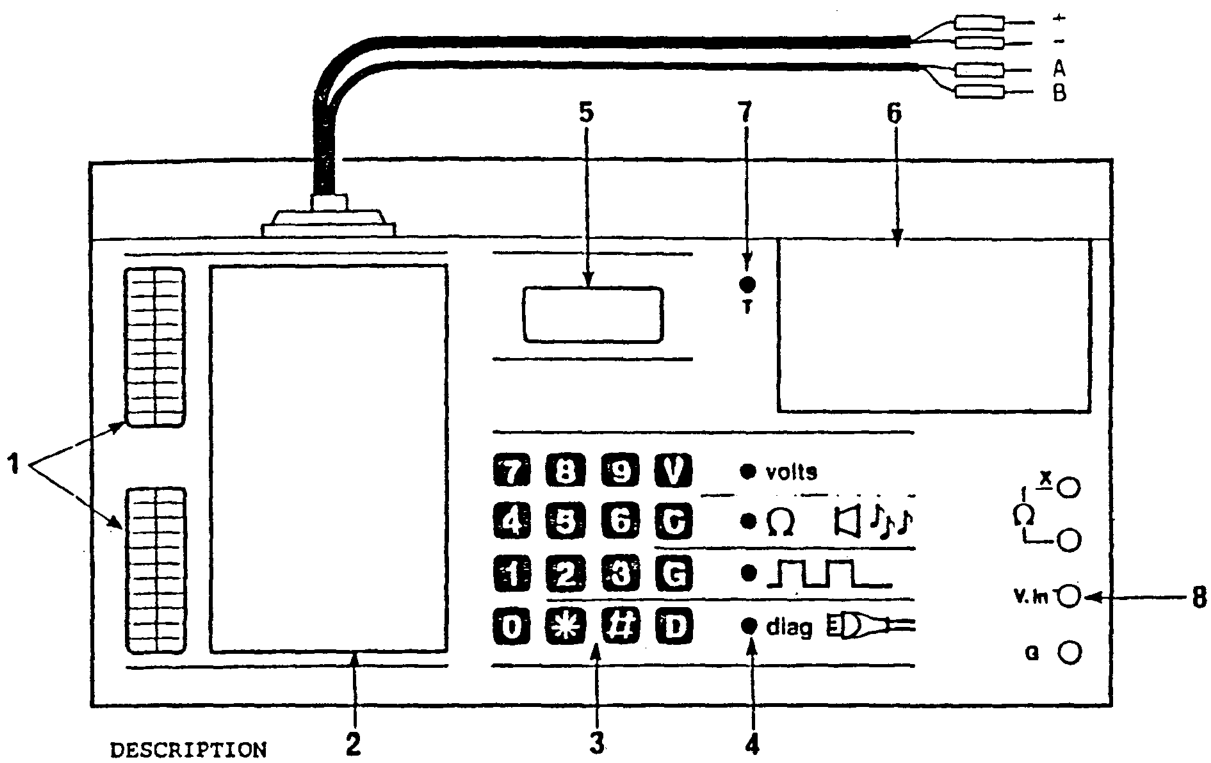
The XR25 tester is used to analyze the diagnostic codes emitted by the Renix electronic control.

An interchangeable memory module contains the information necessary to diagnose the electrical system.

The XR25 may also be used to check DC voltage.

DIAGNOSTIC
XR25 TESTER

GENERAL DISPLAY & FUNCTION IDENTIFICATION

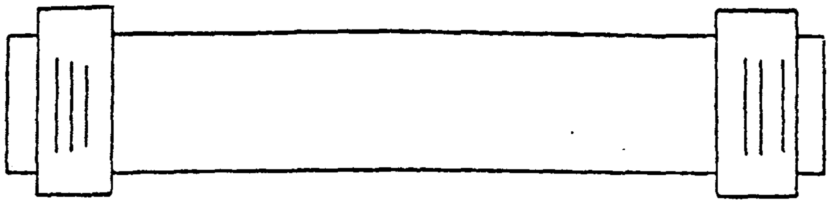


DESCRIPTION

1 - "Go/ No-Go" results display (bargraphs)
2 - Analytical test card
3 - Data entering keyboard
4 - Lights reminding check selected
5 - Display of numbered data (voltage, etc.)
6 - Interchangeable memory module
7 - Memory module "connected" indicator
8 - Voltmeter/Impulse detector input

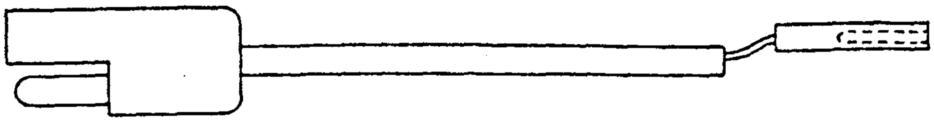
CABLE DESCRIPTION

T



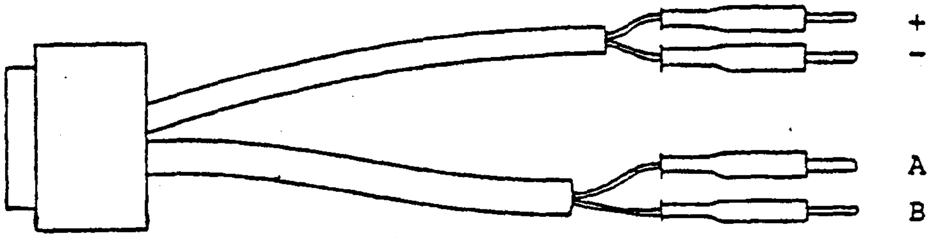
- Extender

X

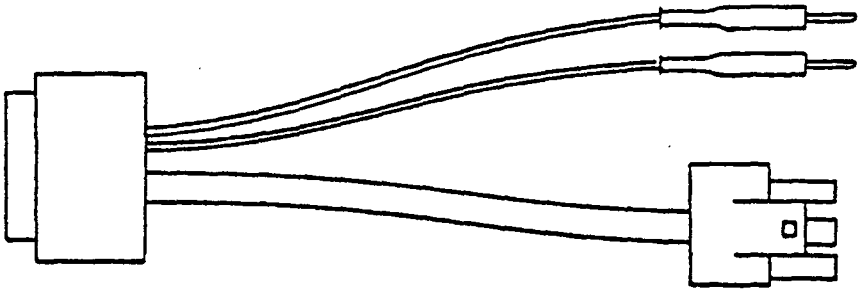


- Adaptor

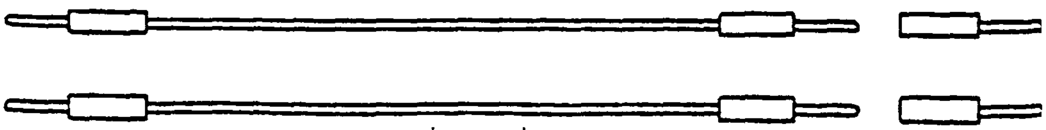
V



W



- Adaptor for potentiometer adjustment



Volt/Ohm Test Leads

CONNECTING THE XR25

The XR25 comes with all the electrical cables necessary for each test. Each cable is identified on page F2-17 with a letter designation.

Cable "T" is an extension cable and can be either the round or ribbon variety. Cable "T" connects the XR25 to either cable "V" or "W". Included also are two alligator clips to connect to the battery as a power source for the XR25 tester.

NOTE: If the power leads are reversed, the XR25 will not operate, but it will not be damaged either. Each test schematic will indicate proper connection.

IMPORTANT
As soon as power leads are properly connected, the XR25 will perform internal circuit diagnosis. Monitor each indication display in sequence, followed by very brief tone. The display (5) will go through a series of numbers (1111 thru 9999) then finish with all zeros (0000).

Checking Connections and Input Circuits:

This check is necessary if internal circuit diagnosis is correct but display indicates no reading.

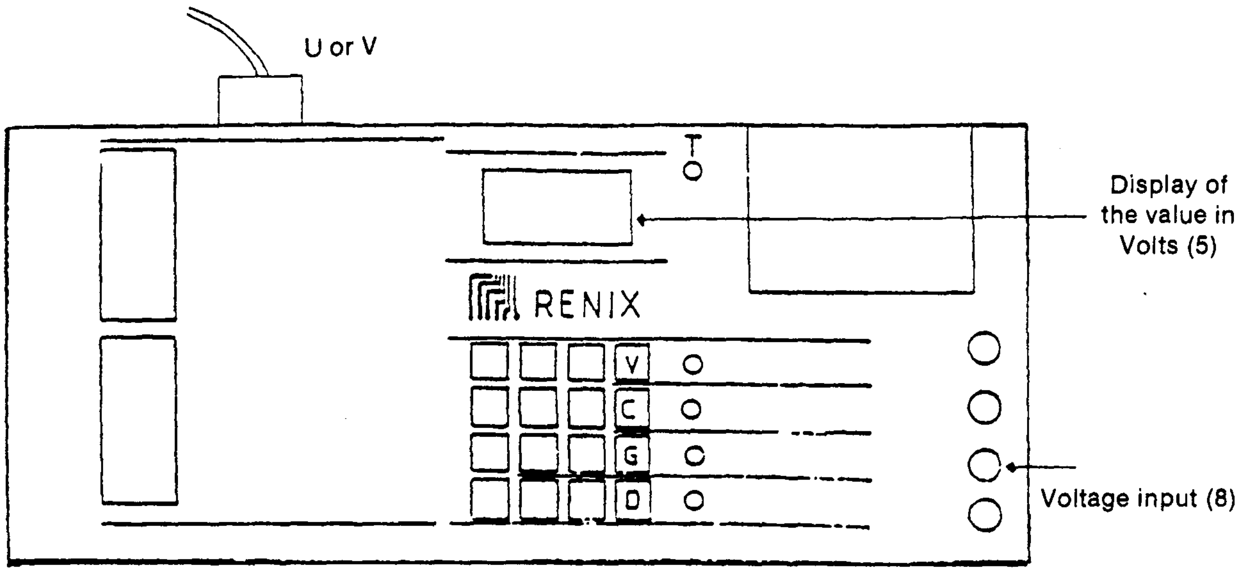
- Connect the extension "T" to the XR25
- Connect cable "V" to extension "T"
- Connect the red terminal to battery +
- Connect the black terminal to battery -
- Depress key "D", then key *
- The display should indicate : C O P
- Connect the yellow and green terminals to vehicle ground.
- Correct indication will be illumination of the right side bar graphs.
  1-2-3-4-5-6-7-8

Should one or more displays remain illuminated on the left, the extension is cut or improperly connected.

USE WITH GENERAL REPAIRS

VOLTMETER

- Connect cable V
- Push key V

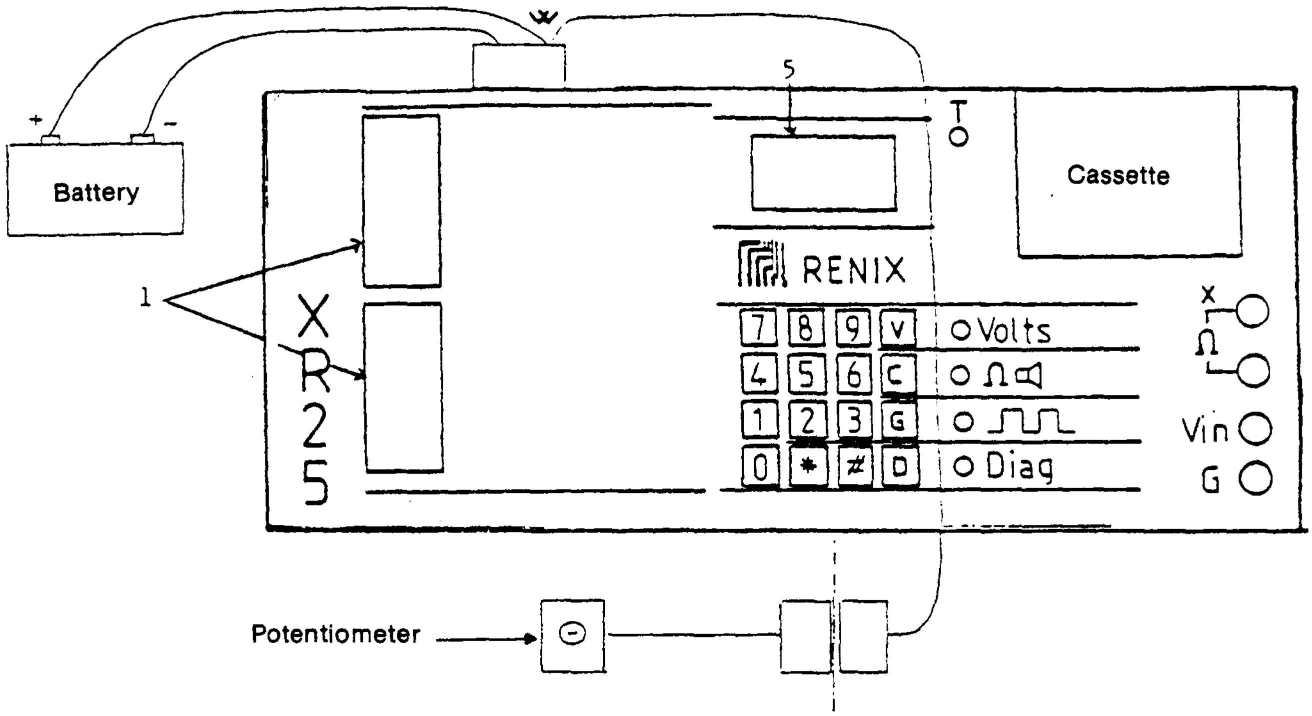


Display characteristics in voltage mode

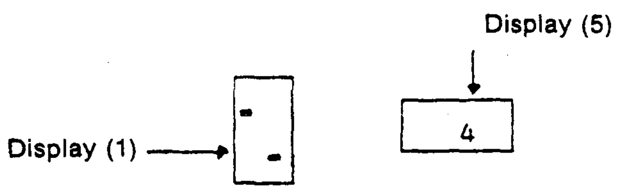
- Scale : 0 to 25 Volts continuous
- Precision : ± 4%
- Protection : 400 Volts max.

POTENTIOMETER (LOAD SENSOR)

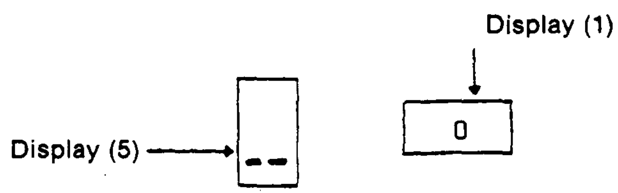
- Connect cable "W"
- Depress key V, then key 1



- **Fully depress** accelerator pedal
- Display (5) must indicate between 0 and 3
  0 indicates the optimum adjustment.
- The bar display must also be aligned.



Potentiometer needs adjusting



Potentiometer adjusted

If the potentiometer is not within the range specified, it must be adjusted.

POTENTIOMETER (LOAD SENSOR) ADJUSTMENT

To adjust the potentiometer, locate the two holes in the throttle control assembly. Potentiometer adjustment can be made only in the W.O.T. (wide open throttle) position. Using a 3 mm hex wrench, loosen the securing screws and rotate the potentiometer. To maintain a proper setting, it is necessary to apply screw tension evenly (tighten both screws equally). Failure to tighten evenly will result in improper adjustment after tightening.

If correct potentiometer adjustment is not possible, the potentiometer is defective and must be replaced, then adjusted.

CAUTION
Be sure that the floor mat does not interfere with full travel of the accelerator pedal.

FAULT INDICATION DIAGNOSIS
The Renix control unit is designed to send a coded signal. The Renix control unit is located on the left side of the firewall and is equipped with a diagnostic lead (lower right corner). The diagnostic lead extends approximately 6" and connects to the transmission warning light in the top right corner of the instrument panel.

When an electrical fault is indicated by the warning light, the XR25 should be connected to the system.

IMPORTANT
There are 2 (two) variations of Renix control operation. This text will distinguish the variations as "Type 1" and "Type 2".

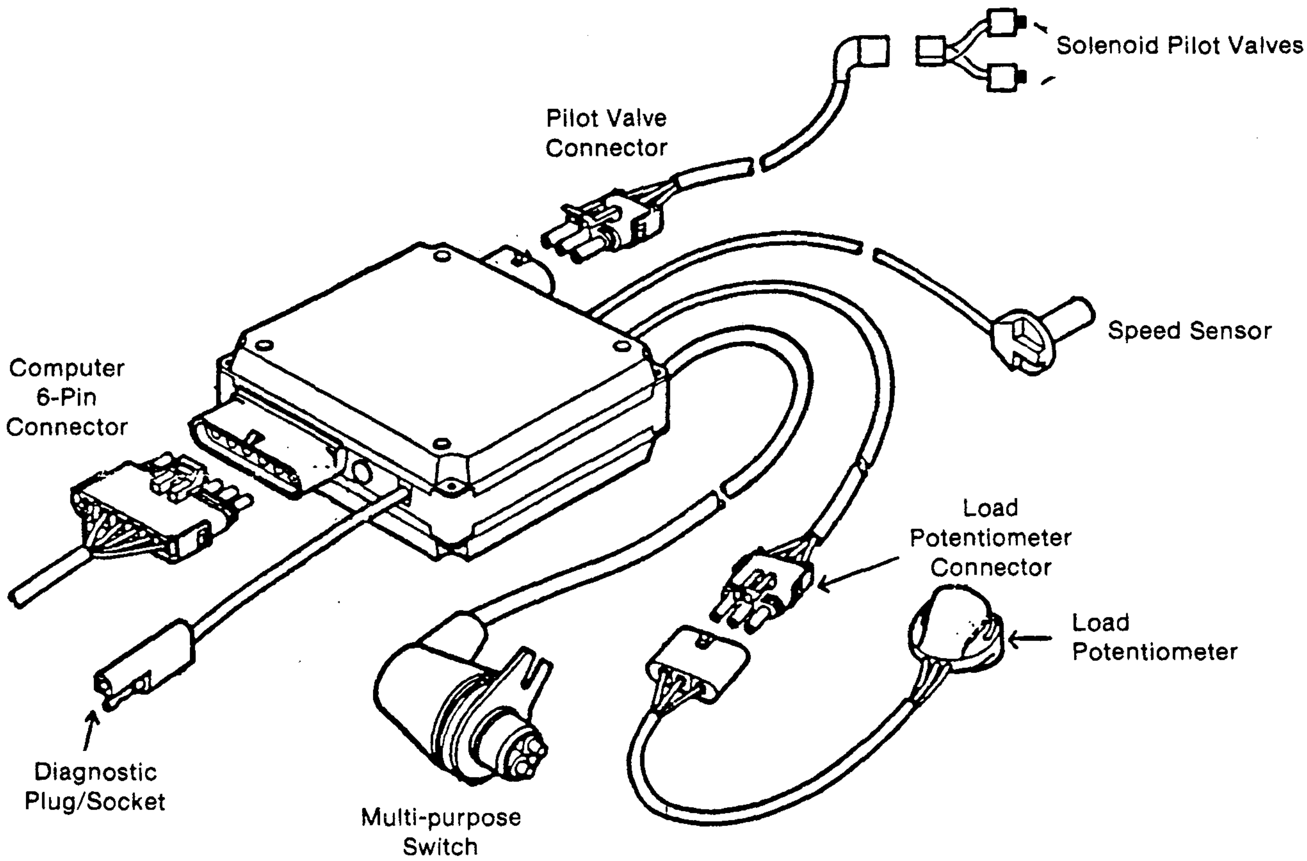
On "Type 1" the Renix control requires an input signal from the road speed sensor before the warning light is extinguished. This means that the vehicle must be moving at approximately 2 m.p.h. before the light will go off. If the light remains on, there is an electrical problem.

"Type 2" is designed so that the warning light comes on when the ignition is switched on and goes out, when the engine starts and other test lights are extinguished. If the light stays on, an electrical problem is indicated.

- On "Type 1" and "Type 2" this diagnosis monitors:
  - the solenoid valves and circuits
  - the road speed sensor and circuit
- On **"Type 2" only** this diagnosis also monitors:
  - continuity through the potentiometer circuit

When an electrical fault is indicated by the warning light, the XR25 should be connected to the system. The engine must be running, the vehicle in park and the park brake engaged. The fault code will be retained in the memory of the Renix control **as long as the ignition is not switched off.**

DIAGNOSTIC
XR25

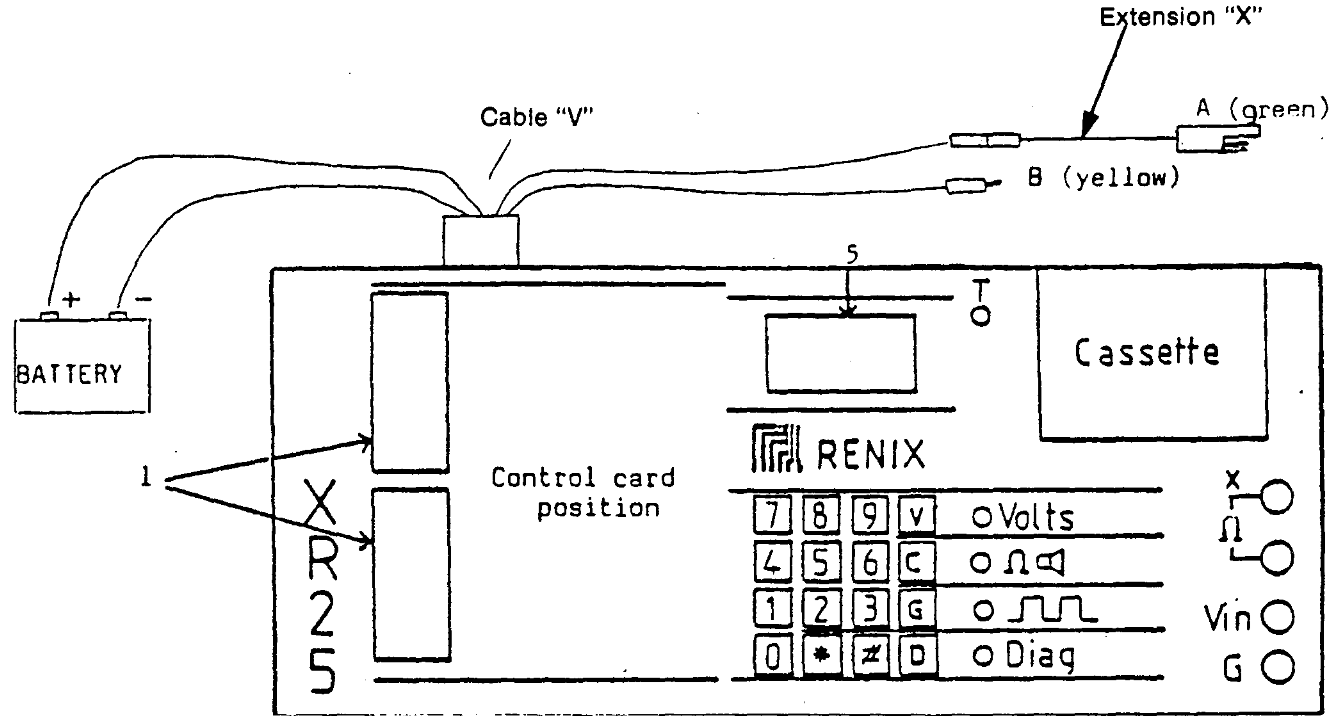


Connecting the XR25 for Fault Indication Diagnosis

- Connect cable "V"
- Observe internal checks
- Depress key "D"
- Depress key "O"
- Depress key "1"
- Position the magnetic display card (supplied with the XR25) next to the display windows on the left side of the face of the XR25.

DIAGNOSTIC
XR25

- Connect adaptor "X" to the green lead on cable "V"
- Connect the yellow lead on cable "V" to the instrument warning light connector.



Test 1 - Cable "V" - Reading the display
This test is performed after a road test, **before the ignition is switched off.** The bar display in the top window of the XR25 is divided into four sections. The top bar indicates that the XR25 is properly connected.

If a bar does no appear in the first section, check all connections for good contact. If a bar appears in one of the other three sections, a fault is indicated. On "Type 1" and "Type 2", this test monitors solenoid valve and road speed sensor circuits. On **"Type 2" only,** continuity through the potentiometer circuit is also checked.

N° code		
	0 □□	**If bargraph extinguished** Check feed to control (12V) Chassis ground Diagnostic plug/socket connection
	1 □■	Check solenoid ball valve wiring Change solenoid ball valves EL1 - EL2
	2 □■	After road test, if it remains illuminated without ignition being switched off, change road speed sensor
	3 □■	Check continuity Check adjustment

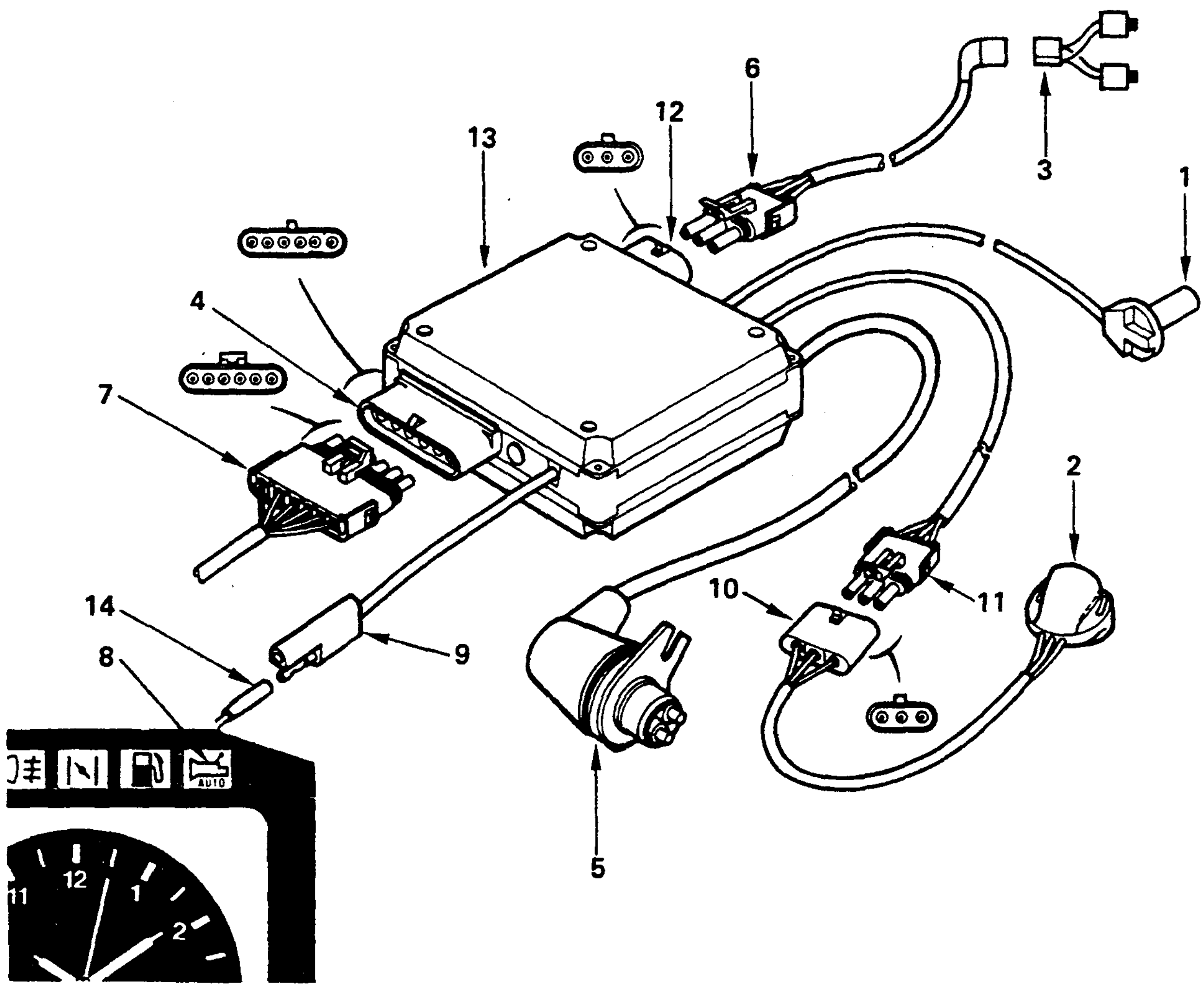
Test 2 - Cable "V" - Reading the display
This test appears in the lower window of the XR25. For this, the engine should be stopped and the ignition switched on. This checks the multi-purpose switch and the kickdown circuit. With the shift selector in the first gear hold position, the bars in section 4 and 5 of the display should appear. Move the selector to the second gear hold position and only 4 should appear. When the selector lever is moved to drive, neutral, reverse or park, no bars should appear.

Check the kickdown switch by pressing the accelerator pedal to the floor. A bar must appear in section 6; if not, the switch is defective and must be replaced. Be certain the floor mat does not interfere with accelerator travel.

		1st	2nd	P.R.N.D.	
Move selector lever	4 □□ 5 □□	4 □■ Correct 5 □■	4 □■ Correct 5 □□	4 □□ Correct 5 □□	**IF INCORRECT: Check selector adjustment, wiring, multi-function switch**
	6 □□	6 □■	Completely depress accelerator pedal.		

DIAGNOSTIC
INTERPRETING THE AUTOMATIC TRANSMISSION WARNING LIGHT

The computer (13) incorporates a system for self-testing the electrical components. A defect warning light (8) on the instrument panel lights up to indicate that this system is operational. Warning light (8) should come on when the vehicle's ignition is switched on and go out either when the vehicle is moving at more than 1.9 mph (3 km/h) or after three seconds have elapsed (depending on version).



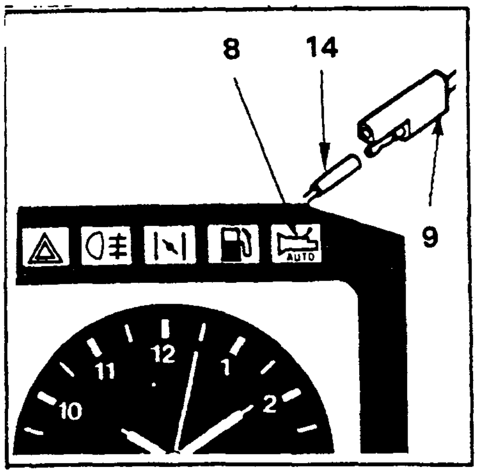
1	- Speed sensor
2	- Load potentiometer
3	- Solenoid pilot valves
4 and 7	- 6-way socket/plug
5	- Multi-purpose switch
6 and 12	- Pilot valve sealed connector
	- socket
8	- Incident warning light
9 and 14	- Diagnostic plug/socket
10 and 11	- Load potentiometer plug and socket
13	- Computer

DIAGNOSTIC
CHECKING CONNECTIONS

- Checking the Instrument Panel Warning Light

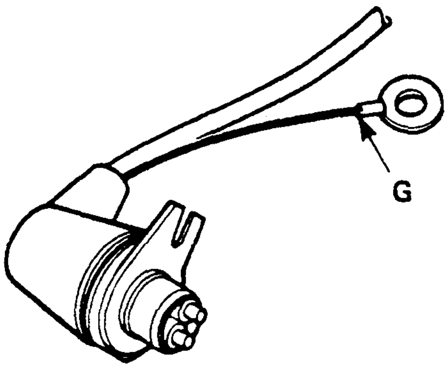
Disconnect connector 9.

Action to be taken on the vehicle	Points for taking readings	Diagnosis
Switch the ignition on	Ground connector (14) at the wiring harness end. The warning light (8) on the instrument panel should turn on	Check the supply fuse, the warning light bulb and the wiring



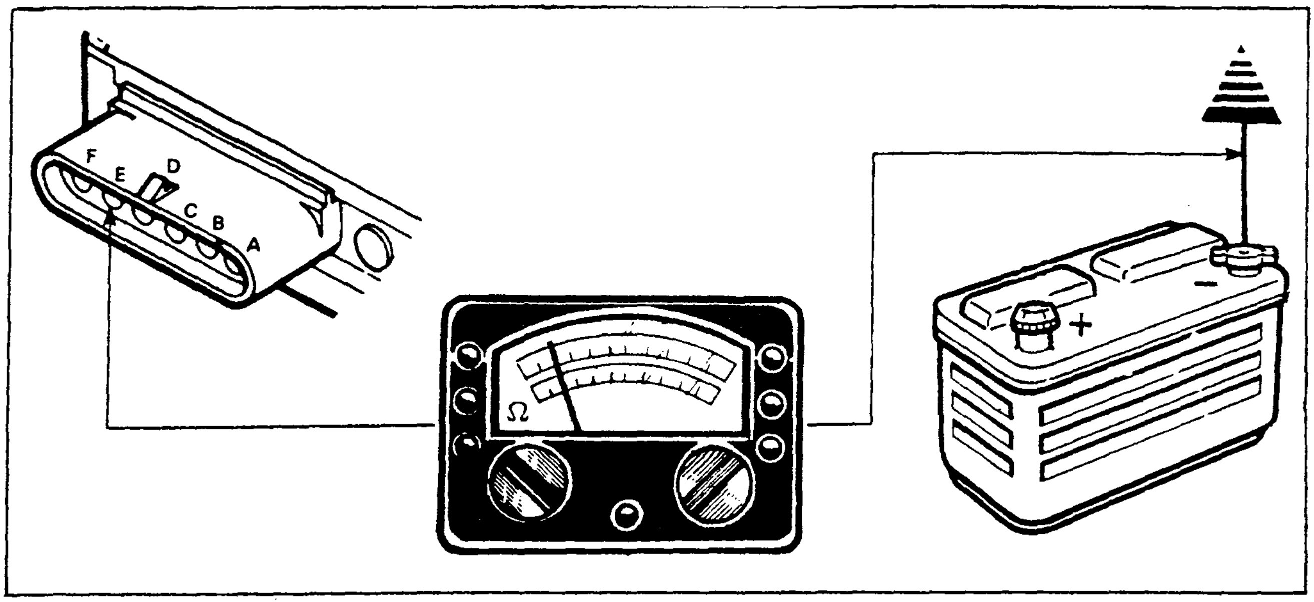
FAULT: COMPUTER INCORRECTLY GROUND

Step 1
The computer is grounded at the multi-purpose switch via lead G secured to the automatic transmission.



DIAGNOSTIC
CHECKING CONNECTIONS

Step 2
Disconnect the 6-way connector at the computer and make the following measurement using an ohmmeter.



Measuring points	Result	Diagnosis
Between the battery - (- on terminal) and point E on computer connector	0 - 0.5	GOOD
	OTHER	INCORRECT See 1 - 2 - 0

1. Check connection and condition of terminal (G) ground lead on automatic transmission housing.

2. Check continuity of ground lead (using ohmmeter) placed between terminal (G) and point (E) on connector on computer. Correct result should be between 0 and 0.5. If incorrect, change the multi-purpose switch or computer depending on where the lead is damaged.

DIAGNOSTIC
CHECKING THE SIXWAY CONNECTOR AT THE COMPUTER

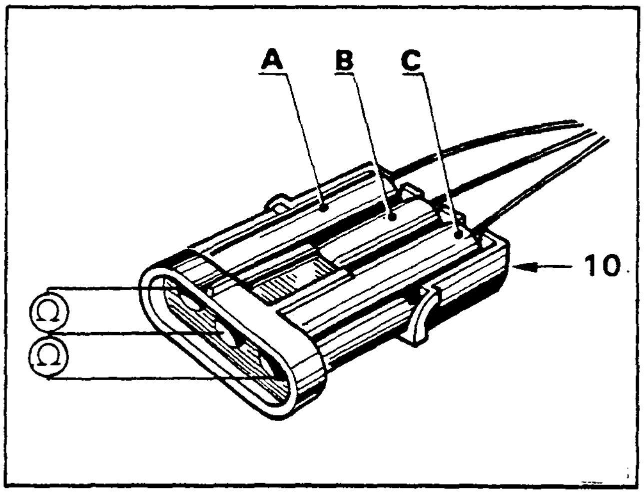
CHECKING WITH AN OHMETER - VOLTMETER			
Measuring Conditions	**Component checked**	**Measuring point and values**	**Operations to be performed if values incorrect**
Ignition on	Computer feed	F and Ground : 12 ± 2 V	Check fuse and harness
	Backup light feed	B and Ground 12 ± 2 V	Check feed (fuse, harness)
Starter activated	Starter activation feed	C and Ground	Check starter relay and harness
Ignition off	Computer ground		
	To backup light bulb	A and ground : $4 \pm 3\ \Omega$	Check backup lights (bulb, harness)
Depress accelerator pedal completely	Kick-down switch	D and Ground: 0 to 0.5 Ω	Check the kick-down switch. Check adjustment and operation directly on the accelerator cable inlet.
Foot off accelerator pedal		D and Ground $\infty\ \Omega$	Check harness

DIAGNOSTIC
CHECKING THE LOAD POTENTIOMETER (Using an ohmmeter)

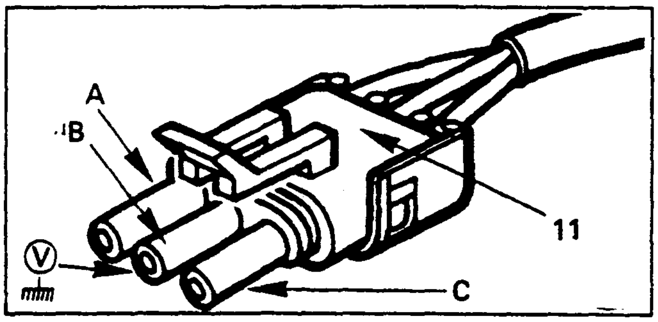
Disconnect connector (10) from (11) and check the following using an ohmmeter:

Disconnect connector (10) from (11) and check the following using an ohmmeter:

Measuring points	Correct Value	Diagnosis
C - B A - B	4 kΩ ± 1 2,5 kΩ ± 1	If the measurements are different, the potentiometer is faulty or badly adjusted. (See adjustment procedure J2-21)
A - B	Open throttle slowly; the ohmmeter should **never** indicate infinite resistance	

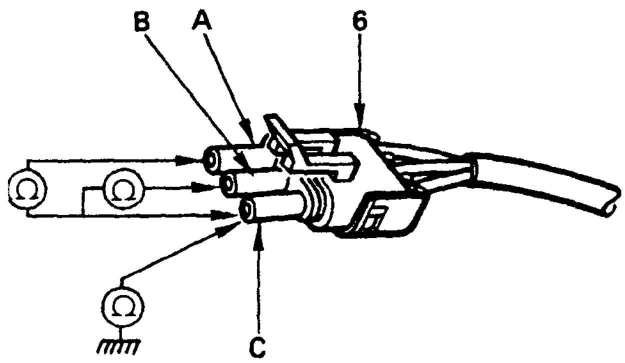


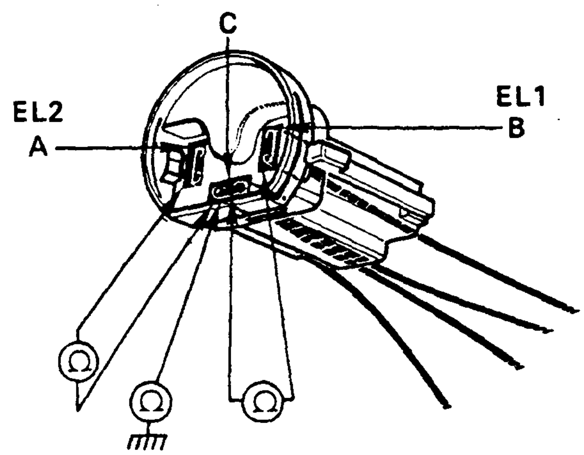
CHECKING 3-WAY CONNECTOR (11) FEEDING THE POTENTIOMETER (using a voltmeter)



A = Potentiometer data
B = Potentiometer feed
C = Ground

DIAGNOSTIC
SEALED CONNECTOR AND SOLENOID PILOT VALVES
CHECKING THE SOLENOID PILOT VALVE SEALED CONNECTOR AND SOLENOID PILOT VALVES ONLY





Measuring Point	Result	Diagnosis	
Between B and C	30 Ω ± 10 Ω	If 0 Ω	change harness or solenoid pilot valves
		60 Ω ± 20 Ω	poor connection
Between A and C	30 Ω ± 10 Ω	∞ Ω	change harness or solenoid pilot valves
Between C and Ground	∞ Ω	If different from ∞ Ω	short circuit between ground and solenoid pilot valve coil (change harness or solenoid pilot valves)

Solenoid valve balls sticking (Reference Subsection "Components" Hydraulic Control Unit, J3-8.)

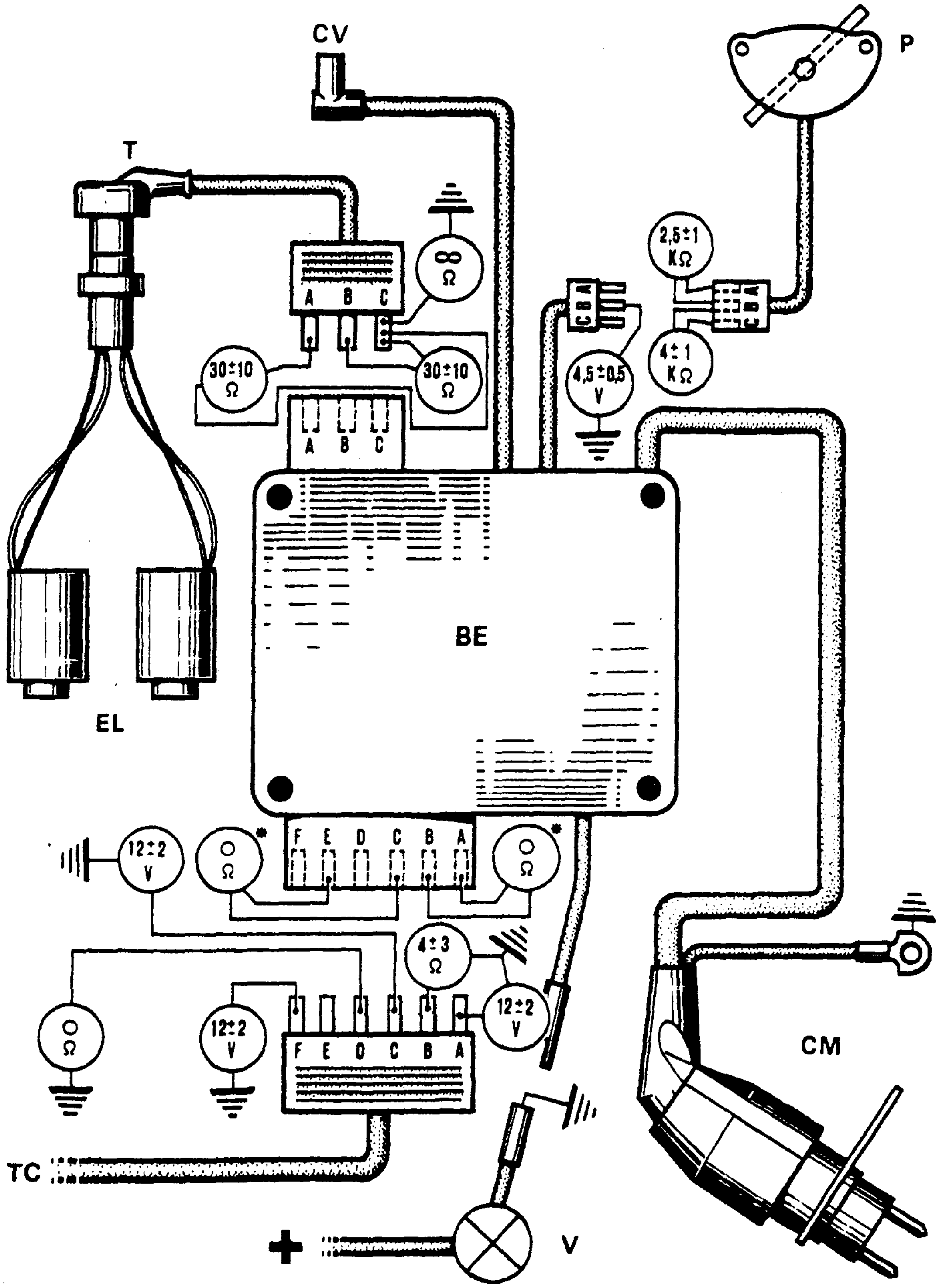
Transmission operating in 2nd speed only, in "D" EL1 remains closed.

No 2nd speed in "D" operating 1 ↗ 3 EL1 remains open.
No 3rd speed in "D" operating 1 ↗ 2 ↘ 1 EL2 remains closed.

No 1st speed in "D" operating 3 ↘ 2 ↗ 3 EL2 remains open.

Operating 2 ↘ 1 ↗ 3 solenoid valves in wrong positions.

DIAGNOSTIC
CHECKING THE CONNECTORS FOR REFERENCE



* Depending on shift lever position	

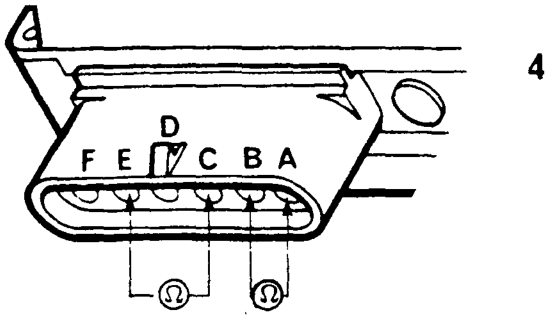
P - Potentiometer CM - Multipurpose switch EL - Solenoid pilot valves	TC - Connection to vehicle harness CV - Speed sensor BE - Computer T - Sealed bulkhead connector

DIAGNOSTIC

PARTIALLY CHECKING THE MULTIPURPOSE SWITCH (5)

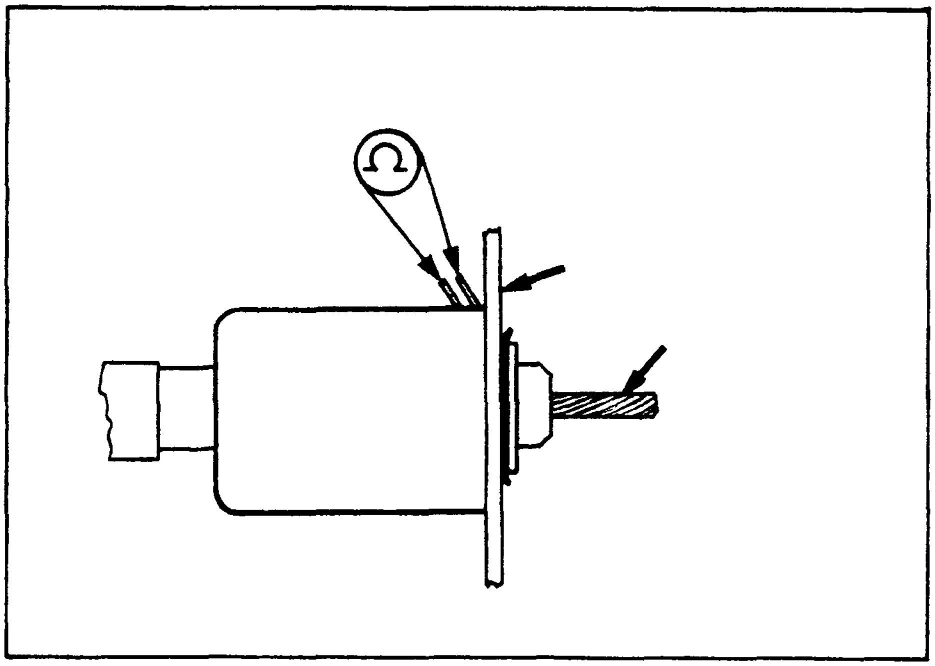
- Disconnect the six pin connector (7) and carry out the check on the base (4) of the computer housing.

Points for taking readings	Diagnosis
A - B = 0 Ω (selector in R)	Replace the multipurpose switch.
E - C = 0 Ω (selector in P or N)	



CHECKING THE ACCELERATOR CABLE KICK-DOWN SWITCH.

The kickdown switch is located on the accelerator cable on the engine side of the firewall connector.

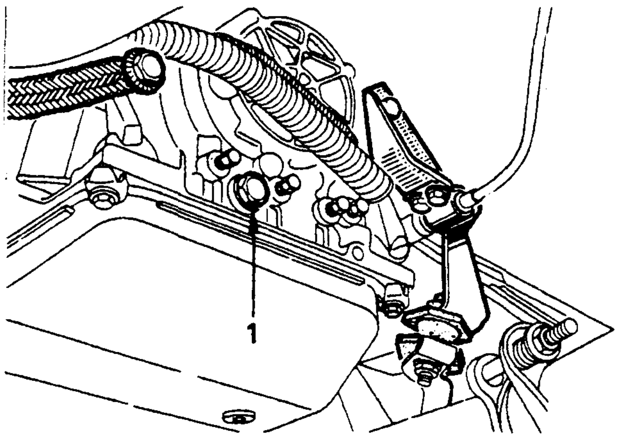


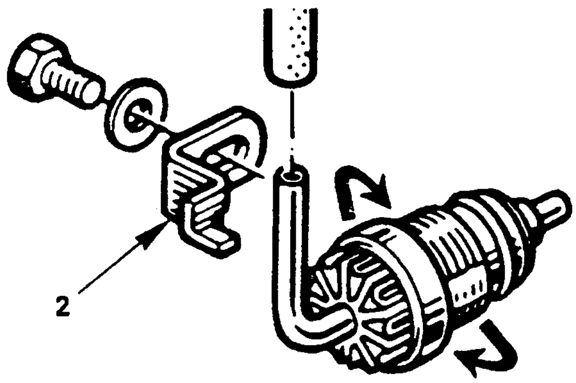
- Disconnect the leads from the kickdown switch and connect an ohmmeter.
- Depress the accelerator pedal **completely.** The resistance should be approximately O ohms. If not, adjust the cable at the stop clip on top of the valve cover.
- Retest and check to make sure cable returns properly to the idling stop.

DIAGNOSTIC
TRANSMISSION FLUID PRESSURE

The quality of gear changing and the useful life of the clutch/brake section of the automatic transmission depend on correct fluid pressure adjustment.

Special Tool B.Vi. 466-07 must be used for this function.





CHECKING

- The fluid pressure must be checked with the transmission hot (80°C) during a road test only (the fluid pressure varies with the temperature).
- Check the fluid level in the automatic transmission. (See page F1-5 and F1-6)
- Make sure that the engine is correctly adjusted.
- Connect pressure gauge B.Vi. 466-07 (before using the apparatus, set the pressure gauge to zero).
- Drive a few miles to allow the oil to reach approximately 80°C.
- Move the selector level to 2nd gear "Hold".
- Depress the accelerator pedal completely and brake at the same time to stabilize speed at 50 mph (80 km/h) and read off the value on the pressure gauge.
- The correct value should be 4.6 bars.

ADJUSTING

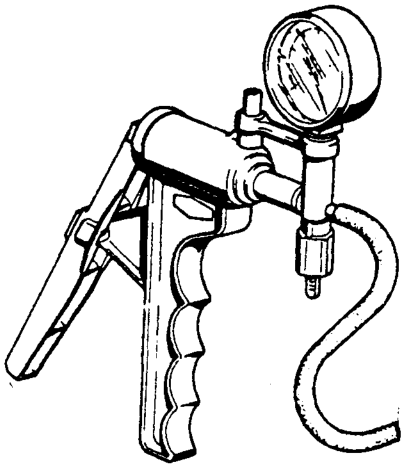
- Remove lock plate (2) and turn the capsule. The pressure is increased by turning the capsule clockwise.

NOTE:

2 notches = approximately 0.1 bars.

DIAGNOSTIC
VACUUM CAPSULE

The vacuum capsule varies the fluid pressure to suit the engine load.



CHECKING THE VACUUM CAPSULE

- Engine stopped
- Check the routing of the vacuum hose.
- Connect a manual vacuum pump to the vacuum hose disconnected from the intake manifold.
- If the reading is incorrect, perform the test again directly on the capsule. If the result is good, change the hose, if it is not, change the capsule.
- Also make sure that the connection on the intake manifold is in good condition.

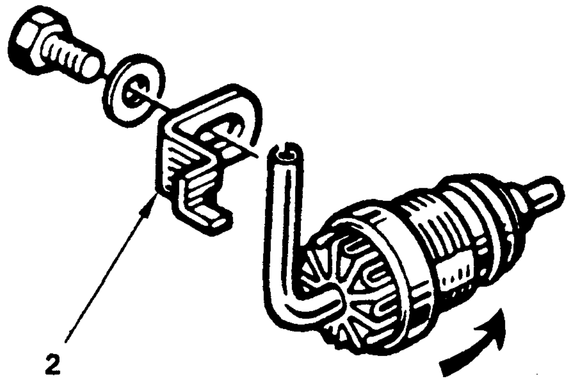
Vacuum to be applied	NEEDLE	
	STABLE	DROPS
525 mbar or 400 mmHg (16 in. Hg)	GOOD	INCORRECT

REMOVAL

- Disconnect the hose, remove stop plate (2) and unscrew the capsule.

REFITTING

- Oil the capsule (black rubber)
- Screw the capsule in 2 1/2 to 3 turns and attach lock plate (2).
- TOP UP THE FLUID AND ADJUST THE FLUID PRESSURE (See "FLUID PRESSURE" on previous page).



COMPONENTS
TRANSMISSION FLUID FILTER

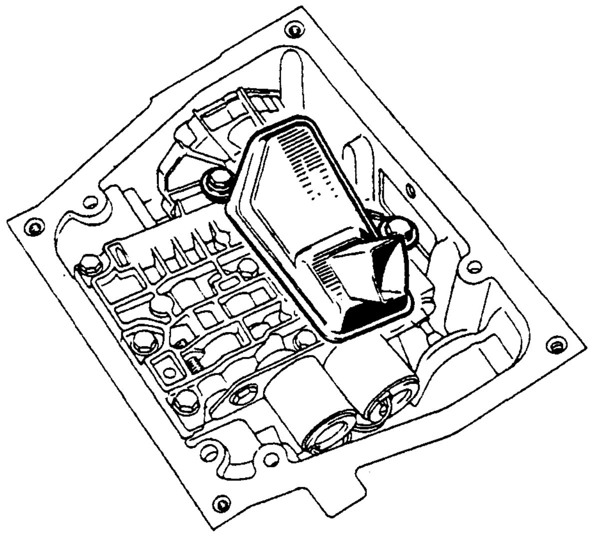
The screen filters the fluid and ensures that the automatic transmission is operating correctly.

TIGHTENING TORQUES (In daNm)

Distributor .... 0.9 daNm
(Filter mounting bolts) (6.5 lb./ft.)

Pan bolts .... 0.6 daNm
(4.5 lb./ft.)

The filter screen must be cleaned or replaced at regular intervals and whenever major work is performed on the gear section.



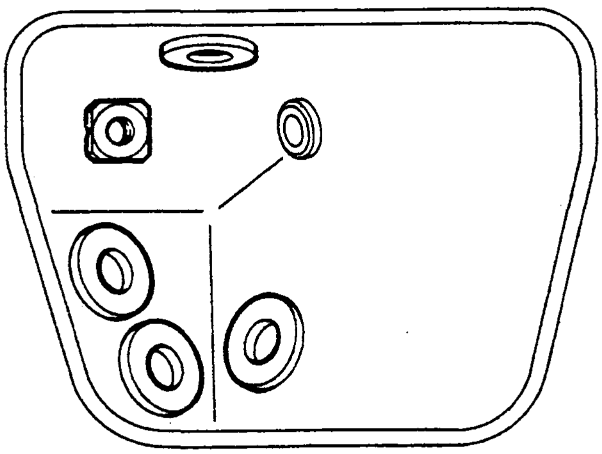
Transmission Filter Location

REMOVAL

Drain the fluid and remove:

- the pan
- the filter screens and its seal. Before refitting, clean the pan and its magnets and replace them as shown.

Magnet Placement



Attach magnets with ribbed side against pan.

REINSTALLATION

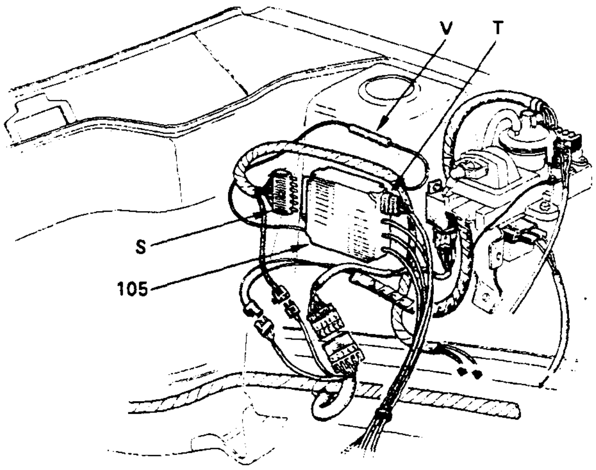
Mount the fluid filter as shown in the illustration at right. Torque tighten mounting bolts to 0.9 daNm (6.5 lb./ft.)

Mount the pan and refill with fluid.

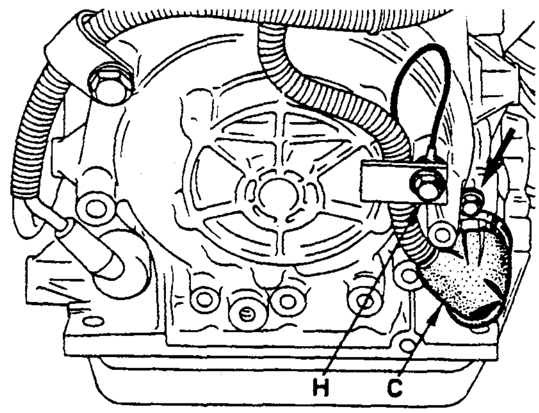
CAUTION
Failure to place magnets as shown may result in interference with the filter screen assembly, causing an air leak at the filter base mount.

COMPONENTS
COMPUTER - REMOVE AND REPLACE

The computer controls the ground connection to the solenoid valve body along with input from the speed sensor, RPM sensor and potentiometer. It ensures that all the electrical connections of the automatic transmission are operating properly.



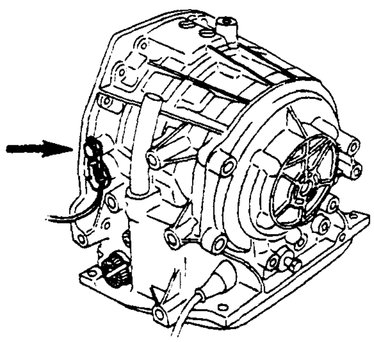
Before removing the computer (105) with its speed sensor and multi-purpose switch, mark the harness routing accurately and disconnect the battery.



REMOVAL

Remove the following from the automatic transmission:

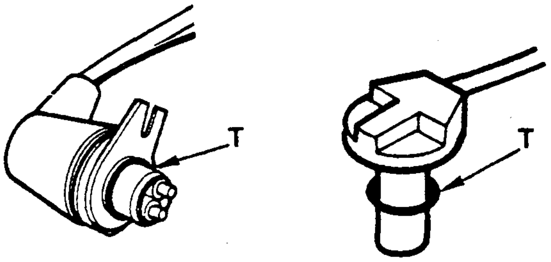
- the multi-purpose switch (C) and its ground lead (H).
- the speed sensor and its seal. Disconnect connectors (S), (T), (V) and the load potentiometer connector.
- Remove the computer.

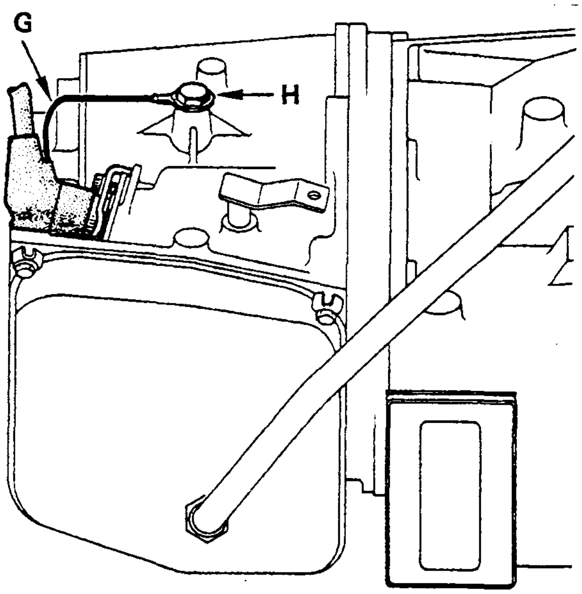


COMPONENTS
COMPUTER - REMOVE AND REPLACE

REINSTALLATION

Check that O-ring seals (T) are present on the speed sensor and multi-purpose switch.





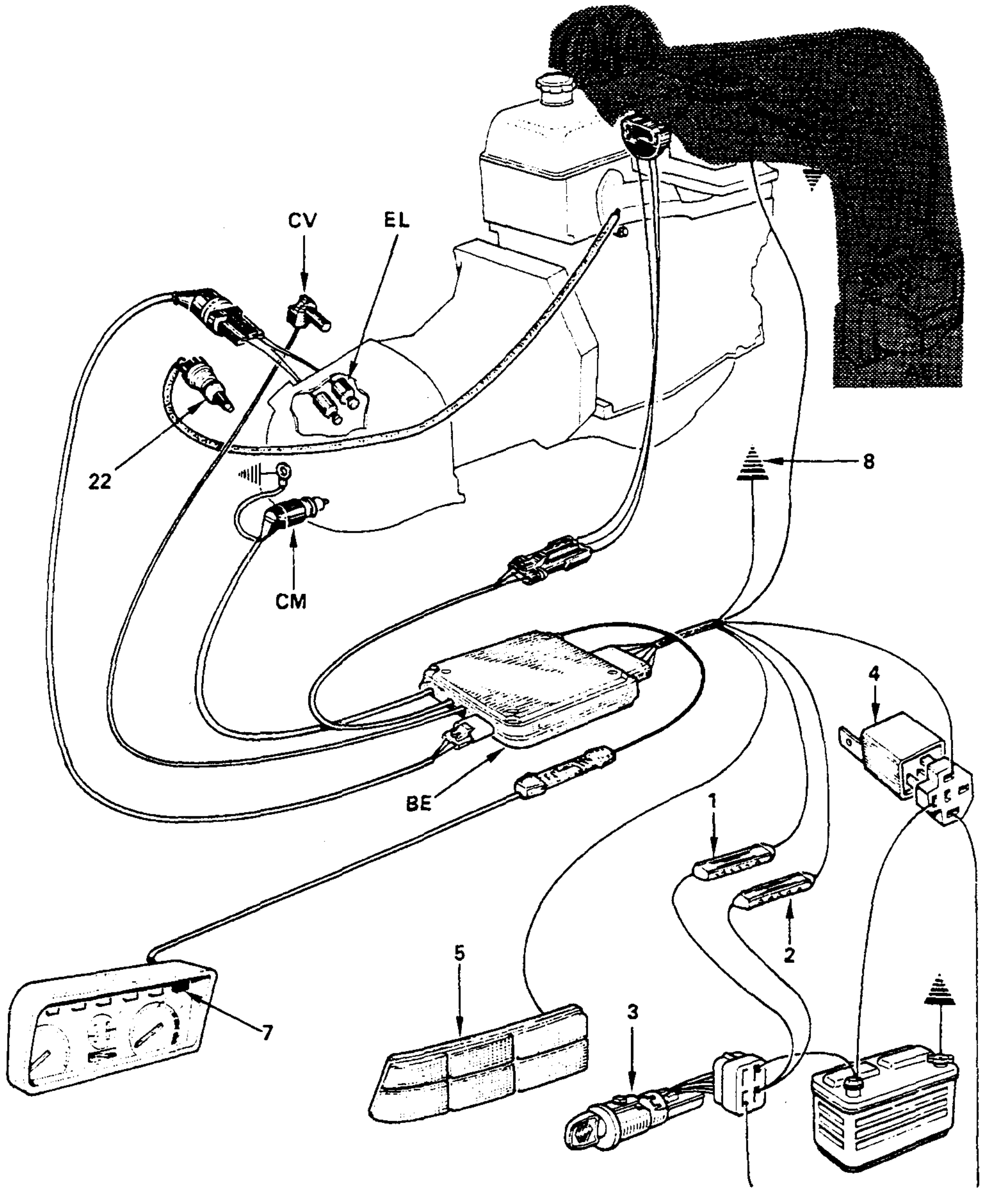
Refit:
- the speed sensor
- the multi-purpose switch and ground lead (G) at (H), to the automatic transmission.

Replace the harnesses in their ribbed sleeving.

Reconnect connectors (S), (T) and (V).

Secure the computer on its support using a strap.

COMPONENTS
COMPUTER - REMOVE AND REPLACE

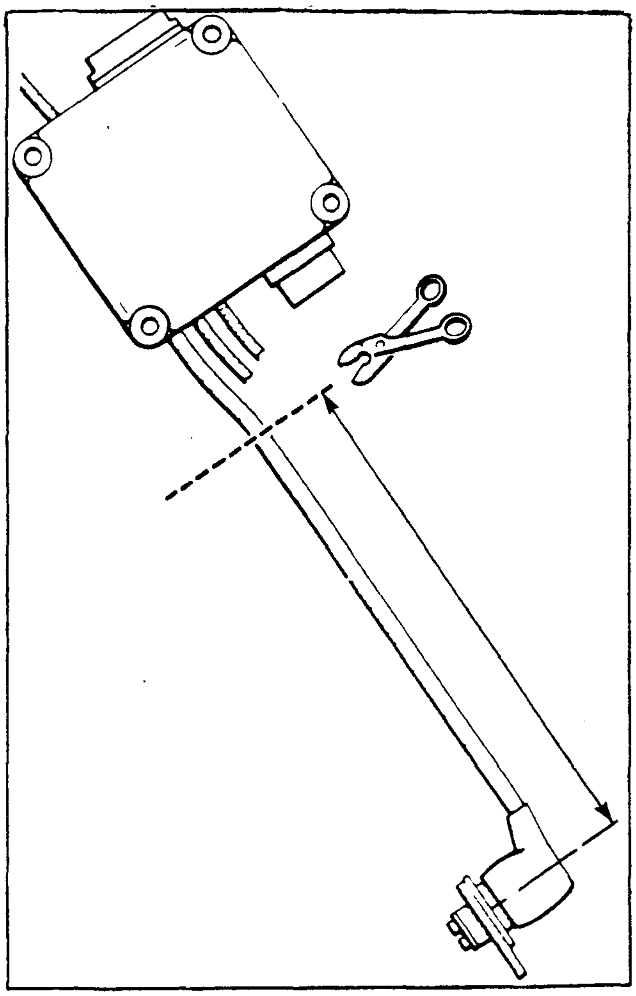


CHECK:

- That the harnesses of the kickdown switch, load potentiometer and computer feed are at least 15 cm (6") away from the ignition high tension lead (area shaded gray). Otherwise there is a risk of interference which could cause the warning light to come on intermittently and the automatic transmission to function irregularly.
- That the high tension harness leads are in perfect condition.

COMPONENTS
MULTI-PURPOSE SWITCH - REPLACEMENT

This operation consists of cutting the wire connecting the electronic module to the multi-purpose switch and replacing the switch with a new one.



Before cutting the wire, check the multi-purpose switch.

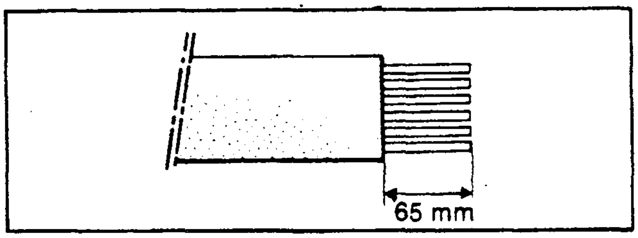
Contents of replacement kit.

- 1 multi-purpose switch together with a ground lead male connector and cable,
- 1 female connector,
- 6 male pins
- 6 seals.

PROCEDURE
Remove the multi-purpose switch from the automatic transmission and cut off the wiring to the same length as the wiring on the replacement part.

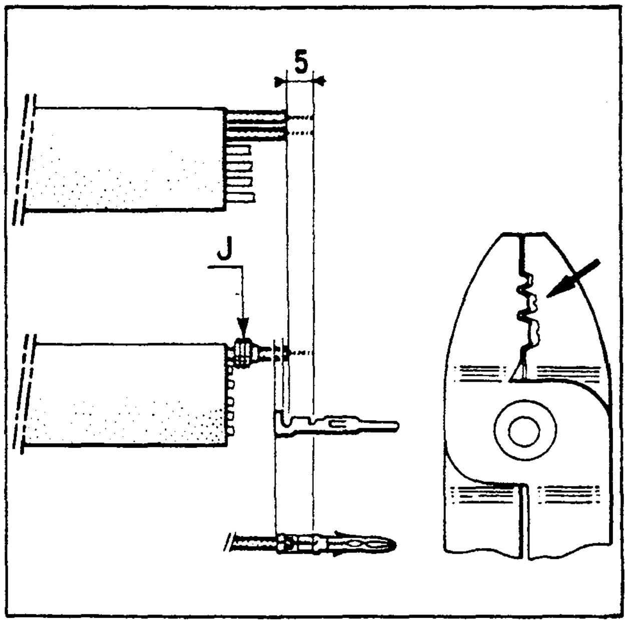
At the electronic module end:

- remove the protective sleeve back 65 mm (2.5 in)



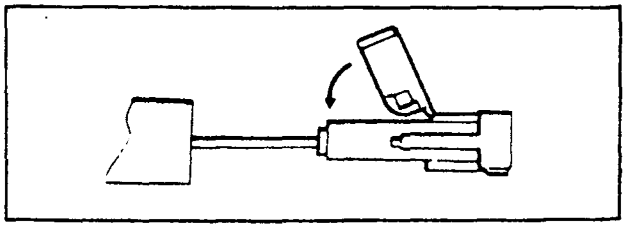
COMPONENTS
MULTI-PURPOSE SWITCH - REPLACEMENT

- Strip the wires back 5 mm (.20 in)
- Place a seal (J) on each wire,
- crimp the end terminals in place.

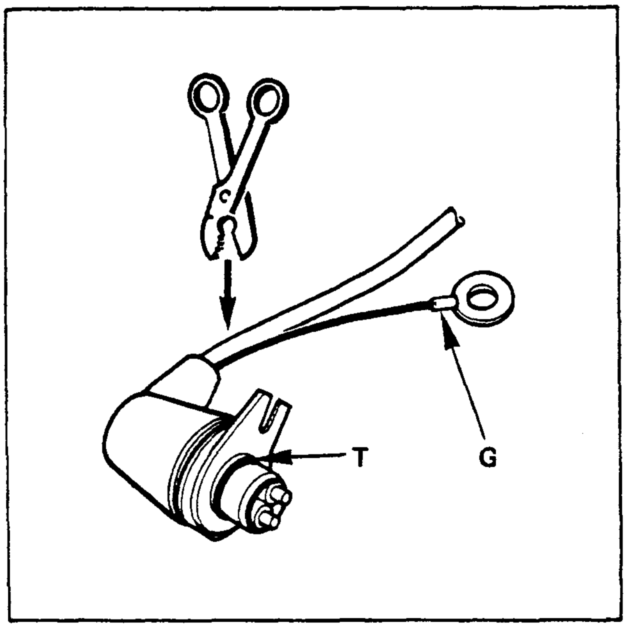


When fitting the wires into the connector, ensure that the color codes are correctly aligned.

Fold down the locking tab on the connector.



There are computers in service which are connected to the multi-purpose switch via seven wires. In this case, the white wire sheath is to be cut off flush with the cable at the computer end.

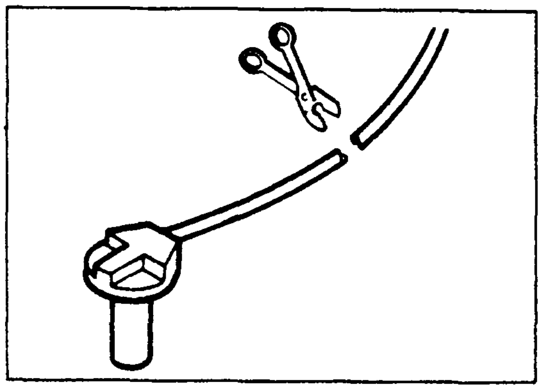


Check that O-ring (T) is in place and attach the multi-purpose switch to the automatic transmission.

IMPORTANT
REMEMBER TO RECONNECT THE GROUND LEAD TO THE AUTOMATIC TRANSMISSION CASE.

COMPONENTS
SPEED SENSOR - REPLACEMENT

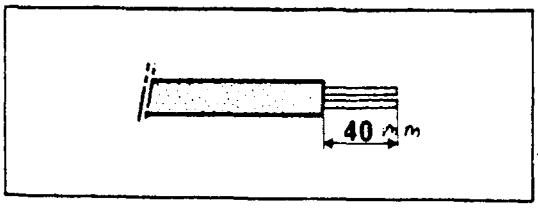
This operation consists of cutting off the wire connecting the electronic module to the speed sensor and replacing the sensor with a new one.



Check the speed sensor before cutting the wire.

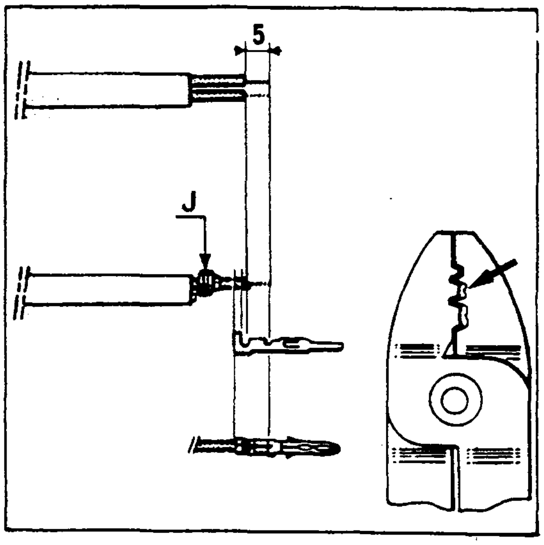
Contents of replacement sensor kit:
- 1 speed sensor equipped with a wire and a male connector,
- 1 female connector,
- 2 male pins,
- 2 seals.

Procedure:
Remove the automatic transmission speed sensor and cut off the cable to the same length as the cable on the replacement unit.



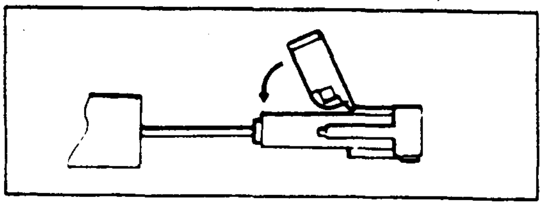
At the electronic module end :

- remove the protective sleeve and the shielding back 40 mm (1.5 in)

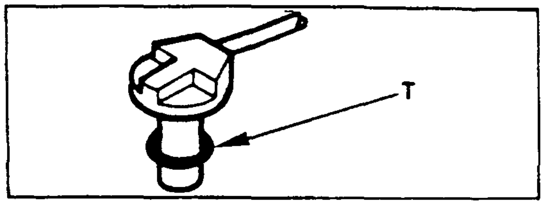


- strip the two wires back 5 mm (.20 in)
- place a seal on each of the wires,
- crimp the terminals in place.

When fitting the wires to the connector, follow the wiring code by placing the same code colors opposite one another.



Fold down the locking tab on the connectors.



Check that O-ring (T) is in place before reassembly.

COMPONENTS
HYDRAULIC CONTROL UNIT (VALVE BODY)

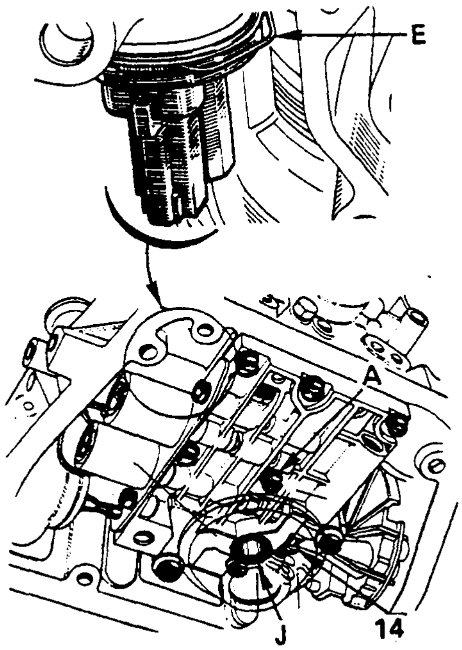
The hydraulic control unit delivers (or discharges) oil to (or from) the clutches and brakes in accordance with the solenoid pilot valve feed.

TIGHTENING TORQUES

Distributor bolts .... 0.9 daNm (6.5 lb./ft.)
Pan bolts.............................. 0.6 daNm (4.5 lb./ft.)
Cover plate bolts................. 1.3 daNm (9.5 lb./ft.)

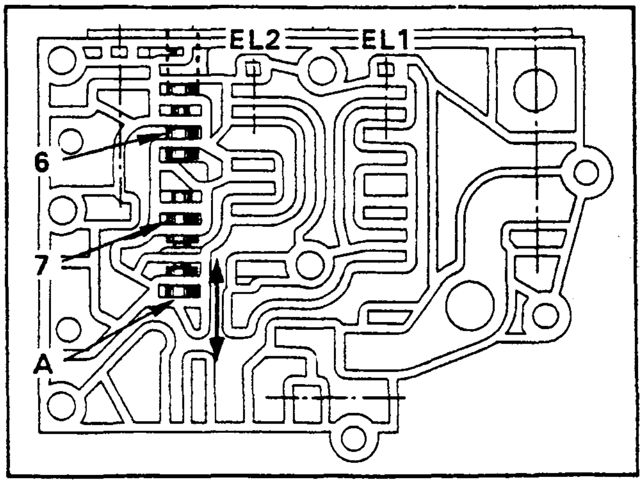
REMOVAL

- Drain the fluid and remove:
  - the pan
  - the filter screen (resuse seal J)
  - all the control unit bolts except for bolt A.
- When removing bolt (A) take care that the following do not fall:
  - manually operated valve (14)
  - the plate and two seals located under the control unit.
- Remove clip (E) from the sealed connector and remove the control unit/solenoid pilot valve assembly.



CHECKING

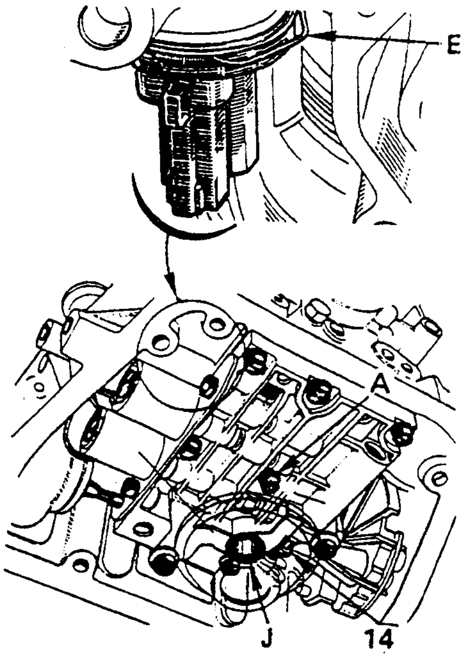
Check that the sequence valves (6) and (7) slide freely at (A) using a small screwdriver and also make sure that the other valves slide freely. TAKE CARE NOT TO DAMAGE THE PARTS.



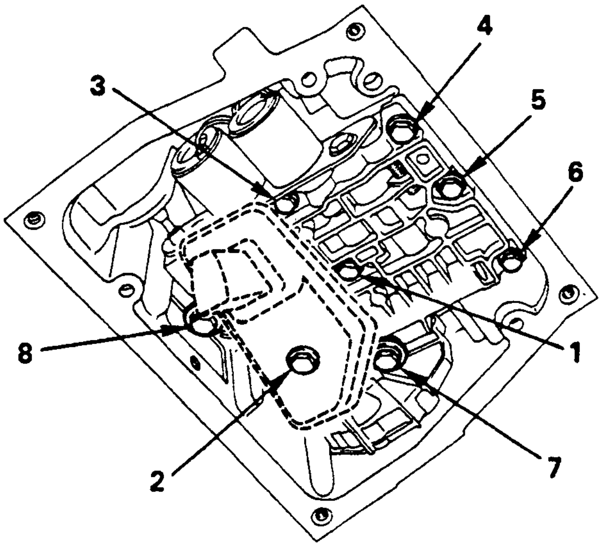
COMPONENTS
HYDRAULIC CONTROL UNIT (VALVE BODY)

REFITTING

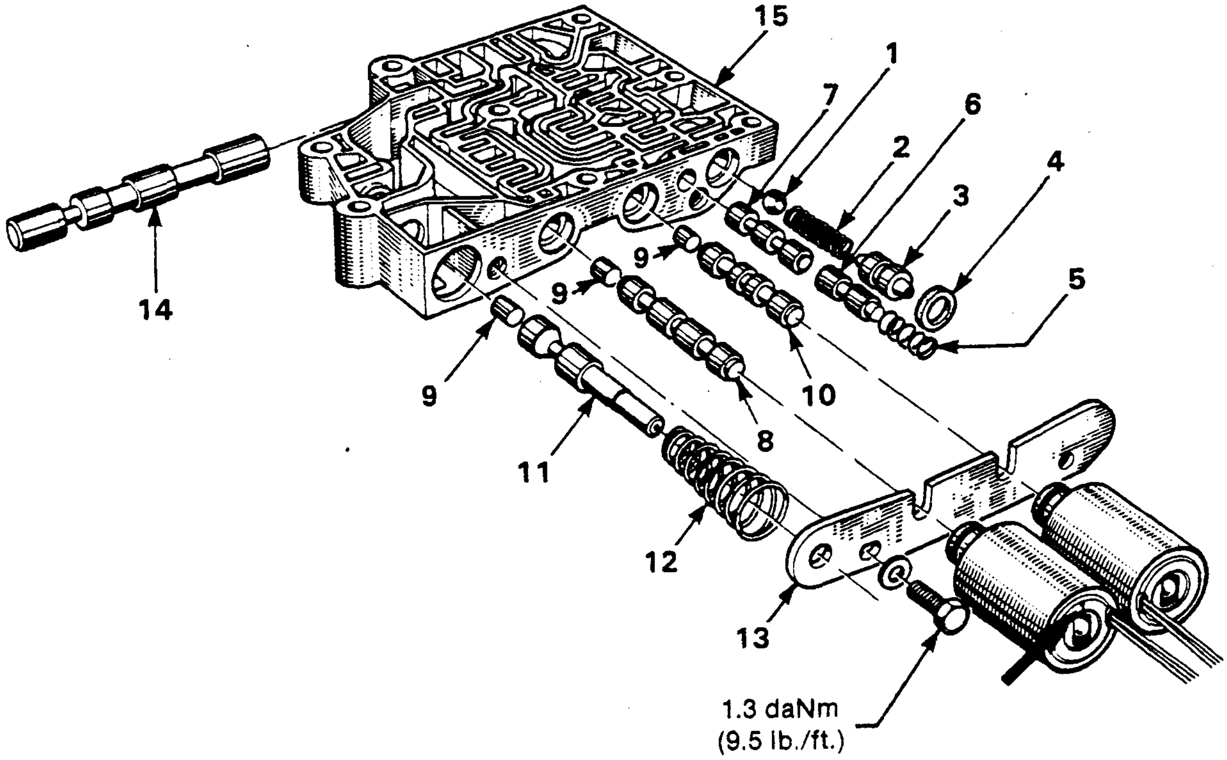
- Attach clip (E) to the sealed connector socket and reconnect socket.
- Fit manually operated valve (14) in the center line of the toothed quadrant.
- Place the vacuum capsule on the pressure regulating valve (11).
- Screw in bolts (2) and (6) on the control unit as far as they will go since they determine the position of the control unit when all the bolts have been tightened.



- Using a torque wrench, tighten the hydraulic control unit bolts to 0.9 daNm (6.5 lb./ft.) in the order shown.
- After tightening bolts (1) to (6), install the new filter screen and seal as shown in the illustration.
- After installing, check that the manually operated valve moves correctly.
- Attach the pan equipped with a new gasket.
- Fill with fluid and adjust the fluid pressure.



COMPONENTS
HYDRAULIC CONTROL UNIT (VALVE BODY)



1 - Pressure limiting valve ball (PLV)
2 - Pressure limiting valve spring (medium size)
3 - Pressure limiting valve (PLV)
4 - Pressure limiting valve seal
5 - Sequence valve (SV) spring (small)
6 - Sequence valve (SV)
7 - Sequence valve (SV)
8 - No. 1 selector valve (SV1)
9 - Plungers
10 - No. 2 selector valve (SV2)
11 - Pressure regulating valve (PRV)
12 - Pressure regulating valve (PRV) spring (large)
13 - Cover plate
14 - Manually operated valve (VM)
15 - Hydraulic unit

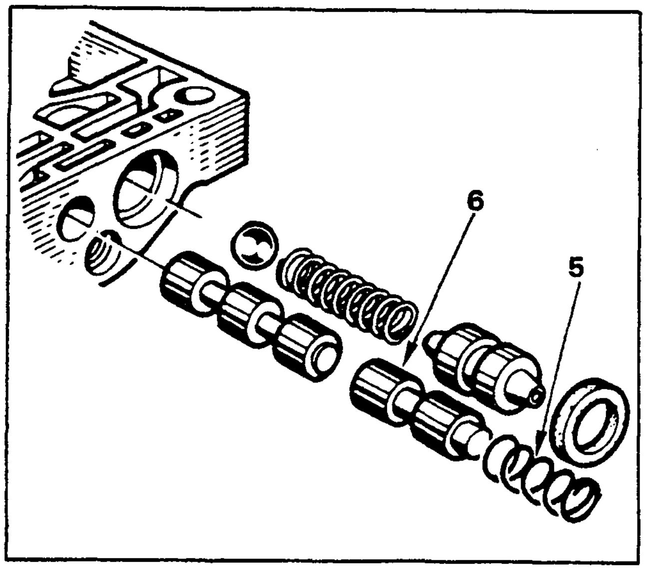
Plungers (9) are identical.

Valves (3, 7, 8, 10) are symmetrical.

Valve (6) is not symmetrical.

COMPONENTS
HYDRAULIC CONTROL UNIT (VALVE BODY) REPAIR

Disassembly must be performed in a clean, dustfree location.

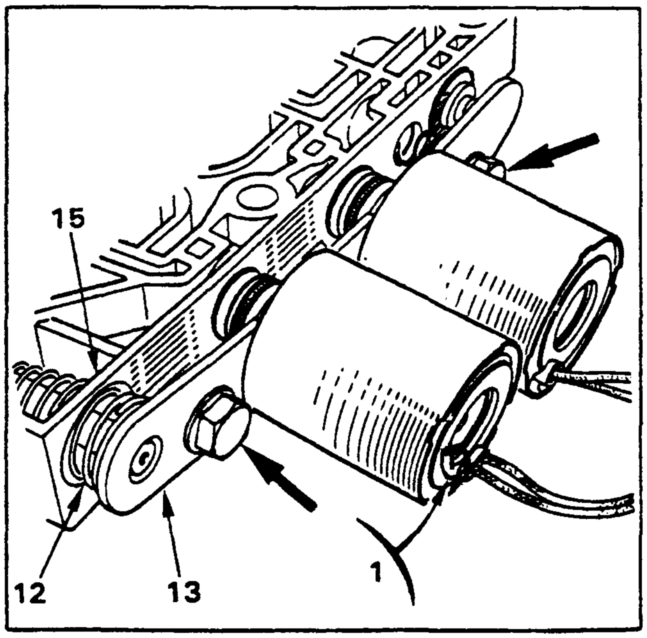


DISASSEMBLY
Remove in succession the 2 bolts securing cover plate (13) TAKING CARE NOT TO LOSE SPRING (12).

Remove the other components, turning over the unit and manual valve (14).

CLEANING
Use:
- clean solvent
- lint-free shop towels for wiping down,
- compressed air, blowing strongly into all ducts.

WARNING
Always wear eye protection when working with compressed air.



CHECKS
If there are any scoring or wear marks on any of the spool valves the entire hydraulic control unit must be changed.

All the spool valves should move freely and should not stick at any point.

Seal (4) and the seals on the solenoid pilot valves must be in perfect condition.

REASSEMBLY
Lubricate all the parts with Mobil® 220 Dexron® II and reassemble them as shown in the exploded view, page F3-10.

CAUTION
The largest spigot on valve (6) must face towards small spring (5).

Secure plate (13) by its 2 bolts and mount solenoid pilot valve with mark 1 at the same end as the pressure regulator valve.

Tighten the cover plate bolts (13) progressively so that the last coil of spring (12) is not jammed between plate (13) and unit (15) and torque tighten to 1.3 daNm (9.5 lb./ft.)

Check that all the valves move freely.

COMPONENTS
SOLENOID PILOT VALVES - REMOVE & REPLACE

Depending on whether or not they are supplied with power, the solenoid pilot valves control the movement of the passage selector valves of the hydraulic control unit which in turn determine the gear changes.

TIGHTENING TORQUES

Control unit mounting bolts	0.9 daNm (6.5 lb./ft.)
Pan mounting bolts	0.6 daNm (4.5 lb./ft.)
Cover plate mounting bolt .... (retains solenoid pilot valves)	1.3 daNm (9.5 lb./ft.)

REMOVAL
The hydraulic control unit must be removed in order to remove the solenoid pilot valves (see HYDRAULIC CONTROL UNIT chapter).

Loosen the two bolts until the solenoid pilot valves can be released.

TAKE CARE NOT TO LOSE SPRING (12).

Before reassembling, check:
- that seal (J) is in perfect condition
- that O-ring seals (T) on the solenoid pilot valves and the sealed connector are in perfect condition
- that the ball-bearings move properly and that the solenoid pilot valves are clean.
-

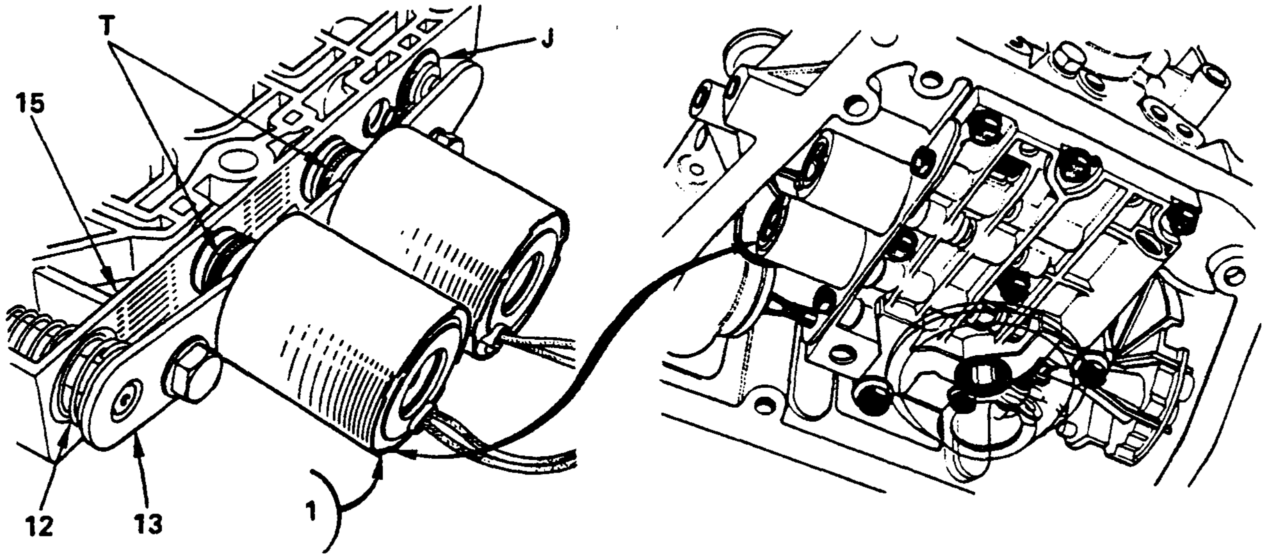
REASSEMBLY
Lubricate the solenoid pilot valves and mount solenoid pilot valve marked (1) at the regulating valve end (see diagram).

Tighten the plate mounting bolts (13) progressively so that the final coil of spring (12) is not jammed between plate (13) and unit (15) and torque tighten to 1.3 daNm. (9.5 lb./ft.)

Insert the clip in the socket of the sealed connector and reconnect it.

Remount the hydraulic control unit (see page F3-10)

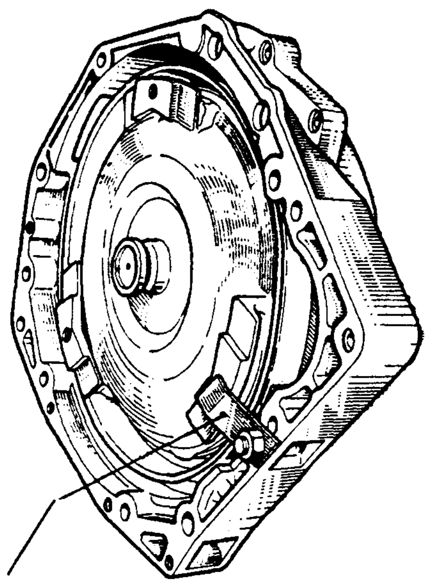
Fill the fluid and adjust the fluid pressure.



ATTENTION: If the solenoid valves are not mounted on the correct sides, 1st gear will not operate.

COMPONENTS
TORQUE CONVERTER

The torque converter ensures a flexible and automatic connection between the engine and the gear section. It multiplies the torque delivered by the engine when the vehicle starts.



Converter Retaining Strap
(Fabricate from Strap Iron)

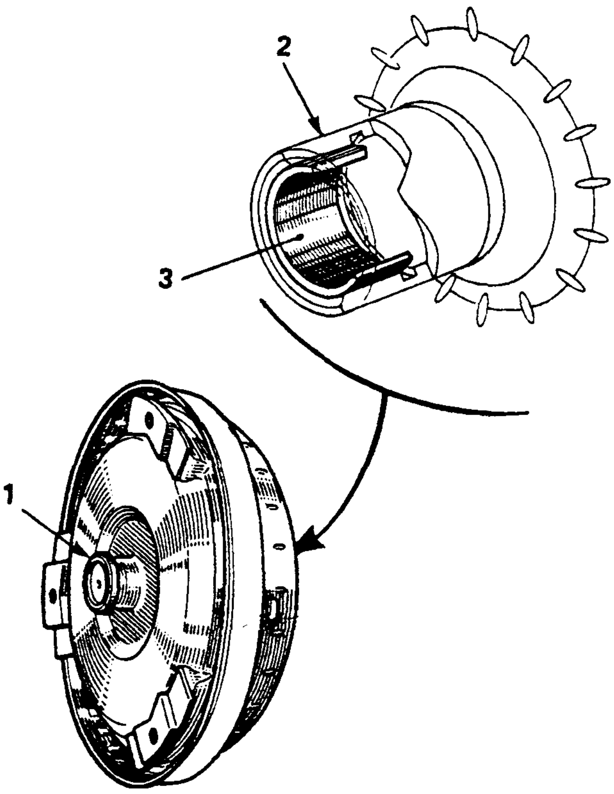
REMOVAL:

- Remove the converter retaining strap. (See illustration).

Pull the converter towards you to remove it.

CHECKING

Check the condition of:
- the converter centering device 1 (at crankshaft and converter end) 40 mm dia.
- sealing area (2)
- converter "white metal" bushing (3)
- the three securing points.



COMPONENTS
TORQUE CONVERTER

NOTE:

1. ONLY THE RECOMMENDED FLUID (MOBIL 220 - DEXRON® II) MUST BE USED IN THE TORQUE CONVERTER.
2. If the fluid contains particles from damaged clutches or brakes (the fluid will be black and smell burnt), follow the instructions below for discharging the fluid from the converter:
   - allow the fluid to drain from the converter
   - fill the converter with clean fluid (Mobil 220-Dexron® II). Using a turbine shaft, rotate the turbine to mix the fluid and let it drain.
   - When the automatic transmission has been reattached, top up the fluid and run the engine (selector in Park) for several minutes. Drain the automatic transmission and clean or replace the filter screen.

NOTE: If heavy metallic contamination is present, replacement of the torque converter will be necessary. Cleaning is unacceptable.

REFITTING

- Rotate the fluid pump shaft and turbine shaft by hand to check that they turn freely.
- Lubricate the "white metal" bushing and the seal joint face with transmission fluid or petroleum jelly.

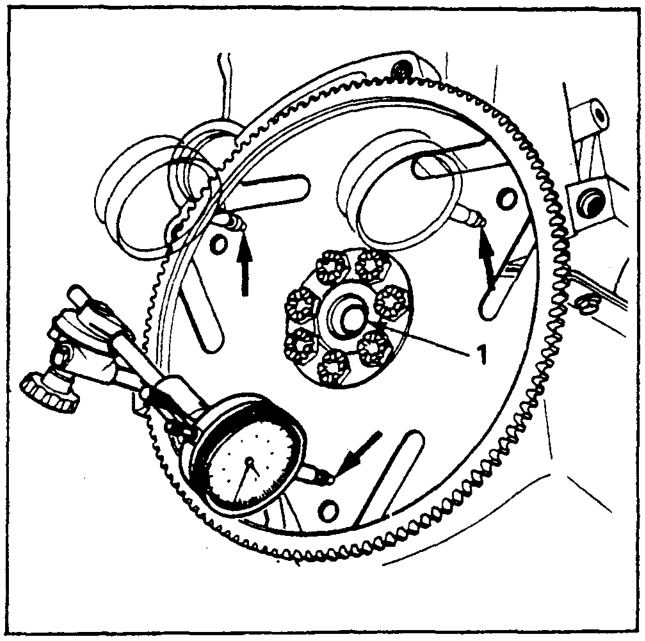
Install the torque converter and the retaining strap in place.

Protect the seal joint face with a plastic cap while the converter is being handled.

COMPONENTS
TORQUE CONVERTER

CHECKING

Place a support with a dial indicator attached on one of the cylinder block securing holes.



Take a reading at each converter mounting hole.

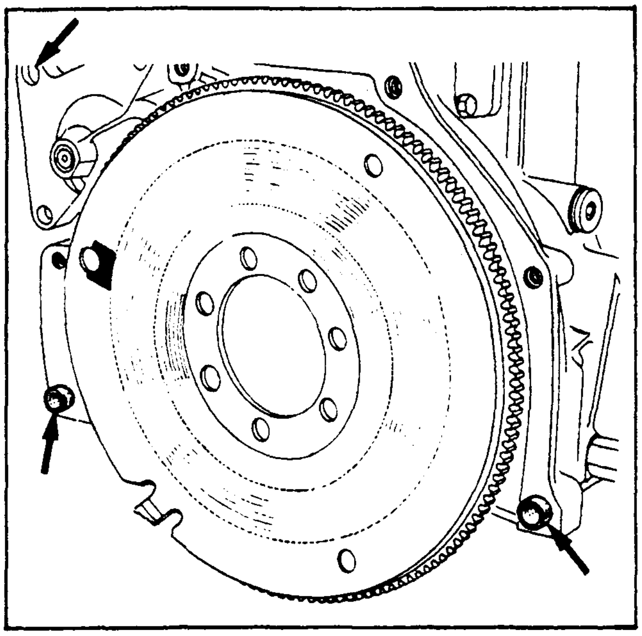
Compare the readings: the permissible run-out is 0.3 mm (.011 in).

If the readings are above this figure the flex plate must be replaced.

Before reinstalling the automatic transmission check:

- the condition of locating hole (1) in the crankshaft

- That the locating dowels are present on the engine and starter.



CAUTION
Failure to reinsert locating dowels may cause additional mechanical damage.

COMPONENTS
TORQUE CONVERTER

REMOVAL

When the converter has been removed, remove the seal using a chisel or a seal extracting tool.

Check the condition of the smooth part of the stator shaft (1).

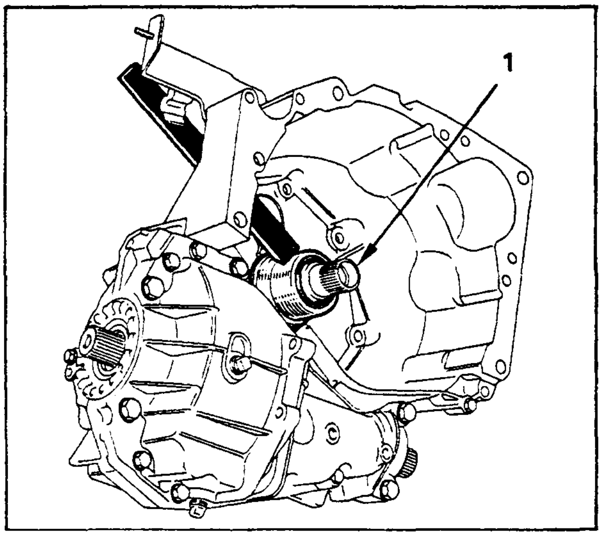
A torque converter seal retainer (used in ML1-011 automatic transmissions) may be retrofitted to model ML1-010 transmissions as described below.

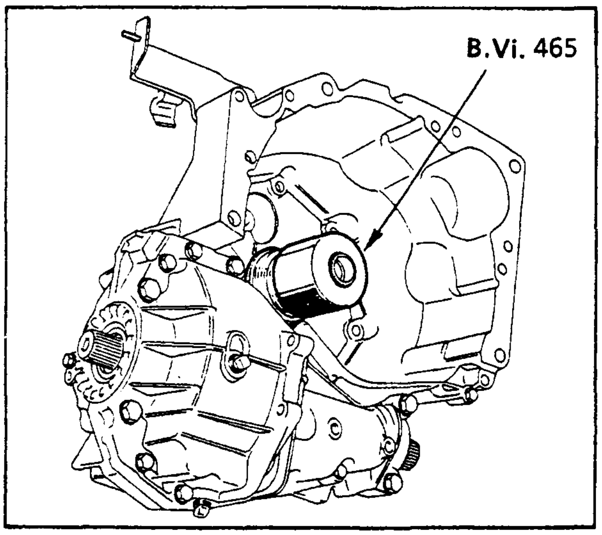
INSTALLATION

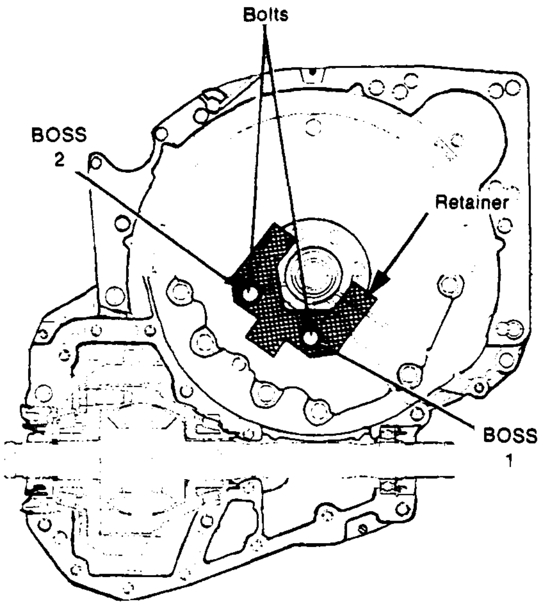
1. Remove and discard the two existing bolts at bosses 1 and 2.
2. Install retainer over seal as shown using new, longer bolts.
3. Coat new retainer bolts with silicone sealant before inserting.
4. Torque tighten retainer bolts to 2.5 daNm (18 lb./ft.)

REASSEMBLY

- Lubricate the seal and push it on using tool B.Vi. 465.
- Refit the converter after lubricating the joint face.

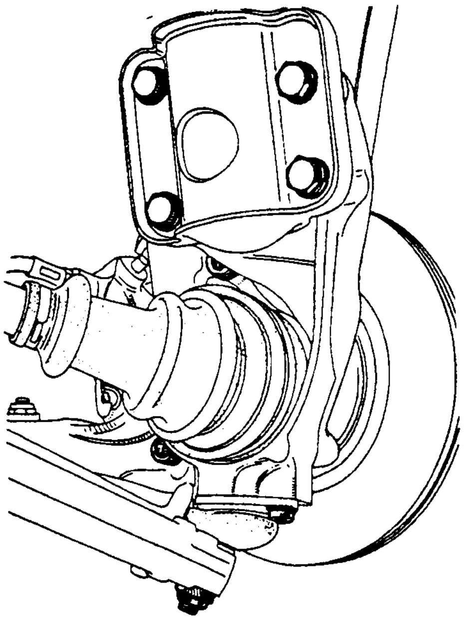






REMOVE AND REINSTALL PROCEDURE

The transaxle must be removed from below using a floor or transmission jack. The transmission section cannot be removed from the final drive assembly (differential) while installed in the vehicle. They must be removed as one assembly.



TIGHTENING TORQUES

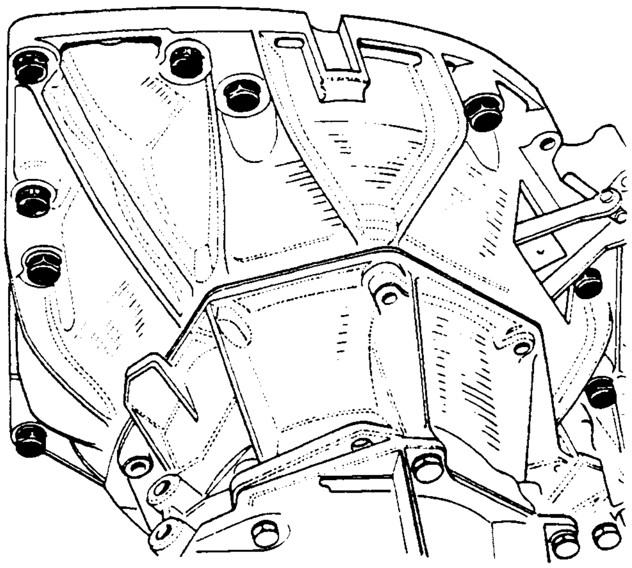
Wheel nuts:	12 daNm (90 lb./ft.)
Shock absorber bottom bolts:	8 daNm (60 lb./ft.0
Steering arm ball joint nut:	3.5 daNm (26 lb./ft.)

REMOVAL: Support vehicle under engine supporting crossmember so the front wheels are off the ground and front suspension at the relaxed end of its travel.

REMOVE OR DISCONNECT

- Drain transmission and final drive
- Front wheels
- Bottom 4 shock absorber bolts
- Steering box connections to the stub axle carriers
- Steering box
- Drive shaft roll pins using drifts B.Vi. 606.

(Tilt stub axle carriers outward while removing drive axles from final drive and position out of the way.)



- Transmission computer and harness from firewall (Tie to transmission)
- Speedometer cable by pinching the plastic end
- Shift cable (prop aside)
- Transmission and final drive cooling lines.
- Speed sensor on bell housing
- Final drive thermo switch wires

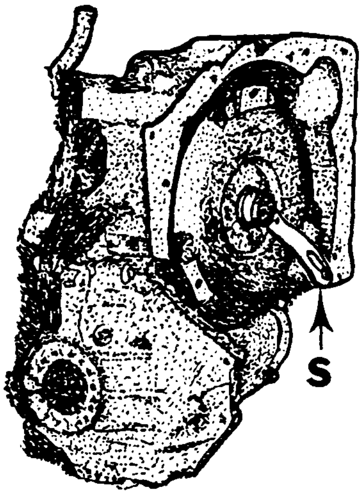
CAUTION
Exercise extreme care during transmission removal and installation process. Even minimal flexplate (flywheel) damage may result in a no-run condition.

- Dipstick
- Vacuum line from vacuum capsule
- Large rear mount bolt
- Rear mount holders on crossmember behind rear mount
- Rear mount from transmission (set safety cable aside)

REMOVE AND REINSTALL PROCEDURE

REMOVE OR DISCONNECT (CONTINUED)

- Lower air scoop
- Lower flywheel cover behind engine oil pan
- Torque converter bolts
- Gearbox - engine support stay-bolts (1 long bolt through bell housing on left and 2 small bolts on right side ahead of final drive housing)
- The ring of gearbox bolts and 3 starter bolts
- Starter
- Converter retaining strap(s) used after removal from vehicle. Fabricate from strap iron.



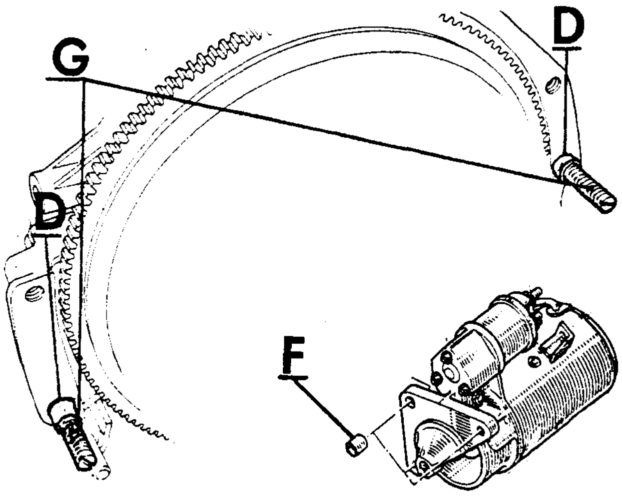
CAUTION

If a jack is used, take care that the assembly is evenly balanced.

REASSEMBLY

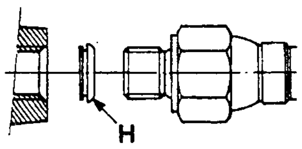
Reassembly is straightforward.
Note however:

- Reassembly will be made easier by using 2 studs (G) to guide the gearbox into position.
- Silicone should be used to plug the rollpins holes in the drive shaft.
- Be sure the alignment dowels (D) are in place and the starter dowel (F) is also in place before reinstallation.
- Install in reverse order of removal.



REMOVE AND REINSTALL PROCEDURE

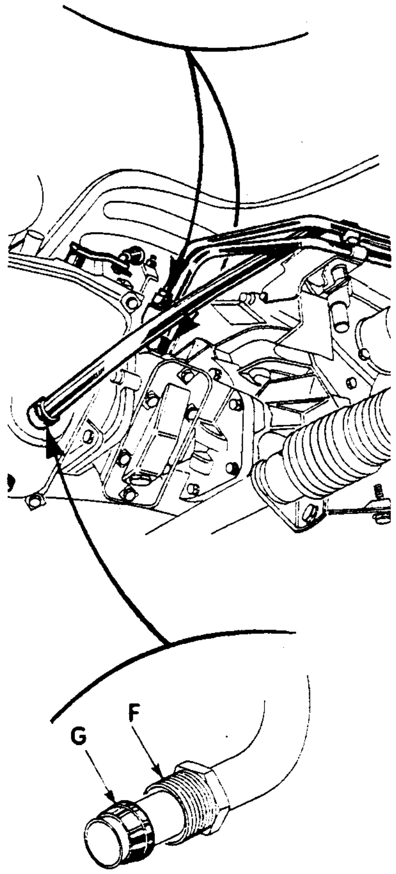
Reconnect the oil cooler lines using new washers (H); torque tighten to 2 daNm (15 lb./ft.)

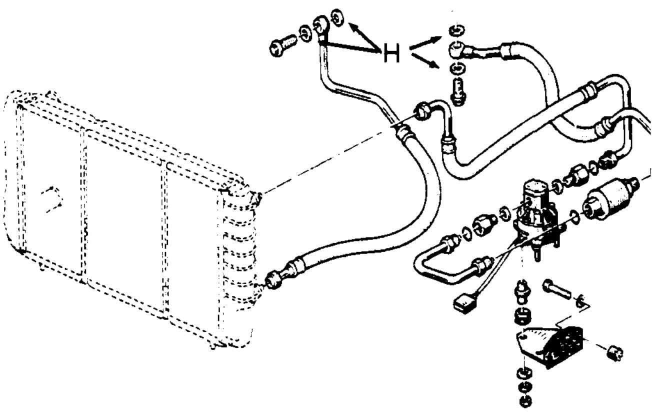


Check the condition of ferrule (G) on the dipstick tube before reattaching.

If the dipstick tube ferrule is worn or damaged, the complete dipstick tube with ferrule and nut must be changed. The nut (F) and ferrule (G) should be installed onto the dipstick tube as shown.

- Fill both final drive and transmission with the proper type and level of fluids:
  - Differential: 80W-90 Gear Lube
  - Transmission: Mobil 220 ATF Dexron© II





- Reprime the final drive oil cooling system with oil as follows:
  - Be sure temperature of differential oil is at least 50°F for pump to work correctly.
  - Disconnect the black and the violet wires from the thermoswitch.
  - Touch these two wires together briefly using a test lead or similar wire.
  - The pump will run for a 3-minute cycle, then it will shut off. (It is normal for the pump to "whine" because of the viscosity of the cool oil.)
  - Reconnect thermoswitch wires.
  - Top off oil level as necessary.

CAUTION

If the pump makes an abnormally shrill, siren-like noise while running, check for plugged or pinched oil lines. If the pump does not stop after 3 minutes, the thermoswitch or the timer-relay may be faulty.

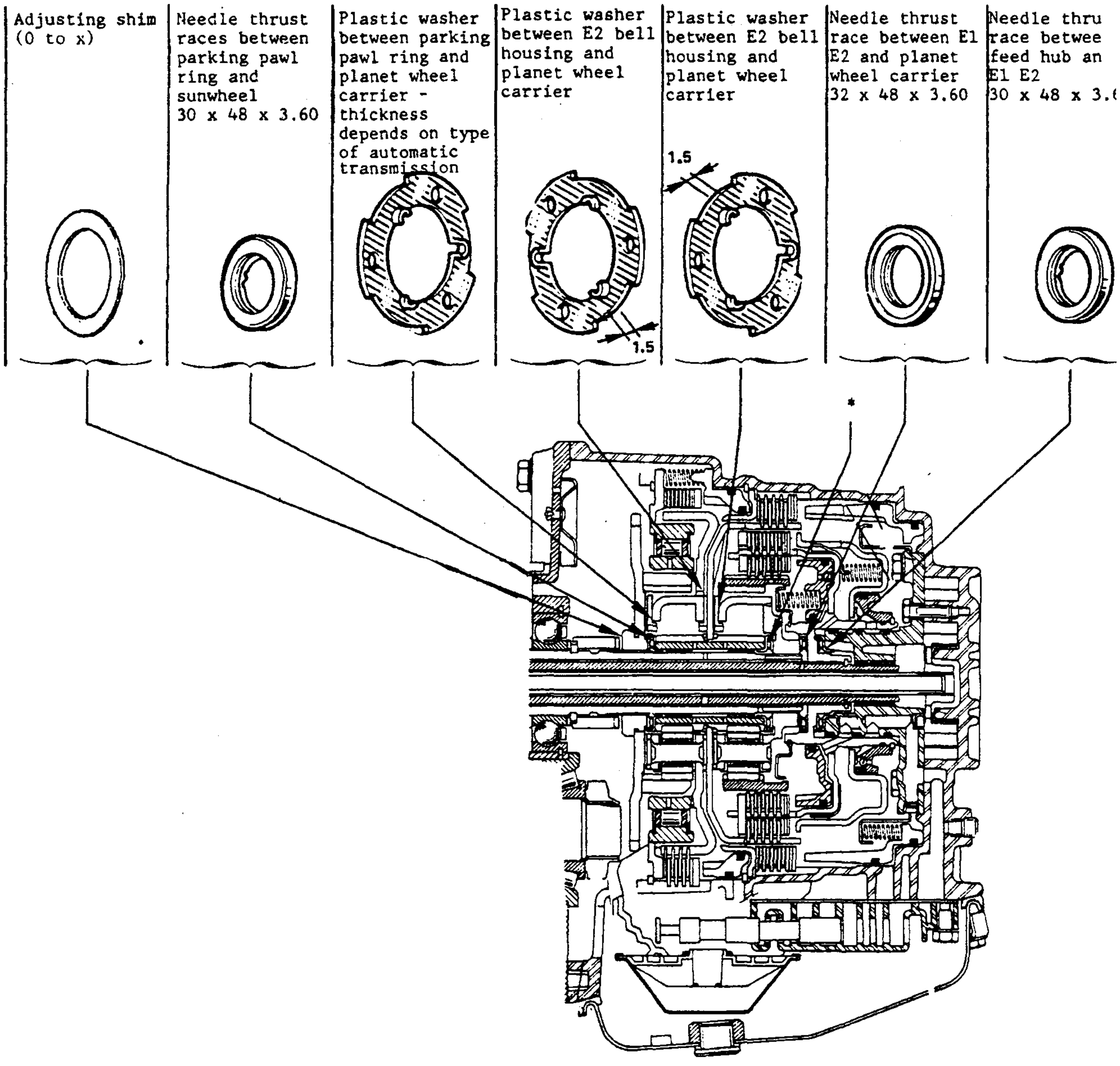
- Check front wheel and steering wheel alignment.
- Check shifter operation.

IMPORTANT
Make sure safety cable is installed properly and is not rubbing on power steering lines. Tie up if needed.

CAUTION

Be sure to fill the final drive with 80W-90 gear lube! Do not fill with ATF since it will not sufficiently lubricate internal parts of the final drive.

TRANSMISSION REBUILD
EXPLODED VIEW

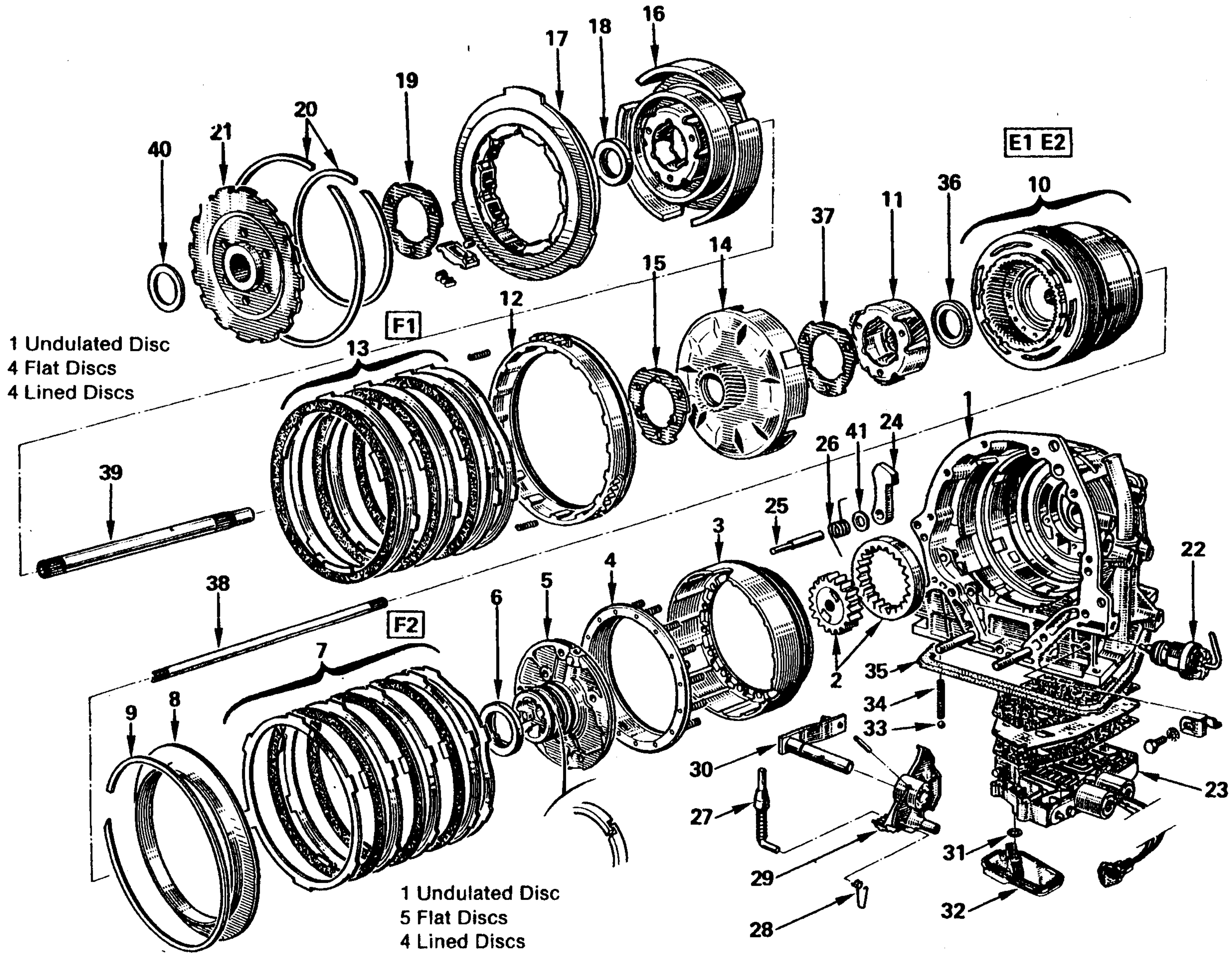


* Cannot be dismantled

TRANSMISSION REBUILD
EXPLODED VIEW

Descriptions

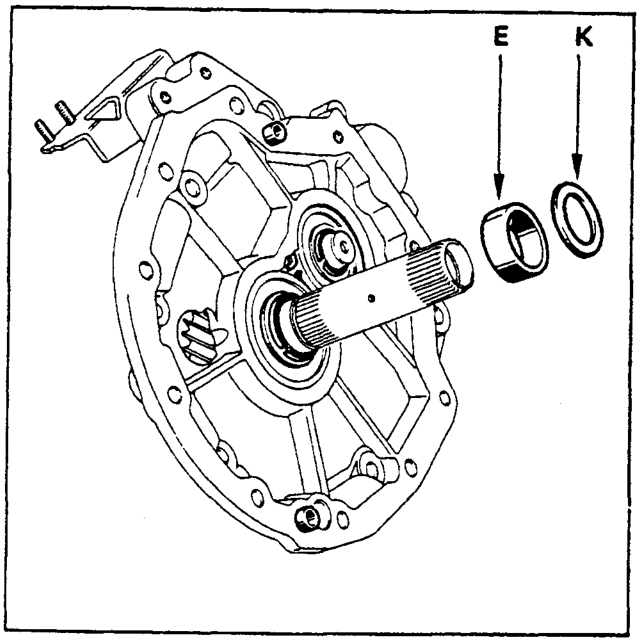
1 : clutch/brake case
2 : pump
3 : F2 brake piston
4 : F2 brake cup
5 : feed hub
6 : needle thrust race
7 : F2 brake discs
8 : F1 clutch piston support
9 : circlip
10 : clutches E1 and E2
11 : forward drive train
12 : F1 clutch piston
13 : F1 clutch discs
14 : E2 clutch-housing
15 : friction washer (1.5 mm thick)
16 : reverse drive train
17 : free wheel
18 : needle thrust race
19 : friction washer (thickness to be determined)
20 : circlip
21 : parking pawl ring
22 : vacuum capsule
23 : valve body
24 : parking pawl
25 : parking pawl pivot pin
26 : parking pawl spring
27 : parking pawl link
28 : clip
29 : gear selector cam
30 : cam pivot pin
31 : filter seal
32 : filter
33 : cam detent ball
34 : cam detent spring
35 : pan gasket
36 : needle thrust race
37 : friction washer (1.5 mm thick)
38 : pump shaft
39 : turbine shaft
40 : end play adjusting shim
41 : washer



NOTE: Most component numbers on the following pages refer back to this illustration.

TRANSMISSION REBUILD
DISASSEMBLY

The components must be disassembled and handled on a bench with a padded top (rubber or thick plastic).

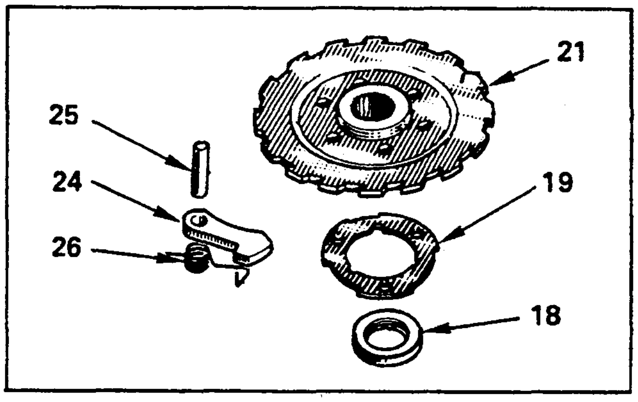


SEPARATING THE CASINGS

- Remove the torque converter.
- Remove the pump drive shaft
- Separate the final drive casing from the gear section casing.
- Remove the external bolts from the gear section casing and the 2 internal bolts which can be reached by removing the pan and filter screen.
- Leave spacer (E) and shim (K) on the output shaft.

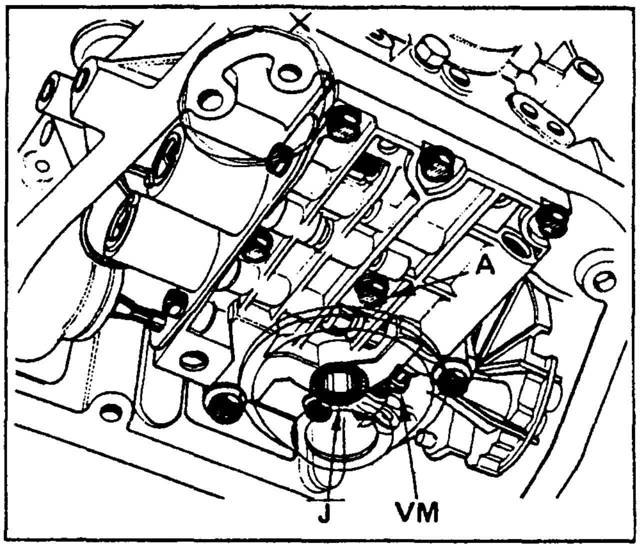
DISASSEMBLY
Remove the following from the gear section:

- parking pawl ring (21),
- parking pawl (24) and its spring (26)
- plastic washer (19)
- needle thrust race (18).



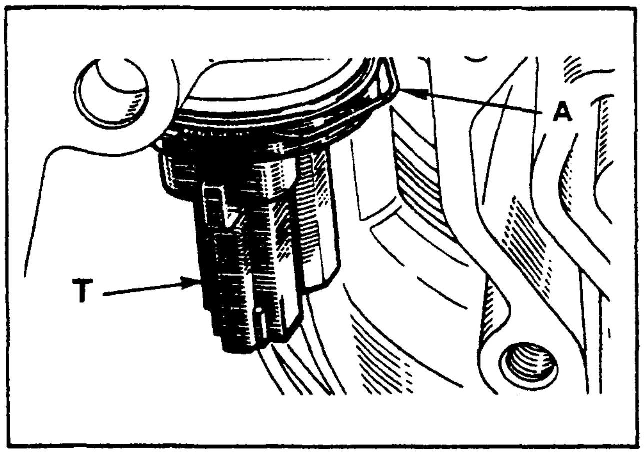
TRANSMISSION REBUILD
DISASSEMBLY

When taking out bolt (A), take care not to drop the manually operated valve (VM) or the plate and two seals under the control unit.



NOTE: See the chapter "Hydraulic Control Unit" for complete instructions on dismantling the valve body.

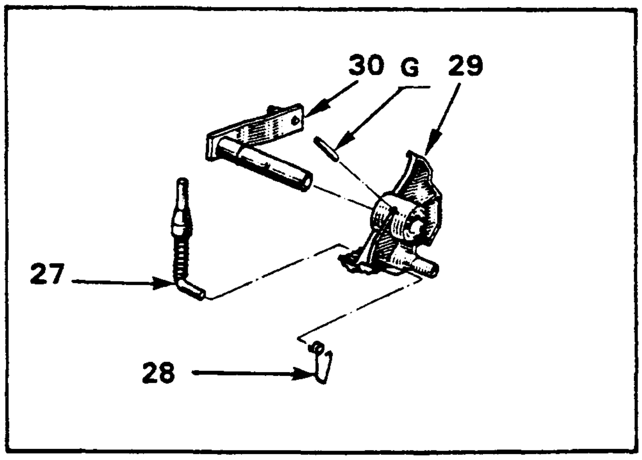
Remove clip (A) and disconnect solenoid pilot valve connector (T).



REMOVE:
- the parking pawl plunger (27)
- spring (28)

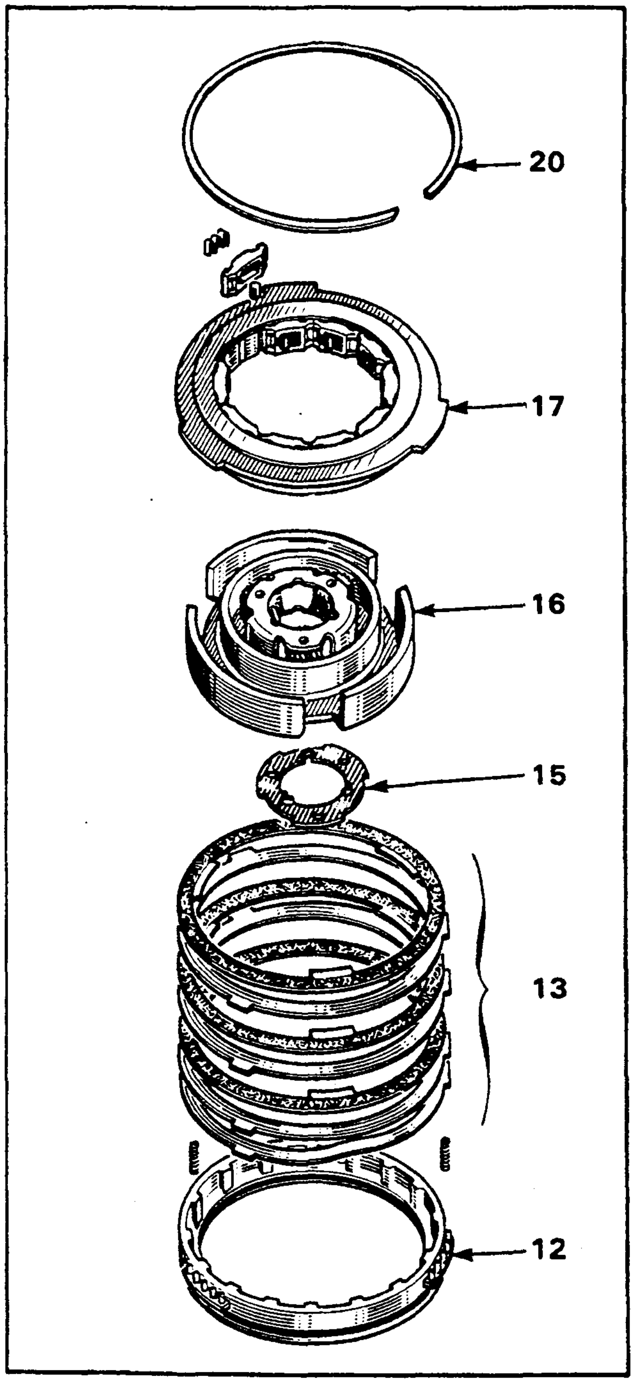
NOTE: To remove lever (30), place it in 1st gear "Hold" (opposite the "Park" position) and extract rollpin (G).

TAKE CARE NOT TO LOSE THE QUADRANT BALL AND SPRING.



- Remove circlip (20) and the assembly 17 - 16 - 15 - 13

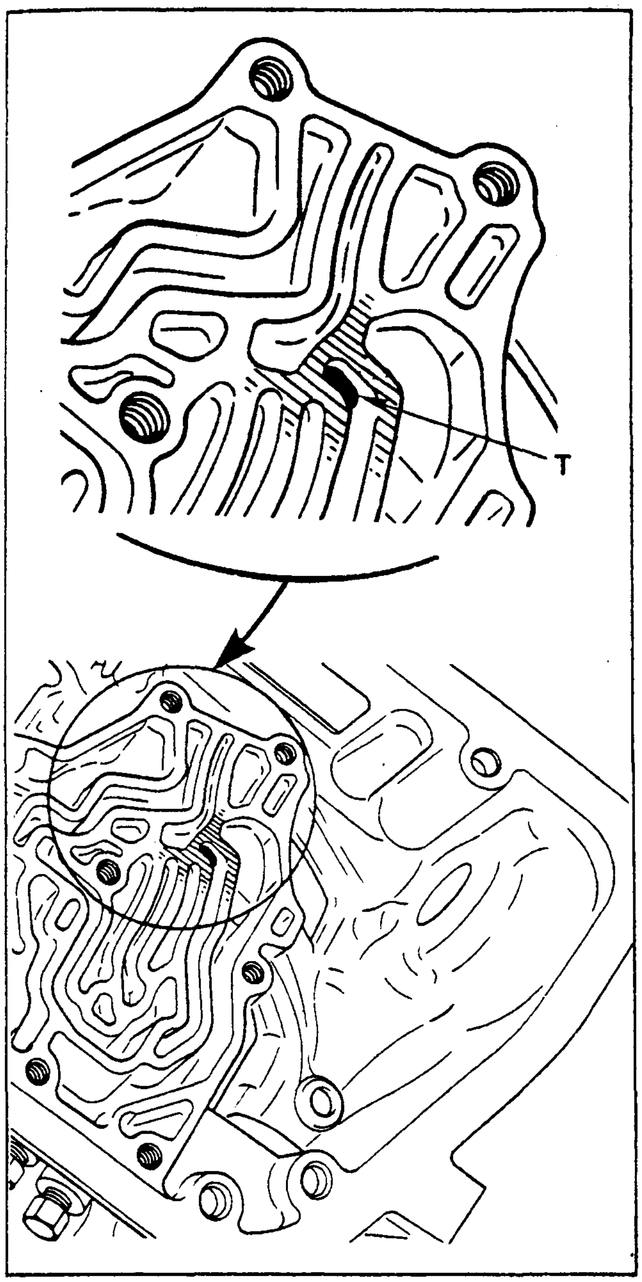
- Remove clutch piston (12) by blowing compressed air through hole (T). See page F5-7.



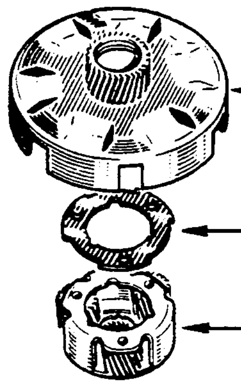
TRANSMISSION REBUILD
DISASSEMBLY

"T" denotes port in worm channels for removal of clutch piston with compressed air.

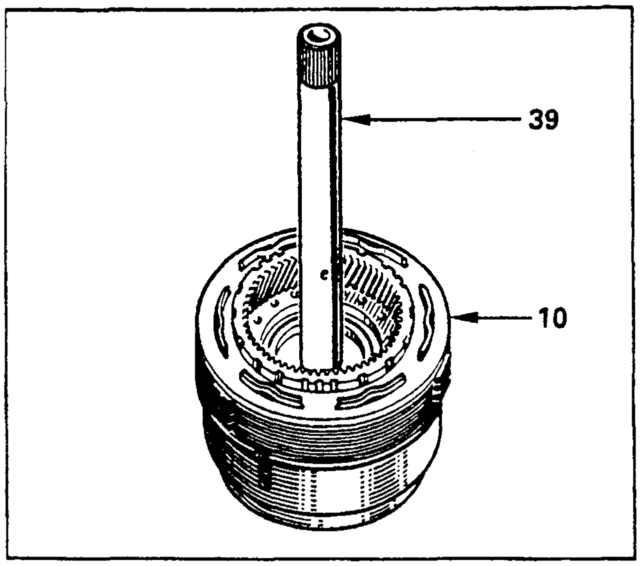
(Insert a small piece of tubing in hole (T) and apply compressed air.) DO NOT USE TOOLS TO RELEASE (12).



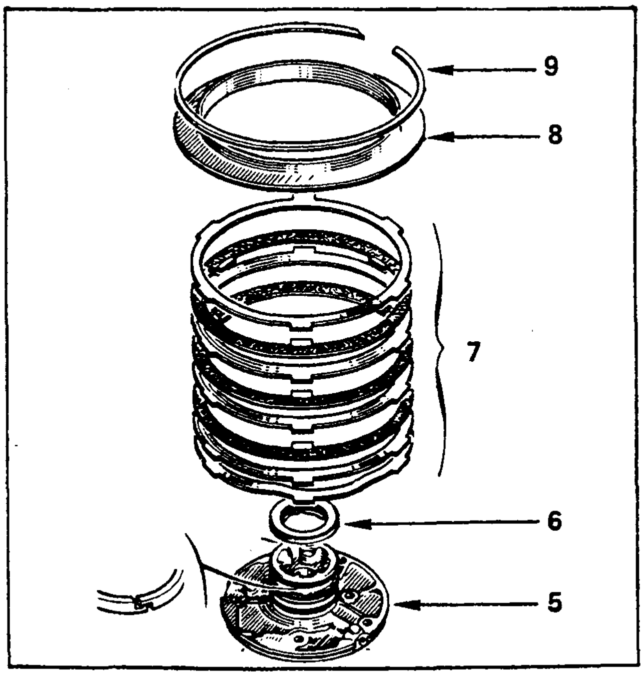
Remove E2 clutch housing (14) and 37-11.



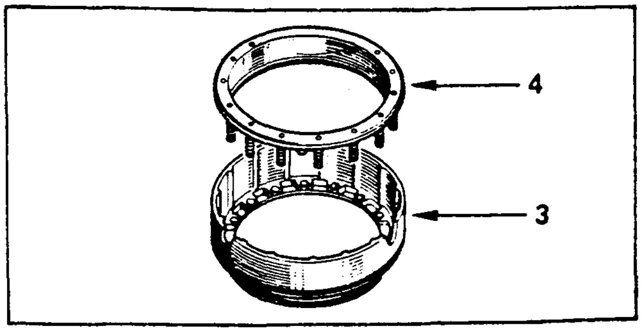
Remove assembly E1/E2 (10) using the turbine shaft (39) (assembly (10) cannot be disassembled):



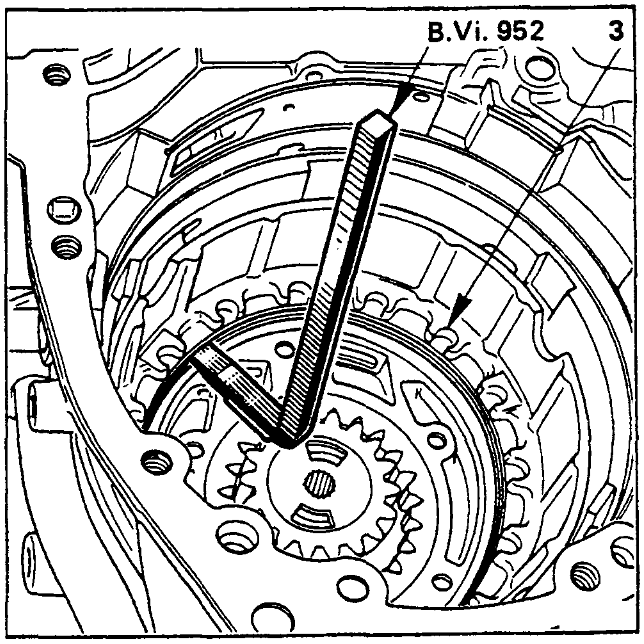
- circlip (9) and parts (8) to (5)

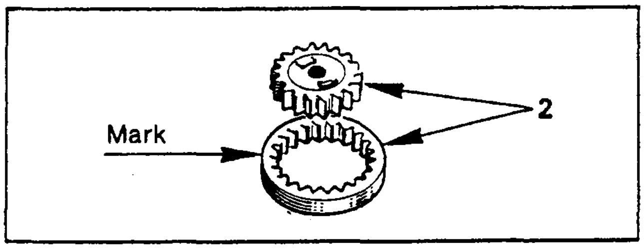


- cup (4) and piston (3) using tool B.Vi. 952.



MARK THE FACE OF THE PUMP OUTER PINION and remove (2).





CLEANING
Do not use trichloroethylene as this may splash on the seals and cause damage.

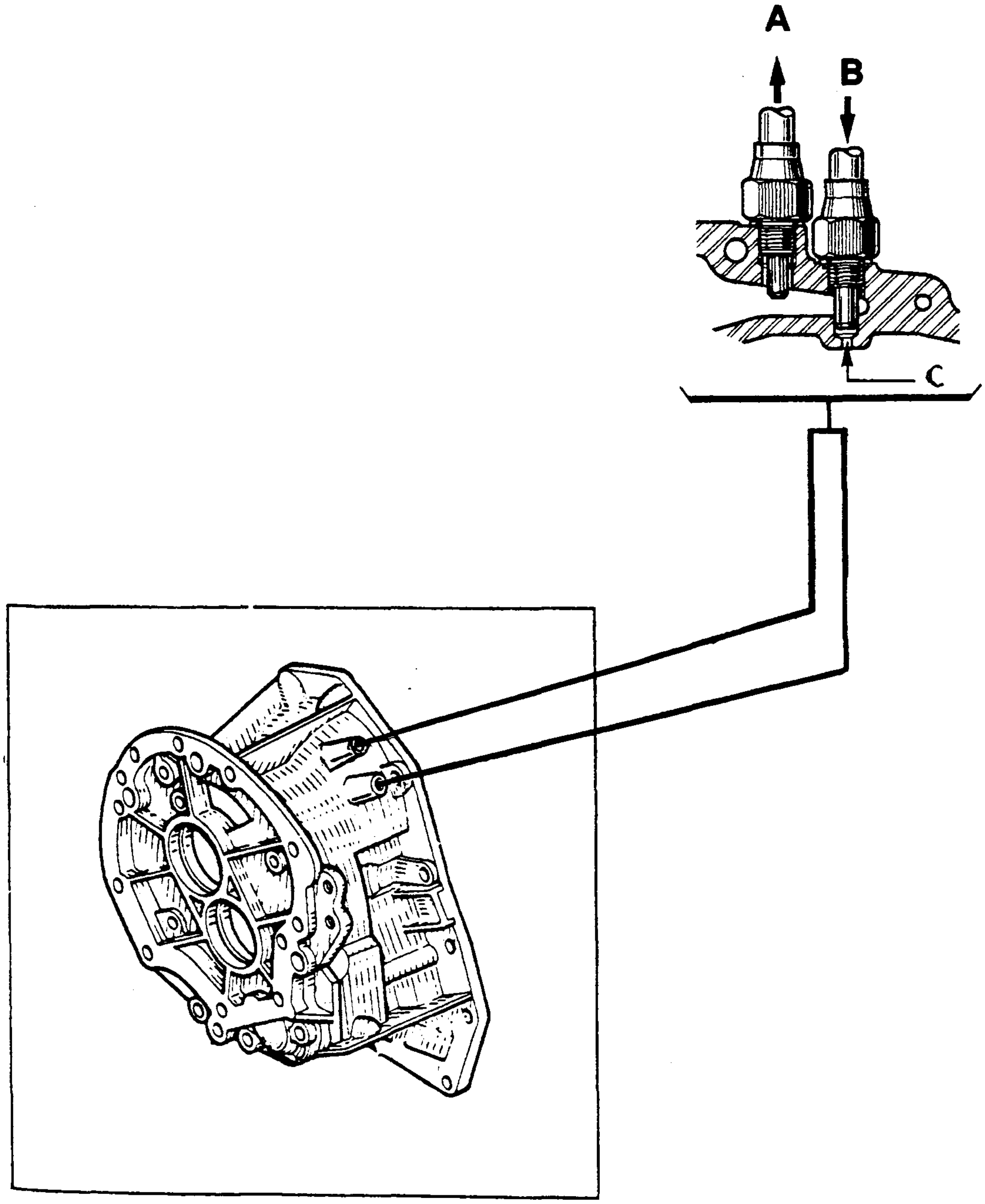
Do not use shop towels which could leave lint particles in the system.

Use:
- solvent or degreasing fluid, (except on the seals) and lint-free towels for wiping off.
- compressed air, blowing hard in all holes, feed ways and oilways on:
- the gear section causing (1)
- the free wheel (17)
- the forward gear train (11)
- the reverse gear train (16)
- the E2 clutch housing (14)
- pistons (12-3)
- feed hub (5)
- pump (2)
- pump shaft (38)
- turbine shaft (39)

TRANSMISSION REBUILD
CLEAN AND INSPECT

Blow compressed air into the fluid cooler inlet and return pipes (A and B).

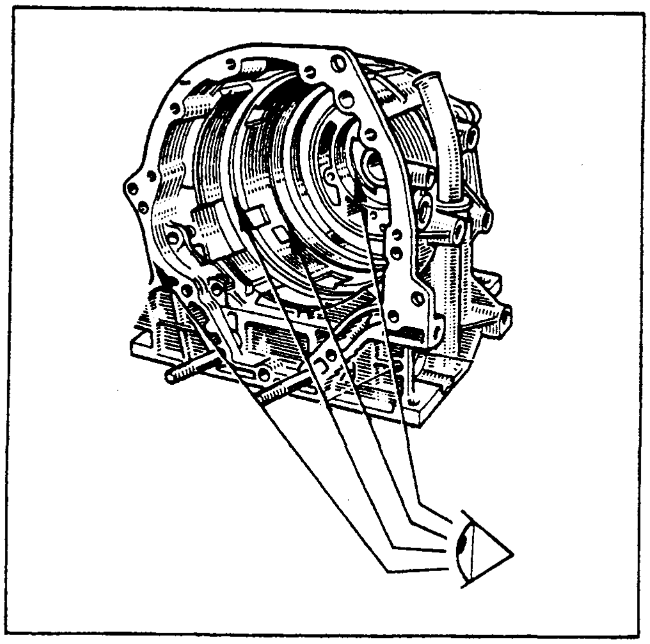
After cleaning, lubricate the parts immediately with Mobil 220-Dexron® II automatic transmission fluid.



GEAR SECTION CASING (1)

Check that the following are in good condition:

- the pump location (see FLUID PUMP)
- the circlip grooves
- the joint faces on pistons F1 and F2
- the face of the valve body casing
- the coupling faces
- the joint faces of the sealed connector and input shaft.

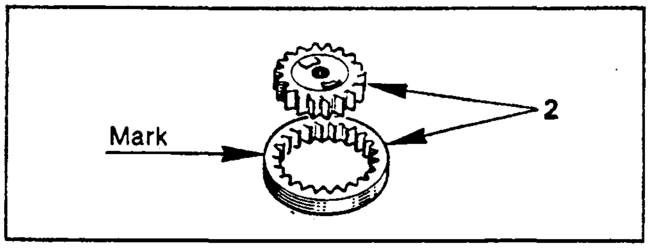


FLUID PUMP (2)

Check that the pump pinions are in good condition.

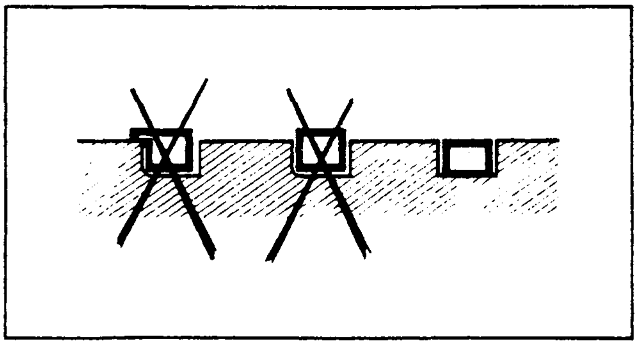
Gear section casing/pinion/wheel assembly is matched.

If one part has to be changed, then the entire assembly must be changed.



TRANSMISSION REBUILD
CLEAN AND INSPECT

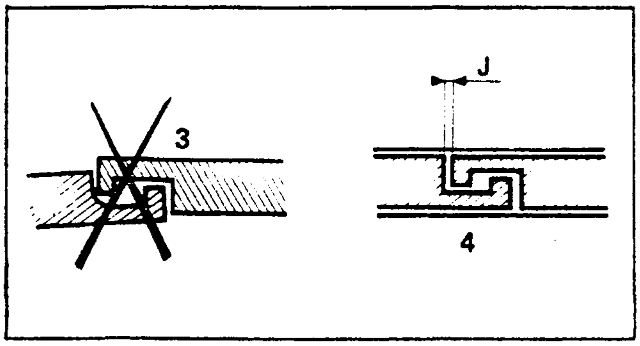
FEED HUB - SEALING RINGS (5)



Before removing the rings from the hub check that they rotate freely on the hub. If any rings are stuck CHANGE THE HUB-RING ASSEMBLY.

Remove the rings and check the condition of the following on the hub:

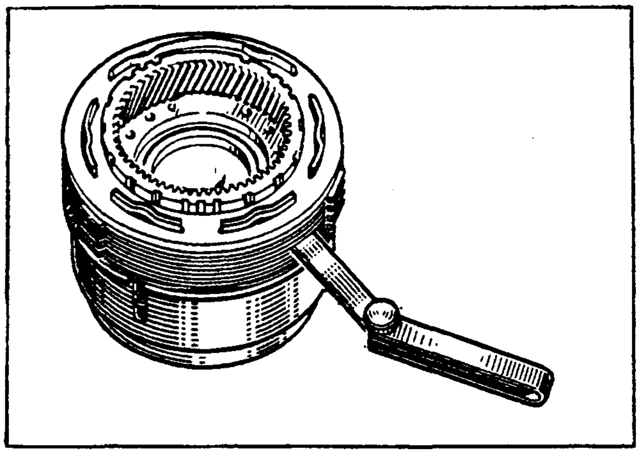
- the bottom of the three grooves in which the rings fit,
- the white metal faced bushing,
- the face at the pump end.



On the rings check:
- the ring gap ends (3) - they should fit together exactly (4).
- the clearance at section (J) : it should be between 0.05 and 0.35 mm (.002 - .010 in)

BRAKES (7) (13)
Any lined discs showing signs of overheating (blackening of lining), on which the finish is poor or which are worn must be replaced.

Scrap all steel discs that show signs of picking-up or seizing.



CLUTCHES E1, E2 (10)

Clutches E1 and E2 cannot be disassembled.

Clutch 2 has visible discs.

Check the clearance of clutch E2 using a set of shims.

Maximum permissible clearance: 4.1 mm (.16 in)

If clearance is not correct replace E1-E2.

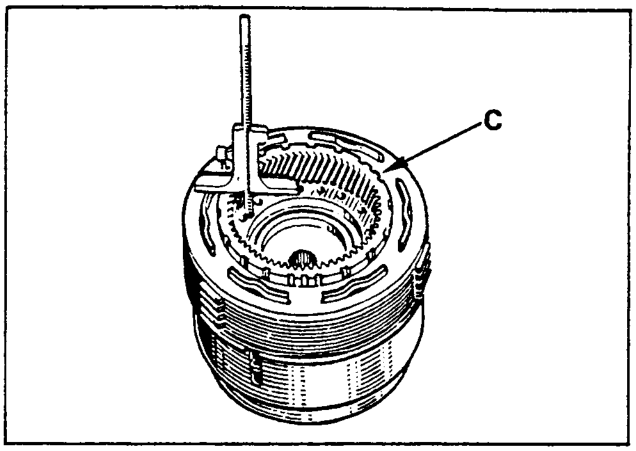
Clutch E1 is not visible but the clearance can be checked by moving crown wheel (C).

If the clearance is not correct change E1-E2 and the hydraulic control unit.

On E1 - E2 check the condition of:

- the turbine shaft retaining seal.
- the inside of the bore accomodating the E2 Clutch Housing feed hub (14).

Check that:
- the pinion,
- the two white metal faced bushings are in good condition.



Allowable play: 3.5 mm (0.137 in.)

CUP WITH CRIMPED SPRING (4)

Check that the springs and their crimped areas are in good condition.

SEAL (All seals removed must be routinely replaced).

Tightening the seals.

0.2 to 0.7 mm (.008 to .027 in) over the diameter.

Replace any seals which do not meet the given tolerances.

VALVE BODY (23)

The valve body assembly can be dismantled (see chapter "Hydraulic Control Unit" in Subsection J3).

PLANETARY GEAR TRAINS (11) (16) - Check the condition of the teeth on all the gears.

Make sure that all the gears in the forward and reverse gear trains turn freely and without excessive play on their shafts.

FREE WHEEL (17)

Check the condition of:

- the components of the free wheel (spring, roller, body)
- the surface of the free wheel track on (16)

If any componets are defective, the entire free wheel and the reverse gear train (16) must be changed.

REASSEMBLY

STEP 1

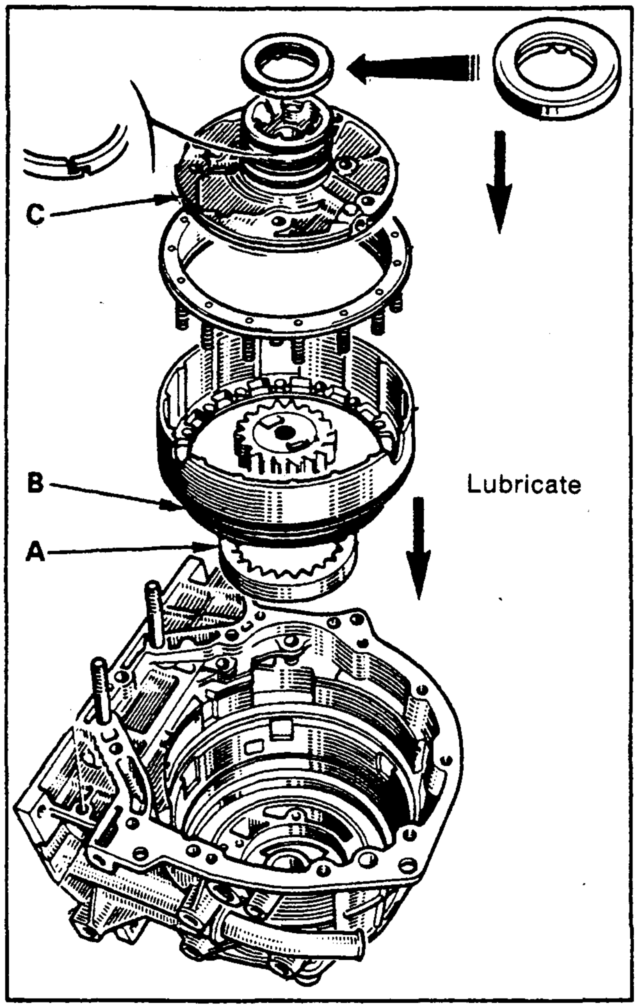
A - Outer pinion according to mark made on dismantling.

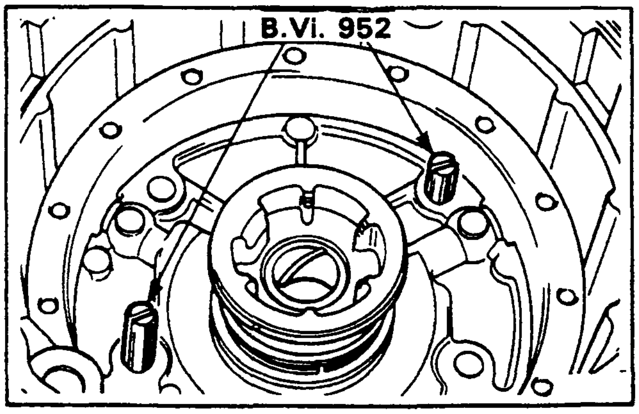
Check that it turns freely in the housing.

B - Lubricate the seals

C - Center using tool B.Vi. 952 and progressively torque tighten the bolts:

Tighten 7 mm dia. bolts to 1.5 daNm (11 lb./ft.)
6 mm dia. bolts to 0.6 daNm (4.5 lb./ft.)



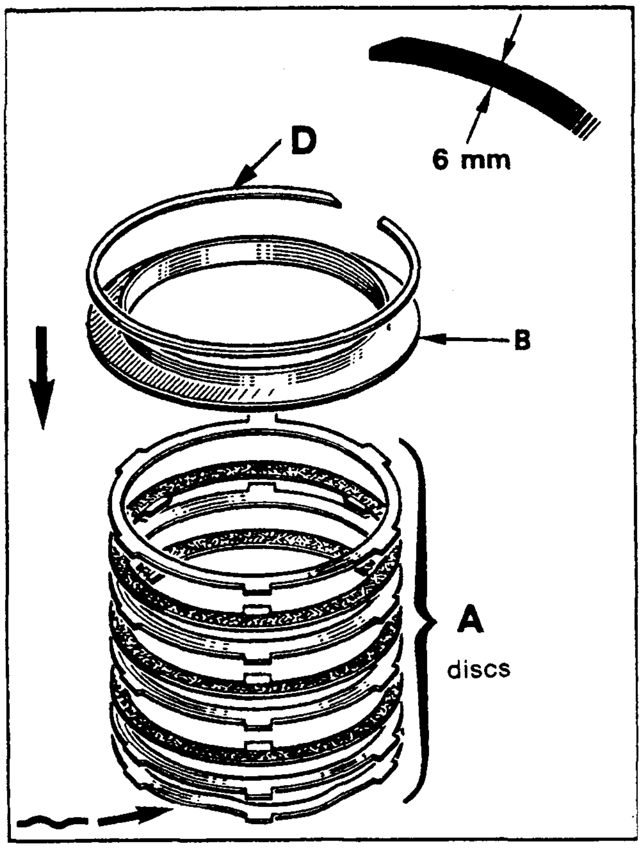


BRAKE F2

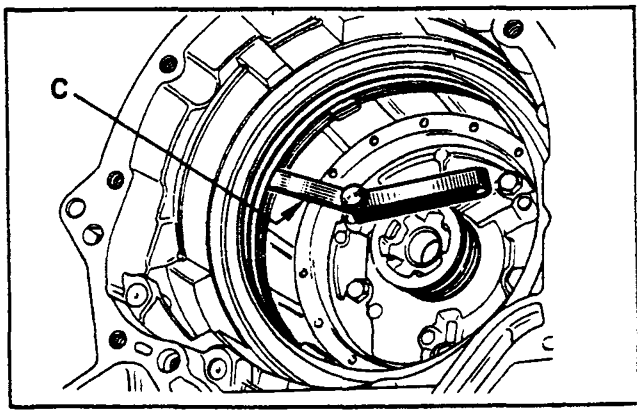
STEP 2

ATTENTION:

Attach the proper circlip (D) as shown in the illustration.

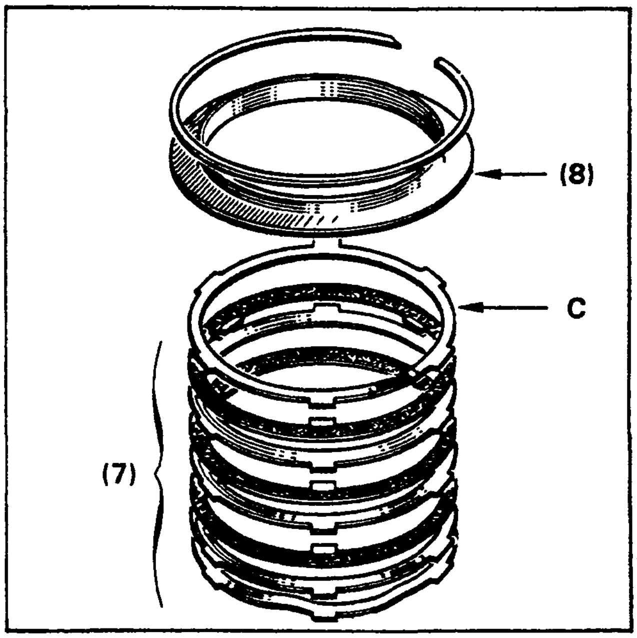


A - one wavy disc, one flat disc and one lined disc alternately.
B - Lubricated F1 piston support



C - Operating clearance should be 1.5 to 2.1 mm

ADJUSTING F2 PISTON



This is adjusted using a spacer shim (C) which is available in three sizes (0.5, 1 and 2 mm). It is placed between the F1 piston support (8) and the F2 brake discs (7).

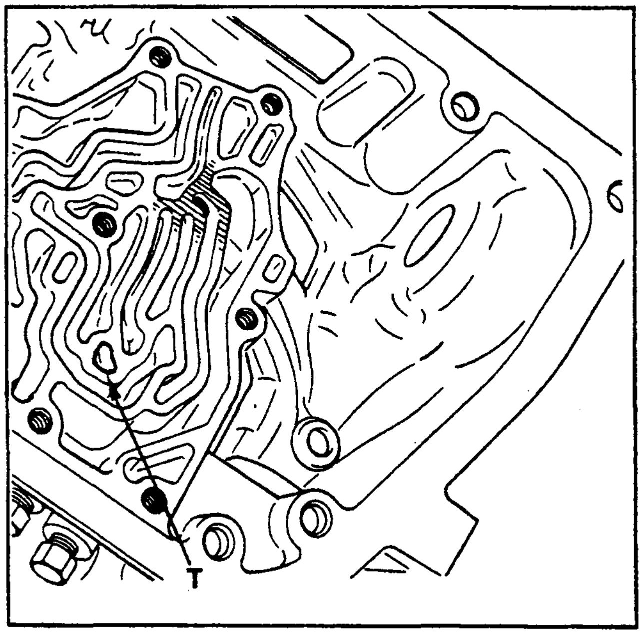
Calculation example

Clearance measured: 3.6 mm
Select the 2 mm shim
Clearance after adjustment: 3.6 - 2 = 1.6

When the assembly has been reassembled with the shim, check the clearance again.

Do not use more than two shims.

CHECKING THE OPERATION OF THE PISTON

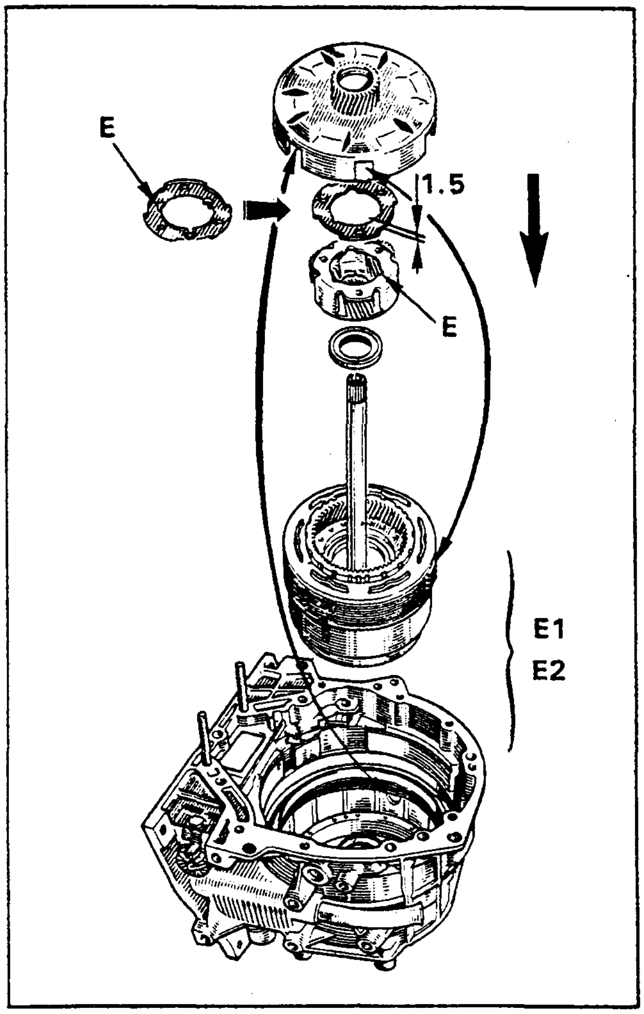


Make sure that the piston is working properly by blowing compressed air through hole (T).

Check that the piston moves backwards and forwards properly.

STEP 3

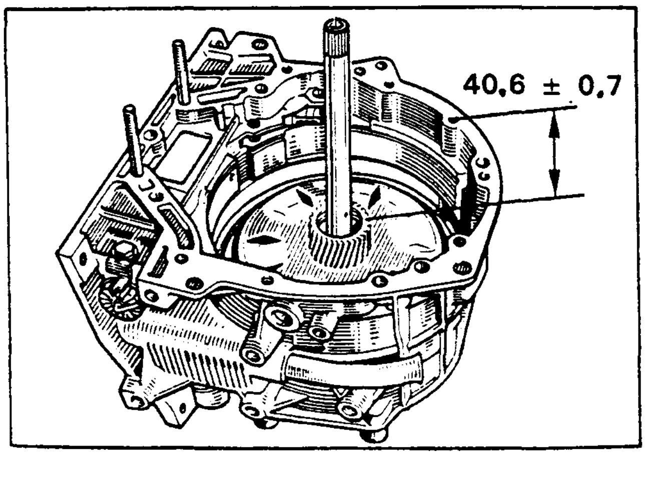
Clip the turbine shaft in the E1 - E2 clutch assembly and fit:



IMPORTANT
TAKE CARE NOT TO MIX THE F2 and E2 DISCS.

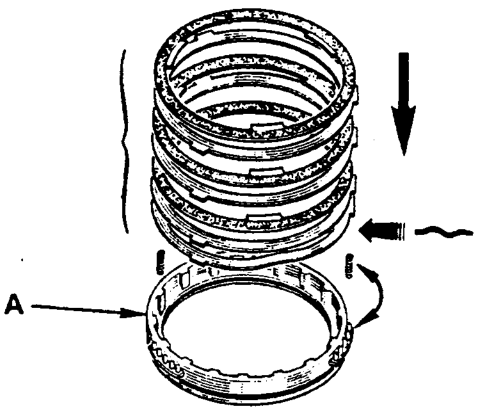
CHECK THAT THE ASSEMBLY IS CORRECT
The dimension between the end of sunwheel (P) and the joint face must be:

39.9 mm - 41.3 mm (1.573 in. - 1.627 in.)



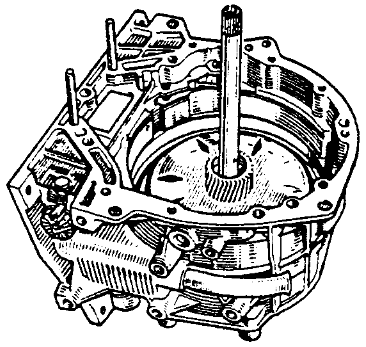
BRAKE F1

STEP 4



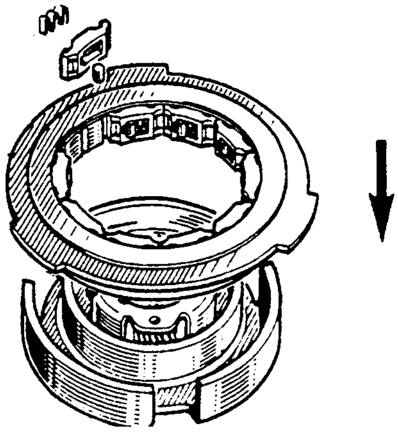
A - Lubricate the seals and assemble them progressively onto the piston.
B - One wavy disc, one flat disc and one lined disc should be fitted alternately, the lined disc on top.

PRE-ASSEMBLY OF FREE WHEEL AND REVERSE GEAR TRAIN



STEP 5

NOTE: The components of the free wheel should not be disassembled unless absolutely necessary.



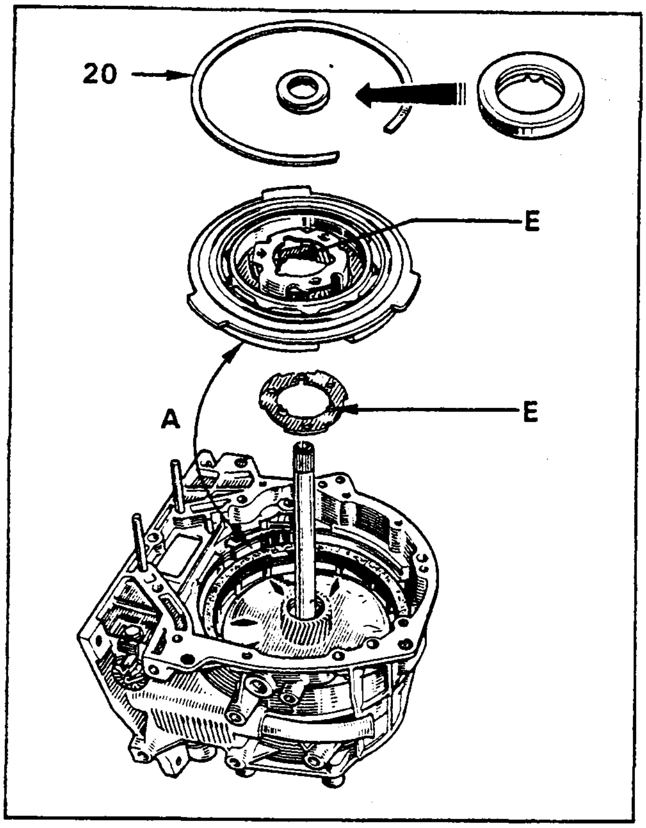
ATTENTION:

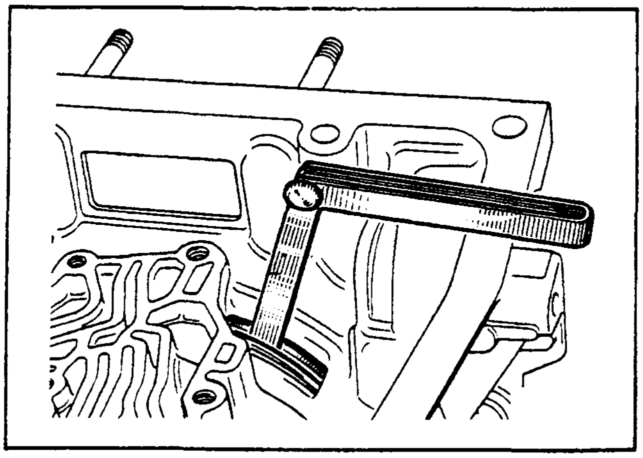
STEP 6

Circlip (20) must be the correct size.

A - Mount the assembly and rotate the reverse gear train so that the brake notches are in line with their locations.

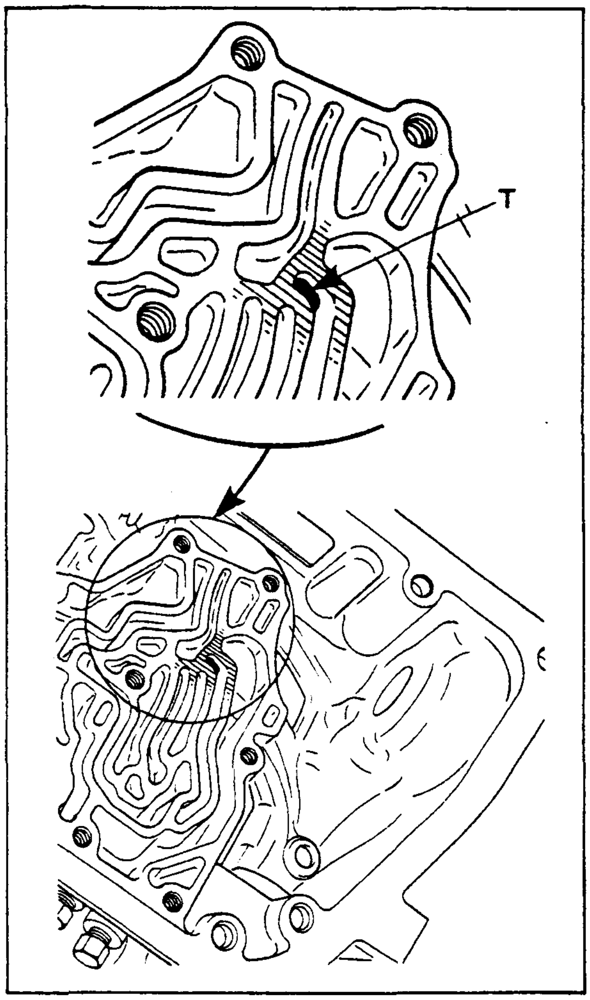
The operating clearance for brake F1 should be 1.1 to 3.1 mm.



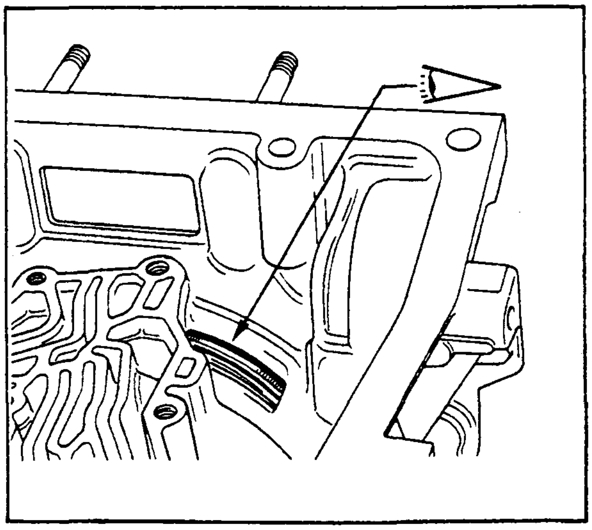


OPERATING CHECK

Make sure that the piston is operating correctly by blowing compressed air through hole (T).

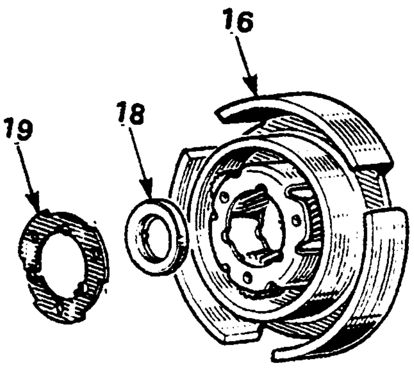


Check that the piston moves backwards and forwards properly.



ADJUSTING THE REVERSE GEAR TRAIN

The object of the adjustment is to restrict the displacement of the reverse gear train by determining the thickness of plastic shim (19).



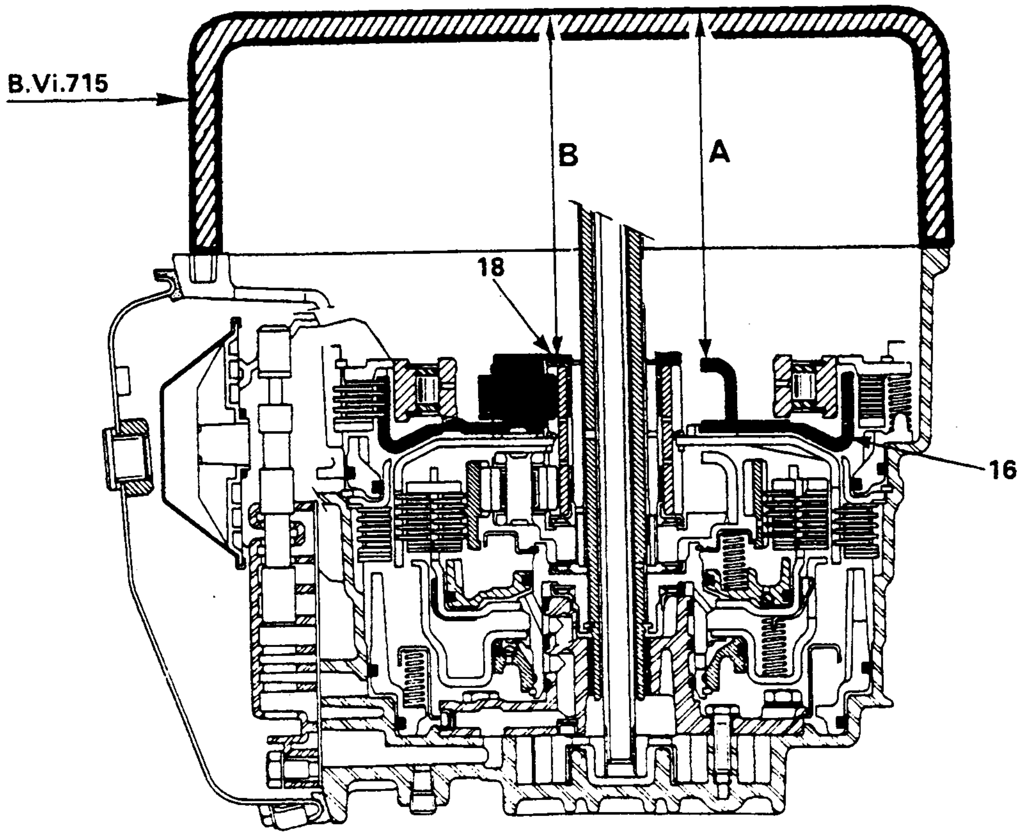
THE AVERAGE CLEARANCE MUST BE 0.4 mm.

The adjustment is made in two stages:

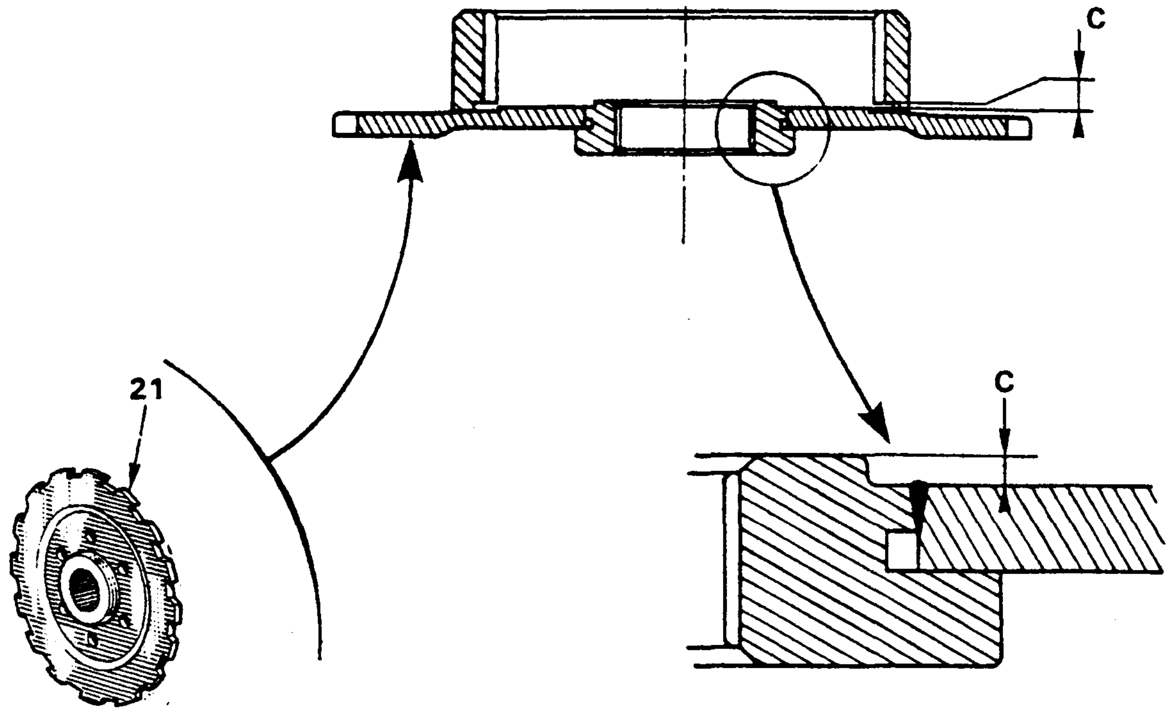
1. At gear selection end

Check that thrust bearing (18) is on the sunwheel and that there is no plastic shim (19).

- Place tool B.Vi 715 (or an accurate straight edge) across the case joint surface as shown.
- Attach a dial indicator to the tool or straight edge and "zero" the indicator on dimension A, the top surface of the planet gear assembly.
- Next, measure dimension B, which is the top surface of the thrust bearing. Record this dimension. You will need to subtract it from the park ring dimension.



2. On the parking pawl ring (21).

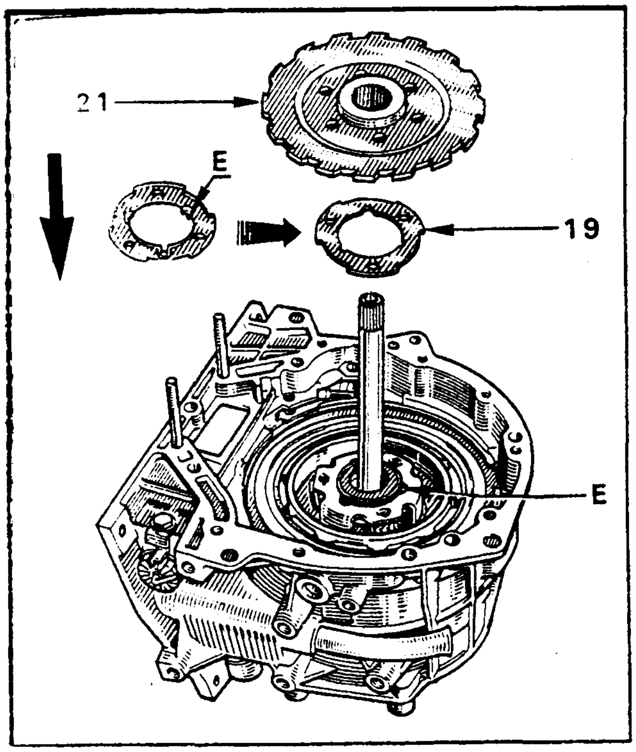


- Place tool B.Vi. 715 or straight edge across the back side of the park ring as shown.
- Attach the dial indicator to the straight edge and "zero" it on the inner face of the gear as shown.
- Then measure dimension **C** at the hub face.
- **Total Clearance = B + C**
  Example: If B was 1.3 mm and C was 1.2 mm, then total clearance is 2.5 mm.
- Next, subtract average clearance (0.4 mm) from total clearance to find the thickness of plastic shim to use.
  Example: 2.5 mm - 0.4 mm = 2.1 mm
  Select a shim which gives a tolerance closest to 0.4 mm.
- Four thicknesses of shims are available:
  - 1.5 mm
  - 2.0 mm
  - 2.6 mm
  - 3.2 mm

In our example, you would pick the 2 mm shim. This would give a 0.5 mm tolerance, which is within 0.1 mm of the desired 0.4 mm.

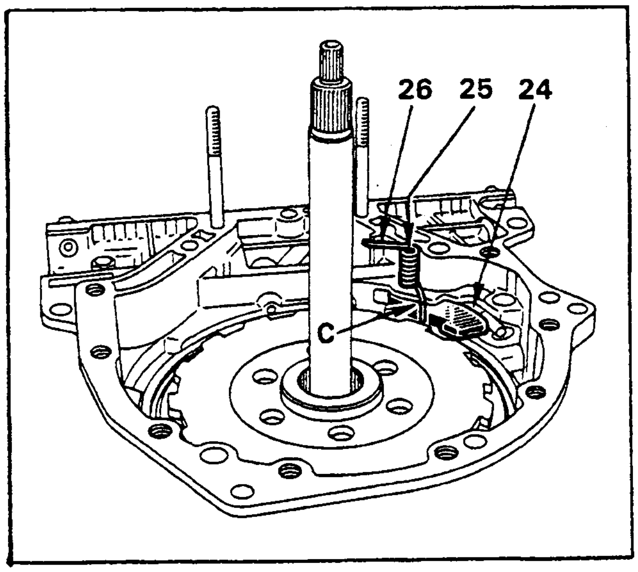
- The 1.5 mm shim would allow 1 mm tolerance; 0.6 mm too much.
- The 2.6 mm shim would allow 0 mm tolerance; in fact, it would bind 0.1 mm.

Fit plastic shim (19), whose thickness has already been determined, and parking pawl ring (21).



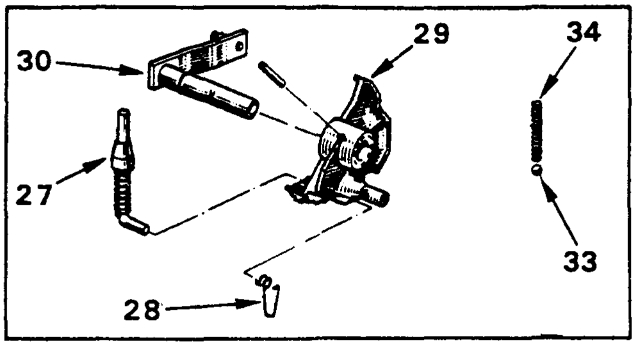
Fit parking pawl (24) and its spring (26) on shaft (25).

NOTE: To limit the movement of parking pawl (24), a shim is placed between the parking pawl and the gear section at (C).

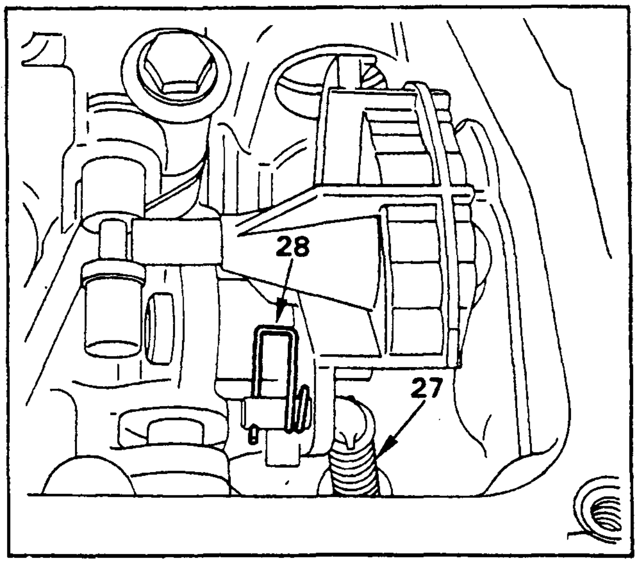


TRANSMISSION REBUILD
REASSEMBLY

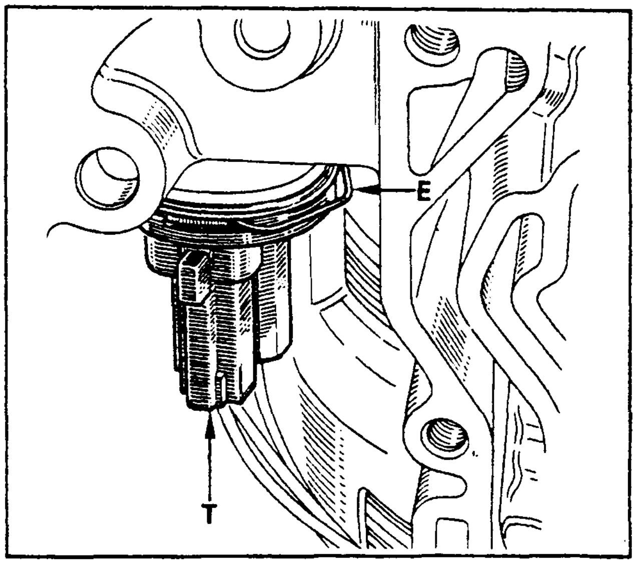
Reassemble: 34 - 33 - 29 - 30 simultaneously, with a new seal and rollpin,



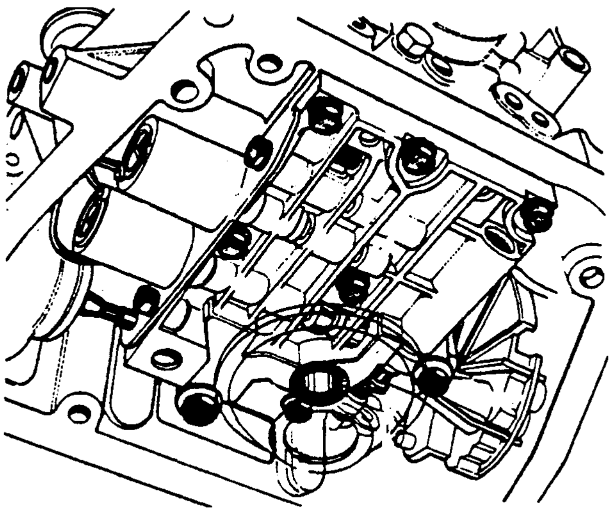
Reassemble 27 and 28.



Attach clip (E) to sealed connector (T) and connect it.



REASSEMBLE:
- the valve body with its two seals and plate;
- torque tighten the valve body bolts in the order indicated (see "Hydraulic Control Unit" in subsection F3).

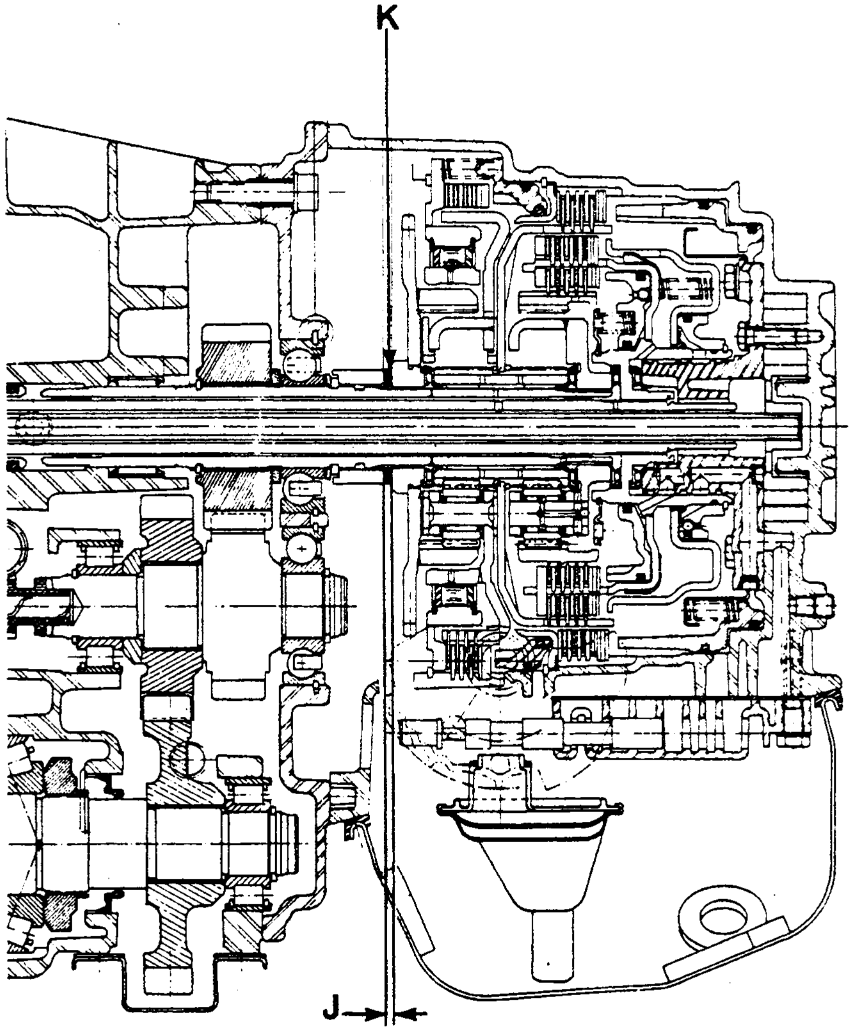


Install the transmission filter screen.

COUPLING TRANSMISSION TO FINAL DRIVE
ADJUSTING THE END FLOAT

The end float is the operating clearance of the gear section of the automatic transmission.

THE AVERAGE CLEARANCE (J) MUST BE 0.8 mm. The end float is adjusted by shim (K) which is a ground shim.



0.8 mm (0.65 - 1.0 mm)

End float (J) is 0.65 mm to 1.0 mm. It is adjusted by thickness of shim (K).

IMPORTANT

The end float must be adjusted when a service exchange transmission section is installed as well as during a transmission or final drive rebuild.

COUPLING TRANSMISSION TO FINAL DRIVE
ADJUSTING THE END FLOAT

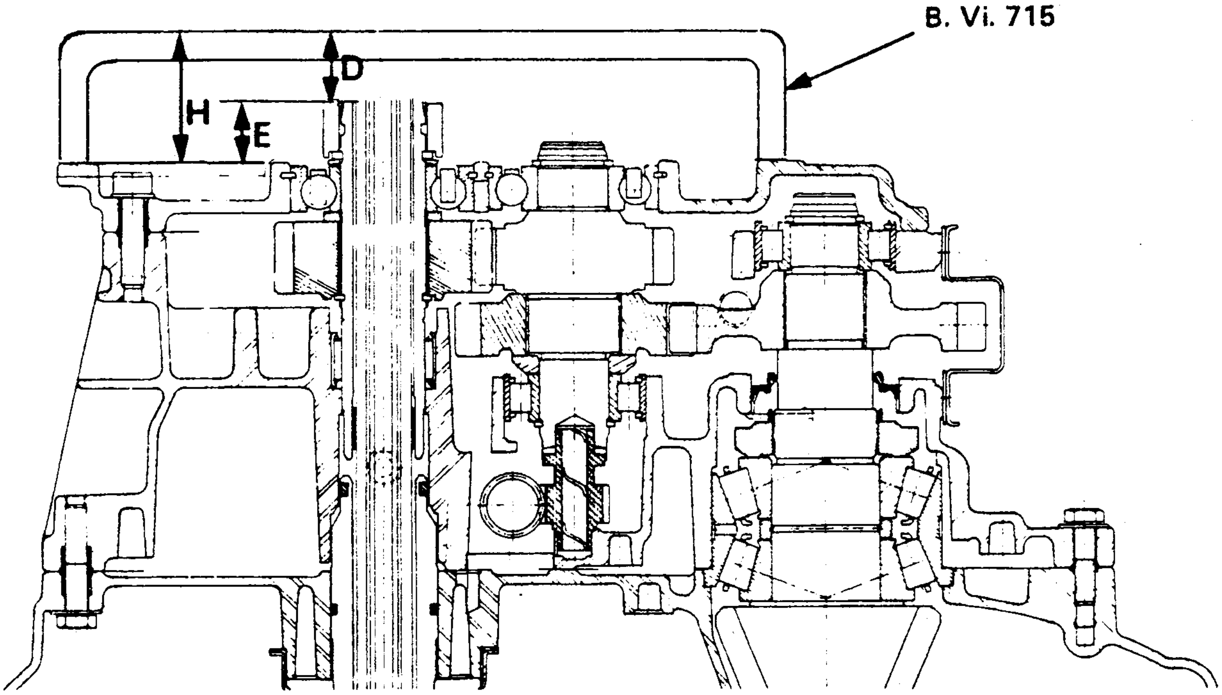
The adjustment is made in 2 stages.

1. Final drive end (shim K removed).

- Place tool B.Vi. 715 (or an accurate straight edge) across the final drive case joint surface as shown.

- Find dimension E, which is the distance from the top edge of the step-down shaft spacer to the case joint surface.

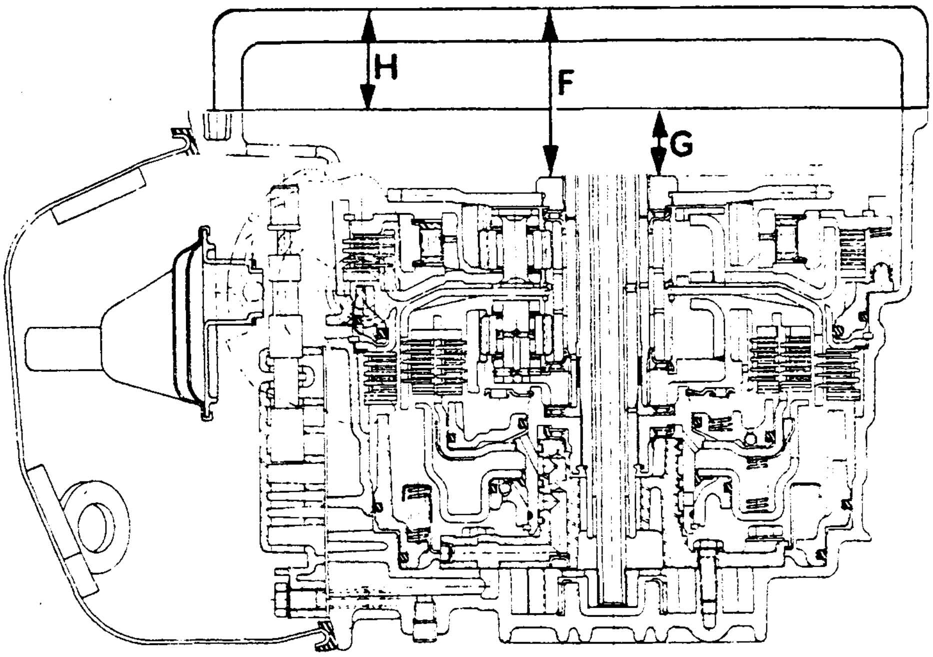
  Zero the dial indicator on the case surface, then move the indicator to the step-down shaft spacer. Record this dimension.



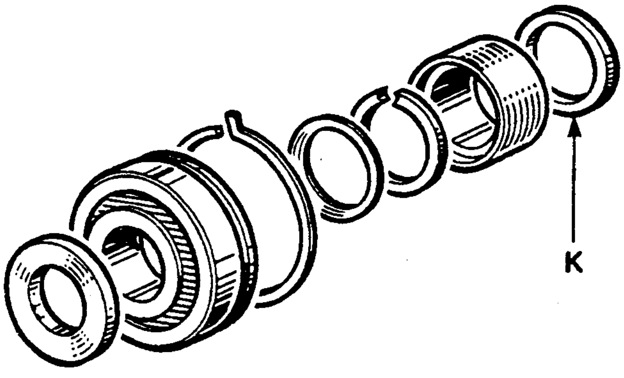
COUPLING TRANSMISSION TO FINAL DRIVE
ADJUSTING THE END FLOAT

2. Transfer case end (Paper gasket in position).

The reverse train clearance must be correct (see F5-21) and the parking pawl wheel correctly installed.



- Find dimension **G,** which is the distance from the park gear hub to the case joint surface. Zero the dial indicator on the park gear hub, then move the indicator to the case surface. Record this dimension.
- Subtract dimension E from dimension G to find the total end play.
  Example: If G is 25.3 mm and E is 22.4 mm, then total end play is 2.9 mm. 25.3 mm - 22.4 mm = 2.9 mm.
- Subtract average end play 0.8 mm (0.65 mm - 1.0 mm) from total end play to find the proper thickness of shim to be used.
  Example: 2.9 mm - 0.8 mm = 2.1 mm
- Select a shim which adjusts end play tolerance closet to 0.8 mm.
- Five thicknesses of shims are available:
  - 0.25 mm
  - 0.7 mm
  - 1.1 mm
  - 1.7 mm
  - 2.3 mm



In our example, you would pick the 2.3 mm shim. This would give 0.7 mm tolerance, which is within the necessary 0.65 mm to 1.0 mm range.

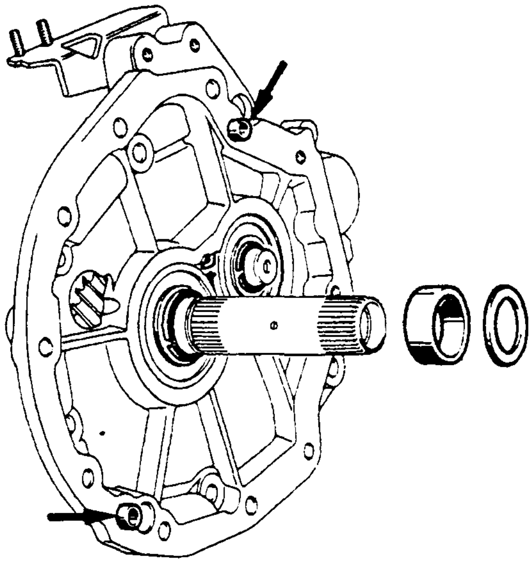
COUPLING TRANSMISSION TO FINAL DRIVE
ADJUSTING THE END FLOAT

Once the adjustment has been made, set the mechanism in the "Park" position.

FINAL REASSEMBLY PROCEDURE

REASSEMBLY

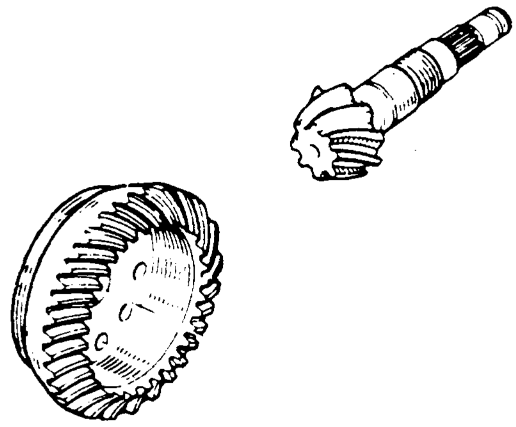
- Check that the 2 dowel bushings are fitted and that their locations are in good condition.
- Clean the case joint faces and coat them with anaerobic sealant compound. Install a replacement paper gasket.
- Secure the transfer case to the final drive case and tighten the bolt to 2.0 daNm (15 lb./ft.)
- Check that the 4 magnets are in place in the fluid pan.
- Mount the pan and torque tighten the bolts to 0.6 daNm (4.5 lb./ft.)



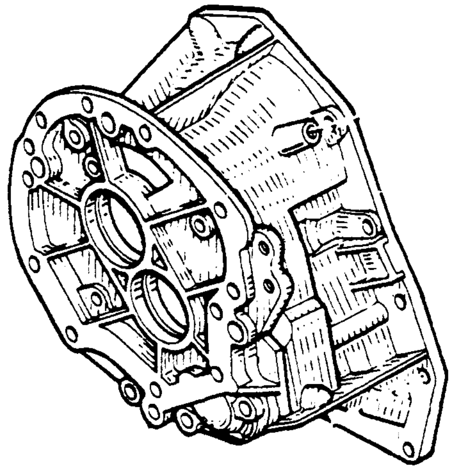
FINAL DRIVE REBUILD
GENERAL INFORMATION

Matching parts

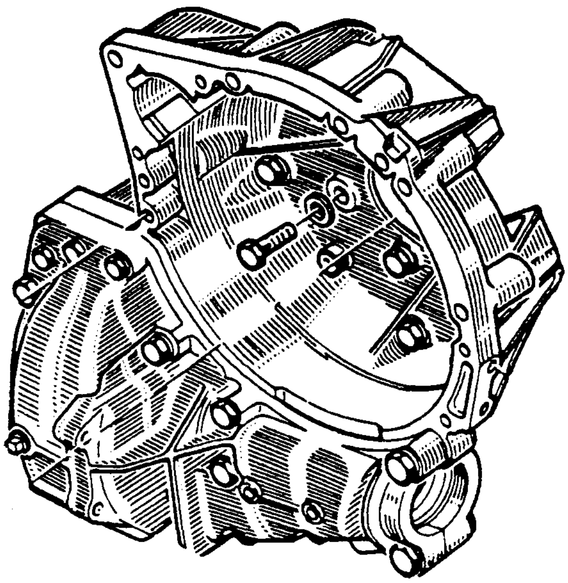
The final drive pinion and ring gear.



The separator case and the step-down case.



The final drive casing and the converter casing.



TIGHTENING TORQUES

Bearing nut on final drive pinion........... 22 daNm (160 lb./ft.)
Bolt securing separator casing to step-down casing 2.5 daNm (18 lb./ft.)
Bolt securing step-down casing to converter casing 2.5 daNm (18 lb./ft.)

FINAL DRIVE REBUILD
GENERAL INFORMATION

Differential/Intermediate Case Gasket

The gasket between the differential bell housing and the intermediate gear case must be replaced each time the transmission is disassembled. The metal shim(s) between the pinion bearing collar and the intermediate gear case must also be replaced at that time, since the shims are matched to the gasket thickness. (Refer to figure 1). Winnebago Part Sales Department has a parts package available which contains 1 gasket and a quantity of shims. Order part number **R77014-64-332** for all transmissions.

NOTE: The quantity of shims provided with each gasket will vary according to the thickness of the gasket. **Always use all shims included in the package.**

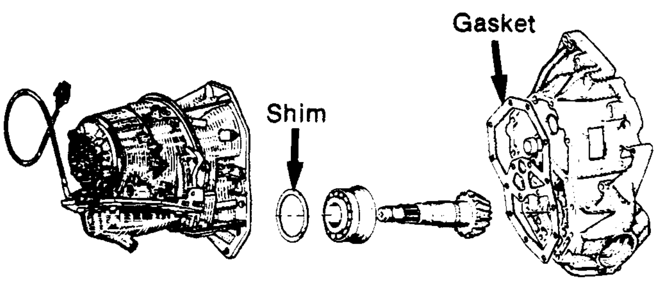


Figure 1

REPAIR PROCEDURE

This procedure allows you to replace the shim(s) without totally disassembling the intermediate section of the transmission. **If total disassembly of the transmission is to be performed regardless, this procedure does not apply.**

The following steps assume that you have already removed the transmission from the vehicle, separated the differential bell housing from the intermediate case, and that the intermediate case is on the bench.

FINAL DRIVE REBUILD
GENERAL INFORMATION

Differential/Intermediate Case Gasket

1. Insert a pry tool or large screwdriver into the rectangular opening on the pinion bearing collar and pry the pinion bearing forward approximately 1/4". Use a wooden slat between the screwdriver and the case to protect the case from damage. (See figure 2).

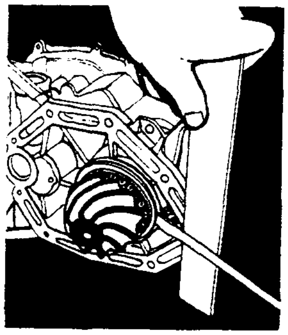


Figure 2

2. Make a cut in the shim(s) using a sharp scissors as shown, (See figure 3). It is important that you use **scissors only** - not "tin snips".

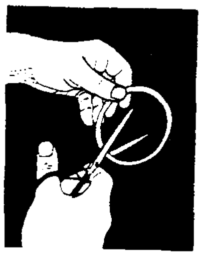


Figure 3

3. Insert the shim(s) between the pinion bearing and the case in the same manner as installing rings on a piston.

NOTE: Use all shims provided in the package.

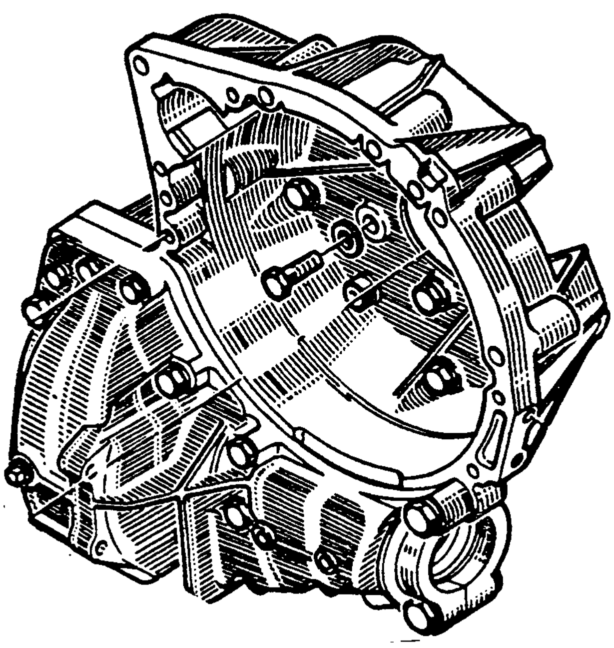
4. Press the pinion gear and bearing back into the case using the heel of your hand or tap lightly with a rubber mallet if necessary.

5. Install the new gasket between the intermediate gear case and the differential bell housing, (See figure 1) then reassemble the transmission.

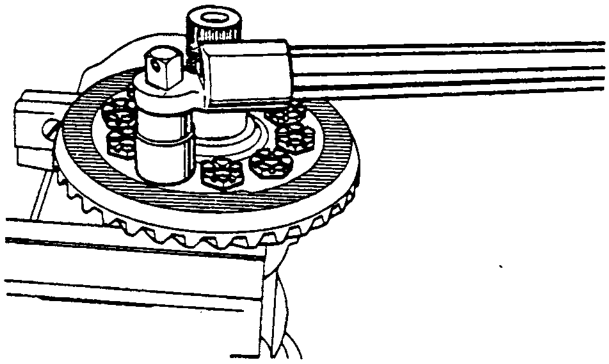
FINAL DRIVE REBUILD
DISASSEMBLY

Dismantling

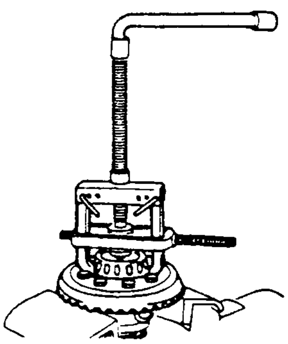
- Separate the converter - final drive housing from the step down housing.
- Mark the position of the differential nut. Remove the final drive half housing.



- Take out the differential.
- Remove the ring gear mounting bolts (they are self-locking bolts that cannot be re-used). Leave two in place, diametrically opposite one another.

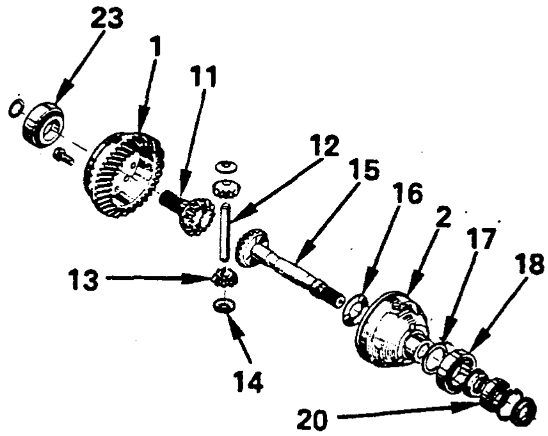


- Extract the three bearings using special tools B.Vi. 28-01 and B.Vi. 48 or a bearing splitter.

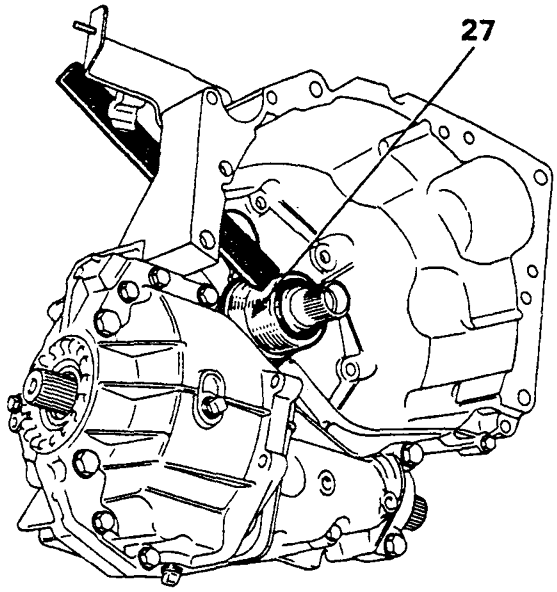


FINAL DRIVE REBUILD
DISASSEMBLY

- Remove parts 11 to 16

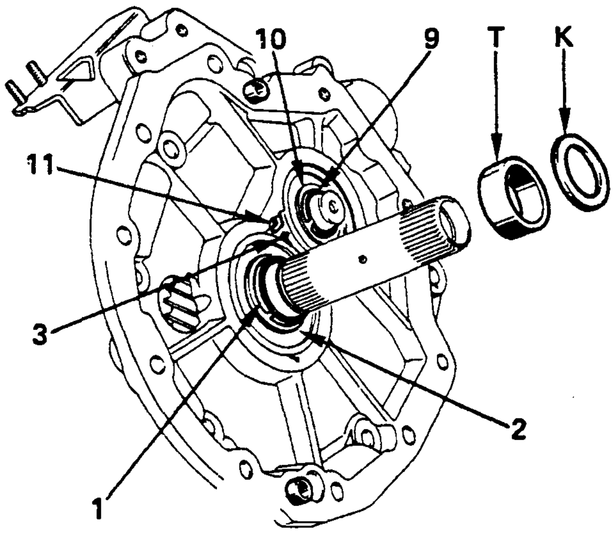


Remove the converter seal (27) using a chisel or a seal removal tool.



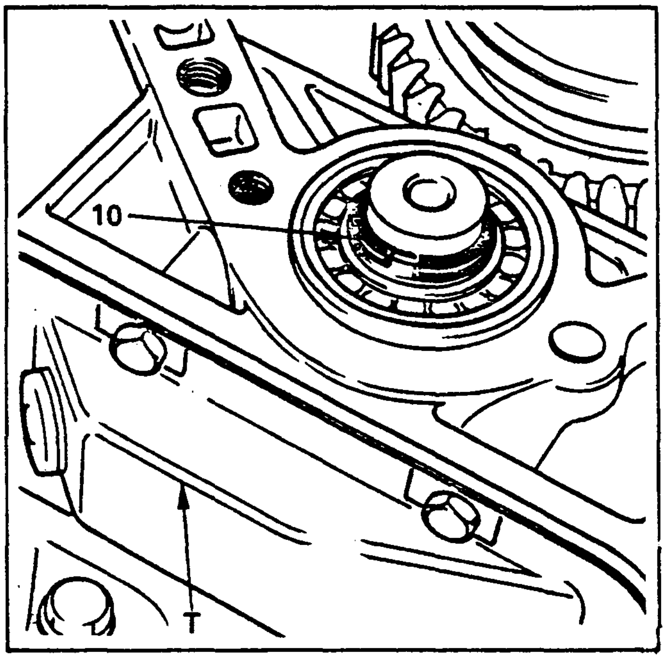
SEPARATOR HOUSING
REMOVE:

- Shim (K) and spacer (T)
- Circlips (1) and (9)
- The bolts securing the separator housing; separate it from the step-down casing.
- Bearings (2) and (10), separating circlips (3) and (11)

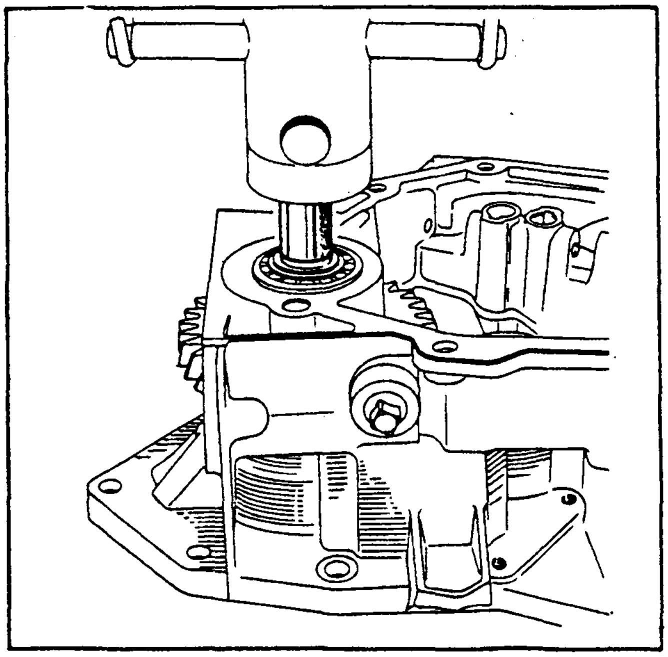


FINAL DRIVE REBUILD
DISASSEMBLY

REMOVING THE FINAL DRIVE PINION
REMOVE:
- the circlip (10),
- the pressed steel cover (T)

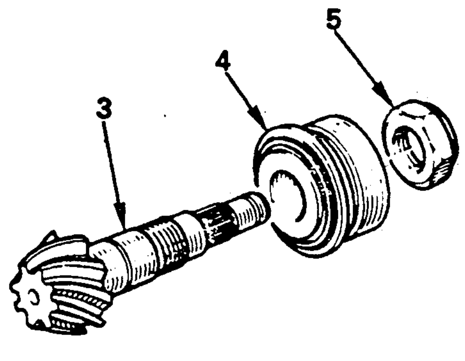


- Push out the pinion on the press.

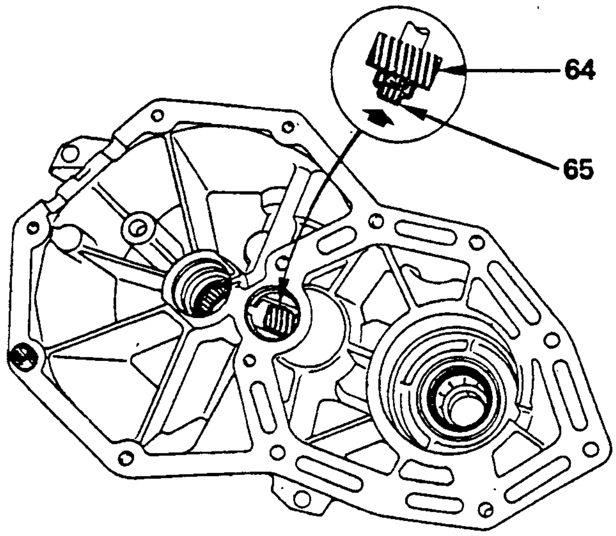


FINAL DRIVE REBUILD
DISASSEMBLY

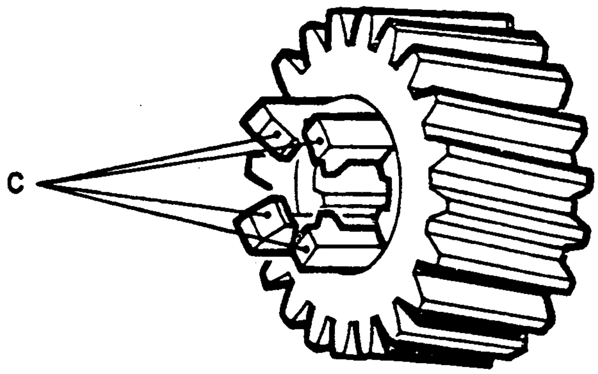
- Unlock the nut (5) and remove it with tool B.Vi. 903.
- Using tools B.Vi. 28-01 and B.Vi. 48, extract the pinion bearing (4).



REMOVE:
- The speedometer drive pinion (64) and its shaft (65).
- Break the lugs (C) that secure the pinion to the shaft.

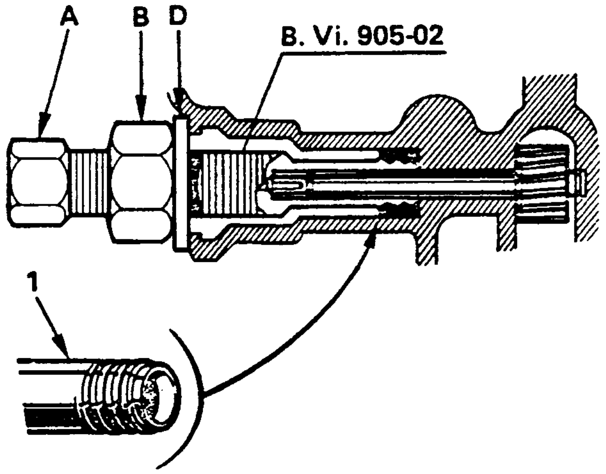


- Remove the shaft
- The pinion must be replaced with a new one each time it is removed.

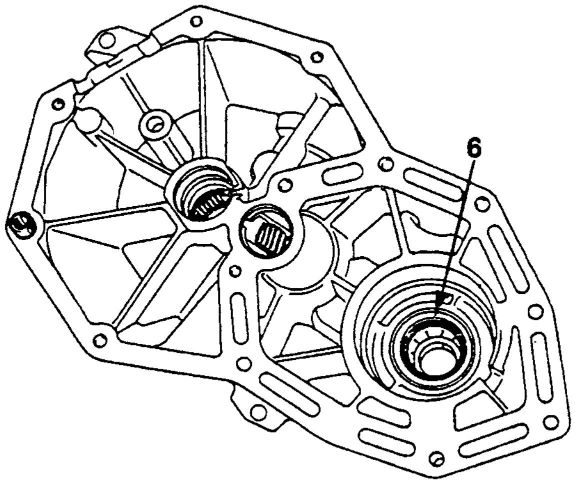


FINAL DRIVE REBUILD
DISASSEMBLY

- Remove the speedometer drive seal using tool B.Vi. 905-02.
- Attach the extractor tool (A) equipped with the nut (B) and the spacer (D).
- Screw in the tool (A) approximately three to four turns after it has made contact with the seal so that the thread (1) enters the rubber.
- Extract the seal by turning the nut (B) while holding the tool (A).



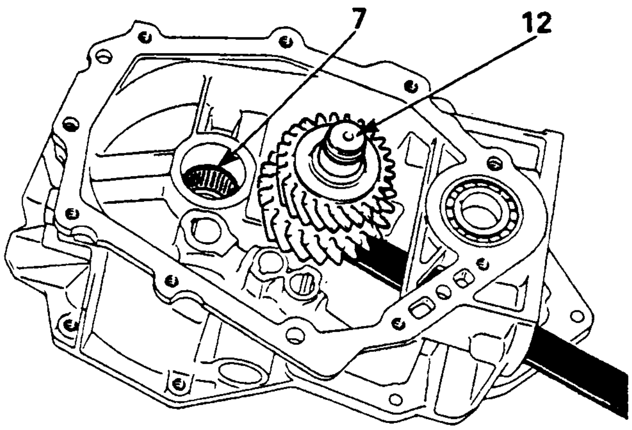
REMOVE:
- The lip seal (6) using tool B.Vi. 465.



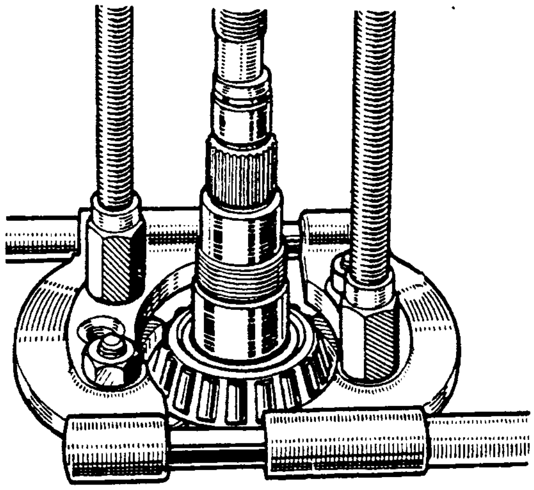
FINAL DRIVE REBUILD
DISASSEMBLY

REMOVE:

- step-down driveshaft (12) using a tool through the inspection cover for leverage.
- needle bearing (7)

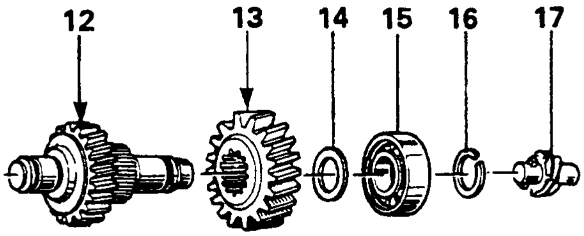


- extract the bearing



- Disassemble step-down drive shaft (12).

Remove parts 12 to 17 (13 and 15 must be removed on the press).



FINAL DRIVE REBUILD
CLEAN AND INSPECT

CLEAN

- All parts with a good grade of cleaning solvent and dry with compressed air.

- Flush final drive oil cooling lines and replace final drive oil filter.

WARNING
Always wear safety goggles when working with compressed air to prevent eye injuries.

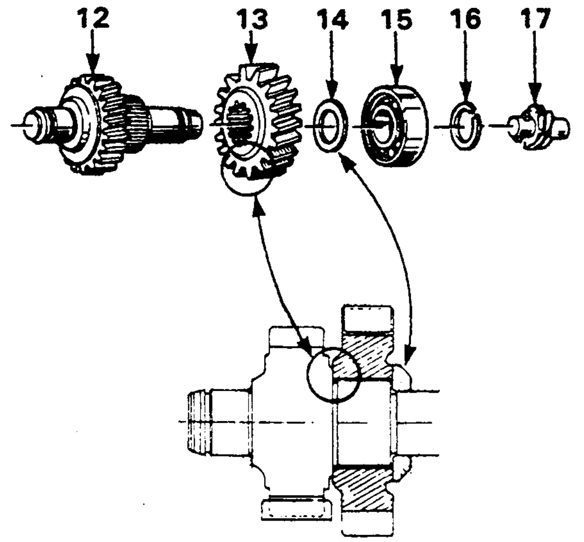
INSPECT

Check that the following are in good condition.

- the gear teeth,
- the bearing locating areas
- the planet wheel washers
- the splines in the differential housing.

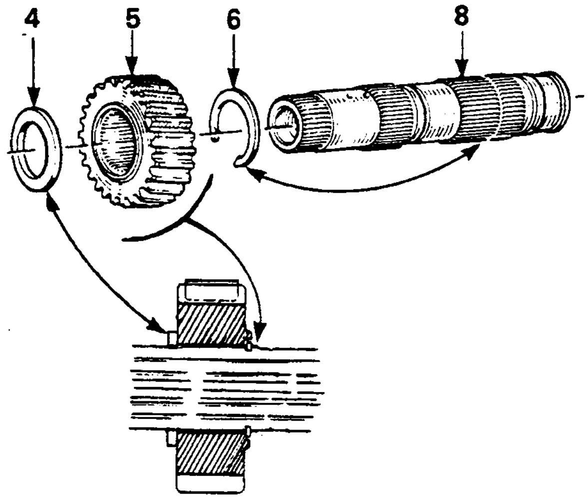
FINAL DRIVE REBUILD
REASSEMBLY

Step-Down drive shaft (12).



Refit:
- parts 12 to 17 (parts 15 and 13 must be installed on the press). Make sure pinion (13) is facing the correct direction.

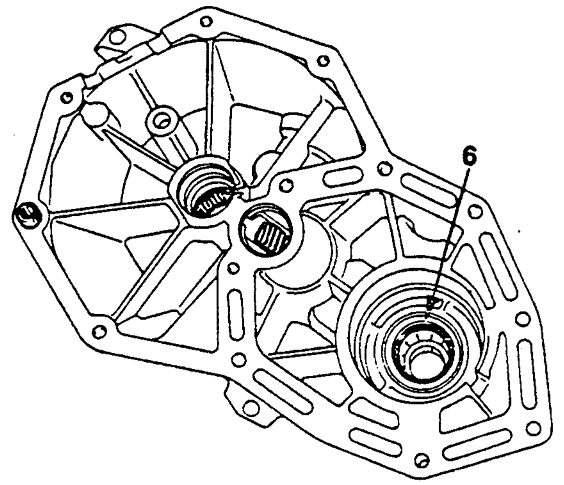
Output shaft (8)



Mount parts 4 to 6 on part 8. Make sure that pinion (5) is facing the correct direction.

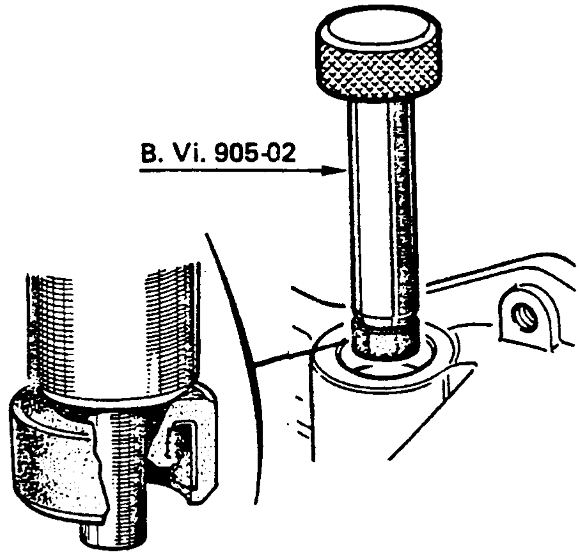
INSTALL:

- Oil the lip seal (6) and install with tool B.Vi. 465.



Insert:

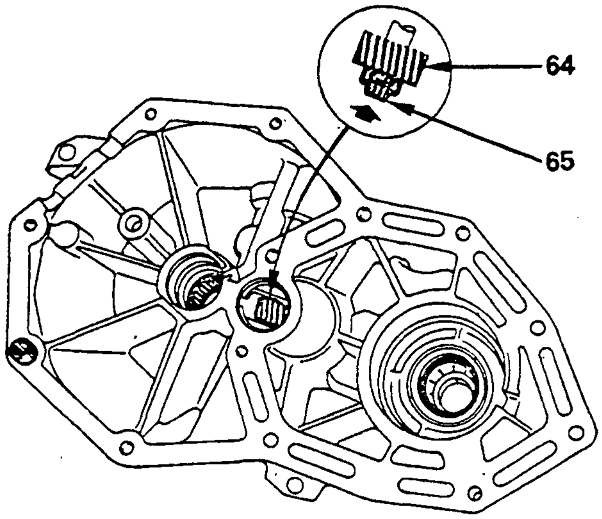
- The speedometer pinion seal ensuring that it is facing the correct direction.
- Use tool B.Vi. 905-02.



FINAL DRIVE REBUILD
REASSEMBLY

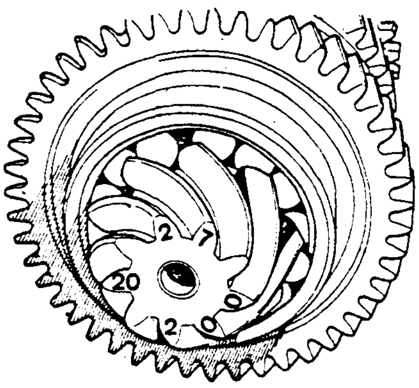
INSTALL:

- The new speedometer drive pinion (64) and its shaft (65) check that the pinion clips correctly into its groove in the shaft).



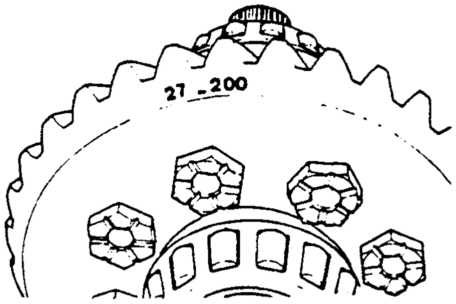
NOTE:

- The ring gear and pinion are matched.
- The same references are marked on both the ring gear and pinion.



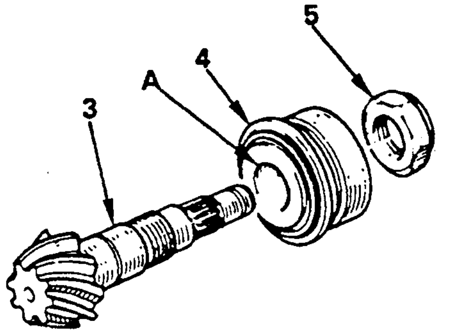
IMPORTANT

- If one of these parts requires replacement, the other must also be replaced.



FINAL DRIVE REBUILD
REASSEMBLY

- Install the bearing (4) on the press with the reference mark (A) toward the final drive pinion.
- Apply 3 drops of "Loctite®" to the threads in the nut.
- Hold the pinion vertically in a vise with soft jaws. Run up the nut (5) and tighten it to a torque of 4 daNm (30 lb./ft.) using tool B.Vi. 903.
- Turn the bearing by hand then tighten the nut to a torque of 22 daNm (160 lb./ft.)

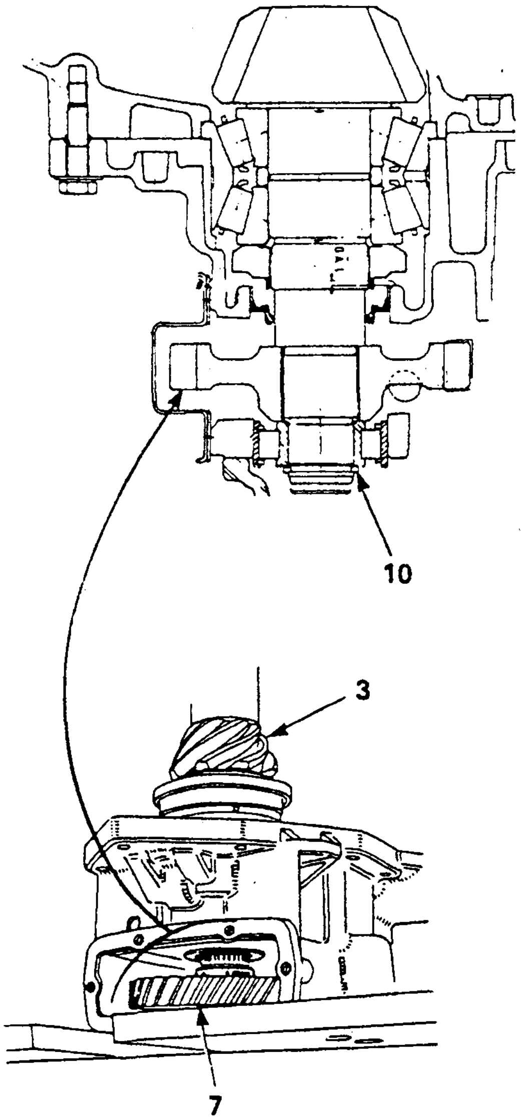


REASSEMBLING THE FINAL DRIVE PINION:

- Install the pinion assembly into the center case. Install the shim first if the gasket/shim set is being used between the case housings. (Refer to "Differential/Intermediate Case Gasket", pages F7-2 and F7-3.)

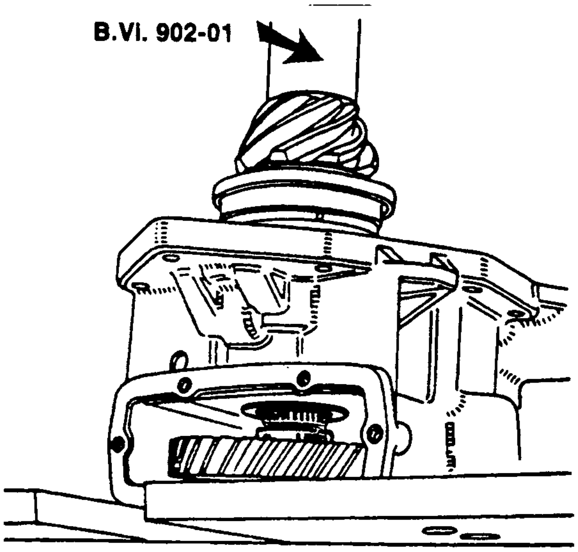
- Mount the gear (7) with its offset toward the cylindrical roller bearing.

- Install the final drive pinion (3) on the press.

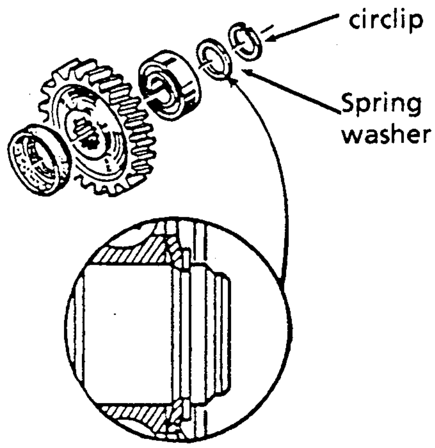


FINAL DRIVE REBUILD
REASSEMBLY

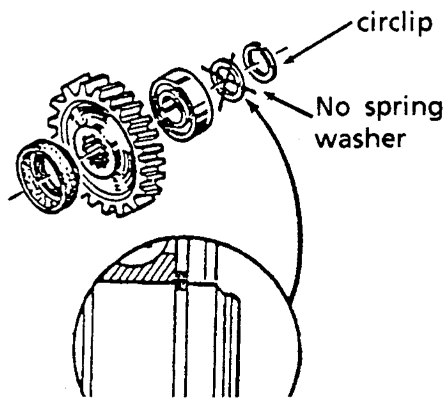
Assemble:
- the cylindrical roller bearings,
- the spring washer (1st type only), ensuring that it is the correct way round.
- the circlip using tool B.Vi. 902-01.
- ensure that it is located correctly.



1st Type:
- Circlip thickness = 1.5 mm
- Assembly includes spring washer



2nd Type:
- Circlip thickness = 2.0 mm
- Does NOT use spring washer
- Pinion tail shaft is 2 mm shorter
- Groove is located 1.6 mm further ahead and is widened to 2.5 mm.

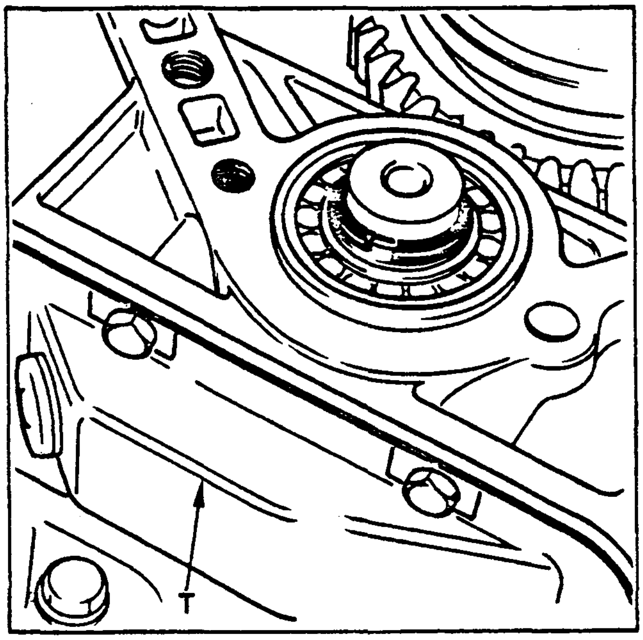


FINAL DRIVE REBUILD
REASSEMBLY

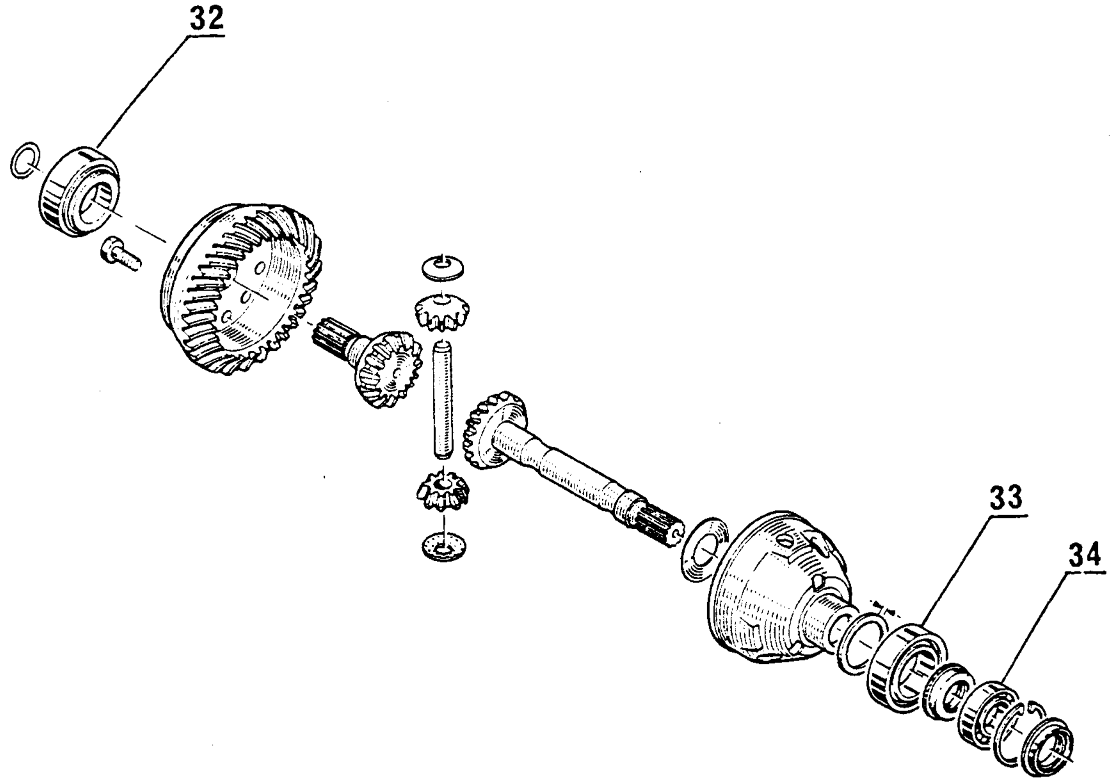
- Attach the pressed steel cover (T) with the drain plug on the opposite side to the filter plug (coat the gasket with gasket seal compound).

Tighten the bolts to a torque of 1.5 daNm (11 lb./ft.)

- Install the drain plug with a new sealing ring when applicable.



DIFFERENTIAL



FINAL DRIVE REBUILD
REASSEMBLY

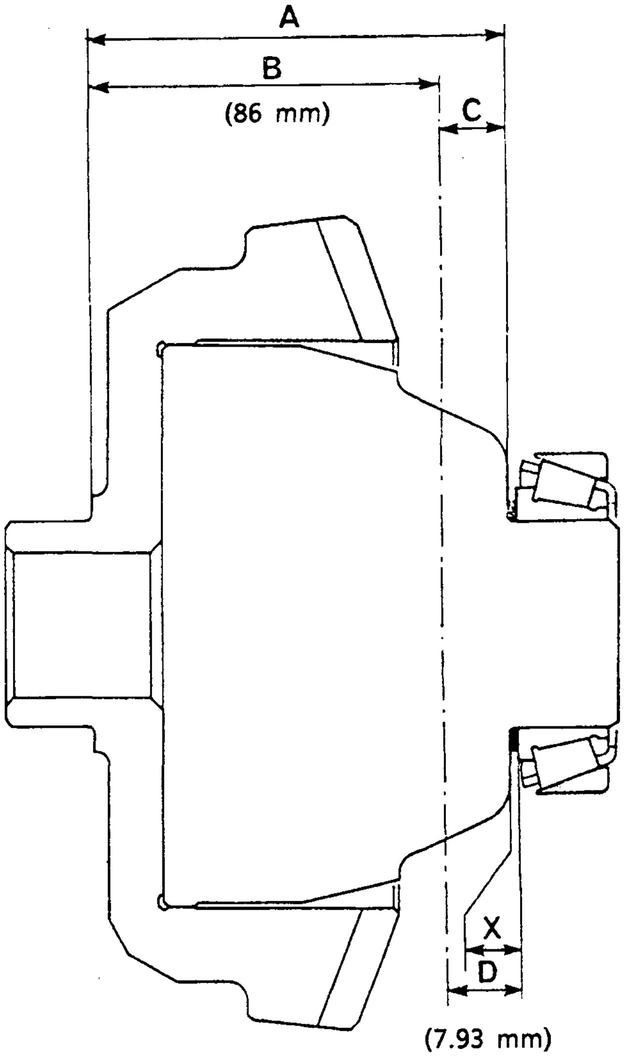
ADJUSTING BACKLASH

Backlash cannot be measured after the gearbox is assembled. It must be adjusted when the differential bearings are mounted.

PROCEDURE
Assemble the differential housing and ring gear using 3 bolts.

- Use an accurate calipers to measure dimension A, the distance between bearing thrust surfaces on the differential gear assembly. Record this dimension.
- Subtract B (86 mm for all differentials) from dimension A. The result is dimension C.
  Example: If A is 93 mm, then 93 - 86 = 7 mm
- Subtract dimension C from D (7.93 mm for all differentials) to determine dimension X, which is the proper backlash adjustment.
  Example: 7.93 - 7 = .93 mm backlash
- Select a shim to use between the bearing and differential housing, which adjusts backlash closest to dimension X.
- Three thicknesses of shims are available:
  - 0.8 mm
  - 1.0 mm
  - 1.2 mm

In our example, you would choose the 1 mm shim, which would be only .07 mm over .93 mm. The .8 mm shim would be .13 mm too close.



- Place the proper shim between the bearing and differential housing.

- Fit the bearings usings a press.
  The larger bearing goes on the ring gear end of the differential assembly.

Mount the ring gear to the differential housing using new bolts.

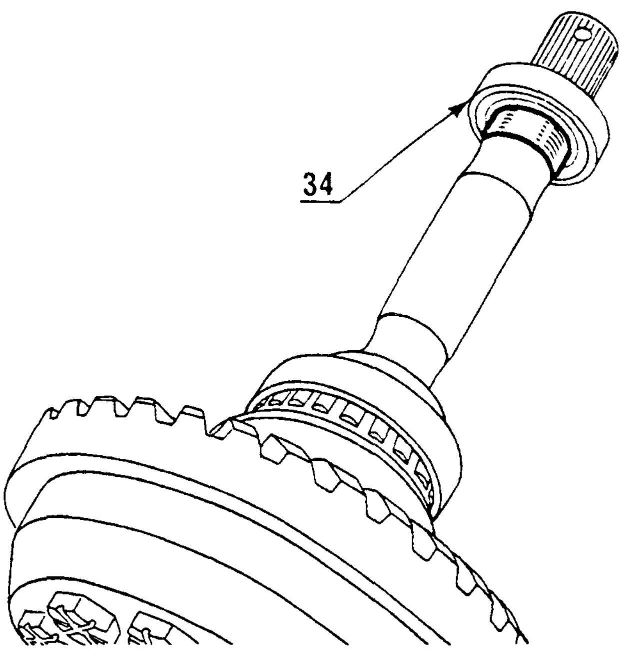
Torque tighten the ring gear bolts.

Press the ball bearing on the shaft (34) a few millimeters at the planetary gear end to center it.

Lift up the assembly to the differential housing (bearing (34) not being in its working position.)

Coat the half-casing joint faces with an anaerobic sealer, fit the other half-casing and assemble them with several bolts.

Hand tighten these bolts only at this stage.



Mount the differential ring nut with its seals and its threads coated with gasket sealer using castellated wrench B.Vi. 645.

Tighten the right nut until it contacts the differential bearing outer race.

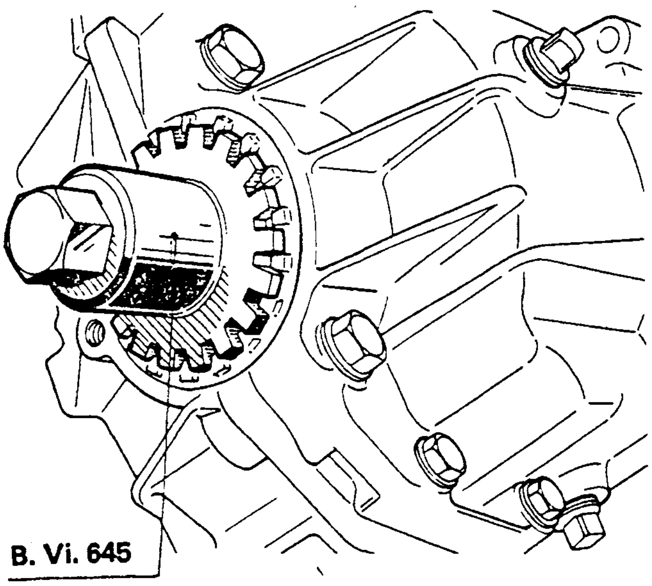
Complete the assembling of ball bearing (34) driving it on until it touches shoulder (E) in the casing.

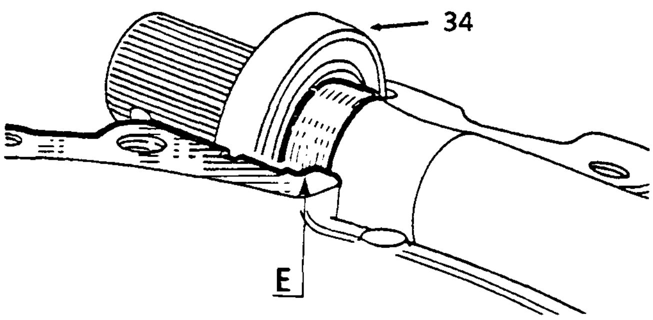
Unscrew the differential ring nut one half-turn.

Torque tighten the casing bolts.

Place the following at the planetary gear end:

- the circlip
- and the plastic bushing.





ADJUSTING DIFFERENTIAL BEARING PRE-LOAD

Rotate the differential assembly to seat the bearings.

Place the tip of the torque measuring tool, B.Vi. 906, against the outer edge of one tooth of the ring gear.

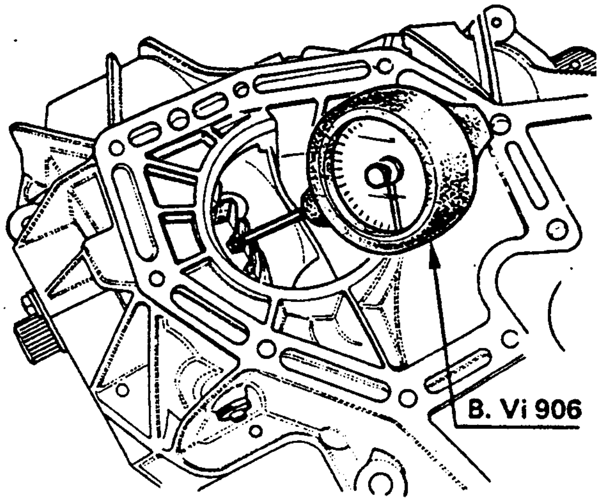
Press against the ring gear tooth to rotate the differential in the forward direction. (Bearing roller-to-cage play will give a false reading if rotated in reverse.)

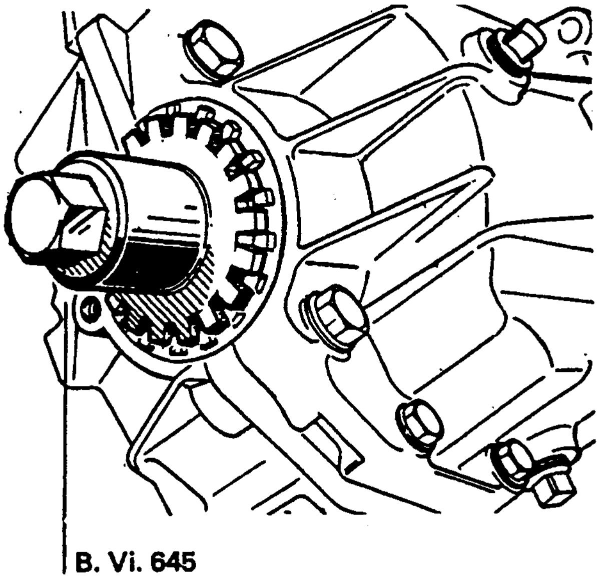
When the ring gear rotates, remove the tool and read the torque indicated by the red pointer.

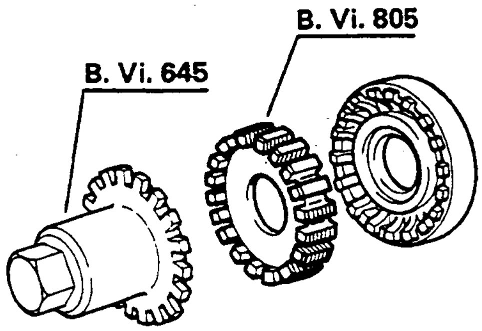
Screw the differential ring nut in or out to obtain a reading of: 2 to 2.5 daNm

NOTE: The specification 2 to 2.5 daNm represents the pressure required for ring gear movement as measured with tool B.Vi. 906, not the actual torque applied at tool B.Vi. 645.

- Adapter B.Vi. 805 must be used with wrench B.Vi. 645 when removing or replacing a 3-lip seal nut to avoid damaging the outer lip.
- When the correct adjustment has been obtained, lock the nut with its locking washer.



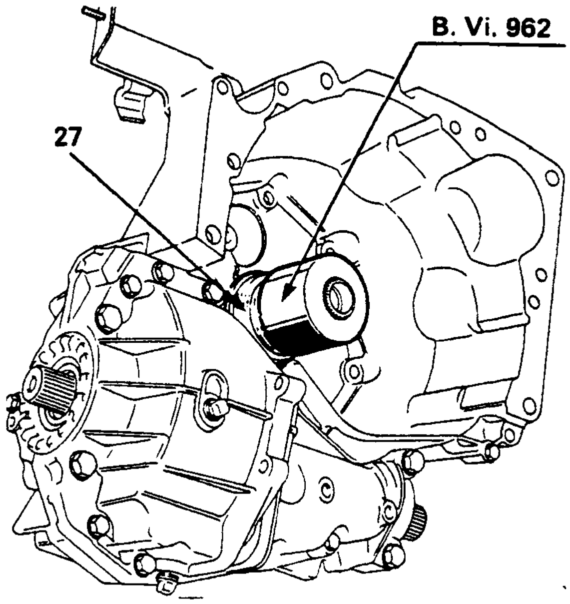




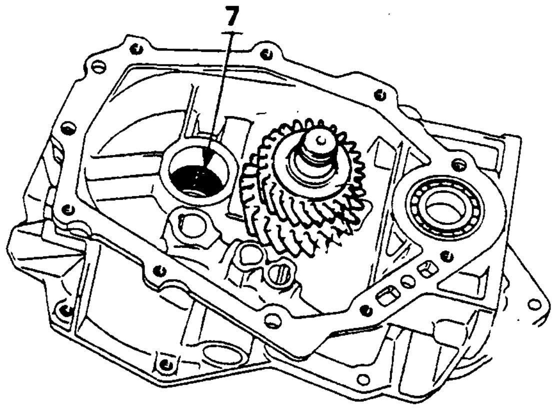
FINAL DRIVE REBUILD
REASSEMBLY

INSTALL:

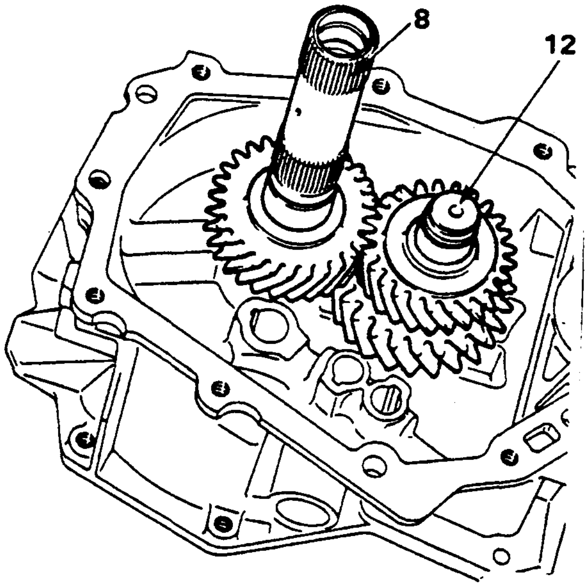
- Torque converter seal (27). Use tool B.Vi. 962 - see page F3-16 for procedure.



- Press the needle bearing as indicated (7) and recess to a dimension of 37 mm (1.45 in).

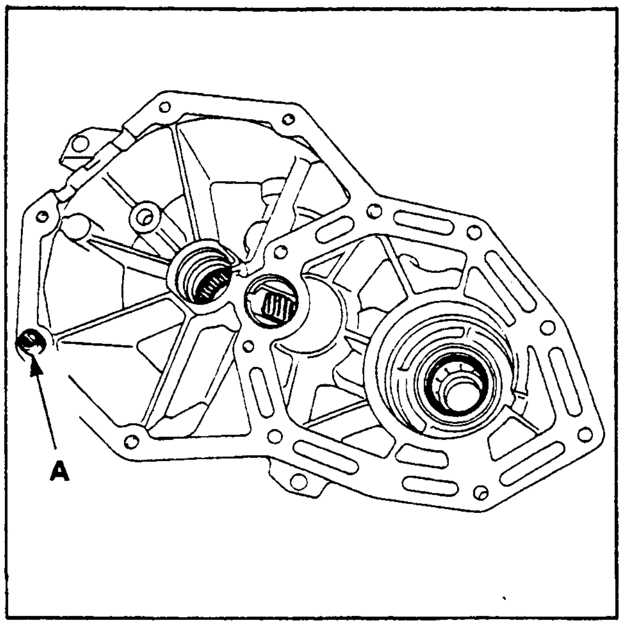


- step down drive shaft (12).
- output shaft (8).

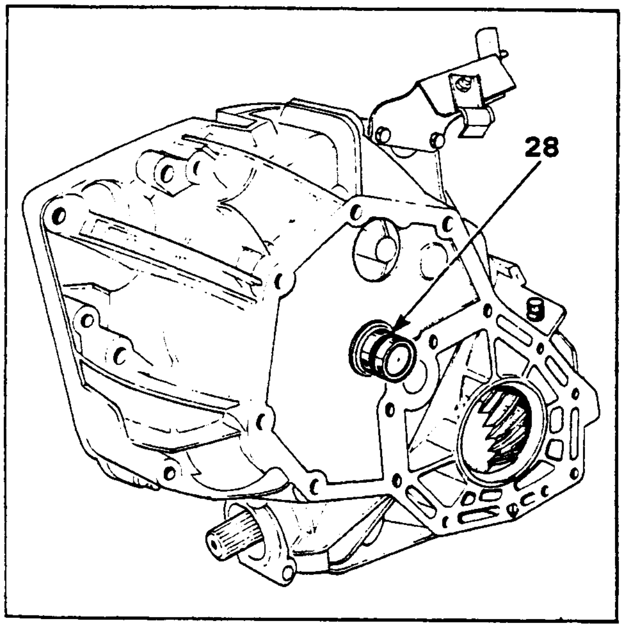


FINAL DRIVE REBUILD
REASSEMBLY

Before attaching the step-down casing to the converter/final drive casing, check that locating dowel (A) and O-ring (28) are in position. Use the gasket-shim package described on page F7-2.



ATTENTION:
The two bolts under the stator shaft must be coated with silicone sealant (see page F1-10, item B).

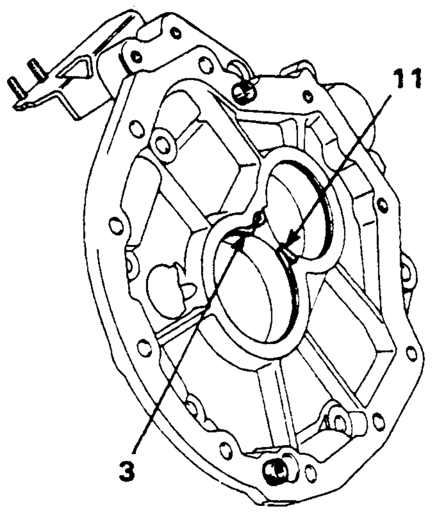


FINAL DRIVE REBUILD
REASSEMBLY

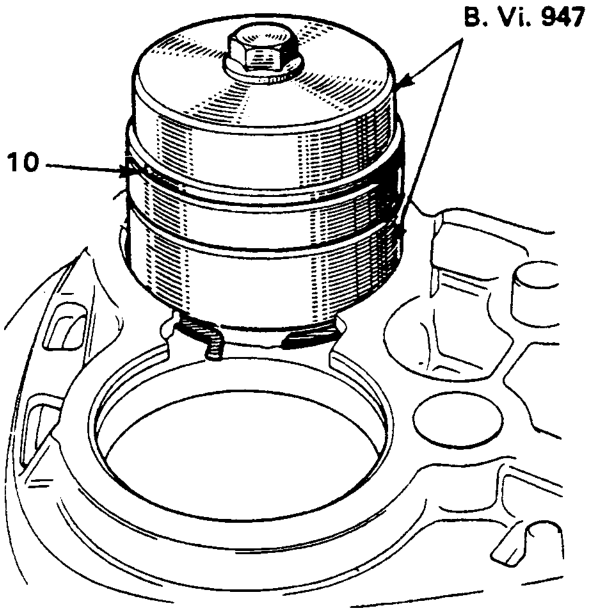
REASSEMBLING THE SEPARATOR HOUSING

INSTALL:

- circlips (3) and (11) with the notches on the same side.

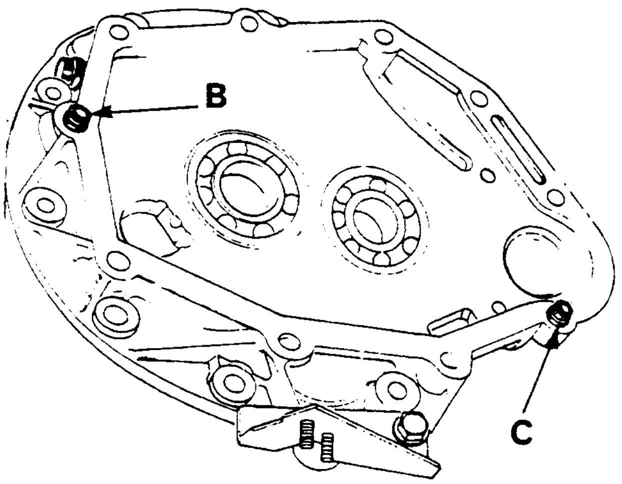


- bearing (10) using tool B.Vi. 947.
- bearing (2), inserting a piece of strap iron to keep the circlip open.



Make sure that the circlips are correctly positioned in the bearing grooves.

Before attaching the separator housing to the step-down casing, check that the 2 locating dowels (B) and (C) are present and install the paper seal (it must be installed dry).



FINAL DRIVE REBUILD
REASSEMBLY

IMPORTANT
All the separator housing bolts must be coated with anaerobic sealer before being installed.

INSTALL:
- washer (28),
- circlip (1) (bringing it under groove (G) to output shaft (8).

Use tool B.Vi. 959 to position circlip (1) in its groove:

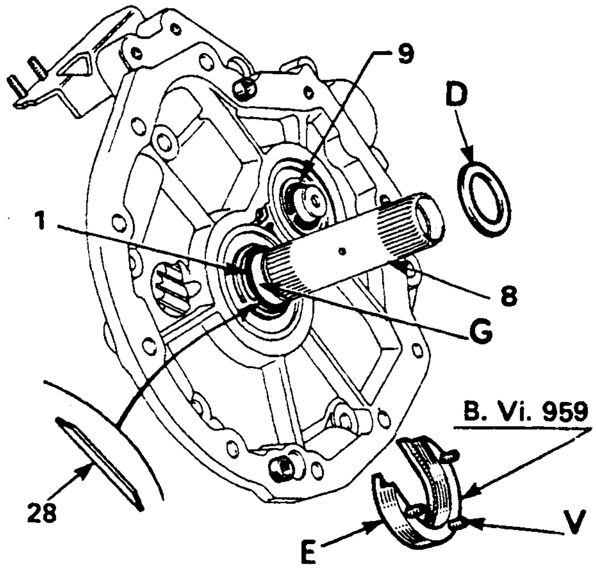
- fit washer (D) from the tool on the circlip,

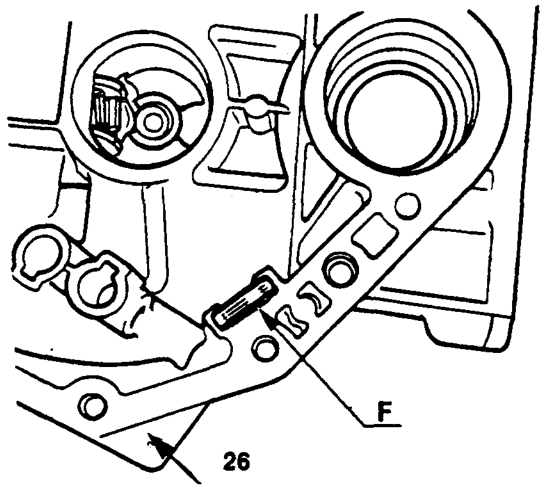
- place crescent piece (E) in the tooling groove (G) and tighten the three bolts (V) until circlip (1) enters its groove.

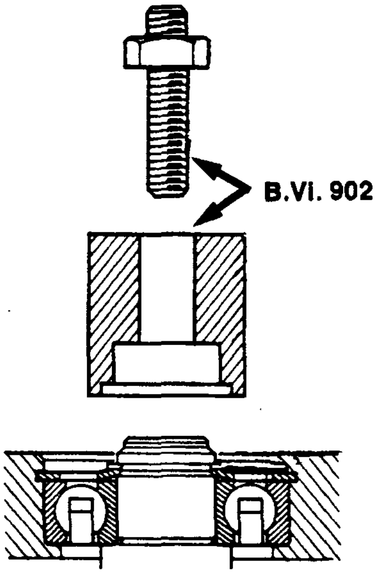
Make sure that (1) is positioned correctly.

Refit:
- circlip (9) using tool B.Vi. 902-01 (keep the output shaft in position through the inspection cover);
- center housing (26) equipped with its seal (cap towards the bottom) and its magnet (F).

See Subsection 6 for assembling the gear section casing to the separator casing.







FINAL DRIVE OIL COOLING SYSTEM

All 1987 and later vehicles are equipped with a final drive oil cooler.

The final drive cooling system consists of seven main components:

1. an oil-to-water cooler incorporated into the radiator
2. an electrical oil pump
3. an in-line oil filter assembly
4. a final drive oil thermoswitch
5. oil lines
6. a timer-relay
7. a circuit breaker

Principle of Operation

1. When the final drive oil reaches 248°F (120°C) the thermoswitch, mounted into the lower front of the final drive case, triggers a timer-relay which turns on the electric oil pump. (Since the electrical components are connected directly to the battery through the alternator, this can take place even while the ignition key is off.)
2. The timer-relay allows the pump to operate for a minimum cycle of 3 minutes after starting. The timer-relay is mounted on the EGR Control bracket behind the driver side headlight. (See Figure 1.)
3. The oil is circulated from the bottom of the final drive case to an in-line oil filter* and the pump assembly. The filter and pump are located on the driver side frame rail beside the engine. *The oil filter is designed for the life of the vehicle **unless** final drive or pump failure occurs. In this case, the system must be flushed and the filter replaced.
4. The oil travels from the pump to an oil cooler incorporated into the radiator and returns to the final drive case. (See Figure 2.)

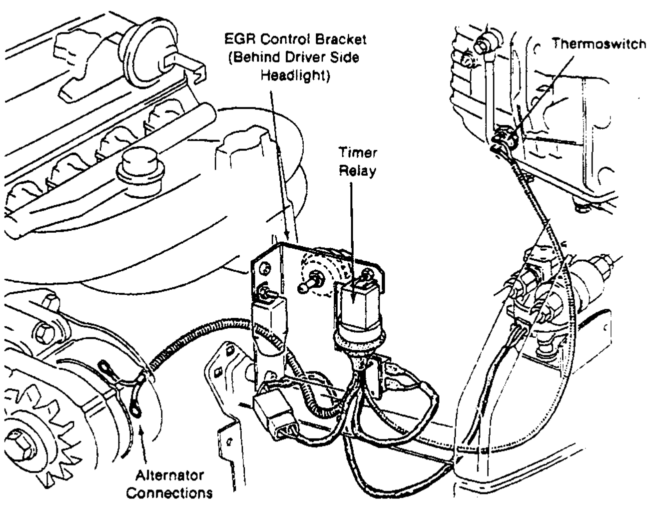


Figure 1

*Pipe (A) must always slope upward from pump inlet to prevent loss of prime.

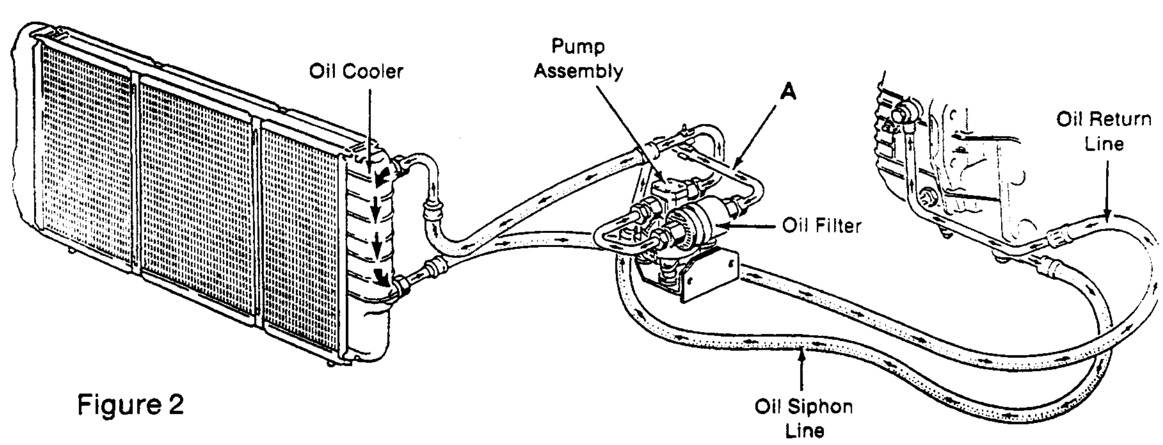


Figure 2

FINAL DRIVE OIL COOLING SYSTEM

5. The pump will shut off after 3 minutes if the oil temperature has cooled to below 248°F. If the oil temperature has not cooled sufficiently, the pump will continue to run until the oil temperature is reduced to below 248°.

6. The system's electrical supply is connected directly to the alternator. It is protected by a 20-amp circuit breaker, which is also mounted on the EGR Control bracket (See Figure 3.)

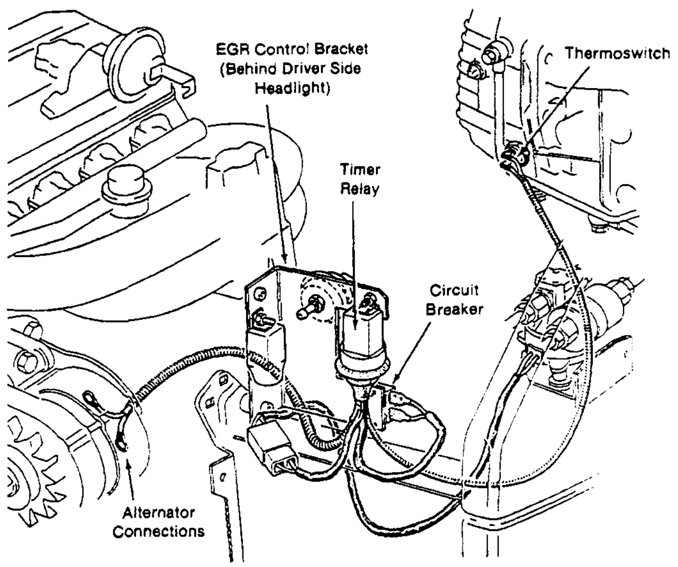


Figure 3

FINAL DRIVE OIL CHANGE

The final drive oil must be replaced periodically according to the intervals listed on the segment of the Chassis Maintenance Schedule listed below.

Operation	Miles x 1000	1	5	10	15	20	25	30	35	40	45	50
Final Drive Oil		R	I	I	R	I	I	R	I	I	R	I
Manual Trans. Oil		R	I	I	R	I	I	R	I	I	R	I
Auto Trans. Fluid		R	I	I	R	I	I	R	I	I	R	I

I = Inspect - add if necessary
R = Replacement required

FINAL DRIVE OIL COOLING SYSTEM

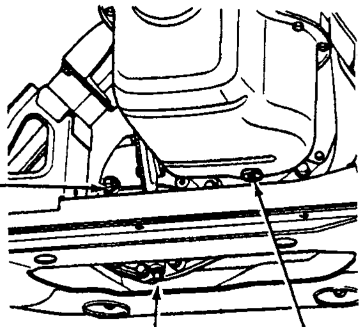
PROCEDURE

1. Remove the final drive plug and allow adequate time for the old oil to drain.

2. Reinstall the drain plug.

3. Remove the fill plug and add gear oil until it just begins to flow back out of the hole. Use only gear oil which meets or exceeds API-GL5 standards. The temperature/viscosity recommendations are as follows:
   15°F (-10°C) and above: SAE 80W-90
   Below 15°F (-10°C): SAE 75W

4. Reinstall the fill plug.



When replacing a system component only, such as the differential, radiator, oil line, oil filter or the pump, the system must be reprimed with oil. Only in this event, perform these additional steps **after following steps 1-4 above:**

NOTE: This procedure should not be performed unless the temperature of the oil in the differential is at least 50°F. The pump will not operate properly due to the thickness of the oil if the temperature is below this point.

5. Disconnect the black and the violet thermoswitch leads and briefly "touch" them together using a test lead or similar wire. The pump will then operate for a 3-minute cycle. (The pump will "whine" while operating due to the greater viscosity of the cooler oil. This is normal.)

CAUTION
If the pump makes an abnormally shrill, siren-like noise while operating, check for plugged or pinched oil lines. If the pump does not stop after 3 minutes, the thermoswitch or the timer-relay may be faulty.

6. When the pump stops, add the necessary amount of oil through the final drive fill hole to bring it up to the required level.

FINAL DRIVE OIL COOLING SYSTEM

ELECTRICAL TROUBLESHOOTING

Figure 5 shows the electrical circuitry for the cooling system. Figure 6 illustrates the electrical components and their relative locations on the vehicle.

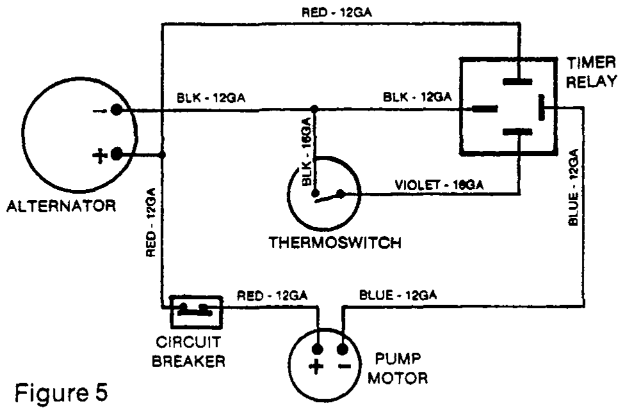


Figure 5

You will note in the diagram that the pump motor is grounded through the timer-relay. This means that, when the system is off, both wires to the pump will be "hot". When the system turns on, the blue wire will become the ground connection to the pump.

The thermoswitch is preset to close its contacts at 248°F (120°C). The final drive oil does not normally reach this temperature except under extreme load or temperature conditions. If an owner should report that his pump seems to never run, it may be due to light-duty usage of the vehicle by the owner.

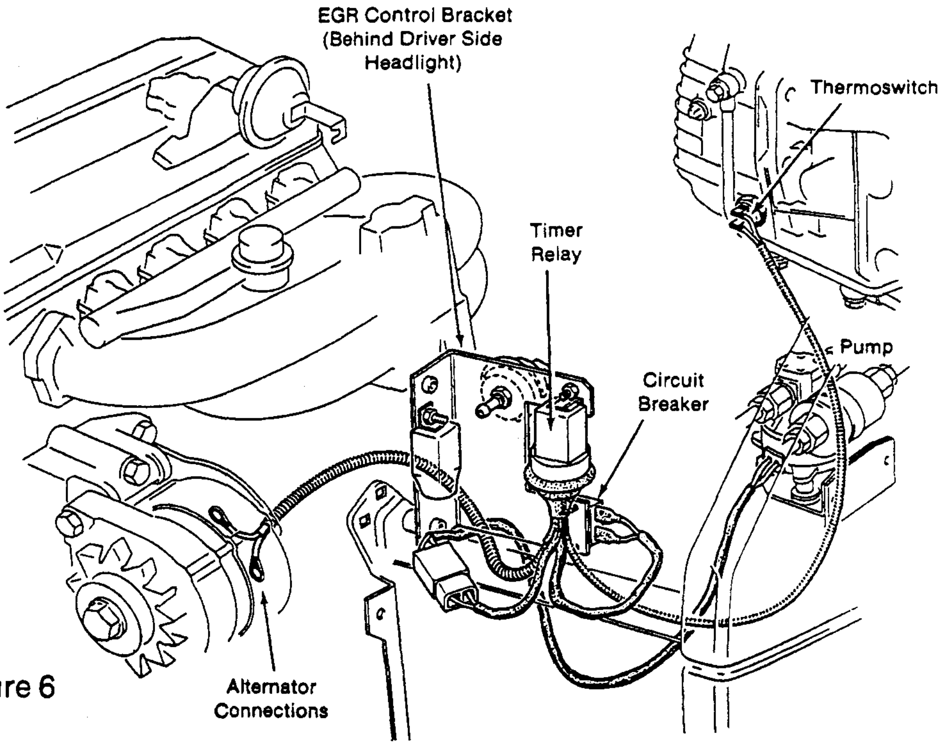


Figure 6

FINAL DRIVE OIL COOLING SYSTEM

TROUBLESHOOTING

NOTE: Since this system is connected directly to the battery through the alternator, testing may be done with the ignition key in the OFF position. Always disconnect the negative terminal of the battery while replacing an electrical component.

The following troubleshooting procedures assume a final drive oil temperature of 50°F - 120°F.

If the Pump Does Not Run:

1. Disconnect the thermoswitch wires and touch them together briefly.
2. If the motor runs, the thermoswitch may be defective.
3. If the motor does not run, check the power supply connections at the alternator for corrosion or looseness.
4. If the alternator connections are OK, check the circuit breaker by making a connection across the terminals of the circuit breaker.
5. If the pump motor runs, the circuit breaker is defective. If the motor still does not operate, the pump motor itself may be faulty.
6. Double check the pump motor by attaching the red wire to positive voltage and the blue wire to ground. If the pump does not run, the pump assembly should be replaced.

If the Pump Keeps Running and Does Not Stop:

1. Disconnect the thermoswitch contacts and wait 3 minutes for the timer-relay to shut the pump off.
2. If the pump shuts off after 3 minutes, the thermoswitch is defective.
3. If the pump continues to run after 3 minutes, the timer-relay is defective.

EXTERNAL SEAL REPLACEMENT
DIFFERENTIAL SEAL

REMOVAL:

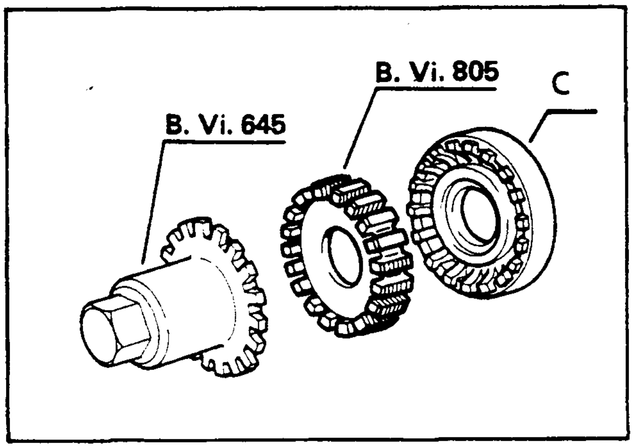
Drain the final drive case.

Disconnect the transmission shaft at the final drive end.

Mark the position of the adjusting nut (C) in relation to the housing.

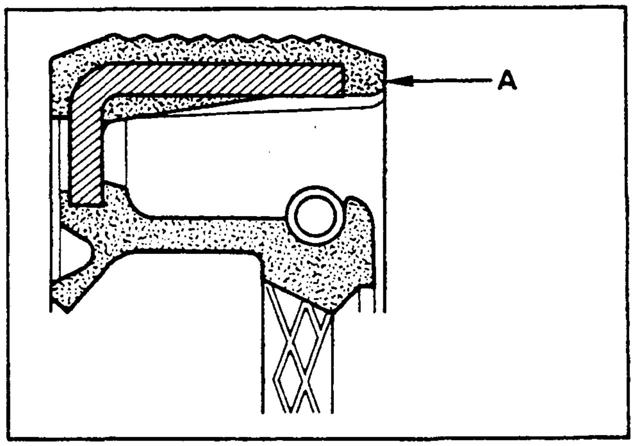
Remove the locking washer.

Unscrew the nut, counting the number of turns. Use tools B.Vi. 805 and B.Vi. 645.

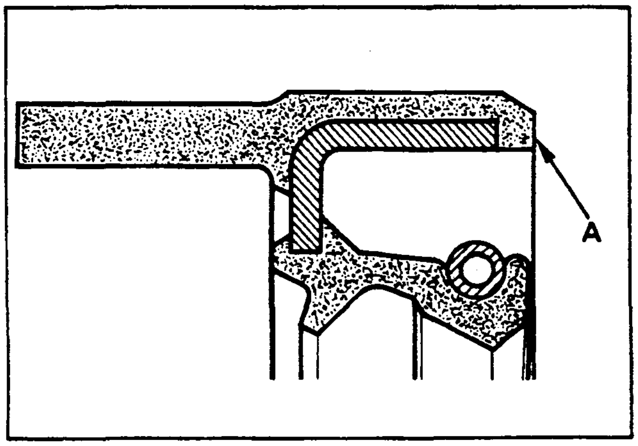


Replace either the seal only or the nut/seal assembly.

1st ARRANGEMENT: Seal with 2 lips.



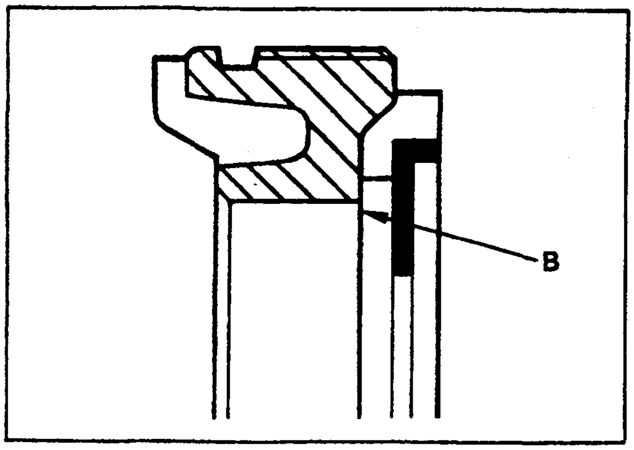
2nd ARRANGEMENT: Seal with 3 lips



EXTERNAL SEAL REPLACEMENT
DIFFERENTIAL SEAL

It is essential to use tool B.Vi. 805 in addition to B.Vi. 645 to remove or refit the nut when the seal is of the 2nd type in order not to damage the outer lip.

Whatever the type of seal, face A must be flush with the inner face of nut B.



NOTE: The 3 lip seal can be fitted as a replacement for the 2 lip seal.

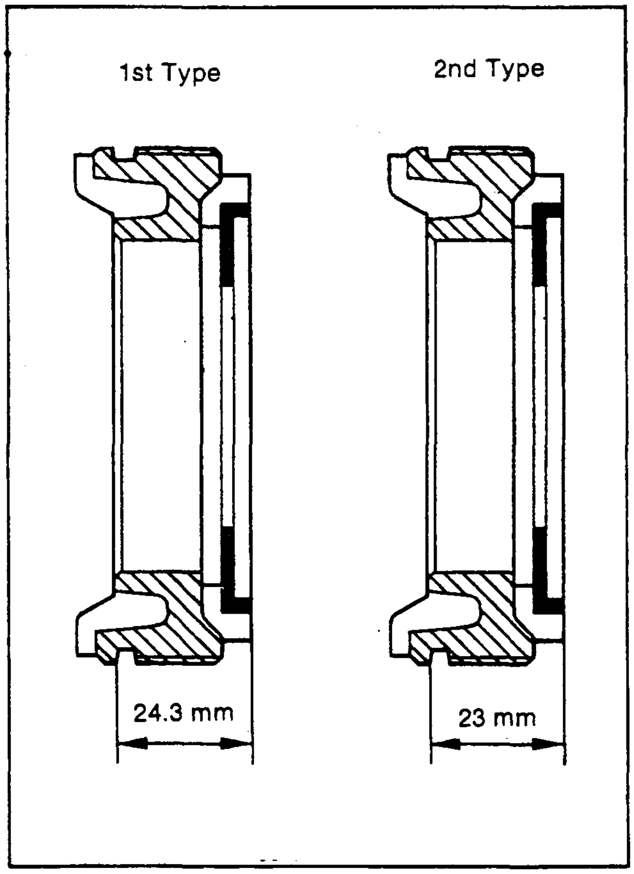
REFITTING:
Refit the nut, equipped with a new, oiled O-ring, screwing it in by the number of turns and aligning it with the marks made during dismantling.

Refit the locking washer.

Reconnect the transmission shaft.

Fill the final drive housing.

NOTE: There are two types of differential nuts. The O-ring groove is offset.



When replacing a nut, use the same type of arrangement which was originally fitted.

When replacing the housing, a nut of the second type must be used.

EXTERNAL SEAL REPLACEMENT
SPEEDOMETER SHAFT SEAL

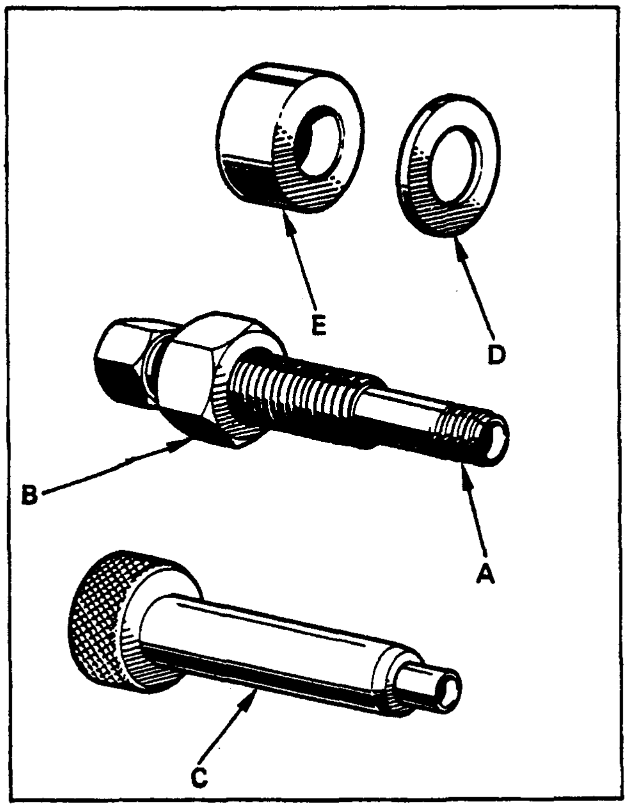
The speedometer shaft seal is replaced using tool B.Vi. 905 which comprises:

- a seal extractor (A) fitted with a nut (B).

- a seal fitting tool (C).

- a thin spacer (D).

- spacer (E) is not used.



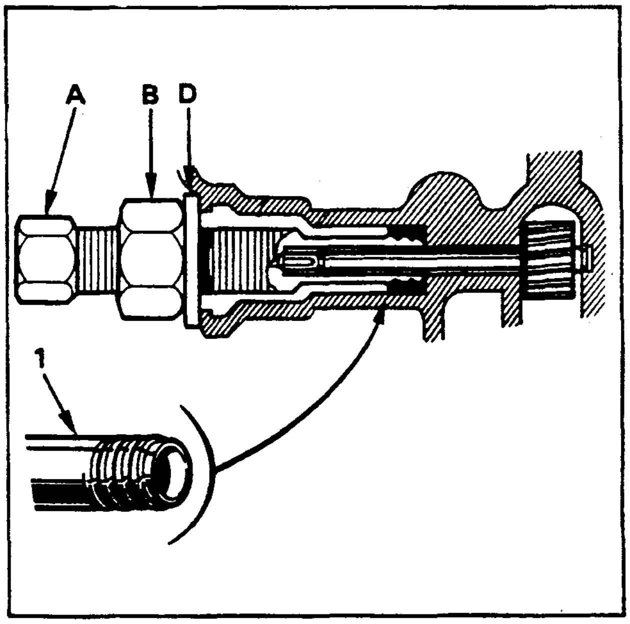
REMOVING

Disconnect the speedometer drive cable from the gearbox.

Fit the extractor tool (A) equipped with nut (B) and spacer (D).

Screw the tool (A) in by approximately three turns after it has made contact with the seal so that its thread (1) penetrates the rubber.

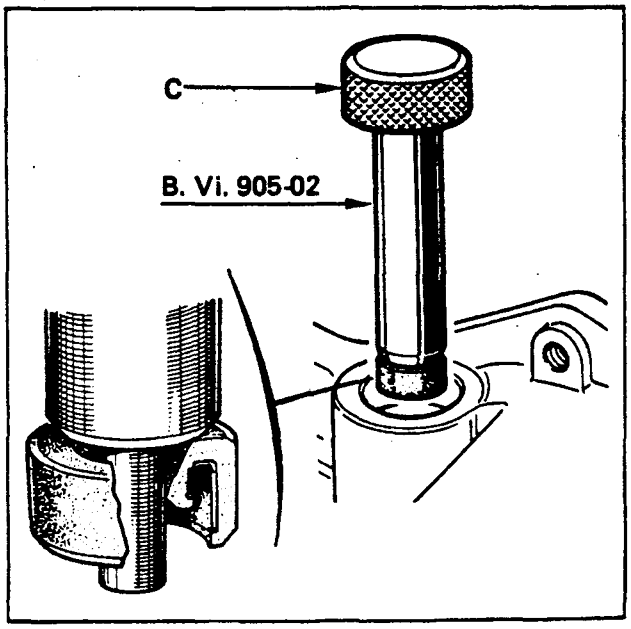
Extract the seal by screwing in the nut (B) while holding the tool (A).



EXTERNAL SEAL REPLACEMENT
SPEEDOMETER SHAFT SEAL

INSTALLATION

Place the seal on tool (C), ensuring that the seal is facing the correct way, and tap the end of the tool.



SECTION "G"

5-SPEED GEARBOX (TRANSAXLE)

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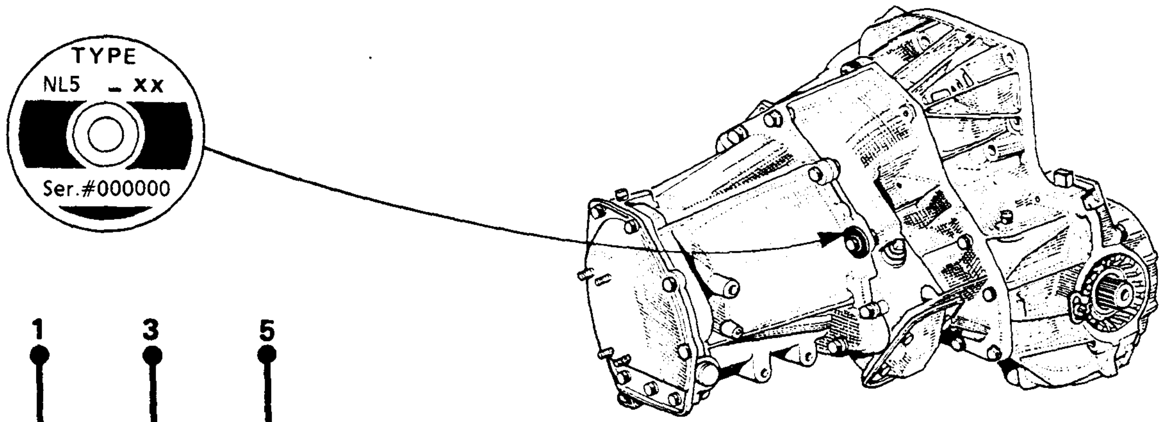
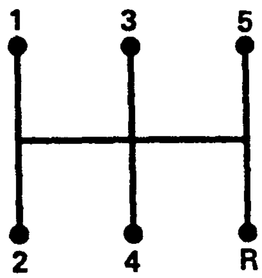
GENERAL INFORMATION
SPECIFICATIONS

The type, suffix and fabrication number are stamped on a plate secured by a casing bolt. (See below) Always use this when ordering replacement parts.





5 forward synchronized speeds:
1st - 2nd - Renault synchro
3rd - 5th Borg-Warner synchro

Oil

Type	API-GL 5 or MIL-L-2105 B or C
Viscosity	Above 32°F (-10°C): SAE80W-90 Below 32°F (-10°C): SAE75W
Capacity	Gearbox: 2.6 qts. (2.5 liter) Final Drive: 1.16 qt. (1.1 liter)

- The clutch shaft oil seal can only be removed after the gearbox has been removed and opened.
- The hubs are free-turning on the secondary shaft and limited in sliding movement by snap rings.
- The pinion protrusion cannot be adjusted.
- Adjustment of the ring gear and pinion backlash and differential bearing pre-load are unique to this type of gearbox. (See page G3-22.)

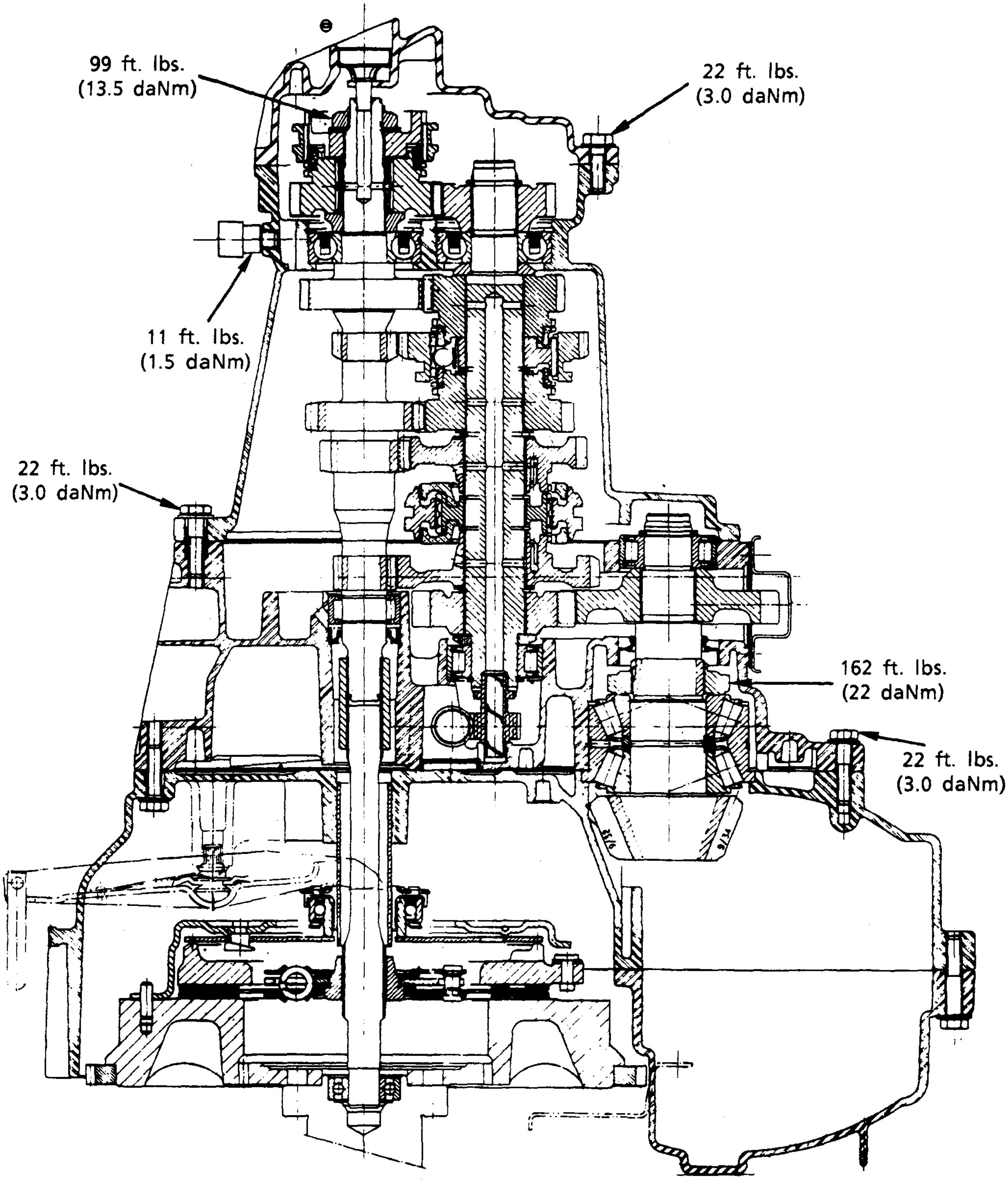
GENERAL INFORMATION
SPECIFICATIONS

IMPORTANT

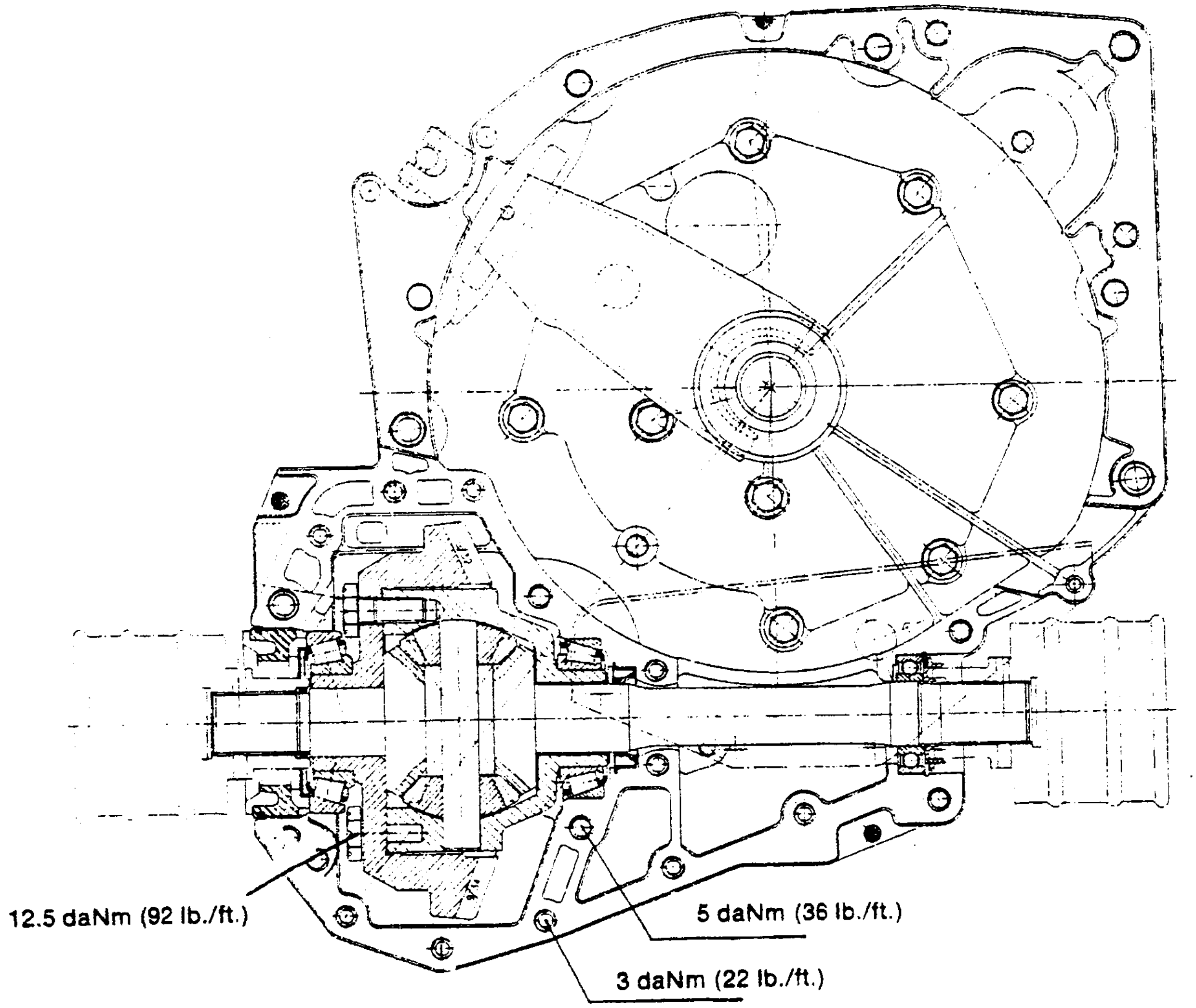
The following parts must be changed routinely whenever a gearbox is overhauled:

- all paper gaskets
- all lip-type oil seals
- rollpins
- speedo drive worm gear
- all circlips and snap rings.

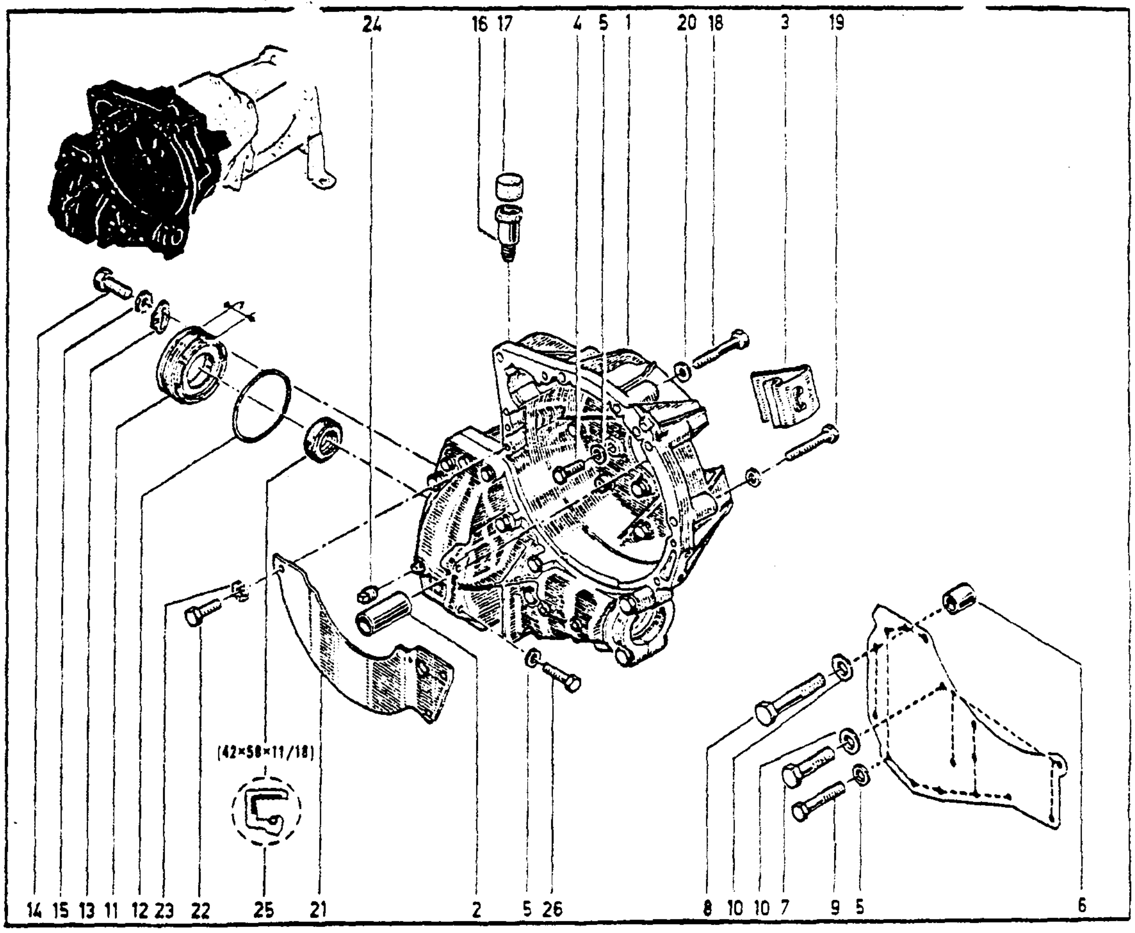
NL5


99 ft. lbs.
(13.5 daNm)
22 ft. lbs.
(3.0 daNm)
11 ft. lbs.
(1.5 daNm)
22 ft. lbs.
(3.0 daNm)
162 ft. lbs.
(22 daNm)
22 ft. lbs.
(3.0 daNm)

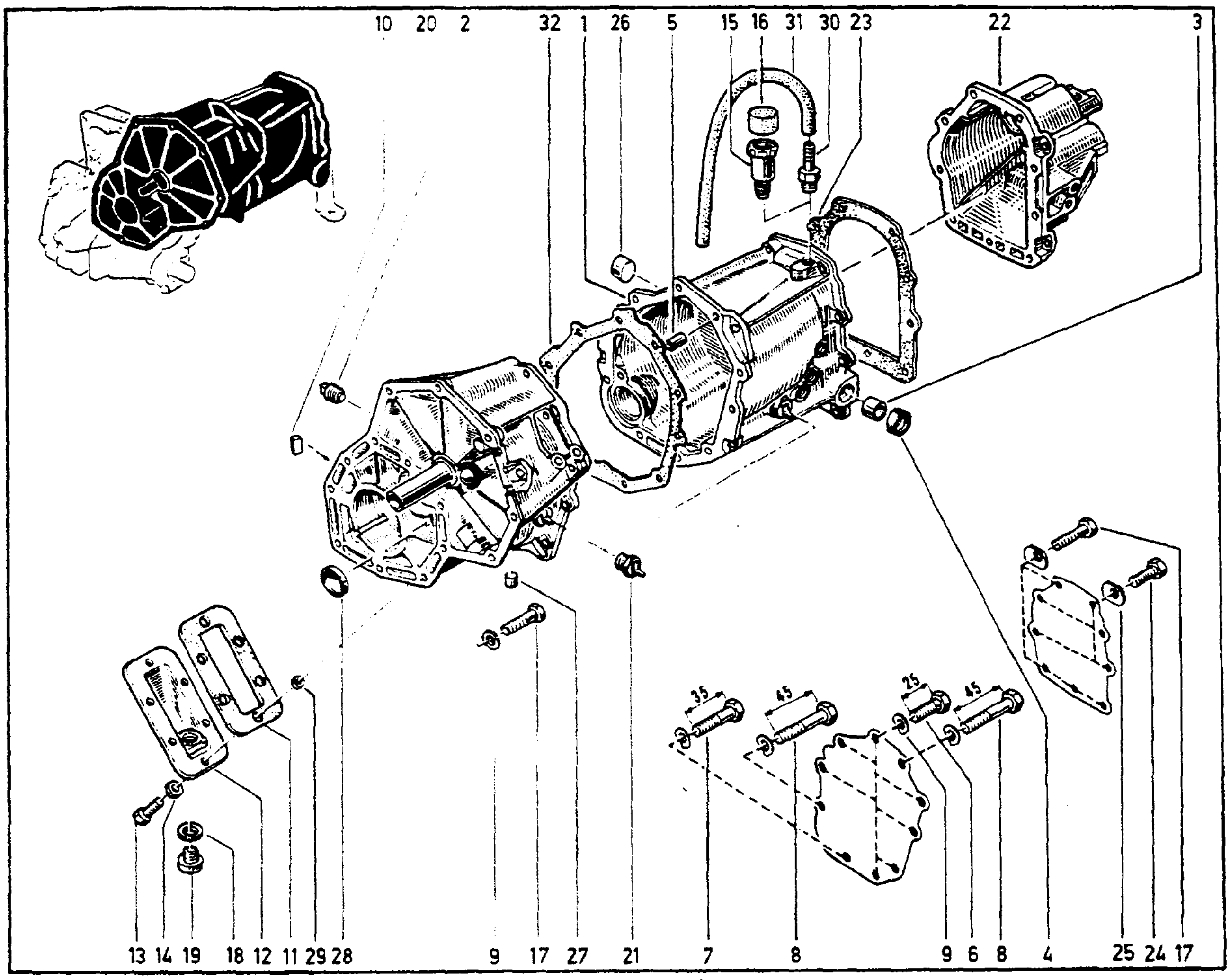
GENERAL INFORMATION
EXPLODED VIEWS



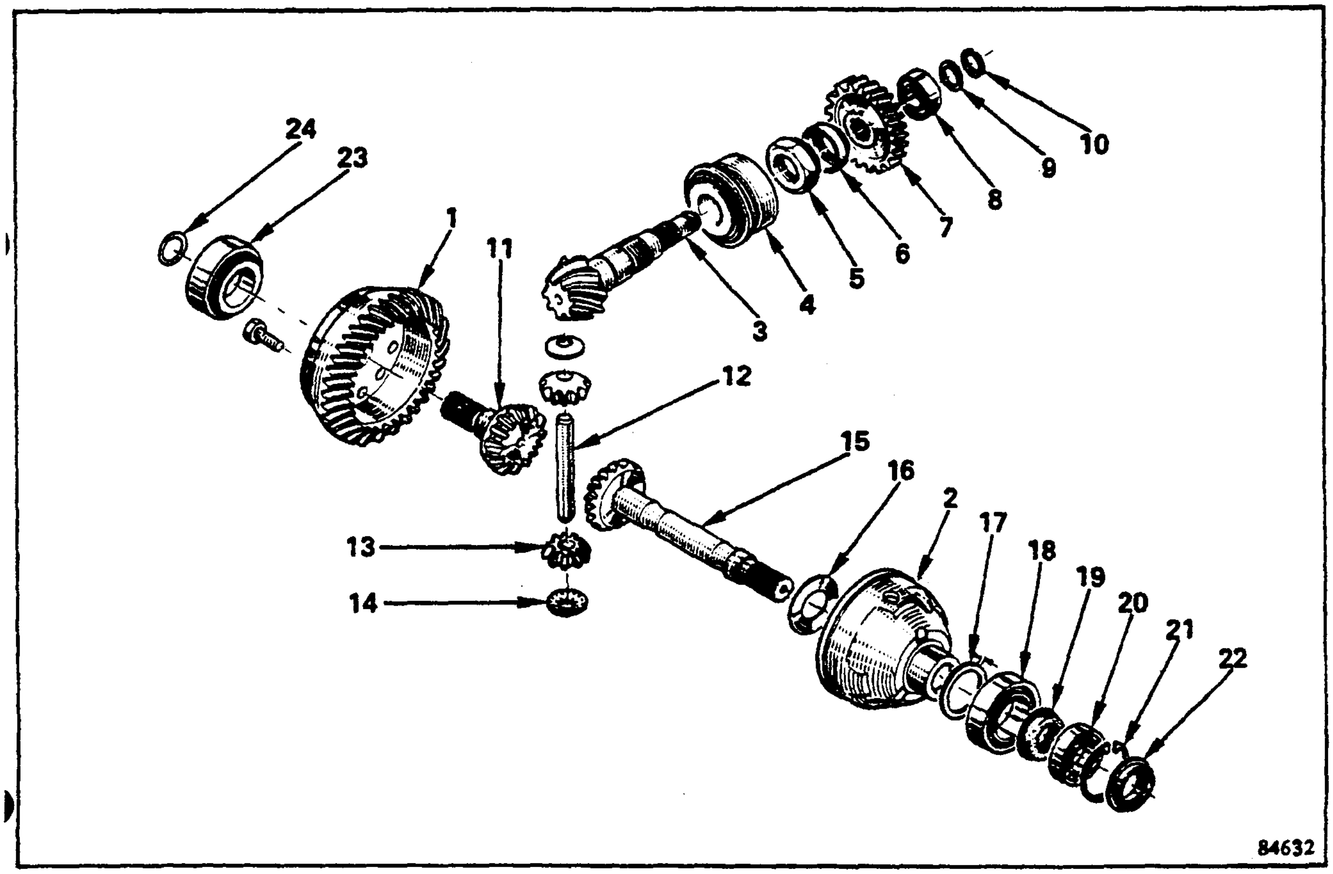
Bearing nut on final drive piston	22 daNm (162 lb./ft.)
Ring gear bolts	12.5 daNm (92 lb./ft.)
Half housing bolts : 8 mm	3 daNm (22 lb./ft.)
Half housing bolts : 10 mm	5 daNm (36 lb./ft.)
Bolts securing clutch housing to step down housing	3 daNm (22 lb./ft.)
Step-down housing cover bolts	1.5 daNm (11 lb./ft.)



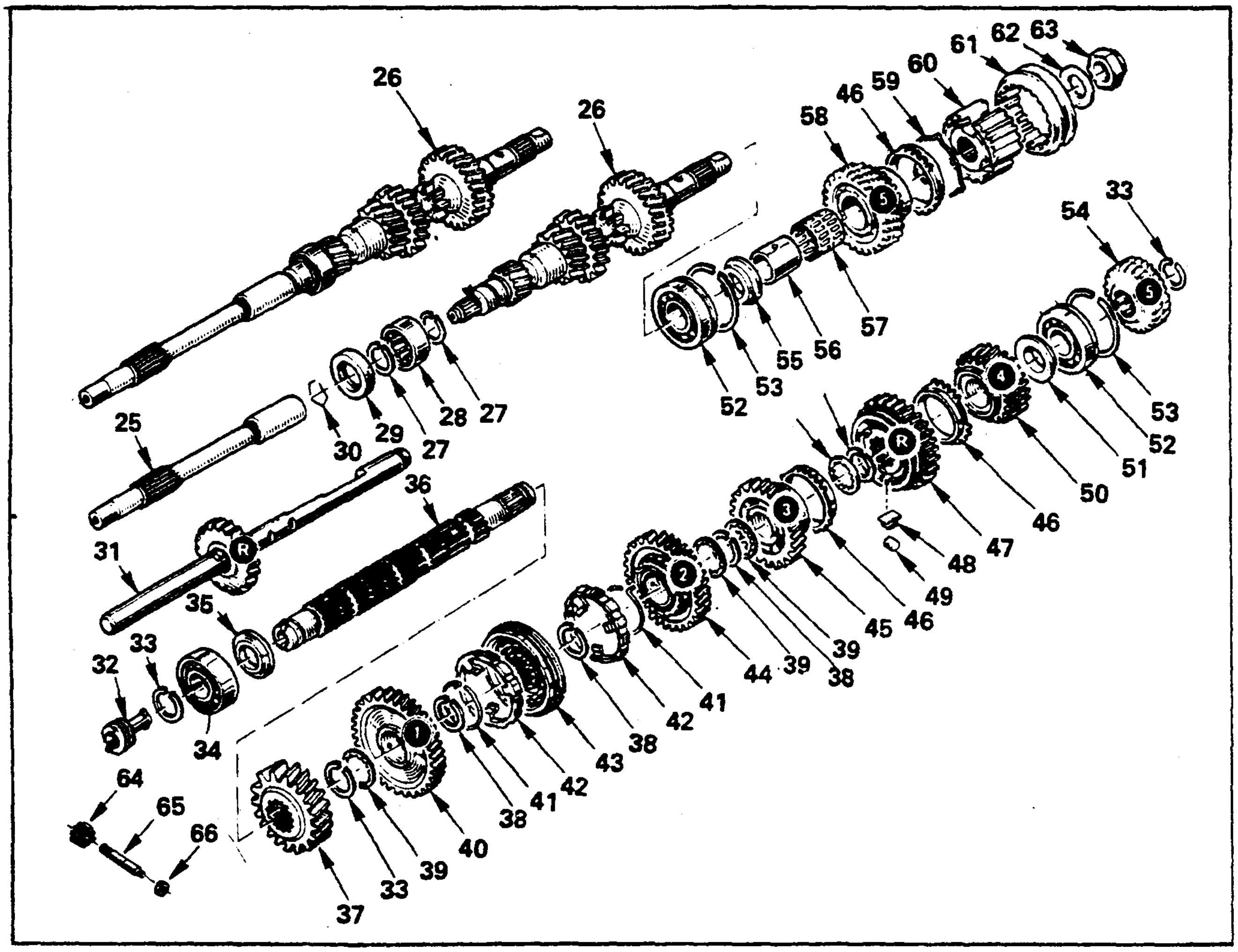
1. Final drive housing
2. Sleeve
3. Boot
4. Bolt
5. Washer
6. Alignment dowel
7. Bolt
8. Bolt
9. Bolt
10. Washer
11. O-Ring
12. Washer
13. Clip
14. Bolt
15. Washer
16. Vent
17. Cover
18. Bolt
19. Bolt
20. Washer
21. Cover
22. Bolt
23. Washer
24. Fill or drain plug
25. Seal
26. Bolt



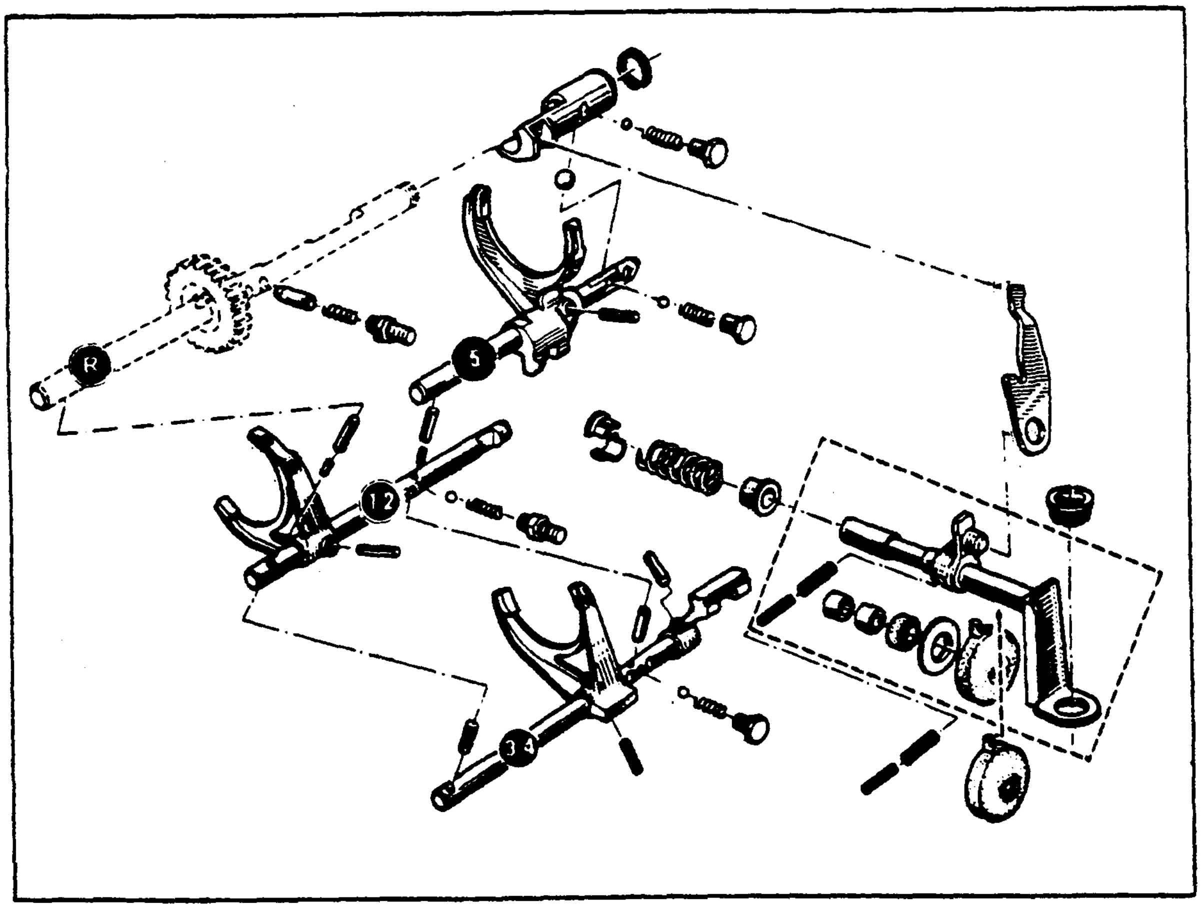
1. Transmission housing
2. Center housing
3. Bushing
4. Seal
5. Alignment dowel
6. Bolt
7. Bolt
8. Bolt
9. Washer
10. Magnet
11. Gasket
12. Cover
13. Bolt
14. Washer
15. Vent
16. Cover
17. Bolt
18. Seal Ring
19. Drain plug
20. Fill plug
21. Plug
22. Cover
23. Gasket
24. Bolt
25. Washer
26. Plug
27. Plug
28. Plug
29. Alignment dowel



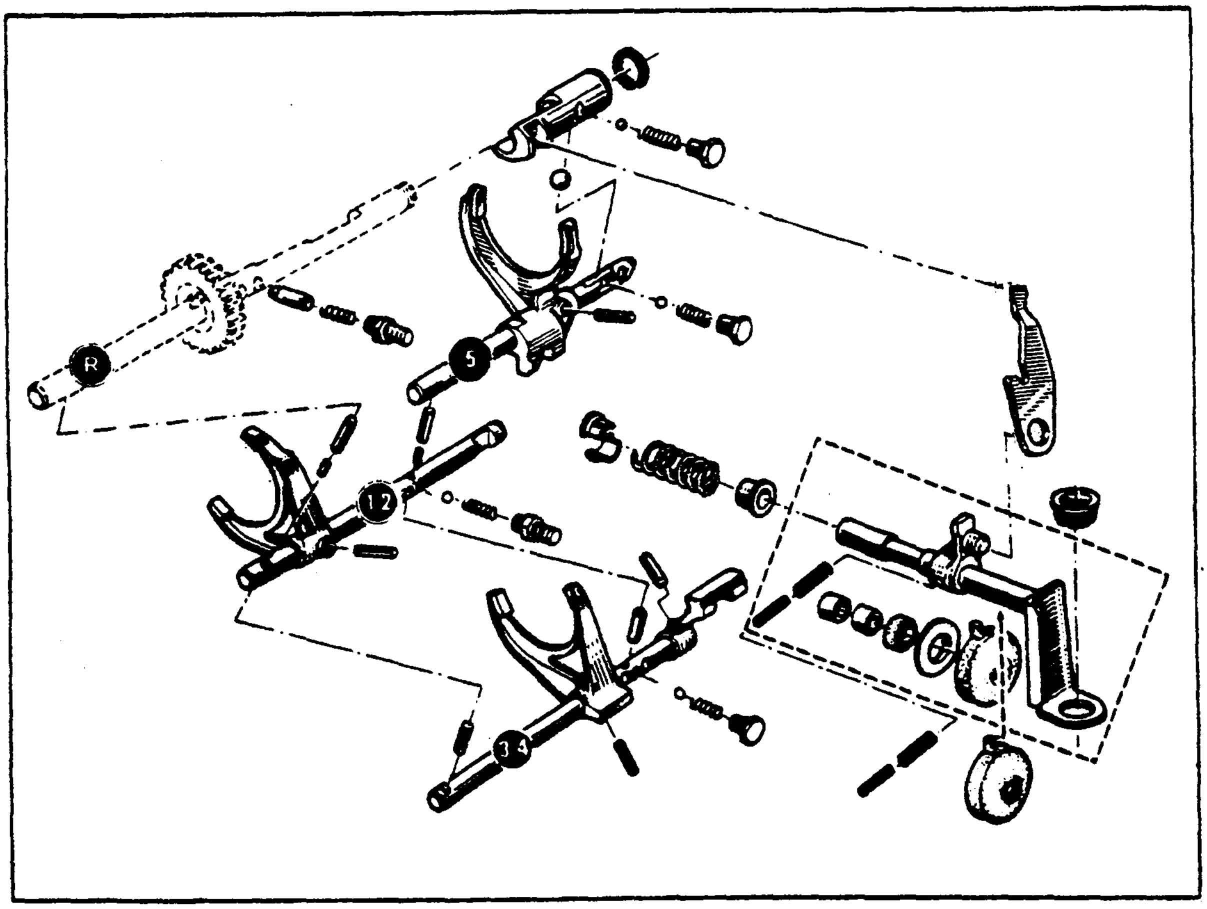
1. Crown wheel
2. Differential housing
3. Final drive pinion
4. Double taper roller bearing
5. Nut
6. Lip seal
7. Step down gear
8. Bearing
9. Spring washer
10. Circlip
11. Short sun wheel
12. Planet wheel shaft
13. Planet wheel
14. Cup
15. Sun wheel
16. Washer
17. Backlash adjusting shim
18. Taper roller bearing
19. Lip seal
20. Ball race
21. Circlip
22. Plastic ring
23. Taper roller bearing
24. O-ring



25. Clutch shaft
26. Primary shaft
27. Circlip
28. Roller bearing
29. Lip seal
30. Snap ring
31. Reverse shaft
32. Speedometer drive worm
33. Circlip
34. Bearing
35. Shouldered washer
36. Secondary shaft
37. Step down gear
38. Circlip
39. Splined washer
40. 1st speed gear
41. Synchronizer spring (Renault)
42. Synchronizer ring (Renault)
43. 1st/2nd hub - sliding gear
44. 2nd speed gear
45. 3rd speed gear
46. Synchronizer ring (Borg Warner)
47. 3rd/4th hub - sliding gear
48. Synchronizer roller spring
49. Synchronizer roller
50. 4th speed gear
51. Washer
52. Ball race
53. Circlip
54. 5th speed fixed gear
55. Thrust washer
56. 5th speed ring
57. Needle race
58. 5th speed idle gear
59. Synchronizer spring
60. 5th speed synchronizer hub
61. 5th speed synchronizer - sliding gear
62. Spring washer
63. Primary shaft nut.
64. Speedometer drive pinion.
65. Speedometer drive pinion shaft
66. Lip seal



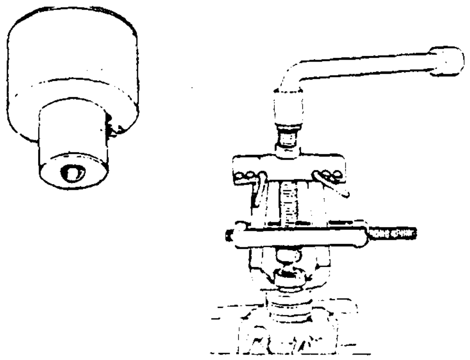
67. 1st/2nd speed fork shaft
68. 1st/2nd speed shift fork
69. 3rd/4th speek fork shaft
70. 3rd/4th speed shift fork
71. 3rd/4th speed lever
72. 1st/2nd speed shaft plungers
73. Plunger between 1st/2nd and reverse shafts
74. Plunger between 1st/2nd and 3rd/4th shafts
75. Interlocks
76. 5th speed fork shaft
77. 5th speed shift fork
78. Reverse sleeve
79. Circlip
80. Reverse lever
81. Selector control shaft
82. Selector lever
83. Plastic ring
84. Shift shaft spring
85. Half shells
86. Shift shaft bushing
87. Lip seal
88. Ring
89. Boot
90. Pins



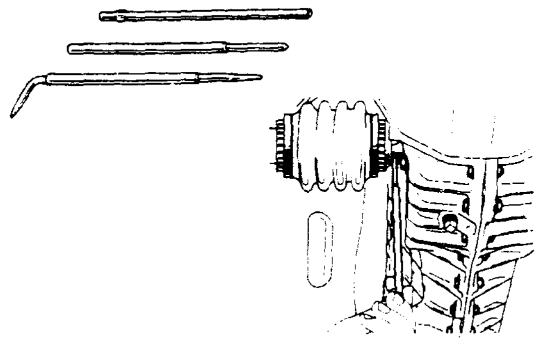
91. Flexible coupling
92. Locating bolt
93. Gearbox output flange
94. Rear housing
95. Output shaft
96. Engagement sliding gear
97. Circlip
98. Engagement drive gear
99. Needle race
100. Lip seal
101. Output shaft bearing
102. Circlip
103. Locking ball on engagement control shaft
104. Engagement control shaft
105. Engagement control fork
106. Engagement fork pin
107. Lip seal
108. Boot
109. Washer

D Control lever.

* "Loctite RENBLOC"

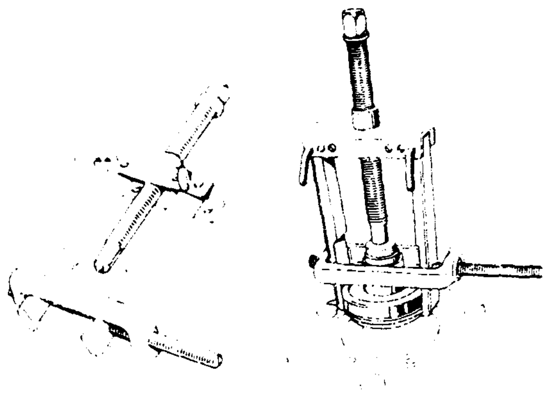


Ele. 22-01
End fitting for extracting alternator bearing
(Use with tool B.Vi. 28-01)
Order Tool No. 700013-31-001
Order Tool No. 700013-30-300 Set



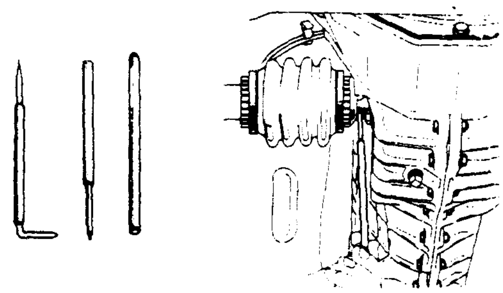
B.VI. 606

Set of drifts for extracting and
inserting 6 mm dia. roll pins
Order Tool No. 700000-60-600 Set



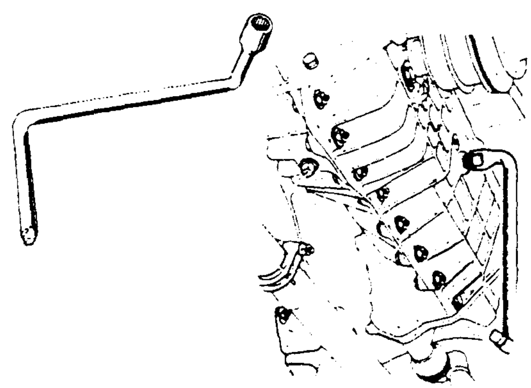
B.VI. 28-01

Bearing extractor with jaws 146 mm long
Order Tool No. 700012-27-301 EA



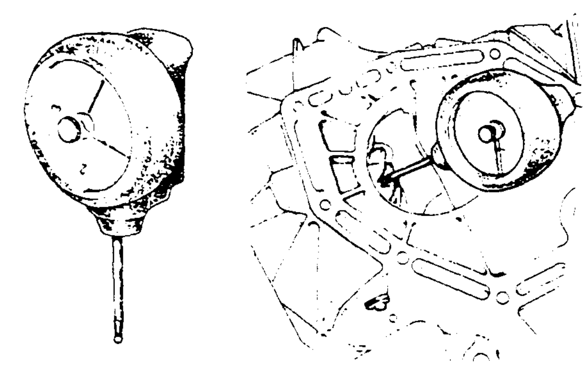
B.VI 31-01

Set of three drifts for 5 mm dia. roll pins
Order Tool No. 700012-59-401 Set



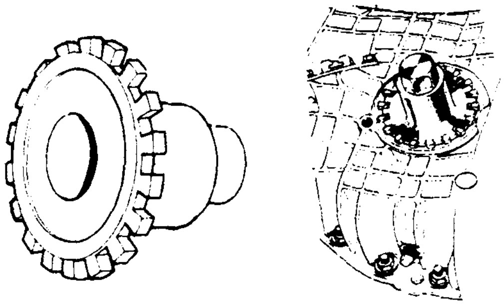
Mot. 593

Engine/Gearbox drainplug wrench
Order Tool No. 700000-59-300 EA



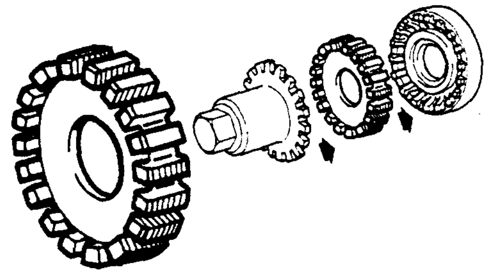
B.VI. 906

Torque meter for measuring
differential bearing preload
Order Tool No. 700000-90-600 EA



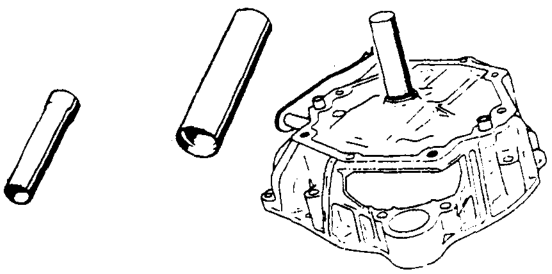
B.Vl. 645

Castellated differential nut wrench
Order Tool No. 700000-64-500 EA



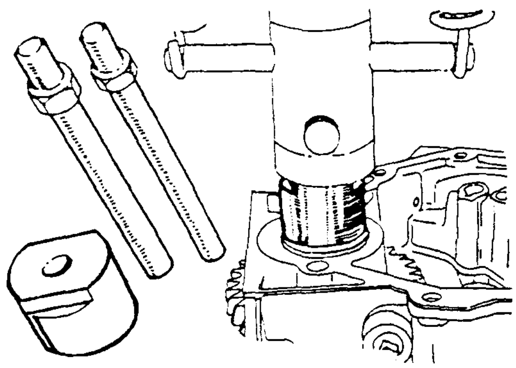
B.Vl. 805

Differential nut wrench adapter
(For 3-lip seal nut)
Order Tool No. 700000-80-500 EA



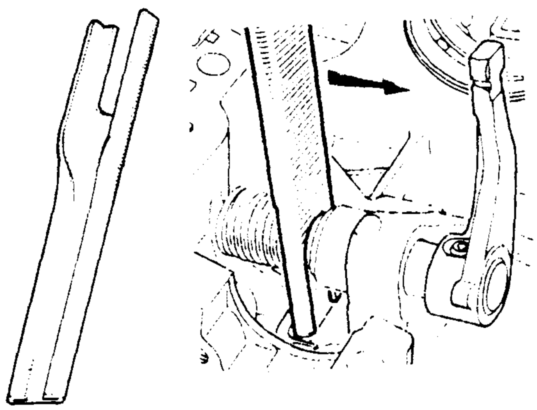
B.Vl. 526

Clutch shaft oil seal inserting and protecting tool
Order Tool No. 700000-52-600 EA



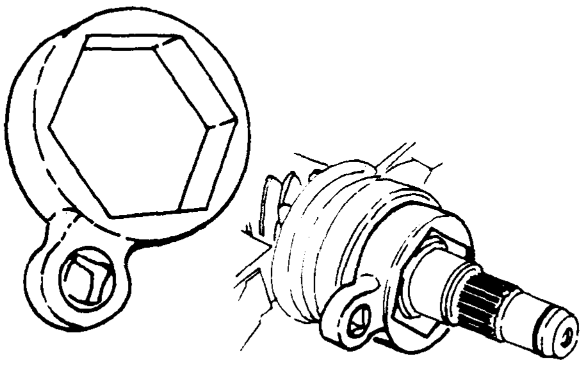
B.Vi. 902.01

Extracting and inserting tool for input shaft and output shaft circlip
Order Tool No. 700000-90-201 EA



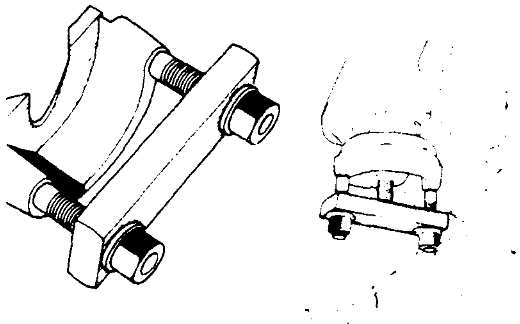
B.Vl. 747

Selector spring dismantling and re-assembly tool
Order Tool No. 700000-74-700 EA



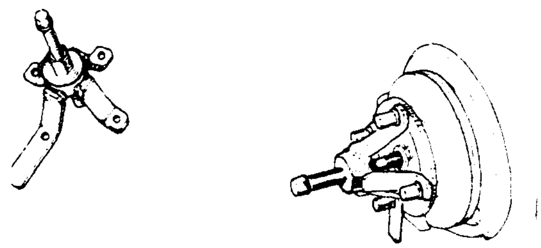
B.Vl. 903

Wrench 58 mm for driving pinion nut
Order Tool No. 700000-90-300 EA



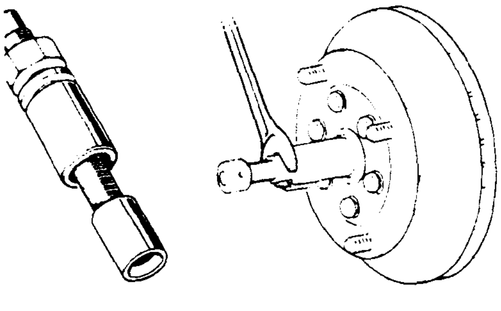
T.Av. 476

Tool for extracting ball joint
Order Tool No. 700000-47-600 EA



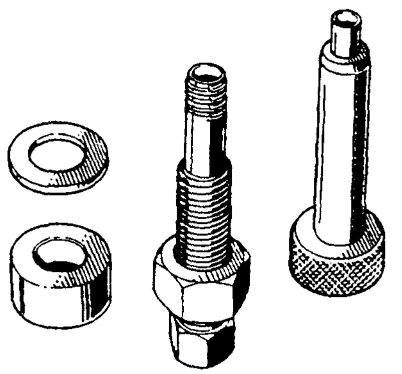
T.Av. 601

Tool for extracting drive shaft and hub
Order Tool No. 700000-60-100 EA



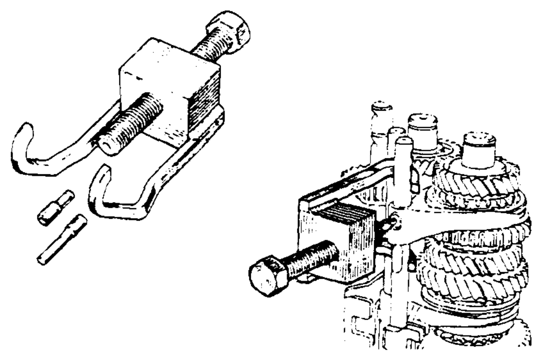
T.Av. 602

Drive shaft inserting tool
Order Tool No. 700000-60-200 EA



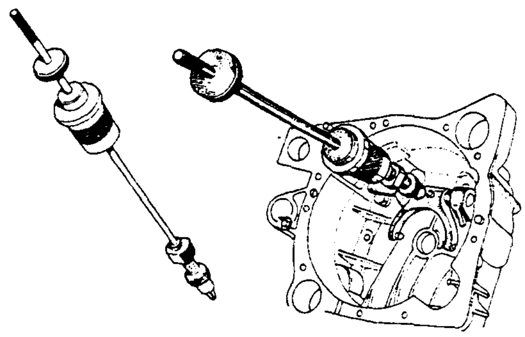
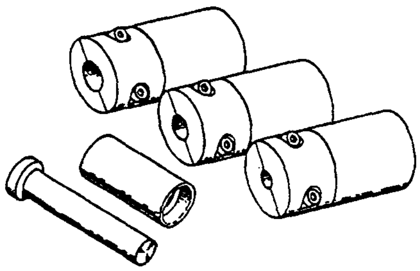
B.VI. 905-02

Tools for replacing the speedometer drive shaft seal
Order Tool No. 700000-90-502 EA

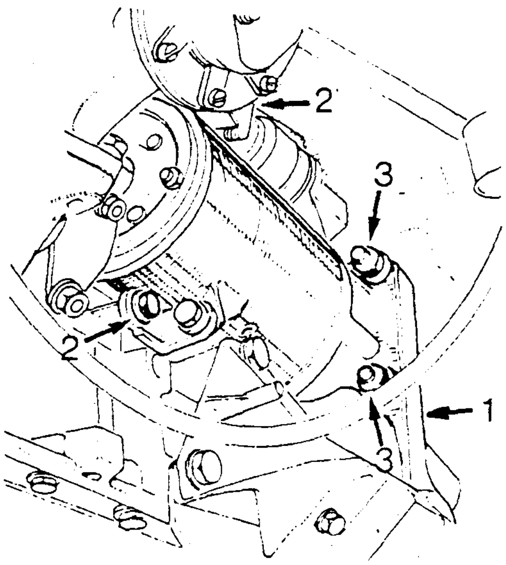


B.VI. 949

Tool for removing and refitting the shift fork shaft spring pins
Order Tool No. 700000-94-900 EA

 **Emb. 880** Extractor (slide hammer) Order Tool No. 700000-88-000 EA	 **Emb. 1075** Input shaft extractor kit (For use with tool Emb. 880) Order Tool No. 700001-07-500 EA

Starter Mount/Clutch Housing Cracks
CAUTION
Incorrect mounting of the starter can cause cracks to develop in the clutch housing near the starter mounting plate.



The starter must be completely removed from the unit any time the engine or gearbox are removed. NEVER leave the starter attached by the two (2) rear mounting bolts. This may cause the bolts to bend and become distorted.

A starter with distorted or improperly positioned rear mounting bolts may cause the clutch housing to crack due to vibration at high engine R.P.M.'s.

When remounting a starter, ALWAYS tighten the rear mounting bolts before the front mounting bolts. (See illustration.)

1. Area or possible crack
2. Starter mounting bolts - Front
3. Starter mounting bolts - Rear

GENERAL INFORMATION
Anaerobic Sealant

Assembly of gearbox and transmission cases may require use of a special type of silicone sealant known as **anaerobic sealer**. This compound is used as a gasket material in specified applications.

In each application which specifies anaerobic sealant, we recommend using Loctite® "518" or "515", or NAPA/Balkamp® Part No. 765-1189, or an equivalent anaerobic sealant.

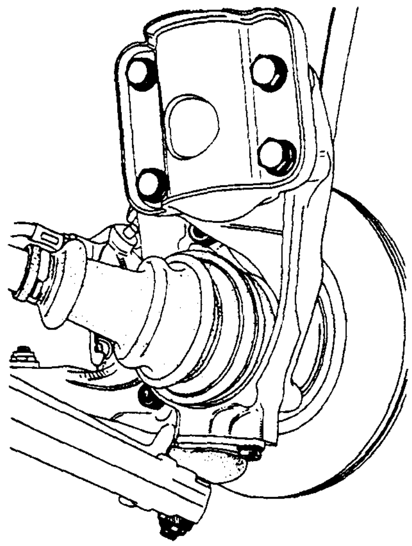
CAUTION

Do not substitute anaerobic sealer with RTV silicone sealant or other adhesive gasket materials. These do not possess the heat-resistant properties required to affect a durable seal.

Improper sealing could allow fluid leakage, resulting in serious mechanical damage.

REMOVAL AND INSTALLATION

The gearbox must be removed from below using a floor jack or transmission jack.

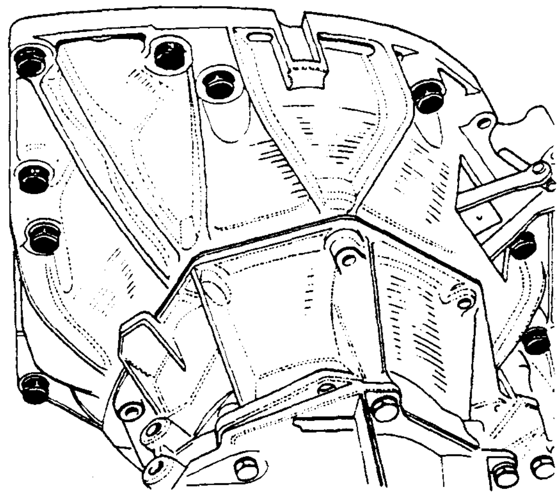


Tightening Torques
Wheel Nuts: 12 daNm (90 lb./ft.)
Shock Absorber Bottom Bolts: 8 daNm (60 lb./ft.)
Steering Arm Ball Joint Nut 3.5 daNm (26 lb./ft.)

REMOVAL
Support vehicle under engine supporting cross-member so the road wheels are off the ground and front suspension is at the relaxed end of its travel.

Remove or Disconnect
- Battery
- Transmission and final drive fluids (drain)
- Front wheels
- Bottom 4 front strut bolts
- Steering rack connections to stub axle carriers
- Steering rack (mark the location)
- Drive shaft roll pins (using drift B.Vi. 606)

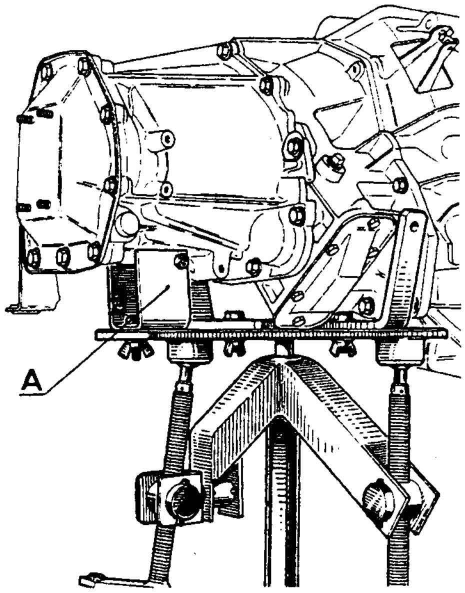
Tilt stub axle carriers outward while removing drive axles from final drive and position out of the way.



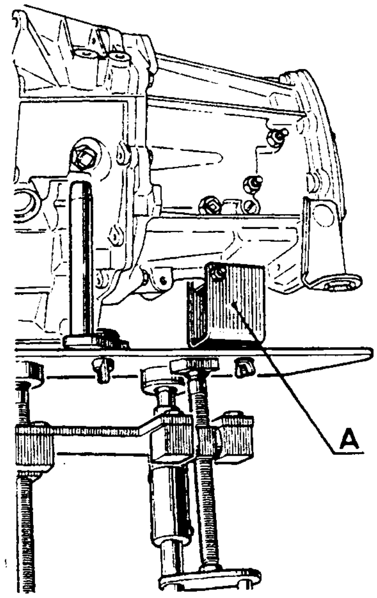
- Back-up light wires
- Speedometer cable (by squeezing the plastic end together and pulling)
- Shift lever - prop aside
- Clutch release cable
- Long rear mount bolt
- Rear mount holders on crossmember behind rear mount
- Rear mount from transmission - set cable aside
- Lower air scoop
- Lower flywheel cover behind engine oil pan

Place transmission jack in position and secure. (Make certain the assembly is evenly balanced.)
- Gearbox Engine support stay-bolts (1 long bolt through bell housing on left and 2 small bolts on right ahead of final drive housing)
- Clutch housing bolts (shown at right)
- Starter (3 bolts)

REMOVAL AND INSTALLATION

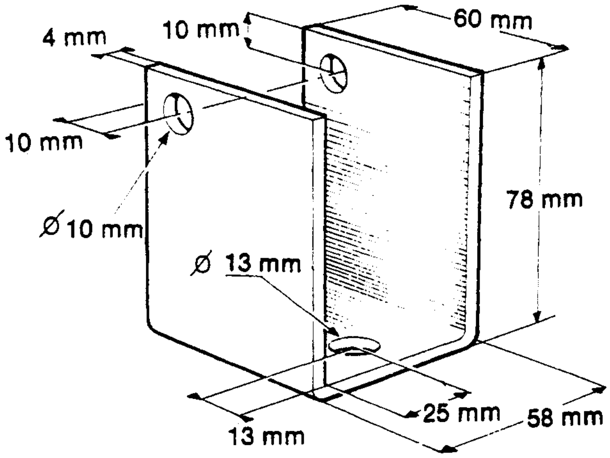


Typical
Jacking
Arrangements



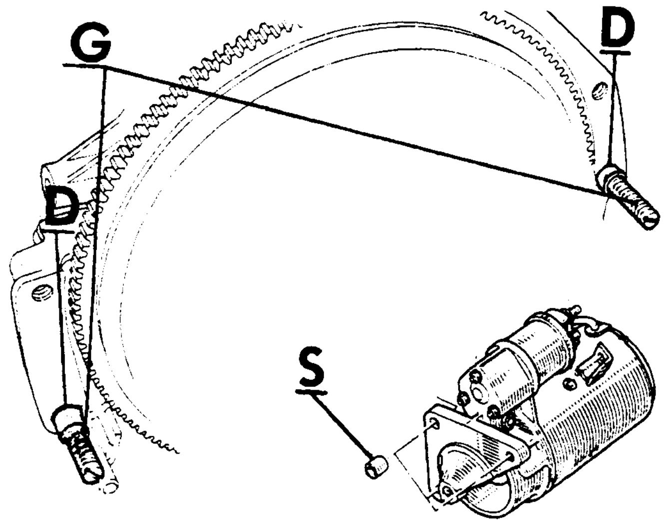
Remove and lower the gearbox.

NOTE: Fabricate a "U" bracket (A) to the dimensions shown at right to support the rear of the gearbox.



REASSEMBLY
- Reassembly can be made easier by using 2 studs (G) to guide the gearbox into position.
- Grease should be smeared on the clutch shaft splines and planetary gear splines.
- Make sure that the alignment dowels (D) are in place and the starter dowel (S) is also in place before reinstallation.
- Install in reverse order of removal.
- Fill both final drive and transmission with the proper type and level of oil.
- Check front wheel and steering wheel alignment
- Check clutch operation

IMPORTANT
Make sure safety cable is installed properly and is not rubbing on power steering lines. Tie up if needed.

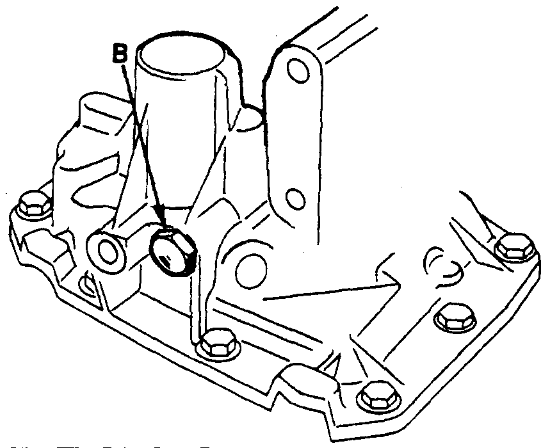


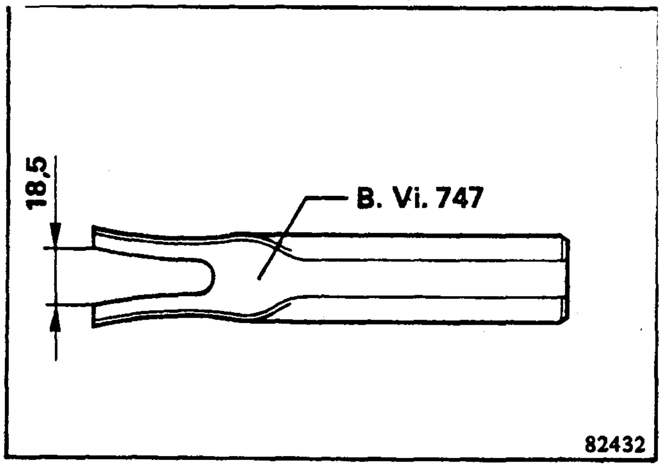
5-SPEED GEARBOX
DISASSEMBLY

TYPE "NL" 5-SPEED TRANSMISSIONS

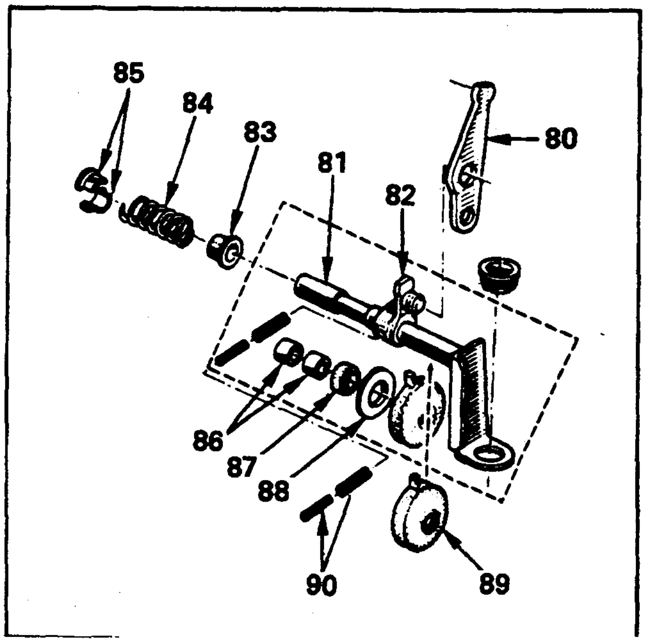
DISASSEMBLY

- Remove the detent ball assembly (B) from the 5th speed shaft.

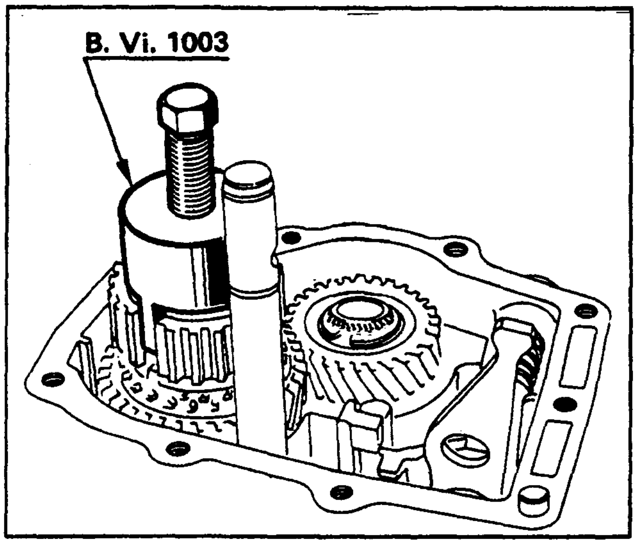




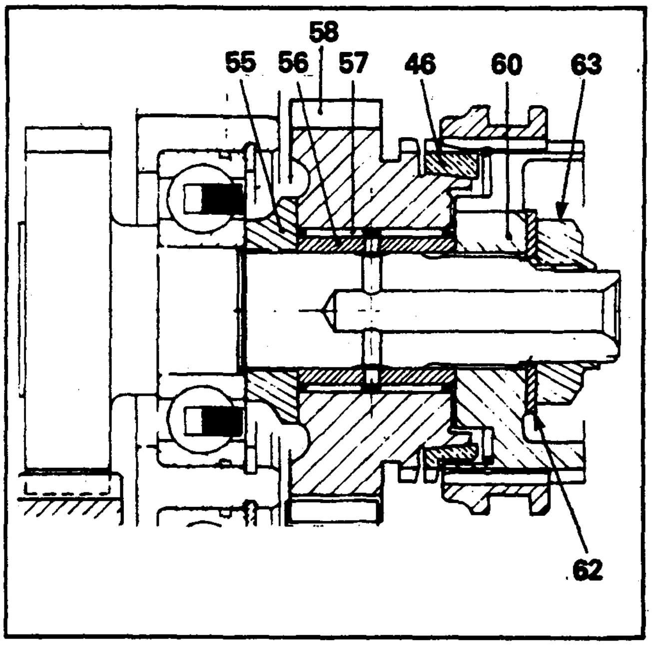
- Remove the bolts from the 5th gear rear case, and separate it from the main case.



- Simultaneously remove the fork, the 5th speed sliding gear and the Reverse lever assembly.
- Place the sliding gear back onto the shaft, then engage 5th gear and Reverse at the same time to lock the primary shaft in place.
- Remove the nut and washer from the primary shaft.
- Pull the 5th gear hub using tool #B.Vi. 28-01 with long jaws.

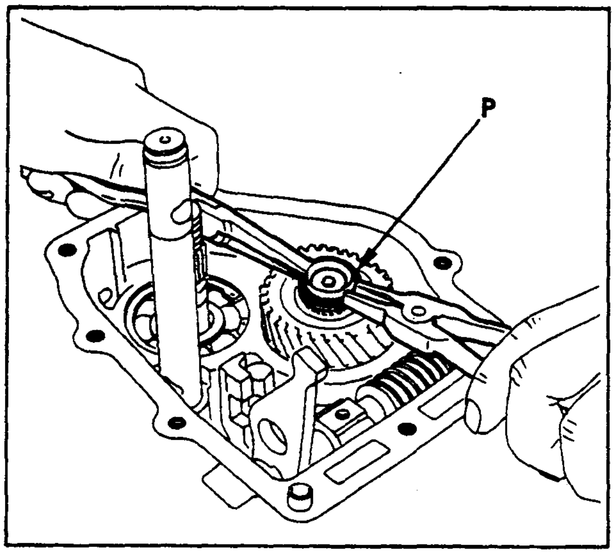


- Remove the following parts:
  - Synchronizer ring (46)
  - 5th speed idle gear (58)
  - Needle bearing race (57) - Be careful not to lose bearing
  - Bushing (56)
  - Thrust washer (55)

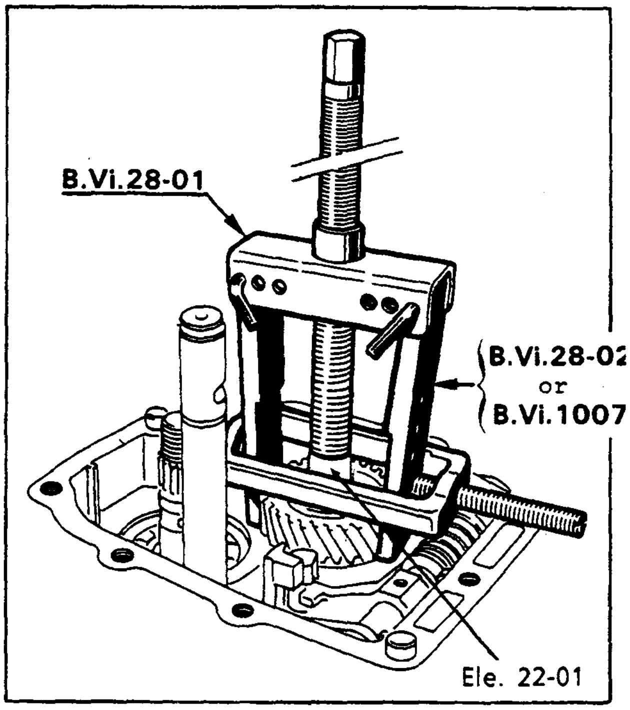


5-SPEED GEARBOX
DISASSEMBLY

- Remove the circlip (P) from the 5th speed secondary shaft. Use a pair of flat-nosed pliers to keep the circlip from twisting.

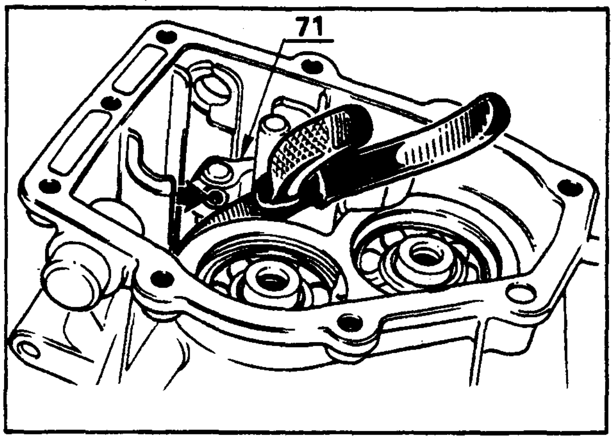


- Use tool #B.Vi. 28-01 with long jaws #B.Vi. 10-07 to pull the 5th speed fixed gear. Place tool #Ele 22-01 on the gear hub as shown to avoid damage.



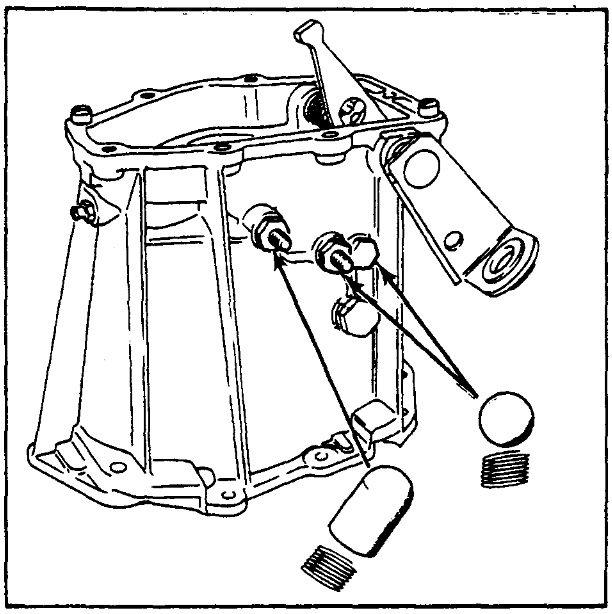
5-SPEED GEARBOX
DISASSEMBLY

- Shift the transmission into 4th gear. Then remove the roll pin connecting the "dogleg" (71) to the 3rd/4th gear shaft using tool #B.Vi. 31-01.



Remove :

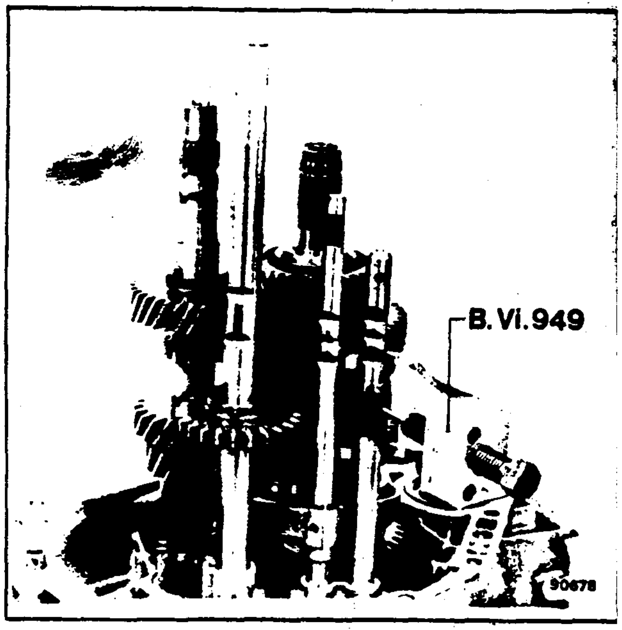
The locking assemblies (V).
The three springs are identical.



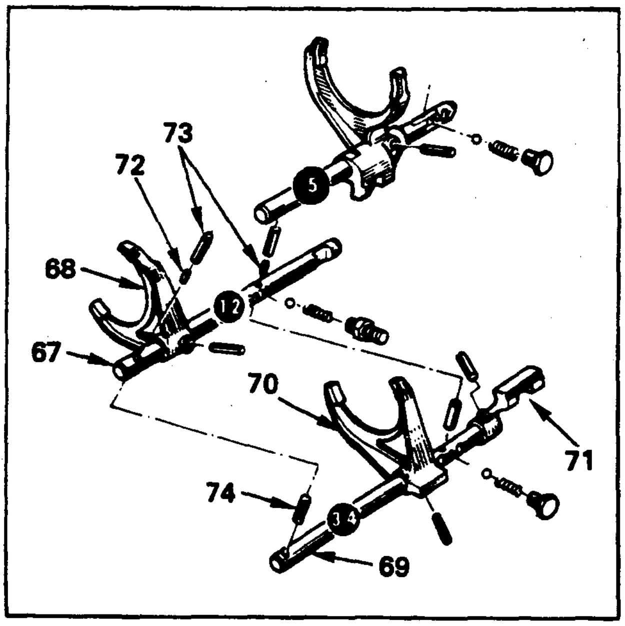
- Remove the three detent assemblies. Be careful to return the piston and balls to their proper locations when reassembling transmission. The piston should be located on the reverse rod. The springs, however, are interchangeable.

5-SPEED GEARBOX
DISASSEMBLY

- Remove the bolts from the main gear case and separate the cases.
- Remove the roll pin from the 3rd/4th gear fork (70) with tool #B.Vi. 949.
- Remove the roll pin from the 1st/2nd gear fork (68) with tool B.Vi. 949.

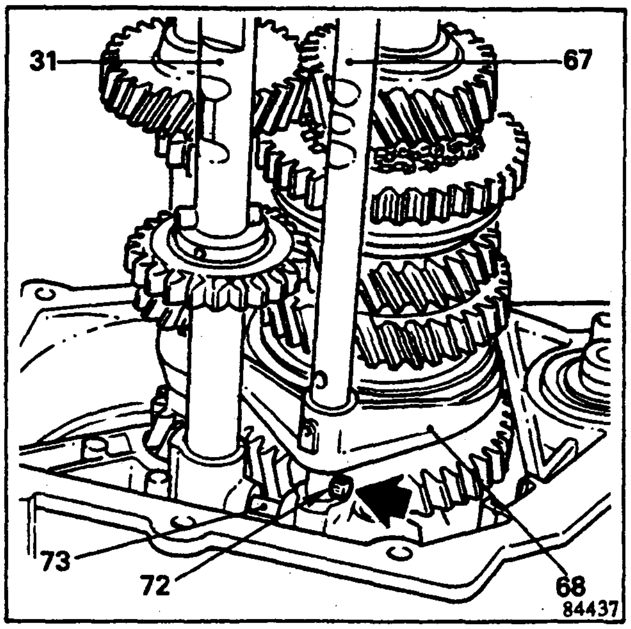


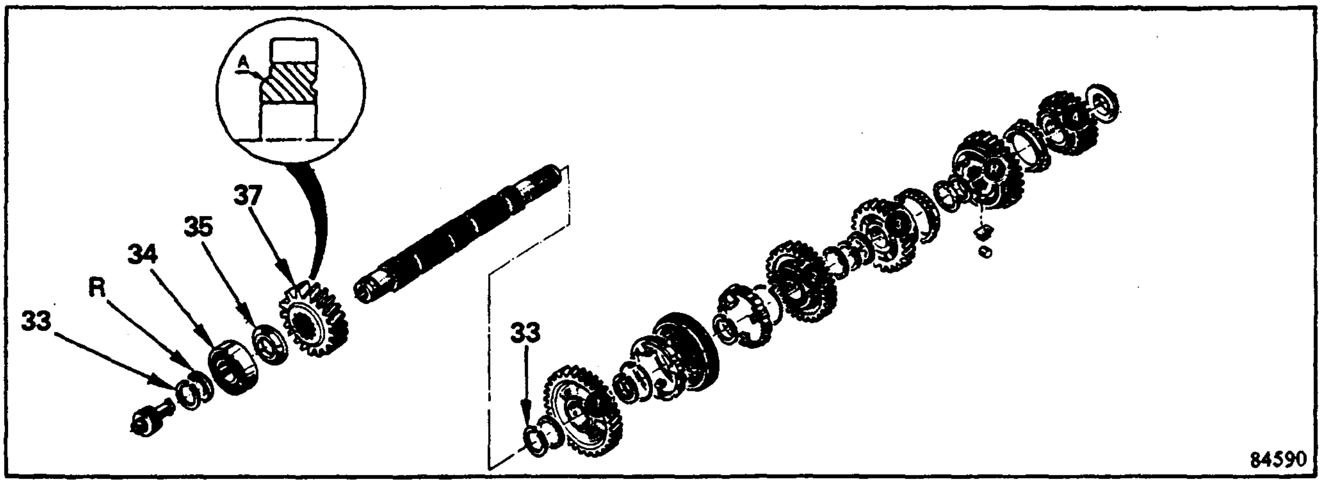
- Make sure the 1st/2nd fork shaft (67) and Reverse shaft are both in the neutral position.
- Remove the 3rd/4th shaft (69) and fork assembly (70).



5-SPEED GEARBOX
DISASSEMBLY

- Be sure that the Reverse shaft (31) is in neutral.
- Remove the 1st/2nd shaft and fork assembly (67, 68). Be sure not to lose the lock-out plungers (72) from the shaft.
- Push lock-out plunger (73) toward the 1st/2nd shaft bore to remove the Reverse shaft.
- Pull simultaneously on the three gear shafts (primary, secondary and reverse) and remove them.
- Hold the secondary shaft vertically, with the 1st speed at the bottom to prevent the gears from falling off. (Or wrap tape around the open end of the shaft to provide a "stop".)
- Retrieve the lock-out plunger (74) and magnet from inside the case, and clean them thoroughly before assembly.

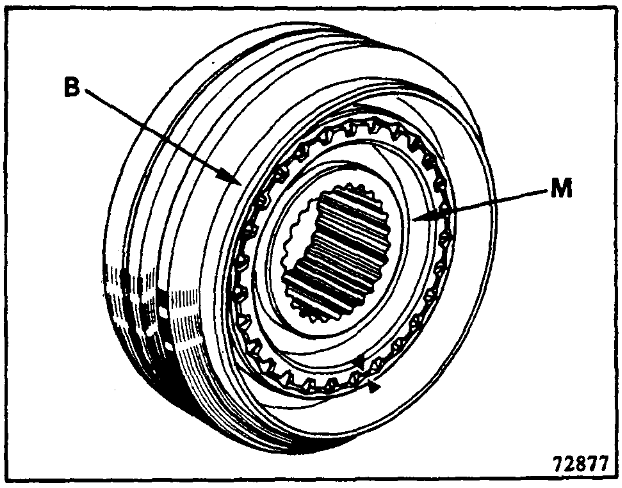




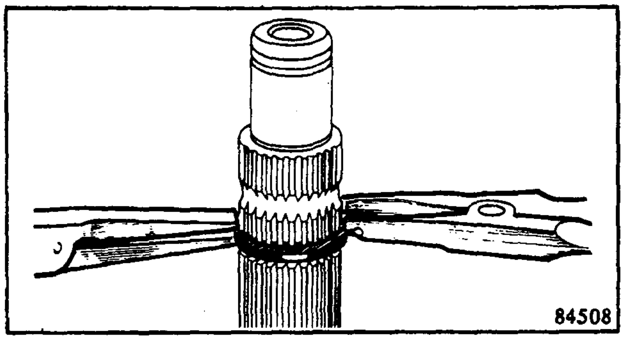
5-SPEED GEARBOX
GEAR DISASSEMBLY/REASSEMBLY

GEAR DISASSEMBLY

- Grip the secondary shaft by the step-down gear (37) in a soft-jaw vise, and remove all the gears.
- Match mark the positions of the hubs (M) with the sliding gears (B).



- Release the secondary shaft from the vise and remove the circlip (33), bearing (34), washer (35) and step-down gear (37) from the shaft.



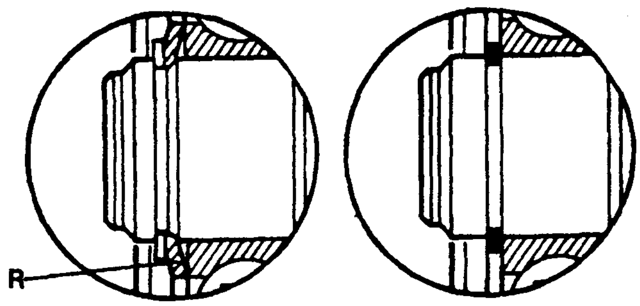
GEAR ASSEMBLY

- All circlips must be replaced with new ones.
- When installing circlips, use circlip pliers to open the ends, and flat-nosed pliers on the opposite side to keep the circlip from twisting.

Special features :

There are two types of bearing assembly at the step down gear end :

1st Arrangement 2nd Arrangement



With a spring washer (R) and a circlip 1.5 mm thick.

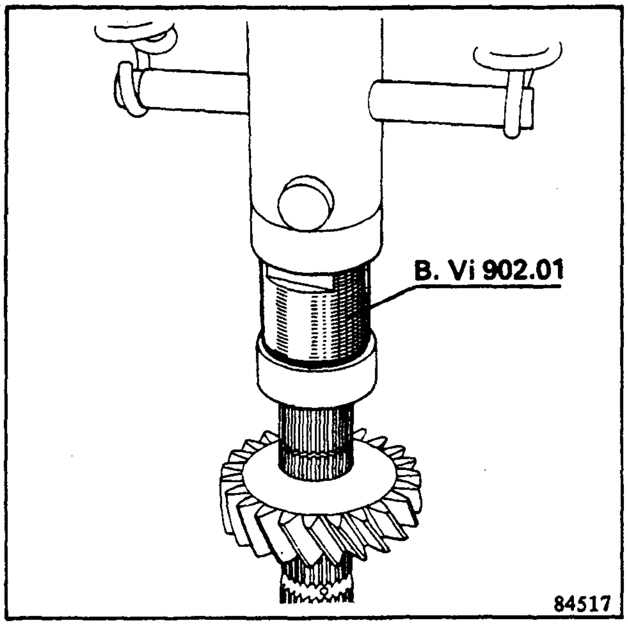
Without the spring washer (R).
With only a circlip 2 mm thick.

The groove has been moved by 1.5 mm and widened to 2.5 mm

NOTE: Two types of bearing assemblies are used at the step-down gear end of the shaft. Make note of which type you have and reassemble as shown.

NOTE: The step-down gear must be bonded to the shaft with Loctite® when reassembling.

- Reattach the following parts to the secondary shaft:
  - Circlip (33)
  - Step-down gear (37) - Be sure that the shoulder (A) is on the correct side.
  - Washer (35) - The large bearing surface should face the step-down gear.
  - Bearing (and spring washer, if equipped).
  - Circlip (33) - Use tool #B.Vi. 902-01 if necessary.



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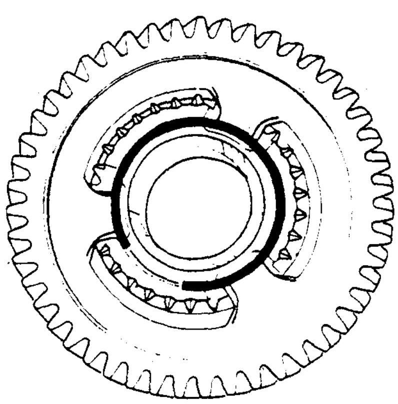
- Be sure the circlip is correctly located in its groove in the secondary shaft.
- Reassemble the gears in reverse order of removal. Oil each gear and synchronizer ring as you reassemble them.

- Fit the synchronizer springs to the 1st and 2nd gears with their ends folded into the cutouts in the gears.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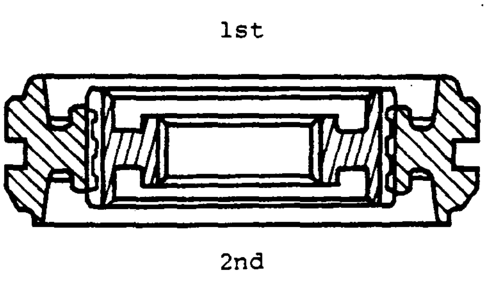
- Be sure the synchronizer gear assemblies are facing the right direction.
  The beveled side of the teeth on the 1st/2nd synchronizer gear should face 2nd gear.



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5-SPEED GEARBOX
REASSEMBLY

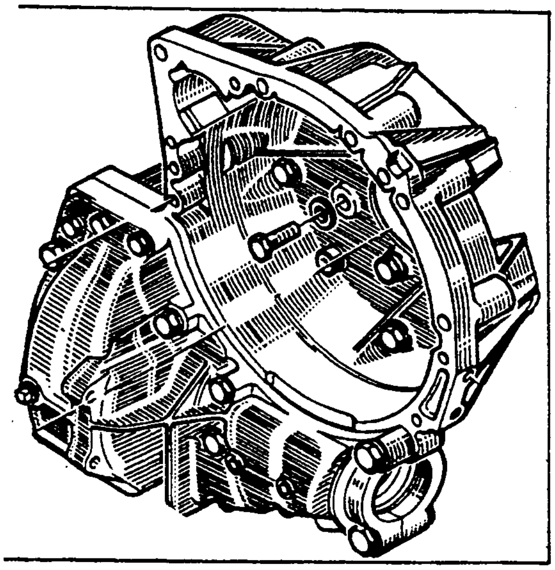
TRANSMISSION REASSEMBLY

Reassemble the gears and transmission in reverse order of disassembly.

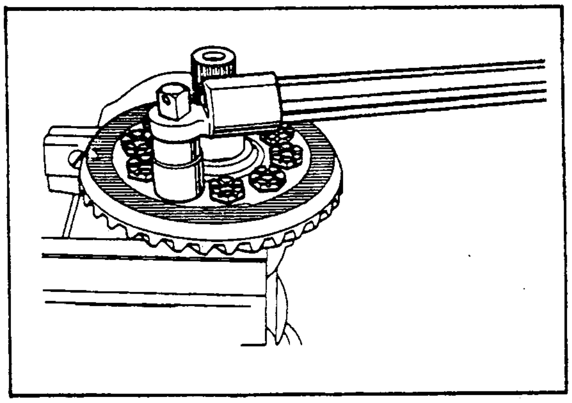
REBUILD
DISASSEMBLY

Dismantling:

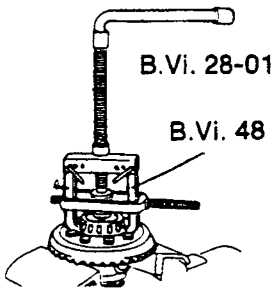
- Free the clutch-final drive housing from the step down housing.
- Mark the position of the differential nut. Remove the final drive half housing.



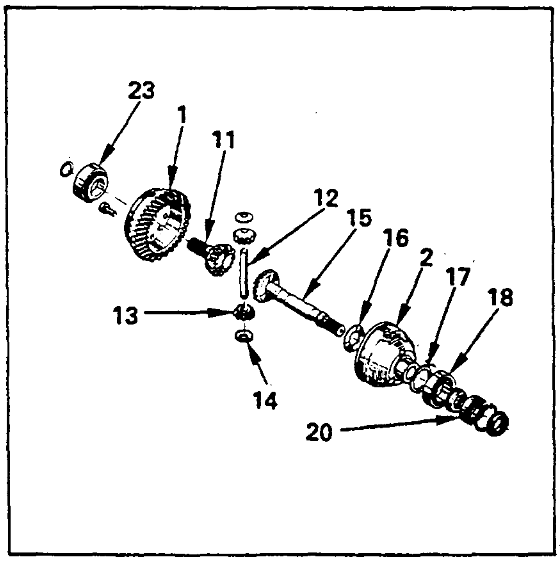
- Take out the differential
- Remove the ring gear bolts (they are self-locking bolts that cannot be re-used). Leave two in place, diametrically opposite to one another.



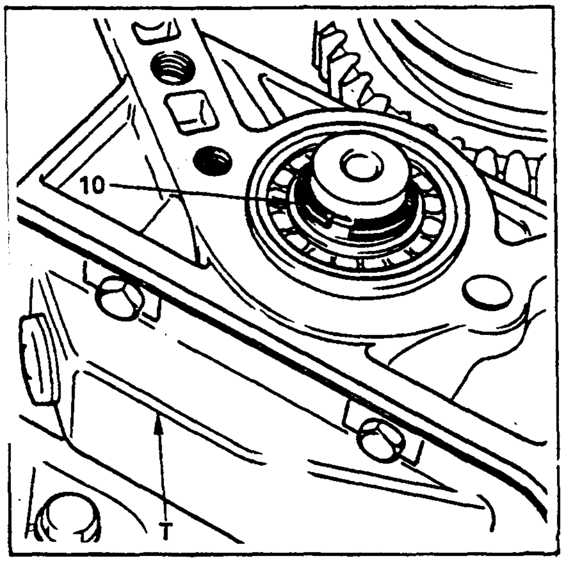
- Extract the three bearings using special tools B.Vi. 28-01 and B.Vi. 48.



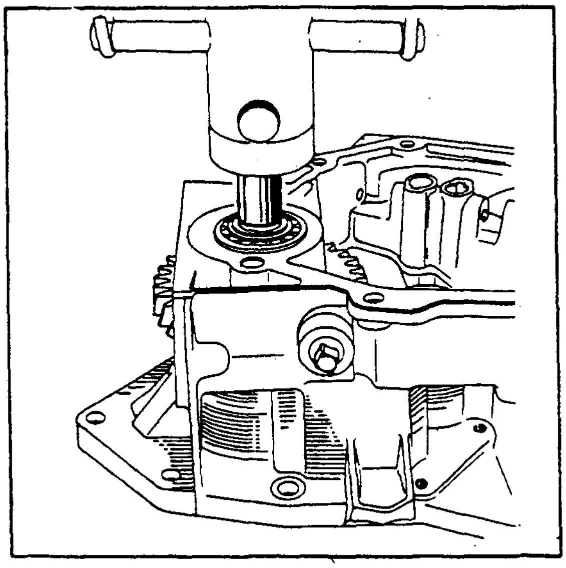
- Remove parts 11 to 16.



REMOVING THE FINAL DRIVE PINION
Remove:
- circlip (10),
- pressed steel cover (T).



- Push out the pinion on the press.



REBUILD
DISASSEMBLY

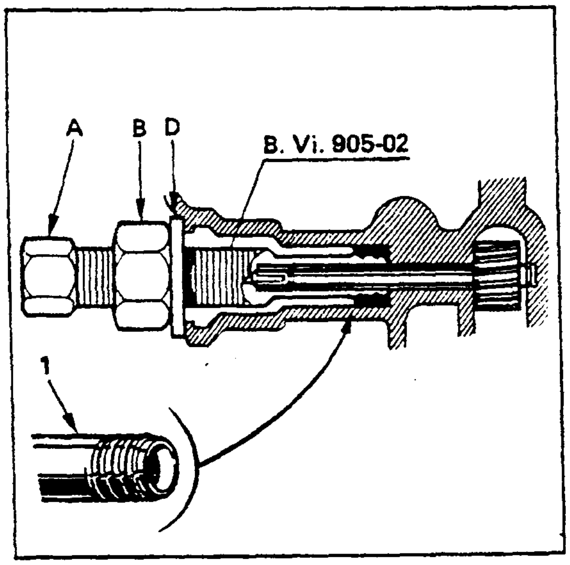
- Unlock the nut (5) and remove it with tool B.Vi. 903.

- Using Tools B.Vi. 28-01 and B.Vi. 48, extract the pinion bearing (4).

REMOVE:
- The speedometer drive pinion (64) and its shaft (65).
- Spread the lugs (C) that secure the pinion to the shaft.

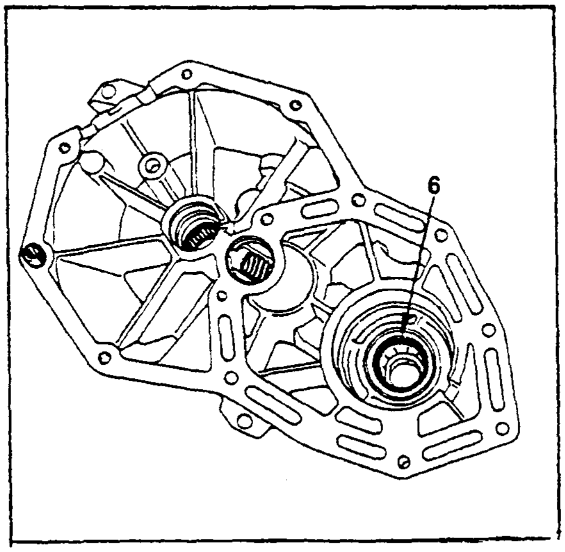
- Remove the shaft.
- The pinion must be replaced with a new one each time it is removed.

- Take out the speedometer drive seal using tool B.Vi. 905-02.
- Fit the extractor tool (A) equipped with the nut (B) and the spacer (D).
- Screw in the tool (A) by approximately three to four turns after it has made contact with the seal so that the thread (1) enters the rubber.
- Extract the seal by turning the nut (B) while holding the tool (A).



REMOVE:

- The lip seal (6) using tool B.Vi. 465.



REBUILD
CLEAN AND INSPECT

CLEAN

- All parts with a good grade of cleaning solvent and dry with compressed air.

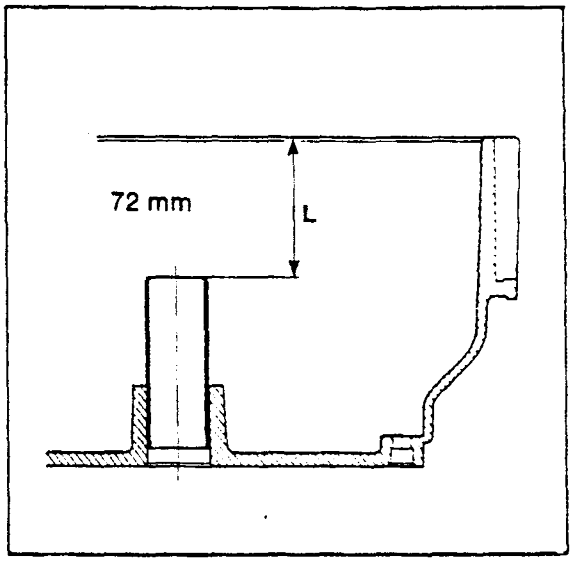
WARNING
Always wear safety goggles when working with compressed air to prevent eye injuries.

INSPECT:

Check that the following are in good condition:
- the gear teeth
- the bearing locating areas
- the planet wheel washers
- the splines in the differential housing
- the shift forks
- synchronizer teeth and parts

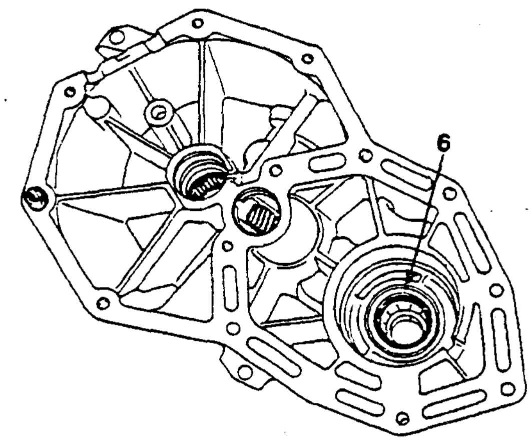
CLUTCH HOUSING THRUST BEARING TUBE

Place the unhardened section of the tube (white) into the housing and push it in to obtain the dimension (L) shown at right.



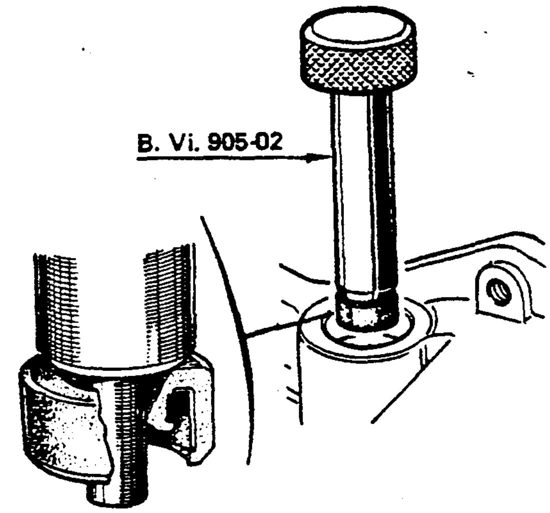
INSTALL:

- Oil the lip seal (6) and install it with tool B.Vi. 465.



REFIT:

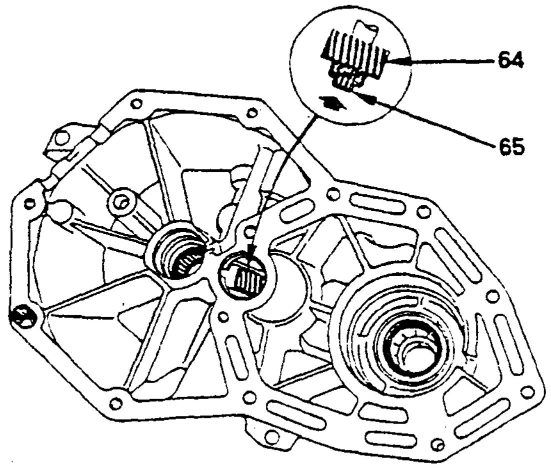
- The speedometer pinion seal ensuring that it is facing the correct direction.
- Use tool B.Vi. 905-02.



REBUILD
FINAL DRIVE ASSEMBLY

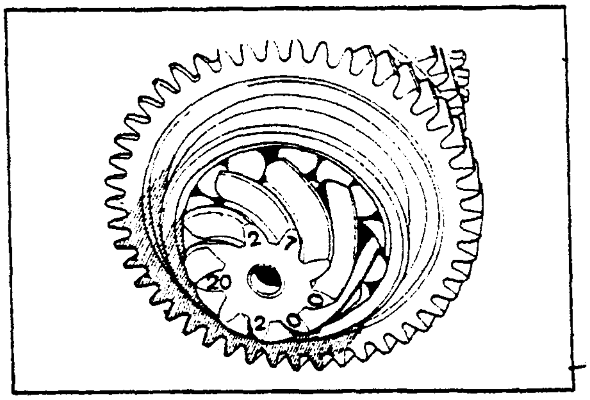
INSTALL:

- The new speedometer drive pinion (64) and its shaft (65) check that the pinion clips correctly into its groove in the shaft.



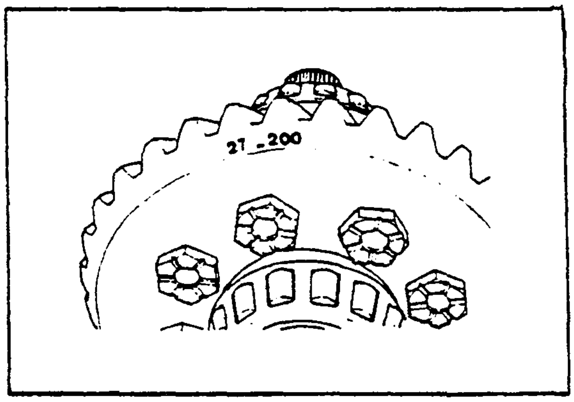
NOTE:

- The ring gear and pinion are matched.
- The same references are marked on both the ring gear and pinion.

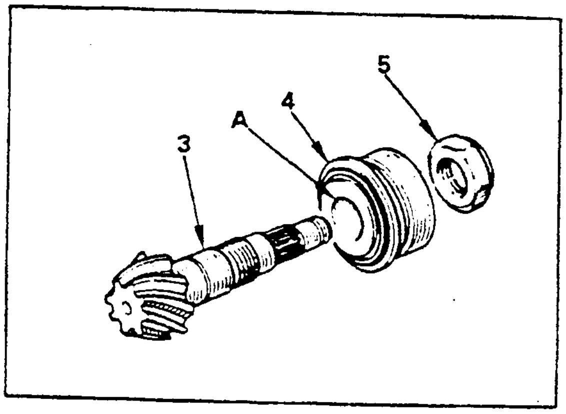


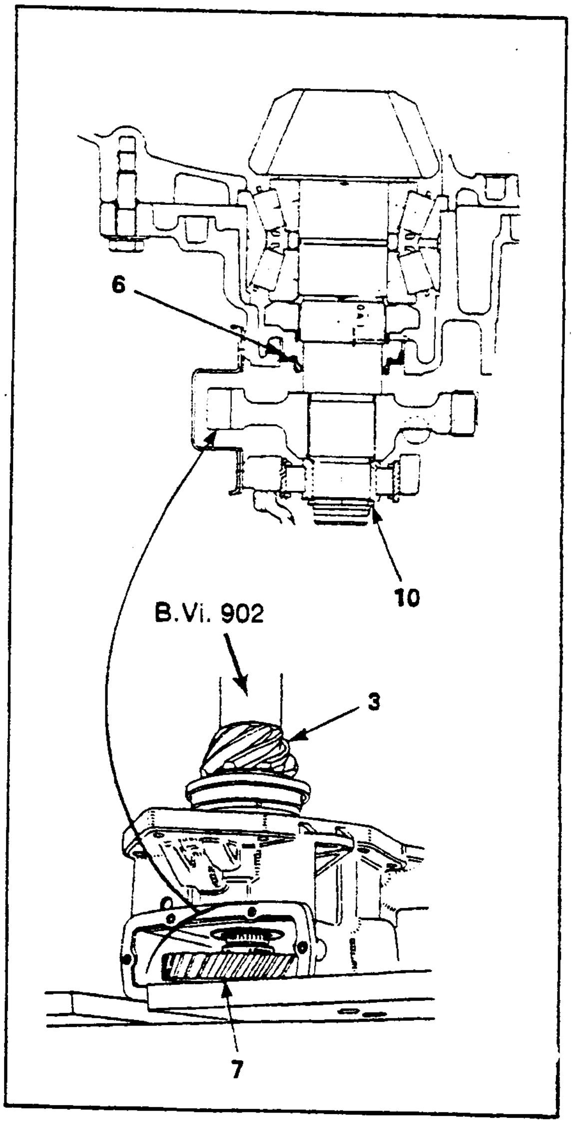
IMPORTANT

- If one of these parts requires replacing, the other must also be replaced.



- Fit the bearing (4) on the press with the reference mark (A) towards the final drive pinion.
- Apply 3 drops of Loctite® threadlocker to the threads in the nut.
- Hold the pinion vertically, spin the nut up (5) and tighten it to a torque of 4 daNm (30 lb./ft.) using tool B.Vi. 903.
- Turn the bearing by hand then tighten the nut to a torque of 22 daNm (162 lb./ft.)





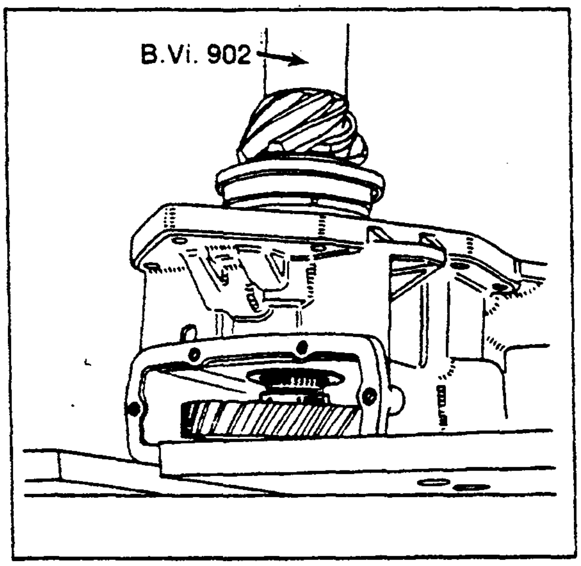
REFITTING THE FINAL DRIVE PINION:

- Install the gear (7) with its offset towards the cylindrical roller bearing.
- Fit the final drive pinion (3) on the press.

REBUILD
FINAL DRIVE ASSEMBLY

REFIT:

- cylindrical roller bearings,
- spring washer (1st arrangement only), ensuring that it faces the correct direction,
- circlip (10) using tool B.Vi. 902,
- Ensure that it locates correctly.

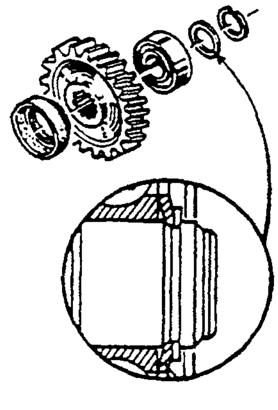


1st Type

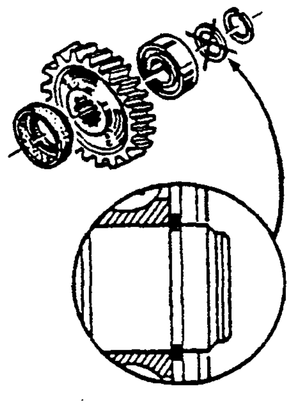
- Circlip thickness = 1.5 mm
- Assembly includes spring washer.

2nd Type

- Circlip thickness = 2.0 mm
- NO spring washer used
- Pinion tail shaft is 2 mm shorter
- Groove is located 1.6 mm further ahead and is widened to 2.5 mm.



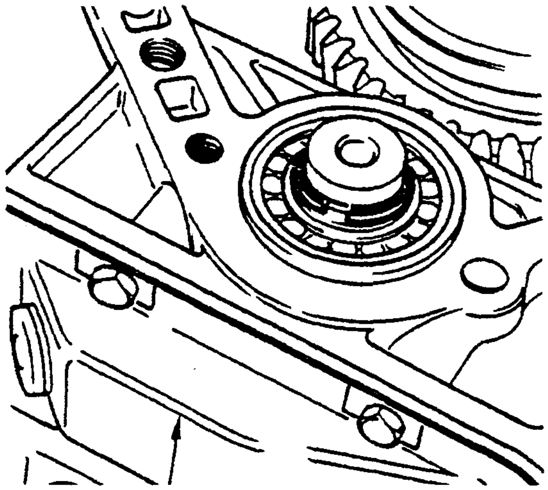
1st Type



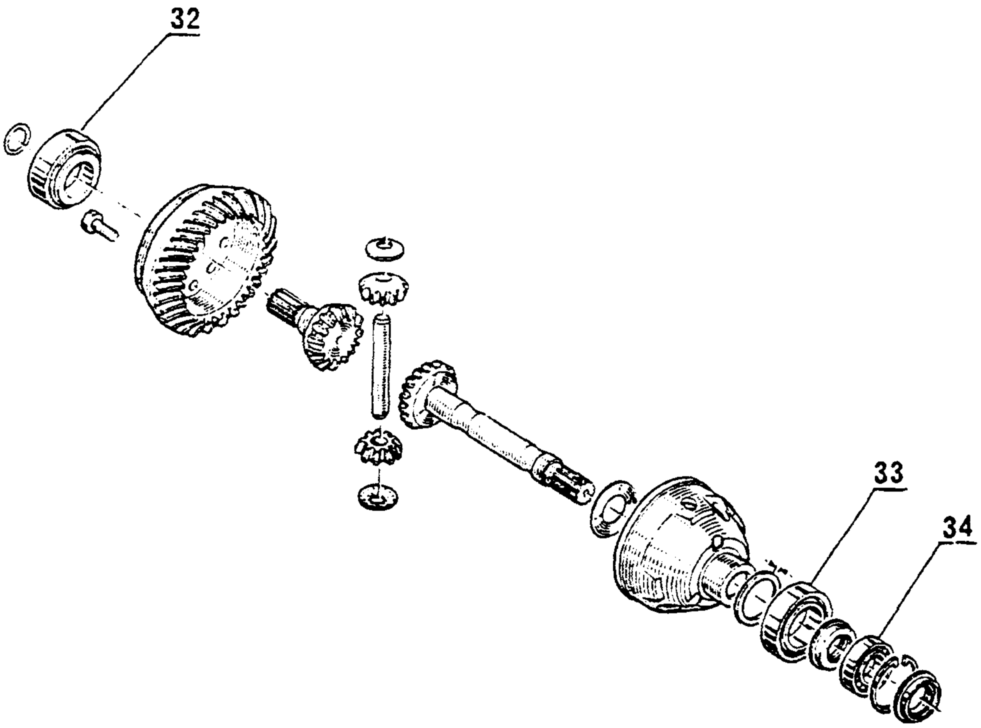
2nd Type

REBUILD
FINAL DRIVE ASSEMBLY

- Fit the pressed steel cover (T) with the drain plug on the opposite side to the filler plug (coat the gasket with gasket seal compound.)
- Tighten the bolts to a torque of 1.5 daNm (11 lb./ft.)
- Install the drain plug with a new sealing ring.



DIFFERENTIAL



FINAL DRIVE REBUILD
REASSEMBLY

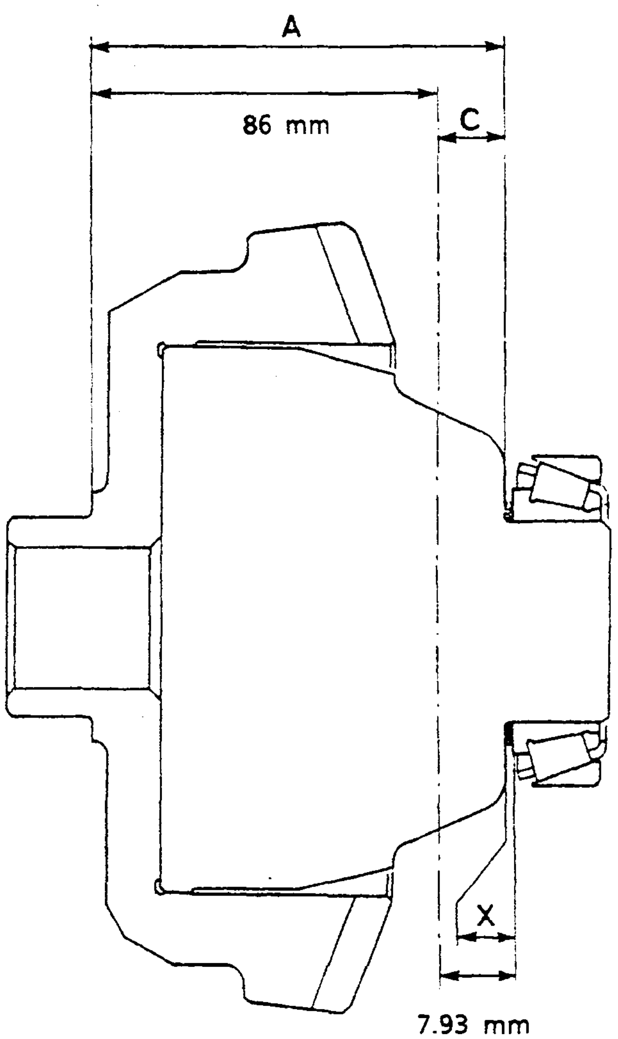
ADJUSTING BACKLASH

Backlash cannot be measured after the gearbox is assembled. It must be adjusted when the differential bearings are mounted.

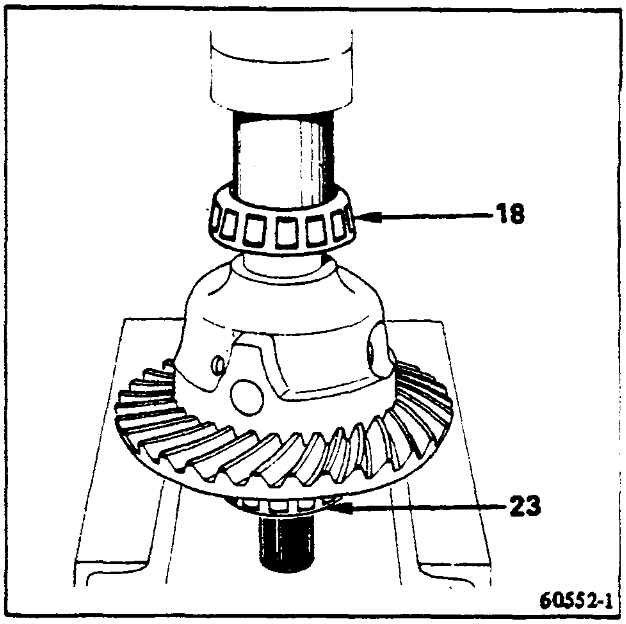
PROCEDURE
Assemble the differential housing and ring gear using 3 bolts.

- Use an accurate calipers to measure dimension A, the distance between bearing thrust surfaces on the differential gear assembly. Record this dimension.
- Subtract B (86 mm for all differentials) from dimension A. The result is dimension C.
  Example: If A is 93 mm, then 93 - 86 = 7 mm
- Subtract dimension C from D (7.93 mm for all differentials) to determine dimension X, which is the proper backlash adjustment.
  Example: 7.93 - 7 = .93 mm backlash
- Select a shim to use between the bearing and differential housing, which adjusts backlash closest to dimension X.
- Three thicknesses of shims are available:
  - 0.8 mm
  - 1.0 mm
  - 1.2 mm

In our example, you would choose the 1 mm shim, which would be only .07 mm over .93 mm. The .8 mm shim would be .13 mm too close.



- Place the proper shim between the bearing and differential housing.
- Fit the bearings using a press.
  The larger bearing (23) goes on the ring gear end of the differential assembly.



REASSEMBLY

Mount the ring gear to the differential housing using new bolts.

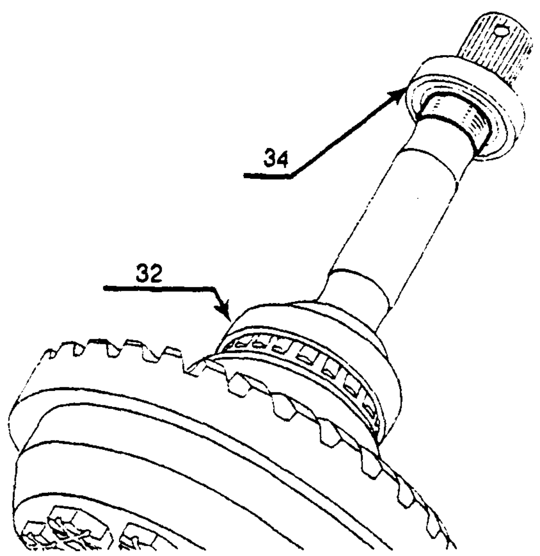
Torque tighten the ring gear bolts. (See G1-4)

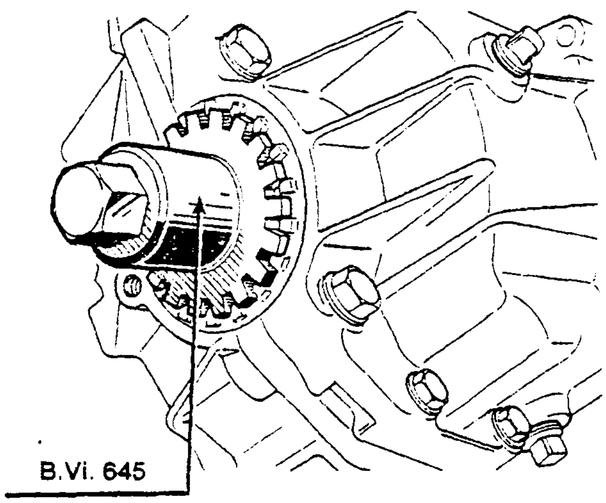
Press the ball bearing onto the shaft (34) a few millimeters at the planetary gear end to center it.

Lift up the assembly to the differential housing (bearing (34) not being in its working position.)

Coat the half-casing joint faces with anaerobic sealer, fit the other half-casing and assemble them with several bolts.

Hand tighten these bolts only at this stage.





Mount the differential ring nut (with its seal and its threads coated with gasket sealer) using castellated wrench B.Vi. 645.

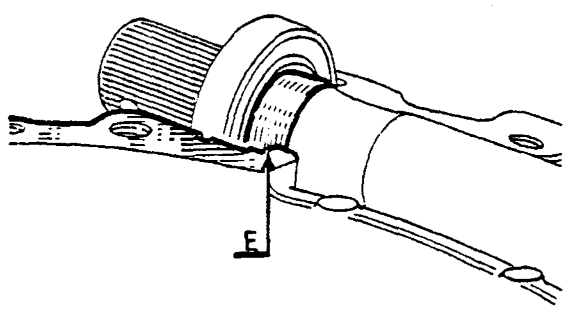
Tighten the ring nut until it contacts the differential bearing outer track ring.

Complete the assembling of ball bearing (34) driving it on until it touches shoulder (E) in the casing.

Unscrew the differential ring nut one half-turn.

Torque tighten the casing bolts. (See G1-4)

Place the following at the planetary gear end:
- circlip
- plastic bushing



ADJUSTING DIFFERENTIAL BEARING PRE-LOAD

Rotate the differential assembly to settle the bearings.

Ensure that the differential bearings locate correctly by turning the assembly.

Place the plunger on the torque measuring tool B.Vi. 906 against one tooth of the ring gear at its largest diameter, square with the differential shaft.

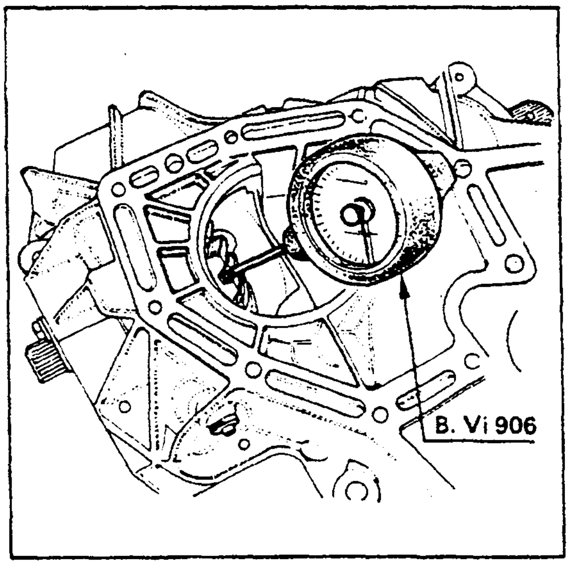
Using the torque measuring tool B.Vi. 906, press a ring gear tooth to rotate the differential slightly **in the same direction** as the bearing was installed. (Bearing roller-to-cage play will give a false reading if rotated in the opposite direction.)

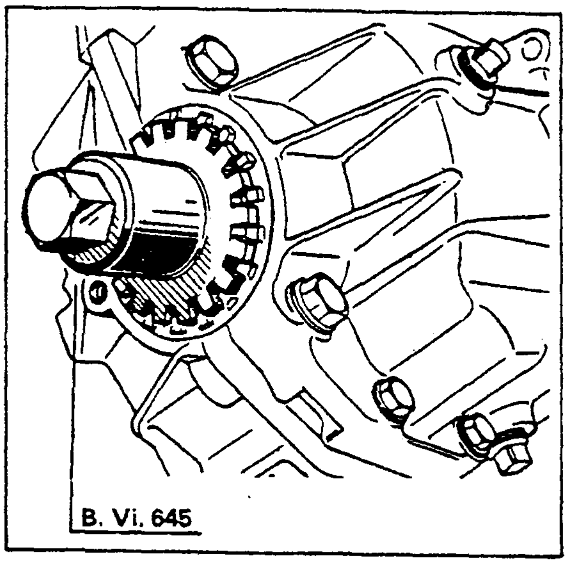
Release the torque measuring tool and read the torque shown by the follow-up pointer (Red).

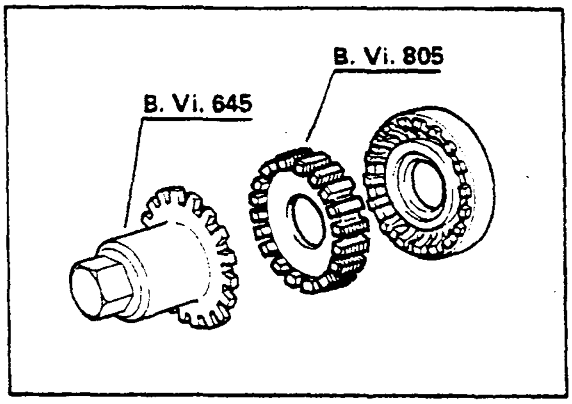
Screw the differential ring nut in or out to obtain a reading of: 2 to 2.5 daNm.

NOTE: The specification 2 to 2.5 daNm represents the pressure required for crown wheel movement as measured with tool B.Vi. 906; NOT the actual torque applied at tool B.Vi. 645.

- Adapter B.Vi. 805 must be used with wrench B.Vi. 645 when removing or replacing a 3-lip seal nut to avoid damaging the outer lip.
- When the correct adjustment has been obtained, lock the nut with its locking washer.





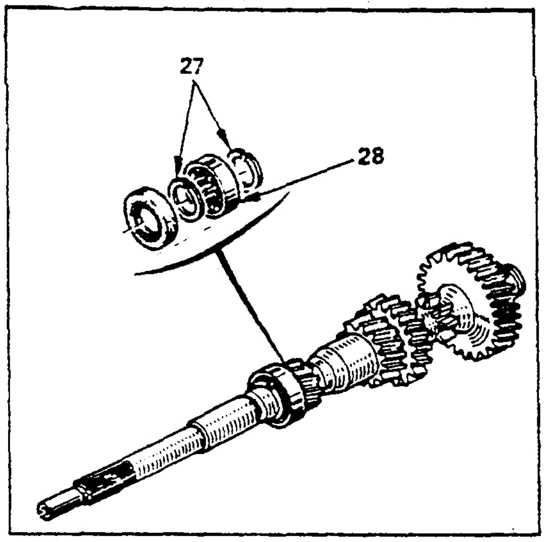


REBUILD
PRIMARY SHAFT ASSEMBLY

Replace the circlips (27) with new ones each time they are removed.

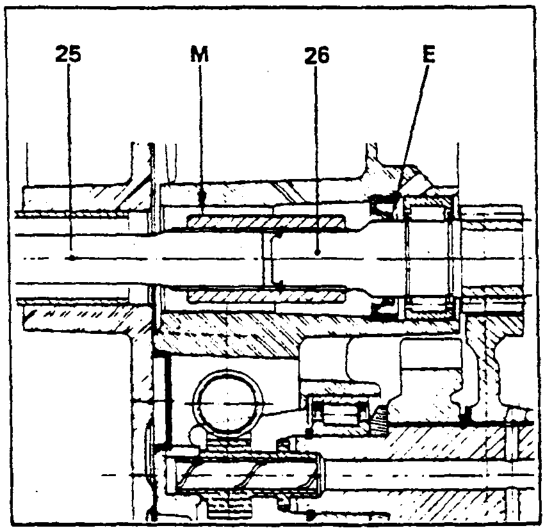
NOTE: The bearing (28) has no inner race. The rollers may possibly fall out when removing.

Since the lip seal and the bearing rollers run directly on the shaft, check the condition of their bearing area. If it is scored or appears defective, replace the primary shaft.

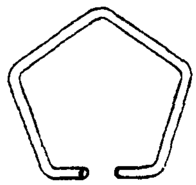


Type 1:
- The clutch shaft and primary shaft are one piece.

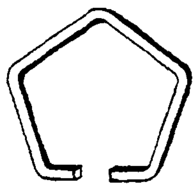
Type 2:
- The connecting sleeve (M) is press fit onto the clutch shaft (25) and is circlipped to the primary shaft (26) using a round-wire, pentagonal circlip as shown at right.
- Damage to seal (E) can be avoided by installing the primary shaft before attaching the clutch shaft.
- The clutch housing must be removed to replace the clutch shaft.



Type 3:
- The primary shaft and clutch shaft are designed to use a square-wire, pentagonal circlip as shown at right, rather than a round-wire type.



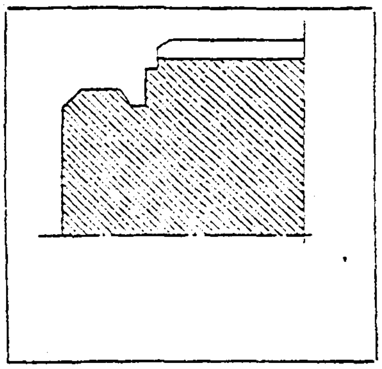
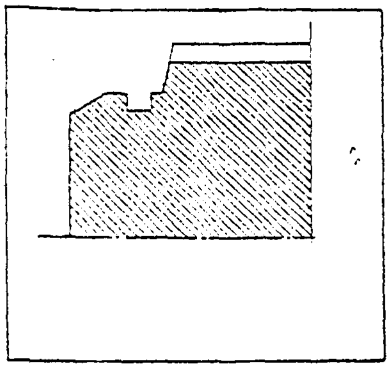
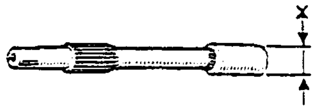
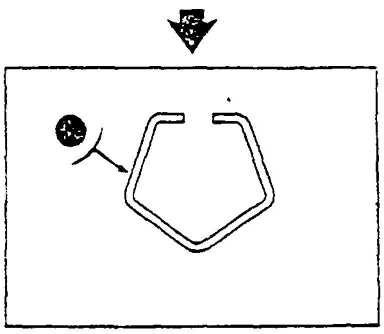
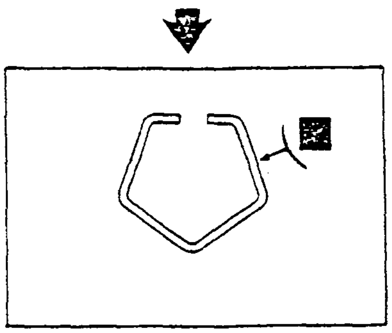
Type 2 Circlip
(Round-wire)



Type 3 Circlip
(Square-wire)

CAUTION
Parts from types 1, 2 and 3 are not interchangeable.

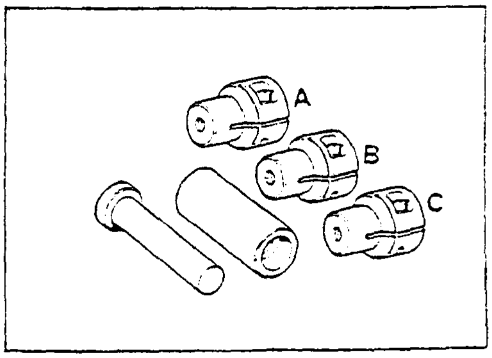
REBUILD
PRIMARY SHAFT ASSEMBLY

	2nd type of assembly	3rd type of assembly
Profile of clip groove for primary shaft		
Outer Ø of sleeve	x = 27.5 mm 	x = 28.5 mm
Special points	These parts can only be fitted with the circlip with the round cross-section. 	The modified parts can only be fitted with a circlip having a square cross-section. 

NOTE:
The circlip with a square cross-section must be replaced systematically each time it is removed.

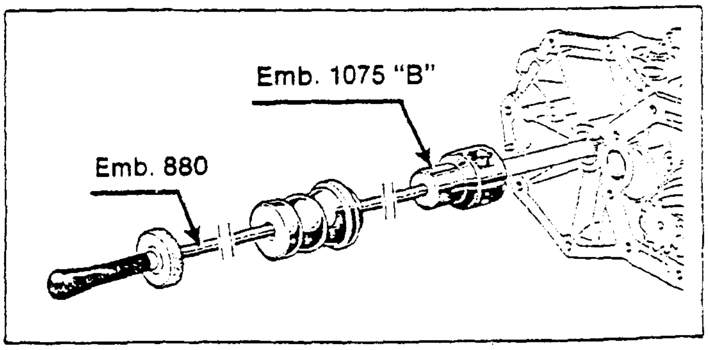
REBUILD
PRIMARY SHAFT ASSEMBLY

The clutch shaft is removed and the pentagonal circlip fitted in the sleeve using tools Emb. 880 and part "B" of tool Emb. 1075.



REMOVAL
Fit part "B" of Tool Emb. 1075, which matches the shaft diameter, and tighten it on the splines.

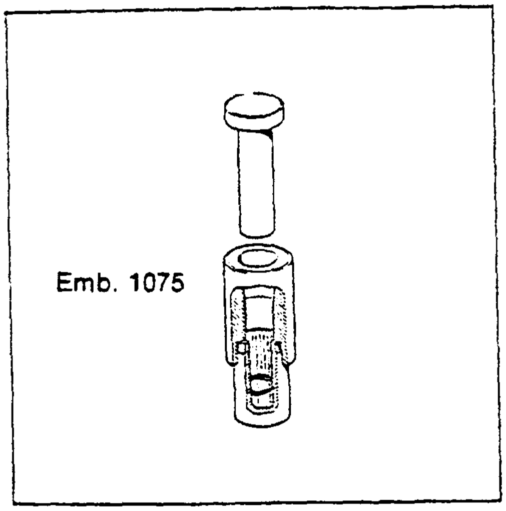
Screw tool Emb. 880 onto this tool and remove the shaft.



The pentagonal circlip with a square cross-section must be replaced with a new one after each dismantling operation.

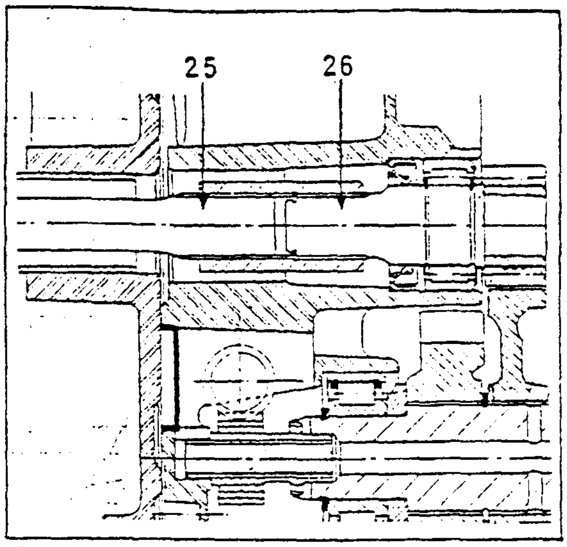
Using a small screwdriver and pliers, take the circlip out of the sleeve.

Refitting
Fit the pentagonal circlip in the sleeve using tool Emb. 1075.



PRIMARY SHAFT ASSEMBLY

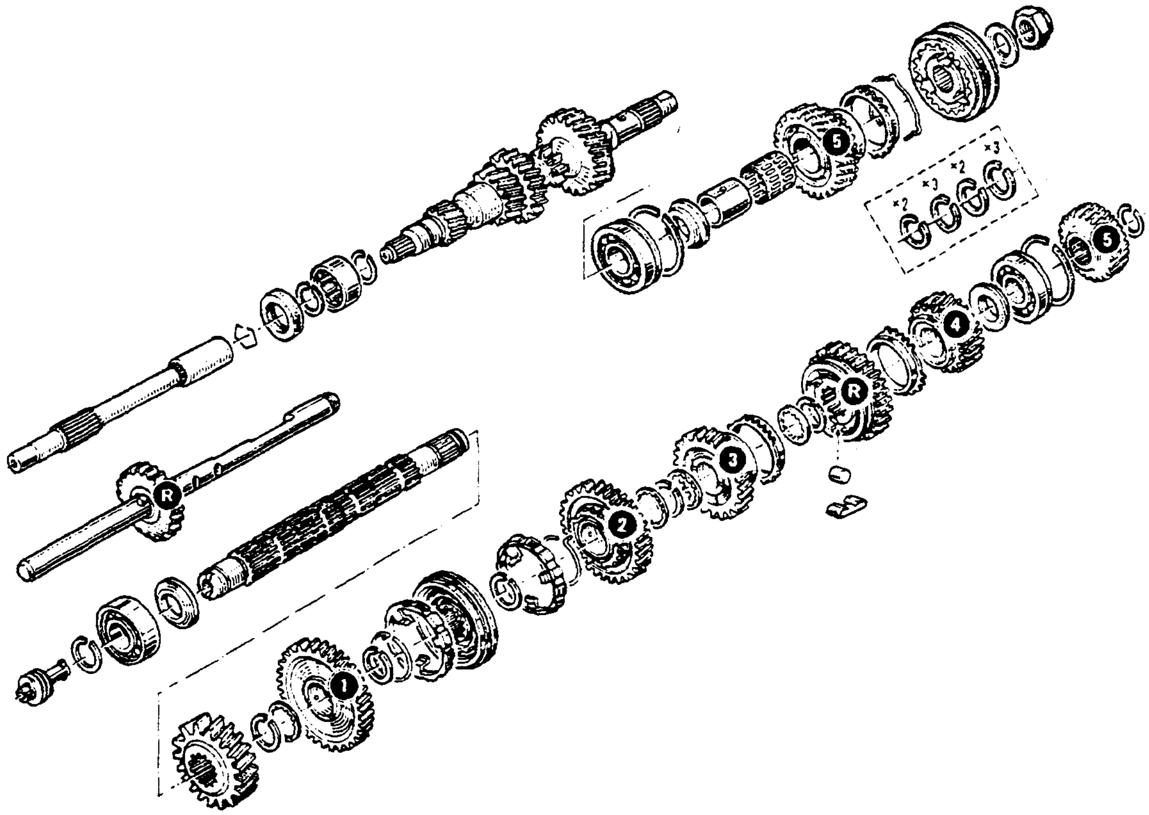
Using a small hammer, mount the clutch shaft on the primary shaft.



CAUTION
Use the hammer gently. A heavy impact could break the circlip.

If there is a slight axial clearance, this indicates that the circlip is clipped correctly in place in the primary shaft groove.

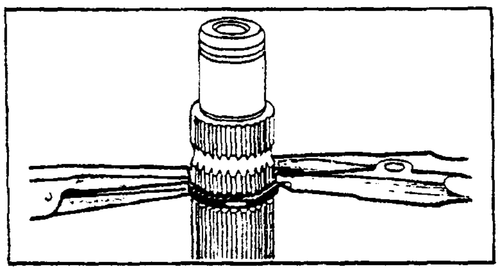
REBUILD
PRIMARY SHAFT ASSEMBLY



REASSEMBLY

All the circlips must be replaced with new ones.

When refitting the circlips, use a pair of circlip pliers to open the ends and a pair of flat nosed pliers on the opposite side to prevent the circlip from twisting.



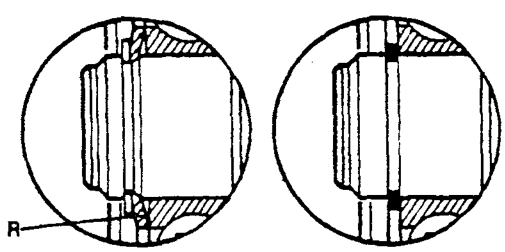
There are two types of bearing assembly at the step down gear end:

1st Type:

- Circlip thickness = 1.5 mm
- Assembly includes spring washer (R).

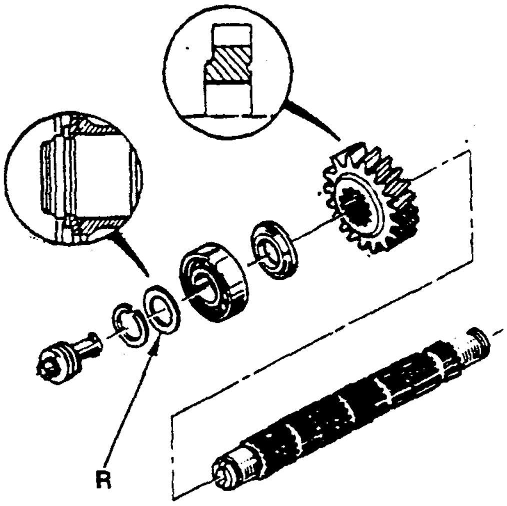
2nd Type:

- Circlip thickness = 2.0 mm
- Spring washer (R) is NOT used.
- Groove is located 1.5 mm further ahead and is widened to 2.5 mm.



SECONDARY SHAFT ASSEMBLY

Different arrangements of the bearing on the step down gear side and the 4th speed side.



1st Type:
- Circlip thickness = 1.5 mm
- Assembly includes spring washer (R).

2nd Type:
- Circlip thickness = 2.0 mm
- Does NOT use spring washer (R).
- Groove is located 1.5 mm further ahead and is widened to 2.5 mm

This modification has been accompanied by the widening of the groove and the bearing retaining circlip on the 4th speed side (thickness 2 mm). The spring washer has been replaced by a flat washer.

Installing the Step-Down Gear onto the Secondary Shaft
The original step-down gear may have been bonded to the shaft with Loctite® adhesive. The replacement step-down gear, however, is designed to be press fit onto the shaft.

Step-Down Gear Thickness
The standard step-down gear thickness is 22.9 mm.

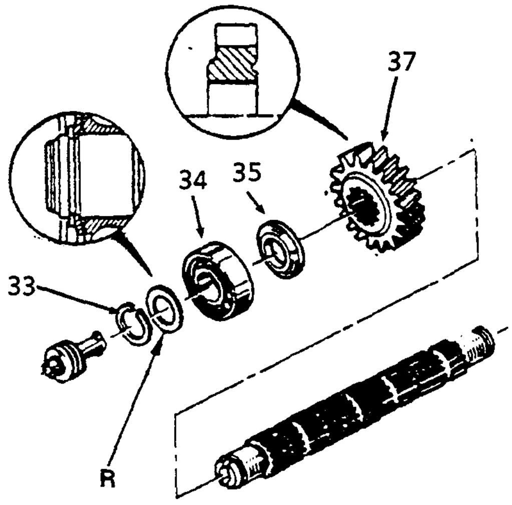
A limited number of NL gearboxes were produced with a 21.4 mm gear and a spline washer between the gear and the circlip.

Replacing a 21.4 mm Step-Down Gear
Should it be necessary to replace a 21.4 mm step-down gear, remove the spline washer and replace the gear with a standard 22.9 mm gear.

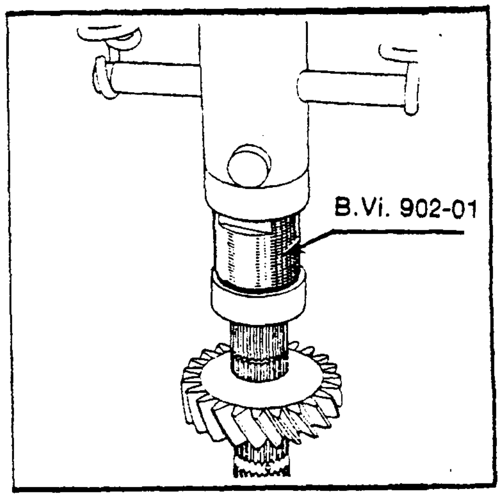
REASSEMBLY:

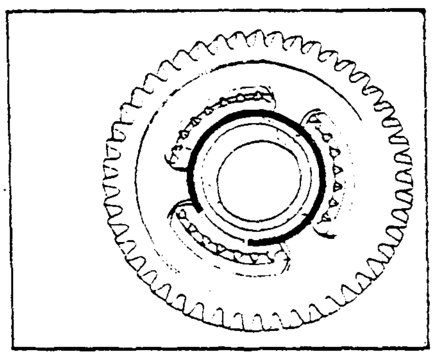
Install or Connect:

- The circlip (33).
- The step down gear (37), ensuring that the shoulder (A) is on the correct side.
- The washer (35) with the large flat face on the step down gear side. The shouldered face goes toward the bearing (34).
- The bearing (and the spring washer, in those cases where one is fitted).
- The circlip (33) using tool B.Vi. 902-01 if necessary.



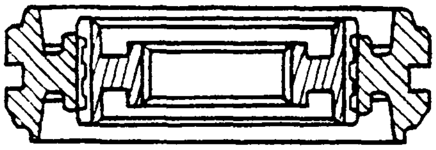
- Ensure that the circlip is correctly located in its groove in the secondary shaft.
- Refit the gear wheels by performing the removal sequence in reverse and oiling the gear wheels and synchornizer rings.
- Fit the synchronizer springs to the 1st and 2nd gear wheels with their ends folded into the apertures in the gears.





REBUILD
SECONDARY SHAFT ASSEMBLY

- Ensure that the hub-sliding gear assemblies face the correct direction.
- 1st - 2nd : sliding gear chamfer towards 2nd.



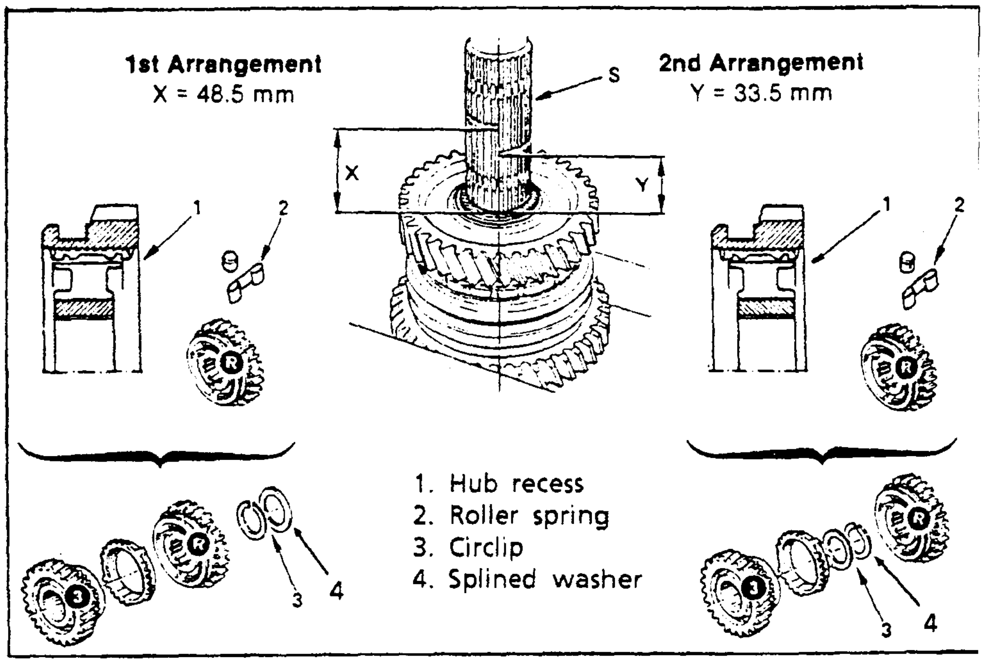
3rd - 4th : Reverse gear teeth towards 4th.

: There are three types of synchronizer hub arrangements

REBUILD
SECONDARY SHAFT ASSEMBLY

SECONDARY SHAFT

3rd/4th Synchronizer Hub Installation



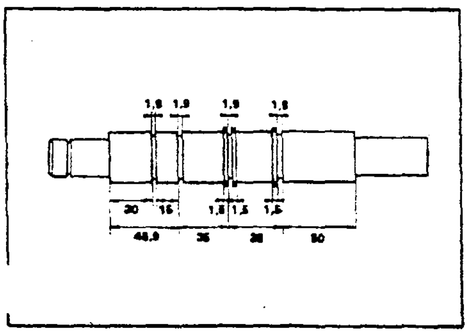
The synchronizer assembly parts are identical except for two different versions of the secondary shaft (S). On the 1st type, the groove is located 48.5 mm from the gear as indicated by dimension X. On the 2nd type, the groove is closer to the gear (33.5 mm) as indicated by dimension Y. This variation results in two different assembly arrangements as shown.

Note the position of the synchronizer roller and spring in the relation to the hub and the location of the circlip and washer in relation to the reverse gear.

Only the 1st speed gear from the "2nd arrangement" can be used regardless of the original arrangement. There can be an axial clearance of approximately 2 mm in the case of a secondary shaft of the "1st arrangement" type.

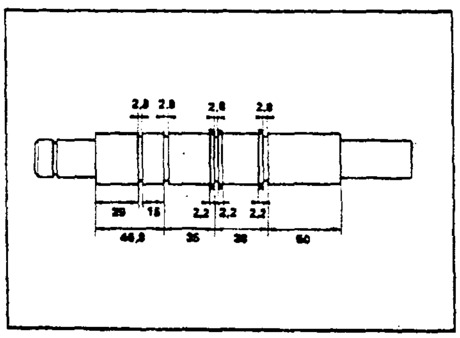
1st Arrangement

Circlip:	1.9 mm
Splined washer:	1.5 mm



2nd Arrangement

Circlip:	2.8 mm
Splined washer:	2.2 mm



REBUILD
SECONDARY SHAFT ASSEMBLY

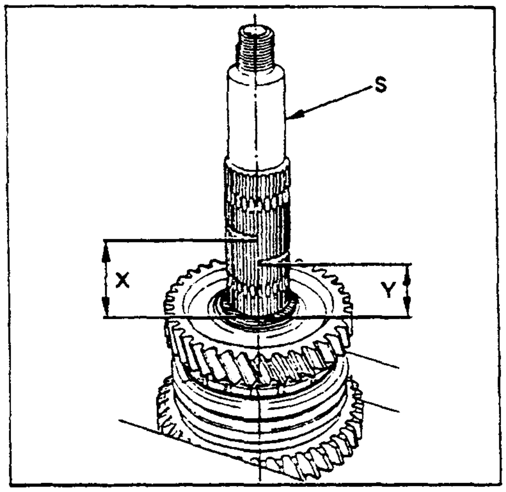
REASSEMBLY:

Special Features:
All the parts are identical except for dimensions X and Y on the secondary shaft.

1st arrangement **X = 48.5 mm**

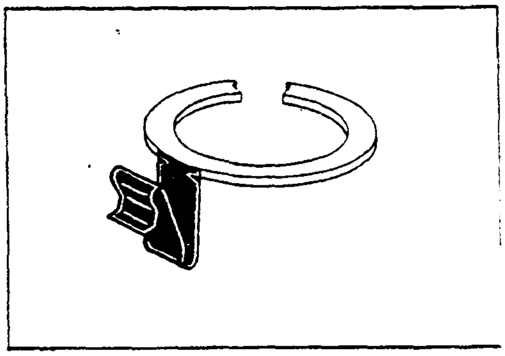
2nd arrangement **Y = 33.5 mm**

Ensure that the synchronizer roller springs face the correct direction.



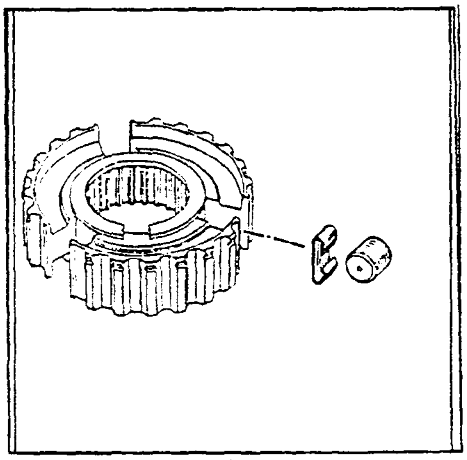
The locking tabs must be on the same side as the circlip.

The washer must be installed with the large bearing face towards the 4th speed gear.

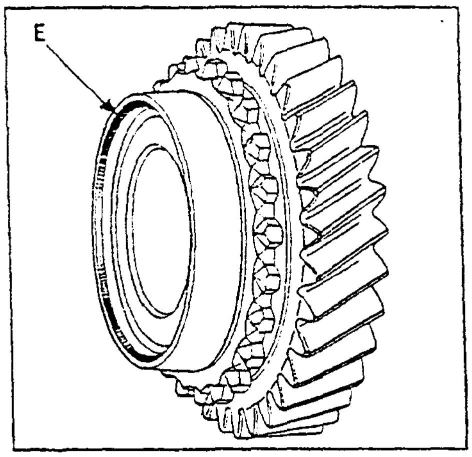


REBUILD
SECONDARY SHAFT ASSEMBLY

NOTE: In all NL gearboxes, the "Z-shaped" BORG-WARNER (3rd/4th speed) synchro roller springs used to date have now been replaced in production by "heart-shaped" springs.



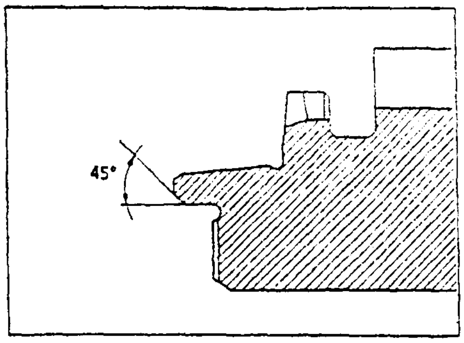
1 : 1st type of assembly ("Z" shape)
2 : 2nd type of assembly (heart-shaped)



The inlet recess chamfer (E) of 3rd and 4th speed idler synchro cones has been redesigned to accommodate the new shape roller spring. The new springs can only be used with the new design idler gears. They will not work with old design idler gears.

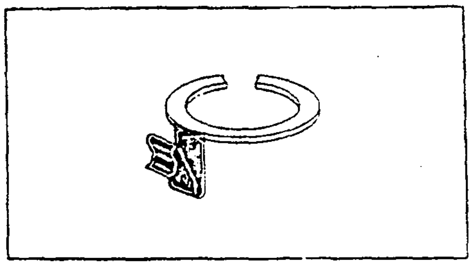
REBUILD
SECONDARY SHAFT ASSEMBLY

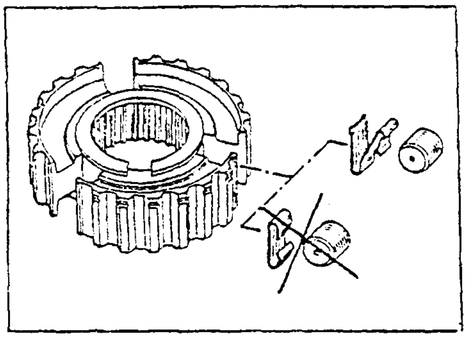
1st TYPE OF ASSEMBLY

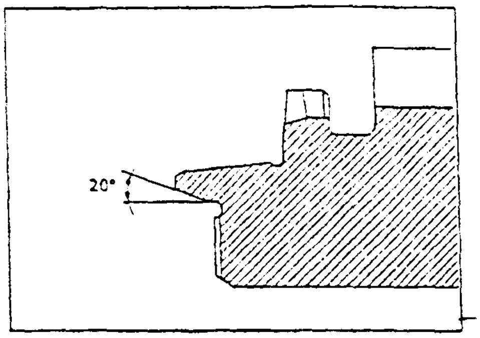


The 45° inlet chamfer "E" for the recess under the synchro cone can only be fitted with a "Z-shaped" spring.

Remember: Make sure the synchro roller "Z-shaped" springs are mounted the correct direction : locking the tabs fitted at the lock ring end.



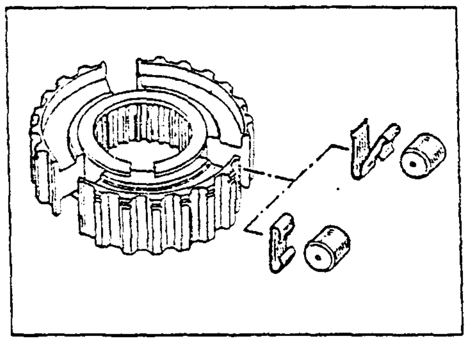




2nd TYPE OF ASSEMBLY

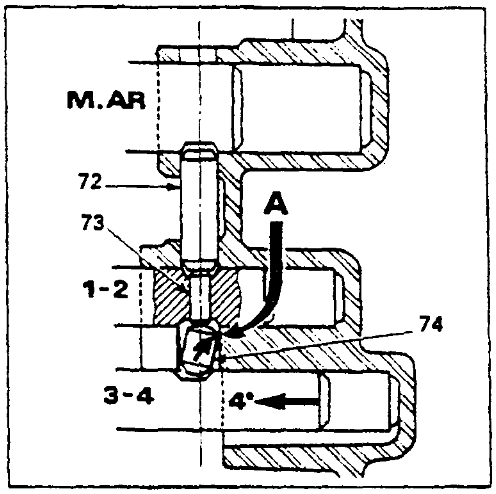
Special Point: idler gears with a 20° inlet chamfer "E" can be fitted either with "heart-shaped" or "Z-shaped" springs. However, different shaped springs **must not** be used on the same synchro assembly.

Make sure the "heart-shaped" springs are fitted correctly with the flat section fitted at the synchro hub end.



Reassembly:

- Place the locking balls in the housing :
- Between the reverse shaft and 1st/2nd shaft bores (73).
- Between the 1st/2nd and 3rd/4th shaft bores (74).
- Ensure that they slide correctly.
- Refit the shafts to the step down housing.



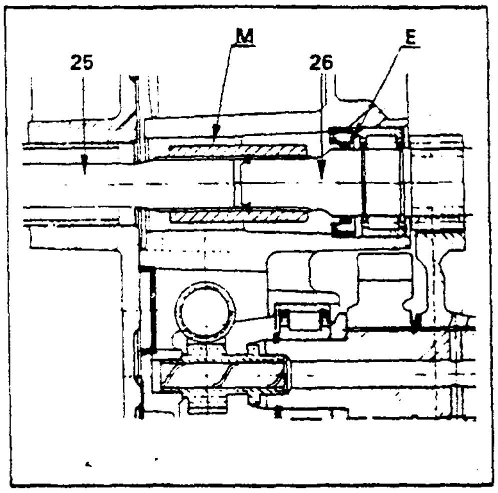
- Precautions : To avoid damaging the lip on the primary shaft seal, carefully guide the clutch shaft to prevent its splines or sleeve from making contact with the lip on the seal.

1st arrangement:

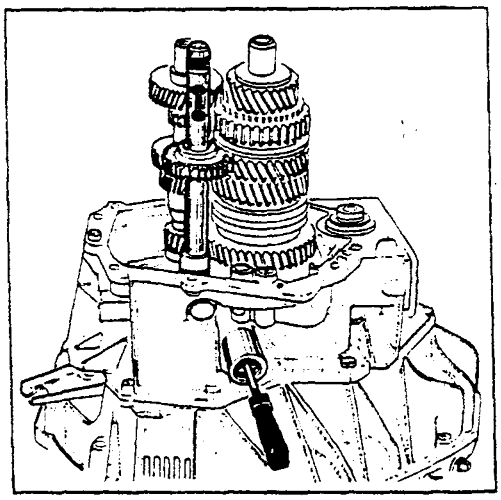
- The clutch shaft is integral with the primary shaft.

2nd arrangement:

- A coupling flange (M) is press fitted to the clutch shaft (25) and is clipped to the primary shaft (26).
- The two shafts are assembled after fitting the primary shaft to avoid damaging the lip seal (E). See page **G3-26**;



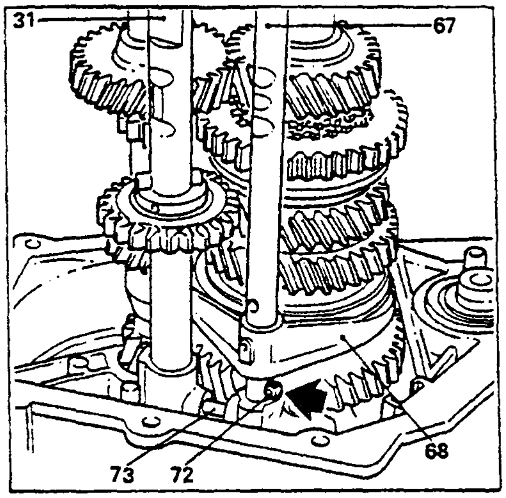
- Fit the speedometer worm to the secondary shaft.
- Connect the primary shaft to the secondary shaft. Take both the shafts and position them in their housings simultaneously.
- Fit the reverse shaft with locking recesses opposite the shafts.
- Turn the speedometer pinion and tap the three shafts with a plastic mallet until they align into their correct positions.
- Place a cloth under the step down gears to prevent any parts from falling into the housing.



REBUILD
FINAL ASSEMBLY

REASSEMBLY:

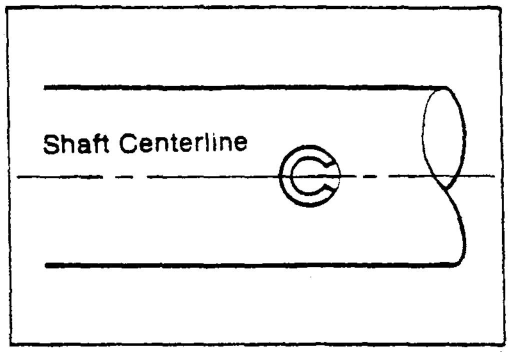
- Fit the 1st/2nd shift fork (with the flat face of the fork on the 1st speed side).
- Slide the large locking plunger up to the reverse shaft and ensure that the shaft is locked.
- Insert the 1st/2nd fork shaft, with the small locking plunger (72) into the fork and lower it into the bore in the housing. Pin the fork using tool B.Vi. 949 with the locking recesses in the fork shaft opposite the secondary shaft.



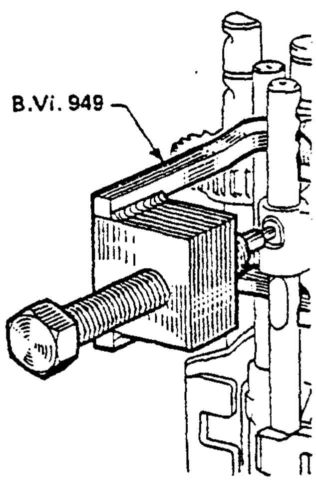
NOTE:

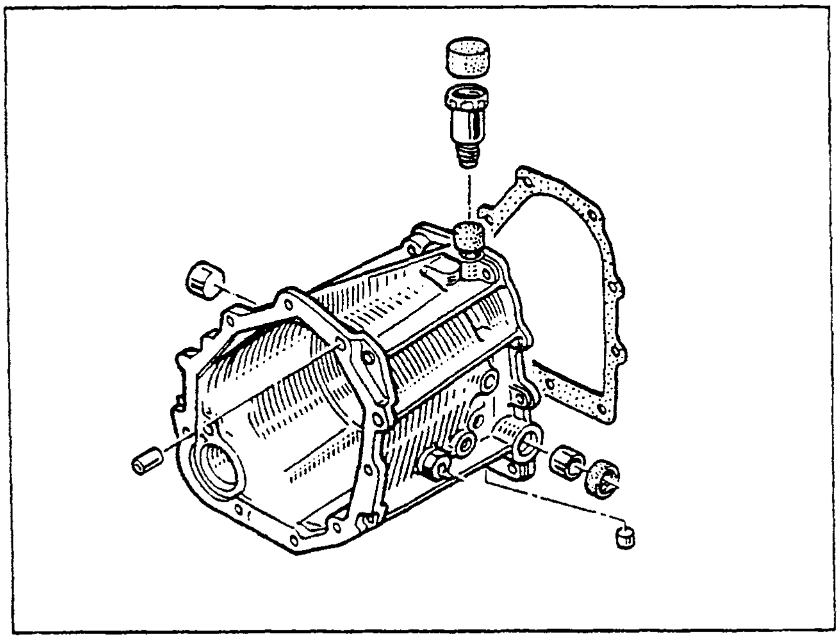
1 - The seams in the pins must line up with the shaft centerline.

2 - These pins must be replaced with new ones each time they are removed.

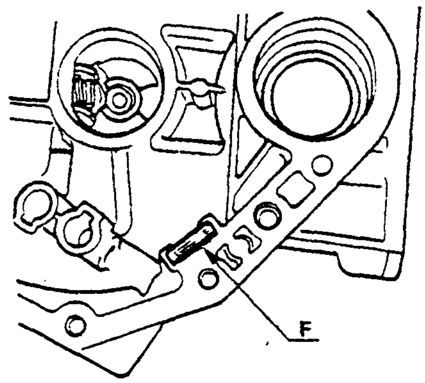


- Fit the 3rd/4th speed fork (flat face towards 4th speed) on the sliding gear. Ensure that the reverse shaft and 1st/2nd fork shaft are locked. Slide the 3rd/4th fork shaft into the fork and lower it into the housing. Ensure that the bore recesses on the shaft are opposite the secondary shaft and that the plunger (74) is in position. (See G3-35) Pin the fork in place using tool B.Vi. 949.





- Be sure the magnet (F) is in its location. Also be sure the 2 locating dowels are in the housing.

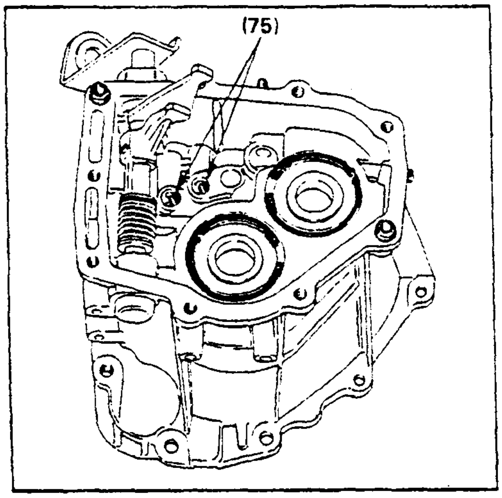


REBUILD
FINAL ASSEMBLY

In the main housing :

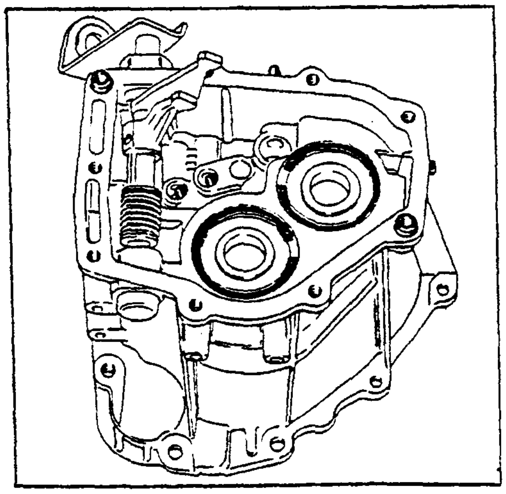
- Fit the two interlocks (75) between the fork shaft bores:

  - 1st/2nd and 3rd/4th



Replacing the bearings
1st arrangement : thickness : 17 mm
2nd arrangement : thickness : 17.5 mm

When replacing a bearing, it must be identical to the one removed.



Removing:
- Remove the circlips and push out the bearings with a tube from inside the housing.

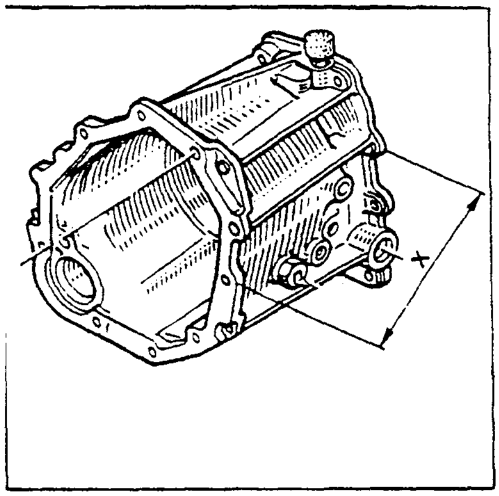
Refitting:
- Fit the bearings on the press, taking the load on the outer race (0.61 mm).
- The bearing plastic cage should face towards the outside of the housing.
- Fit the circlip, ensuring that it enters correctly into its groove in the housing.

1st arrangement : without a gasket.

Coat the joint face between the main and step-down housing with anaerobic sealant. Refer to "Anaerobic Sealants" on page G1-16 for recommendations.

2nd arrangement : Fit a gasket (dry).

To check whether the arrangement is of the gasket or no gasket type, simply measure dimension X on the main housing or the thickness of the bearings fitted to it.



1st case:

Dimension X : 205 mm, bearing thickness 176 mm.

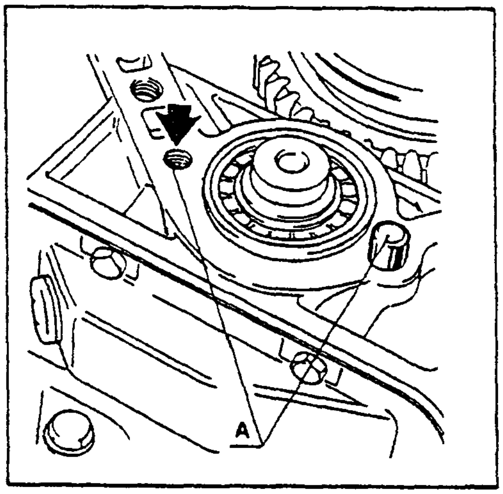
- arrangement without gaskets

Coat the joint face between the main and step down housings with an anaerobic sealant. Refer to "Anaerobic Sealants" on page G1-16 for recommendations.

2nd case:

Dimension X : 204.2 mm with bearings 17.5 mm thick.

Arrangement with gaskets
(do not use jointing compound).



CAUTION

1st arrangement without a gasket **cannot** be fitted with a gasket.

- The two bolts fitted at (A) must be coated with anaerobic sealant.
- Fit the main housing and tighten the bolts to a torque of 3 daNm (22 lb./ft.)

REBUILD
FINAL ASSEMBLY

Different repair arrangements:

1st case: The fitting of a new housing to a gearbox with the old type primary and secondary shafts.

a) first type gearbox:

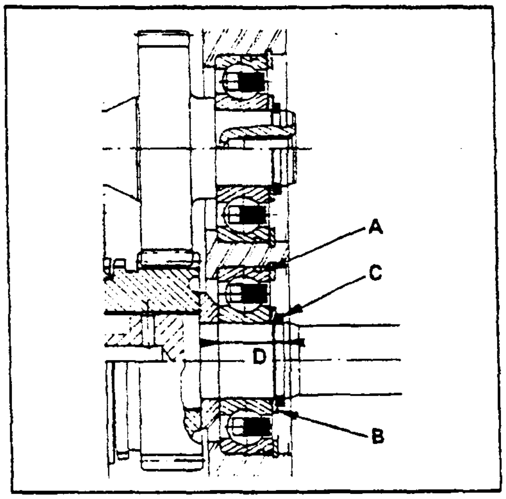
Fit a new washer 1.5 mm thick and circlip 1.5 mm thick.

b) 2nd type gearbox:

Fit the original washer 2.05 mm thick and a new circlip 1.5 mm thick instead of 2 mm.

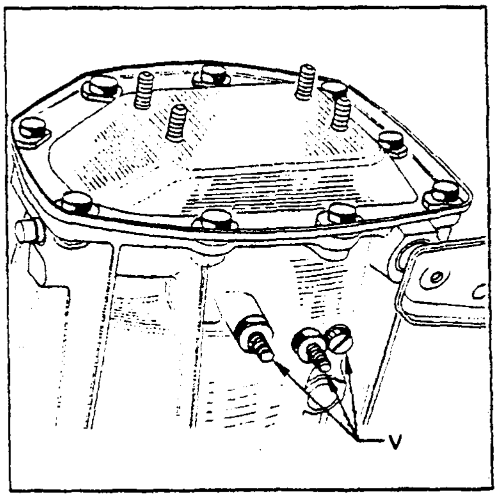
2nd case : - Fitting new primary and secondary shafts to an old type gearbox.

Fit the washer 2.05 mm thick with a circlip 2.4 mm thick.

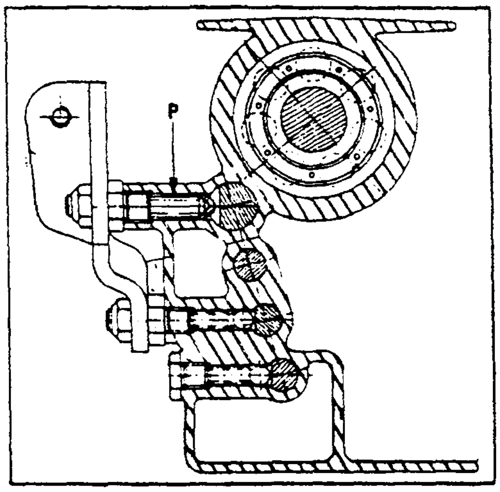


	Thicknesses in mm			
	Bearings A	Washer B	Circlip : C	Dimension D
First Arrange.	17	2.05	1.5	20.65
Second Arrange.	17	2.05	2	21.15
Third Arrange.	17.5	2.05	2	21.65

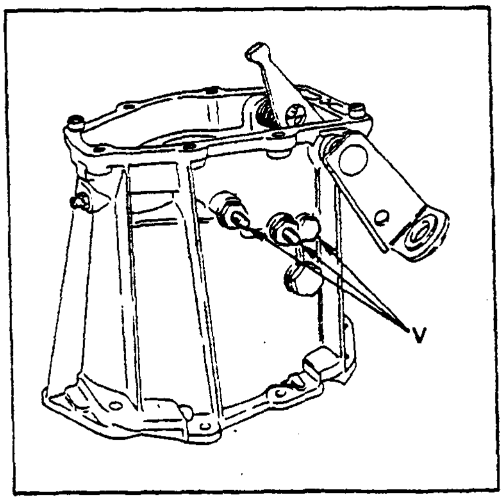
- Refit the locking assemblies (V).



- The 2 locking balls for the 1st/2nd and 3rd/4th shafts are identical.
- Reverse is locked by a plunger (P).
- The 3 springs are identical.

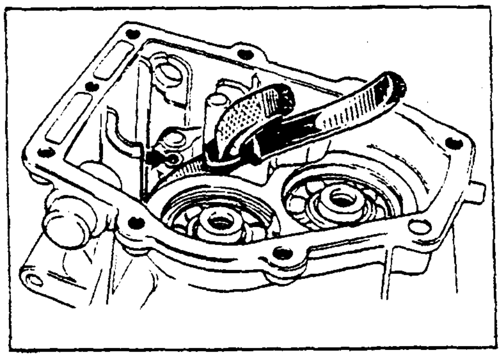


- Coat the plugs with anaerobic silicone and tighten them to a torque of 1.7 daNm (12.5 lb./ft.)



REBUILD
FINAL ASSEMBLY

Pin the 3rd/4th lever (14) to its shaft, holding it in place with a pair of long bent-nosed pliers, with the 3rd/4th shaft in 4th.



- Fit the spring washers to the primary and secondary shafts ensuring that they face the correct direction.

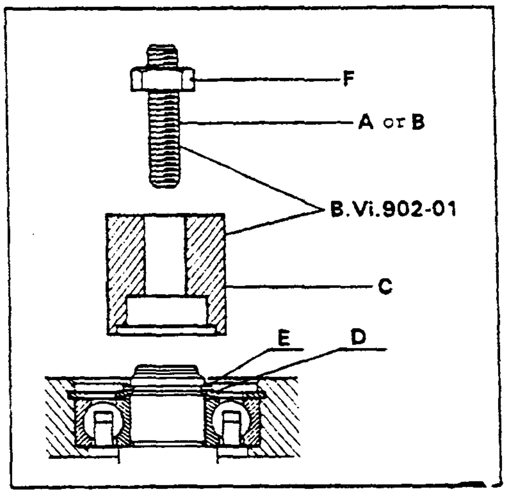
- Attach the circlip using tool B.Vi. 902-01.

Primary shaft:
- Use the (10 x 150) threaded rod.

Secondary shaft:
- Use the (12 x 150) threaded rod.

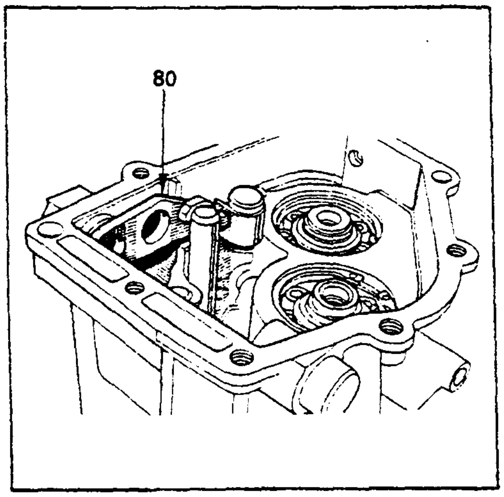
- Screw the rod (A) into the shaft (primary or secondary).

Attach the body of the tool C and screw on the nut (F) while holding tool (C) to prevent it from turning. After removing the tool, ensure that the circlips have correctly entered their locations.

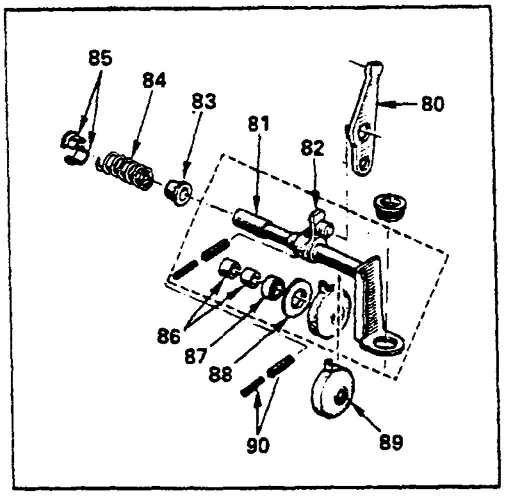


REBUILD
FINAL ASSEMBLY

NOTE: The lip seal must be replaced each time the shift shaft is removed, since it is unavoidably damaged as the shaft is taken out.

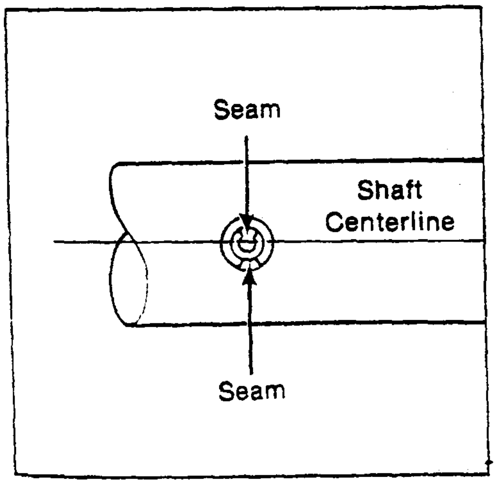


- Fit the lip seal (oiled).
- Ensure that there are no burrs on the shaft to avoid damaging the lip on the seal.
- Refit the ring (if there is one).
- Place the reverse lever (80) in position with its boss towards the outside and clip it to the shaft.
- Oil the shaft and fit it together with its boot (when applicable).

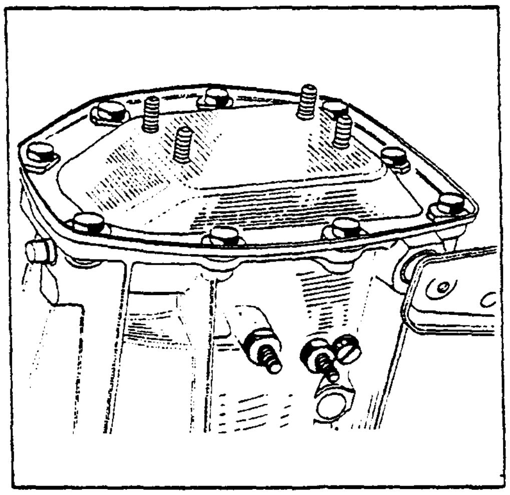


Assemble:
- The selector lever (82).
- The bushing (83) and the spring (84).
- The half shells (85) using tool B.Vi. 747
- Pin the selector lever (82) in place.
- Ensure that the pins are installed facing the right direction.

- The seams of the pins must be perpendicular to the shaft center line and on opposite sides to one another.
- Check that the control slides freely and that there is no play.

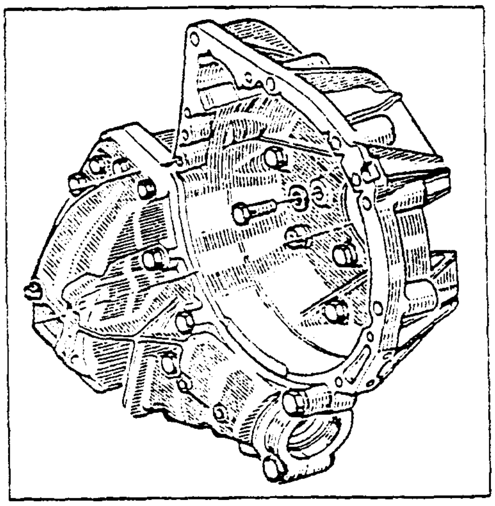


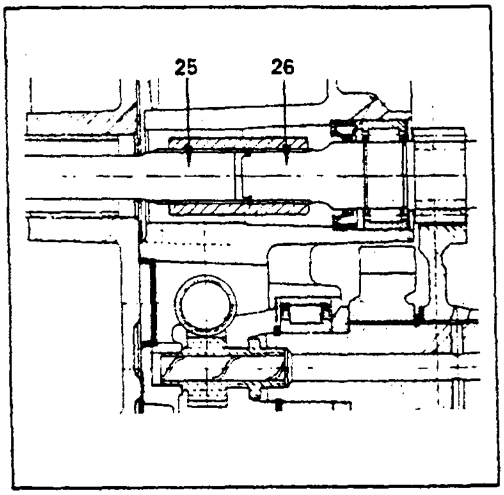
- Check that all the gears engage.
- Attach the rear cover after coating its gasket with jointing compound.



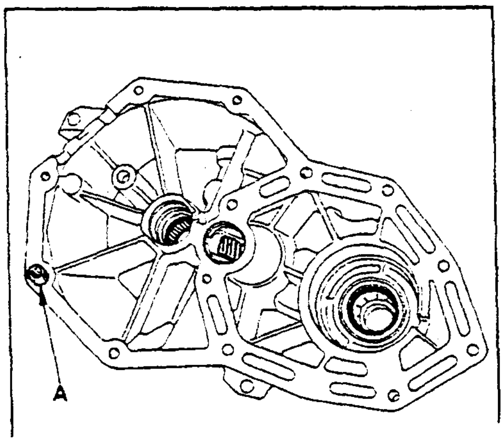
REBUILD
FINAL ASSEMBLY

Before connecting the clutch housing-final drive assembly to the step down and main housings:





- Assemble the clutch shaft (25) (2nd arrangement) by clipping it to the primary shaft (26). See page G3-26.



- Check that the locating dowel A is in position and coat the assembly faces of the housings with anaerobic sealer. Refer to "Anaerobic Sealants" on page G1-16 for recommendations.

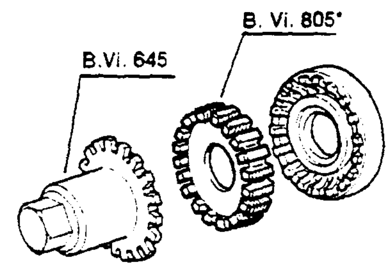
- Assemble the housings and tighten the bolts to a torque of 3 daNm (22 lb./ft.)

FINAL DRIVE OIL COOLING SYSTEM

Refer to pages F7-24 through F7-28.

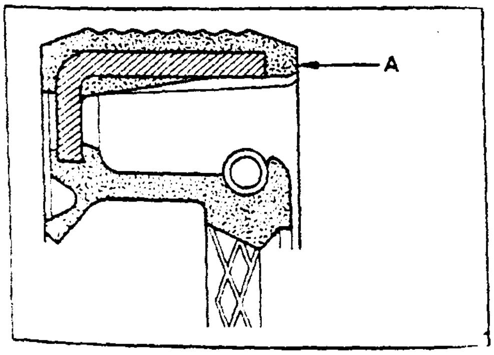
DIFFERENTIAL SEAL AND NUT
REMOVE AND REPLACE

REMOVING:
- Drain the final drive case.
- Disconnect the transmission shaft at the final drive end.
- Mark the position of the adjusting nut in relation to the case.
- Remove the locking washer.
- Unscrew the nut, counting the number of turns. Use tool B.Vi. 645.



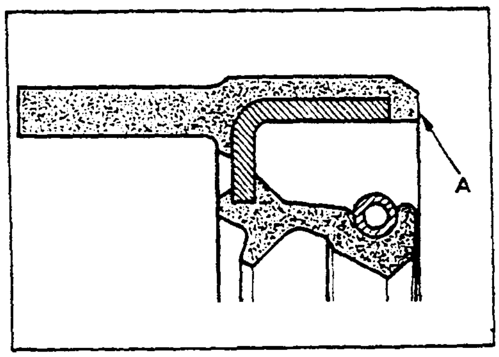
*Use with 3-lip seal

1st Type: Seal with 2 lips



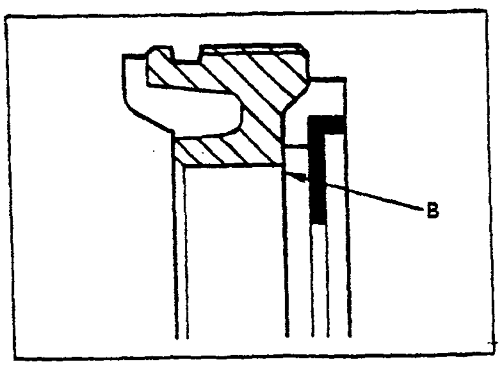
2nd Type: Seal with 3 lips

- Adapter B.Vi. 805 must be used with wrench B.Vi. 645 when removing or replacing a 3-lip seal nut to avoid damaging the outer lip.



Face A must be flush with the inner face of the nut B regardless of the type of seal.

Refitting:
- Refit the nut, equipped with a new, oiled O-ring, screwing in by the same number of turns and aligning it with the marks made during dismantling.
- Refit the locking washer.
- Reconnect the transmission shaft.
- Fill the final drive case.

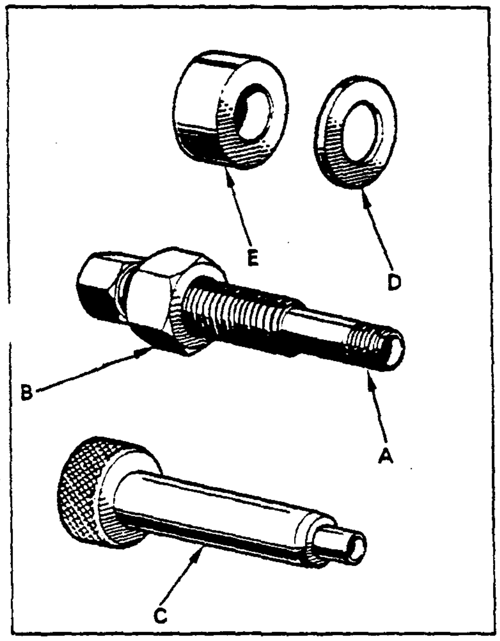


NOTE: The 3 lip seal can be installed as a replacement for the 2 lip seal.

SPEEDOMETER SHAFT SEAL
REMOVE AND REPLACE

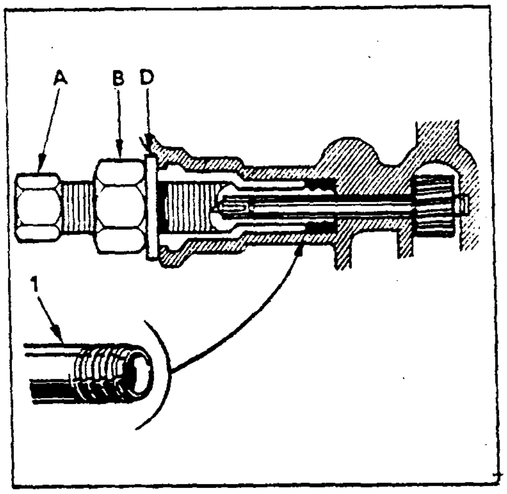
The speedometer shaft seal is replaced using tool B.Vi. 905 which includes:

- a seal extractor (A) fitted with a nut (B),
- a seal fitting tool (C),
- a thin spacer (D),
- spacer (E) is not used.



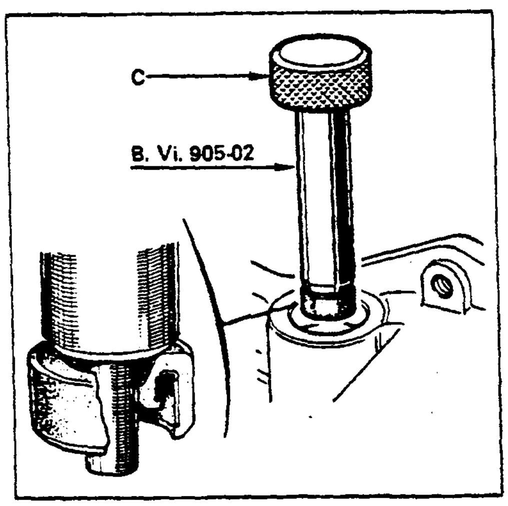
REMOVING

- Disconnect the speedometer drive cable from the gearbox.
- Attach the extractor tool (A) equipped with nut (B) and spacer (D).
- Screw the tool (A) in by approximately three turns after it has made contact with the seal so that its thread (1) penetrates the rubber.
- Extract the seal by screwing in the nut (B) while holding the tool (A).



REFITTING

- Place the seal on tool (C) as shown and hit the end of the tool.



SECTION "H"
CLUTCH

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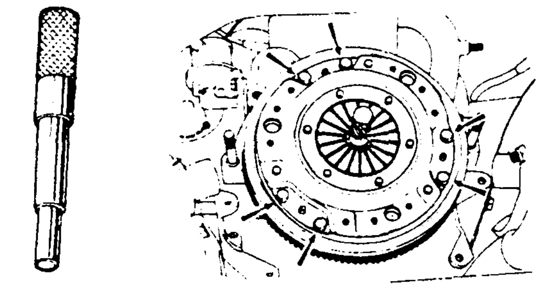
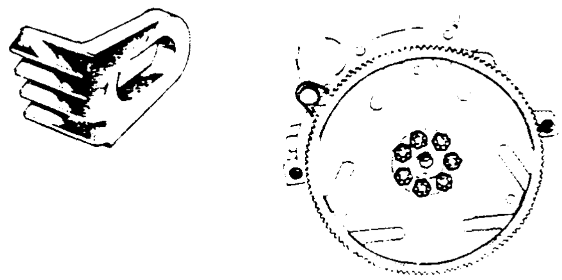
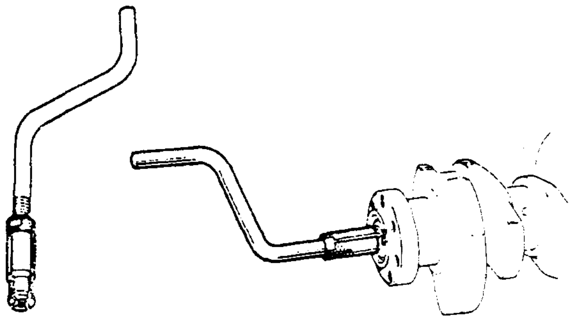
SPECIAL TOOLS



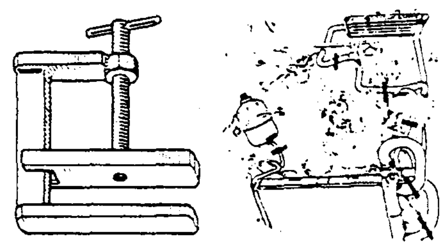
Emb. 786.01
Mandrel for locating clutch disc
Order Tool No. 700000-78-601 EA



Mot. 582
Flywheel locking sector
Order Tool No. 700000-58-200 EA

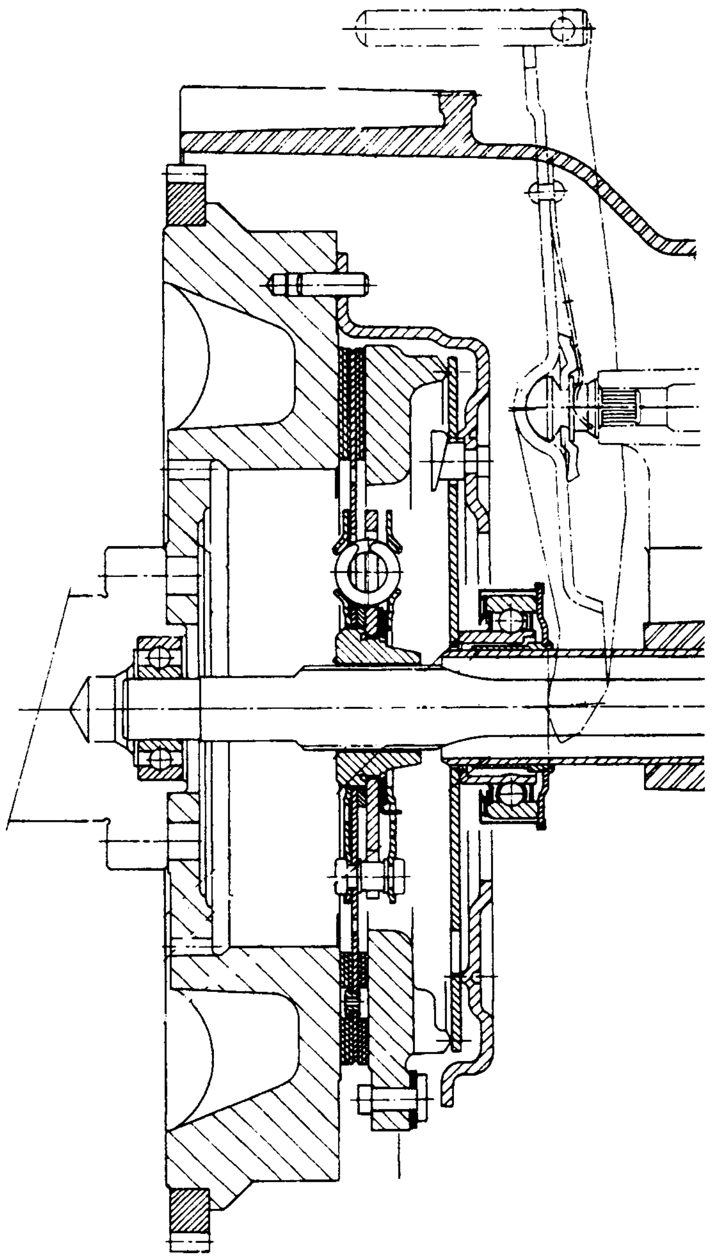


Mot. 11
Crankshaft bushing extractor
Order Tool No. 700000-72-500 EA



Mot. 453-01
Hose clamp (25 mm dia. max.)
Order Tool No. 700000-45-301 EA

SPECIFICATIONS



LeSharo, Phasar and Utility Van

- Single dry plate cable operated clutch.
- Diaphragm spring pressure plate
- Clutch disc with cushioned hub
- Self-centering guided ball thrust pad

PRESSURE PLATE - DISC
CHANGING

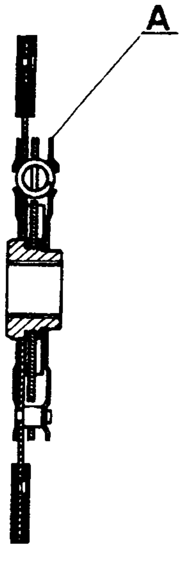
The gearbox must be removed for this operation.

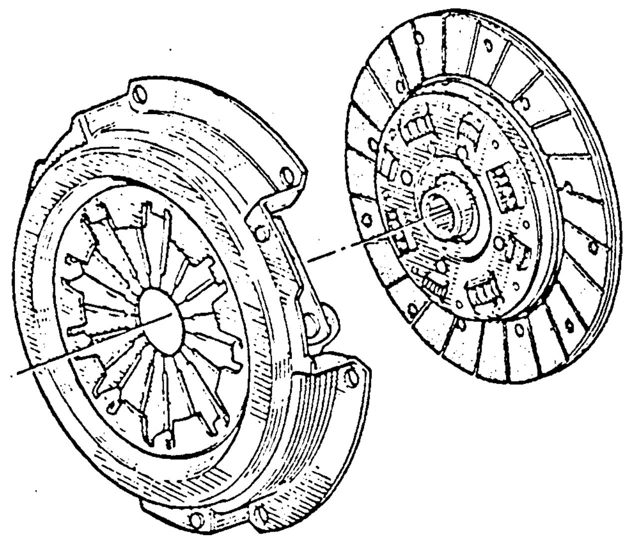
Removal

- Unscrew the ring of pressure plate bolts. Remove the plate and the disc.
- Inspect all components and change any that are worn or faulty.

REASSEMBLY

- Clean the flywheel friction face.
- Mount the disc (hub offset A facing gearbox) using mandrel Emb. 786-01
- Tighten the pressure plate mounting bolts gradually and evenly in a cross-pattern sequence. Torque bolts to 2 daNm (22 lb./ft.).
- Lightly grease the bearing surface for the thrust pad.



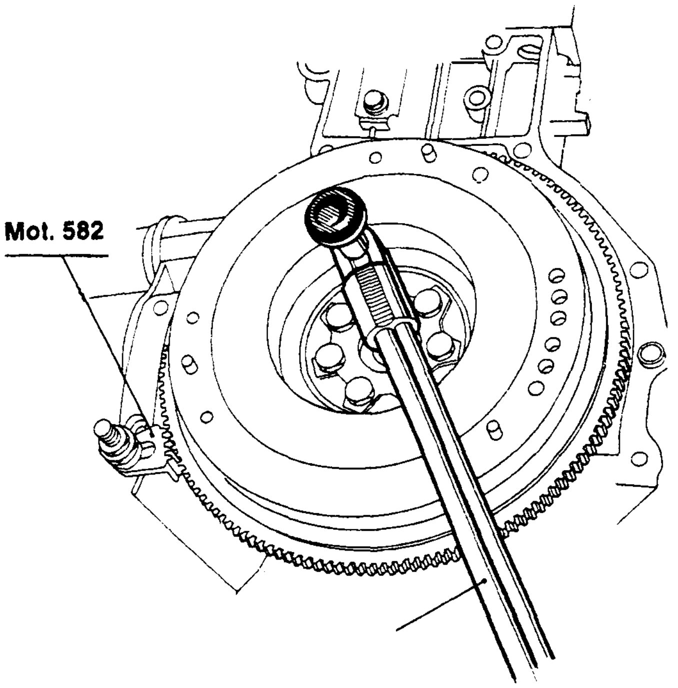


FLYWHEEL
REMOVE AND REPLACE

The gearbox and clutch must be removed for this operation.

TIGHTENING TORQUES
Flywheel bolts: 6 daNm (45 lb./ft.)

Removal
- Mount locking sector Mot. 582.
- Unlock (if applicable) and unscrew the flywheel bolts.
- These are self-locking bolts which cannot be reused.
- Remove the flywheel.



IMPORTANT
- The flywheel friction face cannot be resurfaced.
- The flywheel must be changed if unservicable.

REASSEMBLY
- Use a dry cloth to clean the threaded holes in the crankshaft.
- Degrease the flywheel locating face on the crankshaft.
- Apply Loctite© or equivalent to the mating faces.
- Mount the flywheel, coat the bolt threads with 1 or 2 drops of Loctite © and insert new self-locking bolts through new lockplate.
- Torque tighten the bolts using a torque wrench.
- Bend the lockplate tabs onto one hexagon only on each bolt.

CLUTCH SHAFT PILOT BEARING CHANGING

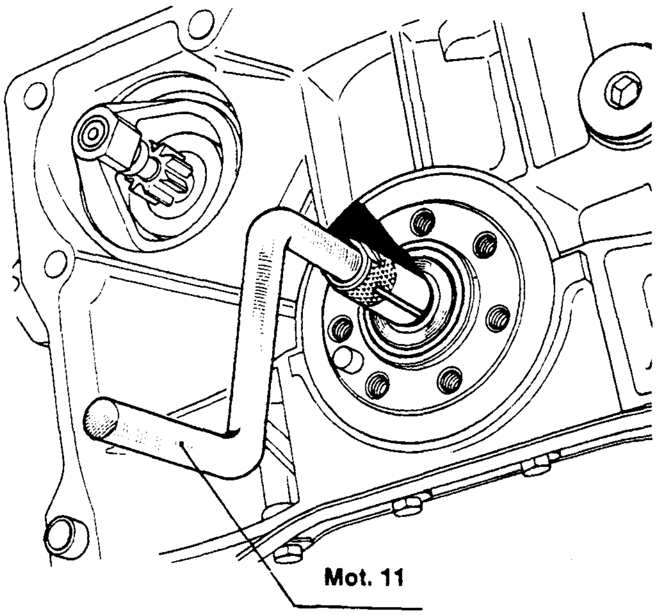
The gearbox, clutch and flywheel must be removed for this operation.

REMOVAL

- Extract the bearing using extractor Mot. 11.

REASSEMBLY

- Coat the outside of the bearing with Loctite© or equivalent.
- Insert the new bearing. Clean the outside only since it is pre-greased.



THROW-OUT BEARING
CHANGING

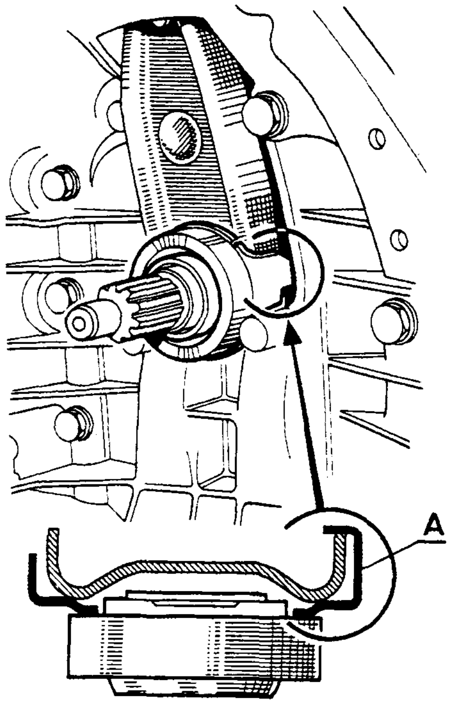
The gearbox must be removed for this operation.

REMOVAL

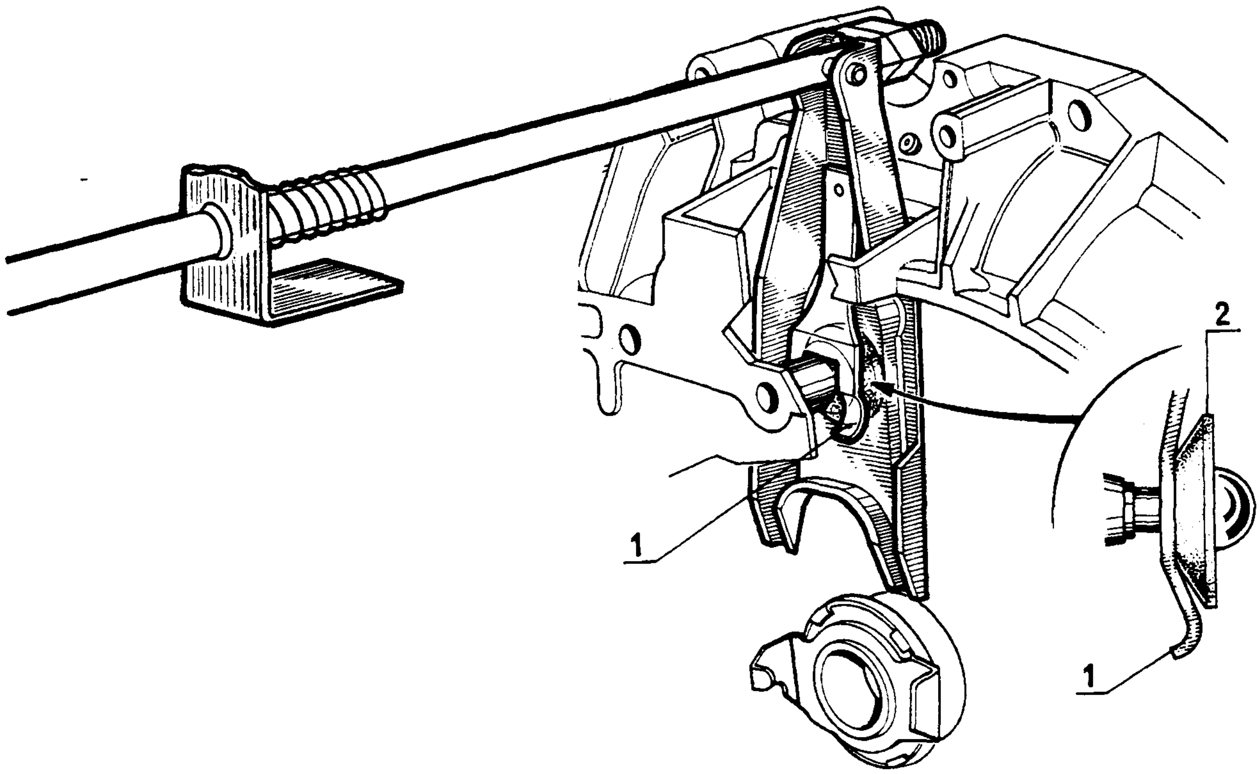
- Remove the thrust pad.

REASSEMBLY

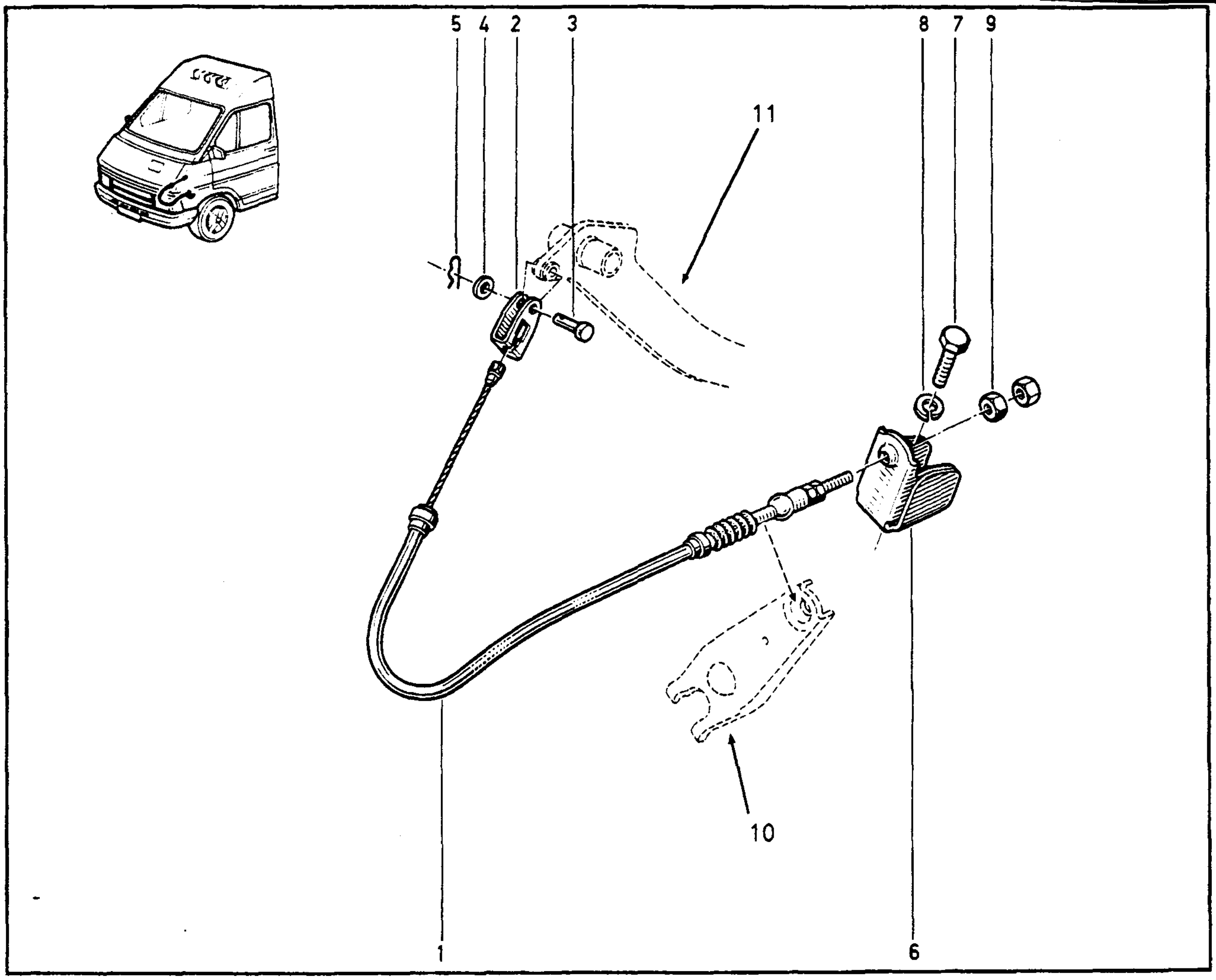
- Lightly grease the diaphragm spring bearing surface.
- Coat the pivot pin with graphite grease.
- Attach the thrust pad to the guide tube correctly as shown at (A).



- Lift up the fork, placing retainer (1) behind seal (2)



CLUTCH CABLE
REMOVE AND REPLACE



1. Cable
2. Clevis
3. Clevis Pin
4. Washer
5. Hair Pin Clip
6. Bracket
7. Bolt
8. Lock Washer
9. Jam Nuts
10. Fork
11. Pedal

CLUTCH CABLE
REMOVE AND REPLACE

REMOVAL

- Remove hair pin clip (5) from clutch pedal (11).
- Remove clevis pin (3), then remove clevis (2) from cable end.
- Remove two jam nuts (9) from fork end (10) and remove the cable from fork.
- Remove nuts from cable, then remove cable from bracket (6) and from vehicle.

REASSEMBLY

- Install clevis to cable end, then fasten to pedal with pin and hair pin clip.
- Route the cable
- Install cable onto bracket and fasten with nuts.
- Insert cable to fork.
- Install jam nuts and adjust. Make sure collar is properly positioned where cable goes through floor.

ADJUSTMENT

- Loosen jam nuts
- Pull cable or have an assistant lift clutch pedal 3/4" (15-20mm) above brake pedal.
- With slack removed, tighten jam nuts against fork.
- Check clutch operation.

SECTION "I"
BRAKES

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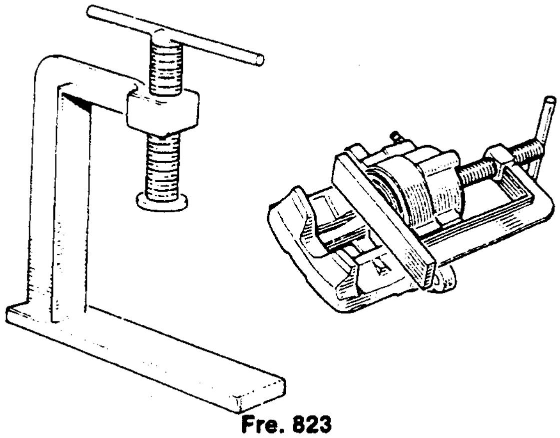
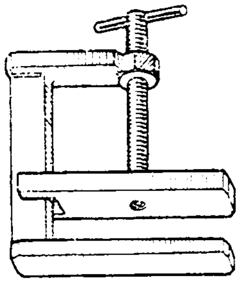
SPECIAL TOOLS



Fre. 823

Piston insertion tool

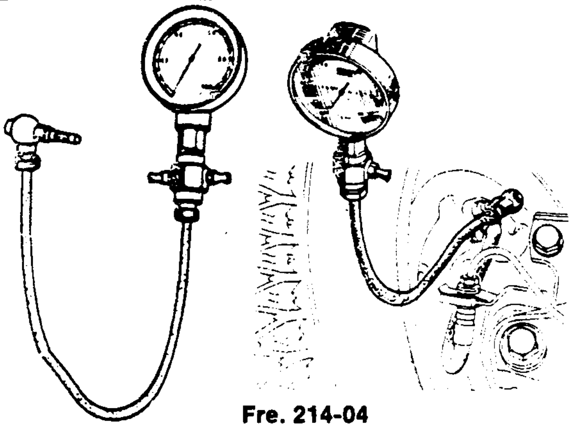
Order Tool No. 700000-82-300 EA



Mot. 453-01

Hose clamp (maximum dia. 25 mm)

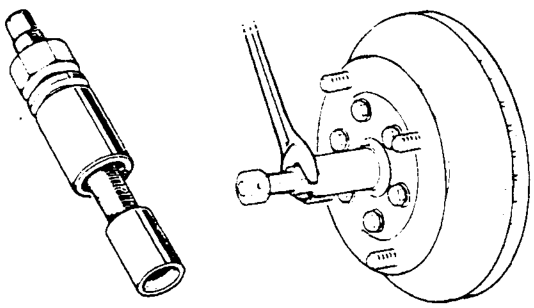
Order Tool No. 700000-45-301 EA



Fre. 214-04

Pressure checking gauge for brake limiter (range 0 to 100 bars)

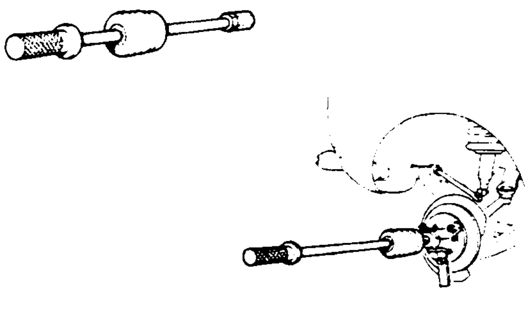
Order Tool No. 700000-21-404 EA



T.Av. 602

Drive shaft insertion tool

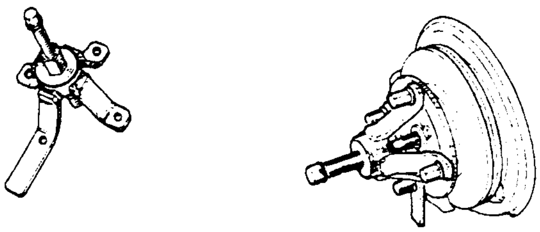
Order Tool No. 700000-60-200 EA



Ms. 580

Slide hammer for hub removal

Order Tool No. 700000-58-000 EA

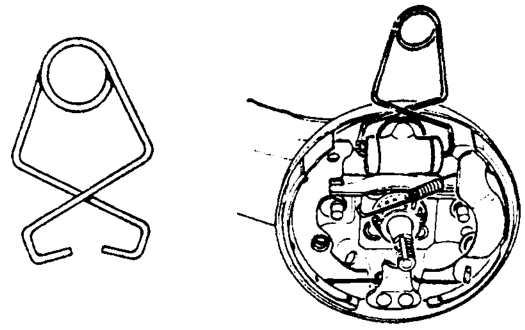


T.Av. 601

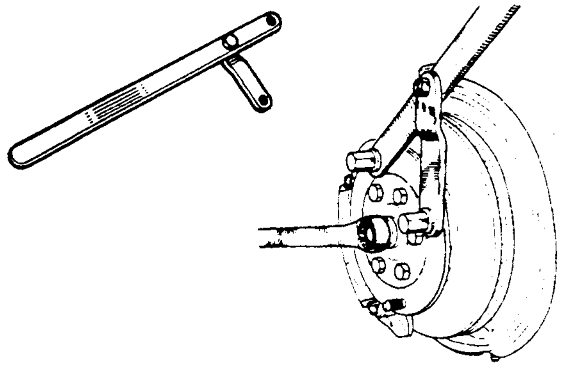
Tool for extracting drive shaft and hub

Order Tool No. 700000-60-100 EA

SPECIAL TOOLS

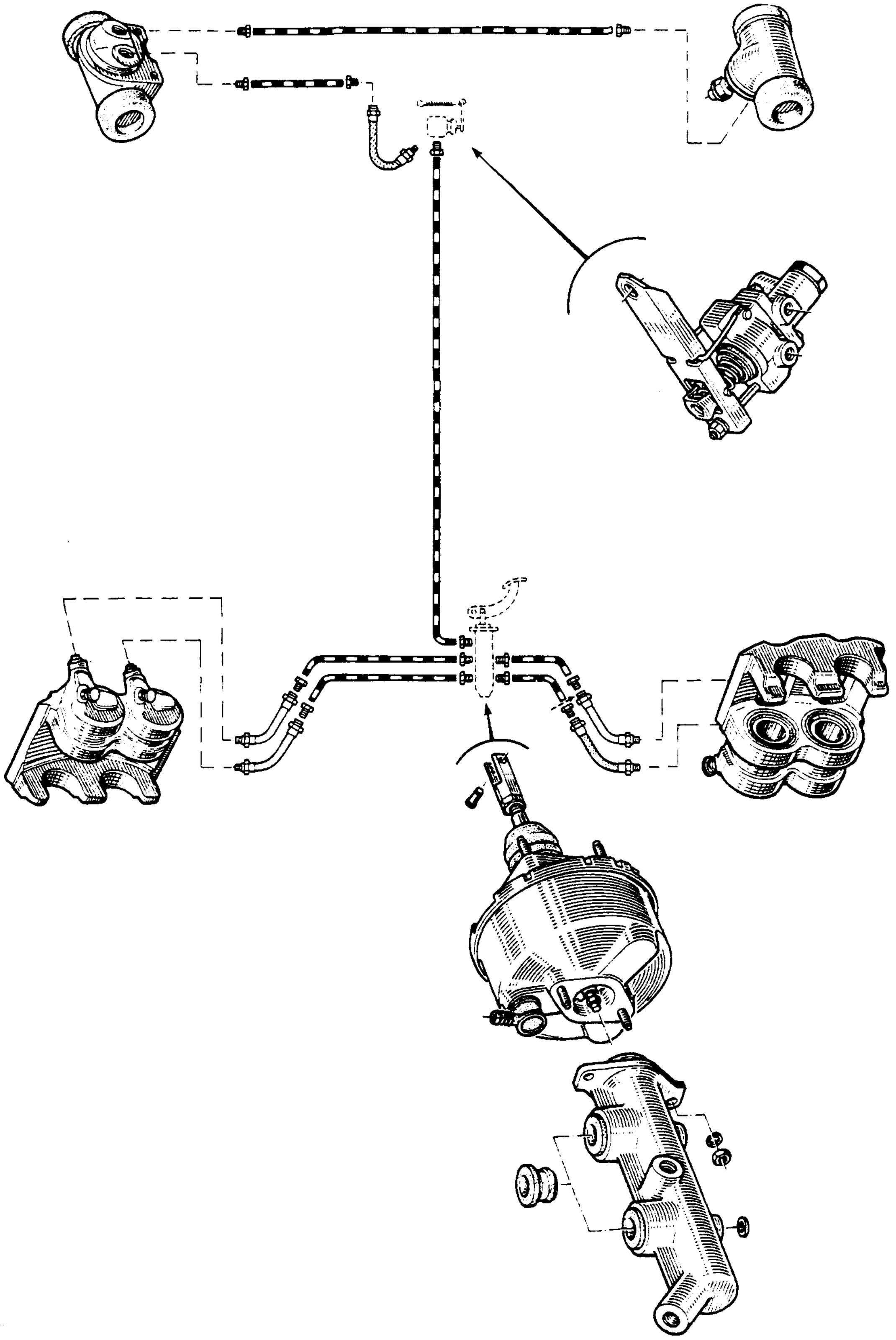


Fre. 05
Set of two wheel cylinder clips
Order Tool No. 700009-99-400 Set



Rou. 604
Hub locking tool
Order Tool No. 700000-60-401 EA

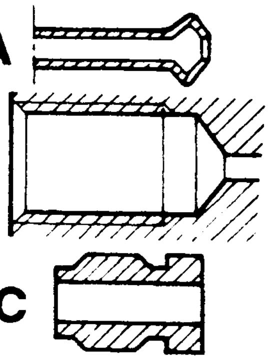
SPECIFICATIONS
BRAKE LAYOUT



SPECIFICATIONS
IDENTIFICATION AND SPECIAL FEATURES

HYDRAULIC CIRCUIT

Metric threads are used for all pipeline unions connecting the master cylinder, front calipers, limiter and rear wheel cylinders.



Use only replacement parts listed in the LeSharo, Phasar, and Utility Van Service Parts Catalog.

Component Identification (Shape):
A - Pipe Ends
B - Threaded Bores in wheel cylinders
C - Pipe Unions

METHOD OF LOCKING CALIPER BRACKET BOLTS

The front caliper bracket bolts have their threads coated with Loctite® or equivalent.

If these bolts are unscrewed during a repair, they must be cleaned and their threads coated with Loctite® or equivalent on reassembly.

FRONT BRAKES

Caliper Cylinder Bore	45 mm
Disc diameter	252 mm (9.921")
Disc thickness	24 mm (.945")
Min. disc thickness	22 mm (.866")
Pad thickness (incl. backing)	18.5 mm (.728")
Min. pad thickness (incl. backing)	9 mm (.354")
Max. disc run-out	0.07 mm (.003") on 242 mm (9.528") dia.

REAR BRAKE with self-adjusting brake shoes

Wheel cylinder bore	25.4 mm (1.0)
Drum diameter	254 mm (10.0")
Max. drum diameter after regrinding	254.75 mm (10.04")
Lining width	57 mm (2.24")
Lining thickness (incl. shoe)	7 mm (.276")
Min. lining thickness	.5 mm (.020")

TANDEM MASTER CYLINDER

Bore	23.8 mm (.937")
Stroke with Servo	22 mm (.866")
Pressure Drop Indicator	not equipped
Servo cylinder bore	22.8 mm (.897")
Residual pressure valve	not equipped

Handbrake: Mechanically applied at rear wheel via floor-mounted lever.
Maximum travel: 12 notches

BRAKE FLUID: Must conform to SAE J 1703 F and DOT3 and DOT4 standards

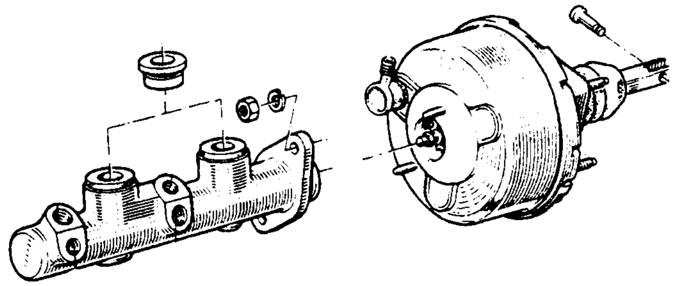
SPECIFICATIONS
TIGHTENING TORQUES

Wheel Nuts	12 daNm (90 lb./ft.)
Caliper bracket bolts	9 daNm (66 lb./ft.)
Stub axle nut	20 daNm (147 lb./ft.)
Bleed screws	0.7 daNm (5 lb./ft.)
Hose at caliper end	2 daNm (15 lb./ft.)
Metal pipe union on hose	2 daNm (15 lb./ft.)
Wheel cylinder mounting bolts	0.7 daNm (5 lb./ft.)

MASTER CYLINDER
REMOVE AND REPLACE

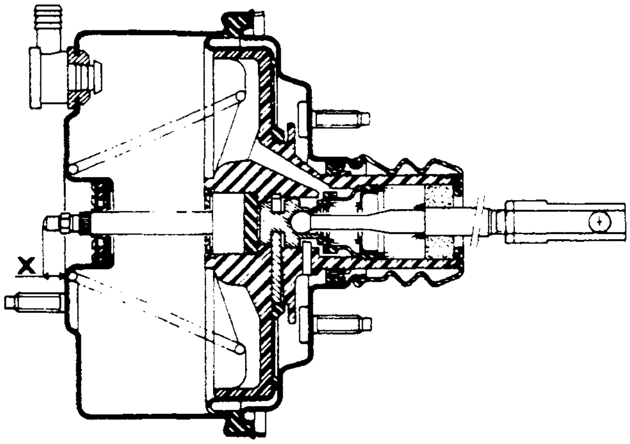
REMOVAL

- Drain the brake fluid reservoir with a syringe and remove the rubber rings
- Unscrew:
  - the metal pipe unions on the master cylinder
  - and the 2 servo nuts
- Remove the master cylinder



REINSTALLATION

- Check the master cylinder operating clearance. It should be 0.5 mm (.020") measured from the end of the pushrod to the master cylinder mounting face (dimension X). Turn pushrod nut (P) to adjust if necessary.
- Attach the master cylinder to the brake servo
- Reconnect the brake lines to the correct unions on the master cylinder.
- Reassemble the fluid reservoir including the rubber rings
- Fill the reservoir
- Bleed the system

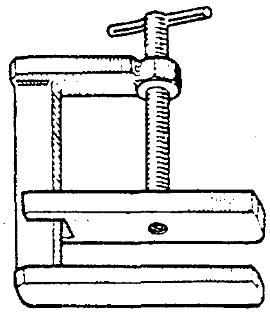


BRAKE SERVO

Checking for Loss of Vacuum Pressure

The check for loss of vacuum pressure in the brake servo unit must be carried out with the hydraulic circuit functioning normally.

- Connect a vacuum gauge to the line between the brake servo and vacuum source (inlet manifold) using a "T" piece union and as short a length of flexible pipe as possible.
- Run the engine at idling speed for 1 minute.
- Clamp the pipe between the "T" piece union and vacuum source using clamp Mot. 453-01.
- Switch off the engine.
- If the vacuum drops 33 m/bar (1" Hg) within 15 seconds, a leak is present which may be in either:
  - the check valve (change it)
  - or in the pushrod diaphragm (if in the latter, change the complete servo)

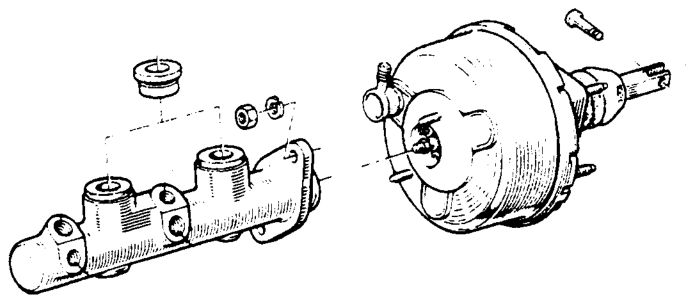


Tool Mot.453-01

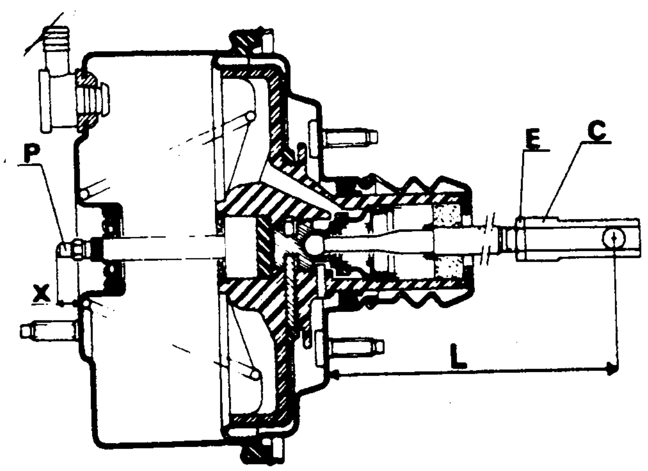
BRAKE SERVO
REMOVE AND REPLACE

REMOVAL

- Remove the master cylinder from the vehicle.



- Remove
  - the brake pedal clevis pin
  - the nuts securing the master cylinder to the firewall
  - and the servo



REINSTALLATION

- Before installing the brake servo, check the following:

  - Master cylinder operating clearance is 0.5 mm (.020"). This is measured from the end of the pushrod to the master cylinder mounting face (dimension X). Turn pushrod nut (P) to adjust if necessary.

  - Brake pedal clevis (C) adjustment - dimension (L) should be 116 mm (4.56"). Loosen locknut (E) and turn the clevis to adjust if necessary.

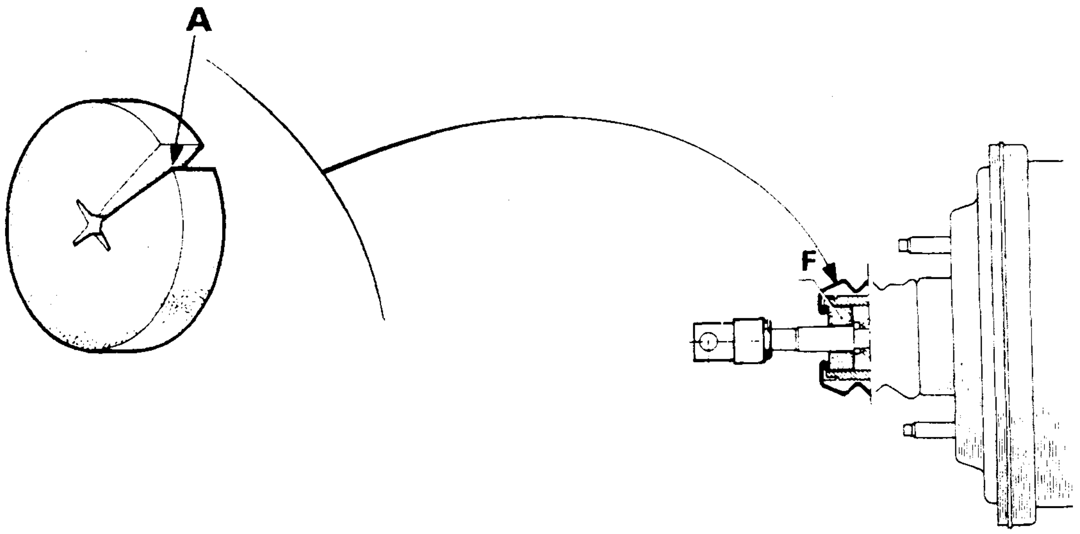
- Mount the servo to the master cylinder. (If the servo is being replaced, use the spacer plate from the old servo.)

- Mount and fasten the master cylinder/servo assembly to the firewall. Then insert the brake pedal clevis pin.

- Reconnect the servo vacuum hose and attach the master cylinder brake lines to the correct unions.

BRAKE SERVO
CHANGING THE AIR FILTER

- The servo need not be removed to change air filter (F).
- Remove the old filter (F) under the pedal assembly with a screwdriver or scriber.
- Make a cut (A) in the new filter (see insert), slip it over the pushrod and push it fully home evenly so that no unfiltered air can enter.

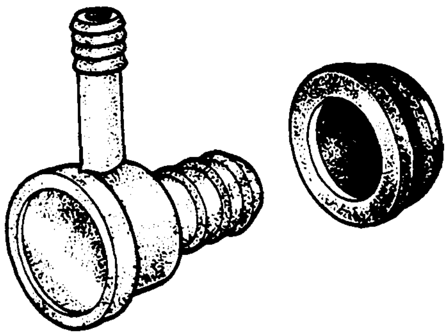


Changing the check valve

- This operation may be carried out in place.

REMOVAL
- Disconnect the vacuum hose at the servo end.
- Pull and turn the check valve to free it from the rubber sealing washer.

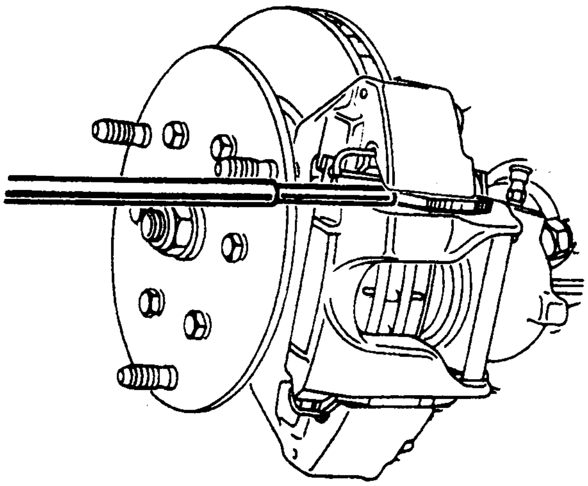
REINSTALLATION
- Check the condition of the sealing washer and check valve.
- Replace all faulty parts.
- Mount the assembly.



FRONT BRAKE PADS
REMOVE AND REPLACE

TIGHTENING TORQUES

Wheel nuts	12 daNm (90 lb./ft.)



IMPORTANT
Brake pads must be changed in complete axle sets and each pad must be located correctly.

This is essential to ensure even pad wear, efficient braking and an even spread of braking effort.

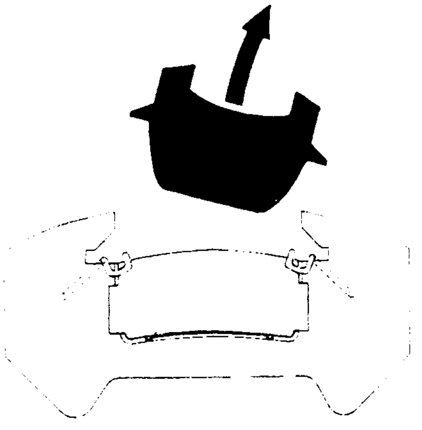
REMOVAL
- Remove both clips.
- Tap out one retaining key with a pin punch.
- Slide out the second retaining key.

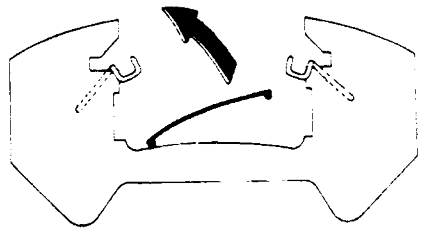
FRONT BRAKE PADS
REMOVE AND REPLACE

- Remove the caliper

IMPORTANT
Do not touch the brake pedal from this point until completion of this operation.

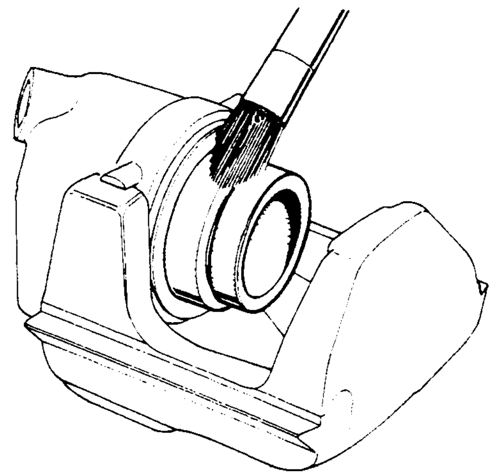
- Remove the brake pads.
- Lift out the springs under the pads.



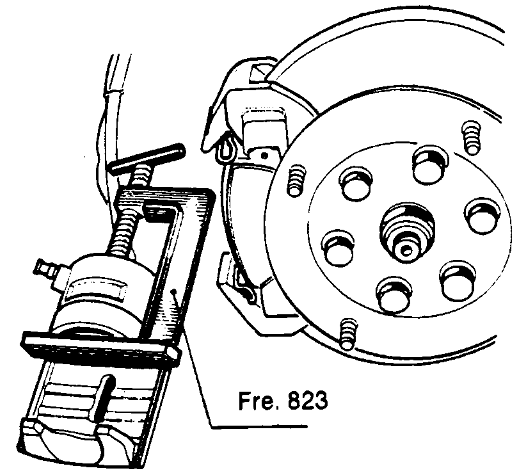


REASSEMBLY

- Remove the dust covers from their grooves and clean them and the ends of the pistons with methylated spirit.
- Lubricate the piston skirts all around with graphite grease.

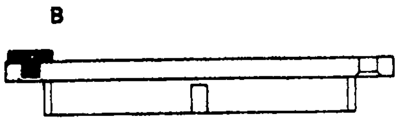


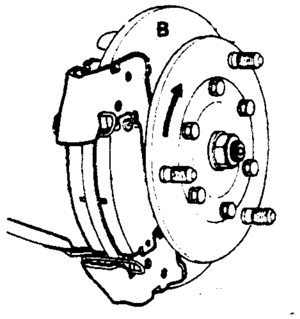
- Mount the dust cover.
- Push the piston back into its bore with tool Fre. 823.
- Remount the springs under the pads.



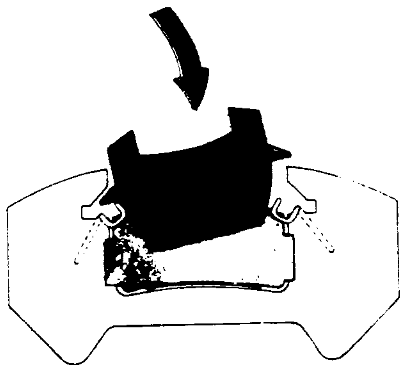
FRONT BRAKE PADS
REMOVE AND REPLACE

- Mount the pads in position (they must be free to slide.)
- The retaining peg (B) on replacement service pads must be at the front (direction of wheel rotation).

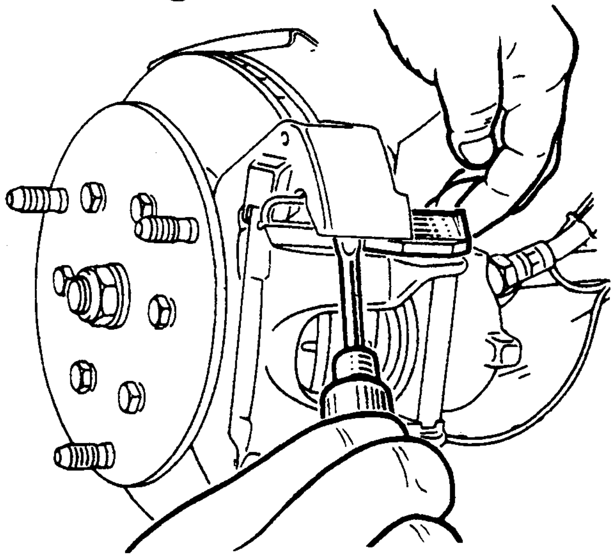




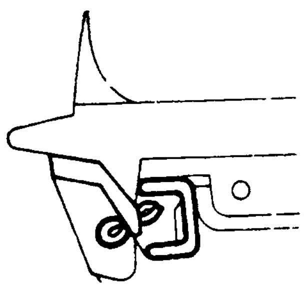
- Slip one end of the caliper between the spring clip and the key location on the caliper bracket.



- Insert the other end by compressing both springs.
- Mount the first key, insert a screwdriver in the slot for the second key, press on the screwdriver and push the second key in.



- Remove the screwdriver and tap the key until fully seated with a pin punch.
- Mount two new key retaining pins.
- Press the brake pedal several times to push the pistons up into contact with the back of the pad.

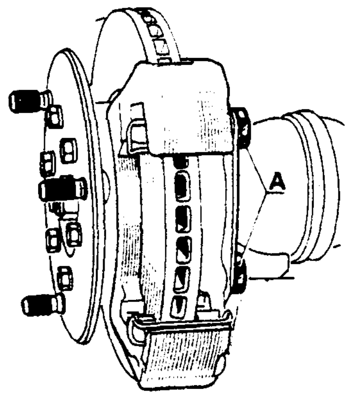


FRONT BRAKE ROTORS
REMOVE AND REPLACE

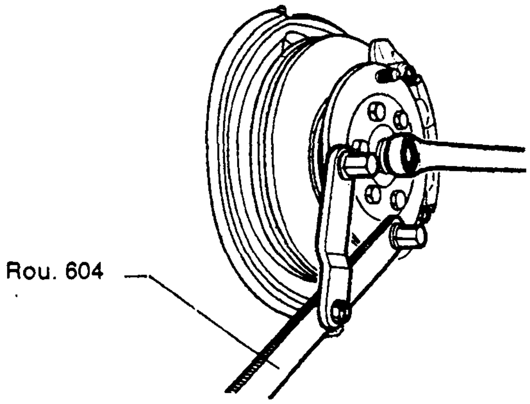
IMPORTANT
Brake rotors (discs) cannot be resurfaced. A rotor must be changed if excessive or uneven wear is present.

Disc Thickness: 22 mm (.866") minimum
Brake disc wear is acceptable up to a minimum disc thickness of 22 mm (.866")

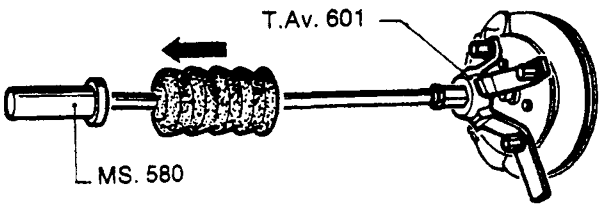
Disc Run-Out: 0.07 mm (.003") max. - measured 5 mm in from the outer edge using dial a indicator.



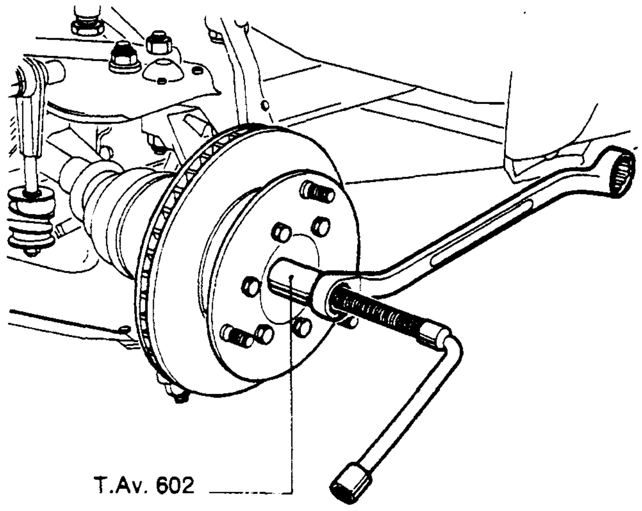
REMOVAL
- Remove the brake assembly : pads, caliper and caliper bracket (bolts A).
- Attach locking tool Rou. 604 over 2 wheel studs and unscrew the stub axle nut.



- Remove the screw from tool T.Av. 601 and place slide hammer Ms. 580 in its place.
- Attach the assembly to the wheel studs.
- Remove the hub-rotor assembly.
- Separate the rotor from the hub.



REASSEMBLY
- Remove the protective coating from the rotor and fasten the rotor to the hub.
- Coat the bearing with grease.
- Apply loctite® 680 to driveshaft splines.
- Mount the rotor-outer bearing-spacer assembly to the stub axle splines.
- Screw tool T.Av. 602 onto the stub axle; align the assembly with the stub axle carrier then screw in the tool to draw the drive shaft into the hub.
- Mount the washer and a new stub axle nut and torque tighten; 20 daNm (147 lb./ft.)
- Reassemble
  - the caliper bracket (coat the bolt threads with Loctite® or equivalent).
  - pads
  - and caliper bracket
- Press the brake pedal several times to take up the play.

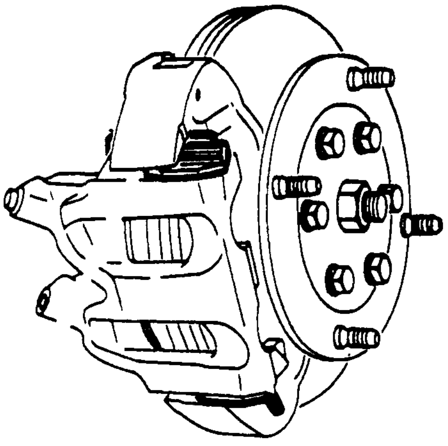


NOTE: See Section H for detailed information on axle tightening procedure.

FRONT BRAKE CALIPERS
REMOVE AND REPLACE

TIGHTENING TORQUES

Bleed screws	0.7 daNm (5 lb./ft.)
Hose at caliper end	2 daNm (15 lb./ft.)
Metal pipe union on hose	2 daNm (15 lb./ft.)
Wheel nuts	12 daNm (90 lb./ft.)
Caliper bracket bolts	9.0 daNm (66 lb./ft.)



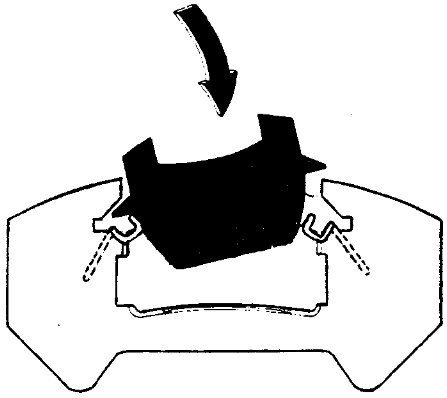
REMOVAL

- Isolate the clutch master cylinder with clamp Mot. 453-01 if applicable
- Drain the fluid reservoir with a syringe.
- Remove the key retaining pins.
- Slide out the keys.
- Unscrew the metal pipe unions on the hoses.
- Remove the hose clips from the brackets and release the caliper
- Unscrew the hoses from the caliper and check them.
- Check the condition of the pads.

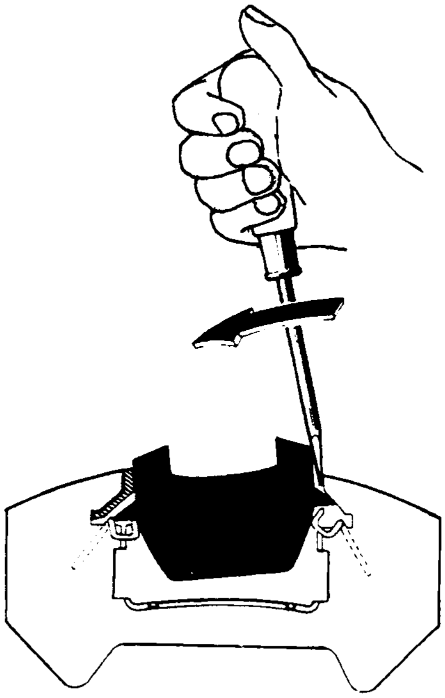
FRONT BRAKE CALIPERS
REMOVE AND REPLACE

REASSEMBLY

- Mount the brake pads
- Slip one end of the caliper between the spring clip and the key locating face on the bracket.
- The first key should slide in easily; use a screwdriver to insert the second key by prying between the caliper and bracket.
- Remove the screwdriver and tap the second key fully home with a pin punch.
- Mount new key retaining clips.
- Bleed the clutch hydraulic circuit (if applicable) followed by the brake circuit.

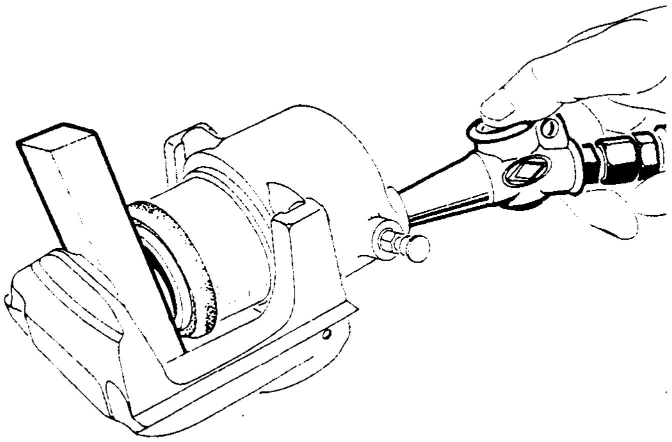


- Press the brake pedal several times to push the pistons up into contact with the pad.

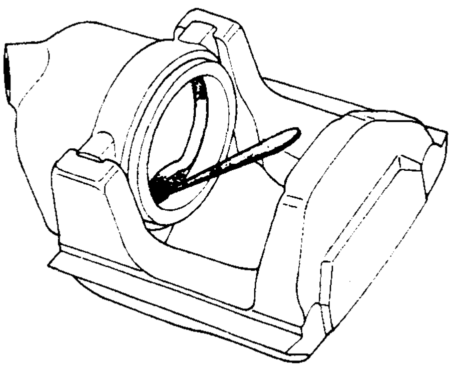


FRONT BRAKE CALIPERS
OVERHAUL

- The caliper must be removed for this operation.
- The complete caliper assembly must be changed if the bore shows any signs of scoring.



DISMANTLING
- Remove rubber dust cover.
- Push out the piston with compressed air, inserting a block of wood between the caliper and piston to prevent the piston from being damaged. The piston must not be re-used if the skirt is scored.
- Use a flexible strip of steel with smooth round edges (like a feeler gauge) to extract the rectangular section seal from the caliper groove.
- Change all worn parts and reassemble.



REASSEMBLING
- The piston must never be hammered or forced in as this would damage the seal.
- Lubricate the caliper bore, groove and the new seal with clean brake fluid.
- Mount the new seal and the piston, pushing the piston in by hand.
- Coat the piston skirt and the space between it and the bore with grease.
- Mount a new dust cover.
- Fill the caliper with brake fluid through the bleed screw aperture to make the bleeding operation easier.
  Remove the bleed screw, tilt the caliper from side to side during filling to release any air, then remount the bleed screw.

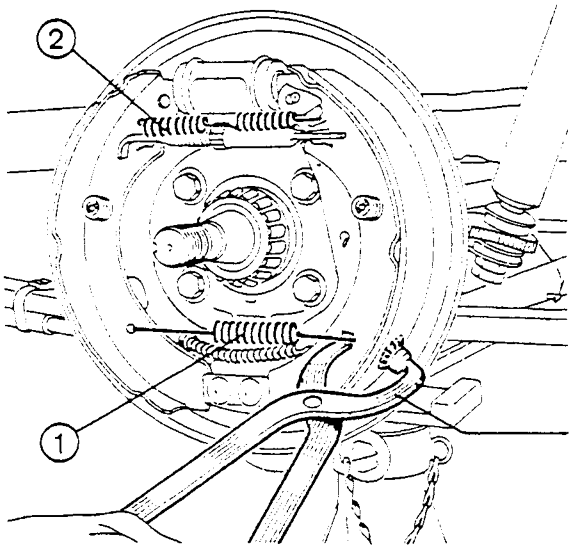
  Attach the hose to the caliper using a new copper washer.

REAR BRAKE SHOES
REMOVE AND REPLACE

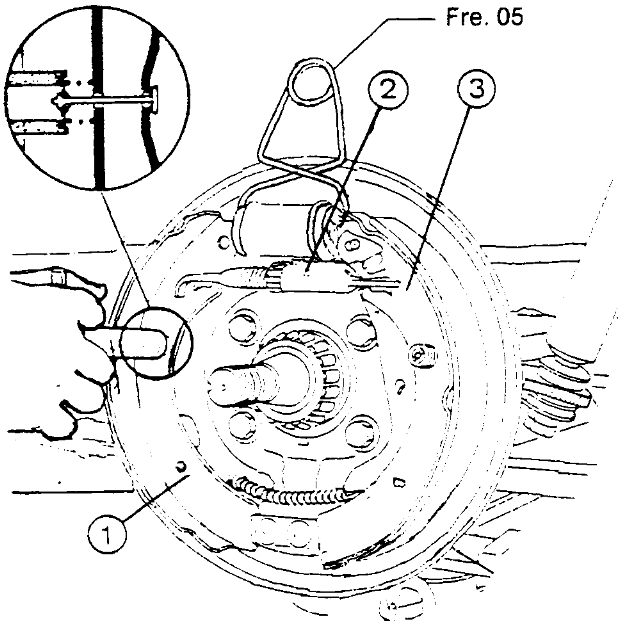
Rear Brake Drums Must Be Removed For This Operation. See Rear Axle Section.

REMOVAL

- Unhook bottom return spring (1) followed by top return spring (2).

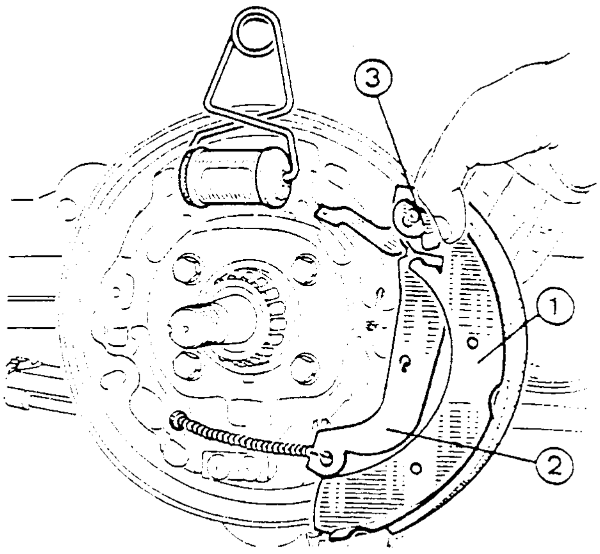


- Fit wheel cylinder clip Fre. 05 astride the cylinder.
- Using the same shoe locator tool or a piece of tube, remove the spring retaining cup locating brake shoe (1) by pressing it in and turning.
- Remove the cup and spring followed by brake shoe (1) and threaded body (2).
- Disconnect the handbrake cables at the swivel (where the cables meet).
- Remove the spring retaining cup and spring locating brake shoe (3).

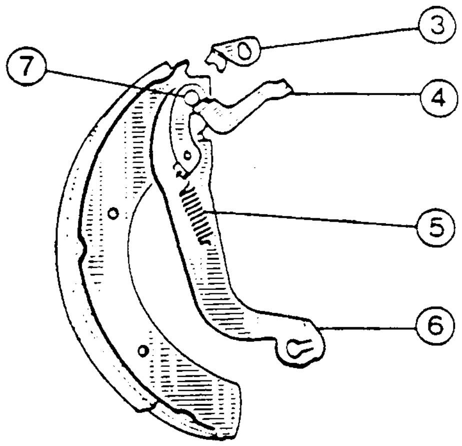


REAR BRAKE SHOES
REMOVE AND REPLACE

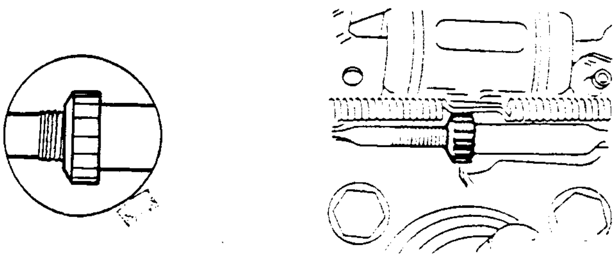
- Remove brake shoe (1) and disconnect the cable from lever (2).
- Keep stop plate (3) on its pin during this operation.



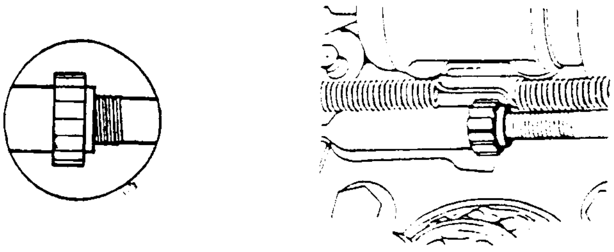
- Remove stop plate (3).
- Disconnect lever (6) from the brake shoe followed by ratchet arm (4) and its spring (5).
- Check all the components. Replace any part which appears worn.
- When reassembling : lubricate pin (7) lightly.
- Check the adjuster body and rod assembly. The rod should screw in freely along the entire length of the threads.
- When reassembling : lubricate the threads.



- Identifying the L.H. and R.H. adjuster assembly:
  - L.H. rear brake : this has a R.H. thread and the ratchet is chamfered.

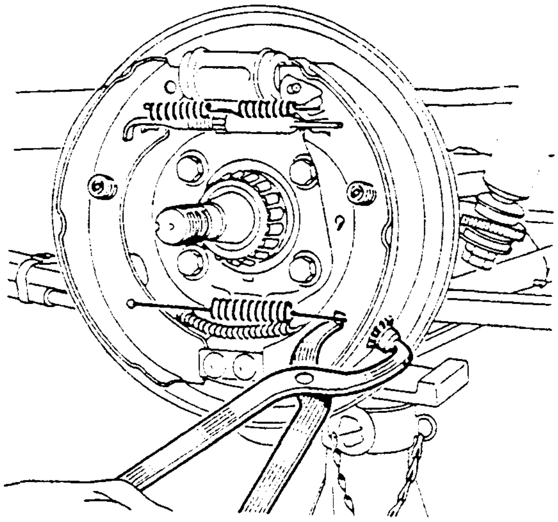


  - R.H. rear brake : this has a L.H. thread and the ratchet is shouldered.



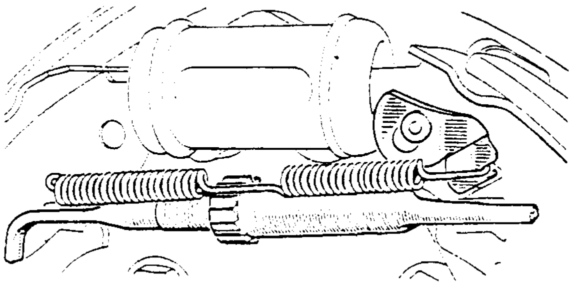
REAR BRAKE SHOES
REMOVE AND REPLACE

RE-INSTALLATION

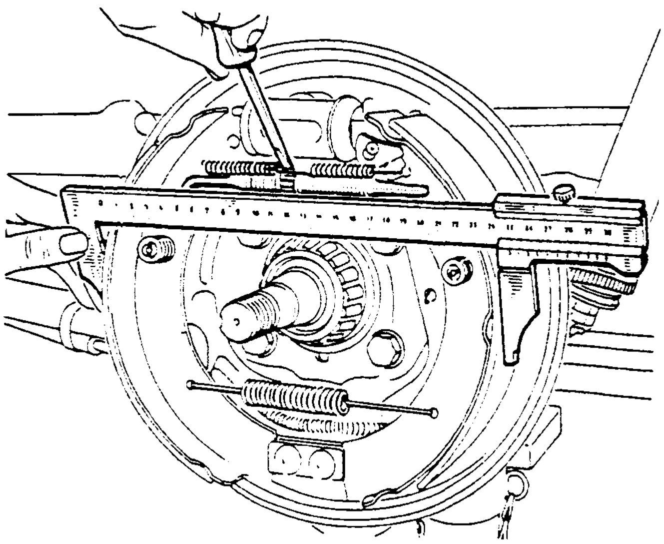


- Lightly grease the areas on the backplate where the brake shoes rub.
- Insert the end of the handbrake cable into the lever.
- Mount one brake shoe. Reattach the brake shoe spring and spring retaining using a special tool or piece of tubing.
- Screw the brake adjuster assembly in all the way and hold it in position on the mounted shoe.
- Mount the other brake shoe. Reattach the brake shoe spring and spring retainer using a special tool or piece of tubing.
- Remove wheel cylinder tool Fre. 05.
- Use a brake spring pliers to mount the top return spring, then the bottom return spring.

WARNING
The longer hook end of the spring must be attached to the handbrake lever end.



- Make sure that stop plate is mounted correctly when reassembling.



- Adjust brakes to a pre-setting diameter of 252.5 mm - 253 mm (9.94" - 9.96") across the brake shoes. Unscrew the brake adjuster by turning the teeth with a brake adjuster tool or screwdriver.
- Also adjust brakes on opposite side of vehicle to these specifications.
- Remount the brake drum and bleed the brakes. Press the brake pedal several times to obtain the normal operating clearance between drum and shoes, then adjust handbrake cables.

REAR WHEEL CYLINDERS
REMOVE AND REPLACE

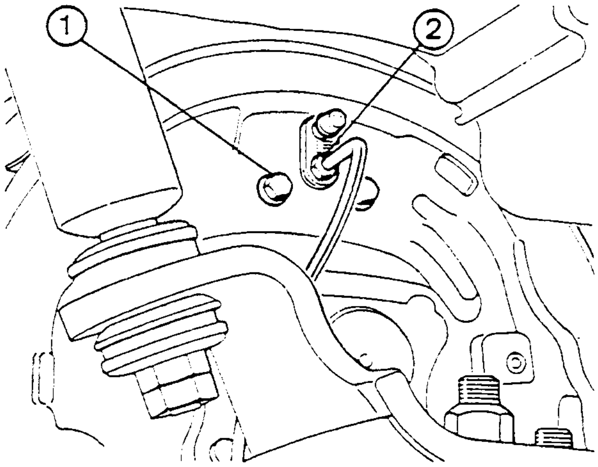
TIGHTENING TORQUES

Bleed screw	0.7 daNm (5 lb./ft.)
Metal pipe union on wheel cylinder	2 daNm (15 lb./ft.)
Wheel cylinder mounting bolts	0.7 daNm (5 lb./ft.)

- Remove the brake drum and brake shoes then check the wheel cylinders. The wheel cylinders must show no signs of external leakage and the pistons must slide easily with finger pressure.
- This check must be carried out:
  - every 60,000 km (40,000 miles) or once every 3 years (whichever occurs first)
  - each time the brake linings or shoes are changed.
- If a defect is found, then both the left and right rear wheel cylinders must be replaced. Wheel cylinders may be overhauled if the bores and pistons are completely free of scratches and oxidation.

REMOVAL

- Unscrew metal pipe union (2) and mounting bolts (1).
- Remove the wheel cylinder and its seal.

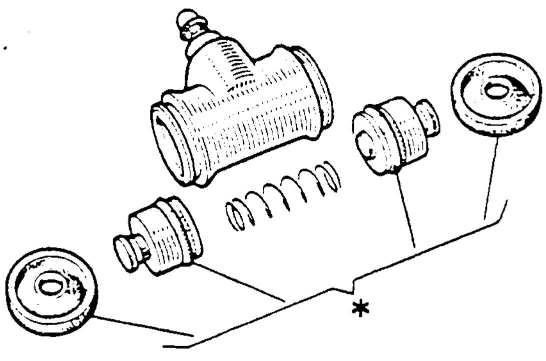


RE-INSTALLATION

- Stick the seal to the back of the wheel cylinder with a dab of grease.
- Mount the cylinder and secure bolts (1).
- Torque tighten metal pipe union (2) followed by bolts (1).
- Refit the brake shoes and drums then bleed the circuit.
- Press the brake pedal several times to restore the correct operating clearance between linings and drum.

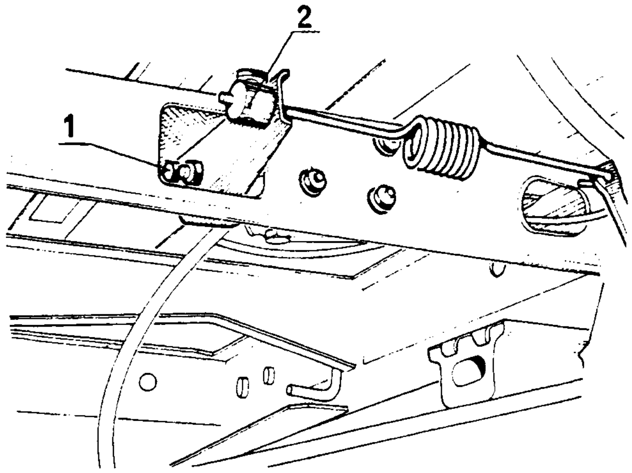
OVERHAULING

- Change all the components marked (*) routinely.
- Check the pistons and bore. The complete wheel cylinder must be changed if any traces of scratches are present.
- If the pistons and cylinder are serviceable, install new cupwashers.
- Dip all moving parts in new clean brake fluid. Assemble the pistons, spring and dust covers. Check that the assembly slides freely. Mount clip Fre. 05 astride the wheel cylinder to hold the assemby together.



BRAKE LIMITER ADJUSTMENT

TIGHTENING TORQUES



Bleed screws	0.7 daNm (5 lb./ft.)

IMPORTANT
The brake limited must be checked and adjusted with the wheels on the ground, vehicle unladen and driver on board.

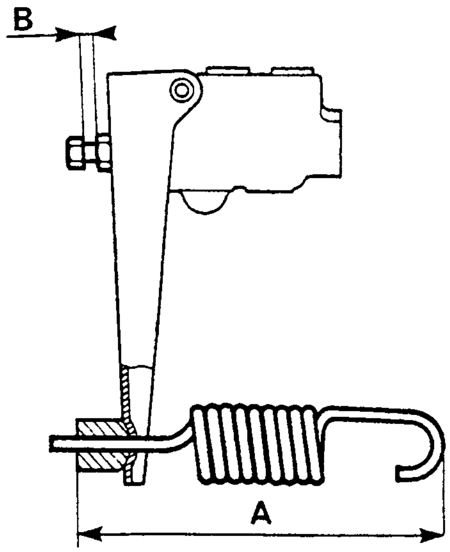
CHECKS
There are 2 preliminary checks to be made before proceeding with the pressure check:

1 - Check setting of the spring length (A). Adjust by moving collar (2).

A = 200 mm (7 7/8")

2 - Check protrusion of bolt (1).

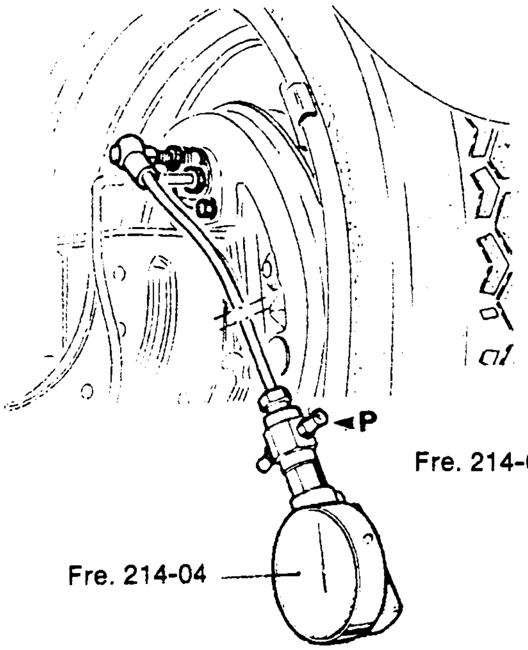
B = 5 mm + 0.5 (.197")



BRAKE LIMITER
Checking the Pressure

Once the preliminary checks are complete, connect the 2 pressure gauges: Fre. 214-04
- one at the front, with a standard union
- one at the back, with a union Fre. 214-05.

Press the brake pedal gradually and observe the pressure at front and rear simultaneously with the help of an assistant.



LESHARO/PHASAR

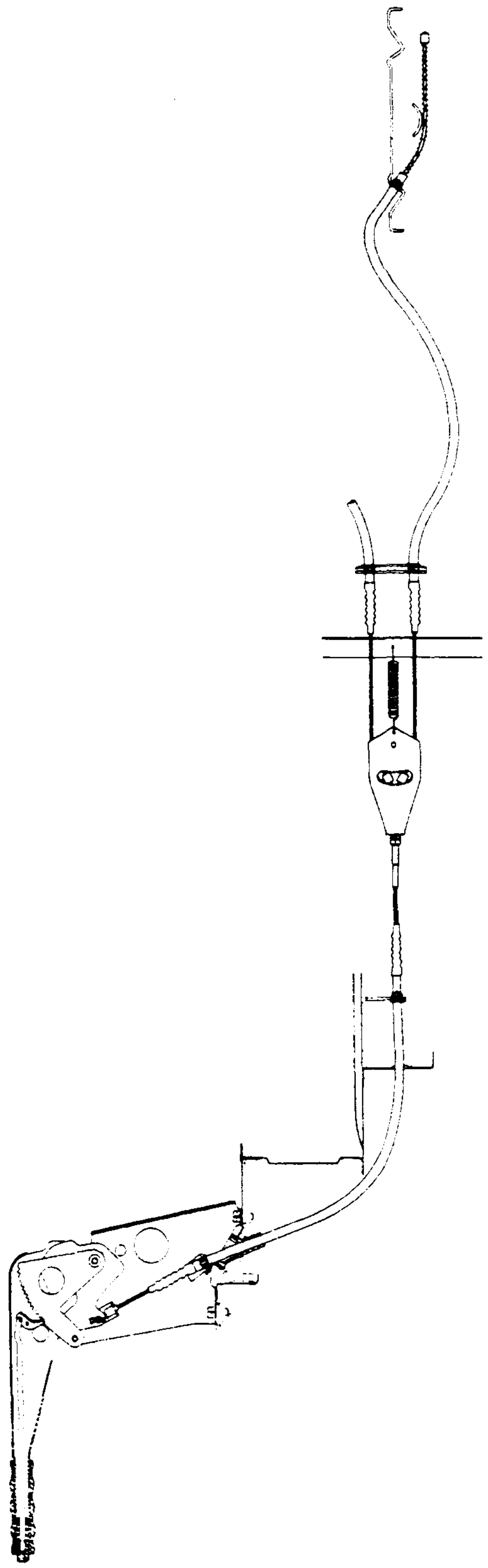
Front Pressure:	Rear Pressure:
50 - 51 bars (724 - 739 PSI)	46 - 50 bars (667 - 725 PSI)
75 - 76 bars (1087 - 2001 PSI)	50 - 54 bars (725 - 783 PSI)
100 - 101 bars (1450 1464 PSI)	54.5 - 58.5 bars (790 - 848 PSI)

UTILITY VAN

Front Pressure:	Rear Pressure:
40 - 41 bars (580 - 594 PSI)	36 - 40 bars (522 - 580 PSI)
70 - 71 bars (1015 - 1029 PSI)	42 - 46 bars (609-667 PSI)
100 - 101 bars (1450 - 1464 PSI)	48 - 52 bars (696 - 754 PSI)

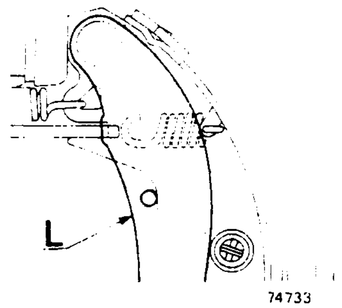
NOTE: Wheel nut tightening torque: 12 daNm (90 lb./ft.). All models.

HANDBRAKE
LAYOUT



HANDBRAKE ADJUSTMENT

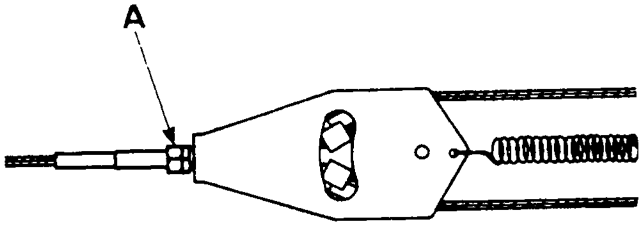
In order to allow the self-adjusting mechanism to function normally, the cable should be tensioned so that the handbrake lever will travel 6 notches on the ratchet quadrant to apply the rear brakes when new; 10 notches after break-in.



An adjustment with a travel of more than 12 notches will unmesh lever (L) and upset the self-adjusting mechanism.

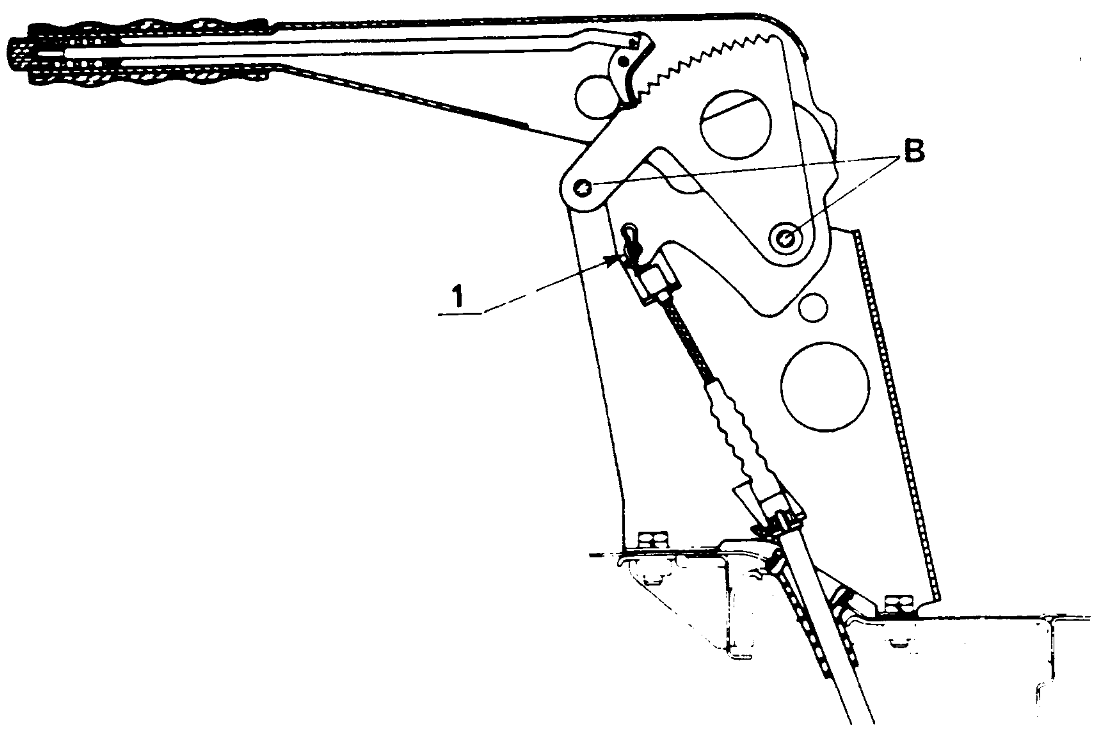
ADJUSTING

- Place the vehicle on a hoist and release the handbrake (safety blocks in position).
- Unscrew locknut (A) and turn the main nut to adjust cable tension.



Removing - Reassembling the handbrake lever

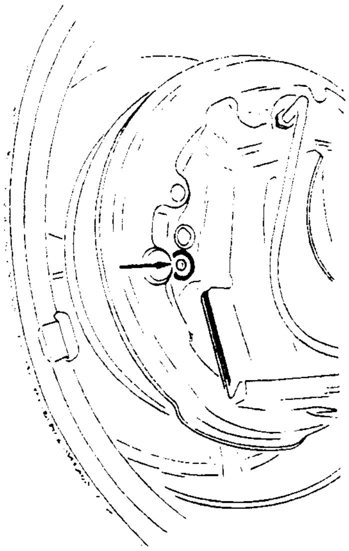
- Remove pins (B) holding the quadrant and primary cable clevis pin (1).



HANDBRAKE SECONDARY CABLE
REMOVE AND REPLACE

TIGHTENING TORQUE

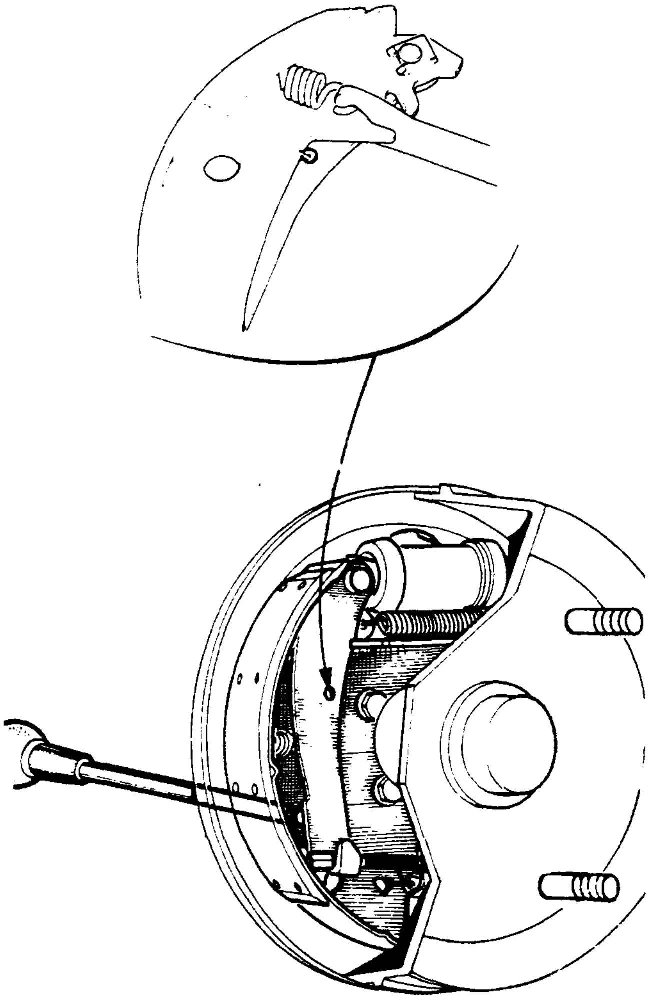
Wheel nuts 12 daNm (90 lb./ft.)



REMOVAL

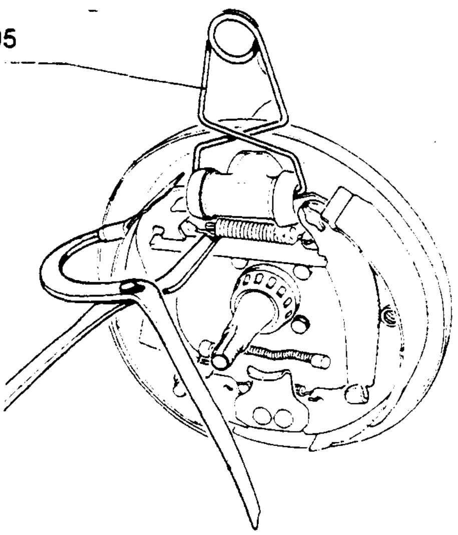
- Release the handbrake
- Loosen the secondary cables to allow the operating lever to return.
- Remove the plastic plug in the backplate and zero the self-adjusting mechanism.

- Push the operating lever inward with a screwdriver as shown to free peg (E) from the brake shoe. (Access holes are provided in the backplate and brake shoe.)
- When the peg is free, push the lever to the rear.



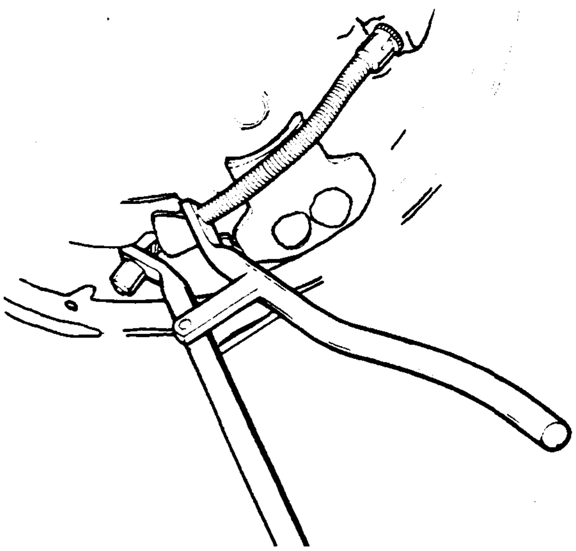
HANDBRAKE SECONDARY CABLE
REMOVE AND REPLACE

- Remove the brake drum (see previous sections).
- Mount clip Fre. 05 astride the wheel cylinder.
- Unhook the top return spring.
- Disconnect the handbrake cable.
- Remove the cable stop in the backplate.
- Disconnect the cable under the floor.



REASSEMBLE

- Reconnect the cable under the floor, attach the cable stop to the backplate.
- Connect the handbrake cable.
- Hook the top return spring.
- Remove wheel cylinder clip Fre. 05
- Mount the brake drum and adjust the bearing endplay.
- Insert fresh grease in the cup and reassemble.
- Reassemble the rear wheel and torque tighten the nuts with a torque wrench.
- Adjust the cable tension.
- Mount a new plastic plug to the backplate.
- Remove the brake drum and tire.



BRAKE SYSTEM BLEEDING

Procedure
This vehicle is equipped with a brake servo. It is important that the servo is not applied during the bleeding operation, regardless of the procedure used.

BLEEDING WITH PRESSURE BLEEDING APPARATUS

- Fill apparatus with brake fluid and pressurize. Do not exceed the pressure recommended by the equipment manufacturer.
- The compressed air must be humidity-free. Before connecting the air hose check that no water droplets are present in the line.
- Let the apparatus stand pressurized for a while to prevent possible foaming.

BLEEDING
Do not exceed a pressure of 1.2 to 2 bars (17 to 29 psi) to prevent foaming.
- Attach a bleed tube to each bleed screw and route each one into a clean container.
- Fill the fluid reservoir to the brim with new fluid.
- Screw the special cap onto the reservoirs and connect the apparatus to the cap.
- Adjust the pressure to between 1.2 and 2 bars (17 to 29 psi), and gradually open the control valve on the apparatus to pressurize the hydraulic circuit on the vehicle.
- Close all the bleed screws when fluid begins to flow from them.
- Remove the special cap.
- Check the fluid level in the reservoir and perform a brake test.

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SECTION "J"
FRONT AXLE

Subsection 1 - Specifications

Subsection 2 - Front Axle Alignment

Subsection 3 - Lower Suspension Arms

Subsection 4 - Stub Axle Carriers

Subsection 5 - Steering Box

Subsection 6 - Power Steering Pump

Subsection 7 - Steering Wheel and Shaft

Subsection 8 - Drive Shafts

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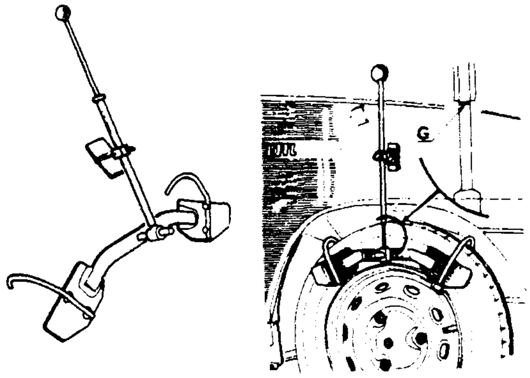
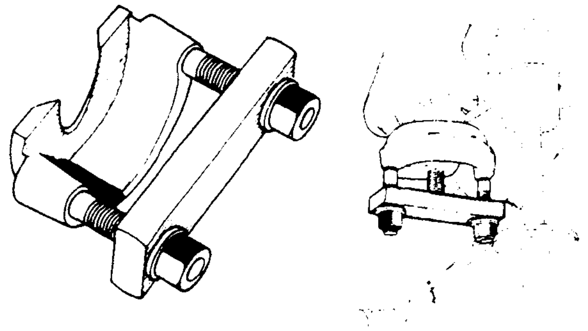
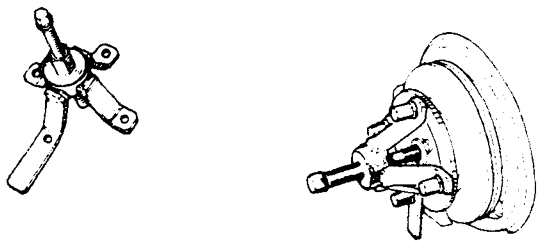
SPECIAL TOOLS



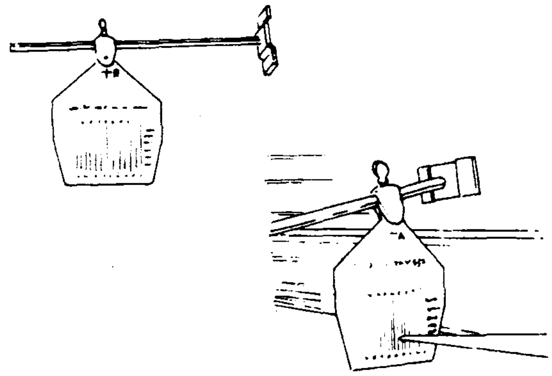
T.Av. 549
Front axle alignment measuring tool
Order Tool No. 700000-54-900 EA



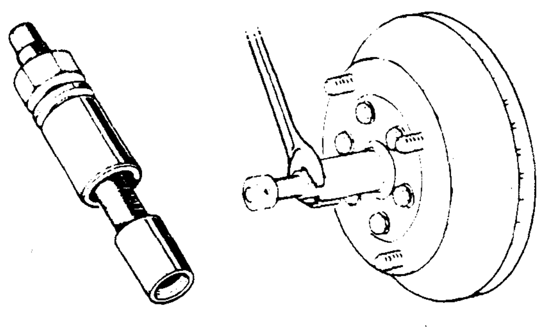
T.Av. 476
Tool for extracting ball joint
Order Tool No. 700000-47-600 EA



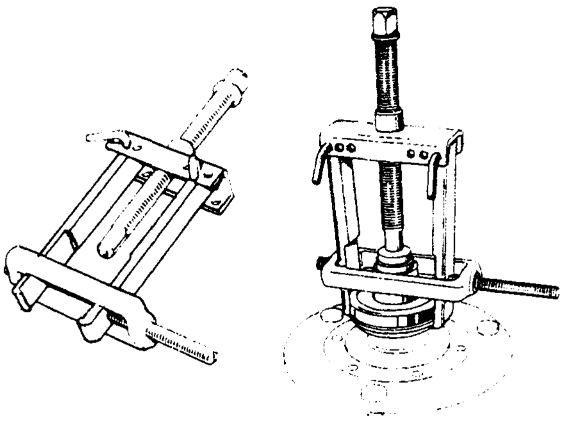
T.Av. 601
Tool for extracting drive shaft and hub
Order Tool No. 700000-60-100 EA



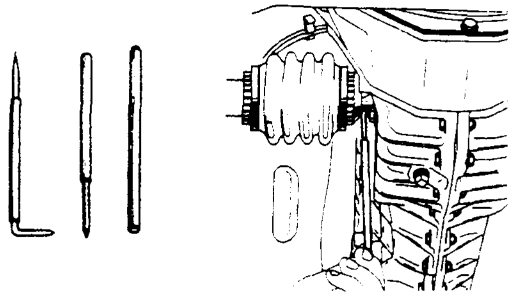
T.Av. 552
Scaleboard for steering box height setting
Order Tool No. 700000-55-200 EA



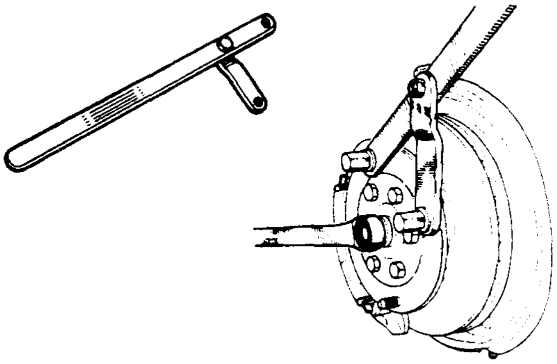
T.Av. 602
Drive shaft inserting tool
Order Tool No. 700000-60-200 EA



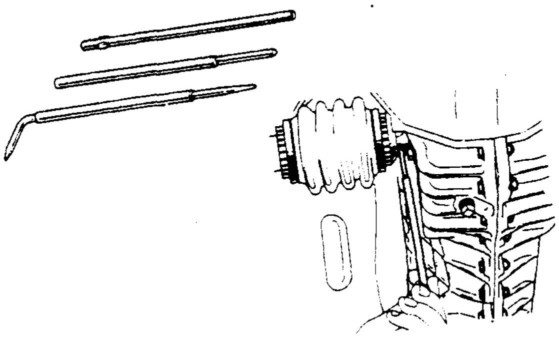
B.Vi. 28-01
Bearing extractor with jaws 146mm long
Order Tool No. 700012-27-301 EA



B.Vi. 31-01
Set of drifts for 5 mm dia. roll pins
Order Tool No. 700012-59-401 SET

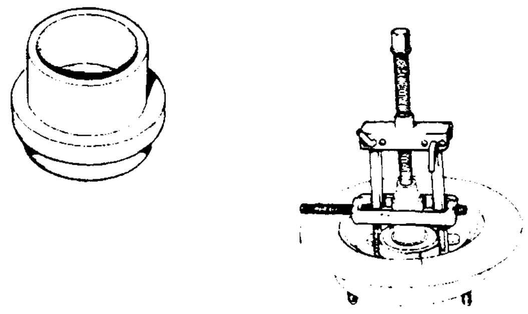


Rou. 604
Hub locking tool
Order Tool No. 700000-60-401 EA

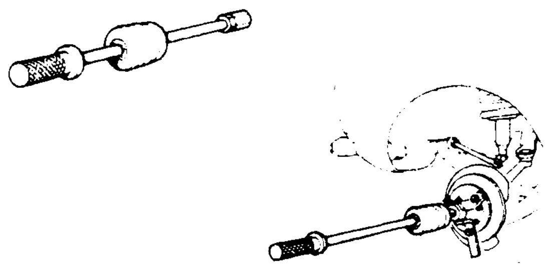


B.Vi. 606
Set of drifts for extracting and inserting 6 mm dia. roll pins
Order Tool No. 700000-60-600 SET

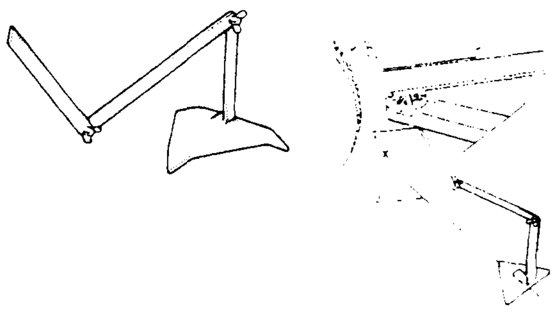
SPECIAL TOOLS



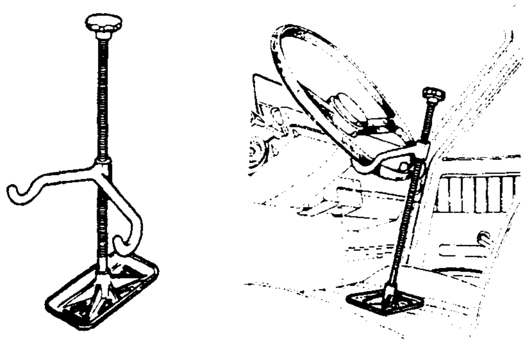
Rou. 15-01
Protective end cup with 16 mm dia. bore for shaft
Order Tool No. 700013-31-601 EA



Ms. 580
Slide Hammer for hub removal.
Use with T.Av. 601
Order Tool No. 700000-58-000 EA



T.Av. 605-04
Height gauge
Order Tool No. 700000-60-504 EA



Ms. 504-01
Steering wheel lock
Order Tool No. 700000-50-401 EA

GENERAL INFORMATION

Features

Independently sprung wheels and MacPherson® front suspension.

Suspension pivot point:

- at chassis end: rubber bushes in lower arm and at top of strut.
- at wheel end: sealed ball joint at bottom of strut.

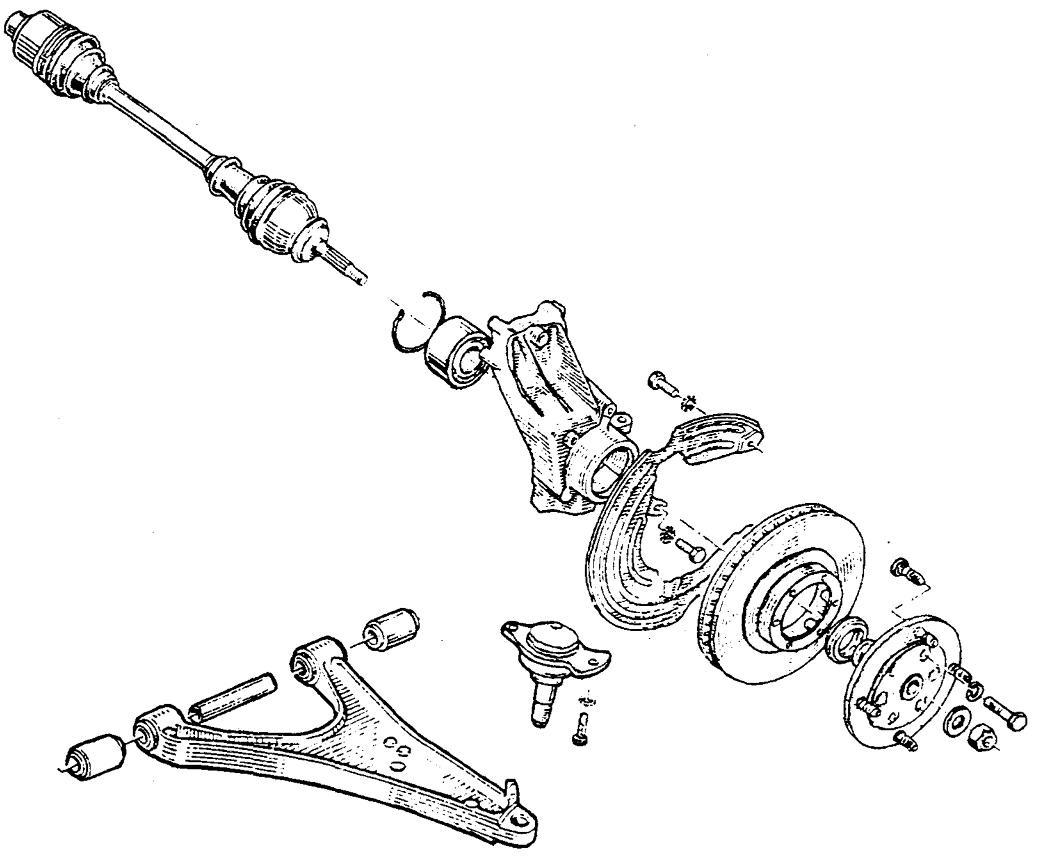
MacPherson® struts pivot at top in sleeve and sealed needle thrust bearing:

- Rack and pinion steering box
- Front wheel drive (FWD) through drive shafts with constant velocity joint
- Hubs fitted with dual-row ball bearings.

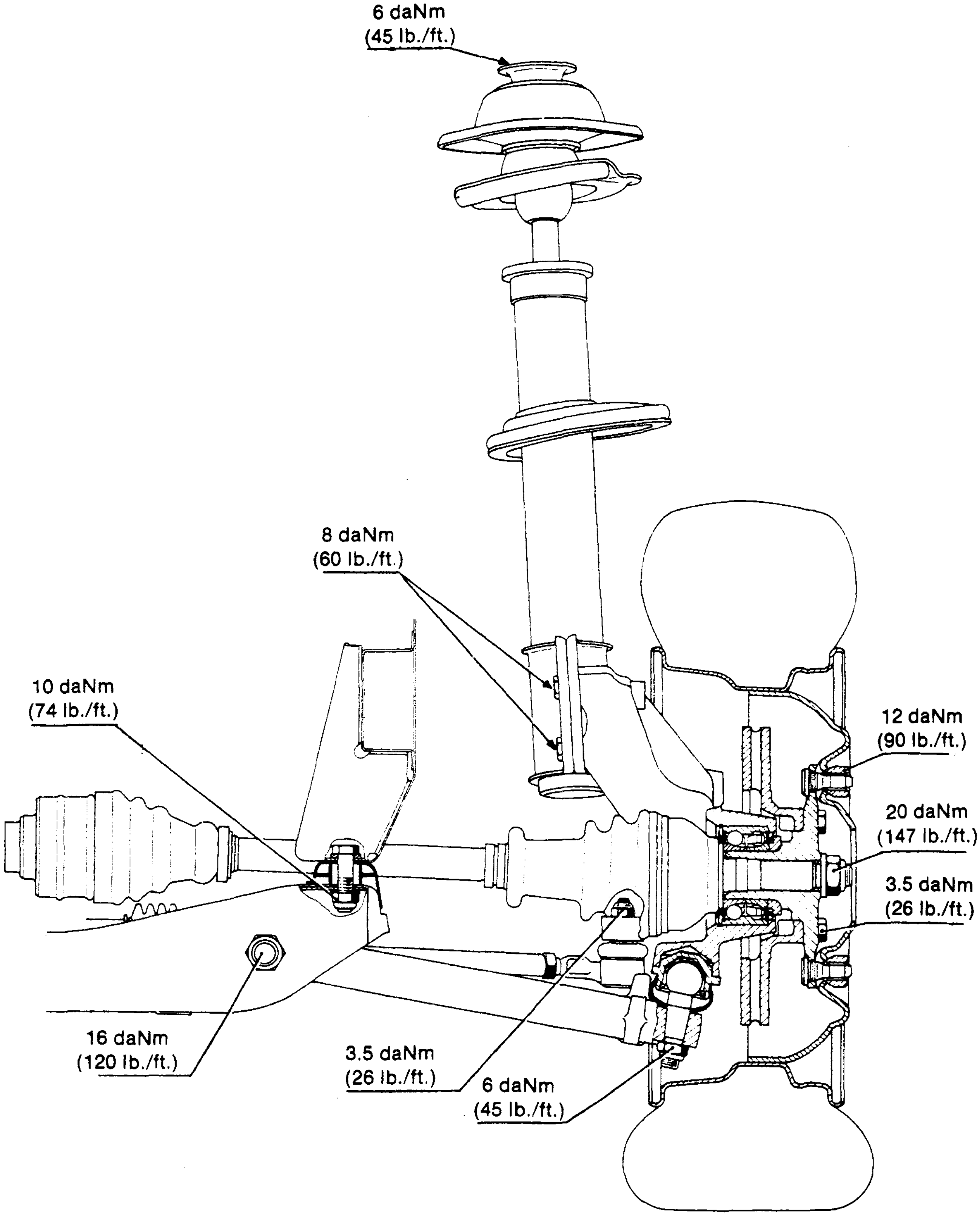
If it becomes necessary to replace a front axle bearing on a straight splined driveshaft, the following procedures MUST be followed during reinstallation to ensure the proper performances and longevity of the replacement bearings.

1. Apply shaft sealer (Loctite® 680 High Strength®) (Winnebago part number 076062-01-700). **Do not use any other form of Loctite® for this operation,** as it will not meet the required specifications. Be careful not to apply shaft sealer onto the surrounding parts.
2. When reinstalling the assembly, always replace the driveshaft washer (Winnebago part number R79030-53-143) and the driveshaft nut (included in Front Bearing Kit - Left or Right - Winnebago part number R77014-62-021).
3. Torque tighten the driveshaft nut to 25 daNm (184 lb./ft.)

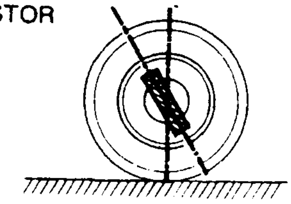
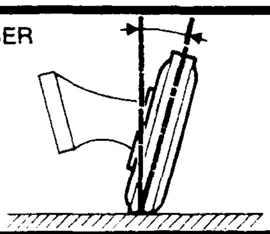
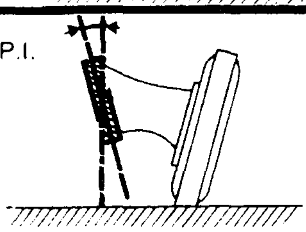
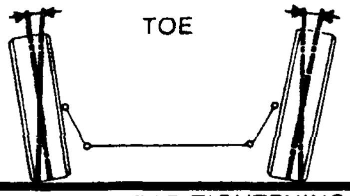
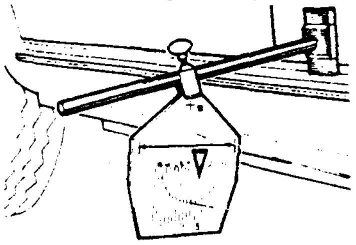
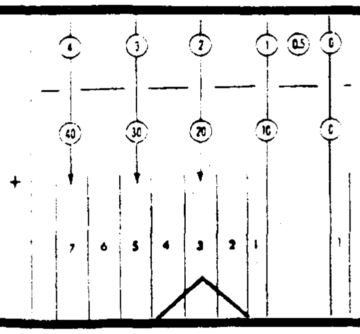
Power Steering	Max. Operation Pressure
Pump and Rack	65-68.5 bars (940-990 p.s.i.)



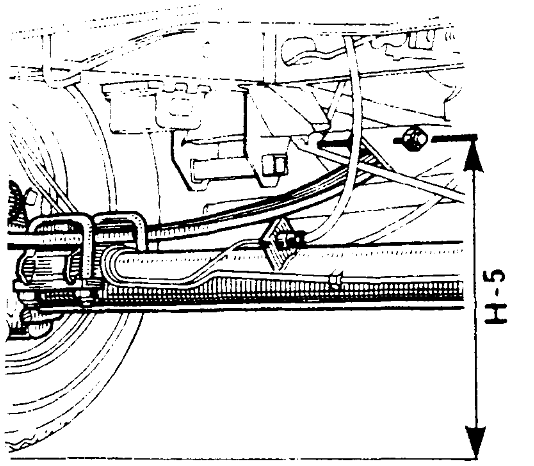
SPECIFICATIONS
TIGHTENING TORQUES

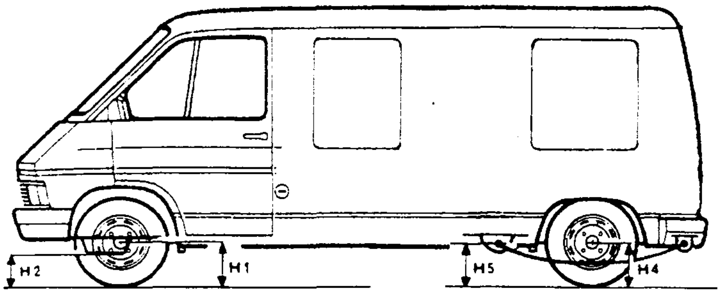


SPECIFICATIONS
FRONT AXLE ALIGNMENT

Angles	Values	Checking position	Adjustment
CASTOR 	1°30′) 1°) 0°30′) ± 30′ 0°) Max. difference between R.H. and L.H. sides 1°	Short Long 90 90 H^5-H^2 110 110 H^5-H^2 130 135 H^5-H^2 150 160 H^5-H^2	NON-ADJUSTABLE
CAMBER 	1° ± 30′ Max. difference between R.H. and L.H. sides 1°	UNLADEN	NON-ADJUSTABLE
K.P.I. 	9° ±30′ Max. difference between R.H. and L.H. sides 1°	UNLADEN	NON-ADJUSTABLE
TOE 	Toe-out 0° 10′ ±10′ (1 mm ± 1)	UNLADEN	By turning steering arms: 1 complete turn= 30′ (3 mm)
POSITION FOR TIGHTENING RUBBER BUSHES		$H_1 - H_2$ = 100 mm	In this position tighten the lower arm pivot pin
STEERING BOX HEIGHT 	Method with compression 8 to 10 On 55-200. scaleboards	Low position $H^1 - H^2$ = 130 mm	BY SLOTS
	Method without compression Zone 3 on setting scale From 1.5 to 2.5 mm (per wheel) variation in the direction of the toe-in.	Low position unladen High position unladen + 40 mm	

SPECIFICATIONS
MEASURING POINTS





GREASE APPLICATION

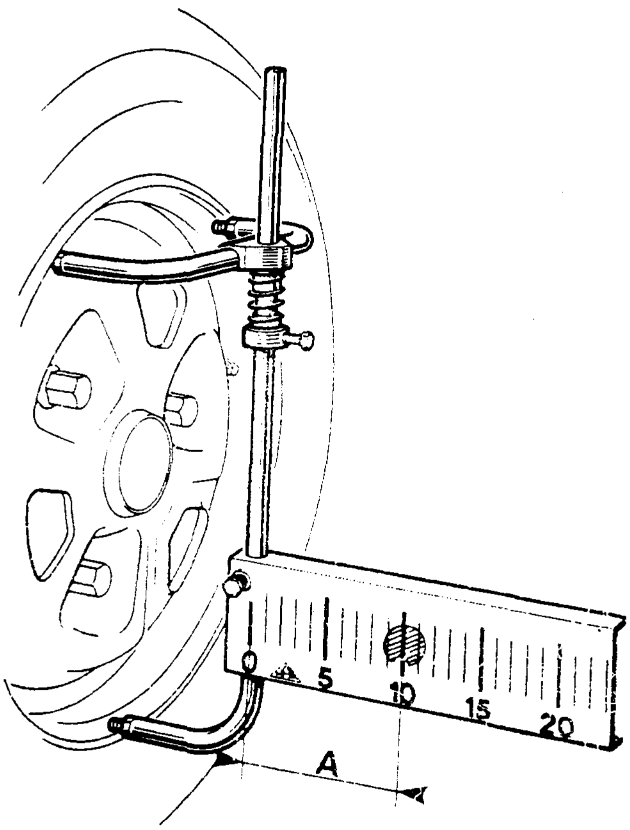
Component	Amount
Oil seal lips	5 g (.175 oz.)
Hub bearings	10 g (.35 oz.)
Drive Shaft Splines	coating
Wheel Stud Threads	coating
MacPherson® Strut (Top Thrust Bearing)	coating
Lower arm pivot pins	coating
Steering Shaft Splines	coating
Steering Shaft Bushings	coating
Steering Arm Pins	coating
Gearbox/Driveshaft Splines	coating
Wheel/Driveshaft Coupling	140 g (5 oz.)
Gearbox/Driveshaft Coupling	160 g (5.65 oz.)

FRONT AXLE ALIGNMENT
CHECKING - ADJUSTING

Preliminary Checks

Examine the following and correct if necessary before checking and adjusting the front axle alignment:

- Uniformity of front tires
  (size, inflation pressure and wear)
- Pivot points
- Condition of rubber bushings
- Play: in ball joints and in bearings
- Wheel end play : not to exceed 1 mm
  (compensate for this with measuring instruments)
- Underbody height symmetry (condition of suspension)

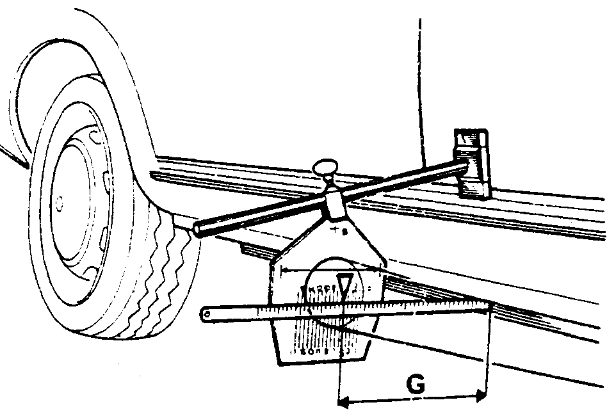


Sequence of Operations

The design of the front axle geometry is such that should one of the angles be altered (caster, camber, KPI, toe and variation) there will be a greater or lesser change in the values of the other angles. (The caster angle exerts the greatest influence).

So it is absolutely necessary to follow this sequence:

1. Attach the measuring instrument to the vehicle according to the manufacturer's instructions.
2. Jack up the vehicle under the body.
3. Neutralize any wheel end play.
4. Lower the vehicle onto the turntables.
5. Attach the brake pedal press.
6. Settle the suspension so that it adopts its normal position.
7. Align the front wheels in relation to the rear wheels or in relation to the body on each side by turning the steering wheel so as to obtain values A and G which are identical on the R.H. and L.H. sides.
8. Set the turntables to zero in this position.



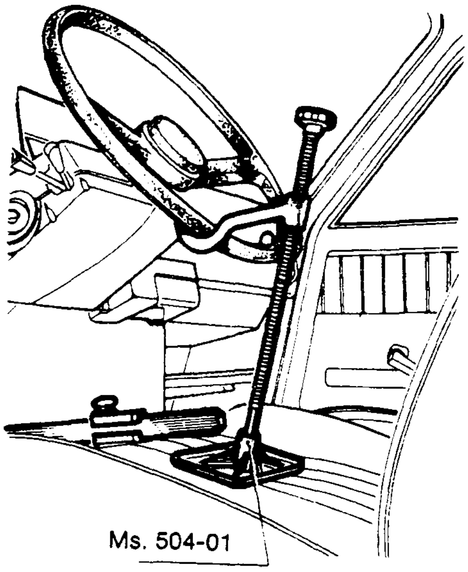
Check the following in the order shown and adjust:

1. Castor
2. K.P.I.
3. Camber
4. Steering box height setting
5. Toe and its distribution

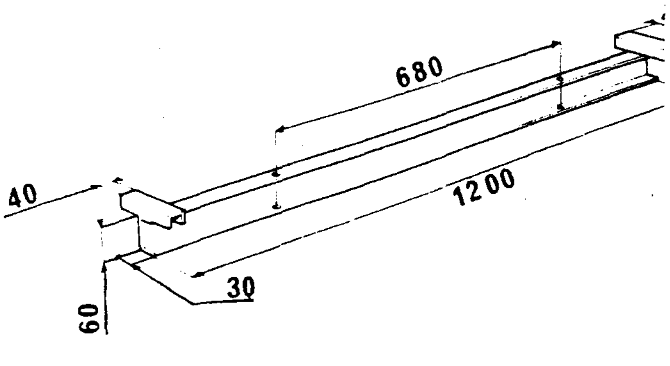
FRONT AXLE ALIGNMENT
STEERING BOX HEIGHT SETTING

METHOD WITH COMPRESSION

CHECKING
- Place the vehicle on a hoist
- Place the front wheels on turntables and attach the brake pedal press.
- Set the steering to center point then prevent it from turning with steering wheel lock Ms. 504-01.



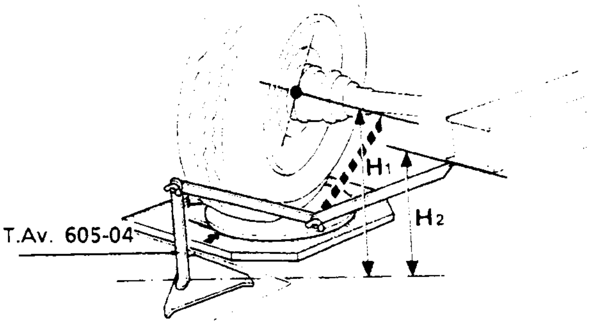
Fabricate a compressing bar for the front axle locally to the dimensions shown at the right.



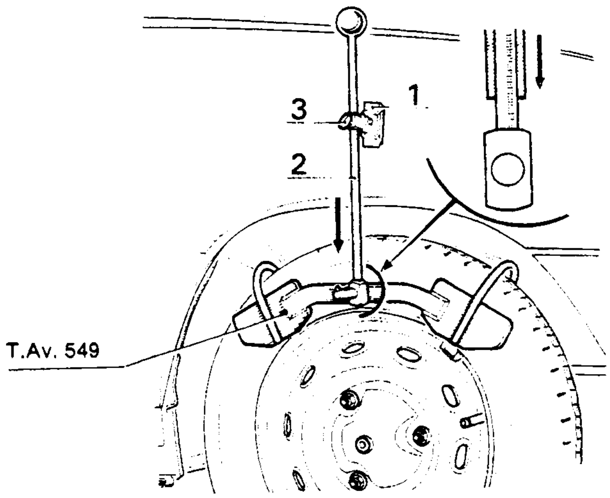
FRONT AXLE ALIGNMENT
STEERING BOX HEIGHT SETTING

Method with compression

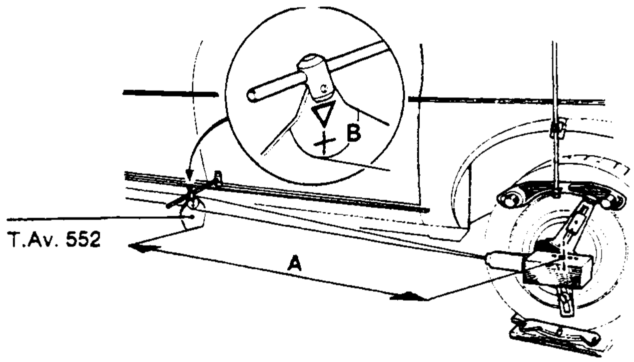
- Use height gauge T.Vi. 605-04 to measure heights H1 and H2.



- Compress the front axle.
- Place tool T.Av. 549 on the tire and hold it to the wing with magnetic base (1). Adjust measuring rod (2) so that it is vertical and in the low position.
- Tighten screw (3)



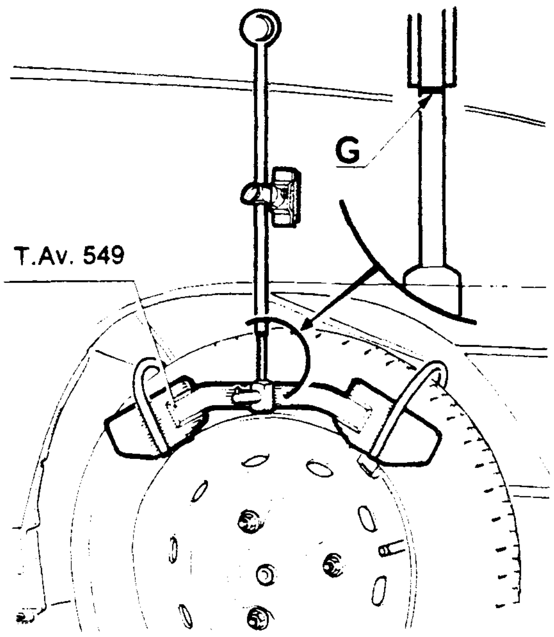
- Attach a scaleboard (T.Av. 552) to the bottom of each door by means of its magnetic base so that A = 1.30 m (51 5/32") from the front wheel center.
- Mount a measuring instrument on each side so that the beam lines up with cross B on the scaleboard.



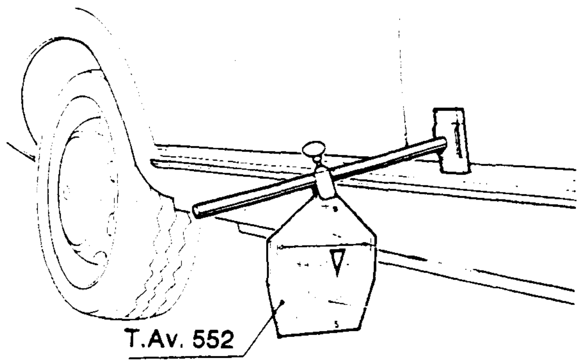
FRONT AXLE ALIGNMENT
STEERING BOX HEIGHT SETTING

Method with compression

- Jack up the front of the vehicle slowly until red line (G) on T.Av. 549 becomes visible. This corresponds to a front axle height variation of 80 mm (3 5/32").
- In this position, read off the figure nearest the beam tip on the scaleboards on each side.
- Compare the values as read with those given in the chapter "Specifications".



If the beam tip is outside this zone, the steering box height must be increased or reduced to reach the correct value.



List of equipment currently available which requires the front axle to be compressed when adjusting steering box height.

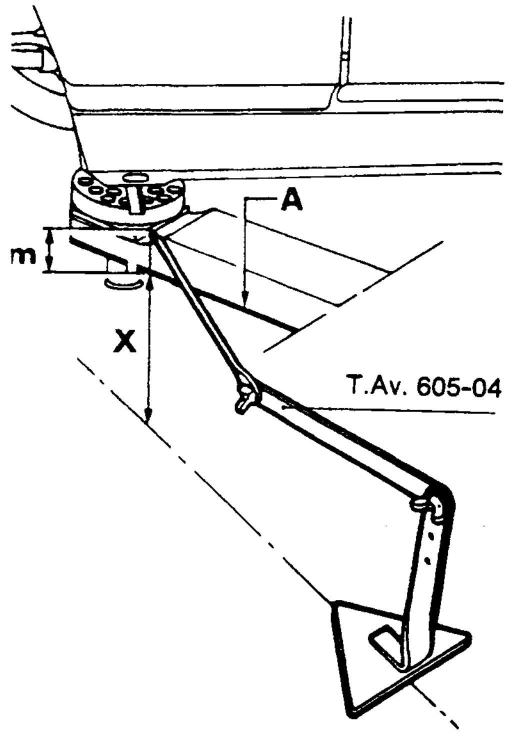
Manufacturer	Type
Facom	U 70
Muller	665

FRONT AXLE ALIGNMENT
STEERING BOX HEIGHT SETTING
METHOD WITHOUT COMPRESSION

This method is only possible by the back projection method using front axle measuring instruments which read off the toe direct.

CHECKING

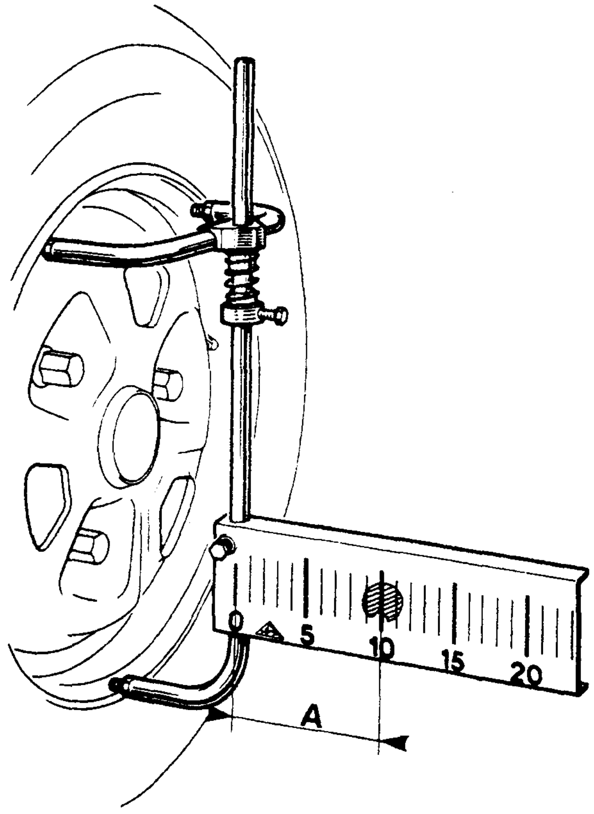
- Place the vehicle on a lift.
- It should be empty and in its normal position. Place the front wheel on turntables and fit the brake pedal press.
- Place the lift swing arms under the body front jacking points so that the pads make contact.



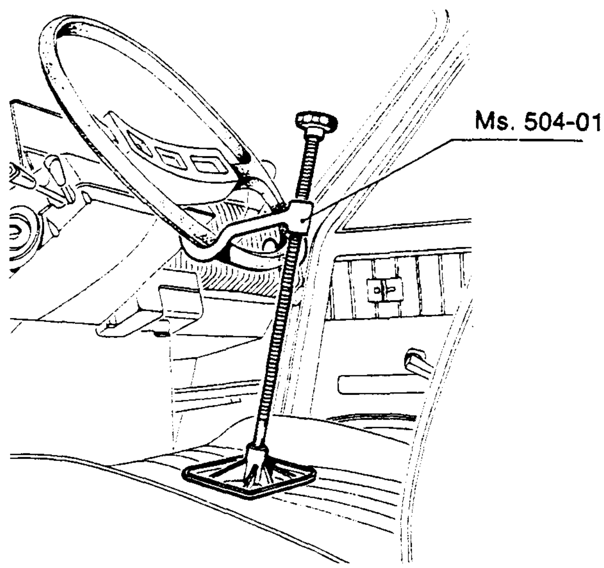
- Measure dimension (X) between the lift floor (or ground) and underside (A) of the swing arm (or under bodyshell).
- Set the tip of height gauge T.Av. 605-04 to dimension X + 40 mm (1 9/16").

FRONT AXLE ALIGNMENT
STEERING BOX HEIGHT SETTING

- Align the front wheels to the rear wheels so that each beam image gives an identical value (A) on the aligning rule (or divide the amount of toe equally).



- Lock the steering wheel with tool Ms. 504-01.
- Read off the toe value of each wheel and note the values.

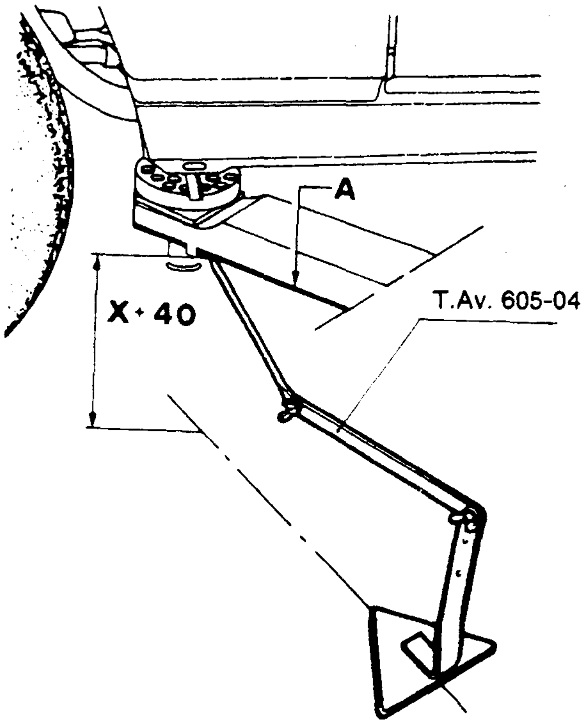


FRONT AXLE ALIGNMENT
STEERING BOX HEIGHT SETTING

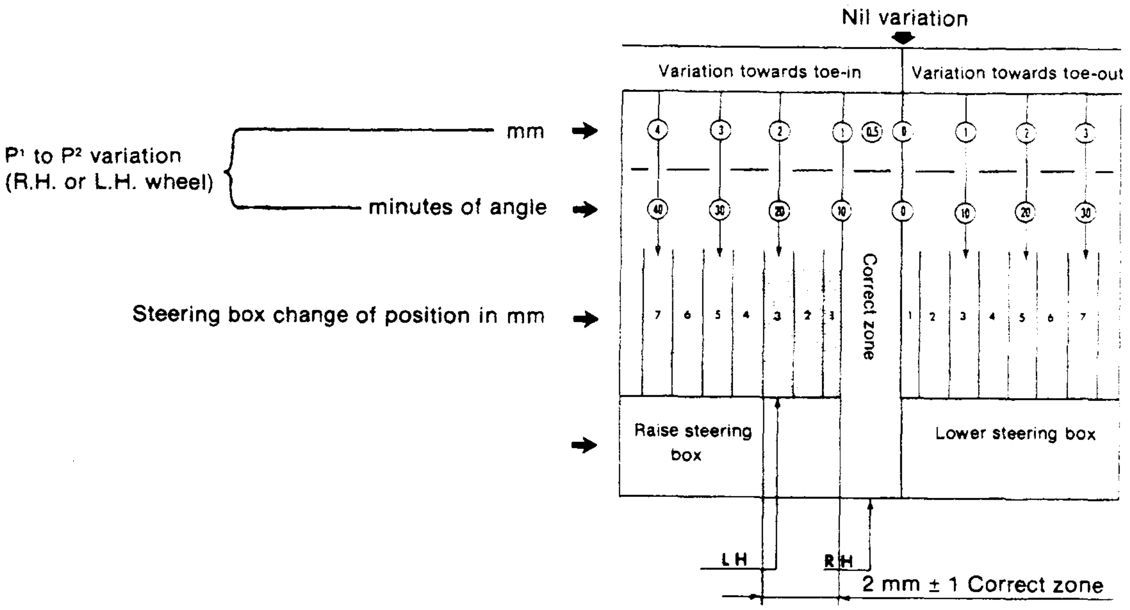
METHOD WITHOUT COMPRESSION

Identification:

- P^1D is the R.H. front wheel reading
- P^1G is the L.H. front wheel reading



- Now raise the front of the vehicle until the underside of the lift swing arm (or underside of the bodyshell) is level with the tip of gauge T.Av. 605-04.
- Read off and note the new toe values, which are:
  - P^2D for the R.H. front wheel reading
  - P^2G for the L.H. front wheel reading
- Therefore a variation in toe exists of:
  - P^1D to P^2D for the R.H. front wheel
  - P^1G to P^2G for the L.H. front wheel
- This variation may be:
  - towards toe-in
  - towards toe-out
  - or nil (if $P^1 = P^2$)
- Refer the values obtained to the table below and read off the corrections to be made to the existing shims on each side on the vehicle.



Correct R.H. Value
L.H. value to be 2 mm ± 1 mm
R.H. side + Do not alter steering box position
L.H. side + Remove 2 mm ± 1 mm from existing shim or raise steering box 2 mm ± 1 (depending on position of steering box).

- After adjusting the steering box height, recheck, then adjust the parallelism to keep the steering wheel center.

Example

Supposing

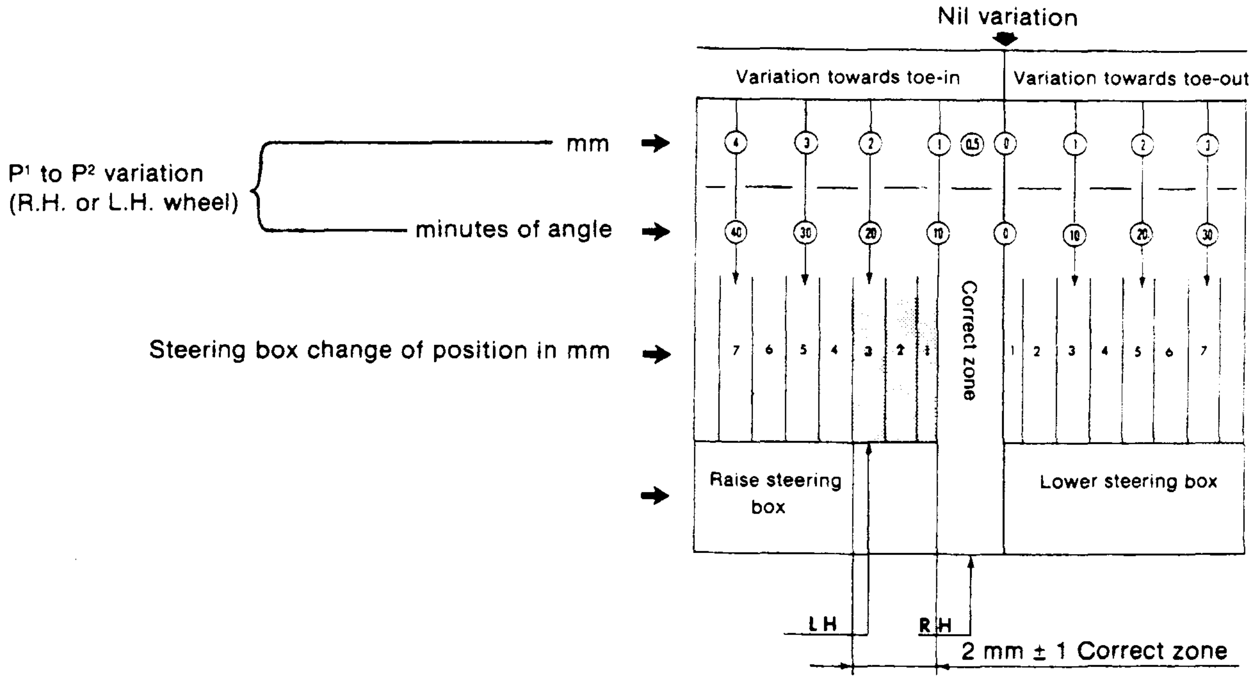
P^1D = 2 mm (20') toe-out
P^1G = 1 mm (10') toe-out
and P^2D = 1.5 mm (15') toe-out

Supposing: P^2G = 1 mm (10') toe-out

Then:
- the variation between P^1D and P^2D = 2 mm (20') to 1.5 mm (15') toe-out
  = a variation towards toe-in of 0.5 mm (5')

- the variation between P^1G and P^2G = 1 mm (10') toe-out to 1 mm (10') toe-in
  = a variation towards toe-in of 2 mm (20')

Now refer the above values to the table on the previous page:



Correct R.H. Value
L.H. value to be 2 mm ± 1 mm
R.H. side = Do not alter steering box position
L.H. side = Remove 2 mm ± 1 mm from existing shim or raise steering box 2 mm ± 1 (depending on position of steering box).

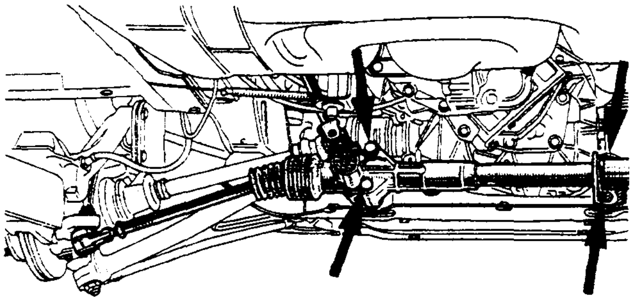
- After adjusting the steering box height, recheck then adjust the parallelism to keep the steering wheel center.

FRONT AXLE ALIGNMENT
STEERING BOX HEIGHT SETTING

ADJUSTING

Always begin the operation with the side which is the furthest from the correct zone.

- Loosen the four steering box mounting bolts and move the box by hand to:
  - bring the beam tips onto the correct zones on the T.Av. 552 scaleboards (method with compression).
  - carry out the corrections given in the table (method without compression).
- Retighten the four bolts gradually and check the setting.
- Check the toe and adjust if necessary.



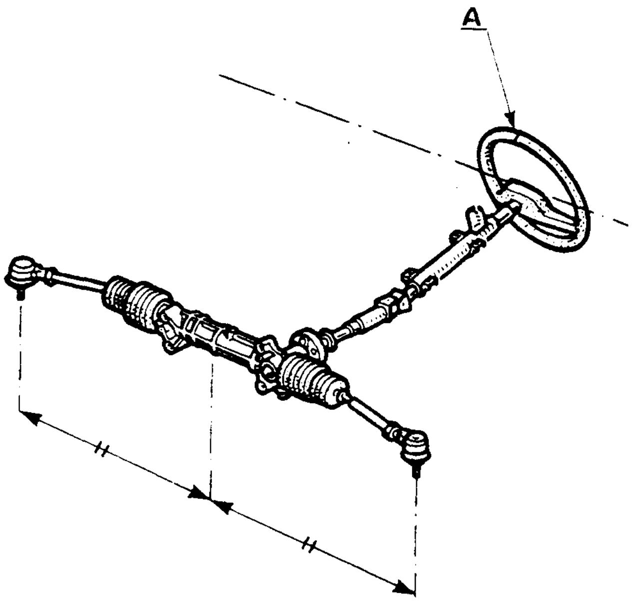
List of apparatus currently available in the U.S. giving a direct parallelism reading wheel by wheel:

Manufacturer	Type
Lowener	Uniflex
John Bean	Optoe Liner
Hunter	Autron-a-Line
Muller	666

FRONT AXLE ALIGNMENT
CENTERING THE STEERING WHEEL

With this operation it is not necessary to remove the bellows to measure the steering center point:

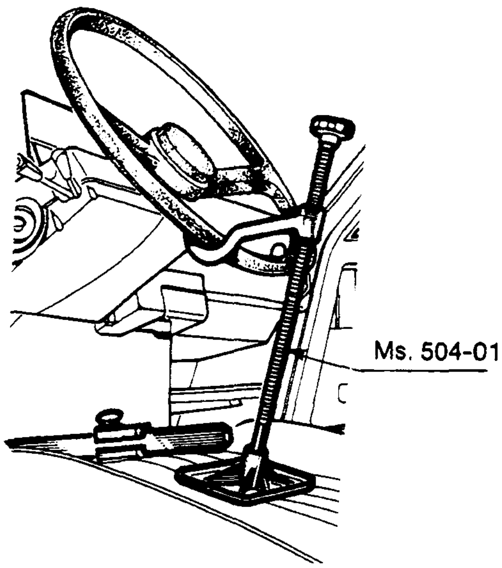
- turn the steering wheel full lock in one direction
- mark the top center of the rim at (A)
- now turn the steering wheel on full opposite lock, counting the number of complete turns and fractions of a turn while doing so.
- turn the steering wheel back half the number of complete turns and half the fractions of a turn noted. This is the steering center point.



Remove the steering wheel without moving the setting and mount it to the splines with the spokes as near horizontal as possible.

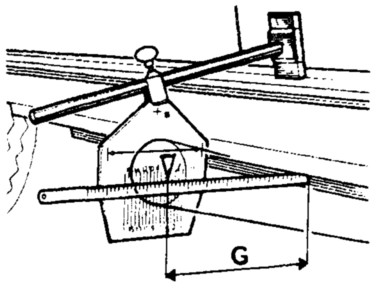
This is the "Steering straight ahead position".

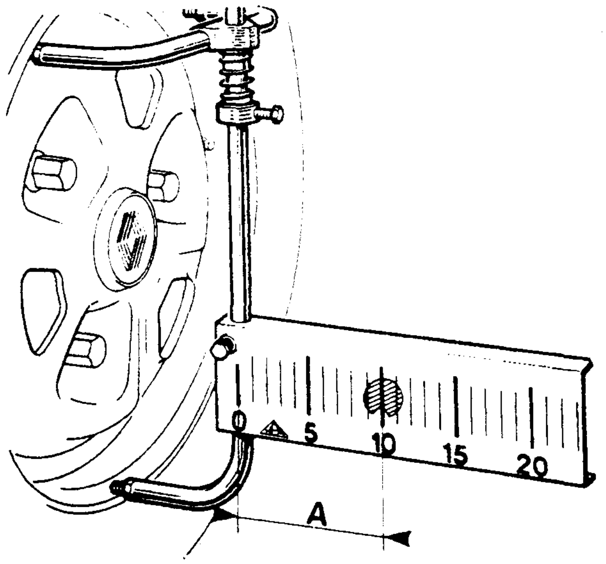
Check that the steering wheel is centered and bring it in the "straight ahead" position with spokes horizontal (see above paragraph).
Prevent the steering wheel from turning using lock Ms. 504-01.



FRONT AXLE ALIGNMENT
PARALLELISM

Measure the toe and then how it is divided between the two sides either in relation to the rear wheels (dimension A) or in relation to the body sides (dimension G).

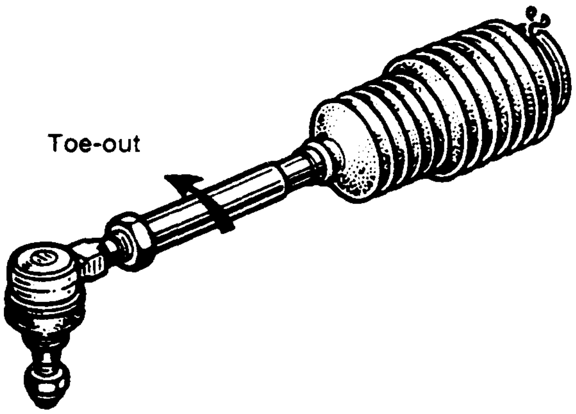




ADJUSTING

There are several possibilities:

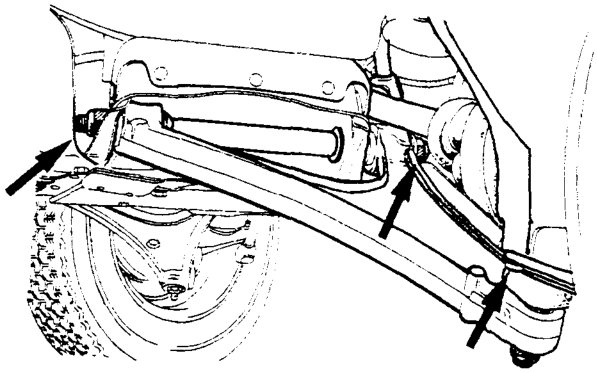
Toe-In	Toe-Out	Correction to be made
CORRECT	INCORRECT	Turn each steering arm rod (or end fitting) an equal number of turns but in opposite directions to obtain values A and G which are equal both sides.
INCORRECT	CORRECT	Adjust the toe-in on both sides to the same value making sure that values (A and G) remain the same.
INCORRECT	INCORRECT	Adjust the toe-in first to the correct value, then adjust the toe-out.



1 complete turn = 30′ (3 mm) of toe-in or toe-out.

LOWER SUSPENSION ARMS
REMOVING - REASSEMBLING

TIGHTENING TORQUES
Lower arm pivot pin 16 daNm (120 lb./ft.)
Ball joint mounting screw 2.5 daNm (19 lb./ft.)
Wheel nuts 12 daNm (90 lb./ft.)



REMOVING
- Place the side concerned on stands and remove the tire.
- Remove the two ball joint mounting screws from the stub axle carrier using a male angle wrench with TORX® T40 tip.
- Withdraw the pivot pin and remove the lower arm.

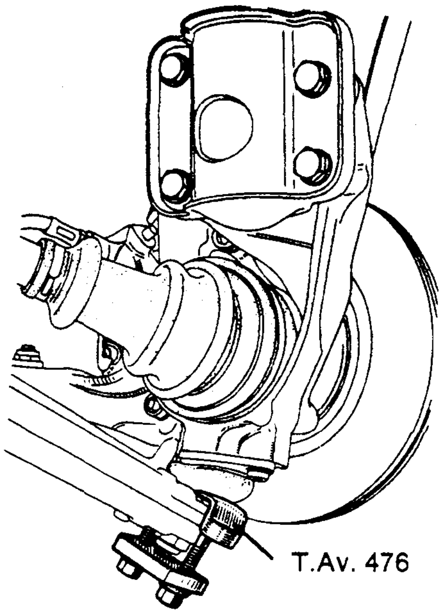
REASSEMBLING
- Coat the lower arm pivot pin with grease and lift up the arm to the engine crossmember. Degrease the pivot pin threads and screw the nut up. Do not tighten it yet.
- Attach the other end of the arm with its ball joint to the stub axle carrier.
- Compress the front axle using a bar fabricated to the dimensions shown at right.

- Compress the front axle so that H1 - H2 = 100 mm (4").
- Torque tighten the pivot pin nut.

LOWER SUSPENSION ARMS
CHANGING A BALL JOINT

TIGHTENING TORQUES

Ball joint nut 6 daNm (45 lb./ft.)
Ball joint mounting screws 2.5 daNm (19 lb./ft.)
Wheel nuts 12 daNm (90 lb./ft.)



REMOVING
- Place the side concerned on stands and remove the tire.
- Unscrew the ball joint nut and remove the lower arm from the taper using extractor T.Av. 476.
- Remove the two ball joint mounting screws from the stub axle carrier using an allen wrench with TORX® T40 tip.

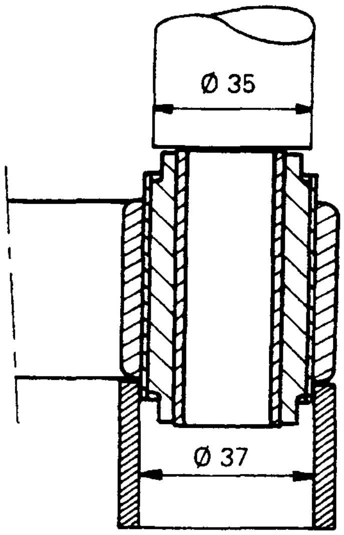
REASSEMBLY
- Mount the ball joint to the stub axle carrier.
- Insert the ball joint taper into the lower arm and screw on the nut.
- Place a jack under the lower arm to prevent the taper from turning in its seat while the nut is torque tightened.

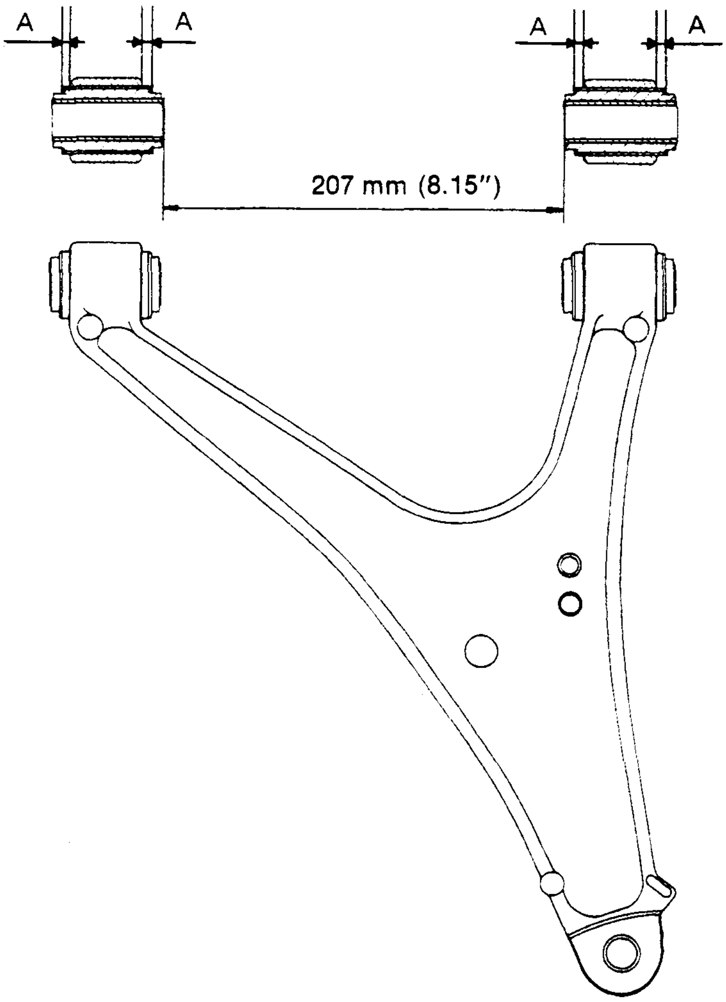
LOWER SUSPENSION ARMS
CHANGING THE RUBBER BUSHINGS

A press is required for this operation after the arm has been removed from the vehicle.

Use a piece of tube 37 mm bore (1.45") under the arm on the press and a 35 mm (1.37") dia. mandrel to push out the bushings.

When pressing in new bushings, they must be symmetrical in relation to the mounting (shown by dimension A) and there must be a distance of 207 mm (8.15") between them as shown below.

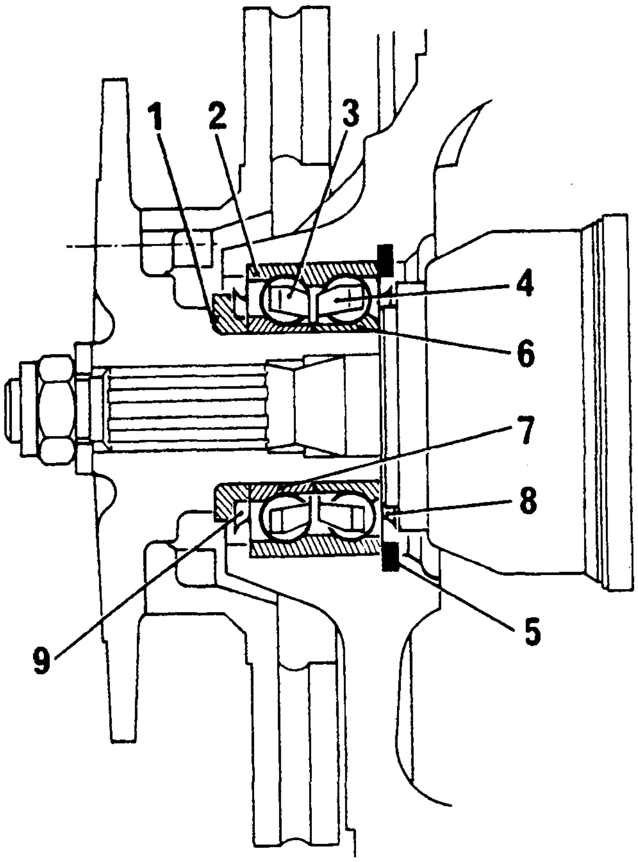




STUB AXLE CARRIERS
CHANGING THE BEARINGS

TIGHTENING TORQUES

Shock absorber bolts 8 daNm (60 lb./ft.)
Ball joint mounting
Screws in stub axle carrier 2.5 daNm (19 lb./ft.)
Steering arm nut 3.5 daNm (26 lb./ft.)
Drive shaft nut 20 daNm (147 lb./ft.)
Wheel nuts 12 daNm (90 lb./ft.)



Front hub bearings contain:
- 2 rows of balls
- 2 inner races
- 1 outer race
- and 2 lip-type oil seals

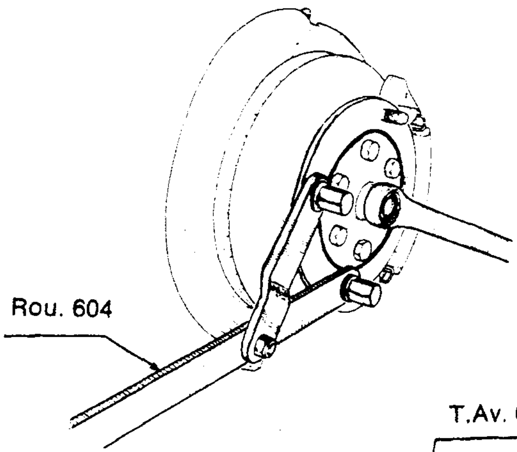
1. Inner race thrust washer
2. Outer race
3. Outer ball cage
4. Inner ball cage
5. Circlip
6. Inside inner race
7. Outside inner race
8. Inside oil slinger
9. Outside oil seal

STUB AXLE CARRIERS
CHANGING THE BEARINGS

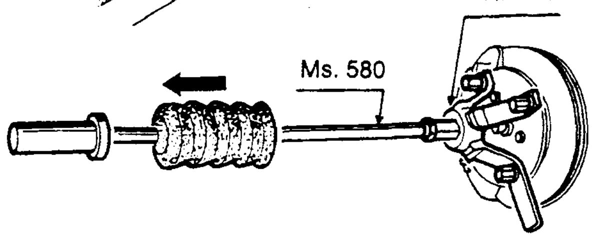
REMOVING

Place the vehicle on stands.

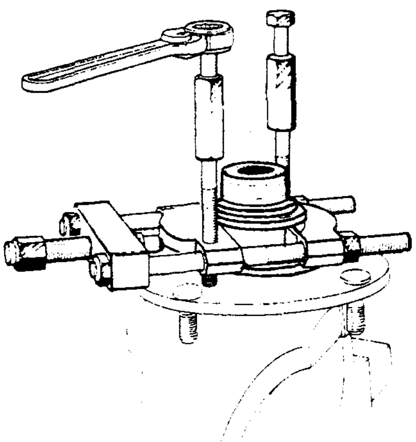
- Remove the wheel.
- Remove the brake caliper without disconnecting the hose.
- Mount locking tool Rou. 604 to prevent the hub from turning and unscrew the drive shaft nut.



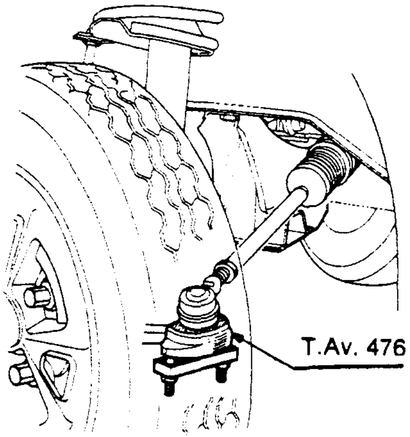
- Mount extractor T.Av. 601 using the 4 wheel nuts.
- Remove the long bolt from the extractor, mount slide hammer Ms 580 in its place and extract the hub-disc assembly.



- Use an axle bearing splitter/extractor as shown to remove the inner race thrust washer remaining on the hub. Obtain tool from local tool vendor. Jaw range 0-100 mm (4").
- Retain the thrust washer.



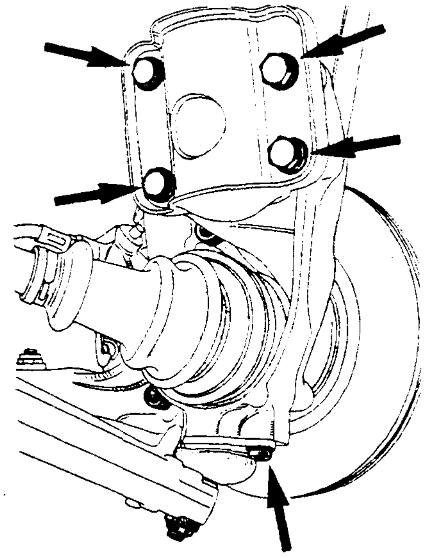
- Extract the steering arm ball joint from the stub axle carrier using extractor T.Av. 476



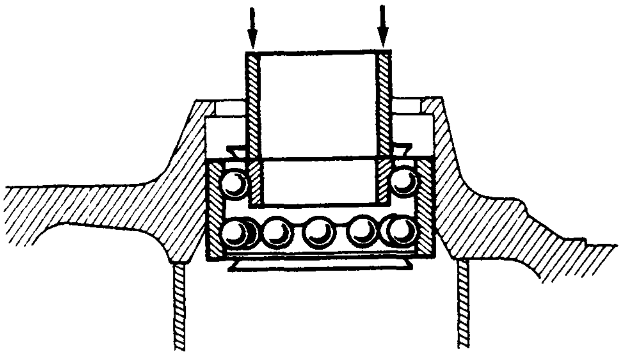
STUB AXLE CARRIERS
CHANGING THE BEARINGS

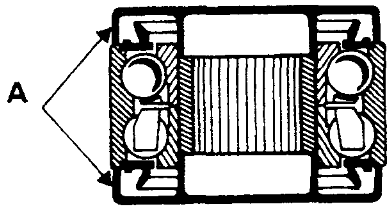
REMOVE:

- The Torx® head bolts from the lower ball joint mount.
- The shock absorber bottom bolts (4).



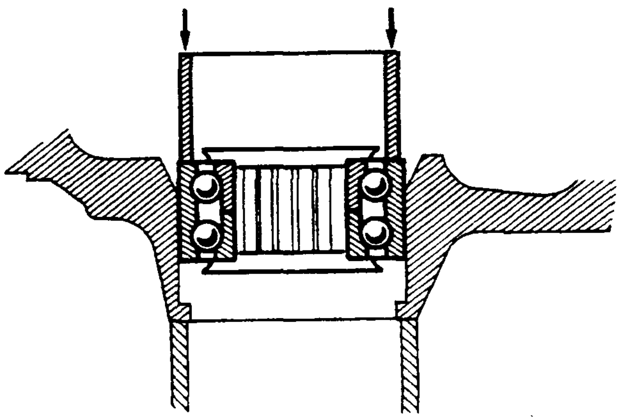
- The circlip from the hub.
- The outer race using a press and one of the old inner races, leaving the ball cages and seals in position.





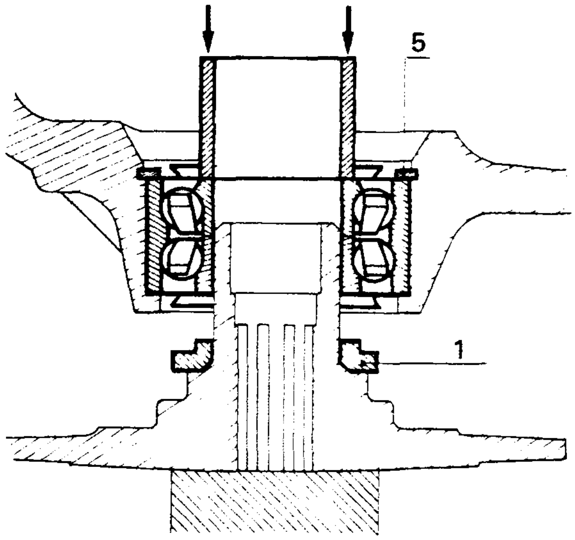
REASSEMBLY

- Remove the two plastic covers (A) from the oil seals on the new bearing.
- Press in the complete new bearing with its plastic ring. Hold the 2 inner races using a piece of tube 83 mm (3.26") OD x 76 mm (3.00") ID. Apply pressure to the outer race only.
- Do not press on the inner race since this could damage the bearing.



STUB AXLE CARRIERS
CHANGING THE BEARINGS

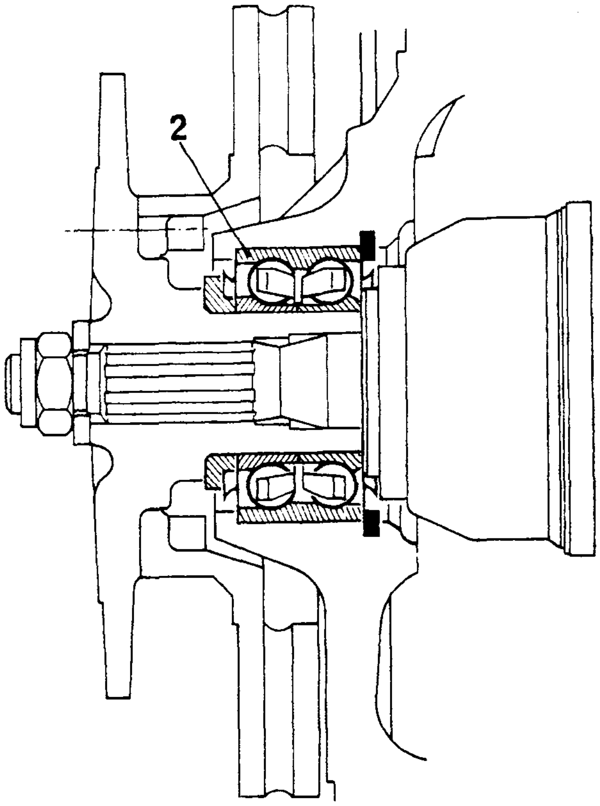
- Insert circlip (5) so that it rests against the outer race. Make certain that it is fully seated in the groove.
- Coat each lip seal with grease.
- Slip thrust washer (1) on the hub and press in the hub-disc assembly using a piece of tube 53 mm (2.08") OD x 43 mm (1.70") ID, applying the load to the inner race.



STUB AXLE CARRIER
REMOVAL & REASSEMBLY

The bearing replacement steps described above must be performed first in order to gain access to the carrier assembly.

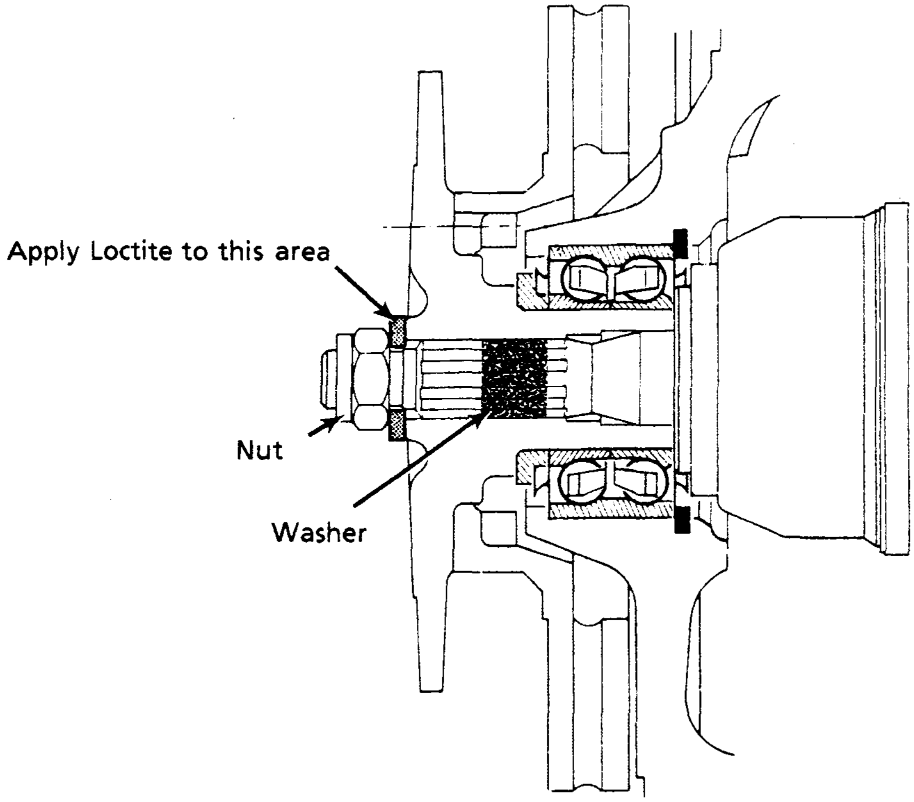
NOTE: The bearing assembly is non-serviceable and must be replaced whenever it is removed.



STUB AXLE CARRIERS
CHANGING THE BEARINGS

If it becomes necessary to replace a front axle bearing or change a driveshaft, the following procedures MUST be followed during reinstallation to ensure the proper performance and longevity of the replacement bearings.

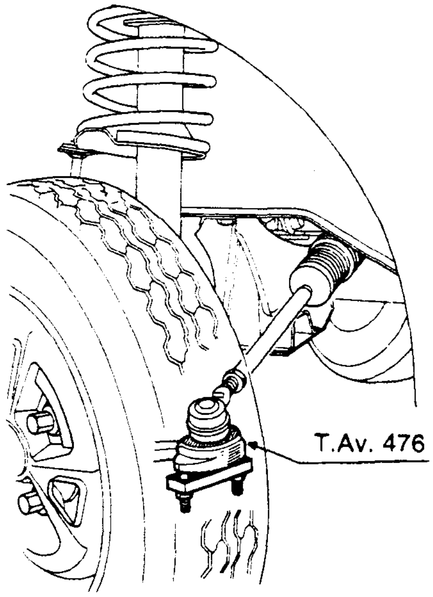
1. Apply shaft sealer (Loctite® 680 High Strength) (Winnebago Part number 076062-01-700), per manufacturer's instructions, onto the center 1.3 of the inside hub grooves (See Diagram). **Do not use any other form of Loctite® for this operation,** as it will not meet the require specifications. Be careful not to apply shaft sealer onto the surrounding parts.
2. When reinstalling the assembly, always replace the driveshaft washer (Winnebago Part Number R79030-53-143) and the driveshaft nut (Included in Front Bearing Kit - Left or Right - Winnebago Part Number R77014-62-021).
3. Torque tighten the driveshaft nut to 20 daNm (147 lb./ft.)



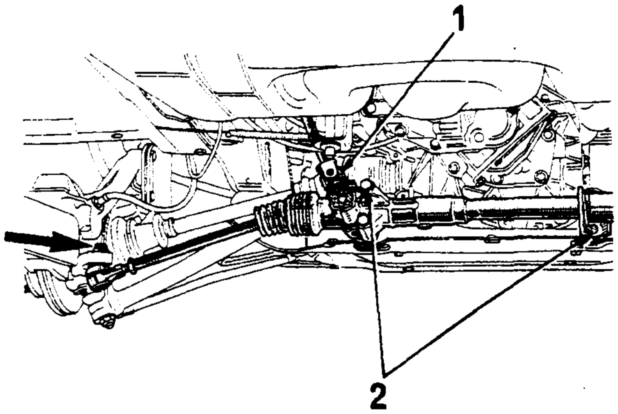
RACK & PINION STEERING ASSEMBLY
REMOVING - REASSEMBLING

TIGHTENING TORQUES
Ball joint nut 3.5 daNm (26 lb./ft.)

REMOVING
- Place the front of the vehicle on stands and unscrew the ball joint nuts.
- Use extractor T.Av. 476 to separate the ball joint from the stub axle carrier taper.

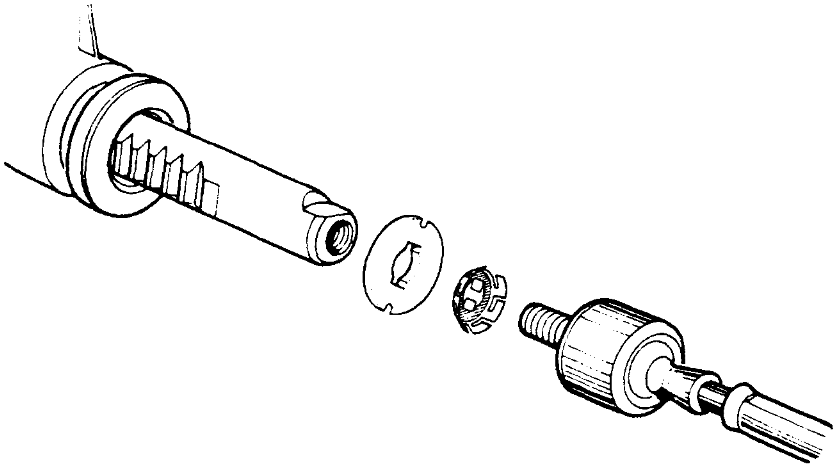


- Mark the position of the steering wheel shaft in relation to the pinion splines than unscrew the key bolt (1) and disconnect the shaft.
- Unscrew the four steering assembly mounting bolts on the crossmember.
- Remove the steering assembly complete with its arms.
- NEVER unscrew the rack axial ball joints unless they are to be changed. New lockplates must always be used in this instance.



REASSEMBLY

- Mount the axial ball joint components to the rack in the sequence shown.
- Mount the steering assembly, with arms, to the vehicle. Align the U-joint onto the steering shaft using the mark made before disassembly.
- Check and adjust the steering assembly height and toe-in.

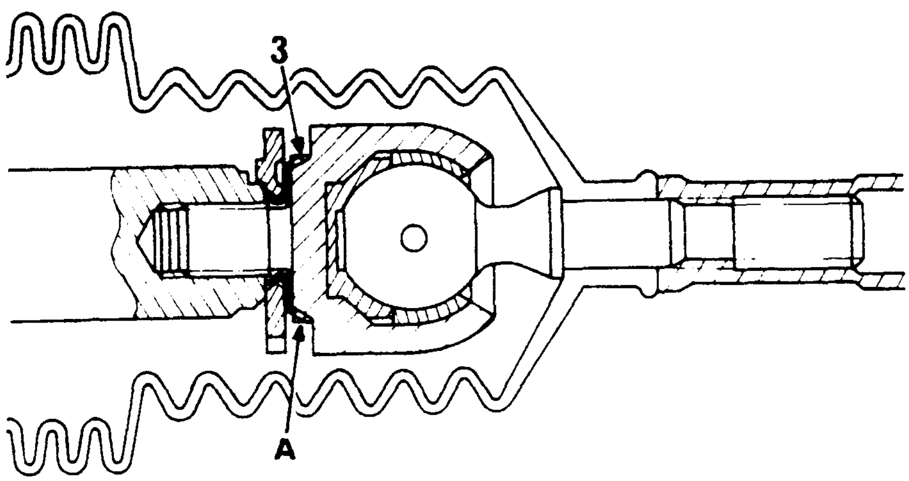


Changing a Steering Arm

TIGHTENING TORQUES

Ball joint nut 3.5 daNm (26 lb./ft.)
Axial ball joint 4 daNm (30 lb./ft.)

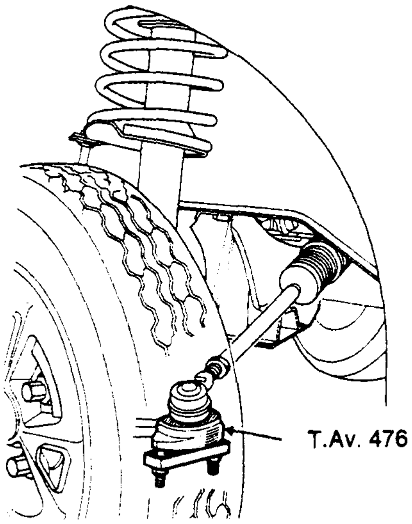
STEERING BOX
CHANGING THE STEERING ARM



STEERING ARMS FITTED WITH AN AXIAL BALL JOINT AND THIS TYPE OF LOCKPLATE CANNOT BE RE-USED ONCE THEY HAVE BEEN REMOVED.

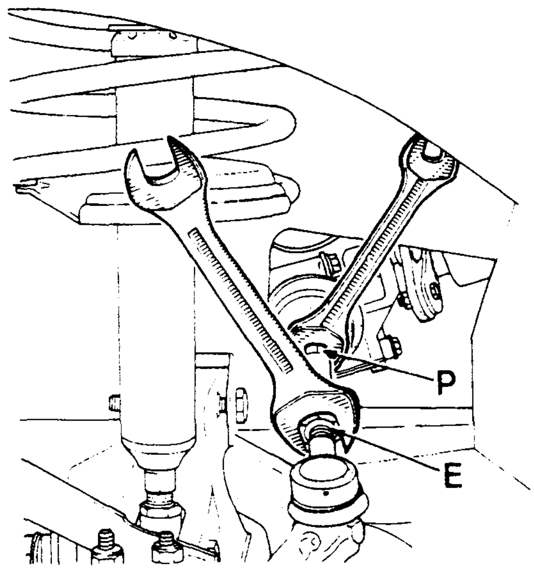
This is because lockwasher (3) damages the notched area (A) on the ball joint body when the assembly is removed and a good mechanical joint is no longer possible on re-assembly.

For this reason, the steering arm assembly and lockwasher must be changed routinely after each disassembly.



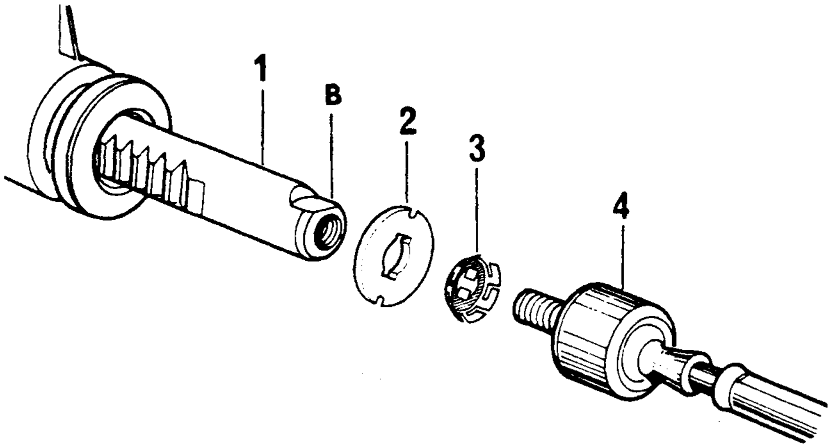
REMOVING
- Place the side concerned on a stand.
- Disconnect the steering arm ball joints using extractor T.Av. 476

Remove the steering arm ball joint and axial ball joint; to do this:
- Hold axial ball joint at (P) with an open end wrench and loosen locknut (E)
- Unscrew the steering arm ball joint, counting the number of turns required to clear the threads so that an approximate toe-in setting may be obtained immediately on mounting the new arm.



STEERING BOX
STEERING ARM AXIAL BALL JOINT

- Remove the rack boot.
- Unlock the axial ball joint from inside the inner wing panel.



REASSEMBLY

Mount the following to rack (1):

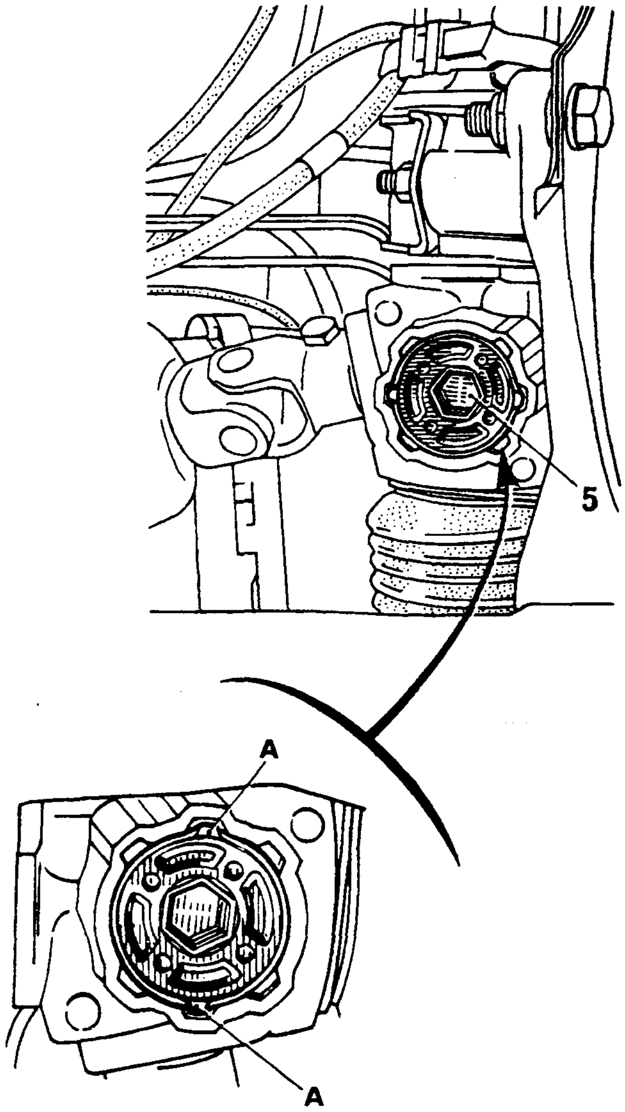
- thrust washer (2)
- a new lockplate (3)
- and a new axial ball joint (4) having coated its threads beforehand with Loctite® or equivalent.

NOTE: Check that the two lugs on lockwasher (3) are in line with flats (B) on the rack before tightening the axial ball joint assembly.

- Reassemble the boot and its clip.
- Screw on the new steering arm ball joint turning it the same number of turns counted during removal.
- Reconnect the steering arm to the stub axle carrier.
- Check the tow-in and adjust if necessary. Then tighten the locknut.

STEERING BOX
ADJUSTING THE PLUNGER

- Place the vehicle on a frame hoist and remove the front wheels.
- Unlock adjusting nut (5) by raising locking tabs (A).
- Torque tighten the adjusting nut to 1 daNm ± 0.2 (7 1/2 lb./ft.) using a 10 mm allen wrench. The steering wheel should be fairly hard to turn at this point.
- Next, back off the nut 1/4 turn. The steering should now be free turning without any hard spots.
- Lock the nut by bending the nut flange down into two opposite notches in the steering box.



POWER STEERING HOSE REPLACEMENT

REMOVAL

- Remove steering hose bracket bolts (A) and hose pipe nut (B) to access U-bolt nuts.
- Remove U-bolt and remove steering hose from bracket.

REINSTALLATION

1. Attach the hose to the bracket with the U-bolt and lock nuts. The U-bolt should seat into the groove around the hose collar as shown. Run the lock nuts up to the bracket but DO NOT TIGHTEN. The hose must be able to move until the assembly is mounted to the pump.
2. Reinstall the bracket with bolts (A) and finger tighten only.
3. Install the hose elbow with pipe nut into the pump outlet but DO NOT TIGHTEN.
4. Tighten the lock nuts on the U-bolt, making sure that the hose pipe nut (B) does not bind after the U-bolt is tightened. If so, loosen the U-bolt and reposition the hose slightly. Then retighten the U-bolt, making sure again that the pipe nut turns freely.
5. Tighten the pipe nut to 10 ft./lb. (14 Nm $\pm$ 2). Then tighten the bracket/pump mounting bolts (A).
6. Check power steering fluid level and add as necessary.

NOTE: If the vehicle is not equipped with a steering hose bracket, see Winnebago Service Bulletin 01-89-05G. (See your dealer.)

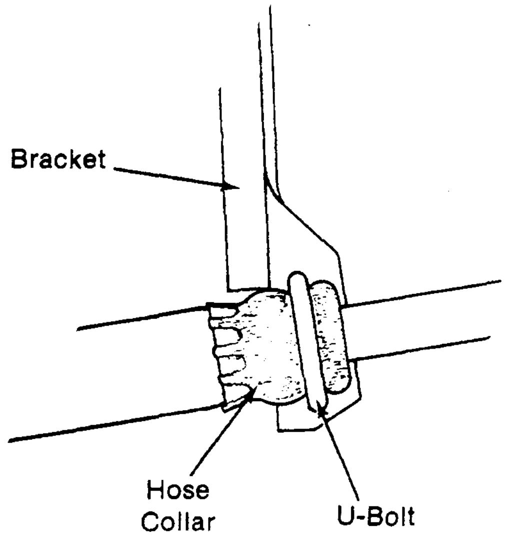


Figure 1 - Attach Hose to Bracket

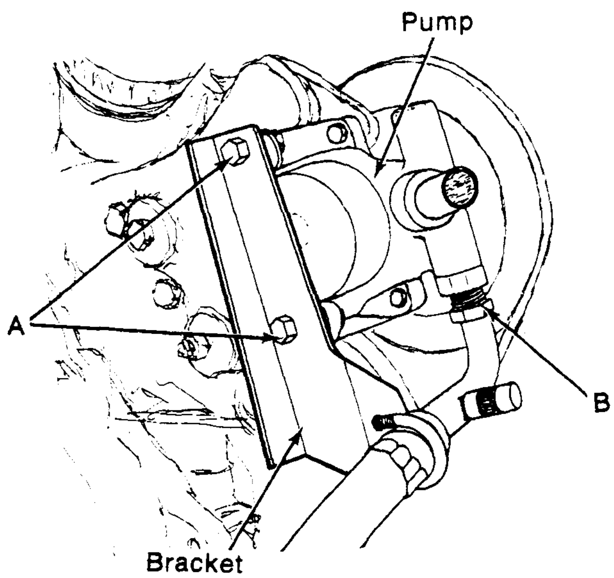
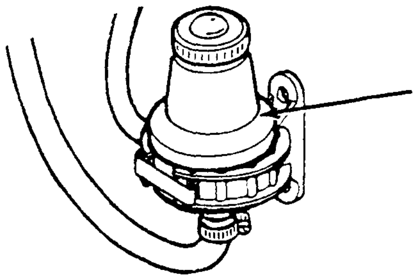


Figure 2 - Attach Bracket to Pump Mount

POWER STEERING
FLUID LEVEL - PUMP REMOVAL



POWER STEERING FLUID LEVEL CHECK

The power steering fluid reservoir is located in the front of the engine compartment near the driver side headlight. The level should be maintained at the bottom of the filler cap neck. When adding power steering fluid to the reservoir, use Mobil 220ATF Dexron® Type II automatic transmission fluid or an equivalent Dexron II transmission fluid. The capacity of the power steering reservoir is 1.22 quarts (1.15 liters).

Fluid Refill

- Fill reservoir with fluid and run engine to pull fluid into pump and hoses.
- Turn steering wheel all the way to the left and right (lock-to-lock) to purge air from system.
- Refill reservoir until fluid level is at bottom of filler neck as indicated at right.

POWER STEERING PUMP REMOVAL

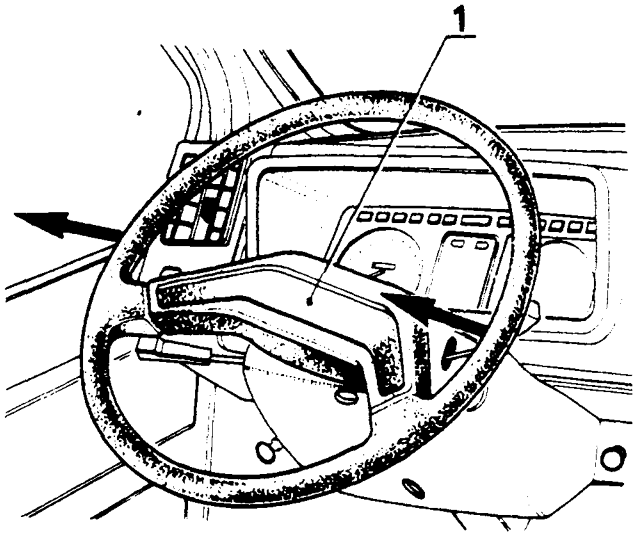
To avoid damage to the steering pump when removing the pulley, standard Saginaw-type removal and installation tools must be used.

These tools are available from local tool suppliers. They may be available either as separate removal and installation tools or as a single combination tool (e.g., OTC 7060A).

STEERING WHEEL AND SHAFT
REMOVING - REASSEMBLING

STEERING WHEEL

REMOVAL
- Remove plastic spoke cover (1)
- Unscrew the shaft nut several turns, but do not remove.
- Pull the steering wheel upward by hand. Ease it to right and left to free it from splines.
- Mark its position in relation to the shaft
- Remove the nut and the steering wheel



REASSEMBLY
- Align the steering wheel with the marks made during removal, otherwise recenter the steering wheel (see corresponding paragraph).

TIGHTENING TORQUES
Steering wheel nut 4.5 daNm (34 lb./ft.)

STEERING WHEEL SHAFT

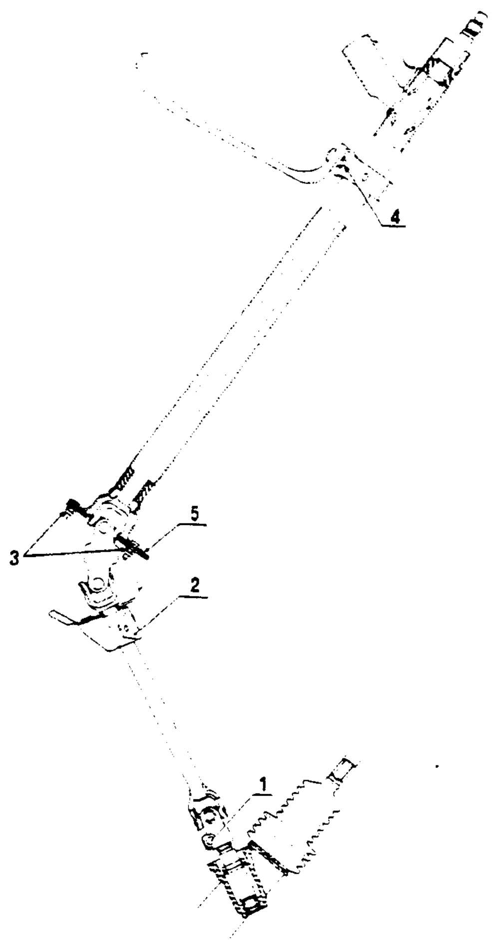
REMOVING

- Place the front of the vehicle on stands.

From underneath, remove:
- keybolt (1) and disconnect the shaft,
- disconnect the intermediate bearing (2) (2 bolts) and remove it,
- remove 4 nuts (3) holding the shaft column to the firewall.

From inside, remove:
- the steering wheel,
- column covers,
- combination lighting switch,
- anti-theft lock,
- steering column bolts (4) under the dashboard.

Pull out the steering column and shaft assembly from inside.



STEERING WHEEL SHAFT
REMOVING - REASSEMBLING

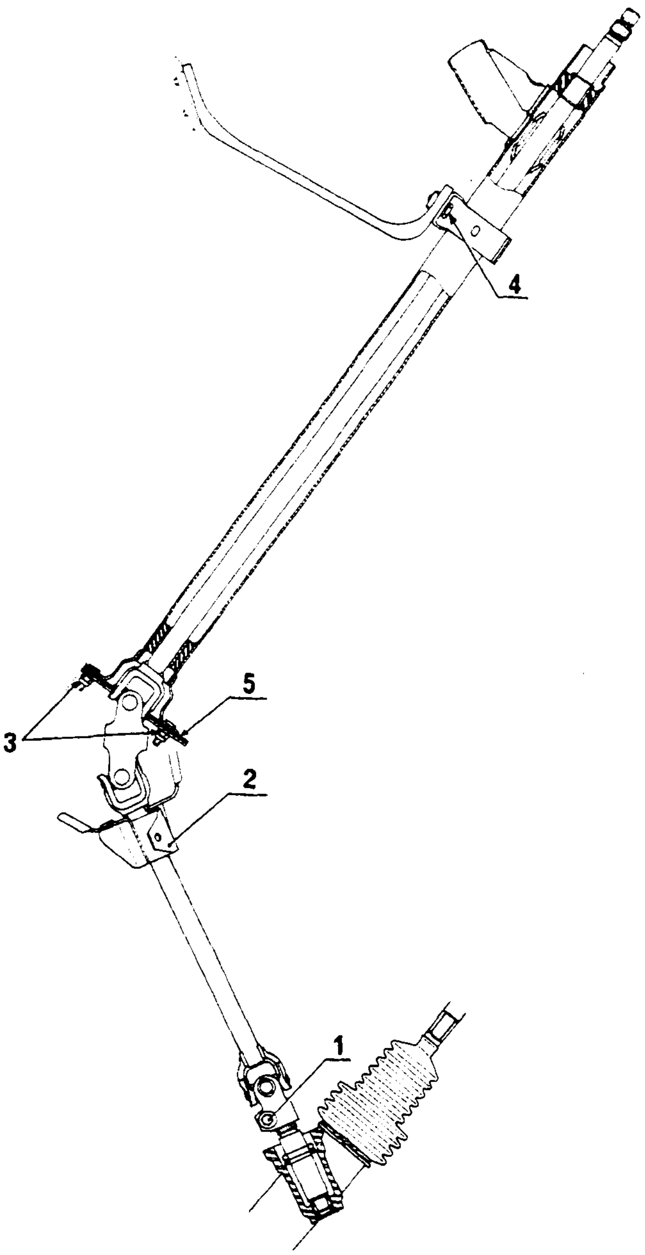
REASSEMBLY

Inside the vehicle

- Insert the steering column assembly through the firewall.
- Fasten the column by 2 bolts (4) to the bracket under the dashboard.

Reassemble:

- the anti-theft lock
- combination lighting switch
- column covers
- and steering wheel



Underneath the vehicle

- attach the steering column and its plate (5) by 2 bolts
- slide the universal joint over the pinion splines and secure it with keybolts (1) (See section J7-4)
- re-center the steering wheel if necessary (See Section J7-4)

INCORRECT STEERING CENTERING

PROBLEM:
The steering wheel does not return to center position after either a right or left turn. The driver must manually turn the steering wheel back to straighten out.

ORIGIN OF PROBLEM:
1 - Sticking steering
2 - Hard spot in steering column

CAUSES
1 - Incorrect plunger adjustment causes sticking.
2 - Steering column bushes fitted incorrectly.
Steering wheel shaft not greased on assembly.
Steering column U/J's not aligned correctly.
Intermediate shaft clip on pinion shank fitted incorrectly.

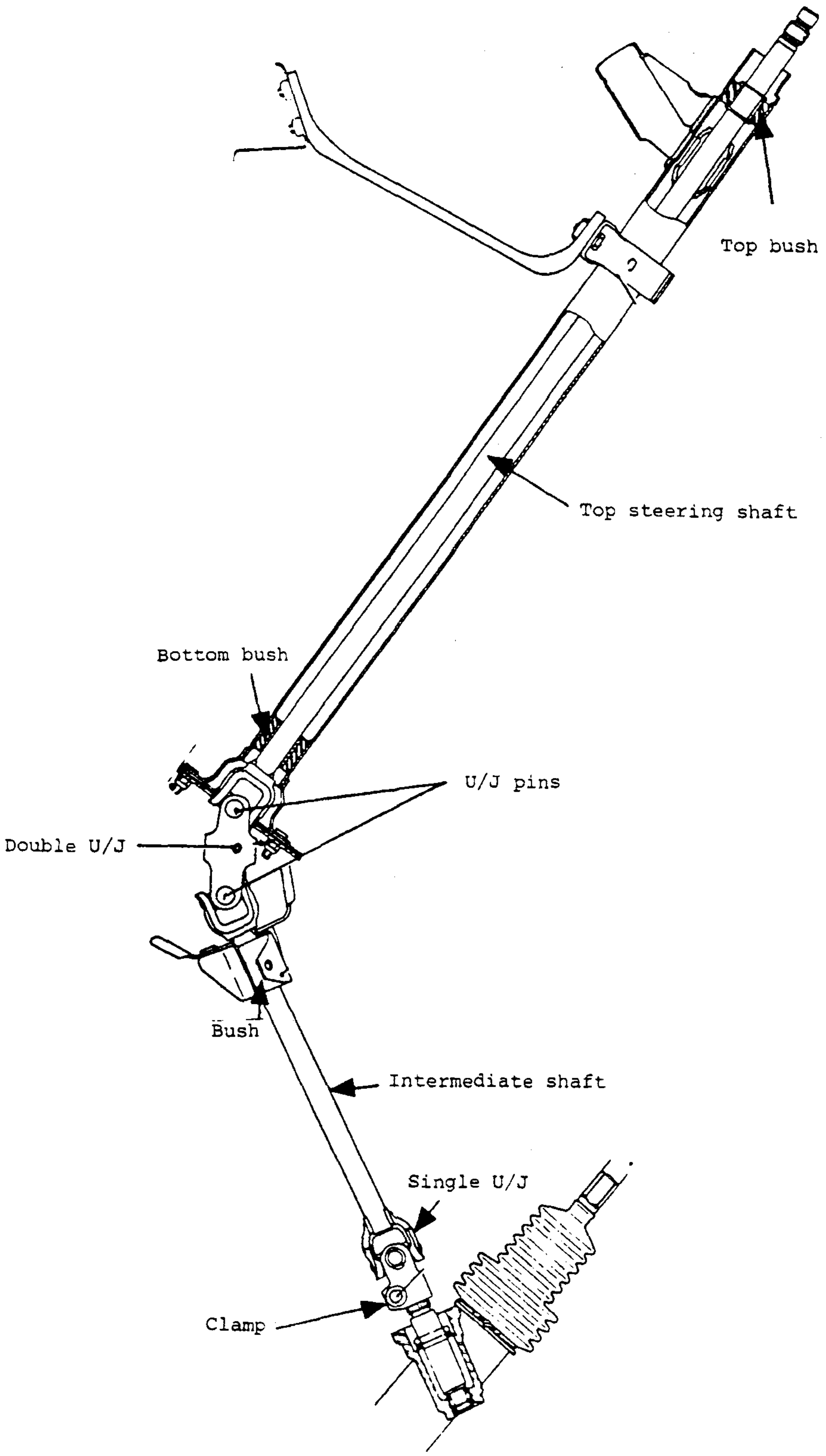
SOLUTION:
1 - Adjust steering box plunger
(Refer to J5-5)
2 - If the steering box is not the cause, perform the following operations:

- Disconnect the intermediate shaft from the steering box
- Make sure that the assembly (steering wheel, top shaft and intermediate shaft) turn easily.
- It may be necessary to withdraw the assembly to lubricate or change the bushings. (See J5-5)

In all cases the double universal joint must be aligned as follows:

- Set the front wheels in the straight ahead position.
- Turn the shafts so that the double universal joint pins (see drawing on following page) are at right angles to the intermediate shaft and top shaft plane.
  This position is reached when the universal joint pins are virtually parallel to the scuttle.
- Now fit the bottom universal joint to the steering box pinion (grease the splines).
  The bottom universal joint should enter the pinion splines easily. Open the clamp slightly if necessary using a screwdriver so that fitting is achieved without any strain on the column assembly.

STEERING BOX
ADJUSTING THE PLUNGER



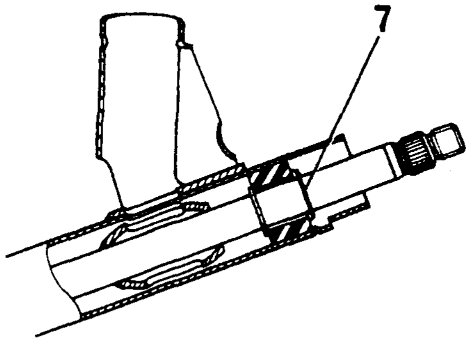
STEERING WHEEL SHAFT
CHANGING THE BUSHINGS

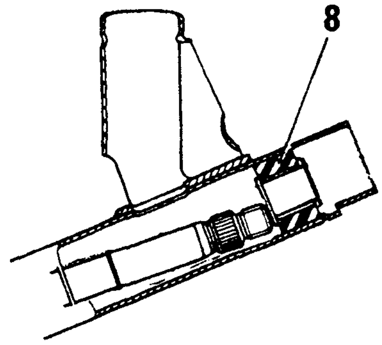
TIGHTENING TORQUE

Steering wheel nut 4.5 daNm (34 lb./ft.)

REMOVING

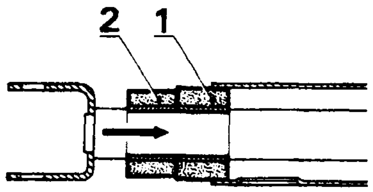
- Remove the steering column assembly (see previous paragraph) but leave the anti-theft lock in position.
- Remove the circlip (7) and extract the shaft from the bottom of the column withdrawing the bottom bushing at the same time.
- Now use the top of the steering wheel shaft at an angle to push out top bushing (8).

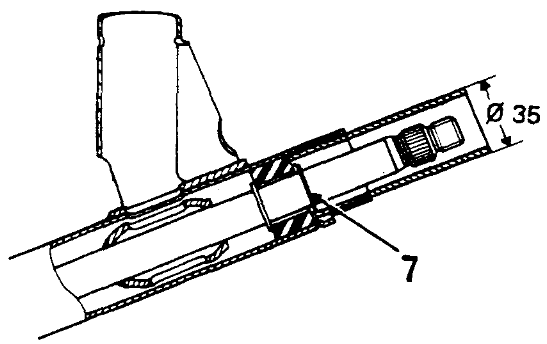




REASSEMBLY

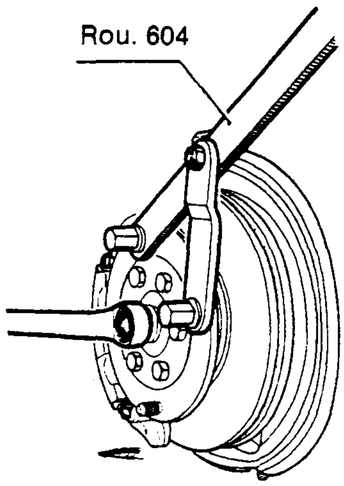
- Coat the inside of the new bushing with grease and the outside with rubber lubricant or soapy water solution.
- Lift up the new bottom split bushing (1) to the shaft with an old bushing (2) reduced 2 mm (0.08") in diameter underneath it.
- Insert the shaft with its new bottom bushing into the bottom of the steering column and push it until the bushing is between the indents.
- Withdraw the shaft and remove the old bushings (2).
- Tap the top bushing into the top of the column using a piece of tube 35 mm (1.38") diameter.
- Attach the circlip
- Reassemble the steering column assembly to the vehicle (see previous chapter)



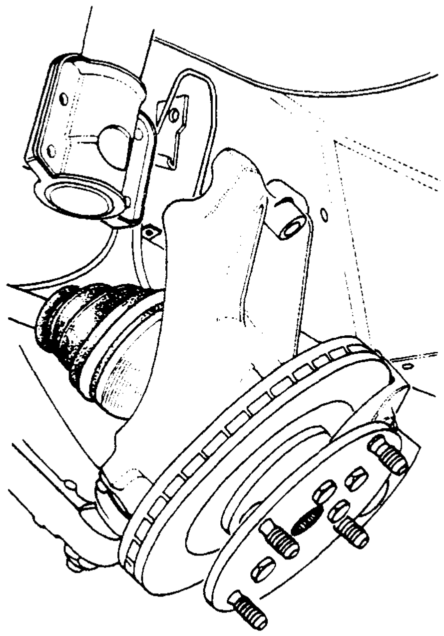


DRIVE SHAFTS
REMOVING - REASSEMBLING

TIGHTENING TORQUES
Shock absorber base bolts 8 daNm (60 lb./ft.)
Steering arm nut 3.5 daNm (26 lb./ft.)
Drive shaft nuts 20. daNm (147 lb./ft.)
Wheel nuts 12 daNm (90 lb./ft.)

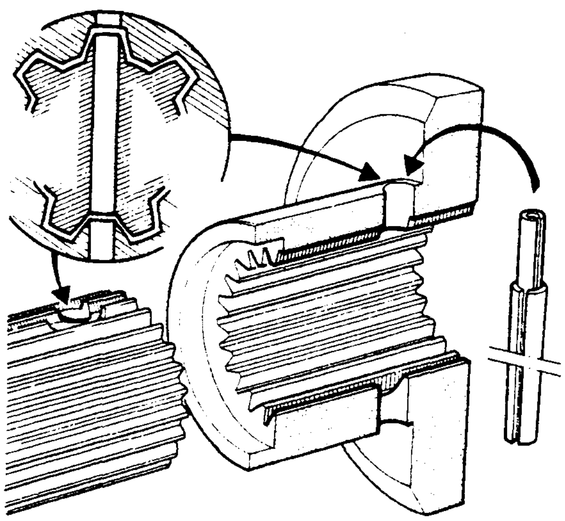


REMOVING
- Place the affected side on a stand and remove the wheel.
- Remove:
  - the drive shaft nut; prevent the hub from turning with locking tool Rou. 604.
  - the steering arm ball joint nut at the stub axle carrier end using extractor T.Av. 476.
- Remove the 4 shock absorber bottom mounting bolts on the MacPherson® strut.
- Tilt the stub axle carrier and release the drive shaft at the wheel end.



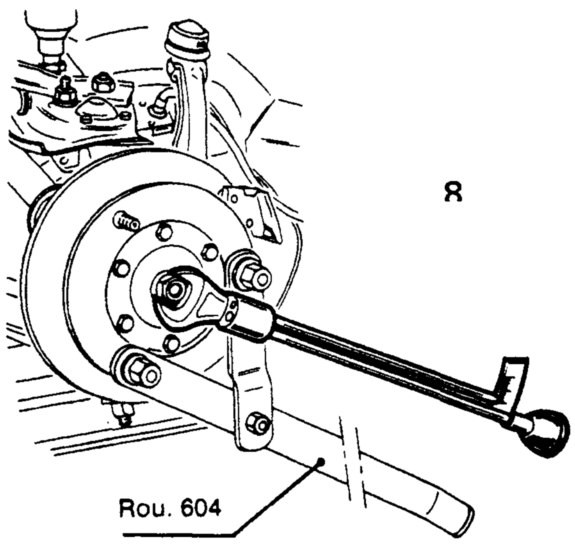
DRIVE SHAFTS
REMOVING - REASSEMBLING

- Punch out the drive shaft rollpins at the gearbox end using drift B.Vi. 606.
- Place a receptacle to catch the oil and withdraw the drive shaft from the planetary gear.



REASSEMBLY

- Coat the drive shaft splines with grease and insert the shaft into the planetary gear splines.
- Insert 2 new rollpins using drive B.Vi. 606 smear grease on the inside oil slinger.
- Coat the drive shaft splines at the stub axle end with Loctite 680® and insert it in the hub. (See page J4-5)
- Re-attach the stub axle carrier to the shock absorber (4 bolts).
- Reconnect the steering arm ball joint to the stub axle carrier.
- Torque tighten the drive shaft nut using locking tool Rou. 604 and a torque wrench.

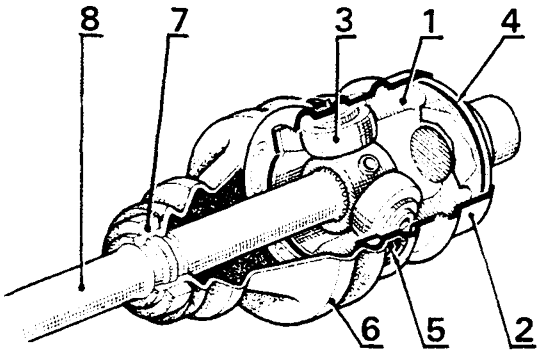


CAUTION
Inside oil slinger must be installed at drive axle replacement. See page J4-1, item 8.

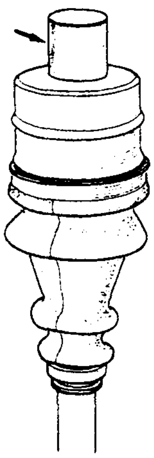
DRIVE SHAFTS
OVERHAULING (SPIDER G182 COUPLING)

These operations may be carried out on this type of coupling:
- boot change
- spider gear change
- and a yoke change

The disassembly method is the same for all three operations. The method of reassembly differs for the yoke as the sheet metal cover must be crimped in place.



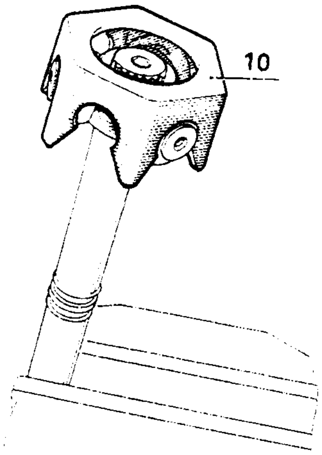
1. Yoke
2. Cover
3. Spider gear
4. Seal
5. Retaining clip
6. Rubber boot
7. Retaining ring
8. Drive shaft



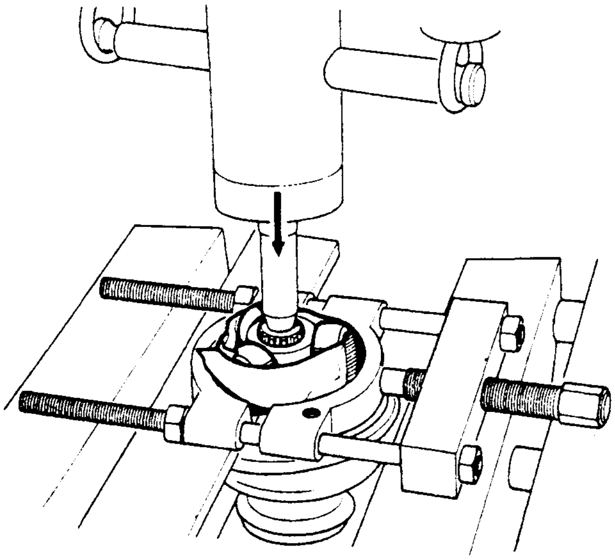
DISMANTLING
- Place adhesive tape or the protective cap (supplied with new drive shaft) on the bearing surface for the differential nut oil seal.
- Cut the crimped clip and the boot along its full length.
- Remove as much grease as possible.

DRIVE SHAFTS
OVERHAULING (SPIDER G182 COUPLING)

- Remove the yoke.
- Do not remove the roller cages from their respective trunnions. The cages and rollers are matched and must never be mixed.
- Attach plastic retainer (10) supplied with new spider gears, or adhesive tape around the spider gear to make sure of this.
- Never use any sort of thinners for cleaning the component parts.



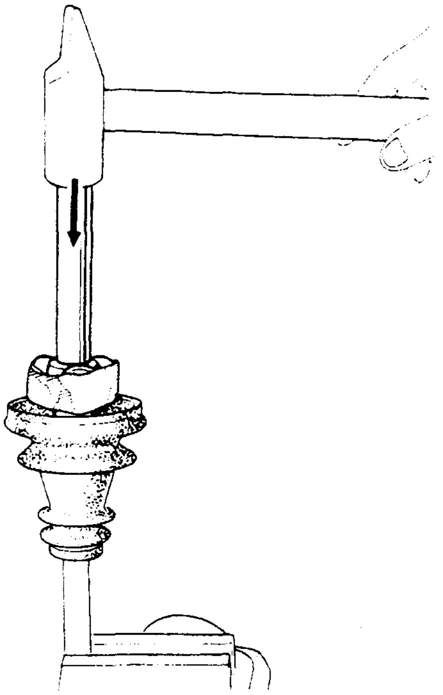
- Extract the spider gear in a press.



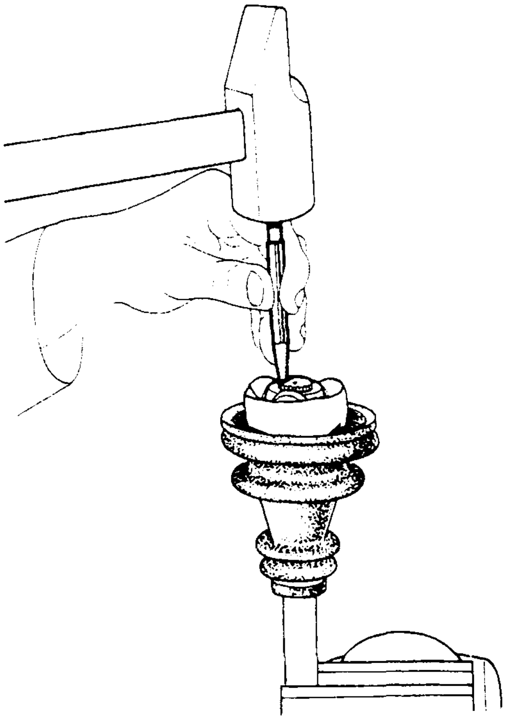
REASSEMBLING

When replacing the spider gear or boot:

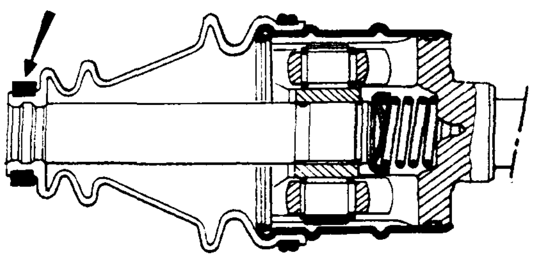
- Lubricate the drive shaft and slide on the new retaining clip and boot.
- Mount the spider gear onto the splined shaft.

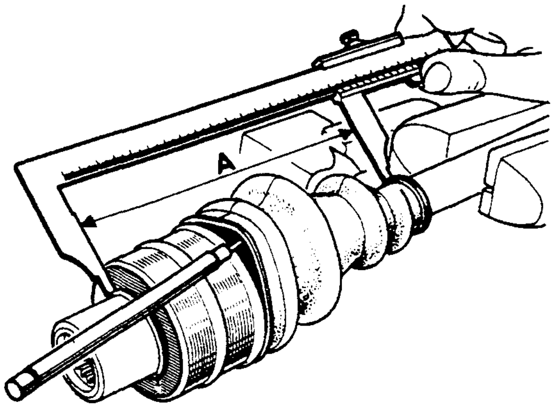


- Crimp at 3 points 120° apart by peening the metal on the splines over onto the drive shaft.
- Remove the plastic retainer or adhesive tape.
- Mount the spider gear onto the yoke.



- Spread the grease equally between the boot and the yoke (150 gr.)
- Locate the boot lip in the grooves on the drive shaft and on the cover.
- Mount the retaining ring over the boot.





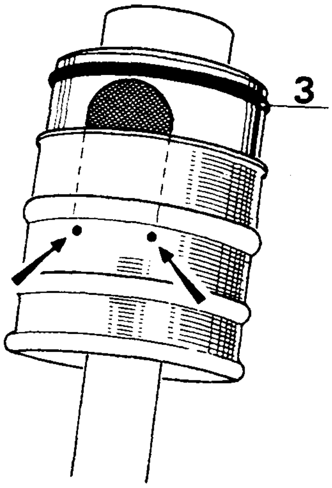
- Insert a smooth round-ended piece of rod between the boot and yoke to restrict the amount of air trapped inside the coupling.
- Lengthen or shorten the coupling to obtain dimension A = 162 mm (6 3/8") (dimension taken between the boot and face and the largest diameter machined face on the yoke.)
- Remove the rod when in this position.

- Mount a new boot retaining clip and crimp with an appropriate tool.

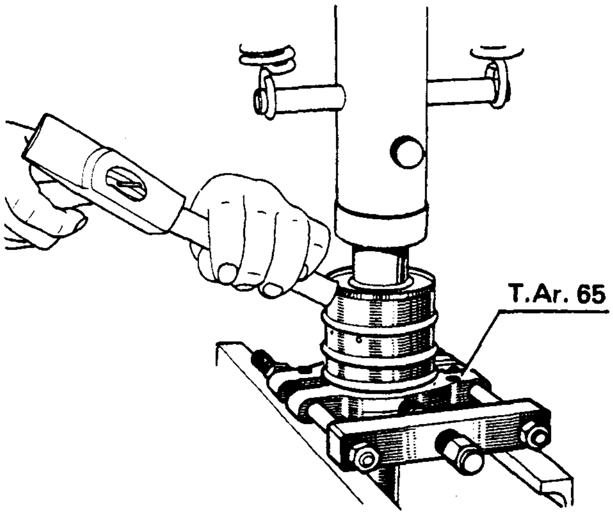
REASSEMBLING

When changing a yoke:

- Lubricate the drive shaft and slide on the new retaining clip and boot.
- Slide the yoke cover over the shaft and spider gear onto the drive shaft splines.
- Crimp at 3 points 120° apart by peening the spline metal over onto the drive shaft.



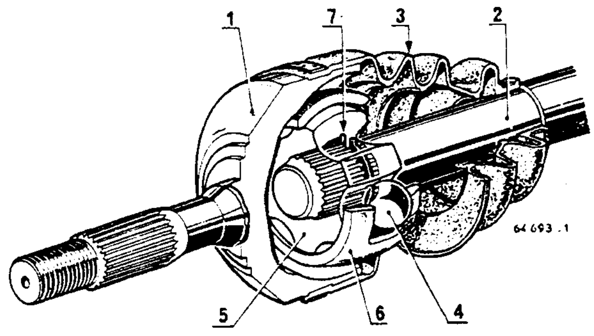
- Align the 2 raised dots on the cover with a yoke cut-out (the yoke being fitted with a new O-ring (3) and slide the yoke into the cover.



- Use a press to crimp the cover over the yoke.
- Make sure the yoke is fully seated.
  DO NOT ALLOW THE PRESSURE TO INCREASE.
- Crimp the cover to the yoke in this position then complete the operation in the same manner as for a boot change.

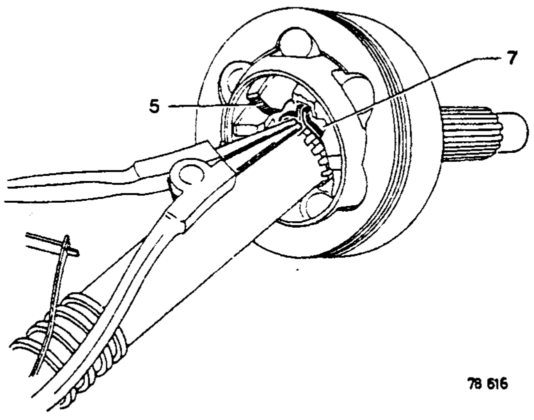
DRIVE SHAFTS
OVERHAULING (LOBRO 6-BALL COUPLING)

Two operations may be carried out on this type of coupling:
- a coupling change
- a boot change



6-BALL COUPLING AT THE WHEEL END

1. Bell-shaped stub axle
2. Drive shaft
3. Rubber boot
4. Balls
5. Ball hub
6. Ball cage
7. Retaining ring



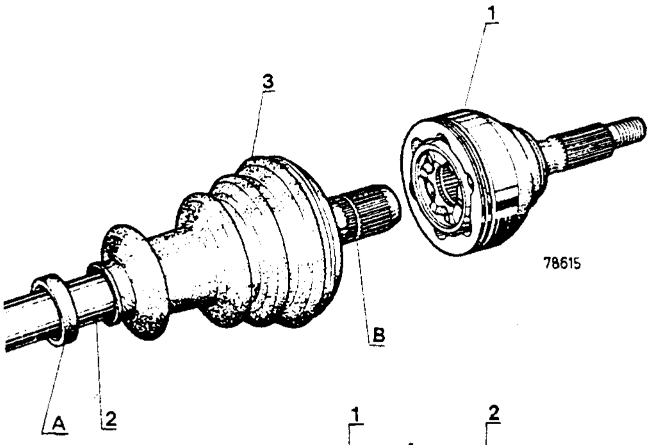
DISMANTLING

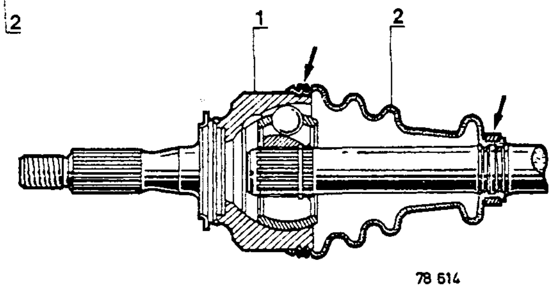
- Cut the clip and boot all the way along.
- Remove as much grease as possible.
- Spread retaining ring (7) and tap the exposed face of ball hub (5) at the same time.
- Separate the coupling from the shaft.

DRIVE SHAFTS
OVERHAULING (LOBRO 6-BALL COUPLING)

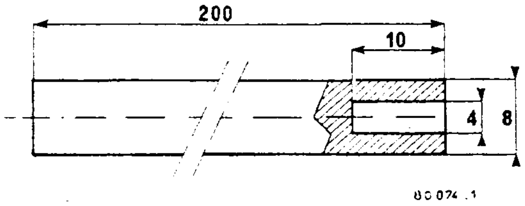
DISASSEMBLING

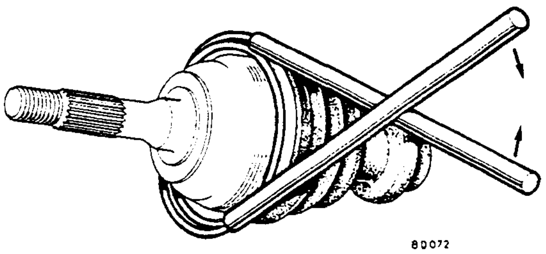
- Slide onto the shaft:
- rubber collar (A)
- boot (3)
- Slide the ball coupling complete with retaining ring onto the shaft splines until the retaining ring locates in shaft groove (B).





- Spread the grease (140 g.) around inside the boot.
- Locate the lips of the boot in the grooves in bell-shaped stub axle (1) and in drive shaft (2).





- Mount the retaining clips over the boot with 2 short lengths of tube.

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SECTION "K"

REAR AXLE

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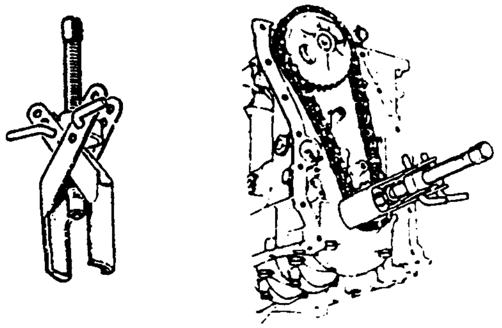
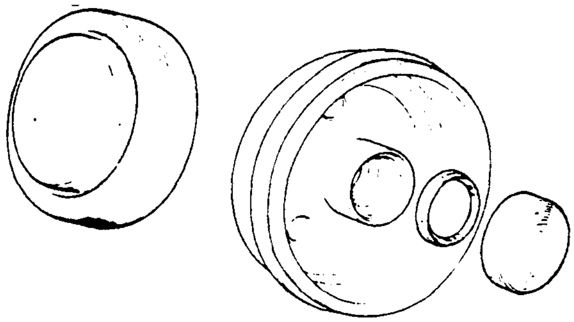
SPECIAL TOOLS



Mot. 49

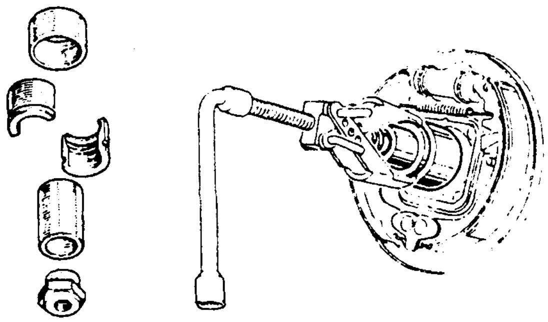
Sprocket and bearing extractor

Order Tool No. 700010-75-600 EA



Hub seal inserting tool

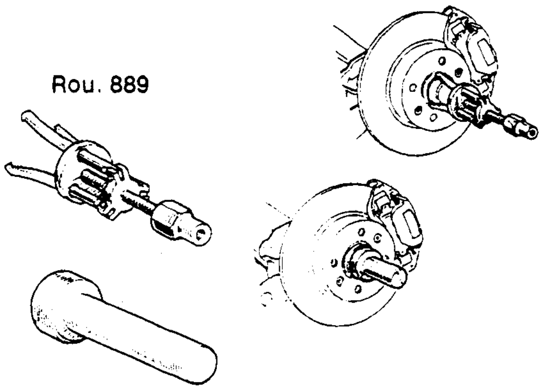
		Order Tool No.
Rou. 907	Standard Axle	700000-90-700
Rou. 896	Heavy Axle	700000-89-600



Tool for extracting inserting rear hub inner bearing

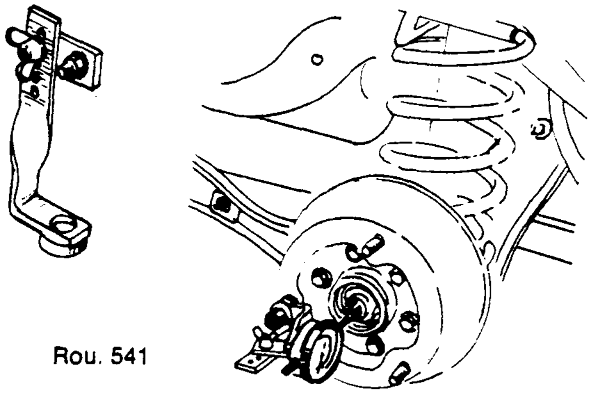
		Order Tool No.
Rou. 801	Standard Axle	700000-80-100
Rou. 1080	Medium Axle	700001-08-000
Rou. 898	Heavy Duty Axle	700000-89-800

Rou. 889



Tools for removing/installing hub grease cup - heavy duty axle

Order Tool No. 700000-94-300 EA

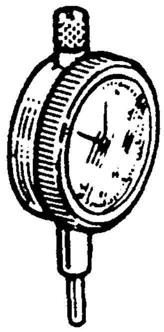


Rou. 541

Dial indicator bracket for measuring rear hub end play

Dial indicator

Order Tool No. 700000-54-100 EA

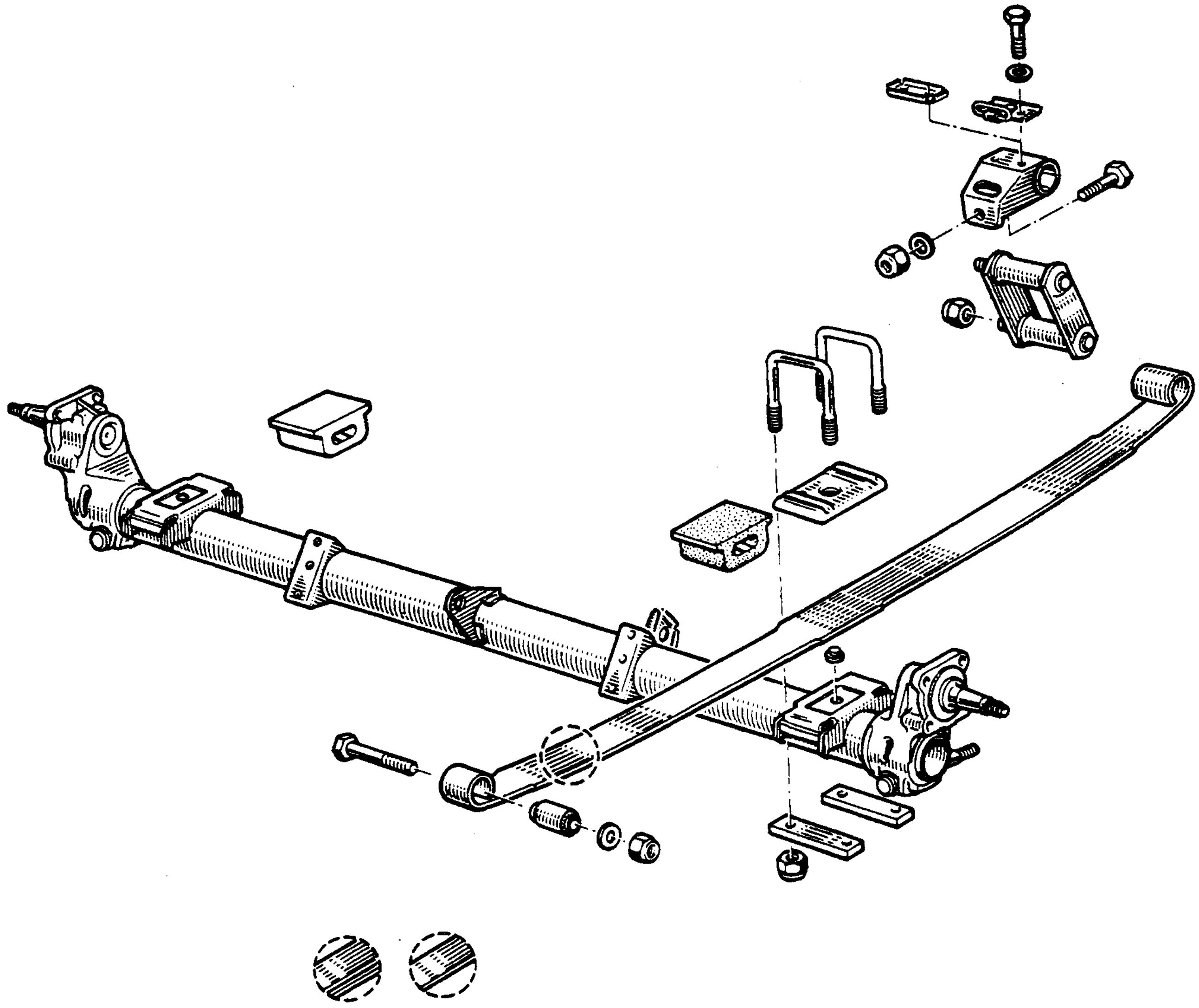


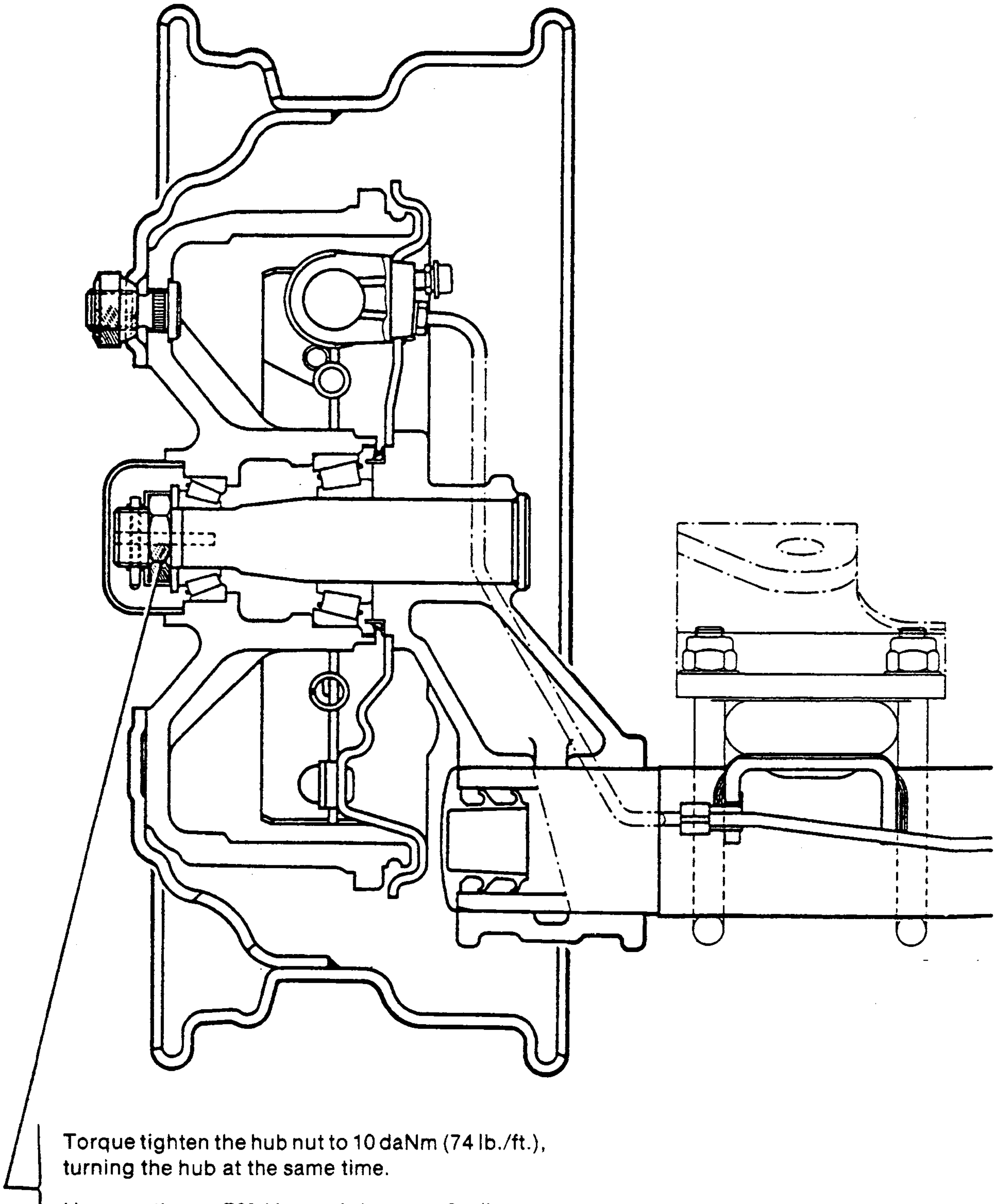
Dial indicator

Order Tool No. 72046E-B0-000 EA

SPECIFICATIONS
IDENTIFICATIONS AND SPECIAL FEATURES

- One-piece tubular axle beam secured to the chassis by means of a double leaf spring and rear swinging link on each side.
- Rubber bushed pivot points.
- Hub-drum assemblies mounted on taper roller bearings.





Torque tighten the hub nut to 10 daNm (74 lb./ft.), turning the hub at the same time.

Unscrew the nut 72° (the angle between 2 adjacent wheel studs).

REAR AXLE ALIGNMENT

DIAGNOSIS

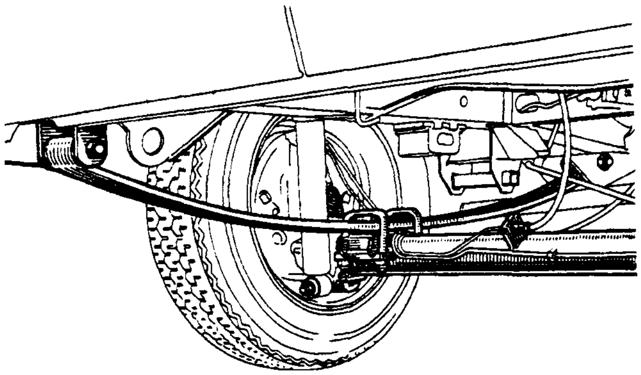
Preliminary checks

Examine the following and check if necessary before proceeding with the alignment check:
- tire symmetry on the same axle
- dimensions
- inflation pressures
- tread wear
- pivot points
- condition of rubber bushings
- bearing play
- wheel end play
- not to exceed 1 mm (.040") (to be compensated for with measuring instrument)
- underbody height symmetry (condition of suspension)

CHECKING AND ADJUSTING

The vehicle must be unladen and ready for the road.

Place the rear wheels on turntables.

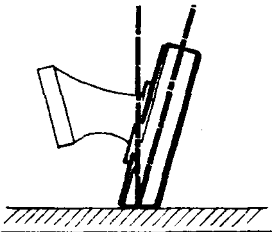
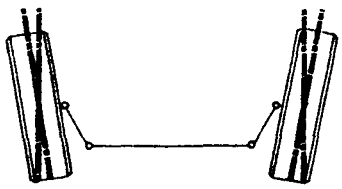
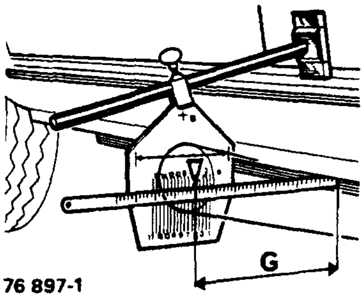
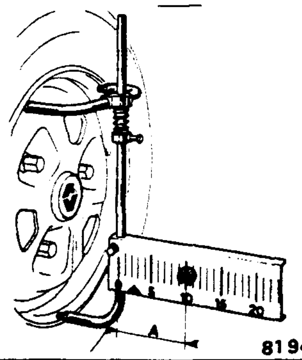


Check:
- toe-in
- toe-out
- and camber

If necessary, adjust the toe-in distribution (or axle alignment) by loosening the "U" bolts. Retighten the "U" bolts after adjustment.

NOTE: Check that any correction made is in the right direction or on the right side so as to avoid excessive displacement of the axle in relation to the spring blade longitudinal center.

SPECIFICATIONS
ALIGNMENT

	Value	Position	Adjustment
CAMBER  78 423	0° to 0°30′	UNLADEN*	Non-adjustable
TOE-IN  78423	0° to - 0°30′ (0 to - 3 mm) (0 to - 1/8″)	UNLADEN*	Non-adjustable
TOE-OUT (or axle alignment)  76 897-1  81 940-F	Max. difference between R.H. and L.H. sides: G = 10 mm (3/8″) A = 20 mm (25/32″)	UNLADEN*	By moving axle on spring blades

* The "UNLADEN" position means that the vehicle is in running order ready for the road (fuel tank full and tire inflation pressures correct).

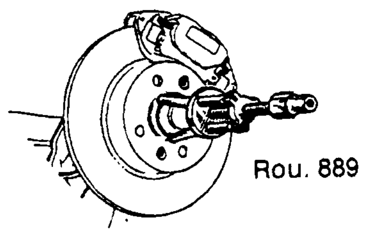
LUBRICATION

GREASE

Units to be greased	Quantity
Drum bore	20 g
Hub grease cup	10 g
Taper rollers	Smear
Wheel studs	Smear

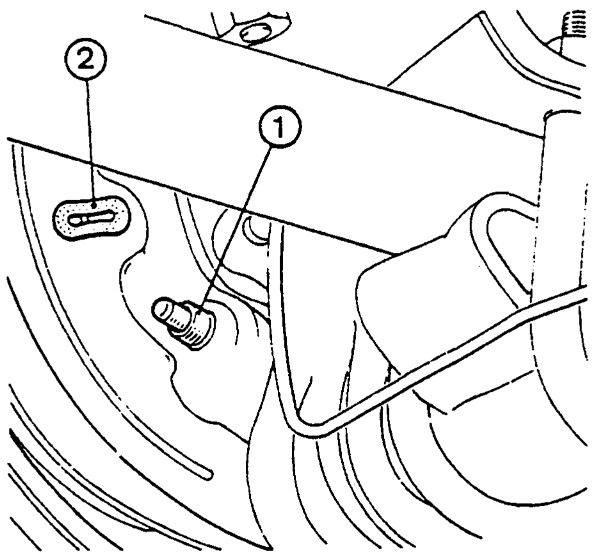
REAR AXLE
CHANGING THE BEARINGS

HEAVY DUTY REAR AXLE
Changing the Bearings



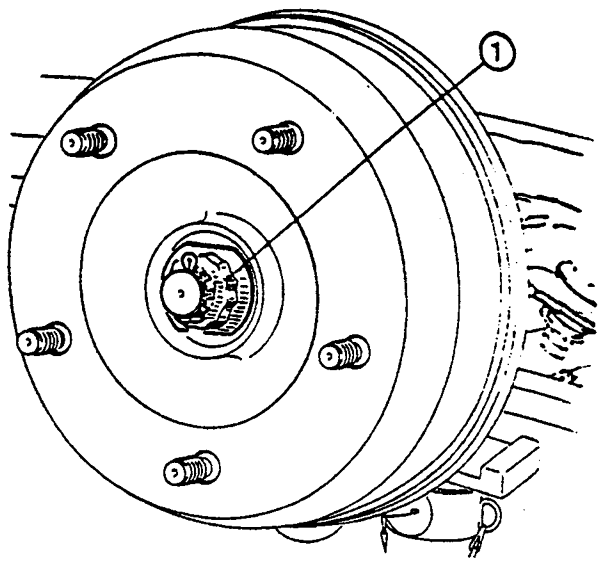
REMOVAL

- Use pullers Rou. 889 to remove the hub grease cup.
- Loosen the wheel nuts only and place the rear of the vehicle on stands.
- Remove the wheel nuts and wheel concerned.
- Release the handbrake and slacken the secondary cables to allow the lever to return.
- Remove backplate plug (2) and visually check for sufficient clearance between brake linings and enable the drum to be removed.
- If the clearance is insufficient because of the position of the self-adjusting system, pull the brake lever stop (1) with a pair of pliers to allow the shoes to back off further.



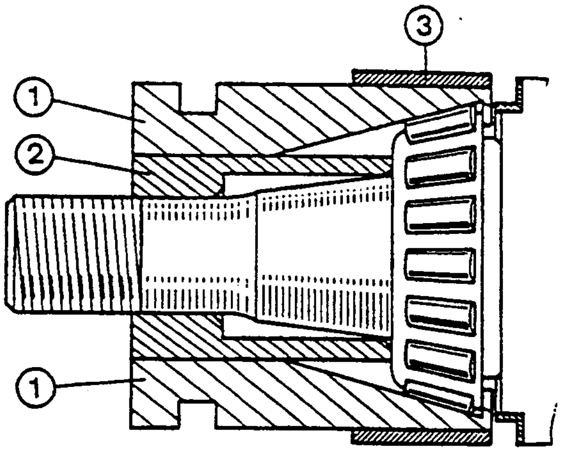
HEAVY DUTY REAR AXLE
CHANGING THE BEARINGS

- Remove the cotter pin and nutlock (1)
- Unscrew the nut, remove the thrust washer and outer bearing
- Remove the hub-drum, extract the worn grease seal and the bearing outer race.

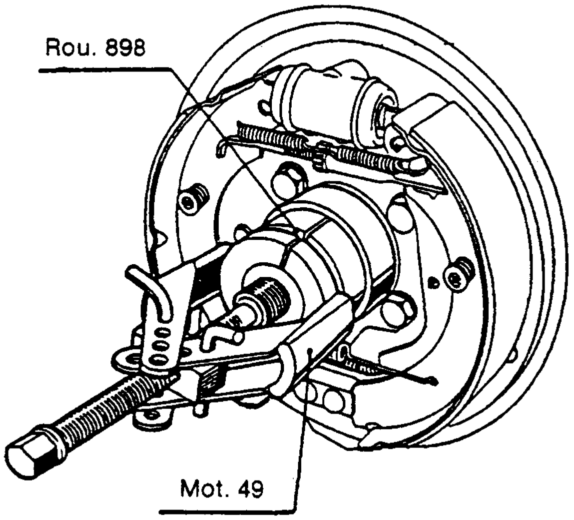


Fitting extractor Rou. 898

- Fit locating sleeve (2) over the stub axle
- Slip over the 2 half-shells (1)
- Hold the complete assembly with sleeve (3)



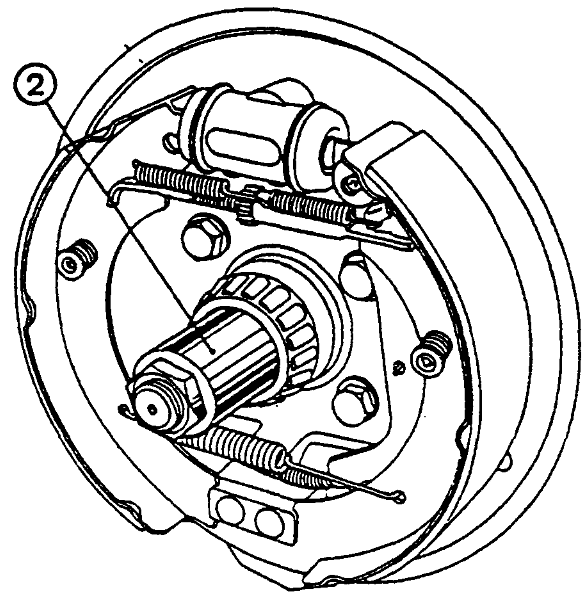
- Use tool Rou. 898 and extractor Mot. 49 to extract the inner bearing.
- Use a screwdriver to extract the deflector, if necessary.



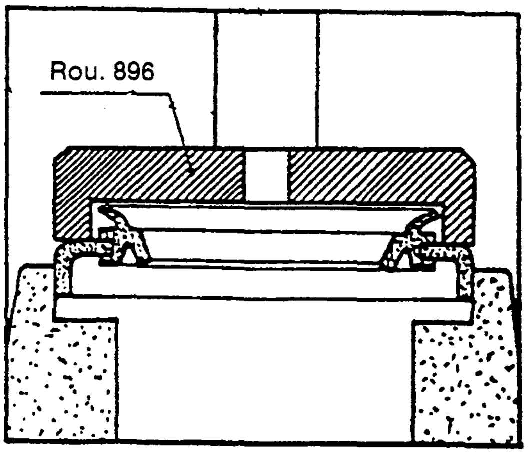
HEAVY DUTY REAR AXLE
CHANGING THE BEARINGS

REASSEMBLY

- If the old deflector has been removed, install a new one using a piece of pipe with 68.5 mm (2.69") bore.
- Mount the bearing to the stub axle and push it on the first 10 mm (.39") using a piece of 36 mm bore pipe.
- Complete the operation by drawing it on with sleeve (2) from tool Rou. 898 and the stub axle nut.

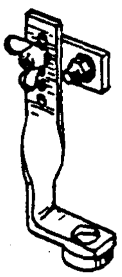


- Fit the following to the hub:
  - The bearing outer race using pipe of suitable diameter
  - A new grease seal using tool Rou. 896
  - Fill the inside of the hub with 65 g. (2.5 oz) of multi-purchase grease and smear the rollers and grease seal lip as well.

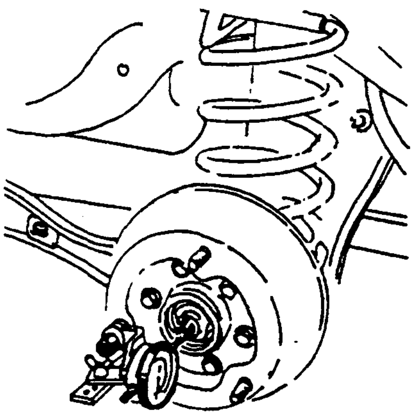


- Fit the following to the stub axle:
  - the hub
  - the outer bearing
  - and the thrust washer and nut

  - Torque tighten the stub axle nut to 10 daNm (74 lb./ft.) turning the hub-drum at the same time.
  - Loosen the nut 72° (the angle between 2 adjacent studs).
  - Mount dial indicator bracket Rou. 541 and dial indicator to the drum face and set the plunger on the end of the stub axle.
  - Check the endplay, which should be between 0.02 and 0.08 mm (.001 and .003"). Adjust by turning the nut.
  - Fit the nut lock, cotter pin and grease cup filled with multi-purpose grease.
  - Adjust the handbrake.
  - Fit the wheel and torque tighten the nuts.



Rou. 541



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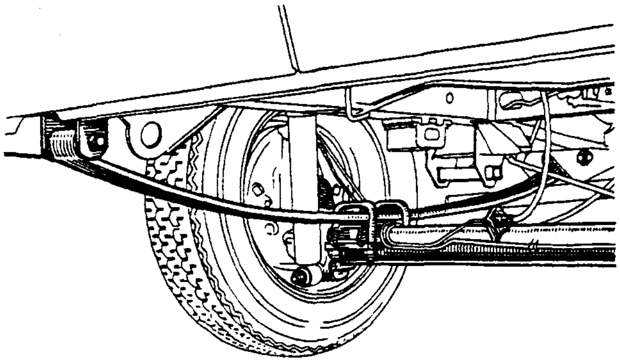
REAR AXLE ASSEMBLY
REMOVE AND REPLACE

TIGHTENING TORQUES

"U" bolt nuts	8 daNm (60 lb./ft.)
Shock absorber bottom Mounting nuts	4 daNm (30 lb./ft.)
Wheel nuts	12 daNm (90 lb./ft.)

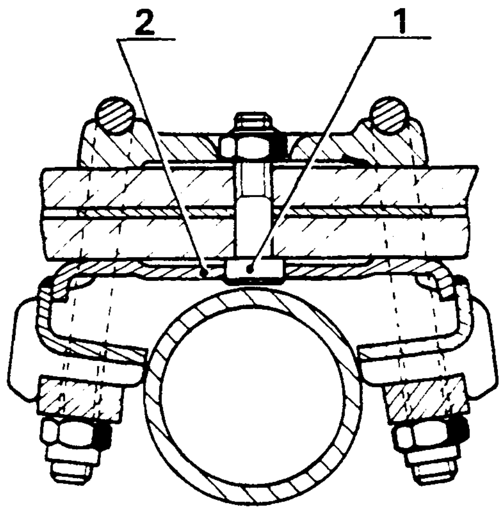


REMOVAL

- Place the rear of the vehicle on stands
- Remove the following (refer to appropriate sections):
  - wheels
  - brake drums
  - bearings
  - hub grease seal defectors
  - brake backplates
  - brake pipelines
  - shock absorbers (at bottom fixings only)
  - and the "U" bolts

REASSEMBLY

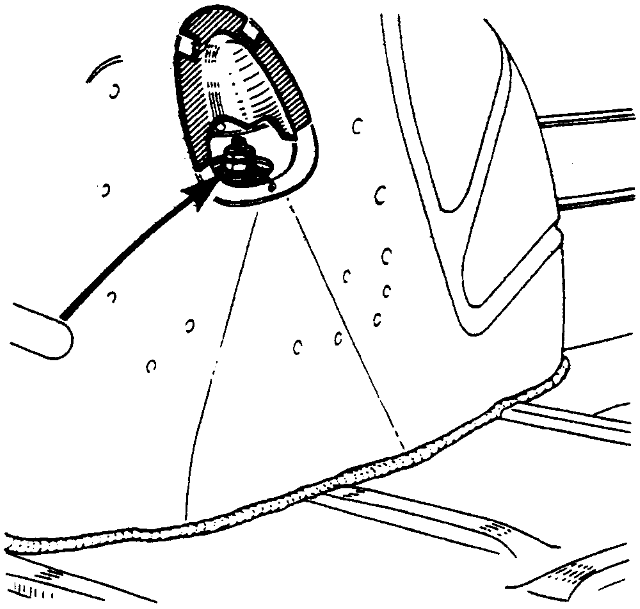
- Align the axle beam under its spring blades so that locating dowels (1) fit into their holes (2) in the beam.
- Bleed the brake circuit on completion of the operation.
- Check rear axle alignment and adjust if necessary.
- Torque tighten the "U" bolts.



REAR AXLE AND SPRING ASSEMBLY
REMOVE AND REPLACE

TIGHTENING TORQUES

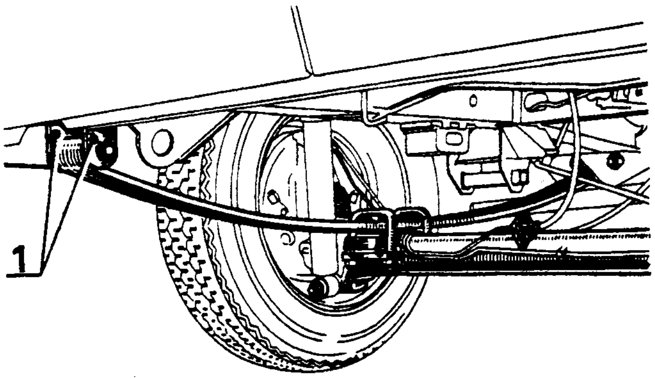
Spring front and rear trunnion bolts
(10 daNm 74 lb./ft.)
Shock absorber top mounting nuts
1.5 daNm (11 lb./ft.)



REMOVAL
- Place the rear of the vehicle on stands. From inside the vehicle, remove the shock absorber top mounting nuts.
- Remove the rear spring trunnion mounting bolt nuts and the shock absorber bottom mounting nuts.
- Disconnect the brake hose and handbrake secondary cables.
- Using a jack under the axle beam, take its weight so that the front trunnion bolts may be removed. Lower the jack and free the limiter control.
- Remove rear blade clips (1)
- Withdraw the complete assembly.

REASSEMBLY
- With the rear of the vehicle on stands, lift up the rear axle assembly and insert the trunnion bolts at the front of the rear springs. Remember to mount the limiter control in its bearing.
- Using a jack under the axle beam, take its weight and mount the rear trunnion bolts.

- the handbrake
- brake hose
- shock absorbers at their top mountings
- lower the vehicle onto its wheels and fasten the shock absorber bottom mountings.
- torque tighten all the trunnion bolt nuts and bleed the brake circuit.



SECTION "L"

SUSPENSION

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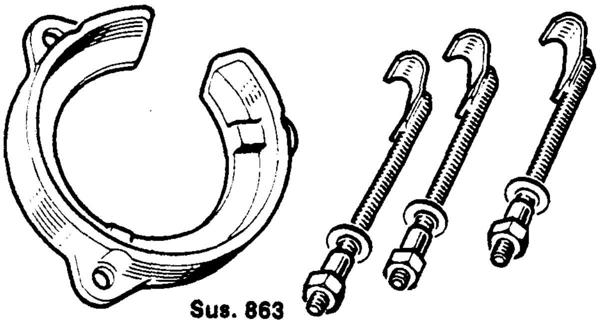
SPECIAL TOOLS

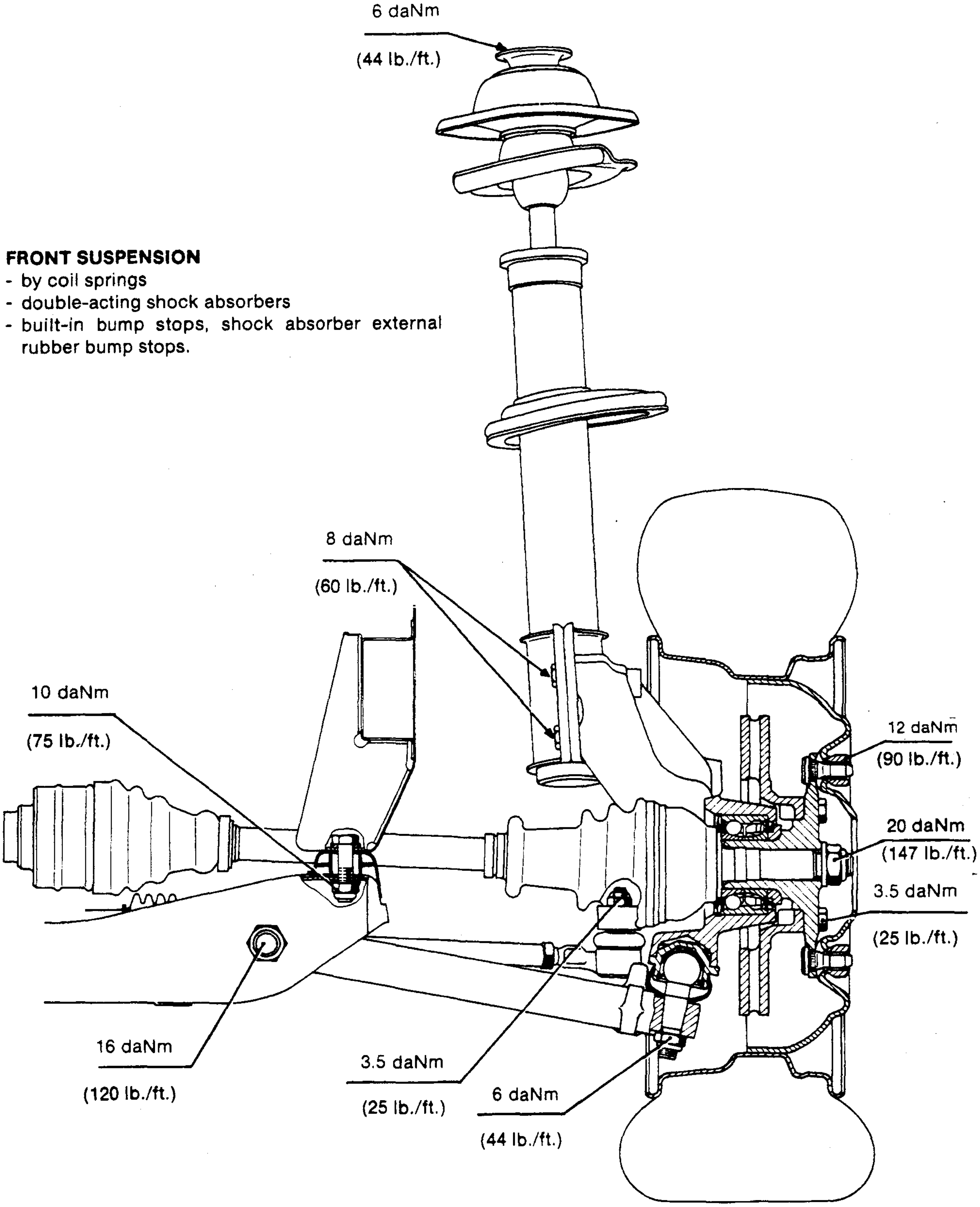


Front Spring Compressor (3-point)
(when changing front struts)

Order Part No. 700000-59-601	EA
Order Part No. 700000-86-300	EA

SPECIFICATIONS
TIGHTENING TORQUES

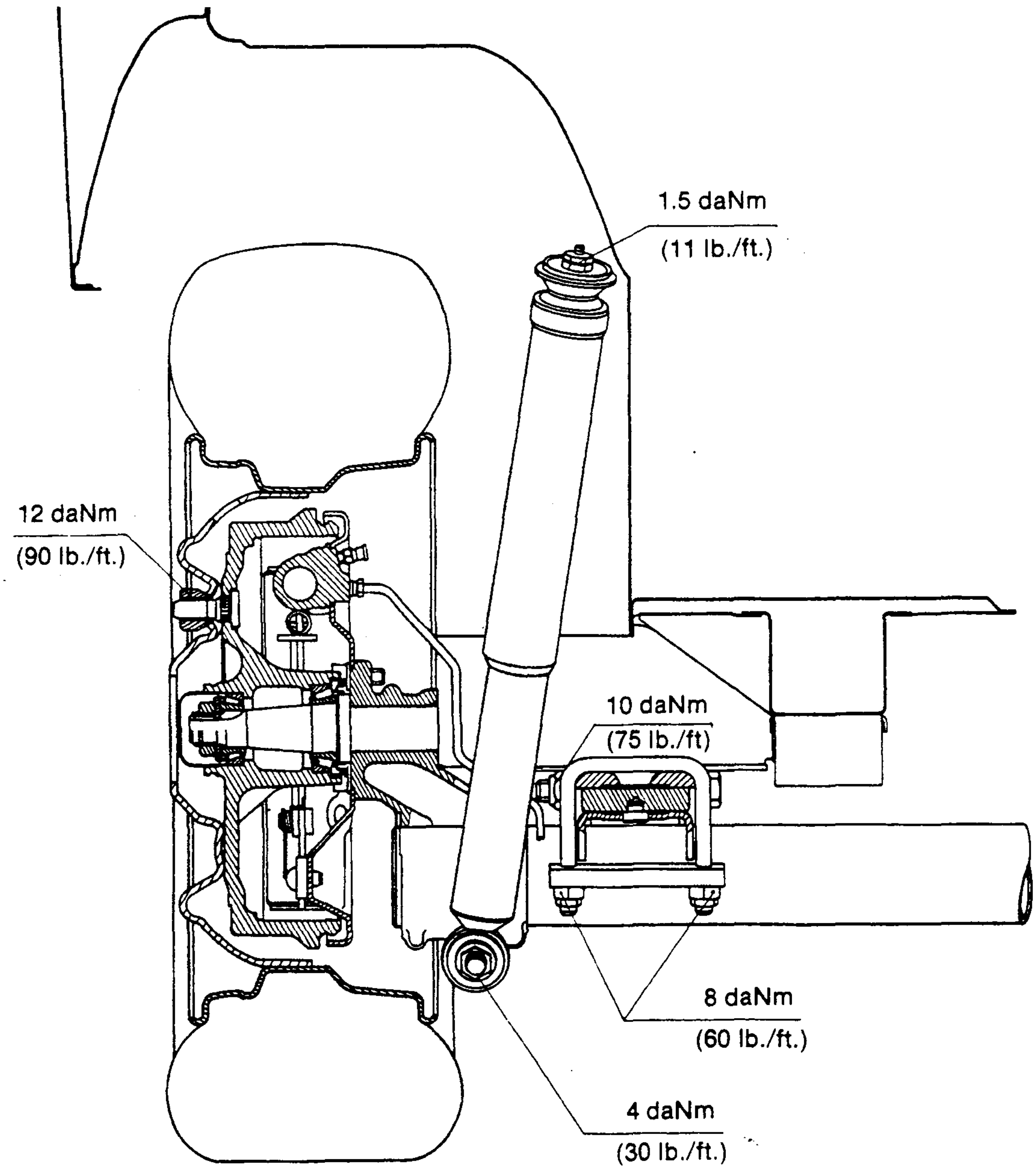
FRONT SUSPENSION
- by coil springs
- double-acting shock absorbers
- built-in bump stops, shock absorber external rubber bump stops.



SPECIFICATIONS
IDENTIFICATION - TIGHTENING TORQUES

REAR SUSPENSION

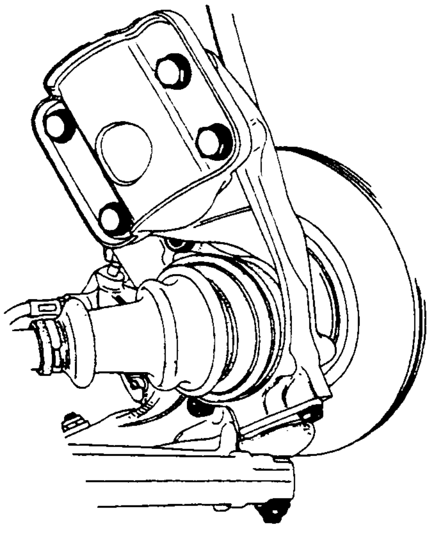
- by double leaf spring with rear double trunnions
- double-acting hydraulic shock absorbers with built-in bump stop
- rubber snubbers on sidemembers



FRONT STRUTS
CHANGING

TIGHTENING TORQUES

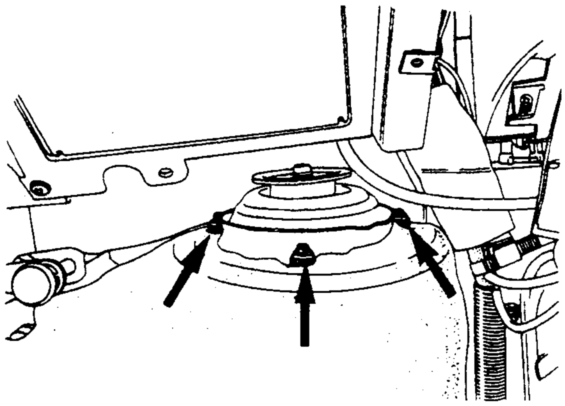
Shock absorber bottom mounting bolts
8 daNm (60 lb./ft.)
Wheel nuts
12 daNm (90 lb./ft.)



REMOVING
Place the side concerned on a stand.

Unscrew only 3 shock absorber bolts on the stub axle carrier. The 4th bolt will remain in position to hold the shock absorber-spring assembly while the top mounting is unfastened.

- Place a jack under the lower suspension arm to support the half-axle.
- From inside the passenger compartment remove the 3 nuts holding the top mounting.
- Remove the MacPherson® strut assembly by undoing the 4th bolt on the stub axle carrier.



FRONT STRUTS
CHANGING

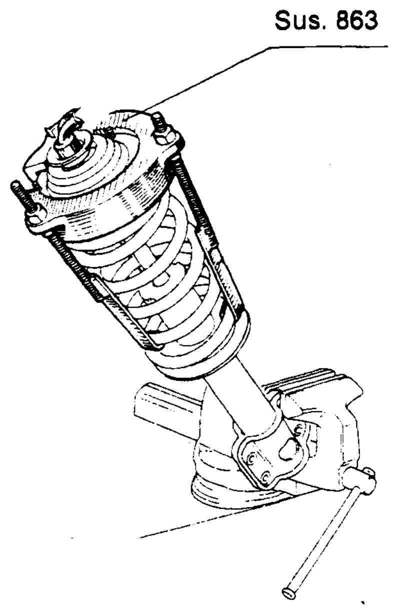
Hold the MacPherson® strut assembly in a vise.

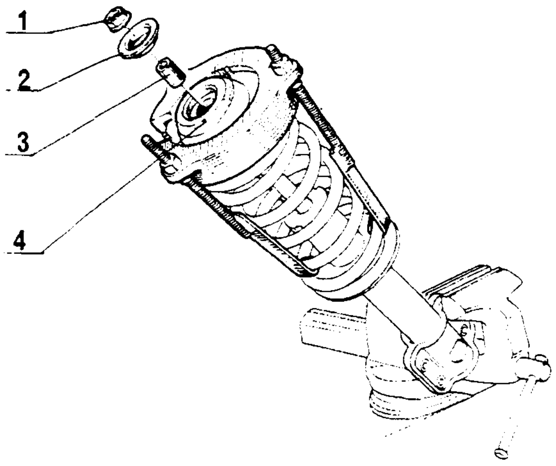
Place spring compressor Sus. 863 over the coil spring.

Before compressing the spring, unlock the nut on the shock absorber piston rod using a wrench and a right-angle screwdriver after first removing the socket.

Compress the spring until the tool assembly and spring turn free on the shock absorber.

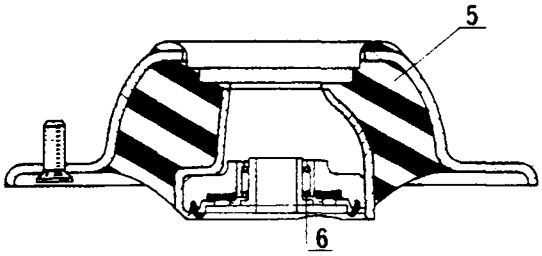
Remove:
- rod nut (1)
- cupwasher (2)
- distance piece (3)
- and washer (4)





FRONT STRUTS
CHANGING

NOTE: Rubber mounting pad (5) and needle roller bearing (6) are an assembly and cannot be separated. If one or other is worn, the assembly must be changed.

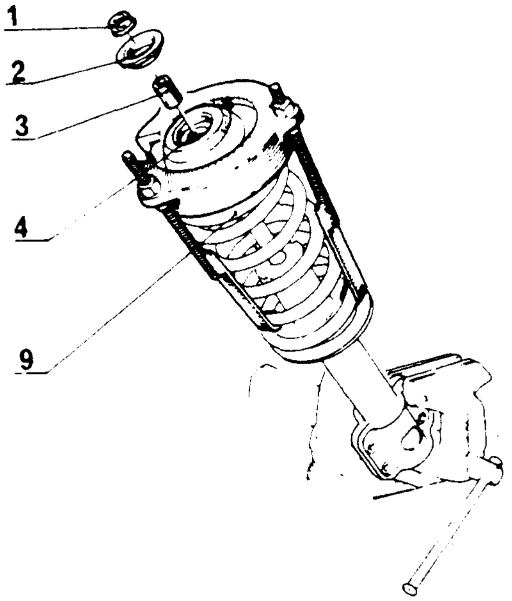


Release the spring tension gradually until it reaches its free length then remove it.

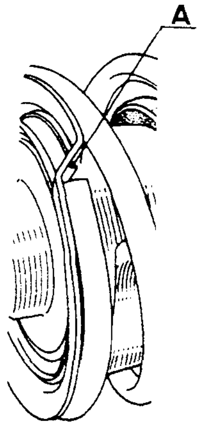
REASSEMBLY
Compress the spring.

Place the shock absorber in a vise and place the spring-tool assembly over it.

Place the following on the shock absorber piston rod:
- washer (4)
- spacer (3)
- cupwasher (2)
- and nut (1)



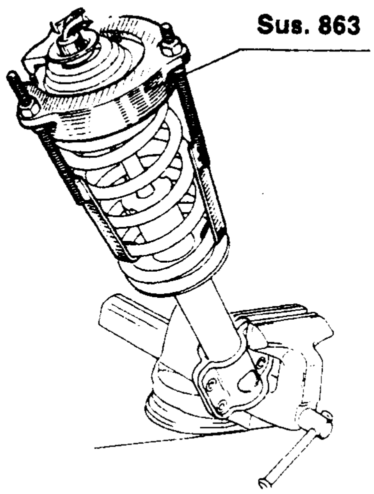
Check that the end of the last spring coil butts up against the cupwasher at (A).

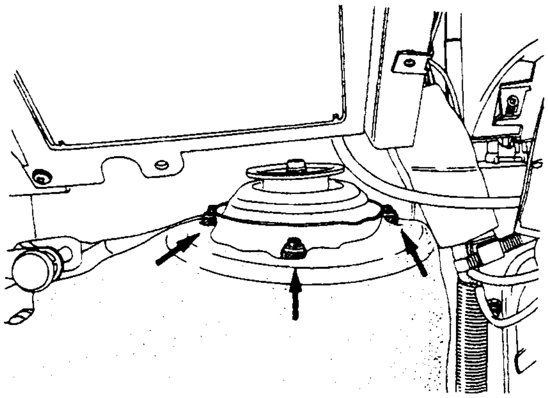


FRONT STRUTS
CHANGING

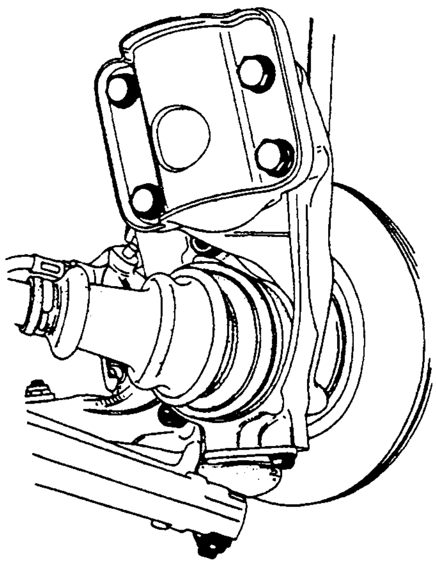
Remove spring compressor Sus. 863.

Tighten the nut on the top of the rod with a wrench and a right-angled screwedriver.





Reassemble the MacPherson® strut to the vehicle securing it at the top first (3 nuts) then at the bottom (4 bolts).



FRONT STRUTS
CHANGING

TIGHTENING TORQUES

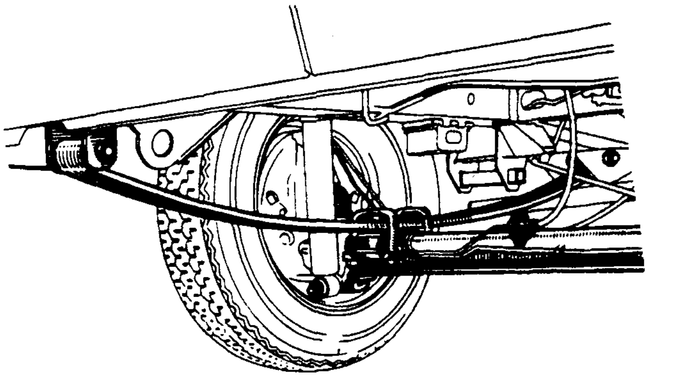
Stub axle carrier bolts................8 daNm (60 lb./ft.)
Wheel nuts............................ 12 daNm (90 lb./ft.)

The MacPherson® strut has no serviceable parts and cannot be rebuilt.

REAR SPRING BLADES
CHANGING

TIGHTENING TORQUES

Spring trunnion bolts............. 10 daNm (75 lb./ft.)
"U" bolt nuts........................... 8 daNm (60 lb./ft.)

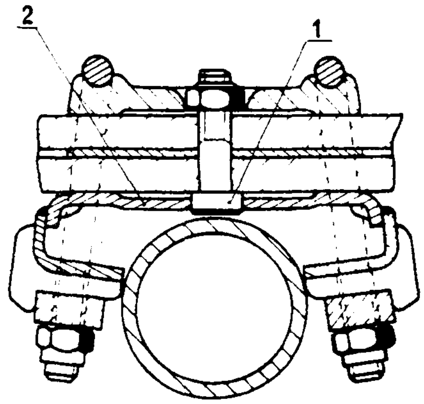


REMOVING

- Place the rear of the vehicle on stands and remove the nuts from spring trunnion bolts.
- Using a jack, take the weight of the axle and remove the "U" bolts. Remove the front and rear trunnion bolts and remove the spring blade(s).

REASSEMBLY

With the rear of the vehicle on stands, coat the trunnion bolts with grease. Fasten the spring blade(s) at the trunnion end first then attach the "U" bolts. Make sure that locating dowel (1) is in its recess (2) in the axle beam.



Check the rear axle alignment and adjust if necessary.

REAR SHOCK ABSORBERS

TIGHTENING TORQUES

Piston rod nut (as a guide) .. 1.5 daNm (11 lb./ft.)
Bottom mounting nut .... 4 daNm (30 lb./ft.)

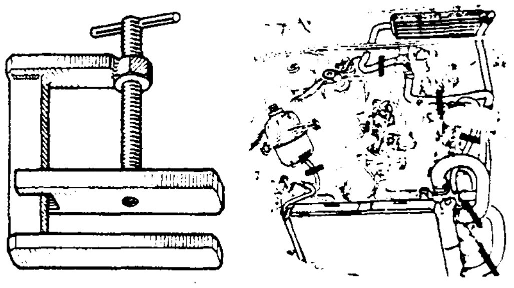
REMOVING

- Unscrew the top locknut and main nut
- Place the rear of the vehicle on a stand on the side concerned
- Unscrew the bottom mounting nut
- Mark the way in which the cupwashers are stacked
- Remove the shock absorber

SECTION "M"

HEATING - VENTILATING

SPECIAL TOOLS



MOT. 453-01

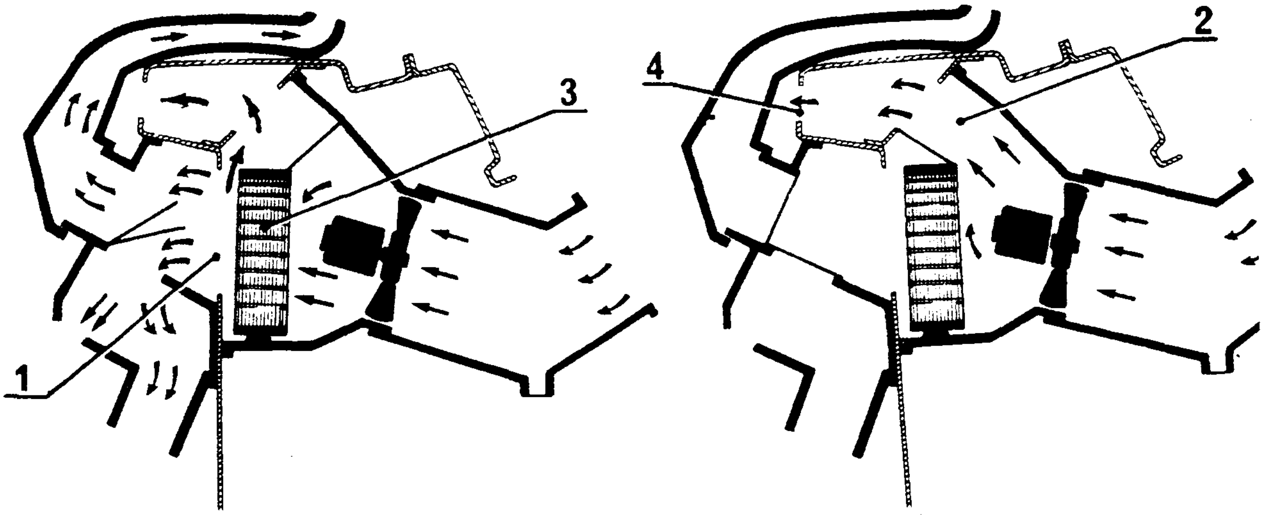
Hose Clamp (maximum dia. 25 mm)

Order Part No. 700000-45-301 EA

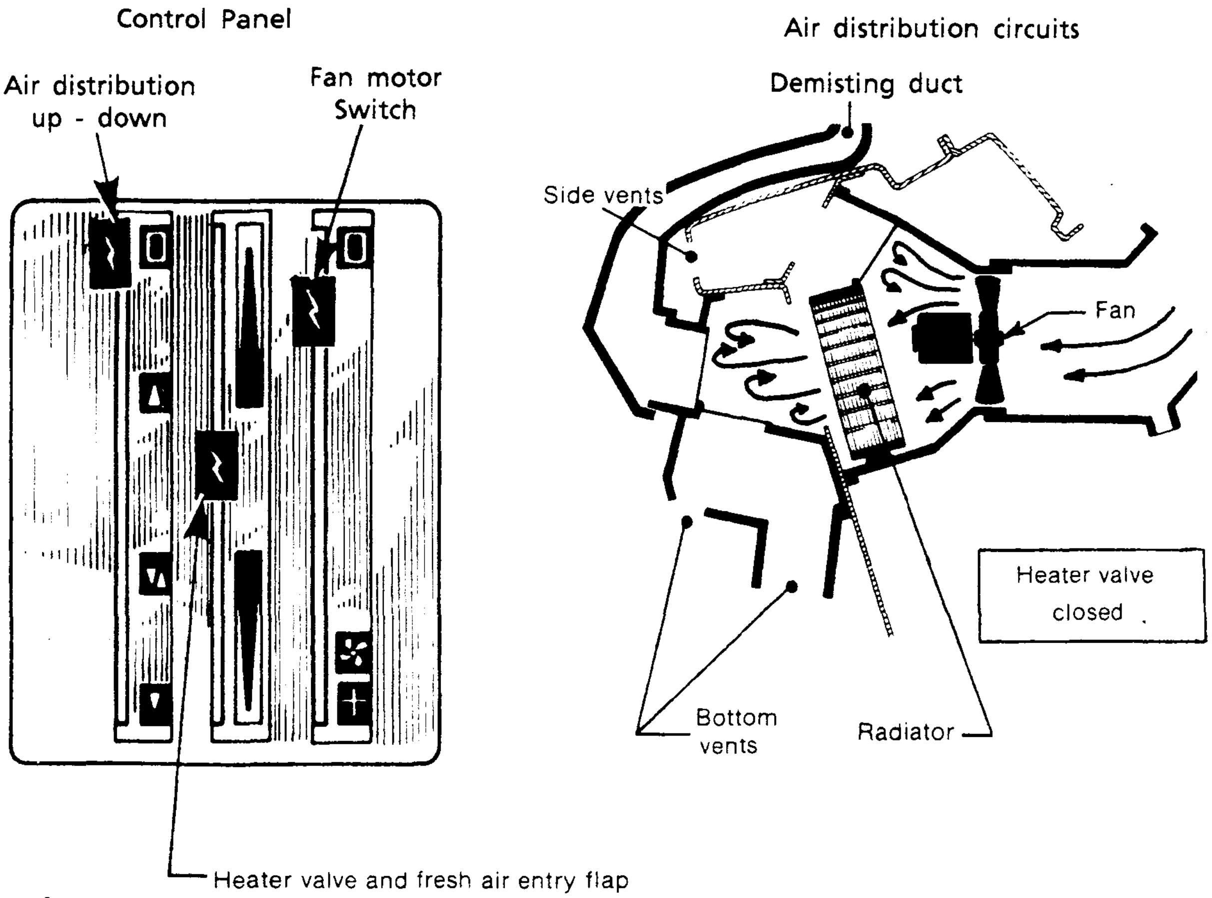
SPECIFICATIONS
GENERAL

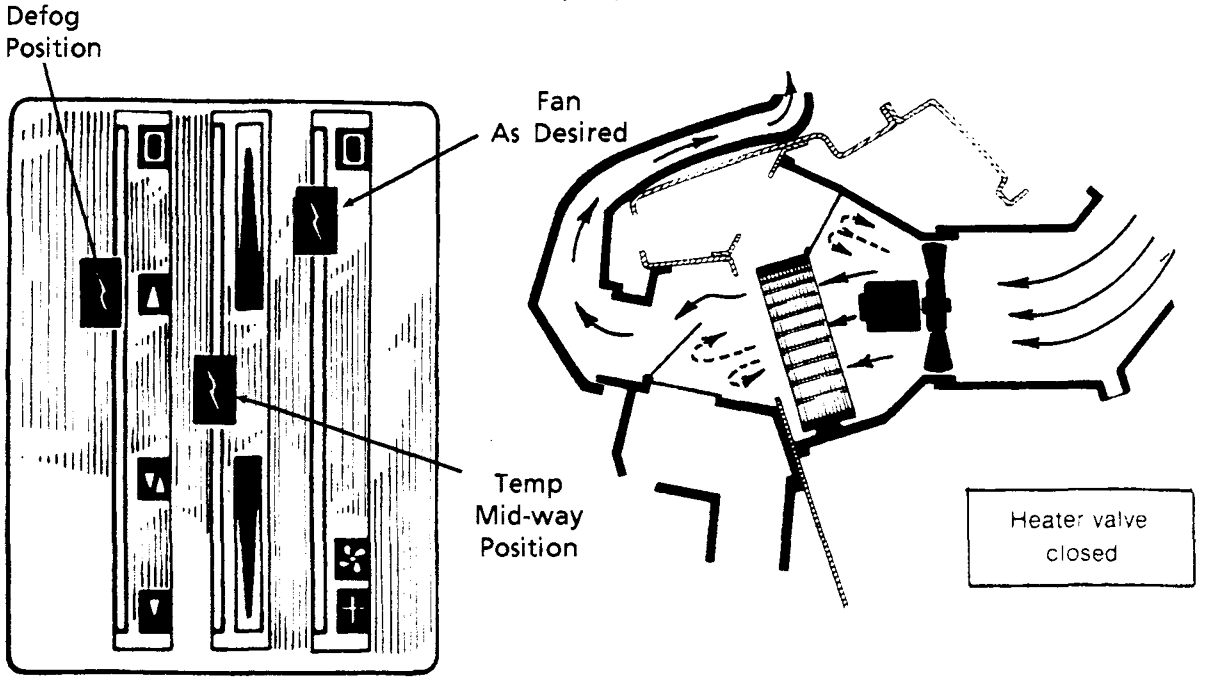
Heating, defrosting and ventilating functions are provided by air taken from outside the vehicle and channelled through the warm air blower.

Two air distribution circuits leave the warm air blower housing.



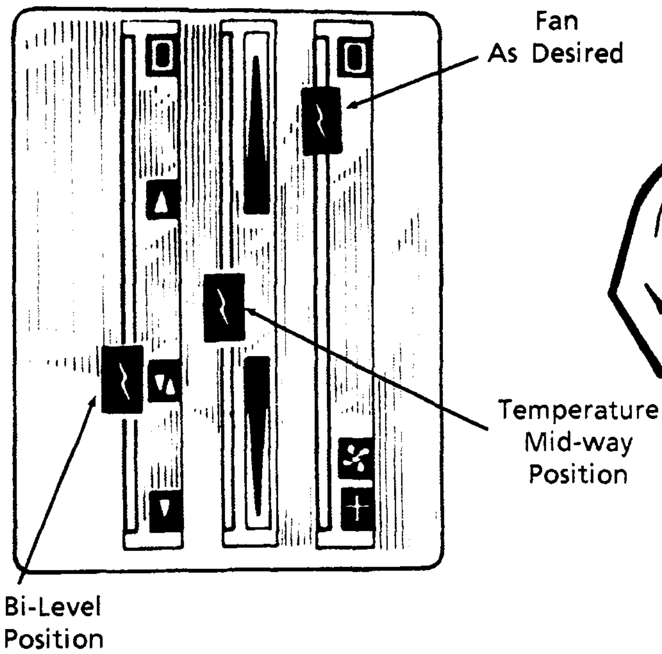
- Circuit (1) passes through the heater assembly (3). This circuit provides:
  - windshield defrosting and heating when the heater valve is open
  - fresh air when the heater valve is closed.
- Circuit (2) is a direct fresh air supply for side ventilators (4) on the dashboard.

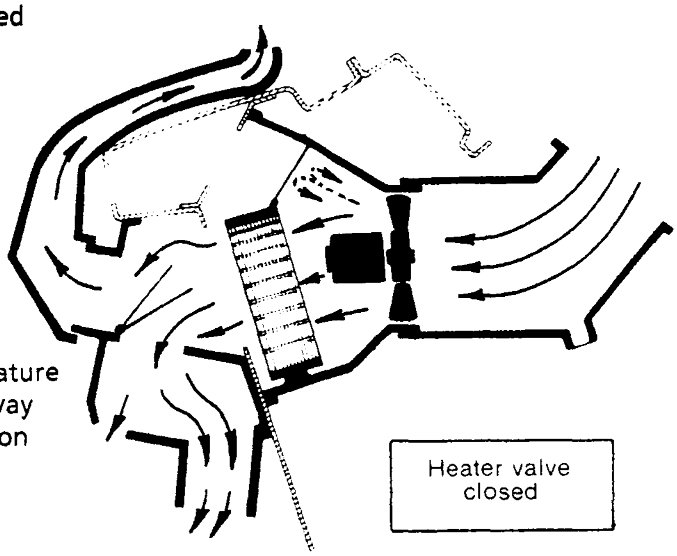

Control Panel
Air distribution circuits
Air distribution up - down
Fan motor Switch
Demisting duct
Side vents
Fan
Heater valve closed
Bottom vents
Radiator
Heater valve and fresh air entry flap

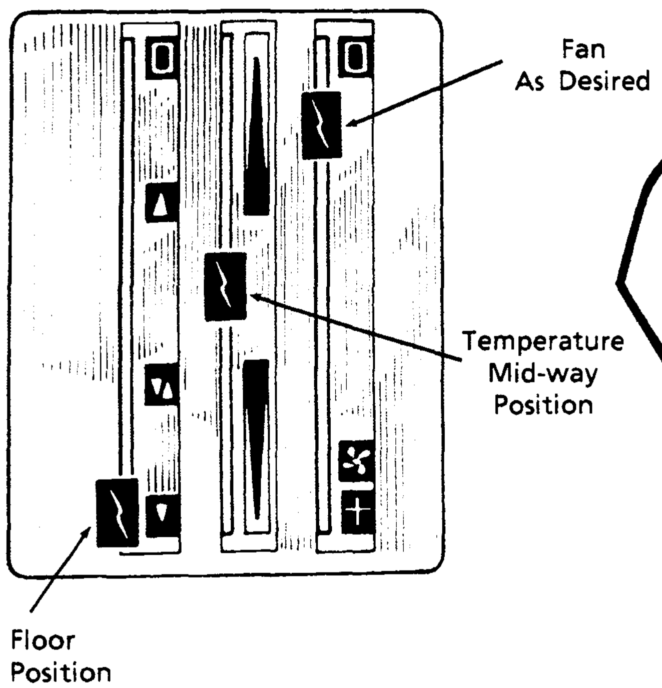

Defog Position
Fan As Desired
Temp Mid-way Position
Heater valve closed

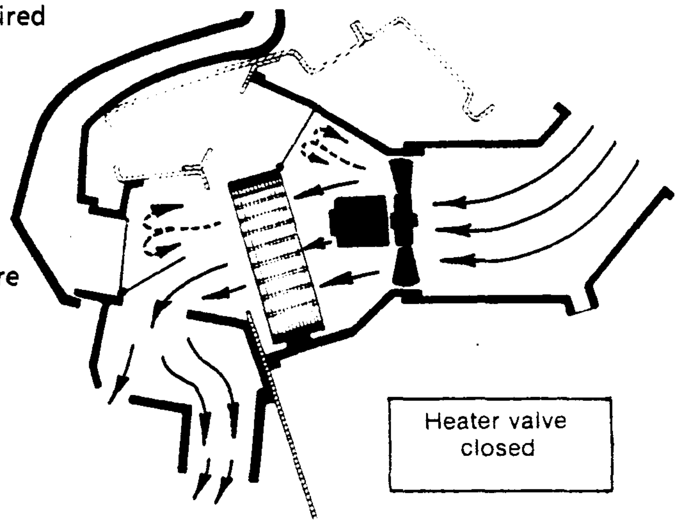
Control panel

Air distribution circuits





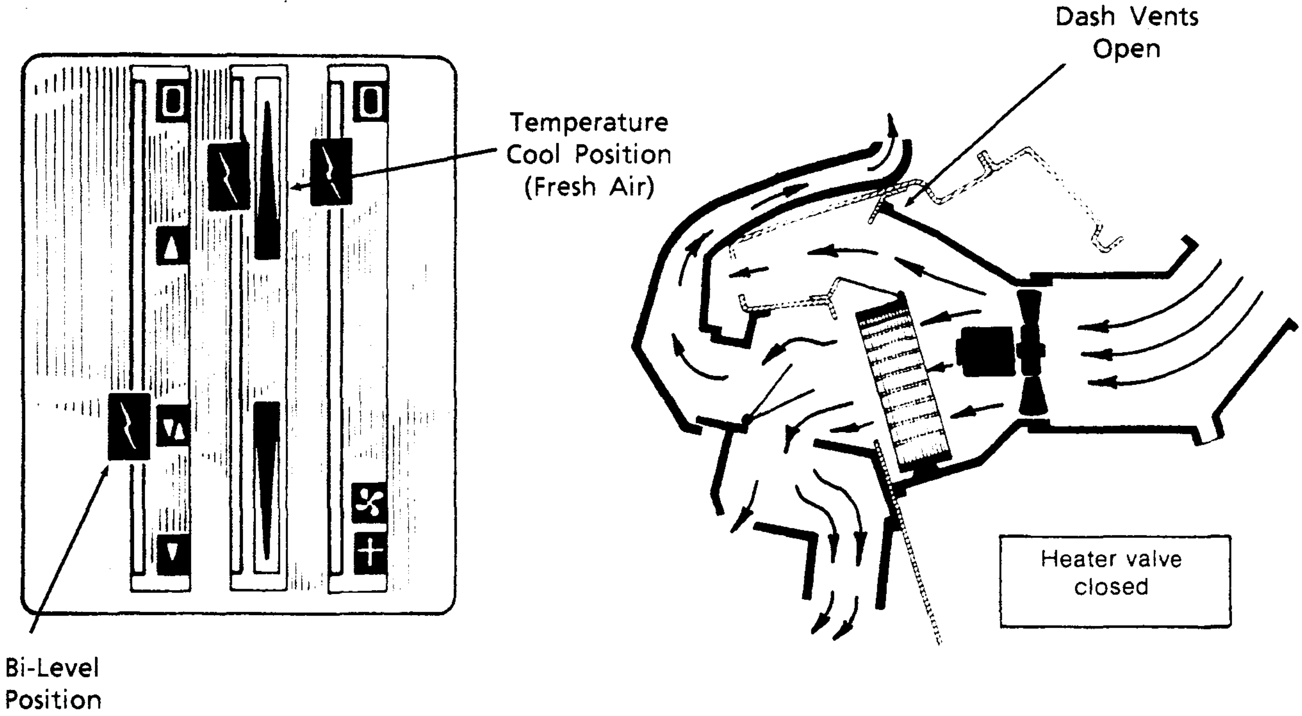


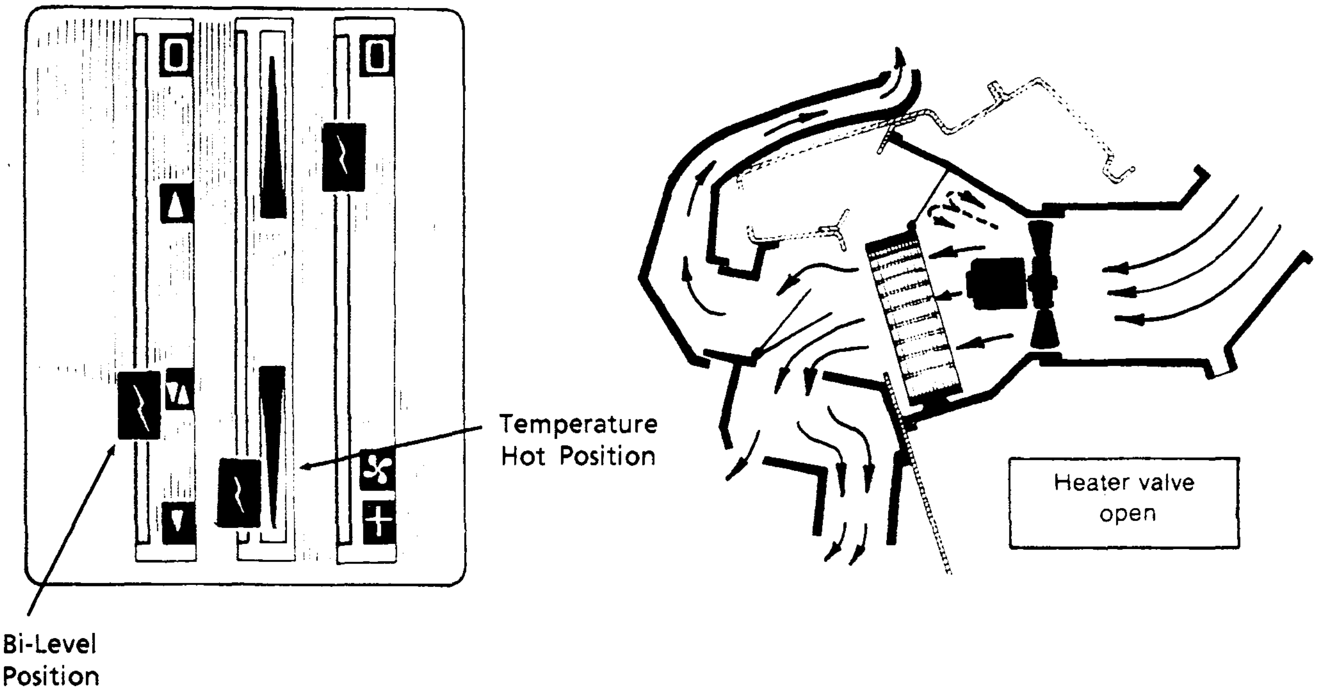


SPECIFICATIONS
OPERATION

Control panel

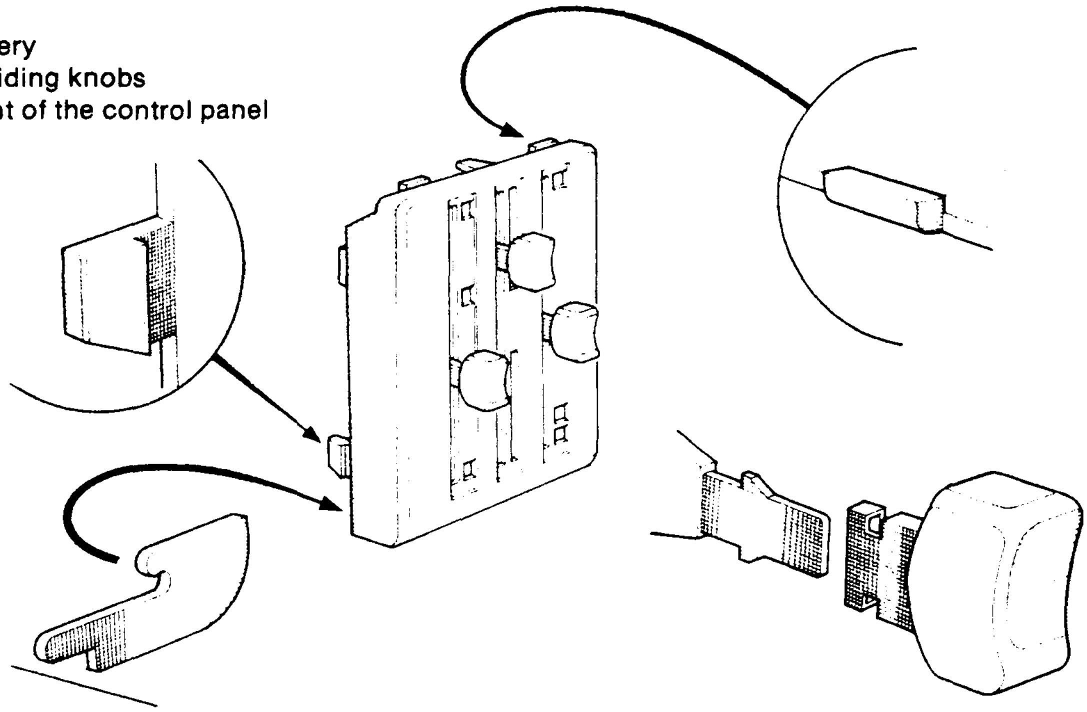
Air distribution circuits



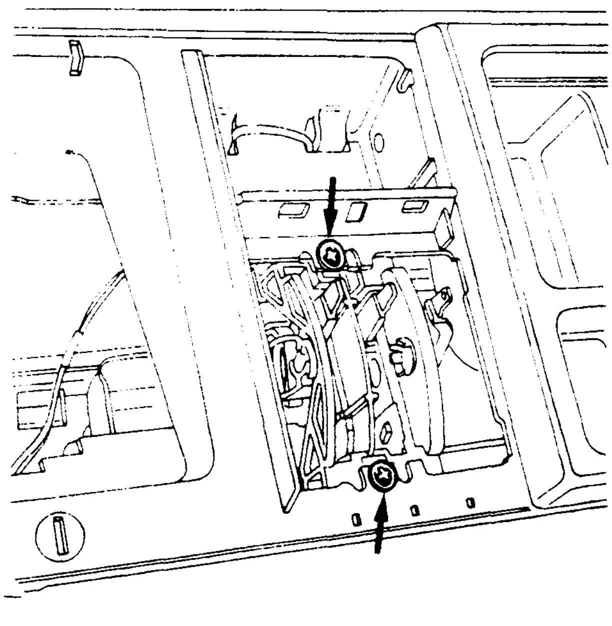


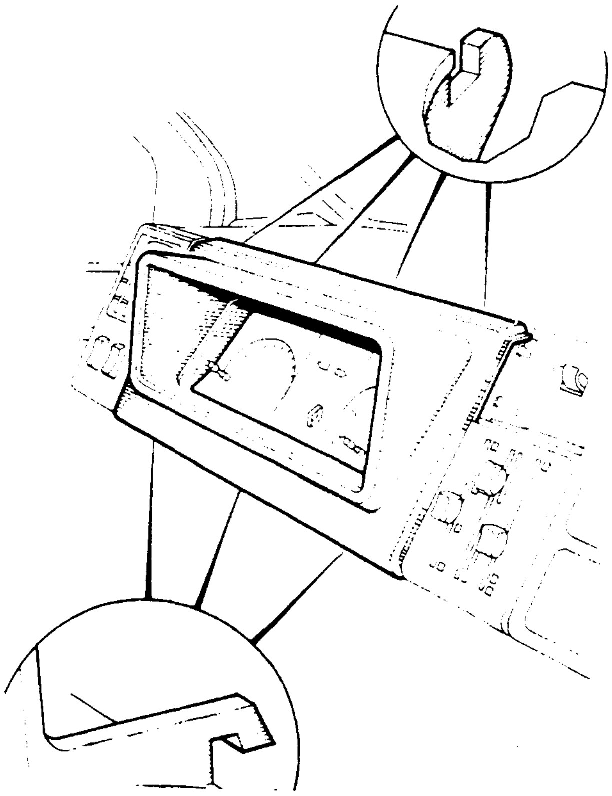
DASHBOARD
REMOVE AND REPLACE

- Disconnect battery
- Remove the 3 sliding knobs
- Remove the front of the control panel



- Remove the 2 screws holding the control panel

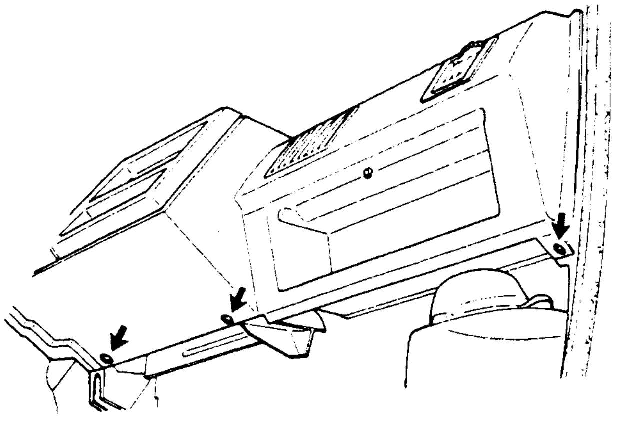


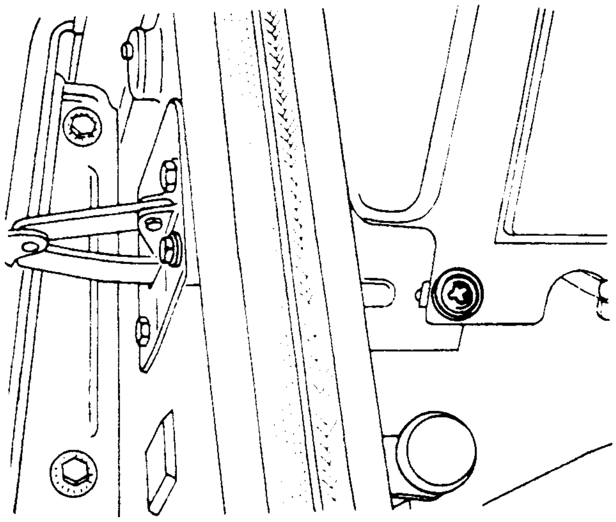


- Remove the instrument panel cowl
- Press down on the top of the cowl then pull it towards the steering wheel.
- Remove gauge cluster assembly. Depress upper retaining clips and tip toward steering wheel. Harnesses and speedometer cable can now be disconnected for complete removal.

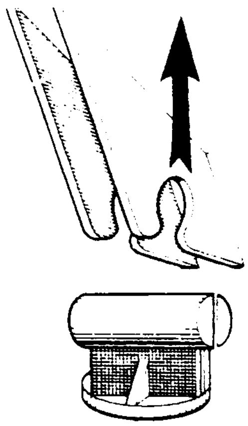
DASHBOARD
REMOVE AND REPLACE

- Remove steering wheel
- Remove the top and bottom covers from steering column
- Remove the accessories plate on the left, label and remove wiring
- Remove ash tray
- Disconnect heater control lights and lay aside.
- Remove radio
- Remove beverage tray
- Open fuse panel door
- Pull out fuse panel - turn sideways - push back through hole and out of the way
- Disconnect battery condition gauge (if equipped)
- Remove the lower dashboard retaining screws





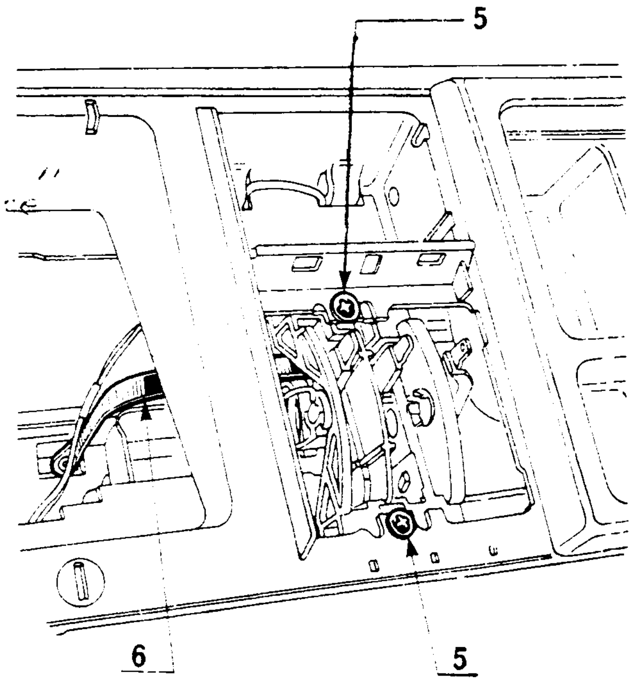
- Lift the dashboard to remove it
- Top side is retained by snap-clips illustrated at right
- Remove through passenger side door



HEATER CONTROL PANEL
CHANGING

REMOVING

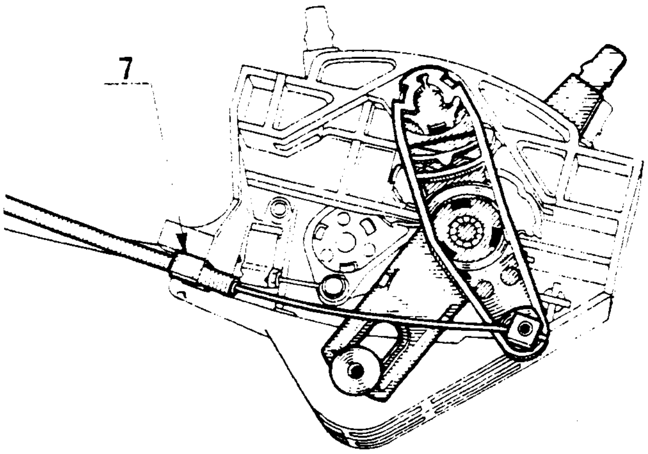
- Disconnect the battery
- Remove:
  - the front of the control panel
  - instrument panel cowl
  - instrument panel
    (refer to chapter "Dashboard remove & replace")
- Remove the two control panel screws (5).
- The control panel is fastened by 2 metal brackets (6) in production. These may be cut to assist removal.

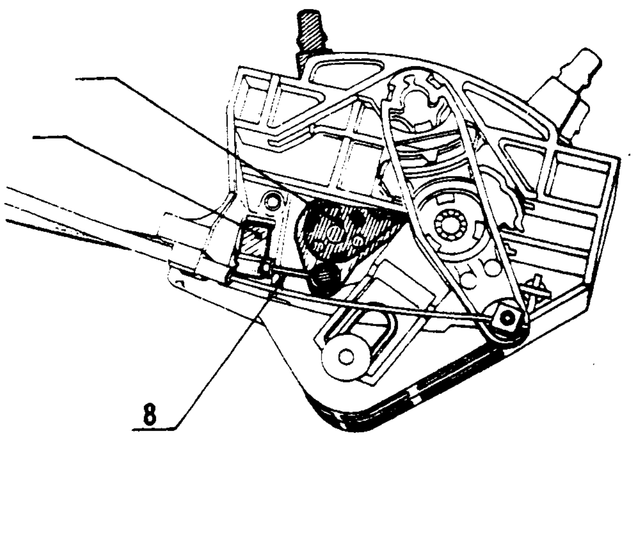


- Disconnect cables (7) and (8).
- Disconnect the feed wires.

REASSEMBLY

- Perform the removal operations in reverse order.



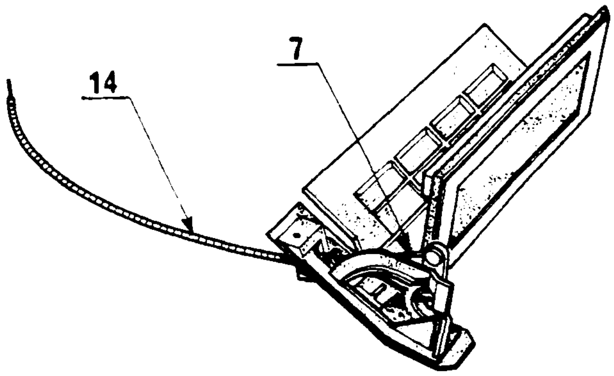


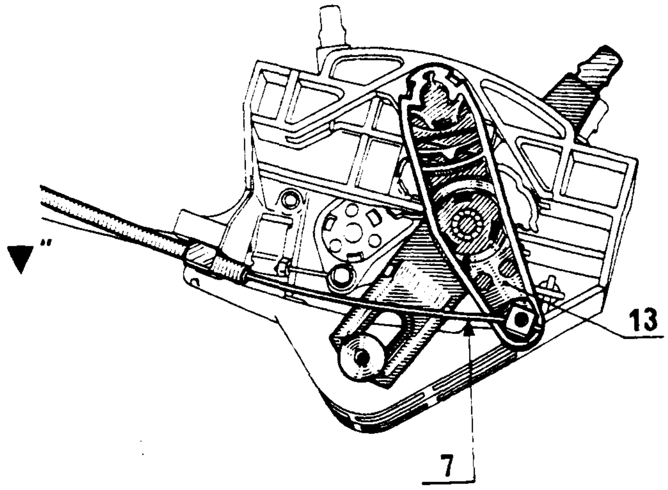
AIRFLOW DISTRIBUTION CABLE
ADJUSTING

Position of sliding knob	Top door	Bottom door
○	Closed	Closed
▲	Open	Closed
▲▼	Open	Open
▼	Closed	Open

This cable controls both distribution flaps (top and bottom)

- Push outer sleeve (14) against the stop
- Clip the outer sleeve
- Attach outer sleeve (14) to the panel
- Door positions:
  - bottom: open
  - top: closed
- Slide control knob to position
- Tighten the cable
- Replace the cable in the panel if the cable cannot be tightened in the above position
- Check the operation by sliding the control knob and observing that the doors open and close.



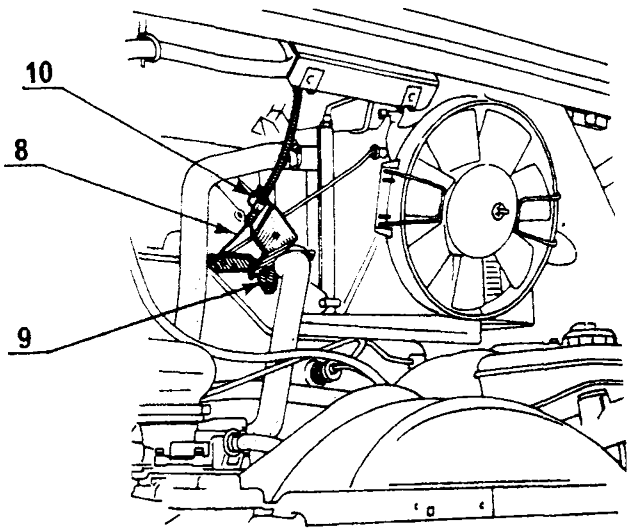


HEATER VALVE AND FRESH AIR DOOR CABLE ADJUSTING

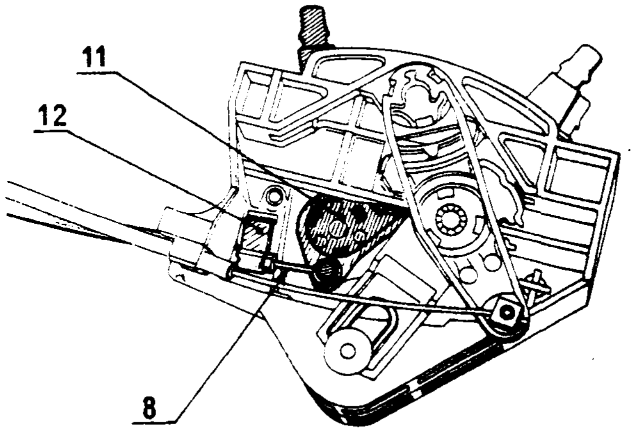
This cable controls the heater valve and fresh air door.

Position sliding knob	Fresh air door	Heater valve
MAX. COLD	Open	Closed
INTERMEDIATE	Closed	Closed
MAX. HOT	Closed	Open

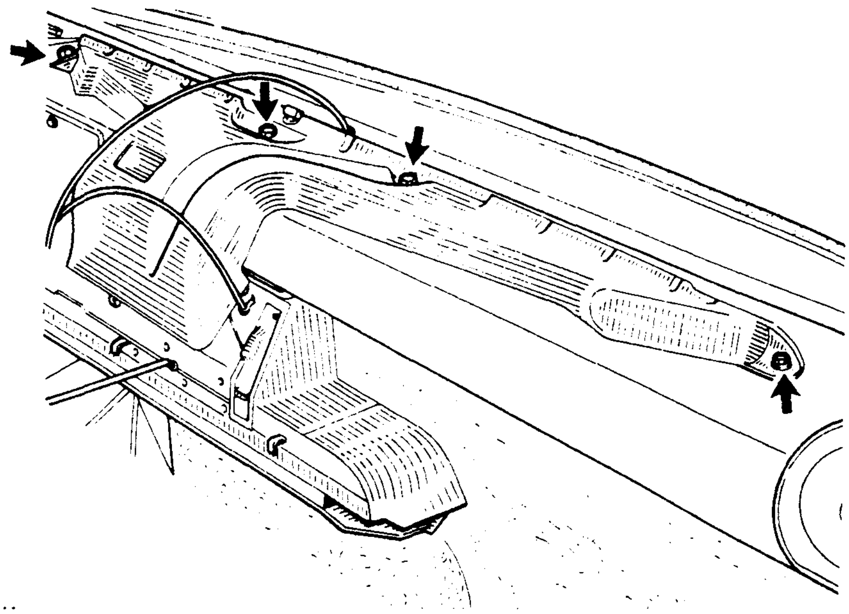
- Attach cable (8) to heater valve (9).
- Clip outer sleeve (10).



- Attach cable (8) to sliding knob (11).
- Set the heater valve in the "Off" position.
- Set sliding knob (11) to "Max. Cold" position.
- Clip outer sleeve (12).
  - If the cable cannot be clipped in this position, reset it at the heater valve end.
  - Check the operation by sliding the control knob and observing that both the heater valve and the fresh air door open and close correctly.

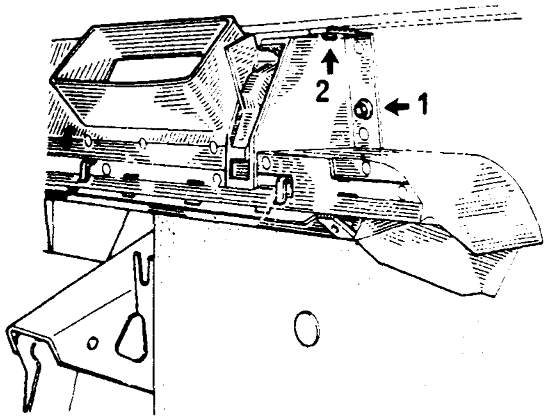


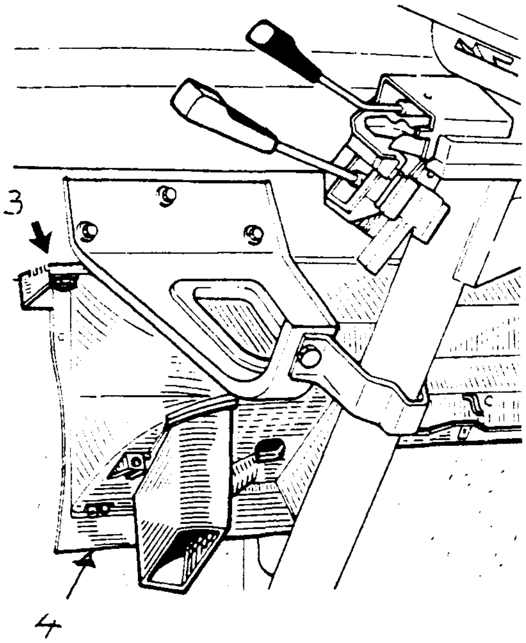
AIRFLOW DISTRIBUTOR
REMOVE AND REPLACE



REMOVING

- Disconnect the battery
- Remove the dashboard
- Remove the windshield defrosting duct
- Remove the heater control panel. Do not disconnect the heater valve cable.
- Remove screws (1), (2), and (3)
- Remove the airflow distributor on reassembly
- Make sure that lip (4) is behind the metal retaining lip on the firewall.

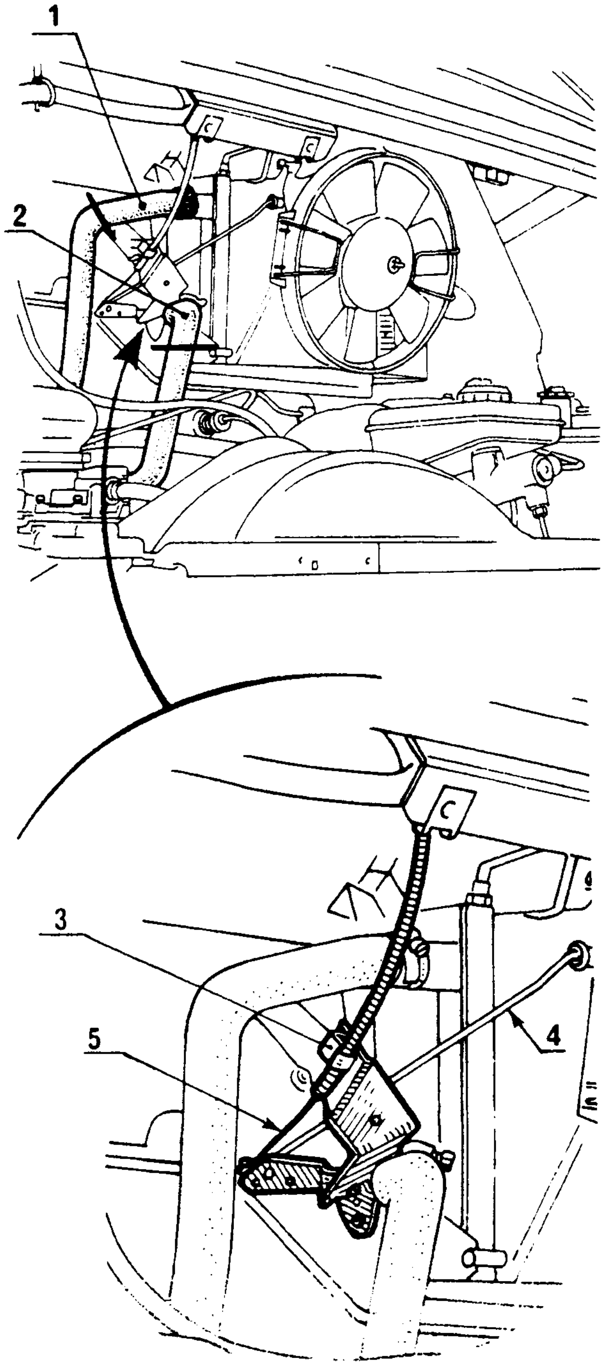




HEATER VALVE
CHANGING

REMOVING

- Clamp hoses (1) and (2) using clamp Mot. 453-01.
- Disconnect hoses (1) and (2)
- Remove cable clip (3)
- Disconnect cable (5) at the heater valve end
- Remove fresh air door rod (4)
- Remove the screws holding the heater valve
- Remove the valve



REASSEMBLY

- Lift up the new heater valve
- Attach the heater valve cable
- Attach the fresh air door rod
- Attach hoses (1) and (2)
- Bleed the cooling system after the operation is complete

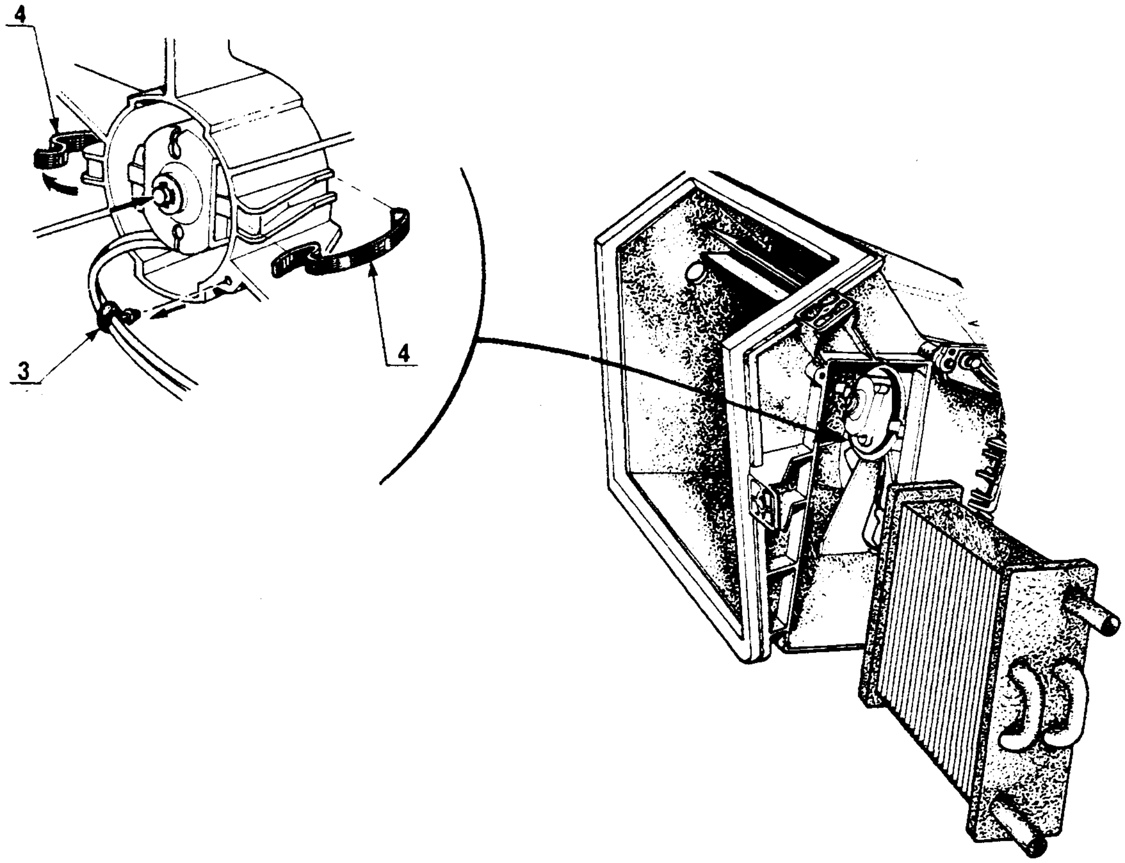
CAUTION

Serious internal engine damage could result due to low coolant level if the cooling system is not bled after this operation.

HEATING - VENTILATING FAN MOTOR
REMOVE AND REPLACE

REMOVING

- Disconnect the battery
- Clamp hoses (1) and (2) with clamp Mot. 453-01
- Disconnect hoses (1) and (2)
- Remove the fan
- Remove the heater assembly
- Remove clip (3) holding the fan motor feed wire
- Release clips (4) holding the fan motor
- Withdraw the motor



SECTION "N"

AIR CONDITIONING

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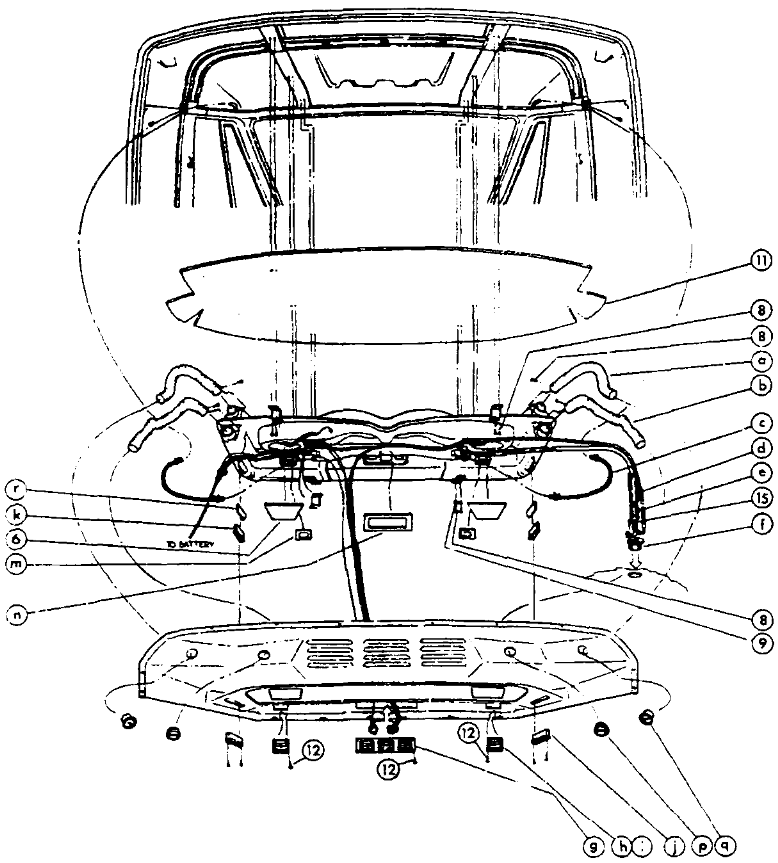
TYPICAL OVERHEAD AIR CONDITIONING



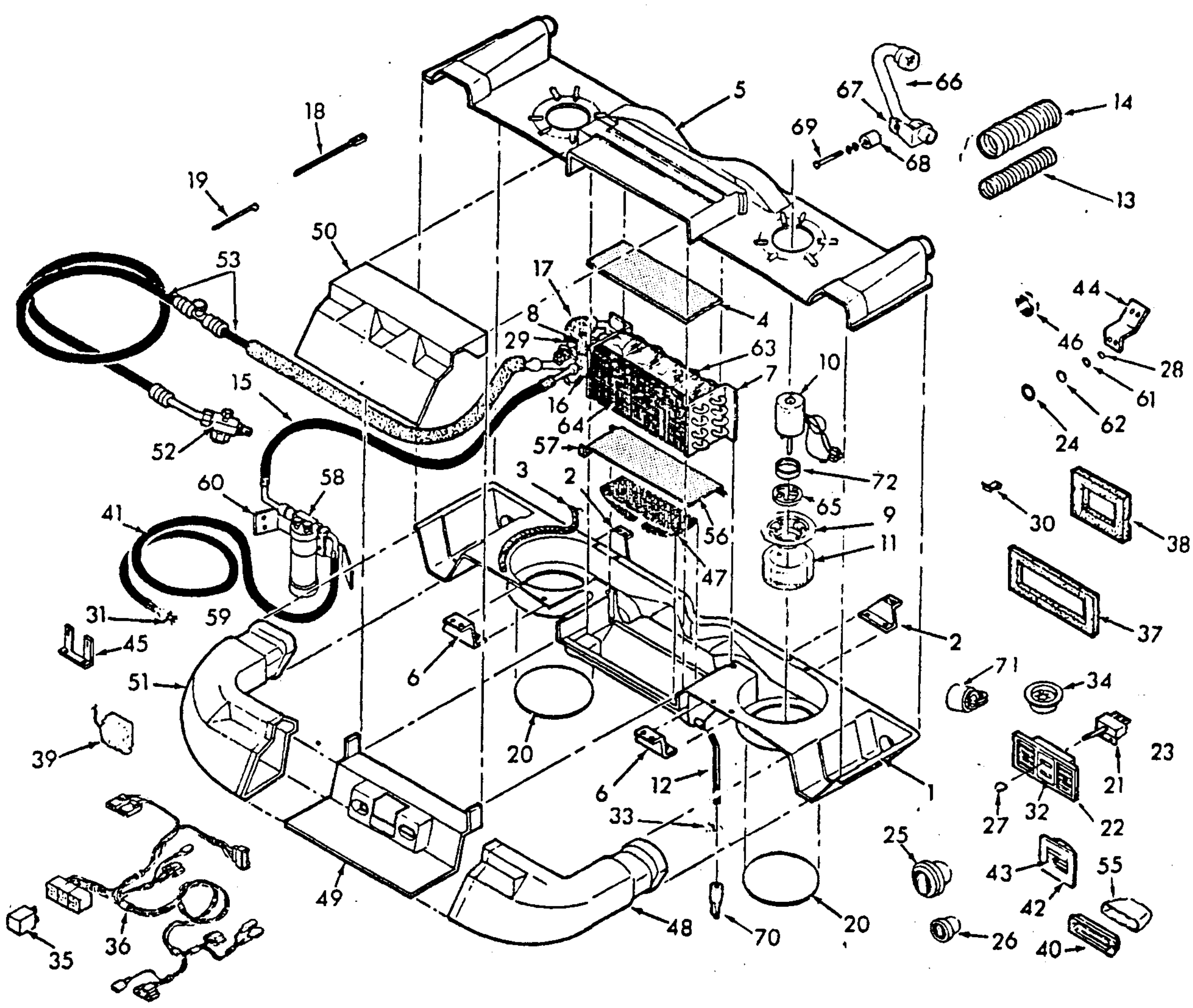
ITEM	DESCRIPTION	QTY
a	Wire Hose - 2 x 32	2
b	Wire Hose - 2 1/2 x 18	2
c	Drain Tube	1
d	Liquid Hose	1
e	Suction Hose	1
f	Floorboard Grommet	1
g	Louver Escutch/Switch Panel	1
h	Louver Eschutcheon	2
i	Louver	4
j	Side Vent Assembly	2
k	Side Vent Adapter	2
m	Seal - Plenum to Louver	2
n	Seal - Center Plenum	1
p	Louver Assembly - 3"	2
q	Louver Assembly - 2"	2
r	Extension	2
6	Insulation	2
8	Screw	12
9	Washer	12
11	Roof Insulation Pad	1
12	Screw	14
15	Screw	3

TYPICAL OVERHEAD AIR CONDITIONING SYSTEM
EVAPORATOR ASSEMBLY

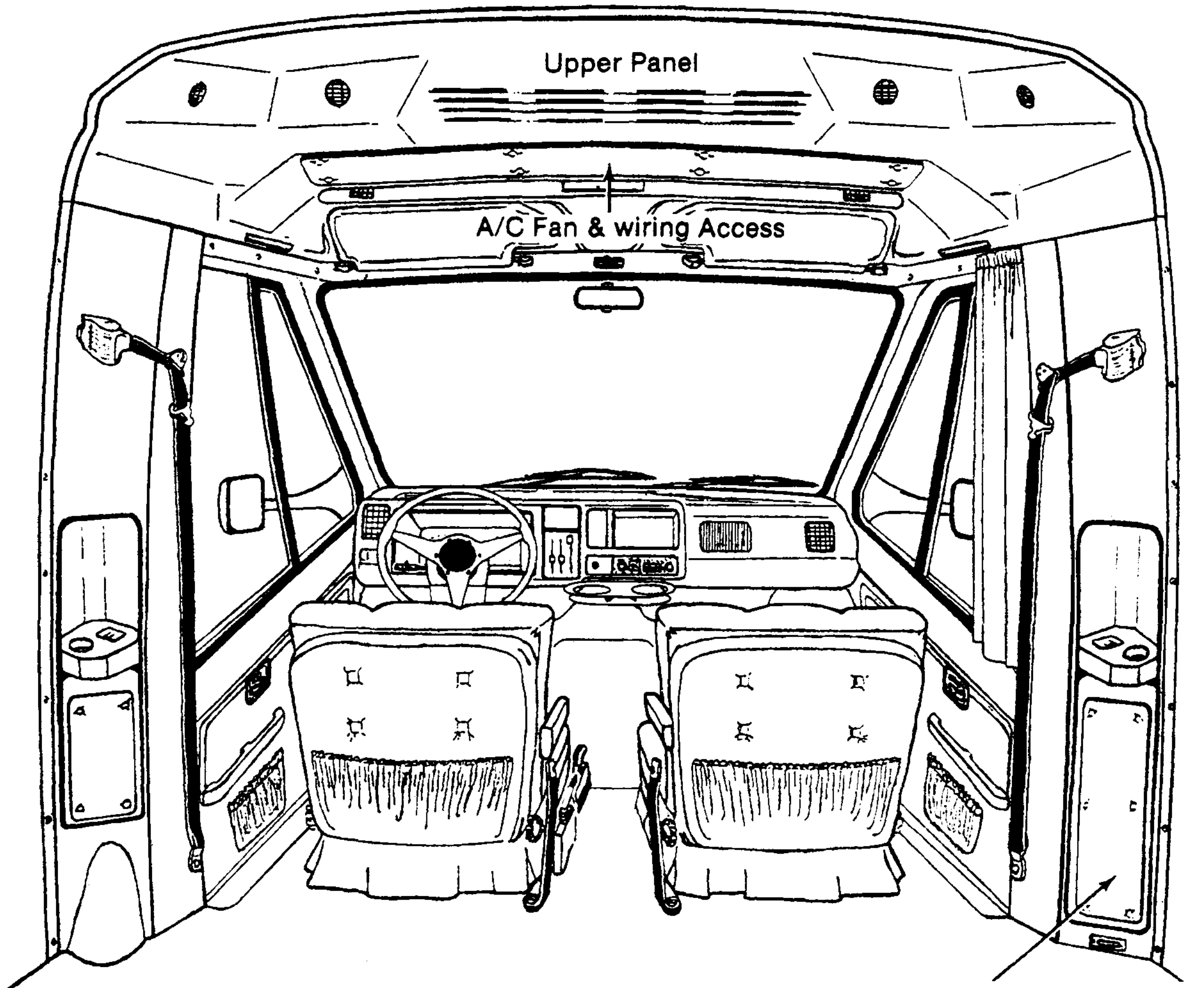
ITEM	DESCRIPTION
1	Case, Bottom Sub Assembly
2	Bracket, Forward - Evaporator Mounting
3	Gasket Tape Seal 1/8" x 3/4" x 106"
4	Insulation, Top
5	Case, Top
6	Bracket Rear Evaporator Mounting
7	Evaporator Coil
8	Armorflex, 3/4" ID x 6"
9	Motor Mount
10	Blower Motor
11	Wheel, Blower CCW Rotation
NS	Wheel, Blower CW Rotation
12	Drain Tube 1/2" x 30"
13	Hose, Wireform 2" x 32"
14	Hose, Wireform 2 1/2" x 20"
15	Hose, Liquid #6 TXV/Receiver
16	Expansion Valve
17	Armorflex 7/8 ID x 6"
18	Tiewrap w/Mounting Hole
19	Tiewrap, 15"
20	Motor Cover
21	Fan Switch Bracket
22	Escutcheon, Louver and Switch Panel
23	Fan Switch
24	"O" Ring, #10
25	Louver Assembly, 3"
26	Louver Assembly, 2"
27	Knobs
28	"O" Ring Cap Tube
29	Bulb Clamp
30	"V" Clip
31	Fitting, Aeroquip
32	Hose, Clamp #6
33	Clamp, Hose Drain 1/2"
34	Floorboard Grommet
35	Relay

ITEM	DESCRIPTION
36	Wire, Harness
37	Seal, Center Plenum to Louver
38	Seal, Plenum to Louver
39	Thermostat
40	Escutcheon Vane Assembly Side Vent
41	Hose, Liquid Condenser Receive (In)
42	Escutcheon Louver
43	Louver
44	Bracket, Front Plenum Mounting
45	Bracket, Thermostat
46	Hose Clamp, #10
47	Lint Screen, Mesh
48	Plenum, Right Side
49	Plenum, Bottom
50	Plenum, Top
51	Plenum, Left Side
52	Service Valve
53	Suction Hose #10
54	"O" Ring, Aeroquip Fitting
55	Coupling, Flexible
56	Insulation, Baffle Plate
57	Plate, Baffle
58	Receiver/Drier
59	Bracket, Rec/Drier, Mtg Clamp
60	Receiver/Drier Mtg Bracket
61	"O" Ring #6
62	"O" Ring #8
63	Scott Foam 20 x 12"
64	Aluminum Screen Wire
65	Vibration Eliminator
66	Compressor Suction Adaptor Assembly
67	Nut, Speed 1/4 - 12"
68	Steel Spacer 3/4" x 21/64" x 5/8"
69	Bolt, 1/4 - 20 x 3/4"

TYPICAL EVAPORATOR ASSEMBLY

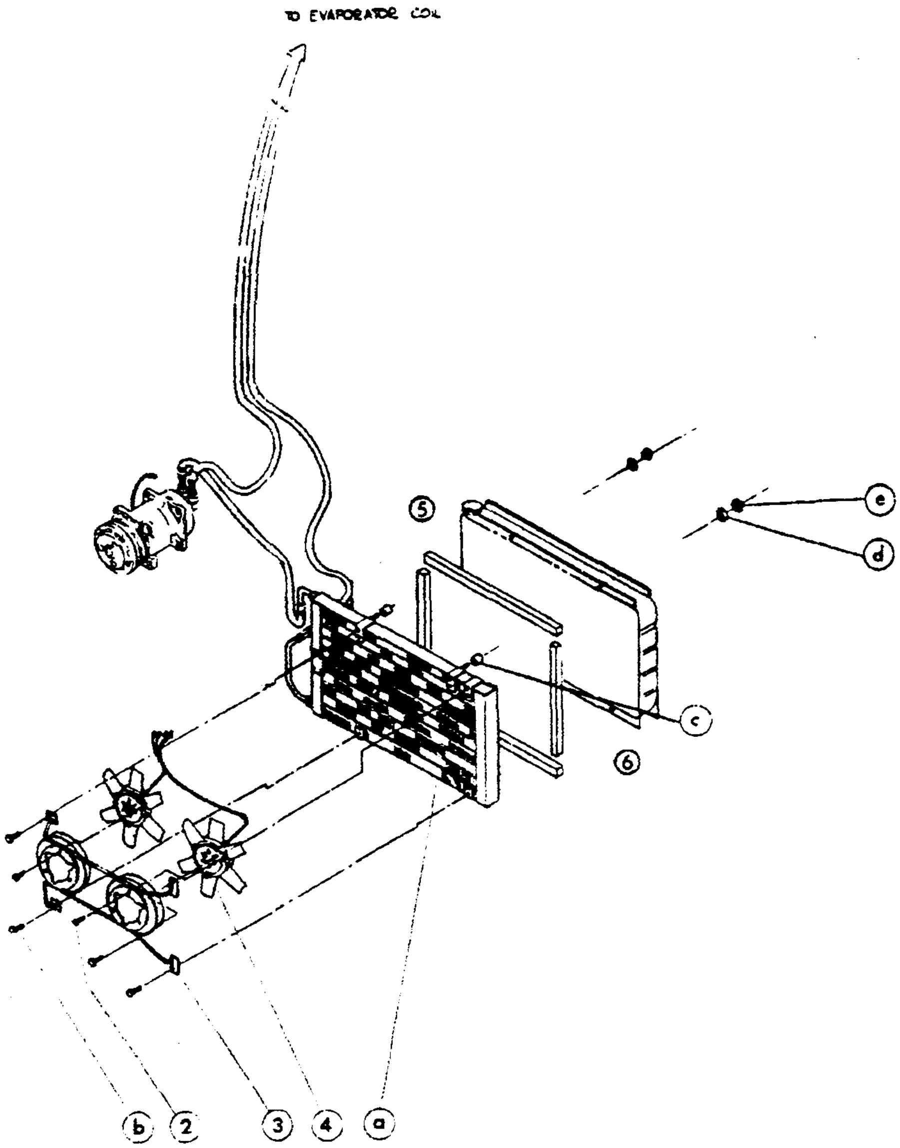


RECEIVER - DRIER ACCESS



IMPORTANT
This Trim Pad provides access to the Receiver-Drier

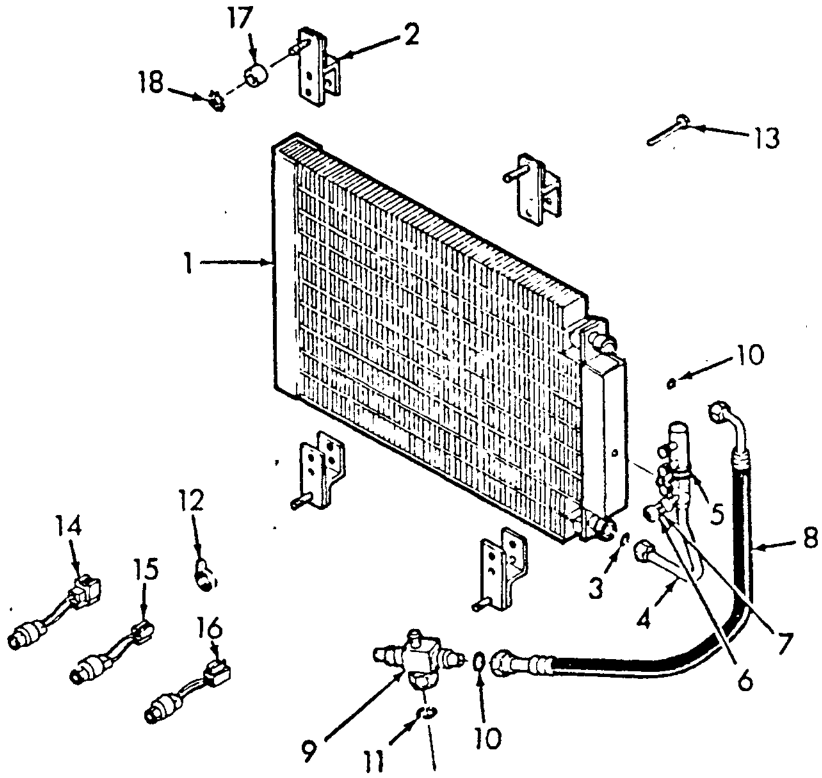
A/C COMPRESSOR - CONDENSER ASSEMBLY



ITEM	DESCRIPTION	QTY
a	Condenser	1
b	Bolt	4
c	Spacer	4
d	Washer	4
e	Nut	4

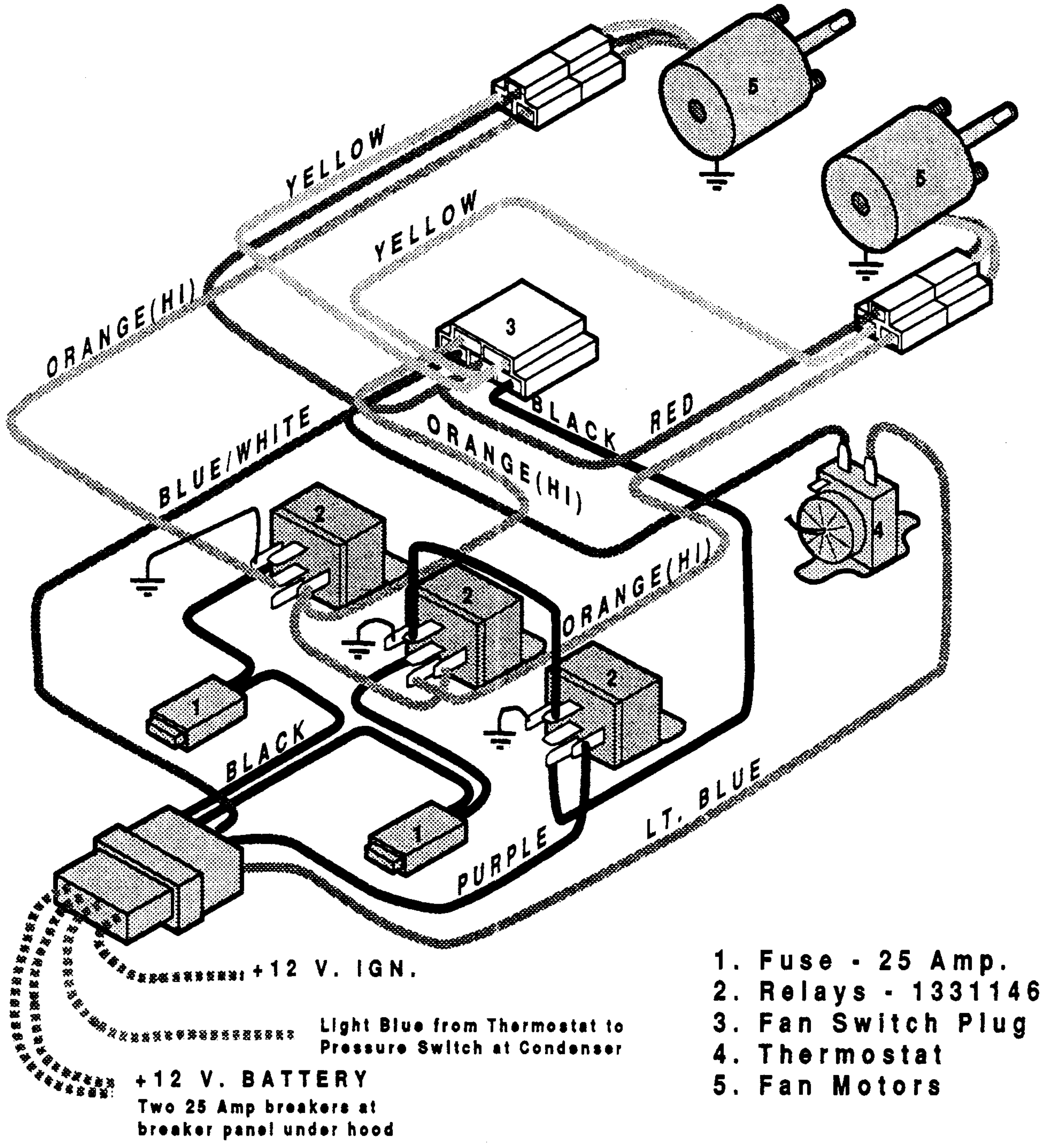
ITEM	DESCRIPTION	QTY
2	Bolt	4
3	Fan Bracket	1
4	Fan	2
5	Radiator Gasket	2
6	Radiator Gasket	2

CONDENSER ASSEMBLY



ITEM	DESCRIPTION	QTY
1	Coil, Condenser	1
2	Bracket, Condenser Mounting	4
3	O-ring #6	
4	Line, Liquid Condenser	1
5	Clamp, Hose	1
6	Fittings, Aeroquip	1
7	O-ring	1
8	Hose, Discharge #8	1
9	Service Valve, Discharge	1
10	O ring #8	2
11	O ring #10	1
12	Clamp, Hose #4	2
13	Screw, 10 24 x 1 1/2 PPH	8
14	Switch, High Pressure	1
15	Switch, Low Pressure (Fan)	1
16	Switch, Low Pressure Cut Out	1
17	Spacer	4
18	Keps Nut 1/4 - 20	4

EVAPORATOR WIRING



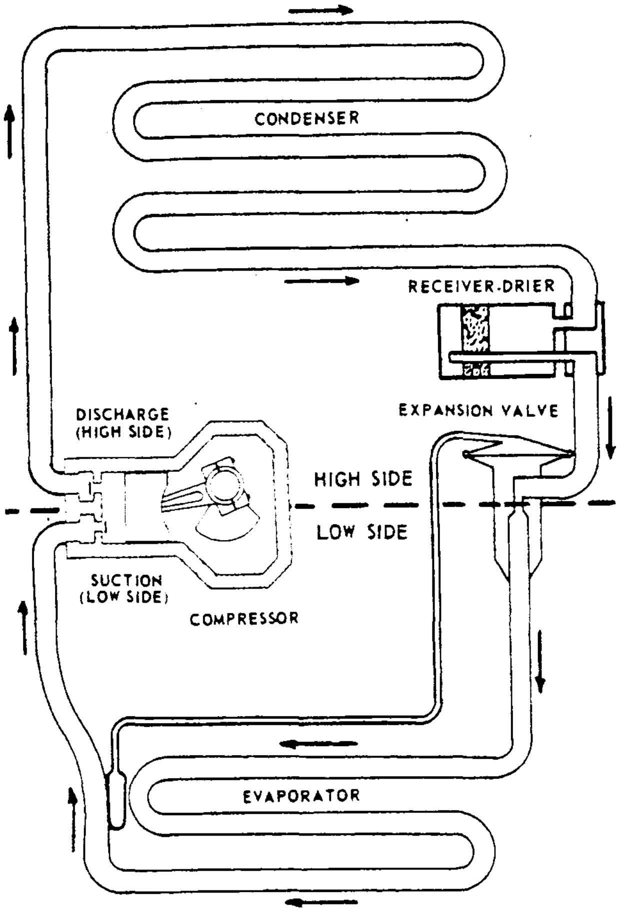
1. Fuse - 25 Amp.
2. Relays - 1331146
3. Fan Switch Plug
4. Thermostat
5. Fan Motors

A/C SYSTEM OPERATION

Basic Operation

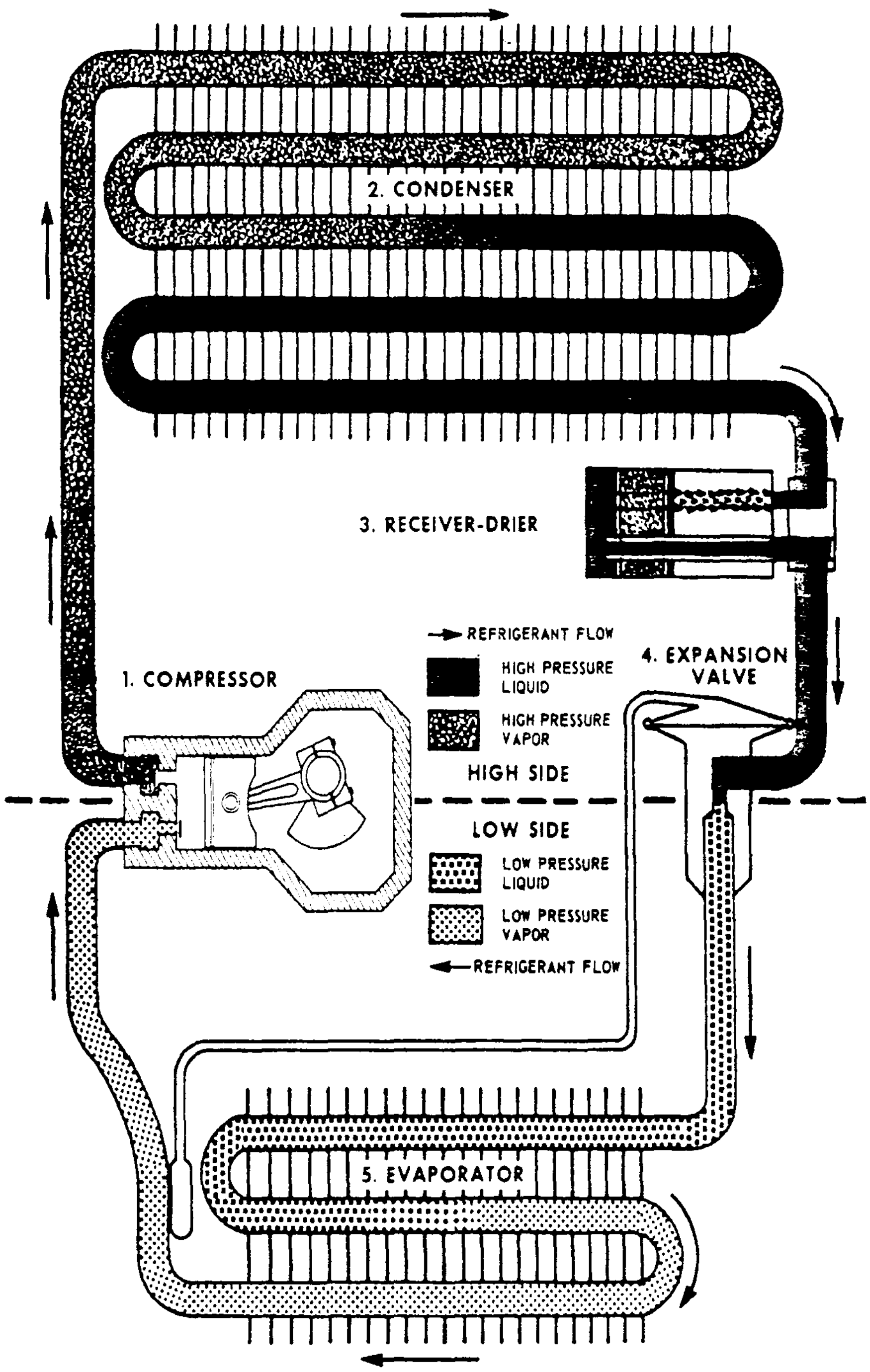
The automotive air conditioning system is a simple mechanical device designed to move heat from within the vehicle to the outside air. It uses all of the principles of heat transfer discussed in the previous chapter and is divided into a HIGH PRESSURE SIDE and a LOW PRESSURE SIDE as indicated by the line drawn through the center of the Compressor and Expansion Valve as shown in the accompanying diagram. All components above this line are on the high side and operate under high pressure; all components below the line are on the low side and operate under low pressure.

BASIC AIR CONDITIONING SYSTEM



A/C SYSTEM OPERATION

BASIC AIR CONDITIONING SYSTEM
REFRIGERANT FLOW CYCLE



LOW SIDE CONTAINS:

1. Suction side of the Compressor and its Low Side Service Fitting.
2. Evaporator
3. Outlet half of Expansion Valve
4. Connecting hoses to all parts described above.

HIGH SIDE CONTAINS:

1. Discharge side of Compressor and its High Side Service Fitting.
2. Condenser
3. Receiver-Drier
4. Inlet half of expansion valve.
5. Connecting hoses to all parts described above.

STABILIZING THE SYSTEM

With Manifold Gauge Set connected into the system, air and moisture purged from high and low side test hoses, and both manifold hand valves closed, the air conditioner is ready for testing. The system must be operated for a few minutes to allow all components to attain operating stability and the system must be checked for a full refrigerant charge before tests can be made. Stabilize the system as follows:

System must be properly stabilized.

System Stabilizing Procedure

1. Start engine and adjust engine to normal fast idle speed.
2. Turn air conditioner on and set for maximum cooling with blower fan on high speed.
3. Open doors or windows.
4. Operate air conditioner for 5-10 minutes to stabilize system.
5. Check system for full refrigerant charge by noting sight glass indication. See page N3-4 for sight glass data. On systems where sight glass is not used, note gauge readings. See N4-3 for normal gauge readings. An insufficient charge will be indicated by high and low gauges registering lower than normal.

System must have full charge.
If an insufficient refrigerant charge is indicated by the test gauge readings and sight glass indication, the system must first be fully charged before accurate tests can be performed to determine the cause of system failure. The stabilizing period is an ideal time to add refrigerant to bring the system to a full charge. Refer to ADDING REFRIGERANT.

Some refrigerant loss is normal.
Some refrigerant loss will occur from one season to the next and is accepted as normal. Vibration, hose porosity, and the general construction of components mounted on a moving vehicle make the leak-free system an exception. Replacing this refrigerant loss between seasons will constitute much of the quick service required on air conditioning equipment.

ADDING REFRIGERANT

System must contain full refrigerant charge.
The air conditioner must contain a full refrigerant charge before an accurate system check can be made. An insufficient charge is indicated by both the high and low side gauge readings registering lower than normal. Also the sight glass will show a stream of bubbles or foam. Refer to the accompanying illustration and proceed as follows with the system still in operation.

Adding Refrigerant Procedure

1. If can of refrigerant-12 is not already connected to manifold gauge set center hose, connect can as follows: Install can valve on can of R-12 and connect can valve to center hose.
2. Loosen center hose connection at gauge manifold, open can valve for several seconds to purge air from the center hose, then tighten hose connection and close can valve.
3. **Start engine and operate air conditioner.** With system operating, slowly open low side manifold hand valve to allow refrigerant to enter the system.

NOTE : The low side of the system is the SUCTION side and the Compressor will pull refrigerant from the can into the system.

Add charge on Low Side Only.

CAUTION

High side hand valve must never be opened while system is operating. This would result in refrigerant being pumped into the can and causing it to burst. NOTE: The high side of the system is the DISCHARGE side and compressor would push refrigerant out of the system (unless safety can valve used).

4. With refrigerant container in **upright** vapor position, add refrigerant until sight glass clears or gauge readings are normal.

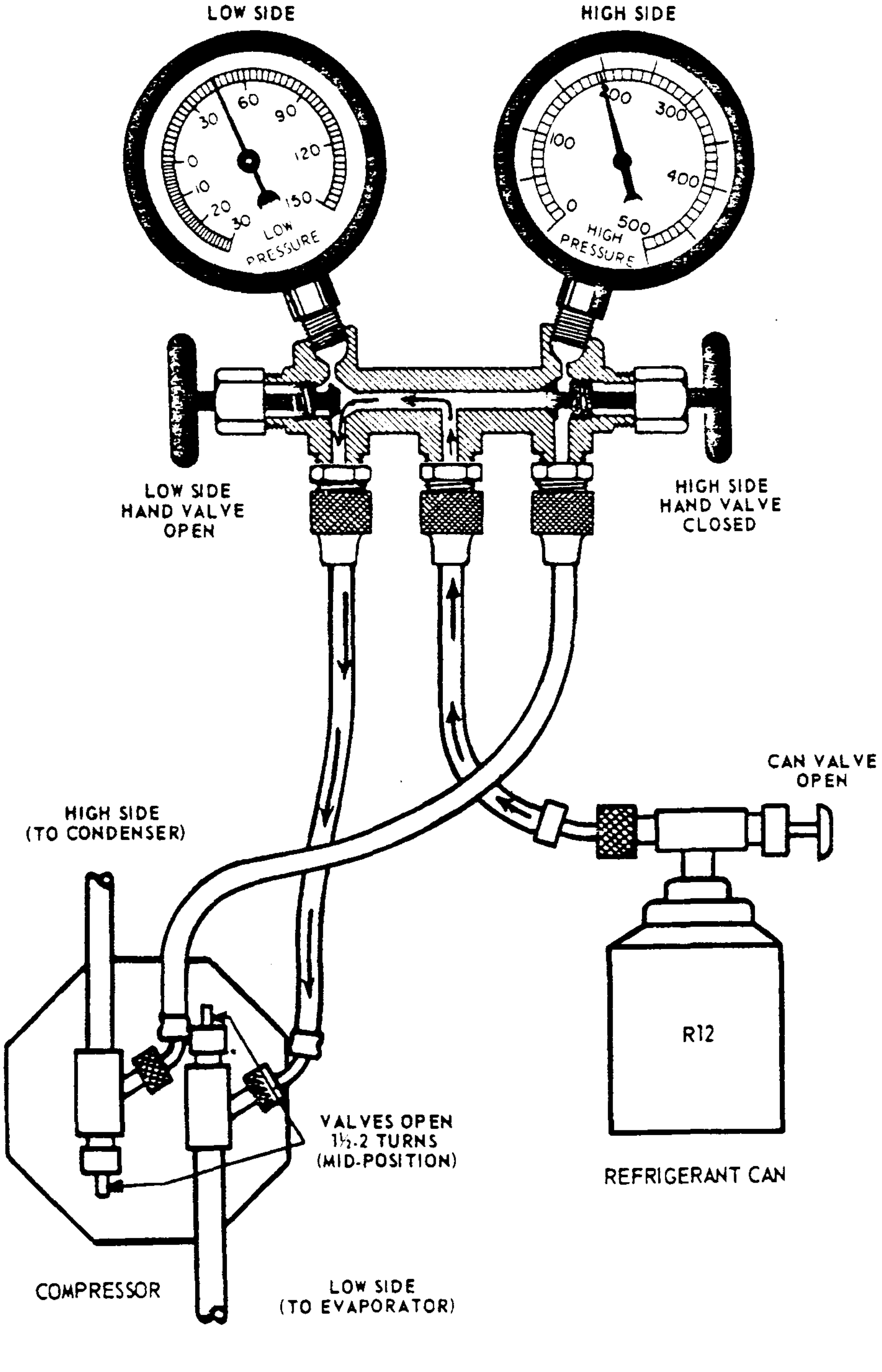
NOTE : Refrigerant can may be rocked from side to side to increase flow of refrigerant into system.

CAUTION

Never turn can into a position where liquid refrigerant will flow into system.

5. Close low side manifold hand valve and refrigerant can valve.
6. Continue to stabilize system and check for normal refrigerant charge.

ADDING REFRIGERANT TO SYSTEM (SYSTEM OPERATING)



SERVICING THE A/C SYSTEM

RECEIVING-DRIER REPLACEMENT INTERVALS

The receiver-drier cannot be serviced and should be replaced whenever there is reason to believe the dessiccant has become saturated with moisture or if there is any doubt as to its correct functioning.

A quick check of the receiver-drier can be made by feeling the receiver-drier and the inlet and outlet hoses or refrigerant lines with the system operating. These should be warm to the touch. A cool receiver-drier or lines indicates a malfunction.

Receiver-Drier must be replaced at certain intervals.

In regular operation, the following replacement schedule should be used:

Normal Conditions - Replace receiver-drier every third time the system is opened for repair or servicing.

Special Conditions - Replace receiver-drier **each time** the system is opened when operated under the following conditions.

1. In a high humidity area (high moisture content in the air.)
2. If the system has been open for a long period as when an existing leak (broken hoses, loose connections, etc) has allowed air and moisture to enter the system.
3. Whenever thermostatic expansion valve is replaced (usually because of corrosion caused by moisture in system).
4. Whenever the receiver-drier or the outlet hoses or lines are cool to the touch with system operating.
5. When cloudiness is noted in the sight glass.

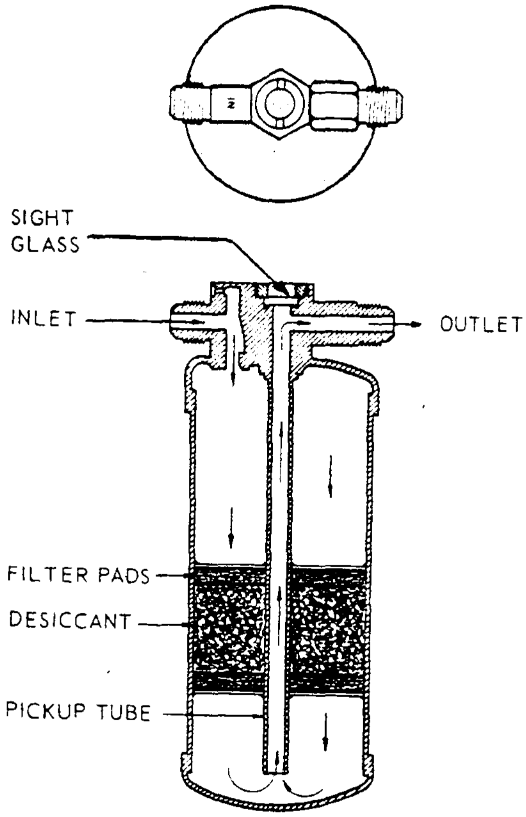
MOISTURE CONTAMINATION

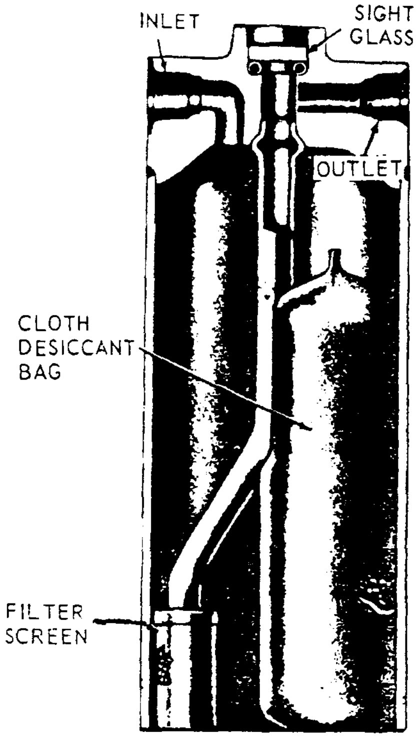
Moisture in system will cause a corrosive acid to form.

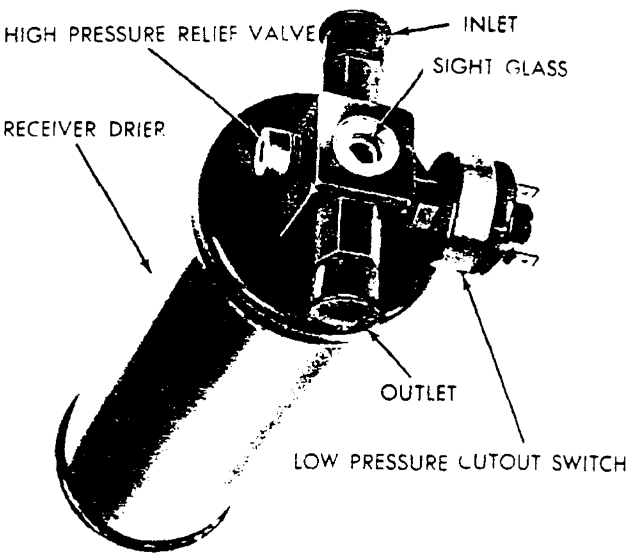
Any moisture in the air conditioning system is extremely harmful. Moisture not absorbed by the desiccant in the receiver-drier will circulate with the refrigerant and droplets may collect and freeze in the Thermostatic Expansion Valve orifice. This would block the refrigerant flow and stop the cooling action. Also, moisture will react with Refrigerant-12 to form a hydrochloric acid which will cause corrosion of the metal parts in the system. Corrosion particles may become detached and block the small passages and orifices in the system.

Moisture must not be allowed to enter the air conditioning system and the receiver-drier must be replaced when the desiccant becomes saturated and can no longer remove moisture from within the system.

RECEIVER-DRIER ASSEMBLIES
(TYPICAL)







EVACUATING THE SYSTEM

A system that has had the refrigerant removed to perform repairs, or is excessively low on refrigerant, must be evacuated with a vacuum pump before new refrigerant is installed.

System must be evacuated to remove air and moisture.

MOISTURE in any quantity (even a few drops of water) is extremely harmful to the air conditioning system and if not retained by the desiccant in the receiver-drier will circulate with the refrigerant. Moisture may collect and freeze in the Thermostatic Expansion Valve orifice which would block refrigerant flow and stop the cooling action. Moisture will also react with Refrigerant-12 to form hydrochloric acid which will cause corrosion of the metal parts of the system. Corrosion particles may become detached and block the small passages and orifices in the system. The desiccant in the receiver-drier can absorb only a limited amount of moisture before it becomes saturated and it is extremely important to prevent moisture entering the system, and to remove moisture which may have entered the system through a leak or open connection.

Vacuum pump must be used for evacuation.

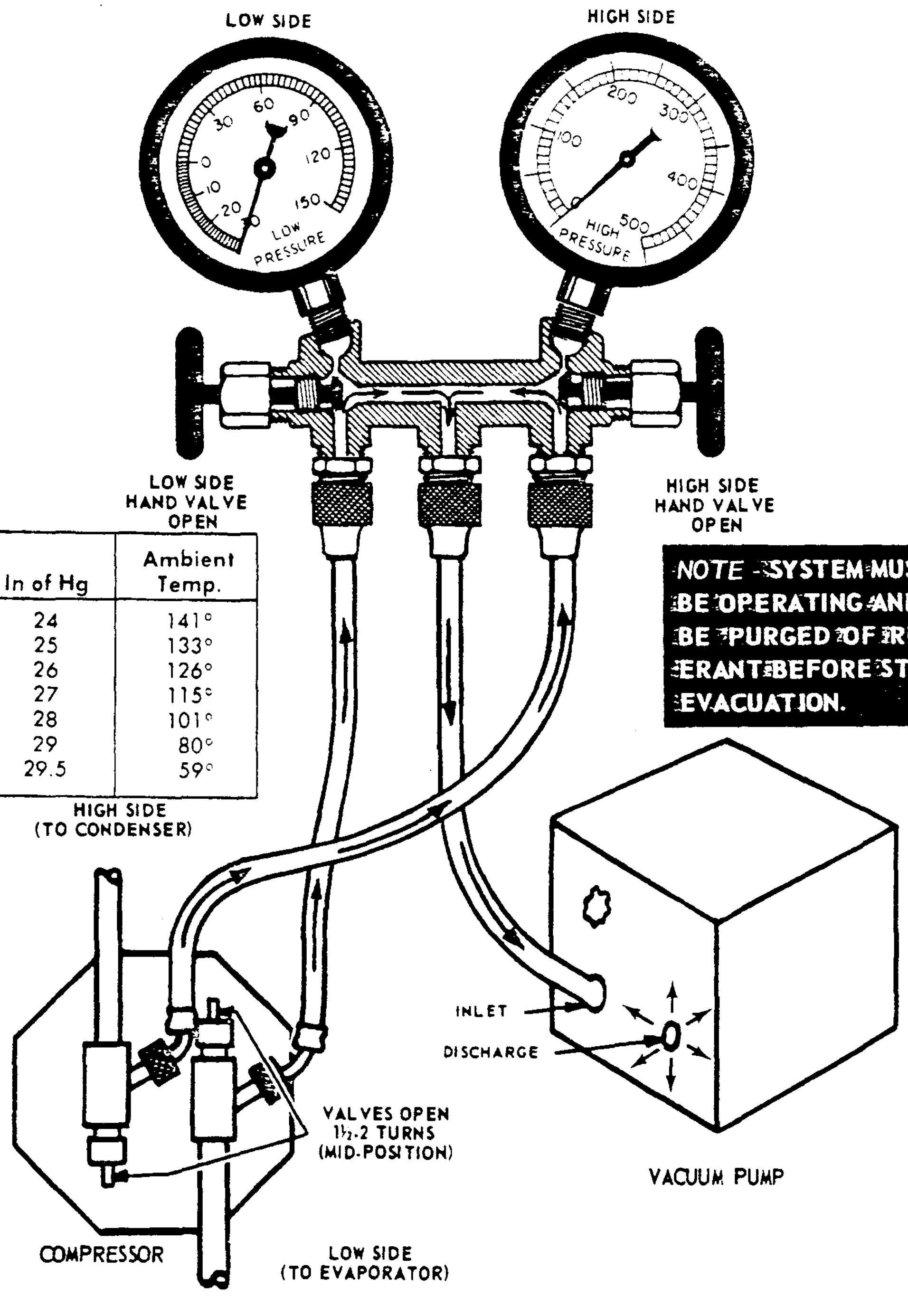
Unwanted air and moisture are removed from the system by controlling the pressure; however, instead of adding pressure, we remove pressure or **evacuate** the system. A vacuum pump is the only piece of equipment designed to lower the pressure sufficiently so that the moisture boiling temperature is reduced to a point where the water will vaporize and can then be evacuated from the system.

Water boils at 212°F, at 14.7 psi (sea level). As the vacuum pump lowers the pressure of the closed air conditioning system, the boiling point of the moisture in the system will also be lowered. In evacuating the system, it is necessary to lower the boiling point of any moisture in the system to a point lower than the ambient temperature to ensure that all moisture is boiled off. At an ambient temperature of 75°F., when the desired vacuum of 29.5 inches of Hg. is reached, water will boil at approximately 72°F and a complete boiling off of all moisture in the system is assured when this vacuum reading has been reached.

Altitude affects vacuum gauge readings.

At altitudes higher than sea level, it will not be possible to obtain a vacuum reading of 29.5 inches of Hg. on the low side compound gauge. For each 1000 feet of altitude, the vacuum gauge must be corrected by 1 inch of Hg. to compensate for a change in atmospheric pressure. For example, at altitudes between 950 and 1,050 feet, a gauge reading of 28.5 inches of Hg. will be the same as a gauge reading of 29.5" of Hg. at sea level. When this vacuum is reached, approximately 30 minutes should be allowed in evacuating the system to ensure complete moisture removal.

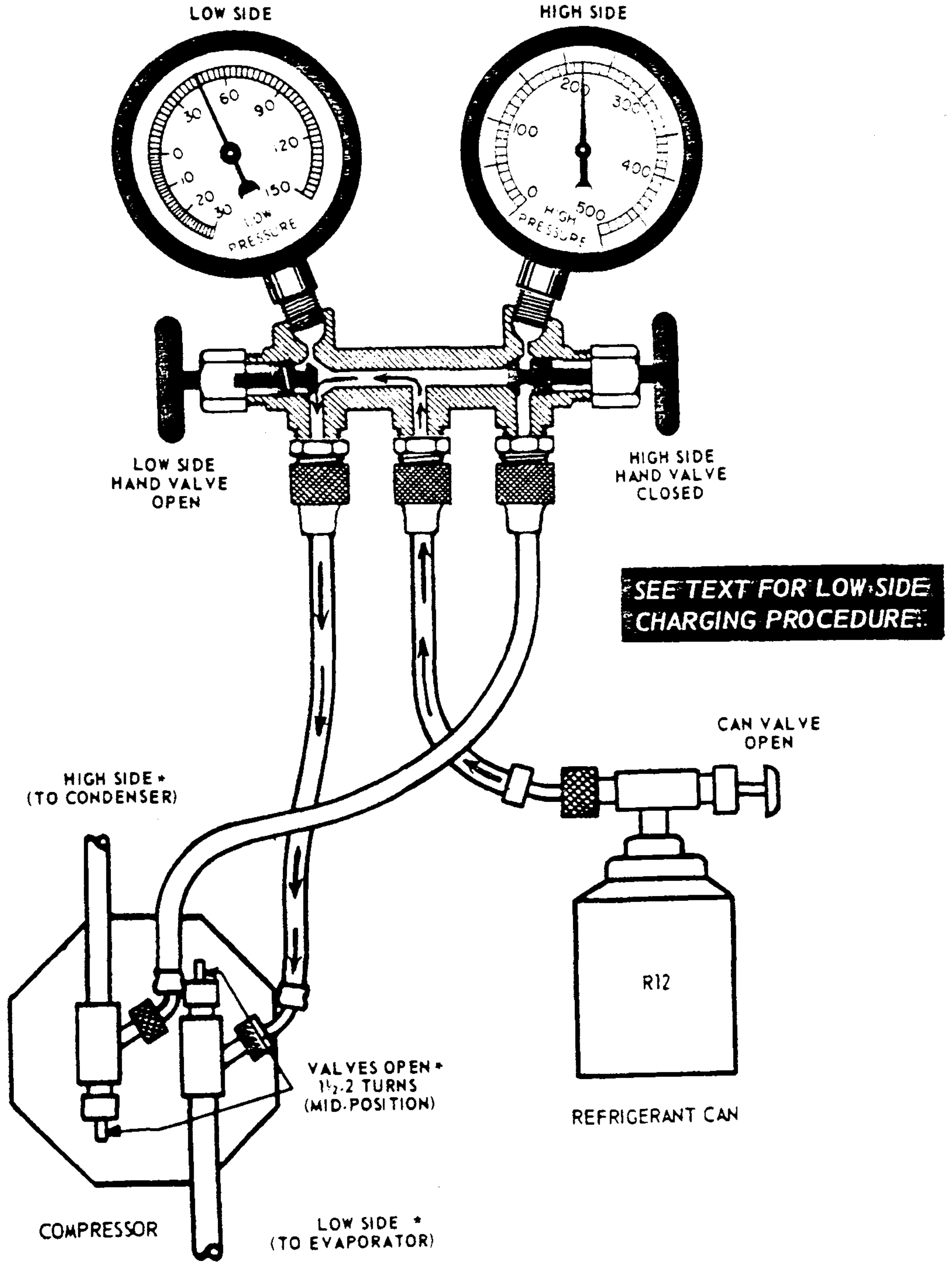
EVACUATING THE SYSTEM



In of Hg	Ambient Temp.
24	141°
25	133°
26	126°
27	115°
28	101°
29	80°
29.5	59°

NOTE - SYSTEM MUST NOT BE OPERATING AND MUST BE PURGED OF REFRIGERANT BEFORE STARTING EVACUATION.

CHARGING THE SYSTEM (COMPLETE CHARGE)



DIAGNOSIS OF A/C SYSTEM

In most instances, when a vehicle is brought in for air conditioning service work, the complaint will be "Lack of Cooling" or "Insufficient Cooling". The first problem will be to determine why the air conditioner is not operating at normal efficiency.

The conditions summarized on the following pages cover the common causes of the air conditioner failure to cool the vehicle satisfactorily. A corrective procedure is detailed for each condition.

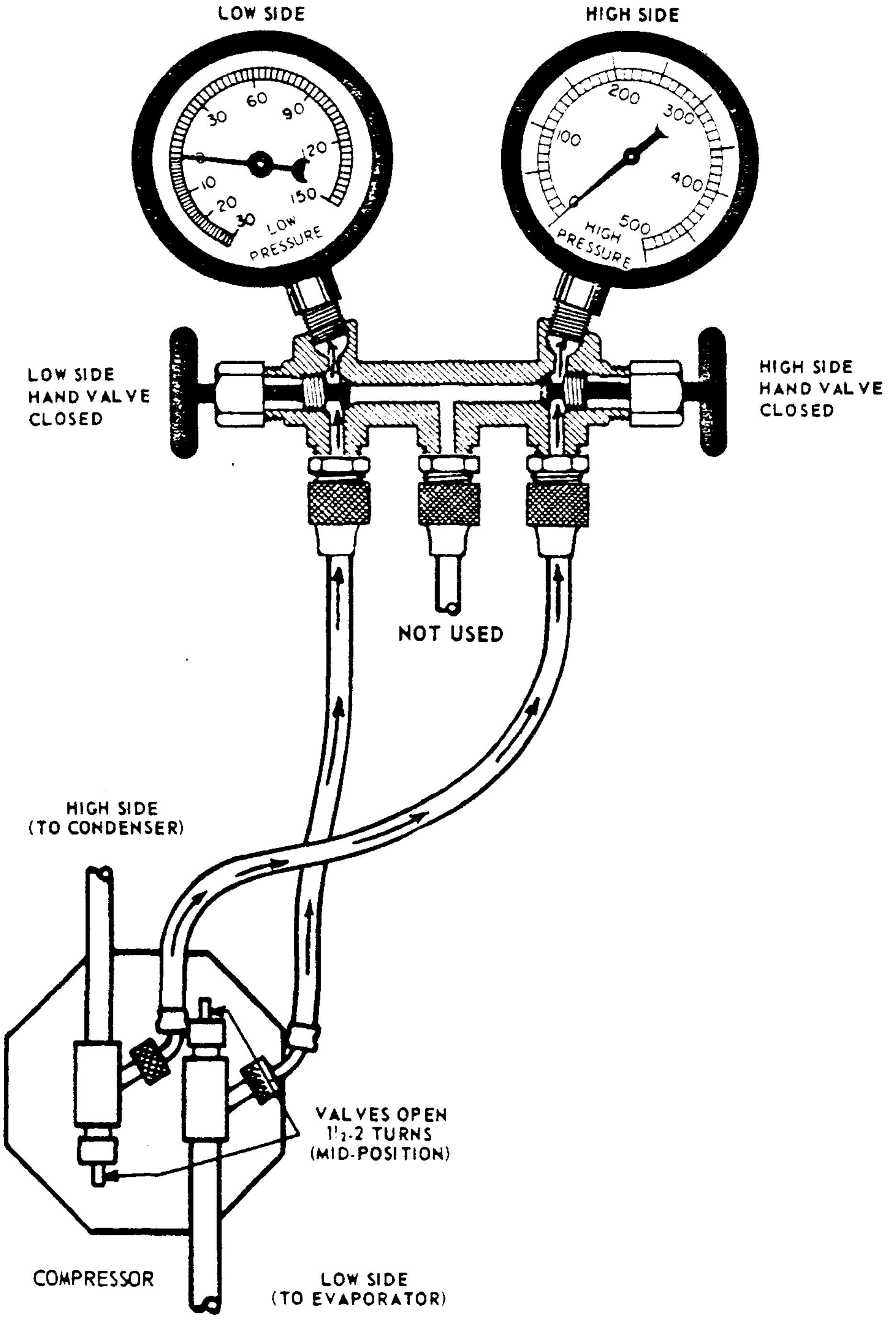
Perform the following diagnostic procedure to determine the conditions applying to each particular case.

DIAGNOSIS PROCEDURE

1. Connect the gauge manifold set to the high and low side connections at the compressor.
2. Operate air conditioner to stabilize system and perform an operating test.
3. Note gauge readings and other indications as listed under "Conditions". Refer to "Pressure-Temperature Relationship" chart if ambient temperature is not the same as that listed. NOTE: "Shaded" section of chart indicates normal operating range (see page N4-3).
4. Note trouble as listed under complaint and make any additional tests indicated.
5. Perform all corrective procedures indicated under "Correction".

EVACUATING THE SYSTEM

GAUGE SET CONNECTIONS FOR TESTING



DIAGNOSIS OF A/C SYSTEM

PRESSURE-TEMPERATURE RELATIONSHIP

NOTE: Pressures shown are subject to specific conditions (see Test Conditions below), and are not necessarily true for every vehicle checked.

Ambient Temperature is given as the temperature of the air surrounding the condenser, and is taken 2" in front of the condenser.

LOW PRESSURE GAUGE READING	EVAPORATOR TEMPERATURE F°
10	2
12	6
14	10
16	14
18	18
20	20
22	22
24	24
26	27
28	29
30	32
35	36
40	42
45	48
50	53
55	58
60	62
65	66
70	70

AMBIENT TEMPERATURE °F	HIGH PRESSURE GAUGE READING
60	95-115
65	105-125
70	115-135
75	130-150
80	150 - 170
85	165 - 185
90	175 - 195
95	185 - 205
100	210 - 230
105	230 - 250
110	250 - 270
115	265-285
120	280-310

TEST CONDITIONS:

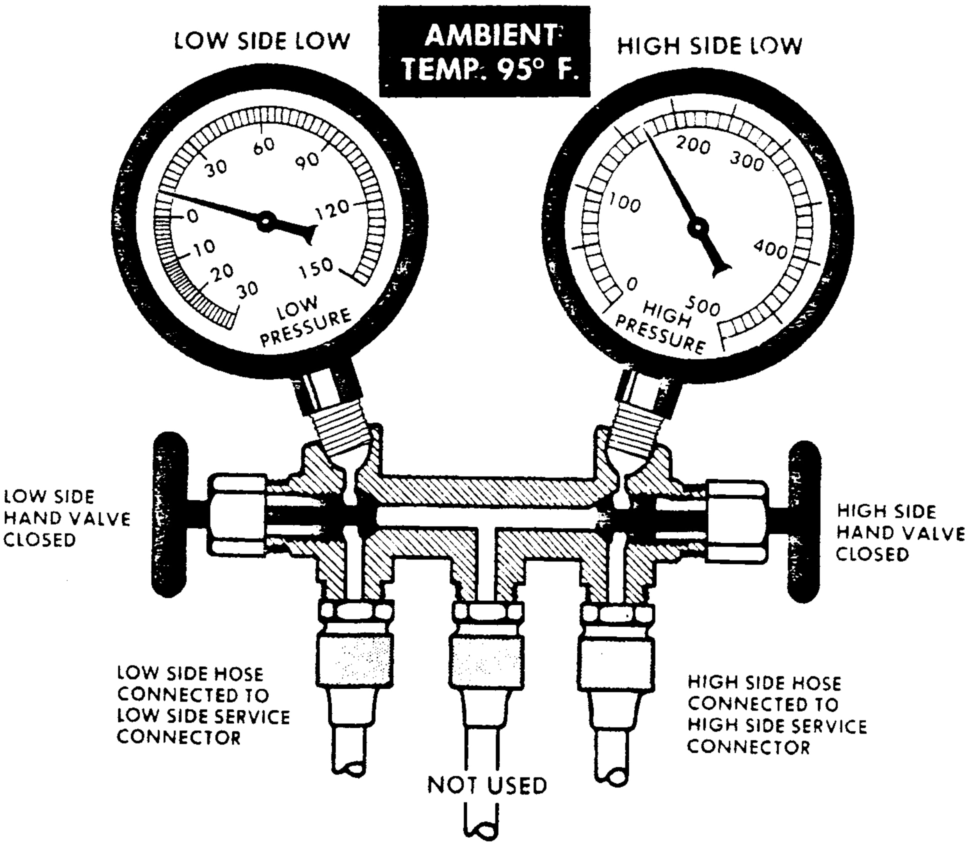
1. Use large fan to subsitute normal ram air flow through condenser.
2. Engine adjusted to normal fast idle speed.
3. System fully charged.
4. All conditions equivalent to vehicle operation at 30 MPH.

Normal operating ranges shown by shaded areas.

DIAGNOSIS OF A/C SYSTEM

CONDITION 1

REFRIGERANT SLIGHTLY LOW



Complaint

Little or no cooling.

Condition

1. Low side gauge reading too low. Should be 15-30 psi.
2. High side gauge reading too low. Should be 185-205 psi ambient temperature of 95°F. See Chart for pressures at other ambient temperatures.
3. Stream of bubbles visible in sight glass.
4. Discharge air from evaporator only slightly cool.

Diagnosis

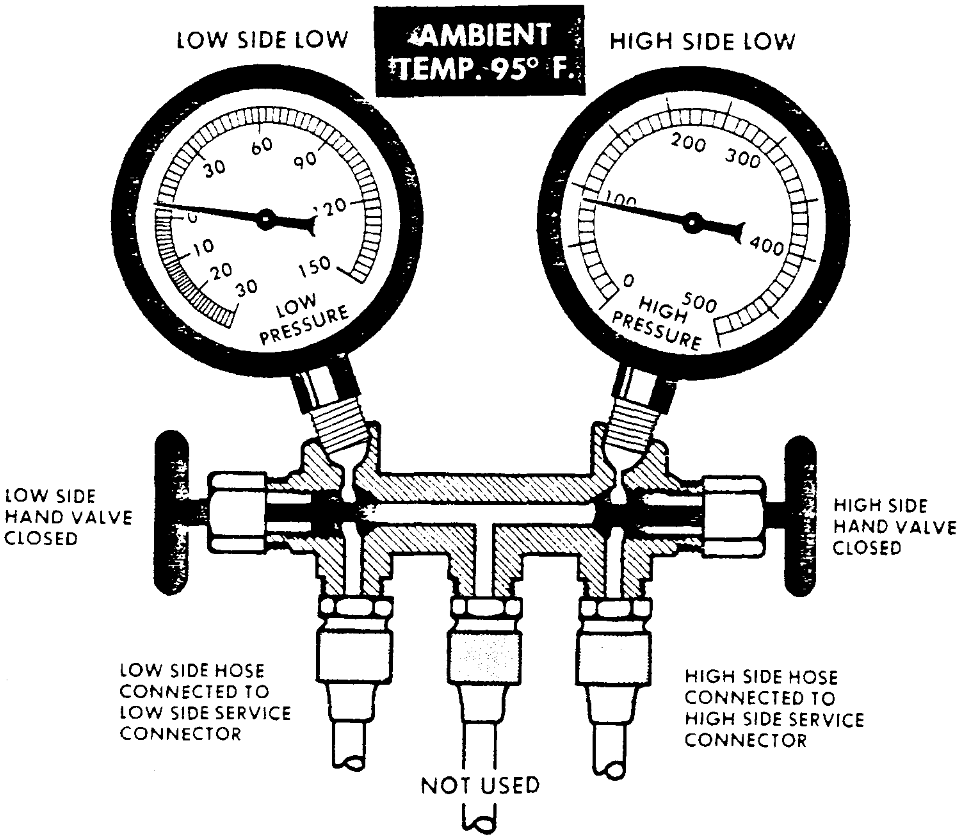
System low on refrigerant. May be caused by small leak.

Correction

1. Leak test system.
2. Discharge refrigerant from system if necessary to replace units or lines.
3. Repair leaks.
4. Check compressor oil level. System may have lost oil due to leakage.
5. Evacuate system using vacuum pump.
6. Charge system with NEW Refrigerant-12.
7. Operate system and check performance.

CONDITION 2

REFRIGERANT EXCESSIVELY LOW



Complaint

Cooling is not adequate

Condition

1. Low side gauge reading very low. Should be 15-30 psi.
2. High side gauge reading very low. Should be 185-205 psi at ambient temperature of 95°F. See chart for pressures at other ambient temperature.
3. No liquid and no bubbles visible in sight glass.
4. Discharge air from evaporator is warm.

Diagnosis

System excessively low on refrigerant. Serious leak indicated.

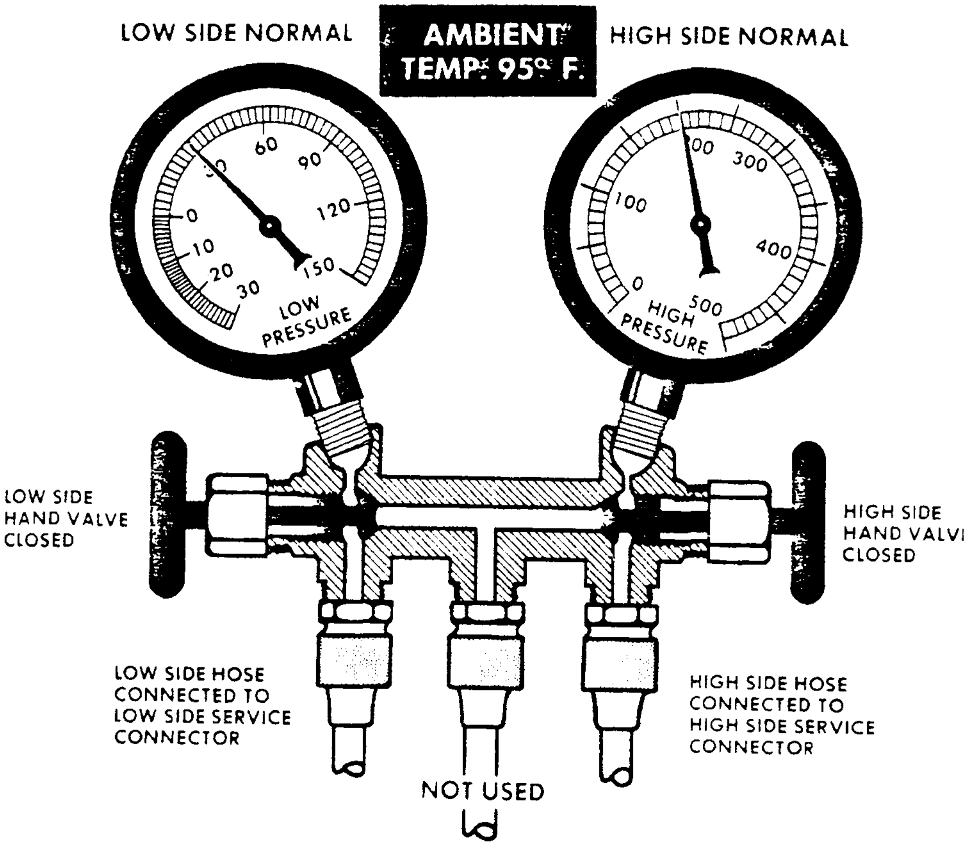
Correction

1. Leak test system.
   NOTE: Add partial refrigerant charge before leak testing to ensure a leak test indication. a). Leak test compressor seal area very carefully. b). On cars with suction throttling valve, valve diaphragm may be leaking.
2. Discharge refrigerant from system.
3. Repair leaks.
4. Check compressor oil level. System may have lost oil due to leakage.
5. Evacuate system using vacuum pump.
6. Charge system with NEW Refrigerant-12.
7. Operate system and check performance.

DIAGNOSIS OF A/C SYSTEM

CONDITION 3

AIR IN SYSTEM



Complaint

Cooling is not adequate

Condition

1. Low side gauge reading is constant and does not drop. Pressure should drop until compressor cycles (thermostat control) or should indicate modulation (suction control).
2. High side gauge reading slightly high (or slightly lower especially if large fan used to substitute ram air). High side gauge reading should be 185-205 psi at ambient temperature of 95°F. See chart for pressures at other ambient temperatures.
3. Sight glass free of bubbles or shows only occasional bubble.
4. Discharge air from evaporator only slightly cool.

Diagnosis

Non-condensables present in system. Air or moisture present instead of full refrigerant charge.

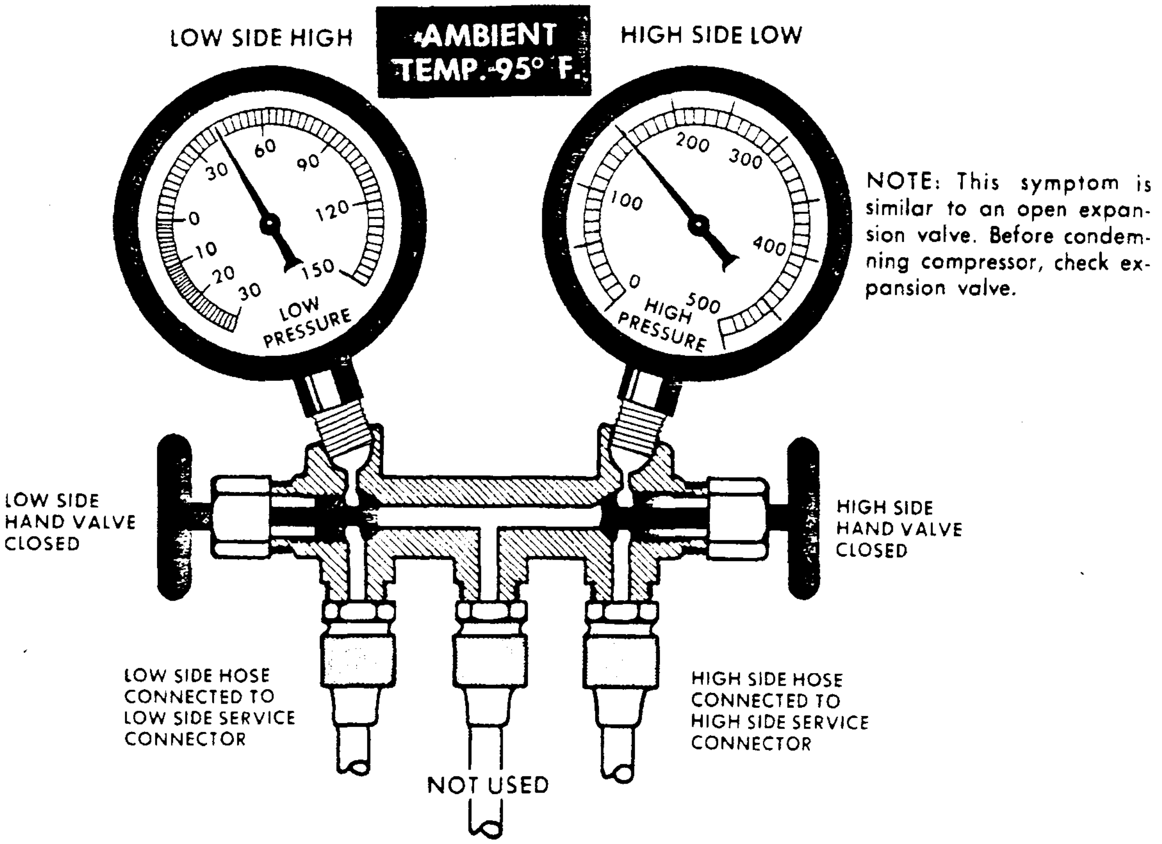
Correction

1. Leak test system.
   a. Leak test compressor seal area very carefully.
2. Discharge refrigerant from system.
3. Repair leaks as located.
4. Replace Receiver-Drier. Drier probably saturated with moisture.
5. Check compressor oil level.
6. Evacuate system using a vacuum pump, with particular attention to moisture removal from system.
7. Charge system with NEW Refrigerant-12.
8. Operate system and check performance.

DIAGNOSIS OF A/C SYSTEM

CONDITION 4

COMPRESSOR MALFUNCTION



Complaint

Cooling is not adequate.

Condition

1. Low side gauge reading too high. Should be 15-30 psi.
2. High side gauge reading too low. Should be 185-205 psi at temperature of 95°F. See Chart for pressures at other ambient temperatures.
3. Sight glass free of bubbles (system is fully charged).
4. Discharge air from evaporator not sufficiently cool.

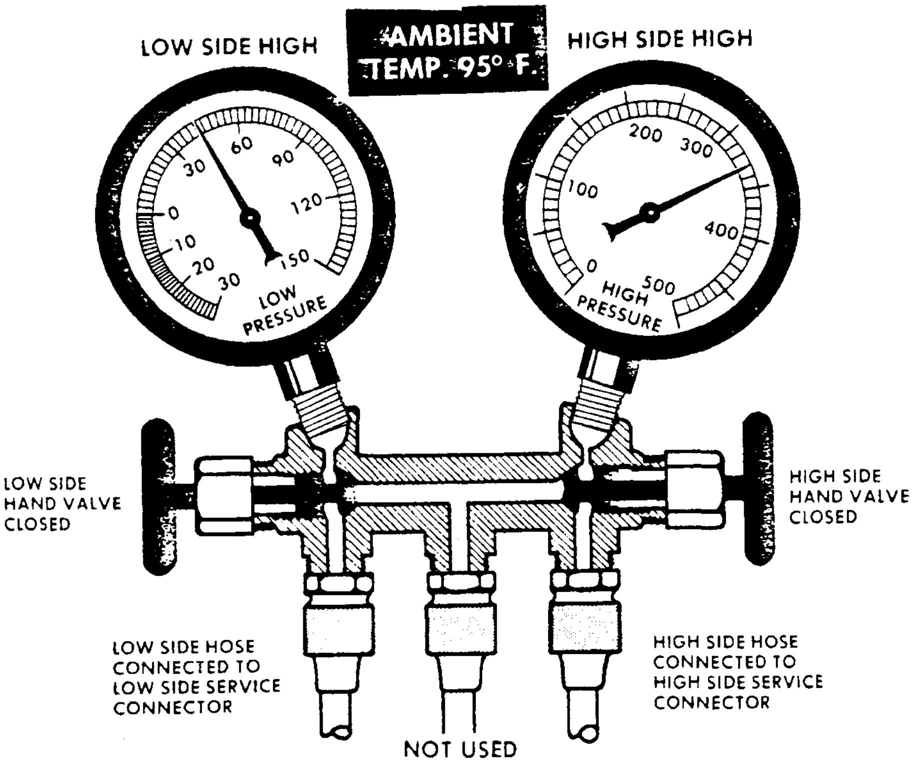
Diagnosis

Internal leak in compressor. Reed valves or head gasket leaking. Compressor pistons, rings, or cylinders excessively worn or scored.

Correction

1. Isolate compressor (systems with high and low side service valves) or discharge system (systems without service valves).
2. Remove compressor cylinder head and inspect compressor.
   a. replace reed valve plate assembly if necessary.
   b. install cylinder head using NEW gasket.
3. Check compressor oil level.
4. Replace Receiver-Drier if:
   a. System previously opened.
   b. System operated two or more seasons with present unit.
   c. Compressor inspection reveals desiccant particles (very fine golden or brown particles).
5. Evacuate compressor or evacuate system (if completely discharged) using vacuum pump.
6. Charge system with NEW Refrigerant-12.
7. Operate system and check performance.

CONDITION 5
CONDENSER MALFUNCTION OR SYSTEM OVERCHARGE



Complaint

Little or no cooling. Engine overheating may also be noted.

Condition

1. Low side gauge reading excessively high. Should be 15-30 psi.
2. High side gauge reading excessively high. Should be 185-205 psi at 95°F. See chart for pressures at other ambient temperatures.
3. Bubbles may appear occasionally in sight glass. Liquid line very hot.
4. Discharge air from evaporator is warm.

Diagnosis

Improper condenser operation with lack of cooling caused by excessive high side pressure. System may have either normal charge or overcharge of refrigerant.

Correction

1. Check for loose or worn drive belts causing excessive compressor head pressures.
2. Inspect condenser for clogged air passages, bug screen, or other obstructions preventing air flow through condenser.
3. Inspect condenser mounting for proper radiator clearance.
4. Inspect clutch type fan for proper operation.
5. Inspect radiator pressure cap for correct type and proper operation.

After making above corrections:

1. Operate system and check performance.

If condition not corrected:

1. Inspect system for overcharge of refrigerant and correct as follows:
   a. Discharge refrigerant until stream of bubbles appears in sight glass and both high and low gauge readings drop below normal.
   b. Add new Refrigerant-12 until bubbles disappear and pressures are normal, then add 1/4-1/2 lb. more refrigerant.
2. Operate system and check performance.

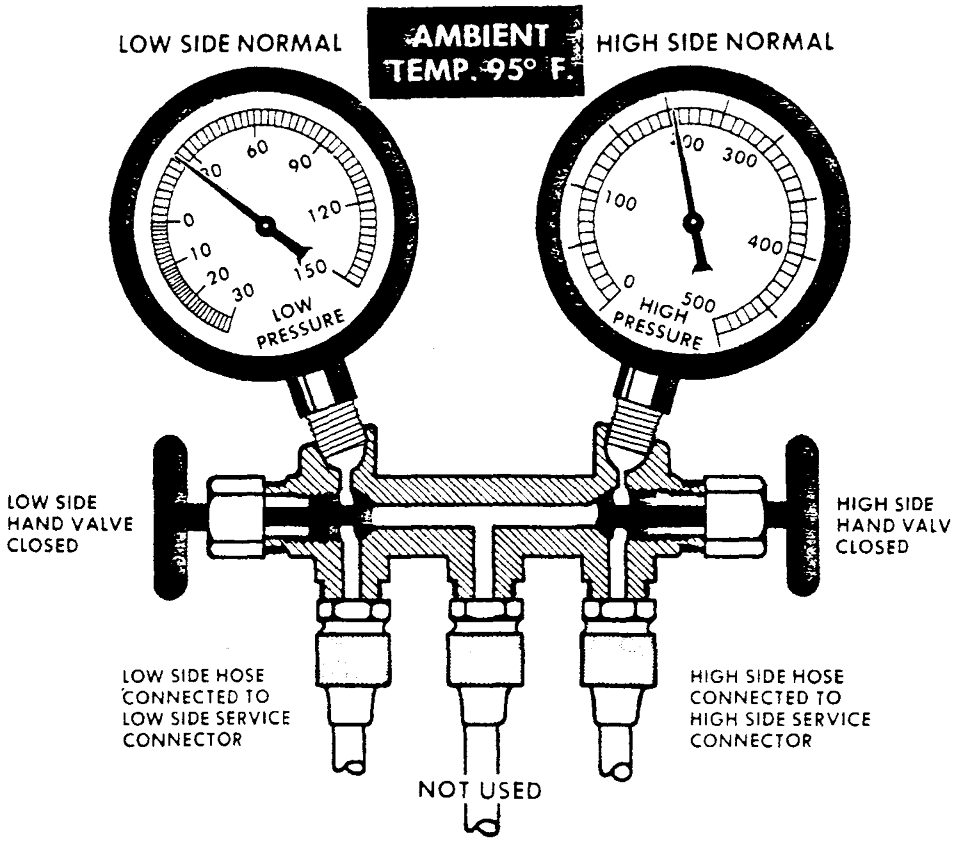
If gauge readings still too high:

1. Discharge system.
2. Remove and inspect condenser for oil clogging.
3. Replace Receiver-Drier.
4. Evacuate system using vacuum pump.
5. Charge system with NEW Refrigerant-12.
6. Operate system and check performance.

DIAGNOSIS OF A/C SYSTEM

CONDITION 6

MOISTURE IN SYSTEM



Complaint

Cooling is not adequate

NOTE : Cooling may be satisfactory during early morning or late evening hours but is not adequate during hot part of the day.

Condition

1. Low side gauge reading normal (15-30 psi) but may drop into vacuum during testing.
2. High side gauge reading normal (205 psi at 95°F) but will drop when low side gauge reading drops into vacuum. See chart for high side gauge reading at other ambient temperatures.
3. Sight glass may show tiny bubbles.
4. Discharge air from evaporator is sharp and cold but becomes warm when low side gauge reading drops into a vacuum.

Diagnosis

Excessive moisture in system. Desiccant agent saturated with moisture which is released during high ambient temperatures. Moisture collects and freezes in expansion valve and stops refrigerant flow.

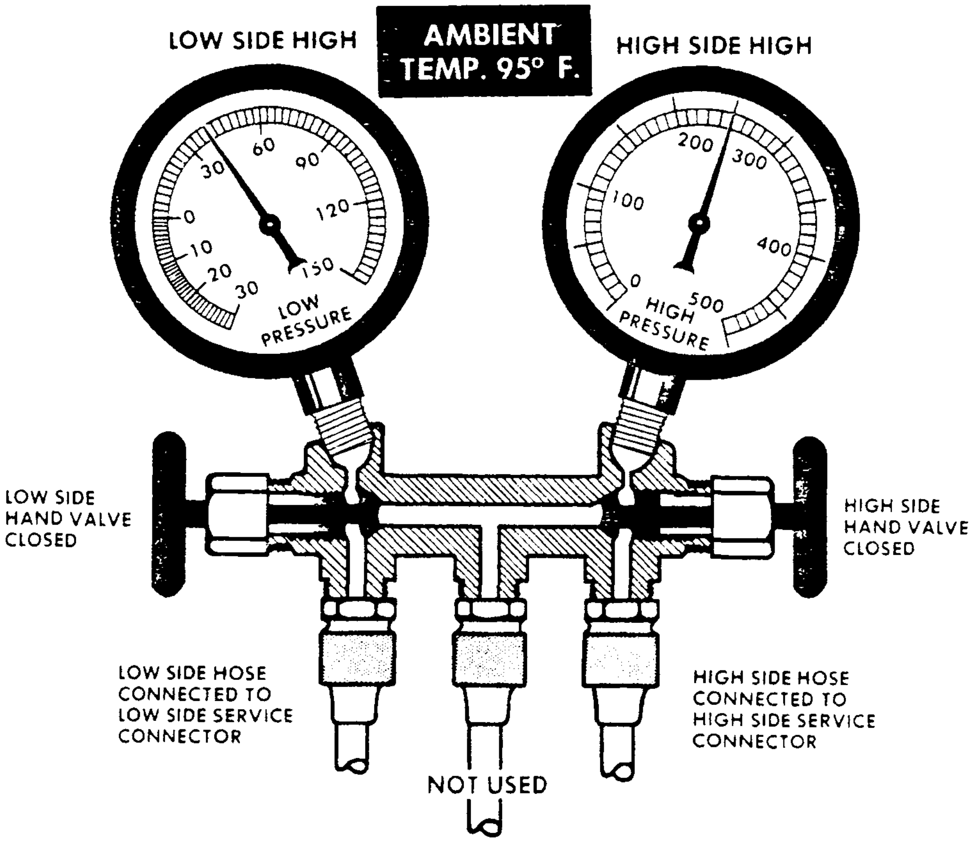
Correction

1. Discharge refrigerant from system.
2. Replace Receiver-Drier.
3. Evacuate system with vacuum pump.
4. Charge system with NEW Refrigerant-12.
5. Operate system and check performance.

DIAGNOSIS OF A/C SYSTEM

CONDITION 7

LARGE AMOUNT OF AIR IN SYSTEM



Complaint

Little or no cooling

Condition

1. Low side gauge reading too high. Should be 15-30 psi.
2. High side gauge reading too high. Should be 185-205 psi at ambient temperature of 95°F. See chart for pressures at other ambient temperatures.
3. Occasional bubbles evident in sight glass.
4. Discharge air from evaporator is not cool.

Diagnosis

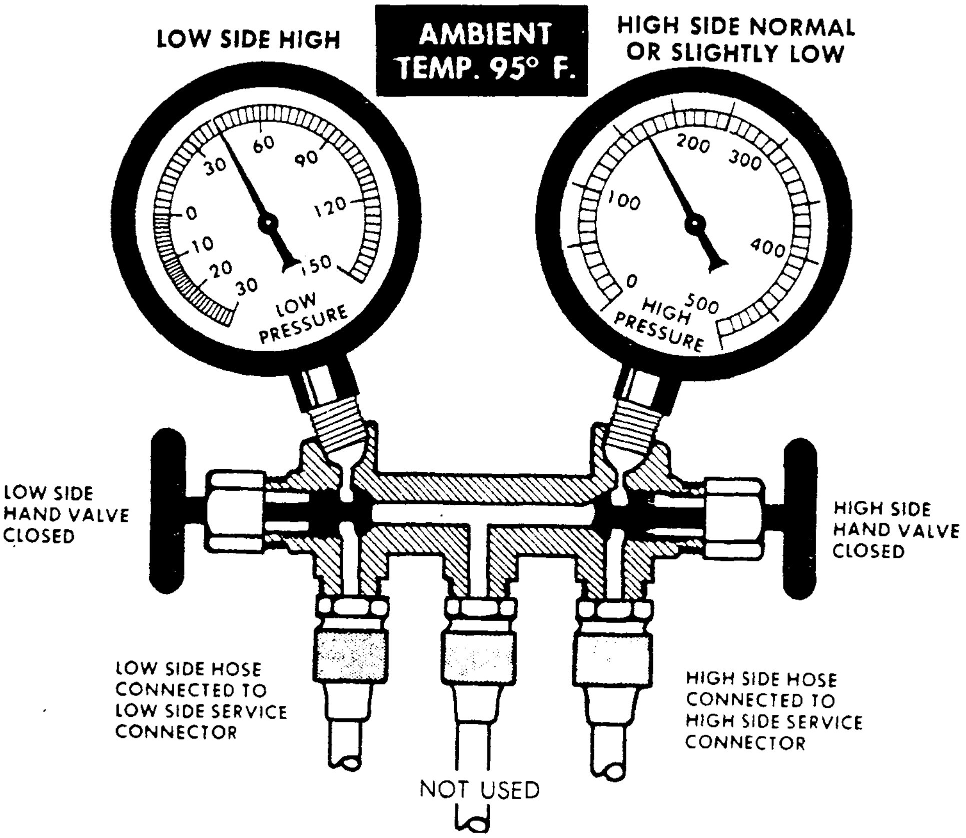
Air in system. Refrigerant contaminated by non-condensables (air and/or moisture).

Correction

1. Discharge refrigerant from system.
2. Replace Receiver-Drier which may be saturated with moisture.
3. Evacuate system using vacuum pump.
4. Charge system with NEW Refrigerant-12.
5. Operate system and check performance.

DIAGNOSIS OF A/C SYSTEM

CONDITION 8
THERMOSTATIC EXPANSION VALVE MALFUNCTION
(VALVE STUCK OPEN)



Complaint

Little or no cooling.

Condition
1. Low side gauge reading too high. Should be 15-30 psi.
2. High side gauge reading normal or slightly low. Should be 185-205 psi at an ambient temperature of 95°F. See chart for pressures at other ambient temperatures.
3. Discharge air from evaporator warm.
4. Suction hose and evaporator show heavy sweating.

Diagnosis
Expansion valve allowing excessive flow of refrigerant through evaporator causing flooding of evaporator coils.

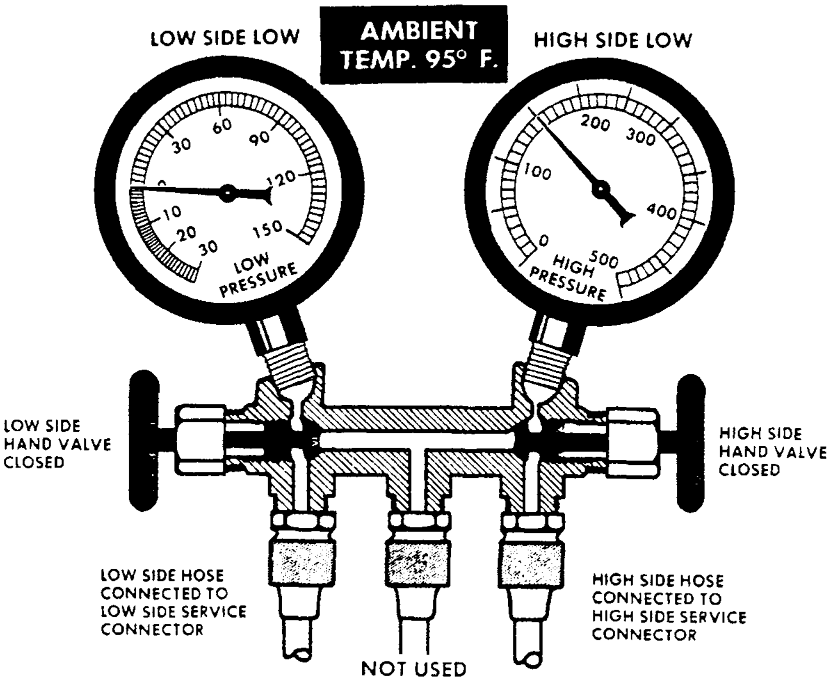
Testing
1. Check for expansion valve stuck open or incorrect mounting of temperature sensing bulb as follows:
   a.) Set air conditioner for maximum cooling and operate the system.
   b.) Spray liquid Refrigerant-12 on head of valve or capillary bulb; note low side gauge reading. Low side gauge should drop into a vacuum.
   c.) If low side vacuum reading obtained, warm expansion valve diaphragm chamber with hand, then repeat test (Step "b").

Correction
1. If expansion valve test indicates valve operation is satisfactory, proceed as follows:
   a.) Clean contact surface of evaporator outlet pipe and temperature sensing bulb, clamp bulb securely in contact with pipe.
   b.) Operate system and check performance.
2. If expansion valve test indicates valve is defective, proceed as follows:
   a.) Discharge system
   b.) Replace expansion valve
   c.) Evacuate system using vacuum pump.
   d.) Charge system with New Refrigerant-12.
   e.) Operate system and check performance.

DIAGNOSIS OF A/C SYSTEM

CONDITION 9

THERMOSTATIC EXPANSION VALVE MALFUNCTION (VALVE STUCK CLOSED)



Complaint

Cooling is not adequate.

Condition

1. Low side gauge reading too low (0 psi or a vacuum). Should be 15-30 psi.
2. High side gauge reading too low. Should be 185-205 psi at ambient temperature of 95°F. See chart for pressures at other ambient temperatures.
3. Discharge air from evaporator only slightly cool.
4. Expansion valve inlet may show heavy sweating or frost.

Diagnosis

Expansion valve restricting refrigerant flow due to clogged screen, stuck valve, or temperature sensing bulb having lost its charge.

Testing

1. If expansion valve inlet is cool to touch, proceed as follows:
   a.) Set air conditioner for maximum cooling and operate the system.
   b.) Spray liquid Refrigerant-12 on head of valve or capillary bulb, note low side gauge reading. Low side gauge should drop into a vacuum.
   c.) If low side vacuum reading obtained, warm expansion valve diaphragm chamber with hand, then repeat test (Step "b").
   d.) If expansion valve test indicates valve operation is satisfactory, clean contact surface of evaporator outlet pipe and temperature sensing bulb, clamp bulb securely in contact with pipe. Proceed with correction procedure (below).
2. If expansion valve inlet shows sweating or frost proceed as follows:
   a.) Discharge system.
   b.) Disconnect inlet line at expansion valve, remove and inspect screen.
   c.) Clean and replace screen, reconnect inlet line.
   d.) Proceed with correction procedure (below).
3. If expansions valve test (step "1" preceding) indicates valve is defective, proceed as follows:
   a.) Discharge system.
   b.) Replace expansion valve, then proceed with correction procedure (below).

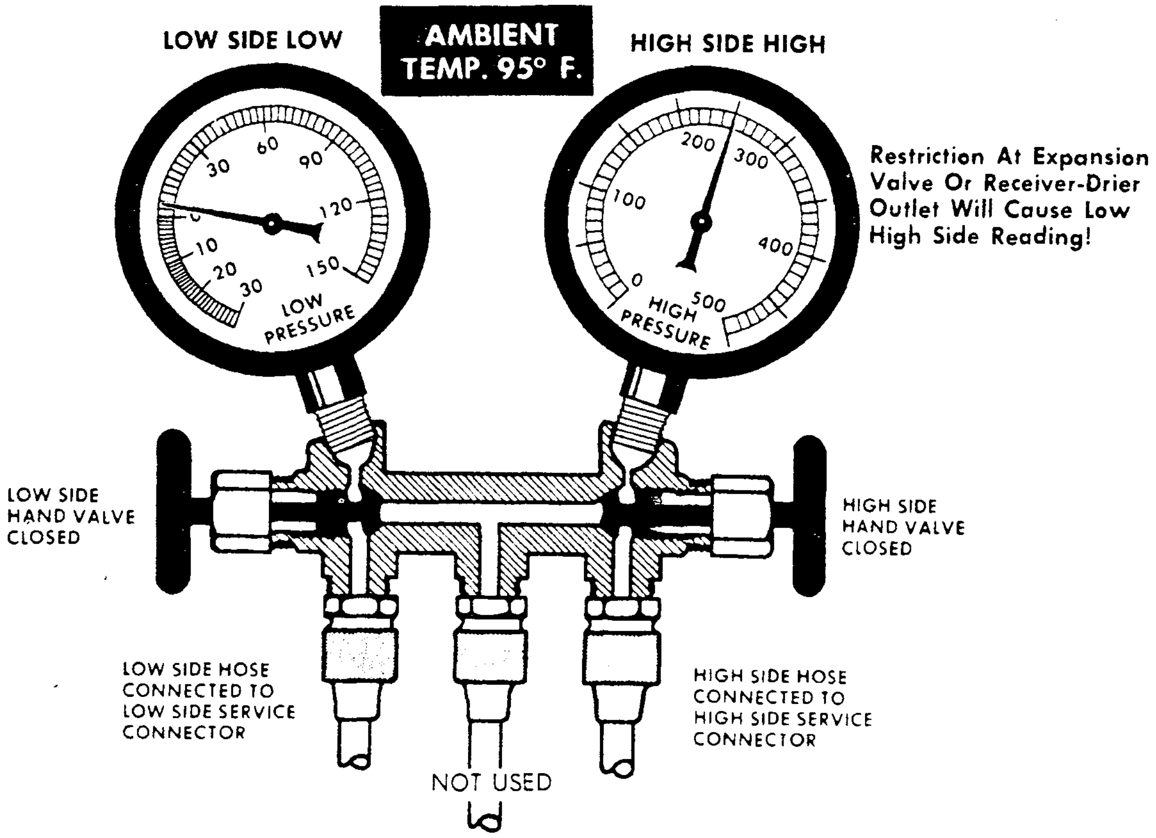
Correction

1. After cleaning expansion valve screen, or replacing expansion valve if necessary, and properly mounting temperature sensing bulb on evaporator outlet pipe, proceed as follows:
   a.) Evacuate system using vacuum pump.
   b.) Charge system with NEW Refrigerant-12.
   c.) Operate system and check performance.

DIAGNOSIS OF A/C SYSTEM

CONDITION 10

RESTRICTION IN HIGH SIDE



Complaint

Cooling is not adequate

Condition

1. Low side gauge reading too low. Should be 15-30 psi.
2. High side gauge reading will build excessively high. Should be 185-205 psi at an ambient temperature of 95°F. See chart for pressures at other ambient temperatures.
   NOTE: An overcharged system, or a Condenser or Receiver-Drier that is too small, will cause high side gauge reading to be normal or excessively high.
3. Discharge air from evaporator only slightly cool.
4. Liquid line cool to the touch; line or Receiver-Drier may show heavy sweating or frost.

Discharge

Restriction in Receiver-Drier or liquid line with compressor removing refrigerant from evaporator faster than it can enter resulting in a "starved" evaporator.

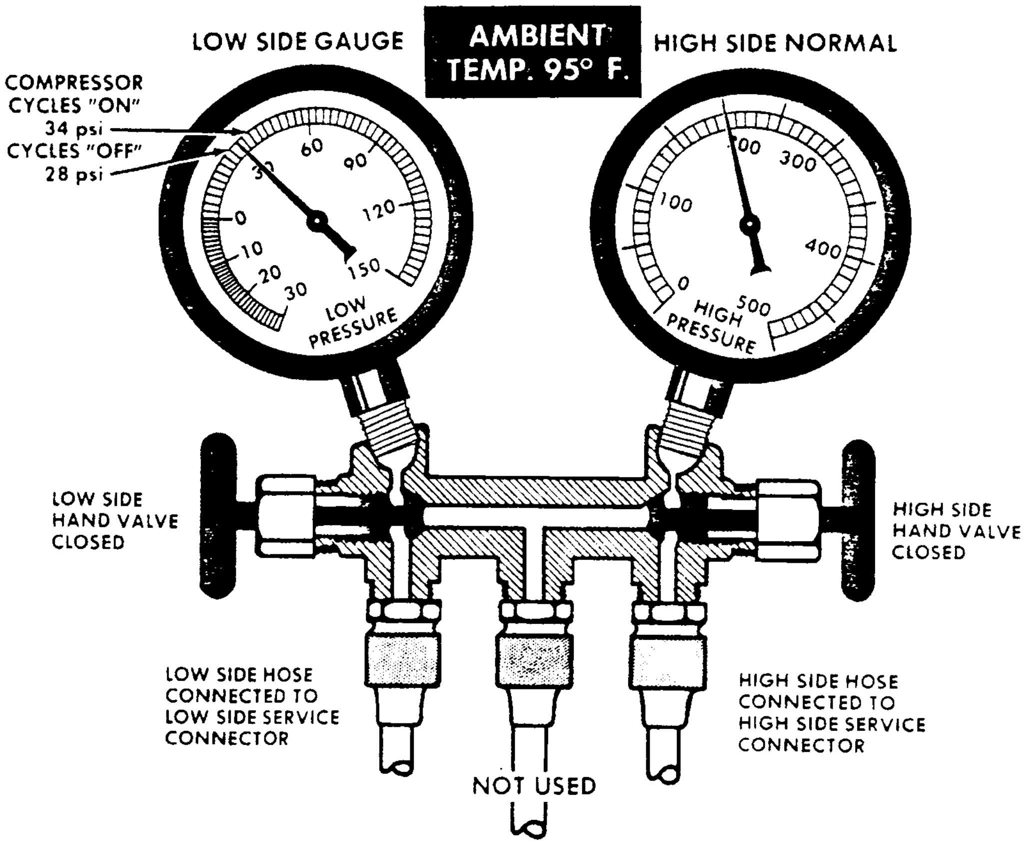
Correction

1. Discharge system.
2. Remove and replace Receiver-Drier, liquid lines, or other defective parts.
3. Evacuate system using vacuum pump.
4. Charge system with NEW Refrigerant 12.
5. Operate system and check performance.

DIAGNOSIS OF A/C SYSTEM

CONDITION 11

DEFECTIVE THERMOSTATIC SWITCH



Complaint

Compressor cycles (cuts in and out) too rapidly.

Condition

1. Low side pressure cycle too high with insufficient range between OFF and ON. Cycle should be:

   Cycle "Off" - 12-15 psi.
   Cycle "On" - 36-39 psi.
   Cycle Range - 24-28 psi.

2. High side gauge reading Normal (200 psi). Should be 185-205 psi at ambient temperature of 95°F. See chart for pressures at other ambient temperatures.

Diagnosis

Thermostatic switch defective.

Correction

1. Stop engine and turn air conditioner OFF.
2. Remove and discard old thermostatic switch, install new switch of same type.
3. When installing new Thermostatic Switch, make certain the capillary tube is installed in same position and to same depth in evaporator core as old switch tube.

CAUTION

Do not kink or bend capillary tube sharply (tube is gas filled).

4. Operate system and check performance of new thermostatic switch.

SECTION "O"
DANA ELECTRONIC SPEED CONTROL (CRUISE)

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VEHICLES WITH AUTOMATIC TRANSMISSION OPERATING INSTRUCTIONS

In the regulator box of your Speed Control is a safety switch which will not let the system operate until your vehicle is moving above a pre-selected low speed. At the factory this "low speed switch" is set to close between 27 and 33 mph; it should, however, be checked during the Road Test.

The **Control Switch** is the switch you use to operate all features of the system described in the following paragraphs. It is installed near the turn signal lever.

Set Speed - On the control switch, move the slide button to the ON position and drive at any speed above 32 mph at which you want automatic control. Hold that speed with your foot while you press and release the SET/COAST button. One second after release, take your foot off the accelerator pedal.

You can increase speed at any time with the accelerator pedal. When you release the pedal, you will return to the set speed.

Acceleration - Hold the slide button in the RESUME/ACCEL position and your vehicle will accelerate until you release it, then your vehicle will slow to your set speed and again control there.

If you want to make the higher speed your new set speed, release the slide button when you reach the speed you want, and as you do, quickly press and release the SET/COAST button. Remember, you set speed as you release the button - Not when you press it.

COAST - When you press and hold the SET/COAST button, you erase the set speed from the regulator's memory and allow the vehicle to coast. Just before you reach the lower speed you want, release the button and it will control there, providing it is above the low speed setting.

DISENGAGEMENT - Depress the brake pedal about an inch and you are again in control of the vehicle speed. You can also disengage the Speed Control by pushing the slide button to OFF, but this erases the set speed from the regulator's memory.

RESUME - When you disengage the system with the brake, you do not erase the set speed from the regulator's memory, even if you come to a complete stop. To return to your chosen speed, drive to a speed above 32 mph, then move the slide button to the RESUME/ACCEL position and release it. The Speed Control will take you back to your set speed and control there.

If the rate of acceleration is faster or slower than you like, drive with the accelerator to a speed close to the set speed, then slide the button to the RESUME/ACCEL position and release it.

UNUSUAL CONDITIONS - When the regulator is adjusted right, your selected speed should be held within plus or minus 4 mph, as long as grades do not exceed 7% (most interstate highways). Since the Speed Control is vacuum operated, this speed range will widen as you drive at higher altitudes.

When you are pulling an extra heavy load, climbing a very steep hill, or bucking a severe head wind, a much wider than normal throttle opening is needed.

The way to handle these occasional problems is to bring the vehicle up to speed with the accelerator pedal - and then let the Speed Control take over again.

There is no drain on the battery when the ignition switch is off - even if the control switch is left on.

WARNING

Do not use your Speed Control on slippery roads, nor in heavy traffic.

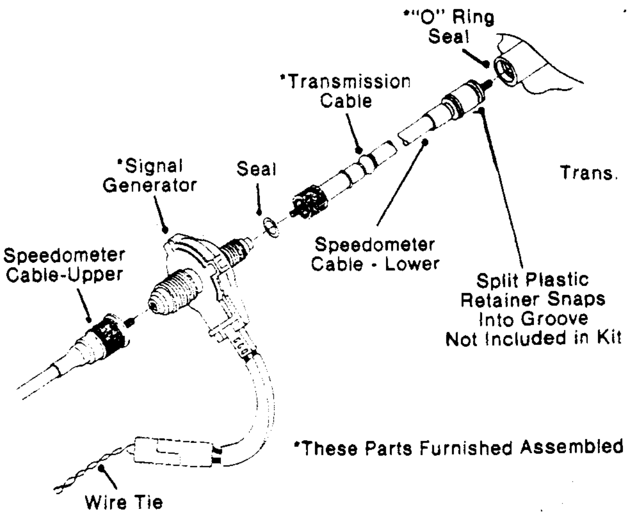
COMPONENTS

The major components of the system are:

- **Signal Generator** - attached to the speedometer cable drive adaptor at the transmission.
- **Regulator** - a computer board mounted behind the instrument panel.
- **Servo** - mounted in the engine compartment and linked to the throttle.
- **Control Switch** - on the steering column near the turn signal lever.
- **Disengagement Switch/Dump Valve Assembly** - operated by the brake pedal.

All other parts in the kit are for connecting these components to the vehicle, and to each other.

SIGNAL GENERATOR

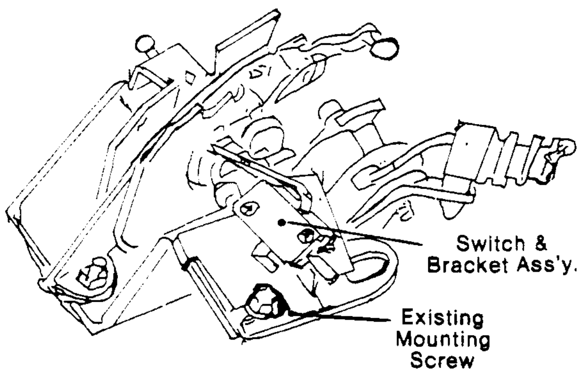


CAUTION
Be SURE all square driving members and speedometer cable are properly engaged with their mating counterparts and all cable nuts are tight. "Snap-in" type ends must be completely engaged.

AUXILIARY TRANSMISSION KICK-DOWN SWITCH

Explanation of Auxiliary Switch: When the Cruise Control is pulling on the throttle, the vehicle's existing trans. kick-down switch cannot be activated because the vehicle's throttle cable is at rest. The switch is activated when cruise cable moves to nearly full end of its travel. The throttle linkage strikes switch lever and closes the contacts of switch to activate kick-down.

A. Bracket and Micro-Switch Assembly. To install, unscrew metric hex head, screw, slip notch of bracket under lock-washer and retighten screw to hold switch bracket. (See Figure 7).

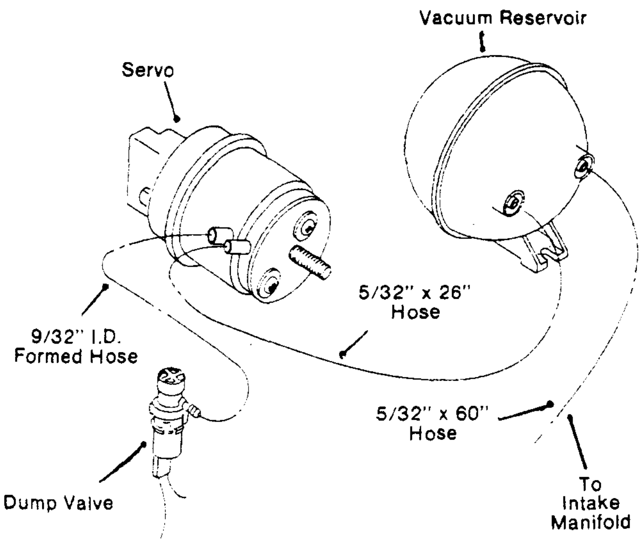


NOTE: Switch is factory adjusted, but if kick-down need be adjusted, the lever of the switch can be bent to get adjustment. After adjusting, move throttle by hand to full open to see that switch **IS NOT** acting as a stop.

COMPONENTS

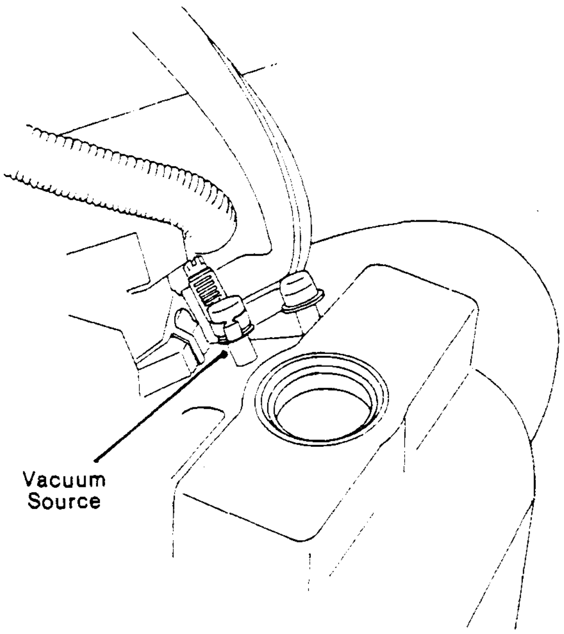
VACUUM RESERVOIR MOUNTING

The vacuum reservoir is mounted beneath battery bracket. May require removing battery and bracket to locate reservoir.

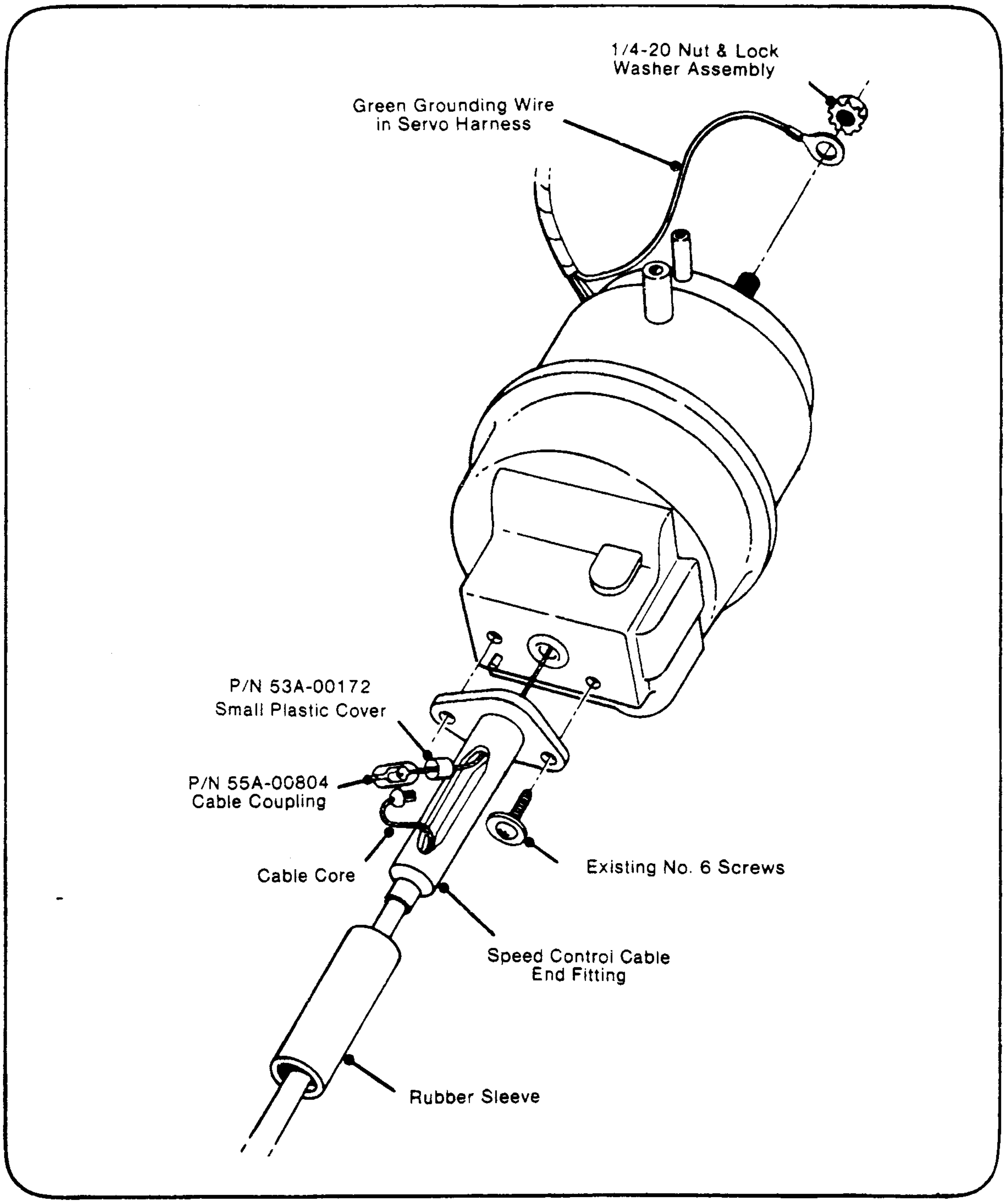


VACUUM HOSE INSTALLATION

5/32" I.D. x 60" long attaches to intake manifold. Locate nipple on top of intake manifold (left hand side of engine).

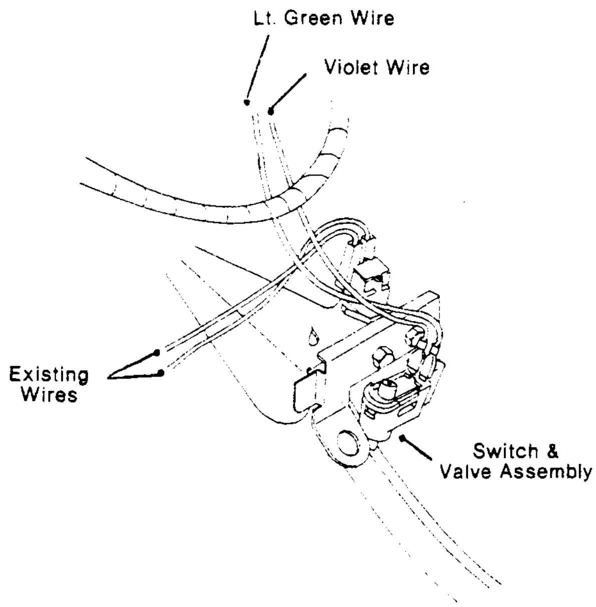


COMPONENTS



A. To remove old cable, slide rubber sleeve off cable end fitting so slots are exposed.
B. Slide small plastic cover off coupling and onto servo coupling cable. Use side cutter pliers or small screwdriver to spread coupling. Remove core end of old cable from coupling.
C. Remove and retain two No. 6 screw and washer assemblies-attaching cable end fitting to servo.
D. Thread servo coupling cable into end fitting of new Speed Control cable and out through slot. Attach cable to servo with two screw retained.
E. Put core end of cable in coupling and squeeze it closed with pliers. Slide small plastic sleeve back onto coupling.
F. From other end of cable, pull all slack from cable core and slide rubber sleeve back into place over end fitting slots.

C. Loosen No. 10 screw in slot and slide switch forward against brake arm until plunger extends 3/8" to 1/4" from switch body. Hold switch there and tighten screw. Switch must be closed. Vacuum nipple not used.



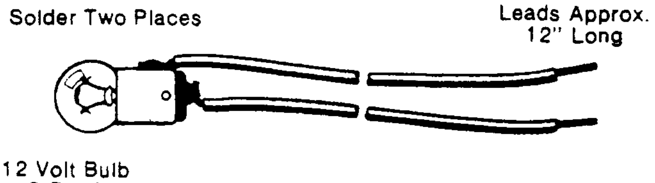
ELECTRICAL CHECK

ELECTRICAL CHECK PROCEDURE
Use a 12-volt Test Light To Perform These Checks

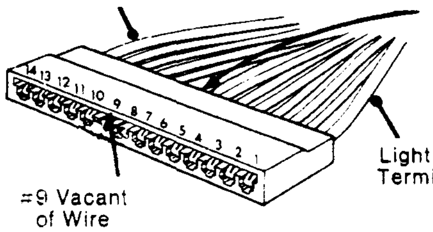
CONDITION	POSSIBLE CAUSE	REMEDY
Ignition Switch OFF. Control Switch ON. Ground one lead of test light, touch other lead to each terminal of connector individually.	Light OFF, all terminals	None, system O.K.
	Test light ON at terminals 5,7, and 14	Red fused wire connected to wrong power source. Use a "switched" power source at fuse block. Test light should be "ON" when ignition switch is "ON" and "OFF" when ignition switch is "OFF".
Ignition Switch ON. Control Switch ON. Ground one test light lead. Touch other lead to each terminal of connector individually.	Test light ON at terminals 5, 7, and 14 only	None system O.K.
	No light on any terminal	Replace fuse, if blown. Connect red wire to ignition switched power source.
Ignition switch ON. Control Switch ON. Ground one test light lead. Press and hold SET SPEED button and touch other test lead to terminal 14.	Test light OFF at terminal 14.	None, system O.K.
	Test light ON at terminal 14.	See Trouble Shooting Guide - Control Switch.
Ignition Switch ON. Control Switch ON. Ground one test light lead. Press and hold. Slide switch to RESUME while touching other lead to terminal 10 and 14 individually.	Test light ON at terminal 10 and 14.	None, system O.K.
	No light at terminal 10 and/or 14.	See Trouble Shooting Guide - Control Switch.
Ignition Switch ON. Control Switch ON. Touch one test light lead to terminal No. 5 and other lead to terminal No. 13.	Test light ON; push brake and test light goes OFF.	None, system O.K.
	Test light OFF.	Adjust disengagement switch. Plunger travel to get test light ON; OFF when brake pedal is pushed. Ground green servo wire with eyelet terminal. Check light green wire connections.

A. A test light or volt-ohmeter is needed to perform these checks. If you have neither, a test light can be made as shown.

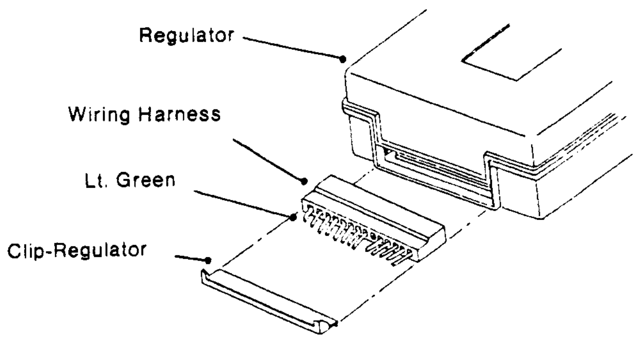
HOMEMADE TEST LIGHT



B. A Speed Control System Tester is available which will quickly indicate any problem area. The Dana part number is 250-3122. More information is given on pages O1-11 and O1-12. If attaching the connector to the tester, the dark green wire and Light No. 1 are at the same end.



C. To make this check, the 14-pin connector must be disconnected from the electronic regulator. The terminal numbers are very small and are molded on the wire side of the connector. Wire colors for the system are shown on page O1-11.



NOTE: To release wiring harness, pry up and out to release clip-regulator from regulator, pull wiring harness from regulator.

D. When electrical check is done, turn ignition off. Plug wiring harness onto regulator. Use Black Plastic Clip-Regulator to hold regulator and wiring harness together. Just push it into place to install.

PRELIMINARY OPERATION CHECK

Electronic Regulator Check

A. Set parking brake hard, put shift lever in "park" and start engine.

B. Keep one hand on ignition key and with other hand push slide button on control switch to ON position.

C. Press and hold SET/COAST button for two or three seconds, then release it. The system should NOT engage. If it does (indicated by engine racing faster than cold idle), turn off ignition switch immediately. If system passed electrical check above, and in this check, engine did not race until SET/COAST button was pressed, electronic regulator must be replaced.

Vacuum Check

D. Run engine at idle, unplug hose from small servo fitting, and put your finger over end. You should feel a strong suction. If you do, put hose back on servo fitting. If not, check hose to intake manifold or hose attachment to VAC Reservoir.

ROAD TEST

For Electrical Regulator Adjustments

NOTE: The adjustments on the Electronic Regulator (Low Speed Switch, Centering, and Sensitivity) are set nearly correct at the factory. However, the electronic regulator can be adjusted if necessary. Full adjustment range is 3/4 of a turn. DO NOT force beyond stops. A small screwdriver may be inserted through the appropriate hole to engage the adjusting slot.

WARNING
To insure driving safety, a passenger should accompany the driver to make adjustments.

A. **Low Speed Switch Adjustment**

1. Start vehicle and make ready for the road.
2. Move slide button to ON position. Drive at about 45 mph. Press and release SET/COAST button to activate the system. Apply brake and reduce speed to about 18 mph.
3. Move slide button to RESUME/ACCEL position and hold it. Accelerate slowly, noting speed at which accelerator pulls away from your foot. This is the LOW SPEED switch setting. It should be within the range of 27-33 mph. If it is not, adjust the "LOW SPEED SW ADJ." on the electronic regulator.
4. Turn clockwise to increase the setting, or counterclockwise to decrease setting.

B. Centering Adjustment

1. Move slide button to ON position.
2. On a level road drive at about 45 mph. Then push and release the SET/COAST button. The system should engage, and the speed should be within 2 mph of your selected speed. If it is not, adjust the "CENTERING ADJ." on the electronic regulator.

3. Turn clockwise if the speed decreased, or counterclockwise if the speed increased. Make these adjustments in small steps.

C. Sensitivity Adjustment

The "SENSITIVITY ADJ." is set at the factory. No further adjustment is required. It should be set to full clockwise position.

D. Final Test

After adjustments have been made, use all the features of the system - Set Speed, Coast, Resume, Accelerate - and move slide button to "OFF". If everything checks satisfactorily, you are done with the road test. If it does not, see the Trouble Shooting Guide.

TROUBLE SHOOTING GUIDE

CONDITION	POSSIBLE CAUSE	REMEDY
Does not operate. "ON-OFF" switch "ON".	No voltage at either brown wire of 14 pin connector, main wiring harness	Check for correct power source, blown fuse, broken red wire, broken brown wire(s) or loose connections. Replace, repair, or tighten.
NOTE: System will not engage if vehicle is not moving faster than the **low speed setting**.	Poor electrical ground connection at servo and/or servo bracket.	Check light green wire & its eyelet terminal. Tighten "servo-to-bracket" nut. Tighten "bracket-to-body" screws (this is part of electrical ground return circuit).
	Disengagement Switch improperly adjusted Switch **"open"**.	Adjust switch. Must be **"closed"** when brake pedal is released.
	Restricted vacuum or no vacuum.	Check for pinched or disconnected vacuum hoses.
	Electrical.	**See "Electrical Check"**, and Schematic.
	In-line **fuse blown**, red wire.	Check for short(s). Replace fuse (5 amp max.)
	Control Switch faulty.	Replace Control Switch. For Control Switch check, see end of "Trouble Shooting", "Control Switch".
	Signal Generator faulty. No continuity between blue wire & grey wire.	Replace Signal Generator.
	At **regulator**, electrical terminals in 14-pin connector of main wiring harness **not** making good contact with printed circuit board in regulator.	Bend contacts up slightly with small sharp probe. Must be **above** small plastic separators of main wiring harness 14-pin connector body.
	Low speed switch set too high.	Turn **"low speed switch adj"** counterclockwise. "Road Test".
	Servo cable not connected.	Check cable connections at servo and at throttle.
	Electronic regulator faulty.	Replace electronic regulator.
	Light green wire of dump valve and servo wiring harness not grounded.	Ground light green wires to vehicle's chassis.
	Dump valve inoperative (coil open or valve leaking).	Electrical Check - Unplug connector from regulator and check continuity between term #8 (pink) and #1 (lt. green). If circuit is open, check ground of light green wire at dump valve and connection of pink wire. If connections ok and circuit open, replace dump valve.
		Leak Check - Disconnect pink wire from main wiring harness and apply 12 V. to dump valve wire. Unplug large hose from servo, suck on hose and seal end with tongue. If vacuum cannot be held, replace dump valve.
Engine accelerates when started.	No clearance at carburetor end of servo cable.	Adjust slack at throttle lever.
	Servo faulty.	Replace servo.
Vehicle continues to accelerate after depressing and releasing **"SET/COAST"** button.	Servo faulty.	Replace Servo.
	Electronic regulator faulty.	Replace electronic regulator.
"RESUME/ACCEL" inoperative	Poor electrical ground connection at servo and/or servo bracket.	Check light green wire & its eyelet terminal. Tighten "servo-to-bracket" nut. Tighten "bracket-to-body" screws. (This is part of electrical ground return circuit.)
	Control Switch faulty.	Replace Control Switch. For Control Switch Check, see end of "Trouble Shooting", "Control Switch".
Does **NOT** disengage when brake pedal is depressed.	**Disengagement Switch Assembly** improperly adjusted; switch **"CLOSED"** when brake pedal is depressed.	Adjust switch(s). Must be "OPEN" when brake pedal is depressed.
	Servo cable kinked or binding.	Replace servo cable.
	Servo faulty.	Replace servo.
System in use, brake pedal depressed, system disengages. Then release brake pedal and system re-engages.	Disengagement Switch faulty **(electrical portion only)**.	Replace switch assembly.
	Electronic regulator faulty.	Replace electronic regulator.

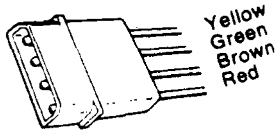
TROUBLE SHOOTING GUIDE (Cont.)

CONDITION	POSSIBLE CAUSE	REMEDY
"Resume" does **not** cancel when ignition switch is turned off.	Wrong power source. Power supply is always on.	Select 12 volt power source for fused red wire which is "hot" when ignition switch is **"ON"** and **"COLD"** (no voltage) when ignition switch is **"OFF"**.
Throttle does not return to normal idle.	No clearance at throttle end of servo cable.	Adjust slack at throttle lever.
	Improper vehicle accelerator linkage adjustment.	Adjust vehicle accelerator linkage.
	Weak or disconnected vehicle throttle return spring(s).	Replace or connect vehicle throttle return spring(s).
Vehicle speed increases or decreases more than 2 miles per hour when setting speed with "SET/COAST" button.	**"Centering Adj."** improperly set.	Adjust **"Centering Adj."** at electronic regulator.
Erratic operation or surging of Speed Control.	Loose speedometer cable nut and/or loose double hexagon adaptor at **Signal Generator.**	Tighten cable nut and/or adaptor.
	Bent drive tip(s), kinked or worn (relaxed) speedometer cable core.	Replace Speedometer cable.
	Servo faulty.	Replace Servo.
	Electronic regulator faulty.	Replace Electronic Regulator.
System disengages on level road without depressing brake pedal.	Loose wiring connections.	Tighten connections.
	Loose or leaky vacuum connections.	Tighten connections.
	Disengagement Switch Assembly not adjusted correctly.	Adjust switch. Must be **"Closed"** when brake pedal is released.
System engages but loses speed; then slowly returns to **"SET SPEED"** selected.	Poor electrical ground connection at servo and/or servo bracket.	Check light green wire & its eyelet terminal. Tighten "servo-to-bracket" nut. Tighten "bracket-to-body" screws. (This is part of electrical ground return circuit).
	Dump Valve leaks.	Replace dump valve.
	Hose from Servo to Dump Valve leaks.	Replace hose.
After system has been used and working for some time, **Speed Control** operation ceases. **Speedometer** may be inoperative.	Square drive of signal generator or speedometer cable(s) broken.	Replace signal generator or speedometer cable(s).

For additional assistance call Winnebago Technical Service or 1-800-438-3262.

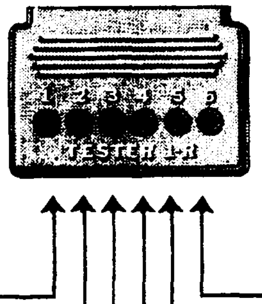
CONTROL SWITCH

Use 12 volt test light and jumper wire. Disconnect **Control Switch** at flat, 4-wire harness connector. Connect jumper wire from 12 volt power source to red wire terminal of **Control Switch.**



TEST CONDITION	WIRE COLOR	LIGHT: SWITCH O.K.	LIGHT: REPLACE SWITCH
Slide switch **OFF,** ground one test light lead, touch other test lead in turn, to terminal of:	Brown Green Yellow	OFF OFF OFF	ON ON ON
Slide switch **ON,** ground one test light lead, touch other test lead in turn, to terminal of:	Brown Yellow Yellow	ON ON OFF	OFF OFF ON
Slide switch **ON,** hold **"SET/COAST"** button in. Ground one test light lead, touch other test lead in turn, to terminal of:	Brown Green Yellow	ON OFF ON	OFF ON OFF
Press and hold **"RESUME/ACCEL"** slide Ground one test light lead, touch other test lead in turn, to terminal of:	Brown Green Yellow	ON ON ON	OFF OFF OFF

THIS PROCEDURE FOR TESTING SYSTEM WITH GRAY BOX REGULATOR
SPEED CONTROL SYSTEM TESTER
EACH LIGHT CHECKS THE FOLLOWING



7-R

***NOTE:** There will be a 250-3122 number on back to identify revision made to Test 7-R System as well as previous systems.

LIGHT 1
Power Source, Fuse and Ground, "On-Off" and "Set/Coast" Position of Control Switch, and Associated Wiring Terminals and Connectors.

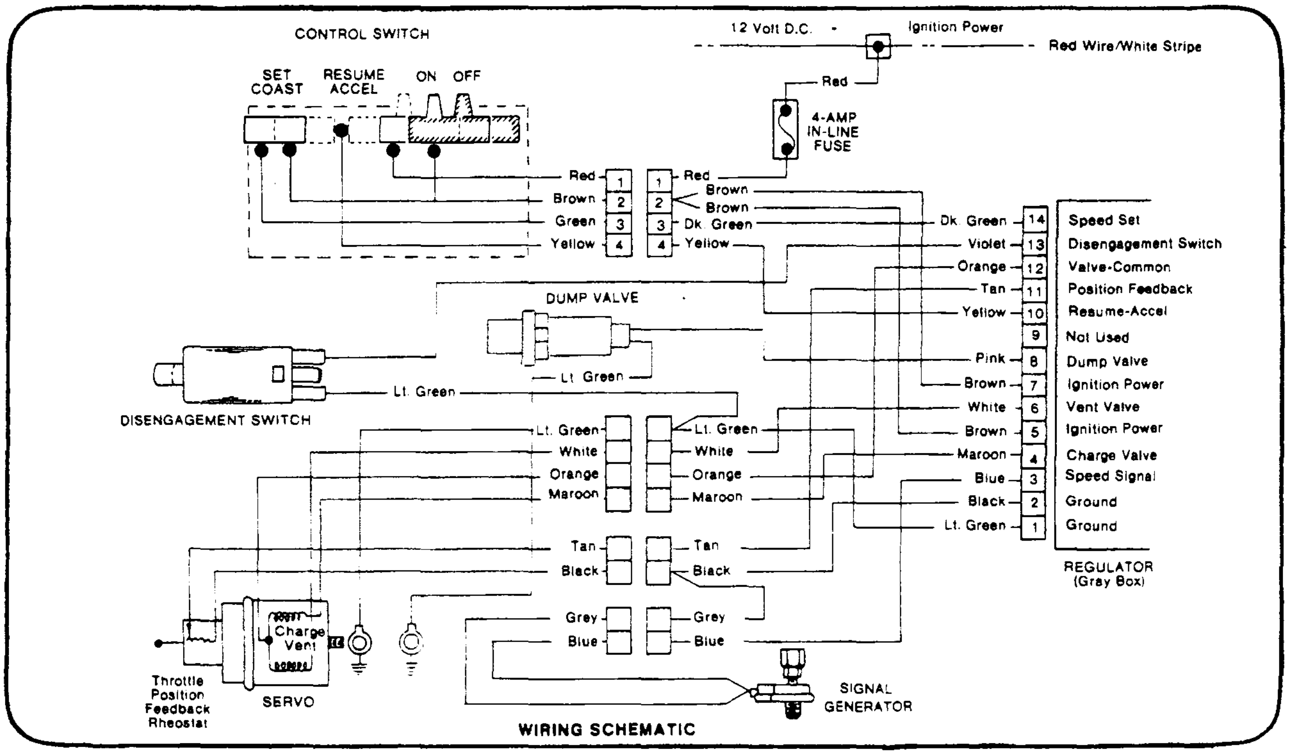
LIGHT 2
Signal Generator and Associated Wiring Harness Terminals and Connectors.

LIGHT 3
Disengagement Switch Adjustment and Associated Wiring Harness Terminals and Connectors.

LIGHT 6
Servo Charge Valve "Resume/Accel" Contact of the Control Switch and Associated Wiring Harness Terminals and Connectors.

LIGHT 5
Servo Vent Valve, "Resume" Contacts in the Control Switch and Associated Wiring Harness Terminals and Connectors.

LIGHT 4
Throttle Position Feedback and Associated Wiring Harness Terminals and Connectors.



WIRING SCHEMATIC

THE TESTER IS AVAILABLE FROM WINNEBAGO SERVICE PARTS.

DANA PART NUMBER 250-3122

To Test, Disconnect Harness From Regulator and Connect To Tester

Test No. and Condition	Correct Response	Trouble Shooting For Incorrect Response
1. Correct Power Source: Ignition Switch "Off" Control Switch "On"	*ALL LIGHTS OFF*	*ANY LIGHT ON DURING TEST NO. 1* Red Wire Connected Directly To Constant Power Source.
2. System's Electrical Continuity: Ignition Switch "On" Control Switch "On"	*LIGHTS* ON 1,2,3,&4 OFF 5&6	***These Are Checks To Make For Incorrect Lights in Tests 2 Thru 5. Replace Components if Necessary.*** *ALL LIGHTS OFF* - Check Red Wire Fuse. Check Light Green Wire Ground. *LIGHT 1 OFF*-Check Red, Brown and Green Wires and Terminal at Control Switch Connectors. Check Dark Green Wire (No. 14) at 14-Pin Connector. Check all Light Green Connections between 14-Pin Connector and Servo. *LIGHT 2 OFF*-Check Continuity between Blue and Grey Wires of Signal Generator Harness. Check Light Green Wire Connections between 14-Pin Connector and Servo, and Connections of Black, Blue, Brown (No. 5) and Grey Wires in Main Wiring Harness. *LIGHT 3 OFF*-Check Disengagement Switch Adjustment. Check No. 7 Brown Wire at 14-Pin connector. Check both Violet Wire Connections and All Light Green Wire Connections between Disengagement Switch and Servo. *LIGHT 4 OFF*-Check Continuity between Black and Tan Wires of Servo Harness. Check Light Green Wire Connections between 14-Pin Connector and Servo. Check Connections of Black and Tan Wires in Main Wiring Harness. *LIGHT 5 OFF*-Check Continuity between Orange and White Wires in Servo Harness. Check All Connections of White, Yellow and Orange Wires in Main Wiring Harness. *LIGHT 6 OFF*-Check Continuity between Orange and Maroon Wires in Servo Harness. Check All Connections of Maroon, Yellow and Orange Wires in Main Wiring Harness. *ALL LIGHTS OFF*-After Pushing "SET/COAST" or "RESUME/ACCEL" in Tests 4, 5, or 6; Blown Fuse, Maroon or White wires Shorted; Bad Servo.
3. Disengagement Switch Continuity: Ignition Switch "On" Control Switch "On" Push and Hold Brake pedal	*LIGHTS* ON 1,2,&4 OFF 3,5,&6 Release Brake Pedal and Light 3 Will Go "On"	
4. Servo Continuity: Ignition Switch "On" Control Switch "On" Push and Hold Set/Coast Button	*LIGHTS* ON 2,3,4,5&6 OFF 1	
5. Control Switch Contact Check: Ignition Switch "On" Control Switch "On" Slide and Hold ON-OFF Switch to "Resume/Accel"	*ALL LIGHTS - ON*	
6. Start Engine Momentarily Hold SET/COAST Button In and **Release it When Engine Starts to Race**	Engine Should Run in a Normal Manner Throttle Will Open Quickly and Light 4 Will Dim	*IF THROTTLE DOES NOT OPEN*, Check Connection of Servo Cable to Servo and Servo Cable to Throttle Lever, Check Adjustment of Disengagement Switch; Check Attachment at Both Ends of Vacuum Hoses. Check Dump Valve and Servo for Leaks or Disconnection.

TESTER CANNOT BE USED TO ROAD TEST
SPEED CONTROL

VEHICLES WITH 5-SPEED TRANSMISSION OPERATING INSTRUCTIONS

In the regulator box of your Speed Control is a safety switch which will not let the system operate until your vehicle is moving above a pre-selected low speed. At the factory this "low speed switch" is set to close between 27 and 33 mph; it should, however, be checked during the Road Test.

The **Control Switch** is the switch you use to operate all features of the system described in the following paragraphs. It is installed near the turn signal lever.

Set Speed - On the control switch, move the slide button to the ON position and drive at any speed above 32 mph at which you want automatic control. Hold that speed with your foot while you press and release the SET/COAST button. One second after release, take your foot off the accelerator pedal.

You can increase speed at any time with the accelerator pedal. When you release the pedal, you will return to the set speed.

Acceleration - Hold the slide button in the RESUME/ACCEL position and your vehicle will accelerate until you release it, then your vehicle will slow to your set speed and again control there.

If you want to make the higher speed your new set speed, release the slide button when you reach the speed you want, and as you do, quickly press and release the SET/COAST button. Remember, you set speed as you release the button - Not when you press it.

COAST - When you press and hold the SET/COAST button, you erase the set speed from the regulator's memory and allow the vehicle to coast. Just before you reach the lower speed you want, release the button and it will control there, providing it is above the low speed setting.

DISENGAGEMENT - Depress the brake pedal about an inch and you are again in control of the vehicle speed. You can also disengage the Speed Control by pushing the slide button to OFF, but this erases the set speed from the regulator's memory.

RESUME - When you disengage the system with the brake, you do not erase the set speed from the regulator's memory, even if you come to a complete stop. To return to your chosen speed, drive to a speed above 32 mph, then move the slide button to the RESUME/ACCEL position and release it. The Speed Control will take you back to your set speed and control there.

If the rate of acceleration is faster or slower than you like, drive with the accelerator to a speed close to the set speed, then slide the button to the RESUME/ACCEL position and release it.

UNUSUAL CONDITIONS - When the regulator is adjusted right, your selected speed should be held within plus or minus 4 mph, as long as grades do not exceed 7% (most interstate highways). Since the Speed Control is vacuum operated, this speed range will widen as you drive at higher altitudes.

When you are pulling an extra heavy load, climbing a very steep hill, or bucking a severe head wind, a much wider than normal throttle opening is needed.

The way to handle these occasional problems is to bring the vehicle up to speed with the accelerator pedal - and then let the Speed Control take over again.

There is no drain on the battery when the ignition switch is off - even if the control switch is left on.

WARNING

Do not use your Speed Control on slippery roads, nor in heavy traffic.

COMPONENTS

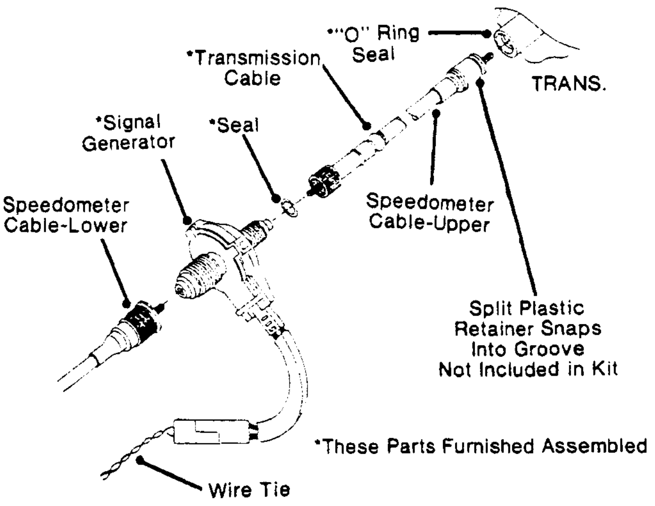
The major componentns of the system are:

- **Signal Generator** - attached to the speedometer cable drive adaptor at the transmission.
- **Regulator** - a computer board mounted behind the instrument panel.
- **Servo** - mounted in the engine compartment and linked to the throttle.
- **Control Switch** - on the steering column near the turn signal lever.
- **Disengagement Switch/Dump Valve Assembly** - operated by the brake pedal.

All other parts in the kit are for connecting these components to the vehicle, and to each other.

SIGNAL GENERATOR

> **CAUTION**
>
> Be SURE all square driving members and speedometer cable are properly engaged with their mating counterparts and all cable nuts are tight. "Snap-in" type ends must be completely engaged.



AUXILIARY TRANSMISSION KICK-DOWN SWITCH

Explanation of Auxiliary Switch: When the Cruise Control is pulling on the throttle, the vehicle's existing trans. kick-down switch cannot be activated because the vehicle's throttle cable is at rest. The switch is activated when cruise cable moves to nearly full end of its travel. The throttle linkage strikes switch lever and closes the contacts of switch to activate kick-down.

A. Bracket and Micro-Switch Assembly. To install unscrew metric hex head. screw, slip notch of bracket under lock-washer and retighten screw to hold switch bracket. (See Figure 7).

NOTE: Switch is factory adjusted, but if kick-down need be adjusted, the lever of the switch can be bent to get adjustment. After adjusting, move throttle by hand to full open to see that switch **IS NOT** acting as a stop.

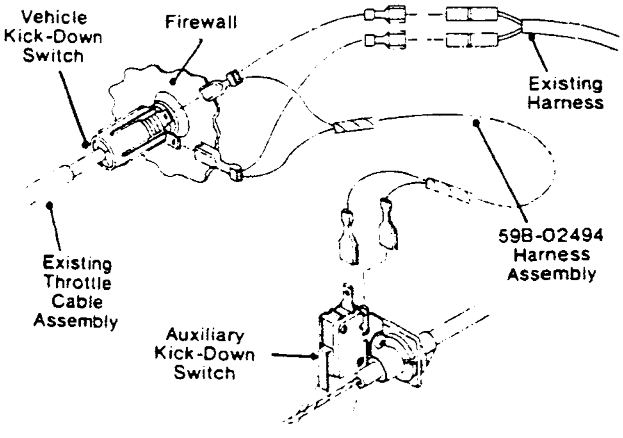
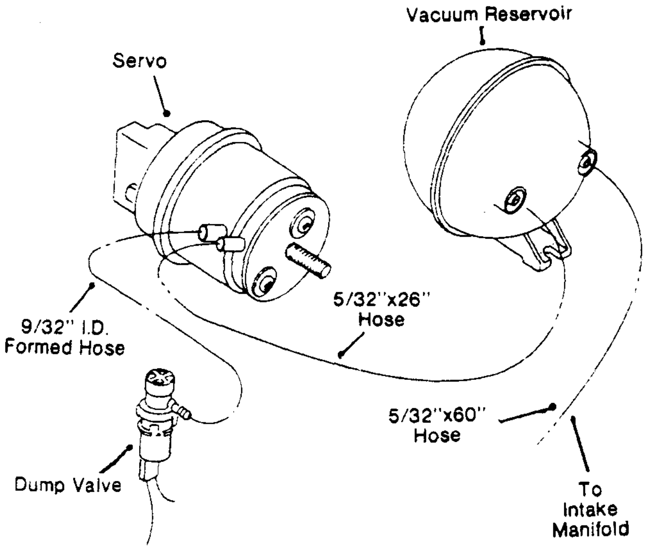


Figure 7

COMPONENTS

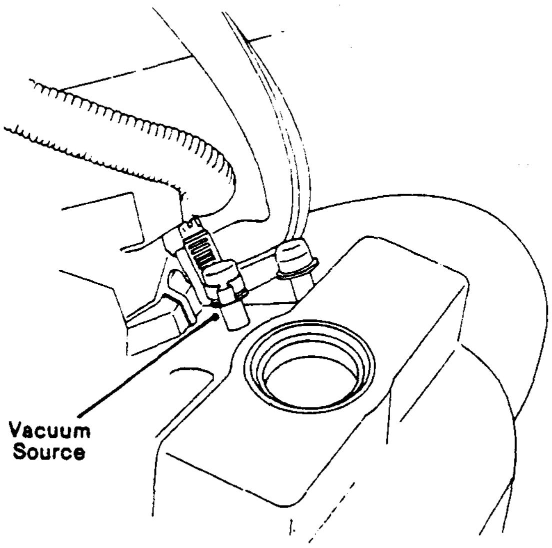
VACUUM RESERVOIR MOUNTING

The vacuum reservoir is mounted beneath battery bracket. May require removing battery and bracket to locate reservoir. Screws to hold reservoir are not provided. NOTE: Re-install battery bracket and battery after servo wiring extension and vacuum hoses are hooked up.



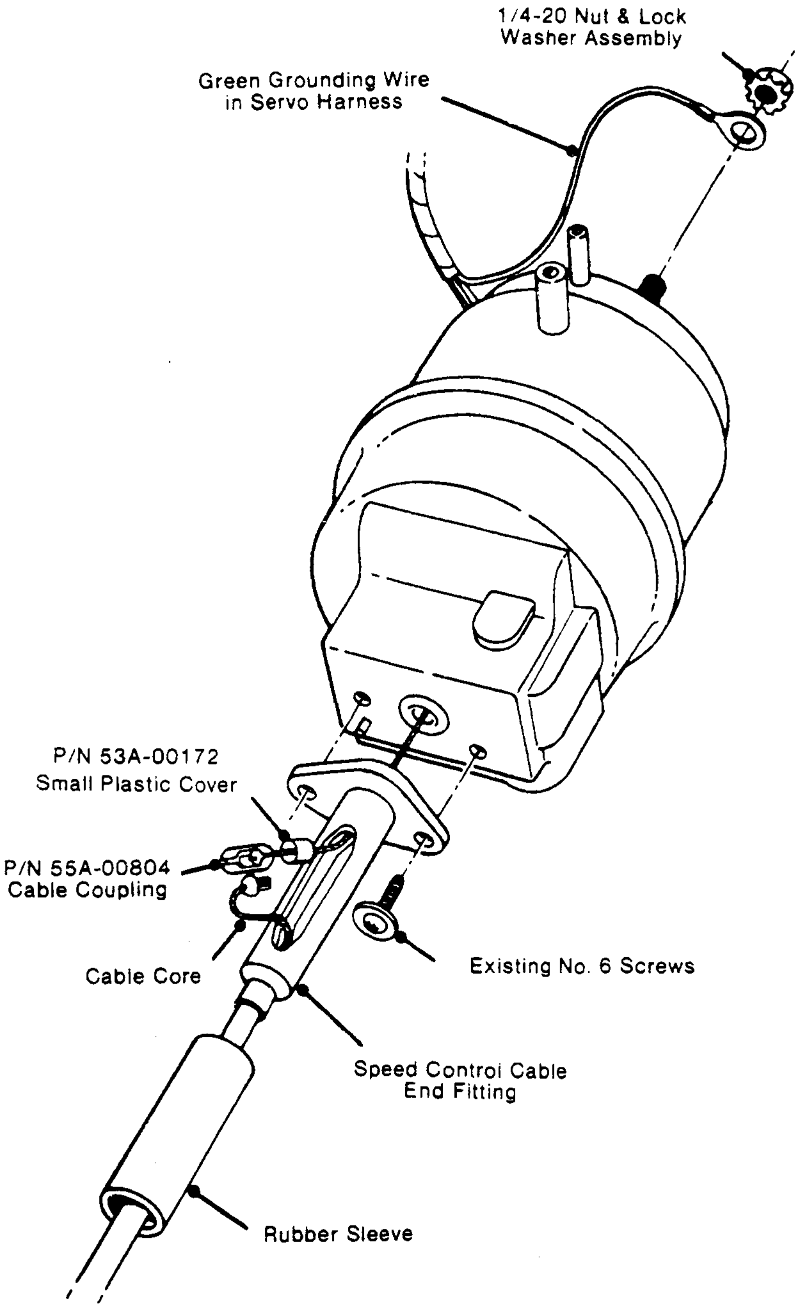
VACUUM HOSE INSTALLATION

5/32" I.D. x 60" long attaches to intake manifold. Locate nipple on top of intake manifold (left hand side of engine).



COMPONENTS

SHOULD IT BECOME NECESSARY TO REPLACE SPEED CONTROL CABLE, USE THIS PROCEDURE



A. To remove old cable, slide rubber sleeve off cable end fitting so slots are exposed.

B. Slide small plastic cover off coupling and onto servo coupling cable. Use side cutter pliers or small screwdriver to spread coupling. Remove core end of old cable from coupling.

C. Remove and retain two No. 6 screw and washer assemblies-attaching cable end fitting to servo.

D. Thread servo coupling cable into end fitting of new Speed Control cable and out through slot. Attach cable to servo with two screws retained.

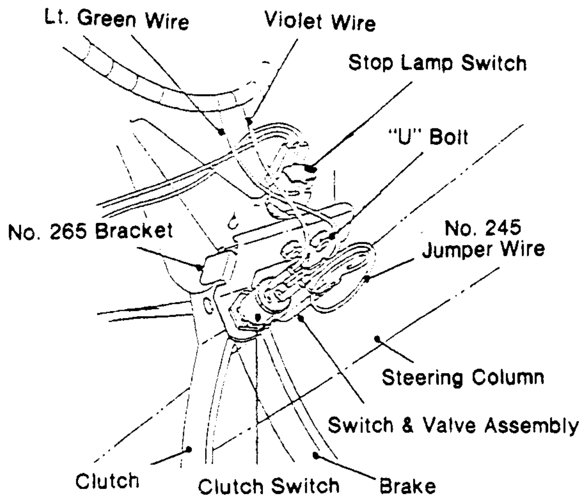
E. Put core end of cable in coupling and squeeze it closed with pliers. Slide small plastic sleeve back onto coupling.

F. From other end of cable, pull all slack from cable core and slide rubber sleeve back into place over end fitting slots.

DISENGAGEMENT SWITCH ASSEMBLY

A. Loosen No. 10 screw in slot and slide switch forward against brake arm until plunger extends 3/8" to 1/4" from switch body. Hold switch there and tighten screw. Switch must be closed. Vacuum nipple not used.

B. Adjust clutch switch until plunger extends 1/8" to 1/4" from switch body. Tighten 5/8-18 stamped nuts.

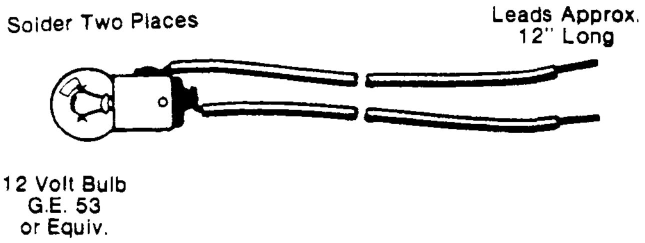


ELECTRICAL CHECK PROCEDURE
Use a 12-volt Test Light To Perform These Checks

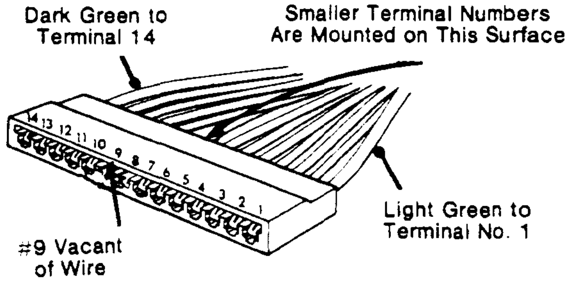
CONDITION	POSSIBLE CAUSE	REMEDY
Ignition Switch OFF. Control Switch ON. Ground one lead of test light, touch other lead to each terminal of connector individually.	Light OFF, all terminals	None, system O.K.
	Test light ON at terminals 5,7, and 14	Red fused wire connected to wrong power source. Use a "switched" power source at fuse block. Test light should be "ON" when ignition switch is "ON" and "OFF" when ignition switch is "OFF".
Ignition Switch ON. Control Switch ON. Ground one test light lead. Touch other lead to each terminal of connector individually.	Test light ON at terminals 5, 7, and 14 only	None system O.K.
	No light on any terminal	Replace fuse, if blown. Connect red wire to ignition switched power source.
Ignition switch ON. Control Switch ON. Ground one test light lead. Press and hold SET SPEED button and touch other test lead to terminal 14.	Test light OFF at terminal 14.	None, system O.K.
	Test light ON at terminal 14.	See Trouble Shooting Guide - Control Switch.
Ignition Switch ON. Control Switch ON. Ground one test light lead. Press and hold. Slide switch to RESUME while touching other lead to terminal 10 and 14 individually.	Test light ON at terminal 10 and 14.	None, system O.K.
	No light at terminal 10 and/or 14.	See Trouble Shooting Guide - Control Switch.
Ignition Switch ON. Control Switch ON. Touch one test light lead to terminal No. 5 and other lead to terminal No. 13.	Test light ON; push brake and test light goes OFF.	None, system O.K.
	Test light OFF.	Adjust disengagement switch(s) plunger travel to get test light ON; OFF when brake or clutch pedal is pushed.

A. A test light or volt-ohmeter is needed to perform these checks. If you have neither, a test light can be made as shown.

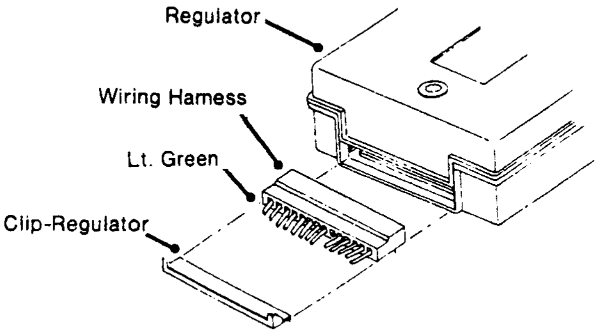
HOMEMADE TEST LIGHT



B. A Speed Control System Tester is available which will quickly indicate any problem area. The Dana part number is 250-3122. More information is given on pages O1-11 and O1-12. If attaching the connector to the tester, the dark green wire and Light No. 1 are at the same end.



C. To make this check, the 13-pin connector must be disconnected from the electronic regulator. The terminal numbers are very small and are molded on the wire side of the connector. Wire colors for the system are shown on page O2-11.



NOTE: To release wiring harness, pry up and out to release clip-regulator from regulator, pull wiring harness from regulator.

D. When electrical check is done, turn ignition off. Plug wiring harness onto regulator. Use Black Plastic Clip-Regulator to hold regulator and wiring harness together. Just push it into place to install.

PRELIMINARY OPERATION CHECK

Electronic Regulator Check

A. Set parking brake hard, put shift lever in "neutral" and start engine.

B. Keep one hand on ignition key and with other hand push slide button on control switch to ON position.

C. Press and hold SET/COAST button for two or three seconds, then release it. The system should NOT engage. If it does (indicated by engine racing faster than cold idle), turn off ignition switch immediately. If system passed electrical check above, and in this check, engine did not race until SET/COAST button was pressed, electronic regulator must be replaced.

Vacuum Check

D. Run engine at idle, unplug hose from small servo fitting, and put your finger over end. You should feel a strong suction. If you do, put hose back on servo fitting. If not, check hose to intake manifold or hose attachment to VAC Reservoir.

ROAD TEST

For Electrical Regulator Adjustments

NOTE: The adjustments on the Electronic Regulator (Low Speed Switch, Centering, and Sensitivity) are set nearly correct at the factory. However, the electronic regulator can be adjusted if necessary. Full adjustment range is 3/4 of a turn. DO NOT force beyond stops. A small screwdriver may be inserted through the appropriate hole to engage the adjusting slot.

WARNING

To insure driving safety, a passenger should accompany the driver to make adjustments.

A. **Low Speed Switch Adjustment**

1. Start vehicle and make ready for the road.
2. Move slide button to ON position. Drive at about 45 mph. Press and release SET/COAST button to activate the system. Apply brake and reduce speed to about 18 mph.
3. Move slide button to RESUME/ACCEL position and hold it. Accelerate slowly, noting speed at which accelerator pulls away from your foot. This is the LOW SPEED switch setting. It should be within the range of 27-33 mph. If it is not, adjust the "LOW SPEED SW ADJ." on the electronic regulator.
4. Turn clockwise to increase the setting, or counterclockwise to decrease setting.

B. Centering Adjustment

1. Move slide button to ON position.
2. On a level road drive at about 45 mph. Then push and release the SET/COAST button. The system should engage, and the speed should be within 2 mph of your selected speed. If it is not, adjust the "CENTERING ADJ." on the electronic

regulator.

3. Turn clockwise if the speed decreased, or counterclockwise if the speed increased. Make these adjustments in small steps.

C. Sensitivity Adjustment

The "SENSITIVITY ADJ." is set at the factory. No further adjustment is required. It should be set to full clockwise position.

D. Final Test

After adjustments have been made, use all the features of the system - Set Speed, Coast, Resume, Accelerate - and move slide button to "OFF". If everything checks satisfactorily, you are done with the road test. If it does not, see the Trouble Shooting Guide.

TROUBLE SHOOTING GUIDE

CONDITION	POSSIBLE CAUSE	REMEDY
Does not operate. "ON-OFF" switch "ON".	No voltage at either brown wire of 14 pin connector, main wiring harness.	Check for correct power source, blown fuse, broken red wire, broken brown wire(s) or loose connections. Replace, repair, or tighten.
NOTE: System will not engage if vehicle is not moving faster than the **low speed setting.**	Poor electrical ground connection at servo and/or servo bracket.	Check light green wire & its eyelet terminal. Tighten "servo-to-bracket" nut. Tighten "bracket-to-body" screws (this is part of electrical ground return circuit).
	Disengagement Switch or Switches improperly adjusted; switch **"CLOSED"** when brake pedal or clutch is depressed.	Adjust switch. Must be **"closed"** when brake or clutch pedal is released.
	Restricted vacuum or no vacuum.	Check for pinched or disconnected vacuum hoses.
	Electrical.	**See "Electrical Check"**, and Schematic.
	In-line **fuse blown**, red wire.	Check for short(s). Replace fuse (5 amp max.)
	Control Switch faulty.	Replace Control Switch. For Control Switch check, see end of "Trouble Shooting", "Control Switch".
	Signal Generator faulty. No continuity between blue wire & grey wire.	Replace Signal Generator.
	At **regulator**, electrical terminals in 14-pin connector of main wiring harness **not** making good contact with printed circuit board in regulator.	Bend contacts up slightly with small sharp probe. Must be **above** small plastic separators of main wiring harness 14-pin connector body.
	Low speed switch set too high.	Turn **"low speed switch adj"** counterclockwise. "Road Test".
	Servo cable not connected.	Check cable connections at servo and at throttle.
	Electronic regulator faulty.	Replace electronic regulator.
	Light green wire of dump valve and servo wiring harness not grounded.	Ground light green wires to vehicle's chassis.
	Dump valve inoperative (coil open or valve leaking).	Electrical Check - Unplug connector from regulator and check continuity between term #8 (pink) and #1 (lt. green). If circuit is open, check ground of light green wire at dump valve and connection of pink wire. If connections ok and circuit open, replace dump valve.
		Leak Check - Disconnect pink wire from main wiring harness and apply 12 V. to dump valve wire. Unplug large hose from servo, suck on hose and seal end with tongue. If vacuum cannot be held, replace dump valve.
Engine accelerates when started.	No clearance at carburetor end of servo cable.	Adjust slack at throttle lever.
	Servo faulty.	Replace servo.
Vehicle continues to accelerate after depressing and releasing **"SET/COAST"** button.	Servo faulty.	Replace Servo.
	Electronic regulator faulty.	Replace electronic regulator.
"RESUME/ACCEL" inoperative	Poor electrical ground connection at servo and/or servo bracket.	Check light green wire & its eyelet terminal. Tighten "servo-to-bracket" nut. Tighten "bracket-to-body" screws. (This is part of electrical ground return circuit.)
	Control Switch faulty.	Replace Control Switch. For Control Switch Check, see end of "Trouble Shooting", "Control Switch".
Does **NOT** disengage when brake pedal or clutch pedal is depressed.	Disengagement Switches improperly adjusted. Switches closed when brake and/or clutch pedal is depressed.	Adjust switch(s). Must be "OPEN" when brake pedal or clutch pedal is depressed.
	Servo cable kinked or binding.	Replace servo cable.
	Servo faulty.	Replace servo.
System in use, brake and/or clutch pedal depressed, system disengages. Then release brake and or clutch pedal and system re-engages.	Disengagement Switch(s) faulty **(electrical portion only on brake)**	Replace switch(s) assembly.
	Electronic regulator faulty.	Replace electronic regulator.

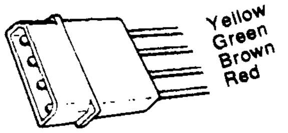
TROUBLE SHOOTING GUIDE (Cont.)

CONDITION	POSSIBLE CAUSE	REMEDY
"**Resume**" does **not** cancel when ignition switch is turned off.	Wrong power source. Power supply is always on.	Select 12 volt power source for fused red wire which is "hot" when ignition switch is "**ON**" and "**COLD**" (no voltage) when ignition switch is "**OFF**".
Throttle does not return to normal idle.	No clearance at throttle end of servo cable.	Adjust slack at throttle lever.
	Improper vehicle accelerator linkage adjustment.	Adjust vehicle accelerator linkage.
	Weak or disconnected vehicle throttle return spring(s).	Replace or connect vehicle throttle return spring(s).
Vehicle speed increases or decreases more than 2 miles per hour when setting speed with "SET/COAST" button.	"**Centering Adj.**" improperly set.	Adjust "**Centering Adj.**" at electronic regulator.
Erratic operation or surging of Speed Control.	Loose speedometer cable nut and/or loose double hexagon adaptor at **Signal Generator**.	Tighten cable nut and/or adaptor.
	Bent drive tip(s), kinked or worn (relaxed) speedometer cable core.	Replace Speedometer cable.
	Servo faulty.	Replace Servo.
	Electronic regulator faulty.	Replace Electronic Regulator.
System disengages on level road without depressing brake pedal or clutch pedal.	Loose wiring connections.	Tighten connections.
	Loose or leaky vacuum connections.	Tighten connections.
	Disengagement Switch(s) Assembly not adjusted correctly.	Adjust switch(s). Must be "**Closed**" when brake pedal or clutch pedal is released.
System engages but loses speed; then slowly returns to "**SET SPEED**" selected.	Poor electrical ground connection at servo and/or servo bracket.	Check light green wire & its eyelet terminal. Tighten "servo-to-bracket" nut. Tighten "bracket-to-body" screws. (This is part of electrical ground return circuit).
	Dump Valve leaks.	Replace dump valve.
	Hose from Servo to Dump Valve leaks.	Replace hose.
After system has been used and working for some time, **Speed Control** operation ceases. **Speedometer** may be inoperative.	Square drive of signal generator or speedometer cable(s) broken.	Replace signal generator or speedometer cable(s).

For additional assistance call Winnebago Technical Service or 1-800-438-3262

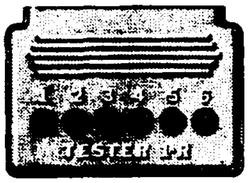
CONTROL SWITCH

Use 12 volt test light and jumper wire. Disconnect **Control Switch** at flat, 4-wire harness connector. Connect jumper wire from 12 volt power source to red wire terminal of **Control Switch**.



TEST CONDITION	WIRE COLOR	LIGHT: SWITCH O.K.	LIGHT: REPLACE SWITCH
Slide switch **OFF**, ground one test light lead, touch other test lead in turn, to terminal of:	Brown Green Yellow	OFF OFF OFF	ON ON ON
Slide switch **ON**, ground one test light lead, touch other test lead in turn, to terminal of:	Brown Yellow Yellow	ON ON OFF	OFF OFF ON
Slide switch **ON**, hold "**SET/COAST**" button in. Ground one test light lead, touch other test lead in turn, to terminal of:	Brown Green Yellow	ON OFF ON	OFF ON OFF
Press and hold "**RESUME/ACCEL**" slide Ground one test light lead, touch other test lead in turn, to terminal of:	Brown Green Yellow	ON ON ON	OFF OFF OFF

THIS PROCEDURE FOR TESTING SYSTEM WITH GRAY BOX REGULATOR
SPEED CONTROL SYSTEM TESTER
EACH LIGHT CHECKS THE FOLLOWING



7-R

***NOTE:** There will be a 250-3122 number on back to identify revision made to Test 7-R System as well as previous systems.

LIGHT 1 Power Source, Fuse and Ground, "On-Off" and "Set/Coast" Position of Control Switch, and Associated Wiring Terminals and Connectors.

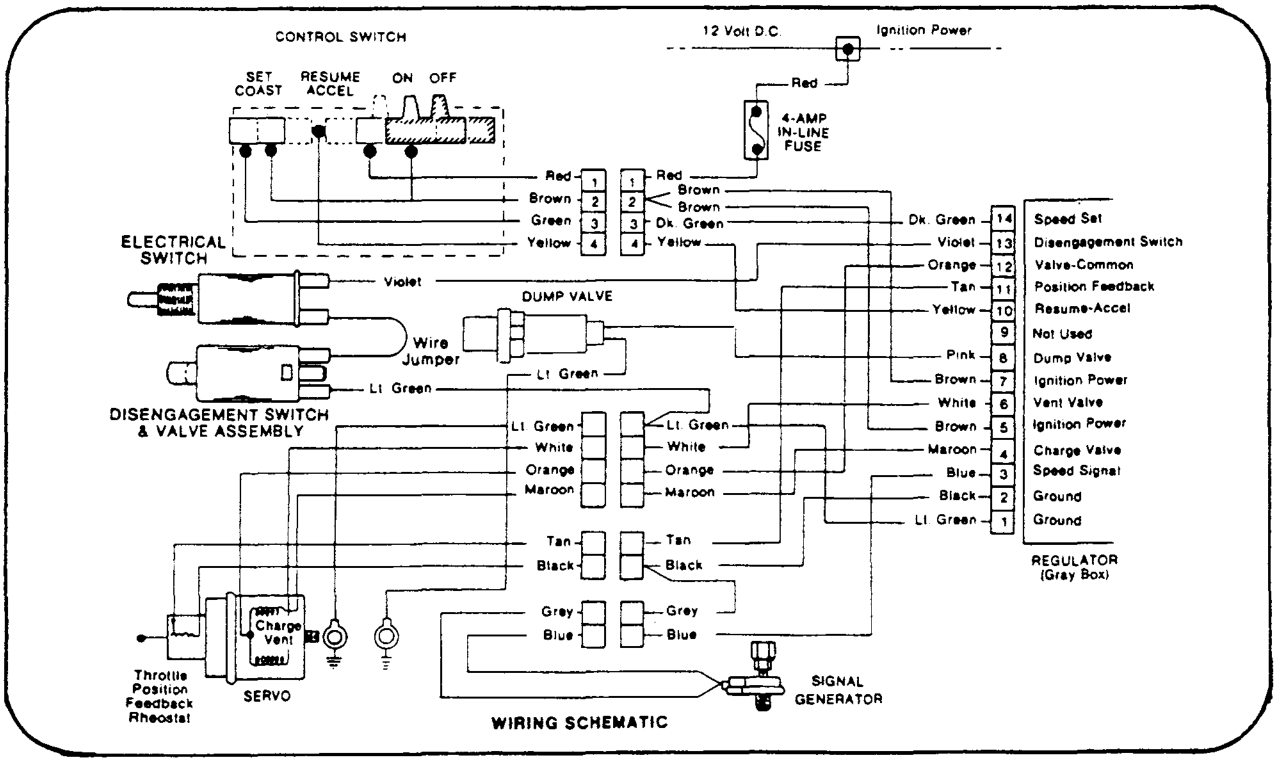
LIGHT 2 Signal Generator and Associated Wiring Harness Terminals and Connectors.

LIGHT 3 Disengagement Switch Adjustment and Associated Wiring Harness Terminals and Connectors.

LIGHT 6 Servo Charge Valve "Resume/Accel" Contact of the Control Switch and Associated Wiring Harness Terminals and Connectors.

LIGHT 5 Servo Vent Valve, "Resume" Contacts in the Control Switch and Associated Wiring Harness Terminals and Connectors.

LIGHT 4 Throttle Position Feedback and Associated Wiring Harness Terminals and Connectors.



THE TESTER IS AVAILABLE FROM WINNEBAGO SERVICE PARTS.

DANA PART NUMBER 250-3122

To Test, Disconnect Harness From Regulator and Connect To Tester

Test No. and Condition	Correct Response	Trouble Shooting For Incorrect Response
1. Correct Power Source: Ignition Switch "Off" Control Switch "On"	***ALL LIGHTS OFF***	***ANY LIGHT ON DURING TEST NO. 1*** Red Wire Connected Directly To Constant Power Source.
2. System's Electrical Continuity: Ignition Switch "On" Control Switch "On"	***LIGHTS*** ON 1,2,3,&4 OFF 5&6	***These Are Checks To Make For Incorrect Lights in Tests 2 Thru 5. Replace Components if Necessary.*** ***ALL LIGHTS OFF*** - Check Red Wire Fuse. Check Light Green Wire Ground. ***LIGHT 1 OFF***-Check Red, Brown and Green Wires and Terminal at Control Switch Connectors. Check Dark Green Wire (No. 14) at 14-Pin Connector. Check all Light Green Connections between 14-Pin Connector and Servo. ***LIGHT 2 OFF***-Check Continuity between Blue and Grey Wires of Signal Generator Harness. Check Light Green Wire Connections between 14-Pin Connector and Servo, and Connections of Black, Blue, Brown (No. 5) and Grey Wires in Main Wiring Harness. ***LIGHT 3 OFF***-Check Disengagement Switch(s) Adjustment. Check No. 7 Brown Wire at 14-Pin connector. Check both Violet Wire Connections and all Light Green Wire Connections between Disengagement Switch and Servo. ***LIGHT 4 OFF***-Check Continuity between Black and Tan Wires of Servo Harness. Check Light Green Wire Connections between 14-Pin Connector and Servo. Check Connections of Black and Tan Wires in Main Wiring Harness. ***LIGHT 5 OFF***-Check Continuity between Orange and White Wires in Servo Harness. Check All Connections of White, Yellow and Orange Wires in Main Wiring Harness. ***LIGHT 6 OFF***-Check Continuity between Orange and Maroon Wires in Servo Harness. Check All Connections of Maroon, Yellow and Orange Wires in Main Wiring Harness. ***ALL LIGHTS OFF***-After Pushing "SET/COAST" or "RESUME/ACCEL" in Tests 4, 5, or 6; Blown Fuse, Maroon or White wires Shorted; Bad Servo.
3. Disengagement Switch Continuity: Ignition Switch "On" Control Switch "On" Push and Hold Brake pedal or clutch pedal.	***LIGHTS*** ON 1,2,&4 OFF 3,5,&6 Release Brake or Clutch Pedal and Light 3 Will Go "On".	
4. Servo Continuity: Ignition Switch "On" Control Switch "On" Push and Hold Set/Coast Button	***LIGHTS*** ON 2,3,4,5&6 OFF 1	
5. Control Switch Contact Check: Ignition Switch "On" Control Switch "On" Slide and Hold ON-OFF Switch to "Resume/Accel"	***ALL LIGHTS - ON***	
6. Start Engine	Engine Should Run in a Normal Manner	
Momentarily Hold SET/COAST Button In and **Release it When Engine Starts to Race**	Throttle Will Open Quickly and Light 4 Will Dim	***IF THROTTLE DOES NOT OPEN,*** Check Connection of Servo Cable to Servo and Servo Cable to Throttle Lever. Check Adjustment of Disengagement Switch(s). Check Attachment at Both Ends of Vacuum Hoses. Check Dump Valve and Servo for Leaks or Disconnection.

TESTER CANNOT BE USED TO ROAD TEST
SPEED CONTROL

SECTION "P"

BODY

Subsection 1 - General Information

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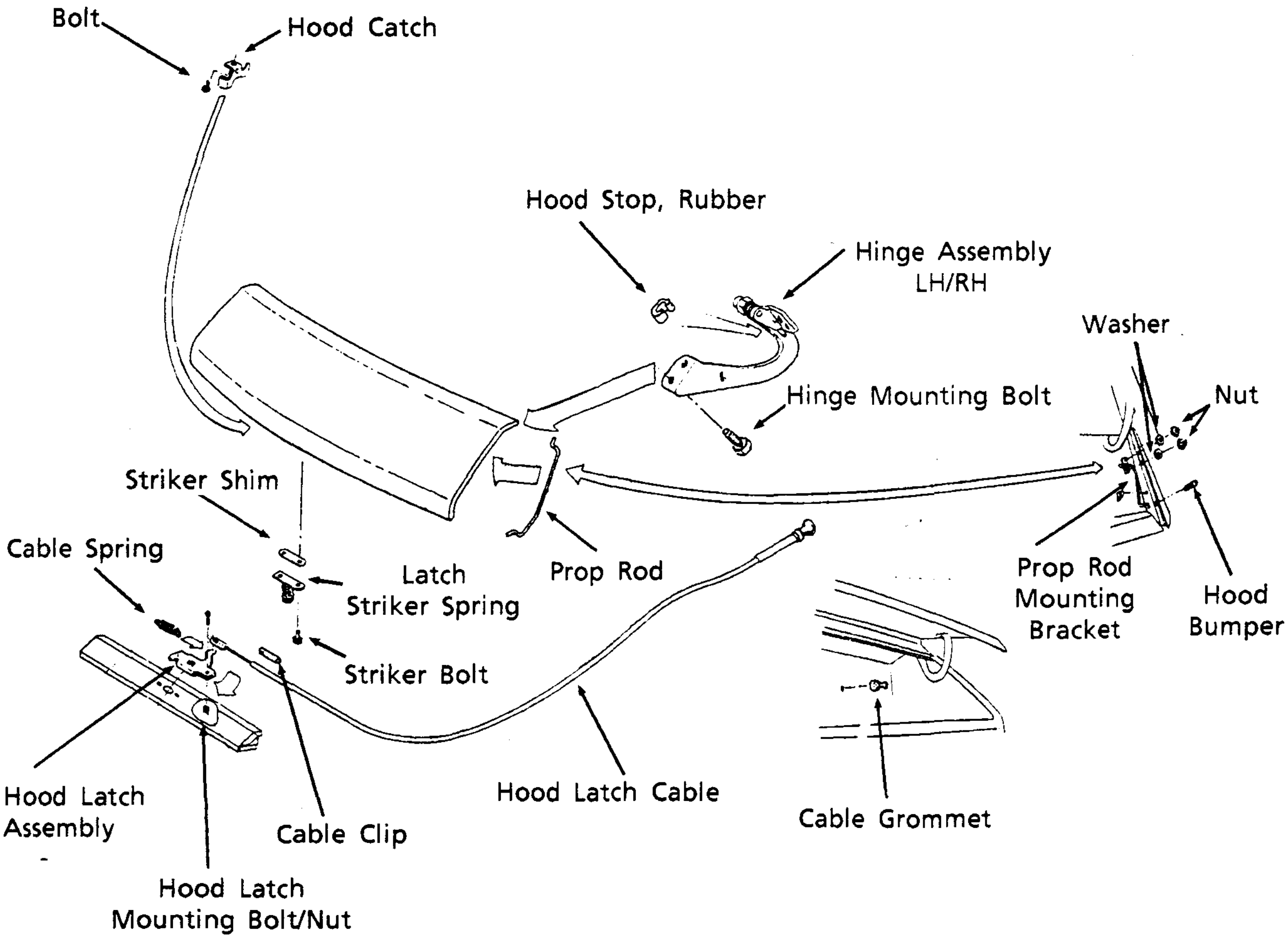
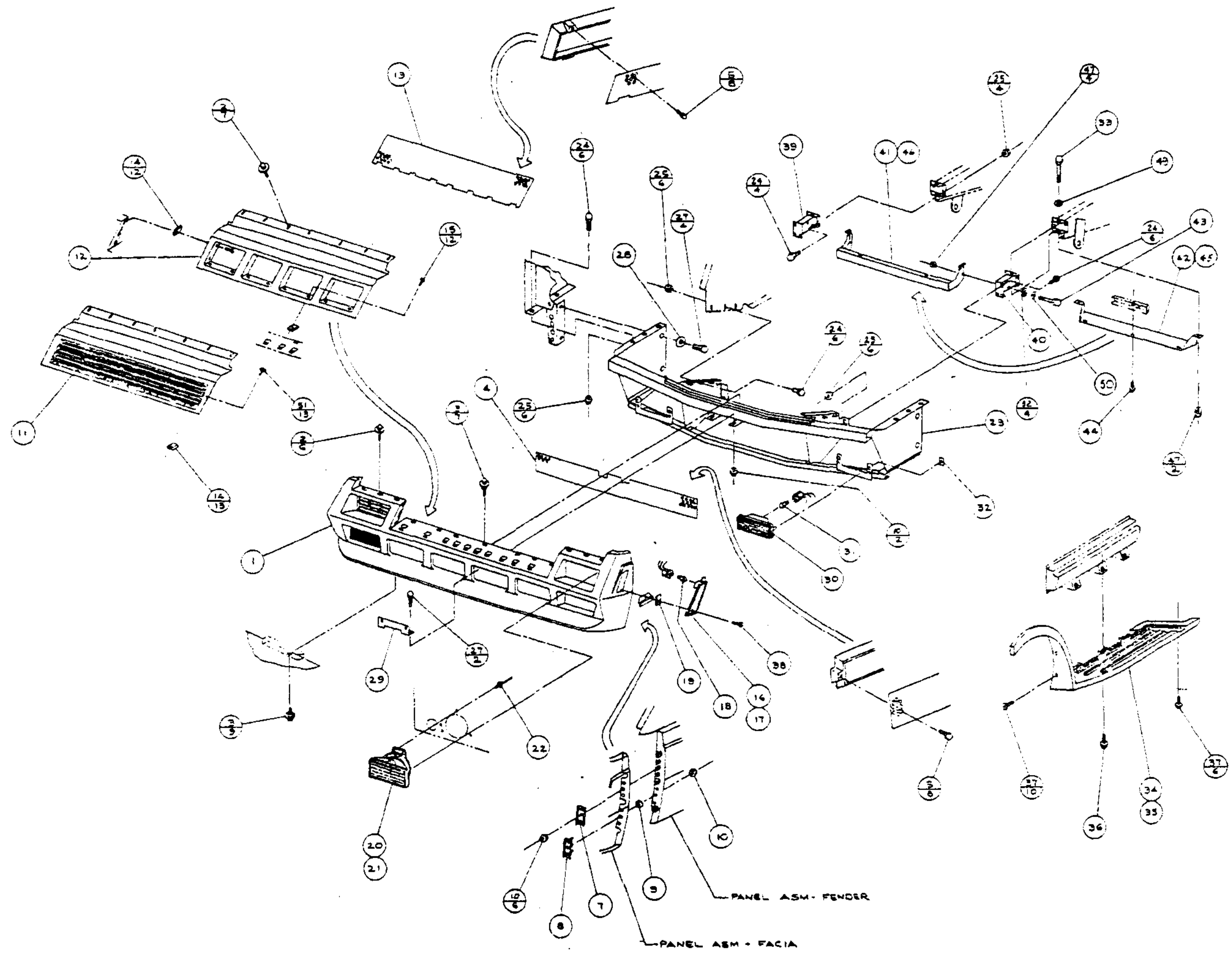
FRONT END
HOOD ASSEMBLY



PARTS DESCRIPTION - FRONT END ASSEMBLY

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Panel Asm. - Facia	1	27	Bolt	6
2	Screw	13	28	Washer - Flat	4
3	Screw	16	29	Bracket Plate	1
4	Screen - Facia	1	30	Lamp Asm. - Park	2
5	Screw	16	31	Bulb	2
6			32	Nut - Speed	4
7	Stiffener	2	33	Bolt - Hex	2
8	Stiffener	2	34	Running Board, RH	1
9	Nut	2	35	Running Board, LH	1
10	Nut	14	36	Screw Asm.	12
11	Grille (Winn)	1	37	Screw	16
12	Grille (Itasca)	1	38	Screw	2
13	Screen (Itasca)	1	39	Extension Asm. - RH	1
14	Nut-Speed	AR	40	Extension Asm. - LH	1
15	Screw	AR	41	Crossmember Asm.	1
16	Lamp - Side, RH	1	42	Shield - Engine	1
17	Lamp - Side, LH	1	43	Bolt	4
18	Bulb	2	44	Bolt	3
19	Nut-Speed	2	45	Shield - Engine	1
20	Headlamp Asm - RH	1	46	Crossmember Asm.	1
21	Headlamp Asm. - LH	1	47	Nut - Hex	6
22	Rivet	6	48		
23	Bumper Asm.	1	49	Washer - Flat	2
24	Bolt	22	50	Screw	4
25	Nut	22	51	Screw	AR
26			52	Washer - Flat	4

FRONT END
GRILLE/BUMPER ASSEMBLY



PAINT CODES

Listed below are paint colors and part numbers (DuPont and Winnebago) for all units manufactured by Winnebago Industries, Inc. All colors are available in 16 ounce aerosol can. Main body colors are also available in one (1) gallon containers.

COLOR	UNIT OF MEASURE	DUPONT NUMBER	WINNEBAGO P/N
LeSharo and Utility Van			
Off White	16 oz. spray can	L8723A	041561-03-000
Phasar			
Light Gray	16 oz. spray can	L8730A	058637-05-000
Interior (Dash) Colors			
Lt. Saddle Tan	16 oz. spray	C8352L	900379-01-700
Dark Grey	16 oz. spray	C8550L	900379-02-700
Black	N/A	B8479V*	N/A

*This color is a vinyl coating available from your Dupont paint dealer. Specify low or medium gloss when ordering.

SEALANT PART NUMBERS

Ref. Code	Winnebago Part Number (WPN)	Unit of Measure (U/M)	Description (Vendor, P/N, Size)	Packaging Qty.
none	002328-02-000	EA	W/S spacer blocks, rubber, .98 x .062 x .50	EA
FT1	076322-02-000	FT	3M Y-4950 Double-coat Foam Tape, .045 x 1.0	108 ft. roll
FT3	063642-01-000	FT	3M Y-9473 Adhesive Tape, .10 mil x 1.5	180 ft. roll
BT1	038886-01-000	FT	PTI Butyl Tape, Black	148 in. roll
SC1	053752-04-000	EA	Schnee 5504 Roof Sealer, Alum.	Tube
SC2	053766-06-000	EA	Schnee 5522 Bedding Compound, Clear	Tube
SC2	053766-02-000	EA	Schnee 5522 Bedding Compound, White	Tube
SC2	053766-07-000	EA	Schnee 5522 Bedding Compound, Beige	Tube
SC2	053766-08-000	EA	Schnee 5522 Bedding Compound, Gray	Tube
SC4	077967-01-000	EA	Schnee 8200 Acrylic Sealant, White	Tube
SC6	069637-01-000	EA	3M 404 Weatherban Sealer, White	Tube
ST1	069640-06-000	FT	Schnee 5603 Isocryl Tape, 5/16" Bead, Black	25 ft. roll
ST2	069640-02-000	FT	Schnee 5603 Isocryl Tape, 1/2" x 1/8", Gray	30 ft. roll
ST3	069640-03-000	FT	Schnee 5603 Isocryl Tape, 3/4" x 1/8", Gray	60 ft. roll
ST4	069640-05-000	FT	Schnee 5603 Isocryl Tape, 2 1/2" x 3/32", Gray	30 ft. roll
ST5	069640-07-000	FT	Schnee 5603 Isocryl Tape, 2" x 3/32", Gray	30 ft. roll
ST6	069640-01-000	FT	Schnee 5603 Isocryl Tape, 1/4" Bead, Gray	20 ft. roll

NOTE: Throughout this section, sealants are designated by Reference Codes listed above in Column 1. Winnebago part numbers are prefixed by the letters WPN.

SEALANT SPECIFICATIONS

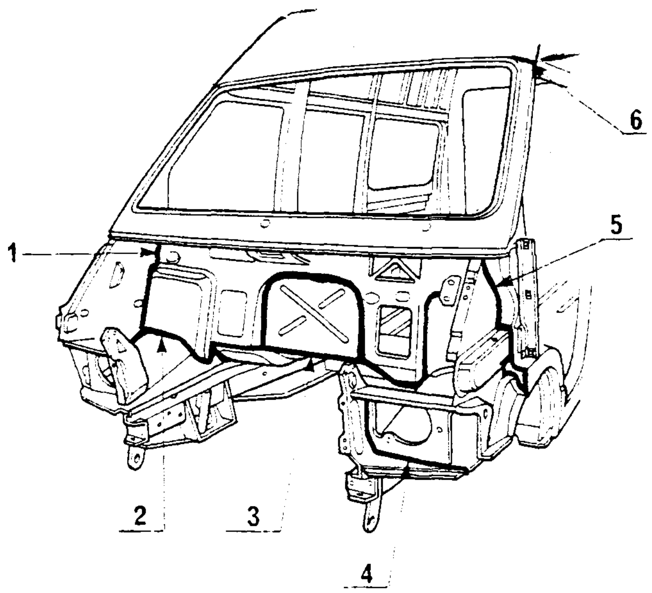
Product	Workable Temp. Range	Cure Time Workable (Max.)	Shelf Life	Storage Precautions
(SC1) Schnee 5504	40°F - 100°F+	1 hr. (90%/24 hr.)	1 yr. (min) at 80°F max.	Avoid extreme heat.
(SC2) Schnee 5522	40°F - 100°F+	1 hr. (90%/24 hr.)	1 yr. (min) at 80°F max.	Avoid extreme heat
(SC3) Schnee 5525	40°F - 100°F+	1 hr. (90%/24 hr.)	1 yr. (min) at 80°F max.	Avoid extreme heat
(SC4) Schnee 8200	40°F - 100°F+	1 hr. (90%/24 hr.)	1 yr. (min) at 80°F max.	Avoid extreme heat & freezing
(ST1 thru ST^) Schnee 5603	40°F - 100°F+	non-curing	1 yr. (min) at 80°F max.	Avoid extreme heat
(FT1) 3M Y-4950	70°F - 100°F+	non-curing	12 mo. at 70°F/50% RH	Avoid heat and humidity
(FT3) 3M Y-9473	70°F - 100°F+	non-curing	12 mo. at 70°F/50% RH	Avoid heat and humidity
(SC6) 3M 404 weatherban	50°F - 100°F+	1 hr. (24 hr.)	10 mo. at 80°F max.	Avoid heat

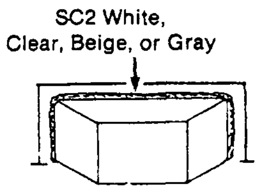
GENERAL BODY SEALING

Cab Front Section

1 - Pillar lining - inner wing panel
2 - Scuttle side section - inner wing panel
3 - Scuttle - front floor
4 - Headlight panel - inner wing panel
5 - Pillar lining - front pillar
6 - Windshield frame pillar - roof pillar

Seal all seams with SC4.

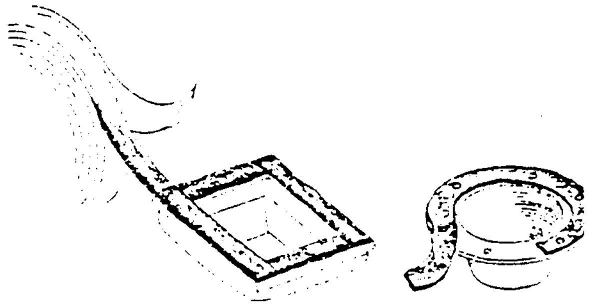




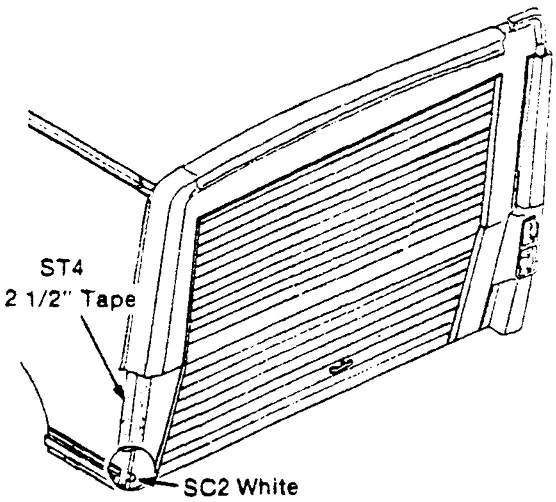
CLEARANCE LIGHTS

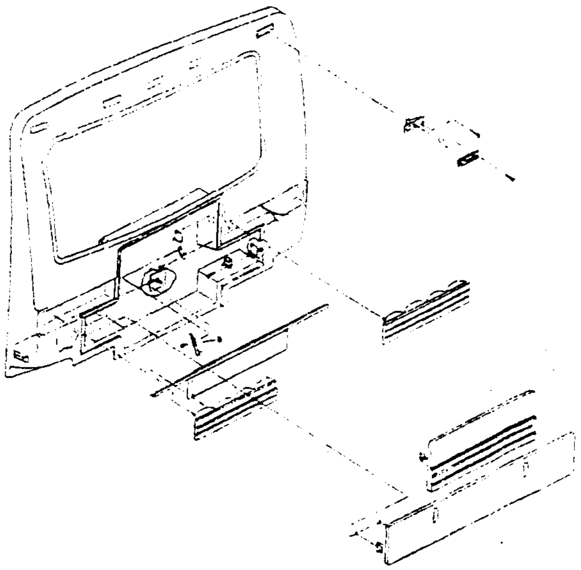
Cap seal top and side edges of base with SC2 clear as shown.

ROOF MOUNTED COMPONENTS (A/C, Vents, Soil Pipes, Etc.)
Apply 1/2 inch tape, ST2, to bottom of all mounting flanges before fastening. Screws must penetrate sealant.



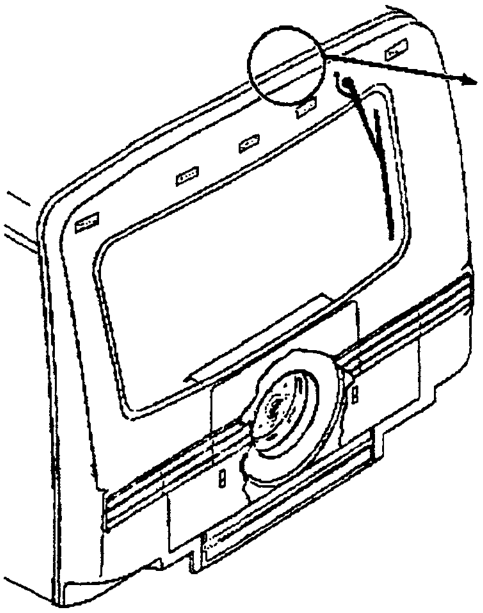
BACKWALL/SIDEWALL JOINT
Apply 2 1/2 inch tape along outside corner of joint. Apply SC2 white over wire holes after wires are through. Install contour moldings.

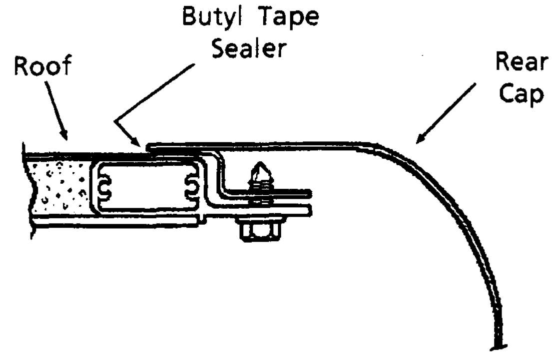




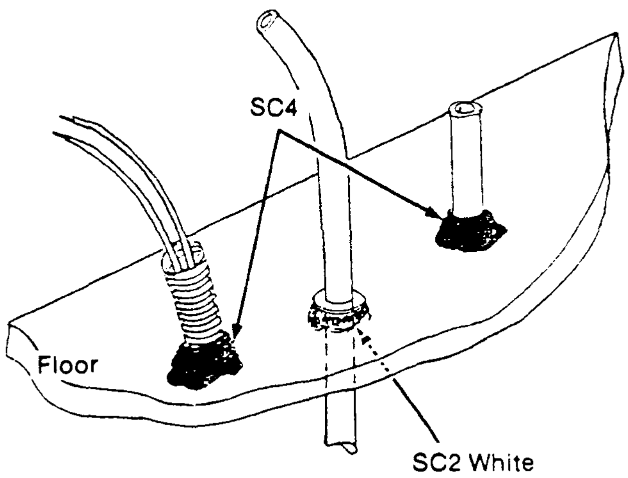
GENERAL BODY SEALING

BACKWALL/ROOF JOINT
Place 2 inch sealant tape along edge of roof joint as shown and install rear cap.





HOLES IN FLOOR
Seal on top side with SC4 and on bottom side with SC2 white.



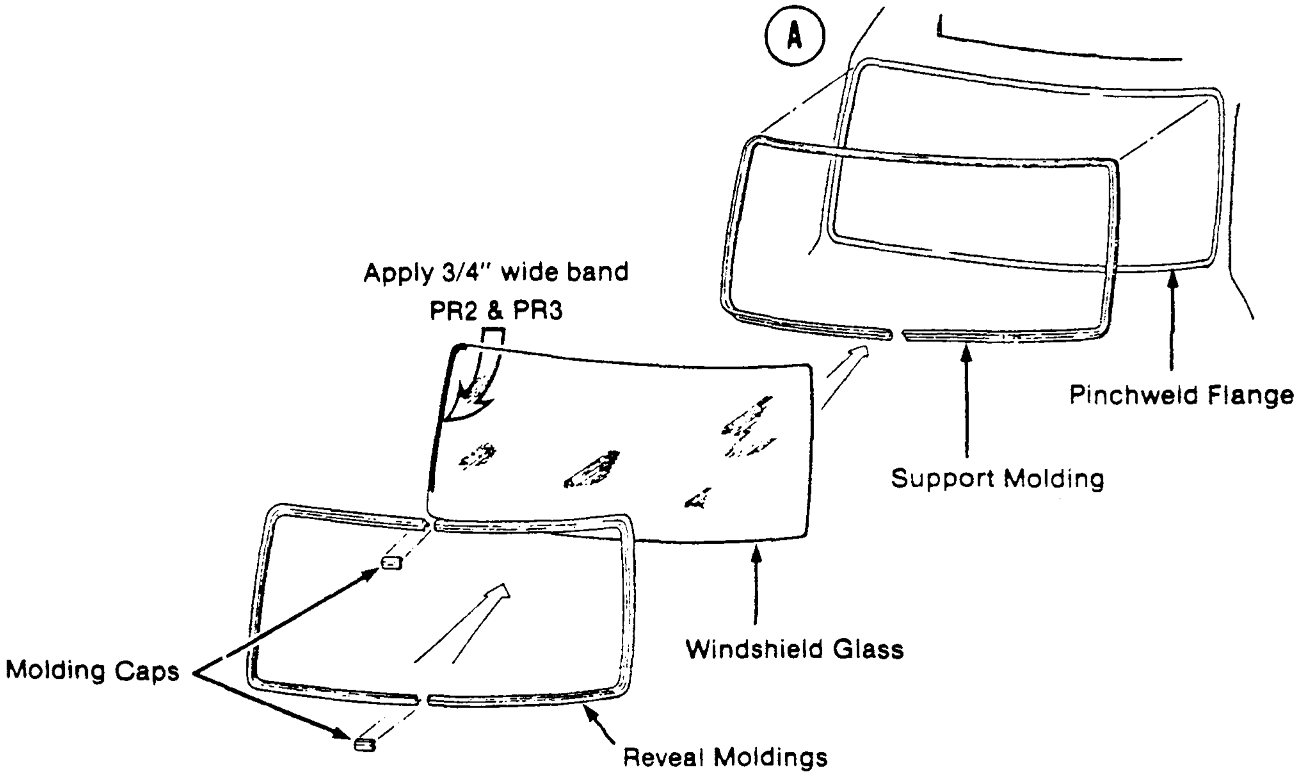
WINDSHIELD

The windshield glass is retained to the body by urethane adhesive. Glass rests on a rubber support molding placed around the perimeter of the pinchweld. urethane is pumped into the cavity between the body and glass and capped by reveal moldings.

Removal Procedure
Reveal and support moldings must be pulled off in order to remove glass. Pull reveal moldings away from urethane. Remove support molding from pinchweld flange from inside vehicle. Use a urethane cutting knife to cut adhesive completely around perimeter of glass and carefully remove glass. (Urethane knife is available at your auto body supply dealer.) Make sure that an even bead of the existing urethane remains on the flange to serve as a base for replacement glass.

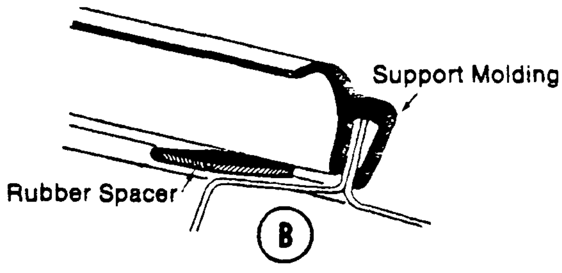
IMPORTANT
If body repair or painting requires that existing urethane be totally removed, pinchweld must be thoroughly cleaned with alcohol and primed with PR1 pinchweld primer before proceeding with installation. (Allow 30 minutes set time). Do not use a petroleum base solvent (kerosene, gasoline, etc.) to clean metal or glass as any pressence of oil will prevent adhesion of urethane. Primers must be agitated before use and frequently during use to keep carbon particles in suspension.

Glass Preparation
1. Clean inside edge of glass with alcohol dampened cloth and allow to air dry.
2. Apply clear glass primer PR2 in a 3/4 inch wide band on inside of glass and on edge around entire perimeter. Wipe off excess immediately. Allow 5 minutes set time before preceeding.
3. Apply black glass primer, PR3 on same area as Step 3. Let dry to touch (10 minutes approx.)

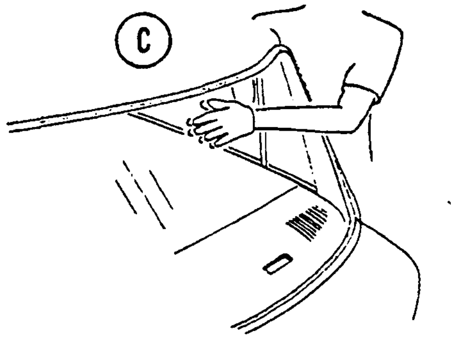


Installation Procedure

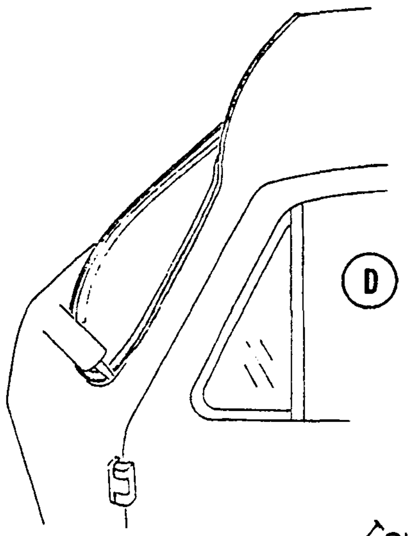
1. Install support molding onto pinchweld flange with joint located at bottom center of opening. Trim to ensure a flush fit at joint. Refer to Fig. A.
2. Place rubber spacers (1/16" x 1/2" x 1") on windshield glass supports at bottom of opening. (Refer to Figure B). Glass should not be allowed to contact metal at any point to avoid breakage from road vibration.

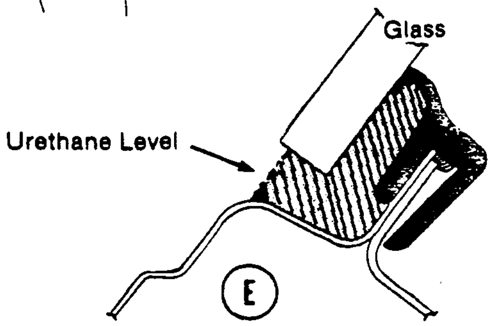


3. With aid of an assistant, carry glass with one hand on outside and other on inside. Do not touch primed edges. Set glass onto opening in an upright position. White helper holds glass, reach one arm around pillar and hold glass while he does likewise. (Fig. C).
4. Lower glass onto support molding, centering it side to side and reseting on rubber support spacers.



5. Cut tip of urethane tube, UR1, to an opening of 3/16 inch and fill in completely around glass spacer supports.
6. Apply a smooth continuous bead of urethane around perimeter of glass. Direct flow down into cavity to fill space between glass edge and original urethane base or primed metal. Fill approximately to level indicated. This allows for displacement by reveal molding.

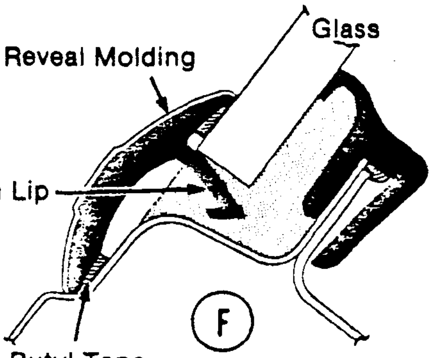




7. Spray a mist of water onto urethane and dry off areas where molding will contact body and glass. Urethane is a moisture curing compound, so this step will assist the curing process.

IMPORTANT
Reveal moldings must be installed into urethane adhesive **within 10 minutes** after application.

8. Slide molding caps onto both ends of one of the reveal moldings and peel backing from butyl strips on rear edges of moldings. If original moldings are reusable, remove any excessive butyl or urethane from rear edges.
9. Install reveal moldings by pressing retention lip into urethane using glass edge as a guide. (See cross section, Fig. F).



IMPORTANT
Make sure molding is seated at corners and that butyl tape contacts body and glass as shown. (Fig. F). Use hand roller if necessary to obtain best fit to body and glass. Use duct tape to hold molding down in correct position until adhesive cures.

WARNING
Vehicles should be allowed to remain at room temperature for **six hours** before being driven to allow proper curing of adhesive.

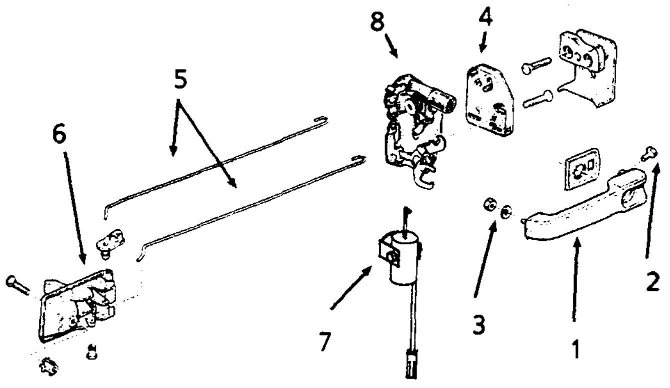
CLEAN-UP
A solvent such as naptha is suggested for cleaning tools and equipment. For hand cleaning, use a lanolin base, waterless hand cleaner.

CAB DOOR LOCK MECHANISM

REMOVING:

- Raise the window to its full extent.
- Remove the inside trim panel.
- Remove the plastic sheet.

Remove:
- outer handle (1) held by screw (2) and nut (3)
- the 3 screws holding plate (4)
- unhook remote control rods (5) from the inside handle (6)
- disconnect power lock solenoid linkage (7) from latch mechanism (8)
- remove the lock mechanism by pivoting it around the window channel

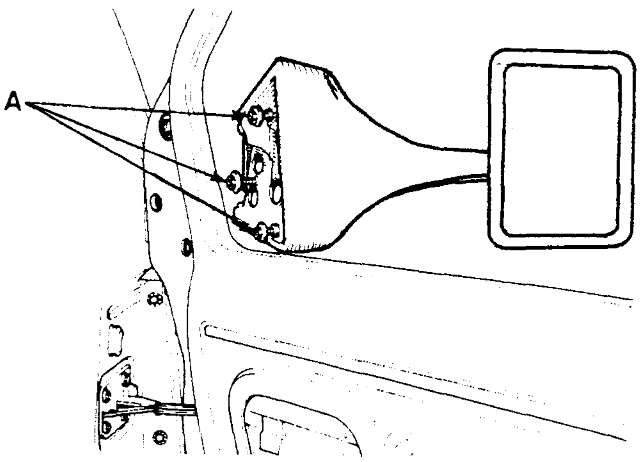


OUTSIDE MIRRORS

REMOVE:

- the 3 plugs on the inside of the door frame
- and 3 bolts (A), the longer bolt is in the center

The rubber which protects the mirror hinge is locked in position between the bracket and outer door panel.



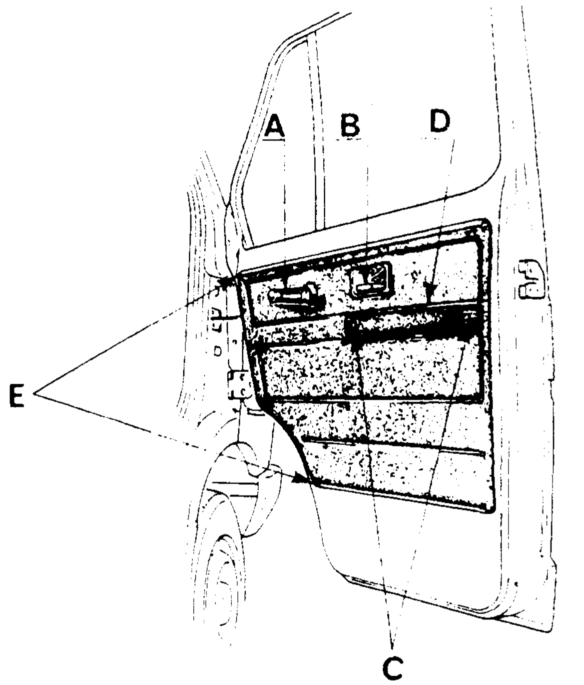
INNER DOOR PANEL
REMOVAL

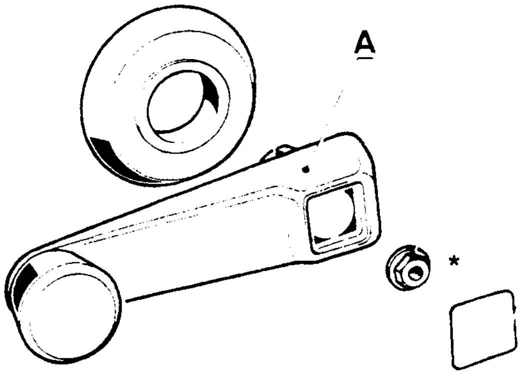
Remove:
- window crank handle (A)
  NOTE: 1987 and 1988 models use the window crank handle shown. 1989 and newer models use a snap-on/off version, which does not use the nut fastener.
- remote control lever (B)
- and the 2 screws holding door pull (C).

The door pull remains attached to the panel by rivet (D).

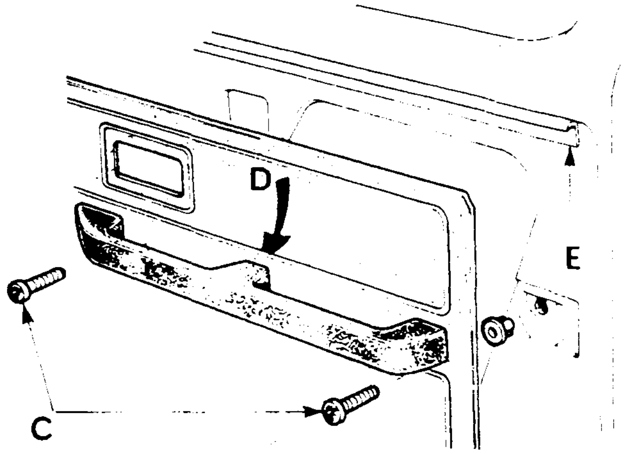
Unclip the panel and ease it out of the channels (E).

Remove the plastic sheet.



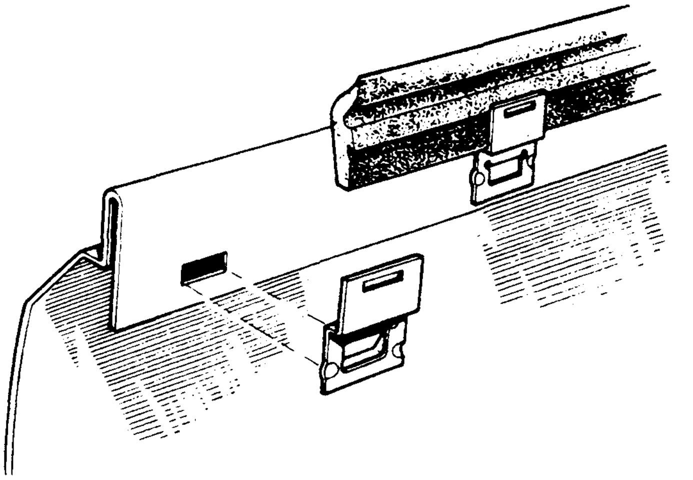


*Not used on 89 or newer snap-on style.

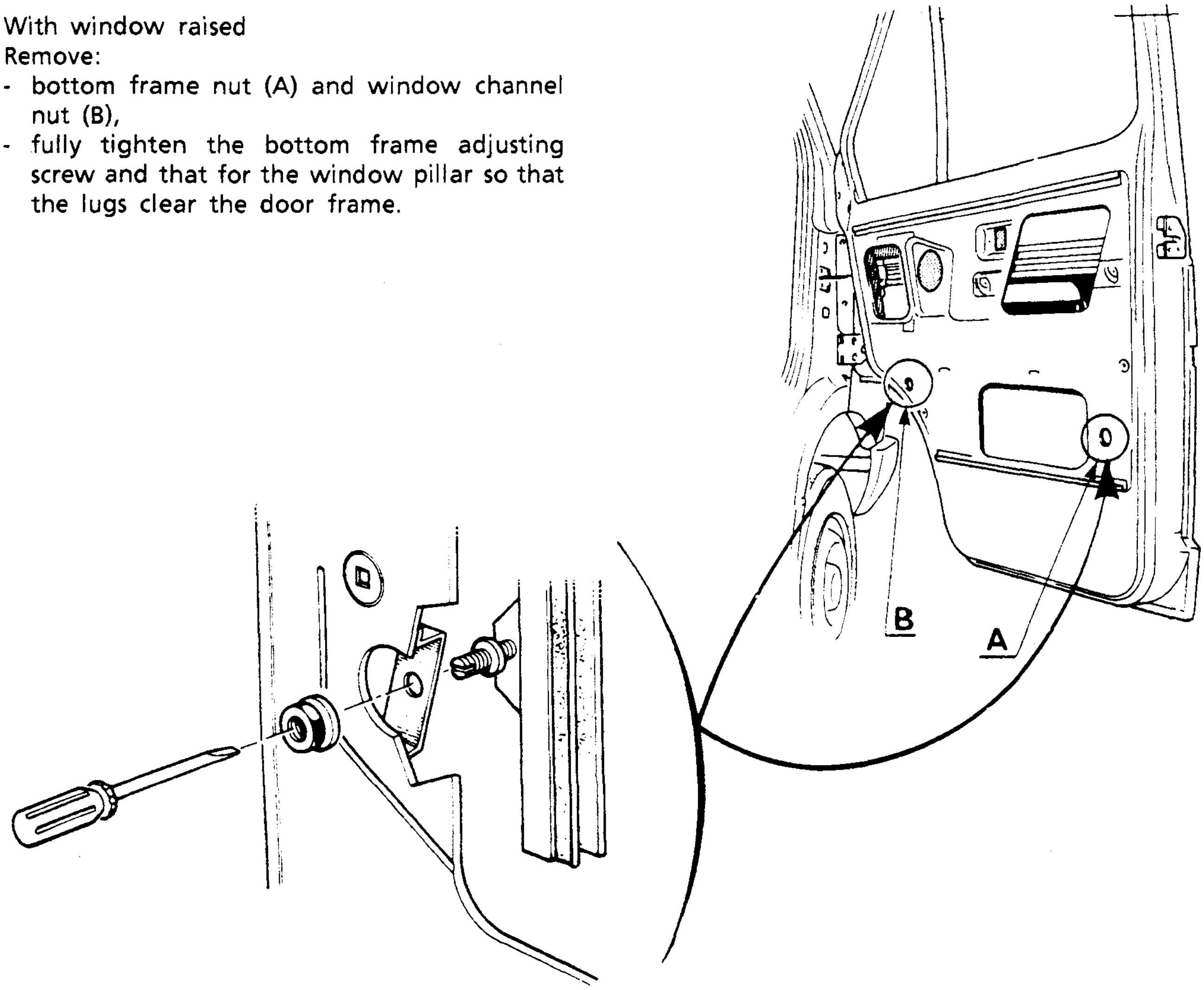


CAB WINDOWS AND CRANKS
REMOVE AND REPLACE

REMOVAL
With window lowered, remove the inner and outer wiper strips and clips.



With window raised
Remove:
- bottom frame nut (A) and window channel nut (B),
- fully tighten the bottom frame adjusting screw and that for the window pillar so that the lugs clear the door frame.

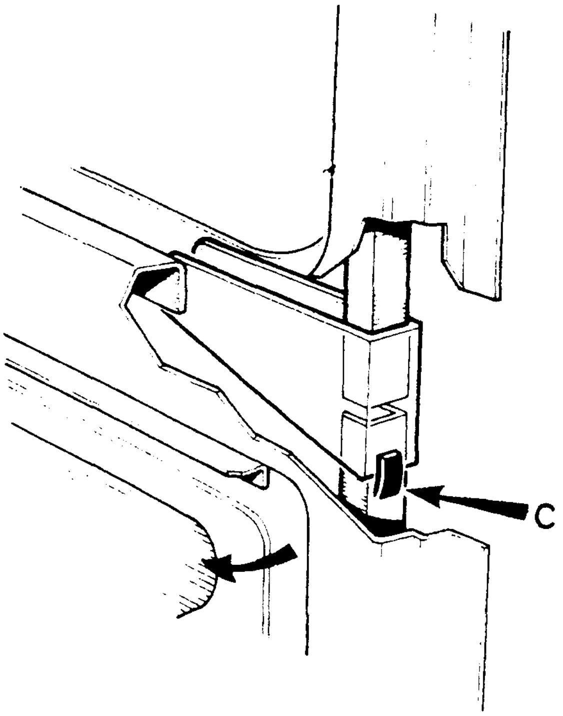


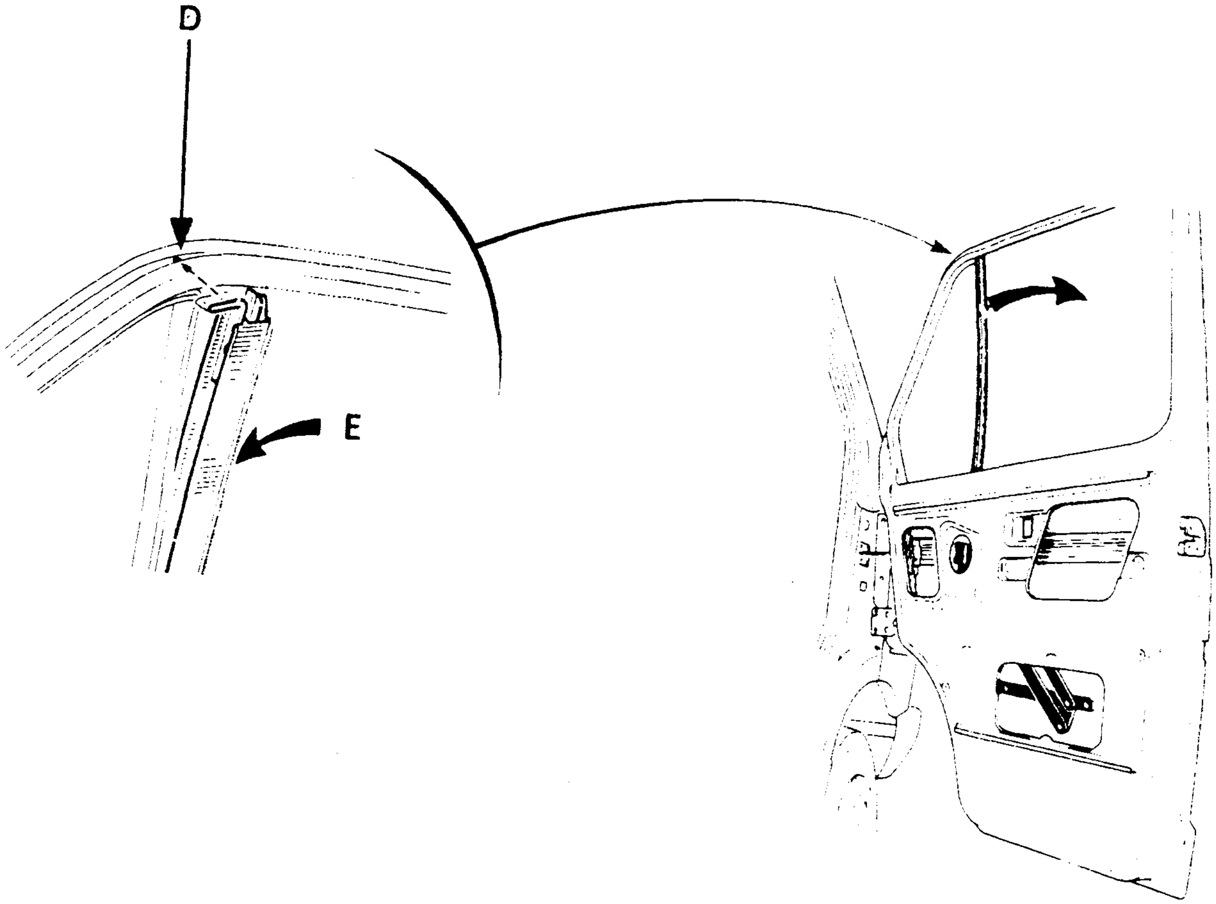
CAB WINDOWS AND CRANKS
REMOVE AND REPLACE

Remove lower frame (C) by pivoting it.

With window lowered:

Remove:
- fixed window pillar top screw (D), channel (E),
- and tilt the fixed window pillar.

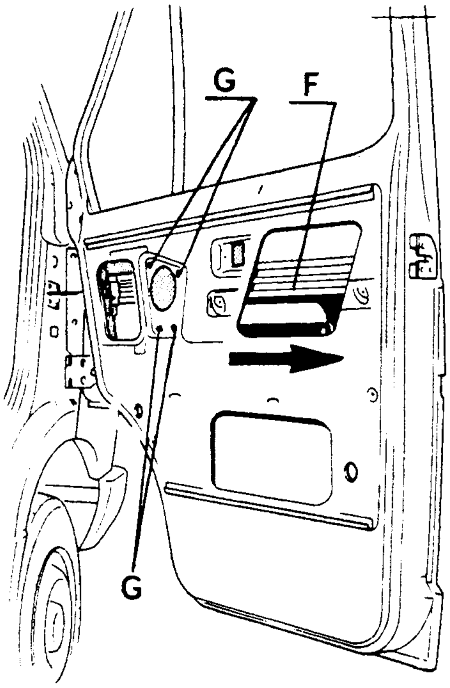


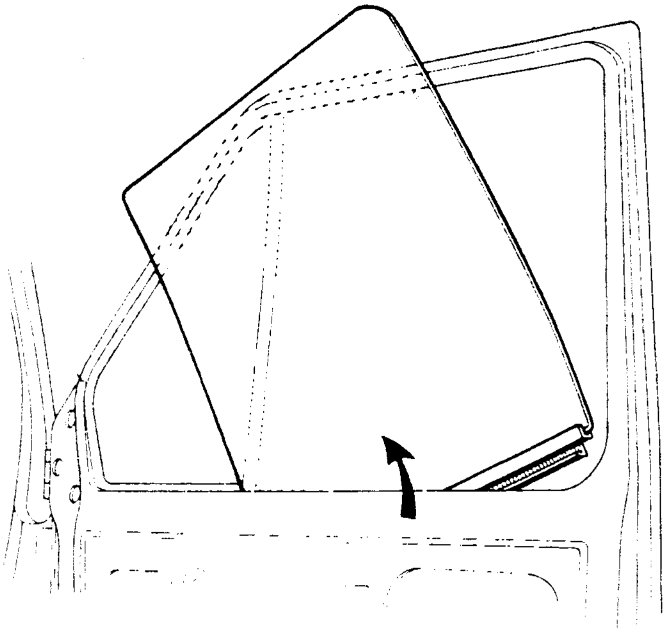


CAB WINDOWS AND CRANKS
REMOVE AND REPLACE

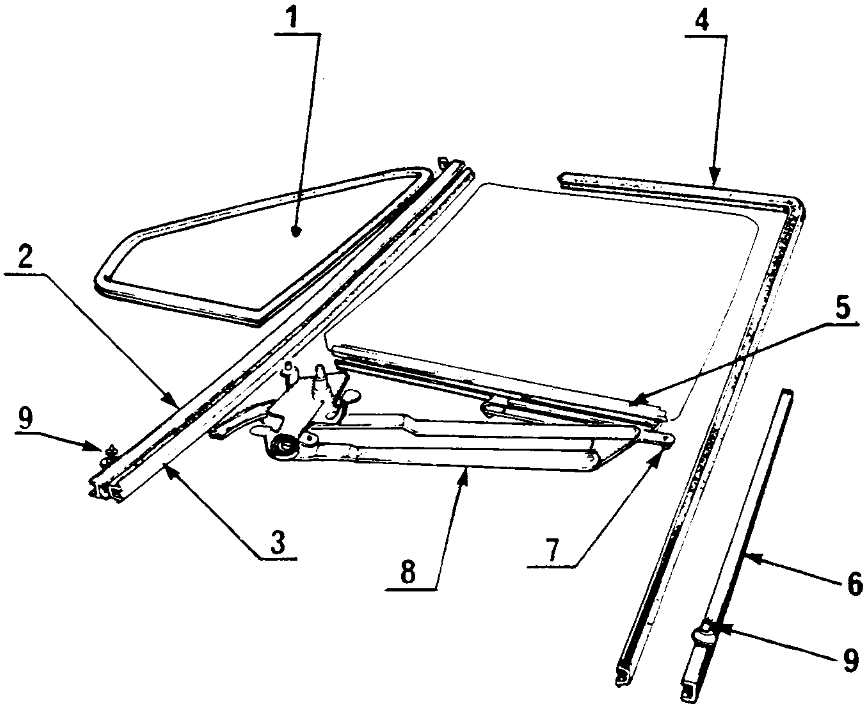
REMOVING THE WINDOW CRANK MECHANISM

- Raise the mechanism level with door panel stiffener (F).
- Unscrew the 4 mechanism nuts (G),
- Slide the mechanism to the rear to clear the rollers at the bottom
- Remove the window.



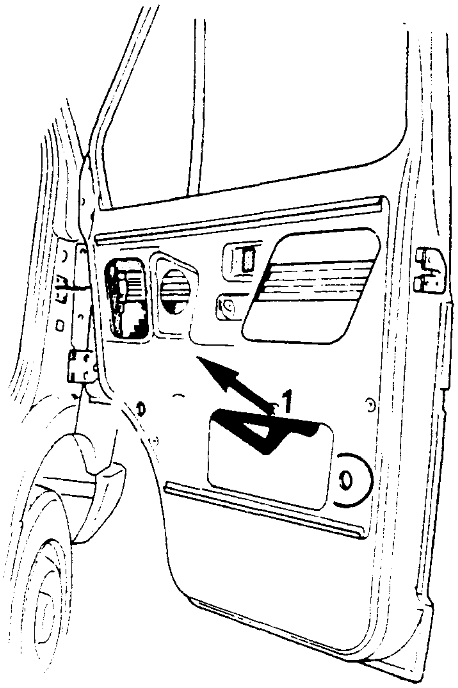


1. Fixed window
2. Fixed window pillar
3. Fixed window pillar channel
4. Channel
5. Bottom channel
6. Bottom frame
7. Mechanism rollers
8. Window crank mechanism
9. Window pillar adjusting screws

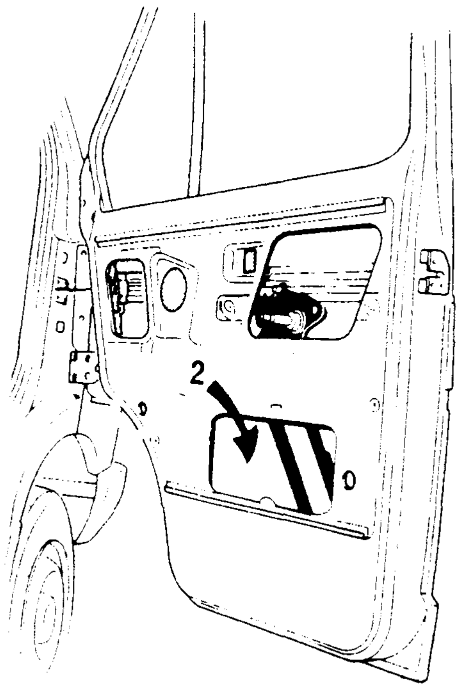


TO REMOVE THE MECHANISM

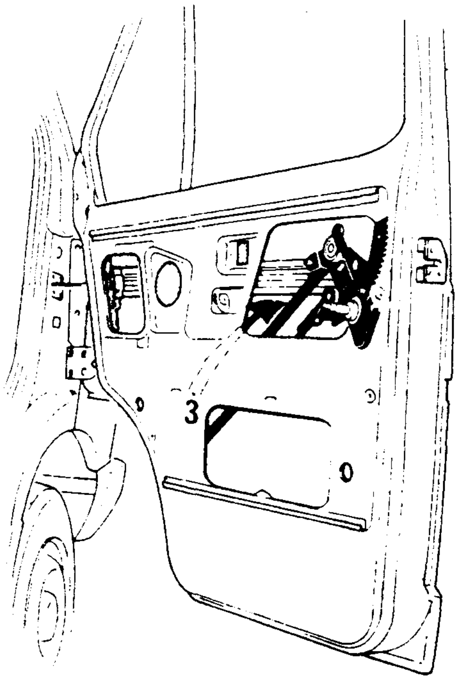
1 - Push the mechanism forward.



2 - Tilt it downwards.



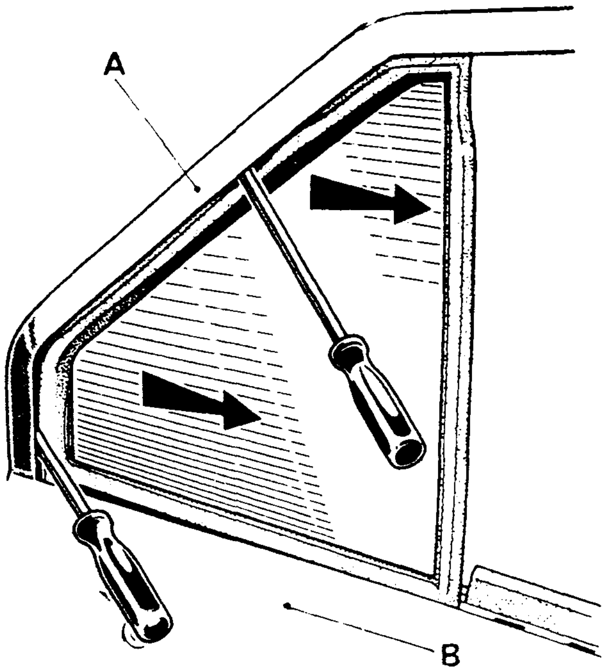
3 - Withdraw it through the top cut-out.



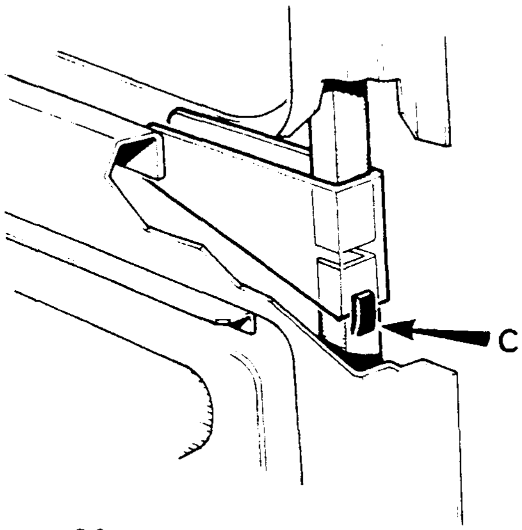
CAB WINDOWS AND CRANKS
REMOVE AND REPLACE

REMOVING - REPLACING
The fixed window is held firm by its rubber seal in frame (A) and between door frame (B) and the outer panel.

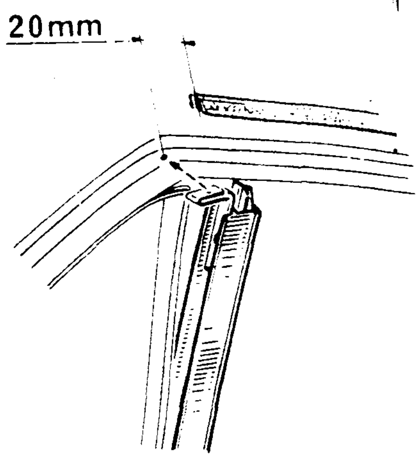
Use soapy water to insert the window to make the operation easier.



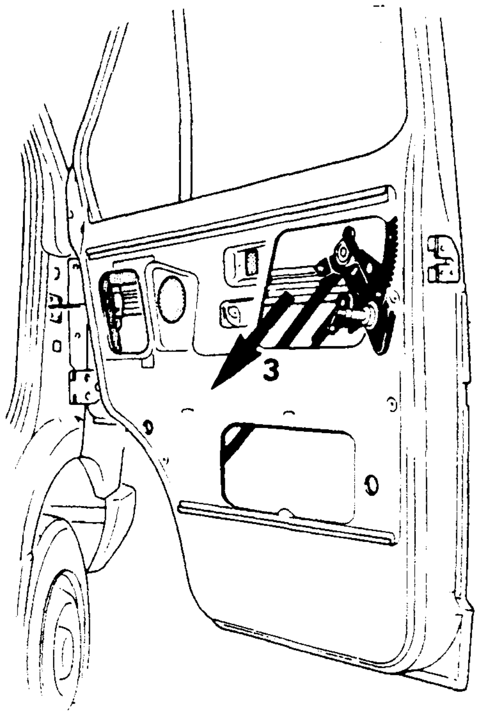
REASSEMBLING THE WINDOW CRANK MECHANISM
1 - Insert lower frame (C);



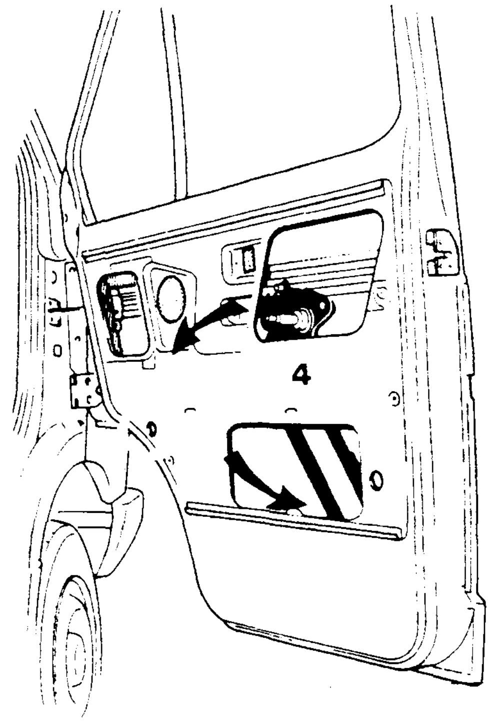
2 - Position the channel in the window frame, the front part of the channel 20 mm from the fixed window pillar fixing hole.



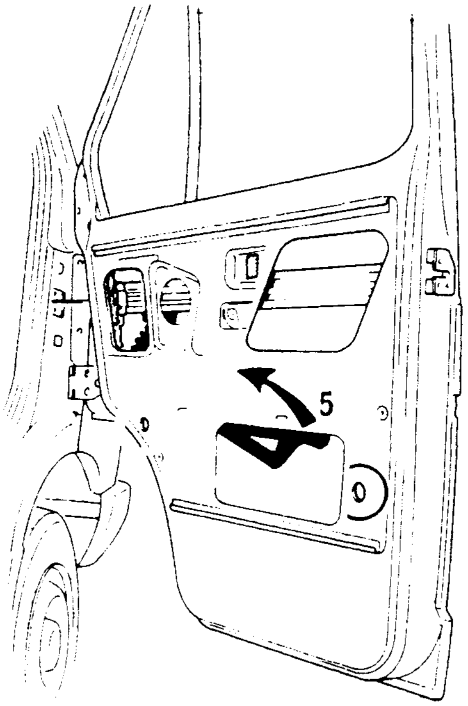
3 - Insert the window crank mechanism in the door frame via the cut-out at the top.



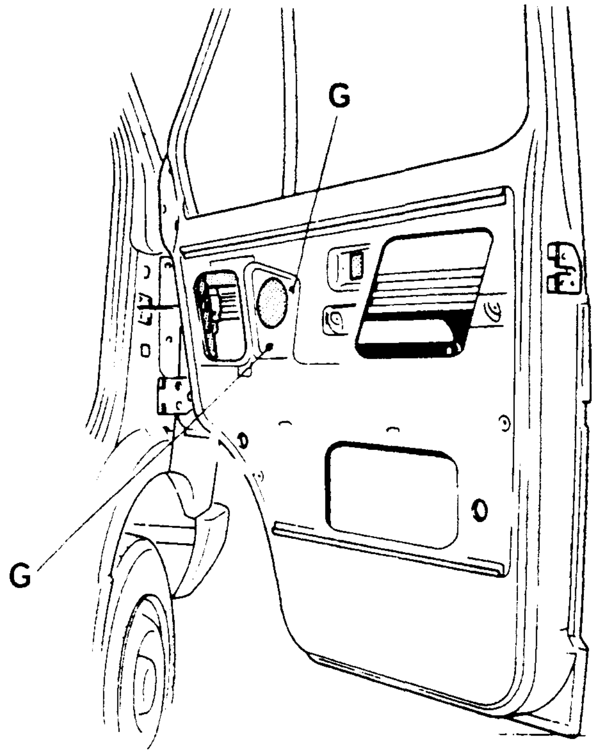
4 - Tilt the mechanism down.



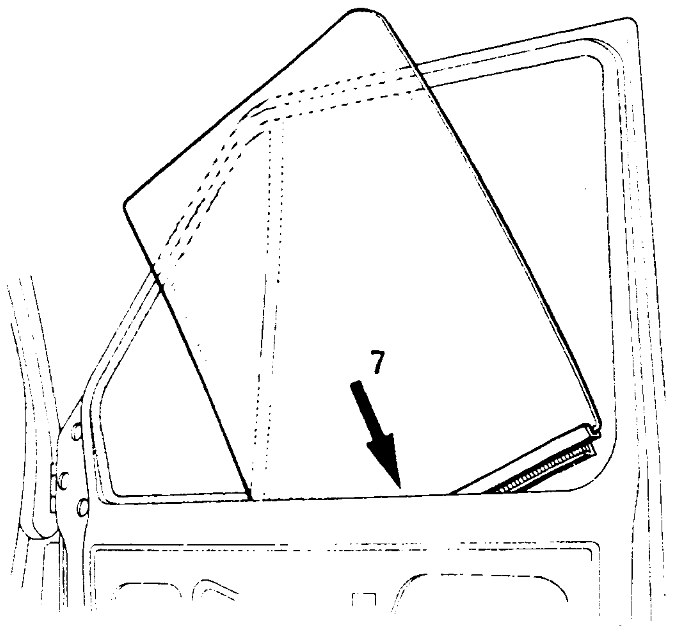
5 - Pull the mechanism back.



6 - Hold it temporarily with 2 nuts (G).

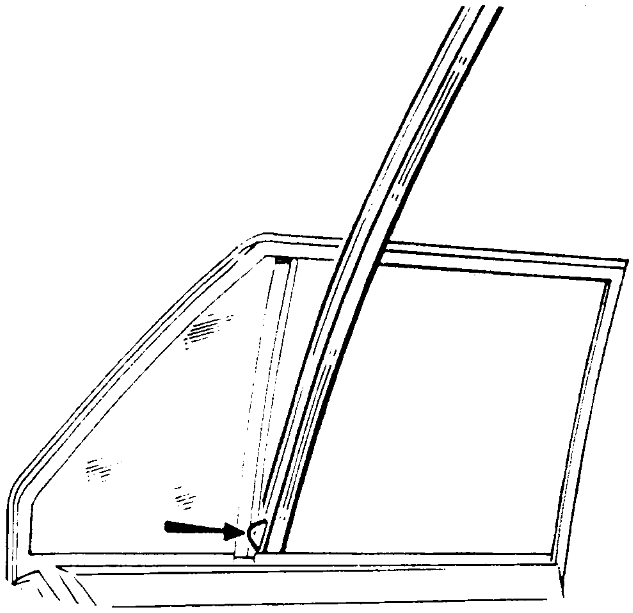


7 - Insert the window into the bottom of the door frame.

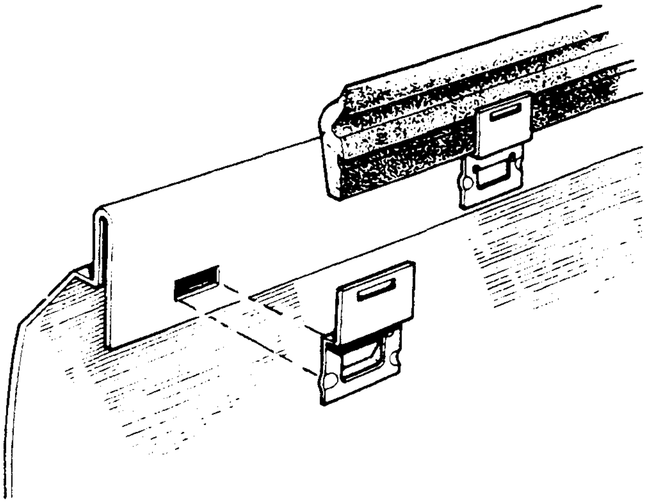


8 - Attach the fixed window pillar to the door frame. On the way down, insert the pillar angle adjusting screw.

9 - Position the pillar and fasten it at each end.

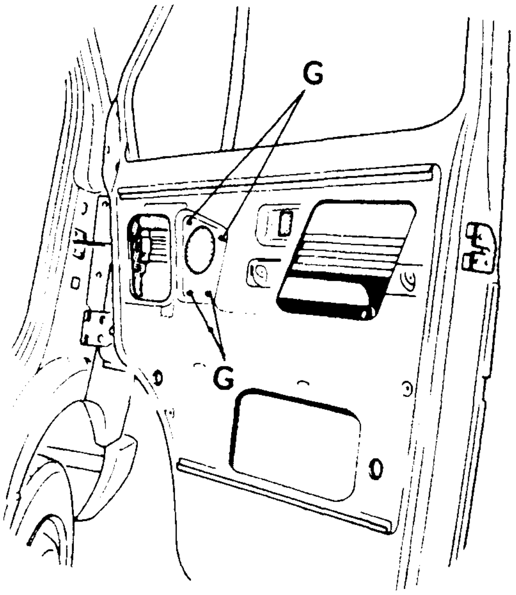


10 - Insert the inside and outside wiper strip clips.



11 - Position the window level with the panel stiffener, remove the 2 screws holding the mechanism temporarily. Slide the mechanism rollers into the bottom channel.

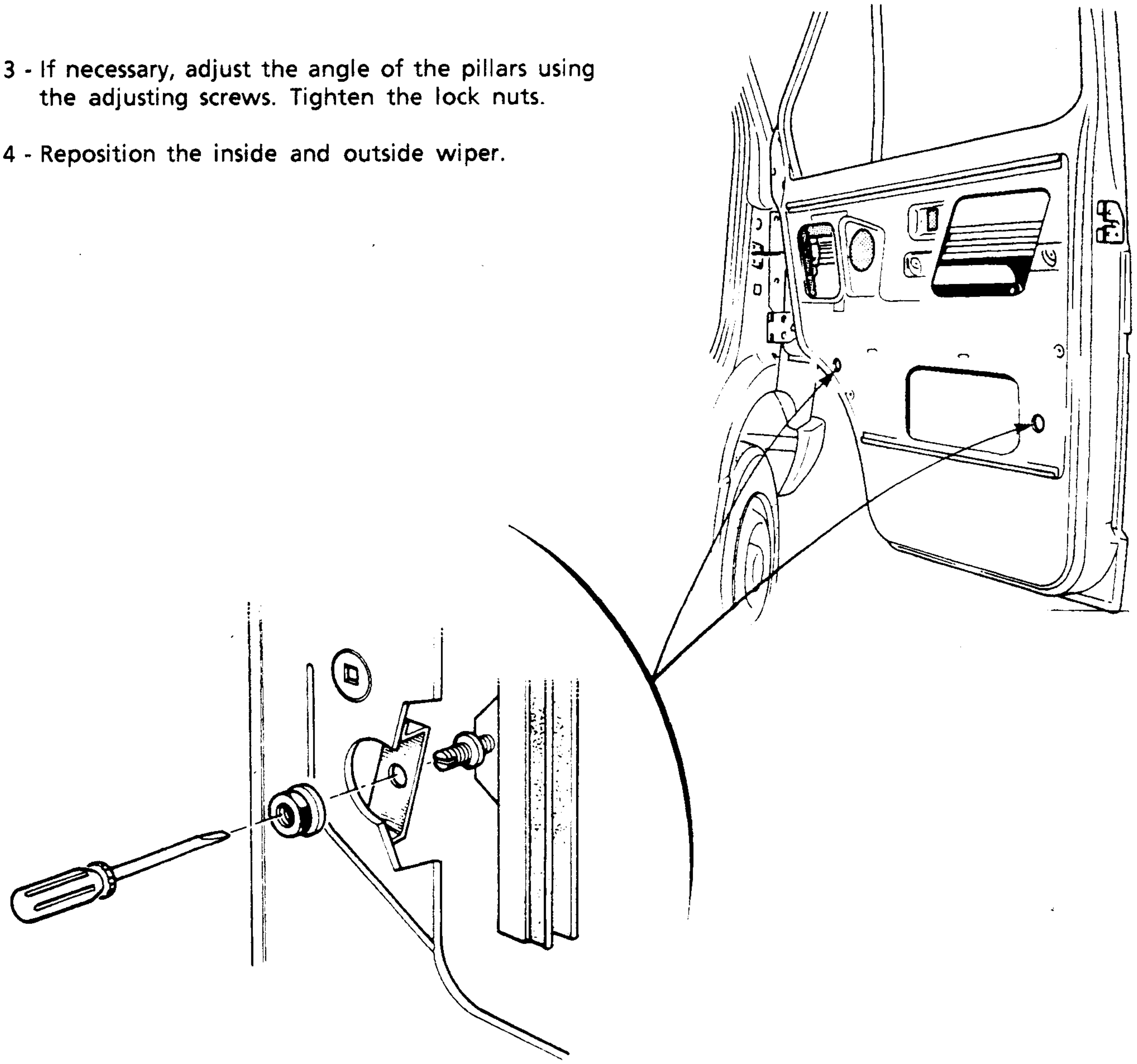
12 - Crank the window up to the top and tighten the 4 mechanism nuts (G).



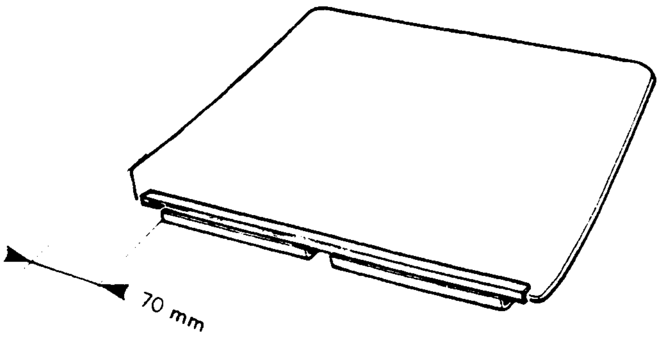
CAB WINDOWS AND CRANKS
REMOVE AND REPLACE

13 - If necessary, adjust the angle of the pillars using the adjusting screws. Tighten the lock nuts.

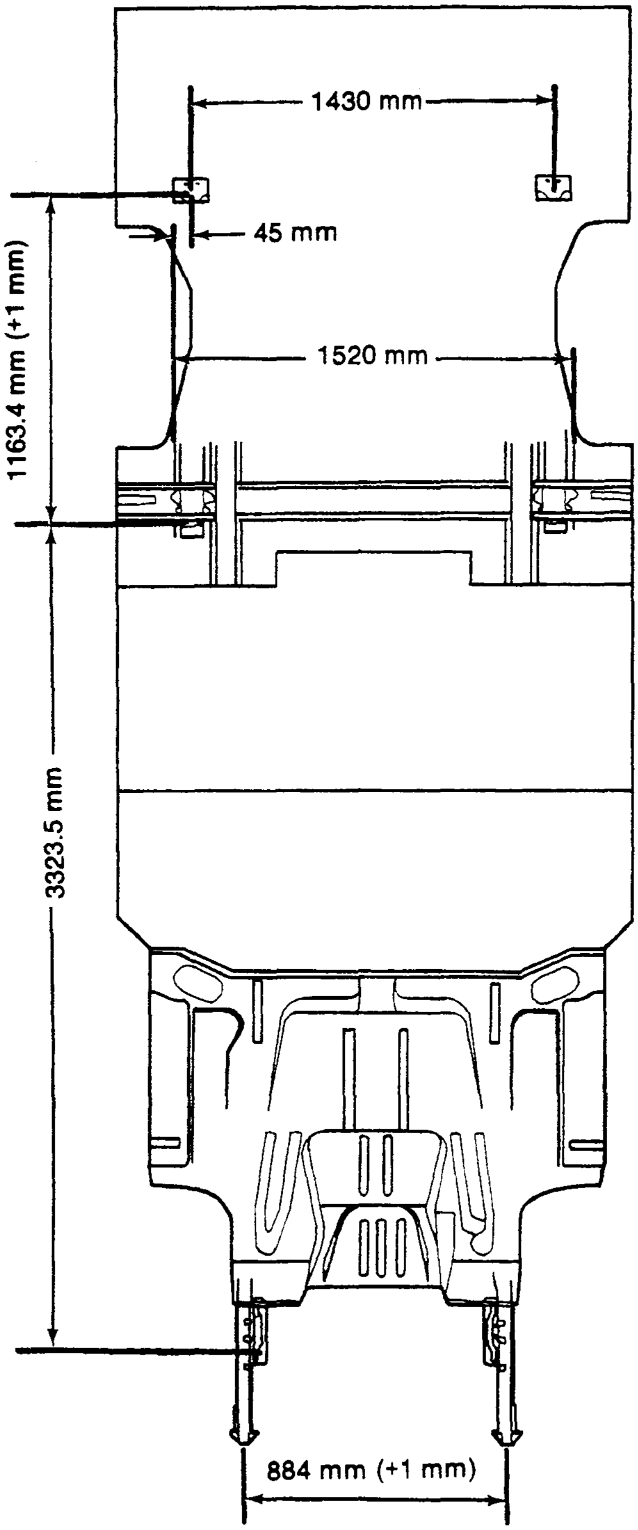
14 - Reposition the inside and outside wiper.



The edge of the glass should be 2 3/4" (70 mm) from the bottom channel as shown.

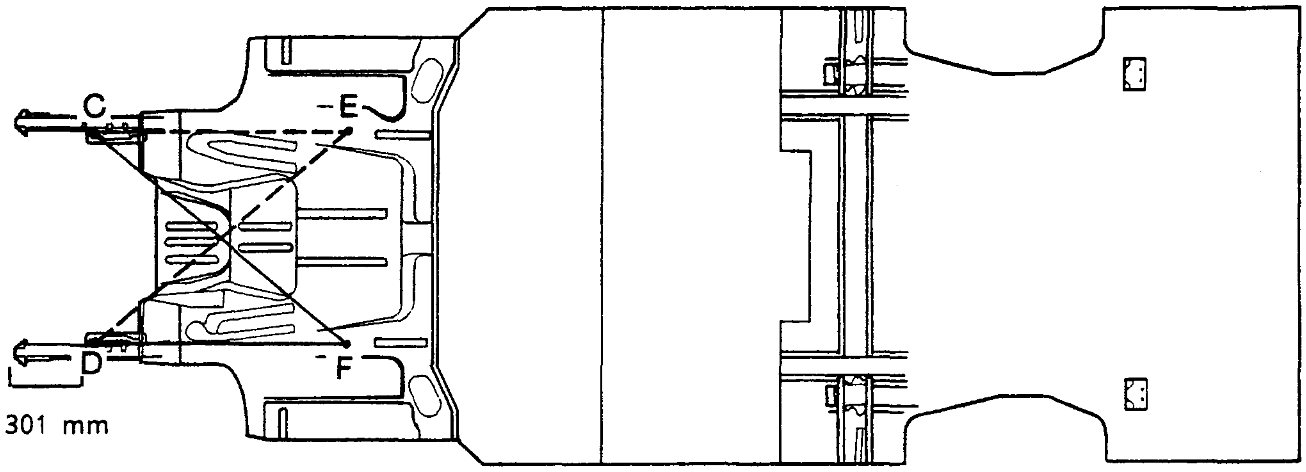


FRAME DIMENSIONS
(METRIC ONLY)



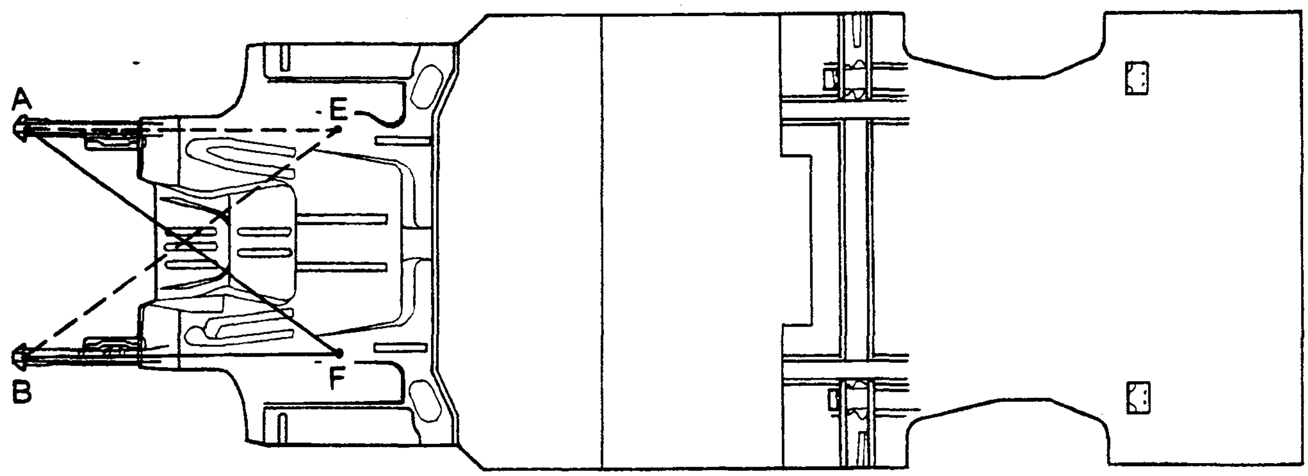
FRAME DIMENSIONS

Checking with the trammel gauge (or equivalent)



Checking the mounting points for the front axle crossmember.

Compare lengths: CE = DF
CF = DE
CE = 1377 mm
DF = 1377 mm
CD = 884 mm
EF = 950 mm

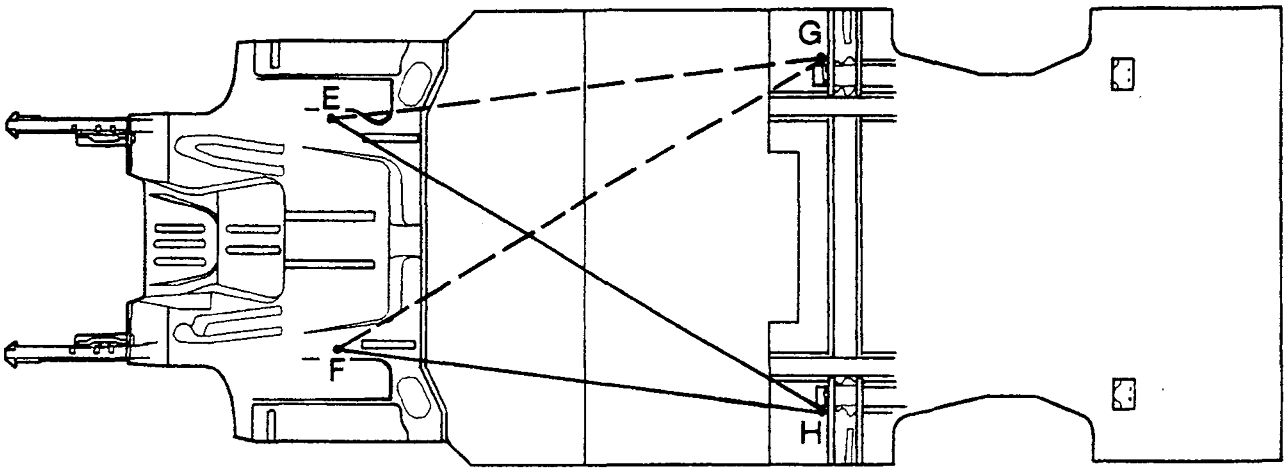


Checking the end of the front sidemember.

Compare lengths: AE = BF
AF = BE
AE = 1678 mm
AB = 954 mm
BF = 1678 mm
EF = 950 mm

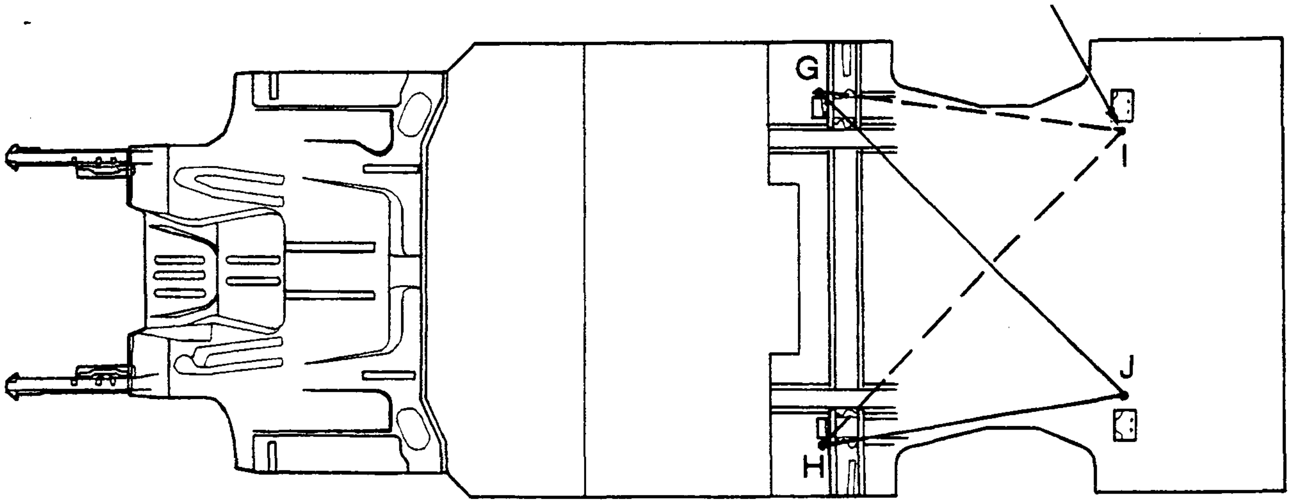
FRAME DIMENSIONS

Checking with the trammel gauge (or equivalent)



Checking spring blade mounting gusset.

Compare lengths: EG = FH
EH = FG



Checking the rear crossmember.

Compare lengths: GI = HJ
HI = GJ

The procedures in this section describing how to change welded components are given purely as a guide. They depend on:

- how the panels are cut,
- the degree of accessibility inside for positioning the panel to be welded and the tools available for planishing, etc.
- the zones of less serious distortion where welding is concerned.

NOTE: These methods are guidelines only and may be modified to suit each particular situation depending upon the degree of damage.

SPECIAL PRECAUTIONS

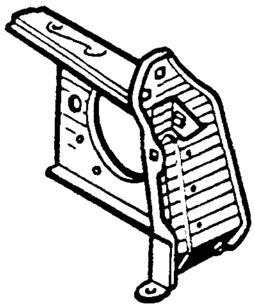
There are certain sections of these vehicles which **cannot** be cut or replaced without sacrificing the structural integrity and initial safety characteristics. Details on these sections are listed below.

IMPORTANT

Never:

- partially change a front sidemember
- heat up a frame sidemember for straightening
- change a component or section which supports a mechanical component without the use of a jig bench.
- submit a vehicle positioned on a jig bench to hydraulic force (pull or push) without first correctly anchoring the vehicle.
- change a front or rear section without using all the special supports on a jig bench designed for the vehicle.

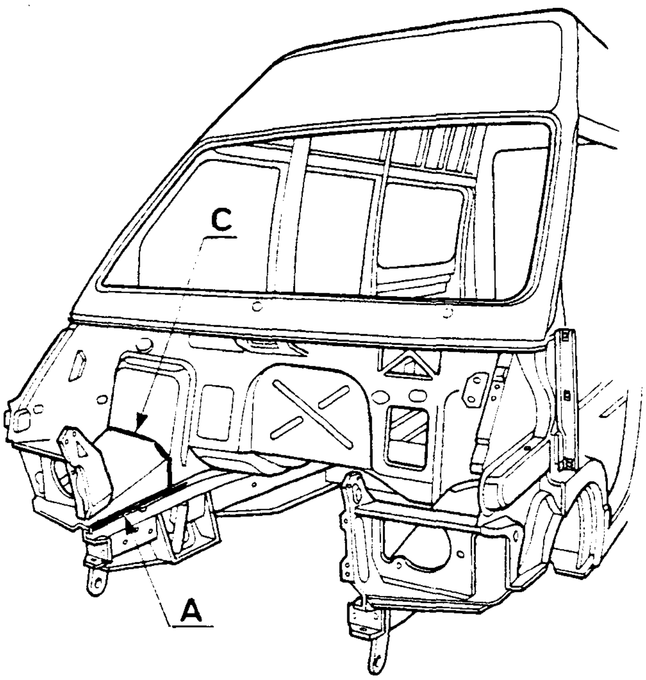
CHANGING THE FRONT SECTION

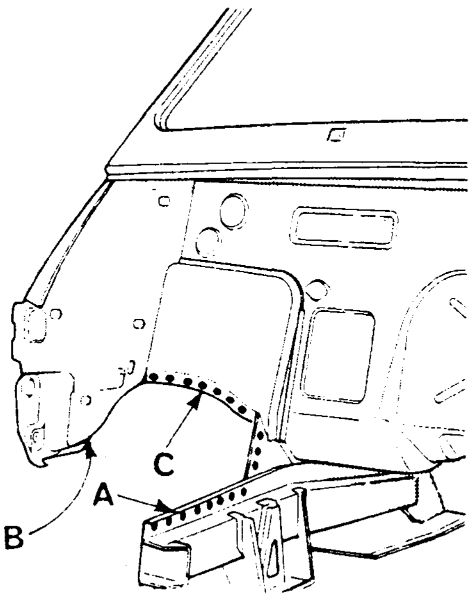


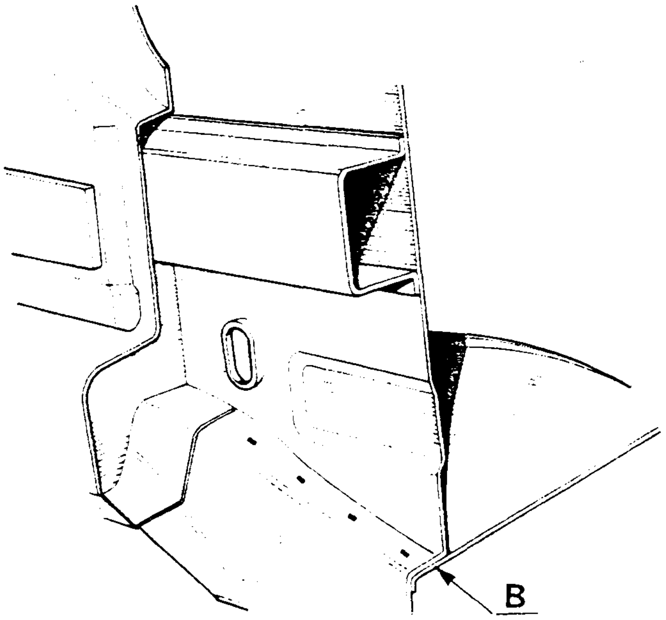
REMOVING:
Chisel cut the inner wing panel at the following joints:

A: Inner wing panel - sidemember
B: Inner wing panel - pillar lining.
C: Inner wing panel

Then separate the spotwelds at these joints.



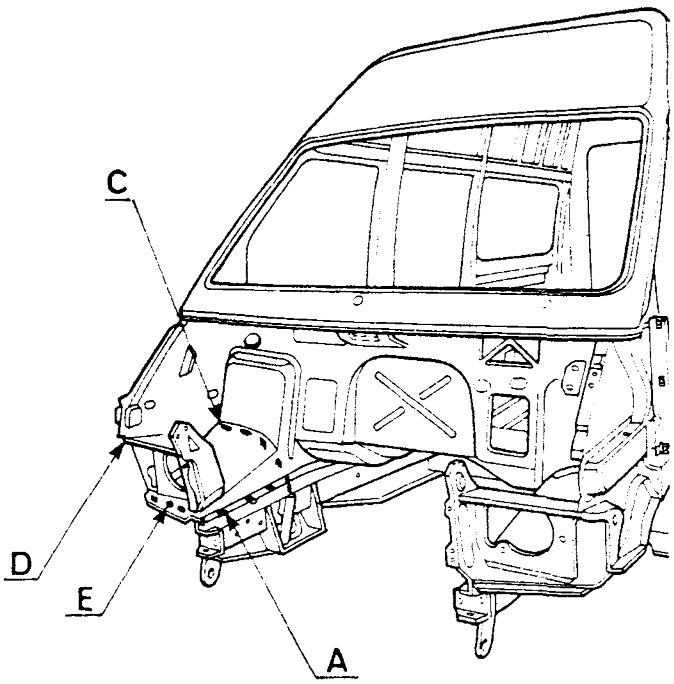




CHANGING THE FRONT SECTION

PREPARATION
After grinding the joints smooth, apply a coat of plastic filler or zinc-based paint to the new panel to prevent rust forming.

REFITTING
Mount and align the new inner wing panel front section followed by the headlight panel. Hold these panels with vice-grips.



Spotweld the following joints:
-A : Sidemember - inner wing panel
-B : Inner wing panel - pillar lining
-D : Headlight panel - pillar lining
-E : Headlight panel - pillar lining

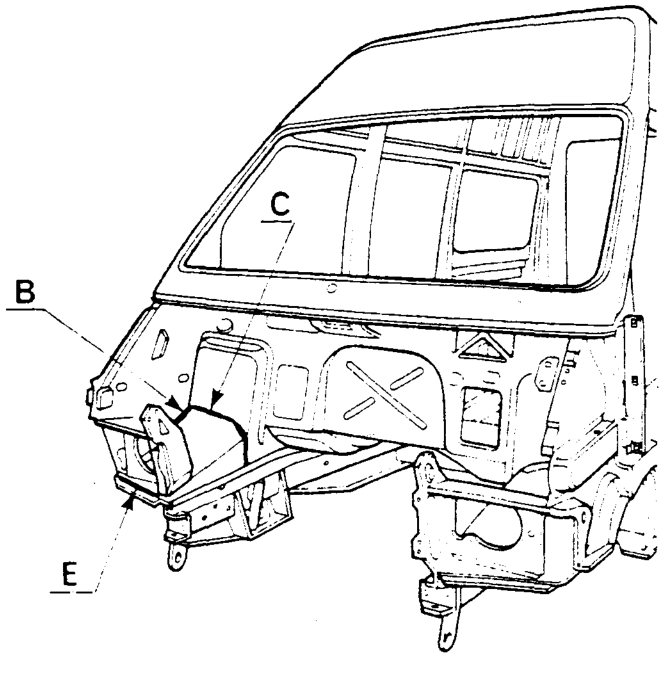
Seam braze:

-C : Inner wing panel

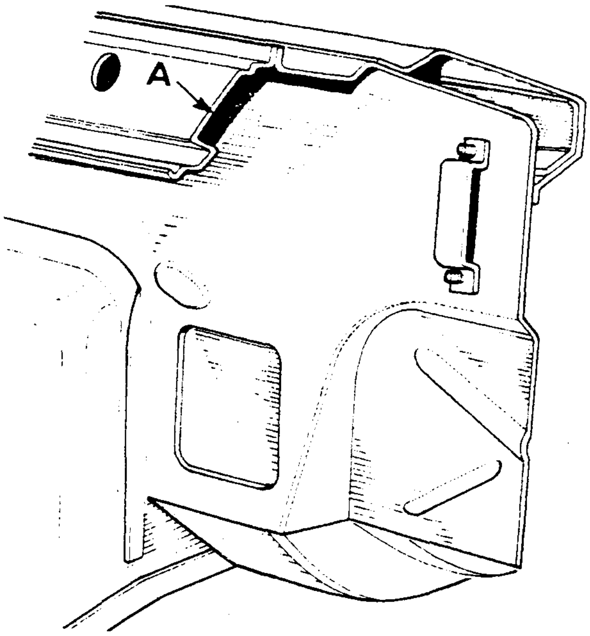
Apply strips of SC4 sealer to the following joints:

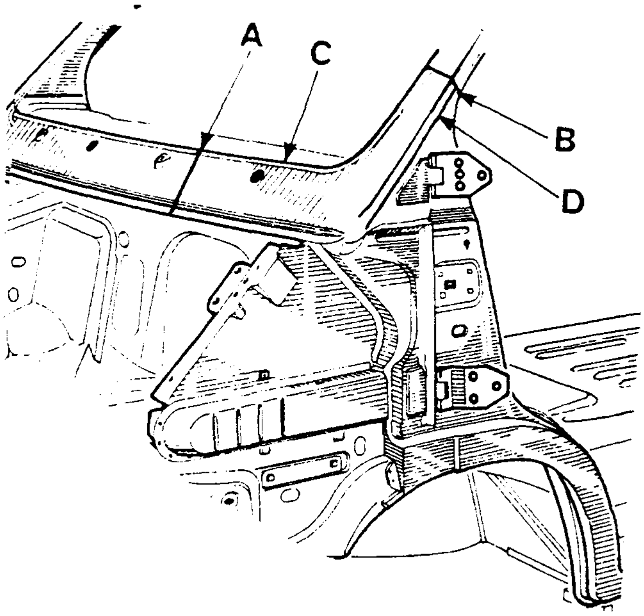
-B : Pillar lining - inner wing panel
-C : Inner wing panel - side section
-E : Headlight panel - inner wing panel

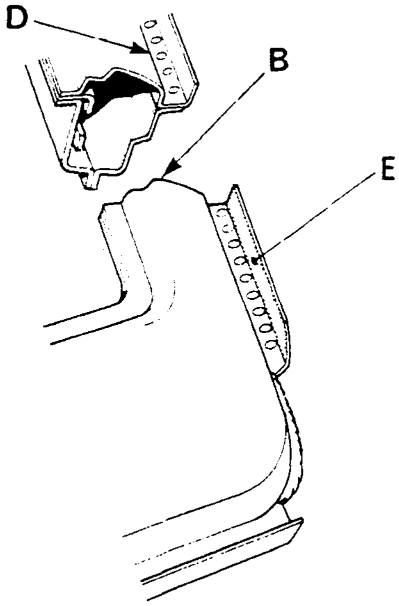
Apply undercoating material to the inner wing panel.



PART REPLACEMENT
SCUTTLE PANEL







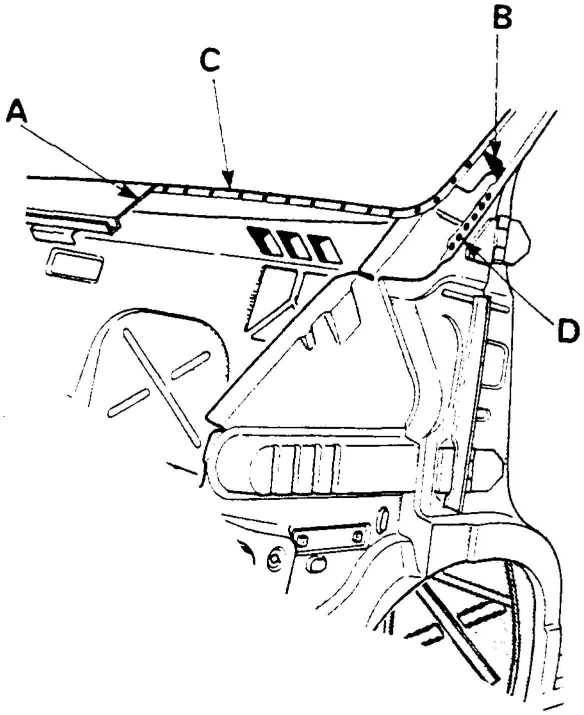
REMOVING:
Saw cut the w/s/hood panel (A) and the pillar at (B).

Chisel cut the panels at the following joints:

C: w/s cowl
D: A pillar

Snip off the rain channel flange (E) leaving the welded seam in position.

Because of the large number of spotwelds in this area, the lining will tend to distort.

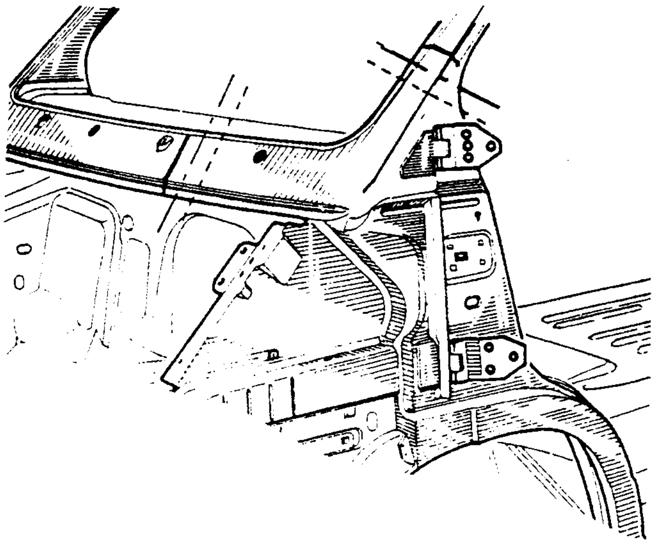


PART REPLACEMENT
SCUTTLE PANEL

PREPARATION

Cut a section out of a new panel which is larger than the section it is to replace.

After grinding the joint smooth, apply a coat of plastic filler or zinc based paint to the new panel to prevent rust forming.

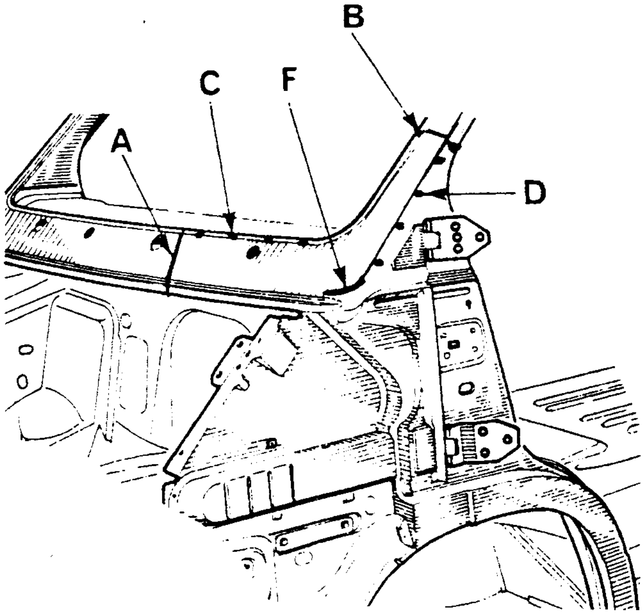


REFITTING

Mount and align the new panel so that it overlaps the section remaining in place.

Sawcut both sections to obtain a but joint.

New section
Old section
Overlapped section

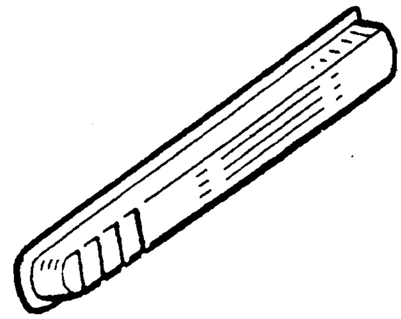


Spotweld the following joints:
-C : w/s cowl
-D : "A" - front pillar

Oxy-acetylene or MIG butt weld:
- both panel sections (A) and pillar (B).
- corner (F) where it joins the pillar.

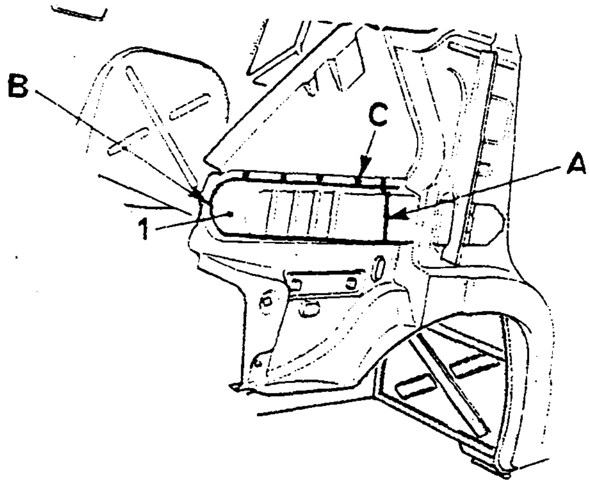
Apply a coat of body solder to the pillar seam.

PART REPLACEMENT
PILLAR LINING STIFFENER



Stiffener (1) is welded to the pillar lining below the pillar and along its full length.

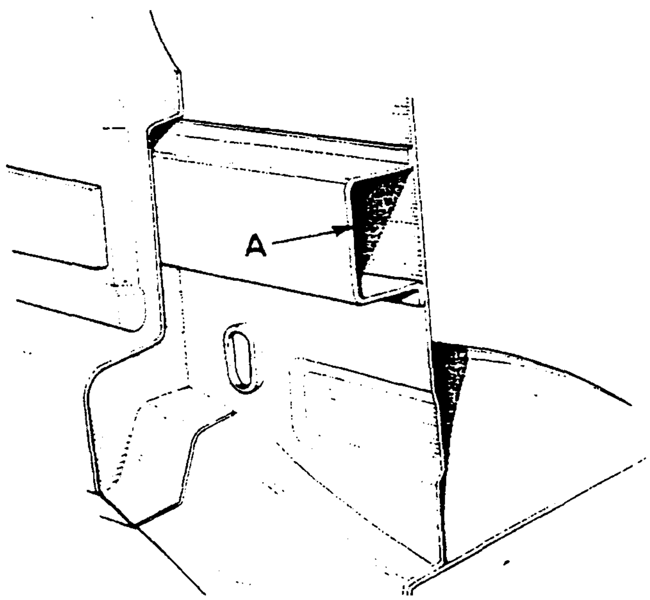
This stiffener may be partly replaced if the impact was at the front.



REMOVING
Saw cut the stiffener at (A).

Chisel cut the stiffener flush with the pillar lining welded seam at (B).

Then separate the spotwelds on the remaining section at (C).

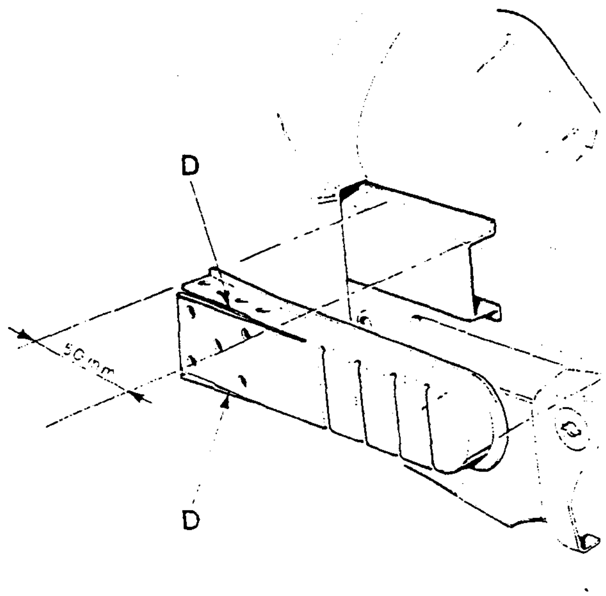


PART REPLACEMENT
PILLAR LINING STIFFENER

PREPARATION
Cut a section out of new stiffener which is about 50 mm (2") longer than the section it is to replace.

Saw cut the new section along corners (D) for 60 mm (2 1/2") so that it overlaps.

Drill a series of 6 mm dia. holes for plug welding the overlapping section.



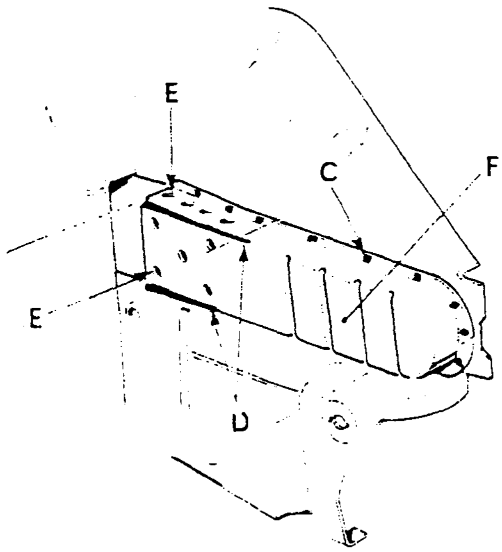
REFITTING
Mount and align the new stiffener section so that it overlaps the section remaining in place.

Spotweld the following joints:

-C : stiffener and pillar lining.

MIG plugweld:
-E : the holes in the new section

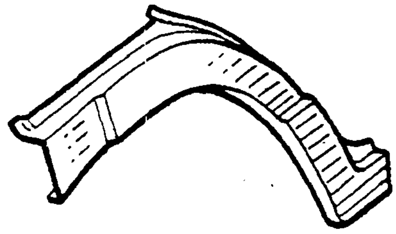
MIG seam weld:
-D : the 2 corners (D) and the end of the new section where it overlaps.



COMPLETE REPLACEMENT
FRONT PILLAR BOTTOM

REMOVING

Remove the spotwelds using a cutter at the following joints:



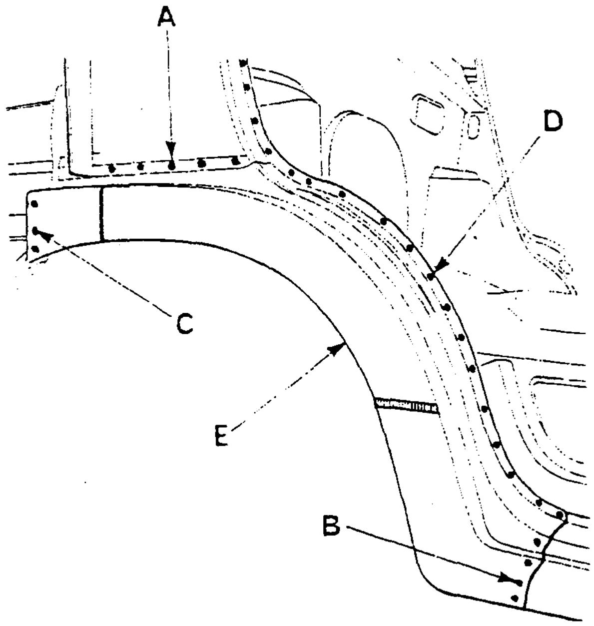
-A : top section
-B : bottom panel

Chisel cut the front pillar bottom section as close as possible to the following joints:

-C : pillar lining
-D : front pillar closure panel

Grind away the front pillar bottom edge (E).

Separate those spotwelds which remain after chisel cutting.

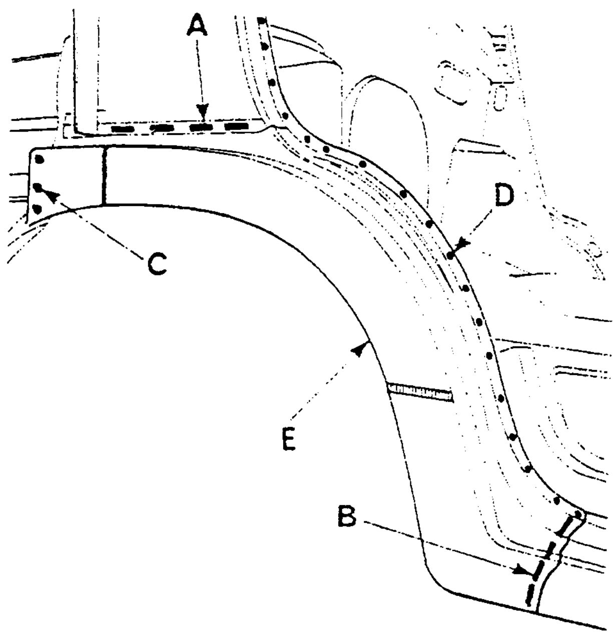


PREPARATION
After grinding the joints smooth, apply a coat of plastic filler or zinc-based paint to the new panel to prevent rust forming.

COMPLETE REPLACEMENT
FRONT PILLAR BOTTOM

REFITTING

Mount the new bottom section and insert it below the pillar top section.



Line it up with the door and wing.

Spotweld the following joints:

-C : pillar lining
-D : front pillar closure panel

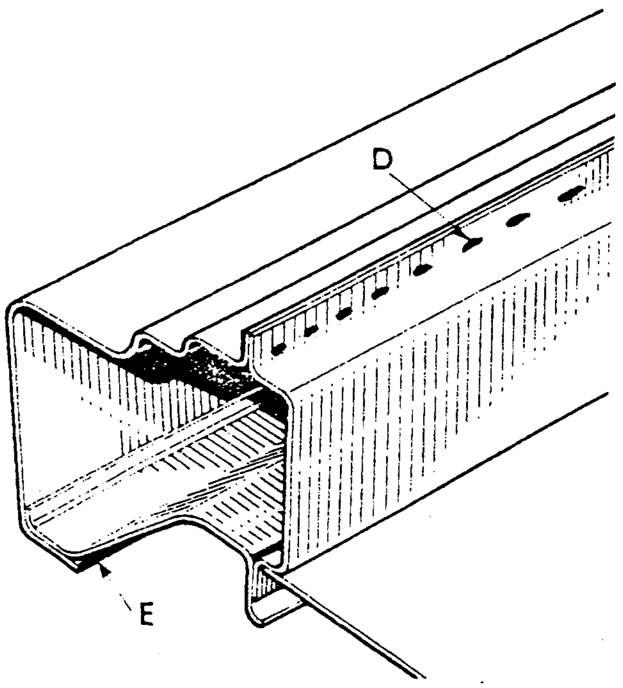
Chain weld the following joints:

-A : top section
-B : body bottom panel
-E : bottom section lining

Apply SC4 sealer to the following joints:

-A : pillar top section
-B : body bottom panel

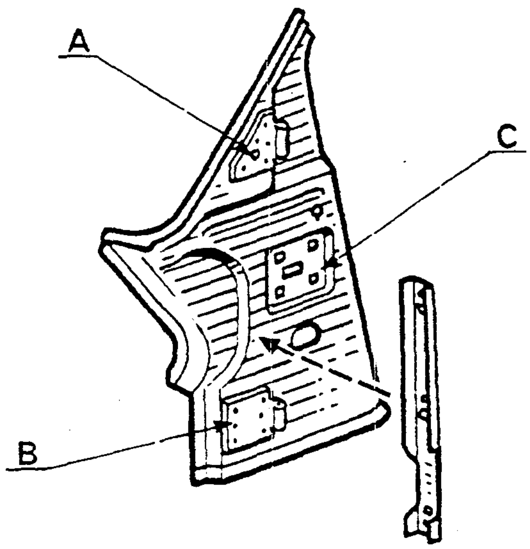
Apply a coat of underbody protectant to underneath the front pillar bottom section lining (E).



COMPLETE REPLACEMENT
FRONT PILLAR TOP

Because of the position of the various stifferners it is not advisable to change only part of the front pillar top section.

- top hinge (A),
- bottom hinge (B),
- door pull (C).



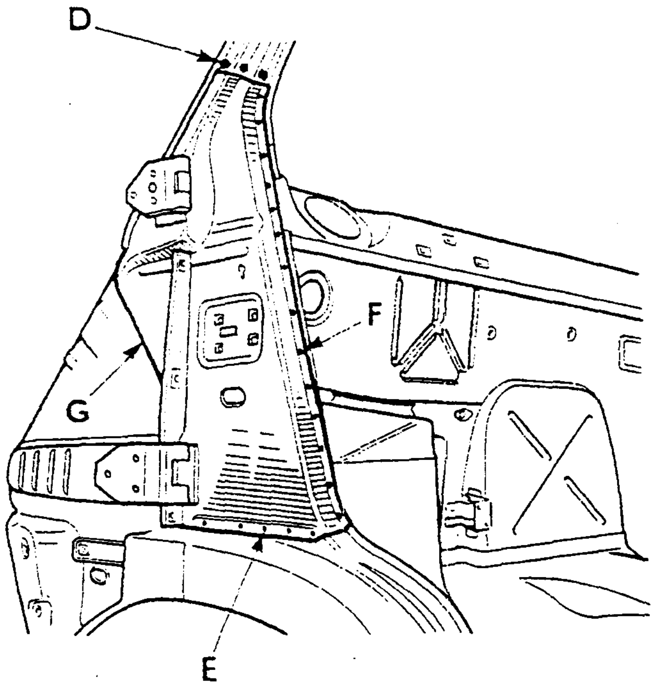
REMOVING

Separate the spotwelds at the following joints using a cutter:

-D : top of body
-E : front pillar bottom section

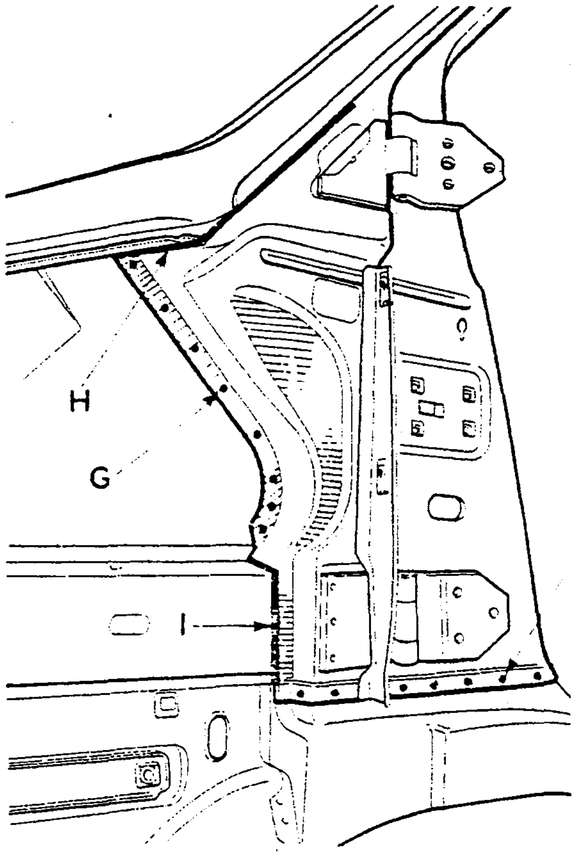
Chisel cut the front pillar top section as near as possible to the following joints:

-F and G : pillar lining.



COMPLETE REPLACEMENT
FRONT PILLAR TOP

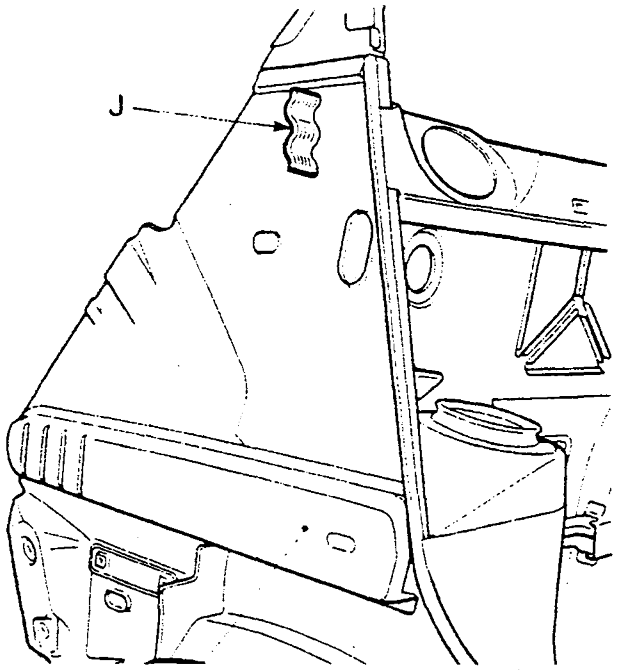
-H : scuttle panel,
-I : fender lining stiffener



Cut joint gusset (J) with a pneumatic saw, inserting the blade between the front pillar and lining.

NOTE: Front pillar lining stiffener (K) is not spotwelded to the front pillar top section.

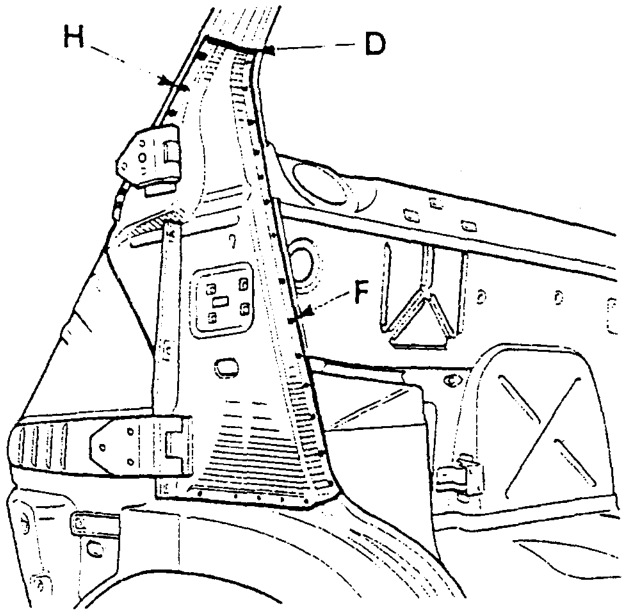
Separate the spotwelds remaining after cutting.



COMPLETE REPLACEMENT
FRONT PILLAR TOP SECTION

PREPARATION

After grinding the joints smooth, apply a coat of plastic filler or zinc-based paint to the new panel to prevent rust forming.



REFITTING

Mount the new section and align it with the door and wing.

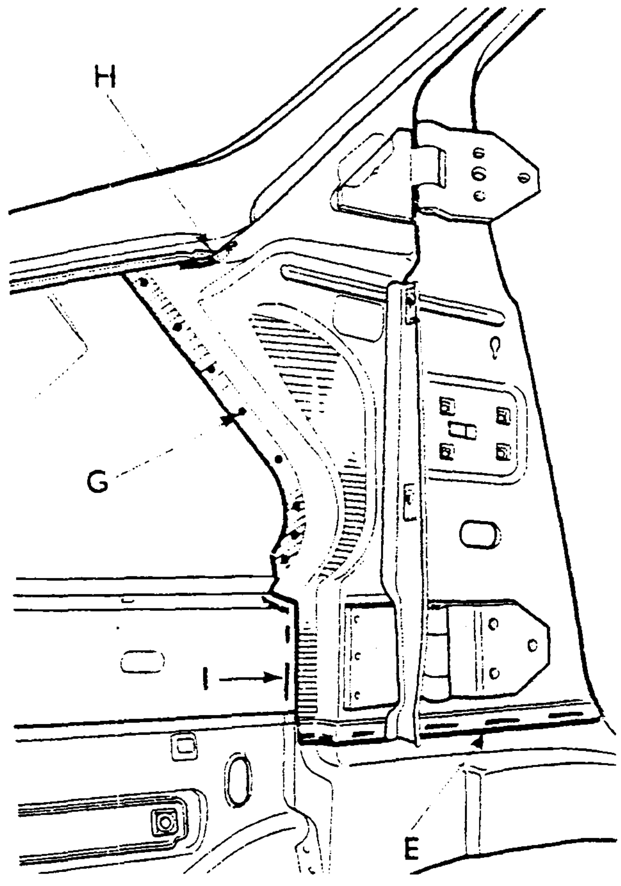
Spotweld the following joints:
-H : "A" pillar
-F and G : pillar lining

Chain weld the following:

-E : front pillar bottom section
-I : pillar lining stiffener

Braze seam weld:
-D : Body top.

Oxy-acetylene butt-weld:
-H : w/s to Hood cowl



Apply strips of CS4 sealer to the following joints:

G: pillar lining.
E: front pillar bottom section
I: fender lining stiffener
D: body top